Pinellas Suncoast Transit Authority

Florida Electric Transit Buses with Charging and Associated Equipment

AGREEMENT FOR ELECTRIC TRANSIT BUSES WITH CHARGING AND ASSOCIATED EQUIPMENT

THIS AGREEMENT for ELECTRIC TRANSIT BUSES WITH CHARGING AND ASSOCIATED EQUIPMENT ("Agreement") is made on October 27, 2021, by and between the Pinellas Suncoast Transit Authority ("PSTA"), an independent special district with its principal place of business located at 3201 Scherer Drive, St. Petersburg, Florida, 33716 and New Flyer of America ("Contractor"), an Inc with its principal place of business located at 711 Kernaghan Avenue, Winnipeg, Manitoba R2C 3T4 (collectively, the "Parties").

WHEREAS, PSTA issued RFP 21-980369 for Electric Transit Buses with Charging and Associated Equipment on July 15, 2021 (the "RFP"); and

WHEREAS, Contractor timely submitted its response to the RFP on or before September 23, 2021 ("Contractor's Response"); and

WHEREAS, PSTA's Board of Directors awarded the contract to Contractor at its duly held Board of Directors meeting on October 27, 2021 (the "Effective Date").

NOW, THEREFORE, in consideration of the mutual promises and agreements set forth herein, and for other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, the Parties agree as follows:

1. RECITALS. The above recitals are true and correct and incorporated herein by reference.

2. CONTRACT DOCUMENTS. The "Contract Documents" shall mean and refer to this Agreement, the RFP including all exhibits attached thereto including any and all duly executed and issued addenda (attached hereto as **Exhibit 1**), any and all Purchase Orders (as defined below and attached as composite **Exhibit 2**), Contractor's Best and Final Offer (BAFO), if any (attached hereto as **Exhibit 3**), and Contractor's Response (attached hereto as **Exhibit 4**). All of the foregoing are incorporated herein by reference and are made a part of this Agreement. In interpreting this Agreement and resolving any ambiguities or conflicts between this Agreement and the exhibits, this Agreement takes precedence over the exhibits and any inconsistency between the exhibits will be resolved in the following order:

Exhibit 1	RFP
Exhibit 2	Purchase Order(s)
Exhibit 3	Contractor's BAFO
Exhibit 4	Contractor's Response

3. SCOPE OF SERVICES. Contractor, at the direction of PSTA, shall furnish to PSTA Electric Transit Buses with Charging and Associated Equipment as described in, and in accordance with the specifications, tasks, and scope of work set forth in the RFP (the "Services"), and in the amount set forth in the RFP. Contractor acknowledges that it has read the specifications and understands them. Contractor also agrees to provide electric transit buses with charging and associated equipment to all permissible assignees of PSTA. PSTA's permissible assignees shall have the option to purchase electric transit buses and charging and associated equipment in accordance with the terms and conditions of the RFP, and specifically SP 3 of the RFP.

4. EFFECTIVE DATE AND TERM OF AGREEMENT. This Agreement shall become effective and commence on the Effective Date and shall remain in effect for five (5) years.

5. TERMS OF PERFORMANCE.

5.01. Time for Completion/Purchase Orders. PSTA will issue purchase orders for the electric buses with charging and associated equipment it needs provided under this Agreement ("Purchase Order(s)"). Upon issuance, the Purchase Order shall be appended to this Agreement and incorporated as an exhibit, Contractor shall immediately begin providing the Services pursuant to the Purchase Order, and all work and deliverables shall be completed by the date set forth in the Purchase Order, unless modified in writing by the Parties. In the event a Purchase Order approved during the term of the Contract Term has a completion date beyond the Contract Term, the terms and conditions of this Agreement shall be automatically extended through the completion of the Purchase Order to the full satisfaction of PSTA.

5.02. Representatives. Prior to the start of any ordering or supplying the Services under this Agreement, Contractor shall designate a primary and alternate representative, who will have management responsibility for the Services and who will have authority to act on technical matters and resolve problems with the Services, Purchase Order(s), and the Contract Documents, to PSTA in writing. Such designation shall include the contact information (including phone numbers) of Contractor's representative. PSTA will advise Contractor in writing of the personnel who will represent PSTA in the administration of the Contract Documents. Such writing from PSTA may include the specific duties of each individual and each representative's limits of authority.

5.03. Non-exclusive Contract. PSTA specifically reserves the right to contract with other entities for the Services described in the Contract Documents or for similar products if it deems, in its sole discretion, such action to be in PSTA's best interest.

5.04. Contractor Responsibility. Contractor shall provide electric buses with charging and associated equipment of first quality, and the workmanship must be in accordance with customary standards of the various trades and industries involved in the manufacturing and furnishing of such products. The Services and the work associated therewith shall be of high-quality in all respects. No advantage will be taken by Contractor in the omission of any part or detail of the Services. Contractor hereby assumes responsibility for all materials, equipment, and processes used in the manufacturing and furnishing of the electric buses and charging and associated equipment, whether the same is manufactured by Contractor or purchased readymade from a source outside Contractor's company.

5.05. Compliance with Laws. Contractor shall comply with all federal, state, county, and local laws, rules and/or regulations, and lawful orders of public authorities including those set forth in this Agreement and that, in any manner, could bear on the provision of the Services under the Contract Documents. Omission of any applicable laws, ordinances, rules, regulations, standards or orders by PSTA in the Contract Documents shall be construed as an oversight and shall not relieve Contractor of its obligations to comply with such laws fully and completely. Upon request, Contractor shall furnish to PSTA certificates of compliance with all such laws, orders and regulations. Contractor shall be responsible for obtaining all necessary permits and licenses required for performance under this Agreement.

6. COMPENSATION. In consideration of Contractor's faithful performance of the Contract Documents, PSTA agrees to pay Contractor pursuant to the rates and pricing set forth in Contractor's Response or Contractor's BAFO, if any. However, all payments to Contractor individually and in the aggregate shall not exceed the Contract Total. Payment shall be made in accordance with the RFP and the Florida Prompt Payment Act, section 218.70, *et seq.*, Florida Statutes.

6.01. Invoices. All invoices shall be submitted in accordance with the Florida Prompt Payment Act, section 218.72, et seq., Florida Statutes, with all details prescribed by PSTA, and delivered to the following address:

Pinellas Suncoast Transit Authority
Attention: Finance Department/Accounts Payable
Purchase Order or Contract #: C-22-MT-002
3201 Scherer Drive
St. Petersburg, Florida 33716

or via electronic mail to:
AccountsPayable@psta.net

6.02. *Disputed Invoices.* In the event of a disputed invoice, only that portion so contested may be withheld from payment and the undisputed portion shall be due and payable on the terms set forth herein.

6.03. *Availability of Funds*. Contractor understands that the funds are not presently available under this Agreement beyond the current fiscal year. PSTA's obligation for performance under this Agreement beyond the current fiscal year is contingent upon the availability of funds from which payments can be made. PSTA is not legally liable for any payment that may arise under this Agreement beyond the current fiscal year, until the Contractor receives a written notice of availability of funds from the PSTA's Contracting Officer.

7. WARRANTIES AND COVENANTS.

7.01. *Patent, Trademark, Copyright, and Trade Secret.* Contractor warrants that the Services, and all goods and work associated therewith, do not infringe on any patent, trademark, copyright or trade secret of any third parties and agrees to defend, indemnify and hold PSTA, its officers, agents, employees, trustees and its successors and assigns, harmless from and against any and all liabilities, loss, damage or expense, including, without limitation, court costs and reasonable attorneys' fees, arising out of any infringement or claims of infringement of any patent, trade name, trademark, copyright or trade secret by reason of the sale or use of any goods or services purchased under this Agreement. PSTA shall promptly notify Contractor of any such claim. PSTA makes no warranty that the production, sale or use of goods or services under this Agreement will not give rise to any such claim and PSTA shall not be liable to Contractor for any such claim brought against Contractor. If any invention, improvement, or discovery of the Contractor is conceived or first actually reduced to practice in the course of providing the Services under this Agreement, and that invention, improvement, or discovery is patentable under the laws of the United States of America or any foreign country, the Contractor agrees to notify the PSTA immediately and provide a detailed report. The rights and responsibilities of the Contractor and PSTA with respect to such invention, improvement, or discovery will be determined in accordance with applicable Federal laws, regulations, policies, and any waiver thereof.

7.02. *Covenants against Gratuities.* Contractor warrants that he or she has not offered or given gratuities (in the form of entertainment, gifts, or otherwise) to any official or employee of PSTA with a view toward securing favorable treatment in the awarding, amending, or evaluating performance of this Agreement.

7.03. *E-Verify.* Contractor shall utilize the U.S. Department of Homeland Security's E-Verify System to verify the employment eligibility of: (a) all persons employed by Contractor throughout the term of this Agreement; and (b) all persons, including subcontractors, retained or hired by Contractor, regardless of compensation, to perform work on the Services provided pursuant to the Contract Documents.

8. DELAY IN PERFORMANCE/FORCE MAJEURE.

8.01. *Time of the Essence.* The timely receipt of the Services and deliverables to PSTA is essential. If the Services and all deliverables under each Purchase Order are not received by PSTA within the date specified in each Purchase Order, PSTA may cancel the unfilled portion of the Purchase Order and this

Agreement for cause, purchase substitutes elsewhere, and recover from Contractor any increased costs and damages thereby incurred by PSTA.

8.02. Unavoidable Delay. If completion of the Services under any Purchase Order is unavoidably delayed, PSTA may, in its sole and absolute discretion, extend the time for completion for a determined number of days of excusable delay. A delay is unavoidable only if the delay was not reasonably expected to occur in connection with or during Contractor's performance; was not caused directly or substantially by negligent errors, omissions, or mistakes of Contractor, its subcontractors, or its suppliers or their agents; was substantial; and, in fact, caused Contractor to miss delivery dates and could not adequately have been guarded against by contractual or legal means.

8.03. No Damages for Delay. Contractor shall not be entitled to any claim for damages on account of hindrances or delays in the work from any cause whatsoever, including any delays or hindrances caused by PSTA. This paragraph shall include, but not be limited to, any actions which result in delays in scheduling, substantial changes in scope of the Services or deliverables or substantial increases in the costs of performing the work under the Contract Documents.

8.04. Notification. Contractor will notify PSTA as soon as Contractor has, or should have, knowledge that an event has occurred which will delay completion of the Services under a Purchase Order. Within five (5) working days, Contractor will confirm such notice in writing, furnishing as much detail as is available and including any request for extension of time. Contractor shall supply, as soon as such data is available, any reasonable proofs that are required by PSTA to make a decision on any request for extension. PSTA will examine the request and any documents supplied by Contractor and will determine if Contractor is entitled to an extension and the duration of such extension. PSTA will notify Contractor of its decision in writing. It is expressly understood and agreed that Contractor will not be entitled to any extension and the granting of such extension is in the sole discretion of PSTA. It is further expressly understood that Contractor shall not be entitled to any damages or compensation, and will not be reimbursed for any losses, on account of delays resulting from any cause.

9. DISPUTES, BREACHES, DEFAULTS, OR OTHER LITIGATION.

9.01. Rights and Remedies. The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by PSTA or Contractor shall constitute a waiver of any right or duty afforded any of them under this Agreement, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

9.02. Attorneys' Fees. In the event of legal action or other proceeding arising under this Agreement, PSTA shall be entitled to recover from Contractor all its reasonable attorneys' fees and cost incurred by PSTA in the prosecution or defense of such action, or in any post-judgment or collection proceedings and whether incurred before suit, at the trial level or at the appellate level. This shall include any bankruptcy proceedings filed by or against Contractor. PSTA also shall be entitled to recover any reasonable attorneys' fees and costs incurred in litigating the entitlement to attorneys' fees and costs, as well as in determining the amount of attorneys' fees and costs due to PSTA. The reasonable costs to which PSTA will be entitled include costs that are taxable under any applicable statute, rule, or guideline, as well as costs of investigation, copying costs, electronic discovery costs, mailing and delivery charges, costs of conducting legal research, consultant and expert witness fees, travel expenses, court reporter fees and mediator fees, regardless of whether such costs are taxable under any applicable statue, rule or guideline.

10. INDEMNIFICATION.

10.01 Indemnification. The Parties recognize that Contractor is an independent contractor. Contractor

agrees to assume liability for and indemnify, hold harmless, and defend PSTA, its board members, officers, employees, agents and attorneys, of, from, and against all liability and expense, including reasonable attorneys' fees, in connection with any and all claims, demands, damages, actions, causes of action, and suits in equity of whatever kind or nature, including claims for personal injury, property damage, equitable relief, or loss of use, arising out of the execution, performance, nonperformance, or enforcement of this Agreement, whether or not due to or caused by the negligence of PSTA, its board members, officers, employees, agents, and/or attorneys excluding only the sole negligence of PSTA, its officers, employees, agents, and attorneys. This includes claims made by the employees of Contractor against PSTA, and Contractor hereby waives its entitlement, if any, to immunity under Section 440.11, Florida Statutes. Contractor's liability hereunder shall include all attorneys' fees and costs incurred by PSTA in the enforcement of this indemnification provision. Notwithstanding anything contained herein to the contrary, this indemnification provision shall not be construed as a waiver of any immunity from or limitation of liability to which PSTA is entitled to pursuant to the doctrine of sovereign immunity or Section 768.28, Florida Statutes. The obligations contained in this provision shall survive termination of this Agreement, however terminated, and shall not be limited by the amount of any insurance required to be obtained or maintained under this Agreement.

10.02 Control of Defense. Subject to the limitations set forth in this provision, Contractor shall assume control of the defense of any claim asserted by a third party against PSTA arising from or in any way related to this Agreement and, in connection with such defenses, shall appoint lead counsel, in each case at Contractor's expense. Contractor shall have the right, at its option, to participate in the defense of any third party claim, without relieving Contractor of any of its obligations hereunder. If Contractor assumes control of the defense of any third party claim in accordance with this paragraph, Contractor shall obtain the prior written consent of PSTA before entering into any settlement of such claim. Notwithstanding anything to the contrary in this provision, Contractor shall not assume or maintain control of the defense of any third party claim, but shall pay the fees of counsel retained by PSTA and all expenses including experts' fees, if (i) an adverse determination with respect to the third party claim would, in the good faith judgment of PSTA, be detrimental in any material respect of PSTA's reputation; (ii) the third party claim seeks an injunction or equitable relief against PSTA; or (iii) Contractor has failed or is failing to prosecute or defend vigorously the third party claim. Each party shall cooperate, and cause its agents to cooperate, in the defense or prosecution of any third party claim and shall furnish or cause to be furnished such records and information, and attend such conferences, discovery proceedings, hearings, trials, or appeals, as may be reasonably requested in connection therewith.

11. MISCELLANEOUS PROVISIONS.

11.01 Entire Agreement. The Contract Documents, including all exhibits, constitute the entire agreement between the parties with respect to the subject matter hereof and supersedes all previous written or oral negotiations, agreements, proposals and/or understandings. There are no representations or warranties unless set forth in the Contract Documents.

11.02 Notices. All notices required or made pursuant to this Agreement shall be made in writing and sent by certified U.S. mail, return receipt requested, addressed to the following:

To PSTA:
Pinellas Suncoast Transit Authority
Attn: Brad Miller, CEO
3201 Scherer Drive
St. Petersburg, FL 33716

To Contractor: New Flyer of America Inc
Adrian Graca
6200 Glenn Carlson Dr, St Cloud, MN 56301,

With required copy to:

Alan S. Zimmet, B.C.S.
Bryant Miller Olive
One Tampa City Center
Suite 2700
Tampa, FL. 33602

Either party may change its above noted address by giving written notice to the other party in accordance with the requirements of this section.

11.03 *Waiver of Remedies for any Breach.* In the event that PSTA elects to waive its remedies for any breach by Contractor of any covenant, term or condition of this Agreement, such waiver by PSTA shall only be valid if set forth in writing and shall not limit PSTA's remedies for any succeeding breach of that or of any other term, covenant, or condition of this Agreement.

11.04 *Modification.* The Contract Documents, including the scope, specification, and details of the Services may only be modified by written agreement of the Parties. No modification shall serve to increase the Contract Total unless such change has been approved by PSTA's Board of Directors prior to any work being performed that would serve to increase the Contract Total.

11.05 *Headings and Section References.* The headings and section references in this Agreement are inserted only for the purpose of convenience and shall not be construed to expand or limit the provisions contained in such sections.

11.06 *Authorization.* Both parties to this Agreement represent and warrant that they are authorized to enter into this Agreement without the consent and joinder of any other party and that the parties executing this Agreement have full power and authority to bind their respective parties to the terms hereof.

11.07 *Assignment*. The terms and provisions of this Agreement shall be binding upon the Parties and their respective partners, successors, heirs, executors, administrators, assigns and legal representatives. Notwithstanding the foregoing, a party's rights and obligations under this Agreement may only be transferred, assigned, sublet, mortgaged, pledged or otherwise disposed of or encumbered in any way with the other party's prior written consent.

11.08 *Severability*. If any one or more provisions of this Agreement shall be held to be invalid, illegal, or unenforceable in any respect by a court of competent jurisdiction, the validity, legality, and enforceability of the remaining provisions hereof shall not in any way be affected or impaired thereby and this Agreement shall be treated as though the invalidated portion(s) had never been a part hereof.

11.09 *Electronic Signatures*. This Agreement may be executed by electronic signature technology and such electronic signature shall act as the Parties' legal signatures on this Agreement and shall be treated in all respects as an original handwritten signature.

11.010 *Counterparts*. This Agreement may be executed in one or more counterparts, any one of which need not contain the signatures of more than one party, but all such counterparts taken together will constitute one and the same instrument.

(SIGNATURES ON FOLLOWING PAGE)

IN WITNESS WHEREOF the Parties hereto have caused this Agreement to be duly executed on the date first above written.

CONTRACTOR:

By: _____

Print Name:Jennifer McNeill/Chris Stoddart

Title: Vice President, Sales & Marketing/
President, North American Bus
and Coach

WITNESS/ATTEST:

By: _____

By: _____

Print Name: _Adrian Graca

PSTA:

By: _____
Brad Miller, CEO

Attest:

Rachael Cappolla
Rachael Cappolla, Executive Assistant

Approved as to form:

APPROVED
By Alan S. Zimmet at 2:49 pm, 11/15/21

Alan S. Zimmet, General Counsel



PSTA – Pinellas Suncoast Transit Authority

RFP 21-980369
Xcelsior CHARGE™
- XE35
- XE40
- XE60
- D45 CRT LE CHARGE™
- D45 CRT CHARGE

Package 1 Technical

NEW FLYER OF AMERICA

Package 1 – Technical Proposal Requirements

Section	Title
1	Letter of Transmittal
2	Technical Proposal
3	Acknowledgement of Addenda
4	Contractor Service and Parts Support Data
5	Form for Proposal Deviation (without price data)
6	Vehicle Questionnaire
7	References and Non-Priced Information
8	Engineering organization chart, engineering change control procedure, field modification process
9	Manufacturing facilities plant layout, other contracts, staffing
10	Production and delivery schedule and other Contract commitments for the duration of this Contract
11	Management Plan
12	Quality Assurance Program

Section 1

Solicitation Requirement:

Letter of Transmittal.

New Flyer Response:

Please refer to the attached Letter of Transmittal.

NEW FLYER OF AMERICA

September 17, 2021

Alvin R. Burns Jr.
Director of Procurement
Pinellas Suncoast Transit Authority
3201 Scherer Drive, St. Petersburg, FL 33716

Subject: Request for Proposal for the Florida Electric Transit Buses with charging and associated equipment, RFP No. 21-980369

Dear Mr. Burns,

New Flyer of America Inc. ("New Flyer") is honored to have the opportunity to submit our response to the Pinellas Suncoast Transit Authority ("PSTA") for proposal No. 21-980369. This proposal is for the manufacture and delivery of 35-foot, 40-foot, 45-foot, 60-foot electric buses, and charging equipment.

We understand the importance of connecting people safely and on time to places for PSTA, based on that, we believe our most advanced product line under the Xcelsior® brand which includes our battery-electric 35, 40, 45 and 60 foot heavy-duty transit buses, charging options and our aftermarket service are the perfect combination of technology and lifetime support that will best help PSTA reach its goal.



New Flyer will partner with PSTA to achieve the following goals:

- Looking for innovative ways to make sure our riders get to their destinations on time, this will assist PSTA's goal to increase ridership.
- PSTA's mission is to be people's first choice for transportation and a driving force for social, environmental, and economic vitality in the community through innovation and partnership. This is what drives us, and our buses, to safely connect people to places.
- Provide transportation options to meet the needs of disadvantaged communities.



NEW FLYER OF AMERICA

[redacted]

New Flyer would be honored to have the opportunity to meet with you to present our proposed solution, along with additional opportunities we have identified for enhanced value and reduced cost.

We appreciate the opportunity to participate in this procurement, and we are eager to join hands and provide quality transportation that meets the needs of the communities served by PSTA.

New Flyer's proposal will remain valid for a period of 180 days from the opening date.

[redacted]

NEW FLYER OF AMERICA

[redacted]

Built to Rely On®

Section 2A

Solicitation Requirement:

TS 5.5.2 Operator Training.

New Flyer Response:

Please refer to Operator Training attachment, this document will provide PSTA with an overall training guide and availablity for the Motor Coach D45 CRT LE CHARGE™ and D45 CRT CHARGE coaches. During the purchase of the coaches a comprehensive plan will be completed for each order depending on the criteria requested from each purchaser from this contract.

New Flyer Institute Technical Training Programs

LESSON PLAN

TOPIC: MCI Operator Familiarization CLASS SIZE: 10 Students

DATE: _____ CLASS DURATION: 4 Hours

INSTRUCTOR: _____ SR.# _____

TRAINING AIDS

SHOP	√	CLASSROOM	√
COACH	X	LCD PROJECTOR	X
		SCREEN DISPLAY	
		DRAWING BOARD / MARKERS	X
		COMPUTER	X
		MANUALS	
		Operators Guide	X
		MCI Dash Quick Reference Card	X

Learning Objectives:

THE STUDENT WILL LEARN THE FOLLOWING:

1. General overview of the complete coach.
2. To know the function of the various control switches/components on the side console and instrument panel.
3. To understand how to use the IP mode and enter button to access information
4. To know the function of the heating and cooling system control.
5. To know the proper procedures to start / shut off the coach.
6. To know how to prepare the coach for service operation.
7. To know how to inspect and test the door functions.
8. To know how to perform a pre-trip inspection
9. Connecting the coach to the depot charger (as required)

PREREQUISITE:

THE STUDENT SHOULD HAVE THE FOLLOWING SKILLS / KNOWLEDGE:
1. Basic understanding of coach operation.
2. Basic understanding of door systems.
3. Basic understanding of air systems.
4. Basic understanding of electrical systems.
5. Basic understanding of a Pre-Trip inspection.

THE STUDENT SHOULD HAVE COMPLETED THE FOLLOWING TRAINING ON MCI COACHES:

1. Not applicable for orientation class.

INTRODUCTION

1. INTRODUCTION OF SELF / INCLUDE BACKGROUND
2. REPRESENTING: COMPANY / SCHOOL / ETC.
3. DISCUSS BREAKS / LUNCH / EXITS / WASHROOM LOCATION / ETC.
4. COMPLETE ATTENDANCE FORM / COPY TO PROPERTY
5. SUBJECT AND MATERIAL TO BE COVERED
6. OUTLINE HOW CLASS WILL BE CONDUCTED / DURATION

COURSE CONTENT

METHOD / AIDS	
Discussion	1.BRIEF OVERVIEW EXPLANATION OF SYSTEM
Discussion	2.DESCRIPTION OF COMPONENTS a. ASK FOR AND RESPOND TO QUESTIONS
Discussion	3.STEP BY STEP DESCRIPTION OF SYSTEMS AND OPERATION a. ASK FOR AND RESPOND TO QUESTIONS
Discussion	4.DESCRIPTION OF SERVICE LITERATURE a. ASK FOR AND RESPOND TO QUESTIONS
Discussion	5.STEP BY STEP DESCRIPTION OF SERVICE PROCEDURES AND DIAGNOSIS a. ASK FOR AND RESPOND TO QUESTIONS

CONCLUSION

1. BRIEFLY REVIEW MAIN TOPICS OF DISCUSSION
    a. ASK FOR AND RESPOND TO QUESTIONS

2. ENCOURAGE READING OF STUDENT MANUAL AS HOMEWORK AND A MEANS OF SELF LEARNING

3. CLOSE DISCUSSION THANKING STUDENTS FOR PARTICIPATION

Training Materials

Instructor Materials

1. MCI Operators Manual
2. MCI Dash Quick Refence Card

Student Materials

1. Copies of Course Presentation

MCI OPERATORS Familiarization
COURSE OUTLINE

A. Classroom Training (1-2 hours)

1. Instructor and Student Introductions
2. Attendance Documentation
3. Overview of training plan
4. Safety Overview
5. Theory of Operation
    1. Review the Operators Guide / Specifications / Operating Principles/ Emergency information / and High Voltage safety (if equipped).
    2. Review the Drivers Check List / Drivers Controls / Instrumentation & Controls.
    3. Review Kneeling, Wheelchair Ramp/Lift and Securement System.

B. Practical (On the Bus 2-3 hours)

Operator Instruction

1. Demonstrate the Entrance and Exit door operation.
2. Demonstrate the operation of the Wheel Chair Ramp / Kneeling / Interlocks.
3. Demonstrate proper engine starting / shut down procedures.
4. Explain & Show engine components / access doors / compartments.
5. Demonstrate & Operate Drive Controls / Heating Ventilation and Air Conditioning (HVAC) system controls.

Section 2B

Solicitation Requirements:

TS 5.13 Fire Suppression.

Description to match the specifications.

New Flyer Response:

Fire Suppression on the D45CRTeLE and C45CRTe is not standard as there are no gasses on an electric coach, therefore not required.

Section 2C

Solicitation Requirements:

TS 5.11 Interior Noise and Exterior Noise.

New Flyer response:

In the attachments Motor Coach Industries is providing the exterior noise and vibrations tests, interior noise and vibrations tests. These tests have been completed through the Altoona Testing; the objective of these tests is to record exterior and interior noise levels under various conditions to ensure the SAE standards are met. The results are on the following pages.

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission up shift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the PSBRTF and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 43.6 dB(A), the average test result obtained while accelerating from a constant speed was 66.1 dB(A) on the right side and 66.1 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 44.1 dB(A), the average of the results obtained were 64.5 dB(A) on the right side and 64.9 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 48.8 dB(A) at idle. With the accessories and air conditioning off, the readings averaged 9.6 dB(A) lower at idle. Note; this electric bus is not equipped with high idle and wide open throttle positions. The exterior ambient noise level measured during this test was 43.9 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 66	Humidity (%): 39
Wind Speed (mph): 5	Wind Direction: S
Barometric Pressure (in.Hg): 30.19	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.R.	
Initial Sound Level Meter Calibration: ■ checked by: S.R.	
Exterior Ambient Noise Level dB(A): 43.6	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	63.7	1	64.8
2	64.6	2	66.4
3	66.1	3	65.1
4	66.0	4	65.8
5	65.0	5	65.1
Average of two highest actual noise levels = 66.1 dB(A)		Average of two highest actual noise levels = 66.1 dB(A)	
Final Sound Level Meter Calibration Check: ■ checked by: E.D.			
Remarks/Comments/recommended changes: None noted.			

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 67	Humidity (%): 38
Wind Speed (mph): 5	Wind Direction: S
Barometric Pressure (in.Hg): 30.19	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.R.	
Initial Sound Level Meter Calibration: ■ checked by: S.R.	
Exterior Ambient Noise Level dB(A): 44.1	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	62.8	1	62.5
2	64.9	2	65.6
3	64.0	3	64.1
4	63.5	4	62.9
5	63.4	5	62.4
Average of two highest actual noise levels = 64.5 dB(A)		Average of two highest actual noise levels = 64.9 dB(A)	

Final Sound Level Meter Calibration Check: ■ checked by: E.D.
Remarks/comments/recommended changes: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 67	Humidity (%): 39
Wind Speed (mph): 7	Wind Direction: S
Barometric Pressure (in.Hg): 30.19	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.R.

Initial Sound Level Meter Calibration: ■ checked by: S.R.

Exterior Ambient Noise Level dB(A): 43.9

Accessories and Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	49.3	48.3
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Accessories and Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	38.9	39.4
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Final Sound Level Meter Calibration Check: ■ checked by: S.R.

Remarks/Comments/recommended changes: This electric bus is not equipped with high idle and wide open throttle.

7.2 EXTERIOR NOISE TESTS



TEST BUS UNDERGOING
EXTERIOR NOISE TESTING



7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.

2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the Test Track Facility.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the Test Track and the Bus Testing Center.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80.0 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 47.0 dB(A); ranging from 45.5 dB(A) at the rear passenger seats to 47.9 dB(A) in line with the rear speaker. The interior ambient noise level for this test was < 30.0 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 66.4 dB(A) at the front passenger seats to 70.2 dB(A) at the rear passenger seats. The overall average was 68.6 dB(A). The interior ambient noise level for this test was < 30.0 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 1405	Date: 06-20-14
Personnel: T.S., E.D. & S.R.	
Temperature (°F): 79	Humidity (%): 32
Wind Speed (mph): < 12	Wind Direction: Variable
Barometric Pressure (in.Hg): 28.94	
Initial Sound Level Meter Calibration: ■ checked by: T.S.	
Interior Ambient Noise Level dB(A): < 30.0	Exterior Ambient Noise Level dB(A): 43.2
Microphone Height During Testing (in): 29" above seat cushion	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	46.5
Front Passenger Seats	47.4
In Line with Front Speaker	46.9
In Line with Middle Speaker	47.7
In Line with Rear Speaker	47.9
Rear Passenger Seats	45.5

Final Sound Level Meter Calibration: ■ checked by: E.D.

Comments: All readings taken in the center aisle.
Remarks/comments/recommended changes: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 1405	Date: 7-9-15
Personnel: S.R., E.D. & C.S.	
Temperature (°F): 72	Humidity (%): 82
Wind Speed (mph): 2	Wind Direction: N
Barometric Pressure (in.Hg): 30.02	
Initial Sound Level Meter Calibration: ■ checked by: S.R.	
Interior Ambient Noise Level dB(A): < 30.0	Exterior Ambient Noise Level dB(A): 43.1
Microphone Height During Testing (in): 29" from seat cushion.	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	69.3
Front Passenger Seats	66.4
Middle Passenger Seats	68.5
Rear Passenger Seats	70.2

Final Sound Level Meter Calibration: ■ checked by: S.R.

Comments: All readings taken in the center aisle.
Remarks/comments/recommended changes: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 57	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted.
Windows and Doors	None noted.
Seats and Wheel Chair lifts	None noted.

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted.
Remarks/comments/recommended changes: None noted.

7.1 INTERIOR NOISE TEST



TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

Section 2D

Solicitation Requirements:

TS 5.14 Respect for the Environment.

The Contractor shall provide a plan for reuse or recycling of replaced battery cells and/or battery packs.

New Flyer response:

In the attached documents, Environmental, Social & Governance Report, and Li-Cycle. The report/study from Environmental, Social & Governance Report outlining the importance of electric batteries regarding the recycling is noted on Page 35. The full report is included as a matter of importance and interest in our changing world.



NFI

MAY 2021

Environmental, Social & Governance Report for 2020

NEW FLYER · ALEXANDER DENNIS · MCI · ARBOC SPECIALTY VEHICLES · PLAXTON · nfi parts · CARFAIR · KMG

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INTRODUCTION

About This Report

This ESG report ("Report") covers the activities of NFI Group Inc. and its subsidiaries (collectively, "NFI" or the "Company") from January 1, 2020 to December 31, 2020, unless otherwise indicated herein.

To develop this Report, NFI consulted with a broad range of stakeholders on regional and global levels, including customers, suppliers, investors and community partners. NFI sought expertise in Human Resources, Legal, Procurement, Ethics and Compliance, Health and Safety, Risk Management, Investor Relations and Communications. The Report is published with the approval of NFI's Board of Directors.

As a result of data coverage and quality improvements, a limited number of past performance figures published in our 2019 report have been restated, and these are clarified in our footnotes.

All references to $ in this document refer to U.S. dollars unless otherwise noted.

ESG Frameworks

Th s Report nc udes env ronmenta , soc a and governance metr cs and d scuss ons that are focused on areas N be eves are most re evant to our bus ness and our stakeho ders, and are gu ded by the pr nc p es of accuracy, ba ance, and c ar ty N cont nues to assess a var ety of frameworks to determ ne wh ch of these address matters most re evant to our stakeho ders and our organ zat ona goa s Our annua ESG report w reflect any add t ona content requ red by se ected frameworks; future report ng cou d nc ude frameworks such as the G oba Report ng n t at ve (GR), the Susta nab ty Account ng Standards Board (SASB), and/or the Un ted Nat ons Susta nab e Deve opment Goa s (SDG)

N expects to respond to the CDP C mate Change Quest onna re for the first t me n summer 2021, fo ow ng wh ch our env ronmenta metr cs w be adjusted to support ongo ng d sc osure requ rements Report ng through the CDP w prov de N w th a framework to systemat ca y measure and d sc ose our r sks and opportun t es re ated to carbon and c mate change, and to create targets around areas of mean ngfu mpact



Forward-Looking Statements

Th s Report conta ns forward- ook ng nformat on and forward- ook ng statements , w th n the mean ng of app cab e Canad an secur t es aws, wh ch reflect the expectat ons of management regard ng the Company s future growth, financ a performance and object ves and the Company s v s on, strateg c n t at ves, p ans, bus ness prospects and opportun t es, nc ud ng the Company s soc a , econom c, env ronmenta and governance-re ated mpacts and object ves The forward- ook ng nformat on n th s ESG Report s nc uded to ass st the Company s stakeho ders n understand ng these matters Th s nformat on may not be appropr ate for other purposes The words be eves , v ews , ant c pates , p ans , expects , ntends , projects , forecasts , est mates , gu dance , goa s , object ves and targets and s m ar express ons such as may , w , shou d , cou d , wou d are ntended to dent fy forward ook ng statements These forward- ook ng statements reflect management s current expectat ons regard ng future events and speak on y as of the date of th s Report (or as otherw se nd cated)

By the r very nature, forward- ook ng statements requ re management to make assumpt ons and nvo ve s gn ficant r sks and uncerta nt es, shou d not be read as guarantees of future events, performance or resu ts, and are subject to the poss b ty that management s pred ct ons, forecasts, project ons, expectat ons or conc us ons w not prove to be accurate, that the assumpt ons may not be correct and that the Company s future growth, financ a performance and object ves and the Company s v s on, strateg c n t at ves, p ans, bus ness prospects and opportun t es, nc ud ng the Company s soc a , econom c, env ronmenta and governance-re ated mpacts and object ves, w not occur or be ach eved

The Company caut ons readers and nvestors not to p ace undue re ance on these forward- ook ng statements and nformat on as a number of r sk factors cou d cause the Company s actua resu ts to d ffer mater a y from the expectat ons expressed n such forward- ook ng statements These factors – many of wh ch are beyond the Company s and management s contro and the effects of wh ch are d ff cu t to pred ct – nc ude r sks re ated to genera econom c and market factors; r sks re ated to the Company s bus ness env ronment; r sks re ated to the Company s operat ons, strategy, financ ng, cap ta structure, tax, regu atory comp ance, reputat on, env ronmenta and soc a r sk; and the r sks d scussed n the R sk actors sect on of the Company s Annua nformat on orm and other d sc osure documents fi ed w th the Canad an secur t es regu atory author t es and ava ab e on SEDAR at www sedar com The Company caut ons that the forego ng st of r sk factors s not exhaust ve and other factors cou d mater a y adverse y affect the Company s future growth, financ a performance and object ves and the Company s v s on, strateg c n t at ves, p ans, bus ness prospects and opportun t es, nc ud ng the Company s soc a , econom c, env ronmenta and governance-re ated mpacts and object ves Except as requ red by aw, the Company does not undertake to update any forward- ook ng statement, whether wr tten or ora , that may be made from t me to t me by the Company or on ts beha f The Company prov des no assurance that forward- ook ng statements and nformat on w prove to be accurate, as actua resu ts and future events cou d d ffer mater a y from those ant c pated n such statements

LETTER TO STAKEHOLDERS

Recovering from the pandemic to lead the evolution to electric and zero-emission mobility.

Without a doubt, 2020 was a year none of us will ever forget.

The pandem c mpacted our operat ons around the wor d and brought w th t many cha enges To say that we are extreme y proud of the response from the N team g oba y s a mass ve understatement

S nce the onset of COV D-19, N has d gent y focused on the hea th and safety of our peop e and on de ver ng for our customers who prov de essent a mob ty serv ces N sought to ach eve a ba ance n our dec s on-mak ng and n our response to the rea t es of the pandem c Desp te a cha eng ng 2020, as we move forward, we are proud of our h story and exc ted about our future

As we reflect on the mpacts of the pandem c, a s ver n ng has been the ncreased focus on ESG ssues by compan es, governments, nvestors and the commun ty at arge N s comm tment to ead n zero-em ss on mob ty and to best- n-c ass ESG pract ces and performance has never been n more c ear focus

N has progressed from a bus and coach manufacturer to a susta nab e mob ty so ut ons prov der, and battery-e ectr c buses and coaches are ead ng the charge to a zero-em ss on future (we ca t the ***ZE***vo ut on™) S nce 2015, we have de vered over 1,380 ZEBs that have trave ed more than 40 m on zero-em ss on serv ce m es and dr ven em ss on reduct ons n four countr es n 2020, we de vered 389 zero-em ss on buses (ZEBs), or 9% of our tota de ver es, and we ant c pate that ZEBs w be 20% to 25% of our overa product on n 2021 Our mob ty so ut ons enab e smart c ty deve opment, reduce the harmfu mpacts of c mate change, traff c congest on and no se po ut on, and create econom c opportun ty for current and future generat ons More than 80 c t es around the wor d have an N ZEB n serv ce or on order

Th s pub cat on marks our th rd annua ESG Report and demonstrates s gn ficant growth and matur ty n our company-w de ESG pract ces We have a so added an ESG sect on to our webs te, where stakeho ders can keep nformed of the atest updates n add t on, 2021 w mark N s first year of forma d sc osure under CDP, a g oba non-profit organ zat on w th defined env ronmenta mpact d sc osure frameworks and defin t ons

As one of the wor d s argest des gners, manufacturers and supporters of mass transportat on so ut ons, we know that we have a respons b ty to ead We are comm tted to the journey, and we w cont nue to work to mprove our ESG pract ces and report ng each year

Passengers around the wor d are seek ng modern susta nab e transportat on opt ons as traff c congest on and a r qua ty cont nue to cha enge today s grow ng c t es We comm t to p ay ng our ro e by ead ng the ***ZE***vo ut on™ to g oba susta nab e mob ty



The Honourable Brian Tobin, P.C., OC
Chair of the Board



Paul Soubry
President & CEO

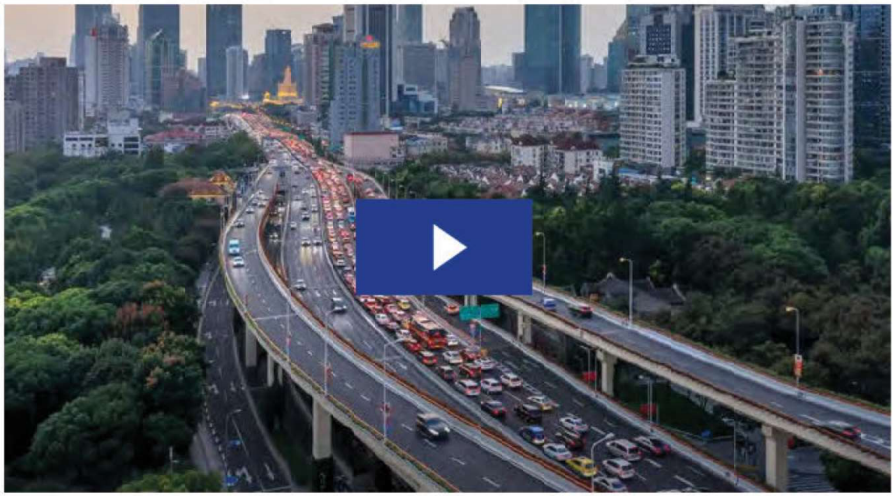
INTRODUCTION

About NFI

Video Links



NFI exists to move people



NFI is leading the *ZE*volution™ to electric and zero-emission mobility

INTRODUCTION

About NFI

NFI is leading the evolution to global zero-emission mobility. We continue to build upon our legacy of innovation to deliver transit technology that meets the complex environmental and social demands of communities today and into the future.



Our Why? To Move People.

Our Vision:
To enab e the future of mob ty w th nnovat ve and susta nab e so ut ons

Our Mission:
To des gn and de ver except ona transportat on so ut ons that are safe, access b e, eff cent, and re ab e

Our Strategy:
We seek ong-term success through ndustry- ead ng transportat on so ut ons and comm t to cont nuous nvestment n our peop e and processes, to opt m ze, defend, d vers fy and grow our bus ness Our products, serv ces, and our company are bu t to re y on

~8,000
team members

50+
fac t es n 10 countr es

105,000+
buses and coaches n serv ce around the wor d



ARBOC Eq ess CHARGE™


BYD AD Env ro400EV



New F yer Xce s or CHARGE NG™


MC D45 CR E CHARGE™

INTRODUCTION

Seeking Long-Term Success

NFI is committed to creating long-term and sustainable value for all our stakeholders, while also being responsible to the environment and the communities in which we live and work.

At N , the cons derat on of a our stakeho ders nterests s cr t ca to our dec s on mak ng n 2009, we mp emented a stakeho der engagement system that encompasses the var ous part es d sp ayed n the mode

n some jur sd ct ons, N part c pates n consu tat ons w th representat ves of the commun t es n the mmed ate v c n ty of our product on fac t es These commun ty meet ngs are used to d scuss any s gn ficant process or product on rate changes that cou d mpact the env ronmenta cond t ons n the area These meet ngs are the forum used to h gh ght safety and env ronmenta mprovements ncorporated nto our manufactur ng operat ons

Our supp ers are subject to our env ronmenta , abor, and human r ghts codes of conduct, ver fied through s te v s ts Our Env ronmenta Hea th & Safety Po cy encompasses a fac t es, operat ons, contractors, and vendors/supp ers

We recogn ze, v a our Env ronmenta Management System (EMS), the mpact our d rect operat ons, supp y cha n, and consumer use of our products and serv ces has on the consumpt on of natura resources, energy, and water, and the generat on of waste Our EMS dent fies how our operat ons nteract w th the env ronment and comm ts to cont nua y mprov ng our efforts to m n m ze env ronmenta mpacts Our comm tment s further shown through the cert fcat on of many of our manufactur ng d v s ons N s heavy-duty and med um-duty trans t bus and motor coach manufactur ng fac t es n North Amer ca have been reg stered to the SO 9001 (qua ty) cert fcat on New yer s heavy-duty trans t bus manufactur ng fac t es have a so been reg stered to SO 14001 (env ronmenta) and SO 45001 (safety) cert fcat ons, mak ng them the first North Amer can bus or coach manufacturer to ach eve a three SO cert fcat ons ARBOC was awarded SO 9001 2008 n 2009 and s now SO 9001 2015 cert fied AD has been awarded SO 9001 cert fcat on for some of ts product on fac t es n the UK, and MC product on fac t es are schedu ed for SO 14001 and SO 45001 reg strat on n 2021

Our comm tment to m n m z ng env ronmenta mpacts s why each bus s des gned and programmed for e ther a) zero em ss ons, or b) fue eff c ency and, n turn, a reduct on n em ss ons Our zero-em ss on and battery-e ectr c products demonstrate our comm tment to a susta nab e future Env ronmenta des gn cr ter a, nc ud ng em ss ons output, resource use and waste generat on, are cr t ca cons derat ons n the creat on of our products Eng nes are des gned to be eff c ent and to meet, and somet mes exceed, regu atory em ss ons and eff c ency requ rements per country On-board em ss ons measurements systems are emp oyed dur ng dr v ng to reduce fue consumpt on



As a publicly traded company on the Toronto Stock Exchange (TSX), NFI ensures decisions are made to drive shareholder value and provide long-term returns. As you'll see throughout this Report, employees and customers are also critical stakeholder groups that drive our business and strategy.

Our Companies

NEW FLYER

New F yer Nor h Amer ca' heavy d y ran b eader and offer he mo advanced prod c ne nder he Xce or® and Xce or C ARGE brand a o offer n ra r c re deve opmen hro gh New F yer n ra r c re So on ™, a erv ce ded ca ed o prov d ng a e, a nab e, and re ab e charg ng and mob y o on New F yer ac ve y ppor over 35,000 heavy d y ran b e (New F yer, NAB, and Or on) c rren y n erv ce, o wh ch 8,600 are powered by e ec r c mo or and ba ery prop on and 1,900 are zero em on



→ newflyer.com

ALEXANDER DENNIS | PLAXTON

A exander Denn m ed ("AD ") a g oba eader n he de gn and man ac re o do b e deck b e and he U ' arge b and coach man ac rer AD offer nge and do b e deck veh c e nder he brand o A exander Denn and P ax on, and ha over 31,000 veh c e n erv ce n he U , E rope, ong ong, S ngapore, New Zea and, Mex co, Canada and he Un ed S a e AD ' oc on zero em on nc de nge deck, 2 ax e do b e deck and 3 ax e do b e deck ba ery e ec r c b mode , a we a e ec r c range hybr d do b e deck and 2nd genera on hydrogen e ce ba ery e ec r c do b e deck, he 20 AD ha over 500 ba ery e ec r c b e n erv ce n he U , Nor h Amer ca and New Zea and, p ano her 500 ba ery e ec r c b e on order



→ alexander-dennis.com

MCI

MC Nor h Amer ca' ead ng p b c and pr va e marke mo or coach brand, b d ng he nd ry' be e ng J4500 coach, ma er ver on J3500, and he new ba ery e ec r c zero em on J4500 C ARGE™ n add on o he J ere , MC b d he B y Amer ca comp an and A oona e ed D mode er e , nc d ng he ADA acce b e D45 CRT E Comm er Coach, he ba ery e ec r c, zero em on D45 CRT E C ARGE™, he a new pr va e ec or D4520, and he p b c ec or D45 CRT MC a o prov de man enance, repa r, 24 ho r road de a ance, par , and echn c an ran ng



→ mcicoach.com

ARBOC SPECIALTY VEHICLES

ARBOC Nor h Amer ca' ow floor, body on cha ("c away") b eader erv ng ran , para ran , and h e app ca on W h more han 4,000 b e prod ced, ARBOC ead he ow floor c away b marke prov d ng n rpa ed pa enger acce b y and com or ARBOC a o offer he Eq e , a med m d y b ed or ran and h e app ca on , and he Eq e C ARGE™, a zero em on ba ery e ec r c mode



→ arbocsv.com

nfi.parts

NF Par ™ Nor h Amer ca' mo comprehen ve par organ za on, prov d ng par , echn ca p b ca on , ran ng, ppor or OEM prod c ne (ran b e , mo or coache and c away), a we a o her man ac rer hro gh o r ex en ve cro re erence da aba e



→ nfi.parts

CARFAIR

Car a r Compo e nc Nor h Amer ca' eader n eng neered fiber re n orced pa c (FRP) and compo e echno oge or b e , w h over 50 year o exper ence

→ carfaircomposites.com

KMG

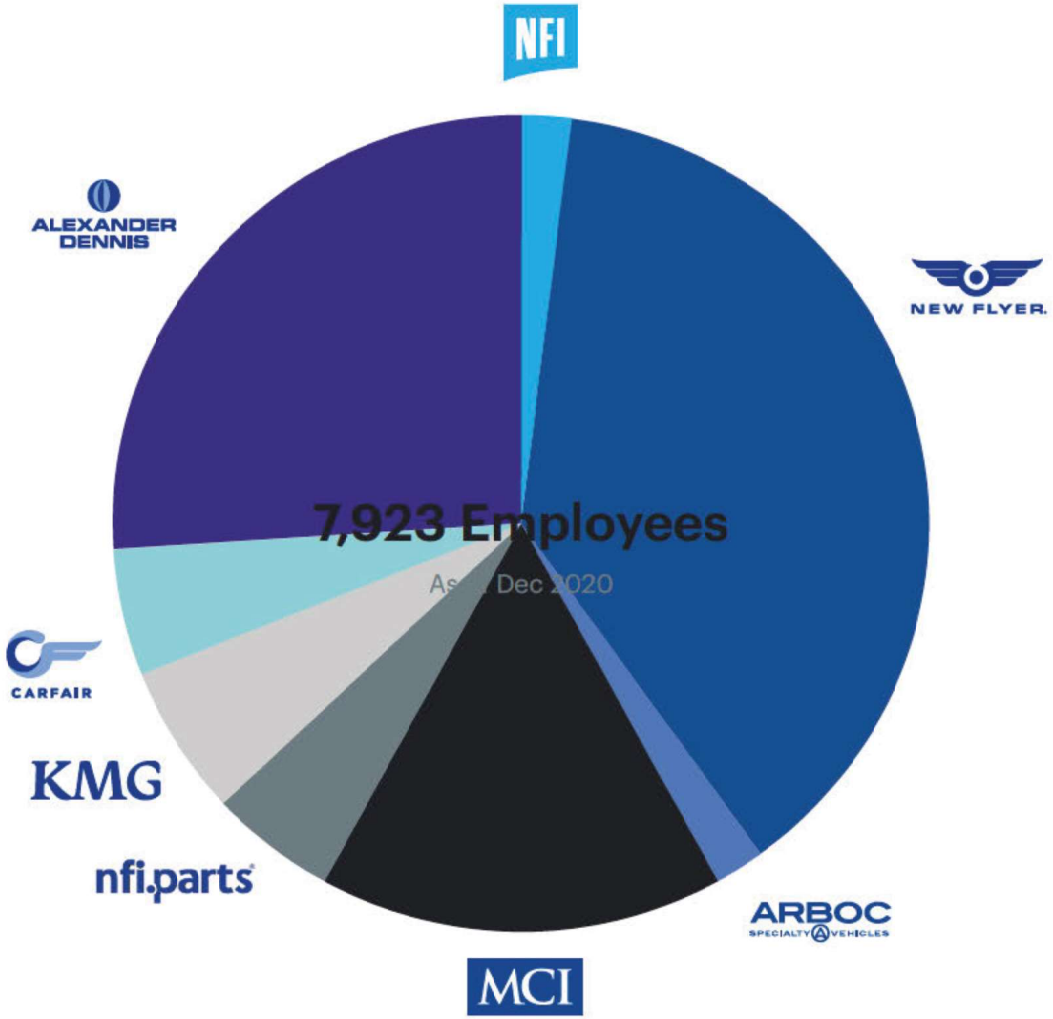
MG NF ' par abr ca on ac y wh ch a nched n 2018 n Shepherd v e, en cky

INTRODUCTION

Our People



142 Employees	NF Gro p
2,996 Employees	New F yer
128 Employees	ARBOC
1,244 Employees	MC
396 Employees	NF Par
483 Employees	MG
378 Employees	Car a r Compo e
2,156 Employees	A exander Denn m ed



INTRODUCTION

Our Milestones

- **1895** Dennis founded in England
- **1907** Plaxton founded in Scotland
- **1924** Alexander founded in Scotland
- **1930** Western Auto and Truck Body Works founded in Winnipeg, Canada
- **1932** Motor Coach Industries founded in Winnipeg
- **2001** Dennis, Alexander and Plaxton become Alexander Dennis Limited
- **2008** ARBOC Specialty Vehicles founded in Middlebury, IN
- **2010** NFI acquires TCB Industries
- **2013** NFI acquires Orion Parts and North American Bus Industries in Anniston, AL
- **2015** NFI acquires Motor Coach Industries and Frank Fair Industries
- **2017** NFI acquires ARBOC Specialty Vehicles
- **2017** NFI Parts established (New Flyer, NABI, Orion and MCI Parts)
- **2017** NFI opens Vehicle Innovation Center (VIC) in Anniston, AL
- **2017** NFI acquires Carlson Engineered Composites and Wausaukee-Sintex Composites
- **2018** NFI launches KMG Part Fabrication in Shepherdsville, KY
- **2019** NFI acquires Alexander Dennis Limited
- **2019** NFI introduces Infrastructure Solutions™
- **2020** NFI introduces the national Community Benefits Framework
- **2020** NFI launches NFI Forward, a transformational initiative to move NFI from a holding company to an integrated operating company
- **2021** NFI unveils its strategy, entitled Leading the ***ZE***volution™, to drive the evolution to zero-emission mobility



New F yer Xce s or AV ™

INTRODUCTION

Our Communities

NEW FLYER

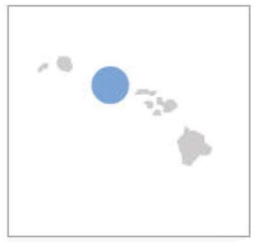
- **Crookston, MN**
  B Compe on
- **Ontario, CA**
  NF B Compe on
  MC Serv ce Cen er
- **Renton, WA**
  NF Serv ce Cen er
- **St. Cloud, MN**
  NF B Man ac r ng
  F berg a Fabr ca on
  Par Fabr ca on
- **NFI Winnipeg, MB**
  Par Fabr ca on
  F berg a Fabr ca on
  B She A emb y
  New Prod c Deve opmen

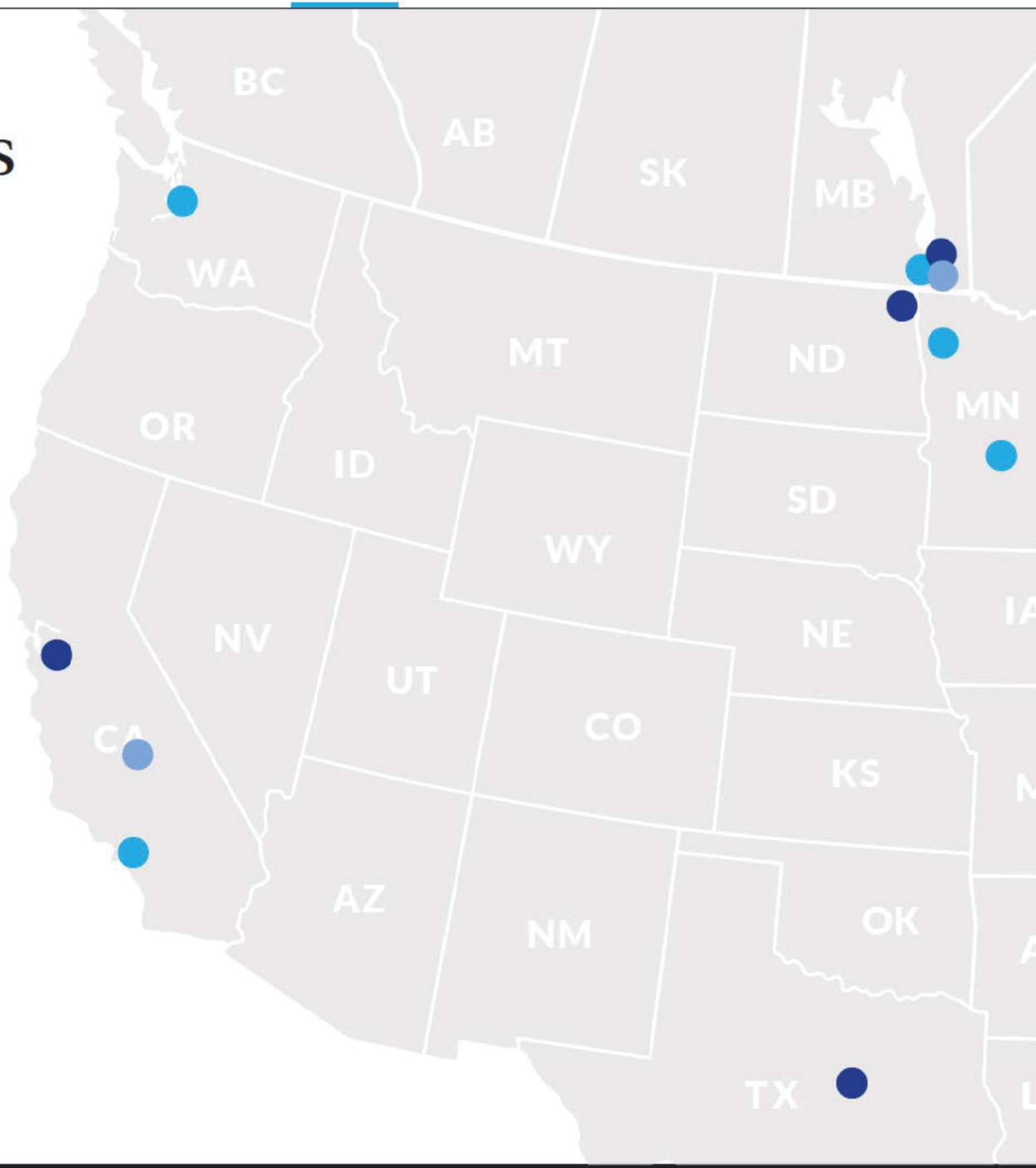
MCI

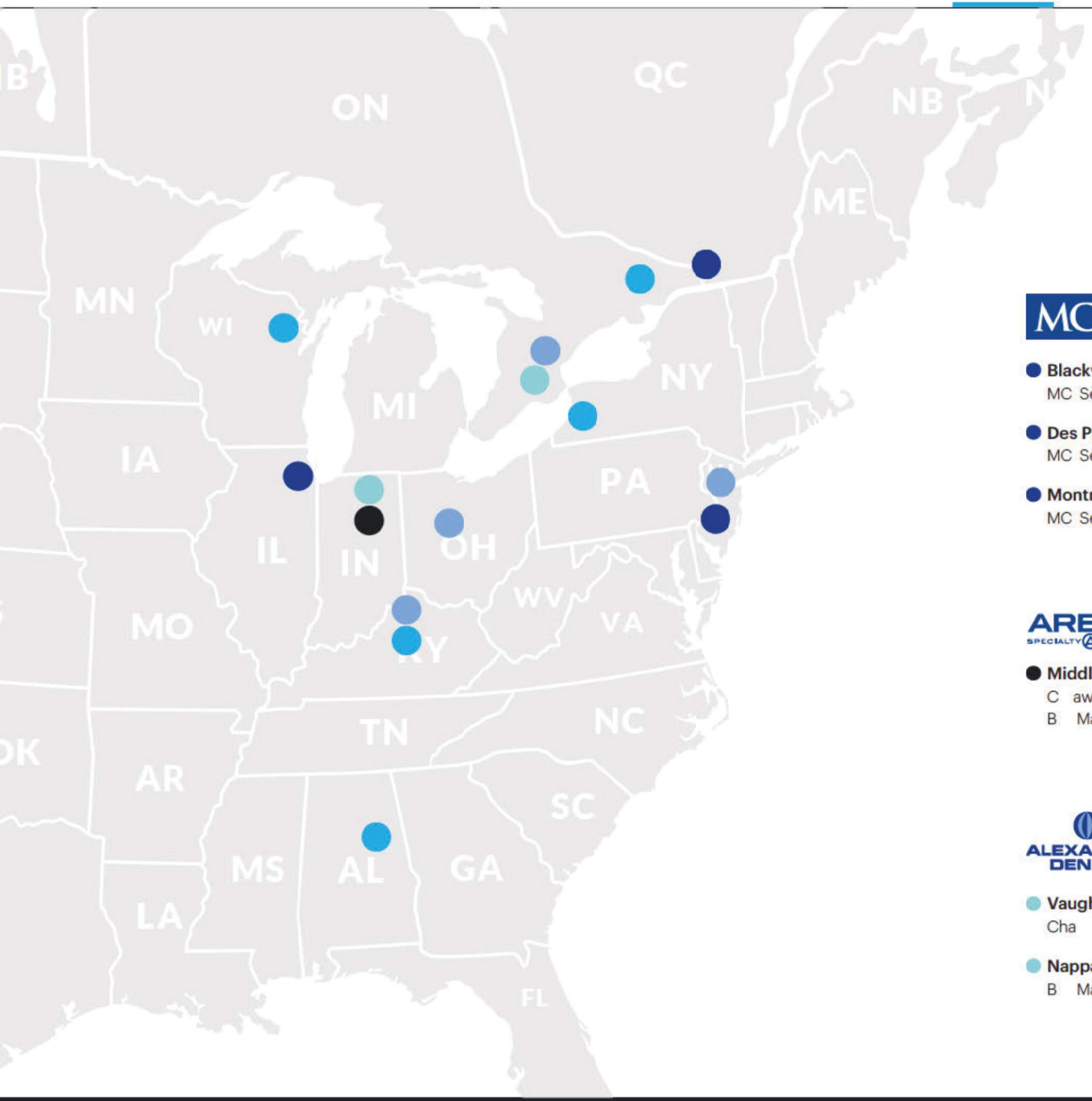
- **Dallas, TX**
  MC Serv ce Cen er
- **Hayward, CA**
  MC Serv ce Cen er
- **Pembina, ND**
  MC D She Compe on
- **Winnipeg, MB**
  Par Fabr ca on
  MC D Mode She A emb y
  Compe e J Mode Man ac r ng
  New Prod c Deve opmen
  F berg a Fabr ca on

nfi.parts

- **Fresno, CA**
  NF Par D r b on Cen er
- **Honolulu, HI**
  NF Par D r b on Cen er
- **Winnipeg, MB**
  NF Par D r b on Cen er
  P b ca on
  C omer Tra n ng







MCI

- **Blackwood, NJ**
  MC Serv ce Cen er
- **Des Plaines, IL**
  MC Serv ce Cen er
- **Montreal, QC**
  MC Serv ce Cen er

ARBOC SPECIALTY VEHICLES

- **Middlebury, IN**
  C away & Med m D y
  B Man ac rng

ALEXANDER DENNIS

- **Vaughan, ON**
  Cha Man ac rng
- **Nappanee, IN**
  B Man ac rng

NEW FLYER

- **Anniston, AL**
  NF B Man ac rng
  Par Fabr ca on
  Veh c e nnova on Cen er
- **Arnprior, ON**
  NF Serv ce Cen er
- **Jamestown, NY**
  Par Man ac rng
- **Shepherdsville, KY**
  Par Fabr ca on
- **Wausaukee & Gillett, WI**
  F berg a Fabr ca on

nfi.parts

- **Brampton, ON**
  NF Par D r b on Cen er
- **Delaware, OH**
  NF Par D r b on Cen er
- **East Brunswick, NJ**
  NF Par D r b on Cen er
- **Louisville, KY**
  NF Par D r b on Cen er
  P b ca on
  C omer Tra n ng



ALEXANDER DENNIS

- **Anston, England**
  Par D r b on and Serv ce Cen er
- **Falkirk, Scotland**
  B Body Man ac r ng
- **Farnborough, England**
  De gn and Eng neer ng
- **Harlow, England**
  Serv ce Cen er
- **Larbert, Scotland**
  ead Off ce
- **Skelmersdale, England**
  Par D r b on and Serv ce Cen er
- **Scarborough, England**
  B & Coach Man ac r ng
- **Dublin, Ireland**
  Par D r b on Cen er
- **Ballymena, Northern Ireland**
  Eng neer ng b
- **Ciudad de Mexico, Mexico**
  Serv ce Cen er
- **Berlin, Germany**
  Commerc a Off ce
- **Kowloon, Hong Kong**
  APAC ead Off ce
- **Auckland, New Zealand**
  Par D r b on and Serv ce Cen er
- **Singapore**
  Commerc a Off ce

INTRODUCTION

Our COVID-19 Response

The COVID-19 pandemic has had a significant impact on our company and our team around the world.

Across N , we d ed the major ty of our fac t es for near y two months (Mar – May 2020), wh ch resu ted n near y 8,000 peop e on temporary fur ough We resumed product on n the second quarter of 2020, wh ch saw many of our peop e return to our manufactur ng fac t es, and we worked d gent y to create a safe env ronment for the r return

At the beg nn ng of the pandem c, we aunched a ded cated COV D-19 Response Team that has coord nated Safe Work, Commun cat ons, R sk and Operat ons n t at ves, and we have prov ded cons stent commun cat on to a emp oyees throughout the ongo ng pandem c

Our focus rema ns on the hea th, safety and we -be ng of our team members no matter where they are work ng

A few of our initiatives have included:

- → Prov d ng PPE requ red for a staff
- → Spec a zed c ean ng and san t z ng
- → Ensur ng phys ca d stanc ng and re-eng neer ng processes where feas b e
- → Work from home, where feas b e
- → mp ement ng hea th and temperature checks
- → mp ement ng symptom d sc osure po c es
- → Ded cated on ne porta s for commun cat on

NFI COVID-19 Training Sessions

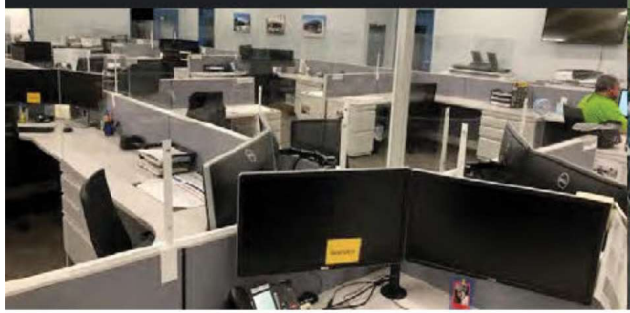
	Leadership	Employees	Visitors
To a # o Tra n ng o r	1,774	12,174	376
To a # o Tra n ng Se on A ended	639	7,014	1,502



14,323
Tota # of Tra n ng Hours

9,155
Tota # of Tra n ng Sess ons Attended









ENVIRONMENTAL, SOCIAL & GOVERNANCE REPORT FOR 2020

Principles & Governance

A better product.
A better workplace.
A better world.

PRINCIPLES & GOVERNANCE

Our Core Values

1. We pledge to be customer focused

n prov d ng safe, access b e, re ab e, and techno og ca y advanced transportat on so ut ons w th the goa of prov d ng the owest tota cost of ownersh p to keep peop e and commun t es mov ng

2. We must earn the trust of those we serve and those they serve

through a steadfast comm tment to safety and qua ty de vered as prom sed

3. We foster smart leadership

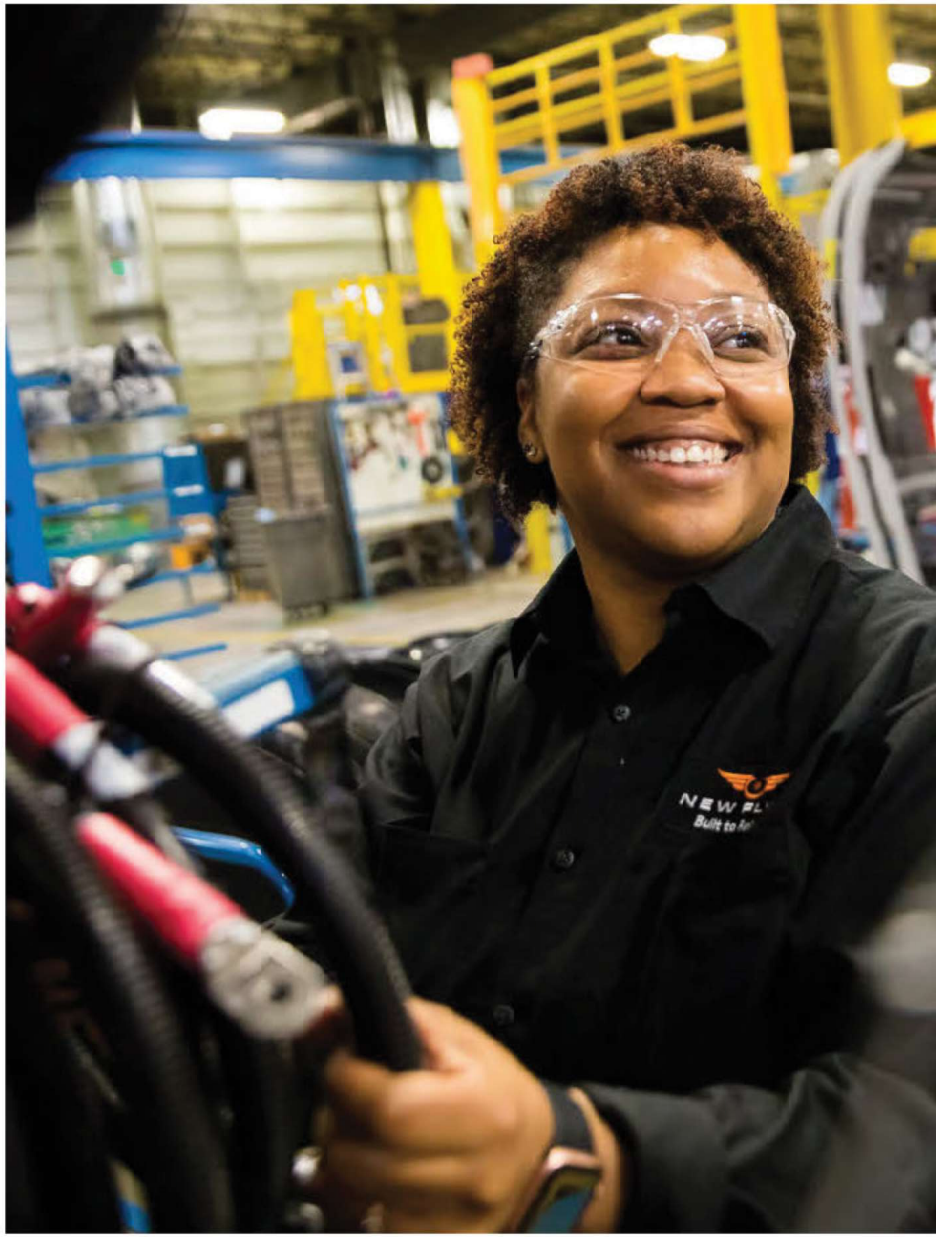
at every eve of N , to cont nuous y ra se standards and advance techno og ca nnovat on and serv ce performance We re pass onate about a never-end ng pursu t of operat ona exce ence

4. We believe in sustainability

and the pos t ve soc a , econom c, and env ronmenta mpact of the work we do every day

5. We value honesty, hard work and team work

and those who do that work w th pr de and ntegr ty We str ve to be a great p ace to bu d careers



PRINCIPLES & GOVERNANCE

NFI Board of Directors



Hon. Brian Tobin*
(Ontar o)
Board Cha r
HRCH Comm ttee Member
Member s nce 2005



Colin Robertson
(Un ted K ngdom)
V ce Cha r
Member s nce 2020



Phyllis Cochran*
(South Caro na)
A d t Comm ttee Cha r
Member s nce 2015



Larry Edwards*
(Ok ahoma)
HRCG Comm ttee Cha r
A d t Comm ttee Member
Member s nce 2005



Paul Soubry
(Man toba)
Pres dent & CEO
Member s nce 2009



Katherine Winter*
(I no s)
HRCG Comm ttee Member
Member s nce 2019
Kathy is the VP & GM Autonomous Transportation & Infrastructure Division Intel Corporation



John Marinucci*
(Ontar o)
Member at arge
Member s nce 2005



Adam Gray*
(Connect cut)
A d t Comm ttee
Member s nce 2012
Adam is co-founder and Managing Partner at Coliseum Capital Management LLC



Krystyna Hoeg*
(Ontar o)
A d t Comm ttee Member
Member s nce 2015



Paulo Nunez*
(Braz)
HRCG Comm ttee Member
Member s nce 2015
Paulo also serves on the Board of Directors of Marcopolo S A Management LLC

* Denotes ndependent D rectors

Key Facts

80%
Board ndependence

33%
fema e

4
geograph ca d vers ty across four countr es

300
years of comb ned exper ence

100%
of D rectors own shares

Str v ng for ncreased representat on of underrepresented groups

Robust Governance Program

Ded ca ed A d , R and Nom na on Comm ee

De a ed po cy ramework

Enhanced ESG d c o re and po cy deve opmen

Wh eb ower and Fra d o ne

ghe SS Rank ng or A d , R k and Shareho der r gh

PRINCIPLES & GOVERNANCE

Our ESG Disclosure Journey

May 2019
1st Env ronmenta , Soc a & Governance Report



March 2020
aunched Nat ona Commun ty Benefits ramework



May 2020
2nd Env ronmenta , Soc a & Governance Report



May 2021
3rd Env ronmenta , Soc a & Governance Report



2021
naugura CDP part c pat on

2021+
Cont nue to eva uate and cons der mp ement ng add t ona vo untary d sc osure framework(s)

PRINCIPLES & GOVERNANCE

Our ESG Priorities for 2021

Company Management	Environment	Employees	Community
B ne per ormance	Zero em on prod c and o on	Ce ebra ng, o er ng and mea r ng d ver y, eq y and nc on	Re pon b e corpora e c zen
ead ng w h n egr y	Em on managemen , nc d ng oo pr n ra ona za on	Env ronmen a hea h and a e y	man R gh
Q a y prod c , con n o nnova on	Energy and wa er con mp on managemen	Re pec and v bran workp ace c re	Comm n y and char ab e n a ve
Rob governance	n ra r c re So on o ppor zero em on pro ec	Comm n y Bene Framework and n a ve	Team and comm n y pr , ppor ed by he Comm n y Bene Framework

"ESG will continue to drive our decision making in 2021 and beyond. We are focused on both our internal initiatives, including an increase in the diversity of our team and reduction of our carbon footprint, and on the environmental and social benefits created by our products."

Janice Harper, Executive Vice President, People & Culture



PRINCIPLES & GOVERNANCE

Our Sustainability Pledge

A better product.
A better workplace.
A better world.

Our Sustainability Pledge guides our daily actions and long-term planning. NFI is passionate about creating a better product, a better workplace, and a better world.





NFI

ENVIRONMENTAL, SOCIAL & GOVERNANCE REPORT FOR 2020

Better Product

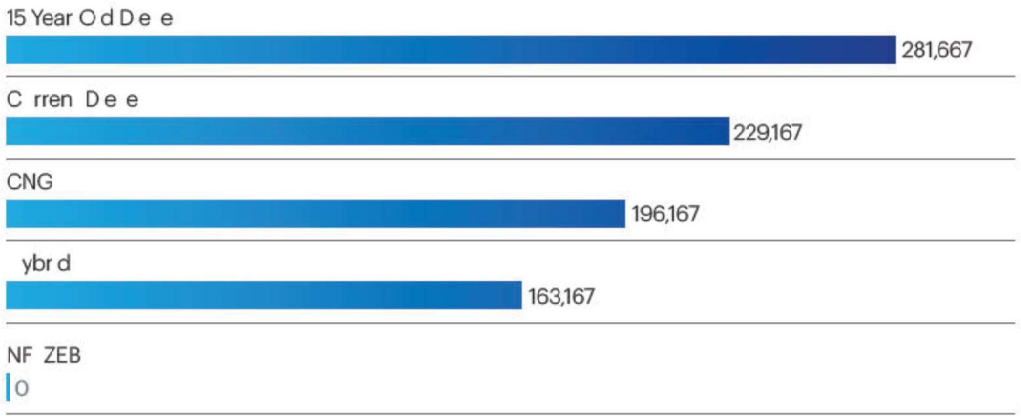
A better product.
A better workplace.
A better world.

BETTER PRODUCT

The Power of a Bus

- or every $1 commun t es nvest n pub c transportat on, t generates $5 n econom c returns
- Amer cans took 4 66 b on bus tr ps n 2019 ; UK passengers took 4 6 b on bus journeys from Apr 2019-Mar 2020[2]; and Canad ans took 1 89 b on bus tr ps n 2019[3]
- Every ZEB prevents the em ss on of 3,380,000 bs of CO_2 over a 12-year fe, the equ va ent of the em ss ons from 28 cars per year

Annual Tailpipe Emissions[4] (CO_2, lbs)



Comparative Cost and Time to Delivery

Transit mode	Cost	Time to deliver
gh Ra Tran (RT)	$3B $6B	>5 year
100 Tran B e	$40M $50M	1 2 year
100 ZEB	$90M $100M	1 2 year

1. A TA 2. N SRA and Gov.uk 3. S a s Can 4. GR T Mode ee oo pr n Ca cu a or & A Mo or Veh c e m ss on S mu a or
5. A TA's conom c mpac of ub c Transpor a on nves men 6. A TA and The Na ona Assoc a on of Rea ors
7. The H dden Traff c Safe y So u on ub c Transpor a on

Key Facts

+24%
home va ues near pub c transportat on[5]

$11.7B
offset to annua car operat ng costs[5]

49,700
obs created from every $1 b on nvested[5]

10x
safer per m e to trave by pub c trans t than automob es[7]

40
cars removed from the road for every 1 bus



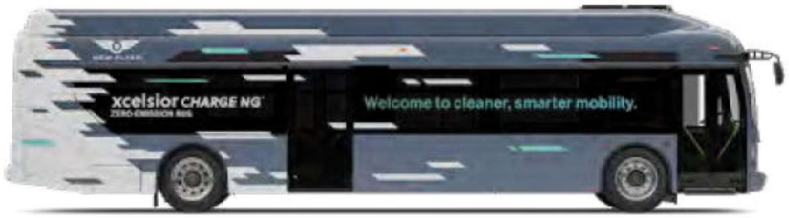
New F yer b ses, from eft Xce s or AV™, Xce s or CHARGE NG™, Xce s or CHARGE H2™, and Xce s or CNG

BETTER PRODUCT

Product Highlights

NFI's portfolio of companies have 450 combined years of experience in business development, manufacturing, transportation solutions and the supply of buses and coaches.

Xce s or CHARGE NG ᴹ, next generat on, zero em ss on, battery e ectr c trans t b s



Environment:

The zero-em ss on Xce s or CHARGE NG™ trans t buses do not em t any greenhouse gas, as compared to the 100 to 160 tons on average em tted from a 40-foot convent ona d ese bus AD s zero-em ss on e ectr c buses reduce we -to-whee greenhouse gas em ss ons by up to 63% compared w th a convent ona d ese bus (when charged w th gr d e ectr c ty), and even more when fu y charged by renewab e energy

n 2020, ARBOC re eased the zero-em ss on battery-e ectr c Equess CHARGE™, and MC aunched the J4500 CHARGE™ n add t on, N Parts™ cont nues to seek out green techno ogy w th ts ntroduct on of no- d e so ut ons, such as so ar pane and e ectron c HVAC systems

Energy Costs:

The Xce s or CHARGE NG™ trans t bus prov des up to $400,000 ower fue costs over the 12-year fe of the bus (compared to a 40-foot d ese bus; actua sav ngs w depend on reg ona energy costs and charg ng methods) ts new ghtwe ght e ectr c tract on dr ve system prov des up to 90% energy recovery

Industry-Leading Accessibility:

ARBOC ed the ndustry by creat ng the first patented ow-floor cutaway and ow-floor non-knee ng cutaway, a ow ng equa access for a passengers

The nnovat ve des gn of MC s D45 CRT E CHARGE™ veh c e prov des eas er board ng and greater ndependence

A of P axton s coach mode s are ava ab e n whee cha r-fr end y vers ons, meet ng the requ rements of the UK s Pub c Serv ce Veh c es (PSV) Access b ty Regu at ons

New yer s SmartR der™ ramp and suspens on system enab es buses to knee to var ab e he ghts, m n m z ng the s ope d fference between a ow-floor ramp and bus floor and u t mate y prov d ng unmatched access b ty for a

The Xce s or AV™ automated trans t bus prov des prec s on dock ng that m n m zes p atform gaps, he p ng to ensure board ng s ADA-comp ant (Amer cans w th D sab t es Act Standards for Access b e Des gn), and ncreas ng access b ty for a passengers

Quiet:

Dur ng the A toona nter or No se 0 to 35 mph Acce erat on Test ng, the Xce s or CHARGE H2™ scored the owest dBA eve , mak ng t the qu etest bus on the market

Interoperable:

New yer nfrastructure So ut ons™ dep oys e ectr c veh c e supp y equ pment and charg ng systems that are compat b e w th a types, makes and mode s of e ectr c veh c es, adher ng to ndustry standards AD s e ectr c buses are s m ar y ava ab e w th nteroperab e charg ng nterfaces for s ow and opportun ty charg ng

BETTER PRODUCT

Leading the *ZE*volution.™

NFI is leading electric bus mobility.

- Our end products are a key dr ver to enab e c t es to ower em ss ons, decrease congest on and enab e econom c opportun ty
- We are comm tted to cont nu ng to nnovate n order to de ver smarter, safer, more susta nab e, and more connected pub c transportat on



Xce s or CHARGE®



BYD AD Env ro200EV

Leading Electric Bus Mobility

105K
veh c es n serv ce (ZEB rep acement opportun ty)

50+
years of e ectr c bus exper ence

13
countr es w th NF buses n serv ce

40M+
e ectr c serv ce m es s nce 2015

80+
c t es w th an NF ZEB n serv ce or on order

1,371
ZEBs de vered from 2015-2020

389
ZEBs de vered n 2020

632
ZEBs n back og as at end of 2020 (5.8% of tota back og)

$24.7M
nfrastructure So ut ons revenue n 2020

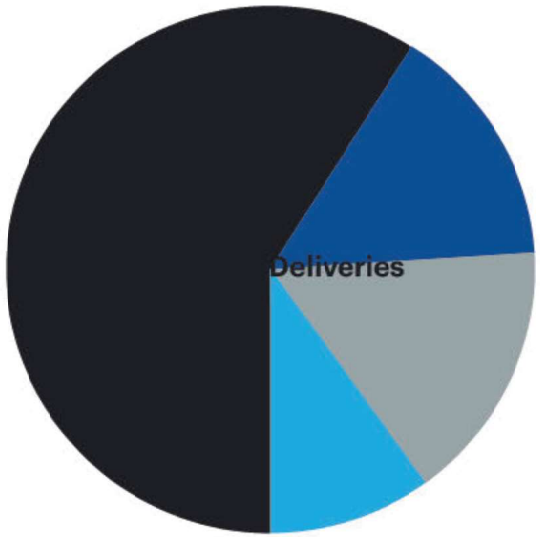
20-25%
of 2021 product on w be ZEBs

8,000
annua ZEB product on capac ty

BETTER PRODUCT

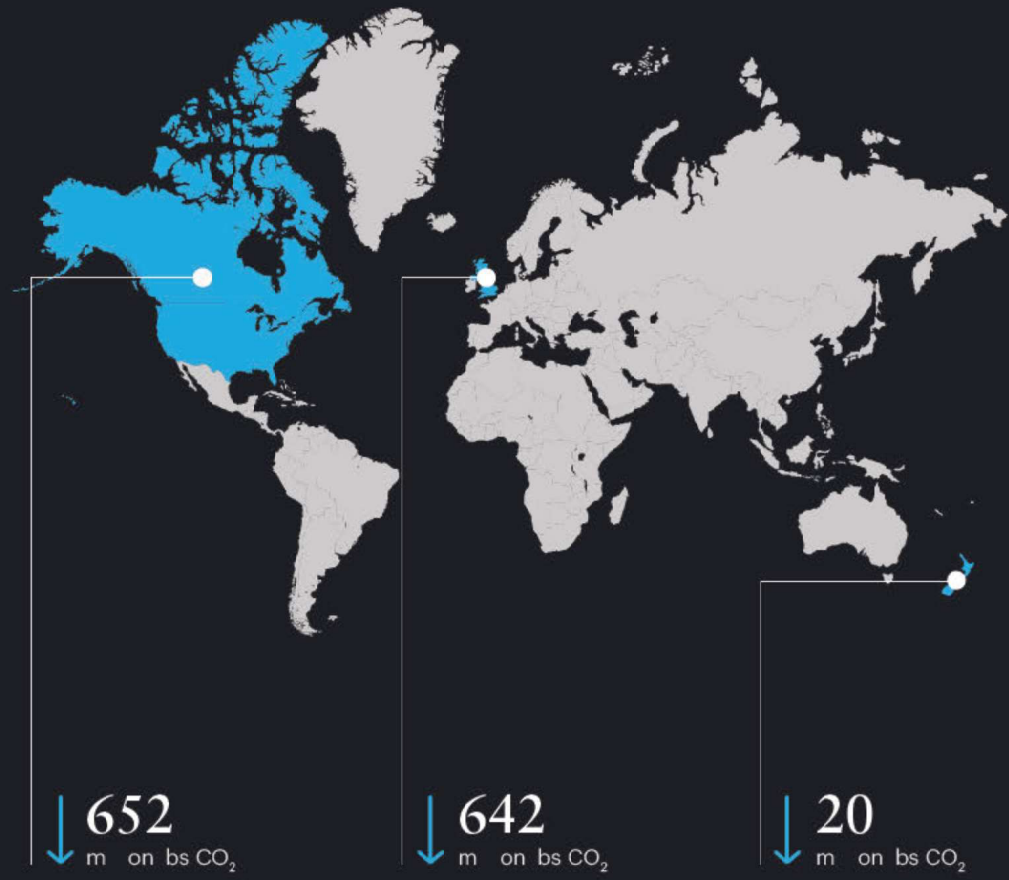
Impact of 2020 ZEB Deliveries

NFI 2020 Deliveries by Propulsion Type



- Diesel
- CNG
- Hybrid
- Battery-Electric

In 2020, NFI sold 389 ZEBs, which will eliminate the equivalent of 1.3 billion lbs of CO_2 over the expected 12-year life of those buses[1]



1. GR T Mode ee co pr n Ca cu a or & A Mo or Veh c e m ss on S mu a or

BETTER PRODUCT

Our Zero-Emission Journey Dates Back to 1969...



1994
rst compressed natura gas (CNG) bus

2005
rst d ese hybr d w th BAE and first gas eng ne hybr d



2012
rst battery-e ectr c bus

2015
aunched New yer Connect®

2018
aunched New yer nfrastructure So ut ons™

Continued on next page

1969
rst North Amer can e ectr c tro ey



1998
rst d ese hybr d veh c e produced w th A son

2010
20 hydrogen fue ce buses for 2010 O ymp cs

2014
rst product on of fue ce range extender

2017
Opened V C and aunched next generat on battery-e ectr c bus

2019
Acqu red AD and aunched Connect 360™

BETTER PRODUCT

...and continues in 2021



New Flyer Xcelsior AV™
North Amer ca s first SAE eve 4 automated heavy-duty trans t bus; zero-em ss on, battery-e ectr c

Li-Cycle™

Battery Recycling Pilot
Successfu aunch of battery recyc ng p ot w th -Cyc e Corporat on



ADL H2.0
Next-generat on hydrogen fue ce -e ectr c doub e-deck



MCI D45 CRT LE CHARGE™
Zero-em ss on, battery-e ectr c, ow-floor motor coach

New Flyer Xcelsior CHARGE NG™
Next-generat on, zero-em ss on, battery-e ectr c trans t bus



ARBOC Equess CHARGE™
Zero-em ss on, battery-e ectr c, med um-duty ow-floor trans t



MCI J4500 CHARGE™
Zero-em ss on, battery-e ectr c uxury motor coach



+ more to come in 2021

BETTER PRODUCT

Case Study
King County Metro

King County METRO
Moving forward together

NEW FLYER.

18-month evaluation of two NFI battery-electric vehicles followed by the purchase of twenty 60-foot EVs will help lower Seattle emissions and assist King County Metro in achieving its vision of 100% zero-emission vehicles by 2040.

n ear y 2021, K ng County Metro awarded New yer w th an order for 20 of ts 60-foot (art cu ated) battery-e ectr c Xce s or CHARGE® buses, fo ow ng the comp et on of an 18-month e ectr c bus p ot project and eva uat on

K ng County Metro s one of the 10 argest trans t agenc es n the Un ted States, prov d ng over 122 m on annua passenger tr ps n K ng County, Wash ngton, and the c ty of Seatt e n January 2020, K ng County Metro announced ts comm tment to ach eve a 100% zero-em ss ons fleet powered by renewab e energy no ater than 2040 The add t on of these 20 battery-e ectr c buses marked a key m estone n he p ng K ng County Metro reach ts goa to mprove a r qua ty, reduce carbon em ss ons, and prov de equ tab e access to susta nab e transportat on

The 18-month p ot project nvo ved test ng the Xce s or CHARGE™ buses aga nst K ng County Metros pre-determ ned key performance nd cators (KP s), nc ud ng range, performance, and serv ce

K ng County Metro noted that the strong partnersh p t found n New yer was a key determ n ng factor n the dec s on to purchase add t ona buses

"New Flyer has been a very good partner to us throughout this lease. It's very important because, what happens after you buy the bus? What happens after you put the infrastructure in place? You need to have a strong partnership with a company that has the resources, the will, and the ability to support the product,"

- Danny o u, Zero Em ss ons eet Strateg c P ann ng Manager, K ng County Metro and Seatt e

"Having delivered over 1,830 buses to King County since 1979, with over half comprised of zero-emission or hybrid electric propulsions on common and proven Xcelsior® bus platforms, New Flyer technology has assisted Metro's transition to clean, quiet, reliable and sustainable transit,"

- Chr s Stoddart, Pres dent, New yer and MC

N subs d ary ARBOC has a so supported Metros comm tment to fast, equ tab e, and re ab e serv ce, w th 37 ow-floor cut-away buses de vered s nce 2011 nc ud ng the reedom, ndependence, berty, and Mob ty mode s



New F yer Xce s or CHARGE®, K ng Co nty Metro, Seatt e, WA

BETTER PRODUCT

The "VIC": The Industry's Vehicle Innovation Center

The only ZEB collaboration center of its kind.

The Veh c e nnovat on Center s the first and on y nnovat on ab n North Amer ca so e y ded cated to the nnovat on and advancement of bus and coach techno ogy The V C prov des comprehens ve e ectr c veh c e (EV) and automated veh c e (AV) tra n ng and workforce deve opment, now ava ab e on ne



Veh c e nnovat on Center, Ann ston, A

VIC | VEHICLE INNOVATION CENTER

2017	3,000+	200+	650+
Launch	V s tors	Agenc es / Operators	Attendees for 2020 V rtua Sess ons

BETTER PRODUCT

The VIC: Vehicle Innovation Center

The center's focus is to promote research and development, education and innovation, progressive manufacturing, and bold thinking, as well as to:

- oster d a ogue through d scuss on, educat on, and tra n ng on the atest zero-em ss on, connected, and autonomous dr v ng veh c e techno og es
- Engage earn ng through nteract ve exh b ts, s mu at on and hands-on exper ences, and observat ons
- Generate nterest and comm tment to c ean a r, qua ty, safety, and econom c benefits for peop e, commun t es, and bus nesses
- Harness the pos t ve nfluence of co aborat on, env ronmenta stewardsh p, and soc a change to advance smart mob ty so ut ons
- Advance bus and coach techno ogy through susta nab e research and deve opment, fresh nnovat on, progress ve manufactur ng, and bo d th nk ng

W th ncreased soc eta focus on susta nab ty to protect the env ronment and preserve natura resources, the demand for zero-em ss on battery-e ectr c buses s qu ck y ncreas ng throughout the wor d N has met th s demand and ra sed the bar w th ts state-of-the-art V C

n 2020, the V C p voted to v rtua earn ng sess ons and hosted over 650 attendees



he V Cs battery e ectr c b ss m ator

24	8
D sp ays	nteract ve Act v t es

3	3	1
Observat on Decks	Charger Types	S mu ator

BETTER PRODUCT

Leveraging Four Pillars to Enable the Future of Mobility

Today, over 3.9 billion people live in urban areas (more than 54% of the world's total population), and urbanization is expected to intensify. By 2045, the global population living in urban areas is expected to surpass 6 billion. As cities continue to grow, so too will demand pressure on urban services – including the need for efficient and sustainable mobility, cleaner air, and multi-modal transportation.

N s best pos t oned to enab e the future of mob ty and meet today and tomorrow s urban demands for sca ab e so ut ons N s accomp sh ng th s through a four-p ar approach

Our comprehens ve, unmatched, nnovat ve approach d rect y supports the evo ut on of zero-em ss on techno ogy, the need for equ tab e access to mob ty, and the deve opment of the workforce that w dr ve a susta nab e future

Through ntens ve nterna tra n ng v a the N earn ng nst tute, and externa tra n ng prov ded v rtua y and n-person by the Veh c e nnovat on Center, N s de ver ng cr t ca y needed workforce deve opment to ts teams and those of trans t agenc es across North Amer ca, bu d ng know edge and sk s on EV and AV techno ogy n the face of rap d zero-em ss on bus adopt on

Commun t es are demand ng c eaner a r and ess congest on, wor d eaders are advocat ng for m t gat on of c mate change, and c t es are demand ng safer, more re ab e and eff c ent mob ty Through a wor d sh ft ng gears, trans t has stepped nto the spot ght as a cr t ca enab er of remob zat on, and N s four-p ar approach w cont nue to meet the need for greater susta nab ty, equ ty, and access b ty n mov ng peop e around the wor d

NFI's Four-Pillar Approach

1 **Buses & Coaches**



2 **Infrastructure**



3 **Smart, Connected Technology**



4 **Workforce Development**



BETTER PRODUCT

The Industry's Widest Range of ZEBs

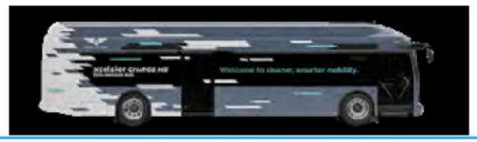
30- & 35-foot
Med um-Duty, ow- oor E ectr c



35-foot
Battery-E ectr c



40-foot
Battery-E ectr c



40-foot
ue Ce -E ectr c



60-foot
Battery-E ectr c



60-foot
ue Ce -E ectr c



Single-Deck
Battery-E ectr c



Double-Deck
Battery-E ectr c



Double-Deck
ue Ce -E ectr c



Motor Coach
Battery-E ectr c



Motor Coach
Battery-E ectr c ow-Entry



BETTER PRODUCT

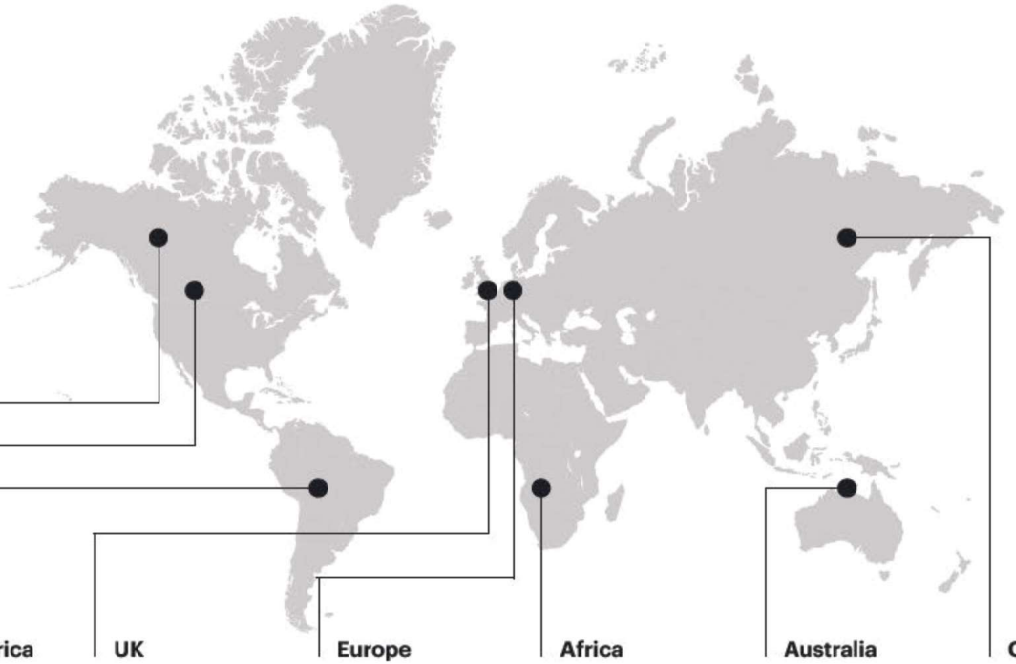
The Global ZEB Opportunity

t w take t me to move to 100% ZEB fleets g ven current fleet status and adopt on rates, but there s a mass ve opportun ty for em ss on reduct on as countr es around the wor d trans t on to ZEBs f each reg on p ctured be ow were to move to a 100% ZEB fleet, the comb ned equ va ent of ~9 tr on bs of CO_2 wou d be e m nated over the expected 12-year m n mum fe of those buses

Global installed bus fleets, number of installed ZEBs, and the opportunity for emission reduction

Poss b e em ss on reduct on over the expected 12-year fe of bus fleets f 100% of ex st ng fleets moved to ZEB

% of nsta ed bus fleets that are current y ZEB



Canada
53
b on bs CO_2
2.5%
ZEB nsta ed

U.S.
205
b on bs CO_2
2.0%
ZEB nsta ed

Latin America
3,289
b on bs CO_2
0.2%
ZEB nsta ed

UK
122
b on bs CO_2
2.7%
ZEB nsta ed

Europe
2,900
b on bs CO_2
0.7%
ZEB nsta ed

Africa
1,179
b on bs CO_2
0.3%
ZEB nsta ed

Australia
113
b on bs CO_2
1.6%
ZEB nsta ed

China
937
b on bs CO_2
60%
ZEB nsta ed

Source Sus a nab e Bus, AC A, S agecoach, ns de C ma e News, R , ndus ry Week, Bus ndus ry Confedera on, Managemen s ma es. Canada/US repor ed n qu va en Un s. Da a as of end of December 2020.

BETTER PRODUCT

Case Study
Cradle-to-Grave Sustainability

Battery Recycling

As part of ts env ronmenta and commun ty comm tments, N s cont nuous y exp or ng ways to susta nab y recyc e end-use products n January 2021, N announced the successfu aunch of a battery recyc ng p ot w th North Amer cas argest th um- on battery recyc er, -Cyc e Corporat on (-Cyc e)

-Cyc e offers a propr etary, c osed oop th um- on battery resource recovery serv ce produc ng m n ma so d waste, and zero qu d and a r em ss ons that can susta nab y produce battery grade th um, coba t, and n cke products The p ot was -Cyc es first program n the heavy duty veh c e space

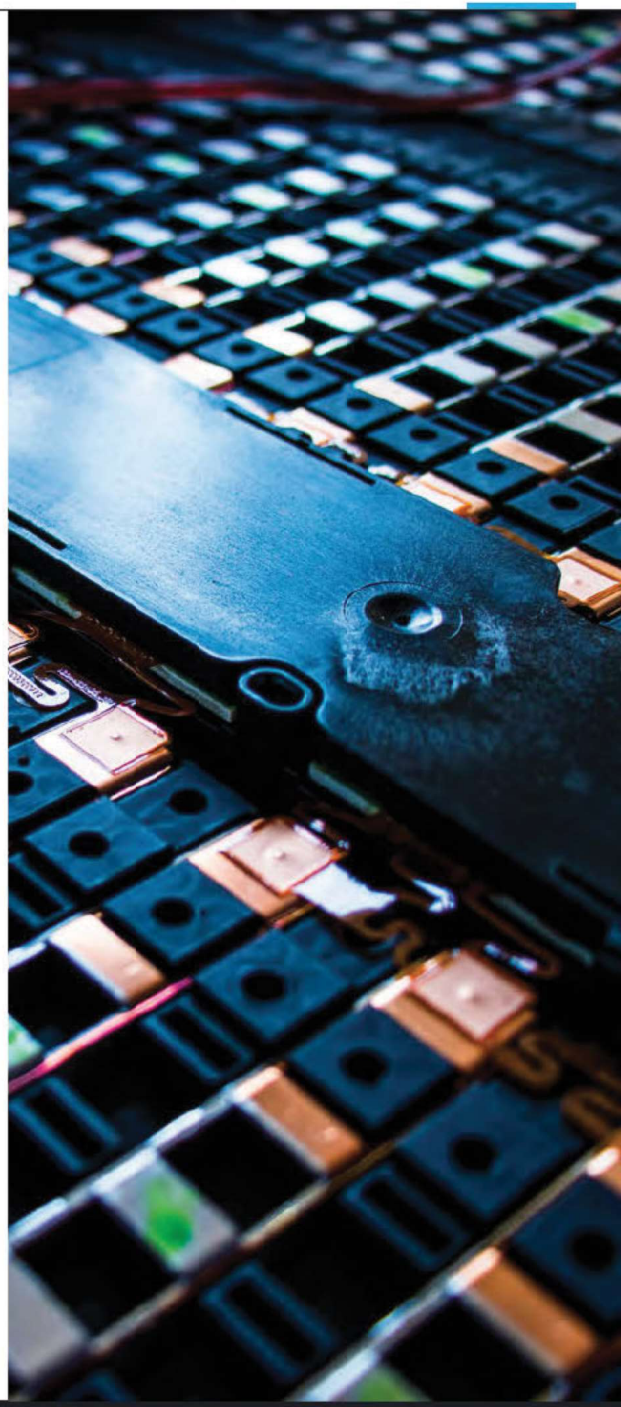
N prov ded -Cyc e w th 45 end-of- fe th um- on battery modu es (used for research and deve opment) tota ng 3,200 pounds to be processed at -Cyc es Spoke fac ty and turned nto b ack mass, wh ch s then further refined to recover cr t ca mater a s such as n cke and coba t

-Cyc es patented Spoke & Hub techno og es recover an mpress ve 95% of a th um- on battery mater a s – extract ng h gh-grade mater a s for battery reproduct on, at a ower econom c and env ronmenta cost than m ned and refined mater a

Key d fferent ators of the Spoke & Hub mode nc ude an automated process at Spoke fac t es where batter es are rece ved n any state of charge and are mechan ca y shredded w th no sort ng, d smant ng, d scharg ng, or therma process ng needed Patented -Cyc e Hub techno ogy then ntakes the b ack mass produced at Spoke p ants, processes the mater a s hydrometa urg ca y (e us ng aqueous so ut ons for the recovery of meta s), and outputs h gh-pur ty battery bu d ng b ocks to be red rected to the th um- on battery supp y cha n and broader economy

New yer and -Cyc e are both members of CA START, an nternat ona nonprofit ded cated to acce erat ng the pace of c ean techno ogy and the adopt on of c ean transportat on

Li-Cycle™





NFI

ENVIRONMENTAL, SOCIAL & GOVERNANCE REPORT FOR 2020

Better Workplace

A better product.
A better workplace.
A better world.

BETTER WORKPLACE

Environment, Health & Safety Policy

Understanding the importance of sustainability, NFI is committed to protecting human health and the environment within our facilities and globally. We recognize the impact we have through our direct operations, supply chain, and consumer use of our products and services, through the consumption of natural resources, energy, water, and the generation of waste. As such, this policy applies to all of our facilities and operations, as well as contractors and suppliers through NFI's Supplier Code of Conduct.

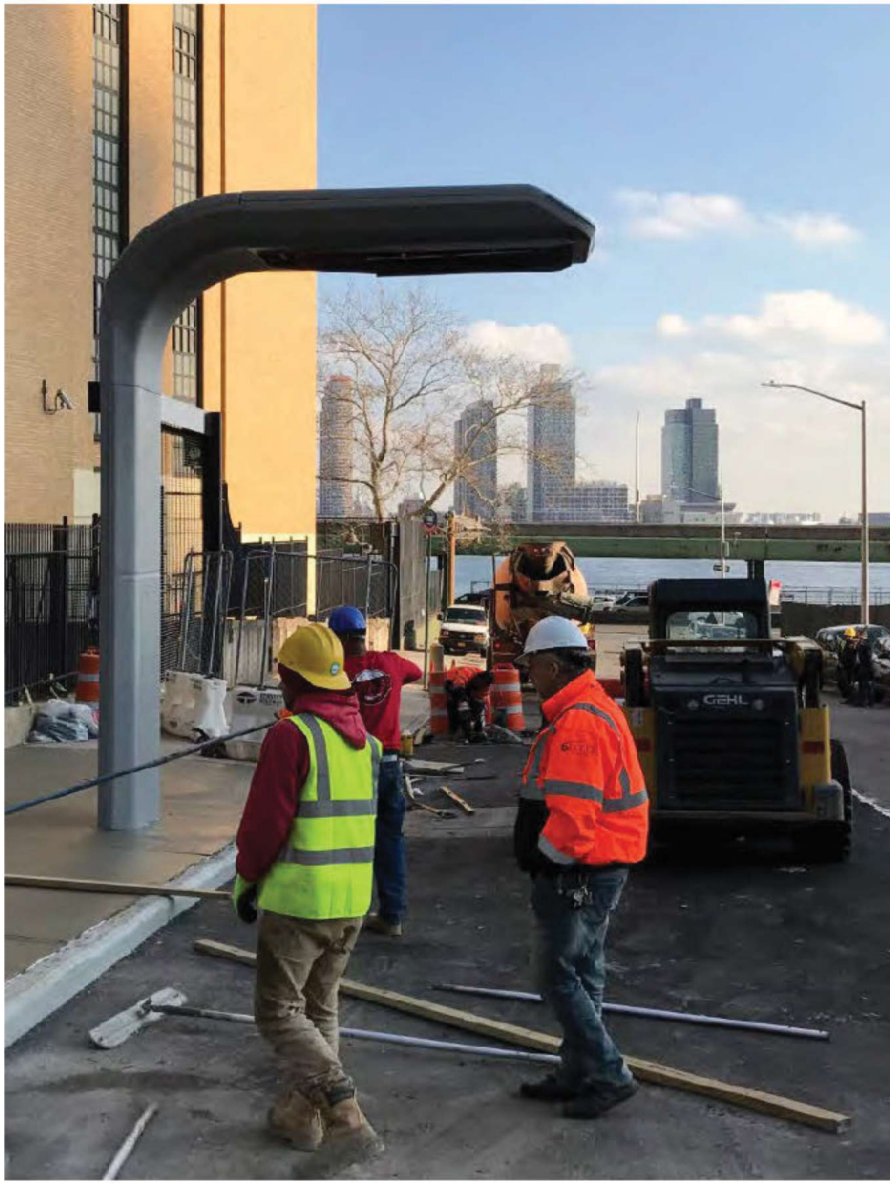
At N , we be eve that noth ng s more mportant than the hea th and safety of our team members and others v s t ng or work ng n our fac t es We are comm tted to meet ng our Env ronment, Hea th and Safety (EHS) respons b t es and ma nta n ng a safe work ng env ronment at a ocat ons Hea th, safety and the protect on of the env ronment s the respons b ty of a and a top pr or ty for N

We are comm tted to comp y ng w th a app cab e EHS aws and other requ rements to wh ch we subscr be mproved EHS performance s cont nua y sought at a N ocat ons through the ntegrat on of r sk-based and cost-effect ve management pract ces, wh ch are app ed to s te act v t es

Adherence to the EHS po cy s the respons b ty of a emp oyees and persons work ng at or v s t ng our fac t es

W th wor d-c ass workp aces and manufactur ng fac t es, N cont nues to ead the ndustry n the des gn, bu d, and de very of fue -eff c ent and zero-em ss on buses and coaches

Our Env ronment, Hea th & Safety Po cy may be requested through **nfigroup.com/contact**



NF nfrastr ct re So t ons™ nsta at on

BETTER WORKPLACE

Ongoing Commitments

- Seek to ntegrate EHS cons derat ons nto our product and process des gn, manufactur ng and bus ness p ann ng
- Cons der the fe cyc e perspect ve
- Protect assets through robust r sk assessment pract ces
- Prov de safe and secure fac t es for emp oyees, customers and v s tors by
  - Ma nta n ng and mprov ng a progress ve EHS management system w th programs des gned to prevent nc dents and prov de effect ve procedures n the event of emergency
  - Ma nta n ng and support ng act ve hea th and safety comm ttees or representat ves at each ocat on
  - Cont nuous y str v ng to ma nta n a c ean and organ zed workp ace, free from debr s and recogn zed hazards
  - Prov d ng support for a EHS procedures, nc ud ng but not m ted to superv sory tra n ng and the prompt e m nat on of recogn zed hazards
- Requ re that contractors, supp ers, and the r workers meet or exceed a N EHS program requ rements
- Deve op an understand ng among those n eadersh p pos t ons of the r respons b t es to prov de and promote a safe, hea thy and env ronmenta y respons b e workp ace
- Prevent po ut on w th top pr or ty of waste prevent on at source, e m nat on of wastefu pract ces, and recyc ng
- Respons b y, eff c ent y, and susta nab y use natura resources such as energy, water and wood products
- M n m ze our contr but on to c mate change, and deve op and produce products that transpo t peop e wh e a so reduc ng greenhouse gas em ss on footpr nts
- n accordance w th our EHS management system requ rements, per od ca y rev ew th s po cy statement to ensure ts cont nu ng su tab ty and commun cate changes and add t ons as appropr ate



BETTER WORKPLACE

2020 Occupational Health & Safety Performance

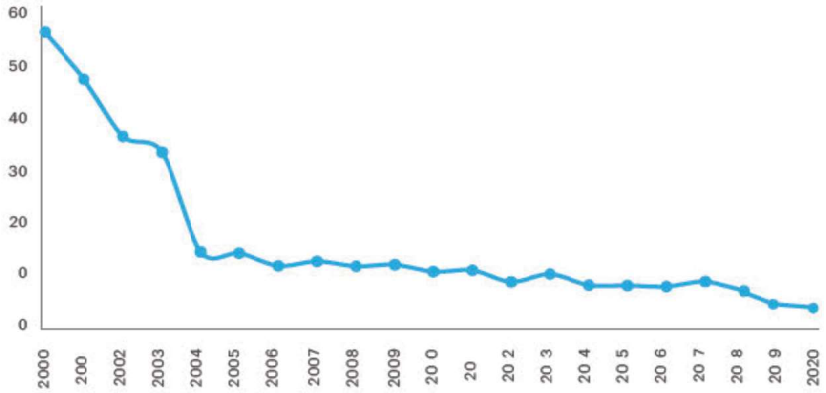
Safety performance s tracked and measured aga nst our respect ve North Amer can ndustry C ass ficat on System (NA CS) codes as a benchmark for s m ar ndustry performance Reports are produced and shared month y w th management and emp oyees 2020 nc dent rates showed mprovement even though norma product on operat ons and dep oyment of EHS resources were s gn ficant y mpacted due to COV D-19 response act v t es N d d not have a fata ty at any of ts ocat ons n 2020

2020 NFI OSHA Rate: 4.4 → 2021 NFI OSHA Target Rate: 3.4
2020 NFI Lost Time Rate: 1.6 → 2021 NFI Lost Time Target Rate: 1.3
2020 NFI Fatality Rate: 0.0 → 2021 NFI Fatality Target Rate: 0.0

N s focused on emp oyee safety OSHA and ost T me nc dent rates are tracked and reported month y to both management and emp oyees Week y and month y reports capture a N emp oyees, wh e contractor nju es are nvest gated and recorded w th the Pr mary Contractor respons b e for work

NFI OSHA Rate

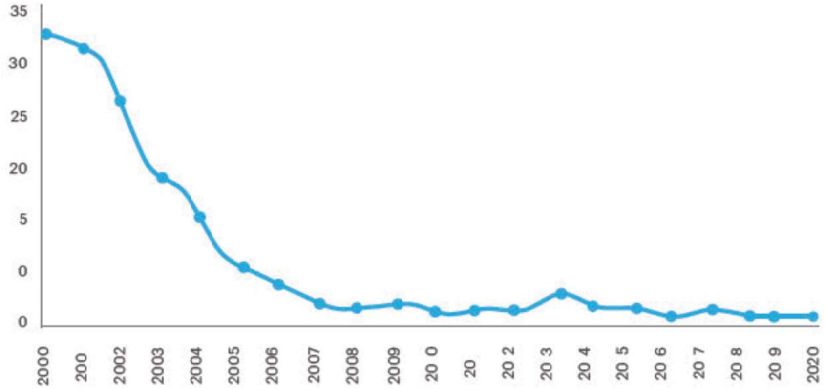
(occu ences pe 200,000 hou s)



S nce 2000, Ou OSHA and Lost me Rates have educed by 90% and 96% espect ve y

NFI Lost Time Rate

(occu ences pe 200,000 hou s)



Safety

N s focus on occupat ona hea th and safety has resu ted n strong and cont nuous mprovements over the past two decades Management be eves that N s ded cated comm tment to safety and hea th mprovements s not on y a compet t ve advantage for the organ zat on, but s essent a to the creat on of a safe and hea thy work ng env ronment for N s emp oyees and operat ons

BETTER WORKPLACE

Case Study
Clean and Protect™

NFI launched the Clean and Protect™ product and solution line to assist operators with restoring and maintaining consumer confidence during the COVID-19 pandemic.



n 2020, N Parts™, the parts subs d ary of N , aunched ts C ean and Protect product ne—a su te of safety, c ean ng, and d s nfect ng products—as a response to the COV D-19 pandem c

C ean and Protect products are cr t ca components n restor ng and ma nta n ng r der confidence, and each work to support the five pr nc p es of bus and coach transportat on safety

The Five Principles of Bus and Coach Transportation Safety



Disinfecting



Distancing



Air Quality



PPE



Communication

nfi.parts

Proactive Air and Surface Purification ("PASP")

N s Proact ve A r and Surface Pur ficat on (PASP) system s an examp e of a so ut on ava ab e from the C ean and Protect™ ne The PASP system uses propr etary techno ogy to create advanced pur ficat on by produc ng H gh Energy C usters that are d str buted throughout the nter or of the veh c e, safe y san t z ng both a r and surfaces, eav ng beh nd no harmfu res due t s mounted d rect y n the passenger compartment, a ow ng for deact vat on of v ruses as they are ntroduced nto the veh c e V rus deact vat on at the source of ntroduct on s one of the cr t ca factors to ncreas ng passenger and veh c e safety

PASP: "The Most Validated Purifier on the Market"

Test ng at the Un vers ty of or da confirmed the PASP techno ogy deact vates SARS-CoV-2, the v rus that causes COV D-19, as we as coronav rus 229E The techno ogy has a so been tested n a stat onary mass transportat on veh c e env ronment where surface bacter a eve s were reduced to a most non-detectab e eve s and VOC (vo at e organ c compounds) a r qua ty measurements were reduced by a most 96% n-serv ce test ng done n partnersh p w th the C ty and County of Hono u u showed overa bacter a count reduct on of 99 3% and va dated the techno ogy s ab ty to deact vate the SARS-CoV-2 v rus

Keeping Riders Safe in Washington State

n ear y 2021, N announced that GO Trans t and Va ey Trans t, both ocated n Wash ngton state, were keep ng the r r ders safe w th the PASP system, where t s ab e to d s nfect the veh c e wh e t s on the road, w thout downt me or add t ona c ean ng dur ng serv ce

We re extreme y happy to have someth ng nsta ed n our fleet that s ab e to d s nfect a r and surfaces throughout the day, sa d Ron McDona d, Genera Manager, Va ey Trans t The un t runn ng wh e buses are on the road, pa red w th da y c ean ng crews and new dr ver barr ers, covers a bases

BETTER WORKPLACE

Workplace Culture

NFI fosters a workplace culture that is inclusive, promotes continuous improvement, and embraces efforts to empower team members through employee listening channels and responsive action.

Our v s on s to ach eve bus ness success through a gned and engaged emp oyees, and the de very of resources and serv ces to prepare our peop e to support the growth and profitab ty of the company gu ded by the pr nc p es of N We do so w th these va ues at work

- We care about our commun t es and the env ronment
- We care about peop e
- We be eve prov d ng a safe work env ronment s cr t ca
- We a m to create a commun ty sp r t w th n N , through soc a comm ttees/company events encourag ng emp oyee nvo vement at a eve s
- We a m to be a great organ zat on to work for and an emp oyer of cho ce
- We empower our peop e through earn ng and deve opment and create opportun t es for advancement
- We str ve to do the r ght th ng and a m to exemp fy our core pr nc p es n everyth ng we do



BETTER WORKPLACE

Workplace Culture

In addition to annual performance reviews, NFI provides leadership development, team coaching and mentorship by the management support team, and also conducts and assesses leadership performance each year through anonymous peer surveys.

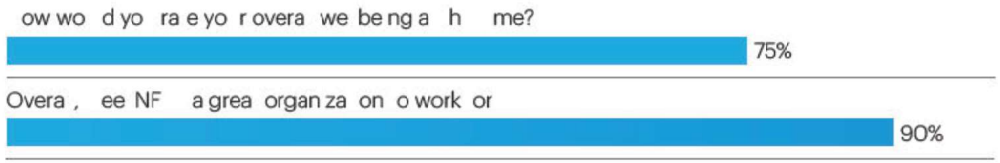
n add t on, the eadersh p team has persona and profess ona goa s estab shed each year, wh ch are measured and mon tored through a Management By Object ves goa structure

We measure progress n emp oyee sat sfact on through our Emp oyee eedback ramework, wh ch nc udes emp oyee surveys, e ectron c feedback, round tab e commun cat on, and 360 eadersh p feedback

n 2020, we conducted an anonymous COV D-19 emp oyee pu se check to gauge progress on safety, we ness, and emp oyee sat sfact on and to determ ne the effect veness of COV D safety protoco s and emergency response commun cat on A ser es of e ght quest ons nc uded an overa 58% response rate from a N emp oyees Emp oyees were a so asked to assess whether they fe t that N was a great organ zat on to work for and th s quest on rece ved a favourab e response rate of 90% n 2020, mprov ng from 82% n 2018 and 78% n 2016 Another COV D Pu se Check Survey s schedu ed for a 2021 The next fu survey s schedu ed for Summer 2022



NFI December 2020 Employee Pulse Check



BETTER WORKPLACE

Equal Employment Opportunity

NFI seeks to employ the best qualified team, better representing communities we work and live in, and promoting activity free from discrimination. We encourage team-building and respecting unique differences, all of which lead to a better culture and respectful workplace in accordance with our Human Rights statement.

Employment

N s comm tted to recru t, h re, tra n and promote nto a job eve s the most qua fied persons w thout regard to race, co or, re g on, gender or gender express on, sexua or entat on, nat ona or g n, age, mar ta status, genet c nformat on, d sab ty, veteran, or d sadvantaged status (defined as be ng home ess, be ng a custod a s ng e parent, rece v ng pub c ass stance, ack ng a genera educat on deve opment or h gh schoo d p oma, hav ng a cr m na record or other nvo vement w th the cr m na just ce system, suffer ng from chron c unemp oyment, or emanc pated from the foster care system)

We have nst tuted act on-or ented programs des gned to e m nate dent fied obstac es and he p us ach eve our mprovement goa s

Compensation

We work to advance emp oyment for a peop e and are comm tted to adm n ster a emp oyment matters n accordance w th the va ue we p ace on foster ng a d verse and we com ng workp ace that va ues the contr but ons of a emp oyees and that emp oyees protected categor es, nc ud ng gender, shou d not factor nto compensat on dec s ons

We be eve that fa r and equ tab e pay shou d be an essent a e ement of any successfu bus ness mode , and we are proud to stand w th other compan es that share th s same va ue N conducts gap ana yses on an ongo ng bas s to dent fy any pay d screpanc es and makes adjustments whenever unaccounted for d screpanc es are found We pract ce transparency and m t d scret on n pay dec s ons

Living Wage Assessment

N acknow edges and supports the need to contr bute to the econom c we -be ng of our team members and the commun t es n wh ch our compan es operate

As an mportant first step, N has commenced a v ng wage assessment of the ma n trans t bus product on fac t es of New yer, ts subs d ary, n Canada and the Un ted States to understand the compet t veness of New yer s wage sca es n re at on to app cab e oca v ng wage gu de nes We ant c pate comp et ng th s n t a assessment work over the next 12-month per od and w prov de an update on our progress and the opportun t es observed n the 2021 ESG Report



BETTER WORKPLACE

Leading with Integrity

NFI is committed to conducting all business activities with the highest standards of fairness, honesty, and integrity, and to complying with all legal and regulatory requirements, especially with respect to employees, suppliers, competitors, government and the public.

We str ve to outperform our compet tors fa r y and honest y, wh e a ways fo ow ng eth ca and ega bus ness pract ces Each d rector, off cer, emp oyee and agent of N s bound by the Code of Bus ness Conduct and Eth cs when h red or reta ned Emp oyees n eadersh p, adm n strat ve, and customer ro es are prov ded a copy of the Code on an annua bas s A other emp oyees are prov ded a copy of the Code on a b annua bas s Each emp oyee s requ red to s gn and acknow edge the r ob gat on to adhere to the Code

N Code of Bus ness Conduct and Eth cs tra n ng s conducted v a N s earn ng management system and a qu z s comp eted to test that a team members understand the Code and how t app es to them The N Code of Bus ness Conduct and Eth cs may be obta ned at **www.nfigroup.com**

The N Wh st eb ower Po cy out nes procedures for the rece pt, retent on, and treatment of comp a nts regard ng actua or apparent v o at ons of the Code, the D sc osure and ns der Trad ng Po cy, and the aw genera y and spec fica y regard ng nterna account ng contro s or aud t ng matters N Wh st eb ower Po cy may be obta ned at **www.nfigroup.com**

Reports or nanc a A egat ons Reports may be subm tted to the Eth cs and Comp ance Hot ne on a confident a and anonymous bas s, by phone or on ne us ng an ndependent th rd-party report ng serv ce prov ded by NAVEX G oba



Pa So bry, Pres dent & Ch ef Exec t ve Off cer, NF , speaks to CBC reporters at NF s prod ct on fac ty n W nn peg, Canada

BETTER WORKPLACE

Anti-Corruption and Bribery Policy

N s comm tted to conduct ng ts bus ness free of corrupt on, br bery, and any mproper nfluenc ng act on when dea ng w th government and pub c off c a s

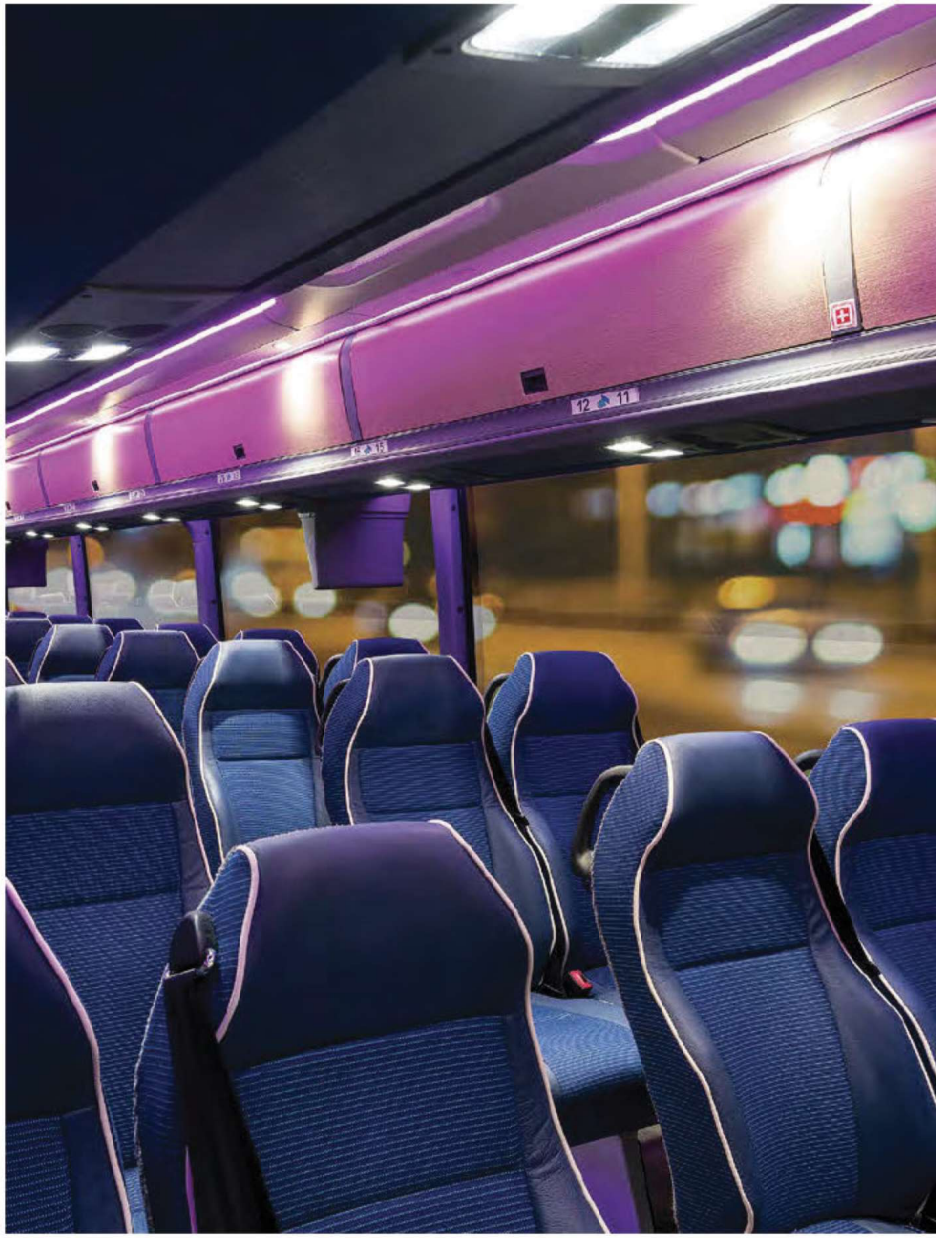
N s ant -corrupt on pr nc p es govern re at onsh ps and nteract ons w th pub c off c a s, payments, records of payments and th rd-party dea ngs Add t ona y, N emp oyees w th n scope of th s po cy are tra ned to fam ar ze themse ves w th add t ona restr ct ons and spec fic requ rements of the pub c agenc es w th whom they nteract Tra n ng for a emp oyees w th n the po cys scope s conducted on an annua bas s

The Eth cs Off cer (the Execut ve V ce Pres dent, Genera Counse and Corporate Secretary, N) can be reached at **ethics@nfigroup.com** for quest ons or gu dance

Political Advocacy

N w not make contr but ons of any k nd (money, emp oyee work t me, goods or serv ces), d rect y or nd rect y, to po t ca part es or cand dates, or to promote or support ba ot n t at ves, n t at ve measures, propos t ons or s m ar proposa s or measures nc ud ng through ntermed ary organ zat ons such as po t ca act on comm ttees, campa gn funds, or trade or ndustry assoc at ons

N s Po t ca Contr but on Po cy may be found at **www.nfigroup.com**



BETTER WORKPLACE

Respectful Workplace

NFI has zero tolerance for workplace discrimination and harassment. All employees are responsible for ensuring that NFI is a safe and respectful environment, free of discrimination and harassment, where high value is placed on equity, fairness and dignity.

D scr m nat on and harassment based on race, gender dent ty or express on, sexua or entat on, co or, nat ona or ethn c or g n, re g on, mar ta status, fam y status, c t zensh p status, veteran status, age or ab t es s proh b ted N has zero to erance for acts of v o ence, threats of v o ence, and acts of nt m dat on aga nst another person or group

A emp oyees are requ red to comp ete tra n ng regard ng the Respectfu Workp ace po cy and report ng procedures on a two-year cyc e N has robust nc dent report ng and nvest gat on processes to ma nta n confident a ty and to prevent non-reta atory behav or



BETTER WORKPLACE

Human Rights Statement

Our Commitment

At N , we are comm tted to respect ng the human r ghts and d gn ty of nd v dua s w th n our operat ons, supp y cha n, and commun t es where we do bus ness, and to promot ng and protect ng the human r ghts of our team and other stakeho ders We str ve to do th s through our Code of Bus ness Conduct and Eth cs, our Supp er Code of Conduct and other Group po c es n recogn t on of the evo ut on of human r ghts and that c rcumstances may change over t me, we regu ar y rev ew our human r ghts approach and focus areas and make updates where appropr ate

Our Approach

We v ew human r ghts w th n the mean ng of nternat ona y recogn zed human r ghts Our approach s nformed by nternat ona pr nc p es nc ud ng those encompassed n the Un ted Nat ons Gu d ng Pr nc p es on Bus ness and Human R ghts, Un versa Dec arat on of Human R ghts, nternat ona B of R ghts, and the nternat ona abor Organ zat on s Dec arat on on undamenta Pr nc p es and R ghts at Work

Based upon our operat ona context and ab ty to nfluence, N s human r ghts approach focuses on the management of human r ghts w th n our operat ons, supp y cha n and commun t es n wh ch we do bus ness Among other th ngs, we concentrate on abor and emp oyee we fare or examp e, the work ng cond t ons of our emp oyees are, at m n mum, n comp ance w th nternat ona y recogn zed abour standards and the aws of the countr es n wh ch we operate

n accordance w th re evant aws and regu at ons, and as descr bed n our Code of Bus ness Conduct and Eth cs as we as our Supp er Code of Conduct, we str ve to

- Treat peop e w th respect and d gn ty, n accordance w th reasonab e expectat ons
- oster a workp ace free of harassment and d scr m nat on
- Prov de an nc us ve workp ace, and promote d vers ty n the workp ace
- Proh b t forced, bonded, traff cked and ch d abor n our operat on and to avo d such abor n our supp y cha n
- Recru t eth ca y based on the needs of our bus ness and seek to recogn ze the ta ent and potent a of new app cants
- Prov de fa r wages and benefits that are based on the cons derat on of numerous app cab e factors
- Promote hea th and safety n the workp ace as descr bed n our Env ronmenta , Hea th, and Safety Po cy
- Adopt pract ces to protect the persona nformat on of our emp oyees and customers
- Recogn ze the freedom of workers to assoc ate or not assoc ate w th a abor un on, and to co ect ve y barga n when represented by a ega y recogn zed abor un on

urther nformat on about the N Group Human R ghts statement s ava ab e at **www.nfigroup.com**

BETTER WORKPLACE

Supply Chain Management

NFI seeks to do business with reputable business partners who are committed to ethical standards and business practices compatible with those set out in the NFI Group Supplier Code of Conduct. NFI strongly encourages suppliers to exceed the requirements of this Code and to promote best practices and continuous improvement throughout their operations.

N takes proact ve steps to ensure that t does not conduct bus ness w th persons or ent t es that use forced, ndentured, nvo untary or ch d abor, or engage n human traff ck ng A supp ers, domest c and fore gn, are subject to on-s te ver f cat on aud ts of the r qua ty and management systems to ensure adherence to N s spec f cat ons and requ rements These supp er ver f cat on aud ts nc ude a rev ew of the supp er s safety management and human resources po c es

N sourc ng personne rece ve tra n ng spec f c to the r sks of proh b ted abor pract ces to ensure d gence s susta ned w th n supp er management processes Supp ers that operate n h gh-r sk reg ons must prov de an off c a cert f cat on attest ng they do not part c pate n any of these act v t es n the event t s determ ned that a supp er engages n any of these act v t es, N w move to deve op a ternate sources of supp y and w term nate ts re at onsh p w th the offend ng supp er

Approved supp ers are requ red to manufacture products and prov de serv ces n accordance w th a other app cab e aws, statutes, ru es, regu at ons, ord nances, and standards of a app cab e government agenc es and author t es, nc ud ng env ronmenta , occupat ona hea th and safety standards, emp oyment and m n mum wage requ rements, and export/ mport requ rements

N s proud to prov de D sadvantaged Bus ness Enterpr ses (DBE) and M nor ty Women Bus ness Enterpr ses (MWBE) the opportun ty to part c pate n the sourc ng of components and mater a s used n manufactur ng We estab sh an annua goa of MBE/DBE/MWBE part c pat on n our Supp y Cha n and act ve y work to dent fy, onboard and deve op m nor ty and d sadvantaged bus nesses

N s Supp er Terms and Cond t ons may be requested through **nfigroup.com/contact**



BETTER WORKPLACE

Data Security & Privacy

NFI has established data and cyber security policies outlining our guidelines and provisions for preserving the security of our data and technology infrastructure.

We understand that the more we re y on techno ogy to co ect, store, and manage nformat on, the more vu nerab e we can become to secur ty breaches or th s reason we have out ned cons derab e secur ty measures n our mob e dev ce usage, soc a med a and ema / nternet usage po c es to prov de N team members w th nstruct ons on how to protect persona and company dev ces, safe y use ema , manage passwords and transfer data secure y

N has estab shed a group data pr vacy po cy out n ng our comm tment to comp y w th a app cab e pr vacy aws n the countr es n wh ch we operate or conduct bus ness The app cab e N compan es comp y w th the Genera Data Protect on Regu at on (GDPR) regard ng the use and management of persona data n reg ons n wh ch GDPR app es

We have taken add t ona measures to mp ement a Pr vacy and Data Secur ty nc dent Response P an that out nes workforce respons b t es and how to report any suspected nc dents Regu ar tra n ng s prov ded to emp oyees regard ng how to detect scam and ph sh ng ema s, and we encourage our emp oyees to reach out to N s ega department w th quest ons or concerns



BETTER WORKPLACE

NFI Learning Institute

NFI invested approximately $5 million in training in 2020.

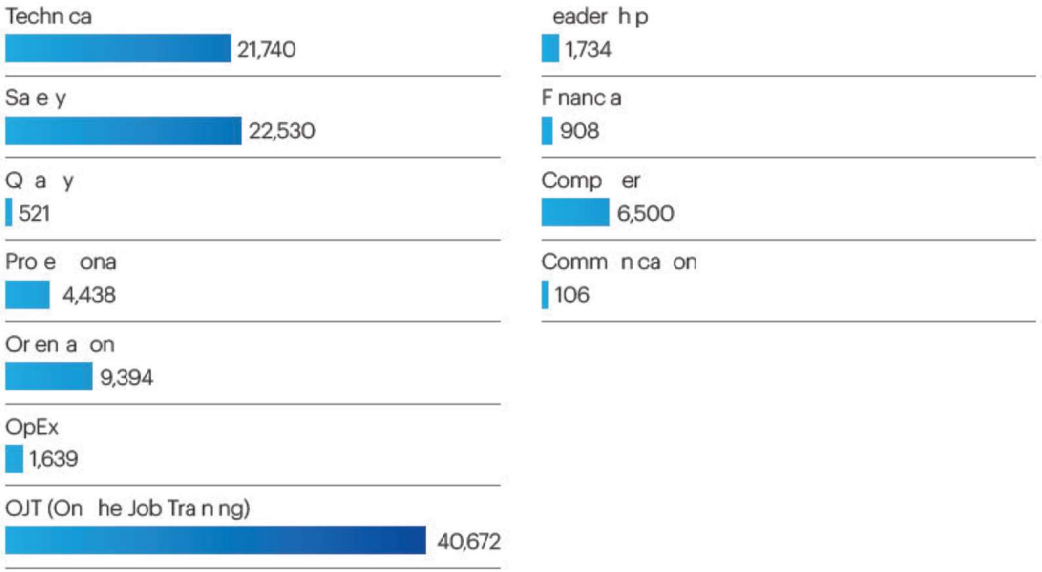
N de vers cons derab e tra n ng and educat ona programm ng that s d rected at support ng the success of the organ zat on and ts workforce The N earn ng nst tute dr ves tra n ng and deve opment across a bus nesses through the de very of tra n ng programs that support the d verse needs of our workforce To ensure that the programm ng s re evant and meets the ever-chang ng requ rements of N and the ndustry, the N earn ng nst tute engages n ma nta n ng strong nterna oca and reg ona partnersh ps that he p support tra n ng pr or t es a gned w th organ zat ona goa s

N focuses on a areas of deve opment wh ch nc ude a robust or entat on program for those jo n ng N , techn ca and profess ona deve opment that supports the workforce n the r current and future ro es, p us eadersh p tra n ng and workshops for current and emerg ng eaders

To meet the tra n ng needs of a geograph ca y w despread workforce, the N earn ng nst tute conducts tra n ng n person and on ne



NFI Training Hours 2020 by Topic



BETTER WORKPLACE

Xpressline

Launched in 2014, Xpressline is an electronic employee suggestion and feedback program that has delivered tremendous value to New Flyer and NFI Parts and will be extended to MCI in 2021.

Emp oyees can subm t the r suggest on and/or feedback and rece ve a response through the on ne system to the r ema or t cket number n 2020, we rece ved 511 subm ss ons even w th the mpacts of COV D-19 and two months of d ed fac t es, and we have seen a steady ncrease n subm ss ons s nce 2014

Emp oyee feedback through Xpress ne can nc ude, but s not m ted to, the fo ow ng

- Genera eedback
- Company ntranet mprovement
- Soc a Comm ttee eedback and Suggest ons
- Safety Concerns and Suggest ons
- Env ronmenta Concerns and Suggest ons
- Respectfu Workp ace Concerns
- oss Prevent on Concerns and Suggest ons
- Border Secur ty Concerns and Suggest ons
- Product and Bu d Process mprovement Suggest ons
- Tra n ng and Deve opment Concerns and Suggest ons



BETTER WORKPLACE

Case Study
ADL's Employee Well Being Initiative

NFI strongly believes that mental health and wellbeing is important for a healthy lifestyle. Early on in the pandemic, ADL realized that mental health has become an important challenge in the workplace and implemented a series of initiatives to support its team members throughout 2020.

Start Well program



AD organ zed a week- ong ser es of five 15-m nute sess ons start ng at 8 00 a m oca t me, focused on breathwork and med tat on, to create a moment of ca m and to he p set members up for the day ahead The sess ons were recorded for those unava ab e to jo n at the spec fied t me

eedback was ncred b y pos t ve for these breath and med tat on sess ons, and AD has p ans to extend th s ser es nto 2021

- 87% found the sess ons benefic a
- created a sense of togetherness
- t was good to re ax my m nd for the start of the day
- Great to see the company nvest n someth ng ke th s

Mental Health First Aiders

AD strong y be eves that menta hea th and phys ca hea th shou d be va ued equa y To proact ve y support menta hea th, AD prov ded tra n ng for more than 35 vo unteer Menta Hea th rst A ders Menta Hea th rst A ders were taught to dent fy, understand and respond to s gns of menta hea th cha enges; earn r sk factors and warn ng s gns; be prepared when a menta hea th cr s s occurs; and ass st emp oyees w th find ng appropr ate ass stance for the r spec fic c rcumstance AD ensured that a s tes had representat ves ava ab e to prov de support to those n our fac t es, as we as those work ng remote y #endthest gma

"When I had the chance to volunteer to become a Mental Health First Aider, I thought it was a great opportunity to be a part of an initiative at our workplace which will increase mental health awareness and reduce the stigma attached to mental health. Mental Health is something which can affect anyone and everyone."

- Menta Hea th rst A der, UK

Mental Health Awareness e-Learning

n add t on, AD managers part c pated n an on ne menta hea th awareness program to earn to better understand and support menta hea th n the workp ace Externa y hosted programs were a so he d for ne managers

E ectron c gu des and handouts were prov ded to managers and emp oyees, on top cs nc ud ng support ng remote work ng and ho d ng effect ve v rtua meet ngs

> " Following the success experienced at ADL, NFI is now looking to roll out these practices more broadly across the Group. "



NFI

ENVIRONMENTAL, SOCIAL & GOVERNANCE REPORT FOR 2020

Better World

A better product.
A better workplace.
A better world.

BETTER WORLD

Celebrating Diversity, Inclusion & Equity

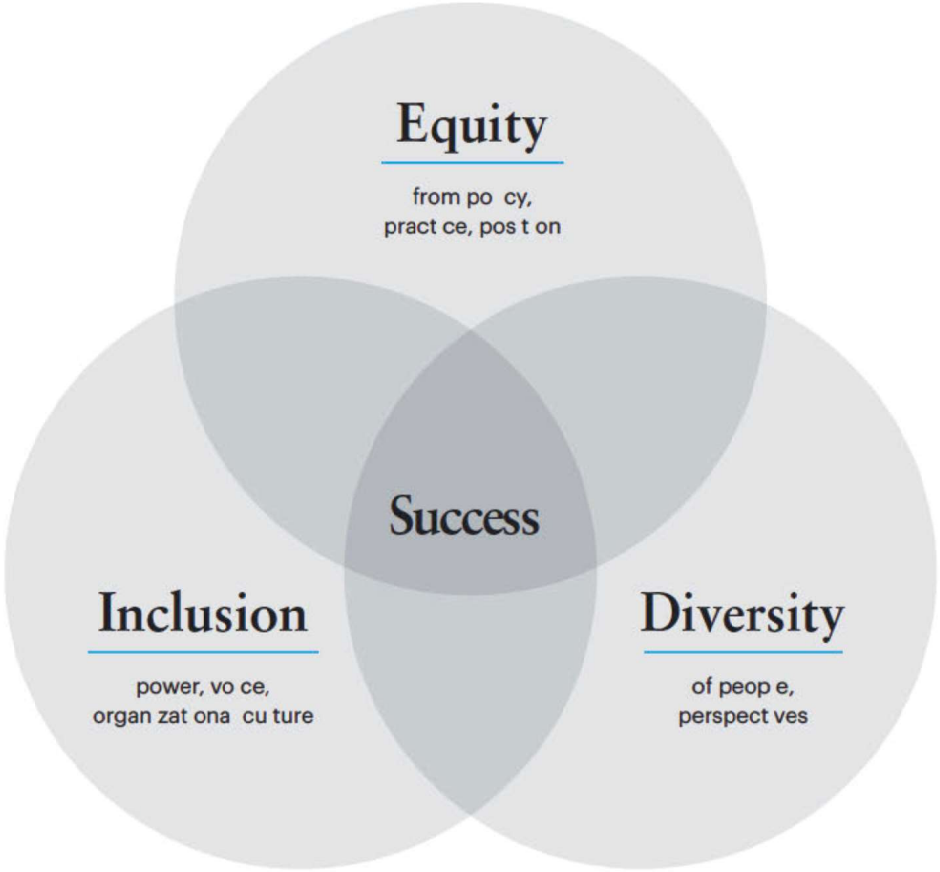
NFI celebrates diversity through the creation of programs that recognize and support our differences, working to foster diversity in ways that create a sense of belonging while enabling uniqueness.

Diversity + Inclusion + Equity = Success

A key step n creat ng an env ronment that encourages d vers ty, equ ty, and nc us veness s to educate nd v dua s on the benefits

An nteract ve d vers ty and nc us on tra n ng program was first ro ed out to our eadersh p team n 2015 and has become a cr t ca component of our tra n ng programs Th s program descr bes the benefits of d vers ty and takes each eader on a journey of exp orat on of the r persona b ases and how they can mpede the r ab ty to create an nc us ve env ronment Th s program has been firm y embedded nto our eadersh p program and to date has been de vered to more than 600 eaders rang ng from execut ves to team eads

N embeds tse f firm y n the commun t es where we do bus ness Commun t es are such an ntegra part of our bus ness that they have been bu t nto our stakeho der and workforce deve opment frameworks We work c ose y w th commun ty groups on the deve opment of programs that support sk and career deve opment for groups that are underserved n many workp aces wh ch nc ude women, nd genous and found ng nat ons groups, persons of co or and rac a zed commun t es, newcomers to our countr es, persons w th v s b e or nv s b e d sab t es, the GBTQ2S+ commun t es, those former y ncarcerated, and youth



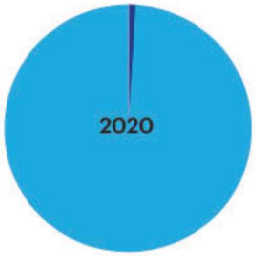
BETTER WORLD

Measuring Diversity, Inclusion & Equity

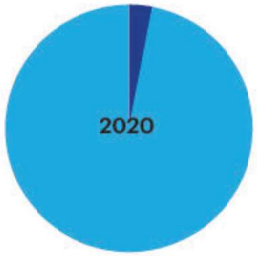
NFI measures diversity to ensure representation is tracking in a positive direction, adjusting focus where required, and implementing actions to more effectively and inclusively manage a diverse workforce.

A though changes n organ zat ona headcount, dr ven by acqu s t ons and bus ness opt m zat on efforts, have mpacted h stor c and year-over-year numbers, we have nst tuted act on-or ented programs focused on tra n ng, workforce deve opment, and commun ty outreach des gned to address prob em areas by reg on and representat on

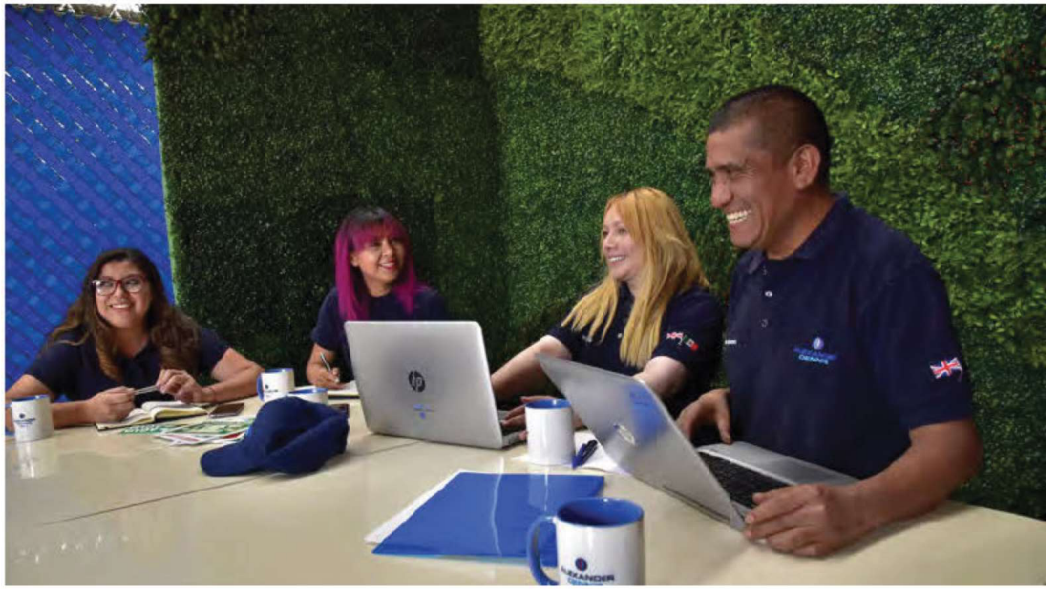
N s an equa opportun ty emp oyer



1.32% D advan aged Work orce



3.12% Ve eran Work orce



Diversity & Inclusion

	2017	2018	2019*	2020
Women	25 0%	21 0%	18 7%	19 3%
Women n M dd e Managemen & Above	25 0%	21 0%	19 6%	17 7%
Women n Exec ve Ro e	12 5%	20 6%	15 8%	20 7%
Women n Board Ro e	25 0%	25 0%	38 0%	33 0%**
V be M nor e	19 4%	23 5%	19 0%	28 5%
V be M nor e n M dd e Managemen & Above	11 7%	11 2%	6 8%	11 7%
V be M nor e n Exec ve Ro e	3 7%	3 4%	5 6%	3 5%
Peop e W h D ab e	n/a	2 0%	2 1%	1 2%
nd geno Peop e	0 5%	0 7%	0 5%	0 5%

*Note A exande Denn s nc uded n 2019 onwa d

**NF nc eased the numbe of Boa d pos t ons by 1 n 2020; t d d not ose a fema e Boa d membe

BETTER WORLD

Fostering Diversity, Inclusion & Equity

As of the end of 2020, NFI had reached and maintained a target objective that the Board would be comprised of 25% female Directors, reinforcing its commitment to gender diversity. This target will be revisited in 2021.

Our Objectives

- Advanc ng d vers ty and workp ace nc us on through deve op ng a cu ture of representat on and be ong ng
- Promot ng d verse and nc us ve eadersh p, cha eng ng b as and nurtur ng d verse ta ent
- Bu d ng upon pract ces to fac tate a d verse and equ tab e future

N s comm tted to rev ew ng ts D vers ty, Equ ty, and nc us on efforts n 2021, and s do ng so w th the he p of externa consu tant Korn erry Th s effort s compr sed of a qua tat ve and quant tat ve rev ew to pr or t ze and focus on ntervent ons that are targeted and spec fic

Our d vers ty goa s are rooted n our Board D vers ty Po cy estab shed n 2016, wh ch recogn zes the mportance and benefit of hav ng a board of d rectors and sen or management of N compr sed of d verse backgrounds, reflect ng the chang ng demograph cs of the commun t es n wh ch N operates

There are now 29 members compr s ng N s execut ve eadersh p team, of wh ch s x (or 21%) are women Our overa execut ve eadersh p team was reduced n 2020 as we comb ned bus ness un ts and owered our overhead expenses n response to COV D-19 A though 2020 was a cha eng ng year due to the mpacts of the pandem c, we were ab e to ma nta n Group-w de fema e representat on at 19%

n March 2021, N jo ned the **50-30 Challenge**, forma z ng our comm tment to advance d vers ty, nc us on, equ ty, gender par ty, and econom c prosper ty n a our workp aces

An n t at ve of nnovat on, Sc ence and Econom c Deve opment Canada (SED), s gnatory organ zat ons asp re to two goa s

- Gender par ty (50%) on Canad an board(s) and sen or management; and
- S gn ficant representat on (30%) on Canad an board(s) and sen or management of other under-represented groups, nc ud ng rac a zed persons, peop e v ng w th d sab t es (nc ud ng nv s b e and ep sod c d sab t es) and members of the GBTQ2S+ commun ty The program and part c pants recogn ze that rst Nat ons, nu t and Mét s peop es as found ng peop es of Canada are under-represented n pos t ons of econom c nfluence and eadersh p

We are comm tted to th s journey



BETTER WORLD

Community Benefits Framework

N s enhanc ng ts ex st ng approaches to workp ace deve opment through the h r ng of d verse, underserved, and underrepresented nd v dua s The Commun ty Benefits ramework (CB) serves as the gu d ng framework from wh ch forma agreements and programs out n ng our oca commun ty partnersh p and workforce deve opment comm tments are created and mp emented

The measures out ned n the CB are ntended to dent fy, tra n, and onboard new h res and support the deve opment and dep oyment of pre-apprent cesh p/apprent cesh p programs and ongo ng career deve opment of peop e nc ud ng veterans, women, peop e of co or, peop e w th d ffer ng ab t es, and underrepresented and underserved nd v dua s n the fie d of advanced manufactur ng

Adopted by New yer n 2020, the CB nforms oca workforce deve opment act ons, d vers ty and nc us on, commun ty benefits, and a path to manufactur ng jobs for d sadvantaged, underserved, and under-represented nd v dua s

Workforce Development Programs

Acce erate Ann ston™ s the first n t at ve of our Ann ston Workforce Deve opment Programs (AWDP), a nat ona workforce deve opment n t at ve ntroduced by New yer and ts partner the Transportat on D vers ty Counc (TDC), a nonprofit organ zat on de ver ng wor d-c ass educat on and deve opment programs that promote d vers ty n the transportat on and construct on ndustr es, w th add t ona programs to come n other oca ons n future years The oca Program underway n Ann ston, A abama nc udes the h r ng of 20 nd v dua s from d sadvantaged or underserved popu at ons, and nc udes compensat on tra n ng and soc a support comm tments

Anniston Workforce Development Program Progress Report 2021 Q1

Community Partnerships

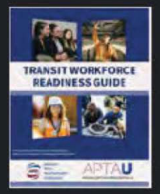
# o Comm n y Ba ed Organ za on Engaged	10
# o Comm n y Ba ed Organ za on S gned	7
# o Peop e Re erra	8

Workforce Development

# o re	5
# o re (Targe)	20
# o Tra n ng o r De vered	1,750
# o re Comp e ng Pre Appren ce h p	5
# o re En er ng E ec r ca Appren ce h p Program	
# o Emp oyee Engagemen Comm ee Member	10
# o Emp oyee Engagemen Comm ee Mee ng o Da e	5

Educational Bursaries and Social Investment

# o Ed ca ona B r ar e Awarded	n progre
Va e o Ed ca ona B r ar e	$25,000
Va e o S pend (Trave /Daycare/ o ng)	$500



APTA 2021 Workforce Readiness Guide

N s D vers ty, nc us on & Equ ty n t at ves and New yer s CB were profi ed n the APTA 2021 Workforce Read ness Gu de by the Amer can Pub c Transportat on Assoc at on, a comprehens ve handbook captur ng the state of workforce read ness n North Amer ca, and out n ng key n t at ves that w he p dr ve t forward As the e ectr fica on of mass mob ty cont nues, workforce deve opment and equ ty for every person to part c pate n the transportat on ndustry w rema n a cr t ca enab er of the new mob ty era or deta s, v s t **newflyer.com/CBF**

BETTER WORLD

Truth & Reconciliation Efforts

In order to redress the legacy of residential schools and advance the process of Canadian reconciliation, the Truth and Reconciliation Commission made 94 calls to action, including some directed at businesses.

We have exam ned these ca s to act on and our emp oyment pract ces to mp ement app cab e aspects of the ca s to act on w th n our bus ness operat ons and to promote and advance reconc at on w th our emp oyee groups and the commun t es we serve

- Measur ng and mon tor ng workforce demograph cs to understand workforce representat on and dent fy ng mprovement opportun t es;
- De ver ng d vers ty and nc us on tra n ng as a requ red eadersh p deve opment modu e to promote awareness of d verse workp ace and understand ng of unconsc ous and mp c t b as;
- mp emented nd genous ns ghts earn ng program w th Un vers ty of W nn peg that supports organ zat ons seek ng to understand and respond to the Truth and Reconc at on Comm ss ons Ca s to Act on; and
- Part c pat ng n TRC92 Emp oyer Consort um Youth Emp oyment n t at ve

N s comm tted to bu d ng respectfu re at onsh ps, ensur ng that nd genous peop es have equ tab e access to jobs and tra n ng, and deve op ng eadersh p and workforce ntercu tura competenc es We cont nue to focus on approaches to advance reconc at on efforts n our operat ons

Truth and Reconciliation Commission of Canada





N s g oba headquarters s ocated on Treaty One terr tory, the or g na ands of the An sh naabe, Cree, Oj -Cree, Dakota, akota, Dene peop es, and the b rth p ace and home and of the Mét s Nat on We acknow edge that our water s sourced from Shoa ake 40 rst Nat on We respect and g ve honor to the nd genous peop es h story on th s and and recogn ze rst Nat ons, Mét s, and nu t peop es ongo ng contr but on n our ne ghborhoods and commun t es today

BETTER WORLD

Case Study
Innovation in Accessibility

ARBOC has been innovating in accessibility since 2008, with the goal of Equal Access for Everyone®. The ARBOC Freedom, built on the General Motors 4500 cutaway chassis, provides a single, non-discriminatory patented angled and accessible entranceway for passengers of all mobility capabilities, including wheelchair riders and those using walkers. The single-plane floor inside the vehicle reduces trip hazards and ensures ease of navigating throughout the bus.

The nnovat ve fu y access b e, ow-floor reedom s the on y bus of ts k nd, sa d Doug M n x, Genera Manager, ARBOC t offers a the benefits of a ow-floor bus at a compet t ve pr ce and makes super or access b ty ava ab e to everyone

Making Transit More Accessible To Customers

n December 2020, ARBOC announced a firm order of fifty-three 27-foot reedom buses from Trans nk (v a ARBOC s oca d str butor Dynam c Spec a ty Veh c es td) Trans nk, forma y the South Coast Br t sh Co umb a Transportat on Author ty, s the statutory author ty respons b e for the reg ona transportat on network of Metro Vancouver n Br t sh Co umb a, Canada, nc ud ng pub c transport, major roads, and br dges

Trans nk w ut ze the new buses to support the rejuvenat on of the Commun ty Shutt e fleet w th n the Metro Vancouver area, add ng more ow-floor buses for enhanced access b ty and vab ty for ts transportat on network that prov des 247 m on tr ps per year



ARBOC Freedom b s

BETTER WORLD

Environmental Performance

Each NFI facility is evaluated to determine and categorize activities that could potentially impact the environment or health and safety.

Th s assessment s performed annua y by the env ronment, hea th and safety (EHS) personne respons b e for the fac ty and cons ders the env ronmenta footpr nt of our manufactur ng processes The scope nc udes parameters such as a r em ss ons, raw mater a and natura resource usage, and waste generat on The major ty of our greenhouse gas (GHG) em ss ons are re ated to heat ng, coo ng, and vent at ng our fac t es N s product on s not energy ntens ve, and cons derat on s g ven to reduce energy consumpt on and GHG em ss ons for each fac ty upgrade The ongo ng mon tor ng of key env ronmenta metr cs he ps prov de the bas s for more focused mprovement n t at ves

A Note on Report ng: he COV D 19 pandem c mpacted fac ty sage and, s bseq ent y, NF s env ronmenta metr cs n 2020 A var ety of s t at ons nc d ng, b t not m ted to emp oyees work ng from home, np anned sh tdowns and fac ty d ng, ad sted prod ct on sched es, b s ness reconfig rat on, and s te c os res ed to ower than expected demand on t t es n add t on to the mpacts of the COV D 19 pandem c, 2020 was NF s first f year of operat on w th AD as a s bs d ary company; as a res t, a n mber of reported abso te va es may have ncreased from 2019 eve s

NF expects to respond to the CDP C mate Change Q est onna re for the first t me n S mmer 2021, fo ow ng wh ch t me o r env ronmenta metr cs w be ad sted to s pport ongo ng d sc os re req rements Report ng thro gh the CDP w prov de NF w th a framework to systemat ca y meas re and d sc ose o r r sks and opport n t es re ated to carbon and c mate change, and to create targets aro nd areas of mean ngf mpact Go ng forward, as we cont n e to mprove o r env ronmenta report ng, nc d ng o r nterna track ng and report ng processes, year over year ncreases may st be seen We a so ant c pate prod ct on to ncrease n 2021 as compared to 2020, wh ch w key ncrease abso te va es

n y 2020, NF anno nced ts transformat ve cost red ct on n t at ve, NF Forward , foc sed on mov ng NF from a ho d ng company to an ntegrated operat ng company As part of NF Forward, NF has a nched a s gn ficant footpr nt rev ew, foc sed on rat ona z ng fac ty footpr nt thro gho t the organ zat on h s rev ew and s bseq ent act ons w ead to mean ngf base ne nformat on, as we as prov de d rect on n terms of the deve opment of sc ence based targets mov ng forward

Consumption	Units	2020**	2019
To a Energy Con mp on	GWh_{eq}	852	1,054*
Gro Renewab e Energy	GWh	33	35
Gro Non Renewab e Energy	GWh_{eq}	820	1,019*
Renewab e E ec r c y	%	49	54
Non Renewab e E ec r c y	%	51	46
Facility Heating Totals			
Carbon D ox de Em on CO_2 To a	US on	159,266	199,781*
Me hane Em on C o a	US on	303	380*
N rogen Ox de Em on N_2O o a	US on	289	364*
Par c a e Ma er Em on <30µm	US on	1000	1257*
S r D ox de Em on SO_2 o a	US on	079	099*
Vo a e Organ c Compo nd Em on VOC o a	US on	724	910*
So ven Em on (VOC)	US on	436	415
Par c a e Ma er Em on <30µm (prod c on o a)	US on	223	130
azardo A r Po an (AP) Em on	US on	137	136
To a Wa er Con mp on	US ga	47,601,675	40,651,177*
To a azardo Wa e	US on	483	540
To a nd r a Wa e	US on	9,526	8,930
Recyc ed Cardboard	US on	4,724	1,080
Recyc ed Me a	US on	3,886	3,280
Recyc ed Wood	US on	10,939	1,470
Prod c on To a B e & Coache (var o prop on y em)	Veh c e	4,363	3,915

*2019 va ues have been correc ed o address an error made n prev ous y repor ed na ura gas usage and wa er usage.
**Some d rec and nd rec em ss ons (such as GHG em ss ons produced by company veh c es) are no ye nc uded.

BETTER WORLD

Climate Change

NF con n e o work on e ec r fica on and ba ery echno og e ha red ce he demand or o e con mp on, and o r zero em on prod c range ra e o r ab e n he e area n o rc ng var o componen hro gh o r pr mary abr ca on opera on cen ra ze prod c on and n rn prov de NF be er con ro over o r pp y cha n and effec on c ma e change

NFI Greenhouse Gas (GHG) Emissions (US tons)

2018		2019		2020	
VOC	7.155	VOC	9.10	VOC	7.24
SO_2	0.781	SO_2	0.99	SO_2	0.79
PM	9.887	PM	12.57	PM	10.00
N_2O	2.862	N_2O	3.64	N_2O	2.89
C	2.992	C	3.80	C	3.03
CO_2	156,151	CO_2	199,781	CO_2	159,266

A Note on Report ng: NF has d v ded ts em ss on profi e nto two streams, represent ng b d ng and process energy req rements, and d rect chem ca em ss ons from man fact r ng and serv ce processes Carbon D ox de (CO_2), Methane (CH), N tro s Ox de (N_2O) and fl or nated gas (none) em ss ons are re ated to heat ng o r fac t es

A Note on Report ng: 2020 metr cs are mpected by severa factors, nc d ng b t not m ted to the COV D 19 pandem c P ease see deta ed note A Note on Report ng on Page 60 exp a n ng these tems and the r mpact

BETTER WORLD

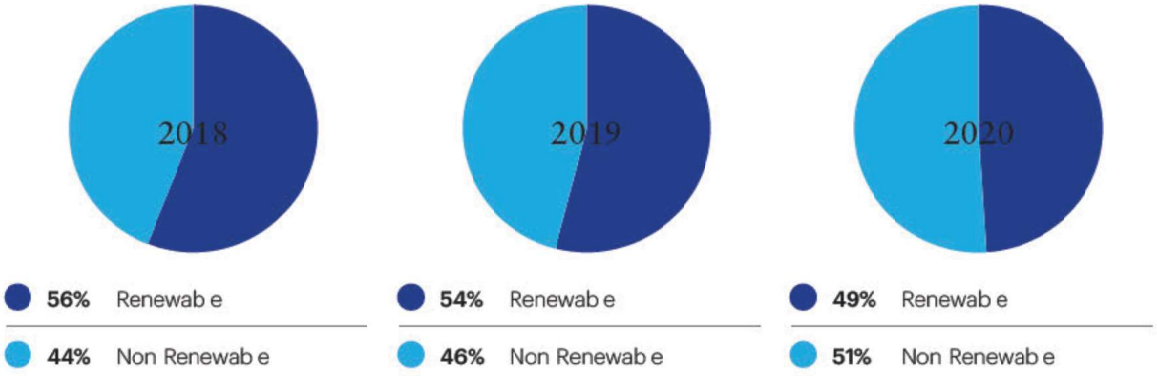
Energy

Con erv ng energy mpor an o NF Energy e red c on a key ra egy o m ga e o r con r b on o G G and c ma e changer k , a we a o m n m ze re o rce age Renewab e e ec r c y me r c or 2020 are prov ded o he r gh

The ma or y o NF ' man ac r ng ac e are oca ed n co d c ma e reg on , and ac y hea repre en he ma or y o o r energy con mp on Red c on pro ec oc on ac y energy age a proce energy age m n ma by compar on Energy con erva on ncrea ed on a pro ec ba Wherever po b e, pro ec ha are d rec y re a ed o ac y energy con mp on a m o red ce con mp on by 10%, w h n he con ex o he pro ec For he e pro ec , energy con mp on da a mmar zed, va da ed, and repor ed o o r eader h p gro p

Fac y pro ec were owed n 2020 d e o he COV D 19 pandem c and w re me n 2021 Energy av ng have been rea zed n o r ac e hro gh he n a a on o ED gh ng (nc d ng emergency and ex er or gh ng), rad an hea ng, mproved ven a on and hea ng, bo er y em pgrade , n rared wa er hea er , var ab e req ency compre or , and pa n boo h exha an , a we a n a ng/ ea ng o o r ac e

NFI Electrical Energy Use



A Note on Report ng: 2020 metr cs are mpected by severa factors, nc d ng b t not m ted to the COV D 19 pandem c P ease see deta ed note A Note on Report ng on Page 60 exp a n ng these tems and the r mpact

BETTER WORLD

Air Emissions

Air emissions from NFI operations are quantified, monitored and managed to meet and, where commercially feasible, be reduced beyond local regulatory requirements.

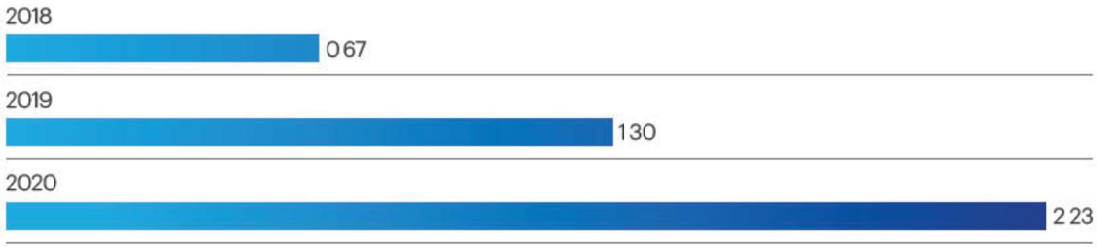
Vo at e Organ c Compounds (VOCs), Part cu ate Matter (PM), and Hazardous A r Po utant (HAP) a r em ss ons from pa nt ng and fiberg ass manufactur ng act v t es are managed by str v ng to meet ndustry best pract ces and proper y ma nta n ng a r po ut on contro equ pment N has mp emented powder coat ng techno ogy wherever pract cab e to reduce a r em ss ons

- ncreases shown n 2020 VOC and HAPs em ss ons are arge y due to the add t on of new y acqu red s tes, nc ud ng a fu -year of AD operat ons
- ncreases seen n PM can be attr buted to mprovements made to our nterna track ng and report ng processes

NFI VOC Emissions (US tons)



NFI PM Emissions (US tons)



NFI HAPs Emissions (US tons)



A Note on Report ng: 2020 metr cs are mpacted by severa factors, nc d ng b t not m ted to the COV D 19 pandem c P ease see deta ed note A Note on Report ng on Page 60 exp a n ng these tems and the r mpact

BETTER WORLD

Water Use

n N fac t es, water s predom nant y used for san tary purposes, jur sd ct ona y mandated fac ty rr gat on, and water eak tests Water test ng for bus she ntegr ty s our argest water consumpt on for manufactur ng process usage Requ rements for these tests vary by contract and can have a s gn ficant mpact on our water consumpt on We are ab e to conserve water dur ng manufactur ng process through on-s te re-use of the water requ red for extreme weather eak test ng

Waste

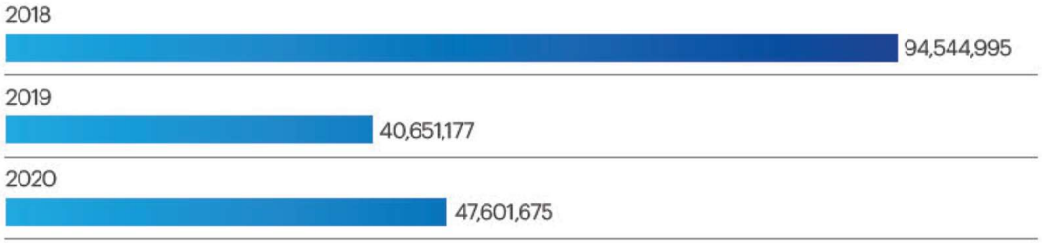
N manages waste n an env ronmenta y consc ous manner, and waste management programs are n p ace at each of our fac t es ean manufactur ng methodo og es a so dr ve eff c enc es n the use of raw mater a s, wh ch reduces N s overa waste footpr nt

→ Due to reduced product on rates n 2020, ex st ng fac t es saw reduced ndustr a waste n 2020; however, w th the add t on of new y acqu red s tes, the tota ndustr a waste shows an overa ncrease

Hazardous waste s d sposed us ng cert fied hazardous waste d sposa contractors A chem ca s used n product on are rev ewed pr or to use n order to m n m ze the use of hazardous products, and to eva uate the subst tut on of products that m n m ze the mpact on env ronmenta or human hea th

Waste streams are reduced through recyc ng where app cab e n 2020, N d verted 10,939 tons of wood and 4,724 tons of cardboard from andfi s, and recyc ed 3,886 tons of meta

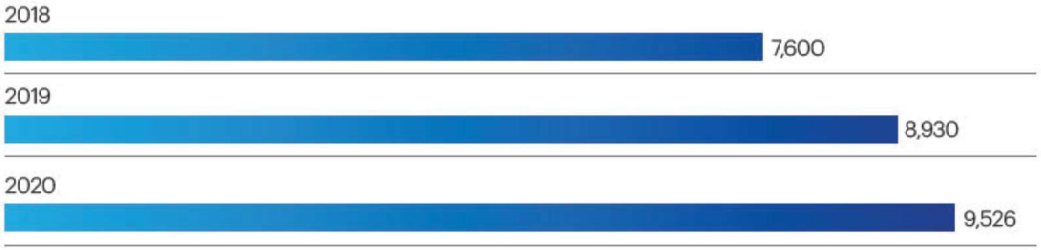
NFI Total Water Consumption (US Gallons)



NFI Total Hazardous Waste (US tons)



NFI Total Industrial Waste (US tons)



A Note on Report ng: 2020 metr cs are mpacted by severa factors, nc d ng b t not m ted to the COV D 19 pandem c P ease see deta ed note A Note on Report ng on Page 60 exp a n ng these tems and the r mpact

BETTER WORLD

Case Study
Building the Best Drivers in the Industry

MCI Academy
Training for Advancing Technology

Helping to educate drivers to enable safer communities.

n ebruary 2020, MC ntroduced the Motorcoach Operator Cert ficate Program, a dr ver tra n ng program to he p answer the ndustry s shortage of qua fied dr vers and to he p contr bute to safer commun t es The Motorcoach Operator Cert ficate Program s part of the ASE-accred ted (Automot ve Serv ce Exce ence) MC Academy, and s a graduated sequence of on ne tra n ng courses on safety, federa regu at ons, and coach systems, des gned to meet the needs of both new and exper enced dr vers, and enab e career advancement

n an ndependent recru tment survey, externa tra n ng was c ted as one of emp oyees most preferred ncent ves for stay ng w th a company t can a so ncent v ze job seekers to app y because of the potent a to advance the r career

MC Academy s program s on ne, free of charge and spans a sk eve s The program s des gned around four eve s of tra n ng The first three eve s nc ude e ght hours of tra n ng per eve w th coursework taught v a v deo and PowerPo nt narrat ves eve 4 s a Master eve cert ficate for the most exper enced coach operator

The eve 3 Cert ficate he ps prepare entry- eve dr vers to meet new edera Motor Carr er Safety Adm n strat on (MCSA) ru es for Commerc a Dr ver s cense (CD) app cat on M d-career dr vers benefit by eve 2 and 1 coursework des gned to mprove road safety and coach system know edge There s a so Master eve coursework for dr vers who comp ete the three eve s of cert ficat on

The beauty of the program s that dr vers can comp ete the r tra n ng wh e wa t ng for the r groups or dur ng the r off hours from any ocat on v a aptop or mob e dev ce, sa d Scott Crawford, MC Tra n ng Manager And operators w benefit from dr vers who are we -tra ned, engaged and proud to work n a profess on that contr butes to the we -be ng of transportat on bus nesses, passengers and road safety

Over 2,500 customers, nc ud ng both pub c and pr vate operators, part c pated n tra n ng th s year n 2020, 29,874 courses were comp eted, for a tota of 30,278 hours of tra n ng



BETTER WORLD

Community Support

NFI is proud to support community, charitable, and not-for-profit initiatives through community partnerships, sponsorships, and customer support.

Program support s centered on commun ty, non-profit, vo unteer, pub c serv ce, or char tab e organ zat ons focus ng n the areas of youth, hea th, and commun ty deve opment Our program object ves are as fo ows

- Promote and enhance commun ty re at ons
- Promote c t zensh p and act ve ro es n our commun t es
- Support corporate object ves and N pr nc p es
- Promote and enhance customer re at ons
- Prov de w despread commun ty benefit
- Prov de our emp oyees the opportun ty to act ve y part c pate and contr bute

Donat ons are approved n accordance w th the N Group Code of Bus ness Conduct and Eth cs, N Group Po t ca Contr but on Po cy, N Group G ft and Enterta nment po c es, and app cab e Customer s Code of Conduct, Bus ness Eth cs, and G ft Acceptance po c es

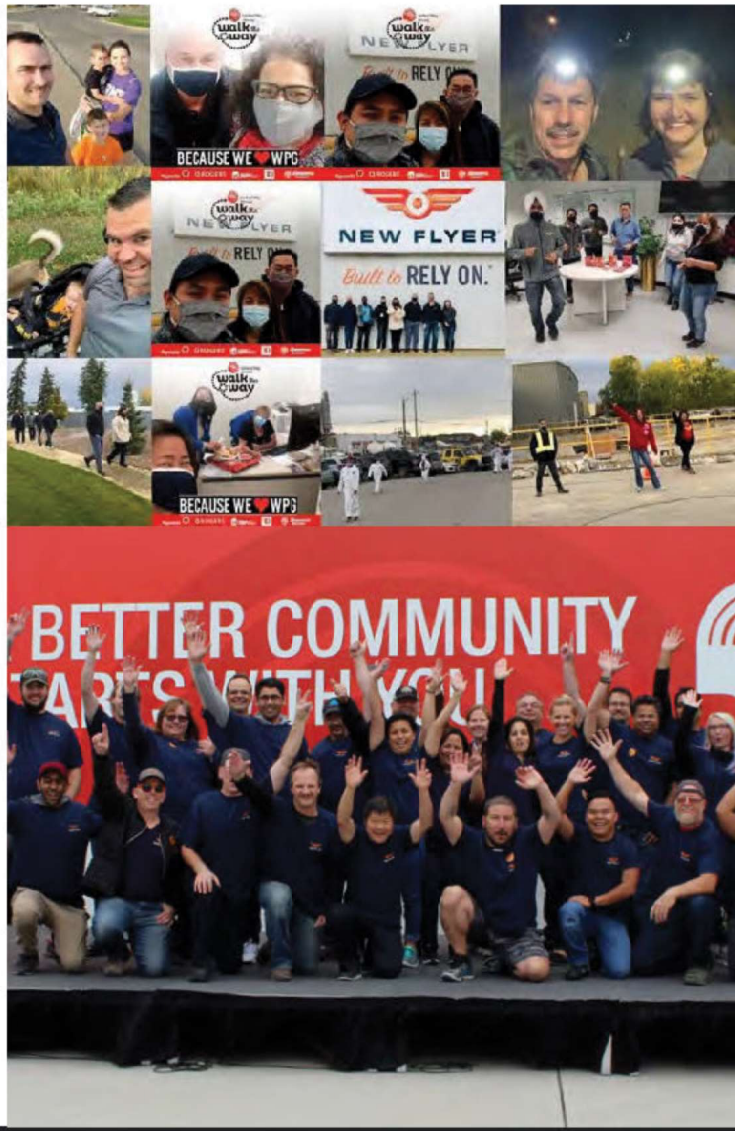
A number of commun ty groups rece ved support and contr but ons from N n 2020 We support a var ety of commun ty, hea th, and youth organ zat ons and programs, such as Canad an Museum of Human R ghts, Crookston Ox Cart Days, D abetes Canada, W nn peg Art Ga ery nu t Art Centre (Oaumajug), and W nn peg Jets Hockey Academy n add t on, the N team co ect ve y nvests hundreds of hours back nto the commun t es where they work, and ve each year

n 2020, the th rd N -w de Un ted Way campa gn was he d across 31 ocat ons, and our team came together to donate $378,701 to Un ted Way agenc es across North Amer ca—proud y support ng 23 d fferent Un ted Way agenc es n the U S and Canada, n or nearby commun t es we operate n We recogn ze that we are better together, and that our commun t es can thr ve as a strong co ect ve

Our team stepped up and part c pated n the 2020 Un ted Way Wa k th s Way Event , ogg ng a tota of over 1 m on steps or 1,065 k ometers

N co ect ve y has donated more than $2 5 m on to the Un ted Way from ts workp ace campa gns over the past decade

United Way



BETTER WORLD

Team & Community Spirit

Teamwork, community involvement, and a collaborative spirit are inherent aspects of NFI culture. Employee-led social committees are established in various business units, with unique employee-planned events held throughout NFI locations annually. Although in-person events were limited in 2020, groups held several virtual events to promote team connections and collaboration between sites, and between those working from home and on site during this time. We are proud of these efforts to build stronger communities, and to create a fun and caring workplace.

Shout-Outs and Standing Ovations

Over 60 emp oyees were recogn zed by the r peers n a Shout-Out or Stand ng Ovat on recogn t on over the past year Shout-Outs prov de a way to say thank-you to someone at N for go ng the extra m e, and we take a moment to say so pub c y The Stand ng Ovat on s a way for co eagues to recogn ze the r fe ow team member for the r efforts n the oca commun ty We want to recogn ze our N commun ty for the r accomp shments outs de of the workp ace wa s Whether someone has run a marathon, vo unteered w th a oca char ty, or has an accomp shment they want to share w th others, we want to hear and share the r story

We're In This Together Campaign

Dur ng COV D, emp oyees were asked to share good deeds stor es and we w shes Over 30 d fferent stor es were shared on how peop e supported fr ends, fam y and the r commun ty Emp oyees a so shared persona stor es on how they spent the r t me dur ng the COV D-19 pandem c








NFI
Leading the ZEvolution.™
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Corporate Presentation

July 2020

Non-Confidential

LI-CYCLE OVERVIEW

Year Founded: 2016

Service: Closed-loop lithium-ion battery resource recovery

Key Partners: CALSTART, MaRS, Responsible Battery Coalition, NAATBatt International, Suppliers Partnership for the Environment

Key Investors: TECHMET, bdc, DELPH25, Pella Resources Limited, Bioindustrial Innovation Canada – A Sustainable Chemistry Alliance

Awards: 2020 Global CleanTech 100, 2020 Clean 16 – Outstanding Contributions to Clean Capitalism, CV Magazine Energy Innovator Awards 2019, Start Up Energy Transition, CleanEquity Monaco 2018, Business Awards of Excellence 2018 Winner

VISION



To be the most sustainable, vertically integrated, and globally preeminent lithium-ion battery resource recovery company

MISSION



1. Providing sustainable and safe customer-centric solutions and technology to solve the global end-of-lifecycle lithium-ion battery problems/opportunities.

2. Meeting the rapidly growing demand for critical battery materials.



TEAM, BOARD, AND ADVISORS

Leadership & Team



Tim Johnston
Exec. Chairman
Mech. Eng., CFA



Ajay Kochhar
President & CEO
Chem. Eng.



Kunal Phalpher
CCO
Elec. Eng., MBA



Bruce MacInnis
CFO
CPA and CA



Chris Biederman
Chief Process Engineer
Sr. Chem. Eng. Mgr.



Ala Hussain
Eng. & Const. Mgt.
Sr. Civil Eng. Mgr.



Ethan Callender
HSEQ Manager
HSE, Quality Expert

Board of Directors



Tim Johnston
Exec. Chairman
Co-Founder



Ajay Kochhar
Exec. Director
Co-Founder



Anthony Tse
Non-Exec. Director
Critical Materials



Mark Wellings
Non-Exec. Director
Capital Raising



Rick Findlay
Non-Exec. Director
Business Ops. & Scaling



Alex Lowrie
Non-Exec. Director
Financial Mgt.



Brian Menell
Non-Exec. Director
Strategic Growth

Advisory Board



Adonis Pouroulis
Senior Advisor
Mining & Metals



Yuan Gao
Technical Advisor
Li-ion Battery Expert



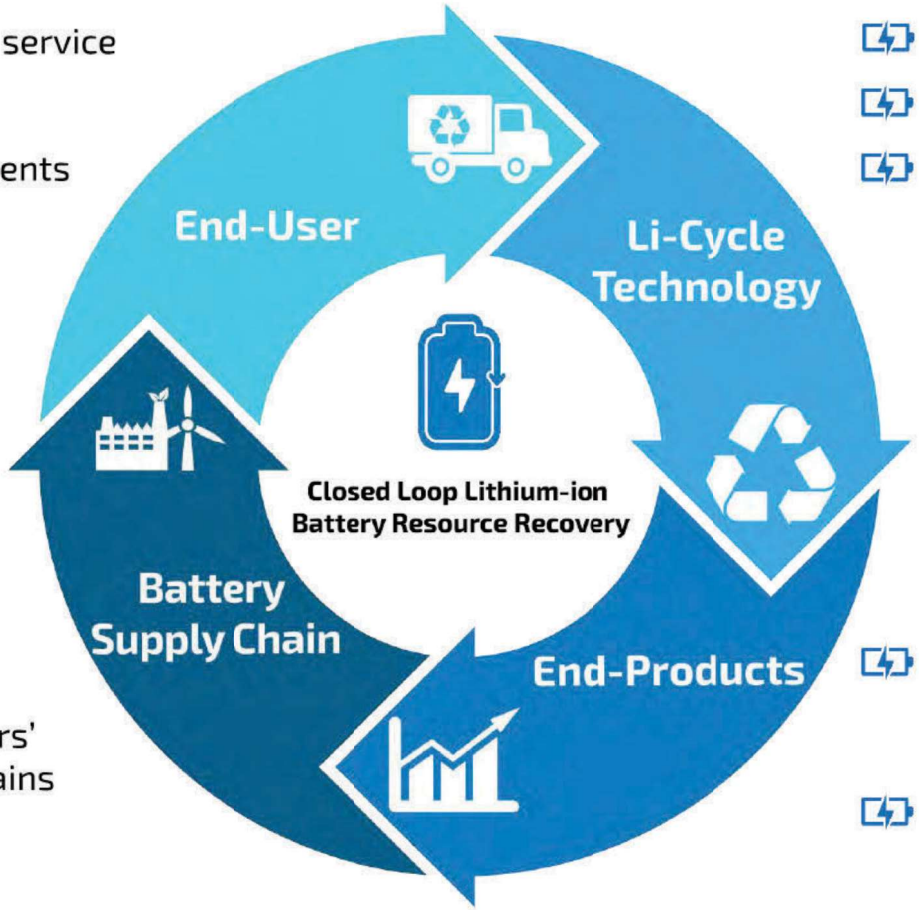
Ahmad Ghahreman
Technical Advisor
Ph.D. Hydromet.



Chris Berry
Energy Metals Advisor
Leading Co & Li Analyst

LI-CYCLE CAPABILITIES

- Holistic logistics coordination service
- Handle damaged batteries
- Advise on packaging requirements
- Manage battery replacement campaigns



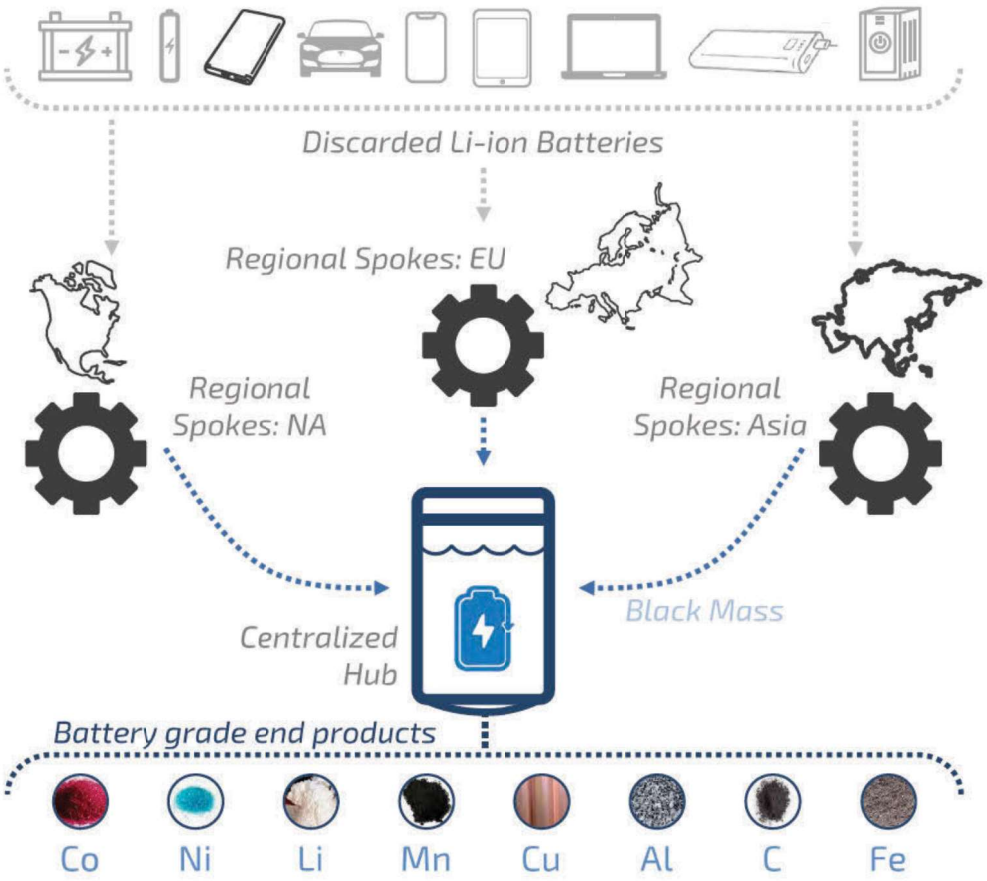
- 100% recycling efficiency rate
- > 95% functional recovery rate
- Safe and sustainable process

- Close the loop in our customers' lithium-ion battery supply chains

- Produce battery-grade end-products for re-use in battery or other technical applications
- Produce by-products reusable in the general economy

PROVEN LI-CYCLE TECHNOLOGY

Li-Cycle's patented Spoke and Hub technologies recover 95% of all li-ion battery materials— extracting high-grade materials for battery production, at a cost competitive to mined and refined material



EXISTING SPOKES: CANADA & NY

Patented Li-Cycle Spoke technology intakes all li-ion battery chemistries at any charge state, without manual sorting, discharging, or dismantling

Saves circa 50 person-hours per tonne

Spoke plants safely reduce the size of battery mass in an automated fashion, eliminating the risk of fire through inherently safe technology. Key to securing supply

Local to each region, reducing the safety risk and cost associated with battery transport

Modular & Scalable: starting size equivalent to 4 shipping containers, capable of 5,000 tonne/yr

Low cost and economically viable on a standalone basis

Fully sustainable with no solid or liquid waste and zero impact air emissions

EXISTING HUB: CANADA

Patented Li-Cycle Hub technology intakes the black mass produced at Spoke plants globally, and outputs high-purity battery chemicals—with 95% recovery

Each Hub plant can support a network of Spokes across the globe. Key structural advantage for Li-Cycle into the future, enabling a circular economy approach

- **Sell all products & by-products:** only plant globally able to recover battery grade lithium
- **Centralized & optimized:** maximizing economies of scale and efficiencies
- **Economically viable** on a standalone basis
- **Fully sustainable** with no solid or liquid waste and zero impact air emissions

LI-CYCLE MILESTONES

✔ **Q4 2016:** Li-Cycle proof of concept
Capacity: 5 tonne/year

✔ **Q3 2017:** Mini-piloting complete in Canada
Capacity: 50 tonne/year

✔ **Q4 2018:** Spoke demo complete in Kingston, Ontario
Capacity: 50 tonne/year

✔ **Q3 2019:** First Commercial Spoke in Kingston, Ontario
Capacity: 2,500 tonne/year

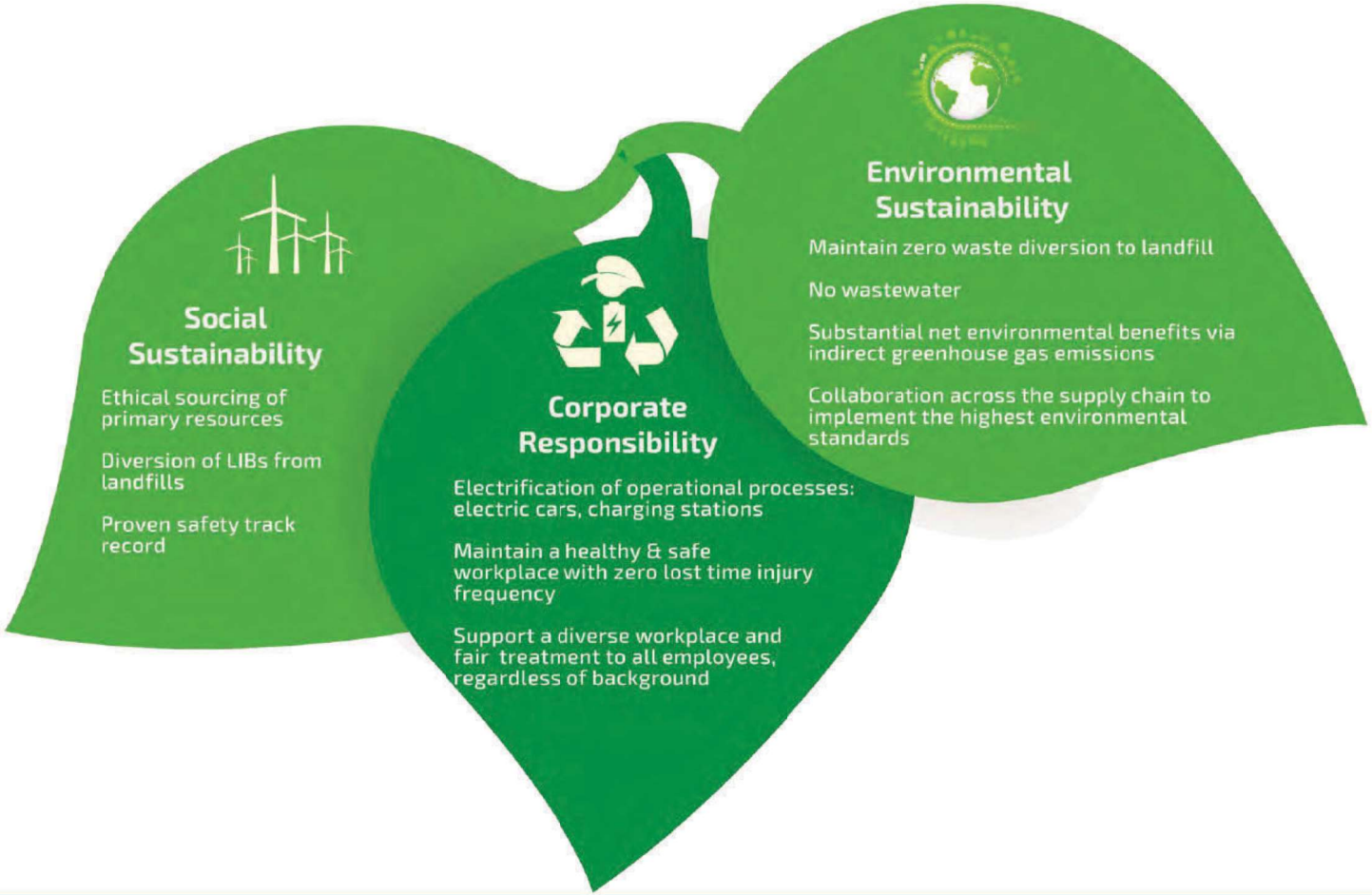
✔ **Q4 2019:** Hub Demo complete in Kingston, Ontario
Capacity: 365 tonne/year

Q4 2020: Second Commercial Spoke established in Rochester, New York
Capacity: 5,000 tonne/year

Q4 2021: Third Commercial Spoke established in Nevada
Capacity: > 5,000 tonne/year

Q4 2022: First Commercial Hub established in Rochester, NY
Capacity: 60,000 tonne/year

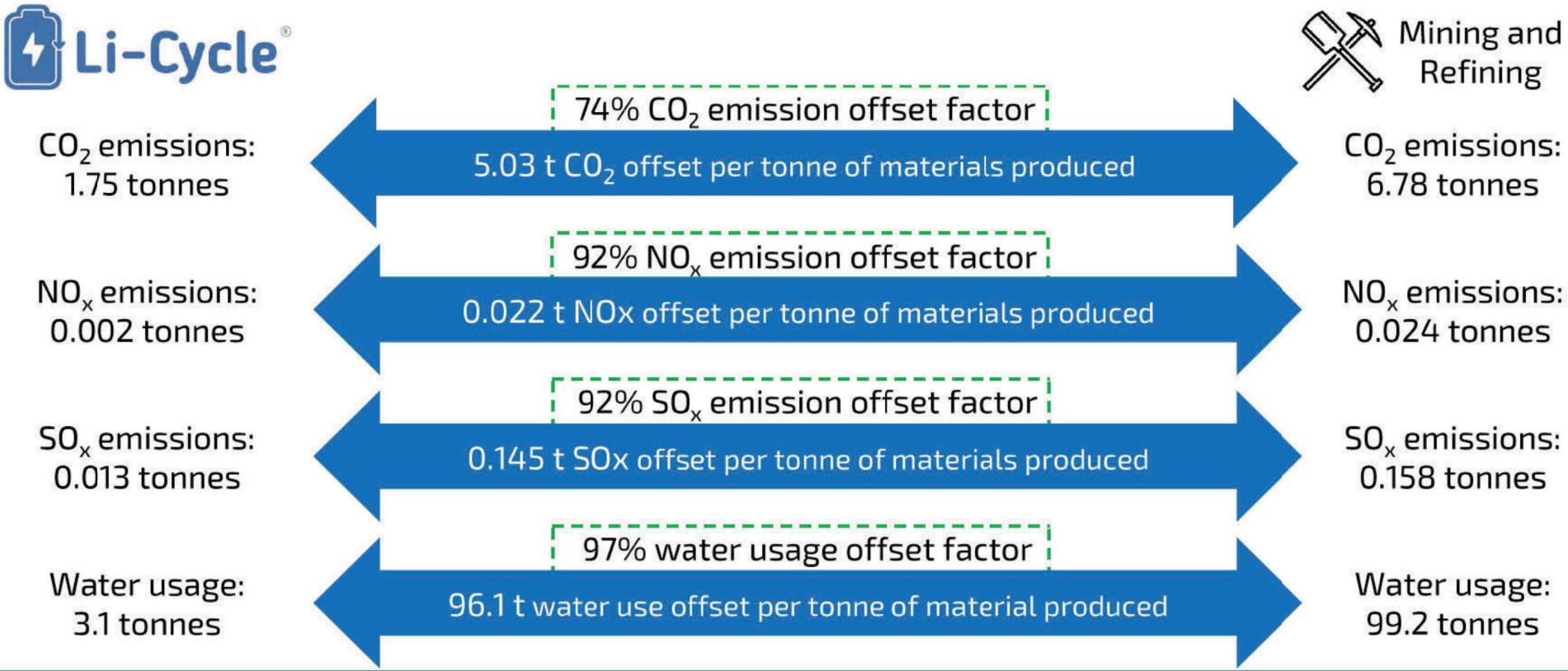
CORPORATE SOCIAL RESPONSIBILITY COMMITMENT



ENVIRONMENTAL BENEFITS

Third Party Life Cycle Analysis Results

Environmental benefits comparison for production of 1 tonne of Battery Materials



CONCLUSION – WHY LI-CYCLE?

Technology	Enables industry-leading 80-100% recovery from all types of li-ion batteries
Battery Supply	Capable of processing all formats, chemistries of lithium-ion batteries and their component products (e.g. cathode scrap)
End-products	Ability to produce virgin grade-equivalent critical battery materials – Li, Co, Ni
Strategic Advantage	Vision to be global partner for end-of-life batteries and critical material supply
Safety & Environment	Inherently safe and sustainable process with zero solid and liquid waste


Li-Cycle®

Section 2E

Solicitation Requirements:

TS 6 Physical Size.

Dimensions as per specification request / include dimension drawing.

New Flyer response:

Attached is the dimensional drawing for the D45CRTeLE the coach, D45CRTeLE drawing 9950561 Rev A. The attached drawing outlines the physical dimensions on the exterior of the coach.

Section 2F

Solicitation Requirements:

TS 7 Performance Information/Graphs to be include with Proposal submittal shall include:

- Energy Consumption vs. Road Speed
- Torque vs. Road Speed
- Energy consumption vs. torque.
- Vehicle speed vs. time (both loaded and unloaded)
- Vehicle speed vs. grade (both loaded and unloaded)
- Acceleration vs. time
- Change of acceleration vs. time
- Top Speed
- Acceleration
- Altoona Energy Consumption Tests.

New Flyer response:

Please refer to the Performance charts attachments:
The attached charts will help PSTA understand the performance the D45 CRT LE CHARGE™ D45 CRT CHARGE are rated at.

TS 7 Vehicle speed vs grade - top sp.
TS 7 Acceleration vs time", "TS 7 Vehicle Speed vs time.
TS 8.1Altoona energy consumption test.
TS 7 - Torque and Power vs Road Speed.

Top speed of 65 mph is achieved with the 5.67 axle ratio and Siemens traction motor.

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus was operated at SLW on a chassis dynamometer. The procedure dictates that the test bus be accelerated to a maximum "power-limited"/"governed" or maximum "safe" speed not exceeding 80 mph. The maximum power-limited/governed speed, if applicable, is the top speed as limited by the engine control system. The maximum safe speed is defined as the maximum speed that the dynamometer, the tires or other bus components are limited to. The test vehicle speed was measured using a speed encoder built in the chassis dynamometer. The time intervals between 10 mph increments were recorded using a Data Acquisitions System. Time-speed data and the top speed attained were recorded on the Performance Data Form. The recorded data was used to generate a percent grade versus speed table and a speed versus time curve. All the above are available in the following pages.

4-III. DISCUSSION

This test consisted of three runs from standstill to full throttle on the chassis dynamometer. Speed versus time data was obtained for each run and results are averaged to minimize test variability. The test was performed up to a maximum governed speed of 71.9 mph. The calculated gradeability results are attached. The average time to reach 30 mph was 8.0 seconds. The maximum gradeablity at 10 mph was 19.4% and at 40 mph was 5.3%.

PERFORMANCE DATA FORM

Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. & S.I.	
Temperature (°F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

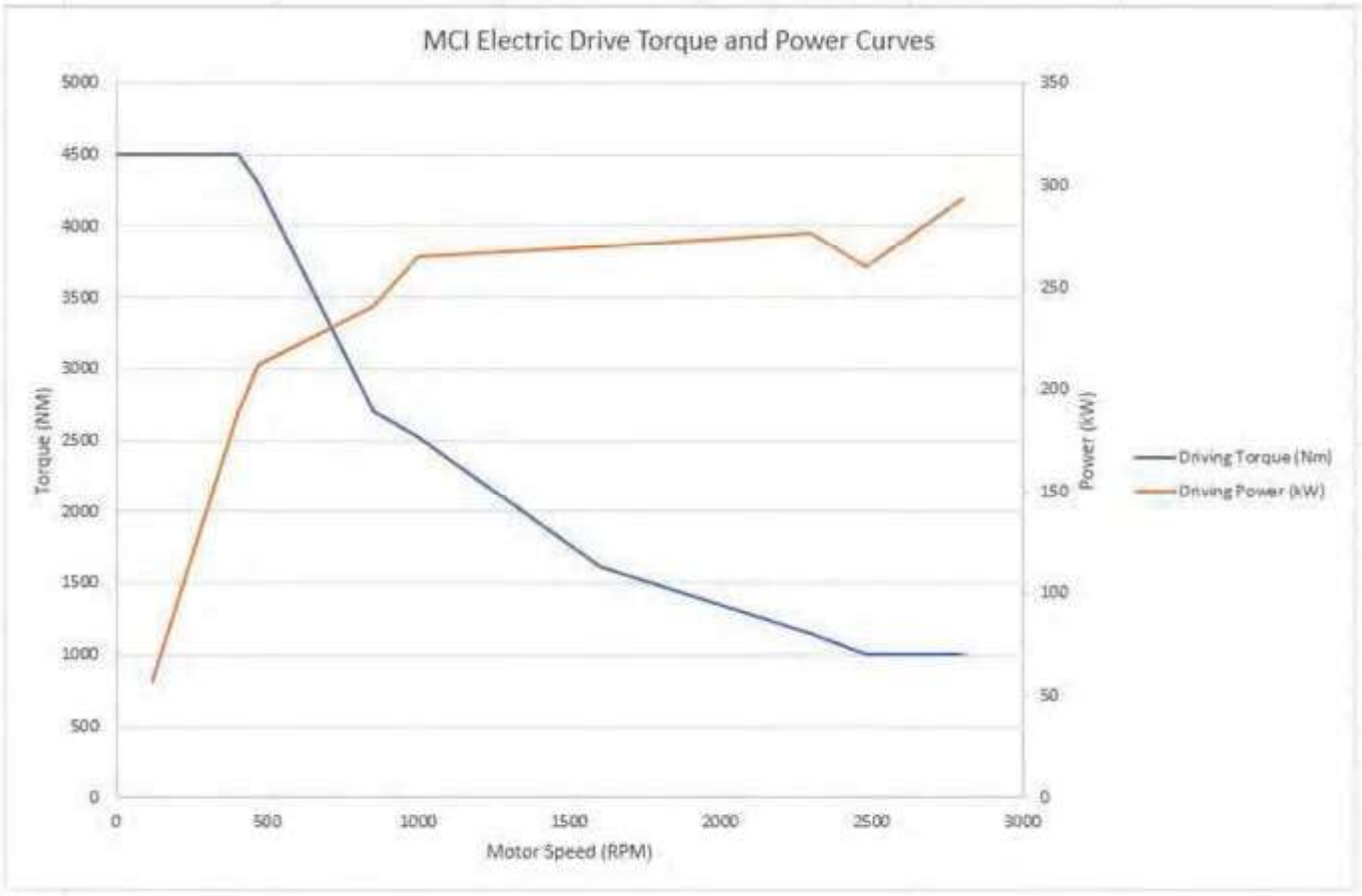
		INITIALS:
Air Conditioning - OFF	✓Checked	M.H.
Heater pump motor - OFF	✓Checked	M.H.
Defroster - OFF	✓ Checked	M.H.
Exterior and interior lights - ON	✓ Checked	M.H.
Windows and doors - CLOSED	✓ Checked	M.H.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.3	3.1	3.0
20 mph	5.6	5.3	5.3
30 mph	8.2	7.9	7.9
40 mph	14.4	14.2	14.3
50 mph	24.6	24.4	24.4
60 mph	40.7	40.5	40.6
70 mph	78.4	77.6	77.6

Maximum Speed (mph): 71.9 (maximum governed speed reached)


MCI Electric Drive Torque and Power Curves
Torque (NM)
Power (kW)
Motor Speed (RPM)
Driving Torque (Nm)
Driving Power (kW)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000

PERFORMANCE DATA FORM

Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. & S.I.	
Temperature (°F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

		INITIALS:
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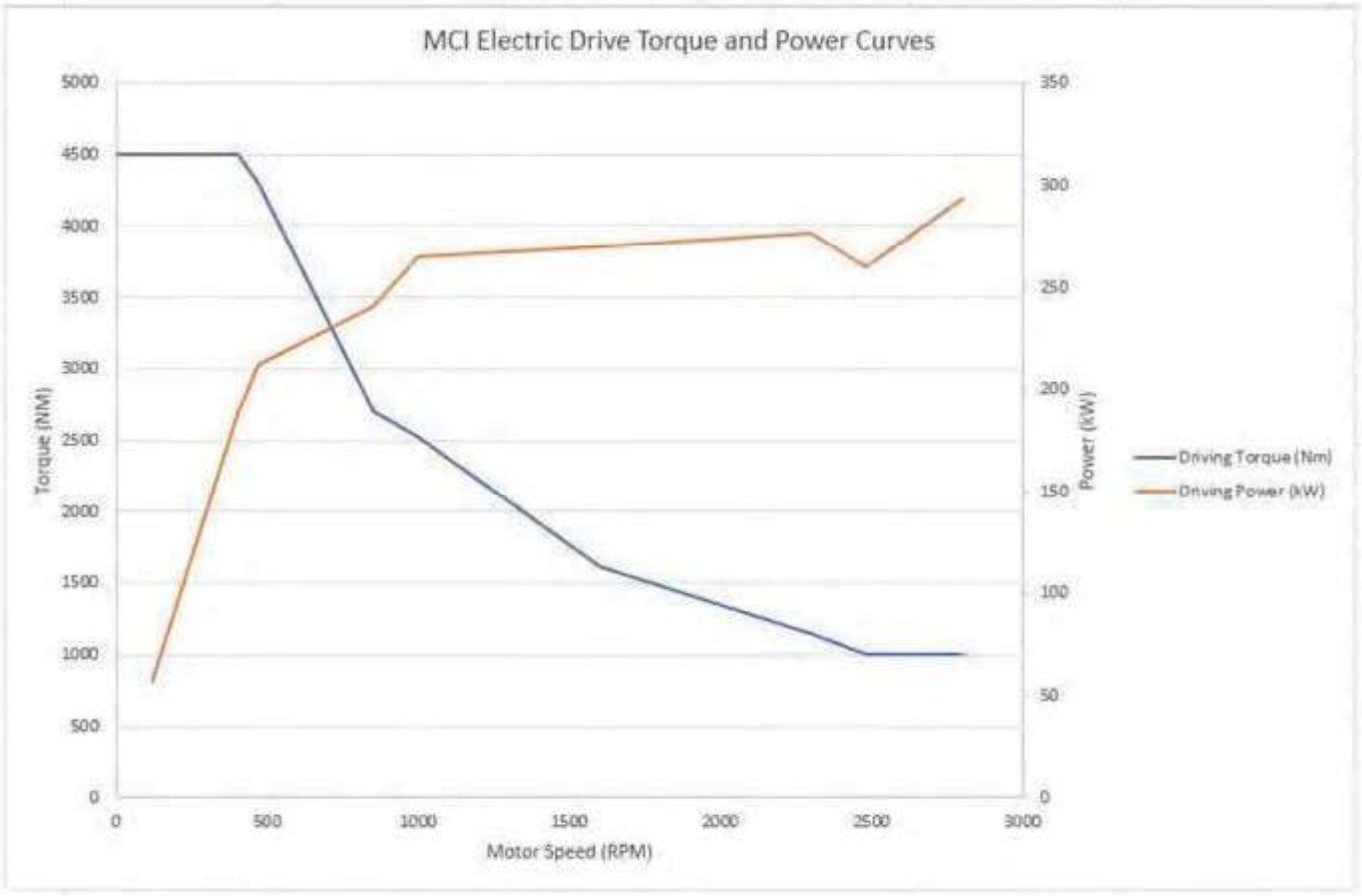
Heater pump motor - OFF	✓Checked	M.H.
Defroster - OFF	✓ Checked	M.H.
Exterior and interior lights - ON	✓ Checked	M.H.
Windows and doors - CLOSED	✓ Checked	M.H.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.3	3.1	3.0
20 mph	5.6	5.3	5.3
30 mph	8.2	7.9	7.9
40 mph	14.4	14.2	14.3
50 mph	24.6	24.4	24.4
60 mph	40.7	40.5	40.6
70 mph	78.4	77.6	77.6

Maximum Speed (mph): 71.9 (maximum governed speed reached)


MCI Electric Drive Torque and Power Curves
Torque (NM)
Power (kW)
Motor Speed (RPM)
Driving Torque (Nm)
Driving Power (kW)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000

PERFORMANCE DATA FORM

Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. S.I.	

Temperature (F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

		INITIALS:
Air Conditioning - OFF	✓Checked	M.H.
Heater pump motor - OFF	✓Checked	M.H.
Defroster - OFF	✓ Checked	M.H.
Exterior and interior lights - ON	✓ Checked	M.H.
Windows and doors - CLOSED	✓ Checked	M.H.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.3	3.1	3.0
20 mph	5.6	5.3	5.3
30 mph	8.2	7.9	7.9
40 mph	14.4	14.2	14.3
50 mph	24.6	24.4	24.4
60 mph	40.7	40.5	40.6
70 mph	78.4	77.6	77.6

Maximum Speed (mph): 71.9 (maximum governed speed reached)

6. ENERGY ECONOMY AND RANGE TEST – AN ENERGY CONSUMPTION AND RANGE TEST FOR BATTERY ELECTRIC BUSES USING APPROPRIATE OPERATING CYCLES

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable energy consumption data on battery electric transit buses produced by different manufacturers. This energy economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This energy economy test, as designated here, is a measurement of the energy consumed by a vehicle traveling a specified test operating profile, under specified operating conditions that are typical of transit bus operation. The results of this test will not represent actual energy usage but will provide data that can be used by FTA Grantees to compare buses tested using this procedure.

6-II. TEST DESCRIPTION

This test is performed in the emissions bay of the LTI Vehicle Testing Laboratory. The Laboratory is equipped with a Schenk Pegasus 300 HP, large-roll (72 inch diameter) chassis dynamometer suitable for heavy-vehicle emissions testing. The driving cycles are the Manhattan cycle, a low average speed, highly transient urban cycle (Figure 1), the Orange County Bus Cycle which consists of urban and highway driving segments (Figure 2), and the EPA HD-UDDS Cycle (Figure 3). This test is conducted at seated load weight.

This test is conducted generally as per the methods described in the SAE standard J 1634-2017. The light-duty test cycles specified in this standard are replaced by transit bus test cycles mentioned above.

The Multi-Cycle test (MCT) procedure is adopted for this bus. The end of test is determined when the bus cannot keep up with the speed trace of the test cycle, as recommended by the bus manufacturer. The battery system is recharged to full SOC at the end of the test, following procedures specified in SAE J 1634-2017. During the recharge, the DC energy (into the battery system) and the AC energy (into the charger) are recorded. From these data, the average AC energy consumption, the charger efficiency (DC Energy, kWh/AC Energy, kWh) and range (miles) for each test cycle is calculated.

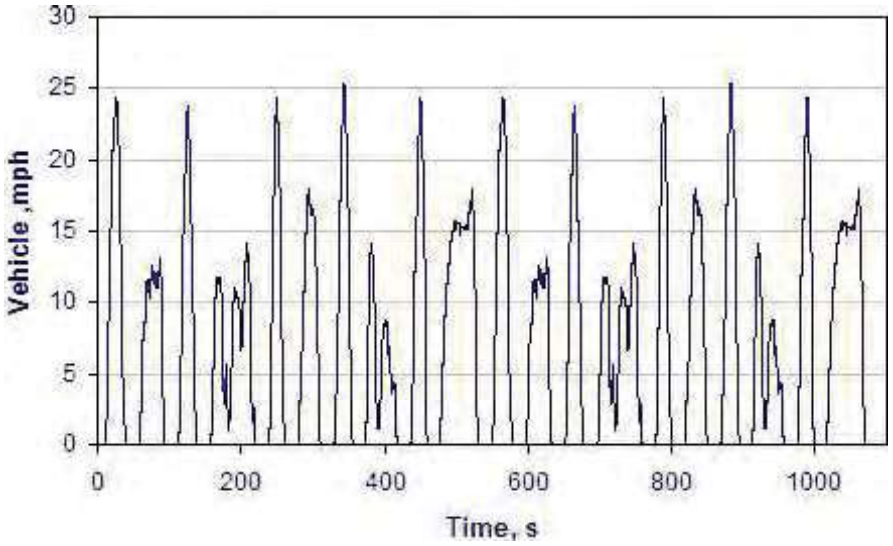


Figure 1. Manhattan Driving Cycle (duration 1089 sec, Maximum speed 25.4 mph, average speed 6.8 mph)

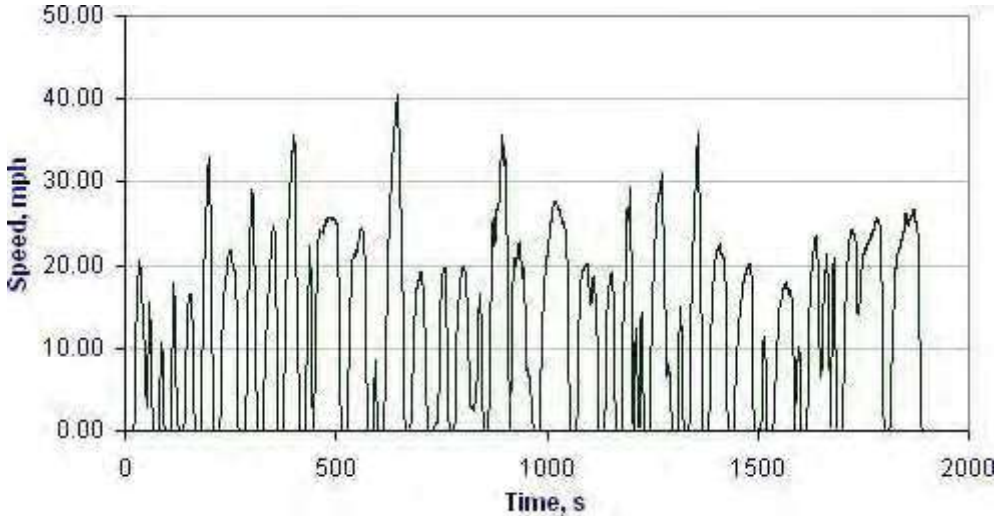


Figure 2. Orange County Bus Cycle (Duration 1909 Sec, Maximum Speed 41 mph, Average Speed 12 mph).

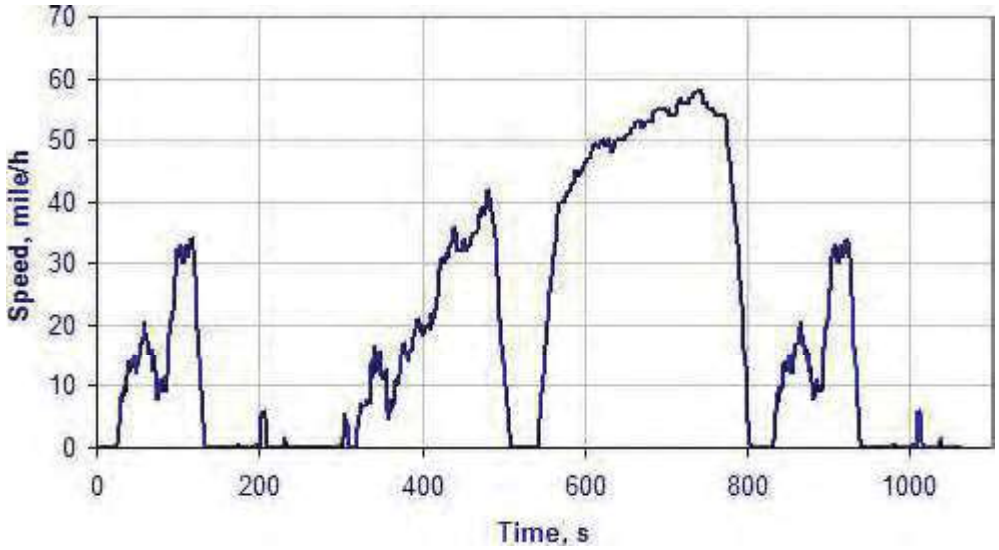


Figure 3. HD-UDDS Cycle (duration 1060 seconds, Maximum Speed 58 mph, Average Speed 18.86 mph).

6-III. DISCUSSION

The driving cycle consists of three simulated transit driving cycles: Manhattan, Orange County Bus Cycle and the HD-UDDS, as described in 6-II.

An extensive pretest maintenance check is conducted including the replacement of all lubrication fluids, if applicable. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection Form. Finally, the summary sheet provides the average energy consumption and range of bus for the three test cycles. The test was conducted at a seated load weight of 52,340 lbs. The average AC energy consumption for the Manhattan, OCBC and the HD-UDDS were 3533 Wh/mile, 2664 Wh/mile and 2290 Wh/mile, respectively. The range for the three driving cycles were 117 miles, 155 miles and 180 miles, respectively.

This bus was tested using the Manhattan, Orange County and UDDS driving cycles. The energy economy and range results for buses tested using these cycles are not directly comparable to buses tested under the earlier protocol that uses the CBD, Arterial and Commuter driving cycles.

Section 2G

Solicitation Requirements:

TS 8.2 Design Operating Profile (Battery Electric Bus).

Supply a computer simulation of bus performance, utilizing the physical and mechanical characteristics of a specific bus, for each type of bus offered.

New Flyer response:

The Design operation Profile for the Battery Electric bus has been addressed in the deviation process. Please refer to the deviations addressing such.

Section 2H

Solicitation Requirements:

TS 8.2 Operating Narratives.

The Contractor shall provide the following narratives with its Technical Proposal:
• Narrative description of the methods used to validate that the proposed system will meet the Agency design operating profile under nominal and worst-case conditions. Detailed results should include, at a minimum, the following for both nominal and worst-case conditions:
• expected bus range (miles)
• fuel economy (kWh/mile); and
• auxiliary loads (kW).
• Projected performance on the Agency design operating profile when the battery reaches end-of-life (EOL) state. The Proposer will provide specific details on EOL criteria. Detailed results should include, at a minimum, the following: expected battery life from factory delivery under normal operating conditions (months), EOL battery capacity (kWh), EOL bus range (miles).
• Description of any required or recommended charge strategies or other bus operation strategies that are necessary to meet the Agency design operating profile. Note that the agency requires that operational impacts be minimized.
• Description of the flexibility and considerations necessary to place the proposed bus and its charging solution on any Agency route at the Agency's discretion.
• Description of any required charge strategies, on-route charge requirements, bus blocking requirements or other bus operational requirements that are necessary to meet the Agency design operating profile. Note that the agency requires that operational impacts be minimized.
• Description of the flexibility and considerations necessary to place the proposed bus and its charging solution on any Agency route at the Agency's discretion.

New Flyer response:

Please refer to the attached documentation provided Narrative bus range.

A variety of Plug-in and Overhead charging options have been provided to meet the current industry standard applications and the various operating conditions expected by transit agencies. Charge strategy will vary slightly from agency to agency. The typical scenario will include off-peak depot charging supplemented by on-route charging (if needed). Agencies will want to consider battery type and capacity, power consumption, routes, utility tariffs, layover time, etc. in determining the appropriate charger size and dispensers.
Charging infrastructure systems including their engineering, construction, installation, and commissioning is required and can be accomplished through the standard agency procurement methods.

Section 2l

Solicitation Requirements:

TS 9.1.1 Electric Propulsion System.

Provide a list of applicable industry standards that the proposed propulsion system meets.

New Flyer response:

Attached documentation for the Electric Vehicle Codes Standards for the electric propulsion system that meet the industry standards.

Truck & Buses – Hybrid & Electric Vehicle	Society of Automotive Engineers	SAE J1715 SAE J2344 ISO 6469 FMVSS 305	Full compliance Full compliance Full compliance Full compliance
Storage Battery Standards	Society of Automotive Engineers	ISO 12405 IEC 62133 IEC 61960 IEC 62281 EN 60068 UN T 38.3 UL 1642/2202	Full compliance Full compliance Full compliance Full compliance Full compliance Full compliance
Vehicle and Charger Interface	Society of Automotive Engineers	SAE J1772 SAE J1850 SAE J2293 SAE J2836 SAE J2847	Full compliance Full compliance Full compliance Capable of compliance
Vehicle Charging Stations	Society of Automotive Engineers	SAE J2293 SAE J3105 SAE J3068 SAE J2954	Full compliance Full compliance N/A Under-development
Charging Station Components		UL Certification CSA Cetification	Full compliance Full compliance

Section 2J

Solicitation Requirements:

TS 9.1.2 Propulsion System Service.

Provide all specialty tools and diagnostic equipment required for maintaining the propulsion system in accordance with the Special Tools List.

New Flyer response:

Provided in the attachment is the D45 CRT LE CHARGE™ and D45 CRT CHARGE Tools

Proposal, tool list provides specialty tools and diagnostic tools required to maintain the coaches.

CONTRACT DELIVERABLES LIST	DIAGNOSTICS & TOOLS
CUSTOMER NAME	Pinellas Suncoast Transit
BID/OPTION/SR NUMBER	
BUS MODEL	D45CRTeLE
QUANTITY	

NOTE: TOOL KITS MAY BE SUBJECT TO CHANGE

*** All claims for concealed shortages must be reported within 20 days of shipment date. Shipping damages and / or loss must be noted on the delivering carrier waybill at the time of receipt of shipment. A copy of the carrier waybill and / or carrier inspection report must be submitted with your claim within 5 days of receipt of shipment to New Flyer Customer Service.*

PAGE REFERENCE	COMMENTS	DESCRIPTION	QUOTED PART	REQUIREMENT	BILLABLE: Y/N To be confirmed by CPM
		Data Logger - Vector GL1000	6473056	Required	TBD
		Siemens Siadis Software (Download from Net)	NPN	Required	TBD
		Siemens PCAN Interface Harness	711447	Required	TBD
		USB CAN Adapter - Siadis Interface	6402046	Required	TBD
		XALT Service Tool Software	NPN	Required	TBD
		XALT Interface Cable - Batteries	704950	Required	TBD
		Nexiq USB Link 2 - WIFI Edition	6465863	Required	TBD
		Diagnostic Kit - Vanner HBA/EBA	6406922	Required	TBD
		EMP Software (Download from Net)	NPN	Required	TBD
		Spheros Diagnostic Software & Cables	6396448	Required	TBD
		Adapter Harness - Spheros Interface	6477477	Required	TBD
		Luminator IPS Software	6339792	Required	TBD
		Vansco Software (Download from Net)	NPN	Required	TBD
		Vansco DLA Adapter Kit	6351820	Required	TBD
		Smartrider Software	NPN	Required	TBD
		Amerex SafetyNet Software & Interface	6355551	Required	TBD
		Service Cable - IRMA APC Analyzer	479892	Required	TBD
		Ethernet Cable - IRMA APC	6465569	Required	TBD
		Amerex Discharge Hose Blowout Adapter	052132	Required	TBD
		Amerex Fire Alarm/Simulator Module	135582	Required	TBD
		Coolant System Pressure Tester	594400	Required	TBD
		Kit - Coolant Pressure Fill	6484741	Required	TBD
		Fluke 2 in 1 Multimeter - 1587FC	6400746	Required	TBD
		McMaster Conductivity Meter	6473771	Required	TBD
		modular test lead kit	6473267	Required	TBD
		test probe flat blade	6473268	Required	TBD
		test probe back probe	6473269	Required	TBD
		Wiha Insulated Master Electrician's tool kit	6473445	Required	TBD
		wiha 1/4 in ratchet set insulated SAE	6473447	Required	TBD
		wiha 1/4 in ratchet set insulated Metric	6473448	Required	TBD
		16 PC 3/8 drive socket set	6473449	Required	TBD
		3/8 Extension set	6473450	Required	TBD
		wiha open end wrench insulated metric	6473452	Required	TBD
		wiha open end wrench insulated sae	6473453	Required	TBD
		Wiha insulated Serrated Tweezers Straight	6473454	Required	TBD
		Wiha insulated Serrated Tweezers Angled	6473455	Required	TBD
		Insulated Torque Wrench 1/4"	6473456	Required	TBD
		Insulated Torque Wrench 3/8"	6472024	Required	TBD
		Insulated Torque Wrench 1/2"	6473457	Required	TBD
		torque screwdriver set	6473458	Required	TBD
		insulated crimper 30 - 6 Awg 7"	6473459	Required	TBD
		wire striper 6 - 3/8 overall 20 to 10	6473460	Required	TBD
		insolated hex key set 10pc metric	6473462	Required	TBD
		Long SAE Natural insulated hex key set 12 pc	6473463	Required	TBD
		bit driver	6473464	Required	TBD
		Stubby Bit Driver	6473465	Required	TBD
		Wiha Insulated "bitFlip" Set	6472034	Required	TBD
		Mini Screw Driver set	6473466	Required	TBD
		ARC Flash Protection Clothing Kit - 2PC Small	6471958	Required	TBD
		ARC Flash Protection Clothing Kit - 2PC Medium	6473412	Required	TBD
		ARC Flash Protection Clothing Kit - 2PC Large	6473413	Required	TBD
		ARC Flash Protection Clothing Kit - 2PC XL	6473414	Required	TBD
		ARC Flash Protection Clothing Kit - 2PC 2XL	6471962	Required	TBD
		ARC Flash Protection Clothing Kit - 2PC 3XL	6471963	Required	TBD
		ARC Flash Protection Clothing Kit - 2PC 4XL	6471964	Required	TBD
		ARC Flash Protection Clothing Kit - 2PC 5XL	6471965	Required	TBD
		ARC Flash Protection Clothing Kit - 1PC Small	6471966	Required	TBD
		ARC Flash Protection Clothing Kit - 1PC Medium	6473415	Required	TBD
		ARC Flash Protection Clothing Kit - 1PC Large	6473416	Required	TBD
		ARC Flash Protection Clothing Kit - 1PC XL	6473417	Required	TBD
		ARC Flash Protection Clothing Kit - 1PC 2XL	6473418	Required	TBD
		ARC Flash Protection Clothing Kit - 1PC 3XL	6471971	Required	TBD
		ARC Flash Protection Clothing Kit - 1PC 4XL	6471972	Required	TBD
		ARC Flash Protection Clothing Kit - 1PC 5XL	6471973	Required	TBD
		Balaclava Head Cover one size fits all	6473440	Required	TBD
		Hard Hat and Face Shield one size fits all	6368561	Required	TBD
		Fall Saftey Harness 425LBS	6473270	Required	TBD
		Black electrical glove kit Size 7	6471976	Required	TBD
		Black electrical glove kit, Size 8	6473420	Required	TBD
		Black electrical glove kit, Size 8.5	6471978	Required	TBD

PAGE REFERENCE	COMMENTS	DESCRIPTION	QUOTED PART	REQUIREMENT	BILLABLE: Y/N To be confirmed by CPM
		Black electrical glove kit, size 9	6471979	Required	TBD
		Black electrical glove kit, Size 9.5	6473421	Required	TBD
		Black electrical glove kit size 10	6473422	Required	TBD
		Black electrical glove kit, Size 10.5	6473423	Required	TBD
		Black electrical glove kit, size 11	6473424	Required	TBD
		Black electrical glove kit size 12	6473425	Required	TBD
		Over Boots Size 9	6473426	Required	TBD
		Over Boots Size 10	6473427	Required	TBD
		Over Boots Size 11	6473428	Required	TBD
		Over Boots Size 12	6473429	Required	TBD
		Over Boots Size 13	6473430	Required	TBD
		Over Boots Size 14	6471990	Required	TBD
		HV Blanket 3' x 3'	6473431	Required	TBD
		Blanket Clamp 9-1/2" L, 5" Opening	6473432	Required	TBD
		Glove Dust 0.5oz	6473433	Required	TBD
		Hot Stick 6FT	6400745	Required	TBD
		Hot Stick 8FT	6473435	Required	TBD
		Defibrillator Adult	6473177	Required	TBD
		PPE-Lockout Tagout Kit	6472002	Required	TBD
		Steel Lock Hasp with Tab	6473442	Required	TBD
		American lock A1106RED	6473443	Required	TBD
		Lock Out Tag	6473444	Required	TBD
		Hv Warning sign	6473436	Required	TBD
		Arc Flash Warning sign	6473437	Required	TBD
		Hv Caution tape	6473438	Required	TBD
		steering wheel covers	6473439	Required	TBD
		KIT-TOOLS,WHEEL BEARINGS	20-02-0041	Required	TBD
		KIT-TOOLS CALIPER REMOVAL	20-00-0042	Required	TBD
		KIT-TOOLS,WHEEL END REMOVAL	20-02-0040	Required	TBD
		KIT-TOOLS,DIFF SEAL SERVICE	20-02-0042	Required	TBD
		KIT-TOOL BENDIX AIR DISC BRAKE SEE EIC	20-04-0020	Required	TBD
		KIT-TOWING COVER,ZF DRIVE AXLE SEE EIC	20-02-0019/2	Required	TBD
		TOOL-GAUGE,PAD AND ROTOR	20-04-0046	Required	TBD
		KIT-TOOLS DIFFERENTIAL PINION GEN II SEAL SERVICE	20-02-0048	Required	TBD
		DISPLAY-DIAGNOSTIC,ECOTEMP,V1.00	20-16-0006	Required	TBD
		KIT-JPRO DIAGNOSTIC TOOLBOX	20-08-0053	Required	TBD
				Required	TBD

Customer Programs Manager
New Flyer

Customer Representative
AVTA

Section 2K1

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Include a description of all battery maintenance requirements including any periodic charge requirements necessary for cell balancing.

New Flyer response:

All hardware and software componentry are designed to meet lifetime expectations without regular maintenance schedules or needed replacement.
The battery manufacturer recommends annual inspections of all plumbing, cabling and connection points to ensure no visible physical damage that may compromise safety and functionality. Additionally, the supplier recommends testing of ESS coolant quality to meet standards every 2 years, with a complete flush and refill of coolant every 5 years or until coolant does not meet quality criteria.
Cell re-balancing is performed by an internal passive system as part of the battery management system to ensure optimal functionality.

Section 2K2

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.
Include a detailed analysis of expected battery performance in the Design Operating Profile.

New Flyer response:

In the attached document 06 XMP125E High Energy, detailed information regarding the battery performance which includes information on the following:

- Exceptional cycle life with proven XALT NMC SHE cells
- High specific energy and volumetric energy density
- Rugged design for challenging environments
- Outstanding safety and abuse tolerance
- Efficient direct liquid cooling maintains ideal cell temperatures y IP67 compliant (with connectors
- mated)
- Easy to install, configure and upgrade
- ISO 9001:2015 certified production environment

XMP 125E HIGH ENERGY



XALT Energy is a premium total system solution manufacturer of lithium-ion batteries, packs, battery management systems and controls, racks and telematics. XALT Energy is capable of handling any energy storage need, anywhere in the world, from our highly automated advanced production facility in Midland, Michigan.

The XPAND Modular Pack (XMP) is XALT Energy's Energy Storage System based on XALT Energy's lithium-ion cells. XMP is designed for use in medium to heavy duty commercial trucks, bus, marine and specialty applications, such as construction and mining equipment.

XMP 125E is ideal for applications with moderate discharge and charge rates for high energy applications requiring long usage periods between plug-in charges. Each sub-pack contains Voltage-Temperature-Balancing boards (VTBs) that report voltage for all cell pairs and internal pack temperatures, and perform cell balancing. XMP 125E is designed for use with XALT's Battery Disconnect Unit (BDU) and Master Control Unit (MCU) through the Input/Output port.

Upgradeable, Ultra-Long Life Cycle Roadmap

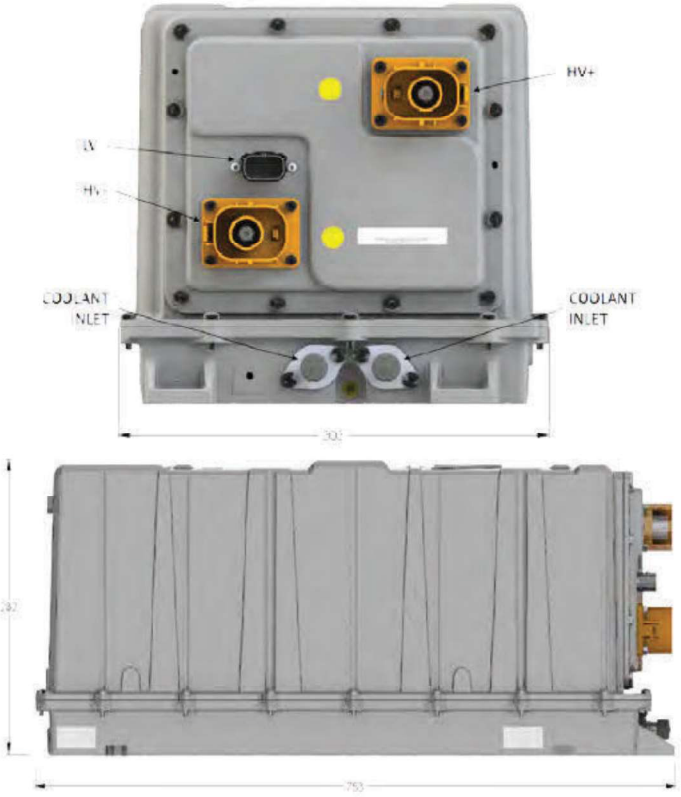
- XMP core accommodates cells in XALT's 225mm family without the need for retooling, anticipating a wide variety of application voltage, power, and energy
- As cell technologies advance or packs become available for re-purposing, the XMP core can be replaced while all external interfaces remain the same

Advanced Thermal Management

- XMP's advanced active liquid cooling system maintains ideal cell temperatures throughout the pack and responds quickly to increases in power demand and changes in ambient (environmental) temperatures
- Efficient direct liquid cooling prolongs cell life under the most demanding cycle profiles and severe environments. The base pack (non-marine) is also IP67 rated in terms of sealing performance.

THE XALT ENERGY ADVANTAGE

- Exceptional cycle life with proven XALT NMC SHE cells
- High specific energy and volumetric energy density
- Rugged design for challenging environments
- Outstanding safety and abuse tolerance
- Efficient direct liquid cooling maintains ideal cell temperatures
- IP67 compliant (with connectors mated)
- Easy to install, configure and upgrade
- ISO 9001:2015 certified production environment



XALT Energy

FREUDENBERG
INNOVATING TOGETHER

FEATURES AND BENEFITS

Modular and Flexible Design

- Easy to customize high voltage, low voltage and cooling interfaces to each application
- All connections at front panel; rear access not needed for installation

System Support

- Battery Disconnect Unit (BDU)
- Master Control Unit (MCU)
- Low Voltage Harness (LVH) Kit
- High Voltage Cable (HVC) Sets
- XALT Battery Viewer (XBV) Telematics
- XALT Rack System (XRS)

Life Cycle Support

- XPAND Service Tool
- Remote Data Monitoring & Prognostics
- Pack Replacement Maintaining Interface Connections
- End-of-Life Re-purposing, Recycling
- Integration Support
- On-Site Training Classes

Additional Benefits

- In-house cell modeling and development creates sophisticated software and controls for accurate Power, SOC and SOH predictions
- Custom warranty programs available

Performance	
Capacity (Rated @ C/10)	142Ah
Discharge Energy (Rated @ C/10)	12,500Wh
Nominal Voltage	88.3VDC
Specific Power*	≥258W/kg
Specific Energy	≥161Wh/kg
Energy Density	≥194Wh/l
Discharge Peak*	1.5C / 225A
Charge Peak*	0.5C / 71A
Discharge Continuous**	**1C / 142A**
Charge Continuous**	**0.3C / 47A**
Weight	**77.4kg**
Dimensions (all versions incl base) (L) 753mm (W) 303mm (H) 282mm	

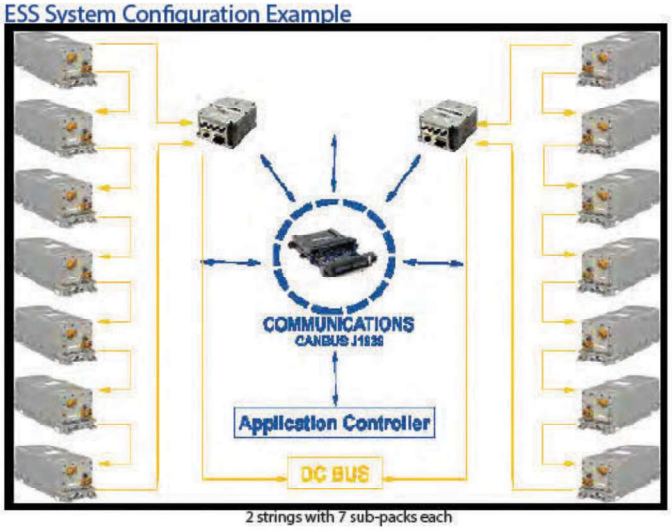
*10 seconds duration

**Cell performance will be affected by temperature, SoC, SoH, aging, etc.

Cycle Life	Typical
100% DOD Cycles @ 0.3C charge-discharge	>3,000 cycles***
80% DOD Cycles @ 0.3C charge-discharge	>4,000 cycles***

***Cycle life to 80% of rated capacity at 25°C room temperature with 10 min. step rest

ESS System Configuration Example



2 strings with 7 sub-packs each

The information contained herein is believed to be reliable, but no representation, guarantees or warranties of any kind are made to its accuracy or suitability for any purpose. The information presented herein is based on laboratory testing and does not necessarily indicate end product performance. Full scale testing and end product performance are the responsibility of the user.

www.XALTEnergy.com

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08-17-2021

Section 2K3

TS 9.1.4 Energy Storage System and Controller.

Solicitation Requirements:

The Proposal shall also include a comprehensive statement of the warranty terms relating to the battery, including explanation of all disclaimers within the warranty.

New Flyer response:

In the attached letter from New Flyer / MCI is the Statement of Warranty terms, which includes the disclaimer regarding the warranty explaining the capacity fade during the life of the battery.

NEW FLYER

New Flyer Energy Cell/Pack Warranty

A. New Flyer warrants the Energy Storage System for twelve (12) years/800,000 km's (whichever occurs first) after the date of acceptance of each bus ("**Warranty Period**"), to be free of defects in design, material and workmanship; (the "**Warranty**"). In addition, the string Battery Management System (BMS) controllers and Power Distribution Unit (PDU) are warranted for proper operation up to year 12 or 800,000 km's when the ESS is maintained in the manner described in the New Flyer Service Manual."

B. In a warrantable event, New Flyer shall, at its sole discretion:

- During the twelve years of the foregoing warranty period, the sole remedy under the Warranty shall be the repair or replacement of the Product at New Flyer's option and at its expense (including costs of shipping and packaging)

- This Warranty shall be null and void and there shall be no right to recovery whatsoever if the Cell's or Pack's date code or serial number is defaced, missing or altered.

Capacity Fade Disclaimer

"Capacity fade is the relative reduction of the total amount of energy the battery system can store in a single charge for the purpose of powering the bus as compared to capacity at beginning of life (BOL).
Capacity fade is warranted to 70% of BOL total energy capacity at year 12 or 800,000 km's when;

1) Capacity measurements are taken from a balanced ESS, and
2) ESS is maintained in the manner described in the New Flyer Service Manual."

THE WARRANTY HEREIN RESPECTING CELLS AND PACKS INCLUDING, WITHOUT LIMITATION, QUALITY AND PERFORMANCE AND ARE MADE EXPRESSLY IN LIEU OF AND EXCLUDE ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES PROVIDED BY STATUTE OR COMMON LAW.

Section 2K4

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

The charge cycle and cycle life shall be stated in the proposal, and a life-cycle cost analysis of the proposed battery system in the specified application shall be provided.

New Flyer response:

Testing was performed by the battery supplier in laboratory settings on single cells (that compose MCI's ESS) that are cycled between a minimum of 2.7 V and maximum of 4.2 V at various rates and various depths of discharge (DOD) (i.e. > 2.7 V). Using data provided to MCI from battery supplier XALT Energy, a cycle life of 4700 cycles until degradation to 70% of original capacity can be expected for an ESS for which cycling occurs approximately linearly; to 85% DOD; at ~25°C; and at a rate equivalent to a 3-hour charge/discharge cycle (reasonable conditions to be experienced in field use).
Ambient temperature is assumed to have no significant effect on ESS life, given that all cells are held in the optimal temperature range for maximum battery life by the sophisticated BTMS provided. Thus, no adjustments are required to be made to cycle life estimates based on conditions related to ambient temperature.

Section 2K5

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

If the ESS running a low SOC will in any way damage the ESS and/or the propulsion system, the propulsion system manufacturer together with the Contractor shall provide sufficient warning to the operator.

New Flyer response:

The request for warning to the operator is not applicable to the D45 CRT LE CHARGE™ and D45 CRT CHARGE.

Section 2K6

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Proposals shall include complete descriptions of all life-cycle testing procedures used to validate the life of batteries used for this application at the proposed charging rates, charge durations, and expected ambient temperatures and operating profiles. Proposers shall include documented results of life-cycle testing.

New Flyer response:

Testing was performed by the battery supplier in laboratory settings on single cells (that compose MCI's ESS) that are cycled between a minimum of 2.7 V and maximum of 4.2 V at various rates and various depths of discharge (DOD) (i.e. > 2.7 V). Herein, data obtained under the following conditions were primarily considered: 85% DOD; at ~25°C; and at a rate equivalent to a 3-hour charge/discharge cycle (C/3) (reasonable conditions to be experienced in field use).
Ambient temperature is assumed to have no significant effect on ESS life, given that all cells are held in the optimal temperature range for maximum battery life by the sophisticated BTMS provided. Thus, no adjustments are required to be made to cycle life estimates based on conditions related to ambient temperature.

Section 2K7

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Proposers shall include certification of battery life-cycle testing by an independent testing agency.

New Flyer Response:

Life cycle analysis was performed by Xalt Energy. Xalt Energy has confirmed they have not had a life cycle analyis performed by a third party on the Xalt battery system. The attached document provides information obtained from Xalt Energy verifing the testing completed by Xalt Energy.

Section 2K8

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Written confirmation from the battery manufacturer attesting to the safety of the proposed battery system in the specified application and charging profile shall be submitted as part of the proposal, and shall include full disclosure and discussion of any and all relevant issues or prior incidents relating to safety.

New Flyer Response:

Xalt Energy has provided a letter regarding the battery safety in the attachment. Xalt Energy has performed safety tests to meet multiple industry standards. Xalt states that the ESS system is safe, Xalt Energy encourges the review of the user manual to ensure that all safety protocol is followed.

XALT Energy

XALT Energy Midland Headquarters
2700 S. Saginaw Road, Midland, MI, 48640, USA

Motor Coach Industries
Charles Pelton
Sourcing Manager
1475 Clarence Ave.
Winnipeg, MB R3T 1T5

XALT Battery Safety Statement

XALT Energy's Energy Storages Systems (ESS) have been tested to multiple industry standards and are deemed safe when operated in a manner consistent with our User Manual. Safety tests performed on XALT ESSs include, but are not limited to:

- UNDOT 38.3 – Transportation Test
- Forced Internal Coolant Leak
- External Short Circuit
- In addition, Battery Management System (BMS) software and hardware have passed a full validation plan both separately and as installed in an ESS solution

Furthermore, XALT's Lithium Ion cells are designed with a ceramic separator to offer high thermal stability and are produced in a world class manufacturing facility with a 100% end-of-line inspection. XALT has six Functional Safety Certified Automotive Engineers (FSCAE) on staff. Extensive work has occurred to develop a robust DFMEA to address and design out potential failure modes. Safety Data Sheets for our ESS solutions are available upon request.

Feel free to reach out to the XALT staff if there are any questions or if specific details of the testing performed is required.

Sincerely,

Martin Klein
Senior Vice President of Engineering
XALT Energy

Section 2K9

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Proposals shall include complete descriptions of all safety standards followed in the design and manufacture of the battery system, safety testing procedures used to validate the safety of battery operation in this application, and documented results of safety testing to confirm that standards have been met.

New Flyer Response:

The following safety testing and standards have been performed and are met by MCI's battery supplier:
- UN 38.3 certified (altitude simulation, thermal cycling, vibration, mechanical shock, external short circuit. Passed all)
- Housing load (GMW 16390)
- Water submersion and dust ingress (ISO 20653- IP67 compliant)
- Forced internal leak (DOT HS 811573)
- Drop test (IEC 62281)
- Salt spray and gas corrosion (ISO 16750-4, IEC 60068-2-52, IEC 60068-2-11, IEC 60068-2-60)
- External short circuits (SAE J2464 and SAE J2929,UNDOT38.3-T5)
- BMS testing (DNV-GL & NMA, EN61000, ISO 16750, ISO 10605, CISPR 25, ISO 11452, ISO 7637, GMW 3172, J1113, IEC 60068, IEC 60529)
- Thermal shock (UNDOT38.3-T2, DNV-GL and NMA, ISO 12405)
- Dew test (ISO 16750, IEC 60068-2-30)
- Composite heat and humidity (ISO 16750, IEC 60068-2-38
- Chemical load (ISO 16750)
- Dielectric withstand (SAE J2578)
- Passive propagation (DNV-GL and NMA)
- External fuel fire exposure test (ECE R100 8E)
- Global EMC and EMI requirements (DNV-GL & NMA, EN61000, ISO 16750, ISO 10605, CISPR 25, ISO 11452, ISO 7637)
- Unbalanced overcharge (200% overcharge at 77°C)
- Mechanical shock and vibration (UNDOT38.3 T3 and T4, DNV-GL &NMA, IEC60068, ISO 12405, ECE R-100 8A and 8C (M2/N2, M3/N3))
- Coolant system stress (GMW 16390)
- Life cycle testing (Altoona accelerated life)

Section 2K10

TS 9.1.4 Energy Storage System and Controller.

Solicitation Requirements:

- Proposer should indicate where their standard mounting is located.
- If the mounting location is customizable, meaning the Agency has a choice, the Proposer should so indicate in their Proposal response.
- If the Proposer allows more than one charging receptacle to be installed on the bus then the Proposer shall also indicate in their Proposal response.

New Flyer Response:

Please refer to the provided attachment, the location of Charging Receptacle. There are other options that will be provided during negotiations or pre-production meetings with each Property during the purchasing process.

Section 2K11

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Include a description of the charging infrastructure required to charge the bus on route and/or at the depot.

New Flyer Response:

4 Installation/Infrastructure Requirements
Per the specifications. New Flyer understands that it's Infrastructure Solutions team shall:

- Provide all charging equipment design requirements and specifications to the Agency and it's designated architectural, civil, electrical, and mechanical engineering contractors to enable charging station site design, permitting, and construction.
- Coordinate with the Agency and its engineering contractors during site design and construction of the charging stations, including plan reviews and site reviews at critical project milestones.
- Be responsible for equipment start-up and testing to ensure that the charging equipment meets all stated specifications and functionality prior to site acceptance.

The infrastructure work (Provided by others) required at each site, for the charging systems described above, would include:

- Dedicated utility service and meter.
- Switchgear, including main switch and a sub-breaker for each charger.
- Power cabling and conduit.
- Communication cabling and conduit.
- Disconnect switches.
- Equipment pads and protective bollards.
- Charger equipment installation.
- Base plate(s), anchor rod(s), connectors, or other structural components required to be embedded in foundations.
- Other site/civil improvements as required by the Agency.

Section 2L

Solicitation Requirements:

TS13.1 Service.

List all special tools, fixtures or facility requirements recommended for servicing.

New Flyer Response:

There are no special tools or fixture requirements for this RFP.

Section 2M

Solicitation Requirements:

TS 19 Altoona Testing report required for RFP.

New Flyer Response:

Refer to the 2 reports attached as requested, Altoona Report and the Partial Altoonta Test December 2020 D45 CRT LE CHARGE™ for test results that PSTA requires for the RFP.

Section 20

Solicitation Requirements

TS 23 Towing.

Provide the towing procedure.

New Flyer Response:

Please refer to attachment D45CRTeLE Operators Manual for Service and Towing Operation.

This document provides full instructions for Towing and MCI Electric coach.

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT
In accordance with 49 CFR, Part 665

Manufacturer: Motor Coach Industries
Model: D45 CRTe LE

Partial Test

December 2020

Report Number: LTI-BT-R2020-10-P

The Thomas D. Larson
Pennsylvania Transportation Institute
201 Transportation Research Building
The Pennsylvania State University
University Park, PA 16802
(814) 865-1891

Bus Testing and Research Center
2237 Plank Road
Duncansville, PA 16635
(814) 695-3404



PennState
College of Engineering

LTI BUS RESEARCH
AND TESTING CENTER

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration, U.S. DOT
1200 New Jersey Avenue, SE
Washington, DC 20590

In accordance with 49 CFR Part, 665

Manufacturer: Motor Coach Industries

Manufacturer's address: 1475 Clarence Avenue Winnipeg, Manitoba, Canada R3T1T5

Model: D45 CRTe LE

Partial Test

Report Number: LTI-BT-R2020-10-P



David J Klinikowski	Director, Bus Research and Testing Center	12/07/2020
Quality Authorization	Title	Date

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EXECUTIVE SUMMARY

TEST HIGHLIGHTS

The information in this report pertains only to this specific bus, as received from the manufacturer for testing.

The Check-In section of the report provides a description of the bus and specifies its major components. The following table gives the salient specifications.

Manufacturer	Motor Coach Industries
Model	D45 CRTe LE
Chassis Make/Model	MCI / D45 CRTe LE
Chassis Modified	No
Length	45 feet, 8 ½ inches
Fuel	Battery Electric
Service Life	12 Year / 500,000 mile Partial Test
Number of Seats (including driver)	51 & 2 wheelchairs
Manufacturer-Designated Standing Passenger Capacity	11 Standees
Gross Vehicle Weight used for testing	54,000 lb.
Gross Vehicle Weight Rating	54,000 lb.
Mileage at Delivery	33,991
Test Start Date	September 16, 2020
Test Completion Date	October 30, 2020

The measured curb weight was 13,100 lb. for the front axle, 17,780 for the middle axle and 12,600 lb. for the rear axle. These combined weights provided a total measured curb weight of 43,480 lb. There are 53 seats (including the driver) and one wheelchair position. Two of these seats fold away for an additional wheelchair position. There is free floor space for 36 standing passengers. However, a placard shows the maximum number of standing passengers as 11. Therefore, the gross load represents 51 seated passengers, two wheelchairs and 11 standees only, for a total of 64 passengers. Gross load is calculated as (150 lb. x 62) + (600 lb. x 2) = 10,500 lb. At full declared capacity, the measured gross vehicle weight was 54,000 lb. There is a potential to overload this bus with the available free floor space for standing passengers.

The FTA determined that this bus be tested for Accessibility, Replacement and/or Repair of Selected Subsystems, Performance and Gradeability, Energy Economy and both Interior and Exterior Noise; the baseline full Bus Testing report for this test is LTI-BT-R1713.

ABBREVIATIONS AND ACRONYMS

ABS - anti-skid braking system
ABTC - Altoona Bus Test Center
A/C - air conditioner, or air conditioning
AC - alternating current
ADA - American Disability Act
CDCTS - chassis dynamometer test control system
CVS - constant volume sampling
CW - curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A) - decibels with reference to 0.0002 microbar as measured on the "A" scale
DC - direct current
DIR - test director
DR - bus driver
EPA - Environmental Protection Agency
GAWR – gross axle weight rating
GVL - gross vehicle load (150 lb. for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW - gross vehicle weight (curb weight plus gross vehicle load)
GVWR - gross vehicle weight rating
HD-UDDS – Heavy Duty-Urban Dynamometer Driving Schedule
LTI - Larson Transportation Institute
mpg - miles per gallon
mph - miles per hour
PM - Preventive maintenance
PSTT - Penn State Test Track
rpm - revolutions per minute
SAE - Society of Automotive Engineers
SCF - Standard cubic foot
SCH - test scheduler
SA - staff assistant
SLW - seated load weight (curb weight plus 150 lb. for every designed passenger seating position and for the driver)
TD - test driver
TECH - test technician
TM - track manager
TP - test personnel
Wh - Watt hour

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consisted of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer certified that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consisted of a Motor Coach Industries, model D45 CRTe LE. The bus has a front passenger door forward of the front axle, and an ADA accessible passenger door equipped with a Braun NFRC30X78 slide out ramp between the front and middle axles. Power is provided by a 389 kWh battery pack, a Siemens 1DB2024-ONA06 traction motor and a Siemens ELFA2 Control System.

The measured curb weight was 13,100 lb. for the front axle, 17,780 for the middle axle and 12,600 lb. for the rear axle. These combined weights provided a total measured curb weight of 43,480 lb. There are 53 seats (including the driver), one wheelchair position. Two of these seats fold away for an additional wheelchair position. There is free floor space for 36 standing passengers. However, a placard shows the maximum number of standing passengers as 11. Therefore, the gross load represents 51 seated passengers, two wheelchairs and 11 standees only, for a total of 64 passengers. Gross load is calculated as (150 lb. x 62) + (600 lb. x 2) = 10,500 lb. At full declared capacity, the measured gross vehicle weight was 54,000 lb. There is a potential to overload this bus with the available floor space for standing passengers.

VEHICLE DATA FORM

Bus Number: 2020-10-P	Date of Check-In: 09/24/2020
Bus Manufacturer: Motor Coach Industries	Vehicle Identification Number (VIN): 2MGWDMZA9KW068606
Model Number: D45 CRTe LE	Chassis Mfr./Mod. #: MCI / D45 CRTe LE
Personnel: S.R. & E.D.	Starting Odometer Reading: 33,991

WEIGHT:

Individual Wheel Reactions:

Weights (lb.)	Front Axle		Middle Axle		Rear Axle	
	Curb	Street	Curb	Street	Curb	Street
CW	6,480	6,620	8,420	9360	5,820	6,780
SLW	7,910	7,930	10,460	11,670	6,780	7,590
GVW	8,440	8,550	10,520	12,130	6,760	7,600

Total Weight Details:

Weight (lb.)	CW	SLW	GVW	GAWR
Front Axle	13,100	15,840	16,990	17,000
Middle Axle	17,780	22,130	22,650	23,000
Rear Axle	12,600	14,370	14,360	16,500
Total	43,480	52,340	54,000	GVWR: 54,000 (Declared by Manufacturer)

Dimensions:

Length (ft/in)	45 / 8.5
Width (in)	103 (molding protruding from both sides of bus)
Height (in)	138.5
Front Overhang (in)	77.5
Rear Overhang (in)	107.75
Wheelbase (in)	314.25 Tag wheelbase: 49.25
Wheel Track (in)	Front: 84.9
	Middle: 75.5
	Rear: 85.0

Bus Number: 2020-10-P	Date: 09/16/2020

CLEARANCES:

Lowest Point Outside Front Axle	Location: Vertical framework at bulkhead Clearance(in): 8.7
Lowest Point Outside Rear Axle	Location: Skid plate welded to framework Clearance(in): 8.7
Lowest Point between Axles	Location: Body panels Clearance(in): 12.7
Ground Clearance at the center (in)	12.7
Front Approach Angle (deg)*	9.7
Rear Approach Angle (deg)*	5.6
Ramp Clearance Angle (deg)	4.6
Aisle Width (in)	13.9
Inside Standing Height at Center Aisle (in)	75

*measurements used to calculate approach and departure angles are taken from the centerline of the axles.

BODY DETAILS:

Body Structural Type	Monocoque		
Frame Material	Steel and stainless steel		
Body Material	Composite		
Floor Material	Plywood		
Roof Material	Aluminum		
Windows Type	■ Fixed	☐ Movable	
Window Mfg./Model No.	Dura Automotive Systems / V339-03 (Egress) Dura Automotive Systems / V337-03 (Non-egress)		
Number of Doors	1 Front	1 Rear	
Mfr. / Model No.	Front: Masats / DM10802CA000 Rear: Masats / DM10314AA007		
Dimension of Each Door (in)	Front: 84.1 x 24.4 Rear: 87.5 x 31.6		
Passenger Seat Type	☐ Cantilever	■ Pedestal	☐ Other (explain)
Driver Seat Type	■ Air	☐ Spring	☐ Other (explain)
Mfr. / Model No.	Recaro / Ergo Metro AM80		
Number of Seats (including Driver)	53 and 1 wheelchair or 51 and 2 wheelchairs		

Bus Number: 2020-10-P	Date: 09/19/2020

BODY DETAILS (Contd.)

Free Floor Space (ft^2)	57.2
Height of Each Step at Normal Position (in)	Front: 1.)16.2 2.) 7.5 3.) 7.5 4.) 7.5 5.) 7.7 6.) 7.5
	Middle 1. N/A 2. N/A 3. N/A 4. N/A
	Rear: 1.)17.7 2.) 8.6 3.) 8.3 4.) 8.5 5.) 8.5 6.) 8.2
Step Elevation Change - Kneeling (in)	Front: 6.2 Rear:3.3

ENGINE

Type	☐ C.I.	☐ Alternate Fuel	
	☐ S.I.	■ Other (Battery Electric)	
Air Compressor Mfr. / Model No.	Powerex / SDCHO5021MCI		
Maximum Capacity (ft^3 / min)	12.5 at 145 psi		
Starter Type – N/A	☐ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	N/A		

BATTERY SYSTEM

Drive Battery – Mfr. /Model No.	XALT Energy / XMP 111E, XMOD 111E & ½ MOD
Maximum Rated Capacity (kWh)	389 (comprised of 5 battery strings at different locations on the bus)
Battery Capacity (AMP hrs)	630 Total (XMP 111E & XMOD 111E @ 126 Ah; ½ MOD @ 63 Ah)
Battery Type (Chemistry)	Nickel Manganese Cobalt (NMC) Lithium-Ion
Battery Location	String 1: Forward streetside compartment, String 2: Partially in the forward streetside compartment and partially in the curbside compartment ahead of the drive axle Strings 3 & 4: Rear compartment (behind the motor) String 5: Partially in the rear compartment and partially in curbside rear compartment behind the rear (tag) axle.
Usable Capacity (kWh)	331
Nominal Voltage (Vdc)	700

PROPULSION CONTROL SYSTEM (Middle Axle)

Propulsion Control System Mfr. / Model No.	Siemens ELFA2 System / A5E46207904
Traction Motor - Mfr. / Model No.	Siemens / 1DB2024-0NA06
Traction Motor Power rating (kW)	310

Bus Number: 2020-10-P	Date: 09/16/2020

PROPULSION CONTROL SYSTEM (Middle Axle) (Cont.)

DCDC Converter Mfr. / Model No.	Siemens / EMDAG2303303U0S
HV Distribution Box Mfr. / Model No.	MCI P/N 07-13-4653

SUSPENSION

Number of Axles	3		
Front Axle Type	■ Independent	☐ Beam Axle	
Mfr. / Model No.	ZF-CSS&C LLC / RL80E		
Axle Ratio (if driven)	N/A		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Sachs / 481700005968		
Middle Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	ZF-CSS&C LLC / A132 I-3.82		
Axle Ratio (if driven)	4.70		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	4		
Mfr. / Model No.	Sachs / 481700013549		
Rear Axle Type	■ Independent	☐ Beam Axle	
Mfr. / Model No.	ZF-CSS&C LLC / RL80E		
Axle Ratio (if driven)	N/A		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Sachs / 481700013548		

Bus Number: 2020-10-P	Date: 09/16/2020

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Alcoa / Durabright 22.5 x 9
	Tire Mfr./ Model No.	Michelin / XZA2 Energy 315/80R22.5
Rear	Wheel Mfr./ Model No.	Alcoa /Durabright 22.5 x 9
	Tire Mfr./ Model No.	Michelin / XZA2 Energy 315/80R22.5

BRAKES

Front Axle Brakes Type	☐ Cam	■ Disc	☐ Other (explain)
Mfr. / Model No.	Bendix / ADB22X		
Middle Axle Brakes Type	☐ Cam	■ Disc	☐ Other
Mfr. / Model No.	Bendix / ADB22X		
Rear Axle Brakes Type	☐ Cam	■ Disc	☐ Other (explain)
Mfr. / Model No.	Bendix / ADB22X		

HVAC

Heating System Type	☐ Air	■Water	■ Other (Electrically powered liquid cooled braking resistor)
Capacity (Btu/hr)	170,600 (50Kw)		
Mfr. / Model No.	Siemens / A5E00291704		
Air Conditioner	■ Yes	☐ No	
Location	Streetside second baggage bay		
Capacity (Btu/hr)	Driver Unit: 25,000	Main Cabin: 122,150	
A/C Compressor Mfr. / Model No.	Bitzer / 4PE-15-2NU		

STEERING

Steering Gear Box Type	Hydraulic-assisted gear (Parker 19-08-4020-09 ES)		
Mfr. / Model No.	ZF / 8018 955 900		
Steering Wheel Diameter	18”		
Number of turns (lock to lock)	5		
Control Type	■ Electric	■ Hydraulic	☐ Other (explain)

Bus Number: 2020-10-P	Date: 09/16/2020

OTHERS

Wheelchair Ramps	Location: Middle	Type: Slide out
Wheelchair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	Braun / NFRC30X78	
Emergency Exit	Location: Window Door Roof hatch	Number: 13 2 2

CAPACITIES

Fuel Tank Capacity (gallons)	N/A
Engine Crankcase Capacity (gallons)	N/A
Transmission Capacity (gallons)	N/A
Differential Capacity (quarts)	4.9
Cooling System Capacity (gallons)	Cabin heating: 17.8 Motor/Inverter: 17.7 Battery thermal management system: 19.3
Power Steering Fluid Capacity (quarts)	10

VEHICLE DATA FORM

Bus Number: 2020-10-P	Date: 09/16/2020

List all spare parts, tools and manuals delivered with the bus.

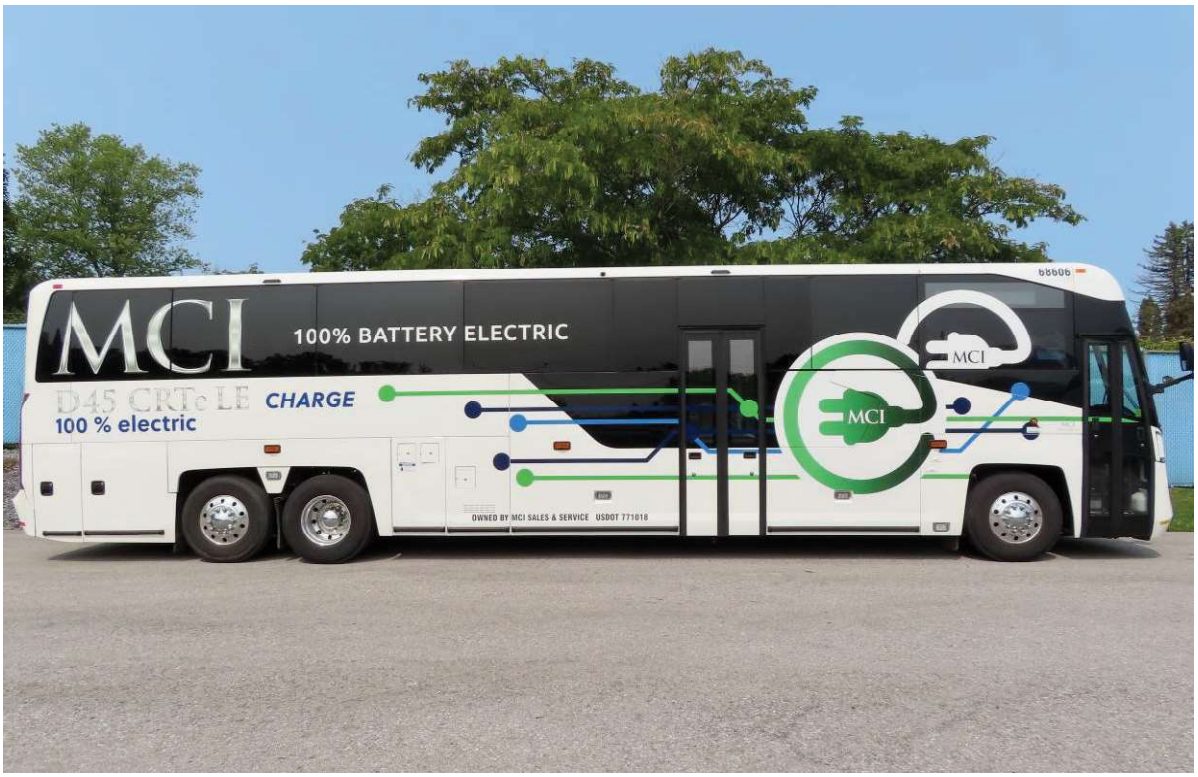
Part Number	Description	Qty.
N/A	N/A	

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 2020-10-P	Date: 09/16/2020

Subsystem	Checked	Initials	Comments
Air Conditioning Heating and Ventilation	✓	E.D.	None noted.
Body and Sheet Metal	✓	E.D.	None noted.
Frame	✓	E.D.	None noted.
Steering	✓	E.D.	None noted.
Suspension	✓	E.D.	None noted.
Interior/Seating	✓	E.D.	None noted.
Axles	✓	E.D.	None noted.
Brakes	✓	E.D.	None noted.
Tires/Wheels	✓	E.D.	None noted.
Exhaust	N/A	E.D.	Battery Electric
Fuel System	✓	E.D.	Battery Electric
Power Plant	✓	E.D.	None noted.
Accessories	✓	E.D.	None noted.
ADA Accessible Lift System	N/A	E.D.	None noted.
ADA Accessible Ramp System	✓	E.D.	None noted.
Interior Fasteners	✓	E.D.	None noted.
Batteries	✓	E.D.	None noted.

CHECK - IN



MOTOR COACH INDUSTRIES
D45 CRTe LE



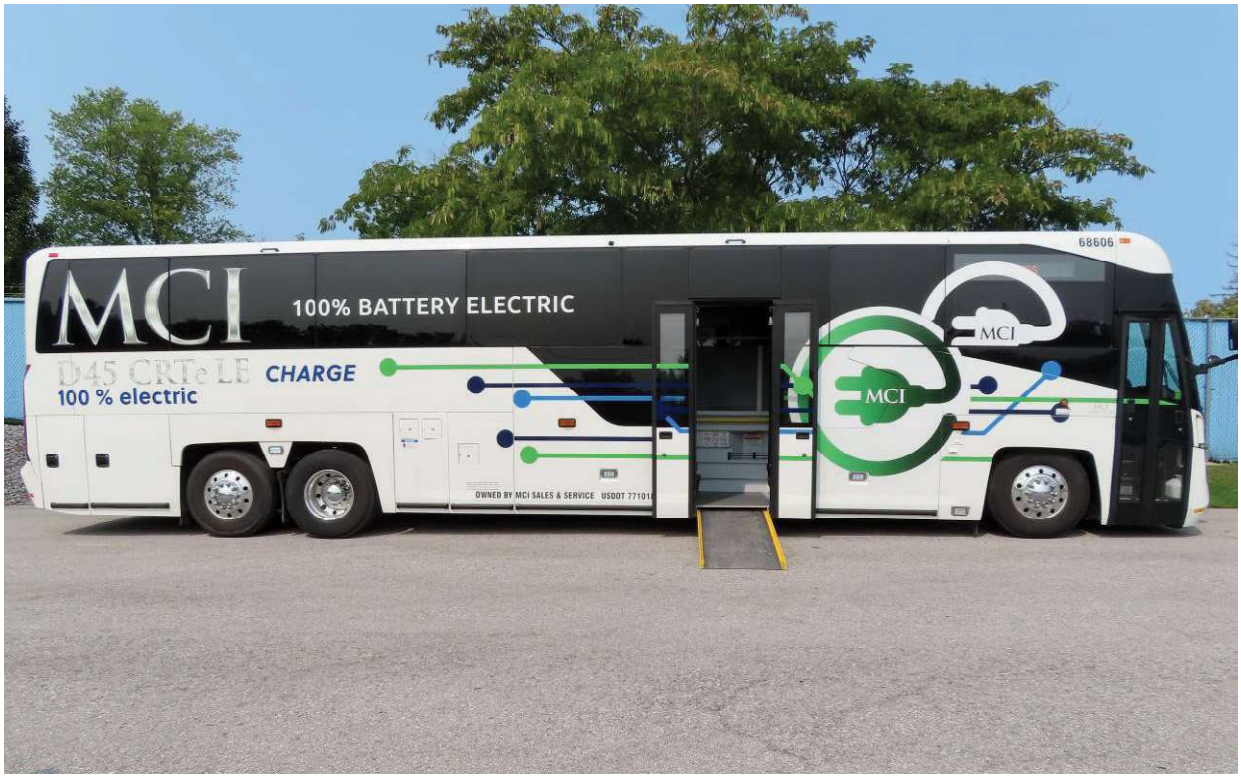
CHECK - IN CONT.



MOTOR COACH INDUSTRIES
D45 CRTe LE



CHECK - IN CONT.



BRAUN NFRC30X78
SLIDEOUT ADA ACCESSIBLE RAMP

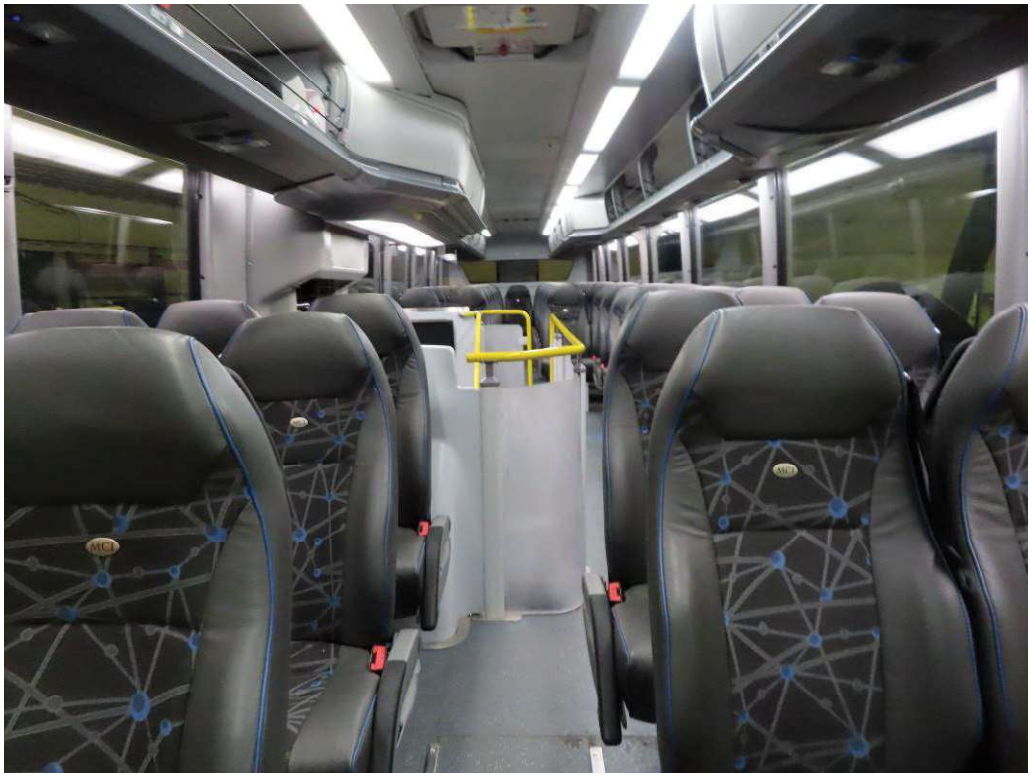


REAR BATTERY COMPARTMENT

CHECK - IN CONT.

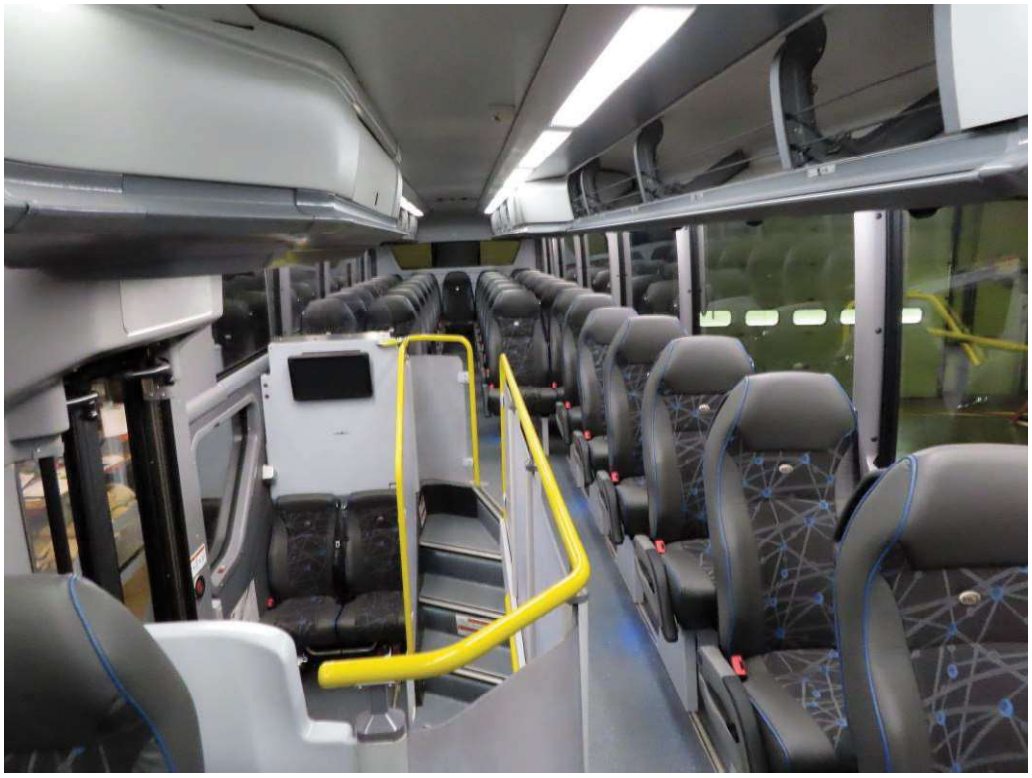


OPERATOR'S AREA

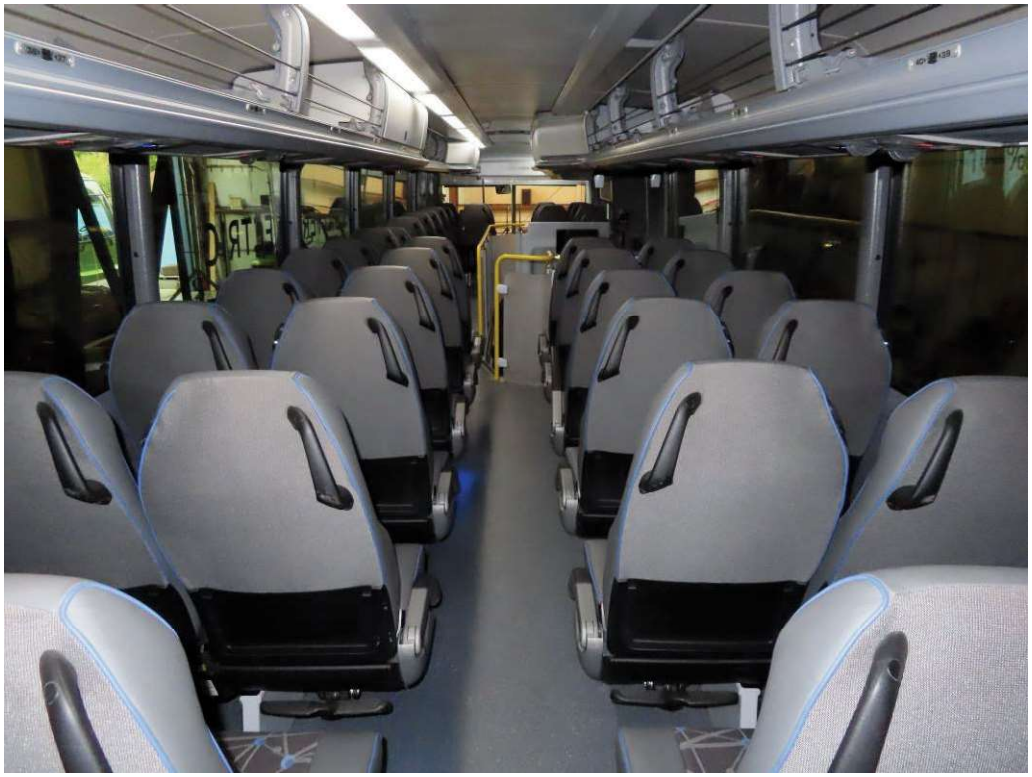


INTERIOR FROM FRONT

CHECK - IN CONT.

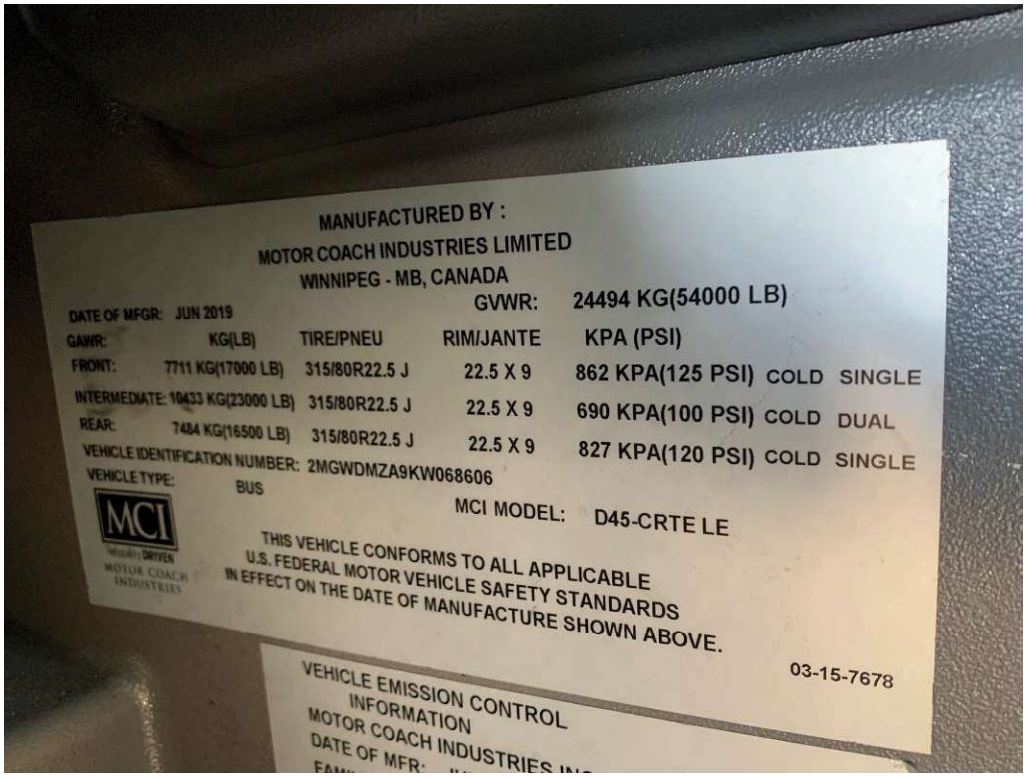


INTERIOR FROM MIDDLE

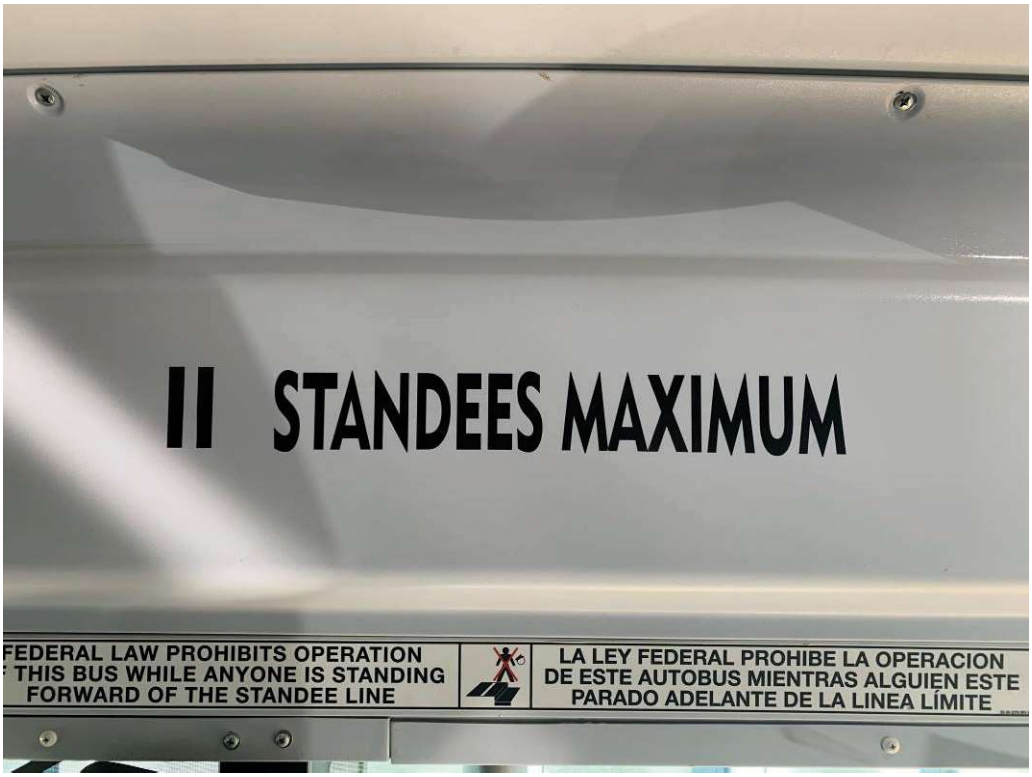


INTERIOR FROM REAR

CHECK - IN CONT.



VIN TAG



STANDEE PLACARD

CHECK - IN CONT.



CHARGE POINT CHARGER

1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems was checked, and where accessibility was restricted the subsystem was noted along with the reason for the restriction.

1.1-III. DISCUSSION

Accessibility, in general, was adequate. Components covered in Section 1.3 (repair and/or replacement of selected subsystems), along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 2020-10-P	Date: 10/22/2020

Component	Checked	Comments
ENGINE:		
Oil Dipstick	N/A	None noted.
Oil Filler Hole	N/A	None noted.
Oil Drain Plug	N/A	None noted.
Oil Filter	N/A	None noted.
Fuel Filter	N/A	None noted.
Air Filter	N/A	None noted.
Belts	N/A	None noted.
Coolant Level	✓	None noted.
Coolant Filler Hole	✓	None noted.
Coolant Drain	N/A	None noted.
Spark / Glow Plugs	N/A	None noted.
Alternator	N/A	None noted.
Diagnostic Interface Connector	✓	None noted.
TRANSMISSION:		
Fluid Dipstick	N/A	None noted.
Filler Hole	N/A	None noted.
Drain Plug	N/A	None noted.
SUSPENSION:		
Bushings	✓	None noted.
Shock Absorbers	✓	None noted.
Air Springs	✓	None noted.
Leveling Valves	✓	None noted.
Grease Fittings	✓	None noted.

ACCESSIBILITY DATA FORM

Bus Number: 2020-10-P	Date: 10/22/2020

Component	Checked	Comments
HVAC:		
A/C Compressor	✓	None noted.
Filters	N/A	None noted.
Fans	✓	None noted.
ELECTRICAL SYSTEM:		
Fuses	✓	None noted.
Batteries	✓	None noted.
Voltage regulator	N/A	None noted.
Voltage Converters	✓	None noted.
Lighting	✓	None noted.
MISCELLANEOUS:		
Brakes	✓	None noted.
ADA Accessible Lifts/Ramps	✓	None noted.
Instruments	✓	None noted.
Axles	✓	None noted.
Exhaust	N/A	None noted.
Fuel System	✓	Battery Electric
OTHERS:		
Drive motor	✓	None noted.
Battery packs	✓	None noted.

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test involved components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that failed during testing of the bus was added to this list. Components to be included are:

1. Drive Motor
2. DC/DC Inverter
3. High Voltage Batteries
4. Batteries
5. Windshield Wiper Motor

1.3-III. DISCUSSION

At the end of the test, the items on the list were removed and replaced. The drive motor assembly took 12.00 labor-hours (2 persons @ 6.00 hrs.) to remove and replace. The time required for repair/replacement of the other four components is given on the following Repair and/or Replacement Form.

REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Drive Motor	12.00 labor hours
Wiper Motor	1.50 labor hours
DC/DC Inverter	1.50 labor hours
High Voltage Battery String #5	4.00 labor hours
Batteries	0.50 labor hours

It was noted that high voltage battery string #5 was the easiest to remove and that the other strings may require more time. Additionally, it was noted that the DC/DC inverter that was removed during testing was one of three in the compartment and the easiest to remove. The other two may require additional time.

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS



DRIVE MOTOR REMOVAL AND REPLACEMENT (12.00 LABOR HOURS)



WIPER MOTOR REMOVAL AND REPLACEMENT (1.50 LABOR HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.



DC/DC INVERTER REMOVAL AND REPLACEMENT
(1.50 LABOR HOURS)



HIGH VOLTAGE BATTERY STRING #5 REMOVAL AND REPLACEMENT
(4.00 LABOR HOURS)

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus was operated at SLW on a chassis dynamometer. The procedure dictates that the test bus be accelerated to a maximum "power-limited"/"governed" or maximum "safe" speed not exceeding 80 mph. The maximum power-limited/governed speed, if applicable, is the top speed as limited by the engine control system. The maximum safe speed is defined as the maximum speed that the dynamometer, the tires or other bus components are limited to. The test vehicle speed was measured using a speed encoder built in the chassis dynamometer. The time intervals between 10 mph increments were recorded using a Data Acquisitions System. Time-speed data and the top speed attained were recorded on the Performance Data Form. The recorded data was used to generate a percent grade versus speed table and a speed versus time curve. All the above are available in the following pages.

4-III. DISCUSSION

This test consisted of three runs from standstill to full throttle on the chassis dynamometer. Speed versus time data was obtained for each run and results are averaged to minimize test variability. The test was performed up to a maximum governed speed of 71.9 mph. The calculated gradeability results are attached. The average time to reach 30 mph was 8.0 seconds. The maximum gradeablity at 10 mph was 19.4% and at 40 mph was 5.3%.

PERFORMANCE DATA FORM

Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. & S.I.	
Temperature (°F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

		INITIALS:
Air Conditioning - OFF	✓Checked	M.H.
Heater pump motor - OFF	✓Checked	M.H.
Defroster - OFF	✓ Checked	M.H.
Exterior and interior lights - ON	✓ Checked	M.H.
Windows and doors - CLOSED	✓ Checked	M.H.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.3	3.1	3.0
20 mph	5.6	5.3	5.3
30 mph	8.2	7.9	7.9
40 mph	14.4	14.2	14.3
50 mph	24.6	24.4	24.4
60 mph	40.7	40.5	40.6
70 mph	78.4	77.6	77.6

Maximum Speed (mph): 71.9 (maximum governed speed reached)

PERFORMANCE SUMMARY SHEET

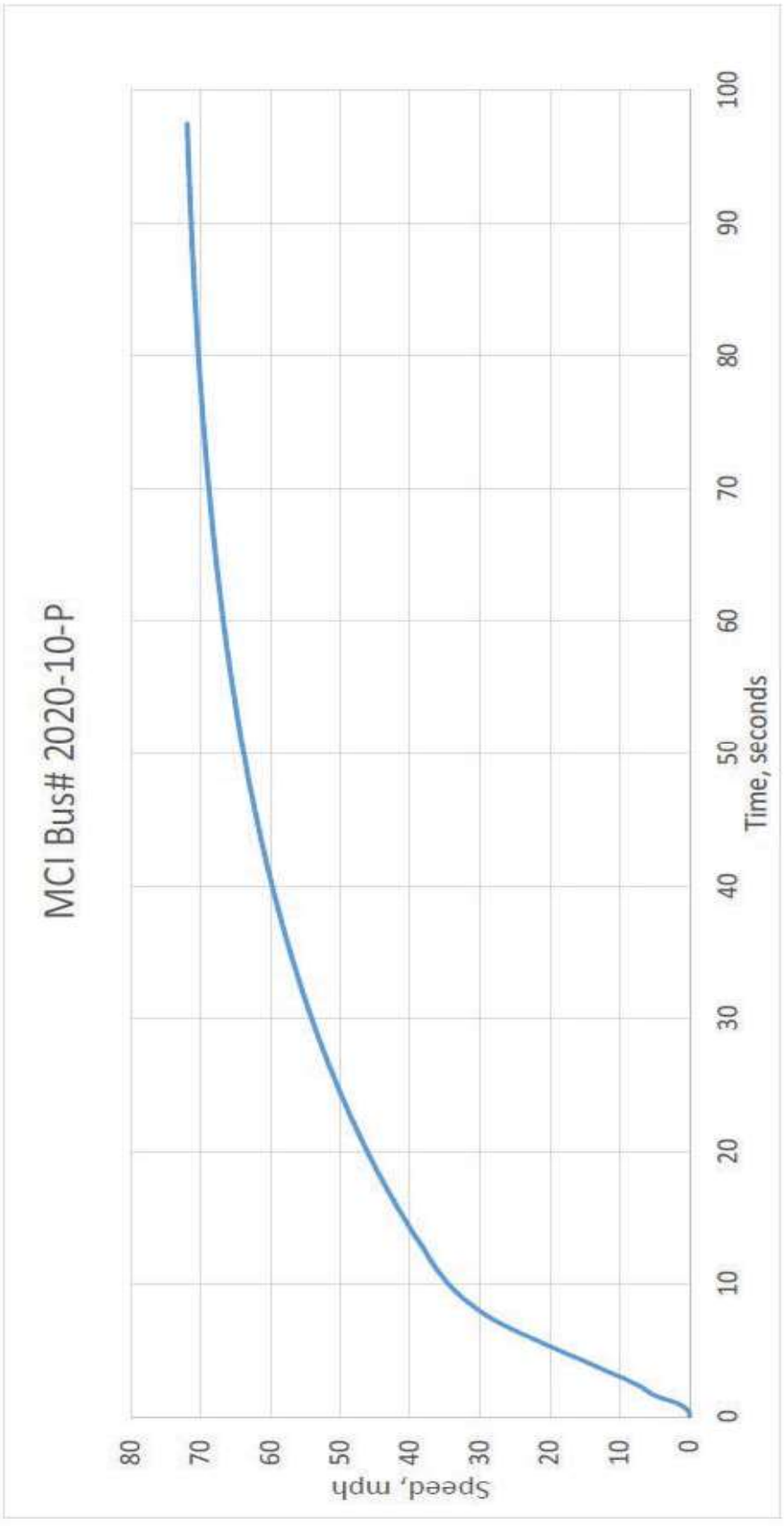
Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. & S.I.	

Test Conditions:

Temperature (°F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

Test Results:

Vehicle Speed (MPH)	Time (SEC)	Acceleration (FT/SEC^2)	Max. Grade (%)
1.0	0.8	5.38	16.7
5.0	1.7	5.71	17.7
10.0	3.1	6.26	19.4
15.0	4.2	6.50	20.2
20.0	5.3	6.19	19.2
25.0	6.5	5.85	18.2
30.0	8.0	4.00	12.4
35.0	10.4	2.26	7.0
40.0	14.3	1.70	5.3
45.0	18.9	1.43	4.4
50.0	24.5	1.18	3.7
55.0	31.5	0.92	2.9
60.0	40.6	0.69	2.1
65.0	53.7	0.47	1.5
70.0	78.0	0.20	0.6
71.9	97.2	Maximum Speed	


MCI Bus# 2020-10-P
Speed, mph
0
10
20
30
40
50
60
70
80
Time, seconds
0
10
20
30
40
50
60
70
80
90
100

6. ENERGY ECONOMY AND RANGE TEST – AN ENERGY CONSUMPTION AND RANGE TEST FOR BATTERY ELECTRIC BUSES USING APPROPRIATE OPERATING CYCLES

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable energy consumption data on battery electric transit buses produced by different manufacturers. This energy economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This energy economy test, as designated here, is a measurement of the energy consumed by a vehicle traveling a specified test operating profile, under specified operating conditions that are typical of transit bus operation. The results of this test will not represent actual energy usage but will provide data that can be used by FTA Grantees to compare buses tested using this procedure.

6-II. TEST DESCRIPTION

This test is performed in the emissions bay of the LTI Vehicle Testing Laboratory. The Laboratory is equipped with a Schenk Pegasus 300 HP, large-roll (72 inch diameter) chassis dynamometer suitable for heavy-vehicle emissions testing. The driving cycles are the Manhattan cycle, a low average speed, highly transient urban cycle (Figure 1), the Orange County Bus Cycle which consists of urban and highway driving segments (Figure 2), and the EPA HD-UDDS Cycle (Figure 3). This test is conducted at seated load weight.

This test is conducted generally as per the methods described in the SAE standard J 1634-2017. The light-duty test cycles specified in this standard are replaced by transit bus test cycles mentioned above.

The Multi-Cycle test (MCT) procedure is adopted for this bus. The end of test is determined when the bus cannot keep up with the speed trace of the test cycle, as recommended by the bus manufacturer. The battery system is recharged to full SOC at the end of the test, following procedures specified in SAE J 1634-2017. During the recharge, the DC energy (into the battery system) and the AC energy (into the charger) are recorded. From these data, the average AC energy consumption, the charger efficiency (DC Energy, kWh/AC Energy, kWh) and range (miles) for each test cycle is calculated.

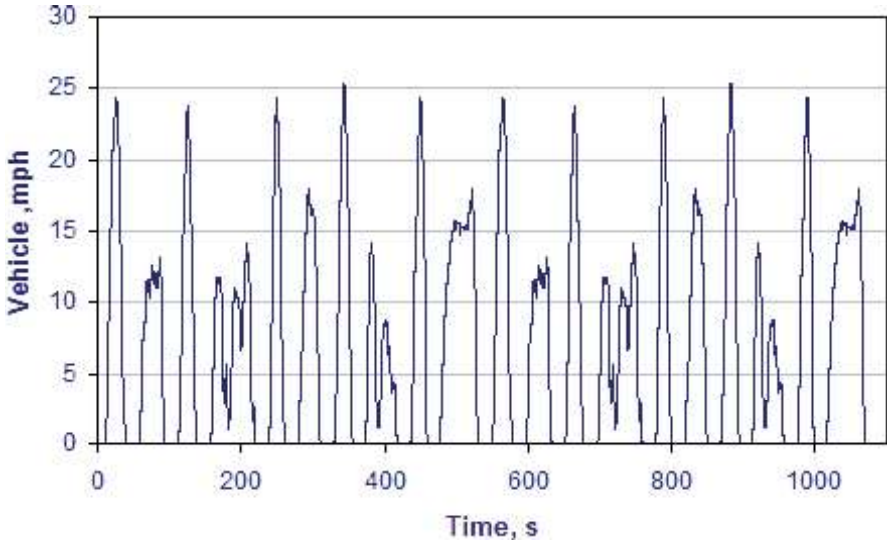


Figure 1. Manhattan Driving Cycle (duration 1089 sec, Maximum speed 25.4 mph, average speed 6.8 mph)

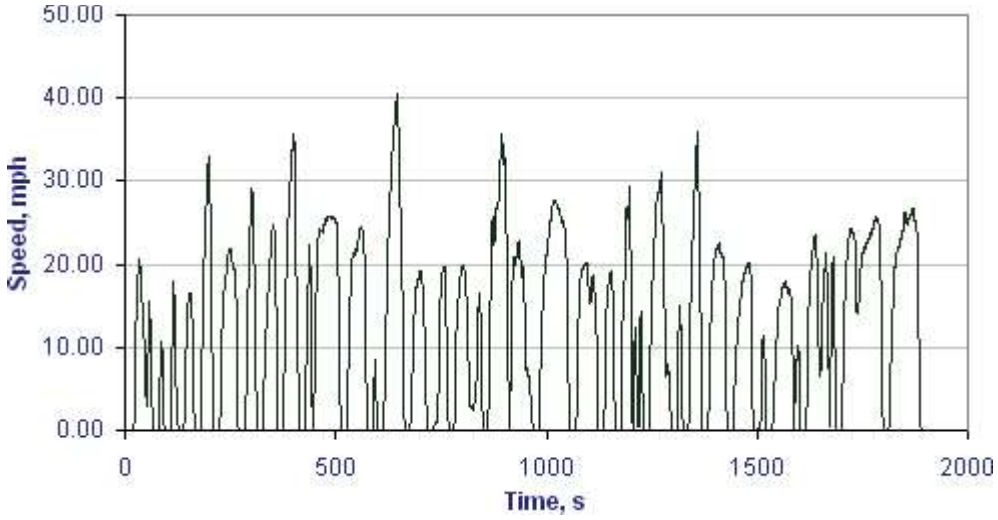


Figure 2. Orange County Bus Cycle (Duration 1909 Sec, Maximum Speed 41 mph, Average Speed 12 mph).

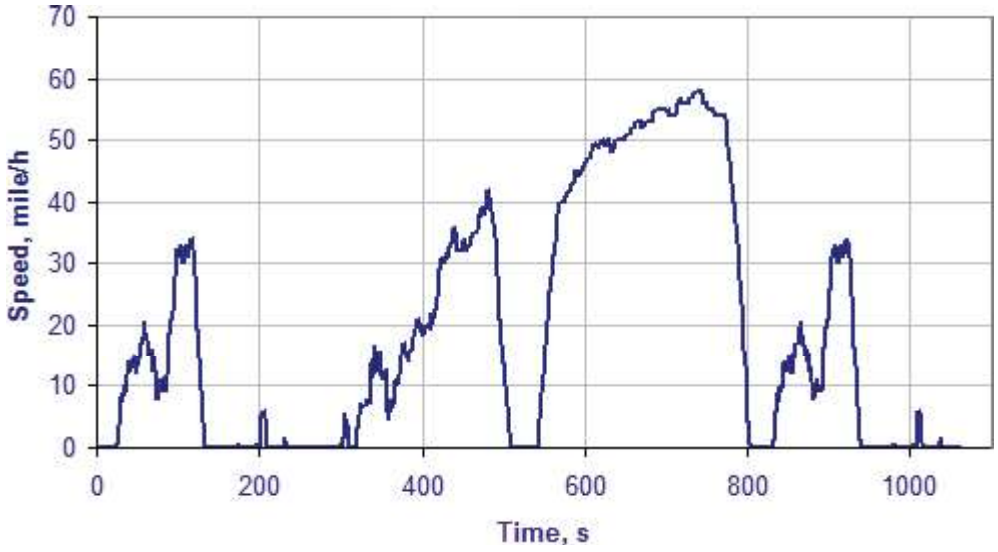


Figure 3. HD-UDDS Cycle (duration 1060 seconds, Maximum Speed 58 mph, Average Speed 18.86 mph).

6-III. DISCUSSION

The driving cycle consists of three simulated transit driving cycles: Manhattan, Orange County Bus Cycle and the HD-UDDS, as described in 6-II.

An extensive pretest maintenance check is conducted including the replacement of all lubrication fluids, if applicable. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection Form. Finally, the summary sheet provides the average energy consumption and range of bus for the three test cycles. The test was conducted at a seated load weight of 52,340 lbs. The average AC energy consumption for the Manhattan, OCBC and the HD-UDDS were 3533 Wh/mile, 2664 Wh/mile and 2290 Wh/mile, respectively. The range for the three driving cycles were 117 miles, 155 miles and 180 miles, respectively.

This bus was tested using the Manhattan, Orange County and UDDS driving cycles. The energy economy and range results for buses tested using these cycles are not directly comparable to buses tested under the earlier protocol that uses the CBD, Arterial and Commuter driving cycles.

ENERGY ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 2020-10-P	Date:	SLW (lb.): 52,340
Personnel: T.S., S.R., E.D. & E.L.		

ENERGY SYSTEM	OK
Install fuel measurement system	✓
Remarks: None noted.	
BRAKES/TIRES	OK
Inspect hoses	✓
Inspect brakes	✓
Check tire inflation pressures (mfg. specs.)	✓
Check tire wear (less than 50%)	✓
Remarks: None noted.	
BATTERY COOLING SYSTEM	OK
Check hoses and connections	✓
Check system for coolant leaks	✓
Remarks: None noted.	

ENERGY ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 2020-10-P	Date: 09/24/2020
Personnel: T.S., S.R., E.D. & E.L.	

ELECTRICAL SYSTEM	OK
Check battery	✓
Inspect wiring	✓
Inspect terminals	✓
Check lighting	✓
Remarks: None noted.	

DRIVE SYSTEM	OK
Drain transmission fluid	N/A
Replace filter/gasket	N/A
Check hoses and connections	✓
Replace transmission fluid	N/A
Check for fluid leaks	✓
Remarks: Drive motor – refer to manufacturer maintenance specifications	

LUBRICATION	OK
Lube all chassis grease fittings	✓
Lube universal joints	N/A
Replace differential lube including axles	N/A
Remarks: None noted.	

ENERGY ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 2020-10-P	Date: 09/24/2020
Personnel: T.S., S.R., E.D. & E.L.	

OTHER ITEMS	OK
Replace air filter	N/A
Inspect air compressor and air system	✓
Inspect vacuum system, if applicable	N/A
Check and adjust all drive belts	N/A
Remarks: None noted	

STEERING SYSTEM	OK
Check power steering hoses and connectors	✓
Service fluid level	✓
Check power steering operation	✓
Remarks: None noted	

	OK
Ballast bus to seated load weight	✓

TEST DRIVE	OK
Check brake operation	✓
Check transmission operation	✓
Remarks: Electric Bus – has drive motor	

ENERGY ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 2020-10-P	Date: 09/24/2020 & 10/13/2020
Personnel: T.S., S.R., E.D., E.L. & M.H.	

PRE WARM-UP	If OK, Initial
Energy Economy Pre-Test Maintenance Form is complete	E.D.
Cold tire pressure (psi): Front 125 Middle/Drive 100 Rear 120	T.S.
Energy economy instrumentation installed and working properly.	T.S.
Bus is loaded to SLW during coast down	E.D.
WARM-UP	**If OK, Initial**
Interior and exterior lights on	M.H.
Air conditioner off	M.H.
Defroster off	M.H.
Windows and doors closed	M.H.
Do not drive with left foot on brake	M.H.

ENERGY ECONOMY DATA FORM
(Battery Electric Buses)

Bus Number: 2020-10-P	Manufacturer: MCI	Date: 10/13/2020
Fuel Type: Electric	Personnel: M.H. & S.I.	
Temperature (°F): 69.5	Humidity (%): 54	Barometric Pressure (inHg): 28.7
SLW (lb.): 52,340	Charger: Charge Point	

	Manhattan	**Orange County**	**UDDS**
AC Energy (Wh/mile)	3533	2664	2290
Range (miles)	117	155	180

Comments: None noted.

6.0 ENERGY ECONOMY



BUS TESTED ON CHASSIS DYNAMOMETER FOR PERFORMANCE AND ENERGY ECONOMY

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level was measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system provided a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories were switched off and all openings including doors and windows were closed. This test was performed at the LTI Test Track Facility.

2. The bus was accelerated at full throttle from a standing start to 35 mph on a level pavement. All openings were closed and all accessories were operating during the test. This test was performed on the track at the LTI Test Track Facility.

3. The bus was operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles were noted. This test was performed on the test segment between the LTI Test Track and the Bus Testing Center.

All tests were performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions were recorded in the test data.

7.1-III. DISCUSSION

For the first part, the overall average of the six measurements was 42.2 dB(A); ranging from 40.6 dB(A) at the driver's seat to 44.2 dB(A) in line with the middle speaker. The interior ambient noise level for this test was less than 30 dB(A).

For the second part, the interior noise level ranged from 65.4 dB(A) at the rear passenger seats to 76.4 dB(A) at the driver's seat. The overall average was 70.3 dB(A). The interior ambient noise level for this test was less than 30 dB(A).

No vibrations or rattles were noted during the third part of this test, however, a wind noise was heard at the front door when the bus was operated at highway speeds.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 2020-10-P	Date: 10/15/2020
Personnel: S.R., E.D. & E.L.	
Temperature (°F): 57	Humidity (%): 67
Wind Speed (mph): 8	Wind Direction: SW
Barometric Pressure (inHg): 29.92	
Interior Ambient Noise Level dB(A): less than 30	Exterior Ambient Noise Level dB(A): 42.6
Microphone Height During Testing (in): 47	

Reading Location	Measured Sound Level dB(A)
Driver's Seat	40.6
Front Passenger Seats	41.0
In Line with Front Speaker	43.2
In Line with Middle Speaker	44.2
In Line with Rear Speaker	41.7
Rear Passenger Seats	42.3

Comments: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 2020-10-P	Date: 10/15/2020
Personnel: S.R. & E.D.	
Temperature (°F): 70	Humidity (%): 55
Wind Speed (mph): 7	Wind Direction: SW
Barometric Pressure (inHg): 29.90	
Interior Ambient Noise Level dB(A): Less than 30	Exterior Ambient Noise Level dB(A): 43.6
Microphone Height During Testing (in): 47	

Reading Location	Measured Sound Level dB(A)
Driver's Seat	76.4
Front Passenger Seats	70.5
Middle Passenger Seats	69.0
Rear Passenger Seats	65.4

Comments: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 2020-10-P	Date: 10/15/2020
Personnel: S.R. & E.D.	
Temperature (°F): 70	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location	Description of Noise
Engine and Accessories	N/A	N/A
Windows and Doors	Front door	Wind noise at highway speeds.
Seats and Wheelchair lifts	N/A	None noted.
Other	N/A	None noted.

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted.
Comments: None noted.

7.1 INTERIOR NOISE TEST



TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus was operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed starting from 35 mph.

2. Accelerating at full throttle from standstill.

3. Stationary, with the engine at low idle, high idle, and wide-open throttle, where applicable. In addition, the bus was tested with and without the air conditioning operating.

The test site is at the Larson Transportation Institute Test Track and the test procedures were performed in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus was used to measure the noise level.

During the test, special attention was paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an outside ambient noise level of 43.9 dB(A), the average of the two highest readings obtained while accelerating from a constant speed was 65.8 dB(A) on the right side and 66.7 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 43.9 dB(A), the average of the two highest readings obtained were 61.5 dB(A) on the right side and 63.1 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 56.2 dB(A). With the accessories and air conditioning off, the readings 43.6 dB(A). The exterior ambient noise level measured during this test was 43.9 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 2020-10-P	Date: 10/15/2020
Personnel: S.R., E.D. & E.L.	
Temperature (°F): 70	Humidity (%): 55
Wind Speed (mph): 7	Wind Direction: SW
Barometric Pressure (inHg): 29.90	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■

Initial Sound Level Meter Calibration: 94.0 dB(A)

Exterior Ambient Noise Level: 43.9 dB(A)

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	65.1	1	66.3
2	64.6	2	66.2
3	65.9	3	66.7
4	65.2	4	66.4
5	65.6	5	66.6
6	N/A	6	N/A
7	N/A	7	N/A
8	N/A	8	N/A
9	N/A	9	N/A
10	N/A	10	N/A
Average of two highest actual noise levels = 65.8 dB(A)		Average of two highest actual noise levels = 66.7 dB(A)	

Final Sound Level Meter Calibration Check: 94.0 dB(A)

Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 2020-10-P	Date: 10/15/2020
Personnel: S.R., E.D. & E.L.	
Temperature (°F): 70	Humidity (%): 55
Wind Speed (mph): 7	Wind Direction: SW
Barometric Pressure (inHg): 29.90	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■

Initial Sound Level Meter Calibration: 94.0 dB(A)

Exterior Ambient Noise Level: 43.9 dB(A)

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	61.6	1	62.6
2	61.3	2	62.9
3	60.7	3	62.9
4	60.8	4	62.5
5	60.7	5	63.3
6	N/A	6	N/A
7	N/A	7	N/A
8	N/A	8	N/A
9	N/A	9	N/A
10	N/A	10	N/A
Average of two highest actual noise levels = 61.5 dB(A)		Average of two highest actual noise levels = 63.1 dB(A)	

Final Sound Level Meter Calibration Check: 94.0 dB(A)

Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 2020-10-P	Date: 10/15/2020
Personnel: S.R., E.D. & E.L.	
Temperature (°F): 70	Humidity (%): 55
Wind Speed (mph): 7	Wind Direction: SW
Barometric Pressure (inHg): 29.90	
Initial Sound Level Meter Calibration: 94.0 dB(A)	
Exterior Ambient Noise Level: 43.9 dB(A)	

Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	52.6	59.7
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	42.6	44.6
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Final Sound Level Meter Calibration Check: 94.0 dB(A)

Comments: No high idle or wide open throttle as this bus is all electric.

7.2 EXTERIOR NOISE TESTS



TEST BUS UNDERGOING EXTERIOR NOISE TESTING

Section 2N

Solicitation Requirements:

TS 21.2 Crashworthiness Report.

New Flyer Response:

Please refer to the attachment impact 2019-001-D45 CRT LE Side Impact Test Report for complete description of procedures regarding towing the D45eLE electric coaches
This bulletin serves as material to assist in the towing of any of the MCI Charge buses, if there are any situations that require assistance New Flyers RPSM will be available to assist with any questions the agency may have.

Please note:
There is no regulatory requirement for rollover or roof impact that applies to D45CRTeLE coaches.

8 - SERVICE AND TOWING OPERATION

Remote Box, Rear ESS

⚠ DANGER

The Electric Drive System uses electrical energy that has a potential to be hazardous. There is a risk of electric shock and severe burns. Only High Voltage Qualified Technician should access components of the electric drive system. Failure to observe all high voltage (HV) electrical safety precautions may result in severe personal injury and/or death.

NOTICE

The "HV ENABLE" switch on the remote rear ESS is primarily for maintenance purposes. Before attempting to start the HV system from the front of the coach, make sure that the "HV ENABLE" switch is in the ON position, shift selector is in NEUTRAL, ignition switch is ON, and the parking brake is applied.

The remote electrical control box is capable of enabling/disabling the HV system from the rear of the coach, it can also prevent normal HV starting from the dash Start switch. The control box panel is located inside the rear ESS compartment. To gain access to the remote box panel, open the rear ESS compartment doors.

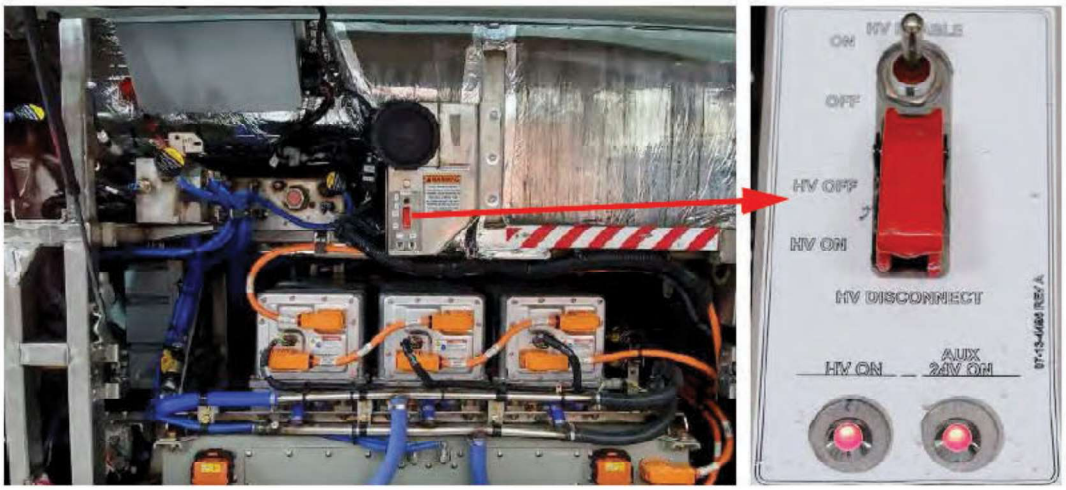


Figure 103: Remote Box

Setting the "HV ENABLE" toggle switch to the "OFF" position will prevent starting the HV system from the dash "START" switch.

The "HV DISCONNECT" toggle switch allows you to cut off the High Voltage contactors from the rear of the coach. Lift up the red protective cover to activate switch. This is to be used for Emergency purpose only.

NOTICE

There are 2 (two) more HV disconnect switch available on the coach, one is located on the transom panel above the driver, and the other is beside the charging port..

System Air Fill Connection

The system air fill connections consists of a standard quick disconnect fitting and a one-way check valve that allow for filling of the entire air system. Compressed air that is added through this fitting enters the system upstream from the cooling coil and air dryer and is therefore dried and filtered before entering the remainder of the air system. The system air fill provision is located inside the service door on the curbside.

⚠WARNING

The emergency air fill is to be used only in emergency cases on a disabled coach.



Figure 104: Rear Air Fill & Air Supply

Emergency Air Fill Provisions

The emergency air fill provisions consist of standard quick disconnect fittings, each with its own one-way check valve, that allow for filling of the primary and secondary air reservoirs and the park brake system. Compressed air that is added through these fittings enters the system at the supply ports of the two-way check valve (park brake valve supply) and is therefore not dried or filtered before entering the service brake reservoirs and park brake system. Because of the potential for contaminated air being introduced into the coach air system when using these provisions, they should be used only in emergency situations. The emergency air fill provisions are located on the left hand front side service compartment under the front junction box. The minimum pressure to fill is 105 psi.



Figure 105: Emergency Air Fill Provisions

⚠WARNING

Apply parking brake using parking valve located inside coach before disconnecting the tow vehicle.

Gladhands and Electrical Receptacle (Optional)

Two air line connections and an electrical receptacle are located on the roadside of the coach, beneath the front junction box. They are mounted on a plate attached to the roadside coach wall and are accessed by unlatching and lowering the front bumper. The bumper includes a prop rod that allows air lines to be safely routed without a risk of pinches, snags, or kinks.

The air line connections are color coded: red is for air supply and blue is for the service brakes. Air lines have quick connectors. Included are dummy couplings to protect the system when not in use.

The electrical receptacle is a 7-pole socket. It functions to provide communication from the towing vehicle to the coach multiplex system providing turning signals, stop lights, and towing mode while the coach is being towed. This requires the coach power to be active. If the coach does not have power, this receptacle will not function and other external measures will be required for turn signals and stop lights.

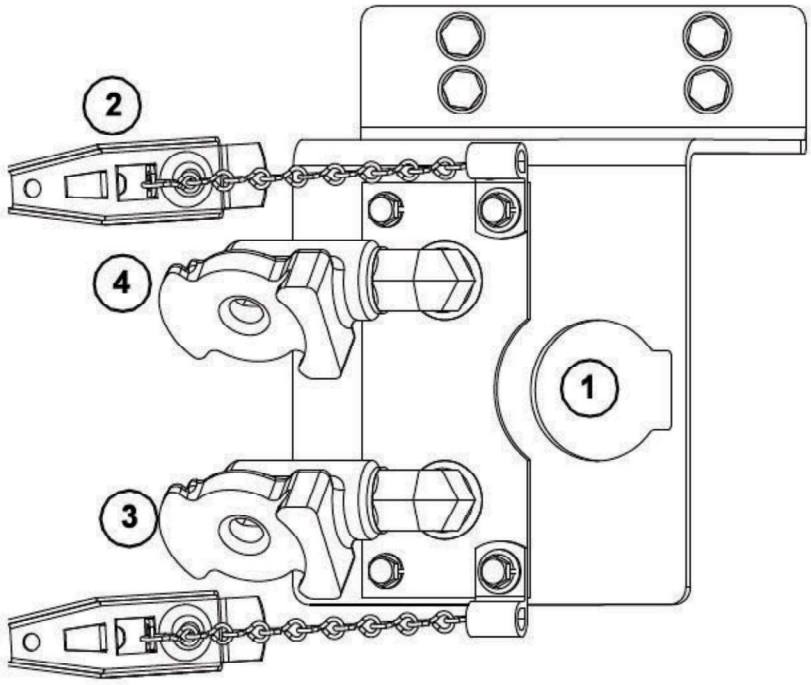


Figure 106: Optional Gladhands Towing Connection

1. Electrical Receptacle
2. Dummy Coupling
3. Red Air Coupling
4. Blue Air Coupling

Section 2P

Solicitation Requirements:

TS 28.3 Articulated Joint (Articulated Transit Coach).

Proposed configuration of these devices and the reverse-speed requirements shall be submitted for approval of the Agency

New Flyer Response:

Please note:
D45 CRT LE CHARGE™ and D45 CRT CHARGE, there will be no information provide in this proposal as these coaches are not available in 60 foot length, therefore not requiring an articulated joint.

Section 2Q

Solicitation Requirements:

TS 28.5 Bellows.

Supply information on the actual service life achieved by the type of bellows being proposed. A sample of the bellows and attaching hardware may be requested for evaluation at the Agency's option. Bellows shall be approved by the Agency.

New Flyer Response:

Please note:
D45 CRT LE CHARGE™ and D45 CRT CHARGE, there will be no information provide in this proposal as these coaches are not available in 60 foot length, therefore not requiring bellows.

Section 2R

Solicitation Requirements:

TS 35.4 Hubs and Drums / Discs.

Provide which configuration is being submitted, include in proposal.

New Flyer Response:

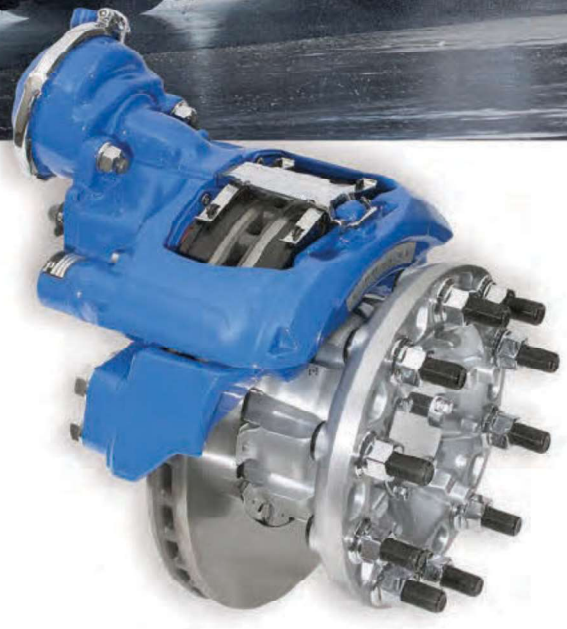
The coach shall be equipped with a Bendix or approved equal antilock brake system or approved equal electronic controller assembly that will provide full vehicle wheel control braking for the coach. The system shall utilize a Bendix 6S/6M antilock brake system with disc brakes. The design of the digital electronics shall provide a high degree of protection from radio and electromagnetic interference.
The Bendix ECU shall be remote mounted from the brake valve in a location that permits easy access of the controller for maintenance functions.
The antilock brake system shall provide individual wheel control by using a wheel speed sensor and modulator at the front axle, drive axle and tag axle. The drive axle brakes shall be controlled completely independent of each other and therefore brake application pressure at an individual wheel shall be adjusted solely on the basis of its behavior on the road surface on which it is traveling. Wheel speed sensors shall be provided on the drive axle and will simultaneously control the wheels on the tag axle. ABS modulators will be provided for each wheel end. Inputs to the Bendix ECU shall be generated from a tone ring (exciter) by wheel sensors, which generate a signal, which varies in voltage and frequency as the speed of the wheel increases or decreases. The wheel sensor shall provide wheel speed information at the rate of 100 pulses per wheel revolution. The Bendix ECU shall simultaneously receive, and individually interpret speed signals from six-wheel sensors.
Outputs from the Bendix ECU shall be provided to Bendix brake modulators. The modulator shall be capable of receiving signals from the Bendix ECU and shall be designed to modify operator applied air pressure to the service brakes. The modulator shall be located near the service actuator(s) it controls and shall be the last air valve through which air passes on its way to the brake actuator. A wiring harness shall connect each modulator to the Bendix ECU. Solenoid valves contained in the modulator shall provide the electrical interface between the controller electronics and the air brake system. The Bendix ECU shall be capable of simultaneously and independently controlling four individual modulator assemblies.
The antilock brake system logic shall be designed to respond to component equipment failure using a conservative fail-safe philosophy. Any single electrical failure of a component devoted to antilock braking shall result in simultaneous illumination of the antilock condition lamp on the dash, a disabling of all or part of the antilock system, and reversion to standard braking on wheels no longer under the control of antilock. The ECU is divided into two separate parts, each equally controlling a pair of diagonal brakes. When a failure or damage occurs to one half of the ECU, ABS braking function shall be maintained in the wheels that are controlled by the working part of the ECU.
The wires that carry information and power into and out of the controller shall be terminated with a weatherproof connector with the wiring sealed to the connector with the exception of the ECU connectors. The wire gauge used shall be sized specifically for the task which it is designed to perform. A dashboard mounted antilock condition lamp shall be provided which shall be controlled by the Bendix ECU via the multiplex system and shall serve as a means of providing the operator with the operating condition of the antilock brake system. All electrical connections on the antilock system shall be Bendix molded connectors or approved equal.
The Data Link function shall be provided which enables the Bendix ECU to report its operating condition to an external source. The controller data link configuration shall conform to SAE standard J1708 and the coded language used shall conform to SAE J1587. Two connections in the controller shall be provided.

Attached is also a brochure from New Flyer's vendor Bendix. The brochure outlines the Bendix Air Disc Brake Advantage with the following information:

- Brake chamber
- ADB system available
- Dust Shields
- Pad wear sensing
- Air disc brake pads
- Brake caliper
- Rotor and hub



BENDIX® ADB22X® AIR DISC BRAKES



Bendix® ADB22X® Air Disc Brakes

Lower your total cost of ownership (TCO) with North America's leading air disc brake.

Bendix air disc brake packages deliver a powerful return on investment through superior braking performance, shorter stopping distances, enhanced safety, and lower overall maintenance costs.

As one of the lightest dual piston air disc brakes available, the Bendix® ADB22X® unit provides a weight advantage over competitive air disc systems, offering the potential for increased payload.

Proven…perfected…trusted. Nearly 75 percent of the North American air disc brake market trusts the Bendix ADB22X – the only air disc brake approved at all major truck and trailer OEMs.

Get more uptime and lower your total cost of ownership with Bendix air disc brakes.

Bendix®

The Bendix® Air Disc Brake Advantage

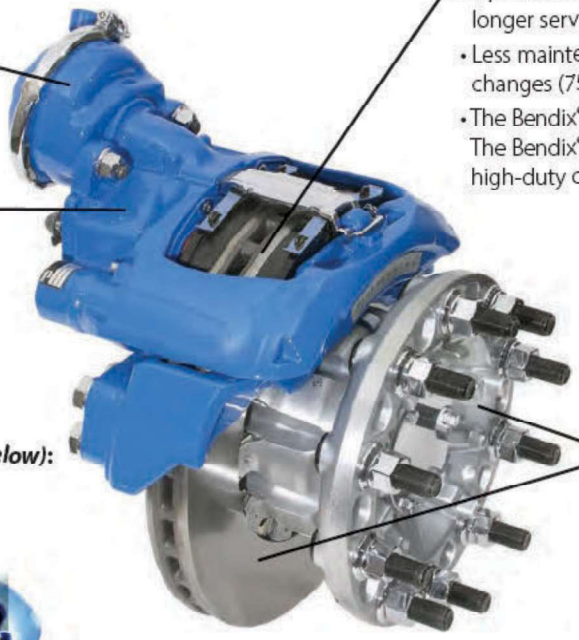
Brake chamber:
- No Touch™ Power Spring extends service life
- Proprietary dust seal keeps contaminants out

Lightest ADB system available in the market:
- Improves fuel efficiency, allows greater payload

Dust shield *(optional, not shown)*:
- Optional rotor and pad shield available, recommended with super singles

Pad Wear Sensing *(optional, image below)*:
- Reduces risk of damage to wheel-end components





Air disc brake pads:
- Optimized friction and rotor pairing for longer service life
- Less maintenance and quick pad changes (75% less time than drum)
- The Bendix® BX276™ pad offers longer life. The Bendix® BX283™ pad is designed for high-duty cycle applications.

Brake caliper:
- Lightest dual piston caliper available
- Integrated auto adjust for lowered risk of out-of-adjustment conditions
- Mono-block construction
- Sealed design – no periodic service lubrication required

Rotor and hub:
- Patented splined rotor design
- Optimized for maximum weight savings
- One of the lightest rotor/hub combinations in the market

For performance, safety, and productivity you can count on, stay with the leader – Bendix® air disc brakes.

Bendix air disc brake packages deliver a powerful return on investment through superior braking performance, lower overall maintenance costs – including less brake adjustment, reduced risk to CSA scores, and lower total cost of ownership.

In addition, the Bendix® ADB22X® unit is the lightest dual piston air disc brake available, providing a weight advantage over competitive air disc systems.

- Exceeds all stopping distance requirements
- Improved braking consistency (side-to-side)
- Lowers risk of out-of-service conditions (compared to drum)
- Reduces maintenance costs
- Up to 50% more pad life than drum linings
- Five (5) year limited warranty
- Easy access to parts through our aftermarket parts network of 5,000 dealers and distributors
- Convenient service – same size on all axles, so fewer parts to stock
- Superior Bendix support after the sale with a single point of contact
- Largest air disc brake supplier with more than 4 million produced in North America
- Approved at all major truck and trailer OEMs, with common platform for both
- Spec Bendix trailer air disc brake too – the Bendix® ADB22X®-LT

Find our how much you can save by spec'ing Bendix ADB. **Visit valuebybendix.com**

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Log on and learn from the best. Online training that's available when you are – 24/7/365. Visit brake-school.com

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To find out more about the Bendix ADB22X Air Disc Brake advantage, talk to your Bendix Account Manager, call 1-800-AIR-BRAKE (1-800-247-2725) or visit bendix.com today.

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Section 2S

Solicitation Requirements:

TS 88.4 "In-Field" and/or "On-Route" Charger.

Documentation showing that the chargers meet such applicable codes shall be included with each Proposal.

New Flyer Response:
In the attached brochures provided is a full description with technical specifications of each type of charger / system that New Flyer / Motor Coach offer. The property, at the time of purchase will decide which type of system that they will want, it can be decided at time of pre-production meeting.

ABB_HVC-PD Charger
ChargePoint
Flex180 Power Cabinet
HVC-C_Depot-Charger
Product_leaflet _Charger_450_KW
Terra-94-124-184

All Plug-in chargers will meet:

Applicable codes

- UL Requirements
- SAE J1772 for Plug-in Chargers
- SAE 1772 for Overhead Chargers
- OCPP1.6 Communication requirements.

PRODUCT LEAFLET

Electric Vehicle Infrastructure

HVC-PD UL opportunity charging for electric buses



ABB's HVC-PD opportunity charging system offers high-power charging via an automated rooftop connection. With typical charge times of 3 to 6 minutes the system can be easily integrated in existing operations by installing chargers at endpoints, terminals and intermediate stops.

—
The HVC-PD charging system leverages an automated connection to enable extremely fast charge times.

A practical solution for route charging
ABB's Heavy Vehicle Charger (HVC) system architecture offers an ideal solution for opportunity charging, ensuring zero-emission public transit during the day without impacting daily route operations.

Key Benefits
+ Charge in 3 to 6 minutes
+ One charger serves many vehicle makes and models
+ Safe and reliable fully automated connection
+ SAE J3105-1 and OCPP 1.6 compliant
+ Remote diagnostics and management tools

Future-proof modular design
Additional power cabinets can be installed at any time, allowing operators to scale their operation and flexibly spread out infrastructure investments as their fleet grows.

Safe and reliable operation
ABB fast chargers are designed to the highest international electrical, safety, and quality standards, and are certified by notified bodies - ensuring safe and reliable operation.

Interoperability
ABB HVC chargers are based on international standards for operational compatibility with multiple vehicle types and brands. This allows operators to select vehicles from multiple vendors and not be locked into a single supplier.

Connectivity and remote services
ABB chargers come with an extensive suite of connectivity features including remote services such as monitoring, diagnostics and software upgrades. These advanced services provide equipment owners with powerful insights into their charging operations while delivering high uptime.

OCPP 1.6
ABB HVC-PD charging systems can be connected to standardized charging infrastructure management platforms using OCPP 1.6. ABB's HVC suite supports OCPP 1.6 Core and Smart Charging Profiles.

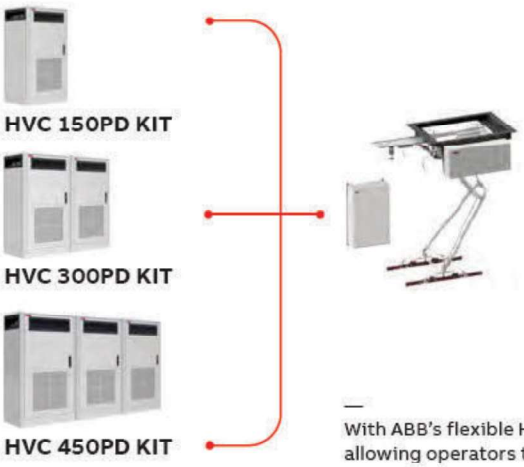
Buy America
ABB can offer the HVC-PD Depot Charging Solution with compliance to the Buy America Act, Rule 49 CFR Part 661.5.

ABB is your experienced partner
ABB HVC products are based on a decade of high-power experience in EV charging solutions. ABB has installed over 20,000 fast charging systems in more than 85 countries – and is the leading EV infrastructure technology supplier globally.

Opportunity charging 150 kW to 450 kW

A scalable system with future-proof reliability

Charging on existing structure



Charging on route



With ABB's flexible HVC architecture, power capability can be expanded over time, allowing operators to spread out infrastructure investments as their fleet grows.

Technical specifications

Configurations		HVC 150PD	HVC 300PD	HVC 450PD
Maximum output power		150 kW	300 kW	450 kW
Input AC connection		UL: 3-phase, 480Y/277 VAC +/- 10 % (60 Hz); CSA: 3-phase, 600Y/347 VAC +/-10% (60 Hz)		
Rated input power		170 kVA	2x 170 kVA	3x 170 kVA
Rated input current		UL: 198 A CSA: 168 A	UL: 2x 198 A CSA: 2x 168 A	UL: 3x 198 A CSA: 3x 168 A
Recommended upstream circuit breaker(s)		1 x 250 A	2 x 250 A	3 x 250 A
Output voltage range		150 – 850 VDC		
Maximum DC output current		250 A	500 A	600 A*
Vehicle connection interface		Inverted crossrail pantograph - OppCharge		
DC connection standard		SAE J3105-1 - IEC 61851-23-1** - ISO 15118		
Environment		Indoor/Outdoor		
Operating temperature		Standard: -10 °C to +50 °C (de-rating characteristic applies); Optional: -35 °C to +50 °C		
Protection		IP54 – IK10 (NEMA 3R)		
Network connection		GSM/3G/4G modem | 10/100 base-T Ethernet		
Compliance and safety		CSA No. 107.1-16 and UL 2202, certified by TUV BA Rule 49 CFR Part 661.5 (Optional)		
Dimensions				
Power cabinet (each)	Number of Power Cabinets	1	2	3
	Dimensions (H x W x D)	2030 x 1170 x 770 mm / 79.9" x 46.1" x 30.3"		
	Weight	1340 kg / 2954 lbs		
Charge pole (includes Pantograph & ACM)	Dimensions (H x W x D)	5240 x 1040 x 300 mm / 206.3" x 40.9" x 11.8"		
	Outreach	4670 mm / 183.9" x 30.3"		
	Weight	1706 kg / 3762 lbs		
ACM Control Module KIT	Dimensions (H x W x D)	1600 x1000 x 476.9 mm / 63" x 39.4" x 18.8"		
	Weight	193 kg / 425 lbs		
Pantograph KIT	Dimensions (H x W x D)	(resting position / bolt-hole pattern) 574 x 1300 x 900mm / 22.6"H x 51.2"W x 35.4"D		
	Weight	387 kg / 854 lbs		

* Limited by inverted pantograph contact ratings
** IEC 61851-23-1 in draft status

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heliox

Flex
180kW
B DC HPC D UL

824-Technical specifications



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This document is part of the technical handbook which is an integral part of the Electric Vehicle Supply Equipment (EVSE), the Flex 180kW B DC HPC D UL. It is the responsibility of the copy holder to keep the distributed technical handbook and the related appendices up-to-date.

It is possible that a service bulletin is issued to give important safety information. These service bulletins may include safety items among other updates. When issued, these service bulletins are also an integral part of the technical handbook.

If changes occur, a new copy will be distributed and the copy holder shall take care of a controlled distribution and the disposal of the previous copy.

Date (day-mon-year)	Version	Description
14-01-2021	EN-001	Pre-release
22-01-2021	EN-002	Initial release

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1 Preface

This section gives information about the technical specifications as well as the compliancy details of the Electric Vehicle Supply Equipment (EVSE). The information for the storage conditions is given in the section logistic information.

The section Logistic information is also part of this technical handbook.

1.1 About the document

This document is part of the technical handbook which is an integral part of the Electric Vehicle Supply Equipment (EVSE), the Flex 180kW.

1.1.1 Structure of this document

This document gives the technical specifications, information on torque values and compliancy.

For easy access to the information, this document is divided into chapters. The chapters are:

- the preface, to give an introduction to the content and the use of the document;
- the technical specifications, to give the different design details;
- the torque tables, to give information for the torque values of electrical and mechanical constructions;
- the compliancy, to detail the information for the applicable Standards, Rules and Regulations.

1.1.2 How to use the documentation

The technical handbook is an integral part of the EVSE. You must keep the technical handbook, at all times, available and accessible in the vicinity of the EVSE.

Read the manual and understand the instructions before you do any work. Follow the instructions carefully. Heliox B.V. is not responsible for any damage caused by poor planning, not or incorrect follow-up or execution of the instructions as given in the document.

If you are in doubt, do not continue and ask for assistance.

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2 Technical specification

2.1 Safety design

Description	Specification
Human machine interface	Emergency stop, charge abort button
Ingress protection	NEMA 3R
Impact class	IK10

2.2 Electrical data

2.2.1 Power input requirements

Description	Specification
Input connections	3P+PE
Input power, full load	205 kW Nominal full load
Input power, idle	100 VA
Input AC line voltage range	480 +6/-13%
Input AC line frequency	60 Hz
Input AC phase current, max	283 A, Inrush current limited
Input AC phase current, MCB	400 A
Power factor	>0.99
Peak power conversion efficiency e.g. best case scenario	>96%
Total Harmonic Distortion	V<2, I<5%
Dielectric withstand	3000 Vrms
SCCR	35kA

2.2.2 Power output requirements

Description	Specification
Output DC voltage range	150 – 1000 Vdc
Rated DC output power	Triple DC output: 3x82HP [3x60kW] Single DC output: 245HP [180kW]
Rated DC output current	3-250 A

2.2.3 Network requirements

Description	Specification
Cellular	2G, 3G, 4G modem, LAN
Back office	OCPP, ChargeSight

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2.2.4 Cable specifications

Description	Specification
AC cable	Cross section between 3/0 AWG (95mm2) and 250 kcmil (120mm2). Wire rated temperature of 194 °F (90 °C). (Not is scope of delivery)
AC cable connection to busbar	Two wires per phase, narrow cable lugs, M10, galvanized, class 8.8 (Not in scope of delivery)



NOTICE
Actual cable quadrature calculations to be done by installer based on AC input requirements, local regulations and the type plate information.

2.3 Mechanical data

2.3.1 General data

Description	Specification
Material	Steel, coated
Color	RAL7035, Light grey

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2.3.2 Dimensions and weight

Description	Specification
Dimensions	
- Length	31.5" (800 mm)
- Width	31.5" (800 mm)
- Height	91" (2312 mm)
Weight	1570 lbs (712 kg) Charger packaged in wooden box

2.4 Ambient conditions

Description	Specification
Charger standard ambient temperature range	-4°F to 104°F (-20°C to 40°C) full output power
Charger extended ambient temperature range	-22°F to 113°F (-30 to +45°C) derating outside standard range
Relative humidity	between 5 and 95, no condensation allowed
Altitude, above sea level	Maximum: 6500 ft (2000 m)

2.5 Environmental specifications

Description	Specification

Environment	Indoor / Outdoor
Floor load	-
Point load	-

2.5.1 Emissions

Description	Specification
Noise [dB(A) @ m]	<60 @ 36ft
Air, max. temp	6 604 30 gal/h (2500 m^3/h), 131°F (55°C)

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3 Torque tables

The, indicative, torque tables are given for electrical connections on busbars and for mechanical plain or zinc-plated steel connections. The electrical connections on switches, relays, terminals, etc. are torque tightened.

These torque values are application and brand specific. Refer to the related technical information that came with these parts.

NOTICE
Equipment of Heliox is metric.

3.1.1 Torque table for electrical connections

Make sure, the threads of the fastener are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

When terminating busbars at the terminals, they should be tightened with "Conical Spring Washer DIN 6796-X Spring Steel" x = diameter (dia) of the corresponding bolt in mm.

NOTICE
Lubricated means coated with a lubricant such as oil, grease, or fasteners with phosphate and oil coatings or the use of a tread lock compound (e.g. Loctite). Dry means plain metal or zinc plated without any lubrication.

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This table is applicable for bolts, class 8.8 and copper busbar:

Size	Dry	Lubricated
M6 (or 1/4"-20)	76 inlb (8.6 Nm)	60 inlb (6.8 Nm)
M8 (or 5/16"-18)	186 inlb (21 Nm)	150 inlb (17 Nm)
M10 (or 3/8"-16)	372 inlb (42 Nm)	301 inlb (34 Nm)
M12 (or 7/16"-14)	637 inlb (72 Nm)	513 inlb (58 Nm)
M14 (or 1/2"-13)	1009 inlb (114 Nm)	805 inlb (91 Nm)
M16 (or 9/16"-12)	1540 inlb (174 Nm)	1230 inlb (139 Nm)

3.1.2 Torque table for mechanical connections

Make sure, the threads of the fastener are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

NOTICE
Lubricated means coated with a lubricant such as oil, grease, or fasteners with phosphate and oil coatings or the use of a tread lock compound (Loctite). Dry means plain metal or zinc plated without any lubrication.

This table is applicable for bolts, class 8.8 used in steel or zinc plated constructions:

Size	Dry	Lubricated
M6 (or 1/4"-20)	106 inlb (12 Nm)	85 inlb (12 Nm)
M8 (or 5/16"-18)	248 inlb (28 Nm)	195 inlb (22 Nm)
M10 (or 3/8"-16)	478 inlb (54 Nm)	381 inlb (43 Nm)
M12 (or 7/16"-14)	823 inlb (93 Nm)	655 inlb (74 Nm)
M14 (or 1/2"-13)	1310 inlb (148 Nm)	1044 inlb (118 Nm)
M16 (or 9/16"-12)	2036 inlb (230 Nm)	1629 inlb (184 Nm)

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4 Compliance

4.1 Standards to which each product has been tested and is approved for

Standard	Version	Title
2014/35/EU		Low Voltage Directive
2014/30/EU		EMC Directive
2014/863/EU		RoHS Directive (3)
IEC 60529	1989 A1: 1999 A2: 2013	Degrees of protection provided by enclosures (IP code)
IEC 61439		Low-voltage switchgear and control gear assemblies
Part 1	ed2 2011	General rules
Part 2	ed2 2011	Power switchgear and control gear assemblies
IEC 62262	2002	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
UL 2202	ed2	Standard for Electric Vehicle (EV) Charging System Equipment
UL 2231	ed2	Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits

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4.2 Standards to which the EVSE system has been tested and is approved for

These standards apply to the described cabinet and the cabinets distributed together.

Standard	Version	Title
IEC 61851		Electrical vehicle conductive charging system
Part 1	2017	General requirements
Part 21-2	2018	EMC requirements for off board electrical vehicle charging systems[1]
Part 23	2014	DC electric vehicle charging station
23/COR1	2016	Corrigendum 1
Part 24	2014	Digital communication between a DC EV charging station and an electric vehicle for control of DC charging

[1] In case of a distributed system the EMC marking has to be tested again when compliancy is necessary.

4.3 Certification related standards that are followed as guideline, product not to be certified for

Standard	Version	Title
DIN 70121[2]	2014	Electromobility – Digital communication between a DC. EV charging station and an electric vehicle for control of DC. charging in the Combined Charging System
ISO 15118[4]	ed 1	Road vehicles – Vehicle-to-Grid Communication Interface
Part 1	2019	General information and use-case definition
Part 2	2016	Network and application protocol requirements
Part 3	2015	Physical and data link requirements
ISO 12944	2019	Paints and varnishes – Corrosion protection of steel structures by protective paint systems
Part 5		Protective paint systems
ISO 3740	2019	Acoustics – Determination of sound power levels of noise sources – Guidelines for the use of basic standards

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[2] Communication guidelines (DIN 70121 and ISO 15118) have been extensively tested within Heliox and EV OEMs.

heliox

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PRODUCT LEAFLET

Electric Vehicle Infrastructure

HVC-C UL depot charging for electric fleets



ABB HVC-C UL Depot Charging systems offer a highly reliable, intelligent and cost-effective solution to charge large EV fleets such as buses, trucks and other commercial vehicles.

—
HVC Depot Boxes and power cabinets, lined up at a depot site.

A practical solution for busy depots
ABB Heavy Vehicle Charger (HVC) products enable electric buses and trucks to charge at the depot ensuring flexibility and scale for every fleet operation that is transitioning to zero-emission transportation.

Key Benefits
+ Smart charging
+ Small infrastructure footprint at vehicle interface
+ Flexible design for roof and floor mounting
+ SAE J1772 CCS and OCPP 1.6 compliant
+ Remote diagnostics and management tools

Sequential Charging
Improving total cost of ownership is easy using the sequential charging feature offered by ABB's depot chargers. This feature allows connection of up to three depot charge boxes with a single power cabinet and vehicles are charged sequentially over time. The system can follow an embedded, predefined charging process or remote triggers sent by a fleet management system via OCPP 1.6.

- Vehicles are charged with high power, maximizing vehicle availability
- The required grid connection is smaller, reducing upfront investments and operational costs
- The compact depot box is easy to install at sites with space constraints
- Optimal utilization of installed infrastructure meaning lower investments in charging equipment.

Buy America
ABB can offer the HVC-C Depot Charging Solution with compliance to the Buy America Act Rule 49 CFR Part 661.5.

Future-proof modular design
Power cabinets can be upgraded from 100 or 150 kW in the field, as well as add additional depot charge boxes, allowing operators to scale their operation and to spread investments over time.

Safe and reliable operation
ABB fast chargers are designed to the highest international electrical, safety, and quality standards, and are certified by notified bodies - guaranteeing safe and reliable operation.

Connectivity and remote services
ABB chargers come with an extensive suite of connectivity features including remote services such as monitoring, management, diagnostics and software upgrades. These advanced services provide equipment owners with powerful insights into their charging operations while enabling high uptime.

ABB is your experienced partner
ABB HVC products are based on a decade of high power experience in EV charging solutions. ABB has installed over 17,000 fast charging systems in more than 80 countries – and is the leading EV infrastructure technology supplier globally.

Overnight charging 100 kW - 150 kW

A field upgradeable system with future proof reliability

HVC 100C



upgradable

HVC 150C



A power upgrade can be done in the field by adding an extra power module. No groundworks, digging and disturbance to the site are required.

HVC 150C*



* 150 kW overnight charging system with three depot charge boxes; shown mounted on pedestal option.

Technical specifications

Configurations		**HVC 100C**	**HVC 150C**
Maximum output power		100 kW	150 kW
AC Input voltage		UL: 3-phase, 480Y/277 VAC +/- 10% (60 Hz) CSA: 3-phase, 600Y/347 VAC +/-10% (60 Hz)	
AC Input connection		L1, L2, L3, GND (no neutral)	
Rated input power		117 kVA	170 kVA
Rated input current		UL: 132 A / CSA: 108 A	UL: 198 A / CSA: 168 A
Recommended upstream circuit breaker(s)		UL: 1 x 200 A / CSA: 1 x 150 A	UL: 1 x 250 A / CSA: 1 x 250 A
Output voltage range		150 – 850 VDC	
Maximum DC output current		166 A	200 A
Vehicle connection interface		CCS/Combo Type 1 Connector	
Cable length		3.5 m (11.5 ft) standard; 7 m (23 ft) optional	
DC connection standard		SAE J1772 - IEC 61851-23 / DIN 70121 - ISO 15118	
Environment		Indoor/Outdoor	
Operating temperature		Standard: -10 °C to +50 °C (de-rating characteristic applies) Optional: -35 °C to +50 °C	
Protection		Power Cabinet: IP54 – IK10 (equivalent to NEMA 3R) Depot Charge Box: IP65 - IK10	
Network connection		GSM/3G modem | 10/100 base-T Ethernet	
Compliance and Safety		CSA No. 107.1-16 and UL 2202 certified by TUV BA Rule 49 CFR Part 661.5 (Optional)	
Dimensions			
Power Cabinet	Dimensions (H x W x D)	2030 x 1170 x 770 mm / 79.9 x 46.1 x 30.3 in	
	Weight	1340 kg / 2954 lbs	
Depot Charge Box (without pedestal)	Dimensions (H x W x D)	800 x 600 x 210 mm / 31.5 x 23.6 x 8.3 in	
	Weight	61 kg / 134.5 lbs (with 7 m / 23 ft cable)	
Depot Charge Box (with pedestal)	Dimensions (H x W x D)	1914 x 600 x 400 mm / 75.4 x 23.6 x 16.3 in	
	Weight	181 kg / 398 lbs (with 7 m / 23 ft cable)	

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Opportunity Charger
450 KW



Opportunity Charging is Ultra Fast charging at the turn-around location of the bus route and offers a zero impact solution. Without the need of schedule change, electric buses can run all day and a significant passenger capacity increase and cost reduction can be achieved.

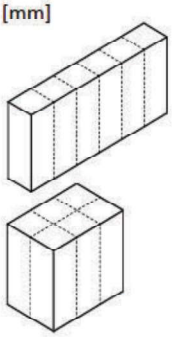
Heliox Power Curve Technology results in ultrashort charge sessions, that reduce the impact on the timetable to a minimum: within 2-5 minutes of opportunity charging at the end bus stops, you can optimize your electric bus operation. Implementation is simple and straightforward; the solution is fully scalable and can be introduced route by route. All chargers have the elements required for vehicle to grid communication.

*** Under development**

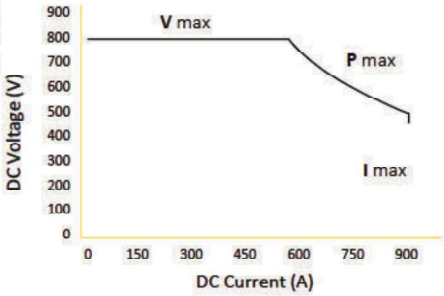
Dimensions

Line
H: 2300
W: 4800
D: 800
[mm]

Block
H: 2400
W: 2400
D: 1600



Power Curve



V min = 460 V DC
P max = 450 kW

Specifications

General	Charger
Environment operating	Indoor/Outdoor
Temperature	-4 to 122 ˚F (optional to -22 ˚F)
Charging standard	SAE J3105*
Compliance and safety	UL 2202* / UL2231*
Output DC voltage range	460 - 800 V
Rated DC output power	450 kW
Rated DC output current	900 A, bidirectional
Input connections	3P + PE
Input power rating; full load / idle	480 kVA / 500 VA
Input AC line-line voltage range	480 V +/-10%
Input AC phase current; maximum / fused	587 / 700 A, inrush current limited
Power factor, THD	> 0.99, < 5%
Power conversion efficiency	> 96%
Dielectric withstand	3000 V RMS
Network connection	3/4G modem / OCPP
Protection	NEMA 3R / IK10
Operational noise level	<55 dB(A) @ 6.56 ft
System weight	8818.49 lbs

*** Under development**

97% Efficiency

Highest up time

Back office systems

Zero Emissions

Support services

Industry's quietest

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Terra 94/124/184 UL Product guide

Terra fast chargers: The most deployed DC fast chargers in the world.

- Power sharing for high utilization
- Future proof, high-voltage technology
- Reliable, compact and flexible design
- Always connected, always smart

—

With more than 135 years of heritage in electrification technology, ABB offers a world-class EV charging solutions for safe, smart and reliable e-mobility – from the vehicle to the grid.

20,000+
fast chargers
sold worldwide

in operation
across
85+
countries

interoperability
tested with
50+ OEMs

10+ years
of EV charging
field experience

24/7/365
connectivity for
remote services

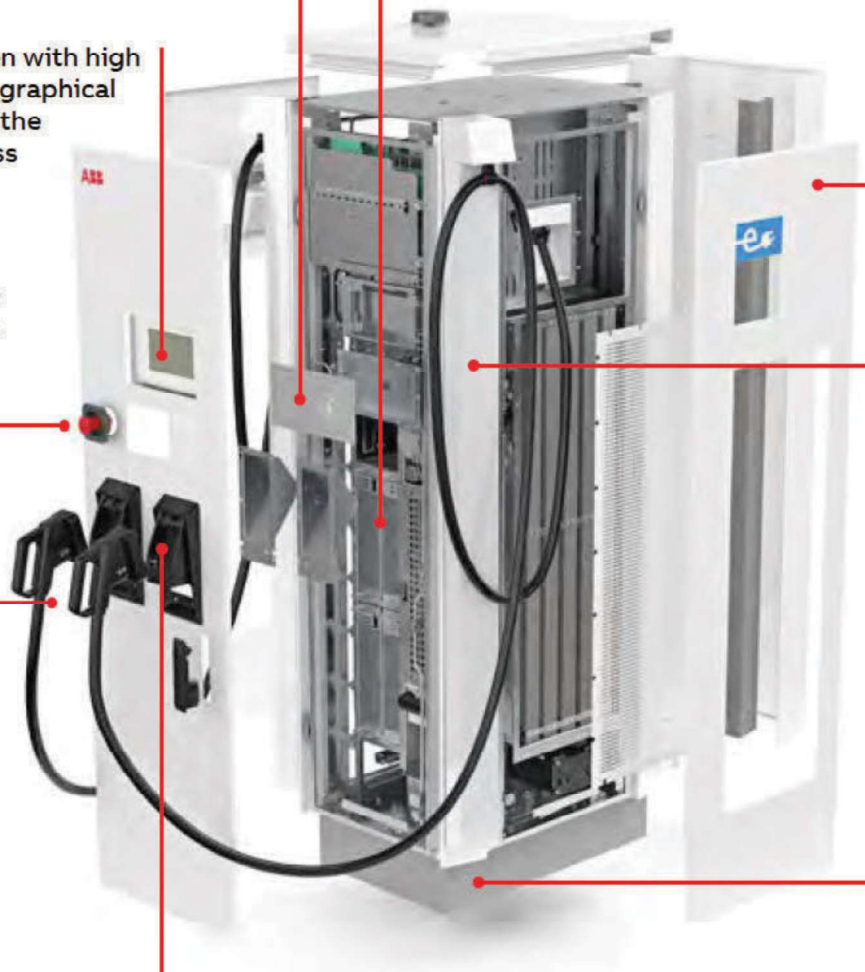
Terra 94/124/184 DC Fast Charger
At a glance

CONNECTED by cellular modem for 24/7 remote services, receiving updates over-the-air to support every new EV on the road - plus easy remote OCPP integration.

COMPACT power modules to support increasing demand from more EVs with bigger batteries - in a very easy to service package.

LCD touchscreen with high brightness and graphical visualization of the charging process

ROBUST all-weather powder-coated stainless steel enclosure



SAFETY: Emergency stop push button to immediately stop charging operation

CONVENIENCE and hassle-free reach for users – with retractable cable management option

GREATER revenue potential with simultaneous charging for 2 electric vehicles, including CCS and CHAdeMO combinations

EASY installation design with fast remote commissioning and start-up

AUTOMATIC authentication capability via CCS connector in the vehicle thanks to easy OCPP integration and Autocharge functionality

MAX CHARGING POWER
Terra 94: 90 kW
Terra 124: 120 kW (and 2 x 60 kW)
Terra 184: 180 kW (and 2 x 90 kW)

MAX CHARGING VOLTAGE
CCS 920 VDC
CHAdeMO 500 VDC

DIMENSIONS
Height 1900 mm / 74.8 in
Width 5655 mm / 222.6 in
Depth 880 mm / 34.6 in
Weight 395 kg / 871 lbs

Why Terra DC Fast Chargers?
Advanced, flexible, compact and smart



Power sharing for high utilization

- Terra 124 and Terra 184 can charge two vehicles simultaneously
- High utilization of charging assets benefit both public and fleet business models
- Supports all open charging standards in flexible configurations
- Safety certified to the highest standards



Future-proof, flexible high-voltage technology

- Flexible, redundant power architecture supports high uptime
- High-voltage charging range up to 920 V
- Fully compatible with current and future EVs
- Choices for power delivery up to 180 kW, following EV market growth



Reliable, compact and flexible design

- Based on the Terra platform, the most widely deployed DCFC family in the world
- Space-saving, all-in-one footprint with very easy installation and servicing
- Robust construction for all operational environments
- Cable management options enhance longevity



Always connected, always smart

- 24/7 connectivity, 99.5% ABB network uptime
- Remote services with remote firmware updates and upgrades
- OCPP integration-ready as well as ABB Web Tools functionality
- Autocharge and ISO 15118-ready for plug and charge operation

Fast charging beyond 50 kW

Power sharing delivers high utilization

90kW Charging Points
Terra chargers can provide a quick refill adding 100 miles of range in as little as 15 minutes (Terra 94).*

one EV
up to
90 kW



Retail/Shopping Sites
The Terra 124 charger can provide a full battery charge to two vehicles simultaneously while drivers are shopping, dining or at the movies.

one EV
up to
120 kW

two EVs
each up to
60 kW



Highway corridors and Fleets
The Terra 184 chargers can add 100 miles of range in as little as 10 minutes as well as fast-charge two vehicles at the same time in less than 20 minutes.*

one EV
up to
180 kW

two EVs
each up to
90 kW



* Actual charging speed depends on the electric vehicle model(s) and charging conditions.

Simultaneous charging with high power fast chargers can deliver maximum charging asset utilization while serving an ever-growing population of large battery electric vehicles.

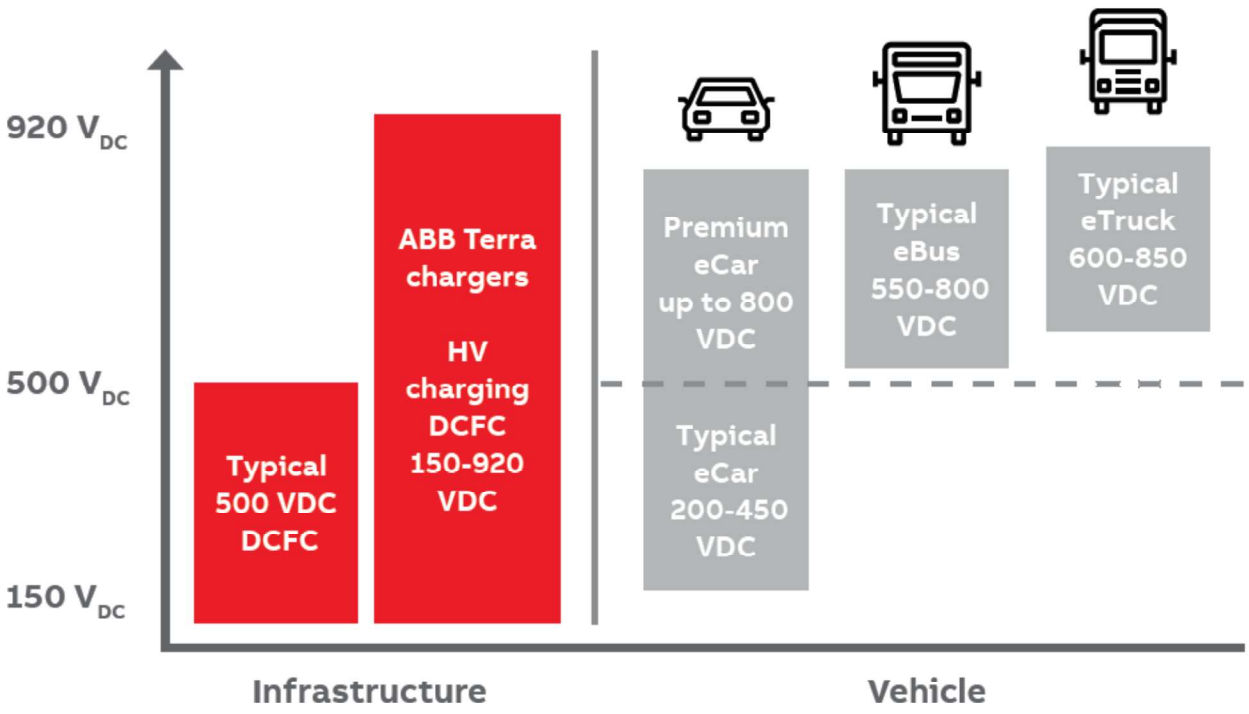
High voltage charging explained
A future-proof strategy

High voltage charging capabilities
As electric vehicles and their use cases diversify, high voltage DC charging has become more important to increase charging power while ensuring as much efficiency, safety and usability in DC charging systems.

Traditional passenger vehicle battery packs are usually designed for 400 VDC charging, so many standard charging systems do not exceed 500 VDC capability. However, some newer vehicles may have battery packs that exceed 400 VDC, often in the 600 to 800 VDC range.

Some EV battery packs, such as with vehicles designed for fleet usage, may only charge at high voltage ratings, demanding charging infrastructure that can deliver power tailored to HV battery packs.

ABB's Terra 94, Terra 124 and Terra 184 chargers are designed to meet EV battery voltage capabilities up to 920V to deliver charging services across a wider range of today's and tomorrow's EVs.



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A high range of DC voltage capability is demanded to deliver efficient charging service to every EV and use case.

Terra charging times

All-in-one charging for every EV

		Charging time (minutes)					
		50 kW Terra 54 Terra 54HV	**90 kW** Terra 94	**120 kW** Terra 124		**180 kW** Terra 184	
				2 EVs	1 EV	2 EVs	1 EV
Car	60 kWh BEV 400 VDC	50	25	40	20	25	13
	90 kWh BEV 400 VDC	70	40	60	30	40	20
	100 kWh BEV 800 VDC	80	45	65	33	45	22
Bus/Truck	120 kWh BEV School Bus 400 VDC	95	53	80	40	55	26
	150 kWh BEV Delivery Van 800 VDC	120	65	100	50	65	33
	200 kWh BEV Work Truck 800 VDC	160	88	133	66	88	44
	300 kWh BEV 60' Transit Bus 800 VDC	240	130	200	100	130	66

—
Charge times shown based on average vehicle battery management system (BMS) requesting charging power from 20% to 80% under mild environmental conditions. Data assumes vehicles capable of charging at cited power levels.

Designed for flexibility
A configuration for every use case



Terra 94/124/184 C
Single outlet CCS with cable management system



Terra 94/124/184 CC
Dual outlet CCS with cable management system



Terra 94/124/184 CJ
Dual outlet CCS and CHAdeMO with cable management system and credit card reader

Power levels
- 90 kW
- 120 kW / 60 kW shared
- 180 kW / 90 kW shared

Charging standards
- CCS+CHAdeMO
- CCS-only single outlet
- CCS-only dual outlet

Cable management
- Reliable, tested system
- Factory or field install

User access / payment
- OCPP Integration
- Credit card reader
- PIN via Web Tools
- Autocharge/ISO 15118

Terra DC Fast Chargers
Technical specification UL

Specifications	Terra 94	Terra 124	Terra 184
Electrical			
Maximum output power	90 kW	120 kW or 60 kW x 2	180 kW or 90 kW x 2
AC Input voltage	480Y / 277 VAC +/- 10% (60 Hz)		
AC input connection	3-phase: L1, L2, L3, GND (no neutral)		
Nominal input current and input power rating	115 A, 96 kVA	153 A, 128 kVA	230 A, 192 kVA
Recommended upstream circuit breaker(s)	150 A	200 A	300 A
Power Factor*	> 0.96		
Current THD*	< 5%		
Short circuit current rating	65 kA		
DC output voltage	CCS-1: 150 - 920 VDC; CHAdeMO: 150 - 500 VDC		
DC output current	CCS-1: 200 A; CHAdeMO: 200 A		
Efficiency*	95%		
Interface and Control			
Charging protocols	CCS1 and CHAdeMO 1.2		
User interface	7" high brightness full color touchscreen display		
RFID system	ISO/IEC 14443A/B, ISO/IEC 15393, FeliCa™ 1, NFC reader mode, Mifare, Calypso, (option: Legic)		
Network connection	GSM/3G/4G modem; 10/100 Base-T Ethernet		
Communication	OCPP 1.6 Core and Smart Charging Profiles; Autocharge via OCPP		
Supported languages	English (others available on request)		
Environment			
Operating temperature	-35 °C to +55 °C / -31 °F to +131 °F (de-rating characteristics apply at extreme temperatures)		
Recommended storage conditions	-10 °C to +70 °C / 14 °F to +158 °C (dry environment)		
Protection	IP54, NEMA 3R; indoor and outdoor rated		
Humidity	5% to 95%, non-condensing		
Altitude	up to 2000 m (6560 ft)		
General			
Charge cable	6 m (19.6 ft)		
Dimensions (H x W x D)	1900 x 565 x 880 mm / 74.8 x 22.2 x 34.6 in		
Weight	350 kg / 775 lbs	365 kg / 800 lbs	395 kg / 870 lbs
Compliance and safety	UL 2202, CSA No. 107.1-16; UL 2231-1, UL 2231-2, CSA STD C22.2 No. 107.1; NEC Article 625, EN 61851, EN 62196; CHAdeMO 1.2; DIN 70121, ISO 15118; IEC 61000-6-3; EMC Class B, FCC Part 15		

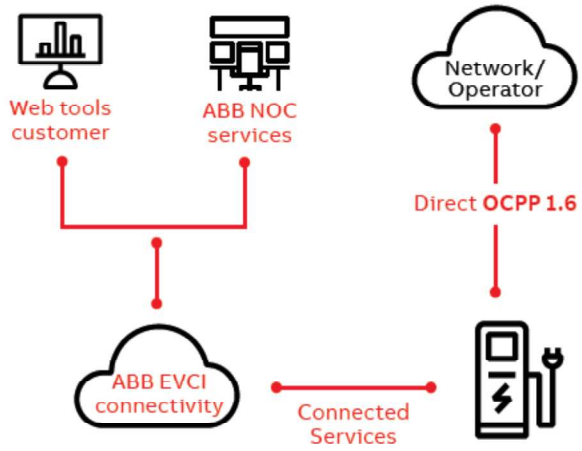
*Data shown at nominal output power

Flexible OCPP enablement

Back-office integrations backed by ABB connectivity

Network communications
ABB has integrated with nearly every major charging network around the world for OCPP support across public and fleet charging operations. ABB chargers can be operated using a direct OCPP connection while linking to ABB's advanced diagnostics and firmware update services for additional intelligence, technical support as well as reduced maintenance.

Leading the industry in implementing authentication technologies, ABB enables Autocharge coupled with an OCPP server. This functionality offers access control at the vehicle level, ideal for fleet asset telematics. ABB's software engineers work with the latest standardized protocols in the EV charging industry including roaming platforms, energy management software and next generation authentication solutions.



Better and faster support: Chargers connected to ABB's network operations center can achieve the fastest remote support from ABB network engineers. This leads to higher uptime of a charger network, minimizes the number of unplanned on-site visits, and significantly reduces overall operational costs.

Scalability and security: IT resources can scale in the ABB Ability cloud while connectivity monitoring is supported by ABB around the clock. ABB leverages Microsoft Azure based security with fewer backend connections to monitor.

OCPP Integrations

The Open Charge Point Protocol (OCPP) includes a broad set of messages with a wide range of functionality for enterprise telematics and usage data. The transaction-based set-up of the messages makes it easy to connect to a back-end system to process charging sessions, define usage models and handle data. Other capabilities include integration with apps and energy management, such as with OCPP Smart Charging Profiles.

Plug and charge

Eliminating manual authentication methods for drivers while delivering granular data sets to network operators and fleets has never been easier with 'plug and play' charging solutions.

ABB supports Autocharge, in conjunction with an OCPP network integration, to meet vehicle-based authentication demands seamlessly with any CCS vehicle.

Additionally, ABB has proactively enabled ISO 15118 (Plug & Charge) for its charging systems to deliver more advanced plug and play charging experience for the next generation of electric vehicles.

ABB EV Infrastructure services

For highest utilization and lowest downtime

Operational excellence
Charging infrastructure must be optimized for the highest utilization and lowest downtime. ABB's remote and real-time services meets that demand, incorporating a decade of experience with thousands of intelligent fast chargers deployed across the globe.

ABB's Terra family of all-in-one chargers are the easiest chargers in the market to service, with high uptime due to its innovative modularity, round the clock connectivity and experience-led design.



Remote services

- 24/7 connectivity
- Remote services
- Remote diagnostics
- Firmware upgrades
- Driver care web tools
- Charger Care web tools

Parts and warranty services

- Full service warranty process
- Extended warranties
- Preventive service and maintenance
- Network spare parts programs
- Fleet spare parts programs

Custom software services

- OCPP integration
- Autocharge integration testing
- Interoperability testing and validation
- Customized enterprise software support

Training

- Standardized online training
- Customized service training
- Third-party service training programs



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Section 2T

Solicitation Requirements:

TS 88.4 Cost of Ownership.

Proposers submittals describing and defining the service and maintenance requirements for the equipment, a "Cost of Ownership" template has been developed and included in the forms to be filled out by the Proposer as an element of the submittal package. This form itemizes tasks in three areas, PMI, scheduled maintenance and major component replacement.

New Flyer Response:

In the attachment Maintenance Support Cost Model Based on 12 Year Life Cycle are detailed. This will provide you with information to determine the life cycles of each coach.

Section 2U

Solicitation Requirements:

TS 90 Exportable Power Supply:

· available power, current and voltage,
· number, type, and location of receptacles,
· type of connector required,
· available energy at full charge,
· shutoff features and conditions,
· traction battery SOC and estimated remaining bus range at automatic shutoff,
· environmental condition requirements,
· compliance with applicable standards and UL Classification,
· maintenance requirements,
· warranty terms for related power electronics and inverters.

New Flyer Response:
Exportable Power Supply is not available on the D45 CRT LE CHARGE™, and D45 CRT CHARGE. Deviation for Exportable Power supply has addressed this request.

Section 2A

Solicitation Requirement:

TS 5.5.2 Operator Training.

New Flyer Response:

Please refer to Operator Training attachment, this document will provide PSTA with an overall training guide and availablity for the New Flyer Xcelsior buses. During the purchase of the coaches a comprehensive plan will be completed for each order depending on the criteria requested from each purchaser from this contract.

LESSON PLAN

TOPIC: Xcelsior Electric Bus Operator Orientation

CLASS SIZE: 5-6 Students

DATE: _____

CLASS DURATION: 4 Hours

INSTRUCTOR: _____ SR.# _____

TRAINING AIDS

SHOP	√	CLASSROOM	√
BUS	X	LCD PROJECTOR	X
DOOR ACCESS SQUARE KEY	X	SLIDE PROJECTOR	
		SCREEN	
		TV-VCR	
		DRAWING BOARD / MARKERS	X
		COMPUTER	X
		NF Operators Guide	X
		NF Instrument Lamp Information section from Service Manual	X
		MANUALS	
		Operators Guide	X

RATIONALE:

THE STUDENT WILL LEARN THE FOLLOWING:

1. General overview of the complete coach.
2. To know the function of the various control switches/components on the side console and instrument panel.
3. To understand how to use the IP mode and enter button to access information
4. To know the function of the heating and cooling system control.
5. To know the proper procedures to start / shut off the coach.
6. To know how to prepare the coach for service operation.
7. To know how to inspect and test the door functions.
8. To know how to perform a pre-trip inspection
9. Connecting the coach to the depot charger (as required)

PREREQUISITE:

THE STUDENT SHOULD HAVE THE FOLLOWING SKILLS / KNOWLEDGE:
1. Basic understanding of coach operation.
2. Basic understanding of door systems in a transit environment.
3. Basic understanding of air systems.
4. Basic understanding of electrical systems in a transit environment.
5. Basic understanding of a Pre-Trip inspection.

THE STUDENT SHOULD HAVE COMPLETED THE FOLLOWING TRAINING ON NEW FLYER TRANSIT BUSES:

1. Not applicable for orientation class.

INTRODUCTION

1. INTRODUCTION OF SELF / INCLUDE BACKGROUND
2. REPRESENTING: COMPANY / SCHOOL / ETC.
3. DISCUSS BREAKS / LUNCH / EXITS / WASHROOM LOCATION / ETC.
4. COMPLETE ATTENDANCE FORM / COPY TO PROPERTY
5. SUBJECT AND MATERIAL TO BE COVERED
6. OUTLINE HOW CLASS WILL BE CONDUCTED / DURATION

BODY

METHOD / AIDS	
Discussion	1.BRIEF OVERVIEW EXPLANATION OF SYSTEM
Discussion	2.DESCRIPTION OF COMPONENTS a. ASK FOR AND RESPOND TO QUESTIONS
Discussion	3.STEP BY STEP DESCRIPTION OF SYSTEMS AND OPERATION a. ASK FOR AND RESPOND TO QUESTIONS
Discussion	4.DESCRIPTION OF SERVICE LITERATURE a. ASK FOR AND RESPOND TO QUESTIONS
Discussion	5.STEP BY STEP DESCRIPTION OF SERVICE PROCEDURES AND DIAGNOSIS a. ASK FOR AND RESPOND TO QUESTIONS

CONCLUSION

1. BRIEFLY REVIEW MAIN TOPICS OF DISCUSSION
   a. ASK FOR AND RESPOND TO QUESTIONS
2. ENCOURAGE READING OF STUDENT MANUAL AS HOMEWORK AND A MEANS OF SELF LEARNING
3. CLOSE DISCUSSION THANKING STUDENTS FOR PARTICIPATION

Training Materials

Instructor Materials

1. NF Operators Guide
2. NF Service Manual Section 19 Drivers Controls

Student Materials

1. Copies of New Flyer Operators Guide
2. Section 19 NF Service Manual

XCELSIOR OPERATORS ORIENTATION
COURSE OUTLINE

A. Classroom Training (1-2 hours)
1. Instructor and Student Introductions
2. Attendance Documentation
3. Overview of training plan
4. Safety Overview
5. Theory of Operation
    1. Review the Operators Guide / Specifications / Operating Principles/ Emergency information / and High Voltage safety (if equipped).
    2. Review the Drivers Check List / Drivers Controls / Instrumentation & Controls /DMAS display.
    3. Review Kneeling, Wheelchair Ramp and Securement System.

B. Practical (On the Bus 2-3 hours)
Operator Instruction
1. Demonstrate the Entrance and Exit door operation.
2. Demonstrate the operation of the Wheel Chair Ramp / Kneeling / Interlocks.
3. Demonstrate proper engine starting / shut down procedures.
4. Explain & Show engine components / access doors / compartments.
5. Demonstrate & Operate Drive Controls / Heating & cooling system controls.

Section 2B

Solicitation Requirements:

TS 5.13 Fire Suppression.

Description to match the specifications.

New Flyer Response:

Please refer to the attachment for Electric Bus Fire Suppression and Detection, although, New Flyer and the proposed battery supplier have robust multi-level approaches to prevent a thermal event from happening making it an extremely unlikely event, not requiring a fire suppression system install.

Section 2C

Solicitation Requirements:

TS 5.11 Interior noise and exterior noise.

New Flyer response:

Please refer to the attachment:

In the attachments New Flyer is providing the exterior noise and vibrations tests, interior noise and vibrations tests. These tests have been completed through the Altoona Testing the objective of these tests is to record exterior and interior noise levels under various conditions to ensure the SAE standards are met. The results are on the following pages.

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission up shift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the PSBRTF and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 43.6 dB(A), the average test result obtained while accelerating from a constant speed was 66.1 dB(A) on the right side and 66.1 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 44.1 dB(A), the average of the results obtained were 64.5 dB(A) on the right side and 64.9 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 48.8 dB(A) at idle. With the accessories and air conditioning off, the readings averaged 9.6 dB(A) lower at idle. Note; this electric bus is not equipped with high idle and wide open throttle positions. The exterior ambient noise level measured during this test was 43.9 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 66	Humidity (%): 39
Wind Speed (mph): 5	Wind Direction: S
Barometric Pressure (in.Hg): 30.19	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.R.	
Initial Sound Level Meter Calibration: ■ checked by: S.R.	
Exterior Ambient Noise Level dB(A): 43.6	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	63.7	1	64.8
2	64.6	2	66.4
3	66.1	3	65.1
4	66.0	4	65.8
5	65.0	5	65.1
Average of two highest actual noise levels = 66.1 dB(A)		Average of two highest actual noise levels = 66.1 dB(A)	
Final Sound Level Meter Calibration Check: ■ checked by: E.D.			
Remarks/Comments/recommended changes: None noted.			

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 67	Humidity (%): 38
Wind Speed (mph): 5	Wind Direction: S
Barometric Pressure (in.Hg): 30.19	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.R.	
Initial Sound Level Meter Calibration: ■ checked by: S.R.	
Exterior Ambient Noise Level dB(A): 44.1	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	62.8	1	62.5
2	64.9	2	65.6
3	64.0	3	64.1
4	63.5	4	62.9
5	63.4	5	62.4
Average of two highest actual noise levels = 64.5 dB(A)		Average of two highest actual noise levels = 64.9 dB(A)	

Final Sound Level Meter Calibration Check: ■ checked by: E.D.
Remarks/comments/recommended changes: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 67	Humidity (%): 39
Wind Speed (mph): 7	Wind Direction: S
Barometric Pressure (in.Hg): 30.19	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.R.

Initial Sound Level Meter Calibration: ■ checked by: S.R.

Exterior Ambient Noise Level dB(A): 43.9

Accessories and Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	49.3	48.3
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Accessories and Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	38.9	39.4
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Final Sound Level Meter Calibration Check: ■ checked by: S.R.

Remarks/Comments/recommended changes: This electric bus is not equipped with high idle and wide open throttle.

7.2 EXTERIOR NOISE TESTS



TEST BUS UNDERGOING
EXTERIOR NOISE TESTING



7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.

2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the Test Track Facility.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the Test Track and the Bus Testing Center.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80.0 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 47.0 dB(A); ranging from 45.5 dB(A) at the rear passenger seats to 47.9 dB(A) in line with the rear speaker. The interior ambient noise level for this test was < 30.0 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 66.4 dB(A) at the front passenger seats to 70.2 dB(A) at the rear passenger seats. The overall average was 68.6 dB(A). The interior ambient noise level for this test was < 30.0 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 1405	Date: 06-20-14
Personnel: T.S., E.D. & S.R.	
Temperature (°F): 79	Humidity (%): 32
Wind Speed (mph): < 12	Wind Direction: Variable
Barometric Pressure (in.Hg): 28.94	
Initial Sound Level Meter Calibration: ■ checked by: T.S.	
Interior Ambient Noise Level dB(A): < 30.0	Exterior Ambient Noise Level dB(A): 43.2
Microphone Height During Testing (in): 29" above seat cushion	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	46.5
Front Passenger Seats	47.4
In Line with Front Speaker	46.9
In Line with Middle Speaker	47.7
In Line with Rear Speaker	47.9
Rear Passenger Seats	45.5

Final Sound Level Meter Calibration: ■ checked by: E.D.

Comments: All readings taken in the center aisle.
Remarks/comments/recommended changes: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 1405	Date: 7-9-15
Personnel: S.R., E.D. & C.S.	
Temperature (°F): 72	Humidity (%): 82
Wind Speed (mph): 2	Wind Direction: N
Barometric Pressure (in.Hg): 30.02	
Initial Sound Level Meter Calibration: ■ checked by: S.R.	
Interior Ambient Noise Level dB(A): < 30.0	Exterior Ambient Noise Level dB(A): 43.1
Microphone Height During Testing (in): 29" from seat cushion.	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	69.3
Front Passenger Seats	66.4
Middle Passenger Seats	68.5
Rear Passenger Seats	70.2

Final Sound Level Meter Calibration: ■ checked by: S.R.

Comments: All readings taken in the center aisle.
Remarks/comments/recommended changes: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 57	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted.
Windows and Doors	None noted.
Seats and Wheel Chair lifts	None noted.

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted.
Remarks/comments/recommended changes: None noted.

7.1 INTERIOR NOISE TEST



TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

Section 2D

Solicitation Requirements:

TS 5.14 Respect for the Environment.

The Contractor shall provide a plan for reuse or recycling of replaced battery cells and/or battery packs.

New Flyer response:

In the attached documents, Environmental, Social Governance Report, and LLi-cycle. The report study from Environmental, Social Governance report outlining the importance of electric batteries regarding the recycling is noted on Page 35. The full report is included as a matter of importance and interest in our changing world.



NFI

MAY 2021

Environmental, Social & Governance Report for 2020

NEW FLYER · ALEXANDER DENNIS · MCI · ARBOC SPECIALTY VEHICLES · PLAXTON · nfi parts · CARFAIR · KMG

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INTRODUCTION

About This Report

This ESG report ("Report") covers the activities of NFI Group Inc. and its subsidiaries (collectively, "NFI" or the "Company") from January 1, 2020 to December 31, 2020, unless otherwise indicated herein.

To develop this Report, NFI consulted with a broad range of stakeholders on regional and global levels, including customers, suppliers, investors and community partners. NFI sought expertise in Human Resources, Legal, Procurement, Ethics and Compliance, Health and Safety, Risk Management, Investor Relations and Communications. The Report is published with the approval of NFI's Board of Directors.

As a result of data coverage and quality improvements, a limited number of past performance figures published in our 2019 report have been restated, and these are clarified in our footnotes.

All references to $ in this document refer to U.S. dollars unless otherwise noted.

ESG Frameworks

Th s Report nc udes env ronmenta , soc a and governance metr cs and d scuss ons that are focused on areas N be eves are most re evant to our bus ness and our stakeho ders, and are gu ded by the pr nc p es of accuracy, ba ance, and c ar ty N cont nues to assess a var ety of frameworks to determ ne wh ch of these address matters most re evant to our stakeho ders and our organ zat ona goa s Our annua ESG report w reflect any add t ona content requ red by se ected frameworks; future report ng cou d nc ude frameworks such as the G oba Report ng n t at ve (GR), the Susta nab ty Account ng Standards Board (SASB), and/or the Un ted Nat ons Susta nab e Deve opment Goa s (SDG)

N expects to respond to the CDP C mate Change Quest onna re for the first t me n summer 2021, fo ow ng wh ch our env ronmenta metr cs w be adjusted to support ongo ng d sc osure requ rements Report ng through the CDP w prov de N w th a framework to systemat ca y measure and d sc ose our r sks and opportun t es re ated to carbon and c mate change, and to create targets around areas of mean ngfu mpact



Forward-Looking Statements

Th s Report conta ns forward- ook ng nformat on and forward- ook ng statements , w th n the mean ng of app cab e Canad an secur t es aws, wh ch reflect the expectat ons of management regard ng the Company s future growth, financ a performance and object ves and the Company s v s on, strateg c n t at ves, p ans, bus ness prospects and opportun t es, nc ud ng the Company s soc a , econom c, env ronmenta and governance-re ated mpacts and object ves The forward- ook ng nformat on n th s ESG Report s nc uded to ass st the Company s stakeho ders n understand ng these matters Th s nformat on may not be appropr ate for other purposes The words be eves , v ews , ant c pates , p ans , expects , ntends , projects , forecasts , est mates , gu dance , goa s , object ves and targets and s m ar express ons such as may , w , shou d , cou d , wou d are ntended to dent fy forward ook ng statements These forward- ook ng statements reflect management s current expectat ons regard ng future events and speak on y as of the date of th s Report (or as otherw se nd cated)

By the r very nature, forward- ook ng statements requ re management to make assumpt ons and nvo ve s gn ficant r sks and uncerta nt es, shou d not be read as guarantees of future events, performance or resu ts, and are subject to the poss b ty that management s pred ct ons, forecasts, project ons, expectat ons or conc us ons w not prove to be accurate, that the assumpt ons may not be correct and that the Company s future growth, financ a performance and object ves and the Company s v s on, strateg c n t at ves, p ans, bus ness prospects and opportun t es, nc ud ng the Company s soc a , econom c, env ronmenta and governance-re ated mpacts and object ves, w not occur or be ach eved

The Company caut ons readers and nvestors not to p ace undue re ance on these forward- ook ng statements and nformat on as a number of r sk factors cou d cause the Company s actua resu ts to d ffer mater a y from the expectat ons expressed n such forward- ook ng statements These factors – many of wh ch are beyond the Company s and management s contro and the effects of wh ch are d ff cu t to pred ct – nc ude r sks re ated to genera econom c and market factors; r sks re ated to the Company s bus ness env ronment; r sks re ated to the Company s operat ons, strategy, financ ng, cap ta structure, tax, regu atory comp ance, reputat on, env ronmenta and soc a r sk; and the r sks d scussed n the R sk actors sect on of the Company s Annua nformat on orm and other d sc osure documents fi ed w th the Canad an secur t es regu atory author t es and ava ab e on SEDAR at www sedar com The Company caut ons that the forego ng st of r sk factors s not exhaust ve and other factors cou d mater a y adverse y affect the Company s future growth, financ a performance and object ves and the Company s v s on, strateg c n t at ves, p ans, bus ness prospects and opportun t es, nc ud ng the Company s soc a , econom c, env ronmenta and governance-re ated mpacts and object ves Except as requ red by aw, the Company does not undertake to update any forward- ook ng statement, whether wr tten or ora , that may be made from t me to t me by the Company or on ts beha f The Company prov des no assurance that forward- ook ng statements and nformat on w prove to be accurate, as actua resu ts and future events cou d d ffer mater a y from those ant c pated n such statements

LETTER TO STAKEHOLDERS

Recovering from the pandemic to lead the evolution to electric and zero-emission mobility.

Without a doubt, 2020 was a year none of us will ever forget.

The pandem c mpacted our operat ons around the wor d and brought w th t many cha enges To say that we are extreme y proud of the response from the N team g oba y s a mass ve understatement

S nce the onset of COV D-19, N has d gent y focused on the hea th and safety of our peop e and on de ver ng for our customers who prov de essent a mob ty serv ces N sought to ach eve a ba ance n our dec s on-mak ng and n our response to the rea t es of the pandem c Desp te a cha eng ng 2020, as we move forward, we are proud of our h story and exc ted about our future

As we reflect on the mpacts of the pandem c, a s ver n ng has been the ncreased focus on ESG ssues by compan es, governments, nvestors and the commun ty at arge N s comm tment to ead n zero-em ss on mob ty and to best- n-c ass ESG pract ces and performance has never been n more c ear focus

N has progressed from a bus and coach manufacturer to a susta nab e mob ty so ut ons prov der, and battery-e ectr c buses and coaches are ead ng the charge to a zero-em ss on future (we ca t the ***ZE***vo ut on™) S nce 2015, we have de vered over 1,380 ZEBs that have trave ed more than 40 m on zero-em ss on serv ce m es and dr ven em ss on reduct ons n four countr es n 2020, we de vered 389 zero-em ss on buses (ZEBs), or 9% of our tota de ver es, and we ant c pate that ZEBs w be 20% to 25% of our overa product on n 2021 Our mob ty so ut ons enab e smart c ty deve opment, reduce the harmfu mpacts of c mate change, traff c congest on and no se po ut on, and create econom c opportun ty for current and future generat ons More than 80 c t es around the wor d have an N ZEB n serv ce or on order

Th s pub cat on marks our th rd annua ESG Report and demonstrates s gn ficant growth and matur ty n our company-w de ESG pract ces We have a so added an ESG sect on to our webs te, where stakeho ders can keep nformed of the atest updates n add t on, 2021 w mark N s first year of forma d sc osure under CDP, a g oba non-profit organ zat on w th defined env ronmenta mpact d sc osure frameworks and defin t ons

As one of the wor d s argest des gners, manufacturers and supporters of mass transportat on so ut ons, we know that we have a respons b ty to ead We are comm tted to the journey, and we w cont nue to work to mprove our ESG pract ces and report ng each year

Passengers around the wor d are seek ng modern susta nab e transportat on opt ons as traff c congest on and a r qua ty cont nue to cha enge today s grow ng c t es We comm t to p ay ng our ro e by ead ng the ***ZE***vo ut on™ to g oba susta nab e mob ty



The Honourable Brian Tobin, P.C., OC
Chair of the Board



Paul Soubry
President & CEO

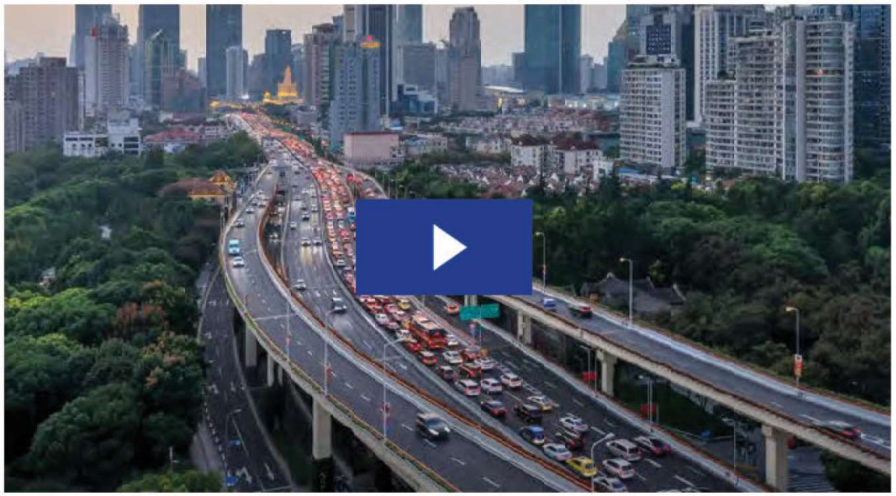
INTRODUCTION

About NFI

Video Links



NFI exists to move people



NFI is leading the *ZE*volution™ to electric and zero-emission mobility

INTRODUCTION

About NFI

NFI is leading the evolution to global zero-emission mobility. We continue to build upon our legacy of innovation to deliver transit technology that meets the complex environmental and social demands of communities today and into the future.



Our Why? To Move People.

Our Vision:
To enab e the future of mob ty w th nnovat ve and susta nab e so ut ons

Our Mission:
To des gn and de ver except ona transportat on so ut ons that are safe, access b e, eff cent, and re ab e

Our Strategy:
We seek ong-term success through ndustry- ead ng transportat on so ut ons and comm t to cont nuous nvestment n our peop e and processes, to opt m ze, defend, d vers fy and grow our bus ness Our products, serv ces, and our company are bu t to re y on

~8,000
team members

50+
fac t es n 10 countr es

105,000+
buses and coaches n serv ce around the wor d



ARBOC Eq ess CHARGE™


BYD AD Env ro400EV



New F yer Xce s or CHARGE NG™


MC D45 CR E CHARGE™

INTRODUCTION

Seeking Long-Term Success

NFI is committed to creating long-term and sustainable value for all our stakeholders, while also being responsible to the environment and the communities in which we live and work.

At N , the cons derat on of a our stakeho ders nterests s cr t ca to our dec s on mak ng n 2009, we mp emented a stakeho der engagement system that encompasses the var ous part es d sp ayed n the mode

n some jur sd ct ons, N part c pates n consu tat ons w th representat ves of the commun t es n the mmed ate v c n ty of our product on fac t es These commun ty meet ngs are used to d scuss any s gn ficant process or product on rate changes that cou d mpact the env ronmenta cond t ons n the area These meet ngs are the forum used to h gh ght safety and env ronmenta mprovements ncorporated nto our manufactur ng operat ons

Our supp ers are subject to our env ronmenta , abor, and human r ghts codes of conduct, ver fied through s te v s ts Our Env ronmenta Hea th & Safety Po cy encompasses a fac t es, operat ons, contractors, and vendors/supp ers

We recogn ze, v a our Env ronmenta Management System (EMS), the mpact our d rect operat ons, supp y cha n, and consumer use of our products and serv ces has on the consumpt on of natura resources, energy, and water, and the generat on of waste Our EMS dent fies how our operat ons nteract w th the env ronment and comm ts to cont nua y mprov ng our efforts to m n m ze env ronmenta mpacts Our comm tment s further shown through the cert fcat on of many of our manufactur ng d v s ons N s heavy-duty and med um-duty trans t bus and motor coach manufactur ng fac t es n North Amer ca have been reg stered to the SO 9001 (qua ty) cert fcat on New yer s heavy-duty trans t bus manufactur ng fac t es have a so been reg stered to SO 14001 (env ronmenta) and SO 45001 (safety) cert fcat ons, mak ng them the first North Amer can bus or coach manufacturer to ach eve a three SO cert fcat ons ARBOC was awarded SO 9001 2008 n 2009 and s now SO 9001 2015 cert fied AD has been awarded SO 9001 cert fcat on for some of ts product on fac t es n the UK, and MC product on fac t es are schedu ed for SO 14001 and SO 45001 reg strat on n 2021

Our comm tment to m n m z ng env ronmenta mpacts s why each bus s des gned and programmed for e ther a) zero em ss ons, or b) fue eff c ency and, n turn, a reduct on n em ss ons Our zero-em ss on and battery-e ectr c products demonstrate our comm tment to a susta nab e future Env ronmenta des gn cr ter a, nc ud ng em ss ons output, resource use and waste generat on, are cr t ca cons derat ons n the creat on of our products Eng nes are des gned to be eff c ent and to meet, and somet mes exceed, regu atory em ss ons and eff c ency requ rements per country On-board em ss ons measurements systems are emp oyed dur ng dr v ng to reduce fue consumpt on



As a publicly traded company on the Toronto Stock Exchange (TSX), NFI ensures decisions are made to drive shareholder value and provide long-term returns. As you'll see throughout this Report, employees and customers are also critical stakeholder groups that drive our business and strategy.

Our Companies

NEW FLYER

New F yer Nor h Amer ca' heavy d y ran b eader and offer he mo advanced prod c ne nder he Xce or® and Xce or C ARGE brand a o offer n ra r c re deve opmen hro gh New F yer n ra r c re So on ™, a erv ce ded ca ed o prov d ng a e, a nab e, and re ab e charg ng and mob y o on New F yer ac ve y ppor over 35,000 heavy d y ran b e (New F yer, NAB, and Or on) c rren y n erv ce, o wh ch 8,600 are powered by e ec r c mo or and ba ery prop on and 1,900 are zero em on



→ newflyer.com

ALEXANDER DENNIS | PLAXTON

A exander Denn m ed ("AD ") a g oba eader n he de gn and man ac re o do b e deck b e and he U ' arge b and coach man ac rer AD offer nge and do b e deck veh c e nder he brand o A exander Denn and P ax on, and ha over 31,000 veh c e n erv ce n he U , E rope, ong ong, S ngapore, New Zea and, Mex co, Canada and he Un ed S a e AD ' oc on zero em on nc de nge deck, 2 ax e do b e deck and 3 ax e do b e deck ba ery e ec r c b mode , a we a e ec r c range hybr d do b e deck and 2nd genera on hydrogen e ce ba ery e ec r c do b e deck, he 20 AD ha over 500 ba ery e ec r c b e n erv ce n he U , Nor h Amer ca and New Zea and, p ano her 500 ba ery e ec r c b e on order



→ alexander-dennis.com

MCI

MC Nor h Amer ca' ead ng p b c and pr va e marke mo or coach brand, b d ng he nd ry' be e ng J4500 coach, ma er ver on J3500, and he new ba ery e ec r c zero em on J4500 C ARGE™ n add on o he J ere , MC b d he B y Amer ca comp an and A oona e ed D mode er e , nc d ng he ADA acce b e D45 CRT E Comm er Coach, he ba ery e ec r c, zero em on D45 CRT E C ARGE™, he a new pr va e ec or D4520, and he p b c ec or D45 CRT MC a o prov de man enance, repa r, 24 ho r road de a ance, par , and echn c an ran ng



→ mcicoach.com

ARBOC SPECIALTY VEHICLES

ARBOC Nor h Amer ca' ow floor, body on cha ("c away") b eader erv ng ran , para ran , and h e app ca on W h more han 4,000 b e prod ced, ARBOC ead he ow floor c away b marke prov d ng n rpa ed pa enger acce b y and com or ARBOC a o offer he Eq e , a med m d y b ed or ran and h e app ca on , and he Eq e C ARGE™, a zero em on ba ery e ec r c mode



→ arbocsv.com

nfi.parts

NF Par ™ Nor h Amer ca' mo comprehen ve par organ za on, prov d ng par , echn ca p b ca on , ran ng, ppor or OEM prod c ne (ran b e , mo or coache and c away), a we a o her man ac rer hro gh o r ex en ve cro re erence da aba e



→ nfi.parts

CARFAIR

Car a r Compo e nc Nor h Amer ca' eader n eng neered fiber re n orced pa c (FRP) and compo e echno oge or b e , w h over 50 year o exper ence

→ carfaircomposites.com

KMG

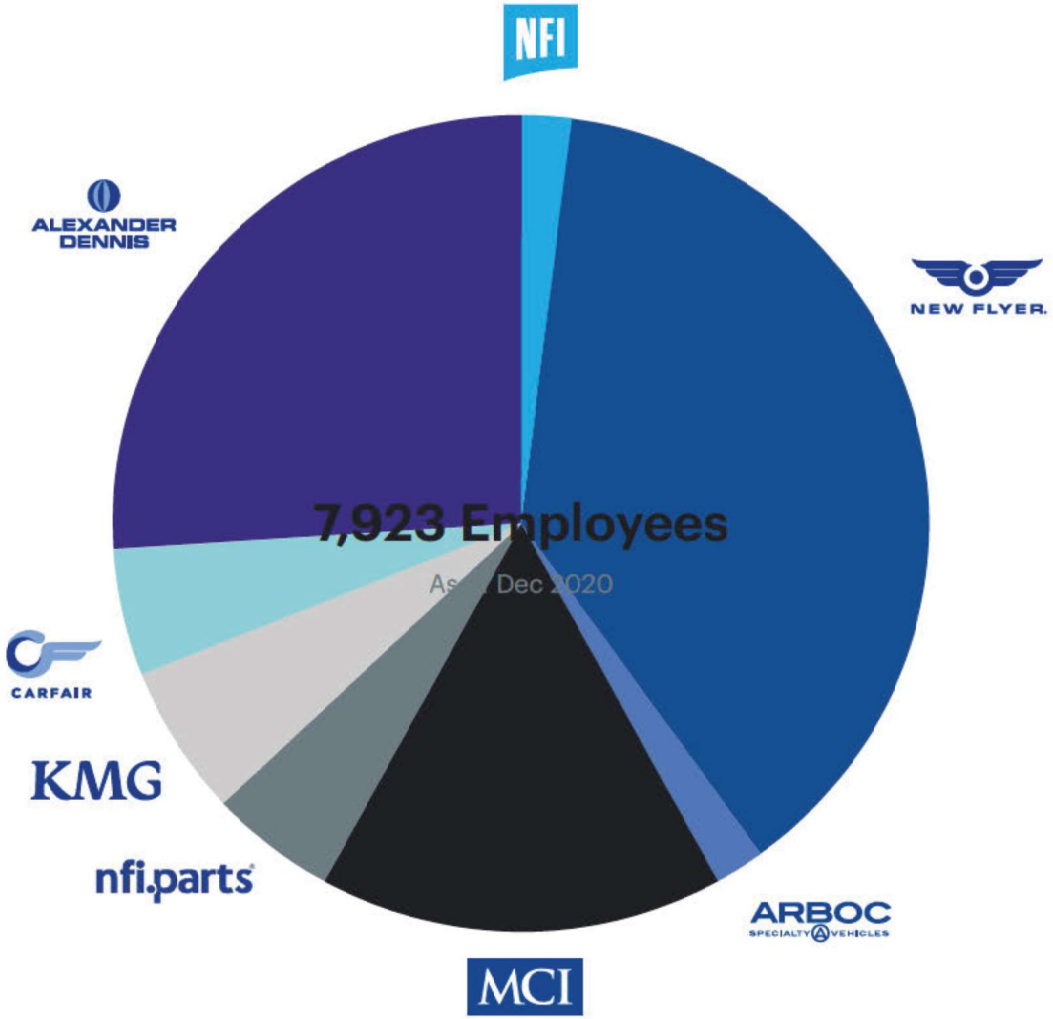
MG NF ' par abr ca on ac y wh ch a nched n 2018 n Shepherd v e, en cky

INTRODUCTION

Our People



142 Employees	NF Gro p
2,996 Employees	New F yer
128 Employees	ARBOC
1,244 Employees	MC
396 Employees	NF Par
483 Employees	MG
378 Employees	Car a r Compo e
2,156 Employees	A exander Denn m ed



INTRODUCTION

Our Milestones

- **1895** Dennis founded in England
- **1907** Plaxton founded in Scotland
- **1924** Alexander founded in Scotland
- **1930** Western Auto and Truck Body Works founded in Winnipeg, Canada
- **1932** Motor Coach Industries founded in Winnipeg
- **2001** Dennis, Alexander and Plaxton become Alexander Dennis Limited
- **2008** ARBOC Specialty Vehicles founded in Middlebury, IN
- **2010** NFI acquires TCB Industries
- **2013** NFI acquires Orion Parts and North American Bus Industries in Anniston, AL
- **2015** NFI acquires Motor Coach Industries and Frank Fair Industries
- **2017** NFI acquires ARBOC Specialty Vehicles
- **2017** NFI Parts established (New Flyer, NABI, Orion and MCI Parts)
- **2017** NFI opens Vehicle Innovation Center (VIC) in Anniston, AL
- **2017** NFI acquires Carlson Engineered Composites and Wausaukee-Sintex Composites
- **2018** NFI launches KMG Part Fabrication in Shepherdsville, KY
- **2019** NFI acquires Alexander Dennis Limited
- **2019** NFI introduces Infrastructure Solutions™
- **2020** NFI introduces the national Community Benefits Framework
- **2020** NFI launches NFI Forward, a transformational initiative to move NFI from a holding company to an integrated operating company
- **2021** NFI unveils its strategy, entitled Leading the ***ZE***volution™, to drive the evolution to zero-emission mobility



New F yer Xce s or AV ™

INTRODUCTION

Our Communities

NEW FLYER

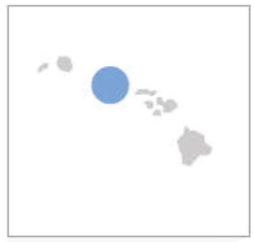
- **Crookston, MN**
  B Compe on
- **Ontario, CA**
  NF B Compe on
  MC Serv ce Cen er
- **Renton, WA**
  NF Serv ce Cen er
- **St. Cloud, MN**
  NF B Man ac r ng
  F berg a Fabr ca on
  Par Fabr ca on
- **NFI Winnipeg, MB**
  Par Fabr ca on
  F berg a Fabr ca on
  B She A emb y
  New Prod c Deve opmen

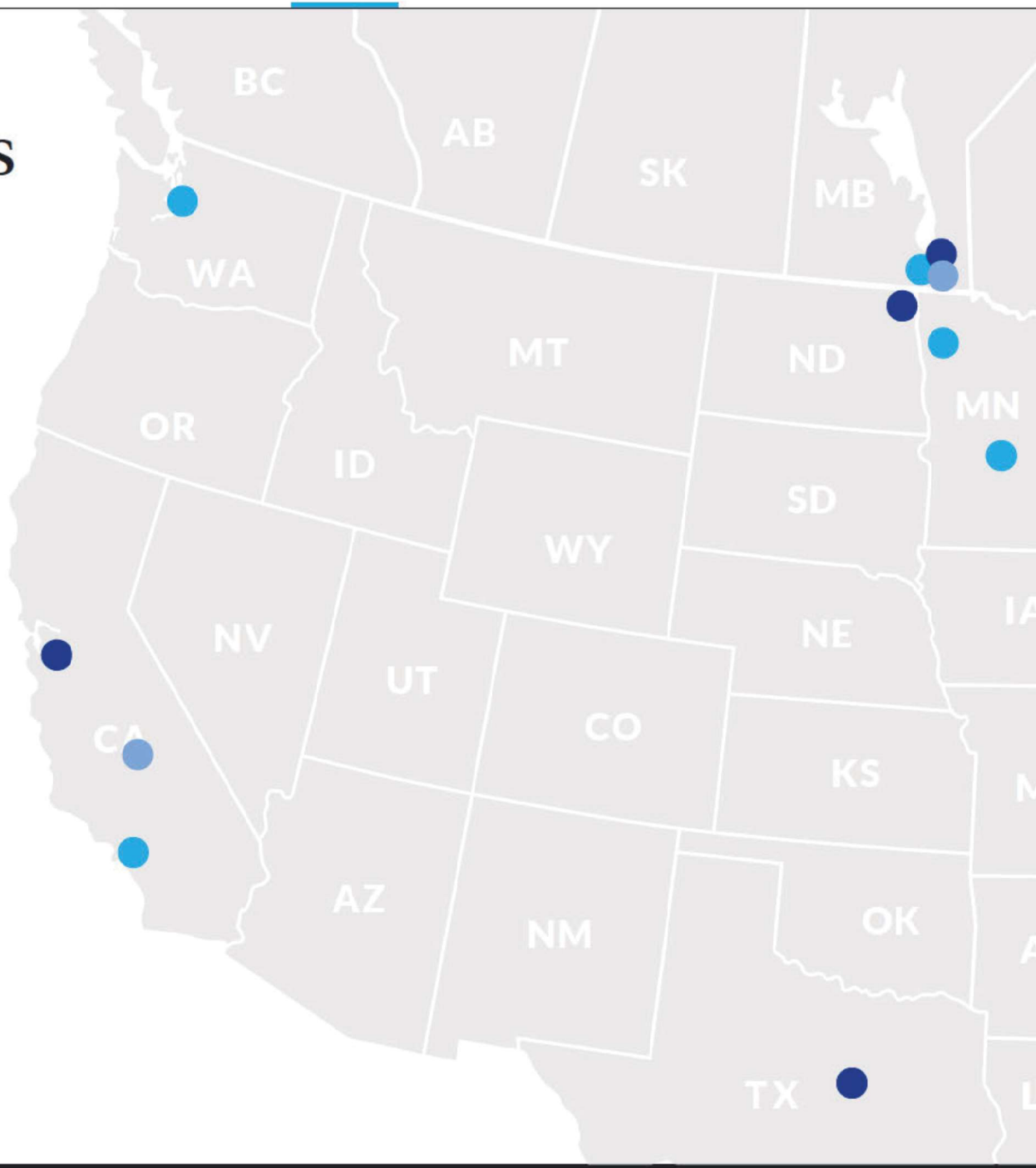
MCI

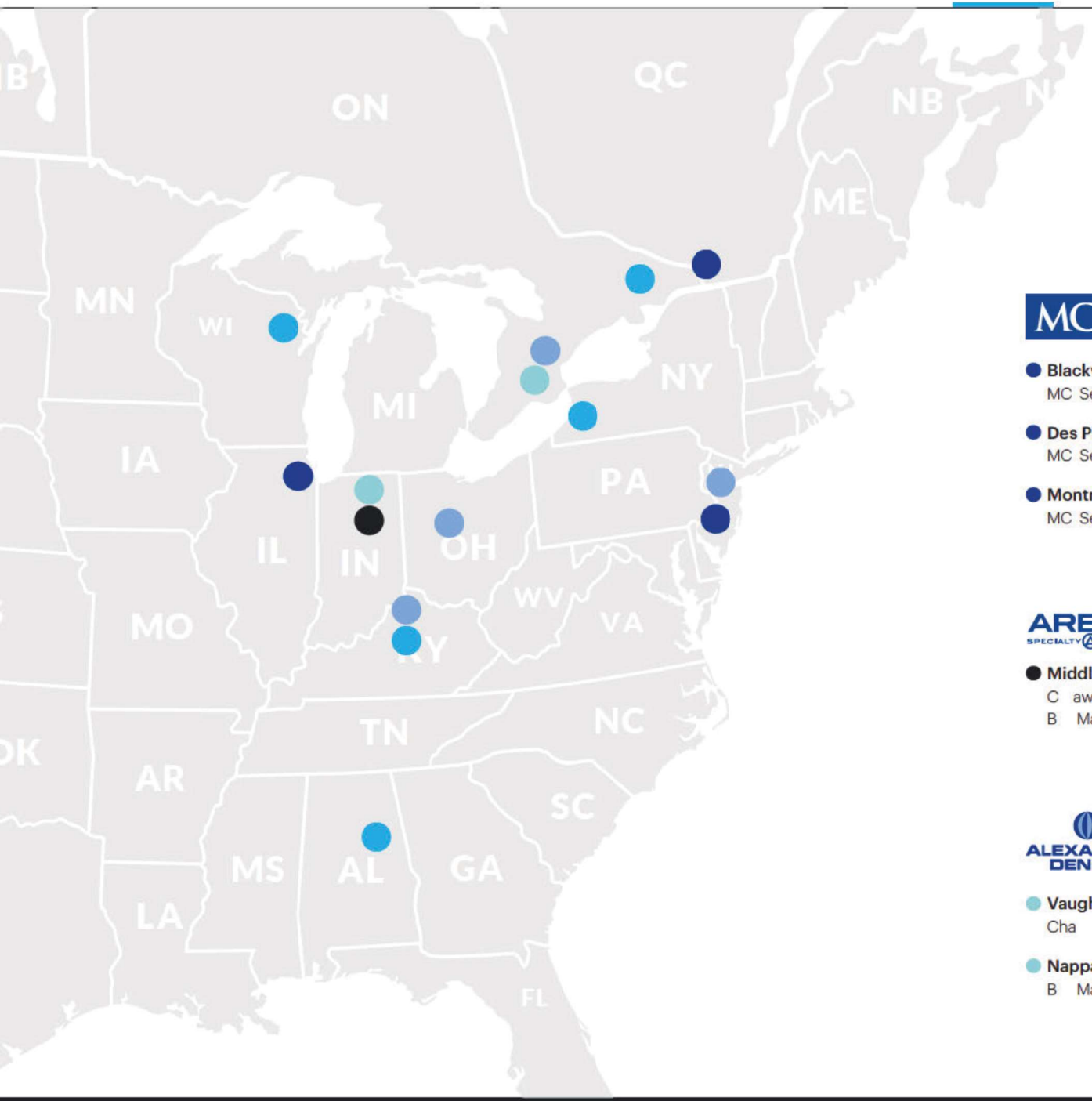
- **Dallas, TX**
  MC Serv ce Cen er
- **Hayward, CA**
  MC Serv ce Cen er
- **Pembina, ND**
  MC D She Compe on
- **Winnipeg, MB**
  Par Fabr ca on
  MC D Mode She A emb y
  Compe e J Mode Man ac r ng
  New Prod c Deve opmen
  F berg a Fabr ca on

nfi.parts

- **Fresno, CA**
  NF Par D r b on Cen er
- **Honolulu, HI**
  NF Par D r b on Cen er
- **Winnipeg, MB**
  NF Par D r b on Cen er
  P b ca on
  C omer Tra n ng







MCI

- **Blackwood, NJ**
  MC Serv ce Cen er
- **Des Plaines, IL**
  MC Serv ce Cen er
- **Montreal, QC**
  MC Serv ce Cen er

ARBOC SPECIALTY VEHICLES

- **Middlebury, IN**
  C away & Med m D y
  B Man ac rng

ALEXANDER DENNIS

- **Vaughan, ON**
  Cha Man ac rng
- **Nappanee, IN**
  B Man ac rng

NEW FLYER

- **Anniston, AL**
  NF B Man ac rng
  Par Fabr ca on
  Veh c e nnova on Cen er
- **Arnprior, ON**
  NF Serv ce Cen er
- **Jamestown, NY**
  Par Man ac rng
- **Shepherdsville, KY**
  Par Fabr ca on
- **Wausaukee & Gillett, WI**
  F berg a Fabr ca on

nfi.parts

- **Brampton, ON**
  NF Par D r b on Cen er
- **Delaware, OH**
  NF Par D r b on Cen er
- **East Brunswick, NJ**
  NF Par D r b on Cen er
- **Louisville, KY**
  NF Par D r b on Cen er
  P b ca on
  C omer Tra n ng



ALEXANDER DENNIS

- **Anston, England**
  Par D r b on and Serv ce Cen er
- **Falkirk, Scotland**
  B Body Man ac r ng
- **Farnborough, England**
  De gn and Eng neer ng
- **Harlow, England**
  Serv ce Cen er
- **Larbert, Scotland**
  ead Off ce
- **Skelmersdale, England**
  Par D r b on and Serv ce Cen er
- **Scarborough, England**
  B & Coach Man ac r ng
- **Dublin, Ireland**
  Par D r b on Cen er
- **Ballymena, Northern Ireland**
  Eng neer ng b
- **Ciudad de Mexico, Mexico**
  Serv ce Cen er
- **Berlin, Germany**
  Commerc a Off ce
- **Kowloon, Hong Kong**
  APAC ead Off ce
- **Auckland, New Zealand**
  Par D r b on and Serv ce Cen er
- **Singapore**
  Commerc a Off ce

INTRODUCTION

Our COVID-19 Response

The COVID-19 pandemic has had a significant impact on our company and our team around the world.

Across N , we d ed the major ty of our fac t es for near y two months (Mar – May 2020), wh ch resu ted n near y 8,000 peop e on temporary fur ough We resumed product on n the second quarter of 2020, wh ch saw many of our peop e return to our manufactur ng fac t es, and we worked d gent y to create a safe env ronment for the r return

At the beg nn ng of the pandem c, we aunched a ded cated COV D-19 Response Team that has coord nated Safe Work, Commun cat ons, R sk and Operat ons n t at ves, and we have prov ded cons stent commun cat on to a emp oyees throughout the ongo ng pandem c

Our focus rema ns on the hea th, safety and we -be ng of our team members no matter where they are work ng

A few of our initiatives have included:

- → Prov d ng PPE requ red for a staff
- → Spec a zed c ean ng and san t z ng
- → Ensur ng phys ca d stanc ng and re-eng neer ng processes where feas b e
- → Work from home, where feas b e
- → mp ement ng hea th and temperature checks
- → mp ement ng symptom d sc osure po c es
- → Ded cated on ne porta s for commun cat on

NFI COVID-19 Training Sessions

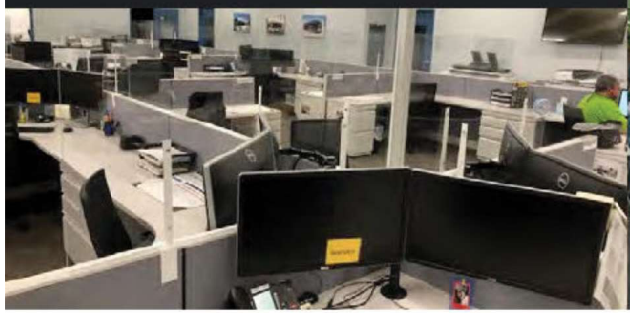
	Leadership	Employees	Visitors
To a # o Tra n ng o r	1,774	12,174	376
To a # o Tra n ng Se on A ended	639	7,014	1,502



14,323
Tota # of Tra n ng Hours

9,155
Tota # of Tra n ng Sess ons Attended









ENVIRONMENTAL, SOCIAL & GOVERNANCE REPORT FOR 2020

Principles & Governance

A better product.
A better workplace.
A better world.

PRINCIPLES & GOVERNANCE

Our Core Values

1. We pledge to be customer focused

n prov d ng safe, access b e, re ab e, and techno og ca y advanced transportat on so ut ons w th the goa of prov d ng the owest tota cost of ownersh p to keep peop e and commun t es mov ng

2. We must earn the trust of those we serve and those they serve

through a steadfast comm tment to safety and qua ty de vered as prom sed

3. We foster smart leadership

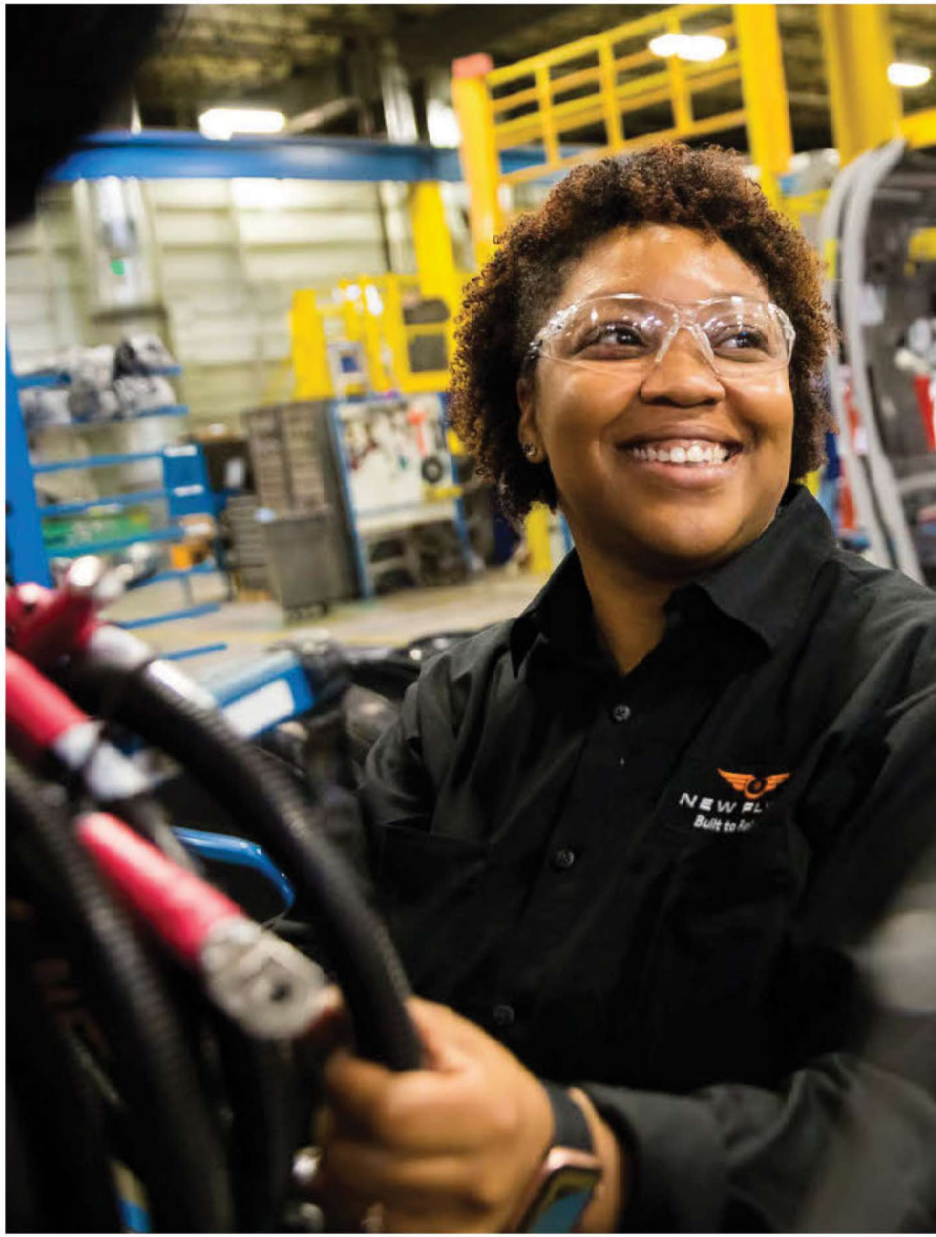
at every eve of N , to cont nuous y ra se standards and advance techno og ca nnovat on and serv ce performance We re pass onate about a never-end ng pursu t of operat ona exce ence

4. We believe in sustainability

and the pos t ve soc a , econom c, and env ronmenta mpact of the work we do every day

5. We value honesty, hard work and team work

and those who do that work w th pr de and ntegr ty We str ve to be a great p ace to bu d careers



PRINCIPLES & GOVERNANCE

NFI Board of Directors



Hon. Brian Tobin*
(Ontar o)
Board Cha r
HRCH Comm ttee Member
Member s nce 2005



Colin Robertson
(Un ted K ngdom)
V ce Cha r
Member s nce 2020



Phyllis Cochran*
(South Caro na)
A d t Comm ttee Cha r
Member s nce 2015



Larry Edwards*
(Ok ahoma)
HRCG Comm ttee Cha r
A d t Comm ttee Member
Member s nce 2005



Paul Soubry
(Man toba)
Pres dent & CEO
Member s nce 2009



Katherine Winter*
(I no s)
HRCG Comm ttee Member
Member s nce 2019
Kathy is the VP & GM Autonomous Transportation & Infrastructure Division Intel Corporation



John Marinucci*
(Ontar o)
Member at arge
Member s nce 2005



Adam Gray*
(Connect cut)
A d t Comm ttee
Member s nce 2012
Adam is co-founder and Managing Partner at Coliseum Capital Management LLC



Krystyna Hoeg*
(Ontar o)
A d t Comm ttee Member
Member s nce 2015



Paulo Nunez*
(Braz)
HRCG Comm ttee Member
Member s nce 2015
Paulo also serves on the Board of Directors of Marcopolo S A Management LLC

* Denotes ndependent D rectors

Key Facts

80%
Board ndependence

33%
fema e

4
geograph ca d vers ty across four countr es

300
years of comb ned exper ence

100%
of D rectors own shares

Str v ng for ncreased representat on of underrepresented groups

Robust Governance Program

Ded ca ed A d , R and Nom na on Comm ee

De a ed po cy ramework

Enhanced ESG d c o re and po cy deve opmen

Wh eb ower and Fra d o ne

ghe SS Rank ng or A d , R k and Shareho der r gh

PRINCIPLES & GOVERNANCE

Our ESG Disclosure Journey

May 2019
1st Env ronmenta , Soc a & Governance Report



March 2020
aunched Nat ona Commun ty Benefits ramework



May 2020
2nd Env ronmenta , Soc a & Governance Report



May 2021
3rd Env ronmenta , Soc a & Governance Report



2021
naugura CDP part c pat on

2021+
Cont nue to eva uate and cons der mp ement ng add t ona vo untary d sc osure framework(s)

PRINCIPLES & GOVERNANCE

Our ESG Priorities for 2021

Company Management	Environment	Employees	Community
B ne per ormance	Zero em on prod c and o on	Ce ebra ng, o er ng and mea r ng d ver y, eq y and nc on	Re pon b e corpora e c zen
ead ng w h n egr y	Em on managemen , nc d ng oo pr n ra ona za on	Env ronmen a hea h and a e y	man R gh
Q a y prod c , con n o nnova on	Energy and wa er con mp on managemen	Re pec and v bran workp ace c re	Comm n y and char ab e n a ve
Rob governance	n ra r c re So on o ppor zero em on pro ec	Comm n y Bene Framework and n a ve	Team and comm n y pr , ppor ed by he Comm n y Bene Framework

"ESG will continue to drive our decision making in 2021 and beyond. We are focused on both our internal initiatives, including an increase in the diversity of our team and reduction of our carbon footprint, and on the environmental and social benefits created by our products."

Janice Harper, Executive Vice President, People & Culture



PRINCIPLES & GOVERNANCE

Our Sustainability Pledge

A better product.
A better workplace.
A better world.

Our Sustainability Pledge guides our daily actions and long-term planning. NFI is passionate about creating a better product, a better workplace, and a better world.





NFI

ENVIRONMENTAL, SOCIAL & GOVERNANCE REPORT FOR 2020

Better Product

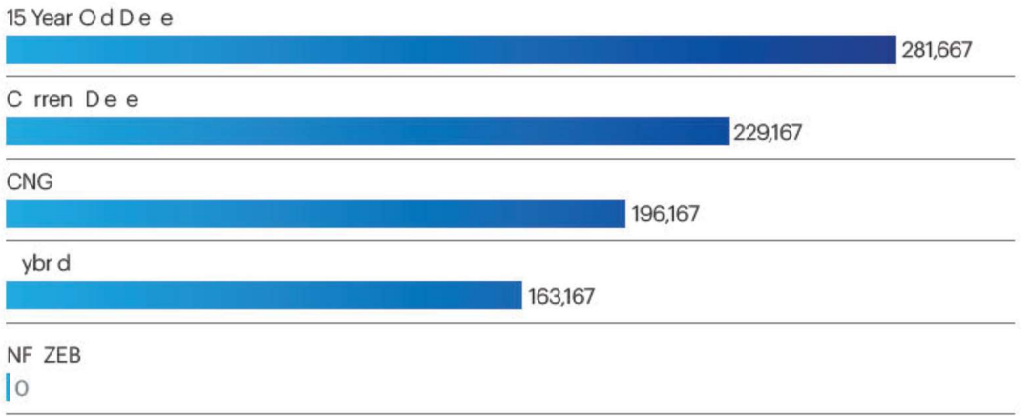
A better product.
A better workplace.
A better world.

BETTER PRODUCT

The Power of a Bus

- or every $1 commun t es nvest n pub c transportat on, t generates $5 n econom c returns
- Amer cans took 4 66 b on bus tr ps n 2019 ; UK passengers took 4 6 b on bus journeys from Apr 2019-Mar 2020[2]; and Canad ans took 1 89 b on bus tr ps n 2019[3]
- Every ZEB prevents the em ss on of 3,380,000 bs of CO_2 over a 12-year fe, the equ va ent of the em ss ons from 28 cars per year

Annual Tailpipe Emissions[4] (CO_2, lbs)



Comparative Cost and Time to Delivery

Transit mode	Cost	Time to deliver
gh Ra Tran (RT)	$3B $6B	>5 year
100 Tran B e	$40M $50M	1 2 year
100 ZEB	$90M $100M	1 2 year

1. A TA 2. N SRA and Gov.uk 3. S a s Can 4. GR T Mode ee oo pr n Ca cu a or & A Mo or Veh c e m ss on S mu a or
5. A TA's conom c mpac of ub c Transpor a on nves men 6. A TA and The Na ona Assoc a on of Rea ors
7. The H dden Traff c Safe y So u on ub c Transpor a on

Key Facts

+24%
home va ues near pub c transportat on[5]

$11.7B
offset to annua car operat ng costs[5]

49,700
obs created from every $1 b on nvested[5]

10x
safer per m e to trave by pub c trans t than automob es[7]

40
cars removed from the road for every 1 bus



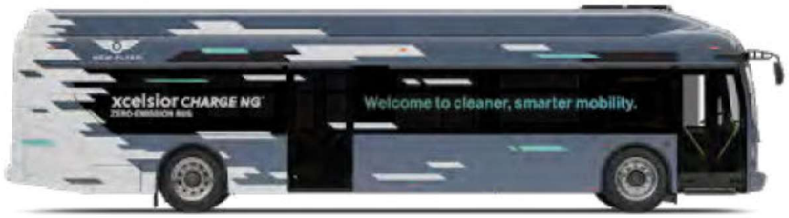
New F yer b ses, from eft Xce s or AV™, Xce s or CHARGE NG™, Xce s or CHARGE H2™, and Xce s or CNG

BETTER PRODUCT

Product Highlights

NFI's portfolio of companies have 450 combined years of experience in business development, manufacturing, transportation solutions and the supply of buses and coaches.

Xce s or CHARGE NG ᴹ, next generat on, zero em ss on, battery e ectr c trans t b s



Environment:

The zero-em ss on Xce s or CHARGE NG™ trans t buses do not em t any greenhouse gas, as compared to the 100 to 160 tons on average em tted from a 40-foot convent ona d ese bus AD s zero-em ss on e ectr c buses reduce we -to-whee greenhouse gas em ss ons by up to 63% compared w th a convent ona d ese bus (when charged w th gr d e ectr c ty), and even more when fu y charged by renewab e energy

n 2020, ARBOC re eased the zero-em ss on battery-e ectr c Equess CHARGE™, and MC aunched the J4500 CHARGE™ n add t on, N Parts™ cont nues to seek out green techno ogy w th ts ntroduct on of no- d e so ut ons, such as so ar pane and e ectron c HVAC systems

Energy Costs:

The Xce s or CHARGE NG™ trans t bus prov des up to $400,000 ower fue costs over the 12-year fe of the bus (compared to a 40-foot d ese bus; actua sav ngs w depend on reg ona energy costs and charg ng methods) ts new ghtwe ght e ectr c tract on dr ve system prov des up to 90% energy recovery

Industry-Leading Accessibility:

ARBOC ed the ndustry by creat ng the first patented ow-floor cutaway and ow-floor non-knee ng cutaway, a ow ng equa access for a passengers

The nnovat ve des gn of MC s D45 CRT E CHARGE™ veh c e prov des eas er board ng and greater ndependence

A of P axton s coach mode s are ava ab e n whee cha r-fr end y vers ons, meet ng the requ rements of the UK s Pub c Serv ce Veh c es (PSV) Access b ty Regu at ons

New yer s SmartR der™ ramp and suspens on system enab es buses to knee to var ab e he ghts, m n m z ng the s ope d fference between a ow-floor ramp and bus floor and u t mate y prov d ng unmatched access b ty for a

The Xce s or AV™ automated trans t bus prov des prec s on dock ng that m n m zes p atform gaps, he p ng to ensure board ng s ADA-comp ant (Amer cans w th D sab t es Act Standards for Access b e Des gn), and ncreas ng access b ty for a passengers

Quiet:

Dur ng the A toona nter or No se 0 to 35 mph Acce erat on Test ng, the Xce s or CHARGE H2™ scored the owest dBA eve , mak ng t the qu etest bus on the market

Interoperable:

New yer nfrastructure So ut ons™ dep oys e ectr c veh c e supp y equ pment and charg ng systems that are compat b e w th a types, makes and mode s of e ectr c veh c es, adher ng to ndustry standards AD s e ectr c buses are s m ar y ava ab e w th nteroperab e charg ng nterfaces for s ow and opportun ty charg ng

BETTER PRODUCT

Leading the *ZE*volution.™

NFI is leading electric bus mobility.

- Our end products are a key dr ver to enab e c t es to ower em ss ons, decrease congest on and enab e econom c opportun ty
- We are comm tted to cont nu ng to nnovate n order to de ver smarter, safer, more susta nab e, and more connected pub c transportat on



Xce s or CHARGE®



BYD AD Env ro200EV

Leading Electric Bus Mobility

105K
veh c es n serv ce (ZEB rep acement opportun ty)

50+
years of e ectr c bus exper ence

13
countr es w th NF buses n serv ce

40M+
e ectr c serv ce m es s nce 2015

80+
c t es w th an NF ZEB n serv ce or on order

1,371
ZEBs de vered from 2015-2020

389
ZEBs de vered n 2020

632
ZEBs n back og as at end of 2020 (5.8% of tota back og)

$24.7M
nfrastructure So ut ons revenue n 2020

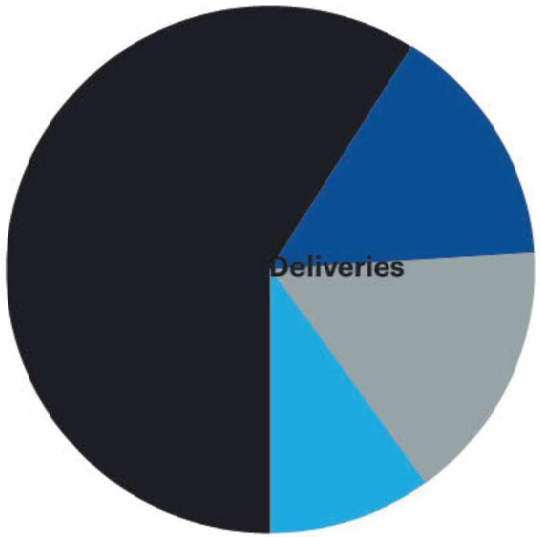
20-25%
of 2021 product on w be ZEBs

8,000
annua ZEB product on capac ty

BETTER PRODUCT

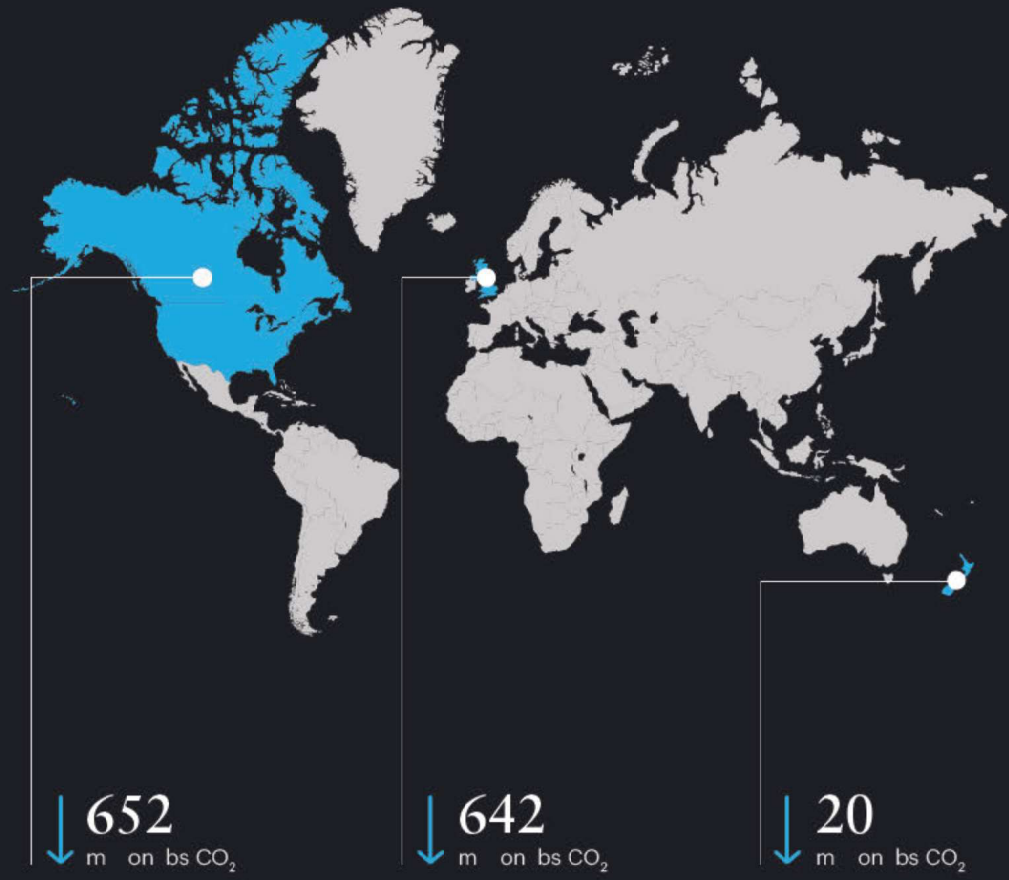
Impact of 2020 ZEB Deliveries

NFI 2020 Deliveries by Propulsion Type



- Diesel
- CNG
- Hybrid
- Battery-Electric

In 2020, NFI sold 389 ZEBs, which will eliminate the equivalent of 1.3 billion lbs of CO_2 over the expected 12-year life of those buses[1]



1. GR T Mode ee co pr n Ca cu a or & A Mo or Veh c e m ss on S mu a or

BETTER PRODUCT

Our Zero-Emission Journey Dates Back to 1969...



1994
rst compressed natura gas (CNG) bus

2005
rst d ese hybr d w th BAE and first gas eng ne hybr d



2012
rst battery-e ectr c bus

2015
aunched New yer Connect®

2018
aunched New yer nfrastructure So ut ons™

Continued on next page

1969
rst North Amer can e ectr c tro ey



1998
rst d ese hybr d veh c e produced w th A son

2010
20 hydrogen fue ce buses for 2010 O ymp cs

2014
rst product on of fue ce range extender

2017
Opened V C and aunched next generat on battery-e ectr c bus

2019
Acqu red AD and aunched Connect 360™

BETTER PRODUCT

...and continues in 2021



New Flyer Xcelsior AV™
North Amer ca s first SAE eve 4 automated heavy-duty trans t bus; zero-em ss on, battery-e ectr c

Li-Cycle™

Battery Recycling Pilot
Successfu aunch of battery recyc ng p ot w th -Cyc e Corporat on



ADL H2.0
Next-generat on hydrogen fue ce -e ectr c doub e-deck



MCI D45 CRT LE CHARGE™
Zero-em ss on, battery-e ectr c, ow-floor motor coach

New Flyer Xcelsior CHARGE NG™
Next-generat on, zero-em ss on, battery-e ectr c trans t bus



ARBOC Equess CHARGE™
Zero-em ss on, battery-e ectr c, med um-duty ow-floor trans t



MCI J4500 CHARGE™
Zero-em ss on, battery-e ectr c uxury motor coach



+ more to come in 2021

BETTER PRODUCT

Case Study
King County Metro

King County METRO
Moving forward together

NEW FLYER.

18-month evaluation of two NFI battery-electric vehicles followed by the purchase of twenty 60-foot EVs will help lower Seattle emissions and assist King County Metro in achieving its vision of 100% zero-emission vehicles by 2040.

n ear y 2021, K ng County Metro awarded New yer w th an order for 20 of ts 60-foot (art cu ated) battery-e ectr c Xce s or CHARGE® buses, fo ow ng the comp et on of an 18-month e ectr c bus p ot project and eva uat on

K ng County Metro s one of the 10 argest trans t agenc es n the Un ted States, prov d ng over 122 m on annua passenger tr ps n K ng County, Wash ngton, and the c ty of Seatt e n January 2020, K ng County Metro announced ts comm tment to ach eve a 100% zero-em ss ons fleet powered by renewab e energy no ater than 2040 The add t on of these 20 battery-e ectr c buses marked a key m estone n he p ng K ng County Metro reach ts goa to mprove a r qua ty, reduce carbon em ss ons, and prov de equ tab e access to susta nab e transportat on

The 18-month p ot project nvo ved test ng the Xce s or CHARGE™ buses aga nst K ng County Metros pre-determ ned key performance nd cators (KP s), nc ud ng range, performance, and serv ce

K ng County Metro noted that the strong partnersh p t found n New yer was a key determ n ng factor n the dec s on to purchase add t ona buses

"New Flyer has been a very good partner to us throughout this lease. It's very important because, what happens after you buy the bus? What happens after you put the infrastructure in place? You need to have a strong partnership with a company that has the resources, the will, and the ability to support the product,"

- Danny o u, Zero Em ss ons eet Strateg c P ann ng Manager, K ng County Metro and Seatt e

"Having delivered over 1,830 buses to King County since 1979, with over half comprised of zero-emission or hybrid electric propulsions on common and proven Xcelsior® bus platforms, New Flyer technology has assisted Metro's transition to clean, quiet, reliable and sustainable transit,"

- Chr s Stoddart, Pres dent, New yer and MC

N subs d ary ARBOC has a so supported Metros comm tment to fast, equ tab e, and re ab e serv ce, w th 37 ow-floor cut-away buses de vered s nce 2011 nc ud ng the reedom, ndependence, berty, and Mob ty mode s



New F yer Xce s or CHARGE®, K ng Co nty Metro, Seatt e, WA

BETTER PRODUCT

The "VIC": The Industry's Vehicle Innovation Center

The only ZEB collaboration center of its kind.

The Veh c e nnovat on Center s the first and on y nnovat on ab n North Amer ca so e y ded cated to the nnovat on and advancement of bus and coach techno ogy The V C prov des comprehens ve e ectr c veh c e (EV) and automated veh c e (AV) tra n ng and workforce deve opment, now ava ab e on ne



Veh c e nnovat on Center, Ann ston, A

VIC | VEHICLE INNOVATION CENTER

2017	3,000+	200+	650+
Launch	V s tors	Agenc es / Operators	Attendees for 2020 V rtua Sess ons

BETTER PRODUCT

The VIC: Vehicle Innovation Center

The center's focus is to promote research and development, education and innovation, progressive manufacturing, and bold thinking, as well as to:

- oster d a ogue through d scuss on, educat on, and tra n ng on the atest zero-em ss on, connected, and autonomous dr v ng veh c e techno og es
- Engage earn ng through nteract ve exh b ts, s mu at on and hands-on exper ences, and observat ons
- Generate nterest and comm tment to c ean a r, qua ty, safety, and econom c benefits for peop e, commun t es, and bus nesses
- Harness the pos t ve nfluence of co aborat on, env ronmenta stewardsh p, and soc a change to advance smart mob ty so ut ons
- Advance bus and coach techno ogy through susta nab e research and deve opment, fresh nnovat on, progress ve manufactur ng, and bo d th nk ng

W th ncreased soc eta focus on susta nab ty to protect the env ronment and preserve natura resources, the demand for zero-em ss on battery-e ectr c buses s qu ck y ncreas ng throughout the wor d N has met th s demand and ra sed the bar w th ts state-of-the-art V C

n 2020, the V C p voted to v rtua earn ng sess ons and hosted over 650 attendees



he V Cs battery e ectr c b ss m ator

24	8
D sp ays	nteract ve Act v t es

3	3	1
Observat on Decks	Charger Types	S mu ator

BETTER PRODUCT

Leveraging Four Pillars to Enable the Future of Mobility

Today, over 3.9 billion people live in urban areas (more than 54% of the world's total population), and urbanization is expected to intensify. By 2045, the global population living in urban areas is expected to surpass 6 billion. As cities continue to grow, so too will demand pressure on urban services – including the need for efficient and sustainable mobility, cleaner air, and multi-modal transportation.

N s best pos t oned to enab e the future of mob ty and meet today and tomorrow s urban demands for sca ab e so ut ons N s accomp sh ng th s through a four-p ar approach

Our comprehens ve, unmatched, nnovat ve approach d rect y supports the evo ut on of zero-em ss on techno ogy, the need for equ tab e access to mob ty, and the deve opment of the workforce that w dr ve a susta nab e future

Through ntens ve nterna tra n ng v a the N earn ng nst tute, and externa tra n ng prov ded v rtua y and n-person by the Veh c e nnovat on Center, N s de ver ng cr t ca y needed workforce deve opment to ts teams and those of trans t agenc es across North Amer ca, bu d ng know edge and sk s on EV and AV techno ogy n the face of rap d zero-em ss on bus adopt on

Commun t es are demand ng c eaner a r and ess congest on, wor d eaders are advocat ng for m t gat on of c mate change, and c t es are demand ng safer, more re ab e and eff c ent mob ty Through a wor d sh ft ng gears, trans t has stepped nto the spot ght as a cr t ca enab er of remob zat on, and N s four-p ar approach w cont nue to meet the need for greater susta nab ty, equ ty, and access b ty n mov ng peop e around the wor d

NFI's Four-Pillar Approach

1 **Buses & Coaches**



2 **Infrastructure**



3 **Smart, Connected Technology**



4 **Workforce Development**



BETTER PRODUCT

The Industry's Widest Range of ZEBs

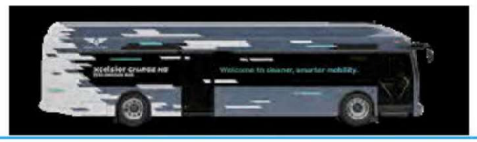
30- & 35-foot
Med um-Duty, ow- oor E ectr c



35-foot
Battery-E ectr c



40-foot
Battery-E ectr c



40-foot
ue Ce -E ectr c



60-foot
Battery-E ectr c



60-foot
ue Ce -E ectr c



Single-Deck
Battery-E ectr c



Double-Deck
Battery-E ectr c



Double-Deck
ue Ce -E ectr c



Motor Coach
Battery-E ectr c



Motor Coach
Battery-E ectr c ow-Entry



BETTER PRODUCT

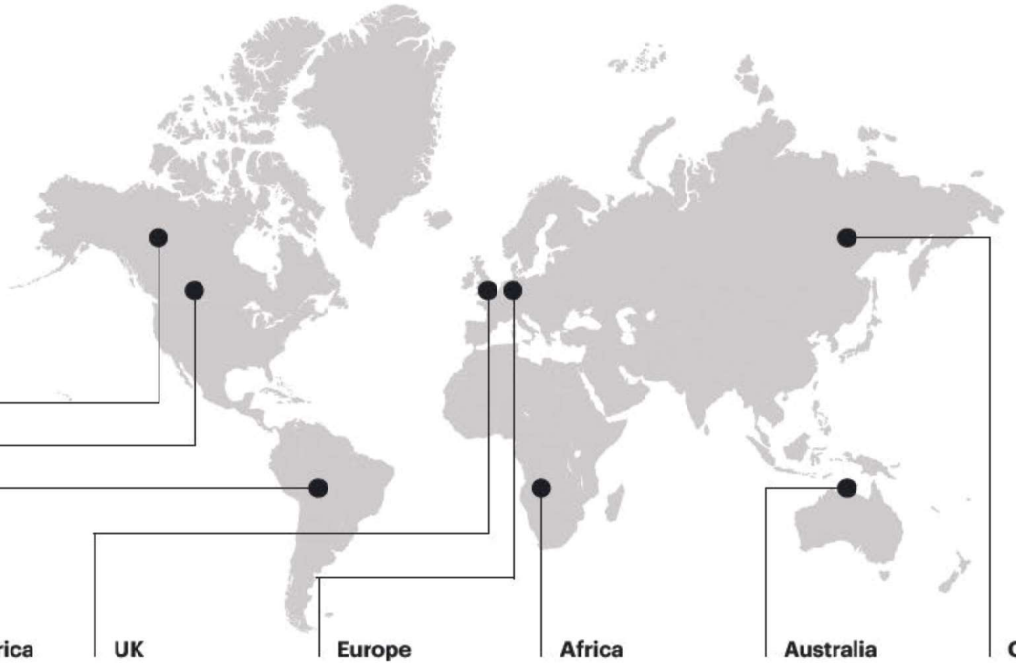
The Global ZEB Opportunity

t w take t me to move to 100% ZEB fleets g ven current fleet status and adopt on rates, but there s a mass ve opportun ty for em ss on reduct on as countr es around the wor d trans t on to ZEBs f each reg on p ctured be ow were to move to a 100% ZEB fleet, the comb ned equ va ent of ~9 tr on bs of CO_2 wou d be e m nated over the expected 12-year m n mum fe of those buses

Global installed bus fleets, number of installed ZEBs, and the opportunity for emission reduction

Poss b e em ss on reduct on over the expected 12-year fe of bus fleets f 100% of ex st ng fleets moved to ZEB

% of nsta ed bus fleets that are current y ZEB



Canada
53
b on bs CO_2
2.5%
ZEB nsta ed

U.S.
205
b on bs CO_2
2.0%
ZEB nsta ed

Latin America
3,289
b on bs CO_2
0.2%
ZEB nsta ed

UK
122
b on bs CO_2
2.7%
ZEB nsta ed

Europe
2,900
b on bs CO_2
0.7%
ZEB nsta ed

Africa
1,179
b on bs CO_2
0.3%
ZEB nsta ed

Australia
113
b on bs CO_2
1.6%
ZEB nsta ed

China
937
b on bs CO_2
60%
ZEB nsta ed

Source Sus a nab e Bus, AC A, S agecoach, ns de C ma e News, R , ndus ry Week, Bus ndus ry Confedera on, Managemen s ma es. Canada/US repor ed n qu va en Un s. Da a as of end of December 2020.

BETTER PRODUCT

Case Study
Cradle-to-Grave Sustainability

Battery Recycling

As part of ts env ronmenta and commun ty comm tments, N s cont nuous y exp or ng ways to susta nab y recyc e end-use products n January 2021, N announced the successfu aunch of a battery recyc ng p ot w th North Amer cas argest th um- on battery recyc er, -Cyc e Corporat on (-Cyc e)

-Cyc e offers a propr etary, c osed oop th um- on battery resource recovery serv ce produc ng m n ma so d waste, and zero qu d and a r em ss ons that can susta nab y produce battery grade th um, coba t, and n cke products The p ot was -Cyc es first program n the heavy duty veh c e space

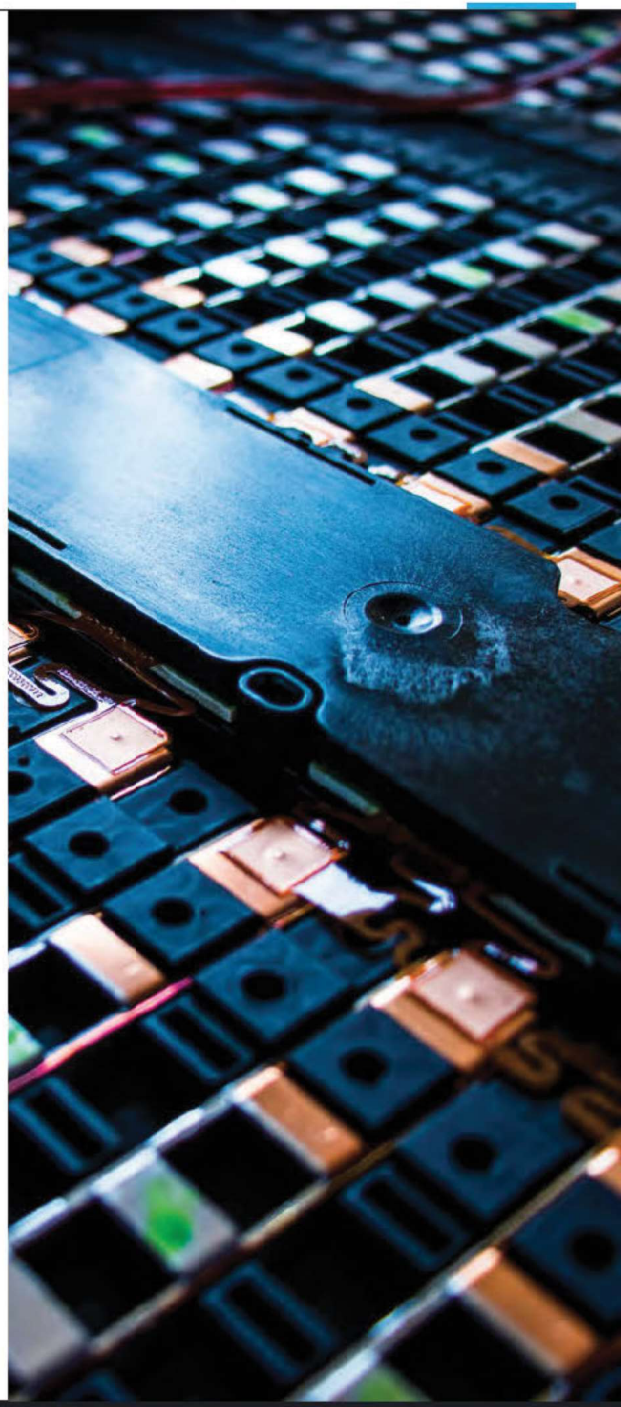
N prov ded -Cyc e w th 45 end-of- fe th um- on battery modu es (used for research and deve opment) tota ng 3,200 pounds to be processed at -Cyc es Spoke fac ty and turned nto b ack mass, wh ch s then further refined to recover cr t ca mater a s such as n cke and coba t

-Cyc es patented Spoke & Hub techno og es recover an mpress ve 95% of a th um- on battery mater a s – extract ng h gh-grade mater a s for battery reproduct on, at a ower econom c and env ronmenta cost than m ned and refined mater a

Key d fferent ators of the Spoke & Hub mode nc ude an automated process at Spoke fac t es where batter es are rece ved n any state of charge and are mechan ca y shredded w th no sort ng, d smant ng, d scharg ng, or therma process ng needed Patented -Cyc e Hub techno ogy then ntakes the b ack mass produced at Spoke p ants, processes the mater a s hydrometa urg ca y (e us ng aqueous so ut ons for the recovery of meta s), and outputs h gh-pur ty battery bu d ng b ocks to be red rected to the th um- on battery supp y cha n and broader economy

New yer and -Cyc e are both members of CA START, an nternat ona nonprofit ded cated to acce erat ng the pace of c ean techno ogy and the adopt on of c ean transportat on

Li-Cycle™





NFI

ENVIRONMENTAL, SOCIAL & GOVERNANCE REPORT FOR 2020

Better Workplace

A better product.
A better workplace.
A better world.

BETTER WORKPLACE

Environment, Health & Safety Policy

Understanding the importance of sustainability, NFI is committed to protecting human health and the environment within our facilities and globally. We recognize the impact we have through our direct operations, supply chain, and consumer use of our products and services, through the consumption of natural resources, energy, water, and the generation of waste. As such, this policy applies to all of our facilities and operations, as well as contractors and suppliers through NFI's Supplier Code of Conduct.

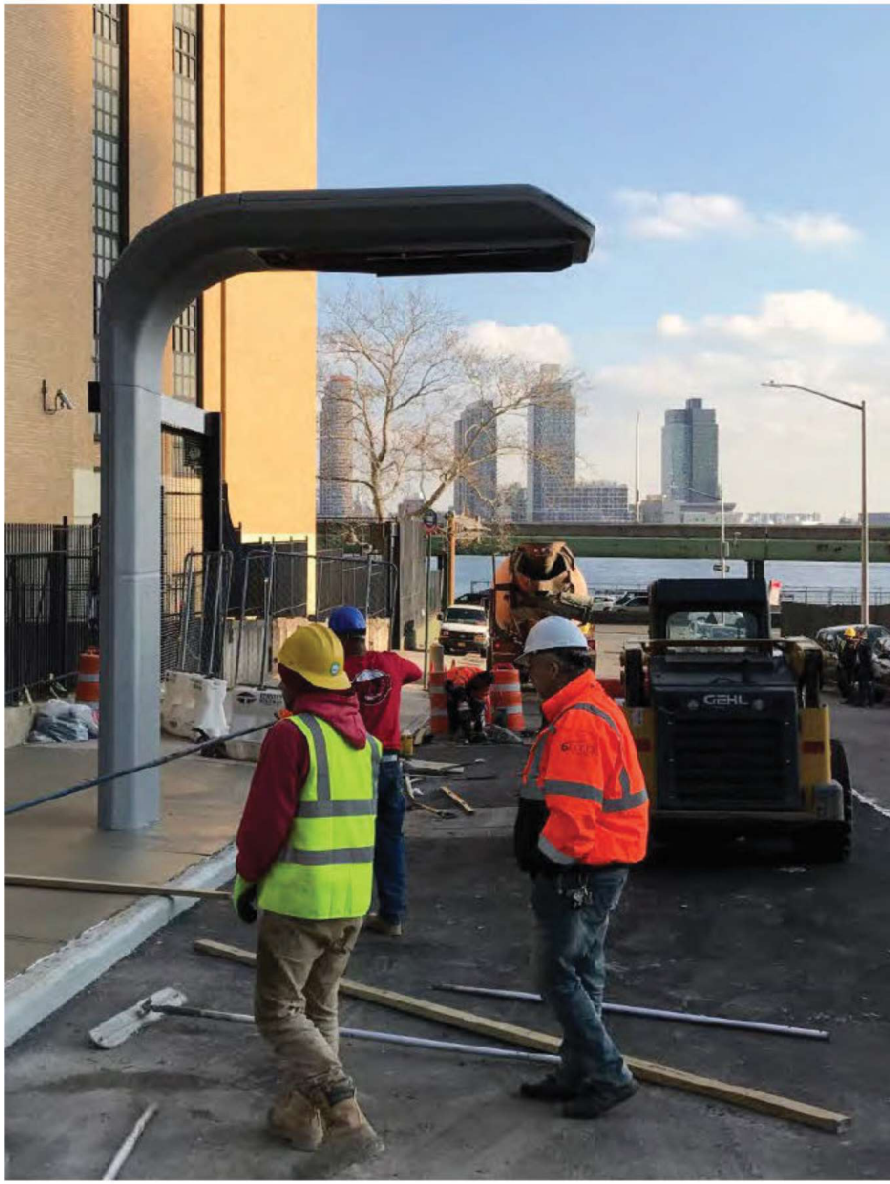
At N , we be eve that noth ng s more mportant than the hea th and safety of our team members and others v s t ng or work ng n our fac t es We are comm tted to meet ng our Env ronment, Hea th and Safety (EHS) respons b t es and ma nta n ng a safe work ng env ronment at a ocat ons Hea th, safety and the protect on of the env ronment s the respons b ty of a and a top pr or ty for N

We are comm tted to comp y ng w th a app cab e EHS aws and other requ rements to wh ch we subscr be mproved EHS performance s cont nua y sought at a N ocat ons through the ntegrat on of r sk-based and cost-effect ve management pract ces, wh ch are app ed to s te act v t es

Adherence to the EHS po cy s the respons b ty of a emp oyees and persons work ng at or v s t ng our fac t es

W th wor d-c ass workp aces and manufactur ng fac t es, N cont nues to ead the ndustry n the des gn, bu d, and de very of fue -eff c ent and zero-em ss on buses and coaches

Our Env ronment, Hea th & Safety Po cy may be requested through **nfigroup.com/contact**



NF nfrastr ct re So t ons™ nsta at on

BETTER WORKPLACE

Ongoing Commitments

- Seek to ntegrate EHS cons derat ons nto our product and process des gn, manufactur ng and bus ness p ann ng
- Cons der the fe cyc e perspect ve
- Protect assets through robust r sk assessment pract ces
- Prov de safe and secure fac t es for emp oyees, customers and v s tors by
  - Ma nta n ng and mprov ng a progress ve EHS management system w th programs des gned to prevent nc dents and prov de effect ve procedures n the event of emergency
  - Ma nta n ng and support ng act ve hea th and safety comm ttees or representat ves at each ocat on
  - Cont nuous y str v ng to ma nta n a c ean and organ zed workp ace, free from debr s and recogn zed hazards
  - Prov d ng support for a EHS procedures, nc ud ng but not m ted to superv sory tra n ng and the prompt e m nat on of recogn zed hazards
- Requ re that contractors, supp ers, and the r workers meet or exceed a N EHS program requ rements
- Deve op an understand ng among those n eadersh p pos t ons of the r respons b t es to prov de and promote a safe, hea thy and env ronmenta y respons b e workp ace
- Prevent po ut on w th top pr or ty of waste prevent on at source, e m nat on of wastefu pract ces, and recyc ng
- Respons b y, eff c ent y, and susta nab y use natura resources such as energy, water and wood products
- M n m ze our contr but on to c mate change, and deve op and produce products that transpo t peop e wh e a so reduc ng greenhouse gas em ss on footpr nts
- n accordance w th our EHS management system requ rements, per od ca y rev ew th s po cy statement to ensure ts cont nu ng su tab ty and commun cate changes and add t ons as appropr ate



BETTER WORKPLACE

2020 Occupational Health & Safety Performance

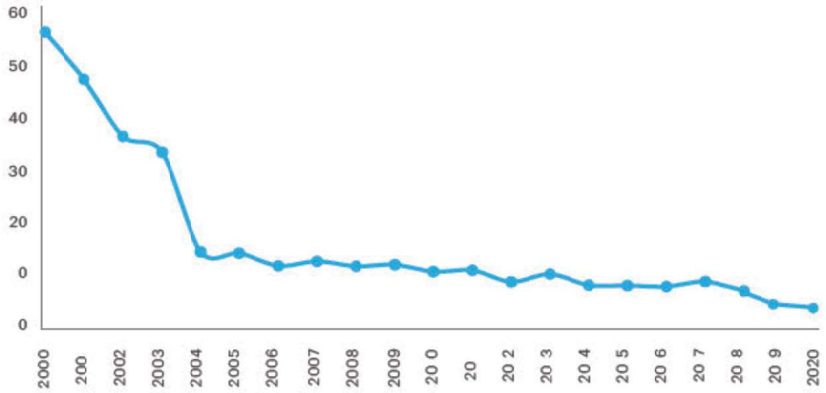
Safety performance s tracked and measured aga nst our respect ve North Amer can ndustry C ass ficat on System (NA CS) codes as a benchmark for s m ar ndustry performance Reports are produced and shared month y w th management and emp oyees 2020 nc dent rates showed mprovement even though norma product on operat ons and dep oyment of EHS resources were s gn ficant y mpacted due to COV D-19 response act v t es N d d not have a fata ty at any of ts ocat ons n 2020

2020 NFI OSHA Rate: 4.4 → 2021 NFI OSHA Target Rate: 3.4
2020 NFI Lost Time Rate: 1.6 → 2021 NFI Lost Time Target Rate: 1.3
2020 NFI Fatality Rate: 0.0 → 2021 NFI Fatality Target Rate: 0.0

N s focused on emp oyee safety OSHA and ost T me nc dent rates are tracked and reported month y to both management and emp oyees Week y and month y reports capture a N emp oyees, wh e contractor nju es are nvest gated and recorded w th the Pr mary Contractor respons b e for work

NFI OSHA Rate

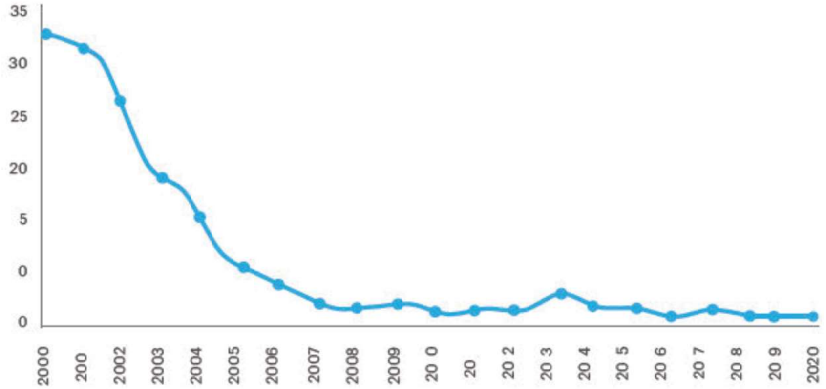
(occu ences pe 200,000 hou s)



S nce 2000, Ou OSHA and Lost me Rates have educed by 90% and 96% espect ve y

NFI Lost Time Rate

(occu ences pe 200,000 hou s)



Safety

N s focus on occupat ona hea th and safety has resu ted n strong and cont nuous mprovements over the past two decades Management be eves that N s ded cated comm tment to safety and hea th mprovements s not on y a compet t ve advantage for the organ zat on, but s essent a to the creat on of a safe and hea thy work ng env ronment for N s emp oyees and operat ons

BETTER WORKPLACE

Case Study
Clean and Protect™

NFI launched the Clean and Protect™ product and solution line to assist operators with restoring and maintaining consumer confidence during the COVID-19 pandemic.



n 2020, N Parts™, the parts subs d ary of N , aunched ts C ean and Protect product ne—a su te of safety, c ean ng, and d s nfect ng products—as a response to the COV D-19 pandem c

C ean and Protect products are cr t ca components n restor ng and ma nta n ng r der confidence, and each work to support the five pr nc p es of bus and coach transportat on safety

The Five Principles of Bus and Coach Transportation Safety



Disinfecting



Distancing



Air Quality



PPE



Communication

nfi.parts

Proactive Air and Surface Purification ("PASP")

N s Proact ve A r and Surface Pur ficat on (PASP) system s an examp e of a so ut on ava ab e from the C ean and Protect™ ne The PASP system uses propr etary techno ogy to create advanced pur ficat on by produc ng H gh Energy C usters that are d str buted throughout the nter or of the veh c e, safe y san t z ng both a r and surfaces, eav ng beh nd no harmfu res due t s mounted d rect y n the passenger compartment, a ow ng for deact vat on of v ruses as they are ntroduced nto the veh c e V rus deact vat on at the source of ntroduct on s one of the cr t ca factors to ncreas ng passenger and veh c e safety

PASP: "The Most Validated Purifier on the Market"

Test ng at the Un vers ty of or da confirmed the PASP techno ogy deact vates SARS-CoV-2, the v rus that causes COV D-19, as we as coronav rus 229E The techno ogy has a so been tested n a stat onary mass transportat on veh c e env ronment where surface bacter a eve s were reduced to a most non-detectab e eve s and VOC (vo at e organ c compounds) a r qua ty measurements were reduced by a most 96% n-serv ce test ng done n partnersh p w th the C ty and County of Hono u u showed overa bacter a count reduct on of 99 3% and va dated the techno ogy s ab ty to deact vate the SARS-CoV-2 v rus

Keeping Riders Safe in Washington State

n ear y 2021, N announced that GO Trans t and Va ey Trans t, both ocated n Wash ngton state, were keep ng the r r ders safe w th the PASP system, where t s ab e to d s nfect the veh c e wh e t s on the road, w thout downt me or add t ona c ean ng dur ng serv ce

We re extreme y happy to have someth ng nsta ed n our fleet that s ab e to d s nfect a r and surfaces throughout the day, sa d Ron McDona d, Genera Manager, Va ey Trans t The un t runn ng wh e buses are on the road, pa red w th da y c ean ng crews and new dr ver barr ers, covers a bases

BETTER WORKPLACE

Workplace Culture

NFI fosters a workplace culture that is inclusive, promotes continuous improvement, and embraces efforts to empower team members through employee listening channels and responsive action.

Our v s on s to ach eve bus ness success through a gned and engaged emp oyees, and the de very of resources and serv ces to prepare our peop e to support the growth and profitab ty of the company gu ded by the pr nc p es of N We do so w th these va ues at work

- We care about our commun t es and the env ronment
- We care about peop e
- We be eve prov d ng a safe work env ronment s cr t ca
- We a m to create a commun ty sp r t w th n N , through soc a comm ttees/company events encourag ng emp oyee nvo vement at a eve s
- We a m to be a great organ zat on to work for and an emp oyer of cho ce
- We empower our peop e through earn ng and deve opment and create opportun t es for advancement
- We str ve to do the r ght th ng and a m to exemp fy our core pr nc p es n everyth ng we do



BETTER WORKPLACE

Workplace Culture

In addition to annual performance reviews, NFI provides leadership development, team coaching and mentorship by the management support team, and also conducts and assesses leadership performance each year through anonymous peer surveys.

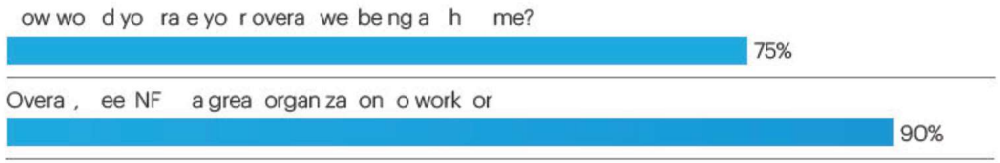
n add t on, the eadersh p team has persona and profess ona goa s estab shed each year, wh ch are measured and mon tored through a Management By Object ves goa structure

We measure progress n emp oyee sat sfact on through our Emp oyee eedback ramework, wh ch nc udes emp oyee surveys, e ectron c feedback, round tab e commun cat on, and 360 eadersh p feedback

n 2020, we conducted an anonymous COV D-19 emp oyee pu se check to gauge progress on safety, we ness, and emp oyee sat sfact on and to determ ne the effect veness of COV D safety protoco s and emergency response commun cat on A ser es of e ght quest ons nc uded an overa 58% response rate from a N emp oyees Emp oyees were a so asked to assess whether they fe t that N was a great organ zat on to work for and th s quest on rece ved a favourab e response rate of 90% n 2020, mprov ng from 82% n 2018 and 78% n 2016 Another COV D Pu se Check Survey s schedu ed for a 2021 The next fu survey s schedu ed for Summer 2022



NFI December 2020 Employee Pulse Check



BETTER WORKPLACE

Equal Employment Opportunity

NFI seeks to employ the best qualified team, better representing communities we work and live in, and promoting activity free from discrimination. We encourage team-building and respecting unique differences, all of which lead to a better culture and respectful workplace in accordance with our Human Rights statement.

Employment

N s comm tted to recru t, h re, tra n and promote nto a job eve s the most qua fied persons w thout regard to race, co or, re g on, gender or gender express on, sexua or entat on, nat ona or g n, age, mar ta status, genet c nformat on, d sab ty, veteran, or d sadvantaged status (defined as be ng home ess, be ng a custod a s ng e parent, rece v ng pub c ass stance, ack ng a genera educat on deve opment or h gh schoo d p oma, hav ng a cr m na record or other nvo vement w th the cr m na just ce system, suffer ng from chron c unemp oyment, or emanc pated from the foster care system)

We have nst tuted act on-or ented programs des gned to e m nate dent fied obstac es and he p us ach eve our mprovement goa s

Compensation

We work to advance emp oyment for a peop e and are comm tted to adm n ster a emp oyment matters n accordance w th the va ue we p ace on foster ng a d verse and we com ng workp ace that va ues the contr but ons of a emp oyees and that emp oyees protected categor es, nc ud ng gender, shou d not factor nto compensat on dec s ons

We be eve that fa r and equ tab e pay shou d be an essent a e ement of any successfu bus ness mode , and we are proud to stand w th other compan es that share th s same va ue N conducts gap ana yses on an ongo ng bas s to dent fy any pay d screpanc es and makes adjustments whenever unaccounted for d screpanc es are found We pract ce transparency and m t d scret on n pay dec s ons

Living Wage Assessment

N acknow edges and supports the need to contr bute to the econom c we -be ng of our team members and the commun t es n wh ch our compan es operate

As an mportant first step, N has commenced a v ng wage assessment of the ma n trans t bus product on fac t es of New yer, ts subs d ary, n Canada and the Un ted States to understand the compet t veness of New yer s wage sca es n re at on to app cab e oca v ng wage gu de nes We ant c pate comp et ng th s n t a assessment work over the next 12-month per od and w prov de an update on our progress and the opportun t es observed n the 2021 ESG Report



BETTER WORKPLACE

Leading with Integrity

NFI is committed to conducting all business activities with the highest standards of fairness, honesty, and integrity, and to complying with all legal and regulatory requirements, especially with respect to employees, suppliers, competitors, government and the public.

We str ve to outperform our compet tors fa r y and honest y, wh e a ways fo ow ng eth ca and ega bus ness pract ces Each d rector, off cer, emp oyee and agent of N s bound by the Code of Bus ness Conduct and Eth cs when h red or reta ned Emp oyees n eadersh p, adm n strat ve, and customer ro es are prov ded a copy of the Code on an annua bas s A other emp oyees are prov ded a copy of the Code on a b annua bas s Each emp oyee s requ red to s gn and acknow edge the r ob gat on to adhere to the Code

N Code of Bus ness Conduct and Eth cs tra n ng s conducted v a N s earn ng management system and a qu z s comp eted to test that a team members understand the Code and how t app es to them The N Code of Bus ness Conduct and Eth cs may be obta ned at **www.nfigroup.com**

The N Wh st eb ower Po cy out nes procedures for the rece pt, retent on, and treatment of comp a nts regard ng actua or apparent v o at ons of the Code, the D sc osure and ns der Trad ng Po cy, and the aw genera y and spec fica y regard ng nterna account ng contro s or aud t ng matters N Wh st eb ower Po cy may be obta ned at **www.nfigroup.com**

Reports or nanc a A egat ons Reports may be subm tted to the Eth cs and Comp ance Hot ne on a confident a and anonymous bas s, by phone or on ne us ng an ndependent th rd-party report ng serv ce prov ded by NAVEX G oba



Pa So bry, Pres dent & Ch ef Exec t ve Off cer, NF , speaks to CBC reporters at NF s prod ct on fac ty n W nn peg, Canada

BETTER WORKPLACE

Anti-Corruption and Bribery Policy

N s comm tted to conduct ng ts bus ness free of corrupt on, br bery, and any mproper nfluenc ng act on when dea ng w th government and pub c off c a s

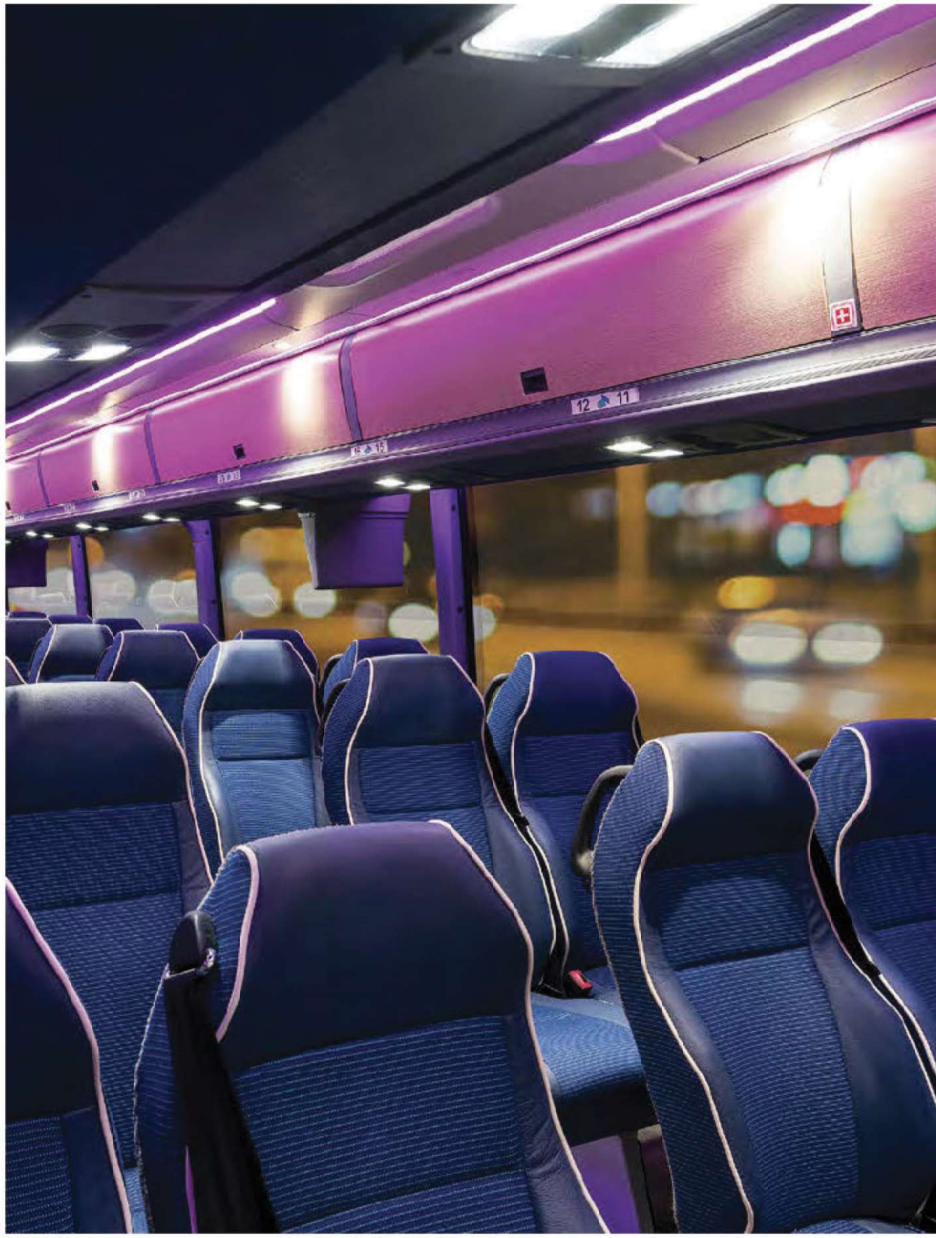
N s ant -corrupt on pr nc p es govern re at onsh ps and nteract ons w th pub c off c a s, payments, records of payments and th rd-party dea ngs Add t ona y, N emp oyees w th n scope of th s po cy are tra ned to fam ar ze themse ves w th add t ona restr ct ons and spec fic requ rements of the pub c agenc es w th whom they nteract Tra n ng for a emp oyees w th n the po cys scope s conducted on an annua bas s

The Eth cs Off cer (the Execut ve V ce Pres dent, Genera Counse and Corporate Secretary, N) can be reached at **ethics@nfigroup.com** for quest ons or gu dance

Political Advocacy

N w not make contr but ons of any k nd (money, emp oyee work t me, goods or serv ces), d rect y or nd rect y, to po t ca part es or cand dates, or to promote or support ba ot n t at ves, n t at ve measures, propos t ons or s m ar proposa s or measures nc ud ng through ntermed ary organ zat ons such as po t ca act on comm ttees, campa gn funds, or trade or ndustry assoc at ons

N s Po t ca Contr but on Po cy may be found at **www.nfigroup.com**



BETTER WORKPLACE

Respectful Workplace

NFI has zero tolerance for workplace discrimination and harassment. All employees are responsible for ensuring that NFI is a safe and respectful environment, free of discrimination and harassment, where high value is placed on equity, fairness and dignity.

D scr m nat on and harassment based on race, gender dent ty or express on, sexua or entat on, co or, nat ona or ethn c or g n, re g on, mar ta status, fam y status, c t zensh p status, veteran status, age or ab t es s proh b ted N has zero to erance for acts of v o ence, threats of v o ence, and acts of nt m dat on aga nst another person or group

A emp oyees are requ red to comp ete tra n ng regard ng the Respectfu Workp ace po cy and report ng procedures on a two-year cyc e N has robust nc dent report ng and nvest gat on processes to ma nta n confident a ty and to prevent non-reta atory behav or



BETTER WORKPLACE

Human Rights Statement

Our Commitment

At N , we are comm tted to respect ng the human r ghts and d gn ty of nd v dua s w th n our operat ons, supp y cha n, and commun t es where we do bus ness, and to promot ng and protect ng the human r ghts of our team and other stakeho ders We str ve to do th s through our Code of Bus ness Conduct and Eth cs, our Supp er Code of Conduct and other Group po c es n recogn t on of the evo ut on of human r ghts and that c rcumstances may change over t me, we regu ar y rev ew our human r ghts approach and focus areas and make updates where appropr ate

Our Approach

We v ew human r ghts w th n the mean ng of nternat ona y recogn zed human r ghts Our approach s nformed by nternat ona pr nc p es nc ud ng those encompassed n the Un ted Nat ons Gu d ng Pr nc p es on Bus ness and Human R ghts, Un versa Dec arat on of Human R ghts, nternat ona B of R ghts, and the nternat ona abor Organ zat on s Dec arat on on undamenta Pr nc p es and R ghts at Work

Based upon our operat ona context and ab ty to nfluence, N s human r ghts approach focuses on the management of human r ghts w th n our operat ons, supp y cha n and commun t es n wh ch we do bus ness Among other th ngs, we concentrate on abor and emp oyee we fare or examp e, the work ng cond t ons of our emp oyees are, at m n mum, n comp ance w th nternat ona y recogn zed abour standards and the aws of the countr es n wh ch we operate

n accordance w th re evant aws and regu at ons, and as descr bed n our Code of Bus ness Conduct and Eth cs as we as our Supp er Code of Conduct, we str ve to

- Treat peop e w th respect and d gn ty, n accordance w th reasonab e expectat ons
- oster a workp ace free of harassment and d scr m nat on
- Prov de an nc us ve workp ace, and promote d vers ty n the workp ace
- Proh b t forced, bonded, traff cked and ch d abor n our operat on and to avo d such abor n our supp y cha n
- Recru t eth ca y based on the needs of our bus ness and seek to recogn ze the ta ent and potent a of new app cants
- Prov de fa r wages and benefits that are based on the cons derat on of numerous app cab e factors
- Promote hea th and safety n the workp ace as descr bed n our Env ronmenta , Hea th, and Safety Po cy
- Adopt pract ces to protect the persona nformat on of our emp oyees and customers
- Recogn ze the freedom of workers to assoc ate or not assoc ate w th a abor un on, and to co ect ve y barga n when represented by a ega y recogn zed abor un on

urther nformat on about the N Group Human R ghts statement s ava ab e at **www.nfigroup.com**

BETTER WORKPLACE

Supply Chain Management

NFI seeks to do business with reputable business partners who are committed to ethical standards and business practices compatible with those set out in the NFI Group Supplier Code of Conduct. NFI strongly encourages suppliers to exceed the requirements of this Code and to promote best practices and continuous improvement throughout their operations.

N takes proact ve steps to ensure that t does not conduct bus ness w th persons or ent t es that use forced, ndentured, nvo untary or ch d abor, or engage n human traff ck ng A supp ers, domest c and fore gn, are subject to on-s te ver f cat on aud ts of the r qua ty and management systems to ensure adherence to N s spec f cat ons and requ rements These supp er ver f cat on aud ts nc ude a rev ew of the supp er s safety management and human resources po c es

N sourc ng personne rece ve tra n ng spec f c to the r sks of proh b ted abor pract ces to ensure d gence s susta ned w th n supp er management processes Supp ers that operate n h gh-r sk reg ons must prov de an off c a cert f cat on attest ng they do not part c pate n any of these act v t es n the event t s determ ned that a supp er engages n any of these act v t es, N w move to deve op a ternate sources of supp y and w term nate ts re at onsh p w th the offend ng supp er

Approved supp ers are requ red to manufacture products and prov de serv ces n accordance w th a other app cab e aws, statutes, ru es, regu at ons, ord nances, and standards of a app cab e government agenc es and author t es, nc ud ng env ronmenta , occupat ona hea th and safety standards, emp oyment and m n mum wage requ rements, and export/ mport requ rements

N s proud to prov de D sadvantaged Bus ness Enterpr ses (DBE) and M nor ty Women Bus ness Enterpr ses (MWBE) the opportun ty to part c pate n the sourc ng of components and mater a s used n manufactur ng We estab sh an annua goa of MBE/DBE/MWBE part c pat on n our Supp y Cha n and act ve y work to dent fy, onboard and deve op m nor ty and d sadvantaged bus nesses

N s Supp er Terms and Cond t ons may be requested through **nfigroup.com/contact**



BETTER WORKPLACE

Data Security & Privacy

NFI has established data and cyber security policies outlining our guidelines and provisions for preserving the security of our data and technology infrastructure.

We understand that the more we re y on techno ogy to co ect, store, and manage nformat on, the more vu nerab e we can become to secur ty breaches or th s reason we have out ned cons derab e secur ty measures n our mob e dev ce usage, soc a med a and ema / nternet usage po c es to prov de N team members w th nstruct ons on how to protect persona and company dev ces, safe y use ema , manage passwords and transfer data secure y

N has estab shed a group data pr vacy po cy out n ng our comm tment to comp y w th a app cab e pr vacy aws n the countr es n wh ch we operate or conduct bus ness The app cab e N compan es comp y w th the Genera Data Protect on Regu at on (GDPR) regard ng the use and management of persona data n reg ons n wh ch GDPR app es

We have taken add t ona measures to mp ement a Pr vacy and Data Secur ty nc dent Response P an that out nes workforce respons b t es and how to report any suspected nc dents Regu ar tra n ng s prov ded to emp oyees regard ng how to detect scam and ph sh ng ema s, and we encourage our emp oyees to reach out to N s ega department w th quest ons or concerns



BETTER WORKPLACE

NFI Learning Institute

NFI invested approximately $5 million in training in 2020.

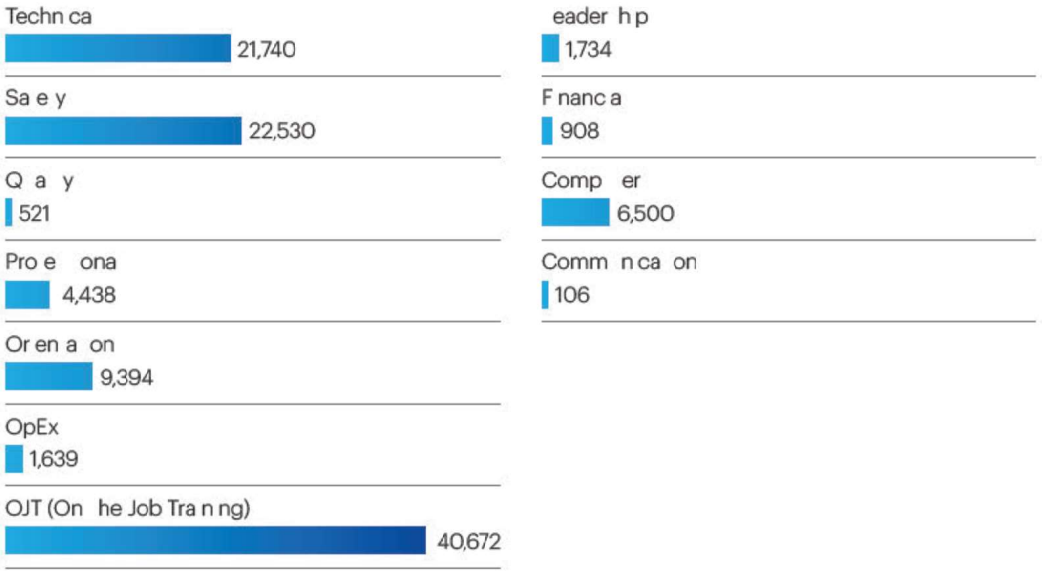
N de vers cons derab e tra n ng and educat ona programm ng that s d rected at support ng the success of the organ zat on and ts workforce The N earn ng nst tute dr ves tra n ng and deve opment across a bus nesses through the de very of tra n ng programs that support the d verse needs of our workforce To ensure that the programm ng s re evant and meets the ever-chang ng requ rements of N and the ndustry, the N earn ng nst tute engages n ma nta n ng strong nterna oca and reg ona partnersh ps that he p support tra n ng pr or t es a gned w th organ zat ona goa s

N focuses on a areas of deve opment wh ch nc ude a robust or entat on program for those jo n ng N , techn ca and profess ona deve opment that supports the workforce n the r current and future ro es, p us eadersh p tra n ng and workshops for current and emerg ng eaders

To meet the tra n ng needs of a geograph ca y w despread workforce, the N earn ng nst tute conducts tra n ng n person and on ne



NFI Training Hours 2020 by Topic



BETTER WORKPLACE

Xpressline

Launched in 2014, Xpressline is an electronic employee suggestion and feedback program that has delivered tremendous value to New Flyer and NFI Parts and will be extended to MCI in 2021.

Emp oyees can subm t the r suggest on and/or feedback and rece ve a response through the on ne system to the r ema or t cket number n 2020, we rece ved 511 subm ss ons even w th the mpacts of COV D-19 and two months of d ed fac t es, and we have seen a steady ncrease n subm ss ons s nce 2014

Emp oyee feedback through Xpress ne can nc ude, but s not m ted to, the fo ow ng

- Genera eedback
- Company ntranet mprovement
- Soc a Comm ttee eedback and Suggest ons
- Safety Concerns and Suggest ons
- Env ronmenta Concerns and Suggest ons
- Respectfu Workp ace Concerns
- oss Prevent on Concerns and Suggest ons
- Border Secur ty Concerns and Suggest ons
- Product and Bu d Process mprovement Suggest ons
- Tra n ng and Deve opment Concerns and Suggest ons



BETTER WORKPLACE

Case Study
ADL's Employee Well Being Initiative

NFI strongly believes that mental health and wellbeing is important for a healthy lifestyle. Early on in the pandemic, ADL realized that mental health has become an important challenge in the workplace and implemented a series of initiatives to support its team members throughout 2020.

Start Well program



AD organ zed a week- ong ser es of five 15-m nute sess ons start ng at 8 00 a m oca t me, focused on breathwork and med tat on, to create a moment of ca m and to he p set members up for the day ahead The sess ons were recorded for those unava ab e to jo n at the spec fied t me

eedback was ncred b y pos t ve for these breath and med tat on sess ons, and AD has p ans to extend th s ser es nto 2021

- 87% found the sess ons benefic a
- created a sense of togetherness
- t was good to re ax my m nd for the start of the day
- Great to see the company nvest n someth ng ke th s

Mental Health First Aiders

AD strong y be eves that menta hea th and phys ca hea th shou d be va ued equa y To proact ve y support menta hea th, AD prov ded tra n ng for more than 35 vo unteer Menta Hea th rst A ders Menta Hea th rst A ders were taught to dent fy, understand and respond to s gns of menta hea th cha enges; earn r sk factors and warn ng s gns; be prepared when a menta hea th cr s s occurs; and ass st emp oyees w th find ng appropr ate ass stance for the r spec fic c rcumstance AD ensured that a s tes had representat ves ava ab e to prov de support to those n our fac t es, as we as those work ng remote y #endthest gma

"When I had the chance to volunteer to become a Mental Health First Aider, I thought it was a great opportunity to be a part of an initiative at our workplace which will increase mental health awareness and reduce the stigma attached to mental health. Mental Health is something which can affect anyone and everyone."

- Menta Hea th rst A der, UK

Mental Health Awareness e-Learning

n add t on, AD managers part c pated n an on ne menta hea th awareness program to earn to better understand and support menta hea th n the workp ace Externa y hosted programs were a so he d for ne managers

E ectron c gu des and handouts were prov ded to managers and emp oyees, on top cs nc ud ng support ng remote work ng and ho d ng effect ve v rtua meet ngs

> " Following the success experienced at ADL, NFI is now looking to roll out these practices more broadly across the Group. "



NFI

ENVIRONMENTAL, SOCIAL & GOVERNANCE REPORT FOR 2020

Better World

A better product.
A better workplace.
A better world.

BETTER WORLD

Celebrating Diversity, Inclusion & Equity

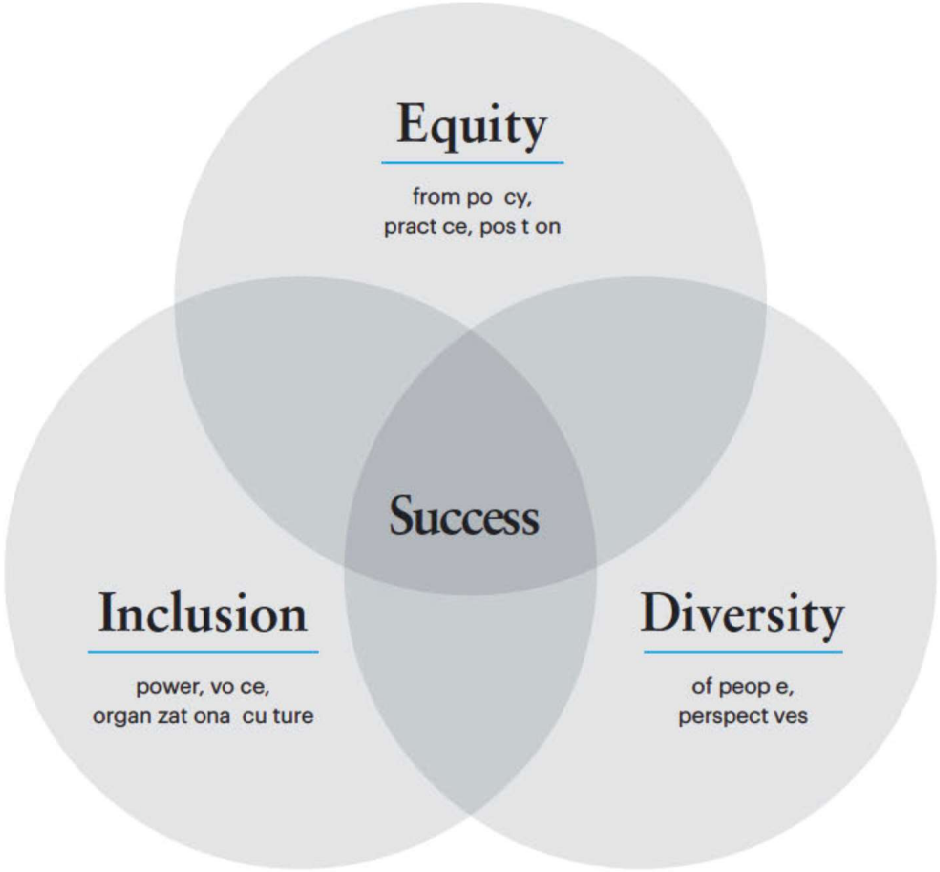
NFI celebrates diversity through the creation of programs that recognize and support our differences, working to foster diversity in ways that create a sense of belonging while enabling uniqueness.

Diversity + Inclusion + Equity = Success

A key step n creat ng an env ronment that encourages d vers ty, equ ty, and nc us veness s to educate nd v dua s on the benefits

An nteract ve d vers ty and nc us on tra n ng program was first ro ed out to our eadersh p team n 2015 and has become a cr t ca component of our tra n ng programs Th s program descr bes the benefits of d vers ty and takes each eader on a journey of exp orat on of the r persona b ases and how they can mpede the r ab ty to create an nc us ve env ronment Th s program has been firm y embedded nto our eadersh p program and to date has been de vered to more than 600 eaders rang ng from execut ves to team eads

N embeds tse f firm y n the commun t es where we do bus ness Commun t es are such an ntegra part of our bus ness that they have been bu t nto our stakeho der and workforce deve opment frameworks We work c ose y w th commun ty groups on the deve opment of programs that support sk and career deve opment for groups that are underserved n many workp aces wh ch nc ude women, nd genous and found ng nat ons groups, persons of co or and rac a zed commun t es, newcomers to our countr es, persons w th v s b e or nv s b e d sab t es, the GBTQ2S+ commun t es, those former y ncarcerated, and youth



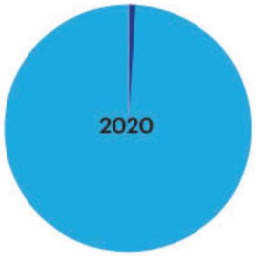
BETTER WORLD

Measuring Diversity, Inclusion & Equity

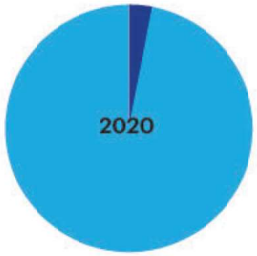
NFI measures diversity to ensure representation is tracking in a positive direction, adjusting focus where required, and implementing actions to more effectively and inclusively manage a diverse workforce.

A though changes n organ zat ona headcount, dr ven by acqu s t ons and bus ness opt m zat on efforts, have mpacted h stor c and year-over-year numbers, we have nst tuted act on-or ented programs focused on tra n ng, workforce deve opment, and commun ty outreach des gned to address prob em areas by reg on and representat on

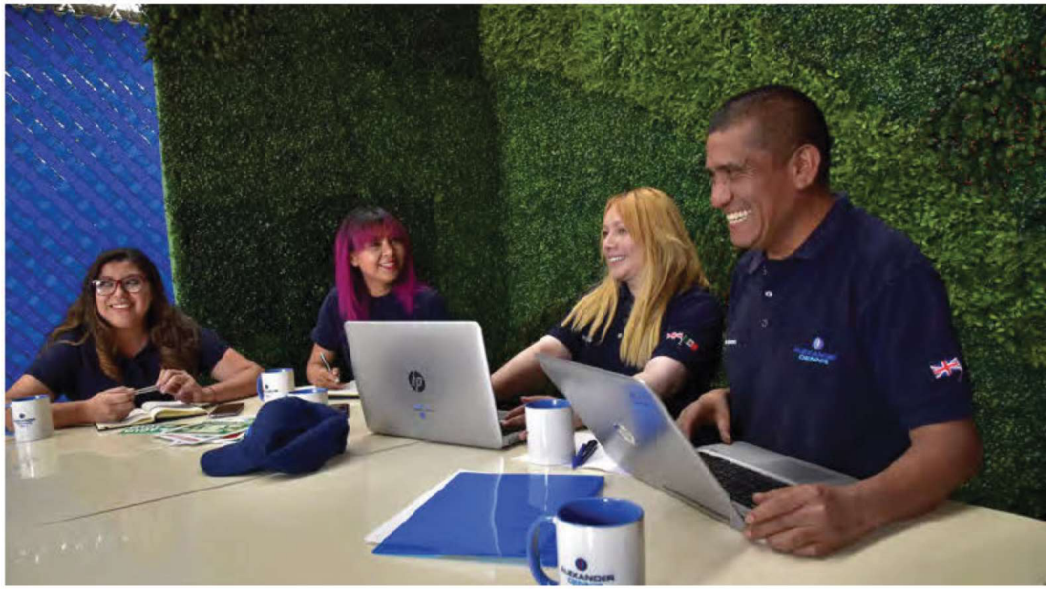
N s an equa opportun ty emp oyer



1.32% D advan aged Work orce



3.12% Ve eran Work orce



Diversity & Inclusion

	2017	2018	2019*	2020
Women	25 0%	21 0%	18 7%	19 3%
Women n M dd e Managemen & Above	25 0%	21 0%	19 6%	17 7%
Women n Exec ve Ro e	12 5%	20 6%	15 8%	20 7%
Women n Board Ro e	25 0%	25 0%	38 0%	33 0%**
V be M nor e	19 4%	23 5%	19 0%	28 5%
V be M nor e n M dd e Managemen & Above	11 7%	11 2%	6 8%	11 7%
V be M nor e n Exec ve Ro e	3 7%	3 4%	5 6%	3 5%
Peop e W h D ab e	n/a	2 0%	2 1%	1 2%
nd geno Peop e	0 5%	0 7%	0 5%	0 5%

*Note A exande Denn s nc uded n 2019 onwa d

**NF nc eased the numbe of Boa d pos t ons by 1 n 2020; t d d not ose a fema e Boa d membe

BETTER WORLD

Fostering Diversity, Inclusion & Equity

As of the end of 2020, NFI had reached and maintained a target objective that the Board would be comprised of 25% female Directors, reinforcing its commitment to gender diversity. This target will be revisited in 2021.

Our Objectives

- Advanc ng d vers ty and workp ace nc us on through deve op ng a cu ture of representat on and be ong ng
- Promot ng d verse and nc us ve eadersh p, cha eng ng b as and nurtur ng d verse ta ent
- Bu d ng upon pract ces to fac tate a d verse and equ tab e future

N s comm tted to rev ew ng ts D vers ty, Equ ty, and nc us on efforts n 2021, and s do ng so w th the he p of externa consu tant Korn erry Th s effort s compr sed of a qua tat ve and quant tat ve rev ew to pr or t ze and focus on ntervent ons that are targeted and spec fic

Our d vers ty goa s are rooted n our Board D vers ty Po cy estab shed n 2016, wh ch recogn zes the mportance and benefit of hav ng a board of d rectors and sen or management of N compr sed of d verse backgrounds, reflect ng the chang ng demograph cs of the commun t es n wh ch N operates

There are now 29 members compr s ng N s execut ve eadersh p team, of wh ch s x (or 21%) are women Our overa execut ve eadersh p team was reduced n 2020 as we comb ned bus ness un ts and owered our overhead expenses n response to COV D-19 A though 2020 was a cha eng ng year due to the mpacts of the pandem c, we were ab e to ma nta n Group-w de fema e representat on at 19%

n March 2021, N jo ned the **50-30 Challenge**, forma z ng our comm tment to advance d vers ty, nc us on, equ ty, gender par ty, and econom c prosper ty n a our workp aces

An n t at ve of nnovat on, Sc ence and Econom c Deve opment Canada (SED), s gnatory organ zat ons asp re to two goa s

- Gender par ty (50%) on Canad an board(s) and sen or management; and
- S gn ficant representat on (30%) on Canad an board(s) and sen or management of other under-represented groups, nc ud ng rac a zed persons, peop e v ng w th d sab t es (nc ud ng nv s b e and ep sod c d sab t es) and members of the GBTQ2S+ commun ty The program and part c pants recogn ze that rst Nat ons, nu t and Mét s peop es as found ng peop es of Canada are under-represented n pos t ons of econom c nfluence and eadersh p

We are comm tted to th s journey



BETTER WORLD

Community Benefits Framework

N s enhanc ng ts ex st ng approaches to workp ace deve opment through the h r ng of d verse, underserved, and underrepresented nd v dua s The Commun ty Benefits ramework (CB) serves as the gu d ng framework from wh ch forma agreements and programs out n ng our oca commun ty partnersh p and workforce deve opment comm tments are created and mp emented

The measures out ned n the CB are ntended to dent fy, tra n, and onboard new h res and support the deve opment and dep oyment of pre-apprent cesh p/apprent cesh p programs and ongo ng career deve opment of peop e nc ud ng veterans, women, peop e of co or, peop e w th d ffer ng ab t es, and underrepresented and underserved nd v dua s n the fie d of advanced manufactur ng

Adopted by New yer n 2020, the CB nforms oca workforce deve opment act ons, d vers ty and nc us on, commun ty benefits, and a path to manufactur ng jobs for d sadvantaged, underserved, and under-represented nd v dua s

Workforce Development Programs

Acce erate Ann ston™ s the first n t at ve of our Ann ston Workforce Deve opment Programs (AWDP), a nat ona workforce deve opment n t at ve ntroduced by New yer and ts partner the Transportat on D vers ty Counc (TDC), a nonprofit organ zat on de ver ng wor d-c ass educat on and deve opment programs that promote d vers ty n the transportat on and construct on ndustr es, w th add t ona programs to come n other oca ons n future years The oca Program underway n Ann ston, A abama nc udes the h r ng of 20 nd v dua s from d sadvantaged or underserved popu at ons, and nc udes compensat on tra n ng and soc a support comm tments

Anniston Workforce Development Program Progress Report 2021 Q1

Community Partnerships

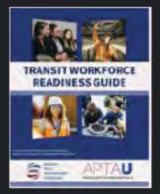
# o Comm n y Ba ed Organ za on Engaged	10
# o Comm n y Ba ed Organ za on S gned	7
# o Peop e Re erra	8

Workforce Development

# o re	5
# o re (Targe)	20
# o Tra n ng o r De vered	1,750
# o re Comp e ng Pre Appren ce h p	5
# o re En er ng E ec r ca Appren ce h p Program	
# o Emp oyee Engagemen Comm ee Member	10
# o Emp oyee Engagemen Comm ee Mee ng o Da e	5

Educational Bursaries and Social Investment

# o Ed ca ona B r ar e Awarded	n progre
Va e o Ed ca ona B r ar e	$25,000
Va e o S pend (Trave /Daycare/ o ng)	$500



APTA 2021 Workforce Readiness Guide

N s D vers ty, nc us on & Equ ty n t at ves and New yer s CB were profi ed n the APTA 2021 Workforce Read ness Gu de by the Amer can Pub c Transportat on Assoc at on, a comprehens ve handbook captur ng the state of workforce read ness n North Amer ca, and out n ng key n t at ves that w he p dr ve t forward As the e ectr fica on of mass mob ty cont nues, workforce deve opment and equ ty for every person to part c pate n the transportat on ndustry w rema n a cr t ca enab er of the new mob ty era or deta s, v s t **newflyer.com/CBF**

BETTER WORLD

Truth & Reconciliation Efforts

In order to redress the legacy of residential schools and advance the process of Canadian reconciliation, the Truth and Reconciliation Commission made 94 calls to action, including some directed at businesses.

We have exam ned these ca s to act on and our emp oyment pract ces to mp ement app cab e aspects of the ca s to act on w th n our bus ness operat ons and to promote and advance reconc at on w th our emp oyee groups and the commun t es we serve

- Measur ng and mon tor ng workforce demograph cs to understand workforce representat on and dent fy ng mprovement opportun t es;
- De ver ng d vers ty and nc us on tra n ng as a requ red eadersh p deve opment modu e to promote awareness of d verse workp ace and understand ng of unconsc ous and mp c t b as;
- mp emented nd genous ns ghts earn ng program w th Un vers ty of W nn peg that supports organ zat ons seek ng to understand and respond to the Truth and Reconc at on Comm ss ons Ca s to Act on; and
- Part c pat ng n TRC92 Emp oyer Consort um Youth Emp oyment n t at ve

N s comm tted to bu d ng respectfu re at onsh ps, ensur ng that nd genous peop es have equ tab e access to jobs and tra n ng, and deve op ng eadersh p and workforce ntercu tura competenc es We cont nue to focus on approaches to advance reconc at on efforts n our operat ons

Truth and Reconciliation Commission of Canada





N s g oba headquarters s ocated on Treaty One terr tory, the or g na ands of the An sh naabe, Cree, Oj -Cree, Dakota, akota, Dene peop es, and the b rth p ace and home and of the Mét s Nat on We acknow edge that our water s sourced from Shoa ake 40 rst Nat on We respect and g ve honor to the nd genous peop es h story on th s and and recogn ze rst Nat ons, Mét s, and nu t peop es ongo ng contr but on n our ne ghborhoods and commun t es today

BETTER WORLD

Case Study
Innovation in Accessibility

ARBOC has been innovating in accessibility since 2008, with the goal of Equal Access for Everyone®. The ARBOC Freedom, built on the General Motors 4500 cutaway chassis, provides a single, non-discriminatory patented angled and accessible entranceway for passengers of all mobility capabilities, including wheelchair riders and those using walkers. The single-plane floor inside the vehicle reduces trip hazards and ensures ease of navigating throughout the bus.

The nnovat ve fu y access b e, ow-floor reedom s the on y bus of ts k nd, sa d Doug M n x, Genera Manager, ARBOC t offers a the benefits of a ow-floor bus at a compet t ve pr ce and makes super or access b ty ava ab e to everyone

Making Transit More Accessible To Customers

n December 2020, ARBOC announced a firm order of fifty-three 27-foot reedom buses from Trans nk (v a ARBOC s oca d str butor Dynam c Spec a ty Veh c es td) Trans nk, forma y the South Coast Br t sh Co umb a Transportat on Author ty, s the statutory author ty respons b e for the reg ona transportat on network of Metro Vancouver n Br t sh Co umb a, Canada, nc ud ng pub c transport, major roads, and br dges

Trans nk w ut ze the new buses to support the rejuvenat on of the Commun ty Shutt e fleet w th n the Metro Vancouver area, add ng more ow-floor buses for enhanced access b ty and vab ty for ts transportat on network that prov des 247 m on tr ps per year



ARBOC Freedom b s

BETTER WORLD

Environmental Performance

Each NFI facility is evaluated to determine and categorize activities that could potentially impact the environment or health and safety.

Th s assessment s performed annua y by the env ronment, hea th and safety (EHS) personne respons b e for the fac ty and cons ders the env ronmenta footpr nt of our manufactur ng processes The scope nc udes parameters such as a r em ss ons, raw mater a and natura resource usage, and waste generat on The major ty of our greenhouse gas (GHG) em ss ons are re ated to heat ng, coo ng, and vent at ng our fac t es N s product on s not energy ntens ve, and cons derat on s g ven to reduce energy consumpt on and GHG em ss ons for each fac ty upgrade The ongo ng mon tor ng of key env ronmenta metr cs he ps prov de the bas s for more focused mprovement n t at ves

A Note on Report ng: he COV D 19 pandem c mpacted fac ty sage and, s bseq ent y, NF s env ronmenta metr cs n 2020 A var ety of s t at ons nc d ng, b t not m ted to emp oyees work ng from home, np anned sh tdowns and fac ty d ng, ad sted prod ct on sched es, b s ness reconfig rat on, and s te c os res ed to ower than expected demand on t t es n add t on to the mpacts of the COV D 19 pandem c, 2020 was NF s first f year of operat on w th AD as a s bs d ary company; as a res t, a n mber of reported abso te va es may have ncreased from 2019 eve s

NF expects to respond to the CDP C mate Change Q est onna re for the first t me n S mmer 2021, fo ow ng wh ch t me o r env ronmenta metr cs w be ad sted to s pport ongo ng d sc os re req rements Report ng thro gh the CDP w prov de NF w th a framework to systemat ca y meas re and d sc ose o r r sks and opport n t es re ated to carbon and c mate change, and to create targets aro nd areas of mean ngf mpact Go ng forward, as we cont n e to mprove o r env ronmenta report ng, nc d ng o r nterna track ng and report ng processes, year over year ncreases may st be seen We a so ant c pate prod ct on to ncrease n 2021 as compared to 2020, wh ch w key ncrease abso te va es

n y 2020, NF anno nced ts transformat ve cost red ct on n t at ve, NF Forward , foc sed on mov ng NF from a ho d ng company to an ntegrated operat ng company As part of NF Forward, NF has a nched a s gn ficant footpr nt rev ew, foc sed on rat ona z ng fac ty footpr nt thro gho t the organ zat on h s rev ew and s bseq ent act ons w ead to mean ngf base ne nformat on, as we as prov de d rect on n terms of the deve opment of sc ence based targets mov ng forward

Consumption	Units	2020**	2019
To a Energy Con mp on	GWh_{eq}	852	1,054*
Gro Renewab e Energy	GWh	33	35
Gro Non Renewab e Energy	GWh_{eq}	820	1,019*
Renewab e E ec r c y	%	49	54
Non Renewab e E ec r c y	%	51	46
Facility Heating Totals			
Carbon D ox de Em on CO_2 To a	US on	159,266	199,781*
Me hane Em on C o a	US on	303	380*
N rogen Ox de Em on N_2O o a	US on	289	364*
Par c a e Ma er Em on <30µm	US on	1000	1257*
S r D ox de Em on SO_2 o a	US on	079	099*
Vo a e Organ c Compo nd Em on VOC o a	US on	724	910*
So ven Em on (VOC)	US on	436	415
Par c a e Ma er Em on <30µm (prod c on o a)	US on	223	130
azardo A r Po an (AP) Em on	US on	137	136
To a Wa er Con mp on	US ga	47,601,675	40,651,177*
To a azardo Wa e	US on	483	540
To a nd r a Wa e	US on	9,526	8,930
Recyc ed Cardboard	US on	4,724	1,080
Recyc ed Me a	US on	3,886	3,280
Recyc ed Wood	US on	10,939	1,470
Prod c on To a B e & Coache (var o prop on y em)	Veh c e	4,363	3,915

*2019 va ues have been correc ed o address an error made n prev ous y repor ed na ura gas usage and wa er usage.
**Some d rec and nd rec em ss ons (such as GHG em ss ons produced by company veh c es) are no ye nc uded.

BETTER WORLD

Climate Change

NF con n e o work on e ec r fica on and ba ery echno og e ha red ce he demand or o e con mp on, and o r zero em on prod c range ra e o r ab e n he e area n o rc ng var o componen hro gh o r pr mary abr ca on opera on cen ra ze prod c on and n rn prov de NF be er con ro over o r pp y cha n and effec on c ma e change

NFI Greenhouse Gas (GHG) Emissions (US tons)

2018		2019		2020	
VOC	7.155	VOC	9.10	VOC	7.24
SO_2	0.781	SO_2	0.99	SO_2	0.79
PM	9.887	PM	12.57	PM	10.00
N_2O	2.862	N_2O	3.64	N_2O	2.89
C	2.992	C	3.80	C	3.03
CO_2	156,151	CO_2	199,781	CO_2	159,266

A Note on Report ng: NF has d v ded ts em ss on profi e nto two streams, represent ng b d ng and process energy req rements, and d rect chem ca em ss ons from man fact r ng and serv ce processes Carbon D ox de (CO_2), Methane (CH), N tro s Ox de (N_2O) and fl or nated gas (none) em ss ons are re ated to heat ng o r fac t es

A Note on Report ng: 2020 metr cs are mpected by severa factors, nc d ng b t not m ted to the COV D 19 pandem c P ease see deta ed note A Note on Report ng on Page 60 exp a n ng these tems and the r mpact

BETTER WORLD

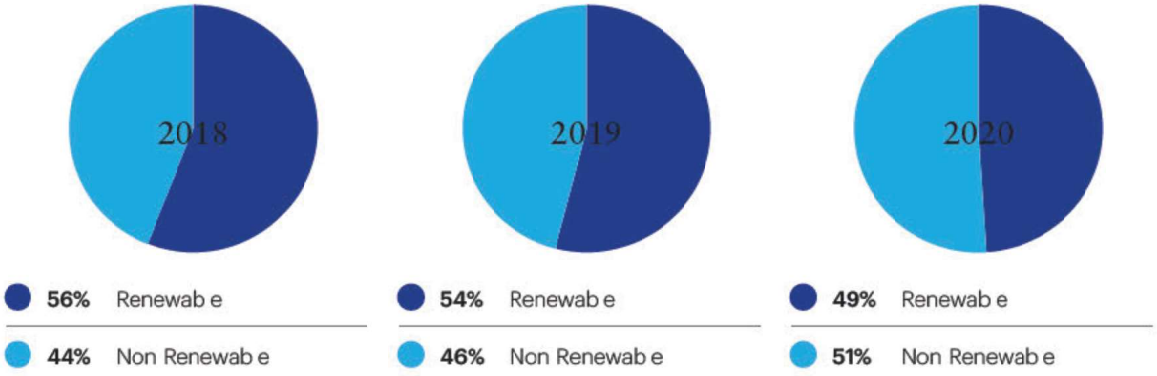
Energy

Con erv ng energy mpor an o NF Energy e red c on a key ra egy o m ga e o r con r b on o G G and c ma e changer k , a we a o m n m ze re o rce age Renewab e e ec r c y me r c or 2020 are prov ded o he r gh

The ma or y o NF ' man ac r ng ac e are oca ed n co d c ma e reg on , and ac y hea repre en he ma or y o o r energy con mp on Red c on pro ec oc on ac y energy age a proce energy age m n ma by compar on Energy con erva on ncrea ed on a pro ec ba Wherever po b e, pro ec ha are d rec y re a ed o ac y energy con mp on a m o red ce con mp on by 10%, w h n he con ex o he pro ec For he e pro ec , energy con mp on da a mmar zed, va da ed, and repor ed o o r eader h p gro p

Fac y pro ec were owed n 2020 d e o he COV D 19 pandem c and w re me n 2021 Energy av ng have been rea zed n o r ac e hro gh he n a a on o ED gh ng (nc d ng emergency and ex er or gh ng), rad an hea ng, mproved ven a on and hea ng, bo er y em pgrade , n rared wa er hea er , var ab e req ency compre or , and pa n boo h exha an , a we a n a ng/ ea ng o o r ac e

NFI Electrical Energy Use



A Note on Report ng: 2020 metr cs are mpected by severa factors, nc d ng b t not m ted to the COV D 19 pandem c P ease see deta ed note A Note on Report ng on Page 60 exp a n ng these tems and the r mpact

BETTER WORLD

Air Emissions

Air emissions from NFI operations are quantified, monitored and managed to meet and, where commercially feasible, be reduced beyond local regulatory requirements.

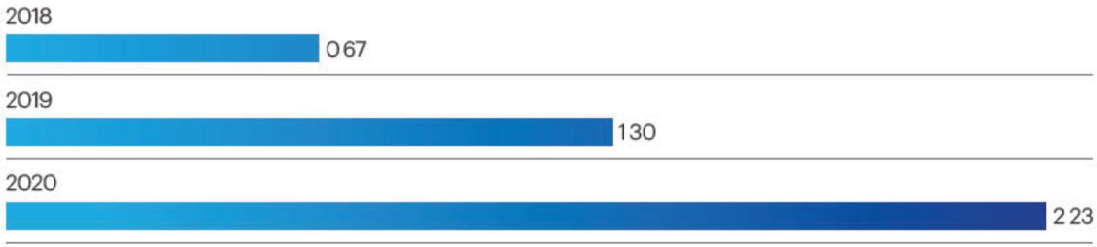
Vo at e Organ c Compounds (VOCs), Part cu ate Matter (PM), and Hazardous A r Po utant (HAP) a r em ss ons from pa nt ng and fiberg ass manufactur ng act v t es are managed by str v ng to meet ndustry best pract ces and proper y ma nta n ng a r po ut on contro equ pment N has mp emented powder coat ng techno ogy wherever pract cab e to reduce a r em ss ons

- ncreases shown n 2020 VOC and HAPs em ss ons are arge y due to the add t on of new y acqu red s tes, nc ud ng a fu -year of AD operat ons
- ncreases seen n PM can be attr buted to mprovements made to our nterna track ng and report ng processes

NFI VOC Emissions (US tons)



NFI PM Emissions (US tons)



NFI HAPs Emissions (US tons)



A Note on Report ng: 2020 metr cs are mpacted by severa factors, nc d ng b t not m ted to the COV D 19 pandem c P ease see deta ed note A Note on Report ng on Page 60 exp a n ng these tems and the r mpact

BETTER WORLD

Water Use

n N fac t es, water s predom nant y used for san tary purposes, jur sd ct ona y mandated fac ty rr gat on, and water eak tests Water test ng for bus she ntegr ty s our argest water consumpt on for manufactur ng process usage Requ rements for these tests vary by contract and can have a s gn ficant mpact on our water consumpt on We are ab e to conserve water dur ng manufactur ng process through on-s te re-use of the water requ red for extreme weather eak test ng

Waste

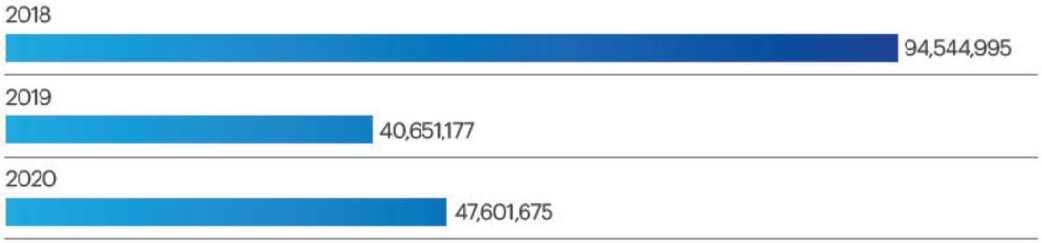
N manages waste n an env ronmenta y consc ous manner, and waste management programs are n p ace at each of our fac t es ean manufactur ng methodo og es a so dr ve eff c enc es n the use of raw mater a s, wh ch reduces N s overa waste footpr nt

→ Due to reduced product on rates n 2020, ex st ng fac t es saw reduced ndustr a waste n 2020; however, w th the add t on of new y acqu red s tes, the tota ndustr a waste shows an overa ncrease

Hazardous waste s d sposed us ng cert fied hazardous waste d sposa contractors A chem ca s used n product on are rev ewed pr or to use n order to m n m ze the use of hazardous products, and to eva uate the subst tut on of products that m n m ze the mpact on env ronmenta or human hea th

Waste streams are reduced through recyc ng where app cab e n 2020, N d verted 10,939 tons of wood and 4,724 tons of cardboard from andfi s, and recyc ed 3,886 tons of meta

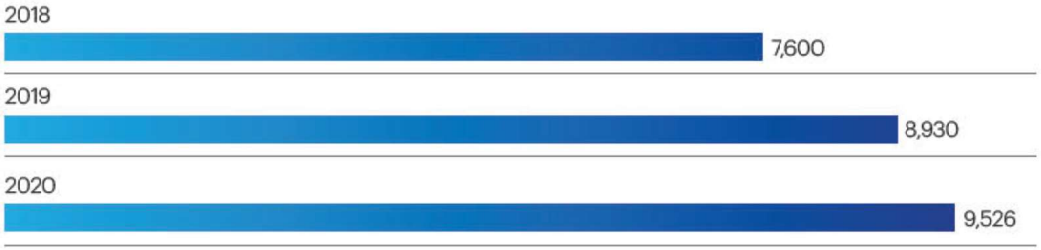
NFI Total Water Consumption (US Gallons)



NFI Total Hazardous Waste (US tons)



NFI Total Industrial Waste (US tons)



A Note on Report ng: 2020 metr cs are mpacted by severa factors, nc d ng b t not m ted to the COV D 19 pandem c P ease see deta ed note A Note on Report ng on Page 60 exp a n ng these tems and the r mpact

BETTER WORLD

Case Study
Building the Best Drivers in the Industry

MCI Academy
Training for Advancing Technology

Helping to educate drivers to enable safer communities.

n ebruary 2020, MC ntroduced the Motorcoach Operator Cert ficate Program, a dr ver tra n ng program to he p answer the ndustry s shortage of qua fied dr vers and to he p contr bute to safer commun t es The Motorcoach Operator Cert ficate Program s part of the ASE-accred ted (Automot ve Serv ce Exce ence) MC Academy, and s a graduated sequence of on ne tra n ng courses on safety, federa regu at ons, and coach systems, des gned to meet the needs of both new and exper enced dr vers, and enab e career advancement

n an ndependent recru tment survey, externa tra n ng was c ted as one of emp oyees most preferred ncent ves for stay ng w th a company t can a so ncent v ze job seekers to app y because of the potent a to advance the r career

MC Academy s program s on ne, free of charge and spans a sk eve s The program s des gned around four eve s of tra n ng The first three eve s nc ude e ght hours of tra n ng per eve w th coursework taught v a v deo and PowerPo nt narrat ves eve 4 s a Master eve cert ficate for the most exper enced coach operator

The eve 3 Cert ficate he ps prepare entry- eve dr vers to meet new edera Motor Carr er Safety Adm n strat on (MCSA) ru es for Commerc a Dr ver s cense (CD) app cat on M d-career dr vers benefit by eve 2 and 1 coursework des gned to mprove road safety and coach system know edge There s a so Master eve coursework for dr vers who comp ete the three eve s of cert ficat on

The beauty of the program s that dr vers can comp ete the r tra n ng wh e wa t ng for the r groups or dur ng the r off hours from any ocat on v a aptop or mob e dev ce, sa d Scott Crawford, MC Tra n ng Manager And operators w benefit from dr vers who are we -tra ned, engaged and proud to work n a profess on that contr butes to the we -be ng of transportat on bus nesses, passengers and road safety

Over 2,500 customers, nc ud ng both pub c and pr vate operators, part c pated n tra n ng th s year n 2020, 29,874 courses were comp eted, for a tota of 30,278 hours of tra n ng



BETTER WORLD

Community Support

NFI is proud to support community, charitable, and not-for-profit initiatives through community partnerships, sponsorships, and customer support.

Program support s centered on commun ty, non-profit, vo unteer, pub c serv ce, or char tab e organ zat ons focus ng n the areas of youth, hea th, and commun ty deve opment Our program object ves are as fo ows

- Promote and enhance commun ty re at ons
- Promote c t zensh p and act ve ro es n our commun t es
- Support corporate object ves and N pr nc p es
- Promote and enhance customer re at ons
- Prov de w despread commun ty benefit
- Prov de our emp oyees the opportun ty to act ve y part c pate and contr bute

Donat ons are approved n accordance w th the N Group Code of Bus ness Conduct and Eth cs, N Group Po t ca Contr but on Po cy, N Group G ft and Enterta nment po c es, and app cab e Customer s Code of Conduct, Bus ness Eth cs, and G ft Acceptance po c es

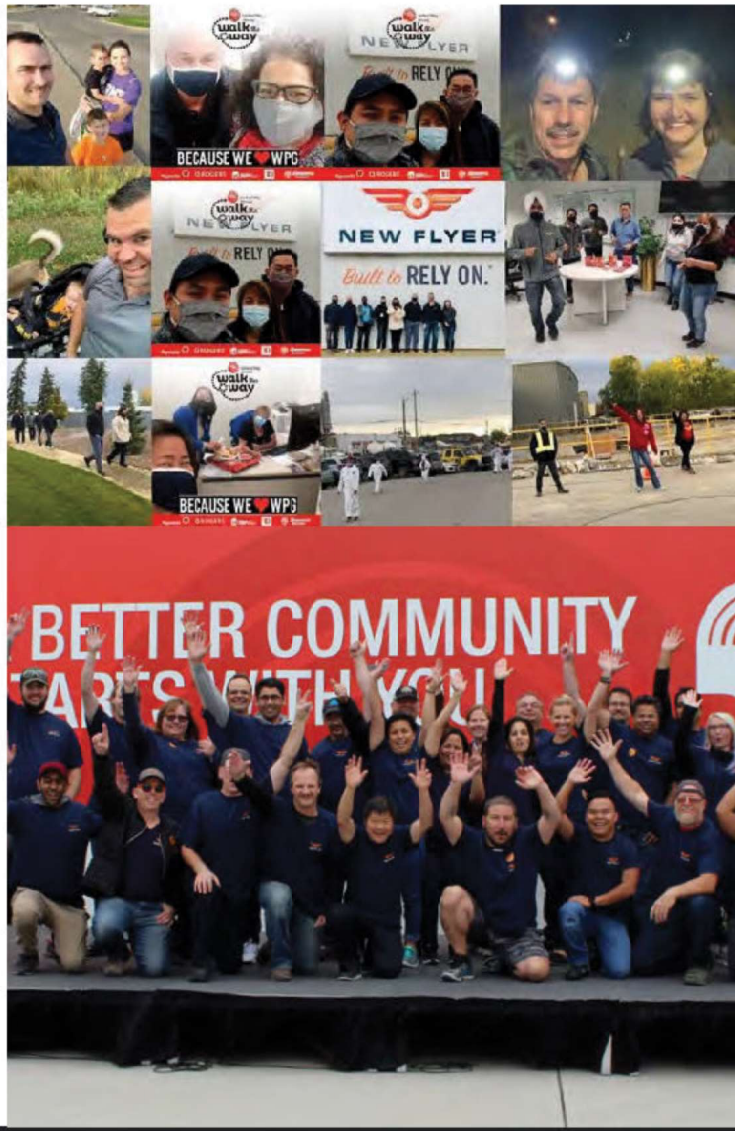
A number of commun ty groups rece ved support and contr but ons from N n 2020 We support a var ety of commun ty, hea th, and youth organ zat ons and programs, such as Canad an Museum of Human R ghts, Crookston Ox Cart Days, D abetes Canada, W nn peg Art Ga ery nu t Art Centre (Oaumajug), and W nn peg Jets Hockey Academy n add t on, the N team co ect ve y nvests hundreds of hours back nto the commun t es where they work, and ve each year

n 2020, the th rd N -w de Un ted Way campa gn was he d across 31 ocat ons, and our team came together to donate $378,701 to Un ted Way agenc es across North Amer ca—proud y support ng 23 d fferent Un ted Way agenc es n the U S and Canada, n or nearby commun t es we operate n We recogn ze that we are better together, and that our commun t es can thr ve as a strong co ect ve

Our team stepped up and part c pated n the 2020 Un ted Way Wa k th s Way Event , ogg ng a tota of over 1 m on steps or 1,065 k ometers

N co ect ve y has donated more than $2 5 m on to the Un ted Way from ts workp ace campa gns over the past decade

United Way



BETTER WORLD

Team & Community Spirit

Teamwork, community involvement, and a collaborative spirit are inherent aspects of NFI culture. Employee-led social committees are established in various business units, with unique employee-planned events held throughout NFI locations annually. Although in-person events were limited in 2020, groups held several virtual events to promote team connections and collaboration between sites, and between those working from home and on site during this time. We are proud of these efforts to build stronger communities, and to create a fun and caring workplace.

Shout-Outs and Standing Ovations

Over 60 emp oyees were recogn zed by the r peers n a Shout-Out or Stand ng Ovat on recogn t on over the past year Shout-Outs prov de a way to say thank-you to someone at N for go ng the extra m e, and we take a moment to say so pub c y The Stand ng Ovat on s a way for co eagues to recogn ze the r fe ow team member for the r efforts n the oca commun ty We want to recogn ze our N commun ty for the r accomp shments outs de of the workp ace wa s Whether someone has run a marathon, vo unteered w th a oca char ty, or has an accomp shment they want to share w th others, we want to hear and share the r story

We're In This Together Campaign

Dur ng COV D, emp oyees were asked to share good deeds stor es and we w shes Over 30 d fferent stor es were shared on how peop e supported fr ends, fam y and the r commun ty Emp oyees a so shared persona stor es on how they spent the r t me dur ng the COV D-19 pandem c








NFI
Leading the ZEvolution.™
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Corporate Presentation

July 2020

Non-Confidential

LI-CYCLE OVERVIEW

Year Founded: 2016

Service: Closed-loop lithium-ion battery resource recovery

Key Partners: CALSTART, MaRS, Responsible Battery Coalition, NAATBatt International, Suppliers Partnership for the Environment

Key Investors: TECHMET, bdc, DELPH25, Pella Resources Limited, Bioindustrial Innovation Canada – A Sustainable Chemistry Alliance

Awards: 2020 Global CleanTech 100, 2020 Clean 16 – Outstanding Contributions to Clean Capitalism, CV Magazine Energy Innovator Awards 2019, Start Up Energy Transition, CleanEquity Monaco 2018, Business Awards of Excellence 2018 Winner

VISION



To be the most sustainable, vertically integrated, and globally preeminent lithium-ion battery resource recovery company

MISSION



1. Providing sustainable and safe customer-centric solutions and technology to solve the global end-of-lifecycle lithium-ion battery problems/opportunities.

2. Meeting the rapidly growing demand for critical battery materials.



TEAM, BOARD, AND ADVISORS

Leadership & Team



Tim Johnston
Exec. Chairman
Mech. Eng., CFA



Ajay Kochhar
President & CEO
Chem. Eng.



Kunal Phalpher
CCO
Elec. Eng., MBA



Bruce MacInnis
CFO
CPA and CA



Chris Biederman
Chief Process Engineer
Sr. Chem. Eng. Mgr.



Ala Hussain
Eng. & Const. Mgt.
Sr. Civil Eng. Mgr.



Ethan Callender
HSEQ Manager
HSE, Quality Expert

Board of Directors



Tim Johnston
Exec. Chairman
Co-Founder



Ajay Kochhar
Exec. Director
Co-Founder



Anthony Tse
Non-Exec. Director
Critical Materials



Mark Wellings
Non-Exec. Director
Capital Raising



Rick Findlay
Non-Exec. Director
Business Ops. & Scaling



Alex Lowrie
Non-Exec. Director
Financial Mgt.



Brian Menell
Non-Exec. Director
Strategic Growth

Advisory Board



Adonis Pouroulis
Senior Advisor
Mining & Metals



Yuan Gao
Technical Advisor
Li-ion Battery Expert



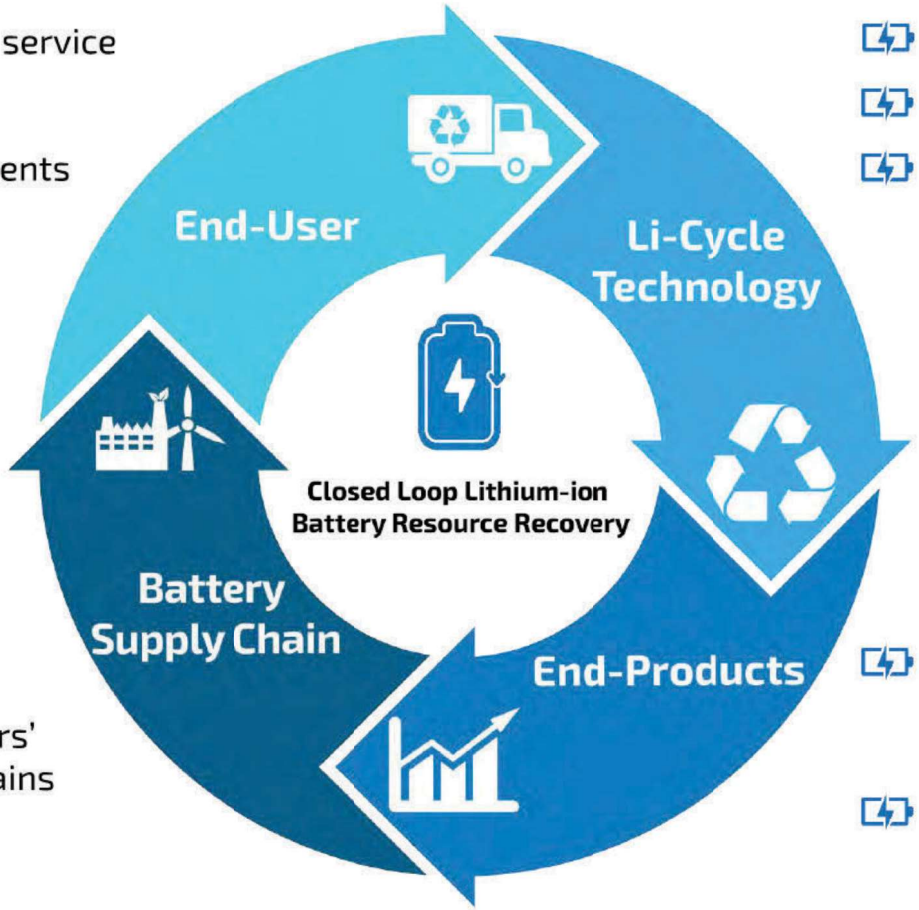
Ahmad Ghahreman
Technical Advisor
Ph.D. Hydromet.



Chris Berry
Energy Metals Advisor
Leading Co & Li Analyst

LI-CYCLE CAPABILITIES

- Holistic logistics coordination service
- Handle damaged batteries
- Advise on packaging requirements
- Manage battery replacement campaigns



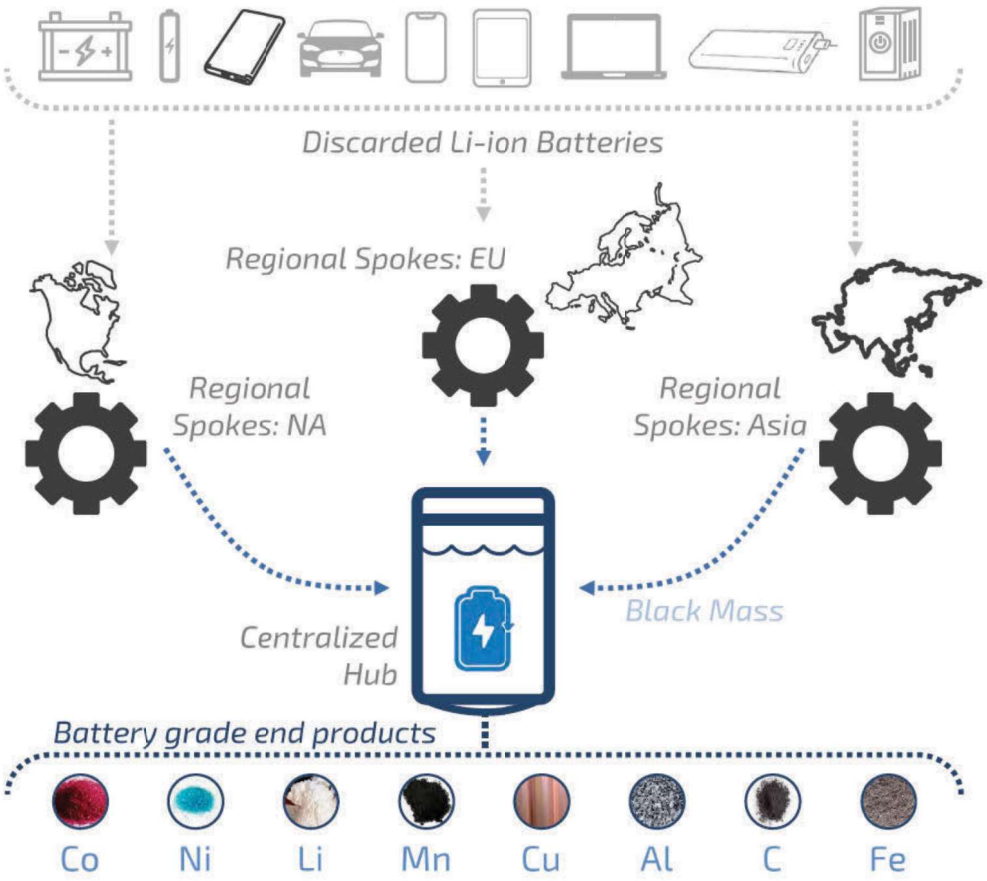
- 100% recycling efficiency rate
- > 95% functional recovery rate
- Safe and sustainable process

- Close the loop in our customers' lithium-ion battery supply chains

- Produce battery-grade end-products for re-use in battery or other technical applications
- Produce by-products reusable in the general economy

PROVEN LI-CYCLE TECHNOLOGY

Li-Cycle's patented Spoke and Hub technologies recover 95% of all li-ion battery materials— extracting high-grade materials for battery production, at a cost competitive to mined and refined material



EXISTING SPOKES: CANADA & NY

Patented Li-Cycle Spoke technology intakes all li-ion battery chemistries at any charge state, without manual sorting, discharging, or dismantling

Saves circa 50 person-hours per tonne

Spoke plants safely reduce the size of battery mass in an automated fashion, eliminating the risk of fire through inherently safe technology. Key to securing supply

Local to each region, reducing the safety risk and cost associated with battery transport

Modular & Scalable: starting size equivalent to 4 shipping containers, capable of 5,000 tonne/yr

Low cost and economically viable on a standalone basis

Fully sustainable with no solid or liquid waste and zero impact air emissions

EXISTING HUB: CANADA

Patented Li-Cycle Hub technology intakes the black mass produced at Spoke plants globally, and outputs high-purity battery chemicals—with 95% recovery

Each Hub plant can support a network of Spokes across the globe. Key structural advantage for Li-Cycle into the future, enabling a circular economy approach

- **Sell all products & by-products:** only plant globally able to recover battery grade lithium
- **Centralized & optimized:** maximizing economies of scale and efficiencies
- **Economically viable** on a standalone basis
- **Fully sustainable** with no solid or liquid waste and zero impact air emissions

LI-CYCLE MILESTONES

✔ **Q4 2016:** Li-Cycle proof of concept
Capacity: 5 tonne/year

✔ **Q3 2017:** Mini-piloting complete in Canada
Capacity: 50 tonne/year

✔ **Q4 2018:** Spoke demo complete in Kingston, Ontario
Capacity: 50 tonne/year

✔ **Q3 2019:** First Commercial Spoke in Kingston, Ontario
Capacity: 2,500 tonne/year

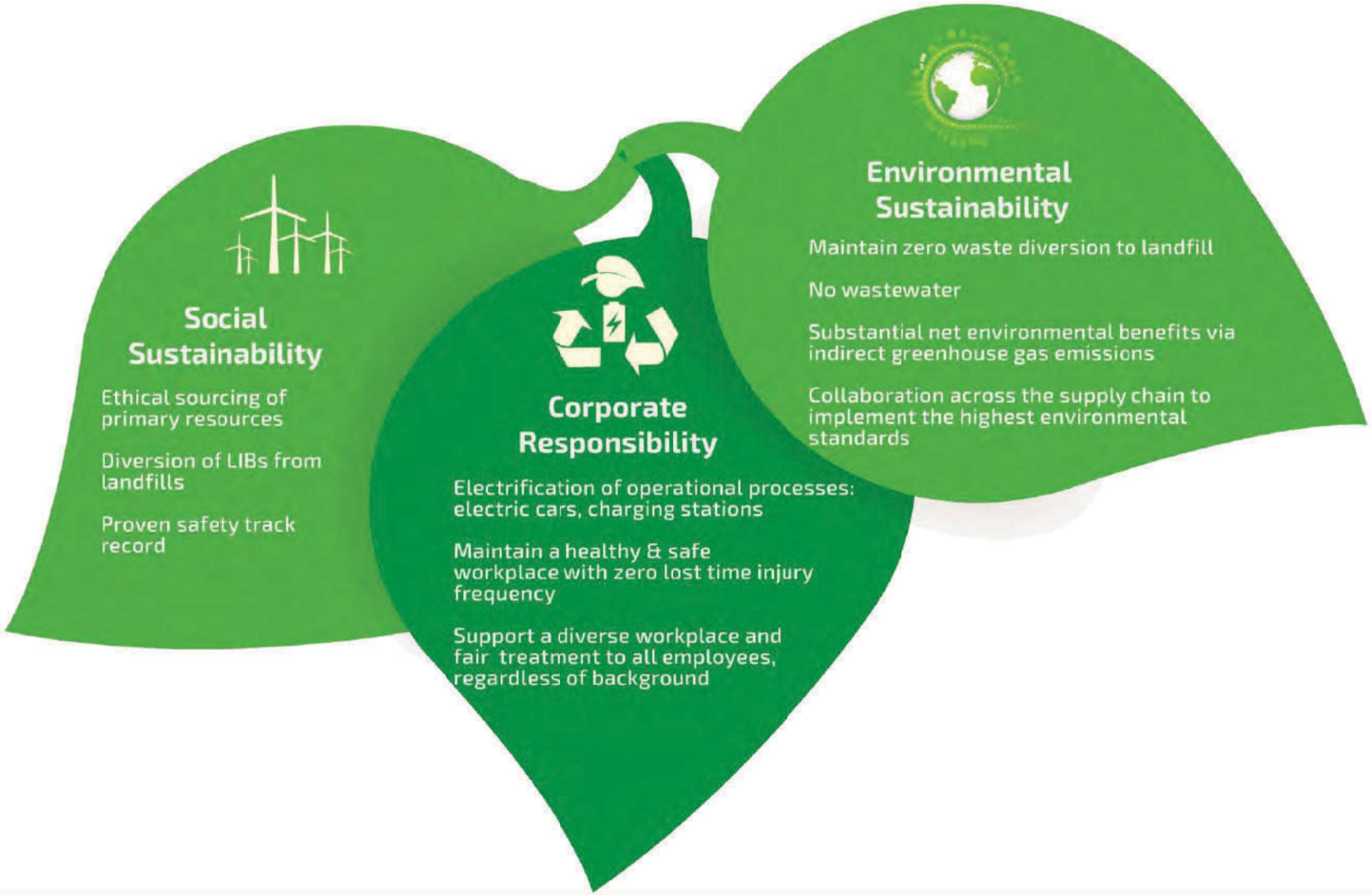
✔ **Q4 2019:** Hub Demo complete in Kingston, Ontario
Capacity: 365 tonne/year

Q4 2020: Second Commercial Spoke established in Rochester, New York
Capacity: 5,000 tonne/year

Q4 2021: Third Commercial Spoke established in Nevada
Capacity: > 5,000 tonne/year

Q4 2022: First Commercial Hub established in Rochester, NY
Capacity: 60,000 tonne/year

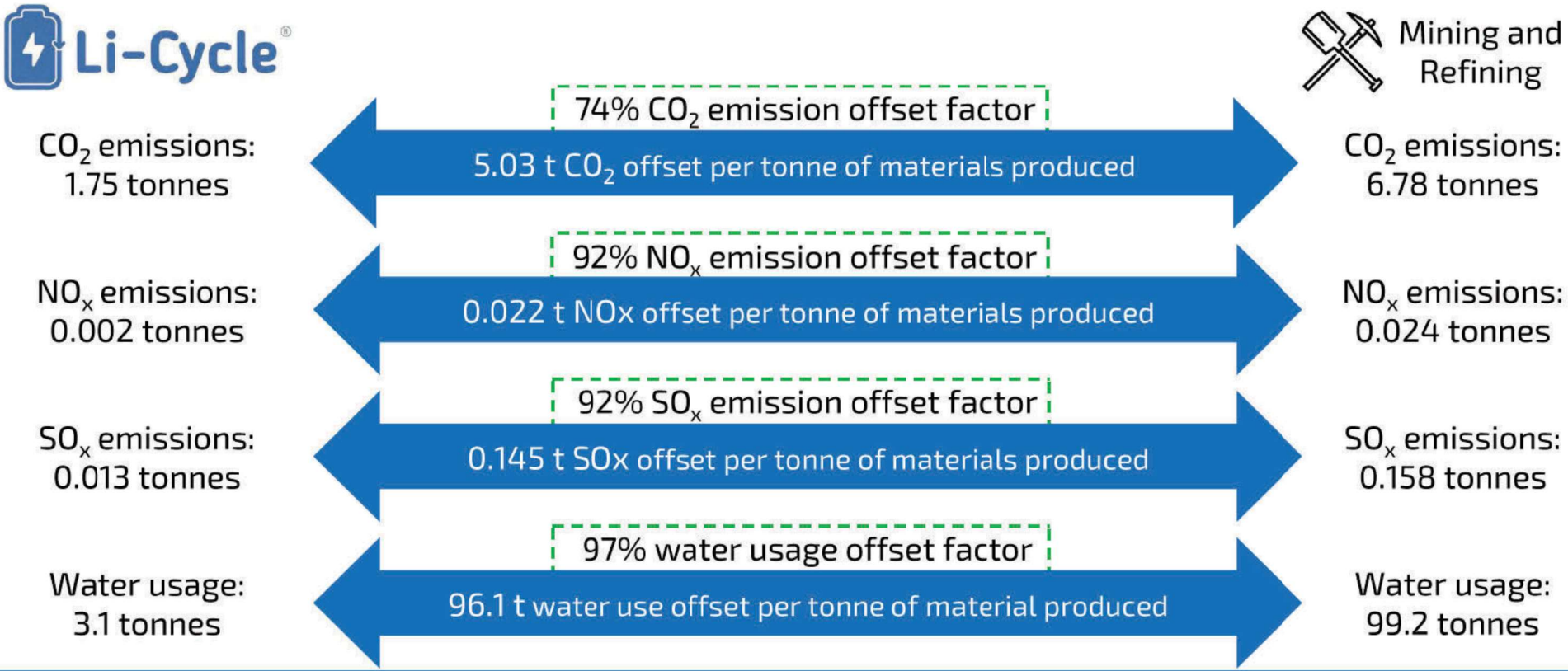
CORPORATE SOCIAL RESPONSIBILITY COMMITMENT



ENVIRONMENTAL BENEFITS

Third Party Life Cycle Analysis Results

Environmental benefits comparison for production of 1 tonne of Battery Materials



CONCLUSION – WHY LI-CYCLE?

Technology	Enables industry-leading 80-100% recovery from all types of li-ion batteries
Battery Supply	Capable of processing all formats, chemistries of lithium-ion batteries and their component products (e.g. cathode scrap)
End-products	Ability to produce virgin grade-equivalent critical battery materials – Li, Co, Ni
Strategic Advantage	Vision to be global partner for end-of-life batteries and critical material supply
Safety & Environment	Inherently safe and sustainable process with zero solid and liquid waste


Li-Cycle®

Section 2E

Solicitation Requirements:

TS 6 Physical Size - dimensions as per specification request / include dimension drawing.

New Flyer response:

The exterior dimensions for the XE40 and XE60 are in the attachment, this will help PSTA and any Agencies purchasing off of this contract to present any questions or concerns with the dimensions of each bus.
Layout XE40 814733_A
Layout XE60 837420_A.

Section 2F

Solicitation Requirements:

TS 7 Performance Information/Graphs to be include with Proposal submittal shall include:

- Energy Consumption vs. Road Speed
- Torque vs. Road Speed
- Energy consumption vs. torque.
- Vehicle speed vs. time (both loaded and unloaded)
- Vehicle speed vs. grade (both loaded and unloaded)
- Acceleration vs. time
- Change of acceleration vs. time
- Top Speed
- Acceleration

New Flyer response:

New Flyer is please to provide our performance charts as attached with this document, also note that there is information as noted below in other areas for your determination of the performance of the Xcelsior buses:

XE40 Performance Charts.
XE60 Performance Charts

Top speed of 65 mph is achieved with the 5.67 axle ratio and Siemens traction motor.

Acceleration information is provided in the attachments XE40 Performance Charts pages 4 and 5.
Acceleration information is provided in the attachments XE60 Performance Charts pages 6, 7 and 10.

Please refer to the information and attachments provided in the Altoona Report from Section 2M.

XE40 Altoona Report on Pages 93-117 - Graphs with results on page 114.
XE60 Altoona Report onPages 31-34 – Graphs with results on page 31-32.



High Gradeability 40’ Performance Curves

NEW FLYER

MCI

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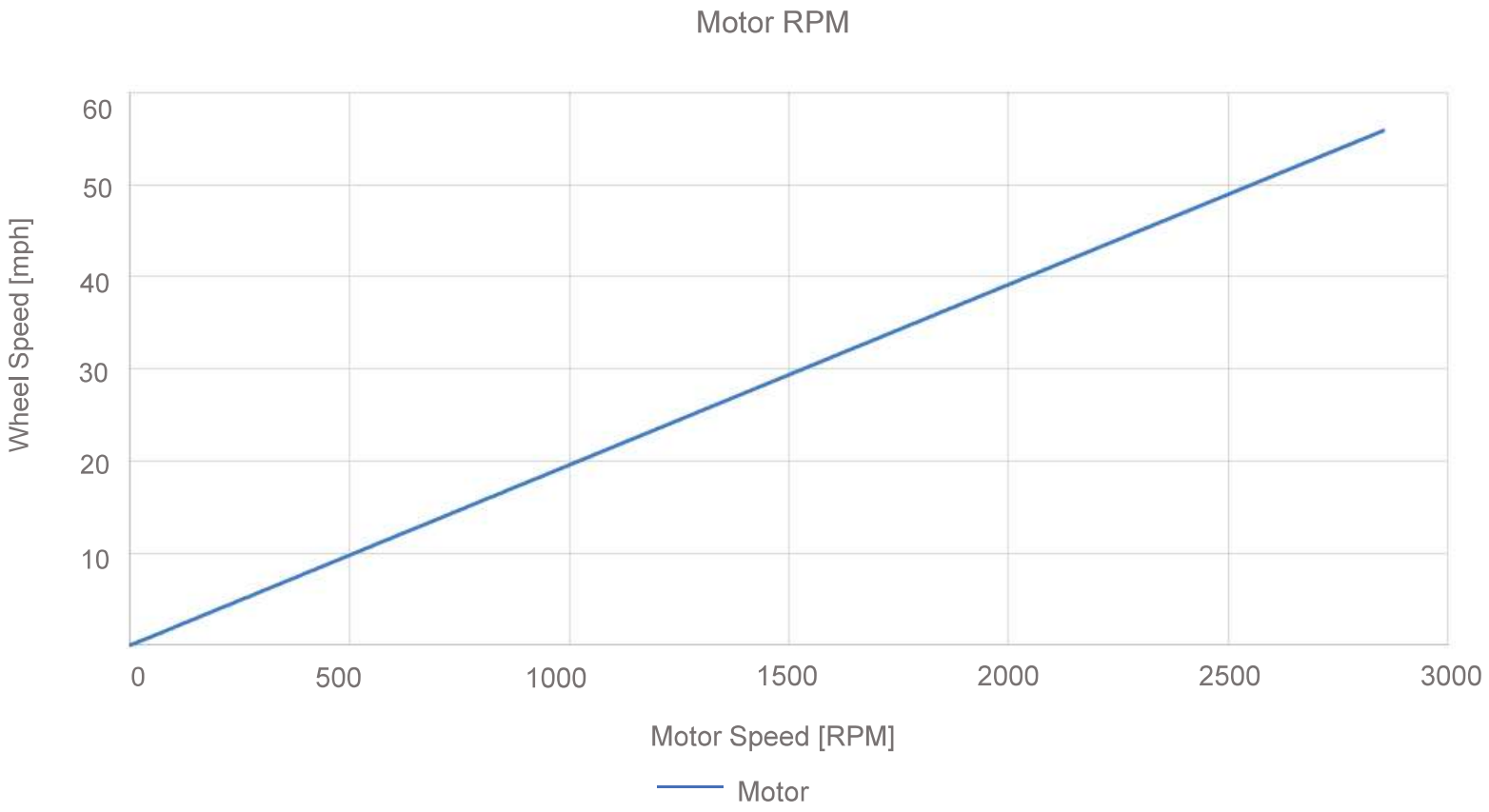
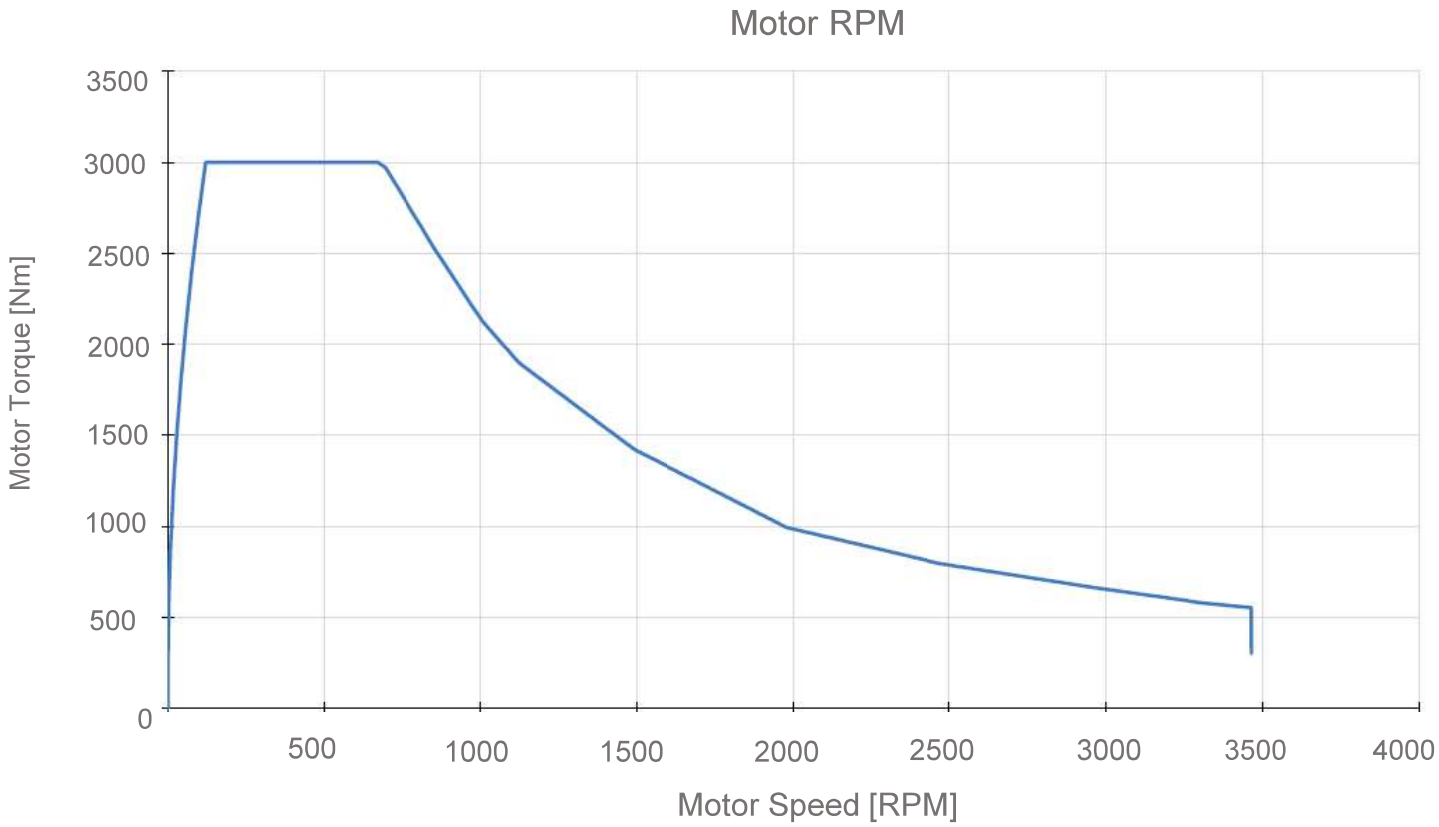
Engine Speed vs Road Speed

NEW FLYER | Engineering Services



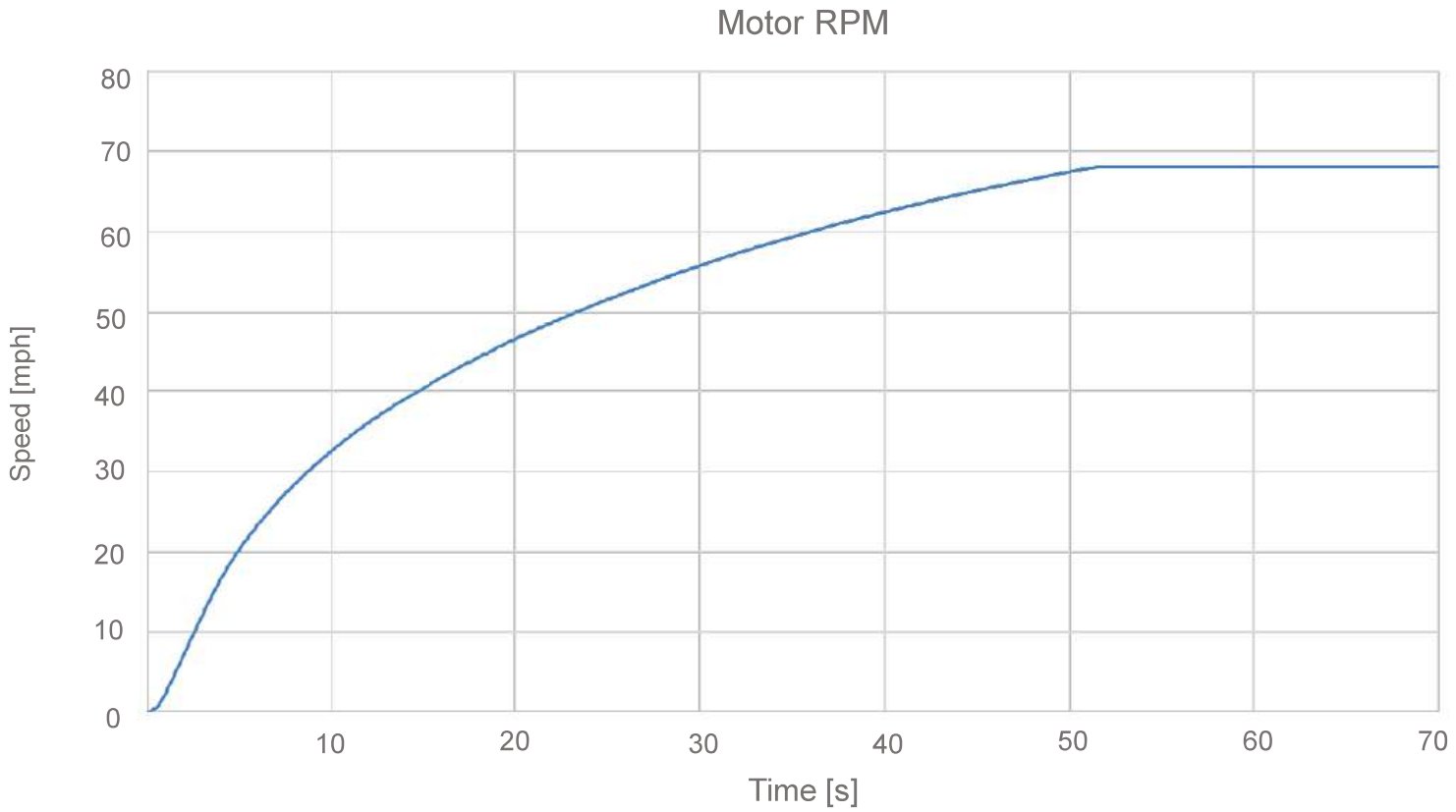
Motor Torque vs Motor Speed

NEW FLYER | Engineering Services



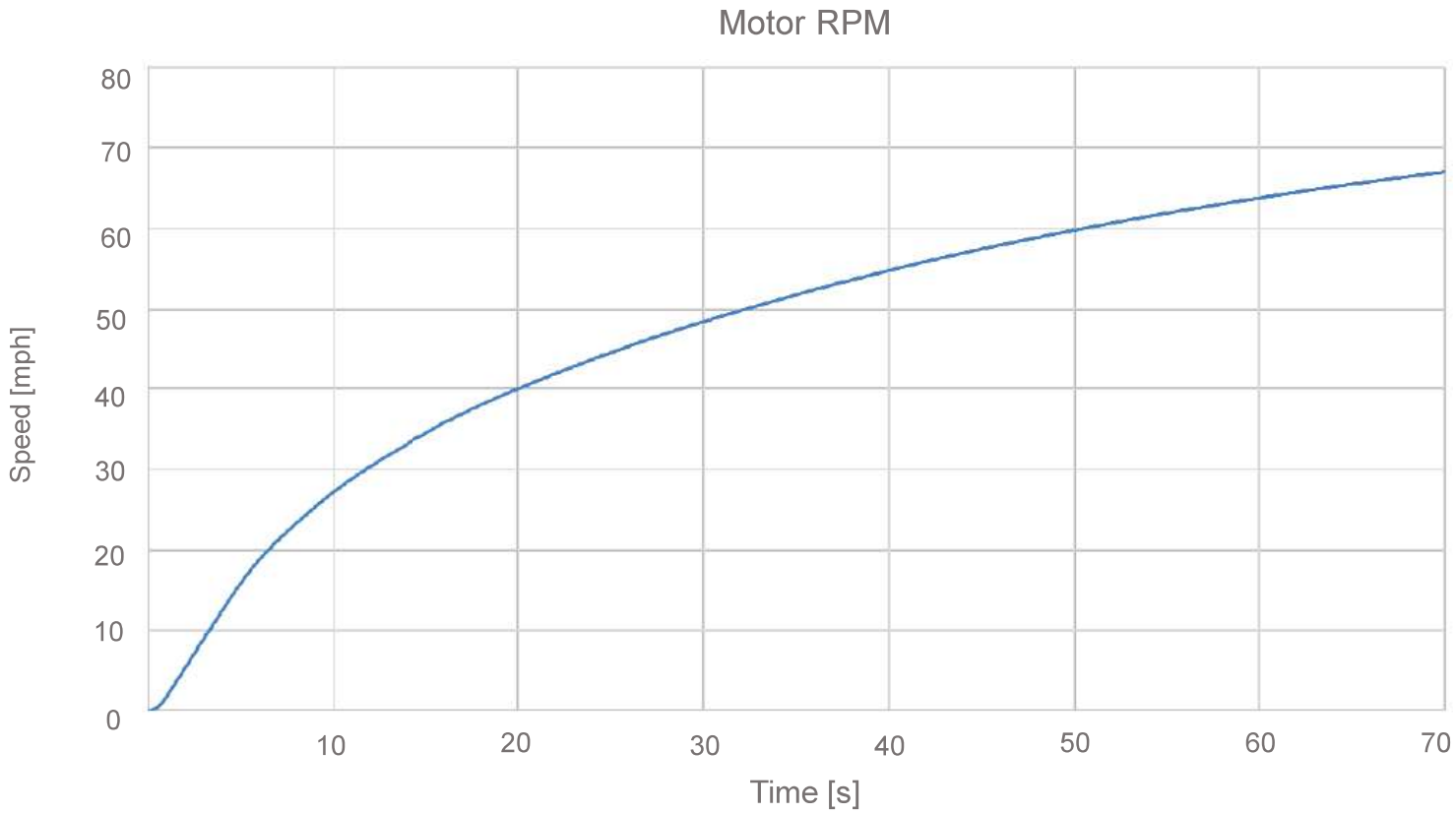
Vehicle Speed vs Time Unloaded

NEW FLYER | Engineering Services



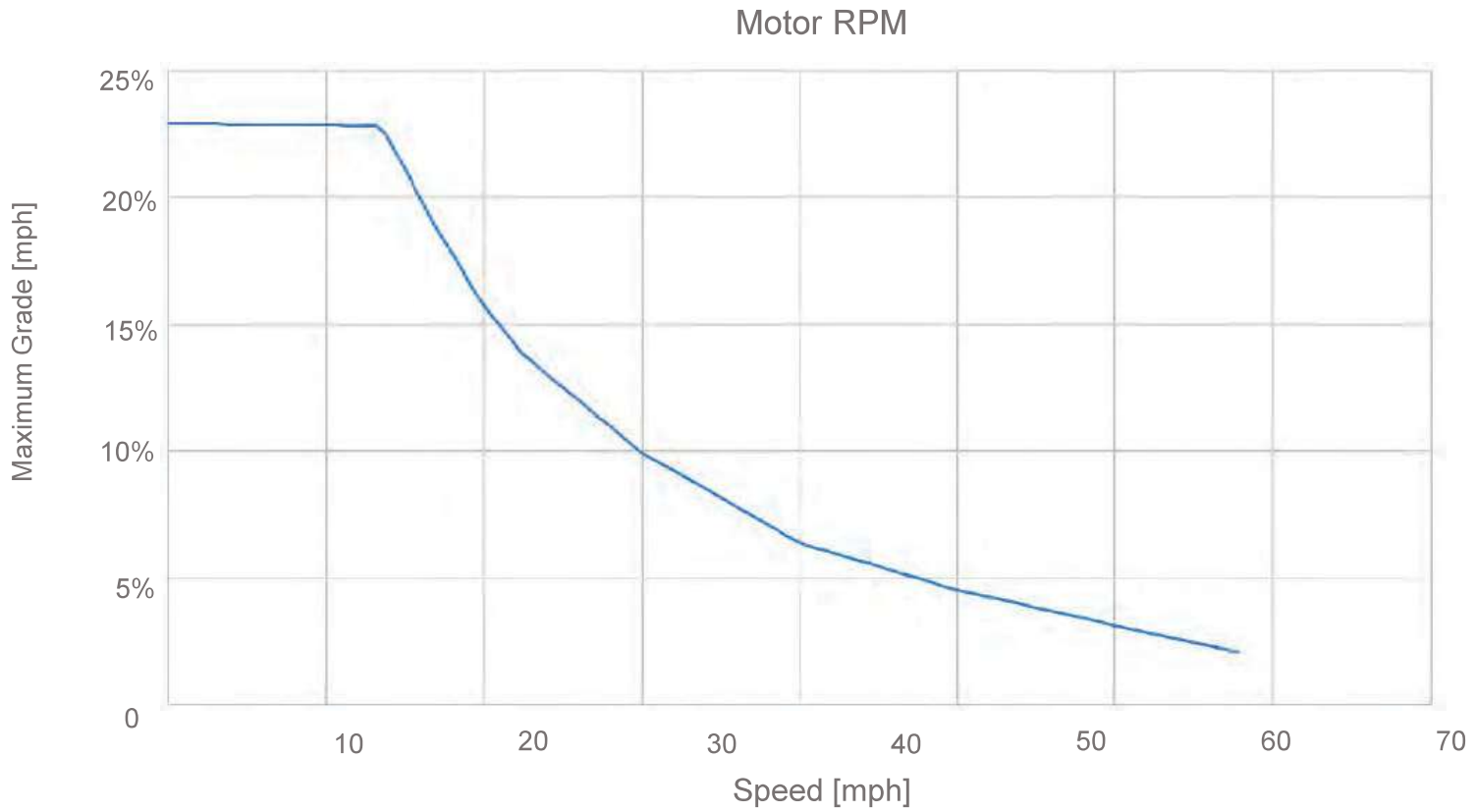
Vehicle Speed vs Time Fully Load

NEW FLYER | Engineering Services



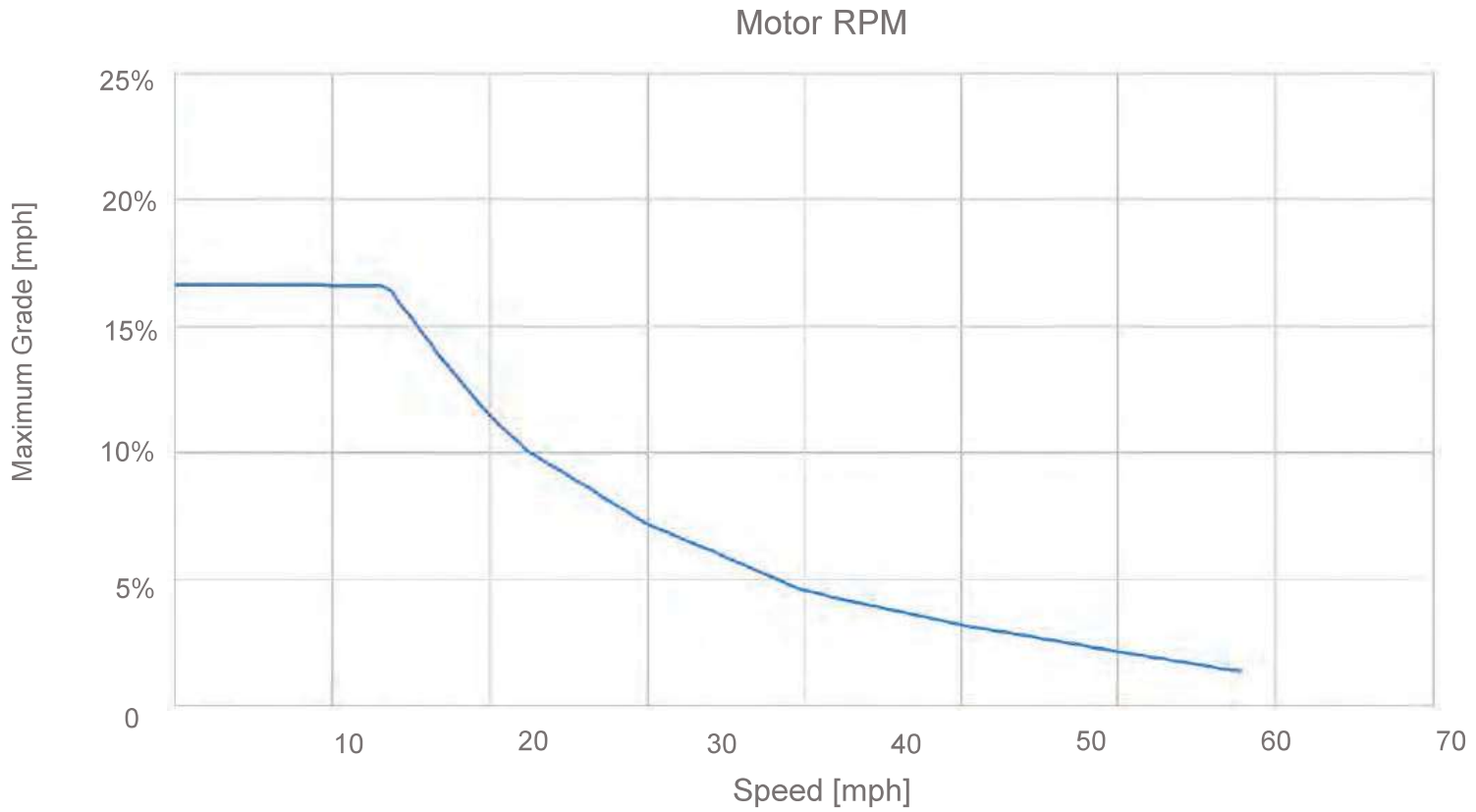
Unloaded Speed vs Grade

NEW FLYER | Engineering Services



Fully Loaded Speed vs Grade

NEW FLYER | Engineering Services




NEW FLYER®



Xcelsior Charge Performance Curves

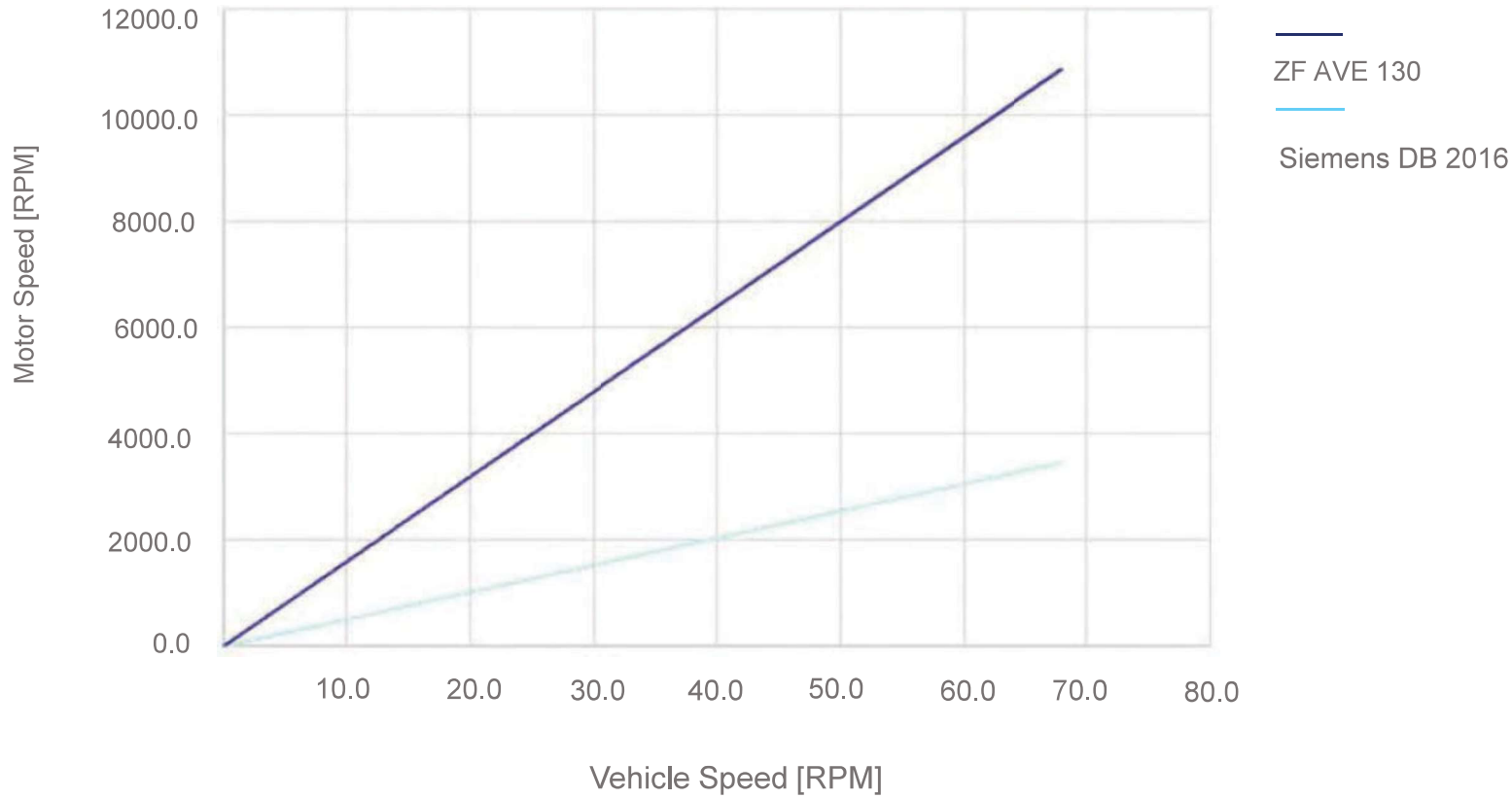
60 Foot

Standard Grade, 2016 PEM Motor

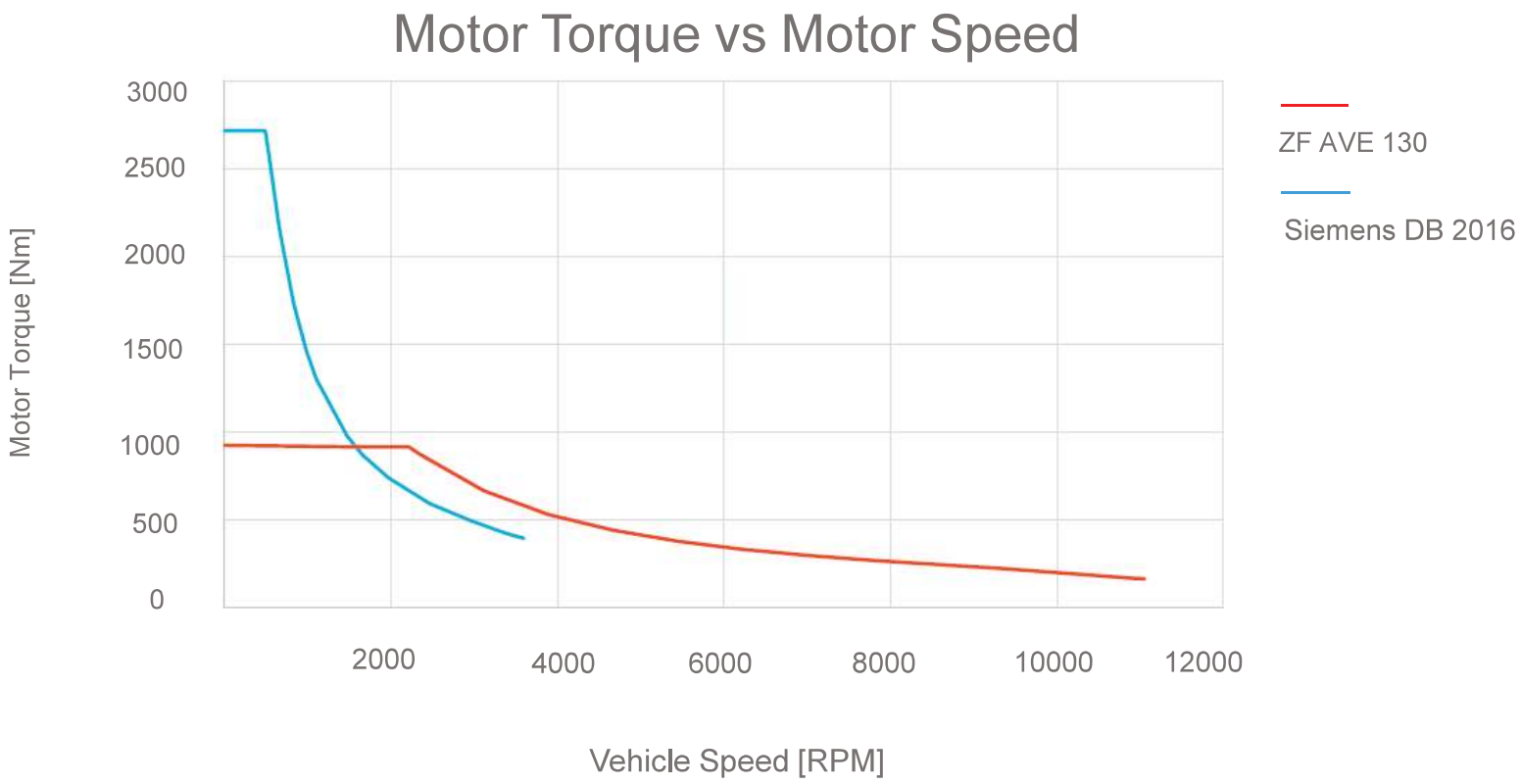
NEW FLYER

MCI

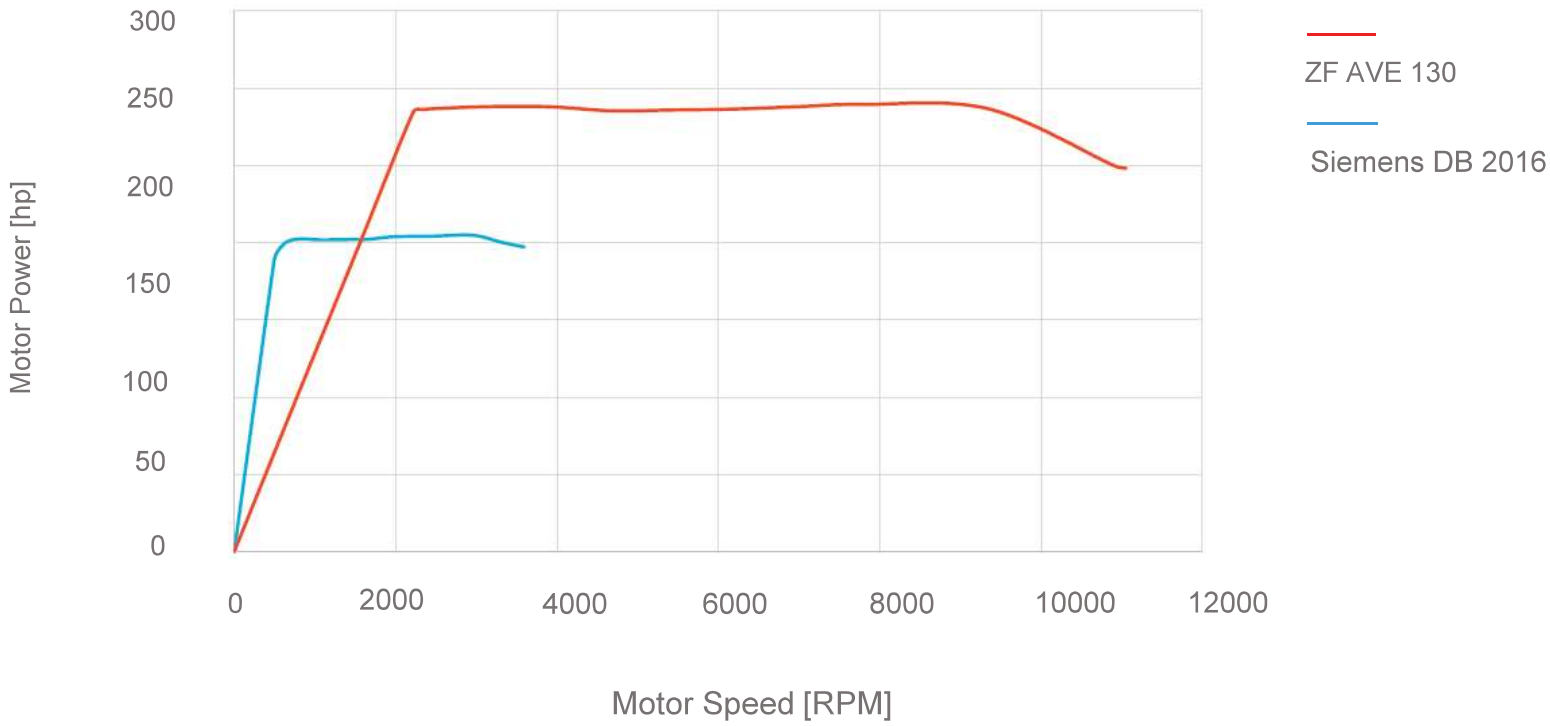
Motor Speed vs Vehicle Speed



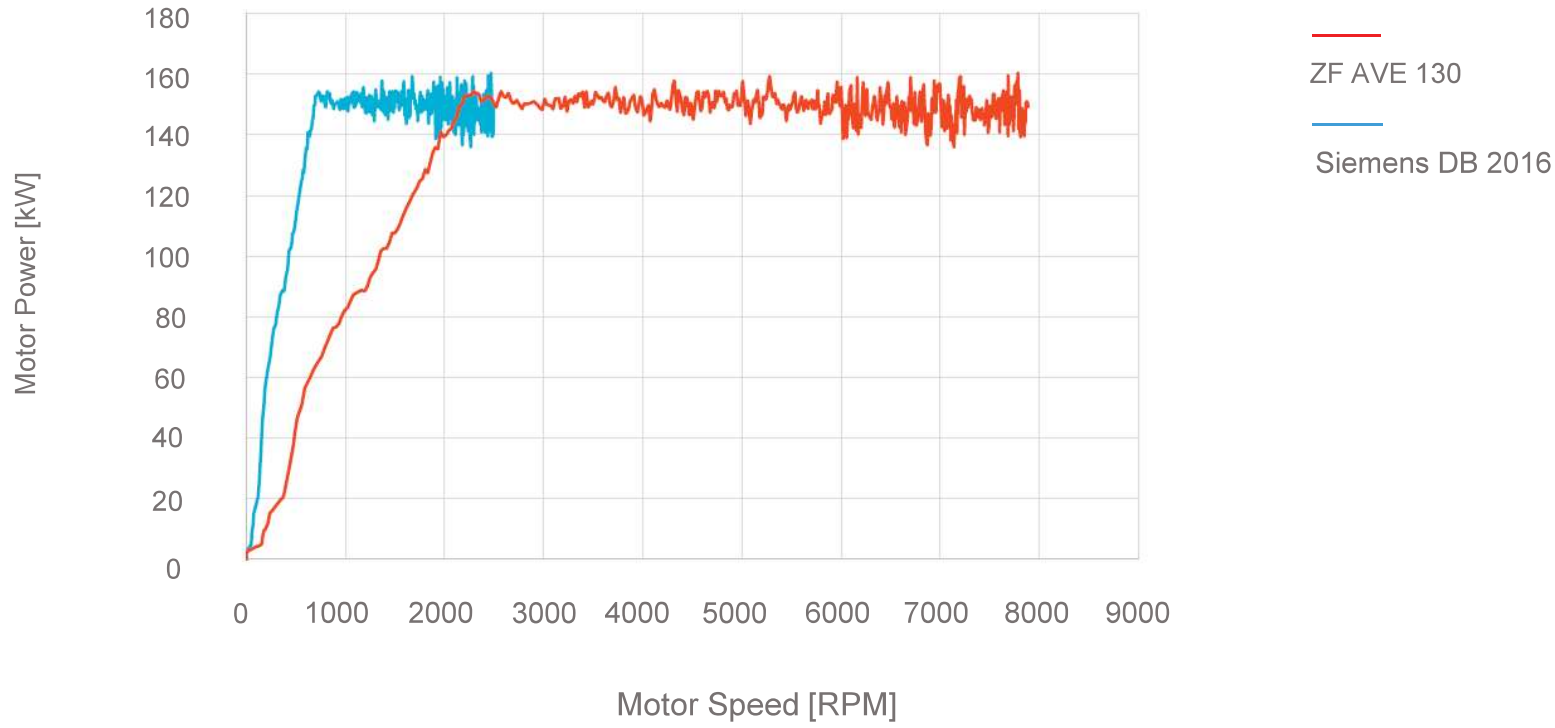
Motor Torque vs Motor Speed



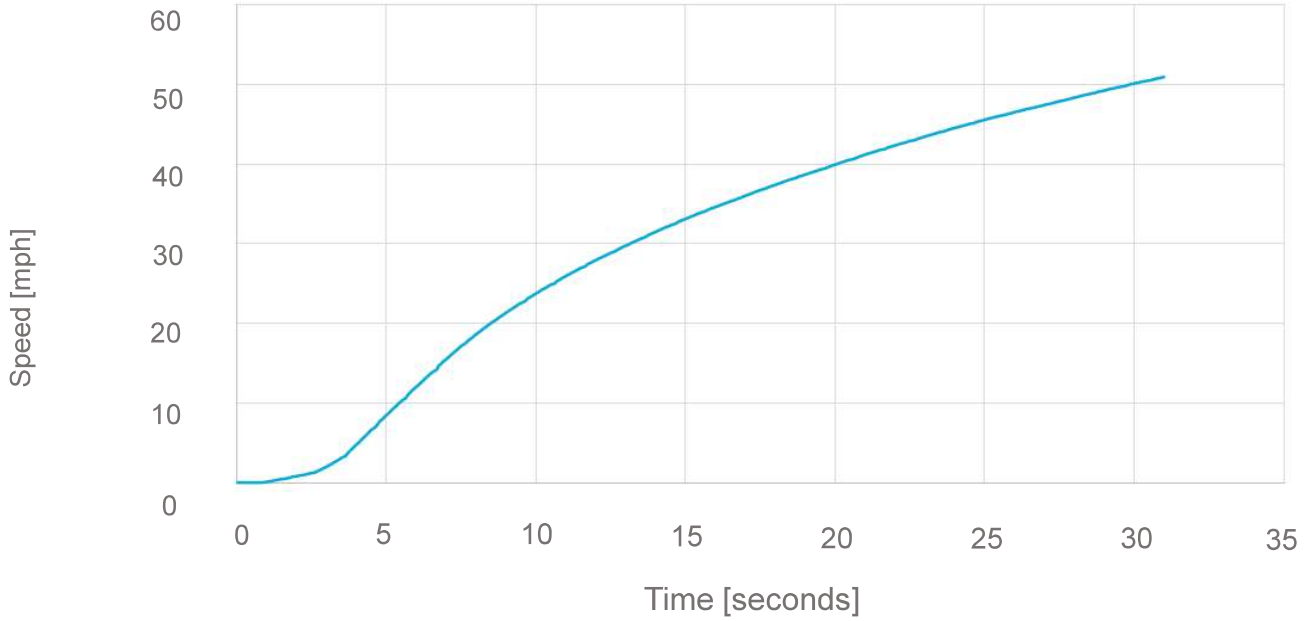
Horsepower vs Engine Speed



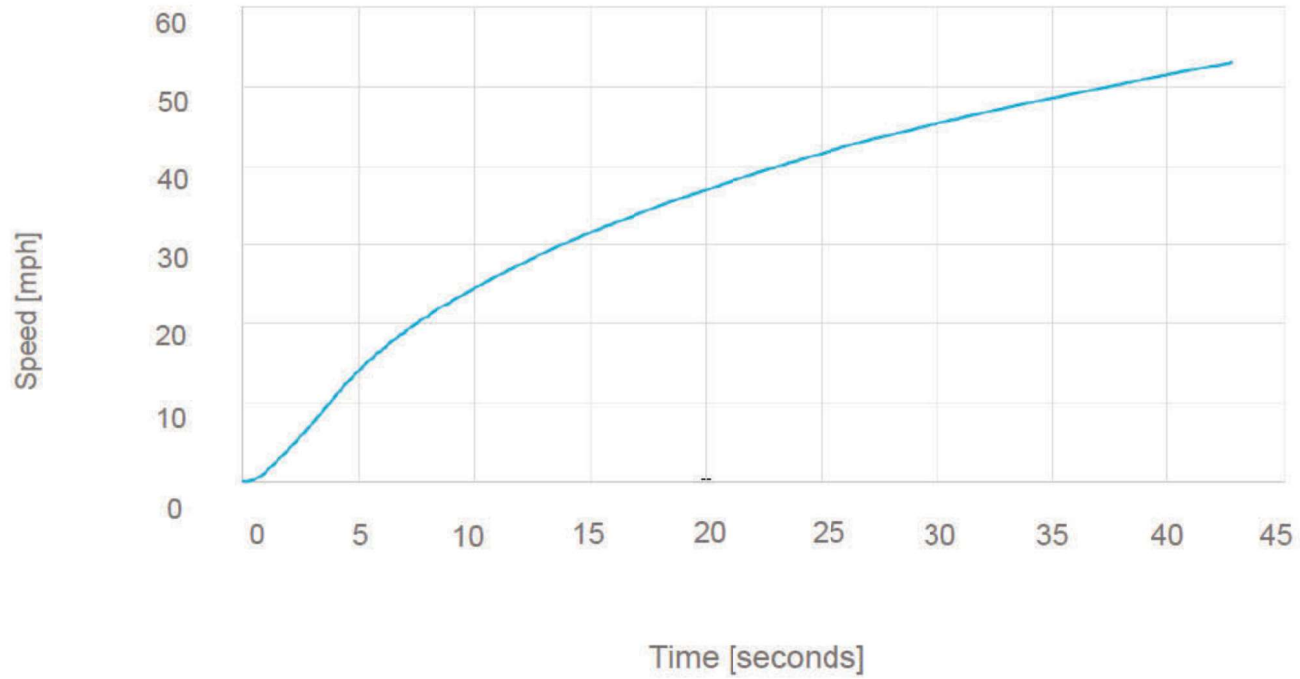
Energy Consumption vs Motor Speed



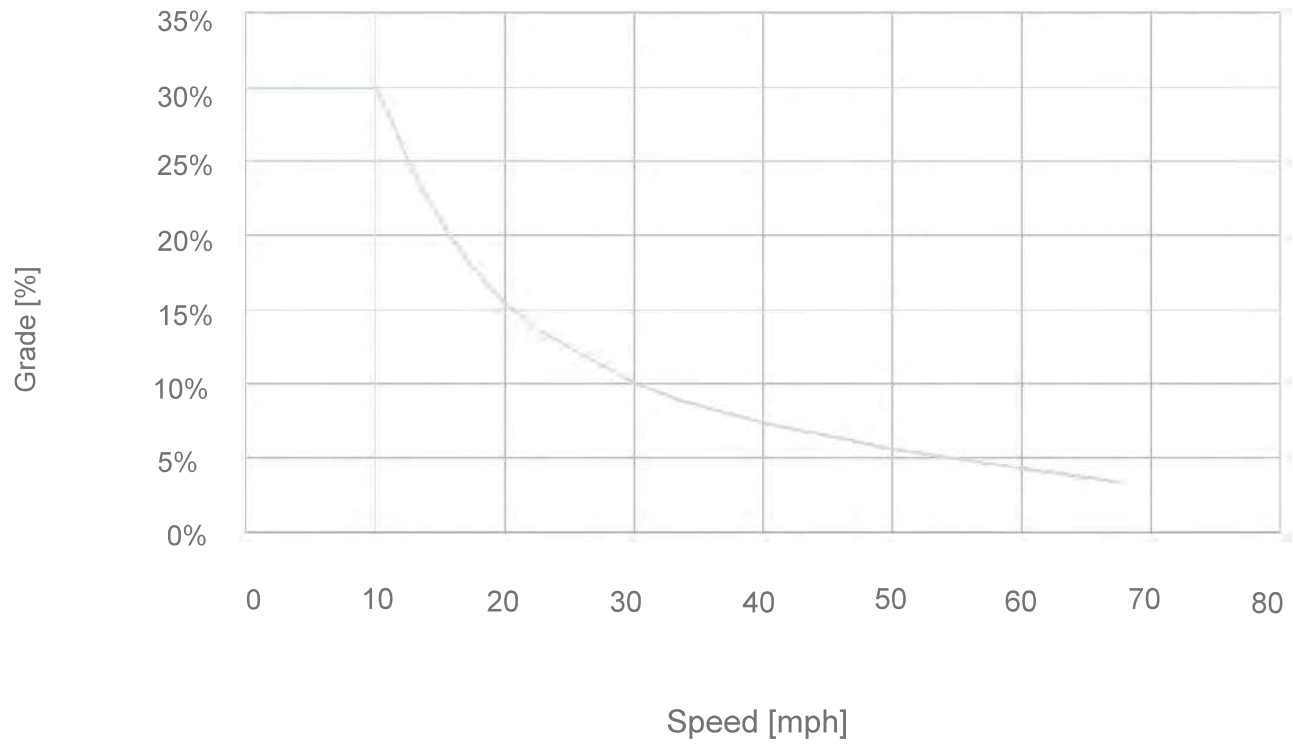
Vehicle Speed vs Time (Unloaded)



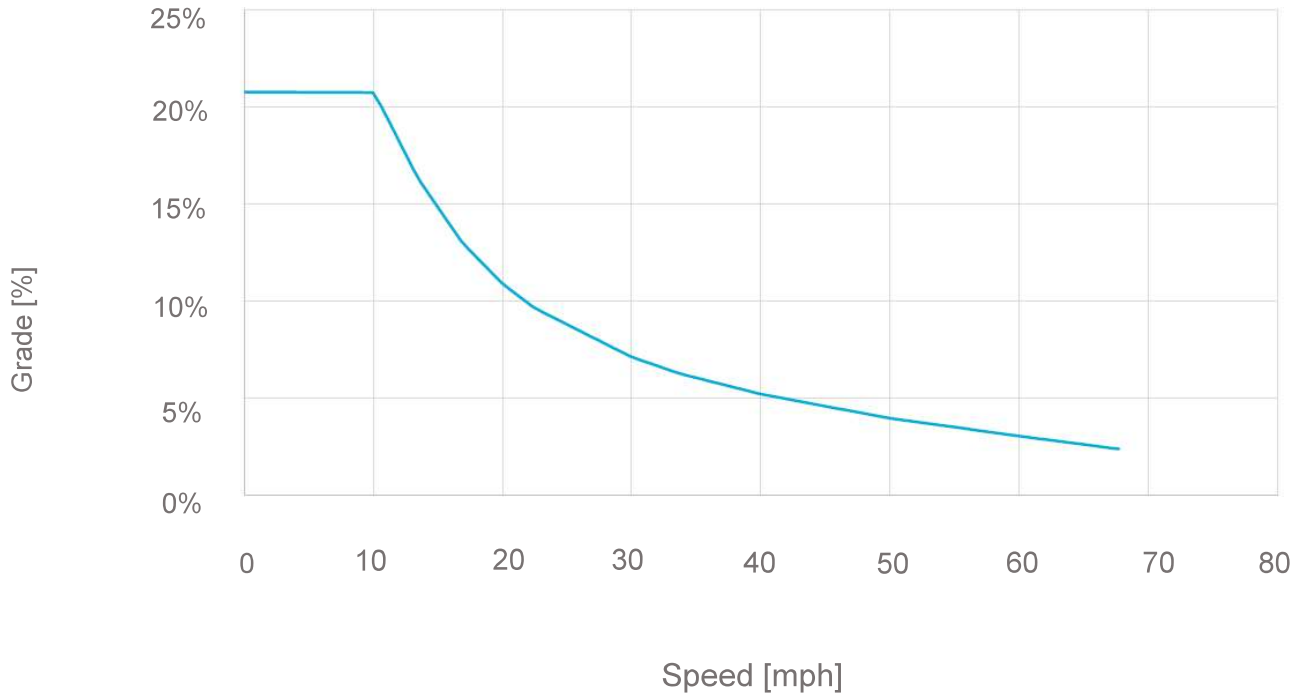
Vehicle Speed vs Time (Loaded)



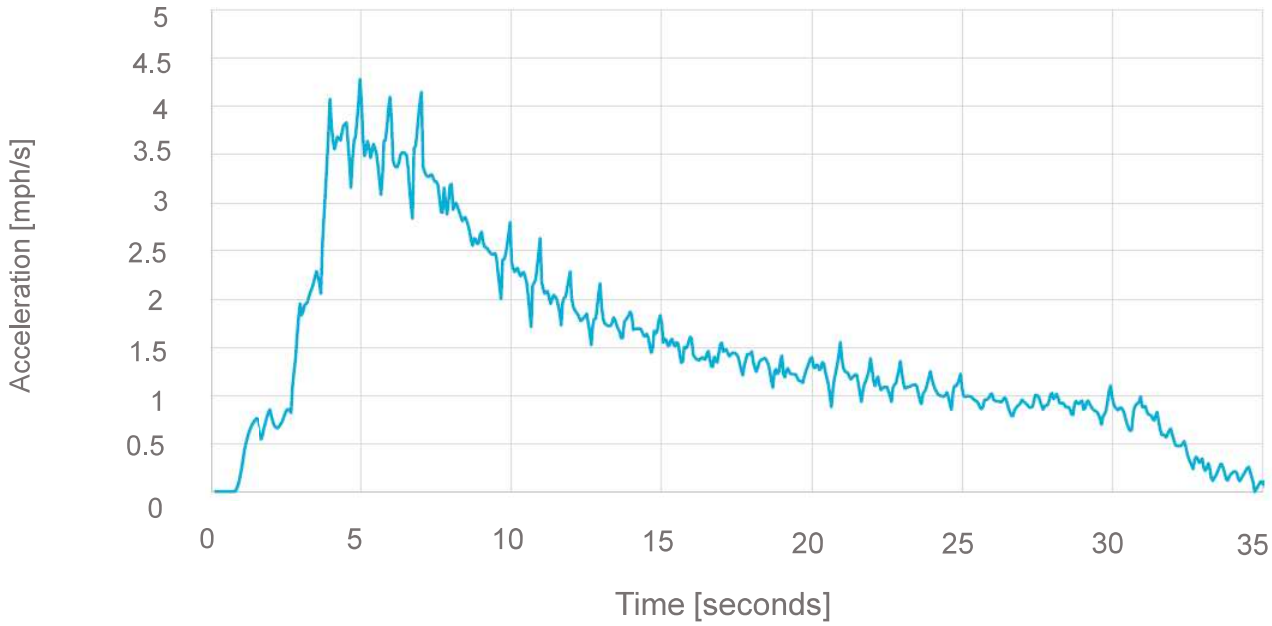
Vehicle Speed vs Grade (Unloaded)



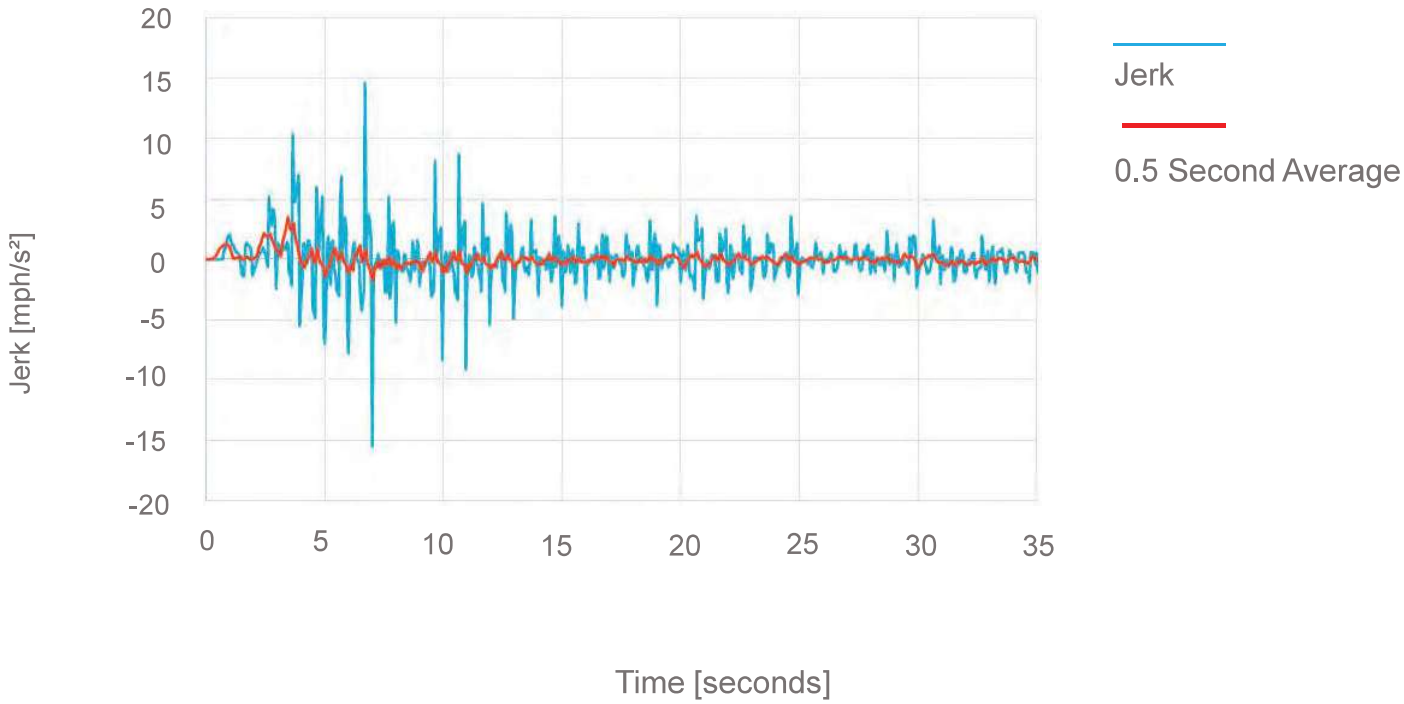
Vehicle Speed vs Grade (Loaded)



Acceleration vs Time



Jerk vs Time


20
15
10
5
0
-5
-10
-15
-20
Jerk [mph/s²]
0
5
10
15
20
25
30
35
Time [seconds]
Jerk
0.5 Second Average


NEW FLYER®

Section 2G

Solicitation Requirements:

TS 8.2 Design Operating Profile.

Supply a computer simulation of bus performance, utilizing the physical and mechanical characteristics of a specific bus, for each type of bus offered.

New Flyer response:

The range review is in the attached document for PSTA s analysis for the Xcelsior buses, Range Review for XE40 and XE60. The attached graphs will provide the bus performace information specific to each type of bus being offered in this RFP.

Section 2H

Solicitation Requirements:

TS 8.2 Operating Narratives.

The Contractor shall provide the following narratives with its Technical Proposal:
• Narrative description of the methods used to validate that the proposed system will meet the Agency design operating profile under nominal and worst-case conditions. Detailed results should include, at a minimum, the following for both nominal and worst-case conditions:
• expected bus range (miles)
• fuel economy (kWh/mile); and
• auxiliary loads (kW).
• Projected performance on the Agency design operating profile when the battery reaches end-of-life (EOL) state. The Proposer will provide specific details on EOL criteria. Detailed results should include, at a minimum, the following: expected battery life from factory delivery under normal operating conditions (months), EOL battery capacity (kWh), EOL bus range (miles).
• Description of any required or recommended charge strategies or other bus operation strategies that are necessary to meet the Agency design operating profile. Note that the agency requires that operational impacts be minimized.
• Description of the flexibility and considerations necessary to place the proposed bus and its charging solution on any Agency route at the Agency's discretion.
• Description of any required charge strategies, on-route charge requirements, bus blocking requirements or other bus operational requirements that are necessary to meet the Agency design operating profile. Note that the agency requires that operational impacts be minimized.
• Description of the flexibility and considerations necessary to place the proposed bus and its charging solution on any Agency route at the Agency's discretion.

New Flyer response:

Please refer to the attached documentation provided in Section 2F:
XE40 Performance Charts.
XE60 Performance Charts.

In this section please review to the Xpand Modular Pack for details regarding the battery.

A variety of Plug-in and overhead charging options have been provided to meet the current industry standard applications and the various operating conditions expected by transit agencies. CCharge strategy will vary slightly from agency to agency. The typical scenario will include off-peak depot charging supplemented by on-route charging if needed. Agencies will want to consider battery type and capacity, power consumption, routes, utility tariffs, layover time, etc. in determining the appropriate charger size and dispensers.

XMP 125E HIGH ENERGY



XALT Energy is a premium total system solution manufacturer of lithium-ion batteries, packs, battery management systems and controls, racks and telematics. XALT Energy is capable of handling any energy storage need, anywhere in the world, from our highly automated advanced production facility in Midland, Michigan.

The XPAND Modular Pack (XMP) is XALT Energy's Energy Storage System based on XALT Energy's lithium-ion cells. XMP is designed for use in medium to heavy duty commercial trucks, bus, marine and specialty applications, such as construction and mining equipment.

XMP 125E is ideal for applications with moderate discharge and charge rates for high energy applications requiring long usage periods between plug-in charges. Each sub-pack contains Voltage-Temperature-Balancing boards (VTBs) that report voltage for all cell pairs and internal pack temperatures, and perform cell balancing. XMP 125E is designed for use with XALT's Battery Disconnect Unit (BDU) and Master Control Unit (MCU) through the Input/Output port.

Upgradeable, Ultra-Long Life Cycle Roadmap

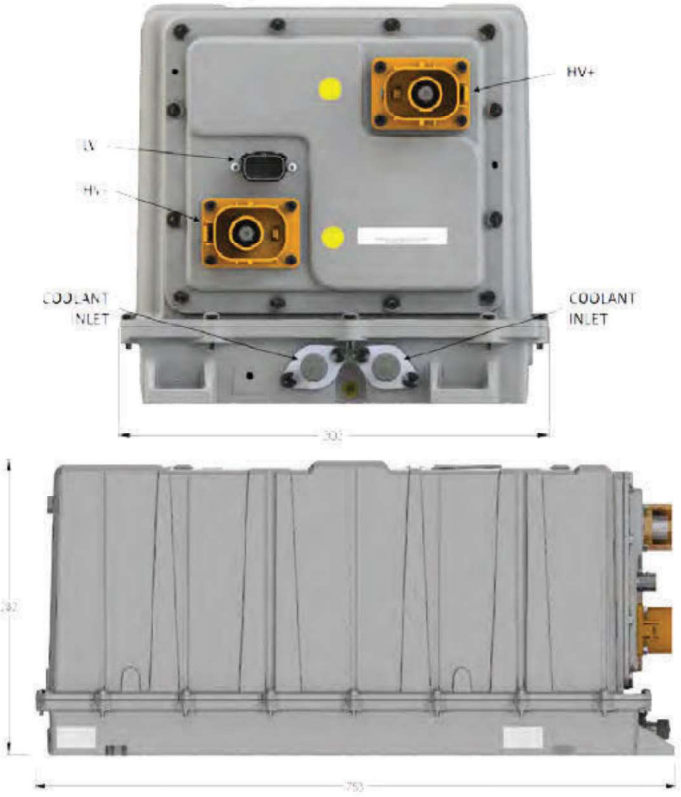
- XMP core accommodates cells in XALT's 225mm family without the need for retooling, anticipating a wide variety of application voltage, power, and energy
- As cell technologies advance or packs become available for re-purposing, the XMP core can be replaced while all external interfaces remain the same

Advanced Thermal Management

- XMP's advanced active liquid cooling system maintains ideal cell temperatures throughout the pack and responds quickly to increases in power demand and changes in ambient (environmental) temperatures
- Efficient direct liquid cooling prolongs cell life under the most demanding cycle profiles and severe environments. The base pack (non-marine) is also IP67 rated in terms of sealing performance.

THE XALT ENERGY ADVANTAGE

- Exceptional cycle life with proven XALT NMC SHE cells
- High specific energy and volumetric energy density
- Rugged design for challenging environments
- Outstanding safety and abuse tolerance
- Efficient direct liquid cooling maintains ideal cell temperatures
- IP67 compliant (with connectors mated)
- Easy to install, configure and upgrade
- ISO 9001:2015 certified production environment



XALT Energy

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FEATURES AND BENEFITS

Modular and Flexible Design

- Easy to customize high voltage, low voltage and cooling interfaces to each application
- All connections at front panel; rear access not needed for installation

System Support

- Battery Disconnect Unit (BDU)
- Master Control Unit (MCU)
- Low Voltage Harness (LVH) Kit
- High Voltage Cable (HVC) Sets
- XALT Battery Viewer (XBV) Telematics
- XALT Rack System (XRS)

Life Cycle Support

- XPAND Service Tool
- Remote Data Monitoring & Prognostics
- Pack Replacement Maintaining Interface Connections
- End-of-Life Re-purposing, Recycling
- Integration Support
- On-Site Training Classes

Additional Benefits

- In-house cell modeling and development creates sophisticated software and controls for accurate Power, SOC and SOH predictions
- Custom warranty programs available

Performance	
Capacity (Rated @ C/10)	142Ah
Discharge Energy (Rated @ C/10)	12,500Wh
Nominal Voltage	88.3VDC
Specific Power*	≥258W/kg
Specific Energy	≥161Wh/kg
Energy Density	≥194Wh/l
Discharge Peak*	1.5C / 225A
Charge Peak*	0.5C / 71A
Discharge Continuous**	**1C / 142A**
Charge Continuous**	**0.3C / 47A**
Weight	**77.4kg**
Dimensions (all versions incl base) (L) 753mm (W) 303mm (H) 282mm	

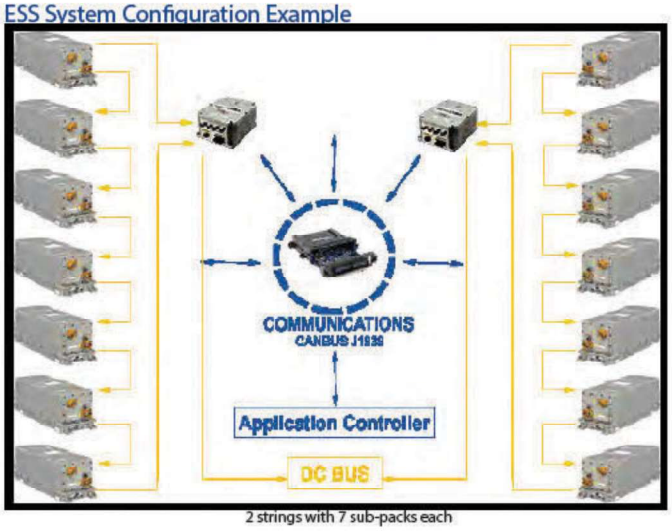
*10 seconds duration

**Cell performance will be affected by temperature, SoC, SoH, aging, etc.

Cycle Life	Typical
100% DOD Cycles @ 0.3C charge-discharge	>3,000 cycles***
80% DOD Cycles @ 0.3C charge-discharge	>4,000 cycles***

***Cycle life to 80% of rated capacity at 25°C room temperature with 10 min. step rest

ESS System Configuration Example



2 strings with 7 sub-packs each

The information contained herein is believed to be reliable, but no representation, guarantees or warranties of any kind are made to its accuracy or suitability for any purpose. The information presented herein is based on laboratory testing and does not necessarily indicate end product performance. Full scale testing and end product performance are the responsibility of the user.

www.XALTEnergy.com

XALT Energy

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08-17-2021

Section 2l

Solicitation Requirements:

TS 9.1.1 Electric Propulsion System.

Provide a list of applicable industry standards that the proposed propulsion system meets.

New Flyer response:

Provided in this section is a Sales Information Bulletin #219-003 for the Siemens Electric Propulsion. Also, is the attached documentation for the electric Vehicle Code Standards for the electric propulsion system that meet the industry standards.

Truck & Buses – Hybrid & Electric Vehicle	Society of Automotive Engineers	SAE J1715 SAE J2344 ISO 6469 FMVSS 305	Full compliance Full compliance Full compliance Full compliance
Storage Battery Standards	Society of Automotive Engineers	ISO 12405 IEC 62133 IEC 61960 IEC 62281 EN 60068 UN T 38.3 UL 1642/2202	Full compliance Full compliance Full compliance Full compliance Full compliance Full compliance
Vehicle and Charger Interface	Society of Automotive Engineers	SAE J1772 SAE J1850 SAE J2293 SAE J2836 SAE J2847	Full compliance Full compliance Full compliance Capable of compliance
Vehicle Charging Stations	Society of Automotive Engineers	SAE J2293 SAE J3105 SAE J3068 SAE J2954	Full compliance Full compliance N/A Under-development
Charging Station Components		UL Certification CSA Cetification	Full compliance Full compliance

Section 2J

Solicitation Requirements:

TS 9.1.2 Propulsion System Service.

Provide all specialty tools and diagnostic equipment required for maintaining the propulsion system in accordance with the Special Tools List.

New Flyer response:

Provided is the XE40 XE35 Tools Proposal and XE60 Tools Proposal. The tool list provides the Agency specialty tools and diagnostic tools required to maintain the Xcelsior buses.

CONTRACT DELIVERABLES LIST	DIAGNOSTICS & TOOLS
CUSTOMER NAME	Pinellas
BID/OPTION/SR NUMBER	21-128
TECHNICAL SUMMARY	Rev Draft
BUS MODEL	XE40 XE35
QUANTITY	
PROPULSION SYSTEM	Siemens ELFA 3
ALTERNATOR	Vanner EBA
ENERGY STORAGE SYSTEM	XALT Gen 3
COOLING SYSTEM	EMP
AXLES	MAN VOK07 Front, HY1350 Rear
LEVELING/KNEELING	Smartrider Lite
STEERING	Berendsen Electric
ABS	Meritor Wabco
AIR CONDITIONING	Thermo King, Intelligaire III, TE15, R407c
CABIN HEATER	Valeo Thermo Electric
PLC	Vansco
DESTINATION SIGNS	Luminator
DOORS	Vapor
WHEELCHAIR RAMP	Smartrider
BRAKE MONITORING	MGM eStroke

NOTE: TOOL KITS MAY BE SUBJECT TO CHANGE

***** All claims for concealed shortages must be reported within 20 days of shipment date. Shipping damages and / or loss must be noted on the delivering carrier waybill at the time of receipt of shipment. A copy of the carrier waybill and / or carrier inspection report must be submitted with your claim within 5 days of receipt of shipment to New Flyer Customer Service.***

PAGE REFERENCE	COMMENTS	DESCRIPTION	QUOTED PART #	REQUIREMENT	BILLABLE Y/N
		Diagnostic Equipment			
	for use with all diagnostic software	Panasonic FZ55 Toughbook Laptop	108658	Recommended	Y
		Intelligaire III Diagnostic Software & Cables	6393934	Recommended	Y
	free download from EMP website	EMP Software	NPN	Recommended	Y
		Meritor Wabco ABS Software (1-year subscription)	6334596	Recommended	Y
		Valeo Diagnostic Software & Cables	6396448	Recommended	Y
		Adapter - Diagnostic	6477477	Recommended	Y
	provided by Luminator at n/c	Luminator MIE Software	NPN	Recommended	Y
	free download from Parker-Vansco website	Vansco Software	NPN	Recommended	Y
	free download from Parker-Vansco website	PVSG Software	NPN	Recommended	Y
		Cable - PVSG Interface	6487019	Recommended	Y
	free download from Parker-Vansco website	Smartrider Software	NPN	Recommended	Y
		USB CAN Adapter - Vector Interface	6402046	Recommended	Y
	for ELFA 3	UDS Software - Vector Indigo	6487897	Recommended	Y
	for ELFA 3, optional	Annual Maintenance - Vector Indigo	6487898	Recommended	Y
	for ELFA 3, optional	Vector Keyman - USB Dongle	6487899	Recommended	Y
	provided by XALT at n/c	XALT Service Tool Software	NPN	Recommended	Y
		XALT Interface Cable - Batteries	704950	Recommended	Y
		Kit - XALT SPI Tool Universal	6482554	Recommended	Y
		Nexiq USB Link 2 - WIFI Edition	6465863	Recommended	Y
		Data Logger - Vector GL1000	6473056	Recommended	Y
		Diagnostic Kit - Vanner HBA/EBA	6406922	Recommended	Y
	provided by Berendsen at n/c	Danfoss Software - Berendsen Pwr Strg	NPN	Recommended	Y
		eStroke Diagnostic Kit - J1939	6466350	Recommended	Y
	optional stand-alone kit (not for PC)	eDT Diagnostic Handheld Kit - MGM eStroke	6412679	Recommended	Y
		Special Tools & PPE			
		Kit - Lift Tow Universal	6396565	Recommended	Y
		Kit - Lift Tow Receivers	6396567	Recommended	Y
		Xcelsior Flat Tow adapter (2 pcs. Per set)	6395097	Recommended	Y
		Jacking Adapters	434434	Recommended	Y
		Repair Kit - Disc Brakes & Calipers	6408310	Recommended	Y

PAGE REFERENCE	COMMENTS	DESCRIPTION	QUOTED PART #	REQUIREMENT	BILLABLE Y/N
		Torque Multiplier	6314711	Recommended	Y
		Hub Repair Kit - MAN VOK-07 Frt Axle	6408311	Recommended	Y
		Optional Hub Removal Hydraulic Tool Kit - MAN VOK-07	6458834	Recommended	Y
		King Pin Press Kit - MAN VOK-07 Frt Axle	6408312	Recommended	Y
		Hub Repair Kit - MAN HY1350 RR Axle	6408306	Recommended	Y
		ABS Sensor R&R Kit - MAN HY1350 RR Axle	6408307	Recommended	Y
		Pinion Seal Repair Kit - MAN HY1350 RR Axle	6444302	Recommended	Y
		Differential Repair Kit - MAN HY1350 RR Axle	6444303	Recommended	Y
		Optional Tool Kit - MAN HY1350 RR Axle	6444304	Recommended	Y
	Leak Tester for next gen ESS	Kit - Pressure Test Tool	6485784	Recommended	Y
	For next gen ESS	Head Wrench, Dessicant Canister	6485513	Recommended	Y
	For next gen ESS	Kit - ESS Coolant Pressure Tester	6486719	Recommended	Y
		Coolant System Pressure Tester	660817	Recommended	Y
		Kit - Coolant Pressure Fill	6484741	Recommended	Y
		Adj Tool - Strg Gear Box Press Relief	6465265	Recommended	Y
		Depth Punch - Strg Gear Box Press Relief	6465266	Recommended	Y
		Flow Meter Tester - Strg Gear Box	140809	Recommended	Y
		Puller Tool - Pitman Arm	6394270	Recommended	Y
		TK A/C Tool Kit - TE15 R407c	6472762	Recommended	Y
		Lifting Adapter Assy - Siemens PEM	6481413	Recommended	Y
		Lifting Device - XALT XMOD Battery Modules	6476635	Recommended	Y
	HV Tools	Detector - Voltage Self Tester	6485951	Recommended	Y
	HV Tools	Clamp Meter - 1000A Fluke 376	6487900	Recommended	Y
	HV Tools	Fluke 2 in 1 Multimeter - 1587FC	6400746	Recommended	Y
	HV Tools	McMaster Conductivity Meter	6473771	Recommended	Y
	HV Tools	modular test lead kit	6473267	Recommended	Y
	HV Tools	test probe flat blade	6473268	Recommended	Y
	HV Tools	test probe back probe	6473269	Recommended	Y
	HV Tools	Wiha Insulated Master Electrician's tool kit	6473445	Recommended	Y
	HV Tools	wiha 1/4 in ratchet set insulated SAE	6473447	Recommended	Y
	HV Tools	wiha 1/4 in ratchet set insulated Metric	6473448	Recommended	Y
	HV Tools	16 PC 3/8 drive socket set	6473449	Recommended	Y
	HV Tools	3/8 Extension set	6473450	Recommended	Y
	HV Tools	3/8 Extension set	6473451	Recommended	Y
	HV Tools	wiha open end wrench insulated metric	6473452	Recommended	Y
	HV Tools	wiha open end wrench insulated sae	6473453	Recommended	Y
	HV Tools	Wiha insulated Serrated Tweezers Straight	6473454	Recommended	Y
	HV Tools	Wiha insulated Serrated Tweezers Angled	6473455	Recommended	Y
	HV Tools	Insulated Torque Wrench 1/4"	6473456	Recommended	Y
	HV Tools	Insulated Torque Wrench 3/8"	6472024	Recommended	Y
	HV Tools	Insulated Torque Wrench 1/2"	6473457	Recommended	Y
	HV Tools	torque screwdriver set	6473458	Recommended	Y
	HV Tools	insulated crimper 30 - 6 Awg 7"	6473459	Recommended	Y
	HV Tools	wire striper 6 - 3/8 overall 20 to 10	6473460	Recommended	Y
	HV Tools	insulated water pump pliers v-jaw	6473461	Recommended	Y
	HV Tools	insolated hex key set 10pc metric	6473462	Recommended	Y
	HV Tools	Long SAE Natural insulated hex key set 12 pc	6473463	Recommended	Y
	HV Tools	bit driver	6473464	Recommended	Y
	HV Tools	Stubby Bit Driver	6473465	Recommended	Y
	HV Tools	Wiha Insulated "bitFlip" Set	6472034	Recommended	Y
	HV Tools	Mini Screw Driver set	6473466	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC Small	6471958	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC Medium	6473412	Recommended	Y

PAGE REFERENCE	COMMENTS	DESCRIPTION	QUOTED PART #	REQUIREMENT	BILLABLE Y/N
	PPE	ARC Flash Protection Clothing Kit - 2PC Large	6473413	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC XL	6473414	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC 2XL	6471962	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC 3XL	6471963	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC 4XL	6471964	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC 5XL	6471965	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC Small	6471966	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC Medium	6473415	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC Large	6473416	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC XL	6473417	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC 2XL	6473418	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC 3XL	6471971	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC 4XL	6471972	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC 5XL	6471973	Recommended	Y
	PPE	Balaclava Head Cover one size fits all	6473440	Recommended	Y
	PPE	Hard Hat and Face Shield one size fits all	6368561	Recommended	Y
	PPE	Fall Saftey Harness 425LBS	6473270	Recommended	Y
	PPE	Black electrical glove kit, Size 7	6471976	Recommended	Y
	PPE	Black electrical glove kit, Size 8	6473420	Recommended	Y
	PPE	Black electrical glove kit, Size 8.5	6471978	Recommended	Y
	PPE	Black electrical glove kit, size 9	6471979	Recommended	Y
	PPE	Black electrical glove kit, Size 9.5	6473421	Recommended	Y
	PPE	Black electrical glove kit, size 10	6473422	Recommended	Y
	PPE	Black electrical glove kit, Size 10.5	6473423	Recommended	Y
	PPE	Black electrical glove kit, size 11	6473424	Recommended	Y
	PPE	Black electrical glove kit, size 12`	6473425	Recommended	Y
	PPE	HV Blanket 3' x 3'	6473431	Recommended	Y
	PPE	Blanket Clamp 9-1/2" L, 5" Opening	6473432	Recommended	Y
	PPE	Glove Dust 0.5oz	6473433	Recommended	Y
	PPE	Rescue Hook 6FT	6400745	Recommended	Y
	PPE	Defibrillator Adult	6473177	Recommended	Y
	PPE	Brady Personal Lockout Pouch Kit	6473441	Recommended	Y
	PPE	Steel Lock Hasp with Tab	6473442	Recommended	Y
	PPE	American lock A1106RED	6473443	Recommended	Y
	PPE	Lock Out Tag	6473444	Recommended	Y
	PPE	Hv Warning sign	6473436	Recommended	Y
	PPE	Arc Flash Warning sign	6473437	Recommended	Y
	PPE	steering wheel covers	6473439	Recommended	Y

Sales Specialist
New Flyer

[redacted]

CONTRACT DELIVERABLES LIST	DIAGNOSTICS & TOOLS
CUSTOMER NAME	Pinellas
BID/OPTION/SR NUMBER	21-128
TECHNICAL SUMMARY	Rev Draft
BUS MODEL	XE60
QUANTITY	
PROPULSION SYSTEM	Siemens ELFA 3
ALTERNATOR	Vanner EBA
ENERGY STORAGE SYSTEM	XALT Gen 3
COOLING SYSTEM	EMP
AXLES	MAN VOK07 Front, HY1350 Rear, ZF AVE130 Ctr
LEVELING/KNEELING	Smartrider Lite
STEERING	Berendsen Electric
ABS	Meritor Wabco
AIR CONDITIONING	Thermo King, Intelligaire III, TE/RLFE, R407c
CABIN HEATER	Valeo Thermo Electric
PLC	Vansco
DESTINATION SIGNS	Luminator
DOORS	Vapor
WHEELCHAIR RAMP	Smartrider
ARTICULATED JOINT	ATG/PEI
BRAKE MONITORING	MGM eStroke

NOTE: TOOL KITS MAY BE SUBJECT TO CHANGE

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PAGE REFERENCE	COMMENTS	DESCRIPTION	QUOTED PART #	REQUIREMENT	BILLABLE Y/N
		Diagnostic Equipment			
	for use with all diagnostic software	Panasonic FZ55 Toughbook Laptop	108658	Recommended	Y
		Intelligaire III Diagnostic Software & Cables	6393934	Recommended	Y
	free download from EMP website	EMP Software	NPN	Recommended	Y
		Meritor Wabco ABS Software (1-year subscription)	6334596	Recommended	Y
		Valeo Diagnostic Software & Cables	6396448	Recommended	Y
		Adapter - Diagnostic	6477477	Recommended	Y
	provided by Luminator at n/c	Luminator MIE Software	NPN	Recommended	Y
	free download from Parker-Vansco website	Vansco Software	NPN	Recommended	Y
	free download from Parker-Vansco website	PVSG Software	NPN	Recommended	Y
		Cable - PVSG Interface	6487019	Recommended	Y
	free download from Parker-Vansco website	Smartrider Software	NPN	Recommended	Y
		USB CAN Adapter - Vector Interface	6402046	Recommended	Y
	for ELFA 3	UDS Software - Vector Indigo	6487897	Recommended	Y
	for ELFA 3, optional	Annual Maintenance - Vector Indigo	6487898	Recommended	Y
	for ELFA 3, optional	Vector Keyman - USB Dongle	6487899	Recommended	Y
	provided by XALT at n/c	XALT Service Tool Software	NPN	Recommended	Y
		XALT Interface Cable - Batteries	704950	Recommended	Y
		Kit - XALT SPI Tool Universal	6482554	Recommended	Y
		Nexiq USB Link 2 - WIFI Edition	6465863	Recommended	Y
		Data Logger - Vector GL1000	6473056	Recommended	Y
		Diagnostic Kit - Vanner HBA/EBA	6406922	Recommended	Y
	provided by Berendsen at n/c	Danfoss Software - Berendsen Pwr Strg	NPN	Recommended	Y
		eStroke Diagnostic Kit - J1939	6466350	Recommended	Y
	optional stand-alone kit (not for PC)	eDT Diagnostic Handheld Kit - MGM eStroke	6412679	Recommended	Y
		Special Tools & PPE			
		Kit - Lift Tow Universal	6396565	Recommended	Y
		Kit - Lift Tow Receivers	6396567	Recommended	Y
		Xcelsior Flat Tow adapter (2 pcs. Per set)	6395097	Recommended	Y

PAGE REFERENCE	COMMENTS	DESCRIPTION	QUOTED PART #	REQUIREMENT	BILLABLE Y/N
		Jacking Adapters	434434	Recommended	Y
		Repair Kit - Disc Brakes & Calipers	6408310	Recommended	Y
		Torque Multiplier	6314711	Recommended	Y
		Hub Repair Kit - MAN VOK-07 Frt Axle	6408311	Recommended	Y
		Optional Hub Removal Hydraulic Tool Kit - MAN VOK-07	6458834	Recommended	Y
		King Pin Press Kit - MAN VOK-07 Frt Axle	6408312	Recommended	Y
		Hub Repair Kit - MAN HY1350 RR Axle	6408306	Recommended	Y
		ABS Sensor R&R Kit - MAN HY1350 RR Axle	6408307	Recommended	Y
		Pinion Seal Repair Kit - MAN HY1350 RR Axle	6444302	Recommended	Y
		Differential Repair Kit - MAN HY1350 RR Axle	6444303	Recommended	Y
		Optional Tool Kit - MAN HY1350 RR Axle	6444304	Recommended	Y
		ZF AVE130 Center Axle Tool Kit	6476735	Recommended	Y
	Leak Tester for next gen ESS	Kit - Pressure Test Tool	6485784	Recommended	Y
	For next gen ESS	Head Wrench, Dessicant Canister	6485513	Recommended	Y
	For next gen ESS	Kit - ESS Coolant Pressure Tester	6486719	Recommended	Y
		Coolant System Pressure Tester	660817	Recommended	Y
		Kit - Coolant Pressure Fill	6484741	Recommended	Y
		Adj Tool - Strg Gear Box Press Relief	6465265	Recommended	Y
		Depth Punch - Strg Gear Box Press Relief	6465266	Recommended	Y
		Flow Meter Tester - Strg Gear Box	140809	Recommended	Y
		Puller Tool - Pitman Arm	6394270	Recommended	Y
		TK A/C Tool Kit - TE15 R407c	6472762	Recommended	Y
		Accumulator Fill and Test Kit	6458813	Recommended	Y
		Pressure Regulator - ATG Accumulator	6465316	Recommended	Y
		Swivel Union - ATG Accumulator	6465317	Recommended	Y
		Adapter - ATG Accumulator	6465318	Recommended	Y
		Hydraulic Block Torque Kit	6353626	Recommended	Y
		Cylinder Pin Holder	6353636	Recommended	Y
		Cylinder Pin Extractor	6353637	Recommended	Y
		Hydraulic Fill and Test Kit	6358964	Recommended	Y
		Roof Strut R&R Tool	6359042	Recommended	Y
		Eye Bolt	6357775	Recommended	Y
		Wrist Joint Nut Restraint	6461222	Recommended	Y
		Socket, 32mm	6389935	Recommended	Y
		Torque Multiplier, 1350 Nm	6389936	Recommended	Y
		Holder, Cover Plate	6389937	Recommended	Y
		Repair Kit - PEI Bellows	6469948	Recommended	Y
		Pneumatic Crimper Kit - PEI Bellows	6470145	Recommended	Y
		Lifting Adapter Assy - Siemens PEM	6481413	Recommended	Y
		Lifting Device - XALT XMOD Battery Modules	6476635	Recommended	Y
	HV Tools	Detector - Voltage Self Tester	6485951	Recommended	Y
	HV Tools	Clamp Meter - 1000A Fluke 376	6487900	Recommended	Y
	HV Tools	Fluke 2 in 1 Multimeter - 1587FC	6400746	Recommended	Y
	HV Tools	McMaster Conductivity Meter	6473771	Recommended	Y
	HV Tools	modular test lead kit	6473267	Recommended	Y
	HV Tools	test probe flat blade	6473268	Recommended	Y
	HV Tools	test probe back probe	6473269	Recommended	Y
	HV Tools	Wiha Insulated Master Electrician's tool kit	6473445	Recommended	Y
	HV Tools	wiha 1/4 in ratchet set insulated SAE	6473447	Recommended	Y
	HV Tools	wiha 1/4 in ratchet set insulated Metric	6473448	Recommended	Y
	HV Tools	16 PC 3/8 drive socket set	6473449	Recommended	Y
	HV Tools	3/8 Extension set	6473450	Recommended	Y

PAGE REFERENCE	COMMENTS	DESCRIPTION	QUOTED PART #	REQUIREMENT	BILLABLE Y/N
	HV Tools	3/8 Extension set	6473451	Recommended	Y
	HV Tools	wiha open end wrench insulated metric	6473452	Recommended	Y
	HV Tools	wiha open end wrench insulated sae	6473453	Recommended	Y
	HV Tools	Wiha insulated Serrated Tweezers Straight	6473454	Recommended	Y
	HV Tools	Wiha insulated Serrated Tweezers Angled	6473455	Recommended	Y
	HV Tools	Insulated Torque Wrench 1/4"	6473456	Recommended	Y
	HV Tools	Insulated Torque Wrench 3/8"	6472024	Recommended	Y
	HV Tools	Insulated Torque Wrench 1/2"	6473457	Recommended	Y
	HV Tools	torque screwdriver set	6473458	Recommended	Y
	HV Tools	insulated crimper 30 - 6 Awg 7"	6473459	Recommended	Y
	HV Tools	wire striper 6 - 3/8 overall 20 to 10	6473460	Recommended	Y
	HV Tools	insulated water pump pliers v-jaw	6473461	Recommended	Y
	HV Tools	insolated hex key set 10pc metric	6473462	Recommended	Y
	HV Tools	Long SAE Natural insulated hex key set 12 pc	6473463	Recommended	Y
	HV Tools	bit driver	6473464	Recommended	Y
	HV Tools	Stubby Bit Driver	6473465	Recommended	Y
	HV Tools	Wiha Insulated "bitFlip" Set	6472034	Recommended	Y
	HV Tools	Mini Screw Driver set	6473466	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC Small	6471958	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC Medium	6473412	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC Large	6473413	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC XL	6473414	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC 2XL	6471962	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC 3XL	6471963	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC 4XL	6471964	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 2PC 5XL	6471965	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC Small	6471966	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC Medium	6473415	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC Large	6473416	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC XL	6473417	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC 2XL	6473418	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC 3XL	6471971	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC 4XL	6471972	Recommended	Y
	PPE	ARC Flash Protection Clothing Kit - 1PC 5XL	6471973	Recommended	Y
	PPE	Balaclava Head Cover one size fits all	6473440	Recommended	Y
	PPE	Hard Hat and Face Shield one size fits all	6368561	Recommended	Y
	PPE	Fall Saftey Harness 425LBS	6473270	Recommended	Y
	PPE	Black electrical glove kit, Size 7	6471976	Recommended	Y
	PPE	Black electrical glove kit, Size 8	6473420	Recommended	Y
	PPE	Black electrical glove kit, Size 8.5	6471978	Recommended	Y
	PPE	Black electrical glove kit, size 9	6471979	Recommended	Y
	PPE	Black electrical glove kit, Size 9.5	6473421	Recommended	Y
	PPE	Black electrical glove kit, size 10	6473422	Recommended	Y
	PPE	Black electrical glove kit, Size 10.5	6473423	Recommended	Y
	PPE	Black electrical glove kit, size 11	6473424	Recommended	Y
	PPE	Black electrical glove kit, size 12`	6473425	Recommended	Y
	PPE	HV Blanket 3' x 3'	6473431	Recommended	Y
	PPE	Blanket Clamp 9-1/2" L, 5" Opening	6473432	Recommended	Y
	PPE	Glove Dust 0 5oz	6473433	Recommended	Y
	PPE	Rescue Hook 6FT	6400745	Recommended	Y
	PPE	Defibrillator Adult	6473177	Recommended	Y
	PPE	Brady Personal Lockout Pouch Kit	6473441	Recommended	Y

PAGE REFERENCE	COMMENTS	DESCRIPTION	QUOTED PART #	REQUIREMENT	BILLABLE Y/N
	PPE	Steel Lock Hasp with Tab	6473442	Recommended	Y
	PPE	American lock A1106RED	6473443	Recommended	Y
	PPE	Lock Out Tag	6473444	Recommended	Y
	PPE	Hv Warning sign	6473436	Recommended	Y
	PPE	Arc Flash Warning sign	6473437	Recommended	Y
	PPE	steering wheel covers	6473439	Recommended	Y

Sales Specialist
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[redacted]
Training
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Section 2K1

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Include a description of all battery maintenance requirements including any periodic charge requirements necessary for cell balancing.

New Flyer response:

Please refer to attachment in 2K1 for XE40 Battery Maintenance.
In this document we are providing a full maintenance guide for the XE bus.
Please note that the pages in this document that cover the battery maintenance are as follows:

Pages 2, 3, 5, 6, 7,17-21, 26, 27, 32, 107-109, 118 and 120.

Please refer to attachment in 2K1 for XE60 Bty Maintenance.
In this document we are providing a full maintenance guide for the XE bus.
Please note that the pages in this document that cover the battery maintenance are as follows:

Pages 2, 5, 6, 7, 9, 14, 17-21, 26, 27, 30, 80, 92-94, 109-112, 128.

The above listed information will give the Agencies material that will assist in the battery maintenance for all Xcelsior buses.

2. PREVENTIVE MAINTENANCE

2.1. Introduction

The transit authority is responsible for the performance of all scheduled maintenance as outlined in this preventive maintenance manual to maintain the New Flyer vehicle warranty. New Flyer reserves the right to deny warranty coverage on claims due to lack of maintenance, misuse, abuse or neglect.

The maintenance intervals indicated in this manual are based upon average vehicle use and typical operating conditions. Unusual vehicle operating conditions, such as geographic environmental conditions, will require service at more frequent intervals. It is the customer's responsibility based upon experience with localized environmental conditions and local regulations to determine if more frequent intervals are required. If you are unsure, please contact your New Flyer Customer Service Technical Support representative.

All the described maintenance operations must be performed by qualified personnel using standard shop practices. All replacement parts used for maintenance services or repairs must be OEM parts or parts with equivalent quality and performance. Use of inferior parts will void the warranty. Warranty claims in question must be supported by preventive maintenance records.

Consumable maintenance items such as (but not limited to) lights, light bulbs, lamps, belts, bushings, and items with progressive wear characteristics, lubricants, fluids, filters, hoses, wiper blades and tires are not covered by warranty.

Refer to the illustrations included with this section as a guide to location of servicing points.

For compliance to warranties covering the following equipment, refer to complete preventive maintenance intervals and procedures contained in the applicable vendor supplied information:

- ❒ Xalt Xpand Battery Packs
- ❒ Siemens Traction Motor
- ❒ Siemens Distribution Boxes
- ❒ Siemens Insulating Monitoring Device
- ❒ Thermo King HVAC Unit
- ❒ Spheros/Valeo Electric Coolant Heater
- ❒ Amerex Fire Suppression System
- ❒ ChargePoint Depot Charger

2.2. Rear Axle Operating Conditions

The rear axle oil change interval is determined by operating conditions that affect the temperature of the oil in the axle. The following criteria have been established to assess the severity of the conditions under which the axle will be operated:

- ❒ Moderate Region - this description will apply to all regions where the average monthly temperature does not exceed 25°C (77°F) for more than two months of the year.
- ❒ Hot Region - this description will apply to all regions where the average monthly temperature exceeds 25°C (77°F) for more than two months of the year.

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2.3. Run-In Maintenance

Certain procedures described in this section are designed to ensure a smooth vehicle run-in process. Perform the following procedures as part of vehicle run-in. Thereafter, Refer to 2.5. “Preventive Maintenance Guide” on page 13 in this section for regularly scheduled maintenance intervals on this equipment.

- ❒ Wheels - Check wheel torque upon receipt of vehicle. Refer to Section 1 and 2 of this manual for torque specifications and sequence.
- ❒ Rear Axle - Change oil upon receipt of vehicle, Check oil level after first 3,000 miles (4,800 km). Refer to Section 2 of this manual for oil drain and fill procedure. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for fluid specification.

2.4. Conditional Maintenance

The following items are subject to maintenance on a conditional basis and do not have a specific interval assigned against the maintenance requirement:

- ❒ Rear Axle Oil Filter - Replace the rear axle oil filter whenever the differential is removed from the axle housing. Refer to Section 2 of this manual for replacement procedure.
- ❒ Rear Axle Wheel Bearings - Repack wheel bearings and hub cavity with grease whenever the wheel bearings or grease seals are being serviced. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for grease specification. Refer to Section 2 of this manual for grease repacking procedure.

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2.5. Preventive Maintenance Guide

INTERVALS (Daily - Monthly)		
DAILY	**WEEKLY**	**MONTHLY**
Exterior Check	HVAC System Test	HVAC System Inspection
Operational Check		Bike Rack Inspection
Wheelchair Ramp		Air Tanks
Wheelchair Tie-Down & Occupant Restraints		Fire Suppression System
Bike Rack Inspection		Fire Extinguisher
Floor Covering		Depot Charging Station Inspection
Fire Suppression System		Traction Motor Inspection
S-1 Gard		
Depot Charging Station Inspection		

INTERVALS (Quarterly - 12,000 mi.)		
QUARTERLY	**6,000 mi. (9,600 km)**	**12,000 mi. (19,300 km)**
High Voltage Power Cable Inspection	Disc Brake Pad Inspection	Electronic Accelerator
HVAC System Inspection & Test	Wheels & Tires Inspection	Driver's Heater/Defroster
Low Voltage Electrical Wiring Inspection	Driveshaft	S-1 Gard
Rooftop Electronics Rack Inspection	Steering System Inspection	Driver's Seat Inspection
High Voltage DC-DC Converter Inspection	Steering Driveshafts	
Traction Motor/Inverter Radiator Inspection	Steering Damper	
ESS Condenser Inspection	Shock Absorber Inspection	
High Voltage Charging Receptacle Inspection	Ride Height	

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INTERVALS (Quarterly - 12,000 mi.)		
QUARTERLY	**6,000 mi. (9,600 km)**	**12,000 mi. (19,300 km)**
High Voltage Accessory Power Cable Inspection	Air Springs	
HVAC High Voltage Power Cable Inspection	Front & Rear Axles & Suspension	
Air Compressor Air Filter Inspection	Front Stabilizer Bar Inspection	
Electronic Equipment Enclosure Ventilator Inspection	Radius Rods	
Power Steering System Inspection	Air System Inspection & Functional Tests	
	Driver's Window	
	Window Emergency Release System	
	Interior & Exterior Access Doors	
	Roof Vent/Hatch	
	Splash Guards	
	Windshield Wiper & Washer	
	Driver's Seat	
	Passenger Seats	
	Stanchions & Grab Rails	
	Wheelchair Tie-Down & Occupant Restraints	
	Interior Panels	
	Exterior Panels	
	Battery System (12/24 VDC)	
	Wheelchair Ramp Inspection	
	Driver's Heater/Defroster	
	HVAC Return Air Filter	
	Rear Axle Breather Tube	

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INTERVALS (24,000 - 54,000 mi.)			
24,000 mi. (38,600 km)	**36,000 mi. (58,000 km)**	**48,000 mi. (77,200 km)**	**54,000 mi, (87,000 km)**
Driver's Seat Inspection	Disc Brake Caliper Inspection	Front End Alignment	Rear Axle Oil Change (Moderate Region Only - see NOTE at the end of this chart)
Air Dryer	Rear Axle Oil Change (Hot Region Only - see NOTE at the end of this chart)	Driver's Seat Inspection	
Brake Treadle Assembly & Brake Valve		Front Brake Chambers	
		Rear Brake Chambers	

INTERVALS (96,000 - 250,000 mi.)		
96,000 mi. (154,500 km)	**150,000 mi. (241,400 km)**	**250,000 mi. (400,000 km)**
Front End Alignment	Battery Compartment Access Door Inspection	Stabilizer Bar Mounting Bolt Replacement
		Support Frame Inspection

INTERVALS (6 Months - 2 Years)		
6 MONTHS	**YEARLY**	**2 YEARS**
PR-2 Pressure Protection Valve	Door Sensitive Edge Inspection & Test	Fire Suppression System
ST-1 Safety Valve	Wheelchair Ramp Pump Hydraulic Fluid	Door System Inspection
SR-7 Spring Brake Modulating Valve	Instrument Panel & Side Console	Traction Motor Lubrication
SC-1 Single Check Valve	Fire Extinguisher	Cooling/Heating System Coolant Change
DC-4 Double Check Valve	QR-1 Quick Release Valve	ESS Battery System Coolant Change
RV-3 Pressure Reducing Valve	Air Strainer	ESS Coolant Filter Replacement

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INTERVALS (6 Months - 2 Years)		
6 MONTHS	**YEARLY**	**2 YEARS**
R-14 Brake Relay Valve	Headlight Aim	Motor/Inverter Radiator Inspection & Cleaning
Brake Foot Valve	Front & Rear Wheel Bearing Inspection	
Parking Brake Control Valve	Support Frame Inspection	
Emergency Brake Release Valve	Air Dryer	
Steering Knuckle Lubrication	HVAC System Inspection & Test	
Battery Compartment Access Door Inspection	Electric Coolant Heater	
Bike Rack Servicing	Power Steering Pump	
Fire Suppression System	Low Voltage Distribution Box (DICO)	
Power Steering Miter Box	Auxiliary Power Distribution Box	
Cooling & Heating System Inspection	High Voltage Distribution and Fuse Box	
HVAC System Test & Lubrication	Insulation Monitoring Device (IMD) Box	
Battery Rack Inspection	Battery Rack Inspection	
	Depot Charging Station Inspection	
	Traction Motor/Inverter Radiator Inspection	
	Electric Coolant Heater	

INTERVALS (3 - 6 Years)			
3 YEARS	**4 YEARS**	**5 YEARS**	**6 YEARS**
Under Body Inspection	Air Compressor Cleaning, Lubrication, & Parts Replacement	Door Operator Proximity Switches	Fire Suppression System
		Door Component Replacement	Fire Extinguisher

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INTERVALS (3 - 6 Years)			
3 YEARS	**4 YEARS**	**5 YEARS**	**6 YEARS**
		Electric Coolant Heater	Air Compressor Motor Lubrication
		Depot Charging Station Coolant Change & Inspection	Power Steering Oil & Filter Change

INTERVALS (10 - 16 Years)			
10 YEARS	**12 YEARS**	**15 YEARS**	**16 YEARS**
Door Component Replacement	Fire Extinguisher	Traction Motor Bearing Replacement	Air Compressor Component Replacement
Depot Charging Station Inspection	Fire Suppression System		
	Electric Coolant Heater		

☞NOTE:

Moderate regions are defined as geographic locations where the average monthly temperature does not exceed 25°C (77°F) for more than two months of the year.

Hot regions are defined as geographic locations where the average monthly temperature exceeds 25°C (77°F) for more than two months of the year.

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2.6. Daily Preventive Maintenance

2.6.1. Exterior Check

- ❒ Wheels are undamaged and studs and nuts are secure.
- ❒ Tires correctly inflated.
- ❒ Vehicle is level.
- ❒ Exterior panels are undamaged.
- ❒ No fluid leaks exist under vehicle.
- ❒ No fluid leaks exist at axles.
- ❒ Motor & Inverter coolant reservoir level is correct.
- ❒ ESS Battery coolant reservoir level is correct.
- ❒ Cabin heating coolant reservoir level is correct.
- ❒ Power steering reservoir level is correct.

2.6.2. Operational Check

Start the vehicle and check the following for correct condition and operation.

- ❒ Low air warning indicator and buzzer.
- ❒ Instrument panel indicators.
- ❒ Turn signals.
- ❒ Door control.
- ❒ Mirror condition and adjustment.
- ❒ Window and windshield visibility.
- ❒ Windshield wipers and washer.
- ❒ Destination signs.
- ❒ Front and rear doors.
- ❒ Exit door sensitive edge.
- ❒ Wheelchair ramp.
- ❒ Interior and exterior lights.
- ❒ Steering column.
- ❒ Door master switch.
- ❒ Headlights.
- ❒ Door manual air release valve.
- ❒ Passenger signals.
- ❒ Instrument panel gauges.
- ❒ Brake pedal.
- ❒ Parking brake.
- ❒ Accelerator.
- ❒ Shift selector.
- ❒ Air system charges to 125 psi within 5 minutes if system is fully depleted.

☞NOTE:

If any of these systems do not operate correctly, or if a fault indicator illuminates, DO NOT drive the vehicle. Refer to Section 19 of this manual for details on the correct operation of all vehicle controls.

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2.6.3. Wheelchair Ramp

Inspect the wheelchair ramp area for cleanliness on a regular basis depending on operating conditions. Exposure to salt, sand, or slush during the winter months may require inspection on a daily basis. Likewise, operating in gritty, dusty conditions during the summer months will require more frequent inspections. Clean any dirt or foreign matter from the ramp, hinge, and operating shaft areas. Inspect the recessed area between the floor and ramp for any accumulation of debris. Manually deploy and stow the ramp to check for smooth operation. Inspect hinge for binding or distortion. Repair or replace hinge as necessary.

2.6.4. Wheelchair Tie-Down & Occupant Restraints

[redacted]

If the vehicle was involved in an impact situation, significant enough to have the vehicle towed, then the wheelchair tie-downs, occupant restraints, and anchorages that were in use at the time should be replaced.

The following items should be inspected on a daily basis:

- ❒ Check belt retractor mechanism by extending and releasing belt. Ensure belt retractor operates as designed and functions smoothly.
- ❒ Inspect belts to ensure webbing is not cut, frayed, damaged, or contaminated by polishes, oils, or chemicals.
- ❒ Operate buckles and any locking or release mechanisms. Ensure mechanisms operate smoothly and release completely.
- ❒ Ensure all floor anchors are secure and free of obstructions, debris and dirt. Tighten mounting hardware as required.

☞NOTE:

If any mounting hardware requires tightening or adjustment, the fastener must be removed to have the threads cleaned and Loctite 243 reapplied/

- ❒ Ensure all wall anchors for belts are properly secured and allow proper freedom of movement.
- ❒ Ensure floor surface in wheelchair restraint area is undamaged and free of any condition which would impede use of equipment.
- ❒ Ensure the belts are kept clean and recoiled within the retractor when not in use.
- ❒ Ensure all labels detailing use of restraint equipment are undamaged and clearly legible.

2.6.5. Bike Rack Inspection

Inspect the bike rack on a daily basis as follows:

- ❒ Check the hex cap nut on the latch assembly to ensure it is tight. Tighten as required.
- ❒ Check for presence of two black plastic end plugs near the ends of the lowering tube on the main frame of the bike rack. Replace end plugs if missing or damaged.
- ❒ Check for presence of bolts on support arms. Replace as required.
- ❒ Check for presence of magnets which are used for stowing hook arms.
- ❒ Ensure that the hook arms slide smoothly and self stow on magnets. DO NOT lubricate the support arm assembly.
- ❒ Ensure that the latch releases easily without binding.
- ❒ Ensure that the rack pivots freely and locks in both the deployed and stowed position.
- ❒ Ensure that the instruction labels are intact and legible. Replace any damaged or illegible labels.
- ❒ Inspect the clevis pins and split rings that attach the support arm assembly to the bracket. Replace missing or damaged parts.

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2.6.6. Floor Covering

CAUTION

DO NOT clean the vehicle interior with pressure washing equipment. This type of cleaning causes excessive soaking of the floor covering and can result in separation of the rubber floor covering from the floor substrate, warping or deterioration of the floor substrate, and possible damage to floor mounted equipment such as floor heaters.

Inspect the interior flooring for cleanliness on a regular basis depending on operating conditions. Exposure to salt, sand, or slush during the winter months may require inspection on a daily basis.

- ❒ Vacuum or sweep the floor area daily to remove surface soil before it becomes embedded in the rubber floor covering.
- ❒ Wash the floor using a mild detergent and a minimum amount of water to avoid soaking seams and edge areas.
- ❒ Visually inspect rubber flooring for gouges, cracks, seam separation, lifting, or any other damage. Refer to Section 12 of this manual for floor covering repair procedures.

CAUTION

Damaged rubber flooring covering must be repaired immediately to prevent water intrusion and subsequent damage to the wood flooring.

2.6.7. Fire Suppression System

Check the operational status of the fire suppression system on a daily basis. Set the Master Run switch to DAY-RUN and observe the display panel for the following:

- ❒ The display should read “System OK” immediately following self-configuration.
- ❒ Confirm that the system POWER green LED is illuminated.
- ❒ Confirm that both the FIRE red LED and TROUBLE yellow LED are extinguished.
- ❒ Confirm that both GAS CONCENTRATION LED’s (if equipped) are extinguished.
- ❒ Confirm that the RELAY RESET red LED is extinguished

☞NOTE:

DO NOT operate the vehicle if any of the red or yellow LED’s are illuminated. Contact service personnel to investigate the cause.

2.6.8. S-1 Gard

As part of the exterior vehicle inspection, ensure the S-1 Gard is securely in place, is installed level to the ground and is undamaged. Make note of any damage, such as twists or tears in the guard material.

2.6.9. Depot Charging Station Inspection

Perform a visual inspection of the station to ensure there is no debris or any substance blocking the front and rear vents.

☞NOTE:

During the winter months, do not allow snow to build up any more that 10 in. (25 mm) to ensure proper ventilation.

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2.7. Weekly Preventive Maintenance

2.7.1. HVAC System Test

Operate all systems periodically, especially during the off season. By operating the system weekly for short intervals (5 to 10 minutes) year round, the internal parts of the compressor will remain lubricated. Off-season operation also helps reduce compressor shaft seal leakage and allows early detection of refrigerant loss.

⚠CAUTION

Prior to operating the compressor during winter months, you must warm up the vehicle interior to normal operating temperature (60 to 76 F [15 to 21 C]). Unless this precaution is taken, liquid refrigerant might be forced into the compressor, causing severe damage.

2.8. Monthly Preventive Maintenance

2.8.1. HVAC System Inspection

☞NOTE:

The following inspection requirements also apply to the ESS Battery Chiller.

Perform the following maintenance tasks every month or 6,000 miles (9,600 km), whichever occurs first. Refer to your Thermo King Maintenance Manual for procedures.

- ❒ Check refrigerant charge.
- ❒ Visually inspect condition of refrigerant hoses and tubing.
- ❒ Visually inspect for refrigerant and oil leaks.
- ❒ Check “dry eye” in the liquid line sight glass for moisture content.
- ❒ Inspect condenser and evaporator coils for cleanliness.
- ❒ Visually inspect unit for loose damaged, or broken parts.

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2.8.2. Bike Rack Inspection

Inspect the bike rack on a monthly basis as part of general maintenance. In addition to the general maintenance inspection, perform specific servicing and repairs resulting from the monthly general maintenance inspection. Refer to Section 13 of this manual for specific servicing and repair procedures.

- ❒ Ensure that the rack swings freely between stowed and deployed positions.
- ❒ Ensure that the release latch functions easily without binding in the release position.
- ❒ Ensure that the release latch locks securely in both the stowed and deployed positions.
- ❒ Ensure that the support arm hinge permits the support arm to raise and lower without binding.
- ❒ Ensure that the support arm magnet contacts and retains the support arm. Adjust magnet position as required.
- ❒ Ensure that the support arm hooks pull out smoothly, stop at the stop screw, slide easily into the stowed position, and self stow on the magnet when released.
- ❒ Check the pivot bolt assemblies to ensure they are tight.
- ❒ Check pivot bolt bronze oilite bushings for wear or cracks. Replace as necessary.
- ❒ Check that all mounting bracket fasteners are tight, including the hardware for the support strap, quadrant, pivot plate to bracket pieces, and bracket pieces to vehicle bumper/structure.
- ❒ Check for presence of two black plastic end plugs near the ends of the lowering tube on the main frame of the bike rack. Replace end plugs if missing or damaged.
- ❒ Check torsion spring wear pad for excessive wear or loose attachment to frame.
- ❒ Check torsion spring pivot bolts for tightness.
- ❒ Ensure torsion springs do not interfere with rack deployment.
- ❒ Ensure that the instruction labels are intact and legible. Replace any damaged or illegible labels. Clean the bike rack surface with isopropyl alcohol before applying new label.
- ❒ Inspect stainless steel surfaces for evidence of surface rust. Use naval jelly to remove rust.

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2.8.3. Air Tanks

It is recommended that all air tanks be drained monthly and a record of the contents collected be recorded. Performing these inspections on a regular basis will establish trend monitoring to assess the performance of the compressor (excessive oil passing) and air dyer (saturated desiccant cartridge).

The following factors can influence that amount of water collected and should be taken into consideration before making an assessment:

- ❒ An outside air source was used to charge the system and did not pass through the air dryer.
- ❒ Exceptionally high air usage, exceeding 25% compressor duty cycle due to either heavy accessory demand or system leakage
- ❒ Daily temperature range exceeds 30°F (17°C) resulting in condensation. Under these conditions the presence of small amounts of moisture is normal and should not be considered as an indication that the air dryer is not functioning properly.

☞NOTE:

A small amount of oil in the system is not unusual and should not be considered a reason to replace the desiccant cartridge. Oil stained desiccant can function adequately.

Perform the air tank drain and collection process as follows:

1. Obtain Bendix BASIC test kit or equivalent.
2. Park the vehicle on level ground and chock the wheels.
3. Place the collection cup at each drain valve and slowly drain the air tank. Repeat this process for all air tanks and collect total contents in a single collection cup.
4. Allow contents in collection cup to settle and assess whether fluid is primarily water, oil, or an emulsion.
5. Evaluate volume collected as follows:
   a. More than one unit of oil in a 30 day period will require the desiccant cartridges to be changed and is considered cause for further inspection of the air compressor. Worn pistons or rings will allow oil bypass and may require repair if amount of oil bypassed is excessive. Also inspect compressor discharge line for excessive carbon buildup.
   b. More than one unit of water or emulsion will be cause to conduct an air system leakage test. Refer to Section 8 of this manual for procedure.
   c. More than five units of water in a 30 day period indicates unsatisfactory air dryer performance. Replace air dryer desiccant cartridges.

2.8.4. Fire Suppression System

- ❒ Open access door behind streetside light panel, opposite the exit door, to access gauge. See “Fig. PM-1: Fire Suppression Cylinder Inspection” on page 24.
- ❒ Check pressure gauge on agent cylinder to ensure it is in the operating (green) range.
- ❒ Check all nameplates and instructional labels for legibility.
- ❒ Check physical condition of all components for mechanical damage and security of mounting.
- ❒ Check nozzles of agent cylinder. Nozzle outlets must be free of obstructions. Blow-off caps must be intact and secure.
- ❒ Ensure pull pin on manual actuator is in place.
- ❒ Test the alarm and LED functions by pressing the diamond-shaped “PRESS TO TEST” button on the face of the control panel. The alarm should sound and all LED's should illuminate.
- ❒ Test relay operation by pressing and holding the SYSTEM TEST button. This will engage all relay operations as well as sounding the alarm and illuminating the LED’s. Reset the relays by pressing the RELAY RESET button.

☞NOTE:

The “Push to Test” function will not cause a system discharge.

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Fig. PM-1: Fire Suppression Cylinder Inspection

2.8.5. Fire Extinguisher

Inspect the fire extinguisher every month as follows:

- ❒ Ensure the fire extinguisher is securely mounted in its proper location.
- ❒ Check that the safety pin lock is installed.
- ❒ Ensure that the hose is in good condition and the nozzle is not obstructed.
- ❒ Confirm that the cylinder pressure indicated on the gauge is within the green operating range.

2.8.6. Depot Charging Station Inspection

Inspect the Depot Charger on a monthly basis as follows:

- ❒ Inspect the station for any evidence of vandalism or damage. Contact ChargePoint if sign replacement is required or if the station is damaged.
- ❒ Check the charging cable for any signs of wear or damage. Contact ChargePoint if a cable appears to be damaged.

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2.8.7. Traction Motor Inspection

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

Visually inspect the traction motor every month or 3,000 miles (5,000 km), whichever occurs first.

- ❒ Inspect for any evidence of external mechanical damage. Repair or replace any damaged parts. See “Fig. PM-2: Traction Motor Inspection” on page 25.
- ❒ Visually inspect traction motor mounts for any obvious damage or loose fasteners.
- ❒ Remove any coarse debris such as leaves, paper etc.
- ❒ Check all electrical connections to ensure they are in good condition and properly secured. Replace any damaged cables.
- ❒ Visually inspect coolant hoses for damage or leaks.
- ❒ Visually inspect connection of traction motor to driveshaft for loose or missing fasteners.

[redacted]

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2.9. Quarterly Preventive Maintenance

2.9.1. High Voltage Power Cable Inspection

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

☞NOTE:

High voltage power cables can be easily identified by their orange colored protective covering.

Inspect the electric drive high voltage cables every three months or whenever a high voltage component has been inspected, serviced, or replaced. Refer to high voltage component inspections within this section of the manual for more information on the specific component.

Inspect high voltage cables for the following conditions:

- ❒ Inspect for evidence of chaffing, rubbing, cuts, or other damage. Investigate cause of damage and provide additional clamping or reroute cable as necessary.
- ❒ Inspect for proper routing and clamping. The cable should not be in direct contact with adjacent cables, sharp surfaces, or hot surfaces. Cables should be clamped to provide minimal slack without being taut.
- ❒ Visually inspect any accessible connections for loose or corroded connections. Clean and tighten connections as required. Apply Truck-Lite NYK-77 corrosion preventive compound, or equivalent, to the terminals.
- ❒ Ensure cable jacket is sealed at connector gland nut. See “Fig. PM-3: High Voltage Cable Inspection” on page 27.

2.9.2. HVAC System Inspection & Test

☞NOTE:

The following inspection requirements also apply to the ESS Battery Chiller.

Perform the following maintenance tasks every three months or 18,000 miles (29,000 km), whichever occurs first. Refer to your Thermo King Maintenance Manual for procedures.

- ❒ Install service gauge manifold set and check system operating pressures, temperatures, and suction line conditions.

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2.9.4. Rooftop Electronics Rack Inspection



Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**



Use work platforms or scaffolding whenever working on roof-mounted components. Ensure maintenance personnel use an approved safety harness.

Inspect the inverter rack assembly and components every three months.

1. Set the Battery Disconnect switch to the OFF position.
2. Set the High Voltage Interlock switch to the OFF position.
3. Open the hinged access doors on the rooftop inverter rack to gain access to the internal components. See “Fig. PM-4: Rooftop Electronics Rack” on page 29.
4. Check the function of the two proximity switches located inside the box. Refer to 2.9.4.1. “Proximity Switch Test” on page 30 for procedure.
5. Inspect all low and high voltage power cables. Refer to 2.9.1. “High Voltage Power Cable Inspection” on page 26 and Refer to 2.9.3. “Low Voltage Electrical Wiring Inspection” on page 27 for inspection procedures.
6. Inspect the inverter coolant lines for evidence of leakage. Torque hose clamps to 30 to 70 in-lbs. as required.
7. Check all the electrical boxes to ensure no damage or corrosion is evident.
8. Check all the electrical boxes to ensure they are securely mounted to the rack assembly.
9. Inspect the fasteners that attach the rack assembly to the vehicle roof structure and ensure the torque witness marks are aligned.
10. Close the access doors and ensure they are properly latched and sealed.

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2.9.4.1. Proximity Switch Test

☞NOTE:

Use the assistance of another person when performing this test. One person will need to monitor the instrument panel while the other person is on the rooftop.

1. Power up the vehicle.
2. Gain access to the rooftop inverter rack.
3. Carefully unlatch one door and slowly raise the door until the “HV Interlock” message displays on the instrument panel LCD screen.
4. If the “HV Interlock” message does not display, then the proximity switch will need to be adjusted or replaced. Refer to 2.9.4.2. “Proximity Switch Adjustment” on page 30 for adjustment procedure.
5. Repeat the previous steps for the other access door.

2.9.4.2. Proximity Switch Adjustment

1. Set the Battery Disconnect switch to the OFF position.
2. Set the High Voltage Interlock switch to the OFF position.
3. Unlatch and open both access doors on the rooftop electronics rack.
4. Place a straightedge across the top surface of the latch retaining bracket.

☞NOTE:

Placing a straightedge across the bracket will represent the cover in the closed position.

5. Loosen the adjustment nuts on the proximity switch and adjust the proximity switch until the desired gap of 0.063 to 0.197 inch (1.6 to 5.0 mm) is obtained. See “Fig. PM-5: Proximity Switch Adjustment” on page 31.
6. Repeat the adjustment procedure for the second proximity switch as required.
7. Close and latch the access doors.
8. Set the Battery Disconnect switch to the ON position.
9. Set the High Voltage Interlock switch to the ON position.
10. Retest the proximity switch.

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2.9.5. High Voltage DC-DC Converter Inspection

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

[redacted]

Use work platforms or scaffolding whenever working on roof-mounted components. Ensure maintenance personnel use an approved safety harness.

Inspect the high voltage DC-DC converter every three months.

1. Set the Battery Disconnect switch to the OFF position.
2. Set the High Voltage Interlock switch to the OFF position.
3. Gain access to the rooftop inverter rack and locate the DC-DC converter. See “Fig. PM-4: Rooftop Electronics Rack” on page 29.
4. Remove the external fan filter/finger guard and clean any dirt or debris if required.
5. Reinstall fan filter/finger guard.

2.9.6. Traction Motor/Inverter Radiator Inspection

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

[redacted]

Use work platforms or scaffolding whenever working on roof-mounted components. Ensure maintenance personnel use an approved safety harness.

Inspect the roof-mounted motor/inverter radiator assembly every three months or 6,000 miles (9,600 km), whichever occurs first, as follows:

1. Set the Battery Disconnect switch to the OFF position.
2. Clean any debris from the fan shrouds and ensure airflow is unrestricted. See “Fig. PM-6: Traction Motor/Inverter Radiator Assembly” on page 33.
3. Inspect the fan shrouds for secure mounting.
4. Inspect the fan blades to ensure they are not broken, chipped, cracked, or otherwise damaged.
5. Rotate the fan blade to ensure it moves freely and does not rub against the shroud.
6. Ensure the wiring harness is properly clamped and there is no evidence of fretting or chafing
7. Check electrical connections from each fan as well as main harness to the system controller to ensure they are secure and no corrosion is evident.
8. Inspect coolant and vent hose connections for any evidence of leakage. Torque hose clamps to 30 to 70 in-lbs. as required.
9. Inspect the rubber mounting isolators for wear, cracks, or deterioration.
10. Check the mounting fasteners that secure the brackets to the roof structure and ensure the torque witness marks are aligned.

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2.9.7. ESS Condenser Inspection

Use work platforms or scaffolding whenever working on roof-mounted components. Ensure maintenance personnel use an approved safety harness.

Inspect the roof-mounted ESS condenser assembly every three months as follows:

1. Set the Battery Disconnect switch to the OFF position.
2. Gain access to the rooftop condenser and clean any debris from the fan shroud and ensure airflow is unrestricted. See “Fig. PM-7: ESS Condenser” on page 34.
3. Inspect refrigerant lines for any evidence of damage.
4. Inspect mounting fasteners and ensure the torque witness marks are aligned.

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2.9.8. High Voltage Charging Receptacle Inspection

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

Inspect the high voltage charging receptacle every three months as follows:

1. Set the Battery Disconnect switch to the OFF position.
2. Set the High Voltage Interlock switch to the OFF position.
3. Open the access door to the high voltage charging receptacle. See “Fig. PM-8: High Voltage Charging Receptacle” on page 35.
4. Inspect external high voltage power cables. Refer to 2.9.1. “High Voltage Power Cable Inspection” on page 26 for inspection procedure.
5. Inspect the dust cover to ensure it is in place and in good condition.
6. Inspect the low voltage terminals for damage or corrosion.
7. Remove the dust cover and inspect the high voltage terminals for damage, corrosion, or evidence of arcing.
8. Inspect the receptacle lock tab to ensure it is in place and not damaged.
9. Plug in the charging cable and ensure the cable fully engages the receptacle and an audible click is heard when the lock tab is engaged.
10. Remove the charging cable and reinstall the high voltage dust cap.
11. Inspect the drain vent on the bottom of the housing to ensure it is open.

[redacted]

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2.9.9. High Voltage Accessory Power Cable Inspection

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

☞NOTE:

High voltage power cables can be easily identified by their orange colored protective loom.

Visually inspect the condition of accessory high voltage power cables and connections every three months.

1. Set the Battery Disconnect switch to the OFF position.
2. Set the High Voltage Interlock switch to the OFF position.
3. Gain access to the accessory power cables for the Thermo King heat exchanger and Powerex scroll compressor at the rear curbside corner access panel. See “Fig. PM-9: Accessory High Voltage Cable Inspection” on page 36.
4. Inspect high voltage power cables. Refer to 2.9.1. “High Voltage Power Cable Inspection” on page 26 for inspection procedure.

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2.9.11. Air Compressor Air Filter Inspection

☞NOTE:

This interval was converted from compressor operating hours to calendar time using an average vehicle speed of 12.5 mph, compressor duty cycle of 40%, and 30,000 miles/year. Adjust the service interval according to actual operating conditions.

Service the air compressor every three months, 7,500 miles (12,000 km), or 250 compressor operating hours, whichever occurs first. Refer to 2.9.11.1. “Air Filter Restriction Indicator Inspection” on page 39 in this section for filter restriction limitations.

- ❒ Clean or replace filter element as required. See “Fig. PM-11: Air Compressor Air Filter Inspection” on page 38.
- ❒ Remove the air compressor cover and clean the cooling fins using compressed air.



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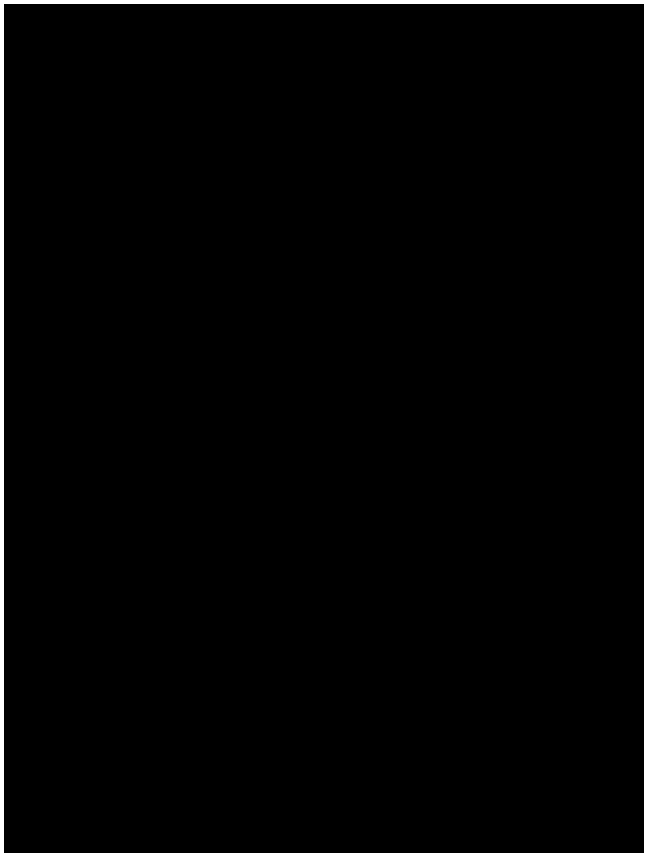
2.9.11.1. Air Filter Restriction Indicator Inspection

Locate the restriction indicator on the air compressor and refer to the scale on the indicator that is calibrated in inches of water. Replace the air filter element when the reading reaches 25" H_2O. See “Fig. PM-12: Air Filter Restriction Indicator” on page 39.

The service life of an air filter element is affected by several factors including operating environment, hours of operation, and total time in service. The requirement for air filter element replacement is determined by monitoring the reading on the Filter Minder® air filter gauge. This gauge monitors air restriction downstream of the air cleaner assembly.

The air filter gauge is calibrated in inches of water on one side and millimeters of water on the opposite side. The gauge will register and retain the highest air restriction reading experienced during operation.



2.9.12. Electronic Equipment Enclosure Ventilator Inspection

Inspect the ventilator, located on the forward side of the enclosure on a quarterly basis.

- ❒ Confirm that the fan is operating properly.
- ❒ Inspect the foam air filter and clean or replace as necessary.

2.9.13. Power Steering System Inspection

Inspect the power steering system every three months or 6,000 miles (9,600 km), whichever occurs first.

1. Set the Battery Disconnect switch to the OFF position.
2. Open the power steering access door on the front streetside of the vehicle.
3. Inspect high voltage power cables. Refer to 2.9.1. “High Voltage Power Cable Inspection” on page 26 for inspection procedure.
4. Inspect power cable connections on motor controller to ensure they are clean and secure. Clean connections and apply dielectric grease as required.
5. Inspect hoses and check for any signs of leakage. Tighten hose connections as required.
6. Check fluid condition. Fluid should be clear red. If fluid is darkened or otherwise contaminated, replace fluid. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 for fluid specification.
7. Check fluid level gauge and top up fluid to fill line if required.
8. Start vehicle and observe reading on the filter pressure gauge located on the filter head. If the gauge is in the red zone, replace the oil filter. See “Fig. PM-13: Power Steering System Inspection” on page 40.

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2.10. 6,000 Miles (9,600 km) Preventive Maintenance

2.10.1. Disc Brake Pad Inspection

Visually check brake pad wear every 6,000 miles (9.600km) or every 3 months, whichever occurs first. Refer to “Brake Pad Wear Inspection” in Section 1 and 2 of this manual for inspection procedure.

2.10.2. Wheels & Tires Inspection

- ❒ Visually inspect tires for unusual tread wear indicating wheels are out of alignment, suspension damage has occurred or tires are not properly inflated.
- ❒ Visually check that wheel rims are not bent, cracked or damaged.
- ❒ Check tires are same make, model and size.
- ❒ Check wheels are balanced.
- ❒ Visually inspect the wheel check indicators to ensure they are properly installed and the arrow of the indicator is pointing to the center of the adjacent nut.
- ❒ Check wheel nuts are tightened to the specified torques. Refer to Section 1 and Section 2 of this manual for specifications.

☞NOTE:

Refer to “Wheels” in Section 1 and Section 2 of this manual for additional wheel inspection requirements.

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[redacted]

☞NOTE:

Excessive movement of the tie rod end typically indicates a worn ball socket and the tie-rod end will require replacement. However if movement is due to a loose fit of the tie-rod end tapered pin in the steering arm, do not attempt to re-tighten the castle nut. Remove the tie-rod end and inspect the bore of the steering arm for wear.

❒ Perform a visual torque inspection of all steering component fasteners, including the lock nut on the steering stop adjusting bolt. Ensure that the torque witness marks are in alignment. Any fastener that has illegible or missing witness marks should be re-torqued to specification. Refer to Section 3 of this manual for torque specifications.

☞NOTE:

If the witness marks are no longer aligned, it is an indication that the fastener has loosened and it will be necessary to replace the fastener, torque to specification, and reapply torque witness mark.

❒ Inspect steering gear, hydraulic pump, and hoses for evidence of leakage.

⚠CAUTION

ALWAYS wipe clean the area around the filler cap before removing to prevent contaminants from entering the system.

❒ Inspect hydraulic reservoir fluid level and condition. Replace fluid if dirt, sludge, or water is evident in the system.

☞NOTE:

If hydraulic fluid appears frothy it is likely that air is trapped in the system and needs to be bled. Refer to Section 3 of this manual for power steering bleeding procedure.

❒ Check for smooth operation while turning the steering system through a full left and full right turn, Ensure that the power steering gear relief valve activates before contacting steering stops. Refer to Section 3 of this manual if steering stop adjustment is required.

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2.10.5. Steering Driveshafts

Inspect and lubricate the upper (vertical) and lower (horizontal) steering driveshafts every 6,000 miles (9,600 km). See “Fig. PM-17: Steering Driveshaft Inspection” on page 45.


[redacted]

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2.10.5.1.Inspection

The steering driveshaft will exhibit a certain amount of movement when rotated or forced side to side and can be attributed mostly to U-joint movement. The following inspection provides procedures and allowable limits specific to each area of the steering driveshaft. Do not reject the steering driveshaft for overall play unless one or more of the following inspection points exceeds maximum allowable limits.

1. Visually inspect the steering driveshafts for any evidence of damage.
2. Visually check torque witness marks on clamp fasteners.
3. Inspect the U-joints to ensure that all snap rings are installed and fully seated within the groove on the bearing cup. The bearing cup must not protrude any more than 0.105" beyond the surface of the yoke bore. See “Fig. PM-18: Snap Ring Inspection” on page 47.
4. Inspect the U-joint cross for end play movement within the bearing cups:
   a. Restrain the end yoke from moving and apply lateral side to side force on each U-joint. Note the total back and forth movement of the U-joint cross within the bearing cups. Maximum allowable end play is 0.012" (0.30 mm). See “Fig. PM-19: U-Joint Inspection” on page 47.
   b. Repeat the previous step on the same U-joint except apply pressure 90° from previous location.

☞NOTE:

If any of the above readings are suspect, remove the steering driveshaft from the vehicle and clamp the yoke in a vise and measure movement with a dial indicator to confirm.

5. Inspect the U-joint for worn needle bearings and/or cross trunnions:
   a. Apply back and forth rotational force to the yokes on the U-joint and note any relative movement between the U-joint cross and the bearing cups.
   b. No perceptible movement is allowed. Replace steering driveshaft as an assembly.

☞NOTE:

U-joints are not field replaceable, but may be serviced by the manufacturer. Contact Prop Shaft Supply in Elkhorn, Wisconsin for further information on driveshaft overhaul.

6. Inspect the steering driveshaft end yokes for excessive play:
   a. Apply lateral side to side force on each end yoke and note the deflection in the area where the end yoke splines are clamped to the attaching component. See “Fig. PM-20: End Yoke Inspection” on page 47.
   b. Spline movement should be minimal. If the amount of spline movement is questionable, remove the steering driveshaft for closer inspection of the splines as well as the male splines on the attaching component.
7. Check for excessive movement or backlash in the telescoping slip-joint:
   a. Grasp the male and female members of the telescoping slip-joint and apply a back and forth twisting motion while observing or feeling for movement. See “Fig. PM-21: Spline Backlash Inspection” on page 47.
   b. Spline movement should be minimal. If the amount of spline movement is questionable, remove the steering driveshaft for closer inspection of the telescoping splines.
8. If telescoping slip-joint is disassembled, check the nylon coating on the splines for wear, cuts, gouges, or any other damage.
9. If damage is evident, the nylon coating must be stripped from the splines and reapplied. Contact Prop Shaft Supply in Elkhorn, Wisconsin for further information on driveshaft overhaul.

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2.10.5.2.Universal Joint Lubrication

1. Locate the grease fittings on the universal joints at both ends of the driveshaft.
2. Purge lubricate through the grease fittings until fresh grease flows out of all four bearing cup seals. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for grease specifications. See “Fig. PM-22: Steering Driveshaft Lubrication Points” on page 48.
3. If all four bearing cups do not purge lubricate successfully, then it will be necessary to remove the steering driveshaft from the vehicle and tap the opposite cap or rotate the adjacent yoke through its full range of motion while applying grease.
4. Wipe off excess grease from universal joint.



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2.10.7. Shock Absorber Inspection

Every 6,000 miles (9,600 km) check for and replace all shock absorbers damaged or leaking oil. Check the rubber mounting bushings and replace them if worn. Ensure the shock absorber mounting brackets are tight and the shock absorber is not striking or rubbing the frame or some other part of the chassis.

☞NOTE:

A leaking shock will show clear signs of fluid leaking in streams from the upper seal. These streams can most easily be seen when the shock is fully extended and one inspects as far up the main body of the shock (underneath the dust cover or tube) as possible. Misting shocks are often misdiagnosed as failures. A misting shock will form a film on the entire outside of the shock body. Misting is perfectly normal and a necessary function of the shock.

2.10.8. Ride Height

Every 6,000 miles (9,600 km) or after service of air suspension components check the vehicle's ride height. Measure the ride height for the front and rear suspension. Refer to Section 3 of this manual for procedures.

2.10.9. Air Springs

☞NOTE:

The air suspension system requires no lubrication.

- ❒ Examine air springs assembly for evidence of cracks, punctures, deterioration, or chafing. Replace with new air springs if any damage is evident. Any surface on upper and lower retainers or on piston that touches air springs should be smooth and free of sharp edges that might cause breaks or damage air springs. Check threads on studs.
- ❒ Check for air leakage at all air springs upper and lower mountings. Coat mountings with soap and water solution and watch for appearance of soap bubbles. No leakage is permissible. If leakage is evident, rubber air springs must be replaced.
- ❒ Check to see that there is sufficient clearance around the complete circumference of the air spring while at its maximum diameter. Make sure contact doesn't exist between any air system component and the outside diameter of the air spring.
- ❒ Check for tightness on all mounting hardware. Retorque to the proper specifications. Refer to "Suspension Torque Specifications" in Section 1 and 2 of this manual for correct values. Do not overtighten.

2.10.10.Front & Rear Axles & Suspension

- ❒ Visually inspect all axle and suspension components for any evidence of damage.
- ❒ Visually inspect all suspension bushings and rubber components for cracks, tears, separation or other damage.
- ❒ Inspect center link, drag link, and tie-rod ends for excessive play. Use a pry bar to lever the component and inspect for excessive movement. Refer to Section 1 and 2 of this manual for specific inspection procedures.
- ❒ Perform a visual torque inspection of all axle and suspension fasteners. Ensure that the torque witness marks are in alignment. Any fastener that has illegible or missing witness marks should be retorqued to specification. Refer to Section 1 and 2 of this manual for torque specifications.

☞NOTE:

If the witness marks are no longer aligned, it is an indication that the fastener has loosened and it will be necessary to replace the fastener, torque to specification, and reapply torque witness mark.

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2.10.11.Front Stabilizer Bar Inspection

Inspect the front stabilizer bar every 6,000 miles (9,600 km) as follows:

- ❒ Check for excessive play in the bushings at the stabilizer ends and link locations. See “Fig. PM-26: Stabilizer Bar Inspection” on page 53. Replace worn bushings as required. Refer to Section 1 of this Service Manual for replacement procedure.
- ❒ Check for excessive play in the bushings at the two saddle clamps on the stabilizer bar. Replace worn bushings as required. Refer to Section 1 of this Service Manual for replacement procedure.
- ❒ Inspect the four 5/8" bolts that attach the stabilizer bar to the vehicle frame for evidence of cracks or damage. Replace all four mounting bolts if any bolt is cracked. Refer to Section 1 of your New Flyer Parts Manual for correct fastener part numbers. Refer to Section 1 of this Service Manual for installation procedure and torque.
- ❒ Visually inspect the torque witness marks on all fasteners to ensure the marks are aligned. If the marks are not aligned, retorque the fasteners to specification. Refer to Section 1 of this Service Manual for torque specifications. Reapply torque witness marks.

[redacted]

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2.10.12.Radius Rods

☞NOTE:

The radius rods are of similar configuration except for the upper radius rod on the front axle which does not have tubular construction, replaceable bushings, nor snap-rings. All other inspection criteria apply.

Inspect all radius rods every 6,000 miles (9,600 km) as follows:

- ❒ Visually inspect torque witness marks on fasteners. If witness marks are not legible, then apply specified torque and paint a witness mark across fastener. Refer to Section 1 & 2 of this manual for torque specifications.
- ❒ Visually inspect radius rod tubes for deformation. Replace radius rod as an assembly if tube is deformed.
- ❒ Inspect bushings for wear by using a pry bar. Apply force both axially and laterally while observing movement. Any excessive relative movement between the rubber component of the bushing and the cross-pin and/or the eye of the radius rod is cause for bushing replacement.

☞NOTE:

If axial or lateral movement is suspect, remove radius rod from vehicle and confirm excessive bushing movement by clamping cross-pin in a vise and moving radius rod through its operating range.

- ❒ Visually inspect rubber component of bushing for cracks or separation. Small cracks are acceptable. Separation of the rubber from the metal cover plate or cross-pin is acceptable providing the separation does not exceed 1/3 of the circumference of the bushing.
- ❒ Inspect the metal cover plate of the bushing for cracks. Replace bushing if cover plate is cracked.
- ❒ Inspect snap-ring to ensure it is installed and fully seated. Check for shiny wear marks as evidence of snap-ring movement. Replace bushing and inspect condition of snap-ring groove if snap-ring is missing, broken, or has rotated significantly.
- ❒ If excessive wear, corrosion or other damage is noted in the snap-ring groove or bore of the radius rod during the course of bushing replacement, then the radius rod should be replaced as an assembly.

2.10.13.Air System Inspection & Functional Tests

Inspect the air system hoses and perform a functional test on the air system every 6,000 miles (9,600 km).

2.10.13.1.Air System Hose Inspection

Inspect all flexible underbody hoses used in the braking, suspension, and main air supply systems as follows:

- ❒ Clean any buildup of debris, grime, or grease that would hinder proper visual inspection.
- ❒ Inspect hose condition for cuts, cracks, kinks, deformation, twisted line, charring, blistering, or any other signs of damage. Replace hose if damaged.
- ❒ Inspect hose connections to ensure fittings are properly tightened.
- ❒ Inspect hoses for proper clamping and routing.

2.10.13.2.Air System Functional Tests

Perform and air system functional test. Refer to "Air System Functional Tests" in Section 8 of this manual for procedure.

2.10.14.Driver's Window

Inspect the driver's window every 6,000 miles (9,600 km) as follows:

- ❒ Slide the forward sash fully aft and ensure the sash slides smoothly and makes contact with the window stop.
- ❒ Inspect the condition of the weather-stripping in the lower window channel/track. Clean window channel/track by vacuuming.
- ❒ Inspect the interior and exterior handles to ensure they are securely mounted.

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2.10.17.Roof Vent/Hatch

Inspect and clean the roof vent/hatch every 6,000 miles (9,600 km).

- ❒ At each vehicle cleaning interval use a mild soap and water solution to clean the vent/hatch surfaces and components. Do not use solvents or petroleum based cleaners or coatings. Do not lubricate its moving parts. Refer to 2.10.17.1. “Coatings & Cleaners” on page 56 in this section for additional information on coatings and cleaners.
- ❒ Inspect the vent/hatch moving parts every 6,000 miles (9,600 km). Make sure the latches close and fasten securely. The latches must fasten securely, with no slack or looseness. If the attaching hardware cannot be tightened, replace the applicable latch parts using new hardware and fasteners. See “Fig. PM-28: Roof Hatch Inspection” on page 57.
- ❒ In cold climates, check daily and remove any accumulated ice and snow that may restrict movement of the vent/hatch.

2.10.17.1.Coatings & Cleaners

CAUTION

DO NOT use lubricants, paints, solvents or other coatings such as graffiti deterring sprays or cleaners. These chemicals often contain acetone, ether, lacquer thinner or other solvents that can destroy the high strength properties of many engineering plastics. Any damage, weakening, malfunction or failure of the vent/hatch structure because of using improper coatings or cleaners is the responsibility of the transit property.

Graffiti resistant coatings often leave a sticky residue that interferes with the free movement of the ventilator mechanisms. Some of these coatings also contain solvent bases that will reduce the strength of certain components. Using these types of coatings on vents/hatches is not recommended.

If in doubt about a type of cleaner or coating, apply a very small amount to an obscure, small area of the vent/hatch. Observe how the substance reacts to the surface after a short interval. If the surface starts to craze, soften, discolor or dissolve, DO NOT use it.

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2.10.18.Splash Guards

- ❒ Check splash guards every 6,000 miles (9,600 km) for loose bolts and damage.
- ❒ Tighten loose bolts and replace any unserviceable guards.
- ❒ Check that ground clearance is within specifications.

2.10.19.Windshield Wiper & Washer

- ❒ Check wiper operation and condition.
- ❒ Remove any accumulated dirt and grit from the wiper blade.
- ❒ Check that the washer system emits an adequate flow of washer fluid.

2.10.20.Driver's Seat Inspection

Perform the following inspections every 6,000 miles (9,600 km) or 1,200 hours, whichever occurs first:

- ❒ Check "anti-cinch" on seatbelt retractor.
- ❒ Check seatbelt for wear.
- ❒ Check seatbelt latch for proper locking.
- ❒ Manually check fore and aft movement of seat on tracks.
- ❒ Check tracks for proper lock engagement.
- ❒ Check auto-actuator switch (optional) for proper stroke.
- ❒ Check suspension up and down travel.
- ❒ Check rake adjustment for full range of adjustment.
- ❒ Check all bushings for wear and lubricate.

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2.10.21.Passenger Seats

Inspect the passenger seats every 6,000 miles (9,600 km) as follows:

- ❒ Check the mounting hardware for tightness and security. Tighten or replace as required.
- ❒ Inspect seats for rips or tears. Repair, patch or replace as required.

2.10.21.1.General Cleaning

For dirt and general spot removal, fiberglass, composite resin and stainless steel may be cleaned with a non-abrasive, mild household detergent. Test a small, inconspicuous area prior to cleaning. Wipe with a clean, damp cloth and allow to dry.

☞NOTE:

Leaving any chemical on fiberglass or composite resin for extended periods can result in damage to the surface. ALWAYS rinse with water after cleaning.

2.10.21.2.Tough Stain & Graffiti Removal

Markings and stains from permanent marker and other compounds like shoe polish or nail polish can be removed from fiberglass, composite resin and stainless steel materials with the following agents (or equivalents):

- ❒ Crown Anti-Vandal Spray 5062 (contains VOC's)
- ❒ TSW9 Plasti-Master (does not contain VOC's)

☞NOTE:

For Vision Seats, Scotch-Brite pads can be used to remove graffiti markings and return the surface to its original appearance.

2.10.21.3.Vacuum Formed Plastic Components

Use TSW9 Plasti-Master when removing graffiti markings from vacuum-formed plastic components.

2.10.21.4.Upholstery Care

⚠CAUTION

Extreme care should be taken when selecting a cleaning agent. Solvent-based cleaners should be avoided. Some solutions may leave a residue or discolor the material. Test an inconspicuous area prior to cleaning and follow the manufacturer's directions.

Regularly remove all dust and loose dirt from fabric with a whisk broom or vacuum cleaner. Always begin with lukewarm water and a white cloth for stain removal before applying any cleaning agent. Use foam upholstery cleaner or a mild household detergent and first testing in a small area. Flush the area with water after cleaning.

2.10.22.Stanchions & Grab Rails

Inspect stanchions and grab rails for security of attachment and any evidence of damage. Tighten any loose hardware. Replace any damaged components.

2.10.23.Wheelchair Tie-Down & Occupant Restraints

Perform the following activities every 6,000 miles (9,600 km):

- ❒ Clean belts as required using mild soap and water. Do not use solvents, chemical solutions or strong detergents. If required, soak belts for several hours in water to loosen dirt. Clean, rinse and dry thoroughly before returning to service.
- ❒ Lubricate the tiedown belt buckles at the hinges being careful not to contaminate the webbing.

2.10.24.Interior Panels

Inspect panels for scuffs, cracks and other forms of damage. Clean panels and repair any defects. Refer to Section 12 of this manual for further information on the interior panels.

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2.10.25.Exterior Panels

- ❒ Every 6,000 miles (9,600 km) inspect the sealant and caulking of the exterior panel seams, and wheel-housings. Replace where substance has failed.

⚠CAUTION

Use only the recommended type of sealant, caulk or adhesive. Refer to Section 13 of this manual for recommended type. DO NOT use substitutes.

- ❒ Clean the entire vehicle thoroughly to inspect for paint condition and for metal corrosion damage. Pay particular attention to the lower panels. Repair any areas with paint failure, or corrosion.

☞NOTE:

Increase inspection frequency in freezing weather, due to the effect of road deicing materials (salt, calcium chloride and so forth) on metal.

- ❒ Protect painted surfaces with a coating of wax immediately after the vehicle has been cleaned.

⚠CAUTION

When cleaning the painted surfaces of the vehicle, use a cleaning agent that will not harm the acrylic finish or fiberglass panels. (for example soap and water).

2.10.26.Battery System (12/24 VDC)

[redacted]

ALWAYS replace batteries with the same type and size identified in your New Flyer Parts Manual and charge the batteries using the recommended voltage. Over-charging a lead acid battery can produce explosive and hazardous gas. Any change in battery configuration may require modification to the charging system voltage levels and battery service procedures to prevent over-charging and equipment damage. Consult the batter manufacturer's recommendations before installing replacement components.

- ❒ Check external condition of battery and battery cables periodically. If required, wash exterior with a dilute solution of ammonia or soda to neutralize acid, then flush off with clean water. Keep vent plugs tight to keep neutralizing solution out of cells. Tighten hold-down nuts to prevent batteries from shaking but not so tight as to strain battery case. See "Fig. PM-29: Battery Tray" on page 60.
- ❒ Check the battery cable ends on the battery posts. To ensure good contact, these must be tightened firmly.
- ❒ Check for post or cable end corrosion. If corrosion exists disconnect cables from the posts and clean both with soda solution and a wire brush. Install ends and tighten firmly, then coat with dielectric grease.
- ❒ Check battery for obvious damage such as, cracked case (shows loss of electrolyte), or damaged, cracked, or loose terminal posts.
- ❒ If obvious damage is noted, replace battery.
- ❒ If no obvious damage is noted, check electrolyte level.
- ❒ If electrolyte level is above top of plates in all cells, conduct specific gravity test. Refer to Section 9 of this manual for procedure.
- ❒ If electrolyte level is below specified level in one or more cells, add water to proper levels, then charge for 15 minutes at 15 to 25 amperes, with vent caps removed. Connect a 300 ampere load to battery for 15 seconds to remove electrolyte surface charge. Conduct specific gravity test. Refer to Section 9 of this manual for procedure.

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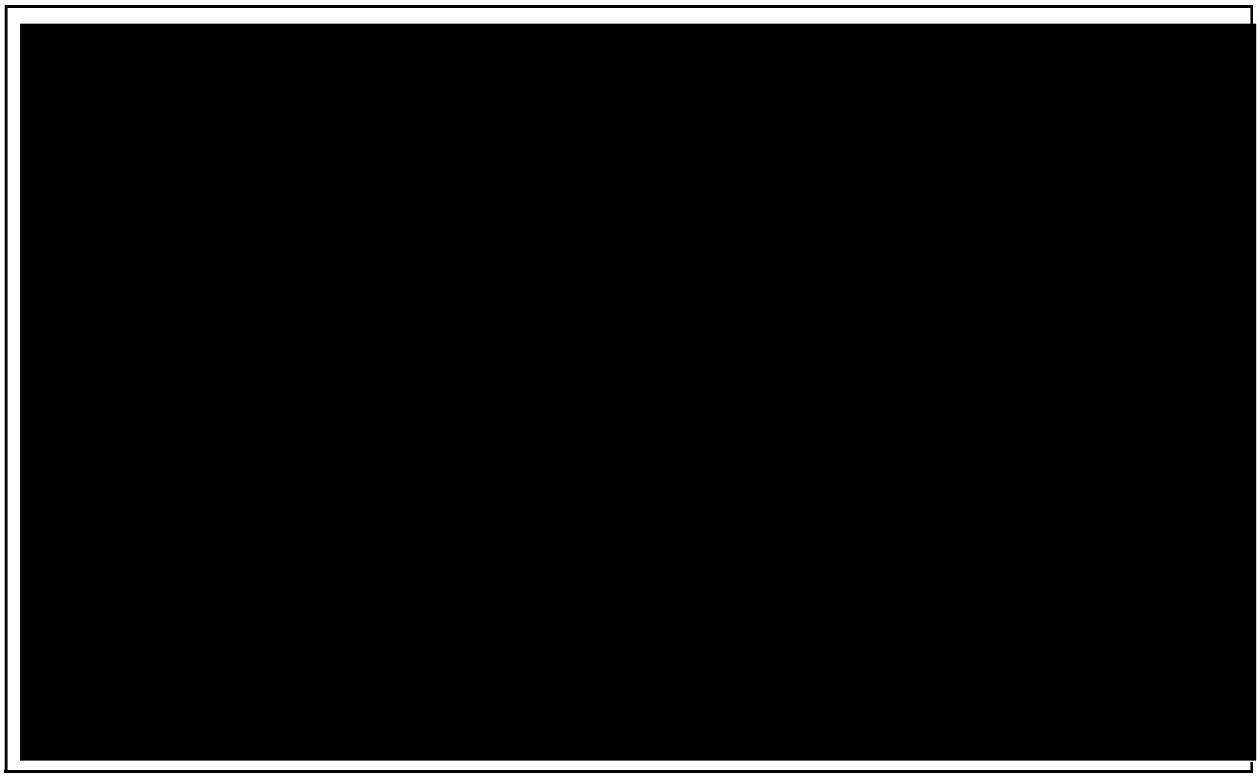

Fig. PM-29: Battery Tray

2.10.27.Wheelchair Ramp Inspection

Inspect & lubricate the wheelchair ramp mechanism every 6,000 miles (9,600 km).

2.10.27.1.Mechanism

- ❒ Inspect and adjust chain tension as required. Refer to Section 20 of this manual for inspection and adjustment procedure.
- ❒ Inspect ramp pump electrical connectors for condition and security. See “Fig. PM-30: Wheelchair Ramp Inspection” on page 61.
- ❒ Inspect electrical harnesses and hydraulic hoses for condition and secure attachment.
- ❒ Inspect fluid level in reservoir. Top up as required.
- ❒ Inspect and tighten mounting hardware as required.
- ❒ Ensure stowed proximity switch is functioning and is positioned to activate at 15° from the STOWED position.

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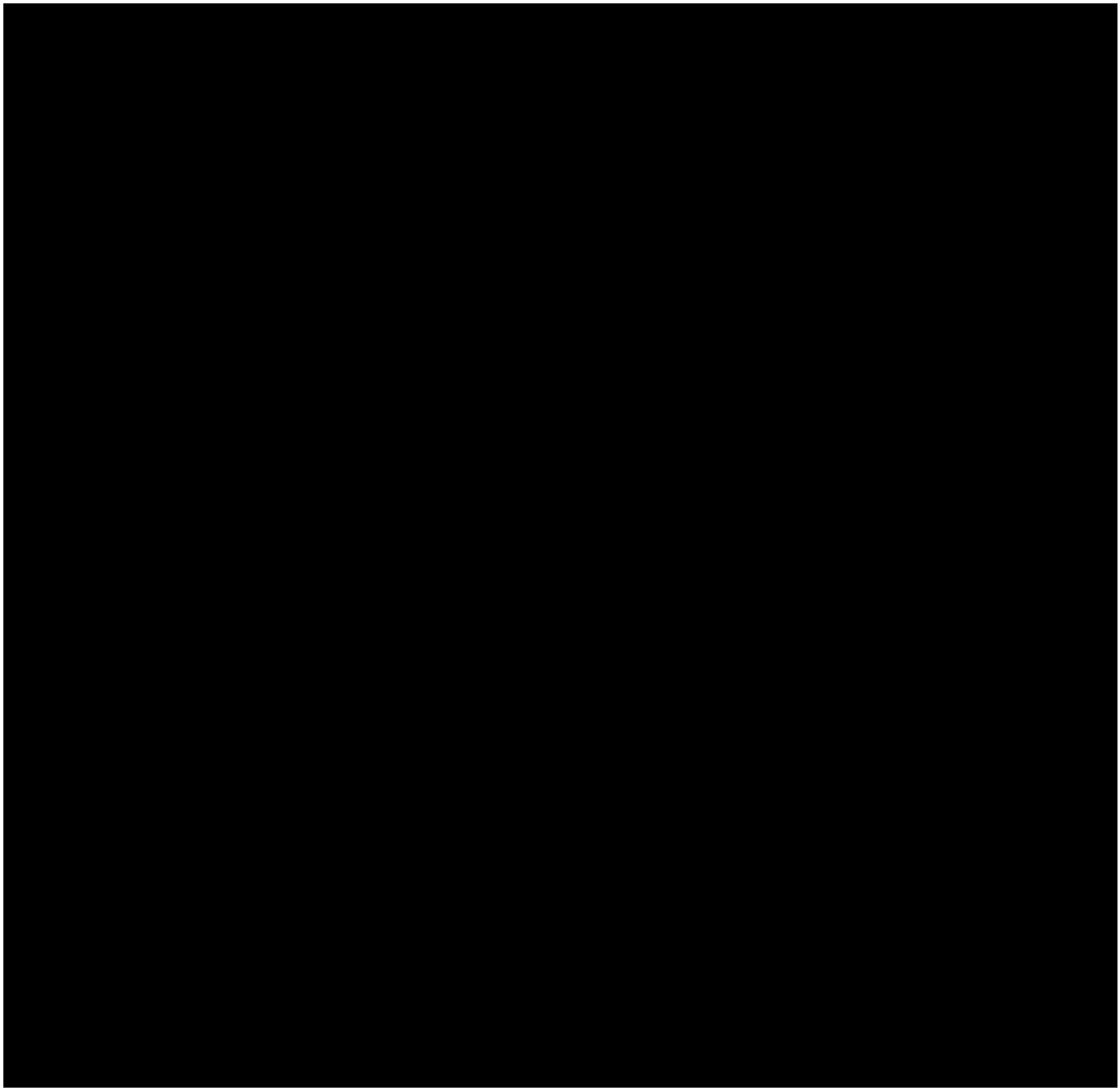

2.10.27.2.Skid Plate

Locate the wheelchair ramp skid plate at the forward edge of the entrance door. See “Fig. PM-31: Ramp Skid Plate Inspection” on page 62. Inspect the skid plate for impact or abrasion damage. Abrasion of the outboard edge is acceptable providing the wear indicator hole on the plate is still evident. Use a 1/8" drill bit to clear the wear indicator hole if plugged with debris. Refer to Section 20 of this manual for skid plate replacement procedure.

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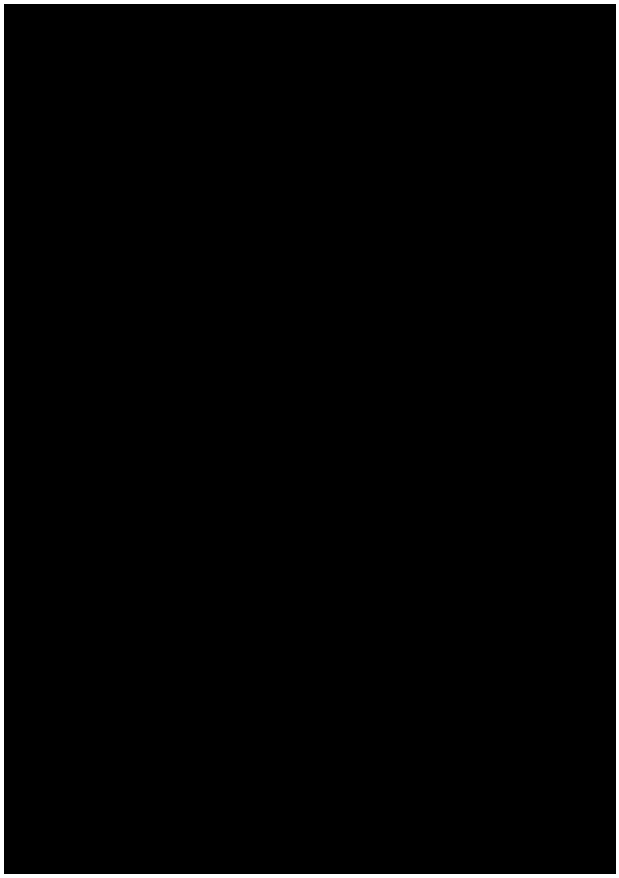

2.10.27.3.Lubrication

Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for lubricant specification. Clean existing lubricated surfaces of any dirt, grime, or dried lubricant and then apply fresh lubricant to the following areas:

- ❒ Drive chain rollers and side plates.
- ❒ Teflon sleeve bushings located on the tensioner blocks.
- ❒ Teflon sleeve bushings located on the LH and RH ramp pivots.
- ❒ Bronze bushing located on idler sprocket.
- ❒ Hydraulic cylinder pivot.
- ❒ Between the sliding surfaces of the mechanism (slots in the support plates and flats on the push shaft and clevis shaft).
- ❒ Hydraulic cylinder pivot points.

Operate the wheelchair ramp through several cycles to distribute the lubricant into the working surfaces.

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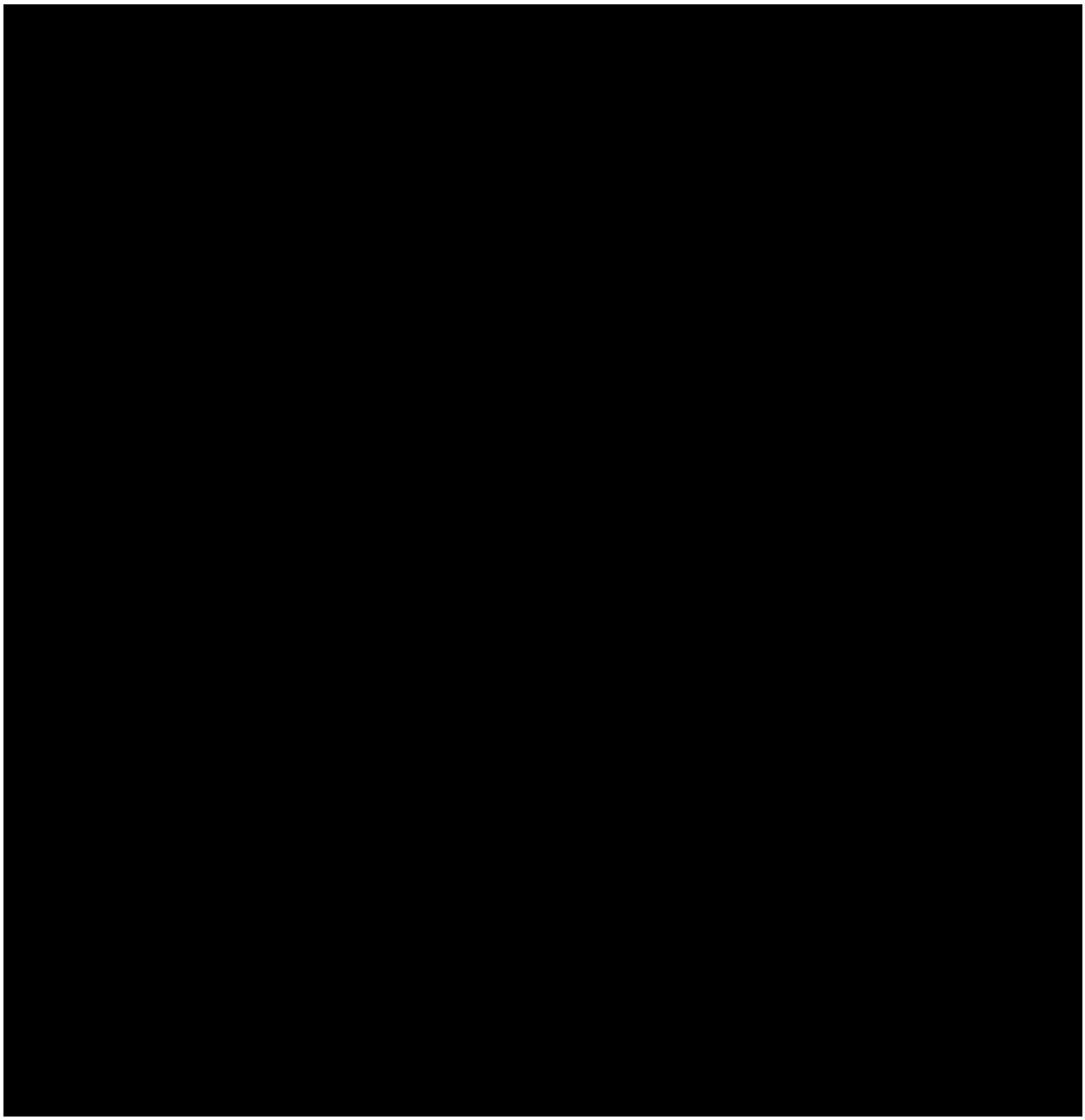
2.10.28.Driver's Heater/Defroster Inspection

CAUTION

Reposition Battery Disconnect switch to OFF before servicing heater/ defroster electrical components to avoid shorts.

- ❒ Inspect air filter. Clean or replace as required. See "Fig. PM-32: Defroster Inspection" on page 63.
- ❒ Inspect electrical plugs for clean contacts. Check wiring for proper routing and for any evidence of rubbing.
- ❒ Inspect condition of coolant hoses and ensure all hoses clamps are properly tightened.



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2.10.29.HVAC Return Air Filter

Clean or replace filter as required every 6,000 miles (9,600 km). See “Fig. PM-33: HVAC Return Air Filter” on page 64.

1. Locate the HVAC return air grille on the ceiling of the vehicle.
2. Unlatch the return air grille and allow the grille to swing downward.
3. Release the shock cord from the filter frame.
4. Remove the filter from the filter frame.
5. Remove accumulated debris by blowing compressed air in direction opposite to normal air flow.
6. Wash filter in warm soapy water, rinse, and allow to dry.
7. Installation is the reverse of removal.

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2.10.30.Rear Axle Breather Tube

CAUTION

DO NOT attempt to shorten or otherwise relocate the breather tube. The volume inside the tube acts as an expansion reservoir and must be at least 5 ft. (1.5 m) in length.

- ❒ Check that the breather tube is securely attached to the elbow located on top of the differential housing and is attached to the breather membrane, located on the street-side suspension support. See “Fig. PM-34: Rear Axle Breather Inspection” on page 65.
- ❒ Clean any sludge or debris accumulation from the breather membrane outlet and ensure that the tube is clear. Replace the breather membrane (valve) if clogged, dirty, or oil soaked. Refer to 2.10.30.1. “Breather Valve Replacement” on page 65 in this section for procedure.

2.10.30.1.Breather Valve Replacement

1. Remove the breather tube from the valve by pushing the collar on the valve towards the valve body. Maintain pressure on the collar while pulling out the tube.
2. Inspect the end of the breather tube before installing new breather valve. Tubing end must be cut square and free from any burrs or rough edges.
3. Push tube into breather valve until seated.

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2.11. 12,000 Miles (19,300 km) Preventive Maintenance

2.11.1. Electronic Accelerator

Perform the following maintenance every 12,000 miles (19,300 km) or 600 operating hours, whichever comes first:

- ❒ Check the area around the treadle to ensure that nothing will interfere with treadle operation (mats, discarded material and so forth). See “Fig. PM-35: Accelerator Inspection” on page 66.
- ❒ Check the entire treadle assembly for cleanliness.
- ❒ Check the nylon roller on the underside of the pedal and on the transfer lever for freedom of movement.
- ❒ Check all pivot points for freedom of movement, excessive wear and corrosion.
- ❒ Check all fasteners, fittings and retaining rings to verify that they are all properly installed.
- ❒ Actuate the treadle valve by pressing the pedal by hand. The action should be smooth without binding. When the pedal is released, it should return immediately without sticky or sluggish action.
- ❒ Excessive wear and corrosion requires the installation of new bushings.



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2.11.2. Driver's Heater/Defroster

Inspect and test the defroster blower motor every 12,000 miles (19,300 km) or as determined by operating conditions. The inspection interval will need to be more frequent during the winter months when the heaters are exposed to slush, salt and grit that have been tracked into the vehicle.

- ❒ Remove defroster access cover to allow detailed inspection of the blower motor and electrical connections.

⚠CAUTION

DO NOT attempt to clean defroster assembly using pressure washing equipment or using shop air in excess of 60 psi

- ❒ Inspect for buildup of salt or dirt deposits in and around the blower motor. Clean surfaces as necessary to remove contamination.
- ❒ Inspect electrical connectors for loose or corroded connections.
- ❒ Test operation of blower motor at all operating speeds to ensure smooth and quiet operation.
- ❒ If blower motor operation is suspect, use a clamp-on Fluke ammeter, or equivalent, to test current draw at each speed setting. Refer to Section 10 of this manual for defroster motor specifications. Replace blower motors that do not meet the specified operating limits.

☞NOTE:

Disassembly, cleaning, and repair of the blower motor is considered uneconomical and it is recommended that the blower motor be replaced if found defective.

2.11.3. S-1 Gard

Every 12,000 miles, inspect the guard and receiver as follows:

1. Raise the vehicle. Refer to the General Information Section of this manual for procedure.
2. Inspect guard material for excessive rips or tears. Excessive damage means that the minimal ground clearance of 4.5 ± 0.5" cannot be maintained. Replace guards which do not meet this specification. Scrapes or scarring of the material do not impair its functionality. The guard's entire lower edge must be level with the ground in order for it to function correctly. Worn guards may display an uneven profile.
3. Excessive wear of guard material may be an indication of suspension problems, such as incorrect ride height adjustment, shock absorber wear, or air spring leaks. Correct suspension problems as required.

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2.11.4. Driver's Seat Inspection

1. Perform the following inspections every 12,000 miles (19,300 km), or 2,400 hours, whichever occurs first:
   a. Inspect and clean the seat tracks. Apply fresh lubricant using premium moly-lithium grease.
   b. Check for proper function of seat recline.
2. Perform the following inspections after the first 12,000 miles (19,300 km) of operation and then every 48,000 miles (77,200 km) thereafter.
   a. Check the tracks to ensure the fasteners are properly tightened. Torque fasteners to 16 ft-lbs (22 Nm) as required.
   b. Check tracks for misalignment, binding, or wear.
   c. Clean control panel switches.
   d. Check control panel to ensure it is securely mounted.
   e. Inspect air lines at control panel for wear or cracks.
   f. Check suspension bellows for cracks, holes, or tears.
   g. Check air spring for wear or leakage.
   h. Inspect shocks for leakage.
   i. Check lumbar bags for leakage.
   j. Check seat covers for abnormal wear or tears.
   k. Check seat foam for deterioration, rips, or tears.
   l. Check fore and aft tilt of adjustable headrest.
   m. Check up and down travel of headrest.
   n. Check headrest for abnormal wear and tear.

2.12. 24,000 Miles (38,600 km) Preventive Maintenance

2.12.1. Driver's Seat Inspection

Perform the following inspections every 12,000 miles (19,300 km) or 4,800 hours, whichever occurs first:

❒ Check the seatbelt mounts to ensure they are properly tightened. Torque lock nuts to 37 ft-lbs (50 Nm) as required.

2.12.2. Air Dryer



DO NOT inject alcohol, anti-freeze, or other de-icing substances into or upstream of the air dryer. Use of these substances may damage the air dryer and void warranty.

Perform the following maintenance every 24,000 miles (38,000 km), 900 operating hours, or every three months, whichever occurs first:

1. Visually inspect the air dryer for physical damage such as chaffed or broken air and electrical lines and broken or missing parts.
2. Check mounting bolts for tightness. Torque the two bolts that secure the air dryer end cover to the mounting bracket to 300 to 360 in-lbs. (34 to 41 Nm). Torque the nut on the upper mounting bracket to 60 to 100 in-lbs. (7 to 11 Nm).
3. Perform operation & Leakage Tests. Refer to 2.12.2.1. "Operation & Leakage Tests" on page 69 in this section for procedure.

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2.12.2.1.Operation & Leakage Tests

1. Test the delivery port check valve assembly as follows:
   a. Install a test gauge in the supply line to the wet tank.
   b. Ensure all lines and fittings leading to and from the air dryer are in good condition and not leaking.
   c. Build up system air pressure to governor cutout (125 psi).
   d. Observe the test gauge to ensure system pressure is maintained. If a rapid loss of pressure is indicated, proceed to the following steps to confirm source of leak.
   e. Confirm cause of rapid pressure loss by shutting down the engine and draining system pressure to a point below governor cut-in (less than 105 psi). Drain residual air pressure in the compressor discharge line and remove the discharge line at the supply port of the air dryer. Ensure there is no air pressure at the control port by disconnecting the line from the governor unload (UNL) port.
   f. Apply a soap solution to the air supply port on the air dryer. If a 1" bubble forms within one second, then the delivery check valve should be repaired.
   g. Remove the test gauge before returning the vehicle to service.
2. Check for excessive leakage around the purge valve. With the compressor in loaded mode (compressing air), apply a soap solution to the purge valve exhaust port and observe that leakage does not exceed a 1" bubble in 1 second. If the leakage exceeds the maximum specified, repair the purge valve assembly.
3. Close all reservoir drain cocks. Build up system pressure to governor cutout and note that each AD-IP purges with an audible escape of air. Apply the service brakes to reduce system air pressure to governor cut-in. Note that the system once again builds to full pressure and is followed by AD-IP purges.
4. Check the operation of the safety valve by pulling the exposed stem while the compressor is loaded (compressing air). There must be an exhaust of air while the stem is held and the valve should reseat when the stem is released.
5. Check the operation of the end cover heater and thermostat assemblies during cold weather operation. Refer to 2.12.2.2. “Electric Power Test” on page 69 and Refer to 2.12.2.3. “Thermostat & Heater Operation” on page 70 in this section for procedure.

2.12.2.2.Electric Power Test

With the Master Run switch set to the DAY RUN or NIGHT RUN operating position, check for voltage to the heater and thermostat assembly using a voltmeter or test light. Unplug the electrical connector at the air dryer and place the test leads on each of the pins of the male connector. If there is no voltage, look for a blown fuse, broken wires, or corrosion in the vehicle wiring harness. Check to see if a good ground path exists.

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2.12.2.3.Thermostat & Heater Operation

☞NOTE:

These tests are not required except in cold weather operation.

Switch off the master run switch and cool the thermostat and heater assembly to below 35°F (2°C). Using an ohmmeter, check the resistance between the electrical pins in the air dryer connector half. The resistance should be 6.0 to 9.0 ohms for the 24 volt heater assembly. Warm the thermostat and heater assembly to over 90°F (32°C) and again check the resistance. The resistance should exceed 1000 ohms. If the resistance values obtained are within the stated limits, the assembly is operating properly. If the resistance values obtained are outside the stated limits, replace the assembly.

☞NOTE:

If, after completing the routine operation and leakage tests, it has been determined that one or more components of the air dryer requires replacement or maintenance, refer to your New Flyer Parts Manual. The air dryer has been designed so that any of the maintenance kits can be installed without removing the air dryer from the vehicle.

2.12.3. Brake Treadle Assembly & Brake Valve

Perform maintenance on the brake treadle assembly and brake valve every 24,000 miles (38,600 km), 900 operating hours or three months, whichever occurs first,

- ❒ Remove any accumulated contamination, such as dirt and gravel, from the heel of the treadle, the plunger, the plunger boot and the mounting plate. See “Fig. PM-36: Brake Valve Inspection” on page 71.
- ❒ Clean and inspect the treadle roller, the roller pin, and the hinge pin. Replace any worn, corroded, or damaged parts. Lubricate with Barium grease. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for lubrication specifications.
- ❒ Inspect the plunger boot for cracks, holes or deterioration and replace boot if damaged.
- ❒ Inspect the plunger for wear or corrosion. Replace plunger if required.
- ❒ Check that the brake treadle mounting plate is securely fastened. Inspect pivot pin holes and plunger bore in mounting plate for wear or corrosion. Replace mounting plate if required.
- ❒ Apply a thin layer of Barium grease between the plunger and the mounting plate bore. Do not use excessive amounts of lubricant.
- ❒ Perform operation and leakage tests on the brake valve. Refer to Section 8 of this manual for test procedures.

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2.13. 36,000 Miles (58,000 km) Preventive Maintenance

2.13.1. Disc Brake Caliper Inspection

Perform a disc brake caliper inspection every 36,000 miles (58,000 km) or every year, whichever occurs first. A more frequent inspection may be necessary depending on the operating conditions. Perform the following inspections:

- ❒ Inspect the six brake caliper mounting bolts that attach the brake caliper to the axle to ensure the bolts are tight. Refer to Section 1 and 2 of this manual for mounting bolt torque specifications.
- ❒ Caliper Running Clearance - refer to “Adjuster Check” in Section 1 and 2 of this manual for inspection procedure.
- ❒ Guide Pin Covers - check that the protective covers are properly installed on the caliper guide pins and are in good condition. Replace covers if damaged or missing.
- ❒ Adjuster Cap - check that the protective cap is properly installed on the adjuster and is in good condition. Replace adjuster cap if damaged or missing
- ❒ Brake Disc - refer to “Brake Disc Inspection” in Section 1 and 2 of this manual for inspection procedure.
- ❒ Brake Adjuster - refer to “Adjuster Check” in Section 1 and 2 of this manual for inspection procedure

☞NOTE:

The brake adjuster should always be inspected and tested whenever brake pads have been replaced

- ❒ Caliper Guide Pin - refer to “Caliper Guide Pin Inspection” in Section 1 and 2 of this manual for inspection procedure.
- ❒ Tappet & Boot Assembly - refer to “Tappet Rubber Boot Inspection” in Section 1 and 2 of this manual for inspection procedure.
- ❒ Guide Pin Inner Boot - refer to “Upper Guide Rubber Boot Inspection” in Section 1 and 2 of this manual for inspection procedure.

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2.13.2. Rear Axle Oil Change

Change the rear axle oil every 36,000 miles (58,000 km), or every year, whichever occurs first. Use this oil change interval only if operating with mineral oil in a hot temperature region. Refer to 2.2. “Rear Axle Operating Conditions” on page 11 in this section for a definition of a hot temperature region. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for fluid specification.

2.13.2.1.Drain

CAUTION

Differential fluid can reach operating temperatures in excess of 212°F (100°C). Allow adequate time for differential to cool before draining fluid.

1. Ensure vehicle is parked on a level surface or raised to a working height that maintains a level attitude.
2. Place a suitably sized container beneath the differential gear housing.

NOTE:

Differential gear housing oil fill quantity is approximately 4.0 U.S. gallons (15 liters)

3. Remove the fill plug from the front of the differential housing. See “Fig. PM-37: Rear Axle Drain & Fill Locations” on page 73.
4. Remove the drain plug from the bottom of the differential housing and allow the differential to drain completely.

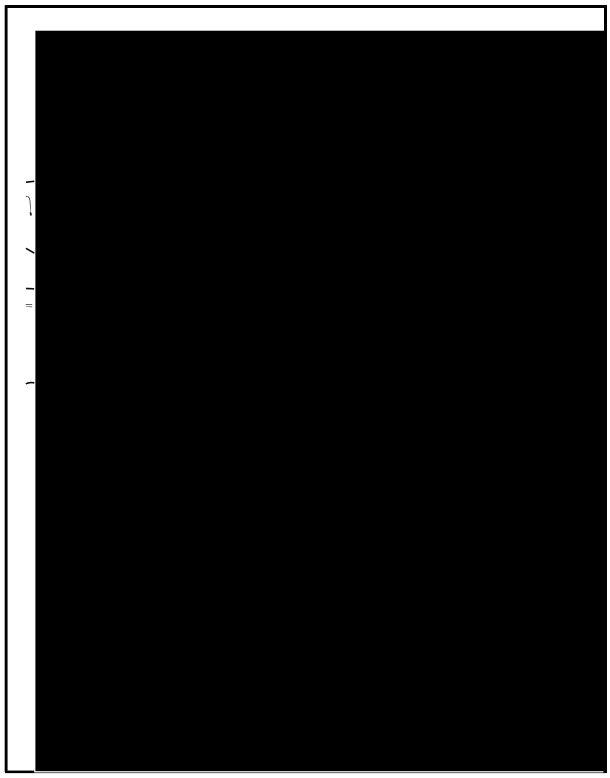
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Fig. PM-37: Rear Axle Drain & Fill Locations

2.13.2.2.Fill

1. Inspect the magnetic drain plug for any significant accumulation of metal particles and wipe clean.

NOTE:

Fine “fuzz-like” metal particles are considered normal but any solid slivers of significant size or chips of metal will require further investigation to determine cause.

2. Clean and inspect the threads of the drain plug before applying Loctite-567 thread sealant. Install and torque the drain plug to 52 ft-lb. (70 Nm).
3. Add slightly less than 4.0 U.S. gallons (15 liters) and allow fluid level to stabilize.
4. Continue to add fluid slowly until the fluid is level with the bottom of the fill plug.
5. Install the fill plug and torque to 52 ft-lb. (70 Nm).

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2.14. 48,000 Miles (77,200 km) Preventive Maintenance

2.14.1. Front End Alignment

Perform minor alignment. Refer to Section 3 of this manual for procedure.

2.14.2. Driver's Seat Inspection

Perform the following inspections every 48,000 miles (77,200 km) or 9,600 hours, whichever occurs first:

- ❒ Check the suspension air lines for wear or leaks.
- ❒ Check the suspension controls for broken or cracked knobs.
- ❒ Check the suspension shock mounts for cracks or breaks.
- ❒ Check the seat back mounting bolts on each side to ensure they are properly tightened. Torque mounting bolts to 30 ft-lbs (41 Nm) as required.
- ❒ Check the tracks to ensure the fasteners are properly tightened. Torque fasteners to 16 ft-lbs (22 Nm) as required.
- ❒ Check tracks for misalignment, binding, or wear.
- ❒ Clean control panel switches.
- ❒ Check control panel to ensure it is securely mounted.
- ❒ Inspect air lines at control panel for wear or cracks.
- ❒ Check suspension bellows for cracks, holes, or tears.
- ❒ Check air spring for wear or leakage.
- ❒ Inspect shocks for leakage.
- ❒ Check lumbar bags for leakage.
- ❒ Check seat covers for abnormal wear or tears.
- ❒ Check seat foam for deterioration, rips, or tears.
- ❒ Check fore and aft tilt of adjustable headrest.
- ❒ Check up and down travel of headrest.
- ❒ Check headrest for abnormal wear and tear.

2.14.3. Front Brake Chambers

2.14.3.1.Inspection

Perform the following inspection every 48,000 miles (77,200 km):

1. Visually inspect the exterior surfaces of the brake chamber for signs of damage. Replace the brake chamber if damaged. Refer to Section 1 of this manual for replacement procedure.
2. Apply system pressure (minimum 100 psi) to the brake chamber and check for leaks around the circumference of the clamp band and air inlet fittings, using soapy water or leak detection solution.
   a. If bubbles appear around clamp band, release air pressure and torque clamp band nuts to 30 to 35 ft-lbs (41 to 47 Nm). Recheck for leaks. If leaks continue, perform a leakdown pressure test. Refer to 2.14.3.2. "Front Brake Chamber Leakdown Test" on page 75 in this section for test procedure.
   b. If bubbles appear at air hose connection, tighten hose until leaks cease, but do not exceed 40 ft-lb. (54 Nm) If leaks continue, release air pressure and remove air line from inlet port. Inspect threads on hose and fitting. Replace hose or fitting as required Reinstall air line to the brake chamber and recheck for leaks.
   c. If bubbles appear at air inlet fitting, tighten fitting until leaks cease, but do not exceed 30 ft-lb. (41 Nm) If leaks continue, release air pressure and remove fitting from brake chamber Install new fitting with Loctite 567 and tighten two full turns past finger tight. Reinstall air lines to the brake chamber and recheck for leaks. If leaks continue, perform a leakdown pressure test. Refer to 2.14.3.2. "Front Brake Chamber Leakdown Test" on page 75 in this section for test procedure. Replace fitting or brake chamber as required.
3. Check to ensure the mounting stud nuts are torqued to 133 to 155 ft-lb. (180 to 210 Nm).

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2.14.3.2.Front Brake Chamber Leakdown Test

☞NOTE:

Perform the leakdown test procedure only if bubbles were evident during the initial leak test.

1. Drain vehicle air system.
2. Disconnect service brake hose from brake chamber,
3. Connect brake chamber to pressure test equipment. See “Fig. PM-38: Front Brake Chamber Leak Test Setup” on page 75.
4. Close the exhaust valve.
5. Open the air supply valve and pressurize service chamber to 100 psi.
6. Cycle the unit 2 to 3 times by releasing and applying air pressure from and to the service chamber.
7. Pressurize the service chamber to 100 psi and close the supply valve.
8. Allow the system to stabilize for approximately one minute.
9. Open the air supply valve to restore the 100 psi system pressure.
10. Close the air supply valve and make note of the time.
11. After three minutes, record the final pressure. If the final pressure does not meet the minimum allowable pressure of 91 psi, then the brake chamber will need to be replaced.



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2.14.4. Rear Brake Chambers

2.14.4.1.Inspection

Perform the following inspection every 48,000 miles (77,200 km):

1. Visually inspect the exterior surfaces of the spring brake chamber for signs of damage. Replace the brake chamber if damaged. Refer to Section 2 of this manual for replacement procedure.
2. Apply system pressure (minimum 100 psi) to the spring brake chamber and check for leaks at the head/flange case interface, air inlet fittings, at vent elbows in non-pressure housing, and center seal using soapy water or leak detection solution.
   a. If bubbles appear at the head/flange case interface, a leak is present and If a leak is detected, perform a leakdown pressure test. Refer to 2.14.4.2. “Spring Brake Leakdown Test” on page 78 and Refer to 2.14.4.3. “Service Brake Leakdown Test” on page 79 in this section for test procedure.
   b. Check for leaks from the vent elbow located in the non-pressure housing. If more than one vent elbow is present, plug all but one elbow and check for leaks at the unplugged elbow. If leaks are detected, there is an internal leak. Perform a leakdown pressure test. Refer to 2.14.4.2. “Spring Brake Leakdown Test” on page 78 and Refer to 2.14.4.3. “Service Brake Leakdown Test” on page 79 in this section for test procedure.
   c. For center seal leaks, check for continuous discharge from the service side quick release valve. If a leak is detected, perform a leakdown pressure test. Refer to 2.14.4.2. “Spring Brake Leakdown Test” on page 78 and Refer to 2.14.4.3. “Service Brake Leakdown Test” on page 79 in this section for test procedure.
   d. If bubbles appear at air hose connection, tighten hose until leaks cease, but do not exceed 20 ft-lb. (27 Nm) for the spring brake hose. If leaks continue, release air pressure and remove air line from inlet port. Inspect threads on hose and fitting. Replace hose or fitting as required Reinstall air line to the brake chamber and recheck for leaks.
   e. If bubbles appear at spring brake air inlet fitting, tighten fitting until leaks cease, but do not exceed 30 ft-lb. (41 Nm). If leaks continue, release air pressure and remove fitting from brake chamber Install new fitting with Loctite 567 and tighten two full turns past finger tight. Reinstall air line to the spring brake chamber and recheck for leaks. If leaks continue, perform a leakdown pressure test. Refer to 2.14.4.2. “Spring Brake Leakdown Test” on page 78 in this section for test procedure. Replace brake chamber as required.

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3. With spring brake still fully pressurized, apply system pressure (minimum 100 psi) to the service brake chamber and check for leaks around the circumference of the clamp band and air inlet fittings, using soapy water or leak detection solution.

   a. If bubbles appear around clamp band, release air pressure and torque clamp band nuts to 30 to 35 ft-lb. (41 to 47 Nm). Recheck for leaks. If leaks continue, perform a leakdown pressure test. Refer to 2.14.4.3. “Service Brake Leakdown Test” on page 79 in this section for test procedure.

   b. If bubbles appear at service brake air inlet fitting, tighten fitting until leaks cease, but do not exceed 30 ft-lb. (41 Nm). If leaks continue, perform a leakdown pressure test. Refer to 2.14.4.3. “Service Brake Leakdown Test” on page 79 in this section for test procedure. Repair or replace hose and fittings as required.

   c. Check to ensure the mounting stud nuts are torqued to 133 to 155 ft-lb. (180 to 210 Nm).



DO NOT use an impact wrench to tighten the release bolt in the following step.

4. Check to ensure that the release bolt is seated against the head insert and torqued to 50 to 60 ft-lb. (68 to 81 Nm). Fully seating the release bolt ensures that the parking brake will have full stroke capability and seals the release bolt threads, preventing contaminants from entering the brake chamber.

5. Check the external breather tube to ensure there is no damage or cracks in the rubber elbows and ensure the tube is securely engaged a minimum of ½ inch (13 mm) into the rubber elbows and glued together with a high quality rubber cement. Replace with breather tube repair kit if required.

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2.14.4.2.Spring Brake Leakdown Test

☞NOTE:

Perform the leakdown test procedure only if bubbles were evident during the initial leak test.

1. Drain vehicle air system.
2. Disconnect both brake hoses from brake chamber,
3. Connect pressure test equipment to spring brake chamber port #12. See “Fig. PM-39: Spring Brake Leak Test Setup” on page 78.
4. Close the exhaust valve.
5. Open the air supply valve and pressurize spring brake chamber to 100 psi.

☞NOTE:

Some minor movement (0.010 inch maximum) to initially position the head may be noticed at the roll in area of the brake chamber. This is a normal condition.

6. Uncage the spring brake.

⚠CAUTION

Exercise caution in the following step when cycling the air pressure. Be aware of push rod movement.

7. Cycle the unit 2 to 3 times by releasing and applying air pressure from and to the spring brake chamber.
8. Pressurize the spring brake chamber to 100 psi and close the air supply valve.
9. Allow the system to stabilize for approximately one minute.
10. Open the air supply valve to restore the 100 psi system pressure.
11. Close the air supply valve and make note of the time.
12. After three minutes, record the final pressure. If the final pressure does not meet the minimum allowable pressure of 95 psi, then the brake chamber will need to be replaced.



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2.14.4.3.Service Brake Leakdown Test

☞NOTE:

Perform the leakdown test procedure only if bubbles were evident during the initial leak test.

1. Drain vehicle air system.
2. Disconnect both brake hoses from brake chamber,
3. Connect pressure test equipment to spring brake chamber port #12 and service brake chamber port #11. See "Fig. PM-40: Service Brake Leak Test Setup" on page 79.
4. Close the exhaust valves.
5. Open the air supply valve to spring brake port #12.
6. Pressurize spring brake chamber to 100 psi.
7. Open the air supply valve to service brake port #11.
8. Pressurize service brake chamber to 100 psi. and close the air supply valve.
9. Allow the system to stabilize for approximately one minute.
10. Open the air supply valve to port #11 and restore the system pressure to 100 psi.
11. Close the air supply valve and make note of the time.
12. After three minutes, record the final pressure. If the final pressure does not meet the minimum allowable pressure of 93 psi, then the brake chamber will need to be replaced.

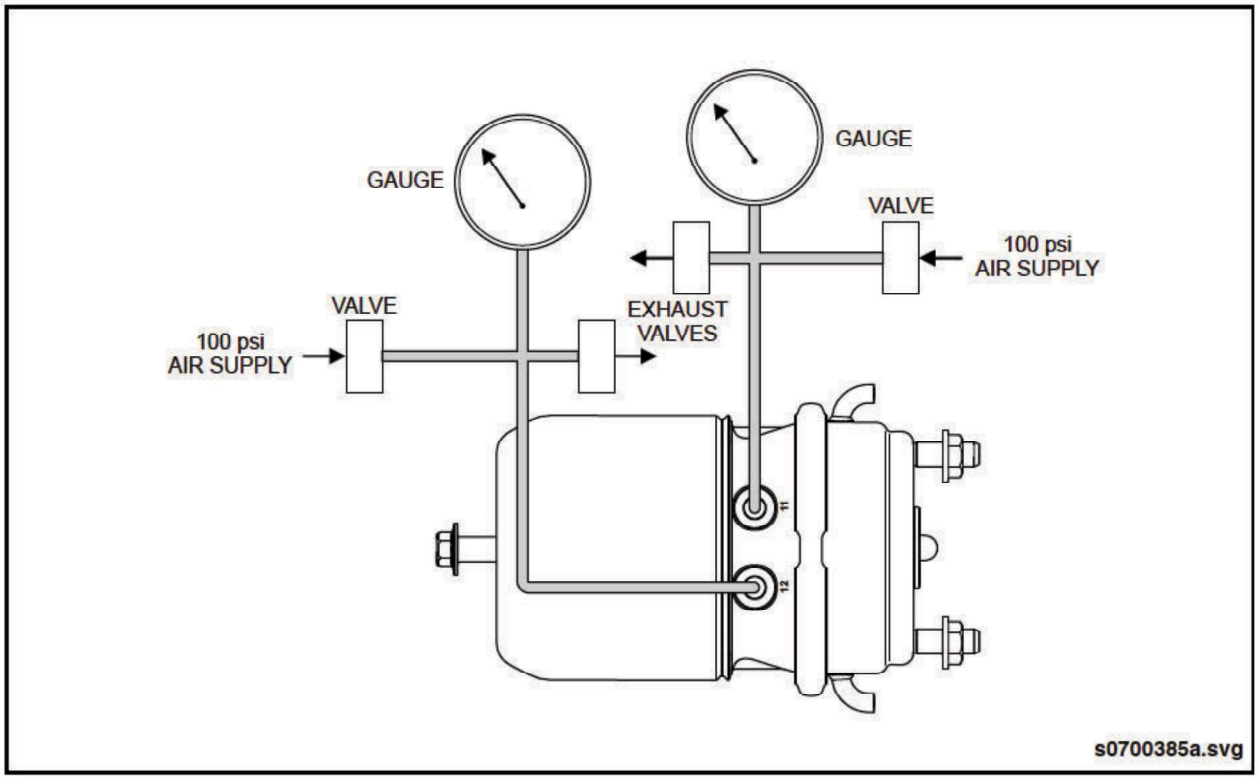

Fig. PM-40: Service Brake Leak Test Setup

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2.15. 54,000 Miles (87,000 km) Preventive Maintenance

2.15.1. Rear Axle Oil Change

Change the rear axle oil every 54,000 miles (87,000 km), or every year, whichever occurs first. Use this oil change interval only if operating with mineral oil in a moderate temperature region. Refer to 2.2. “Rear Axle Operating Conditions” on page 11 in this section for a definition of a moderate temperature region. Refer to 2.13.2. “Rear Axle Oil Change” on page 73 in this section for oil change drain and fill procedure. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for fluid specification.

2.16. 96,000 Miles (154,500 km) Preventive Maintenance

2.16.1. Front End Alignment

Perform major alignment. Refer to Section 3 of this manual for procedure.

2.17. 150,000 Miles (241,400 km) Preventive Maintenance

2.17.1. Battery Compartment Access Door Inspection

Inspect the two scissor hinges on the battery compartment door every 150,000 miles (241,400 km) as follows:

1. Raise and lower the door slowly while observing the action of the scissor hinges. The hinges should operate smoothly without any binding or deflection. Replace hinge if damaged.
2. Inspect all pivot point fasteners to ensure they are in good condition and properly tightened. Pay particular attention to the uppermost fasteners for possible damage or looseness. See “Fig. PM-41: Scissor Hinge Inspection” on page 81. Replace any damaged fasteners.

   ☞NOTE:

   If installing new fasteners, ensure that a light coating of Never-Seez is applied to the inside of the pivot holes, between the moving linkages, and on the underside of the large washers. Wipe off excess grease.

3. Inspect torque witness marks on all fasteners as follows:
   a. If witness marks are legible and aligned, no further action is required.
   b. If witness marks are not aligned, not legible, or missing entirely, then the fastener will need to be loosened and retorqued to 12 ft-lbs. (16 Nm). Reapply torque witness mark.
4. If the hinge is sticking or damaged, replace the hinge assembly.

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2.18. 250,000 Miles (400,000 km) Preventive Maintenance

2.18.1. Stabilizer Bar Mounting Bolt Replacement

Replace the stabilizer bar mounting bolts every 250,000 miles (400,00 km) as follows:

1. Locate the four 5/8" bolts that attach the stabilizer bar to the vehicle frame. See “Fig. PM-42: Stabilizer Bolt Replacement” on page 82.
2. Remove and discard the bolts and washers from the saddle clamps, being careful not to lose the spacers located between the saddle clamps and vehicle frame.
3. Install new bolts and washers and torque to specification. Refer to Section 1 of your New Flyer Parts Manual for correct fastener part numbers. Refer to Section 1 of this manual for installation torque.

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2.18.2. Support Frame Inspection

Inspect the K-member on the support frame after the first 250,000 miles (400,00 km) of operation, and then every year thereafter, as follows:

1. Raise the vehicle. Refer to the General Information Section of this manual for lifting procedures.
2. Locate the support frame. See “Fig. PM-43: Support Frame” on page 83.
3. Clean the support frame in the area of the bolted K-member to allow for proper visual inspection.
4. Inspect all fasteners to ensure torque witness marks are aligned. Retorque any loose fasteners to 370 to 390 ft-lbs. (500-525 Nm) and reapply torque witness marks.
5. Inspect all welded joints of the K-member for any cracks. Pay particular attention to the location identified on the accompanying illustration as “critical area”. Replace K-member if cracks are evident at any location. Contact New Flyer Parts Department for ordering information.

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2.19. Six Month Preventive Maintenance

2.19.1. PR-2 Pressure Protection Valve

Perform an operating test and leakage check of the valve at this interval. Refer to Section 8 of this manual for procedure.

2.19.2. ST-1 Safety Valve

Every six months or 1,500 operating hours perform operating and leakage test. Refer to Section 8 of this manual for test procedure.

2.19.3. SR-7 Spring Brake Modulating Valve

Perform an operating and leakage test every six months or 1,500 hours, whichever occurs first.



DO NOT attempt to disassemble and service the valve. The valve contains high spring forces that could result in personal injury if disassembled.

2.19.3.1. Operating Test

1. Block vehicle and hold by means other than vehicle brakes.
2. Charge air system to governor cut-out pressure.
3. Place parking brake control valve in the APPLIED position. Observe that the spring brake actuators apply promptly.
4. Remove the plug from the unused delivery port and install a test pressure gauge known to be accurate.
5. Place the parking brake control valve in the RELEASE position. Observe that the spring brake actuators release fully.
6. With the parking control valve in the RELEASE position, note the gauge pressure reading. Spring brake actuator hold-off pressure should be 107 psi. If the pressure reading is incorrect, the valve must be replaced.
7. Place the parking brake control valve in the APPLIED position: The gauge reading should drop to zero promptly. A slow release of pressure, more than three seconds, would indicate faulty operation. Replace the valve.
8. Maintain the parking brake control valve in the APPLIED position and gradually apply the brake treadle. The reading on the test pressure gauge, installed in the delivery port should increase.
9. Place the parking brake control valve in the RELEASE position.
10. Drain the rear brake reservoir to zero psi.
11. Apply the brake treadle several times and note that the pressure reading on the gauge decreases each time the brake treadle is applied. After several applications, pressure on the gauge will drop to the point where release of the spring brake actuators will no longer occur.

2.19.3.2. Leakage Test

With the air system fully charged and the parking brake control valve in the RELEASE position, coat all the ports, including the exhaust port, with a soap solution. A 1" bubble in three seconds (175 SCCM) is permitted.

If the Spring Brake Modulating Valve does not function as described in the operating test, or leakage is excessive, it is recommended that the valve be replaced.

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2.19.4. SC-1 Single Check Valve

Every six months or 1,500 operating hours perform operating and leakage test. Refer to Section 8 of this manual for test procedure.

2.19.5. DC-4 Double Check Valve

Every six months or 1,500 operating hours perform operating and leakage test. Refer to Section 8 of this manual for test procedure.

2.19.6. RV-3 Pressure Reducing Valve

Inspect and test the pressure reducing valve every six months or 1500 operating hours, whichever occurs first. Refer to Section 8 of this manual for procedure.

2.19.7. R-14 Brake Relay Valve

Perform an operating and leakage test every six months or 1,500 operating hours. Refer to Section 8 of this manual for procedure.

2.19.8. Brake Foot Valve

Every six months or 1,500 operating hours perform operating and leakage test. Refer to Section 8 of this manual for test procedure. Check for physical damage such as broken air lines and missing parts.

2.19.9. Parking Brake Control Valve

Perform an operating and leakage test every six months or 1,500 hours, whichever occurs first. Refer to Section 8 of this manual for procedure.

2.19.10. Emergency Brake Release Valve

Perform an operating and leakage test every six months or 1,500 hours, whichever occurs first. Refer to Section 8 of this manual for procedure.

2.19.11. Steering Knuckle Lubrication

Lubricate the upper and lower steering knuckle (kingpin) bearings every six months if operating under harsh winter conditions where the vehicle is exposed to salt spray or extremes of temperature. It is recommended that the bearings be greased before the start of the winter season, and then again immediately following the winter season. Do not grease more frequently than recommended.

☞NOTE:

The lubrication interval may be extended to once every year or 36,000 miles (58,000 km), whichever occurs first, if operating under less harsh conditions.

Lubricate the bearings as follows:

1. Ensure the wheels are supporting the weight of the vehicle. Do not lift on the axle or chassis with the wheels hanging unsupported, as this will prevent proper lubrication of the upper bearing.
2. Remove the protective plastic cap from the grease fitting and clean the fitting and surrounding area.
3. Ensure that the adapter on the grease gun properly fits the grease fitting.

⚠CAUTION

DO NOT over-pressurize the bearing cavity when greasing the bearing, as this could cause the sealing washer, located below the circlip, to bulge outward. Replace sealing washer if distorted.

4. Lubricate the upper bearing first. Use only RenoLit LX-OTP-2 lubricant and continue to apply grease until the old grease begins to escape from between the steering knuckle and axle I-beam. It is not necessary to completely purge all of the old grease.

☞NOTE:

If the lower bearing is lubricated first, it will tend to minimize the cavity above the upper kingpin bearing and restrict grease flow to the upper bearing.

5. Lubricate the lower bearing, same as the upper bearing.
6. If difficulty is experienced lubricating either the upper or lower bearing, Refer to 2.19.11.1. “Lubrication Troubleshooting” on page 86 for troubleshooting proceedures.

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7. Clean any excess grease from the steering knuckle joint as well as the area above the sealing washer.
8. Install protective plastic cap on grease fitting.

2.19.11.1.Lubrication Troubleshooting

Use the following checks and procedures if difficulty is experienced lubricating the bearings:

1. If neither bearing is taking grease, proceed as follows:
   a. Confirm that the weight of the vehicle is on the wheels when applying grease.
   b. Confirm that the proper grease gun adapter is being used.
   c. If excessive greasing pressures are being used, a hydraulic lock may form and prevent the flow of grease. Relieve the excessive pressure by turning the wheels fully left and right several times. If grease pressure will not relieve, proceed to the following step.
   d. Use a thin punch or similar tool to depress the check ball in the grease fitting and allow grease to escape. If grease pressure still won't relieve, proceed to the following step.
   e. Remove the circlip and sealing washer, wipe off the grease, and turn the wheels fully left and right several times.
   f. Install new grease fitting and ensure it does not protrude into the kingpin cavity. Reinstall sealing washer and circlip.

☞NOTE:

Replace the sealing washer if any evidence of distortion or bulging is noted.

2. If only the upper bearing is not taking grease, proceed as follows:
   a. Confirm that the weight of the vehicle is on the wheels when applying grease.
   b. Remove the snap ring and sealing washer and examine the grease fitting to ensure that it is flush with the sealing washer and does not protrude into the kingpin cavity.

☞NOTE:

The use of a non-specified grease fitting with longer threads could result in the grease fitting contacting the upper kingpin surface and effectively blocking the flow of grease. Refer to your New Flyer Parts Manual for correct grease fitting application.

2.19.12.Battery Compartment Access Door Inspection

Inspect, clean, and lubricate the scissor hinges on the battery compartment door every six months as follows:

1. Operate the door through its opening range while observing the hinge for smooth operation. Ensure the hinge is not buckled or distorted. Replace the hinge if damaged.
2. Use compressed air to blow out any grit from the pivot points of the hinge.
3. Wipe any displaced lubricant or grit with a clean cloth.
4. If the door is sticking, use a brush to work Never-Seez into all the pivot points of the hinge.
5. Wipe excess lubricant with a clean cloth, being careful not to remove any torque witness marks.

2.19.13.Bike Rack Servicing

Service the bike rack latch mechanism and support arm assembly every six months. Refer to Section 13 of this manual for procedure.

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2.19.14.Fire Suppression System

CAUTION

The fire suppression system must be serviced by an authorized Amerex technician that is trained and certified on the Amerex SafetyNet System and in accordance with NFPA and any federal, state, and/or local code requirements.

❒ Perform a six month inspection in accordance latest version of Amerex Installation, Operation, and Instruction Manual No. 16601 and Amerex Installation, and Maintenance Manual 13980.

2.19.15.Power Steering Miter Box

Locate the grease fitting on the bottom of the power steering miter box. Use a manual grease gun and apply only two pumps of grease to lubricate the miter box. Do not apply excessive pressure or quantity of grease that could result in damage to seals. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for lubricant specification. See “Fig. PM-44: Power Steering Miter Box Lubrication” on page 87.



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2.19.16.Cooling & Heating System Inspection

Pressure test the cooling/heating system and check anti-freeze concentration every six months.

☞NOTE:

The following inspection procedure applies to both reservoirs located on the rear streetside of the vehicle. The reservoir for the traction motor and inverters is labeled "MOTOR & INVERTER COOLANT". The reservoir for the vehicle heating system is labeled "CABIN HEATING COOLANT".

2.19.16.1.Inspection & Pressure Test

DO NOT attempt to open the pressure cap on the coolant reservoir until the system has cooled down and the pressure relief valve has been operated. Opening the pressure cap with pressurized hot coolant can result in scalding injury and loss of coolant.

1. If the system is cold, observe the coolant level through the sight tube. The coolant should be visible within the clear plastic tube.
2. Operate the vehicle until the coolant is hot and then observe the coolant level through the sight tube. The coolant should be level with the FULL line marked on the reservoir. See "Fig. PM-45: Coolant Reservoir Inspection" on page 89.
3. Allow the system to cool and then top off coolant to the correct level as required using premix antifreeze. Refer to 2.31. "Fluid & Lubrication Guide" on page 126 in this section for antifreeze specification.
4. Check hose connections for leaks and tighten clamps as necessary. Cracked, swollen or deteriorated hoses must be replaced.
5. Check coolant sensor connector and electrical wiring.

CAUTION

DO NOT exceed 20 psi while pressure testing, otherwise damage to the cooling system may result.

6. Pressure test the cooling system at 15 to 20 psi (103 to 138 kPA) using special pressure regulated testing equipment. Refer to "Cooling System Pressure Test" and "Cooling System Special Tools" in Section 6 of this manual for pressure test procedure and special tooling. Maintain pressure for one minute while observing gauge reading. If pressure reading drops check for source of leak and repair as necessary.
7. Pressure test reservoir cap at 12 to 15 psi (83 to 103 kPa) and ensure that it maintains pressure. Increase pressure until the pressure relief actuates. Pressure relief should occur at approximately 16 psi. Also inspect the vacuum relief valve on the underside of the cap to ensure that it functions.

2.19.16.2.Antifreeze Inspection

CAUTION

DO NOT use antifreeze concentrations in excess of 60% or less than 40%.

Use only fully formulated coolants meeting ASTM D6210 specification. Refer to 2.31. "Fluid & Lubrication Guide" on page 126 in this section for coolant specification.

Antifreeze broadens the operating temperature range by lowering the coolant freezing point and raising the boiling point. The corrosion inhibitors protect cooling system components from corrosion and prolong component life.

Use a Refractometer to provide a reliable and accurate measurement of freeze point protection and glycol (antifreeze) concentration. Use pre-mixed anti-freeze of 50% distilled water and 50% ethylene glycol to provide year-round protection of -26°F (-32°F).

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2.19.17.ESS HVAC Cooling & Heating System Inspection

Pressure test and check anti-freeze protection for the ESS HVAC system every six months.

☞NOTE:

The ESS HVAC (Battery Thermal Management) system is a separate system, independent of other heating/cooling systems on the vehicle. The reservoir for the ESS HVAC system is labeled "BATTERY COOLANT".

2.19.17.1.Inspection & Pressure Test

[redacted]

Use work platforms or scaffolding whenever working on roof-mounted components. Ensure maintenance personnel use an approved safety harness.

[redacted]

DO NOT attempt to open the pressure cap on the coolant reservoir until the system has cooled down and the pressure relief valve has been operated. Opening the pressure cap with pressurized hot coolant can result in scalding injury and loss of coolant.

1. Locate the "BATTERY COOLANT" reservoir on the rear curbside of the vehicle. See "Fig. PM-46: ESS HVAC Reservoir Inspection" on page 91.
1. If the system is cold, observe the coolant level through the sight tube. The coolant should be visible within the clear plastic tube. If the coolant is hot, it should be level with the FULL line marked on the reservoir.
2. Allow the system to cool and then top off coolant to the correct level as required using premix antifreeze. Refer to 2.31. "Fluid & Lubrication Guide" on page 126 in this section for antifreeze specification.
3. Check hose connections for leaks and tighten clamps as necessary. Cracked, swollen or deteriorated hoses must be replaced.
4. Check coolant sensor connector and electrical wiring.

⚠CAUTION

DO NOT exceed 20 psi while pressure testing, otherwise damage to the cooling system may result.

5. Pressure test the cooling system at 15 to 20 psi (103 to 138 kPA) using special pressure regulated testing equipment. Refer to "Cooling System Pressure Test" and "Cooling System Special Tools" in Section 6 of this manual for pressure test procedure and special tooling. Maintain pressure for one minute while observing gauge reading. If pressure reading drops check for source of leak and repair as necessary.
6. Pressure test reservoir cap at 12 to 15 psi (83 to 103 kPa) and ensure that it maintains pressure. Increase pressure until the pressure relief actuates. Pressure relief should occur at approximately 16 psi. Also inspect the vacuum relief valve on the underside of the cap to ensure that it functions.

2.19.17.2.Antifreeze Inspection

⚠CAUTION

DO NOT use antifreeze concentrations in excess of 60% or less than 40%.

Use only fully formulated coolants meeting ASTM D6210 specification. Refer to 2.31. "Fluid & Lubrication Guide" on page 126 in this section for coolant specification.

Antifreeze broadens the operating temperature range by lowering the coolant freezing point and raising the boiling point. The corrosion inhibitors protect cooling system components from corrosion and prolong component life.

Use a Refractometer to provide a reliable and accurate measurement of freeze point protection and glycol (antifreeze) concentration. Use pre-mixed anti-freeze of 50% distilled water and 50% ethylene glycol to provide year-round protection of -26°F (-32°F).

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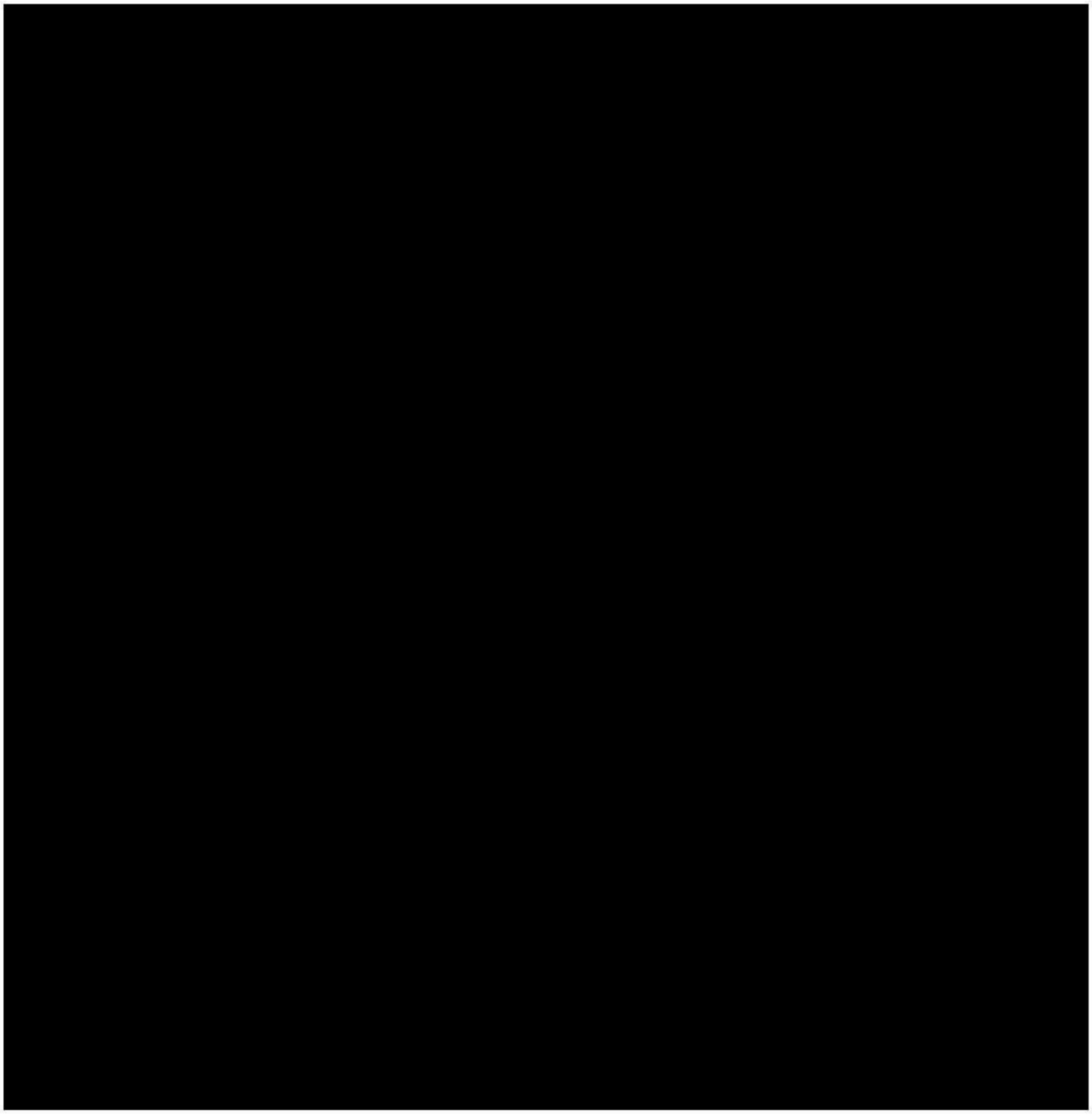

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2.19.18.HVAC System Test & Lubrication

Perform the following maintenance tasks every six months. Refer to your Thermo King Maintenance Manual for procedures.

- ❒ Check evaporator blower motors speed, voltage, and amperes (all motors).
- ❒ Check condenser blower motors speed, voltage, and amperes (all motors).
- ❒ Lubricate fan shaft bearings with Shell Alvania EP grease.

2.19.19.Battery Rack Inspection

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

Inspect the rear compartment and rooftop battery racks every six months.

2.19.19.1.Rear Battery Compartment

1. Set the Battery Disconnect switch to the OFF position.
2. Set the High Voltage Interlock switch to the OFF position.
3. Open the rear battery compartment access door.
4. Inspect the battery enclosure covers to ensure they are properly fastened and not cracked or otherwise damaged. See “Fig. PM-47: Rear Battery Compartment” on page 93.
5. Inspect the high voltage power cables that are external to the battery enclosure. Refer to 2.9.1. “High Voltage Power Cable Inspection” on page 26 for inspection procedure.
6. Ensure all ground connections are clean, properly tightened, and torque marked.
7. Locate the four duck-bill drains at the bottom of the battery enclosure and inspect to ensure they are functional and not damaged. Refer to Fig. PM-48: “Rear Battery Compartment Drains” on page 93
8. Close the battery compartment access door and ensure the latches secure the door and are properly adjusted.

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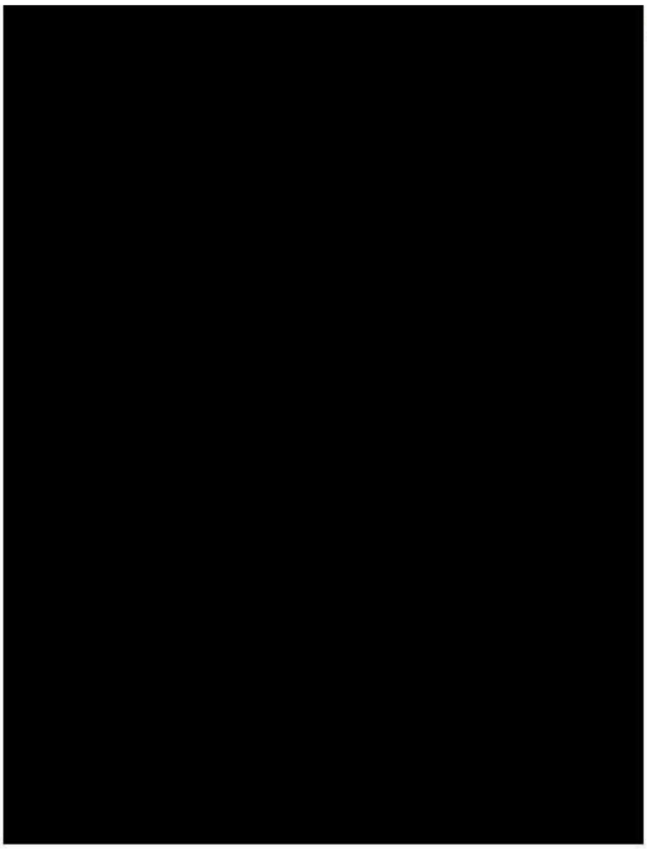
Fig. PM-47: Rear Battery Compartment



2.19.19.2.Rooftop Battery Enclosures

Use work platforms or scaffolding whenever working on roof-mounted components. Ensure maintenance personnel use an approved safety harness.

1. Set the Battery Disconnect switch to the OFF position.
2. Set the High Voltage Interlock switch to the OFF position.
3. Unlatch and open the hinged battery access doors from the front and rear battery pack enclosures. See “Fig. PM-49: Rooftop Battery Enclosures” on page 94.
4. Inspect the battery packs for any obvious signs of damage.
5. Inspect all low and high voltage power cables. Refer to 2.9.1. “High Voltage Power Cable Inspection” on page 26 and Refer to 2.9.3. “Low Voltage Electrical Wiring Inspection” on page 27 for inspection procedures.

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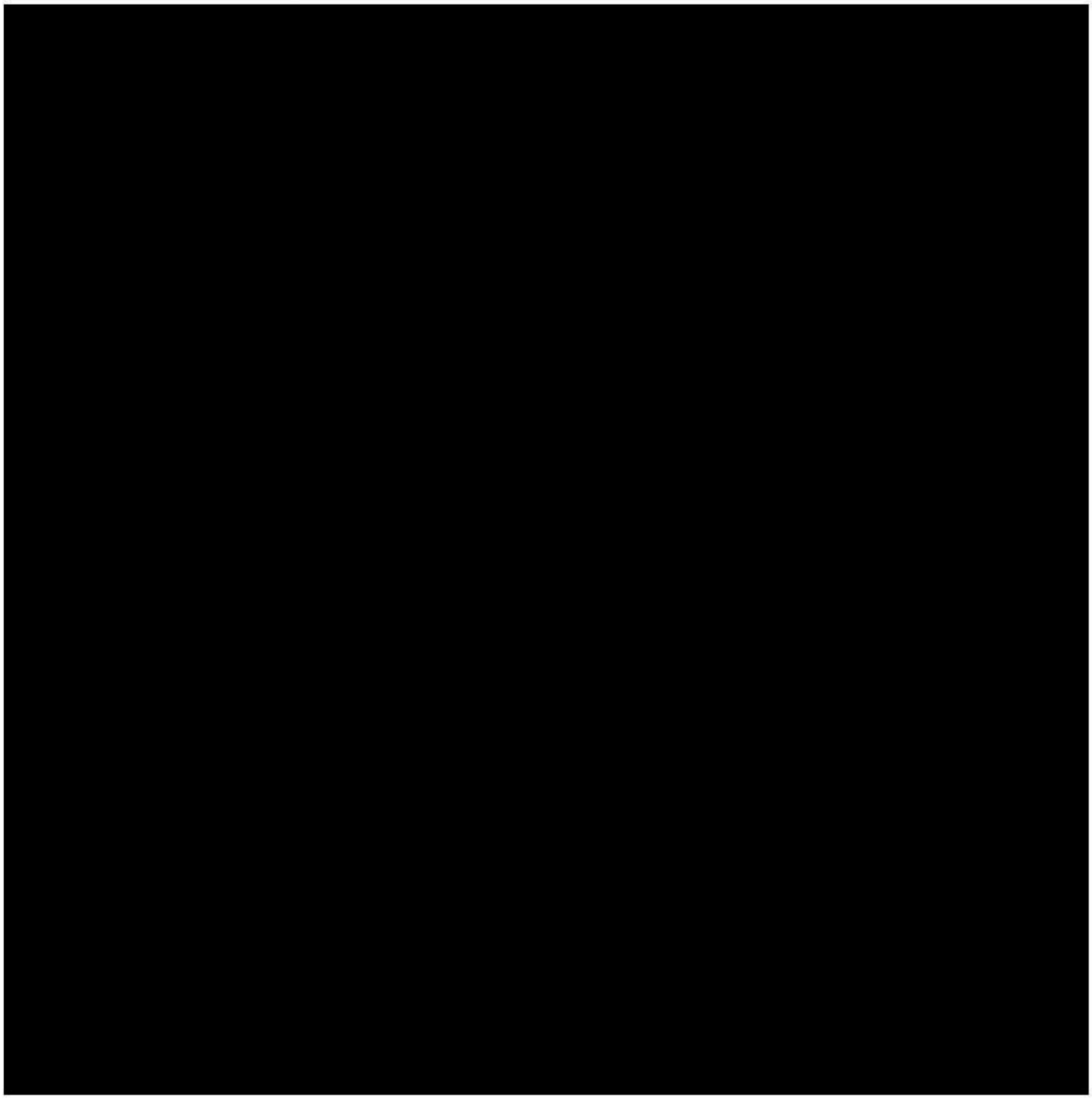
6. Inspect all accessible battery pack mounting fasteners to ensure torque witness marks are aligned.
7. Ensure all ground connections are clean, properly tightened, and torque marked.
8. Inspect accessible coolant lines for any evidence of leakage. Torque hose clamps to 25 in-lbs. as required.
9. Inspect the mounting fasteners on the battery rack structure to ensure torque witness marks are aligned.
10. Ensure access doors seal properly when closed and latched.



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2.20. Yearly Preventive Maintenance

2.20.1. Door Sensitive Edge Inspection & Test

Inspect and test the door sensitive edge function every year or 100,000 door operating cycles, whichever occurs first.

- ❒ Visually inspect door sensitive edge for cuts, tears, or other damage. Replace sensitive edge if damaged.
- ❒ Inspect for properly connect tubing from sensitive edge to pressure wave switch.
- ❒ Inspect electrical connections on pressure wave switch.
- ❒ Perform a functional test on the sensitive edge system. Refer to Section 16 of this manual for test procedure.

2.20.2. Wheelchair Ramp Pump

2.20.2.1. Hydraulic Fluid

☞NOTE:

The yearly fluid change interval is based on typical transit operating conditions but may need to be adjusted to suit actual operating frequency. Periodic oil samplings may also be taken to determine fluid cleanliness.

Change fluid as follows:

1. Set Battery Disconnect switch to OFF position.
2. Suction fluid from reservoir and dispose of fluid in accordance with local regulations.
3. Disconnect hydraulic lines from ports “1” and “2” on manifold.
4. Manually operate ramp through several operating cycles to expel as much fluid as possible from the actuating cylinder and lines.
5. Inspect filters and screens. Refer to 2.20.2.2. “Screen & Filter Inspection” on page 96 in this section for replacement procedure. See “Fig. PM-50: Hydraulic Power Pack Assembly” on page 96.
6. Connect and tighten hydraulic lines to ports “1” and “2” on the manifold.
7. Fill the reservoir. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for fluid specifications.
8. Manually place the ramp in the stowed position.
9. Crack open or remove the STOW line at the aft end of the cylinder.
10. Set the Battery Disconnect switch to the ON position.

⚠CAUTION

DO NOT allow the reservoir to run dry while priming the pump

11. Use the ramp DEPLOY switch to “jog” the unit through short deploy strokes, Gradually increase the length of the deploy strokes until a steady stream of fluid flows from the line without air bubbles.
12. Tighten the STOW pressure line at the aft end of the cylinder and crack open or remove the DEPLOY line at the forward end of the cylinder.
13. Use the ramp STOW switch to “jog” the unit through short stow strokes, Gradually increase the length of the stow strokes until a steady stream of fluid flows from the line without air bubbles.
14. Tighten the DEPLOY line at the forward end of the cylinder.
15. Operate the ramp through several deploy/stow cycles.
16. Top up reservoir to within 1” of filler cap.

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2.20.2.2.Screen & Filter Inspection

Inspect the inlet (suction) screen as follows:

1. Separate the reservoir from the manifold by removing the four bolts and clamp plates.
2. Remove and discard the O-Ring.
3. Remove inlet filter from pump and clean or replace as necessary.
4. Install new O-Ring and install reservoir onto manifold.
5. Install four bolts with clamp plates and tighten bolts.

Inspect the manifold filters as follows:

1. Disconnect hydraulic lines from manifold ports.
2. Remove elbow fittings from manifold.
3. Use dental pick or similar tool to remove filter from each port.
4. Clean or replace filters as necessary.
5. Reinstall elbow fittings into manifold ports.
6. Install and tighten hydraulic lines.

Inspect the breather vent as follows:

1. Locate the breather vent on top of the pump manifold.
2. Use a hex socket to remove the breather vent from the manifold.
3. Clean or replace the sintered bronze filter as necessary.
4. Reinstall breather vent into manifold.

2.20.3. Instrument Panel & Side Console

Once yearly, inspect the interior of the instrument panel for loose wires. Inspect the interior of the side console for loose wires and chafing air lines. Refer to Section 19 of this manual for further information on these components.

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2.20.4. Fire Extinguisher

Examine every 12 months to ensure extinguisher is operable. Recharge if below the specified weight or pressure is below operable range. Replace any damaged parts. Check hose for obstructions.

Record maintenance use and recharge dates on the fire extinguisher maintenance tag.

2.20.5. QR-1 Quick Release Valve

Perform the following operation and leakage test at every year or 1,500 hours, whichever occurs first:

1. Block the vehicle's wheels and fully charge the air system.
2. Apply the parking brake.
3. Locate the QR-1 Quick Release Valve on the front axle.
4. Apply and release the service brakes several times and observe that the brakes promptly respond at both wheels.
5. Make and hold a full brake application and apply a soap solution to the exhaust port. Leakage of a 1" bubble in 3 seconds is permissible.
6. Maintain full brake application and apply a soap solution to the body and cover. No leakage is permitted between the body and cover.
7. Repair or replace valves that do not function properly or have excessive leakage.

2.20.6. Air Strainer

Replace the air strainer every year or 36,000 miles, whichever occurs first.

1. Park the vehicle on level ground and chock the wheels.
2. Drain the air tanks.
3. Locate the air strainer on the front brake & kneeling valve panel.
4. Disconnect air line from air strainer.
5. Unthread air strainer assembly from nipple connector.
6. Remove fittings from air strainer and install in same position on new air strainer. Use Loctite 567 thread sealant on pipe threads.
7. Install new air strainer assembly on nipple connector, using Loctite 567 thread sealant on pipe threads.
8. Connect and tighten air line.
9. Charge the air system to operating pressure and check for leaks at the air strainer connections.

2.20.7. Headlight Aim

Check headlight aim on a yearly basis. Refer to Section 9 of this manual for headlight aiming procedures.

2.20.8. Front & Rear Wheel Bearing Inspection

Inspect the wheel bearing end play every year or 36,000 miles (58,000 km), whichever occurs first. Refer to Sections 1 & 2 of this manual for inspection procedure.

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2.20.9. Support Frame Inspection

Inspect the K-member on the support frame after the first 250,000 miles (400,00 km) of operation, and then every year thereafter. Refer to 2.18.2. “Support Frame Inspection” on page 82 for inspection procedure.

2.20.10.Air Dryer

☞NOTE:

The desiccant replacement interval is dependent on operating conditions and may need to be adjusted to suit the operating environment. The monthly preventive maintenance to drain air tanks and record moisture accumulation will aid in determining the optimum change interval for the desiccant cartridge.

Rebuild the air dryer and replace the desiccant cartridge yearly. Refer to Section 8 of this manual for procedure. See “Fig. PM-51: Air Dryer Inspection” on page 98.

[redacted]

2.20.11.HVAC System Inspection & Test

Perform the following maintenance tasks every year. Refer to your Thermo King Maintenance Manual for procedures.

- ❒ Check thermostat cycle sequence on all operating modes.
- ❒ Clean control panel area and return air sensor with compressed air

☞NOTE:

These components may need to be cleaned more frequently dependent on operating environment.

- ❒ Check boost pump motor operation.
- ❒ Inspect all wires and terminals for damage or corrosion. If corrosion is present, clean terminals with electrical contact cleaner.
- ❒ Check high pressure cut-out.
- ❒ Verify condenser motor speed.
- ❒ Check discharge pressure transducer and suction pressure transducer.
- ❒ Check compressor oil for acidity.
- ❒ Check compressor efficiency.
- ❒ Check compressor oil pump pressure.
- ❒ Replace filter-drier.
- ❒ Check hot water control valve operation.
- ❒ Clean condenser and evaporator drains. Make sure the drain check valves are in place and in good condition.
- ❒ Visually inspect vehicle coolant hose and hose clamp condition on heater coil system.
- ❒ Clean condenser and evaporator coils.
- ❒ Tighten all HVAC unit, fan motor mounting bolts and brackets (more frequently if necessary).
- ❒ Check condenser air seals.

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2.20.12.Electric Coolant Heater

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

☞NOTE:

Refer to your Valeo/Spheros Workshop Manual for specific requirements.

Perform the following inspections and tests on a yearly basis:

- ❒ Inspect electrical connections.
- ❒ Inspect temperature sensors.
- ❒ Inspect burner head.
- ❒ Perform a functional check.

2.20.13.Power Steering Pump

Inspect and lubricate the power steering pump every year or 10,000 operating hours, whichever occurs first.

1. Remove the power steering pump from the vehicle. Refer to Section 3 of this manual for procedure.
2. Clean splines on the power steering pump and drive motor using solvent. Wipe dry.
3. Inspect splines for damage or excessive wear. Replace pump and/or drive motor if splines are damaged or excessively worn.
4. Lubricate the splines with fresh grease. Use Shell Gadus S3 V460D.
5. Install the power steering pump on the electric drive motor. Refer to Section 3 of this manual for procedure.

2.20.14.Low Voltage Junction Box (DICO)

Locate the low voltage junction box on the rooftop inverter rack and perform the following inspections on a yearly basis:

- ❒ Check for internal and external damage.
- ❒ Check for ingress of excessive water or dirt. Check and repair cable gland seals and/or cover seal.
- ❒ Check for signs of corrosion. Clean as required.
- ❒ Check for signs of heat damage. Investigate cause and make repairs as necessary.
- ❒ Check for any other abnormal conditions.

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2.20.15.Auxiliary Power Distribution Box



Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

Locate the auxiliary power distribution box on the rooftop inverter rack and perform the following inspections on a yearly basis:

- ❒ Check for internal and external damage.
- ❒ Check for ingress of excessive water or dirt. Check and repair cable gland seals and/or cover seal.
- ❒ Check for signs of corrosion. Clean as required.
- ❒ Check for signs of heat damage. Investigate cause and make repairs as necessary.
- ❒ Check for any other abnormal conditions.

2.20.16.High Voltage Distribution & Fuse Box



Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

Locate the high voltage distribution and fuse box on the rooftop inverter rack and perform the following inspections on a yearly basis:

- ❒ Check for internal and external damage.
- ❒ Check for ingress of excessive water or dirt. Check and repair cable gland seals and/or cover seal.
- ❒ Check for signs of corrosion. Clean as required.
- ❒ Check for signs of heat damage. Investigate cause and make repairs as necessary.
- ❒ Check for any other abnormal conditions.

2.20.17.Insulation Monitoring Device (IMD) Box



Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

Locate the IMD box on the rooftop inverter rack and perform the following inspections on a yearly basis:

- ❒ Check for internal and external damage.
- ❒ Check for ingress of excessive water or dirt. Check and repair cable gland seals and/or cover seal.
- ❒ Check for signs of corrosion. Clean as required.
- ❒ Check for signs of heat damage. Investigate cause and make repairs as necessary.
- ❒ Check for any other abnormal conditions.

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2.20.18. Battery Rack Inspection

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. "High Voltage Safety" on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

2.20.18.1.Rear Battery Compartment

Inspect the rear battery compartment on a yearly basis.

1. Set the Battery Disconnect switch to the OFF position.
2. Set the High Voltage Interlock switch to the OFF position.
3. Open the rear battery compartment access door.
4. Remove the upper and lower panels from the battery pack enclosure. See "Fig. PM-52: Rear Battery Compartment Inspection" on page 101.
5. Visually inspect the battery packs for any evidence of cracks, deformation, or other damage that could impair the sealing integrity of the battery pack.
6. Visually inspect the battery pack power cable connections for any signs of corrosion or evidence of arcing
7. Inspect all accessible battery pack mounting fasteners and ensure the torque witness marks are aligned.
8. Inspect accessible coolant lines for any evidence of leakage. Tighten connections as required.
9. Inspect the battery rack structure for any evidence of corrosion or cracks.
10. Reinstall service access panels.

[redacted]

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2.20.18.2.Rooftop Battery Enclosures

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

Use work platforms or scaffolding whenever working on roof-mounted components. Ensure maintenance personnel use an approved safety harness.

1. Set the Battery Disconnect switch to the OFF position.
2. Set the High Voltage Interlock switch to the OFF position.
3. Unlatch and remove the hinged battery access doors.
4. Remove the fasteners and remove the remaining access panels from the battery enclosures.
5. Visually inspect the battery packs for any evidence of cracks, deformation, or other damage that could impair the sealing integrity of the battery pack. See “Fig. PM-53: Rooftop Battery Pack Inspection” on page 103.
6. Inspect all low and high voltage power cables. Refer to 2.9.1. “High Voltage Power Cable Inspection” on page 26 and Refer to 2.9.3. “Low Voltage Electrical Wiring Inspection” on page 27 for inspection procedures.
7. Visually inspect battery pack mounting fasteners and confirm that torque witness marks are aligned.
8. Inspect coolant lines for any evidence of leakage. Tighten connections as required.
9. Visually inspect the Battery Disconnect Unit (BDU) to ensure there is no obvious damage and that the component is securely mounted to the rack structure.
10. Check the battery pack power cable connections as follows:
    a. Remove the side screen fairings and side covers to gain access to the power cable locations.
    b. Visually check for any signs of corrosion or evidence of arcing.
11. Reinstall fairings and side covers.

2.20.19.Depot Charging Station Inspection

Inspect the depot charge station on a yearly basis as follows:

- ❒ Check signs for marking or fading and replace as necessary.

CAUTION

DO NOT pressure wash the charging station. Pressurized water could damage the system.

- ❒ Use a damp, lint-free cloth to wipe down the outside surfaces of the staion, including the cables, outer surfaces of the connector, and touchscreen.
- ❒ Perform a test charge and check for proper operation.
- ❒ Check coolant level and top up if necessary.
- ❒ Check the body of the charging station for any signs of rust or damage. Contact ChargePoint if any damage is found.
- ❒ Check the cables and connectors of the charging station for any signs of damage. Do not use the station is damage is found. Contact Chargepoint.
- ❒ Check the area light board and LED display for burned-out bulbs. Repalce lights as required.

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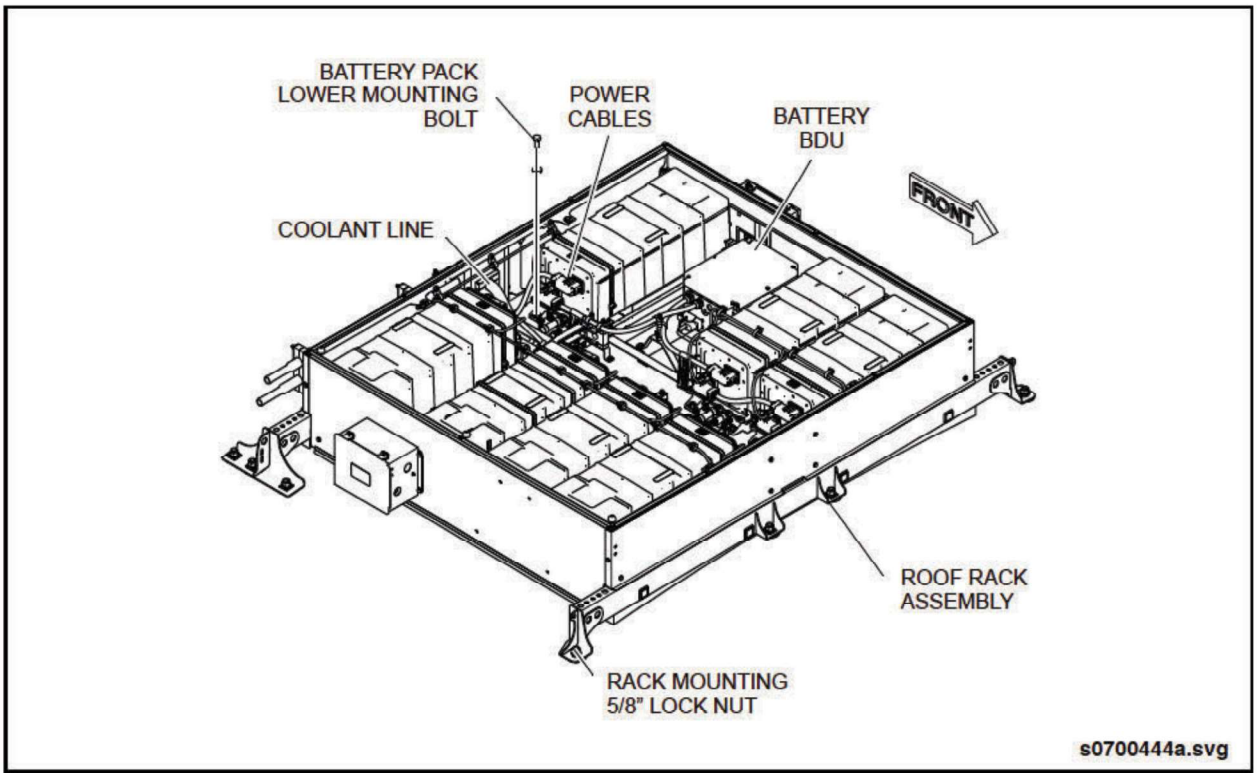

Fig. PM-53: Rooftop Battery Pack Inspection

2.20.20. Traction Motor/Inverter Radiator Inspection

[redacted]

Use work platforms or scaffolding whenever working on roof-mounted components. Ensure maintenance personnel use an approved safety harness.

Inspect the roof-mounted motor/inverter radiator assembly every year as follows:

- ❒ Inspect the main harness and fan connectors. Ensure all wires and pin connectors are intact.
- ❒ Inspect fuses and fuse holders.
- ❒ Inspect support structure for any damage or loose mounting hardware.

2.20.21. Electric Coolant Heater

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. "High Voltage Safety" on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

☞NOTE:

Refer to your Valeo Workshop Manual for specific requirements.

Perform the following inspections and tests on a yearly basis:

- ❒ Inspect electrical connections.
- ❒ Inspect temperature sensors.
- ❒ Inspect HV control head.
- ❒ Perform a functional check.

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2.21. Two Year Preventive Maintenance

2.21.1. Fire Suppression System

The internal Nickel Metal Hydride (NiMH) backup battery, installed in the Control Panel, will require periodic replacement. Refer to your Amerex Installation, Operation, and Instruction Manual 19680 for replacement instructions.

2.21.2. Door System Inspection

Perform the following inspection/maintenance on the major door system components every two years or 250,000 door operating cycles, whichever occurs first:

2.21.2.1. Connecting Rods & Rod End Bearings

- ❒ Visually inspect the fore and aft connecting rods on the baseplate for evidence of bending or distortion. Replace damaged connecting rods.
- ❒ Check jam nuts on the rod ends for tightness.
- ❒ Check for excessive play in the rod ends. Replace worn rod ends.
- ❒ Lubricate rod ends with a few drops of SAE #20 oil. See “Fig. PM-54: Entrance Door Baseplate Lubrication” on page 104. See “Fig. PM-55: Exit Door Baseplate Lubrication” on page 105.



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2.21.2.2.Door Shaft Levers & Mounting Hardware

- ❒ Visually inspect the levers on the upper door shaft for worn splines, cracks or other damage. Replace damaged parts.
- ❒ Check lever clamp bolt (wedge & screw) for tightness.

2.21.2.3.Upper Door Shaft Pivot Bearings

The upper door shaft pivot bearings locate directly on the door baseplate. Check for smooth rotation of door shafts without binding, noise, or excessive radial or axial play. Replace worn or damaged bearings. These are sealed ball bearing assemblies and do not require lubrication.

2.21.2.4.Lower Door Shaft Pivot Bearing

The lower door shaft pivot bearing assemblies are bolted to the vehicle floor and support the door shaft. A spherical bearing rides inside a plain bushing within the lower end of the door shaft. Check for excessive radial play between pivot bearing and the door shaft bushing. Replace pivot bearing and/or bushing if wear exceeds 0.060". DO NOT lubricate pivot bearing.

2.21.2.5.Upper Roller Guide, Brackets, & Bearings

The upper roller bracket assembly is bolted to the door panel and consists of a roller mounted on the shaft of the bracket. The roller tracks within the roller channel (slotted guide) of the baseplate.

- ❒ Manually open the door panel, ensuring that the roller operates smoothly within the roller channel of the baseplate.
- ❒ Inspect the roller for wear or flat spots. DO NOT lubricate the outer surface of the roller.
- ❒ Inspect the bearing shaft on the bracket for wear or scoring. Lubricate the bearing shaft with SAE #20 oil, but DO NOT lubricate the outer surface of the roller.
- ❒ Clean the roller channel in the baseplate but DO NOT lubricate channel.

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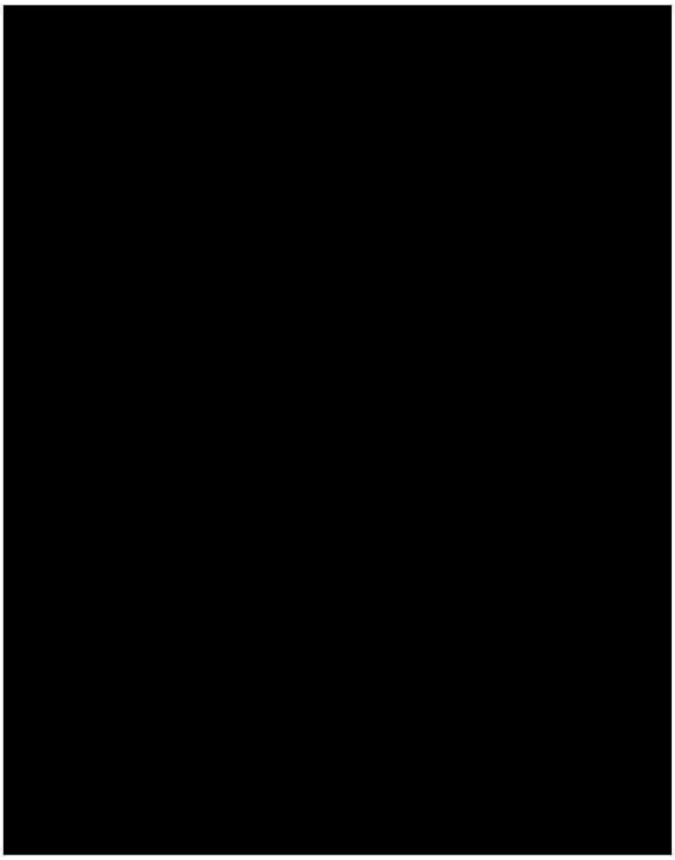
2.21.2.6.Entrance Door Shaft & Arm Assembly

The upper end of the door shaft consists of a splined shaft with a connecting arm and rod end. The lower end of the door shaft consists of a hollow shaft with a connecting arm and hinged mounting bracket. See "Fig. PM-56: Entrance Door Shaft & Arm Assembly" on page 106.

- ❒ Check door shaft and arm assemblies for any evidence of bending, twisting, or other physical damage. Repair or replace damaged door shaft and arm assemblies as required.
- ❒ Inspect splines on upper end of door shaft for wear, cracks, or other damage. Replace damaged door shaft.
- ❒ Clean the rod end and mounting bracket areas on the upper and lower ends of the door shaft using a clean dry cloth. DO NOT lubricate the sealed spherical bearings on rod ends.
- ❒ Inspect upper and lower mounting brackets for any damage and ensure that they are securely mounted to the door panel.
- ❒ Inspect rod end and shoulder bolt for wear or damage. Replace rod end and/or shoulder bolt if worn or damaged.



2.21.2.7.Exit Door Shaft & Arm Assembly

- ❒ The upper and lower hinged mounting brackets attach the door shaft and arm assembly to the exterior side of the door panel. A lubrication fitting is provided on the hinged mounting bracket to allow lubrication of the flanged bronze bushing from the exterior of the vehicle. See "Fig. PM-57: Exit Door Shaft" on page 107. Check door shaft and arm assemblies for any evidence of bending, twisting, or other physical damage. Repair or replace damaged door shaft and arm assemblies as required.
- ❒ Inspect splines on upper end of door shaft for wear, cracks, or other damage. Replace damaged door shaft.
- ❒ Inspect hinged mounting bracket for excessive play.
- ❒ Inspect flanged bronze bushing and pin for wear or scoring. Replace flanged bushing and pivot pin if worn or damaged.
- ❒ Lubricate hinged mounting bracket at grease fitting, using a high pressure, low temperature (-40° F) grease.

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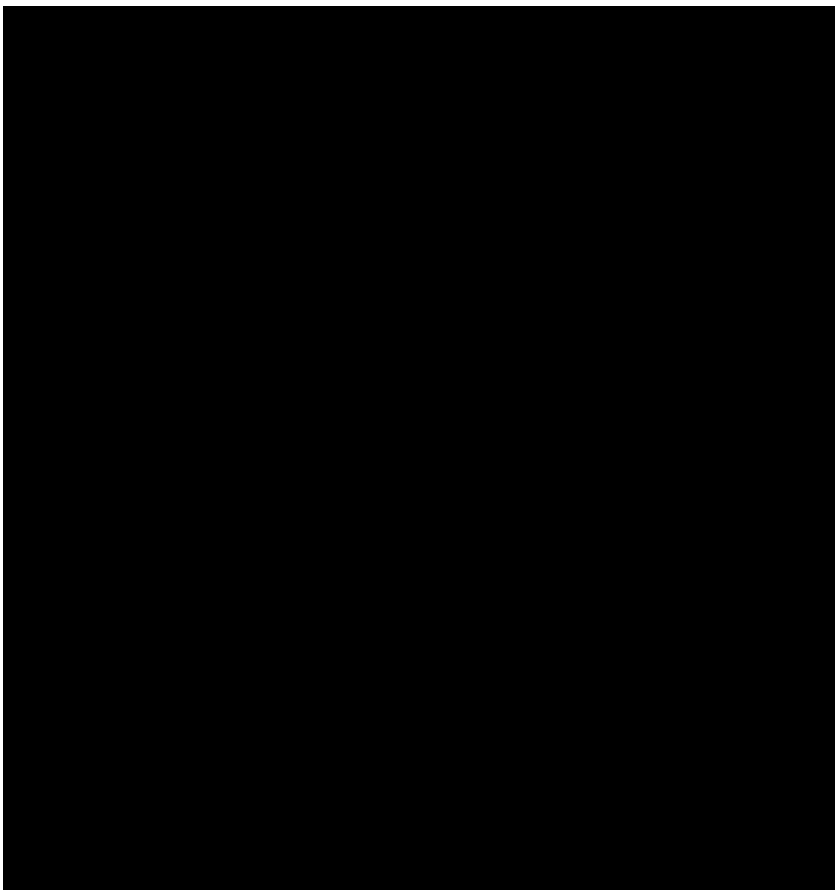

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2.21.2.8.Door Panels

- ❒ Inspect door panels for structural damage. Repair or replace panel if required.
- ❒ Inspect exterior door panel pocket seals for cuts, tears, excessive wear, or other damage. Replace pocket seals if required.
- ❒ Inspect leading edge and door jamb seals for cuts, tears, excessive wear, or other damage. Replace if required.
- ❒ Apply a light film of silicone lubricant on the mating surfaces of the leading edge and door jamb seals and wipe clean with a dry cloth.

2.21.2.9.Door Panel Top & Bottom Seal Assemblies

- ❒ Inspect for damage to brush bristles or rubber seal strip. Replace brush if bristles are damaged.
- ❒ Adjust height of top brush to provide light contact only with the top edge of door panels so as to prevent binding.
- ❒ Adjust height of bottom brush to provide light contact only with the top surface of the flooring so as to prevent binding.

2.21.2.10.Door Operator Proximity Switches

- ❒ Check that the proximity switches function properly.
- ❒ Inspect electrical connections. Repair loose connections.
- ❒ Adjust proximity switch air gap if necessary. Refer to Section 16 of this manual for adjustment procedures.

2.21.2.11.Entrance Door Solenoid Valves

- ❒ Check for proper operation of the emergency release and dump valve solenoids.
- ❒ Inspect electrical connections.
- ❒ Inspect air lines to rotary dump valve and emergency release actuator cylinder. Ensure connections are tight.
- ❒ Inspect emergency release cable for proper operation.

2.21.2.12.Driver's Door Controller

- ❒ Operate the door controller through all positions and check for proper function.
- ❒ Verify that the door controller moves freely without binding. Use a spring scale to measure torque required to rotate controller. Replace door controller if torque exceeds 15 in-lbs.

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2.21.3. Traction Motor Lubrication

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

☞NOTE:

For initial run-in period, lubricate traction motor bearings after first 1,000 miles (1,500 km) of operation. Thereafter, lubricate every two years.

Lubricate the traction motor bearings every two years or 87,000 miles (140,000 km), whichever occurs first. Refer to Siemens Operating Instructions Manual for lubrication procedure.

2.21.4. Cooling/Heating System Coolant Change

☞NOTE:

The following drain and fill procedure applies to both system reservoirs located on the rear streetside of the vehicle. The reservoir for the traction motor and inverters is labeled “MOTOR & INVERTER COOLANT”. The reservoir for the vehicle heating system is labeled “CABIN HEATING COOLANT”.

Change the coolant in the traction motor/inverter cooling system and the cabin heating system every two years. Refer to Section 6 in this manual for drain and fill procedures. Examine the drained coolant for contamination, particulate matter, or discoloration. Flush the system if necessary.

⚠CAUTION

DO NOT use antifreeze concentrations in excess of 60% or less than 40%.

Use only fully formulated coolants meeting ASTM D6210 specification. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for coolant specification.

2.21.5. ESS Battery System Coolant Change

☞NOTE:

The battery coolant reservoir is located on the curbside rear corner of the vehicle. The reservoir is labeled “BATTERY COOLANT”.

Change the coolant in the ESS battery heating/cooling system every two years. Refer to Section 6 in this manual for drain and fill procedures. Examine the drained coolant for contamination, particulate matter, or discoloration. Flush the system if necessary.

⚠CAUTION

DO NOT use antifreeze concentrations in excess of 60% or less than 40%.

Use only fully formulated coolants meeting ASTM D6210 specification. Refer to 2.31. “Fluid & Lubrication Guide” on page 126 in this section for coolant specification.

2.21.6. ESS Battery Coolant Filter Replacement

[redacted]

DO NOT attempt to change the coolant filter until the system has cooled down and the pressure relief valve has been operated. Servicing the coolant filter with pressurized hot coolant can result in scalding injury.

Replace the ESS battery coolant filter every two years or whenever the ESS cooling system is serviced or flushed. Replace the coolant filter as follows:

1. Set the Battery Disconnect switch to the OFF position.
2. Open the curbside corner pillar access door and locate the coolant filter. See “Fig. PM-58: ESS Battery Coolant Filter” on page 110.
3. Use clamps with soft face jaws to pinch the outlet hose at the filter head.

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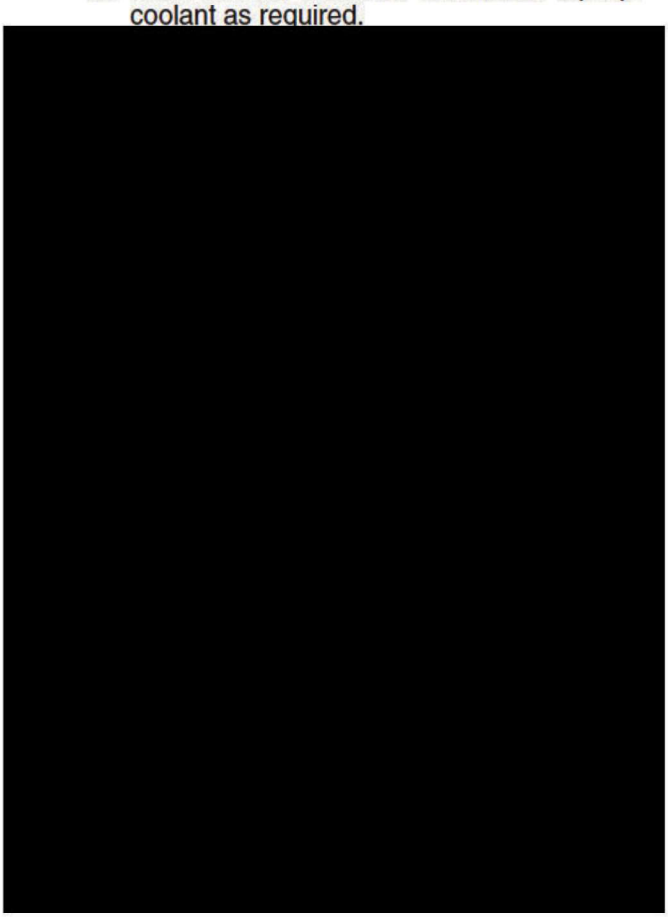
4. Place a suitable container beneath the coolant filter
5. Use a filter wrench to remove the spin-on coolant filter.
6. Lubricate the gasket on the new filter with clean engine oil and install by hand.
7. Tighten filter in accordance with instructions provided on filter.
8. Remove the clamp from the coolant outlet hose.
9. Start vehicle, check for leaks, and top up coolant as required.



2.21.7. Motor/Inverter Radiator Inspection & Cleaning

2.21.7.1. Radiator External Cleaning

☞NOTE:

The interval at which the radiator is removed for a soak cleaning may be adjusted to suit the actual operating environment and radiator condition.

Inspect the rooftop radiator for excessive buildup of dirt, debris, or other contaminants that cannot be removed by cleaning with compressed air or low pressure water rinse.

Use the following procedure to remove any buildup of contaminants from the exterior surface of the radiator:

1. Soak the radiator for 24 hours in a hot (150°F) non-caustic detergent solution with all fittings plugged.
2. Use low pressure spray equipment with cleaning solvent to clean the fin louvers.
3. Final rinse with clear water and air dry.
4. Inspect cooling fins and straighten to the original geometry using needle nose pliers or a fin comb.

2.21.7.2. Radiator Internal Cleaning

☞NOTE:

The interval at which the radiator is removed for internal flushing may be adjusted to suit the actual radiator condition.

1. Flush the core with an aluminum compatible system flush solvent, following manufacturer's instructions.
2. Rinse with clean water and air dry.

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2.22. Three Year Preventive Maintenance

2.22.1. Under Body Inspection

Refer to Section 11 of this manual for procedure.

2.23. Four Year Preventive Maintenance

2.23.1. Air Compressor Cleaning, Lubrication & Parts Replacement

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position and locked-out and tagged-out.**

☞NOTE:

This interval was converted from compressor operating hours to calendar time using an average vehicle speed of 12.5 mph, compressor duty cycle of 40%, and 30,000 miles/year. Adjust the service interval according to actual operating conditions.

2.23.1.1. Compressor Fins, Fan & Duct Cleaning

Clean compressor fins, fan and duct every four years, 125,000 miles (200,000 km) or 4,000 compressor operating hours, whichever occurs first. Remove the blower fan cover and clean the compressor fins and fan using compressed air. Wipe the fan duct interior with a clean cloth.

2.23.1.2. Oscillating Scroll Bearing Lubrication

Lubricate the OS bearing every four years, 125,000 miles (200,000 km), or 4,000 compressor operating hours, whichever occurs first.

☞NOTE:

A grease gun kit with special adapters and grease cartridge is available from Powerex, 150 Production Drive, Harrison OH 45030 YSA. (1-888-769-7979)

1. Remove scroll compressor assembly from vehicle. Refer to Section 8 of this manual for removal procedure.
2. Remove plastic dust cap for orbiting scroll bearing grease fitting. See “Fig. PM-59: Oscillating Scroll Bearing Lubrication” on page 112.
3. Rotate compressor coupling until grease fitting is visible through lubrication port.

☞NOTE:

Pump grease gun to eliminate air from extension adapter before use.

4. Use a grease gun extension adapter to engage the fitting and supply the correct amount of grease to the main bearings. Refer to 2.23.1.3. “Compressor Bearing Grease Delivery” on page 112 in this section for procedure.
5. Remove grease gun and reinstall plastic dust cap
6. Reinstall scroll compressor. Refer to Section 8 of this manual for installation procedure.

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Fig. PM-59: Oscillating Scroll Bearing Lubrication

2.23.1.3.Compressor Bearing Grease Delivery

COMPRESSOR BEARING GREASE DELIVERY		
GREASE DELIVERY	**FIRST LUBRICATION**	**SECOND LUBRICATION**
Orbit Scroll Bearing	7 pumps	6 pumps
Pin Crank Bearing Orbit Scroll Side (3 places)	7 pumps	7 pumps
☞**NOTE:** *Each pump of the grease gun equals 0.65 grams of grease.*		

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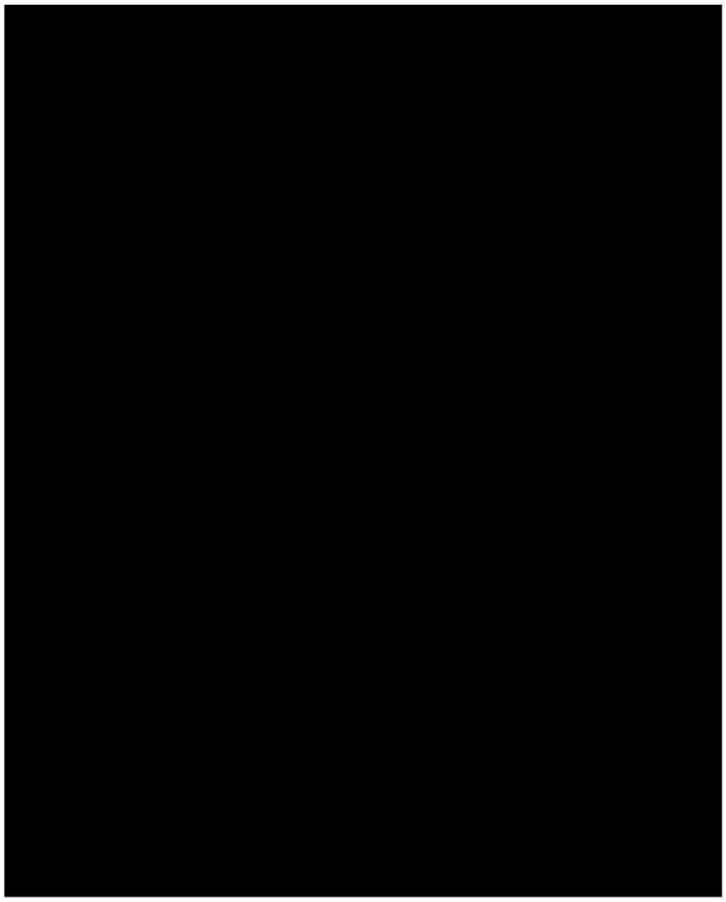
2.23.1.4.Crank Pin Bearings Lubrication

Lubricate the three compressor crank pin bearings every four years, 125,000 miles (200,000 km), or 4,000 compressor operating hours, whichever occurs first.

☞NOTE:

A grease gun kit with special adapters and grease cartridge is available from Powerex, 150 Production Drive, Harrison OH 45030 YSA. (1-888-769-7979)

1. Remove scroll compressor assembly from vehicle. Refer to Section 8 of this manual for removal procedure.
2. Remove the six attaching fasteners and separate the fixed scroll assembly from the orbital scroll assembly.
3. Grease all three crank bearings. Refer to 2.23.1.3. “Compressor Bearing Grease Delivery” on page 112 in this section for procedure. See “Fig. PM-60: Crank Pin Bearing Lubrication” on page 113.
4. Reinstall all removed parts.



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2.23.1.5.Compressor Tip & Dust Seal Replacement

Replace tip seals every four years, 125,000 miles (200,000 km), or 4,000 compressor operating hours, whichever occurs first.

1. Remove the scroll compressor assembly from the vehicle. Refer to Section 8 of this manual for removal procedure.
2. Remove the six attaching fasteners and separate the fixed scroll assembly from the orbital scroll assembly. See “Fig. PM-61: Scroll Compressor Assembly” on page 115.
3. Clean scroll using a clean cloth or compressed air.

☞NOTE:

Tip seals for fixed scroll and orbit scroll have opposing seal cut angles. To distinguish between fixed scroll and orbit scroll seals. See “Fig. PM-62: Seal Identification” on page 115.

4. Insert tip seal so that the lip on the seal is on the bottom of the seal groove and inner side of involute and direction of lip faces center of involute (curving spiral). Exercise caution to prevent tearing or distortion of tip. See “Fig. PM-64: Orbit Scroll Seal Installation” on page 116.
5. Insert new high pressure tip seal from the center section for orbital scroll ensuring no clearance exists at the starting tip and that low pressure seal will contact closely with high pressure seal inside scroll groove. See “Fig. PM-64: Orbit Scroll Seal Installation” on page 116.

⚠CAUTION

Insert approximately half of the low pressure seal and then remove to verify that a notch in the seal has been achieved. This will prevent seal movement during installation. See “Fig. PM-65: Seal Installation” on page 116.

6. Repeat procedure for fixed scroll seal set.
7. Remove the dust seal and backup tube on outermost side of fixed scroll set.
8. Insert new backup tube in fixed scroll set and locate at 6 o’clock position. See “Fig. PM-63: Backup Tube & Dust Seal Installation” on page 115.
9. Insert new dust seal on backup tube. Face seamed section of dust seal at the 3 o’clock position.

☞NOTE:

DO NOT allow dust seal or tip seal to fall out of position during installation.

10. Reassemble fixed scroll set to orbit scroll.
11. Install and lightly tighten six retaining fasteners. Rotate crankshaft to ensure free movement.
12. Torque fasteners n two stages. First stage 17 in-lb., second stage 265 in-lb.

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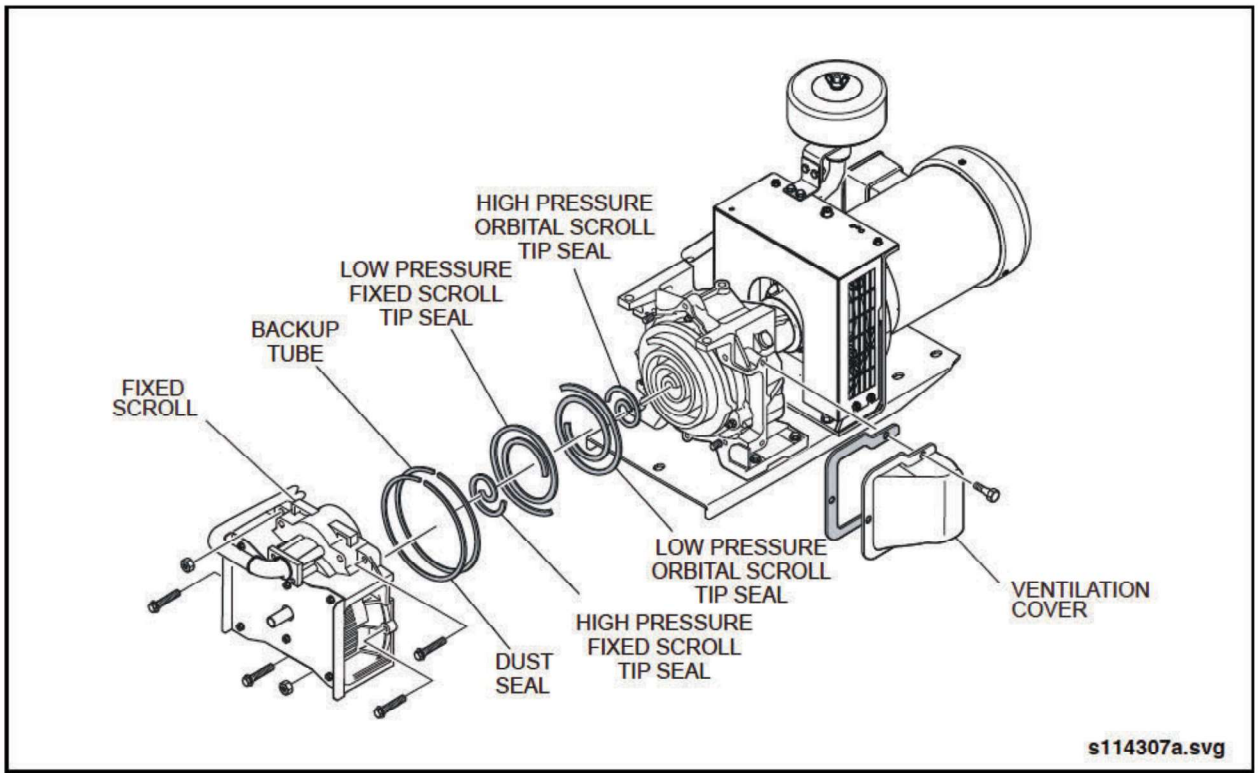

Fig. PM-61: Scroll Compressor Assembly

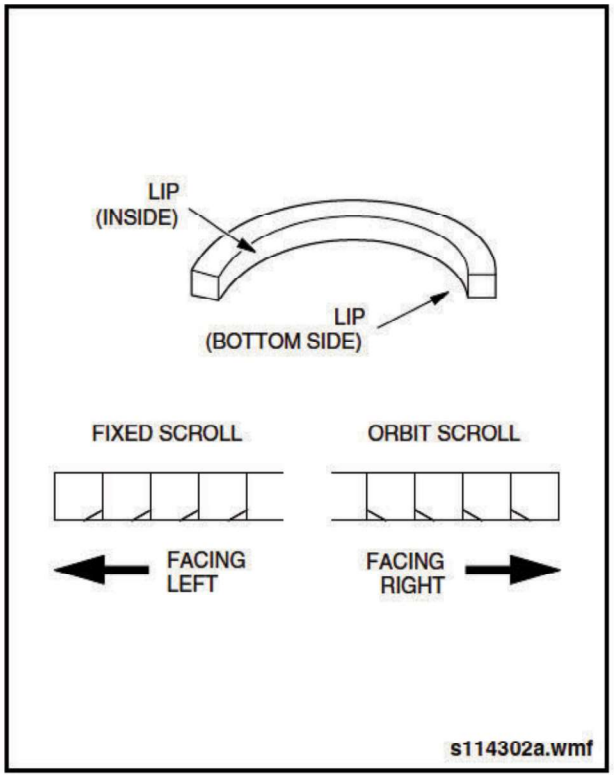

Fig. PM-62: Seal Identification

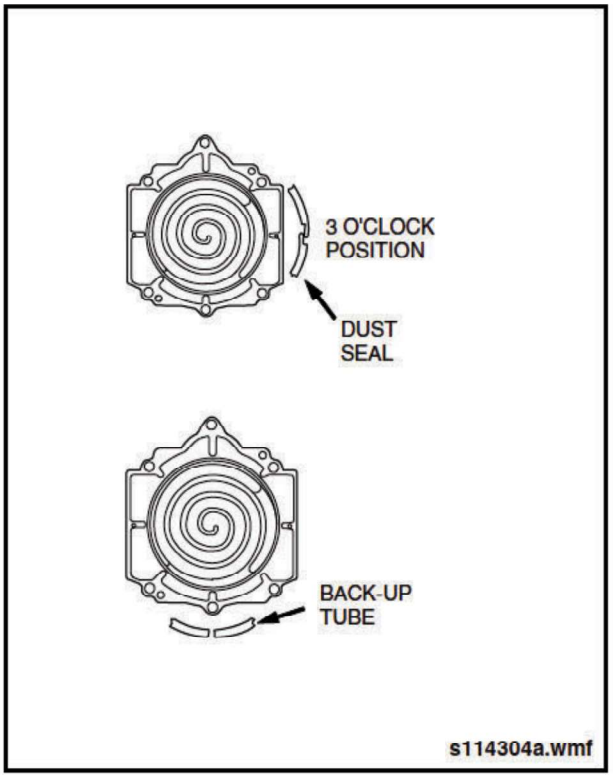

Fig. PM-63: Backup Tube & Dust Seal Installation

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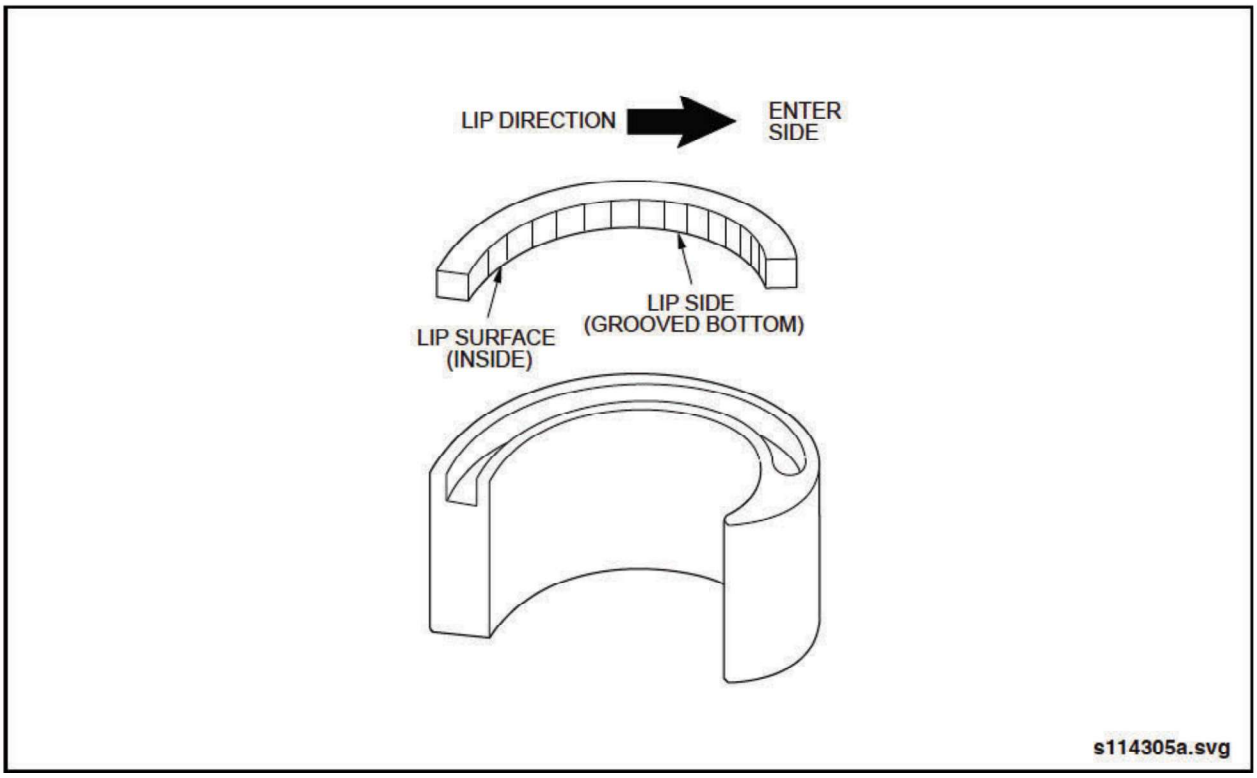

Fig. PM-64: Orbit Scroll Seal Installation

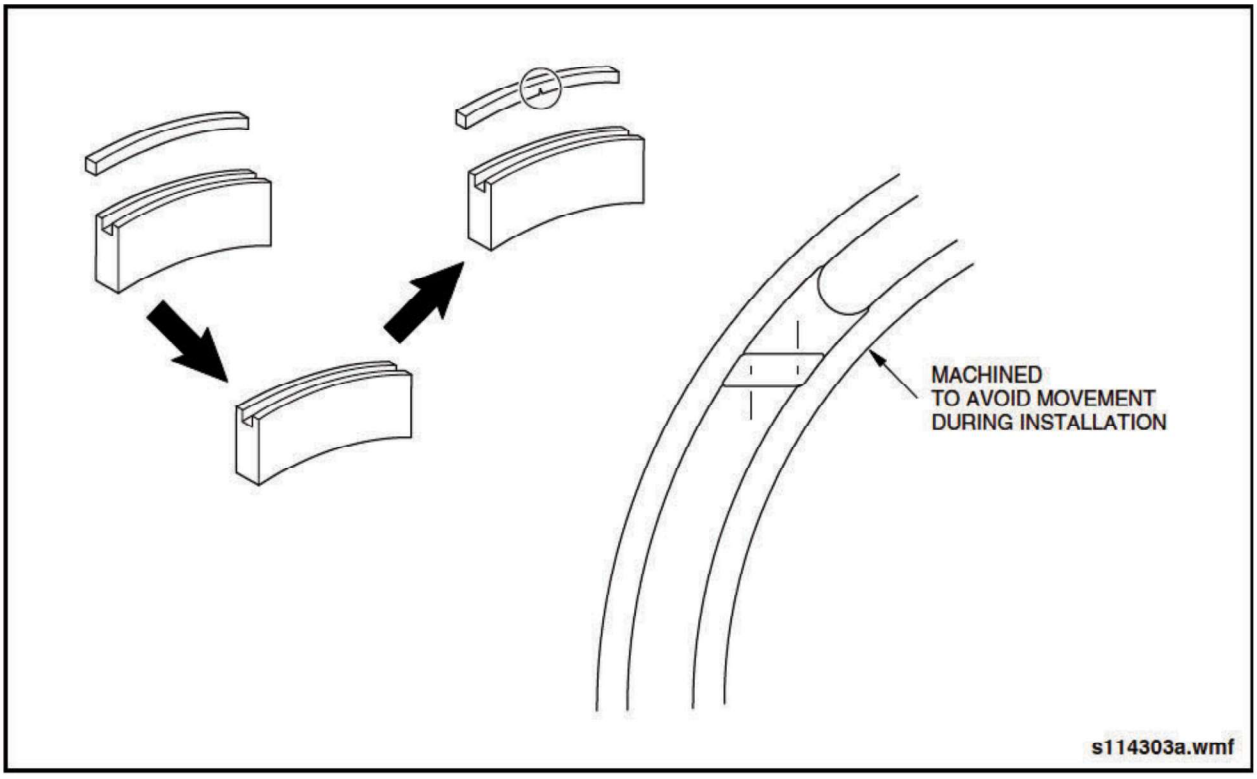

Fig. PM-65: Seal Installation

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2.23.1.6.Heat Insulation Pipe Replacement

Replace heat insulation pipe every four years, 125,000 miles (200,000 km), or 4,000 compressor operating hours, whichever occurs first.

1. Set the Battery Disconnect switch to the OFF position.
2. Drain the vehicle air system.
3. Disconnect the discharge lines and fittings from the long nipple on the compressor.
4. Unthread the long nipple from the compressor housing. See “Fig. PM-66: Heat Insulation Pipe” on page 117.
5. Pull out the heat insulation insert.
6. Install a new heat insulation insert. Installation is the reverse of removal.

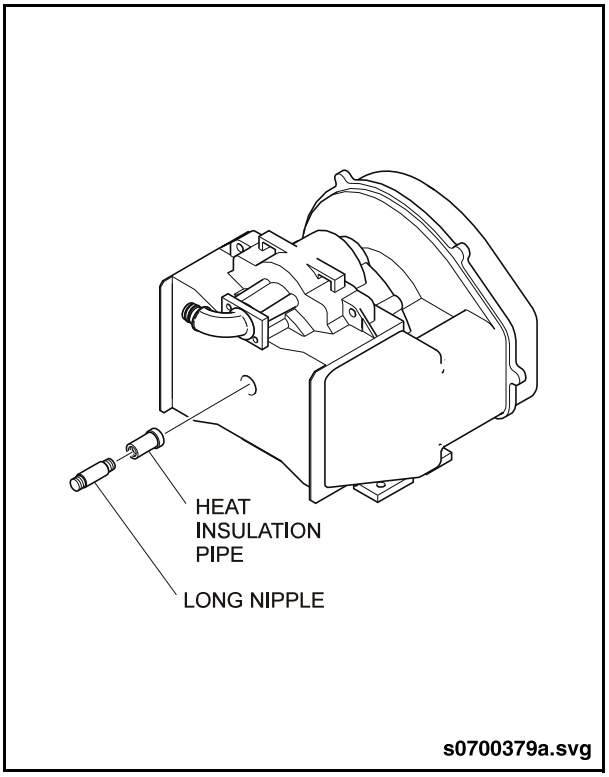

Fig. PM-66: Heat Insulation Pipe

2.24. Five Year Preventive Maintenance

2.24.1. Door Operator Proximity Switches

- ❒ Check that the switches function properly.
- ❒ Check for proper air gap setting between sensor and target. Refer to Section 16 of this manual for adjustment procedures.

2.24.2. Door Component Replacement

It is recommended that the following door components or assemblies be replaced every five years or 500,000 door operating cycles. The replacement interval may need to be adjusted depending on the actual operating conditions. Operating in a harsh environment where the door components are exposed to extremes in temperature, salt spray, sand, grit, or other contaminants will shorten the life expectancy of the door system components.

- ❒ Connecting rods and rod end bearings
- ❒ Upper door shaft pivot bearings
- ❒ Door panel top seal assembly
- ❒ Door panel bottom seal assembly
- ❒ Door panel pocket seals
- ❒ Solenoid valves
- ❒ Sensitive edge system including door edge, transfer tube, pressure wave switch, and mechanical limit switches.

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2.24.3. Electric Coolant Heater



Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

☞NOTE:

Refer to your Valeo Workshop Manual for specific requirements.

Replace the temperature switch every five years.

2.24.4. Depot Charging Station Coolant Change & Inspection

Inspect the depot charging station every five years as follows:

- ❒ Replace the coolant.
- ❒ Check for correct torque on mounting anchors and cable tabs in the contactor assembly.

2.25. Six Year Preventive Maintenance

2.25.1. Fire Suppression System

Perform the following maintenance every six years:

- ❒ As per NFPA 17 guidelines, stored pressure dry chemical Agent Cylinders must be depressurized for inspecting the inside of the agent cylinder and the agent. Refer to latest version of Amerex Installation, Operation, and Maintenance Manual No. 13980 for additional information.
- ❒ Replace the electric linear actuator, located on the discharge valve, if it has been in service for six years.

2.25.2. Fire Extinguisher

Inspect the fire extinguisher every six years. Clean all parts to ensure they are operable and refill with new powder and repressurize. Refer to National Fire Protection Association (NFPA) Standard No.10 for additional information.

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2.25.3. Air Compressor Motor Lubrication

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position and locked-out and tagged-out.**

☞NOTE:

This interval was converted from compressor operating hours to calendar time using an average vehicle speed of 12.5 mph, compressor duty cycle of 40%, and 30,000 miles/year. Adjust the service interval according to actual operating conditions.

Lubricate the bearings on the electric motor every six years, 172,000 miles (277,000 km) or 5,500 compressor operating hours, whichever occurs first. Lubricate the bearings as follows:

1. Locate the grease fittings at either end of the motor and wipe clean the fitting and surrounding area.

☞NOTE:

If a plug is installed at this location, remove it and replace with a grease fitting.

2. Remove the motor housing drain plugs, located on the bottom of the housing at either end.
3. Add the recommended weight or volume of Mobil Polyrex EM grease. Refer to 2.25.3.1. “Motor Bearing Grease Delivery” on page 119.

☞NOTE:

A grease gun kit with special adapters and grease cartridge is available from Powerex, 150 Production Drive, Harrison OH 45030 YSA. (1-888-769-7979)

4. Run the motor for 15 minutes.
5. Reinstall the grease drain plugs.

2.25.3.1.Motor Bearing Grease Delivery

MOTOR BEARING GREASE DELIVERY	
WEIGHT	**VOLUME**
0.19 oz. (5.0 grams)	0.3 $in.^3$ (1.0 teaspoon)
☞NOTE: *Each pump of the grease gun equals 0.65 grams of grease.*	

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2.25.4. Power Steering Oil & Filter Change

Replace the power steering fluid and oil filter every six years or whenever major maintenance has been performed on the power steering system.

1. Remove the magnetic drain plug from the bottom of the reservoir and drain fluid into a suitable container. See "Fig. PM-67: Power Steering Oil & Filter Change" on page 120.
2. Inspect and clean the magnetic plug and reinstall.
3. Unthread the filter housing from the head and replace the filter element with a new element.
4. Reinstall the filter housing.
5. Dispose of used filter, any spilled hydraulic fluid and used shop rags in an environmentally responsible manner.
6. Remove the filler/breather cap and fill the reservoir to the fill line on the fluid level gauge. Refer to 2.31. "Fluid & Lubrication Guide" on page 126 in this section for fluid specification.
7. Reinstall filler/breather cap.
8. Start system and check filter installation for leaks before operating vehicle. Top up power steering fluid as required.

☞NOTE:

Refer to Section 3 of this manual for further information on the power steering reservoir and filter.



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2.26. Ten Year Preventive Maintenance

2.26.1. Door Component Replacement

It is recommended that the following door components or assemblies be replaced every ten years or 1,000,000 door operating cycles. The replacement interval may need to be adjusted depending on the actual operating conditions. Operating in a harsh environment where the door components are exposed to extremes in temperature, salt spray, sand, grit, or other contaminants will shorten the life expectancy of the door system components.

- ❒ Electric door operator
- ❒ Door shaft levers and mounting hardware
- ❒ Lower door shaft pivot bearings
- ❒ Upper roller guides, brackets, & bearings
- ❒ Door panel leading edge seals
- ❒ Door panel jamb seals
- ❒ Driver's door controller
- ❒ Door panels
- ❒ Shaft and arm assemblies
- ❒ Shaft and arm assembly hinged mounting brackets.

2.26.2. Depot Charging Station Inspection

Inspect the charging cables for any degradation every ten years. Replace cables if necessary.

2.27. Twelve Year Preventive Maintenance

2.27.1. Fire Extinguisher

Hydrostatically test the fire extinguisher every twelve years. Refer to label on fire extinguisher for test pressure. Clean all parts to ensure they are operable and refill with new powder and repressurize. Record maintenance and recharge date on fire extinguisher inspection tag. Refer to National Fire Protection Association (NFPA) Standard No.10 for additional information.

2.27.2. Fire Suppression System

CAUTION

Hydrostatic testing may only be done by individuals certified to perform hydrostatic testing by those having jurisdiction in the particular area.

Perform a hydrostatic pressure test on the agent cylinder and all hose assemblies every twelve years. Perform test in accordance with CGA Pamphlet C-6, NFPA 17, and DOT requirements. Refer to latest version of Amerex Installation, Operation, and Maintenance Manual No. 13980 for test pressure and test adapters.

2.27.3. Electric Coolant Heater

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. "High Voltage Safety" on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position.**

☞NOTE:

Refer to your Valeo Workshop Manual for specific requirements.

Replace the high voltage contactor every twelve years.

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2.28. Fifteen Year Preventive Maintenance

2.28.1. Traction Motor Bearing Replacement

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position and locked-out and tagged-out.**

Replace the traction motor bearings every fifteen years or 60,000 operating hours, whichever occurs first. Contact your local Siemens Service Center for instructions.

2.29. Sixteen Year Preventive Maintenance

2.29.1. Air Compressor Component Replacement

[redacted]

Maintenance of high voltage equipment must be performed by qualified personnel only. Refer to 1.1. “High Voltage Safety” on page 1 **at the beginning of this section for safety requirements. Ensure that the High Voltage Interlock and Battery Disconnect switches are set to the OFF position and locked-out and tagged-out.**

☞NOTE:

This interval was converted from compressor operating hours to calendar time using an average vehicle speed of 12.5 mph, compressor duty cycle of 40%, and 30,000 miles/year. Adjust the service interval according to actual operating conditions.

Replace the air compressor check valve and the compressor to motor rubber coupling every sixteen years, 500,000 miles (800,000 km), or 16,000 compressor operating hours, whichever occurs first.

2.29.1.1. Discharge Valve Replacement

1. Set the Battery Disconnect switch to the OFF position.
2. Drain the vehicle air system
3. Locate the discharge valve on the outlet side of the compressor. See “Fig. PM-68: Air Compressor Discharge Valve” on page 123.
4. Disconnect the signal line and exhaust line from the discharge valve.
5. Unthread the discharge valve from the discharge fitting.
6. Place discharge valve in a vise and remove the signal line connector and the exhaust line nipple.
7. Install a new discharge valve. Installation is the reverse of removal.

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2.29.1.2.Coupling Removal

1. Set the Battery Disconnect switch to the OFF position.
2. Drain the vehicle air system.
3. Remove the air compressor coupling guard to gain access to the coupling. See “Fig. PM-69: Air Compressor Coupling” on page 124.

⚠CAUTION

DO NOT loosen the setscrew that secures the drive hub to the motor shaft.

4. Remove the three socket head screws that secure the coupling rubber element radially to the motor drive hub.

☞NOTE:

The motor drive hub is keyed to the motor shaft and secured with a setscrew. The relative position of the drive hub and motor shaft must be maintained.

☞NOTE:

DO NOT loosen the hexagon screws that secure the motor adapter ring to the faceplate.

5. Support the weight of the motor and loosen the inner set of flat socket head screws that hold the motor to the adapter ring.

☞NOTE:

DO NOT loosen the four hex head bolts that secure the motor adapter ring to the faceplate.

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6. Carefully pull the motor straight back to disengage from the coupling.
7. Remove the three socket head bolts that axially secure the rubber coupling element to the compressor hub.

☞NOTE:

DO NOT remove or reposition the drive hub. DO NOT remove or reposition the motor mounting ring.



2.29.1.3.Coupling Installation

1. Position new rubber coupling onto compressor hub and install three socket head screws.

☞NOTE:

Lubricate the body and under side of the three socket head screws with light oil or grease.

2. Torque bolts to 37 ft-lbs. (50 Nm)

☞NOTE:

DO NOT apply threadlocker or adhesives to the screw threads. DO NOT allow the element to become twisted when tightening the screws.

3. Carefully align and slide the motor onto the faceplate adapter ring.
4. Tighten the inner set of flat head socket screws that hold the motor to the adapter ring.
5. Install the three socket head screws that secure the coupling radially to the motor drive hub. Torque the screws to 37 ft-lbs. (50 Nm).
6. Reinstall the coupling guard.
7. Set Battery Disconnect switch to ON position.
8. Start vehicle and check compressor operation.

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Section 2K2

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Include a detailed analysis of expected battery performance in the Design Operating Profile.

New Flyer response:

In the attached document 06 XMP125E High Energy, detailed material regarding the battery performance which includes information on the following:

- Exceptional cycle life with proven XALT NMC SHE cells
- High specific energy and volumetric energy density
- Rugged design for challenging environments
- Outstanding safety and abuse tolerance
- Efficient direct liquid cooling maintains ideal cell temperatures y IP67 compliant (with connectors mated)
- Easy to install, configure and upgrade
- ISO 9001:2015 certified production environment

XMP 125E HIGH ENERGY



XALT Energy is a premium total system solution manufacturer of lithium-ion batteries, packs, battery management systems and controls, racks and telematics. XALT Energy is capable of handling any energy storage need, anywhere in the world, from our highly automated advanced production facility in Midland, Michigan.

The XPAND Modular Pack (XMP) is XALT Energy's Energy Storage System based on XALT Energy's lithium-ion cells. XMP is designed for use in medium to heavy duty commercial trucks, bus, marine and specialty applications, such as construction and mining equipment.

XMP 125E is ideal for applications with moderate discharge and charge rates for high energy applications requiring long usage periods between plug-in charges. Each sub-pack contains Voltage-Temperature-Balancing boards (VTBs) that report voltage for all cell pairs and internal pack temperatures, and perform cell balancing. XMP 125E is designed for use with XALT's Battery Disconnect Unit (BDU) and Master Control Unit (MCU) through the Input/Output port.

Upgradeable, Ultra-Long Life Cycle Roadmap

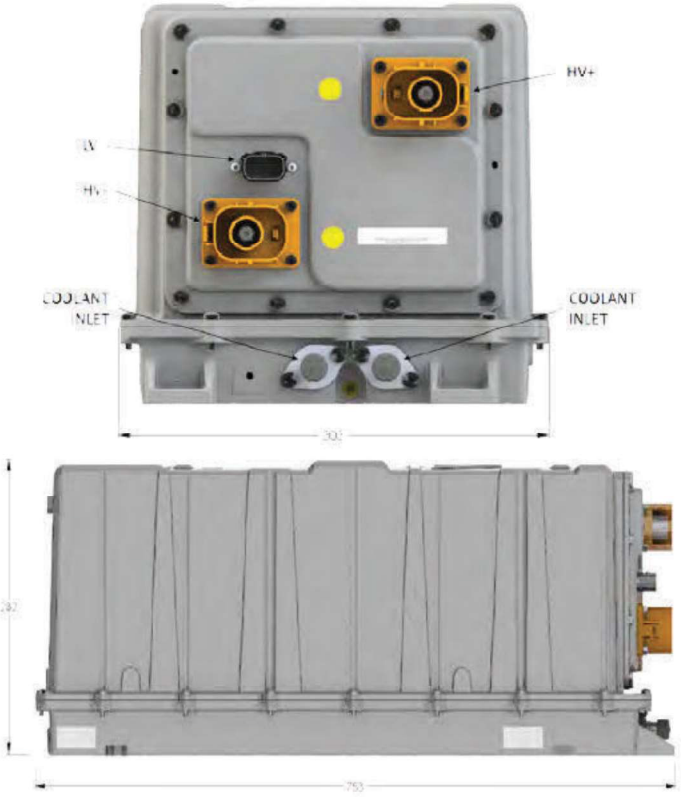
- XMP core accommodates cells in XALT's 225mm family without the need for retooling, anticipating a wide variety of application voltage, power, and energy
- As cell technologies advance or packs become available for re-purposing, the XMP core can be replaced while all external interfaces remain the same

Advanced Thermal Management

- XMP's advanced active liquid cooling system maintains ideal cell temperatures throughout the pack and responds quickly to increases in power demand and changes in ambient (environmental) temperatures
- Efficient direct liquid cooling prolongs cell life under the most demanding cycle profiles and severe environments. The base pack (non-marine) is also IP67 rated in terms of sealing performance.

THE XALT ENERGY ADVANTAGE

- Exceptional cycle life with proven XALT NMC SHE cells
- High specific energy and volumetric energy density
- Rugged design for challenging environments
- Outstanding safety and abuse tolerance
- Efficient direct liquid cooling maintains ideal cell temperatures
- IP67 compliant (with connectors mated)
- Easy to install, configure and upgrade
- ISO 9001:2015 certified production environment



XALT Energy

FREUDENBERG
INNOVATING TOGETHER

FEATURES AND BENEFITS

Modular and Flexible Design

- Easy to customize high voltage, low voltage and cooling interfaces to each application
- All connections at front panel; rear access not needed for installation

System Support

- Battery Disconnect Unit (BDU)
- Master Control Unit (MCU)
- Low Voltage Harness (LVH) Kit
- High Voltage Cable (HVC) Sets
- XALT Battery Viewer (XBV) Telematics
- XALT Rack System (XRS)

Life Cycle Support

- XPAND Service Tool
- Remote Data Monitoring & Prognostics
- Pack Replacement Maintaining Interface Connections
- End-of-Life Re-purposing, Recycling
- Integration Support
- On-Site Training Classes

Additional Benefits

- In-house cell modeling and development creates sophisticated software and controls for accurate Power, SOC and SOH predictions
- Custom warranty programs available

Performance	
Capacity (Rated @ C/10)	142Ah
Discharge Energy (Rated @ C/10)	12,500Wh
Nominal Voltage	88.3VDC
Specific Power*	≥258W/kg
Specific Energy	≥161Wh/kg
Energy Density	≥194Wh/l
Discharge Peak*	1.5C / 225A
Charge Peak*	0.5C / 71A
Discharge Continuous**	**1C / 142A**
Charge Continuous**	**0.3C / 47A**
Weight	**77.4kg**
Dimensions (all versions incl base) (L) 753mm (W) 303mm (H) 282mm	

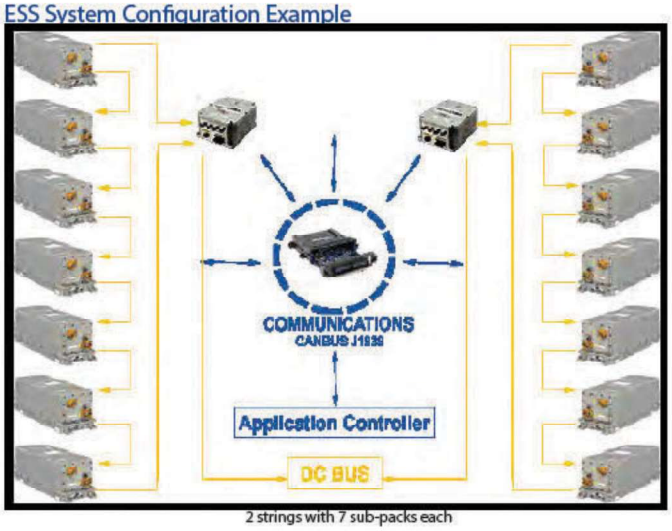
*10 seconds duration

**Cell performance will be affected by temperature, SoC, SoH, aging, etc.

Cycle Life	Typical
100% DOD Cycles @ 0.3C charge-discharge	>3,000 cycles***
80% DOD Cycles @ 0.3C charge-discharge	>4,000 cycles***

***Cycle life to 80% of rated capacity at 25°C room temperature with 10 min. step rest

ESS System Configuration Example



2 strings with 7 sub-packs each

The information contained herein is believed to be reliable, but no representation, guarantees or warranties of any kind are made to its accuracy or suitability for any purpose. The information presented herein is based on laboratory testing and does not necessarily indicate end product performance. Full scale testing and end product performance are the responsibility of the user.

www.XALTEnergy.com

XALT Energy

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08-17-2021

Section 2K3

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

The Proposal shall also include a comprehensive statement of the warranty terms relating to the battery, including explanation of all disclaimers within the warranty.

New Flyer response:

New Flyer of America High Voltage Battery Warranty:

New Flyer Energy Cell/Pack Warranty

A. New Flyer warrants the Energy Storage System for 6 years or 300,000 miles (whichever occurs first) after the date of acceptance of each bus ("Warranty Period"), to be free of defects in design, material and workmanship; (the "Warranty"). The warranty applies to the battery cells and internal components, it also includes the Battery Management System (BMS) controllers and Power Distribution Unit (PDU). These components are warranted for proper operation for 6 years/300,000 miles when the ESS is maintained in the manner described in the New Flyer Service Manual.

B. In a warrantable event, New Flyer shall, at its sole discretion:

• During the six years of the foregoing warranty period, the sole remedy under the Warranty shall be the repair or replacement of the product at New Flyer's option and at its expense (including costs of shipping and packaging).

• This Warranty shall be null and void and there shall be no right to recovery whatsoever if the Cell's or Pack's date code or serial number is defaced, missing or altered. Or if unauthorized or improper maintenance and repairs are performed or if the battery is installed to ambient temperatures above 113°F (45°C) or below -22°F (-30°C) for more than 2 weeks over the life of the warranty.

Capacity Fade Disclaimer:
Capacity fade is the relative reduction of the total amount of energy the battery system can store in a single charge for the purpose of powering the bus as compared to capacity at beginning of life (BOL). Capacity fade is warranted to 80% of BOL total energy capacity at year 6 or 300,000 miles when;

1) Capacity measurements are taken from a balanced ESS (all strings connected and fully charged), and
2) ESS is maintained in the manner described in the New Flyer Service Manual.

THE WARRANTY HEREIN RESPECTING CELLS AND PACKS INCLUDING, WITHOUT LIMITATION, QUALITY AND PERFORMANCE AND ARE MADE EXPRESSLY IN LIEU OF AND EXCLUDE ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES PROVIDED BY STATUTE OR COMMON LAW.

For further information please refer to attached documents:

NF Energy Cell-PackWarranty.
NF Battery Enclosures.

New Flyer Energy Cell/Pack Warranty

A. New Flyer warrants the Energy Storage System for 6 years or 300,000 miles (whichever occurs first) after the date of acceptance of each bus ("**Warranty Period**"), to be free of defects in design, material and workmanship; (the "**Warranty**"). The warranty applies to the battery cells and internal components, it also includes the Battery Management System (BMS) controllers and Power Distribution Unit (PDU). These components are warranted for proper operation for 6 years/300,000 miles when the ESS is maintained in the manner described in the New Flyer Service Manual.

B. In a warrantable event, New Flyer shall, at its sole discretion:

- During the six years of the foregoing warranty period, the sole remedy under the Warranty shall be the repair or replacement of the Product at New Flyer's option and at its expense (including costs of shipping and packaging).

- This Warranty shall be null and void and there shall be no right to recovery whatsoever if the Cell's or Pack's date code or serial number is defaced, missing or altered. Or if unauthorized or improper maintenance and repairs are performed or if the battery is installed to ambient temperatures above 113°F (45°C) or below -22°F (-30°C) for more than 2 weeks over the life of the warranty.

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1) Capacity measurements are taken from a balanced ESS (all strings connected and fully charged), and
2) ESS is maintained in the manner described in the New Flyer Service Manual."

THE WARRANTY HEREIN RESPECTING CELLS AND PACKS INCLUDING, WITHOUT LIMITATION, QUALITY AND PERFORMANCE AND ARE MADE EXPRESSLY IN LIEU OF AND EXCLUDE ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER EXPRESS OR IMPLIED REPRESENTATIONS AND WARRANTIES PROVIDED BY STATUTE OR COMMON LAW.

NEW FLYER®

Xcelsior Charge NG – New Battery Enclosures

Service expectations for the newly designed battery packaging

Built to Rely On®

Section 2K4

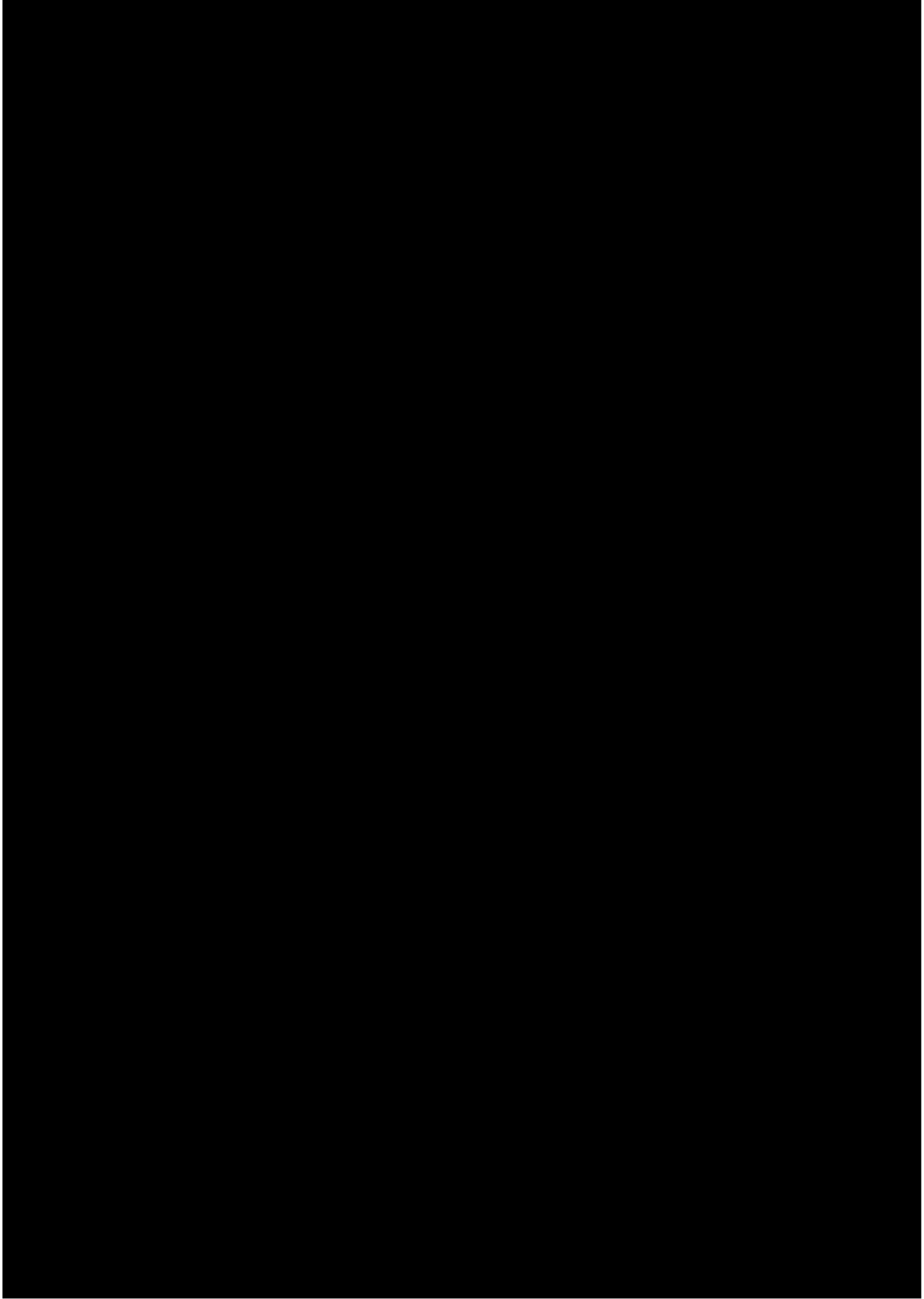
Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

The charge cycle and cycle life shall be stated in the proposal, and a life-cycle cost analysis of the proposed battery system in the specified application shall be provided.

New Flyer response:

Information requested in this RFP is supplied in the documents attached for life cycle costs for the Xcelsior buses based on a 12 year cycle. This report includes all preventative maintenance required based on labor rates. Included is also a chart that outlines the labor hours to perform mechanical tasks, this information will provide a guide to help determine labor costs.



[redacted] [redacted] [redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				1 - FRONT AXLE & SUSPENSION		
MAN	**1000**	**3.6**	**1 & 3**	**FRONT AXLE & SUSPENSION**	**R&R**	**Time listed is per person, 2 people required for this task**
		0.2	1.2	DRAG LINK	DISCONNECT	At Drag Link Arm
		0.2	1.2	LEVELING VALVE LINKS	R&R	
		0.3	1.2	BRAKE CHAMBER AIR LINES	R&R	
		0.1	1.2	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	1.2	ABS SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		1.0	1.2	RADIUS RODS	DISCONNECT	At Structure
		0.1	1.2	LOWER RETAINING NUTS, SHOCK ABSORBER	R&R	
		0.1	1.2	LOWER RETAINING NUTS, AIR SPRINGS	R&R	
		0.2	1.2	CENTER LINK	R&R	
		0.3	1.2	TORQUE BOLTS	ADJUST	
		0.5	3.2	FRONT END ALIGNMENT (MINOR)	ALIGN	
		0.5	1.2	ROAD TEST	CHECK	
MAN	**1001**	**2.1**	**1**	**WHEEL HUB ASSEMBLY, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	1.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.3	1.3	WHEEL FLANGE	R&R	
		0.1	1.5	BRAKE DISC	R&R	
		0.2	1.3	SLOTTED NUT & THRUST WASHER	R&R	
		0.2	1.3	HUB & BEARING ASSEMBLY	R&R	

[redacted]

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
MAN	**1002**	**3.6**	**1**	**STEERING KNUCKLE**	**R&R**	**With wheel hub in place**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	1.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.3	1.3	WHEEL FLANGE	R&R	
		0.1	1.5	BRAKE DISC	R&R	
		0.5	1.3	TIE ROD END	R&R	
		0.1	1.3	KING PIN SEAL CAPS	R&R	
		0.1	1.3	SNAP RINGS	R&R	
		0.1	1.3	KING PIN COVERS & DUST GUARD	R&R	
		1.0	1.3	KING PINS	R&R	
		0.1	1.3	THRUST BEARING & SHIMS	R&R	
MAN	**1004**	**1.2**	**1**	**WHEEL STUDS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.6	1.3	WHEEL STUDS	R&R	
MAN	**1005**	**1.1**	**1**	**BRAKE PADS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
MAN	**1006**	**0.1**	**1**	**ABS SPEED SENSOR, FRONT AXLE**	**R&R**	**Per Side**
		0.1	1.6	SPEED SENSOR	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
MAN	**1007**	**1.4**	**1**	**BRAKE CHAMBER ASSEMBLY, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.5	1.5	BRAKE CHAMBER, FRONT	R&R	
MAN	**1008**	**2.5**	**1**	**CALIPER GUIDE PINS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.5	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
		0.1	1.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.5	1.5	CALIPER GUIDE PINS, BUSHINGS & BOOTS	R&R	
MAN	**1009**	**1.5**	**1**	**TAPPET & RUBBER BOOT, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
		0.2	1.5	TAPPET & RUBBER BOOT	R&R	
		0.1	1.5	INNER SEAL	R&R	
		0.1	1.5	BUSHING	R&R	
ALL		**STAND ALONE ITEMS**	**1**	**FRONT AXLE & SUSPENSION COMPONENTS**	**R&R**	
	1010	1.0	1.4	SHOCKS	R&R	Each

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				2 - REAR AXLE & SUSPENSION		
MAN	**2000**	**4.0**	**2**	**REAR AXLE**	**R&R**	
		0.5	2.8	DRIVE SHAFT	R&R	INCL driveshaft guard
		0.1	2.6	ABS SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	2.4	LEVELING VALVE LINKS	R&R	
		0.6	2.4	UPPER & LOWER RADIUS RODS (AT CHASSIS)	R&R	
		0.3	2.5	BRAKE LINES, REAR	R&R	
		0.1	2.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	2.3	DIFFERENTIAL BREATHER (AT CHASSIS)	DISCONNECT	
		0.4	2.5	AIR LINES & HARNESSES	DISCONNECT	
		0.2	2.4	SHOCKS (LOWER NUTS ONLY)	R&R	
		0.2	2.4	AIR SPRINGS (LOWER BOLTS ONLY)	R&R	
		1.0	2.3	AXLE, U-BOLTS & SPACERS (SEPARATION FROM SUS	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
		0.2	2	RAISE & LOWER WHEEL & AXLE ASSEMBLY	OPERATION	
MAN	**2001**	**1.2**	**2**	**WHEEL STUDS**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.6	2.3	WHEEL STUDS	R&R	
MAN	**2002**	**0.7**	**2**	**AXLE SHAFT**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.1	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	TORQUE HARDWARE	ADJUST	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
MAN	**2003**	**2.4**	**2**	**WHEEL HUB ASSEMBLY, REAR**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		1.0	2.3	RETAINING RING & TAPPERED ROLLER BEARING ASS	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2004**	**2.2**	**2**	**BRAKE DISC, REAR**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		0.3	2.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	2.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	2.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.1	2.5	BRAKE DISC	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2005**	**2.3**	**2**	**ABS SPEED SENSOR, REAR AXLE**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		0.3	2.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	2.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	2.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.1	2.5	BRAKE DISC	R&R	
		0.1	2.6	SPEED SENSOR	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2006**	**1.1**	**2**	**BRAKE PADS, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
MAN	**2007**	**1.6**	**2**	**BRAKE CHAMBER ASSEMBLY, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.3	2.3	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.5	2.5	BRAKE CHAMBER, REAR	R&R	
MAN	**2008**	**2.7**	**2**	**CALIPER GUIDE PINS, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.3	2.3	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.5	2.5	BRAKE CHAMBER, REAR	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
		0.1	2.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.5	2.5	CALIPER GUIDE PINS, BUSHINGS & BOOTS	R&R	
MAN	**2009**	**1.5**	**2**	**TAPPET & RUBBER BOOT, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
		0.2	2.5	TAPPET & RUBBER BOOT	R&R	
		0.1	2.5	INNER SEAL	R&R	
		0.1	2.5	BUSHING	R&R	
MAN	**2010**	**2.6**	**2**	**DIFFERENTIAL CARRIER ASSEMBLY**	**R&R**	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		1.0	2.3	AXLE SHAFTS	R&R	Incl both sides
		0.1	2.3	AXLE BREATHER	R&R	
		0.6	2.8	DRIVESHAFT SHAFT FLANGE & YOKE	R&R	
		0.2	2.3	CARRIER MOUNTING BOLTS	R&R	
		0.5	2.3	DIFFERENTIAL CARRIER	R&R	
ALL		**STAND ALONE ITEMS**	**2**	**REAR AXLE & SUSPENSION COMPONENTS**	**R&R**	
	2011	1.4	2.9	SHOCKS	R&R	Each

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				3 - STEERING SYSTEM		
ALL	**3000**	**4.5**	**3 & 15**	**STEERING GEAR BOX**	**R&R**	
		0.2	3.2	RAISE VEHICLE	OPERATION	
		0.1	15.3	PRIMARY ACCESS COVER	R&R	
		0.1	15.3	SECONDARY ACCESS COVER	R&R	
		0.5	3.2	STEERING JOINT ASSEMBLY (At transfer box)	DISCONNECT	At Transfer Gear Box
		0.2	3.2	DRAG LINK	DISCONNECT	At Pitman Arm
		0.5	3.2	POWER STEERING LINES	DISCONNECT	At Transfer Gear Box
		1.9	3.2	MOUNTING BOLTS, STEERING GEAR BOX	R&R	
		0.5	3.2	REFILL FLUID & BLEED LINES	OPERATION	
		0.5	3.2	ROAD TEST	TEST	Optional
ALL	**3001**	**3.0**	**3**	**MITER BOX**	**R&R**	
		1.0	3.2	"U" JOINT, STEERING COLUMN	DISCONNECT	At Transfer Gear Box
		0.5	3.2	STEERING JOINT ASSEMBLY (At transfer box)	DISCONNECT	At Transfer Gear Box
		0.5	3.2	MITER BOX RETAINING BOLTS	DISCONNECT	
		0.5	3.2	MITER BOX COMPONENT	R&R	
		0.5		ROAD TEST	TEST	Optional
ALL		**STAND ALONE ITEMS**	**3**	**STEERING SYSTEM COMPONENTS**	**R&R**	
	3002	1.0	3.2	STEERING COLUMN	R&R	
	3003	1.0	3.2	"U" JOINT, STEERING COLUMN	R&R	
	3004	0.5	3.2	STEERING WHEEL	R&R	
	3005	0.8	3.2	DRAG LINK	R&R	
	3006	1.5	3.3	HYDRAULIC PUMP (POWER STEERING)	R&R	Includes refill and bleed
	3007	2.5	3.3	HYDRAULIC RESERVOIR	R&R	Includes refill and bleed
	3008	0.5	3.3	FILTER, HYDRAULIC RESERVOIR	R&R	Includes R+R of access cover

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	3009	0.5	3.3	PRESSURE GAUGE ON FILTER HOUSING	R&R	Includes R+R of access cover
				4 - ELECTRIC DRIVE SYSTEM		
ALL	**4000**	**3.5**	**4**	**TRACTION MOTOR**		
		0.2	4.3	RAISE VEHICLE	OPERATION	
		0.5	4.3	DRIVE SHAFT	R&R	
		0.5	4.3	DISCONNECT CABLES	R&R	INCL driveshaft guard
		0.8	4.3	COOLANT LINES	R&R	Includes refill and bleed
		1.5	4.3	TRACTION MOTOR	R&R	
ALL		**STAND ALONE ITEMS**	**4**	**ELECTRIC DRIVE SYSTEM COMPONENTS**		
	4001	0.5	4.4	MASTER CONTROL UNIT (MCU)	R&R	
	4002	0.8	4.4	BATTERY DISCONNECT UNIT	R&R	1 per string
	4003	0.1	4.4	HIGH VOLTAGE FUSES	R&R	Each
Amerex		**STAND ALONE ITEMS**		**AMEREX FIRE SUPPRESSION SYSTEM (REFER TO AMEREX MAINTENANCE MANUAL)**		
	4004	0.3	Amerex MM	AGENT CYLINDER	R & R	
	4005	0.3	Amerex MM	ELECTRICAL / MANUAL ACTUATOR	R & R	
	4006	0.3	Amerex MM	DISCHARGE NOZZLE	R & R	
	4007	0.6	Amerex MM	DISTRIBUTOR	R & R	
	4008	0.3	Amerex MM	DISCHARGE FITTING	R & R	
	4009	0.6	Amerex MM	F&G AVSN PANEL	R & R	
	4010	0.4	Amerex MM	IR SENSOR	R & R	Each
				5 - TRANSMISSION SYSTEM		

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ALL		STAND ALONE ITEMS	5	TRANSMISSION SYSTEM COMPONENTS		
				THIS SECTION IS NOT APPLICABLE		
				6 - COOLING SYSTEM		
ALL		STAND ALONE ITEMS	6 & 10	STAND ALONE ITEMS	R&R	
	6000	1.5	6.3	TRACTION MOTOR COOLER RAD ASSEMBLY	R&R	Includes fill and de-aerate
	6001	0.3	6.3	TRACTION MOTOR COOLER FAN	R&R	Each
	6002	0.5	6.3	TRACTION MOTOR COOLER CONTROL MODULE	R&R	
	6003	0.3	6.3	TRACTION MOTOR COOLER ISOLATOR	R&R	Replace all four
	6004	1.5	6.3	BOOSTER PUMP (TRACTION MOTOR)	R&R	Includes fill and de-aerate
	6005	2.0	6.3	SURGE TANK (TRACTION MOTOR AND INVERTER)	R&R	Traction motor & Inverter
	6006	0.3	6.3	LOW COOLANT SENSOR	R&R	1 per surge tank
	6007	5.0	6.4	ESS HEAT EXCHANGER SCROLL COMPRESSOR	R&R	Includes evac / fill of refrigerant
	6008	0.5	6.4	ESS HEAT EXCHANGER CONTACTOR	R&R	
	6009	0.5	6.4	ESS CONDENSER FAN	R&R	
	6010	3.0	6.4	ESS CONDENSER	R&R	Includes evac / fill of refrigerant
	6011	1.5	6.4 & 10.2	BOOSTER PUMP (ESS & CABIN)	R&R	Includes fill and de-aerate
	6012	2.0	6.4	SURGE TANK (ESS & CABIN)	R&R	
				7 - FUEL SYSTEM		
ALL		STAND ALONE ITEMS	7	FUEL SYSTEM COMPONENTS		
				THIS SECTION IS NOT APPLICABLE		
				8 - AIR SYSTEM		

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ALL		STAND ALONE ITEMS	8 & 2	AIR SYSTEM COMPONENTS	R&R	
	8000	1.0	8.5	AIR BRAKE RELAY VALVE	R&R	
	8001	5.0	8.4	AIR COMPRESSOR	R&R	
	8002	1.7	8.4	AIR COMPRESSOR HEAD	R&R	
	8003	2.5	8.4	AIR DRYER	R&R	
	8004	0.2	8.4	AIR DRYER FILTER	R&R	
	8005	0.6	8.4	AIR PRESSURE REGULATOR (BRAKE INTERLOCK)	R&R	
	8006	0.2	8.4	AIR TANK DRAIN VALVE	R&R	
	8007	1.5	8.4	APPLICATION VALVE (BRAKE TREADLE)	R&R	
	8008	0.5	2.5	BRAKE CHAMBER, REAR	R&R	
	8009	0.3	8.4	BRAKE INTERLOCK MAGNETIC VALVE	R&R	
	8010	0.3	8.5	CHECK VALVE	R&R	
	8011	0.5	8.4	GOVERNOR	R&R	
	8012	0.5	8.4	MUFFLER TANK	R&R	
	8013	0.5	8.4	OIL SEPARATOR	R&R	
	8014	0.3	8.4	OIL SEPARATOR FILTERS	R&R	
	8015	0.2	8.5	PRESSURE PROTECTION VALVE	R&R	
	8016	0.2	8.4	Q. R. VALVE	R&R	
	8017	0.6	8.5	SOLENOID VALVE	R&R	
	8018	1.0	8.5	SPRING BRAKE CONTROL VALVE	R&R	
	8019	0.2	8.5	TRANSDUCER	R&R	
	8020	0.3		LOW AIR PRESSURE SWITCH	R&R	
				9 - ELECTRICAL SYSTEM		
ALL		STAND ALONE ITEMS	9	ELECTRICAL SYSTEM COMPONENTS	R&R	
	9000	0.2	9.2	PLC MODULES	R&R	
	9001	2.0	9.4	HIGH VOLTAGE DC-DC CONVERTER	R&R	In roof rack

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	9002	0.5	9.5	BATTERIES & LEADS	R&R	In battery tray
	9003	0.5	9.5	BATTERY DISONNECT SWITCH	R&R	
	9004	0.7	9.5	VOLTAGE EQUALIZER	R&R	
	9005	1.0	9.5	BATTERY TRAY	R&R	
	9006	0.5	9.6	BATTERY DISCONNECT SOLENOID	R&R	Two - 12 and 24 V
	9007	0.3	9.7	LED HEADLIGHT ASSEMBLY	R&R	
	9008	0.2	9.7	BACK UP LAMP	R&R	
	9009	0.2	9.7	BRAKE LAMP	R&R	
	9010	0.2	9.7	REAR SIGNAL LAMP	R&R	
	9011	0.2	9.7	CLEARANCE LAMP	R&R	
	9012	0.2	9.7	SIDE SIGNAL LAMP	R&R	
	9013	0.3	9.7	CORNERING LAMP	R&R	
	9014	0.1	9.8	INTERIOR LED LIGHT STRIPS	R&R	
	9015	0.2	9.10	HORNS	R&R	
	9016	0.5	9.12	P.A. SPEAKER	R&R	
	9017	0.2	9.17	DUAL USB CHARGE PORT	R&R	
				10 - HVAC SYSTEM		
ALL		**STAND ALONE ITEMS**	**10, 6, & PM**	**HVAC SYSTEM COMPONENTS**	**R&R**	
	10000	1.5	10.2	DRIVERS HEATER / DEFROSTER UNIT	R&R	
	10001	0.5	10.2	DRIVERS BOOSTER FAN MOTOR	R&R	
	10002	0.2	PM	AIR FILTER, DEFROSTER	R&R	
	10003	1.0	10.2	DEFROSTER ELEMENT	R&R	
	10004	1.0	10.2	DEFROSTER FAN / MOTOR ASSEMBLY	R&R	
	10005	0.5	10.2	DEFROSTER ELECTRICAL CONTACTORS	R&R	3 per unit
	10006	2.0	10.2	DEFROSTER THERMAL CUTOUT	R&R	Per each. 2 per unit
	10007	0.2	PM	AIR FILTER, FLOOR HEATER	R&R	
	10008	1.0	10.2	FLOOR HEATER ELEMENT	R&R	
	10009	1.0	10.2	FLOOR HEATER FAN / MOTOR ASSEMBLY	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	10010	0.5	10.2	FLOOR HEATER ELECTRICAL CONTACTORS	R&R	2 per unit
	10011	0.2	10.2	FLOOR HEATER THERMAL CUTOUT	R&R	Per each. 2 per unit
	10012	1.5	6.4 & 10.2	HVAC BOOSTER PUMP	R&R	
Thermo King		**STAND ALONE ITEMS**	**TK MM**	**TK HVAC SYSTEM COMPONENTS (REFER TO TK MAINTENANCE MANUAL)**		
	10013	0.5	TK MM	A C CLUTCH ASSEMBLY	R&R	
	10014	6.0	TK MM	A C COMPRESSOR	Rebuild	Major overhaul
	10015	3.2	TK MM	CONDENSER	R&R	
	10016	1.5	TK MM	CONDENSER FAN MOTOR	R&R	
	10017	0.7	TK MM	CONDENSER FAN BLADES	R&R	
	10018	0.5	TK MM	CONDENSER PRESSURE SWITCH	R&R	
	10019	1.8	TK MM	FILTER DRIER	R&R	Incl evac, charge, leak check
	10020	5.0	TK MM	EVAPORATOR COIL AND PANEL	R&R	
	10021	0.8	TK MM	EVAPORATOR FAN MOTOR	R&R	
	10022	0.5	TK MM	EVAPORATOR HIGH PRESSURE SWITCH	R&R	
	10023	0.5	TK MM	SIGHT GLASS	R&R	
	10024	1.0	TK MM	DISCHARGE HOSE (A/C)	R&R	
	10025	1.7	TK MM	EVAC-CHARGE & LEAK CHECK	Operation	
	10026	1.0	TK MM	SUCTION HOSE	R&R	
	10027	0.5	TK MM	THERMOSTAT -AMBIENT AIR	R&R	
	10028	0.8	TK MM	THERMOSTAT - CAL/SET/RESET	Operation	
	10029	0.5	TK MM	WATER TEMP SWITCH	R&R	
	10030	0.8	TK MM	RETURN AIR SENSOR	R&R	
				12 - INTERIOR PANELS & APPLIED PARTS		
ALL		**STAND ALONE ITEMS**	**12 & 13**	**INTERIOR PANELS & APPLIED PARTS**	**R&R**	
	12000	1.0	12.2	SIDEWALL PANEL	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	12001	1.5	12.2	CEILING PANEL	R&R	
	12002	0.3	13.5	REAR VIEW MIRROR	R&R	
	12003	0.3	13.5	EXIT DOOR MIRROR	R&R	
	12004	0.3	12.2	SUN VISOR	R&R	
				13 - EXTERIOR PANELS & APPLIED PARTS		
ALL		**STAND ALONE ITEMS**	**13**	**EXTERIOR PANELS & APPLIED PARTS**	**R&R**	
	13000	0.5	13.5	CURBSIDE MIRROR	R&R	
	13001	0.5	13.5	DRIVERS MIRROR	R&R	
	13002	1.3	13.3	FRONT BUMPER	R&R	
	13003	0.8	13.3	REAR BUMPER ASSEMBLY	R&R	
	13004	1.0	13.3	POLYURETHANE MODULE	R&R	Per bumper section
	13005	0.3	13.6	WIPER ARM	R&R	
	13006	0.8	13.6	WIPER MOTOR	R&R	
	13007	0.8	13.6	WINDSHIELD WASHER RESERVOIR	R&R	
	13008	1.3	13.4	SPLASH GUARDS / MUD FLAPS	R&R	Front or Rear
	13009	0.3	13	IMPACT PANEL	R&R	
				14 - WINDOWS		
ALL		**STAND ALONE ITEMS**	**14**	**WINDOWS**	**R&R**	
	14000	3.0	14.2	WINDSHIELD	R&R	Per Side
	14001	1.0	14.2	DRIVERS SIDE WINDOW	R&R	
	14002	1.0	14.2	PICTURE WINDOW	R&R	
	14003	1.0	14.2	PASSENGER WINDOW	R&R	
	14004	0.5	14.2	WINDOW TRIM RING	R&R	
	14005	0.4	14.2	WINDOW GLASS	R&R	
	14006	0.2	14.2	PASSENGER WINDOW, RAPID REPLACEMENT	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				15 - ACCESS DOORS		
ALL		**STAND ALONE ITEMS**	**15**	**ACCESS DOORS**	**R&R**	
	15000	0.5	15.2	REAR CROSS SEAT ACCESS DOOR	R&R	
	15001	1.5	15.2	REAR ACCESS DOOR, EXTERIOR	R&R	
	15002	0.2	15.2	TRACTION MOTOR ACCESS DOOR	R&R	Rearmost floor hatch
	15003	0.2	15.2	DRIVE SHAFT ACCESS DOOR	R&R	Middle floor hatch
	15004	0.2	15.2	BRAKE CHAMBER ACCESS DOOR	R&R	Forward floor hatch
	15005	0.7	15.2	AUXILIARY HEATER ACCESS DOOR	R&R	
	15006	0.7	15.2	FUSE BOX ACCESS DOOR	R&R	
	15007	0.8	15.2	ROOF VENT	R&R	
	15008	0.7	15.2	SIDE CONSOLE EXTERIOR DOOR	R&R	
	15009	0.5	15.2	SURGE TANK ACCESS DOOR	R&R	each - 2 total
				16 - ENTRANCE & EXIT DOORS		
VAPOR/NF	**16000**	**2.4**	**16**	**ENTRANCE DOOR ASSEMBLY, SLIDE GLIDE**	**R&R**	
		0.6	16.2	CONNECTING RODS, ENTRANCE DOOR	R&R	
		1.0	16.2	DOOR SHAFT LEVER ASSEMBLY	R&R	
		0.3	16.2	DOOR SHAFT & ARM ASSEMBLY	R&R	
		0.3	16.2	DOOR PANELS (PER PANEL)	R&R	
		0.2	16.2	PIVOT ASSEMBLY, ENTRANCE DOOR TOP	R&R	
VAPOR/NF	**16001**	**1.0**	**16**	**ENTRANCE DOOR SHAFT LEVER ASSEMBLY**	**R&R**	
		0.5	16.2	LEVER ASSEMBLY, ENTRANCE DOOR	R&R	
		0.5	16.2	SPACER & BALL BEARING	R&R	
VAPOR/NF	**16002**	**2.1**	**16**	**ENTRANCE DOOR SHAFT & ARM ASSEMBLY**	**R&R**	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.3	16.2	DOOR PANELS	R&R	Per Panel
		1.0	16.2	DOOR GLASS	R&R	
		0.2	16.2	PIVOT ASSEMBLY, ENTRANCE DOOR TOP	R&R	
		0.3	16.2	SEALS & TRIM, ENTRANCE DOOR	R&R	
		0.3	16.2	BRUSHES, ENTRANCE DOOR	R&R	
VAPOR/NF	**16003**	**2.6**	**16**	**ENTRANCE DOOR MECHANISM OVERHAUL**	**R&R**	
		1.5	16.2	DOOR MOTOR ASSEMBLY	R&R	
		0.2	16.2	DOOR MAG VALVE	R&R	
		0.3	16.2	LIMIT SWITCHES	R&R	
		0.6	16.2	CONNECTING RODS, ENTRANCE DOOR	R&R	
VAPOR/NF	**16004**	**6.4**	**16**	**EXIT DOOR SYSTEM, SWING**	**R&R**	
		2.9	16.3	EXIT DOORS, SWING	R&R	
		0.8	16.3	EXIT DOOR PANELS	R&R	
		2.1	16.3	EXIT DOOR ASSEMBLY	R&R	
		0.6	16.3	EXIT DOOR ENGINE	R&R	
VAPOR/NF	**16005**	**0.6**	**16**	**EXIT DOOR PANELS**	**R&R**	**BOTH**
		0.5	16.3	DOOR GLASS	R&R	
		0.1	16.3	DOOR SHAFT LEVERS	R&R	
VAPOR/NF	**16006**	**0.9**	**16**	**EXIT DOOR ASSEMBLY**	**R&R**	**SINGLE**
		0.3	16.3	SEALS & TRIM	R&R	
		0.3	16.3	DOOR BRUSHES	R&R	
		0.3	16.3	HANDLE	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
VAPOR/NF	**16007**	**5.0**	**16**	**EXIT DOOR BASEPLATE**	**OVERHAUL**	
		1.8	16.3	BASE PLATE ASSEMBLY	R&R	
		0.6	16.3	EXIT DOOR ENGINE	R&R	
		0.2	16.3	DOOR SOLENOID & BRACKET ASSEMBLY	R&R	
		0.2	16.3	HALL EFFECT LOCK PRAWL SWITCH	R&R	
		0.1	16.3	CAM ASSEMBLY	R&R	
		0.2	16.3	MICRO / LIMIT SWITCHES	R&R	
		0.5	16.3	SKINNER VALVE	R&R	
		0.1	16.3	BASEPLATE BUSHINGS	R&R	
		1.0	16.3	EXIT DOOR SOLENOID (MAG VALVE)	R&R	
		0.1	16.3	RETURN SPRING	R&R	
		0.2	16.3	CONNECTING RODS	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
VAPOR/NF	**16008**	**1.4**	**16**	**EXIT DOOR SOLENOID & BRACKET ASSEMBLY**	**R&R**	
		0.2	16.3	BRACKET ASSEMBLY	R&R	
		0.3	16.3	EXTENSION SPRING	R&R	
		0.2	16.3	LEVER ASSEMBLY	R&R	
		0.1	16.3	END PLAY SPACER & BUSHING	R&R	
		0.1	16.3	CAM ASSEMBLY	R&R	
		0.2	16.3	EMERGENCY CONNECTING ROD ASSEMBLY	R&R	
		0.2	16.3	LOCK PRAWL ASSEMBLY	R&R	
		0.1	16.3	SENSOR ASSEMBLY	R&R	
VAPOR/NF		**STAND ALONE ITEMS**	**16**	**EXIT & ENTRANCE DOOR COMPONENTS**	**R&R**	
	16009	0.5	16.2	AIR FILTER, BASEPLATE	R&R	
	16010	1.0	16.3	EXIT DOOR ADJUSTMENT (FIT & ALIGNMENT, CHECK	ADJUST	
	16011	0.3	16.3	EXIT DOOR SPEED ADJUSTMENT	ADJUST	
	16012	0.3	16.3	EXIT DOOR HALL SENSOR VANE ADJUSTMENT	ADJUST	
	16013	0.2	16.3	EXIT DOOR EMERGENCY LINKAGE ADJUSTMENT	ADJUST	
	16014	0.2	16.3	EXIT DOOR LS3 SENSOR ADJUSTMENT	ADJUST	
	16015	0.2	16.3	EXIT DOOR LOCK SOLENOID ADJUSTMENT	ADJUST	
	16016	0.2	16.3	EXIT DOOR LOCK PRAWL TO CAM CLEARANCE ADJU	ADJUST	
	16017	0.2	16.3	EXIT DOOR PANEL SENSOR ADJUSTMENT	ADJUST	
	16018	3.0	16.5	EXIT DOOR COMPLETE FUNCTIONAL TEST	ADJUST	
	16019	1.0	16.2	ENTRANCE DOOR ADJUSTMENT FOR FIT, CHECK & A	ADJUST	
	16020	0.3	16.2	ENTRANCE DOOR SPEED ADJUSTMENT	ADJUST	
	16021	3.0	16.2	ENTRANCE DOOR COMPLETE FUNCTIONAL TEST	TEST	
	16022	1.2	16.2	EXIT DOOR EMERGENCY RELEASE VALVE	TEST	
	16023	1.0	16.2	ENTRANCE DOOR EMERGENCY RELEASE VALVE	R&R	
	16024	1.0	16.6	DOOR CONTROLLER	R&R	
	16025	0.5	16.5	DOOR CONTROLLER MODULE	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	16026	2.2	16.2	ENTRANCE DOOR ASSEMBLY	R&R	
	16027	0.6	16.2	ENTRANCE BASE PLATE ASSEMBLY (Welded)	R&R	
	16028	1.5	16.3	EXIT DOOR ENGINE OVERHAUL	OVERHAUL	
	16029	0.2	16.3	ADJUSTING RODS	R&R	
	16030	1.2	16.3	DOOR SHAFT & ARM ASSEMBLY	R&R	
	16031	0.1	16.3	MICRO SWITCH	R&R	
	16032	0.2	16.3	GRAB HANDLE	R&R	
	16033	0.5	16.3	CHIME	R&R	
	16034	1.0	16.3	REAR DOOR BEARINGS	R&R	
	16035	0.5	16.4	ANNUNCIATE PANEL	R&R	
17 - SEATING & STANCHIONS						
ALL		**STAND ALONE ITEMS**	**17**	**SEATING**	**R&R**	
	17000	1.0	17.2	DRIVERS SEAT	R&R	
	17001	0.5	17.2	DRIVERS SEAT BELT	R&R	
	17002	0.8	17.3	PASSENGER SEAT, DOUBLE	R&R	
	17003	0.1	17.3	SEAT INSERTS	R&R	
	17004	1.0	17.5	WHEELCHAIR FLIP SEAT	R&R	
18 - DESTINATION SIGNS						
ALL		**STAND ALONE ITEMS**	**18**	**DESTINATION SIGNS**	**R&R**	
	18000	1.2	18.2	DESTINATION SIGN ASSEMBLY, FRONT	R&R	
	18001	1.0	18.2	DESTINATION SIGN ASSEMBLY, SIDE	R&R	
	18002	0.5	18.2	REAR ROUTE SIGN	R&R	
	18003	0.5	18.2	DECODER BOARD	R&R	
	18004	0.8	18.2	DESTINATION SIGN CONTROL BOARD	R&R	
	18005	0.8	18.2	PROCESSOR BOARD	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	18006	1.0	18.2	DESTINATION SIGN GLASS	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				19 - DRIVER'S CONTROLS		
ALL		**STAND ALONE ITEMS**	**19 & 3**	**DRIVERS CONTROLS**	**R&R**	
	19000	0.5	19.2	INSTRUMENT PANEL CLUSTER	R&R	
	19001	0.5	19.2	DEFROSTER SWITCH	R&R	
	19002	0.3	19.2	TURN SIGNAL SWITCH	R&R	
	19003	0.2	3.2	HORN BUTTON	R&R	
	19004	0.5	19.2	PARKING BRAKE KNOB	R&R	
	19005	0.5	19.2	DIMMER SWITCH	R&R	
	19006	1.0	19.4	ACCELERATOR TREADLE	R&R	
	19007	0.5	19.4	THROTTLE POSITION SENSOR	R&R	
				20 - WHEELCHAIR RAMP		
NF		**STAND ALONE ITEMS**	**20**	**WHEELCHAIR RAMP COMPONENTS**	**R&R**	
	20000	0.8	20.2	HYD.PUMP/RESERVOIR ASSEMBLY	R&R	
	20001	0.6	20.2	MANIFOLD BLOCK	R&R	
	20002	0.6	20.2	LIFT MECHANISM ASSEMBLY	R&R	
	20003	0.5	20.2	MICRO SWITCHES/LIMIT SWITCHES	R&R	
	20004	1.0	20.2	RAMP PLATE	R&R	
	20005	1.5	20.2	RAMP ASSEMBLY COMPLETE	R&R	
	20006	0.5	20.2	DASH SWITCH	R&R	
	20007	0.2	20.2	RAMP COVER PLATE	R&R	
	20008	1.5	20.2	DRIVE CHAIN	R&R	

1. Times on stand alone items may differ from those same items included in an assembly.

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				2. Refer to each section of the New Flyer Service Manual or OEM supplier manual for identification of any Special Tools		

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				1 - FRONT AXLE & SUPPLY		
MAN	**1000**	**3.4**	**1 & 3**	**FRONT AXLE & SUSPENSION**	**R&R**	**Time listed is per person, 2 people required for this task**
		0.2	1.2	DRAG LINK	DISCONNECT	At Drag Link Arm
		0.3	1.2	BRAKE CHAMBER AIR LINES	R&R	
		0.1	1.2	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	1.2	ABS SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		1.0	1.2	RADIUS RODS	DISCONNECT	At Structure
		0.1	1.2	LOWER RETAINING NUTS, SHOCK ABSORBER	R&R	
		0.1	1.2	LOWER RETAINING NUTS, AIR SPRINGS	R&R	
		0.2	1.2	CENTER LINK	R&R	
		0.3	1.2	TORQUE BOLTS	ADJUST	
		0.5	3.2	FRONT END ALIGNMENT (MINOR)	ALIGN	
		0.5	1.2	ROAD TEST	CHECK	
MAN	**1001**	**2.1**	**1**	**WHEEL HUB ASSEMBLY, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	1.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.3	1.3	WHEEL FLANGE	R&R	
		0.1	1.5	BRAKE DISC	R&R	
		0.2	1.3	SLOTTED NUT & THRUST WASHER	R&R	
		0.2	1.3	HUB & BEARING ASSEMBLY	R&R	
MAN	**1002**	**3.6**	**1**	**STEERING KNUCKLE**	**R&R**	**With wheel hub in place**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD CLEARANCE	ADJUST	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.1	1.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.3	1.3	WHEEL FLANGE	R&R	
		0.1	1.5	BRAKE DISC	R&R	
		0.5	1.3	TIE ROD END	R&R	
		0.1	1.3	KING PIN SEAL CAPS	R&R	
		0.1	1.3	SNAP RINGS	R&R	
		0.1	1.3	KING PIN COVERS & DUST GUARD	R&R	
		1.0	1.3	KING PINS	R&R	
		0.1	1.3	THRUST BEARING & SHIMS	R&R	
MAN	**1004**	**1.2**	**1**	**WHEEL STUDS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.6	1.3	WHEEL STUDS	R&R	
MAN	**1005**	**1.1**	**1**	**BRAKE PADS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
MAN	**1006**	**0.5**	**1**	**ABS SPEED SENSOR, FRONT AXLE**	**R&R**	**Per Side**
		0.5	1.6	SPEED SENSOR	R&R	
MAN	**1007**	**1.4**	**1**	**BRAKE CHAMBER ASSEMBLY, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.5	1.5	BRAKE CHAMBER, FRONT	R&R	
MAN	**1008**	**2.5**	**1**	**CALIPER GUIDE PINS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.5	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
		0.1	1.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.5	1.5	CALIPER GUIDE PINS, BUSHINGS & BOOTS	R&R	
MAN	**1009**	**1.5**	**1**	**TAPPET & RUBBER BOOT, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
		0.2	1.5	TAPPET & RUBBER BOOT	R&R	
		0.1	1.5	INNER SEAL	R&R	
		0.1	1.5	BUSHING	R&R	
ALL		**STAND ALONE ITEMS**	**1**	**FRONT AXLE & SUSPENSION COMPONENTS**	**R&R**	
	1010	1.0	1.4	SHOCKS	R&R	Each
				2 - REAR & CENTLE AXLE & SUSPENSION		
MAN	**2000**	**4.0**	**2**	**REAR AXLE**	**R&R**	
		0.5	2.8	DRIVE SHAFT	R&R	INCL driveshaft guard
		0.1	2.6	ABS SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	2.4	LEVELING VALVE LINKS	R&R	
		0.6	2.4	UPPER & LOWER RADIUS RODS (AT CHASSIS)	R&R	
		0.3	2.5	BRAKE LINES, REAR	R&R	
		0.1	2.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	2.3	DIFFERENTIAL BREATHER (AT CHASSIS)	DISCONNECT	
		0.4	2.5	AIR LINES & HARNESSES	DISCONNECT	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.2	2.4	SHOCKS (LOWER NUTS ONLY)	R&R	
		0.2	2.4	AIR SPRINGS (LOWER BOLTS ONLY)	R&R	
		1.0	2.3	AXLE, U-BOLTS & SPACERS (SEPARATION FROM SUSPENSION BEAM)	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
		0.2	2	RAISE & LOWER WHEEL & AXLE ASSEMBLY	OPERATION	
MAN	**2001**	**1.2**	**2**	**WHEEL STUDS**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.6	2.3	WHEEL STUDS	R&R	
MAN	**2002**	**0.7**	**2**	**AXLE SHAFT**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.1	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2003**	**2.4**	**2**	**WHEEL HUB ASSEMBLY, REAR**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		1.0	2.3	RETAINING RING & TAPPERED ROLLER BEARING ASSEMBLIES	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2004**	**2.2**	**2**	**BRAKE DISC, REAR**	**R&R**	**Per Side**

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		0.3	2.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	2.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	2.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.1	2.5	BRAKE DISC	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2005**	**2.3**	**2**	**ABS SPEED SENSOR, REAR AXLE**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		0.3	2.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	2.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	2.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.1	2.5	BRAKE DISC	R&R	
		0.1	2.6	SPEED SENSOR	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2006**	**1.1**	**2**	**BRAKE PADS, REAR AXLE**	**R&R**	**Per Side**

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
MAN	**2007**	**1.6**	**2**	**BRAKE CHAMBER ASSEMBLY, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.3	2.3	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.5	2.5	BRAKE CHAMBER, REAR	R&R	
MAN	**2008**	**2.7**	**2**	**CALIPER GUIDE PINS, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.3	2.3	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.5	2.5	BRAKE CHAMBER, REAR	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
		0.1	2.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.5	2.5	CALIPER GUIDE PINS, BUSHINGS & BOOTS	R&R	
MAN	**2009**	**1.5**	**2**	**TAPPET & RUBBER BOOT, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
		0.2	2.5	TAPPET & RUBBER BOOT	R&R	
		0.1	2.5	INNER SEAL	R&R	
		0.1	2.5	BUSHING	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
MAN	**2010**	**2.6**	**2**	**DIFFERENTIAL CARRIER ASSEMBLY**	**R&R**	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		1.0	2.3	AXLE SHAFTS	R&R	Incl both sides
		0.1	2.3	AXLE BREATHER	R&R	
		0.6	2.8	DRIVESHAFT SHAFT FLANGE & YOKE	R&R	
		0.2	2.3	CARRIER MOUNTING BOLTS	R&R	
		0.5	2.3	DIFFERENTIAL CARRIER	R&R	
ALL		**STAND ALONE ITEMS**	**2**	**REAR AXLE & SUSPENSION COMPONENTS**	**R&R**	
	2011	1.4	2.4	SHOCKS	R&R	Each
ZF		**STAND ALONE ITEMS**	**2**	**CENTER AXLE (Electric Drive)**	**R&R**	
	2012	0.6	2.9	WHEEL ASSEMBLY	R&R	
	2013	0.5	2.11	BRAKE CYLINDER	R&R	
	2014	0.8	2.11	BRAKE LININGS	R&R	
	2015	2.0	2.11	COMPLETE BRAKE CALIPER	R&R	
	2016	0.3	2.9	PLANETARY CARRIER	R&R	
	2017	0.5	2.9	PLANETARY GEAR	R&R	EACH
	2018	0.3	2.9	RING GEAR	R&R	
	2019	0.8	2.9	HUB	R&R	
	2020	1.5	2.9	10 WHEEL BOLTS	R&R	
	2021	0.3	2.11	BRAKE DISC	R&R	
	2022	0.3	2.9	ABS - SENSOR	R&R	
	2023	1.0	2.9	HUB CARRIER	R&R	
	2024	4.0	2.9	ELECTRIC MOTOR	R&R	AXLE REMOVED
	2025	1.0	2.10	RADIUS RODS	R&R	
	2026	1.4	2.10	SHOCKS	R&R	Each

3 - STEERING SYSTEM

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ALL	**3000**	**4.5**	**3 & 15**	**STEERING GEAR BOX**	**R&R**	
		0.2	3.2	RAISE VEHICLE	OPERATION	
		0.1	15.3	PRIMARY ACCESS COVER	R&R	
		0.1	15.3	SECONDARY ACCESS COVER	R&R	
		0.5	3.2	STEERING JOINT ASSEMBLY (At transfer box)	DISCONNECT	At Transfer Gear Box
		0.2	3.2	DRAG LINK	DISCONNECT	At Pitman Arm
		0.5	3.2	POWER STEERING LINES	DISCONNECT	At Transfer Gear Box
		1.9	3.2	MOUNTING BOLTS, STEERING GEAR BOX	R&R	
		0.5	3.2	REFILL FLUID & BLEED LINES	OPERATION	
		0.5		ROAD TEST	TEST	Optional
ALL	**3001**	**3.0**	**3**	**MITER BOX**	**R&R**	
		1.0	3.2	"U" JOINT, STEERING COLUMN	DISCONNECT	At Transfer Gear Box
		0.5	3.2	STEERING JOINT ASSEMBLY (At transfer box)	DISCONNECT	At Transfer Gear Box
		0.5	3.2	MITER BOX RETAINING BOLTS	DISCONNECT	
		0.5	3.2	MITER BOX COMPONENT	R&R	
		0.5		ROAD TEST	TEST	Optional
ALL		**STAND ALONE ITEMS**	**3**	**STEERING SYSTEM COMPONENTS**	**R&R**	
	3002	3.7	3.2	STEERING GEAR BOX	R&R	
	3003	3.0	3.2	TRANSFER GEAR BOX	R&R	
	3004	1.0	3.2	STEERING COLUMN	R&R	
	3005	1.0	3.2	"U" JOINT, STEERING COLUMN	R&R	
	3006	0.5	3.2	STEERING WHEEL	R&R	
	3007	0.8	3.2	DRAG LINK	R&R	
	3008	1.5	3.3	HYDRAULIC PUMP (POWER STEERING)	R&R	Includes refill and bleed
	3009	2.5	3.3	HYDRAULIC RESERVOIR	R&R	Includes refill and bleed
	3010	0.5	3.3	FILTER, HYDRAULIC RESERVOIR	R&R	Includes R+R of access cover
	3011	0.8	3.3	SIGHT GLASS	R&R	Includes R+R of access cover
	3012	0.5	3.3	PRESSURE GAUGE ON FILTER HOUSING	R&R	Includes R+R of access cover

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				4 - ELECTRIC DRIVE SYSTEM		
ALL	**4000**	**3.5**	**4**	**TRACTION MOTOR**		
		0.2	4.3	RAISE VEHICLE	OPERATION	
		0.5	4.3	DRIVE SHAFT	R&R	
		0.5	4.3	DISCONNECT CABLES	R&R	INCL driveshaft guard
		0.8	4.3	COOLANT LINES	R&R	Includes refill and bleed
		1.5	4.3	TRACTION MOTOR	R&R	
ALL		**STAND ALONE ITEMS**	**4**	**ELECTRIC DRIVE SYSTEM COMPONENTS**		
	4001	0.5	4.4	MASTER CONTROL UNIT (MCU)	R&R	
	4002	0.8	4.4	BATTERY DISCONNECT UNIT	R&R	1 per string
	4003	0.1	4.4	HIGH VOLTAGE FUSES	R&R	Each
Kidde		**STAND ALONE ITEMS**	**4**	**FIRE SUPPRESSION SYSTEM (REFER TO DUAL SPECTRUM MAINTENANCE MANUAL)**	**R&R**	
	4004	0.3	DS MM	AGENT CYLINDER	R&R	
	4005	0.3	DS MM	ELECTRICAL / MANUAL ACTUATOR	R&R	
	4006	0.3	DS MM	PNEUMATIC CONTROL HEAD	R&R	
	4007	0.3	DS MM	DISCHARGE NOZZLE	R&R	
	4008	0.6	DS MM	DISTRIBUTOR	R&R	
	4009	0.3	DS MM	DISCHARGE FITTING	R&R	
	4010	0.4	DS MM	HEAT DETECTION THERMOSTATS	R&R	
				5 - TRANSMISSION SYSTEM		
ALL		**STAND ALONE ITEMS**	**5**	**TRANSMISSION SYSTEM COMPONENTS**		
				THIS SECTION IS NOT APPLICABLE		
				6 - COOLING SYSTEM		

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ALL		STAND ALONE ITEMS	6 & 10	STAND ALONE ITEMS	R&R	
	6000	1.5	6.3	TRACTION MOTOR COOLER RAD ASSEMBLY	R&R	Includes fill and de-aerate
	6001	0.3	6.3	TRACTION MOTOR COOLER FAN	R&R	Each
	6002	0.5	6.3	TRACTION MOTOR COOLER CONTROL MODULE	R&R	
	6003	0.3	6.3	TRACTION MOTOR COOLER ISOLATOR	R&R	Replace all four
	6004	1.5	6.3	BOOSTER PUMP (TRACTION MOTOR)	R&R	Includes fill and de-aerate
	6005	2.0	6.3	SURGE TANK (TRACTION MOTOR AND INVERTER)	R&R	Traction motor & Inverter
	6006	0.3	6.3	LOW COOLANT SENSOR	R&R	1 per surge tank
	6007	5.0	6.4	ESS HEAT EXCHANGER SCROLL COMPRESSOR	R&R	Includes evac / fill of refrigerant
	6008	0.5	6.4	ESS HEAT EXCHANGER CONTACTOR	R&R	
	6009	0.5	6.4	ESS CONDENSER FAN	R&R	
	6010	3.0	6.4	ESS CONDENSER	R&R	Includes evac / fill of refrigerant
	6011	1.5	6.4 & 10.2	BOOSTER PUMP (ESS & CABIN)	R&R	Includes fill and de-aerate
	6012	2.0	6.4	SURGE TANK (ESS & CABIN)	R&R	
				7 - FUEL SYSTEM		
ALL		STAND ALONE ITEMS	7	FUEL SYSTEM COMPONENTS		
				THIS SECTION IS NOT APPLICABLE		
				8 - AIR SYSTEM		
ALL		STAND ALONE ITEMS	8 & 2	AIR SYSTEM COMPONENTS	R&R	
	8000	1.0	8.5	AIR BRAKE RELAY VALVE	R&R	
	8001	5.0	8.4	AIR COMPRESSOR	R&R	
	8002	1.7	8.4	AIR COMPRESSOR HEAD	R&R	
	8003	2.5	8.4	AIR DRYER	R&R	
	8004	0.2	8.4	AIR DRYER FILTER	R&R	
	8005	0.6	8.4	AIR PRESSURE REGULATOR (BRAKE INTERLOCK)	R&R	
	8006	0.2	8.4	AIR TANK DRAIN VALVE	R&R	
	8007	1.5	8.4	APPLICATION VALVE (BRAKE TREADLE)	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	8008	0.5	2.5	BRAKE CHAMBER, REAR	R&R	
	8009	0.3	8.4	BRAKE INTERLOCK MAGNETIC VALVE	R&R	
	8010	0.3	8.5	CHECK VALVE	R&R	
	8013	0.5	8.4	OIL SEPARATOR	R&R	
	8014	0.3	8.4	OIL SEPARATOR FILTERS	R&R	
	8015	0.2	8.5	PRESSURE PROTECTION VALVE	R&R	
	8016	0.2	8.4	Q. R. VALVE	R&R	
	8017	0.6	8.5	SOLENOID VALVE	R&R	
	8018	1.0	8.5	SPRING BRAKE CONTROL VALVE	R&R	
	8019	0.2	8.5	TRANSDUCER	R&R	
	8020	0.3		LOW AIR PRESSURE SWITCH	R&R	
	8021	1.0	2.6	AUTOMATIC TRACTION CONTROL VALVE	R&R	
				9 - ELECTRICAL SYSTEM		
ALL		**STAND ALONE ITEMS**	**9**	**ELECTRICAL SYSTEM COMPONENTS**	**R&R**	
	9000	0.2	9.2	PLC MODULES	R&R	
	9001	2.0	9.4	HIGH VOLTAGE DC-DC CONVERTER	R&R	In roof rack
	9002	0.5	9.5	BATTERIES & LEADS	R&R	In battery tray
	9003	0.5	9.5	BATTERY DISONNECT SWITCH	R&R	
	9004	0.7	9.5	VOLTAGE EQUALIZER	R&R	
	9005	1.0	9.5	BATTERY TRAY	R&R	
	9006	0.5	9.6	BATTERY DISCONNECT SOLENOID	R&R	Two - 12 and 24 V
	9007	0.3	9.7	LED HEADLIGHT ASSEMBLY	R&R	
	9008	0.2	9.7	BACK UP LAMP	R&R	
	9009	0.2	9.7	BRAKE LAMP	R&R	
	9010	0.2	9.7	REAR SIGNAL LAMP	R&R	
	9011	0.2	9.7	CLEARANCE LAMP	R&R	
	9012	0.2	9.7	SIDE SIGNAL LAMP	R&R	
	9013	0.3	9.7	CORNERING LAMP	R&R	
	9014	0.1	9.8	INTERIOR LED LIGHT STRIPS	R&R	
	9015	0.2	9.10	HORNS	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	9016	0.5	9.12	P.A. SPEAKER	R&R	
	9017	0.2	9.17	DUAL USB CHARGE PORT	R&R	
	9018	0.3	19.2	DIMMER SWITCH	R&R	
	9019	0.3	19.2	TURN SIGNAL SWITCH	R&R	
				10 - HVAC SYSTEM		
ALL		**STAND ALONE ITEMS**	**10, 6, & PM**	**HVAC SYSTEM COMPONENTS**	**R&R**	
	10000	1.5	10.2	DRIVERS HEATER / DEFROSTER UNIT	R&R	
	10001	0.5	10.2	DRIVERS BOOSTER FAN MOTOR	R&R	
	10002	0.2	PM	AIR FILTER, DEFROSTER	R&R	
	10003	1.0	10.2	DEFROSTER ELEMENT	R&R	
	10004	1.0	10.2	DEFROSTER FAN / MOTOR ASSEMBLY	R&R	
	10005	0.5	10.2	DEFROSTER ELECTRICAL CONTACTORS	R&R	3 per unit
	10006	2.0	10.2	DEFROSTER THERMAL CUTOUT	R&R	Per each. 2 per unit
	10007	0.2	PM	AIR FILTER, FLOOR HEATER	R&R	
	10008	1.0	10.2	FLOOR HEATER ELEMENT	R&R	
	10009	1.0	10.2	FLOOR HEATER FAN / MOTOR ASSEMBLY	R&R	
	10010	0.5	10.2	FLOOR HEATER ELECTRICAL CONTACTORS	R&R	2 per unit
	10011	0.2	10.2	FLOOR HEATER THERMAL CUTOUT	R&R	Per each. 2 per unit
	10012	1.5	6.4 & 10.2	HVAC BOOSTER PUMP	R&R	
	10013	*	10.12	CABIN HEATER	R&R	
				Note * Information on these items is currently unavailable		
Thermo King		**STAND ALONE ITEMS**	**TK MM**	**TK HVAC SYSTEM COMPONENTS (REFER TO TK MAINTENANCE MANUAL)**		
	10013	*	TK MM	A C CLUTCH ASSEMBLY	R&R	
	10014	*	TK MM	A C COMPRESSOR	Rebuild	Major overhaul
	10015	*	TK MM	CONDENSER	R&R	
	10016	*	TK MM	CONDENSER FAN MOTOR	R&R	
	10017	*	TK MM	CONDENSER FAN BLADES	R&R	
	10018	*	TK MM	CONDENSER PRESSURE SWITCH	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	10019	*	TK MM	FILTER DRIER	R&R	Incl evac, charge, leak check
	10020	*	TK MM	EVAPORATOR COIL AND PANEL	R&R	
	10021	*	TK MM	EVAPORATOR FAN MOTOR	R&R	
	10022	*	TK MM	EVAPORATOR HIGH PRESSURE SWITCH	R&R	
	10023	*	TK MM	SIGHT GLASS	R&R	
	10024	*	TK MM	DISCHARGE HOSE (A/C)	R&R	
	10025	*	TK MM	EVAC-CHARGE & LEAK CHECK	Operation	
	10026	*	TK MM	SUCTION HOSE	R&R	
	10027	*	TK MM	THERMOSTAT -AMBIENT AIR	R&R	
	10028	*	TK MM	THERMOSTAT - CAL/SET/RESET	Operation	
	10029	*	TK MM	WATER TEMP SWITCH	R&R	
	10030	*	TK MM	RETURN AIR SENSOR	R&R	
				Note * Information on these items is currently unavailable		
				12 - INTERIOR PANELS & APPLIED PARTS		
ALL		**STAND ALONE ITEMS**	**12 & 13**	**INTERIOR PANELS & APPLIED PARTS**	**R&R**	
	12000	1.0	12.2	SIDEWALL PANEL	R&R	
	12001	1.5	12.2	CEILING PANEL	R&R	
	12002	0.3	12.5	REAR VIEW MIRROR	R&R	
	12003	0.3	12.5	EXIT DOOR MIRROR	R&R	
	12004	0.3	12.2	SUN VISOR	R&R	
				13 - EXTERIOR PANELS & APPLIED PARTS		
ALL		**STAND ALONE ITEMS**	**13**	**EXTERIOR PANELS & APPLIED PARTS**	**R&R**	
	13000	0.5	13.5	CURBSIDE MIRROR	R&R	
	13001	0.5	13.5	DRIVERS MIRROR	R&R	
	13002	1.3	13.3	FRONT BUMPER	R&R	
	13003	0.8	13.3	REAR BUMPER ASSEMBLY	R&R	
	13004	1.0	13.3	POLYURETHANE MODULE	R&R	Per bumper section
	13005	0.3	13.6	WIPER ARM	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	13006	0.8	13.6	WIPER MOTOR	R&R	
	13007	0.8	13.6	WINDSHIELD WASHER RESERVOIR	R&R	
	13008	1.3	13.4	SPLASH GUARDS / MUD FLAPS	R&R	Front or Rear
	13009	0.3	13	IMPACT PANEL	R&R	
				14 - WINDOWS		
ALL		**STAND ALONE ITEMS**	**14**	**WINDOWS**	**R&R**	
	14000	3.0	14.2	WINDSHIELD	R&R	Per Side
	14001	1.0	14.2	DRIVERS SIDE WINDOW	R&R	
	14003	1.0	14.2	PASSENGER WINDOW	R&R	
	14004	0.5	14.2	WINDOW TRIM RING	R&R	
	14005	0.4	14.2	WINDOW GLASS	R&R	
	14006	0.2	14.2	PASSENGER WINDOW, RAPID REPLACEMENT	R&R	
				15 - ACCESS DOORS		
ALL		**STAND ALONE ITEMS**	**15**	**ACCESS DOORS**	**R&R**	
	15000	0.5	15.2	REAR CROSS SEAT ACCESS DOOR	R&R	
	15001	1.5	15.2	REAR ACCESS DOOR, EXTERIOR	R&R	
	15002	0.2	15.2	TRACTION MOTOR ACCESS DOOR	R&R	Rearmost floor hatch
	15003	0.2	15.2	DRIVE SHAFT ACCESS DOOR	R&R	Middle floor hatch
	15004	0.2	15.2	BRAKE CHAMBER ACCESS DOOR	R&R	Forward floor hatch
	15005	0.7	15.2	AUXILIARY HEATER ACCESS DOOR	R&R	
	15006	0.7	15.2	FUSE BOX ACCESS DOOR	R&R	
	15007	0.8	15.2	ROOF VENT	R&R	
	15008	0.7	15.2	SIDE CONSOLE EXTERIOR DOOR	R&R	
	15009	0.5	15.2	SURGE TANK ACCESS DOOR	R&R	each - 2 total
	15010	0.5	15.3	DEFROSTER ACCESS DOOR	R&R	
				16 - ENTRANCE & EXIT DOORS		

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
VAPOR/NF	**16000**	**2.4**	**16**	**ENTRANCE DOOR ASSEMBLY, SLIDE GLIDE**	**R&R**	
		0.6	16.2	CONNECTING RODS, ENTRANCE DOOR	R&R	
		1.0	16.2	DOOR SHAFT LEVER ASSEMBLY	R&R	
		0.3	16.2	DOOR SHAFT & ARM ASSEMBLY	R&R	
		0.3	16.2	DOOR PANELS (PER PANEL)	R&R	
		0.2	16.2	PIVOT ASSEMBLY, ENTRANCE DOOR TOP	R&R	
VAPOR/NF	**16001**	**1.0**	**16**	**ENTRANCE DOOR SHAFT LEVER ASSEMBLY**	**R&R**	
		0.5	16.2	LEVER ASSEMBLY, ENTRANCE DOOR	R&R	
		0.5	16.2	SPACER & BALL BEARING	R&R	
VAPOR/NF	**16002**	**2.1**	**16**	**ENTRANCE DOOR SHAFT & ARM ASSEMBLY**	**R&R**	
		0.3	16.2	DOOR PANELS	R&R	Per Panel
		1.0	16.2	DOOR GLASS	R&R	
		0.2	16.2	PIVOT ASSEMBLY, ENTRANCE DOOR TOP	R&R	
		0.3	16.2	SEALS & TRIM, ENTRANCE DOOR	R&R	
		0.3	16.2	BRUSHES, ENTRANCE DOOR	R&R	
VAPOR/NF	**16003**	**2.6**	**16**	**ENTRANCE DOOR MECHANISM OVERHAUL**	**R&R**	
		1.5	16.2	DOOR MOTOR ASSEMBLY	R&R	
		0.2	16.2	DOOR MAG VALVE	R&R	
		0.3	16.2	LIMIT SWITCHES	R&R	
		0.6	16.2	CONNECTING RODS, ENTRANCE DOOR	R&R	
VAPOR/NF	**16004**	**6.4**	**16**	**EXIT DOOR SYSTEM, SWING**	**R&R**	
		2.9	16.3	EXIT DOORS, SWING	R&R	
		0.8	16.3	EXIT DOOR PANELS	R&R	
		2.1	16.3	EXIT DOOR ASSEMBLY	R&R	
		0.6	16.3	EXIT DOOR ENGINE	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
VAPOR/NF	**16005**	**0.6**	**16**	**EXIT DOOR PANELS**	**R&R**	**BOTH**
		0.5	16.3	DOOR GLASS	R&R	
		0.1	16.3	DOOR SHAFT LEVERS	R&R	
VAPOR/NF	**16006**	**0.9**	**16**	**EXIT DOOR ASSEMBLY**	**R&R**	**SINGLE**
		0.3	16.3	SEALS & TRIM	R&R	
		0.3	16.3	DOOR BRUSHES	R&R	
		0.3	16.3	HANDLE	R&R	
VAPOR/NF	**16007**	**5.0**	**16**	**EXIT DOOR BASEPLATE**	**OVERHAUL**	
		1.8	16.3	BASE PLATE ASSEMBLY	R&R	
		0.6	16.3	EXIT DOOR ENGINE	R&R	
		0.2	16.3	DOOR SOLENOID & BRACKET ASSEMBLY	R&R	
		0.2	16.3	HALL EFFECT LOCK PRAWL SWITCH	R&R	
		0.1	16.3	CAM ASSEMBLY	R&R	
		0.2	16.3	MICRO / LIMIT SWITCHES	R&R	
		0.5	16.3	SKINNER VALVE	R&R	
		0.1	16.3	BASEPLATE BUSHINGS	R&R	
		1.0	16.3	EXIT DOOR SOLENOID (MAG VALVE)	R&R	
		0.1	16.3	RETURN SPRING	R&R	
		0.2	16.3	CONNECTING RODS	R&R	
VAPOR/NF	**16008**	**1.4**	**16**	**EXIT DOOR SOLENOID & BRACKET ASSEMBLY**	**R&R**	
		0.2	16.3	BRACKET ASSEMBLY	R&R	
		0.3	16.3	EXTENSION SPRING	R&R	
		0.2	16.3	LEVER ASSEMBLY	R&R	
		0.1	16.3	END PLAY SPACER & BUSHING	R&R	
		0.1	16.3	CAM ASSEMBLY	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.2	16.3	EMERGENCY CONNECTING ROD ASSEMBLY	R&R	
		0.2	16.3	LOCK PRAWL ASSEMBLY	R&R	
		0.1	16.3	SENSOR ASSEMBLY	R&R	
VAPOR/NF		**STAND ALONE ITEMS**	**16**	**EXIT & ENTRANCE DOOR COMPONENTS**	**R&R**	
	16009	0.5	16.2	AIR FILTER, BASEPLATE	R&R	
	16010	1.0	16.3	EXIT DOOR ADJUSTMENT (FIT & ALIGNMENT, CHECK & ADJUST)	ADJUST	
	16011	0.3	16.3	EXIT DOOR SPEED ADJUSTMENT	ADJUST	
	16012	0.3	16.3	EXIT DOOR HALL SENSOR VANE ADJUSTMENT	ADJUST	
	16013	0.2	16.3	EXIT DOOR EMERGENCY LINKAGE ADJUSTMENT	ADJUST	
	16014	0.2	16.3	EXIT DOOR LS3 SENSOR ADJUSTMENT	ADJUST	
	16015	0.2	16.3	EXIT DOOR LOCK SOLENOID ADJUSTMENT	ADJUST	
	16016	0.2	16.3	EXIT DOOR LOCK PRAWL TO CAM CLEARANCE ADJUSTMENT	ADJUST	
	16017	0.2	16.3	EXIT DOOR PANEL SENSOR ADJUSTMENT	ADJUST	
	16018	3.0	16.5	EXIT DOOR COMPLETE FUNCTIONAL TEST	ADJUST	
	16019	1.0	16.2	ENTRANCE DOOR ADJUSTMENT FOR FIT, CHECK & ADJUST	ADJUST	
	16020	0.3	16.2	ENTRANCE DOOR SPEED ADJUSTMENT	ADJUST	
	16021	3.0	16.2	ENTRANCE DOOR COMPLETE FUNCTIONAL TEST	TEST	
	16022	1.2	16.2	EXIT DOOR EMERGENCY RELEASE VALVE	TEST	
	16023	1.0	16.2	ENTRANCE DOOR EMERGENCY RELEASE VALVE	R&R	
	16024	1.0	16.6	DOOR CONTROLLER	R&R	
	16025	0.5	16.5	DOOR CONTROLLER MODULE	R&R	
	16026	2.2	16.2	ENTRANCE DOOR ASSEMBLY	R&R	
	16027	0.6	16.2	ENTRANCE BASE PLATE ASSEMBLY (Welded)	R&R	
	16028	1.5	16.3	EXIT DOOR ENGINE OVERHAUL	OVERHAUL	
	16029	0.2	16.3	ADJUSTING RODS	R&R	
	16030	1.2	16.3	DOOR SHAFT & ARM ASSEMBLY	R&R	
	16031	0.1	16.3	MICRO SWITCH	R&R	
	16032	0.2	16.3	GRAB HANDLE	R&R	
	16033	0.5	16.3	CHIME	R&R	
	16034	1.0	16.3	REAR DOOR BEARINGS	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	16035	0.5	16.4	ANNUNCIATE PANEL	R&R	
				17 - SEATING & STANCHIONS		
ALL		**STAND ALONE ITEMS**	**17**	**SEATING**	**R&R**	
	17000	1.0	17.2	DRIVERS SEAT	R&R	
	17001	0.5	17.2	DRIVERS SEAT BELT	R&R	
	17002	0.8	17.3	PASSENGER SEAT, DOUBLE	R&R	
	17003	0.1	17.3	SEAT INSERTS	R&R	
	17004	1.0	17.5	WHEELCHAIR FLIP SEAT	R&R	
				18 - DESTINATION SIGNS		
ALL		**STAND ALONE ITEMS**	**18**	**DESTINATION SIGNS**	**R&R**	
	18000	1.2	18.2	DESTINATION SIGN ASSEMBLY, FRONT	R&R	
	18001	1.0	18.2	DESTINATION SIGN ASSEMBLY, SIDE	R&R	
	18002	0.5	18.2	REAR ROUTE SIGN	R&R	
	18003	0.5	18.2	DECODER BOARD	R&R	
	18004	0.8	18.2	DESTINATION SIGN CONTROL BOARD	R&R	
	18005	0.8	18.2	PROCESSOR BOARD	R&R	
	18006	1.0	18.2	DESTINATION SIGN GLASS	R&R	
	18007	0.5	18.2	FRONT ROUTE SIGN	R&R	
				19 - DRIVER'S CONTROLS		
ALL		**STAND ALONE ITEMS**	**19 & 3**	**DRIVERS CONTROLS**	**R&R**	
	19000	0.5	19.2	INSTRUMENT PANEL CLUSTER	R&R	
	19001	0.5	19.2	DEFROSTER SWITCH	R&R	
	19002	0.3	19.2	TURN SIGNAL SWITCH	R&R	
	19003	0.2	3.2	HORN BUTTON	R&R	
	19004	0.5	19.2	PARKING BRAKE KNOB	R&R	
	19005	0.5	19.2	DIMMER SWITCH	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	19006	1.0	19.4	ACCELERATOR TREADLE	R&R	
	19007	0.5	19.4	THROTTLE POSITION SENSOR	R&R	
	19008	0.3	19.2	MASTER RUN SWITCH	R&R	
				20 - WHEELCHAIR RAMP		
NF		**STAND ALONE ITEMS**	**20**	**WHEELCHAIR RAMP COMPONENTS**	**R&R**	
	20000	0.8	20.2	HYD.PUMP/RESERVOIR ASSEMBLY	R&R	
	20001	0.6	20.2	MANIFOLD BLOCK	R&R	
	20002	0.6	20.2	LIFT MECHANISM ASSEMBLY	R&R	
	20003	0.5	20.2	MICRO SWITCHES/LIMIT SWITCHES	R&R	
	20004	1.0	20.2	RAMP PLATE	R&R	
	20005	1.5	20.2	RAMP ASSEMBLY COMPLETE	R&R	
	20006	0.5	20.2	DASH SWITCH	R&R	
	20007	0.2	20.2	RAMP COVER PLATE	R&R	
	20008	1.5	20.2	DRIVE CHAIN	R&R	

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				21 - ARTICULATED JOINT		
ATG	**21000**	**1.4**	**21**	**FLOOR PLATE ACCESS**	**R&R**	
		1.0	21.2	FLOOR PLATES REMOVAL	R&R	
		0.4	21.2	FLOOR PLATES (LIFT / SECURE)	ACCESS	
ATG	**21001**	**1.8**	**21**	**OPEN BELLOWS (UNDERSIDE)**	**R&R**	
		0.8	21.7	HIP BOOT FLANGE PLATES (2)	R&R	
		0.5	21.7	RETAINING CLIPS	R&R	
		0.3	21.7	TURNBUCKLE ASSEMBLY	R&R	
		0.2	21.7	SHOCK CORD ASSEMBLY	DISCONNECT	
ATG	**21002**	**4.8**	**21**	**BELLOWS ASSEMBLY - ONE SIDE**	**R&R**	
		0.5	21.7	HIP BOOT FLANGE PLATES (2)	R&R	
		0.4	21.7	BUCKLE STRAPS	DISCONNECT	
		0.4	21.7	RETAINING STRIP	R&R	
		0.4	21.7	TURNBUCKLE ASSEMBLY	DISCONNECT	
		0.2	21.7	SHOCK CORD ASSEMBLY	DISCONNECT	
		0.2	21.7	ROOF STRUT	DISCONNECT	
		0.2	21.7	TIE ROD ASSEMBLY	DISCONNECT	
		2.5	21.7	BELLOWS SECTION	R&R	
ATG	**21003**	**6.4**	**21**	**CENTER HOOP ASSEMBLY**	**R&R**	
		1.0	21.6	OPEN FLOOR PLATES FOR SERVICE	ACCESS	
		0.3	21.6	HOOP CONTROL	DISCONNECT	
		0.5	21.6	PLASTIC SLIDER PLATE	R&R	
		0.4	21.6	BEARING, CENTER HOOP	R&R	
		1.0	21.6	CENTER HOOP	R&R	
		3.2	21.6	WRIST JOINT ASSEMBLY	R&R	

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ATG	**21004**	**4.6**	**21**	**WRIST JOINT ASSEMBLY**	**R&R**	
		1.0	21.3	REMOVE FLOOR PLATES FOR SERVICE	ACCESS	
		1.3	21.3	OPEN BELLOWS FOR SERVICE	ACCESS	
		0.2	21.3	YOKE WRIST BOLTS	R&R	
		0.3	21.3	BOLT, 20MM X 2	R&R	
		0.3	21.3	BOLT, 5 / 8" X 6	R&R	
		1.5	21.3	WRIST JOINT	R&R	
ATG	**21005**	**4.1**	**21**	**HYDRAULIC CYLINDER ASSEMBLY**	**R&R**	
		0.6	21.4	CENTER SEATS	R&R	
		1.0	21.4	REMOVE FLOOR PLATES FOR SERVICE	R&R	
		1.5	21.4	HYDRAULIC SYSTEM, BLEED / FILL / ADJUST	R&R	
		0.2	21.4	CYLINDER HOSE X 2	DISCONNECT	
		0.3	21.4	CYLINDER PIN	DISCONNECT	
		0.3	21.4	CYLINDER YOKE PIN	DISCONNECT	
		0.2	21.4	CYLINDER	R&R	
ATG	**21006**	**8.8**	**21**	**YOKE PLATE**	**R&R**	
		1.0	21.3	OPEN FLOOR PLATES FOR SERVICE	ACCESS	
		5.3	21.3	CENTER HOOP ASSEMBLY	R&R	
		0.3	21.3	CYLINDER PIN	DISCONNECT	
		0.3	21.3	CYLINDER YOKE PIN	DISCONNECT	
		0.2	21.3	CYLINDER	R&R	
		0.5	21.3	BOLT, M16 X 8	DISCONNECT	
		0.3	21.3	BOLT, 20MM X 2	DISCONNECT	
		0.3	21.3	BOLT, YOKE PLATE 5 / 8" X 6	DISCONNECT	
		0.6	21.3	WRIST JOINT	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ATG	**21007**	**11.3**	**21**	**MAIN BEARING ASSEMBLY & SUPPORT FRAME**	**R&R**	
		8.8	21.3	YOKE PLATE	R&R	
		0.5	21.3	WEAR PLATE	DISCONNECT	
		1.2	21.3	MAIN BEARING	R&R	
		0.6	21.3	WRIST JOINT	R&R	
		0.2	21.3	CYLINDER BRACKET	DISCONNECT	
ATG	**21008**	**4.0**	**21**	**HYDRAULIC BLOCK ASSEMBLY**	**R&R**	
		1.0	21.4	OPEN FLOOR PLATES FOR SERVICE	ACCESS	
		1.5	21.4	HYD. SYSTEM COMPLETE BLEED, FILL, CHECK & ADJUST	CHK. / ADJ.	
		0.2	21.4	CYLINDER HOSE X 2	DISCONNECT	
		0.3	21.4	ELECTRICAL HARNESS CONNECTIONS	DISCONNECT	
		0.1	21.4	PRESSURE GAUGE	R & R	
		0.5	21.4	HYDRAULIC BLOCK	R & R	
		0.2	21.4	PRESSURE SWITCHES	DISCONNECT	
		0.2	21.4	ACCUMULATOR	DISCONNECT	
ATG	**21009**	**3.0**	**21**	**ACCUMULATOR ASSEMBLY**	**R&R**	
		1.0	21.4	OPEN FLOOR PLATES FOR SERVICE	ACCESS	
		1.5	21.4	HYDRAULIC SYSTEM, COMPLETE BLEED / FILL / ADJUST	CHK. / ADJ.	
		0.1	21.4	BLEED SCREW	CHK. / ADJ.	
		0.4	21.4	ACCUMULATOR ASSEMBLY	R&R	
ATG		**STAND ALONE ITEMS**	**21**	**ATG COMPONENTS**		
	21010	0.2	21.5	HIGH PRESSURE SWITCH	R&R	
	21011	0.2	21.5	LOW PRESSURE SWITCH	R&R	
	21012	0.3	21.5	POSITION SENSOR	R&R	
	21013	0.5	21.5	HYD. SYSTEM PRESSURE TEST	TEST	

1. Times on stand alone items may differ from those same items included in an assembly.

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT

2. Refer to each section of the New Flyer Service Manual for identification of Special Tools.

[redacted]

Section 2K5

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

If the ESS running a low SOC will in any way damage the ESS and/or the propulsion system, the propulsion system manufacturer together with the Contractor shall provide sufficient warning to the operator.

New Flyer response:

Attachment provided XE Low SOC De-rate Overview for theory of operation.

Above 20% SOC vehicle operates as normal. Below 20% various notifications including amber and red indicators, as well as audible buzzers are activated.

XE40 Low SOC De-rate Overview

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NEW FLYER OF AMERICA

Section 2K6

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Proposals shall include complete descriptions of all life-cycle testing procedures used to validate the life of batteries used for this application at the proposed charging rates, charge durations, and expected ambient temperatures and operating profiles. Proposers shall include documented results of life-cycle testing.

New Flyer response:

New Flyer considers this information proprietary, but can offer the following statement:

The life testing involves cycle life testing and storage testing, the packs are cycled at various C rates, at different temperatures and DOD's, and their SOH rate of decay is studied, similarly the packs are also stored at different SOC'S and different temperatures to study the SOH decay over time.

Section 2K7

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Proposers shall include certification of battery life-cycle testing by an independent testing agency.

New Flyer Response:

Life cycle analysis was performed by Xalt Energy. There has not been life cycle analysis done by a third party on the Xalt battery system. The attached document Xalt Energy verifies the testing completed by Xalt Energy.

XALT Energy®

XMOD111E

HIGH ENERGY

XPAND Module (XMOD)



The XALT Energy® Advantage

- High specific energy and volumetric energy density
- Intended for high energy, long-range applications
- Outstanding safety and abuse tolerance
- Efficient direct liquid cooling maintains ideal cell temperatures
- Easy to install, configure, and upgrade
- Fully compatible with XALT's Battery Management Systems

Introducing the XMOD Energy Storage System

The XPAND Module (XMOD) is XALT Energy's ultra-high-density lithium-ion battery building block for highly-integrated Energy Storage Systems based on XALT Energy's world-class lithium-ion cells. XMOD was developed for use in high-voltage, high-capacity multi-module arrays housed in large enclosures to achieve an overall reduction in system mass, volume, and cost. XMOD is designed for use in medium to heavy duty commercial trucks, bus, marine and specialty applications such as construction and mining equipment.

Saving System Cost, Weight and Space

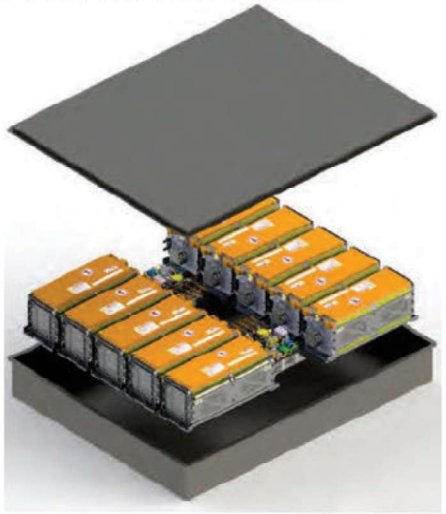
XMOD modules have the same core construction as the exceptionally durable XPAND battery packs, but without the enclosure and bulkhead. The XMOD design is optimized for large systems where the integrator installs the modules in a suitable protective superstructure. Eliminating individual pack enclosures saves system weight and allows these industry-leading 173Wh/kg modules to be packaged very close to each other, resulting in higher energy storage capacity in the available space. Furthermore, with the module arrays enclosed in protective superstructures, high voltage connections can be made directly to the XMOD terminals, thereby eliminating the need for costly HV connector pairs.

Advanced Thermal Management

XMOD uses the same advanced, active liquid cooling system as XALT Energy's XPAND packs, maintaining ideal cell temperatures throughout the module and responding quickly to increases in power demand or ambient temperatures. Efficient direct liquid cooling prolongs cell life under the most demanding cycle profiles, while reducing packaging volume.

Upgradeable, Ultra-Long Lifecycle Roadmap

The XMOD module is designed to accommodate cells in XALT's 225mm family without the need for retooling, anticipating a wide variety of application voltage, power, and energy. This means as XALT's cell technologies advance or modules become available for re-purposing, each XMOD can be replaced while all external interfaces remain the same.



Maximizing Energy Without Sacrificing Volume, Weight or Safety

The XMOD111E module uses XALT's 63Ah Small Format High Energy cells in a 2p24s architecture to provide 11.1kWh total energy. Designed for use with moderate charge and discharge rates (1C and 2C, respectively), XMOD111E is ideal for high energy applications requiring long usage periods between on-plug charging. Each module contains Voltage-Temperature-Balancing boards (VTBs) that measure voltages of all 24 cell pairs and internal pack temperatures, and perform cell balancing to maximize energy throughput. XMOD111E is designed for use with XALT's Battery Disconnect Unit (BDU) and Master Control Unit (MCU). As with all modules in the XMOD and XMP families, XMOD111E is designed for use in large battery arrays to provide hundreds of kWh in demanding mobile and stationary environments.

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XMOD111E

HIGH ENERGY

XPAND Module (XMOD)

Advantages

Modular and Flexible Design

- Simplified high voltage, low voltage and cooling interfaces to each application
- All connections at front panel; rear access not needed
- Designed for use in very large strings and pack combinations (up to 1250V per string and up to 24 strings in parallel)

System Support Options

Accessories

- Battery Disconnect Unit (BDU)
- Master Control Unit (MCU)
- Low Voltage Harness (LVH) Kit
- Telematics Unit (XBV)

Lifecycle Support

- XPAND Service Tool
- Remote Data Monitoring & Prognostics
- End-of-Life Re-purposing, Recycling
- Integration Support
- On-site Training Classes

Performance[1]

XALT Li-ion NMC/G Cell	63Ah SE	Cell Configuration	2p 24s
Capacity (Rated @ C/10)	126Ah	Charge Capability (C/10)	11,100Wh
Voltage (Nominal)	88.3V	Energy Density	≥208Wh/L
Weight	64kg	Specific Energy	≥173Wh/kg
Discharge Capability C-Rate*	2.0C	Charge Capability C-Rate*	1.0C
Dimensions (including base)**	(L) 720mm	(W) 276mm (H) 269mm	

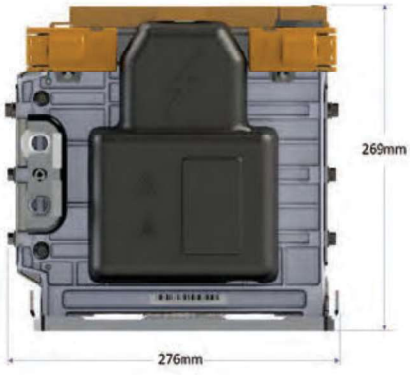
*Cell Performance will be affected by temperature, SoC, aging, etc. ** Excluding mating connector

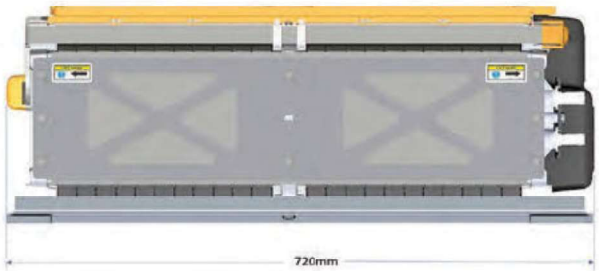
Cycle Life	Typical
100% DOD Cycles @ 0.3C charge-discharge	> 3,000 cycles***
80% DOD Cycles @ 0.3C charge-discharge	> 4,000 cycles***

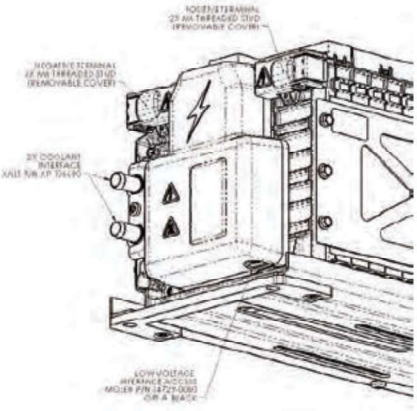
***Cycle life to 80% of rated capacity at 23°C room temperature with 10 min. step rest

Environmental, Safety, and Abuse Tolerance

Test	Conditions	Reference
Vibration	Random, 3 axis, 21 hr/axis	ISO 12405
Mechanical Shock	21.4G, 11ms; 13.5g, 100ms	UNT, R100
Thermal Shock	75°C to -40°C within 30 minutes	ISO 12405
Composite Heat & Humidity	RH93%, 25° - 65°C 28 day	ISO 16750
Housing Load	Knee, Foot	GMW 16390
UNDOT	UN T-1, 2, 3, 4, 5	UNDOT 38.3
Drop Test	1.2m onto cement on corner	IEC 62281
External Short Circuit, Fused	5mΩ, 100mΩ	J2929, UN 38.3







[1]Product specifications are preliminary; XALT Energy reserves the right to modify the product technical specifications.

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MADE IN USA

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2-10-2020

Section 2K8

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Written confirmation from the battery manufacturer attesting to the safety of the proposed battery system in the specified application and charging profile shall be submitted as part of the proposal, and shall include full disclosure and discussion of any and all relevant issues or prior incidents relating to safety.

New Flyer Response:

The XPAND battery system has been designed to protect itself. Nine (9) relevant functions have been defined as critical for functional safety as listed below:

1. Emergency Stop Function

2. Alarms and Shutdowns

3. High Voltage Interlock Loop (HVIL)

4. Temperature protection BMS 4.1. Cell Over-Temperature Protection: A condition when the sensed temperature is more than the peak allowable temperature for more than a specified time. − DTC for high temperature is escalated as “warning”, then “alarm” and finally as “error”.
− The SCU shall prevent continued use of the battery string if a module temperature exceeds the safety threshold (DTC escalation “error”) by entering the “Safe” state.

5. Over-Voltage Protection BMS 5.1. Cell Over-Voltage Protection: A condition when the voltage sensed across a cell is more than the upper operating voltage limit of that cell’s chemistry. − DTC for cell over voltage is escalated as “warning”, then “alarm” and finally as “error”.
− The SCU SW shall prevent sustained cell over-voltage conditions (DTC escalation “error”) by entering the “Safe” state.

6. Under-Voltage Protection BMS 6.1. Cell Under-Voltage Protection: A condition when the voltage sensed across a cell is less than the lower voltage limit of that cell − DTC for cell under voltage is escalated as “warning”, then “alarm” and finally as “error”.
− The SCU SW shall prevent sustained cell under-voltage conditions (DTC escalation “error”) by entering the “Safe” state.
− The SCU SW shall prevent recharging of a cell which is in a critical under-voltage (DTC escalation “lock-out”) condition by entering the “Safe” state. Contactors will not close again if the BMS detects this state.

7. Communication Failure

8. Welded Contactor Protection 8.1. Welded Contactor: A condition when a contactor in the BDU becomes welded in the closed position − The SCU SW shall prevent sustained current by entering the “Safe” state, which will open the other contactor in the BDU.

9. Over-Current Protection BMS
User Manual - XPAND Battery System Overview Document Number: 001006-03

Section 2K9

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

Proposals shall include complete descriptions of all safety standards followed in the design and manufacture of the battery system, safety testing procedures used to validate the safety of battery operation in this application, and documented results of safety testing to confirm that standards have been met.

New Flyer Response:

Over-Current Charge Protection: A condition when the sensed current is greater than the peak allowed current for a specified time while the system is charging. – DTC for charge over current is escalated as "warning", then "alarm" and finally as "error".
– The SCU SW shall prevent sustained over-current charging conditions (DTC escalation "error") by entering the "Safe" state.

In addition, The XPAND BMS is developed in accordance to the ISO 26262 Functional Safety Standards and designed with practices suitable for an ASIL C with respect to cell voltage monitoring. The XPAND BMS involves a dual-core processor which is used for parallel lockstep processing. In parallel lockstep processing, two (2) duplicate instruction sets are fed to the individual processors, and the processing is continuously monitored by a fault checking unit and watchdog timer (WDT). The fault-checking unit compares the operation of processing and storage of each bit in the memory and alerts the application if it sees any difference between the two.

When the battery system is in use, the BMS will provide real-time data regarding the system's status to the application interface to provide the operator with all necessary information. This information can enable the operator to intervene before a fault occurs. If a fault does occur and the battery system is properly integrated with the application, it will trigger an alarm on the application interface. The alarm will provide the operator with information regarding the type of fault.
If the fault is something that cannot be handled by the operator, or if the operator is unsuccessful in their actions, the BMS' functional safety control will act to protect the system.
IMPORTANT: Although the XPAND battery system functional safety protections will intervene to protect the battery system from abuse, it is critical that the application integration is done properly to avoid ever exercising the battery protection functions. This is part of the safety strategy and will prevent over-stress caused by repetitive excursions beyond the safety limits.

Section 2K10

Solicitation Requirements:

TS 9.1.4 Energy Storage System and Controller.

- Proposer should indicate where their standard mounting is located.
- If the mounting location is customizable, meaning the Agency has a choice, the Proposer should so indicate in their Proposal response.
- If the Proposer allows more than one charging receptacle to be installed on the bus then the Proposer shall also indicate in their Proposal response.

New Flyer Response:

The attached document / drawing provides the information where the standard receptacle is installed. New Flyer would be happy to discuss any further locations during the negotiations or pre production meetings.

Section 2K11

Solicitation Requirements:

TS 9.14 Energy Storage System and Controller.

Include a description of the charging infrastructure required to charge the bus on route and/or at the depot.

New Flyer Response:

4 Installation/Infrastructure Requirements
Per the specifications. New Flyer understands that it's Infrastructure Solutions team shall:

- provide all charging equipment design requirements and specifications to the Agency and it's designated architectural, civil, electrical, and mechanical engineering contractors to enable charging station site design, permitting, and construction.
- coordinate with the Agency and its engineering contractors during site design and construction of the charging stations, including plan reviews and site reviews at critical project milestones.
- be responsible for equipment start-up and testing to ensure that the charging equipment meets all stated specifications and functionality prior to site acceptance.

The infrastructure work (Provided by others) required at each site, for the charging systems described above, would include:

- Dedicated utility service and meter
- Switchgear, including main switch and a sub-breaker for each charger
- Power cabling and conduit
- Communication cabling and conduit
- Disconnect switches
- Equipment pads and protective bollards
- Charger equipment installation
- Base plate(s), anchor rod(s), connectors, or other structural components required to be embedded in foundations
- Other site/civil improvements as required by the Agency

Section 2L

Solicitation Requirements:

13.1 Service.

List all special tools, fixtures or facility requirements recommended for servicing.

New Flyer Response:

No special tools or fixture requirements for this RFP.

Section 2M

Solicitation Requirements:

TS 19 Altoona Testing report required for RFP.

New Flyer Response:

Please refer to the attached report as requested, Altoona Report for Xcelsior Buses. Altoona test result date for the Xcelsior XE40 is July 2015, XE60 is April 2019.

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT
In accordance with CFR 49, Volume 7, Part 665

Manufacturer: New Flyer
Model: XE40

Submitted for Testing in Service-Life Category
12Year /500,000 Miles

JULY 2015

Report Number: LTI-BT-R1405

PENNSTATE

THE LARSON INSTITUTE

The Thomas D. Larson
Pennsylvania Transportation Institute
201 Transportation Research Building
The Pennsylvania State University
University Park, PA 16802
(814) 865-1891

Bus Testing and Research Center
2237 Old Route 220 North
Duncansville, PA 16635
(814) 695-3404

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT
1200 New Jersey Avenue, SE
Washington, DC 20590

In accordance with CFR 49, Volume 7, Part 665

Manufacturer: New Flyer

Manufacturer's address:

214 Fifth Avenue, SW
Crookston, MN 56716

Model: XE40

Submitted for Testing in Service-Life Category
12 Year /500,000 Miles

Report Number: LTI-BT-R1405

A2LA ACCREDITED
Mechanical Testing Certificate 3172.01

D.J. Rowell — *Quality Authorization*

Director, Bus Research and Testing Center — *Title*

7/31/15 — *Date*

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EXECUTIVE SUMMARY

New Flyer submitted a model XE40, electric-powered 39 seat (including the driver) 40-foot bus, for a 12 yr. /500,000 mile STURAA test. The odometer reading at the time of delivery was 1,018 miles. Testing started on June 24, 2014 and was completed on July 9, 2015. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of the test program is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on August 26, 2014 and was completed on March 19, 2015.

The interior of the bus is configured with seating for 39 passengers including the driver. Free floor space will accommodate 37 standing passengers resulting in a potential load of 76 persons. At 150 lbs per person, this load results in a measured gross vehicle weight of 43,550 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW of 43,550 lbs. The middle segment was performed at a seated load weight of 38,700 lbs. and the final segment was performed at a curb weight of 32,770 lbs. Durability driving resulted in unscheduled maintenance and failures that involved a variety of subsystems. A description of failures and a complete and detailed listing of scheduled and unscheduled maintenance are provided in the Maintainability section of this report.

Effective January 1, 2010 the Federal Transit Administration determined that the total number of simulated passengers used for loading all test vehicles will be based on the full complement of seats and free-floor space available for standing passengers (150 lbs per passenger). The passenger loading used for dynamic testing will not be reduced in order to comply with Gross Axle Weight Ratings (GAWR's) or the Gross Vehicle Weight Ratings (GVWR's) declared by the manufacturer. Cases where the loading exceeds the GAWR and/or the GVWR will be noted accordingly. During the testing program, all test vehicles transported or operated over public roadways will be loaded to comply with the GAWR and GVWR specified by the manufacturer.

Accessibility, in general, was adequate, components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

The Reliability section compiles failures that occurred during Structural Durability Testing. Breakdowns are classified according to subsystems. The data in this section are arranged so that those subsystems with more frequent problems are apparent. The problems are also listed by class as defined in Section 2. The test bus encountered no Class 1 or Class 2 failures. Of the twenty-one reported failures, twelve were Class 3 and 9 were Class 4.

The Safety Test, (a double-lane change, obstacle avoidance test) was safely performed in both right-hand and left-hand directions up to a maximum test speed of 45 mph. The performance of the bus is illustrated by a speed vs. time plot. Acceleration and gradeability test data are provided in Section 4, Performance. The average time to

obtain 50 mph was 43.96 seconds. The Stopping Distance phase of the Brake Test was completed with the following results; for the Uniform High Friction Test average stopping distances were 35.58' at 20 mph, 67.96' at 30 mph, 118.05' at 40 mph and 145.59' at 45 mph. The average stopping distance for the Uniform Low Friction Test was 34.99'. There was no deviation from the test lane during the performance of the Stopping Distance phase. During the Stability phase of Brake Testing the test bus experienced no deviation from the test lane. The Parking Brake phase was completed with the test bus maintaining the parked position for the full five minute period with no slip or roll observed in both the uphill and downhill positions.

The Shakedown Test produced a maximum final loaded deflection of 0.202 inches with a permanent set ranging between -0.001 to 0.005 inches under a distributed static load of 25,575 lbs. The Distortion Test was completed with all subsystems, doors and escape mechanisms operating properly. No water leakage was observed throughout the test. All subsystems operated properly.

The Static Towing Test was performed using a target load (towing force) of 39,312 lbs. All four front pulls were completed to the full test load with no damage or deformation observed. The Dynamic Towing Test was performed by means of a front-lift tow. The towing interface was accomplished using a hydraulic under-lift wrecker. The bus was towed without incident and no damage resulted from the test. The manufacturer does not recommend towing the bus from the rear; therefore, a rear test was not performed. The Jacking and Hoisting Tests were also performed without incident. The bus was found to be stable on the jack stands, and the minimum jacking clearance observed with a tire deflated was 3.1 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results are available from pages 94-121 with in this report.

A series of Interior and Exterior Noise Tests were performed. These data are listed in Section 7.1 and 7.2 respectively.

ABBREVIATIONS

ABTC - Altoona Bus Test Center
A/C - air conditioner
ADB - advance design bus
ATA-MC - The Maintenance Council of the American Trucking Association
CBD - central business district
CW - curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A) - decibels with reference to 0.0002 microbar as measured on the "A" scale
DIR - test director
DR - bus driver
EPA - Environmental Protection Agency
FFS - free floor space (floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area)
GVL - gross vehicle load (150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW - gross vehicle weight (curb weight plus gross vehicle load)
GVWR - gross vehicle weight rating
MECH - bus mechanic
mpg - miles per gallon
mph - miles per hour
PM - Preventive maintenance
PSTT - Penn State Test Track
PTI - Pennsylvania Transportation Institute
rpm - revolutions per minute
SAE - Society of Automotive Engineers
SCH - test scheduler
SA - staff assistant
SLW - seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA - Surface Transportation and Uniform Relocation Assistance Act
TD - test driver
TECH - test technician
TM - track manager
TP - test personnel

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consists of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consists of a New Flyer, model XE40. The bus has a front door equipped with a New Flyer model 32” wide flip out handicap ramp (1:7 slope), forward of the front axle and a rear door forward of the rear axle. Charging is provided by a New Flyer 100 kW portable depot charger. This charger charges 4 strings of 7 batteries. These Xalt Energy model Xsyst 7 (7 kWh) Lithium Ion batteries supply power to the Siemens Model 1DB2016 drive motor and bus auxiliaries thru Siemens ELFA2 Electric Drive system.

The measured curb weight is 10,550 lbs. for the front axle and 22,220 lbs. for the rear axle. These combined weights provide a total measured curb weight of 32,770 lbs. There are 39 seats including the driver and room for 37 standing passengers bringing the total passenger capacity to 76. Gross load is 150 lb. x 72 = 11,400 lbs. At full capacity, the measured gross vehicle weight is 43,550 lbs.

VEHICLE DATA FORM

Bus Number: 1405	Arrival Date: 06-24-14
Bus Manufacturer: New Flyer Industries	Vehicle Identification Number (VIN): 2FYB8FJ00DC043309
Model Number: XE40	Date: 06-24-14 & 06-25-14
Personnel: T.S., S.R. & E.D.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	5,280	5,270	N/A	N/A	11,020	11,200
SLW	6,120	6,090	N/A	N/A	12,820	13,670
GVW	7,480	7,400	N/A	N/A	13,850	14,820

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	10,550	12,210	14,880	15,660
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	22,220	26,490	28,670	28,660
Total	32,770	38,700	43,550	GVWR: 44,320

Dimensions:

Length (ft/in)	40 / 9.5
Width (in)	101.5
Height (in)	130.0
Front Overhang (in)	85.5
Rear Overhang (in)	119.75
Wheel Base (in)	284.25
Wheel Track (in)	Front: 86.7
	Rear: 74.8

Bus Number: 1405	Date: 06-24-14

CLEARANCES:

Lowest Point Outside Front Axle	Location: Skid Plate Clearance(in): 9.8
Lowest Point Outside Rear Axle	Location: Battery Tray Clearance(in): 10.9
Lowest Point between Axles	Location: Diesel Fuel Tank Clearance(in): 9.7
Ground Clearance at the center (in)	10.2
Front Approach Angle (deg)	8.3
Rear Approach Angle (deg)	8.8
Ramp Clearance Angle (deg)	4.1
Aisle Width (in)	Front: 24.6 Rear: 24.6
Inside Standing Height at Center Aisle (in)	96.1

BODY DETAILS:

Body Structural Type	Semi-Monocoque		
Frame Material	Ferritic Stainless Steel		
Body Material	Fiberglass		
Floor Material	Plywood		
Roof Material	Fiberglass		
Windows Type	☑ Fixed	☑ Movable	
Window Mfg./Model No.	Arow / AS3 DOT411		
Number of Doors	1 Front	1 Rear	
Mfr. / Model No.	Vapor Bus / Electric operated slide glide door w/Ameriview panels & cable releases		
Dimension of Each Door (in)	Front: 78.1 x 34.4	Rear: 77.5 x 30.5	
Passenger Seat Type	☑ Cantilever	☐ Pedestal	☐ Other (explain)
Mfr. / Model No.	4 ONE LLC/Gemini w/cantilever mounting		
Driver Seat Type	☑ Air	☐ Spring	☐ Other (explain)
Mfr. / Model No.	USSC / Q90		
Number of Seats (including Driver)	39 (6 seats fold away for 2 wheel chair positions)		

Bus Number: 1405	Date: 06-24-14

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	58.3			
Height of Each Step at Normal Position (in)	Front 1. 13.5	2. N/A	3. N/A	4. N/A
	Middle 1. N/A	2. N/A	3. N/A	4. N/A
	Rear 1. 14.0	2. N/A	3. N/A	4. N/A
Step Elevation Change - Kneeling (in)	Front: 4.8	Rear: 1.5		

ENGINE

Type	☐ C.I.	☐ Alternate Fuel	
	☐ S.I.	☑ Electric	
Mfr. / Model No.	N/A		
Location	☐ Front	☑ Rear	☐ Other (explain)
Fuel Type	☐ Gasoline	☐ CNG	☐ Methanol
	☐ Diesel	☐ LNG	☑ Electric
Fuel Tank Capacity (indicate units)	33 Gallons (for SPHEROS heater) 30 Gal Usable		
Fuel Induction Type	☐ Injected	☐ Carburetion	
Fuel Injector Mfr. / Model No.	N/A		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	N/A		
Alternator (Generator) Mfr. / Model No.	N/A		
Maximum Rated Output (Volts / Amps)	N/A		
Air Compressor Mfr. / Model No.	Powerex / SDC050700		
Maximum Capacity (ft^3 / min)	12.1 @ 125 psig.		
Starter Type	☐ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	N/A		

VEHICLE DATA FORM

Bus Number: 1405	Date: 06-24-14

TRANSMISSION

Transmission Type	☐ Manual	☐ Automatic	
Mfr. / Model No.	Drive Motor: Siemens / 1DB2016 – ONB06 A5E03653650		
Control Type	☐ Mechanical	☑ Electrical	☐ Other
Torque Converter Mfr. / Model No.	N/A		
Integral Retarder Mfr. / Model No.	N/A		

SUSPENSION

Number of Axles	2		
Front Axle Type	☐ Independent	☑ Beam Axle	
Mfr. / Model No.	MAN / AGGV0K07FB4130845		
Axle Ratio (if driven)	N/A		
Suspension Type	☑ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 902517SP1		
Middle Axle Type	☐ Independent	☐ Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	☐ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	☐ Independent	☑ Beam Axle	
Mfr. / Model No.	MAN / AGGHY1350F7		
Axle Ratio (if driven)	5.667		
Suspension Type	☑ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	4		
Mfr. / Model No.	Koni / 90 2518SP1		

Bus Number: 1405	Date: 06-24-14

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	ALCOA / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin XZU / 305/70R/22.5
Rear	Wheel Mfr./ Model No.	ALCOA / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin XZU / 305/70R/22.5

BRAKES

Front Axle Brakes Type	☐ Cam	☑ Disc	☐ Other (explain)
Mfr. / Model No.	KNORR / SN7000		
Middle Axle Brakes Type	☐ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	☐ Cam	☑ Disc	☐ Other (explain)
Mfr. / Model No.	KNORR / SN7000		
Retarder Type	Regenerative Braking		
Mfr. / Model No.	Siemens / ELFA 2 Drive		

HVAC

Heating System Type	☐ Air	☑ Water	☐ Other
Capacity (Btu/hr)	98,000		
Mfr. / Model No.	TK / TE15-m1		
Air Conditioner	☑ Yes	☐ No	
Location	Rear		
Capacity (Btu/hr)	81,000		
A/C Compressor Mfr. / Model No.	Copeland Scroll / ZR61K3E-TF5-130		

STEERING

Steering Gear Box Type	Hydraulic Gear
Mfr. / Model No.	R.H. Sheperd Co. Inc. / M110
Steering Wheel Diameter	19.9”
Number of turns (lock to lock)	4 3/4

Bus Number: 1405	Date: 06-24-14

OTHERS

Wheel Chair Ramps	Location: Front Door	Type: Electric, fold out
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	New Flyer / 32" wide flip out ramp (1:7 slope)	
Emergency Exit	Location: Windows Doors Hatches	Number: 4 2 2

CAPACITIES

Fuel Tank Capacity (gallons)	33
Engine Crankcase Capacity (gallons)	N/A
Transmission Capacity (gallons)	N/A
Differential Capacity (gallons)	3.83
Cooling System Capacity (quarts)	131.0
Power Steering Fluid Capacity (quarts)	12

OTHER COMPONENTS

Batteries – Lithium Ion	Dow Kokam / XSYST 7 (7kWh) (4 strings of 7 batteries)
Battery Cooling System	Thermo King Corp. / I131PT0002
Battery Cooler Fans	EMP / NFI Battery Bus 2 Fan Cooler
Motor Inverter	Siemens / ELFAZ DC4-650WM
Aux. Inverter	Siemens / ELFAZ DC4-650WM
Aux. Power Distribution Box	Siemens / Ser#: X2013120901
VPM	Siemens / ELFA2 VRI-650NM
Charger	Siemens / ELFA2 DC4-650WM
DICO Box (Low Voltage Distribution Box)	Siemens / Ser#: X2013121301
DC/DC	Vanner / EBA500-28-CAN
Fuse Box (High Voltage Distribution Box)	Siemens / Ser#: X2013121101

VEHICLE DATA FORM

Bus Number: 1405	Date: 06-25-14

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
N/A	N/A	N/A

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 1405	Date: 06-25-14

Subsystem	Checked	Initials	Comments
Air Conditioning Heating and Ventilation	✓	E.D.	
Body and Sheet Metal	✓	E.D.	
Frame	✓	E.D.	
Steering	✓	E.D.	
Suspension	✓	E.D.	
Interior/Seating	✓	E.D.	
Axles	✓	E.D.	
Brakes	✓	E.D.	
Tires/Wheels	✓	E.D.	
Exhaust	✓	E.D.	Only exhaust is for SPHEROS heater
Fuel System	✓	E.D.	Diesel for SPHEROS heater
Power Plant	✓	E.D.	
Accessories	✓	E.D.	
Lift System	✓	E.D.	
Interior Fasteners	✓	E.D.	
Batteries	✓	E.D.	

CHECK - IN



NEW FLYER
MODEL XE40



CHECK - IN CONT.



NEW FLYER MODEL XE40 EQUIPPED WITH A NEW FLYER MODEL 32” WIDE FLIP-OUT (1:7 SLOPE) HANDICAP RAMP



CHECK - IN CONT.



OPERATOR'S AREA



VIN TAG

CHECK - IN CONT.



INTERIOR
VIEW FROM FRONT-TO-REAR



INTERIOR
VIEW FROM REAR-TO-FRONT

1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems is checked, and where accessibility is restricted the subsystem is noted along with the reason for the restriction.

1.1-III. DISCUSSION

Accessibility, in general, was adequate. Components covered in Section 1.3 (repair and/or replacement of selected subsystems), along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 1405	Date: 6-11-15

Component	Checked	Initials	Comments
ENGINE :			Electric drive.
Oil Dipstick	✓	J.P.	
Oil Filler Hole	✓	J.P.	
Oil Drain Plug	✓	J.P.	
Oil Filter	✓	J.P.	
Fuel Filter	✓	J.P.	
Air Filter	✓	J.P.	
Belts	✓	J.P.	
Coolant Level	✓	J.P.	Battery coolant.
Coolant Filler Hole	✓	J.P.	Battery coolant.
Coolant Drain	✓	J.P.	Battery coolant.
Spark / Glow Plugs	✓	J.P.	
Alternator	✓	J.P.	
Diagnostic Interface Connector	✓	J.P.	
TRANSMISSION :			Electric drive.
Fluid Dip-Stick	✓	J.P.	
Filler Hole	✓	J.P.	
Drain Plug	✓	J.P.	
SUSPENSION :			
Bushings	✓	J.P.	
Shock Absorbers	✓	J.P.	
Air Springs	✓	J.P.	
Leveling Valves	✓	J.P.	
Grease Fittings	✓	J.P.	

ACCESSIBILITY DATA FORM

Bus Number: 1405	Date: 6-11-15

Component	Checked	Initials	Comments
HVAC :			
A/C Compressor	✓	J.P.	
Filters	✓	J.P.	
Fans	✓	J.P.	
ELECTRICAL SYSTEM :			
Fuses	✓	J.P.	
Batteries	✓	J.P.	
Voltage regulator	✓	J.P.	
Voltage Converters	✓	J.P.	
Lighting	✓	J.P.	
MISCELLANEOUS :			
Brakes	✓	J.P.	
Handicap Lifts/Ramps	✓	J.P.	
Instruments	✓	J.P.	
Axles	✓	J.P.	
Exhaust	**N/A**	J.P.	Electric drive.
Fuel System	**N/A**	J.P.	Electric drive.
OTHERS :			

1.2 SERVICING, PREVENTIVE MAINTENANCE, AND REPAIR AND MAINTENANCE DURING TESTING

1.2-I. TEST OBJECTIVE

The objective of this test is to collect maintenance data about the servicing, preventive maintenance, and repair.

1.2.-II. TEST DESCRIPTION

The test will be conducted by operating the NBM and collecting the following data on work order forms and a driver log.

1. Unscheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Description of malfunction
    e. Location of malfunction (e.g., in service or undergoing inspection)
    f. Repair action and parts used
    g. Man-hours required

2. Scheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Engine running time (if available)
    e. Results of scheduled inspections
    f. Description of malfunction (if any)
    g. Repair action and parts used (if any)
    h. Man-hours required

The buses will be operated in accelerated durability service. While typical items are given below, the specific service schedule will be that specified by the manufacturer.

A. Service
    1. Fueling
    2. Consumable checks
    3. Interior cleaning

B. Preventive Maintenance
    4. Brake adjustments
    5. Lubrication
    6. 3,000 mi (or equivalent) inspection

7. Oil and filter change inspection
8. Major inspection
9. Tune-up

C. Periodic Repairs
1. Brake reline
2. Transmission change
3. Engine change
4. Windshield wiper motor change
5. Stoplight bulb change
6. Towing operations
7. Hoisting operations

1.2-III. DISCUSSION

Servicing and preventive maintenance were performed at manufacturer-specified intervals. The following Scheduled Maintenance Form lists the mileage, items serviced, the service interval, and amount of time required to perform the maintenance. Finally, the Unscheduled Maintenance List along with Unscheduled Maintenance-related photographs is included in Section 5.7, Structural Durability. This list supplies information related to failures that occurred during the durability portion of testing. The Unscheduled Maintenance List includes the date and mileage at which the malfunction occurred, a description of the malfunction and repair, and the time required to perform the repair.

(Page 1 of 2)
SCHEDULED MAINTENANCE
NEW FLYER #1405

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
09-08-14	1,292	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-29-14	2,353	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-27-14	3,635	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-11-14	4,868	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-25-14	5,616	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-16-14	6,271	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-08-15	7,524	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-19-15	8,735	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

(Page 2 of 2)
SCHEDULED MAINTENANCE
NEW FLYER #1405

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
02-03-15	9,763	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-10-15	10,413	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-20-15	11,723	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-27-15	12,546	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-06-15	13,048	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-17-15	14,236	P.M./Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
05-07-15	14,861	P.M./Inspection Fuel Economy Prep	Linkage, tie rods, universals/u-joints all lubed. Air compressor air filter replaced.	8.00	8.00

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test will involve components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that fails during the NBM testing is added to this list. Components (if applicable) to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motor

1.3-III. DISCUSSION

During the test, several additional components were removed for repair or replacement. Following is a list of components and total repair/replacement time.

	MAN HOURS
Right front air bag & air bag mounting plate.	2.00
Right front air brake chamber air fitting.	2.00
Left front air bag.	2.00
Right front shock.	2.00
Left front shock.	1.00
Both front upper radius rods.	3.00
Drive motor mounting bushings.	1.00
Power steering unit.	4.00
Drive motor mounting brackets.	4.00
Steering stabilizer.	2.00

At the end of the test, the remaining items on the list were removed and replaced. The drive motor assembly took 4.00 man-hours (two men 2.00 hrs.) to remove and replace. The time required for repair/replacement of the four remaining components is given on the following Repair and/or Replacement Form.

REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Drive motor	4.00 man hours
Wiper Motor	1.00 man hours
DC – DC converter	2.50 man hours
Battery String #3	5.50 man hours
Batteries 12/24 volt	0.50 man hours

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS



DRIVE MOTOR REMOVAL AND REPLACEMENT (4.00 MAN HOURS)



WIPER MOTOR REMOVAL AND REPLACEMENT (1.00 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.



DC – DC CONVERTER REMOVAL AND REPLACEMENT (2.50 MAN HOURS)



BATTERY STRING #3 REMOVAL AND REPLACEMENT (5.50 MAN HOURS)

2. RELIABILITY - DOCUMENTATION OF BREAKDOWN AND REPAIR TIMES DURING TESTING

2-I. TEST OBJECTIVE

The objective of this test is to document unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

2-II. TEST DESCRIPTION

Using the driver log and unscheduled work order forms, all significant breakdowns, repairs, man-hours to repair, and hours out of service are recorded on the Reliability Data Form.

CLASS OF FAILURES

Classes of failures are described below:

(a) Class 1: Physical Safety. A failure that could lead directly to passenger or driver injury and represents a severe crash situation.

(b) Class 2: Road Call. A failure resulting in an en route interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

(c) Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.

(d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs is accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above. These classifications are somewhat subjective as the test is performed on a test track with careful inspections every two hours. However, even on the road, there is considerable latitude on deciding how to handle many failures.

The Unscheduled Repair List is also attached to provide a reference for the repairs that are included in the Reliability Data Forms.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. There were no Class 1 or 2 failures. Of the twelve Class 3 failures, 6 involved the suspension system, three in the steering, and one each occurred with HVAC, electrical system, and compartments/framework. These, and the remaining nine Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

RELIABILITY DATA FORM

Bus Number: 1405	Date Completed: 05-14-15
Personnel: B.R.	

	Failure Type					
	Class 4 Bad order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety		
Subsystem	Mileage	Mileage	Mileage	Mileage	Man hours	Down Time
Suspension		1,551			6.00	24.00
	2,353				3.00	256.00
		4,039			2.00	6.00
		4,610			2.00	10.00
		4,646			1.00	1.00
	4,646				3.00	3.00
	10,668				9.00	3.00
		11,183			4.00	6.00
	12,546				3.00	8.00
		13,823			2.00	5.00
Steering	788				1.00	1.00
		9,763			8.00	16.00
		9,967			2.00	4.00
		12,546			2.00	2.00
Drive Motor	5,616				4.00	4.00
	7,524				1.00	6.00
	10,590				4.00	4.00
Brakes	1,551				2.00	2.00
Compartments/Framework		4,646			6.00	16.00
Electrical		6,271			4.00	107.00
HVAC		5,616			5.00	10.00

3. SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3-II. TEST DESCRIPTION

The Safety Test is a vehicle handling and stability test. The bus will be operated at SLW on a smooth and level test track. The bus will be driven through a double lane change course at increasing speed until the test is considered unsafe or a speed of 45 mph is reached. The lane change course will be set up using pylons to mark off two 12 foot center to center lanes with two 100 foot lane change areas 100 feet apart. The bus will begin in one lane, change to the other lane in a 100 foot span, travel 100 feet, and return to the original lane in another 100 foot span. This procedure will be repeated, starting first in the right-hand and then in the left-hand lane.

3-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph.

SAFETY DATA FORM

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	

Temperature (°F): 66	Humidity (%): 39
Wind Direction: S	Wind Speed (mph): 5
Barometric Pressure (in.Hg): 30.19	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change: A safe profile was maintained through all portions of testing.	
Comments of the tire/ground contact patch: Tire/ground contact was maintained through all portions of testing.	



RIGHT - HAND APPROACH



LEFT - HAND APPROACH

4.0 PERFORMANCE

4.1 PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4.1-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4.1-II. TEST DESCRIPTION

In this test, the bus will be operated at SLW on the skid pad at the PSBRTF. The bus will be accelerated at full throttle from a standstill to a maximum "geared" or "safe" speed as determined by the test driver. The vehicle speed is measured using a Correvit non-contacting speed sensor. The times to reach speed between ten mile per hour increments are measured and recorded using a stopwatch with a lap timer. The time to speed data will be recorded on the Performance Data Form and later used to generate a speed vs. time plot and gradeability calculations.

4.1-III. DISCUSSION

This test consists of three runs in both the clockwise and counterclockwise directions on the Test Track. Velocity versus time data is obtained for each run and results are averaged together to minimize any test variability which might be introduced by wind or other external factors. The test was performed up to a maximum speed of 50 mph. The fitted curve of velocity vs. time is attached, followed by the calculated gradeability results. The average time to obtain 50 mph was 43.96 seconds.

PERFORMANCE DATA FORM

Bus Number: 1405	Date: 04-15-15
Personnel: S.R., E.D., T.G. & C.S.	
Temperature (°F): 52	Humidity (%): 43
Wind Direction: NE	Wind Speed (mph): 8
Barometric Pressure (in.Hg): 30.29	

		INITIALS:
Ventilation fans-ON HIGH	✓Checked	S.R.
Heater pump motor-Off	✓Checked	S.R.
Defroster-OFF	✓ Checked	S.R.
Exterior and interior lights-ON	✓ Checked	S.R.
Windows and doors-CLOSED	✓ Checked	S.R.

ACCELERATION, GRADEABILITY, TOP SPEED

Counter Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	4.77	4.14	4.16
20 mph	8.55	8.97	8.36
30 mph	14.00	13.97	14.19
40 mph	24.47	22.78	22.50
Top Test Speed(mph) 50	47.79	47.06	46.37

Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	4.22	4.40	4.32
20 mph	7.87	8.25	8.09
30 mph	13.28	13.56	13.23
40 mph	22.25	23.13	22.69
Top Test Speed(mph) 50	40.53	41.09	40.94

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :New Flyer
BUS MODEL :XE 40
BUS NUMBER :1405
TEST DATE :04-15-15

TEST CONDITIONS :

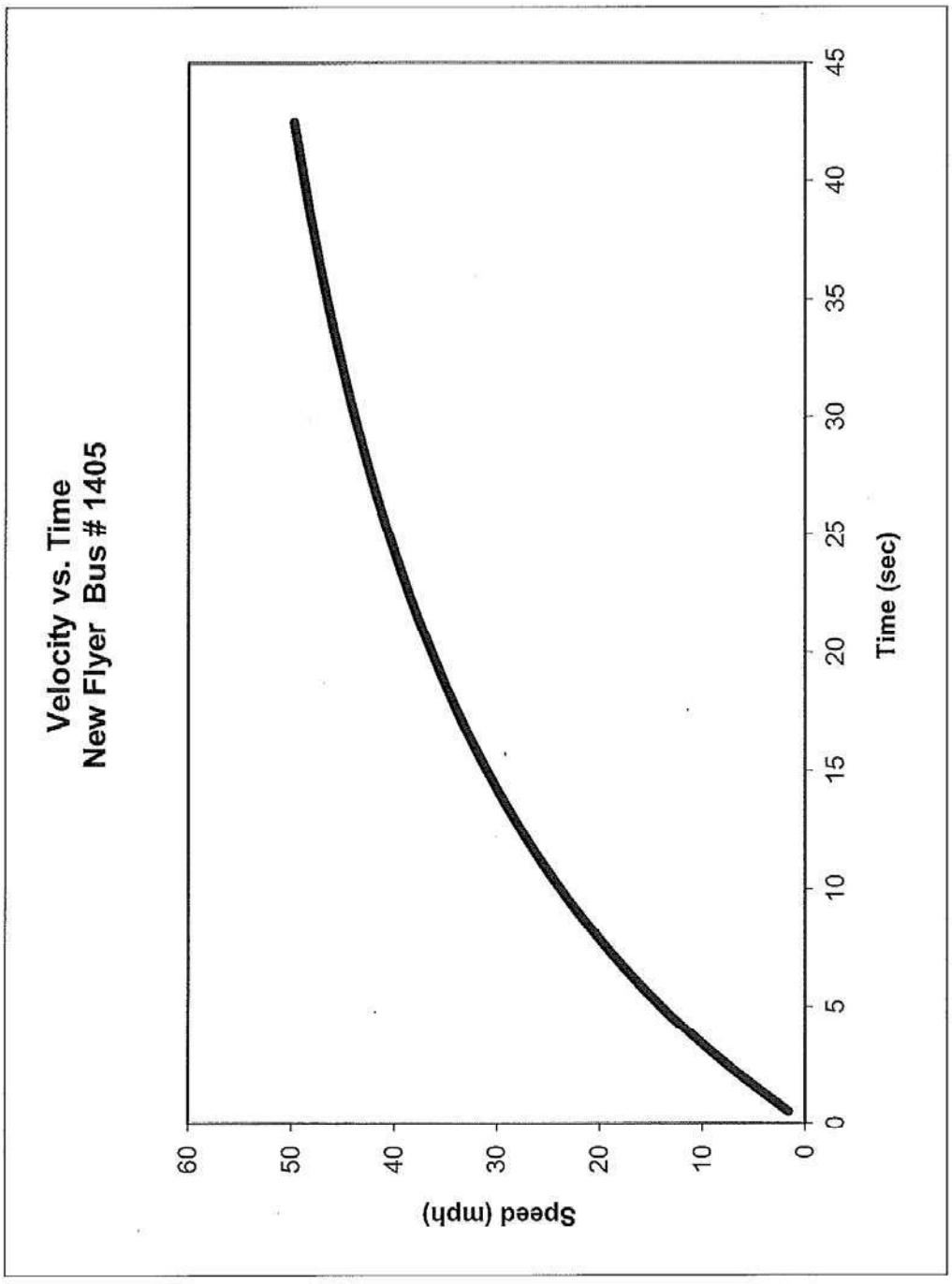
TEMPERATURE (DEG F) : 52.0
WIND DIRECTION : NE
WIND SPEED (MPH) : 8.0
HUMIDITY (%) : 43
BAROMETRIC PRESSURE (IN. HG) : 30.3

VEHICLE SPEED	AVERAGE TIME (SEC)		
(MPH)	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	4.36	4.31	4.34
20.0	8.63	8.07	8.35
30.0	14.05	13.36	13.71
40.0	23.25	22.69	22.97
50.0	47.07	40.85	43.96

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.30	4.8	15.1
5.0	1.58	4.4	13.7
10.0	3.37	3.8	12.0
15.0	5.43	3.3	10.3
20.0	7.84	2.8	8.7
25.0	10.72	2.3	7.2
30.0	14.22	1.9	5.9
35.0	18.60	1.5	4.6
40.0	24.26	1.1	3.5
45.0	31.95	.8	2.5
50.0	43.13	.5	1.7

NOTE : Gradeability results were calculated from performance test data. Actual sustained gradeability performance for vehicles equipped with auto transmission may be lower than the values indicated here.


Velocity vs. Time
New Flyer Bus # 1405
Speed (mph)
0
10
20
30
40
50
60
Time (sec)
0
5
10
15
20
25
30
35
40
45

4.0 PERFORMANCE

4.2 Performance - Bus Braking

4.2 I. TEST OBJECTIVE

The objective of this test is to provide, for comparison purposes, braking performance data on transit buses produced by different manufacturers.

4.2 II. TEST DESCRIPTION

The testing will be conducted at the PTI Test Track skid pad area. Brake tests will be conducted after completion of the GVW portion of the vehicle durability test. At this point in testing the brakes have been subjected to a large number of braking snubs and will be considered well burnished. Testing will be performed when the bus is fully loaded at its GVW. All tires on each bus must be representative of the tires on the production model vehicle

The brake testing procedure comprises three phases:

1. Stopping distance tests

    i. Dry surface (high-friction, Skid Number within the range of 70-76)
    ii. Wet surface (low-friction, Skid Number within the range of 30-36)

2. Stability tests
3. Parking brake test

Stopping Distance Tests

The stopping distance phase will evaluate service brake stops. All stopping distance tests on dry surface will be performed in a straight line and at the speeds of 20, 30, 40 and 45 mph. All stopping distance tests on wet surface will be performed in straight line at speed of 20 mph.

The tests will be conducted as follows:

1. **Uniform High Friction Tests:** Four maximum deceleration straight-line brake applications each at 20, 30, 40 and 45 mph, to a full stop on a uniform high-friction surface in a 3.66-m (12-ft) wide lane.

2. **Uniform Low Friction Tests:** Four maximum deceleration straight-line brake applications from 20 mph on a uniform low friction surface in a 3.66-m (12-ft) wide lane.

When performing service brake stops for both cases, the test vehicle is accelerated on the bus test lane to the speed specified in the test procedure and this speed is maintained into the skid pad area. Upon entry of the appropriate lane of the skid pad area, the vehicle's service brake is applied to stop the vehicle as quickly as possible. The stopping distance is measured and recorded for both cases on the test

data form. Stopping distance results on dry and wet surfaces will be recorded and the average of the four measured stopping distances will be considered as the measured stopping distance. Any deviation from the test lane will be recorded.

Stability Tests

This test will be conducted in both directions on the test track. The test consists of four maximum deceleration, straight-line brake applications on a surface with split coefficients of friction (i.e., the wheels on one side run on high-friction SN 70-76 or more and the other side on low-friction [where the lower coefficient of friction should be less than half of the high one] at initial speed of 30 mph).

(l) The performance of the vehicle will be evaluated to determine if it is possible to keep the vehicle within a 3.66m (12 ft) wide lane, with the dividing line between the two surfaces in the lane's center. The steering wheel input angle required to keep the vehicle in the lane during the maneuver will be reported.

Parking Brake Test

The parking brake phase utilizes the brake slope, which has a 20% grade. The test vehicle, at its GVW, is driven onto the brake slope and stopped. With the transmission in neutral, the parking brake is applied and the service brake is released. The test vehicle is required to remain stationary for five minutes. The parking brake test is performed with the vehicle facing uphill and downhill.

4.2-III. DISCUSSION

The Stopping Distance phase of the Brake Test was completed with the following results; for the Uniform High Friction Test average stopping distances were 35.58' at 20 mph, 67.96' at 30 mph, 118.05' at 40 mph and 145.59' at 45 mph. The average stopping distance for the Uniform Low Friction Test was 34.99' There was no deviation from the test lane during the performance of the Stopping Distance phase.

During the Stability phase of Brake Testing the test bus experienced no deviation from the test lane.

The Parking Brake phase was completed with the test bus maintaining the parked position for the full five minute period with no slip or roll observed in both the uphill and downhill positions.

Table 4.2-6. Braking Test Data Forms

Bus Number: 1405	Date: 03-24-15
Personnel: T.S., S.R., E.D. & C.S.	
Amb. Temperature (°F): 32	Wind Speed (mph): 4
Wind Direction: NNE	Pavement Temp (°F) Star: 54 End: 68

TIRE INFLATION PRESSURE (psi):

Tire Type: Front: Michelin XZU 305/70R 22.5 Rear: Michelin XZU 305/70R 22.5

	Left Tire(s)		Right Tire(s)	
Front	130		130	
	Inner	Outer	Inner	Outer
Rear	130	130	130	130
Tag	N/A	N/A	N/A	N/A

AXLE LOADS (lb)

	Left	Right
Front	7,400	7,480
Rear	14,820	13,850

FINAL INSPECTION

Bus Number: 1405	Date: 03-24-15
Personnel: T.S.	

Table 4.2-7. Record of All Braking System Faults/Repairs.

Date	Personnel	Fault/Repair	Description
03-24-15	T.S., E.D. & S.R.	None noted.	N/A

Table 4.2-8.1. Stopping Distance Test Results Form

Stopping Distance (ft)					
Vehicle Direction	CW	CW	CCW	CCW	
Speed (mph)	**Stop 1**	**Stop 2**	**Stop 3**	**Stop 4**	**Average**
20 (dry)	35.91	35.35	38.17	32.89	35.58
30 (dry)	71.30	71.27	66.35	62.91	67.96
40 (dry)	130.47	124.18	106.66	110.89	118.05
45 (dry)	155.76	150.88	141.33	134.38	145.59
20 (wet)	35.39	33.78	36.11	34.66	34.99

Table 4.2-8.2. Stability Test Results Form

Stability Test Results (Split Friction Road surface)		
Vehicle Direction	Attempt	Did test bus stay in 12' lane? (yes/no)
CW	1	Yes
	2	Yes
CCW	1	Yes
	2	Yes

Table 4.2-8.3. Parking Brake Test Form

PARKING BRAKE (Fully Loaded) – GRADE HOLDING						
Vehicle Direction	Attempt	Hold Time (min)	Slide (in)	Roll (in)	Did Hold	No Hold
Front up	1	5 min.	0	0	✓	
	2	N/A	N/A	N/A	N/A	N/A
	3	N/A	N/A	N/A	N/A	N/A
Front down	1	5 min.	0	0	✓	
	2	N/A	N/A	N/A	N/A	N/A
	3	N/A	N/A	N/A	N/A	N/A

4.2 Performance - Bus Braking



20% UPHILL GRADE HOLDING



20% DOWNHILL GRADE HOLDING

5.1 STRUCTURAL INTEGRITY

5.1 STRUCTURAL STRENGTH AND DISTORTION TESTS – STRUCTURAL SHAKEDOWN TEST

5.1-I. DISCUSSION

The objective of this test is to determine certain static characteristics (e.g., bus floor deflection, permanent structural deformation, etc.) under static loading conditions.

5.1-II. TEST DESCRIPTION

In this test, the bus will be isolated from the suspension by blocking the vehicle under the suspension points. The bus will then be loaded and unloaded up to a maximum of three times with a distributed load equal to 2.5 times gross load. Gross load is 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space. For a distributed load equal to 2.5 times gross load, place a 375-lb load on each seat and on every 1.5 sq ft of free floor space. The first loading and unloading sequence will “settle” the structure. Bus deflection will be measured at several locations during the loading sequences.

5.1-III. DISCUSSION

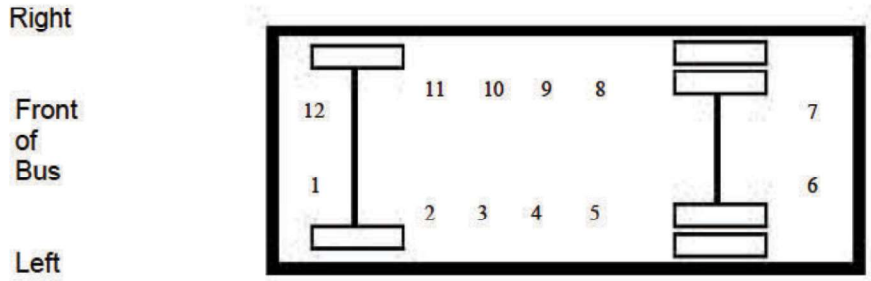
This test was performed based on a maximum passenger capacity of 65 people including the driver plus 2 wheelchair positions. The resulting test load is (65 X 375 lb.) = 24,375 lb. + 1,200 lbs. (2 wheelchair positions) = 25,575 lbs. The load is distributed evenly over the passenger space. Deflection data before and after each loading and unloading sequence is provided on the Structural Shakedown Data Form.

The unloaded height after each test becomes the original height for the next test. Some initial settling is expected due to undercoat compression, etc. After each loading cycle, the deflection of each reference point is determined. The bus is then unloaded and the residual (permanent) deflection is recorded. On the final test, the maximum loaded deflection was 0.202 Inches at reference point 10. The maximum permanent deflection after the final loading sequence ranged from -0.001 Inches at reference point 12 to 0.005 inches at reference points 10 and 11.

STRUCTURAL SHAKEDOWN DATA FORM

Bus Number: 1405	Date: 06-30-14
Personnel: T.S., S.R., T.G. & P.D.	Temperature (°F): 75
Loading Sequence: ■ 1 ☐ 2 ☐ 3 (check one) Test Load (lbs.): 25,575 (32 seated, 33 standees & 2 w/c positions)	

Indicate Approximate Location of Each Reference Point



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	0	.038	.038	.004	.004
2	0	.079	.079	.009	.009
3	0	.123	.123	.013	.013
4	0	.151	.151	.015	.015
5	0	.115	.115	.012	.012
6	0	.125	.125	.027	.027
7	0	.144	.144	.024	.024
8	0	.209	.209	.019	.019
9	0	.229	.229	.022	.022
10	0	.231	.231	.024	.024
11	0	.198	.198	.021	.021
12	0	.109	.109	.018	.018

STRUCTURAL SHAKEDOWN DATA FORM

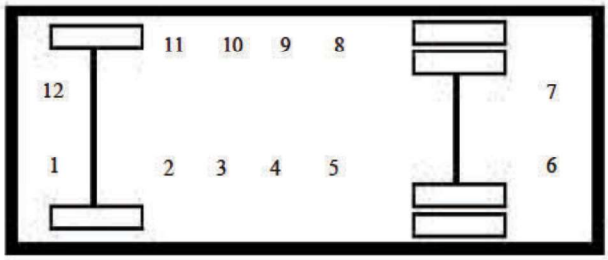
Bus Number: 1405	Date: 07-01-14
Personnel: T.G., S.R., P.D., T.S., E.D., R.S. & M.H.	Temperature (°F): 77
Loading Sequence: ☐ 1 ■ 2 ☐ 3 (check one) Test Load (lbs.): 25,575 (32 seated, 33 standees & 2 w/c positions)	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	.004	.032	.028	.006	.002
2	.009	.084	.075	.012	.003
3	.013	.126	.113	.017	.004
4	.015	.145	.130	.019	.004
5	.012	.102	.090	.014	.002
6	.027	.130	.103	.029	.002
7	.024	.150	.126	.026	.002
8	.019	.181	.162	.021	.002
9	.022	.217	.195	.026	.004
10	.024	.226	.202	.029	.005
11	.021	.194	.173	.026	.005
12	.018	.097	.079	.017	-.001

5.1 STRUCTURAL SHAKEDOWN TEST



DIAL INDICATORS IN POSITION



BUS LOADED TO 2.5 TIMES GVL (25,575 LBS)

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

5.2-II. TEST DESCRIPTION

With the bus loaded to GVWR, each wheel of the bus will be raised (one at a time) to simulate operation over a curb and the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time) to simulate operation through a pothole and the same items inspected.

5.2-III. DISCUSSION

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, steering and handicapped devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. No water leakage was observed during the test. The results of this test are indicated on the following data forms.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	■ before	□ after
Left front	□ 6 in higher	□ 6 in lower
Right front	□ 6 in higher	□ 6 in lower
Right rear	□ 6 in higher	□ 6 in lower
Left rear	□ 6 in higher	□ 6 in lower
Right center	□ 6 in higher	□ 6 in lower
Left center	□ 6 in higher	□ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	■ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	■ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	■ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	■ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	■ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	■ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	■ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	■ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies.
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 1405	Date: 07-18-14
Personnel: E.D., E.L., J.P. & K.D.	Temperature(°F): 70

Wheel Position : (check one)		
All wheels level	☐ before	■ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
■ Windows	No deficiencies.
■ Front Doors	No deficiencies.
■ Rear Doors	No deficiencies.
■ Escape Mechanisms/ Roof Vents	No deficiencies.
■ Engine	No deficiencies.
■ Handicapped Device/ Special Seating	No deficiencies.
■ Undercarriage	No deficiencies
■ Service Doors	No deficiencies.
■ Body	No deficiencies.
■ Windows/ Body Leakage	No deficiencies.
■ Steering Mechanism	No deficiencies.

5.2 STRUCTURAL DISTORTION TEST



RIGHT FRONT WHEEL SIX INCHES HIGHER



LEFT REAR WHEEL SIX INCHES LOWER

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

5.3-II. TEST DESCRIPTION

Utilizing a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure will be recorded.

5.3-III. DISCUSSION

The load-distributing yoke was incorporated as the interface between the Static Tow apparatus and the test bus tow hook/eyes. The test was performed to the full target test weight of 39,312 lbs. (1.2 x 32,760 lbs. CW). No damage or deformation was observed during all four pulls of the test. The manufacturer does not recommend towing from rear therefore a rear test was not performed.

STATIC TOWING TEST DATA FORM

Bus Number: 1405	Date: 6-30-15
Personnel: T.S., S.R., E.D. & P.D.	Temperature (°F): 74

Inspect right front tow eye and adjoining structure.
Comments: No damage or deformation observed.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Welds and bolts inspected.
Inspect left tow eye and adjoining structure.
Comments: No damage or deformation observed.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Welds and bolts inspected.
Inspect right rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
Inspect left rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
General comments of any other structure deformation or failure: All four front pulls were completed to the full target test load of 39,312 lbs. (1.2 x 32,760 lbs. CW) with no damage or deformation observed. The manufacturer does not recommend towing from rear therefore a rear test was not performed.

5.3 STATIC TOWING TEST



FRONT 20° UPWARD PULL



FRONT 20° DOWNWARD PULL

5.3 STATIC TOWING TEST CONT.



FRONT 20° LEFT PULL



FRONT 20° RIGHT PULL

5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST

5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

5.4-II. TEST DESCRIPTION

This test requires the bus be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

5.4-III. DISCUSSION

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by incorporating a hydraulic under lift. A front lift tow was performed. Rear towing is not recommended. No problems, deformation, or damage was noted during testing.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 1405	Date: 03-13-15
Personnel: S.R., E.D., E.L. & J.P	

Temperature (°F): 41	Wind Speed (mph): 11
Wind Direction: SSW	

Inspect tow equipment-bus interface.
Comments: A safe and adequate connection was made between the towing equipment and the bus.
Inspect tow equipment-wrecker interface.
Comments: A safe and adequate connection was made between the towing equipment and the wrecker.
Towing Comments: A front lift tow was performed incorporating a hydraulic under lift wrecker.
Description and location of any structural damage: None noted.
General Comments: No problems with the towing interface or procedures were encountered.

5.4 DYNAMIC TOWING TEST



TOWING INTERFACE



TEST BUS IN TOW

5.5 STRUCTURAL STRENGTH AND DISTORTION TESTS – JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to inspect for damage due to the deflated tire, and determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II. TEST DESCRIPTION

With the bus at curb weight, the tire(s) at one corner of the bus are replaced with deflated tire(s) of the appropriate type. A portable hydraulic floor jack is then positioned in a manner and location specified by the manufacturer and used to raise the bus to a height sufficient to provide 3-in clearance between the floor and an inflated tire. The deflated tire(s) are replaced with the original tire(s) and the jack is lowered. Any structural damage or permanent deformation is recorded on the test data sheet. This procedure is repeated for each corner of the bus.

5.5-III. DISCUSSION

The jack used for this test has a minimum height of 8.75 inches. During the deflated portion of the test, the jacking point clearances ranged from 3.1 inches to 7.9 inches. No deformation or damage was observed during testing. A complete listing of jacking point clearances is provided in the Jacking Test Data Form.

JACKING CLEARANCE SUMMARY

Condition	Frame Point Clearance
Front axle – one tire flat	6.4”
Rear axle – one tire flat	7.7”
Rear axle – two tires flat	5.4”

JACKING TEST DATA FORM

Bus Number: 1405	Date: 06-26-14
Personnel: E.D. & P.D.	Temperature (°F): 72

Record any permanent deformation or damage to bus as well as any difficulty encountered during jacking procedure.

Deflated Tire	Jacking Pad Clearance Body/Frame (in)	Jacking Pad Clearance Axle/Suspension (in)	Comments
Right front	9.4 " I 6.5 " D	6.2 " I 3.1 " D	Frame and Axle
Left front	9.0 " I 6.4 " D	6.3 " I 3.1 " D	Frame and Axle
Right rear—outside	8.9 " I 7.7 " D	9.1 " I 7.9 " D	Frame and Suspension
Right rear—both	8.9 " I 5.4 " D	9.1 " I 5.6 " D	Frame and Suspension
Left rear—outside	9.5 " I 7.9 " D	9.0 " I 7.4 " D	Frame and Suspension
Left rear—both	9.5 " I 6.2 " D	9.0 " I 5.7 " D	Frame and Suspension
Right middle or tag—outside	N/A	N/A	
Right middle or tag—both	N/A	N/A	
Left middle or tag—outside	N/A	N/A	
Left middle or tag—both	N/A	N/A	

Additional comments of any deformation or difficulty during jacking:

None noted.

5.6 STRUCTURAL STRENGTH AND DISTORTION TESTS - HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack/stands.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus is raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus will be checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure is repeated for the rear end of the bus. The procedure is then repeated for the front and rear simultaneously.

5.6-III. DISCUSSION

The test was conducted using four posts of a six-post electric lift and standard 19 inch jack stands. The bus was hoisted from the front wheel, rear wheel, and then the front and rear wheels simultaneously and placed on jack stands.

The bus easily accommodated the placement of the vehicle lifts and jack stands and the procedure was performed without any instability noted.

HOISTING TEST DATA FORM

Bus Number: 1405	Date: 06-26-14
Personnel: E.D. & P.D.	Temperature (°F): 79

Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the front and rear wheels are supported by the jack stands:
None noted.

5.7 STRUCTURAL DURABILITY TEST

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates up to 25 percent of the service life of the vehicle.

5.7-II. TEST DESCRIPTION

The test vehicle is driven a total of 15,000 miles; approximately 12,500 miles on the PSBRTF Durability Test Track and approximately 2,500 miscellaneous other miles. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of approximately 6,250 miles with the bus operated at GVW. The second segment will consist of approximately 2,500 miles with the bus operated at SLW. The remainder of the test, approximately 6,250 miles, will be conducted with the bus loaded to CW. If GVW exceeds the axle design weights, then the load will be adjusted to the axle design weights and the change will be recorded. All subsystems are run during these tests in their normal operating modes. All recommended manufacturers servicing is to be followed and noted on the vehicle maintainability log. Servicing items accelerated by the durability tests will be compressed by 10:1; all others will be done on a 1:1 mi/mi basis. Unscheduled breakdowns and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test vehicle shall be washed down and thoroughly inspected for any signs of failure.

5.7-III. DISCUSSION

The Structural Durability Test was started on August 26, 2014 and was conducted until March 19, 2015. The first 6,250 miles were performed at a GVW of 43,550 lbs. and completed on December 10, 2014. The next 2,500 mile SLW segment was performed at 38,700 lbs. and completed on January 15, 2015, and the final 6,250 mile segment was performed at a CW of 32,770 lbs and completed on March 19, 2015.

Effective January 1, 2010 the Federal Transit Administration determined that the total number of simulated passengers used for loading all test vehicles will be based on the full complement of seats and free-floor space available for standing passengers (150 lbs. per passenger). The passenger loading used for dynamic testing will not be reduced in order to comply with Gross Axle Weight Ratings (GAWR's) or the Gross Vehicle Weight Ratings (GVWR's) declared by the manufacturer. Cases where the loading exceeds the GAWR and/or the GVWR will be noted accordingly. During the testing program, all test vehicles transported or operated over public roadways will be loaded to comply with the GAWR and GVWR specified by the manufacturer.

The following mileage summary presents the accumulation of miles during the Structural Durability Test. The driving schedule is included, showing the operating duty cycle. A detailed plan view of the Test Track Facility and Durability Test Track are attached for reference. Also, a durability element profile detail shows all the measurements of the different conditions. Finally, photographs illustrating some of the failures that were encountered during the Structural Durability Test are included.

[redacted]

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
08/25/2014 TO 08/31/14	549.00	35.00	584.00
09/01/2014 TO 09/07/14	566.00	30.00	596.00
09/08/2014 TO 09/14/14	293.00	14.00	307.00
09/15/2014 TO 09/21/14	388.00	19.00	407.00
09/22/2014 TO 09/28/14	332.00	63.00	395.00
09/29/14 TO 10/05/14	0.00	0.00	0.00
10/06/2014 TO 10/12/14	0.00	0.00	0.00
10/13/2014 TO 10/19/14	438.00	67.00	505.00
10/20/2014 TO 10/26/14	681.00	32.00	713.00
10/27/2014 TO 11/02/14	654.00	28.00	682.00
11/03/2014 TO 11/9/2014	588.00	27.00	615.00
11/10/2014 TO 11/16/2014	67.00	3.00	70.00
11/17/2014 TO 11/23/14	510.00	72.00	582.00
11/24/2014 TO 11/30/14	0.00	0.00	0.00

[redacted]

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
12/01/2014 TO 12/07/14	184.00	98.00	282.00
12/08/2014 TO 12/14/14	0.00	365.00	365.00
12/15/2014 TO 12/21/14	449.00	18.00	467.00
12/22/2014 TO 12/28/14	321.00	14.00	335.00
12/29/2014 TO 01/04/15	68.00	3.00	71.00
01/05/2015 TO 01/11/15	656.00	31.00	687.00
01/12/2015 TO 01/18/15	617.00	228.00	845.00
01/19/2015 TO 01/25/15	198.00	12.00	210.00
01/26/2015 TO 02/01/15	103.00	696.00	799.00
02/02/2015 TO 02/08/15	380.00	17.00	397.00
02/09/2015 TO 02/15/15	765.00	35.00	800.00
02/16/2015 TO 02/22/15	848.00	35.00	883.00
02/23/2015 TO 03/01/15	760.00	34.00	794.00
03/02/2015 TO 03/08/15	526.00	22.00	548.00

[redacted]

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
03/09/2015 TO 03/15/15	752.00	34.00	786.00
03/16/2015 TO 03/22/15	595.00	26.00	621.00
03/23/2015 TO 03/29/15	0.00	32.00	32.00
03/30/2015 TO 04/05/15	0.00	0.00	0.00
04/06/2015 TO 04/12/15	0.00	24.00	24.00
04/13/2015 TO 04/19/15	0.00	78.00	78.00
			0.00
			0.00
			0.00
			0.00
TOTAL	12288.00	2192.00	14480.00

Table 4. Driving Schedule for Bus Operation on the Durability Test Track

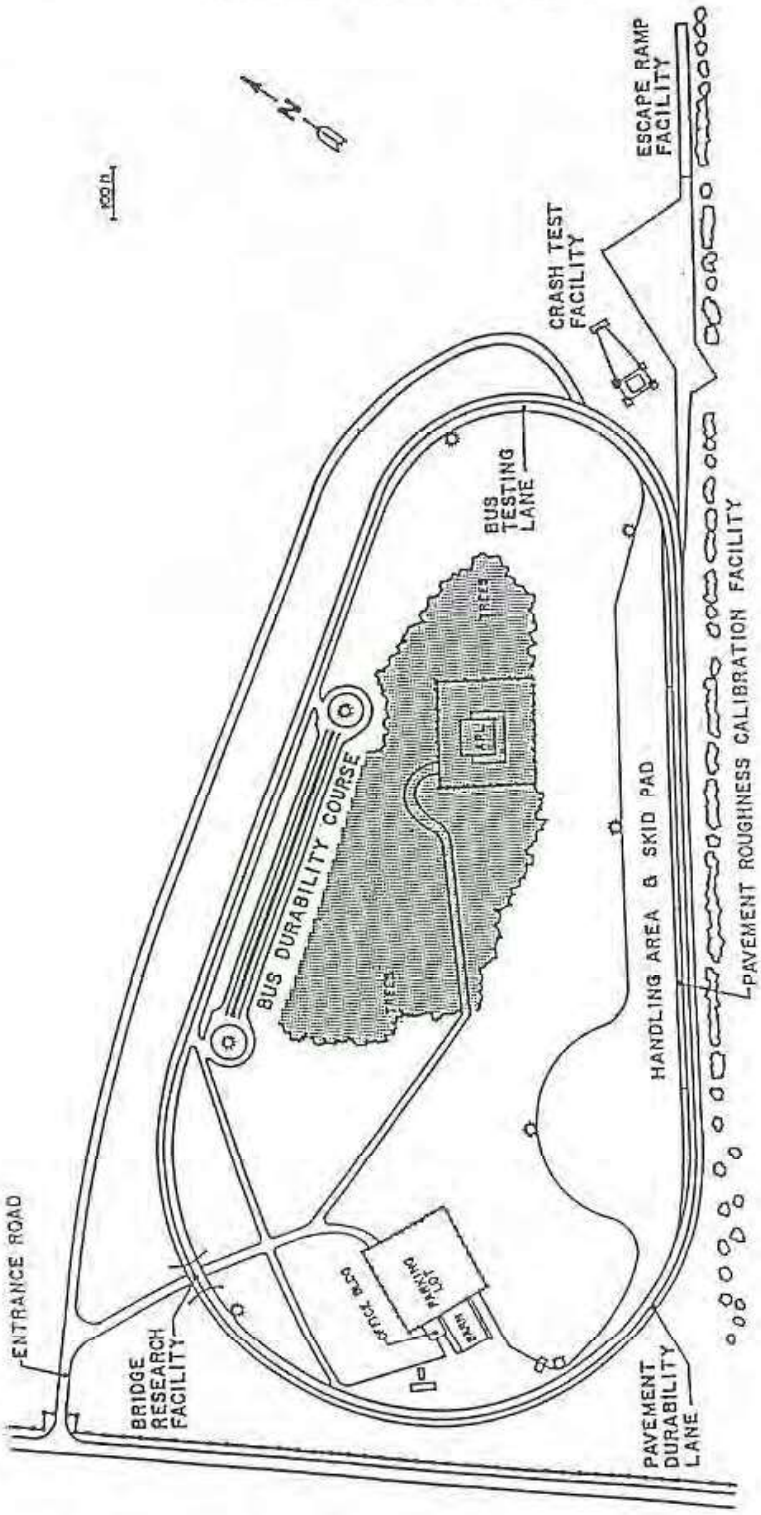
STANDARD OPERATING SCHEDULE

Monday through Friday

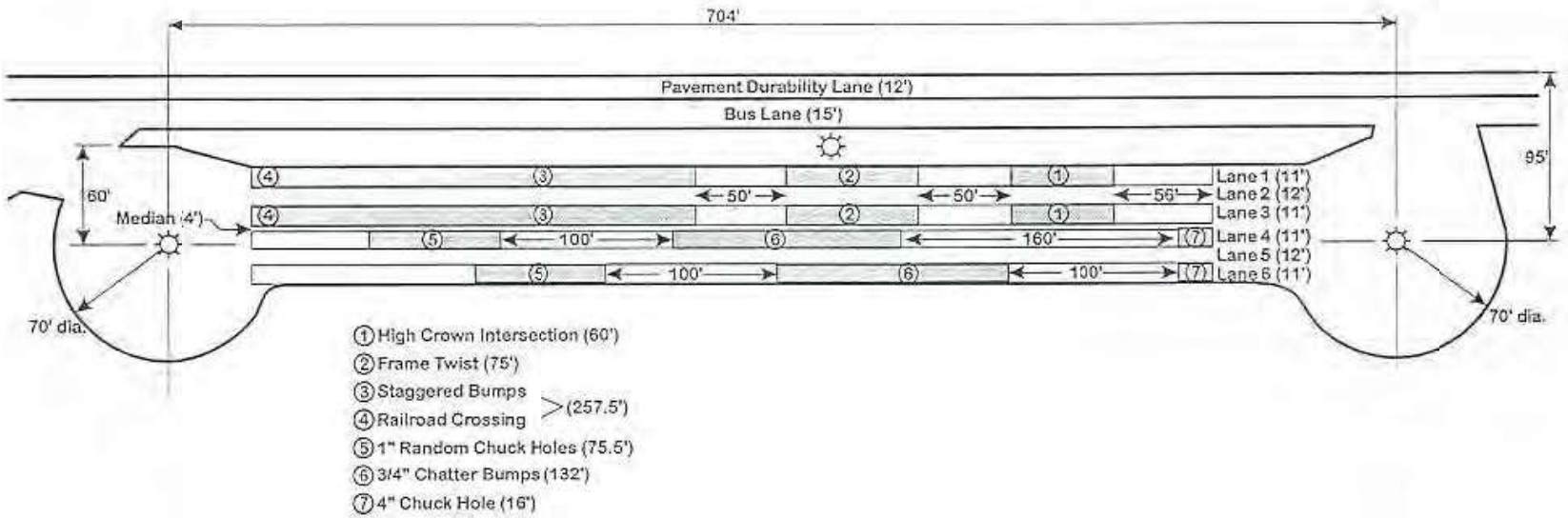
	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift 3	4:00 pm	D
	5:40 pm	C
	5:50 pm	B
	6:00 pm	D
	7:40 pm	C
	7:50 pm	B
	8:05 pm	D
	9:40 pm	C
	9:50 pm	B
	10:00 pm	D
	11:40 pm	C
	11:50 pm	F

B—Break
C—Cycle all systems five times, visual inspection, driver's log entries
D—Drive bus as specified by procedure
F—Fuel bus, complete driver's log shift entries

"PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY"



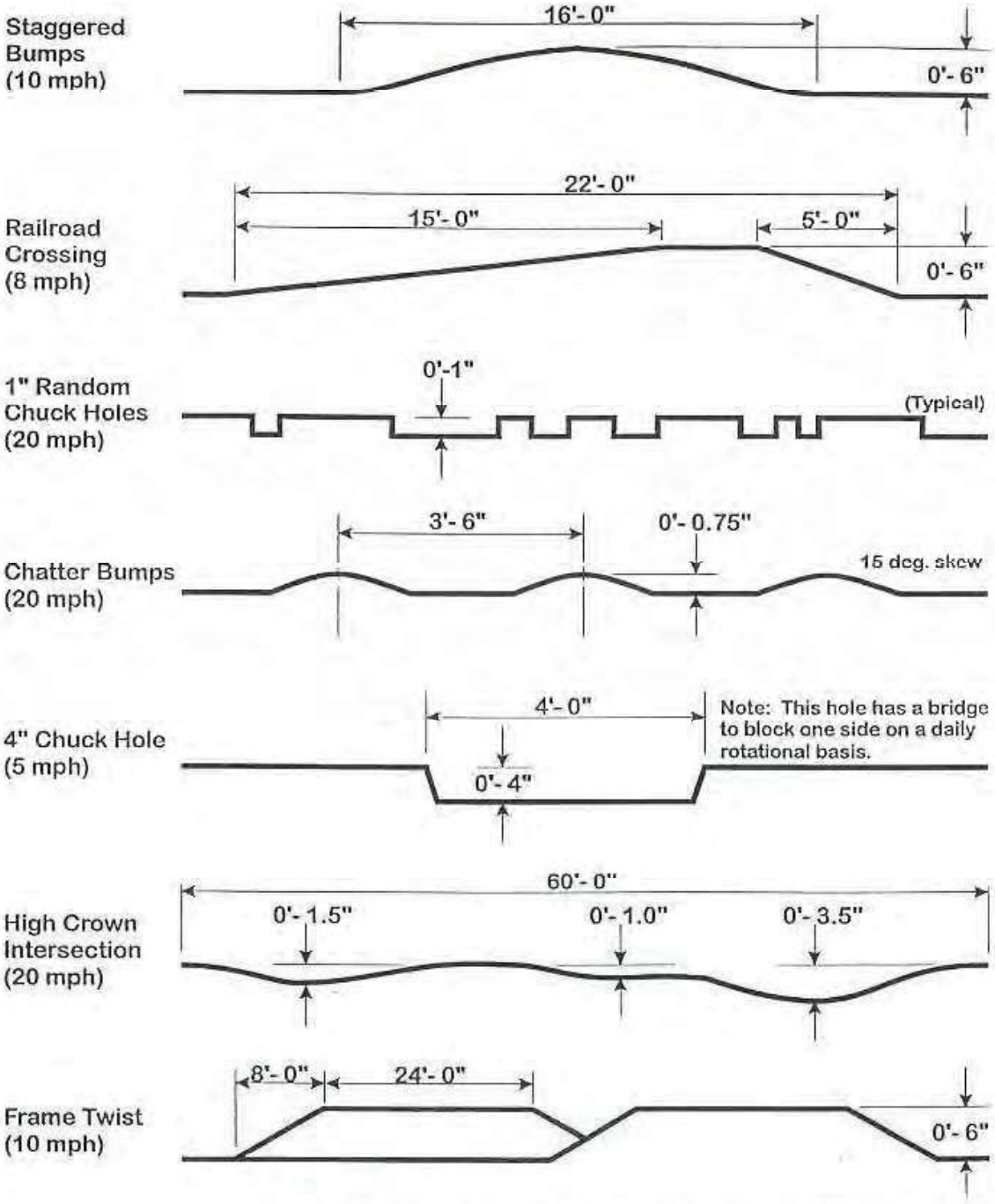
BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA



Plan View

Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

(Page 1 of 3)
UNSCHEDULED MAINTENANCE
[redacted]

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
09-03-14	788	Power steering is tight.	Power steering fluid leaking from fitting at the power steering pump. Tightened fitting and topped off fluid.	1.00	1.00
09-16-14	1,551	The right front air bag is blown.	Replaced the right front air bag and air bag mounting plate.	4.00	24.00
09-16-14	1,551	The right front air brake chamber air fitting is leaking.	Replaced right front air brake chamber air fitting.	2.00	2.00
10-09-14	2,353	As per manufacturer's request.	Removed front air bags and lower mounting plates. Installed newly designed lower mounting plates and file mating surface as needed. Installed new air bags.	3.00	256.00
10-30-14	4,039	The left front air bag failed.	Replaced left front air bag.	2.00	6.00
11-05-14	4,610	The right front shock is broken at the lower bayonet.	Replaced right front shock.	2.00	10.00
11-06-14	4,646	The right rear battery frame mount is cracked approx. 6".	Crack welded/repaired. Installed five gussets to the battery mounts...three on the left side and two on the right side.	6.00	16.00
11-06-14	4,646	The left front shock is bent.	Replaced left front shock.	1.00	1.00

UNSCHEDULED MAINTENANCE [redacted]

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
11-06-14	4,646	The front axle upper radius rod bushings are worn.	Replaced both front upper radius rods.	3.00	3.00
11-25-14	5,616	The drive motor bushings are worn.	Replaced drive motor bushings.	4.00	4.00
12-02-14	5,616	Manufacturer rep requests the Eater electric heater be replaced.	Removed the failed heater and installed the new heater. Heater has not failed. Rep repaired a wiring issue.	5.00	10.00
12-16-14	6,271	Manufacturer's rep troubleshooting electrical system for intermittent issue of a shielded wire contacting ground.	No cause found at this time.	4.00	107.00
01-08-15	7,524	Drive motor mounting bushings are worn.	Assisted manufacturer's rep replacing drive motor mounting bushings.	1.00	6.00
02-03-15	9,763	Experienced momentary interruption of power steering assist.	Manufacturer replaced power steering unit.	6.00	16.00
02-05-15	9,967	Loss of power steering assist.	Manufacturer's rep repaired a broken connector at the power steering control module.	2.00	4.00
02-11-15	10,590	The bushings on the drive motor mounting brackets are worn.	Manufacturer requests heavier mounting brackets to be installed. Installed heavier mounting brackets.	4.00	4.00
02-12-15	10,688	The bushings are worn on both upper and lower rear radius rods.	Replaced both upper and lower rear radius rods.	9.00	3.00

(Page 3 of 3)
UNSCHEDULED MAINTENANCE
[redacted]

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
02-17-15	11,183	The right front shock is broken.	Replaced both front shocks.	4.00	6.00
02-27-15	12,546	The bushings are worn on the front upper radius rods.	Replaced both front upper radius rods.	3.00	8.00
02-27-15	12,546	Steering stabilizer failed.	Replaced steering stabilizer.	2.00	2.00
03-13-15	13,823	The right front shock is broken at the lower bayonet.	Replaced right front shock.	2.00	5.00

UNSCHEDULED MAINTENANCE



LOOSE POWER STEERING LINE AT POWER STEERING PUMP (788 TEST MILES)



BLOWN RIGHT FRONT AIR BAG (1,551 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



NEW DESIGN FRONT, LOWER AIR BAG MOUNTING PLATE
(2,353 TEST MILES)



FAILED LEFT FRONT AIR BAG
(4,039 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



RIGHT FRONT SHOCK BROKEN LOWER BAYONET
(4,610 TEST MILES)



1 OF 5 GUSSETS INSTALLED ON BATTERY FRAME MOUNT
(4,646 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



WORN BUSHINGS IN FRONT UPPER RADIUS RODS (4,646 TEST MILES)



WORN BUSHINGS FROM DRIVE MOTOR (5,616 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



INSTALLED NEW POWER STEERING UNIT
(9,763 TEST MILES)



NEW DRIVE MOTOR MOUNTS
(10,590 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



WORN UPPER AND LOWER REAR RADUIS ROD BUSHINGS
(10,668 TEST MILES)



BROKEN RIGHT FRONT SHOCK
(11,183 TEST MILES)

[redacted]
May 7th/8th

[redacted] Fuel Economy Report
Altoona Bus Test & Research Center

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2 Revision History

This section of the document provides a space to log and track all changes to this document. All changes shall be logged in the revision history below. When this document is revised, the date of revision and nature of the revision shall be logged.

2.1. Revision and Change Authority

Changes to this document must be reviewed by management before approval.

2.2. Revision History

Revision:	Prepared By:	Reviewed:	Approved By:
1	Timothy Cleary	Robert Reifsteck	David Klinikowski
Date of Change:	**Status:**	**Change Order:**	**Code:**
16 June 2015	DRAFT	Initial Version	
Affected Section:	**Change Description:**		
All	Initial Version		

Revision:	Prepared By:	Reviewed:	Approved By:
1.1	Timothy Cleary	Robert Reifsteck	David Klinikowski
Date of Change:	**Status:**	**Change Order:**	**Code:**
13 July 2015	Released for Manufacturer Review	1	
Affected Section:	**Change Description:**		

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1.2	Timothy Cleary	Robert Reifsteck	David Klinikowski
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14 August 2015	Re-released for Manufacturer Review	2	
Affected Section:	**Change Description:**		
	Removed unnecessary references. Highlighted references to the incomplete charge event after run #2 Simplified report structure		

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5 Introduction and Scope of Document

The purpose of this document is to report testing setup, data analysis and results of a fuel economy or more accurately, an energy consumption test performed at the Altoona Bus Test Center. This includes both on-road and charging energy consumption as well as phase specific average fuel economy and measured vehicle range.

The energy consumption test includes both on-road and stationary charge testing. Sensors are installed and tested prior to the official start. Manufacture data for maximum battery temperature, State of Charge (SOC) and vehicle speed are requested via the vehicles CAN bus. Ideally, all manufacturers will provide Deutsch series DT connectors with live, when enabled, high voltage connection directly to the high voltage energy storage bus as well as approximately 1 square foot of space around a high voltage cable carrying the full bus current for DC bus current measurement. Please ensure all high voltage safety precautions are exercised.

6.1. Preparation:

Current and voltage sensors are added to the bus between the battery system and all loads. Internal battery loads such as balancing functions are neglected. These sensors are integrated into an isolated CAN bus and logged during on-road testing. A Fluke 1730 power meter is attached to the power supply of the manufacturer's charger. This meters data are logged during all charges after any on-road energy consumption testing. All sensors and logging systems are tested by driving a minimum of two full laps and charging for a minimum of 10 minutes prior to official testing.

Once preparation is complete testing may start.

6.2. Testing Procedure:

1) Fully charge the bus using manufacturer specific chargers and procedure
    a. A one hour "warm up" is optional prior to on-road testing but the bus must return to the charger and be fully charged prior to any official testing
2) Following a full charge and prior to initial vehicle movement data logging is enabled
3) Starting from the charger location the bus is driven to the start point on the oval test track
4) The bus is then driven in a counter clockwise direction around the track repeating the CBD, Arterial, CBD, Arterial, CBD, Commuter profile until the vehicles propulsion system isn't capable of keeping up with the required profile speeds
5) The bus is then driven directly to the manufactures charger
6) The power meter and its logging function is enabled
7) The bus is fully charged following the manufacturers procedures
8) Steps 2 through 7 are then repeated for clockwise direction

6.3. Preliminary Data Validation:

Following each day of testing data is preliminary reviewed to ensure all systems remained functional throughout the days testing. If any problems are found during this review the issues are presented to management for discussion and consideration. If necessary the bus may be retested.

A measurement of electrical power and energy was performed on the **New Flyer EV bus #1405** while on-road in a charge depleting mode and while stationary in a charging mode. In both modes of operation electrical energy was measured by utilizing current and voltage sensors. The details of these sensors and their data acquisition systems are presented here. All calibration certifications for sensors used in this testing are on file at the Altoona Bus Research and Testing Center.

7.1. On-Road Power and Energy Measurement

While in an on-road energy consumption mode current and voltage of the electrical energy storage system / high voltage battery was measured and logged. A single current sensor was placed in between the high voltage battery and all exterior loads while a single voltage sensor was connected to the high voltage DC bus. Any power consumed internal to the energy storage system for devices such as a battery management systems or functions such as cell balancing were not measured and are assumed to be negligible.

The current and voltage sensors used in this test generate analog signals which are in turn are converted by an analog to digital converter with CAN bus communication. The analog to digital converter scales measurements based on initial device configuration, tailored to the specific sensors and sends these raw measurements out on its associated CAN bus at a rate of 20ms or 50Hz. A CAN data logger is set to log all messages on this isolated CAN bus. A second CAN channel was integrated into the manufacturer's vehicle CAN bus to log vehicle speed, maximum battery/cell temperature and estimated battery SOC. Two separate and dedicated 12V lead acid batteries were used to power the analog to digital converter and CAN data loggers. The other battery supported an inverter to power a technicians PC which was also logging the same CAN data. **In this particular setup vehicle power was used for one of the two CAN loggers. The load of a Vector CANtech CANcaseXL log, the loggers used in this testing, is approximately 500ma at 12V or 6 Watts.**

This intent of this power supply configuration is to limit power drawn from the vehicle during testing. It's also worth noting that the high voltage DC voltage sensor may load the high voltage bus but this load is considered to be negligible.

7.1.1 High Voltage DC Current Sensor

An AEMC brand model MR561 current probe was used along with an IPETRONIK high voltage current clamp isolator to generate the DC battery current analog signal.

Current probe manual:
http://www.aemc.com/products/pdf/1200.73.pdf

High voltage isolator:
https://www.ipetronik.com/sites/default/files/field_product_file/ipe_datasheet_iso_clamp_connector_prelim.pdf

7.1.2 High Voltage DC Voltage Sensor

A high voltage isolator and divider was used to scale and isolate high voltage DC voltage bus measurements taking directly from the high voltage DC bus. This device also generates an analog voltage.

High voltage isolator and divider:
https://www.ipetronik.com/sites/default/files/field_product_file/ipe_datasheet_highvoltage_iso_divider.pdf

7.1.3 Analog to Digital Converter

A four channel analog to digital converter with sensor excitation and CAN bus communication was used to convert the analog signals from the above current and voltage sensors to CAN messages. These CAN messages were then logged.

Analog to digital converter:
https://www.ipetronik.com/sites/default/files/field_product_file/ipe_datasheet_m_sens2.pdf

7.1.4 CAN Logger

A Vector CANtech CANcaseXL CAN bus tool along with a Microsoft Surface Pro3 were used to monitor, calculate and log data during testing. A second CANcaseXL Log device was also used to redundantly log the same data in case of device or logging failure. A PC running CANoe v8.2 software was used to generate real time power and energy calculations based on current and voltage readings. Energy calculations and battery temperature were also manually recorded by a technician at the completion of each phase of testing.

7.1.4.1 Code used to calculate power and energy for manual data points

The following code executed on the technicians PC during testing. It calculates battery power and integrated this power to calculate energy. This information is used only as a manual data point during testing. Reported energy consumption is post processed from logged current and voltage arrays to insure the highest resolution possible. Post processed data includes a calculation for every single data point recorded. The real time calculation is a timed function that samples at 100ms or 10Hz.

```
// Calculate Power and Energy

Variables
{
message 0x011 DC_Power_msg    = {dlc=8};  // create message to send DC power info
message 0x012 DC_Energy_msg   = {dlc=8};  // create message to send DC energy info

mstimer timer1;                           // define timer1

long DC_Power_Calc            = 0;        // initilize DC power
long DC_Energy_Calc           = 0;        // initilize DC energy
long DC_Energy_Calc_kWh       = 0;

int sample_time               = 100;      // timer rate in miliseconds}

on start{
setTimer(timer1,sample_time);             // initialize timer to 100 msec
}

on timer timer1
```

```
{

// reset timer
setTimer(timer1,sample_time);

// Calculate and send DC power and energy from Bus Testing sensors
DC_Power_Calc=($DC_Bus_Current.phys * $DC_Bus_Voltage.phys);  // W
DC_Energy_Calc=DC_Energy_Calc + (($DC_Bus_Current.phys * $DC_Bus_Voltage.phys)*0.1);
// Ws, 0.1 b/c 0.100 sample rate

  if (DC_Energy_Calc >= 36000)  // Ws (trip every 100 Wh){
    DC_Energy_Calc_kWh = DC_Energy_Calc_kWh + 1; // increment by 10 Wh
    DC_Energy_Calc = DC_Energy_Calc - 36000;}

  if (DC_Energy_Calc <= -36000)  // Ws (trip every -100 Wh){
    DC_Energy_Calc_kWh = DC_Energy_Calc_kWh - 1; // increment by 10 Wh
    DC_Energy_Calc = DC_Energy_Calc + 36000;}


DC_Power_msg.dword(0)=DC_Power_Calc;
DC_Energy_msg.dword(0)=DC_Energy_Calc;
DC_Energy_msg.dword(4)=DC_Energy_Calc_kWh;      //_kWh; factor of 0.1

output(DC_Power_msg);
output(DC_Energy_msg);
}
```

7.1.4.2 Technicians Display

The following display represents the screen seen by the technician recording manual measurements.

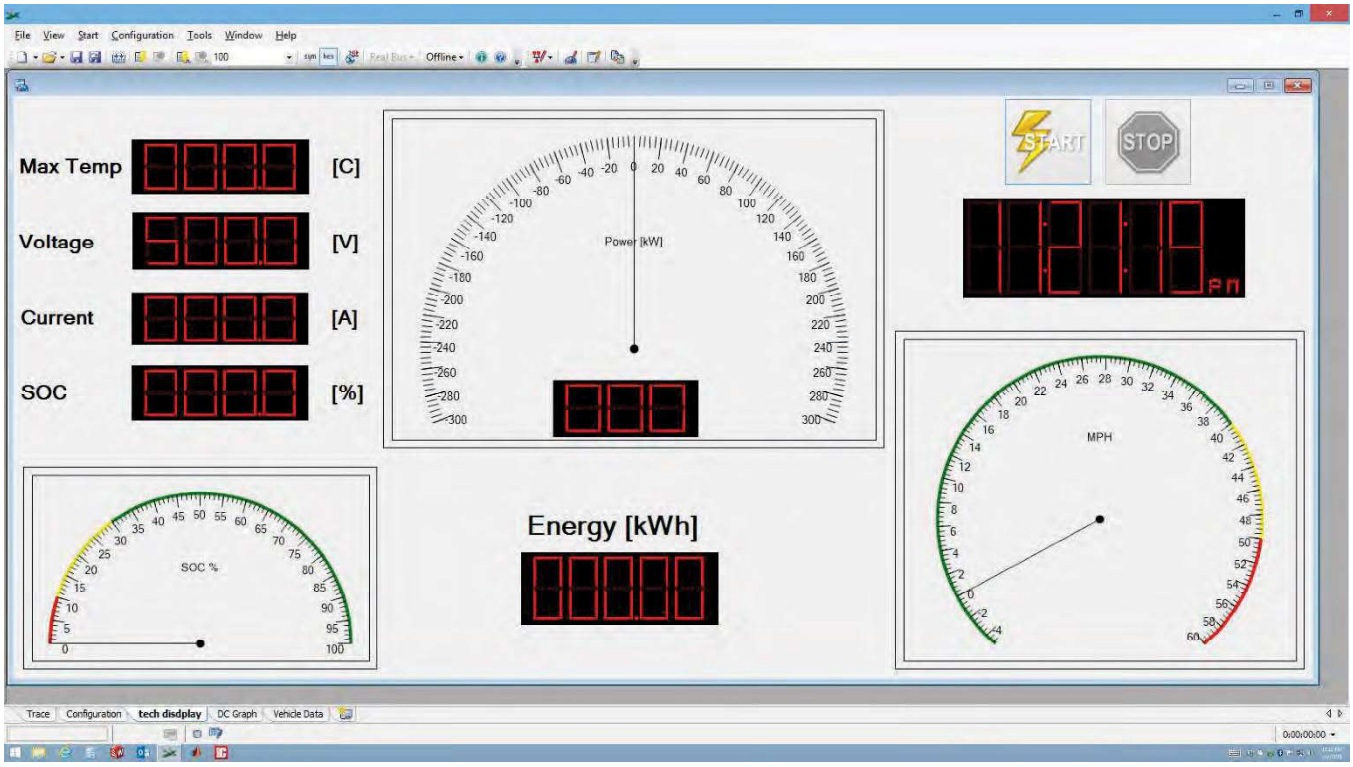

Figure 1. Technicians Dispay of CAN Data

Again the above is solely used for manual data points. All logged current and voltage data is post processed to calculate power and energy. Real time calculations using Vectors CAPL programming running on the technicians PC is only to support test monitoring by a technician.

7.2. Charging Energy and Power Measurement

All AC electrical power measurements are logged using a Fluke 1730 power meter. This devices sensors were installed in between the building power service and the **New Flyer** charging station. All calibration certifications are on file at the Altoona Bus Research and Testing Center.

Fluke 1730 3 Phase Energy Logger: http://www.fluke.com/fluke/m2en/power-quality-tools/logging-power-meters/fluke-1730.htm?PID=77038

Fluke Energy Analyze V1.2 software package is used to extract recorded data from the Fluke 1730 power meter. This data is ultimately exported to a Matlab data file.

This section details the process of data analysis. Once all logged data is extracted from the logging devices a preliminary check is performed to determine if there were any discrepancies in the test procedure or data logging. Then data from multiple files are combined, if necessary, to create one file for the discharge and charge portion of each run. Finally, a point in between each completed phase or section of data is selected and calculated values for this point are reported.

Vehicle range calculation is also covered in this section as well as the Fluke 1730 energy meter data analysis.

8.1. Logged Data Extraction

All data are logged using a Vector CANcaseXL Log or similar. This information is either extracted from the log device itself or a connected PC acting as the logging device. It is then processed through Vector CANoe software and exported into a Matlab data file format. During the export process all messages are exported to ensure the highest possible resolution. No interpolation is performed.

8.2. Preliminary Check

All files extracted from the logging device are then preliminary processed. This includes plotting data such as vehicle speed to ensure that the test was conducted properly. Current and Voltage data is also plotted to ensure the signals are within reasonable ranges and behave as expected. Finally a check for disruptions in the signals is performed.

8.3. Phase and Section Reporting Point Selection

Phases and sections are selected manually based on both the technicians recorded phase time values and obvious stop points in between phases and or sections of the test. Test phases are the CBD, ART and Commuter drive profiles while test sections consist of the drive form the charger to the start point and return from the track to the charge after the last completed phase.

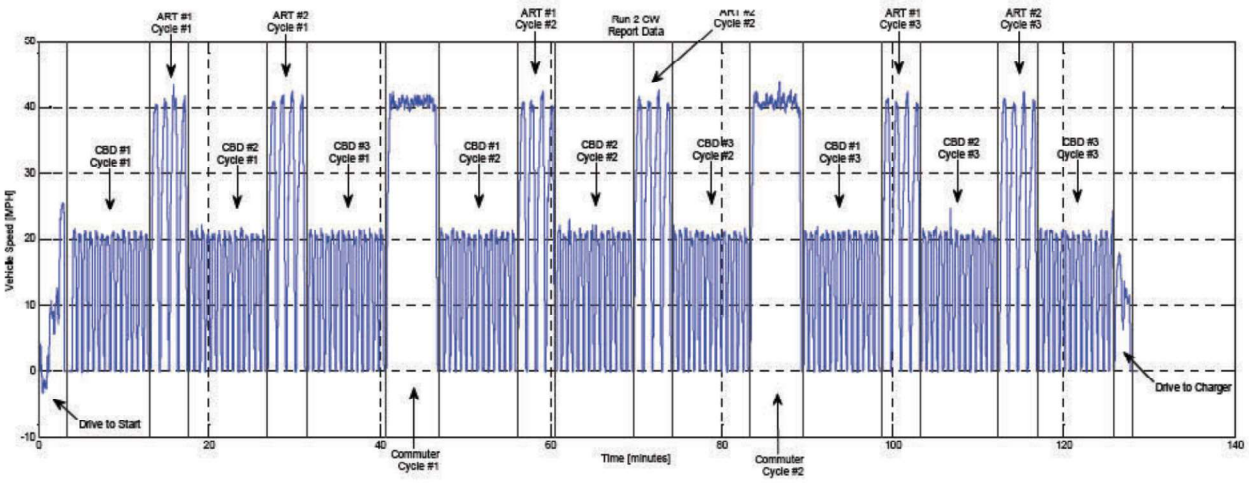

Figure 2. Phase and Section Selection

The vertical lines shown in the example data above represent the points selected as the separation of phases and sections. This run starts with a "Drive to Start" section followed by drive cycle phases then completes with a "Drive to Charger" section.

8.4. Post Processing Analysis

The following Matlab script sorts data and calculates power then integrates power to calculate energy using the following equations, 1 and 2.

$$Power = Current * Voltage \tag{1}$$

$$Energy = \int_0^t Power\, dt \tag{2}$$

Finally a table of data based on phase and section separation points is generated for reporting. This table contains phase time, energy consumption and maximum battery temperature. Some signals are interpolated on to a common time array. The highest resolution possible is used.

```
%% Calculate and Sort

%% Generate Time Scale
    Time = DC_Current(:,1);

%% New Flyer Sensors
    KPH2MPH       = 0.621371;
    vehicle_speed = interp1(ABS_VEHICLE_SPD(:,1),ABS_VEHICLE_SPD(:,2),Time)*KPH2MPH;
% [MPH]

    % Max Battery Temperature
    max_batt_temp(:,1) = BNK_1_MAX_CELL_TMP(:,1);

    for i = 1:length(BNK_1_MAX_CELL_TMP(:,1))
        max_batt_temp(i,2) = max([BNK_1_MAX_CELL_TMP(i,2);...
            BNK_2_MAX_CELL_TMP(i,2);BNK_3_MAX_CELL_TMP(i,2);BNK_4_MAX_CELL_TMP(i,2)]);
    end

    max_batt_temp = interp1(max_batt_temp(:,1),max_batt_temp(:,2),Time);       % [C]
```

```
    SOC           = interp1(BMU_SOC_MSG_CM(:,1),BMU_SOC_MSG_CM(:,2),Time);     % [%]

%% Calculate Power [Amperes,Volts,(kW)]
    current = DC_Current(:,2);
    voltage = interp1(DC_Voltage(:,1),DC_Voltage(:,2),Time) ;

    power = (current.*voltage)/1000;

%% Calculate Energy [seconds,kW,(kWh)]
    energy = power*0; % initilize array to zero

    for i = (2:1:length(power)-1)
        energy(i)=energy(i-1)+(power(i)*((Time(i)-Time(i-1))/3600));
    end

    energy(end) = energy(end - 1); % fill last poit with non-zero value

%% Find Reported Values

    Report(:,1) = phase_time;           % Time in seconds
    Report(:,2) = phase_time/60;        % Time in minuites

    % Find energy value
    for i = 1:1:length(phase_time)

        Report(i,3) = energy(find(Time>Report(i,1),1,'First'));

    end

    % Find batter=y temperature value
    for i = 1:1:length(phase_time)

        Report(i,4) = max_batt_temp(find(Time>Report(i,1),1,'First'));

    end
```

8.5. Vehicle Range Calculation

The range calculation of this testing is performed by adding the actual miles driven in fuel economy test phases with non-profile energy consumption. Profile distances are fixed based on measurements of the oval track and are equal to the following.

CBD cycle = 1.91 miles
Arterial (ART) cycle = 1.91 miles
Commuter phase = 3.82 miles.

Any distance driven outside these phases, such as the drive to and from the start/stop point and charge station is accounted for using the following equation, 3. Note, energy consumption is logged during all phases and sections.

$$Additional\ Distance = \frac{Total\ Energy\ Used(non\ FE\ Profile)\ [kWh]}{Average\ Fuel\ Economy\ [\frac{kWh}{mile}]} \quad (3)$$

8.6. Fluke 1730 AC Energy Analysis

For capturing energy used to recharge the vehicle a Fluke 1730 is employed and installed between site/building power supply and charger.

A logged power signal from the Fluke 1730 power meter and post processing is used to report energy consumption during the charge phase of this testing. A total Active Power signal is logged at a 1 second sample rate by the device. The following code is used to calculate the total charge energy required to fully charge the onboard electrical energy storage system by integrating the recorded power signal.

```
%% Load Data
load(uigetfile);

%% AC Energy Calculation
time = [1:1:length(PowerP_Total_avg)]';

% PowerP_Total_avg = Watts, sample rate is 1 second
energy = time*0;
for i = 2:1:length(time)
    energy(i) = energy(i-1) + PowerP_Total_avg(i); % Ws
end

energy = energy * (1/1000) * (1/3600);  % kWh
power  = PowerP_Total_avg * (1/1000);   % kW
time   = time * (1/60);                 % min

%% Plot Results
total_energy = energy(end);
str = ['Total Energy Used to Charge: ',num2str(total_energy),' [kWh]'];

subplot(3,1,1:2);plot(time, energy);
xlabel('Time [min]'); ylabel('Energy [kWh]');
grid on;
title(str);

subplot(3,1,3);plot(time,power);
xlabel('Time [min]'); ylabel('Power [kW]');
grid on;
```

This section presents all results from testing on **May 7th and 8th, 2015**. This data is referred to as run 1 and 2 respectively.

9.1. Run 1 Discharge Results

The bus was fully charged prior to this test and data logging started just before the bus drove away from its charging station. The bus was driven in a **counter clock wise** direction around the test track oval until it could no longer keep up with the prescribed drive cycle speed. Then the bus was returned directly to the charge station followed by a full charge. Data was recorded and processed, as detailed above, and is presented here. Note, there was one issue reported during this test. See notes below.

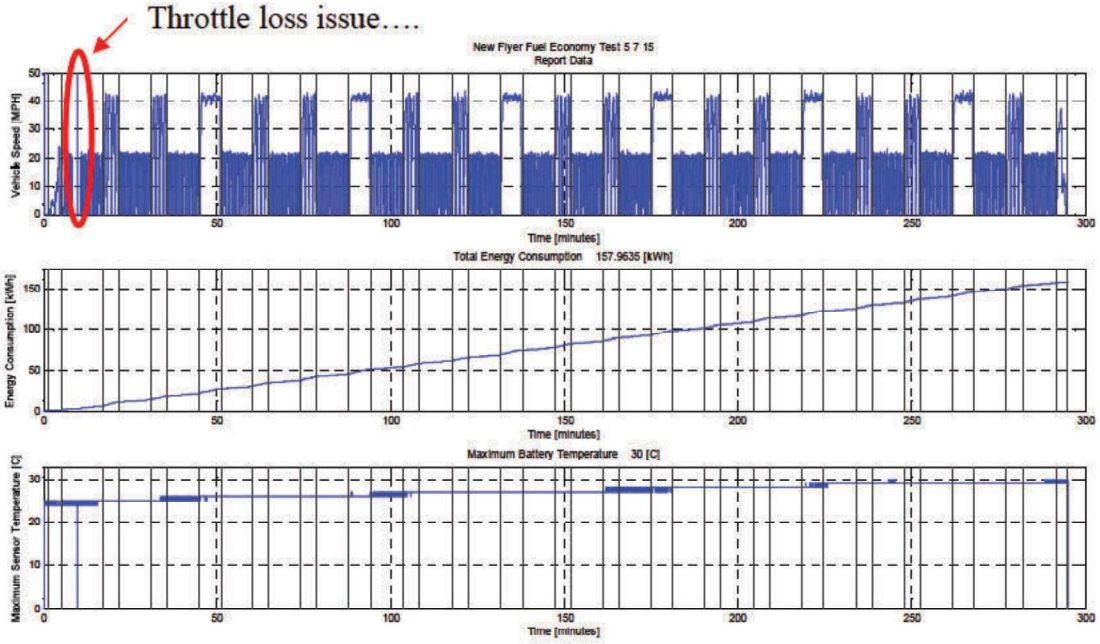

Figure 3. Run 1 Plot

Note, during this test at approximately 10 minutes from the start an unknown error was experienced causing the driver to lose throttle input. All on board, including a representative from New Flyer, discussed the decision to continue the test and concluded that the effects of this event were negligible. The bus ignition (power) was cycled and the test continued form this point without issue.

The figure above shows run #1 data, logged vehicle speed and maximum temperature readings as well as post processed energy consumption. The vertical lines on these plots represent the separation between phases.

The following figure represents the data taken at each phase and section as indicated in the figure above.

Bus Number:	1405					
Date:	5/7/2015		Humidity (%):		93	
Manufacturer:	New Flyer		Barometric Pressure (in Hg) :		30.24	
Personnel:	TS, SR, MH		SLW (lbs):			
Temperature (F):	62.00		Weather Instrument Asset No.		A-58	
Wind Speed/Direction:	2 MPH, N		Wind Speed Instrument Asset No.		A-68	
Run Number:	1					
Test Direction:	CCW					
	Time [min]		Battery Energy [kWh] +/- = Discharge/Charge		Relative Battery Energy Used [kWh]	Final Battery Temperature [Celsius]
Phase	Start	End	Start	End		End
Drive out to Start	1.61	5.39	0.06	1.04	0.98	24.00
CBD #1	5.39	17.27	1.04	6.01	4.97	24.00
ART #1	17.27	21.84	6.01	10.55	4.54	25.00
CBD #2	21 84	31.11	10.55	13.67	3.12	25.00
ART #2	31.11	35.72	13.67	18.12	4.45	25.00
CBD #3	35.72	44.92	18.12	21.18	3.06	26.00
Commuter	44.92	51.21	21.18	26.97	5.79	26.00
CBD #1	51 21	60.31	26.97	30.02	3.06	26.00
ART #1	60.31	64.95	30.02	34.41	4.39	26.00
CBD #2	64 95	74.22	34.41	37.53	3.12	26.00
ART #2	74.22	78.79	37.53	41.99	4.45	26.00
CBD #3	78.79	88.01	41.99	45.25	3.27	26.00
Commuter	88.01	94.28	45.25	50.88	5.63	26.00
CBD #1	94 28	103.63	50.88	54.04	3.16	26.41
ART #1	103.63	108 31	54.04	58.16	4.12	26.00
CBD #2	108.31	117.61	58.16	61.32	3.16	27.00
ART #2	117.61	122 25	61.32	65.58	4.26	27.00
CBD #3	122.25	131 55	65.58	68.73	3.15	27.00
Commuter	131.55	137 92	68.73	74.44	5.71	27.00
CBD #1	137.92	147 24	74.44	77.60	3.15	27.00
ART #1	147.24	151 85	77.60	81.85	4.26	27.00
CBD #2	151.85	161 23	81.85	85.04	3.19	27.00
ART #2	161.23	165 84	85.04	89.20	4.16	27.00
CBD #3	165.84	175 09	89.20	92.40	3.20	28.00
Commuter	175.09	181 31	92.40	98.14	5.75	27.00
CBD #1	181.31	190 58	98.14	101.36	3.21	28.00
ART #1	190.58	195.17	101.36	105.65	4.29	28.00
CBD #2	195.17	204.44	105.65	109.02	3.37	28.00
ART #2	204.44	209.16	109.02	113 26	4.24	28.00
CBD #3	209.16	218.43	113.26	116.55	3.29	28.00
Commuter	218.43	224.75	116.55	122.18	5.64	28.00
CBD #1	224.75	234 02	122.18	125.43	3.24	29.00
ART #1	234.02	238.66	125.43	129.43	4.00	29.00
CBD #2	238.66	247 83	129.43	132.71	3.27	29.00
ART #2	247.83	252 50	132.71	136 88	4.18	29.00
CBD #3	252.50	261.72	136.88	140.23	3.35	29.00
Commuter	261.72	268 04	140.23	145 93	5.70	29.00
CBD #1	268.04	277.46	145.93	149.12	3.19	29.00
ART #1	277.46	282.12	149.12	153.49	4.37	29.00
CBD #2	282.12	291.60	153.49	156.74	3.25	29.00
Drive back to Charger	291.60	294 87	156.74	157.96	1.23	29.00
Charge Data	0.00	1044.4	0.000	-208.690	-208.690	
	# of Phases	Avg. Energy Use [kWh]		Total Energy		
CBD	20	3.29		On Road	155.70	
ART	13	4.28		Non-Profile	2.204	
Commuter	6	5.70		Charge	-208.690	

Figure 4. Run 1 Summary

The above test resulted in the on-road energy consumption of **157.96 kWh**. Beyond the non-profile start and finish sections, **6 complete cycles and up to the 2nd CBD phase of the 7th cycle**

was completed. Note, the distance driven to and from the charger and start/stop location is also accounted for but in terms of energy then applied to the vehicle range value. See section 8.5 for more detail.

Total on road fuel economy profile distance for this run: **85.95 miles**

Total on road non-fuel economy profile distance for this run: **1.20 miles**

Total range for this run: **87.15 miles**

9.2. Run 1 Charge Results

The following results are an integration of Active Power measured by a Fluke 1730 Power Meter during the charging event following the previous, run 1, on-road range and fuel economy / energy efficiency test.

Once the discharge portion of run 1 was complete a full charge was started and data logged until the charge was completed. The figure below represents this tests measured power and calculated energy.

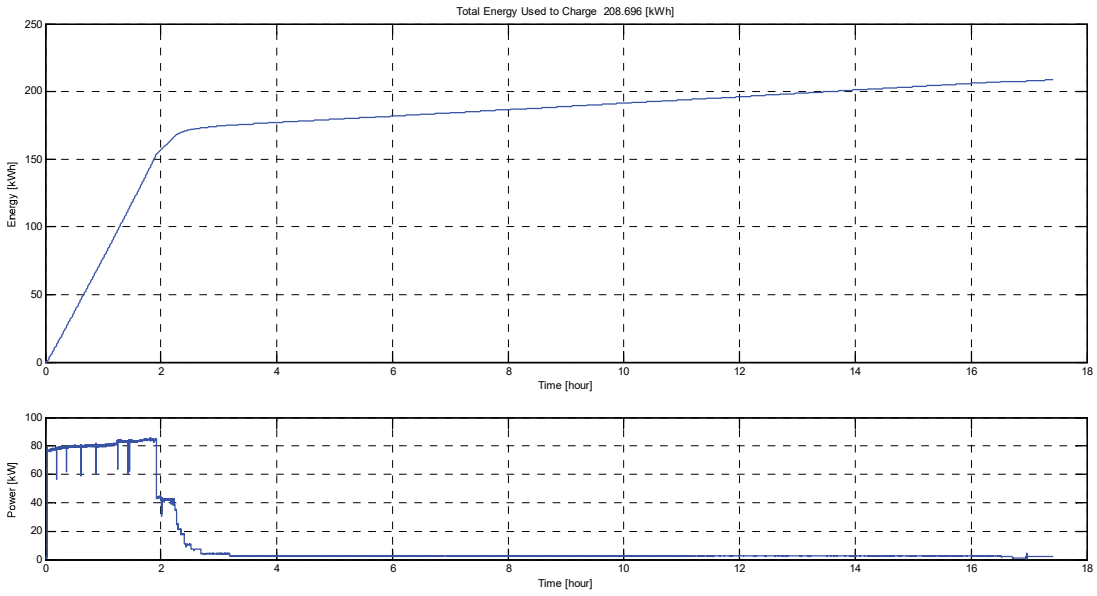

Figure 5. Run 1 Charge

This charge resulted in the consumption of **208 kWh** over approximately **17.5 hours**. The bulk charge mode consumed power at a rate of about **80 kW** and returned the bus to a relatively high State of Charge in about **2.5 hours**. During the remaining **15 hours** a relatively low power of **2.5 kW** was consumed in a "top off" mode.

**Note to operators, your charge time is dependent on many factors. The most important is power source voltage and current limitations. Most bus manufactures will provide charging system options ranging in power. We recommend reviewing them all and choosing one that works best for you needs. Consider charge time including both bulk charge and top off change modes. Top off charges are typically not necessary at every charge event. Consult the manufacture for more details.

9.3. Run 2 Discharge Results

The bus was fully charged prior to this test and data logging started just before the bus drove away from its charging station. The bus was driven in a **clock wise** direction around the test track oval until it could no longer keep up with the prescribed drive cycle speed. Then the bus was

returned directly to the charge station followed by a full charge. Data was recorded and processed, as detailed above, and is presented here.

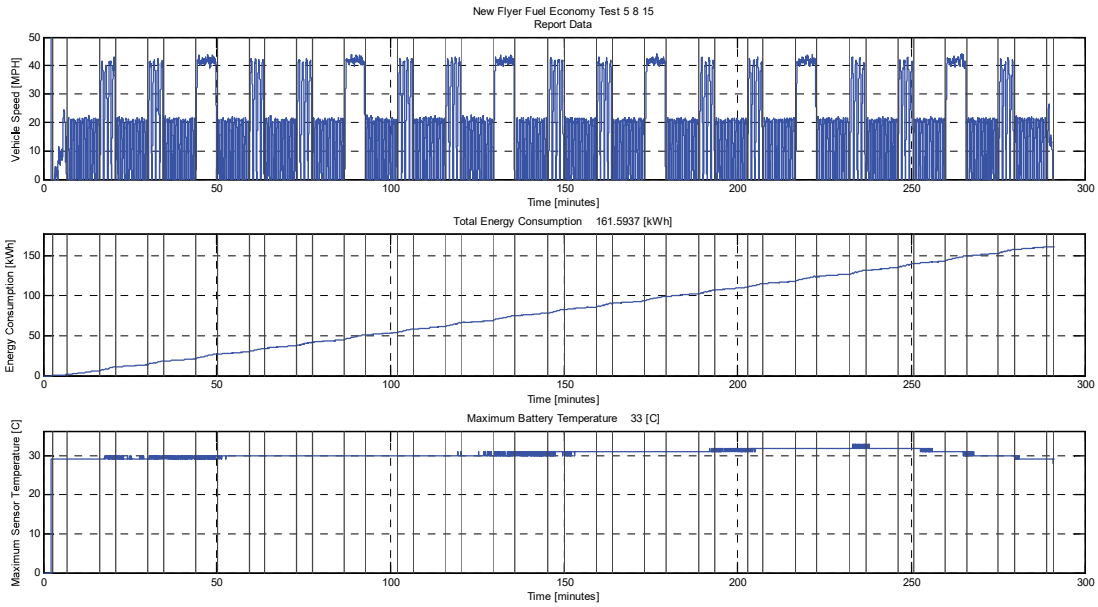

Figure 6. Run 2 Plot

The figure above shows run #2 data, logged vehicle speed and maximum temperature readings as well as post processed energy consumption. The vertical lines on these plots represent the separation between phases. There were no issues noted during the test or as part of the post processing analysis.

The following table represents the data taken at each phase and section indicated in the figure above.

Bus Number:	1405					
Date:	5/8/2015		Humidity (%):		82	
Manufacturer:	New Flyer		Barometric Pressure (in Hg) :		30.15	
Personnel:	TS, SR, MH		SLW (lbs):			
Temperature (F):	66.00		Weather Instrument Asset No.		A-58	
Wind Speed/Direction:	0 MPH, N		Wind Speed Instrument Asset No.		A-68	
Run Number:	2					
Test Direction:	CW					
	Time [min]		Battery Energy [kWh] +/- = Discharge/Charge		Relative Battery Energy Used [kWh]	Final Battery Temperature [Celsius]
Phase	Start	End	Start	End		End
Drive out to Start	2.78	6.89	0.01	1.16	1.15	29.00
CBD #1	6.89	16.26	1.16	6.13	4.97	29.00
ART #1	16.26	20.88	6.13	10.64	4.51	29.00
CBD #2	20 88	30.08	10.64	13.67	3.03	29.00
ART #2	30.08	34.70	13.67	17.92	4.25	30.00
CBD #3	34.70	43.95	17.92	21.00	3.08	29.74
Commuter	43.95	50.16	21.00	26.71	5.71	30.00
CBD #1	50.16	59.28	26.71	29.87	3.16	30.00
ART #1	59.28	63.76	29.87	34.22	4.35	30.00
CBD #2	63.76	72.96	34.22	37.46	3.24	30.00
ART #2	72.96	77.45	37.46	41.77	4.31	30.00
CBD #3	77.45	86.71	41.77	44.97	3.19	30.00
Commuter	86.71	92.89	44.97	50.69	5.72	30.00
CBD #1	92 89	102 02	50.69	53.92	3.23	30.00
ART #1	102.02	106.65	53.92	58.21	4.30	30.00
CBD #2	106.65	115 83	58.21	61.50	3.29	30.00
ART #2	115.83	120 33	61.50	66.04	4.54	30.00
CBD #3	120.33	129.66	66.04	69.20	3.17	30.00
Commuter	129.66	135 95	69.20	74.95	5.75	30.37
CBD #1	135.95	145 33	74.95	78.21	3.25	31.00
ART #1	145.33	150 07	78.21	82.72	4.51	31.00
CBD #2	150.07	159 32	82.72	86.05	3.33	31.00
ART #2	159.32	163 86	86.05	90.36	4.32	31.00
CBD #3	163.86	173.19	90.36	93.62	3.25	31.00
Commuter	173.19	179.49	93.62	99.32	5.70	31.00
CBD #1	179.49	188 84	99.32	102.64	3.32	31.00
ART #1	188.84	193.46	102.64	107.15	4.50	31.00
CBD #2	193.46	202.74	107.15	110.54	3.39	31.51
ART #2	202.74	207 32	110.54	114 97	4.43	32.00
CBD #3	207.32	216.62	114.97	118.32	3.36	32.00
Commuter	216.62	222.78	118.32	123 88	5.56	32.00
CBD #1	222.78	232.11	123.88	127.06	3.18	32.00
ART #1	232.11	236 87	127.06	131.70	4.64	32.92
CBD #2	236.87	246 05	131.70	135.31	3.60	32.00
ART #2	246.05	250.69	135.31	139 92	4.61	32.00
CBD #3	250.69	259.74	139.92	143.63	3.71	31.00
Commuter	259.74	266 00	143.63	149.61	5.98	31.00
CBD #1	266.00	275 08	149.61	153.28	3.66	30.00
ART #1	275.08	279.69	153.28	157 81	4.53	30.00
CBD #2	279.69	288 97	157.81	161.03	3.22	29.00
Drive back to Charger	288.97	290 88	161.03	161.58	0.55	29.00
Charge Data	0.00	1440	0.000	-89.600	-89.600	
	# of Phases	Avg. Energy Use [kWh]		Total Energy		
CBD	20	3.38		On Road	159.87	
ART	13	4.45		Non-Profile	1.701	
Commuter	6	5.74		Charge	-89.600	
* Charge data DOES NOT indicata a full charge! Typical Charge time is at least 2.5 hours at 80 kw						

Figure 7. Run 2 Summary

The above test resulted in the on-road energy consumption of **161.58 kWh**. Beyond the non-profile start and finish sections, **6 complete cycles and up to the 2rd CBD phase of the 7th cycle was completed**. Note, the distance driven to and from the charger and start/stop location is also accounted for but in terms of energy then applied to the vehicle range value. See section 8.5 for more detail.

Total on road fuel economy profile distance for this run: **85.95 miles**

Total on road non-fuel economy profile distance for this run: **0.93 miles**

Total range for this run: **86.88 miles**

9.4. Run 2 Charge Results

The following results are an integration of Active Power measured by a Fluke 1730 Power Meter during the charging event following this runs on-road, discharge/range test.

Once the discharge portion of run 2 was complete a full charge was started and data logged until the charge was completed.

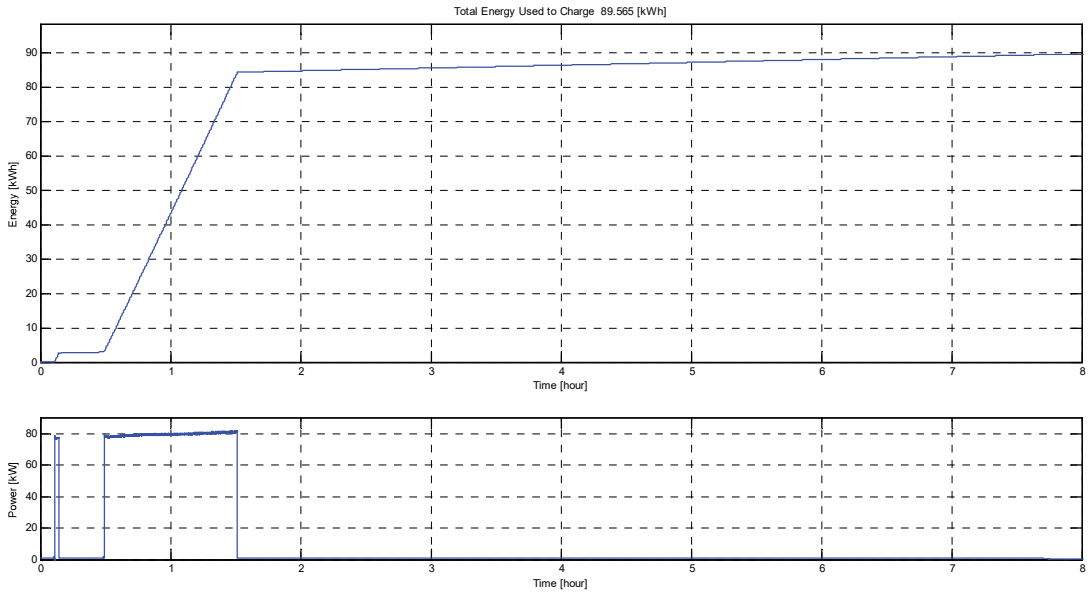

Figure 8. Run 2 Charge

This charge resulted in the consumption of ***89.56 kWh** over approximately **8 hours**. The bulk charge mode consumed power at a rate of about **80 kW** for approximately **1 hour**. During the remaining **7 hours** a relatively low power of **2.5 kW** was consumed.

*NOTE – The energy captured during this charge is about half of that used during the previous run… This indicates that event was NOT a full charge as intended and the charger was likely disabled prior to a full charge.

**Note to operators, your charge time is dependent on many factors. The most important is power source voltage and current limitations. Most bus manufactures will provide charging system options ranging in power. We recommend reviewing them all and choosing one that works best for you needs. Consider charge time including both bulk charge and top off change modes. Top off charges are typically not necessary at every charge event. Consult the manufacture for more details.

9.5. Range Results

Run #1 and #2 resulted in **87.15** and **86.88** miles range respectively for an average of **87.01 miles**. The figure below details all range calculations.

Vehicle Range

Run #1	
Total non profile energy use [kWh]:	2.20
Average Fuel Economy [kWh/Mile]:	1.84
Distance from non profile energy [Miles]:	1.20
Fuel Economy Profile Distance [Miles]:	85.95
Total Range	87.15
Run #2	
Total non profile energy use [kWh]:	1.70
Average Fuel Economy [kWh/Mile]:	1.84
Distance from non profile energy [Miles]:	0.93
Fuel Economy Profile Distance [Miles]:	85.95
Total Range	86.88
Vehicle Range [1]	
Average Vehicle Range [Miles]:	87.01

Vehicle Range [1]: Any distance driven out side the fuel economy testing, driving to and from the charger, was accounted for by using the average fuel economy and energy used during these events. See the following equation.

Additional Distance = Total Energy Used (non FE profile)[kWh] / Average Fuel Economy [kWh/Mile]

Figure 9. Range Results

Energy Economy Summary Sheet					
Bus Manufacture		New Flyer			
Bus Model					
Bus Number		1405			
Test Date		5/7/15 and 5/8/15			
Fuel Type		Electric			
Run # 1 (CCW)					
Cycle	Average Phase Energy Used [kWh]	Phase Distance [Miles]	Total Distance Traveled [Miles]	Fuel Economy [kWh/Mile]	Fuel Economy [MPG] Diesel Equivalent [4]
CBD	3.29	1.91	38.20	1.72	21.86
ART	4.28	1.91	24.83	2.24	16.78
COM	5.70	3.82	22.92	1.49	25.22
Run # 2 (CW)					
Cycle	Average Phase Energy Used [kWh]	Phase Distance [Miles]	Total Distance Traveled [Miles]	Fuel Economy [kWh/Mile]	Fuel Economy [MPG] Diesel Equivalent [4]
CBD	3.38	1.91	38.20	1.77	21.25
ART	4.45	1.91	24.83	2.33	16.17
COM	5.74	3.82	22.92	1.50	25.06
Run Consistency: % difference from overall average of total electrical energy used					
Total Energy Use Run # 1 [kWh] [5]				155.70	
Total Energy Use Run # 2 [kWh] [5]				159.87	
Average Electrical Energy Used [kWh] :				157.78	
Run # 1/2 Consistency[%] :				1.320	
Summary					
				Fuel Economy [kWh/Mile]	Fuel Economy [MPG] Diesel Equivalent [4]
Average CBD Phase Consumption				1.75	21.55
Average Arterial Phase Consumption				2.29	16.47
Average Commuter Phase Consumption				1.50	25.14
Overall Average Consumption				1.84	20.50
Fuel Economy [MPG] Diesel Equivalent [4]: EPA EV Mode Fuel Economy Fuel Economy					
Labeling of Advanced Technologies (neglecting 5-cycle corrections)					
$FE_{MPGe} = (E_D \times 100) / FC_{EV}$					
where:					
FE_{MPGe} = Fuel Economy in miles per gallon diesel equivalent					
FC_{EV} = Measured unadjusted electrical consumption [kWh/100Mile]					
E_D= Energy content per gallon of diesel = 128,450 BTU/gallon = 37.64 kWh/gallon					
[US DoE, Alternative Fuels & Advanced Vehicles Data Center]					
Total Energy Use Run # 1/2 [kWh] [5] : Total energy used during phases used for fuel economy calculation					

Figure 10. Report Summary Sheet

11 Related Document Index

The following documents are referenced or related to this document.

Doc Num	Description	Type	Date
1	calculate_sort.m	.m	5/15/15
2	plot_data.m	.m	6/16/15
3	preliminary_review.m	.m	6/16/15
4	process_data.m	.m	2/1/15
5	New Flyer Fuel Economy Test 5 7 15	.mat	8/12/15
6	New Flyer Fuel Economy Test 5 8 15	.mat	8/14/15
7	New Flyer 5_7_15.fel	.fel	5/8/15
8	New Flyer 5_8_15.fel	.fel	5/14/15
9	process_1730_data.m	.m	6/16/15
10	New Flyer 5_7-8_15.xlsx	.xlsx	8/14/15
11	NewFlyer_FE.cfg	.cfg	5/8/15
12	537697N.dbc	.dbc	1/30/15
13	ECU_Power_Energy.dbc	.dbc	11/25/14

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.

2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the Test Track Facility.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the Test Track and the Bus Testing Center.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80.0 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 47.0 dB(A); ranging from 45.5 dB(A) at the rear passenger seats to 47.9 dB(A) in line with the rear speaker. The interior ambient noise level for this test was < 30.0 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 66.4 dB(A) at the front passenger seats to 70.2 dB(A) at the rear passenger seats. The overall average was 68.6 dB(A). The interior ambient noise level for this test was < 30.0 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 1405	Date: 06-20-14
Personnel: T.S., E.D. & S.R.	
Temperature (°F): 79	Humidity (%): 32
Wind Speed (mph): < 12	Wind Direction: Variable
Barometric Pressure (in.Hg): 28.94	
Initial Sound Level Meter Calibration: ■ checked by: T.S.	
Interior Ambient Noise Level dB(A): < 30.0	Exterior Ambient Noise Level dB(A): 43.2
Microphone Height During Testing (in): 29" above seat cushion	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	46.5
Front Passenger Seats	47.4
In Line with Front Speaker	46.9
In Line with Middle Speaker	47.7
In Line with Rear Speaker	47.9
Rear Passenger Seats	45.5

Final Sound Level Meter Calibration: ■ checked by: E.D.

Comments: All readings taken in the center aisle.
Remarks/comments/recommended changes: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 1405	Date: 7-9-15
Personnel: S.R., E.D. & C.S.	
Temperature (°F): 72	Humidity (%): 82
Wind Speed (mph): 2	Wind Direction: N
Barometric Pressure (in.Hg): 30.02	
Initial Sound Level Meter Calibration: ■ checked by: S.R.	
Interior Ambient Noise Level dB(A): < 30.0	Exterior Ambient Noise Level dB(A): 43.1
Microphone Height During Testing (in): 29" from seat cushion.	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	69.3
Front Passenger Seats	66.4
Middle Passenger Seats	68.5
Rear Passenger Seats	70.2

Final Sound Level Meter Calibration: ■ checked by: S.R.

Comments: All readings taken in the center aisle.
Remarks/comments/recommended changes: None noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 57	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted.
Windows and Doors	None noted.
Seats and Wheel Chair lifts	None noted.

Comment on any other vibration or noise source which may have occurred
that is not described above: None noted.
Remarks/comments/recommended changes: None noted.

7.1 INTERIOR NOISE TEST



TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission up shift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the PSBRTF and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 43.6 dB(A), the average test result obtained while accelerating from a constant speed was 66.1 dB(A) on the right side and 66.1 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 44.1 dB(A), the average of the results obtained were 64.5 dB(A) on the right side and 64.9 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 48.8 dB(A) at idle. With the accessories and air conditioning off, the readings averaged 9.6 dB(A) lower at idle. Note; this electric bus is not equipped with high idle and wide open throttle positions. The exterior ambient noise level measured during this test was 43.9 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 66	Humidity (%): 39
Wind Speed (mph): 5	Wind Direction: S
Barometric Pressure (in.Hg): 30.19	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.R.	
Initial Sound Level Meter Calibration: ■ checked by: S.R.	
Exterior Ambient Noise Level dB(A): 43.6	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	63.7	1	64.8
2	64.6	2	66.4
3	66.1	3	65.1
4	66.0	4	65.8
5	65.0	5	65.1
Average of two highest actual noise levels = 66.1 dB(A)		Average of two highest actual noise levels = 66.1 dB(A)	
Final Sound Level Meter Calibration Check: ■ checked by: E.D.			
Remarks/Comments/recommended changes: None noted.			

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 67	Humidity (%): 38
Wind Speed (mph): 5	Wind Direction: S
Barometric Pressure (in.Hg): 30.19	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.R.	
Initial Sound Level Meter Calibration: ■ checked by: S.R.	
Exterior Ambient Noise Level dB(A): 44.1	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	62.8	1	62.5
2	64.9	2	65.6
3	64.0	3	64.1
4	63.5	4	62.9
5	63.4	5	62.4
Average of two highest actual noise levels = 64.5 dB(A)		Average of two highest actual noise levels = 64.9 dB(A)	

Final Sound Level Meter Calibration Check: ■ checked by: E.D.
Remarks/comments/recommended changes: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 1405	Date: 04-13-15
Personnel: S.R., E.D. & M.R.	
Temperature (°F): 67	Humidity (%): 39
Wind Speed (mph): 7	Wind Direction: S
Barometric Pressure (in.Hg): 30.19	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ■ checked by: S.R.

Initial Sound Level Meter Calibration: ■ checked by: S.R.

Exterior Ambient Noise Level dB(A): 43.9

Accessories and Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	49.3	48.3
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Accessories and Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	N/A	38.9	39.4
High Idle	N/A	N/A	N/A
Wide Open Throttle	N/A	N/A	N/A

Final Sound Level Meter Calibration Check: ■ checked by: S.R.

Remarks/Comments/recommended changes: This electric bus is not equipped with high idle and wide open throttle.

7.2 EXTERIOR NOISE TESTS



TEST BUS UNDERGOING
EXTERIOR NOISE TESTING



FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT
In accordance with 49 CFR, Part 665

Manufacturer: NEW FLYER OF AMERICA
Model: XE60

PARTIAL TEST

APRIL 2019

Report Number: LTI-BT-R1903-P

The Thomas D. Larson
Pennsylvania Transportation Institute
201 Transportation Research Building
The Pennsylvania State University
University Park, PA 16802
(814) 865-1891

Bus Testing and Research Center
2237 Plank Road
Duncansville, PA 16635
(814) 695-3404



PennState
College of Engineering

LTI BUS RESEARCH
AND TESTING CENTER

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration, U.S. DOT
1200 New Jersey Avenue, SE
Washington, DC 20590

In accordance with 49 CFR Part, 665

Manufacturer: NEW FLYER OF AMERICA
Manufacturer's address: 214 5TH AVENUE SW
CROOKSTON, MN 56716

Model: XE60

PARTIAL TEST

Report Number: LTI-BT-R1903-P



Quality Authorization	Director, Bus Research and Testing Center Title	4-23-19 Date

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3. SAFETY

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EXECUTIVE SUMMARY

TEST HIGHLIGHTS

The Check-In section of the report provides a description of the bus and specifies its major components. The following table gives the salient specifications.

Manufacturer	New Flyer of America
Model	XE60
Chassis Make/Model	New Flyer / Xcelsior
Chassis Modified	No
Length	60 feet, 7 ¼ inches
Fuel	Battery Electric
Service Life	Partial – 12 year / 500,000 miles
Number of Seats (including driver)	51 or 45 +2 wheelchairs
Manufacturer-Designated Standing Passenger Capacity	69
Gross Vehicle Weight used for testing	70,170
Gross Vehicle Weight Rating – Declared by Manufacturer	72,488
Mileage at Delivery	4,715
Test Start Date	01/21/19
Test Completion Date	03/12/19

The measured curb weight was 10,800 lb. for the front axle, 19,150 lb. for the middle axle and 22,120 lb. for the rear axle. These combined weights provided a total measured curb weight of 52,070 lb. There are 51 seats including the driver and free floor space for 69 standing passengers bringing the potential total capacity to 120 persons. Therefore gross load is calculated as 150 lb. x 120 = 18,000 lb. At full declared capacity, the measured gross vehicle weight was 70,170 lb.

The FTA determined that this bus be tested for safety double lane change, safety braking and energy economy and range; the baseline full Bus Testing report for this test is LTI-BT-R1615.

This bus was charged using a diesel generator-charger that was provided by the manufacturer.

ABBREVIATIONS AND ACRONYMS

ABS - anti-skid braking system
ABTC - Altoona Bus Test Center
A/C - air conditioner, or air conditioning
AC - alternating current
ADA - American Disability Act
CDCTS - chassis dynamometer test control system
CVS - constant volume sampling
CW - curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A) - decibels with reference to 0.0002 microbar as measured on the "A" scale
DC - direct current
DIR - test director
DR - bus driver
EPA - Environmental Protection Agency
GAWR – gross axle weight rating
GVL - gross vehicle load (150 lb. for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW - gross vehicle weight (curb weight plus gross vehicle load)
GVWR - gross vehicle weight rating
HD-UDDS – Heavy Duty-Urban Dynamometer Driving Schedule
LTI - Larson Transportation Institute
mpg - miles per gallon
mph - miles per hour
PM - Preventive maintenance
PSTT - Penn State Test Track
rpm - revolutions per minute
SAE - Society of Automotive Engineers
SCF - Standard cubic foot
SCH - test scheduler
SA - staff assistant
SLW - seated load weight (curb weight plus 150 lb. for every designed passenger seating position and for the driver)
TD - test driver
TECH - test technician
TM - track manager
TP - test personnel
Wh - Watt hour

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consisted of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer certified that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consisted of New Flyer of America, model XE60. The bus has a front passenger door located forward of the front axle, a passenger door located between the front and middle axles and a rear passenger door between the middle and rear axles. Power is provided by a battery pack coupled to a Siemens 1DB2016-1NB06 drive motor in the rear axle and a driven center axle, ZF AVE130, with individual wheel motors.

The measured curb weight was 10,800 lb. for the front axle, 19,150 lb. for the middle axle and 22,120 lb. for the rear axle. These combined weights provided a total measured curb weight of 52,070 lb. There are 51 seats including the driver and free floor space for 69 standing passengers bringing the potential total capacity to 120 persons. Therefore gross load is calculated as 150 lb. x 120 = 18,000 lb. At full declared capacity, the measured gross vehicle weight was 70,170 lb.

The FTA determined that this bus be tested for safety double lane change, safety braking and energy economy and range; the baseline full Bus Testing report for this test is LTI-BT-R1615.

This bus was charged using a diesel generator-charger that was provided by the manufacturer.

VEHICLE DATA FORM

Bus Number: 1903-P	Date of Check-In: 01-21-19
Bus Manufacturer: New Flyer of America	Vehicle Identification Number (VIN): 5FYB8YJ0XHB051875
Model Number: XE60	Chassis Mfr./Mod.#: New Flyer / Xcelsior
Personnel: T.S., T.G. & E.D.	Starting Odometer Reading: 4,715

WEIGHT:

Individual Wheel Reactions:

Weights (lb.)	Front Axle		Middle Axle		Rear Axle	
	Curb	Street	Curb	Street	Curb	Street
CW	5,340	5,460	9,870	9,280	10,880	11,240
SLW	5,940	6,340	10,550	11,340	12,720	13,250
GVW	7,030	7,130	13,820	13,950	13,410	14,830

Total Weight Details:

Weight (lb.)	CW	SLW	GVW	GAWR
Front Axle	10,800	12,280	14,160	15,520
Middle Axle	19,150	21,890	27,770	28,484
Rear Axle	22,120	25,970	28,240	28,484
Total	52,070	60,140	70,170	GVWR: 72,488 Declared by manufacturer

Dimensions:

Length (ft/in)	60/7 ¼
Width (in)	102
Height (in)	133
Front Overhang (in)	86 ¼
Rear Overhang (in)	119 ¾
Wheel Base (in)	Front: 229 ¼ Rear: 292
Wheel Track (in)	Front: 86.9
	Middle: 77.1
	Rear: 75.4

Bus Number: 1903-P	Date: 01-21-19

CLEARANCES:

Lowest Point Outside Front Axle	Location: Skid Plate Clearance(in): 8.6
Lowest Point Outside Rear Axle	Location: Frame Clearance(in): 12.6
Lowest Point between Axles	Location: Front: Frame Clearance(in): 9.7 Rear: Jack Pad Clearance (in): 9.1
Ground Clearance at the center (in)	Front: 9.7 Rear: 9.1
Front Approach Angle (deg)*	7.2
Rear Approach Angle (deg)*	9.5
Ramp Clearance Angle (deg)	Front: 4.8 Rear: 3.5
Aisle Width (in)	Front: 22.3 Rear: 22.4
Inside Standing Height at Center Aisle (in)	Front: 84.8 Rear: 79

*measurements used to calculate approach and departure angles are taken from the center-line of the axles.

BODY DETAILS:

Body Structural Type	Monocoque		
Frame Material	Hybrid Carbon / Stainless steel		
Body Material	Composite		
Floor Material	Plywood		
Roof Material	Composite		
Windows Type	■ Fixed - Bottom	■ Movable - Top	
Window Mfg./Model No.	Excel / AS3 M6 3/16G DOT 573		
Number of Doors	1 Front	1 Middle	1 Rear
Mfr. / Model No.	Vapor Bus International / Electric Slide Glide		
Dimension of Each Door (in)	Front: 77.8 x 33.9	Middle: 77.5 x 40.8	Rear:77.7 x 40.4
Passenger Seat Type	■ Cantilever	■ Pedestal	□ Other (explain)
Driver Seat Type	■ Air	□ Spring	□ Other (explain)
Mfr. / Model No.	Recaro / Ergo AM80		
Number of Seats (including Driver)	51 or 45 + 2 wheelchairs		

Bus Number: 1903-P	Date: 01-21-19

BODY DETAILS (Contd.)

Free Floor Space (ft^2)	111.3		
Height of Each Step at Normal Position (in)	Front 1. 12.7	2. N/A	3. N/A 4. N/A
	Middle 1. 13.4	2. N/A	3. N/A 4. N/A
	Rear 1. 13.7	2. N/A	3. N/A 4. N/A
Step Elevation Change - Kneeling (in)	Front: 4.9	Middle: 1.7	Rear: +.5

ENGINE

Type	☐ C.I.	☐ Alternate Fuel	
	☐ S.I.	■ Other (explain) – Electric Bus	
Mfr. / Model No.	N/A		
Location	☐ Front	☐ Rear	☐ Other (explain)
Fuel Type	☐ Gasoline	☐ CNG	☐ Methanol
	☐ Diesel	☐ LNG	■ Other (Electric)
Alternator (Generator) Mfr./Model No.	N/A		
Maximum Rated Output (Volts / Amps)	N/A		
Air Compressor Mfr. / Model No.	Powerex / SDCH050704-NF		
Maximum Capacity (ft^3 / min)	12.1 CFM @ 125 PSIG		
Starter Type – N/A	☐ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	N/A		

Bus Number: 1903-P	Date: 01-21-19

TRANSMISSION

Transmission Type – Drive Motor	☐ Manual	■ Automatic	☐ Load Sensing Adaptive
Mfr. / Model No.	Siemens / 1DB2016-1NB06		
Control Type	☐ Mechanical	■ Electrical	☐ Other
Integral Retarder Mfr. / Model No.	☐ Yes	■ No	

SUSPENSION

Number of Axles	3		
Front Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	MAN / VOK-07-F		
Axle Ratio (if driven)	N/A		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 902517 SPI		
Middle Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	ZF / AVE 130-NF1		
Axle Ratio (if driven)	22.66:1		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	4		
Mfr. / Model No.	Koni / 90518 SPI		
Rear Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	MAN / HY-1350-F		
Axle Ratio (if driven)	5.67:1		
Suspension Type	■ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	4		
Mfr. / Model No.	Koni / 902518 SPI		

Bus Number: 1903-P	Date: 01-21-19

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Alcoa Durabright EVO / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin / X incity 305/70R22.5
Rear	Wheel Mfr./ Model No.	Alcoa Durabright EVO / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin / X incity 305/70R22.5

BRAKES

Front Axle Brakes Type	☐ Cam	■ Disc	☐ Other (explain)
Mfr. / Model No.	Knorr / SN7000		
Middle Axle Brakes Type	☐ Cam	■ Disc	☐ Other
Mfr. / Model No.	Knorr / SB7000		
Rear Axle Brakes Type	☐ Cam	■ Disc	☐ Other (explain)
Mfr. / Model No.	Knorr / SN7000		

HVAC

Heating System Type	☐ Air	■Water	☐ Other
Capacity (Btu/hr)	Roof: 105,000 Rear: 98,000		
Mfr. / Model No.	Roof: Thermo King / RFLE2C-M1 Rear: Thermo King / TE1		
Air Conditioner	■ Yes	☐ No	
Location	Roof: Thermo King/ RLFE2C-M1 Rear: Thermo King / TE15-M3		
Capacity (Btu/hr)	Roof: 78,000 Rear: 72,000		
A/C Compressor Mfr. / Model No.	Roof: (2) Thermo King / ZR48 Rear: (1) Thermo King / ZR42 & (1) Thermo King / ZR61		

STEERING

Steering Gear Box Type	Hydraulic Gear		
Mfr. / Model No.	RH Sheppard / M110 Auto		
Steering Wheel Diameter	18.1		
Number of turns (lock to lock)	4		
Control Type	☐ Electric	■ Hydraulic	☐ Other (explain)

Bus Number: 1903-P	Date: 01-21-19

OTHERS

Wheel Chair Ramps	Location: Front	Type: Fold out
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	New Flyer / 32" wide flip out ramp with 1:7 slope	
Emergency Exit	Location: Window Door Roof Hatch	Number: 6 3 2

CAPACITIES

Fuel Tank Capacity (gallons)	N/A
Engine Crankcase Capacity (gallons)	N/A
Transmission Capacity (gallons)	N/A
Differential Capacity (gallons)	Rear: 3.83 Center: 1
Cooling System Capacity (gallons)	22.2
Power Steering Fluid Capacity (gallons)	6

BATTERY SYSTEM

Maximum Rated Capacity (kWh)	600
Usable Capacity (kWh)	540
Nominal Voltage (Vdc)	688

PROPULSION CONTROL SYSTEM (Middle Axle)

Propulsion Control System Mfr. / Model No.	Siemens / ELFA 2 Drive System
Traction Motor - Mfr. / Model No.	ZF / AVE130
Traction Motor Power rating (kW)	Output Power Max: 2x125kW (2x167.6HP) Wheel Torque Max: 2x11,000 Nm (2x8113.2 lb.ft)

PROPULSION CONTROL SYSTEM (Rear Axle)

Propulsion Control System Mfr. / Model No.	Siemens / ELFA 2 Drive System
Traction Motor - Mfr. / Model No.	Siemens / 1DB2016-1NB06
Traction Motor Power rating (kW)	160 kW (214.6 HP); Torque 2400 Nm (1770 lb.ft.)

VEHICLE DATA FORM

Bus Number: 1903-P	Date: 01-08-19

List all spare parts, tools and manuals delivered with the bus.

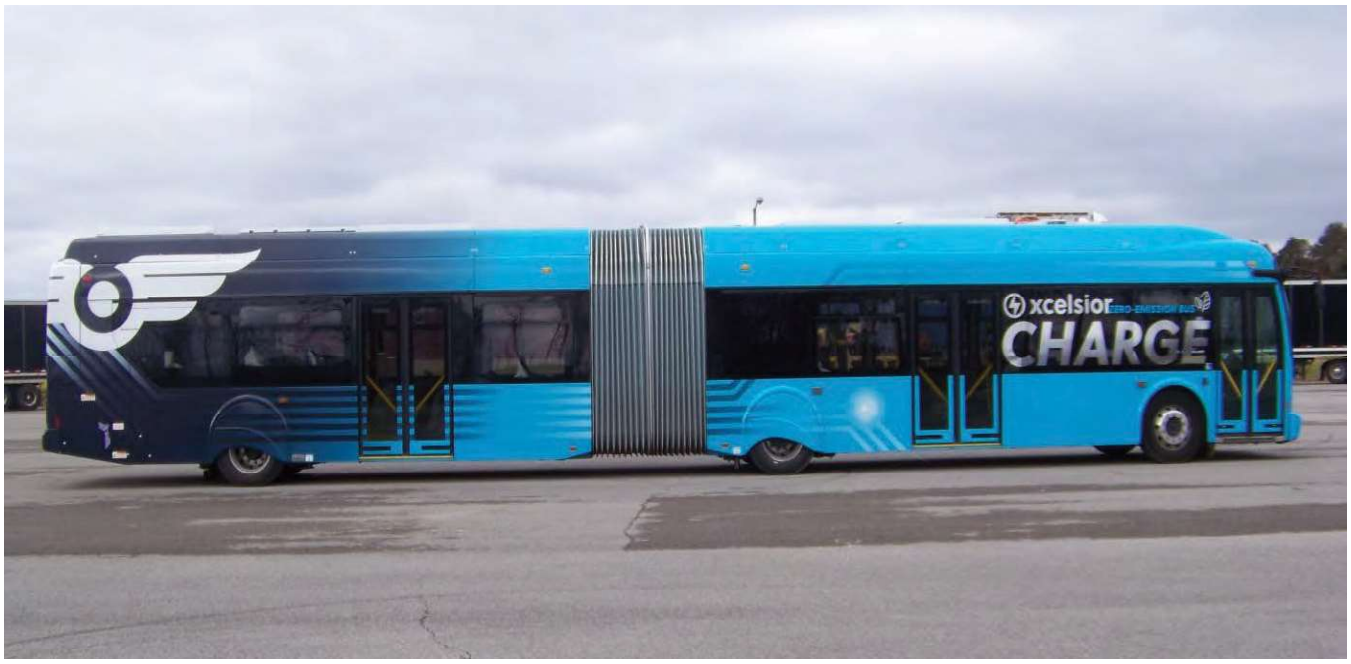
Part Number	Description	Qty.
N/A	N/A	N/A

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 1903-P	Date: 01-08-19

Subsystem	Checked	Initials	Comments
Air Conditioning Heating and Ventilation	✓	E.D.	N/A
Body and Sheet Metal	✓	E.D.	N/A
Frame	✓	E.D.	N/A
Steering	✓	E.D.	N/A
Suspension	✓	T.S.	N/A
Interior/Seating	✓	E.D.	N/A
Axles	✓	T.S.	N/A
Brakes	✓	E.D.	N/A
Tires/Wheels	✓	E.D.	N/A
Exhaust	✓	E.D.	N/A
Fuel System	✓	T.S.	Electric Bus
Power Plant	✓	T.S.	Electric Bus
Accessories	✓	E.D.	N/A
ADA Accessible Lift System	N/A	E.D.	N/A
ADA Accessible Ramp System	✓	E.D.	N/A
Interior Fasteners	✓	E.D.	N/A
Batteries	✓	T.S.	N/A

CHECK – IN



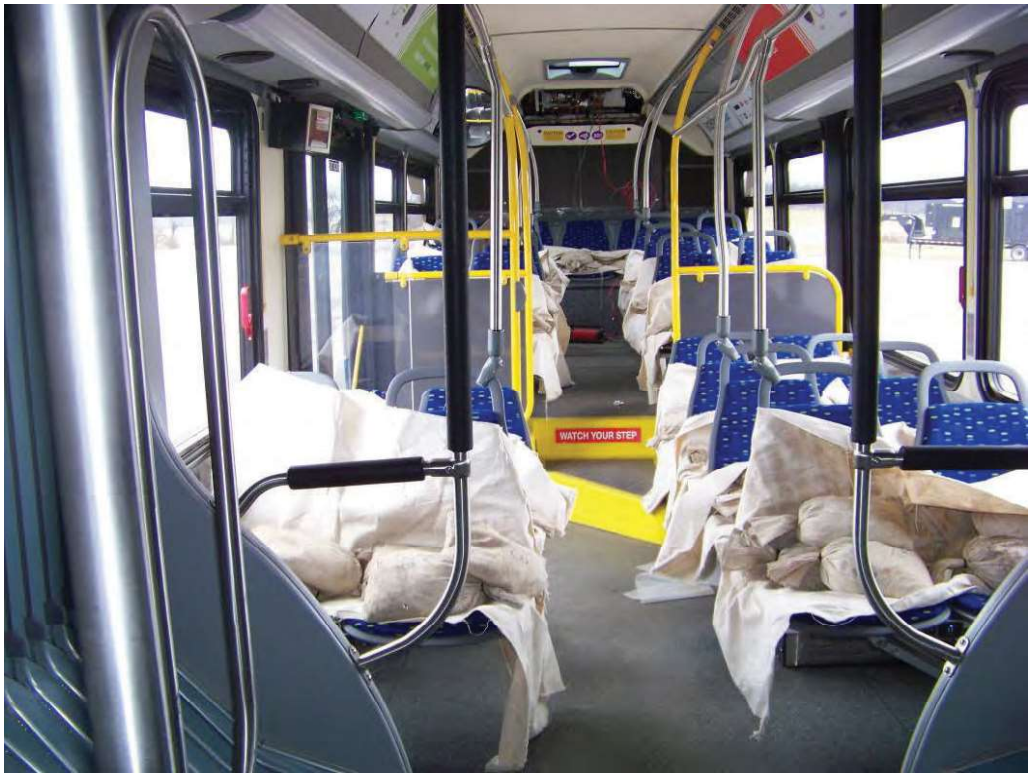
NEW FLYER OF AMERICA
MODEL XE60



CHECK - IN CONT.

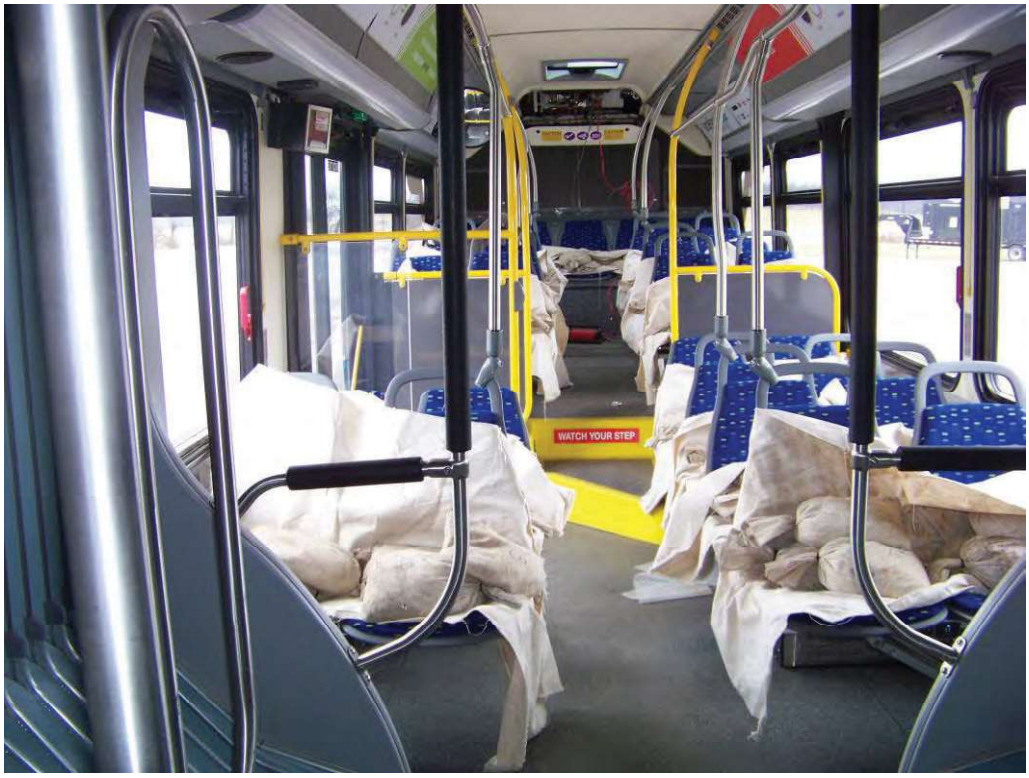


OPERATOR'S AREA

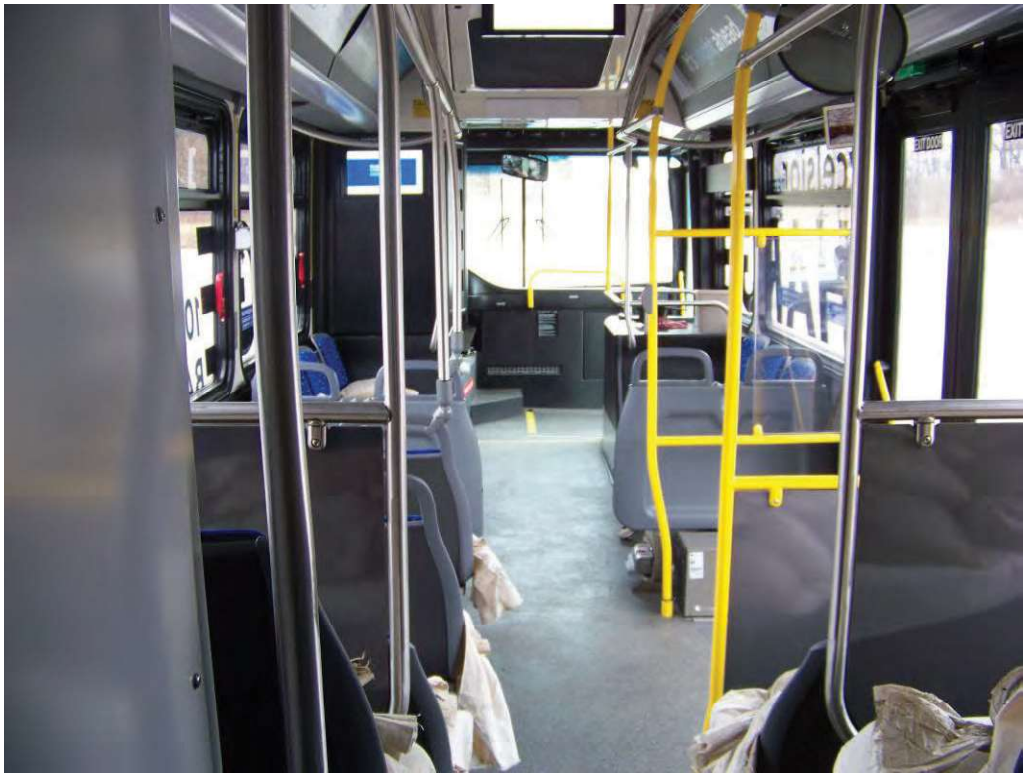


INTERIOR FROM FRONT (FRONT CAR)

CHECK - IN CONT.

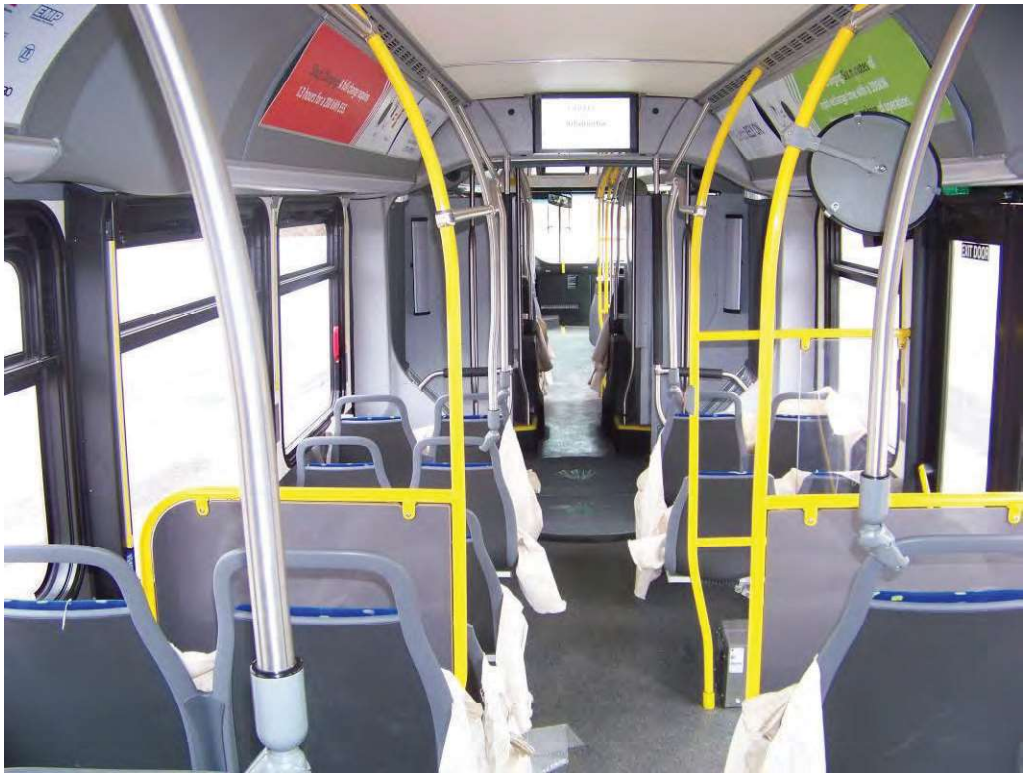


INTERIOR FROM FRONT (REAR CAR)

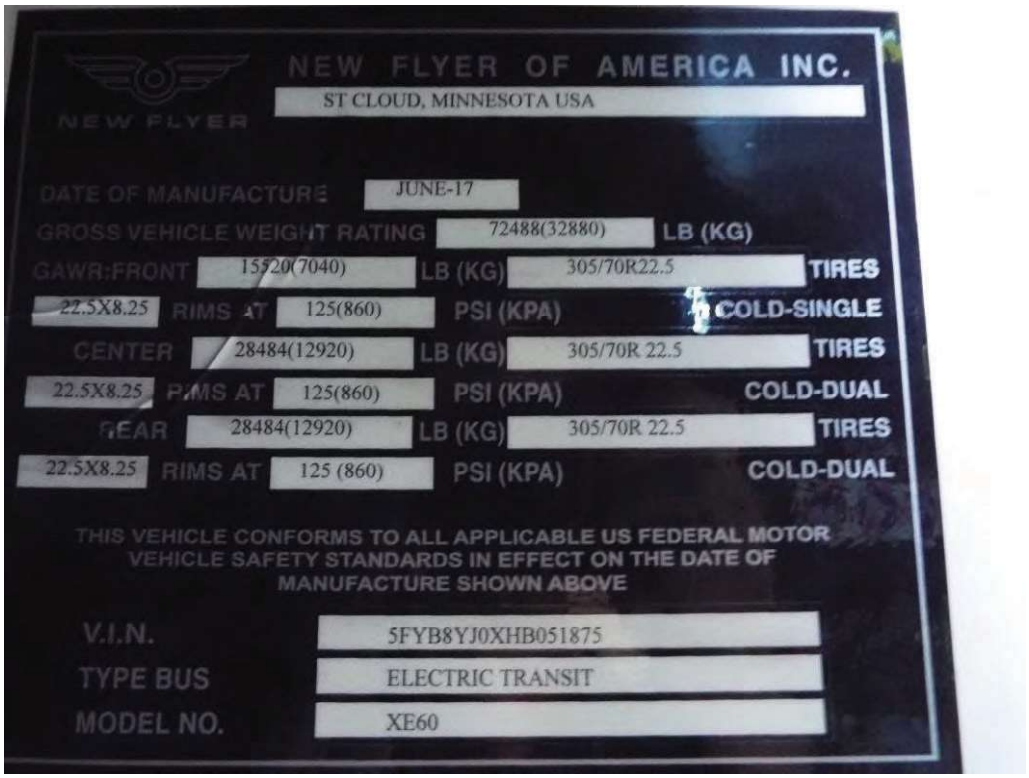


INTERIOR FROM REAR (FRONT CAR)

CHECK - IN CONT.



INTERIOR FROM REAR (REAR CAR)



VIN TAG



PLACARD SHOWING MAXIMUM STANDING PASSENGERS

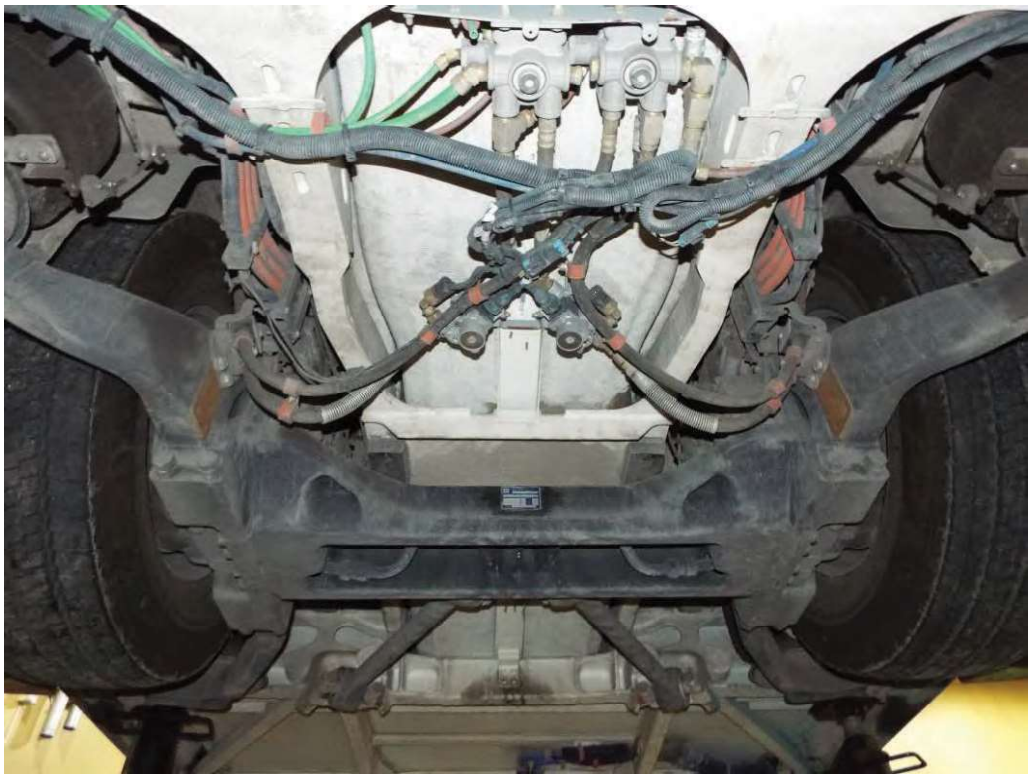


PROPULSION ELECTRONICS RACK

CHECK - IN CONT.



REAR AXLE ELECTRIC DRIVE MOTOR



CENTER AXLE WITH INDIVIDUAL DRIVE MOTORS ON EACH WHEEL

CHECK - IN CONT.



DIESEL GENERATOR CHARGER ON TRAILER



CHARGING UNIT IN TRAILER

3.1 SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3.1-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3.1-II. TEST DESCRIPTION

The Safety Test consisted of an obstacle avoidance maneuver to evaluate the handling and stability of the bus. The test was conducted at the LTI test track on the vehicle dynamics pad. The bus was driven through a double-lane change course at increasing speeds until the test was determined to be unsafe or a speed of 45 mph is reached. The test is determined unsafe if vehicle handling becomes unstable or if any of the tires lose contact with the pavement. This test is conducted at SLW.

The layout of the test course was defined by placing pylons along painted guidelines that delineated the course. The guidelines marked off two 12 foot center-to-center lanes. Each lane had two 100 foot long gates with a spacing distance of 100 feet between them. The bus entered the test course in one lane, crossed over to the other lane within the 100 foot gate, traveled for 100 feet, and then returned back into the original lane within the next 100 foot gate. This maneuver was repeated from 20 mph with speed increasing in increments of 5 mph. The test was performed starting from both the right and left lanes.

A test run is considered valid if the bus is able to perform the maneuver at a constant speed without deviating from the test course or striking pylons. If the bus is not able to successfully complete the maneuver due to vehicle instability, the test will be terminated. The highest speed at which the maneuver can be successfully performed up to a maximum speed of 45 mph is recorded on the Safety Data Form.

3.1-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph.

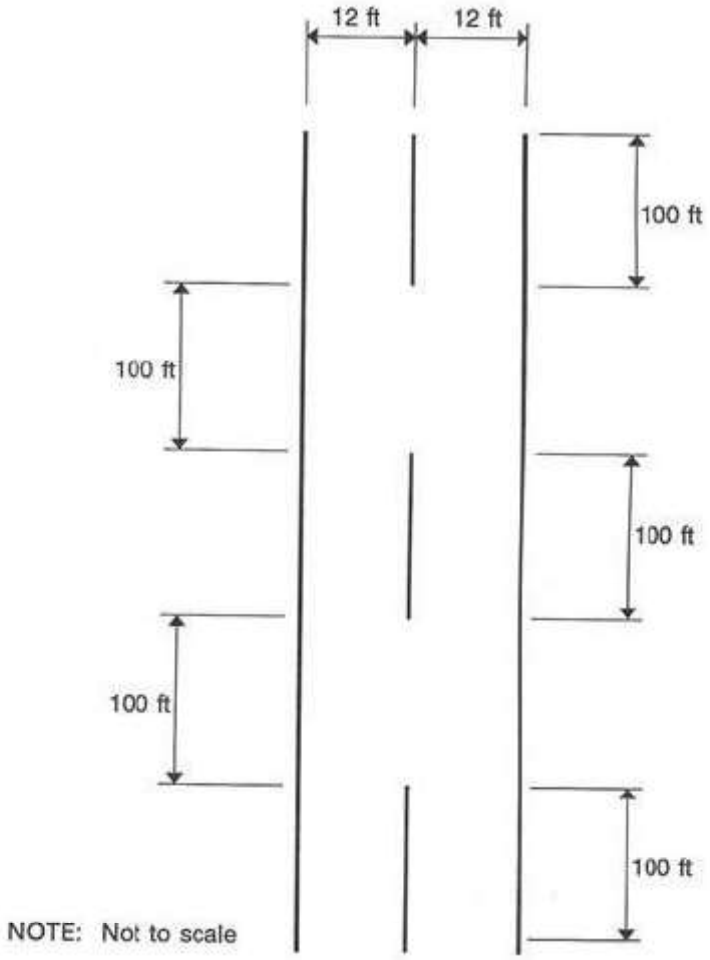


Figure 3.1. Double lane change test course

SAFETY DATA FORM

Bus Number: 1903-P	Date: 02-27-19
Personnel: S.R. & E.D.	

Temperature (°F): 34	Humidity (%): 56
Wind Direction: S	Wind Speed (mph): 5
Barometric Pressure (in.Hg): 30.04	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change:	
Bus maintained an upright position during the lane changes.	
Comments of the tire/ground contact patch:	
Tires maintained contact with ground throughout test.	

3.1 SAFETY



RIGHT - HAND APPROACH



LEFT - HAND APPROACH

3.2 Safety - Braking

3.2 I. TEST OBJECTIVE

The objective of this test is to provide, for comparison purposes, braking performance data on transit buses produced by different manufacturers.

3.2 II. TEST DESCRIPTION

The testing was conducted at the LTI Test Track skid pad area. Brake tests were conducted after completion of the GVW portion of the vehicle durability test. At this point in testing the brakes have been subjected to a large number of braking snubs and will be considered well burnished. For buses that have not completed Durability Testing, the brakes will be burnished according to the test procedure. Testing was performed when the bus was fully loaded at its GVW. All tires on each bus were representative of the tires on the production model vehicle and inflated to the bus manufacturer's specified pressures.

The brake testing procedure is comprised of three phases:

1. Stopping distance tests

    i. Dry surface (high-friction, Skid Number within the range of 70-76)
    ii. Wet surface (low-friction, Skid Number within the range of 30-36)

2. Stability tests
3. Parking brake test

3.2-III. DISCUSSION

The results of the Stopping Distance phase of the Brake Test are available in table 3.2-2. There was no deviation from the test lane during the performance of the Stopping Distance phase. The bus passed this portion of the test.

During the Stability phase of Brake Testing the test bus experienced no deviation from the test lane during both approaches to the Split Friction Road surface.

The Parking Brake phase was completed with the test bus maintaining the parked position for the full five minute period with no slip or roll observed in both the uphill and downhill positions.

Table 3.2-1. Braking Test Data Forms

Bus Number: 1903-P	Date: 02-22-19
Personnel: S.R., E.D., E.L. & F.T.	
Amb. Temperature (ºF): 38	Wind Speed (mph): Calm
Wind Direction: SE	Pavement Temp (°F) Start: 43 End: 46

TIRE INFLATION PRESSURE (psi):

Tire Type: Front: Michelin X Incity 305 70R 22.5
Middle: Michelin X Incity 305 70R 22.5
Rear: Michelin X Incity 305 70R 22.5

	Left Tire(s)		Right Tire(s)	
Front	125		125	
	Inner	Outer	Inner	Outer
Middle	125	125	125	125
Rear	125	125	125	125

AXLE LOADS (lb.)

	Left	Right
Front	7,130	7,030
Middle	13,950	13,820
Rear	14,830	13,410

Table 3.2-2. Stopping Distance Test Results Form
(longest stopping distance in each test condition in bold)

Stopping Distance (ft)					
Vehicle Direction	CW	CW	CCW	CCW	
Speed (mph)	Stop 1	Stop 2	Stop 3	Stop 4	**Average**
20 (dry)	**31.55**	26.83	26.86	29.88	28.78
30 (dry)	64.45	62.12	**65.14**	56.38	62.02
40 (dry)	104.07	114.50	**126.11**	101.28	111.49
45 (dry)	126.24	131.20	131.75	**136.64**	131.45
20 (wet)	30.86	29.97	29.12	**34.53**	31.12

Table 3.2-3. Stability Test Results Form

Stability Test Results (Split Friction Road surface)			
Vehicle Direction	Attempt	Did test bus stay in 12' lane? (Yes/No)	Comments
Driver side on high friction	1	Yes	None noted.
	2	Yes	None noted.
Driver side on low friction	1	Yes	None noted.
	2	Yes	None noted.

Table 3.2-4. Parking Brake Test Form

PARKING BRAKE (Fully Loaded) – GRADE HOLDING						
Vehicle Direction	Attempt	Hold Time (min)	Slide (in)	Roll (in)	Did Hold	No Hold
Front up	1	5:00	N/A	N/A	✓	
	2	N/A	N/A	N/A	N/A	N/A
	3	N/A	N/A	N/A	N/A	N/A
Front down	1	5:00	N/A	N/A	✓	
	2	N/A	N/A	N/A	N/A	N/A
	3	N/A	N/A	N/A	N/A	N/A

Table 3.2-5. Record of All Braking System Faults/Repairs.

Date	Fault/Repair	Description
02-22-19	None noted.	None noted.

3.2 Safety - Bus Braking



PARKING BRAKE TEST
PARKING BRAKE HELD FOR 5 MINUTES IN
BOTH 20% UP AND 20% DOWN POSITIONS



6. ENERGY ECONOMY AND RANGE TEST – AN ENERGY CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable energy consumption data on transit buses produced by different manufacturers. This energy economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This energy economy test, as designated here, is a measurement of the energy expended by a vehicle traveling a specified test loop under specified operating conditions. The results of this test will not represent actual mileage but will provide data that can be used by recipients to compare buses tested by this procedure.

In accordance with FTA policy for two-axle drive buses, this test was performed at the PSBRTC test track using CBD, Arterial, and Commuter drive cycles.

6-II. TEST DESCRIPTION

This test requires operation of the bus over a course based on the Transit Coach Operating Duty Cycle (ADB Cycle) at seated load weight using a procedure based on 'Battery Electric Vehicle Energy Consumption and Range Test Procedure J1634_201707', as practically determined by the FTA Energy Consumption Testing Protocol developed by Penn State University.

The tests were conducted on the bus test lane at the test track at LTI. Signs are erected at carefully measured points which delineate the test course. The test was started with a fully charged battery. A test run was comprised of three CBD phases, two Arterial phases, and one Commuter phase, described later in this section. A test run was completed in the clockwise and counterclockwise direction to minimize effects of grade and wind. At the end of this run, the bus was run at constant speed (40 mph) on the test track until the battery SOC reached approximately 50%, as shown on the vehicle's dashboard. Another test run comprising of the same three phases above was then run in the counterclockwise and clockwise directions. At the end of this test run, the bus was again run at constant speed (40 mph). The 'end of test' was determined when the vehicle could not keep up 40 mph. The depleted battery was then fully charged, and the AC and DC energy required to charge the battery back to full capacity was measured.

Energy consumption during the test runs and constant speed runs was measured from the CAN bus using a Data Acquisition System. Data was collected at 20 Hz. The voltage and current (in/out) of the battery pack were recorded. The energy consumed from the high voltage battery pack as well as the energy recuperated during braking that is fed back into the battery were calculated. The energy consumption (kWh/mile) and

the range of the bus (miles) for all there phases were then calculated following procedures in SAE J 1634 2017.

The three test phases are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph (Figure 1); an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph (Figure 2); and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph (Figure 3). At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.

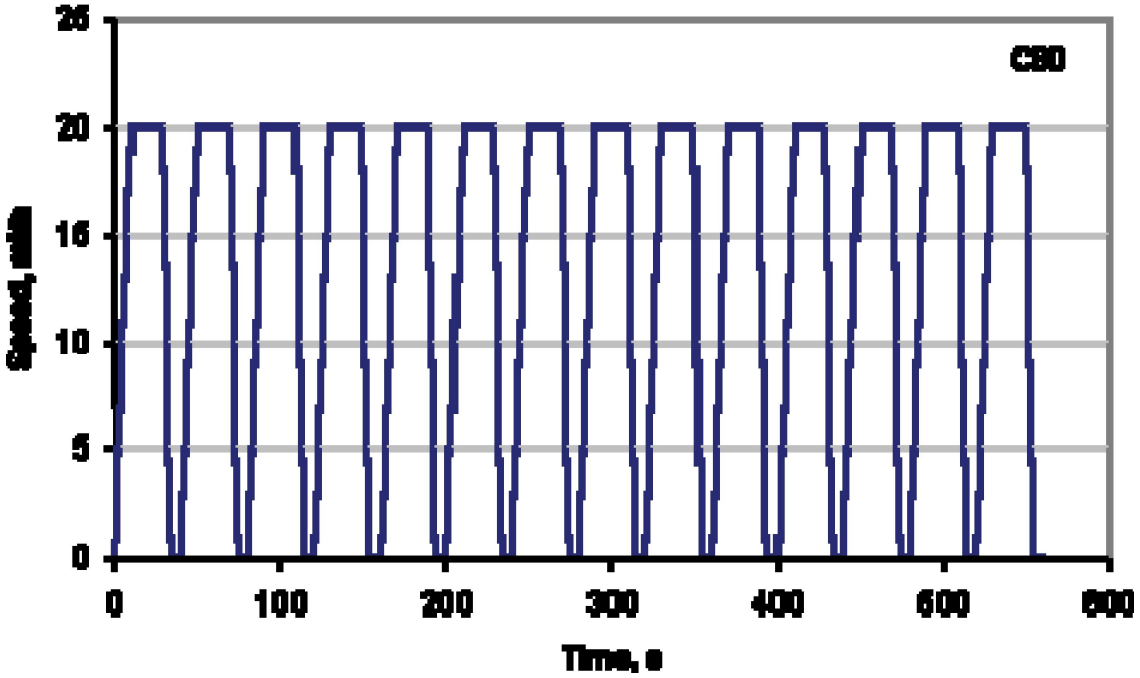


Figure 1. The CBD cycle

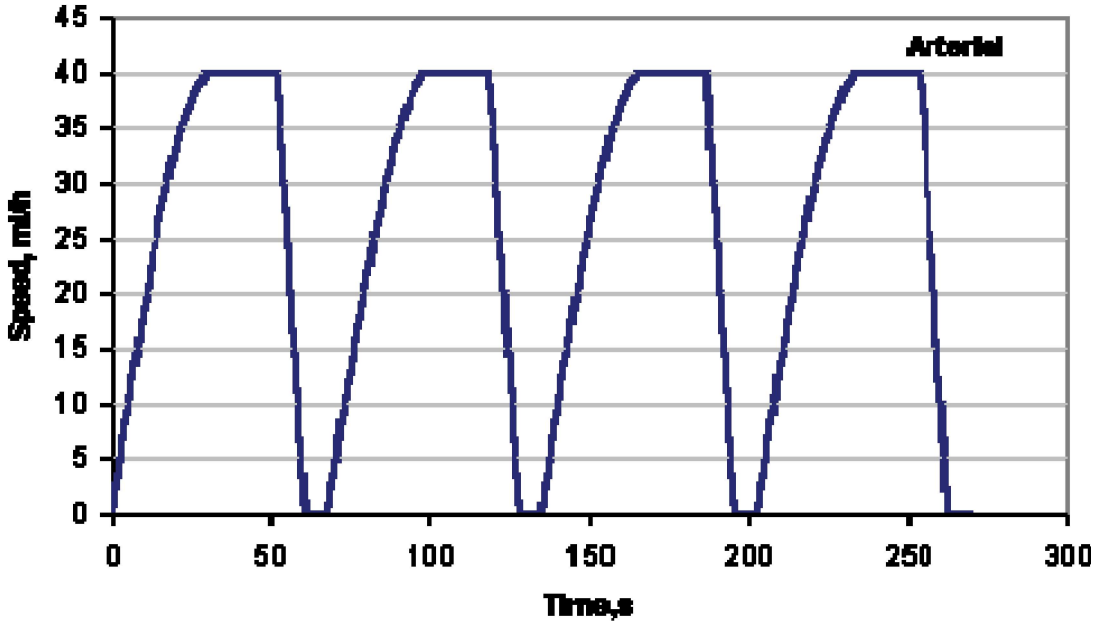


Figure 2. The Arterial cycle

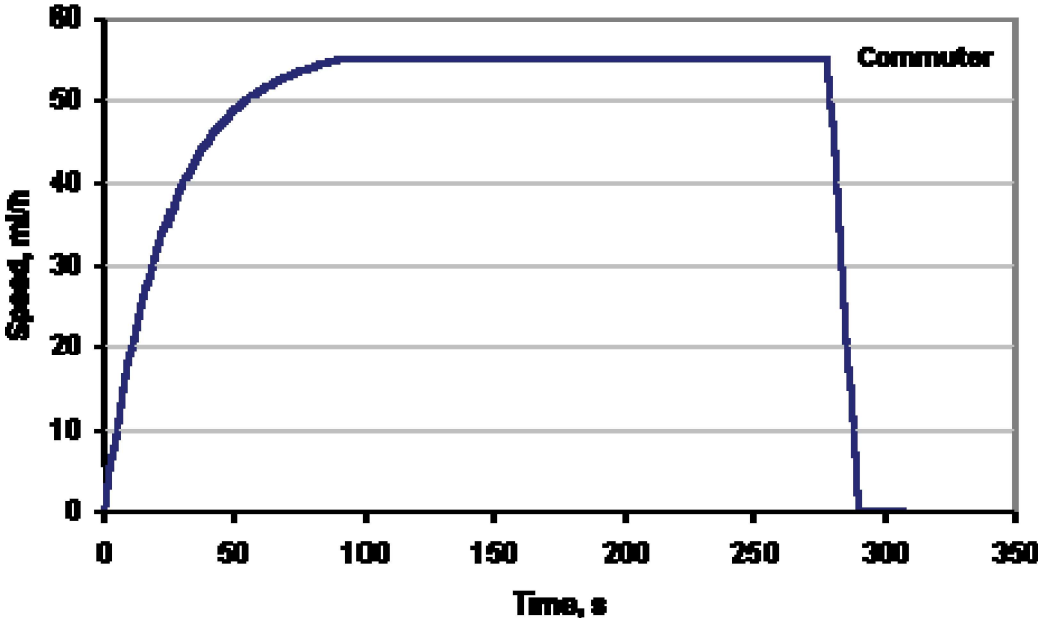


Figure 3. The Commuter cycle

6-III. DISCUSSION

This is a comparative test of energy economy and range. An extensive pretest maintenance check was performed, including checking all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection. The next four Energy Economy Forms provide the data from the four test runs. In order to reduce the effect of high energy consumption during the first test run on the calculated averages, phase scaling factors were applied, as suggested in SAE J1634. Finally, the summary sheet provides the calculated average energy consumption. The overall average fuel consumption values were; CBD – 3484 Wh/mile., ART – 3894 Wh/mile., and COM – 2293 Wh/mile. The range of the bus for the three test cycles were 162 miles, 145 miles, and 246 miles respectively.

ENERGY ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 1903-P	Date: 03-11-19	SLW (lb.): 60,140
Personnel: S.R. & T.G.		

FUEL SYSTEM	
Install fuel measurement system	N/A
Replace fuel filter	N/A
Check for fuel leaks	N/A
Specify fuel type (Battery/Electric)	N/A
Remarks: Battery/Electric	
BRAKES/TIRES	
Inspect hoses	✓
Inspect brakes	✓
Check tire inflation pressures (mfg. specs.)	✓
Check tire wear (less than 50%)	✓
Remarks: None noted	
COOLING SYSTEM	
Check hoses and connections	✓
Check system for coolant leaks	✓
Remarks: None noted.	

ENERGY ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 1903-P	Date: 03-11-19
Personnel: S.R. & T.G.	

ELECTRICAL SYSTEMS	
Check battery	✓
Inspect wiring	✓
Inspect terminals	✓
Check lighting	✓
Remarks: None noted.	

DRIVE SYSTEM	
Drain transmission fluid	N/A
Replace filter/gasket	N/A
Check hoses and connections (Rear Compartment Components)	✓
Replace transmission fluid	N/A
Check for fluid leaks	✓
Remarks: None noted.	

LUBRICATION	
Drain crankcase oil	N/A
Replace filters	N/A
Replace crankcase oil	N/A
Check for oil leaks	N/A
Check oil level	N/A
Lube all chassis grease fittings (drive shaft)	Manufacturer does not recommend at this time
Lube universal joints	✓
Replace differential lube including axles	Manufacturer does not recommend at this time
Remarks: None noted.	

ENERGY ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 1903-P	Date: 03-11-19
Personnel: S.R. & T.G.	

EXHAUST/EMISSION SYSTEM	
Check for exhaust leaks	N/A
Remarks: None noted.	
ENGINE	
Replace air filter	N/A
Inspect air compressor and air system	✓
Inspect vacuum system, if applicable	N/A
Check and adjust all drive belts	N/A
Check cold start assist, if applicable	N/A
Remarks: None noted.	
STEERING SYSTEM	
Check power steering hoses and connectors	✓
Service fluid level	✓
Check power steering operation	✓
Remarks: None noted.	
Ballast bus to seated load weight during coast down	✓
TEST DRIVE	
Check brake operation	✓
Check transmission operation	✓
Remarks: Bus was continuing battery depletion laps on the test track following pre-test inspection.	

ENERGY ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 1903-P	Date: 03-11-19
Personnel: S.R. & T.G.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	S.R.
Cold tire pressure (psi): Front 130 Middle 125 Rear 125	S.R.
Engine oil level	N/A
Engine coolant level	N/A
Fuel economy instrumentation installed and working properly.	N/A
Fuel line -- no leaks or kinks	N/A
Bus is loaded to SLW during coast down	S.R.
WARM-UP & TESTING	**If OK, Initial**
Air conditioning off	S.R.
Exterior & Interior light on	S.R.
Defroster off	S.R.
Windows and doors closed	S.R.
Do not drive with left foot on brake	S.R.

ENERGY ECONOMY DATA FORM (Electric Vehicles)

Bus Number:1903-P	Manufacturer: New Flyer	Date: 03-12-19
Run Number: 1	Personnel: S.R. & E.D.	
Test Direction: ❑ CW or ■ CCW	Ambient Temperature (°F): 27	Humidity (%): 63
SLW (lbs): 60,140	Barometric Pressure (in.Hg): 30.25	

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Pack SOC (%)	
	Start	Finish		Start	Finish
CBD #1	0	8:46	8:46	97	96
ART #1	0	4:22	4:22	96	94
CBD #2	0	8:41	8:41	94	93
ART #2	0	4:05	4:05	93	91
CBD #3	0	8:42	8:42	91	90
COMMUTER	0	6:02	6:02	90	88

Comments: None noted.

ENERGY ECONOMY DATA FORM (Electric Vehicles)

Bus Number: 1903-P	Manufacturer: New Flyer	Date: 03-12-19
Run Number: 2	Personnel: S.R. & E.D.	
Test Direction: ■ CW or ❑ CCW	Ambient Temperature (°F): 27	Humidity (%): 63
SLW (lbs): 60,140	Barometric Pressure (in.Hg): 30.25	

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Pack SOC (%)	
	Start	Finish		Start	Finish
CBD #1	0	8:41	8:41	88	87
ART #1	0	4:05	4:05	87	86
CBD #2	0	8:47	8:47	86	84
ART #2	0	4:20	4:20	84	83
CBD #3	0	8:47	8:47	83	82
COMMUTER	0	6:03	6:03	82	81

Comments: None noted.

ENERGY ECONOMY DATA FORM (Electric Vehicles)

Bus Number: 1903-P	Manufacturer: New Flyer	Date: 03-12-19
Run Number: 3	Personnel: S.R. & E.D.	
Test Direction: ❑ CW or ■ CCW	Ambient Temperature (°F): 36	Humidity (%): 47
SLW (lbs): 60,140	Barometric Pressure (in.Hg): 30.29	

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Pack SOC (%)	
	Start	Finish		Start	Finish
CBD #1	0	8:43	8:43	50	48
ART #1	0	4:07	4:07	48	47
CBD #2	0	8:36	8:36	47	46
ART #2	0	4:07	4:07	46	44
CBD #3	0	8:36	8:36	44	43
COMMUTER	0	6:01	6:01	43	42

Comments: None noted.

ENERGY ECONOMY DATA FORM (Electric Vehicles)

Page 4 of 4

Bus Number: 1903-P	Manufacturer: New Flyer	Date: 03-12-19
Run Number: 4	Personnel: S.R. & E.D.	
Test Direction: ■ CW or ❑ CCW	Ambient Temperature (°F): 36	Humidity (%): 47
SLW (lbs): 60,140	Barometric Pressure (in.Hg): 30.29	

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Pack SOC (%)	
	Start	Finish		Start	Finish
CBD #1	0	8:45	8:45	42	40
ART #1	0	4:13	4:13	40	39
CBD #2	0	8:43	8:43	39	38
ART #2	0	4:09	4:09	38	37
CBD #3	0	8:35	8:35	37	35
COMMUTER	0	6:04	6:04	35	34

Comments: None noted.

ENERGY ECONOMY AND RANGE DATA SUMMARY (Battery Electric Buses)

Bus Number: 19–3	Manufacturer: Newflyer	Date: 3/12/2019
Fuel Type: Electric		
SLW (lb.): 60,140		

Run/Cycle	CBD	Arterial	Commuter
Energy Consumption, Wh/mile	3484	3894	2293
Range, miles	162	145	246

Comments: In accordance with FTA policy for two-axle drive buses, this test was perfomed at the PSBRTC test track using
CBD, Arterial, and Commuter drive cycles.

Section 2N

Solicitation Requirements:

TS 21.2 Crashworthiness Report.

New Flyer Response:

Please refer to the attachments:

Side impact test “TR09-31 Xcelsior Side Impact Test
Roof crush test “TR10-05 Xcelsior Roof Crush Test Report”.

Author(s): Jordan Fast, P.Eng.
Test Date(s): November 5, 2009
Report Date: February 23, 2010
Revision: A

Technical Specifications and Reference(s):

- APTA Whitebook, section 5.4.1.2, Crashworthiness
- TR02-49, Low Floor Roof Crush test report

New Product Development Project Number:
NPD378, Xcelsior Bus Development SR-1212R (XD40)

Approved By:

Signature/Date:

Summary:
The roof of an Xcelsior 40ft bus was loaded statically to 1.5 x the maximum expected curb weight of any 40ft Xcelsior bus configuration. The test demonstrated that the Xcelsior 40ft bus meets the structural strength requirements of APTA 5.4.1.2.

1. Definitions:

[this section is empty]

2. Specifications / Pass/Fail Criteria:
APTA Whitebook Section 5.4.1.2 “Crashworthiness”

The bus body and roof structure shall withstand a static load equal to 150 percent of the curb weight evenly distributed on the roof with no more than a 6-inch reduction in any interior dimension. Windows shall remain in place and shall not open under such a load. These requirements must be met without components such as roof-mounted air conditioning installed.

3. Objectives:
To demonstrate that the Xcelsior structure meets the crashworthiness roof-loading requirement for 150% curb weight of the 2010 Diesel, 2010 Diesel-Electric hybrid and CNG configurations.

4. Test Description:
The Xcelsior 2010 prototype bus (designated SR-1212R) will be loaded with steel plates atop a plywood platform mounted on the roof to the three curb weights listed in section 3, starting with the lowest curb weight. For each load, internal deflection of the structure will be measured to ensure compliance with the Whitebook section 5.4.1.2 requirements.

5. Equipment:
- Roof bow deflection measuring tool (see appendix B for photos).
- Roof load frame – fabricated from treated lumber.
- Plate steel for weight.
- Overhead crane

6. Personnel:
[redacted]

7. Preparations and Procedure:
- All roof equipment was removed from the prototype XD40 bus.
- A level, wooden frame was set on the roof skin of the bus. The frame allowed for even distribution of weight across the roof bows along the full length of the bus.
- The roof structure was loaded evenly by laying steel plate on the wooden frame resting on the roof structure.
- Downward deflection of all of the roofbows was measured using a weight and pulley system as shown in the photos in Appendix B.

Load Layers:

Roof loading of the bus was based on a target curb weights of 29,000lb for Xcelsior hybrid and 31,000lb for Xcelsior CNG. The APTA specification requires that the roof withstand a load of 1.5xcurbweight. Thus, the bus roof was loaded in two stages, first to 1.5x29,000lb (43,500lb) and then, 3,000lb were added to achieve 1.5x31,000lb (46,500lb). Table A, below shows the composition of layers to achieve these stages of loading.

Steel plate was loaded on the roof of the bus in the following layers, evenly distributed front to rear of the bus:

Layer	Plate Size (inches)	Qty	Weight/sheet (lb)	Total
1	3x96x240	1	19603	19603
1	3x96x98	1	8400	8400
1	0.5x96x48	3	653	1959
1	0.25x48x120	1	408	408
			Layer 1 Total	**30307**
2	3x96x57	1	5472	5472
2	3x96x97	1	5282	5282
2	0.5x96x48	4	653	2615
			Layer 2 Total	**13369**
			Layer 1 + Layer 3: Hybrid curb weight x1.5	**43676**
3			Steel material size NA	3000
			Layers 1 + 2 + 3: CNG curb weight x 1.5	**46,676**

Table A: Roof loads

8. Test Location:

- Russel Metals, 1510 Clarence Avenue, Winnipeg, MB

9. Results:

See Table B.1, Appendix B for roof bow deflection results. Deflections did not exceed 6” and no permanent deformation was observed. Windows and doors functioned normally following the test.

10. Discussion:

Roof bow deflection was measured using a system of weights and cables attached to each roof bow and run through the bus to a measuring board, as shown in Figure B.1 (Appendix B). The length and stretch of the cables introduces some error into the

measurement. However, the error is acceptable, given the nature of the measurement. Accuracy is +/- ½". And the specification allows for up to 6" of structural dimensional change.

11. Conclusions:

The Xclesior 40ft bus structure meets the crashworthiness requirements of APTA specification 5.4.1.2.

APPENDIX A: Test Photos – Test Set Up and Roof Load



Figure A.1 – Test configuration

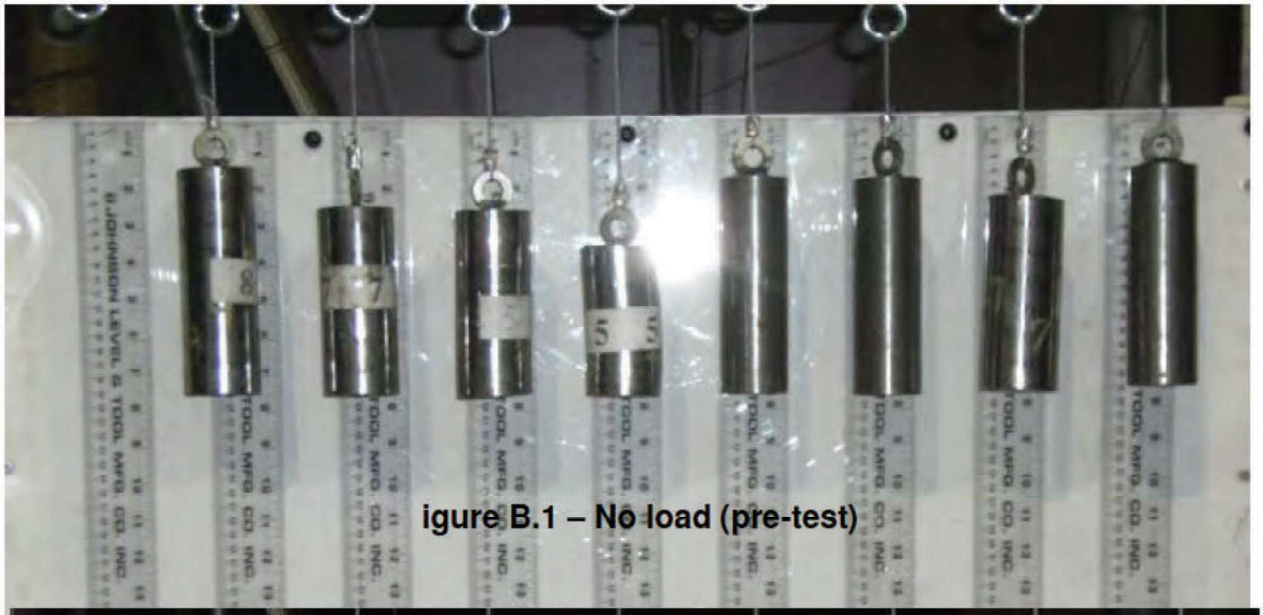


Figure A.2 – Full roof load

B s :os – Roof Bow Deflection ıments

Bow	8	7	6	5	4	3	2	1
Pre-test	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Full load	7.8	8.3	8.1	7.5	7.5	7.5	8.1	8.1
Post-test	7.3	7.5	7.5	7.3	7.3	7.3	7.5	7.5

ıble B.1 Roof bow deflections



igure B.1 – No load (pre-test)



e B.2 – Deflection at full roof load



Figure B.3– Relaxed after load removal

[redacted]

ENGINEERING TEST REPORT: **TR09-31**
TITLE: **Xcelsior Next Generation Light Weight Transit Bus XD40 Side Impact Test, SR-1212**

[redacted]

Test Date: October 27, 2009
Report Date: May 13, 2016
Revision: B

Technical Specifications and Reference(s):

- TP214D-09-Dynamic: U.S. Department of Transportation Laboratory Test Procedure for FMVSS No. 214, DYNAMIC SIDE IMPACT PROTECTION. Sept. 2012.
- TP-214S-05-Static: U.S. Department of Transportation Laboratory Test Procedure for FMVSS 214S (STATIC) SIDE IMPACT PROTECTION. April 15th 1992.
- APTA Standard Bus Procurement Guidelines. Section TS23.2 Crashworthiness (Transit Coach). 2013.
- PDR NO.909 Side Impact Test Simulation of an E200 MiDi Passenger Bus. ALEXANDER DENNIS. Sept. 4th 2014.

Test Article:

Test Bus #1 – Pilot #1:
Model: 40' Xcelsior Next Gen. XD40

New Product Development Project Number:

- **NPD 446**

Test Personnel:

[redacted]

Test Location:

- **Transportation Research Center Inc.**
  P.O. Box B-67
  10820 State Route 347
  East Liberty, OH 43319-0367
  Phone: (937) 666-2011 ext. 231

Approved By
Name: [redacted]

Signature/Date: 25 May 2016

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Crash Test of a 2001 Ford Taurus
Into the Right Side of a
New Flyer Industries SR-1212, Xcelsior D40 2010
Engineering Bus at 25.6 mph
TRC Inc. Test Number: 091027-1

Prepared by:
Transportation Research Center Inc.
10820 State Route 347 P.
O. Box B-67
East Liberty, OH 43319

Final Report
October - November 2009

Prepared For:
New Flyer Industries Limited
Unit #7, 45 Beghin Avenue
Winnipeg, Manitoba, Canada R2J4B9

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[redacted]

Report Approved By:

[redacted]

Date November 9, 2009

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Section 1.0

Purpose and Test Procedure

This report documents a crash test of a 2001 Ford Taurus 4-door impacting the right side of New Flyer Industries SR-1212, Xcelsior D40 2010 Engineering Bus at 25.6 mph. The test was conducted on October 27, 2009. The purpose of the above test was to acquire data relative to the recommendations of the Standard Bus Procurement Guidelines dated May 8, 2000, paragraph 5.4.1.2, regarding crashworthiness.

The test setup was such that the 2001 Ford Taurus struck the bus right side structure 58.3 inches rearward of the front wheel vertical centerline at an angle of 90° relative to the bus' longitudinal axes.

A grid work of crush points was laid out along seventy-eight (78) inches of the bus side at six-inch spacings at the following heights: The New Flyer bus floor height, bumper height, the height of the H-point of a seated 50th percentile male passenger, and six (6) inches above and below the H-point height.

The impact event was recorded by three (3) high-speed digital cameras, and one (1) real-time digital camera.

Static Crush Test Results

Paragraph 5.4.1.2 of the referenced specification requires there be no more that three (3) inches of static deformation at the H-point height. The maximum static deformation for this test was 0.6 inches. In addition, there was no intrusion of the bus side structure into the bus occupant compartment nor were any sharp edges or protrusions generated.

Section 2.0

Vehicle Information

Low Floor Diesel Transit Bus

Vehicle manufacturer:	New Flyer Industries, Limited
Year/make/model:	SR-1212, Xcelsior D40 2010 Engineering Bus
VIN:	2FYD8FV148D034334
Color:	Grey
Transmission data:	__6__ speed, ____ manual, __X__ automatic, ____ fwd, __X__ rwd, ____ 4wd
Date vehicle received:	October 26, 2009
Odometer reading:	6061.8

Accessories:

Power steering	Yes	Automatic transmission	Yes
Power brakes	Air	Automatic speed control	No
Power seats	Yes	Tilting steering wheel	Yes
Power windows	No	Telescoping steering wheel	Yes
Tinted glass	Yes	Air conditioning	Yes
Radio/Cassette/CD	No	Anti-lock brakes	No
Clock	No	Rear window defroster	No
Other:	None		

Certification data from vehicle's label:

Vehicle manufactured by:	New Flyer Industries, Limited	
Date of manufacture:	07/08	
VIN: 2FYD8FV148D034334	GVWR:	42540 lbs.
GAWR: Front:	14780 lbs.	
Rear:	27760 lbs.	

Vehicle Information, Continued

Weight of test vehicle as received:

Front	7050 lbs.	Right rear	8880 lbs.
		Left rear	8240 lbs.

Total front weight 7050 lbs. (29.2 % of total vehicle weight) Total rear weight 17120 lbs. (70.8 % of total vehicle weight)

Total delivered weight 24170 lbs.

Total test weight 24170 lbs.

Weight of ballast secured in cargo area: 0 lb

Components removed to meet target test weight: None

CG = ----[1] inches rearward of front wheel centerline.

Tires on vehicle (mfr., line, size): Michelin, XZU2, 305/70R22.5

Tire pressure with maximum vehicle load: Front: Not recorded Rear: Not recorded Maximum capacity width[1]: Not recorded

Wheelbase[1]: Not recorded

Location of label stating tire & capacity data: Left top of B-Pillar

Data from vehicle's "Recommended Tire Pressure" label:

Recommended tire size: 305/70R22.5

Recommended cold tire pressure: Front: 120 psi Rear: 120 psi

Remarks:

1. Is the vehicle stock throughout? No
2. Does the vehicle show evidence of prior accident history? No
3. Does the vehicle show any significant corrosion? No
4. Condition of the front/rear bumper and frame? Good Test vehicle attitude:

Delivered attitude:	LF	41.5 in;	RF	45.3 in;	LR	42.9 in;	RR 42.9 in
Pre-test attitude:	LF	43.1 in;	RF	39.4 in;	LR	43.1 in;	RR 43.0 in
Post-test attitude:	LF	42.8 in;	RF	43.7 in;	LR	43.1 in;	RR 43.1 in

[1] The maximum width and wheelbase were not recorded; therefore the Transit bus center of gravity could not be calculated or recorded.

Vehicle Information, Continued

Ford Taurus

Vehicle manufacturer:	Ford Motor Company
Year/make/model:	2001 Ford Taurus
VIN:	1FAFP52U91G276968
Color:	Silver
Engine data:	
Type:	Transverse
Cylinders:	6
Displacement:	3.0 liters
Transmission data:	_3_ speed, ___ manual, _X_ automatic,
	_X_ fwd, ___ rwd, ____ 4wd
Date vehicle received:	October 21, 2009
Odometer reading:	99,050

Accessories:

Power steering	Yes	Automatic transmission	Yes
Power brakes	Yes	Automatic speed control	Yes
Power seats	No	Tilting steering wheel	Yes
Power windows	Yes	Telescoping steering wheel	No
Tinted glass	Yes	Air conditioning	Yes
Radio/Cassette/CD	Yes	Anti-lock brakes	Yes
Clock	Yes	Rear window defroster	Yes
Other:	None		

Certification data from vehicle's label:

Vehicle manufactured by:		Ford Motor Company	
Date of manufacture:		06/01	
VIN:	1FAFP52U91G276968	GVWR:	4684 lbs.
GAWR:	Front:	2552 lbs.	
	Rear:	2132 lbs.	

Vehicle Information, Continued

Weight of test vehicle as received:

Right front 1075.4 lbs. Right rear 578.9 lbs. Left front 1048.1 lbs. Left rear 608.0 lbs.

Total front weight 2123.5 lbs. (64.1 % of total vehicle weight) Total rear weight 1186.9 lbs. (35.9 % of total vehicle weight)

Total delivered weight 3310.4 lbs.

Total test weight 4001.4 lbs.

Weight of ballast secured in cargo area: 700.0 lbs.

Components removed to meet target test weight: None CG

= 41.2 inches rearward of front wheel centerline.

Tires on vehicle (mfr., line, size): Bridgestone, Turanza P215/60R16

Tire pressure with maximum vehicle load: Front: 30 psi capacity Rear: 30 psi

Maximum width: 72.8 in

Wheelbase: 108.5 in

Location of label stating tire & capacity data: Driver's door.

Data from vehicle's "Recommended Tire Pressure" label:

Recommended tire size: P215/60R16

Recommended cold tire pressure: Front: 30 psi Rear: 30 psi

Remarks:

5. Is the vehicle stock throughout? Yes
6. Does the vehicle show evidence of prior accident history? No
7. Does the vehicle show any significant corrosion? No
8. Condition of the front/rear bumper and frame? Good Test vehicle attitude:

Delivered attitude:	LF	27.2 in;	RF	27.4 in;	LR	26.3 in;	RR 26.6 in
Pre-test attitude:	LF	26.1 in;	RF	26.4 in;	LR	24.8 in;	RR 25.1 in
Post-test attitude:	LF	26.1 in;	RF	26.8 in;	LR	24.6 in;	RR 25.2 in

Section 3.0

Test Summary and Measurements

Test type:	Car into Right Side of Bus
Test date:	October 27, 2009
Test time:	12:48
Ambient temperature:	62.1° F
Impact angle[1]:	90
Impact velocity[2]:	Primary = 25.56 mph Secondary = 25.54 mph

Maximum static crush: 0.6 inches Impact Point:

58.4 inches

Number of cameras:

High-Speed: 3 Real-Time: 1

[1] Clockwise from front centerline of the test vehicle.

[2] Speed trap measurement (± .05 mph accuracy)

VEHICLE EXTERIOR PROFILES AND STATIC CRUSH

Zero Distance is at Projected Impact Point*

Pre-Test Profile (Distance in Inches from Reference Plane)**

LOCATION	Height (IN)	-36	-30	-24	-18	-12	-6	0	6	12	18	24	30	36	42
H-PT. +6 IN.	27.0	90.4	90.2	90.2	90.0	90.0	90.2	90.0	90.0	90.0	90.0	90.0	91.1	90.6	90.5
H-PT.	21.0	90.2	90.0	90.0	90.0	90.1	89.9	89.9	90.0	90.0	90.1	90.0	91.2	90.6	90.9
H-PT. -6 IN.	15.0	90.0	89.8	89.8	90.1	90.0	90.0	90.1	90.2	90.0	90.2	90.1	91.1	90.7	90.7
BUMPER	10.8	---[1]	89.6	89.5	89.6	89.5	89.6	89.5	89.5	89.5	89.4	89.4	91.7	90.0	91.1
BUS FLOOR	1.0	---[1]	84.8	84.7	84.7	85.0	85.0	84.9	85.0	85.1	85.0	85.0	85.2	85.1	85.1

Post-Test Profile (Distance in Inches from Reference Plane)**

LOCATION	Height (IN)	-36	-30	-24	-18	-12	-6	0	6	12	18	24	30	36	42
H-PT. +6 IN.	27.0	90.7	90.4	90.2	90.2	90.0	89.6	90.0	89.7	89.8	90.6	90.2	91.6	90.7	90.7
H-PT.	21.0	90.4	90.2	89.8	90.0	89.8	89.5	89.7	89.4	89.6	90.0	89.6	91.5	90.7	91.3
H-PT. -6 IN.	15.0	90.2	90.0	89.8	89.4	89.8	89.4	89.7	89.4	89.6	89.8	89.8	91.3	90.7	90.9
BUMPER	10.8	---[1]	89.0	88.6	88.7	88.8	88.4	88.7	88.5	88.5	88.6	88.8	89.6	90.0	90.9
BUS FLOOR	1.0	---[1]	84.8	84.6	84.6	85.0	84.8	85.1	85.0	85.0	85.2	85.0	85.2	85.2	85.1

Static Crush (Inches)

LOCATION	Height (IN)	-36	-30	-24	-18	-12	-6	0	6	12	18	24	30	36	42
H-PT. +6 IN.	27.0	-0.4	-0.2	0.0	-0.2	0.0	0.6	0.0	0.3	0.2	-0.6	-0.2	-0.4	-0.2	-0.2
H-PT.	21.0	-0.2	-0.2	0.2	0.0	0.3	0.4	0.2	0.6	0.4	0.1	0.4	-0.3	-0.2	-0.3
H-PT. -6 IN.	15.0	-0.2	-0.2	0.0	0.7	0.2	0.6	0.4	0.8	0.4	0.4	0.3	-0.2	0.0	-0.2
BUMPER	10.8	---[1]	0.6	0.9	0.9	0.7	1.2	0.9	1.0	1.0	0.9	0.6	2.1	0.0	0.2
BUS FLOOR	1.0	---[1]	0.0	0.1	0.1	0.0	0.2	-0.2	0.0	0.0	-0.2	0.1	-0.1	-0.1	0.0

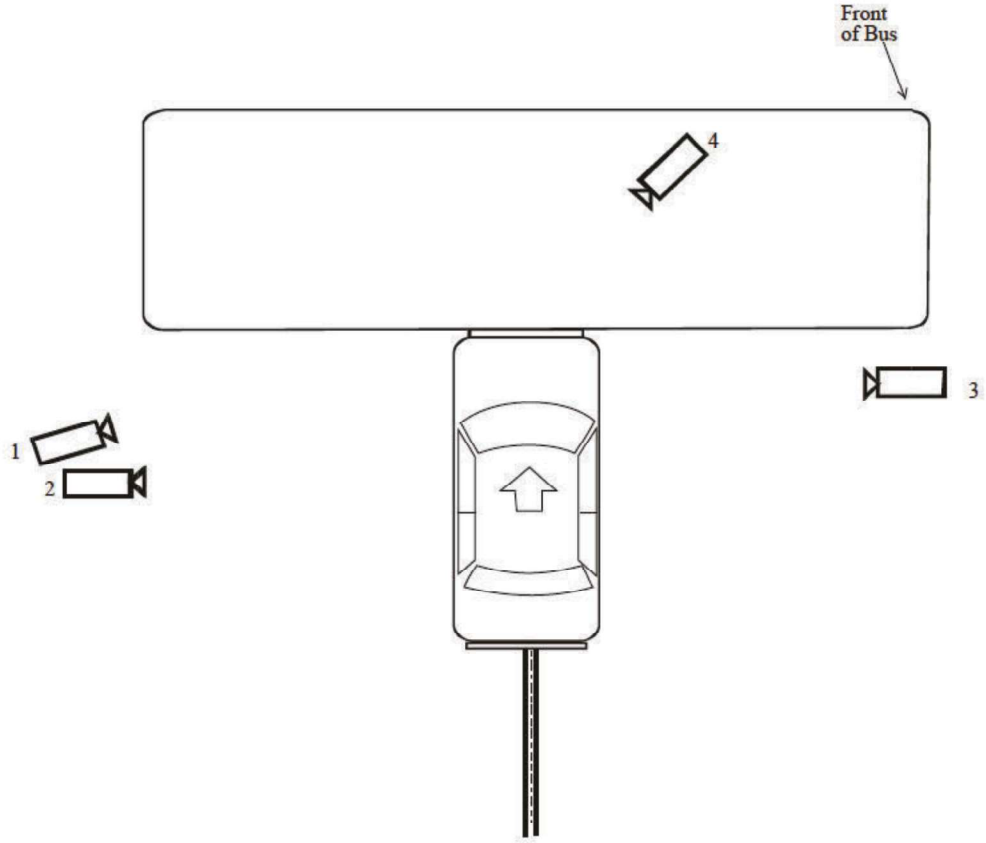
* Projected impact point is the centerline of the striking vehicle on the bus side and is 58.3 inches rearward of the front wheel verticle center line. Column readings are front to rear from left to right.

** Reference plane used is the interior of the non impact side along the rail at floor height.

[1] Unable to record measurement because of wheel well.

Test Summary and Measurements, Continued

Camera Information



Camera Number	Location	Type	Lens (mm)	Speed (fps)	Purpose of Camera Data
1	Event	Canon	Zoom	30	Real-time
2	Left side wide	Redlake LE	12.5	1000	Vehicle crush
3	Right side wide	Redlake LE	12.5	1000	Vehicle crush
4	Onboard bus	Redlake LE	6	1000	Intrusion

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Appendix A
Photographs



Figure A-1 Pre-Test Bus Left Side View



Figure A-2 Post-Test Bus Left Side View



Figure A-3 Pre-Test Bus Rear View



Figure A-4 Post-Test Bus Rear View



Figure A-5 Pre-Test Bus Right Side View



Figure A-6 Post-Test Bus Right Side View



Figure A-7 Pre-Test Bus Right Side Close-up View



Figure A-8 Post-Test Bus Right Side Close-up View



Figure A-9 Pre-Test Vehicle to Bus Left Side View



Figure A-10 Post-Test Vehicle to Bus Left Side View



Figure A-11 Pre-Test Vehicle to Bus Left Side Close-up View

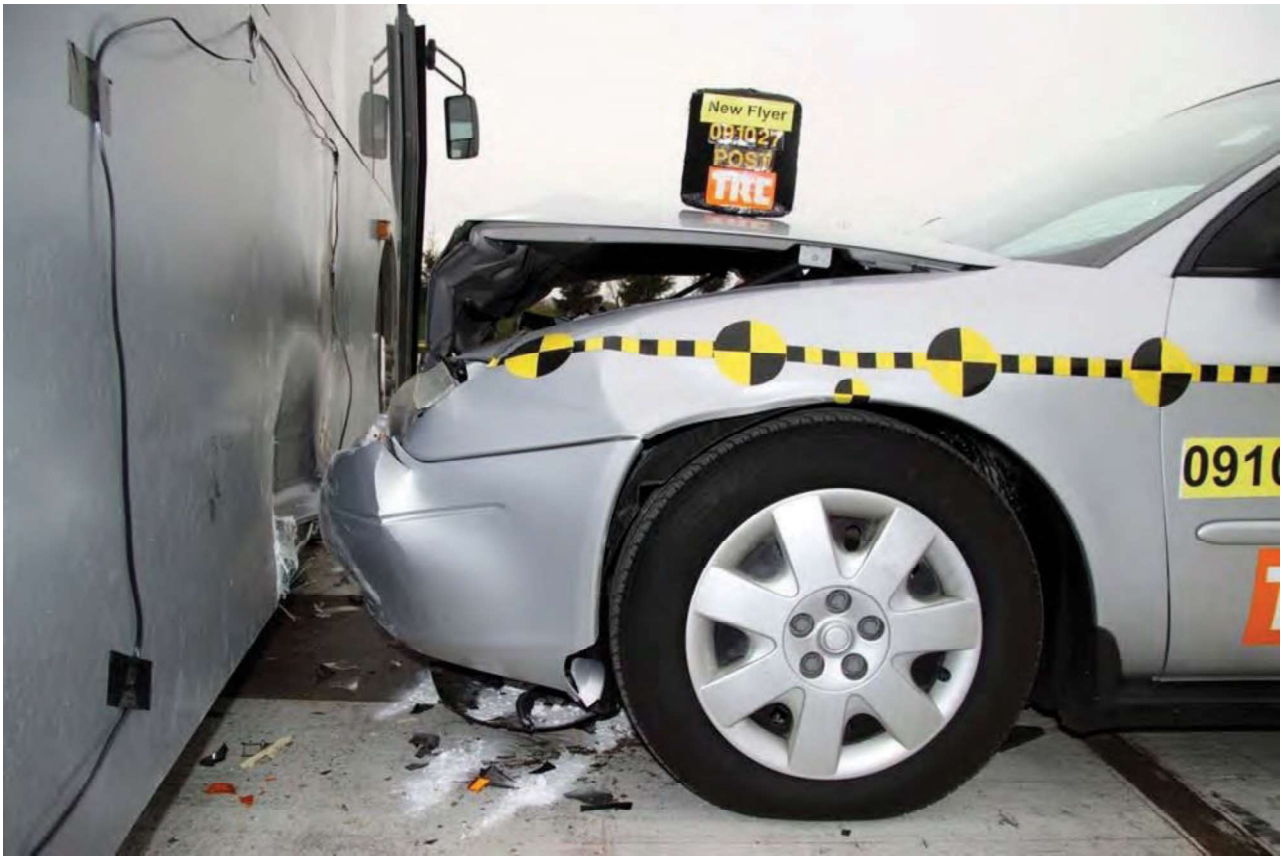

Figure A-12 Post-Test Vehicle to Bus Left Side Close-up View



Figure A-13 Pre-Test Vehicle to Bus Rear View

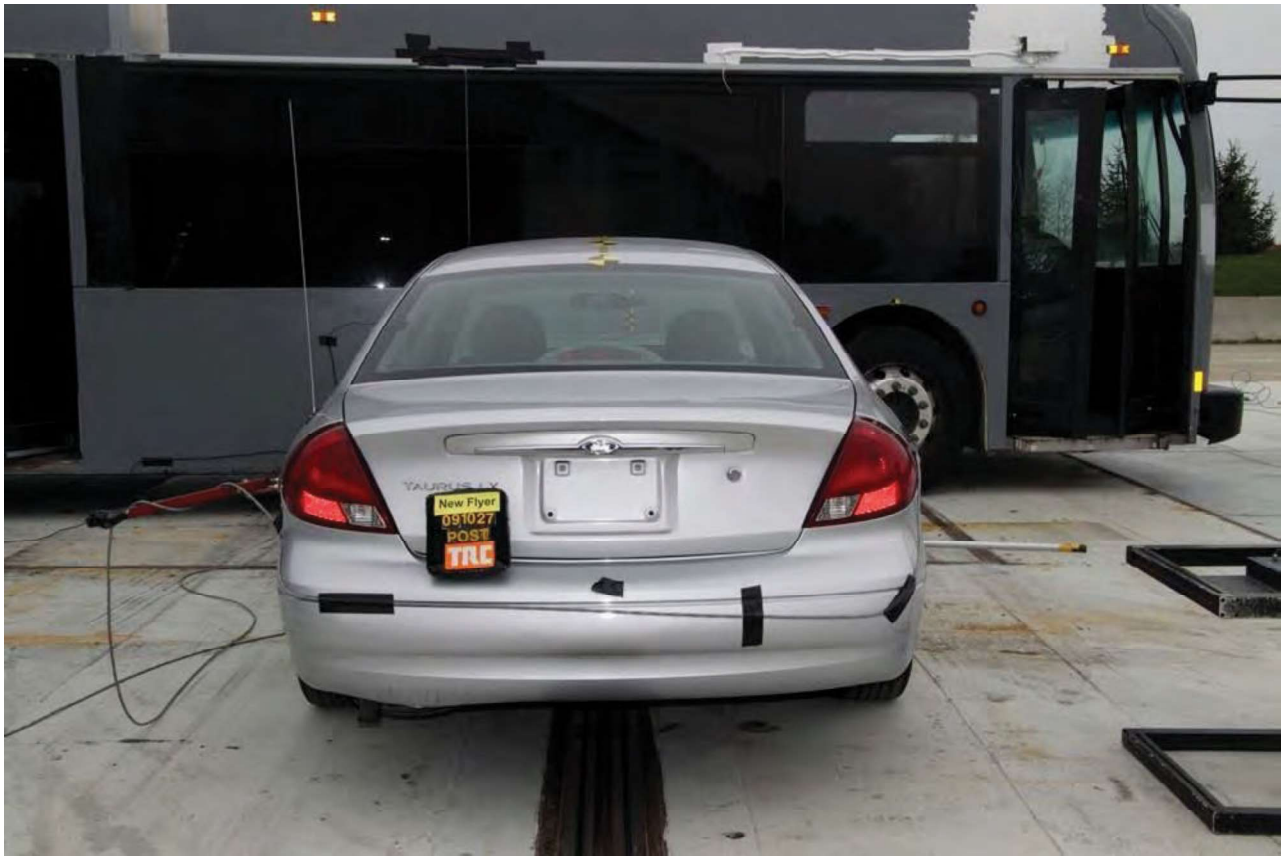

Figure A-14 Post-Test Vehicle to Bus Rear View



Figure A-15 Pre-Test Vehicle to Bus Right Side View



Figure A-16 Post-Test Vehicle to Bus Right Side View



Figure A-17 Pre-Test Vehicle to Bus Right Side Close-up View



Figure A-18 Post-Test Vehicle to Bus Right Side Close-up View



Figure A-19 Pre-Test Bus Floor Level Interior View



Figure A-20 Post-Test Floor Level Interior - View 1



Figure A-21 Post-Test Floor Level Interior - View 2

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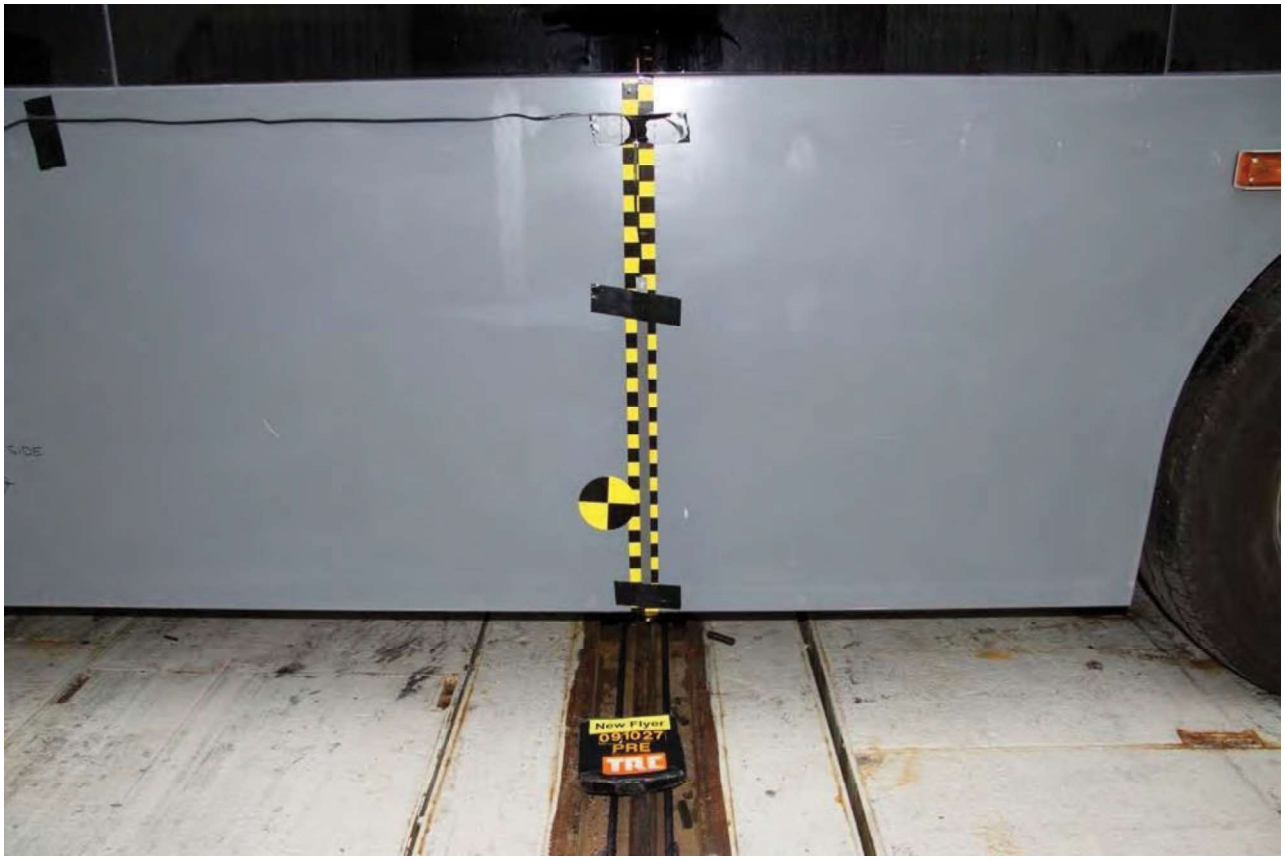

Figure A-22 Pre-Test Impact Point View



Figure A-23 Post-Test Impact Point View



Figure A-24 Pre-Test Impact Point Close-up View



Figure A-25 Post-Test Impact Point Close-up View

Crash Test of a 2001 Ford Taurus
Into the Right Side of a
New Flyer Industries SR-1212, Xcelsior D40 2010
Engineering Bus at 25.6 mph
TRC Inc. Test Number: 091027-1

Prepared by:
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Final Report
October - November 2009

Prepared For:
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Section 1.0

Purpose and Test Procedure

This report documents a crash test of a 2001 Ford Taurus 4-door impacting the right side of New Flyer Industries SR-1212, Xcelsior D40 2010 Engineering Bus at 25.6 mph. The test was conducted on October 27, 2009. The purpose of the above test was to acquire data relative to the recommendations of the Standard Bus Procurement Guidelines dated May 8, 2000, paragraph 5.4.1.2, regarding crashworthiness.

The test setup was such that the 2001 Ford Taurus struck the bus right side structure 58.3 inches rearward of the front wheel vertical centerline at an angle of 90° relative to the bus' longitudinal axes.

A grid work of crush points was laid out along seventy-eight (78) inches of the bus side at six-inch spacings at the following heights: The New Flyer bus floor height, bumper height, the height of the H-point of a seated 50th percentile male passenger, and six (6) inches above and below the H-point height.

The impact event was recorded by three (3) high-speed digital cameras, and one (1) real-time digital camera.

Static Crush Test Results

Paragraph 5.4.1.2 of the referenced specification requires there be no more that three (3) inches of static deformation at the H-point height. The maximum static deformation for this test was 0.6 inches. In addition, there was no intrusion of the bus side structure into the bus occupant compartment nor were any sharp edges or protrusions generated.

Section 2.0

Vehicle Information

Low Floor Diesel Transit Bus

Vehicle manufacturer:	New Flyer Industries, Limited
Year/make/model:	SR-1212, Xcelsior D40 2010 Engineering Bus
VIN:	2FYD8FV148D034334
Color:	Grey
Transmission data:	_6_ speed, ___ manual, _X_ automatic, ____ fwd, _X_ rwd, ____ 4wd
Date vehicle received:	October 26, 2009
Odometer reading:	6061.8

Accessories:

Power steering	Yes	Automatic transmission	Yes
Power brakes	Air	Automatic speed control	No
Power seats	Yes	Tilting steering wheel	Yes
Power windows	No	Telescoping steering wheel	Yes
Tinted glass	Yes	Air conditioning	Yes
Radio/Cassette/CD	No	Anti-lock brakes	No
Clock	No	Rear window defroster	No
Other:	None		

Certification data from vehicle's label:

Vehicle manufactured by:		New Flyer Industries, Limited
Date of manufacture:		07/08
VIN:		2FYD8FV148D034334
GVWR:		42540 lbs.
GAWR:	Front:	14780 lbs.
	Rear:	27760 lbs.

Vehicle Information, Continued

Weight of test vehicle as received:

Front	7050 lbs.	Right rear	8880 lbs.
		Left rear	8240 lbs.
Total front weight	7050 lbs.	(29.2 % of total vehicle weight)	
Total rear weight	17120 lbs.	(70.8 % of total vehicle weight)	
Total delivered weight	24170 lbs.		
Total test weight	24170 lbs.		

Weight of ballast secured in cargo area: 0 lb

Components removed to meet target test weight: None

CG = ----[1] inches rearward of front wheel centerline.

Tires on vehicle (mfr., line, size): Michelin, XZU2, 305/70R22.5

Tire pressure with maximum capacity vehicle load: Front: Not recorded
Rear: Not recorded

Maximum width[1]: Not recorded

Wheelbase[1]: Not recorded

Location of label stating tire & capacity data: Left top of B-Pillar

Data from vehicle's "Recommended Tire Pressure" label:

Recommended tire size: 305/70R22.5

Recommended cold tire pressure: Front: 120 psi
Rear: 120 psi

Remarks:

1. Is the vehicle stock throughout? No
2. Does the vehicle show evidence of prior accident history? No
3. Does the vehicle show any significant corrosion? No
4. Condition of the front/rear bumper and frame? Good

Test vehicle attitude:

Delivered attitude:	LF	41.5 in;	RF	45.3 in;	LR	42.9 in;	RR	42.9 in
Pre-test attitude:	LF	43.1 in;	RF	39.4 in;	LR	43.1 in;	RR	43.0 in
Post-test attitude:	LF	42.8 in;	RF	43.7 in;	LR	43.1 in;	RR	43.1 in

[1] The maximum width and wheelbase were not recorded; therefore the Transit bus center of gravity could not be calculated or recorded.

Vehicle Information, Continued

Ford Taurus

Vehicle manufacturer:	Ford Motor Company
Year/make/model:	2001 Ford Taurus
VIN:	1FAFP52U91G276968
Color:	Silver
Engine data:	
Type:	Transverse
Cylinders:	6
Displacement:	3.0 liters
Transmission data:	_3_ speed, ___ manual, _X_ automatic, _X_ fwd, ___ rwd, ___ 4wd
Date vehicle received:	October 21, 2009
Odometer reading:	99,050

Accessories:

Power steering	Yes	Automatic transmission	Yes
Power brakes	Yes	Automatic speed control	Yes
Power seats	No	Tilting steering wheel	Yes
Power windows	Yes	Telescoping steering wheel	No
Tinted glass	Yes	Air conditioning	Yes
Radio/Cassette/CD	Yes	Anti-lock brakes	Yes
Clock	Yes	Rear window defroster	Yes
Other:	None		

Certification data from vehicle's label:

Vehicle manufactured by:		Ford Motor Company
Date of manufacture:		06/01
VIN:		1FAFP52U91G276968
GVWR:		4684 lbs.
GAWR:	Front:	2552 lbs.
	Rear:	2132 lbs.

Vehicle Information, Continued

Weight of test vehicle as received:

Right front	1075.4 lbs.	Right rear	578.9 lbs.
Left front	1048.1 lbs.	Left rear	608.0 lbs.
Total front weight	2123.5 lbs.	(64.1 % of total vehicle weight)	
Total rear weight	1186.9 lbs.	(35.9 % of total vehicle weight)	
Total delivered weight	3310.4 lbs.		
Total test weight	4001.4 lbs.		

Weight of ballast secured in cargo area: 700.0 lbs.

Components removed to meet target test weight: None

CG = 41.2 inches rearward of front wheel centerline.

Tires on vehicle (mfr., line, size): Bridgestone, Turanza P215/60R16

Tire pressure with maximum capacity vehicle load: Front: 30 psi
Rear: 30 psi

Maximum width: 72.8 in

Wheelbase: 108.5 in

Location of label stating tire & capacity data: Driver's door.

Data from vehicle's "Recommended Tire Pressure" label:

Recommended tire size: P215/60R16

Recommended cold tire pressure: Front: 30 psi
Rear: 30 psi

Remarks:

5. Is the vehicle stock throughout? Yes
6. Does the vehicle show evidence of prior accident history? No
7. Does the vehicle show any significant corrosion? No
8. Condition of the front/rear bumper and frame? Good

Test vehicle attitude:

Delivered attitude:	LF	27.2 in;	RF	27.4 in;	LR	26.3 in;	RR	26.6 in
Pre-test attitude:	LF	26.1 in;	RF	26.4 in;	LR	24.8 in;	RR	25.1 in
Post-test attitude:	LF	26.1 in;	RF	26.8 in;	LR	24.6 in;	RR	25.2 in

Section 3.0

Test Summary and Measurements

Test type:	Car into Right Side of Bus
Test date:	October 27, 2009
Test time:	12:48
Ambient temperature:	62.1° F
Impact angle[1]:	90
Impact velocity[2]:	Primary = 25.56 mph Secondary = 25.54 mph
Maximum static crush:	0.6 inches
Impact Point:	58.4 inches
Number of cameras:	
High-Speed:	3
Real-Time:	1

[1] Clockwise from front centerline of the test vehicle.
[2] Speed trap measurement (± .05 mph accuracy)

VEHICLE EXTERIOR PROFILES AND STATIC CRUSH

Zero Distance is at Projected Impact Point*

Pre-Test Profile (Distance in Inches from Reference Plane)**

LOCATION	Height (IN)	-36	-30	-24	-18	-12	-6	0	6	12	18	24	30	36	42
H-PT. +6 IN.	27.0	90.4	90.2	90.2	90.0	90.0	90.2	90.0	90.0	90.0	90.0	90.0	91.1	90.6	90.5
H-PT.	21.0	90.2	90.0	90.0	90.0	90.1	89.9	89.9	90.0	90.0	90.1	90.0	91.2	90.6	90.9
H-PT. -6 IN.	15.0	90.0	89.8	89.8	90.1	90.0	90.0	90.1	90.2	90.0	90.2	90.1	91.1	90.7	90.7
BUMPER	10.8	---[1]	89.6	89.5	89.6	89.5	89.6	89.5	89.5	89.5	89.4	89.4	91.7	90.0	91.1
BUS FLOOR	1.0	---[1]	84.8	84.7	84.7	85.0	85.0	84.9	85.0	85.1	85.0	85.0	85.2	85.1	85.1

Post-Test Profile (Distance in Inches from Reference Plane)**

LOCATION	Height (IN)	-36	-30	-24	-18	-12	-6	0	6	12	18	24	30	36	42
H-PT. +6 IN.	27.0	90.7	90.4	90.2	90.2	90.0	89.6	90.0	89.7	89.8	90.6	90.2	91.6	90.7	90.7
H-PT.	21.0	90.4	90.2	89.8	90.0	89.8	89.5	89.7	89.4	89.6	90.0	89.6	91.5	90.7	91.3
H-PT. -6 IN.	15.0	90.2	90.0	89.8	89.4	89.8	89.4	89.7	89.4	89.6	89.8	89.8	91.3	90.7	90.9
BUMPER	10.8	---[1]	89.0	88.6	88.7	88.8	88.4	88.7	88.5	88.5	88.6	88.8	89.6	90.0	90.9
BUS FLOOR	1.0	---[1]	84.8	84.6	84.6	85.0	84.8	85.1	85.0	85.0	85.2	85.0	85.2	85.2	85.1

Static Crush (Inches)

LOCATION	Height (IN)	-36	-30	-24	-18	-12	-6	0	6	12	18	24	30	36	42
H-PT. +6 IN.	27.0	-0.4	-0.2	0.0	-0.2	0.0	0.6	0.0	0.3	0.2	-0.6	-0.2	-0.4	-0.2	-0.2
H-PT.	21.0	-0.2	-0.2	0.2	0.0	0.3	0.4	0.2	0.6	0.4	0.1	0.4	-0.3	-0.2	-0.3
H-PT. -6 IN.	15.0	-0.2	-0.2	0.0	0.7	0.2	0.6	0.4	0.8	0.4	0.4	0.3	-0.2	0.0	-0.2
BUMPER	10.8	---[1]	0.6	0.9	0.9	0.7	1.2	0.9	1.0	1.0	0.9	0.6	2.1	0.0	0.2
BUS FLOOR	1.0	---[1]	0.0	0.1	0.1	0.0	0.2	-0.2	0.0	0.0	-0.2	0.1	-0.1	-0.1	0.0

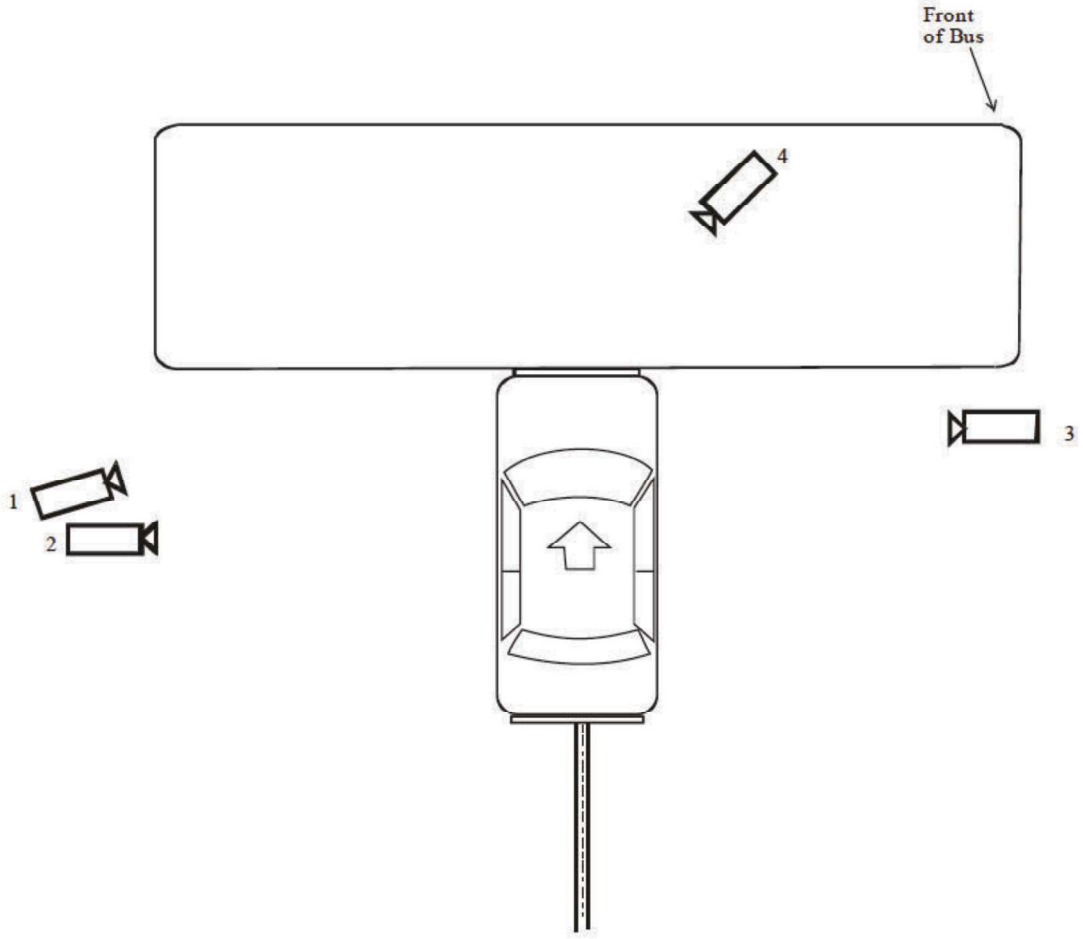
* Projected impact point is the centerline of the striking vehicle on the bus side and is 58.3 inches rearward of the front wheel verticle center line. Column readings are front to rear from left to right.

** Reference plane used is the interior of the non impact side along the rail at floor height.

[1] Unable to record measurement because of wheel well.

Test Summary and Measurements, Continued

Camera Information



Camera Number	Location	Type	Lens (mm)	Speed (fps)	Purpose of Camera Data
1	Event	Canon	Zoom	30	Real-time
2	Left side wide	Redlake LE	12.5	1000	Vehicle crush
3	Right side wide	Redlake LE	12.5	1000	Vehicle crush
4	Onboard bus	Redlake LE	6	1000	Intrusion

Appendix A

Photographs



Figure A-1 Pre-Test Bus Left Side View



Figure A-2 Post-Test Bus Left Side View



Figure A-3 Pre-Test Bus Rear View



Figure A-4 Post-Test Bus Rear View



Figure A-5 Pre-Test Bus Right Side View



Figure A-6 Post-Test Bus Right Side View



Figure A-7 Pre-Test Bus Right Side Close-up View



Figure A-8 Post-Test Bus Right Side Close-up View



Figure A-9 Pre-Test Vehicle to Bus Left Side View



Figure A-10 Post-Test Vehicle to Bus Left Side View



Figure A-11 Pre-Test Vehicle to Bus Left Side Close-up View



Figure A-12 Post-Test Vehicle to Bus Left Side Close-up View



Figure A-13 Pre-Test Vehicle to Bus Rear View



Figure A-14 Post-Test Vehicle to Bus Rear View



Figure A-15 Pre-Test Vehicle to Bus Right Side View



Figure A-16 Post-Test Vehicle to Bus Right Side View



Figure A-17 Pre-Test Vehicle to Bus Right Side Close-up View



Figure A-18 Post-Test Vehicle to Bus Right Side Close-up View



Figure A-19 Pre-Test Bus Floor Level Interior View



Figure A-20 Post-Test Floor Level Interior - View 1



Figure A-21 Post-Test Floor Level Interior - View 2

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Figure A-22 Pre-Test Impact Point View



Figure A-23 Post-Test Impact Point View



Figure A-24 Pre-Test Impact Point Close-up View



Figure A-25 Post-Test Impact Point Close-up View

Section 20

Solicitation Requirements:

TS 23 Towing - Provide the towing procedure.

New Flyer Response:

Please refer to the Service Information Bulletin #100-000 for the complete description of towing procedures for the Xcelsior buses. This bulletin serves as material to assist in the towing of any of the Xcelsior buses, if there are any situations that require assistance New Flyers RPSM will be available to assist with any questions the agency may have.

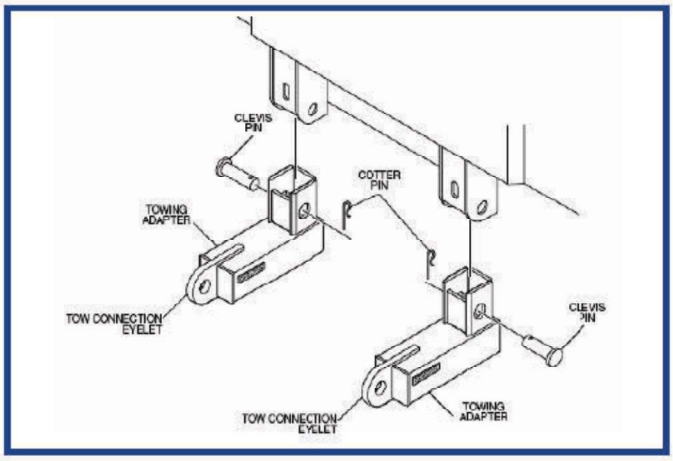
Towing

When towing low-floor buses, extreme care, caution and attention are required. The driveshaft and cover plate (not part of the New Flyer Towing Kit) must be removed, regardless of distance or speed traveled, to prevent damage and voiding warranty to the power train components. All safety precautions should be followed as identified in the New Flyer service manual.

Any customer specific towing procedures should be compared carefully with the procedure specified in the New Flyer service manual.

Front Flat Towing

- Front flat towing is the recommended procedure for the low-floor vehicle using the towing adapter kit to avoid bumper damage
- The method used will vary depending on the type of towing equipment at the disposal of the transit company
- The towing device will withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20 degrees of its longitudinal
- New Flyer has successfully tested the front static and dynamic towing procedure at the Altoona Bus Research and testing Center







Section 2P

Solicitation Requirements:

TS 28.3 Articulated Joint (Articulated Transit Coach).

Proposed configuration of these devices and the reverse-speed requirements shall be submitted for approval of the Agency.

New Flyer Response:

Included is an attachment for the configuration of the Articulated Joint, also included is the maintenance manual for PSTA s guide to maintain the Articulated Joint, this includes removal and installation with full detailed drawings.

Included in the attachment for Articulated Joint is the following information:

- Trouble shooting
- Maintenance
- Removal of the Articulated Joint
- Installation
- Operation
- Main Bearing
- Torque Sequence
- Yoke Plate
- Wrist Joints
- Articulated Joint Torque Specification

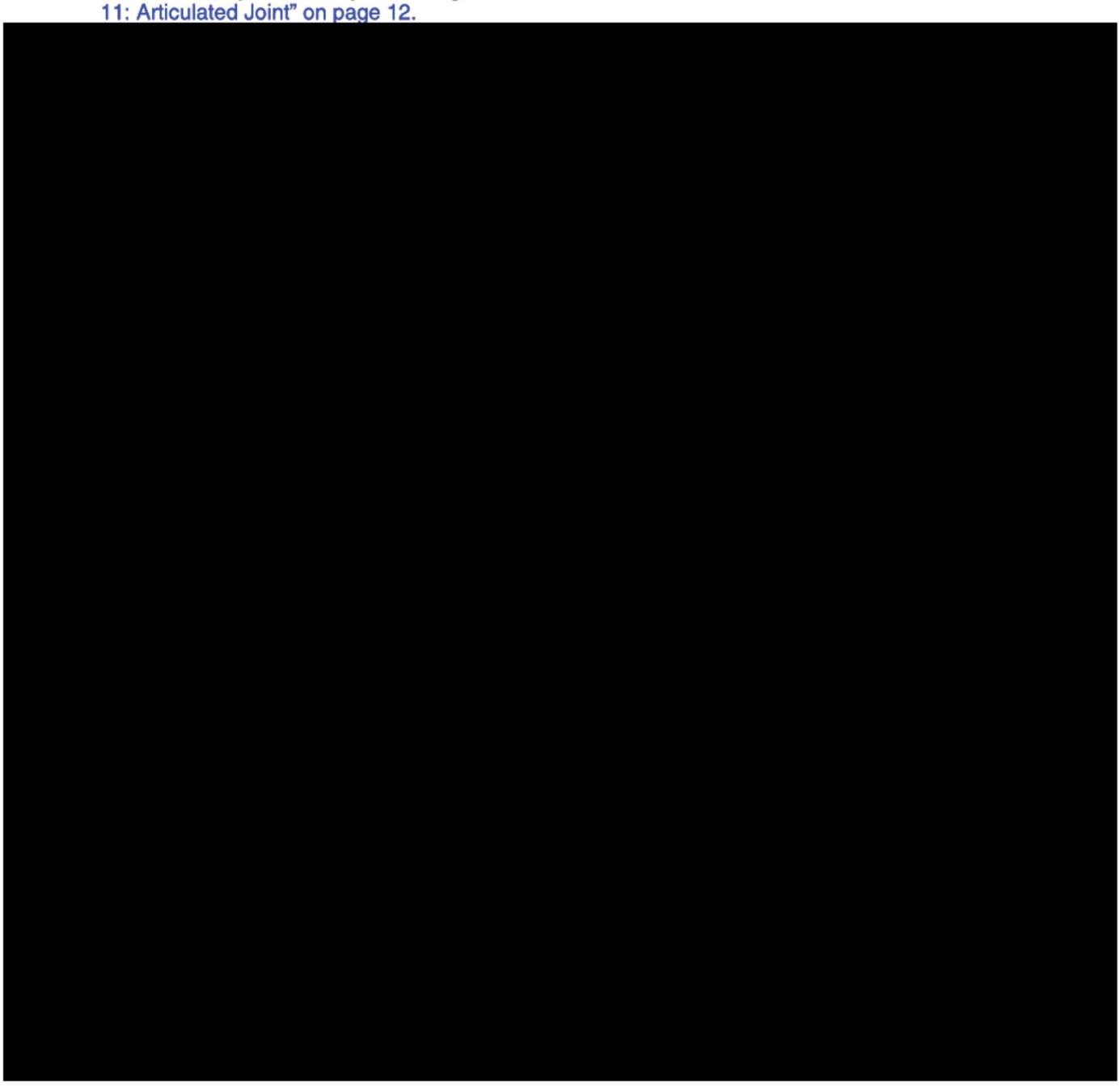
2. ARTICULATED JOINT

2.1. Description

The ARTIC-O-MAT Limbo II 350 Articulation Joint is the assembly that provides a pivoting joint between the front and rear sections of the vehicle and also provides damping and locking control during both forward and reverse operation to ensure vehicle stability and safety. See "Fig. 21-11: Articulated Joint" on page 12.

The major components of the articulation joint include:

- ❒ Articulation Mechanism
- ❒ Hydraulic System
- ❒ Electrical System & Controls
- ❒ Center Hoop Area Components
- ❒ Bellows Assembly



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2.2. Articulated Joint Troubleshooting

ARTICULATED JOINT TROUBLESHOOTING		
PROBLEM	**POSSIBLE CAUSE**	**ACTION REQUIRED**
Joint Fail indicator on instrument panel illuminates	System pressure loss	Check system pressure and refill as necessary. Refer to the Preventive Maintenance Section of this manual for pressure check procedure. Also Refer to 4.3.1. "Filling the Hydraulic System" on page 35 in this section of the manual for filling procedures.
Center hoop sags	Hoop connection improperly adjusted or connection failed	Check center hoop height adjustment. Refer to 6.5.2.4. "Center Hoop Height Adjustment" on page 73 in this section for procedure.
	Hoop connection failed	Inspect center hoop elastic bearings for deterioration or separation of the rubber element. Replace as necessary.
	Plastic wear plates worn	Inspect plastic wear plate thickness. Refer to the Preventive Section of this manual for inspection procedure.
Hoop squeaks at roof area	Roof struts	Lubricate roof strut bushings using silicone spray lubricant.
Grinding noises from turntable cover plates	Lack of lubrication	Clean and lubricate plastic wear strips. Refer to the Preventive Maintenance section of this manual for lubricant specification and procedure.
	Plastic wear strips worn	Check for wear. Refer to 6.3.3. "Plastic Wear Strip Inspection" on page 64 in this section for inspection procedure. Replace worn wear strips.

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2.3. Maintenance

2.3.1. Warranty Limitation

New Flyer Industries reserves the right to refuse warranty on any section or part of the body structure welded on or in any way modified or repaired by other than New Flyer approved personnel. New Flyer also reserves the right to refuse warranty on any component failure deemed to be the result of any unauthorized modification.

2.4. Removal

1. Park the vehicle on a flat surface in the workshop, preferably over a pit.
2. Set the Battery Disconnect switch to the OFF position.
3. Support the rear section of the bus with two floor jacks located at the bulkhead behind the turntable and two more floor jacks behind the rear axle as close to the rear bumper as possible.
4. Remove the roof struts. Refer to 6.5.3. "Roof Struts" on page 74 in this section for removal procedure.
5. Remove the folding bellows assembly. Refer to 7. "BELLOWS ASSEMBLY" on page 83 in this section for removal procedure.
6. Remove the hose clamp, electrical harness and hose bundle as an assembly as follows:

⚠CAUTION

Evacuate the A/C lines prior to disconnecting from the bulkhead connectors. Refer to the Thermo King Maintenance Manual for procedure. Observe all safety precautions and environmental regulations. Depressurize cooling system and drain the coolant supply and return lines at the bulkhead connectors.

   a. Disconnect the clamp from the center hoop by removing the nut at the bottom of the bracket. Note the number and position of washers before removing the lock nut. Leave the hoses fixed in the clamp and mark the hoses to identify which ends are facing the front.
   b. Disconnect all electrical connectors at the bulkhead plates on the front and rear sections of the vehicle.
   c. Disconnect all lines and hoses at the bulkhead connectors on the front and rear sections of the vehicle.
   d. Remove the complete hose bundle assembly with hose clamp from the vehicle. Seal the hose ends and bulkhead connectors to prevent contamination.
7. Remove the center hoop assembly. Refer to 6.5. "Center Hoop & Related Components" on page 69 in this section for procedure.
8. Remove the turntable cover plates. Refer to 6.3.5. "Cover Plate Replacement" on page 66 in this section for procedure.
9. Remove the center hoop beam. Refer to 6.2. "Center Hoop Beam & Plastic Wear Plates" on page 62 in this section for procedure.
10. Bleed off the hydraulic system pressure from the accumulator. Refer to 4.7. "Hydraulic Accumulator" on page 46 in this section for procedure.
11. Disconnect the hydraulic cylinders from the mounting brackets. Use Cylinder Pin Holder (Item 21 from Special Tools List) to hold the pin while removing the castle nut.
12. Swing out the cylinders from the body brackets and tywrap cylinders to the cast support frame ensuring that lifting eyebolts can be threaded into the support frame holes.
13. Disconnect the electrical harness from the hydraulic block and the proximity switches.

☞NOTE:

All electrical connections are labeled. These labels should be inspected and if any are missing the connections should be marked to allow correct reassembly.

14. Install four Eye Bolts (Item 24 from Special Tools List) to the four lifting points on the articulated joint. Support the articulated joint assembly by connecting a suitable hoist to the eyebolts.

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[redacted]

DO NOT apply any more tension on the hoist than is necessary to support the weight of the articulation joint. The vehicle weight must remain fully supported by the jack stands.

15. Remove the bolts that attach the wrist joints to the front section of the vehicle. See "Fig. 21-12: Articulated Joint Installation" on page 16.

☞NOTE:

Each mounting bolt is installed with a spacer between the bolt heads and the front vehicle structure. It is important for proper joint operation, that all fasteners, spacers, and washers are installed correctly. Take careful note of the assembly order for reassembly purposes and refer to the installation drawing in this section, as well as your New Flyer Parts manual, for the correct order of hardware installation.

16. Remove the six 5/8" bolts that attach the cylinder bracket to the vehicle structure. These bolts are installed into threaded inserts in the bulkhead tube.

17. Remove the bolts that attach the cast support frame to the rear section of the vehicle.

☞NOTE:

Each mounting bolt is installed with spacers and most have standoff tubes installed between the joint beam. Take careful note of which bolts have standoffs and the assembly order for reassembly purposes.

18. Carefully lift the articulated joint clear of the vehicle.

[redacted]

DO NOT rely on the adhesive to hold the plate in place once the mounting bolts are removed. The rear spacer plate is heavy and is attached to the chassis beam only with adhesive. Secure the plate in place using straps or some form of fastening to prevent it from falling.

19. If the rear spacer plate is removed, clean the adhesive from the area as follows:

    a. Mask the hydraulic rams.

    b. Use a flat bladed scraping tool to remove as much of the sealant as possible.

⚠CAUTION

DO NOT use sandpaper as the grit residue may be deposited on the hydraulic cylinder rams which will then require thorough cleaning and re-lubrication.

    c. Use Scotchbrite pads in a rotary motion to further clean the adhesive from the surface.

    d. Use Parcosol 264 wipes and a lint free cloth to completely clean the area of residual adhesive. Apply sufficient contact time and pressure to completely wet the adhesive with the wipe. Using the same motion, or a secondary motion, remove the adhesive from the surface.

[redacted]

Paracosol 264 wipes are highly flammable and must be used in a well ventilated area. Store, use and dispose of the wipes in accordance with Local, State or Federal Laws.

    e. Allow the solvent to dry for 5 to 10 minutes before applying adhesive.

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2.5. Installation

1. Lift the articulation joint into position so that the mounting holes in the wrist joints and cast support frame are aligned with threaded holes in the front and rear sections of the vehicle.
2. Install the bolts and spacers attaching the wrist joints to the front of the vehicle as follows:
   a. Ensure the mounting surfaces are free of paint, oil, grease and other contaminants.
   b. Install washers and spacers onto the mounting bolts and apply NEVER-SEEZ® to the threads and shank of the bolt, to the underside of the bolt head, and to both sides of the washers and spacers.
   c. Insert the mounting bolts through the bulkhead plate on the vehicle structure and the wrist joint mounting holes.
   d. Install the nuts and washers onto all the bolts.

☞NOTE:

Artic joint mounting bolts must be tightened in two steps. BE SURE to follow the torque values outlined in the torque specification chart and follow the sequence shown when applying the initial and final torques in the next step.

   e. Torque bolts from the head to specification. Refer to 3.7. "Articulated Joint Torque Specifications" on page 32 in this section for torque sequence and values.
   f. Apply a witness mark on each bolt head once final torque procedure is complete.

☞NOTE:

If the rear spacer plate was removed and the adhesive cleaned during the joint removal procedure, inspect the vehicle structure to be sure all spacer tubes are in place, then reapply gap filler adhesive and install the plates according to the following step.

3. Apply Loctite 635 gap filler adhesive to the vehicle structure and spacer plate bonding surfaces within 3 minutes of installing the spacer plate and completing the bolt connections. Once started the plates must be assembled with high press-on rates and full assembly must be completed quickly, before the adhesive cures.
4. Align the holes in the artic joint support frame with the mounting holes on the vehicle structure.
5. Apply NEVER-SEEZ® or Loctite 2047 to the specific areas of the fasteners as indicated. Refer to 3.7.1. "Support Frame to Rear Chassis Torque Procedure" on page 34 in this section for procedure. See "Fig. 21-12: Articulated Joint Installation" on page 16.

☞NOTE:

The upper bolts and lower bolts are installed with the bolt heads on opposite sides of the bulkhead tube. BE SURE that all short spacers are installed on the artic joint side of the bulkhead tube.

⚠CAUTION

The Artic Joint mounting bolts must be tightened in three stages. ALWAYS follow the torque values outlined in the torque specification chart and follow the sequence shown when applying the first, second and final torques in the next step.

6. Torque fasteners to specification. Refer to 3.7. "Articulated Joint Torque Specifications" on page 32 in this section for torque sequence and values.
7. Apply a witness mark on each nut once final torque procedure is complete.
8. Install the bolts which attach the cylinder support brackets to the bulkhead tube on the rear of the vehicle as follows:
   a. Apply Loctite-2047 and install bolts and washers through the cylinder support bracket mounting holes. Thread bolts into the holes on the bulkhead tube.
   b. Torque bolts to specification. Refer to 3.7. "Articulated Joint Torque Specifications" on page 32 in this section for torque sequence and values.
9. Remove lifting equipment and eyebolts from cast support frame.

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10. Connect electrical harness to hydraulic block and proximity switches.
11. Connect hydraulic cylinders to body bracket by installing cylinder pin. Install castle nut and torque to specification. Refer to 3.7. “Articulated Joint Torque Specifications” on page 32 in this section for torque procedure.
12. Fill and bleed the hydraulic system. Refer to 4.3.1. “Filling the Hydraulic System” on page 35 in this section for procedure.
13. Install the center hoop beam. Refer to 6.2. “Center Hoop Beam & Plastic Wear Plates” on page 62 in this section for procedure.
14. Install the turntable cover plates. Refer to 6.3.5. “Cover Plate Replacement” on page 66 in this section for procedure. Apply multipurpose grease to cover plate plastic wear strips and mating surfaces.
15. Install the center hoop assembly. Refer to 6. “CENTER HOOP AREA COMPONENTS” on page 62 in this section for procedure.
16. Install the hose and harness clamp assembly as follows:
    a. Connect the electrical harnesses at the bulkhead connectors
    b. Install hoses and lines to bulkhead connectors. Refer to 6.5.5. “Artic Joint Hose Torque Specifications” on page 79 in this section for procedure.
    c. Slide three washers and a bushing over center pivot bolt and install clamp assembly onto pivot bolt. Install lower bushing, washer, and nut.
    d. Adjust position of hoses and cables to allow the same bend radius on either side of the clamp.
    e. Tighten clamp end bolts to 15 ft-lb. (20 Nm). Tighten center pivot bolt to 15 ft-lb. (20 Nm) then loosen nut by 1/4 turn.
17. Install the folding bellows assembly. Refer to 7. “BELLOWS ASSEMBLY” on page 83 in this section for procedure.
18. Install the roof struts. Refer to 6.5.3. “Roof Struts” on page 74 in this section for procedure.
19. Remove the floor jacks.
20. Adjust center hoop bearing. Refer to 6.4. “Center Hoop Bearing” on page 66 in this section for procedure.
21. Recharge A/C system. Refer to Thermo King Maintenance manual for procedure.
22. Set the Battery Disconnect switch to the ON position and run the vehicle.
23. Top up coolant and bleed system.
24. Check power steering fluid, top up as necessary, and bleed system.
25. Road test vehicle and perform functional test of articulation joint.

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3. ARTICULATION MECHANISM

3.1. Description

The major mechanical components of articulation assembly include the support frame, yoke plate, main bearing, and wrist joints. See "Fig. 21-13: Articulation Assembly Mechanical Components" on page 20. The articulated joint is built up on a cast steel support structure, which is bolted to the front of rear coach. A large diameter bearing (slewing ring) is bolted on top of support frame and a steel yoke plate is bolted to the top of the bearing. The yoke plate is connected to the rear of the front coach using two metal-elastic "wrist joint" bearings.

3.2. Operation

The articulation assembly is designed to operate in either a free, damped (hydraulically restricted), or locked condition depending on driving conditions. The maximum working pivot angle of the joint is 52° with a maximum operating vertical angle of ± 10°. Mechanical bump stops prevent the joint from exceeding 52°.

The pivot angle between the front and rear vehicle sections is electronically monitored using proximity switches. Unintended pivoting of the joint is prevented by two double acting cylinders. A Max Angle indicator on the instrument panel will illuminate and a warning alarm will sound when the joint reaches a pivot angle of 49°. The brake interlocks are applied if the Max Angle of 49º is reached while reversing the vehicle in order to prevent jack-knifing. To release the brake interlocks put the drive unit into drive and move forward until the pivot angle is less than 49°.

3.2.1. Corrosion Protection

Refer to the Preventive Maintenance Section of this manual for information on the application of corrosion protection products and scheduled intervals.

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3.3. Support Frame

3.3.1. Description

The articulation is built up on a cast steel frame which is bolted to the bulkhead on the front of the rear coach. The main bearing is bolted to this support frame at the centre of the articulation. The support frame also includes mounting point for the hydraulic control block and plate assembly.

3.4. Main Bearing

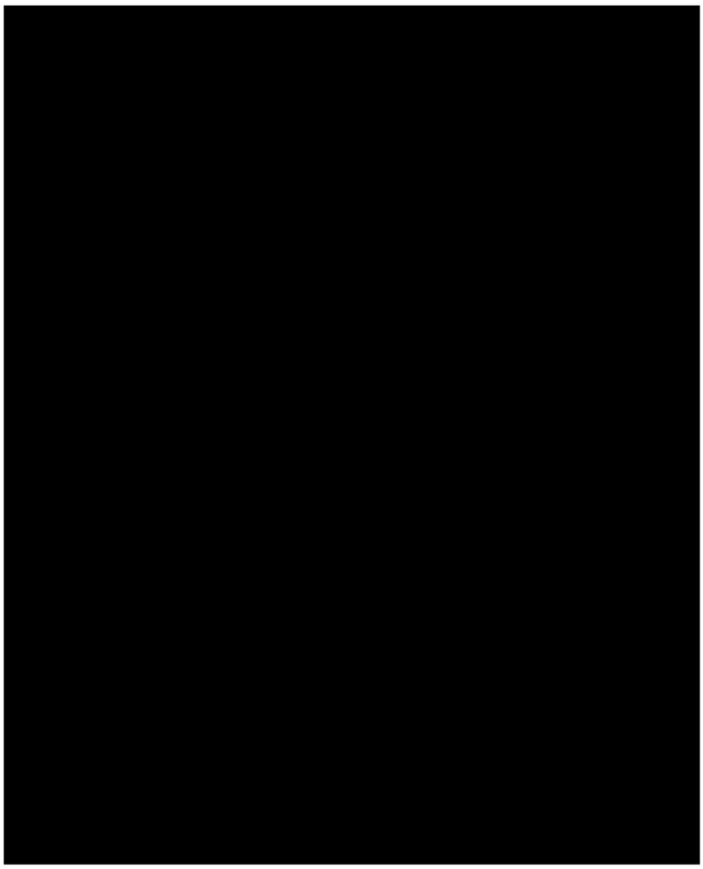
3.4.1. Description

The main bearing is made up of two metal rings with a ball race between them. This race is filled with steel ball bearings via a plug hole in the inside ring of the bearing. This plug is held in place by a pin which is driven through the inside ring at the center of the plug. The pin cannot fall through the inside ring of the bearing as this is mounted flush with the support frame. The plug hole is located at 45° to the centre line of the vehicle where the mechanical forces on the inside ring are at their lowest. See “Fig. 21-14: Main Bearing Fill Location” on page 21.

The inside ring of the main bearing is bolted to the support frame via 24 socket head bolts. The threads for these bolts are machined into the support frame. The outside ring is bolted to the yoke plate via 24 socket head bolts; the threads for these bolts are machined into the outside ring of the main bearing. There are four lubrication points located on the inside ring and four lubrication points on the top of the yoke plate that are connected to the ball race.

☞NOTE:

The main bearing lubrication fittings on the inside ring are redundant and do not require lubrication.



3.4.2. Inspection

The bearing should be inspected thoroughly every time a visual check of the bolted connections is carried out. Refer to the Preventive Maintenance Section of this manual for inspection interval. Inspect the bearing as follows:

1. Hoist the vehicle and remove the bottom section of the bellows. Refer to the General Information Section of this manual for lifting procedures.
2. Visually inspect the condition of the outside ring of the bearing, which is visible between the support frame and the yoke plate.
3. Visually inspect the condition of the bearing seal, which is visible between the inside and outside rings of the bearing.
4. Use a rag and remove all excess grease and dirt from the outside of the bearing after lubricating the bearing. Refer to the Preventive Maintenance Section of this manual for lubrication procedure.

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5. Check the outside circumference of the bearing for signs of material deterioration or cracking.
6. Ensure that the grease seal is not damaged or missing.
7. Check the condition of the inside ring of the bearing by viewing through the cover plate access doors. Carefully check the area around the bearing race filling point for cracks.
8. If the bearing shows any signs of deterioration it should be replaced immediately.

3.4.3. Maintenance

Refer to the Preventive Maintenance Section of this manual for recommended lubrication interval and lubricant specification.

3.4.4. Removal

1. Park the vehicle on a flat surface in the workshop, preferably over a pit.
2. Set the Battery Disconnect switch to the OFF position.
3. Support the rear section of the bus with two floor jacks located at the bulkhead behind the turntable and two more floor jacks behind the rear axle as close to the rear bumper as possible.
4. Remove the roof struts. Refer to 6.5.3. “Roof Struts” on page 74 in this section for procedure.
5. Remove the folding bellows assembly. Refer to 7. “BELLOWS ASSEMBLY” on page 83 in this section for procedure.
6. Remove the hose clamp assembly. Refer to 6.5.4.4. “Removal (Hose Bundle Assembly)” on page 77 in this section for procedure.
7. Remove the center hoop assembly. Refer to 6. “CENTER HOOP AREA COMPONENTS” on page 62 in this section for procedure.
8. Remove the center hoop beam. Refer to 6.2. “Center Hoop Beam & Plastic Wear Plates” on page 62 in this section for procedure.
9. Bleed off the hydraulic system pressure from the accumulator. Refer to 4.7. “Hydraulic Accumulator” on page 46 in this section for procedure.
10. Disconnect the cylinder rod ends from the yoke plate by removing the cotter pin and castle nut. Use Cylinder Pin Extractor (Item 22 from Special Tools List) and remove the pins. See “Fig. 21-15: Main Bearing Installation” on page 23.
11. Pull the cylinders free of the yoke plate, compress them completely to protect the rams, and tie down to the protruding sections of the cast support frame.
12. Remove the bolts that attach the yoke plate to the wrist joints.
13. Support the weight of the yoke plate and remove the four M12 x 90mm long hex head bolts and washers that secure the two plastic wear plates to the yoke plate. Note the location of the four M12 hex bolts for reinstallation.
14. Remove the remaining 20 M12 x 70mm long socket head bolts that attach the yoke plate to the outer ring of the main bearing.

☞NOTE:

The M12 socket head bolts used to attach the main bearing inner and outer rings to the support frame and yoke plate are of different lengths. The yoke plate bolts are 70mm long and the support frame bolts are 80mm long. DO NOT intermix.

15. Use appropriate lifting equipment and remove the yoke plate.
16. Remove the large O-ring from the main bearing.
17. Remove the four O-rings from the grease passageways on the top surface of the main bearing.
18. Remove the 24 M12 socket-head bolts that attach the main bearing assembly to the support frame and remove the main bearing from the vehicle.

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3.4.5. Installation

⚠CAUTION

Observe the markings on the inner and outer rings of the new bearing and follow the instructions in this procedure for correct positioning of the bearing rings. See "Fig. 21-16: Main Bearing Location" on page 26.

1. Clean all mating surfaces between the main bearing and the bearing seat on the cast support frame.
2. Carefully place the new bearing onto the cast support frame, aligning the holes in the inside ring of the bearing with the tapped holes in the cast support frame. The red dot on the surface of the inner ring should be located between the 7 and 8 o'clock positions.

⚠CAUTION

DO NOT reuse the socket or hex head bolts that fasten the main bearing to the cast support frame and to the yoke plate. Use new bolts.

3. Install 24 new M12 socket head bolts and tighten to the specified value and sequence. Refer to 3.4.6. "Main Bearing Torque Sequence" on page 27 in this section for torque procedure.
4. Prepare the main bearing for alignment with the yoke plate by rotating the outer ring of the bearing until the red dot on the outside edge is aligned with the 6 o'clock position. Also note that the factory markings "FRONT" and "REAR" on the face of the outer ring are correctly located with respect to the vehicle.

☞NOTE:

Ensure the correct M12 bolts are used at this location. The bolts should be 80mm in length. Refer to your New Flyer Parts Manual for correct application.

5. Install a new large O-ring onto the main bearing.
6. Install four new O-rings in the grease passageways located on the top surface of the main bearing outer ring.
7. Use appropriate lifting equipment and position the yoke plate onto the main bearing, being careful to align the holes in the yoke plate with the threaded holes in the main bearing.
8. Install two plastic roller wear plates on the top surface of the yoke plate using four new hex head M12 bolts and washers. Do not final tighten at this time.

☞NOTE:

Ensure the correct M12 bolts and washers are used at this location. The washers are thick, galvanized A13 sized washers and should not be substituted with alternate washers. Refer to your New Flyer Parts Manual for correct part number.

9. Install 20 new M12 socket head bolts in the remaining mounting holes and tighten all 24 mounting bolts to the specified value and sequence. Refer to 3.4.6. "Main Bearing Torque Sequence" on page 27 in this section for torque procedure.

☞NOTE:

Ensure the correct M12 bolts are used at this location. The bolts should be 70mm in length. Refer to your New Flyer Parts Manual for correct application.

10. Install the fasteners that attach the yoke plate to the wrist joints and torque to specification. Refer to 3.7. "Articulated Joint Torque Specifications" on page 32 in this section for torque values.
11. Connect the cylinders to the yoke plate using a cylinder pin. Install castle nut, torque to specification, and install cotter pin. Refer to 3.7. "Articulated Joint Torque Specifications" on page 32 in this section for torque values.
12. Fill and bleed the hydraulic system. Refer to 4.3.1. "Filling the Hydraulic System" on page 35 in this section for procedure.
13. Install the center hoop beam. Refer to 6.2. "Center Hoop Beam & Plastic Wear Plates" on page 62 in this section for procedure.
14. Install the center hoop assembly. Refer to 6. "CENTER HOOP AREA COMPONENTS" on page 62 in this section for procedure.

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15. Install the hose clamp assembly. Refer to 6.5.4.6. “Installation (Hose Clamp Only)” on page 78 in this section for procedure.
16. Install the folding bellows assembly. Refer to 7. “BELLOWS ASSEMBLY” on page 83 in this section for procedure.
17. Install the roof struts. Refer to 6.5.3. “Roof Struts” on page 74 in this section for procedure.
18. Remove the floor jacks.
19. Set the Battery Disconnect switch to the ON position and road test the vehicle.

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3.4.6. Main Bearing Torque Sequence

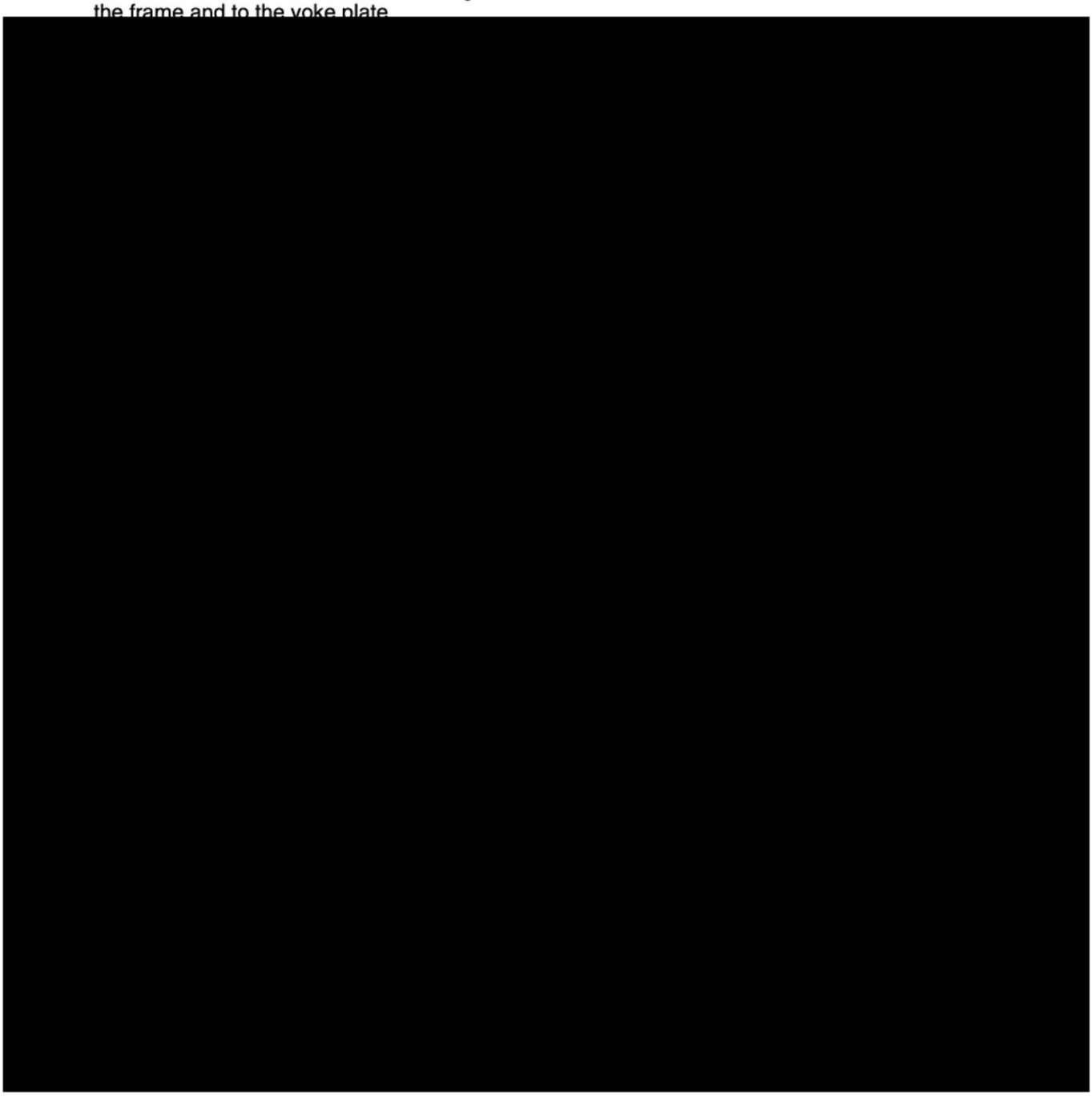
The main bearing bolts can be torqued, with the center hoop and cover plates installed, using the following procedure:

1. Unscrew the aluminum strip between the seats on the center hoop carrier beam.
2. There are four access holes in the center hoop beam, two on each side located above the bolts that connect the bearing to the frame and to the yoke plate.
3. Tighten all bearing bolts to 74 ft-lb. (100 Nm). See "Fig. 21-17: Main Bearing Bolt Torque Sequence" on page 27.

☞NOTE:

If the bolts are loose or stretch when being tightened, the bearing and all the connecting bolts are to be replaced.

4. Once the bolts have been torqued return the hoop to the center position.



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3.5. Yoke Plate

3.5.1. Description

The yoke plate is manufactured from high quality steel plate. The yoke plate is bolted to the top of the outside ring of the main bearing. The plate is connected via two wrist joints to the rear of the front coach. Two double acting hydraulic cylinders are connected between the yoke plate and the rear coach.

3.5.2. Operation

The yoke plate rotates with the front coach body through a total movement of 104° (from 52° right to 52° left). The maximum horizontal angle is limited by mechanical bump stops which are located on the yoke plate behind the wrist joints. These bump stops are equipped with replaceable rubber stoppers that are held in place with a lock nut.

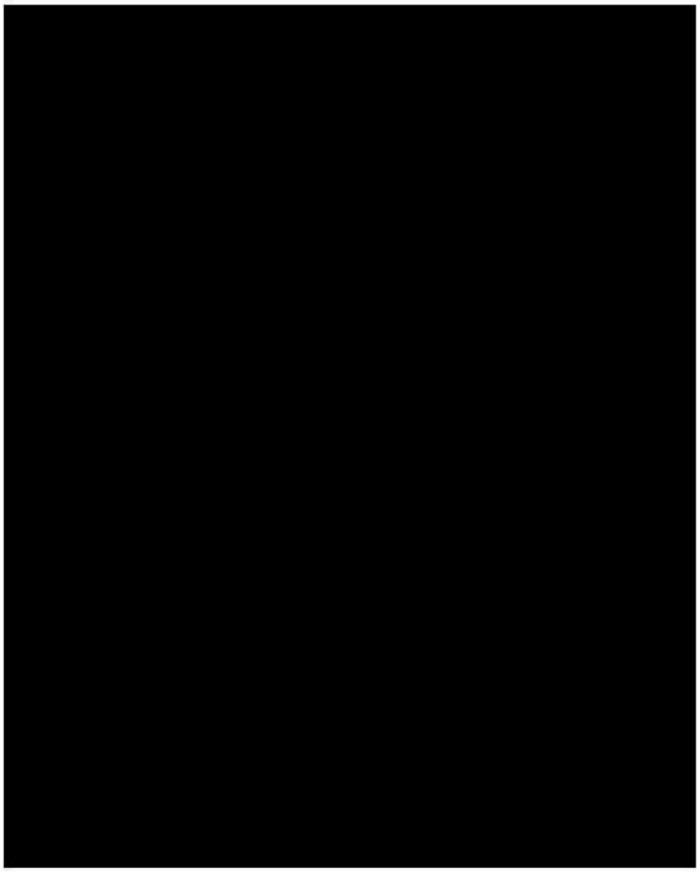
3.5.3. Bump Stop Inspection

⚠CAUTION

Operating the vehicle with worn or missing bump stops will cause damage to the hydraulic cylinders. Damaged or worn bump stops should be replaced immediately.

The bump stops are considered wear parts and must be inspected and replaced as necessary on a regular basis. Refer to the Preventive Maintenance Section of this manual for inspection interval. Inspect the bump stops as follows:

1. Open the access doors in the turntable cover plates.
2. Visually inspect the condition of the bump stops, which are located under the yoke plate between the wrist joints and the cylinders. See "Fig. 21-18: Turntable Bump Stop" on page 28.
3. Use a telescoping mirror if necessary to perform a thorough inspection. Inspect rubber bumper for wear, cracks, tears, or any other signs of deterioration.



3.5.4. Bump Stop Replacement

1. Drive the vehicle over a pit or hoist into the air. Refer to the General Information Section of this manual for lifting procedures.
2. Remove the bottom section of the folding bellows.
3. Remove the lock nut that holds the bump stop to the yoke plate. Remove the bump stop.
4. Apply medium strength Loctite adhesive to the threads on the new bump stop and torque the nut to 15 ft-lb. (20 Nm).

3.6. Wrist Joints

3.6.1. Description

The wrist joints connect the front coach body to the yoke plate. They allow the vertical movement between the two coach bodies. The wrist joint is made up of a cast metal housing with a metal-elastic bearing.

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3.6.2. Operation

The wrist joint bearing allows a vertical movement of ±10° (total movement 20°). The maximum required vertical angle is defined by the approach angle and the break away angle between the centre axle and the hinge point at the turntable when driving forwards and the breakaway angle at the rear of the vehicle when reversing. On a low floor Artic these angles are usually between 6° and 8° and the resulting maximum vertical angle at the turntable is 9°. Under normal driving conditions it is not possible to maneuver the vehicle so that a larger angle can occur. However, it is possible to exceed the maximum vertical angle if the vehicle is lifted with hoists that are improperly synchronized.

3.6.3. Inspection

Inspect the wrist joints on a regular basis or if the operator complains of noise coming from the turntable when driving through a dip in the road or over the crest of a hill.

☞NOTE:

If the vehicle has been involved in an accident or has exceeded the maximum vertical operating angle during a lifting operation, there is the possibility that the rubber element in the wrist joint has separated and turned inside the bearing housing. In this situation, the wrist joint will typically make noise when there is vertical movement between the vehicle body and the articulation joint.

Inspect the wrist joints as follows:

1. Drive the vehicle over a pit or use wheel lifts to hoist vehicle. Refer to the General Information Section of this manual for lifting procedures.
2. Remove the bottom section of the bellows.
3. Check both sides of each bushing. See “Fig. 21-19: Wrist Joint Inspection” on page 30.
4. If the spring ring is damaged or missing or the rubber has deteriorated replace the wrist joint.

3.6.4. Removal

☞NOTE:

The wrist joints should always be replaced as pairs.

1. The vehicle should be parked on a flat surface in the workshop, preferably over a pit.
2. Block the wheels and set the Battery Disconnect switch to the OFF position.
3. Support the rear section of the vehicle with two floor jacks located at the bulkhead behind the turntable and two additional floor jacks behind the rear axle as close to the rear bumper as possible.
4. Remove the bolt that connects the two roof struts to the center hoop on the roof of the vehicle.

☞NOTE:

Retain the spacer and take care to reinstall in the correct position during installation.

5. Swivel the roof struts through 180° so that they rest on the roof of the front and rear sections of the vehicle.
6. Remove the front bellows from the center hoop. It is not necessary to remove the rear bellows from the center hoop. The roof-mounted hoses can remain installed.
7. Open and remove the front aluminum cover plate.
8. Support the wrist joint assembly from below before removing the mounting bolts.
9. Remove the bolts that hold the wrist joint to the yoke plate. The outside bolts have plastic protective covers. These covers must be replaced when reassembling.
10. Remove the bolts that hold the wrist joint to the front bulkhead and remove the wrist joint assembly from the vehicle.

3.6.5. Installation

Installation is the reverse of removal. Refer to 3.7. “Articulated Joint Torque Specifications” on page 32 in this section for wrist joint torque values and torque sequence. Also Refer to 3.6.6. “Wrist Joint Torque Procedure” on page 30 in this section for instructions on the use of special tools used in the torque procedure.

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3.6.6. Wrist Joint Torque Procedure

☞NOTE:

The wrist joint replacement procedure typically requires removal of the front bellows and flexible floor, thereby allowing sufficient access to torque the M22 nut on the wrist joint connection to the yoke. However, if the wrist joint is only being torque-checked during scheduled maintenance, then the following procedure can be used to avoid the need to remove the bellows flexible floor.

The following procedure makes provision for applying torque to the head of the wrist joint M22 bolt, thereby eliminating the time consuming process of removing the bellows flexible floor to access the nut. The special tools allow one person to perform the task. Proceed as follows:

1. Obtain the Holding Tool (Item 27 from Special Tools List) and position the two sockets over the nuts on the wrist joint. Slide the holding bracket under the socket tool to hold the sockets in place. See "Fig. 21-20: Tightening Inboard Curbside Bolt" on page 31.
2. Install the 32mm Socket (Item 25 from Special Tools List) on hex head of wrist joint bolt. See "Fig. 21-21: Tightening Outboard Curbside Bolt" on page 31.
3. Install Torque Multiplier (Item 26 from Special Tools List) onto socket and locate the reaction arm of the torque multiplier against the yoke plate. Depending on the location of the fastener, the reaction arm will be resting against either the edge of the yoke plate or the pocket within the yoke plate. See "Fig. 21-22: Tightening Inboard Streetside Bolt" on page 31. See "Fig. 21-23: Tightening Outboard Streetside Bolt" on page 31.
4. Use the torque multiplier ratio stamped on the torque multiplier to calculate the setting on the torque wrench.

   Example: Torque multiplier ratio of 3.6:1 equates to torque wrench setting of 154 ft-lb. (208 Nm) in order to achieve the desired torque output of 553 ft-lb. (750 Nm).
5. Install torque wrench onto torque multiplier. Tighten the wrist joint bolt head until the torque setting is reached.

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3.7.1. Support Frame to Rear Chassis Torque Procedure

1. Apply NEVER-SEEZ to the specific areas of the fasteners at the locations shown.
2. Insert bolts through support frame and spacer plate.
3. Apply Loctite 2047 to the threaded portion of the fasteners as shown. See "Fig. 21-25: Support Frame to Rear Chassis Fasteners" on page 34.
4. The support frame torque sequence must be followed for all three stages of the torque procedure. See "Fig. 21-24: Artic Joint Torque Points" on page 33.

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4. HYDRAULIC SYSTEM

4.1. Description

The hydraulic system can be divided into two parts, the high pressure section, which includes the cylinders, hoses and the lower part of the control block, and the low pressure section, which consists of the accumulator and the upper part of the control block including the 10 bar pressure switch and the test connection M1. The low pressure section keeps the system under pressure and compensates for temperature volume fluctuations. The high pressure section does the work as the fluid flows from one cylinder chamber to the other via the control block. See "Fig. 21-26: Hydraulic Control System" on page 37.

The hydraulic control system includes the following major components:

- ❒ Hydraulic Control Block
- ❒ Hydraulic Cylinders
- ❒ Hydraulic Accumulator

4.2. Operation

Two double acting hydraulic cylinders are installed in the turntable. Four hoses connect these cylinders to the hydraulic control block. When the turntable rotates, hydraulic oil is forced out of two cylinder chambers through the control block and into the remaining chambers, i.e. oil must flow through the control block if the turntable is to turn.

The vehicle handling can be influenced by controlling the flow through the hydraulic block. Refer to 4.5. "Hydraulic Control Block" on page 40 and Refer to 5. "ELECTRICAL SYSTEM & CONTROLS" on page 52 in this section for further information on the operation and control of the hydraulic system.

4.3. Maintenance

⚠CAUTION

Under no circumstances is work to be carried out on the hydraulic system when it is under pressure. Close off the low and high pressure systems and bleed off pressure from the part of the system that is being serviced. Refer to 4.5. "Hydraulic Control Block" on page 40 **in this section for procedure. DO NOT operate the vehicle with the screw lock closed. Ensure that the screw lock is returned to the open position and the system pressure is restored to 20.7 bar (300 psi) following completion of maintenance activity.**

4.3.1. Filling the Hydraulic System

1. Ensure that the hydraulic system is completely assembled and that the hydraulic hoses are connected properly. The hoses should have intact witness marks at the connections to the cylinders and hydraulic block.
2. Ensure that all connectors are tight. Tighten loose connections to 40 Nm and witness mark.
3. Ensure that the screw-lock connecting the high and low-pressure sections is open, i.e. screwed out.
4. Open all bleed valves on the hydraulic cylinders and connect transparent bleed hoses to each valve. Place free end of hoses in a container to catch escaping fluid.
5. Open the bleed valve located on the adapter fitting between the accumulator and the control block and connect a bleed hose.

⚠CAUTION

If air should enter the hydraulic system during the filling procedure, it could result in dangerously unstable vehicle operation at speeds exceeding 30 mph. The pump reservoir must be adequately sized and mounted above the pump as well as provide visual reference to the fluid level at all times during the filling and bleeding procedure. The pump must not be operated without oil in the reservoir.

6. Connect a pump to test connection PL on the hydraulic block and ensure the following conditions are met:

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a. The hydraulic system is filled with the proper specification and grade of hydraulic fluid. Refer to the Preventive Maintenance Section of this manual for fluid specification.

b. The pump used should be capable of achieving 250 bar pressure and should be primed carefully to ensure that only fluid and not a fluid air mixture is pumped into the system.

c. The pump must be equipped with a fine particle pressure filter of at least 5 microns.

☞NOTE:

A Pump and Diagnostic Equipment (Items 1 through 11, Item 13, and Items 16 through 20 from Special Tools List) are available for servicing the hydraulic system.

7. Pump oil into the system until it starts to flow out of the bleed lines. Continue pumping until the oil flowing through the bleed line is air free.

☞NOTE:

It will take between 20 and 40 minutes to fill the hydraulic system.

8. Close each bleed valve when no air is visible.

9. Open the bleed valve located on the adapter fitting between the accumulator and the control block and allow any entrapped air to escape. Close the bleed valve once all air has been bled out.

10. When all five bleed valves have been purged take a test line and bleed the test connection PR and then the test connection M1 beside the accumulator.

11. Bleed the cylinders once more in the following order: streetside cylinder aft bleed valve, curbside cylinder forward bleed valve, curbside cylinder aft bleed valve, streetside cylinder forward bleed valve. Then bleed the control block and accumulator using the bleed valve located on the adapter fitting between the accumulator and the control block. Loosen the hydraulic block from the frame by removing the four bolts that hold the plate under the hydraulic block to the frame. Tilt the hydraulic block so that the bleed valve is as high as possible.

12. Connect a 0-60 bar Pressure Gauge to the test point M1 and a 0-250 bar Pressure Gauge to the test point PR. (Items 6 and 7 from Special Tools List).

13. Pump the system to 20.7 bar (300 psi) hydraulic pressure. The pressure should rise quickly to 10 bar and then climb slowly to 20.7 bar (300 psi).

⚠CAUTION

DO NOT exceed 130 in-lb. (15 Nm) torque on either the lock nut or the threaded stud when tightening the screw lock.

14. Close the screw lock connecting the high and low pressure sections by screwing into the block.

15. The high-pressure section of the system will now be tested. Under no circumstances should the accumulator be subjected to pressures above 50 bar as higher pressures would damage the membrane

16. Pump the system up to a pressure of 210 bar.

17. Disconnect the pump from “PL”. Note the time.

18. Check each and every connection in the hydraulic system for leaks.

19. Tighten up the connections where necessary.

20. Leave the system under pressure for 60 minutes. The pressure should not drop more than 40 bar i.e. the minimum pressure after 60 minutes 170 bar. If a higher pressure loss is noted, repeat the last three steps.

21. Once the system has passed the high-pressure test bleed the excess pressure by connecting a test line to “PL” Remove the test line once the correct system pressure has been reached.

22. Open the screw lock between the high and low-pressure sections by screwing it out. Do not turn the screw more than 4 turns.

23. Connect the pump to “PL” and fill to 20.7 +0,-0.5 bar.

24. Remove all pressure gauges and tools.

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Section 2Q

Solicitation Requirements:

TS 28.5 Bellows.

Supply information on the actual service life achieved by the type of bellows being proposed. A sample of the bellows and attaching hardware may be requested for evaluation at the Agency's option. Bellows shall be approved by the Agency.

New Flyer Response:

Included is an attachment for the maintenance manual for Bellows for PSTA s guide to maintain the Bellows.

The following information for maintenance and repair:
- Bellows Material Separation Repair
- Aluminum Edge Repair
- Profile replacement
- Fabric repair
- Extension Bracket

7.2. Maintenance

Refer to the Preventive Maintenance Section of this manual for required maintenance and intervals.

7.2.1. Bellows Material Separation Repair

Fix lightly damaged (e.g. cuts, cracks or light deformation) aluminum profile by following these steps:

1. Open aluminum profile using the Manual Opening Profile Tool Pliers (Refer to 7.5. “PEI Repair Kit” on page 96, item 15).
2. Straighten the profile with pliers.
3. Crimp the entire length of the profile with Manual Crimping Profile Tool Pliers (Refer to 7.5. “PEI Repair Kit” on page 96, item 17).
4. Pinch the aluminum profile using Manual Closing Profile Tool Pliers (Refer to 7.5. “PEI Repair Kit” on page 96, item 16). Keep 40 mm (1.6 in) between the pinches.

7.2.2. Aluminum Edge Repair

See “Fig. 21-44: Aluminum Edge Repair” on page 84.

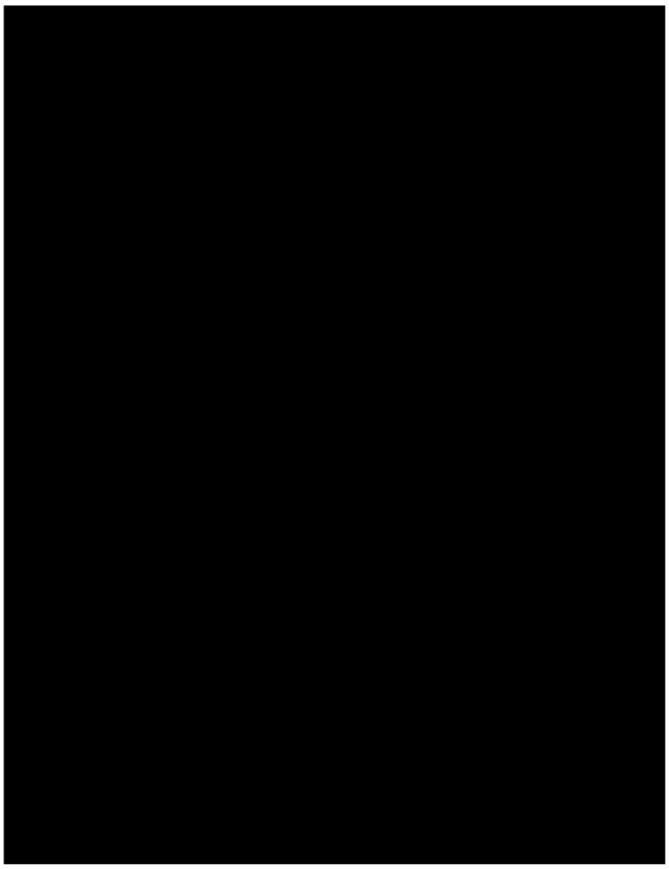
Fix cracked or cut aluminum profile by covering affected area with a section of the Aluminum Reinforce Repair Profile (Refer to 7.5. “PEI Repair Kit” on page 96, item 6).

1. Cut Repair Profile to the required length.

☞NOTE:

The minimum length of Repair Profile should be at least 50 mm (2 in).

2. Crimp the entire length of the profile with Manual Crimping Profile Tool Pliers (Refer to 7.5. “PEI Repair Kit” on page 96, item 17).
3. Pinch the aluminum profile using Manual Closing Profile Tool Pliers (Refer to 7.5. “PEI Repair Kit” on page 96, item 16). Keep 40 mm (1.6 in) between the pinches.



7.2.3. Profile Replacement

Aluminum profile consists of these sections: top curve, straight and bottom curve. If a section has been significantly damaged, follow these steps to replace it: See “Fig. 21-45: Profile Replacement” on page 86.

1. Open aluminum profile using the Manual Opening Profile Tool Pliers (Refer to 7.5. “PEI Repair Kit” on page 96, item 15).
2. Remove damaged profile.
3. Use Sand Paper (Refer to 7.5. “PEI Repair Kit” on page 96, item 9) to deburr the edge.
4. Staple the bellows material together using Stapler Manual Tool (Refer to 7.5. “PEI Repair Kit” on page 96, item 4). Make sure staples are 2 mm from the edge and 30 mm (1.2 in) apart.
5. Select either Top Corner Profile, Aluminum External Profile, or Bottom Corner Profile (Refer to 7.5. “PEI Repair Kit” on page 96, item 12, 5, and 13 respectively).
6. Cut the selected profile to desired size.

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7. Crimp the entire length of the profile with Manual Crimping Profile Tool Pliers (Refer to 7.5. “PEI Repair Kit” on page 96, item 17).
8. Pinch the aluminum profile using Manual Closing Profile Tool Pliers (Refer to 7.5. “PEI Repair Kit” on page 96, item 16). Keep 40 mm (1.6 in) between the pinches.
9. Use 50 mm of Aluminum Reinforce Repair Profile (Refer to 7.5. “PEI Repair Kit” on page 96, item 6) to cover the gaps between old and new profiles. Refer to 7.2.2. “Aluminum Edge Repair” on page 84 in this section for instructions.

7.2.4. Fabric Repair

Fix damaged bellows fabric by applying a patch of the same material (Refer to 7.5. “PEI Repair Kit” on page 96, item 1 for gray bellows, item 2 for black bellows). See “Fig. 21-46: Bellows Patch Repair” on page 86.

Follow these steps:

1. Soak a cloth in cleaning agent (Refer to 7.5. “PEI Repair Kit” on page 96, item 10).
2. Clean affected area.
3. Cut a piece of fabric desired shape.
4. Spread glue (Refer to 7.5. “PEI Repair Kit” on page 96, item 4).
5. Wait for 15 minutes.
6. Apply the patch to affected area and press firmly.
7. Seal the edges with Cyanacrylic Gel (Refer to 7.5. “PEI Repair Kit” on page 96, item 3).

7.2.5. Extension Bracket Repair

Fix damaged aluminum extension profile by replacing damaged profile with a new one.

Follow these steps:

1. Use a drill to remove rivets. See “Fig. 21-47: Bellows Edge Repair” on page 87.
2. Remove damaged extension profile.
3. Install new Aluminum Reinforce Repair Profile (Refer to 7.5. “PEI Repair Kit” on page 96, item 7).
4. Insert new Rivets (Refer to 7.5. “PEI Repair Kit” on page 96, item 8).
5. Press the assembly together with a suitable tool.

☞NOTE:

The tools used for this repair are not part of the PEI Repair Kit.

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Section 2R

Solicitation Requirements:

TS 35.4 Hubs and Drums / Discs.

Configuration to be included in proposal.

New Flyer Response:

Please refer to attached Service Bulletin, SIB-246-060-X-Gemini MDx (Air Dryer) outlining the following:

- Product features
- Equipment and Operation
- Service and Repair
- Warranty Testing

Section 2S

Solicitation Requirements:

TS 87.2 "In-Field" and/or "On-Route" Charger.

Documentation showing that the chargers meet such applicable codes shall be included with each Proposal.

New Flyer Response:

New Flyer is pleased to provide the brochures from the manufacturers we have partnered with in our Infrastructure solutions. This information can be covered during negotiations or pre-procuduction meetings to determine the best fit for the Agency.

Applicable codes

All Plug-in chargers will meet the following codes:

- UL Requirements
- SAE J1772 for Plug-in Chargers
- SAE 1772 for Overhead Chargers
- OCPP1.6 Communication requirements

Please refer to attachments showing the details of the charging systems available:

- ABB Electric Vehicle Infrastructure
- ChargePoint Express Plus Data
- Sheet Heliox Flex180 Power Cabinet
- HVC-C Depot-Charger
- Heliox Opportunity Charger 450KW
- Terra-94-124-184 Product-Guide

PRODUCT LEAFLET

Electric Vehicle Infrastructure

HVC-PD UL opportunity charging for electric buses



ABB's HVC-PD opportunity charging system offers high-power charging via an automated rooftop connection. With typical charge times of 3 to 6 minutes the system can be easily integrated in existing operations by installing chargers at endpoints, terminals and intermediate stops.

—
The HVC-PD charging system leverages an automated connection to enable extremely fast charge times.

A practical solution for route charging
ABB's Heavy Vehicle Charger (HVC) system architecture offers an ideal solution for opportunity charging, ensuring zero-emission public transit during the day without impacting daily route operations.

Key Benefits
+ Charge in 3 to 6 minutes
+ One charger serves many vehicle makes and models
+ Safe and reliable fully automated connection
+ SAE J3105-1 and OCPP 1.6 compliant
+ Remote diagnostics and management tools

Future-proof modular design
Additional power cabinets can be installed at any time, allowing operators to scale their operation and flexibly spread out infrastructure investments as their fleet grows.

Safe and reliable operation
ABB fast chargers are designed to the highest international electrical, safety, and quality standards, and are certified by notified bodies - ensuring safe and reliable operation.

Interoperability
ABB HVC chargers are based on international standards for operational compatibility with multiple vehicle types and brands. This allows operators to select vehicles from multiple vendors and not be locked into a single supplier.

Connectivity and remote services
ABB chargers come with an extensive suite of connectivity features including remote services such as monitoring, diagnostics and software upgrades. These advanced services provide equipment owners with powerful insights into their charging operations while delivering high uptime.

OCPP 1.6
ABB HVC-PD charging systems can be connected to standardized charging infrastructure management platforms using OCPP 1.6. ABB's HVC suite supports OCPP 1.6 Core and Smart Charging Profiles.

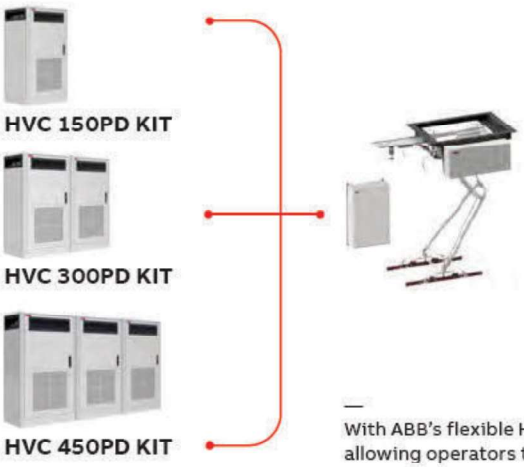
Buy America
ABB can offer the HVC-PD Depot Charging Solution with compliance to the Buy America Act, Rule 49 CFR Part 661.5.

ABB is your experienced partner
ABB HVC products are based on a decade of high-power experience in EV charging solutions. ABB has installed over 20,000 fast charging systems in more than 85 countries – and is the leading EV infrastructure technology supplier globally.

Opportunity charging 150 kW to 450 kW

A scalable system with future-proof reliability

Charging on existing structure



Charging on route



With ABB's flexible HVC architecture, power capability can be expanded over time, allowing operators to spread out infrastructure investments as their fleet grows.

Technical specifications

Configurations		HVC 150PD	HVC 300PD	HVC 450PD
Maximum output power		150 kW	300 kW	450 kW
Input AC connection		UL: 3-phase, 480Y/277 VAC +/- 10 % (60 Hz); CSA: 3-phase, 600Y/347 VAC +/-10% (60 Hz)		
Rated input power		170 kVA	2x 170 kVA	3x 170 kVA
Rated input current		UL: 198 A CSA: 168 A	UL: 2x 198 A CSA: 2x 168 A	UL: 3x 198 A CSA: 3x 168 A
Recommended upstream circuit breaker(s)		1 x 250 A	2 x 250 A	3 x 250 A
Output voltage range		150 – 850 VDC		
Maximum DC output current		250 A	500 A	600 A*
Vehicle connection interface		Inverted crossrail pantograph - OppCharge		
DC connection standard		SAE J3105-1 - IEC 61851-23-1** - ISO 15118		
Environment		Indoor/Outdoor		
Operating temperature		Standard: -10 °C to +50 °C (de-rating characteristic applies); Optional: -35 °C to +50 °C		
Protection		IP54 – IK10 (NEMA 3R)		
Network connection		GSM/3G/4G modem | 10/100 base-T Ethernet		
Compliance and safety		CSA No. 107.1-16 and UL 2202, certified by TUV BA Rule 49 CFR Part 661.5 (Optional)		
Dimensions				
Power cabinet (each)	Number of Power Cabinets	1	2	3
	Dimensions (H x W x D)	2030 x 1170 x 770 mm / 79.9" x 46.1" x 30.3"		
	Weight	1340 kg / 2954 lbs		
Charge pole (includes Pantograph & ACM)	Dimensions (H x W x D)	5240 x 1040 x 300 mm / 206.3" x 40.9" x 11.8"		
	Outreach	4670 mm / 183.9" x 30.3"		
	Weight	1706 kg / 3762 lbs		
ACM Control Module KIT	Dimensions (H x W x D)	1600 x1000 x 476.9 mm / 63" x 39.4" x 18.8"		
	Weight	193 kg / 425 lbs		
Pantograph KIT	Dimensions (H x W x D)	(resting position / bolt-hole pattern) 574 x 1300 x 900mm / 22.6"H x 51.2"W x 35.4"D		
	Weight	387 kg / 854 lbs		

* Limited by inverted pantograph contact ratings
** IEC 61851-23-1 in draft status

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Express Plus

Express Plus Specifications

Power Module

Power Module Output

Max Output Power	40 kW
Max Output Current	100 A
Power Conversion Efficiency	Up to 96%
Power Factor	0.99 at full load

Power Module Specifications

Power Module Dimensions	430 mm (H) x 130 mm (W) x 760 mm (L) (1'5" x 5" x 2'6")
Power Module Weight	45 kg (98.5 lb)
Power Module Cooling	Liquid Cooled Technology
Harmonics	iTHD < 5% (Complies with IEEE 519)

Power Block

Power Block Input

Input Rating	3-phase, 400-480Y VAC, 300-250 A 50/60Hz
Wiring	L1, L2, L3, Earth
Short Circuit Current Rating	65 kA

Power Block Output

Max Output Power	200 kW
Output Voltage, Charging	200V – 1000V
Max Current per Output	200A, 250A, 300A, 350A, 500A*
Number of Stations Served	One Power Block can serve up to 2 Power Link stations. Additional Power Blocks can be added to serve more stations
Max Power Modules per Power Block	5

* Subject to site configuration and installed stations

ChargePoint, Inc. reserves the right to alter product offerings and specifications at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document

Power Block Specifications

Power Block Dimensions	2200 mm (H) x 1000 mm (W) x 1250 mm (L) (7’3” x 3’3” x 4’1”)
Power Block Weight	409 kg (900 lbs) without Power Modules
Power Block Enclosure Rating	Type 3R, IP56

Station

Station Output

Max Output Power	200kW, 250kW, 300kW, 350kW with Power Blocks
Output Voltage, Charging	200V – 1000V
CCS1 Max Output Current**	Option 1: 200A continuous with Power Blocks Option 2: 375A peak, 350A continuous with Power Blocks
CCS2 Max Output Current**	Option 1: 250A continuous with Power Blocks Option 2: 375A peak, 300A continuous with Power Blocks
CHAdeMO Max Output Current**	Option 1: NA & EU: 200A continuous with Power Blocks Option 2: NA: 140A, EU: 125A continuous with Power Blocks

**Availability may vary

Station Specifications

Station Dimensions	2400mm (H) x 720mm (W) x 280mm (D) (7’11” x 2'5" x 11")
Station Footprint	965mm (W) x 635mm (D) (3'2" x 2'1") with Cable Management
Station Weight	250 kg (550 lbs)
Number of Connectors	Up to 2 connectors per station
Supported Connector Types	CHAdeMO, CCS1 (SAE J1772™ Combo), CCS2 (IEC 61851-23)
Cable Length	Standard 4.5 m (15') with Cable Management Kit (CMK) Longer cables with cable management optional
Station Enclosure Rating	Type 3R, IP56
Locking Holster	Yes
Mounting Type	Ground, Wall, Overhead

Functional Interfaces

LCD Display	Optional Full-color 200 mm (8”) LCD display for driver interaction
Authentication	RFID: ISO 15693, ISO 14443, NEMA EVSE 1.2-2015 (UR) Tap to Charge (NFC on Apple & Android) 15118-2 (EIM) Remote: Mobile and in vehicle (if supported by vehicle)

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Connectivity Features

Local Area Network	2.4 GHz and 5 GHz WiFi (802.11 b/g/n)
Wide Area Network	4G LTE
Supported Communication Protocols	OCPP 2.0
Service and Maintenance	Remote system monitoring, diagnostic, and proactive maintenance

Safety and Operational Ratings

Vehicle Safety Communication	CHAdeMO – JEVS G104 over CAN, CCS1 – SAE J1772 over PLC and CCS2 — IEC 61851-23
Plug-In Detection	Power terminated per JEVS G104 (CHAdeMO), SAE J2931 (CCS1) and IEC 61851-23 (CCS2)
Safety Compliance	UL and cUL listed: complies with UL 2202, UL 2231-1, UL 2231-2, CSA 107.1 CE marking: complies with IEC 61851
Surge Protection	Tested to IEC 6100-4-5, Level 5 (6 kV @ 3,000A). In geographic areas subject to frequent thunderstorms, supplemental surge protection at the service panel is recommended.
EMC Compliance	U.S and Canada: FCC 15 subpart A Class A; EU: EN55011, EN55022 and IEC61000-6-3 Class B

Generic Specifications

Operational Altitude	<3,000 m (<9,800 ft)
Operating Temperature	-40°C to 50°C (-40°F to 122°F)
Storage Temperature	-40°C to 70°C (-40°F to 158°F)
Operating Humidity	Up to 95% @ 50°C (122°F) non-condensing

Energy Management Features

Dynamic Power Management	Allows a fixed maximum power output per station or lets the system dynamically manage the power distribution per station
Remote Energy Management	Manage output power via the ChargePoint Admin Portal, API, and Open ADR 2.0b VEN

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Flex
180kW
B DC HPC D UL

824-Technical specifications



Applicability

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This document is part of the technical handbook which is an integral part of the Electric Vehicle Supply Equipment (EVSE), the Flex 180kW B DC HPC D UL. It is the responsibility of the copy holder to keep the distributed technical handbook and the related appendices up-to-date.

It is possible that a service bulletin is issued to give important safety information. These service bulletins may include safety items among other updates. When issued, these service bulletins are also an integral part of the technical handbook.

If changes occur, a new copy will be distributed and the copy holder shall take care of a controlled distribution and the disposal of the previous copy.

Date (day-mon-year)	Version	Description
14-01-2021	EN-001	Pre-release
22-01-2021	EN-002	Initial release

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1 Preface

This section gives information about the technical specifications as well as the compliancy details of the Electric Vehicle Supply Equipment (EVSE). The information for the storage conditions is given in the section logistic information.

The section Logistic information is also part of this technical handbook.

1.1 About the document

This document is part of the technical handbook which is an integral part of the Electric Vehicle Supply Equipment (EVSE), the Flex 180kW.

1.1.1 Structure of this document

This document gives the technical specifications, information on torque values and compliancy.

For easy access to the information, this document is divided into chapters. The chapters are:

- the preface, to give an introduction to the content and the use of the document;
- the technical specifications, to give the different design details;
- the torque tables, to give information for the torque values of electrical and mechanical constructions;
- the compliancy, to detail the information for the applicable Standards, Rules and Regulations.

1.1.2 How to use the documentation

The technical handbook is an integral part of the EVSE. You must keep the technical handbook, at all times, available and accessible in the vicinity of the EVSE.

Read the manual and understand the instructions before you do any work. Follow the instructions carefully. Heliox B.V. is not responsible for any damage caused by poor planning, not or incorrect follow-up or execution of the instructions as given in the document.

If you are in doubt, do not continue and ask for assistance.

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2 Technical specification

2.1 Safety design

Description	Specification
Human machine interface	Emergency stop, charge abort button
Ingress protection	NEMA 3R
Impact class	IK10

2.2 Electrical data

2.2.1 Power input requirements

Description	Specification
Input connections	3P+PE
Input power, full load	205 kW Nominal full load
Input power, idle	100 VA
Input AC line voltage range	480 +6/-13%
Input AC line frequency	60 Hz
Input AC phase current, max	283 A, Inrush current limited
Input AC phase current, MCB	400 A
Power factor	>0.99
Peak power conversion efficiency e.g. best case scenario	>96%
Total Harmonic Distortion	V<2, I<5%
Dielectric withstand	3000 Vrms
SCCR	35kA

2.2.2 Power output requirements

Description	Specification
Output DC voltage range	150 – 1000 Vdc
Rated DC output power	Triple DC output: 3x82HP [3x60kW] Single DC output: 245HP [180kW]
Rated DC output current	3-250 A

2.2.3 Network requirements

Description	Specification
Cellular	2G, 3G, 4G modem, LAN
Back office	OCPP, ChargeSight

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2.2.4 Cable specifications

Description	Specification
AC cable	Cross section between 3/0 AWG (95mm2) and 250 kcmil (120mm2). Wire rated temperature of 194 °F (90 °C). (Not is scope of delivery)
AC cable connection to busbar	Two wires per phase, narrow cable lugs, M10, galvanized, class 8.8 (Not in scope of delivery)



NOTICE
Actual cable quadrature calculations to be done by installer based on AC input requirements, local regulations and the type plate information.

2.3 Mechanical data

2.3.1 General data

Description	Specification
Material	Steel, coated
Color	RAL7035, Light grey

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2.3.2 Dimensions and weight

Description	Specification
Dimensions	
- Length	31.5" (800 mm)
- Width	31.5" (800 mm)
- Height	91" (2312 mm)
Weight	1570 lbs (712 kg) Charger packaged in wooden box

2.4 Ambient conditions

Description	Specification
Charger standard ambient temperature range	-4°F to 104°F (-20°C to 40°C) full output power
Charger extended ambient temperature range	-22°F to 113°F (-30 to +45°C) derating outside standard range
Relative humidity	between 5 and 95, no condensation allowed
Altitude, above sea level	Maximum: 6500 ft (2000 m)

2.5 Environmental specifications

Description	Specification

Environment	Indoor / Outdoor
Floor load	-
Point load	-

2.5.1 Emissions

Description	Specification
Noise [dB(A) @ m]	<60 @ 36ft
Air, max. temp	6 604 30 gal/h (2500 m^3/h), 131°F (55°C)

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3 Torque tables

The, indicative, torque tables are given for electrical connections on busbars and for mechanical plain or zinc-plated steel connections. The electrical connections on switches, relays, terminals, etc. are torque tightened.

These torque values are application and brand specific. Refer to the related technical information that came with these parts.

NOTICE
Equipment of Heliox is metric.

3.1.1 Torque table for electrical connections

Make sure, the threads of the fastener are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

When terminating busbars at the terminals, they should be tightened with "Conical Spring Washer DIN 6796-X Spring Steel" x = diameter (dia) of the corresponding bolt in mm.

NOTICE
Lubricated means coated with a lubricant such as oil, grease, or fasteners with phosphate and oil coatings or the use of a tread lock compound (e.g. Loctite). Dry means plain metal or zinc plated without any lubrication.

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This table is applicable for bolts, class 8.8 and copper busbar:

Size	Dry	Lubricated
M6 (or 1/4"-20)	76 inlb (8.6 Nm)	60 inlb (6.8 Nm)
M8 (or 5/16"-18)	186 inlb (21 Nm)	150 inlb (17 Nm)
M10 (or 3/8"-16)	372 inlb (42 Nm)	301 inlb (34 Nm)
M12 (or 7/16"-14)	637 inlb (72 Nm)	513 inlb (58 Nm)
M14 (or 1/2"-13)	1009 inlb (114 Nm)	805 inlb (91 Nm)
M16 (or 9/16"-12)	1540 inlb (174 Nm)	1230 inlb (139 Nm)

3.1.2 Torque table for mechanical connections

Make sure, the threads of the fastener are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

NOTICE
Lubricated means coated with a lubricant such as oil, grease, or fasteners with phosphate and oil coatings or the use of a tread lock compound (Loctite). Dry means plain metal or zinc plated without any lubrication.

This table is applicable for bolts, class 8.8 used in steel or zinc plated constructions:

Size	Dry	Lubricated
M6 (or 1/4"-20)	106 inlb (12 Nm)	85 inlb (12 Nm)
M8 (or 5/16"-18)	248 inlb (28 Nm)	195 inlb (22 Nm)
M10 (or 3/8"-16)	478 inlb (54 Nm)	381 inlb (43 Nm)
M12 (or 7/16"-14)	823 inlb (93 Nm)	655 inlb (74 Nm)
M14 (or 1/2"-13)	1310 inlb (148 Nm)	1044 inlb (118 Nm)
M16 (or 9/16"-12)	2036 inlb (230 Nm)	1629 inlb (184 Nm)

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4 Compliance

4.1 Standards to which each product has been tested and is approved for

Standard	Version	Title
2014/35/EU		Low Voltage Directive
2014/30/EU		EMC Directive
2014/863/EU		RoHS Directive (3)
IEC 60529	1989 A1: 1999 A2: 2013	Degrees of protection provided by enclosures (IP code)
IEC 61439		Low-voltage switchgear and control gear assemblies
Part 1	ed2 2011	General rules
Part 2	ed2 2011	Power switchgear and control gear assemblies
IEC 62262	2002	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
UL 2202	ed2	Standard for Electric Vehicle (EV) Charging System Equipment
UL 2231	ed2	Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits

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4.2 Standards to which the EVSE system has been tested and is approved for

These standards apply to the described cabinet and the cabinets distributed together.

Standard	Version	Title
IEC 61851		Electrical vehicle conductive charging system
Part 1	2017	General requirements
Part 21-2	2018	EMC requirements for off board electrical vehicle charging systems[1]
Part 23	2014	DC electric vehicle charging station
23/COR1	2016	Corrigendum 1
Part 24	2014	Digital communication between a DC EV charging station and an electric vehicle for control of DC charging

[1] In case of a distributed system the EMC marking has to be tested again when compliancy is necessary.

4.3 Certification related standards that are followed as guideline, product not to be certified for

Standard	Version	Title
DIN 70121[2]	2014	Electromobility – Digital communication between a DC. EV charging station and an electric vehicle for control of DC. charging in the Combined Charging System
ISO 15118[4]	ed 1	Road vehicles – Vehicle-to-Grid Communication Interface
Part 1	2019	General information and use-case definition
Part 2	2016	Network and application protocol requirements
Part 3	2015	Physical and data link requirements
ISO 12944	2019	Paints and varnishes – Corrosion protection of steel structures by protective paint systems
Part 5		Protective paint systems
ISO 3740	2019	Acoustics – Determination of sound power levels of noise sources – Guidelines for the use of basic standards

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[2] Communication guidelines (DIN 70121 and ISO 15118) have been extensively tested within Heliox and EV OEMs.

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PRODUCT LEAFLET

Electric Vehicle Infrastructure

HVC-C UL depot charging for electric fleets



ABB HVC-C UL Depot Charging systems offer a highly reliable, intelligent and cost-effective solution to charge large EV fleets such as buses, trucks and other commercial vehicles.

—
HVC Depot Boxes and power cabinets, lined up at a depot site.

A practical solution for busy depots
ABB Heavy Vehicle Charger (HVC) products enable electric buses and trucks to charge at the depot ensuring flexibility and scale for every fleet operation that is transitioning to zero-emission transportation.

Key Benefits
+ Smart charging
+ Small infrastructure footprint at vehicle interface
+ Flexible design for roof and floor mounting
+ SAE J1772 CCS and OCPP 1.6 compliant
+ Remote diagnostics and management tools

Sequential Charging
Improving total cost of ownership is easy using the sequential charging feature offered by ABB's depot chargers. This feature allows connection of up to three depot charge boxes with a single power cabinet and vehicles are charged sequentially over time. The system can follow an embedded, predefined charging process or remote triggers sent by a fleet management system via OCPP 1.6.

- Vehicles are charged with high power, maximizing vehicle availability
- The required grid connection is smaller, reducing upfront investments and operational costs
- The compact depot box is easy to install at sites with space constraints
- Optimal utilization of installed infrastructure meaning lower investments in charging equipment.

Buy America
ABB can offer the HVC-C Depot Charging Solution with compliance to the Buy America Act Rule 49 CFR Part 661.5.

Future-proof modular design
Power cabinets can be upgraded from 100 or 150 kW in the field, as well as add additional depot charge boxes, allowing operators to scale their operation and to spread investments over time.

Safe and reliable operation
ABB fast chargers are designed to the highest international electrical, safety, and quality standards, and are certified by notified bodies - guaranteeing safe and reliable operation.

Connectivity and remote services
ABB chargers come with an extensive suite of connectivity features including remote services such as monitoring, management, diagnostics and software upgrades. These advanced services provide equipment owners with powerful insights into their charging operations while enabling high uptime.

ABB is your experienced partner
ABB HVC products are based on a decade of high power experience in EV charging solutions. ABB has installed over 17,000 fast charging systems in more than 80 countries – and is the leading EV infrastructure technology supplier globally.

Overnight charging 100 kW - 150 kW

A field upgradeable system with future proof reliability

HVC 100C



upgradable

HVC 150C



A power upgrade can be done in the field by adding an extra power module. No groundworks, digging and disturbance to the site are required.

HVC 150C*



* 150 kW overnight charging system with three depot charge boxes; shown mounted on pedestal option.

Technical specifications

Configurations		**HVC 100C**	**HVC 150C**
Maximum output power		100 kW	150 kW
AC Input voltage		UL: 3-phase, 480Y/277 VAC +/- 10% (60 Hz) CSA: 3-phase, 600Y/347 VAC +/-10% (60 Hz)	
AC Input connection		L1, L2, L3, GND (no neutral)	
Rated input power		117 kVA	170 kVA
Rated input current		UL: 132 A / CSA: 108 A	UL: 198 A / CSA: 168 A
Recommended upstream circuit breaker(s)		UL: 1 x 200 A / CSA: 1 x 150 A	UL: 1 x 250 A / CSA: 1 x 250 A
Output voltage range		150 – 850 VDC	
Maximum DC output current		166 A	200 A
Vehicle connection interface		CCS/Combo Type 1 Connector	
Cable length		3.5 m (11.5 ft) standard; 7 m (23 ft) optional	
DC connection standard		SAE J1772 - IEC 61851-23 / DIN 70121 - ISO 15118	
Environment		Indoor/Outdoor	
Operating temperature		Standard: -10 °C to +50 °C (de-rating characteristic applies) Optional: -35 °C to +50 °C	
Protection		Power Cabinet: IP54 – IK10 (equivalent to NEMA 3R) Depot Charge Box: IP65 - IK10	
Network connection		GSM/3G modem | 10/100 base-T Ethernet	
Compliance and Safety		CSA No. 107.1-16 and UL 2202 certified by TUV BA Rule 49 CFR Part 661.5 (Optional)	
Dimensions			
Power Cabinet	Dimensions (H x W x D)	2030 x 1170 x 770 mm / 79.9 x 46.1 x 30.3 in	
	Weight	1340 kg / 2954 lbs	
Depot Charge Box (without pedestal)	Dimensions (H x W x D)	800 x 600 x 210 mm / 31.5 x 23.6 x 8.3 in	
	Weight	61 kg / 134.5 lbs (with 7 m / 23 ft cable)	
Depot Charge Box (with pedestal)	Dimensions (H x W x D)	1914 x 600 x 400 mm / 75.4 x 23.6 x 16.3 in	
	Weight	181 kg / 398 lbs (with 7 m / 23 ft cable)	

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Opportunity Charger
450 KW



Opportunity Charging is Ultra Fast charging at the turn-around location of the bus route and offers a zero impact solution. Without the need of schedule change, electric buses can run all day and a significant passenger capacity increase and cost reduction can be achieved.

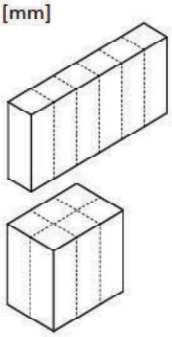
Heliox Power Curve Technology results in ultrashort charge sessions, that reduce the impact on the timetable to a minimum: within 2-5 minutes of opportunity charging at the end bus stops, you can optimize your electric bus operation. Implementation is simple and straightforward; the solution is fully scalable and can be introduced route by route. All chargers have the elements required for vehicle to grid communication.

*** Under development**

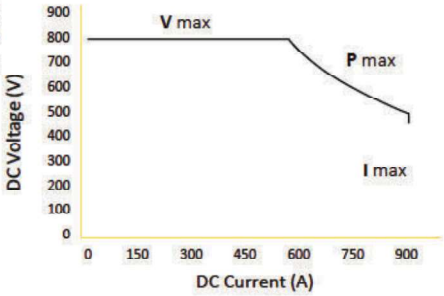
Dimensions

Line
H: 2300
W: 4800
D: 800
[mm]

Block
H: 2400
W: 2400
D: 1600



Power Curve



V min = 460 V DC
P max = 450 kW

Specifications

General	Charger
Environment operating	Indoor/Outdoor
Temperature	-4 to 122 ˚F (optional to -22 ˚F)
Charging standard	SAE J3105*
Compliance and safety	UL 2202* / UL2231*
Output DC voltage range	460 - 800 V
Rated DC output power	450 kW
Rated DC output current	900 A, bidirectional
Input connections	3P + PE
Input power rating; full load / idle	480 kVA / 500 VA
Input AC line-line voltage range	480 V +/-10%
Input AC phase current; maximum / fused	587 / 700 A, inrush current limited
Power factor, THD	> 0.99, < 5%
Power conversion efficiency	> 96%
Dielectric withstand	3000 V RMS
Network connection	3/4G modem / OCPP
Protection	NEMA 3R / IK10
Operational noise level	<55 dB(A) @ 6.56 ft
System weight	8818.49 lbs

*** Under development**

97% Efficiency

Highest up time

Back office systems

Zero Emissions

Support services

Industry's quietest

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Terra 94/124/184 UL Product guide

Terra fast chargers: The most deployed DC fast chargers in the world.

- Power sharing for high utilization
- Future proof, high-voltage technology
- Reliable, compact and flexible design
- Always connected, always smart

—

With more than 135 years of heritage in electrification technology, ABB offers a world-class EV charging solutions for safe, smart and reliable e-mobility – from the vehicle to the grid.

20,000+
fast chargers
sold worldwide

in operation
across
85+
countries

interoperability
tested with
50+ OEMs

10+ years
of EV charging
field experience

24/7/365
connectivity for
remote services

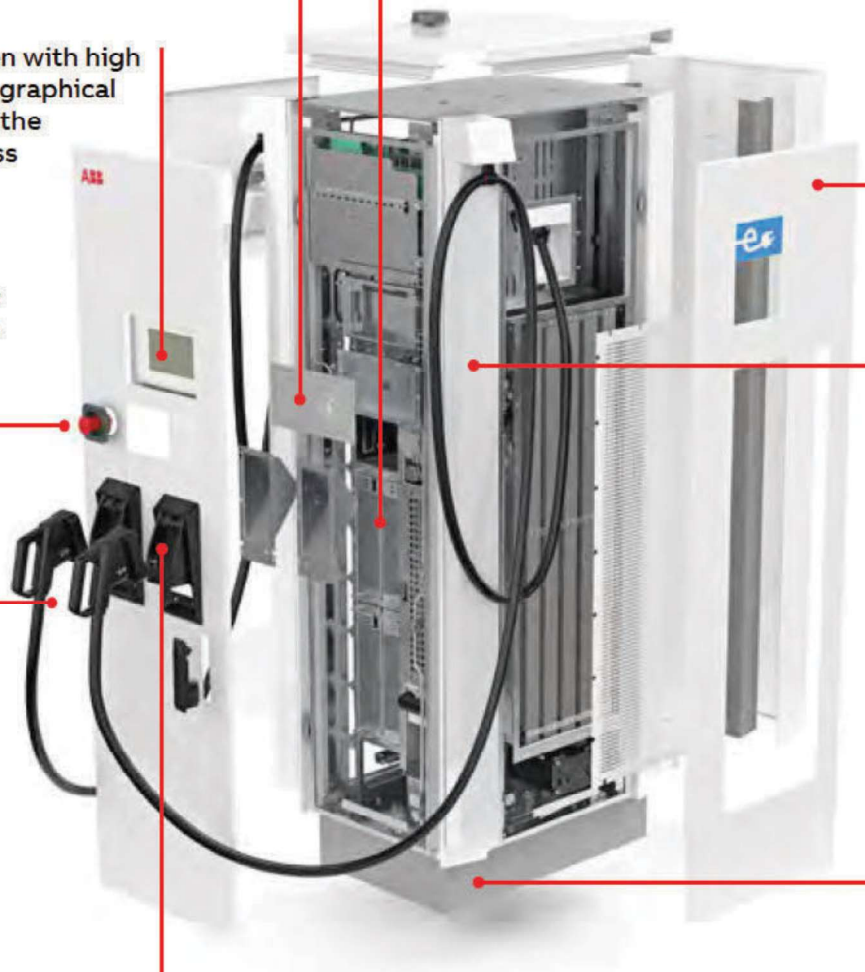
Terra 94/124/184 DC Fast Charger
At a glance

CONNECTED by cellular modem for 24/7 remote services, receiving updates over-the-air to support every new EV on the road - plus easy remote OCPP integration.

COMPACT power modules to support increasing demand from more EVs with bigger batteries - in a very easy to service package.

LCD touchscreen with high brightness and graphical visualization of the charging process

ROBUST all-weather powder-coated stainless steel enclosure



SAFETY: Emergency stop push button to immediately stop charging operation

CONVENIENCE and hassle-free reach for users – with retractable cable management option

GREATER revenue potential with simultaneous charging for 2 electric vehicles, including CCS and CHAdeMO combinations

EASY installation design with fast remote commissioning and start-up

AUTOMATIC authentication capability via CCS connector in the vehicle thanks to easy OCPP integration and Autocharge functionality

MAX CHARGING POWER
Terra 94: 90 kW
Terra 124: 120 kW (and 2 x 60 kW)
Terra 184: 180 kW (and 2 x 90 kW)

MAX CHARGING VOLTAGE
CCS 920 VDC
CHAdeMO 500 VDC

DIMENSIONS
Height 1900 mm / 74.8 in
Width 5655 mm / 222.6 in
Depth 880 mm / 34.6 in
Weight 395 kg / 871 lbs

Why Terra DC Fast Chargers?
Advanced, flexible, compact and smart



Power sharing for high utilization

- Terra 124 and Terra 184 can charge two vehicles simultaneously
- High utilization of charging assets benefit both public and fleet business models
- Supports all open charging standards in flexible configurations
- Safety certified to the highest standards



Future-proof, flexible high-voltage technology

- Flexible, redundant power architecture supports high uptime
- High-voltage charging range up to 920 V
- Fully compatible with current and future EVs
- Choices for power delivery up to 180 kW, following EV market growth



Reliable, compact and flexible design

- Based on the Terra platform, the most widely deployed DCFC family in the world
- Space-saving, all-in-one footprint with very easy installation and servicing
- Robust construction for all operational environments
- Cable management options enhance longevity



Always connected, always smart

- 24/7 connectivity, 99.5% ABB network uptime
- Remote services with remote firmware updates and upgrades
- OCPP integration-ready as well as ABB Web Tools functionality
- Autocharge and ISO 15118-ready for plug and charge operation

Fast charging beyond 50 kW

Power sharing delivers high utilization

90kW Charging Points
Terra chargers can provide a quick refill adding 100 miles of range in as little as 15 minutes (Terra 94).*

one EV
up to
90 kW



Retail/Shopping Sites
The Terra 124 charger can provide a full battery charge to two vehicles simultaneously while drivers are shopping, dining or at the movies.

one EV
up to
120 kW

two EVs
each up to
60 kW



Highway corridors and Fleets
The Terra 184 chargers can add 100 miles of range in as little as 10 minutes as well as fast-charge two vehicles at the same time in less than 20 minutes.*

one EV
up to
180 kW

two EVs
each up to
90 kW



* Actual charging speed depends on the electric vehicle model(s) and charging conditions.

Simultaneous charging with high power fast chargers can deliver maximum charging asset utilization while serving an ever-growing population of large battery electric vehicles.

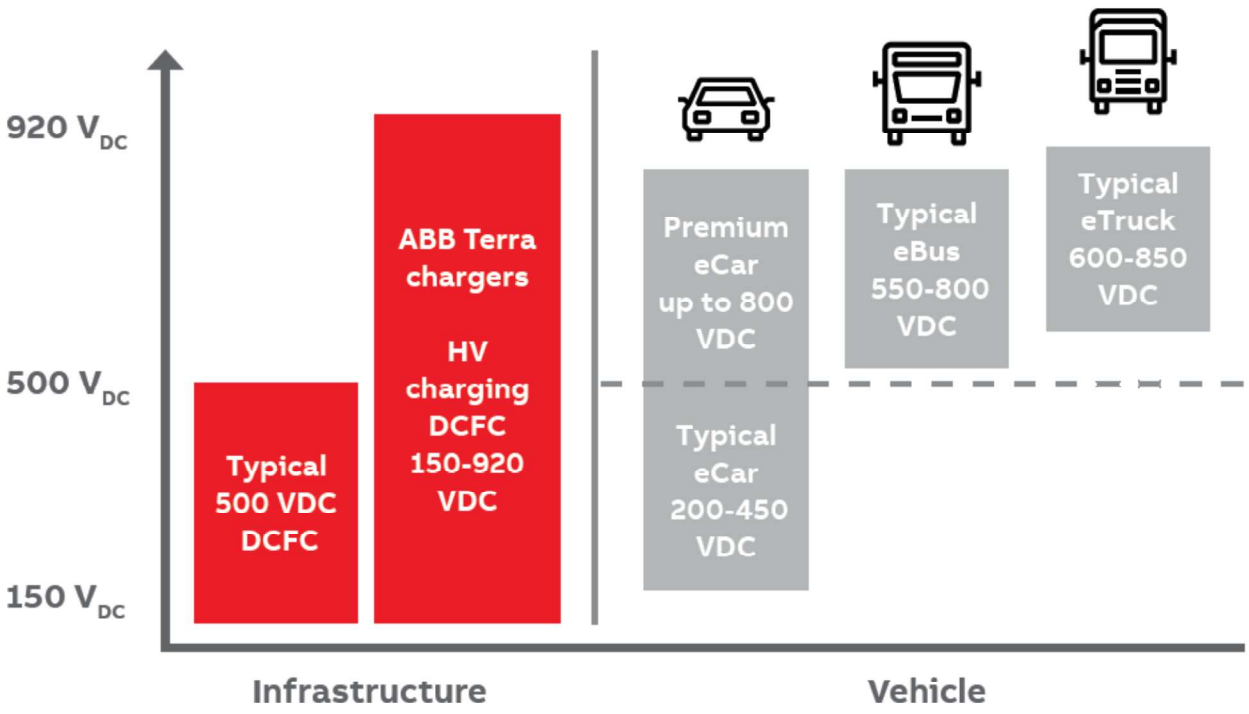
High voltage charging explained
A future-proof strategy

High voltage charging capabilities
As electric vehicles and their use cases diversify, high voltage DC charging has become more important to increase charging power while ensuring as much efficiency, safety and usability in DC charging systems.

Traditional passenger vehicle battery packs are usually designed for 400 VDC charging, so many standard charging systems do not exceed 500 VDC capability. However, some newer vehicles may have battery packs that exceed 400 VDC, often in the 600 to 800 VDC range.

Some EV battery packs, such as with vehicles designed for fleet usage, may only charge at high voltage ratings, demanding charging infrastructure that can deliver power tailored to HV battery packs.

ABB's Terra 94, Terra 124 and Terra 184 chargers are designed to meet EV battery voltage capabilities up to 920V to deliver charging services across a wider range of today's and tomorrow's EVs.



—
A high range of DC voltage capability is demanded to deliver efficient charging service to every EV and use case.

Terra charging times

All-in-one charging for every EV

		Charging time (minutes)					
		50 kW Terra 54 Terra 54HV	**90 kW** Terra 94	**120 kW** Terra 124		**180 kW** Terra 184	
				2 EVs	1 EV	2 EVs	1 EV
Car	60 kWh BEV 400 VDC	50	25	40	20	25	13
	90 kWh BEV 400 VDC	70	40	60	30	40	20
	100 kWh BEV 800 VDC	80	45	65	33	45	22
Bus/Truck	120 kWh BEV School Bus 400 VDC	95	53	80	40	55	26
	150 kWh BEV Delivery Van 800 VDC	120	65	100	50	65	33
	200 kWh BEV Work Truck 800 VDC	160	88	133	66	88	44
	300 kWh BEV 60' Transit Bus 800 VDC	240	130	200	100	130	66

—
Charge times shown based on average vehicle battery management system (BMS) requesting charging power from 20% to 80% under mild environmental conditions. Data assumes vehicles capable of charging at cited power levels.

Designed for flexibility
A configuration for every use case



Terra 94/124/184 C
Single outlet CCS with cable management system



Terra 94/124/184 CC
Dual outlet CCS with cable management system



Terra 94/124/184 CJ
Dual outlet CCS and CHAdeMO with cable management system and credit card reader

Power levels
- 90 kW
- 120 kW / 60 kW shared
- 180 kW / 90 kW shared

Charging standards
- CCS+CHAdeMO
- CCS-only single outlet
- CCS-only dual outlet

Cable management
- Reliable, tested system
- Factory or field install

User access / payment
- OCPP Integration
- Credit card reader
- PIN via Web Tools
- Autocharge/ISO 15118

Terra DC Fast Chargers
Technical specification UL

Specifications	Terra 94	Terra 124	Terra 184
Electrical			
Maximum output power	90 kW	120 kW or 60 kW x 2	180 kW or 90 kW x 2
AC Input voltage	480Y / 277 VAC +/- 10% (60 Hz)		
AC input connection	3-phase: L1, L2, L3, GND (no neutral)		
Nominal input current and input power rating	115 A, 96 kVA	153 A, 128 kVA	230 A, 192 kVA
Recommended upstream circuit breaker(s)	150 A	200 A	300 A
Power Factor*	> 0.96		
Current THD*	< 5%		
Short circuit current rating	65 kA		
DC output voltage	CCS-1: 150 - 920 VDC; CHAdeMO: 150 - 500 VDC		
DC output current	CCS-1: 200 A; CHAdeMO: 200 A		
Efficiency*	95%		
Interface and Control			
Charging protocols	CCS1 and CHAdeMO 1.2		
User interface	7" high brightness full color touchscreen display		
RFID system	ISO/IEC 14443A/B, ISO/IEC 15393, FeliCa™ 1, NFC reader mode, Mifare, Calypso, (option: Legic)		
Network connection	GSM/3G/4G modem; 10/100 Base-T Ethernet		
Communication	OCPP 1.6 Core and Smart Charging Profiles; Autocharge via OCPP		
Supported languages	English (others available on request)		
Environment			
Operating temperature	-35 °C to +55 °C / -31 °F to +131 °F (de-rating characteristics apply at extreme temperatures)		
Recommended storage conditions	-10 °C to +70 °C / 14 °F to +158 °C (dry environment)		
Protection	IP54, NEMA 3R; indoor and outdoor rated		
Humidity	5% to 95%, non-condensing		
Altitude	up to 2000 m (6560 ft)		
General			
Charge cable	6 m (19.6 ft)		
Dimensions (H x W x D)	1900 x 565 x 880 mm / 74.8 x 22.2 x 34.6 in		
Weight	350 kg / 775 lbs	365 kg / 800 lbs	395 kg / 870 lbs
Compliance and safety	UL 2202, CSA No. 107.1-16; UL 2231-1, UL 2231-2, CSA STD C22.2 No. 107.1; NEC Article 625, EN 61851, EN 62196; CHAdeMO 1.2; DIN 70121, ISO 15118; IEC 61000-6-3; EMC Class B, FCC Part 15		

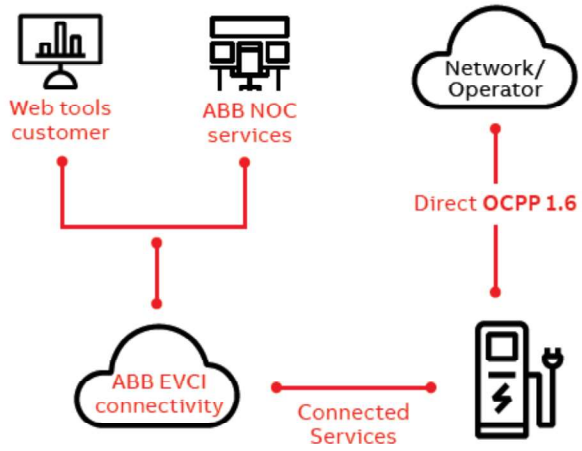
*Data shown at nominal output power

Flexible OCPP enablement

Back-office integrations backed by ABB connectivity

Network communications
ABB has integrated with nearly every major charging network around the world for OCPP support across public and fleet charging operations. ABB chargers can be operated using a direct OCPP connection while linking to ABB's advanced diagnostics and firmware update services for additional intelligence, technical support as well as reduced maintenance.

Leading the industry in implementing authentication technologies, ABB enables Autocharge coupled with an OCPP server. This functionality offers access control at the vehicle level, ideal for fleet asset telematics. ABB's software engineers work with the latest standardized protocols in the EV charging industry including roaming platforms, energy management software and next generation authentication solutions.



Better and faster support: Chargers connected to ABB's network operations center can achieve the fastest remote support from ABB network engineers. This leads to higher uptime of a charger network, minimizes the number of unplanned on-site visits, and significantly reduces overall operational costs.

Scalability and security: IT resources can scale in the ABB Ability cloud while connectivity monitoring is supported by ABB around the clock. ABB leverages Microsoft Azure based security with fewer backend connections to monitor.

OCPP Integrations

The Open Charge Point Protocol (OCPP) includes a broad set of messages with a wide range of functionality for enterprise telematics and usage data. The transaction-based set-up of the messages makes it easy to connect to a back-end system to process charging sessions, define usage models and handle data. Other capabilities include integration with apps and energy management, such as with OCPP Smart Charging Profiles.

Plug and charge

Eliminating manual authentication methods for drivers while delivering granular data sets to network operators and fleets has never been easier with 'plug and play' charging solutions.

ABB supports Autocharge, in conjunction with an OCPP network integration, to meet vehicle-based authentication demands seamlessly with any CCS vehicle.

Additionally, ABB has proactively enabled ISO 15118 (Plug & Charge) for its charging systems to deliver more advanced plug and play charging experience for the next generation of electric vehicles.

ABB EV Infrastructure services

For highest utilization and lowest downtime

Operational excellence
Charging infrastructure must be optimized for the highest utilization and lowest downtime. ABB's remote and real-time services meets that demand, incorporating a decade of experience with thousands of intelligent fast chargers deployed across the globe.

ABB's Terra family of all-in-one chargers are the easiest chargers in the market to service, with high uptime due to its innovative modularity, round the clock connectivity and experience-led design.



Remote services

- 24/7 connectivity
- Remote services
- Remote diagnostics
- Firmware upgrades
- Driver care web tools
- Charger Care web tools

Parts and warranty services

- Full service warranty process
- Extended warranties
- Preventive service and maintenance
- Network spare parts programs
- Fleet spare parts programs

Custom software services

- OCPP integration
- Autocharge integration testing
- Interoperability testing and validation
- Customized enterprise software support

Training

- Standardized online training
- Customized service training
- Third-party service training programs



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Section 2T

Solicitation Requirements:

TS 88.4 Cost of Ownership.

Proposers submittals describing and defining the service and maintenance requirements for the equipment, a "Cost of Ownership" template has been developed and included in the forms to be filled out by the Proposer as an element of the submittal package. This form itemizes tasks in three areas, PMI, scheduled maintenance and major component replacement.

New Flyer Response:

A key objective in the design of our Xcelsior CHARGE bus was to reduce the operating and maintenance costs for transit systems.
Xcelsior CHARGE has proven to deliver life-cycle savings in the areas outlined below:

- Highest passenger per mile fuel economy of any zero-emission vehicle based on FTA Altoona fuel economy test protocol.

- Save up to $400,000 in fuel costs over the 12-year life of the bus. Actual savings will depend on regional energy costs and charging methods.

- With no engine, transmission, intake or exhaust, customers can save up to $125,000 in maintenance costs over 12 years.

- Reduction of 100 - 160 tons of greenhouse gas per year compared to a 40' diesel bus and 75 - 110 tons compared to a 40' diesel-hybrid bus.

 Structure optimization reduced the weight of Xcelsior by 8%, while maintaining the famous rugged durability of New Flyer buses.
 Suspension optimization and a new lightweight, single-reduction axle.
 A lightweight composite material was used in the passenger flooring and other locations throughout the vehicle.
 Implementing the option of New Flyer Connect TM telematics solutions can achieve an additional savings.

1. Longer Tire Life – We anticipate tires on Xcelsior buses to last longer due to the reduction in weight and better weight distribution. A 1% reduction in weight can result in a 2% increase in tire mileage, which means fewer operating dollars spent on tire replacement.
2. Brake Lining Material – We anticipate brake linings on Xcelsior buses to last longer due to the reduced vehicle weight and better weight distribution. Recent studies have documented longer brake material life as a result of weight reduction.
3. Disc Brakes – Transitioning from drum brakes to disc brakes will reduce your life cycle costs as disc brakes are easier and less expensive to maintain and service.
4. New Flyer LED headlights – New Flyer LED headlights have a best-in-class 6-year warranty.

Please refer to the attached completed life cycle cost spreadsheet for the total cost of ownership over the 12-year service life.

Section 2T Continued:

Please refer to attachments for Life cycle cost for the XE40 and the XE60

New Flyer of America Service Repair Time Manuals.

New Flyer's Standard Repair Time Manual is a listing of standard repair times for components on your vehicles. The repair times have been determined using both historical data and current repair times with existing customers and is continually updated when new data is available. Please refer to the attached Electric Bus SRT Manuals.

Please refer to attachments for repair information for the XE40 and XE60.

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				1 - FRONT AXLE & SUSPENSION		
MAN	**1000**	**3.6**	**1 & 3**	**FRONT AXLE & SUSPENSION**	**R&R**	**Time listed is per person, 2 people required for this task**
		0.2	1.2	DRAG LINK	DISCONNECT	At Drag Link Arm
		0.2	1.2	LEVELING VALVE LINKS	R&R	
		0.3	1.2	BRAKE CHAMBER AIR LINES	R&R	
		0.1	1.2	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	1.2	ABS SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		1.0	1.2	RADIUS RODS	DISCONNECT	At Structure
		0.1	1.2	LOWER RETAINING NUTS, SHOCK ABSORBER	R&R	
		0.1	1.2	LOWER RETAINING NUTS, AIR SPRINGS	R&R	
		0.2	1.2	CENTER LINK	R&R	
		0.3	1.2	TORQUE BOLTS	ADJUST	
		0.5	3.2	FRONT END ALIGNMENT (MINOR)	ALIGN	
		0.5	1.2	ROAD TEST	CHECK	
MAN	**1001**	**2.1**	**1**	**WHEEL HUB ASSEMBLY, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	1.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.3	1.3	WHEEL FLANGE	R&R	
		0.1	1.5	BRAKE DISC	R&R	
		0.2	1.3	SLOTTED NUT & THRUST WASHER	R&R	
		0.2	1.3	HUB & BEARING ASSEMBLY	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
MAN	**1002**	**3.6**	**1**	**STEERING KNUCKLE**	**R&R**	**With wheel hub in place**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	1.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.3	1.3	WHEEL FLANGE	R&R	
		0.1	1.5	BRAKE DISC	R&R	
		0.5	1.3	TIE ROD END	R&R	
		0.1	1.3	KING PIN SEAL CAPS	R&R	
		0.1	1.3	SNAP RINGS	R&R	
		0.1	1.3	KING PIN COVERS & DUST GUARD	R&R	
		1.0	1.3	KING PINS	R&R	
		0.1	1.3	THRUST BEARING & SHIMS	R&R	
MAN	**1004**	**1.2**	**1**	**WHEEL STUDS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.6	1.3	WHEEL STUDS	R&R	
MAN	**1005**	**1.1**	**1**	**BRAKE PADS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
MAN	**1006**	**0.1**	**1**	**ABS SPEED SENSOR, FRONT AXLE**	**R&R**	**Per Side**
		0.1	1.6	SPEED SENSOR	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
MAN	**1007**	**1.4**	**1**	**BRAKE CHAMBER ASSEMBLY, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.5	1.5	BRAKE CHAMBER, FRONT	R&R	
MAN	**1008**	**2.5**	**1**	**CALIPER GUIDE PINS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.5	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
		0.1	1.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.5	1.5	CALIPER GUIDE PINS, BUSHINGS & BOOTS	R&R	
MAN	**1009**	**1.5**	**1**	**TAPPET & RUBBER BOOT, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
		0.2	1.5	TAPPET & RUBBER BOOT	R&R	
		0.1	1.5	INNER SEAL	R&R	
		0.1	1.5	BUSHING	R&R	
ALL		**STAND ALONE ITEMS**	**1**	**FRONT AXLE & SUSPENSION COMPONENTS**	**R&R**	
	1010	1.0	1.4	SHOCKS	R&R	Each

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				2 - REAR AXLE & SUSPENSION		
MAN	**2000**	**4.0**	**2**	**REAR AXLE**	**R&R**	
		0.5	2.8	DRIVE SHAFT	R&R	INCL driveshaft guard
		0.1	2.6	ABS SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	2.4	LEVELING VALVE LINKS	R&R	
		0.6	2.4	UPPER & LOWER RADIUS RODS (AT CHASSIS)	R&R	
		0.3	2.5	BRAKE LINES, REAR	R&R	
		0.1	2.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	2.3	DIFFERENTIAL BREATHER (AT CHASSIS)	DISCONNECT	
		0.4	2.5	AIR LINES & HARNESSES	DISCONNECT	
		0.2	2.4	SHOCKS (LOWER NUTS ONLY)	R&R	
		0.2	2.4	AIR SPRINGS (LOWER BOLTS ONLY)	R&R	
		1.0	2.3	AXLE, U-BOLTS & SPACERS (SEPARATION FROM SUS	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
		0.2	2	RAISE & LOWER WHEEL & AXLE ASSEMBLY	OPERATION	
MAN	**2001**	**1.2**	**2**	**WHEEL STUDS**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.6	2.3	WHEEL STUDS	R&R	
MAN	**2002**	**0.7**	**2**	**AXLE SHAFT**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.1	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	TORQUE HARDWARE	ADJUST	

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
MAN	**2003**	**2.4**	**2**	**WHEEL HUB ASSEMBLY, REAR**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		1.0	2.3	RETAINING RING & TAPPERED ROLLER BEARING ASS	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2004**	**2.2**	**2**	**BRAKE DISC, REAR**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		0.3	2.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	2.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	2.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.1	2.5	BRAKE DISC	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2005**	**2.3**	**2**	**ABS SPEED SENSOR, REAR AXLE**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		0.3	2.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	2.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	2.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.1	2.5	BRAKE DISC	R&R	
		0.1	2.6	SPEED SENSOR	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2006**	**1.1**	**2**	**BRAKE PADS, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
MAN	**2007**	**1.6**	**2**	**BRAKE CHAMBER ASSEMBLY, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.3	2.3	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.5	2.5	BRAKE CHAMBER, REAR	R&R	
MAN	**2008**	**2.7**	**2**	**CALIPER GUIDE PINS, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.3	2.3	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.5	2.5	BRAKE CHAMBER, REAR	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
		0.1	2.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.5	2.5	CALIPER GUIDE PINS, BUSHINGS & BOOTS	R&R	
MAN	**2009**	**1.5**	**2**	**TAPPET & RUBBER BOOT, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
		0.2	2.5	TAPPET & RUBBER BOOT	R&R	
		0.1	2.5	INNER SEAL	R&R	
		0.1	2.5	BUSHING	R&R	
MAN	**2010**	**2.6**	**2**	**DIFFERENTIAL CARRIER ASSEMBLY**	**R&R**	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		1.0	2.3	AXLE SHAFTS	R&R	Incl both sides
		0.1	2.3	AXLE BREATHER	R&R	
		0.6	2.8	DRIVESHAFT SHAFT FLANGE & YOKE	R&R	
		0.2	2.3	CARRIER MOUNTING BOLTS	R&R	
		0.5	2.3	DIFFERENTIAL CARRIER	R&R	
ALL		**STAND ALONE ITEMS**	**2**	**REAR AXLE & SUSPENSION COMPONENTS**	**R&R**	
	2011	1.4	2.9	SHOCKS	R&R	Each

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				3 - STEERING SYSTEM		
ALL	**3000**	**4.5**	**3 & 15**	**STEERING GEAR BOX**	**R&R**	
		0.2	3.2	RAISE VEHICLE	OPERATION	
		0.1	15.3	PRIMARY ACCESS COVER	R&R	
		0.1	15.3	SECONDARY ACCESS COVER	R&R	
		0.5	3.2	STEERING JOINT ASSEMBLY (At transfer box)	DISCONNECT	At Transfer Gear Box
		0.2	3.2	DRAG LINK	DISCONNECT	At Pitman Arm
		0.5	3.2	POWER STEERING LINES	DISCONNECT	At Transfer Gear Box
		1.9	3.2	MOUNTING BOLTS, STEERING GEAR BOX	R&R	
		0.5	3.2	REFILL FLUID & BLEED LINES	OPERATION	
		0.5	3.2	ROAD TEST	TEST	Optional
ALL	**3001**	**3.0**	**3**	**MITER BOX**	**R&R**	
		1.0	3.2	"U" JOINT, STEERING COLUMN	DISCONNECT	At Transfer Gear Box
		0.5	3.2	STEERING JOINT ASSEMBLY (At transfer box)	DISCONNECT	At Transfer Gear Box
		0.5	3.2	MITER BOX RETAINING BOLTS	DISCONNECT	
		0.5	3.2	MITER BOX COMPONENT	R&R	
		0.5		ROAD TEST	TEST	Optional
ALL		**STAND ALONE ITEMS**	**3**	**STEERING SYSTEM COMPONENTS**	**R&R**	
	3002	1.0	3.2	STEERING COLUMN	R&R	
	3003	1.0	3.2	"U" JOINT, STEERING COLUMN	R&R	
	3004	0.5	3.2	STEERING WHEEL	R&R	
	3005	0.8	3.2	DRAG LINK	R&R	
	3006	1.5	3.3	HYDRAULIC PUMP (POWER STEERING)	R&R	Includes refill and bleed
	3007	2.5	3.3	HYDRAULIC RESERVOIR	R&R	Includes refill and bleed
	3008	0.5	3.3	FILTER, HYDRAULIC RESERVOIR	R&R	Includes R+R of access cover

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	3009	0.5	3.3	PRESSURE GAUGE ON FILTER HOUSING	R&R	Includes R+R of access cover
				4 - ELECTRIC DRIVE SYSTEM		
ALL	**4000**	**3.5**	**4**	**TRACTION MOTOR**		
		0.2	4.3	RAISE VEHICLE	OPERATION	
		0.5	4.3	DRIVE SHAFT	R&R	
		0.5	4.3	DISCONNECT CABLES	R&R	INCL driveshaft guard
		0.8	4.3	COOLANT LINES	R&R	Includes refill and bleed
		1.5	4.3	TRACTION MOTOR	R&R	
ALL		**STAND ALONE ITEMS**	**4**	**ELECTRIC DRIVE SYSTEM COMPONENTS**		
	4001	0.5	4.4	MASTER CONTROL UNIT (MCU)	R&R	
	4002	0.8	4.4	BATTERY DISCONNECT UNIT	R&R	1 per string
	4003	0.1	4.4	HIGH VOLTAGE FUSES	R&R	Each
Amerex		**STAND ALONE ITEMS**		**AMEREX FIRE SUPPRESSION SYSTEM (REFER TO AMEREX MAINTENANCE MANUAL)**		
	4004	0.3	Amerex MM	AGENT CYLINDER	R & R	
	4005	0.3	Amerex MM	ELECTRICAL / MANUAL ACTUATOR	R & R	
	4006	0.3	Amerex MM	DISCHARGE NOZZLE	R & R	
	4007	0.6	Amerex MM	DISTRIBUTOR	R & R	
	4008	0.3	Amerex MM	DISCHARGE FITTING	R & R	
	4009	0.6	Amerex MM	F&G AVSN PANEL	R & R	
	4010	0.4	Amerex MM	IR SENSOR	R & R	Each
				5 - TRANSMISSION SYSTEM		

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ALL		STAND ALONE ITEMS	5	TRANSMISSION SYSTEM COMPONENTS		
				THIS SECTION IS NOT APPLICABLE		
				6 - COOLING SYSTEM		
ALL		STAND ALONE ITEMS	6 & 10	STAND ALONE ITEMS	R&R	
	6000	1.5	6.3	TRACTION MOTOR COOLER RAD ASSEMBLY	R&R	Includes fill and de-aerate
	6001	0.3	6.3	TRACTION MOTOR COOLER FAN	R&R	Each
	6002	0.5	6.3	TRACTION MOTOR COOLER CONTROL MODULE	R&R	
	6003	0.3	6.3	TRACTION MOTOR COOLER ISOLATOR	R&R	Replace all four
	6004	1.5	6.3	BOOSTER PUMP (TRACTION MOTOR)	R&R	Includes fill and de-aerate
	6005	2.0	6.3	SURGE TANK (TRACTION MOTOR AND INVERTER)	R&R	Traction motor & Inverter
	6006	0.3	6.3	LOW COOLANT SENSOR	R&R	1 per surge tank
	6007	5.0	6.4	ESS HEAT EXCHANGER SCROLL COMPRESSOR	R&R	Includes evac / fill of refrigerant
	6008	0.5	6.4	ESS HEAT EXCHANGER CONTACTOR	R&R	
	6009	0.5	6.4	ESS CONDENSER FAN	R&R	
	6010	3.0	6.4	ESS CONDENSER	R&R	Includes evac / fill of refrigerant
	6011	1.5	6.4 & 10.2	BOOSTER PUMP (ESS & CABIN)	R&R	Includes fill and de-aerate
	6012	2.0	6.4	SURGE TANK (ESS & CABIN)	R&R	
				7 - FUEL SYSTEM		
ALL		STAND ALONE ITEMS	7	FUEL SYSTEM COMPONENTS		
				THIS SECTION IS NOT APPLICABLE		
				8 - AIR SYSTEM		

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ALL		STAND ALONE ITEMS	8 & 2	AIR SYSTEM COMPONENTS	R&R	
	8000	1.0	8.5	AIR BRAKE RELAY VALVE	R&R	
	8001	5.0	8.4	AIR COMPRESSOR	R&R	
	8002	1.7	8.4	AIR COMPRESSOR HEAD	R&R	
	8003	2.5	8.4	AIR DRYER	R&R	
	8004	0.2	8.4	AIR DRYER FILTER	R&R	
	8005	0.6	8.4	AIR PRESSURE REGULATOR (BRAKE INTERLOCK)	R&R	
	8006	0.2	8.4	AIR TANK DRAIN VALVE	R&R	
	8007	1.5	8.4	APPLICATION VALVE (BRAKE TREADLE)	R&R	
	8008	0.5	2.5	BRAKE CHAMBER, REAR	R&R	
	8009	0.3	8.4	BRAKE INTERLOCK MAGNETIC VALVE	R&R	
	8010	0.3	8.5	CHECK VALVE	R&R	
	8011	0.5	8.4	GOVERNOR	R&R	
	8012	0.5	8.4	MUFFLER TANK	R&R	
	8013	0.5	8.4	OIL SEPARATOR	R&R	
	8014	0.3	8.4	OIL SEPARATOR FILTERS	R&R	
	8015	0.2	8.5	PRESSURE PROTECTION VALVE	R&R	
	8016	0.2	8.4	Q. R. VALVE	R&R	
	8017	0.6	8.5	SOLENOID VALVE	R&R	
	8018	1.0	8.5	SPRING BRAKE CONTROL VALVE	R&R	
	8019	0.2	8.5	TRANSDUCER	R&R	
	8020	0.3		LOW AIR PRESSURE SWITCH	R&R	
				9 - ELECTRICAL SYSTEM		
ALL		STAND ALONE ITEMS	9	ELECTRICAL SYSTEM COMPONENTS	R&R	
	9000	0.2	9.2	PLC MODULES	R&R	
	9001	2.0	9.4	HIGH VOLTAGE DC-DC CONVERTER	R&R	In roof rack

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	9002	0.5	9.5	BATTERIES & LEADS	R&R	In battery tray
	9003	0.5	9.5	BATTERY DISONNECT SWITCH	R&R	
	9004	0.7	9.5	VOLTAGE EQUALIZER	R&R	
	9005	1.0	9.5	BATTERY TRAY	R&R	
	9006	0.5	9.6	BATTERY DISCONNECT SOLENOID	R&R	Two - 12 and 24 V
	9007	0.3	9.7	LED HEADLIGHT ASSEMBLY	R&R	
	9008	0.2	9.7	BACK UP LAMP	R&R	
	9009	0.2	9.7	BRAKE LAMP	R&R	
	9010	0.2	9.7	REAR SIGNAL LAMP	R&R	
	9011	0.2	9.7	CLEARANCE LAMP	R&R	
	9012	0.2	9.7	SIDE SIGNAL LAMP	R&R	
	9013	0.3	9.7	CORNERING LAMP	R&R	
	9014	0.1	9.8	INTERIOR LED LIGHT STRIPS	R&R	
	9015	0.2	9.10	HORNS	R&R	
	9016	0.5	9.12	P.A. SPEAKER	R&R	
	9017	0.2	9.17	DUAL USB CHARGE PORT	R&R	
				10 - HVAC SYSTEM		
ALL		**STAND ALONE ITEMS**	**10, 6, & PM**	**HVAC SYSTEM COMPONENTS**	**R&R**	
	10000	1.5	10.2	DRIVERS HEATER / DEFROSTER UNIT	R&R	
	10001	0.5	10.2	DRIVERS BOOSTER FAN MOTOR	R&R	
	10002	0.2	PM	AIR FILTER, DEFROSTER	R&R	
	10003	1.0	10.2	DEFROSTER ELEMENT	R&R	
	10004	1.0	10.2	DEFROSTER FAN / MOTOR ASSEMBLY	R&R	
	10005	0.5	10.2	DEFROSTER ELECTRICAL CONTACTORS	R&R	3 per unit
	10006	2.0	10.2	DEFROSTER THERMAL CUTOUT	R&R	Per each. 2 per unit
	10007	0.2	PM	AIR FILTER, FLOOR HEATER	R&R	
	10008	1.0	10.2	FLOOR HEATER ELEMENT	R&R	
	10009	1.0	10.2	FLOOR HEATER FAN / MOTOR ASSEMBLY	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	10010	0.5	10.2	FLOOR HEATER ELECTRICAL CONTACTORS	R&R	2 per unit
	10011	0.2	10.2	FLOOR HEATER THERMAL CUTOUT	R&R	Per each. 2 per unit
	10012	1.5	6.4 & 10.2	HVAC BOOSTER PUMP	R&R	
Thermo King		**STAND ALONE ITEMS**	**TK MM**	**TK HVAC SYSTEM COMPONENTS (REFER TO TK MAINTENANCE MANUAL)**		
	10013	0.5	TK MM	A C CLUTCH ASSEMBLY	R&R	
	10014	6.0	TK MM	A C COMPRESSOR	Rebuild	Major overhaul
	10015	3.2	TK MM	CONDENSER	R&R	
	10016	1.5	TK MM	CONDENSER FAN MOTOR	R&R	
	10017	0.7	TK MM	CONDENSER FAN BLADES	R&R	
	10018	0.5	TK MM	CONDENSER PRESSURE SWITCH	R&R	
	10019	1.8	TK MM	FILTER DRIER	R&R	Incl evac, charge, leak check
	10020	5.0	TK MM	EVAPORATOR COIL AND PANEL	R&R	
	10021	0.8	TK MM	EVAPORATOR FAN MOTOR	R&R	
	10022	0.5	TK MM	EVAPORATOR HIGH PRESSURE SWITCH	R&R	
	10023	0.5	TK MM	SIGHT GLASS	R&R	
	10024	1.0	TK MM	DISCHARGE HOSE (A/C)	R&R	
	10025	1.7	TK MM	EVAC-CHARGE & LEAK CHECK	Operation	
	10026	1.0	TK MM	SUCTION HOSE	R&R	
	10027	0.5	TK MM	THERMOSTAT -AMBIENT AIR	R&R	
	10028	0.8	TK MM	THERMOSTAT - CAL/SET/RESET	Operation	
	10029	0.5	TK MM	WATER TEMP SWITCH	R&R	
	10030	0.8	TK MM	RETURN AIR SENSOR	R&R	
				12 - INTERIOR PANELS & APPLIED PARTS		
ALL		**STAND ALONE ITEMS**	**12 & 13**	**INTERIOR PANELS & APPLIED PARTS**	**R&R**	
	12000	1.0	12.2	SIDEWALL PANEL	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	12001	1.5	12.2	CEILING PANEL	R&R	
	12002	0.3	13.5	REAR VIEW MIRROR	R&R	
	12003	0.3	13.5	EXIT DOOR MIRROR	R&R	
	12004	0.3	12.2	SUN VISOR	R&R	
				13 - EXTERIOR PANELS & APPLIED PARTS		
ALL		**STAND ALONE ITEMS**	**13**	**EXTERIOR PANELS & APPLIED PARTS**	**R&R**	
	13000	0.5	13.5	CURBSIDE MIRROR	R&R	
	13001	0.5	13.5	DRIVERS MIRROR	R&R	
	13002	1.3	13.3	FRONT BUMPER	R&R	
	13003	0.8	13.3	REAR BUMPER ASSEMBLY	R&R	
	13004	1.0	13.3	POLYURETHANE MODULE	R&R	Per bumper section
	13005	0.3	13.6	WIPER ARM	R&R	
	13006	0.8	13.6	WIPER MOTOR	R&R	
	13007	0.8	13.6	WINDSHIELD WASHER RESERVOIR	R&R	
	13008	1.3	13.4	SPLASH GUARDS / MUD FLAPS	R&R	Front or Rear
	13009	0.3	13	IMPACT PANEL	R&R	
				14 - WINDOWS		
ALL		**STAND ALONE ITEMS**	**14**	**WINDOWS**	**R&R**	
	14000	3.0	14.2	WINDSHIELD	R&R	Per Side
	14001	1.0	14.2	DRIVERS SIDE WINDOW	R&R	
	14002	1.0	14.2	PICTURE WINDOW	R&R	
	14003	1.0	14.2	PASSENGER WINDOW	R&R	
	14004	0.5	14.2	WINDOW TRIM RING	R&R	
	14005	0.4	14.2	WINDOW GLASS	R&R	
	14006	0.2	14.2	PASSENGER WINDOW, RAPID REPLACEMENT	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				15 - ACCESS DOORS		
ALL		**STAND ALONE ITEMS**	**15**	**ACCESS DOORS**	**R&R**	
	15000	0.5	15.2	REAR CROSS SEAT ACCESS DOOR	R&R	
	15001	1.5	15.2	REAR ACCESS DOOR, EXTERIOR	R&R	
	15002	0.2	15.2	TRACTION MOTOR ACCESS DOOR	R&R	Rearmost floor hatch
	15003	0.2	15.2	DRIVE SHAFT ACCESS DOOR	R&R	Middle floor hatch
	15004	0.2	15.2	BRAKE CHAMBER ACCESS DOOR	R&R	Forward floor hatch
	15005	0.7	15.2	AUXILIARY HEATER ACCESS DOOR	R&R	
	15006	0.7	15.2	FUSE BOX ACCESS DOOR	R&R	
	15007	0.8	15.2	ROOF VENT	R&R	
	15008	0.7	15.2	SIDE CONSOLE EXTERIOR DOOR	R&R	
	15009	0.5	15.2	SURGE TANK ACCESS DOOR	R&R	each - 2 total
				16 - ENTRANCE & EXIT DOORS		
VAPOR/NF	**16000**	**2.4**	**16**	**ENTRANCE DOOR ASSEMBLY, SLIDE GLIDE**	**R&R**	
		0.6	16.2	CONNECTING RODS, ENTRANCE DOOR	R&R	
		1.0	16.2	DOOR SHAFT LEVER ASSEMBLY	R&R	
		0.3	16.2	DOOR SHAFT & ARM ASSEMBLY	R&R	
		0.3	16.2	DOOR PANELS (PER PANEL)	R&R	
		0.2	16.2	PIVOT ASSEMBLY, ENTRANCE DOOR TOP	R&R	
VAPOR/NF	**16001**	**1.0**	**16**	**ENTRANCE DOOR SHAFT LEVER ASSEMBLY**	**R&R**	
		0.5	16.2	LEVER ASSEMBLY, ENTRANCE DOOR	R&R	
		0.5	16.2	SPACER & BALL BEARING	R&R	
VAPOR/NF	**16002**	**2.1**	**16**	**ENTRANCE DOOR SHAFT & ARM ASSEMBLY**	**R&R**	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.3	16.2	DOOR PANELS	R&R	Per Panel
		1.0	16.2	DOOR GLASS	R&R	
		0.2	16.2	PIVOT ASSEMBLY, ENTRANCE DOOR TOP	R&R	
		0.3	16.2	SEALS & TRIM, ENTRANCE DOOR	R&R	
		0.3	16.2	BRUSHES, ENTRANCE DOOR	R&R	
VAPOR/NF	**16003**	**2.6**	**16**	**ENTRANCE DOOR MECHANISM OVERHAUL**	**R&R**	
		1.5	16.2	DOOR MOTOR ASSEMBLY	R&R	
		0.2	16.2	DOOR MAG VALVE	R&R	
		0.3	16.2	LIMIT SWITCHES	R&R	
		0.6	16.2	CONNECTING RODS, ENTRANCE DOOR	R&R	
VAPOR/NF	**16004**	**6.4**	**16**	**EXIT DOOR SYSTEM, SWING**	**R&R**	
		2.9	16.3	EXIT DOORS, SWING	R&R	
		0.8	16.3	EXIT DOOR PANELS	R&R	
		2.1	16.3	EXIT DOOR ASSEMBLY	R&R	
		0.6	16.3	EXIT DOOR ENGINE	R&R	
VAPOR/NF	**16005**	**0.6**	**16**	**EXIT DOOR PANELS**	**R&R**	**BOTH**
		0.5	16.3	DOOR GLASS	R&R	
		0.1	16.3	DOOR SHAFT LEVERS	R&R	
VAPOR/NF	**16006**	**0.9**	**16**	**EXIT DOOR ASSEMBLY**	**R&R**	**SINGLE**
		0.3	16.3	SEALS & TRIM	R&R	
		0.3	16.3	DOOR BRUSHES	R&R	
		0.3	16.3	HANDLE	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
VAPOR/NF	**16007**	**5.0**	**16**	**EXIT DOOR BASEPLATE**	**OVERHAUL**	
		1.8	16.3	BASE PLATE ASSEMBLY	R&R	
		0.6	16.3	EXIT DOOR ENGINE	R&R	
		0.2	16.3	DOOR SOLENOID & BRACKET ASSEMBLY	R&R	
		0.2	16.3	HALL EFFECT LOCK PRAWL SWITCH	R&R	
		0.1	16.3	CAM ASSEMBLY	R&R	
		0.2	16.3	MICRO / LIMIT SWITCHES	R&R	
		0.5	16.3	SKINNER VALVE	R&R	
		0.1	16.3	BASEPLATE BUSHINGS	R&R	
		1.0	16.3	EXIT DOOR SOLENOID (MAG VALVE)	R&R	
		0.1	16.3	RETURN SPRING	R&R	
		0.2	16.3	CONNECTING RODS	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
VAPOR/NF	**16008**	**1.4**	**16**	**EXIT DOOR SOLENOID & BRACKET ASSEMBLY**	**R&R**	
		0.2	16.3	BRACKET ASSEMBLY	R&R	
		0.3	16.3	EXTENSION SPRING	R&R	
		0.2	16.3	LEVER ASSEMBLY	R&R	
		0.1	16.3	END PLAY SPACER & BUSHING	R&R	
		0.1	16.3	CAM ASSEMBLY	R&R	
		0.2	16.3	EMERGENCY CONNECTING ROD ASSEMBLY	R&R	
		0.2	16.3	LOCK PRAWL ASSEMBLY	R&R	
		0.1	16.3	SENSOR ASSEMBLY	R&R	
VAPOR/NF		**STAND ALONE ITEMS**	**16**	**EXIT & ENTRANCE DOOR COMPONENTS**	**R&R**	
	16009	0.5	16.2	AIR FILTER, BASEPLATE	R&R	
	16010	1.0	16.3	EXIT DOOR ADJUSTMENT (FIT & ALIGNMENT, CHECK	ADJUST	
	16011	0.3	16.3	EXIT DOOR SPEED ADJUSTMENT	ADJUST	
	16012	0.3	16.3	EXIT DOOR HALL SENSOR VANE ADJUSTMENT	ADJUST	
	16013	0.2	16.3	EXIT DOOR EMERGENCY LINKAGE ADJUSTMENT	ADJUST	
	16014	0.2	16.3	EXIT DOOR LS3 SENSOR ADJUSTMENT	ADJUST	
	16015	0.2	16.3	EXIT DOOR LOCK SOLENOID ADJUSTMENT	ADJUST	
	16016	0.2	16.3	EXIT DOOR LOCK PRAWL TO CAM CLEARANCE ADJU	ADJUST	
	16017	0.2	16.3	EXIT DOOR PANEL SENSOR ADJUSTMENT	ADJUST	
	16018	3.0	16.5	EXIT DOOR COMPLETE FUNCTIONAL TEST	ADJUST	
	16019	1.0	16.2	ENTRANCE DOOR ADJUSTMENT FOR FIT, CHECK & A	ADJUST	
	16020	0.3	16.2	ENTRANCE DOOR SPEED ADJUSTMENT	ADJUST	
	16021	3.0	16.2	ENTRANCE DOOR COMPLETE FUNCTIONAL TEST	TEST	
	16022	1.2	16.2	EXIT DOOR EMERGENCY RELEASE VALVE	TEST	
	16023	1.0	16.2	ENTRANCE DOOR EMERGENCY RELEASE VALVE	R&R	
	16024	1.0	16.6	DOOR CONTROLLER	R&R	
	16025	0.5	16.5	DOOR CONTROLLER MODULE	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	16026	2.2	16.2	ENTRANCE DOOR ASSEMBLY	R&R	
	16027	0.6	16.2	ENTRANCE BASE PLATE ASSEMBLY (Welded)	R&R	
	16028	1.5	16.3	EXIT DOOR ENGINE OVERHAUL	OVERHAUL	
	16029	0.2	16.3	ADJUSTING RODS	R&R	
	16030	1.2	16.3	DOOR SHAFT & ARM ASSEMBLY	R&R	
	16031	0.1	16.3	MICRO SWITCH	R&R	
	16032	0.2	16.3	GRAB HANDLE	R&R	
	16033	0.5	16.3	CHIME	R&R	
	16034	1.0	16.3	REAR DOOR BEARINGS	R&R	
	16035	0.5	16.4	ANNUNCIATE PANEL	R&R	
17 - SEATING & STANCHIONS						
ALL		**STAND ALONE ITEMS**	**17**	**SEATING**	**R&R**	
	17000	1.0	17.2	DRIVERS SEAT	R&R	
	17001	0.5	17.2	DRIVERS SEAT BELT	R&R	
	17002	0.8	17.3	PASSENGER SEAT, DOUBLE	R&R	
	17003	0.1	17.3	SEAT INSERTS	R&R	
	17004	1.0	17.5	WHEELCHAIR FLIP SEAT	R&R	
18 - DESTINATION SIGNS						
ALL		**STAND ALONE ITEMS**	**18**	**DESTINATION SIGNS**	**R&R**	
	18000	1.2	18.2	DESTINATION SIGN ASSEMBLY, FRONT	R&R	
	18001	1.0	18.2	DESTINATION SIGN ASSEMBLY, SIDE	R&R	
	18002	0.5	18.2	REAR ROUTE SIGN	R&R	
	18003	0.5	18.2	DECODER BOARD	R&R	
	18004	0.8	18.2	DESTINATION SIGN CONTROL BOARD	R&R	
	18005	0.8	18.2	PROCESSOR BOARD	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	18006	1.0	18.2	DESTINATION SIGN GLASS	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				19 - DRIVER'S CONTROLS		
ALL		**STAND ALONE ITEMS**	**19 & 3**	**DRIVERS CONTROLS**	**R&R**	
	19000	0.5	19.2	INSTRUMENT PANEL CLUSTER	R&R	
	19001	0.5	19.2	DEFROSTER SWITCH	R&R	
	19002	0.3	19.2	TURN SIGNAL SWITCH	R&R	
	19003	0.2	3.2	HORN BUTTON	R&R	
	19004	0.5	19.2	PARKING BRAKE KNOB	R&R	
	19005	0.5	19.2	DIMMER SWITCH	R&R	
	19006	1.0	19.4	ACCELERATOR TREADLE	R&R	
	19007	0.5	19.4	THROTTLE POSITION SENSOR	R&R	
				20 - WHEELCHAIR RAMP		
NF		**STAND ALONE ITEMS**	**20**	**WHEELCHAIR RAMP COMPONENTS**	**R&R**	
	20000	0.8	20.2	HYD.PUMP/RESERVOIR ASSEMBLY	R&R	
	20001	0.6	20.2	MANIFOLD BLOCK	R&R	
	20002	0.6	20.2	LIFT MECHANISM ASSEMBLY	R&R	
	20003	0.5	20.2	MICRO SWITCHES/LIMIT SWITCHES	R&R	
	20004	1.0	20.2	RAMP PLATE	R&R	
	20005	1.5	20.2	RAMP ASSEMBLY COMPLETE	R&R	
	20006	0.5	20.2	DASH SWITCH	R&R	
	20007	0.2	20.2	RAMP COVER PLATE	R&R	
	20008	1.5	20.2	DRIVE CHAIN	R&R	

1. Times on stand alone items may differ from those same items included in an assembly.

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				2. Refer to each section of the New Flyer Service Manual or OEM supplier manual for identification of any Special Tools		

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				1 - FRONT AXLE & SUPPENSION		
MAN	**1000**	**3.4**	**1 & 3**	**FRONT AXLE & SUSPENSION**	**R&R**	**Time listed is per person, 2 people required for this task**
		0.2	1.2	DRAG LINK	DISCONNECT	At Drag Link Arm
		0.3	1.2	BRAKE CHAMBER AIR LINES	R&R	
		0.1	1.2	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	1.2	ABS SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		1.0	1.2	RADIUS RODS	DISCONNECT	At Structure
		0.1	1.2	LOWER RETAINING NUTS, SHOCK ABSORBER	R&R	
		0.1	1.2	LOWER RETAINING NUTS, AIR SPRINGS	R&R	
		0.2	1.2	CENTER LINK	R&R	
		0.3	1.2	TORQUE BOLTS	ADJUST	
		0.5	3.2	FRONT END ALIGNMENT (MINOR)	ALIGN	
		0.5	1.2	ROAD TEST	CHECK	
MAN	**1001**	**2.1**	**1**	**WHEEL HUB ASSEMBLY, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	1.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.3	1.3	WHEEL FLANGE	R&R	
		0.1	1.5	BRAKE DISC	R&R	
		0.2	1.3	SLOTTED NUT & THRUST WASHER	R&R	
		0.2	1.3	HUB & BEARING ASSEMBLY	R&R	
MAN	**1002**	**3.6**	**1**	**STEERING KNUCKLE**	**R&R**	**With wheel hub in place**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD CLEARANCE	ADJUST	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.1	1.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.3	1.3	WHEEL FLANGE	R&R	
		0.1	1.5	BRAKE DISC	R&R	
		0.5	1.3	TIE ROD END	R&R	
		0.1	1.3	KING PIN SEAL CAPS	R&R	
		0.1	1.3	SNAP RINGS	R&R	
		0.1	1.3	KING PIN COVERS & DUST GUARD	R&R	
		1.0	1.3	KING PINS	R&R	
		0.1	1.3	THRUST BEARING & SHIMS	R&R	
MAN	**1004**	**1.2**	**1**	**WHEEL STUDS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.6	1.3	WHEEL STUDS	R&R	
MAN	**1005**	**1.1**	**1**	**BRAKE PADS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
MAN	**1006**	**0.5**	**1**	**ABS SPEED SENSOR, FRONT AXLE**	**R&R**	**Per Side**
		0.5	1.6	SPEED SENSOR	R&R	
MAN	**1007**	**1.4**	**1**	**BRAKE CHAMBER ASSEMBLY, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.5	1.5	BRAKE CHAMBER, FRONT	R&R	
MAN	**1008**	**2.5**	**1**	**CALIPER GUIDE PINS, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.3	1.5	BRAKE CHAMBER AIR LINES	R&R	
		0.5	1.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
		0.1	1.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.5	1.5	CALIPER GUIDE PINS, BUSHINGS & BOOTS	R&R	
MAN	**1009**	**1.5**	**1**	**TAPPET & RUBBER BOOT, FRONT AXLE**	**R&R**	**Per Side**
		0.6	1.3	WHEEL ASSEMBLY	R&R	
		0.1	1.5	BRAKE PAD RETAINER	R&R	
		0.3	1.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	1.5	BRAKE PADS	R&R	
		0.2	1.5	TAPPET & RUBBER BOOT	R&R	
		0.1	1.5	INNER SEAL	R&R	
		0.1	1.5	BUSHING	R&R	
ALL		**STAND ALONE ITEMS**	**1**	**FRONT AXLE & SUSPENSION COMPONENTS**	**R&R**	
	1010	1.0	1.4	SHOCKS	R&R	Each
				2 - REAR & CENTLE AXLE & SUSPENSION		
MAN	**2000**	**4.0**	**2**	**REAR AXLE**	**R&R**	
		0.5	2.8	DRIVE SHAFT	R&R	INCL driveshaft guard
		0.1	2.6	ABS SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	2.4	LEVELING VALVE LINKS	R&R	
		0.6	2.4	UPPER & LOWER RADIUS RODS (AT CHASSIS)	R&R	
		0.3	2.5	BRAKE LINES, REAR	R&R	
		0.1	2.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.1	2.3	DIFFERENTIAL BREATHER (AT CHASSIS)	DISCONNECT	
		0.4	2.5	AIR LINES & HARNESSES	DISCONNECT	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.2	2.4	SHOCKS (LOWER NUTS ONLY)	R&R	
		0.2	2.4	AIR SPRINGS (LOWER BOLTS ONLY)	R&R	
		1.0	2.3	AXLE, U-BOLTS & SPACERS (SEPARATION FROM SUSPENSION BEAM)	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
		0.2	2	RAISE & LOWER WHEEL & AXLE ASSEMBLY	OPERATION	
MAN	**2001**	**1.2**	**2**	**WHEEL STUDS**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.6	2.3	WHEEL STUDS	R&R	
MAN	**2002**	**0.7**	**2**	**AXLE SHAFT**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.1	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2003**	**2.4**	**2**	**WHEEL HUB ASSEMBLY, REAR**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		1.0	2.3	RETAINING RING & TAPPERED ROLLER BEARING ASSEMBLIES	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2004**	**2.2**	**2**	**BRAKE DISC, REAR**	**R&R**	**Per Side**

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		0.3	2.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	2.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	2.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.1	2.5	BRAKE DISC	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2005**	**2.3**	**2**	**ABS SPEED SENSOR, REAR AXLE**	**R&R**	**Per Side**
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		0.2	2.3	AXLE SHAFT MOUNITNG BOLTS	R&R	
		0.1	2.3	AXLE SHAFT	R&R	
		0.1	2.3	CENTERING DEVICE	OPERATION	
		0.2	2.3	ADJUSTING NUT & THRUST WASHER	R&R	
		0.2	2.3	HUB & BEARING ASSEMBLY	R&R	
		0.3	2.5	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.5	BRAKE CHAMBER, FRONT	R&R	
		0.1	2.5	BRAKE PAD CLEARANCE	ADJUST	
		0.1	2.5	BRAKE CARRIER & CALIPER ASSEMBLY	R&R	
		0.1	2.5	BRAKE DISC	R&R	
		0.1	2.6	SPEED SENSOR	R&R	
		0.2	2.3	TORQUE HARDWARE	ADJUST	
MAN	**2006**	**1.1**	**2**	**BRAKE PADS, REAR AXLE**	**R&R**	**Per Side**

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
MAN	**2007**	**1.6**	**2**	**BRAKE CHAMBER ASSEMBLY, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.3	2.3	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.5	2.5	BRAKE CHAMBER, REAR	R&R	
MAN	**2008**	**2.7**	**2**	**CALIPER GUIDE PINS, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.3	2.3	BRAKE CHAMBER AIR LINES	R&R	
		0.2	2.3	CAGE BRAKE CHAMBER	OPERATION	
		0.5	2.5	BRAKE CHAMBER, REAR	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
		0.1	2.5	WEAR SENSOR ELECTRICAL CONNECTION	DISCONNECT	
		0.5	2.5	CALIPER GUIDE PINS, BUSHINGS & BOOTS	R&R	
MAN	**2009**	**1.5**	**2**	**TAPPET & RUBBER BOOT, REAR AXLE**	**R&R**	**Per Side**
		0.6	2.3	WHEEL ASSEMBLY	R&R	
		0.1	2.5	BRAKE PAD RETAINER	R&R	
		0.3	2.5	BRAKE PAD CLEARANCE	ADJUST	For easier pad removal
		0.1	2.5	BRAKE PADS	R&R	
		0.2	2.5	TAPPET & RUBBER BOOT	R&R	
		0.1	2.5	INNER SEAL	R&R	
		0.1	2.5	BUSHING	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
MAN	**2010**	**2.6**	**2**	**DIFFERENTIAL CARRIER ASSEMBLY**	**R&R**	
		0.2	2.2	DIFFERENTIAL OIL	DRAIN	
		1.0	2.3	AXLE SHAFTS	R&R	Incl both sides
		0.1	2.3	AXLE BREATHER	R&R	
		0.6	2.8	DRIVESHAFT SHAFT FLANGE & YOKE	R&R	
		0.2	2.3	CARRIER MOUNTING BOLTS	R&R	
		0.5	2.3	DIFFERENTIAL CARRIER	R&R	
ALL		**STAND ALONE ITEMS**	**2**	**REAR AXLE & SUSPENSION COMPONENTS**	**R&R**	
	2011	1.4	2.4	SHOCKS	R&R	Each
ZF		**STAND ALONE ITEMS**	**2**	**CENTER AXLE (Electric Drive)**	**R&R**	
	2012	0.6	2.9	WHEEL ASSEMBLY	R&R	
	2013	0.5	2.11	BRAKE CYLINDER	R&R	
	2014	0.8	2.11	BRAKE LININGS	R&R	
	2015	2.0	2.11	COMPLETE BRAKE CALIPER	R&R	
	2016	0.3	2.9	PLANETARY CARRIER	R&R	
	2017	0.5	2.9	PLANETARY GEAR	R&R	EACH
	2018	0.3	2.9	RING GEAR	R&R	
	2019	0.8	2.9	HUB	R&R	
	2020	1.5	2.9	10 WHEEL BOLTS	R&R	
	2021	0.3	2.11	BRAKE DISC	R&R	
	2022	0.3	2.9	ABS - SENSOR	R&R	
	2023	1.0	2.9	HUB CARRIER	R&R	
	2024	4.0	2.9	ELECTRIC MOTOR	R&R	AXLE REMOVED
	2025	1.0	2.10	RADIUS RODS	R&R	
	2026	1.4	2.10	SHOCKS	R&R	Each

3 - STEERING SYSTEM

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ALL	**3000**	**4.5**	**3 & 15**	**STEERING GEAR BOX**	**R&R**	
		0.2	3.2	RAISE VEHICLE	OPERATION	
		0.1	15.3	PRIMARY ACCESS COVER	R&R	
		0.1	15.3	SECONDARY ACCESS COVER	R&R	
		0.5	3.2	STEERING JOINT ASSEMBLY (At transfer box)	DISCONNECT	At Transfer Gear Box
		0.2	3.2	DRAG LINK	DISCONNECT	At Pitman Arm
		0.5	3.2	POWER STEERING LINES	DISCONNECT	At Transfer Gear Box
		1.9	3.2	MOUNTING BOLTS, STEERING GEAR BOX	R&R	
		0.5	3.2	REFILL FLUID & BLEED LINES	OPERATION	
		0.5		ROAD TEST	TEST	Optional
ALL	**3001**	**3.0**	**3**	**MITER BOX**	**R&R**	
		1.0	3.2	"U" JOINT, STEERING COLUMN	DISCONNECT	At Transfer Gear Box
		0.5	3.2	STEERING JOINT ASSEMBLY (At transfer box)	DISCONNECT	At Transfer Gear Box
		0.5	3.2	MITER BOX RETAINING BOLTS	DISCONNECT	
		0.5	3.2	MITER BOX COMPONENT	R&R	
		0.5		ROAD TEST	TEST	Optional
ALL		**STAND ALONE ITEMS**	**3**	**STEERING SYSTEM COMPONENTS**	**R&R**	
	3002	3.7	3.2	STEERING GEAR BOX	R&R	
	3003	3.0	3.2	TRANSFER GEAR BOX	R&R	
	3004	1.0	3.2	STEERING COLUMN	R&R	
	3005	1.0	3.2	"U" JOINT, STEERING COLUMN	R&R	
	3006	0.5	3.2	STEERING WHEEL	R&R	
	3007	0.8	3.2	DRAG LINK	R&R	
	3008	1.5	3.3	HYDRAULIC PUMP (POWER STEERING)	R&R	Includes refill and bleed
	3009	2.5	3.3	HYDRAULIC RESERVOIR	R&R	Includes refill and bleed
	3010	0.5	3.3	FILTER, HYDRAULIC RESERVOIR	R&R	Includes R+R of access cover
	3011	0.8	3.3	SIGHT GLASS	R&R	Includes R+R of access cover
	3012	0.5	3.3	PRESSURE GAUGE ON FILTER HOUSING	R&R	Includes R+R of access cover

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				4 - ELECTRIC DRIVE SYSTEM		
ALL	**4000**	**3.5**	**4**	**TRACTION MOTOR**		
		0.2	4.3	RAISE VEHICLE	OPERATION	
		0.5	4.3	DRIVE SHAFT	R&R	
		0.5	4.3	DISCONNECT CABLES	R&R	INCL driveshaft guard
		0.8	4.3	COOLANT LINES	R&R	Includes refill and bleed
		1.5	4.3	TRACTION MOTOR	R&R	
ALL		**STAND ALONE ITEMS**	**4**	**ELECTRIC DRIVE SYSTEM COMPONENTS**		
	4001	0.5	4.4	MASTER CONTROL UNIT (MCU)	R&R	
	4002	0.8	4.4	BATTERY DISCONNECT UNIT	R&R	1 per string
	4003	0.1	4.4	HIGH VOLTAGE FUSES	R&R	Each
Kidde		**STAND ALONE ITEMS**	**4**	**FIRE SUPPRESSION SYSTEM (REFER TO DUAL SPECTRUM MAINTENANCE MANUAL)**	**R&R**	
	4004	0.3	DS MM	AGENT CYLINDER	R&R	
	4005	0.3	DS MM	ELECTRICAL / MANUAL ACTUATOR	R&R	
	4006	0.3	DS MM	PNEUMATIC CONTROL HEAD	R&R	
	4007	0.3	DS MM	DISCHARGE NOZZLE	R&R	
	4008	0.6	DS MM	DISTRIBUTOR	R&R	
	4009	0.3	DS MM	DISCHARGE FITTING	R&R	
	4010	0.4	DS MM	HEAT DETECTION THERMOSTATS	R&R	
				5 - TRANSMISSION SYSTEM		
ALL		**STAND ALONE ITEMS**	**5**	**TRANSMISSION SYSTEM COMPONENTS**		
				THIS SECTION IS NOT APPLICABLE		
				6 - COOLING SYSTEM		

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ALL		STAND ALONE ITEMS	6 & 10	STAND ALONE ITEMS	R&R	
	6000	1.5	6.3	TRACTION MOTOR COOLER RAD ASSEMBLY	R&R	Includes fill and de-aerate
	6001	0.3	6.3	TRACTION MOTOR COOLER FAN	R&R	Each
	6002	0.5	6.3	TRACTION MOTOR COOLER CONTROL MODULE	R&R	
	6003	0.3	6.3	TRACTION MOTOR COOLER ISOLATOR	R&R	Replace all four
	6004	1.5	6.3	BOOSTER PUMP (TRACTION MOTOR)	R&R	Includes fill and de-aerate
	6005	2.0	6.3	SURGE TANK (TRACTION MOTOR AND INVERTER)	R&R	Traction motor & Inverter
	6006	0.3	6.3	LOW COOLANT SENSOR	R&R	1 per surge tank
	6007	5.0	6.4	ESS HEAT EXCHANGER SCROLL COMPRESSOR	R&R	Includes evac / fill of refrigerant
	6008	0.5	6.4	ESS HEAT EXCHANGER CONTACTOR	R&R	
	6009	0.5	6.4	ESS CONDENSER FAN	R&R	
	6010	3.0	6.4	ESS CONDENSER	R&R	Includes evac / fill of refrigerant
	6011	1.5	6.4 & 10.2	BOOSTER PUMP (ESS & CABIN)	R&R	Includes fill and de-aerate
	6012	2.0	6.4	SURGE TANK (ESS & CABIN)	R&R	
				7 - FUEL SYSTEM		
ALL		STAND ALONE ITEMS	7	FUEL SYSTEM COMPONENTS		
				THIS SECTION IS NOT APPLICABLE		
				8 - AIR SYSTEM		
ALL		STAND ALONE ITEMS	8 & 2	AIR SYSTEM COMPONENTS	R&R	
	8000	1.0	8.5	AIR BRAKE RELAY VALVE	R&R	
	8001	5.0	8.4	AIR COMPRESSOR	R&R	
	8002	1.7	8.4	AIR COMPRESSOR HEAD	R&R	
	8003	2.5	8.4	AIR DRYER	R&R	
	8004	0.2	8.4	AIR DRYER FILTER	R&R	
	8005	0.6	8.4	AIR PRESSURE REGULATOR (BRAKE INTERLOCK)	R&R	
	8006	0.2	8.4	AIR TANK DRAIN VALVE	R&R	
	8007	1.5	8.4	APPLICATION VALVE (BRAKE TREADLE)	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	8008	0.5	2.5	BRAKE CHAMBER, REAR	R&R	
	8009	0.3	8.4	BRAKE INTERLOCK MAGNETIC VALVE	R&R	
	8010	0.3	8.5	CHECK VALVE	R&R	
	8013	0.5	8.4	OIL SEPARATOR	R&R	
	8014	0.3	8.4	OIL SEPARATOR FILTERS	R&R	
	8015	0.2	8.5	PRESSURE PROTECTION VALVE	R&R	
	8016	0.2	8.4	Q. R. VALVE	R&R	
	8017	0.6	8.5	SOLENOID VALVE	R&R	
	8018	1.0	8.5	SPRING BRAKE CONTROL VALVE	R&R	
	8019	0.2	8.5	TRANSDUCER	R&R	
	8020	0.3		LOW AIR PRESSURE SWITCH	R&R	
	8021	1.0	2.6	AUTOMATIC TRACTION CONTROL VALVE	R&R	
				9 - ELECTRICAL SYSTEM		
ALL		**STAND ALONE ITEMS**	**9**	**ELECTRICAL SYSTEM COMPONENTS**	**R&R**	
	9000	0.2	9.2	PLC MODULES	R&R	
	9001	2.0	9.4	HIGH VOLTAGE DC-DC CONVERTER	R&R	In roof rack
	9002	0.5	9.5	BATTERIES & LEADS	R&R	In battery tray
	9003	0.5	9.5	BATTERY DISONNECT SWITCH	R&R	
	9004	0.7	9.5	VOLTAGE EQUALIZER	R&R	
	9005	1.0	9.5	BATTERY TRAY	R&R	
	9006	0.5	9.6	BATTERY DISCONNECT SOLENOID	R&R	Two - 12 and 24 V
	9007	0.3	9.7	LED HEADLIGHT ASSEMBLY	R&R	
	9008	0.2	9.7	BACK UP LAMP	R&R	
	9009	0.2	9.7	BRAKE LAMP	R&R	
	9010	0.2	9.7	REAR SIGNAL LAMP	R&R	
	9011	0.2	9.7	CLEARANCE LAMP	R&R	
	9012	0.2	9.7	SIDE SIGNAL LAMP	R&R	
	9013	0.3	9.7	CORNERING LAMP	R&R	
	9014	0.1	9.8	INTERIOR LED LIGHT STRIPS	R&R	
	9015	0.2	9.10	HORNS	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	9016	0.5	9.12	P.A. SPEAKER	R&R	
	9017	0.2	9.17	DUAL USB CHARGE PORT	R&R	
	9018	0.3	19.2	DIMMER SWITCH	R&R	
	9019	0.3	19.2	TURN SIGNAL SWITCH	R&R	
				10 - HVAC SYSTEM		
ALL		**STAND ALONE ITEMS**	**10, 6, & PM**	**HVAC SYSTEM COMPONENTS**	**R&R**	
	10000	1.5	10.2	DRIVERS HEATER / DEFROSTER UNIT	R&R	
	10001	0.5	10.2	DRIVERS BOOSTER FAN MOTOR	R&R	
	10002	0.2	PM	AIR FILTER, DEFROSTER	R&R	
	10003	1.0	10.2	DEFROSTER ELEMENT	R&R	
	10004	1.0	10.2	DEFROSTER FAN / MOTOR ASSEMBLY	R&R	
	10005	0.5	10.2	DEFROSTER ELECTRICAL CONTACTORS	R&R	3 per unit
	10006	2.0	10.2	DEFROSTER THERMAL CUTOUT	R&R	Per each. 2 per unit
	10007	0.2	PM	AIR FILTER, FLOOR HEATER	R&R	
	10008	1.0	10.2	FLOOR HEATER ELEMENT	R&R	
	10009	1.0	10.2	FLOOR HEATER FAN / MOTOR ASSEMBLY	R&R	
	10010	0.5	10.2	FLOOR HEATER ELECTRICAL CONTACTORS	R&R	2 per unit
	10011	0.2	10.2	FLOOR HEATER THERMAL CUTOUT	R&R	Per each. 2 per unit
	10012	1.5	6.4 & 10.2	HVAC BOOSTER PUMP	R&R	
	10013	*	10.12	CABIN HEATER	R&R	
				Note * Information on these items is currently unavailable		
Thermo King		**STAND ALONE ITEMS**	**TK MM**	**TK HVAC SYSTEM COMPONENTS (REFER TO TK MAINTENANCE MANUAL)**		
	10013	*	TK MM	A C CLUTCH ASSEMBLY	R&R	
	10014	*	TK MM	A C COMPRESSOR	Rebuild	Major overhaul
	10015	*	TK MM	CONDENSER	R&R	
	10016	*	TK MM	CONDENSER FAN MOTOR	R&R	
	10017	*	TK MM	CONDENSER FAN BLADES	R&R	
	10018	*	TK MM	CONDENSER PRESSURE SWITCH	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	10019	*	TK MM	FILTER DRIER	R&R	Incl evac, charge, leak check
	10020	*	TK MM	EVAPORATOR COIL AND PANEL	R&R	
	10021	*	TK MM	EVAPORATOR FAN MOTOR	R&R	
	10022	*	TK MM	EVAPORATOR HIGH PRESSURE SWITCH	R&R	
	10023	*	TK MM	SIGHT GLASS	R&R	
	10024	*	TK MM	DISCHARGE HOSE (A/C)	R&R	
	10025	*	TK MM	EVAC-CHARGE & LEAK CHECK	Operation	
	10026	*	TK MM	SUCTION HOSE	R&R	
	10027	*	TK MM	THERMOSTAT -AMBIENT AIR	R&R	
	10028	*	TK MM	THERMOSTAT - CAL/SET/RESET	Operation	
	10029	*	TK MM	WATER TEMP SWITCH	R&R	
	10030	*	TK MM	RETURN AIR SENSOR	R&R	
				Note * Information on these items is currently unavailable		
				12 - INTERIOR PANELS & APPLIED PARTS		
ALL		**STAND ALONE ITEMS**	**12 & 13**	**INTERIOR PANELS & APPLIED PARTS**	**R&R**	
	12000	1.0	12.2	SIDEWALL PANEL	R&R	
	12001	1.5	12.2	CEILING PANEL	R&R	
	12002	0.3	12.5	REAR VIEW MIRROR	R&R	
	12003	0.3	12.5	EXIT DOOR MIRROR	R&R	
	12004	0.3	12.2	SUN VISOR	R&R	
				13 - EXTERIOR PANELS & APPLIED PARTS		
ALL		**STAND ALONE ITEMS**	**13**	**EXTERIOR PANELS & APPLIED PARTS**	**R&R**	
	13000	0.5	13.5	CURBSIDE MIRROR	R&R	
	13001	0.5	13.5	DRIVERS MIRROR	R&R	
	13002	1.3	13.3	FRONT BUMPER	R&R	
	13003	0.8	13.3	REAR BUMPER ASSEMBLY	R&R	
	13004	1.0	13.3	POLYURETHANE MODULE	R&R	Per bumper section
	13005	0.3	13.6	WIPER ARM	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	13006	0.8	13.6	WIPER MOTOR	R&R	
	13007	0.8	13.6	WINDSHIELD WASHER RESERVOIR	R&R	
	13008	1.3	13.4	SPLASH GUARDS / MUD FLAPS	R&R	Front or Rear
	13009	0.3	13	IMPACT PANEL	R&R	
				14 - WINDOWS		
ALL		**STAND ALONE ITEMS**	**14**	**WINDOWS**	**R&R**	
	14000	3.0	14.2	WINDSHIELD	R&R	Per Side
	14001	1.0	14.2	DRIVERS SIDE WINDOW	R&R	
	14003	1.0	14.2	PASSENGER WINDOW	R&R	
	14004	0.5	14.2	WINDOW TRIM RING	R&R	
	14005	0.4	14.2	WINDOW GLASS	R&R	
	14006	0.2	14.2	PASSENGER WINDOW, RAPID REPLACEMENT	R&R	
				15 - ACCESS DOORS		
ALL		**STAND ALONE ITEMS**	**15**	**ACCESS DOORS**	**R&R**	
	15000	0.5	15.2	REAR CROSS SEAT ACCESS DOOR	R&R	
	15001	1.5	15.2	REAR ACCESS DOOR, EXTERIOR	R&R	
	15002	0.2	15.2	TRACTION MOTOR ACCESS DOOR	R&R	Rearmost floor hatch
	15003	0.2	15.2	DRIVE SHAFT ACCESS DOOR	R&R	Middle floor hatch
	15004	0.2	15.2	BRAKE CHAMBER ACCESS DOOR	R&R	Forward floor hatch
	15005	0.7	15.2	AUXILIARY HEATER ACCESS DOOR	R&R	
	15006	0.7	15.2	FUSE BOX ACCESS DOOR	R&R	
	15007	0.8	15.2	ROOF VENT	R&R	
	15008	0.7	15.2	SIDE CONSOLE EXTERIOR DOOR	R&R	
	15009	0.5	15.2	SURGE TANK ACCESS DOOR	R&R	each - 2 total
	15010	0.5	15.3	DEFROSTER ACCESS DOOR	R&R	
				16 - ENTRANCE & EXIT DOORS		

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
VAPOR/NF	**16000**	**2.4**	**16**	**ENTRANCE DOOR ASSEMBLY, SLIDE GLIDE**	**R&R**	
		0.6	16.2	CONNECTING RODS, ENTRANCE DOOR	R&R	
		1.0	16.2	DOOR SHAFT LEVER ASSEMBLY	R&R	
		0.3	16.2	DOOR SHAFT & ARM ASSEMBLY	R&R	
		0.3	16.2	DOOR PANELS (PER PANEL)	R&R	
		0.2	16.2	PIVOT ASSEMBLY, ENTRANCE DOOR TOP	R&R	
VAPOR/NF	**16001**	**1.0**	**16**	**ENTRANCE DOOR SHAFT LEVER ASSEMBLY**	**R&R**	
		0.5	16.2	LEVER ASSEMBLY, ENTRANCE DOOR	R&R	
		0.5	16.2	SPACER & BALL BEARING	R&R	
VAPOR/NF	**16002**	**2.1**	**16**	**ENTRANCE DOOR SHAFT & ARM ASSEMBLY**	**R&R**	
		0.3	16.2	DOOR PANELS	R&R	Per Panel
		1.0	16.2	DOOR GLASS	R&R	
		0.2	16.2	PIVOT ASSEMBLY, ENTRANCE DOOR TOP	R&R	
		0.3	16.2	SEALS & TRIM, ENTRANCE DOOR	R&R	
		0.3	16.2	BRUSHES, ENTRANCE DOOR	R&R	
VAPOR/NF	**16003**	**2.6**	**16**	**ENTRANCE DOOR MECHANISM OVERHAUL**	**R&R**	
		1.5	16.2	DOOR MOTOR ASSEMBLY	R&R	
		0.2	16.2	DOOR MAG VALVE	R&R	
		0.3	16.2	LIMIT SWITCHES	R&R	
		0.6	16.2	CONNECTING RODS, ENTRANCE DOOR	R&R	
VAPOR/NF	**16004**	**6.4**	**16**	**EXIT DOOR SYSTEM, SWING**	**R&R**	
		2.9	16.3	EXIT DOORS, SWING	R&R	
		0.8	16.3	EXIT DOOR PANELS	R&R	
		2.1	16.3	EXIT DOOR ASSEMBLY	R&R	
		0.6	16.3	EXIT DOOR ENGINE	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
VAPOR/NF	**16005**	**0.6**	**16**	**EXIT DOOR PANELS**	**R&R**	**BOTH**
		0.5	16.3	DOOR GLASS	R&R	
		0.1	16.3	DOOR SHAFT LEVERS	R&R	
VAPOR/NF	**16006**	**0.9**	**16**	**EXIT DOOR ASSEMBLY**	**R&R**	**SINGLE**
		0.3	16.3	SEALS & TRIM	R&R	
		0.3	16.3	DOOR BRUSHES	R&R	
		0.3	16.3	HANDLE	R&R	
VAPOR/NF	**16007**	**5.0**	**16**	**EXIT DOOR BASEPLATE**	**OVERHAUL**	
		1.8	16.3	BASE PLATE ASSEMBLY	R&R	
		0.6	16.3	EXIT DOOR ENGINE	R&R	
		0.2	16.3	DOOR SOLENOID & BRACKET ASSEMBLY	R&R	
		0.2	16.3	HALL EFFECT LOCK PRAWL SWITCH	R&R	
		0.1	16.3	CAM ASSEMBLY	R&R	
		0.2	16.3	MICRO / LIMIT SWITCHES	R&R	
		0.5	16.3	SKINNER VALVE	R&R	
		0.1	16.3	BASEPLATE BUSHINGS	R&R	
		1.0	16.3	EXIT DOOR SOLENOID (MAG VALVE)	R&R	
		0.1	16.3	RETURN SPRING	R&R	
		0.2	16.3	CONNECTING RODS	R&R	
VAPOR/NF	**16008**	**1.4**	**16**	**EXIT DOOR SOLENOID & BRACKET ASSEMBLY**	**R&R**	
		0.2	16.3	BRACKET ASSEMBLY	R&R	
		0.3	16.3	EXTENSION SPRING	R&R	
		0.2	16.3	LEVER ASSEMBLY	R&R	
		0.1	16.3	END PLAY SPACER & BUSHING	R&R	
		0.1	16.3	CAM ASSEMBLY	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
		0.2	16.3	EMERGENCY CONNECTING ROD ASSEMBLY	R&R	
		0.2	16.3	LOCK PRAWL ASSEMBLY	R&R	
		0.1	16.3	SENSOR ASSEMBLY	R&R	
VAPOR/NF		**STAND ALONE ITEMS**	**16**	**EXIT & ENTRANCE DOOR COMPONENTS**	**R&R**	
	16009	0.5	16.2	AIR FILTER, BASEPLATE	R&R	
	16010	1.0	16.3	EXIT DOOR ADJUSTMENT (FIT & ALIGNMENT, CHECK & ADJUST)	ADJUST	
	16011	0.3	16.3	EXIT DOOR SPEED ADJUSTMENT	ADJUST	
	16012	0.3	16.3	EXIT DOOR HALL SENSOR VANE ADJUSTMENT	ADJUST	
	16013	0.2	16.3	EXIT DOOR EMERGENCY LINKAGE ADJUSTMENT	ADJUST	
	16014	0.2	16.3	EXIT DOOR LS3 SENSOR ADJUSTMENT	ADJUST	
	16015	0.2	16.3	EXIT DOOR LOCK SOLENOID ADJUSTMENT	ADJUST	
	16016	0.2	16.3	EXIT DOOR LOCK PRAWL TO CAM CLEARANCE ADJUSTMENT	ADJUST	
	16017	0.2	16.3	EXIT DOOR PANEL SENSOR ADJUSTMENT	ADJUST	
	16018	3.0	16.5	EXIT DOOR COMPLETE FUNCTIONAL TEST	ADJUST	
	16019	1.0	16.2	ENTRANCE DOOR ADJUSTMENT FOR FIT, CHECK & ADJUST	ADJUST	
	16020	0.3	16.2	ENTRANCE DOOR SPEED ADJUSTMENT	ADJUST	
	16021	3.0	16.2	ENTRANCE DOOR COMPLETE FUNCTIONAL TEST	TEST	
	16022	1.2	16.2	EXIT DOOR EMERGENCY RELEASE VALVE	TEST	
	16023	1.0	16.2	ENTRANCE DOOR EMERGENCY RELEASE VALVE	R&R	
	16024	1.0	16.6	DOOR CONTROLLER	R&R	
	16025	0.5	16.5	DOOR CONTROLLER MODULE	R&R	
	16026	2.2	16.2	ENTRANCE DOOR ASSEMBLY	R&R	
	16027	0.6	16.2	ENTRANCE BASE PLATE ASSEMBLY (Welded)	R&R	
	16028	1.5	16.3	EXIT DOOR ENGINE OVERHAUL	OVERHAUL	
	16029	0.2	16.3	ADJUSTING RODS	R&R	
	16030	1.2	16.3	DOOR SHAFT & ARM ASSEMBLY	R&R	
	16031	0.1	16.3	MICRO SWITCH	R&R	
	16032	0.2	16.3	GRAB HANDLE	R&R	
	16033	0.5	16.3	CHIME	R&R	
	16034	1.0	16.3	REAR DOOR BEARINGS	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	16035	0.5	16.4	ANNUNCIATE PANEL	R&R	
				17 - SEATING & STANCHIONS		
ALL		**STAND ALONE ITEMS**	**17**	**SEATING**	**R&R**	
	17000	1.0	17.2	DRIVERS SEAT	R&R	
	17001	0.5	17.2	DRIVERS SEAT BELT	R&R	
	17002	0.8	17.3	PASSENGER SEAT, DOUBLE	R&R	
	17003	0.1	17.3	SEAT INSERTS	R&R	
	17004	1.0	17.5	WHEELCHAIR FLIP SEAT	R&R	
				18 - DESTINATION SIGNS		
ALL		**STAND ALONE ITEMS**	**18**	**DESTINATION SIGNS**	**R&R**	
	18000	1.2	18.2	DESTINATION SIGN ASSEMBLY, FRONT	R&R	
	18001	1.0	18.2	DESTINATION SIGN ASSEMBLY, SIDE	R&R	
	18002	0.5	18.2	REAR ROUTE SIGN	R&R	
	18003	0.5	18.2	DECODER BOARD	R&R	
	18004	0.8	18.2	DESTINATION SIGN CONTROL BOARD	R&R	
	18005	0.8	18.2	PROCESSOR BOARD	R&R	
	18006	1.0	18.2	DESTINATION SIGN GLASS	R&R	
	18007	0.5	18.2	FRONT ROUTE SIGN	R&R	
				19 - DRIVER'S CONTROLS		
ALL		**STAND ALONE ITEMS**	**19 & 3**	**DRIVERS CONTROLS**	**R&R**	
	19000	0.5	19.2	INSTRUMENT PANEL CLUSTER	R&R	
	19001	0.5	19.2	DEFROSTER SWITCH	R&R	
	19002	0.3	19.2	TURN SIGNAL SWITCH	R&R	
	19003	0.2	3.2	HORN BUTTON	R&R	
	19004	0.5	19.2	PARKING BRAKE KNOB	R&R	
	19005	0.5	19.2	DIMMER SWITCH	R&R	

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
	19006	1.0	19.4	ACCELERATOR TREADLE	R&R	
	19007	0.5	19.4	THROTTLE POSITION SENSOR	R&R	
	19008	0.3	19.2	MASTER RUN SWITCH	R&R	
				20 - WHEELCHAIR RAMP		
NF		**STAND ALONE ITEMS**	**20**	**WHEELCHAIR RAMP COMPONENTS**	**R&R**	
	20000	0.8	20.2	HYD.PUMP/RESERVOIR ASSEMBLY	R&R	
	20001	0.6	20.2	MANIFOLD BLOCK	R&R	
	20002	0.6	20.2	LIFT MECHANISM ASSEMBLY	R&R	
	20003	0.5	20.2	MICRO SWITCHES/LIMIT SWITCHES	R&R	
	20004	1.0	20.2	RAMP PLATE	R&R	
	20005	1.5	20.2	RAMP ASSEMBLY COMPLETE	R&R	
	20006	0.5	20.2	DASH SWITCH	R&R	
	20007	0.2	20.2	RAMP COVER PLATE	R&R	
	20008	1.5	20.2	DRIVE CHAIN	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
				21 - ARTICULATED JOINT		
ATG	**21000**	**1.4**	**21**	**FLOOR PLATE ACCESS**	**R&R**	
		1.0	21.2	FLOOR PLATES REMOVAL	R&R	
		0.4	21.2	FLOOR PLATES (LIFT / SECURE)	ACCESS	
ATG	**21001**	**1.8**	**21**	**OPEN BELLOWS (UNDERSIDE)**	**R&R**	
		0.8	21.7	HIP BOOT FLANGE PLATES (2)	R&R	
		0.5	21.7	RETAINING CLIPS	R&R	
		0.3	21.7	TURNBUCKLE ASSEMBLY	R&R	
		0.2	21.7	SHOCK CORD ASSEMBLY	DISCONNECT	
ATG	**21002**	**4.8**	**21**	**BELLOWS ASSEMBLY - ONE SIDE**	**R&R**	
		0.5	21.7	HIP BOOT FLANGE PLATES (2)	R&R	
		0.4	21.7	BUCKLE STRAPS	DISCONNECT	
		0.4	21.7	RETAINING STRIP	R&R	
		0.4	21.7	TURNBUCKLE ASSEMBLY	DISCONNECT	
		0.2	21.7	SHOCK CORD ASSEMBLY	DISCONNECT	
		0.2	21.7	ROOF STRUT	DISCONNECT	
		0.2	21.7	TIE ROD ASSEMBLY	DISCONNECT	
		2.5	21.7	BELLOWS SECTION	R&R	
ATG	**21003**	**6.4**	**21**	**CENTER HOOP ASSEMBLY**	**R&R**	
		1.0	21.6	OPEN FLOOR PLATES FOR SERVICE	ACCESS	
		0.3	21.6	HOOP CONTROL	DISCONNECT	
		0.5	21.6	PLASTIC SLIDER PLATE	R&R	
		0.4	21.6	BEARING, CENTER HOOP	R&R	
		1.0	21.6	CENTER HOOP	R&R	
		3.2	21.6	WRIST JOINT ASSEMBLY	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ATG	**21004**	**4.6**	**21**	**WRIST JOINT ASSEMBLY**	**R&R**	
		1.0	21.3	REMOVE FLOOR PLATES FOR SERVICE	ACCESS	
		1.3	21.3	OPEN BELLOWS FOR SERVICE	ACCESS	
		0.2	21.3	YOKE WRIST BOLTS	R&R	
		0.3	21.3	BOLT, 20MM X 2	R&R	
		0.3	21.3	BOLT, 5 / 8" X 6	R&R	
		1.5	21.3	WRIST JOINT	R&R	
ATG	**21005**	**4.1**	**21**	**HYDRAULIC CYLINDER ASSEMBLY**	**R&R**	
		0.6	21.4	CENTER SEATS	R&R	
		1.0	21.4	REMOVE FLOOR PLATES FOR SERVICE	R&R	
		1.5	21.4	HYDRAULIC SYSTEM, BLEED / FILL / ADJUST	R&R	
		0.2	21.4	CYLINDER HOSE X 2	DISCONNECT	
		0.3	21.4	CYLINDER PIN	DISCONNECT	
		0.3	21.4	CYLINDER YOKE PIN	DISCONNECT	
		0.2	21.4	CYLINDER	R&R	
ATG	**21006**	**8.8**	**21**	**YOKE PLATE**	**R&R**	
		1.0	21.3	OPEN FLOOR PLATES FOR SERVICE	ACCESS	
		5.3	21.3	CENTER HOOP ASSEMBLY	R&R	
		0.3	21.3	CYLINDER PIN	DISCONNECT	
		0.3	21.3	CYLINDER YOKE PIN	DISCONNECT	
		0.2	21.3	CYLINDER	R&R	
		0.5	21.3	BOLT, M16 X 8	DISCONNECT	
		0.3	21.3	BOLT, 20MM X 2	DISCONNECT	
		0.3	21.3	BOLT, YOKE PLATE 5 / 8" X 6	DISCONNECT	
		0.6	21.3	WRIST JOINT	R&R	

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VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT
ATG	**21007**	**11.3**	**21**	**MAIN BEARING ASSEMBLY & SUPPORT FRAME**	**R&R**	
		8.8	21.3	YOKE PLATE	R&R	
		0.5	21.3	WEAR PLATE	DISCONNECT	
		1.2	21.3	MAIN BEARING	R&R	
		0.6	21.3	WRIST JOINT	R&R	
		0.2	21.3	CYLINDER BRACKET	DISCONNECT	
ATG	**21008**	**4.0**	**21**	**HYDRAULIC BLOCK ASSEMBLY**	**R&R**	
		1.0	21.4	OPEN FLOOR PLATES FOR SERVICE	ACCESS	
		1.5	21.4	HYD. SYSTEM COMPLETE BLEED, FILL, CHECK & ADJUST	CHK. / ADJ.	
		0.2	21.4	CYLINDER HOSE X 2	DISCONNECT	
		0.3	21.4	ELECTRICAL HARNESS CONNECTIONS	DISCONNECT	
		0.1	21.4	PRESSURE GAUGE	R & R	
		0.5	21.4	HYDRAULIC BLOCK	R & R	
		0.2	21.4	PRESSURE SWITCHES	DISCONNECT	
		0.2	21.4	ACCUMULATOR	DISCONNECT	
ATG	**21009**	**3.0**	**21**	**ACCUMULATOR ASSEMBLY**	**R&R**	
		1.0	21.4	OPEN FLOOR PLATES FOR SERVICE	ACCESS	
		1.5	21.4	HYDRAULIC SYSTEM, COMPLETE BLEED / FILL / ADJUST	CHK. / ADJ.	
		0.1	21.4	BLEED SCREW	CHK. / ADJ.	
		0.4	21.4	ACCUMULATOR ASSEMBLY	R&R	
ATG		**STAND ALONE ITEMS**	**21**	**ATG COMPONENTS**		
	21010	0.2	21.5	HIGH PRESSURE SWITCH	R&R	
	21011	0.2	21.5	LOW PRESSURE SWITCH	R&R	
	21012	0.3	21.5	POSITION SENSOR	R&R	
	21013	0.5	21.5	HYD. SYSTEM PRESSURE TEST	TEST	

1. Times on stand alone items may differ from those same items included in an assembly.

[redacted]

[redacted]

VENDOR	TASK CODE	TIME	MANUAL SECTION	COMPONENT / TASK DESCRIPTION	ACTION	COMMENT

2. Refer to each section of the New Flyer Service Manual for identification of Special Tools.

Section 2U

Solicitation Requirements:

TS 90 Exportable Power Supply.

Proposers shall provide specifications of the power supply including but not limited to:

· available power, current and voltage,
· number, type, and location of receptacles,
· type of connector required,
· available energy at full charge,
· shutoff features and conditions,
· traction battery SOC and estimated remaining bus range at automatic shutoff,
· environmental condition requirements,
· compliance with applicable standards and UL Classification,
· maintenance requirements,
· warranty terms for related power electronics and inverters.

New Flyer Response:

Exportable Power Supply has not been developed by New Flyer of America Inc. at this time. The listed items in this section of TS 90 is not in our selection of options. New Flyer of America Inc. would be happy to discuss this section during negotiations or during the pre-production stage.

Section 3

Solicitation Requirements:

Acknowledgement of Addenda.

New Flyer Response:

Please refer to the attached Acknowledgment of Addenda.

CER 3. Acknowledgement of Addenda

Failure to acknowledge receipt of all addenda may cause the Proposal to be considered nonresponsive to the Solicitation. Acknowledged receipt of each addendum must be clearly established and included with the Proposal.

The undersigned acknowledges receipt of the following addenda to the documents:

Addendum No.: 1	Dated: July 29, 2021
Addendum No.: 2	Dated: August 5, 2021
Addendum No.: 3	Dated: August 17, 2021
Addendum No.: 4	Dated: August 30, 2021

[redacted]

September 7, 2021

Date

CER 3. Acknowledgement of Addenda

Failure to acknowledge receipt of all addenda may cause the Proposal to be considered nonresponsive to the Solicitation. Acknowledged receipt of each addendum must be clearly established and included with the Proposal.

The undersigned acknowledges receipt of the following addenda to the documents:

Addendum No.:	5	Dated:	September 1, 2021
Addendum No.:	5 Revised	Dated:	September 1, 2021
Addendum No.:	6	Dated:	September 10, 2021
Addendum No.:	7	Dated:	September 15, 2021

[redacted]

September 15 2021

Date

CER 3. Acknowledgement of Addenda

Failure to acknowledge receipt of all addenda may cause the Proposal to be considered nonresponsive to the Solicitation. Acknowledged receipt of each addendum must be clearly established and included with the Proposal.

The undersigned acknowledges receipt of the following addenda to the documents:

Addendum No.: 8	Dated: September 20, 2021
Addendum No.:	Dated:
Addendum No.:	Dated:
Addendum No.:	Dated:

[redacted]

September 21, 2021

Date

Section 4

Solicitation Requirements:

Contractor Service and Parts Support Data

New Flyer response:

Please refer to the attached Contractor Service and Parts Support Data.

CER 4. Contractor Service and Parts Support Data

Location of nearest Technical Service Representative to Agency

[redacted]
[redacted]
[redacted] 1-800-665-2637
[redacted]

NFI Parts has an industry-leading regional distribution network with 7 locations throughout North America with a combined 700,000+ square feet of warehouse space. NFI Parts has a mature supply base and comprehensive supply relationships with an extensive list of bus component and system suppliers (1,000 +). This extensive network enables NFI Parts to provide prompt delivery times and provide a regional base to further extend services directly to customer locations.

[redacted]
[redacted]
[redacted]
[redacted]
[redacted]

All individual customer demand is aggregated by PDC, providing an overall demand profile for the customer supported at each individual PDC. Based on this data, our planning team sets min/max stocking parameters for components that are regularly purchased by our customers. In addition to this large data set, our planning team will also consider other factors including warranty part consumption, specific customer input, changes in customer demand profile, input from suppliers, and feedback from within the NFI Parts team to adjust stocking levels to better support our customers

[redacted]
[redacted]
[redacted]

[redacted]

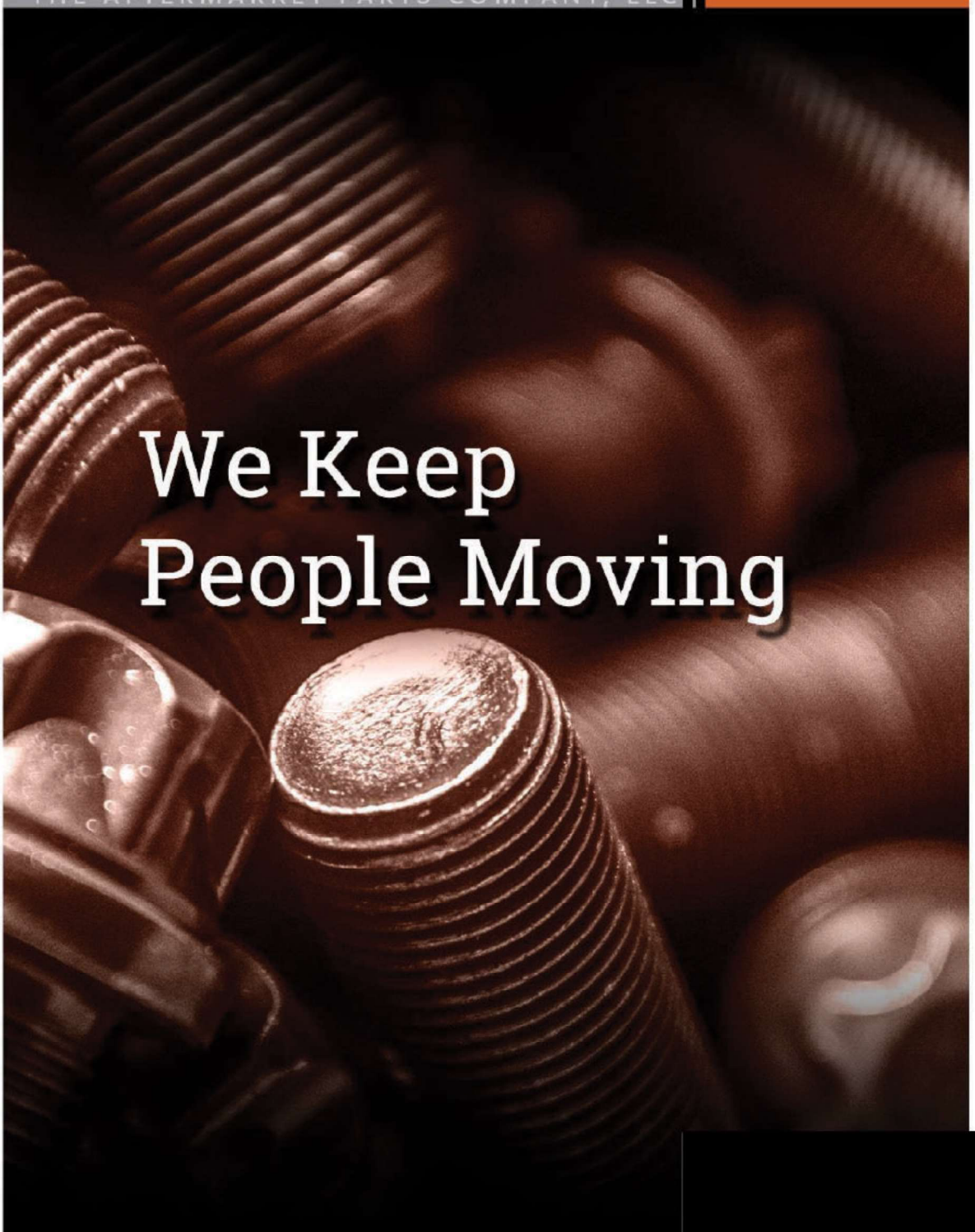
Location of nearest Technical Service Representative to The Agency

[redacted]

[redacted] is the RPSM for numerous properties throughout the Central/Eastern US including the Agency. Lorenzo is responsible for the overall service management of these properties which includes coordinating bus acceptance and in-field service support for bus deliveries and the implementation of company policies, assisting in warranty situations, completing retrofits, gathering product failure information, training and general customer liaison.

Describe Technical Services Readily Available from Said Representative:

New Flyer provides a Regional Product Support Manager to work with the property on warranty related issues as needed. The Regional Product Support Manager is available via phone or e-mail and normally responds within 24 hours. If New Flyer representation is required on-site, New Flyer will have on-site support available as soon as possible.



THE AFTERMARKET PARTS COMPANY, LLC

[redacted]

Overview

NFI Parts™ is North America's most comprehensive parts organization, providing parts, technical publications, training, support for its OEM product lines (transit buses, motor coaches and cutaways), as well as other manufacturers through our extensive cross reference database.

[redacted]n. NFI Parts brings together over 90 years of parts experience and now supports a combined fleet of more than 75,000 active transit buses, motor coaches and cutaway vehicles. [redacted]

[redacted]

[redacted]

[redacted]Parts Support Team



Customer Service

Our commitment to Customer Service excellence begins with our systematic and detailed approach to employee recruiting. We employ individuals with extensive experience in manufacturing and transit parts who have the skills that will support and fulfill all service expectations. The high level of service delivered is facilitated through a combination of in-house and field representation. Customer Service Representatives (CSR) are accessible through the NFI Parts toll-free Customer Call Center.

NFI Parts employs a large team of dedicated CSR. Each individual has a wide range of skills, abilities, and job experience in transit, parts, and manufacturing industries. They have direct access to engineering build information and drawings, access to the physical product, and the ability to contact source suppliers to assist with any technical or supply inquiries. Individuals on this team are assigned to specific customers to ensure the customer has a designated point of contact.

Specialized training is provided to the team to ensure they have comprehensive product knowledge to enhance their understanding of all customer requirements. The CSRs also participate in on-site visits, allowing them to personally view the transit facility environment. This allows for a better understanding of the customer's internal processes, requirements, and works to strengthen constructive working relationships.

On-Site Assistance

NFI Parts Territory Sales Representatives and Technical Solutions Managers are located throughout Canada and the U.S. and conduct regular visits with our customers to better understand their needs as well as provide on-site assistance.

Product Support Team

A team of dedicated Technical Product Specialists maintain the specifications and engineering content of aftermarket parts, working closely with production engineers, suppliers, and customers. As an integral part of aftermarket product development, the Product Support Team, along with Quality Assurance, ensures industry standards are met and sustained through the life of the bus, and will offer engineered solutions to meet the current and future needs of all our customers.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Parts Services and Solutions



NFI Parts continually focuses on expanding the range of services available to our customers. Some of the complementary value-added services we offer include:

- Creating customized stock recommendations for each new customer and contract.
- Providing Bills of Materials for bus collision repair, including an on-site collision repair specialist for extensively damaged buses.
- Developing custom parts kits for regular or periodic maintenance.

NFI Parts also possesses the in-house resources to assemble a variety of components and assemblies including wire harnesses, power cables, and hoses. Reverse-engineering services are also provided to support customers with competitors' buses where a product is not available or in short supply. This service is continually expanding and is competitively priced.

Stocking Methodology

The components within each order of vehicles will vary depending on the specific requirements of an individual customer and any cost or reliability improvements that the NFI OE is in the process of implementing when the buses are manufactured. Each NFI Parts customer is assigned to a PDC that delivers the part support required by the individual customer. All individual customer demand is aggregated by PDC, providing an overall demand profile for the customer supported at each individual PDC. Based on this data, our planning team sets min/max stocking parameters for components that are regularly purchased by our customers. In addition to this large data set, our planning team will also consider other factors including warranty part consumption, specific customer input, changes in customer demand profile, input from suppliers, and feedback from within the NFI Parts team to adjust stocking levels to better support our customers.

Industry Cross Reference

We stock and distribute parts out of our distribution centers for all makes and models of transit buses in North America. Using our industry-wide competitor and supplier cross reference database, we will help our customers to find the right part for the right application.

[redacted]

Our database continues to grow rapidly, and new information is gathered on a daily basis. New cross references are checked and verified by our team of analysts and technical support staff to ensure accuracy of data, and source of supply.

Supply Chain Solutions

This service from NFI Parts is designed to improve our customers' parts availability and reduce their operating costs. Supply Chain Solutions suite of services include storeroom management, inventory planning and forecasting, logistics and freight management, consignment inventory management, and parts replenishment programs. We are able to leverage our extensive expertise and work with customers to design solutions that reduce inventory requirements and lower costs.

OE-Approved Alternate Parts

Now with hundreds of parts to choose from and kits customized for specific fleets, Kinetik™ and MCI Coach Guard® have grown to be some of the largest OE alternative part sources in the industry used by major transit authorities and coach operators in North America. Kinetik™ will continue as the official OE-Approved Alternate line of NFI Parts. Existing MCI Coach Guard parts will remain available; all new OE-Approved Alternates will be released under the Kinetik™ brand moving forward.

Kinetik™ and MCI Coach Guard parts are precision engineered to meet or exceed industry standards. All safety-related items are rigorously tested by independent laboratories and approved by the NFI Parts Engineering team. Kinetik™ parts are clearly identified by the suffix NFA or KIN following the OEM part number. MCI Coach Guard parts are clearly identified by the suffix CG following the OEM part number.

Alternate Parts

The SVP™ (Super Value Parts) product line offers reliable parts at lower prices. These are offerings NFI Parts stands behind and come from trusted suppliers who have provided testing and quality guarantees.

Custom Kits

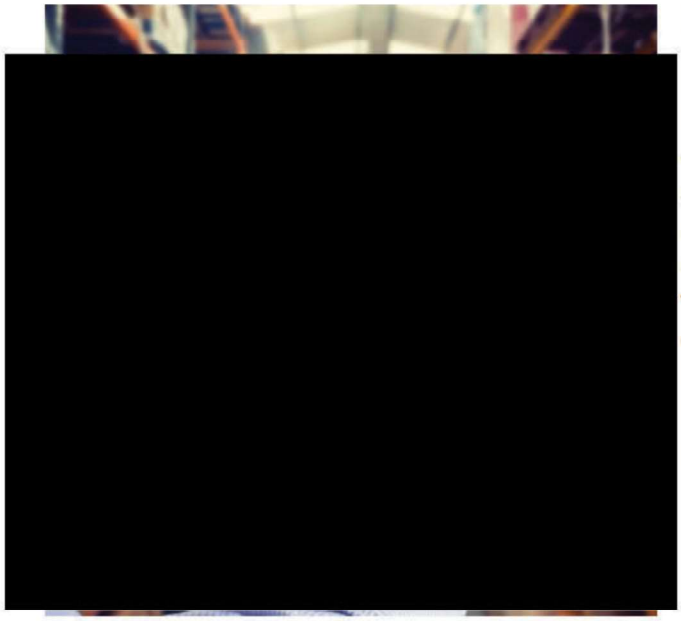
NFI Parts offers Custom Kits which can be delivered based on a pre-determined schedule and we can work together to determine exactly the parts required. Custom Kits ensure all essential parts for a maintenance job are replaced, securing high organizational efficiency and safety levels. These kits will streamline the ordering process and are a cost-effective alternative for any bus application.

[redacted]

[redacted]

Mid-life Overhaul, Retrofit, and Refurbishment Programs

NFI Parts offers a variety of options for customers looking to overhaul or refurbish their buses. Everything from a full overhaul plan, to comprehensive part requirement lists are available. We work with our customers to develop a turn-key solution to the material and service requirements to meet their unique needs.


[redacted]

Part Numbering and Bar Coding

Each assembly and sub-component on an NFI bus is issued a separate part number, as displayed in the Parts Manual. Where items are superseded, such information is clearly shown, and substitutions are not allowed without customer consent. NFI bar codes inventory with the NFI part number, description, and country of origin. NFI Parts can also include a customer's item number on labels when required. The barcode included on a label will bring up the NFI part number when scanned.

Performance Measurement Program

NFI Parts operates a Performance Measurement Program involving back-order tracking, fill rates, and on-time deliveries. This allows insight into the trends and performance of each operational area. Continuous monitoring and improvement in each of the operational areas is central to the growth of NFI Parts and the uninterrupted support of our customers.

Recommended Stocking List

NFI Parts provides an accurate Recommended Stocking List (RSL). The RSL includes the part number, item description, lead time, and stocking status. Each RSL reflects the specific bus configuration of our individual customers.

[redacted]

[redacted]

Parts Provisioning List

NFI Parts will provide the customer with a Parts Provisioning List 30 (thirty) days following the approval of the draft parts manual. This listing will include the part number, item description, stocking status, lead time and 30-day pricing information which will assist in stocking parts that will support both regular and preventative bus maintenance programs. Prices for the parts listed will be held for 30 (thirty) days; for updated pricing beyond this period can be provided by the assigned NFI Parts CSR.

Manuals

New Flyer transit bus manuals are published with comprehensive information based specifically on your bus build. Manuals are located on DVD or USB and include the customized Transit Information View (TIV). The TIV is an electronic Technical Library which contains a compilation of technical documents and manuals, System Layout Drawings, and OEM supplier documents.

[redacted]

Disadvantaged Business Enterprise Program

NFI Group Inc. is committed to meeting and exceeding the goals of the Disadvantaged Business Enterprise Program, as set forth internally as well as through FTA and customer requirements. Ads are placed quarterly in trade magazines/journals to solicit business from DBEs, MBEs, and WBEs. In addition, we contact manufacturers, distributors and carriers that comply, and work to identify quality companies that are registered with individual transit authorities. Transactions that are performed with DBEs, MBEs and WBEs are calculated on a quarterly basis and are available to customers upon request.

[redacted]

Section 5

Solicitation Requirements:

Form for Proposal Deviation (without price data)

New Flyer response:

Please refer to the attached deviations and clarifications from New Flyer of America Inc. The packaged provided are:

- Commercial Deviations and Clarifications
- Technical Deviations and Clarifications for Xcelsior 35', 40' and 60' Electrical Buses
- Technical Deviations and Clarifications for MCI 45' Electrical Buses.

Section 6

[redacted]

Solicitation Requirements:

Vehicle Questionnaire

New Flyer response:

Please refer to the attached Vehicle questionnaires for the proposed Electrical Buses

[redacted] [redacted]

Section 8

Solicitation Requirements:

Engineering org chart, Engineering change control procedure, Field Modification process

New Flyer response:

Please refer to the attached Engineering org chart, Engineering change control procedure, Field Modification process

[redacted] [redacted]

Section 9

Solicitation Requirements:

Manufacturing Plant Layout, Other Contracts, Staffing

New Flyer response:

Please refer to the attached Manufacturing Plant Layout, Other Contracts, Staffing

[redacted] [redacted]

Section 10

Solicitation Requirements:

Production schedule, Other Contract Commitment for the duration of the contract

New Flyer response:

New Flyer's proposal is based on providing the delivery of 1 unit 300 days from NTP. As the contract does not have firm order quantities, we can clarify that deliveries of 1-10 units will be completed 300 days from NTP. Order from 10-20 will be completed 365 days from NTP. For other commitments during the duration of the contract please refer to Package #3 Section 1.

Section 11

Solicitation Requirements:

TS 8.2 Design Operating Profile.

Management Plan This plan shall indicate the key personnel assigned to PSTA's account. Assigned personnel shall include at a minimum, Engineer to conduct pre-build conference, Account Representative, Warranty Administrator, and Parts and Support manager."

New Flyer response:

[redacted]

Section 12

Solicitation Requirements:

Quality Assurance

New Flyer response:

Please refer to the attached Quality Assurance Plan.

[redacted] [redacted]

Section 5

Solicitation Requirements:

Form for Proposal Deviation (without price data)

New Flyer response:

Please refer to the attached deviations and clarifications from New Flyer of America Inc. The packaged provided are:

- Commercial Deviations and Clarifications
- Technical Deviations and Clarifications for Xcelsior 35', 40' and 60' Electrical Buses
- Technical Deviations and Clarifications for MCI 45' Electrical Buses.

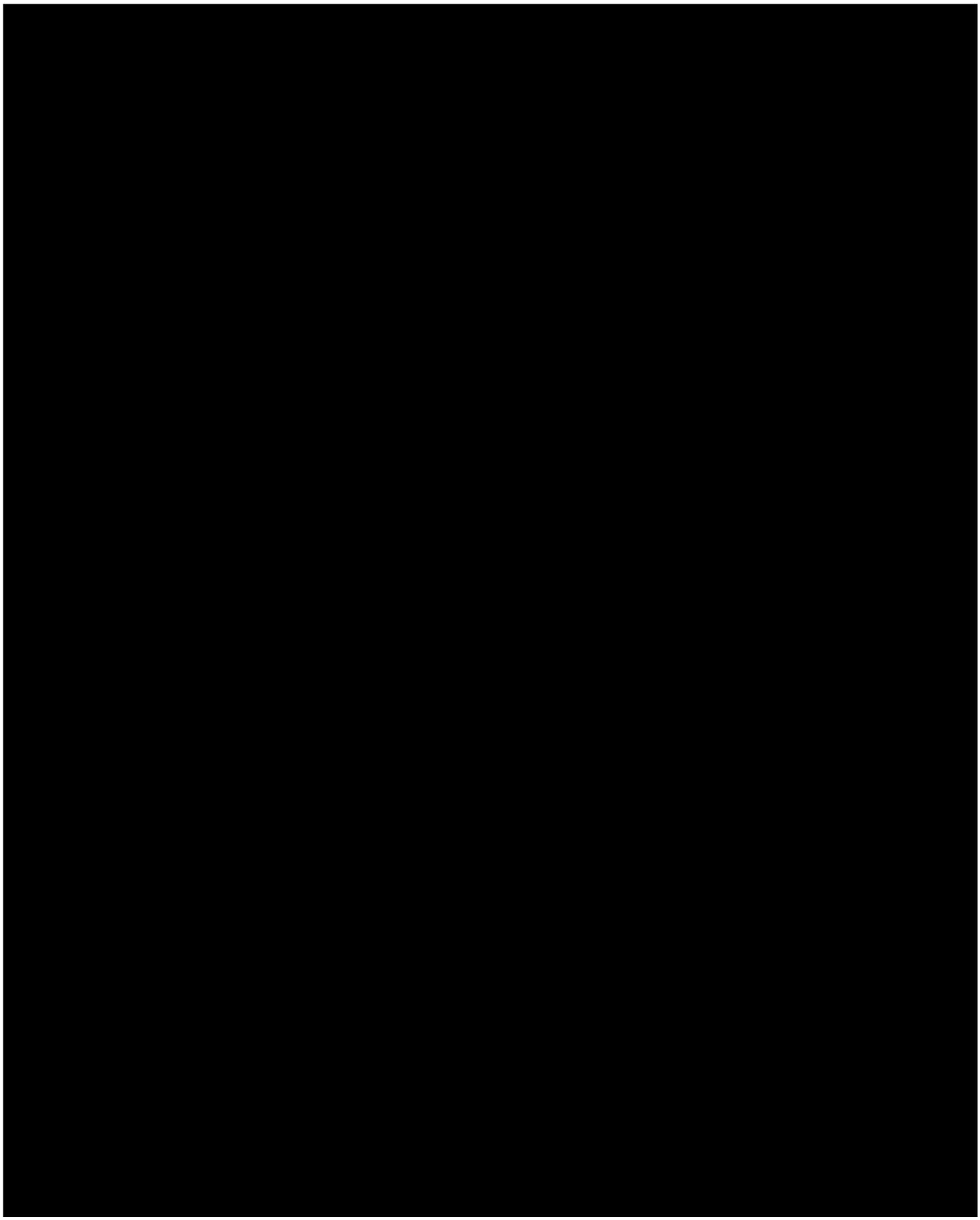
Commercial Clarifications and Deviations

CER 10. Vehicle Technical Information

This form must be completed and included in the Technical Proposal. NOTE—one form must be completed for each type of bus submitted in response to this RFP

GENERAL COACH DATA SHEET	
Bus manufacturer:	New Flyer of America Inc.
Bus model:	XE40
Understructure manufacturer:	New Flyer of America Inc.
Model number:	XE40
Size/Type of Bus	40 Foot Electric

[redacted]



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High Gradeability 40’ Performance Curves

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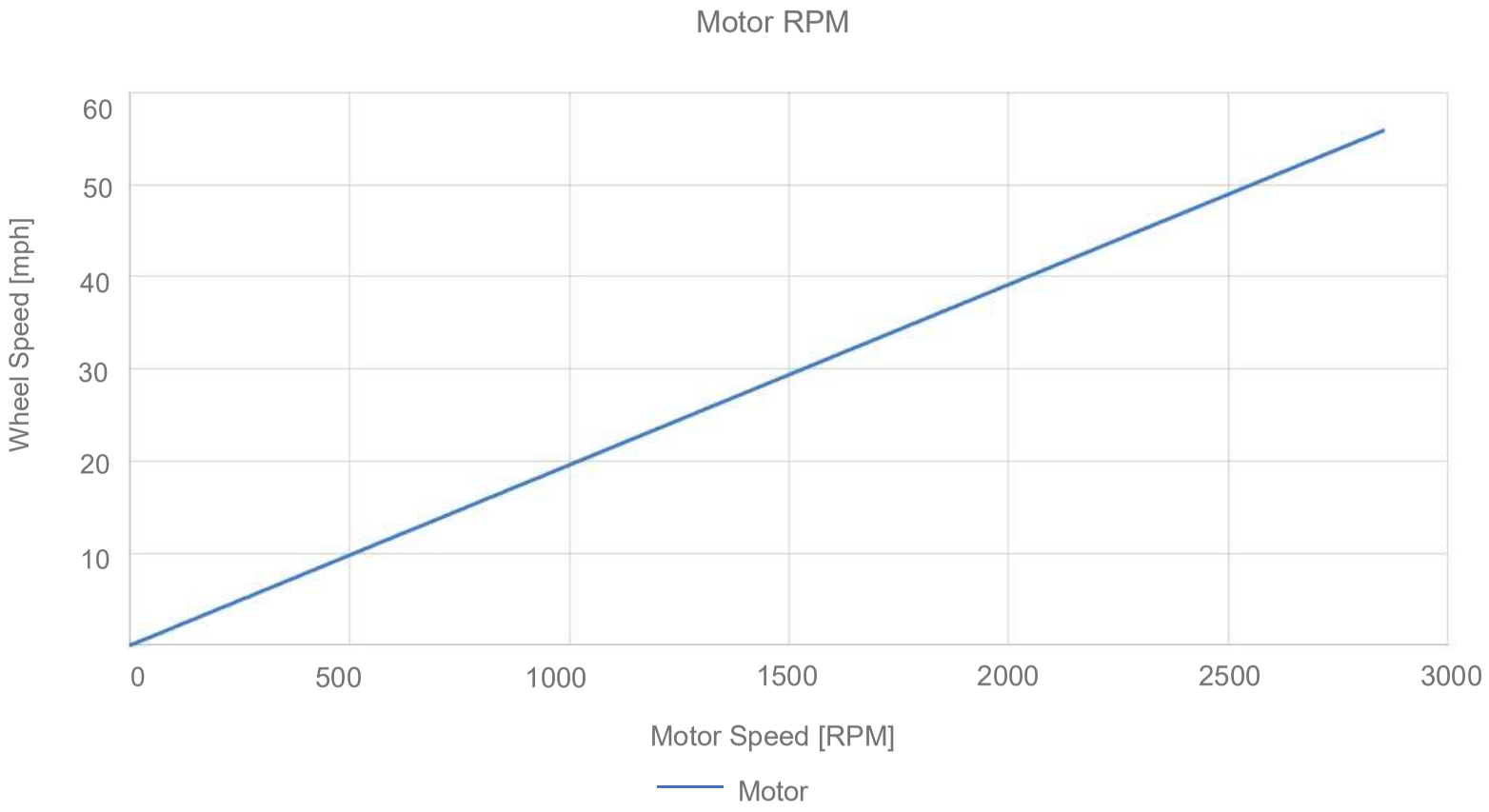
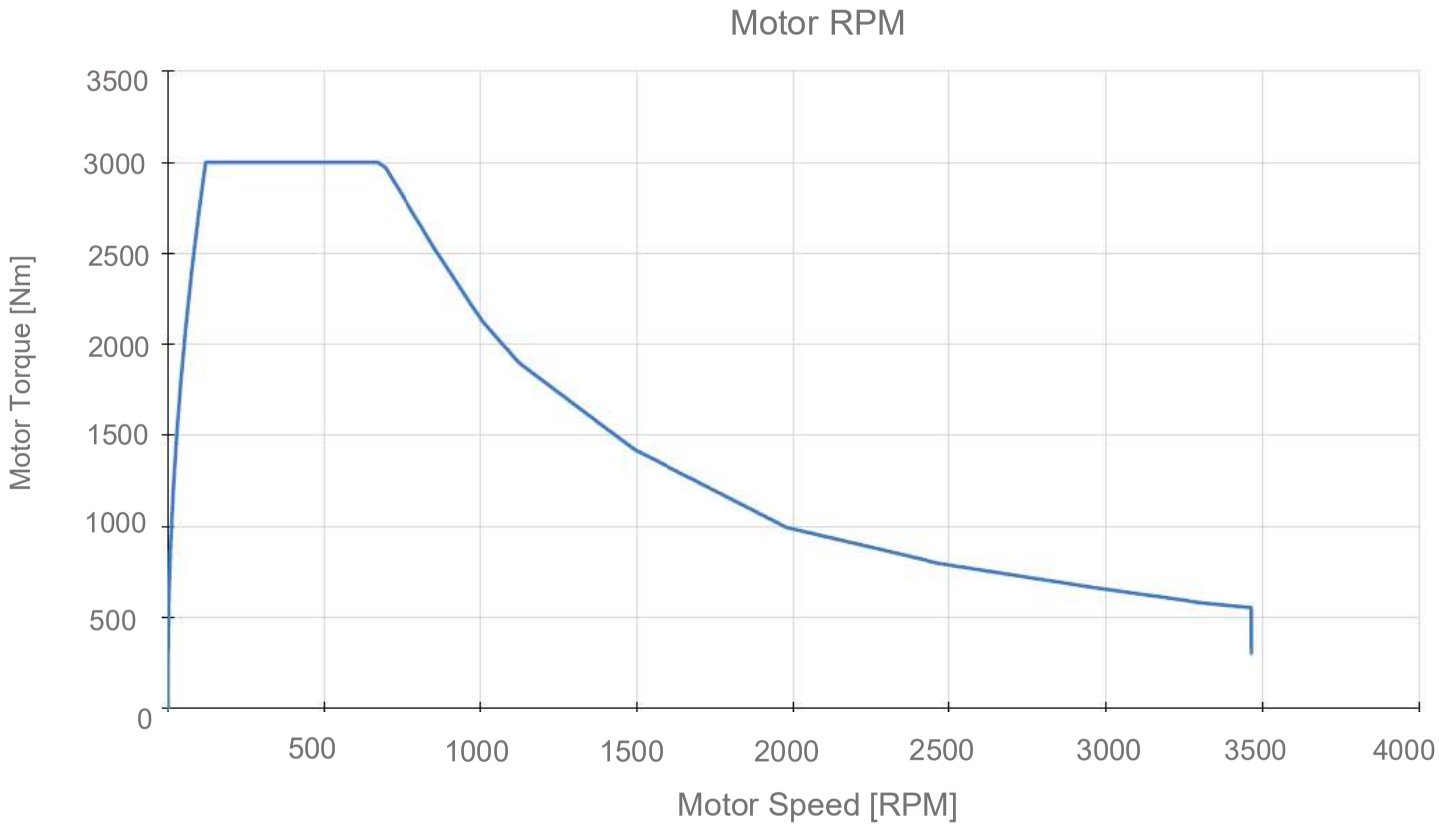
Engine Speed vs Road Speed

NEW FLYER | Engineering Services



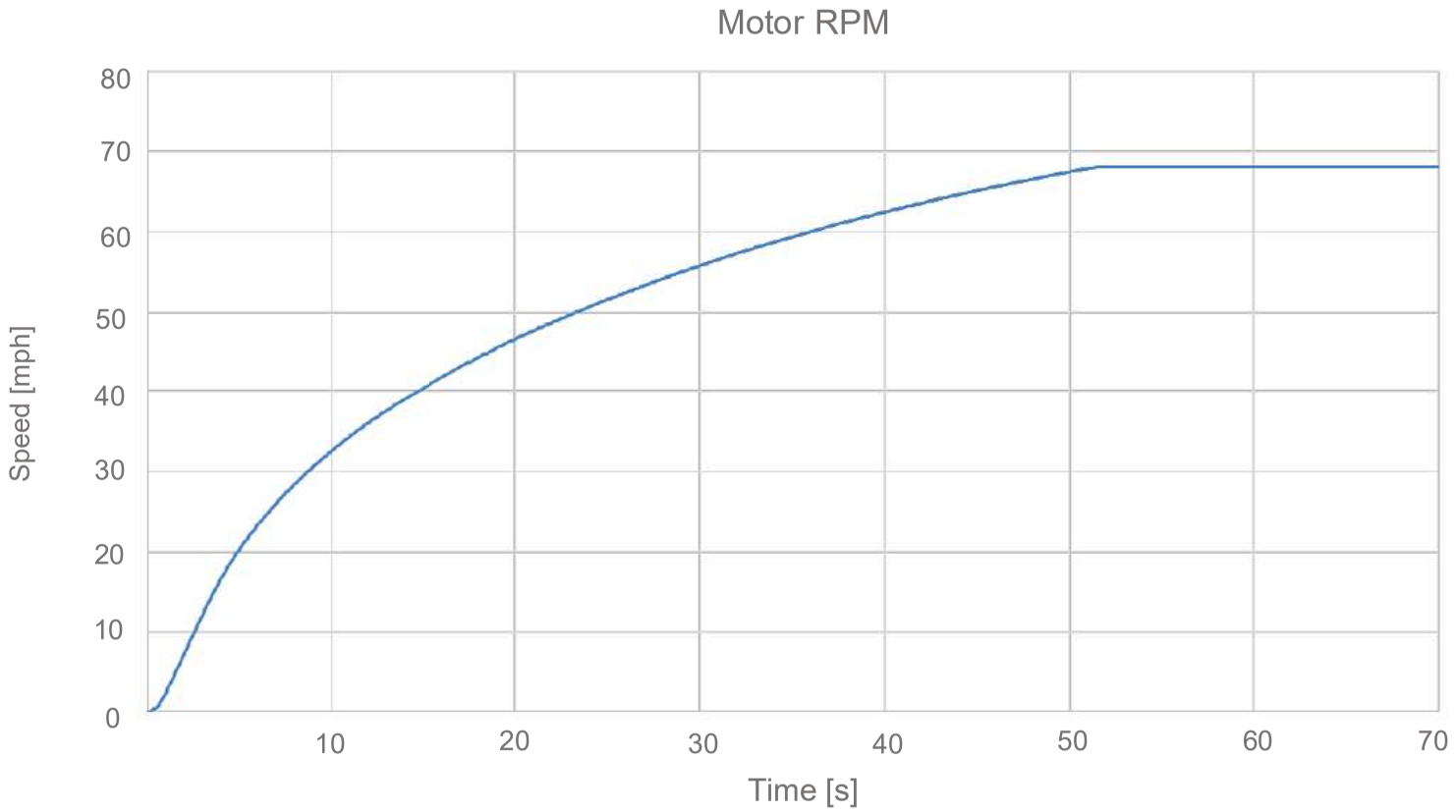
Motor Torque vs Motor Speed

NEW FLYER | Engineering Services



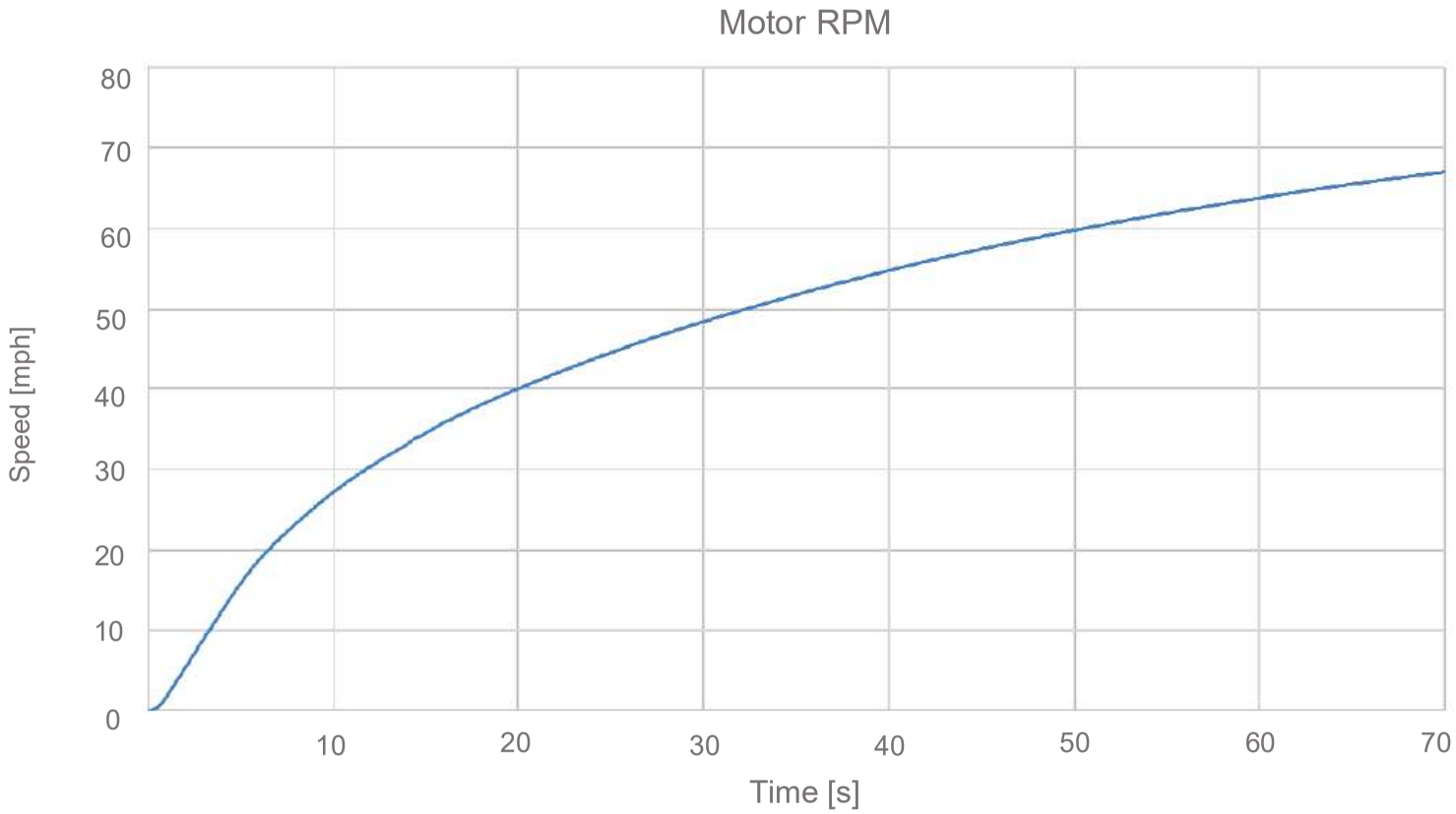
Vehicle Speed vs Time Unloaded

NEW FLYER | Engineering Services



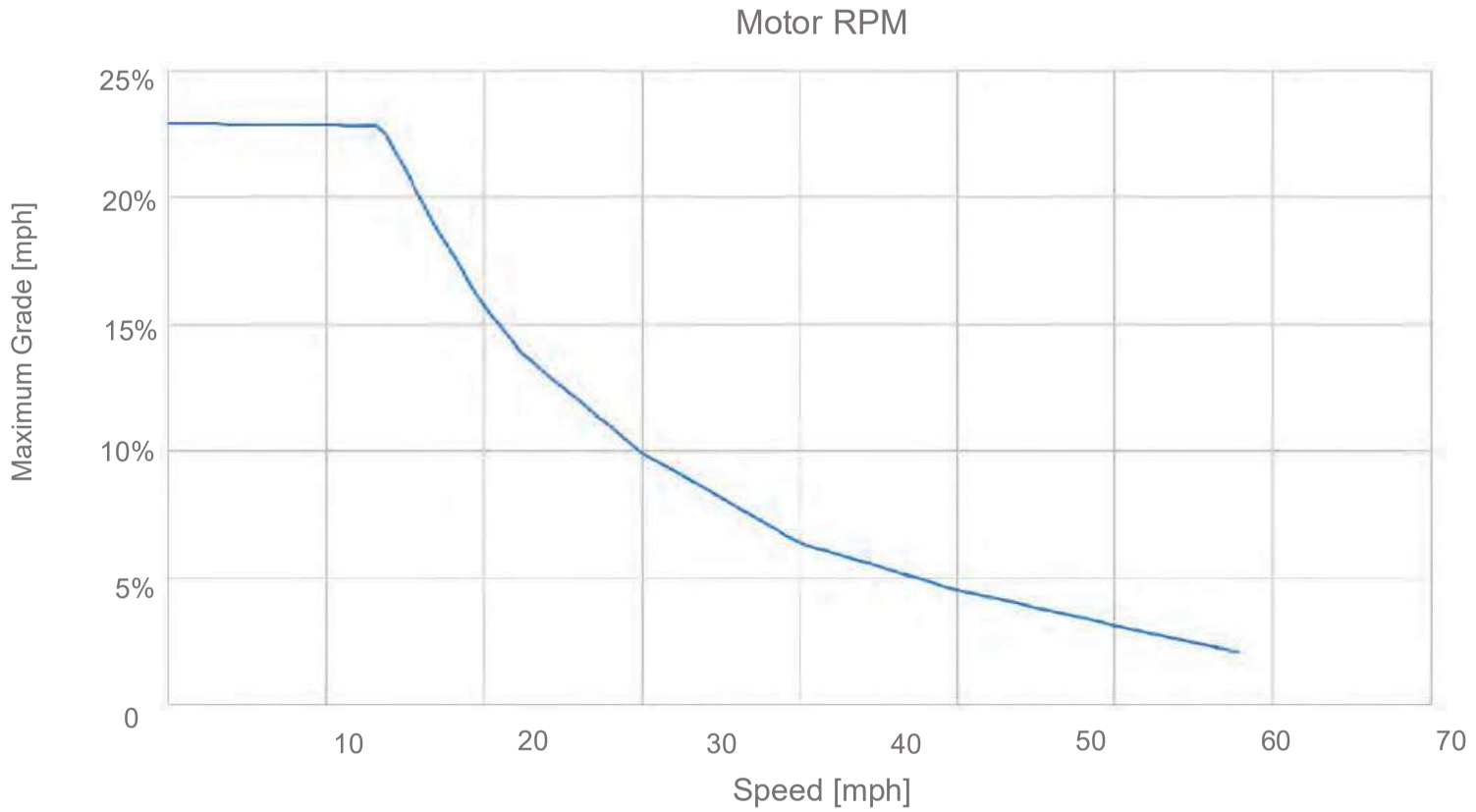
Vehicle Speed vs Time Fully Load

NEW FLYER | Engineering Services



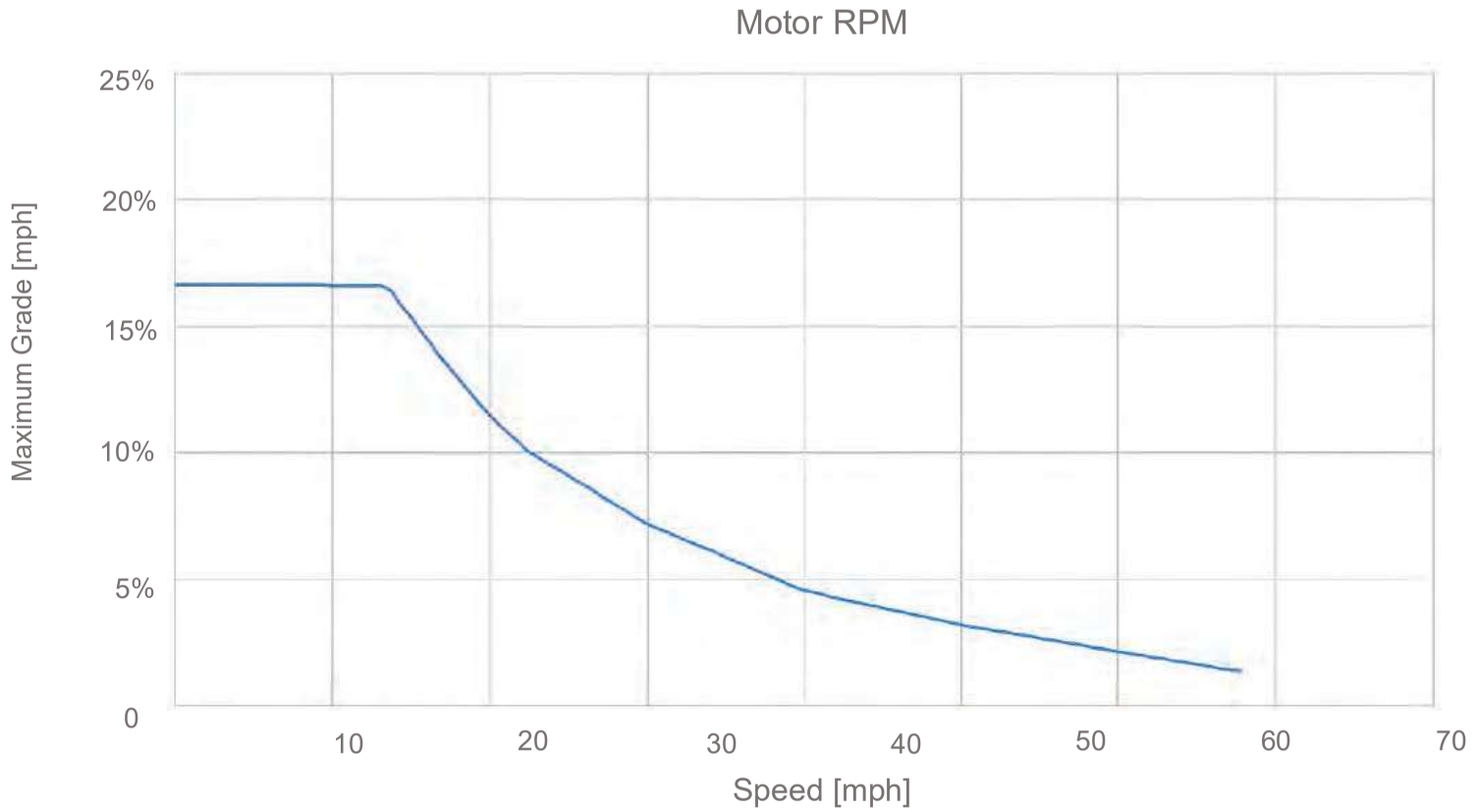
Unloaded Speed vs Grade

NEW FLYER | Engineering Services



Fully Loaded Speed vs Grade

NEW FLYER | Engineering Services




NEW FLYER®

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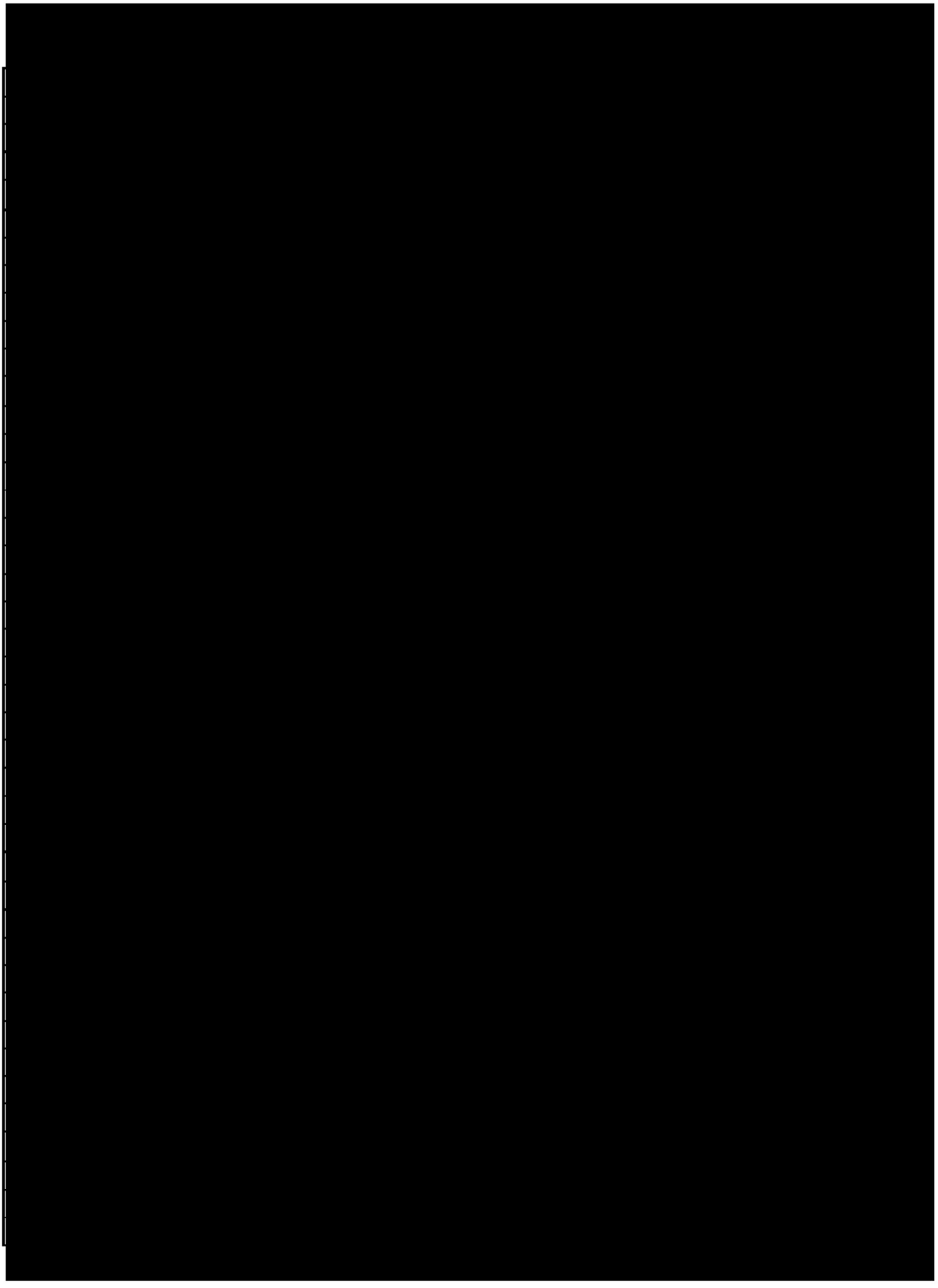

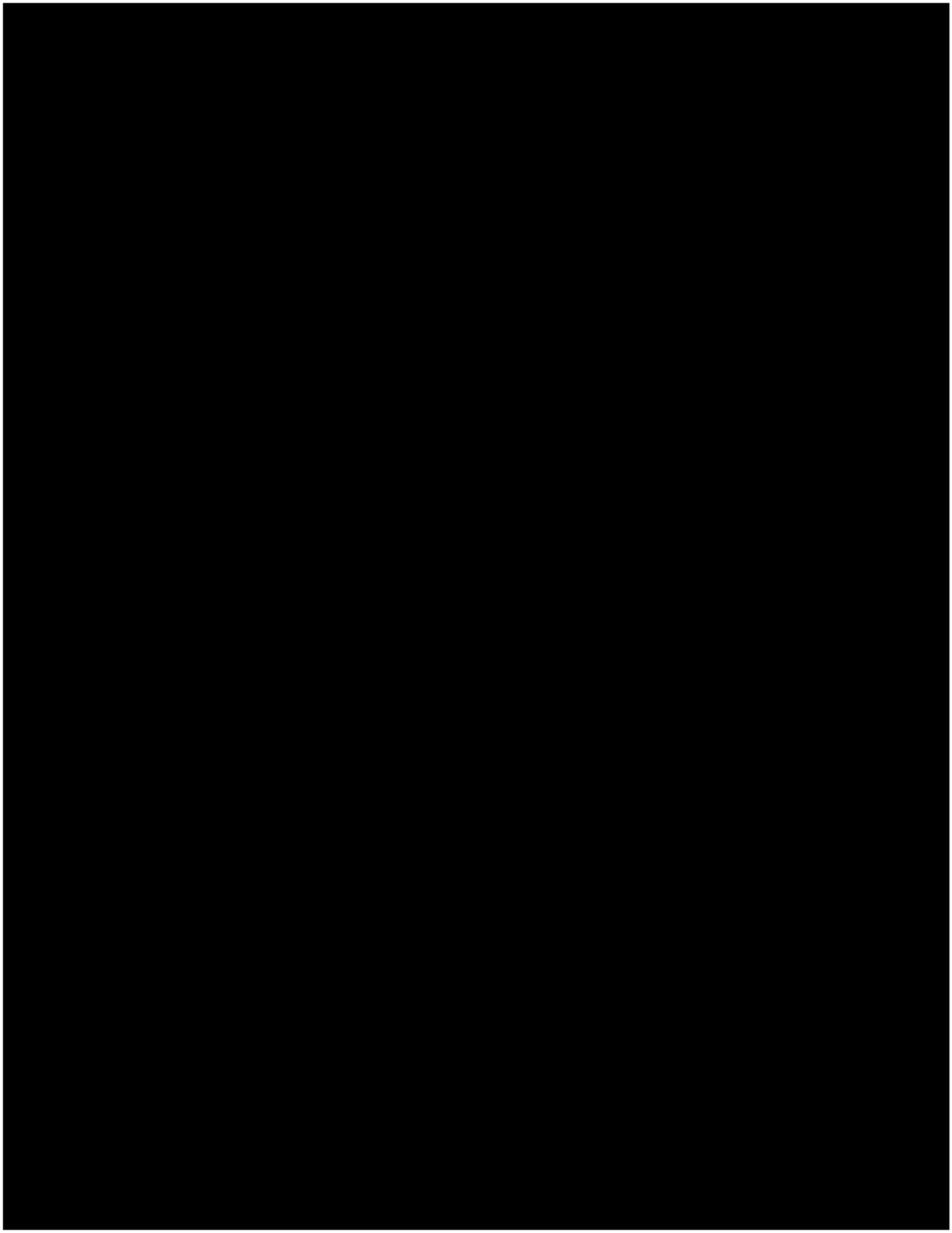

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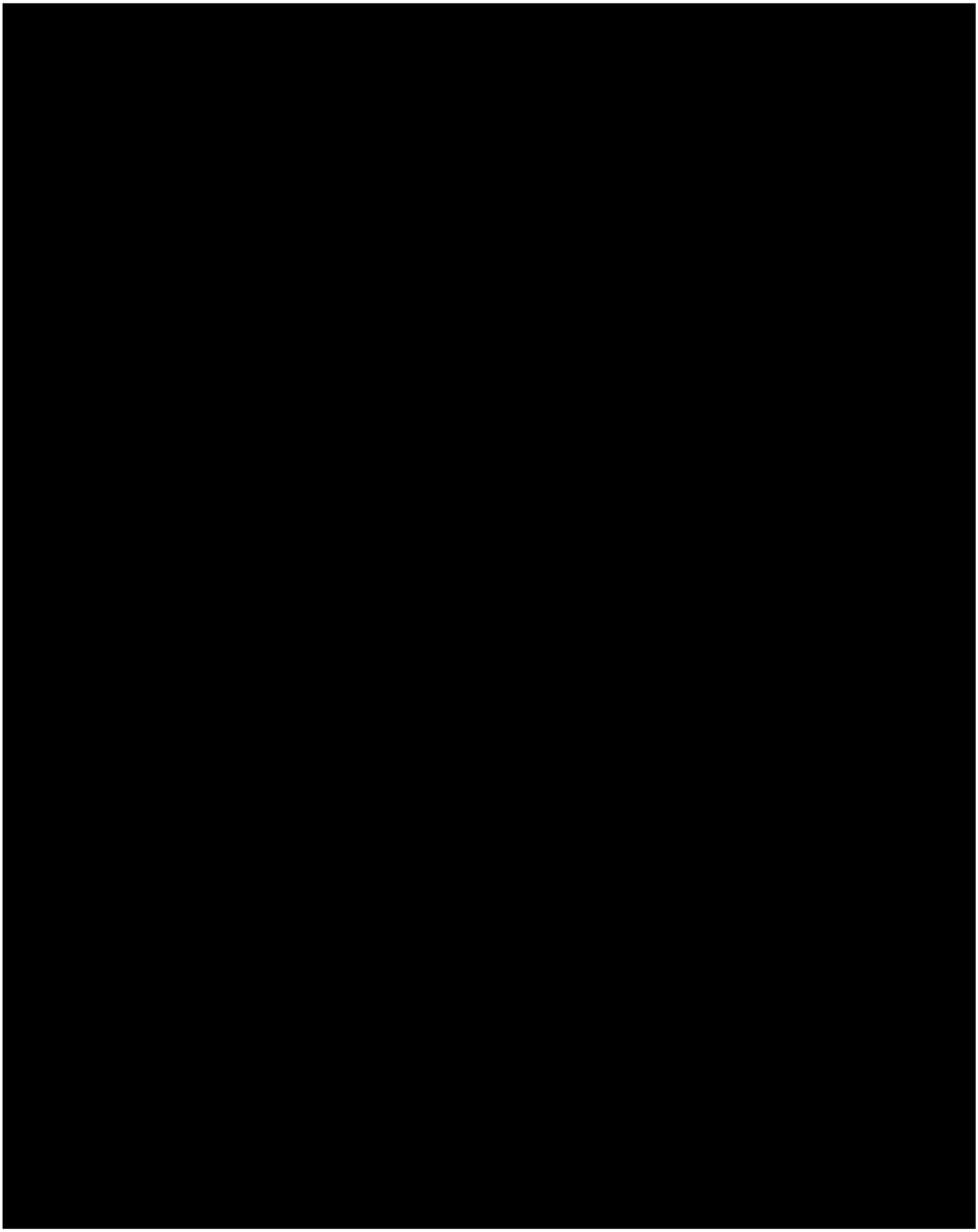

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CER 10. Vehicle Technical Information

This form must be completed and included in the Technical Proposal. NOTE—one form must be completed for each type of bus submitted in response to this RFP

GENERAL COACH DATA SHEET	
Bus manufacturer:	New Flyer of America Inc.
Bus model:	Xcelsior XE60
Understructure manufacturer:	New Flyer of America Inc.
Model number:	XE60
Size/Type of Bus	60 Foot Electric Articulated

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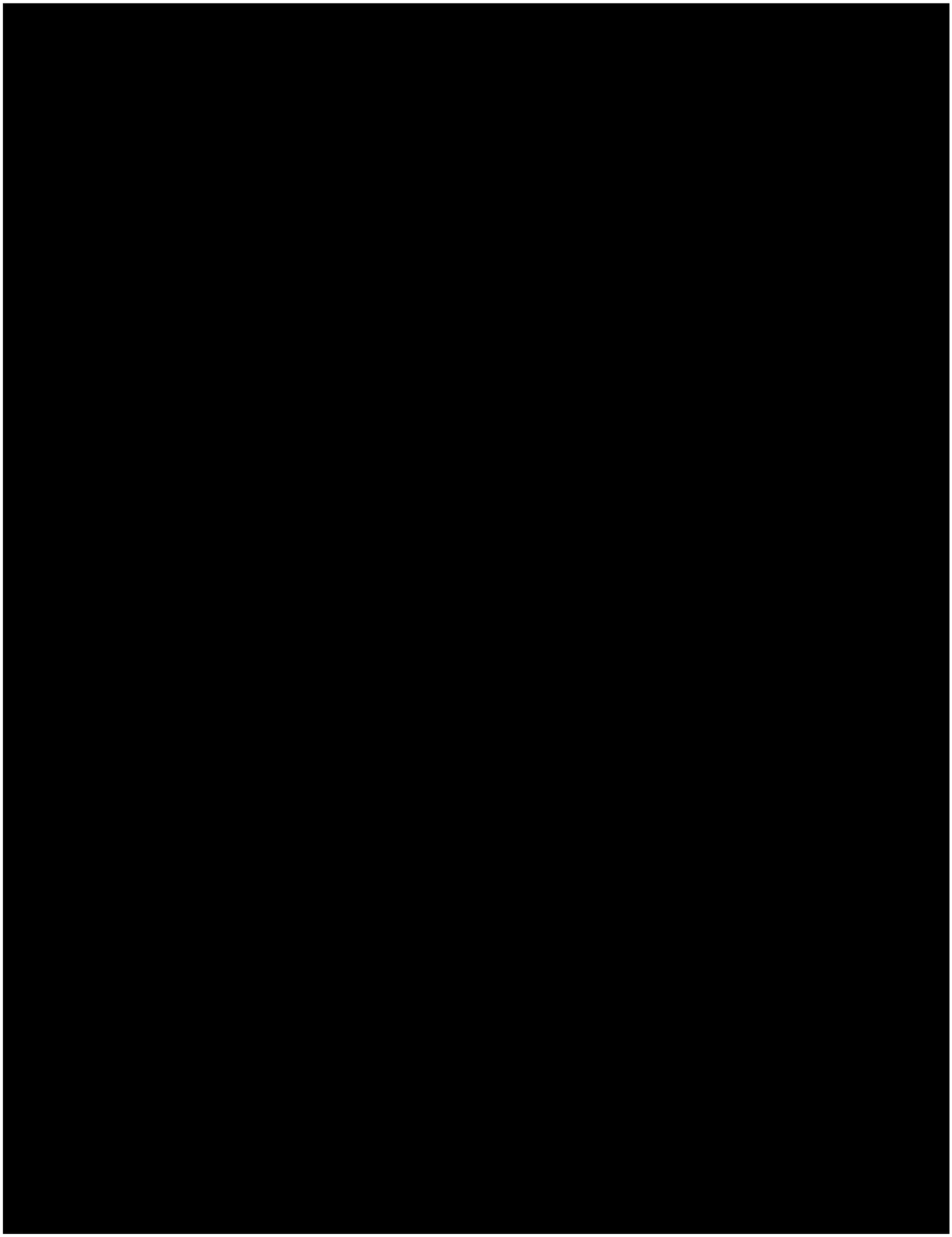

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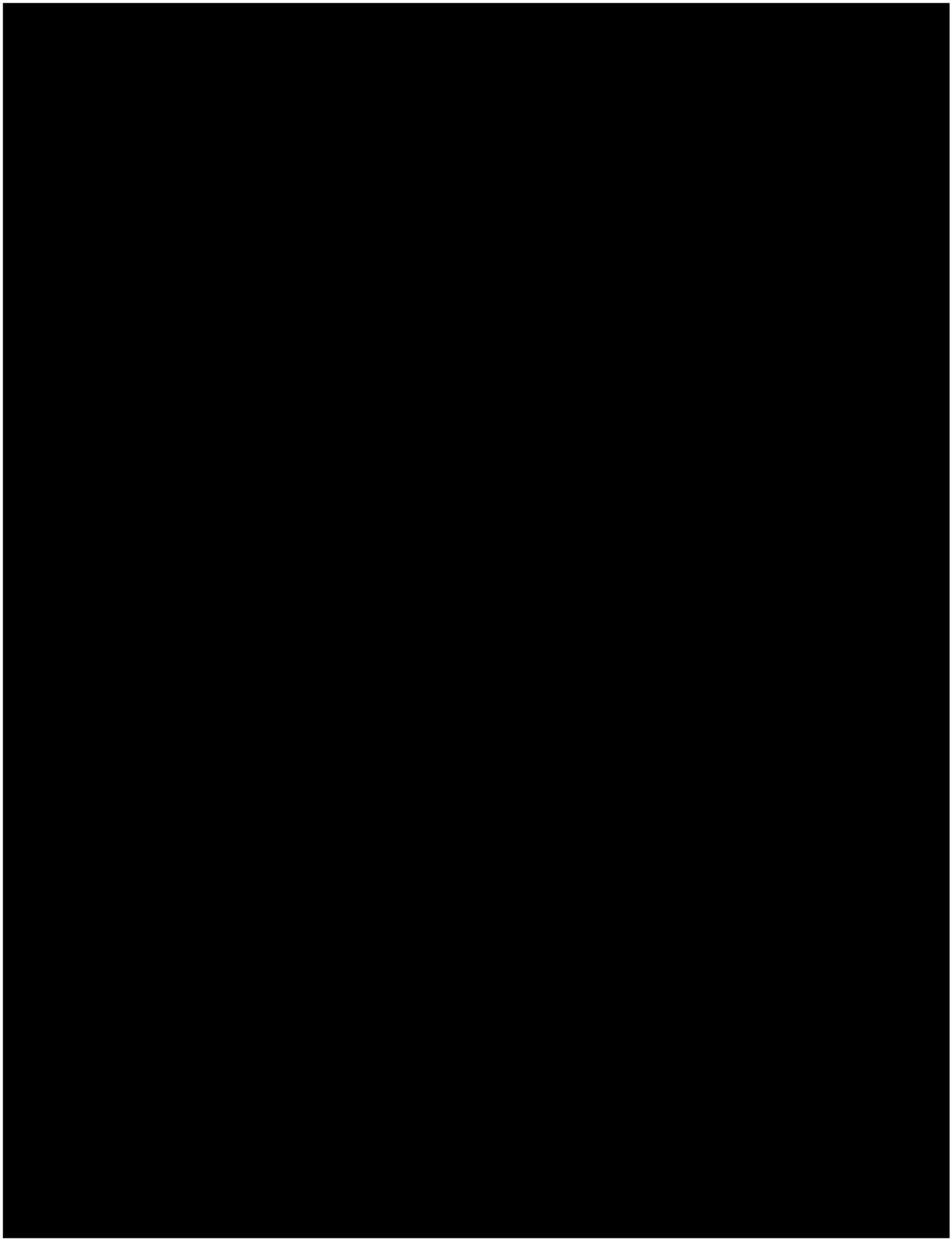




Xcelsior Charge Performance Curves

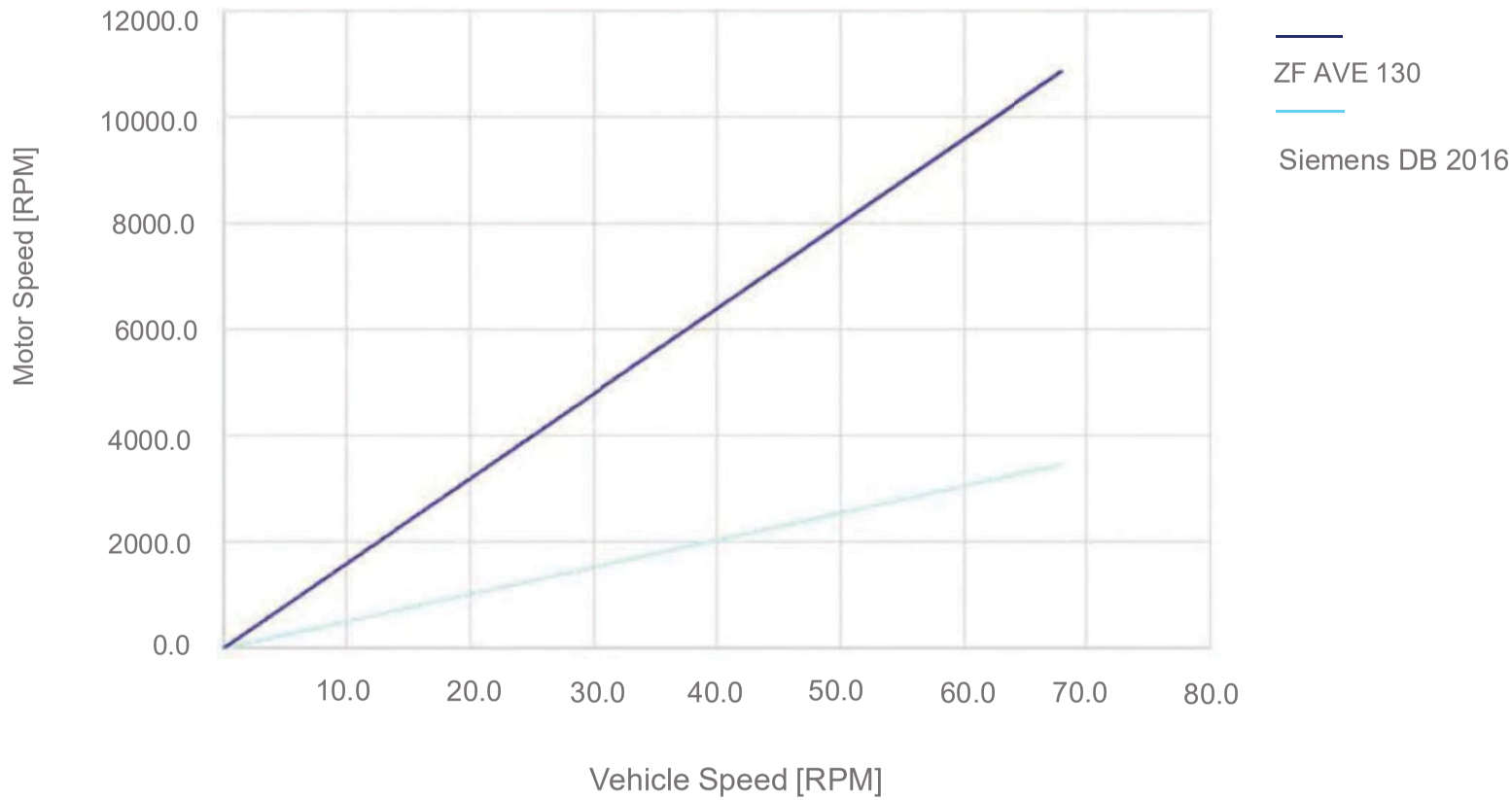
60 Foot

Standard Grade, 2016 PEM Motor

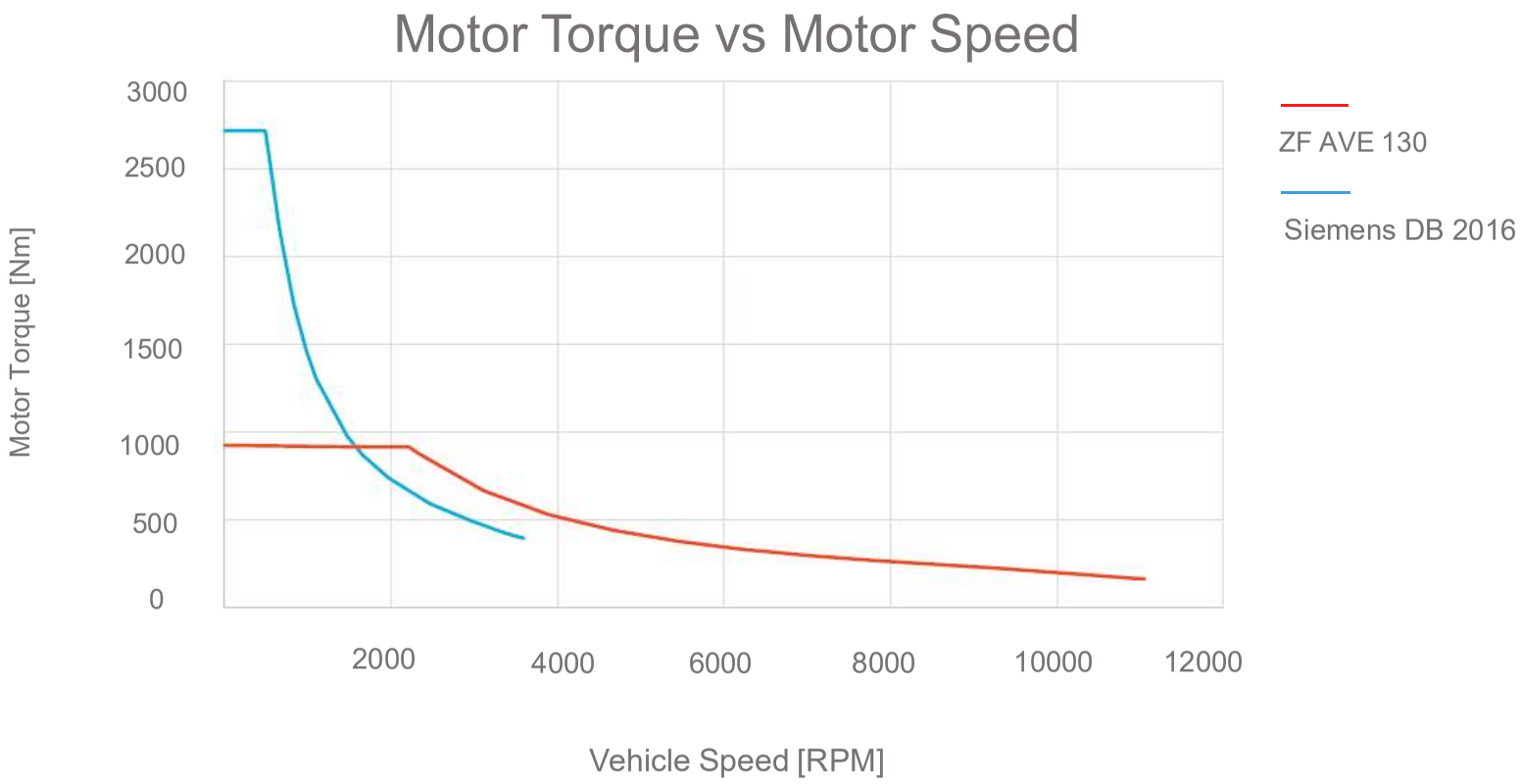
NEW FLYER

MCI

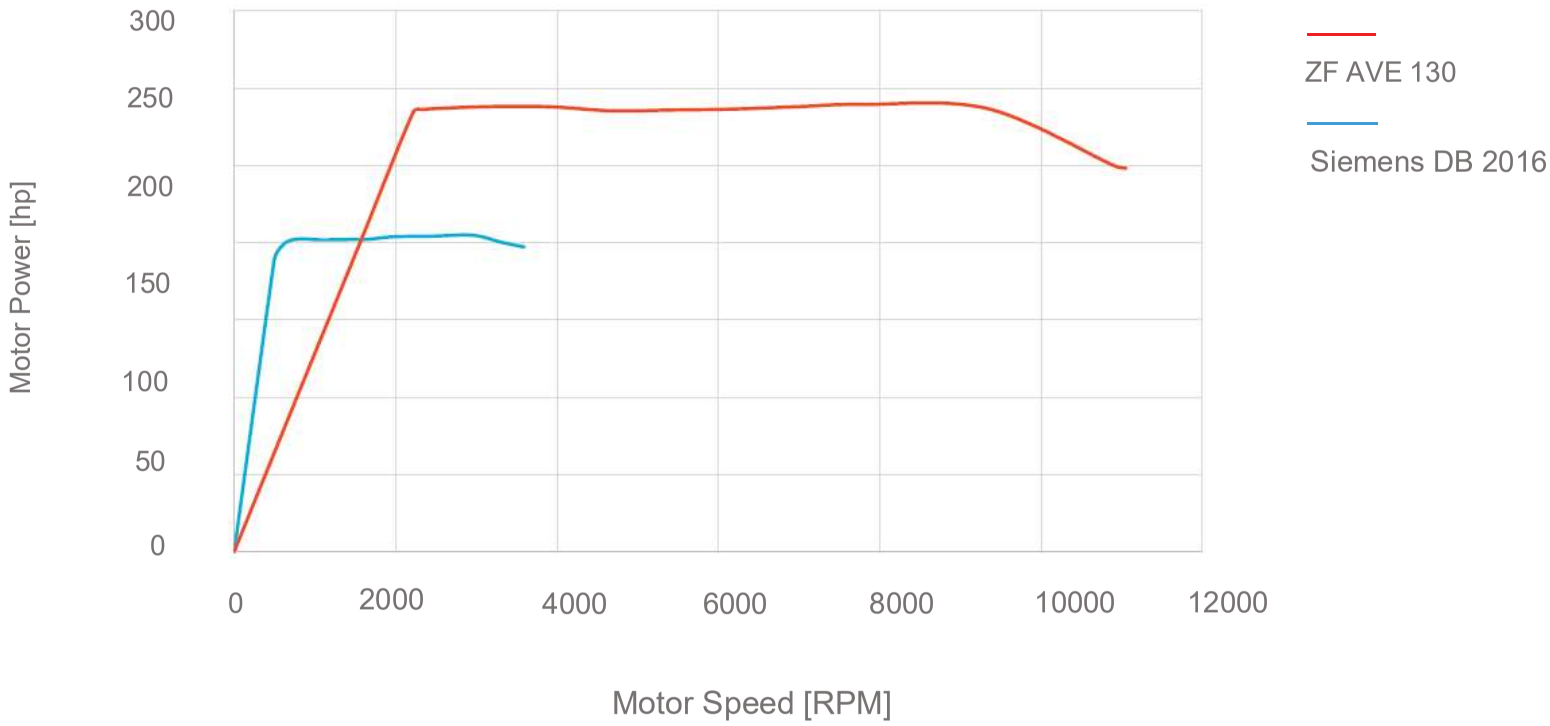
Motor Speed vs Vehicle Speed



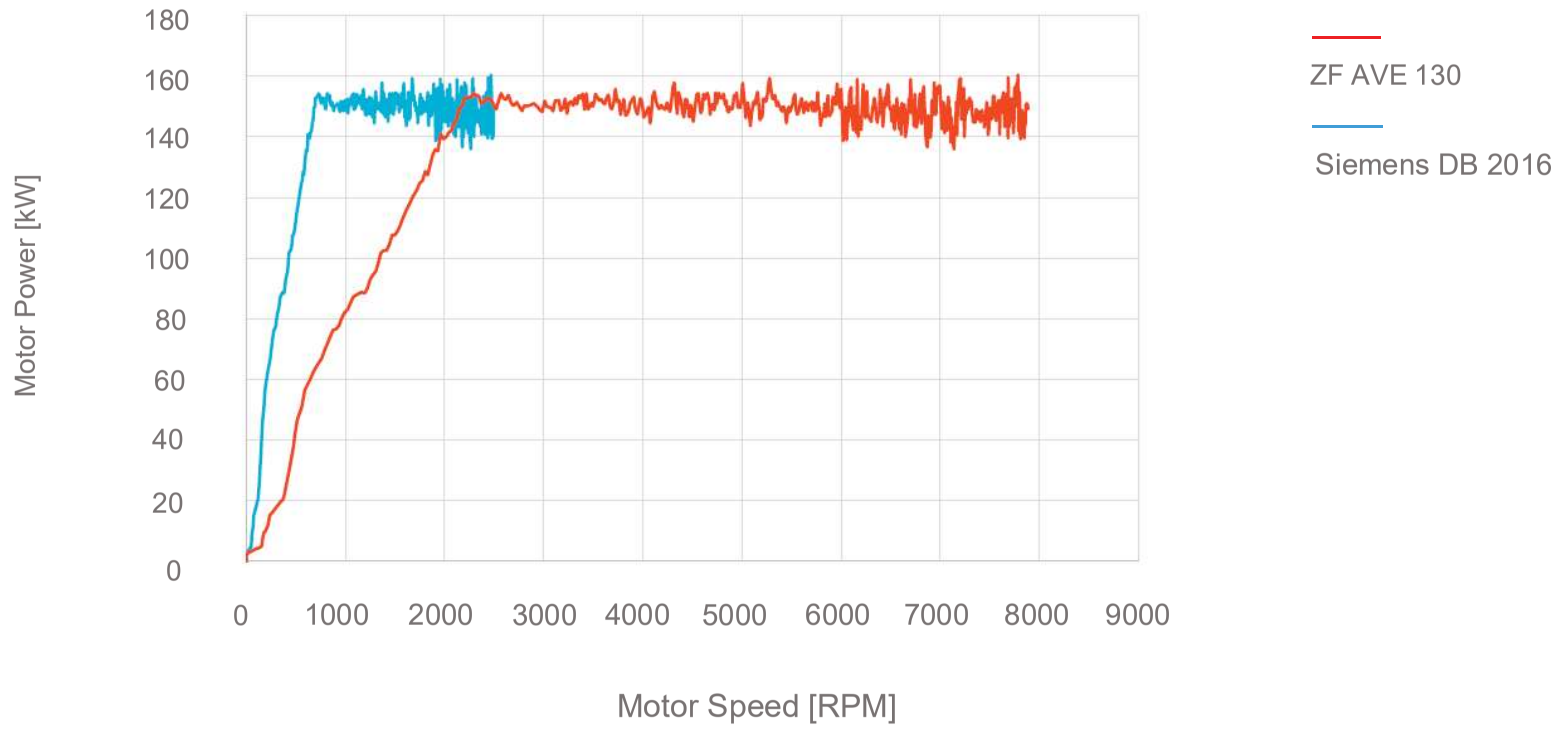
Motor Torque vs Motor Speed



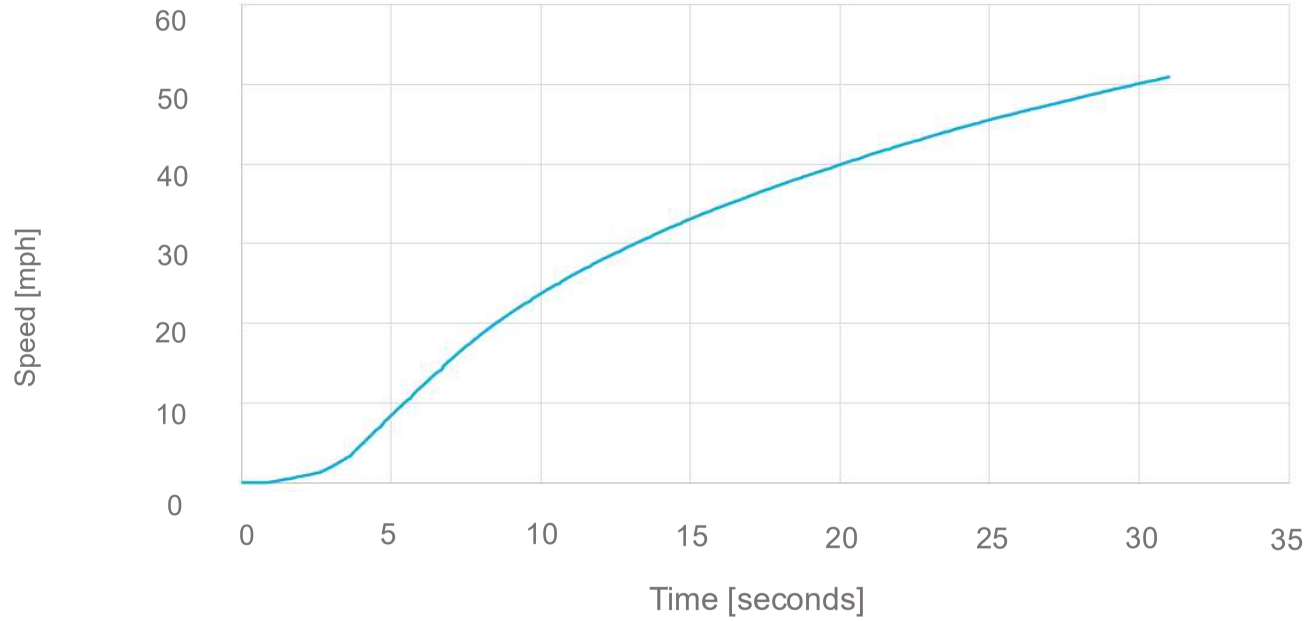
Horsepower vs Engine Speed



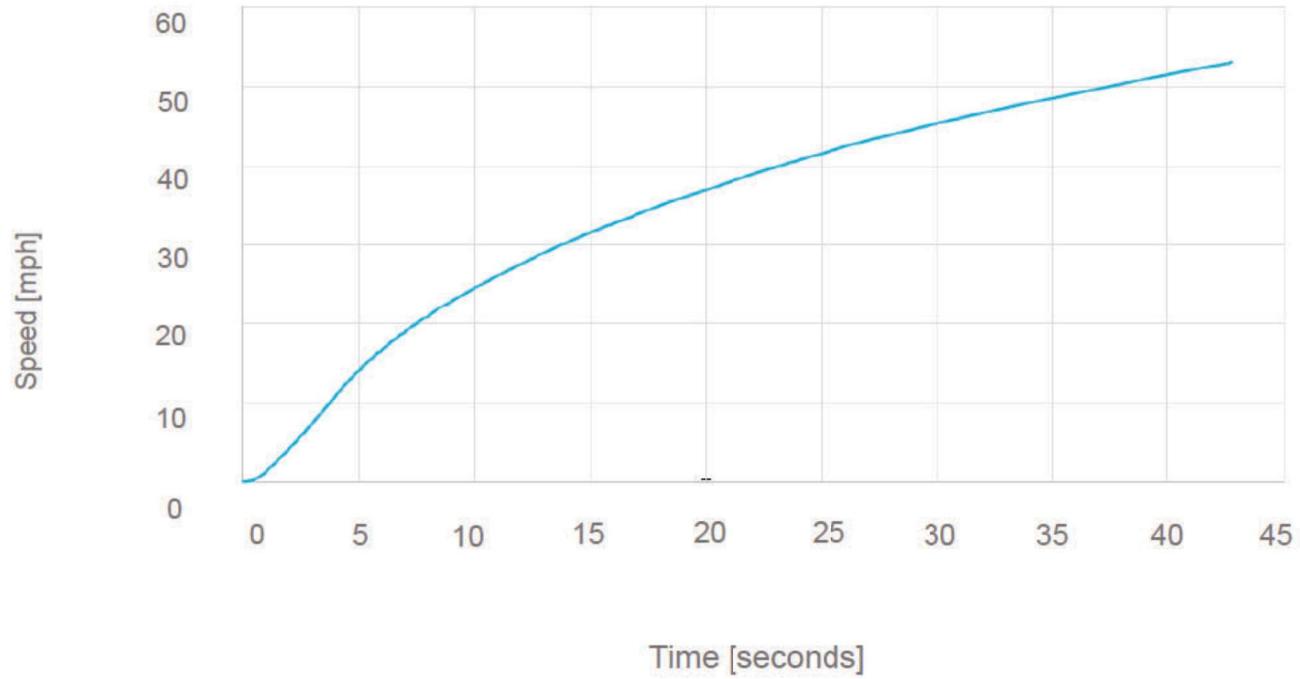
Energy Consumption vs Motor Speed



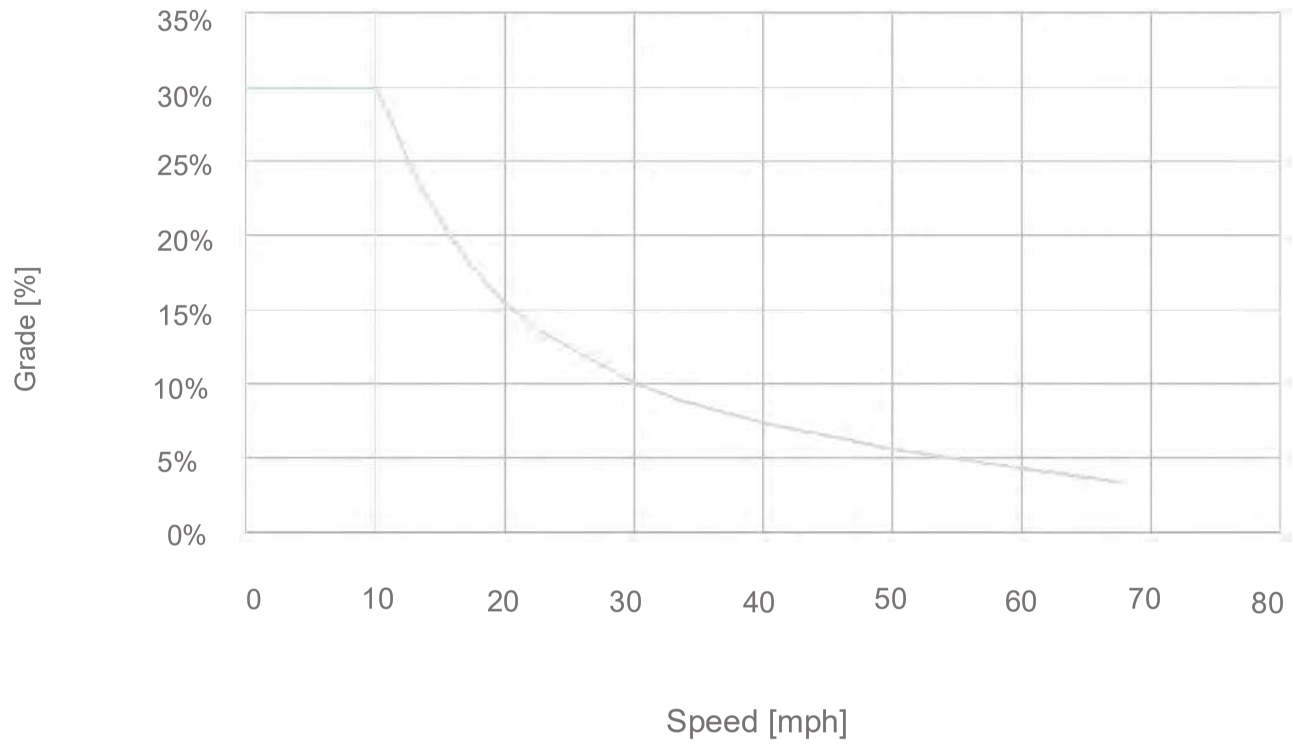
Vehicle Speed vs Time (Unloaded)



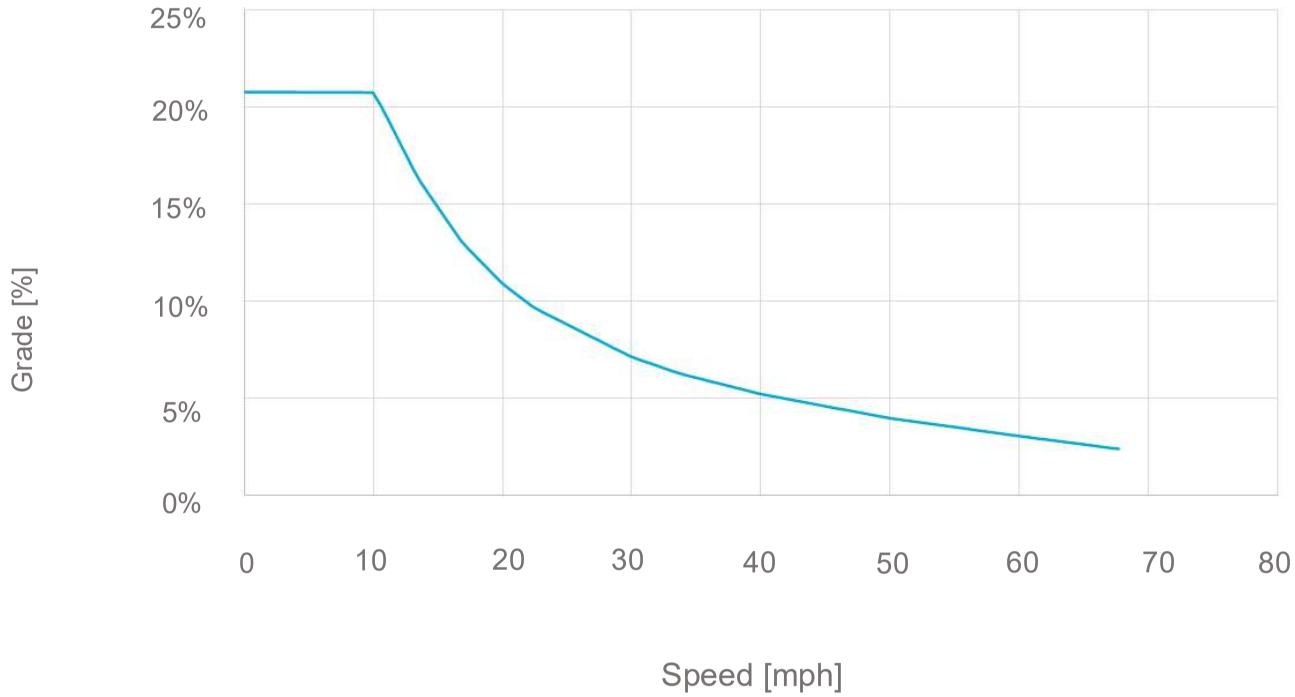
Vehicle Speed vs Time (Loaded)



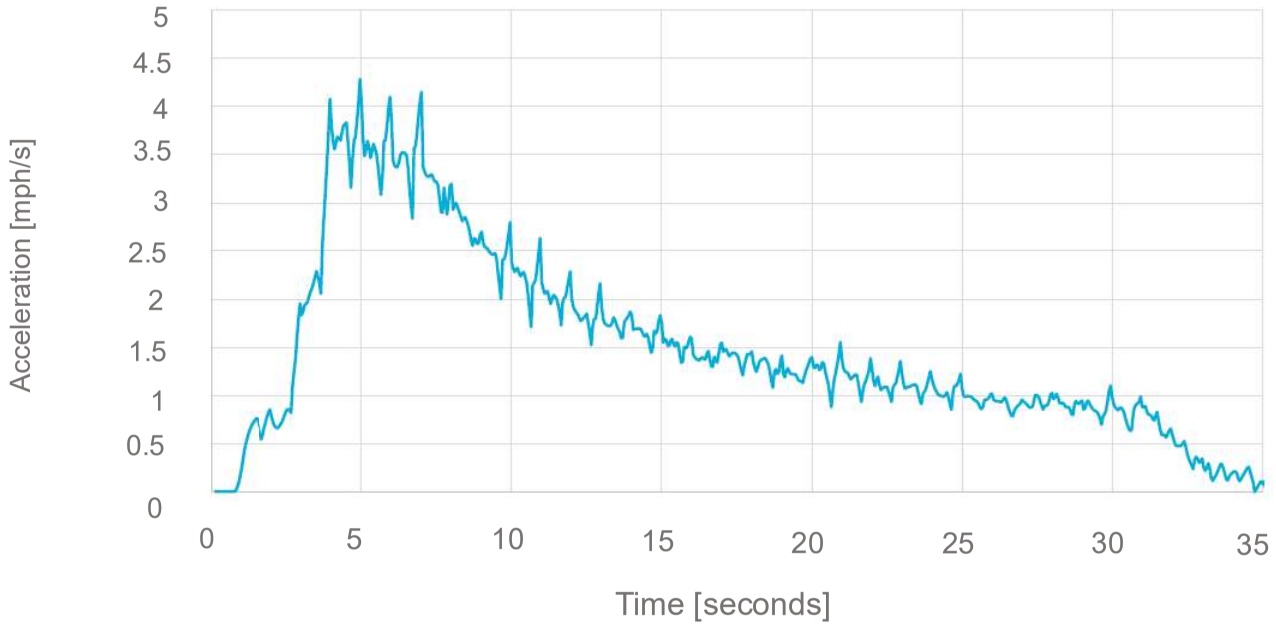
Vehicle Speed vs Grade (Unloaded)



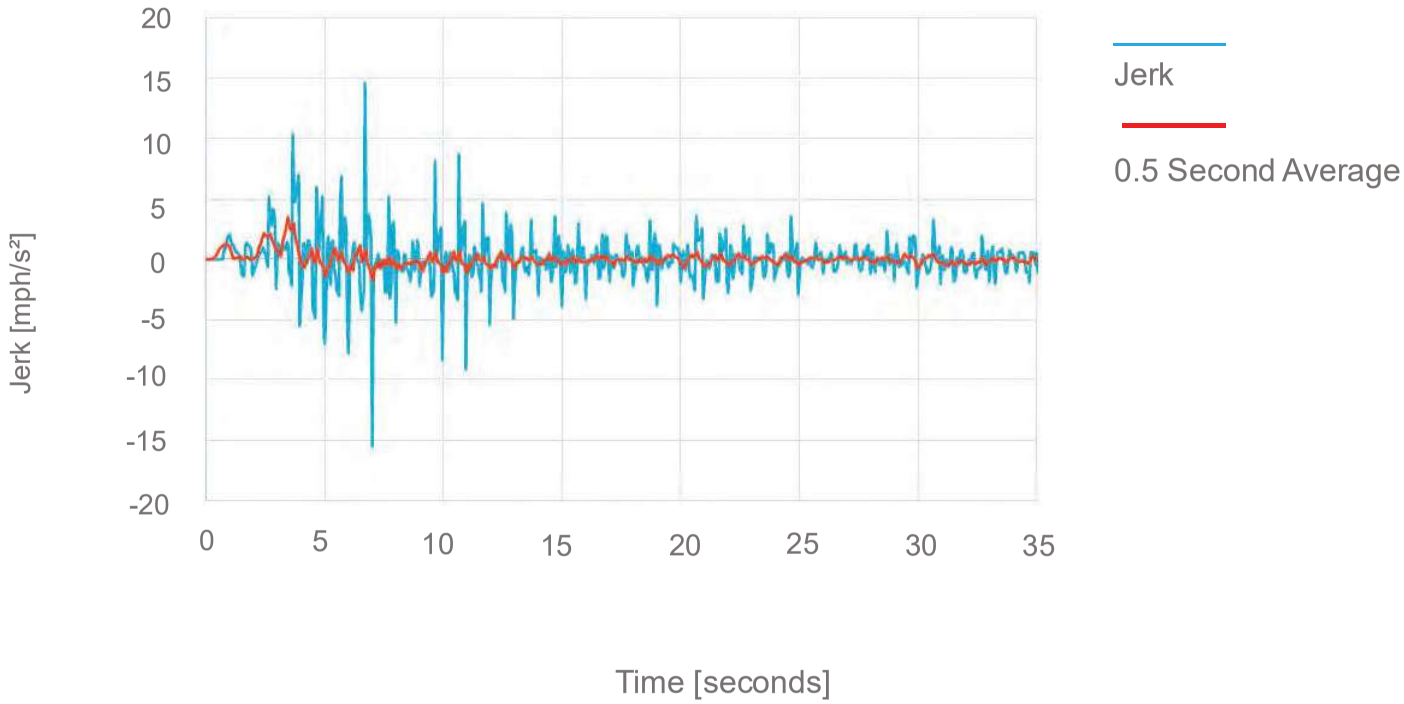
Vehicle Speed vs Grade (Loaded)



Acceleration vs Time



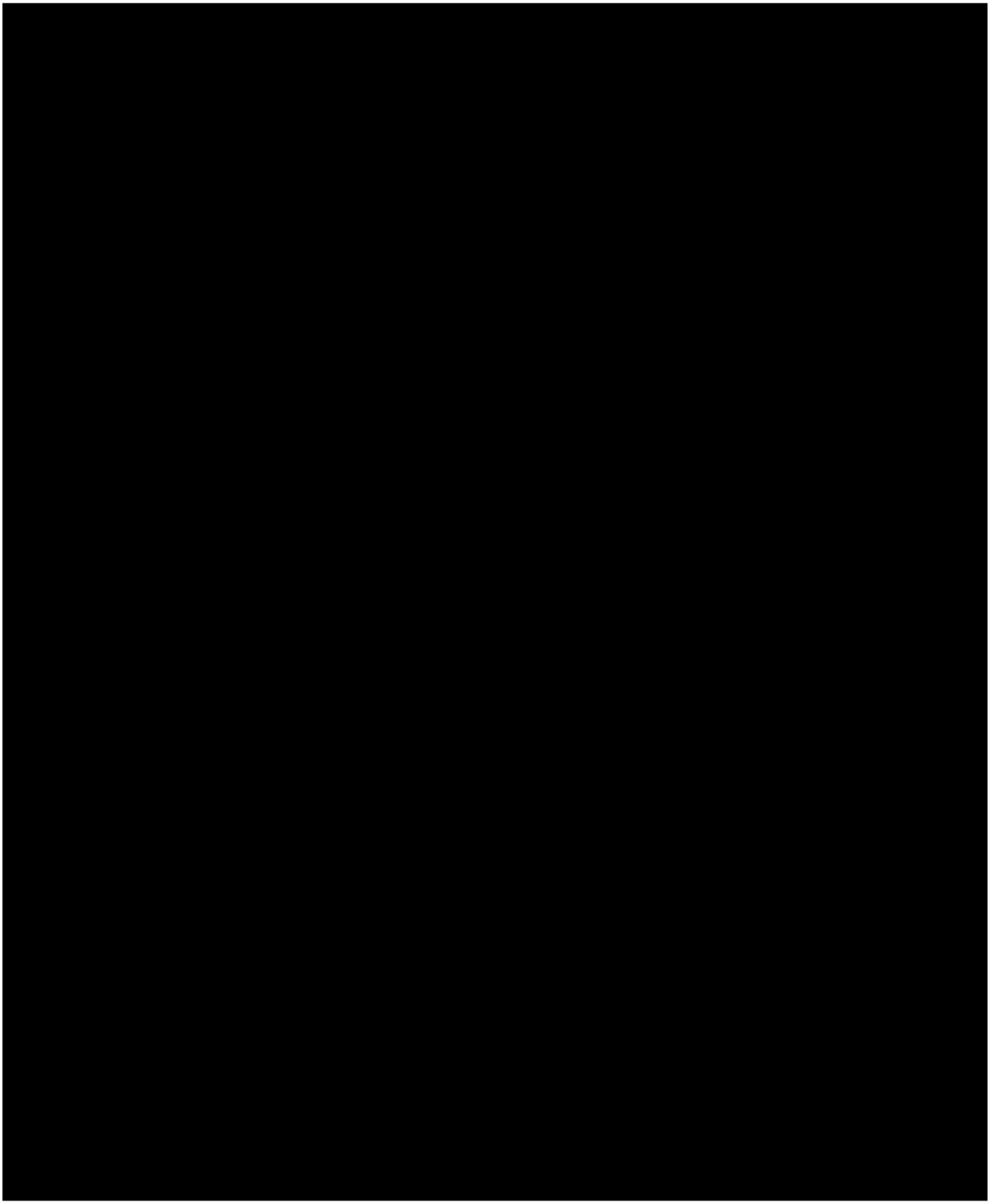
Jerk vs Time


20
15
10
5
0
-5
-10
-15
-20
Jerk [mph/s²]
0
5
10
15
20
25
30
35
Time [seconds]
Jerk
0.5 Second Average


NEW FLYER®

[redacted]

[redacted]



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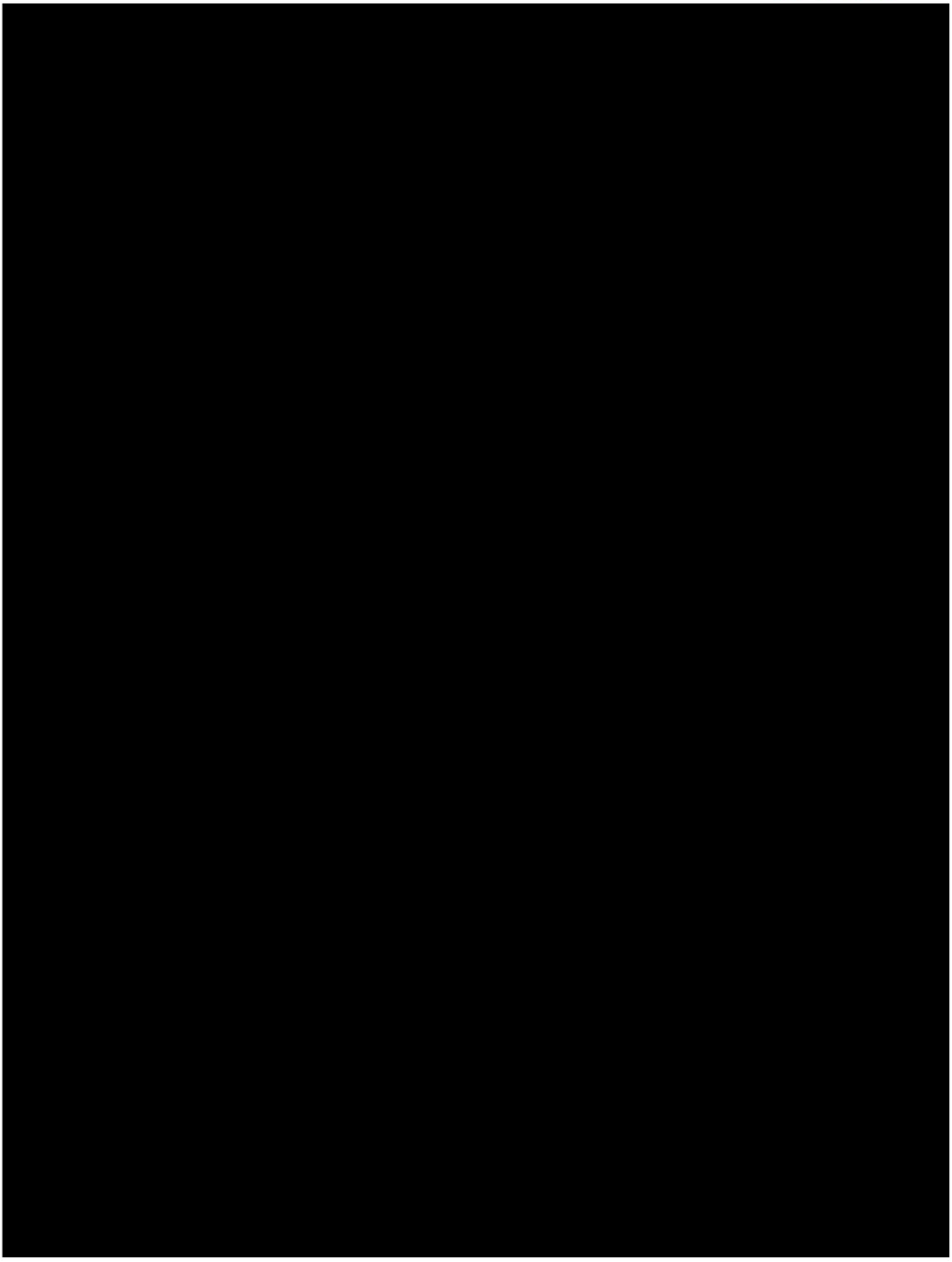

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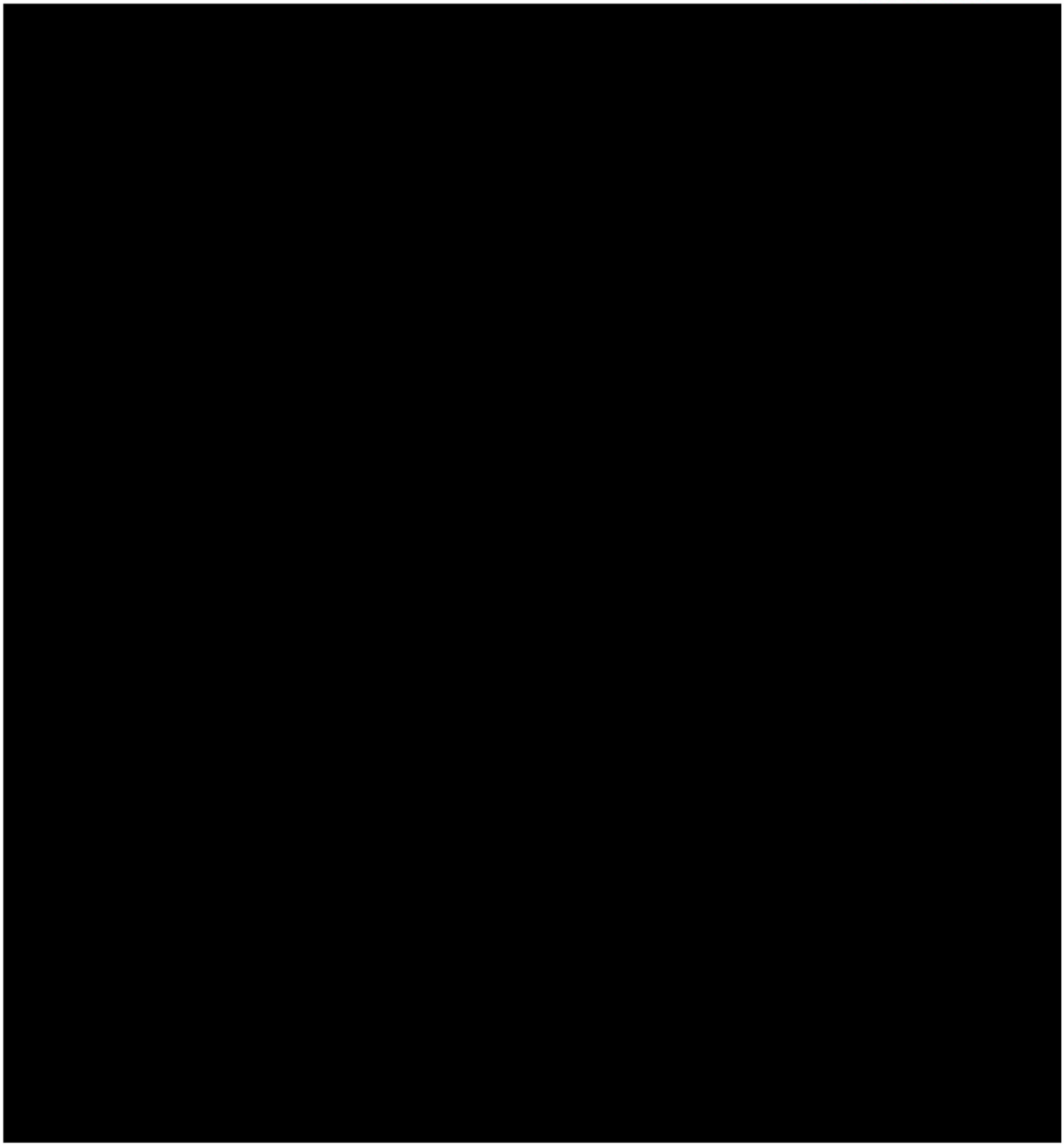
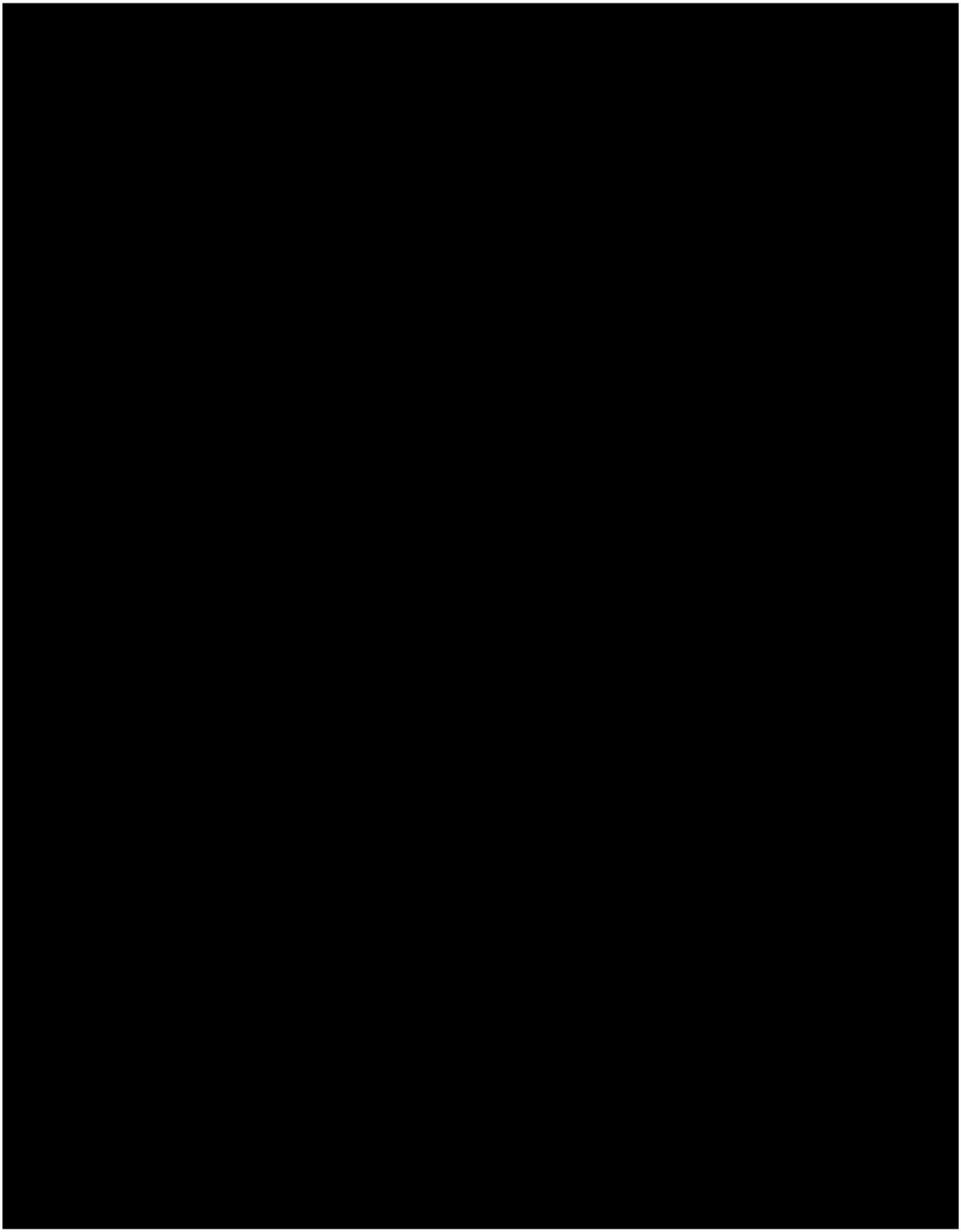


CER 10. Vehicle Technical Information

This form must be completed and included in the Technical Proposal. NOTE—one form must be completed for each type of bus submitted in response to this RFP

GENERAL COACH DATA SHEET	
Bus manufacturer:	Motor Coach Industries, Inc.
Bus model:	D-Commuter, 45 ft, High floor, low WCL entry
Understructure manufacturer:	Motor Coach Industries, Inc.
Model number:	D45 CRT LE CHARGE™
Size/Type of Bus	

[redacted]



[redacted]

[redacted]

Cranking Amps		Amps
Reserve Capacity		Amps

Batteries – high voltage

Manufacturer	
Type	
Model Number	
Total Battery Capacity (kWh)	
Standard Charge Time	
Charging Capacity	
Operating Temperature Range	
Cooling/Heating System	

Performance

Fuel Economy (w/full passenger load, HVAC, and all electric accessories in use)		kWh
Fuel Economy (w/full passenger load, HVAC, and all electric accessories in use)		MPGE
Max Gradeability		%
Top Speed		MPH
Battery Range		Miles
Acceleration (20 MPH)		Seconds
Acceleration (40 MPH)		Seconds
Top Speed (stated above)		Seconds

Performance information/graphs to be attached with this form:

Energy consumption vs. Vehicle speed

Vehicle speed vs. time (both loaded and unloaded)

Vehicle speed vs. grade (both loaded and unloaded)

Acceleration vs. time

Change of acceleration vs. time

PERFORMANCE DATA FORM

Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. & S.I.	

Temperature (°F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

		INITIALS:
Air Conditioning - OFF	✓Checked	M.H.
Heater pump motor - OFF	✓Checked	M.H.
Defroster - OFF	✓ Checked	M.H.
Exterior and interior lights - ON	✓ Checked	M.H.
Windows and doors - CLOSED	✓ Checked	M.H.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.3	3.1	3.0
20 mph	5.6	5.3	5.3
30 mph	8.2	7.9	7.9
40 mph	14.4	14.2	14.3
50 mph	24.6	24.4	24.4
60 mph	40.7	40.5	40.6
70 mph	78.4	77.6	77.6

Maximum Speed (mph): 71.9 (maximum governed speed reached)

PERFORMANCE DATA FORM

Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. & S.I.	

Temperature (°F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

		INITIALS:
Air Conditioning - OFF	✓Checked	M.H.
Heater pump motor - OFF	✓Checked	M.H.
Defroster - OFF	✓ Checked	M.H.
Exterior and interior lights - ON	✓ Checked	M.H.
Windows and doors - CLOSED	✓ Checked	M.H.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.3	3.1	3.0
20 mph	5.6	5.3	5.3
30 mph	8.2	7.9	7.9
40 mph	14.4	14.2	14.3
50 mph	24.6	24.4	24.4
60 mph	40.7	40.5	40.6
70 mph	78.4	77.6	77.6

Maximum Speed (mph): 71.9 (maximum governed speed reached)

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus was operated at SLW on a chassis dynamometer. The procedure dictates that the test bus be accelerated to a maximum "power-limited"/"governed" or maximum "safe" speed not exceeding 80 mph. The maximum power-limited/governed speed, if applicable, is the top speed as limited by the engine control system. The maximum safe speed is defined as the maximum speed that the dynamometer, the tires or other bus components are limited to. The test vehicle speed was measured using a speed encoder built in the chassis dynamometer. The time intervals between 10 mph increments were recorded using a Data Acquisitions System. Time-speed data and the top speed attained were recorded on the Performance Data Form. The recorded data was used to generate a percent grade versus speed table and a speed versus time curve. All the above are available in the following pages.

4-III. DISCUSSION

This test consisted of three runs from standstill to full throttle on the chassis dynamometer. Speed versus time data was obtained for each run and results are averaged to minimize test variability. The test was performed up to a maximum governed speed of 71.9 mph. The calculated gradeability results are attached. The average time to reach 30 mph was 8.0 seconds. The maximum gradeablity at 10 mph was 19.4% and at 40 mph was 5.3%.

PERFORMANCE DATA FORM

Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. & S.I.	
Temperature (°F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

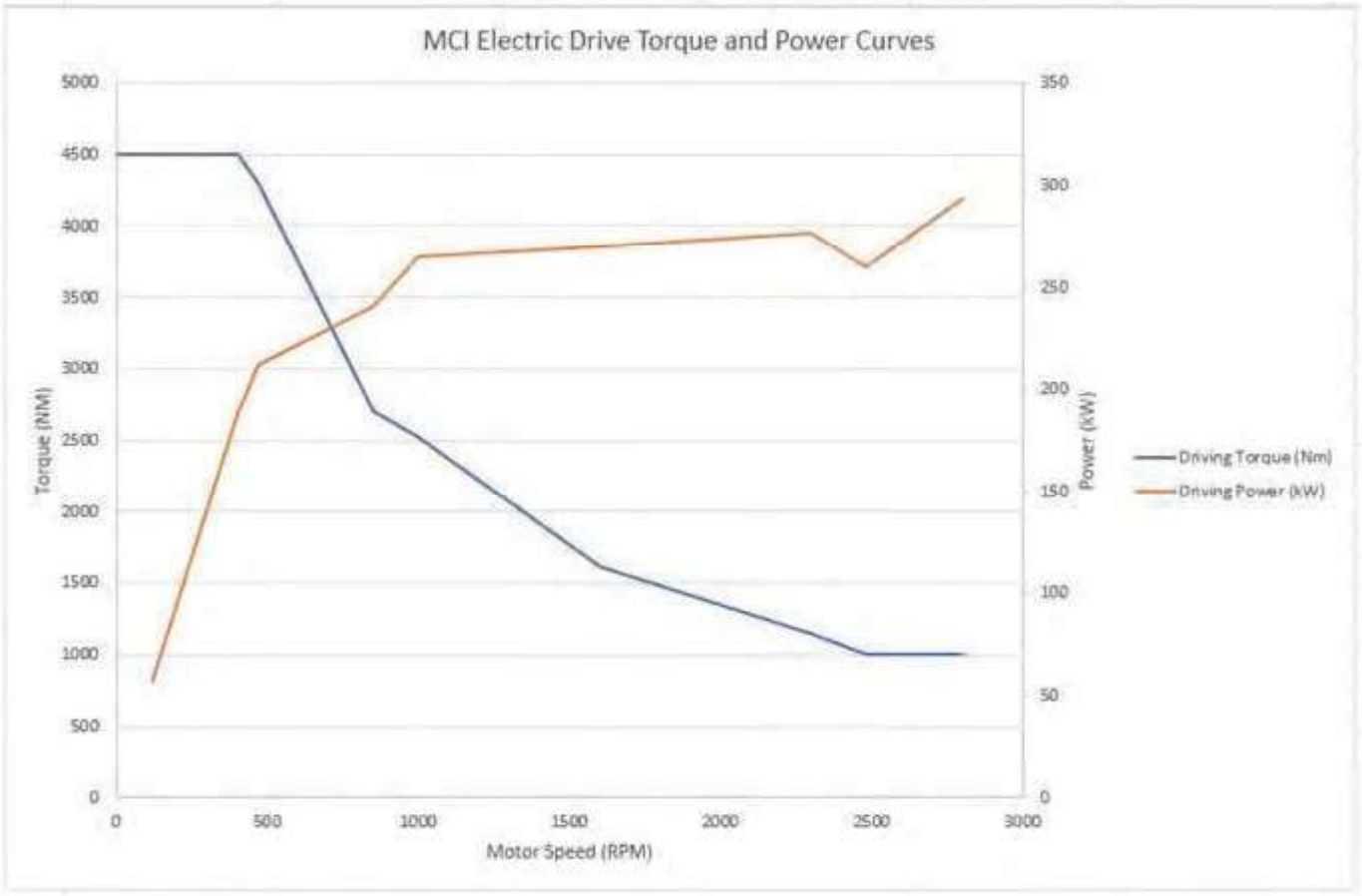
		INITIALS:
Air Conditioning - OFF	✓Checked	M.H.
Heater pump motor - OFF	✓Checked	M.H.
Defroster - OFF	✓ Checked	M.H.
Exterior and interior lights - ON	✓ Checked	M.H.
Windows and doors - CLOSED	✓ Checked	M.H.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.3	3.1	3.0
20 mph	5.6	5.3	5.3
30 mph	8.2	7.9	7.9
40 mph	14.4	14.2	14.3
50 mph	24.6	24.4	24.4
60 mph	40.7	40.5	40.6
70 mph	78.4	77.6	77.6

Maximum Speed (mph): 71.9 (maximum governed speed reached)


MCI Electric Drive Torque and Power Curves
Torque (NM)
Power (kW)
Motor Speed (RPM)
Driving Torque (Nm)
Driving Power (kW)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000

PERFORMANCE DATA FORM

Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. & S.I.	
Temperature (°F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

		INITIALS:
Air Conditioning - OFF	✓Checked	M.H.
Heater pump motor - OFF	✓Checked	M.H.
Defroster - OFF	✓ Checked	M.H.
Exterior and interior lights - ON	✓ Checked	M.H.
Windows and doors - CLOSED	✓ Checked	M.H.

ACCELERATION, GRADEABILITY, TOP SPEED

Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.3	3.1	3.0
20 mph	5.6	5.3	5.3
30 mph	8.2	7.9	7.9
40 mph	14.4	14.2	14.3
50 mph	24.6	24.4	24.4
60 mph	40.7	40.5	40.6
70 mph	78.4	77.6	77.6

Maximum Speed (mph): 71.9 (maximum governed speed reached)

PERFORMANCE SUMMARY SHEET

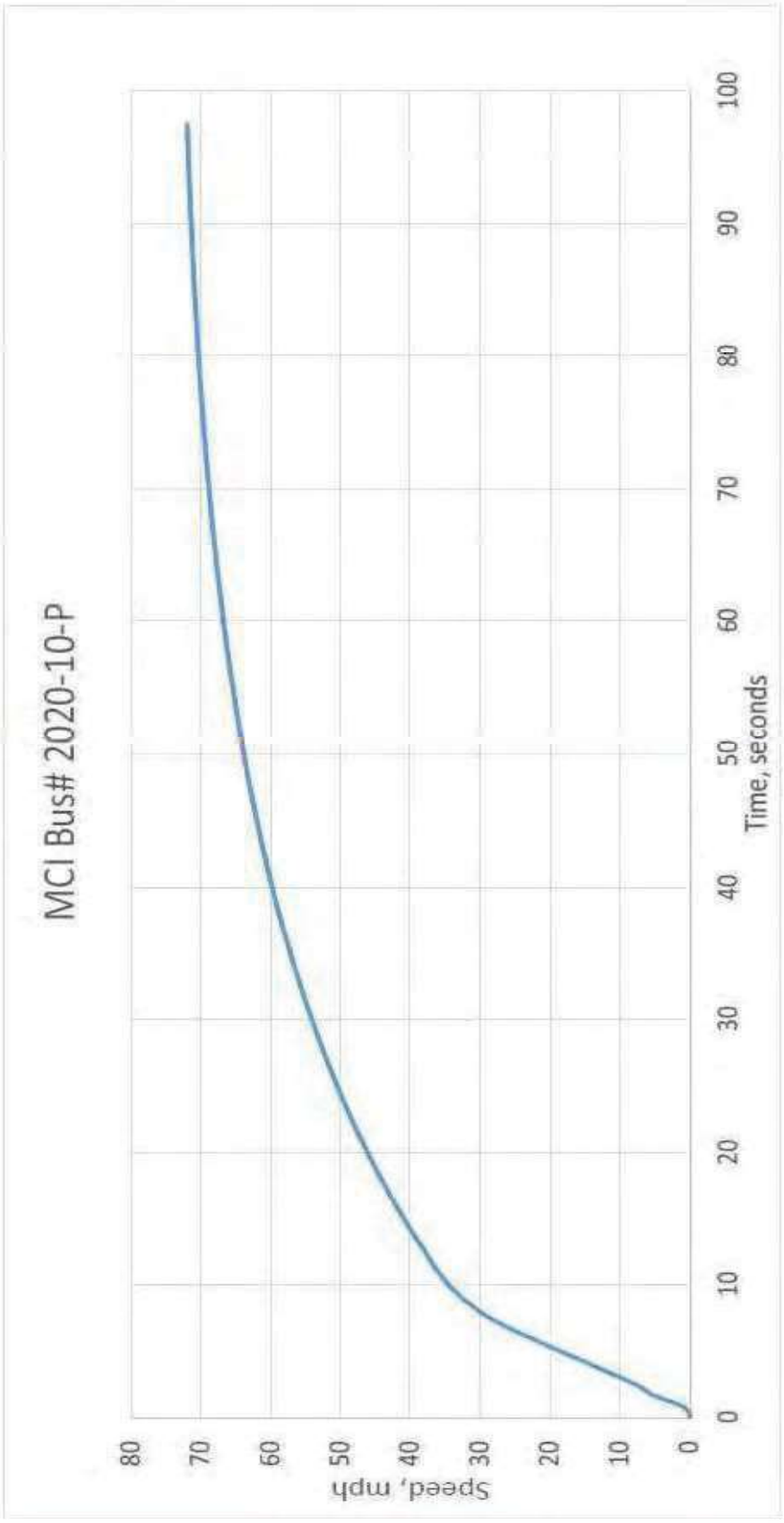
Bus Number: 2020-10-P	Date: 10/14/2020
Personnel: M.H. & S.I.	

Test Conditions:

Temperature (°F): 71.8	Humidity (%): 37
Barometric Pressure (inHg): 28.8	

Test Results:

Vehicle Speed (MPH)	Time (SEC)	Acceleration (FT/SEC^2)	Max. Grade (%)
1.0	0.8	5.38	16.7
5.0	1.7	5.71	17.7
10.0	3.1	6.26	19.4
15.0	4.2	6.50	20.2
20.0	5.3	6.19	19.2
25.0	6.5	5.85	18.2
30.0	8.0	4.00	12.4
35.0	10.4	2.26	7.0
40.0	14.3	1.70	5.3
45.0	18.9	1.43	4.4
50.0	24.5	1.18	3.7
55.0	31.5	0.92	2.9
60.0	40.6	0.69	2.1
65.0	53.7	0.47	1.5
70.0	78.0	0.20	0.6
71.9	97.2	Maximum Speed	

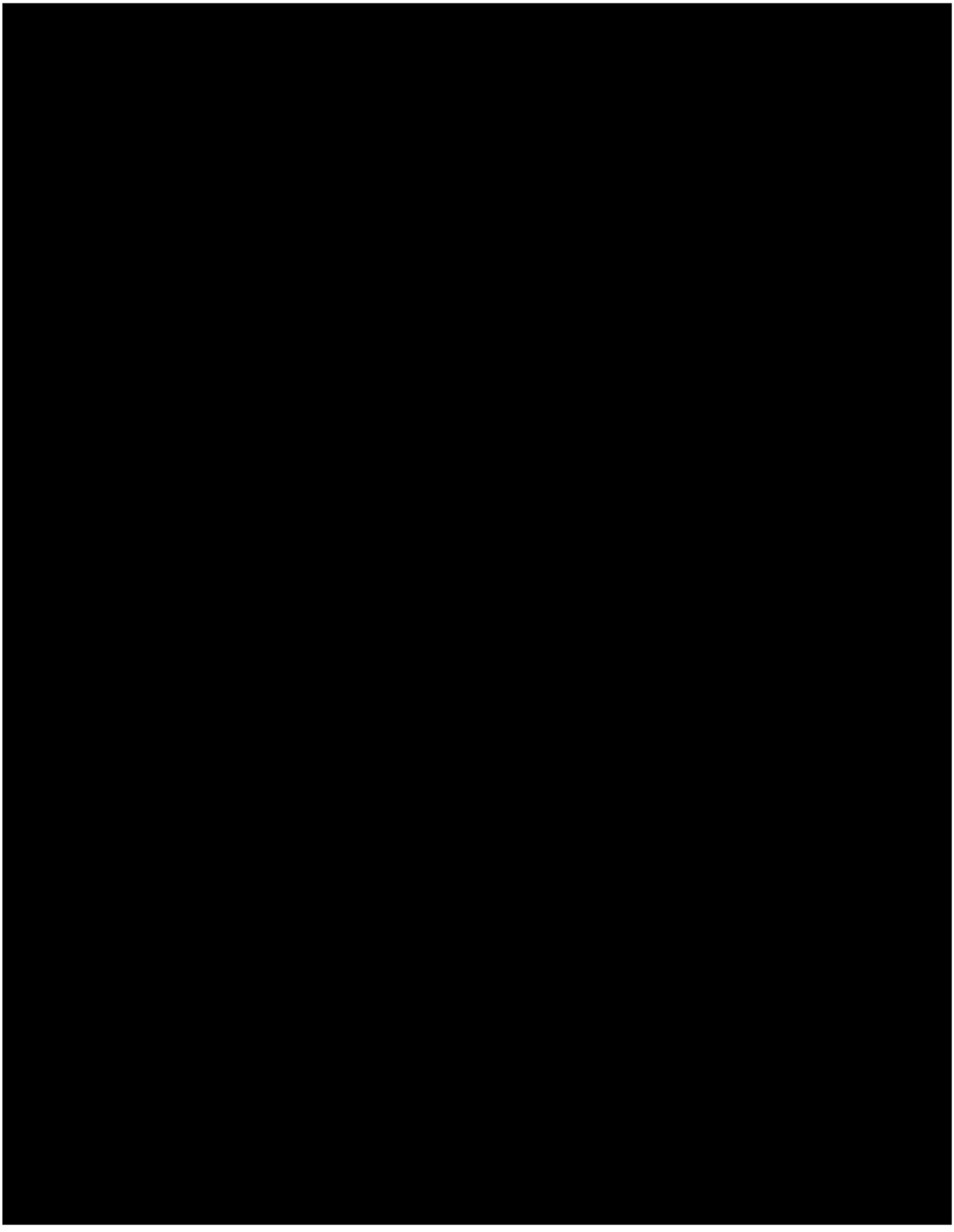

MCI Bus# 2020-10-P
Speed, mph
0
10
20
30
40
50
60
70
80
Time, seconds
0
10
20
30
40
50
60
70
80
90
100

[redacted]

[redacted]

[redacted]

[redacted]



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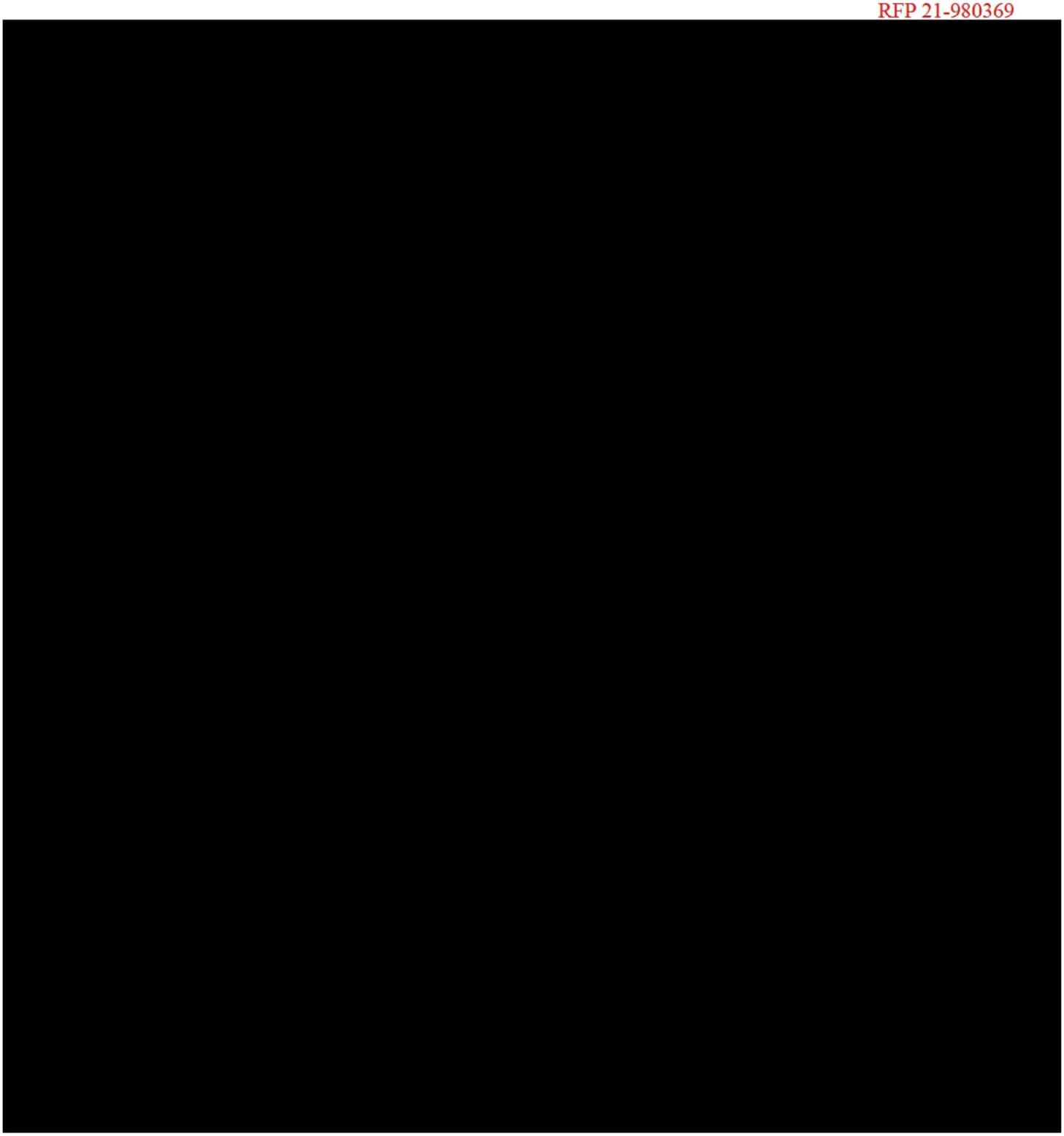


Section 8

Solicitation Requirements:

Engineering org chart, Engineering change control procedure, Field Modification process.

New Flyer response:

Please refer to the attached Engineering org chart, Engineering change control procedure, Field Modification process.

Section 9

Solicitation Requirements:

Manufacturing Plant Layout, Other Contracts, Staffing.

New Flyer response:

Please refer to the attached Manufacturing Plant Layout, Other Contracts, Staffing.

Section 10

Solicitation Requirements:

Production schedule, Other Contract Commitment for the duration of the contract.

New Flyer response:

New Flyer's proposal is based on providing the delivery of 1 unit 300 days from NTP. As the contract does not have firm order quantities, we can clarify that deliveries of 1-10 units will be completed 300 days from NTP. Order from 10-20 will be completed 365 days from NTP. For other commitments during the duration of the contract please refer to Package #3 Section 1.

Section 11

Solicitation Requirements:

TS 8.2 Design Operating Profile.

Management Plan This plan shall indicate the key personnel assigned to PSTA's account. Assigned personnel shall include at a minimum, Engineer to conduct pre-build conference, Account Representative, Warranty Administrator, and Parts and Support manager."

New Flyer response:

Management Overview

With 8,000 team members in ten countries, NFI is a leading global bus manufacturer of mass mobility solutions under the brands New Flyer® (heavy-duty transit buses), MCI® (motor coaches), Alexander Dennis Limited (single and double-deck buses), Plaxton (motor coaches), ARBOC® (low-floor cutaway and medium-duty buses), and NFI Parts™. NFI currently offers the widest range of sustainable drive systems available, including zero-emission electric (trolley, battery, and fuel cell), natural gas, electric hybrid, and clean diesel. In total, NFI supports its installed base of over 105,000 buses and coaches around the world.

[redacted]

Please find below our Management Plan:

Approach to Project Management

[redacted]

New Flyer Team

[redacted]

Project Data Management (PDM) Project Coordinator

All inquiries for PDM can be directed through the CPM.

Accountable for reviewing all technical aspects of the specification/requirements. Creates and maintains the Bill of Material (BOM) and the Technical Summary, and determines and tasks all required internal designs for the program.

[redacted]

[redacted]

Regional Sales Manager (RSM)
Reports to the Executive Vice-President, Sales & Marketing and is responsible for the establishment, growth and continued relationship between New Flyer and customers in their region.

[redacted]

Regional Product Service Manager
Reports to the Manager, Field Operations and coordinates post – delivery activity including inspection, acceptance, and the service and warranty processes.

[redacted]

Customer Services Representative
Reports to the Customer Services Managers of the Parts Organization and provides responses to customer inquiries, parts requests and technical support questions; initiates and manages the Coach Down process; manages the customer's parts orders and offers support while building strong and lasting customer relationships.

[redacted]

Employee Certifications

[redacted]

Communication Plan

[redacted]



PSTA – Pinellas Suncoast Transit Authority

RFP 21-980369
Xcelsior CHARGE™
- XE35
- XE40
- XE60
- D45 CRT LE CHARGE™
- D45 CRT CHARGE

Package 2 Pricing

NEW FLYER OF AMERICA

Section 1

Solicitation Requirement

Letter of Transmittal

New Flyer Response:

Please refer to the attached Letter of Transmittal.

NEW FLYER OF AMERICA

September 17, 2021

Alvin R. Burns Jr.
Director of Procurement
Pinellas Suncoast Transit Authority
3201 Scherer Drive, St. Petersburg, FL 33716

Subject: Request for Proposal for the Florida Electric Transit Buses with charging and associated equipment, RFP No. 21-980369

Dear Mr. Burns,

New Flyer of America Inc. ("New Flyer") is honored to have the opportunity to submit our response to the Pinellas Suncoast Transit Authority ("PSTA") for proposal No. 21-980369. This proposal is for the manufacture and delivery of 35-foot, 40-foot, 45-foot, 60-foot electric buses, and charging equipment.

We understand the importance of connecting people safely and on time to places for PSTA, based on that, we believe our most advanced product line under the Xcelsior® brand which includes our battery-electric 35, 40, 45 and 60 foot heavy-duty transit buses, charging options and our aftermarket service are the perfect combination of technology and lifetime support that will best help PSTA reach its goal.



New Flyer will partner with PSTA to achieve the following goals:

- Looking for innovative ways to make sure our riders get to their destinations on time, this will assist PSTA's goal to increase ridership.
- PSTA's mission is to be people's first choice for transportation and a driving force for social, environmental, and economic vitality in the community through innovation and partnership. This is what drives us, and our buses, to safely connect people to places.
- Provide transportation options to meet the needs of disadvantaged communities.



NEW FLYER OF AMERICA

[redacted]

New Flyer would be honored to have the opportunity to meet with you to present our proposed solution, along with additional opportunities we have identified for enhanced value and reduced cost.

We appreciate the opportunity to participate in this procurement, and we are eager to join hands and provide quality transportation that meets the needs of the communities served by PSTA.

New Flyer's proposal will remain valid for a period of 180 days from the opening date.

[redacted]

NEW FLYER OF AMERICA

[redacted]

Built to Rely On®

PINELLAS SUNCOAST TRANSIT AUTHORITY (PSTA) RFP 21-98369

SCHEDULE

CAUTION: A false statement in any offer submitted to PSTA may be a criminal OFFENSE.

NOTE: For Invitations for Bids the terms "Offer" and "Offeror" shall mean "Bid" and "Bidder", respectively; and for Request for Proposals the terms "Bid" and "Bidder" shall mean "Offer" and "Offeror", respectively, in this solicitation and any associated exhibits.

The rates include all costs that the offeror(s) intends to recover, such as, but not limited to: supervision, labor, equipment, materials, vehicle licensing, vehicle title, pick-up, financing, carrying charges, and all other such charges to accommodate the services and requirements. No price adjustments will be made, unless specifically provided for by an additional provision included in this contract.

PRICING

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
1	Cost of (1) 29FT/30FT, low floor, all electric bus, per the specifications	**BASE BUS**	1	No Bid	No Bid	No Bid	No Bid	No Bid
2	Cost of (1) 35FT, low floor, all electric bus, per the specifications	**BASE BUS**	1	$ 774,400.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
3	Cost of (1) 40FT, low floor, all electric bus, per the specifications	**BASE BUS**	1	$ 824,400.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
4	Cost of (1) 45FT, all electric bus, per the specifications	**BASE BUS**	1	$ 1,059,400.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
5	Cost of (1) 60FT (articulated), low floor, all electric bus, per the specifications	**BASE BUS**	1	$ 1,189,400.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
6	Cost of (1) Depot Charger	1xABB HVC-150 150kW 1:2	1	$ 195,000.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
7	Cost of (1) Depot Charger	1xABB HVC-150 150kW 1:3	1	$ 209,520.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
8	Cost of (1) Depot Charger	1xHeliox DC 50kW Mobile	1	$ 110,590.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
9	Cost of (1) Depot Charger	1xHeliox Flex180 180kW 1:3	1	$ 197,120.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
10	Cost of (1) On Route Charger	ABB 300kW and Mast/Panto	1	$ 427,530.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
11	Cost of (1) On Route Charger	ABB 450kW and Mast/Panto	1	$ 496,530.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
12	Cost of (1) On Route Charger	Heliox 360kw and Panto Only	1	$ 245,700.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
13	Cost of (1) On Route Charger	Heliox 450kw and Panto Only	1	$ 432,850.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
14	Cost of (1) On Route Charger	Heliox 450kw and Mast/Panto	1	$ 597,210.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
15	ADVERTISING FRAMES	None	1	Base				
16	ADVERTISING FRAMES	Advertising Frame - Interior 22" X 21",RH Load, Open Back, Clear Aluminum Finish	1	$ 84.87	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
17	ADVERTISING FRAMES	(1) Information Board (#15-55401-000)	1	No Bid				
18	ADVERTISING FRAMES	ADVERTISING FRAMES - 35 Foot	1	$ 680.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
19	ADVERTISING FRAMES	ADVERTISING FRAMES - 40 Foot	1	$ 686.10	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
20	ADVERTISING FRAMES	ADVERTISING FRAMES - 60 Foot	1	$ 881.61	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
21	AIR SYSTEM	Bendix AD9 Air Dryer	1	$ 12.26	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
22	AIR SYSTEM	Shop Air Connection (Milton S790)	1	$ 44.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
23	AIR SYSTEM	Kingston Auto Drain Valve at Ping Tanks	1	$ 106.40	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
24	AIR SYSTEM	Bendix ADIP , Heated, Air Dryer	1	$ 19.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
25	AIR SYSTEM	Bendix Puraguard Air / Oil Separator	1	$ 215.24	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
26	AIR SYSTEM	Chicago Rawhide Dual Turbo 2000 Air Dryer	1	No Bid				
27	AIR SYSTEM	Graham White Sludge Braker QBA15 Air Dryer	1	$ 411.36	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
28	AIR SYSTEM	Graham White Sludge Braker QBA60 Air Dryer	1	$ 1,143.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
29	AIR SYSTEM	Haldex Consep Moisture Ejector, Heated, at Air Dryer	1	No Bid				
30	AIR SYSTEM	SKF, HCT 2000 Duraguard, 24V Heated, Filtration Plus Air Dryer	1	No Bid				
31	AIR SYSTEM	SKF, HCT_2000 Duraguard Air Dryer	1	No Bid				
32	AIR SYSTEM	Wabco SS 1800, Heated, Air Dryer	1	No Bid				
33	AIR SYSTEM	Shop Air Connection (Milton 770)	1	$ 5.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
34	AIR SYSTEM	Shop Air Connection (Milton 727)	1	$ 5.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
35	AIR SYSTEM	Bendix AD9 Air Dryer for 60'	1	$ 87.69	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
36	AIR SYSTEM		1					

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
37	AIR SYSTEM		1					
38	AIR SYSTEM		1					
39	AIR SYSTEM		1					
40	AIR SYSTEM		1					
41	AIR SYSTEM		1					
42	AUTOMATIC PASSENGER COUNTER	UTA APC Sensors, Cabling, CPU Only (Integrated w/ ITS)	1	$ 5,720.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
43	AUTOMATIC PASSENGER COUNTER	UTA Automatic Passenger Counter System with GPS, WLAN Capabilities	1	$ 67,938.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
44	AUTOMATIC PASSENGER COUNTER	UTA Automatic Passenger Counter System with GPS, WLAN Capabilities (without APC software & Wi-Fi data transfer	1	$ 13,282.50	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
45	AUTOMATIC PASSENGER COUNTER	Clever Devices CleverCount System	1	$ 6,582.73	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
46	AUTOMATIC PASSENGER COUNTER		1					
47	AUTOMATIC PASSENGER COUNTER		1					
48	AXLES & SEALS	Stud Piloted Wheels and Axles w/ Oil Seals	1	No Bid				
49	AXLES & SEALS	Synthetic 75W90 Gear Oil	1	Base				
50	AXLES & SEALS	Hub Piloted Wheels and Axles w/ Grease Seals	1	Base				
51	AXLES & SEALS	Hub Piloted Wheels, Axles with Oil Seals	1	No Bid				
52	AXLES & SEALS	Stud Piloted Wheels and Axles w/ Grease Seals	1	No Bid				
53	AXLES & SEALS	Rear Axle Oil Drain Plug--Magnetic Internal Hex Head Plug	1	$ 13.25	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
54	AXLES & SEALS		1					
55	AXLES & SEALS		1					
56	AXLES & SEALS		1					
57	BATTERIES	(2) DEKA 8D Side or Top Post Connections	1	$ 221.02	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
58	BATTERIES	Anderson 350 Jump Start Connector (Front & Rear)	1	No Bid				
59	BATTERIES	Group 31 Batteries	1	$ 726.45	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
60	BATTERIES	Anderson 350 Jump Start Connector (Each)	1	$ 83.56	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
61	BATTERIES	Anderson 350 Jump Start Delete	1	Base				
62	BATTERIES		1					
63	BATTERIES		1					
64	BATTERIES		1					
65	BIKE RACKS	Sportworks DL2, 2-Position, Stainless Steel	1	$ 1,568.16	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
66	BIKE RACKS	Bike Rack Deployed Indicator Lamp on Driver's Dash	1	Included in Option 65				
67	BIKE RACKS	Sportworks APEX 2, 2-Position, Stainless Steel	1	$ 1,597.95	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
68	BIKE RACKS	Sportworks APEX 2, 2-Position, Powder Coated	1	$ 1,597.74	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
69	BIKE RACKS	Sportworks DL2, 2-Position, Powder Coated	1	$ 1,570.71	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
70	BIKE RACKS	Sportworks APEX3, 3-Position, Stainless Steel	1	$ 1,795.52	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
71	BIKE RACKS	Sportworks APEX 3, 3-Position, Powder Coated	1	$ 1,959.70	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
72	BIKE RACKS	Sportworks Trilogy (DL3), 3-Position, Stainless Steel	1	$ 2,300.11	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
73	BIKE RACKS	Sportworks Trilogy (DL3), 3-Position, Powder Coated	1	$ 2,358.74	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
74	BIKE RACKS	Sportworks Pivot Plate Only	1	$ 247.28	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
75	BIKE RACKS	Sportworks Mounting Brackets Only	1	$ 63.73	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
76	BIKE RACKS	Byk-Rak, 2-Position, Stainless Steel	1	$ 1,582.31	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
77	BIKE RACKS	Byk-Rak, 2-Position, Powder Coated	1	$ 1,497.72	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
78	BIKE RACKS	Byk-Rak, 3-Position, Stainless Steel	1	$ 1,614.18	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
79	BIKE RACKS	Byk-Rak, 3-Position, Powder Coated	1	$ 1,959.70	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
80	BIKE RACKS	Byk-Rak Pivot Plate Only	1	$ 639.44	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
81	BIKE RACKS	Byk-Rak-Mounting Brackets Only	1	$ 297.51	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
82	BIKE RACKS		1					
83	BIKE RACKS		1					
84	BIKE RACKS		1					
85	BIKE RACKS		1					
86	BIKE RACKS		1					

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
87	BIKE RACKS		1					
88	BIKE RACKS		1					
89	BIKE RACKS		1					
90	BRAKES	MGM E-Stroke Brake Wear Monitoring System	1	$ 2,881.57	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
91	BRAKES	Four Wheel Disc Brakes with ABS	1	Base				
92	BRAKES	MGM E-Stroke Brake Wear Monitoring System For 60'	1	$ 5,982.49	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
93	BRAKES		1					
94	COMMUNICATIONS SYSTEM	DC Power Filter for Radio Wiring	1	Quote				
95	COMMUNICATIONS SYSTEM	Power Circuit (Route to RH Dash & Electrical Equipment Box) Roof Mount RF/GPS/Cellular Antenna	1	Quote				
96	COMMUNICATIONS SYSTEM	Motorola APX 4500	1	Quote				
97	COMMUNICATIONS SYSTEM	Motorola APX 6500	1	Quote				
98	COMMUNICATIONS SYSTEM	Harris XG-25M	1	$ 11,000.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
99	COMMUNICATIONS SYSTEM	Antenna Specialist ASP 572 Antenna	1	Quote				
100	COMMUNICATIONS SYSTEM	Antenna Specialist ASP 931 Antenna	1	Quote				
101	COMMUNICATIONS SYSTEM	Antenna Specialist ASP 930T Antenna with RG58 coax cable and TNC connector	1	Quote				
102	COMMUNICATIONS SYSTEM	GPS Antenna (Trimble 502 Model 18334)	1	Quote				
103	COMMUNICATIONS SYSTEM		1					
104	COMMUNICATIONS SYSTEM		1					
105	COMMUNICATIONS SYSTEM		1					
106	COMMUNICATIONS SYSTEM		1					
107	COMMUNICATIONS SYSTEM		1					
108	DESTINATION SIGNS	Hanover 100% White LED Sign (17 x 160)--Front ,Side, Rear	1	$ (1,207.09)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
109	DESTINATION SIGNS	Hanover 100% Amber LED Sign (17 x 160)--Front ,Side, Rear	1	$ (1,235.06)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
110	DESTINATION SIGNS	Hanover 100% Full Color LED Sign (17 x 160)--Front ,Side, Rear	1	$ 1,213.23	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
111	DESTINATION SIGNS	Hanover--Add Front Run Sign--White LED	1	$ 599.24	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
112	DESTINATION SIGNS	Hanover--Add Front Run Sign--Amber LED	1	$ 756.09	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
113	DESTINATION SIGNS	Hanover--Add Front Run Sign--Color LED	1	No Bid				
114	DESTINATION SIGNS	Hanover--Delete Rear Sign	1	$ (600.57)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
115	DESTINATION SIGNS	Hanover Program Software	1	$ 6,875.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
116	DESTINATION SIGNS	TwinVision Smart Series 3 100% Silver LED Sign (16 X 160)-- Front, Side, and Rear	1	$ 873.01	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
117	DESTINATION SIGNS	TwinVision Smart Series 3 100% Amber LED Sign (16 x 160)--Front, Side, and Rear	1	$ (640.78)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
118	DESTINATION SIGNS	Luminator Titan Silver Series LED Sign (24 X 200)--Front, Side, and Rear	1	$ 1,886.74	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
119	DESTINATION SIGNS	Luminator Titan Amber Series Sign (24 x 200)--Front, Side, and Rear	1	$ 680.50	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
120	DESTINATION SIGNS	Luminator GEN 4 Horizon 100% Silver LED Sign (16 x 160)--Front, Side , and Rear	1	$ 886.93	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
121	DESTINATION SIGNS	Luminator GEN 4 Horizon 100% Amber LED Sign (16x 160)--Front, Side , and Rear	1	base				
122	DESTINATION SIGNS	Luminator Spectrum 100% Full Color LED GEN IV Front Sign (16 x 112)	1	$ 3,000.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
123	DESTINATION SIGNS	Luminator/Twinvision--Add Front Run Sign--Amber LED	1	$ 486.66	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
124	DESTINATION SIGNS	Luminator/Twinvision--Add Front Run Sign--Silver LED	1	$ 230.66	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
125	DESTINATION SIGNS	Luminator/Twinvision--Add Front Run Sign--Color LED	1	$ 1,880.66	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
126	DESTINATION SIGNS	Luminator RearView Camera Integraded into Rear LED Sign	1	$ 261.24	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
127	DESTINATION SIGNS	Luminator Rearview Camera without Rear LED Sign	1	$ 550.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
128	DESTINATION SIGNS	Luminator--Delete Rear Sign	1	$ (600.57)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
129	DESTINATION SIGNS		1					
130	DESTINATION SIGNS		1					
131	DESTINATION SIGNS		1					
132	DESTINATION SIGNS		1					
133	DESTINATION SIGNS		1					
134	DESTINATION SIGNS		1					
135	DESTINATION SIGNS		1					
136	DESTINATION SIGNS		1					
137	DESTINATION SIGNS		1					
138	DESTINATION SIGN SOFTWARE	Luminator Program Software	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
139	DESTINATION SIGN SOFTWARE	TwinVision Program Software	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
140	DESTINATION SIGN SOFTWARE	Luminator Destination Sign Wireless Programming	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
141	DESTINATION SIGN SOFTWARE		1					
142	DESTINATION SIGN SOFTWARE		1					
143	DESTINATION SIGN SOFTWARE		1					
144	DOOR SYSTEM--FRONT	OEM Standard Air Open/Spring Close Front Door with Full Driver Control--31.75" Minimum Doorway Clear Width	1	No Bid				
145	DOOR SYSTEM--FRONT		1					
146	DOOR SYSTEM--FRONT		1					
147	DOOR SYSTEM--FRONT		1					
148	DOOR SYSTEM--REAR	OEM Standard Air Open/Spring Close Rear Door with Full Driver Control--31.75" Minimum Doorway Clear Width	1	No Bid				
149	DOOR SYSTEM--REAR	Add Touch Bars (Air Open / Spring Close) at Rear Door with Driver Override	1	No Bid				
150	DOOR SYSTEM--REAR	Add Touch Tape at Rear Doors	1	$ 300.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
151	DOOR SYSTEM--REAR	Slide Glide Doors Air	1	Base				
152	DOOR SYSTEM--REAR	Side Glide Electric Doors	1	$ 4,500.00				
153	DOOR SYSTEM--REAR		1					
154	DOOR SYSTEM	Add Exterior Air Release (Front Door Control Valve)	1	$ 322.46	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
155	DOOR SYSTEM	Add Vapor Class 5 Position Analog Controller	1	$ 104.77	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
156	DOOR SYSTEM	Add Push Button Door Controls	1	$ 48.24	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
157	DOOR SYSTEM	Add--Vapor Activair Differential Engine for Slide-Glide Doors	1	No Bid				
158	DOOR SYSTEM	Add--Vapor CLASS Acoustic (Photo Sensor)	1	$ 4,701.05	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
159	DOOR SYSTEM	Add--Vapor Digital Door Control - DDC	1	$ 474.44	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
160	DOOR SYSTEM	Add--Vapor Electric Transit Operator - ETO	1	Incuded in Option #152				
161	DOOR SYSTEM	Add--Vapor Light Touch Bars	1	No Bid				
162	DOOR SYSTEM	Add--Vapor Optical Pressure Switch - OPS	1	No Bid				
163	DOOR SYSTEM	Add - 5 Door Bus on 60' Model	1	$ 50,000.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
164	DOOR SYSTEM	Add - Road Side door on 40' model	1	$ 15,000.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
165	DOOR SYSTEM		1					
166	DOOR SYSTEM		1					
167	DRIVER BARRIER	None	1	No Bid				
168	DRIVER BARRIER	Drivers Barrier Storage Box	1	$ 160.95	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
169	DRIVER BARRIER	Driver's Security Enclosure	1	Base				
170	DRIVER BARRIER	Flat Melamine, Two Piece	1	No Bid				
171	DRIVER BARRIER	Plexiglass Drivers Security Enclosure Door	1	$ 3,739.86	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
172	DRIVER BARRIER	Wrap Around Fiberglass Drivers Barrier	1	Base				
173	DRIVER BARRIER	Wraparound fiberglass, without schedule holders, with drivers barrier grap handle	1	$ 2,058.24	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
174	DRIVER BARRIER		1					
175	DRIVER BARRIER		1					
176	DRIVER BARRIER		1					

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
177	DRIVER BARRIER		1					
178	DRIVER CONTROLS	Williams Controls 41 Degree Throttle and Brake Pedal (Non-Adjustable)	1	$ 43.95	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
179	DRIVER CONTROLS	Kongsberg Adjustable Throttle and Brake Pedal	1	$ 1,083.94	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
180	DRIVER CONTROLS	Teleflex Adjustable Throttle and Brake Pedal	1	$ 1,083.94	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
181	DRIVER CONTROLS	12 V Cigarette Light Adaptor for PC auxilary power-Drivers area	1	$ 32.30	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
182	DRIVER CONTROLS		1					
183	DRIVER CONTROLS		1					
184	DRIVER HEATERS	Dash Fan	1	$ 175.58	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
185	DRIVER HEATERS		1					
186	DRIVER HEATERS		1					
187	DRIVERS SEAT	USSC G2A Evolution, with Fabric, with 3-Point Belt (Lap & Shoulder)	1	$ 1,775.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
188	DRIVERS SEAT	Recaro Ergo Metro, with Fabric, with 2-Point Belt (Lap)	1	Base	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
189	DRIVERS SEAT	Recaro Ergo Metro, with Fabric, with 3-Point Belts (Lap & Shoulder)	1	$ 288.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
190	DRIVERS SEAT	Add Vinyl Upholstery to Recaro Ergo Metro	1	$ -				
191	DRIVERS SEAT	Add Orange Shoulder Belt to Recaro Ergo Metro	1	$ 165.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
192	DRIVERS SEAT	Add Adjustable D-Ring to Recaro Ergo Metro	1	$ 275.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
193	DRIVERS SEAT	Add Headrest to Recaro Ergo Metro	1	$ -				
194	DRIVERS SEAT	Add Drivers Seat Vacancy Alarm to Recaro Ergo Metro	1	$ 147.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
195	DRIVERS SEAT	Add Seat Belt Alarm to Recaro Ergo Metro	1	$ 48.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
196	DRIVERS SEAT	USSC 9100 ALX, with Fabric, with 2-Point Belt (Lap)	1	$ 314.88	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
197	DRIVERS SEAT	USSC 9100 ALX, with Fabric, with 3-Point Belt (Lap & Shoulder)	1	$ 578.88	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
198	DRIVERS SEAT	USSC G2 Evolution, with Fabric, with 2-Point Belt (Lap)	1	$ 1,541.38	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
199	DRIVERS SEAT	USSC G2 Evolution, with Fabric, with 3-Point Belt (Lap & Shoulder)	1	$ 1,775.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
200	DRIVERS SEAT	USSC G2A Evolution, with Fabric, with 2-Point Belt (Lap)	1	$ 1,541.38	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
201	DRIVERS SEAT	USSC Q Series, with Fabric, with 2-Point Belt (Lap)	1	$ 1,541.38	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
202	DRIVERS SEAT	USSC Q Series, with Fabric, with 3-Point Belt (Lap & Shoulder)	1	$ 1,775.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
203	DRIVERS SEAT	Add Vinyl Upholstery to USSC Seat	1	$ -				
204	DRIVERS SEAT	Add Orange Shoulder Belt to USSC Seat	1	$ -				
205	DRIVERS SEAT	Add Adustable D-Ring to USSC Seat	1	$ -				
206	DRIVERS SEAT	Add Headrest to USSC Seat	1	$ -				
207	DRIVERS SEAT	Add Drivers Seat Vacancy Alarm to USSC Seat	1	$ 99.14	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
208	DRIVERS SEAT	Add Seat Belt Alarm to USSC Seat	1	$ 63.73	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
209	DRIVERS SEAT		1					
210	DRIVERS SEAT		1					
211	DRIVERS SEAT		1					
212	DRIVERS SEAT		1					
213	DRIVERS SEAT		1					
214	DRIVERS SEAT		1					
215	DRIVERS SEAT		1					
216	DRIVERS SEAT		1					
217	DRIVERS SEAT		1					
218	DRIVERS SEAT		1					
219	ELECTRICAL EQUIPMENT CABINET	44"H x 22.5"W x 20"D, 1-Door	1	Base				
220	ELECTRICAL EQUIPMENT CABINET	33"H x 20"D x 22.5"W, 2-Doors	1	No Bid				
221	ELECTRICAL EQUIPMENT CABINET	33"H x 20"D x 22.5"W, 1-Door	1	No Bid				

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
222	ELECTRICAL EQUIPMENT CABINET	33"H x 20"D x 22.5"W, 1-Door, Louvered Back Panel	1	No Bid				
223	ELECTRICAL EQUIPMENT CABINET	8.25"H x 20"W x 13"D, 1-Door, Curbside Wheelhousing Storage Box	1	$ 218.46	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
224	ELECTRICAL EQUIPMENT CABINET	Add 5/16" Square Key Lock--Each	1	$ 5.77	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
225	ELECTRICAL EQUIPMENT CABINET	Add Exhaust Ventilation Fan--Each	1	$ 108.85	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
226	ELECTRICAL EQUIPMENT CABINET	Add Standard Key Lock--Each	1	Base				
227	ELECTRICAL EQUIPMENT CABINET		1					
228	ELECTRICAL EQUIPMENT CABINET		1					
229	ELECTRICAL EQUIPMENT CABINET		1					
230	ELECTRICAL EQUIPMENT CABINET		1					
231	EXTERIOR LIGHTS	4" Diameter LED Tail Lights--Turn, Tail, Stop, Reverse	1	Base				
232	EXTERIOR LIGHTS	4 LED Headlights (Low & High Beam)	1	Base				
233	EXTERIOR LIGHTS	7" Diameter LED Tail Lights--Turn, Tail, Stop, Reverse	1	$ 162.38	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
234	EXTERIOR LIGHTS	Add 4" Diameter LED Brake Light--Each	1	Base				
235	EXTERIOR LIGHTS	Add 7" Diameter LED Brake Light--Each	1	See Option 33	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
236	EXTERIOR LIGHTS	Add 18" Red LED Strip Brake Light--Each	1	Base				
237	EXTERIOR LIGHTS	Add 18" Amber LED Strip Brake Light--Each	1	$ 57.71	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
238	EXTERIOR LIGHTS	Add Red LED "STOP" Sign	1	$ 415.37	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
239	EXTERIOR LIGHTS	Add Amber Triangle Style LED "Yield" Sign	1	$ 813.52	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
240	EXTERIOR LIGHTS	2 LED Headlights (Low Beam Only)	1	Base				
241	EXTERIOR LIGHTS	2 LED Headlights (High Beam Only)	1	Base				
242	EXTERIOR LIGHTS	Dual Halogen Headlights (Low & High Beam Only)	1	No Bid				
243	EXTERIOR LIGHTS	Fog Lights	1	No Bid				
244	EXTERIOR LIGHTS		1					
245	EXTERIOR LIGHTS		1					
246	EXTERIOR LIGHTS		1					
247	EXTERIOR LIGHTS		1					
248	EXTERIOR LIGHTS		1					
249	EXTERIOR LIGHTS		1					
250	EXTERIOR MIRRORS	B&R 10"x11", 2-Piece, Heated, Remote Control (Both Sides)	1	$ 126.90	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
251	EXTERIOR MIRRORS	B&R 8"x8", 1-Piece, Remote Control Both Sides, Stainless Steel Arms	1	$ 24.12	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
252	EXTERIOR MIRRORS	B&R 8"x10", 2-Piece, Heated, Remote Control (Both Sides)	1	$ 65.65	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
253	EXTERIOR MIRRORS	B&R 8"x15", 2-Piece, Heated, Remote Control (Both Sides)	1	$ 52.59	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
254	EXTERIOR MIRRORS	B&R 10"x13", 1-Piece, Heated, Remote Control (Both Sides)	1	$ 395.50	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
255	EXTERIOR MIRRORS	Delete Remote Control (Per Side)	1	$ (0.12)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
256	EXTERIOR MIRRORS	Add Turn Signal Indicator on Exterior Mirror Head	1	$ 330.89	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
257	EXTERIOR MIRRORS	5" Mirror Front Bike Rack Mirror	1	$ 41.30	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
258	EXTERIOR MIRRORS		1					
259	EXTERIOR MIRRORS		1					
260	EXTERIOR MIRRORS		1					
261	EXTERIOR MIRRORS		1					
262	EXTERIOR MIRRORS		1					
263	FARE COLLECTION	No Farebox , Provide Power Circuit and Groundstrap Only	1	Base				
264	FARE COLLECTION	GFI 41" Tall Odyssey	1	$ 19,120.42	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
265	FARE COLLECTION	Add Farebox Lamp, Ceiling mounted	1	Base				
266	FARE COLLECTION	Install Customer Provided Farebox Base Plate	1	$ 500.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
267	FARE COLLECTION		1					
268	FARE COLLECTION		1					
269	FARE COLLECTION		1					

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
270	FIRE SUPPRESSION SYSTEM	Fogmaker Water Mist Fire Suppression System	1	$ 5,167.50	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
271	FIRE SUPPRESSION SYSTEM	Amerex V-25 Fire Suppression System	1	$ 5,630.80	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
272	FIRE SUPPRESSION SYSTEM	Kidde Dual Spectrum LTD Fire Detection and Suppression System	1	$ 6,628.94	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
273	FIRE SUPPRESSION SYSTEM	Add Kidde Armored LTD	1	$ 106.54	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
274	FIRE SUPPRESSION SYSTEM	Add Kidde TLSE	1	$ 9,905.50	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
275	FIRE SUPPRESSION SYSTEM	Add Kidde Optical Sensor (each)	1	$ 763.26	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
276	FIRE SUPPRESSION SYSTEM		1					
277	FIRE SUPPRESSION SYSTEM		1					
278	FIRE SUPPRESSION SYSTEM		1					
279	FLOORING	Greenwood ACQ Plywood	1	Base				
280	FLOORING	Altro Transflor	1	$ 350.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
281	FLOORING	RCA Rubber Flooring	1	No Bid				
282	FLOORING	Composite Sub Floor	1	$ 2,271.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
283	FLOORING	Gerflor Tarabus Helios Flooring	1	$ -				
284	FLOORING	Stainless Steel Trim on Risers and Wheelhousings	1	Base	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
285	FLOORING		1					
286	FLOORING		1					
287	FLOORING		1					
288	FRAME	None	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
289	FRAME	Engine Skid Protection with Extended Tow Eyes	1	$ 1,044.25	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
290	FRAME	Engine Skid Protection W/ Extended Tow Eyes & 2" Thick x 2" Wide Wear Plate	1	$ 1,044.25	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
291	FRAME	Reinforced A-Post Skid Plates (Per Side)	1	No Bid				
292	FRAME	Frame Undercoating	1	Base				
293	FRAME		1					
294	FRAME		1					
295	FRAME		1					
296	GAUGES--DRIVERS DASH	Speedometer, Air Pressure Gauge, 12/24 volt Gauges, Coolant Temp Gauge, State of Charge	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
297	GAUGES--DRIVERS DASH	Add Low State of Charge Alarm	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
298	GAUGES--DRIVERS DASH	Add Low State of Charge Warning Indicator	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
299	GAUGES--DRIVERS DASH	Add Engine Hour Meter	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
300	GAUGES--DRIVERS DASH	Add Auxiliary Stop Request Light	1	$ 1,773.70	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
301	GAUGES--DRIVERS DASH	Add Mutil Function Display (MFD)	1	Base				
302	GAUGES--DRIVERS DASH		1					
303	GAUGES--DRIVERS DASH		1					
304	GAUGES--DRIVERS DASH		1					
305	HEATING/AIR CONDITIONING	Thermo King TE-14 All-Electric	1	T15 Included in Base				
306	HEATING/AIR CONDITIONING	Sutrak All-Electric HVAC SYSTEM--(Roof Mounted/Rear Mounted HVAC system)	1	No Bid				
307	HEATING/AIR CONDITIONING	SanUVAire- Safe Breathe Air Purification System	1	$2,849 (Puradigm)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
308	HEATING/AIR CONDITIONING	Thermo King Pressure and Return Display Mounted to Unit	1	$ 391.88	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
309	HEATING/AIR CONDITIONING		1					
310	HEATING/AIR CONDITIONING		1					
311	HUBOMETER	Veeder Root Mechanical without Tenths, without Guard	1	$ 82.52	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
312	HUBOMETER	E J Ward Data System (Includes CANceiver, Display Unit, and Antenna)	1	No Bid				
313	HUBOMETER	Engler (Stemco) Mechanical without Tenths, without Guard	1	$ 56.60	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
314	HUBOMETER	S/A Fleetwatch Data Logger JX 55	1	$ 586.33	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
315	HUBOMETER	Add Hubodometer Guard	1	$ 1,168.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
316	HUBOMETER		1					
317	HUBOMETER		1					
318	HUBOMETER		1					
319	INTERIOR LIGHTS	LED Interior Lights	1	base				

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
320	INTERIOR LIGHTS	Pretorial LED	1	$ 211.08	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
321	INTERIOR LIGHTS		1					
322	INTERIOR MIRRORS	8.25" x 16" Interior Rear View Mirror, Flat Faced	1	$ 158.89	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
323	INTERIOR MIRRORS	12" Convex at Rear Door Stanchion	1	Base				
324	INTERIOR MIRRORS	6" Flat Faced Spot Mirror at Bottom of Front Destination Sign Compartment	1	Base				
325	INTERIOR MIRRORS	4.75" x 15" Interior Mirror, Flat Faced	1	Use item #322				
326	INTERIOR MIRRORS		1					
327	INTERIOR MIRRORS		1					
328	ITS SYSTEM	None	1	base				
329	ITS SYSTEM	Avail IVU with MDC, GPS, APC, and WLAN	1	$ 32,927.81	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
330	ITS SYSTEM	Avail System Pre-Wire (IVU, MDT, APC, Fare Box)	1	$ 18,392.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
331	ITS SYSTEM	Clever Devices IVN 5 (AVL/GPS/CAD/Automatic Stop Annunciation)	1	$ 19,877.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
332	ITS SYSTEM	Clever Devices Automatic Vehicle Monitoring System	1	$ 4,654.38	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
333	ITS SYSTEM	Clever Devices BusTime System	1	$ 3,117.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
334	ITS SYSTEM	Clever Devices CleverCAD System	1	$ 4,851.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
335	ITS SYSTEM	Clever Devices CleverVision	1	$ 3,634.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
336	ITS SYSTEM	Clever Devices Secure Bus Access System	1	$ 2,695.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
337	ITS SYSTEM	Clever Devices Turn Warning System	1	$ 3,117.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
338	ITS SYSTEM	Opticom Traffic Signal Priority	1	$ 6,531.25	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
339	ITS SYSTEM	MobileEye Collision Avoidance System	1	$ -				
340	ITS SYSTEM	Transloc Transit Visualization System AVL	1	$ -				
341	ITS SYSTEM	Intelligent Vehicle System Prewire Only (Pending System Specification)	1	$ 16,207.57	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
342	ITS SYSTEM	Luminator InfoTransit--2 Monitors (18.5") Proxys Module	1	$ 13,509.38	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
343	ITS SYSTEM	Luminator InfoTransit--Upgrade to 29" Monitors	1	$ 5,775.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
344	ITS SYSTEM	Luminator InfoTransit--Upgrade to 37" Monitors	1	$ 7,425.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
345	ITS SYSTEM	Luminator InfoLite--2 Monitors (18.5") Proxys Module	1	$ 6,393.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
346	ITS SYSTEM	Luminator InfoLite--Upgrade to 29" Monitors	1	$ 5,775.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
347	ITS SYSTEM	Luminator InfoLite--Upgrade to 37"Monitors	1	$ 6,682.50	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
348	ITS SYSTEM		1					
349	ITS SYSTEM		1					
350	ITS SYSTEM		1					
351	ITS SYSTEM		1					
352	ITS SYSTEM		1					
353	ITS SYSTEM		1					
354	ITS SYSTEM		1					
355	ITS SYSTEM		1					
356	ITS SYSTEM		1					
357	ITS SYSTEM		1					
358	MISCELLANOUS	Scissor Style Sunshades--Drivers Windows	1	base				
359	MISCELLANOUS	Drivers Coat Hook	1	base				
360	MISCELLANOUS	Roller Style Sunshades--Drivers Windows	1	base				
361	MISCELLANOUS	Euramatic Cup Holder	1	$ 54.65	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
362	MISCELLANOUS	Registration Card holder	1	$ 12.32	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
363	MISCELLANOUS	Stainless Steel Waste Basket and Bracket	1	$ 47.77	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
364	MISCELLANOUS		1					
365	MISCELLANOUS		1					
366	MISCELLANOUS		1					
367	MODESTY PANELS	Standard Melamine Panels on Lower Section	1	base				
368	MODESTY PANELS	Quick Changing Glazing Upper Clear Plexiglas Modesty Panels Both Sides of Rear Exit Door	1	base				
369	MODESTY PANELS	Front Door Modesty Panel	1	$ 634.44	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
370	MODESTY PANELS	Lower Modesty Panel Forward of Rear Door	1	Base				

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
371	MODESTY PANELS	Melamine Panel Lower Section (Aft Rear Door)	1	Base				
372	MODESTY PANELS	Upper Clear Plexiglas Modesty Panel Forward Rear Door	1	Base				
373	MODESTY PANELS		1					
374	MODESTY PANELS		1					
375	MODESTY PANELS		1					
376	PAINT	One Color w/ Black Mask at Windows	1	No Bid				
377	PAINT	Add--Additional Color--Per Pass	1	base				
378	PAINT	Add--Clear Coat	1	$ 660.20	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
379	PAINT	Add Roof Numbers	1	base				
380	PAINT	Custom Paint / Decal Design (Per Spec)	1	quote				
381	PAINT		1					
382	PAINT		1					
383	PAINT		1					
384	PAINT		1					
385	PASSENGER BARRIERS	Wheelchair Barrier--Curbisde Aft of ADA Area	1	$ 673.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
386	PASSENGER BARRIERS	Wheelchair Barrier--Streetside Aft of ADA Area	1	$ 673.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
387	PASSENGER BARRIERS		1					
388	PASSENGER BARRIERS		1					
389	PASSENGER SEATING	USSC 4ONE Gemini	1	$ (602.00)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
390	PASSENGER SEATING	Kiel North America Citos	1	$ (210.00)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
391	PASSENGER SEATING	Kiel North America Intra	1	No Bid				
392	PASSENGER SEATING	USSC 4One Angel	1	No Bid				
393	PASSENGER SEATING	AMSECO Vision	1	$ 2,326.50	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
394	PASSENGER SEATING	AMSECO Insight	1	base				
395	PASSENGER SEATING	AMESCO Insight Prime Plus	1	$ (864.00)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
396	PASSENGER SEATING	Add--USB Charging Ports at Passenger Locations	1	$110 Per two seats				
397	PASSENGER SEATING	Add--Hinged Rear Settee	1	base				
398	PASSENGER SEATING	Add--3rd Step To Perimeter Seating (Except Settee)	1	No Bid				
399	PASSENGER SEATING		1					
400	PASSENGER SEATING		1					
401	PASSENGER SEATING		1					
402	PASSENGER SEATING		1					
403	PASSENGER SEATING		1					
404	PASSENGER SIGNALS	Pull Cords (Neutral) with Touch Pad at Wheelchair Location	1	$ 28.17	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
405	PASSENGER SIGNALS	Stop Request Button At Rear Door Stanchion	1	$ 486.10	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
406	PASSENGER SIGNALS	Touch Tape (At Window Mullions)	1	$ 512.46	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
407	PASSENGER SIGNALS		1					
408	PASSENGER SIGNALS		1					
409	PASSENGER SIGNALS		1					
410	PASSENGER WINDOWS	Ricon Hidden Frame/Bonded--Full Fixed	1	quote				
411	PASSENGER WINDOWS	Ricon Standard Frame, Safety Glass--Full Sliders	1	quote				
412	PASSENGER WINDOWS	Ricon Standard Frame, Safety Glass--Full Fixed	1	quote				
413	PASSENGER WINDOWS	Add Thermo Guard to Ricon Standard Frame	1	quote				
414	PASSENGER WINDOWS	Add Thermo Guard to Ricon Hidden Frame/Bonded	1	quote				
415	PASSENGER WINDOWS	Arow Standard Frame, Safety Glass--Full Sliders	1	$ 11,421.86	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
416	PASSENGER WINDOWS	Arow Standard Frame, Safety Glass--Full Fixed	1	quote				
417	PASSENGER WINDOWS	Arow Hidden Frame/Bonded--Full Fixed	1	quote				
418	PASSENGER WINDOWS	Add Thermo Guard to Arow Standard Frame	1	quote				
419	PASSENGER WINDOWS	Add Thermo Guard to Arow Hidden Frame/Bonded	1	quote				
420	PASSENGER WINDOWS	Add Window Guards (Acrylic or Film)	1	$ 1,546.88	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
421	PASSENGER WINDOWS	Arow Standard Frame, Safety Glass--Full Sliders for 60'	1	$ 16,468.28	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
422	PASSENGER WINDOWS		1					
423	PASSENGER WINDOWS		1					
424	PASSENGER WINDOWS		1					
425	PASSENGER WINDOWS		1					
426	PUBLIC ANNOUNCEMENT SYSTEM	PA with Handheld Mic w / (8) Flush Mount Speakers 40' (6) w / 30'	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
427	PUBLIC ANNOUNCEMENT SYSTEM	(1) Interior/Both/Exterior Speaker Selct Toggle Switch without Guard & (1) Rheostat Volume Control with XLR Mic Jack	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
428	PUBLIC ANNOUNCEMENT SYSTEM	Boom Microphone--Soundview SVA50SF (24") without ON/OFF Switch on Microphone, Momentary Button toe Switch, Floor Bracket Mounted	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
429	PUBLIC ANNOUNCEMENT SYSTEM	Clever Devises - Speakeasy II	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
430	PUBLIC ANNOUNCEMENT SYSTEM	Luminator VAS System	1	$ 7,871.88	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
431	PUBLIC ANNOUNCEMENT SYSTEM	Clever Devices Automated Voice Announcement System	1	$ 3,581.88	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
432	PUBLIC ANNOUNCEMENT SYSTEM		1					
433	PUBLIC ANNOUNCEMENT SYSTEM		1					
434	PUBLIC ANNOUNCEMENT SYSTEM		1					
435	REAR RUN GAUGES	Add Hour Meter	1	No Bid				
436	REAR RUN GAUGES	Add A/C Hour Meter	1	No Bid				
437	REAR RUN GAUGES	Add Coolant Temperature--Mechanial	1	No Bid				
438	REAR RUN GAUGES	Add Coolant Temperature--Electrical	1	No Bid				
439	REAR RUN GAUGES	Add Voltmeter (12V or 24V)	1	No Bid				
440	REAR RUN GAUGES		1					
441	REAR RUN GAUGES		1					
442	REAR RUN GAUGES		1					
443	REAR RUN GAUGES		1					
444	ROOF HATCHES	Manual Hatch at Front and Rear Positions	1	base				
445	ROOF HATCHES	Delete (1) Roof hatch	1	base				
446	ROOF HATCHES	Glass Roof Hatch	1	$ 163.38	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
447	ROOF HATCHES		1					
448	SAFETY EQUIPMENT	5LBS ABC Fire Extinguisher (Mounted Behind Driver Seat)	1	base				
449	SAFETY EQUIPMENT	Safety Triangles (K-D 610-4645)	1	base				
450	SAFETY EQUIPMENT	Bio- Hazard Disposal Kit	1	$ 22.16	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
451	SAFETY EQUIPMENT	Blood Born Pathogens Kit	1	$ 36.55	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
452	SAFETY EQUIPMENT	Ten Unit First Aid Kit	1	$ 73.16	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
453	SAFETY EQUIPMENT	Wheel Chocks (Per Set)	1	$ 121.80	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
454	SAFETY EQUIPMENT		1					
455	SAFETY EQUIPMENT		1					
456	SAFETY EQUIPMENT		1					
457	SAFETY EQUIPMENT		1					
458	SCHEDULE RACK	NONE	1	$ -	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
459	SCHEDULE RACK	(1) Schedule Holder OBIC 20/9 4PW-49/923BO- 4 Slots,Gray Color	1	No Bid				
460	SCHEDULE RACK	22" x 21" Black, RH Load Open Back	1	$ 189.88	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
461	SCHEDULE RACK	Innocom Schedule Racks 3.75" x 7" x 1.5"	1	No Bid				
462	SCHEDULE RACK	Innocom Schedule Racks 8.62" x 1 1" x 1"	1	$ 12.62	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
463	SCHEDULE RACK	OBIC To (4) Quad Pamphlet & (1) Single Pamphlet Holders	1	No Bid				
464	SCHEDULE RACK	Transit Info Products OBICT10P2LTRMC	1	No Bid				
465	SCHEDULE RACK	Transit Information Products -19"x 21" OBIC 19/214P1LTRMC	1	$ 133.45	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
466	SCHEDULE RACK		1					
467	SCHEDULE RACK		1					
468	SCHEDULE RACK		1					

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
469	SCHEDULE RACK		1					
470	STANCHIONS/GRAB RAILS	Stainless Steel Vertical Stanchions, Grabrails, and Modesty Panel Tubes	1	base				
471	STANCHIONS/GRAB RAILS	Vinyl Coated Nylon Grab Straps--Each	1	$ 11.78	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
472	STANCHIONS/GRAB RAILS	Yellow Powder Coated Vertical Stanchions, Grab Rails, and Modesty Panel Tubes	1	base				
473	STANCHIONS/GRAB RAILS	Yellow Powder Coated Vertical Stanchions Only	1	base				
474	STANCHIONS/GRAB RAILS	Vehicle Stanchion at Front Wheel Wells--Each	1	base				
475	STANCHIONS/GRAB RAILS	Add Farebox Grabrail	1	base				
476	STANCHIONS/GRAB RAILS	Horizontal Grabrail on Curbside & Streetside Wheelhousing	1	base				
477	STANCHIONS/GRAB RAILS	SSTL Spring Loaded Grab Handle--Each	1	$ 63.73	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
478	STANCHIONS/GRAB RAILS		1					
479	STANCHIONS/GRAB RAILS		1					
480	STANCHIONS/GRAB RAILS		1					
481	STANCHIONS/GRAB RAILS		1					
482	STANCHIONS/GRAB RAILS		1					
483	STEERING SYSTEM	Douglas, Single Tilt, Without Column Turn Signal, Without High-Low Beam Switch	1	base				
484	STEERING SYSTEM	Steering Wheel--Standard 20" Non-Padded 3 Spoke Wheel with Center Horn Button	1	$ 9.81	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
485	STEERING SYSTEM	Ross Model TS 65	1	No Bid				
486	STEERING SYSTEM	Steering Box--TRW TAS6505	1	No Bid				
487	STEERING SYSTEM	TRW Electric Assisted Steering	1	No Bid				
488	STEERING SYSTEM	VIP Textured Steering Wheel	1	base				
489	STEERING SYSTEM		1					
490	STEERING SYSTEM		1					
491	STEERING SYSTEM		1					
492	STYLING PACKAGES	Standard Styling Package	1	base				
493	STYLING PACKAGES	Windshield 2-Piece	1	base				
494	STYLING PACKAGES	Windshield 1-Piece	1	No Bid				
495	STYLING PACKAGES	BRT Front Cap Styling Only	1	base				
496	STYLING PACKAGES	BRT Front Cap, Rear Cap and Engine Door Styling	1	base				
497	STYLING PACKAGES	BRT PLUS Front Cap, Rear Cap, Roof Line and Engine Door Styling	1	base				
498	STYLING PACKAGES	BRT Roof Fairings, Front or Rear (each)	1	base				
499	STYLING PACKAGES		1					
500	STYLING PACKAGES		1					
501	STYLING PACKAGES		1					
502	STYLING PACKAGES		1					
503	SURVEILLANCE CAMERA SYSTEMS	Apollo (8) Standard Definition Color Camera System, 6TB HDD, GPS, Wireless, Impact Sensor	1	$ 3,487.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
504	SURVEILLANCE CAMERA SYSTEMS	Apollo--Add (1) Standard Definition Coler Camera	1	$ 367.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
505	SURVEILLANCE CAMERA SYSTEMS	Apollo--Delete (1) Standard Definition Color Camera	1	$ (267.00)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
506	SURVEILLANCE CAMERA SYSTEMS	Apollo--Add (1) High Definition Color Camera	1	$ 834.63	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
507	SURVEILLANCE CAMERA SYSTEMS	Apollo--Add 8TB HDD	1	$ 673.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
508	SURVEILLANCE CAMERA SYSTEMS	Apollo Back Up Camera with LCD Screen	1	$ 1,927.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
509	SURVEILLANCE CAMERA SYSTEMS	SEON NX-16 (7) Camera System, 2TB HDD, Wireless, GPS, Impact Sensor	1	$ 11,433.13	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
510	SURVEILLANCE CAMERA SYSTEMS	SEON Add (1) Standard Definition Color Camera	1	$ 317.63	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
511	SURVEILLANCE CAMERA SYSTEMS	SEON Add (1) High Definition Color Camera	1	$ 566.50	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
512	SURVEILLANCE CAMERA SYSTEMS	SEON Add Solid State Harddrive (SSD)	1	quote				
513	SURVEILLANCE CAMERA SYSTEMS	AngelTrax (7) Standard Definition Color Camera System, 1TB HDD, Wireless, GPS, Impact Sensor	1	$ 4,998.03	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
514	SURVEILLANCE CAMERA SYSTEMS	AngelTrax--Add (1) Standard Definition Color Camera	1	$ 290.36	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
515	SURVEILLANCE CAMERA SYSTEMS	AngelTrax--Add (1) High Definition Color Camera	1	$ 323.88	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
516	SURVEILLANCE CAMERA SYSTEMS	AngelTrax--Add 1TB HDD (Double stacked 500GB HDD)	1	$ 211.34	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
517	SURVEILLANCE CAMERA SYSTEMS	March Network 5412 (10) Camera--Kalatel Mobileview	1	quote				
518	SURVEILLANCE CAMERA SYSTEMS	Mobileview NVR7000 (10) Camera System, High Definition, 4TB HDD, Wireless, GPS, Impact Sensor	1	quote				
519	SURVEILLANCE CAMERA SYSTEMS	Mobileview--Add (1) High Definition Camera	1	quote				
520	SURVEILLANCE CAMERA SYSTEMS	Mobileview--Add Solid State Harddrive (SSD)	1	quote				
521	SURVEILLANCE CAMERA SYSTEMS	REI Bus Watch Digital	1	$ 3,368.75	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
522	SURVEILLANCE CAMERA SYSTEMS	Camera Pre Wire Package	1	$ 599.43	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
523	SURVEILLANCE CAMERA SYSTEMS		1					
524	SURVEILLANCE CAMERA SYSTEMS		1					
525	SURVEILLANCE CAMERA SYSTEMS		1					
526	SURVEILLANCE CAMERA SYSTEMS		1					
527	SURVEILLANCE CAMERA SYSTEMS		1					
528	SURVEILLANCE CAMERA SYSTEMS		1					
529	SURVEILLANCE CAMERA SYSTEMS		1					
530	SURVEILLANCE CAMERA SYSTEMS		1					
531	SURVEILLANCE CAMERA SYSTEMS		1					
532	SURVEILLANCE CAMERA SYSTEMS		1					
533	TIRES	Agency Supplied Tires	1	base				
534	TIRES	OEM Supplied Tires	1	$ 3,874.86	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
535	TIRES	Tire Pressure Monitoring System	1	$ 1,020.44	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
536	TIRES		1					
537	TIRES		1					
538	TIRES		1					
539	TOWING	None	1	No Bid	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
540	TOWING	Cole Hersee 12063 Electrical Tow Connector	1	base	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
541	TOWING	Delete Cole Hersee Tow Connector	1	$ (24.26)	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
542	TOWING		1					
543	TOWING		1					
544	TOWING		1					
545	WHEELCHAIR RAMP	Lift U--Ramp (LU-18 Dual Mode Front Door Ramp Only)	1	$ 2,700.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
546	WHEELCHAIR RAMP	Ricon--6:1 Ratio, Single Slope Ramp – SSR - Front Door Only	1	No Bid				
547	WHEELCHAIR RAMP	Ricon – 4:1 Ratio, FR2E - Front Door Only	1	No Bid				
548	WHEELCHAIR RAMP	New Flyer Smart Rider Ramp	1	$ 1,300.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
549	WHEELCHAIR RAMP	Lift U 11	1	$ 2,500.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
550	WHEELCHAIR RAMP		1					
551	WHEELCHAIR SECUREMENT	USSC--V-PRO-Reliant	1	base				
552	WHEELCHAIR SECUREMENT	Kiel North America K-Pod with Secubar	1	No Bid				
553	WHEELCHAIR SECUREMENT	American Seating--Dual Auto Lok with Advanced Restraint Module (ARM)	1	$ 1,717.38	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
554	WHEELCHAIR SECUREMENT	American Seating--Advanced Restraint Module (ARM) with Remote Belt Release	1	$ 1,622.50	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
555	WHEELCHAIR SECUREMENT	American Seating--Q'Straint Q'Pod	1	$ 9,006.25	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
556	WHEELCHAIR SECUREMENT	USSC--Q'Straint Q' POD	1	$ 8,830.25	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
557	WHEELCHAIR SECUREMENT	Q'Straint Quantum	1	$ 12,633.52	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
558	WHEELCHAIR SECUREMENT	Belt Guard and Wheelchair Ramp Pan Identification Numbers	1	quote				
559	WHEELCHAIR SECUREMENT		1					
560	WHEELCHAIR SECUREMENT		1					
561	WHEELCHAIR SECUREMENT		1					
562	WHEELCHAIR SECUREMENT		1					

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
563	WHEELS/RIMS	(7) Alcoa Aluminum Polished Finish with Durabrite	1	$ 1,442.45	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
564	WHEELS/RIMS	(7) Steel Powder Coated Finish, White or Black	1	No Bid				
565	WHEELS/RIMS	(7) Alcoa Aluminum Clean & Buff Finish	1	$ 332.11	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
566	WHEELS/RIMS	(7) Alcoa Aluminum Polished Finish	1	$ 832.76	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
567	WHEELS/RIMS	(7) Alcoa Aluminum Clean & Buff Finish with Durabrite	1	$ 1,011.20	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
568	WHEELS/RIMS	Alcoa Wheels--Add Duraflange	1	$ 1,579.12	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
569	WHEELS/RIMS	Delete Spare Aluminum Wheel	1	$ -				
570	WHEELS/RIMS	Delete Spare Steel Wheel	1	$ -				
571	WHEELS/RIMS	Alcoa Wheels--Add Duraflange 60'	1	$ 2,624.31	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
572	WHEELS/RIMS		1					
573	WHEELS/RIMS		1					
574	WHEELS/RIMS		1					
575	DECALS & SIGNAGE	ADA Priority Seat Decals--"PLEASE OFFER THESE SEATS TO THE ELDERLY AND PERSONS WITH DISABILITIES", White on Clear	1	base				
576	DECALS & SIGNAGE	Drivers Instructions & Warning--English, Black on White	1	base				
577	DECALS & SIGNAGE	Interior Rear Step Floor Decals--"WATCH YOUR STEP", White Lettering on Red Background	1	base				
578	DECALS & SIGNAGE	Interior Symbol Decals (3)--ISO Symbols, No Smoking/Eating/Drinking/Radio. White on Black	1	base				
579	DECALS & SIGNAGE	Vehicle Height Decal--English "Caution Clearance Height XX FT XX IN, Black on Yellow	1	base				
580	DECALS & SIGNAGE	Drivers /Passengers Standee Warning Decal for Florida--"It Is A Violation For This Bus To Be In Operation With Passengers Occupying The Area Forward Of Yellow Line. Therefore Passengers May Not Stand Forward Of The Yellow Line While Bus Is In Motion." White on Black	1	base				
581	DECALS & SIGNAGE	Wheechair Securement Decals--"WHEELCHAIR SEATING AREA SECUREMENTS ARE LOCATED BELOW THESE SEATS", Black on Optically Clear	1	base				
582	DECALS & SIGNAGE	TrilingualDecals	1	base				
583	DECALS & SIGNAGE	Yield Sign Decal	1	$ 31.65	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
584	DECALS & SIGNAGE		1					
585	DECALS & SIGNAGE		1					
586	DECALS & SIGNAGE		1					
587	DECALS & SIGNAGE		1					
588	MANUALS	Drivers, Service, Parts, Electrical, Vendor (Hardcopy) & Compact Disc (CD)--1 Set Hardcopy & 1 CD (Up to 3 buses ordered)	1	$ 9,266.40	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
589	MANUALS	Additional Driver's Handbook--Each	1	quote				
590	MANUALS	Additional Service Manual (Hardcopy)--Each	1	quote				
591	MANUALS	Additional Parts Manual (Hardcopy)--Each	1	quote				
592	MANUALS	Additional Electrical Schematics (Hardcopy)--Each	1	quote				
593	MANUALS	Additional Drivers, Service, Parts, or Electrical Schematics (CD)--Each	1	quote				
594	MANUALS	Additional Vendor Manuals (Hardcopy)--Each	1	quote				
595	MANUALS	Additional Vendor Manuals (CD)--Each	1	quote				
596	MANUALS		1					
597	MANUALS		1					
598	MANUALS		1					
599	MANUALS		1					

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
600	TRAINING	Operator Orientation Training--By Bus Manufacturer at Agency Property (Per Driver/Per Class)	1	$ 986.85	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
601	TRAINING	Maintenance Orientation Training--By Bus Manufacturer at Agency Property (Per Technician/Per Class)	1	$ 986.85	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
602	TRAINING	Steering System--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 1,973.70	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
603	TRAINING	Chassis & Body--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 986.85	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
604	TRAINING	Door Systems--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 986.85	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
605	TRAINING	Suspension--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	Included in Option 602	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
606	TRAINING	Electrical & Electronics----By Bus Manufacturer and/or OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 7,894.80	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
607	TRAINING	Air & Brake Systems--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 1,973.70	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
608	TRAINING	HVAC & Climate Controls--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 4,050.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
609	TRAINING	Wheelchair Ramp--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 896.85	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
610	TRAINING	Destination Sign--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 2,700.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
611	TRAINING	Fire Suppression--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	No Bid	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
612	TRAINING	Camera System Training--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	quote				
613	TRAINING	Automatic Passenger Counting System--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	quote				
614	TRAINING	Fare Collection Training--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	quote				
615	TRAINING	ITS Technical Training--By OEM Supplier at Agency Property (Per Technician/Per Class)	1	quote				
616	TRAINING	EV HV Battery ESS By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 8,100.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
617	TRAINING	EV Proplusion Operation & Diagnostics By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 12,150.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
618	TRAINING	High Voltage Safety By OEM Supplier at Agency Property (Per Technician/Per Class)	1	$ 11,842.20	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
619	TRAINING		1					
620	TRAINING		1					
621	TRAINING		1					
622	TRAINING		1					
623	TRAINING		1					
624	TRAINING MODULES	Thermo-King Intelligaire Training Module	1	$ 21,600.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
625	TRAINING MODULES	I/O Controls Multiplex Board	1	No Bid				
626	TRAINING MODULES	Air Brake Training Board	1	$ 43,875.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
627	TRAINING MODULES	Vapor Door Training Module	1	$ 50,625.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
628	TRAINING MODULES	Vansco Multiplex Board	1	$ 65,475.00	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI	Yr1 Plus PPI
629	TRAINING MODULES		1					
630	BATTERY	Battery Lease	1 Yr	Quote				
631	BATTERY		1 Yr	quote				
632	BATTERY		1 Yr	quote				
TOTAL				$ 7,608,817.16	$ -	$ -	$ -	$ -
PRICE OFFER								

Line Item	Description	Part #	QTY	Yr1	Yr2	Yr3	Yr 4	Yr5
TOTAL PRICE								
						TOTAL PRICE OFFER --->	$	7,608,817.16

NAME & TITLE OF OFFEROR'S REPRESENTATIVE: (print or type)

Jennifer Mcneill Vice President, Sales & Marketing
(Name & Title)

New Flyer of America Inc
(Offeror's Name)

SIGNATURE & DATE:

See PDF Version for Signature (Signature of Offeror's Representative) 17-Sep-21 Date

S-01 (JAN 18)



PSTA – Pinellas Suncoast Transit Authority

RFP 21-980369
Xcelsior CHARGE™
- XE35
- XE40
- XE60
- D45 CRT LE CHARGE™
- D45 CRT CHARGE

Package 3 Qualifications

NEW FLYER OF AMERICA

Section 1

Solicitation Requirement:

Pre-Award Evaluation Data form.

New Flyer Response:
Please refer to the attached Pre-Evaluation Data following the instructions of the RFP. Attached to this form you will find:

The list of Directors and Officers from New Flyer of America Inc

Schedule 1: Similar Current Contracts

Schedule 2: Three Similar contracts completed in the last 5 years

Schedule 3: Not required by New Flyer of America Inc

Schedule 4: This schedule with the requested financial statements are included in Section 2 of this proposal.

Schedule 5: Not Required by New Flyer of America Inc.

CER 7. Pre-Award Evaluation Data Form

NOTE: This form is to be completed and included in the Qualification Package. Attach additional pages if required.

PSTA
RFP 21-980369

1. **Name of firm:** New Flyer of America Inc.
2. **Address:** [redacted]
3. ☐ **Individual** ☐ **Partnership** ☒ **Corporation** ☐ **Joint Venture**
4. **Date organized:** October 20, 1989
   State in which incorporated: North Dakota
5. **Names of officers or partners:**

a.
b. Please refer to the Attached DIRECTORS and OFFICERS
c.
d.
e.

6. How long has your firm been in business under its present name? 31+ years

7. Attach as **SCHEDULE ONE** a list of similar current contracts that demonstrates your available capacity, including the quantity and type of bus, name of contracting party, percentage completed and expected completion date.

8. Attach as **SCHEDULE TWO** a list of at least three similar contracts that demonstrates your technical proficiency, each with the name of the contracting party and number and they type of buses completed within the last five years.

9. Have you been terminated or defaulted, in the past five years, on any Contract you were awarded?
☐ Yes ☒ No
If yes, then attach as **SCHEDULE THREE** the full particulars regarding each occurrence.

10. Attach as **SCHEDULE FOUR** Proposer's last three (3) financial statements prepared in accordance with generally accepted accounting principles of the jurisdiction in which the Proposer is located, and audited by an independent certified public accountant; or a statement from the Proposer regarding how financial information may be reviewed by the Agency (This may require execution of an acceptable nondisclosure agreement between the Agency and the Proposer.)

11. Attach as **SCHEDULE FIVE** a list of all principal Subcontractors and the percentage and character of Work (Contract amount) that each will perform on this Contract.

12. If the Contractor or Subcontractor is a joint venture, submit **PRE-AWARD EVALUATION DATA** forms for each member of the joint venture.

The above information is confidential and will not be divulged to any unauthorized personnel.

The undersigned certifies to the accuracy of all information:
Name and title: [redacted]
Company: New Flyer of America Inc.

[redacted]

September 7, 2021
Date

Schedule Two

SCHEDULE TWO a list of at least three similar contracts that demonstrates your technical proficiency, each with the name of the contracting party and number and they type of buses completed within the last five years.

Delivery of 4 40' Electric buses in 2019 and 4 electric buses in 2021
Capital District Transportation Authority (CDTA)
[redacted]

Delivery of 12 XE40 buses in 2021
[redacted]
CT Department of Transportation - Bureau of Public Transportation
[redacted]

Delivery of 8 XE40 buses in 2020
[redacted] **Port Authority of Allegany County**
[redacted]

Section 2

Solicitation Requirement:

A copy of the three (3) most recent financial statements audited by an independent third party or a statement from the Proposer regarding how financial information may be reviewed by the Agency.

New Flyer Response:

Please refer to the attached financial reports from the last three (3) years from NFI Group. These reports are also available in our web site:

https://www.nfigroup.com/investor-relations/performance-reports/



NFI GROUP

Financial Results
Fiscal 2020

March 4, 2021

Leading the ZEvolution.™



NFI continues changing the game.

Leading the ZEvolution.™

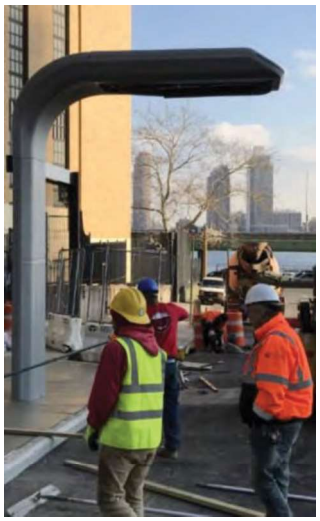


We continue to innovate and drive forward.

Leading the ZEvolution.™









We provide comprehensive mobility solutions.

Leading the ZEvolution.™



We have more than 105,000 buses in service in 11 countries around the world.

Leading the ZEvolution.™



We are leading the evolution to a zero-emission future.

NOTES TO READERS

MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS FOR THE 13-WEEKS AND 52-WEEKS ENDED DECEMBER 27, 2020

Information in this Management's Discussion and Analysis ("MD&A") relating to the financial condition and results of operations of NFI Group Inc. ("NFI" or the "Company") is supplemental to, and should be read in conjunction with, NFI's audited consolidated financial statements (including notes) (the "Financial Statements") for the 52-week period ended December 27, 2020.

This MD&A contains forward-looking statements, which are subject to a variety of factors that could cause actual results to differ materially from those contemplated by such forward-looking statements, including, but not limited to, the factors described in the Company's public filings available on SEDAR at www.sedar.com. See "Forward-Looking Statements" in Appendix A. The Financial Statements have been prepared in accordance with International Financial Reporting Standards ("IFRS") and, except where otherwise indicated, are presented in U.S. dollars, which is the functional currency of NFI. Unless otherwise indicated, the financial information contained in this MD&A has been prepared in accordance with IFRS and references to "$" or "dollars" mean U.S. dollars.

QUARTERLY AND ANNUAL REPORTING PERIODS

The quarterly and annual reporting periods for the current and prior year are as follows:

	Period from December 30, 2019 to December 27, 2020 ("Fiscal 2020")			Period from December 31, 2018 to December 29, 2019 ("Fiscal 2019")		
	Period End Date		# of Calendar Weeks	Period End Date		# of Calendar Weeks
Quarter 1	March 29, 2020	("2020 Q1")	13	March 31, 2019	("2019 Q1")	13
Quarter 2	June 28, 2020	("2020 Q2")	13	June 30, 2019	("2019 Q2")	13
Quarter 3	September 27, 2020	("2020 Q3")	13	September 29, 2019	("2019 Q3")	13
Quarter 4	December 27, 2020	("2020 Q4")	13	December 29, 2019	("2019 Q4")	13
Fiscal year	December 27, 2020		52	December 29, 2019		52

The quarterly and annual reporting periods for Fiscal 2021 will be as follows:

	Period from December 28, 2020 to January 2, 2022 ("Fiscal 2021")		
	Period End Date		# of Calendar Weeks
Quarter 1	March 28, 2021	("2021 Q1")	13
Quarter 2	June 27, 2021	("2021 Q2")	13
Quarter 3	September 26, 2021	("2021 Q3")	13
Quarter 4	January 2, 2022	("2021 Q4")	14
Fiscal year	January 2, 2022		53

NOTES TO READERS

Specific references and definitions are used throughout this MD&A, please see "Meaning of Certain References" and "Definitions of Adjusted EBITDA, return-on-invested-capital ("ROIC"), Free Cash Flow, Adjusted Net Earnings, Adjusted Earnings per Share, and Regions including: North America, UK and Europe, Asia Pacific, and Other" in Appendix A. References to LTM mean last-twelve months ("LTM"). Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share are non-IFRS measures and should not be considered substitutes or alternatives for IFRS measures. These are not defined terms under IFRS and do not have standard meanings, so may not be a reliable way to compare NFI to other companies. See the heading entitled: "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings, Adjusted Earnings Per Share, regions including: North America, UK and Europe, Asia Pacific, and Other" in Appendix A for information about these measures, including how they are calculated and the way in which they are used.

Buses manufactured by New Flyer and ADL's single and double deck buses are classified as "transit buses". ARBOC manufactures body on-chassis or "cutaway" and "medium-duty" buses that service transit, paratransit, and shuttle applications. Collectively, transit buses, medium-duty buses and cutaways, are referred to as "buses". A "motor coach" or "coach" is a 35-foot to 45-foot over-the-highway bus typically used for intercity transportation and travel over longer distances than heavy-duty transit buses, and is typically characterized by (i) one or two axles in the rear (related to the weight of the vehicle), (ii) high deck floor, (iii) baggage compartment under the floor, (iv) high-backed seats with a coach-style interior (often including a lavatory), and (v) no room for standing passengers. "Product lines" include heavy-duty transit buses, motor coaches, pre-owned coaches, cutaway and medium-duty buses.

Zero-emission buses ("ZEBs") consist of trolley-electric, hydrogen fuel cell-electric, and battery-electric buses. All of the data presented in this MD&A with respect to the number of transit buses, medium-duty buses, cutaways and motor coaches in service and delivered, is measured in, or based on, "equivalent units". One equivalent unit (or "EU") represents one production slot, being one 30-foot, 35-foot, 40-foot, 45-foot heavy-duty transit bus, one double deck bus, one medium-duty bus, one cutaway bus or one motor coach, whereas one articulated transit bus represents two equivalent units. An articulated transit bus is an extra-long transit bus (approximately 60-feet in length), composed of two passenger compartments connected by a joint mechanism. The joint mechanism allows the vehicle to bend when the bus turns a corner, yet have a continuous interior.

A summary of the Company's order, delivery and backlog information can be found in Appendix B.

Leading the *ZE*volution.™

Dear Shareholders,

2020 is a year that none of us will ever forget.

As we began the year, we had a plan that would see us deliver record results, and were off to a great start with a solid first quarter. Then the COVID-19 global pandemic became our reality. As the pandemic took hold in our geographies, few of us could ever have imagined the dramatic impact it would have on our world, our customers, our people, and our business.

While **2020 was a period of challenges**, including an immediate standstill of private coach operations, delayed public customer orders, idled facilities and furloughs, organizational changes, economic shocks, closed borders, and stay-at-home orders, we were extremely proud to see the response of the NFI team around the world. In the midst of an unprecedented global pandemic, our people focused on the health and safety of their fellow team members and on delivering for our customers. **Transit is the spinal cord of cities**, and most of our customers provide an essential service - one that connects cities and people, drives economic activity, and improves congestion and air quality. Throughout the pandemic, these operators delivered for their customers and ensured that, while the world stopped, public transit kept moving. We're proud to be able to support these individuals in everything they do, and we remain committed to ensuring our vehicles perform safely, reliably and meet all of our customers' expectations.

Our team worked tirelessly to achieve a balance in our decision-making and in dealing with the realities of the pandemic. This included some very difficult decisions to reduce our operating costs, headcount and facility footprint. While there were no easy answers, our people responded to the challenge and drove the NFI Forward initiative ("NFI Forward"), a group-wide series of projects that is expected to transition NFI from a holding company structure into a more integrated and efficient systems-driven organization.

The pandemic continues to disrupt all aspects of our daily lives, but there is hope on the horizon. We are seeing ridership start to return and vaccines are now being deployed. There is enthusiasm and **desire to re-open cities and start moving again**. At NFI, we are committed to doing everything we can to make sure our vehicles are ready for the recovery by offering products to increase onboard safety and cleanliness for our customers.

Looking beyond the pandemic, we held our annual Investor Day on January 11, 2021, where we outlined the future of NFI and had an opportunity to successfully connect virtually with our stakeholder community. We received fantastic feedback from the event, so much so that we will aim to make this an annual virtual event to continue to provide you with quality information, insights and updates.

NFI is Leading the *ZE*volution™: the evolution to a zero-emission future. *(continued->)*

(-> continued)

At NFI, we don't speak about hypotheticals or unfounded promises of growth or share or margin. **We're the leaders, and we deliver upon our commitments.** We will continue to innovate and lead the way to a zero-emission bus future. We have the largest vehicle production capacity in North America and the UK, the broadest propulsion offering, the deepest customer relationships and unmatched aftermarket and technical support. **And we aren't just a bus manufacturer—we are a mobility solutions provider**. We now offer telematics, connected vehicles, infrastructure solutions, aftermarket, battery-leasing, automated vehicles and advanced driver assistance systems. Our history is painted with innovation, and our focus on innovation will continue as we move forward and continuously disrupt ourselves - as we've done for more than a century.

There is a lot to look forward to. **We are really excited about where we are and where we are going.** We have exciting product launches ahead, which started with the launch of the Xcelsior AV in January 2021, North America's first fully operational heavy-duty Level 4 automated bus. Soon, we will launch new electric vehicle models at New Flyer, unveil the new D45 Commuter Rapid Transit battery-electric coach at MCI, and begin production of ARBOC's Equess CHARGE shuttle bus.

We are **committed to continuing to innovate** in order to ensure better, smarter, safer, more sustainable, and more connected public transportation. Environmental and social governance continues to drive our decision making, and NFI is extremely well positioned to capitalize on both our internal initiatives, including an increase in the diversity of our team, reduction of our carbon footprint, and through the environmental and social benefits created by our products. NFI's vehicles and solutions will enable smart city development, reduce the harmful impacts of climate change, traffic congestion and noise pollution, and create economic opportunity for current and future generations.

Sincerely,





The Honourable Brian V. Tobin
P.C., O.C. Chairman of the Board
NFI Group Inc.

Paul Soubry
President & Chief Executive Officer
NFI Group Inc.

Leading the ZEvolution.™

NFI is a leading global bus manufacturer of mass mobility solutions

NFI GROUP



NEW FLYER

NA Market Leader in Heavy-Duty Transit Buses and Infrastructure Solutions



MCI

NA Market Leader in Motor Coaches



ALEXANDER DENNIS

PLAXTON

World Leader in Double Deck Buses; UK Market Leader in Bus and Coach



ARBOC SPECIALTY VEHICLES

NA market leader in Low-floor Cutaway and medium-duty Shuttle buses



nfi.parts™

Market leader in Bus/Coach Parts

Leading the ZEvolution.™

NFI is leading zero-emission electric mobility

20 million +
Electric service miles driven

1,371
Zero-Emission Buses (ZEBs) delivered since 2015

389
ZEBs delivered in 2020 (9% of total deliveries)
34% improvement from 2019

80+
Cities with an NFI ZEB in service or on order

632
ZEBs in backlog (5.8% of total backlog)

$24.7 million
Infrastructure Solutions revenue in 2020

20% to 25%
of 2021 production is expected to be ZEBs

8,000
Annual ZEB production capacity











Leading the ZEvolution.™

FY 2020 Highlights (US$)

$2.4 billion
Revenue

4,371
EUs delivered

3,519
EUs in New Orders

24,378
Total Bid Universe

$233.5 million
Liquidity

$158 million
Adjusted EBITDA

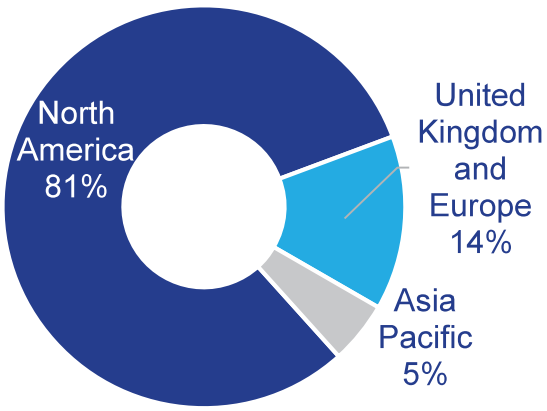
$27.5 million
Free Cash Flow

$18 million
NFI Forward

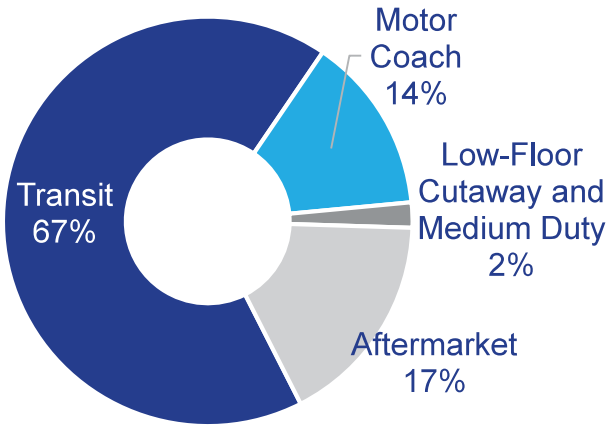
($0.75)
Adjusted Net Earnings per Share

$4.5 billion
Ending Backlog of 8,504 EUs

Revenue by Geography

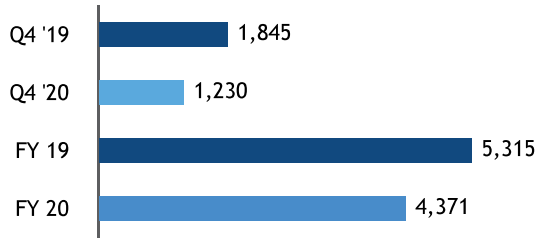


Revenue by Product

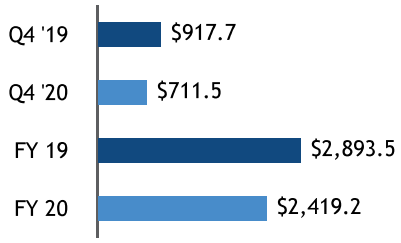


KEY PERFORMANCE INDICATORS

Deliveries (EUs)



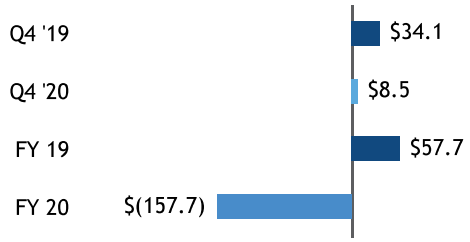
Revenue ($ millions)



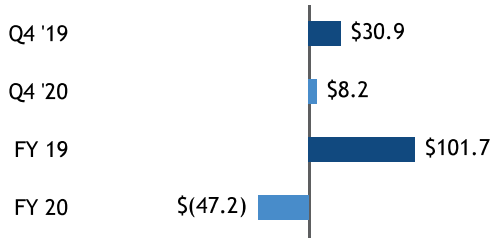
The decrease in deliveries from 2019 Q4 to 2020 Q4 was related to lower production volumes as a result of the ongoing impacts of the COVID-19 pandemic. Lower deliveries were experienced in all of NFI's product lines, with the largest decline seen in private motor coach. Fiscal 2020 new vehicle deliveries were down by 944 EUs, or 17.8%, from Fiscal 2019, with declines in heavy-duty transit and motor coach somewhat offset by increased deliveries of low-floor cutaway vehicles.

Total revenue decreased by 22.5% from 2019 Q4 to 2020 Q4 due to the decline in vehicle deliveries. Aftermarket parts sales were also lower by 11.4%, primarily due to private operators idling their fleets due to the COVID-19 pandemic. The comparative quarter decline is also partly a reflection of the record deliveries achieved in 2019 Q4. Fiscal 2020 revenues were down 16.4% from Fiscal 2019, due to the ongoing impacts of the COVID-19 pandemic, including lower vehicle deliveries and private sector aftermarket parts sales. The acquisition of ADL partially offset the COVID-19 related revenue decline in the fiscal-year comparative.

Net earnings (loss) ($ millions)



Adjusted Net Earnings[1] (Loss) ($ millions)



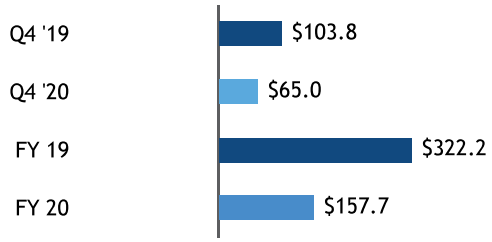
The 2020 Q4 net earnings of $8.5 million, a decrease of $25.6 million from 2019 Q4, was mainly driven by lower revenues mentioned above. The Company continued to lower variable overhead costs in step with lower production, but was unable to reduce fixed costs as quickly. Net earnings were impacted by $5.4 million in exceptional costs related to COVID-19 and $1.0 million in one-time, non-recurring restructuring charges primarily related to the NFI Forward initiative. Losses from operations were partially offset by government grants of $11.3 million received through the Canadian Emergency Wage Subsidy ("CEWS") and the UK Job Retention ("UK Furlough") program.

The Company reported a net loss of $157.7 million in Fiscal 2020, driven by lower production volumes, extraordinary COVID-19 costs, and non-recurring restructuring costs associated with production reductions and the NFI Forward initiative. Fiscal 2020 results were also lower as a result of a $50.8 million goodwill impairment charge related to MCI's private motor coach operations, incurred in 2020 Q1.

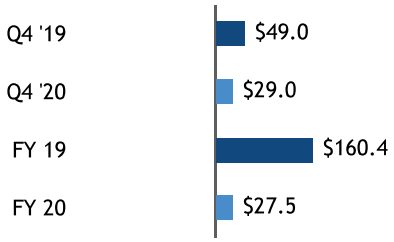
2020 Q4 Adjusted Net Earnings of $8.2 million was primarily driven by the same factors relating to net earnings, but adjusted for several normalizing tax affected items, including $0.7 million in one-time, non-recurring restructuring charges and $3.7 million in other COVID-19 related costs. Fiscal 2020 Adjusted Net Loss of ($47.2) million is normalized for tax-affected items including $19.0

million of one-time, non-recurring restructuring charges and $32.7 million of COVID-19 related costs, as well as the $50.8 million goodwill impairment and $12.2 million of mark-to-market losses on interest rate swaps.

Adjusted EBITDA[1] ($ millions)



Free Cash Flow[1] ($ millions)

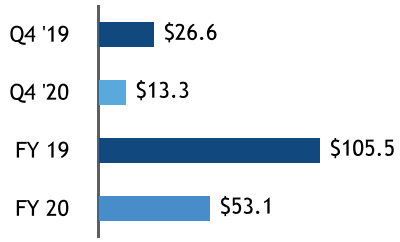


2020 Q4 Adjusted EBITDA of $65.0 million decreased by $38.9 million from 2019 Q4, or 37.4%, driven by the decrease in deliveries and aftermarket revenue mentioned above. In response to the decline in revenue the Company was focused on lowering both variable production costs and fixed general and administrative expenses. This included the transformational NFI Forward initiative, which is anticipated to lower both direct and fixed costs. NFI Forward achieved Adjusted EBITDA savings of $17.0 million, and a further $1.0 million of Free Cash Flow savings related to interest expenses and leases in Fiscal 2020.

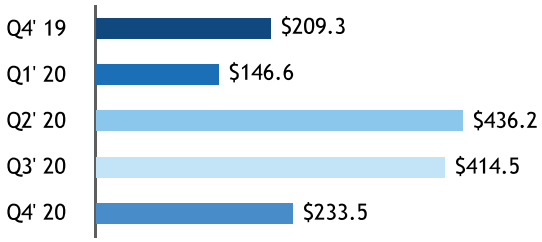
On a yearly basis, Adjusted EBITDA decreased by $164.5 million, or 51.1%, as NFI delivered fewer vehicles in 2020 due to the impacts of the COVID-19 pandemic. In addition, the Company continued to incur fixed operating costs on a lower revenue base. These negative impacts were somewhat offset by government grants of $53.5 million received through the CEWS and UK Furlough programs, and improvements at KMG. Despite headwinds from COVID-19 related absenteeism, KMG achieved positive Adjusted EBITDA for the second consecutive quarter, and despite the many operational challenges COVID-19 presented throughout Fiscal 2020, KMG achieved year-over-year Adjusted EBITDA improvement of $7.3 million.

Free Cash Flow in 2020 Q4 decreased by $20.0 million, or 40.8%, as compared to 2019 Q4, primarily due to lower Adjusted EBITDA and higher maintenance capital expenditures. On a yearly basis, Free Cash Flow decreased by 82.9%, primarily driven by the idling of production facilities in the second quarter, which resulted in second quarter Free Cash Flow losses of $43.1 million.

Declared dividends ($CAD millions)



Total Liquidity ($ millions)



Effective Q1 2020, quarterly dividends were reduced 50.0% to C$0.2125 per common share in direct response to the impact of the COVID-19 pandemic on the Company's end markets and operating business. On a yearly basis, dividends are down 49.7%. While the dividend payment was reduced, the continued payment reflects the confidence of the Board of Directors (the "Board") in the Company's business while maintaining the financial flexibility required to operate during a period of significant uncertainty.

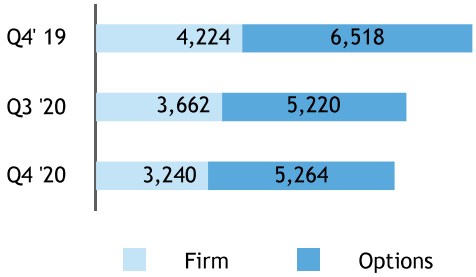
The Company's liquidity position, which combines cash on-hand plus available capacity under credit facilities, as at December 27, 2020 was $233.5 million, up $24.2 million from Q4 2019. On December 23, 2020, NFI announced amendments to its credit facilities: NFI amended the Company's existing $1.25 billion senior revolving credit facility (the "Credit Facility") and its £50 million revolving UK credit facility (the "UK Facility"), and the amended facilities provide NFI with relaxed covenants as it recovers from the impacts of the COVID-19 pandemic. Under the terms of the amended facilities, the total leverage and interest coverage ratios for 2021 and

2022 have been increased to a higher level. During 2021, the Company has received a waiver of the total net leverage covenant and will instead need to comply with a total net leverage ratio that is based on a financial projection for the Company's 2021 fiscal year. In addition to amending the facilities, NFI terminated the unused $250 million unsecured credit facility it entered into in April 2020 (the "Sidecar"), which was intended to provide additional liquidity, which the Company believes it no longer requires. Further details regarding the credit facilities and the Company's covenants can be found in the Capital Allocation section of this MD&A.

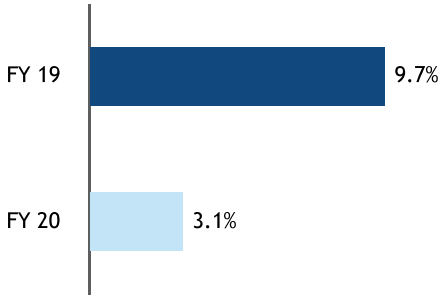
On March 1, 2021, NFI announced that it had closed a bought-deal equity offering (the "Offering") with a syndicate of underwriters (the "Underwriters") pursuant to which NFI issued 8,446,000 common shares at a price of C$29.60 per share for gross proceeds to the Company of C$250 million. The Company intends to use the net proceeds of the Offering to reduce the outstanding balances under its credit facilities, which is expected to strengthen NFI's balance sheet, reduce leverage and interest expense and significantly increase liquidity.

NFI believes that its existing liquidity combined with the additional financial flexibility provided from the Offering will allow it to pursue its operational and strategic goals, such as investments in NFI's zero-emission products and electric propulsion technology, investments required under the previously disclosed NFI Forward cost-reduction initiative and other potential growth opportunities, in addition to continuing to return capital to shareholders through dividends.

Backlog (EUs)



ROIC[1]



At the end of 2020 Q4, the Company's total backlog (firm and options) of 8,504 EUs (valued at $4.3 billion) has decreased compared to 8,882 EUs (valued at $4.5 billion) at the end of 2020 Q3. The decrease was primarily driven by the Company delivering units in the backlog while new orders were lower during the period due to delays in new contract awards as a result of COVID-19 disruptions to public market customers. Backlog was also impacted by the expiry of 120 option EUs and the cancellation of 26 EUs.

FY 2020 ROIC decreased by 68.0% from 2019 Q4 LTM due to the decline in Adjusted EBITDA, driven by the impacts of COVID-19, combined with one-time non-recurring lower of cost or net realizable value adjustments in respect of the Company's pre-owned coaches, and goodwill impairment in the MCI business unit.

Footnotes

1. Non-IFRS Measure - See Appendix A

2020 Q4 HIGHLIGHTS

The fourth quarter of 2020 saw NFI continue to recover from the impacts of COVID-19 and deliver significant improvement over both the third quarter, as well as over the second quarter of idled production. While results improved in 2020 Q4, the ongoing COVID-19 pandemic continued to challenge NFI's customers and end markets. Rising COVID-19 rates in the U.S., Canada, and the UK, combined with mutations of the virus, ongoing work-from-home mandates and the dramatic decline in travel slowed the announcement of new vehicle awards, and delayed or deferred purchases, especially in private coach and UK transit markets.

As a result of the pandemic and in order to achieve the anticipated benefits from the ongoing NFI Forward initiative, the Company incurred several one-time costs that have been normalized within Adjusted EBITDA and Adjusted Net Earnings. These adjustments (tax effected) include:

- Restructuring
    - $1.0 million in severance costs and asset impairments primarily related to the NFI Forward initiative.
- COVID-19
    - $4.6 million in asset impairments from aftermarket parts inventory and ADL private coach.
    - $0.8 million of COVID-19 operating costs that include, but are not limited to, the purchase of personal protective equipment, plant sanitation activities and incremental cleaning activities.

Adjusted Net Earnings are also normalized for other related items including:

- $2.3 million mark-to-market loss on interest rate swap
- $2.2 million unrealized foreign exchange gains
- $1.1 million fair value adjustments to the total return swap

After adjusting for these items, Adjusted Net Earnings is $8.2 million or $0.13 per share.

While the pandemic continued to create challenges during the fourth quarter, it was a busy period for NFI that saw the Company experience several events and achieve significant milestones, including the following:

- In November, ADL expressed support for the UK Government's Ten Point Plan for a Green Industrial Revolution and the commitment to invest £120 million to begin the introduction of at least 4,000 more British built ZEBs. ADL is the UK's leader in ZEBs and is extremely well positioned to capitalize on the transition to zero-emission vehicles. An example of this leadership position was the ADL BYD partnership's electric vehicles completing 600,000 zero-emission service miles in December 2020.
- NFI's North-American ZEB strategy continued in earnest with awards in Nashville for vehicles and the associated charging infrastructure. The California Air Resources Board also approved MCI's zero-emission coaches to be eligible to avail of the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program.
- ADL's new market growth strategy continued with the delivery of the first Enviro500 double-deck vehicles to Berlin, Ireland and New Zealand. In Berlin, ADL expects to receive an order for an additional 198 units following completion of a testing program. In Ireland, there are another 180 EUs on order for 2021 delivery, and ADL delivered two electric vehicles to New Zealand.
- NFI's commitment to the communities in which it operates was more important than ever in 2020, and NFI and its employees were pleased to raise over C$400,000 through its annual United Way fundraising campaign, providing support to 19 communities across North America.
- In December, MCI announced that the MCI Academy had received its fourth consecutive ASE Training Managers Council National Excellence in Training Award, the Grand Award, for its High Voltage Safety Program.
- Throughout the quarter, NFI's Clean and Protect product line helped customers provide a safer transportation experience as customers equipped their vehicles with sanitization, cleaning and air purification products.
- ARBOC's low-floor cutaway growth strategy took significant steps forward as the Company received an order for 53 low-floor Spirit of Freedom buses from British Columbia's TransLink, and Transit St. Louis added 13 new Metro Call-A-Ride vans to its fleet.
- On December 23, 2020, NFI announced amendments to its $1.25 billion Credit Facility and its £50 million UK Facility. The amended facilities provide NFI with relaxed covenants as it recovers from the impacts of the COVID-19 pandemic. In addition to amending the facilities, NFI terminated the unused $250 million Sidecar, which was intended to provide additional liquidity in 2020, which the Company believes it no longer needs.

The Company continued to pay its quarterly dividend of C$0.2125 per share (annual rate of C$0.85 per share), resulting in a payout ratio for Fiscal 2020 of 153.0%%. The Board expects to maintain dividends on a quarterly basis, although such dividends are not assured.

Leading the *ZE*volution™

On January 11, 2021, NFI held its virtual Investor Day 2021, where NFI's Senior Leadership Team and Board provided detailed presentations regarding NFI's business and strategy, with a focus on NFI's vision to drive the increased adoption of ZEBs, what NFI is calling the ***ZE***volution™. The event also featured an informative discussion by a panel made up of mobility experts from Canada, the United States, and the United Kingdom. During the event, NFI announced its 2021 guidance, 2025 targets and longer-term financial outlook, details of which can be found in the Outlook section of this MD&A.

FINANCIAL RESULTS

Despite improvements from the third and second quarters, the COVID-19 pandemic continued to negatively impact NFI's 2020 Q4 results across all financial metrics, including the Company's deliveries, which declined by 615 EUs, or 33.3%, from 2019 Q4. Lower deliveries were experienced in all of NFI's product lines, but the most significantly impacted continued to be the private segments of MCI and ADL. Private market activity remained low as operators continued to idle their vehicles in response to government travel restrictions, social distancing and self-isolation requirements. The comparative quarter decline is also partly a reflection of the record deliveries achieved in 2019 Q4, following a significant build up of work-in-progress inventory ("WIP") in 2019 Q3. The comparative full year decline is partially offset by the acquisition of ADL.

Full details of the Company's orders, delivery and backlog information can be found in Appendix B.

Deliveries (unaudited, EUs)	2020 Q4	2019 Q4	% Change	2020	2019	% Change
Transit buses	913	1,347	*(32.2)%*	3,318	3,931	*(15.6)%*
Motor coaches	221	389	*(43.2)%*	633	1,036	*(38.9)%*
Medium-duty and cutaway	96	109	*(11.9)%*	420	348	*20.7 %*
New Vehicle Deliveries	1,230	1,845	*(33.3)%*	4,371	5,315	*(17.8)%*
Pre-owned coach	133	176	*(24.4)%*	329	469	*(29.9)%*

Revenue (unaudited quarterly results, audited full year results, dollars in millions)	2020 Q4	2019 Q4	% Change	2020	2019	% Change
Transit buses	$ 457.6	$ 571.1	*(19.9)%*	$ 1,593.4	$ 1,841.1	*(13.5)%*
Motor coaches	121.9	192.0	*(36.5)%*	334.4	526.5	*(36.5)%*
Medium-duty	8.7	18.2	*(52.2)%*	41.7	49.8	*(16.3)%*
Total new transit bus, coach and cutaway revenue	**$ 588.2**	**$ 781.3**	***(24.7)%***	**$ 1,969.5**	**$ 2,417.4**	***(18.5)%***
Pre-owned coach revenue	9.0	13.7	*(34.3)%*	18.4	46.0	*(60.0)%*
Infrastructure solutions	9.0	3.8	*136.8 %*	24.7	6.1	*304.9 %*
Fiberglass reinforced polymer components	1.6	1.8	*(11.1)%*	5.1	6.6	*(22.7)%*
Manufacturing Revenue	**$ 607.8**	**$ 800.6**	***(24.1)%***	**$ 2,017.7**	**$ 2,476.1**	***(18.5)%***
Aftermarket	103.7	117.1	*(11.4)%*	401.5	417.4	*(3.8)%*
Total Revenue	**$ 711.5**	**$ 917.7**	***(22.5)%***	**$ 2,419.2**	**$ 2,893.5**	***(16.4)%***
North America	559.7	710.6	*(21.2)%*	1,966.6	2,508.2	*(21.6)%*
United Kingdom and Europe	106.6	174.4	*(38.9)%*	332.5	320.1	*3.9 %*
Asia Pacific	44.5	32.0	*39.1 %*	117.7	63.7	*84.8 %*
Other	0.7	0.8	*(12.5)%*	2.4	1.4	*71.4 %*

Manufacturing revenue for 2020 Q4 decreased by $192.8 million, or 24.1%, compared to 2019 Q4. The decrease is primarily driven by lower deliveries of both transit buses and motor coaches, as the Company lowered production volumes in response to public customer order deferrals and private customer order delays or cancellations, which were both attributable to the economic impacts of the COVID-19 pandemic. Pre-owned coach sales decreased due to a decline in deliveries and demand for vehicles as the majority of North American and UK private coach operators idled operations during the quarter. Due to these market conditions, the Company signed an agreement mid-quarter to sell MCI's pre-owned coach pool to a third party for total proceeds of approximately $19.0 million. The Company recognized $5.8 million of revenue related to the sale in 2020 Q4, and expects to recognize the remainder in the first half of 2021, depending on the timing of deliveries. Medium duty revenue was lower due to an unfavourable product mix.

Revenue from Aftermarket operations in 2020 Q4 decreased by $13.4 million, or 11.4% compared to 2019 Q4. The decline in revenue was primarily driven by lower private sector parts volumes within both the NFI aftermarket and ADL aftermarket businesses. Offsetting some of this pressure was increased sales to public customers for Clean and Protect™ products aimed at improving vehicle safety and cleanliness.

Adjusted EBITDA[1] (unaudited, dollars in millions)	2020 Q4	2019 Q4	% Change	2020	2019	% Change
Manufacturing	54.3	85.7	*(36.6)%*	102.0	256.1	*(60.2)%*
Aftermarket	17.1	18.4	*(7.1)%*	66.7	74.6	*(10.6)%*
Corporate	(6.4)	(0.3)	*(2,033.3)%*	(11.0)	(8.5)	*(29.4)%*
Total Adjusted EBITDA	**$65.0**	**$103.8**	***(37.4)%***	**$157.7**	**$322.2**	***(51.1)%***
Adjusted EBITDA as a percentage of revenue						
Manufacturing	9.1 %	10.7 %	*(15.0)%*	5.1 %	10.3 %	*(50.5)%*
Aftermarket	16.5 %	15.7 %	*5.1 %*	16.6 %	17.9 %	*(7.3)%*
Total	**9.2 %**	**11.3 %**	***(18.6)%***	**6.5 %**	**11.1 %**	***(41.4)%***

Net Earnings (Loss) [2] (unaudited quarterly results, audited full year results, dollars in millions, except per share amounts)	2020 Q4	2019 Q4	% Change	2020	2019	% Change
Manufacturing	11.5	31.5	*(63.5)%*	(117.7)	83.3	*(241.3)%*
Aftermarket	11.2	15.5	*(27.7)%*	52.1	63.6	*(18.1)%*
Corporate	(14.2)	(12.9)	*10.1 %*	(92.1)	(89.2)	*3.3 %*
Net earnings (Loss)	**$ 8.5**	**$ 34.1**	***(75.1)%***	**$ (157.7)**	**$ 57.7**	***(373.3)%***
Goodwill impairment	—	—	*N/A*	50.8	—	*N/A*
Extraordinary COVID-19 costs	5.4	—	*N/A*	47.4	—	*N/A*
Non-recurring restructuring costs	1.0	—	*N/A*	27.5	—	*N/A*
Adjusted Net Earnings (Loss)[1]	8.2	30.9	*(73.5)%*	(47.2)	101.7	*(146.4)%*
Net earnings (Loss) Per Share	0.14	0.55	*(74.5)%*	(2.52)	0.93	*(371.0)%*
Adjusted Earnings (Loss) Per Share[1]	$ 0.13	$ 0.49	*(73.5)%*	$ (0.75)	$ 1.65	*(145.5)%*

[1] Non-IFRS Measure - See Appendix A for details.
[2] Comparative segment allocations have been restated to conform with current period presentation.

2020 Q4 Manufacturing Adjusted EBITDA decreased by $31.4 million, or 36.6%. The Company continued to lower variable overhead in step with production but was unable to reduce fixed costs as quickly, resulting in lower Adjusted EBITDA. The Company has initiated the NFI Forward initiative to reduce direct and general and administrative fixed costs. In 2020, NFI has achieved cost savings of $16.6 million in the Manufacturing Segment. The Q4 decrease in Adjusted EBITDA was partially offset by $11.3 million in government grants and improvements at the Company's parts fabrication facility ("KMG"). Despite challenges from COVID-19 related absenteeism, KMG achieved positive Adjusted EBITDA for the second consecutive quarter, and despite the many operational challenges COVID-19 presented throughout Fiscal 2020, KMG achieved year-over-year Adjusted EBITDA improvement of $7.3 million. Manufacturing 2020 Q4 net earnings decreased by $20.0 million, or 63.5%, due to the items that impacted Adjusted EBITDA, combined with $3.5 million in extraordinary costs related to COVID-19. The previously described extraordinary COVID-19 costs included a $2.7 million impairment charge on ADL's motor coach inventory. Net earnings were also impacted by one-time, non-recurring restructuring charges of $1.0 million. Restructuring charges are associated with production reductions and the NFI Forward initiative.

2020 Q4 Aftermarket Adjusted EBITDA decreased by $1.3 million, or 7.1%. The impact of lower revenue was offset by cost savings from headcount reductions, a favourable product mix, and NFI Forward savings of $0.4 million. 2020 Q4 net earnings decreased by $4.3 million, or 27.7%. The decrease was driven by the same factors that impacted Adjusted EBITDA, combined with a COVID-19 related inventory impairment charge of $1.9 million.

Corporate Adjusted EBITDA decreased by $6.1 million, primarily as a result of realized foreign exchange. Corporate expenses included in the calculation of net earnings decreased by $1.3 million, or 10.1%, primarily due to higher interest costs, partially offset by unrealized foreign exchange gains on non-current monetary items.

Free Cash Flow[1] (unaudited, dollars in millions, except per share amounts)	2020 Q4	2019 Q4	% Change	2020	2019	% Change
Free Cash Flow	$ 29.0	$ 49.0	*(40.8)%*	$ 27.5	$ 160.4	*(82.9)%*
Free Cash Flow (CAD dollars)	39.6	64.1	*(38.2)%*	34.7	211.4	*(83.6)%*
Declared Dividends (CAD dollars)	13.3	26.6	*(50.0)%*	53.1	105.5	*(49.7)%*
Free Cash Flow per Share (CAD dollars)	$ 0.63	$ 1.03	*(38.8)%*	$ 0.56	$ 3.42	*(83.6)%*
Dividends per Share (CAD dollars)	$ 0.21	$ 0.43	*(51.2)%*	$ 0.85	$ 1.71	*(50.3)%*
Payout Ratio (Declared Dividends divided by Free Cash Flow	33.6 %	41.5 %	*(19.0)%*	153.0 %	49.9 %	*206.6 %*

[1]Non-IFRS Measure - See Appendix A for details.

Free Cash Flow in 2020 Q4 decreased by $20.0 million, or 40.8%, compared to 2019 Q4, primarily due to lower Adjusted EBITDA, higher maintenance capital expenditures, and higher lease obligation payments. The Company increased maintenance capital expenditures in the fourth quarter, after limiting expenditures in the second and third quarters to preserve cash during the idling of production facilities. Lease obligation payments were higher because the Company made payments, related to previous quarters, that had been deferred to preserve cash during the idling of production facilities. The decrease in fourth quarter Free Cash Flow was partially offset by lower income taxes.

Fiscal 2020 Free Cash Flow was particularly challenged by the idling of nearly all production facilities in the second quarter, which resulted in second quarter Free Cash Flow losses of $43.1 million. Losses in the second quarter were the primary driver of the Company's Fiscal 2020 payout ratio of 153.0% percent. In response to these challenges, the Company reduced quarterly dividends 50% to C$0.2125 per common share, effective Q1 2020.

OUTLOOK

Management anticipates that NFI's end markets will continue to be impacted by COVID-19 in 2021; however, the Company expects improvement in its financial results as markets recover and the NFI Forward initiative continues to deliver improvements to operating metrics. Market recovery will be dependent upon several factors, including government recovery and green fleet investments, COVID-19 case rates, vaccine distribution, the length of the pandemic, mutations of the virus, travel restrictions, and economic reopening activity. These factors will differ by product and geography. The Company's vehicle product lines (New Flyer, ARBOC, MCI public motor coach, and ADL) are primarily used for public transit, which remains a critical method of transportation for millions of users in the Company's markets and is an economic enabler in cities. Within the North American heavy-duty transit and public coach businesses, near- and longer-term demand is expected to return, although the duration of the recovery from COVID-19 may affect vehicle awards and delivery timing. Management's recovery expectations are supported by continued support for transit operations by all levels of government and the Company's North American bid universe, which includes 4,032 EUs in active procurements. Management also believes recent advancements in COVID-19 vaccines and the commencement of vaccine rollouts are positive signs for continued market recovery.

NFI is Leading the *ZE*volution™

At its January 2021 Investor Day, NFI unveiled its vision to drive the increased adoption of ZEBs, what the Company is calling the ZEvolution™. NFI envisions a consistent adoption of zero-emission vehicles over the next 10 to 15 years as operators in North America, the UK, Europe and Asia Pacific markets transition their fleets to electric vehicles. NFI has been building electric vehicles since 1969 and offers the broadest offering of ZEBs, including battery-electric buses and coaches, hydrogen fuel-cell buses and electric trolleys.

NFI is the leader in North America and the UK for ZEBs and is expected to be a significant beneficiary from the increased acceleration to ZEBs. Currently, ZEBs make up 7.4% of NFI's backlog (up from 3.6% at the end of 2019 Q4), and make up 30% of the Company's total North American bid universe.

A critical component of NFI's strategy is to provide complete mobility solutions, including vehicles, infrastructure installation, telematics, and aftermarket support. NFI has the largest vehicle production capacity in North America and the UK, and can manufacture ZEBs at all of its vehicle facilities. NFI has electric vehicles in service with 15 of the top 25 transit agencies in North America, and the Company's battery-electric and fuel-cell electric vehicles have completed over 4.5 million miles of zero-emission service in North America, and more than 16.0 million zero-emission miles in the UK. The Company has also installed infrastructure with numerous agencies, which saw the Company grow its Infrastructure Solutions™ revenue by more than 300% year-over-year, from 2019 to 2020. The Company has delivered more ZEBs than any competitor in the UK, and is also now selling its innovative battery-electric coach in the US and Canada, with the first public order for 25 coaches to be delivered in 2021. ARBOC's zero-emission battery electric bus, the Equess CHARGE™, will begin production in the second half of 2021, following completion of Altoona testing. Management anticipates that based on the Company's leadership position, product offering, experience and customer relationships it is well positioned to capitalize on the long-term transition to ZEBs in both core and new markets.

Government Support for Recovery and Zero-Emission Transition

During the global pandemic, government support for transit operations has remained strong, recognizing the critical role transit plays in re-mobilizing cities and supporting economic recovery. In addition to billions of dollars in COVID-19 operations relief funds, governments have also committed billions for long-term fleet investments and the transition to zero-emission, battery-electric vehicles.

In the United States, the Fixing America's Surface Transportation Act ("FAST Act"), which is the primary federal funding mechanism, was extended for one year. The FAST Act extension includes funds to maintain the Highway Trust Fund's solvency at current funding levels, which equates to $12.3 billion for transit programs through fiscal year 2021, with dedicated funding of $1.2 billion for bus appropriations in 2021. The proposed successor to the FAST Act is the $494 billion Investing in a New Vision for the Environment and Surface Transportation in America Act ("INVEST in America Act") drafted early in 2020. This new draft Act includes $105 billion for transit capital purchases, including a five-time increase in funding for zero-emission buses from the previous FAST Act.

In October 2020, the Canadian federal government announced $1.5 billion in financing through the Canada Infrastructure Bank to support the adoption of ZEBs and charging infrastructure; the financing is expected to be delivered over a 24- to 36-month period. The Canadian government followed this with a landmark announcement in February 2021 that will see $14.9 billion invested in Canadian public transit. The program includes $5.9 billion in dedicated project funds starting in 2021, and ongoing permanent funding of $3 billion per year beginning in 2026-2027.

The UK, despite numerous headwinds faced in 2020, saw an increase in government support and more subsidies available to bus operators than ever before. The government's new Ten Point Plan for a Green Industrial Revolution, announced November 18, 2020, is a follow-up to the UK government's original plan to invest £5 billion for buses, cycling and walking, and continued to highlight the government's commitment to introduce 4,000 more British-built zero-emission buses into service.

In Asia Pacific markets, the New Zealand government provided an election pledge that only zero-emission buses will be purchased by 2025, and that they will target decarbonizing their entire public transit fleet by 2035. ADL's partnership with BYD has a solid position in the New Zealand market and management expects it will be a beneficiary of this transition. The Hong Kong government continues to advance trials and applications for electric commercial vehicles which may provide opportunities for ADL given its strong relationships with the largest commercial operators in the market.

Looking forward, management is encouraged by the desire of President Biden to rebuild a cleaner and more resilient economy through investments in zero-emission and low-carbon public transportation. A campaign priority of the new Biden administration is to "provide every American city with 100,000 or more residents with high-quality zero-emission public transportation options through flexible federal investments," and Prime Minister Trudeau's plan has an aggressive target of 5,000 zero-emission buses and coaches by 2025.

As the market leader in North American transit and coach operations and the UK's leading provider of zero-emission buses through the ADL BYD partnership, management believes NFI is extremely well positioned for both the near- and long-term based on the multi-year commitments being made by governments in all of the Company's core markets. Management anticipates significant opportunities for NFI to grow top-line revenue from increased market demand for its products with strong underlying financial support from government bodies.

Financial Guidance

As management anticipates market recovery, geographic expansion, increased sales of ZEBs, and continued realization of savings from the NFI Forward Initiative, in January 2021 it provided Adjusted EBITDA guidance for Fiscal 2021 with a range of $220 million to $240 million. This range could represent growth in Adjusted EBITDA of over 50% on a year-over-year basis when compared to Fiscal 2020. Management and the Board remain confident in the following guidance:

2021 Financial Guidance	
Revenue	$2.8 billion to $2.9 billion
ZEB (electric) as a percentage of manufacturing sales	20% to 25%
Adjusted EBITDA[1]	$220 million to $240 million
Cash Capital Expenditures - including NFI Forward	$50 million
Adjusted Effective Tax Rate ("ETR")	~31%
Seasonality	Decline in Q1; year-over-year growth in Revenue and Adjusted EBITDA in Q2, Q3 and Q4

The above table outlines guidance ranges for selected Fiscal 2021 consolidated financial metrics. These ranges take into consideration management's current outlook combined with Fiscal 2020 results and are based on the assumptions set out below. The purpose of the financial guidance is to assist investors, shareholders, and others in understanding certain financial metrics relating to expected Fiscal 2021 financial results for evaluating the performance of NFI's business. The information may not be appropriate for other purposes. Information about guidance, including the various assumptions underlying it, is forward-looking and should be read in conjunction with the section "Forward-Looking Statements" in Appendix A and the related disclosure and information about various economic competitive and regulatory assumptions, factors, and risks that may cause actual future financial and operating results to differ from management's current expectations.

The guidance provided above is driven by numerous expectations and assumptions including, but not limited to, the following:

- Revenue: Growth is expected to be driven by the Company's solid backlog, strong government financial support, new order growth from the anticipated recovery within North American public transit markets and the United Kingdom transit market, combined with an expected increase in sales activity in Asia Pacific and European markets. In addition, management believes there is potential for improvement in private coach aftermarket parts sales.

- ZEB sales: Growth in ZEB sales is based on the Company's backlog and expected new orders from increased market demand for zero-emission vehicles.

- Adjusted EBITDA: Adjusted EBITDA growth is based on expected revenue growth, anticipated margins from vehicles in the Company's current backlog and anticipated new orders, expected increases in the sales of ZEBs and cost reductions from the NFI Forward initiative. NFI expects to realize approximately $30 million of savings from NFI Forward in 2021, and to reach cumulative savings of approximately $47 million at the end of 2021, starting from the inception of the program in the third quarter of 2020. The lower end of the Adjusted EBITDA range is based on scenarios where production is negatively impacted by slower market recovery, limited ongoing impacts of COVID-19 and delays in achieving cost reductions from the NFI Forward initiative.

- Cash Capital Expenditures: Fiscal 2021 cash capital expenditures are expected to be allocated between maintenance and NFI Forward projects, based on approximately a seventy/thirty percent split.

- Adjusted ETR: The Adjusted Effective Tax Rate is based on current tax rates in the jurisdictions in which NFI operates, anticipated financial results, the Company's corporate structure and the assumption that there will not be significant changes in applicable tax rates in 2021.

- COVID-19: Management has assumed that the impact of COVID-19 on the Company's business in 2021 will be significantly lower than in 2020, including no significant idling of any of the Company's facilities, increased buying activity from customers and limited supply disruptions. The overall impact of COVID-19 is expected to reduce steadily through the end of 2021.

Management cautions readers that the consolidated NFI Group's annual results have an element of seasonality due to the nature of each unique market segment and the varied annual production and vacation schedule of each production facility. With the addition of ADL, this has become even more pronounced with the third and fourth quarters now being periods with higher delivery volumes. Management anticipates that on a year-over-year basis the first quarter of 2021 results will be lower than the same period in 2020, while the other three quarters of the year should see improvement from 2020 results. Management also advises readers that NFI's first quarter, second and third quarters are 13-week periods, while the fourth quarter is a 14-week period for a 53-week fiscal year.

Strengthening the Balance Sheet

Proceeds of C$250 million received from the Company's Offering are being utilized to reduce the outstanding balance under NFI's revolving senior credit facility. This is expected to strengthen NFI's balance sheet, reduce leverage and interest expense, and significantly increase liquidity. NFI believes that this will provide the Company with additional financial flexibility to attract new investors and to pursue its operational and strategic objectives, which include investments in NFI's zero-emission products and electric propulsion technology, investments required under the previously disclosed NFI Forward cost-reduction initiative and investigating other potential growth opportunities, in addition to continuing to return capital to shareholders through dividends.

NFI Forward Update

On July 27, 2020, NFI responded to the impacts of COVID-19 by launching its transformative cost reduction initiative, NFI Forward, to significantly reduce manufacturing overhead and selling, general and administration ("SG&A") from 2019 levels. NFI Forward initiatives are on track to meet management's previously announced expectations.

Management continues to expect that the aggregate programs of NFI Forward will drive approximately $67.0 million in annual Adjusted EBITDA savings, plus an additional $10.0 million in annualized Free Cash Flow generation, driven by interest savings and lower lease payments. NFI Forward is expected to deliver an 8% to 10% reduction in both manufacturing overhead and SG&A expenses, based on 2019 production rates, with investments of approximately $15 million to $20 million required to deliver these savings. In 2020, the NFI Forward initiative has achieved approximately $17.0 million in Adjusted EBITDA savings, and a further $1.0 million in Free Cash Flow savings. These savings appear in NFI's gross margins and Adjusted EBITDA, as a reduction to direct material costs, manufacturing overhead, and SG&A.

In addition to the focus on cost savings and additional Free Cash Flow generation, management is also prioritizing working capital improvements through the NFI Forward initiative and other strategic projects aimed at improving supplier payment terms, accounts payable turns and inventory turnover, with specific focus on private vehicle inventory.

SELECTED QUARTERLY AND ANNUAL FINANCIAL AND OPERATING INFORMATION

The following selected unaudited interim condensed consolidated and audited annual consolidated financial and operating information of the Company has been derived from and should be read in conjunction with the historical and current Financial Statements of the Company.

(U.S. dollars in thousands, except per Share figures)

Fiscal Period	Quarter	Revenue	Earnings (loss) from operations	Net earnings (loss)	Adjusted EBITDA[1]	Earnings (loss) per Share
2020						
	Q4	$ 711,523	$ 32,531	$ 8,465	$ 64,956	$ 0.14
	Q3	663,934	(16,453)	(24,912)	60,885	(0.40)
	Q2	333,334	(72,001)	(74,050)	(24,229)	(1.18)
	Q1	710,384	(25,406)	(67,239)	56,071	(1.08)
	Total	**$ 2,419,175**	**$ (81,329)**	**$ (157,736)**	**$ 157,683**	**$ (2.52)**
2019						
	Q4	$ 917,741	$ 69,958	$ 34,127	$ 103,875	$ 0.55
	Q3	725,347	25,200	(1,085)	76,868	(0.02)
	Q2	683,353	37,000	8,507	81,122	0.14
	Q1	566,995	40,906	16,149	60,302	0.26
	Total	**$ 2,893,436**	**$ 173,064**	**$ 57,698**	**$ 322,167**	**$ 0.93**
2018						
	Q4	$ 662,020	$ 60,570	$ 42,815	$ 79,868	$ 0.69
	Q3	605,342	53,469	37,031	70,245	0.59
	Q2	673,025	72,063	49,740	91,400	0.81
	Q1	578,634	51,753	30,356	73,841	0.48
	Total	**$ 2,519,021**	**$ 237,855**	**$ 159,942**	**$ 315,354**	**$ 2.56**

COMPARISON OF FOURTH QUARTER 2020 RESULTS

(U.S. dollars in thousands)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Statement of Earnings Data				
Revenue				
North America	$ 483,011	$ 617,553	$ 1,651,144	$ 2,142,895
United Kingdom and Europe	88,900	154,820	268,916	277,669
Asia Pacific	35,930	28,202	97,669	55,456
Other	—	—	—	—
Manufacturing operations	607,841	800,575	2,017,729	2,476,020
North America	76,704	93,053	315,415	365,304
United Kingdom and Europe	17,696	19,549	63,596	42,447
Asia Pacific	8,625	3,775	20,075	8,247
Other	657	789	2,360	1,418
Aftermarket operations	103,682	117,166	401,446	417,416
Total revenue	$ 711,523	$ 917,741	$ 2,419,175	$ 2,893,436
Earnings (loss) from operations	$ 32,531	$ 69,958	$ (81,329)	$ 173,064
Earnings (loss) before interest and income taxes	$ 36,023	$ 71,546	$ (72,223)	$ 173,050
Net earnings (loss)	$ 8,465	$ 34,127	$ (157,736)	$ 57,698
Adjusted EBITDA[1]	$ 64,956	$ 103,875	$ 157,683	$ 322,167
Capital expenditures	$ 9,686	$ 7,618	$ 27,016	$ 41,757

[1]Non-IFRS Measure - See Appendix A for details.

RECONCILIATION OF NET EARNINGS (LOSS) TO ADJUSTED EBITDA

Management believes that Adjusted EBITDA is an important measure in evaluating the historical operating performance of the Company. However, Adjusted EBITDA is not a recognized earnings measure under IFRS and does not have a standardized meaning prescribed by IFRS. Accordingly, Adjusted EBITDA may not be comparable to similar measures presented by other issuers. Readers of this MD&A are cautioned that Adjusted EBITDA should not be construed as an alternative to net earnings or loss determined in accordance with IFRS as indicators of the Company's performance, or cash flows from operating activities determined in accordance with IFRS as a measure of liquidity and cash flow. The Company defines and has computed Adjusted EBITDA as described under "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share" in Appendix A. The following tables reconcile net earnings or losses to Adjusted EBITDA based on the historical Financial Statements of the Company for the periods indicated.

(U.S. dollars in thousands)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Net earnings (loss)	$ 8,465	$ 34,127	$ (157,736)	$ 57,698
Addback[1]				
Income taxes	12,987	26,118	1,644	41,997
Interest expense	14,571	11,301	83,869	73,355
Amortization	26,126	31,134	110,784	104,570
Loss (gain) on disposition of property, plant and equipment	(257)	52	(56)	(46)
Fair value adjustment for total return swap[11]	(1,584)	273	118	949
Unrealized foreign exchange loss (gain) on non-current monetary items and forward foreign exchange contracts	(3,237)	(1,640)	(9,050)	60
Costs (recoveries) associated with assessing strategic and corporate initiatives[8]	165	(616)	1,396	13,069
Past service costs[13] and other pension costs (recovery)	7	70	(408)	(1,601)
Non-recurring costs (recoveries) relating to business acquisition	—	364	—	365
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue[10]	—	2,156	—	31,004
Proportion of the total return swap realized[12]	641	(203)	(525)	(626)
Equity settled stock-based compensation	608	437	1,770	1,566
Recovery on currency transactions[14]	—	—	—	(4,287)
Prior year sales tax provision [15]	37	300	184	4,094
Extraordinary COVID-19 costs[16]	5,413	—	47,362	—
Impairment loss on goodwill[17]	—	—	50,790	—
Non-recurring restructuring costs[9]	1,014	—	27,541	—
Adjusted EBITDA[1]	$ 64,956	$ 103,875	$ 157,683	$ 322,167
Adjusted EBITDA is comprised of:				
Manufacturing	$ 54,263	$ 85,715	$ 101,964	$ 256,097
Aftermarket	$ 17,103	$ 18,413	$ 66,748	$ 74,572
Corporate	$ (6,410)	$ (254)	$ (11,029)	$ (8,502)

(Footnotes on page 26 and 27)

SUMMARY OF FREE CASH FLOW

Management uses Free Cash Flow as a non-IFRS measure to evaluate the Company's operating performance and liquidity and to assess the Company's ability to pay dividends on the Shares, service debt, and meet other payment obligations.

The Company generates its Free Cash Flow from operations and management expects this will continue to be the case for the foreseeable future. Net cash flows generated from operating activities are significantly impacted by changes in non-cash working capital. The Company uses its credit facilities to finance working capital and therefore has excluded the impact of working capital in calculating Free Cash Flow.

The following is a reconciliation of net cash generated by operating activities (an IFRS measure) to Free Cash Flow (a non-IFRS measure) based on the Company's historical Financial Statements. See "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share" in Appendix A.

(U.S. dollars in thousands, except per Share figures)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Net cash generated by operating activities	$ 88,105	$ 163,761	$ 66,061	$ 98,608
Changes in non-cash working capital items[4]	(50,191)	(85,382)	(68,762)	91,324
Interest paid[4]	15,913	15,447	63,307	47,676
Interest expense[4]	(15,231)	(15,631)	(61,835)	(50,546)
Income taxes paid[4]	4,124	7,228	26,693	40,167
Current income tax expense[4]	(5,733)	(30,842)	(26,580)	(61,339)
Principal portion of finance lease payments	(7,829)	(1,400)	(18,887)	(12,456)
Cash capital expenditures	(9,447)	(6,968)	(25,703)	(37,575)
Proceeds from disposition of property, plant and equipment	2,259	—	2,765	174
Costs (recovery) associated with assessing strategic and corporate initiatives[8]	165	(616)	1,396	13,069
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue [10]	—	2,156	—	31,004
Defined benefit funding[5]	1,118	1,969	5,507	8,140
Defined benefit expense[5]	(756)	(1,322)	(5,307)	(5,849)
Past service costs[13] and other pension costs (recovery)	7	70	(408)	(1,601)
Proportion of the total return swap[12]	641	(203)	(525)	(626)
Recovery on currency transactions[14]	—	—	—	(4,287)
Prior year sales tax provision [15]	37	300	185	4,094
Non-recurring restructuring costs[9]	446	364	22,216	364
Extraordinary COVID-19 costs[16]	5,413	—	$ 47,362	—
Foreign exchange gain (loss) on cash held in foreign currency[6]	(28)	102	(11)	83
Free Cash Flow[2]	$ 29,013	$ 49,033	$ 27,474	$ 160,424
U.S. exchange rate[3]	1.2869	1.3076	1.2645	1.3180
Free Cash Flow (C$)[2]	39,561	64,116	34,741	211,439
Free Cash Flow per Share (C$)[7]	0.6327	1.0269	0.5558	3.4200
Declared dividends on Shares (C$)	13,287	26,561	53,140	105,462
Declared dividends per Share (C$)[7]	$ 0.2125	$ 0.4253	$ 0.8500	$ 1.7062

(1) Adjusted EBITDA is not a recognized earnings measure and does not have standardized meaning prescribed by IFRS. Therefore, Adjusted EBITDA may not be comparable to similar measures presented by other issuers. See "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Net Earnings per Share" in Appendix A. Management believes that Adjusted EBITDA is a useful supplemental measure in evaluating performance of the Company.

(2) Free Cash Flow is not a recognized measure under IFRS and does not have a standardized meaning prescribed by IFRS. Therefore, Free Cash Flow may not be comparable to similar measures presented by other issuers. See Appendix A for "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share".

(3) U.S. exchange rate (C$ per US$) is the weighted average exchange rate applicable to dividends declared for the period.

(4) Changes in non-cash working capital are excluded from the calculation of Free Cash Flow as these temporary fluctuations are managed through the credit facilities which are available to fund general corporate requirements, including working capital

requirements, subject to borrowing capacity restrictions. Changes in non-cash working capital are presented on the consolidated statements of cash flows net of interest and incomes taxes paid.

(5) The cash effect of the difference between the defined benefit expense and funding is included in the determination of cash from operating activities. This cash effect is excluded in the determination of Free Cash Flow as management believes that the defined benefit expense amount provides a more appropriate measure, as the defined benefit funding can be impacted by special payments to reduce the unfunded pension liability.

(6) Foreign exchange loss on cash held in foreign currency is excluded in the determination of cash from operating activities under IFRS; however, because it is a cash item, management believes it should be included in the calculation of Free Cash Flow.

(7) Per Share calculations for Free Cash Flow (C$) are determined by dividing Free Cash Flow by the total number of all issued and outstanding Shares using the weighted average over the period. The weighted average number of Shares outstanding for 2020 Q4 was 62,524,842 and 62,434,520 for 2019 Q4. The weighted average number of Shares outstanding for Fiscal 2020 and Fiscal 2019 are 62,510,544 and 61,809,479, respectively. Per Share calculations for declared dividends (C$) are determined by dividing the amount of declared dividends by the number of outstanding Shares at the respective period end date.

(8) Normalized to exclude non-recurring expenses and recoveries related to the costs of assessing strategic and corporate initiatives.

(9) Normalized to exclude non-recurring restructuring costs. Free Cash Flow reconciling item is net of right-of-use asset and property, plant and equipment impairments. Fourth quarter costs relate to production reductions and the NFI Forward initiative and include severance costs of $0.4 million (Fiscal 2020 - $19.8 million) and right-of-use asset impairments of $0.6 million (Fiscal 2020 - $3.6 million). Fiscal 2020 costs also include severance expense of $19.8 million, right-of-use asset impairments of $3.6 million, inventory impairments of $1.8 million, property, plant and equipment impairments of $1.7 million and other miscellaneous costs of $0.6 million.

(10) The revaluation of ADL's inventory included an adjustment of $31.0 million in Fiscal 2019. These revaluation adjustments relate to purchase accounting as a result of the related acquisition.

(11) The fair value adjustment of the total return swap is a non-cash (gain) loss that is deducted from the definition of Adjusted EBITDA.

(12) A portion of the fair value adjustment of the total return swap is added to Adjusted EBITDA and Free Cash Flow to match the equivalent portion of the related deferred compensation expense recognized.

(13) In 2019 Q3, the Company received $1.6 million recovery related to the closing of one of its pension plans. An additional amount of $0.4 million was received in 2020 Q1.

(14) Recovery of prior period banking fees related to foreign exchange transactions.

(15) Provision for sales taxes as a result of an ongoing state sales tax review.

(16) Normalized to exclude non-recurring COVID-19 related costs. COVID-19 costs include asset impairments of $4.6 million in 2020 Q4 (Fiscal 2020 - $43.6 million). Fourth quarter asset impairments included a parts inventory impairment of $1.9 million, an ADL private coach impairment of $1.7 million and an ADL pre-owned coach impairment of $1.0 million. Fiscal 2020 asset impairments include pre-owned coach write-downs of $36.6 million. Also included in COVID-19 costs are other operating costs of $0.8 million in 2020 Q4 and $3.8 million in Fiscal 2020 that include but are not limited to the purchase of personal protective equipment and plant sanitation activities. Management will continue to assess the costs for COVID-19 and will make an assessment of whether they are deemed in fact to be one time and non-recurring. As more information becomes available, management may change its assessment.

(17) Impairment charge with respect to MCI's goodwill.

RECONCILIATION OF NET EARNINGS (LOSS) TO ADJUSTED NET EARNINGS (LOSS)

Adjusted Net Earnings (Loss) and Adjusted Earnings (Loss) per Share are not recognized measures under IFRS and do not have a standardized meaning prescribed by IFRS. Accordingly, Adjusted Net Earnings (Loss) (Loss) and Adjusted Earnings (Loss) (Loss) per Share may not be comparable to similar measures presented by other issuers. Readers of this MD&A are cautioned that Adjusted Net Earnings (Loss) and Adjusted Earnings (Loss) per Share should not be construed as an alternative to Net Earnings, or Net Earnings per Share, determined in accordance with IFRS as indicators of the Company's performance. The Company defines and has computed Adjusted Net Earnings and Adjusted Earnings per Share under "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share" in Appendix A. The following tables reconcile net earnings (loss) to Adjusted Net Earnings (Loss) based on the historical Financial Statements of the Company for the periods indicated.

(U.S. dollars in thousands, except per Share figures)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Net earnings (loss)	8,465	34,127	(157,736)	57,698
Adjustments, net of tax [1] [8]				
Fair value adjustments of total return swap[5]	(1,093)	145	81	549
Unrealized foreign exchange (gain) loss	(2,233)	(981)	(6,245)	35
Unrealized loss (gain) on interest rate swap	(2,277)	(3,115)	12,199	12,721
Impairment loss on goodwill[11]	—	—	50,790	—
Portion of the total return swap realized[6]	443	(109)	(362)	(362)
Costs (recovery) associated with assessing strategic and corporate initiatives[2]	165	(616)	1,396	13,069
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue[4]	—	707	—	17,943
Equity settled stock-based compensation	419	231	1,221	906
Gain (loss) on disposition of property, plant and equipment	(178)	32	(39)	(27)
Past service costs[7] and other pension costs (recovery)	4	71	(282)	(927)
Recovery on currency transactions[9]	—	80	—	(2,481)
Prior year sales tax provision [10]	26	102	127	2,369
Extraordinary COVID-19 costs [12]	3,735	—	32,680	—
Non-recurring restructuring costs [3]	700	211	19,003	211
Adjusted Net Earnings (Loss)	$ 8,176	30,885	$ (47,167)	101,704
Earnings (Loss) per Share (basic)	$ 0.14	$ 0.55	$ (2.52)	$ 0.93
Earnings (Loss) per Share (fully diluted)	$ 0.14	$ 0.55	$ (2.52)	$ 0.93
Adjusted Earnings (Loss) per Share (basic)	$ 0.13	$ 0.49	$ (0.75)	$ 1.65
Adjusted Earnings (Loss) per Share (fully diluted)	$ 0.13	$ 0.49	$ (0.75)	$ 1.64

1. Addback items are derived from the historical Financial Statements of the Company.
2. Normalized to exclude non-recurring expenses related to the costs of assessing strategic and corporate initiatives.
3. Normalized to exclude non-recurring restructuring costs. Fourth quarter costs relate to production reductions and the NFI Forward initiative and include severance costs of $0.3 million and right-of-use asset impairments of $0.4 million.
4. The revaluation of ADL's inventory included an adjustment of $31.0 million in Fiscal 2019. The after-tax value of the adjustment was $17.9 million. These revaluation adjustments relate to purchase accounting as a result of the related acquisition.
5. The fair value adjustment of the total return swap is a non-cash (gain) loss that is excluded from the definition of Adjusted Net Earnings (Loss).
6. A portion of the fair value adjustment of the total return swap is excluded from Adjusted Net Earnings (Loss) to match the equivalent portion of the related deferred compensation expense recognized.

7. In 2019 Q3, the Company received $1.0 million recovery related to the closing of one of its pension plans. An additional amount of $0.3 million was received in 2020 Q1.
8. For 2020 Q4 and Fiscal 2020, the Company has utilized a rate of 31% to tax effect the adjustments.
9. Recovery of prior period banking fees related to foreign exchange transactions.
10. Provision for sales taxes as a result of an ongoing state tax review.
11. Impairment charge with respect to MCI's goodwill.
12. Normalized to exclude non-recurring COVID-19 related costs. COVID-19 costs include asset impairments of $3.2 million in 2020 Q4 (Fiscal 2020 - $30.1 million). Fourth quarter asset impairments included a parts inventory impairment of $1.3 million, an ADL private coach impairment of $1.2 million and an ADL pre-owned coach impairment of $0.7 million. Fiscal 2020 asset impairments include pre-owned coach write-downs of $25.1 million. Also included in COVID-19 costs are other operating costs of $0.6 million in 2020 Q4 and $2.6 million in Fiscal 2020 that include but are not limited to the purchase of personal protective equipment and plant sanitation activities. Management will continue to assess the costs for COVID-19 and will make an assessment of whether they are deemed in fact to be one time and non-recurring. As more information becomes available, management may change its assessment.

Results of Operations

The discussion below with respect to revenue, operating costs and expenses and earnings from operations has been divided between the Manufacturing and Aftermarket operations segments.

Revenue

(U.S. dollars in thousands)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Manufacturing Revenue	607,841	800,575	2,017,729	2,476,020
Aftermarket Revenue	103,682	117,166	401,446	417,416
Total Revenue	$ 711,523	$ 917,741	$ 2,419,175	$ 2,893,436
Earnings (loss) from Operations	$ 32,531	$ 69,958	$ (81,329)	$ 173,064
Earnings (loss) before interest and income taxes	36,023	71,546	(72,223)	173,050
Earnings (loss) before income tax expense	21,453	60,245	(156,092)	99,695
Net earnings (loss)	8,465	34,127	(157,736)	57,698

Manufacturing revenue for 2020 Q4 decreased by $192.8 million, or 24.1%, compared to 2019 Q4. Manufacturing revenue for Fiscal 2020 decreased by $458.3 million, or 18.5%, compared to Fiscal 2019. Fourth quarter figures were lower in 2020 primarily as a result of the Company reducing production volumes in response to public customer order delays and private customer order deferrals, which were both attributable to the COVID-19 pandemic. Fiscal 2020 figures were significantly impacted by the idling of production facilities in the second quarter of 2020. The comparative year decrease was partially offset by the May 2019 acquisition of ADL and higher Infrastructure Solutions revenue.

Revenue from aftermarket operations in 2020 Q4 decreased by $13.5 million, or 11.5%, compared to 2019 Q4. Revenue from aftermarket operations for Fiscal 2020 decreased by $16.0 million, or 3.8%, compared to Fiscal 2019. The decline in both periods were driven by lower private sector parts volumes within both the NFI parts and ADL parts businesses, partially offset by $1.1 million of Clean and Protect product line sales. The acquisition of ADL partially offset the COVID-19 related revenue decline in the fiscal-year comparative.

Cost of sales

(U.S. dollars in thousands)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Manufacturing				
Direct cost of sales	$ 478,509	$ 602,508	$ 1,620,299	$ 1,868,917
Depreciation and amortization	23,437	28,531	100,269	94,246
Other overhead	46,952	67,157	208,100	221,317
Manufacturing cost of sales	$ 548,898	$ 698,196	$ 1,928,668	$ 2,184,480
As percent of Manufacturing Sales	90.3 %	87.2 %	95.6 %	88.2 %
Aftermarket				
Direct cost of sales	$ 73,771	$ 78,965	$ 280,737	$ 285,151
Depreciation and amortization	2,688	2,603	10,515	10,323
Aftermarket cost of sales	$ 76,459	$ 81,568	$ 291,252	$ 295,474
As percent of Aftermarket Sales	73.7 %	69.6 %	72.6 %	70.8 %
Total Cost of Sales	$ 625,357	$ 779,764	$ 2,219,920	$ 2,479,954
As percent of Sales	87.9 %	85.0 %	91.8 %	85.7 %

The consolidated cost of sales for 2020 Q4 decreased by $154.4 million, or 19.8%, compared to 2019 Q4. The consolidated cost of sales for Fiscal 2020 decreased by $260.0 million, or 10.5%, compared to Fiscal 2019.

Cost of sales from Manufacturing operations in 2020 Q4 was $548.9 (90.3% of Manufacturing operations revenue) compared to $698.2 million (87.2% of Manufacturing operations revenue) in 2019 Q4, a decrease of $149.3 million or 21.4%. Cost of sales increased as a percentage of revenue mainly as a result of lower production volumes absorbing more fixed overhead on a per unit basis. Cost of sales also increased as a percentage of revenue as a result of the Company incurring extraordinary, COVID-19 related costs, including a $2.7 million lower of cost or net realizable value adjustment on ADL motor coach inventory. The cost of sales increase as a percentage of revenue was increased further

by non-recurring restructuring costs of $1.0 million. The cost of sales increase as a percentage of revenue was partially offset by NFI Forward savings, and government grants of $10.5 million, which were netted against wages in the presentation of cost of sales.

Cost of sales from Manufacturing operations in Fiscal 2020 was $1,928.7 million (95.6% of Manufacturing operations revenue) compared to $2,184.5 million (88.2% of Manufacturing operations revenue) in Fiscal 2019, a decrease of $255.8 million or 11.7%. Cost of sales increased as a percentage of revenue mainly due to lower production volumes absorbing more fixed overhead on a per unit basis, primarily as a result of the Company idling production facilities for the majority of Q2 2020. Cost of sales also increased as a percentage of revenue as a result of the Company incurring expenses related to COVID-19 and restructuring activities. The cost of sales increase as a percentage of revenue was partially offset by NFI Forward savings of $8.4 million and government grants of $46.7 million, which were netted against wages in the presentation of cost of sales. Cost of sales as a percentage of revenue also improved as a result of improvements at the Company's parts fabrication facility.

Cost of sales from Aftermarket operations in 2020 Q4 was $76.5 million (73.7% of Aftermarket revenue) compared to $81.6 million (69.6% of Aftermarket revenue) in 2019 Q4, a decrease of $5.1 million or 6.3%. Cost of sales from Aftermarket operations in Fiscal 2020 was $291.3 million (72.6% of Aftermarket revenue) compared to $295.5 million (70.8% of Aftermarket revenue) in Fiscal 2019, a decrease of $4.2 million or 1.4%. Cost of sales as a percentage of revenue was higher year-over-year as the Company had lower sales volumes to cover depreciation and amortization expense. Cost of sales was also impacted by a COVID-19 related impairment charge of $1.9 million in 2020 Q4.

Gross Margins

(U.S. dollars in thousands)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Manufacturing	$ 58,943	$ 102,378	$ 89,060	$ 291,540
Aftermarket	27,223	35,600	110,195	121,942
Total Gross Margins	$ 86,166	$ 137,978	$ 199,255	$ 413,482
As a percentage of sales				
Manufacturing	9.7 %	12.8 %	4.4 %	11.8 %
Aftermarket	26.3 %	30.4 %	27.4 %	29.2 %
	12.1 %	15.0 %	8.2 %	14.3 %

Manufacturing gross margins for 2020 Q4 of $58.9 million (9.7% of revenue), decreased by $43.5 million, or 42.5%, compared to $102.4 million (12.8% of revenue) for 2019 Q4. Manufacturing gross margins for Fiscal 2020 of $89.1 million (4.4% of revenue), decreased by $202.5 million, or 69.5%, compared to Fiscal 2019.

The decrease in gross margins as a percentage of revenue for both periods is mainly due to lower production volumes absorbing more fixed overhead on a per unit basis. Gross margins also decreased as a percentage of revenue as a result of the Company incurring expenses related to COVID-19 and restructuring. Gross margin decline was partially offset by NFI Forward overhead savings and government grants, which were netted against direct labor wages in the presentation of cost of sales. NFI Forward achieved gross margin improvements through direct labour headcount reductions and production facility rationalizations. The gross margin decline was also partially offset by improvements at the Company's parts fabrication facility, which achieved a relative gross margin improvement of 43.9% in 2020 Q4, compared to 2019 Q4.

Gross margins from Aftermarket operations in 2020 Q4 of $27.2 million (26.3% of revenue) decreased by $8.4 million, or 23.6%, compared to 2019 Q4 gross margins of $35.6 million (30.4% of revenue). Gross margins from Aftermarket operations in Fiscal 2020 of $110.2 million (27.4% of revenue) decreased by $11.7 million, or 9.6%, compared to Fiscal 2019 gross margins of $121.9 million (29.2% of revenue). Margins were lower due to lower sales volumes and a COVID-19 related impairment charge of $1.9 million in 2020 Q4.

Selling, general and administrative costs and other operating expenses ("SG&A")

(U.S. dollars in thousands)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Selling expenses	$ 12,327	$ 7,052	$ 28,579	$ 23,739
General and administrative expenses	41,791	62,055	193,868	205,270
Other costs	1,434	(528)	8,856	12,445
Total SG&A	$ 55,552	$ 68,579	$ 231,303	$ 241,454

The consolidated SG&A for 2020 Q4 of $55.6 million (7.8% of consolidated revenue) decreased by $13.0 million, or 19.0%, compared to $68.6 million (7.5% of consolidated revenue) in 2019 Q4. The consolidated SG&A for Fiscal 2020 of $231.3 (9.6% of consolidated revenue) decreased by $10.2 million, or 4.2%, compared to $241.5 million (8.3% of consolidated revenue) in Fiscal 2019.

The decrease in 2020 Q4 is related to NFI Forward savings and government grants, which were netted against expenses in the presentation of SG&A. The quarterly decline was offset by extraordinary COVID-19 related costs and one-time, non-recurring restructuring costs related to NFI Forward. The year-over-year decrease was due to NFI Forward savings of $8.6 million and government grants of $6.8 million. The year-over-year decrease was partially offset by non-recurring restructuring costs, extraordinary COVID-19 costs, and the acquisition of ADL.

Realized foreign exchange loss/gain

During 2020 Q4, the Company recorded a realized foreign exchange gain of $1.9 million compared to a gain of $0.6 million in 2019 Q4.

During Fiscal 2020, the Company recorded a realized foreign exchange gain of $1.5 million compared to a gain of $1.0 million in Fiscal 2019.

The Company uses foreign exchange forward contracts to buy various currencies in which it operates with U.S. dollars, Canadian dollars and British Pounds Sterling ("GBP"). The purchase of these currencies using foreign exchange forward contracts at favorable forward rates compared to the spot rates at settlement were the primary reason for the gains.

Earnings (loss) from operations

Consolidated earnings from operations in 2020 Q4 were $32.5 million (4.6% of consolidated revenue) compared to earnings of $70.0 million (7.6% of consolidated revenue) in 2019 Q4, a decrease of $37.5 million or 53.6%. Consolidated losses from operations in Fiscal 2020 were $81.3 million (-3.4% of consolidated revenue) compared to earnings of $173.1 million (6.0% of consolidated revenue) in Fiscal 2019, a decrease of $254.4 million or 147.0%.

2020 Q4 Earnings from operations related to Manufacturing operations were $23.1 million (3.8% of Manufacturing revenue) compared to earnings of $56.5 million (7.1% of Manufacturing revenue) in 2019 Q4, a decrease of $33.4 million or 59.1%. Losses from operations related to Manufacturing operations in Fiscal 2020 were $125.1 million (-6.2% of Manufacturing revenue) compared to earnings of $112.7 million (4.6% of Manufacturing revenue) in Fiscal 2019, a decrease of $237.8 million or 211.0%. The decrease in 2020 Q4 as a percentage of revenues is primarily due to lower production volumes, exceptional COVID-19 costs of $3.5 million and non-recurring restructuring costs of $1.0 million, partially offset by government grants of $11.3 million. The decrease in Fiscal 2020 as a percentage of revenue is also due to lower volumes, exceptional COVID-19 costs of $44.9 million, non-recurring restructuring costs of $27.4 million and a goodwill impairment charge of $50.8 million. The year-over-year decrease was offset by government grants of $53.5 million, NFI Forward savings of $17.0 million and improvements at KMG.

Earnings from operations related to Aftermarket operations in 2020 Q4 were $12.4 million (12.0% of Aftermarket revenue) compared to $15.5 million (13.3% of Aftermarket revenue) in 2019 Q4, a decrease of $3.1 million or 20.0%. Earnings from operations related to Aftermarket operations in Fiscal 2020 were $53.6 million (13.4% of Aftermarket revenue) compared to $64.0 million (15.3% of Aftermarket revenue) in Fiscal 2019, a decrease of $10.4 million or 16.3%. The 2020 Q4 decrease as a percentage of revenue is a result of lower sales volumes and a COVID-19 related impairment charge of $1.9 million. The decrease as a percentage of revenue for Fiscal 2020 is also a result of lower sales volumes and COVID-19 related costs.

Unrealized foreign exchange gain/loss

The Company has recognized a net unrealized foreign exchange (gain) loss consisting of the following:

(U.S. dollars in thousands)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Unrealized (gain) loss on forward foreign exchanges contracts	$ (1,377)	$ (1,475)	$ (8,272)	$ (1,797)
Unrealized (gain) loss on other long-term monetary assets/liabilities	(1,860)	(165)	(778)	1,857
	$ (3,237)	$ (1,640)	$ (9,050)	$ 60

At December 27, 2020, the Company had $85.0 million of foreign exchange forward contracts to buy currencies in which the Company operates (U.S. dollars, Canadian dollars, or GBP). The related asset of $4.5 million (December 29, 2019: $3.7 million) is recorded on the audited consolidated statements of financial position as a current derivative financial instruments asset and the corresponding change in the fair value of the foreign exchange forward contracts is recorded in the audited consolidated statements of net earnings (loss) and total comprehensive income (loss).

Earnings (loss) before interest and income taxes ("EBIT")

In 2020 Q4, the Company recorded EBIT of $36.0 million compared to EBIT of $71.5 million in 2019 Q4. In Fiscal 2020, the Company recorded an EBIT loss of $72.2 million compared to EBIT of $173.1 million in Fiscal 2019. EBIT has been impacted by non-cash and non-recurring items as follows:

(U.S. dollars in thousands)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Non-cash and non-recurring charges:				
Costs (recoveries) associated with assessing strategic and corporate initiatives	$ 165	$ (616)	$ 1,396	$ 13,069
Unrealized foreign exchange (gain) loss	(3,237)	(1,640)	(9,050)	60
Equity settled stock-based compensation	608	437	1,770	1,566
Loss (gain) on disposition of property, plant and equipment	(257)	52	(56)	(46)
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue	—	2,156	—	31,004
Fair value adjustment of total return swap	(1,584)	273	118	949
Past service costs recovery	7	—	(408)	—
Recovery on currency transactions	—	—	—	(4,287)
Extraordinary COVID-19	5,413	—	47,362	—
Prior year sales tax provision	37	300	184	4,094
Impairment loss on goodwill	—	—	50,790	—
Portion of the total return swap realized	641	(203)	(525)	(626)
Non-recurring restructuring costs	1,014	—	27,541	—
Amortization	26,126	31,135	110,784	104,570
Total non-cash and non-recurring charges:	$ 28,933	$ 31,894	$ 229,906	$ 150,353

Interest and finance costs

The interest and finance costs for 2020 Q4 of $14.6 million increased by $3.3 million when compared 2019 Q4. The increase is primarily due to carrying costs associated with the Sidecar and interest costs incurred on the new UK Facility. The Sidecar was entered in April 2020, to provide additional liquidity, if required, during the temporary idling of production facilities due to COVID-19. The Sidecar was not used and was terminated in December 2020. The UK Facility was entered in May 2020, to support ADL's operations in the UK. Interest and finance costs were also higher due to a fair market value gain on interest rate swap of $3.3 million in 2020 Q4 compared to a gain of $4.5 million in 2019 Q4.

The interest and finance costs for Fiscal 2020 of $83.9 million increased by $10.5 million when compared to Fiscal 2019. The increase is primarily due to increased interest on long-term debt of $9.6 million due to higher average Credit Facility draws for the acquisition of ADL and to finance fixed operating expenses during the temporary idling of production facilities due to COVID-19. The increase is also due to carrying costs associated with the Sidecar and interest on the new UK Facility. The increase was partially offset by a fair market value loss on interest rate swap of $17.7 million in Fiscal 2020, compared to a loss of $22.0 million in Fiscal 2019.

The losses on the interest rate swap relate to risk management activities management has undertaken to reduce the uncertainty related to the Company's cost of borrowing. The interest rate swap fixes the interest rate which the Company will pay on $600.0 million of its long-term debt at 2.27% plus an applicable margin. The fixed portion amortizes $20 million annually and matures in October 2023. The Company has a second interest rate swap on $200 million of its long-term debt on which the Company will pay 0.243% plus an applicable margin and matures in July 2025. The Company's accounting policy is to not designate these types of instruments as accounting hedges. As a result, interest rate increases will result in mark-to-market gains, while interest rate decreases will result in mark-to-market losses.

Earnings (loss) before income taxes ("EBT")

EBT for 2020 Q4 of $21.5 million decreased by $38.7 million compared to EBT of $60.2 million in 2019 Q4. EBT for Fiscal 2020 of $156.1 million loss decreased by $255.8 compared to EBT of $99.7 million in Fiscal 2019. The primary drivers of the changes to EBT are addressed in the Earnings from Operations, EBIT, and Interest and finance costs sections above.

Income tax expense

The income tax expense for 2020 Q4 was $13.0 million, compared to $26.1 million expense in 2019 Q4. The ETR for 2020 Q4 was 60.5% and the ETR for 2019 Q4 was 43.4%. The reduction in the overall income tax expense is primarily due to lower earnings before taxes. The ETR is negatively impacted by the base erosion and anti-abuse tax ("BEAT") and a write-off of unapplied foreign tax credits.

The income tax for Fiscal 2020 was $1.6 million compared to $42.0 million expense in Fiscal 2019. The ETR for Fiscal 2020 was negative 1.1% and the ETR for Fiscal 2019 was 42.1%. The reduction in the overall income tax expense is primarily due to lower earnings before taxes. The ETR is negatively impacted by the Company incurring non-deductible interest, revaluing UK deferred tax liabilities as a result of a reversal of a previously enacted rate reduction, the non-deductible goodwill impairment charge in 2020 Q1, BEAT and a write-off of unapplied foreign tax credits.

Net earnings (loss)

The Company reported net earnings of $8.5 million in 2020 Q4, a decrease of 75.1% compared to net earnings of $34.1 million in 2019 Q4. The Company reported a net loss of $157.7 million in Fiscal 2020, a decrease of 373.3% compared to net earnings of $57.7 million in Fiscal 2019. The decrease in net earnings is due to lower production volumes, exceptional COVID-19 costs and non-recurring restructuring costs associated with production reductions and the NFI Forward initiative. The decrease was partially offset by government grants and NFI Forward savings. The Fiscal 2020 results were also lower as a result of a $50.8 million goodwill impairment charge related to private motor coach operations, incurred in the first quarter.

Net earnings (loss) (U.S. dollars in millions, except per Share figures)	**2020 Q4**	**2019 Q4**	**Fiscal 2020**	**Fiscal 2019**
Earnings (loss) from operations	$ 32.5	$ 70.0	$ (81.3)	$ 173.1
Non-cash gain	3.6	1.5	9.1	—
Interest expense	(14.6)	(11.3)	(83.9)	(73.4)
Income tax expense	(13.0)	(26.1)	(1.6)	(42.0)
Net earnings (loss)	$ 8.5	$ 34.1	$ (157.7)	$ 57.7
Net earnings (loss) per Share (basic)	$ 0.14	$ 0.55	$ (2.52)	$ 0.93
Net earnings (loss) per Share (fully diluted)	$ 0.14	$ 0.55	$ (2.52)	$ 0.93

The Company's net earnings per Share in 2020 Q4 of $0.14 decreased from net earnings per Share of $0.55 in 2019 Q4. The Company's net loss per Share in Fiscal 2020 of $2.52 decreased from net earnings per Share of $0.93 generated in Fiscal 2019. Net earnings per Share were lower in 2020 Q4 and Fiscal 2020 due to lower production volumes, exceptional COVID-19 related costs, non-recurring restructuring costs and goodwill impairment charges. The decrease was partially offset by government grants and NFI Forward savings.

Cash Flow

The cash flows of the Company are summarized as follows:

(U.S. dollars in thousands)	**2020 Q4**	**2019 Q4**	**Fiscal 2020**	**Fiscal 2019**
Cash generated by operating activities before non-cash working capital items and interest and income taxes paid	$ 57,951	$ 101,054	$ 87,299	$ 277,775
Interest paid	(15,913)	(15,447)	(63,307)	(47,676)
Income taxes paid	(4,124)	(7,228)	(26,693)	(40,167)
Net cash earnings (loss)	37,914	78,379	(2,701)	189,932
Cash flow generated by (used in) changes in working capital	50,191	70,891	68,762	(91,324)
Cash flow generated by operating activities	88,105	149,270	66,061	98,608
Cash flow from (used in) financing activities	(27,997)	(145,175)	(37)	298,011
Cash flow used in investing activities	(7,217)	(6,979)	(38,477)	(379,289)

Cash flows from operating activities

The 2020 Q4 net operating cash flow of $88.1 million is comprised of $37.9 million of net cash earnings and $50.2 million of cash generated by changes in working capital. The 2019 Q4 net operating cash flow of $149.3 million is comprised of $78.4 million of net cash earnings and $70.9 million of cash generated by changes in working capital.

The Fiscal 2020 net operating cash flow of $66.1 million is comprised of $2.7 million of net cash losses, offset by $68.8 million of cash generated by changes in working capital. The Fiscal 2019 net operating cash flow of $98.6 million is comprised of $189.9 million of net cash earnings, offset by working capital investment of $91.3 million.

Cash flow from financing activities

The cash outflow of $28.0 million during 2020 Q4 is comprised mainly of short-term debt repayments of $10.0 million, dividend payments of $9.9 million, and lease obligation payments of $7.8 million, offset by proceeds from long-term debt of $3.7 million. Lease obligation payments were higher as the Company made payments, related to previous quarters, that had been deferred to preserve cash during the idling of production facilities.

The cash inflow of $0.0 million during Fiscal 2020 is comprised mainly of proceeds from long-term debt of $72.1 million, offset by lease obligation payments of $18.9 million, dividends paid on shares of $49.4 million and debt issue costs of $3.9 million.

Cash flow from investing activities

(U.S. dollars in thousands)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Acquisition of intangible assets	$ (29)	$ (11)	$ (29)	$ (38)
Proceeds from disposition of property, plant and equipment	2,259	—	2,765	174
Long-term restricted deposits	—	—	(15,510)	(14,490)
Net cash used in acquisitions	—	—	—	(327,360)
Acquisition of property, plant and equipment	(9,447)	(6,968)	(25,703)	(37,575)
Cash from investing activities	$ (7,217)	$ (6,979)	$ (38,477)	$ (379,289)

Investing activities were higher in 2020 Q4, as the Company increased maintenance capital expenditures, after reducing expenditures during the second and third quarters to preserve cash during the pandemic. Yearly outflows from investing activities were lower as a result of the acquisition of ADL in 2019 Q2, as well as lower maintenance capital expenditures to preserve cash during the pandemic.

On January 20, 2016, the Company entered into a $482.0 million interest rate swap designed to hedge floating rate exposure on the $482.0 million Term Credit Facility under the Company's then current fifth amended and restated prior credit agreement. The interest rate swap fixed the interest rate at 1.154% plus the applicable interest margin. On February 13, 2019, the Company blended the unrealized gain from the then current swap into a $600.0 million notional interest rate swap designed to hedge floating rate exposure on the Company's current Credit Facility. The interest rate swap fixes the interest rate at 2.27% plus applicable margin until October 2023 and amortizes at a rate of $20 million per annum.

On July 9, 2020 the Company entered into $200 million amortizing notional interest rate swap designed to hedge floating rate exposure on its Credit Facility. The interest rate swap fixes the interest rate at 0.243% plus applicable margin until July 2025. The swap begins amortizing on December 9, 2022 at a rate of $20 million per annum.

The fair value of the interest rate swap liability of $33.1 million at December 27, 2020 (2019: $15.4 million liability) was recorded on the audited consolidated statements of financial position as a derivative financial instruments liability and the change in fair value has been recorded as finance costs for the reported period. The unrealized losses recorded on the instrument are a result of interest rate reductions subsequent to entering into the transaction.

Credit risk

Financial instruments which potentially subject the Company to credit risk and concentrations of credit risk consist principally of cash, accounts receivable and derivatives. Management believes that the credit risk associated with accounts receivable is mitigated by the significant proportion of counterparties that are well established public transit authorities. Additionally, the U.S. federal government funds a substantial portion of U.S. public sector customer payments - up to 80% of the capital cost of new transit buses, coaches or cutaways, while the remaining 20% comes from state and municipal sources. There are a few U.S. public sector customers that obtain 100% of their funding from state and municipal sources. The maximum exposure to the risk of credit for accounts receivables corresponds to their book value. Historically, the Company has experienced nominal bad debts as a result of the customer base being principally comprised of municipal and other local transit authorities. Management does not anticipate significant credit risk due to the COVID-19 pandemic.

The purchase of new coaches, transit buses or cutaways by private fleet operators is paid from the operators' own capital budgets and funded by their own cash flow. A significant portion of private fleet operators choose to finance new coach purchases with lending organizations. In some cases, MCI assists in arranging this financing, and in some cases, it provides financing through its ultimate net loss program. The Company has experienced a nominal amount of bad debts with its private sales customers as most transactions require payment on delivery. Management does not anticipate significant credit risk due to the COVID-19 pandemic.

The carrying amount of accounts receivable is reduced through the use of an allowance account and the amount of the loss is recognized in the earnings statement within SG&A. When a receivable balance is considered uncollectible, it is written off against the allowance for doubtful accounts. Subsequent recoveries of amounts previously written off are credited against SG&A in the consolidated statements of net earnings (loss) and total comprehensive income (loss).

The following table details the aging of the Company's receivables and related allowance for doubtful accounts:

U.S. dollars in thousands	December 27, 2020	December 29, 2019
Current, including holdbacks	$ 380,328	$ 482,476
Past due amounts but not impaired		
1 - 60 days	39,988	37,413
Greater than 60 days	7,081	6,800
Less: allowance for doubtful accounts	(989)	(284)
Total accounts receivables, net	$ 426,408	$ 526,405

The counterparties to the Company's derivatives are chartered Canadian banks and international financial institutions. The Company could be exposed to loss in the event of non-performance by the counterparty. However, credit ratings and concentration of risk of the financial institutions are monitored on a regular basis.

Commitments and Contractual Obligations

The following table describes the Company's maturity analysis of the undiscounted cash flows of leases and accrued benefit liabilities as at December 27, 2020:

U.S. dollars in thousands	Total	2021	2022	203	2024	2025	Post 2025
Leases	194,376	22,204	21,040	18,498	13,571	10,083	108,980
Accrued benefit liability	2,911	2,911	—	—	—	—	—
	$ 197,287	$ 25,115	$ 21,040	$ 18,498	$ 13,571	$ 10,083	$ 108,980

As at December 27, 2020, outstanding surety bonds guaranteed by the Company amounted to $357.2 million, representing a decrease compared to $384.5 million at December 29, 2019. The estimated maturity dates of the surety bonds outstanding at December 27, 2020 range from January 2021 to December 2026.. Management believes that adequate facilities exist to meet projected surety requirements.

The Company has not recorded a liability under these guarantees as management believes that no material events of default exist under any applicable contracts with customers.

Under the Credit Facility, the Company had established a letter of credit sub-facility of $100.0 million. As at December 27, 2020, letters of credit amounting to $11.8 million (December 29, 2019: $12.8 million) remained outstanding as security for the contractual obligations of the Company under the Credit Facility.

The Company has an additional bi-lateral credit facility of £50.0 million. As at December 27, 2020, letters of credit totaling $22.1 million were outstanding under the bi-lateral credit facility. Additionally, there are $30.0 million of letters of credit outstanding outside of the Credit Facility and the bi-lateral credit facility.

The Company does not have any off-balance sheet arrangement or any material capital asset commitments at December 27, 2020.

Share Option Plan

The Board adopted a Share Option Plan (the "2013 Option Plan") for NFI on March 21, 2013, under which employees of NFI and certain of its affiliates may receive grants of options for Shares. The 2013 Option Plan was amended and restated on December 8, 2015, December 31, 2018 and August 5, 2020. Directors who are not employed with NFI are not eligible to participate in the 2013 Option Plan. A maximum of 3,600,000 Shares are reserved for issuance under the 2013 Option Plan. The options become vested as to one-quarter on the first grant date anniversary and an additional one-quarter on the second, third and fourth anniversary of the grant date.

Option Grant dates	Number	Exercised	Expired	Vested	Unvested	Expiry date	Exercise price	Fair Value at grant date
March 26, 2013	490,356	(483,030)	—	(7,326)	—	March 26, 2021	C$10.20	C$1.55
December 30, 2013	612,050	(573,668)	(9,631)	(28,751)	—	December 30, 2021	C$10.57	C$1.44
December 28, 2014	499,984	(252,233)	(11,368)	(236,383)	—	December 28, 2022	C$13.45	C$1.83
December 28, 2015	221,888	(19,532)	—	(202,356)	—	December 28, 2023	C$26.75	C$4.21
September 8, 2016	2,171	—	(2,171)	—	—	September 8, 2024	C$42.83	C$8.06
January 3, 2017	151,419	(1,610)	(12,534)	(102,557)	34,718	January 3, 2025	C$40.84	C$7.74
January 2, 2018	152,883	—	(10,750)	(71,071)	71,062	January 2, 2026	C$54.00	C$9.53
January 2, 2019	284,674	—	(25,314)	(64,844)	194,516	January 2, 2027	C$33.43	C$5.01
July 15, 2019	2,835	—	—	(709)	2,126	July 15, 2027	C$35.98	C$4.90
December 31, 2019	519,916	—	(33,218)	—	486,698	December 31, 2027	C$26.81	C$3.36
	2,938,176	(1,330,073)	(104,986)	(713,997)	789,120		C$29.32	

The Board adopted a new share option plan on March 12, 2020 (the "2020 Option Plan"), which was approved by shareholders on May 7, 2020, and amended on August 5, 2020, under which employees of NFI and certain of its affiliates may receive grants of options for Shares. Directors who are not employed with NFI are not eligible to participate in the 2020 Option Plan. A maximum of 3,200,000 Shares are reserved for issuance under the 2020 Option Plan. The options become vested as to one-quarter on the first grant date anniversary and an additional one-quarter on the second, third and fourth anniversary of the grant date. No options have been issued under the 2020 Option Plan.

The following reconciles the Share options outstanding:

	Fiscal 2020		Fiscal 2019	
	Number	Weighted average exercise price	Number	Weighted average exercise price
Balance at beginning of period	1,068,906	C$30.77	946,306	C$27.02
Granted during the period	519,916	C$26.81	287,559	C$33.46
Expired during the period	(77,059)	C$34.26	(6,928)	C$40.75
Exercised during the period	(8,646)	C$13.45	(158,031)	C$12.77
Balance at end of period	1,503,117	C$29.32	1,068,906	C$30.77

Restricted Share Unit Plan for Non-Employee Directors

Pursuant to the Company's Restricted Share Unit Plan for Non-Employee Directors, a maximum of 500,000 Shares are reserved for issuance to non-employee directors. The Company did not issue any director restricted Share units ("Director RSUs") in 2020 Q4.

Critical accounting estimates and judgments

The Company's critical accounting estimates and judgments can be found within note 2 to the 2020 Annual Financial Statements.

New and amended standards adopted by the Company

IAS 20 - Accounting for Government Grants and Disclosure of Government Assistance ("IAS 20")

The Company recognizes government grants when there is reasonable assurance that it will comply with the conditions attached to them and that the grants will be received. Government grants are recognized in the consolidated statement of net earnings (loss) and total comprehensive income (loss) over the periods in which the Company recognizes and expenses the related costs for which the grants are intended to compensate. Grants related to income are deducted in reporting the related expense.

Capital Allocation Policy

The Company has established a capital allocation policy based on an operating model intended to provide consistent and predictable cash flow and maintain a strong balance sheet. This policy has established guidelines that are reviewed by the Board on a quarterly basis and provides targets for maintaining financial flexibility, business investment, and return of capital to shareholders.

Maintaining Financial Flexibility

The Company plans to prudently use leverage to manage liquidity risk. Liquidity risk arises from the Company's financial obligations and from the management of its assets, liabilities and capital structure. This risk is managed by regularly evaluating the liquid financial resources to fund current and long-term obligations, and to meet the Company's capital commitments in a cost-effective manner.

The main factors that affect liquidity include sales mix, production levels, cash production costs, working capital requirements, capital expenditure requirements, scheduled repayments of long-term debt obligations, funding requirements of the Company's pension plans, income taxes, credit capacity, expected future debt and equity capital market conditions.

The Company's liquidity requirements are met through a variety of sources, including cash on hand, cash generated from operations, the credit facilities, leases, and debt and equity capital markets.

On December 23, 2020, the Company amended its credit facilities, including the Company's existing $1.25 billion Credit Facility and its £50 million UK Facility. The amended facilities provide NFI with relaxed covenants as it recovers from the impacts of the COVID-19 pandemic. In addition to amending the facilities, NFI terminated the unused $250 million Sidecar facility, which was intended to provide additional liquidity in 2020, which the Company believes it no longer requires.

Under the terms of the amended facilities, the total leverage and interest coverage ratios for 2021 and 2022 have been relaxed. During 2021, the Company has received a waiver of the total net leverage covenant and will instead need to comply with a total net leverage ratio that is based on a conservative financial projection for the Company's 2021 fiscal year.

Beginning in 2022, the Company will be required to maintain a total net leverage ratio at follows:

January 3, 2022 - April 3, 2022	<5.00
April 4, 2022 - July 3, 2022	<4.50
July 4, 2022 - October 2, 2022	<4.25
October 3, 2022 and thereafter	<3.75

The Company will also have to comply with a $50 million minimum liquidity covenant at all times until the total net leverage covenant is less than 3.75x, a total net debt to capitalization ratio of less than 0.70:1.00 during 2021, and an interest coverage ratio of at least 2.25x during 2021 and 3.00x beginning in the first quarter 2022. The amended facilities require the dividend payment not exceed the current level.

Adjusted EBITDA is calculated on a rolling last twelve-month basis, provided that for those calculations required on April 4, 2021, the rolling period is calculated as Adjusted EBITDA for the three Fiscal Quarters ending April 4, 2021, December 27, 2020 and September 27, 2020 multiplied by 4/3.

Management believes the Company's cash position, anticipated future revenues, liquidity from credit facilities together with access to equity markets and other borrowings capacity are sufficient to support current operations, dividends and strategic initiatives.

Subsequent to quarter- and year-end, on March 1, 2021 NFI announced that it had closed a bought-deal equity offering (the "Offering") with a syndicate of underwriters (the "Underwriters") pursuant to which NFI issued 8,446,000 common shares at a price of C$29.60 per share for gross proceeds to the Company of C$250 million. The Company intends to use the net proceeds of the Offering to reduce the outstanding balances under its credit facilities, which is expected to strengthen NFI's balance sheet, reduce leverage and interest expense and significantly increase liquidity.

NFI believes that its existing liquidity combined with the additional financial flexibility provided from the Offering will allow it to pursue its operational and strategic goals, such as investments in NFI's zero-emission products and electric propulsion technology, investments required under the previously disclosed NFI Forward cost-reduction initiative and other potential growth opportunities, in addition to continuing to return capital to shareholders through dividends.

The calculation of the financial covenants for Fiscal 2020 are provided for information purposes below:

	December 27, 2020	December 29, 2019
Total Leverage Ratio (must be less than 6.25 [2019: 4.25])	4.90	3.24
Interest Coverage Ratio (must be greater than 3.00 [2019: 3.00])	4.11	7.73

US dollars in thousands		**December 27, 2020**
Liquidity Position (must be greater than $50 million)	$	233,459

The Company remains focused on deleveraging its balance sheet and returning to its target leverage of 2.0x to 2.5x total debt to EBITDA. Management had originally expected the Company to return to those levels 18 to 24 months following the acquisition of ADL in May 2019, but the impact of COVID-19 has extended the expected timing of deleveraging. The Company has executed upon a variety of initiatives focused on lowering cash outflows to help mitigate the impacts of COVID-19 including:

- Permanent workforce reductions across NFI Group, generating savings of $17 million in fiscal 2020;

- A reduction in planned 2020 cash capital expenditures from $45 million to $25 million;
- The 50% reduction in the Company's quarterly dividend in 2020 Q1; and
- Reducing working capital

Management expects to reduce the Company's total leverage over time as the recovery from COVID-19 continues, and the Company achieves the benefits of the NFI Forward strategic cost reduction initiatives.

Compliance with financial covenants is reviewed monthly by the Executive team and reported quarterly to the Board. Other than the requirements imposed by borrowing agreements, the Company is not subject to any externally imposed capital requirements. Capital management objectives are reviewed on an annual basis or when strategic capital transactions arise.

Business Investment

The Company plans to invest in the current business for future growth and will continue to invest in common systems and lean manufacturing operations to improve quality and cost effectiveness, and to continue to invest in ZEB, Infrastructure Solutions and Advanced Driver Assistance Systems ("ADAS") and automated vehicles. The Company has made significant investments in its ZEB production capabilities to be prepared for the expected longer-term transition to a more electrified fleet. New Flyer now has the capability to manufacture ZEBs at all of its North American facilities. ADL is the market leader in ZEBs with production capabilities at all of its UK facilities, MCI has invested in model upgrades to generate its first electric coach offering, which has been well received by the market and ARBOC is commencing production of its medium-duty Equess CHARGE electric bus in the second quarter of 2021, subject to completion of Altoona testing. To support customers making the transition to zero-emission fleets, New Flyer launched an Infrastructure Solutions business in 2019 that has helped numerous agencies develop and launch infrastructure installation projects.

The Company has a number of autonomous bus projects in development with specialized partners who have a deep understanding of artificial intelligence and ADAS. As part of this program to advance automated and ADAS, subsequent to quarter-end, on January 29, 2021, NFI announced the launch of the New Flyer Xcelsior AV, North America's first automated transit bus. ARBOC's zero-emission battery electric bus, the Equess CHARGE™, will begin production in the second half of 2021, following completion of Altoona testing. The Company has also made numerous investments into telematics solutions to ensure customers can track detailed performance and maintenance metrics associated with their vehicles.

In addition to internal investments, business acquisitions will be considered to further grow and diversify the business and to contribute to the long-term competitiveness and stability of the Company. Investment decisions are based on several criteria, including but not limited to: investment required to maintain or enhance operations; enhancement of cost effectiveness through vertical integration of critical supply and sub-assembly in-sourcing; and acquisitions in current or adjacent markets that are considered accretive to the business.

Return of Capital to Shareholders

The Company intends to have a Share dividend policy that is consistent with the Company`s financial performance and the desire to retain certain cash flows to support the ongoing requirements of the business and to provide the financial flexibility to pursue revenue diversification and growth opportunities.

The Company's 2020 Q4 Free Cash Flow was C$39.6 million compared to declared dividends of C$13.3 million during this period. For 2019 Q4 Free Cash Flow was C$64.1 million compared to declared dividends of C$26.6 million. This resulted in a payout ratio of 33.6% in 2020 Q4 compared to 41.5% in 2019 Q4.

To support cash management efforts while the Company's operations are impacted by COVID-19, in 2020 Q1 the Board reduced the Company's quarterly dividend to C$0.2125 per Share. While the dividend payment was reduced, the continued payment reflects the Board's confidence in the Company's business while maintaining the financial flexibility required to operate during a period of significant economic uncertainty.

On June 11, 2018, the Company announced that the TSX had accepted a notice filed by the Company of its intention to implement the previous Normal Course Issuer Bid (the "Former NCIB") to repurchase its Shares through the facilities of the TSX and any alternative Canadian trading systems on which the Shares are traded. On January 17, 2019 the Company amended the Former NCIB. Pursuant to the amended Former NCIB, the Company was permitted to repurchase for cancellation up to 5,549,465 Shares, representing approximately 10% of the outstanding public float of Shares on June 4, 2018. The Company was permitted to repurchase Shares commencing on June 14, 2018 up to June 13, 2019, or earlier should the Company have completed its repurchases prior to such date. The Former NCIB expired June 13, 2019.

On June 12, 2019 the Company announced that the TSX had accepted a notice filed by the Company of its intention to implement a Normal Course Issuer Bid to replace the Former NCIB to repurchase its Shares (the "Second NCIB"). The Company was permitted to repurchase for cancellation up to 5,357,914 Shares, representing approximately 10% of the outstanding public float of Shares on June 4, 2019. The Company was permitted to repurchase Shares commencing on June 17, 2019 up to June 16, 2020, or earlier should the Company complete its repurchases prior to such date.

During 2019 Q1, the Company repurchased 232,100 Shares under the Former NCIB at an average price of C$31.82 per Share for a total repurchase of C$7.4 million. The Company canceled 986,075 Shares during 2019 Q1, including 232,100 Shares purchased in 2019 Q1 and 753,975 Shares that were purchased in 2018 Q4. There were no shares purchased or canceled under the Former NCIB or the Second NCIB

subsequent to 2019 Q2. The Second NCIB expired on June 16, 2020. The Company did not file for another normal course issuer bid to replace the expired Second NCIB.

Total Capital Distributions to Shareholders
(U.S. dollars in millions)

	2020 Q4	2019 Q4	Fiscal 2020	Fiscal 2019
Dividends paid	$ 9.9	$ 20.0	$ 49.4	$76.4
NCIB Share repurchase	—	—	—	5.7
Total	$ 9.9	$ 20.0	$ 49.4	$ 82.1

Controls and Procedures

Internal Controls over Financial Reporting

Management is responsible for establishing and maintaining internal controls over financial reporting ("ICFR"), as defined under rules adopted by the Canadian Securities Administrators. ICFR were designed under the supervision of, and with the participation of, the President and Chief Executive Officer ("CEO") and the Chief Financial Officer ("CFO"). The Company's ICFR are designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of Financial Statements for external purposes in accordance with IFRS.

On December 15, 2014, management adopted the "Internal Control – Integrated Framework 2013" ("COSO 2013") from the Committee of Sponsoring Organizations of the Treadway Commission, which replaces the previously issued COSO framework, COSO 1992. This new framework necessitated a re-evaluation of the controls that management relies upon to support its conclusions, as well as changes to the Company's testing programs.

Management, under the supervision of the CEO and CFO, evaluated the design and operational effectiveness of the Company's ICFR as of December 27, 2020 in accordance with the criteria established in COSO 2013, and concluded that the Company's ICFR are effective.

ICFR, no matter how well designed, have inherent limitations. Therefore, ICFR can provide only reasonable assurance with respect to financial statement preparation and may not prevent or detect all misstatements.

There have been no changes in our internal control over financial reporting during the quarter ended December 27, 2020 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Disclosure Controls

Management is responsible for establishing and maintaining disclosure controls and procedures in order to provide reasonable assurance that material information relating to the Company is made known to them in a timely manner and that information required to be disclosed is reported within time periods prescribed by applicable securities legislation. There are inherent limitations to the effectiveness of any system of disclosure controls and procedures, including the possibility of human error and the circumvention or overriding of the controls and procedures. Accordingly, even effective disclosure controls and procedures can only provide reasonable assurance of achieving their control objectives. The Company's CEO and CFO have concluded that disclosure controls and procedures as at December 27, 2020 were effective.

Appendix A - Meaning of Certain References

References in this MD&A to the "Company" are to NFI and all of its direct or indirect subsidiaries, including New Flyer Industries Canada ULC ("NFI ULC"), New Flyer of America Inc. ("NFAI"), The Aftermarket Parts Company, LLC ("TAPC"), TCB Enterprises, LLC ("TCB"), KMG Fabrication, Inc. ("KMG"), Carfair Composites Inc. ("CCI") and Carfair Composites USA, Inc. ("CCUI", and together with "CCI", "Carfair"), The Reliable Insurance Company Limited, ARBOC Specialty Vehicles, LLC ("ARBOC"), New MCI Holdings, Inc. and its affiliated entities (collectively, "MCI"), NFI Holdings Luxembourg s.a.r.l., and Alexander Dennis Limited and its affiliated entities (collectively, "ADL") References to "New Flyer" generally refer to NFI ULC, NFAI, TAPC, KMG, CCI, CCUI and TCB. References in this MD&A to "management" are to senior management of NFI and the Company.

The common shares of NFI ("Shares") are traded on the Toronto Stock Exchange ("TSX") under the symbol "NFI". As at December 27, 2020, 62,524,842 Shares were issued and outstanding. Additional information about NFI and the Company, including NFI's annual information form, is available on SEDAR at www.sedar.com.

Buses manufactured by New Flyer and ADL's single and double deck buses are classified as "transit buses". ARBOC manufactures body-on-chassis or "cutaway" and "medium-duty" buses that service transit, paratransit, and shuttle applications. Collectively, transit buses, medium-duty buses and cutaways, are referred to as "buses".

A "motor coach" or "coach" is a 35-foot to 45-foot over-the-highway bus typically used for intercity transportation and travel over longer distances than heavy-duty transit buses, and is typically characterized by (i) one or two axles in the rear (related to the weight of the vehicle), (ii) high deck floor, (iii) baggage compartment under the floor, (iv) high-backed seats with a coach-style interior (often including a lavatory and underfloor baggage compartments), and (v) no room for standing passengers.

All of the data presented in this MD&A with respect to the number of transit buses, medium-duty buses, cutaways and motor coaches in service and delivered, is measured in, or based on, "equivalent units". One equivalent unit (or "EU") represents one production slot, being one 30-foot, 35-foot, 40-foot, 45-foot heavy-duty transit bus, one double deck bus, one medium-duty bus, one cutaway bus or one motor coach, whereas one articulated transit bus represents two equivalent units. An articulated transit bus is an extra-long transit bus (approximately 60-feet in length), composed of two passenger compartments connected by a joint mechanism. The joint mechanism allows the vehicle to bend when the bus turns a corner, yet have a continuous interior.

Forward-Looking Statements

This MD&A contains "forward-looking information" and "forward-looking statements", within the meaning of applicable Canadian securities laws, which reflect the expectations of management regarding the Company's future growth, financial performance and financial position and the Company's strategic initiatives, plans, business prospects and opportunities, including the duration, impact of and recovery from the COVID-19 pandemic. The words "believes", "views", "anticipates", "plans", "expects", "intends", "projects", "forecasts", "estimates", "guidance" and "targets", "may", "will" and similar expressions are intended to identify forward looking statements. These forward-looking statements reflect management's current expectations regarding future events (including the recovery of the Company's markets and the expected benefits to be obtained through its "NFI Forward" initiative) and the Company's financial and operating performance and speak only as of the date of this MD&A. Forward-looking statements involve significant risks and uncertainties, should not be read as guarantees of future events, performance or results, and will not necessarily be accurate indications of whether or not or the times at or by which such performance or results will be achieved.

A number of factors that may cause actual results to differ materially from the results discussed in the forward-looking statements include: the anticipated use of proceeds of the Offering; the Company may not be able to achieve its targets for sales growth; funding may not continue to be available to the Company's customers at current levels or at all; the Company's business is affected by economic factors and adverse developments in economic conditions could have an adverse effect on the for the Company's products and the results of its operations; currency fluctuations could adversely affect the Company's financial results or competitive position; interest rates could change substantially, materially impacting the Company's revenue and profitability; an active, liquid trading market for the Shares may cease to exist, which may limit the ability of shareholders to trade Shares; the market price for the Shares may be volatile; if securities or industry analysts do not publish research or reports about the Company and its business, if they adversely change their recommendations regarding the Shares or if the Company's results of operations do not meet their expectations, the Share price and trading volume could decline; in addition, if securities or industry analysts publish inaccurate or unfavorable research about the Company or its business, the Share price and trading volume of the Shares could decline; competition in the industry and entrance of new competitors; current requirements under "Buy America" regulations may change and/or become more onerous or suppliers' "Buy America" content may change; failure of the Company to comply with the U.S. Disadvantaged Business Enterprise ("**DBE**") program requirements or the failure to have its DBE goals approved by the U.S. Federal Transit Administration; absence of fixed term customer contracts, exercise of options and customer suspension or termination for convenience; local content bidding preferences in the United States may create a competitive disadvantage; uncertainty resulting from the exit of the UK from the European Union; requirements under Canadian content policies may change and/or become more onerous; operational risk resulting from inadequate or failed internal processes, people and/or systems or from

external events, including fiduciary breaches, regulatory compliance failures, legal disputes, business disruption, pandemics, floods, technology failures, processing errors, business integration, damage to physical assets, employee safety and insurance coverage; international operations subject the Company to additional risks and costs and may cause profitability to decline; compliance with international trade regulations, tariffs and duties; dependence on limited sources or unique sources of supply; a disruption of the supply of components containing microprocessors and other computer chips could materially adversely affect the production and sale of the Company's vehicles and certain other products; dependence on supply of engines that comply with emission regulations; a disruption, termination or alteration of the supply of vehicle chassis or other critical components from third-party suppliers could materially adversely affect the sales of certain of the Company's products; the Company's profitability can be adversely affected by increases in raw material and component costs; the Company may incur material losses and costs as a result of product warranty costs, recalls and remediation of transit buses and motor coaches; production delays may result in liquidated damages under the Company's contracts with its customers; catastrophic events may lead to production curtailments or shutdowns; the Company may not be able to successfully renegotiate collective bargaining agreements when they expire and may be adversely affected by labour disruptions and shortages of labour; the Company's operations are subject to risks and hazards that may result in monetary losses and liabilities not covered by insurance or which exceed its insurance coverage; the Company may be adversely affected by rising insurance costs; the Company may not be able to maintain performance bonds or letters of credit required by its contracts or obtain performance bonds and letters of credit required for new contracts; the Company is subject to litigation in the ordinary course of business and may incur material losses and costs as a result of product liability claims; the Company may have difficulty selling pre-owned coaches and realizing expected resale values; the Company may incur costs in connection with regulations relating to axle weight restrictions and vehicle lengths; the Company may be subject to claims and liabilities under environmental, health and safety laws; dependence on management information systems and cyber security risks; the Company's ability to execute its strategy and conduct operations is dependent upon its ability to attract, train and retain qualified personnel, including its ability to retain and attract executives, senior management and key employees; the Company may be exposed to liabilities under applicable anti-corruption laws and any determination that it violated these laws could have a material adverse effect on its business; the Company's risk management policies and procedures may not be fully effective in achieving their intended purposes; internal controls over financial reporting, no matter how well designed, have inherent limitations; there are inherent limitations to the effectiveness of any system of disclosure controls and procedures, including the possibility of human error and the circumvention or overriding of the controls and procedures; ability to successfully execute strategic plans and maintain profitability; development of competitive or disruptive products, services or technology; development and testing of new products or model variants; acquisition risk; reliance on third party manufacturers; third-party distribution/dealer agreements; availability to the Company of future financing; the Company may not be able to generate the necessary amount of cash to service its existing debt, which may require the Company to refinance its debt; the restrictive covenants in the credit facilities could impact the Company's business and affect its ability to pursue its business strategies; payment of dividends is not guaranteed; a significant amount of the Company's cash is distributed, which may restrict potential growth; the Company is dependent on its subsidiaries for all cash available for distributions; future sales or the possibility of future sales of a substantial number of Shares may impact the price of the Shares and could result in dilution; if the Company is required to write down goodwill or other intangible assets, its financial condition and operating results would be negatively affected; income tax risk due to the Company's operations being complex and income tax interpretations, regulations and legislation that pertain to its activities are subject to continual change; investment eligibility and Canadian federal income tax risks; certain U.S. tax rules may limit the ability of New Flyer Holdings, Inc. and its U.S. subsidiaries (the "NF Group") to deduct interest expense for U.S. federal income tax purposes and may increase the NF Group's tax liability and certain financing transactions could be characterized as "hybrid transactions" for U.S. tax purposes, which could increase the NF Group's tax liability.

Factors relating to the global COVID-19 pandemic include: the magnitude and duration of the global, national and regional economic and social disruption being caused as a result of the pandemic; the impact of national, regional and local governmental laws, regulations and "shelter in place" or similar orders relating to the pandemic which may materially adversely impact the Company's ability to continue operations; partial or complete closures of one, more or all of the Company's facilities and work locations or the reduction of production rates (including due to government mandates and to protect the health and safety of the Company's employees or as a result of employees being unable to come to work due to COVID-19 infections with respect to them or their family members); production rates may be further decreased as a result of the pandemic; supply delays and shortages of parts and components and disruption to labour supply as a result of the pandemic; the pandemic will likely adversely affect operations of customers and reduce and delay, for an unknown period, customers' purchases of the Company's products; the anticipated recovery of the Company's markets in the future may be delayed or increase in demand may be lower than expected as a result of the continuing effects of the pandemic; the Company's ability to obtain access to additional capital if required; and the Company's financial performance and condition, obligations, cash flow and liquidity and its ability to maintain compliance with the covenants under its credit facilities, which may also negatively impact the ability of the Company to pay dividends. There can be no assurance that the Company will be able to maintain sufficient liquidity for an extended period, obtain future satisfactory covenant relief under its credit facilities, if required, or access to additional capital or access to government financial support or as to when production operations will return to previous production rates. There is also no assurance that governments will provide continued or adequate stimulus funding during or after the pandemic for public transit agencies to purchase transit vehicles or that public or private demand for the Company's vehicles will return to pre-pandemic levels in the anticipated period of time. The Company cautions that due to the dynamic, fluid and highly unpredictable nature of the pandemic and its impact on global and local

economies, businesses and individuals, it is impossible to predict the severity of the impact on the Company's business, operating performance, financial condition and ability to generate sufficient cash flow and maintain adequate liquidity and any material adverse effects could very well be rapid, unexpected and may continue for an extended and unknown period of time.

Factors relating to the Company's "NFI Forward" initiative include: the Company's ability to successfully execute the initiative and to generate the planned savings in the expected time frame or at all; management may have overestimated the amount of savings and production efficiencies that can be generated or may have underestimated the amount of costs to be expended; the implementation of the initiative may take longer than planned to achieve the expected savings; further restructuring and cost-cutting may be required in order to achieve the objectives of the initiative; the estimated amount of savings generated under the initiative may not be sufficient to achieve the planned benefits; combining business units and/or reducing the number of production or parts facilities may not achieve the efficiencies anticipated; and the impact of the continuing global COVID-19 pandemic. There can be no assurance that the Company will be able to achieve the anticipated financial and operational benefits, cost savings or other benefits of the initiative.

Factors relating to the Company's January 11, 2021 financial guidance (the "Guidance") include the degree to which actual future events accord with, or vary from, the expectations of, and assumptions used by, NFI's management in preparing the Guidance and the Company's ability to successfully execute the "NFI Forward" initiative and to generate the planned savings in the expected time frame or at all. Although the Company has attempted to identify important factors that could cause actual actions, events or results to differ materially from those described in the Guidance, there may be other factors that could cause actions, events or results not to be as anticipated, estimated or intended. Specific reference is made to "*Risk Factors*" in the Annual Information Form ("AIF") for a discussion of the factors that may affect forward-looking statements and information. Should one or more of these risks or uncertainties materialize, or should any of the underlying assumptions used by the Company in preparing any of the forward-looking statements and information contained in the Guidance prove incorrect, NFI's actual results may vary from those described in the Guidance and any such variations may be material. The forward-looking statements and information contained in the Guidance were made as of January 11, 2021 and the Company disclaims any intent or obligation to update any such forward-looking statements or information except as required by law. The Company provides no assurance that forward-looking statements and information contained in the Guidance will prove to be accurate, as actual results and future events could differ materially from those anticipated in such statements. Accordingly, readers should not place undue reliance on such forward-looking statements and information.

Although the Company has attempted to identify important factors that could cause actual actions, events or results to differ materially from those described in forward-looking statements, there may be other factors that could cause actions, events or results not to be as anticipated, estimated or intended. Specific reference is made to "*Risk Factors*" in the AIF for a discussion of the factors that may affect forward-looking statements and information. Should one or more of these risks or uncertainties materialize, or should underlying assumptions prove incorrect, actual results may vary materially from those described in forward-looking statements and information. The forward-looking statements and information contained herein are made as of the date of this MD&A (or as otherwise indicated) and the Company disclaims any intent or obligation to update forward-looking statements or information except as required by law. The Company provides no assurance that forward-looking statements and information will prove to be accurate, as actual results and future events could differ materially from those anticipated in such statements. Accordingly, readers should not place undue reliance on forward-looking statements and information.

DEFINITIONS OF ADJUSTED EBITDA, ROIC, FREE CASH FLOW, ADJUSTED NET EARNINGS (LOSS), ADJUSTED EARNINGS (LOSS) PER SHARE, REGIONS INCLUDING: NORTH AMERICA, UK AND EUROPE, ASIA PACIFIC, AND OTHER

References to "Adjusted EBITDA" are to earnings before interest, income taxes, depreciation and amortization after adjusting for the effects of certain non-recurring and/or non-operations related items that do not reflect the current ongoing cash operations of the Company. These adjustments include gains or losses on disposal of property, plant and equipment, fair value adjustment for total return swap, unrealized foreign exchange losses or gains on non-current monetary items and forward foreign exchange contracts, costs associated with assessing strategic and corporate initiatives, past service costs and other pension costs or recovery, non-recurring costs or recoveries related to business acquisition, fair value adjustment to acquired subsidiary company's inventory and deferred revenue, proportion of the total return swap realized, equity settled stock-based compensation, recovery of currency transactions, prior year sales tax provision, , COVID-19 costs and impairment loss on goodwill and non-recurring restructuring costs.

"Free Cash Flow" means net cash generated by or used in operating activities adjusted for changes in non-cash working capital items, interest paid, interest expense, income taxes paid, current income tax expense, principal portion of finance lease payments, cash capital expenditures, proceeds from disposition of property, plant and equipment, costs associated with assessing strategic and corporate initiatives, fair value adjustment to acquired subsidiary company's inventory and deferred revenue, defined benefit funding, defined benefit expense, past service costs and other pension costs or recovery, proportion of total return swap, recovery on currency transactions, prior year sales tax provision, non-recurring restructuring costs, COVID-19 costs, foreign exchange gain or loss on cash held in foreign currency.

References to "ROIC" are to net operating profit after taxes (calculated as Adjusted EBITDA less depreciation of plant and equipment, depreciation of right-of-use assets and income taxes at a rate of 31%) divided by average invested capital for the last 12-month period (calculated as to shareholders' equity plus long-term debt, obligations under leases, other long-term liabilities and derivative financial instrument liabilities less cash).

References to "Adjusted Net Earnings (Loss)" are to net earnings (loss) after adjusting for the after tax effects of certain non-recurring and/or non-operational related items that do not reflect the current ongoing cash operations of the Company including: fair value adjustments of total return swap, unrealized foreign exchange loss or gain, unrealized gain or loss on the interest rate swap, impairment loss on goodwill, portion of the total return swap realized, costs associated with assessing strategic and corporate initiatives, fair value adjustment to acquired subsidiary company's inventory and deferred revenue, equity settled stock-based compensation, gain or loss on disposal of property, plant and equipment, past service costs and other pension costs or recovery, recovery on currency transactions, prior year sales tax provision, COVID-19 costs and non-recurring restructuring costs .

References to "Adjusted Earnings (Loss) per Share" are to Adjusted Net Earnings (Loss) divided by the average number of Shares outstanding.

Management believes Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings (Loss) and Adjusted Earnings (Loss) per Share are useful measures in evaluating the performance of the Company. However, Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings (Loss) and Adjusted Earnings (Loss) per Share are not recognized earnings measures under IFRS and do not have standardized meanings prescribed by IFRS. Readers of this MD&A are cautioned that ROIC, Adjusted Net Earnings (Loss) and Adjusted EBITDA should not be construed as an alternative to net earnings or loss or cash flows from operating activities determined in accordance with IFRS as an indicator of NFI's performance, and Free Cash Flow should not be construed as an alternative to cash flows from operating, investing and financing activities determined in accordance with IFRS as a measure of liquidity and cash flows. A reconciliation of net earnings to Adjusted EBITDA, based on the Financial Statements, has been provided under the headings "Reconciliation of Net Earnings (Loss) to Adjusted EBITDA". A reconciliation of Free Cash Flow to cash flows from operations is provided under the heading "Summary of Free Cash Flow". A reconciliation of net earnings to Adjusted Net Earnings (Loss) is provided under the heading "Reconciliation of Net Earnings (Loss) to Adjusted Net Earnings (Loss)".

NFI's method of calculating Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings (Loss) and Adjusted Earnings (Loss) per Share may differ materially from the methods used by other issuers and, accordingly, may not be comparable to similarly titled measures used by other issuers. Dividends paid from Free Cash Flow are not assured, and the actual amount of dividends received by holders of Shares will depend on, among other things, the Company's financial performance, debt covenants and obligations, working capital requirements and future capital requirements, all of which are susceptible to a number of risks, as described in NFI's public filings available on SEDAR at www.sedar.com.

References to NFI's geographic regions for the purpose of reporting global revenues are as follows: "North America" refers to Canada, United States, and Mexico; United Kingdom and Europe refer to the United Kingdom and Europe; "Asia Pacific" or "APAC" refers to Hong Kong, Malaysia, Singapore, Australia, and New Zealand; and the "Other" category includes any sales that do not fall into the categories above.

2020 Appendix B - 2020 Fourth Quarter Order Activity

Demand for Transit Buses and Motor Coaches

The Company's "Bid Universe" metric estimates active public competitions in Canada and the United States and attempts to provide an overall indication of anticipated heavy-duty transit bus and motor coach public sector market demand. It is a point-in-time snapshot of: (i) EUs in active competitions, defined as all requests for proposals received by the Company and in process of review plus bids submitted by the Company and awaiting customer action, and (ii) management's forecast, based on data provided by operators for their fleet replacement plans, of expected EUs to be placed out for competition over the next five years.

The fourth quarter of 2020 saw further decline in the Company's Bid Universe, similar to the decline experienced in the third quarter, after reaching record highs in the first half of 2020. The decrease in Active Bids, which were down by 35.2%, or 2,189 EUs, from 2020 Q3 reflects the release of awards that had been delayed during the first and second quarters of 2020 due to the ongoing COVID-19 pandemic. Compared to the same period in 2019, Active Bids are down by 14.1%, or 662 EUs, primarily driven by the release of significant awards during the fourth quarter and the delay of certain procurements into the first half of 2021.

The forecasted five-year industry procurement was up 5.5%, or 1,066 EUs, quarter-over-quarter, providing early signs of recovery, but still down from record highs in the first half of 2020. These decreases in expected transit procurements are the direct result of pressures facing operators and agencies due to the COVID-19 pandemic. Most of the decline was seen in public motor coach. Management anticipates that forecasted five-year industry procurement will increase as transit agencies and operators learn more about and all are able to access the multi-billion funding programs being launched by governments in Canada and the US.

The Bid Universe EUs fluctuate significantly from quarter-to-quarter based on public tender activity procurement and award processes.

	Bids in Process (EUs)	Bids Submitted (EUs)	Active EUs	Forecasted Industry Procurement over 5 Years (EUs)[1]	Total Bid Universe (EUs)
2019 Q4	1,760	2,934	4,694	22,954	27,648
2020 Q1	2,005	3,461	5,466	23,770	29,236
2020 Q2	2,975	4,374	7,349	22,089	29,438
2020 Q3	1,927	4,294	6,221	19,280	25,501
2020 Q4	**297**	**3,735**	**4,032**	**20,346**	**24,378**

(1) Management's estimate of anticipated future industry procurement over the next five years is based on direct discussions with select U.S. and Canadian transit authorities. This estimate includes potential public customers activity for New Flyer and MCI vehicles, but excludes potential ARBOC and ADL U.S. and Canadian sales.

Procurement of heavy-duty transit buses and motor coaches by the U.S. and Canadian public sector is typically accomplished through formal multi-year contracts and stock schedules, while procurement by the private sector, in North America, the UK and Europe and Asia Pacific is typically made on a transactional basis. As a result, the Company does not maintain a Bid Universe for private sector buses and coaches.

The sale of cutaway and medium-duty buses manufactured by ARBOC is accomplished on a transactional purchase order basis through non-exclusive third-party dealers who hold contracts directly with the customers. Bids are submitted by and agreements are held with a network of dealers. Cutaway and medium-duty bus activity therefore is not included in the Bid Universe metric.

ADL does not currently have a Bid Universe metric for the UK and European or Asia Pacific markets similar to New Flyer and MCI's North American Bid Universe. Management does not believe a similar Bid Universe metric for those markets is suitable given that the majority of customers in those regions are private operators who make annual purchase decisions. The overall UK market declined from 2015 to 2019, and was expected to remain relatively flat in 2020 prior to the occurrence of the pandemic. The UK market was hit disproportionately hard by the COVID-19 pandemic, with bus patronage down by nearly 80% at its worst point in 2020, and overall deliveries down by 24%. We expect to see a slow recovery in 2021 due to customers' fleet recovery plans, a government focus on the green recovery, and an aging vehicle fleet. In Asia Pacific, the Hong Kong market is highly cyclical, and, following busier periods in 2015 through 2018, the market has declined as expected. As in other regions, Hong Kong was also impacted by the COVID-19 pandemic, but ADL remains the leader in double-deck buses and retains deep customer relationships in Hong Kong. Management expects the market to see stable annual deliveries and a slow recovery through 2021. New Zealand and Singapore remain cyclical markets; both markets saw increased activity in 2017, 2018 and 2019, but were also impacted by the COVID-19 pandemic, with expectations for recovery in 2021.

Order activity

New orders (firm and options) during 2020 Q4 totaled 998 EUs, a decrease of 13.9% from 2019 Q4 and an increase of 45.9% from 2020 Q3. The new firm and option orders awarded to the Company for Fiscal 2020 were 3,519 EUs, a decrease of 1.6% from Fiscal 2019. The Company was also successful at converting 171 EUs of options during 2020 Q4 to firm orders, a decrease of 79.0% from 2019 Q4 and a decrease of 29.3% from 2020 Q3. These conversions contributed to the 953 EUs of options converted to firm orders during 2020 Q4, a decline of 37.2% from 2019 Q4.

	New Orders in Quarter (Firm and Option EUs)	LTM New Orders (Firm and Option EUs)	Option Conversions in Quarter (EUs)	LTM Option Conversions (EUs)
2019 Q4	1,159	3,577	813	1,518
2020 Q1	1,346	4,014	139	1,531
2020 Q2	491	4,031	401	1,582
2020 Q3	684	3,680	242	1,595
2020 Q4	**998**	**3,519**	**171**	**953**

Options

In 2020 Q4, 120 option EUs expired, compared to 159 option EUs that expired during 2019 Q4 and 427 EUs that expired in 2020 Q3.

A significant number of public transit contracts in the U.S. and Canada have a term of five years. In addition, some contracts in the UK and APAC also have multi-year terms. The table below shows the number of option EUs that have either expired or have been exercised annually over the past five years, as well as the current backlog of options that will expire each year if not exercised.

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
A) Options Expired (EUs)	965	504	550	331	741	512	1,202					4,805
B) Options Exercised (EUs)	1,149	1,339	2,064	1,404	1,795	1,518	953					10,222
C) Current Options by year of expiry (EUs)								1,497	2,038	614	222	4,371
D) Conversion rate % = B / (A+B)	**54 %**	**73 %**	**79 %**	**81 %**	**71 %**	**75 %**	**44 %**					

The Company's conversion rate can vary significantly from quarter-to-quarter and should be looked at on an annual or LTM basis.

In addition to contracts for identified public customers, the Company has focused on state procurements and cooperative purchasing agreements, with the objective of having available schedules from which customers within a prescribed region or defined list can purchase. The Company has successfully bid and been named on several state contracts. These contracts, however, are not recorded in backlog as they do not have defined quantities allocated to the Company or any other original equipment manufacturer. Once a customer purchases a bus under one of these agreements, the purchase is recorded as a firm order.

The Company's Fiscal 2020 Book-to-Bill ratio (defined as new firm orders and exercised options divided by new deliveries) was 81.7%, a decrease of 3.5% from 85.2% for Fiscal 2019.

In addition, 247 EUs of new firm and option orders were pending from customers at the end of 2020 Q4, where approval of the award to the Company had been made by the customer's board, council, or commission, as applicable, but purchase documentation had not yet been received by the Company and therefore not yet included in the backlog.

Backlog

The Company's total backlog consists of buses sold primarily to U.S. and Canadian public customers and private operators in the UK and Europe. The majority of the backlog relates to New Flyer transit buses for public clients with some of the backlog consisting of units from MCI, ADL and ARBOC. Options for ARBOC vehicles are held by dealers, rather than the operator, and are not included as options are in the NFI backlog, but are converted to firm backlog when vehicles are ordered by the dealer.

Transit buses and motor coaches incorporating clean propulsion systems, including compressed natural gas, diesel-electric hybrid, and ZEBs, which consist of trolley-electric, fuel cell-electric, and battery-electric buses represent approximately 34.5% of the total backlog. ZEBs represent approximately 5.8% of total backlog.

	2020 Q4			2020 Q3			2019 Q4		
	Firm Orders	Options	Total	Firm Orders	Options	Total	Firm Orders	Options	Total
Beginning of period	3,662	5,220	8,882	4,400	5,604	10,004	4,313	7,281	11,594
New orders	663	335	998	399	285	684	950	209	1,159
Options exercised	171	(171)	—	242	(242)	—	813	(813)	—
Shipments[1]	(1,230)	—	(1,230)	(1,317)	—	(1,317)	(1,844)	—	(1,844)
Cancelled/expired	(26)	(120)	(146)	(62)	(427)	(489)	(8)	(159)	(167)
End of period	**3,240**	**5,264**	**8,504**	**3,662**	**5,220**	**8,882**	**4,224**	**6,518**	**10,742**
Consisting of:									
Heavy-duty transit buses	2,271	4,730	7,001	2,519	4,640	7,159	3,236	5,722	8,958
Motor coaches	621	534	1,155	805	580	1,385	615	796	1,411
Cutaway and medium-duty buses	348	—	348	338	—	338	373	—	373
Total Backlog	**3,240**	**5,264**	**8,504**	**3,662**	**5,220**	**8,882**	**4,224**	**6,518**	**10,742**

(1) Shipments do not include delivery of pre-owned coaches as these coaches are not included in the backlog.

At the end of 2020 Q4, the Company's total backlog (firm and options) of 8,504 EUs (valued at $4.3 billion) has decreased compared to 8,882 EUs (valued at $4.5 billion) at the end of 2020 Q3. The decrease was driven by deliveries in the quarter, cancellations and delays in new awards within North American and UK transit operations. The summary of the values is provided below.

	2020 Q4		2020 Q3		2019 Q4	
		Equivalent Units		Equivalent Units		Equivalent Units
Total firm orders	$ 1,631.5	3,240	$ 1,788.5	3,662	$ 1,928.8	4,224
Total options	2,706.3	5,264	2,703.1	5,220	3,245.1	6,518
Total backlog	**$ 4,337.8**	**8,504**	**$ 4,491.6**	**8,882**	**$ 5,173.9**	**10,742**

Consolidated Financial Statements of

NFI GROUP INC.

December 27, 2020

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Independent Auditor's Report

To the Shareholders of NFI Group Inc.

Opinion

We have audited the consolidated financial statements of NFI Group Inc. (the "Company"), which comprise the consolidated statements of financial position as at December 27, 2020 and December 29, 2019, and the consolidated statements of net earnings (loss) and total comprehensive income (loss), changes in equity and cash flows for the years then ended, and notes to the consolidated financial statements, including a summary of significant accounting policies (collectively referred to as the "financial statements").

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Company as at December 27, 2020 and December 29, 2019, and its financial performance and its cash flows for the years then ended in accordance with International Financial Reporting Standards ("IFRS").

Basis for Opinion

We conducted our audit in accordance with Canadian generally accepted auditing standards ("Canadian GAAS"). Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of our report. We are independent of the Company in accordance with the ethical requirements that are relevant to our audit of the financial statements in Canada, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Key Audit Matters

A key audit matter is a matter that, in our professional judgment, was of most significance in our audit of the consolidated financial statements for the year ended December 27, 2020. This matter was addressed in the context of our audit of the consolidated financial statements as a whole, and in forming our opinion thereon, and we do not provide a separate opinion on this matter.

Goodwill – Motor Coach Manufacturing CGU (pre-restructuring), ADL Aftermarket Parts CGU, ADL Manufacturing CGU — Refer to Notes 2.14, 2.15, 2.22 and 7 of the financial statements

Key Audit Matter Description

The Company's evaluation of goodwill for impairment involves the comparison of the recoverable amount of each cash generating units ("CGU") to their carrying value. The Company used the discounted cash flow model to estimate the value-in-use of each CGU. This requires management to make significant estimates and assumptions including those with respect to future cash inflows and outflows, growth rates and discount rates. Changes in these assumptions could have a significant impact on either the recoverable amount, the amount of any goodwill impairment charge, or both. During the first quarter of 2020, the carrying amount of the motor coach manufacturing CGU exceeded its recoverable amount which resulted in an impairment charge of $50.8 million to goodwill. At the evaluation date, the recoverable amounts of the CGUs exceeded their carrying amounts and no other impairments

Specifically, due to the impact of COVID-19 on the motor coach manufacturing CGU operations and the resulting change in short term demand in the private coach market, and the sensitivity of the ADL manufacturing and ADL aftermarket parts operations due to short term changes in demand, we have identified the goodwill impairment analysis as a key audit matter for the following CGUs (collectively "identified CGUs"):

We have identified the goodwill impairment analysis as a key audit matter for the following CGUs:

- Motor coach manufacturing, prior to the Company's restructuring and combination with the bus manufacturing CGU in the third quarter of 2020
- ADL Manufacturing
- ADL Manufacturing Parts

While there are several key assumptions that are required to estimate the recoverable amount of the identified CGUs, the assumptions with the highest degree of subjectivity and impact on the recoverable amounts are related to the determination of the discount rates, forecasts of future revenues, revenue growth rates, and operating margins. This required a high degree of significant auditor attention as these estimates are subject to estimation uncertainty. Auditing these estimates and assumptions required a high degree of subjectivity in applying audit procedures and in evaluating the results of those procedures. This resulted in an increased extent of audit effort including the involvement of fair value specialists.

How the Key Audit Matter Was Addressed in the Audit

Our audit procedures related to the determination of the discount rates, forecasts of future revenues, revenue growth rates and operating margins used to estimate the recoverable amount of the identified CGU's included the following, among others:

- Evaluated management's ability to accurately forecast future revenues, revenue growth rates and operating margins by comparing actual results to management's historical forecasts.
- Evaluated the reasonableness of the forecast of future revenues, revenue growth rates and operating margins by comparing the forecasts to:
    - Historical revenues and operating margins.
    - Known changes in the Company's operations and its industry, including the impact of the COVID-19 pandemic, which are expected to impact future operating performance;
    - Internal reports including production and backlog;
    - Internal communications to management and the Board of Directors; and
    - Forecasted information included in the Company's press releases as well as in analyst and industry reports for the Company and peer companies.
- With the assistance of fair value specialists, evaluated the reasonableness of the discount rates by testing the source information underlying the determination of the discount rates, developing a range of independent estimates and comparing those to the discount rates selected by management.

Other Information

Management is responsible for the other information. The other information comprises:

- Management's Discussion and Analysis

Our opinion on the financial statements does not cover the other information and we do not and will not express any form of assurance conclusion thereon. In connection with our audit of the financial statements, our responsibility is to read the other information identified above and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated.

We obtained Management's Discussion and Analysis prior to the date of this auditor's report. If, based on the work we have performed on this other information, we conclude that there is a material misstatement of this other information, we are required to report that fact in this auditor's report. We have nothing to report in this regard.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with IFRS, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the Company's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Company or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the Company's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian GAAS will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with Canadian GAAS, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Company's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Company to cease to continue as a going concern.

- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- Obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Company to express an opinion on the financial statements. We are responsible for the direction, supervision and performance of the group audit. We remain solely responsible for our audit opinion.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, related safeguards.

From the matters communicated with those charged with governance, we determine those matters that were of most significance in the audit of the consolidated financial statements of the current period and are therefore the key audit matters. We describe these matters in our auditor's report unless law or regulation precludes public disclosure about the matter or when, in extremely rare circumstances, we determine that a matter should not be communicated in our report because the adverse consequences of doing so would reasonably be expected to outweigh the public interest benefits of such communication.

The engagement partner on the audit resulting in this independent auditor’s report is Michael Boucher.

/s/ Deloitte LLP

Chartered Professional Accountants
Winnipeg, Manitoba
March 3, 2021

NFI GROUP INC.

CONSOLIDATED STATEMENTS OF NET EARNINGS (LOSS) AND TOTAL COMPREHENSIVE INCOME (LOSS)
52-Weeks ended December 27, 2020 ("Fiscal 2020") and 52-Weeks ended December 29, 2019 ("Fiscal 2019")
(in thousands of U.S. dollars except per share figures)

	Fiscal 2020	Fiscal 2019
Revenue (note 22)	$ 2,419,175	$ 2,893,436
Cost of sales (note 4)	2,219,920	2,479,954
Gross profit	199,255	413,482
Sales, general and administration costs and other operating expenses	231,303	241,454
Foreign exchange gain	(1,509)	(1,036)
Impairment loss on goodwill (note 7)	50,790	—
(Loss) earnings from operations	(81,329)	173,064
Gain on disposition of property, plant and equipment	56	46
Unrealized foreign exchange gain (loss) on non-current monetary items	9,050	(60)
(Loss) earnings before interest and income taxes	(72,223)	173,050
Interest and finance costs		
Interest on long-term debt	48,717	39,127
Accretion in carrying value of long-term debt (note 16)	4,354	829
Interest expense on lease liability	7,352	7,211
Other interest and bank charges	5,766	4,208
Fair market value loss on interest rate swap	17,680	21,980
	83,869	73,355
(Loss) earnings before income tax expense	(156,092)	99,695
Income tax expense (note 15)		
Current income taxes	26,580	61,339
Deferred income taxes recovered	(24,936)	(19,342)
	1,644	41,997
Net (loss) earnings for the period	$ (157,736)	$ 57,698
Other comprehensive income (loss)		
Actuarial loss on defined benefit pension plan - this item will not be reclassified subsequently to profit or loss	(9,206)	(4,390)
Unrealized foreign exchange gain on translation of foreign operations	7,324	11,865
Total comprehensive (loss) income for the period	$ (159,618)	65,173
Net (loss) earnings per share (basic) (note 18)	$ (2.52)	$ 0.93
Net (loss) earnings per share (diluted) (note 18)	$ (2.52)	$ 0.93

The accompanying notes are an integral part of the audited consolidated financial statements.

NFI GROUP INC.

CONSOLIDATED STATEMENTS OF FINANCIAL POSITION
As at December 27, 2020
(in thousands of U.S. dollars)

	December 27, 2020	December 29, 2019
Assets		
Current		
Cash	$ 55,769	$ 28,233
Accounts receivable (note 3, 21c)	426,408	531,736
Inventories (note 4)	657,036	672,243
Income tax receivable	18,759	17,375
Derivative financial instruments (note 21 b,c)	4,490	—
Prepaid expenses and deposits	13,308	10,094
	1,175,770	1,259,681
Property, plant and equipment (note 5, 22)	232,150	268,748
Right-of-use asset (note 6)	133,373	153,323
Goodwill and intangible assets (note 7)	1,177,381	1,250,518
Accrued benefit asset (note 10)	319	3,879
Other long-term assets (note 8)	36,922	19,612
	$ 2,755,915	$ 2,955,761
Liabilities		
Current		
Accounts payable and accrued liabilities	$ 523,461	$ 581,612
Derivative financial instruments (note 21 b,c)	1,078	4,651
Current portion of long-term liabilities (note 9)	148,610	144,524
	673,149	730,787
Accrued benefit liability (note 10)	21,061	11,916
Obligations under leases (note 6)	130,674	143,999
Deferred compensation obligation (note 11)	3,234	2,790
Deferred revenue (note 13)	15,608	13,354
Provisions (note 14)	56,605	62,180
Deferred tax liabilities (note 15)	76,689	105,023
Derivative financial instruments (note 21 b,c)	33,069	15,388
Long-term debt (note 16)	1,125,685	1,053,126
	$ 2,135,774	$ 2,138,563
Commitments and contingencies (note 24)		
Shareholders' equity		
Share capital (note 17)	681,405	680,962
Stock option and restricted share unit reserve (note 12)	8,400	6,828
Accumulated other comprehensive (loss) income	(1,113)	769
Retained (deficit) earnings	(68,551)	128,639
	$ 620,141	$ 817,198
	$ 2,755,915	$ 2,955,761

The accompanying notes are an integral part of the audited consolidated financial statements.

NFI GROUP INC.

CONSOLIDATED STATEMENTS OF CHANGES IN EQUITY

For the period ended December 27, 2020
(in thousands of U.S. dollars)

	Share Capital	Stock Option and Restricted Share Unit Reserve	Accumulated Other Comprehensive (Loss) Income	Treasury shares	Retained (Deficit) Earnings	Total Shareholders' Equity
Balance, December 30, 2018	**$ 654,307**	**$ 5,796**	**$ (6,706)**	**$ (8,835)**	**$ 152,925**	**$ 797,487**
Net earnings	—	—	—	—	57,698	57,698
Other comprehensive income	—	—	7,475	—	—	7,475
Dividends declared on common shares	—	—	—	—	(79,950)	(79,950)
Repurchase and cancellation of common shares	(10,451)	—	—	—	(2,034)	(12,485)
Change in share purchase commitment	—	—	—	8,835	—	8,835
Share-based compensation, net of deferred income taxes	—	1,515	—	—	—	1,515
Shares issued	37,106	(483)	—	—	—	36,623
Balance, December 29, 2019	**$ 680,962**	**$ 6,828**	**$ 769**	**$ —**	**$ 128,639**	**$ 817,198**
Net loss	—	—	—	—	$ (157,736)	(157,736)
Other comprehensive loss	—	—	(1,882)	—	—	(1,882)
Dividends declared on common shares	—	—	—	—	(39,454)	(39,454)
Share-based compensation, net of deferred income taxes	—	1,931	—	—	—	1,931
Shares issued	443	(359)	—	—	—	84
Balance, December 27, 2020	**$ 681,405**	**$ 8,400**	**$ (1,113)**	**$ —**	**$ (68,551)**	**$ 620,141**

The accompanying notes are an integral part of the audited consolidated financial statements.

NFI GROUP INC.

CONDENSED CONSOLIDATED STATEMENTS OF CASH FLOWS

For the period ended December 27, 2020

(in thousands of U.S. dollars)

	Fiscal 2020	Fiscal 2019
Operating activities		
Net (loss) earnings for the period	$ (157,736)	$ 57,698
Income tax expense	1,644	41,997
Depreciation of plant and equipment	70,333	61,985
Amortization of intangible assets	40,451	42,585
Share-based compensation	1,770	1,566
Interest and finance costs recognized in profit or loss	83,869	73,355
Fair value adjustment for total return swap	118	949
Unrealized foreign exchange (gain) loss on non-current monetary items	(9,050)	60
Foreign exchange (gain) loss on cash held in foreign currency	11	(83)
Impairment loss on goodwill	50,790	—
Gain on disposition of property, plant and equipment	(56)	(46)
Impairment loss on property, plant and equipment	1,758	—
Impairment loss on right-of-use asset	3,597	—
Defined benefit expense	5,307	5,849
Defined benefit funding	(5,507)	(8,140)
Cash generated by operating activities before non-cash working capital items and interest and income taxes paid	87,299	277,775
Changes in non-cash working capital items (note 19)	68,762	(91,324)
Cash generated from operating activities before interest and income taxes paid	156,061	186,451
Interest paid	(63,307)	(47,676)
Income taxes paid	(26,693)	(40,167)
Net cash generated by operating activities	66,061	98,608
Financing activities		
Debt issue costs	(3,931)	(1,636)
Repayment of obligations under lease	(18,887)	(12,456)
Proceeds from long-term debt	72,136	357,516
Share issuance	84	36,690
Repurchase of shares	—	(5,682)
Dividends paid	(49,439)	(76,421)
Net cash (used by) generated from financing activities	(37)	298,011
Investing activities		
Acquisition of intangible assets	(29)	(38)
Proceeds from disposition of property, plant and equipment	2,765	174
Investment in long-term restricted deposits	(15,510)	(14,490)
Net cash used in acquisitions	—	(327,360)
Acquisition of property, plant and equipment	(25,703)	(37,575)
Net cash used in investing activities	(38,477)	(379,289)
Effect of foreign exchange rate on cash	(11)	83
Increase in cash	27,536	17,413
Cash — beginning of period	28,233	10,820
Cash — end of period	$ 55,769	$ 28,233

The accompanying notes are an integral part of the audited consolidated financial statements.

1. CORPORATE INFORMATION

NFI Group Inc. ("NFI" or the "Company") was incorporated on June 16, 2005 as New Flyer Industries Inc. under the laws of the Province of Ontario. The name of the Company was changed to "NFI Group Inc." on May 14, 2018 to better reflect the multi-platform nature of the Company's business. NFI is a leading independent global bus manufacturer providing a comprehensive suite of mass transportation solutions under brands: New Flyer® (heavy-duty transit buses), Alexander Dennis Limited (single and double-deck buses), Plaxton (motor coaches), MCI® (motor coaches), ARBOC® (low-floor cutaway and medium-duty buses) and NFI Parts™ (aftermarket parts sales). The Company's common shares (the "Shares") are listed on the Toronto Stock Exchange ("TSX") under the symbol "NFI".

These audited consolidated financial statements (the "Statements") were approved by the Company's board of directors (the "Board") on March 3, 2021.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

The principal accounting policies applied in the preparation of these Statements are set out below. These policies have been consistently applied to all periods presented, unless otherwise stated.

2.1 Basis of preparation

The Statements were prepared on a going concern basis in accordance with International Financial Reporting Standards ("IFRS") which require management to make judgments, estimates and assumptions that affect the application of accounting policies and the reported amounts of assets and liabilities, revenue and expenses. Actual results may differ from these estimates.

2.2 Principles of consolidation

The Statements include the accounts of the Company's subsidiaries.

Subsidiaries

Subsidiaries are entities over which the Company has control, where control is achieved when the Company: has power over the investee; is exposed, or has rights, to variable returns from its involvement with the investee; and has the ability to use its power to affect its returns. The Company holds 100% of the voting rights in, and therefore controls, its subsidiaries.

The effects of potential voting rights that are currently exercisable are considered when assessing whether control exists. Subsidiaries are fully consolidated from the date control is transferred to the Company, and are de-consolidated from the date control ceases.

The acquisition method of accounting is used to account for the acquisition of subsidiaries as follows:

- cost is measured as the fair value of the assets given, equity instruments issued and liabilities incurred or assumed at the date of exchange, and business acquisition related expenses are expensed as incurred;
- identifiable assets acquired and liabilities assumed are measured at their fair values at the acquisition date;
- the excess of acquisition cost over the fair value of the identifiable net assets acquired is recorded as goodwill; and
- if the acquisition cost is less than the fair value of the net assets acquired, the fair value of the net assets is reassessed and any remaining difference is recognized directly in the consolidated statements of net earnings and comprehensive income.

Inter-company transactions between subsidiaries are eliminated on consolidation.

2.3 New and amended standards adopted by the Company

IAS 20 - Accounting for Government Grants and Disclosure of Government Assistance ("IAS 20")

The Company recognizes government grants when there is reasonable assurance that it will comply with the conditions attached to them and that the grants will be received. Government grants are recognized in the consolidated statement of net earnings (loss) and total comprehensive income (loss) over the periods in which the Company recognizes as expenses the related costs for which the grants are intended to compensate. Grants related to income are deducted in reporting the related expense.

2.4 Reportable Segments

The Company's reportable segments are organized around the markets it serves and are reported in a manner consistent with the internal reporting provided to the chief operating decision-maker ("CODM"). The President and Chief Executive Officer of the Company has authority for resource allocation and assessment of the Company's performance and therefore acts as the CODM.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

2.5 Foreign currency

The Company operates with multiple functional currencies. The Company's consolidated financial statements are presented in U.S. dollars as this presentation is most meaningful to financial statement users. References to "$" are to U.S. dollars, references to "C$" are to Canadian dollars, references to "£" are to British pounds sterling. For those subsidiaries with different functional currencies, exchange rate differences arising from the translation of items that form part of the net investment in the foreign operation are recorded in unrealized foreign exchange gains (losses) on translation of foreign operations in other comprehensive income.

Monetary balances denominated in a currency other than U.S. dollars are translated at the period end rates of exchange, and the results of the operations are translated at average rates of exchange for the period. Non-monetary balances are translated at the exchange rate prevailing at the date of the transaction.

Foreign exchange gains and losses that relate to borrowings, non-current monetary items and non-current forward foreign exchange contracts are presented in the consolidated statements of net earning (loss) and comprehensive income (loss) within "unrealized foreign exchange loss (gain) on non-current monetary items".

All other foreign exchange gains and losses are presented in the consolidated statements of net earnings (loss) and comprehensive income (loss) within "foreign exchange gain".

2.6 Revenue recognition

Manufacturing Operations

Persuasive evidence of an arrangement exists in the form of a written contract. A process is in place that initiates a pre-shipment acceptance by the customer at the Company's plant. This acceptance prior to shipment mitigates the likelihood of customer's dissatisfaction with the final product upon delivery to the customer. Revenue is recorded when the vehicle is delivered or shipped. The customer does not have a legal right to return the delivered products after the acceptance period, or deviate from the agreed upon price. The Company's contract clearly identifies a fixed and determinable price.

In connection with its sales of new coaches, the Company at times agrees to accept a pre-owned coach in exchange and gives the buyer a credit equal to the pre-owned coach's then-current fair value. Any credit provided to the customer in excess of the fair value of the pre-owned coach is deducted from the selling price of the new coach.

Operating lease revenue is recorded on a straight-line basis in the period earned over the life of the contract and is recognized in revenue in the consolidated statements of net earnings (loss) and comprehensive income (loss) due to its operating nature.

When a single sale transaction requires the delivery of more than one product or service (multiple performance obligations), the revenue recognition criteria are applied to the separately identifiable performance obligations. A performance obligation is considered to be separately identifiable if the product or service delivered has stand-alone value to that customer and the fair value associated with the product or service can be measured reliably. The amount recognized as revenue for each performance obligation is its fair value in relation to the fair value of the contract as a whole. Management has determined that the standard base warranty included in the bus or coach purchase is not a separate performance obligation and therefore recognized upon delivery of the vehicle.

The Company sells extended warranty contracts that provide coverage in addition to the basic coverage. Proceeds from the sale of these contracts are deferred and amortized into revenue over the extended warranty period commencing at the end of the basic warranty period. The Company also receives proceeds from the sale of extended warranties relating to major subsystems such as engines, transmissions, axles and air conditioning that are purchased for the customer from the original equipment manufacturer ("OEM"). The related cost to purchase the OEM warranty contracts have been recorded as a reduction of revenue as the Company is an agent to the transaction.

The Company, from time-to-time, may enter into arrangements with customers where the customer has requested that the Company defer shipping a vehicle and instead hold it for a specified period until the customer is able to take possession. The Company recognizes revenue for bill and hold arrangements when the arrangement is substantive, the product is identified separately as belonging to the customer and ready for physical transfer to the customer, and the Company cannot use the product or allocate it to another customer.

The Company does not recognize revenue on any bus or coach firm or option orders that have not yet been delivered except on bill and hold arrangements.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

The Infrastructure Solutions™ division supplies, installs and commissions electric vehicle chargers, and constructs the related charging infrastructure. Revenues related to the supply, installation and commissioning of electric vehicle chargers are recognized once the chargers pass final customer acceptance testing. Revenues related to construction of charging infrastructure are recognized over time using the cost-to-cost input method. The cost-to-cost method measures the Company's progress toward completion based on the total costs incurred relative to the total estimated contract costs.

Aftermarket Operations

Persuasive evidence of an arrangement exists in the form of an authorized sales order. The customer is invoiced, and revenue is recorded at the time the part is delivered using a commercial shipper. The price list for parts clearly identifies a fixed and determinable price, while also describing that the Company has no legal obligation to accept the return of goods other than on defective and/or warrantable parts product. Aftermarket parts revenue does not contain any revenue related to the bus or coach warranty.

2.7 Employee benefits

For defined benefit pension plans and other post-employment benefits, the net periodic pension expense is actuarially determined by independent actuaries using the projected unit credit method. Actuarial remeasurement is comprised of actuarial gains and losses, the effect of the changes to the asset ceiling (if applicable) and the return on plan assets (excluding interest), and is reflected immediately in the statement of financial position with a charge or credit recognized in other comprehensive income in the period in which they occur. Remeasurement recognized in other comprehensive income is reflected immediately in accumulated other comprehensive loss and will not be reclassified to profit or loss. Past service cost is recognized in profit or loss in the period of a plan amendment. Net interest is calculated by applying the discount rate at the beginning of the period to the net defined benefit liability or asset. Defined benefit costs are comprised of service costs (including current service cost, past service cost and gain or losses on curtailments and settlements), net interest expense or income and remeasurement.

The asset or liability recognized in the consolidated statements of financial position is the present value of the defined benefit obligation at the end of the reporting period less the fair value of plan assets, together with adjustments for past service costs. The present value of the defined benefit obligation is determined by discounting the estimated future cash outflows using interest rates of high-quality corporate bonds that are denominated in the currency in which the benefits will be paid and that have terms to maturity approximating the terms of the related pension liability. For funded plans, surpluses are recognized only to the extent that the surplus is considered recoverable. Recoverability is primarily based on the extent to which the Company can unilaterally reduce future contributions to the plan.

Payments to defined contribution plans are expensed as incurred, which is as the related employee service is rendered.

2.8 Share-based compensation plans

The Company operates cash-settled and equity-settled share-based compensation plans under which it receives services from senior management and non-employee members of the Board.

For the cash-settled plans (note 11), the expense is determined based on the fair value of the liability at the end of the reporting period until the awards are settled. Certain share-based compensation plans include non-market performance conditions. The Company`s accounting policy is to recognize the impact of non-market performance conditions by adjusting the number of awards that are expected to vest. At the end of each reporting period, the Company re-assesses its estimates of the number of awards that are expected to vest and recognizes the impact of the revisions on compensation expense (note 23) in the consolidated statements of net earnings (loss) and comprehensive income (loss).

For the equity-settled plans (note 12), share-based payments to senior management are measured at the fair value of the equity instruments at the grant date. The fair value is measured at grant date and each tranche is recognized on a graded-vesting basis over the period in which the options vest. The offset to the recorded cost is the stock option reserve. Consideration received on the exercise of stock options is recorded as share capital and the related stock option reserve is transferred to share capital. Upon expiry, the recorded value is transferred to retained earnings. At the end of each reporting period, the Company revises its estimate of the number of equity instruments expected to vest. The impact of the revision of the original estimates, if any, is recognized in the consolidated statements of net earnings (loss) and comprehensive income (loss) such that the cumulative expense reflects the revised estimate, with a corresponding adjustment to the stock option reserve. Where the terms and conditions of options are modified, the increase in the fair value of the options, measured immediately before and after the modification, is also charged to the consolidated statements of net earnings (loss) and comprehensive income (loss).

2.9 Cash

Cash and cash equivalents comprise cash on hand, demand deposits and investments with an original maturity at the date of purchase of three months or less.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

2.10 Accounts receivables

Accounts receivables are amounts due from customers from the rendering of services or sale of goods in the ordinary course of business. Accounts receivables are classified as current assets if payment is due within one year or less. Accounts receivables are recognized initially at fair value and subsequently measured at amortized cost, less impairment, if any.

The Company maintains an allowance for doubtful accounts and sales adjustments to provide for impairment of trade receivables. The expense relating to doubtful accounts is included within "Sales, general and administration costs and other operating expenses" in the consolidated statements of net earnings (loss) and comprehensive income (loss).

2.11 Inventories

Inventories are measured at the lower of cost and net realizable value. The cost of inventories is based on the first-in first-out principle, and includes expenditures incurred in acquiring the inventories, production or conversion costs and other costs incurred in bringing them to their existing location and condition. In the case of finished goods inventories and work in progress, cost includes an appropriate share of production overheads based on normal operating capacity. Net realizable value is the estimated selling price in the ordinary course of business, less the estimated costs of completion and selling expenses.

2.12 Property, plant and equipment

Property, plant and equipment are recorded at cost reduced by applicable investment tax credits, less accumulated depreciation. Depreciation is calculated at the following annual rates:

Building and building improvements	4% declining-balance basis
Machinery and equipment	25% declining-balance basis
Demo buses and coaches	20% - 50% straight-line basis
Computer hardware and software	30% declining-balance basis
Office equipment	20% declining-balance basis
Buses and coaches available for lease	20% - 50% straight-line basis

Property, plant and equipment are tested for impairment as described under "Impairment of non-financial assets" in note 2.15.

2.13 Intangible assets

Identifiable intangible assets are initially recorded at fair value. Based on management's forecasts and business plans and the going concern of the Company, the trade names intangible asset (note 7) has been deemed to have an indefinite life, except for the "NABI Parts" tradename which is amortized over its useful life of 12 years. For purposes of impairment testing, the fair value of trade names is determined using an income approach.

Intangible assets that have a finite life are amortized using the straight-line method over the estimated useful lives of the assets as follows:

Patents and Licenses	5-12 years
Backlog of sales orders	1-2 years
Customer relationships	21 years

Identifiable intangible assets with finite and indefinite lives are tested for impairment as described under "Impairment of non-financial assets" in note 2.15.

2.14 Goodwill

Goodwill represents the excess of the cost of an acquisition over the fair value of the Company's share of the net identifiable assets of the acquired business at the date of acquisition. Separately recognized goodwill is tested at the end of every reporting period for possible impairment when there are events or changes in circumstances that indicate that their carrying amounts may not be recoverable and also tested annually for impairment. Goodwill is carried at cost less accumulated impairment losses. Gains and losses on the disposal of an entity include the carrying amount of goodwill relating to the entity sold.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

2.15 Impairment of non-financial assets

Non-financial assets with finite lives are tested at the end of every reporting period for possible impairment when there are events or changes in circumstances that indicate that their carrying amounts may not be recoverable. In addition, non-financial assets that are not amortized are subject to an annual impairment assessment. The carrying values of identifiable intangible assets with indefinite lives are tested annually for impairment because they are not amortized. Impairment is determined by comparing the recoverable amount of such assets with their carrying amounts. Any impairment loss is recognized for the amount by which the asset's carrying amount exceeds its recoverable amount within earnings of continuing or discontinued operations, as appropriate.

The recoverable amount is the higher of an asset's fair value less cost to sell or its value in use. For the purpose of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash inflows or cash generating units ("CGUs"). The Company evaluates impairment losses for potential reversals, other than goodwill impairment, when events or changes in circumstances warrant such consideration.

2.16 Provisions

Provisions represent liabilities to the Company for which the amount or timing is uncertain. Provisions are recognized when the Company has a present legal or constructive obligation as a result of past events, it is probable that an outflow of resources will be required to settle the obligation and the amount can be reliably estimated. Provisions are not recognized for future operating losses, unless the losses relate to an onerous contract. Provisions are measured at the present value of the expenditures expected to be required to settle the obligation using a discount rate that reflects current market assessments of the time value of money and the risks specific to the obligation. Provisions are re-measured at each consolidated statements of financial position date using the current discount rate. The increase in the provision due to passage of time is recognized as interest expense.

At the time of sale, a provision for warranty claims relating to the base warranty on the entire bus or motor coach and a corrosion warranty on the related structure, is recorded and charged against operations. This warranty provision is based upon management's best estimate of expected future warranty costs utilizing past claims experience. Actual warranty expenditures are charged against the provision as incurred.

A provision for onerous contracts is recognized when the expected benefits to be derived by the Company from a contract are lower than the unavoidable cost of meeting its obligations under the contract. The provision is measured at the present value of the lower of the expected cost of terminating the contract and the expected net cost of continuing with the contract. Before a provision is established, the Company recognizes any impairment loss on the assets associated with that contract.

2.17 Long-term debt

Long-term debt is recognized initially at fair value, net of transaction costs incurred. Debt is subsequently stated at amortized cost with any difference between the proceeds and the amortized cost recognized in the consolidated statements of net earnings (loss) and comprehensive income (loss) over the term of the debt using the effective interest method.

Debt is classified as a current liability unless the Company has an unconditional right to defer settlement for at least 12 months after the date of the consolidated statements of financial position.

2.18 Financial instruments

Financial assets

Purchases and sales of financial assets are recognized on the settlement date, which is the date on which the asset is delivered to or by the Company. Financial assets are derecognized when the rights to receive cash flows from the investments have expired or were transferred and the Company has transferred substantially all risks and rewards of ownership. Financial assets are classified in the following categories at the time of initial recognition based on the purpose for which the financial assets were acquired:

Financial assets at fair value through profit or loss

Classification

Financial assets at fair value through profit or loss are financial assets held for trading or designated as fair value through profit or loss. A financial asset is classified in this category if acquired principally for the purpose of selling in the short-term or if so designated by management. Assets in this category include derivative financial instruments and are classified as short or long term assets in the consolidated statements of financial position.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

Recognition and measurement

Financial assets are initially recognized at fair value and subsequently carried at fair value through profit and loss, with changes recognized in the consolidated statements of net earnings (loss) and comprehensive income (loss). Transaction costs are expensed as incurred.

Financial assets carried at amortized cost

Classification

Financial assets classified as amortized cost are non-derivative financial assets that the Company intends to hold in order to collect the contractual cash flows and have fixed or determinable payments that are not quoted in an active market. They are included in current assets, except for those with maturities greater than 12 months after the consolidated statements of financial position date, which are classified as non-current assets. Assets in this category include accounts receivables, deposits and cash and are classified as current assets in the consolidated statements of financial position.

Recognition and measurement

Financial assets carried at amortized cost are initially recognized at fair value plus transaction costs and subsequently carried at amortized cost using the effective interest method.

Financial liabilities carried at amortized cost

Financial liabilities primarily consist of accounts payable and accrued liabilities, derivative financial instruments, other long-term liabilities and long-term debt. Financial liabilities are initially measured at fair value and subsequently measured at amortized cost unless classified as fair value through profit or loss.

Derivative instruments

Derivatives are initially recognized at fair value on the date a contract is entered into and are subsequently re-measured at their fair value. The Company's derivative instruments, while providing effective economic hedges, are not designated as hedges for accounting purposes. Changes in the fair value of any derivatives that are not designated as hedges for accounting purposes are recognized within "Fair market value gain (loss) on interest rate swap" or "unrealized foreign exchange (loss) gain on non-current monetary items" in the consolidated statements of net earnings (loss) and comprehensive income (loss)consistent with the underlying nature and purpose of the derivative instruments.

2.19 Taxation

Tax expense comprises current and deferred tax. Tax is recognized in the consolidated statements of net earnings (loss) and total comprehensive income (loss) except to the extent it relates to items recognized directly in equity, in which case the related tax is recognized in equity.

Current tax expense is based on the results for the period as adjusted for items that are not taxable or not deductible. Current tax is calculated using the tax rates under the laws that were enacted or substantively enacted at the date of the consolidated statements of financial position.

Deferred tax is accounted for using the liability approach and is the tax expected to be payable or recoverable on temporary differences between the carrying amount of assets and liabilities in the consolidated statements of financial position and the corresponding tax base used in the computation of taxable profit. Deferred tax is calculated based on the expected manner of realization or settlement of the carrying amount of assets and liabilities, using tax rates that are expected to apply to the year of realization or settlement based on tax rates and laws enacted or substantively enacted at the date of the consolidated statements of financial position.

Deferred tax assets are recognized to the extent it is probable that taxable profits will be available against which the deductible temporary differences can be utilized, unless the deferred tax asset arises from the initial recognition of an asset or liability in a transaction that is not a business combination, and at the time of the transaction, affects neither accounting profit nor taxable profit (tax loss). The carrying amount of deferred tax assets is reviewed at each consolidated statements of financial position date and reduced to the extent that it is no longer probable that sufficient taxable profits will be available to allow all or part of the asset to be recovered.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

Deferred tax liabilities are generally recognized for all taxable temporary differences except to the extent that the deferred tax liability arises from: the initial recognition of goodwill; or the initial recognition of an asset or liability in a transaction which is not a business combination and, at the time of the transaction, affects neither accounting profit nor taxable profit (tax loss). As well, deferred tax liabilities are recognized for taxable temporary differences arising on investments in subsidiaries except where the reversal of the temporary difference can be controlled and it is probable that the difference will not reverse in the foreseeable future.

2.20 Investment tax credits

The Company has earned investment tax credits ("ITCs") relating to a percentage of eligible current and capital research and development expenditures incurred in each taxation year. Investment tax credits are recognized when there is reasonable assurance that the Company will comply with the associated conditions and the grants will be received. The investment tax credits are recognized either as a reduction in cost of sales on the consolidated statements of net earnings (loss) and comprehensive income (loss), or as a reduction in property, plant and equipment, depending on where the original costs which gave rise to the credits were recorded.

2.21 Vendor Rebates

The Company records certain consideration received from a vendor, which is probable and can be reasonably estimated, as a reduction of the cost of purchases during the period.

2.22 Critical accounting estimates and judgments

Estimates and judgments are continually evaluated and are based on historical experience and other factors, including expectations of future events that are believed to be reasonable under the circumstances.

Critical accounting estimates and assumptions

Management makes estimates and assumptions concerning the future. The resulting accounting estimates will, by definition, seldom equal the actual results. Estimates are reviewed on a regular basis and, as adjustments become necessary, they are reported in the consolidated statements of net earnings and comprehensive income in the periods in which they become known. The assets and liabilities which require management to make significant estimates and assumptions in determining carrying values include, inventories, derivative financial instruments, property, plant and equipment, intangible assets, goodwill, provisions, accrued benefit liability, deferred compensation obligation, government grants and deferred income taxes.

Information about assumptions and estimation uncertainties that have a significant risk of resulting in a material adjustment are addressed below.

Intangible assets and goodwill

The values associated with the initial recognition and impairment tests of the intangible assets and goodwill involve significant estimates and assumptions, including those with respect to future cash inflows and outflows, discount rates and asset lives.

These significant estimates are subject to the Company's future results. These determinations will affect the amount of amortization expense on intangible assets recognized in future periods.

Management assesses impairment by comparing the recoverable amount of an intangible asset or goodwill with its carrying value. The determination of the recoverable amount involves significant estimation by management.

Management has determined that for purposes of this evaluation the Company has five CGUs: North American bus/coach manufacturing, ARBOC, ADL manufacturing, ADL aftermarket parts operations, and aftermarket parts operations.

Goodwill is allocated to the Company's five CGUs for the purpose of impairment testing. The Company performs its annual test for impairment of goodwill in the fourth quarter of each year and also when indicators of impairment exist.

Accrued benefit liability

The present value of the defined benefit obligation is determined by discounting the estimated future cash outflows using interest rates of high-quality corporate bonds that are denominated in the currency in which the benefits will be paid and that have terms to maturity approximating the terms of the related pension liability. Determination of benefit expense requires assumptions such as the discount rate to measure obligations and return on assets, the projected age of employees upon retirement, life expectancy and the expected rate of future compensation changes.

Actual results will differ from results which are estimated based on assumptions. See note 2.7 for certain assumptions made with respect to employee benefits.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

Income Taxes

Estimation of income taxes includes evaluating the recoverability of deferred tax assets based on an assessment of the Company's ability to utilize the underlying future tax deductions against future taxable income before they expire. Management's assessment is based upon existing tax laws and estimates of future taxable income. If the assessment of the Company's ability to utilize the underlying future tax deductions changes, the Company would be required to recognize more or fewer of the tax deductions as assets, which would decrease or increase the income tax expense in the period in which this is determined.

The Company is subject to taxation in multiple jurisdictions. Significant judgment is required in determining the worldwide provision for taxation. There are many transactions and calculations for which the ultimate tax determination is uncertain during the ordinary course of business. The Company maintains provisions for uncertain tax positions that it believes appropriately reflect its risk with respect to tax matters under active discussion, audit, dispute or appeal with tax authorities, or which are otherwise considered to involve uncertainty. These provisions for uncertain tax positions are made using management's best estimate of the amount expected to be paid based on a qualitative assessment of all relevant factors. Management reviews the adequacy of these provisions at the date of each consolidated statements of financial position. However, it is possible that at some future date an additional liability could result from audits by taxing authorities. Where the final tax outcome of these matters is different from the amounts that were initially recorded, such differences will affect the tax provisions in the period in which such determination is made.

Provision for Warranty Costs

The Company offers warranties on the buses and coaches it sells. Management estimates the related provision for future warranty claims based on historical warranty claim information, as well as recent trends that might suggest that past cost information may differ from future claims. Factors that could impact the estimated claim information include quality initiatives, as well as parts and labour costs.

Critical judgments in applying accounting policies

The following critical judgments that were made by management have the most significant effect on the amounts recognized in the financial statements.

Revenue recognition

As described in note 2.6, management assessed the criteria for the recognition of revenue related to arrangements that have multiple components as set out in IFRS 15. Also, judgment is necessary to determine when components can be recognized separately and the allocation of the related consideration allocated to each component.

Also described in note 2.6, management assessed the criteria for the recognition of revenue in an agency relationship related to the sale of extended warranties that are purchased for the customer from the OEM as set out in IFRS 15.

Functional currency

Management assessed the criteria for the determination of functional currency as set out in IAS 21. An entity is required to place the greatest weight on the currency that influences the pricing of the transactions that it undertakes rather than focusing on the currency in which the transactions are denominated in. The functional currency of the Company is the United States dollar as it is the currency of the primary economic environment in which the Company operates. In addition, it is the competitive forces of the United States marketplace that determines the sales prices of its goods and services. Predominantly, the costs for labour, material and overhead that address the needs and support the Company's customers are incurred in United States dollars, and hence the pricing of goods and services to the customer is more greatly influenced from operations and the competitive forces in the United States.

Goodwill

Judgment is required in the selection of CGUs and the allocation of assets and liabilities to these CGUs, which is necessary to assess the impairment of long-term assets, goodwill and intangible assets.

3. ACCOUNTS RECEIVABLE

	December 27, 2020	December 29, 2019
Trade, net of allowance for doubtful accounts	$ 383,086	$ 471,552
Other	43,322	60,184
	$ 426,408	$ 531,736

4. INVENTORIES

	December 27, 2020	December 29, 2019
Raw materials	$ 299,476	$ 300,447
Work in process	216,311	263,343
Finished goods	141,249	108,453
	$ 657,036	$ 672,243

	Fiscal 2020	Fiscal 2019
Cost of inventories recognized as expense and included in cost of sales	$ 2,107,143	$ 2,452,170
Write-down of inventory to net realizable value in cost of sales	47,274	4,538
Reversals of a previous write-down in inventory	403	471

The write-down of inventory for Manufacturing is $44.7 million (2019: $2.6 million), of which $38.6 million pertains to pre-owned coach, $2.9 million for bus and $1.7 million for new coach impairment. Aftermarket write-down of inventory is $2.6 million (2019: $1.9 million).

5. PROPERTY, PLANT AND EQUIPMENT

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Office equipment	Demo buses and coaches	Buses and coaches available for lease	Total
Cost	$ 102,202	$ 192,983	$ 54,002	$ 7,615	$ 26,421	$ 24,615	$ 407,838
Accumulated depreciation	11,875	92,410	33,654	3,571	12,705	5,680	159,895
December 30, 2018 net book value	90,327	100,573	20,348	4,044	13,716	18,935	247,943
Transition to IFRS 16	(3,013)	(22,734)	(1,572)	—	—	—	(27,319)
Adjusted December 31, 2018 net book value	87,314	77,839	18,776	4,044	13,716	18,935	220,624
Assumed as a result of business acquisitions	15,490	19,166	2,587	—	6,405	—	43,648
Additions	4,151	18,792	6,728	254	4,759	2,892	37,576
Transfers from inventory	—	—	—	—	6,646	3,931	10,577
Disposals	(27)	(117)	(33)	(44)	(159)	—	(380)
Depreciation charge	(3,387)	(21,369)	(5,797)	(746)	(7,252)	(6,119)	(44,670)
Cumulative translation adjustment	500	558	86	—	229	—	1,373
December 29, 2019 net book value	104,041	94,869	22,347	3,508	24,344	19,639	268,748
Additions	1,434	12,862	3,608	13	7,328	458	25,703
Transfer from inventory	(1,827)	(137)	(8)	(14)	(3,744)	(6,265)	(11,995)
Disposals	(22)	(659)	(136)	(13)	(1,878)	—	(2,708)
Depreciation charge	(3,551)	(23,411)	(5,346)	(700)	(9,219)	(5,199)	(47,426)
Impairment	—	(782)	(976)	—	—	—	(1,758)
Cumulative translation adjustment	278	864	93	—	351	—	1,586
December 27, 2020 net book value	$ 100,353	$ 83,606	$ 19,582	$ 2,794	$ 17,182	$ 8,633	$ 232,150

5. PROPERTY, PLANT AND EQUIPMENT (Continued)

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Office equipment	Demo buses and coaches	Buses and coaches available for lease	Total
Recorded as:							
Cost	$ 118,390	$ 190,215	$ 50,582	$ 7,825	$ 44,301	$ 31,438	$442,751
Accumulated depreciation	14,349	95,346	28,235	4,317	19,957	11,799	174,003
December 29, 2019 net book value	$ 104,041	$ 94,869	$ 22,347	$ 3,508	$ 24,344	$ 19,639	$268,748
Cost	$ 118,253	$ 202,225	$ 53,163	$ 7,812	$ 46,358	$ 25,631	$453,442
Accumulated depreciation	17,900	118,619	33,581	5,018	29,176	16,998	221,292
December 27, 2020 net book value	$ 100,353	$ 83,606	$ 19,582	$ 2,794	$ 17,182	$ 8,633	$232,150

6. RIGHT-OF-USE ASSETS

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Total
Opening balance at December 30, 2018	**$ 103,794**	**$ 443**	**$ 39**	**$ 104,276**
Transition to IFRS 16	3,013	22,734	1,572	27,319
Adjusted December 31, 2018 net book value	106,807	23,177	1,611	131,595
Assumed as a result of business acquisitions	15,353	1,845	—	17,198
Additions	17,369	4,475	680	22,524
Disposals	—	—	—	—
Depreciation charge	(12,363)	(6,113)	(874)	(19,350)
Cumulative translation adjustment	1,269	87	—	1,356
December 29, 2019 net book value	$ 128,435	$ 23,471	$ 1,417	$ 153,323
Additions	2,699	3,890	184	6,773
Disposals	(257)	(267)	—	(524)
Impairment	(3,597)	—	—	(3,597)
Depreciation charge	(14,654)	(7,492)	(761)	(22,907)
Cumulative translation adjustment	213	92	—	305
December 27, 2020 net book value	$ 112,839	$ 19,694	$ 840	$ 133,373

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Total
Recorded as:				
Cost	$ 141,711	$ 48,016	$ 13,506	$ 203,233
Accumulated Depreciation	13,276	24,545	12,089	49,910
December 29, 2019 net book value	128,435	23,471	1,417	153,323
Cost	140,250	49,708	13,690	203,648
Accumulated Depreciation	27,411	30,014	12,850	70,275
December 27, 2020 net book value	$ 112,839	$ 19,694	$ 840	$ 133,373

Total cash outflows for payments on lease liabilities was $26.2 million for the period ended December 27, 2020, (2019: $15.6 million) of which $18.9 million (2019: $9.9 million) was for principal repayments.

During the period, the Company expensed $0.5 million (2019: $1.0 million) in leases that did not meet the requirements for recognition under IFRS 16. These leases were either low value, or had a term of less than twelve months.

6. RIGHT-OF-USE ASSET (Continued)

Right-of-use asset impairments are associated with a service center location and production facility location that will not be used by the Company for the remaining duration of the lease as a result of the NFI Forward restructuring program (see note 28). The impairments total of $3.6 million are reflected in the Manufacturing reportable segment.

The Company assessed the extension periods embedded within each lease for inclusion in the lease liabilities on a lease by lease basis. When it determined it was reasonably certain to exercise the extension option within the lease, the Company has included those extension periods in the initial recognition of the right-of-use asset and lease liability. Significant leases where assumptions have been made are long-term building leases.

7. GOODWILL AND INTANGIBLE ASSETS

	Goodwill	Trade names	Patents and Licenses	Customer relationships	Backlog of sales orders	Total
Cost	$ 436,278	$ 224,300	$ 130,917	$ 398,321	$ 6,400	$ 1,196,216
Accumulated amortization	—	1,238	114,094	123,474	6,400	245,206
December 30, 2018 net book value	436,278	223,062	16,823	274,847	—	951,010
Additions	—	—	61	—	—	61
Assumed as a result of business acquisitions	124,462	43,181	22,287	123,338	14,562	327,830
Amortization charge	—	(275)	(10,842)	(23,054)	(8,414)	(42,585)
Cumulative translation adjustment	8,168	1,408	630	3,879	117	14,202
December 29, 2019 net book value	568,908	267,376	28,959	379,010	6,265	1,250,518
Additions	—	—	29	—	—	29
Adjustment to purchase equation for business combinations	9,748	—	—	511	125	10,384
Amortization charge	—	(275)	(8,324)	(25,662)	(6,190)	(40,451)
Impairment loss	(50,790)	—	—	—	—	(50,790)
Cumulative translation adjustment	1,621	1,610	481	4,179	(200)	7,691
December 27, 2020 net book value	$ 529,487	$ 268,711	$ 21,145	$ 358,038	$ —	$ 1,177,381
Recorded as:						
Cost	$ 568,908	$ 268,889	$ 153,895	$ 525,538	$ 21,079	$ 1,538,309
Accumulated amortization	—	1,513	124,936	146,528	14,814	287,791
December 29, 2019 net book value	568,908	267,376	28,959	379,010	6,265	1,250,518
Cost	529,487	270,499	154,852	530,823	22,118	1,507,779
Accumulated amortization	—	1,788	133,707	172,785	22,118	330,398
December 27, 2020 net book value	$ 529,487	$ 268,711	$ 21,145	$ 358,038	$ —	$ 1,177,381

The recoverable amount of the Company's cash generating units ("CGUs") is determined based on value-in-use calculations. These calculations use estimated cash flow projections based on financial plans approved by the Board covering three to five-year periods and discount rates based on weighted average cost of capital of like businesses that range between 7% and 14% per annum for the Alexander Dennis Limited ("ADL") and North American bus/coach manufacturing CGUs, between 11% and 17% for the ARBOC CGU, and between 7% and 12% per annum for the aftermarket parts and ADL parts CGU. Cash flows beyond this period are extrapolated using a steady estimated growth rate based on the long-term average annual growth rate of 3% for each industry in which the CGUs operate. Management has determined planned cash flows based on a projected production schedule, past performance and expectations of market development. The discount rates used reflect specific risks relating to the relevant CGUs.

Sensitivity testing is conducted as part of the annual impairment tests. Management believes that any reasonable change in the key assumptions used to determine the recoverable amounts would not cause the carrying amounts of any of the CGUs to exceed its recoverable amount.

During the first quarter of 2020, the Company idled production facilities to manage the adverse impacts of the COVID-19 pandemic on the Company's business and operations and that of its customers and suppliers and to address the health and safety concerns of its employees. The idling of production facilities resulted in significant downward revisions to the budgeted net cash flows of all manufacturing CGUs. The expected impact of government lock-downs on demand for aftermarket parts and services also resulted in

7. GOODWILL AND INTANGIBLE ASSETS (Continued)

significant downward revisions to the budgeted net cash flows of all aftermarket CGUs. The COVID-19 pandemic also caused a significant decline in private markets, resulting in the cancellation or deferral of many private customer orders for coaches in North America and coaches and buses in the UK, further reducing budgeted net cash flows at the motor coach manufacturing and ADL manufacturing CGUs. Public market order delays and decline also reduced budgeted net cash flows at the bus manufacturing CGU. The uncertainty surrounding the COVID-19 pandemic also caused significant volatility in the equity markets, resulting in a systematic increase in the cost of equity capital. Based on these factors, management concluded that impairment indicators existed at all CGUs and, accordingly, an interim quantitative impairment test was performed for all CGUs as at the end of the first, second and third quarters of 2020.

Based upon the results of the interim quantitative impairment test performed during the first quarter of 2020, management determined that the estimated recoverable amount of the motor coach manufacturing CGU was $295 million and, as the carrying amount exceeded the recoverable amount, a goodwill impairment charge of $50.8 million was recorded. No other impairments were identified in any of the first, second or third quarters tests.

During the third quarter of 2020, the Company announced its commitment to a significant restructuring program called "NFI Forward" (see Note 28). Prior to this restructuring, management monitored goodwill for impairment separately at each of its six CGUs: bus manufacturing, motor coach manufacturing, ARBOC, ADL manufacturing, ADL aftermarket parts operations and aftermarket parts operations. As a result of the restructuring, management had determined that it was appropriate to combine the goodwill and intangible assets of the bus manufacturing and motor coach manufacturing CGUs for impairment testing purposes. This determination is based on the Company combining the business operations of the two CGUs as part of NFI Forward. While both CGUs still generate separately identifiable cash inflows, management is no longer able to separately identify the cash outflows of each CGU. Both CGUs are expected to benefit from the synergies of the combination, which further supports management's decision to monitor for impairment at the combined level. The NFI Forward restructuring program also combined the North American aftermarket parts operations of ADL and NFI parts. As a result of this combination, the Company reallocated $6.2 million of goodwill and $10.5 million of intangible assets from the ADL aftermarket parts operations CGU to the aftermarket parts operations CGU for impairment testing purposes.

Based upon historical operating results, management's forecasts and business plans, the Company's trade names were assigned an indefinite life, except for the "NABI Parts" tradename (net book value of $1,513 at December 27, 2020) which is amortized over its useful life, which ends in 2025.

8. OTHER LONG-TERM ASSETS

	December 27, 2020	December 29, 2019
Long-term restricted deposit (note 24c)	$ 30,000	$ 14,490
Long-term accounts receivable	5,113	5,122
Non-current asset held for sale	1,809	—
	$ 36,922	$ 19,612

Long-term restricted deposit is collateral for certain of the Company's letters of credit.

The non-current asset held for sale represents a service facility that is being sold to a third party. The sale of the property was finalized in January 2021. The service facility is part of the manufacturing segment operations.

9. CURRENT PORTION OF LONG TERM LIABILITIES

	December 27, 2020	December 29, 2019
Deferred revenue (note 13)	$ 99,454	$ 94,372
Provisions (note 14)	28,208	29,314
Deferred compensation obligation (note 11)	1,045	1,678
Obligations under leases (note 6)	19,903	19,160
	$ 148,610	$ 144,524

10. ACCRUED BENEFIT LIABILITY

Defined benefit plan

The Company's subsidiaries have defined benefit plans which cover employees in Canada and the United States. Actuarial valuations for the Company's subsidiaries were last performed as at December 31, 2019 and December 31, 2017.

Information in respect of the Company's defined benefit plan is as follows:	**December 27, 2020**	December 29, 2019
Change in plan assets		
Plan assets at fair value — beginning of period	$ 101,436	$ 125,684
Interest income	3,106	4,503
Remeasurement gains - return on plan assets (excluding amounts in net interest)	4,911	13,617
Administrative expenses	(159)	(1,440)
Employer's contributions	5,678	7,803
Benefits paid	(4,078)	(52,341)
Plan settlement	—	(108)
Foreign exchange (loss) gain	(2,144)	3,718
Plan assets at fair value — end of period	108,750	101,436
Change in defined benefit obligation		
Defined benefit obligation — beginning of period	109,473	130,949
Current service cost	5,279	4,625
Interest cost	3,317	4,685
Benefits paid	(7,921)	(52,341)
Plan settlement	(683)	(1,779)
Foreign exchange loss	1,997	3,847
Actuarial loss arising from changes in financial assumptions	14,749	19,636
Actuarial loss (gain) arising from experience adjustments assumptions	3,281	(149)
Defined benefit obligation — end of period	129,492	109,473
Accrued benefit liability - present value of unfunded obligations	$ (20,742)	$ (8,037)

The actual gain on the plan assets for Fiscal 2020 was $8,017 (Fiscal 2019: loss of $18,120).

The significant actuarial assumptions adopted in measuring the Company's accrued benefit obligation and net pension plan expenses are as follows:

		Fiscal 2020	Fiscal 2019
Country	Mortality Table	Discount Rate	
Canada	CPM2014 Private sector with Scale MI-2017 with size adjustment	3.10 %	3.80 %
Canada	CPM2014 Private sector with Scale MI-2017 with no size adjustment	2.60 %	3.10 %

			Discount rate - sensitivity		**Life expectancy - sensitivity**	
			1% increase	1% decrease	one year increase	one year decrease
Country	Last valuation date	Next valuation date	Then obligation would decrease by:	Then obligation would increase by:	Then obligation would increase by:	Then obligation would decrease by:
Canada	Dec. 31, 2017	Dec. 31, 2020	17.7 %	22.8 %	1.5 %	1.5 %
Canada	Dec. 31, 2019	Dec. 31, 2022	21.1 %	27.4 %	3.4 %	3.5 %

The defined benefit plan typically exposes the Company to actuarial risks such as: investment risk, interest rate risk and longevity risk.

10. ACCRUED BENEFIT LIABILITY (Continued)

Investment risk

The present value of the defined benefit plan liability is calculated using a discount rate determined by reference to high quality corporate bond yields; if the return on plan assets is below this rate, it will create a plan deficit. Management believes the plan currently has a relatively balanced investment in equity securities and debt instruments. Due to the long-term nature of the plan liabilities, the Company's pension committee considers it appropriate that a reasonable portion of the plan assets should be invested in equity securities to leverage the return generated by the fund.

Interest rate risk

A decrease in the bond interest rate will increase the plan liability; however, this will be partially offset by an increase in the return on the plan's debt investments.

Longevity risk

The present value of the defined benefit plan liability is calculated by reference to the best estimate of the mortality of plan participants both during and after their employment. An increase in the life expectancy of the plan participants will increase the plan's liability.

The Company's defined benefit plan is a fixed benefit plan and, as a result, the rate of compensation increases does not have any impact on the actuarially determined accrued benefit liability. Expected contributions to the defined benefit plan for the 52-week period ending December 27, 2020 are $2,309.

The Company's defined benefit pension plan expense, included in cost of sales and sales, general and administration costs and other operating expenses is as follows:

	Fiscal 2020	Fiscal 2019
Current service costs	$ 5,279	$ 4,625
Net interest expense	211	183
Administrative expenses	159	1,440
Plan settlement	(683)	(1,671)
Foreign exchange loss	341	1,272
Components of defined benefit costs recognized in net earnings	$ 5,307	$ 5,849

	Fiscal 2020	Fiscal 2019
Remeasurement gains - return on plan assets (excluding amounts in net interest)	$ 4,911	$ 13,617
Actuarial losses arising from changes in financial assumptions	(14,749)	(19,636)
Actuarial (losses) gains arising from experience adjustments assumptions	(3,281)	149
Foreign exchange gain	825	1,836
	(12,294)	(4,034)
Deferred income taxes recorded through other comprehensive (loss) income	3,088	(356)
Net actuarial losses recognized in other comprehensive (loss) income	$ (9,206)	$ (4,390)

An analysis of the assets of the plans by investment category is provided as follows:

	December 27, 2020	December 29, 2019
Asset category		
Cash and cash equivalents	0.6%	0.4%
Canadian equities	11.8%	17.7%
Foreign equities	24.1%	32.8%
Real estate	16.2%	3.6%
Bonds	47.3%	45.5%
	100.0%	100.0%

11. DEFERRED COMPENSATION OBLIGATION

	December 27, 2020	December 29, 2019
Performance share units under PRSU Plan (officers and senior management)	$ 473	$ 2,088
Restricted share units under PRSU Plan (officers and senior management)	1,045	50
Deferred share units under DSU Plan (non-employee board of directors)	2,761	2,330
	4,279	4,468
Less: current portion	1,045	1,678
	$ 3,234	$ 2,790

Effective December 17, 2012, the Board approved the Performance and Restricted Share Unit Plan (the "PRSU Plan") and it was amended on December 16, 2013, December 18, 2018 and August 5, 2020. The terms of the amended PRSU Plan govern awards made on or after the 2014 plan year, 2018 plan year and August 2020, respectively.

The purposes of the PRSU Plan are to attract, retain and motivate key personnel, reward officers and senior management and to align their interests with those of shareholders by making a significant portion of their incentive compensation directly dependent on achieving key strategic, financial and operational objectives that are crucial to the ongoing growth and profitability of the Company. Under the terms of the PRSU Plan, the human resources, compensation and corporate governance committee of the Board may grant eligible participants performance share units ("PSUs") or restricted share units ("RSUs"), which give the holders thereof the right to receive, upon vesting and redemption of a unit, a cash payment equal to the fair market value of a Share at the time of redemption. When dividends are paid on a Share, additional units equivalent to the amount of the dividends multiplied by the number of PSUs and RSUs held (and determined based on the then fair market value of the Shares) are credited to a participant's account. The actual value of a PSU on the settlement date is contingent on the Share price and the Company's actual performance over a three-year period relative to the established objectives. The actual value of an RSU on the settlement date is contingent on the Share price only and RSUs generally vest and settle as to one-third on each of the first, second and third anniversaries of the grant date. PSUs and RSUs also immediately vest upon a participant's termination without cause or resignation for good reason within a specified period of time following the closing of a transaction resulting in certain change of control events and upon certain terminations of employment and, with respect to PSUs and RSUs granted prior to 2019, upon the closing of a transaction resulting in certain change of control events.

RSUs and PSUs granted in Fiscal 2020 were determined based on the volume weighted average trading price of a Share for the last five trading days of 2019 and the desired compensation value.

As well, the Board adopted NFI's Deferred Share Unit Plan for Non-Employee Directors (the "DSU Plan") on November 7, 2011 and it was amended and restated on December 8, 2015, December 18, 2015, March 14, 2019 and September 14, 2020. Pursuant to the plan, non-employee directors may elect once each calendar year to receive all or a portion of their annual retainer and meeting fees in the form of deferred share units ("DSUs") instead of cash. A DSU is the right to receive a cash payment based on the value of a Share credited by means of a bookkeeping entry to an account in the name of the non-employee director. DSUs are credited to the director's account on the first day of each calendar quarter, the number of which is determined by dividing the amount of the applicable portion of the director's elected amount by the volume weighted average trading price of a Share for the last five trading days.

When dividends are paid on a Share, additional DSUs equivalent to the amount of the dividend multiplied by the number of DSUs held (and determined based on the then fair market value of the Shares) will be credited to the director's account. At the end of the director's tenure as a member of the Board, the director will be entitled to receive a cash redemption payment equal to the fair market value of a Share multiplied by the number of DSUs held.

11. DEFERRED COMPENSATION OBLIGATION (Continued)

	PSUs	RSUs	DSUs	Total
Units outstanding at December 30, 2018	115,841	28,627	93,595	238,063
Units granted	96,523	44,373	18,082	158,978
Distribution units granted	10,460	3,729	5,082	19,271
Units Expired	—	(910)	—	(910)
Units Redeemed	—	—	(10,411)	(10,411)
Vested and reclassified as current liability	(71,347)	(35,470)	—	(106,817)
Units outstanding at December 29, 2019	151,477	40,349	106,348	298,174
Units granted	126,381	63,191	32,271	221,843
Distribution units granted	15,574	5,802	6,969	28,345
Units Expired	(70,876)	(6,744)	—	(77,620)
Units Redeemed	—	—	—	—
Vested and reclassified as current liability	(4,665)	(25,580)	—	(30,245)
Units outstanding at December 27, 2020	217,891	77,018	145,588	440,497
Vested units	—	—	145,588	145,588
Unvested units	217,891	77,018	—	294,909

12. SHARE-BASED COMPENSATION - EQUITY SETTLED

The Board adopted a Share Option Plan (the "2013 Option Plan") for NFI on March 21, 2013, under which employees of NFI and certain of its affiliates may receive grants of share options. The 2013 Option Plan was amended and restated on December 8, 2015, December 31, 2018 and August 5, 2020. Directors who are not employed with NFI are not eligible to participate in the 2013 Option Plan. A maximum of 3,600,000 Shares are reserved for issuance under the 2013 Option Plan. One quarter of the share options become vested on the first grant date anniversary and an additional one-quarter on the second, third and fourth anniversary of such date.

The Board adopted a new share option plan on March 12, 2020 (the "2020 Option Plan"), which was approved by shareholders on May 7, 2020 and amended on August 5, 2020, under which employees of NFI and certain of its affiliates may receive grants of options for Shares. Directors who are not employed with NFI are not eligible to participate in the 2020 Option Plan. A maximum of 3,200,000 Shares are reserved for issuance under the 2020 Option Plan. The options become vested as to one-quarter on the first grant date anniversary and an additional one-quarter on the second, third and fourth anniversary of the grant date.No options have been granted under the 2020 Option Plan.

Option Grant dates	Number	Exercised	Expired	Vested	Unvested	Expiry date	Exercise price	Fair Value at grant date
March 26, 2013	490,356	(483,030)	—	(7,326)	—	March 26, 2021	C$10.20	C$1.55
December 30, 2013	612,050	(573,668)	(9,631)	(28,751)	—	December 30, 2021	C$10.57	C$1.44
December 28, 2014	499,984	(252,233)	(11,368)	(236,383)	—	December 28, 2022	C$13.45	C$1.83
December 28, 2015	221,888	(19,532)	—	(202,356)	—	December 28, 2023	C$26.75	C$4.21
September 8, 2016	2,171	—	(2171)	—	—	September 8, 2024	C$42.83	C$8.06
January 3, 2017	151,419	(1,610)	(12,534)	(102,557)	34,718	January 3, 2025	C$40.84	C$7.74
January 2, 2018	152,883	—	(10,750)	(71,071)	71,062	January 2, 2026	C$54.00	C$9.53
January 2, 2019	284,674	—	(25,314)	(64,844)	194,516	January 2, 2027	C$33.43	C$5.01
July 15, 2019	2,835	—	—	(709)	2,126	July 15, 2027	C$35.98	C$4.90
December 31, 2019	519,916	—	(33,218)	—	486,698	December 31, 2027	C$26.81	C$3.36
	2,938,176	(1,330,073)	(104,986)	(713,997)	789,120		C$29.32	

12. SHARE-BASED COMPENSATION - EQUITY SETTLED (Continued)

The following reconciles the share options outstanding:

	Fiscal 2020		Fiscal 2019	
	Number	Weighted average exercise price	Number	Weighted average exercise price
Balance at beginning of period	1,068,906	C$30.77	946,306	C$27.02
Granted during the period	519,916	C$26.81	287,559	C$33.46
Expired during the period	(77,059)	C$34.26	(6,928)	C$40.75
Exercised during the period	(8,646)	C$13.45	(158,031)	C$12.77
Balance at end of period	1,503,117	C$29.32	1,068,906	C$30.77

Fair values were measured based on the Black-Scholes formula. Expected volatility is estimated by considering historic average share price volatility. The inputs used in the measurement of the fair values of the share-based payment plans granted in Fiscal 2020 and Fiscal 2019 are the following:

Options grant date	December 31, 2019	January 2, 2019
Fair value at grant date (C$)	$3.36	$5.01
Share price (C$)	$26.81	$33.43
Exercise price (C$)	$26.81	$33.43
Expected volatility	28.4 %	24.4 %
Option life (expected weighted average life)	5.5 years	5.5 years
Expected dividends	6.16 %	3.71 %
Risk-free interest rate (based on government bonds)	1.64 %	1.89 %

On May 8, 2014, shareholders' approved the Company's Restricted Share Unit Plan for Non-Employee Directors (the "Director RSU Plan"). The Director RSU Plan was amended and restated on December 8, 2015, December 31, 2017, March 14, 2019 and September 14, 2020. A maximum of 500,000 Shares are reserved for issuance under the Director RSU Plan. Pursuant to the Director RSU Plan, non-employee directors are permitted to elect, once each calendar year, to receive all or a portion of their annual retainer in the form of restricted share units ("Director RSUs") and/or DSUs instead of cash. A Director RSU is a right to acquire a fully-paid and non-assessable Share credited by means of a bookkeeping entry to an account in the name of the non-employee director.

A director generally must make the election prior to the end of the calendar year preceding the year to which such election is to apply. The Board, in its sole discretion, may award additional Director RSUs, subject to an annual aggregate value of $150 per director. The number of Director RSUs to be awarded to a director is determined by dividing the amount of the applicable portion of the director's annual retainer by the applicable fair market value of a Share on that date. When dividends are paid on a Share, additional Director RSUs equivalent to the aggregate number of Director RSUs held by a director on the dividend record date multiplied by the amount of dividend paid by NFI on each Share, and then divided by the fair market value of the Shares on the dividend payment date, will automatically be credited to the director's account. Under the Director RSU Plan, Director RSUs vest immediately as at each applicable award date. A director (other than a U.S. director) will be permitted to exercise the Director RSUs credited to his or her account at any time prior to December 15 of the year following the year in which the director ceases to be a non-employee director of NFI or one of its affiliates. A U.S. director will be required to specify the exercise date in the annual election form in accordance with Section 409A of the U.S. Internal Revenue Code.

	Number of Director RSUs
Balance - December 30, 2018	22,743
Director RSUs issued	25,686
Director RSUs exercised	(17,754)
Balance - December 29, 2019	30,675
Director RSUs issued	40,344
Director RSUs exercised	(25,549)
Balance - December 27, 2020	45,470

13. DEFERRED REVENUE

	December 27, 2020	December 29, 2019
Extended warranties	$ 29,327	$ 21,220
Progress payments	85,735	86,506
	115,062	107,726
Less: current portion of deferred revenue	(99,454)	(94,372)
	$ 15,608	$ 13,354

Deferred revenue is comprised of progress payments that have not yet qualified for recognition as revenue under the Company's revenue recognition policies and also deferred revenue from the sale of extended warranty contracts which are amortized over the extended warranty period commencing at the end of the one-year basic warranty period

14. PROVISIONS

The Company's insurance risk retention meets the IFRS definition of provisions, a liability with uncertain timing or amount.

The restructuring provision consists of employee termination benefits associated with the NFI Forward restructuring initiative that was announced on July 27, 2020 (note 28).

The Company generally provides its customers with a base warranty on the entire transit bus or motor coach and a corrosion warranty on the related structure. The movements in the provisions are as follows:

	Insurance Risk Retention	Restructuring	Warranty	Total
December 30, 2018	$ 24,504	—	76,280	100,784
Assumed as a result of business acquisition	—	—	7,434	7,434
Additions	8,880	—	44,226	53,106
Amounts used/realized	(5,383)	—	(47,693)	(53,076)
Unused provision	(504)	—	(16,642)	(17,146)
Unwinding of discount and effect of changes in the discount rate	—	—	225	225
Exchange rate differences	—	—	167	167
December 29, 2019	$ 27,497	$ —	$ 63,997	$ 91,494
Additions	6,352	20,102	39,889	66,343
Amounts used/realized	(8,137)	(15,184)	(41,045)	(64,366)
Unused provision	(2,533)	(1,401)	(5,163)	(9,097)
Unwinding of discount and effect of changes in the discount rate	—	—	60	60
Exchange rate differences	—	189	190	379
	23,179	3,706	57,928	84,813
Less current portion	3,000	3,706	21,502	28,208
December 27, 2020	$ 20,179	$ —	$ 36,426	$ 56,605

15. DEFERRED TAXES AND INCOME TAX EXPENSE

Deferred income tax assets and liabilities are offset when there is a legally enforceable right to offset current tax assets against current tax liabilities and when the deferred income tax assets and liabilities relate to income taxes levied by the same taxation authority on either the taxable entity or different taxable entities where there is an intention to settle the balances on a net basis. The offset amounts by tax jurisdiction presented on the statements of financial position are as follows:

	December 27, 2020	December 29, 2019
As presented on statements of financial position:		
Deferred tax liabilities	76,689	105,023
	$ 76,689	$ 105,023

The gross movement on the deferred income tax account is as follows:

	Fiscal 2020	Fiscal 2019
Beginning of period	$ (105,023)	$ (83,121)
Assumed as a result of business acquisitions	259	(41,850)
Exchange rate differences	535	64
Tax recorded through net earnings (loss)	24,936	19,342
Tax recorded through other comprehensive loss	3,335	1,530
Tax recorded through equity	(731)	(988)
End of period	$ (76,689)	$ (105,023)

The movement in deferred income tax assets and liabilities during the period, without taking into consideration the offsetting of balances within the same tax jurisdiction, is as follows:

Deferred tax liabilities	Property Plant and Equipment	Goodwill and Intangibles	Right of Use Assets	Other	**Total**
December 30, 2018	(11,799)	(127,311)	—	(1,079)	$ (140,189)
Tax recorded through net earnings (loss)	(1,586)	7,639	(28,565)	3,854	(18,658)
Assumed as a result of business acquisition	(2,724)	(36,269)	—	(5,643)	(44,636)
Cumulative translation adjustment	—	(935)	—	—	(935)
December 29, 2019	**(16,109)**	**(156,876)**	**(28,565)**	**(2,868)**	**(204,418)**
Tax recorded through net earnings (loss)	(4,272)	5,237	2,415	(360)	3,020
Assumed as a result of business acquisition	—	400	—	—	400
Cumulative translation adjustment	—	(892)	—	—	(892)
December 27, 2020	**$ (20,381)**	**$ (152,131)**	**$ (26,150)**	**$ (3,228)**	**$ (201,890)**

15. DEFERRED TAXES AND INCOME TAX EXPENSE (Continued)

Deferred tax assets	Reserves and accruals not currently deductible	Tax Credits	Provisions	Property Plant and Equipment	Right of Use Assets	Loss carry forward	Pension	Deferred Financing Costs and Interest	Other	Total
December 30, 2018	14,576	1,086	30,471	—	—	2,613	1,762	2,059	4,501	$ 57,068
Tax recorded through net earnings	11,457	(1,086)	(8,066)	—	29,831	8,930	185	(645)	(2,606)	38,000
Tax recorded through other comprehensive income	—	—	—	—	—	—	1,530	—	—	1,530
Tax recorded through equity	—	—	—	—	—	—	—	—	(53)	(53)
Assumed as a result of business acquisition	—	—	—	—	—	—	—	—	2,786	2,786
Exchange rate differences	17	—	35	—	—	3	2	2	5	64
December 29, 2019	$ 26,050	$ —	$ 22,440	$ —	$ 29,831	$ 11,546	$ 3,479	$ 1,416	$ 4,633	$ 99,395
Tax recorded through net earnings (loss)	1,612	—	880	61	(1,884)	16,723	(22)	(155)	4,701	$ 21,916
Tax recorded through other comprehensive income (loss)	—	—	—	—	—	—	3,335	—	—	$ 3,335
Tax recorded through equity	—	—	—	—	—	—	—	—	161	$ 161
Assumed as a result of business acquisition	—	—	—	—	—	—	—	—	(146)	$ (146)
Exchange rate differences	141	—	122	—	162	63	19	8	25	$ 540
December 27, 2020	$ 27,803	$ —	$ 23,442	$ 61	$ 28,109	$ 28,332	$ 6,811	$ 1,269	$ 9,374	$125,201

Deferred income tax assets are recognized for income tax loss carry-forwards to the extent that the realization of the related tax benefit through future taxable profits is probable. At December 27, 2020, the Company has recognized all of its deferred income tax assets with the exception of $6.8 million of net operating losses in the U.S, which were acquired through the acquisition of ADL, and $23.2 million of tax credits shown below. These losses are restricted to a maximum utilization of $0.2 million per year. At December 27, 2020 the Company has the following tax credits and loss pools expiring as follows:

	United States		Canada	Other
	Tax Credits	Tax Losses	Tax Losses	Tax Losses
2021-2026	—	1,501	—	—
2027	5,049	250	—	—
2028	1,146	250	—	—
2029	2,349	250	—	—
2030	14,620	222	—	—
2031-2037	—	1,078	320	—
2038	—	154	11,673	—
2039	—	154	25,532	—
2040	—	154	20,207	—
2041-2063	—	3,676	—	—
No expiry	—	—	—	65,321

15. DEFERRED TAXES AND INCOME TAX EXPENSE (Continued)

The reconciliation of income tax computed at the U.S. statutory rate, to income tax expense is as follows:

	Fiscal 2020	Fiscal 2019
Earnings before income tax expense	$ (156,092)	$ 99,695
Tax calculated using a 21% U.S. tax rate	(32,779)	20,936
Tax effect of:		
Withholding and other taxes	2,869	3,747
Non-taxable income	(1,231)	(6,007)
Non-deductible impairment loss on goodwill	10,746	—
Revision of tax estimates	2,278	3,974
Foreign exchange impact	(138)	(1,896)
State taxes	(406)	11,873
Impact of rate change on deferred income taxes	3,695	(528)
Foreign tax credit pools and base erosion and anti-abuse tax	20,356	10,482
Rate differential on income taxed at other than U.S. statutory rate	(3,869)	(728)
Other	123	144
Income tax expense	$ 1,644	$ 41,997

Current income taxes	$ 26,580	$ 61,339
Deferred income taxes recovered	(24,936)	(19,342)
Income tax expense for the period	$ 1,644	$ 41,997

16. LONG-TERM DEBT

	Face Value	Unamortized Transaction Costs	**Net Book Value December 27, 2020**	Net Book Value December 29, 2019
Revolving Credit Facility, Secured ("Credit Facility")	1,063,100	2,253	1,060,847	1,053,126
Revolving Credit Facility, Secured ("UK Facility")	65,136	298	64,838	—
	1,128,236	2,551	1,125,685	1,053,126

The Credit Facility has a total borrowing limit of $1.250 billion, which includes a $100 million letter-of-credit facility and a $250 million accordion feature. $11.8 million of outstanding letters-of-credit were drawn against the Credit Facility at December 27, 2020. The Credit Facility bears interest at a rate equal to LIBOR or a U.S. base rate for loans denominated in U.S. dollars and a Canadian prime rate or bankers' acceptance rate for loans denominated in Canadian dollars, plus an applicable margin to those rates and matures on August 2, 2024.

On April 23, 2020 NFI entered into the $250 million unsecured, one-year Sidecar facility that could be utilized for general corporate purposes. Amounts drawn under the Sidecar were to bear interest at a rate equal to LIBOR or a U.S. base rate for loans denominated in U.S. dollars and a Canadian prime rate or bankers' acceptance rate for loans denominated in Canadian dollars, plus an applicable margin to those rates. No amounts were drawn under the Sidecar and it was terminated on December 23, 2020.

On May 4, 2020 NFI entered into the £50 million unsecured, revolving UK Facility to support ADL's operations in the UK. The facility has a two year term with options to extend. Amounts drawn under the UK Facility bear interest at a rate equal to LIBOR plus an applicable margin. The UK Facility matures on May 4, 2022.

17. SHARE CAPITAL

	December 27, 2020	December 29, 2019
Authorized - Unlimited		
Issued - 62,524,842 Common Shares (December 29, 2019: 62,493,880)	$ 681,405	$ 680,962

17. SHARE CAPITAL(Continued)

Share repurchase

On June 12, 2019, the Company announced the TSX had accepted a notice filed by the Company of its intention to implement a new Normal Course Issuer Bid (the "NCIB") to replace the previous Normal Course Issuer Bid to repurchase its Shares through the facilities of the TSX and any alternative Canadian trading systems on which the Shares are traded. The Company was permitted to repurchase for cancellation up to 5,357,914 Shares, representing approximately 10% of the outstanding public float of Shares on June 4, 2019. The Company was permitted to repurchase Shares under the NCIB commencing June 17, 2019 up to June 16, 2020, or earlier should the Company complete its repurchases prior to such date.

There were no shares purchased or canceled under the NCIB in 2020. The NCIB expired on June 16, 2020. The Company did not file for another normal course issuer bid to replace the expired NCIB.

The following is a summary of changes to the issued and outstanding capital stock during the period:

Shares	Number (000s)	Net Book Value
Balance - December 29, 2019	62,494	$ 680,962
Stock options exercised	9	96
Restricted share units exercised	22	347
Balance - December 27, 2020	62,525	$ 681,405

18. EARNINGS PER SHARE

	Fiscal 2020	Fiscal 2019
Net (loss) earnings attributable to equity holders	$ (157,736)	$ 57,698
Weighted average number of Shares in issue	62,510,544	61,809,479
Add: net incremental Shares from assumed conversion of stock options and exercise of restricted share units	—	188,398
Weighted average number of Shares for diluted earnings per Share	62,510,544	61,997,877
Net (loss) earnings per Share (basic)	$ (2.5234)	$ 0.9335
Net (loss) earnings per Share (diluted)	$ (2.5234)	$ 0.9306

Basic earnings per Share is calculated by dividing the net earnings (loss) attributable to equity holders of the Company by the weighted average number of Shares outstanding during the period.

Diluted earnings per Share is calculated using the same method as basic earnings per Share except that the average number of Shares outstanding includes the potential dilutive effect of outstanding stock options and restricted share units granted by the Company, as determined by the treasury stock method.

19. SUPPLEMENTAL CASH FLOW INFORMATION

Changes in non-cash working capital items

Cash inflow (outflow)	Fiscal 2020	Fiscal 2019
Accounts receivable	$ 105,328	$ (63,592)
Income tax receivable	—	15,111
Inventories	22,483	(40,147)
Prepaid expenses and deposits	(3,214)	5,627
Accounts payable and accrued liabilities	(64,001)	42,474
Deferred revenue	7,336	(4,786)
Provisions	(11,764)	(16,724)
Other	12,594	(29,287)
	$ 68,762	$ (91,324)

20. DEFINED CONTRIBUTION PENSION PLANS

The Company maintains a defined contribution plan for salaried employees. The net pension expense for the Company's defined contribution plans is as follows:

	Fiscal 2020	Fiscal 2019
Defined contribution pension expense	$ 12,783	$ 9,767

Cash payments contributed by the Company during Fiscal 2020 for its defined benefit and defined contribution pension plans amounted to $18.5 million (2019: $17.6 million).

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT

(a) Financial Instruments

The Company has made the following classifications:

Cash	Fair value through profit or loss
Long-term deposit	Fair value through profit or loss
Receivables	Amortized cost
Deposits	Amortized cost
Accounts payables and accrued liabilities	Amortized cost
Other long-term liabilities	Amortized cost
Long-term debt	Amortized cost
Derivative financial instruments	Fair value through profit or loss

(b) Fair value measurement of financial instruments

The Company categorizes its fair value measurements of financial instruments recorded at fair value according to a three-level hierarchy. The hierarchy prioritizes the inputs used by the Company's valuation techniques. A level is assigned to each fair value measurement based on the lowest level input significant to the fair value measurement in its entirety. The three levels of the fair value hierarchy are defined as follows:

Level 1 - fair value measurements that reflect unadjusted, quoted prices in active markets for identical assets and liabilities that the Company has the ability to access at the measurement date.

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT (Continued)

Level 2 - fair value measurements using inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly. These include quoted prices for similar assets and liabilities in active markets, quoted prices for identical or similar assets and liabilities in inactive markets, inputs that are observable that are not prices (such as interest rates and credit risks) and inputs that are derived from or corroborated by observable market data.

Level 3 - fair value measurements using significant non-market observable inputs. These include valuations for assets and liabilities that are derived using data, some or all of which is not market observable data, including assumptions about risk.

The following table presents the carrying amounts and fair values of financial liabilities and financial assets, including their levels in the fair value hierarchy. The table excludes fair value information for financial assets and financial liabilities not measured at fair value if the carrying amount is a reasonable approximation of fair value.

	December 27, 2020		
	Fair value level	Carrying amount	Fair value
Financial assets recorded at fair value			
Cash	Level 1	$ 55,769	$ 55,769
Long-term restricted deposit	Level 1	$ 30,000	$ 30,000
Foreign exchange forward contracts	Level 2	$ 4,490	$ 4,490
Derivative financial instrument assets - current		$ 4,490	$ 4,490
Financial liabilities recorded at fair value			
Total return swap contracts	Level 2	$ 1,078	$ 1,078
Derivative financial instrument liabilities - current		$ 1,078	$ 1,078
Interest rate swap	Level 2	$ 33,069	$ 33,069
Derivative financial instrument liabilities - long term		$ 33,069	$ 33,069

	December 29, 2019		
	Fair value level	Carrying amount	Fair value
Financial assets recorded at fair value			
Cash	Level 1	$ 28,233	$ 28,233
Long-term restricted deposit	Level 1	$ 14,490	$ 14,490
Financial liabilities recorded at fair value			
Total return swap contracts	Level 2	$ 944	$ 944
Foreign exchange forward contracts	Level 2	$ 3,707	$ 3,707
Derivative financial instrument liabilities - current		$ 4,651	$ 4,651
Interest rate swap	Level 2	$ 15,388	$ 15,388
Derivative financial instrument liabilities - long term		$ 15,388	$ 15,388

(c) Risk Management

The Company uses derivative financial instruments including interest rate swaps, total return swaps and forward foreign exchange contracts. These instruments are financial contracts whose value depends on interest rates, share price and foreign currency prices.

The use of derivatives allows the transfer, modification and reduction of current and expected risks, including interest rate, share price, foreign exchange and other market risks. The Company uses derivative financial instruments to manage interest rate, share price and foreign exchange risks in accordance with its risk management policies. Certain derivative instruments, while providing effective economic hedges, are not designated as hedges for accounting purposes. Changes in the fair value of any derivatives that are not designated as hedges for accounting purposes are recognized within “interest and finance costs” or “unrealized foreign exchange loss (gain) on non-current monetary items” in the consolidated statements of net earnings (loss) and total comprehensive income (loss) consistent with the underlying nature and purpose of the derivative instruments.

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT (Continued)

Market risk (interest rate risk and foreign currency risk)

Market risk incorporates a range of risks. Movements in risk factors, such as interest rate risk, equity price risk and foreign currency risk, affect the fair values of financial assets and liabilities. The Company uses derivative financial instruments including interest rate swaps, foreign exchange options and forwards foreign exchange contracts to manage its risks associated with potentially adverse changes in interest rates and foreign exchange rates. These instruments are financial contracts whose values depends on interest rates and foreign currency prices. The use of derivatives allows the transfer, modification and reduction of current and expected risks, including interest rate, foreign exchange and other market risks. The Company uses derivative financial instruments to manage interest rate and foreign exchange risks in accordance with its risk management policies.

The Company does not hold financial instruments for speculative or trading purposes. The Company elected not to apply hedge accounting to its derivative financial instruments.

Interest rate risk

The Company's borrowing under the Credit Facility are at variable rates of interest and expose the Company to interest rate risk. The Company attempts to mitigate this risk through interest rate swaps that could become materially more expensive if interest rates increase or become more volatile. If the cost of mitigating interest rate increases, the Company's debt service obligations on its variable rate indebtedness would increase even though the amount borrowed remained the same, and the Company's net earnings and cash available for servicing its other indebtedness would decrease.

The interest rate swap is subject to interest rate risk. As an illustration, if the interest rates at the Consolidated Statements of Financial Position date had been 100 basis points lower, with all other variable held constant, net loss and comprehensive loss for Fiscal 2020 would have been higher by $17.9 million (Fiscal 2019: $15.3 million), arising mainly as a result of the related fair value adjustment recorded due to lower interest rate. If interest rates had been 100 basis points higher, with all other variables held constant, net loss and comprehensive loss for Fiscal 2020 would have been lower by $17.9 million (Fiscal 2019: $14.8 million), arising mainly as a result of the related fair value adjustment recorded due to higher interest rate.

On February 13, 2019, the Company blended the unrealized gain from the existing swap into a $600 million amortizing notional interest rate swap designed to hedge floating rate exposure on the Credit Facility. The interest rate swap fixes the interest rate at 2.27% plus applicable margin until October 2023.

On July 9, 2020, the Company entered into a $200 million amortizing notional interest rate swap designed to hedge floating rate exposure on its Credit Facility. The interest rate swap fixes the interest rate at 0.243% plus applicable margin until July 2025. The swap begins amortizing on December 9, 2022 at a rate of $20 million per annum.

Equity price risk

The Company entered into a total return swap transaction to hedge the exposure associated with increases in its share value on a portion of the outstanding performance share units, restricted share units, and deferred share units. The total return swap has a re-investment feature which increases the number of Shares in the swap when dividends are paid by the Company. As at December 27, 2020 the Company held a position of 246,136 Shares at a weighted average price of C$30.28. The Company does not apply hedge accounting to these derivative instruments and as such, gains and losses arising from marking these derivatives to market are recognized in net earnings in the period in which they arise.

Foreign currency risk

The United States dollar is the Company's functional currency. Fluctuations in the exchange rate between the United States dollar, Canadian dollar and GBP will affect the Company's reported results. However, the impact of changes in foreign exchange rates on the Company's reported results differ over time depending on whether the Company is generating a net cash inflow or outflow of Canadian dollars and GBP. This is largely dependent on the Company's revenue mix by currency as operating costs denominated in Canadian dollars and GBP have been historically relatively stable.

During Fiscal 2020, the Company generated a net outflow of Canadian dollars. As a matter of policy, the Company enters into foreign exchange forward contracts to protect the expected net Canadian dollar exposure from exchange fluctuation. The Company recorded a net realized foreign exchange gain of $1.5 million during Fiscal 2020 (Fiscal 2019: gain of $1.0 million). This was comprised of a $3.6 million gain on settlement of foreign exchange contracts and a $2.1 million foreign currency loss on translation of Canadian dollar denominated working capital and dividends.

At December 27, 2020, the Company had $85 million of foreign exchange forward contracts to buy currencies in which the Company operates with U.S. dollars, Canadian dollars, or GBP. These foreign exchange contracts range in expiry dates from December 2020 to May 2021. The related asset of $4.5 million (December 29, 2019: $3.7 million liability) is recorded on the consolidated statements of

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT (Continued)

financial position as a current derivative financial instruments asset and the corresponding change in the fair value of the foreign exchange forward contracts is recorded in the consolidated statements of net earnings (loss) and total comprehensive income (loss).

Currency risk is the risk that the fair value of future cash flows of a financial instrument will fluctuate because of changes in foreign exchange rates. The Company is exposed to currency risk, primarily Canadian dollar balances. As an illustration, at December 27, 2020 if the Canadian dollar had weakened 10 percent against the U.S. dollar, with all variable held constant, net loss for Fiscal 2020 would have been higher by $0.6 million (Fiscal 2019: $3.2 million). Conversely, if the Canadian dollar had strengthened 10 percent against the U.S. dollar, with all other variables held constant, net loss would have been lower by $0.7 million for Fiscal 2020 (Fiscal 2019: $3.9 million).

(d) Liquidity Management

The Company's approach to managing liquidity risk is to ensure, as far as possible, that it will always have sufficient liquidity to meet liabilities when due. At December 27, 2020, the Company had a cash balance of $55.8 million (December 29, 2019: $28.2 million), the $1.063 billion under the Credit Facility due in 2024 (December 29, 2019: $1.056 billion), $65.1 million under the UK Facility due in 2022, and $11.8 million of outstanding letters of credit (December 29, 2019: $12.8 million). In addition, there are $52.1 million of the letters of credit outstanding outside of the Credit Facility. The Credit Facility has a total borrowing limit of $1.250 billion, which includes a $100 million letter-of-credit facility and a $250 million accordion feature. The UK Facility has a total borrowing limit of £50.0 million. The liquidity position as at December 27, 2020 is $233.5 million.

The Company's principal sources of funds are cash generated from its operating activities, share issuances and borrowing capacity remaining under the credit facilities. Management believes these sources of funds together with access to equity markets and other borrowings will provide NFI with sufficient liquidity and capital resources to meet its current and future financial obligations as they come due, as well as to provide funds for its financing requirements, capital expenditures and other needs for the foreseeable future.

The following table outlines the maturity analysis of the undiscounted cash flows of certain non-financial liability and committed leases as at December 27, 2020:

US dollars in thousands	Total	2021	2022	2023	2024	2025	Post 2025
Leases	194,376	22,204	21,040	18,498	13,571	10,083	108,980
Accrued benefit liability	2,911	2,911	—	—	—	—	—
	$ 197,287	$ 25,115	$ 21,040	$ 18,498	$ 13,571	$ 10,083	$ 108,980

Credit risk

Financial instruments which potentially subject the Company to credit risk and concentrations of credit risk consist principally of cash, accounts receivable and derivative financial instruments. Management has assessed that the credit risk associated with accounts receivable is mitigated by the significant proportion for which the counterparties are well-established transit authorities.

Additionally, up to 80% of the capital cost of new transit buses and coaches sold to public transit authorities and municipalities in the United States typically come from the U.S. Federal Transit Administration, while the remaining 20% comes from state and municipal sources. The maximum exposure to the risk of credit for accounts receivable corresponds to their book value. Historically, the Company has experienced nominal bad debts as a result of the customer base being principally comprised of municipal and other local transit authorities. During Fiscal 2020, the Company recorded a bad debt expense of $574 as compared to $177 bad debt expense in Fiscal 2019.

The carrying amount of accounts receivable is reduced through the use of an allowance account and the amount of the loss is recognized in the consolidated statements of net earnings (loss) and total comprehensive income (loss) within "sales, general and administration costs and other operating expenses". When a receivable balance is considered uncollectible, it is written off against the allowance for doubtful accounts. Subsequent recoveries of amounts previously written off are credited against "sales, general and administration costs and other operating expenses":

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT (Continued)

	December 27, 2020	December 29, 2019
Current, including holdbacks	$ 380,328	$ 482,476
Past due amounts but not impaired		
1 - 60 days	39,988	37,413
Greater than 60 days	7,081	6,800
Less: Allowance for doubtful accounts	(989)	(284)
Total accounts receivables, net	$ 426,408	$ 526,405

As at December 27, 2020, there was no amount that would otherwise be past due or impaired whose terms have been renegotiated.

The counterparties to the Company's derivatives are significant financial institutions. The Company could be exposed to loss in the event of non-performance by the counterparty; however, credit ratings and concentration of risk of the financial institutions are monitored on a regular basis.

On December 23, 2020, the Company amended its $1.250 billion Credit Facility and its UK Facility (together the "amended facilities"). The amended facilities provide the Company with relaxed covenants as it recovers from the impacts of the COVID-19 pandemic. In addition to amending the facilities, the Company terminated the unused Sidecar facility.

Under the terms of the amended facilities, the total leverage and interest coverage ratios for 2021 and 2022 have been relaxed. During 2021, the Company has received a waiver of the total net leverage covenant and will instead need to comply with a total net leverage ratio that is based on a financial projection for the Company's 2021 fiscal period.

Beginning in 2022, the Company will be required to maintain a total net leverage ratio of less than 5.00 to 1 from January 3, 2022 until April 3, 2022; of less than 4.50 to 1 from April 4, 2022 to July 3, 2022; of less than 4.25 to 1 from July 4, 2022 until October 2, 2022; and of less than 3.75 to 1 at all times thereafter.

The Company will also have to comply with a $50 million minimum liquidity covenant at all times until the total net leverage covenant is less than 3.75x, a total net debt to capitalization ratio of less than 0.70:1.00 during 2021, and an interest coverage ratio of at least 2.25x during 2021 and 3.00x beginning in the first quarter 2022. The amended facilities require the dividend payment not exceed the current level.

Adjusted EBITDA is calculated on a rolling last twelve-month basis, provided that for those calculations required on April 4, 2021, the rolling period is calculated as Adjusted EBITDA for the three Fiscal Quarters ending April 4, 2021, December 27, 2020 and September 27, 2020 multiplied by 4/3.

Under the amended facilities the Company has until February 23, 2021 to provide the lenders security on certain of its assets, including a general security agreement on NFI's personal property, but excluding security on real property. The financing security arrangements were put in place on February 19, 2021. The general security agreement is in place until the later of April 3, 2023 or the date on which NFI has delivered two consecutive fiscal quarters with a total leverage ratio at less than 3.75 to 1.

Management believes the Company's cash position, anticipated future revenues, liquidity from credit facilities together with access to equity markets and other borrowings are sufficient to support current operations, dividends and strategic initiatives.

The calculation of the financial covenants at December 27, 2020 are provided below. As at December 27, 2020, the Company was in compliance with the requirements.

	December 27, 2020	December 29, 2019
Total Leverage Ratio (must be less than 6.25 [2019: 4.25])	4.90	3.24
Interest Coverage Ratio (must be greater than 3.00 [2019: 3.00])	4.11	7.73

US dollars in thousands	December 27, 2020
Liquidity Position (must be greater than $50 million)	$ 233,459

Compliance with financial covenants is reported quarterly to the Board. Other than the requirements imposed by borrowing agreements, the Company is not subject to any externally imposed capital requirements. Capital management objectives are reviewed on an annual basis or when strategic capital transactions arise.

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT (Continued)

(e) Capital management

The Company's objectives in managing capital are to deploy capital to provide an appropriate return to shareholders and to maintain a capital structure that provides the flexibility to take advantage of growth and development opportunities, maintain existing assets, meet financial obligations and enhance the value of the Shares. The capital structure of the Company consists of cash, long-term debt, other long-term liabilities and shareholders' equity. The Company manages capital to ensure an appropriate balance between debt and equity. In order to maintain or adjust its capital structure, the Company may issue additional Shares, repurchase Shares, borrow additional funds or refinance debt at different terms and conditions.

22. SEGMENT INFORMATION

The Company has two reportable segments which are the Company's strategic business units: bus/coach manufacturing operations, medium-duty/cutaway manufacturing operations ("Manufacturing Operations") and Aftermarket Operations. The strategic business units offer different products and services, and are managed separately because they require different technology and marketing strategies. For each of the strategic business units, the Company's President and CEO reviews internal management reports on a monthly basis.

The Manufacturing Operations segment derives its revenue from the manufacture, service and support of new transit buses, coaches, medium-duty and cutaway buses. Based on management's judgment and applying the aggregation criteria in IFRS 8.12, the Company's bus/coach manufacturing operations and medium-duty/cutaway manufacturing operations fall under a single reportable segment. Aggregation of these operating segments is based on the segments having similar economic characteristics with similar long-term average returns, products and services, production methods, distribution, geographic market and regulatory environment.

The Manufacturing Operations segment has recorded vendor rebates of $278 (2019: $413), which have been recognized into earnings during 2020, but for which the full requirements for entitlement to these rebates have not yet been met.

The Aftermarket Operations segment derives its revenue from the sale of aftermarket parts for transit buses and motor coaches and medium-duty and cutaway buses.

There is no inter-segment revenue. Unallocated items in the consolidated earnings before income taxes primarily include unrealized foreign exchange gains or losses, interest and finance costs and corporate overhead costs.

The unallocated total assets of the Company primarily include cash, certain goodwill and intangible assets, derivative financial instruments and deferred income tax assets. Corporate assets that are shared by both operating segments are allocated fully to the Manufacturing Operations segment.

Segment information about profits and assets is as follows:

	Fiscal 2020			
	Manufacturing Operations	Aftermarket Operations	Unallocated	Total
Revenue from external customers	$ 2,017,729	$ 401,446	—	$ 2,419,175
Operating costs and expenses	2,133,872	349,342	92,053	2,575,267
Earnings (loss) before income tax expense	(116,143)	52,104	(92,053)	(156,092)
Total assets	1,966,973	487,580	301,362	2,755,915
Addition of capital expenditures	24,989	714	—	25,703
Addition of goodwill and intangibles assets	10,413	—	—	10,413
Impairment loss on goodwill	(50,790)	—	—	(50,790)
Indefinite-life intangible assets	248,231	18,968	—	267,199
Goodwill	340,389	189,098	—	529,487

22. SEGMENT INFORMATION (Continued)

	Fiscal 2019			
	Manufacturing Operations	**Aftermarket Operations**	**Unallocated**	**Total**
Revenue from external customers	$ 2,476,020	$ 417,416	—	2,893,436
Operating costs and expenses	2,350,710	353,805	89,226	2,793,741
Earnings (loss) before income tax expense	125,310	63,611	(89,226)	99,695
Total assets	2,272,684	421,693	261,384	2,955,761
Addition of capital expenditures	36,195	1,380	—	37,575
Addition of goodwill and intangibles assets	250,174	25,674	—	275,848
Indefinite-life intangible assets	246,843	18,746	—	265,589
Goodwill	416,934	151,974	—	568,908

Goodwill and intangible assets related to the acquisition of ADL had been provisionally allocated as at December 29, 2019. Comparative figures have not been restated to reflect final segment purchase price allocation.

The Company's revenue by geography is summarized below:

	Fiscal 2020	Fiscal 2019
North America	$ 1,966,558	$ 2,508,199
UK and Europe	332,512	320,116
Asia Pacific	117,745	63,703
Other	2,360	1,418
Total	$ 2,419,175	$ 2,893,436

The Company's disaggregated manufacturing revenue by major product type is provided below. The Aftermarket operations revenue does not have similarly disaggregated categories.

	Fiscal 2020	Fiscal 2019
Transit buses	$ 1,593,390	$ 1,841,055
Motor coaches	334,421	526,539
Medium-duty and cutaway buses	41,712	49,816
Pre-owned coach	18,424	45,951
Infrastructure solutions	24,714	6,071
Fiberglass reinforced polymer components	5,068	6,588
Manufacturing revenue	$ 2,017,729	$ 2,476,020

The allocation of property, plant and equipment to geographic area is as follows:

	December 27, 2020	December 29, 2019
North America	$ 190,372	$ 224,085
UK and Europe	40,829	43,623
Asia Pacific	949	1,040
Other	—	—
Total	$ 232,150	$ 268,748

23. RELATED PARTY TRANSACTIONS

Compensation of key management

Key management includes the roles of the Board, President and CEO, the CFO, Presidents of each business unit, executive vice presidents and vice presidents. The compensation expense for key management for employee services is shown below:

	Fiscal 2020	Fiscal 2019
Salaries and short-term employee benefits	$ 9,692	$ 8,333
Post-employment benefits	455	414
Share-based payment benefits	3,821	1,433
	$ 13,968	$ 10,180

Share-based payment benefits shown above represent the PSU, RSU, Director RSU, DSU and stock option expense that was recorded in the period.

24. COMMITMENTS AND CONTINGENCIES

(a) In the normal course of business, the Company receives notice of potential legal proceedings or is named as a defendant in legal proceedings, including those that may be related to product liability, wrongful dismissal or personal injury. Many claims are covered by the Company's insurance policies and management does not expect any of the current claims to have a material adverse effect on the Company's financial position, results of operations or cash flows.

(b) Through the normal course of operations, the Company has indemnified the surety companies providing surety bonds required under various contracts with customers. In the event that the Company fails to perform under a contract and the surety companies incur a cost on a surety bond, the Company is obligated to repay the costs incurred in relation to the claim up to the value of the bond.

The Company's guarantee under each bond issued by the surety companies expires on completion of obligations under the customer contract to which the bond relates. The estimated maturity dates of the surety bonds outstanding at December 27, 2020 range from January 2021 to December 2026.

At December 27, 2020, outstanding surety bonds guaranteed by the Company totaled $357.2 million (December 29, 2019: $384.5 million). The Company has not recorded any liability under these guarantees, as management believes that no material events of default exist under any contracts with customers.

(c) The Company has a letter of credit sub-facility of $100.0 million as part of the Credit Facility (December 29, 2019: $100.0 million). As at December 27, 2020, letters of credit totaling $11.8 million (December 29, 2019: $12.8 million) remain outstanding as security for contractual obligations of the Company under the Credit Facility.

The Company has an additional bi-lateral credit facility of £50.0 million. As at December 27, 2020, letters of credit totaling $22.1 million were outstanding under the bi-lateral credit facility. Additionally, there are $30.0 million of letters of credit outstanding outside of the Credit Facility and the bi-lateral credit facility.

As at December 27, 2020, management believes that the Company was in compliance in all material respects with all applicable contractual obligations and the Company has not provided for any costs associated with these letters of credit.

25. GUARANTEES

The Company indemnifies its directors and officers against claims and damages that may be incurred in the performance of their services to the Company. Liability insurance has been purchased with respect to the Company's directors and officers.

26. SUPPLEMENTARY EXPENSE INFORMATION

	Fiscal 2020	Fiscal 2019
Employee benefit expense	$ 317,451	$ 445,167
Depreciation of plant and equipment	70,333	61,985
Amortization of intangible assets	40,451	42,585

The expenses listed above are included in cost of sales and sales, general and administration costs and other operating expenses.

27. GOVERNMENT GRANTS

On March 27, 2020, the Canada Emergency Wage Subsidy ("CEWS") program was introduced by the Government of Canada, reimbursing eligible employers who have experienced the required reduction in revenue for a portion of wages paid to employees during the COVID-19 pandemic.

The claims submitted or expected to be submitted under the CEWS program are $31.9 million for the fiscal period, $9.7 million of which is included in 'Accounts Receivable' on the Company's audited consolidated statement of financial position at December 27, 2020. In accordance with IAS 20 Accounting for Government Grants and Disclosure of Government Assistance, the CEWS has been recognized as an offset to wage expense ($25.9 million against 'Cost of Sales' and $4.6 million against 'Selling, General and Administration Costs and Other Operating Expenses') on the Company's audited consolidated statement of net earnings (loss) and total comprehensive income (loss). An additional $1.4 million was used to reimburse employee vacation credits. The Company will continue to evaluate its eligibility under the CEWS program in subsequent periods.

On March 26, 2020, the Coronavirus Job Retention Scheme ("CJRS") program was introduced by the Government of the United Kingdom, reimbursing employers who have been unable to maintain their workforce as a result of COVID-19's impact on operations for a portion of wages paid to furloughed employees.

The claims submitted under the CJRS program are $23.0 million for the fiscal period, $1.0 million of which is included in 'Accounts Receivable' on the Company's audited consolidated statement of financial position at December 27, 2020. In accordance with IAS 20 Accounting for Government Grants and Disclosure of Government Assistance, the CJRS has been recognized as an offset to wage expense ($20.8 million against 'Cost of Sales' and $2.2 million against 'Selling, General and Administration Costs and Other Operating Expenses') on the Company's audited consolidated statement of net earnings (loss) and total comprehensive income (loss). The Company will continue to evaluate its eligibility under the CJRS program in subsequent periods.

28. RESTRUCTURING

On July 27, 2020, the Company announced the NFI Forward restructuring initiative ("NFI Forward"). NFI Forward is a transformational initiative expected to generate cost savings by the end of fiscal 2022. These cost reduction initiatives are expected to come from a reduced number of business units, facility rationalization, reduced overhead and a more efficient and integrated company. The items included in net income (loss) for NFI Forward are as follows:

		Fiscal 2020
Employee termination benefits (note 14)	$	18,701
Right-of-use asset impairments (note 6)		3,597
Write-down of inventory to net realizable value (note 4)		1,849
Write-down of property, plant and equipment (note 5)		1,728
Other		568
Total restructuring costs	$	26,443

29. SUBSEQUENT EVENT

On February 3, 2021, the Company entered into an agreement with a syndicate of underwriters (the "Underwriters"), pursuant to which the Company will issue from treasury, and the Underwriters will purchase on a bought deal basis, 8,446,000 common shares at a price of C$29.60 per share for gross proceeds to the Company of C$250.0 million. The Offering was completed on March 1, 2021.

30. COMPARATIVE FIGURES

Certain comparative figures have been restated where necessary to conform with current period presentation.



Financial Results Fiscal 2019

March 11, 2020

NOTES TO READERS

MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS FOR THE 13-WEEKS AND 52-WEEKS ENDED DECEMBER 29, 2019

Information in this Management's Discussion and Analysis ("MD&A") relating to the financial condition and results of operations of NFI Group Inc. ("NFI") is supplemental to, and should be read in conjunction with, NFI's audited consolidated financial statements (including notes) (the "Financial Statements") for the 52-week period ended December 29, 2019. This MD&A contains forward-looking statements, which are subject to a variety of factors that could cause actual results to differ materially from those contemplated by the forward-looking statements. See "Forward-looking Statements" in Appendix B. Some of the factors that could cause results or events to differ from current expectations include, but are not limited to, the factors described in the public filings of NFI available on SEDAR at www.sedar.com. The Financial Statements have been prepared in accordance with International Financial Reporting Standards ("IFRS") and, except where otherwise indicated, are presented in U.S. dollars, which is the functional currency of NFI. Unless otherwise indicated, the financial information contained in this MD&A has been prepared in accordance with IFRS and references to "$" or "dollars" mean U.S. dollars.

	Period from December 31, 2018 to December 29, 2019 ("Fiscal 2019")			**Period from January 1, 2018 to December 30, 2018 ("Fiscal 2018")**		
	Period End Date		# of Calendar Weeks	Period End Date		# of Calendar Weeks
Quarter 1	March 31, 2019	("2019 Q1")	13	April 1, 2018	("2018 Q1")	13
Quarter 2	June 30, 2019	("2019 Q2")	13	July 1, 2018	("2018 Q2")	13
Quarter 3	September 29, 2019	("2019 Q3")	13	September 30, 2018	("2018 Q3")	13
Quarter 4	December 29, 2019	("2019 Q4")	13	December 30, 2018	("2018 Q4")	13
Fiscal year	December 29, 2019		52	December 30, 2018		52

Specific references, definitions and non-GAAP measures are used throughout this MD&A, please see "Meaning of Certain References" and "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings, Adjusted Earnings per Share, and Regions including: North America, UK and Europe, Asia Pacific and Other" and EU's in Appendix B.

Buses manufactured by New Flyer and ADL's single and double deck buses are classified as "transit buses". ARBOC manufactures body on-chassis or "cutaway" and "medium-duty" buses that service transit, paratransit, and shuttle applications. Collectively, transit buses, medium-duty buses and cutaways, are referred to as "buses". A "motor coach" or "coach" is a 35-foot to 45-foot over-the-highway bus typically used for intercity transportation and travel over longer distances than heavy-duty transit buses, and is typically characterized by (i) one or two axles in the rear (related to the weight of the vehicle), (ii) high deck floor, (iii) baggage compartment under the floor, (iv) high-backed seats with a coach-style interior (often including a lavatory and underfloor baggage compartments), and (v) no room for standing passengers. "Product lines" include heavy-duty transit, motor coach, pre-owned coach and cutaway and medium-duty. All of the data presented in this MD&A with respect to the number of transit buses, medium-duty buses, cutaways and motor coaches in service and delivered, is measured in, or based on, "equivalent units". One equivalent unit (or "EU") represents one production slot, being one 30-foot, 35-foot, 40-foot, 45-foot heavy-duty transit bus, one double deck bus, one medium-duty bus, one cutaway bus or one motor coach, whereas one articulated transit bus represents two equivalent units. An articulated transit bus is an extra-long transit bus (approximately 60-feet in length), composed of two passenger compartments connected by a joint mechanism. The joint mechanism allows the vehicle to bend when the bus turns a corner, yet have a continuous interior.

A summary of the Company's order, delivery and backlog information can be found in Appendix C.

Effective December 31, 2018, the Company adopted IFRS 16, the accounting standard which specifies how to recognize, present and disclose leases. This standard provides a single lessee accounting model, requiring lessees to recognize assets and liabilities for all major leases. On transition, the Company has elected to use the following practical expedients and policies:

- To utilize the modified retrospective approach to adopting the standard, accordingly comparative information for 2018 has not been restated
- To utilize the definition of a lease under International Accounting Standard 17 to identify contracts that are, or contain, leases
- To exclude the recognition of the right-of-use asset and lease liability for leases with a term of twelve months or less
- To exclude the recognition of the right-of-use asset and lease liability for leases and of low-value assets and to value the right-of-use asset as equal to the lease liability, adjusting for related amounts prepaid or accrued

The impact of the adoption of IFRS 16 primarily impacts NFI's Gross Margin, Adjusted EBITDA, Net earnings and Adjusted Net Earnings, and the associated per common share ("Share") amounts, Return on Invested Capital ("ROIC") and several balance sheet accounts as reported in the Financial Statements and MD&A.

DEMONSTRATING OUR RESILIENCY

Fellow shareholders,

Fiscal 2019 was a period of significant milestones for NFI as we completed the transformative acquisition of Alexander Dennis Limited and continued to secure our position as a market leader in zero emission buses. NFI is now one of the world's largest independent bus and coach manufacturers with operations in 10 countries and with 9,300 team members around the world supporting a fleet of over 105,000 vehicles in service. We are solely focused on bus and coach design, manufacture, service and support which provides a competitive advantage over many of our more broad competitors.

While there were many achievements during 2019, they were somewhat offset by challenges. The combination of learning curve associated with the launch of several new bus and coach models and the ramp-up of a parts fabrication facility in Kentucky were not as successful as originally planned, resulting in operational issues and significant work-in-progress build up. One year does not a company make. The successful execution of our company wide plan to reduce work-in-progress inventory significantly contributed lowering our total debt and leverage ratio by year-end. We have now moved past the challenges that impacted us in 2019 and are focused on delivering results in 2020. We expect to see growth in revenue, Adjusted EBITDA, Free Cash Flow and EPS while maintaining leadership positions in all of our core markets, and delivering an increasingly broad portfolio of mobility solutions to our customers.

As we begin this new decade we look forward with increased confidence, based on our fourth quarter 2019 financial results which saw record quarterly vehicle deliveries and the highest revenue and Adjusted EBITDA in NFI's history. Management and the Board are aligned and focused on driving results in 2020 while also ensuring that we deliver for all our stakeholders including our employees, customers (and their customers), shareholders, suppliers, our community partners and the environment. The addition of ADL to the NFI Group adds scope and scale plus substantial international experience that will play a key role in our future.

Social and environmental governance have always been pillars for NFI and will continue to be a focus. Finally, in a rapidly changing global economy the Board is ensuring that we have the appropriate risk mitigation plans in place to ensure that NFI Group is prepared for obstacles as they arise.



The Honourable Brian V. Tobin, P.C., OC. Chairman of the Board
NFI Group Inc.



Paul Soubry
President & Chief Executive Officer
NFI Group Inc.

"Following a challenging year in 2019 we are focused on delivering on our 2020 plan and driving shareholder returns through performance and dividends"

A LEADING INDEPENDENT GLOBAL BUS AND COACH MANUFACTURER

NFI GROUP

NEW FLYER



MCI



ARBOC



ALEXANDER DENNIS



PLAXTON



nfi.parts



FY 2019 Highlights (US$)

$2.9 billion
Revenue

5,315
EUs delivered

$322 million
Adjusted EBITDA

$160 million
Free Cash Flow

$1.65
Adjusted Net Earnings per Share

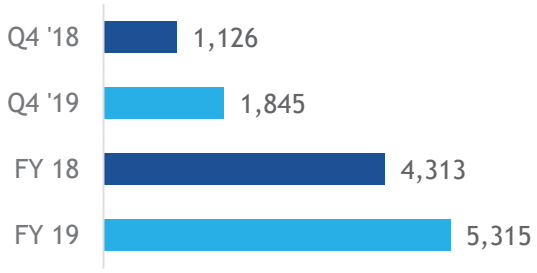
$5.2 billion
Ending Backlog of 10,742 EUs

105,000
Vehicles in Service

9,300
Team Members

KEY PERFORMANCE INDICATORS

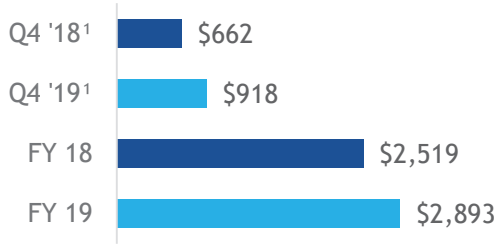
Deliveries (EUs)



Increase in quarterly deliveries was driven by NFI's transformative acquisition of ADL and the Company's focus on work-in-progress ("WIP") reduction. NFI reported record fourth quarter deliveries of 1,845 EUs, an increase of 64% from 2018. All three product lines of NFI saw increases in quarterly deliveries.

For the year NFI delivered 5,215 EUs, an increase of 23%, driven by the strength of fourth quarter deliveries.

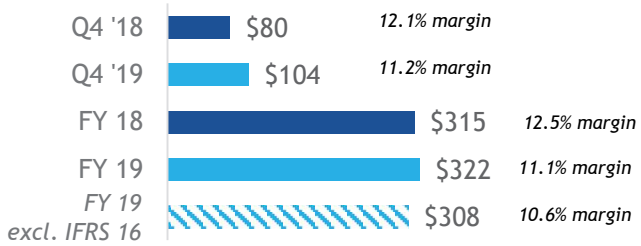
Revenue



The significant increase in deliveries drove record quarterly and annual revenue. Revenue increased by 39% from 2019 Q4 to 2018 Q4.

Full year revenue increased by 15% to a record $2.9 billion driven by the acquisition of ADL and NFI's strong fourth quarter.

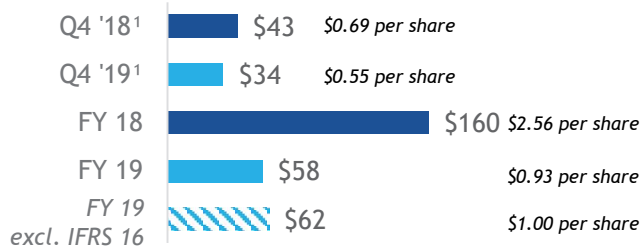
Adjusted EBITDA [2]



Fourth quarter Adjusted EBITDA increased by 30% primarily as a result of record deliveries and revenue, favourable sales mix within the Aftermarket segment and reduced corporate expenses related to lower performance incentives offset by higher SG&A costs from the acquisition of ADL.

Full year Adjusted EBITDA increased by 2% with the strong fourth-quarter results offset by delivery challenges experienced during the first three quarters of 2019 from KMG, learning curve challenges on new products and margin pressure within the bus and coach businesses. Excluding the impact of IFRS 16, Fiscal 2019 Adjusted EBITDA would have been $308.0 million

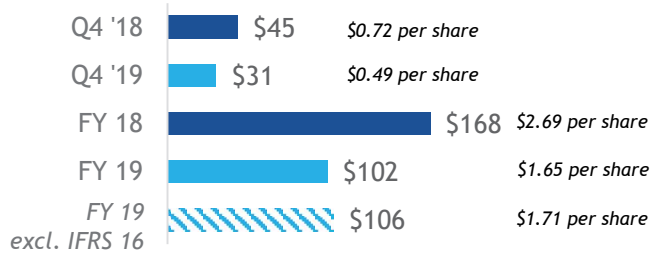
Net Earnings



Fourth quarter net earnings decreased by 20% driven by adjustments for purchase accounting, higher interest and income taxes.

Full year net earnings decreased due to the same items that impacted Adjusted EBITDA, plus ADL acquisition costs, adjustments for purchase accounting, interest on long-term debt, and fair value adjustments on foreign exchange and interest contracts. Full year net earnings, excluding the impact of IFRS 16, was $62 million or $1.00 per share.

Adjusted Net Earnings [2]



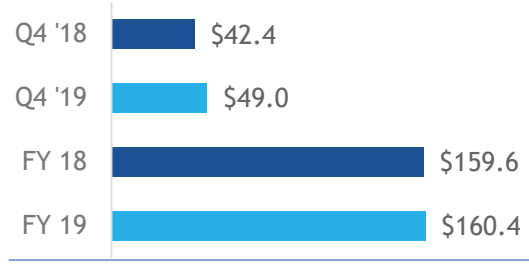
Fourth quarter Adjusted net earnings decreased by 31%. The decrease was driven by the items noted above for net earnings as well as the adjustment for a $4 million gain on interest rate swap in 2019 Q4, compared to the adjustment of a $2 million loss in 2018 Q4.

Full year Adjusted net earnings decreased by 39% due to the items noted above in net earnings, offset by adjustments related to costs and fair value adjustments associated with the purchase of ADL. A full reconciliation of Adjusted net earnings for both the quarter and Fiscal 2019 is provided on page 18. Full year Adjusted net earnings, excluding the impact of IFRS 16, was $106 million.

1 Unaudited quarterly results
2 Non-IFRS Measure – See Appendix B

KEY PERFORMANCE INDICATORS

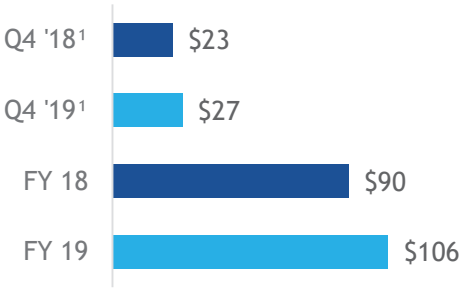
Free Cash Flow [2]



Fourth quarter Free Cash Flow increased by 16% year-over-year due to the increases in revenue and Adjusted EBITDA, and lower cash capital expenditures offset by higher interest and taxes.

Full year Free Cash Flow was essentially flat with Fiscal 2018 as higher Adjusted EBITDA and lower capital expenditures were offset by higher taxes and interest expense.

Declared Dividends ($CAD)

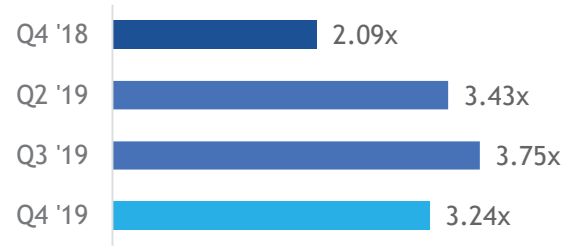


2019 Q4 declared dividends increased by 16% as a result of the Board of Directors approving a 13% increase in the dividend per Share rate in March 2019 partially offset by a lower number of Shares outstanding as a result of the purchases of Shares by the Company under its the Normal Course Issuer Bid ("NCIB") in 2019 Q1. Offsetting NCIB purchases was the issuance of shares as part of the proceeds of the ADL transaction completed in May 2019.

Fiscal 2019 declared dividends increased by 17% due to the higher dividend per Share rate in offset by the lower number of Shares as a result of the Company's use of its NCIB, which were somewhat offset by the ADL transaction.

Dividends declared represent a payout ratio of 41% in 2019 Q4 and 50% in Fiscal 2019

Total Leverage Ratio



Total Leverage Ratio of 3.24x decreased by 0.51x from 2019 Q3 to 2019 Q4. The decrease Leverage primarily relates to changes in non-cash working capital due to decreases in work-in-progress ("WIP") inventory, somewhat offset by the amount of capital returned to shareholders through dividends.

Backlog (EUs)



Backlog was relatively stable from 2018 Q4 to 2019 Q4, and down by 852 EUs from 2019 Q3. The third quarter backlog was especially high due to pent-up deliveries through the first three quarters of the year as a result of the build-up of WIP. Backlog lowered in the fourth quarter as the Company executed on its WIP recovery plan and completed record deliveries.

The ending backlog at 2019 Q4 included 4,224 EU firm and 6,518 EU option orders.

ROIC[2]



ROIC decreased 4 percentage points with overall improvements to Adjusted EBITDA from higher deliveries and aftermarket growth offset by delivery challenges felt during the first three quarters of 2019 from KMG, learning curve on new products, invested capital related to the acquisition of ADL, elevated working capital from higher WIP and margin pressure within the coach business. In addition ROIC was also impacted by accounting adjustments related to the ADL acquisition.

1 Unaudited quarterly results
2 Non-IFRS Measure - See Appendix B

2019 Q4 HIGHLIGHTS

During the fourth quarter of 2019 the Company was focused on executing its WIP reduction plan while continuing to complete integration activities with ADL. Management is pleased to report that nearly all of the targeted excess vehicles in WIP were delivered during the quarter and that delivery activity for the period was also very busy for private motor coach, low-floor and medium-duty cutaway, and ADL vehicles.

The Company continued to pay its quarterly dividend of C$0.425 per share (annual rate of C$1.70 per share) resulting in a payout ratio for Fiscal 2019 of 50%. The board of directors of NFI (the "Board") expects to maintain dividends at this rate on a quarterly basis, although such dividends are not assured. The Board will consider potential dividend increases as total leverage is decreased as per the ADL acquisition plan.

Other significant events during the quarter included:

- The 2019 Q4 Canada and U.S. active Bid Universe continued to show strength with active bids up by 1,963 EUs compared to 2018 Q4, and the total Bid Universe up by 4,223, representing increases of 72% and 18%, respectively.
- Canadian and U.S. heavy-duty transit markets finished 2019 with deliveries of 6,753 EU, up 4% over 2018, based on industry sources. The American Bus Association reported coach market deliveries of 2,053 EUs in 2019 down by 10% from 2018. New Flyer market share for 2019 was 41.2%, down 1.6% from the previous year, due primarily to New Flyer deliveries being impacted by operational challenges. MCI market share was 46.1%, up 1.2% from 2018 with increased penetration from its new models.
- Based on data from the Society of Motor Manufacturers and Traders, ADL's largest market, UK transit, finished with deliveries of 1,728 EUs, down 13% from 2018. ADL increased its market share to 72%, up from 67% in 2018. Other ADL markets remained broadly stable with Hong Kong moving past its peak delivery cycle.
- MCI received significant orders for its D45 Commuter Rapid Transit Low Entry ("D45 CRT LE") diesel commuter vehicles from customers in Phoenix, AZ and the Bay Area in California.
- ADL continued its strong relationship with Hong Kong customer Kowloon Motor Bus Co., with an order for an additional 180 Enviro500 double deck buses.
- NFI continued to realize upon its strategy to be the leader in zero-emission buses ("ZEBs") and had the largest share of 2019 ZEB deliveries in North America and UK heavy-duty transit markets. NFI had battery electric bus deliveries from ADL into London and Glasgow and new orders in the UK and New Zealand. New Flyer delivered ZEBs into Toronto, Los Angeles, Laval and San Diego. New Flyer also received new orders in New York, NY and was selected by the California Department of General Services as an approved supplier for zero-emission buses.
- MCI debuted its 2020 model lineup with a preview of its new battery-electric D45 CRT LE vehicle.
- ADL completed a demo of its autonomous Enviro200 vehicle in Glasgow at the Connected and Autonomous Vehicle Summit.
- NFI held its November 2019 Investor Day in Toronto to update the market on its strategic priorities surrounding the acquisition of ADL and the global transition to ZEBs and mobility solutions.
- NFI and its subsidiaries set a new record for its employee lead United Way fundraising goals, exceeding the prior year by 8%.
- NFI announced the selection of its new Chief Financial Officer, Mr. Pipasu H. Soni, who joined the company in December 2019 and will succeed Mr. Glenn Asham as CFO on March 27, 2020

1,159
2019 Q4 New Orders

0.51x
Leverage reduced to 3.24x

$263M
WIP decrease of $32M

85%
Book-to-Bill

18%
YoY North American Bid Universe Growth

RECORD DELIVERIES AND REVENUE

Driven by the transformative acquisition of ADL, NFI reported record deliveries of 5,315 EUs in 2019, an increase of 23% from the same period in 2018. All three product lines of NFI saw increase in quarterly deliveries with a 64% increase from 2018 Q4 to 2019 Q4.

Full details of the Company's orders, delivery and backlog information can be found in Appendix C.

Deliveries (EUs)	Q4 2019	Q4 2018	% Change	2019	2018	% Change
Heavy-Duty Transit (single and Double Deck)	1,347	679	*98%*	3,931	2,781	*41%*
Motor Coach	389	341	*14%*	1,036	1,030	*-%*
Cutaway and Medium-Duty	109	106	*3%*	348	502	*(31%)*
New Vehicle Deliveries	**1,845**	**1,126**	***64%***	**5,315**	**4,313**	*23%*
Pre-Owned Coach Sold	176	187	*(6%)*	469	468	-

Revenue (unaudited quarterly results, audited full year results, dollars in millions)	Q4 2019	Q4 2018	% Change	2019	2018	% Change
Heavy-Duty Transit (single and Double Deck)	$574.9	$377.9	*52%*	$1,847.1	$1,502.3	*23%*
Motor Coach	192.0	176.0	*9%*	526.5	537.1	*-2%*
Cutaway and Medium-Duty	18.2	9.4	*94%*	49.8	41.7	*19%*
New Vehicle Revenue	**$785.1**	**$563.3**	***39%***	**$2,423.4**	**$2,081.1**	*16%*
Pre-Owned Coach Sales	13.7	11.0	*25%*	46.0	46.3	*-%*
3rd Party Fiber Reinforced Polymer	1.8	2.2	*(18%)*	6.6	14.5	(54%)
Total Manufacturing	**$800.6**	**$576.5**	***39%***	**$2,476.0**	**$2,141.9**	**16%**
Aftermarket	117.1	85.5	*37%*	417.4	377.1	*11%*
Total Revenue	**$917.7**	**$662.0**	***39%***	**$2,893.4**	**$2,519.0**	***15%***
North America	710.6	662.0	*7%*	2,508.2	2,519.0	-
United Kingdom and Europe	174.3	-		320.1	-	
Asia Pacific	32.0	-		63.7	-	
Other	0.8	-		1.4	-	

SEGMENT PERFORMANCE

Adjusted EBITDA (unaudited, dollars in millions)	Q4 2019	Q4 2018	% Change	2019	2018	% Change
Manufacturing	85.7	72.8	*18%*	256.1	276.0	*(7%)*
Aftermarket	18.4	17.3	*6%*	74.6	73.7	*1%*
Corporate	(0.3)	(10.3)	*97%*	(8.5)	(34.3)	*75%*
Total Adjusted EBITDA	**$103.9**	**$79.9**	***30%***	**$322.2**	**$315.4**	*2%*
Adjusted EBITDA as a percentage of revenue						
Manufacturing	10.7%	12.6%	*(1.9%)*	10.3%	12.9%	(2.6%)
Aftermarket	15.7%	20.2%	*(4.5%)*	17.9%	19.5%	(1.6%)
Total	**11.3%**	**12.1%**	***(0.8%)***	**11.1%**	**12.5%**	**(1.4%)**

Net Earnings (unaudited quarterly results, audited full year results, dollars in millions)	Q4 2019	Q4 2018	% Change	2019	2018	% Change
Manufacturing	35.1	47.0	*(25%)*	86.9	155.2	*(44%)*
Aftermarket	11.9	15.5	*(23%)*	60.1	67.0	*(10%)*
Corporate	(12.9)	(19.7)	*34%*	(89.2)	(62.3)	*(43%)*
Net earnings	**$34.1**	**$42.8**	***(20%)***	**$57.7**	**$159.9**	*(64%)*

2019 Q4 Manufacturing Adjusted EBITDA increased by $12.9 million due to higher quarterly deliveries from all product lines and the addition of ADL. Manufacturing 2019 Q4 net earnings decreased by 25% with increases in Adjusted EBITDA offset by higher depreciation and costs associated with accounting adjustments related to the acquisition of ADL. Full year 2019 Manufacturing Adjusted EBITDA decreased by $19.9 million with the addition of ADL and overall higher heavy-duty transit vehicle deliveries offset by the impact of KMG, learning curve on new model launches, product mix, margin pressure within the coach business and lower cutaway and medium-duty deliveries. Fiscal 2019 Manufacturing net earnings decreased by $68.3 million, or 44%, due to lower Adjusted EBITDA discussed above plus higher depreciation and costs associated with accounting adjustments related to the acquisition of ADL.

2019 Q4 Aftermarket Adjusted EBITDA increased by $1.1, or 6%, with volume increases from ADL and improved margins from product mix offset by increased SG&A costs from the addition of ADL into the Aftermarket segment. Aftermarket 2019 Q4 net earnings decreased by $3.6 million with the improvements in Adjusted EBITDA being offset by higher depreciation and expenses associated with accounting adjustments related to the acquisition of ADL. Full year 2019 Aftermarket Adjusted EBITDA increased by $0.9 million, or 1%, with volume increases from ADL offset by increased SG&A costs from the addition of ADL. Full year 2019 Aftermarket net earnings decreased by $6.9 million due to higher depreciation and expenses associated with accounting adjustments related to the acquisition of ADL.

The improvement in Corporate Adjusted EBITDA was driven by lower long-term and short-term incentive plan payments with reductions of $10.0 million, or 97%, in 2019 Q4 and $25.8 million, or 75% for the full year.

2020 OUTLOOK

Management remains optimistic about the Company's overall end markets. Public transit remains a primary method of transportation for millions of users, the age of the population is increasing and numerous jurisdictions are implementing strategies to improve accessibility through advanced mobility solutions while improving air quality through the migration to zero-emission propulsion technology for buses and coaches. While the Company's overall outlook is positive, management does expect increased competition, softness in some segments and geographic regions and timing of the ZEB transition to impact project awards, deliveries and margins during Fiscal 2020. The Outlook for each of the Company's two reporting segments is provided below. Management continues to expect its transformative acquisition of ADL to be a platform for future international growth as ADL is the largest bus and coach provider in the UK and the global market leader in double deck vehicles, with an established presence in numerous geographic jurisdictions.

As the Company's product offering and geographic diversity is now broader, for the first-time management is introducing annual Adjusted EBITDA guidance for Fiscal 2020 with a range of $320 million to $350 million, which could represent growth of up to 9% on a year-over-year basis.

Financial Guidance Full Year 2020	
Adjusted EBITDA	$320 million - $350 million
Cash Capital Expenditures	$45 million - $55 million
Effective Tax Rate ("ETR")	31% - 33%
Free Cash Flow Conversion (as a % of Adjusted EBITDA)	45% - 50%
Seasonality	Q1 down slightly, growth in Q2, Q3 and Q4

The above table outlines guidance ranges for selected Fiscal 2020 consolidated financial metrics. These ranges take into consideration our current outlook and our Fiscal 2019 results and are based on the assumptions set out below. The purpose of the financial guidance is to assist investors, shareholders and others in understanding certain financial metrics relating to expected Fiscal 2020 financial results for evaluating the performance of our business. The information may not be appropriate for other purposes. Information about our guidance, including the various assumptions underlying it, is forward looking and should be read in conjunction with the section "Forward-looking Statements" in Appendix B and the related disclosure and information about various economic competitive and regulatory assumptions, factors and risks that may cause actual future financial and operating results to differ from management's current expectations. Note that potential impact of COVID-19 (also known as "Coronavirus") is not included in guidance ranges provided above. COVID-19 has not had a material impact on NFI's operations as of March 12, 2020.

The guidance ranges provided above are driven by numerous assumptions including, but not limited to, the following:

- Does not include any potential impact from COVID-19
- Adjusted EBITDA expectations are based on management's expectations of mid-teen revenue percentage growth, assisted by a full year of ADL operations plus the Company's existing backlog and anticipated new orders and margin improvement as NFI's KMG parts fabrication facility shifts from a loss position to profitability with operations no longer delaying new vehicle production.
- The lower end of the Adjusted EBITDA range is based on scenarios where production is negatively impacted by new model learning curves, weather delays and supply disruption.
- Expected Fiscal 2020 cash capital expenditures are primarily maintenance expenditures with some growth spending following periods of increased investment from 2017 to 2019, primarily driven by strategic projects.
- The Company's ETR range for Fiscal 2020 is based on the Company's corporate structure, operating jurisdictions, existing and proposed tax legislation. It excludes the impact of purchase accounting adjustments related to the acquisition of ADL and other one-time items which may increase the expected ETR. Looking forward, management expects the ETR to decline as global activities are reflected in the Company's financial results.
- FCF conversion is based on the Company's Adjusted EBITDA expectations, historic FCF conversion, projected cash capital expenditures and cash interest and tax expectations.

2020 OUTLOOK

Management notes that the Company's annual delivery schedule has notable seasonality due to the nature of each unique market segment and the varied annual production and vacation schedules of each production facility. Even after accounting for the addition of ADL, management expects that the first quarter will be the Company's slowest period, and potentially flat with the prior-year, with increased activity expected to occur in the second, third and fourth quarters. Some vehicle deliveries may shift from quarter-to-quarter depending on timing of client inspections and acceptance processes.

NFI is closely monitoring the COVID-19 virus outbreak and while NFI is experiencing some supply delays, the virus has not materially impacted NFI's production operations nor has the Company experienced any adverse impact on delivery of our products. Additional supply delays and possible shortages of critical components may arise if the disruption of certain suppliers' operations and/or subcomponent supply from China or elsewhere continue or escalate. Such occurrences or negative impacts of the outbreak on customer demand for our products could potentially have a material adverse effect on NFI's operations. NFI is monitoring the dynamic situation and actively assessing supply alternatives and developing appropriate mitigation plans. Given that it is nearly impossible to accurately forecast the impact of COVID-19 on NFI, the Company has not included any adjustment related to it in the 2020 guidance or other outlook information contained in the MD&A.

To date, COVID-19 has not caused any delays or reductions in planned vehicle deliveries but could potentially have an impact on our end-customers. While every operator is different, they are all focused on continuing to offer a clean and safe experience for their customers. If the virus continues to spread and prevention policies are escalated there could potentially be an impact on travel of customer inspectors which could impact NFI's new build or bus/coach delivery and acceptance programs. There could also be an impact of lower ridership for operators, which could decrease demand for new and pre-owned vehicles.

Management is focused on deleveraging and believes that the Company's combined financial results will enable it to return to a target of 2.0x to 2.5x net debt to Adjusted EBITDA within the next 18 months, without impacting the Company's dividend policy and provide the flexibility to evaluate potential growth in the annual dividend rate.

Manufacturing

Management expects to see growth in the Manufacturing segment from 2020 to 2022 due to several factors. Demand in North America is anticipated to continue to be healthy, with 2019 deliveries up 4% over 2018, driven by aging fleets, economic conditions, dedicated U.S. federal funding and expected customer fleet replacement plans based on the Company's discussion with transit agencies and its total Bid Universe. While overall demand is expected to remain healthy, management anticipates there will be more smaller firm orders, increased use of state contracts for procurements and fewer long-term option orders as transit agencies increase their purchases of ZEBs and want to maintain flexibility in propulsion type during this transition. These market dynamics play into NFI's strength of being propulsion agnostic.

The UK market is expected be relatively flat in 2020, following a decline of 13% in 2019, with potential for modest growth, as large commercial operators and smaller regional players increase orders after several years of low activity. In addition to this increased activity, the challenges of one of ADL's major UK competitors has provided numerous opportunities for ADL to grow its industry leading market share in the UK. This competitive change also saw ADL win a major award in the Republic of Ireland. Asia Pacific markets continue to vary by jurisdiction. The highly cyclical Hong Kong heavy-duty transit market came off peak demand to lower, but stable deliveries, which are expected to continue for several years. ADL continues to expand in Asia Pacific with significant contract wins in Singapore and further penetration into the New Zealand market. Management expects to see increased growth over the long-term from UK market recovery and increased deliveries in the European region from its landmark contract win in Berlin, with significant deliveries into that market starting in 2021.

ZEBs are expected to continue to grow and be a larger percentage of New Flyer and ADL vehicle deliveries. NFI is the only manufacturer in North America to offer 35-foot, 40-foot, 45-foot, 60-foot and double deck battery electric vehicles and 40-and 60-foot fuel cell electric vehicles. NFI has ZEB contracts with some of the largest transit agencies in North America, with many vehicles in operation delivering clean, safe and reliable

2020 OUTLOOK

transportation on the proven Xcelsior platform. NFI's Infrastructure Solutions offering is also expected to grow as it supports transit agencies charging infrastructure requirements. ADL through its partnership with BYD is the market leader for ZEBs in the UK and is growing its presence in New Zealand. ZEBs represented 7% of ADL's total 2019 deliveries. MCI is continuing the development and testing of its battery-electric motor coaches and ARBOC has recently launched an electrification program for the Equess medium-duty bus.

While overall motor coach deliveries in North America declined by 10% in 2019, and are expected to decline again in 2020, management expects that the Company can continue to gain market share, which was up 1.3% in 2019, from its expanded product portfolio. Management anticipates competitive factors will place increased pressure on margins in the North American coach market during 2020 and potentially into 2021. ADL's coach manufacturing business, Plaxton (which builds coach bodies on third-party chassis), is primarily focused on the UK market which is a very small component of the segment. MCI and Plaxton closely monitor pre-owned coach valuations and ensure that products obtained through trades are accurately reflected at their fair market value on the Company's balance sheet. Management believes the overall demand for low-floor cutaway and medium-duty buses remains encouraging, driven by changing population demographics, which could increase the demand for ARBOC's market leading products. Management does not anticipate any chassis related supply disruptions in 2020 for its low-floor cutaway vehicles. ARBOC is also focused on its medium-duty transit bus offerings, which generates a higher gross margin than its low-floor cutaway vehicles and has been very well received by numerous public and private customers.

Aftermarket

NFI Parts continues to focus on numerous strategic initiatives to counter adverse market pressures, a decreasing installed base of NFI vehicles, from the expected retirement of NABI and Orion buses, and increasing competitive intensity. These initiatives include additional focus on vendor managed inventory ("VMI") programs, an enhanced product offering and capitalizing on the implementation of a common IT platform. In 2020, NFI parts is looking to expand sales of ARBOC and cutaway spare parts and is exploring North American co-operation with ADL parts.

ADL's Parts business continues to focus on enhancing its online parts and services platform AD 24, which provides industry leading aftermarket support to customers in the UK. Management expects ADL Aftermarket revenue to grow as ADL expands its installed base. Due to the nature of the parts business, parts sales remain difficult to forecast resulting in quarter-to-quarter volatility which at times can be material.

SELECTED QUARTERLY AND ANNUAL FINANCIAL AND OPERATING INFORMATION

The following selected unaudited interim condensed consolidated financial and operating information of the Company has been derived from and should be read in conjunction with the historical Financial Statements of the Company.

Fiscal Period	Quarter	Revenue	Earnings from Operations	Net earnings (loss)	Adjusted EBITDA[(1)]	Earnings (loss) per Share
2019 - Actual						
	Q4	$ 917,741	$ 69,958	$ 34,127	$ 103,875	$ 0.55
	Q3	725,347	25,200	(1,085)	76,868	(0.02)
	Q2	683,353	37,000	8,507	81,122	0.14
	Q1	566,995	40,906	16,149	60,302	0.26
	Total	**$ 2,893,436**	**$ 173,064**	**$ 57,698**	**$ 322,167**	**$ 0.93**
2019 - Excluding the impact of IFRS 16						
	Q4	$ 917,741	$ 70,023	$ 35,767	$ 99,952	$ 0.57
	Q3	725,347	23,766	(985)	72,663	(0.02)
	Q2	683,353	36,718	9,687	77,561	0.15
	Q1	566,995	40,543	17,540	57,837	0.30
	Total	**$ 2,893,436**	**$ 171,050**	**$ 62,009**	**$ 308,013**	**$ 1.00**
2018	Q4	$ 662,020	$ 60,570	$ 42,815	$ 79,868	$ 0.69
	Q3	605,342	53,469	37,031	70,245	0.59
	Q2	673,025	72,063	49,740	91,400	0.81
	Q1	578,634	51,753	30,356	73,841	0.48
	Total	**$ 2,519,021**	**$ 237,855**	**$ 159,942**	**$ 315,354**	**$ 2.56**
2017	Q4	$ 654,560	$ 71,495	$ 76,118	$ 90,488	$ 1.21
	Q3	541,721	55,141	34,577	70,998	0.55
	Q2	613,430	70,363	42,769	85,090	0.69
	Q1	572,147	59,203	37,904	71,450	0.61
	Total	**$ 2,381,858**	**$ 256,202**	**$ 191,368**	**$ 318,026**	**$ 3.06**

(1) Adjusted EBITDA is not a recognized earnings measure and does not have standardized meanings prescribed by IFRS. Therefore, Adjusted EBITDA may not be comparable to similar measures presented by other issuers. See "Definitions of Adjusted EBITDA, ROIC, Free Cash, Adjusted Net Earnings and Adjusted Net Earnings per share" in Appendix B. Management believes that Adjusted EBITDA and ROIC are useful supplemental measures in evaluating performance of NFI.

(Unaudited, U.S. dollars in thousands)

	2019 Q4	2018 Q4	Fiscal 2019	Fiscal 2018
Statement of Earnings Data				
Revenue				
North America	$ 617,553	$ 576,520	$ 2,142,895	$ 2,141,867
United Kingdom and Europe	154,820	—	277,669	—
Asia Pacific	28,202	—	55,456	—
Other	—	—	—	—
Manufacturing operations	800,575	576,520	2,476,020	2,141,867
North America	93,053	85,500	365,304	377,154
United Kingdom and Europe	19,549	—	42,447	—
Asia Pacific	3,775	—	8,247	—
Other	789	—	1,418	—
Aftermarket operations	117,166	85,500	417,416	377,154
Total revenue	$ 917,741	$ 662,020	$ 2,893,436	$ 2,519,021
Earnings from operations	$ 69,958	$ 60,570	$ 173,064	$ 237,855
Earnings before interest and income taxes	71,546	61,405	173,050	238,345
Net earnings	34,127	42,815	57,698	159,942
Adjusted EBITDA[(1)]	$ 103,875	$ 79,868	$ 322,167	$ 315,354
Statement of Earnings Data, excluding IFRS 16				
Earnings from operations	$ 70,023	$ 60,570	171,050	237,855
Earnings before interest and income taxes	$ 71,612	61,405	171,038	238,345
Net earnings	35,767	42,815	62,009	159,942
Adjusted EBITDA[(1)]	99,952	79,868	308,013	315,354
Capital expenditures	$ 7,618	$ 20,144	$ 41,757	$ 70,991

(Footnotes on page 16 and 17)

RECONCILIATION OF NET EARNINGS TO ADJUSTED EBITDA

Management believes that Adjusted EBITDA is an important measure in evaluating the historical operating performance of the Company. However, Adjusted EBITDA is not a recognized earnings measure under IFRS and does not have a standardized meaning prescribed by IFRS. Accordingly, Adjusted EBITDA may not be comparable to similar measures presented by other issuers. Readers of this MD&A are cautioned that Adjusted EBITDA should not be construed as an alternative to net earnings or loss determined in accordance with IFRS as indicators of the Company's performance, or cash flows from operating activities determined in accordance with IFRS as a measure of liquidity and cash flow. The Company defines and has computed Adjusted EBITDA as described under "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share" in Appendix B. The following tables reconcile net earnings or losses to Adjusted EBITDA based on the historical Financial Statements of the Company for the periods indicated. See Appendix A for ADL Adjusted EBITDA reconciliation for information related to historical ADL performance.

(Unaudited, U.S. dollars in thousands)

	2019 Q4	2018 Q4	Fiscal 2019	Fiscal 2018
Net earnings	34,127	42,815	57,698	159,942
Addback[1]				
Income taxes	26,118	7,933	41,997	50,711
Interest expense	11,301	10,657	73,355	27,693
Amortization	31,134	18,017	104,570	67,796
Loss (gain) on disposition of property, plant and equipment	52	(8)	(46)	267
Fair value adjustment for total return swap[10]	273	5,629	949	6,547
Unrealized foreign exchange loss (gain) on non-current monetary items and forward foreign exchange contracts	(1,640)	1,311	60	1,381
Costs associated with assessing strategic and corporate initiatives[7]	(616)	—	13,069	137
Past service costs[11] and other pension costs	70	—	(1,601)	6,482
Non-recurring restructuring costs [8]	364	—	364	—
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue[9]	2,156	—	31,004	266
Proportion of the total return swap realized[8]	(203)	(4,382)	(626)	(5,139)
Equity settled stock-based compensation	437	34	1,566	1,409
Recovery on currency transactions[13]	—	—	(4,287)	—
Prior year sales tax provision [14]	300	—	4,094	—
Release of provisions related to purchase accounting[12]	—	(2,138)	—	(2,138)
Adjusted EBITDA[1]	103,875	79,868	322,167	315,354
Adjusted EBITDA is comprised of:				
Manufacturing	$ 85,715	$ 72,817	$ 256,097	$ 275,970
Aftermarket	18,413	17,339	74,572	73,655
Corporate	(254)	(10,288)	(8,503)	(34,271)

See page 16 and 17 for footnotes.

SUMMARY OF FREE CASH FLOW

Management uses Free Cash Flow as a non-IFRS measure to evaluate the Company's operating performance and liquidity and to assess the Company's ability to pay dividends on the Shares, service debt, and meet other payment obligations.

The Company generates its Free Cash Flow from operations and management expects this will continue to be the case for the foreseeable future. Net cash flows generated from operating activities are significantly impacted by changes in non-cash working capital. The Company uses its unsecured revolving credit facility "Credit Facility" to finance working capital and therefore has excluded the impact of working capital in calculating Free Cash Flow. As well, net cash generated by operating activities and net earnings are significantly affected by the volatility of current income taxes, which in turn produces temporary fluctuations in the determination of Free Cash Flow.

The following is a reconciliation of net cash generated by operating activities (an IFRS measure) to Free Cash Flow (a non-IFRS measure) based on the Company's historical Financial Statements. See "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share" in Appendix B.

(Unaudited, U.S. dollars in thousands, except per Share figures)

	2019 Q4	2018 Q4	Fiscal 2019	Fiscal 2018
Net cash generated from operating activities	$ 163,761	$ 67,340	$ 98,608	$ 175,144
Changes in non-cash working capital items[3]	(85,382)	1,992	91,324	34,344
Interest paid[3]	15,447	6,338	47,676	23,073
Interest expense[3]	(15,631)	(6,273)	(50,546)	(23,546)
Income taxes paid[3]	7,228	12,154	40,167	73,082
Current income tax expense[3]	(30,842)	(9,495)	(61,339)	(56,263)
Principal portion of finance lease payments	(1,400)	(1,547)	(12,456)	(5,125)
Cash capital expenditures	(6,968)	(20,144)	(37,575)	(70,991)
Proceeds from disposition of property, plant and equipment	—	10	174	235
Costs associated with assessing strategic and corporate initiatives[7]	(616)	—	13,069	137
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue [9]	2,156	—	31,004	266
Defined benefit funding[4]	1,969	608	8,140	22,241
Defined benefit expense[4]	(1,322)	(1,755)	(5,849)	(12,333)
Past service costs[11] and other pension costs	70	—	(1,601)	6,482
Proportion of the total return swap[10]	(203)	(4,382)	(626)	(5,138)
Recovery on currency transactions[13]	—	—	(4,287)	—
Prior year sales tax provision [14]	300	—	4,094	—
Non-recurring restructuring costs[8]	364	—	364	—
Gain on release of provision related to purchase accounting[12]	—	(2,138)	—	(2,138)
Foreign exchange gain (loss) on cash held in foreign currency[5]	102	(289)	83	194
Free Cash Flow (US$)[1]	$ 49,033	$ 42,419	$ 160,424	$ 159,664
U.S. exchange rate[2]	1.3076	1.3638	1.3180	1.3183
Free Cash Flow (C$)[1]	64,116	57,851	211,439	210,485
Free Cash Flow per Share (C$)[6]	1.0269	0.9302	3.4200	3.3733
Declared dividends on Shares (C$)	26,561	22,890	105,462	90,343
Declared dividends per Share (C$)[6]	$ 0.4253	$ 0.3680	$ 1.7062	$ 1.4479

(1) Free Cash Flow is not a recognized measure under IFRS and does not have a standardized meaning prescribed by IFRS. Therefore, Free Cash Flow may not be comparable to similar measures presented by other issuers. See Appendix B for "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share".

(2) U.S. exchange rate (C$ per US$) is the weighted average exchange rate applicable to dividends declared for the period.

(3) Changes in non-cash working capital are excluded from the calculation of Free Cash Flow as these temporary fluctuations are managed through the Credit Facility which is available to fund general corporate requirements, including working capital requirements, subject to borrowing capacity restrictions. Changes in non-cash working capital are presented on the consolidated statements of cash flows net of interest and incomes taxes paid.

(4) The cash effect of the difference between the defined benefit expense and funding is included in the determination of cash from operating activities. This cash effect is excluded in the determination of Free Cash Flow as management believes that the defined

benefit expense amount provides a more appropriate measure, as the defined benefit funding can be impacted by special payments to reduce the unfunded pension liability.

(5) Foreign exchange loss on cash held in foreign currency is excluded in the determination of cash from operating activities under IFRS; however, because it is a cash item, management believes it should be included in the calculation of Free Cash Flow.

(6) Per Share calculations for Free Cash Flow (C$) are determined by dividing Free Cash Flow by the total number of all issued and outstanding Shares using the weighted average over the period. The weighted average number of Shares outstanding for 2019 Q4 was 62,434,520 and 62,192409 for 2018 Q4. The weighted average number of Shares outstanding for Fiscal 2019 and Fiscal 2018 are 61,809,479 and 62,396,962 respectively. Per Share calculations for declared dividends (C$) are determined by dividing the amount of declared dividends by the number of outstanding Shares at the respective period end date.

(7) Normalized to exclude non-recurring expenses related to the costs of assessing strategic and corporate initiatives.

(8) Normalized to exclude non-recurring restructuring costs.

(9) The revaluation of ARBOC's inventory included an adjustment of $0.5 million of which $0.3 million negatively impacted 2018 YTD net earnings. The revaluation of ADL's inventory included an adjustment of $2.2 million in 2019 Q4 and $31.0 million in Fiscal 2019. These revaluation adjustments relate to purchase accounting as a result of the related acquisitions.

(10) A portion of the fair value adjustment of the total return swap is added to Free Cash Flow to match the equivalent portion of the related deferred compensation expense recognized.

(11) A new collective bargaining agreement at the Company's Winnipeg facility commenced on April 1, 2018 which included retroactive changes to New Flyer's Canadian defined benefit pension plan. The effect of the pension plan amendments was to increase the accrued benefit liability and the expected annual pension plan expense in Fiscal 2018 by $6.5 million to reflect pension benefits provided to employees for past service. In 2018 Q2, the Company completed an actuarial valuation related to the past service costs which resulted in an adjustment of $0.7 million.

(12) During the fourth quarter of 2018, purchase accounting provisions recorded during the acquisition of MCI were deemed to be no longer needed and were released resulting in an increase to net earnings. The amounts released have been deducted in the calculation of Free Cash Flow.

(13) Recovery of prior period banking fees related to foreign exchange transactions.

(14) Provision for sales taxes as result of an ongoing state tax review.

RECONCILIATION OF NET EARNINGS TO ADJUSTED NET EARNINGS

Adjusted Net Earnings and Adjusted Earnings per Share are not recognized measures under IFRS and do not have a standardized meaning prescribed by IFRS. Accordingly, Adjusted Net Earnings and Adjusted Earnings per Share may not be comparable to similar measures presented by other issuers. Readers of this MD&A are cautioned that Adjusted Net Earnings and Adjusted Earnings per Share should not be construed as an alternative to net earnings, or net earnings per Share, determined in accordance with IFRS as indicators of the Company's performance. The Company defines and has computed Adjusted Net Earnings and Adjusted Earnings per Share under "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share" in Appendix B. The following tables reconcile net earnings to Adjusted Net Earnings based on the historical Financial Statements of the Company for the periods indicated.

(Unaudited, U.S. dollars in thousands other than earnings per Share and Adjusted Earnings per Share)	2019 Q4	2018 Q4	Fiscal 2019	Fiscal 2018
Net earnings	$ 34,127	42,815	$ 57,698	$ 159,942
Net earnings, excluding IFRS 16	$ 35,767	42,815	62,009	159,942
Adjustments, net of tax [1] [10]				
Fair value adjustments of total return swap[7]	145	4,274	549	4,971
Unrealized foreign exchange (gain) loss	(981)	995	35	1,049
Unrealized (gain) loss on interest rate swap	(3,115)	1,682	12,721	630
Portion of the total return swap realized[8]	(109)	(3,325)	(362)	(3,900)
Costs associated with assessing strategic and corporate initiatives[4]	(616)	—	13,069	104
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue[6]	707	—	17,943	202
Equity settled stock-based compensation	231	26	906	1,070
Gain on disposition of property, plant and equipment	32	(6)	(27)	203
Past service costs[9] and other pension costs	71	—	(927)	4,922
Gain on release of provision related to purchase accounting [11]	—	(1,623)	—	(1,623)
Recovery on currency transactions[12]	80	—	(2,481)	—
Prior year sales tax provision [13]	102	—	2,369	—
Non-recurring restructuring costs [5]	211	—	211	—
Adjusted Net Earnings	30,885	44,838	101,704	167,570
Adjusted Net Earnings, excluding IFRS 16	$ 32,525	$ 44,838	$ 106,015	$ 167,570
Earnings per Share (basic)	$ 0.55	$ 0.69	$ 0.93	$ 2.56
Earnings per Share (fully diluted)	$ 0.55	$ 0.68	$ 0.93	$ 2.55
Adjusted Earnings per Share (basic)	$ 0.49	$ 0.72	$ 1.65	$ 2.69
Adjusted Earnings per Share (fully diluted)	$ 0.49	$ 0.72	$ 1.64	$ 2.67
Earnings per Share and Adjusted Earnings per Share, excluding IFRS 16				
Earnings per Share (basic)	$ 0.57	$ 0.69	$ 1.00	$ 2.56
Earnings per Share (fully diluted)	$ 0.57	$ 0.68	$ 1.00	$ 2.55
Adjusted Earnings per Share (basic)	$ 0.52	$ 0.72	$ 1.71	$ 2.69
Adjusted Earnings per Share (fully diluted)	$ 0.52	$ 0.72	$ 1.71	$ 2.67

1. Addback items are derived from the historical Financial Statements of the Company.
2. Adjusted EBITDA is not a recognized earnings measure and does not have standardized meaning prescribed by IFRS. Therefore, Adjusted EBITDA may not be comparable to similar measures presented by other issuers. See "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Net Earnings per Share" in Appendix B. Management believes that Adjusted EBITDA is a useful supplemental measure in evaluating performance of the Company.
3. As a result of the Company's multinational corporate structure, income taxes paid are subject to high degrees of volatility due to the mix of earnings within various jurisdictions and the timing of required installment payments.
4. Normalized to exclude non-recurring expenses related to the costs of assessing strategic and corporate initiatives.

5. Normalized to exclude non-recurring restructuring costs.

6. The revaluation of ADL's inventory included an adjustment of $2.2 million in 2019 Q4 after-tax value of $(0.5) million and $31.0 million in Fiscal 2019 after-tax value of $16.7 million. ARBOC's inventory included an adjustment of $0.3 million or $0.2 million after-tax in 2018 Q2. These revaluation adjustments relate to purchase accounting as a result of the related acquisitions.

7. The fair value adjustment of the total return swap is a non-cash gain that is deducted from the definition of Adjusted EBITDA.

8. A portion of the gain from the fair value adjustment of the total return swap is added to Adjusted EBITDA to match the equivalent portion of the related deferred compensation expense recognized.

9. A new collective bargaining agreement at the Company's Winnipeg facility commenced on April 1, 2018 which included retroactive changes to New Flyer's Canadian defined benefit pension plan. The effect of the pension plan amendments was to increase the accrued benefit liability and the expected annual pension plan expense in Fiscal 2018 by $6.5 million to reflect pension benefits provided to employees for past service. In 2018 Q2, the Company completed an actuarial valuation which resulted in an adjustment of $0.7 million for past service costs.

10. The expected ETR normalized for the acquisition of ADL, in each respective quarterly period is used to calculate adjustments, net of tax.

11. During 2018 Q4 purchase accounting provisions recorded during the acquisition of MCI were deemed to be no longer needed and were released resulting in an increase to net earnings. The amounts released have been deducted in the calculation of Adjusted EBITDA.

12. Recovery of prior period banking fees related to foreign exchange transactions.

13. Provision for sales taxes as a result of an ongoing state tax review.

Results of Operations

The discussion below with respect to revenue, operating costs and expenses and earnings from operations has been divided between the Manufacturing and Aftermarket operations segments.

(Unaudited Q4 results, U.S. dollars in thousands)	2019 Q4	2019 Q4 (excluding IFRS 16)	2018 Q4	Fiscal 2019	Fiscal 2019 (excluding IFRS 16)	Fiscal 2018
Manufacturing Revenue	800,575	800,575	576,520	2,476,020	2,476,020	2,141,867
Aftermarket Revenue	117,166	117,166	85,500	417,416	417,416	377,154
Total Revenue	917,741	917,741	$ 662,020	$ 2,893,436	$ 2,893,436	$ 2,519,021
Earnings from Operations	$ 69,958	$ 70,023	$ 60,570	$ 173,064	$ 171,050	$ 237,855
Earnings before interest and income taxes	71,546	71,612	61,405	173,050	171,038	238,345
Earnings before income tax expense	60,245	60,312	50,748	99,695	97,683	210,653
Net earnings for the period	34,127	35,767	42,815	57,698	62,009	159,942

Revenue

Manufacturing revenue for 2019 Q4 increased by $224.1 million, or 38.9% compared to 2018 Q4. The increase is related to the acquisition of ADL. Also contributing to the increase is higher volumes in the motor coach business. Partially offsetting this increase is lower selling prices in the Company's motor coach and transit businesses prior to the acquisition of ADL ("legacy manufacturing businesses").

Manufacturing revenue for Fiscal 2019 increased by $334.2 million, or 15.6% compared to Fiscal 2018. The increase is related to acquisition of ADL. Partially offsetting the increase is lower volumes of 7.4% in the Company's legacy manufacturing businesses.

During the year the Company has experienced production and delivery challenges as a result of new product launches, ARBOC's chassis supply disruption, extended start-up of KMG, international external supply issues and missed production days due to inclement weather. The result of these factors all lead to missed production and deliveries. A significant portion of the missed deliveries prior to 2019 Q4 were recovered during 2019 Q4 which contributed to the strong revenue for the quarter.

Revenue from aftermarket operations in 2019 Q4 increased by $31.7 million, or 37.0% compared to 2018 Q4. The acquisition of ADL contributed to increased revenue during 2019 Q4. Also contributing to increased revenue is increased sales volumes in the legacy aftermarket business (being the aftermarket business prior to the acquisition of ADL).

Revenue from aftermarket operations in Fiscal 2019 increased by $40.3 million, or 10.7% compared to Fiscal 2018. The acquisition of ADL contributed to revenue during Fiscal 2019. This is partially offset by lower sales volumes in the legacy aftermarket business due to competitive pressures in the private motor coach market. In 2018 Daimler canceled MCI's Distribution Rights Agreement ("DRA") relating to the distribution of Daimler's Setra motor coaches and parts. The cancellation of the DRA resulted in a $4.0 million decrease in the aftermarket parts revenue in Fiscal 2019 compared to Fiscal 2018.

Cost of sales

(Unaudited, U.S. dollars in thousands)	2019 Q4	2019 Q4 (excluding IFRS 16)	2018 Q4	Fiscal 2019	Fiscal 2019 (excluding IFRS 16)	Fiscal 2018
Manufacturing						
Direct cost of sales	$ 602,508	$ 602,508	$ 423,229	$ 1,868,917	$ 1,868,917	$ 1,569,543
Depreciation and amortization	28,531	25,188	16,087	94,246	84,669	60,509
Other overhead	67,157	70,093	44,097	221,317	231,419	164,509
Manufacturing cost of sales	$ 698,196	$ 697,789	$ 483,413	$ 2,184,480	$ 2,185,005	$ 1,794,561
As percent of Manufacturing Sales	87.2%	87.2%	83.9%	88.2%	88.2%	83.8%
Aftermarket						
Direct cost of sales	$ 78,965	$ 78,965	$ 58,410	$ 285,151	$ 285,151	$ 262,965
Depreciation and amortization	2,603	1,956	1,931	10,323	7,760	7,287
Aftermarket cost of sales	$ 81,568	$ 80,921	$ 60,341	$ 295,474	$ 292,911	$ 270,252
As percent of Aftermarket Sales	69.6%	69.1%	70.6%	70.8%	70.2%	71.7%
Total Cost of Sales	$ 779,764	$ 778,710	$ 543,754	$ 2,479,954	$ 2,477,916	$ 2,064,813
As percent of Sales	85.0%	84.9%	82.1%	85.7%	85.6%	82.0%

The consolidated cost of sales, excluding the impact of IFRS 16, for 2019 Q4 increased by $235.0 million or 43.2% compared to 2018 Q4.

Cost of sales from Manufacturing operations in 2019 Q4, excluding the impact of IFRS 16, were $697.8 million (87.2% of manufacturing operations revenue) compared to $483.4 million (83.9% of Manufacturing operations revenue) in 2018 Q4, an increase of $214.4 million or 44.4%. Cost of sales increased as a percentage of revenue as a result of lower margins in the ADL business. Additionally, continued startup costs and related inefficiencies related to KMG's parts fabrication facility contributed to the higher cost of sales as a percentage of revenues.

Cost of sales from Manufacturing operations in Fiscal 2019, excluding the impact of IFRS 16 were $2,184.5 million (88.2% of manufacturing operations revenue) compared to $1,794.6 million (83.8% of Manufacturing operations revenue) in Fiscal 2018, an increase of $390.4 million or 21.8%. Cost of sales increased as a percentage of revenue for the same reasons noted in the comparison of 2019 Q4 to 2018 Q4.

Fair value adjustments charged into the statement of net earnings and total comprehensive income within Manufacturing operations were $2.2 million for 2019 Q4 and $31.0 million Fiscal 2019. The adjustment relates to purchase accounting as a result of the ADL acquisition, where on the acquisition date the inventory is valued at the fair value, and as the inventory is sold, the write up is released into cost of sales as an expense.

Cost of sales from Aftermarket operations in 2019 Q4, excluding the impact of IFRS 16 were $80.9 million (69.1% of Aftermarket revenue) compared to $60.3 million (70.6% of Aftermarket revenue) in 2018 Q4, an increase of $20.6 million.

Cost of sales from Aftermarket operations in Fiscal 2019, excluding the impact of IFRS 16 were $292.9 million (70.2% of Aftermarket revenue) compared to $270.3 million (71.7% of Aftermarket revenue) in Fiscal 2018, an increase of $22.6 million. The difference is consistent with the higher revenues.

Fair value adjustments charged into the statement of net earnings and total comprehensive income within Aftermarket operations were $0.8 million for Fiscal 2019. The adjustment relates to purchase accounting as a result of the ADL acquisition, where on the acquisition date the inventory is valued at the fair value, and as the inventory is sold, the write up is released into cost of sales as an expense.

Gross Margins

(Unaudited, U.S. dollars in millions)	2019 Q4	2019 Q4 (excluding IFRS 16)	2018 Q4	Fiscal 2019	Fiscal 2019 (excluding IFRS 16)	Fiscal 2018
Manufacturing	102,378	102,785	93,107	291,541	291,016	347,307
Aftermarket	35,600	36,247	25,158	121,943	124,507	106,901
Total Gross Margins	$ 137,978	$ 139,032	$ 118,265	$ 413,484	$ 415,523	$ 454,208
As a percentage of sales						
Manufacturing	12.8%	12.8%	16.1%	11.8%	11.8%	16.2%
Aftermarket	30.4%	30.9%	29.4%	29.2%	29.8%	28.3%
	15.0%	15.1%	17.9%	14.3%	14.4%	18.0%

Manufacturing gross margins for 2019 Q4, excluding the impact of IFRS 16, of $102.8 million (12.8% of revenue), increased by $9.7 million, or 10.4% compared to $93.1 million (16.1% of revenue) for 2018 Q4. Manufacturing gross margin for Fiscal 2019, excluding the impact of IFRS 16, of $291.0 million (11.8% of revenue) decreased by $55.6 million, or 16.2% compared to $347.3 million (16.2% of revenue) for Fiscal 2018.

Included in manufacturing gross margin is a charge of $2.2 million for 2019 Q4 and $31.0 million for Fiscal 2019 related to the unwind of fair value adjustments related to the valuation of acquired assets. Also contributing to the decrease in gross margin is amortization of intangible assets of $5.3 million for 2019 Q4 and $14.4 million for Fiscal 2019 related to the acquisition of ADL. This decreased gross margin as a percentage of revenue by 0.9% for 2019 Q4 and 1.8% for Fiscal 2019.

In addition to the unwind of the fair value adjustment, the decrease in gross margin as a percentage of revenue for both the 2019 Q4 and Fiscal 2019 periods is primarily caused by temporary production inefficiencies within both the motor coach and transit bus businesses. These inefficiencies are due to learning curves related to the production of new products, startup costs at the KMG parts fabrication facility and higher remediation costs.

Gross margins from Aftermarket operations in 2019 Q4, excluding the impact of IFRS 16, of $36.2 million (30.9% of revenue) increased by $11.0 million, or 44.1% compared to 2018 Q4 gross margins of $25.2 million (29.4% of revenue). The increase as a percentage of revenue is primarily due to favourable sales mix.

Gross margins from Aftermarket operations in Fiscal 2019, excluding the impact of IFRS 16, of $124.5 million (29.8% of revenue) increased by $17.6 million, or 16.5% compared to gross margins of $106.9 million (28.3 % of revenue) in Fiscal 2018. The increase as a percentage of revenue is primarily due to favourable sales mix.

Gross margins from Aftermarket operations were negatively impacted by the unwinding of fair value adjustments related to the valuation of acquired assets by $0.8 million for Fiscal 2019. This decreased gross margin as a percentage of revenue by 0.2% for Fiscal 2019.

Selling, general and administrative costs and other operating expenses ("SG&A")

(Unaudited, U.S. dollars in thousands)

	2019 Q4	2019 Q4 (excluding IFRS 16)	2018 Q4	Fiscal 2019	Fiscal 2019 (excluding IFRS 16)	Fiscal 2018
Selling expenses	$ 7,052	$ 7,052	$ 4,808	$ 23,739	$ 23,739	$ 18,056
General and administrative expenses	62,055	63,043	50,030	205,270	209,321	186,285
Other costs	(528)	(528)	499	12,445	12,446	6,219
Total SG&A	$ 68,579	$ 69,567	$ 55,337	$ 241,454	$ 245,506	$ 210,560

The consolidated SG&A, excluding the impact of IFRS 16, for 2019 Q4 of $69.6 million (7.6% of consolidated revenue) increased by $14.3 million or 25.7% compared with $55.3 million (8.4% of consolidated revenue) in 2018 Q4. The increase is mostly related to the acquisition of ADL.

The consolidated SG&A, excluding the impact of IFRS 16, for Fiscal 2019 of $245.5 million (8.5% of consolidated revenue) increased by $34.9 million or 16.6% compared with $210.6 million (8.4% of consolidated revenue) in Fiscal 2018. Other costs from acquisition related expenses of $13.0 million and additional SG&A expenses were the primary reason for the increase in overall SG&A expenses. These increases were partially offset by lower incentive plans expense.

Realized foreign exchange loss/gain

During 2019 Q4, the Company recorded a realized foreign exchange gain of $0.6 million compared to a loss of $2.4 million in 2018 Q4. During Fiscal 2019, the Company recorded a realized foreign exchange gain of $1.0 million compared to a loss of $5.8 million in Fiscal 2018.

The Company uses foreign exchange forward contracts to buy various currencies in which it operates with U.S. dollars, Canadian dollars and British Pounds Sterling ("GBP"). The purchase of these currencies using foreign exchange forward contracts at favorable forward rates compared to the spot rates at settlement were the primary reason for the gains.

Earnings from operations

Consolidated earnings from operations in 2019 Q4, excluding IFRS 16 were $70.0 million (7.6% of consolidated revenue) compared to $60.6 million (9.1% of consolidated revenue) in 2018 Q4, an increase of $9.4 million or 15.6%.

Earnings from operations related to Manufacturing operations in 2019 Q4 were $56.5 million (7.1% of Manufacturing revenue) compared to $56.3 million (9.8% of Manufacturing revenue) in 2018 Q4, an increase of $0.2 million or 0.3%. Earnings from operations related to Manufacturing operations in Fiscal 2019 were $112.7 million (4.6% of Manufacturing revenue) compared to $203.3 million (9.5% of Manufacturing revenue) in

Fiscal 2018, a decrease of $90.6 million or 44.6%. The decrease as a percentage of revenues is primarily due to the production inefficiencies and the fair value adjustment described within the Cost of Sales section above.

Earnings from operations related to Aftermarket operations in 2019 Q4 were $15.5 million (13.3% of Aftermarket revenue) compared to $15.4 million (18.0% of Aftermarket revenue), an increase of $0.1 million or 0.9%. Earnings from operations related to Aftermarket operations in Fiscal 2019 were $64.0 million (15.3% of Aftermarket revenue) compared to $66.3 million (17.6% of Aftermarket revenue), a decrease of $2.3 million or 3.5%. The decrease as a percentage of revenue is related to the fair value adjustments described within the Cost of Sales section above.

Unrealized foreign exchange gain/loss

The Company has recognized a net unrealized foreign exchange (gain)/loss consisting of the following:

(Unaudited, U.S. dollars in thousands)	2019 Q4	2018 Q4	Fiscal 2019	Fiscal 2018
Unrealized (gain) loss on forward foreign exchanges contracts	$ (1,475)	$ 2,342	$ (1,797)	$ 2,974
Unrealized (gain) loss on other long-term monetary assets/liabilities	(165)	(1,031)	1,857	(1,593)
	$ (1,640)	$ 1,311	$ 60	$ 1,381

At December 29, 2019, the Company had $216.4 million of foreign exchange forward contracts to buy currencies in which the Company operates (U.S. dollars, Canadian dollars, or GBP). The related liability of $3.7 million (December 30, 2018: $1.5 million) is recorded on the audited consolidated statements of financial position as a current derivative financial instruments liability and the corresponding change in the fair value of the foreign exchange forward contracts is recorded in the consolidated statements of net earnings and total comprehensive income.

Earnings before interest and income taxes ("EBIT")

In 2019 Q4, the Company recorded EBIT of $71.5 million compared to EBIT of $61.4 million in 2018 Q4. In Fiscal 2019, the Company recorded EBIT of $173.1 million compared to EBIT of $238.3 million in Fiscal 2018. EBIT has been impacted by non-cash and non-recurring items as follows:

(Unaudited, U.S. dollars in thousands)	2019 Q4	2018 Q4	Fiscal 2019	Fiscal 2018
Non-cash and non-recurring charges:				
Costs associated with assessing strategic and corporate initiatives	$ (616)	$ —	$ 13,069	$ 137
Unrealized foreign exchange (gain) loss	(1,640)	1,311	60	1,381
Equity settled stock-based compensation	437	34	1,566	1,409
Loss (gain) on disposition of property, plant and equipment	52	(8)	(46)	267
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue	2,156	—	31,004	266
Fair value adjustment of total return swap	273	5,629	949	6,547
Past service costs	—	—	—	6,482
Recovery on currency transactions	—	—	(4,287)	—
Prior year sales tax provision	300	—	4,094	—
Amortization	31,135	18,017	104,570	67,796
Total non-cash and non-recurring charges:	$ 32,097	$ 24,983	$ 150,979	$ 84,285

Interest and finance costs

The interest and finance costs for 2019 Q4 of $11.3 million increased by $0.6 million when compared 2018 Q4.

The increase is primarily due increased interest on long-term debt of $5.8 million. Increased interest is the result of higher average Credit Facility draws for the acquisition of ADL and to finance higher non-cash working capital, which is expected to be recovered as WIP levels are reduced. Interest related to leases capitalized under IFRS 16 and higher other banking charges also contributed. This is offset by a $4.5 million gain on the interest rate swap in 2019 Q4.

The interest and finance costs for Fiscal 2019 of $73.4 million increased by $45.7 million when compared to Fiscal 2018. The increase is primarily due to a $22.0 million loss on the interest rate swap in Fiscal 2019 compared to a loss of $0.8 million in Fiscal 2018. Higher average Credit Facility draws contributed to the increase in interest on long-term debt of $18.6 million and interest related to leases capitalized under IFRS 16 and higher other banking charges contributed to the remaining increase.

The losses on the interest rate swap relates to risk management activities management has undertaken to reduce the uncertainty related to its cost of borrowing. The interest rate swap entered into fixes the interest rate which the Company will pay on $600 million of its long-term debt at 2.27% plus an applicable margin. The Company's accounting policy is to not designate these types of instruments as accounting hedges. As a result, interest rate increases will result in mark-to-market gains, while interest rate decreases will result in mark-to-market losses.

Earnings before income taxes ("EBT")

EBT for 2019 Q4 of $60.2 million increased by $9.5 million compared to EBT of $50.7 million in 2018 Q4. EBT for Fiscal 2019 of $99.7 million decreased by $111.0 million compared to EBT of $210.7 million in Fiscal 2018. The primary drivers of the changes to EBT are addressed in the Earnings from Operations, EBIT, and Interest and finance costs sections above.

Income tax expense

The income tax expense for 2019 Q4 was $26.1 million compared to $7.9 million in 2018 Q4. The ETR for 2019 Q4 was 43.4% and the ETR for 2018 Q4 was 15.6%. The increase in the overall income tax expense and high ETR, is primarily due to the occurrence of base erosion and anti-abuse tax ("BEAT"), and a revision of prior year tax estimates.

The income tax expense for Fiscal 2019 was $42.0 million compared to $50.7 million in Fiscal 2018. The ETR for Fiscal 2019 was 42.1% and the ETR for Fiscal 2018 was 24.1%. The reduction in the overall income tax expense is due to lower earnings before taxes, partially offset by the occurrence of BEAT, and a revision of prior year tax estimates. The high ETR is predominantly due to the impact of low earnings before tax due to adjustments relating to the ADL acquisition accounting discussed in the gross margin section, and a revision to prior year's tax estimates, adjusting for these two items, the ETR would be 30.3%.

Net earnings

The Company reported net earnings of $34.1 million in 2019 Q4, a decrease of 20.3% compared to net earnings of $42.8 million in 2018 Q4. The Company reported net earnings of $57.7 million in Fiscal 2019, a decrease of 63.9% compared to net earnings of $160.0 million in Fiscal 2018. The decrease in net earnings is a result of ADL acquisition costs, adjustments for purchase accounting, interest on long-term debt, and fair value adjustments on foreign exchange and interest contracts.

Net earnings (Unaudited U.S. dollars in millions)	**2019 Q4**	**2019 Q4 (excluding IFRS 16)**	**2018 Q4**	**Fiscal 2019**	**Fiscal 2019 (excluding IFRS 16)**	**Fiscal 2018**
Earnings from operations	$ 70.0	$ 70.0	$ 60.6	$ 173.1	$ 171.1	$ 237.9
Non-cash gain (loss)	1.5	1.5	0.8	—	—	0.5
Interest expense	(11.3)	(9.6)	(10.7)	(73.4)	(67.4)	(27.7)
Income tax expense	(26.1)	(26.1)	(7.9)	(42.0)	(41.7)	(50.7)
Net earnings	$ 34.1	$ 35.8	$ 42.8	$ 57.7	$ 62.0	$ 160.0
Net earnings per Share (basic)	$ 0.55	$ 0.57	$ 0.69	$ 0.93	$ 1.00	$ 2.56
Net earnings per Share (fully diluted)	$ 0.55	$ 0.57	$ 0.68	$ 0.93	$ 1.00	$ 2.55

The Company's net earnings per Share in 2019 Q4 and Fiscal 2019, excluding the impact of IFRS 16, of $0.57 and $1.00, respectively decreased from net earnings per Share of $0.69 and $2.56 generated in 2018 Q4 and Fiscal 2018. Net earnings were lower in 2019 Q4 for the reasons discussed throughout the Results of Operation section in this MD&A, which decreased earnings per Share in 2019 Q4. Partially offsetting the impact of these decreases in net earnings per Share were lower weighted average common Shares.

Cash Flow

The cash flows of the Company are summarized as follows:

(Unaudited Quarterly Results, U.S. dollars in thousands)	**2019 Q4**	**2018 Q4**	**Fiscal 2019**	**Fiscal 2018**
Cash generated by operating activities before non-cash working capital items and interest and income taxes paid	$ 101,054	$ 87,823	$ 277,775	$ 305,643
Interest paid	(15,447)	(6,338)	(47,676)	(23,073)
Income taxes paid	(7,228)	(12,154)	(40,167)	(73,082)
Net cash earnings	78,379	69,331	189,932	209,488
Cash flow used in changes in working capital	70,891	(1,991)	(91,324)	(34,344)
Cash flow generated from operating activities	149,270	67,340	98,608	175,144
Cash flow from (used in) financing activities	(145,175)	(37,700)	298,011	(83,774)
Cash flow used in investing activities	(6,979)	(20,166)	(379,289)	(70,806)

Cash flows from operating activities

The 2019 Q4 net operating cash inflow of $149.3 million is mostly comprised of $101.1 million of net cash earnings and $70.9 million of cash inflows related to changes in working capital. The 2018 Q4 net operating cash inflow of $67.3 million is comprised of $69.3 million of net cash earnings partially offset by cash used for working capital of $2.0 million.

The Fiscal 2019 net operating cash inflow of $98.6 million is comprised of $91.3 million outflows related to changes in working capital partially offset by net cash earnings of $189.9 million. Management anticipates that working capital will continue to decline during the coming year as it primarily relates to deferred deliveries and temporary production issues. The Fiscal 2018 net operating cash inflow of $175.1 million is comprised of $209.5 million of net cash earnings and a decrease in cash used for working capital of $34.3 million.

Cash flow from financing activities

The cash outflow of $145.2 million during 2019 Q4 mostly related to the repayment of debt and dividends paid to shareholders. The Fiscal 2019 inflow of $298.0 million related to proceeds from debt related for the acquisition of ADL, Shares issued for the acquisition of ADL, financing higher non-cash working capital balances and dividends paid to shareholders.

Cash flow from investing activities

(Unaudited Quarterly Results, U.S. dollars in thousands)	2019 Q4	2018 Q4	Fiscal 2019	Fiscal 2018
Acquisition of intangible assets	$ (11)	$ (32)	(38)	$ (50)
Proceeds from disposition of property, plant and equipment	—	10	174	235
Net cash used in acquisitions	—	—	(327,360)	—
Long-term restricted deposit	—	—	(14,490)	—
Acquisition of property, plant and equipment	(6,968)	(20,144)	(37,575)	(70,991)
Cash from investing activities	$ (6,979)	$ (20,166)	$ (379,289)	$ (70,806)

2019 Q4 investing activities have decreased outflows compared to 2018 Q4 primarily due to lower acquisition of property, plant and equipment. Fiscal 2019 investing activities have greater outflows than Fiscal 2018 primarily due to the acquisition of ADL, partially offset by lower acquisition of property, plant and equipment.

Interest rate risk

On January 20, 2016, the Company entered into a $482,000 interest rate swap designed to hedge floating rate exposure on the $482,000 Term Credit Facility under the Company's fifth amended and restated prior credit agreement. The interest rate swap fixes the interest rate at 1.154% plus the applicable interest margin. On February 13, 2019, the Company blended the unrealized gain from the existing swap into a $600,000 notional interest rate swap designed to hedge floating rate exposure on the Company's current Credit Facility. The interest rate swap fixes the interest rate at 2.27% plus applicable margin until October 2023.

The fair value of the interest rate swap liability of $15.4 million at December 29, 2019 (2018: $6.6 million asset) was recorded on the audited consolidated statements of financial position as a derivative financial instruments liability and the change in fair value has been recorded as finance costs for the reported period. The unrealized losses recorded on the instrument are a result of interest rate reductions subsequent to entering into the transaction.

Credit risk

Financial instruments which potentially subject the Company to credit risk and concentrations of credit risk consist principally of cash, accounts receivable and derivatives. Management has assessed that the credit risk associated with accounts receivable is mitigated by the significant proportion of counterparties that are well established public transit authorities. Additionally, the U.S. federal government funds a substantial portion of U.S. public sector customer payments - up to 80% of the capital cost of new transit buses, coaches or cutaways, while the remaining 20% comes from state and municipal sources. There are a few U.S. public sector customers that obtain 100% of their funding from state and municipal sources. The maximum exposure to the risk of credit for accounts receivables corresponds to their book value. Historically, the Company has experienced nominal bad debts as a result of the customer base being principally comprised of municipal and other local transit authorities.

The purchase of new coaches, transit buses or cutaways by private fleet operators is paid from the operators' own capital budgets and funded by its own cash flow. A significant portion of private fleet operators choose to finance new coach purchases with lending organizations. In some cases, MCI assists in arranging this financing, and in some cases, it provides financing through its ultimate net loss pool. The Company has experienced a nominal amount of bad debts with its private sales customers as most transactions require payment on delivery.

The carrying amount of accounts receivable is reduced through the use of an allowance account and the amount of the loss is recognized in the earnings statement within SG&A. When a receivable balance is considered uncollectible, it is written off against the allowance for doubtful accounts. Subsequent recoveries of amounts previously written off are credited against SG&A in the audited consolidated statements of net earnings and total comprehensive income.

The following table details the aging of the Company's receivables and related allowance for doubtful accounts:

	December 29, 2019	December 30, 2018
Current, including holdbacks	$ 482,476	$ 358,729
Past due amounts but not impaired		
1 – 60 days	37,413	24,153
Greater than 60 days	6,800	4,830
Less: allowance for doubtful accounts	(284)	(226)
Total accounts receivables, net	$ 526,405	$ 387,486

The counterparties to the Company's derivatives are chartered Canadian banks and international financial institutions. The Company could be exposed to loss in the event of non-performance by the counterparty. However, credit ratings and concentration of risk of the financial institutions are monitored on a regular basis.

Commitments and Contractual Obligations

The following table describes the Company's maturity analysis of the undiscounted cash flows of accrued benefit liabilities as at December 29, 2019:

U.S. dollars in thousands	Total	2020	2021	2022	2023	2024	Post 2024
Leases	211,101	23,271	21,886	19,666	16,539	12,489	117,250
Accrued benefit liability	3,936	3,936	—	—	—	—	—
	$ 215,037	$ 27,207	$ 21,886	$ 19,666	$ 16,539	$ 12,489	$ 117,250

As at December 29, 2019, outstanding surety bonds guaranteed by the Company amounted to $384.5 million, representing a decrease compared to $394.4 million at December 30, 2018. The estimated maturity dates of the surety bonds outstanding at December 29, 2019 range from January 2020 to December 2026. Management believes that adequate facilities exist to meet projected surety requirements.

The Company has not recorded a liability under these guarantees as management believes that no material events of default exist under any applicable contracts with customers.

Under the Credit Facility, the Company had established a letter of credit sub-facility of $100.0 million. As at December 29, 2019, letters of credit amounting to $12.8 million (December 30, 2018: $13.8 million) remained outstanding as security for the contractual obligations of the Company under the Credit Facility.

The Company has an additional bi-lateral credit facility of $63.6 million. As at December 29, 2019, letters of credit totaling $23.8 million were outstanding under the bi-lateral credit facility. Additionally, there are $14.5 million of letters of credit outstanding outside of the Credit Facility and the bi-lateral credit facility.

The Company does not have any off-balance sheet arrangement or any material capital asset commitments at December 29, 2019.

Stock Option Plan

The Board adopted a Share Option Plan (the "Option Plan") for NFI on March 21, 2013 (and amended and restated on December 8, 2015 and December 31, 2018), under which employees of NFI and certain of its affiliates may receive grants of Share options. Directors who are not employed with NFI are not eligible to participate in the Option Plan. A maximum of 3,600,000 Shares are reserved for issuance under the Option Plan. The options become vested as to one-quarter on the first grant date anniversary and an additional one-quarter on the second, third and fourth anniversary of the grant date.

Option Grant dates	Number	Exercised	Expired	Vested	Unvested	Expiry date	Exercise price	Fair Value at grant date
March 26, 2013	490,356	(483,030)	—	(7,326)	—	March 26, 2021	C$10.20	C$1.55
December 30, 2013	612,050	(573,668)	(9,631)	(28,751)	—	December 30, 2021	C$10.57	C$1.44
December 28, 2014	499,984	(243,587)	(11,368)	(245,029)	—	December 28, 2022	C$13.45	C$1.83
December 28, 2015	221,888	(19,532)	—	(146,884)	55,472	December 28, 2023	C$26.75	C$4.21
September 8, 2016	2,171	—	—	(1,629)	542	September 8, 2024	C$42.83	C$8.06
January 3, 2017	151,419	(1,610)	(1,615)	(73,299)	74,895	January 3, 2025	C$40.84	C$7.74
January 2, 2018	152,883	—	(1,882)	(37,754)	113,247	January 2, 2026	C$54.00	C$9.53
January 2, 2019	284,674	—	(3,431)	—	281,243	January 2, 2027	C$33.43	C$5.01
July 15, 2019	2,835	—	—	—	2,835	July 15, 2027	C$35.98	C$4.90
	2,418,260	(1,321,427)	(27,927)	(540,672)	528,234		C$30.77	

The following reconciles the stock options outstanding:

	Fiscal 2019		Fiscal 2018	
	Number	Weighted average exercise price	Number	Weighted average exercise price
Balance at beginning of period	946,306	C$27.02	979,333	C$19.94
Granted during the period	287,559	C$33.46	152,833	C$54.00
Expired during the period	(6,928)	C$40.75	—	—
Exercised during the period	(158,031)	C$12.77	(185,860)	C$11.91
Balance at end of period	1,068,906	C$30.77	946,306	C$27.02

Restricted Share Unit Plan for Non-Employee Directors

Pursuant to the Company's Restricted Share Unit Plan for Non-Employee Directors, a maximum of 500,000 Shares are reserved for issuance to non-employee directors. The Company issued approximately $145 thousand of director restricted Share units ("Director RSUs") in 2019 Q4. Of these Director RSUs issued, approximately $94 thousand were exercised and exchanged for 4,434 Shares.

Capital Allocation Policy

The Company has established a capital allocation policy based on an operating model intended to provide consistent and predictable cash flow and maintain a strong balance sheet. This policy has established guidelines that are reviewed by the Board on a quarterly basis and provides targets for maintaining financial flexibility, business investment, and return of capital to shareholders.

Maintaining Financial Flexibility

The Company plans to prudently use leverage to manage liquidity risk. Liquidity risk arises from the Company's financial obligations and from the management of its assets, liabilities and capital structure. This risk is managed by regularly evaluating the liquid financial resources to fund current and long-term obligations, and to meet the Company's capital commitments in a cost-effective manner.

The main factors that affect liquidity include sales mix, production levels, cash production costs, working capital requirements, capital expenditure requirements, scheduled repayments of long-term debt obligations, funding requirements of the Company's pension plans, income taxes, credit capacity, expected future debt and equity capital market conditions and repurchase of equity through the Company's Normal Course Issuer Bid ("NCIB").

The Company's liquidity requirements are met through a variety of sources, including cash on hand, cash generated from operations, the credit facilities, leases, and debt and equity capital markets.

Within the capital allocation policy, management has targeted to maintain leverage between 2 times and 2.5 times Adjusted EBITDA, excluding IFRS 16 - leases ("IFRS 16"). The Company however, has and may in the future increase leverage beyond this range to fund accretive acquisitions that are capable of reducing leverage through earnings.

There are certain financial covenants under the Credit Facility that have to be maintained. These financial covenants include an interest coverage ratio and a total leverage ratio. The maximum total leverage ratio under the Credit Facility is 3.75 and increases to 4.25 for one year following a material acquisition. The acquisition of ADL on May 28, 2019 was a material acquisition. The terms of the Credit Facility provide relief from the impact of changes in accounting policies, including the impact of IFRS 16. At as December 29, 2019, the Company was in compliance with the ratios.

	December 29, 2019	December 30, 2018
Total Leverage Ratio (must be less than 4.25 for one year following a material acquisition)	3.24	2.09
Interest Coverage Ratio (must be greater than 3.00)	7.73	13.39

Business Investment

The Company plans to invest in the current business for future growth and will continue to invest in lean manufacturing operations to improve quality and cost effectiveness. In addition, business acquisitions will be considered to further grow and diversify the business and to contribute to the long-term competitiveness and stability of the Company. Investment decisions are based on several criteria, including but not limited to: investment required to maintain or enhance operations; enhancement of cost effectiveness through vertical integration of critical supply and sub-assembly in-sourcing; and acquisitions in current or adjacent markets that are considered accretive to the business.

Return of Capital to Shareholders

The Company intends to have a Share dividend policy that is consistent with the Company`s financial performance and the desire to retain certain cash flows to support the ongoing requirements of the business and to provide the financial flexibility to pursue revenue diversification and growth opportunities.

The Company`s Fiscal 2019 Free Cash Flow was C$211.4 million compared to declared dividends of C$105.5 million during this period. For Fiscal 2018 Free Cash Flow was C$210.5 million compared to declared dividends of C$90.3 million. This resulted in a payout ratio of 49.9% in 2019 compared to 42.9% in 2018.

As a result of continued expectations for strong Free Cash Flow generation and lower expected capital expenditures in Fiscal 2019, on March 13, 2019, the Board approved an annual dividend rate increase to C$1.70 per Share from the prior annual rate of C$1.50 per share, effective for dividends declared subsequent to March 13, 2019. This represents an annual dividend rate increase of 13.3% and the Board and management believe that this dividend rate has been established at a sustainable level. The Board expects to maintain dividends at this rate on a quarterly basis, although such distributions are not assured.

On June 11, 2018, the Company announced that the TSX had accepted a notice filed by the Company of its intention to implement the previous Normal Course Issuer Bid (the "Former NCIB") to repurchase its Shares through the facilities of the TSX and any alternative Canadian trading systems on which the Shares are traded. On January 17, 2019 the Company amended the Former NCIB. Pursuant to the amended Former NCIB, the Company was permitted to repurchase for cancellation up to 5,549,465 Shares, representing approximately 10% of the outstanding public float of Shares on June 4, 2018. The Company was permitted to repurchase Shares commencing on June 14, 2018 up to June 13, 2019, or earlier should the Company have completed its repurchases prior to such date. The Former NCIB expired June 13, 2019.

On June 12, 2019 the Company announced that the TSX had accepted a notice filed by the Company of its intention to implement the NCIB to replace the Former NCIB to repurchase its Shares through the facilities of the TSX and any alternative Canadian trading systems on which the Shares are traded. The Company is permitted to repurchase for cancellation up to 5,357,914 Shares, representing approximately 10% of the outstanding public float of Shares on June 4, 2019. The Company is permitted to repurchase Shares commencing on June 17, 2019 up to June 16, 2020, or earlier should the Company complete its repurchases prior to such date.

The actual number of Shares to be purchased and the timing and pricing of any purchases under the NCIB will depend on future market conditions and potential alternative uses for cash resources. The Company may elect to modify, suspend or discontinue the program at any time without prior notice. During 2019 Q1, the Company repurchased 232,100 Shares under the Former NCIB at an average price of C$31.82 per Share for a total repurchase of C$7.4 million. The Company canceled 986,075 Shares during 2019 Q1, including 232,100 Shares purchased in 2019 Q1 and 753,975 Shares that were purchased in 2018 Q4. There were no shares purchased or canceled under the Former NCIB or the NCIB during 2019 subsequent to 2019 Q1.

Total Capital Distributions to Shareholders (U.S. dollars in millions)	**2019 Q4**	**2018 Q4**	**Fiscal 2019**	**Fiscal 2018**
Dividends paid	$ 20.0	$ 18.1	$ 76.4	$ 68.2
NCIB Share repurchase	—	36.9	5.7	66.5
Total	$ 20.0	$ 55.0	$ 82.1	$ 134.7

Critical accounting estimates and judgments

The Company's critical accounting estimates and judgments can be found within note 2 to the 2019 Annual Financial Statements.

New and amended standards adopted by the Company

IFRS 16

Effective December 31, 2018, the Company adopted IFRS 16, which specifies how to recognize, present and disclose leases. The standard provides a single lessee accounting model, requiring lessees to recognize assets and liabilities for all major leases. The adoption of this standard resulted in the recognition of amounts through the consolidated statements of net earnings through depreciation and interest charges on the right-of-use asset and lease liability, respectively. Under the former accounting policy, IAS 17, expenses related to leases were recorded through operating expenses. On transition, the Company elected to use the following practical expedients:

- To utilize the modified retrospective approach to adopting the standard, accordingly comparative information for 2018 has not been restated.
- To utilize the definition of a lease under IAS 17, leases to identify contracts that are, or contain, leases.
- To exclude the recognition of the right-of-use asset and lease liability for leases with a term of twelve months or less.

Lease assets formerly capitalized as fixed assets are transferred at their net book value to the right-of-use asset line item within consolidated statement of financial position. No adjustments to the carrying value of these leased assets was made as a part of transition to IFRS 16.

The transition adjustment is shown in below.

	Assets			Liabilities		
	Right-of-use asset	Property, plant and equipment	Other long-term asset	Obligations under leases	Current portion of obligation under leases	Accounts Payable and accrued liabilities
Opening balances at December 31, 2018	$ —	$ 247,943	$ 1,052	$ 19,087	$ 7,936	$ 366,517
Transition to IFRS 16	131,595	(27,319)	4,225	104,670	5,553	(1,722)
Adjusted December 31, 2018	$ 131,595	$ 220,624	$ 5,277	$ 123,757	$ 13,489	$ 364,795

The following table reconciles the Company's operating lease obligations at December 30, 2018, as previously disclosed in the Company's audited consolidated financial statements.

Operating lease commitments at December 30, 2018	$ 70,690
Extension options reasonably certain to be exercised	134,422
Discounted using the incremental borrowing rate at December 31, 2018	(94,316)
Recognition exemptions for short-term and low-value leases	(573)
Lease obligations recognized at December 31, 2018	$ 110,223

The weighted average incremental borrowing rate at December 31, 2018 was 5.3%.

The Company's accounting policy under IFRS 16 is as follows:

At inception of a contract, the Company assesses whether a contract is, or contains, a lease based on whether the contract conveys a right to control the use of an identified asset for a period of time in exchange for consideration.

The Company recognizes a right-of-use asset and a lease liability at the lease commencement date. The right-of-use asset is initially measured based on the initial amount of the lease liability adjusted for any lease payments made at or before the commencement date, plus any initial direct costs incurred and an estimate of costs to dismantle and remove the underlying asset or to restore the underlying asset or the site on which it is located, less any lease incentives received. The assets are depreciated based on the lease term of the asset using the straight-line method. The lease term includes periods covered by an option to extend if the Company is reasonably certain to exercise that option. Lease terms are as follows:

Land and Building	4 - 35 years
Machinery and Equipment	15 months - 5 years
Automobiles	13 months - 3 years
Office Equipment	14 months - 5 years

The lease liability is initially measured at the present value of the lease payments that are not paid at commencement date, discounted using the interest rate implicit in the lease or, if that rate cannot be readily determined, the Company uses its incremental borrowing rate. The lease

liability is measured at amortized cost using the effective interest method. It is remeasured when there is a change in the future lease payments arising from a change in an index or rate or if the Company changes its assessment of whether it will exercise a purchase, extension or termination option.

When the lease liability is remeasured in this way, a corresponding adjustment is made to the carrying amount of the right-of-use asset, or is recorded in profit or loss if the carrying amount of the right-of-use asset has been reduced to zero.

Controls and Procedures

Internal Controls over Financial Reporting

Management is responsible for establishing and maintaining internal controls over financial reporting ("ICFR"), as defined under rules adopted by the Canadian Securities Administrators. ICFR were designed under the supervision of, and with the participation of, the President and Chief Executive Officer ("CEO") and the Chief Financial Officer ("CFO"). The Company's ICFR are designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of Financial Statements for external purposes in accordance with IFRS.

On December 15, 2014, management adopted the "Internal Control – Integrated Framework 2013" ("COSO 2013") from the Committee of Sponsoring Organizations of the Treadway Commission, which replaces the previously issued COSO framework, COSO 1992. This new framework necessitated a re-evaluation of the controls that management relies upon to support its conclusions, as well as changes to the Company's testing programs.

Management, under the supervision of the CEO and CFO, evaluated the design and operational effectiveness of the Company's ICFR as of December 29, 2019 in accordance with the criteria established in COSO 2013, and concluded that the Company's ICFR are effective.

The Company has limited its design of ICFR to exclude controls, policies and procedures of ADL, as they were acquired not more than 365 days before the end of the financial period to which this MD&A relates.

ICFR, no matter how well designed, have inherent limitations. Therefore, ICFR can provide only reasonable assurance with respect to financial statement preparation and may not prevent or detect all misstatements.

Disclosure Controls

Management is responsible for establishing and maintaining disclosure controls and procedures in order to provide reasonable assurance that material information relating to the Company is made known to them in a timely manner and that information required to be disclosed is reported within time periods prescribed by applicable securities legislation. There are inherent limitations to the effectiveness of any system of disclosure controls and procedures, including the possibility of human error and the circumvention or overriding of the controls and procedures. Accordingly, even effective disclosure controls and procedures can only provide reasonable assurance of achieving their control objectives. The Company's CEO and CFO have concluded that disclosure controls and procedures as at December 29, 2019 were effective.

Limitation of Disclosure Controls and Procedures & Internal Control over Financial Reporting

As permitted by securities legislation, for the period ended December 29, 2019, the Company's management has limited the scope of its design of the Company's disclosure controls and procedures and the Company's ICFR to exclude controls, policies and procedures of ADL, which the Company acquired on May 28, 2019.

From the date of acquisition to December 29, 2019 and as at December 29, 2019, certain financial results and financial position of ADL are:

(Unaudited, U.S. dollars in thousands)	**Fiscal 2019**
Revenue	$ 449,101
Net loss	(43,026)
Current assets	380,226
Non-current assets	403,953
Current liabilities	269,271
Non-current liabilities	310,347

Net loss of ADL is impacted by $31.0 million of charges related to the unwind of fair value adjustments of acquired assets and $14.4 million of intangible amortization related to the purchase price accounting.

Appendix A - Acquisition of ADL

On the acquisition date, of May 28, 2019 (the "Acquisition Date") the Company, through its wholly owned subsidiary NFI International Limited, acquired 100% of the voting equity interest in ADL for £295.1 million. In order to provide context on ADL's operations, management has provided adjusted historical Fiscal 2018, 2019 Q1 and 2019 Q2 financial information in the table below and has used this information to present proforma 2018 Q3 and Fiscal 2018 information to provide comparative including ADL's results.

The information below, with the exception of the column entitled "2019 Q2 (Post-acquisition)" do not form a part of NFI's consolidated reporting.

ADL Select Adjusted Historical Information
(Unaudited, U.S. dollars in thousands unless noted)

	2018 Q1	2018 Q2	2018 Q3	2018 Q4	Fiscal 2018	2019 Q1	2019 Q2	2019 Q2 (Pre-Acquisition)	2019 Q2 (Post-Acquisition)
ADL's deliveries (units)	365	765	682	625	2437	556	393	235	158
ADL's adjusted historical revenue - Manufacturing[1]	£ 80,632	£160,240	£148,074	£134,393	£523,339	£131,507	£ 85,615	£ 53,240	£ 32,375
ADL's adjusted historical revenue - Aftermarket[1]	£ 18,513	£ 17,714	£ 16,976	£ 18,115	£ 71,318	£ 18,820	£ 17,864	£ 10,892	£ 6,972
Total Revenue	£ 99,145	£177,954	£165,050	£152,508	£594,657	£150,327	£103,479	£ 64,132	£ 39,347
Average exchange rate for the period	1.391	1.363	1.304	1.288		1.301	1.280	1.292	1.267
Total Revenue	$137,911	$242,551	$215,225	$196,430	$792,117	$195,575	$132,712	$ 82,859	$ 49,853
Reconciliation of earnings (loss) before interest and income tax expense to Adjusted EBITDA									
ADL's adjusted historical earnings (loss) before interest and income tax	£ (4,370)	£ 10,212	£ 9,912	£ 7,371	£ 23,125	£ 9,947	£ (9,094)	£ (6,270)	£ (2,824)
Depreciation and amortization	1,071	1,450	1,288	1,225	5,034	2,040	2,048	1,273	775
Acquisition related costs	—	—	—	—	—	—	2,486	1,509	977
Gain/(loss) on sale of assets	26	(161)	(82)	(150)	(367)	(98)	(23)	(28)	5
ADL's Adjusted EBITDA	£ (3,273)	£ 11,501	£ 11,118	£ 8,446	£ 27,792	£ 11,889	£ (4,583)	£ (3,516)	£ (1,067)
Average exchange rate for the period	1.391	1.363	1.304	1.288		1.301	1.280	1.292	1.267
ADL's Adjusted EBITDA	$ (4,553)	$ 15,676	$ 14,498	$ 10,878	$ 36,499	$ 15,468	$ (5,895)	$ (4,543)	$ (1,352)

[1] All ADL information related to the periods before the Acquisition Date are based on the audited financial statements of ADL provided to NFI, which were prepared on the basis of UK GAAP. NFI has not independently verified such statements. ADL's previously reported results have been conformed to IFRS, as presented above.

The following table presents NFI proforma comparative information including ADL pre-acquisition results.

Consolidated Revenue (Unaudited, U.S. dollars in millions)	**2019 Q4**	**2018 Q4** Proforma	**2018 Q4**	**Fiscal 2019**	**Fiscal 2019** Proforma	**Fiscal 2018** Proforma	**Fiscal 2018**
Deliveries (EUs)	2021	1938	1313	5784	6575	7218	4781
Manufacturing	$ 800.6	$ 749.6	576.5	2,476.0	$ 2,715.9	$ 2,838.7	2,141.9
Aftermarket	117.2	108.8	85.5	417.4	456.0	472.6	377.2
Total Revenue	$ 917.8	$ 858.4	$ 662.0	$ 2,893.4	$ 3,171.9	$ 3,311.3	$ 2,519.1
Reconciliation of earnings before interest and income tax expense to Adjusted EBITDA							
Adjusted historical earnings before interest and income tax expense	$ 71.5	$ 70.9	$ 61.4	173.1	177.9	$ 268.6	$ 238.3
Depreciation and amortization	31.1	19.6	18.0	104.6	108.9	$ 74.5	67.8
Acquisition related costs	1.5	—	—	44.1	44.1	(1.7)	(1.7)
Gain on sale of assets	0.1	—	—	—	—	$ 0.3	0.3
Other adjustments [1]	(0.5)	$ 0.5	$ 0.5	0.4	0.4	$ 10.7	$ 10.7
Adjusted EBITDA	$ 103.9	$ 91.0	$ 79.9	$ 322.2	$ 331.3	$ 352.4	$ 315.4

[1] Other adjustments to Adjusted EBITDA are disclosed in the table Reconciliation of Net Earnings to Adjusted EBITDA.

The information in the table above is provided for 2019 and 2018 to allow readers to understand the impact of ADL's performance as it relates to the Company.

As a result of the acquisition of ADL, management has updated its presentation of revenue information on the geographic basis of "North America", "United Kingdom and Europe", "Asia Pacific", and "Other" geographies in order to reflect the global nature of the Company's operations as a result of the acquisition of ADL. Comparative period information has been restated to reflect this presentation.

On the Acquisition Date, NFI completed the acquisition of ADL through the purchase of all the issued and outstanding shares of ADL for total consideration of £320 million (approximately $405 million) subject to certain purchase price adjustments (including repayment of outstanding indebtedness) resulting in a purchase price of £295 million (approximately $374 million).

In conjunction with the acquisition, NFI borrowed approximately $118 million under its existing senior credit facility, entered into and drew the full amount under a new $300 million credit facility, and issued from treasury 1.47 million Shares, in lieu of cash, to ADL’s primary shareholders. The funds were used to fund the acquisition, repay ADL's credit facilities, and provide operating capital to ADL.

The acquisition is considered to be a business combination under IFRS 3, Business Combinations (“IFRS 3”) with NFI as the acquirer and ADL as the acquired entity.

For the purposes of preparing the unaudited financial information of ADL presented below, adjustments have been made to the historical financial statements of ADL to convert its financial statements prepared in accordance with UK GAAP to IFRS and to conform its accounting policies and presentation to those used by the Company. The details of these adjustments are as presented in the following tables.

(Unaudited, U.S. dollars in thousands unless noted)	UK GAAP	IFRS Adjustments	IFRS (GBP)	US Dollar £1 = US $1.2663	Fair Value Adjustments	May 28, 2019 Opening Balance Sheet
Cash and contingent consideration			267,578	$ 338,834		338,834
NFI shares issued			27,552	34,888		34,888
Purchase price			295,130	373,723		373,723
Cash acquired			36,614	46,364		46,364
Net purchase price			258,516	327,359		327,359
Net assets acquired						
Inventory	117,180	34,608	151,788	192,209	29,367	221,576
Accounts receivable	66,167	5,283	71,450	90,477		90,477
Prepaid expenses	8,243	(4,068)	4,175	5,287		5,287
Derivative financial instruments	3,972	(4,248)	(276)	(349)		(349)
Property, plant and equipment	18,256	3,563	21,819	27,629	16,020	43,649
Right-of-use assets	—	13,581	13,581	17,198		17,198
Accounts payable and accrued liabilities	(151,309)	14,989	(136,320)	(172,622)		(172,622)
Income taxes payable	(1,286)		(1,286)	(1,628)		(1,628)
Deferred revenues	(1,565)	(61,634)	(63,199)	(80,029)		(80,029)
Lease liability	(177)	(13,941)	(14,118)	(17,877)		(17,877)
Long-term debt	(45,000)	—	(45,000)	(56,984)		(56,984)
Provisions	(5,871)	—	(5,871)	(7,434)		(7,434)
Deferred tax liabilities	(1,211)	3,503	2,292	2,902	(44,636)	(41,734)
Net tangible assets acquired	7,399	(8,364)	(965)	(1,221)	751	(470)
Trade names					43,181	43,181
Patent and licenses					22,287	22,287
Customer relationships					123,338	123,338
Backlog of sales orders					14,562	14,562
Identifiable intangible assets acquired					203,368	203,368
Goodwill acquired					124,462	124,462

The goodwill acquired is largely attributable to NFI's opportunity to grow its geographical footprint, diversify its product offering and take leading positions in new markets. This goodwill is not expected to be deductible for tax purposes. As of December 29, 2019, the analysis of identified intangible assets and fair values is incomplete. Management continues to assess and value the purchase price allocation and as such remains subject to adjustments that could arise as a result of new information that would impact the determination of fair value of the assets acquired and liabilities assumed. There is continued analysis to be undertaken which will complete the validation of the valuation assumptions, these items include valuation of provisions, and accrued liabilities.

Alexander Dennis Limited

Unaudited Consolidated Statement of Earnings

Reconciliation of UK GAAP financial statements to IFRS consistent with NFI Group Inc. accounting policies

As at December 30, 2018

	December 30, 2018			December 30, 2018	
	UK GAAP (000s in £)	IFRS Adjustments	Note	IFRS (000s in £)	IFRS (000s in $)
Turnover	£ 630,797	£ (36,140)	(d)(e)	594,657	792,116
Cost of Sales	536,963	(24,299)	(d)(e)	512,664	682,897
Gross Profit	93,834			81,993	109,219
Distribution Costs	21,461			21,461	28,587
Administrative Expenses	41,591	(4,184)	(a)(b)(c)	37,407	49,828
Operating Profit	30,782			23,125	30,804
Interest income	(4,611)	(1,466)	(f)	(6,077)	(8,095)
Interest expense	2,675			2,675	3,563
Earnings before income tax expense	32,718			26,527	35,336
Income tax expense					
Current income taxes	3,082			3,082	4,105
Deferred income taxes	985	(1,459)		(474)	(631)
Tax on profit	4,067	(1,459)		2,608	3,474
Net earnings for the period	£ 28,651			£ 23,919	£ 31,862
Other comprehensive income					
Foreign exchange differences on translation of foreign operations	1,240			1,240	1,652
Cash flow hedging	1,528	(1,528)	(f)	—	—
Taxation on hedging instruments	(62)	62	(f)	—	—
Other comprehensive income for the period	2,706			1,240	1,652
Total comprehensive income for the period	31,357			25,159	33,514

Notes:

(a) Reduction new product development costs previously capitalized and reclassification of costs related to demo buses from intangible assets to tangible assets.
(b) Adjustment to reflect that goodwill is not amortizing under IFRS.
(c) Recognition of right-of-use assets, lease liabilities and related interest and depreciation related to IFRS 16.
(d) Change in revenue recognition timing from completion of vehicle production to customer delivery or pickup.
(e) Change in revenue recognition from revenue recognized over time to revenue recognized at a point in time.
(f) Change in accounting for derivatives in accordance with NFI policy. Financial instruments are no longer designated as accounting hedges.

Appendix B - Meaning of Certain References

References in this MD&A to the “Company” are to NFI and all of its direct or indirect subsidiaries, including New Flyer Industries Canada ULC (“NFI ULC”), New Flyer of America Inc. (“NFAI”), The Aftermarket Parts Company, LLC (“TAPC”), TCB Enterprises, LLC ("TCB"), KMG Fabrication, Inc. ("KMG"), Carfair Composites Inc. (“CCI”) and Carfair Composites USA, Inc. (“CCUI”, and together with "CCI", "Carfair"), The Reliable Insurance Company Limited, ARBOC Specialty Vehicles, LLC ("ARBOC"), New MCI Holdings, Inc. and its affiliated entities (collectively, "MCI”), NFI Holdings Luxembourg s.a.r.l., and Alexander Dennis Limited and its affiliated entities (collectively, "ADL") References to “New Flyer” generally refer to NFI ULC, NFAI, TAPC, KMG, CCI, CCUI and TCB. References in this MD&A to “management” are to senior management of NFI and the Company.

The common shares of NFI (“Shares”) are traded on the Toronto Stock Exchange ("TSX") under the symbol “NFI”. As at December 29, 2019, 62,493,880 Shares were issued and outstanding. Additional information about NFI and the Company, including NFI’s annual information form, is available on SEDAR at www.sedar.com.

Buses manufactured by New Flyer and ADL's single and double deck buses are classified as "transit buses". ARBOC manufactures body-on-chassis or “cutaway” and "medium-duty" buses that service transit, paratransit, and shuttle applications. Collectively, transit buses, medium-duty buses and cutaways, are referred to as "buses".

A “motor coach” or “coach” is a 35-foot to 45-foot over-the-highway bus typically used for intercity transportation and travel over longer distances than heavy-duty transit buses, and is typically characterized by (i) one or two axles in the rear (related to the weight of the vehicle), (ii) high deck floor, (iii) baggage compartment under the floor, (iv) high-backed seats with a coach-style interior (often including a lavatory and underfloor baggage compartments), and (v) no room for standing passengers.

All of the data presented in this MD&A with respect to the number of transit buses, medium-duty buses, cutaways and motor coaches in service and delivered, is measured in, or based on, “equivalent units”. One equivalent unit (or “EU”) represents one production slot, being one 30-foot, 35-foot, 40-foot, 45-foot heavy-duty transit bus, one double deck bus, one medium-duty bus, one cutaway bus or one motor coach, whereas one articulated transit bus represents two equivalent units. An articulated transit bus is an extra-long transit bus (approximately 60-feet in length), composed of two passenger compartments connected by a joint mechanism. The joint mechanism allows the vehicle to bend when the bus turns a corner, yet have a continuous interior.

Forward–looking Statements

Certain statements in this MD&A are “forward looking statements”, which reflect the expectations of management regarding the Company's future growth, results of operations, performance and business prospects and opportunities. The words “believes”, “anticipates”, “plans”, “expects”, “intends”, “projects”, “forecasts”, “estimates” and similar expressions are intended to identify forward looking statements. These forward-looking statements reflect management's current expectations regarding future events and operating performance and speak only as of the date of this MD&A. Forward-looking statements involve significant risks and uncertainties, should not be read as guarantees of future performance or results, and will not necessarily be accurate indications of whether or not or the times at or by which such performance or results will be achieved. A number of factors could cause actual results to differ materially from the results discussed in the forward-looking statements. Such differences may be caused by factors which include, but are not limited to, funding may not continue to be available to the Company’s customers at current levels or at all; the Company’s business is affected by economic factors and adverse developments in economic conditions which could have an adverse effect on the demand for the Company’s products and the results of its operations (including the effect on demand for the Company's products and services as a result of the impact of the COVID-19 virus on customers); currency fluctuations could adversely affect the Company’s financial results or competitive position; interest rates could change substantially, materially impacting the Company’s revenue and profitability; an active, liquid trading market for the Shares may cease to exist, which may limit the ability of shareholders to trade Shares; the market price for the Shares may be volatile; if securities or industry analysts do not publish research or reports about the Company or if their reports are inaccurate or unfavorable to the Company or its business, or if they adversely change their recommendations regarding the Shares or if the Company’s results of operations do not meet their expectations, the Share price and trading volume could decline. In addition, other risk factors may include entrance of new competitors; failure of the ratification of the United States-Mexico-Canada Agreement (USMCA) could be materially adverse to NFI; current requirements under “Buy America” regulations may change and/or become more onerous or suppliers’ “Buy America” content may change; changes resulting from a hard exit of United Kingdom (UK) from the European Union (commonly referred to as "Brexit")and/or changes to the US Federal Funding mechanism (FAST Act) or Trade Policies may result in supply chain disruption and a potential downturn in the UK and US economies that may suppress demand; failure of the Company to comply with the disadvantaged business enterprise ("DBE") program requirements or the failure to have its DBE goals approved by the FTA; absence of fixed term customer contracts; exercise of options and customer suspension or termination for convenience; United States content bidding preference rules may create a competitive disadvantage; local content bidding preferences in the United States may create a competitive disadvantage; requirements under Canadian content policies may change and/or become more onerous; operational risk, dependence on limited sources or unique sources of supply (including the risk of supply disruption due to suppliers affected by the COVID-19 virus); dependence on supply of engines that comply with emission regulations; a disruption, termination or alteration of the supply of vehicle chassis or other critical components from third-party suppliers

could materially adversely affect the sales of certain of the Company's products; the Company's profitability can be adversely affected by increases in raw material and component costs as well as the imposition of tariffs and surtaxes on material imports; the Company may incur material losses and costs as a result of product warranty costs, recalls and remediation of buses; production delays may result in liquidated damages under the Company's contracts with its customers; catastrophic events may lead to production curtailments or shutdowns; the Company may not be able to successfully renegotiate collective bargaining agreements when they expire and may be adversely affected by labour disruptions and shortages of labour; the Company's operations are subject to risks and hazards that may result in monetary losses and liabilities not covered by insurance or which exceed its insurance coverage; the Company may be adversely affected by rising insurance costs; the Company may not be able to maintain performance bonds or letters of credit required by its contracts or obtain performance bonds and letters of credit required for new contracts; the Company is subject to litigation in the ordinary course of business and may incur material losses and costs as a result of product liability claims; the Company may have difficulty selling pre-owned coaches and realizing expected resale values; the Company may incur costs in connection with provincial, state or federal regulations relating to axle weight restrictions and vehicle lengths; the Company may be subject to claims and liabilities under environmental, health and safety laws; dependence on management information systems and cyber security risks; the Company's ability to execute its strategy and conduct operations is dependent upon its ability to attract, train and retain qualified personnel, including its ability to retain and attract executives, senior management and key employees; the Company may be exposed to liabilities under applicable anti-corruption laws and any determination that it violated these laws could have a material adverse effect on its business; the Company's risk management policies and procedures may not be fully effective in achieving their intended purposes; internal controls over financial reporting, disclosure controls and procedures; ability to successfully execute strategic plans and maintain profitability; development of competitive or disruptive products, services or technology; development and testing of new products; acquisition risk; third-party distribution/dealer agreements; availability to the Company of future financing; the Company may not be able to generate the necessary amount of cash to service its existing debt, which may require the Company to refinance its debt; the Company's substantial consolidated indebtedness could negatively impact the business; the restrictive covenants in the Company's credit facilities could impact the Company's business and affect its ability to pursue its business strategies; payment of dividends is not guaranteed; a significant amount of the Company's cash is distributed, which may restrict potential growth; NFI is dependent on its subsidiaries for all cash available for distributions; future sales or the possibility of future sales of a substantial number of Shares may impact the price of the Shares and could result in dilution; if the Company is required to write down goodwill or other intangible assets, its financial condition and operating results would be negatively affected; income tax risk, investment eligibility and Canadian Federal Income Tax risks; the effect of comprehensive U.S. tax reform legislation on the NF Holdings and its U.S. subsidiaries (the "NF Group"), whether adverse or favorable, is uncertain; certain U.S. tax rules may limit the ability of NF Group to deduct interest expense for U.S. federal income tax purposes and may increase the NF Group's tax liability; certain financing transactions could be characterized as "hybrid transactions" for U.S. tax purposes, which could increase the NF Group's tax liability. NFI cautions that this list of factors is not exhaustive. These factors and other risks and uncertainties are discussed in NFI's press releases, Annual Information Form and materials filed with the Canadian securities regulatory authorities which are available on SEDAR at www.sedar.com.

Although the forward-looking statements contained in this MD&A are based upon what management believes to be reasonable assumptions, investors cannot be assured that actual results will be consistent with these forward-looking statements, and the differences may be material. These forward-looking statements are made as of the date of this MD&A and NFI assumes no obligation to update or revise them to reflect new events or circumstances, except as required by applicable securities laws.

DEFINITIONS OF ADJUSTED EBITDA, ROIC, FREE CASH FLOW, ADJUSTED NET EARNINGS, ADJUSTED EARNINGS PER SHARE, REGIONS INCLUDING: NORTH AMERICA, UK AND EUROPE, ASIAPACIFIC, AND OTHER

References to "Adjusted EBITDA" are to earnings before interest, income taxes, depreciation and amortization after adjusting for the effects of certain non-recurring and/or non-operations related items that do not reflect the current ongoing cash operations of the Company. These adjustments include gains or losses on disposal of property, plant and equipment, fair value adjustment for total return swap, unrealized foreign exchange losses or gains on non-current monetary items and forward foreign exchange contracts, costs associated with assessing strategic and corporate initiatives, past service costs and other pension costs, non-recurring restructuring costs, fair value adjustment to acquired subsidiary company's inventory and deferred revenue, proportion of the total return swap realized, equity settled stock-based compensation, recovery of currency transactions, prior year sales tax provision, and release of provision related to purchase accounting.

"Free Cash Flow" means net cash generated by operating activities adjusted for changes in non-cash working capital items, interest paid, interest expense, income taxes paid, current income tax expense, principal portion of finance lease payments, cash capital expenditures, proceeds from disposition of property, plant and equipment, costs associated with assessing strategic and corporate initiatives, fair value adjustment to acquired subsidiary company's inventory and deferred revenue, defined benefit funding, defined benefit expense, past service costs, proportion of total return swap, recovery on currency transactions, prior year sales tax provision, non-recurring restructuring costs, gain on release of provision related to purchase accounting, foreign exchange gain (loss) on cash held in foreign currency.

References to "ROIC" are to net operating profit after taxes (calculated as Adjusted EBITDA less depreciation of plant and equipment, depreciation of right-of-use assets and income taxes at the expected effective tax rate) divided by average invested capital for the last

twelve month period (calculated as to shareholders' equity plus long-term debt, obligations under leases, other long-term liabilities and derivative financial instrument liabilities less cash).

References to "Adjusted Net Earnings" are to net earnings after adjusting for the after tax effects of certain non-recurring and/or non-operational related items that do not reflect the current ongoing cash operations of the Company including: fair value adjustments of total return swap, unrealized foreign exchange loss or gain, unrealized gain or loss on the interest rate swap, portion of the total return swap realized, costs associated with assessing strategic and corporate initiatives, fair value adjustment to acquired subsidiary company's inventory and deferred revenue, equity settled stock-based compensation, gain or loss on disposal of property, plant and equipment, past service costs and other pension costs, gain on release of provision related to purchase accounting, recovery on currency transactions, prior year sales tax provision, and non-recurring restructuring costs .

References to "Adjusted Earnings per Share" are to Adjusted Net Earnings divided by the average number of Shares outstanding.

Management believes Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share are useful measures in evaluating the performance of the Company. However, Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share are not recognized earnings measures under IFRS and do not have standardized meanings prescribed by IFRS. Readers of this MD&A are cautioned that ROIC, Adjusted Net Earnings and Adjusted EBITDA should not be construed as an alternative to net earnings or loss or cash flows from operating activities determined in accordance with IFRS as an indicator of NFI's performance, and Free Cash Flow should not be construed as an alternative to cash flows from operating, investing and financing activities determined in accordance with IFRS as a measure of liquidity and cash flows. A reconciliation of net earnings to Adjusted EBITDA, based on the Financial Statements, has been provided under the headings "Reconciliation of Net Earnings to Adjusted EBITDA". A reconciliation of Free Cash Flow to cash flows from operations is provided under the heading "Summary of Free Cash Flow". A reconciliation of net earnings to Adjusted Net Earnings is provided under the heading "Reconciliation of Net Earnings to Adjusted Net Earnings".

NFI's method of calculating Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share may differ materially from the methods used by other issuers and, accordingly, may not be comparable to similarly titled measures used by other issuers. Dividends paid from Free Cash Flow are not assured, and the actual amount of dividends received by holders of Shares will depend on, among other things, the Company's financial performance, debt covenants and obligations, working capital requirements and future capital requirements, all of which are susceptible to a number of risks, as described in NFI's public filings available on SEDAR at www.sedar.com.

Effective December 31, 2018, the Company has adopted IFRS 16, which specifies how to recognize, present and disclose leases. The standard provides a single lessee accounting model, requiring lessees to recognize assets and liabilities for all major leases. This MD&A separately presents 2019 Q4 and Fiscal 2019 information, excluding the impact of IFRS 16 in areas where the impact is significant. See "Critical Accounting Estimates and Judgments" in Note 2 to the Consolidated Financial Statements .

References to NFI's geographic regions for the purpose of reporting global revenues are as follows: North America refers to Canada, United States, and Mexico; United Kingdom and Europe refer to the United Kingdom and Europe; Asia Pacific refers to Hong Kong, Malaysia, Singapore, Australia, and New Zealand; and the Other category includes any sales that do not fall into the categories above.

Appendix C - 2019 Fourth Quarter Order Activity

Demand for Transit Buses and Motor Coaches

The Company's "Bid Universe" metric estimates active public competitions in Canada and the United States and attempts to provide an overall indication of anticipated heavy-duty transit bus and motor coach public sector market demand. It is a point-in-time snapshot of: (i) EUs in active competitions, defined as all requests for proposals received by the Company and in process of review plus bids submitted by the Company and awaiting customer action, and (ii) management's forecast, based on data provided by operators, of expected EUs to be placed out for competition over the next five years.

Management was encouraged by fourth quarter growth in the Company's Bid Universe. At the end of 2019 Q4, the total Bid Universe was 27,648 EUs, an increase of 18.0% from 2018 Q4 and 0.6% from 2019 Q3, while the active Bid Universe increased by 71.9% from 2018 Q4 and decreased by 4.3% from 2019 Q3. The Bid Universe EUs fluctuate significantly from quarter-to-quarter based on public tender activity procurement and award processes.

	Bids in Process (EUs)	Bids Submitted (EUs)	Active EUs	Forecasted Industry Procurement over 5 Years (EUs)[1]	Total Bid Universe (EUs)
2018 Q4	670	2,061	2,731	20,694	23,425
2019 Q1	1,350	2,039	3,389	21,143	24,532
2019 Q2	1,231	2,929	4,160	20,686	24,846
2019 Q3	1,216	3,691	4,907	22,588	27,495
2019 Q4	1,760	2,934	4,694	22,954	27,648

(1) Management's estimate of anticipated future industry procurement over the next five years is based on direct discussions with select U.S. and Canadian transit authorities. This estimate includes potential activity for New Flyer and MCI vehicles, but excludes potential ARBOC and ADL U.S. and Canadian sales.

Procurement of heavy-duty transit buses and motor coaches by the U.S. and Canadian public sector is typically accomplished through formal multi-year contracts, while procurement by the private sector, in North America, the UK and Europe and Asia Pacific is typically made on a transactional basis. As a result, the Company does not maintain a Bid Universe for private sector buses and coaches.

The sale of cutaway and medium-duty buses manufactured by ARBOC is accomplished on a transactional purchase order basis through non-exclusive third-party dealers who hold contracts directly with the customers. Bids are submitted by and agreements are held with a network of dealers. Cutaway and medium-duty bus activity therefore is not included in the Bid Universe metric.

ADL does not currently have a Bid Universe metric for the UK and European or Asia Pacific markets similar to New Flyer and MCI's North American Bid Universe. Management does not believe a similar Bid Universe metric for those markets is suitable given that the majority of customers in those regions are private operators who make annual purchase decisions. The overall UK market declined from 2015 to 2019, but is expected to be flat in 2020 with recovery in 2021 due to customers' fleet recovery plans. In Asia Pacific, the Hong Kong market is highly cyclical, and following busier periods in 2015 through 2018, the market has declined as expected to stable annual deliveries. New Zealand and Singapore remain cyclical markets and both markets saw increased activity in 2017, 2018 and 2019.

Order activity

New orders (firm and options) during 2019 Q4 totaled 1,159 EUs. The new firm and option orders awarded to the Company for 2019 Q4 last twelve months ("LTM") were 3,577 EUs. The Company was also successful at converting 813 EUs of options during 2019 Q4 to firm orders, which contributed to the 1,518 EUs of options converted to firm orders during 2019 Q4 LTM.

	New Orders in Quarter (Firm and Option EUs)	LTM New Orders (Firm and Option EUs)	Option Conversions in Quarter (EUs)	LTM Option Conversions (EUs)
2018 Q4	857	3,763	575	1,795
2019 Q1	909	3,936	126	1,480
2019 Q2	474	2,998	350	1,325
2019 Q3	1,035	3,276	229	1,554
2019 Q4	**1,159**	**3,577**	**813**	**1,518**

Options

In 2019 Q4, 159 option EUs expired, compared to 71 option EUs that expired during 2019 Q3.

A significant number of public transit contracts in the U.S. and Canada have a term of five years. In addition, some contracts in the UK and APAC also have multi-year terms. The table below shows the number of option EUs that have either expired or have been exercised annually over the past five years, as well as the current backlog of options that will expire each year if not exercised.

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
A) Options Expired (EUs)	965	504	550	331	741	512						3,603
B) Options Exercised (EUs)	1,149	1,339	2,064	1,404	1,795	1,518						9,269
C) Current Options by year of expiry (EUs)							1,629	1,526	2,059	639	665	6,518
D) Conversion rate % = B / (A+B)	**54%**	**73%**	**79%**	**81%**	**71%**	**75%**						

The Company's conversion rate can vary significantly from quarter-to-quarter and should be looked at on an annual or LTM basis.

In addition to contracts for identified public customers, the Company has focused on state procurements and cooperative purchasing agreements, with the objective of having available schedules from which customers within a prescribed region or defined list can purchase. The Company has successfully bid and been named on several state contracts. These contracts, however, are not recorded in backlog as they do not have defined quantities allocated to the Company or any other OEM. Once a customer purchases a bus under one of these agreements, the purchase is recorded as a firm order.

The Company's 2019 Q4 LTM Book-to-Bill ratio (defined as new firm orders and exercised options divided by new deliveries) was 85%, a decrease of 4% from 88% in 2018 Q4 LTM largely driven by the large number of deliveries made during 2019 Q4.

In addition, 664 EUs of new firm and option orders were pending from customers at the end of 2019 Q4, where approval of the award to the Company had been made by the customer’s board, council, or commission, as applicable, but purchase documentation had not yet been received by the Company and therefore not yet included in the backlog.

Backlog

The Company's total backlog consists of buses sold primarily to U.S. and Canadian public customers and private operators in the UK and Europe. The majority of the backlog relates to New Flyer transit buses for public clients with some of the backlog consisting of units from MCI, ADL and ARBOC. Options for ARBOC vehicles are held by dealers, rather than the operator, and are not included as optionsgre in the NFI backlog, but are converted to firm backlog when vehicles are ordered by the dealer.

Transit buses and motor coaches incorporating clean propulsion systems, including compressed natural gas ("CNG"), diesel-electric hybrid, and ZEBs, which consist of trolley-electric, fuel cell-electric, and battery-electric buses represent approximately 42.0% of the total backlog. ZEBs represent approximately 4% of total backlog.

	2019 Q4			2019 Q3			2018 Q4		
	Firm Orders	Options	Total	Firm Orders	Options	Total	Firm Orders	Options	Total
Beginning of period	4,313	7,281	11,594	3,306	6,691	9,997	3,423	7,687	11,110
Acquired Backlog (ADL)[1]	—	—	—	1,226	805	2,031	—	—	—
New orders	950	209	1,159	950	85	1,035	785	73	858
Options exercised	813	(813)	—	229	(229)	0	575	(575)	0
Shipments[2]	(1,844)	—	(1,844)	(1,392)	—	(1,392)	(1,126)	—	(1,126)
Cancelled/expired	(8)	(159)	(167)	(6)	(71)	(77)	(8)	(1)	(9)
End of period	**4,224**	**6,518**	**10,742**	**4,313**	**7,281**	**11,594**	**3,649**	**7,184**	**10,833**
Consisting of:									
Heavy-duty transit buses	3,236	5,722	8,958	3,295	6,480	9,775	3,024	6,177	9,201
Motor coaches	615	796	1,411	664	801	1,465	468	1,007	1,475
Cutaway and medium-duty buses	373	—	373	354	—	354	157	—	157
Total Backlog	**4,224**	**6,518**	**10,742**	**4,313**	**7,281**	**11,594**	**3,649**	**7,184**	**10,833**

(1) ADL's acquired backlog was as of the period ended June 30, 2019
(2) Shipments do not include delivery of pre-owned coaches as these coaches are not included in the backlog.

At the end of 2019 Q4, the Company's total backlog (firm and options) of 10,742 EUs (valued at $5.2 billion) has decreased compared to 11,594 EUs (valued at $5.5 billion) at the end of 2019 Q3. The decrease was driven by record deliveries in the quarter of 1,844 EUs. The summary of the values is provided below.

	2019 Q4		2019 Q3		2018 Q4	
		Equivalent Units		Equivalent Units		Equivalent Units
Total firm orders	$ 1,928.8	4,224	$ 1,877.3	4,313	$ 1,937.5	3,649
Total options	3,245.1	6,518	3,598.6	7,281	3,414.1	7,184
Total backlog	**$ 5,177.9**	**10,742**	**$ 5,475.9**	**11,594**	**$ 5,351.6**	**10,833**

Consolidated Financial Statements of

NFI GROUP INC.

December 29, 2019

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Independent Auditor's Report

To the Shareholders of NFI Group Inc.

Opinion
We have audited the consolidated financial statements of NFI Group Inc. (the "Company"), which comprise the consolidated statements of financial position at December 29, 2019 and December 30, 2018, and the consolidated statements of net earnings and total comprehensive income, changes in equity and cash flows for the years then ended, and notes to the consolidated financial statements, including a summary of significant accounting policies (collectively referred to as the "financial statements").
In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Company as at December 29, 2019 and December 30, 2018, and its financial performance and its cash flows for the years then ended in accordance with International Financial Reporting Standards ("IFRS").

Basis for Opinion
We conducted our audit in accordance with Canadian generally accepted auditing standards ("Canadian GAAS"). Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of our report. We are independent of the Company in accordance with the ethical requirements that are relevant to our audit of the financial statements in Canada, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Other Information
Management is responsible for the other information. The other information comprises:

Management's Discussion and Analysis

Our opinion on the financial statements does not cover the other information and we do not and will not express any form of assurance conclusion thereon. In connection with our audit of the financial statements, our responsibility is to read the other information identified above and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated.

We obtained Management's Discussion and Analysis prior to the date of this auditor's report. If, based on the work we have performed on this other information, we conclude that there is a material misstatement of this other information, we are required to report that fact in this auditor's report. We have nothing to report in this regard.

Responsibilities of Management and Those Charged with Governance for the Financial Statements
Management is responsible for the preparation and fair presentation of the financial statements in accordance with IFRS, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the Company's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Company or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the Company's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian GAAS will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with Canadian GAAS, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control.

Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.

Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Company's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Company to cease to continue as a going concern.

Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

Obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Company to express an opinion on the financial statements. We are responsible for the direction, supervision and performance of the group audit. We remain solely responsible for our audit opinion.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, related safeguards.

The engagement partner on the audit resulting in this independent auditor's report is Michael Boucher.

Deloitte LLP

Chartered Professional Accountants
Winnipeg, Manitoba
March 11, 2020

NFI GROUP INC.

CONSOLIDATED STATEMENTS OF NET EARNINGS AND TOTAL COMPREHENSIVE INCOME
52 Weeks ended December 29, 2019 ("Fiscal 2019") and 52 Weeks ended December 30, 2018 ("Fiscal 2018")
(in thousands of U.S. dollars except per share figures)

	Fiscal 2019	Fiscal 2018
Revenue (note 22)	$ 2,893,436	$ 2,519,021
Cost of sales (note 4)	2,479,954	2,064,813
Gross profit	413,482	454,208
Sales, general and administration costs and other operating expenses	241,454	210,560
Foreign exchange loss (gain)	(1,036)	5,793
Earnings from operations	173,064	237,855
Gain on release of provision	—	2,138
Gain (loss) on disposition of property, plant and equipment	46	(267)
Unrealized foreign exchange loss on non-current monetary items	(60)	(1,381)
Earnings before interest and income taxes	173,050	238,345
Interest and finance costs		
Interest on long-term debt and convertible debentures	39,127	20,518
Accretion in carrying value of long-term debt and convertible debentures (note 16)	829	3,316
Interest expense on lease liability	7,211	—
Other interest and bank charges	4,208	3,028
Fair market value loss on interest rate swap	21,980	830
	73,355	27,692
Earnings before income tax expense	99,695	210,653
Income tax expense (note 15)		
Current income taxes	61,339	56,263
Deferred income taxes recovered	(19,342)	(5,552)
	41,997	50,711
Net earnings for the year	$ 57,698	$ 159,942
Other comprehensive income (loss)		
Actuarial income (loss) on defined benefit pension plan - this item will not be reclassified subsequently to profit or loss	(4,390)	3,170
Unrealized foreign exchange gains on translation of foreign operations	11,865	—
Total comprehensive income for the year	$ 65,173	163,112
Net earnings per share (basic) (note 18)	$ 0.93	$ 2.56
Net earnings per share (diluted) (note 18)	$ 0.93	$ 2.55

The accompanying notes are an integral part of the audited consolidated financial statements.

NFI GROUP INC.
CONSOLIDATED STATEMENTS OF FINANCIAL POSITION
As at December 29, 2019
(in thousands of U.S. dollars)

	December 29, 2019	December 30, 2018
Assets		
Current		
Cash	$ 28,233	$ 10,820
Accounts receivable (note 3, 21 c)	531,736	387,486
Income tax receivable	17,375	34,115
Inventories (note 4)	672,243	424,685
Prepaid expenses and deposits	10,094	10,434
	1,259,681	867,540
Property, plant and equipment (note 5, 22)	268,748	247,943
Right-of-use asset (note 6)	153,323	—
Derivative financial instruments (note 21 b,c)	—	6,592
Goodwill and intangible assets (note 7)	1,250,518	951,010
Other long term asset (note 8)	19,612	1,052
	$ 2,951,882	$ 2,074,137
Liabilities		
Current		
Accounts payable and accrued liabilities	581,612	366,517
Derivative financial instruments (note 21 b,c)	4,651	1,542
Current portion of long-term liabilities (note 9)	144,524	80,310
	730,787	448,369
Accrued benefit liability (note 10)	8,037	5,265
Obligations under leases (note 6)	143,999	19,087
Deferred compensation obligation (note 11)	2,790	4,979
Deferred revenue (note 13)	13,354	10,443
Other long-term liabilities	—	1,008
Provisions (note 14)	62,180	64,946
Deferred tax liabilities (note 15)	105,023	83,121
Derivative financial instruments	15,388	—
Long-term debt (note 16)	1,053,126	639,432
	$ 2,134,684	$ 1,276,650
Commitments and contingencies (note 24)		
Shareholders' equity		
Share capital (note 17)	680,962	654,307
Stock option and restricted share unit reserve (note 12)	6,828	5,796
Accumulated other comprehensive income (loss)	769	(6,706)
Treasury shares (note 17)	—	(8,835)
Retained earnings	128,639	152,925
	$ 817,198	$ 797,487
	$ 2,951,882	$ 2,074,137

The accompanying notes are an integral part of the audited consolidated financial statements.

Approved and authorized by the board of directors on March 11, 2020.

"Hon. Brian V. Tobin, Director"

"Phyllis Cochran, Director"

NFI GROUP INC.

CONSOLIDATED STATEMENTS OF CHANGES IN EQUITY

For the year ended December 29, 2019
(in thousands of U.S. dollars)

	Share Capital	Stock Option and Restricted Share Unit Reserve	Accumulated Other Comprehensive Income (Loss)	Treasury shares	Retained Earnings (Deficit)	Total Shareholders' Equity
Balance, December 31, 2017	**$ 665,602**	**$ 4,724**	**$ (9,876)**	**$ —**	**$ 107,379**	**$ 767,829**
Net earnings	—	—	—	—	159,942	159,942
Other comprehensive loss	—	—	3,170	—	—	3,170
Dividends declared on common shares	—	—	—	—	(68,646)	(68,646)
Repurchase and cancellation of common shares	(13,973)				(32,234)	(46,207)
Change in share purchase commitment				(8,835)	(13,516)	(22,351)
Share-based compensation, net of deferred income taxes	—	2,061	—	—	—	2,061
Shares issued	2,678	(989)	—	—	—	1,689
Balance, December 30, 2018	**$ 654,307**	**$ 5,796**	**$ (6,706)**	**$ (8,835)**	**$ 152,925**	**$ 797,487**
Net earnings	—	—	—	—	$ 57,698	57,698
Other comprehensive income	—	—	7,475	—	—	7,475
Dividends declared on common shares	—	—	—	—	(79,950)	(79,950)
Repurchase and cancellation of common shares	(10,451)	—	—	—	(2,034)	(12,485)
Change in share purchase commitment	—	—	—	8,835	—	8,835
Share-based compensation, net of deferred income taxes	—	1,515	—	—	—	1,515
Shares issued	37,106	(483)	—	—	—	36,623
Balance, December 29, 2019	**$ 680,962**	**$ 6,828**	**$ 769**	**$ —**	**$ 128,639**	**$ 817,198**

The accompanying notes are an integral part of the audited consolidated financial statements.

NFI GROUP INC.

CONSOLIDATED STATEMENTS OF CASH FLOWS
For the year ended December 29, 2019
(in thousands of U.S. dollars)

	Fiscal 2019	Fiscal 2018
Operating activities		
Net earnings for the period	$ 57,698	$ 159,942
Income tax expense	41,997	50,711
Depreciation of plant and equipment	61,985	32,840
Amortization of intangible assets	42,585	34,956
Share-based compensation	1,566	1,409
Interest and finance costs recognized in profit or loss	73,355	27,692
Fair value adjustment for total return swap	949	6,547
Unrealized foreign exchange loss on non-current monetary items	60	1,381
Foreign exchange gain on cash held in foreign currency	(83)	(194)
Loss (gain) on disposition of property, plant and equipment	(46)	267
Defined benefit expense	5,849	12,333
Defined benefit funding	(8,140)	(22,241)
Cash generated by operating activities before non-cash working capital items and interest and income taxes paid	277,775	305,643
Changes in non-cash working capital items (note 19)	(91,324)	(34,344)
Cash generated from operating activities before interest and income taxes paid	186,451	271,299
Interest paid	(47,676)	(23,073)
Income taxes paid	(40,167)	(73,082)
Net cash generated from operating activities	98,608	175,144
Financing activities		
Debt issue costs	(1,636)	(2,246)
Repayment of obligations under lease	(12,456)	(5,125)
Proceeds from long-term debt	357,516	57,600
Share issuance	36,690	1,689
Repayment of other long-term liabilities	—	(1,000)
Repurchase of shares	(5,682)	(66,522)
Dividends paid	(76,421)	(68,170)
Net cash generated (used) in financing activities	298,011	(83,774)
Investing activities		
Acquisition of intangible assets	(38)	(50)
Proceeds from disposition of property, plant and equipment	174	235
Investment in long-term restricted deposits	(14,490)	—
Net cash used in acquisitions (note 1.1)	(327,360)	—
Acquisition of property, plant and equipment	(37,575)	(70,991)
Net cash used in investing activities	(379,289)	(70,806)
Effect of foreign exchange rate on cash	83	194
Increase in cash	17,413	20,758
Cash (bank indebtedness) — beginning of period	10,820	(9,938)
Cash — end of period	$ 28,233	$ 10,820

The accompanying notes are an integral part of the consolidated financial statements.

1. CORPORATE INFORMATION

NFI Group Inc. ("NFI" or the "Company") was incorporated on June 16, 2005 as New Flyer Industries Inc. under the laws of the Province of Ontario. The name of the Company was changed to "NFI Group Inc." on May 14, 2018 to better reflect the multi-platform nature of the Company's business. NFI is a leading independent global bus manufacturer providing a comprehensive suite of mass transportation solutions under brands: New Flyer® (heavy-duty transit buses), Alexander Dennis Limited (single and double-deck buses), Plaxton (motor coaches), MCI® (motor coaches), ARBOC® (low-floor cutaway and medium-duty buses) and NFI Parts™ (aftermarket parts sales). The Company's common shares (the "Shares") are listed on the Toronto Stock Exchange ("TSX") under the symbol "NFI".

These audited consolidated financial statements (the "Statements") were approved by the Company's board of directors (the "Board") on March 11, 2020.

1.1 Acquisition of ADL

On May 28, 2019 (the "Acquisition Date"), the Company through its wholly owned subsidiary NFI International Limited, acquired 100% of the voting equity interest in Alexander Dennis Limited ("ADL") for £295.1 million ($373.7 million). ADL is an independent bus and coach manufacturer and a global producer of double deck buses. The purchase price was funded through NFI's existing credit facility, a new US $300 million credit facility and the issuance from treasury of 1.47 million Shares, in lieu of cash, to ADL's primary shareholders. The Company has included within its consideration £3.4 million ($4.3 million) placed in escrow and £1.5 million ($1.9 million), of contingent consideration which will be released or paid, respectively to the seller once certain post-closing conditions are met. The acquisition has been accounted for using the acquisition method. The fair values of the identifiable assets and liabilities acquired have been based on management's best estimates and valuation techniques as at the Acquisition Date. The Company adjusted the preliminary purchase price allocation as set out below to account for information that was not previously available. This included the addition of specific intangible assets for trade names, patent and licenses, customer relationships, and backlog of sales orders. It also included an adjustment to net tangible assets acquired. The adjustments recorded resulted in an adjustment to goodwill from the amount originally reported.

	Initial British Pound Sterling ("GBP")	Adjustments (GBP)	Revised (GBP)	**Opening Balance Sheet** U.S. Dollar £1 = US$1.2663
Cash and contingent consideration	267,578	—	267,578	338,834
NFI shares issued	27,552	—	27,552	34,888
Purchase price	295,130	—	295,130	373,722
Cash acquired	36,614	—	36,614	46,364
Net purchase price	258,516	—	258,516	327,359
Net assets acquired				
Inventories	177,700	(2,721)	174,979	221,576
Accounts receivable	72,195	(745)	71,450	90,477
Prepaid expenses and deposits	8,884	(4,709)	4,175	5,287
Derivative financial instruments	(276)	—	(276)	(349)
Property, plant and equipment	28,038	6,432	34,470	43,649
Right-of-use assets	13,581	—	13,581	17,198
Accounts payable and accrued liabilities	(139,264)	2,944	(136,320)	(172,622)
Income tax payable	(1,286)	—	(1,286)	(1,628)
Deferred revenue	(59,943)	(3,256)	(63,199)	(80,029)
Obligations under leases	(14,118)	—	(14,118)	(17,878)
Long-term debt	(45,000)	—	(45,000)	(56,984)
Provisions	(5,871)	—	(5,871)	(7,434)
Deferred tax liabilities	(6,056)	(26,901)	(32,957)	(41,734)
Net tangible assets acquired	28,584	(28,956)	(372)	(471)
Trade Names	—	34,100	34,100	43,181
Patent and Licenses	—	17,600	17,600	22,287
Customer relationships	—	97,400	97,400	123,338
Backlog of sales orders	—	11,500	11,500	14,562
Identifiable intangible assets acquired	—	160,600	160,600	203,368
Goodwill acquired			98,288	124,462

The goodwill acquired is largely attributable to NFI's opportunity to grow its geographical footprint, diversify its product offering and take leading positions in new markets. This goodwill is not expected to be deductible for tax purposes. As of December 29, 2019, the analysis of identified intangible assets and fair values is incomplete. Management continues to assess and value the purchase price allocation and as such remains subject to adjustments that could arise as a result of new information that would impact the determination of fair value of the assets acquired and liabilities assumed. There is continued analysis to be undertaken which will complete the validation of the valuation assumptions, these items include valuation of provisions, deferred revenue and accrued liabilities.

During the 214 days between the Acquisition Date and December 29, 2019, ADL produced revenues of approximately $449.0 million and net loss of $43.0 million, which have been recorded in the audited consolidated statements of net earnings and total comprehensive income for 2019. If ADL had been acquired on December 31, 2018 the incremental consolidated pro-forma revenue and income for the 52-week period ending December 29, 2019 would have been as follows:

	Results as stated	**Incremental**	**Pro-forma results**
Revenue	$ 2,893,436	$ 278,464	$ 3,171,900
Net earnings	57,698	22,934	80,632

Acquisition costs of $13.0 million are recorded in the consolidated statements of net earnings under sales, general and administration costs, related to the acquisition of ADL.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

The principal accounting policies applied in the preparation of these Statements are set out below. These policies have been consistently applied to all periods presented, unless otherwise stated.

2.1 Basis of preparation

The Statements were prepared on a going concern basis in accordance with International Financial Reporting Standards ("IFRS") which requires management to make judgments, estimates and assumptions that affect the application of accounting policies and the reported amounts of assets and liabilities, revenue and expenses. Actual results may differ from these estimates.

2.2 Principles of consolidation

The Statements include the accounts of the Company's subsidiaries.

Subsidiaries

Subsidiaries are entities over which the Company has control, where control is achieved when the Company: has power over the investee; is exposed, or has rights, to variable returns from its involvement with the investee; and has the ability to use its power to affect its returns. The Company holds 100% of the voting rights in, and therefore controls, its subsidiaries.

The effects of potential voting rights that are currently exercisable are considered when assessing whether control exists. Subsidiaries are fully consolidated from the date control is transferred to the Company, and are de-consolidated from the date control ceases.

The acquisition method of accounting is used to account for the acquisition of subsidiaries as follows:

- cost is measured as the fair value of the assets given, equity instruments issued and liabilities incurred or assumed at the date of exchange, and business acquisition related expenses are expensed as incurred;
- identifiable assets acquired and liabilities assumed are measured at their fair values at the acquisition date;
- the excess of acquisition cost over the fair value of the identifiable net assets acquired is recorded as goodwill; and
- if the acquisition cost is less than the fair value of the net assets acquired, the fair value of the net assets is reassessed and any remaining difference is recognized directly in the consolidated statements of net earnings and comprehensive income.

Inter-company transactions between subsidiaries are eliminated on consolidation.

2.3 New and amended standards adopted by the Company

IFRS 16 - Leases ("IFRS 16")

Effective December 31, 2018, the Company adopted IFRS 16, which specifies how to recognize, present and disclose leases. The standard provides a single lessee accounting model, requiring lessees to recognize assets and liabilities for all major leases. The adoption of this standard resulted in the recognition of amounts through the consolidated statements of net earnings through depreciation and interest charges on the right-of-use asset and lease liability, respectively. Under the former accounting policy, IAS 17, leases ("IAS 17"), expenses related to leases were recorded through operating expenses. On transition, the Company has elected to use the following practical expedients:

- To utilize the modified retrospective approach to adopting the standard, accordingly comparative information for 2018 has not been restated.
- To utilize the definition of a lease under IAS 17, to identify contracts that are, or contain, leases.
- To exclude the recognition of the right-of-use asset and lease liability for leases with a term of twelve months or less.

Lease assets formerly capitalized as fixed assets are transferred at their net book value to the right-of-use asset line item within consolidated statement of financial position. No adjustments to the carrying value of these leased assets was made as a part of transition to IFRS 16.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

The transition adjustment is shown in below.

	Assets			Liabilities		
	Right-of-use asset	Property, plant and equipment	Other long-term asset	Obligations under leases	Current portion of obligation under leases	Accounts Payable and accrued liabilities
Opening balances at December 31, 2018	$ —	$ 247,943	$ 1,052	$ 19,087	$ 7,936	$ 366,517
Transition to IFRS 16	131,595	(27,319)	4,225	104,670	5,553	(1,722)
Adjusted December 31, 2018	$ 131,595	$ 220,624	$ 5,277	$ 123,757	$ 13,489	$ 364,795

The following table reconciles the Company's operating lease obligations at December 30, 2018, as previously disclosed in the Company's audited consolidated financial statements.

Operating lease commitments at December 30, 2018	$ 70,690
Extension options reasonably certain to be exercised	134,422
Discounted using the incremental borrowing rate at December 31, 2018	(94,316)
Recognition exemptions for short-term and low-value leases	(573)
Lease obligations recognized at December 31, 2018	$ 110,223

The weighted average incremental borrowing rate at December 31, 2018 was 5.3%.

The Company's accounting policy under IFRS 16 is as follows:

At inception of a contract, the Company assesses whether a contract is, or contains, a lease based on whether the contract conveys a right to control the use of an identified asset for a period of time in exchange for consideration.

The Company recognizes a right-of-use asset and a lease liability at the lease commencement date. The right-of-use asset is initially measured based on the initial amount of the lease liability adjusted for any lease payments made at or before the commencement date, plus any initial direct costs incurred and an estimate of costs to dismantle and remove the underlying asset or to restore the underlying asset or the site on which it is located, less any lease incentives received. The assets are depreciated based on the lease term of the asset using the straight-line method. The lease term includes periods covered by an option to extend if the Company is reasonably certain to exercise that option. Lease terms are as follows:

Land and Building	4 - 35 years
Machinery and Equipment	15 months - 5 years
Automobiles	13 months - 3 years
Office Equipment	14 months - 5 years

The lease liability is initially measured at the present value of the lease payments that are not paid at commencement date, discounted using the interest rate implicit in the lease or, if that rate cannot be readily determined, the Company uses its incremental borrowing rate. The lease liability is measured at amortized cost using the effective interest method. It is remeasured when there is a change in the future lease payments arising from a change in an index or rate or if the Company changes its assessment of whether it will exercise a purchase, extension or termination option.

When the lease liability is remeasured in this way, a corresponding adjustment is made to the carrying amount of the right-of-use asset, or is recorded in profit or loss if the carrying amount of the right-of-use asset has been reduced to zero.

The Company has elected to apply the practical expedient not to recognize right-of-use assets and lease liabilities for short-term leases that have a lease term of 12 months or less and leases of low-value assets. The lease payments associated with these leases are recognized as an expense on a straight-line basis over the lease term.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

2.4 Reportable Segments

The Company's reportable segments are organized around the markets it serves and are reported in a manner consistent with the internal reporting provided to the chief operating decision-maker ("CODM"). The President and Chief Executive Officer of the Company has authority for resource allocation and assessment of the Company's performance and therefore acts as the CODM.

2.5 Foreign currency

The Company operates with multiple functional currencies. The Company's consolidated financial statements are presented in U.S. dollars as this presentation is most meaningful to financial statement users. References to "$" are to U.S. dollars, references to "C$" are to Canadian dollars, references to "£" are to British pounds sterling. For those subsidiaries with different functional currencies, exchange rate differences arising from the translation of items that form part of the net investment in the foreign operation are recorded in unrealized foreign exchange gains (losses) on translation of foreign operations in other comprehensive income.

Monetary balances denominated in a currency other than U.S. dollars are translated at the period end rates of exchange, and the results of the operations are translated at average rates of exchange for the period. Non-monetary balances are translated at the exchange rate prevailing at the date of the transaction.

Foreign exchange gains and losses that relate to borrowings, non-current monetary items and non-current forward foreign exchange contracts are presented in the consolidated statements of net earnings and comprehensive income within "unrealized foreign exchange loss (gain) on non-current monetary items".

All other foreign exchange gains and losses are presented in the consolidated statements of net earnings and comprehensive income within "foreign exchange (loss) gain".

2.6 Revenue recognition

Manufacturing Operations

Persuasive evidence of an arrangement exists in the form of a written contract. A process is in place that initiates a pre-shipment acceptance by the customer at the Company's plant. This acceptance prior to shipment mitigates the likelihood of customer's dissatisfaction with the final product upon delivery to the customer. Revenue is recorded when the buses or coaches are delivered or shipped. The customer does not have a legal right to return the delivered products after the acceptance period, or deviate from the agreed upon price. The Company's contract clearly identifies a fixed and determinable price.

In connection with its sales of new coaches, the Company at times agrees to accept a pre-owned coach in exchange and gives the buyer a credit equal to the pre-owned coach's then-current fair value. Any credit provided to the customer in excess of the fair value of the pre-owned coach is deducted from the selling price of the new coach.

Operating lease revenue is recorded on a straight-line basis in the period earned over the life of the contract and is recognized in revenue in the consolidated statements of net earnings and comprehensive income due to its operating nature.

When a single sale transaction requires the delivery of more than one product or service (multiple performance obligations), the revenue recognition criteria are applied to the separately identifiable performance obligations. A performance obligation is considered to be separately identifiable if the product or service delivered has stand-alone value to that customer and the fair value associated with the product or service can be measured reliably. The amount recognized as revenue for each performance obligation is its fair value in relation to the fair value of the contract as a whole. Management has determined that the standard base warranty included in the bus or coach purchase is not a separate performance obligation and therefore recognized upon delivery of the bus or coach.

The Company sells extended warranty contracts that provide coverage in addition to the basic coverage. Proceeds from the sale of these contracts are deferred and amortized into revenue over the extended warranty period commencing at the end of the basic warranty period. The Company also receives proceeds from the sale of extended warranties relating to major subsystems such as engines, transmissions, axles and air conditioning that are purchased for the customer from the original equipment manufacturer ("OEM"). The related cost to purchase the OEM warranty contracts have been recorded as a reduction of revenue as the Company is an agent to the transaction.

The Company does not recognize revenue on any bus or coach firm or option orders that have not yet been delivered.

Aftermarket Operations

Persuasive evidence of an arrangement exists in the form of an authorized sales order. The customer is invoiced, and revenue is recorded at the time the part is delivered using a commercial shipper. The price list for parts clearly identifies a fixed and determinable price,

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

while also describing that the Company has no legal obligation to accept the return of goods other than on defective and/or warrantable parts product. Aftermarket parts revenue does not contain any revenue related to the bus or coach warranty.

2.7 Employee benefits

For defined benefit pension plans and other post-employment benefits, the net periodic pension expense is actuarially determined by independent actuaries using the projected unit credit method. Actuarial remeasurement is comprised of actuarial gains and losses, the effect of the changes to the asset ceiling (if applicable) and the return on plan assets (excluding interest), and is reflected immediately in the statement of financial position with a charge or credit recognized in other comprehensive income in the period in which they occur. Remeasurement recognized in other comprehensive income is reflected immediately in accumulated other comprehensive loss and will not be reclassified to profit or loss. Past service cost is recognized in profit or loss in the period of a plan amendment. Net interest is calculated by applying the discount rate at the beginning of the period to the net defined benefit liability or asset. Defined benefit costs are comprised of service costs (including current service cost, past service cost and gain or losses on curtailments and settlements), net interest expense or income and remeasurement.

The asset or liability recognized in the consolidated statements of financial position is the present value of the defined benefit obligation at the end of the reporting period less the fair value of plan assets, together with adjustments for past service costs. The present value of the defined benefit obligation is determined by discounting the estimated future cash outflows using interest rates of high-quality corporate bonds that are denominated in the currency in which the benefits will be paid and that have terms to maturity approximating the terms of the related pension liability. For funded plans, surpluses are recognized only to the extent that the surplus is considered recoverable. Recoverability is primarily based on the extent to which the Company can unilaterally reduce future contributions to the plan.

Payments to defined contribution plans are expensed as incurred, which is as the related employee service is rendered.

2.8 Share-based compensation plans

The Company operates cash-settled and equity-settled share-based compensation plans under which it receives services from senior managment and non-employee members of the Board.

For the cash-settled plans (note 11), the expense is determined based on the fair value of the liability at the end of the reporting period until the awards are settled. Certain share-based compensation plans include non-market performance conditions. The Company`s accounting policy is to recognize the impact of non-market performance conditions by adjusting the number of awards that are expected to vest. At the end of each reporting period, the Company re-assesses its estimates of the number of awards that are expected to vest and recognizes the impact of the revisions on compensation expense (note 22) in the consolidated statements of net earnings and comprehensive income.

For the equity-settled plans (note 12), share-based payments to senior management are measured at the fair value of the equity instruments at the grant date. The fair value is measured at grant date and each tranche is recognized on a graded-vesting basis over the period in which the options vest. The offset to the recorded cost is the stock option reserve. Consideration received on the exercise of stock options is recorded as share capital and the related stock option reserve is transferred to share capital. Upon expiry, the recorded value is transferred to retained earnings. At the end of each reporting period, the Company revises its estimate of the number of equity instruments expected to vest. The impact of the revision of the original estimates, if any, is recognized in the consolidated statements of net earnings and comprehensive income such that the cumulative expense reflects the revised estimate, with a corresponding adjustment to the stock option reserve. Where the terms and conditions of options are modified, the increase in the fair value of the options, measured immediately before and after the modification, is also charged to the consolidated statements of net earnings and comprehensive income.

2.9 Cash

Cash and cash equivalents comprise cash on hand, demand deposits and investments with an original maturity at the date of purchase of three months or less.

2.10 Accounts receivables

Accounts receivables are amounts due from customers from the rendering of services or sale of goods in the ordinary course of business. Accounts receivables are classified as current assets if payment is due within one year or less. Accounts receivables are recognized initially at fair value and subsequently measured at amortized cost, less impairment, if any.

The Company maintains an allowance for doubtful accounts and sales adjustments to provide for impairment of trade receivables. The expense relating to doubtful accounts is included within “Sales, general and administration costs and other operating expenses” in the consolidated statements of net earnings and comprehensive income.

2.11 Inventories

Inventories are measured at the lower of cost and net realizable value. The cost of inventories is based on the first-in first-out principle, and includes expenditures incurred in acquiring the inventories, production or conversion costs and other costs incurred in bringing them

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

to their existing location and condition. In the case of manufactured inventories and work in progress, cost includes an appropriate share of production overheads based on normal operating capacity. Net realizable value is the estimated selling price in the ordinary course of business, less the estimated costs of completion and selling expenses.

2.12 Property, plant and equipment

Property, plant and equipment are recorded at cost reduced by applicable investment tax credits, less accumulated depreciation. Depreciation is calculated at the following annual rates:

Building and building improvements	4% declining-balance basis
Machinery and equipment	25% declining-balance basis
Demo buses and coaches	20% - 50% straight-line basis
Computer hardware and software	30% declining-balance basis
Office equipment	20% declining-balance basis
Buses and coaches available for lease	20% - 50% straight-line basis

Depreciation of equipment under finance leases is based on the lesser of the equipment's useful life or the term of the finance lease.

Property, plant and equipment are tested for impairment as described under "Impairment of non-financial assets" in note 2.15.

2.13 Intangible assets

Identifiable intangible assets are initially recorded at fair value. Based on management's forecasts and business plans and the going concern of the Company, the trade names intangible asset (note 7) has been deemed to have an indefinite life, except for the "NABI Parts" tradename which is amortized over its useful life of 12 years. For purposes of impairment testing, the fair value of trade names is determined using an income approach.

Intangible assets that have a finite life are amortized using the straight-line method over the estimated useful lives of the assets as follows:

Patents and Licenses	5-12 years
Backlog of sales orders	1-2 years
Customer relationships	21 years

Identifiable intangible assets with finite and indefinite lives are tested for impairment as described under "Impairment of non-financial assets" in note 2.15.

2.14 Goodwill

Goodwill represents the excess of the cost of an acquisition over the fair value of the Company's share of the net identifiable assets of the acquired business at the date of acquisition. Separately recognized goodwill is tested at the end of every reporting period for possible impairment when there are events or changes in circumstances that indicate that their carrying amounts may not be recoverable and also tested annually for impairment. Goodwill is carried at cost less accumulated impairment losses. Gains and losses on the disposal of an entity include the carrying amount of goodwill relating to the entity sold.

2.15 Impairment of non-financial assets

Non-financial assets with finite lives are tested at the end of every reporting period for possible impairment when there are events or changes in circumstances that indicate that their carrying amounts may not be recoverable. In addition, non-financial assets that are not amortized are subject to an annual impairment assessment. The carrying values of identifiable intangible assets with indefinite lives are tested annually for impairment because they are not amortized. Impairment is determined by comparing the recoverable amount of such assets with their carrying amounts. Any impairment loss is recognized for the amount by which the asset's carrying amount exceeds its recoverable amount within earnings of continuing or discontinued operations, as appropriate.

The recoverable amount is the higher of an asset's fair value less cost to sell or its value in use. For the purpose of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash inflows or cash generating units ("CGUs"). The Company evaluates impairment losses for potential reversals, other than goodwill impairment, when events or changes in circumstances warrant such consideration.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

2.16 Provisions

Provisions represent liabilities to the Company for which the amount or timing is uncertain. Provisions are recognized when the Company has a present legal or constructive obligation as a result of past events, it is probable that an outflow of resources will be required to settle the obligation and the amount can be reliably estimated. Provisions are not recognized for future operating losses, unless the losses relate to an onerous contract. Provisions are measured at the present value of the expenditures expected to be required to settle the obligation using a discount rate that reflects current market assessments of the time value of money and the risks specific to the obligation. Provisions are re-measured at each consolidated statements of financial position date using the current discount rate. The increase in the provision due to passage of time is recognized as interest expense.

At the time of sale, a provision for warranty claims relating to the base warranty on the entire bus or motor coach and a corrosion warranty on the related structure, is recorded and charged against operations. This warranty provision is based upon management's best estimate of expected future warranty costs utilizing past claims experience. Actual warranty expenditures are charged against the provision as incurred.

A provision for onerous contracts is recognized when the expected benefits to be derived by the Company from a contract are lower than the unavoidable cost of meeting its obligations under the contract. The provision is measured at the present value of the lower of the expected cost of terminating the contract and the expected net cost of continuing with the contract. Before a provision is established, the Company recognizes any impairment loss on the assets associated with that contract.

2.17 Long-term debt

Long-term debt is recognized initially at fair value, net of transaction costs incurred. Debt is subsequently stated at amortized cost with any difference between the proceeds and the amortized cost recognized in the consolidated statements of net earnings and comprehensive income over the term of the debt using the effective interest method.

Debt is classified as a current liability unless the Company has an unconditional right to defer settlement for at least 12 months after the date of the consolidated statements of financial position.

2.18 Financial instruments

Financial assets

Purchases and sales of financial assets are recognized on the settlement date, which is the date on which the asset is delivered to or by the Company. Financial assets are derecognized when the rights to receive cash flows from the investments have expired or were transferred and the Company has transferred substantially all risks and rewards of ownership. Financial assets are classified in the following categories at the time of initial recognition based on the purpose for which the financial assets were acquired:

Financial assets at fair value through profit or loss

Classification

Financial assets at fair value through profit or loss are financial assets held for trading or designated as fair value through profit or loss. A financial asset is classified in this category if acquired principally for the purpose of selling in the short-term or if so designated by management. Assets in this category include derivative financial instruments and are classified as short or long term assets in the consolidated statements of financial position.

Recognition and measurement

Financial assets are initially recognized at fair value and subsequently carried at fair value through profit and loss, with changes recognized in the consolidated statements of net earnings and comprehensive income. Transaction costs are expensed as incurred.

Financial assets carried at amortized cost

Classification

Financial assets classified as amortized cost are non-derivative financial assets that the Company intends to hold in order to collect the contractual cash flows and have fixed or determinable payments that are not quoted in an active market. They are included in current assets, except for those with maturities greater than 12 months after the consolidated statements of financial position date, which are classified as non-current assets. Assets in this category include accounts receivables, deposits and cash and are classified as current assets in the consolidated statements of financial position.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

Recognition and measurement

Financial assets carried at amortized cost are initially recognized at fair value plus transaction costs and subsequently carried at amortized cost using the effective interest method.

Financial liabilities carried at amortized cost

Financial liabilities primarily consist of bank indebtedness, accounts payable and accrued liabilities, derivative financial instruments, other long-term liabilities and long-term debt. Financial liabilities are initially measured at fair value and subsequently measured at amortized cost unless classified as fair value through profit or loss.

Derivative instruments

Derivatives are initially recognized at fair value on the date a contract is entered into and are subsequently re-measured at their fair value. The Company's derivative instruments, while providing effective economic hedges, are not designated as hedges for accounting purposes. Changes in the fair value of any derivatives that are not designated as hedges for accounting purposes are recognized within "Fair market value gain (loss) on interest rate swap" or "unrealized foreign exchange (loss) gain on non-current monetary items" in the consolidated statements of net earnings and comprehensive income consistent with the underlying nature and purpose of the derivative instruments.

2.19 Taxation

Tax expense comprises current and deferred tax. Tax is recognized in the consolidated statements of net earnings and total comprehensive income except to the extent it relates to items recognized directly in equity, in which case the related tax is recognized in equity.

Current tax expense is based on the results for the period as adjusted for items that are not taxable or not deductible. Current tax is calculated using the tax rates under the laws that were enacted or substantively enacted at the date of the consolidated statements of financial position.

Deferred tax is accounted for using the liability approach and is the tax expected to be payable or recoverable on temporary differences between the carrying amount of assets and liabilities in the consolidated statements of financial position and the corresponding tax base used in the computation of taxable profit. Deferred tax is calculated based on the expected manner of realization or settlement of the carrying amount of assets and liabilities, using tax rates that are expected to apply to the year of realization or settlement based on tax rates and laws enacted or substantively enacted at the date of the consolidated statements of financial position.

Deferred tax assets are recognized to the extent it is probable that taxable profits will be available against which the deductible temporary differences can be utilized, unless the deferred tax asset arises from the initial recognition of an asset or liability in a transaction that is not a business combination, and at the time of the transaction, affects neither accounting profit nor taxable profit (tax loss). The carrying amount of deferred tax assets is reviewed at each consolidated statements of financial position date and reduced to the extent that it is no longer probable that sufficient taxable profits will be available to allow all or part of the asset to be recovered.

Deferred tax liabilities are generally recognized for all taxable temporary differences except to the extent that the deferred tax liability arises from: the initial recognition of goodwill; or the initial recognition of an asset or liability in a transaction which is not a business combination and, at the time of the transaction, affects neither accounting profit nor taxable profit (tax loss). As well, deferred tax liabilities are recognized for taxable temporary differences arising on investments in subsidiaries except where the reversal of the temporary difference can be controlled and it is probable that the difference will not reverse in the foreseeable future.

2.20 Investment tax credits

The Company has earned investment tax credits ("ITCs") relating to a percentage of eligible current and capital research and development expenditures incurred in each taxation year. Investment tax credits are recognized when there is reasonable assurance that the Company will comply with the associated conditions and the grants will be received. The investment tax credits are recognized either as a reduction in cost of sales on the consolidated statements of net earnings and comprehensive income, or as a reduction in property, plant and equipment, depending on where the original costs which gave rise to the credits were recorded.

2.21 Vendor Rebates

The Company records certain consideration received from a vendor, which is probable and can be reasonably estimated, as a reduction of the cost of purchases during the period.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

2.22 Critical accounting estimates and judgments

Estimates and judgments are continually evaluated and are based on historical experience and other factors, including expectations of future events that are believed to be reasonable under the circumstances.

Critical accounting estimates and assumptions

Management makes estimates and assumptions concerning the future. The resulting accounting estimates will, by definition, seldom equal the actual results. Estimates are reviewed on a regular basis and, as adjustments become necessary, they are reported in the consolidated statements of net earnings and comprehensive income in the periods in which they become known. The assets and liabilities which require management to make significant estimates and assumptions in determining carrying values include, inventories, derivative financial instruments, property, plant and equipment, intangible assets, goodwill, provisions, accrued benefit liability, deferred compensation obligation and deferred income taxes.

Information about assumptions and estimation uncertainties that have a significant risk of resulting in a material adjustment are addressed below.

Intangible assets and goodwill

The values associated with the initial recognition and impairment tests of the intangible assets and goodwill involve significant estimates and assumptions, including those with respect to future cash inflows and outflows, discount rates and asset lives.

These significant estimates are subject to the Company's future results. These determinations will affect the amount of amortization expense on intangible assets recognized in future periods.

Management assesses impairment by comparing the recoverable amount of an intangible asset or goodwill with its carrying value. The determination of the recoverable amount involves significant estimation by management.

Management has determined that for purposes of this evaluation the Company has six CGUs: bus manufacturing, motor coach manufacturing, ARBOC, ADL manufacturing, ADL aftermarket parts operations and aftermarket parts operations.

Goodwill is allocated to the Company's six CGUs for the purpose of impairment testing. The Company performs its annual test for impairment of goodwill in the fourth quarter of each year and also when indicators of impairment exist.

Accrued benefit liability

The present value of the defined benefit obligation is determined by discounting the estimated future cash outflows using interest rates of high-quality corporate bonds that are denominated in the currency in which the benefits will be paid and that have terms to maturity approximating the terms of the related pension liability. Determination of benefit expense requires assumptions such as the discount rate to measure obligations and return on assets, the projected age of employees upon retirement, life expectancy and the expected rate of future compensation changes.

Actual results will differ from results which are estimated based on assumptions. See note 2.7 for certain assumptions made with respect to employee benefits.

Income Taxes

Estimation of income taxes includes evaluating the recoverability of deferred tax assets based on an assessment of the Company's ability to utilize the underlying future tax deductions against future taxable income before they expire. Management's assessment is based upon existing tax laws and estimates of future taxable income. If the assessment of the Company's ability to utilize the underlying future tax deductions changes, the Company would be required to recognize more or fewer of the tax deductions as assets, which would decrease or increase the income tax expense in the period in which this is determined.

The Company is subject to taxation in multiple jurisdictions. Significant judgment is required in determining the worldwide provision for taxation. There are many transactions and calculations for which the ultimate tax determination is uncertain during the ordinary course of business. The Company maintains provisions for uncertain tax positions that it believes appropriately reflect its risk with respect to tax matters under active discussion, audit, dispute or appeal with tax authorities, or which are otherwise considered to involve uncertainty. These provisions for uncertain tax positions are made using management's best estimate of the amount expected to be paid based on a qualitative assessment of all relevant factors. Management reviews the adequacy of these provisions at the date of each consolidated statements of financial position. However, it is possible that at some future date an additional liability could result from audits by taxing authorities. Where the final tax outcome of these matters is different from the amounts that were initially recorded, such differences will affect the tax provisions in the period in which such determination is made.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

Provision for Warranty Costs

The Company offers warranties on the buses and coaches it sells. Management estimates the related provision for future warranty claims based on historical warranty claim information, as well as recent trends that might suggest that past cost information may differ from future claims. Factors that could impact the estimated claim information include quality initiatives, as well as parts and labour costs.

Critical judgments in applying accounting policies

The following critical judgments that were made by management have the most significant effect on the amounts recognized in the financial statements.

Revenue recognition

As described in note 2.6, management assessed the criteria for the recognition of revenue related to arrangements that have multiple components as set out in IFRS 15. Also, judgment is necessary to determine when components can be recognized separately and the allocation of the related consideration allocated to each component.

Also described in note 2.6, management assessed the criteria for the recognition of revenue in an agency relationship related to the sale of extended warranties that are purchased for the customer from the OEM as set out in IFRS 15.

Functional currency

Management assessed the criteria for the determination of functional currency as set out in IAS 21. An entity is required to place the greatest weight on the currency that influences the pricing of the transactions that it undertakes rather than focusing on the currency in which the transactions are denominated in. The functional currency of the Company is the United States dollar as it is the currency of the primary economic environment in which the Company operates. In addition, it is the competitive forces of the United States marketplace that determines the sales prices of its goods and services. Predominantly, the costs for labour, material and overhead that address the needs and support the Company's customers are incurred in United States dollars, and hence the pricing of goods and services to the customer is more greatly influenced from operations and the competitive forces in the United States.

Goodwill

Judgment is required in the selection of CGUs and the allocation of assets and liabilities to these CGUs, which is necessary to assess the impairment of long-term assets, goodwill and intangible assets.

3. ACCOUNTS RECEIVABLE

	December 29, 2019	December 30, 2018
Trade, net of allowance for doubtful accounts	$ 471,552	$ 358,441
Other	60,184	29,045
	$ 531,736	$ 387,486

4. INVENTORIES

	December 29, 2019	December 30, 2018
Raw materials	$ 300,447	$ 213,117
Work in process	263,343	150,654
Finished goods	108,453	60,914
	$ 672,243	$ 424,685

	Fiscal 2019	Fiscal 2018
Cost of inventories recognized as expense and included in cost of sales	$ 2,452,170	$ 2,015,272
Write-down of inventory to net realizable value in cost of sales	4,538	4,407
Reversals of a previous write-down in inventory	471	2,545

5. PROPERTY, PLANT AND EQUIPMENT

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Office equipment	Buses and coaches	Revenue Producing Assets	Total
Cost	$ 83,149	$ 143,561	$ 45,877	$ 5,619	$ 22,093	$ 13,931	$ 314,230
Accumulated depreciation	9,010	75,108	28,349	2,920	9,960	2,010	127,357
December 31, 2017 net book value	74,139	68,453	17,528	2,699	12,133	11,921	186,873
Additions (owned and leased)	19,369	50,024	8,191	2,006	470	9,097	89,157
Transfers from inventory	—	—	—	—	3,857	1,588	5,445
Disposals	(300)	(336)	(50)	(6)	—	—	(692)
Depreciation charge	(2,881)	(17,568)	(5,321)	(655)	(2,744)	(3,671)	(32,840)
December 30, 2018 net book value	90,327	100,573	20,348	4,044	13,716	18,935	247,943
Transition to IFRS 16 (note 2.3)	(3,013)	(22,734)	(1,572)	—	—	—	(27,319)
Adjusted December 31, 2018 net book value	87,314	77,839	18,776	4,044	13,716	18,935	220,624
Assumed as a result of business acquisitions	15,490	19,166	2,587	—	6,405	—	43,648
Additions	4,151	18,792	6,728	254	4,759	2,892	37,576
Transfer from inventory	—	—	—	—	6,646	3,931	10,577
Disposals	(27)	(117)	(33)	(44)	(159)	—	(380)
Depreciation charge	(3,387)	(21,369)	(5,797)	(746)	(7,252)	(6,119)	(44,670)
Cumulative translation adjustment	500	558	86	—	229	—	1,373
December 29, 2019 net book value	$ 104,041	$ 94,869	$ 22,347	$ 3,508	$ 24,344	$ 19,639	$ 268,748

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Office equipment	Demo buses and coaches	Buses and coaches available for lease	Total
Recorded as:							
Cost	$ 102,202	$ 192,983	$ 54,002	$ 7,615	$ 26,421	$ 24,615	$407,838
Accumulated depreciation	11,875	92,410	33,654	3,571	12,705	5,680	159,895
December 30, 2018 net book value	$ 90,327	$ 100,573	$ 20,348	$ 4,044	$ 13,716	$ 18,935	$247,943
Transition to IFRS 16 (note 2.3)	(3,013)	(22,734)	(1,572)	—	—	—	(27,319)
Adjusted December 31, 2018 net book value	$ 87,314	$ 77,839	$ 18,776	$ 4,044	$ 13,716	$ 18,935	$220,624
Cost	$ 118,390	$ 190,215	$ 50,582	$ 7,825	$ 44,301	$ 31,438	$442,751
Accumulated depreciation	14,349	95,346	28,235	4,317	19,957	11,799	174,003
December 29, 2019 net book value	$ 104,041	$ 94,869	$ 22,347	$ 3,508	$ 24,344	$ 19,639	$268,748

6. LEASES

Effective December 31, 2018, the Company adopted IFRS 16, which specifies how to recognize, present and disclose leases. The standard provides a single lessee accounting model, requiring lessees to recognize assets and liabilities for all major leases. Right-of-use assets consist of the following:

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Total
Opening balance at December 30, 2018	**$ 103,794**	**$ 443**	**$ 39**	**$ 104,276**
Transition to IFRS 16 (note 2.3)	3,013	22,734	1,572	27,319
Adjusted December 31, 2018 net book value	106,807	23,177	1,611	131,595
Assumed as a result of business acquisitions	15,353	1,845	—	17,198
Additions	17,369	4,475	680	22,524
Disposals	—	—	—	—
Depreciation charge	(12,363)	(6,113)	(874)	(19,350)
Cumulative translation adjustment	1,269	87	—	1,356
December 29, 2019 net book value	$ 128,435	$ 23,471	$ 1,417	$ 153,323

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Total
Recorded as:				
Cost	$ 107,720	$ 41,608	$ 12,827	$ 162,155
Accumulated Depreciation	913	18,431	11,216	30,560
Adjusted December 31, 2018 net book value	106,807	23,177	1,611	131,595
Cost	141,711	48,016	13,506	203,233
Accumulated Depreciation	13,276	24,545	12,089	49,910
December 29, 2019 net book value	$ 128,435	$ 23,471	$ 1,417	$ 153,323

Total cash outflows for payments on lease liabilities was $15.6 million for the year ended December 29, 2019, of which $9.9 million was for principal repayments.

During the year, the Company expensed $1.0 million in leases that did not meet the requirements for recognition under IFRS 16. These leases were either low value, or had a term of less than twelve months.

The Company assessed the extension periods embedded within each lease for inclusion in the lease liabilities on a lease by lease basis. When it determined it was reasonably certain to exercise the extension option within the lease, the Corporation has included those extension periods in the initial recognition of the right-of-use asset and lease liability. Significant leases where assumptions have been made are long-term building leases.

7. GOODWILL AND INTANGIBLE ASSETS

	Goodwill	Trade names	Patents and Licenses	Customer relationships	Backlog of sales orders	Total
Cost	$ 436,324	$ 224,300	$ 130,867	$ 398,321	$ 6,400	$ 1,196,212
Accumulated amortization	—	963	101,859	103,894	3,534	210,250
December 31, 2017 net book value	436,324	223,337	29,008	294,427	2,866	985,962
Additions	—	—	50	—	—	50
Adjustment to purchase equation for business combinations	(46)	—	—	—	—	(46)
Amortization charge	—	(275)	(12,235)	(19,580)	(2,866)	(34,956)
December 30, 2018 net book value	436,278	223,062	16,823	274,847	—	951,010
Additions	—	—	61	—	—	61
Assumed as a result of business acquisitions (note 1.1)	124,462	43,181	22,287	123,338	14,562	327,830
Amortization charge	—	(275)	(10,842)	(23,054)	(8,414)	(42,585)
Cumulative translation adjustment	8,168	1,408	630	3,879	117	14,202
December 29, 2019 net book value	$ 568,908	$ 267,376	$ 28,959	$ 379,010	$ 6,265	$ 1,250,518
Recorded as:						
Cost	$ 436,278	$ 224,300	$ 130,917	$ 398,321	$ 6,400	$ 1,196,216
Accumulated amortization	—	1,238	114,094	123,474	6,400	245,206
December 30, 2018 net book value	436,278	223,062	16,823	274,847	—	951,010
Cost	568,908	268,889	153,895	525,538	21,079	1,538,309
Accumulated amortization	—	1,513	124,936	146,528	14,814	287,791
December 29, 2019 net book value	$ 568,908	$ 267,376	$ 28,959	$ 379,010	$ 6,265	$ 1,250,518

The recoverable amount of the Company's cash generating units ("CGUs") is determined based on value-in-use calculations. These calculations use estimated cash flow projections based on financial plans approved by the Board covering a three-year period and discount rates based on weighted average cost of capital of like businesses that range between 7% and 14% per annum for the bus, ADL and motor coach manufacturing CGUs, between 11% and 17% for the ARBOC CGU, and between 5% and 10% per annum for the aftermarket parts and ADL parts CGU. Cash flows beyond this period are extrapolated using a steady estimated growth rate based on the long-term average annual growth rate of 3% for each industry in which the CGUs operate. Management has determined planned gross margins based on a projected production schedule, past performance and expectations of market development. The discount rates used reflect specific risk relating to the relevant CGUs.

Sensitivity testing is conducted as part of the annual impairment tests. Management believes that any reasonable change in the key assumptions used to determine the recoverable amount would not cause the carrying amount of the transit bus, ADL and ARBOC manufacturing and the aftermarket parts or ADL parts CGU to exceed its recoverable amount.

Impairment of the coach CGU may result if one of the following occurs:

- the cash flow projections are lower by 5.6% annually;
- the long-term average annual growth rate is decreased by 0.6% ; or
- the discount rate is higher by at least 0.7%.

Based upon historical operating results, management's forecasts and business plans, the Company's trade names were assigned an indefinite life, except for the "NABI Parts" tradename (net book value of $1,788 at December 29, 2019) which is amortized over its useful life of 12 years.

8. OTHER LONG-TERM ASSETS

	December 29, 2019	December 30, 2018
Long-term restricted deposit (note 24c)	$ 14,490	$ —
Long-term accounts receivable	5,122	1,052
	$ 19,612	$ 1,052

Long-term restricted deposit is collateral for certain of the Company's letters of credit.

9. CURRENT PORTION OF LONG TERM LIABILITIES

	December 29, 2019	December 30, 2018
Deferred revenue (note 13)	$ 94,372	$ 31,859
Provisions (note 14)	29,314	35,838
Deferred compensation obligation (note 11)	1,678	4,677
Obligations under finance leases (note 6)	19,160	7,936
	$ 144,524	$ 80,310

10. ACCRUED BENEFIT LIABILITY

Defined benefit plan

The Company's subsidiaries have defined benefit plans which cover employees in Canada and the United States. Actuarial valuations for the Company's subsidiaries were last performed as at December 31, 2017 and December 31, 2016.

Information in respect of the Company's defined benefit plan is as follows:	December 29, 2019	December 30, 2018
Change in plan assets		
Plan assets at fair value — beginning of period	$ 125,684	$ 121,651
Interest income	4,503	4,682
Remeasurement gains (losses) - return on plan assets (excluding amounts in net interest)	13,617	(7,608)
Administrative expenses	(1,440)	(399)
Employer's contributions	7,803	22,241
Benefits paid	(52,341)	(7,842)
Plan settlement	(108)	—
Foreign exchange gain (loss)	3,718	(7,041)
Plan assets at fair value — end of period	101,436	125,684
Change in defined benefit obligation		
Defined benefit obligation — beginning of period	130,949	141,455
Current service cost	4,625	5,262
Interest cost	4,685	4,901
Benefits paid	(52,341)	(7,842)
Plan settlement	(1,779)	—
Foreign exchange (gain) loss	3,847	(7,242)
Past Service Costs	—	6,482
Actuarial loss (gain) arising from changes in demographic assumptions	—	(132)
Actuarial loss (gain) arising from changes in financial assumptions	19,636	(12,427)
Actuarial loss arising from experience adjustments assumptions	(149)	492
Defined benefit obligation — end of period	109,473	130,949
Accrued benefit liability - present value of unfunded obligations	$ (8,037)	$ (5,265)

During the year, the Company paid the liabilities for a defined benefit plan that was terminated.

The actual gain on the plan assets for Fiscal 2019 was $18,120 (Fiscal 2018: loss of $2,926).

The significant actuarial assumptions adopted in measuring the Company's accrued benefit obligation and net pension plan expenses are as follows:

		Fiscal 2019	Fiscal 2018
Country	Mortality Table	Discount Rate	
Canada	CPM2014 Private sector with Scale MI-2017 with size adjustment	3.80%	3.50%
Canada	CPM2014 Private sector with Scale MI-2017 with no size adjustment	3.10%	3.90%
United States	Base table: RP2006, projection scale MP2018	4.35%	4.35%

10. ACCRUED BENEFIT LIABILITY (Continued)

			Discount rate - sensitivity		Life expectancy - sensitivity	
			1% increase	1% decrease	one year increase	one year decrease
Country	Last valuation date	Next valuation date	Then obligation would decrease by:	Then obligation would increase by:	Then obligation would increase by:	Then obligation would decrease by:
Canada	Dec. 31, 2017	Dec. 31, 2020	16.8%	21.6%	1.4%	1.4%
Canada	Dec. 31, 2016	Dec. 31, 2019	20.4%	26.1%	3.5%	3.6%
United States	Dec. 31, 2016	Dec. 31, 2019	5.9%	5.9%	2.9%	2.9%

The defined benefit plan typically exposes the Company to actuarial risks such as: investment risk, interest rate risk and longevity risk.

Investment risk

The present value of the defined benefit plan liability is calculated using a discount rate determined by reference to high quality corporate bond yields; if the return on plan assets is below this rate, it will create a plan deficit. Management believes the plan currently has a relatively balanced investment in equity securities and debt instruments. Due to the long-term nature of the plan liabilities, the Company's pension committee considers it appropriate that a reasonable portion of the plan assets should be invested in equity securities to leverage the return generated by the fund.

Interest rate risk

A decrease in the bond interest rate will increase the plan liability; however, this will be partially offset by an increase in the return on the plan's debt investments.

Longevity risk

The present value of the defined benefit plan liability is calculated by reference to the best estimate of the mortality of plan participants both during and after their employment. An increase in the life expectancy of the plan participants will increase the plan's liability.

The Company's defined benefit plan is a fixed benefit plan and, as a result, the rate of compensation increases does not have any impact on the actuarially determined accrued benefit liability. Expected contributions to the defined benefit plan for the 52-week period ending December 29, 2019 are $5,904.

The Company's defined benefit pension plan expense, included in cost of sales and sales, general and administration costs and other operating expenses is as follows:

	Fiscal 2019	Fiscal 2018
Current service costs	$ 4,625	$ 5,262
Past service costs	—	6,482
Net interest expense	183	219
Administrative expenses	1,440	399
Plan settlement	(1,671)	—
Foreign exchange loss (gain)	1,272	(29)
Components of defined benefit costs recognized in net earnings	$ 5,849	$ 12,333

10. ACCRUED BENEFIT LIABILITY (Continued)

	Fiscal 2019	Fiscal 2018
Remeasurement gains (losses) - return on plan assets (excluding amounts in net interest)	$ 13,617	$ (7,608)
Actuarial gains arising from changes in demographic assumptions	—	132
Actuarial (losses) gains arising from changes in financial assumptions	(19,636)	12,427
Actuarial gains (losses) arising from experience adjustments assumptions	149	(492)
Foreign exchange gain (loss)	1,836	(74)
	(4,034)	4,385
Deferred income taxes recorded through other comprehensive loss or income	(356)	(1,215)
Net actuarial (losses) gains recognized in other comprehensive loss or income	$ (4,390)	$ 3,170

An analysis of the assets of the plans by investment category is provided as follows:

	December 29, 2019	December 30, 2018
Asset category		
Cash and cash equivalents	0.4%	2.5%
Canadian equities	17.7%	12.3%
Foreign equities	32.8%	25.1%
Real estate	3.6%	2.3%
Bonds	45.5%	57.8%
	100.0%	100.0%

11. DEFERRED COMPENSATION OBLIGATION

	December 29, 2019	**December 30, 2018**
Performance share units under PRSU Plan (officers and senior management)	$ 2,088	$ 6,753
Restricted share units under PRSU Plan (officers and senior management)	50	638
Deferred share units under DSU Plan (non-employee board of directors)	2,330	2,265
	4,468	9,656
Less: current portion	1,678	4,677
	$ 2,790	$ 4,979

Effective December 17, 2012, the Board approved the Performance and Restricted Share Unit Plan (the "PRSU Plan") and it was amended on December 16, 2013 and on December 18, 2018. The terms of the amended PRSU Plan govern awards made on or after the 2014 plan year and 2018 plan year, respectively.

The purposes of the PRSU Plan are to attract, retain and motivate key personnel and reward officers and senior management and to align their interests with those of shareholders by making a significant portion of their incentive compensation directly dependent on achieving key strategic, financial and operational objectives that are crucial to the ongoing growth and profitability of the Company. Under the terms of the PRSU Plan, the human resources, compensation and corporate governance committee of the Board may grant eligible participants performance share units ("PSUs") or restricted share units ("RSUs"), which give the holders thereof the right to receive, upon vesting and redemption of a unit, a cash payment equal to the fair market value of a Share at the time of redemption. When dividends are paid on a Share, additional units equivalent to the amount of the dividends multiplied by the number of PSUs and RSUs held (and determined based on the then fair market value of the Shares) are credited to a participant's account. The actual value of a PSU on the settlement date is contingent on the Share price and the Company's actual performance over a three-year period relative to the established objectives. The actual value of an RSU on the settlement date is contingent on the Share price only and RSUs generally vest and settle as to one-third on each of the first, second and third anniversaries of the grant date. PSUs and RSUs also immediately vest upon a participant's termination without cause or resignation for good reason within a specified period of time following the closing of a transaction resulting in certain change of control events and upon certain terminations of employment and, with respect to PSUs and RSUs granted prior to 2019, upon the closing of a transaction resulting in certain change of control events.

RSUs and PSUs granted in Fiscal 2019 were determined based on the volume weighted average trading price of a Share for the last five trading days of 2018 and the desired compensation value.

11. DEFERRED COMPENSATION OBLIGATION (Continued)

As well, the Board adopted NFI's Deferred Share Unit Plan for Non-Employee Directors (the "DSU Plan") on November 7, 2011 and it was amended and restated on December 8, 2015, December 18, 2015 and March 14, 2019. Pursuant to the plan, non-employee directors may elect once each calendar year to receive all or a portion of their annual retainer and meeting fees in the form of deferred share units ("DSUs") instead of cash. A DSU is the right to receive a cash payment based on the value of a Share credited by means of a bookkeeping entry to an account in the name of the non-employee director. DSUs are credited to the director's account on the first day of each calendar quarter, the number of which is determined by dividing the amount of the applicable portion of the director's elected amount by the volume weighted average trading price of a Share for the last five trading days.

When dividends are paid on a Share, additional DSUs equivalent to the amount of the dividend multiplied by the number of DSUs held (and determined based on the then fair market value of the Shares) will be credited to the director's account. At the end of the director's tenure as a member of the Board, he or she will be entitled to receive a cash redemption payment equal to the fair market value of a Share multiplied by the number of DSUs held.

	PSUs	RSUs	DSUs	Total
Units outstanding at December 31, 2017	131,847	31,780	81,907	245,534
Units granted	53,883	26,942	9,262	90,087
Distribution units granted	5,112	1,620	2,426	9,158
Vested and reclassified as current liability	(75,001)	(31,715)	—	(106,716)
Units outstanding at December 30, 2018	115,841	28,627	93,595	238,063
Units granted	96,523	44,373	18,082	158,978
Distribution units granted	10,460	3,729	5,082	19,271
Units Expired	—	(910)	—	(910)
Units Redeemed	—	—	(10,411)	(10,411)
Vested and reclassified as current liability	(71,347)	(35,470)	—	(106,817)
Units outstanding at December 29, 2019	151,477	40,349	106,348	298,174
Vested units	—	—	106,348	106,348
Unvested units	151,477	40,349	—	191,826

12. SHARE-BASED COMPENSATION - EQUITY SETTLED

The Board adopted a Share Option Plan (the "Option Plan") for NFI on March 21, 2013, under which employees of NFI and certain of its affiliates may receive grants of share options. The Option Plan was amended and restated on December 8, 2015 and on December 31, 2018. Directors who are not employed with NFI are not eligible to participate in the Option Plan. A maximum of 3,600,000 Shares are reserved for issuance under the Option Plan. One quarter of the share options become vested on the first grant date anniversary and an additional one-quarter on the second, third and fourth anniversary of such date.

Option Grant dates	Number	Exercised	Expired	Vested	Unvested	Expiry date	Exercise price	Fair Value at grant date
March 26, 2013	490,356	(483,030)	—	(7,326)	—	March 26, 2021	C$10.20	C$1.55
December 30, 2013	612,050	(573,668)	(9,631)	(28,751)	—	December 30, 2021	C$10.57	C$1.44
December 28, 2014	499,984	(243,587)	(11,368)	(245,029)	—	December 28, 2022	C$13.45	C$1.83
December 28, 2015	221,888	(19,532)	—	(146,884)	55,472	December 28, 2023	C$26.75	C$4.21
September 8, 2016	2,171	—	—	(1,629)	542	September 8, 2024	C$42.83	C$8.06
January 3, 2017	151,419	(1,610)	(1,615)	(73,299)	74,895	January 3, 2025	C$40.84	C$7.74
January 2, 2018	152,883	—	(1,882)	(37,754)	113,247	January 2, 2026	C$54.00	C$9.53
January 2, 2019	284,674	—	(3,431)	—	281,243	January 2, 2027	C$33.43	C$5.01
July 15, 2019	2,835	—	—	—	2,835	July 15, 2027	C$35.98	C$4.90
	2,418,260	(1,321,427)	(27,927)	(540,672)	528,234		C$30.77	

12. SHARE-BASED COMPENSATION - EQUITY SETTLED (Continued)

The following reconciles the share options outstanding:

	Fiscal 2019		Fiscal 2018	
	Number	Weighted average exercise price	Number	Weighted average exercise price
Balance at beginning of period	946,306	C$27.02	979,333	C$19.94
Granted during the period	287,559	C$33.46	152,833	C$54.00
Expired during the period	(6,928)	C$40.75	—	—
Exercised during the period	(158,031)	C$12.77	(185,860)	C$11.91
Balance at end of period	1,068,906	C$30.77	946,306	C$27.02

Fair values were measured based on the Black-Scholes formula. Expected volatility is estimated by considering historic average share price volatility. The inputs used in the measurement of the fair values of the share-based payment plans granted in Fiscal 2019 and Fiscal 2018 are the following:

Options grant date	January 2, 2019	January 2, 2018
Fair value at grant date (C$)	$5.01	$9.53
Share price (C$)	$33.43	$54.00
Exercise price (C$)	$33.43	$54.00
Expected volatility	24.4%	23.3%
Option life (expected weighted average life)	5.5 years	5.5 years
Expected dividends	3.71%	2.48%
Risk-free interest rate (based on government bonds)	1.89%	1.73%

On May 8, 2014, shareholders' approved the Company's Restricted Share Unit Plan for Non-Employee Directors (the "Director RSU Plan"). The Director RSU Plan was amended and restated on December 8, 2015, December 31, 2017 and March 14, 2019. A maximum of 500,000 Shares are reserved for issuance under the Director RSU Plan. Pursuant to the Director RSU Plan, non-employee directors are permitted to elect, once each calendar year, to receive all or a portion of their annual retainer in the form of restricted share units ("Director RSUs") and/or DSUs instead of cash. A Director RSU is a right to acquire a fully-paid and non-assessable Share credited by means of a bookkeeping entry to an account in the name of the non-employee director.

A director generally must make the election prior to the end of the calendar year preceding the year to which such election is to apply. The Board, in its sole discretion, may award additional Director RSUs, subject to an annual aggregate value of $150 per director. The number of Director RSUs to be awarded to a director is determined by dividing the amount of the applicable portion of the director's annual retainer by the applicable fair market value of a Share on that date. When dividends are paid on a Share, additional Director RSUs equivalent to the aggregate number of Director RSUs held by a director on the dividend record date multiplied by the amount of dividend paid by NFI on each Share, and then divided by the fair market value of the Shares on the dividend payment date, will automatically be credited to the director's account. Under the Director RSU Plan, Director RSUs vest immediately as at each applicable award date. A director (other than a U.S. director) will be permitted to exercise the Director RSUs credited to his or her account at any time prior to December 15 of the year following the year in which the director ceases to be a non-employee director of NFI or one of its affiliates. A U.S. director will be required to specify the exercise date in the annual election form in accordance with Section 409A of the U.S. Internal Revenue Code.

	Number of Director RSUs
Balance - December 31, 2017	22,505
Director RSUs issued	15,759
Director RSUs exercised	(15,521)
Balance - December 30, 2018	22,743
Director RSUs issued	25,686
Director RSUs exercised	(17,754)
Balance - December 29, 2019	30,675

13. DEFERRED REVENUE

	December 29, 2019	December 30, 2018
Extended warranties	$ 21,220	$ 16,910
Progress payments	86,506	25,392
	107,726	42,302
Less: current portion of deferred revenue	(94,372)	(31,859)
	$ 13,354	$ 10,443

Deferred revenue is comprised of progress payments that have not yet qualified for recognition as revenue under the Company's revenue recognition policies and also deferred revenue from the sale of extended warranty contracts which are amortized over the extended warranty period commencing at the end of the one-year basic warranty period.

14. PROVISIONS

The Company's insurance risk retention meets the IFRS definition of provisions, a liability with uncertain timing or amount.

The Company generally provides its customers with a base warranty on the entire transit bus or motor coach and a corrosion warranty on the related structure. The movements in the provision for the base warranty costs during the periods are as follows:

	Insurance Risk Retention	Warranty	Total
December 31, 2017	$ 22,746	80,358	103,104
Additions	12,032	32,711	44,743
Amounts used/realized	(10,274)	(36,332)	(46,606)
Unwinding of discount and effect of changes in the discount rate	—	(82)	(82)
Exchange rate differences	—	(375)	(375)
December 30, 2018	$ 24,504	$ 76,280	$ 100,784
Assumed as a result of business acquisition	—	7,434	7,434
Additions	8,880	44,226	53,106
Amounts used/realized	(5,383)	(47,693)	(53,076)
Unused provision	(504)	(16,642)	(17,146)
Unwinding of discount and effect of changes in the discount rate	—	225	225
Exchange rate differences	—	167	167
	27,497	63,997	91,494
Less current portion	3,000	26,314	29,314
December 29, 2019	$ 24,497	$ 37,683	$ 62,180

15. DEFERRED TAXES AND INCOME TAX EXPENSE

Deferred income tax assets and liabilities are offset when there is a legally enforceable right to offset current tax assets against current tax liabilities and when the deferred income tax assets and liabilities relate to income taxes levied by the same taxation authority on either the taxable entity or different taxable entities where there is an intention to settle the balances on a net basis. The offset amounts by tax jurisdiction presented on the statements of financial position are as follows:

	December 29, 2019	December 30, 2018
As presented on statements of financial position:		
Deferred tax liabilities	105,023	83,121
	$ 105,023	$ 83,121

15. DEFERRED TAXES AND INCOME TAX EXPENSE (Continued)

The gross movement on the deferred income tax account is as follows:

		Fiscal 2019		Fiscal 2018
Beginning of period	$	(83,121)	$	(88,453)
Assumed as a result of business acquisitions		(41,850)		—
Exchange rate differences		64		321
Tax recorded through net earnings		19,342		5,552
Tax recorded through other comprehensive loss		1,530		(1,171)
Benefit of loss carry forward and share issuance costs recognized against income taxes payable		—		(29)
Tax recorded through equity		(988)		659
End of period	$	(105,023)	$	(83,121)

The movement in deferred income tax assets and liabilities during the period, without taking into consideration the offsetting of balances within the same tax jurisdiction, is as follows:

Deferred tax liabilities	Unrealized Foreign Exchange	Property Plant and Equipment	Goodwill and Intangibles	Right of Use Assets	Other	**Total**
December 31, 2017	(8,025)	(6,275)	(136,594)	—	(7,796) $	(158,690)
Tax recorded through net earnings	8,025	(5,524)	9,283	—	6,717	18,501
December 30, 2018	**—**	**(11,799)**	**(127,311)**	**—**	**(1,079)**	**(140,189)**
Tax recorded through net earnings	—	(1,586)	7,639	(28,565)	3,854	(18,658)
Assumed as a result of business acquisition	—	(2,724)	(36,269)	—	(5,643)	(44,636)
Cumulative translation adjustment	—	—	(935)	—	—	(935)
December 29, 2019	**$ —**	**$ (16,109)**	**$ (156,876)**	**$ (28,565)**	**$ (2,868)**	**$ (204,418)**

15. DEFERRED TAXES AND INCOME TAX EXPENSE (Continued)

Deferred tax assets	Reserves and accruals not currently deductible	Tax Credits	Provisions	Property Plant and Equipment	Right of Use Assets	Loss carry forward	Pension	Deferred Financing Costs and Interest	Other	Total
December 31, 2017	23,513	1,153	30,502	1,648	—	1,764	3,541	2,395	5,721	$ 70,237
Tax recorded through net earnings	(9,046)	(67)	(172)	(1,656)	—	867	(624)	(318)	(1,933)	(12,949)
Tax recorded through other comprehensive loss	—	—	—	—	—	—	(1,171)	—	—	(1,171)
Tax recorded through equity	—	—	—	—	—	—	—	—	659	659
Benefit of loss carry forward and share issuance costs recognized against income taxes payable	—	—	—	—	—	—	—	(29)	—	(29)
Exchange rate differences	109	—	141	8	—	(18)	16	11	54	321
December 30, 2018	$ 14,576	$ 1,086	$ 30,471	$ —	$ —	$ 2,613	$ 1,762	$ 2,059	$ 4,501	$ 57,068
Tax recorded through net earnings	11,457	(1,086)	(8,066)	—	29,831	8,930	185	(645)	(2,606)	$ 38,000
Tax recorded through other comprehensive loss	—	—	—	—	—	—	1,530	—	—	$ 1,530
Tax recorded through equity	—	—	—	—	—	—	—	—	(53)	$ (53)
Assumed as a result of business acquisition	—	—	—	—	—	—	—	—	2,786	$ 2,786
Exchange rate differences	17	—	35	—	—	3	2	2	5	$ 64
December 29, 2019	$ 26,050	$ —	$ 22,440	$ —	$ 29,831	$ 11,546	$ 3,479	$ 1,416	$ 4,633	$ 99,395

Deferred income tax asset are recognized for income tax loss carry-forwards to the extent that the realization of the related tax benefit through future taxable profits is probable. At December 29, 2019, the Company has recognized all of its deferred income tax assets with the exception of $6.9 million of net operating losses in the U.S, which were acquired through the acquisition of ADL. These losses are restricted to a maximum utilization of $0.2 million per year. At December 29, 2019 the Company has non-capital losses in Canada of $37.2 million, and net operating losses in the U.S. of $7.9 million expiring as follows:

	United States		Canada
	Tax Credits	Tax Losses	Tax Losses
2020-2026	—	1,750	—
2027	5,049	250	—
2028	1,146	250	—
2029	2,349	250	—
2030-2037	—	1,300	317
2038	—	154	11,741
2039	—	154	25,114
2040 - 2063	—	3,696	—
2064	—	134	—

15. DEFERRED TAXES AND INCOME TAX EXPENSE (Continued)

The reconciliation of income tax computed at the U.S. statutory rate, to income tax expense is as follows:

	Fiscal 2019	Fiscal 2018
Earnings before income tax expense	$ 99,695	$ 210,653
Tax calculated using a 21% U.S. tax rate	20,936	44,237
Tax effect of:		
Withholding and other taxes	3,747	2,989
Non-taxable income	(6,007)	(1,967)
Revision of tax estimates	3,974	(1,737)
Foreign exchange impact	(1,896)	(8,275)
State taxes	11,873	14,566
Impact of rate change on deferred income taxes	(528)	(849)
Foreign tax credit pools and base erosion and anti-abuse tax	10,482	1,146
Rate differential on income taxed at other than U.S. statutory rate	(728)	(377)
Other	144	978
Income tax expense	$ 41,997	$ 50,711

Current income taxes	$ 61,339	$ 56,263
Deferred income taxes recovered	(19,342)	(5,552)
Income tax expense for the period	$ 41,997	$ 50,711

16. LONG-TERM DEBT

	Face Value	Unamortized Transaction Costs	**Net Book Value December 29, 2019**	Net Book Value December 30, 2018
Revolving Credit Facility, Unsecured (“Credit Facility”)	1,056,100	2,974	1,053,126	639,432

On October 25, 2018 NFI entered into a new five-year senior unsecured, revolving credit facility and extinguished its fifth amended and restated credit agreement (the "Prior Credit Agreement").

In May 2019, NFI entered into a $300 million revolving credit facility (the "Acquisition Revolver") to fund the acquisition of ADL. The terms of the Acquisition Revolver were principally the same as those of the syndicated Credit Facility. On August 6, 2019 NFI entered into an agreement to roll the Acquisition Revolver into its existing Credit Facility. The Credit Facility was increased by $250M and the $300M Acquisition Revolver was extinguished. The term of the Credit Facility was extended to August 2, 2024.

The unsecured Credit Facility has a total borrowing limit of $1.250 billion, which includes a $100 million letter-of-credit facility and a $250 million accordion feature. $12.8 million of outstanding letters-of-credit were drawn against the Credit Facility at December 29, 2019. The Credit Facility bears interest at a rate equal to LIBOR or a U.S. base rate for loans denominated in U.S. dollars and a Canadian prime rate or bankers' acceptance rate for loans denominated in Canadian dollars, plus an applicable margin to those rates and matures on August 2, 2024. Amounts drawn under the Credit Facility bear interest at a rate equal to LIBOR or a U.S. base rate for loans denominated in U.S. dollars and a Canadian prime rate or bankers' acceptance rate for loans denominated in Canadian dollars, plus an applicable margin to those rates.

17. SHARE CAPITAL

	December 29, 2019	**December 30, 2018**
Authorized - Unlimited		
Issued - 62,493,880 Common Shares (December 30, 2018: 61,832,625)	$ 680,962	$ 654,307

Share repurchase

On June 11, 2018, the Company announced that the TSX had accepted a notice filed by the Company of its intention to implement the previous Normal Course Issuer Bid ("Former NCIB") to repurchase its Shares through the facilities of the TSX and any alternative Canadian trading systems on which the Shares are traded. On January 17, 2019 the Company amended the Former NCIB. Pursuant to the amended

17. SHARE CAPITAL (Continued)

Former NCIB, the Company was permitted to repurchase for cancellation up to 5,549,465 Shares, representing approximately 10% of the outstanding public float of Shares on June 4, 2018. The Company was permitted to repurchase Shares commencing on June 14, 2018 up to June 13, 2019, or earlier should the Company have completed its repurchases prior to such date. The Former NCIB expired on June 13, 2019.

On June 12, 2019 the Company announced that the TSX had accepted a notice filed by the Company of its intention to implement a new Normal Course Issuer Bid (the "NCIB") to replace the Former NCIB to repurchase its Shares through the facilities of the TSX and any alternative Canadian trading systems on which the Shares are traded. The Company is permitted to repurchase for cancellation up to 5,357,914 Shares, representing approximately 10% of the outstanding public float of Shares on June 4, 2019. The Company is permitted to repurchase Shares under the NCIB commencing on June 17, 2019 up to June 16, 2020, or earlier should the Company complete its repurchases prior to such date.

The actual number of Shares to be purchased and the timing and pricing of any purchases under the NCIB will depend on future market conditions and potential alternative uses for cash resources. The Company may elect to modify, suspend or discontinue the program at any time without prior notice. During 2019 Q1 the Company repurchased 232,100 Shares under the Former NCIB at an average price of $31.82 Canadian ("C") per Share for a total repurchase of C$7.4 million. The Company canceled 986,075 Shares during 2019 Q1, including 232,100 Shares purchased in 2019 Q1 and 753,975 Shares that were purchased in 2018 Q4. There were no shares purchased or canceled under the Former NCIB or the NCIB subsequent to 2019 Q1.

The following is a summary of changes to the issued and outstanding capital stock during the period:

Shares	Number (000s)	Net Book Value
Balance - December 30, 2018	61,833	$ 654,307
Stock options exercised	159	1,802
Restricted share units exercised	16	416
Issuance of shares - ADL purchase	1,472	34,888
Repurchase and cancellation of Shares	(986)	(10,451)
Balance - December 29, 2019	62,494	$ 680,962

18. EARNINGS PER SHARE

	Fiscal 2019	Fiscal 2018
Net earnings attributable to equity holders	$ 57,698	$ 159,942
Weighted average number of Shares in issue	61,809,479	62,396,962
Add: net incremental Shares from assumed conversion of stock options and exercise of restricted share units	188,398	438,968
Weighted average number of Shares for diluted earnings per Share	61,997,877	62,835,930
Net earnings per Share (basic)	$ 0.9335	$ 2.5633
Net earnings per Share (diluted)	$ 0.9306	$ 2.5454

Basic earnings per Share is calculated by dividing the net earnings attributable to equity holders of the Company by the weighted average number of Shares outstanding during the period excluding Shares purchased by the Company and held as treasury shares. During the period the Company held no treasury shares.

Diluted earnings per Share is calculated using the same method as basic earnings per Share except that the average number of Shares outstanding includes the potential dilutive effect of outstanding stock options and restricted share units granted by the Company as determined by the treasury stock method.

19. SUPPLEMENTAL CASH FLOW INFORMATION

Changes in non-cash working capital items

Cash inflow (outflow)	Fiscal 2019	Fiscal 2018
Accounts receivable	$ (63,592)	$ (1,019)
Income tax receivable	15,111	(9,204)
Inventories	(40,147)	(70,382)
Prepaid expenses and deposits	5,627	4,820
Accounts payable and accrued liabilities	42,474	51,925
Income tax payable	—	(7,328)
Deferred revenue	(4,786)	(525)
Provisions	(16,724)	(2,279)
Other	(29,287)	(352)
	$ (91,324)	$ (34,344)

20. DEFINED CONTRIBUTION PENSION PLANS

The Company maintains a defined contribution plan for salaried employees. The net pension expense for the Company's defined contribution plans is as follows:

	Fiscal 2019	Fiscal 2018
Defined contribution pension expense	$ 9,767	$ 5,522

Cash payments contributed by the Company during Fiscal 2019 for its defined benefit and defined contribution pension plans amounted to $17.6 million (2018: $27.6 million).

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT

(a) Financial Instruments

The Company has made the following classifications:

Cash	Fair value through profit or loss
Long-term deposit	Fair value through profit or loss
Receivables	Amortized cost
Deposits	Amortized cost
Bank indebtedness	Fair value through profit or loss
Accounts payables and accrued liabilities	Amortized cost
Other long-term liabilities	Amortized cost
Long-term debt	Amortized cost
Derivative financial instruments	Fair value through profit or loss

(b) Fair value measurement of financial instruments

The Company categorizes its fair value measurements of financial instruments recorded at fair value according to a three-level hierarchy. The hierarchy prioritizes the inputs used by the Company’s valuation techniques. A level is assigned to each fair value measurement based on the lowest level input significant to the fair value measurement in its entirety. The three levels of the fair value hierarchy are defined as follows:

Level 1 - fair value measurements that reflect unadjusted, quoted prices in active markets for identical assets and liabilities that the Company has the ability to access at the measurement date.

Level 2 - fair value measurements using inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly. These include quoted prices for similar assets and liabilities in active markets, quoted prices for identical or

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT(Continued)

similar assets and liabilities in inactive markets, inputs that are observable that are not prices (such as interest rates and credit risks) and inputs that are derived from or corroborated by observable market data.

Level 3 - fair value measurements using significant non-market observable inputs. These include valuations for assets and liabilities that are derived using data, some or all of which is not market observable data, including assumptions about risk.

The following table presents the carrying amounts and fair values of financial liabilities and financial assets, including their levels in the fair value hierarchy. The table excludes fair value information for financial assets and financial liabilities not measured at fair value if the carrying amount is a reasonable approximation of fair value.

	December 29, 2019		
	Fair value level	Carrying amount	Fair value
Financial assets recorded at fair value			
Cash	Level 1	$ 28,233	$ 28,233
Long-term restricted cash	Level 1	$ 14,490	$ 14,490
Financial liabilities recorded at fair value			
Total return swap contracts	Level 2	$ 944	$ 944
Foreign exchange forward contracts	Level 2	$ 3,707	$ 3,707
Derivative financial instrument liabilities - current		$ 4,651	$ 4,651
Interest rate swap	Level 2	$ 15,388	$ 15,388
Derivative financial instrument liabilities - long term		$ 15,388	$ 15,388

	December 30, 2018		
	Fair value level	Carrying amount	Fair value
Financial assets recorded at fair value			
Cash	Level 1	$ 10,820	$ 10,820
Interest rate swap	Level 2	$ 6,592	$ 6,592
Derivative financial instrument assets - long term		$ 6,592	$ 6,592
Financial liabilities recorded at fair value			
Foreign exchange forward contracts	Level 2	$ 1,542	$ 1,542
Derivative financial instrument liabilities - current		$ 1,542	$ 1,542

(c) Risk Management

The Company uses derivative financial instruments including interest rate swaps, total return swaps and forward foreign exchange contracts. These instruments are financial contracts whose value depends on interest rates, share price and foreign currency prices.

The use of derivatives allows the transfer, modification and reduction of current and expected risks, including interest rate, share price, foreign exchange and other market risks. The Company uses derivative financial instruments to manage interest rate, share price and foreign exchange risks in accordance with its risk management policies. Certain derivative instruments, while providing effective economic hedges, are not designated as hedges for accounting purposes. Changes in the fair value of any derivatives that are not designated as hedges for accounting purposes are recognized within “interest and finance costs” or “unrealized foreign exchange loss (gain) on non-current monetary items” in the consolidated statements of net earnings and total comprehensive income consistent with the underlying nature and purpose of the derivative instruments.

Market risk (interest rate risk and foreign currency risk)

Market risk incorporates a range of risks. Movements in risk factors, such as interest rate risk, equity price risk and foreign currency risk, affect the fair values of financial assets and liabilities. The Company uses derivative financial instruments including interest rate swaps, foreign exchange options and forward foreign exchange contracts to manage its risks associated with potentially adverse changes in interest rates and foreign exchange rates. These instruments are financial contracts whose value depends on interest rates and foreign currency prices. The use of derivatives allows the transfer, modification and reduction of current and expected risks, including interest rate, foreign

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT(Continued)

exchange and other market risks. The Company uses derivative financial instruments to manage interest rate and foreign exchange risks in accordance with its risk management policies.

The Company does not hold financial instruments for speculative or trading purposes. The Company has elected not to apply hedge accounting to its derivative financial instruments.

Interest rate risk

The Company's borrowings under the Credit Facility are at variable rates of interest and expose the Company to interest rate risk. The Company attempts to mitigate this risk through interest rate swaps that could become materially more expensive if interest rates increase or become more volatile. If the cost of mitigating interest rates increases, the Company's debt service obligations on its variable rate indebtedness would increase even though the amount borrowed remained the same, and the Company's net earnings and cash available for servicing its other indebtedness would decrease.

The interest rate swap is subject to interest rate risk. As an illustration, if interest rates at the Consolidated Statements of Financial Position date had been 100 basis points lower, with all other variables held constant, net earnings and comprehensive income for Fiscal 2019 would have been lower by $15.3 million (Fiscal 2018: $3.2 million), arising mainly as a result of the related fair value adjustment recorded due to lower interest rate. If interest rates had been 100 basis points higher, with all other variables held constant, net earnings and comprehensive income for Fiscal 2019 would have been higher by $14.8 million (Fiscal 2018: $2.9 million), arising mainly as a result of the related fair value adjustment recorded due to higher interest rate.

On February 13, 2019, the Company entered into a $600,000 notional interest rate swap to hedge floating rate exposure on the Company's Credit Facility. The interest rate swap fixes the interest rate at 2.27% plus applicable margin until October 2023.

Equity price risk

The Company entered into a total return swap transaction to hedge the exposure associated with increases in its share value on a portion of the outstanding performance share units, restricted share units, and deferred share units. The total return swap has a re-investment feature which increases the number of Shares in the swap when dividends are paid by the Company. As at December 29, 2019 the Company held a position of 232,995 Shares at a weighted average price of C$31.99. The Company does not apply hedge accounting to these derivative instruments and as such, gains and losses arising from marking these derivatives to market are recognized in net earnings in the period in which they arise.

Foreign currency risk

The United States dollar is the Company's functional currency. Fluctuations in the exchange rate between the United States dollar, Canadian dollar and GBP will affect the Company's reported results. However, the impact of changes in foreign exchange rates on the Company's reported results differ over time depending on whether the Company is generating a net cash inflow or outflow of Canadian dollars and GBP. This is largely dependent on the Company's revenue mix by currency as operating costs denominated in Canadian dollars and GBP have been historically relatively stable.

During Fiscal 2019, the Company generated a net outflow of Canadian dollars. As a matter of policy, the Company enters into foreign exchange forward contracts to protect the expected net Canadian dollar exposure from exchange fluctuation. The Company recorded a net realized foreign exchange gain of $1.0 million during Fiscal 2019 (Fiscal 2018: loss of $5.8 million). This was comprised of a $1.8 million gain on settlement of foreign exchange contracts and a $0.8 million foreign currency loss on translation of Canadian dollar denominated working capital and dividends.

At December 29, 2019, the Company had $216.4 million of foreign exchange forward contracts to buy currencies in which the Company operates with U.S. dollars, Canadian dollars, or GBP. These foreign exchange contracts range in expiry dates from January 2020 to November 2020. The related liability of $3.7 million (December 30, 2018: $1.5 million liability) is recorded on the consolidated statements of financial position as a current derivative financial instruments liability and the corresponding change in the fair value of the foreign exchange forward contracts is recorded in the consolidated statements of net earnings and total comprehensive income.

Currency risk is the risk that the fair value of future cash flows of a financial instrument will fluctuate because of changes in foreign exchange rates. The Company is exposed to currency risk, primarily Canadian dollar balances. As an illustration, at December 29, 2019 if the Canadian dollar had weakened 10 percent against the U.S. dollar, with all other variables held constant, net earnings for Fiscal 2019 would have been lower by $3.2 million (Fiscal 2018: $1.3 million). Conversely, if the Canadian dollar had strengthened 10 percent against the U.S. dollar, with all other variables held constant, net earnings would have been higher by $3.9 million for Fiscal 2019 (Fiscal 2018: $1.5 million).

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT(Continued)

Liquidity management

The Company's approach to managing liquidity risk is to ensure, as far as possible, that it will always have sufficient liquidity to meet liabilities when due. At December 29, 2019, the Company had a cash balance of $28.2 million (December 30, 2018: $10.8 million), the $1.056 billion under the Credit Facility due in 2024 (December 30, 2018: $641.6 million) and $12.8 million of outstanding letters of credit (December 30, 2018: $13.8 million). In addition, there are $38.3 million of the letters of credit outstanding outside of the Credit Facility. The unsecured Credit Facility has a total borrowing limit of $1.250 billion, which includes a $100 million letter-of-credit facility and a $250 million accordion feature. The liquidity position as at December 29, 2019 is $209.3 million.

The Company's principal sources of funds are cash generated from its operating activities, share issuances and borrowing capacity remaining under the Credit Facility. Management believes these sources of funds will provide NFI with sufficient liquidity and capital resources to meet its current and future financial obligations as they come due, as well as to provide funds for its financing requirements, capital expenditures and other needs for the foreseeable future.

The following table outlines the maturity analysis of the undiscounted cash flows of certain non-financial liability and committed leases as at December 29, 2019:

US dollars in thousands	Total	2020	2021	2022	2023	2024	Post 2024
Leases	211,101	23,271	21,886	19,666	16,539	12,489	117,250
Accrued benefit liability	3,936	3,936	—	—	—	—	—
	$ 215,037	$ 27,207	$ 21,886	$ 19,666	$ 16,539	$ 12,489	$ 117,250

Credit risk

Financial instruments which potentially subject the Company to credit risk and concentrations of credit risk consist principally of cash, accounts receivable and derivative financial instruments. Management has assessed that the credit risk associated with accounts receivable is mitigated by the significant proportion for which the counterparties are well-established transit authorities.

Additionally, up to 80% of the capital cost of new transit buses and coaches sold to public transit authorities and municipalities typically come from the U.S. Federal Transit Administration, while the remaining 20% comes from state and municipal sources. The maximum exposure to the risk of credit for accounts receivable corresponds to their book value. Historically, the Company has experienced nominal bad debts as a result of the customer base being principally comprised of municipal and other local transit authorities. During Fiscal 2019, the Company recorded a bad debt expense of $177 as compared to $184 bad debt expense in Fiscal 2018.

The carrying amount of accounts receivable is reduced through the use of an allowance account and the amount of the loss is recognized in the consolidated statements of net earnings and total comprehensive income within "sales, general and administration costs and other operating expenses". When a receivable balance is considered uncollectible, it is written off against the allowance for doubtful accounts. Subsequent recoveries of amounts previously written off are credited against "sales, general and administration costs and other operating expenses":

	December 29, 2019	December 30, 2018
Current, including holdbacks	$ 482,476	$ 358,729
Past due amounts but not impaired		
1 – 60 days	37,413	24,153
Greater than 60 days	6,800	4,830
Less: Allowance for doubtful accounts	(284)	(226)
Total accounts receivables, net	$ 526,405	$ 387,486

As at December 29, 2019, there was no amount that would otherwise be past due or impaired whose terms have been renegotiated.

The counterparties to the Company's derivatives are significant financial institutions. The Company could be exposed to loss in the event of non-performance by the counterparty; however, credit ratings and concentration of risk of the financial institutions are monitored on a regular basis.

There are certain financial covenants under the Credit Facility that must be maintained. These financial covenants include an interest coverage ratio and total leverage ratio. The maximum total leverage ratio under the Credit Facility is 3.75 and increases to 4.25 for one year following a material acquisition. The acquisition of ADL on May 28, 2019 was a material acquisition. The terms of the Credit Facility

21. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT(Continued)

provide relief from the impact of changes in accounting policies, including the impact of IFRS 16. At as December 29, 2019, the Company was in compliance with the ratios. The results of the financial covenants tests as of such date are as follows:

	December 29, 2019	December 30, 2018
Total Leverage Ratio (must be less than 4.25 for one year following a material acquisition)	3.24	2.09
Interest Coverage Ratio (must be greater than 3.00)	7.73	13.39

Under the Credit Facility, the total leverage ratio is 3.75 and increases to 4.25 for one year, in the event of a material acquisition. The acquisition of ADL is considered material. The interest coverage ratio remains unchanged.The terms of the Credit Facility provide relief for changes in accounting requirements.

Compliance with financial covenants is reported quarterly to the Board. Other than the requirements imposed by borrowing agreements, the Company is not subject to any externally imposed capital requirements. Capital management objectives are reviewed on an annual basis or when strategic capital transactions arise.

(d) Capital management

The Company's objectives in managing capital are to deploy capital to provide an appropriate return to shareholders and to maintain a capital structure that provides the flexibility to take advantage of growth and development opportunities, maintain existing assets, meet financial obligations and enhance the value of the Shares. The capital structure of the Company consists of cash, long-term debt, other long-term liabilities and shareholders' equity. The Company manages capital to ensure an appropriate balance between debt and equity. In order to maintain or adjust its capital structure, the Company may issue additional Shares, repurchase Shares, borrow additional funds or refinance debt at different terms and conditions.

22. SEGMENT INFORMATION

The Company has two reportable segments which are the Company's strategic business units: bus, coach and medium-duty and cutaway manufacturing operations ("Manufacturing Operations") and Aftermarket Operations. The strategic business units offer different products and services, and are managed separately because they require different technology and marketing strategies. For each of the strategic business units, the Company's President and CEO reviews internal management reports on a monthly basis.

The Manufacturing Operations segment derives its revenue from the manufacture, service and support of new transit buses, coaches, medium-duty and cutaway buses. Based on management's judgment and applying the aggregation criteria in IFRS 8.12, the Company's transit bus, motor coach and medium-duty and cutaway operations fall under a single reportable segment. Aggregation of these operating segments is based on the segments having similar economic characteristics with similar long-term average returns, products and services, production methods, distribution, geographic market and regulatory environment.

The Manufacturing Operations segment has recorded vendor rebates of $413 (2018: $235), which have been recognized into earnings during 2019, but for which the full requirements for entitlement to these rebates have not yet been met.

The Aftermarket Operations segment derives its revenue from the sale of aftermarket parts for transit buses and motor coaches and medium-duty and cutaway buses.

In 2018 the MCI service function, comprised of technical service management and customer training, which was previously managed by the MCI aftermarket operations, was moved to the coach manufacturing operations. To improve the comparability between periods, the related prior year segment information has been restated to reflect these changes.

There is no inter-segment revenue. Unallocated items in the consolidated earnings before income taxes primarily include unrealized foreign exchange gains or losses, interest and finance costs and corporate overhead costs.

The unallocated total assets of the Company primarily include cash, certain goodwill and intangible assets, derivative financial instruments and deferred income tax assets. Corporate assets that are shared by both operating segments are allocated fully to the Manufacturing Operations segment.

Segment information about profits and assets is as follows:

22. SEGMENT INFORMATION (Continued)

	Fiscal 2019			
	Manufacturing Operations	Aftermarket Operations	Unallocated	Total
Revenue from external customers	$ 2,476,020	$ 417,416	—	$ 2,893,436
Operating costs and expenses	2,350,710	353,805	89,226	2,793,741
Earnings (loss) before income tax expense	125,310	63,611	(89,226)	99,695
Total assets	2,268,805	421,693	261,384	2,951,882
Addition of capital expenditures	36,195	1,380	—	37,575
Addition of goodwill and intangibles assets	250,174	25,674		327,891
Goodwill	416,934	151,974	—	568,908

Goodwill and intangible assets related to acquisition of ADL have been provisionally allocated as at December 29,2019.

In 2019 Q3 the company reallocated Goodwill between Manufacturing and Aftermarket based on changes within the business. The impact of the change is an increase in Goodwill in Aftermarket and a decrease in Manufacturing of $20.5 million.

	Fiscal 2018			
	Manufacturing Operations	Aftermarket Operations	Unallocated	Total
Revenue from external customers	$ 2,141,867	$ 377,154	—	2,519,021
Operating costs and expenses	1,935,186	310,864	62,318	2,308,368
Earnings (loss) before income tax expense	206,681	66,290	(62,318)	210,653
Total assets	1,422,771	403,336	248,030	2,074,137
Addition of capital expenditures	66,720	4,271	—	70,991
Addition of goodwill and intangibles assets	50	—	—	50
Goodwill	304,804	131,474	—	436,278

The Company's revenue by geography is summarized below:

	Fiscal 2019	Fiscal 2018
North America	$ 2,508,199	$ 2,519,021
UK and Europe	320,116	—
Asia Pacific	63,703	—
Other	1,418	—
Total	$ 2,893,436	$ 2,519,021

The Company had no customers in Fiscal 2019 or Fiscal 2018 with revenue greater than 10% of the Company's revenue.

The Company's disaggregated manufacturing revenue by major product type is provided below. The Aftermarket operations revenue does not have similarly disaggregated categories.

	Fiscal 2019	Fiscal 2018
Transit buses	$ 1,847,126	$ 1,502,115
Motor coaches	526,539	537,159
Medium-duty and cutaway buses	49,816	41,770
Pre-owned coach	45,951	46,284
Fiberglass reinforced polymer components	6,588	14,539
Manufacturing revenue	$ 2,476,020	$ 2,141,867

22. SEGMENT INFORMATION (Continued)

The allocation of property, plant and equipment to geographic areas is as follows:

	December 29, 2019	December 30, 2018
North America	$ 224,085	$ 247,943
UK and Europe	43,623	—
Asia Pacific	1,040	—
Other	—	—
Total	$ 268,748	$ 247,943

23. RELATED PARTY TRANSACTIONS

Compensation of key management

Key management includes the roles of the Board, President and CEO, the CFO, Presidents of each business unit, executive vice presidents and vice presidents. The compensation expense for key management for employee services is shown below:

	Fiscal 2019	Fiscal 2018
Salaries and short-term employee benefits	$ 8,333	$ 10,294
Post-employment benefits	414	396
Share-based payment benefits	1,433	1,352
	$ 10,180	$ 12,042

Share-based payment benefits shown above represent the PSU, RSU, Director RSU, DSU and stock option expense that was recorded in the period.

24. COMMITMENTS AND CONTINGENCIES

(a) In the normal course of business, the Company receives notice of potential legal proceedings or is named as a defendant in legal proceedings, including those that may be related to product liability, wrongful dismissal or personal injury. Many claims are covered by the Company's insurance policies and management does not expect any of the current claims to have a material adverse effect on the Company’s financial position, results of operations or cash flows.

(b) Through the normal course of operations, the Company has indemnified the surety companies providing surety bonds required under various contracts with customers. In the event that the Company fails to perform under a contract and the surety companies incur a cost on a surety bond, the Company is obligated to repay the costs incurred in relation to the claim up to the value of the bond.

The Company's guarantee under each bond issued by the surety companies expires on completion of obligations under the customer contract to which the bond relates. The estimated maturity dates of the surety bonds outstanding at December 29, 2019 range from January 2020 to December 2026.

At December 29, 2019, outstanding surety bonds guaranteed by the Company totaled $384.5 million (December 30, 2018: $394.4 million). The Company has not recorded any liability under these guarantees, as management believes that no material events of default exist under any contracts with customers.

(c) The Company has a letter of credit sub-facility of $100.0 million as part of the Credit Facility (December 30, 2018: $100.0 million). As at December 29, 2019, letters of credit totaling $12.8 million (December 30, 2018: $13.8 million) remain outstanding as security for contractual obligations of the Company under the Credit facility.

24. COMMITMENTS AND CONTINGENCIES (Continued)

	December 29, 2019	December 30, 2018
Collateral to secure operating facility leases	$ 329	$ 315
Collateral to secure line of credit	6,700	6,700
Customer performance guarantees	655	1,099
Collateral for self-insured workers compensation and general liability obligations	5,155	5,655
	$ 12,839	$ 13,769

The Company has an additional bi-lateral credit facility of $63.6 million. As at December 29, 2019, letters of credit totaling $23.8 million were outstanding under the bi-lateral credit facility. Additionally, there are $14.5 million of letters of credit outstanding outside of the Credit Facility and the bi-lateral credit facility.

As at December 29, 2019, management believes that the Company was in compliance in all material respects with all applicable contractual obligations and the Company has not provided for any costs associated with these letters of credit.

25. GUARANTEES

The Company indemnifies its directors and officers against claims and damages that may be incurred in the performance of their services to the Company. Liability insurance has been purchased with respect to the Company's directors and officers.

26. SUPPLEMENTARY EXPENSE INFORMATION

	Fiscal 2019	Fiscal 2018
Employee benefit expense	$ 445,167	$ 365,142
Depreciation of plant and equipment	61,985	32,840
Amortization of intangible assets	42,585	34,956

The expenses listed above are included in cost of sales and sales, general and administration costs and other operating expenses.

27. COMPARATIVE FIGURES

Certain comparative figures have been restated where necessary to conform with current period presentation.

March 13, 2019

MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS FOR THE 13-WEEKS AND 52-WEEKS ENDED DECEMBER 30, 2018

Information in this Management's Discussion and Analysis ("MD&A") relating to the financial condition and results of operations of NFI Group Inc., formerly "New Flyer Industries Inc." ("NFI") is supplemental to, and should be read in conjunction with, NFI's audited consolidated financial statements (including notes) (the "Financial Statements") for the 13-week period and the 52-week period ended December 30, 2018.

This MD&A contains forward-looking statements, which are subject to a variety of factors that could cause actual results to differ materially from those contemplated by the forward-looking statements. See "Forward-looking Statements". Some of the factors that could cause results or events to differ from current expectations include, but are not limited to, the factors described in the public filings of NFI available on SEDAR at www.sedar.com. The Financial Statements have been prepared in accordance with International Financial Reporting Standards ("IFRS") and, except where otherwise indicated, are presented in U.S. dollars, which is the functional currency of NFI. Unless otherwise indicated, the financial information contained in this MD&A has been prepared in accordance with IFRS and references to "$" or "dollars" mean U.S. dollars.

QUARTERLY AND ANNUAL REPORTING PERIODS

The quarterly and annual reporting periods for the current and prior year are as follows.

	Period from January 1, 2018 to December 30, 2018 ("Fiscal 2018")			Period from January 2, 2017 to December 31, 2017 ("Fiscal 2017")		
		Period End Date	# of Calendar Weeks		Period End Date	# of Calendar Weeks
Quarter 1	April 1, 2018	("2018 Q1")	13	April 2, 2017	("2017 Q1")	13
Quarter 2	July 1, 2018	("2018 Q2")	13	July 2, 2017	("2017 Q2")	13
Quarter 3	September 30, 2018	("2018 Q3")	13	October 1, 2017	("2017 Q3")	13
Quarter 4	December 30, 2018	("2018 Q4")	13	December 31, 2017	("2017 Q4")	13
Fiscal year	December 30, 2018		52	December 31, 2017		52

MEANING OF CERTAIN REFERENCES

References in this MD&A to the "Company" are to NFI and all of its direct or indirect subsidiaries, including New Flyer Industries Canada ULC ("NFI ULC"), New Flyer of America Inc. ("NFAI"), The Aftermarket Parts Company, LLC ("TAPC"), TCB Enterprises, LLC ("TCB"), KMG Fabrication, Inc. ("KMG"), Carfair Composites Inc. ("CCI") and Carfair Composites USA, Inc. ("CCUI", and together with "CCI", "Carfair"), The Reliable Insurance Company Limited, ARBOC Specialty Vehicles, LLC ("ARBOC"), New MCI Holdings, Inc. and its affiliated entities (collectively, "MCI") and NFI Holdings Luxembourg s.a.r.l. References to "New Flyer" generally refer to NFI ULC, NFAI, TAPC, KMG, CCI, CCUI and TCB. References in this MD&A to "management" are to senior management of NFI and the Company.

The common shares of NFI ("Shares") are traded on the Toronto Stock Exchange ("TSX") under the symbol "NFI". As at December 30, 2018, 61,832,625 Shares were issued and outstanding. Additional information about NFI and the Company, including NFI's annual information form, is available on SEDAR at www.sedar.com.

A "motor coach" or "coach" is a 35-foot to 45-foot over-the-highway bus typically used for intercity transportation and travel over longer distances than heavy-duty transit buses, and is typically characterized by (i) two axles in the rear (related to the weight of the vehicle), (ii) high deck floor, (iii) baggage compartment under the floor, (iv) high-backed seats with a coach-style interior (often including a lavatory and underfloor baggage compartments), and (v) no room for standing passengers. ARBOC manufactures body-on-chassis or "cutaway" and "medium-duty" buses that service transit, paratransit, and shuttle applications. Buses manufactured by New Flyer are classified as "transit buses". Collectively, transit buses, medium-duty buses and cutaways, are referred to as "buses".

All of the data presented in this MD&A with respect to market share, the number of transit buses, medium-duty buses, cutaways and motor coaches in service and delivered, is measured in, or based on, "equivalent units". One equivalent unit (or "EU") represents one 30-foot, 35-foot, 40-foot or 45-foot heavy-duty transit bus, one medium-duty bus, one cutaway bus or one motor coach, whereas one articulated transit bus represents two equivalent units. An articulated transit bus is an extra long transit bus (approximately 60-feet in length), composed of two passenger compartments connected by a joint mechanism. The joint mechanism allows the vehicle to bend when the bus turns a corner, yet have a continuous interior.

Forward-looking Statements

Certain statements in this MD&A are “forward-looking statements”, which reflect the expectations of management regarding the Company's future growth, results of operations, performance and business prospects and opportunities. The words “believes”, “anticipates”, “plans”, “expects”, “intends”, “projects”, “forecasts”, “estimates” and similar expressions are intended to identify forward-looking statements. These forward-looking statements reflect management's current expectations regarding future events and operating performance and speak only as of the date of this MD&A. Forward-looking statements involve significant risks and uncertainties, should not be read as guarantees of future performance or results, and will not necessarily be accurate indications of whether or not or the times at or by which such performance or results will be achieved. A number of factors could cause actual results to differ materially from the results discussed in the forward-looking statements. Such differences may be caused by factors which include, but are not limited to, availability of funding to the Company's customers to purchase transit buses and coaches and to exercise options and to purchase parts or services at current levels or at all, aggressive competition and reduced pricing in the industry, material losses and costs may be incurred as a result of product warranty issues and product liability claims, changes in Canadian or United States tax legislation, the absence of fixed term customer contracts and the suspension or the termination of contracts by customers for convenience, the current U.S. federal "Buy-America" legislation may change and/or become more onerous, inability to achieve U.S. Disadvantaged Business Enterprise Program requirements, local content bidding preferences and requirements under Canadian content policies may change and/or become more onerous, trade policies in the United States and Canada (including USMCA, tariffs, duties, surtaxes and the Canadian federal Duties Relief Program) may undergo significant change, potentially in a manner materially adverse to the Company, production delays may result in liquidated damages under the Company's contracts with its customers, inability of the Company to execute its planned production targets as required for current business and operational needs, currency fluctuations could adversely affect the Company's financial results or competitive position in the industry, the Company may not be able to maintain performance bonds or letters of credit required by its existing contracts or obtain performance bonds and letters of credit required for new contracts, third party debt service obligations may have important consequences to the Company, the covenants contained in the Company’s senior credit facility could impact the ability of the Company to fund dividends and take certain other actions, interest rates could change substantially and materially impact the Company's profitability, the dependence on limited or unique sources of supply, the timely supply of materials from suppliers, the possibility of fluctuations in the market prices of the pension plan investments and discount rates used in the actuarial calculations will impact pension expense and funding requirements, the Company's profitability and performance can be adversely affected by increases in raw material and component costs, the availability of labor could have an impact on production levels, new products must be tested and proven in operating conditions and there may be limited demand for such new products from customers, the Company may have difficulty selling pre-owned coaches and realizing expected resale values, inability of the Company to successfully execute strategic plans and maintain profitability, development of competitive products or technologies, catastrophic events may lead to production curtailments or shutdowns, dependence on management information systems and risks related to cyber security, dependence on a limited number of key executives who may not be able to be adequately replaced if they leave the Company, employee related disruptions as a result of an inability to successfully renegotiate collective bargaining agreements when they expire, risks related to acquisitions and other strategic relationships with third parties, inability to successfully integrate acquired businesses and assets into the Company’s existing business and to generate accretive effects to income and cash flow as a result of integrating these acquired businesses and assets. NFI cautions that this list of factors is not exhaustive. These factors and other risks and uncertainties are discussed in NFI’s press releases and materials filed with the Canadian securities regulatory authorities which are available on SEDAR at www.sedar.com.

Although the forward-looking statements contained in this MD&A are based upon what management believes to be reasonable assumptions, investors cannot be assured that actual results will be consistent with these forward-looking statements, and the differences may be material. These forward-looking statements are made as of the date of this MD&A and NFI assumes no obligation to update or revise them to reflect new events or circumstances, except as required by applicable securities laws.

DEFINITIONS OF ADJUSTED EBITDA, ROIC, FREE CASH FLOW, ADJUSTED NET EARNINGS AND ADJUSTED EARNINGS PER SHARE

References to “Adjusted EBITDA” are to earnings before interest, income taxes, depreciation and amortization after adjusting for the effects of certain non-recurring and/or non-operations related items that do not reflect the current ongoing cash operations of the Company including: gains or losses on disposal of property, plant and equipment, fair value adjustment for total return swap, unrealized foreign exchange losses or gains on non-current monetary items and forward foreign exchange contracts, costs associated with assessing strategic and corporate initiatives, past service costs, non-recurring costs or recoveries relating to business acquisitions, fair value adjustment to acquired subsidiary company's inventory and deferred revenue, proportion of the total return swap realized, equity settled stock-based compensation, gain on bargain purchase of subsidiary company, and provision release related to purchase accounting. “Free Cash Flow” means net cash generated by operating activities adjusted for changes in non-cash working capital items, interest paid, interest expense, income taxes paid, current income tax expense, principal portion of finance lease payments, cash capital expenditures, proceeds from disposition of property, plant and equipment, costs associated with assessing strategic and corporate initiatives, non-recurring transitional costs related to business acquisition, fair value adjustment to acquired subsidiary company's inventory and deferred revenue, defined benefit funding, defined benefit expense, past service costs, gain received on total return

swap, foreign exchange gain (loss) on cash held in foreign currency. References to "ROIC" are to net operating profit after taxes (calculated as Adjusted EBITDA less depreciation of plant and equipment and income taxes at the expected effective tax rate) divided by average invested capital for the last twelve month period (calculated as to shareholders' equity plus long-term debt, obligations under finance leases, other long-term liabilities, convertible debentures and derivative financial instrument liabilities less cash). References to "Adjusted Net Earnings" are to net earnings after adjusting for the after tax effects of certain non-recurring and/or non-operational related items that do not reflect the current ongoing cash operations of the Company including: gains or losses on disposal of property, plant and equipment, unrealized foreign exchange losses or gains on non-current monetary items, fair value adjustment for total return swap, non-recurring transitional costs or recoveries relating to business acquisitions, equity settled stock-based compensation, gain on bargain purchase of subsidiary company, fair value adjustment to acquired subsidiary company's inventory and deferred revenue, past service costs, costs associated with assessing strategic and corporate initiatives and proportion of the total return swap realized. References to "Adjusted Earnings per Share" are to Adjusted Net Earnings divided by the average number of Shares outstanding.

Management believes Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share are useful measures in evaluating the performance of the Company. However, Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share are not recognized earnings measures under IFRS and do not have standardized meanings prescribed by IFRS. Readers of this MD&A are cautioned that ROIC, Adjusted Net Earnings and Adjusted EBITDA should not be construed as an alternative to net earnings or loss or cash flows from operating activities determined in accordance with IFRS as an indicator of NFI's performance, and Free Cash Flow should not be construed as an alternative to cash flows from operating, investing and financing activities determined in accordance with IFRS as a measure of liquidity and cash flows. A reconciliation of net earnings and cash flows to Adjusted EBITDA, based on the Financial Statements, has been provided under the headings "Reconciliation of Net Earnings to Adjusted EBITDA" and "Reconciliation of Cash Flow to Adjusted EBITDA", respectively. A reconciliation of Free Cash Flow to cash flows from operations is provided under the heading "Summary of Free Cash Flow". A reconciliation of net earnings to Adjusted Net Earnings is provided under the heading "Reconciliation of Net Earnings to Adjusted Net Earnings".

NFI's method of calculating Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share may differ materially from the methods used by other issuers and, accordingly, may not be comparable to similarly titled measures used by other issuers. Dividends paid from Free Cash Flow are not assured, and the actual amount of dividends received by holders of Shares will depend on, among other things, the Company's financial performance, debt covenants and obligations, working capital requirements and future capital requirements, all of which are susceptible to a number of risks, as described in NFI's public filings available on SEDAR at www.sedar.com.

Business Overview

The Company is North America's largest bus and coach manufacturer and parts distributor providing a comprehensive suite of mass transportation solutions under brands: New Flyer® (heavy-duty transit buses), ARBOC® (low-floor cutaway and medium-duty buses), MCI® (motor coaches), NFI Parts™ (parts, support, and service) and Carfair® (fibre-reinforced plastic and composites). The Company has over 6,000 team members, operating from 31 facilities across Canada and the United States, and can trace its roots back to 1930.

On May 14, 2018, the articles of incorporation of New Flyer Industries Inc. were amended to change the name to "NFI Group Inc.". The Company believes the new name better reflects the multi-platform nature of its business.

The Company's buses incorporate the widest range of drive systems available including: clean diesel, natural gas, diesel-electric hybrid, and zero-emission electric (trolley, battery, and fuel cell) on proven bus platforms. It also supports infrastructure development through New Flyer Infrastructure Solutions™, a service dedicated to providing safe and reliable charging and mobility solutions.

In total, the Company supports over 74,000 buses and coaches currently in service across North America. The Company's Shares are traded on the Toronto Stock Exchange under the symbol NFI.

New Flyer is North America's heavy-duty transit bus leader and offers the most advanced product line under the Xcelsior® and Xcelsior CHARGE™ brands. New Flyer actively supports over 41,000 heavy-duty transit buses (New Flyer, NABI, and Orion) currently in service, of which 7,300 are powered by electric motors and battery propulsion and 1,600 are zero-emission.

MCI is North America's public and private market motor coach leader, building the J4500 (the industry's best-seller for 13 consecutive years), the all-new 35-foot J3500 model, and the workhorse D-Series including the breakthrough ADA-accessible MCI D45 Commuter Rapid Transit (CRT) Low Entry Commuter Coach offering lower dwell times. With nearly 30,000 MCI coaches on the road, MCI also provides maintenance, repair, 24-hour roadside assistance, parts supply through NFI Parts, and technician training through the industry's only Automotive Service Excellence (ASE) accredited MCI Academy.

ARBOC is North America's low-floor cutaway bus leader serving transit, paratransit, and shuttle applications. With more than 3,000 buses produced, ARBOC leads the low-floor cutaway bus market providing unsurpassed passenger accessibility and comfort. ARBOC also offers the Spirit of Equess® ("Equess"), Spirit of Liberty® and Spirit of America® medium-duty buses for transit and shuttle applications.

NFI Parts is North America's most comprehensive bus and motor coach parts organization, providing replacement parts, technical publications, training, service, and support.

Carfair is a leader in fibre-reinforced plastic ("FRP") composites manufacturing and has over 700 dedicated team members located in facilities in Canada and the U.S. As a comprehensive manufacturer of engineered composite products, Carfair supplies to original equipment manufacturers ("OEM") in agriculture, construction, transportation, commercial, and medical industries, and is primarily focused on supplying NFI Group companies. Carfair brings together the strength of historic North American composite leaders formerly known as Carlson Composites, Frank Fair Industries and Sintex-Wausaukee Composites.

2018 Fourth Quarter Financial Results

Year-over-year comparisons reported in this MD&A compares 2018 Q4 to 2017 Q4 and Fiscal 2018 to Fiscal 2017. Organizational changes to better align business functions within operating segments were made effective January 2, 2017. These organizational changes were implemented in two phases. In 2017, over-the-counter parts sales were moved from manufacturing operations to aftermarket operations. In 2018 the MCI service function, comprised of technical service management and customer training, which was previously managed by the MCI aftermarket operations, was moved to the coach manufacturing operations. To improve the comparability between periods, the related prior year segment information has been restated to reflect these changes.

On December 1, 2017, the Company acquired ARBOC. To enhance comparability between the periods, proforma results for 2017 Q4 and Fiscal 2017 are provided. If ARBOC had been acquired on January 2, 2017, the unaudited consolidated pro forma revenue, Adjusted EBITDA and deliveries for 2017 Q4 and Fiscal 2017 would have been as follows:

Revenue - Manufacturing Segment Only (Unaudited Quarterly Results, U.S. dollars in millions)	**2017 Q4**	**Fiscal 2017**
ARBOC cutaway buses revenue	$ 7.7	$ 35.2
NFI's manufacturing revenue, excluding ARBOC	560.8	2,010.3
NFI's pro forma revenue	$ 568.5	$ 2,045.5

Adjusted EBITDA - Manufacturing Segment Only (Unaudited, U.S. dollars in thousands)	**2017 Q4 (restated)**	**Fiscal 2017**
ARBOC's pro forma manufacturing Adjusted EBITDA[(1)]	1,470	8,435
NFI's manufacturing Adjusted EBITDA, excluding ARBOC	72,332	237,945
NFI pro forma manufacturing Adjusted EBITDA	$ 73,802	$ 246,380
NFI pro forma Adjusted EBITDA per EU	$ 65.5	$ 59.2

Deliveries	**2017 Q4**	**2017 YTD**
ARBOC cutaway sales (EUs)	86	364
NFI new transit bus and coach	1,041	3,801
Total pro forma deliveries	1,127	4,165

[(1)] ARBOC's prior definition of Adjusted EBITDA excluded product development costs as a majority of these costs related to the continued development of its medium-duty bus. Subsequent to the December 1, 2017 acquisition date, ARBOC treats all development costs in accordance with NFI's definition of Adjusted EBITDA.

Deliveries (EUs) (Unaudited)	**2018 Q4**	**2017 Q4**	**Fiscal 2018**	**Fiscal 2017**
Transit buses	679	695	2,781	2,730
Motor coaches	341	346	1,030	1,071
Medium-duty and cutaway buses	106	27	502	27
New transit bus, coach and cutaway	1,126	1,068	4,313	3,828
Pre-owned coach	187	146	468	410
Average EU selling price[(1)] (Unaudited, U.S. dollars in thousands)				
Transit buses	$ 556.5	$ 512.3	$ 540.1	$ 507.8
Motor coaches	516.2	528.2	521.5	532.8
Medium-duty and cutaway buses	88.9	85.0	83.2	85.0
New transit bus, coach and cutaway	$ 500.3	$ 506.6	$ 482.5	$ 511.8
Pre-owned coaches	$ 58.7	$ 137.5	$ 98.9	$ 123.0

[(1)] Average EU selling prices vary based on customization and options selected on units delivered and does not represent equivalent changes in margins related to the product lines noted above.

Consolidated Revenue (Unaudited Quarterly Results, U.S. dollars in millions)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Transit buses	$ 377.9	$ 356.1	$ 1,502.1	$ 1,386.3
Motor coaches	176.0	182.7	537.2	570.7
Medium-duty and cutaway buses	9.4	2.3	41.8	2.3
New transit bus, coach and cutaway	563.3	541.1	2,081.1	1,959.3
Pre-owned coach	11.0	20.1	46.3	50.4
Fiberglass reinforced polymer components	2.2	2.0	14.5	3.0
Manufacturing	576.5	563.2	2,141.9	2,012.7
Aftermarket	85.5	91.4	377.1	369.2
Total Revenue	$ 662.0	$ 654.6	$ 2,519.0	$ 2,381.9

Manufacturing revenue for 2018 Q4 increased by $13.3 million, or 2.4% compared to 2017 Q4. Transit bus revenues increased by $21.8 million primarily due to higher average selling prices in the 2018 Q4 compared to 2017 Q4. Also contributing to the increase is the full-quarter revenue from ARBOC in 2018 Q4 compared to one-month in 2017 Q4 which resulted in a $7.1 million increase in revenues. These increases were partially offset by lower revenues related to new and pre-owned coaches, primarily due to lower average selling prices.

Manufacturing revenue for Fiscal 2018 increased by $129.2 million, or 6.4% compared to Fiscal 2017, primarily due to higher Transit bus revenues of $116.0 million primarily due to higher selling prices and volume increases in Fiscal 2018 compared to Fiscal 2017. The full-year contribution from ARBOC in Fiscal 2018 compared to one-month in Fiscal 2017 resulted in a $39.5 million increase in revenues. The FRP business also contributed $11.6 million to the revenue increase, primarily as a result of the acquisition of Sintex-Wausaukee Composites Inc. and Carlson Engineered Composites Inc. in 2017. These increases were partially offset by decreases of $33.5 million and $4.2 million from new coach and pre-owned coach businesses. Coach volumes were impacted by management's estimate of a 6.7% decline in motor coach market volume, partially offset by a 2.0% increase in MCI's market share. Lower average selling prices further contributed to the decline. The cancellation of MCI's Distribution Rights Agreement ("DRA") with Daimler for the sale of Setra motor coaches also contributed to the decrease in new coach revenue by $7.7 million.

Revenue from aftermarket operations in 2018 Q4 decreased by $5.9 million, or 6.5% compared to 2017 Q4. The decrease is primarily due to the impact of the cancellation of the DRA of $1.2 million and lower volumes and margins. Fiscal 2018 revenue increased by $7.9 million, or 2.1%, compared to Fiscal 2017. The Fiscal 2018 increase is primarily due to increased volumes during the year and the full-year impact of ARBOC parts sales. These increases are partially offset by the impact of the cancellation of the DRA of $2.7 million.

Adjusted EBITDA (Unaudited, U.S. dollars in millions)	2018 Q4	2017 Q4 (restated)	Fiscal 2018	Fiscal 2017 (restated)
Manufacturing	62.6	72.6	241.7	238.2
Aftermarket	17.3	17.9	73.7	79.8
Total Adjusted EBITDA	$ 79.9	$ 90.5	$ 315.4	$ 318.0
Adjusted EBITDA % of revenue				
Manufacturing	11.1%	12.9%	11.3%	11.8%
Aftermarket	20.2%	19.6%	19.5%	21.6%
Total	12.1%	13.8%	12.5%	13.4%

Manufacturing Adjusted EBITDA per new EU delivered (Unaudited, U.S. dollars in millions)	2018 Q4	2017 Q4 (restated)	Fiscal 2018	Fiscal 2017 (restated)
Manufacturing Adjusted EBITDA	62.6	72.6	241.7	238.2
New transit bus, coach and cutaway deliveries (EUs)	1,126	1,068	4,313	3,828
Manufacturing Adjusted EBITDA per new EU delivered (in thousands)	$ 55.6	$ 68.0	$ 56.0	$ 62.2

Consolidated Adjusted EBITDA for 2018 Q4 decreased by $10.6 million, or 11.7% compared to 2017 Q4. Fiscal 2018 decreased by $2.6 million, or 0.8% compared to Fiscal 2017.

The 2018 Q4 manufacturing Adjusted EBITDA decreased by $10.0 million or 13.7% compared to 2017 Q4. The decrease is primarily due to lower new coach and transit bus volumes and continued pricing pressures on new and pre-owned coach sales. Startup costs related

to the Shepherdsville facility resulted in a negative Adjusted EBITDA impact of $3.4 million in 2018 Q4 compared to 2017 Q4. These decreases were partially offset by improved margins from transit buses in 2018 Q4 compared to 2017 Q4.

The Fiscal 2018 manufacturing Adjusted EBITDA increased by $3.5 million, or 1.5%, compared to Fiscal 2017. The increase is primarily due to the higher volumes for transit buses and the $9.2 million increase from full year results of ARBOC (which was acquired in December 2017). These increases were partially offset by losses related to Sintex-Wausaukee Composites Inc., the $0.9 million impact of the cancellation of the DRA on the pre-owned coach business and continued volume and pricing pressures on new coach sales. Coach volumes were impacted by management's estimate of a 6.7% decline in motor coach market volume, partially offset by a 2.0% increase in MCI's market share. Startup costs related to the Shepherdsville facility resulted in a negative Adjusted EBITDA impact of $6.6 million in Fiscal 2018 compared to Fiscal 2017.

The 2018 Q4 and Fiscal 2018 aftermarket Adjusted EBITDA decreased by $0.5 million compared to 2017 Q4. The decrease is primarily due to lower volumes and margins in 2018 Q4 compared to 2017 Q4, partially offset by lower selling, general and administrative expenses. The $6.1 million decrease in Adjusted EBITDA in Fiscal 2018 compared to Fiscal 2017 is primarily due to lower margins. The impact of the cancellation of the DRA for 2018 Q4 and Fiscal 2018 also resulted in a decrease to Adjusted EBITDA of $0.6 million and $1.2 million, respectively. Aftermarket sales and margins vary period-to-period due to the transactional nature of the business.

(Unaudited Quarterly Results, U.S. dollars in millions)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Net earnings	$ 42.8	$ 76.1	$ 159.9	$ 191.4
Adjusted net earnings	43.2	80.4	166.9	192.9
Net earnings per share	$ 0.69	$ 1.21	$ 2.56	$ 3.06
Adjusted earnings per share	$ 0.69	$ 1.28	$ 2.68	$ 3.09

Net earnings during 2018 Q4 decreased by $33.3 million, or 43.8% compared to 2017 Q4. The same factors that caused a decrease to Adjusted EBITDA discussed above also led to a decrease in net earnings. Additionally, higher income tax expense of $16.9 million, interest expense of $7.5 million and depreciation of $2.0 million further reduced net earnings in 2018 Q4 compared to 2017 Q4. The increase in income taxes during 2018 Q4 compared to 2017 Q4 was primarily due to the impact of U.S. tax reforms that occurred in December 2017. The reduction in tax rates resulted in a $9 million income tax recovery in 2017 Q4 which did not recur in 2018 Q4.

Net earnings during Fiscal 2018 decreased by $31.5 million, or 16.5% compared to Fiscal 2017. In addition to the factors negatively impacting Adjusted EBITDA, higher depreciation expense of $10.2 million, interest expense of $9.7 million, past service cost adjustment expense of $6.5 million and foreign exchange translation expense of $3.3 million further contributed to the decrease.

As a result of the decreases discussed above, net earnings per Share for 2018 Q4 and Fiscal 2018 decreased by $0.52 and $0.50, respectively, compared to the same periods in 2017.

Adjusted net earnings during 2018 Q4 and Fiscal 2018 decreased by $37.2 million and $26.0 million compared to 2017 Q4 and Fiscal 2017, primarily for the same reasons noted above with respect to changes in net earnings. The decrease in 2018 Q4 adjusted net earnings excludes the 2017 Q4 costs associated with corporate and strategic initiatives of $2.2 million and gain on bargain purchase of Sintex-Wausaukee Composites Inc. in 2017 Q4, both of which did not recur. The Fiscal 2018 Adjusted net earnings included a $4.9 million negative impact relating to past service cost adjustment, which did not occur in 2017.

As a result of the decreases discussed above, adjusted Earnings per Share in 2018 Q4 and Fiscal 2018 decreased by $0.59 and $0.41, respectively, compared to the same periods in 2017.

Free Cash Flow (Unaudited, dollars in millions)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Free Cash Flow (U.S. dollars)	42.4	59.3	159.7	161.2
Free Cash Flow (CAD dollars)	57.9	74.4	210.5	206.9
Declared dividends (CAD dollars)	22.9	20.5	90.3	76.1
Payout Ratio (Declared dividends divided by Free Cash Flow)	39.6%	27.6%	42.9%	36.8%

Free cash flow in 2018 Q4 decreased by $16.9 million, or 28.5%, when compared to 2017 Q4, primarily due to lower earnings from operations. The amount of dividends declared increased by 11.7% in 2018 Q4 compared to 2017 Q4 as a result of increases in the annual dividend rate.

Free cash flow in Fiscal 2018 decreased by $1.6 million or 1.0% when compared to Fiscal 2017. The decrease was primarily due to higher planned capital expenditures during the year and an increase in interest costs partially offset by lower current taxes. The amount of dividends declared increased by 18.7% in Fiscal 2018 as a result of increases in the annual dividend rate.

The Company returned $55.0 million back to shareholders in 2018 Q4 as a result of Share repurchases made under its Normal Course Issuer Bid ("NCIB") and dividends paid, which represents an increase of 235.4% when compared to $16.4 million in 2017 Q4. Similarly the Company returned $134.7 million in Fiscal 2018 which represents an increase of 148.1% when compared to $54.3 million in Fiscal 2017.

The liquidity position of $355.4 million as at December 30, 2018 is comprised of available cash of $10.8 million and $344.6 million available under the new five-year senior unsecured, revolving credit facility entered into on October 25, 2018 (the "Credit Facility") as compared to a liquidity position of $222.3 million at December 31, 2017. The increase in liquidity primarily relates to the new Credit Facility which increased the amount available to be drawn by $175.0 million, partially offset by capital returned to shareholders through dividends, the repurchase of Shares under the NCIB and capital expenditures. Changes in non-cash working capital are primarily a result of seasonality and are expected to be temporary in nature. Management believes these funds, together with Share and debt issuances, other borrowings capacity and the cash generated from the Company's operating activities, will provide the Company with sufficient liquidity and capital resources to meet its current financial obligations as they come due, as well as provide funds for its financing requirements, capital expenditures, dividend payments and other operational needs for the foreseeable future.

Property, Plant and Equipment ("PPE) expenditures (Unaudited Quarterly Results, U.S. dollars in millions)	**2018 Q4**	**2017 Q4**	**Fiscal 2018**	**Fiscal 2017**
PPE expenditures	22.2	24.5	89.4	57.4
Less PPE expenditures funded by capital leases	(2.1)	(3.4)	(18.4)	(4.6)
Cash acquisition of PPE reported on statement of cash flows	20.1	21.1	71.0	52.8

PPE cash expenditures for 2018 Q4 decreased by $1.0 million or 4.7% compared to 2017 Q4. Expenditures for Fiscal 2018 increased by $18.2 million or 34.5% as a result of planned increased investments in facilities, parts fabrication capacity from the Company's new Shepherdsville facility and as a result of insourcing and continuous improvement programs.

Management believes that ROIC is an important ratio and metric that can be used to assess investments against their related earnings and capital utilization. ROIC during Fiscal 2018 was 13.7% as compared to 15.8% for Fiscal 2017. The decrease was primarily a result of material investments made in the Shepherdsville, KY parts fabrication facility and renovations and expansion of the Anniston, AL facility which are not expected to generate benefits until 2019. As previously discussed, these investment negatively affected Adjusted EBITDA.

(Unaudited, U.S. dollars in thousands)	**December 30, 2018**	**December 31, 2017**
Total assets	2,074.1	1,974.6
Total long-term liabilities	828.3	783.6
ROIC LTM[1, 2]	13.7%	15.8%

(1) Adjusted EBITDA and ROIC are not recognized earnings measures and do not have standardized meanings prescribed by IFRS. Therefore, Adjusted EBITDA and ROIC may not be comparable to similar measures presented by other issuers. See "Definitions of Adjusted EBITDA, ROIC, Free Cash, Adjusted Net Earnings and Adjusted Net Earnings per share" above. Management believes that Adjusted EBITDA and ROIC are useful supplemental measures in evaluating performance of NFI.

(2) The effective tax rate ("ETR") used in the ROIC calculation at December 30, 2018 was 31%. The ETR used in the ROIC calculation at December 31, 2017 was 35%.

2018 Fourth Quarter Order Activity

Demand for Transit Buses and Motor Coaches

The Company's "Bid Universe" metric estimates active public competitions in Canada and the United States and attempts to provide an overall indication of anticipated heavy-duty transit bus and motor coach public sector market demand. It is a point-in-time snapshot of: (i) EUs in active competitions, defined as all requests for proposals received by the Company and in process of review plus bids submitted by the Company and awaiting customer action, and (ii) management's forecast, based on data provided by operators, of expected EUs to be placed out for competition over the next five years.

	Bids in Process (EUs)	Bids Submitted (EUs)	Active EUs	Forecasted Industry Procurement over 5 Years (EUs)[1]	Total Bid Universe (EUs)
2017 Q4	3,091	1,687	4,778	16,406	21,184
2018 Q1	2,974	3,479	6,453	17,186	23,639
2018 Q2	1,319	2,391	3,710	18,440	22,150
2018 Q3	955	2,323	3,278	18,084	21,362
2018 Q4	**670**	**2,061**	**2,731**	**20,694**	**23,425**

(1) Management's estimate of anticipated expected future industry procurement over the next five years is based on direct discussions with select U.S. and Canadian transit authorities.

Procurement of transit buses and motor coaches by the public sector is typically accomplished through formal multi-year contracts, while procurement by the private sector is typically made on a transactional basis. As a result, the Company does not maintain a Bid Universe for private sector buses and coaches.

The sale of cutaway and medium-duty buses manufactured by ARBOC is accomplished on a transactional purchase order basis through non-exclusive third party dealers who hold contracts directly with the customers. Bids are submitted by and agreements are held with a network of dealers. Cutaway and medium-duty bus activity therefore, is not included in the Bid Universe metric.

Order activity

New orders (firm and options) during 2018 Q4 totaled 857 EUs. The new firm and option orders awarded to the Company for 2018 Q4 LTM were 3,763 EUs. The Company was also successful at converting 575 EUs of options during 2018 Q4 to firm orders, which contributed to the 1,795 EUs of options converted to firm orders in Fiscal 2018.

	New Orders in Quarter (Firm and Option EUs)	LTM New Orders (Firm and Option EUs)	Option Conversions in Quarter (EUs)	LTM Option Conversions (EUs)
2017 Q4	2,520	5,820	238	1,404
2018 Q1	736	5,848	441	1,627
2018 Q2	1,413	6,303	505	1,743
2018 Q3	757	5,426	274	1,458
2018 Q4	**857**	**3,763**	**575**	**1,795**

Options

In 2018 Q4, one option EU expired, compared to 288 option EUs that expired during the 2018 Q3.

A significant number of public transit contracts have a term of five years. The table below shows the number of option EUs that have either expired or have been exercised annually over the past five years, as well as the current backlog of options that will expire each year if not exercised.

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
A) Options Expired (EUs)	965	504	550	331	741						3,091
B) Options Exercised (EUs)	1,149	1,339	2,064	1,404	1,795						7,751
C) Current Options by year of expiry (EUs)						1,243	1,031	1,633	2,335	942	7,184
D) Conversion rate % = B / (A+B)	**54%**	**73%**	**79%**	**81%**	**71%**						

The Company's conversion rate is lower in Fiscal 2018 compared to Fiscal 2017. The decrease was primarily driven by expired five-year contracts with three customers who no longer required the contracted specific size/propulsion configurations, and who were not permitted to assign the options to other transit agencies due to the amendment to U.S. Federal Transit Administration ("FTA") guidelines which went into effect after the contracts were awarded.

In addition to contracts for identified public customers, the Company has focused on state procurements and cooperative purchasing agreements, with the objective of having available schedules from which customers within a prescribed region can purchase. The Company has successfully bid and been named on several state contracts. These contracts, however, are not recorded in backlog as they do not have defined quantities allocated to the Company or any other OEM.

The Company's Fiscal 2018 Book-to-Bill ratio (defined as new firm and option orders divided by new transit bus, medium-duty, cutaways and coach deliveries) was 87%, down from 152% in Fiscal 2017. The Book-to-Bill ratio in the second half of Fiscal 2018 was impacted by a higher number of smaller individual transactions and by delayed bid activity for multi-year contracts. Management believes transit agencies' assessment of future battery-electric vehicle adoption as a component of their overall fleet renewal strategies contributed to the delays in releasing multi-year procurements.

In addition, 589 EUs of new firm and option orders were pending from customers at the end Fiscal 2018, where approval of the award to the Company had been made by the customer's board, council, or commission, as applicable, but purchase documentation had not yet been received by the Company and therefore not yet included in the backlog.

Backlog

The Company's total backlog consists of transit buses sold primarily to public customers. The majority of the backlog relates to New Flyer transit buses for public clients with some of the backlog consisting of units from MCI and ARBOC. Options for ARBOC vehicles are held by dealers, rather than the operator, and are not included as an option in the NFI backlog, but are converted to firm backlog when vehicles are ordered by the dealer.

Transit buses and motor coaches incorporating clean propulsion systems, including compressed natural gas ("CNG"), diesel-electric hybrid, and zero emission buses ("ZEB"), which consist of trolley-electric, fuel cell-electric, and battery-electric buses represent approximately 42.0% of the total backlog. ZEBs represent approximately 5% of total backlog.

	Fiscal 2018			Fiscal 2017		
	Firm Orders	Options	Total	Firm Orders	Options	Total
Beginning of period	4,186	7,971	12,157	3,442	6,745	10,187
New orders	2,015	1,749	3,764	2,859	2,961	5,820
Acquired backlog[1]	—	—	—	315	—	315
Options exercised	1,795	(1,795)	0	1,404	(1,404)	0
Shipments[2]	(4,313)	—	(4,313)	(3,828)	—	(3,828)
Cancelled/expired	(34)	(741)	(775)	(6)	(331)	(337)
End of period	**3,649**	**7,184**	**10,833**	**4,186**	**7,971**	**12,157**
Consisting of:						
Heavy-duty transit buses	3,024	6,177	9,201	3,542	6,622	10,164
Motor coaches	468	1,007	1,475	322	1,349	1,671
Cutaway and medium-duty buses	157	—	157	322	—	322
Total Backlog	3,649	7,184	10,833	4,186	7,971	12,157

(1) On December 1, 2017 the Company acquired ARBOC and its related backlog.
(2) Shipments do not include delivery of pre-owned coaches as these coaches are not included in the backlog.

At the end of Fiscal 2018, the Company's total backlog (firm and options) of 10,833 EUs (valued at $5.4 billion) has decreased compared to 12,157 EUs (valued at $6.0 billion) at the end of Fiscal 2017. The summary of the values is provided below.

	Fiscal 2018		Fiscal 2017	
		Equivalent Units		Equivalent Units
Firm orders – USA	$ 1,721,689	3,172	$ 1,886,958	3,713
Firm orders – Canada	215,830	477	212,276	473
Total firm orders	$ 1,937,519	3,649	2,099,234	4,186
Options – USA	3,312,589	6,928	3,772,651	7,637
Options – Canada	101,493	256	147,584	334
Total options	3,414,082	7,184	3,920,235	7,971
Total backlog	**$ 5,351,601**	**10,833**	**6,019,469**	**12,157**

Parts shipment activity during 2018 Q4

Total aftermarket shipments for 2018 Q4 decreased by 8.2% compared to the previous quarter, and decreased by 6.9% compared to 2017 Q4. The lower shipments in 2018 Q4 compared to 2018 Q3 were largely due to lower bid activity and cancellation of the DRA during the period. The win rate for aftermarket during 2018 Q4 was within historical ranges. Aftermarket parts orders from ARBOC are not included in these figures as they are not material.

Outlook

Management's outlook for the heavy-duty transit bus market remains healthy, while private motor coach is expected to continue to experience some headwinds. Overall, demand for low-floor cutaway and medium-duty buses is encouraging.

NFI Parts continues to focus on numerous strategic initiatives to counter adverse market pressures and competitive intensity. These initiatives include additional focus on vendor managed inventory ("VMI") programs, an enhanced product offering, and capitalizing on the implementation of a common IT platform across the aftermarket business. During Fiscal 2018, NFI secured six VMI programs and continues to pursue other VMI opportunities across Canada and the U.S.

Management believes the significant investments the Company has made in new product models, ZEBs, facility upgrades and LEAN processes, parts fabrication, and IT harmonization will allow NFI to defend its leading positions in core markets, improve profit margins and generate free cash flow.

Heavy-Duty Transit

Aging fleets, healthy economic conditions, defined U.S. federal funding and expected customer fleet replacement plans support management's expectation that transit bus procurement activity throughout the U.S. and Canada will remain healthy. Management's view is reinforced by estimated 2018 heavy-duty transit delivery data which shows overall deliveries were 6,504 EUs, an increase of 2.7% from 2017. New Flyer maintained its leading share of 43% of market deliveries in Fiscal 2018 and expects to continue its leading position in Fiscal 2019.

ZEBs continue to be an area of growing focus for New Flyer customers. ZEBs currently represent approximately 5% of New Flyer's total backlog, with significant orders from major cities including: Toronto, Boston, Minneapolis, San Diego, New York, Seattle, Portland, Oakland, and Vancouver. In August of 2018, New Flyer also received Canada's largest ever battery-electric bus order from two Quebec operators. To further strengthen NFI's ZEB offering, in the quarter ended March 31, 2019 ("2019 Q1") the Company launched New Flyer Infrastructure Solutions™, a service aimed at providing safe, reliable, smart and sustainable charging and mobility solutions to public transit customers.

Management's ongoing discussions with several public transit customers throughout the US and Canada suggests there may be an increase in active bids issued in Fiscal 2019, however, individual awards may be smaller in size with fewer options or shorter contract terms. Management believes this is primarily due to transit agencies assessing their fleet replacement plans and their approach to ZEB programs.

Motor Coach

Management estimates that U.S. and Canadian motor coach deliveries declined by 165 units, or 6.7% from 2017 to 2018, but MCI's market share increased by 2% to 45%. In 2019, management anticipates that overall market demand for private motor coaches will also decline slightly, but that MCI can continue to gain share based on its market leading and expanding product portfolio.

Low-floor Cutaway and Medium-duty

Management expects continued growth in the low-floor cutaway and medium-duty bus markets driven by changing population demographics that are anticipated to increase the demand for ARBOC's market leading products. ARBOC's new Spirit of Equess® offering, which has a higher EBITDA/EU contribution than it's low-floor cutaway vehicles, is the first and only medium-duty transit bus to successfully complete the U.S. Federal Transit Administration's mandated Altoona bus testing program. The Equess is now in production and management expects this model to account for 10% to 15% of ARBOC deliveries in Fiscal 2019.

2019 Guidance

Based on NFI's current master production schedule combined with its firm backlog, anticipated option conversions and new orders anticipated to be awarded by customers from procurements, management reaffirms its expected delivery guidance of 4,455 EUs in Fiscal 2019, an increase of 142 EUs, or 3.3% over Fiscal 2018 comprised of the following vehicle types:

Heavy Duty Transit	Motor Coach	Cutaway and Medium-Duty	Total
2,845 EUs	1,065 EUs	545 EUs	4,455 EUs

With the addition of MCI and ARBOC, the Company's annual delivery schedule now has an element of seasonality due to the nature of each market segment and the annual production and vacation schedule of each facility. Overall, management anticipates deliveries will tend to be higher in the quarter ended June 30, 2019 ("2019 Q2") and the quarter ended December 29, 2019 ("2019 Q4") when compared to 2019 Q1 and the quarter ended September 29, 2019 ("2019 Q3"). Within NFI Parts, Management anticipates there to be typical quarterly volatility.

Management advises that 2019 Q1 deliveries will be impacted by non-recurring factors including: adverse winter weather conditions in Minnesota and North Dakota causing New Flyer and MCI to miss a number of production days, new model launches impacting production line efficiencies, and select ARBOC chassis supply disruption - these factors are expected to be resolved throughout 2019.

Daimlers termination of the DRA had an impact on NFI's Fiscal 2018 results, however, management expects the impact to be significantly reduced in Fiscal 2019. Fiscal 2018 was also impacted as a result of startup losses associated with KMG commissioning its 315,000 sq. ft. Shepherdsville, KY facility, which is a strategic long-term investment needed to meet increased U.S. content requirements which take effect in October 2019. Management expects KMG will continue to negatively impact Adjusted EBITDA for the first half of 2019, prior to the facility achieving break-even status in the second half of the year and beginning to provide a positive return on the $30 million investment made to fabricate parts for New Flyer, MCI, ARBOC and NFI Parts.

As a result of NFI's delivery guidance, continued expectations for strong Free Cash Flow generation and lower expected capital expenditures in Fiscal 2019, the Company's board of directors (the "Board") has decided to increase the annual dividend rate to C$1.70 per share which represents an increase of 13.3% from the previously announce annual dividend rate of C$1.50 per share on May 9, 2017. The new annual dividend rate of C$1.70 per share is effective for dividends declared after March 13, 2019, although such distributions are not assured.

SELECTED QUARTERLY AND ANNUAL FINANCIAL AND OPERATING INFORMATION

The following selected unaudited consolidated financial and operating information of the Company has been derived from and should be read in conjunction with the historical Financial Statements of the Company (see footnotes on page 14).

Fiscal Period	Quarter	Revenue	Earnings from Operations	Net earnings	Adjusted EBITDA[1]	Earnings per Share	Adjusted Earnings per Share
2018	Q4	$ 662,020	60,570	$ 42,815	$ 79,868	$ 0.69	$ 0.69
	Q3	605,342	53,469	37,031	70,245	0.59	0.57
	Q2	673,025	72,063	49,740	91,400	0.81	0.83
	Q1	578,634	51,753	30,356	73,841	0.48	0.57
	Total	**$ 2,519,021**	**$ 237,855**	**$ 159,942**	**$ 315,354**	**$ 2.56**	**$ 2.68**
2017	Q4	654,560	71,495	76,118	90,488	1.21	1.25
	Q3	541,721	55,141	34,577	70,998	0.55	0.55
	Q2	613,430	70,363	42,769	85,090	0.69	0.68
	Q1	572,147	59,203	37,904	71,450	0.61	0.59
	Total	**$ 2,381,858**	**$ 256,202**	**$ 191,368**	**$ 318,026**	**$ 3.06**	**$ 3.07**
2016	Q4	$ 622,530	$ 61,244	$ 41,558	$ 76,824	$ 0.68	$ 0.70
	Q3	511,483	46,633	26,002	63,788	0.43	0.36
	Q2	586,937	64,789	34,746	80,331	0.58	0.61
	Q1	553,226	43,882	22,588	68,178	0.40	0.48
	Total	**$ 2,274,176**	**$ 216,548**	**$ 124,894**	**$ 289,121**	**$ 2.10**	**$ 2.15**

								Ending inventory comprised of:	
Fiscal Period	Quarter	New inventory, Beginning (EUs)	New inventory transferred to property, plant and equipment (EUs)	New ARBOC inventory acquired (EUs)	New Line Entry (EUs)	Deliveries (EUs)	New inventory, Ending(EUs)	Work in process (EUs)	Finished goods (EUs)[2]
2018	Q4	571	9	—	1,069	1,126	523	463	60
	Q3	590	(22)	—	1,038	1,035	571	505	66
	Q2	633	(6)	—	1,122	1,159	590	496	94
	Q1	489	(3)	—	1,140	993	633	456	177
	Total	**489**	**(22)**	—	**4,369**	**4,313**	**523**	**463**	**60**
2017	Q4	566	(4)	31	964	1,068	489	392	97
	Q3	534	—	—	909	877	566	400	166
	Q2	547	—	—	978	991	534	397	137
	Q1	495	—	—	944	892	547	359	188
	Total	**495**	**(4)**	**31**	**3,795**	**3,828**	**489**	**392**	**97**
2016	Q4	632	—	—	856	993	495	347	148
	Q3	559	—	—	850	777	632	387	245
	Q2	571	—	—	900	912	559	391	168
	Q1	494	—	—	906	829	571	416	155
	Total	**494**	—	—	**3,512**	**3,511**	**495**	**347**	**148**

Fiscal Period	Quarter	Pre-owned inventory, Beginning (EUs)	Pre-owned inventory transferred from (to) property, plant and equipment (EUs)	Trades taken in (EUs)	Sale of Pre-owned Coaches (EUs)*	Pre-owned inventory, Ending (EUs)
2018	Q4	337	19	199	187	368
	Q3	355	19	78	115	337
	Q2	379	(26)	104	102	355
	Q1	343	21	79	64	379
	Total	**343**	**33**	**460**	**468**	**368**
2017	Q4	323	5	161	146	343
	Q3	342	(15)	85	89	323
	Q2	370	9	73	110	342
	Q1	379	(36)	92	65	370
	Total	**379**	**(37)**	**411**	**410**	**343**
2016	Q4	316	—	164	101	379
	Q3	308	—	78	70	316
	Q2	338	—	76	106	308
	Q1	323	—	119	104	338
	Total	**323**	**—**	**437**	**381**	**379**

(1) Adjusted EBITDA is not a recognized earnings measure and does not have standardized meanings prescribed by IFRS. Therefore, Adjusted EBITDA may not be comparable to similar measures presented by other issuers. See "Definitions of Adjusted EBITDA, ROIC, Free Cash, Adjusted Net Earnings and Adjusted Net Earnings per share" above. Management believes that Adjusted EBITDA and ROIC are useful supplemental measures in evaluating performance of NFI.

(2) Finished goods are comprised of completed buses ready for delivery and transit bus and coach deliveries in-transit.

* During 2018 Q4 and Fiscal 2018, pre-owned coach revenue was $11.0 million and $46.3 million, respectively.

COMPARISON OF FOURTH QUARTER AND FISCAL 2018 RESULTS

(Unaudited Quarterly Results, U.S. dollars in thousands, except for deliveries in equivalent units)

	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Statement of Earnings Data		(restated*)	(restated*)	(restated*)
Revenue				
Canada	$ 75,734	$ 24,628	$ 240,253	$ 154,604
U.S.	500,786	538,494	1,901,614	1,858,023
Manufacturing operations	576,520	563,122	2,141,867	2,012,627
Canada	14,965	18,669	70,662	75,531
U.S.	70,535	72,769	306,492	293,700
Aftermarket operations	85,500	91,438	377,154	369,231
Total revenue	$ 662,020	$ 654,560	$ 2,519,021	$ 2,381,858
Earnings from operations	$ 60,570	$ 71,495	$ 237,855	$ 256,202
Earnings before interest and income taxes	61,405	70,274	238,345	259,588
Net earnings	42,815	76,118	159,942	191,368
Adjusted EBITDA, unaudited[(2)]				
Transit bus and coach manufacturing operations including realized foreign exchange losses/gains	62,529	72,621	241,699	238,234
Aftermarket operations	17,339	17,867	73,655	79,792
Total Adjusted EBITDA[(2)]	$ 79,868	$ 90,488	$ 315,354	$ 318,026
Other Data (unaudited)				
Total Deliveries (New and Pre-owned Coaches)				
Canada	160	52	512	334
U.S.	966	1,016	3,801	3,494
New deliveries	1,126	1,068	4,313	3,828
Pre-owned deliveries	187	146	468	410
Total deliveries (EUs)	1,313	1,214	4,781	4,238
Capital expenditures	$ 20,144	$ 21,052	$ 70,991	$ 52,813
New options awarded	$ 33,646	$ 748,286	$ 531,588	$ 1,366,492
New firm orders awarded	$ 357,281	$ 433,997	$ 1,183,543	$ 1,426,022
Exercised options	361,560	117,056	1,000,623	812,875
Total firm orders	$ 718,841	$ 551,053	$ 2,184,166	$ 2,238,897

(Footnotes on page 18)

* In 2018 the MCI service function, comprised of technical service management and customer training, which was previously managed by the MCI aftermarket operations, was moved to the coach manufacturing operations. To improve the comparability between periods, the related prior year segment information has been restated to reflect these changes. The restatements did not have an impact on consolidated amounts.

RECONCILIATION OF NET EARNINGS TO ADJUSTED EBITDA

Management believes that Adjusted EBITDA is an important measure in evaluating the historical operating performance of the Company. However, Adjusted EBITDA is not a recognized earnings measure under IFRS and does not have a standardized meaning prescribed by IFRS. Accordingly, Adjusted EBITDA may not be comparable to similar measures presented by other issuers. Readers of this MD&A are cautioned that Adjusted EBITDA should not be construed as an alternative to net earnings or loss determined in accordance with IFRS as indicators of the Company's performance, or cash flows from operating activities determined in accordance with IFRS as a measure of liquidity and cash flow. The Company defines and has computed Adjusted EBITDA as described under "Definitions of Adjusted EBITDA, ROIC and Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share" above. The following tables reconcile net earnings or losses and cash flow from operations to Adjusted EBITDA based on the historical Financial Statements of the Company for the periods indicated.

(Unaudited, U.S. dollars in thousands)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Net earnings	42,815	76,118	$ 159,942	191,368
Addback[1]				
Income taxes	7,933	(9,041)	$ 50,711	50,254
Interest expense	10,657	3,197	$ 27,692	17,966
Amortization	18,017	16,007	$ 67,796	57,602
Loss (gain) on disposition of property, plant and equipment	(8)	28	$ 267	(167)
Fair value adjustment for total return swap[7]	5,629	(935)	$ 6,547	(4,719)
Unrealized foreign exchange loss (gain) on non-current monetary items and forward foreign exchange contracts	1,311	867	$ 1,381	(2,060)
Costs associated with assessing strategic and corporate initiatives[4]	—	2,812	$ 137	3,693
Past service costs[9]	—	—	$ 6,482	—
Non-recurring recoveries relating to business acquisition[5]	—	(525)	$ —	(435)
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue[6]	—	266	$ 266	266
Proportion of the total return swap realized[8]	(4,382)	1,021	$ (5,138)	3,964
Equity settled stock-based compensation	34	347	$ 1,409	1,453
Release of provisions related to purchase accounting[11]	(2,138)	—	$ (2,138)	—
Gain on bargain purchase of subsidiary company	—	326	—	(1,159)
Adjusted EBITDA[2]	$ 79,868	$ 90,488	$ 315,354	$ 318,026

(Footnotes on pages 18)

RECONCILIATION OF NET EARNINGS TO ADJUSTED NET EARNINGS

In 2018 Q2, management adopted an Adjusted Net Earnings and Adjusted Earnings per Share calculation to provide a measure of the Company's performance that is aligned with the Company's calculation of Adjusted EBITDA. Adjusted Net Earnings and Adjusted Earnings per Share are used to assess the overall financial performance of the Company. Adjusted Net Earnings and Adjusted Earnings per Share are not recognized measures under IFRS and do not have a standardized meaning prescribed by IFRS. Accordingly, Adjusted Net Earnings and Adjusted Earnings per Share may not be comparable to similar measures presented by other issuers. Readers of this MD&A are cautioned that Adjusted Net Earnings and Adjusted Earnings per Share should not be construed as an alternative to net earnings, or net earnings per Share, determined in accordance with IFRS as indicators of the Company's performance. The Company defines and has computed Adjusted Net Earnings and Adjusted Earnings per Share under "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share" above. The following tables reconcile net earnings to Adjusted Net Earnings based on the historical Financial Statements of the Company for the periods indicated.

(Unaudited, U.S. dollars in thousands other than earnings per Share and Adjusted Earnings per Share)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Net earnings	$ 42,815	$ 76,118	$ 159,942	$ 191,368
Adjustments, net of tax [10]				
Fair value adjustment of total return swap [7]	4,274	(741)	4,971	(3,738)
Unrealized foreign exchange (gain) loss	995	687	1,049	(1,632)
Portion of the total return swap realized [8]	(3,325)	809	(3,900)	3,140
Costs associated with assessing strategic and corporate initiatives [4]	—	2,227	104	2,925
Non recurring costs (recoveries) relating to business acquisition [5]	—	(416)	—	(345)
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue [6]	—	211	202	211
Equity settled stock-based compensation	26	275	1,070	1,151
Gain on disposition of property, plant and equipment	(6)	22	203	(133)
Gain on bargain purchase option	—	1,175	—	—
Gain on release of provision related to purchase accounting[11]	(1,623)	—	(1,623)	—
Past service costs [9]	—	—	4,922	—
Adjusted Net Earnings	43,156	80,367	166,940	192,947
Earnings per Share (basic)	$ 0.69	$ 1.21	$ 2.56	$ 3.06
Earnings per Share (fully diluted)	$ 0.68	$ 1.20	$ 2.55	$ 3.03
Adjusted Earnings per Share (basic)	$ 0.69	$ 1.28	$ 2.68	$ 3.09
Adjusted Earnings per Share (fully diluted)	$ 0.69	$ 1.26	$ 2.66	$ 3.06

(Footnotes on pages 18)

RECONCILIATION OF CASH FLOW TO ADJUSTED EBITDA

(Unaudited, U.S. dollars in thousands)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Net cash generated from operating activities	$ 67,340	$ 7,372	$ 175,144	$ 172,059
Addback[1]				
Changes in non-cash working capital items	1,992	42,728	34,344	7,061
Defined benefit funding	608	5,025	22,241	11,476
Defined benefit expense	(1,755)	(1,338)	(12,333)	(5,150)
Interest paid	6,338	4,673	23,073	18,755
Foreign exchange gain (loss) on cash held in foreign currency	(289)	(52)	194	460
Income taxes paid [3]	12,154	28,506	73,082	105,877
Costs associated with assessing strategic and corporate initiatives[4]	—	2,812	137	3,693
Past service costs[9]	—	—	6,482	—
Non-recurring costs relating to business acquisition[5]	—	(525)	—	(435)
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue [6]	—	266	266	266
Gain on release of provision related to purchase accounting[11]	(2,138)	—	(2,138)	—
Proportion of the total return swap [8]	(4,382)	1,021	(5,138)	3,964
Adjusted EBITDA[2]	$ 79,868	$ 90,488	$ 315,354	$ 318,026

1. Addback items are derived from the historical Financial Statements of the Company.
2. Adjusted EBITDA is not a recognized earnings measure and does not have standardized meaning prescribed by IFRS. Therefore, Adjusted EBITDA may not be comparable to similar measures presented by other issuers. See “Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Net Earnings per Share” above. Management believes that Adjusted EBITDA is a useful supplemental measure in evaluating performance of the Company.
3. As a result of the Company’s multinational corporate structure, income taxes paid are subject to high degrees of volatility due to the mix of U.S. and Canadian earnings and the timing of required installment payments.
4. Normalized to exclude non-recurring expenses related to the costs of assessing strategic and corporate initiatives.
5. Normalized to exclude non-recurring expenses associated with transitional costs related to acquired subsidiary companies.
6. The revaluation of ARBOC's inventory included an adjustment of $0.5 million of which $0.3 million impacted net earnings in the first quarter of 2018.
7. The fair value adjustment of the total return swap is a non-cash gain that is deducted from the definition of Adjusted EBITDA.
8. A portion of the gain from the fair value adjustment of the total return swap is added to Adjusted EBITDA to match the equivalent portion of the related deferred compensation expense recognized.
9. A new collective bargaining agreement at the Company's Winnipeg facility commenced on April 1, 2018 which included retroactive changes to New Flyer's Canadian defined benefit pension plan. The effect of the pension plan amendments was to increase the accrued benefit liability and the expected annual pension plan expense in Fiscal 2018 by $6.5 million to reflect pension benefits provided to employees for past service. In 2018 Q2, the Company completed an actuarial valuation which resulted in an adjustment of $0.7 million for past service costs.
10. The expected ETR in each respective period is used to calculate adjustments, net of tax
11. During 2018 Q4 purchase accounting provisions recorded during the acquisition of MCI were deemed to be no longer needed and were released resulting in an increase to net earnings. The amounts released have been deducted in the calculation of Adjusted EBITDA.

SUMMARY OF FREE CASH FLOW

Management uses Free Cash Flow as a non-IFRS measure to evaluate the Company's operating performance and liquidity and to assess the Company's ability to pay dividends on the Shares, service debt, and meet other payment obligations.

The Company generates its Free Cash Flow from operations and management expects this will continue to be the case for the foreseeable future. Net cash flows generated from operating activities are significantly impacted by changes in non-cash working capital. The Company uses the Revolver under the new Credit Facility to finance working capital and therefore has excluded the impact of working capital in calculating Free Cash Flow. As well, net cash generated by operating activities and net earnings are significantly affected by the volatility of current income taxes, which in turn produces temporary fluctuations in the determination of Free Cash Flow.

The following is a reconciliation of net cash generated by operating activities (an IFRS measure) to Free Cash Flow (a non-IFRS measure) based on the Company's historical Financial Statements. See "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share".

(Unaudited, U.S. dollars in thousands, except per Share figures)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Net cash generated from operating activities	$ 67,340	$ 7,372	$ 175,144	$ 172,059
Changes in non-cash working capital items[3]	1,992	42,728	34,344	7,061
Interest paid[3]	6,338	4,673	23,073	18,755
Interest expense[3]	(6,273)	(5,108)	(23,546)	(19,285)
Income taxes paid[3]	12,154	28,506	73,082	105,877
Current income tax expense[3]	(9,495)	(3,959)	(56,263)	(81,116)
Principal portion of finance lease payments	(1,547)	(1,069)	(5,125)	(4,115)
Cash capital expenditures	(20,144)	(21,052)	(70,991)	(52,813)
Proceeds from disposition of property, plant and equipment	10	18	235	526
Costs associated with assessing strategic and corporate initiatives[7]	—	2,812	137	3,693
Non-recurring transitional costs relating to business acquisition[8]	—	(525)	—	(435)
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue [9]	—	266	266	266
Defined benefit funding[4]	608	5,025	22,241	11,476
Defined benefit expense[4]	(1,755)	(1,338)	(12,333)	(5,150)
Past service costs[11]	—	—	6,482	—
Gain received on total return swap settlement	—	—	—	—
Proportion of the total return swap[10]	(4,382)	1,021	(5,138)	3,964
Gain on release of provision related to purchase accounting[12]	(2,138)	—	(2,138)	—
Foreign exchange gain (loss) on cash held in foreign currency[5]	(289)	(52)	194	460
Free Cash Flow (US$)[1]	42,419	59,318	159,664	161,223
U.S. exchange rate[2]	1.3638	1.2545	1.3183	1.2835
Free Cash Flow (C$)[1]	**57,851**	**74,414**	**210,485**	**206,922**
Free Cash Flow per Share (C$)[6]	0.9302	0.4125	3.3733	3.3114
Declared dividends on Shares (C$)	**22,890**	**20,452**	**90,343**	**76,082**
Declared dividends per Share (C$)[6]	$ 0.3680	$ 0.3250	$ 1.4479	$ 1.2175

(1) Free Cash Flow is not a recognized measure under IFRS and does not have a standardized meaning prescribed by IFRS. Therefore, Free Cash Flow may not be comparable to similar measures presented by other issuers. See "Definitions of Adjusted EBITDA, ROIC, Free Cash Flow, Adjusted Net Earnings and Adjusted Earnings per Share".

(2) U.S. exchange rate (C$ per US$) is the weighted average exchange rate applicable to dividends declared for the period.

(3) Changes in non-cash working capital are excluded from the calculation of Free Cash Flow as these temporary fluctuations are managed through the Revolver which is available to fund general corporate requirements, including working capital requirements, subject to borrowing capacity restrictions. Changes in non-cash working capital are presented on the consolidated statements of cash flows net of interest and incomes taxes paid.

(4) The cash effect of the difference between the defined benefit expense and funding is included in the determination of cash from operating activities. This cash effect is excluded in the determination of Free Cash Flow as management believes that the defined benefit expense amount provides a more appropriate measure, as the defined benefit funding can be impacted by special payments to reduce the unfunded pension liability.

(5) Foreign exchange loss on cash held in foreign currency is excluded in the determination of cash from operating activities under IFRS; however, because it is a cash item, management believes it should be included in the calculation of Free Cash Flow.

(6) Per Share calculations for Free Cash Flow (C$) are determined by dividing Free Cash Flow by the total number of all issued and outstanding Shares using the weighted average over the period. The weighted average number of Shares outstanding for 2018 Q4 was 62,193,409 and 62,396,962 for Fiscal 2018. The weighted average number of Shares outstanding for 2017 Q4 was 62,936,167 and 62,488,370 for Fiscal 2017. Per Share calculations for declared dividends (C$) are determined by dividing the amount of declared dividends by the number of outstanding Shares at the respective period end date.

(7) Normalized to exclude non-recurring expenses related to the costs of assessing strategic and corporate initiatives.

(8) Normalized to exclude non-recurring expenses associated with transitional costs related to acquired subsidiary companies.

(9) The revaluation of ARBOC's inventory included an adjustment of $0.5 million of which $0.3 million negatively impacted 2018 Q1 net earnings.

(10) A portion of the fair value adjustment of the total return swap is added to Free Cash Flow to match the equivalent portion of the related deferred compensation expense recognized.

(11) A new collective bargaining agreement at the Company's Winnipeg facility commenced on April 1, 2018 which included retroactive changes to New Flyer's Canadian defined benefit pension plan. The effect of the pension plan amendments was to increase the accrued benefit liability and the expected annual pension plan expense in Fiscal 2018 by $6.5 million to reflect pension benefits provided to employees for past service. In 2018 Q2, the Company completed an actuarial valuation related to the past service costs which resulted in an adjustment of $0.7 million.

(12) During the fourth quarter purchase accounting provisions recorded during the acquisition of MCI were deemed to be no longer needed and were released resulting in an increase to net earnings. The amounts released have been deducted in the calculation of Free Cash Flow.

Capital Allocation Policy

The Company has established a capital allocation policy based on an operating model intended to provide consistent and predictable cash flow and maintaining a strong balance sheet. This policy has established guidelines that are reviewed by the board of directors ("Board") on a quarterly basis and provides targets for maintaining financial flexibility, business investment, and return of capital to shareholders.

Maintaining Financial Flexibility

The Company plans to prudently use leverage to manage liquidity risk. Liquidity risk arises from the Company's financial obligations and from the management of its assets, liabilities and capital structure. This risk is managed by regularly evaluating the liquid financial resources to fund current and long term obligations, and to meet the Company's capital commitments in a cost-effective manner.

The main factors that affect liquidity include sales mix, production levels, cash production costs, working capital requirements, capital expenditure requirements, scheduled repayments of long-term debt obligations, funding requirements of the Company's pension plans, income taxes, credit capacity and expected future debt and equity capital market conditions.

The Company's liquidity requirements are met through a variety of sources, including cash on hand, cash generated from operations, the credit facility, leases, and debt and equity capital markets.

The liquidity position of $355.4 million as at December 30, 2018 is comprised of available cash of $10.8 million and $344.6 million available under the new Credit Facility as compared to a liquidity position of $222.3 million at December 30, 2017. The increase in liquidity primarily relates to the new Credit Facility which increased the amount available to draw by $175 million partially offset by capital returned to shareholders through dividends and the repurchase of Shares under the NCIB and capital expenditures. Changes in non-cash working capital are primarily a result of seasonality and are expected to be temporary in nature. Management believes these funds, together with Share and debt issuances, other borrowings capacity and the cash generated from the Company's operating activities, will provide the Company with sufficient liquidity and capital resources to meet its current financial obligations as they come due, as well as provide funds for its financing requirements, capital expenditures, dividend payments and other operational needs for the foreseeable future.

Within the capital allocation policy, management has targeted to maintain leverage between 2 times and 2.5 times Adjusted EBITDA. The Company however, would increase leverage beyond this range to fund accretive acquisitions that are capable of reducing leverage through earnings. This was the case in 2013 when the Company acquired NABI-Optima Holdings Inc. (NABI) and again in 2015 when the Company acquired MCI. Leverage is defined as debt (net of cash) divided by Adjusted EBITDA.

There are certain financial covenants under the Credit Facility that have to be maintained. These financial covenants included an interest coverage ratio and a total leverage ratio. The total leverage ratio under the Credit Facility is 3.75 and increases to 4.25 for one year following a material acquisition. At December 30, 2018, the Company was in compliance with the ratios. Under the fifth amended and restated credit agreement (the "Prior Credit Agreement"), which was extinguished on October 25, 2018, the total leverage ratio reduced to less than 3.50 beginning January 1, 2018. The results of the financial covenant tests under the Prior Credit Agreement as of such date are as follows:

	December 30, 2018	December 31, 2017
Total Leverage Ratio (must be less than 3.75)	2.09	1.84
Interest Coverage Ratio (must be greater than 3.00)	13.39	17.15

Business Investment

The Company plans to invest in the current business for future growth and will continue to invest in lean manufacturing operations to improve quality and cost effectiveness. In addition, business acquisitions will be considered to further grow and diversify the business and to contribute to the long-term competitiveness and stability of the Company. Investment decisions are based on several criteria, including but not limited to: investment required to maintain or enhance operations; enhancement of cost effectiveness through vertical integration of critical supply and sub-assembly in-sourcing; and acquisitions in current or adjacent markets that are considered accretive to the business.

Return of Capital to Shareholders

The Company intends to have a Share dividend policy that is consistent with the Company`s financial performance and the desire to retain certain cash flows to support the ongoing requirements of the business and to provide the financial flexibility to pursue revenue diversification and growth opportunities.

The Company`s Free Cash Flow translated to C$57.9 million in 2018 Q4 compared to declared dividends of C$22.9 million during this period. For Fiscal 2018, Free Cash Flow was C$210.5 million compared to declared dividends of C$90.3 million. This resulted in a payout ratio of 39.6% and 42.9% in 2018 Q4 and Fiscal 2018, respectively, compared to 27.6% and 36.8% in 2017 Q4 and Fiscal 2017, respectively.

As a result of NFI's delivery guidance, continued expectations for strong Free Cash Flow generation and lower expected capital expenditures in Fiscal 2019, on March 13, 2019, the Board approved an annual dividend rate increase to C$1.70 per Share from the prior annual rate of C$1.50 per share, effective for dividends declared subsequent to March 13, 2019. This represents an annual dividend rate increase of 13.3% and the Board and management believe that this dividend rate has been established at a sustainable level. The Board expects to maintain dividends at this rate on a quarterly basis, although such distributions are not assured.

On May 9, 2018 the Board approved an annual dividend rate increase of 15.4% to C$1.50 per Share from an annual rate of C$1.30 per Share, effective for dividends declared subsequent to May 9, 2018. The Board believes that the dividend rate has been established at a sustainable level, although such distributions are not assured.

On June 11, 2018, the Company announced that the TSX had accepted a notice filed by the Company of its intention to implement a Normal Course Issuer Bid ("NCIB") to repurchase its Shares through the facilities of the TSX and any alternative Canadian trading systems on which the Shares are traded. On January 17, 2019 the Company amended the NCIB. Pursuant to the amended NCIB, the Company is permitted to repurchase for cancellation up to 5,549,465 Shares, representing approximately 10% of the outstanding public float of Shares on June 4, 2018. The Company was permitted to repurchase Shares commencing on June 14, 2018 up to June 13, 2019, or earlier should the Company complete its repurchases prior to such date. The actual number of Shares to be purchased and the timing and pricing of any purchases under the NCIB will depend on future market conditions and potential alternative uses for cash resources. The Company may elect to modify, suspend or discontinue the program at any time without prior notice. The Company has a policy to not purchase Shares during a trading blackout period. During Fiscal 2018 the Company repurchased 2,153,275 Shares (of which 833,075 Shares were settled and canceled after December 30, 2018) at an average price of C $41.39 per Share for a total repurchase cost of C$89.12 million. Shares settled after December 30, 2018 totaled C$29.1 million.

Total Capital Distributions to Shareholders (U.S. dollars in millions)	**2018 Q4**	**2017 Q4**	**Fiscal 2018**	**Fiscal 2017**
Dividends paid	$ 18.1	$ 16.4	$ 68.2	$ 54.3
NCIB Share repurchase	36.9	—	66.5	—
Total	$ 55.0	$ 16.4	$ 134.7	$ 54.3

Results of Operations

The Company's operations are divided into two business segments: manufacturing operations and aftermarket operations. Organizational changes to better align business functions within operating segments were made effective January 2, 2017. These organizational changes were implemented in two phases. In 2017, over-the-counter parts sales were moved from manufacturing operations to aftermarket operations. In 2018 the MCI service function, comprised of technical service management and customer training, which was previously managed by the MCI aftermarket operations, was moved to the coach manufacturing operations. To improve the comparability between periods, the related prior year segment information has been restated to reflect these changes.

(Unaudited U.S. dollars in thousands)	2017 Q1 (13-Weeks)	2017 Q2 (13-Weeks)	2017 Q3 (13-Weeks)	2017 Q4 (13-Weeks)	Fiscal 2017 (52-weeks)
Loss from operations related to service function	(1,861)	(1,841)	(2,089)	(2,075)	(7,866)
Manufacturing Adjusted EBITDA related to service function	$ (1,861)	$ (1,841)	$ (2,089)	$ (2,075)	$ (7,866)

The discussion below with respect to revenue, operating costs and expenses and earnings from operations has been divided between the manufacturing and aftermarket operations segments.

(Unaudited Q4 results, U.S. dollars in thousands)	2018 Q4	2017 Q4 ("restated")	Fiscal 2018	Fiscal 2017 ("restated")
Manufacturing Revenue	576,520	563,122	2,141,867	2,012,627
Aftermarket Revenue	85,500	91,438	377,154	369,231
Total Revenue	$ 662,020	$ 654,560	$ 2,519,021	$ 2,381,858
Earnings from Operations	$ 60,570	$ 71,495	$ 237,855	$ 256,202
Earnings before interest and income taxes	61,405	70,274	238,345	259,588
Earnings before income tax expense	50,748	67,077	210,653	241,622
Net earnings for the period	42,815	76,118	159,942	191,368

Revenue

Manufacturing revenue for 2018 Q4 increased by $13.3 million, or 2.4% compared to 2017 Q4. Transit bus revenues increased by $21.8 million primarily due to higher average selling prices in the 2018 Q4 compared to 2017 Q4. Also contributing to the increase is the full-quarter contribution from ARBOC in 2018 Q4 compared to one-month in 2017 Q4 which resulted in a $7.1 million increase in revenues. These increases were partially offset by lower revenues related to new and pre-owned coaches, primarily due to lower average selling prices.

Manufacturing revenue for Fiscal 2018 increased by $129.2 million, or 6.4% compared to Fiscal 2017. Transit bus increases in revenues of $116.0 million are primarily due to higher selling prices and volume increases in Fiscal 2018 compared to Fiscal 2017. The full-year contribution from ARBOC in Fiscal 2018 compared to one-month in Fiscal 2017 resulted in a $39.5 million increase in revenues. The FRP business also contributed $11.6 million to the revenue increase, primarily as a result of the acquisition of Sintex-Wausaukee Composites Inc. and Carlson Engineered Composites Inc. in 2017. These increases were partially offset by decreases of $33.5 million and $4.2 million from new coach and pre-owned coach businesses. Coach volumes were impacted by management's estimate of a 6.7% decline in motor coach market volume, partially offset by a 2.0% increase in MCI's market share. Lower average selling prices further contributed to the decline. The termination of the DRA with Daimler for the sale of Setra motor coaches also contributed to the decrease in new coach revenue by $7.7 million.

Revenue from aftermarket operations in 2018 Q4 decreased by $5.9 million, or 6.5% compared to 2017 Q4. The decrease is primarily due to the impact of the termination of the DRA of $1.2 million and lower volumes and margins. Fiscal 2018 revenue increased by $7.9 million, or 2.1%, compared to Fiscal 2017. The Fiscal 2018 increase is primarily due to increased volumes during the year and the full-year impact of ARBOC parts sales in Fiscal 2018. These increases are partially offset by the impact of the cancellation of the DRA of $2.7 million.

Cost of sales

(Unaudited Q4 results, U.S. dollars in thousands)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017 ("restated")
Total Cost of Sales	$ 543,755	$ 527,941	2,064,813	1,930,465

The consolidated cost of sales for 2018 Q4 and Fiscal 2018 increased by $15.8 million or 3.0% and $134.3 million or 6.9% compared to 2017 Q4 and Fiscal 2017, respectively. The increases are consistent with increased revenues for these respective periods.

Cost of sales from manufacturing operations in 2018 Q4 were $483.4 million (83.9% of manufacturing operations revenue) compared to $462.7 million (82.2% of manufacturing operations revenue), an increase of $20.7 million or 4.5% compared to 2017 Q4. Pricing pressures related to the coach business, the loss of the DRA, and lower production efficiency related to the start-up of the Shepherdsville facility have contributed to the increase of cost of sales as a percentage of manufacturing operations revenue. Cost of sales from manufacturing operations in Fiscal 2018

were $1.79 billion (83.8% of manufacturing operations revenue) compared to $1.67 billion (83.1% of manufacturing operations revenue) an increase of 7.2%. The same factors that contributed to the changes in 2018 Q4 contributed to the year-to-date changes.

Cost of sales from aftermarket operations in 2018 Q4 were $60.3 million (70.6% of aftermarket revenue) compared to $65.3 million (71.4% of aftermarket revenue) in 2017 Q4, a decrease of $5.0 million or 7.6%. Cost of sales from aftermarket operations in Fiscal 2018 were $270.3 million (71.7% of aftermarket revenue) compared to $257.0 million in Fiscal 2017 (69.6% of aftermarket revenue), an increase of $13.2 million or 5.1%. Changes in sales mix have resulted in cost of sales as a percentage of revenues to increase in both the 2018 Q4 and year-to-date.

Selling, general and administrative costs and other operating expenses ("SG&A")

The consolidated SG&A for 2018 Q4 of $55.4 million (8.4% of consolidated revenue) decreased by $0.2 million or 0.5% compared $55.6 million (8.5% of consolidated revenue) in 2017 Q4. The consolidated SG&A for Fiscal 2018 of $210.6 million (8.3% of consolidated revenue) increased $14.5 million or 7.4% compared to $196.0 million (8.2% of consolidated revenue) in Fiscal 2017. The increase in Fiscal 2018 SG&A was primarily as a result of a $6.5 million past service cost adjustment based on the collective bargaining agreement which was ratified by the New Flyer collective bargaining unit in Winnipeg on April 8, 2018, as well as the inclusion of both ARBOC and FRP components operations.

Realized foreign exchange loss/gain

During 2018 Q4, the Company recorded a realized foreign exchange loss of $2.4 million compared to a gain of $0.5 million in 2017 Q4. The Fiscal 2018 realized foreign exchange loss is $5.8 million, compared to a gain of $0.8 during Fiscal 2017. The Company uses foreign exchange forward contracts to buy Canadian dollars with U.S. dollars. The purchase of Canadian dollars using foreign exchange forward contracts at unfavourable forward rates compared to the spot rates at settlement were the primary reason for the losses.

Earnings from operations

Consolidated earnings from operations in 2018 Q4 were $60.6 million (9.1% of consolidated revenue) compared to $71.5 million (10.9% of consolidated revenue) in 2017 Q4, a decrease of $10.9 million or 15.3%. Fiscal 2018 consolidated earnings from operations were $237.9 million (9.4% of revenue) compared to $256.2 million (10.8% of consolidated revenue) in Fiscal 2017, a decrease of $18.3 million or 7.2%.

Earnings from operations related to manufacturing operations in 2018 Q4 were $45.2 million (7.8% of manufacturing revenue) compared to $55.5 million (9.9% of manufacturing revenue) in 2017 Q4, a decrease of $10.3 million or 18.6%. The decrease is primarily due lower new coach and transit bus volumes and continued pricing pressures on new and pre-owned coach sales. Losses related to the startup of the Shepherdsville facility of $6.6 million further contributed to the decrease. Higher transit bus margins partially offset the decreases noted above. Earnings from operations in Fiscal 2018 were $171.5 million (8.0% of manufacturing revenues) compared to $183.9 million in Fiscal 2017 (9.1% of manufacturing revenues) a decrease of $12.4 million or 6.7%. The same factors that contributed to the results in 2018 Q4 contributed to the year-to-date changes.

Earnings from operations related to aftermarket operations in 2018 Q4 were $15.4 million (18.0% of aftermarket revenue) compared to $16.0 million (17.5% of aftermarket revenue), a decrease of $0.6 million or 3.8%. Earnings from operations in Fiscal 2018 were $66.3 million (17.6% of aftermarket revenues) compared to $72.3 million in Fiscal 2017 (19.6% of aftermarket revenues), a decrease of $6.0 million or 8.3%.

Unrealized foreign exchange gain/loss

The Company has recognized a net unrealized foreign exchange gain/loss consisting of the following:

(Unaudited Q4 results, U.S. dollars in thousands)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Unrealized (gain) loss on forward foreign exchanges contracts	$ 2,342	$ 878	$ 2,974	$ (2,768)
Unrealized (gain) loss on other long-term monetary assets/liabilities	(1,031)	(11)	(1,593)	708
	$ 1,311	$ 867	$ 1,381	$ (2,060)

At December 30, 2018, the Company had $57 million of foreign exchange forward contracts to buy Canadian dollars with U.S. dollars at an average agreed exchange rate of $0.76. These foreign exchange contracts range in expiry dates from January 2019 to June 2019. The related liability of $1.5 million (December 31, 2017: $1.4 million asset) is recorded on the consolidated statements of financial position as a current derivative financial instruments liability and the corresponding change in the fair value of the foreign exchange forward contracts is recorded in the consolidated statements of net earnings and total comprehensive income.

Earnings before interest and income taxes ("EBIT")

In 2018 Q4, the Company recorded EBIT of $61.4 million compared to EBIT of $70.3 million in 2017 Q4. Similarly, the Company recorded Fiscal 2018 EBIT of $238.3 million compared to EBIT of $259.6 million in Fiscal 2017. EBIT has been impacted by non-cash and non-recurring items as follows:

(Unaudited Q4 results, U.S. dollars in thousands)	2018 Q4	2017 Q4	Fiscal 2018	Fiscal 2017
Non-cash and non-recurring charges:				
Costs associated with assessing strategic and corporate initiatives	$ —	$ 2,812	$ 137	$ 3,693
Unrealized foreign exchange (gain) loss	1,311	867	1,381	(2,060)
Equity settled stock-based compensation	34	347	1,409	1,453
Loss (gain) on disposition of property, plant and equipment	(8)	28	267	(167)
Fair value adjustment to acquired subsidiary company's inventory and deferred revenue	—	266	266	266
Fair value adjustment of total return swap	5,629	(935)	6,547	(4,719)
Past service costs	—	—	6,482	—
Non-recurring costs related to business acquisition	—	(525)	—	(435)
Gain on bargain purchase of subsidiary company	—	326	—	(1,159)
Amortization	18,017	16,007	67,796	57,602
Total non-cash and non-recurring charges:	$ 24,983	$ 19,193	$ 84,285	$ 54,474

Interest and finance costs

The interest and finance costs for 2018 Q4 of $10.7 million increased by $7.5 million when compared to $3.2 million in 2017 Q4. The increase is primarily due to a $2.3 million loss on the interest rate swap in 2018 Q4 compared to a gain of $2.3 million in 2017 Q4 and the impact of recognizing unamortized transaction costs related to the extinguished Prior Credit Agreement in the amount of $1.9 million in 2018 Q4. Interest and finance costs for Fiscal 2018 of $27.7 million increased by $9.7 million when compared to $18.0 million in Fiscal 2017. The increase is primarily due to higher interest on long-term debt of $3.7 million due to higher average amounts drawn on the Prior Credit Agreement, and after its termination, under the new Credit Facility, throughout Fiscal 2018. The higher amounts drawn are primarily as a result of strategic initiatives including the acquisition of ARBOC and repurchases under the Company's NCIB. The recognition of unamortized transaction costs related to the termination of the Prior Credit Agreement which negatively impacted the 2018 Q4 amount and also negatively impacted Fiscal 2018.

Earnings before income taxes ("EBT")

EBT for 2018 Q4 of $50.7 million decreased compared to EBT of $67.1 million in 2017 Q4 and the EBT for Fiscal 2018 of $210.7 million decreased compared to EBT of $241.6 million in Fiscal 2017. The primary drivers of the changes to EBT are addressed in the Earnings from Operations, EBIT, and Interest and finance costs sections above.

Income tax expense

The income tax expense for 2018 Q4 was $7.9 million, consisting of $9.5 million of current income tax expense offset by $1.6 million of deferred income tax recovery. In comparison, the income tax recovery for 2017 Q4 was $9.0 million, consisting of $4.0 million of current income tax expense and $13.0 million of deferred income tax recovery. The income tax expense for Fiscal 2018 was $50.7 million, consisting of $56.3 million of current income tax expense offset by $5.6 million of deferred income tax recovery. In comparison, the income tax expense for Fiscal 2017 was $50.2 million, consisting of $81.1 million of current income tax expense and $30.9 million of deferred income tax recovery.

The ETR for 2018 Q4 of 15.6% increased compared to the effective tax rate of negative 13.5% in 2017 Q4. The ETR for Fiscal 2018 of 24.1% increased compared to the ETR of 20.8% in Fiscal 2017. The ETR for 2018 Q4 was lower than expected primarily due to the impact of foreign exchange in the quarter while the ETR for 2017 Q4 was significantly lower due to the impact of the US Federal tax rate reduction (introduced as part of U.S. tax reform enacted on December 22, 2017) on the Company's deferred tax balances. The ETR for Fiscal 2018 and 2017 were similarly impacted by these factors.

Net earnings

The Company reported net earnings of $42.8 million in 2018 Q4, a decrease of 43.8% compared to net earnings of $76.1 million in 2017 Q4. The Fiscal 2018 net earnings of $159.9 million, decreased by 16.5% compared to net earnings of $191.4 million in Fiscal 2017.

Net earnings (Unaudited U.S. dollars in millions)	**2018 Q4**	**2017 Q4**	**Fiscal 2018**	**Fiscal 2017**
Earnings from operations	$ 60.6	$ 71.5	$ 237.8	$ 256.2
Non-cash gain (loss)	0.8	(1.2)	0.5	3.5
Interest expense	(10.7)	(3.2)	(27.7)	(18.0)
Income tax expense	(7.9)	9.0	(50.7)	(50.3)
Net earnings	$ 42.8	$ 76.1	$ 159.9	$ 191.4
Net earnings per Share (basic)	$ 0.69	$ 1.21	$ 2.56	$ 3.06
Net earnings per Share (fully diluted)	$ 0.68	$ 1.20	$ 2.55	$ 3.03

The Company's net earnings per Share in 2018 Q4 of $0.69 decreased from net earnings per Share of $1.21 generated in 2017 Q4. The Company's net earnings per Share in Fiscal 2018 of $2.56 decreased from $3.06 generated in Fiscal 2017. Net earnings were lower in 2018 Q4 and Fiscal 2018 for the reasons discussed throughout the Results of Operation section in this MD&A, which decreased earnings per share in 2018 Q4 and Fiscal 2018 compared to 2017 Q4 and Fiscal 2017. Partially offsetting the impact of these decreases in net earnings per share were lower weighted average common Shares as disclosed in note 14 to the consolidated financial statements.

Cash Flow

The cash flows of the Company are summarized as follows:

(Unaudited Quarterly Results, U.S. dollars in thousands)	**2018 Q4**	**2017 Q4**	**Fiscal 2018**	**Fiscal 2017**
Cash generated by operating activities before non-cash working capital items and interest and income taxes paid	$ 87,824	$ 83,279	305,643	303,752
Interest paid	(6,338)	(4,673)	(23,073)	(18,755)
Income taxes paid	(12,154)	(28,506)	(73,082)	(105,877)
Net cash earnings	69,332	50,100	209,488	179,120
Cash flow used in changes in working capital	(1,992)	(42,728)	(34,344)	(7,061)
Cash flow generated from operating activities	67,340	7,372	175,144	172,059
Cash flow used in financing activities	(37,699)	84,713	(83,774)	(31,382)
Cash flow used in investing activities	(20,166)	(117,385)	(70,806)	(164,122)

Cash flows from operating activities

The 2018 Q4 net operating cash inflow of $67.3 million is comprised of $69.3 million of net cash earnings offset by a decrease in non-cash working capital of $2.0 million. The 2017 Q4 net operating cash inflow of $7.4 million is comprised of $50.1 million of net cash earnings and a decrease in cash used for working capital of $42.7 million. The Fiscal 2018 net operation cash flow of $175.1 million is comprised of $209.5 million net cash earnings and an increase in cash used in for working capital of $34.3 million. The Fiscal 2017 net operation cash flow of $172.1 million resulting from $179.1 million net cash earnings and an increase in cash used in changes in working capital of $7.1 million.

Cash flow from financing activities

The cash outflows during 2018 Q4 and Fiscal 2018 primarily related to proceeds from long-term debt related to the new Credit Facility and capital returned to shareholders through dividends and Shares repurchased under the NCIB.

Cash flow from investing activities

(Unaudited Quarterly Results, U.S. dollars in thousands)	**2018 Q4**	**2017 Q4**	**Fiscal 2018**	**Fiscal 2017**
Acquisition of intangible assets	$ (32)	$ (126)	$ (50)	$ (193)
Proceeds from disposition of property, plant and equipment	10	18	235	526
Net cash used in acquisitions	—	(96,225)	—	(111,642)
Acquisition of property, plant and equipment	(20,144)	(21,052)	(70,991)	(52,813)
Net cash earnings	$ (20,166)	$ (117,385)	$ (70,806)	$ (164,122)

2018 Q4 investing activities are significantly lower than 2017 Q4 primarily due to the impact of the acquisition of ARBOC in 2017 as well as the impact of higher capital purchases Fiscal 2018 compared to Fiscal 2017. There were no acquisitions in 2018 Q4. Fiscal 2018 investing activities were significantly lower than Fiscal 2017 for the same reasons noted in the 2018 Q4 to 2017 Q4 comparison above as well as the acquisitions of Sintex-Wausaukee Composites Inc. and Carlson Engineered Composites Inc. which occurred prior to 2017 Q4.

Interest rate risk

On January 20, 2016, the Company entered into a $482,000 interest rate swap designed to hedge floating rate exposure on the $482,000 Term Credit Facility of the Prior Credit Agreement. The interest rate swap fixes the interest rate at 1.154% plus the applicable interest margin. On February 13, 2019, the Company blended the unrealized gain from the existing swap into a $600,000 notional interest rate swap designed to hedge floating rate exposure on the Company's Credit Facility. The interest rate swap fixes the interest rate at 2.27% plus applicable margin until October 2023.

The fair value of the interest rate swap asset of $6.6 million at Fiscal 2018 (Fiscal 2017: $7.4 million) was recorded on the consolidated statements of financial position as a derivative financial instruments asset and the change in fair value has been recorded as finance costs for the reported period.

Credit risk

Financial instruments which potentially subject the Company to credit risk and concentrations of credit risk consist principally of cash, accounts receivable and derivatives. Management has assessed that the credit risk associated with accounts receivable is mitigated by the significant proportion of counterparties that are well established public transit authorities. Additionally, the U.S. federal government funds a substantial portion of U.S. public sector customer payments - up to 80% of the capital cost of new transit buses, coaches or cutaways, while the remaining 20% comes from state and municipal sources. There are a few U.S. public sector customers that obtain 100% of their funding from state and municipal sources. The maximum exposure to the risk of credit for accounts receivables corresponds to their book value. Historically, the Company has experienced nominal bad debts as a result of the customer base being principally comprised of municipal and other local transit authorities.

In both the U.S. and Canada, purchase of new coaches, transit buses or cutaways by private fleet operators is paid from the operators' own capital budgets and funded by their own cash flow. A significant portion of private fleet operators choose to finance new coach purchases with lending organizations. In some cases MCI assists in arranging this financing, and in some cases it provides financing through its ultimate net loss pool. The Company has experienced a nominal amount of bad debts with its private sales customers as most cash transactions require payment on delivery.

The carrying amount of accounts receivable is reduced through the use of an allowance account and the amount of the loss is recognized in the earnings statement within SG&A. When a receivable balance is considered uncollectible, it is written off against the allowance for doubtful accounts. Subsequent recoveries of amounts previously written off are credited against SG&A in the consolidated statements of net earnings and total comprehensive income.

The following table details the aging of the Company’s receivables and related allowance for doubtful accounts:

	December 30, 2018	December 31, 2017
Current, including holdbacks	$ 358,729	$ 361,805
Past due amounts but not impaired		
1 – 60 days	24,153	22,306
Greater than 60 days	4,830	2,878
Less: allowance for doubtful accounts	(226)	(522)
Total accounts receivables, net	$ 387,486	$ 386,467

The counterparties to the Company's derivatives are chartered Canadian banks. The Company could be exposed to loss in the event of non-performance by the counterparty. However, credit ratings and concentration of risk of the financial institutions are monitored on a regular basis.

Commitments and Contractual Obligations

The following table describes the Company's maturity analysis of the undiscounted cash flows of certain non-current financial liabilities and leases as at December 30, 2018:

U.S. dollars in thousands	Total	2019	2020	2021	2022	2023	Post 2023
Other long-term liabilities	1,008	1,008	—	—	—	—	—
Finance leases	29,363	8,803	7,204	5,990	4,358	3,008	—
Accrued benefit liability	9,266	8,967	299	—	—	—	—
Operating leases	70,690	10,759	9,519	9,465	9,055	8,714	23,178
	$ 110,327	$ 29,537	$ 17,022	$ 15,455	$ 13,413	$ 11,722	$ 23,178

As at December 30, 2018, outstanding surety bonds guaranteed by the Company amounted to $394.4 million, representing an increase compared to $327.3 million at December 31, 2017. The estimated maturity dates of the surety bonds outstanding at December 30, 2018 range from December 2018 to August 2020. Management believes that adequate facilities exist to meet projected surety requirements.

The Company has not recorded a liability under these guarantees as management believes that no material events of default exist under any applicable contracts with customers.

Under the Credit Facility, the Company had established a letter of credit sub-facility of $100.0 million. As at December 30, 2018, letters of credit amounting to $13.8 million (December 31, 2017: $8.8 million) remained outstanding under the letter of credit facility as security for the contractual obligations of the Company.

The Company does not have any off-balance sheet arrangement or any material capital asset commitments at December 30, 2018.

Stock Option Plan

The Board adopted a Share Option Plan (the "Option Plan") for NFI on March 21, 2013 (and amended and restated on December 8, 2015 and December 31, 2018), under which employees of NFI and certain of its affiliates may receive grants of Share options. Directors who are not employed with NFI are not eligible to participate in the Option Plan. A maximum of 3,600,000 Shares are reserved for issuance under the Option Plan. The options become vested as to one-quarter on the first grant date anniversary and an additional one-quarter on the second, third and fourth anniversary of the grant date.

Option Grant dates	Number	Exercised	Expired	Vested	Unvested	Expiry date	Exercise price	Fair Value at grant date
March 26, 2013	490,356	(468,117)	—	(22,239)	—	March 26, 2021	C$10.20	C$1.55
December 30, 2013	612,050	(522,298)	(9,631)	(80,121)	—	December 30, 2021	C$10.57	C$1.44
December 28, 2014	499,984	(158,539)	(11,368)	(330,077)	—	December 28, 2022	C$13.45	C$1.83
December 28, 2015	221,888	(12,832)	—	(153,584)	55,472	December 28, 2023	C$26.75	C$4.21
September 8, 2016	2,171	—	—	(1,629)	542	September 8, 2024	C$42.83	C$8.06
January 3, 2017	151,419	(1,610)	—	(36,247)	113,562	January 3, 2025	C$40.84	C$7.74
January 2, 2018	152,833	—	—	—	152,833	January 2, 2026	C$54.00	C$9.53
	2,130,701	(1,163,396)	(20,999)	(623,897)	322,409		C$27.02	

The following reconciles the stock options outstanding:

	Fiscal 2018		Fiscal 2017	
	Number	Weighted average exercise price	Number	Weighted average exercise price
Balance at beginning of period	979,333	C$19.94	1,175,099	C$14.70
Granted during the period	152,833	C$54.00	151,419	C$40.84
Expired during the period	—	—	—	—
Exercised during the period	(185,860)	C$11.91	(347,185)	C$11.31
Balance at end of period	946,306	C$27.02	979,333	C$19.94

Restricted Share Unit Plan for Non-Employee Directors

Pursuant to the Company's Restricted Share Unit Plan for Non-Employee Directors, a maximum of 500,000 Shares are reserved for issuance to non-employee directors. The Company issued approximately $162 thousand of director restricted Share units ("Director RSUs") in 2018 Q4. Of these Director RSUs issued, approximately $93 thousand were exercised and exchanged for 2,909 Shares.

New and amended standards adopted by the Company

IFRS 9 – Financial Instruments:

The Company has adopted IFRS 9 Financial Instruments as of January 1, 2018. The requirements of IFRS 9 represent a significant change from IAS 39 Financial Instruments: Recognition and Measurement.

The details and quantitative impact of the changes in accounting policies are disclosed below.

- IFRS 9 contains three principal classification categories for financial assets: measured at amortized cost, fair value through other comprehensive income and fair value through profit or loss. This standard eliminates the previous IAS 39 categories of fair value through profit or loss, held to maturity, loans and receivables and available for sale. Under IFRS 9, financial asset derivatives are never bifurcated. Refer to the table below for a summary of the classification changes upon transition to IFRS 9.
- IFRS 9 sets out a new forward looking 'expected loss' impairment model which replaces the incurred loss model in IAS 39 and applies to financial assets measured at amortized cost, contract assets and debt investments at fair value through other comprehensive income. Under the IFRS 9 'expected loss' model, a credit event no longer has to occur before credit losses are recognized. An assessment was performed to determine the expected credit loss of financial assets and the Company determined the expected credit loss to not be material.

The following table shows the original measurement categories under IAS 39 and the new measurement categories under IFRS 9 for each class of the Company's financial assets and liabilities as at January 1, 2018.

	Original classification under IAS 39	New classification under IFRS 9
Cash	Loans and receivables	Amortized cost
Accounts receivable	Loans and receivables	Amortized cost
Deposits	Loans and receivables	Amortized cost
Accounts payables and accrued liabilities	Loans and receivables	Amortized cost
Other long-term liabilities	Loans and receivables	Amortized cost
Long-term debt	Loans and receivables	Amortized cost
Derivative financial instruments	Fair value through profit or loss	Fair value through profit or loss

The implementation of IFRS 9 had no material impact on the Company's Financial Statements.

IFRS 15 - Revenue from Contracts with Customers:

The Company has adopted IFRS 15 Revenue from Contracts with Customers as of January 1, 2018. In accordance with the transition provisions in IFRS 15, the Company has elected to apply the new rules retrospectively whereby the transitional adjustment is recognized in retained earnings, if any, with adjustment of comparatives.

The Company's manufacturing operations recognizes revenue from the sale of its new transit buses, coaches or cutaways when control passes to the customer. However, in some contracts, a portion of the selling price includes the revenue for contract spares and training in which the goods and services are delivered to the customer on a separate date. IFRS 15 requires that the Company assesses the goods or service promised in a contract with a customer and identify as a performance obligation each promise to transfer to the customer a good or service that is distinct. Management has determined that the delivery of contract spares and training meets the criteria of goods or service being distinct as it is separately identifiable and the customer benefits from the good or service separate from the delivery of a new transit bus, coach or cutaway. Hence, with the adoption of IFRS 15, the revenue from contract spares and training is deferred and recognized in revenue when provided to the customer.

Prior to adoption of IFRS 15, accrual for the cost of the contract spares and training were recorded at that time of delivery of the new transit bus, coach or cutaway and depleted when provided to the customer. As there is no margin on contract spares and training, the accrual amount approximates the deferred revenue as the reversal of the accrual of cost of goods sold equals the reversal of revenue that is now required to be recorded as deferred. There is therefore, no retained earnings impact in the transitional adjustment and the adjustment will only affect the statements of financial position accounts as described below:

	As reported December 31, 2017	Transition adjustments	As restated January 1, 2018
Accounts payable and accrued liabilities	$ 319,436	$ (6,876)	$ 312,560
Current portion of deferred revenue	27,255	6,876	34,131

Future Changes to Accounting Standards

The following issued accounting pronouncements represent a summary of the pronouncements that are likely to, or may at some future time, have an impact on the Company.

IFRS 16 – Leases:

In January 2016, the IASB issued IFRS 16, Leases, with an effective date of January 1, 2019, which introduced new guidance for identifying leases as well as the accounting, measurement and presentation of leases by the lessee. The lessee now recognizes a liability for the future lease payments to be made for each lease. A right-of-use asset is also recognized and amortized over the useful life. As a result, the previous distinction between operating and finance leases no longer applies. The new standard will retain many key aspects of the current lessor accounting model. With respect to first time application of IFRS 16, the Company can choose to apply the standard using the full retrospective approach or modified retrospective approach The Company plans on using the modified retrospective approach.

The Company will adopt the standard on its effective date. The Company is in the process of finalizing its transition approach. The right-of-use assets and lease liability will be presented separately on the balance sheet. The Company anticipates the adoption of the standard will result in increases to assets of approximately $109 million and liabilities of approximately $109 million on the consolidated statements of financial position. The Company does not anticipate that there will be a material impact in the consolidated statements of earnings and total comprehensive income. The Company's lease payments in 2018 were approximately $10.2 million. These payments will no longer be included within EBITDA, as the impact of leases will be reported through the depreciation of right-of-use assets and finance charges related to lease liabilities.

Controls and Procedures

Internal Controls over Financial Reporting

Management is responsible for establishing and maintaining internal controls over financial reporting ("ICFR"), as defined under rules adopted by the Canadian Securities Administrators. ICFR were designed under the supervision of, and with the participation of, the President and Chief Executive Officer ("CEO") and the Chief Financial Officer ("CFO"). The Company's ICFR are designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of Financial Statements for external purposes in accordance with IFRS.

On December 15, 2014, management adopted the "Internal Control – Integrated Framework 2013" ("COSO 2013") from the Committee of Sponsoring Organizations of the Treadway Commission, which replaces the previously issued COSO framework, COSO 1992. This new framework necessitated a re-evaluation of the controls that management relies upon to support its conclusions, as well as changes to the Company's testing programs.

Management, under the supervision of the CEO and CFO, evaluated the design and operational effectiveness of the Company's ICFR as of December 30, 2018 in accordance with the criteria established in COSO 2013, and concluded that the Company's ICFR are effective.

Management believes there have been no changes in the Company's ICFR during 2018 Q4 that have materially affected, or are reasonably likely to materially affect, the Company's ICFR.

ICFR, no matter how well designed, have inherent limitations. Therefore, ICFR can provide only reasonable assurance with respect to financial statement preparation and may not prevent or detect all misstatements.

Disclosure Controls

Management is responsible for establishing and maintaining disclosure controls and procedures in order to provide reasonable assurance that material information relating to the Company is made known to them in a timely manner and that information required to be disclosed is reported within time periods prescribed by applicable securities legislation. There are inherent limitations to the effectiveness of any system of disclosure controls and procedures, including the possibility of human error and the circumvention or overriding of the controls and procedures. Accordingly, even effective disclosure controls and procedures can only provide reasonable assurance of achieving their control objectives. The Company's CEO and CFO have concluded that disclosure controls and procedures as at December 30, 2018 were effective.

Consolidated Financial Statements of

NFI GROUP INC.

(FORMERLY NEW FLYER INDUSTRIES INC.)

December 30, 2018

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Independent Auditor's Report

To the Shareholders of NFI Group Inc.

Opinion
We have audited the consolidated financial statements of NFI Group Inc. (the "Company"), which comprise the consolidated statements of financial position at December 30, 2018 and December 31, 2017, and the consolidated statements of net earnings and total comprehensive income, changes in equity and cash flows for the years then ended, and notes to the consolidated financial statements, including a summary of significant accounting policies (collectively referred to as the "financial statements").

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Company as at December 30, 2018 and December 31, 2017, and its financial performance and its cash flows for the years then ended in accordance with International Financial Reporting Standards ("IFRS").

Basis for Opinion
We conducted our audit in accordance with Canadian generally accepted auditing standards ("Canadian GAAS"). Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of our report. We are independent of the Company in accordance with the ethical requirements that are relevant to our audit of the financial statements in Canada, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Other Information
Management is responsible for the other information. The other information comprises:

- Management's Discussion and Analysis

Our opinion on the financial statements does not cover the other information and we do not and will not express any form of assurance conclusion thereon. In connection with our audit of the financial statements, our responsibility is to read the other information identified above and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated.

We obtained Management's Discussion and Analysis prior to the date of this auditor's report. If, based on the work we have performed on this other information, we conclude that there is a material misstatement of this other information, we are required to report that fact in this auditor's report. We have nothing to report in this regard.

Responsibilities of Management and Those Charged with Governance for the Financial Statements
Management is responsible for the preparation and fair presentation of the financial statements in accordance with IFRS, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the Company's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Company or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the Company's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements
Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian GAAS will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with Canadian GAAS, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Company's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Company to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- Obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Company to express an opinion on the financial statements. We are responsible for the direction, supervision and performance of the group audit. We remain solely responsible for our audit opinion.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, related safeguards.

The engagement partner on the audit resulting in this independent auditor's report is Haik (Haig) Vanlian.

Deloitte LLP

Chartered Professional Accountants
Winnipeg, Manitoba
March 13, 2019

NFI GROUP INC. (FORMERLY NEW FLYER INDUSTRIES INC.)

CONSOLIDATED STATEMENTS OF NET EARNINGS AND TOTAL COMPREHENSIVE INCOME

52 Weeks ended December 30, 2018 ("Fiscal 2018") and 52 Weeks ended December 31, 2017 ("Fiscal 2017")

(in thousands of U.S. dollars except per share figures)

	Fiscal 2018	Fiscal 2017
Revenue (note 19)	$ 2,519,021	$ 2,381,858
Cost of sales (note 4)	2,064,813	1,930,465
Gross profit	454,208	451,393
Sales, general and administration costs and other operating expenses	210,560	195,957
Foreign exchange loss (gain)	5,793	(766)
Earnings from operations	237,855	256,202
Gain on bargain purchase of subsidiary company	—	1,159
Gain on release of provision	2,138	—
Gain (loss) on disposition of property, plant and equipment	(267)	167
Unrealized foreign exchange gain (loss) on non-current monetary items	(1,381)	2,060
Earnings before interest and income taxes	238,345	259,588
Interest and finance costs		
Interest on long-term debt and convertible debentures	20,518	16,794
Accretion in carrying value of long-term debt and convertible debentures (note 10)	3,316	1,594
Other interest and bank charges	3,028	2,491
Fair market value loss (gain) on interest rate swap	830	(2,913)
	27,692	17,966
Earnings before income tax expense	210,653	241,622
Income tax expense (note 7)		
Current income taxes	56,263	81,116
Deferred income taxes recovered	(5,552)	(30,862)
	50,711	50,254
Net earnings for the year	$ 159,942	$ 191,368
Other comprehensive income (loss)		
Actuarial income (loss) on defined benefit pension plan - this item will not be reclassified subsequently to profit or loss	3,170	(6,842)
Total comprehensive income for the year	$ 163,112	184,526
Net earnings per share (basic) (note 14)	$ 2.56	$ 3.06
Net earnings per share (diluted) (note 14)	$ 2.55	$ 3.03

The accompanying notes are an integral part of the audited consolidated financial statements.

NFI GROUP INC. (FORMERLY NEW FLYER INDUSTRIES INC.)

CONSOLIDATED STATEMENTS OF FINANCIAL POSITION
As at December 30, 2018
(in thousands of U.S. dollars)

	December 30, 2018	December 31, 2017
Assets		
Current		
Cash	$ 10,820	$ —
Accounts receivable (note 3,18 c)	387,486	386,467
Income tax receivable	34,115	24,911
Inventories (note 4)	424,685	359,482
Derivative financial instruments (note 18 b,c)	—	8,217
Prepaid expenses and deposits	10,434	15,253
	867,540	794,330
Property, plant and equipment (note 5, 19)	247,943	186,873
Derivative financial instruments (note 18 b,c)	6,592	7,422
Goodwill and intangible assets (note 6)	951,010	985,962
Other long term asset	1,052	—
	$ 2,074,137	$ 1,974,587
Liabilities		
Current		
Bank indebtedness	$ —	$ 9,938
Accounts payable and accrued liabilities	366,517	319,436
Income tax payable	—	7,328
Derivative financial instruments (note 18 b,c)	1,542	—
Current portion of long-term liabilities (note 25)	80,310	86,483
	448,369	423,185
Accrued benefit liability (note 16)	5,265	19,804
Obligations under finance leases (note 8)	19,087	9,400
Deferred compensation obligation (note 9)	4,979	10,083
Deferred revenue (note 12)	10,443	8,697
Other long-term liabilities	1,008	1,107
Provisions (note 23)	64,946	65,266
Deferred tax liabilities (note 7)	83,121	88,453
Long-term debt (note 10)	639,432	580,763
	$ 1,276,650	$ 1,206,758
Commitments and contingencies (note 21)		
Shareholders' equity		
Share capital (note 13)	654,307	665,602
Stock option and restricted share unit reserve (note 11)	5,796	4,724
Accumulated other comprehensive loss	(6,706)	(9,876)
Treasury shares (note 13)	(8,835)	—
Retained earnings	152,925	107,379
	$ 797,487	$ 767,829
	$ 2,074,137	$ 1,974,587

The accompanying notes are an integral part of the audited consolidated financial statements.

Approved and authorized by the board of directors on March 13, 2019.

"Hon. Brian V. Tobin, Director"

"Phyllis Cochran, Director"

NFI GROUP INC. (FORMERLY NEW FLYER INDUSTRIES INC.)

CONSOLIDATED STATEMENTS OF CHANGES IN EQUITY

For the year ended December 30, 2018
(in thousands of U.S. dollars)

	Share Capital	Equity Component of Convertible Debentures	Stock Option and Restricted Share Unit Reserve	Accumulated Other Comprehensive Loss	Treasury shares	Retained Earnings (Deficit)	Total Shareholders' Equity
Balance, January 1, 2017	**$ 653,671**	**$ 481**	**$ 3,514**	**$ (3,034)**	**$ —**	**$ (24,465)**	**$ 630,167**
Net earnings	—	—	—	—	—	191,368	191,368
Other comprehensive loss	—	—	—	(6,842)	—	—	(6,842)
Dividends declared on common shares	—	—	—	—	—	(59,524)	(59,524)
Share-based compensation, net of deferred income taxes	—	—	1,824	—	—	—	1,824
Shares issued	3,547	—	(614)	—	—	—	2,933
Conversion of debentures to common shares	8,384	(481)	—	—	—	—	7,903
Balance, December 31, 2017	**$ 665,602**	**$ —**	**$ 4,724**	**$ (9,876)**	**$ 0**	**$ 107,379**	**$ 767,829**
Net earnings	—	—	—	—	—	$ 159,942	159,942
Other comprehensive income	—	—	—	3,170	—	—	3,170
Dividends declared on common shares	—	—	—	—	—	(68,646)	(68,646)
Repurchase and cancellation of common shares	(13,973)	—	—	—	—	(32,234)	(46,207)
Change in share purchase commitment	—	—	—	—	(8,835)	(13,516)	(22,351)
Share-based compensation, net of deferred income taxes	—	—	2,061	—	—	—	2,061
Shares issued	2,678	—	(989)	—	—	—	1,689
Balance, December 30, 2018	**$ 654,307**	**$ —**	**$ 5,796**	**$ (6,706)**	**$ (8,835)**	**$ 152,925**	**$ 797,487**

The accompanying notes are an integral part of the audited consolidated financial statements.

NFI GROUP INC. (FORMERLY NEW FLYER INDUSTRIES INC.)

CONSOLIDATED STATEMENTS OF CASH FLOWS
For the year ended December 30, 2018
(in thousands of U.S. dollars)

	Fiscal 2018	Fiscal 2017
Operating activities		
Net earnings for the period	$ 159,942	$ 191,368
Income tax expense	50,711	50,254
Depreciation of plant and equipment	32,840	27,906
Amortization of intangible assets	34,956	29,696
Share-based compensation	1,409	1,453
Interest and finance costs recognized in profit or loss	27,692	17,966
Fair value adjustment for total return swap	6,547	(4,719)
Unrealized foreign exchange loss (gain) on non-current monetary items	1,381	(2,060)
Foreign exchange gain on cash held in foreign currency	(194)	(460)
Gain on bargain purchase of subsidiary company	—	(1,159)
Loss (gain) on disposition of property, plant and equipment	267	(167)
Defined benefit expense	12,333	5,150
Defined benefit funding	(22,241)	(11,476)
Cash generated by operating activities before non-cash working capital items and interest and income taxes paid	305,643	303,752
Changes in non-cash working capital items (note 15)	(34,344)	(7,061)
Cash generated from operating activities before interest and income taxes paid	271,299	296,691
Interest paid	(23,073)	(18,755)
Income taxes paid	(73,082)	(105,877)
Net cash generated from operating activities	175,144	172,059
Financing activities		
Debt issue costs	(2,246)	—
Repayment of obligations under finance leases	(5,125)	(4,115)
Proceeds from long-term debt	57,600	25,000
Share issuance	1,689	3,021
Repayment of convertible debentures	—	(141)
Repayment of other long-term liabilities	(1,000)	(1,000)
Repurchase of shares	(66,522)	—
Dividends paid	(68,170)	(54,147)
Net cash used in financing activities	(83,774)	(31,382)
Investing activities		
Acquisition of intangible assets	(50)	(193)
Proceeds from disposition of property, plant and equipment	235	526
Net cash used in acquisitions (note 1.1)	—	(111,642)
Acquisition of property, plant and equipment	(70,991)	(52,813)
Net cash used in investing activities	(70,806)	(164,122)
Effect of foreign exchange rate on cash	194	460
Increase (decrease) in cash	20,758	(22,985)
(Bank indebtedness) cash — beginning of period	(9,938)	13,047
Cash (Bank indebtedness) — end of period	$ 10,820	$ (9,938)

The accompanying notes are an integral part of the consolidated financial statements.

1. CORPORATE INFORMATION

NFI Group Inc. ("NFI" or the "Company") was incorporated on June 16, 2005 as New Flyer Industries Inc. under the laws of the Province of Ontario. The name of the Company was changed to "NFI Group Inc." on May 14, 2018 to better reflect the multi-platform nature of the Company's business. NFI is the largest transit bus and motor coach manufacturer and parts distributor in North America with fabrication, manufacturing, distribution and service centers in Canada and the United States. The Company provides a comprehensive suite of mass transportation solutions under several brands: New Flyer® (heavy-duty transit buses), MCI® (motor coaches), ARBOC® (low-floor cutaway and medium-duty buses) and NFI Parts™ (bus and coach parts and support).

The Company's common shares (the "Shares") are listed on the Toronto Stock Exchange ("TSX") under the symbol "NFI".

These audited consolidated financial statements (the "Statements") were approved by the Company's board of directors (the "Board") on March 13, 2019.

1.1 Acquisitions

During 2017, NFI completed three acquisitions using existing cash and proceeds from the revolving portion of the Company's senior secured credit facility. The $111,642 of net cash used in the acquisitions is made up as follows:

	Cash Used
Acquisition of Carlson Engineered Composites Inc.	$ 11,439
Acquisition of Sintex-Wausaukee Composites Inc.	3,579
Acquisition of ARBOC Specialty Vehicles, LLC	96,624
Net cash used in acquisitions	$ 111,642

Acquisition of Carlson Engineered Composites Inc.

On June 1, 2017, the Company acquired 100% of the voting equity interest in Carlson Engineered Composites Inc. ("Carlson") and the assets of Carlson's U.S. affiliated companies in Minnesota and Alabama. Carlson, a privately-owned company headquartered in Winnipeg, Manitoba, manufactured fiberglass reinforced polymer components primarily to original equipment manufacturers of transportation vehicles and agricultural equipment. The acquisition has been accounted for using the acquisition method. The fair values of the identifiable assets and liabilities acquired have been based on management's best estimates and valuation techniques as at June 1, 2017. The Company adjusted the preliminary purchase price allocation as set out below to account for information that was not previously available. The adjustments resulted in a decrease to goodwill of $826. The purchase price allocation was finalized on October 1, 2017.

	Original	Adjustments	Revised
Cash purchase price	$ 13,840	$ —	$ 13,840
Less: working capital adjustment	—	(18)	(18)
Less: cash acquired	(2,383)	—	(2,383)
Net cash used in acquisition	11,457	(18)	11,439
Net assets acquired			
Accounts receivable	2,140	—	2,140
Inventories	1,361	—	1,361
Prepaid expenses and deposits	224	—	224
Property, plant and equipment	6,815	—	6,815
Accounts payable and accrued liabilities	(3,135)	—	(3,135)
Income taxes payable	(352)	246	(106)
Obligations under finance leases	(1,185)	—	(1,185)
Long-term debt	(562)	562	—
Deferred tax liabilities	(889)	—	(889)
Net tangible assets acquired	4,417	808	5,225
Patent and licenses	2,000	—	2,000
Identifiable intangible assets acquired	2,000	—	2,000
Goodwill acquired	$ 5,040	$ (826)	$ 4,214

The goodwill acquired is largely attributable to the synergies and economies of scale expected from the combined businesses of NFI and Carlson. This goodwill is not deductible for tax purposes.

Acquisition of the Assets of Sintex-Wausaukee Composites Inc.

On September 25, 2017, the Company acquired certain assets and certain liabilities of Sintex-Wausaukee Composites Inc., a privately-owned manufacturer of fiberglass reinforced polymer components, headquartered in Wausaukee, Wisconsin for net cash of $3,579. The acquisition has been accounted for using the acquisition method. The fair values of the identifiable assets and liabilities acquired have been based on management's best estimates and valuation techniques as at September 25, 2017. The revised fair values of the net assets acquired exceeded the purchase price by $1,159, as a result a gain has been recognized in the Statements relating to this bargain purchase in accordance with IFRS 3.36. The purchase price allocation was finalized on December 31, 2017.

Acquistion of ARBOC Specialty Vehicles, LLC

On December 1, 2017 (the "Acquisition Date"), the Company acquired 100% of the voting equity interest in ARBOC Specialty Vehicles, LLC ("ARBOC"). ARBOC, established in 2008 and located in Middlebury, Indiana, is the North American pioneer and leader in low-floor body-on-chassis (or "cutaway") bus technology. ARBOC also builds medium-duty transit and shuttle buses. The acquisition has been accounted for using the acquisition method. The fair values of the identifiable assets and liabilities acquired have been based on management's best estimates and valuation techniques as at the Acquisition Date. The Company adjusted the preliminary purchase price allocation as set out below to account for information that was not previously available. The adjustments resulted in a decrease of goodwill of $46. The purchase price allocation was finalized on July 1, 2018.

	Original	Adjustments	Revised
Cash purchase price	$ 99,885	$ —	$ 99,885
Less: working capital adjustment	—	(46)	(46)
Less: cash acquired	(3,261)	—	(3,261)
Net cash used in acquisition	96,624	(46)	96,578
Net assets acquired			
Accounts receivable	601	—	601
Income tax receivable	1,351	—	1,351
Inventories	6,437	—	6,437
Prepaid expenses and deposits	473	—	473
Property, plant and equipment	3,408	—	3,408
Deferred tax assets	685	—	685
Accounts payable and accrued liabilities	(3,789)	—	(3,789)
Provision for warranties	(475)	—	(475)
Other long-term liabilities	(1,107)	—	(1,107)
Deferred tax liabilities	(25,502)	—	(25,502)
Net tangible assets acquired	(17,918)	—	(17,918)
Trade names	4,800	—	4,800
Patent and licenses	7,000	—	7,000
Customer relationships	50,500	—	50,500
Backlog of sales orders	3,200	—	3,200
Identifiable intangible assets acquired	65,500	—	65,500
Goodwill acquired	$ 49,042	$ (46)	$ 48,996

The goodwill acquired is largely attributable to the synergies and economies of scale expected from the combined businesses of NFI and ARBOC. This goodwill is not deductible for tax purposes.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

The principal accounting policies applied in the preparation of these Statements are set out below. These policies have been consistently applied to all periods presented, unless otherwise stated.

2.1 Basis of preparation

The Statements were prepared on a going concern basis in accordance with International Financial Reporting Standards ("IFRS") which requires management to make judgments, estimates and assumptions that affect the application of accounting policies and the reported amounts of assets and liabilities, revenue and expenses. Actual results may differ from these estimates.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

2.2 Principles of consolidation

The Statements include the accounts of the Company's subsidiaries.

Subsidiaries

Subsidiaries are entities over which the Company has control, where control is achieved when the Company: has power over the investee; is exposed, or has rights, to variable returns from its involvement with the investee; and has the ability to use its power to affect its returns. The Company holds 100% of the voting rights in, and therefore controls, its subsidiaries.

The effects of potential voting rights that are currently exercisable are considered when assessing whether control exists. Subsidiaries are fully consolidated from the date control is transferred to the Company, and are de-consolidated from the date control ceases.

The acquisition method of accounting is used to account for the acquisition of subsidiaries as follows:

- cost is measured as the fair value of the assets given, equity instruments issued and liabilities incurred or assumed at the date of exchange, and business acquisition related expenses are expensed as incurred;
- identifiable assets acquired and liabilities assumed are measured at their fair values at the acquisition date;
- the excess of acquisition cost over the fair value of the identifiable net assets acquired is recorded as goodwill; and
- if the acquisition cost is less than the fair value of the net assets acquired, the fair value of the net assets is reassessed and any remaining difference is recognized directly in the consolidated statements of net earnings and comprehensive income.

Inter-company transactions between subsidiaries are eliminated on consolidation.

2.3 New and amended standards adopted by the Company

IFRS 9 – Financial Instruments:

The Company has adopted IFRS 9 Financial Instruments as of January 1, 2018 on a retrospective basis. The requirements of IFRS 9 represent a significant change from IAS 39 Financial Instruments: Recognition and Measurement.

The details and quantitative impact of the changes in accounting policies are disclosed below.

- IFRS 9 contains three principal classification categories for financial assets: measured at amortized cost, fair value through other comprehensive income and fair value through profit or loss. This standard eliminates the previous IAS 39 categories of held to maturity, loans and receivables and available for sale. Under IFRS 9, financial asset derivatives are never bifurcated.

- IFRS 9 sets out a new forward looking 'expected loss' impairment model which replaces the incurred loss model in IAS 39 and applies to financial assets measured at amortized cost, contract assets and debt investments at fair value through other comprehensive income. Under the IFRS 9 'expected loss' model, a credit event no longer has to occur before credit losses are recognized.

The following table shows the original measurement categories under IAS 39 and the new measurement categories under IFRS 9 for each class of the Company's financial assets and liabilities as at January 1, 2018.

	Original classification under IAS 39	New classification under IFRS 9
Cash	Loans and receivables	Amortized cost
Accounts receivable	Loans and receivables	Amortized cost
Deposits	Loans and receivables	Amortized cost
Bank indebtedness	Loans and receivables	Amortized cost
Accounts payables and accrued liabilities	Loans and receivables	Amortized cost
Other long-term liabilities	Loans and receivables	Amortized cost
Long-term debt	Loans and receivables	Amortized cost
Derivative financial instruments	Fair value through profit or loss	Fair value through profit or loss

The implementation of IFRS 9 had no material impact on the Statements.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

IFRS 15 Revenue from Contracts with Customers

The Company has adopted IFRS 15 Revenue from Contracts with Customers as of January 1, 2018. In accordance with the transition provisions in IFRS 15, the Company has elected to apply the new standards using the modified retrospective approach.

The Company's manufacturing operations recognize revenue from the sale of its new transit buses, coaches or cutaways when control passes to the customer. However, in some contracts, a portion of the selling price includes the revenue for contract spares and training in which the goods and services are delivered to the customer on a separate date. IFRS 15 requires that the Company assesses the goods or service promised in a contract with a customer and identify as a performance obligation each promise to transfer to the customer a good or service that is distinct. As per the Company's assessment, the delivery of contract spares and training meets the criteria of goods or service being distinct as it is separately identifiable and the customer benefits from the good or service separate from the delivery of a new transit bus, coach or cutaway. Hence, with the adoption of IFRS 15, the revenue from contract spares and training is deferred and recognized to revenue when provided to the customer.

Prior to adoption of IFRS 15, accrual for the cost of the contract spares and training were recorded at that time of delivery of the new transit bus, coach or cutaway and depleted when provided to the customer. As there is no margin on contract spares and training, the accrual amount approximates the deferred revenue as the reversal of the accrual of cost of goods sold equals the reversal of the revenue that is now required to be recorded as deferred. There is therefore, no retained earnings impact in the transitional adjustment and it only affects certain statements of financial position accounts as shown below:

	As reported December 31, 2017	Transition adjustments	As restated January 1, 2018
Accounts payable and accrued liabilities	$ 319,436	$ (6,876)	$ 312,560
Current portion of deferred revenue	27,255	6,876	34,131

2.4 Reportable Segments

The Company's reportable segments are organized around the markets it serves and are reported in a manner consistent with the internal reporting provided to the chief operating decision-maker ("CODM"). The President and Chief Executive Officer of the Company has authority for resource allocation and assessment of the Company's performance and therefore acts as the CODM.

2.5 Foreign currency

The Statements are presented in U.S. dollars, which is the currency of the primary economic environment in which the Company operates (the "functional currency"). References to "$" are to U.S. dollars, references to "C$" are to Canadian dollars.

Items included in the financial statements of each of the Company's subsidiaries are measured using the functional currency. Foreign currency transactions are translated into the functional currency using the exchange rates prevailing at the dates of the transaction. Foreign exchange gains and losses resulting from the settlement of such transactions and from the translation of monetary assets and liabilities not denominated in the functional currency of an entity are recognized in the consolidated statements of net earnings and comprehensive income.

Monetary balances denominated in a currency other than U.S. dollars are translated at the period end rates of exchange, and the results of the operations are translated at average rates of exchange for the period. Non-monetary balances are translated at the exchange rate prevailing at the date of the transaction.

Foreign exchange gains and losses that relate to borrowings, non-current monetary items and non-current forward foreign exchange contracts are presented in the consolidated statements of net earnings and comprehensive income within "unrealized foreign exchange loss (gain) on non-current monetary items".

All other foreign exchange gains and losses are presented in the consolidated statements of net earnings and comprehensive income within "foreign exchange (loss) gain".

2.6 Revenue recognition

Manufacturing Operations

Persuasive evidence of an arrangement exists in the form of a written contract. A process is in place that initiates a pre-shipment acceptance by the customer at the Company's plant. This acceptance prior to shipment mitigates the likelihood of customer's dissatisfaction with

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

the final product upon delivery to the customer. Revenue is recorded when the buses or coaches are delivered or shipped. The customer does not have a legal right to return the delivered products after the acceptance period, or deviate from the agreed upon price. The Company's contract clearly identifies a fixed and determinable price.

In connection with its sales of new coaches, the Company at times agrees to accept a pre-owned coach in exchange and gives the buyer a credit equal to the pre-owned coach's then-current fair value. Any credit provided to the customer in excess of the fair value of the pre-owned coach is deducted from the selling price of the new coach.

Operating lease revenue is recorded on a straight-line basis in the period earned over the life of the contract and is recognized in revenue in the consolidated statements of net earnings and comprehensive income due to its operating nature.

When a single sale transaction requires the delivery of more than one product or service (multiple performance obligations), the revenue recognition criteria are applied to the separately identifiable performance obligations. A performance obligation is considered to be separately identifiable if the product or service delivered has stand-alone value to that customer and the fair value associated with the product or service can be measured reliably. The amount recognized as revenue for each performance obligation is its fair value in relation to the fair value of the contract as a whole. Management has determined that the standard base warranty included in the bus or coach purchase is not a separate performance obligation and therefore recognized upon delivery of the bus or coach.

The Company sells extended warranty contracts that provide coverage in addition to the basic coverage. Proceeds from the sale of these contracts are deferred and amortized into revenue over the extended warranty period commencing at the end of the basic warranty period. The Company also receives proceeds from the sale of extended warranties relating to major subsystems such as engines, transmissions, axles and air conditioning that are purchased for the customer from the original equipment manufacturer ("OEM"). The related cost to purchase the OEM warranty contracts have been recorded as a reduction of revenue as the Company is an agent to the transaction.

The Company does not recognize revenue on any bus or coach firm or option orders that have not yet been delivered.

Aftermarket Operations

Persuasive evidence of an arrangement exists in the form of an authorized sales order. The customer is invoiced, and revenue is recorded at the time the part is delivered using a commercial shipper. The price list for parts clearly identifies a fixed and determinable price, while also describing that the Company has no legal obligation to accept the return of goods other than on defective and/or warrantable parts product. Aftermarket parts revenue does not contain any revenue related to the bus or coach warranty.

2.7 Employee benefits

For defined benefit pension plans and other post-employment benefits, the net periodic pension expense is actuarially determined by independent actuaries using the projected unit credit method. Actuarial remeasurement is comprised of actuarial gains and losses, the effect of the changes to the asset ceiling (if applicable) and the return on plan assets (excluding interest), and is reflected immediately in the statement of financial position with a charge or credit recognized in other comprehensive income in the period in which they occur. Remeasurement recognized in other comprehensive income is reflected immediately in accumulated other comprehensive loss and will not be reclassified to profit or loss. Past service cost is recognized in profit or loss in the period of a plan amendment. Net interest is calculated by applying the discount rate at the beginning of the period to the net defined benefit liability or asset. Defined benefit costs are comprised of service costs (including current service cost, past service cost and gain or losses on curtailments and settlements), net interest expense or income and remeasurement.

The asset or liability recognized in the consolidated statements of financial position is the present value of the defined benefit obligation at the end of the reporting period less the fair value of plan assets, together with adjustments for past service costs. The present value of the defined benefit obligation is determined by discounting the estimated future cash outflows using interest rates of high-quality corporate bonds that are denominated in the currency in which the benefits will be paid and that have terms to maturity approximating the terms of the related pension liability. For funded plans, surpluses are recognized only to the extent that the surplus is considered recoverable. Recoverability is primarily based on the extent to which the Company can unilaterally reduce future contributions to the plan.

Payments to defined contribution plans are expensed as incurred, which is as the related employee service is rendered.

2.8 Share-based compensation plans

The Company operates cash-settled and equity-settled share-based compensation plans under which it receives services from senior managment and non-employee members of the board of directors of the Company (the "Board").

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

For the cash-settled plans (note 9), the expense is determined based on the fair value of the liability at the end of the reporting period until the awards are settled. Certain share-based compensation plans include non-market performance conditions. The Company`s accounting policy is to recognize the impact of non-market performance conditions by adjusting the number of awards that are expected to vest. At the end of each reporting period, the Company re-assesses its estimates of the number of awards that are expected to vest and recognizes the impact of the revisions on compensation expense (note 20) in the consolidated statements of net earnings and comprehensive income.

For the equity-settled plans (note 11), share-based payments to senior management are measured at the fair value of the equity instruments at the grant date. The fair value is measured at grant date and each tranche is recognized on a graded-vesting basis over the period in which the options vest. The offset to the recorded cost is the stock option reserve. Consideration received on the exercise of stock options is recorded as share capital and the related stock option reserve is transferred to share capital. Upon expiry, the recorded value is transferred to retained earnings. At the end of each reporting period, the Company revises its estimate of the number of equity instruments expected to vest. The impact of the revision of the original estimates, if any, is recognized in the consolidated statements of net earnings and comprehensive income such that the cumulative expense reflects the revised estimate, with a corresponding adjustment to the stock option reserve. Where the terms and conditions of options are modified, the increase in the fair value of the options, measured immediately before and after the modification, is also charged to the consolidated statements of net earnings and comprehensive income.

2.9 Cash

Cash and cash equivalents comprise cash on hand, demand deposits and investments with an original maturity at the date of purchase of three months or less.

2.10 Accounts receivables

Accounts receivables are amounts due from customers from the rendering of services or sale of goods in the ordinary course of business. Accounts receivables are classified as current assets if payment is due within one year or less. Accounts receivables are recognized initially at fair value and subsequently measured at amortized cost, less impairment, if any.

The Company maintains an allowance for doubtful accounts and sales adjustments to provide for impairment of trade receivables. The expense relating to doubtful accounts is included within “Sales, general and administration costs and other operating expenses” in the consolidated statements of net earnings and comprehensive income.

2.11 Inventories

Inventories are measured at the lower of cost and net realizable value. The cost of inventories is based on the first-in first-out principle, and includes expenditures incurred in acquiring the inventories, production or conversion costs and other costs incurred in bringing them to their existing location and condition. In the case of manufactured inventories and work in progress, cost includes an appropriate share of production overheads based on normal operating capacity. Net realizable value is the estimated selling price in the ordinary course of business, less the estimated costs of completion and selling expenses.

2.12 Property, plant and equipment

Property, plant and equipment are recorded at cost reduced by applicable investment tax credits, less accumulated depreciation. Depreciation is calculated at the following annual rates:

Building and building improvements	4% declining-balance basis
Machinery and equipment	25% declining-balance basis
Demo buses and coaches	20% - 50% straight-line basis
Computer hardware and software	30% declining-balance basis
Office equipment	20% declining-balance basis
Buses and coaches available for lease	20% - 50% straight-line basis

Depreciation of equipment under finance leases is based on the lesser of the equipment’s useful life or the term of the finance lease.

Leases of property, plant and equipment on terms that transfer substantially all of the risks and rewards of ownership are accounted for as finance leases. All other leases of property, plant and equipment are accounted for as operating leases.

Property, plant and equipment are tested for impairment as described under “Impairment of non-financial assets” in note 2.15.

2.13 Intangible assets

Identifiable intangible assets are initially recorded at fair value. Based on management’s forecasts and business plans and the going concern of the Company, the trade names intangible asset (note 6) has been deemed to have an indefinite life, except for the NABI Parts tradename

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

which is amortized over its useful life of 12 years. For purposes of impairment testing, the fair value of trade names is determined using an income approach.

Intangible assets that have a finite life are amortized using the straight-line method over the estimated useful lives of the assets as follows:

Patents and Licenses	5-12 years
Backlog of sales orders	1-2 years
Customer relationships	21 years

Identifiable intangible assets with finite and indefinite lives are tested for impairment as described under "Impairment of non-financial assets" in note 2.15.

2.14 Goodwill

Goodwill represents the excess of the cost of an acquisition over the fair value of the Company's share of the net identifiable assets of the acquired business at the date of acquisition. Separately recognized goodwill is tested at the end of every reporting period for possible impairment when there are events or changes in circumstances that indicate that their carrying amounts may not be recoverable and also tested annually for impairment. Goodwill is carried at cost less accumulated impairment losses. Gains and losses on the disposal of an entity include the carrying amount of goodwill relating to the entity sold.

2.15 Impairment of non-financial assets

Non-financial assets with finite lives are tested at the end of every reporting period for possible impairment when there are events or changes in circumstances that indicate that their carrying amounts may not be recoverable. In addition, non-financial assets that are not amortized are subject to an annual impairment assessment. The carrying values of identifiable intangible assets with indefinite lives are tested annually for impairment because they are not amortized. Impairment is determined by comparing the recoverable amount of such assets with their carrying amounts. Any impairment loss is recognized for the amount by which the asset's carrying amount exceeds its recoverable amount within earnings of continuing or discontinued operations, as appropriate.

The recoverable amount is the higher of an asset's fair value less cost to sell or its value in use. For the purpose of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash inflows or cash generating units ("CGUs"). The Company evaluates impairment losses for potential reversals, other than goodwill impairment, when events or changes in circumstances warrant such consideration.

2.16 Provisions

Provisions represent liabilities to the Company for which the amount or timing is uncertain. Provisions are recognized when the Company has a present legal or constructive obligation as a result of past events, it is probable that an outflow of resources will be required to settle the obligation and the amount can be reliably estimated. Provisions are not recognized for future operating losses, unless the losses relate to an onerous contract. Provisions are measured at the present value of the expenditures expected to be required to settle the obligation using a discount rate that reflects current market assessments of the time value of money and the risks specific to the obligation. Provisions are re-measured at each consolidated statements of financial position date using the current discount rate. The increase in the provision due to passage of time is recognized as interest expense.

At the time of sale, a provision for warranty claims relating to the base warranty on the entire bus or motor coach and a corrosion warranty on the related structure, is recorded and charged against operations. This warranty provision is based upon management's best estimate of expected future warranty costs utilizing past claims experience. Actual warranty expenditures are charged against the provision as incurred.

A provision for onerous contracts is recognized when the expected benefits to be derived by the Company from a contract are lower than the unavoidable cost of meeting its obligations under the contract. The provision is measured at the present value of the lower of the expected cost of terminating the contract and the expected net cost of continuing with the contract. Before a provision is established, the Company recognizes any impairment loss on the assets associated with that contract.

2.17 Long-term debt

Long-term debt is recognized initially at fair value, net of transaction costs incurred. Debt is subsequently stated at amortized cost with any difference between the proceeds and the amortized cost recognized in the consolidated statements of net earnings and comprehensive income over the term of the debt using the effective interest method.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

Debt is classified as a current liability unless the Company has an unconditional right to defer settlement for at least 12 months after the date of the consolidated statements of financial position.

2.18 Financial instruments

Financial assets

Purchases and sales of financial assets are recognized on the settlement date, which is the date on which the asset is delivered to or by the Company. Financial assets are derecognized when the rights to receive cash flows from the investments have expired or were transferred and the Company has transferred substantially all risks and rewards of ownership. Financial assets are classified in the following categories at the time of initial recognition based on the purpose for which the financial assets were acquired:

Financial assets at fair value through profit or loss

Classification

Financial assets at fair value through profit or loss are financial assets held for trading or designated as fair value through profit or loss. A financial asset is classified in this category if acquired principally for the purpose of selling in the short-term or if so designated by management. Assets in this category include derivative financial instruments and are classified as short or long term assets in the consolidated statements of financial position.

Recognition and measurement

Financial assets are initially recognized at fair value and subsequently carried at fair value through profit and loss, with changes recognized in the consolidated statements of net earnings and comprehensive income. Transaction costs are expensed as incurred.

Financial assets carried at amortized cost

Classification

Financial assets classified as amortized cost are non-derivative financial assets that the Company intends to hold in order to collect the contractual cash flows and have fixed or determinable payments that are not quoted in an active market. They are included in current assets, except for those with maturities greater than 12 months after the consolidated statements of financial position date, which are classified as non-current assets. Assets in this category include accounts receivables, deposits and cash and are classified as current assets in the consolidated statements of financial position.

Recognition and measurement

Financial assets carried at amortized cost are initially recognized at fair value plus transaction costs and subsequently carried at amortized cost using the effective interest method.

Financial liabilities carried at amortized cost

Financial liabilities primarily consist of bank indebtedness, accounts payable and accrued liabilities, derivative financial instruments, other long-term liabilities and long-term debt. Financial liabilities are initially measured at fair value and subsequently measured at amortized cost unless classified as fair value through profit or loss.

Derivative instruments

Derivatives are initially recognized at fair value on the date a contract is entered into and are subsequently re-measured at their fair value. The Company's derivative instruments, while providing effective economic hedges, are not designated as hedges for accounting purposes. Changes in the fair value of any derivatives that are not designated as hedges for accounting purposes are recognized within "Fair market value gain (loss) on interest rate swap" or "unrealized foreign exchange (loss) gain on non-current monetary items" in the consolidated statements of net earnings and comprehensive income consistent with the underlying nature and purpose of the derivative instruments.

2.19 Taxation

Tax expense comprises current and deferred tax. Tax is recognized in the consolidated statements of net earnings and total comprehensive income except to the extent it relates to items recognized directly in equity, in which case the related tax is recognized in equity.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

Current tax expense is based on the results for the period as adjusted for items that are not taxable or not deductible. Current tax is calculated using the tax rates under the laws that were enacted or substantively enacted at the date of the consolidated statements of financial position.

Deferred tax is accounted for using the liability approach and is the tax expected to be payable or recoverable on temporary differences between the carrying amount of assets and liabilities in the consolidated statements of financial position and the corresponding tax base used in the computation of taxable profit. Deferred tax is calculated based on the expected manner of realization or settlement of the carrying amount of assets and liabilities, using tax rates that are expected to apply to the year of realization or settlement based on tax rates and laws enacted or substantively enacted at the date of the consolidated statements of financial position.

Deferred tax assets are recognized to the extent it is probable that taxable profits will be available against which the deductible temporary differences can be utilized, unless the deferred tax asset arises from the initial recognition of an asset or liability in a transaction that is not a business combination, and at the time of the transaction, affects neither accounting profit nor taxable profit (tax loss). The carrying amount of deferred tax assets is reviewed at each consolidated statements of financial position date and reduced to the extent that it is no longer probable that sufficient taxable profits will be available to allow all or part of the asset to be recovered.

Deferred tax liabilities are generally recognized for all taxable temporary differences except to the extent that the deferred tax liability arises from: the initial recognition of goodwill; or the initial recognition of an asset or liability in a transaction which is not a business combination and, at the time of the transaction, affects neither accounting profit nor taxable profit (tax loss). As well, deferred tax liabilities are recognized for taxable temporary differences arising on investments in subsidiaries except where the reversal of the temporary difference can be controlled and it is probable that the difference will not reverse in the foreseeable future.

2.20 Investment tax credits

The Company has earned investment tax credits ("ITCs") relating to a percentage of eligible current and capital research and development expenditures incurred in each taxation year. Investment tax credits are recognized when there is reasonable assurance that the Company will comply with the associated conditions and the grants will be received. The investment tax credits are recognized either as a reduction in cost of sales on the consolidated statements of net earnings and comprehensive income, or as a reduction in property, plant and equipment, depending on where the original costs which gave rise to the credits were recorded.

2.21 Vendor Rebates

The Company records certain consideration received from a vendor, which is probable and can be reasonably estimated, as a reduction of the cost of purchases during the period.

2.22 Critical accounting estimates and judgments

Estimates and judgments are continually evaluated and are based on historical experience and other factors, including expectations of future events that are believed to be reasonable under the circumstances.

Critical accounting estimates and assumptions

Management makes estimates and assumptions concerning the future. The resulting accounting estimates will, by definition, seldom equal the actual results. Estimates are reviewed on a regular basis and, as adjustments become necessary, they are reported in the consolidated statements of net earnings and comprehensive income in the periods in which they become known. The assets and liabilities which require management to make significant estimates and assumptions in determining carrying values include, inventories, derivative financial instruments, property, plant and equipment, intangible assets, goodwill, provisions, accrued benefit liability, deferred compensation obligation and deferred income taxes.

Information about assumptions and estimation uncertainties that have a significant risk of resulting in a material adjustment are addressed below.

Intangible assets and goodwill

The values associated with the initial recognition and impairment tests of the intangible assets and goodwill involve significant estimates and assumptions, including those with respect to future cash inflows and outflows, discount rates and asset lives.

These significant estimates are subject to the Company's future results. These determinations will affect the amount of amortization expense on intangible assets recognized in future periods.

Management assesses impairment by comparing the recoverable amount of an intangible asset or goodwill with its carrying value. The determination of the recoverable amount involves significant estimation by management.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

Management has determined that for purposes of this evaluation the Company has four CGUs: bus manufacturing, motor coach manufacturing, ARBOC and aftermarket parts operations.

Goodwill is allocated to the Company's four CGUs for the purpose of impairment testing. The Company performs its annual test for impairment of goodwill and trade names in the fourth quarter of each year and also when indicators of impairment exist.

Accrued benefit liability

The present value of the defined benefit obligation is determined by discounting the estimated future cash outflows using interest rates of high-quality corporate bonds that are denominated in the currency in which the benefits will be paid and that have terms to maturity approximating the terms of the related pension liability. Determination of benefit expense requires assumptions such as the discount rate to measure obligations and return on assets, the projected age of employees upon retirement, life expectancy and the expected rate of future compensation changes.

Actual results will differ from results which are estimated based on assumptions. See note 2.7 for certain assumptions made with respect to employee benefits.

Income Taxes

Estimation of income taxes includes evaluating the recoverability of deferred tax assets based on an assessment of the Company's ability to utilize the underlying future tax deductions against future taxable income before they expire. Management's assessment is based upon existing tax laws and estimates of future taxable income. If the assessment of the Company's ability to utilize the underlying future tax deductions changes, the Company would be required to recognize more or fewer of the tax deductions as assets, which would decrease or increase the income tax expense in the period in which this is determined.

The Company is subject to taxation in multiple jurisdictions. Significant judgment is required in determining the worldwide provision for taxation. There are many transactions and calculations for which the ultimate tax determination is uncertain during the ordinary course of business. The Company maintains provisions for uncertain tax positions that it believes appropriately reflect its risk with respect to tax matters under active discussion, audit, dispute or appeal with tax authorities, or which are otherwise considered to involve uncertainty. These provisions for uncertain tax positions are made using management's best estimate of the amount expected to be paid based on a qualitative assessment of all relevant factors. Management reviews the adequacy of these provisions at the date of each consolidated statements of financial position. However, it is possible that at some future date an additional liability could result from audits by taxing authorities. Where the final tax outcome of these matters is different from the amounts that were initially recorded, such differences will affect the tax provisions in the period in which such determination is made.

Provision for Warranty Costs

The Company offers warranties on the buses and coaches it sells. Management estimates the related provision for future warranty claims based on historical warranty claim information, as well as recent trends that might suggest that past cost information may differ from future claims. Factors that could impact the estimated claim information include quality initiatives, as well as parts and labour costs.

Critical judgments in applying accounting policies

The following critical judgments that were made by management have the most significant effect on the amounts recognized in the financial statements.

Revenue recognition

As described in note 2.6, management assessed the criteria for the recognition of revenue related to arrangements that have multiple components as set out in IFRS 15. Also, judgment is necessary to determine when components can be recognized separately and the allocation of the related consideration allocated to each component.

Also described in note 2.6, management assessed the criteria for the recognition of revenue in an agency relationship related to the sale of extended warranties that are purchased for the customer from the OEM as set out in IFRS 15.

Functional currency

Management assessed the criteria for the determination of functional currency as set out in IAS 21. An entity is required to place the greatest weight on the currency that influences the pricing of the transactions that it undertakes rather than focusing on the currency in which the transactions are denominated in. The functional currency of the Company is the United States dollar as it is the currency of the primary economic environment in which the Company operates. In addition, it is the competitive forces of the United States marketplace that determines the sales prices of its goods and services. Predominantly, the costs for labour, material and overhead that address the

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (Continued)

needs and support the Company's customers are incurred in United States dollars, and hence the pricing of goods and services to the customer is more greatly influenced from operations and the competitive forces in the United States.

Goodwill

Judgment is required in the selection of CGUs and the allocation of assets and liabilities to these CGUs, which is necessary to assess the impairment of long-term assets, goodwill and intangible assets.

2.23 Standards issued but not yet adopted

IFRS 16 – Leases:

In January 2016, the IASB issued IFRS 16, Leases, with an effective date of January 1, 2019, which introduced new guidance for identifying leases as well as the accounting, measurement and presentation of leases by the lessee. The lessee now recognizes a liability for the future lease payments to be made for each lease. A right-of-use asset is also recognized and amortized over the useful life. As a result, the previous distinction between operating and finance leases no longer applies. The new standard will retain many key aspects of the current lessor accounting model. With respect to first time application of IFRS 16, the Company can choose to apply the standard using the full retrospective approach or modified retrospective approach The Company plans on using the modified retrospective approach.

The Company will adopt the standard on its effective date. The Company is in the process of finalizing its transition approach. The right-of-use assets and lease liability will be presented separately on the balance sheet. Management anticipates the adoption of the standard will result in increases to assets of approximately $109 million and liabilities of approximately $109 million on the consolidated statements of financial position. Management does not anticipate there will be a material impact in the consolidated statements of net earnings and total comprehensive income.

3. ACCOUNTS RECEIVABLE

	December 30, 2018	December 31, 2017
Trade, net of allowance for doubtful accounts	$ 358,441	$ 349,036
Other	29,045	37,431
	$ 387,486	$ 386,467

4. INVENTORIES

	December 30, 2018	December 31, 2017
Raw materials	$ 213,117	$ 182,240
Work in process	150,654	101,611
Finished goods	60,914	75,631
	$ 424,685	$ 359,482

	Fiscal 2018	Fiscal 2017
Cost of inventories recognized as expense and included in cost of sales	$ 2,015,272	$ 1,856,223
Write-down of inventory to net realizable value in cost of sales	4,407	9,186
Reversals of a previous write-down in inventory	2,545	1,108

5. PROPERTY, PLANT AND EQUIPMENT

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Office equipment	Demo buses and coaches	Buses and coaches available for lease	Total
Cost	60,724	113,153	38,518	4,852	15,564	2,069	234,880
Accumulated depreciation	6,524	61,162	23,842	2,263	8,819	689	103,299
January 1, 2017 net book value	54,200	51,991	14,676	2,589	6,745	1,380	131,581
Assumed as a result of business acquisitions	7,339	4,644	899	127	—	—	13,009
Additions (owned and leased)	15,139	26,245	6,500	680	3,805	5,049	57,418
Disposals	(25)	(159)	(27)	(32)	(116)	—	(359)
Transfers from inventory	—	—	—	—	4,813	8,317	13,130
Depreciation charge	(2,514)	(14,268)	(4,520)	(665)	(3,114)	(2,825)	(27,906)
December 31, 2017 net book value	74,139	68,453	17,528	2,699	12,133	11,921	186,873
Additions (owned and leased)	19,369	50,024	8,191	2,006	470	9,097	89,157
Transfer from inventory	—	—	—	—	3,857	1,588	5,445
Disposals	(300)	(336)	(50)	(6)	—	—	(692)
Depreciation charge	(2,881)	(17,568)	(5,321)	(655)	(2,744)	(3,671)	(32,840)
December 30, 2018 net book value	90,327	100,573	20,348	4,044	13,716	18,935	247,943

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Office equipment	Demo buses and coaches	Buses and coaches available for lease	Total
Recorded as:							
Cost	$ 83,149	$ 143,561	$ 45,877	$ 5,619	$ 22,093	$ 13,931	314,230
Accumulated depreciation	9,010	75,108	28,349	2,920	9,960	2,010	127,357
December 31, 2017 net book value	$ 74,139	$ 68,453	$ 17,528	$ 2,699	$ 12,133	$ 11,921	$186,873
Cost	$ 102,202	$ 192,983	$ 54,002	$ 7,615	$ 26,421	$ 24,615	407,838
Accumulated depreciation	11,875	92,410	33,654	3,571	12,705	5,680	159,895
December 30, 2018 net book value	$ 90,327	$ 100,573	$ 20,348	$ 4,044	$ 13,716	$ 18,935	$247,943

The Company leases various machinery and computer hardware and software licenses under non-cancellable finance lease agreements (note 8). During Fiscal 2018, the Company had $18,167 (Fiscal 2017: $4,605) of additions to leased machinery and computer hardware and software licenses. The Company is a lessee under finance leases for building improvements, machinery and computer hardware and software licenses as follows (which amounts have been included in the preceding table):

	Land, building and building improvements	Machinery and equipment	Computer hardware and software	Total
Cost	$ 3,926	$ 23,004	$ 12,783	$ 39,713
Accumulated depreciation	345	14,517	10,532	25,394
December 31, 2017 net book value	3,581	$ 8,487	$ 2,251	$ 14,319
Cost	3,926	41,165	12,788	57,879
Accumulated depreciation	913	18,431	11,216	30,560
December 30, 2018 net book value	$ 3,013	$ 22,734	$ 1,572	$ 27,319

6. GOODWILL AND INTANGIBLE ASSETS

	Goodwill	Trade names	Patents and Licenses	Customer relationships	Backlog of sales orders	Total
Cost	$ 383,068	$ 219,500	$ 121,674	$ 347,821	$ 3,200	$ 1,075,263
Accumulated amortization	—	688	90,708	86,358	2,800	180,554
January 1, 2017 net book value	383,068	218,812	30,966	261,463	400	894,709
Additions	—	—	193	—	—	193
Assumed as a result of business acquisitions	53,256	4,800	9,000	50,500	3,200	120,756
Amortization charge	—	(275)	(11,151)	(17,536)	(734)	(29,696)
December 31, 2017 net book value	436,324	223,337	29,008	294,427	2,866	985,962
Additions	—	—	50	—	—	50
Adjustment to purchase equation for business combinations (note 1.1)	(46)	—	—	—	—	(46)
Amortization charge	—	(275)	(12,235)	(19,580)	(2,866)	(34,956)
December 30, 2018 net book value	$ 436,278	$ 223,062	$ 16,823	$ 274,847	$ —	$ 951,010
Recorded as:						
Cost	$ 436,324	$ 224,300	$ 130,867	$ 398,321	$ 6,400	$ 1,196,212
Accumulated amortization	—	963	101,859	103,894	3,534	210,250
December 31, 2017 net book value	436,324	223,337	29,008	294,427	2,866	985,962
Cost	436,278	224,300	130,917	398,321	6,400	1,196,216
Accumulated amortization	—	1,238	114,094	123,474	6,400	245,206
December 30, 2018 net book value	$ 436,278	$ 223,062	$ 16,823	$ 274,847	$ —	$ 951,010

The recoverable amount of the Company's cash generating units ("CGUs") is determined based on value-in-use calculations. These calculations use estimated cash flow projections based on financial plans approved by the Board covering a three-year period and discount rates based on weighted average cost of capital of like businesses that range between 9% and 15% per annum for the bus and motor coach manufacturing CGUs, between 11% and 17% for the ARBOC CGU and between 6% and 10% per annum for the aftermarket parts CGU. Cash flows beyond this period are extrapolated using a steady estimated growth rate based on the long-term average annual growth rate of 3% for each industry in which the CGUs operate. Management has determined planned gross margins based on a projected production schedule, past performance and expectations of market development. The discount rates used reflect specific risk relating to the relevant CGUs.

Sensitivity testing is conducted as part of the annual impairment tests. Management believes that any reasonable change in the key assumptions used to determine the recoverable amount would not cause the carrying amount of the transit bus, motor coach and ARBOC manufacturing and the aftermarket parts CGU to exceed its recoverable amount.

Based upon historical operating results, management's forecasts and business plans, the Company's trade names were assigned an indefinite life, except for the NABI Parts tradename (net book value of $2,063 at December 30, 2018) which is amortized over its useful life of 12 years. The fair value less cost to sell of the Company's trade name intangible asset is determined using a variation of the Income Approach known as the Relief from Royalty Method. The underlying concept for this methodology is that the Company owns its trade name as opposed to having a license to use it; the Company does not have to pay royalties for the use of its trade name on its own products and services. These royalties are usually expressed as a percentage of sales. The Relief from Royalty Method is based on the premise that free cash flow is a more valid criterion for measuring value than "book" or accounting profits. Cash flows are based on an estimated royalty rate applied to management's projected revenue attributable to the trade name. The cash flows are summarized and discounted back to their net present value at an appropriate intangible asset rate of return in order to estimate the fair value of the trade name. The estimated royalty rate of 4.0% was applied to all the Company's projected revenues based upon comparable publicly reported trade name and trademark licensing data and specific qualitative factors. The cash flows were discounted at the risk adjusted weighted average cost of capital for the Company.

7. DEFERRED TAXES AND INCOME TAX EXPENSE

Deferred income tax assets and liabilities are offset when there is a legally enforceable right to offset current tax assets against current tax liabilities and when the deferred income tax assets and liabilities relate to income taxes levied by the same taxation authority on

either the taxable entity or different taxable entities where there is an intention to settle the balances on a net basis. The offset amounts by tax jurisdiction presented on the statements of financial position are as follows:

	December 30, 2018	December 31, 2017
As presented on statements of financial position:		
Deferred tax liabilities	(83,121)	(88,453)
	$ (83,121)	$ (88,453)

The gross movement on the deferred income tax account is as follows:

	Fiscal 2018	Fiscal 2017
Beginning of period	$ (88,453)	$ (94,324)
Assumed as a result of business acquisitions	—	(25,705)
Exchange rate differences	321	198
Tax recorded through net earnings	5,552	30,862
Tax recorded through other comprehensive loss	(1,171)	1,679
Tax recorded on bargain purchase gain	—	(763)
Benefit of loss carry forward and share issuance costs recognized against income taxes payable	(29)	(114)
Tax recorded through equity	659	(286)
End of period	$ (83,121)	$ (88,453)

The movement in deferred income tax assets and liabilities during the period, without taking into consideration the offsetting of balances within the same tax jurisdiction, is as follows:

Deferred tax liabilities	Unrealized Foreign Exchange	Property Plant and Equipment	Goodwill and Intangibles	Pensions	Other	**Total**
January 1, 2017	(2,762)	(7,522)	(182,977)	—	(2,705)	$ (195,966)
Assumed as a result of business acquisitions	—	(636)	(25,539)	—	(215)	(26,390)
Tax recorded on bargain purchase gain	—	(763)	—	—	—	(763)
Tax reversed through net earnings	(5,263)	2,646	71,922	—	(4,876)	64,429
December 31, 2017	**(8,025)**	**(6,275)**	**(136,594)**	**—**	**(7,796)**	**(158,690)**
Tax recorded through net earnings	8,025	(5,524)	9,283	—	6,717	18,501
December 30, 2018	**$ —**	**$ (11,799)**	**$ (127,311)**	**$ —**	**$ (1,079)**	**$ (140,189)**

Deferred tax assets	Reserves and accruals not currently deductible	Tax Credits	Provisions	Property Plant and Equipment	Pension	Deferred Financing Costs and Interest	Other	Total
January 1, 2017	32,513	6,047	38,292	7,553	5,578	2,698	8,961	$101,642
Assumed as a result of business acquisitions	445	—	240	—	—	—	—	685
Tax recovered (charged) through net earnings	(9,513)	(4,894)	(8,111)	(5,921)	(3,728)	(195)	(1,205)	(33,567)
Tax recorded through other comprehensive loss	—	—	—	—	1,679	—	—	1,679
Tax recorded through equity	—	—	—	—	—	—	(286)	(286)
Benefit of loss carry forward and share issuance costs recognized against income taxes payable	—	—	—	—	—	(114)	—	(114)
Exchange differences	68	—	81	16	12	6	15	198
December 31, 2017	$ 23,513	$ 1,153	$ 30,502	$ 1,648	$ 3,541	$ 2,395	$ 7,485	$ 70,237
Tax recorded through net earnings	(9,046)	(67)	(172)	(1,656)	(624)	(318)	(1,066)	$ (12,949)
Tax recorded through other comprehensive loss	—	—	—	—	(1,171)	—	—	$ (1,171)
Tax recorded through equity	—	—	—	—	—	—	659	$ 659
Benefit of loss carry forward and share issuance costs recognized against income taxes payable	—	—	—	—	—	(29)	—	$ (29)
Exchange rate differences	109	—	141	8	16	11	36	$ 321
December 30, 2018	$ 14,576	$ 1,086	$ 30,471	$ 0	$ 1,762	$ 2,059	$ 7,114	$ 57,068

Deferred income tax asset are recognized for income tax loss carry-forwards to the extent that the realization of the related tax benefit through future taxable profits is probable. The Company has an income tax loss carry-forward of $9,701 which will more likely than not be applied against future taxable income.

2019	151
2020 to 2038 (includes U.S. federal tax losses that are restricted in application to $96 per year)	9,550
	$ 9,701

The reconciliation of income tax computed at the U.S. statutory rate, to income tax expense is as follows:

	Fiscal 2018	Fiscal 2017
Earnings before income tax expense	$ 210,653	$ 241,622
Tax calculated using a 21% U.S. tax rate in 2018 and 35% in 2017	44,237	84,567
Tax effect of:		
Withholding and other taxes	2,989	1,591
Non-taxable income	(1,967)	(13,859)
Revision of tax estimates	(1,737)	(2,824)
Foreign exchange impact	(8,275)	2,490
State taxes	14,566	7,905
U.S. tax reform impact of rate change on deferred income taxes	(849)	(32,978)
U.S. tax reform impact on foreign tax credit pool	1,146	5,941
Rate differential on income taxed at other than U.S. statutory rate	(377)	(2,547)
Other	978	(32)
Income tax expense	$ 50,711	$ 50,254

Current income taxes	$ 56,263	$ 81,116
Deferred income taxes recovered	(5,552)	(30,862)
Income tax expense for the period	$ 50,711	$ 50,254

On December 22, 2017, U.S. Public Law 115-97, commonly referred to as the Tax Cuts and Jobs Act, was enacted. The legislation, which is generally effective for tax years beginning after December 31, 2017 results in significant U.S. tax reform and revises the Internal Revenue Code by, among other things, lowering the corporate federal income tax rate from 35% to 21%, eliminating the domestic production activities deduction, and modifying how the U.S. taxes multinational entities.

The net impact of the revaluation of deferred tax balances due to the lowering of the corporate federal tax rate from 35% to 21% was a recovery of $32,978 and the write-down of the foreign tax credit carryover pool resulted in an expense of $5,941, for a net income tax recovery of $27,037.

The impact of U.S. tax reform in 2017 is disclosed above as “U.S. tax reform impact of rate changes on deferred income taxes” and “U.S. tax reform impact on foreign tax credit pool”. The net of these two items resulted in a recovery of $27,037, reducing the 2017 effective income tax rate by 11.2%. These estimates continue to be adjusted as additional guidance from the U.S. Department of the Treasury is provided.

8. OBLIGATIONS UNDER FINANCE LEASES

The Company has entered into finance leases for equipment, building improvements, computer hardware and software licenses, with an imputed weighted average interest rate of 4.25% based on individual lease rates ranging between 3.5% and 5.9%, expiring between 2019 and 2022. The following is a schedule of future minimum lease payments, together with the balance of the obligation under the finance leases as at December 30, 2018:

2019	8,803
2020	7,204
2021	5,990
2022	4,358
2023	3,008
	29,363
Less: Amounts representing interest	2,340
	27,023
Less: Current portion	7,936
	$ 19,087

9. DEFERRED COMPENSATION OBLIGATION

	December 30, 2018	December 31, 2017
Performance share units under PRSU Plan (officers and senior management)	$ 6,753	$ 20,091
Restricted share units under PRSU Plan (officers and senior management)	638	2,185
Deferred share units under DSU Plan (non-employee board of directors)	2,265	3,531
	9,656	25,807
Less: current portion	4,677	15,724
	$ 4,979	$ 10,083

Effective December 17, 2012, the Board approved the Performance and Restricted Share Unit Plan (the "PRSU Plan") and it was amended on December 16, 2013 and on December 18, 2018. The terms of the amended PRSU Plan govern awards made on or after the 2014 plan year and 2018 plan year, respectively.

The purposes of the PRSU Plan are to attract, retain and motivate key personnel and reward officers and senior management and to align their interests with those of shareholders by making a significant portion of their incentive compensation directly dependent on achieving key strategic, financial and operational objectives that are crucial to the ongoing growth and profitability of the Company. Under the terms of the PRSU Plan, the human resources, compensation and corporate governance committee of the Board may grant eligible participants performance share units ("PSUs") or restricted share units ("RSUs"), which give the holders thereof the right to receive, upon vesting and redemption of a unit, a cash payment equal to the fair market value of a Share at the time of redemption. When dividends are paid on a Share, additional units equivalent to the amount of the dividends multiplied by the number of PSUs and RSUs held (and determined based on the then fair market value of the Shares) are credited to a participant's account. The actual value of a PSU on the settlement date is contingent on the Share price and the Company's actual performance over a three-year period relative to the established objectives. The actual value of an RSU on the settlement date is contingent on the Share price only and RSUs generally vest and settle as to one-third on each of the first, second and third anniversaries of the grant date. PSUs and RSUs also immediately vest upon a participant's termination without cause or resignation for good reason within a specified period of time following the closing of a transaction resulting in certain change of control events and upon certain terminations of employment and, with respect to PSUs and RSUs granted prior to 2019, upon the closing of a transaction resulting in certain change of control events.

RSUs and PSUs granted in Fiscal 2018 were determined based on the volume weighted average trading price of a Share for the last five trading days of 2017 and the desired compensation value.

As well, the Board adopted NFI's Deferred Share Unit Plan for Non-Employee Directors (the "DSU Plan") on November 7, 2011 and it was amended and restated on December 8, 2015 and December 18, 2015. Pursuant to the plan, non-employee directors may elect once each calendar year to receive all or a portion of their annual retainer and meeting fees in the form of deferred share units ("DSUs") instead of cash. A DSU is the right to receive a cash payment based on the value of a Share credited by means of a bookkeeping entry to an account in the name of the non-employee director. DSUs are credited to the director's account on the first day of each calendar quarter, the number of which is determined by dividing the amount of the applicable portion of the director's elected amount by the volume weighted average trading price of a Share for the last five trading days.

When dividends are paid on a Share, additional DSUs equivalent to the amount of the dividend multiplied by the number of DSUs held (and determined based on the then fair market value of the Shares) will be credited to the director's account. At the end of the director's tenure as a member of the Board, he or she will be entitled to receive a cash redemption payment equal to the fair market value of a Share multiplied by the number of DSUs held.

	PSUs	RSUs	DSUs	Total
Units outstanding at January 1, 2017	216,010	47,162	71,985	335,157
Units granted	199,305	28,764	8,145	236,214
Distribution units granted	6,287	1,742	1,777	9,806
Vested and reclassified as current liability	(289,755)	(45,888)	—	(335,643)
Units outstanding at December 31, 2017	131,847	31,780	81,907	245,534
Units granted	53,883	26,942	9,262	90,087
Distribution units granted	5,112	1,620	2,426	9,158
Vested and reclassified as current liability	(75,001)	(31,715)	—	(106,716)
Units outstanding at December 30, 2018	115,841	28,627	93,595	238,063
Vested units	—	—	93,595	93,595
Unvested units	115,841	28,627	—	144,468

10. LONG-TERM DEBT

	Face Value	Unamortized Transaction Costs	**Net Book Value December 30, 2018**	Net Book Value December 31, 2017
Term Credit Facility	$ —	$ —	$ —	$ 478,763
Revolving Credit Facility, Secured ("Secured Revolver")	—	—	—	102,000
Revolving Credit Facility, Unsecured (“Revolver”)	641,600	2,168	639,432	—
	$ 641,600	$ 2,168	$ 639,432	$ 580,763

On October 25, 2018 NFI entered into a new five-year senior unsecured, revolving credit facility (the"Credit Facility") and extinguished its fifth amended and restated credit agreement (the "Prior Credit Agreement"). Upon extinguishment of the Prior Credit Agreement, the unamortized transaction costs related thereto were realized in the consolidated statements of earnings and total comprehensive Income as an increase to Accretion in carrying value of long-term debt and convertible debentures expense of $1.9 million.

The unsecured Credit Facility has a total borrowing limit of $1.0 billion, which includes a $100 million letter-of-credit facility and a $250 million accordion feature. The Credit Facility bears interest at a rate equal to LIBOR or a U.S. base rate for loans denominated in U.S. dollars and a Canadian prime rate or bankers' acceptance rate for loans denominated in Canadian dollars, plus an applicable margin to those rates and matures on October 25, 2023. Amounts drawn under the Credit Facility bear interest at a rate equal to LIBOR or a U.S. base rate for loans denominated in U.S. dollars and a Canadian prime rate or bankers' acceptance rate for loans denominated in Canadian dollars, plus an applicable margin to those rates.

The Prior Credit Agreement had a total borrowing limit of $825.0 million. Under the Prior Credit Agreement the borrowing limit of the Secured Revolver was $343.0 million to support working capital fluctuations. The Secured Revolver included a $55.0 million letter of credit sub-facility, of which $8.8 million of outstanding letters of credit were drawn at December 31, 2017. Under the Prior Credit Agreement the borrowing limit of the Term Credit Facility is $482.0 million. The Prior Credit Agreement also included an accordion feature of $75.0 million.

Loans under the Prior Credit Agreement bore interest at a rate equal to LIBOR or a U.S. base rate for loans denominated in U.S. dollars and a Canadian prime rate or bankers’ acceptance rate for loans denominated in Canadian dollars, plus an applicable margin to those rates. The obligations in respect of the Prior Credit Agreement are secured by: (a) a perfected lien on, and pledge of, (i) all inter-company notes owing to NFI, and (ii) certain of the capital stock of, and all inter-company notes owing to all of NFI’s existing and direct and indirect subsidiaries, and (b) a perfected lien on, and security interest in, all of the existing and future tangible and intangible properties and assets of NFI and its direct and indirect subsidiaries, with certain exceptions.

11. SHARE-BASED COMPENSATION - EQUITY SETTLED

The Board adopted a Share Option Plan (the “Option Plan”) for NFI on March 21, 2013, under which employees of NFI and certain of its affiliates may receive grants of share options. The Option Plan was amended and restated on December 8, 2015 and on December 31, 2018. Directors who are not employed with NFI are not eligible to participate in the Option Plan. A maximum of 3,600,000 Shares are reserved for issuance under the Option Plan. One quarter of the share options become vested on the first grant date anniversary and an additional one-quarter on the second, third and fourth anniversary of such date.

Option Grant dates	Number	Exercised	Expired	Vested	Unvested	Expiry date	Exercise price	Fair Value at grant date
March 26, 2013	490,356	(468,117)	—	(22,239)	—	March 26, 2021	C$10.20	C$1.55
December 30, 2013	612,050	(522,298)	(9,631)	(80,121)	—	December 30, 2021	C$10.57	C$1.44
December 28, 2014	499,984	(158,539)	(11,368)	(330,077)	—	December 28, 2022	C$13.45	C$1.83
December 28, 2015	221,888	(12,832)	—	(153,584)	55,472	December 28, 2023	C$26.75	C$4.21
September 8, 2016	2,171	—	—	(1,629)	542	September 8, 2024	C$42.83	C$8.06
January 3, 2017	151,419	(1,610)	—	(36,247)	113,562	January 3, 2025	C$40.84	C$7.74
January 2, 2018	152,833	—	—	—	152,833	January 2, 2026	C$54.00	C$9.53
	2,130,701	(1,163,396)	(20,999)	(623,897)	322,409		C$27.02	

The following reconciles the share options outstanding:

	Fiscal 2018		Fiscal 2017	
	Number	Weighted average exercise price	Number	Weighted average exercise price
Balance at beginning of period	979,333	C$19.94	1,175,099	C$14.70
Granted during the period	152,833	C$54.00	151,419	C$40.84
Exercised during the period	(185,860)	C$11.91	(347,185)	C$11.31
Balance at end of period	946,306	C$27.02	979,333	C$19.94

Fair values were measured based on the Black-Scholes formula. Expected volatility is estimated by considering historic average share price volatility. The inputs used in the measurement of the fair values of the share-based payment plans granted in Fiscal 2018 and Fiscal 2017 are the following:

Options grant date	January 2, 2018	January 3, 2017
Fair value at grant date (C$)	$9.53	$7.74
Share price (C$)	$54.00	$40.84
Exercise price (C$)	$54.00	$40.84
Expected volatility	23.3%	26.8%
Option life (expected weighted average life)	5.5 years	5.5 years
Expected dividends	2.48%	2.38%
Risk-free interest rate (based on government bonds)	1.73%	1.20%

On May 8, 2014, shareholders' approved the Company's Restricted Share Unit Plan for Non-Employee Directors (the "Director RSU Plan"). The Director RSU Plan was amended and restated on December 8, 2015 and December 31, 2017. A maximum of 500,000 Shares are reserved for issuance under the Director RSU Plan. Pursuant to the Director RSU Plan, non-employee directors are permitted to elect, once each calendar year, to receive all or a portion of their annual retainer in the form of restricted share units ("Director RSUs") and/or DSUs instead of cash. A Director RSU is a right to acquire a fully-paid and non-assessable Share credited by means of a bookkeeping entry to an account in the name of the non-employee director.

A director generally must make the election prior to the end of the calendar year preceding the year to which such election is to apply. The Board, in its sole discretion, may award additional Director RSUs, subject to an annual aggregate value of $150 per director. The number of Director RSUs to be awarded to a director is determined by dividing the amount of the applicable portion of the director's annual retainer by the applicable fair market value of a Share on that date. When dividends are paid on a Share, additional Director RSUs equivalent to the aggregate number of Director RSUs held by a director on the dividend record date multiplied by the amount of dividend paid by NFI on each Share, and then divided by the fair market value of the Shares on the dividend payment date, will automatically be credited to the director's account. Under the Director RSU Plan, Director RSUs vest immediately as at each applicable award date. A director (other than a U.S. director) will be permitted to exercise the Director RSUs credited to his or her account at any time prior to December 15 of the year following the year in which the director ceases to be a non-employee director of NFI or one of its affiliates. A U.S. director will be required to specify the exercise date in the annual election form in accordance with Section 409A of the U.S. Internal Revenue Code.

	Number of Director RSUs
Balance – January 1, 2017	16,947
Director RSUs issued	10,648
Director RSUs exercised	(5,090)
Balance – December 31, 2017	22,505
Director RSUs issued	15,759
Director RSUs exercised	(15,521)
Balance – December 30, 2018	22,743

12. DEFERRED REVENUE

	December 30, 2018	December 31, 2017
Extended warranties (note 23)	$ 16,910	$ 15,095
Progress payments	25,392	20,857
	42,302	35,952
Less: current portion of deferred revenue	(31,859)	(27,255)
	$ 10,443	$ 8,697

Deferred revenue is comprised of progress payments that have not yet qualified for recognition as revenue under the Company's revenue recognition policies and also deferred revenue from the sale of extended warranty contracts which are amortized over the extended warranty period commencing at the end of the one-year basic warranty period.

13. SHARE CAPITAL

	December 30, 2018	December 31, 2017
Authorized - Unlimited		
Issued - 61,832,625 Common Shares (December 31, 2017: 62,951,444)	$ 654,307	$ 665,602

Share repurchase

On June 11, 2018, the Company announced that the TSX had accepted a notice filed by the Company of its intention to implement a Normal Course Issuer Bid ("NCIB") to repurchase its Shares through the facilities of the TSX and any alternative Canadian trading systems on which the Shares are traded. On January 17, 2019 the Company amended the NCIB. Pursuant to the amended NCIB, the Company is permitted to repurchase for cancellation up to 5,549,465 Shares, representing approximately 10% of the outstanding public float of Shares on June 4, 2018. The Company was permitted to repurchase Shares commencing on June 14, 2018 up to June 13, 2019, or earlier should the Company complete its repurchases prior to such date. The actual number of Shares to be purchased and the timing and pricing of any purchases under the NCIB will depend on future market conditions and potential alternative uses for cash resources. The Company may elect to modify, suspend or discontinue the program at any time without prior notice. During Fiscal 2018 the Company repurchased 2,153,275 Shares (of which 833,075 Shares were settled and canceled after December 30, 2018) at an average price of C$41.39 per Share for a total repurchase cost of C$89.12 million. Shares settled after December 30, 2018 totaled C$29.1 million.

The following is a summary of changes to the issued and outstanding capital stock during the period:

Shares	Number (000s)	Net Book Value
Balance – December 31, 2017	62,951	$ 665,602
Stock options exercised	186	1,933
Restricted share units exercised	16	745
Repurchase and cancellation of Shares	(1,320)	(13,973)
Balance – December 30, 2018	61,833	$ 654,307

14. EARNINGS PER SHARE

		Fiscal 2018		Fiscal 2017
Net earnings attributable to equity holders	$	159,942	$	191,368
Weighted average number of Shares in issue		62,396,962		62,488,370
Add: net incremental Shares from assumed conversion of stock options and exercise of restricted share units		438,968		592,412
Weighted average number of Shares for diluted earnings per Share		62,835,930		63,080,782
Net earnings per Share (basic)	$	2.5633	$	3.0625
Net earnings per Share (diluted)	$	2.5454	$	3.0337

Basic earnings per Share is calculated by dividing the net earnings attributable to equity holders of the Company by the weighted average number of Shares outstanding during the period excluding Shares purchased by the Company and held as treasury shares. During the period the Company held 833,075 Shares as treasury shares.

Diluted earnings per Share is calculated using the same method as basic earnings per Share except that the average number of Shares outstanding includes the potential dilutive effect of outstanding stock options and restricted share units granted by the Company as determined by the treasury stock method.

15. SUPPLEMENTAL CASH FLOW INFORMATION

Changes in non-cash working capital items

Cash inflow (outflow)		Fiscal 2018		Fiscal 2017
Accounts receivable	$	(1,019)	$	(5,738)
Income tax receivable		(9,204)		(23,560)
Inventories		(70,382)		1,804
Prepaid expenses and deposits		4,820		(1,173)
Accounts payable and accrued liabilities		51,925		(6,329)
Income tax payable		(7,328)		3,479
Deferred revenue		(525)		(12,577)
Provisions		(2,279)		16,430
Other		(352)		20,603
	$	(34,344)	$	(7,061)

16. ACCRUED BENEFIT LIABILITY

Defined benefit plan

The Company's subsidiaries have defined benefit plans which cover employees in Canada and the United States. Actuarial valuations for the Company's subsidiaries were last performed as at December 31, 2017 and December 31, 2016.

Information in respect of the Company's defined benefit plan is as follows:	December 30, 2018	December 31, 2017
Change in plan assets		
Plan assets at fair value — beginning of period	$ 121,651	$ 102,108
Interest income	4,682	4,234
Remeasurement gains (losses) - return on plan assets (excluding amounts in net interest)	(7,608)	7,581
Administrative expenses	(399)	(913)
Employer's contributions	22,241	11,476
Benefits paid	(7,842)	(8,370)
Foreign exchange gain (loss)	(7,041)	5,535
Plan assets at fair value — end of period	125,684	121,651
Change in defined benefit obligation		
Defined benefit obligation — beginning of period	141,455	119,323
Current service cost	5,262	3,867
Interest cost	4,901	4,764
Benefits paid	(7,842)	(8,370)
Foreign exchange (gain) loss	(7,242)	6,000
Past Service Costs	6,482	—
Actuarial loss (gain) arising from changes in demographic assumptions	(132)	1,404
Actuarial loss (gain) arising from changes in financial assumptions	(12,427)	11,745
Actuarial loss arising from experience adjustments assumptions	492	2,722
Defined benefit obligation — end of period	130,949	141,455
Accrued benefit liability - present value of unfunded obligations	$ (5,265)	$ (19,804)

The actual loss on the plan assets for Fiscal 2018 was $2,926 (Fiscal 2017: gain of $11,815).

A new collective bargaining agreement at the Company's Winnipeg facility commenced on April 1, 2018 which included retroactive changes to New Flyer's Canadian defined benefit pension plan. The effect of the pension plan amendments was to increase the accrued benefit liability and the expected annual pension plan expense in Fiscal 2018 by $6,482 to reflect pension benefits provided to employees for past service.

The significant actuarial assumptions adopted in measuring the Company's accrued benefit obligation and net pension plan expenses are as follows:

		Fiscal 2018	Fiscal 2017
Country	Mortality Table	Discount Rate	
Canada	CPM2014 Private sector with Scale MI-2017 with size adjustment	5.50%	3.25%
Canada	CPM2014 Private sector with Scale MI-2017 with no size adjustment	3.90%	3.50%
United States	Base table: RP2006, projection scale MP2018	4.35%	4.20%

16. ACCRUED BENEFIT LIABILITY (Continued)

			Discount rate - sensitivity		Life expectancy - sensitivity	
			1% increase	1% decrease	one year increase	one year decrease
Country	Last valuation date	Next valuation date	Then obligation would decrease by:	Then obligation would increase by:	Then obligation would increase by:	Then obligation would decrease by:
Canada	Dec. 31, 2017	Dec. 31, 2018	15.2%	19.5%	1.2%	1.2%
Canada	Dec. 31, 2016	Dec. 31, 2017	13.3%	17.0%	2.0%	2.1%
United States	Dec. 31, 2016	Dec. 31, 2017	9.5%	11.3%	3.0%	3.0%

The defined benefit plan typically exposes the Company to actuarial risks such as: investment risk, interest rate risk and longevity risk.

Investment risk

The present value of the defined benefit plan liability is calculated using a discount rate determined by reference to high quality corporate bond yields; if the return on plan assets is below this rate, it will create a plan deficit. Management believes the plan currently has a relatively balanced investment in equity securities and debt instruments. Due to the long-term nature of the plan liabilities, the Company's pension committee considers it appropriate that a reasonable portion of the plan assets should be invested in equity securities to leverage the return generated by the fund.

Interest rate risk

A decrease in the bond interest rate will increase the plan liability; however, this will be partially offset by an increase in the return on the plan's debt investments.

Longevity risk

The present value of the defined benefit plan liability is calculated by reference to the best estimate of the mortality of plan participants both during and after their employment. An increase in the life expectancy of the plan participants will increase the plan's liability.

The Company's defined benefit plan is a fixed benefit plan and, as a result, the rate of compensation increases does not have any impact on the actuarially determined accrued benefit liability. Expected contributions to the defined benefit plan for the 52-week period ending December 29, 2019 are $8,967.

The Company's defined benefit pension plan expense, included in cost of sales and sales, general and administration costs and other operating expenses is as follows:

	Fiscal 2018	Fiscal 2017
Current service costs	$ 5,262	$ 3,867
Past service costs	6,482	—
Net interest expense	219	530
Administrative expenses	399	913
Foreign exchange gain	(29)	(160)
Components of defined benefit costs recognized in net earnings	$ 12,333	$ 5,150

16. ACCRUED BENEFIT LIABILITY (Continued)

	Fiscal 2018	Fiscal 2017
Remeasurement (losses) gains - return on plan assets (excluding amounts in net interest)	$ (7,608)	$ 7,581
Actuarial (losses) gains arising from changes in demographic assumptions	132	(1,404)
Actuarial (losses) gains arising from changes in financial assumptions	12,427	(11,745)
Actuarial losses arising from experience adjustments assumptions	(492)	(2,722)
Foreign exchange loss	(74)	(231)
	4,385	(8,521)
Deferred income taxes recorded through other comprehensive loss or income	(1,215)	1,679
Net actuarial (losses) gains recognized in other comprehensive loss or income	$ 3,170	$ (6,842)

An analysis of the assets of the plans by investment category is provided as follows:

	December 30, 2018	December 31, 2017
Asset category		
Cash and cash equivalents	2.5%	0.7%
Canadian equities	12.3%	13.2%
Foreign equities	25.1%	39.2%
Real estate	2.3%	3.4%
Bonds	57.8%	43.5%
	100.0%	100.0%

17. Defined contribution pension plans

The Company maintains a defined contribution plan for salaried employees. The net pension expense for the Company's defined contribution plans is as follows:

	Fiscal 2018	Fiscal 2017
Defined contribution pension expense	$ 5,522	$ 4,370

Cash payments contributed by the Company during Fiscal 2018 for its defined benefit and defined contribution pension plans amounted to $27,600 (2017: $15,846).

18. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT

(a) Financial Instruments

The Company has made the following classifications:

Cash	Amortized cost
Accounts receivable	Amortized cost
Deposits	Amortized cost
Other long-term asset	Amortized cost
Bank indebtedness	Amortized cost
Accounts payables and accrued liabilities	Amortized cost
Other long-term liabilities	Amortized cost
Long-term debt	Amortized cost
Derivative financial instruments	Fair value through profit or loss

18. FINANCIAL INSTRUMENTS AND RISK MANAGEMENT, (Continued)

(b) Fair value measurement of financial instruments

The Company categorizes its fair value measurements of financial instruments recorded at fair value according to a three-level hierarchy. The hierarchy prioritizes the inputs used by the Company's valuation techniques. A level is assigned to each fair value measurement based on the lowest level input significant to the fair value measurement in its entirety. The three levels of the fair value hierarchy are defined as follows:

Level 1 - fair value measurements that reflect unadjusted, quoted prices in active markets for identical assets and liabilities that the Company has the ability to access at the measurement date.

Level 2 - fair value measurements using inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly. These include quoted prices for similar assets and liabilities in active markets, quoted prices for identical or similar assets and liabilities in inactive markets, inputs that are observable that are not prices (such as interest rates and credit risks) and inputs that are derived from or corroborated by observable market data.

Level 3 - fair value measurements using significant non-market observable inputs. These include valuations for assets and liabilities that are derived using data, some or all of which is not market observable data, including assumptions about risk.

The following table presents the carrying amounts and fair values of financial liabilities and financial assets, including their levels in the fair value hierarchy. The table excludes fair value information for financial assets and financial liabilities not measured at fair value if the carrying amount is a reasonable approximation of fair value.

	December 30, 2018		
	Fair value level	Carrying amount	Fair value
Financial assets recorded at fair value			
Interest rate swap	Level 2	$ 6,592	$ 6,592
Derivative financial instrument assets - long term		$ 6,592	$ 6,592
Financial liabilities recorded at fair value			
Foreign exchange forward contracts	Level 2	$ 1,542	$ 1,542
Derivative financial instrument liabilities - current		$ 1,542	$ 1,542

	December 31, 2017		
	Fair value level	Carrying amount	Fair value
Financial assets recorded at fair value			
Derivative financial instrument liabilities			
Total return swap contracts	Level 2	$ 6,785	$ 6,785
Foreign exchange forward contracts	Level 2	1,432	1,432
Derivative financial instrument assets - current		$ 8,217	$ 8,217
Interest rate swap	Level 2	7,422	7,422
Derivative financial instrument assets - long term		$ 7,422	$ 7,422

(c) Risk Management

The Company is exposed to risks of varying degrees of significance which could affect its ability to achieve its strategic objectives for growth. The main objective of the Company's risk management process is to ensure that risks are properly identified and that the capital base is adequate in relation to these risks. The principal financial risk to which the Company is exposes are described below.

The use of derivatives allows the transfer, modification and reduction of current and expected risks, including interest rate, share price, foreign exchange and other market risks. The Company uses derivative financial instruments to manage interest rate, share price and foreign exchange risks in accordance with its risk management policies. Certain derivative instruments, while providing effective economic hedges, are not designated as hedges for accounting purposes. Changes in the fair value of any derivatives that are not designated as hedges for accounting purposes are recognized within "interest and finance costs" or "unrealized foreign exchange loss (gain) on non-current monetary items" in the consolidated statements of net earnings and total comprehensive income consistent with the underlying nature and purpose of the derivative instruments.

Market risk (interest rate risk and foreign currency risk)

Market risk incorporates a range of risks. Movements in risk factors, such as interest rate risk, equity price risk and foreign currency risk, affect the fair values of financial assets and liabilities. The Company uses derivative financial instruments including interest rate swaps, foreign exchange options and forward foreign exchange contracts to manage its risks associated with potentially adverse changes in interest rates and foreign exchange rates. These instruments are financial contracts whose value depends on interest rates and foreign currency prices. The use of derivatives allows the transfer, modification and reduction of current and expected risks, including interest rate, foreign exchange and other market risks. The Company uses derivative financial instruments to manage interest rate and foreign exchange risks in accordance with its risk management policies.

The Company does not hold financial instruments for speculative or trading purposes. The Company has elected not to apply hedge accounting to its derivative financial instruments.

Interest rate risk

The Company's borrowings under the Credit Facility are at variable rates of interest and expose the Company to interest rate risk. The Company attempts to mitigate this risk through interest rate swaps that could become materially more expensive if interest rates increase or become more volatile. If the cost of mitigating interest rates increases, the Company's debt service obligations on its variable rate indebtedness would increase even though the amount borrowed remained the same, and the Company's net earnings and cash available for servicing its other indebtedness would decrease.

The interest rate swap is subject to interest rate risk. As an illustration, if interest rates at the Consolidated Statements of Financial Position date had been 100 basis points lower, with all other variables held constant, net earnings and comprehensive income for Fiscal 2018 would have been lower by $3,170 (Fiscal 2017: $911), arising mainly as a result of the related fair value adjustment recorded due to lower interest rate. If interest rates had been 100 basis points higher, with all other variables held constant, net earnings and comprehensive income for Fiscal 2018 would have been higher by $2,906 (Fiscal 2017 $1,042), arising mainly as a result of the related fair value adjustment recorded due to higher interest rate.

On January 20, 2016, the Company entered into a $482,000 interest rate swap designed to hedge floating rate exposure on the $482,000 Term Credit Facility under the Prior Credit Agreement. The interest rate swap fixes the interest rate at 1.154% plus the applicable interest margin. On February 13, 2019, the Company blended the unrealized gain from the existing swap into a $600,000 notional interest rate swap designed to hedge floating rate exposure on the Company's new Credit Facility. The interest rate swap fixes the interest rate at 2.27% plus applicable margin until October 2023.

Equity price risk

The Company entered into a total return swap transaction to hedge the exposure associated with increases in its share value on a portion of the outstanding PSUs, RSUs and DSUs. The total return swap has a re-investment feature which increases the number of Shares in the swap when dividends are paid by the Company. As at December 30, 2018, the Company held a position of 221,500 Shares at a weighted average price of C$33.65. The Company does not apply hedge accounting to these derivative instruments and as such, gains and losses arising from marking these derivatives to market are recognized in net earnings in the period in which they arise.

Foreign currency risk

The United States dollar is the Company's functional currency. Fluctuations in the exchange rate between the United States dollar and Canadian dollar will affect the Company's reported results. However, the impact of changes in foreign exchange rates on the Company's reported results differ over time depending on whether the Company is generating a net cash inflow or outflow of Canadian dollars. This is largely dependent on the Company's revenue mix by currency as operating costs denominated in Canadian dollars have been historically relatively stable.

During Fiscal 2018, the Company generated a net outflow of Canadian dollars. As a matter of policy, the Company enters into foreign exchange forward contracts to protect the expected net Canadian dollar exposure from exchange fluctuation. The Company recorded a net realized foreign exchange loss of $5,793 during Fiscal 2018 (Fiscal 2017: gain of $766). This was comprised of a $4,814 loss on settlement of foreign exchange contracts and a $979 foreign currency loss on translation of Canadian dollar denominated working capital and dividends.

At December 30, 2018, the Company had $57 million of foreign exchange forward contracts to buy Canadian dollars with U.S. dollars at an average agreed exchange rate of $0.76. These foreign exchange contracts range in expiry dates from January 2019 to June 2019. The related liability of $1.5 million (December 31, 2017: $1.4 million asset) is recorded on the consolidated statements of financial position as a current derivative financial instruments liability and the corresponding change in the fair value of the foreign exchange forward contracts is recorded in the consolidated statements of net earnings and total comprehensive income.

Currency risk is the risk that the fair value of future cash flows of a financial instrument will fluctuate because of changes in foreign exchange rates. The Company is exposed to currency risk, primarily Canadian dollar balances. As an illustration, at December 30, 2018 if the Canadian dollar had weakened 10 percent against the U.S. dollar, with all other variables held constant, net earnings for Fiscal 2018

would have been lower by $1,259 (Fiscal 2017: $1,327). Conversely, if the Canadian dollar had strengthened 10 percent against the U.S. dollar, with all other variables held constant, net earnings would have been higher by $1,539 for Fiscal 2018 (Fiscal 2017: $1,621).

Liquidity risk

Liquidity risk is the risk that the Company will not be able to meet its financial obligations as they come due. Financial liabilities consist of accounts payable and accrued liabilities, obligations under finance leases and derivative financial instruments. Account payable and accrued liabilities are paid in the normal course of business and except under certain exceptions, no later than three months of being incurred.

The following table outlines the maturity analysis of the undiscounted cash flows of certain non-financial liability and committed leases as at December 30, 2018:

US dollars in thousands	Total	2019	2020	2021	2022	2023	Post 2023
Other long-term liabilities	1,008	1,008	—	—	—	—	—
Finance leases	29,363	8,803	7,204	5,990	4,358	3,008	—
Accrued benefit liability	9,266	8,967	299	0	—	—	—
Operating leases	70,690	10,759	9,519	9,465	9,055	8,714	23,178
	$ 110,327	$ 29,537	$ 17,022	$ 15,455	$ 13,413	$ 11,722	$ 23,178

The Company's approach to managing liquidity risk is to ensure, as far as possible, that it will always have sufficient liquidity to meet liabilities when due. At December 30, 2018, the Company had a cash balance of $10,820 (December 31, 2017: $9,938 of bank indebtedness), the $641,600 Revolver due in 2023 (December 31, 2017: $102,000 Revolver and $482,000 Term Credit Facility) and $13,769 of outstanding letters of credit (December 31, 2017: $8,817) under the Revolver.

The Company's principal sources of funds are cash generated from its operating activities, share issuances and borrowing capacity remaining under the Credit Facility. Management believes these sources of funds will provide NFI with sufficient liquidity and capital resources to meet its current and future financial obligations as they come due, as well as to provide funds for its financing requirements, capital expenditures and other needs for the foreseeable future.

Credit risk

Financial instruments which potentially subject the Company to credit risk and concentrations of credit risk consist principally of cash, accounts receivable and derivative financial instruments. Management has assessed that the credit risk associated with accounts receivable is mitigated by the significant proportion for which the counterparties are well-established transit authorities.

Additionally, up to 80% of the capital cost of new transit buses and coaches sold to public transit authorities and municipalities typically come from the U.S. Federal Transit Administration, while the remaining 20% comes from state and municipal sources. The maximum exposure to the risk of credit for accounts receivable corresponds to their book value. Historically, the Company has experienced nominal bad debts as a result of the customer base being principally comprised of municipal and other local transit authorities. During Fiscal 2018, the Company recorded a bad debt expense of $184 as compared to $174 bad debt expense in Fiscal 2017.

The carrying amount of accounts receivable is reduced through the use of an allowance account and the amount of the loss is recognized in the consolidated statements of net earnings and total comprehensive income within "sales, general and administration costs and other operating expenses". When a receivable balance is considered uncollectible, it is written off against the allowance for doubtful accounts. Subsequent recoveries of amounts previously written off are credited against "sales, general and administration costs and other operating expenses":

	December 30, 2018	December 31, 2017
Current, including holdbacks	$ 358,729	$ 361,805
Past due amounts but not impaired		
1 – 60 days	24,153	22,306
Greater than 60 days	4,830	2,878
Less: Allowance for doubtful accounts	(226)	(522)
Total accounts receivables, net	$ 387,486	$ 386,467

As at December 30, 2018, there was no amount that would otherwise be past due or impaired whose terms have been renegotiated.

The counterparties to the Company's derivatives are significant financial institutions. The Company could be exposed to loss in the event of non-performance by the counterparty; however, credit ratings and concentration of risk of the financial institutions are monitored on a regular basis.

There are certain financial covenants under the Credit Facility that must be maintained. These financial covenants include an interest coverage ratio and total leverage ratio. In accordance with terms of the Credit Facility. At December 30, 2018, the Company was in compliance with the ratios. The results of the financial covenants tests as of such date are as follows:

	December 30, 2018	December 31, 2017
Total Leverage Ratio (must be less than 3.75)	2.09	1.84
Interest Coverage Ratio (must be greater than 3.00)	13.39	17.15

Under the Credit Facility, the total leverage ratio is 3.75 and increases to 4.25 in the event of a material acquisition. The interest coverage ratio remains unchanged. Under the Prior Credit Agreement. The total leverage ratio covenant was reduced by 0.25 to 3.50 beginning January 1, 2018.

Compliance with financial covenants is reported quarterly to the Board. Other than the requirements imposed by borrowing agreements, the Company is not subject to any externally imposed capital requirements. Capital management objectives are reviewed on an annual basis or when strategic capital transactions arise.

(d) Capital management

The Company's objectives in managing capital are to deploy capital to provide an appropriate return to shareholders and to maintain a capital structure that provides the flexibility to take advantage of growth and development opportunities, maintain existing assets, meet financial obligations and enhance the value of the Shares. The capital structure of the Company consists of cash, long-term debt, other long-term liabilities and shareholders' equity, and prior to June 30, 2017, Debentures. The Company manages capital to ensure an appropriate balance between debt and equity. In order to maintain or adjust its capital structure, the Company may issue additional Shares, repurchase Shares, borrow additional funds or refinance debt at different terms and conditions.

There are certain financial covenants under the Credit Facility that must be maintained. These financial covenants include an interest coverage ratio and total leverage ratio. In accordance with terms of the Credit Facility. At December 30, 2018, the Company was in compliance with the ratios.

19. SEGMENT INFORMATION

The Company has two reportable segments which are the Company's strategic business units: Bus, Coach and Cutaway Manufacturing Operations ("Manufacturing Operations") and Aftermarket Operations. The strategic business units offer different products and services, and are managed separately because they require different technology and marketing strategies. For each of the strategic business units, the Company's President and CEO reviews internal management reports on a monthly basis.

The Manufacturing Operations segment derives its revenue from the manufacture, service and support of new transit buses, coaches, medium duty buses and cutaways. Based on management's judgement and applying the aggregation criteria in IFRS 8.12, the Company's transit bus, motor coach and cutaway operations fall under a single reportable segment. Aggregation of these operating segments is based on the segments having similar economic characteristics with similar long-term average returns, products and services, production methods, distribution, geographic market and regulatory environment.

The Manufacturing Operations segment has recorded vendor rebates of $235 (2017: $244), which have been recognized into earnings during 2018, but for which the full requirements for entitlement to these rebates have not yet been met.

The Aftermarket Operations segment derives its revenue from the sale of aftermarket parts for transit buses and motor coaches.

In 2018 the MCI service function, comprised of technical service management and customer training, which was previously managed by the MCI aftermarket operations, was moved to the coach manufacturing operations. To improve the comparability between periods, the related prior year segment information has been restated to reflect these changes.

There is no inter-segment revenue. Unallocated items in the consolidated earnings before income taxes primarily include unrealized foreign exchange gains or losses, interest and finance costs and corporate overhead costs.

The unallocated total assets of the Company primarily include cash, certain goodwill and intangible assets, derivative financial instruments and deferred income tax assets. Corporate assets that are shared by both operating segments are allocated fully to the Manufacturing Operations segment.

Segment information about profits and assets is as follows:

	Fiscal 2018			
	Manufacturing Operations	Aftermarket Operations	Unallocated	Total
Revenue from external customers	$ 2,141,867	$ 377,154	—	$ 2,519,021
Operating costs and expenses	1,935,186	310,864	62,318	2,308,368
Earnings (loss) before income tax expense	206,681	66,290	(62,318)	210,653
Total assets	1,422,771	403,336	248,030	2,074,137
Addition of capital expenditures	66,720	4,271	—	70,991
Addition of goodwill and intangibles assets	50	—	—	50
Goodwill	304,804	131,474	—	436,278

	Fiscal 2017 ("restated")			
	Manufacturing Operations	Aftermarket Operations	Unallocated	Total
Revenue from external customers	$ 2,012,627	$ 369,231	—	2,381,858
Operating costs and expenses - originally reported	1,787,277	304,838	48,121	2,140,236
Adjustment	7,866	(7,866)	—	—
Operating costs and expenses - restated	1,795,143	296,972	48,121	2,140,236
Earnings (loss) before income tax expense - originally reported	225,350	64,393	(48,121)	241,622
Adjustment	(7,866)	7,866	—	—
Earnings (loss) before income tax expense - restated	217,484	72,259	(48,121)	241,622
Total assets	1,310,528	401,935	262,124	1,974,587
Addition of capital expenditures	51,947	866	—	52,813
Addition of goodwill and intangibles assets	120,912	37	—	120,949
Goodwill	304,850	131,474	—	436,324

The Company's revenue by geography is summarized below:

	Fiscal 2018	Fiscal 2017
United States	$ 2,208,106	$ 2,151,723
Canada	310,915	230,135
Total	$ 2,519,021	$ 2,381,858

The Company had no customers in Fiscal 2018 or Fiscal 2017 with revenue greater than 10% of the Company's revenue.

The Company's disaggregated manufacturing revenue by major product type is provided below. The Aftermarket operations revenue does not have similarly disaggregated categories.

	Fiscal 2018	Fiscal 2017
Transit buses	$ 1,502,115	$ 1,386,273
Motor coaches	537,159	570,653
Medium-duty and cutaway buses	41,770	2,294
Pre-owned coach	46,284	50,441
Fiberglass reinforced polymer components	14,539	2,966
Manufacturing revenue	$ 2,141,867	$ 2,012,627

The allocation of property, plant and equipment to geographic areas is as follows:

	December 30, 2018	December 31, 2017
United States	$ 148,355	$ 92,445
Canada	99,588	94,428
Total	$ 247,943	$ 186,873

20. RELATED PARTY TRANSACTIONS

Compensation of key management

Key management includes the roles of the Board, President and CEO, the CFO, Presidents of each business unit, executive vice presidents, senior vice presidents and vice presidents. The compensation expense for key management for employee services is shown below:

	Fiscal 2018	Fiscal 2017
Salaries and short-term employee benefits	$ 10,294	$ 12,262
Post-employment benefits	396	357
Share-based payment benefits	1,352	16,405
	$ 12,042	$ 29,024

Share-based payment benefits shown above represent the PSU, RSU, Director RSU, DSU and stock option expense that was recorded in the period.

21. COMMITMENTS AND CONTINGENCIES

(a) Operating lease commitments

The Company has leased real property with aggregate minimum lease payments of $70,690 (Fiscal 2017: $89,024) payable as follows:

2019	10,759
2020	9,519
2021	9,465
2022	9,055
2023	8,714
Thereafter	23,178
	$ 70,690

(b) In the normal course of business, the Company receives notice of potential legal proceedings or is named as a defendant in legal proceedings, including those that may be related to product liability, wrongful dismissal or personal injury. Many claims are covered by the Company's insurance policies and management does not expect any of the current claims to have a material adverse effect on the Company’s financial position, results of operations or cash flows.

(c) Through the normal course of operations, the Company has indemnified the surety companies providing surety bonds required under various contracts with customers. In the event that the Company fails to perform under a contract and the surety companies incur a cost on a surety bond, the Company is obligated to repay the costs incurred in relation to the claim up to the value of the bond.

The Company's guarantee under each bond issued by the surety companies expires on completion of obligations under the customer contract to which the bond relates. The estimated maturity dates of the surety bonds outstanding at December 30, 2018 range from January 2019 to December 2022.

At December 30, 2018, outstanding surety bonds guaranteed by the Company totaled $394,428 (December 31, 2017: $327,290). The Company has not recorded any liability under these guarantees, as management believes that no material events of default exist under any contracts with customers.

(d) The Company has a letter of credit sub-facility of $100,000 as part of the Credit Facility (December 31, 2017: $55,000 as part of the Prior Credit Agreement). As at December 30, 2018, letters of credit totaling $13,769 (December 31, 2017: $8,817) remain outstanding under the letter of credit facility as security for the following contractual obligations of the Company:

	December 30, 2018	December 31, 2017
Collateral to secure operating facility leases	$ 315	$ 315
Collateral to secure line of credit	6,700	—
Customer performance guarantees	1,099	2,847
Collateral for self-insured workers compensation and general liability obligations	5,655	5,655
	$ 13,769	$ 8,817

As at December 30, 2018, management believes that the Company was in compliance in all material respects with all applicable contractual obligations and the Company has not provided for any costs associated with these letters of credit.

22. GUARANTEES

The Company indemnifies its directors and officers against claims and damages that may be incurred in the performance of their services to the Company. Liability insurance has been purchased with respect to the Company's directors and officers.

23. PROVISIONS

The Company's insurance risk retention meets the IFRS definition of provisions, a liability with uncertain timing or amount. The insurance risk retention was previously recorded as other long-term liability and the current portion recorded in accounts payable and accrued liabilities on the consolidated statements of financial position, is now reclassified to provisions.

The Company generally provides its customers with a base warranty on the entire transit bus or motor coach and a corrosion warranty on the related structure. The Company also provides certain extended warranties, including those covering brake systems, lower level components, fleet defect provisions and engine-related components, covering a warranty period of approximately one to five years, depending on the contract. The movements in the provision for the base warranty costs during the periods are as follows:

	Insurance Risk Retention	Warranty	Total
January 1, 2017	$ 19,656	66,543	86,199
Assumed as a result of business acquisitions	—	475	475
Additions	8,462	43,436	51,898
Amounts used/realized	(5,372)	(29,745)	(35,117)
Unwinding of discount and effect of changes in the discount rate	—	(8)	(8)
Exchange rate differences	—	(343)	(343)
December 31, 2017	$ 22,746	$ 80,358	$ 103,104
Additions	12,032	32,711	44,743
Amounts used/realized	(10,274)	(36,332)	(46,606)
Unwinding of discount and effect of changes in the discount rate	—	(82)	(82)
Exchange rate differences	—	(375)	(375)
	24,504	76,280	100,784
Less current portion	3,000	32,838	35,838
December 30, 2018	$ 21,504	$ 43,442	$ 64,946

24. SUPPLEMENTARY EXPENSE INFORMATION

	Fiscal 2018	Fiscal 2017
Employee benefit expense	$ 365,142	$ 342,078
Depreciation of plant and equipment	32,840	27,906
Amortization of intangible assets	34,956	29,696

The expenses listed above are included in cost of sales and sales, general and administration costs and other operating expenses.

25. CURRENT PORTION OF LONG TERM LIABILITIES

	December 30, 2018	December 31, 2017 (restated note 2.3)
Deferred revenue (note 12)	$ 31,859	$ 27,255
Provisions (note 23)	35,838	37,838
Other long-term liabilities	—	981
Deferred compensation obligation (note 9)	4,677	15,724
Obligations under finance leases (note 8)	7,936	4,685
	$ 80,310	$ 86,483

Section 3

Solicitation Requirement:

Letter for insurance, indicating the Proposer's ability to obtain the insurance coverage in accordance with the RFP requirements.

New Flyer Response:

Please refer to the attached letter from our surety confirming the compliance to the insurance requirements of the RFP.

Section 5

Solicitation Requirements:

Form for Proposal Deviation (without price data)

New Flyer response:

Please refer to the attached deviations and clarifications from New Flyer of America Inc. The packaged provided are:

- Commercial Deviations and Clarifications
- Technical Deviations and Clarifications for Xcelsior 35', 40' and 60' Electrical Buses
- Technical Deviations and Clarifications for MCI 45' Electrical Buses.

Commercial Clarifications and Deviations

Section 5

Solicitation Requirement:

Proposal Form

New Flyer Response:

Please refer to the attached Proposal Form Executed by our President, North American Bus and Coach and our Vice President, Sales & Marketing.

CER 9. Other Certifications

CER 9.1 Proposal Form

Proposer shall complete the following form and include it in the price Proposal.

PROPOSAL

By execution below by a duly authorized representative(s) of the Proposer, the Proposer hereby offers to furnish equipment and services as specified in its Proposal submitted to Pinellas Suncoast Transit Authority in response to Request for Proposal No. 21-980369 Electric Transit Buses with Charging and Associated Equipment

Proposer: New Flyer of America Inc.

Street address: 711 Kernaghan Avenue

City, state, ZIP: Winnipeg, Manitoba R2C 3T4

Name and title of Authorized Signer(s): [redacted]

Name and title of Authorized Signer(s): [redacted]

Phone: (204) 224-1251

[redacted]

Section 6

Solicitation Requirement:

All federal certifications: Buy America Certification, Debarment and Suspension Certification for Prospective Contractor, Debarment and Suspension Certification (Lower-Tier Covered Transaction), Non-Collusion Affidavit, Lobbying Certification, Certificate of Compliance with Bus Testing Requirement, DBE Approval Certification, and Federal Motor Vehicle Safety Standards.

New Flyer Response:

Please refer to the attached Federal Certifications as required by the RFP.

CER 8. Federal Certifications

CER 8.1 Buy America Certification

This form is to be submitted with an offer exceeding the small purchase threshold for federal assistance programs, currently set at $$150,000.

Certificate of Compliance

The Contractor hereby certifies that it will comply with the requirements of 49 USC 5323(j)(1) and (13), as amended, and the regulations of 49 CFR 661.11:

[redacted]

OR

Certificate of Non-Compliance

The Contractor hereby certifies that it cannot comply with the requirements of 49 USC 5323(j)(1) and (13), as amended, but may qualify for an exception to the requirements consistent with 49 USC 5323(j)(1) and (13), as amended, and regulations in 49 CFR 661.7.

Name and title:
Company:

Authorized signature Date

CER 8.2 Debarment and Suspension Certification for Prospective Contractor

Primary covered transactions must be completed by Proposer for contract value over $25,000.

Choose one alternative:

☒ The Proposer, New Flyer of America Inc..certifies to the best of its knowledge and belief that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any federal department or agency;
2. Have not within a three-year period preceding this Proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction or Contract under a public transaction; violation of federal or state antitrust statutes or commission or embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
3. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state, or local) with commission of any of the offenses enumerated in Paragraph 2 of this certification; and
4. Have not within a three-year period preceding this Proposal had one or more public transactions (federal, state or local) terminated for cause or default.

OR

☐ The Proposer is unable to certify to all of the statements in this certification, and attaches its explanation to this certification. (In explanation, certify to those statements that can be certified to and explain those that cannot.)

The Proposer certifies or affirms the truthfulness and accuracy of the contents of the statements submitted on or with this certification and understands that the provisions of Title 31 USC § Sections 3801 are applicable thereto.

[redacted]

CER 8.3 Debarment and Suspension Certification (Lower-Tier Covered Transaction)

This form is to be submitted by each Subcontractor receiving an amount exceeding $25,000.

The prospective lower-tier participant (Proposer) certifies, by submission of this Proposal, that neither it nor its "principals" as defined at 49 CFR § 29.105(p) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

If the prospective Proposer is unable to certify to the statement above, it shall attach an explanation, and indicate that it has done so by placing an "X" in the following space: _____

THE PROPOSER, _____, CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF EACH STATEMENT OF ITS CERTIFICATION AND EXPLANATION, IF ANY. IN ADDITION, THE PROPOSER UNDERSTANDS AND AGREES THAT THE PROVISIONS OF 31 USC §§ 3801 *ET SEQ.* APPLY TO THIS CERTIFICATION AND EXPLANATION, IF ANY.

[redacted]

CER 8.4 Non-Collusion Affidavit

This affidavit is to be filled out and executed by the Proposer; if a corporation makes the bid, then by its properly executed agent. The name of the individual swearing to the affidavit should appear on the line marked "Name of Affiant." The affiant's capacity, when a partner or officer of a corporation, should be inserted on the line marked "Capacity." The representative of the Proposer should sign his or her individual name at the end, not a partnership or corporation name, and swear to this affidavit before a notary public, who must attach his or her seal.

State of Minnesota, County of Stearns I, Jennifer McNeill, being first duly sworn, do hereby state that

(Name of Affiant)

I am _Vice President, Sales & Marketing_____ of New Flyer of America Inc._____
(Capacity) (Name of Firm, Partnership or Corporation)

whose business is Bus Manufacturing

and who resides at Winnipeg, Manitoba

and that New Flyer of America Inc.

[redacted]

CER 8.5 Lobbying Certification

This form is to be submitted with an offer exceeding $100,000.

The Proposer certifies, to the best its knowledge and belief, that:

1. No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of a federal department or agency, a member of the U.S. Congress, an officer or employee of the U.S. Congress, or an employee of a member of the U.S. Congress in connection with the awarding of any federal Contract, the making of any federal grant, the making of any federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification thereof.

2. If any funds other than federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this federal Contract, grant, loan or cooperative agreement, the undersigned shall complete and submit Standard Form LLL, "Disclosure Form to Report Lobbying," in accordance with its instruction, as amended by "Government wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96).

3. The undersigned shall require that the language of this certification be included in the award documents for all sub awards at all tiers (including subcontracts, sub grants and contracts under grants, loans and cooperative agreements) and that all sub recipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, USC § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

THE PROPOSER, New Flyer of America Inc. _____**, CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF EACH STATEMENT OF ITS CERTIFICATION AND DISCLOSURE, IF ANY. IN ADDITION, THE PROPOSER UNDERSTANDS AND AGREES THAT THE PROVISIONS OF 31 USC §§ 3801 ET SEQ. APPLY TO THIS CERTIFICATION AND DISCLOSURE, IF ANY.**

[redacted]

CER 8.6 Certificate of Compliance with Bus Testing Requirement

The undersigned certifies that the vehicle offered in this procurement complies and will, when delivered, comply with 49 USC § 5323(c) and FTA's implementing regulation at 49 CFR Part 665 according to the indicated one of the following three alternatives.

Mark one and only one of the three blank spaces with an "X."

1. __X__ The buses offered herewith have been tested in accordance with 49 CFR Part 665 on July 2015 (date). If multiple buses are being proposed, provide additional bus testing information below or on attached sheet. The vehicles being sold should have the identical configuration and major components as the vehicle in the test report, which must be submitted with this Proposal. If the configuration or components are not identical, then the manufacturer shall provide with its Proposal a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing. If multiple buses are being proposed, testing data on additional buses shall be listed on the bottom of this page.

2. _____ The manufacturer represents that the vehicle is "grandfathered" (has been used in mass transit service in the United States before October 1, 1988, and is currently being produced without a major change in configuration or components), and submits with this Proposal the name and address of the recipient of such a vehicle and the details of that vehicle's configuration and major components.

3. _____ The vehicle is a new model and will be tested and the results will be submitted to the Agency prior to acceptance of the first bus.

The undersigned understands that misrepresenting the testing status of a vehicle acquired with federal financial assistance may subject the undersigned to civil penalties as outlined in the Department of Transportation's regulation on Program Fraud Civil Remedies, 49 CFR Part 31. In addition, the undersigned understands that FTA may suspend or debar a manufacturer under the procedures in 49 CFR Part 29.



CER 8.6 Certificate of Compliance with Bus Testing Requirement

The undersigned certifies that the vehicle offered in this procurement complies and will, when delivered, comply with 49 USC § 5323(c) and FTA's implementing regulation at 49 CFR Part 665 according to the indicated one of the following three alternatives.

Mark one and only one of the three blank spaces with an "X."

1. X The buses offered herewith have been tested in accordance with 49 CFR Part 665 on August 2018 (date). If multiple buses are being proposed, provide additional bus testing information below or on attached sheet. The vehicles being sold should have the identical configuration and major components as the vehicle in the test report, which must be submitted with this Proposal. If the configuration or components are not identical, then the manufacturer shall provide with its Proposal a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing. If multiple buses are being proposed, testing data on additional buses shall be listed on the bottom of this page.

2. _____ The manufacturer represents that the vehicle is "grandfathered" (has been used in mass transit service in the United States before October 1, 1988, and is currently being produced without a major change in configuration or components), and submits with this Proposal the name and address of the recipient of such a vehicle and the details of that vehicle's configuration and major components.

3. _____ The vehicle is a new model and will be tested and the results will be submitted to the Agency prior to acceptance of the first bus.

The undersigned understands that misrepresenting the testing status of a vehicle acquired with federal financial assistance may subject the undersigned to civil penalties as outlined in the Department of Transportation's regulation on Program Fraud Civil Remedies, 49 CFR Part 31. In addition, the undersigned understands that FTA may suspend or debar a manufacturer under the procedures in 49 CFR Part 29.



CER 8.6 Certificate of Compliance with Bus Testing Requirement

The undersigned certifies that the vehicle offered in this procurement complies and will, when delivered, comply with 49 USC § 5323(c) and FTA's implementing regulation at 49 CFR Part 665 according to the indicated one of the following three alternatives.

Mark one and only one of the three blank spaces with an "X."

1. X The buses offered herewith have been tested in accordance with 49 CFR Part 665 on December 2020 (date). If multiple buses are being proposed, provide additional bus testing information below or on attached sheet. The vehicles being sold should have the identical configuration and major components as the vehicle in the test report, which must be submitted with this Proposal. If the configuration or components are not identical, then the manufacturer shall provide with its Proposal a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing. If multiple buses are being proposed, testing data on additional buses shall be listed on the bottom of this page.

2. _____ The manufacturer represents that the vehicle is "grandfathered" (has been used in mass transit service in the United States before October 1, 1988, and is currently being produced without a major change in configuration or components), and submits with this Proposal the name and address of the recipient of such a vehicle and the details of that vehicle's configuration and major components.

3. _____ The vehicle is a new model and will be tested and the results will be submitted to the Agency prior to acceptance of the first bus.

The undersigned understands that misrepresenting the testing status of a vehicle acquired with federal financial assistance may subject the undersigned to civil penalties as outlined in the Department of Transportation's regulation on Program Fraud Civil Remedies, 49 CFR Part 31. In addition, the undersigned understands that FTA may suspend or debar a manufacturer under the procedures in 49 CFR Part 29.



CER 8.7 DBE Approval Certification

I hereby certify that the Proposer has complied with the requirements of 49 CFR 26, Participation by Disadvantaged Business Enterprises in DOT Programs, and that its goals have not been disapproved by the Federal Transit Administration.



CER 8.8 Federal Motor Vehicle Safety Standards

The Proposer and (if selected) Contractor shall submit (1) manufacturer's FMVSS self-certification sticker information that the vehicle complies with relevant FMVSS or (2) manufacturer's certified statement that the contracted buses will not be subject to FMVSS regulations.

