



The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at ***wvOASIS.gov***. As part of the State of West Virginia's procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at ***WVPurchasing.gov*** with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.

Header 74

List View

General Information

Contact

Default Values

Discount

Document Information

Clarification Request

Procurement Folder: 1010761

Procurement Type: Central Master Agreement

Vendor ID: VS0000011255

Legal Name: CREATIVE BUS SALES INC

Alias/DBA:

Total Bid: \$0.00

Response Date: 04/26/2022

Response Time: 10:54

Responded By User ID: CreativeBus

First Name: Nick

Last Name: Corley

Email: biddepartment@creative1

Phone: 9094655528

SO Doc Code: CRFQ

SO Dept: 0805

SO Doc ID: PTR2200000008

Published Date: 4/19/22

Close Date: 4/26/22

Close Time: 13:30

Status: Closed

Solicitation Description: 158" - 176" Wheelbase Cutaway Vehicle

Total of Header Attachments: 74

Total of All Attachments: 74





Department of Administration  
Purchasing Division  
2019 Washington Street East  
Post Office Box 50130  
Charleston, WV 25305-0130

State of West Virginia  
Solicitation Response

**Proc Folder:** 1010761  
**Solicitation Description:** 158" - 176" Wheelbase Cutaway Vehicle  
**Proc Type:** Central Master Agreement

Solicitation Closes	Solicitation Response	Version
2022-04-26 13:30	SR 0805 ESR04252200000006630	1

**VENDOR**  
VS0000011255  
CREATIVE BUS SALES INC

**Solicitation Number:** CRFQ 0805 PTR2200000008  
**Total Bid:** 0  
**Response Date:** 2022-04-26  
**Response Time:** 10:54:05  
**Comments:**

**FOR INFORMATION CONTACT THE BUYER**  
David H Pauline  
304-558-0067  
david.h.pauline@wv.gov

<b>Vendor</b>		
<b>Signature X</b>	<b>FEIN#</b>	<b>DATE</b>

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	158"- 176" Wheelbase Cutaway Vehicle	0.00000	EA	3279052.000000	0.00

Comm Code	Manufacturer	Specification	Model #
25101502			

Commodity Line Comments:

Extended Description:

158" - 176" Wheelbase Cutaway vehicle with air / heat, fixed seats, wheelchair securement and lift to provide specialized transportation services in a urban and suburban-rural environment. .



# Creative Bus Sales

THE NATION'S LARGEST BUS DEALER SINCE 1980

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Re: RFP Number: PTR2200000008  
Bid Title: 158" – 176" Wheelbase Cutaway Vehicle  
Bid Due Date: April 26, 2022 at 1:30pm (ESDT)

Mr. David Pauline

We are pleased to participate in the above noted IFB. However, as you are already aware, we did run into some technical issues with the wvOasis portal on Friday 4/22 and yesterday 4/25, when we were uploading documents. For that reason, we decided to send you a hard copy of our bid proposal to ensure that it would be there in time should the website prove unusable. In the meantime, we were able to successfully submit our proposal online using the wvOasis system, late yesterday afternoon. We would ask that you consider it the "official" submittal for Creative Bus Sales and disregard the paper version arriving today.

Thank you

**Nick Corley | Sales Operations Manager**

Creative Bus Sales, Inc.

800-326-2877

[ncorley@creativebussales.com](mailto:ncorley@creativebussales.com)

**REQUEST FOR QUOTATION EXHIBIT A PRICING PAGE****158" - 176" Wheelbase Cutway Vehicle****VENDOR NAME: Creative Bus Sales, Inc.****MANUFACTURER/MAKE/MODEL: FOREST RIVER BUS/GLAVAL/UNIVERSAL**

CLASS	VEHICLE DESCRIPTION	UNIT PRICE PER VEHICLE	ESTIMATED QUANTITY	EXTENDED PRICE
A	158" Vehicle, Six (6) Fixed Double Seats, Two (2) Wheelchair Positions with One (1) Fold Up Seat (Double), Rear Curbside Lift Location, Vinyl Logo and Stripes	\$134062.00	5	\$670310.00
B	158" Vehicle, Six (6) Fixed Double Seats, Two (2) Wheelchair Positions with One (1) Fold Up Seat (Double), Rear Curbside Lift Location, Full Bus Body Paint or 3/4 Bus Body Paint with Expanded Graphics	\$140410.00	5	\$702050.00
C	Vehicle, Five (5) Fixed Double Seats, Two (2) Wheelchair Positons with Two (2) Fold Up Seats (Double), Extended Wheelbase to 176", Front Wheel Chair Lift Location, Vinyl Logo and Stripes	\$131583.00	5	\$657915.00
D	Vehicle, Five (5) Fixed Double Seats, Two (2) Wheelchair Positons with Two (2) Fold Up Seats (Double), Extended Wheelbase to 176", Front Wheel Chair Lift Location, Full Bus Body Paint or 3/4 Bus Body Paint with Expanded Graphics	\$137931.00	5	\$689655.00
E	Vehicle, Four (4) Fixed Double Seats, Three (3) Wheelchair Positons with Three (3) Fold Up Seats (Double), Extended Wheelbase to 176", Front Wheel Chair Lift Location, Vinyl Logo and Stripes	\$134362.00	2	\$268724.00
F	Vehicle, Four (4) Fixed Double Seats, Three (3) Wheelchair Positons with Three (3) Fold Up Seats (Doulbe), Extended Wheelbase to 176", Front Wheel Chair Lift Location, Full Bus Body Paint or 3/4 Bus Body Paint with Expanded Graphics	\$140710.00	2	\$281420.00
AA	Option to Add on all Classes On Board Automatic Audio / Visual LED Display Voice Announcement System	\$4489.00	2	\$8978.00
<b>TOTAL BID FOR EVALUATION</b>				3279052.00

\*Complete form provided. The DPT may purchase more or less as needed.

Note: These are only estimated quantities and do not reflect any guarantee of purchase.

Please do not alter pricing page.



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# Creative Bus Sales

THE NATION'S LARGEST BUS DEALER SINCE 1980

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# Creative Bus Sales

*THE NATION'S LARGEST BUS DEALER SINCE 1980*

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Department of Administration  
Purchasing Division  
2019 Washington Street East  
Post Office Box 50130  
Charleston, WV 25305-0130

State of West Virginia  
Centralized Request for Quote

Proc Folder: 1010761

Doc Description: 158" - 176" Wheelbase Cutaway Vehicle

Reason for Modification:

Addendum no. 3

Proc Type: Central Master Agreement

Date Issued	Solicitation Closes	Solicitation No	Version
2022-04-19	2022-04-26 13:30	CRFQ 0805 PTR2200000008	4

**BID RECEIVING LOCATION**

BID CLERK  
DEPARTMENT OF ADMINISTRATION  
PURCHASING DIVISION  
2019 WASHINGTON ST E  
CHARLESTON WV 25305  
US

**VENDOR**

Vendor Customer Code:

Vendor Name : Creative Bus Sales, Inc.

Address :

Street : 9365 Counselors Row, Suite 112

City : Indianapolis

State : IN

Country : USA

Zip : 46240

Principal Contact : Mike Wilson

Vendor Contact Phone: 877-686-9447

Extension:

**FOR INFORMATION CONTACT THE BUYER**

David H Pauline  
304-558-0067  
david.h.pauline@wv.gov

Vendor  
Signature X

FEIN# 33-0388707

DATE 4/22/21

All offers subject to all terms and conditions contained in this solicitation



**Responder Information**

Creative Bus Sales, Inc.  
9365 Counselors Row, Suite 112  
Indianapolis, IN 46240

Mike Wilson – General Manager  
(877) 686-9448 – Phone,  
[MikeW@creativebussales.com](mailto:MikeW@creativebussales.com)

**Company History - Bidders Qualifications**

Creative Bus Sales, Inc. began serving the needs of California transportation providers in 1980 under the name of Creative Transportation Services, Inc. (CTS). In 1980, CTS was sold and became Creative Bus Sales, Inc. Tony Matijevich subsequently purchased Creative in 1993. Under the current leadership and vision, Creative Bus Sales has become the largest volume small and mid-size bus dealership in the United States. Creative is unique in the bus industry as a dealer that focuses only on the needs of the commercial bus customer.

**Creative Family of Companies Include:**

Creative Bus Sales - Chino, California  
Creative Bus Sales - Atlantic Beach, Florida  
Creative Bus Sales - Phoenix, Arizona  
Creative Bus Sales - Irving, Texas  
Creative Collision and Paint-Chino, California  
Green Alternative Systems- Chicago, IL  
Creative Bus Sales- Tulsa, OK  
Creative Bus Sales- Jacksonville, FL  
Creative Bus Sales- Seattle, WA

El Dorado Bus Sales - San Mateo, California  
Green Alternative Systems -Elkhart, Indiana  
Creative Bus Sales -Albuquerque, New Mexico  
Creative Fleet Leasing - Chino, California  
Green Alternative Systems – Brooklyn, NY  
Green Alternative Systems- Yorba, CA  
Creative Bus Sales- Orlando, FL  
Creative Bus Sales – Portland, OR

Creative Bus Sales was incorporated in the State of California in 1993 under the current ownership. Creative Bus Sales has had no judgments, litigation, licensing violations or other violations outstanding or resolved against it within the past five (5) years.

**Background:** Creative Bus Sales is the largest commercial bus dealership in the United States and sells, delivers and services hundreds of buses per year to agencies and companies in California and throughout the United States. Creative Bus Sales has held several State Contracts over the last 17 years and has delivered several thousand State contract vehicles during this time.

**Experience (a partial listing of significant projects)**

Significant Transit Projects Completed Over The Last 4-5 Years

OCTA	Over 950 Paratransit Buses
City of Los Angeles	Over 500 Paratransit Buses
Caltrans Division of Mass Transit	Over 2,000 Paratransit Buses
RTC Las Vegas	Over 400 Paratransit and Transit Buses
Access Services	Over 700 Paratransit Mini Vans
Dallas DART	398 Paratransit Buses
Montgomery County, MD.	93 Paratransit Buses

**Notices should be sent c/o:**

Mike Wilson – General Manager  
Creative Bus Sales, Inc.  
9365 Counselors Row, Suite 112, Indianapolis, IN 46240  
(877) 686-9448 [MikeW@creativebussales.com](mailto:MikeW@creativebussales.com)

**Preparer:** Nick Corley, Sales Operations Manager for Creative Bus Sales, Inc. is the preparer of this proposal.

**Flexible Scope:** Creative Bus Sales, Inc. is committed to flexibility in the products and services offered in the contract upon request by the State.

**Independent Pricing:** Creative Bus Sales, Inc. certifies that in connection with this Contract the prices proposed have been arrived at without consultation, communication or agreement for the purpose of restricting competition.

**Signer(s):** Each person signing this proposal and/or addenda is the person responsible for or authorized to make decisions as to the prices quoted in the cost proposal and has not participated and will not participate in any action contrary to those stated above.

**Key Personnel:** Project Manager – Mike Wilson is the proposed Project Manager for this contract.

**Organization and Key Staff Members Assigned to This Contract:**

Tony Matijevich, President  
Mike Wilson, General Manager  
Nick Corley, Sales Operations Manager  
Matt Mashuda, Transit Bus Sales  
Justin Rougemont, Operations & Service Manager  
Jason Hohalek, Corporate Warranty Administrator  
Keith Grube, Parts & Warehouse Manager

**Project Team:** Mike Wilson, Project Manager will be responsible for the day-to-day maintenance of this contract. Some or all the above-mentioned personnel will be utilized as needed during this project.

**Consent:** Creative Bus Sales, Inc. if awarded a contract will not assign any part of its interest in the agreement without prior consent of the State.

**Acceptance of Terms:** Creative Bus Sales, Inc. accepts the Contract Terms and Conditions.

**Solicitation Response:** Our understanding of the scope of work pertaining to this solicitation and components includes but not limited to: Terms and Conditions, Specifications, Delivery and Pricing, etc.

**Customer Service Capabilities:** Our service locations or are located within 5 hours of all recipients' locations. Technical assistance is provided on the day of the phone call. We are exclusively able to direct factory personnel from any discipline including engineering, manufacturing, parts, service and management, in response to your need at the time. No delay in problem resolution due to out of state factory personnel availability is experienced. Swift and accurate resolutions to issues and needs are achieved through factory personnel directly reviewing issues, "firsthand", as they are presented.

Creative has excellent relations with all major component manufacturers. Creative's service technicians and supervisory team are certified by John Deere, Cummins, A/C Carrier, Trans Air, Thermo King, Ricon, and Braun. Service technicians are graduates of the Automotive Technical College and Automotive Service Excellence (ASE) Master Technicians.

Creative's parts service department is dedicated solely to the service and support of commercial and transit buses and does not service any other type of equipment, school buses or trucks. Such focus

insures an unmatched level of competency in the industry. Technical assistance can be provided immediately during business hours by contacting Creative Bus Sales service technicians.

#### **List of Centers**

One call to our Warranty Administration team will facilitate the best warranty option. Creative Bus Sales is an authorized repair facility. They have the authority to make on the spot decisions regarding warranty repairs. As needed, local to the end user warranty repair facilities will be authorized to perform the required repair.

#### **Spare Parts and Inventory Levels**

A critical part of the project is a quick response time to service assistance and parts supply. Both items are provided from locations in Arizona, California, Florida, Indiana, and Texas. One call to our Parts network will facilitate the end user's needs. Most parts can be shipped within twenty-four hours of order. A Complete description of our parts policy and procedures can be provided upon award.

#### **Inspection procedures**

Each vehicle will have a PDI (Pre-Delivery Inspection) performed before final delivery to the end customer. Any deficiency noted shall be repaired before delivery. All documents required under the contract shall be provided upon delivery or pickup. This pre-delivery inspection will be in addition to inspections performed by the manufacturer and/or line inspectors hired by the end user.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Nick Corley', with a stylized flourish at the end.

Nick Corley  
Sales Operations Manager  
Creative Bus Sales, Inc.

REQUEST FOR QUOTATION  
158" – 176" Wheelbase Cutaway Vehicle

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**BID DOCUMENTATION CHECKLIST**

Manufacturer: Glaval      Model Year: 2023      Model: Universal

**Bid Forms to be submitted with Bid:**

- X   Bid Form #1: Locations of Technical Service Representatives  
and Parts Distribution Centers
- X   Bid Form #2: Certification for Air & Water Pollution
- X   Bid Form #3: Disadvantaged Business Enterprise Vendors/Manufacturers Certification  
**The vendor shall also supply with bid FTA TVM DBE Goal Concurrence for  
the Current Fiscal Year Approval Letter.**
- X   Bid Form #4: Buy America Certification Rolling Stock  
**Should the Vendor be declared responsive and low bid, pursuant to Pre-  
Award and Post Delivery Audit Requirements, the Division will require the  
Vendor to submit documentation (with the bid or prior to any award) that  
lists:**
- 1) Component and sub-component parts of the rolling stock to be purchased  
identified by manufacturer of the parts, their country of origin and costs: and
  - 2) The location of the final assembly point for the rolling stock, including a  
description of the activities that will take place at the final assembly point  
and the cost of final assembly.
- X   Bid Form #5: Federal Motor Vehicle Safety Standards Certification  
**Vendor shall also supply with bid a breakdown of FMVSS standards to be met  
with proposed vehicle.**
- X   Bid Form #6: U.S. Comptroller's Debarment List Certification
- X   Bid Form #7: Certification of Primary Participant Regarding  
Debarment, Suspension, and Other Responsibility Matters
- X   Bid Form #8: Vendor's Certification of Understanding and Acceptance
- X   Bid Form #9: Certification of Restrictions on Lobbying
- X   Bid Form #10: Certification of Compliance with FTA's Vehicle Testing Requirements  
**A copy of the vehicle testing report (if available) shall be included with the bid.**
- X   Exhibit A Pricing Page



REQUEST FOR QUOTATION  
158" – 176" Wheelbase Cutaway Vehicle

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**DOCUMENTATION TO BE SUBMITTED WITH BID:**

**Section**  
**Referenced**

- |          |         |  |
|----------|---------|--|
| <u>X</u> | 3.1.11  | Provide details of water testing procedures.   |
| <u>X</u> | 3.2     | Chassis: provide product description, warranty information and product literature.   |
| <u>X</u> | 3.2     | Wheelbase: provide length of proposed wheelbase.   |
| <u>X</u> | 3.3     | Engine: gasoline: provide product description, warranty information and product literature.  |
| <u>X</u> | 3.5     | Radiator and Cooling System: provide product description, warranty information and product literature.   |
| <u>X</u> | 3.6     | High Idle System, provide product description, warranty information and product literature.  |
| <u>X</u> | 3.8     | Transmission: provide product description, warranty information and product literature.  |
| <u>X</u> | 3.10.4  | Rear View Back-Up Camera: provide product description, warranty information and literature.  |
| <u>X</u> | 3.11.4  | Tilt Wheel, Cruise Control and Power Steering: provide product description.  |
| <u>X</u> | 3.13    | Brakes: provide product description, warranty information and product literature.  |
| <u>X</u> | 3.14    | Wheels: provide product description, warranty information and product literature.  |
| <u>X</u> | 3.15    | Tires: provide product description, warranty information and product literature.   |
| <u>X</u> | 3.16.5  | Alternator: provide product description, warranty information and product literature.  |
| <u>X</u> | 3.16.6  | Battery: provide product description, warranty information and product literature.   |
| <u>X</u> | 3.17.1  | Radio/AM/FM/USB/MP3: provide product description, warranty information and product literature.   |
| <u>X</u> | 3.19    | Body Structure/Roof Specifications: provide a description of how construction/ conversion will take place and meet the specification requirements. Provide actual interior height and body length of proposed vehicle. |
| <u>X</u> | 3.19.15 | Stepwell: provide a description of construction.   |
| <u>X</u> | 3.22    | Entrance, Exit, Lift, and Emergency Exit Doors: Provide product description, dimensions, description of connection with interlock system, and locks to be provided.  |

REQUEST FOR QUOTATION  
158" – 176" Wheelbase Cutaway Vehicle

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- X 3.23      Rear Bumper: provide product description, warranty information and product literature.
- X 3.24      Wheelchair Lift: provide product description, warranty information and product literature.
- X 3.24.9    Interlock System: provide product description, warranty information and product literature.
- X 3.26      Front and Rear Heating and Air Conditioning: provide product description, warranty information, product literature.
- X 3.29      Flooring: provide a description of product to be used, samples of floor covering, colors to be used and assembly process.
- X 3.30.1    Passenger Seats and Restraints: provide product description, warranty information and product literature.
- X 3.30.2    Padded Grab Handle: provide product description.
- X 3.30.11   Driver's Seat: provide product description, warranty information and product literature.
- X 3.31      Wheelchair Securement System: provide product description, warranty information and product literature.
- X 3.32      Mobility Aid/ Occupant Restraint Systems: provide product description, warranty information and product literature.
- X 3.33.1    Exterior Mirrors: provide product description, warranty information and product literature.
- X 3.37      Digital Destination Signs: provide product description, warranty information and product literature.
- X 3.38      Passenger Signaling System: provide product description, warranty information and product literature.
- X 3.39      Mobile PA System: provide product description, warranty information and product literature.
- X 3.40      Fare Box Provision: provide description of provision.
- X 3.41      Strobe Light: provide product description, warranty information and product literature.
- X 3.42      Radio Install Prep: provide description of process.
- X 3.44      Security Camera System Including Playback: provide product description, warranty information and product literature.

REQUEST FOR QUOTATION  
158" – 176" Wheelbase Cutaway Vehicle

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- X   3.45      Dual Purpose Safety Vent: provide product description, warranty information and product literature.
- X   3.46      Storage Compartment: provide information on proposed location.
- X   3.51      Training: submit letter of understanding to the terms in this Section.
- X   4.0.5      Overhead Luggage Rack: provide product description and product literature.  
    4.0.6      Classes E & F
- X   4.0.5      High Back Passenger Seating: provide product description, warranty information and  
    4.0.6      product literature. Classes E & F
- X   6.1.7.4    Warranty Provider Locations: provide names of providers in WV.
- X   6.1.7.5    Warranties: provide information on warranties to be provided.
- NA  9.3      Complete two (2) bids in binder form –one (1) marked for DPT.
- X   11.1.1      Complete mechanical description of vehicle, its construction and equipment including manufacturer's model name and/or number.
- X   11.1.2      Proposed interior floor plans, showing detailed dimensions including the location of the wheelchair securement system.
- X   11.1.3      Curb weight (empty weight) and gross vehicle weight rating (GVWR of vehicle.
- X   11.1.6      Rustproofing and Undercoating: provide product description, warranty information and product literature.
- X   11.1.8      A list of five (5) users names, addresses, emails, and telephone numbers who have been provided similar equipment.
- 
- X              No Debt Affidavit
- X              Addendum Acknowledgement

**ADDENDUM ACKNOWLEDGEMENT FORM**  
**SOLICITATION NO.: CRFQ PTR22\*08**

**Instructions:** Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

**Acknowledgment:** I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

**Addendum Numbers Received:**

(Check the box next to each addendum received)

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6  |
| <input checked="" type="checkbox"/> Addendum No. 2 | <input type="checkbox"/> Addendum No. 7  |
| <input checked="" type="checkbox"/> Addendum No. 3 | <input type="checkbox"/> Addendum No. 8  |
| <input type="checkbox"/> Addendum No. 4            | <input type="checkbox"/> Addendum No. 9  |
| <input type="checkbox"/> Addendum No. 5            | <input type="checkbox"/> Addendum No. 10 |

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Creative Bus Sales, Inc.

\_\_\_\_\_  
Company



\_\_\_\_\_  
Authorized Signature

4/22/22

\_\_\_\_\_  
Date

NOTE: This addendum acknowledgment should be submitted with the bid to expedite document processing.

**DESIGNATED CONTACT:** Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

Mike Wilson, Regional Sales Manager

(Name, Title)

Mike Wilson, Regional Sales Manager

(Printed Name and Title)

9365 Counselors Row, Suite 112, Indianapolis, IN 46240

(Address)

877-686-9448

(Phone Number) / (Fax Number)

mikew@creativebussales.com

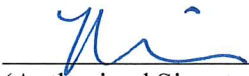
(email address)

**CERTIFICATION AND SIGNATURE:** By signing below, or submitting documentation through wvOASIS, I certify that: I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

By signing below, I further certify that I understand this Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law.

Creative Bus Sales, Inc.

(Company)



Nick Corley, Sales Operations Manager

(Authorized Signature) (Representative Name, Title)

Nick Corley, Sales Operations Manager

(Printed Name and Title of Authorized Representative)

4/22/22

(Date)

317-448-0896

(Phone Number) (Fax Number)

**BID FORM #2**

**CERTIFICATION FOR AIR & WATER POLLUTION  
BID FORM 2– TO BE SUBMITTED WITH BID**

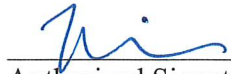
The Vendor certifies that the vehicles proposed:

**ARE**   X   in compliance with the regulations in 40 CFR Part 85, 40 CFR Part 86, 40 CFR Part 600, Clean Water Act and the air/water pollution criteria established by the Environmental Protection Agency of the United States Government.

**ARE NOT**        in compliance with the regulations in 40 CFR Part 85, 40 CFR Part 86, 40 CFR Part 600, Clean Water Act and the air/water pollution criteria established by the Environmental Protection Agency of the United States Government.

4/22/22

Date



Authorized Signature

Sales Operations Manager

Title

Creative Bus Sales, Inc.

Company Name



**BID FORM #3**

**DISADVANTAGED BUSINESS ENTERPRISE  
VENDORS/ MANUFACTURERS CERTIFICATION**

**BID FORM 2 – TO BE SUBMITTED WITH BID**

**(Check appropriate statement)**

\_\_\_\_\_ The Vendor, if a transit vehicle manufacturer, hereby certifies that it has complied with the requirements of 49 CFR Section 26.49 by submitting an annual DBE goal to the Federal Transit Administration (FTA). The goal has either been approved or not disapproved by FTA.

X\_\_\_\_\_ The Vendor, if a non-manufacturing supplier, hereby certifies that the manufacturer of the transit vehicle to be supplied has complied with the above-referenced requirement of 49 CFR Section 26.49.

4/22/22

\_\_\_\_\_

Date

  
\_\_\_\_\_

Authorized Signature

Sales Operations Manager

\_\_\_\_\_

Title

Creative Bus Sales, Inc.

\_\_\_\_\_

Company Name

STATE OF WEST VIRGINIA  
Purchasing Division

## PURCHASING AFFIDAVIT

**CONSTRUCTION CONTRACTS:** Under W. Va. Code § 5-22-1(i), the contracting public entity shall not award a construction contract to any bidder that is known to be in default on any monetary obligation owed to the state or a political subdivision of the state, including, but not limited to, obligations related to payroll taxes, property taxes, sales and use taxes, fire service fees, or other fines or fees.

**ALL CONTRACTS:** Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

**EXCEPTION:** The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

**DEFINITIONS:**

**"Debt"** means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

**"Employer default"** means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

**"Related party"** means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceeds five percent of the total contract amount.

**AFFIRMATION:** By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (W. Va. Code §61-5-3) that: (1) for construction contracts, the vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

**WITNESS THE FOLLOWING SIGNATURE:**

Vendor's Name: Creative Bus Sales, Inc.

Authorized Signature:  Date: 4/22/22

State of Georgia

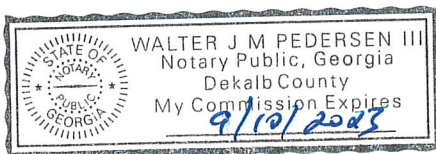
County of Clayton, to-wit:

Taken, subscribed, and sworn to before me this 22 day of April, 2022.

My Commission expires September 10, 2023.

**AFFIX SEAL HERE**

**NOTARY PUBLIC**





Purchasing Affidavit (Revised 01/19/2018)

**BID FORM #1**

**BID FORM 1 – TO BE SUBMITTED WITH BID**

**Location(s) of Technical Service Representative(s)  
closest or in the State of West Virginia**

**Name:** Creative Bus Sales-Indiana

**Address:** 9365 Counselors Row, Suite 112

Contact: Mike Wilson

877-686-9448

**Telephone:** \_\_\_\_\_

**Name:** Creative Bus Sales-Georgia

**Address:** 1926 Hyannis Ct. College Park, GA 30337

Contact: Carl Henderson - Eastern Service Manager

**Telephone:** 888-633-8380

**Location(s) of Parts Distribution Center(s)  
closest or in the State of West Virginia**

**Name:** Creative Bus Sales - Indiana

**Address:** 57475 County Road Elkhart, IN 46517

**Telephone:** 877-686-9448

**Name:** Creative Bus Sales - Parts Distribution Warehouse

**Address:** 3832 E. Roeser, Phoenix, AZ 85040

**Telephone:** 888-993-5040

**BID FORM #5**

**FEDERAL MOTOR VEHICLE  
SAFETY STANDARDS CERTIFICATION**

**BID FORM 5– TO BE SUBMITTED WITH BID**

The vendor hereby certifies that it shall submit, as required by Title 49 of the CFR, Part 663 - Subpart D, its self-certification information stating that the vehicle(s) will comply with the relevant Federal Motor Vehicle Safety Standards issued by the National Highway Traffic Safety Administration in Title 49 of the Code of Federal Regulations, Part 571.

4/22/22

Date



Authorized Signature

Sales Operations Manager

Title

Creative Bus Sales, Inc.

Company Name

**BID FORM #6**  
**U.S. Comptroller's Debarment List Certification**

**BID FORM 6 – TO BE SUBMITTED WITH BID**

Creative Bus Sales, Inc.

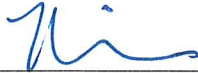
hereby certifies that it

       **IS or**

  X   **IS NOT** (specify one) included on the U.S. GSA's debarment and suspension  
information available at <https://www.sam.gov>.

4/22/22

Date



Authorized Signature

Sales Operations Manager

Title

Creative Bus Sales, Inc.

Company Name



**BID FORM #7**

**BID FORM 7 - TO BE SUBMITTED WITH BID**

**CERTIFICATION OF PRIMARY PARTICIPANT REGARDING  
DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS**

The Primary Participant (applicant for an FTA grant or cooperative agreement, or potential contractor for a major third-party contract),

Creative Bus Sales, Inc. (COMPANY NAME) 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 of 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 application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

If the primary participant (applicant for an FTA grant, or cooperative agreement, or potential third-party contractor) is unable to certify to any of the statements in this certification, the participant shall attach an explanation to this certification.)

THE PRIMARY PARTICIPANT (APPLICANT FOR AN FTA GRANT OR COOPERATIVE AGREEMENT, OR POTENTIAL CONTRACTOR FOR A MAJOR THIRD-PARTY CONTRACT),

Creative Bus Sales, Inc., 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 31 U.S.C. SECTIONS 3801 ET SEQ. ARE APPLICABLE THERETO.



Sales Operations Manager

Signature and Title of Authorized Official



**BID FORM #4**

**BUY AMERICA CERTIFICATION  
ROLLING STOCK  
BID FORM 4– TO BE SUBMITTED WITH BID**

**Certificate of Compliance**

The bidder or offeror hereby certifies that it will comply with the requirements of 49 U.S.C. § 5323(j), as amended and the applicable regulations of 49 CFR 661.12:

4/22/22

Date

  
Authorized Signature

Creative Bus Sales, Inc.

Company Name

Nick Corley

Name

Sales Operations Manager

Title

**Certificate for Non-Compliance**

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 U.S.C. § 5323(j), as amended, but may qualify for an exception to the requirement consistent and the applicable regulations in 49 CFR 661.7.

Date

Authorized Signature

Company Name

Name

Title

REQUEST FOR QUOTATION  
158" – 176" Wheelbase Cutaway Vehicle

---

**BID FORM #9**  
**BID FORM 9 – TO BE SUBMITTED WITH BID**  
**CERTIFICATION OF RESTRICTIONS ON LOBBYING**

The undersigned (Vendor, Contractor) certifies, to the best of his or her knowledge and belief, that:

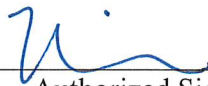
1. No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influence or attempt to influence an officer or employee of any Federal agency, a member of Congress, an officer or employee of Congress, or an employee of a Member of Congress regarding the award of a federal grant, loan (including a line of credit), cooperative agreement, loan guarantee, or loan insurance, or the extension, continuation, renewal, amendment, or modification of any Federal grant, loan (Including a line of credit), cooperative agreement, loan guarantee, or loan insurance.
2. If any funds other than Federal appropriated funds have been or will be paid to any person to influence or attempt to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or any employee of a Member of Congress in connection with any application for a federal grant, loan (including a line of credit), cooperative agreement, loan guarantee, or loan insurance, the undersigned assures that it will complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," Rev. 7-97; and
3. The undersigned understands that the language of this certification shall be included in the award documents for all sub awards at all tiers (including subcontracts, sub grants, sub agreements, and contracts under grants, loans (including a line of credit), cooperative agreements, loan guarantees, and loan insurance.

Undersigned understands that this certification is a material representation of fact upon which reliance is placed by the Federal government and that submission of this certification is a prerequisite for providing a Federal grant, loan (including a line of credit), cooperative agreement, loan guarantee, or loan insurance for a transaction covered by 31 U.S.C. 1352. The undersigned also understands that any person who fails to file a 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 (Vendor, Contractor) Creative Bus Sales, Inc., certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the (Vendor, Contractor) understands and agrees that the provisions of 31 U.S.C. §§ 3801, et seq., apply to this certification and disclosure.

4/22/22

Date



Authorized Signature

Sales Operations Manager

Title

REQUEST FOR QUOTATION  
158" – 176" Wheelbase Cutaway Vehicle

---

**BID FORM #10**

**CERTIFICATION OF COMPLIANCE WITH FTA'S  
BUS TESTING REQUIREMENTS**

The undersigned (Vendor/Manufacturer) certifies that the vehicle offered in this procurement complies with 49 U.S.C. 5318, as amended by MAP-21, and FTA regulations, "Bus Testing," 49 CFR Part 665.

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.

4/22/22

Date



\_\_\_\_\_  
Authorized Signature

Sales Operations Manager

Title

Creative Bus Sales, Inc.

Company Name

REQUEST FOR QUOTATION  
158" – 176" Wheelbase Cutaway Vehicle

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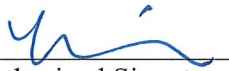
**BID FORM #8**  
**BID FORM 8 – TO BE SUBMITTED WITH BID**

***VENDOR'S CERTIFICATION OF  
UNDERSTANDING AND ACCEPTANCE***

The Vendor hereby certifies that all Technical Specifications and Contract Terms and Conditions have been carefully reviewed, are fully understood, and shall be adhered to in performance and completion of any contract resulting from this bid.

4/22/22

\_\_\_\_\_  
Date

  
\_\_\_\_\_  
Authorized Signature

Sales Operations Manager  
\_\_\_\_\_  
Title

Creative Bus Sales, Inc.  
\_\_\_\_\_  
Company Name

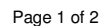
**SPECIFICATION COMPLIANCE**

NOTE: Please check if what is offered is not in exact compliance with specifications. **Any discrepancies must be listed as an attachment to the bid proposal. Exact dimensions and/or descriptions must be provided as a part of the Vendor's bid proposal when submitted.**

- X   Bid proposal submitted meets and/or exceeds all specification requirements.
- Bid proposal submitted contains deviations from specification requirements.  
Detailed descriptions of these deviations have been provided with this bid proposal.

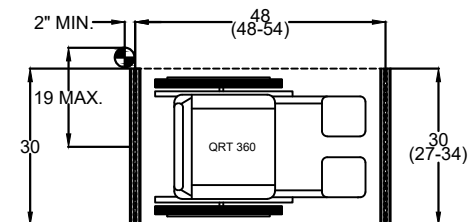
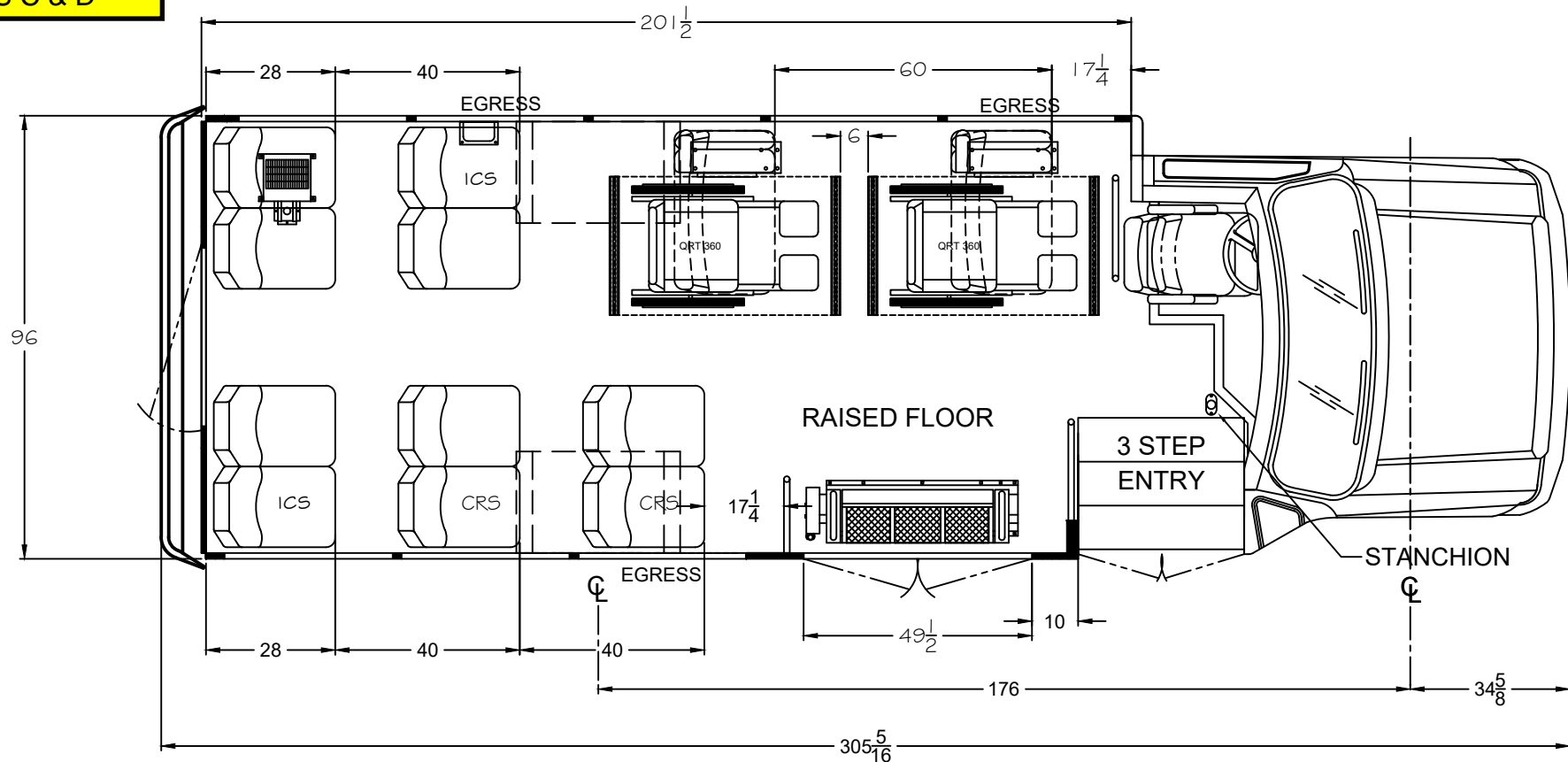
**8/13/2018 12 2 WC 1 DB FOLD 158 163-28 USA**

AS BUILT 50917B
RLIFT MID DBL DBL FOLD RFLOOR



--

# CLASS C & D



## DEALER APPROVAL

☐ APPROVED

CUSTOMER SIGNATURE

NOTE: SHOWN WITH MID HI FREEDMAN SEATS  
E-450 14,500 GVWR  
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.  
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.  
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A  
COMPLETED ORDER WITH ALL OPTIONS SHOWN.  
OPTIONAL EQUIPMENT MAY BE SHOWN.  
THE SALES ORDER PLACED DICTATES ACTUAL OPTION CONTENT.

SCALE  
IN INCHES



THIS DRAWING AND THE INFORMATION THEREON ARE THE EXCLUSIVE PROPERTY OF FOREST RIVER BUS, A DIVISION OF FOREST RIVER. IT SHALL NOT BE COPIED OR DUPLICATED IN ANY MANNER, NOR SHALL IT BE SUBMITTED TO OUTSIDE PARTIES FOR EXAMINATION WITHOUT OUR WRITTEN CONSENT. IT IS LOANED FOR USE WITH REFERENCE TO WORK UNDER CONTRACT WITH, OR PROPOSALS SUBMITTED TO FOREST RIVER BUS, A DIVISION OF FOREST RIVER.

REV.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.
LET.					

TOLERANCE UNLESS  
OTHERWISE SPECIFIED

WOOD	OTHER
+ 1/8"	+ 1/16"
+ 1"	+ 1/2"



FOREST RIVER BUS

DWG. No. 10 2 WC 2 DB FOLD 176 190 FRB

TITLE:  
10 2 W/C 176" WB 190 BDY  
MODEL 25

NAME: DH DATE: 4/20/22



### WEIGHT ANALYSIS

AS BUILT 52341B

rfloor Front lift, 3/4 marine

Morryde smi bumper	
--------------------	--



**1890.33**

Combined Front

3882.88

5000

Maximum Capacity

1992.55

Maximum Capacity

### Front Roadside

	<b>Rear Curbside</b>
Maximum Capacity	4800

4463.99

Combined Rear

8861.75

9600

Maximum Capacity

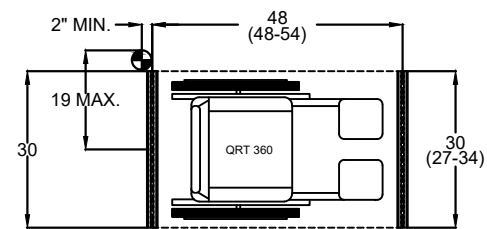
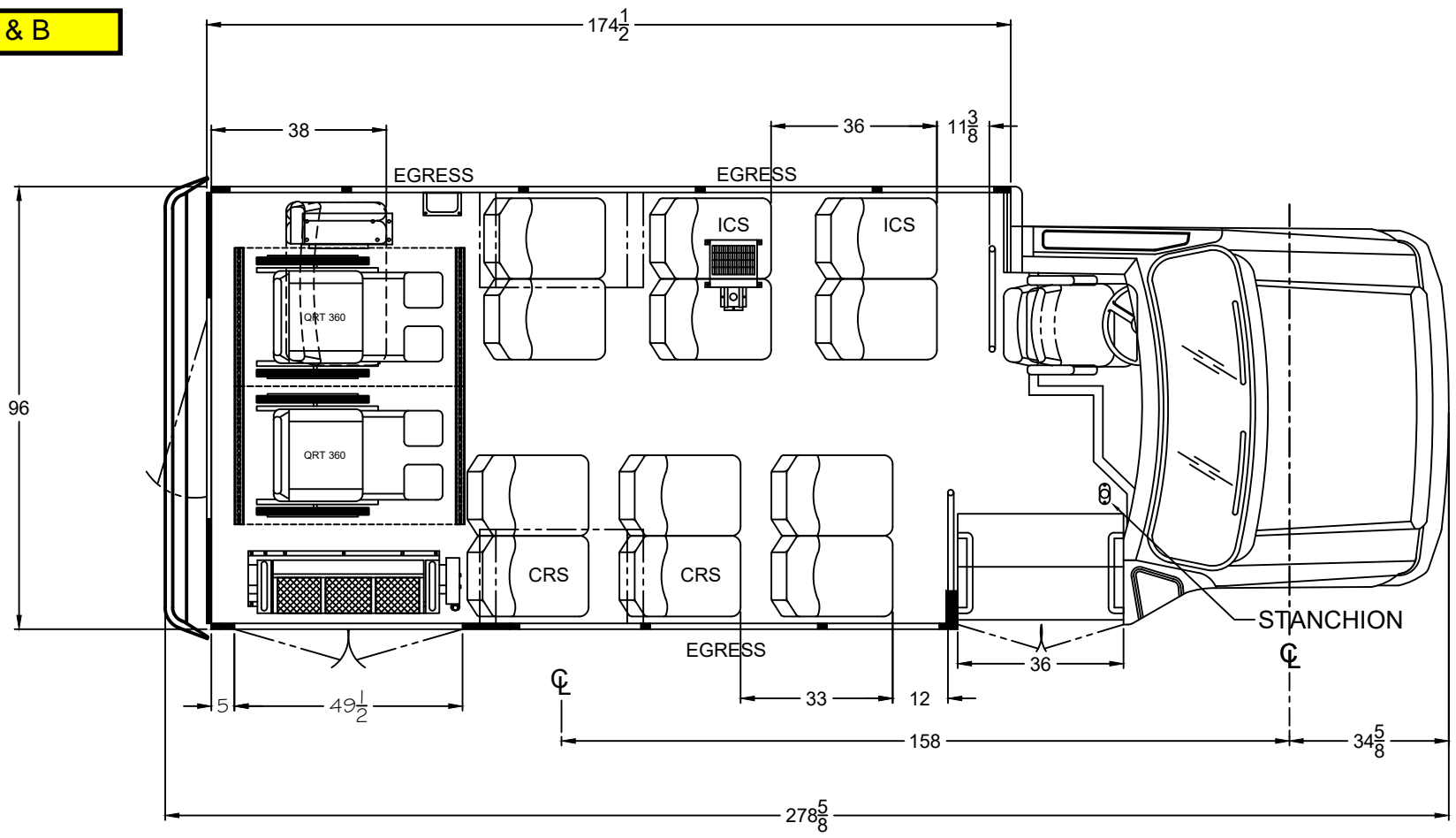
4397.76

Maximum Capacity

### Rear Roadside



CLASS A & B



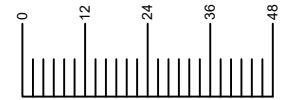
DEALER APPROVAL

☐ APPROVED

CUSTOMER SIGNATURE

NOTE: SHOWN WITH MID HI FREEDMAN SEATS  
E-450 14,500 GVWR  
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.  
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.  
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A  
COMPLETED ORDER WITH ALL OPTIONS SHOWN.  
OPTIONAL EQUIPMENT MAY BE SHOWN.  
THE SALES ORDER PLACED DICTATES ACTUAL OPTION CONTENT.

SCALE  
IN INCHES



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REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		FOREST RIVER BUS		TITLE: 12 2 WC 158" WB 163 BDY MODEL 22	
WOOD	OTHER	NAME: DH		DATE: 4/19/22	
+ 1/8"	+ 1/16"	DWG. No. 12 2 WC 1 DB FOLD 158 163-8 USA			
+ 1"	+ 1/2"				

## 2023 FORD E-SERIES CUTAWAY

# TECHNICAL SPECIFICATIONS



### BODY

Construction/materials	High-strength C-section, steel frame
Body style	Body-on-frame
Final assembly location	Ohio Assembly Plant, Avon Lake, Ohio

### DRIVETRAIN

Layout	Front-engine, rear-drive
--------	--------------------------

### ENGINES

	7.3-liter premium V8 (standard)	7.3-liter economy V8 (optional)
Configuration	90-degree V8, single in-block cam	90-degree V8, single in-block cam
Block/head material	Cast iron block, aluminum heads	Cast iron block, aluminum heads
Displacement	7.3 liters (445 cubic inches)	7.3 liters (445 cubic inches)
Bore x stroke	4.22 x 3.97	4.22 x 3.97
Compression ratio	10.5:1	10.5:1
Valvetrain	Pushrod and rocker arms, two valves per cylinder	Pushrod and rocker arms, two valves per cylinder
Recommended fuel	87 octane	87 octane
Fuel delivery	Sequential multiport electronic	Sequential multiport electronic
Engine control system	Electronic	Electronic
Intake manifold	Naturally aspirated, tuned intake	Naturally aspirated, tuned intake
Dyno certified horsepower	350 @ 3,900 rpm	300 @ 3,750 rpm
Dyno certified torque	468 lb.-ft. @ 3,900 rpm	425 lb.-ft. @ 3,250 rpm
Oil-life monitor	Oil-minder system	Oil-minder system

### ELECTRICAL

Alternator	Standard 210-amp, optional 240-amp, or optional dual 240-amp/157-amp
Battery group	12-volt; 750-CCA 78-amp/hr

### TRANSMISSION

Configuration	Aluminum 6-speed with two overdrive speeds and tow/haul; auxiliary cooler
---------------	---

#### Gear ratios:

First	3.974:1
Second	2.318:1
Third	1.516:1
Fourth	1.149:1
Fifth	0.858:1
Sixth	0.674:1
Reverse	-3.128:1

FORD E-SERIES



## CHASSIS SPECIFICATIONS

Front suspension	Twin I-beam independent with computer-selected coil springs and stabilizer bar
Rear suspension	Multileaf single-stage leaf springs/solid axle and stabilizer bar (DRW only)
Front and rear shocks	Heavy-duty gas-pressurized
Steering	Recirculating ball, power-assisted

## BRAKES

Type	Power four-wheel vented discs, ABS, traction control
Front (rotor diameter)	13.58 inches (345 millimeters)
Rear (rotor diameter)	13.58 inches (345 millimeters)

## WHEELS

Type	Steel
Size	16 inches
Number of studs	Eight
Bolt-circle diameter	6.5 inches

## EXTERIOR DIMENSIONS (INCHES UNLESS OTHERWISE NOTED)

	138-inch wheelbase E-350 SRW	158-inch wheelbase E-350 SRW	138-inch wheelbase E-350 DRW	158-inch wheelbase E-350 DRW	176-inch wheelbase E-350 DRW	158-inch wheelbase E-450 DRW	176-inch wheelbase E-450 DRW
Overall length	241.1	261.1	241.1	261.1	261.1	261.1	261.1
Overall width	79.4	79.4	94.9	94.9	94.9	94.9	94.9
Rear track	72.1	72.1	75.4	75.4	75.4	77.7	77.7
Cab, rear to rear axle	80	100	80	100	118	100	118
Rear axle to end of frame	68.5	68.5	68.5	68.5	50.5	68.5	50.5
Front overhang	34.6	34.6	34.6	34.6	34.6	34.6	34.6

## INTERIOR DIMENSIONS

	E-350/E-450 Cutaway
First row headroom	42 inches
First row shoulder room	68.1 inches
First row hip room	65.6 inches
First row maximum legroom	42.1 inches

**FORD E-SERIES**



## PASSENGER AND FUEL CAPACITIES

	E-350 SRW, DRW	E-450 DRW
Seating capacity	Two (one optional)	Two (one optional)
Fuel capacity	40 gallons (55 optional)	55 gallons (40 optional)

## PAYLOAD PACKAGE SELECTOR (LBS.)

	Engine	GCWR	GVWR	Payload
E-350 SRW 138-inch wheelbase	7.3-liter economy	13,000	10,050	5,100
E-350 SRW 138-inch wheelbase	7.3-liter premium	18,500	10,050	5,100
E-350 DRW 138-inch wheelbase	7.3-liter economy	13,000/17,000	11,500	6,270
E-350 DRW 138-inch wheelbase	7.3-liter premium	18,500	11,500	6,270
E-350 SRW 158-inch wheelbase	7.3-liter economy	13,000	10,050	5,030
E-350 SRW 158-inch wheelbase	7.3-liter premium	18,500	10,050	5,030
E-350 DRW 158-inch wheelbase	7.3-liter economy	13,000/17,000	11,500	6,210
E-350 DRW 158-inch wheelbase	7.3-liter premium	18,500	11,500	6,210
E-350 DRW 158-inch wheelbase	7.3-liter economy	13,000	12,500	7,210
E-350 DRW 158-inch wheelbase	7.3-liter premium	18,500	12,500	7,210
E-350 DRW 176-inch wheelbase	7.3-liter economy	13,000/17,000	12,500	7,200
E-350 DRW 176-inch wheelbase	7.3-liter premium	18,500	12,500	7,200
E-450 DRW 158-inch wheelbase	7.3-liter economy	18,000	14,000	8,480
E-450 DRW 176-inch wheelbase	7.3-liter premium	22,000	14,200/14,500	8,680/8,980

## WARRANTY

Bumper to bumper:	Three years/36,000 miles
Powertrain:	Five years/60,000 miles
Safety restraint system:	Five years/60,000 miles
Corrosion (perforation only):	Five years/unlimited miles
Roadside assistance program:	Five years/60,000 miles

**FORD E-SERIES**





## Creative Bus Sales

### **3.5 Cooling System**

The chassis cooling system will be Ford OEM and will meet the requirements of CRFQ PTR22\*07, Section 3.5.1

### **3.13 Brakes**

The chassis service brakes will be Ford OEM anti-lock and will meet the requirements of CRFQ PTR22\*07, Section 3.13.1. Emergency brake is Ford OEM standard provided on the rear wheels

### **3.14 Wheels**

The standard Ford OEM wheels are steel and painted white on both sides

### **3.15 Tires**

Ford Motor Company utilizes multiple manufactures. CBS can not regulate which manufacture your vehicles will come with.

Manufactures: Bridgestone, Firestone, BFGoodrich, Continental, Goodyear, Dunlop, Hankook, Maxxis, Michelin, Pirelli, Toyo, & Yokohama

Tire warranties are based on miles and wear in 32nds of an inch.

Miles Driven Percent of Parts Covered by Ford

1-12,000 Miles 100%

12,001-24,000 Miles 60%

24,001-36,000 Miles 30%

### **3.16.5 Alternator Rectifier**

The alternator rectifier is Ford standard equipment and is installed by Ford

### **3.17.1 Radio**

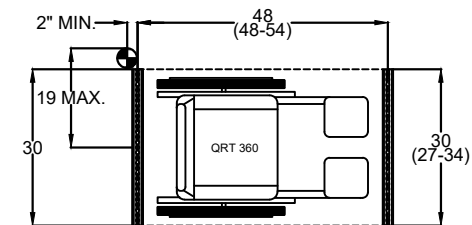
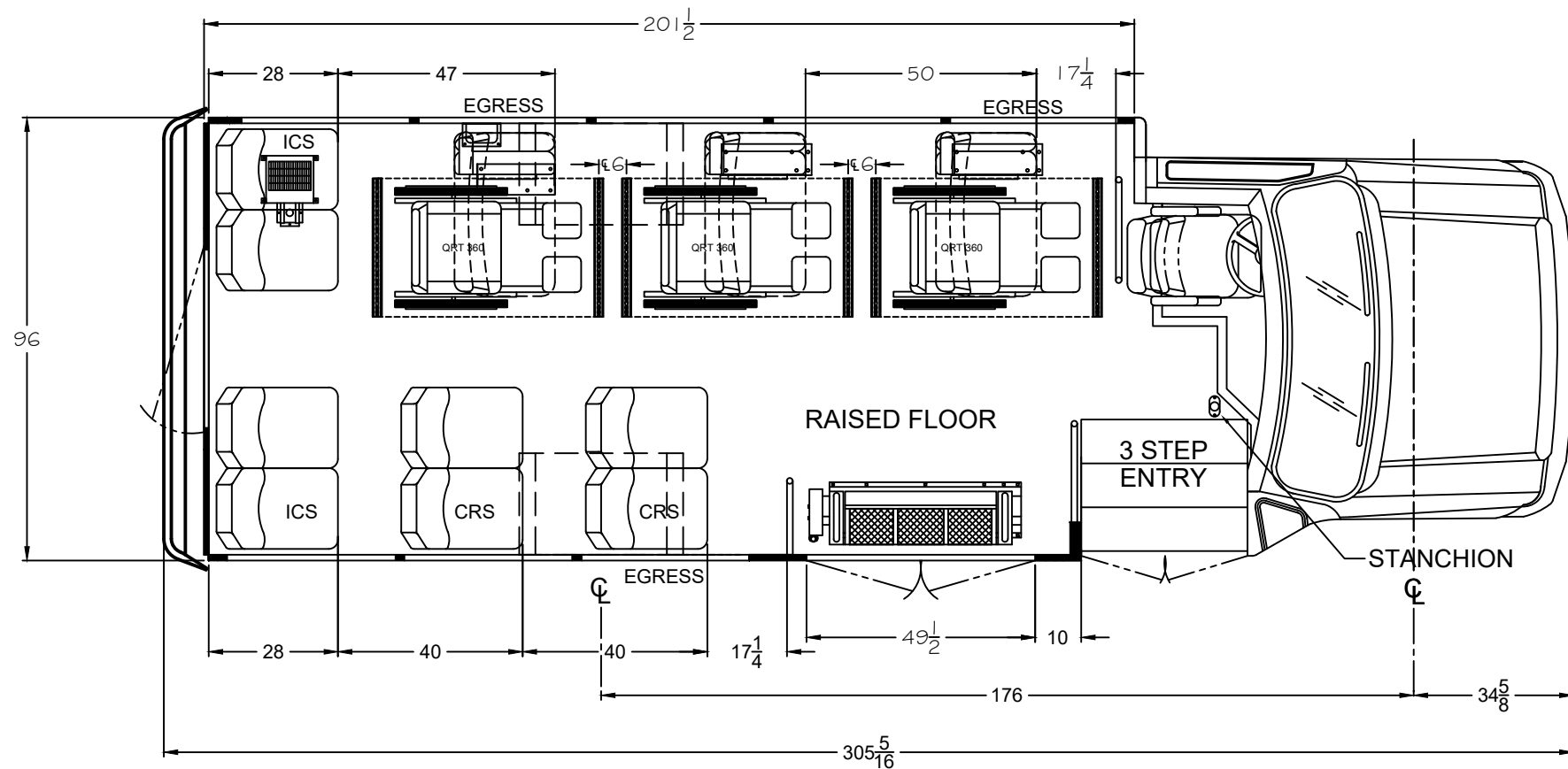
The AM/FM/USB/MP3 radio will be standard Ford OEM

### **3.26 Front Heat and Air Conditioning**

The front heater and air conditioner will be standard Ford OEM

Creative Bus Sales | **800.326.2877** | [CreativeBusSales.com](http://CreativeBusSales.com)  
14740 Ramona Ave., Chino, CA 91710

CLASS E & F



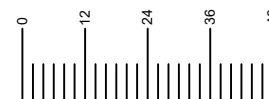
DEALER APPROVAL

☐ APPROVED

CUSTOMER SIGNATURE

NOTE: SHOWN WITH MID HI FREEDMAN SEATS  
E-450 14,500 GVWR  
THIS FLOOR PLAN IS FOR ILLUSTRATION PURPOSES ONLY.  
A WEIGHT ANALYSIS HAS NOT YET BEEN PERFORMED.  
FINAL APPROVAL WITH A WEIGHT ANALYSIS IS REQUIRED UPON RECEIPT OF A  
COMPLETED ORDER WITH ALL OPTIONS SHOWN.  
OPTIONAL EQUIPMENT MAY BE SHOWN.  
THE SALES ORDER PLACED DICTATES ACTUAL OPTION CONTENT.

SCALE  
IN INCHES



THIS DRAWING AND THE INFORMATION THEREON ARE THE EXCLUSIVE PROPERTY OF FOREST RIVER BUS, A DIVISION OF FOREST RIVER. IT SHALL NOT BE COPIED OR DUPLICATED IN ANY MANNER, NOR SHALL IT BE SUBMITTED TO OUTSIDE PARTIES FOR EXAMINATION WITHOUT OUR WRITTEN CONSENT. IT IS LOANED FOR USE WITH REFERENCE TO WORK UNDER CONTRACT WITH, OR PROPOSALS SUBMITTED TO FOREST RIVER BUS, A DIVISION OF FOREST RIVER.

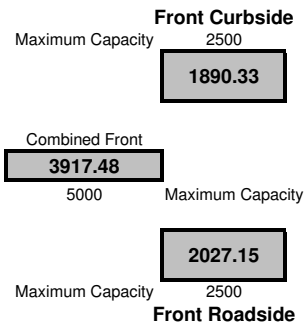
REV.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.
LET.					

TOLERANCE UNLESS OTHERWISE SPECIFIED		FOREST RIVER BUS		TITLE: 8 3 W/C 176" WB 190 BODY MODEL 25	
WOOD	OTHER	NAME: DH		DATE: 4/20/22	
+ 1/8"	+ 1/16"	DWG. No. 8 3 WC 3 DB FOLDS 176 190 FRB			
+ 1"	+ 1/2"				

## WEIGHT ANALYSIS

AS BUILT 52341B

Morryde smi bumper	
--------------------	--







## Creative Bus Sales

### **Warranties**

#### **Ford E450 Cutaway Chassis Engine, Transmission, Drive Axle, Brake System**

See document titled Ford Warranty

#### **Bus Body Bumper to Bumper**

See document titled Glaval Limited warranty

#### **Basic Body Structure Integrity**

See document titled Glaval Limited warranty

#### **Wheelchair Lift System**

Five Year Limited Warranty

#### **All Add On Components**

Two Years, Unlimited Miles

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14740 Ramona Ave., Chino, CA 91710

## 2023 FORD E-SERIES CUTAWAY

# TECHNICAL SPECIFICATIONS



### BODY

Construction/materials	High-strength C-section, steel frame
Body style	Body-on-frame
Final assembly location	Ohio Assembly Plant, Avon Lake, Ohio

### DRIVETRAIN

Layout	Front-engine, rear-drive
--------	--------------------------

### ENGINES

	7.3-liter premium V8 (standard)	7.3-liter economy V8 (optional)
Configuration	90-degree V8, single in-block cam	90-degree V8, single in-block cam
Block/head material	Cast iron block, aluminum heads	Cast iron block, aluminum heads
Displacement	7.3 liters (445 cubic inches)	7.3 liters (445 cubic inches)
Bore x stroke	4.22 x 3.97	4.22 x 3.97
Compression ratio	10.5:1	10.5:1
Valvetrain	Pushrod and rocker arms, two valves per cylinder	Pushrod and rocker arms, two valves per cylinder
Recommended fuel	87 octane	87 octane
Fuel delivery	Sequential multiport electronic	Sequential multiport electronic
Engine control system	Electronic	Electronic
Intake manifold	Naturally aspirated, tuned intake	Naturally aspirated, tuned intake
Dyno certified horsepower	350 @ 3,900 rpm	300 @ 3,750 rpm
Dyno certified torque	468 lb.-ft. @ 3,900 rpm	425 lb.-ft. @ 3,250 rpm
Oil-life monitor	Oil-minder system	Oil-minder system

### ELECTRICAL

Alternator	Standard 210-amp, optional 240-amp, or optional dual 240-amp/157-amp
Battery group	12-volt; 750-CCA 78-amp/hr

### TRANSMISSION

Configuration	Aluminum 6-speed with two overdrive speeds and tow/haul; auxiliary cooler
---------------	---

#### Gear ratios:

First	3.974:1
Second	2.318:1
Third	1.516:1
Fourth	1.149:1
Fifth	0.858:1
Sixth	0.674:1
Reverse	-3.128:1

FORD E-SERIES



## CHASSIS SPECIFICATIONS

Front suspension	Twin I-beam independent with computer-selected coil springs and stabilizer bar
Rear suspension	Multileaf single-stage leaf springs/solid axle and stabilizer bar (DRW only)
Front and rear shocks	Heavy-duty gas-pressurized
Steering	Recirculating ball, power-assisted

## BRAKES

Type	Power four-wheel vented discs, ABS, traction control
Front (rotor diameter)	13.58 inches (345 millimeters)
Rear (rotor diameter)	13.58 inches (345 millimeters)

## WHEELS

Type	Steel
Size	16 inches
Number of studs	Eight
Bolt-circle diameter	6.5 inches

## EXTERIOR DIMENSIONS (INCHES UNLESS OTHERWISE NOTED)

	138-inch wheelbase E-350 SRW	158-inch wheelbase E-350 SRW	138-inch wheelbase E-350 DRW	158-inch wheelbase E-350 DRW	176-inch wheelbase E-350 DRW	158-inch wheelbase E-450 DRW	176-inch wheelbase E-450 DRW
Overall length	241.1	261.1	241.1	261.1	261.1	261.1	261.1
Overall width	79.4	79.4	94.9	94.9	94.9	94.9	94.9
Rear track	72.1	72.1	75.4	75.4	75.4	77.7	77.7
Cab, rear to rear axle	80	100	80	100	118	100	118
Rear axle to end of frame	68.5	68.5	68.5	68.5	50.5	68.5	50.5
Front overhang	34.6	34.6	34.6	34.6	34.6	34.6	34.6

## INTERIOR DIMENSIONS

	E-350/E-450 Cutaway
First row headroom	42 inches
First row shoulder room	68.1 inches
First row hip room	65.6 inches
First row maximum legroom	42.1 inches

FORD E-SERIES



## PASSENGER AND FUEL CAPACITIES

	E-350 SRW, DRW	E-450 DRW
Seating capacity	Two (one optional)	Two (one optional)
Fuel capacity	40 gallons (55 optional)	55 gallons (40 optional)

## PAYLOAD PACKAGE SELECTOR (LBS.)

	Engine	GCWR	GVWR	Payload
E-350 SRW 138-inch wheelbase	7.3-liter economy	13,000	10,050	5,100
E-350 SRW 138-inch wheelbase	7.3-liter premium	18,500	10,050	5,100
E-350 DRW 138-inch wheelbase	7.3-liter economy	13,000/17,000	11,500	6,270
E-350 DRW 138-inch wheelbase	7.3-liter premium	18,500	11,500	6,270
E-350 SRW 158-inch wheelbase	7.3-liter economy	13,000	10,050	5,030
E-350 SRW 158-inch wheelbase	7.3-liter premium	18,500	10,050	5,030
E-350 DRW 158-inch wheelbase	7.3-liter economy	13,000/17,000	11,500	6,210
E-350 DRW 158-inch wheelbase	7.3-liter premium	18,500	11,500	6,210
E-350 DRW 158-inch wheelbase	7.3-liter economy	13,000	12,500	7,210
E-350 DRW 158-inch wheelbase	7.3-liter premium	18,500	12,500	7,210
E-350 DRW 176-inch wheelbase	7.3-liter economy	13,000/17,000	12,500	7,200
E-350 DRW 176-inch wheelbase	7.3-liter premium	18,500	12,500	7,200
E-450 DRW 158-inch wheelbase	7.3-liter economy	18,000	14,000	8,480
E-450 DRW 176-inch wheelbase	7.3-liter premium	22,000	14,200/14,500	8,680/8,980

## WARRANTY

Bumper to bumper:	Three years/36,000 miles
Powertrain:	Five years/60,000 miles
Safety restraint system:	Five years/60,000 miles
Corrosion (perforation only):	Five years/unlimited miles
Roadside assistance program:	Five years/60,000 miles

**FORD E-SERIES**





## **Trans/Air Manufacturing Corporation Limited Warranty FTA Funded Vehicles 36 Month (Unlimited Mileage)**

Subject to the conditions and limitations set forth below, for a period of thirty six (36) months (with unlimited mileage) starting at the date of delivery to the End User and with proper registration documentation, Trans/Air Manufacturing Corporation (Trans/Air) warrants to the original owner, if still the user, that each manufactured system/component will be free from defects in factory workmanship and materials when used and maintained in accordance with the recommended procedures. Trans/Air will furnish new or remanufactured replacement parts and cover the cost of repair labor for thirty six (36) months following delivery in accordance with the current Trans/Air flat rate labor schedule when performed at an authorized Trans/Air Service Center. This is the End User's sole and exclusive remedy.

THIS IS TRANS/AIR'S SOLE WARRANTY AND IT IS FURNISHED IN LIEU OF ANY AND ALL OTHER WARRANTIES. TRANS/AIR MAKES NO OTHER EXPRESS OR IMPLIED WARRANTIES WHATSOEVER. NO WARRANTY OF MERCHANTABILITY AND NO WARRANTY OF FITNESS FOR PARTICULAR PURPOSE IS MADE BY TRANS/AIR.

### **Conditions and Limitations**

- 1) In order for a thirty six (36) month system warranty to apply, the customer must purchase the evaporator(s), condenser(s), compressor(s), piping kits, electrical kits, mount kits and refrigeration hose from Trans/Air. If the full system is not purchased from Trans/Air, the thirty six (36) month warranty applies to Trans/Air supplied evaporators and condensers only. All compressors, piping kits, and electrical kits purchased outside of a full system, will be considered a service part and will carry a 180 day warranty. All mount kits purchased outside of a full system, and used on a Trans/Air system, will be considered a service part and will carry a 180 day warranty. All mount kits purchased outside of a full system, and used on a system other than Trans/Air, will carry no warranty. All other components supplied by Trans/Air are covered by standard parts warranty (see #4 below). Extended warranty coverage may be purchased from Trans/Air at the time of purchase of the unit or system. Correction of a failure under this warranty does not extend the warranty beyond the standard thirty six (36) month warranty period.
- 2) Service parts are warranted for a 180 day period from the date of sale or until the expiration of the original equipment warranty, whichever is later. (Compressors are warranted for 1 year) If required, parts covered by warranty must be returned to Trans/Air's factory in Dallastown, PA, by specified carrier freight prepaid, within standard Return Goods Authorization procedures, for evaluation, in order for Trans/Air to authorize any warranty claim.
- 3) Trans/Air will be responsible for the costs of repairs or replacement covered by warranty only if performed at an authorized Trans/Air Service Center. The Service Center is responsible for effecting repairs or replacement during the warranty period in accordance with current Trans/Air warranty procedures. A customer requesting service at a location other than an approved Service Center, or one requesting overtime, shall be responsible for all additional warranty repair expenses in excess of the flat rate allowed. Trans/Air is not responsible for towing charges.
- 4) If the customer has not properly registered the Trans/Air system, the Service Center is not authorized to render warranty services without charge. All information on the warranty registration form must be completed in its entirety and returned to Trans/Air to activate the warranty.



- 5) Trans/Air does not warrant the installation of Trans/Air products unless installed by Trans/Air or an authorized Trans/Air Turnkey installation facility. In the cases of installation related failures, which are not covered by warranty Trans/Air specifically is not responsible for failures attributable to inadequate provision by the installer of structural support or inadequate provision of electrical requirements.
- 6) This warranty does not apply in cases of a failure of Trans/Air product which is attributable to improper evacuation procedures, or the introduction of non-approved refrigerant oil, additives, or other contaminants into the system.
- 7) This warranty does not apply in cases of failure of Trans/Air product, which is attributable to failure of the end user to perform or provide preventative maintenance in accordance with Trans/Air's guidelines. Examples include, but are not limited to, failure to properly maintain belt tension, clean condenser coils, replace evaporator filters, maintain electrical systems to provide proper voltage to components, or check and tighten hardware or fittings, which may have loosened due to vibration. (See Trans/Air Preventive Maintenance Schedule)
- 8) This warranty does not apply to loss of refrigerant or any damage caused by loss of refrigerant unless directly attributable to the failure of a Trans/Air product which, at the time of the failure, was under warranty.
- 9) Trans/Air reserves the right to make changes in design or improvements to its products or parts thereof, without obligation to make or install of such changes or improvements on existing units or upon products covered by this warranty.
- 10) If Trans/Air makes a product improvement program available to the End User, Trans/Air reserves the right to limit the duration of the programs unless it is safety related. Expenses incurred in completing said product improvements after the closing date of the program are the responsibility of the End User.
- 11) Trans/Air's warranty shall not apply in the case of damage incurred during shipment, accidental damage, abuse, misuse, act of nature, or if the serial number is missing, or to any product which, in the sole opinion of Trans/Air, has been installed, altered or repaired in a manner affecting the efficiency or performance of the unit or inconsistent with Trans/Air's written procedures.
- 12) This warranty applies only within the boundaries of the whole United States, its territories, and Canada. For other available coverage that may be purchased, contact Trans/Air.

TRANS/AIR'S LIABILITY TO THE PURCHASER FOR DAMAGES FROM ANY CAUSE WHATSOEVER AND REGARDLESS OF THE FORM (S) OF ACTION, WHETHER IN CONTACT OR TORT, INCLUDING NEGLIGENCE OR OTHERWISE, SHALL BE LIMITED TO THE VALUE OF REPAIRS TO OR REPLACEMENT OF THE DEFECTIVE COMPONENTS DURING THE WARRANTY PERIOD, AS THE EXCLUSIVE REMEDY, AND STRAIGHT TIME LABOR CHARGES AS OUTLINED IN ITS CURRENT WARRANTY PROCEDURE MANUAL AND FLATE RATE LABOR SCHEDULE. IN NO EVENT SHALL TRANS/AIR BE LIABLE WHATSOEVER FOR ANY PUNITIVE, INCIDENTAL OR CONSEQUENTIAL DAMAGES, OR FOR LOST PROFITS OR OTHER COMMERCIAL LOSSES FROM ANY CAUSE WHATSOEVER, WHETHER OR NOT TRANS/AIR HAS RECEIVED NOTICE OF THE POSSIBILITY OR CERTAINTY OF SUCH DAMAGES OR LOSSES. TRANS/AIR WILL NOT BE LIABLE FOR ANY LOSS OCCURRING BECAUSE THE EQUIPMENT IS OUT OF SERVICE. NO ACTION OR PROCEEDING ARISING OUT OF, FOR BREACH OF, OR IN ANY MANNER RELATING TO THIS WARRANTY MAY BE BROUGHT BY ANYONE AFTER SIX (6) MONTHS FROM NOTIFICATION TO TRANS/AIR OF AN IN-WARRANTY FAILURE.





# Creative Bus Sales

## **Training**

Creative Bus Sales understands and is prepared to meet the training requirements as outlined in section 3.45.

If any further information is needed, please contact Mike Wilson at [mikew@creativebussales.com](mailto:mikew@creativebussales.com).



## Creative Bus Sales

### **Warranty Provider Locations**

Fleetpride  
3204 Maccorkle Ave SW, South  
Charleston, WV 25303

Matheny Motors  
50 Matheny Lane  
Mineral Wells, WV 26150

Matheny Motors  
4125 1<sup>st</sup> Ave  
Nitro, WV 25143

Matheny Motors  
1375 US Rt 52  
Kenova, WV 25530



Creative Bus Sales

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CRFQ 0805 PTR220000007 158" Wheelbase Cutaway Vehicle Paratransit

#### 11.1.5 Nearest Parts Depot

Creative Bus Sales  
57475 County Road 3  
Elkhart, IN 46517  
(877) 686-9448

# BEACONS

## 3000 Series Strobe

4" High Model w/ clear lens is our standard option



REPLACE (x) AND (xx) IN ORDER NUMBER FOR PERSONALIZED SELECTIONS

Product Number: 3 (xx) 7 (x) (x) (x)

Watt Options: 1Ø = 10 Watt or 2Ø = 20 Watt

Flash: 7 = Double and Quad (included in product number)

Height Options: L = Low, 4" Dome or H = High, 6" Dome

Mounting Options: C = Flat/Pipe or M = Magnetic

LED Color/Dome Color Options: ● A = Amber LEDs/Amber Lens ○ C = White LEDs/Clear Lens

### Features

- > Lens with UV inhibitor prevents sun fade
- > Rated to last 20,000+ hours
- > Advanced circuitry designed tolerate high vibration applications

### accessories

Branch Guard and Dust Cover (Beacon not included)



Branch Guards (6" shown)

4" Height #PESB41BG4

6" Height #PESB41BG6



Dust Cover

6" Height #E36ØDC6

### TECHNICAL SPECIFICATIONS

FLASH PATTERNS	2 flash patterns - double or quad (user selectable)
TECHNOLOGY	Xenon Helix Strobe Tube
INPUT VOLTAGE	10-30 Vdc
CURRENT DRAW	10 Watts: 1 Amp @ 12 Vdc, 0.5 Amps @ 24 Vdc or 20 Watts: 2 Amps @ 12 Vdc, 1 Amp @ 24 Vdc
OPERATING TEMPERATURE	-40° C to 50° C
DIMENSIONS	4" Dome with base: 4.75" (12 cm) H 6" Dome with base: 6.7" (17 cm) H x 6.3" (16 cm) base diameter
MOUNTING	Permanent or Magnetic mount (polycarbonate lens and black base)
CERTIFICATIONS	SAE J 1318 Class 2 certified
WARRANTY	Two-year (strobe tube, one-year)



Creative Bus Sales

Final Assembly Point for the proposed Light Duty Cutaway Vehicles will take place at the Forest River Bus Assembly Plant located at 2367 Century Dr, Goshen, IN 46528.



Creative Bus Sales

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CRFQ 0805 PTR2200000008 158" – 176" Wheelbase Cutaway Vehicles

#### 3.38.4 Farebox Provision location

As the location of the farebox varies widely in our industry, Creative will count on each ordering agency to provide us with their desired location of any farebox provision equipment.

## Vulcan™ Series V12 HD/IP Mobile DVR

### 12-CHANNEL DVR

#### DIMENSIONS

- Height: 3.5 inches
- Width: 8.7 inches
- Depth: 11.6 inches
- Weight: 5.7 pounds

#### TWELVE (12) A/V INPUTS

- 8 channels D1, WD1, 720P, or up to 1080P
- + 4 channels IP up to 1080P

#### VIDEO OUTPUTS

- 2 channels

#### AUDIO OUTPUTS

- 2 channels

#### CAMERA COMPATIBILITY

- 8 channels D1, WD1, 720P, or up to 1080P (see NTSC)
- 4 channels IP up to 1080P

### STORAGE MEDIA

#### RECORDING MEDIUM

- One (1) 2.5" SATA hard drive and one (1) optional solid-state SD card

#### CAPACITY

- 1TB (standard) up to 2TB (capable) (optional) 64GB SD card up to 512GB

#### RECORDING OPTIONS

- SD card slot for redundant recording

### INTERFACE

#### NETWORK DATA CONNECTION

- One RJ45 x 1 (10/100 M/1000M)

#### EXPANSION

- RS232 x 2, RS485 x 2

#### GPS INTERFACE

- Built-in, compatible with optional GPS antenna

### DRIVER ACTION DETECTION

#### PANIC BUTTON

- The remote status indicator (panic button) can be connected to show DVR power/record status without using a video monitor
- The driver-operated panic button has the following functions:
  - Solid green LED indicates that the unit has power and is recording
  - Event marker (panic button)

#### DRIVER ACTION DETECTION WIRES

- 8 signal wires individually programmable to indicate alarm or event



#### BUILT-IN G-FORCE SENSOR

#### COMPRESSION FORMAT

- Video: H.264
- Audio: ADPCM, G.711A G.711U

### RECORD RESOLUTION

#### NTSC

- 1080P, 720P, WD1(928X480), WHD1(928X240), WCIF(464X240), D1(704x480), HD1(704x240), CIF(352x240)

#### PAL

- 1080P, 720P, WD1(928X576), WHD1(928X288), WCIF(464X288), D1(704X576), HD1(704x288), CIF(352x288)

#### RECORDING OPTIONS

- **Continuous record:** System will record all channels continuously while vehicle is running (factory setting).
- **Alarm record:** System will record when an alarm is triggered.
- **Motion record:** System will record when the cameras detect motion while vehicle is running.
- **Schedule record:** System will boot and record according to user-selectable schedule.

### ELECTRICAL & OPERATING REQUIREMENTS

#### AUTO ON/OFF DETECTION

- ACC detection

#### DELAY OFF SETTING

- User selectable up to 24 hours

#### OPERATING VOLTAGE

- 8~36VDC

#### OPERATING TEMPERATURE

- -14°F (-25°C) ~ +158°F (+70°C); -40°F (-40°C) ~ +158°F (+70°C) with heater

#### POWER CONSUMPTION

- 0W-105.3W

### POWER SUPPLY

#### INPUT RANGE

- DC 8-36V

#### OUTPUT RANGE

- DC5V/DC12V

#### OUTPUT CURRENT

- 5V@500mA, 12V@500mA

#### BUILT-IN POWER PROTECTION

#### LOW VOLTAGE PROTECTION

- User selectable and programmed at installation

#### HOUSING/CASING

- Removable, shock-mounted
- Vandal-resistant locking front cover
- Shock-resistant: MIL-STD-810F
- Aluminum
- Optional fan with filter, removable for cleaning

#### BUILT-IN WI-FI MODULE

### OPTIONAL COMPONENTS

#### VIRTUAL SYNCHRONIZED MAPPING

- External Virtual Synchronized Mapping™ module with North American maps
- Includes GPSV1 antenna
- Embeds GPS tracking information synchronized with recorded video footage

#### GPS ANTENNA

#### FIREPROOF BOX BACKUP

#### CELLULAR MODEM





Creative Bus Sales

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CRFQ 0805 PTR220000007 158" Wheelbase Cutaway Vehicle Paratransit

#### 11.1.8 References

Tri River Transit  
753 Marconi Drive  
Hamlin, WV 25523  
(304) 824-2944

Buckwheat Express  
108 Senior Center Drive  
Kingwood, WV 26357  
(304) 329-0464

Berkeley Senior Services  
217 North High Street  
Martinsburg, WV 25404  
(304) 263-8873

Heart 2 Heart Volunteers Inc.  
667 Stone Shannon Road  
Wheeling, WV 26003  
(304) 277-4657

Logan-Mingo Area Mental Health Inc.  
300 Prosperity Lane  
Logan, WV 25601  
(304) 792-7130

# Safe Fleet Transit & Coach Roof Hatches

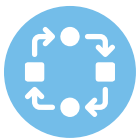
## Ventilator and Emergency Escape Hatches



Enhance your passenger comfort and safety with a hatch from the leader in bus safety equipment.



Safe Fleet roof hatches demonstrate over 40 years of proven performance and come in a wide variety of styles and configurations. Hatches are also customizable to meet your specific application needs. Each hatch features a low-profile design and meets all FMVSS and CMVSS regulations.



### Adaptable

Low profile design adapts to wide range of roof surfaces



### High Strength

Constructed of high strength UV stable materials



### Made in the USA

Proudly manufactured in North Carolina with over 40 years of proven performance



### Warranty

5 Year Manufacturer Warranty



The Safe Fleet – Transpec family of ventilators and escape hatches – designed to meet the wide-ranging needs of today’s transit fleet.

### Dual Purpose Safety Vent

The Dual Purpose Safety Vent is a combination roof ventilator/emergency exit that provides 5-position, fresh air ventilation and a simple release handle for emergency exit.

- Multi position fresh air vent
- Emergency exit
- Most popular model



### Glass Safety Vent

The Safe Fleet Glass Roof Hatch is made of 4mm tempered glass with gray tint featuring an 18% light transmission and is also available in a motorized version.

- Multi position fresh air vent
- Emergency exit
- Glass panel to allow natural light into the vehicle cabin







## Power Safety Vent

The Power Safety Vent II provides all the features of the Dual-Purpose Safety Vent II with the addition of an electric fan for extracting condensation, stale or hot air from inside the vehicle to improve passenger comfort.

- Multi position fresh air vent
- Emergency exit
- High-capacity powered exhaust fan provides ventilation in the closed position



## Motorized Safety Vent

The Motorized Safety Vent (MSV) is an electrically operated combination roof ventilator/emergency exit that provides fresh air ventilation as well as a simple release handle that allows the hatch to hinge open for emergency exit. The ventilation portion of the hatch is controlled by a simple switch contained within the driver's compartment of the vehicle on which it is installed.

- Multi position fresh air vent
- Emergency exit
- Allows the ventilation feature to be controlled from driver's seat



	COLORS	STATIC VENT	OUTSIDE RELEASE	RETENTION CABLE (1 or 2)	HATCH AJAR ALARM	ADHESIVE SEALANT	MULTILINGUAL DECALS
MODEL	STANDARD FEATURE & OPTIONS						
<b>T1070 Series Dual Purpose Safety Vent II</b>	White. Light Gray, Dark Gray, Black, Beige		●	●	●	●	●
<b>T1670 Series Power Safety Vent II</b>	White. Light Gray, Dark Gray, Beige	●	●	●	●	●	●
<b>T2070 Series Motorized Safety Vent II</b>	White. Light Gray, Dark Gray		●	●	●	●	●
<b>T2870 Series Glass Roof Hatch</b>	White. Light Gray, Dark Gray, Black			●	●	●	●

● Standard    ● Optional





1245-SF-Hatch-BR-TR-091721

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U.S. Department  
Of Transportation  
**Federal Transit  
Administration**

Headquarters

East Building, 5<sup>th</sup> Floor – TCR  
1200 New Jersey Avenue, SE  
Washington, DC 20590

August 31, 2021

Donall Hasty  
Forest River: Elkhart Coach, Glaval Bus,  
Starcraft, StarTrans Bus, Van, Eldorado-KS  
Lone Star Van, Champion Bus  
2367 Century Drive  
Goshen, IN 46528

Re: TVM DBE Goal Concurrence/Certification Letter – Fiscal Year 2022

Dear Mr. Hasty:

This letter is to inform you that the Federal Transit Administration's (FTA) Office of Civil Rights has received Forest River's Disadvantaged Business Enterprise (DBE) goal and methodology for FY 2022 for the period of October 1, 2021–September 30, 2022. This goal submission is required by the U.S. Department of Transportation's DBE regulations at 49 CFR Part 26 and must be implemented in good faith.

We have reviewed your firm's FY 2022 DBE goal and determined that it complies with DOT's DBE regulations. Your firm is eligible to bid on FTA-funded transit contracts. This letter or a copy of the TVM listing on FTA's website may be used to demonstrate your firm's compliance with DBE requirements when bidding on federally funded vehicle procurements.

FTA reserves the right to remove/suspend this concurrence if your DBE program or FY 2022 DBE goal is not implemented in good faith. In accordance with this good faith requirement, you must submit your DBE Uniform Report to FTA by December 1, 2021. This report should reflect all FTA-funded contracting activity for the second period of FY 2021 (i.e., from April 1 to September 30).

Also note that your FY 2023 DBE goal methodology must be submitted to FTA by August 1, 2022. Any significant updates to the program plan must be submitted to FTA as they occur. If you have any questions, please contact the FTA DBE Team via email at [FTATVMSubmissions@dot.gov](mailto:FTATVMSubmissions@dot.gov).

Sincerely,

John Day  
Program Manager  
Office of Civil Rights



06/21/2017

MB#

## Z GUARD™ 9902 STAR

A wax based undercoating intended to protect commercial vehicles from corrosion. The wax electrochemically inhibits the rate of corrosion and also, due to the film characteristics, provides a coating resistant to stone impingement and elevated temperatures.

### PHYSICAL PROPERTIES

Appearance	Black Liquid
% NVM by WT.	50
Density	10.43 lb/gal
Viscosity (after reduction with water) per Brookfield RVT #5 Spindle 20RPM	2500
Viscosity per #4 Zahn cup	26 sec.
Mechanical Stability	Excellent
Heat Stability	Excellent
V.O.C.	0.00 lbs/gal
D.O.T. Flammability Rating	>200q F
pH	8.5
Cryptometer/#2 Wedge, ASTM D1212	15
60° Gloss	< 5 matt finish)
Sag (mils)	>15

**Z TECHNOLOGIES CORPORATION**

World Leaders in Corrosion Protection

26500 Capitol Avenue, Redford, Michigan 48239-2597  
Telephone (313) 937-0710 • Fax (313) 937-1470

## Z GUARD 9902 STAR Film Properties

Performance testing reflects coating on unpolished Q panels with four day air-dried films at 3.0 – 4.0 mils dry.

Dry to touch at R.T., ASTM D 1640	10 ± 2 minutes
Dry-to-Handle at R.T., ASTM D 1640	20 ± 5 minutes
Pencil Hardness	6B
Flexibility 180° bend over conical mandral	Pass
Salt Spray, ASTM B 117, 1000 hours	Field, scribe, edge clean; slight blistering
Salt Fog Resistance (463PB-10-01), 240 hours.	Pass (No rust)
◆ 500 F x 16 hours plus 240 hrs salt fog	Pass (No rust)
◆ 325 F x 16 hours plus 16 hours humidity.	Pass (No rust, nor blisters)
Salt Fog Resistance (WSS-M2P178-A), 240 hours.	
◆ 662°F x 1 hour; 1°C water quench; plus 240 hrs salt fog.	Pass (#8-9 corrosion rating or <0.1% surface rust per ASTM D 610-95)
Salt Water Immersion, 5% NaCl, 100° F, 96 Hours	Pass
Detergent Immersion, 100° F, 48 Hours	Pass
Gravelometer, ASTM D 3170, -20° F	Good(8A)
Poultice, GM 998-5470, 20 cycles	Pass
Q.U.V., ASTM G 53, 3000 Hours	Pass
Q.U.V., 100 Hours + Salt Spray, 336 Hours	Pass
Q.C.T., 3000 Hours	Pass
Humidity Resistance, ASTM D 2247, 2000 Hours	Pass
Sag resistance	≥5 mils
Impact (direct & reverse) ASTM D 3281	160/40 inch-lbs.
Adhesion (FLTM B 1 6-1 B) cross Hatch	5A Pass
Scab corrosion resistance, 20 cycles	Pass

### APPLICATION

For ultimate protection, apply films to clean metals at a thickness of at least four (4) mils dry, by any of the following methods:

Airless spray, with a 33:1 1.5 - 3.5 GPM, .013 - .026 tip at 50-75 psi line pressure, 20 - 40 fan

[www.ztechprotection.com](http://www.ztechprotection.com)

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Telephone (313) 937-0710 • Fax (313) 937-1470





**3 Year Limited Warranty**  
**on**  
**Undercoating produced by Z Technologies Corporation**  
**for use by**  
**Forest River Bus**

Subject to the terms, conditions and limitations in this Warranty, Z Technologies Corporation (the "Warrantor") hereby warrants to the original owner ("Owner") that the Z Technologies Undercoating used in the construction of Forest River Bus products meets the specifications set forth in Z Technologies' current Product Profile and when applied to Forest River products in the manner set forth in Z Technologies application recommendations, will protect those products from damage by rust for a period of three (3) years from the date of the Owner's purchase.

In the event that refurbishing is required as a result of damage caused by rusting within three (3) years of the Purchase Date, Warrantor's entire liability to Owner, and Owner's sole and exclusive remedy, will be to provide replacement undercoating, to advise Owner on proper refurbishing methods and to reimburse the cost of refurbishing up to the original cost of installing the undercoating on the unit in question. Owner will be responsible for all other costs and expenses in connection with the refurbishing, including transportation. Warrantor will not, under any circumstances, be responsible for special (except as expressly stated in this paragraph), indirect, incidental, consequential or punitive damages.

If corrosion damage appears to have occurred while this Warranty is in effect, Owner shall notify Forest River Bus within 90 days after discovery of same. Forest River Bus will, in turn, notify Z TECH. All claims made under this Warranty must be made to Z Technologies within 36 months after the Purchase Date. This Warranty shall have no effect unless Owner authorizes Z Technologies to inspect the unit on site. Z Technologies will make the final determination as to whether or not repairs are authorized under this Warranty. This Warranty does not apply to claims arising from damage due to: Misuse, alteration or negligence, subsequent or additional coatings applied over or under the undercoating warranted, Dents, scratches, unusual contact, abrasion or fair wear and tear attributed to normal operating conditions. Failure to promptly repair damaged coating. Exposure to fire, heat, chemicals, explosion or any other natural causes.

The limited warranty provided herein is the sole and exclusive warranty with respect to Z Technologies undercoating. Any implied warranty, including any warranty of merchantability or warranty of fitness for a particular purpose, is limited in duration to the stated period of these written warranties. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

No dealer, salesman, representative or other person is authorized to make any warranties with respect to Undercoating, extend the warranty period or otherwise change modify or amend the provisions of this warranty.

This warranty is applicable only to the original Forest River Bus owner and may not be transferred to any other person, firm or entity.

*Z Technologies, the Originators of Ziebart Protective Coatings*



**ISO 9001:2008 CERTIFIED**

August 12, 2014

Subject: Z Guard 9902 Water Based Corrosion Preventative

To Whom It May Concern

Z Technologies Product, Z Guard 9902, was tested to the requirements of Specification A-A- 55295 which supersedes Specification MIL PRF 62218 which supersedes Specification TT C 520.

The test results are attached.

Based on the results of testing, Z Guard 9902 meets or exceeds the performance requirements of the specification.

The product Z Guard 9902 is widely utilized in the Commercial Vehicles OEM market and carries a three year corrosion warranty.

Sincerely

Ellis Breskman Ph.D.  
Director of Research & Development  
*Dr. Kurt Ziebart Memorial laboratory*

Z Technologies Corporation  
26500 Capitol Ave.  
Redford, MI 48239 USA  
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Desk 313 937 0710 xt 211  
Fax 313 937 1470  
Cell 313 506 2772  
[www.ztechprotection.com](http://www.ztechprotection.com)  
**World Leaders in Corrosion Protection**

**[www.ZTechCoatings.com](http://www.ZTechCoatings.com)**

26500 Capitol Avenue, Redford, Michigan 48239-2597 • Telephone (313) 937-0710 • Fax (313) 937-1470



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Z Technologies Corporation  
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26500 Capitol Avenue, Redford, Michigan 48239-2597 • Telephone (313) 937-0710 • Fax (313) 937-1470

Supplier		Part Name	
Z Technologies Corporation			
Name Of Laboratory		Z-Guard ® 9902	
Dr. Kurt Ziebart Memorial Laboratories			
Material Specification			
Spec. No.#	Com. Item Description A-A-59295		Superseding MIL - PRF - 62218B June 3, 1996; which supersedes TT C 520B
2	Type I Motor Vehicles and Trailers		Originally issued Sept. 9, 1998
NSN 8030-01-127-3683			
	REQUIREMENTS:	RESULTS	OK NOT OK
3.1	INGREDIENTS		
3.1	Non Volatiles dispersed in petroleum solvent	water based	X
3.1.1	no highly toxic ingredients	comply	X
3.1.1.1	No benzene or HAPS	comply	X
3.1.1.2	No halogenated hydrocarbons	comply	X
3.2	CHEMICAL AND PHYSICAL CHARACTERISTICS		
3.2.1.2	Non Volatiles (weight) not less than 52% ± 5%	61%	X
3.2.1.3	Wt per liter to not vary by more than 5% ASTM D1475	comply	X
3.2.1.4	Sulfated Ash content Each batch shall be within 10% of established value ASTM D95	comply	X
3.2.2	Water Content shall be less than 1% ASTM D95	water based coating	X
3.2.3	Lead Content less than 0.015% ASTM D3335	< 0.006%	X
3.2.4	Flash Point not less than 100F ASTM D93	>240 F	X
3.2.5	Condition in Container: no settling, lumps, skins, or separation of the solvent	comply	X
3.2.6.2	Color: Color Brown or Black: no fluorescent pigments or dyes	black	X
3.3	PERFORMANCE PROPERTIES		
3.3.1	Sag Sag resistance ≥ 10 wet mils (250μ)	23 mils	X
3.3.2.2	Creep: (1) expose 2 std cold rolled steel panels to 24 Hrs of ASTM 117 Salt Spray. (2) Clamp the panels together so that they overlap by 1/2 inch (3) apply the coating with a spatula to the joint (4) allow the test panels to stand in a vertical orientation for 7 days at room temp. (5) examine for creep of coating: no more than 0.25 inches allowed	creep 0.1 inches pass	X
3.3.3	Copper Corrosion. The compound shall not be corrosive to copper when tested to ASTM D130. Test duration 3 hours. Test Temperature 100C. Copper strip classification value shall not exceed 1-b (slight tarnish, dark orange)	1-b Pass	X
3.3.4	Fire Resistance: Expose the coating to a flame for 20 seconds. The coating shall not support combustion for more than 15 seconds after the flame is removed per ASTM D1310	flame out in 5 seconds: Pass	X
3.3.5	Detergent Resistance. Immerse the dry coating into a solution of 2.5 grams sodium lauryl sulfate or equivalent per liter of water at 50C (122F) for 10 minutes. The coating must remain intact and continuous.	Slightly affected	X
3.3.6	Chip Resistance. ASTM D3170 rating of 3A or better	4A Pass	X
3.3.7	Solvent Vapor Wash Resistance. Place fresh wet film into non air circulation oven at 121C for 15 minutes. After 15 min cool at room temp, no evidence of sag, channeling, or removal from surface	no evidence of sag channeling or removal	X
3.3.8	Condition to Touch. After 7 days at room temp, the coating shall be dry to touch	dry to touch: Pass	X
3.3.9	Environmental. Testing shall conform to SAE J1959	Pass	X
3.3.9.1	Low Temperature Stability. Expose the films to temperature of -20F for 16 hours. Film shall remain homogenous.	no effect: Pass	X
3.3.9.2	Low Temperature Sprayability. Coating applies at temperatures 4C (40F) or above.	OK: pass	X
3.3.9.3	Low Temperature Flexibility. Coating shall be flexible at temperatures -20F and above	Pass	X
3.3.9.4	High Temperature Sprayability. The coating shall spray well 100F or below	Pass	X
3.3.9.5	High Temperature Flow Resistance. Expose dry film to 300F for 2 hours: No sag allowed.	No Sag: Pass	X
3.3.9.6	Salt Fog. Apply coating to corroded surface. Expose to 1000 hours per SAE J1959. Rating must be 2 or better.	ASTM Rating of 6: Pass	X
3.3.9.7	Salt Water Immersion: Immerse dry film for 21 days in solution of 27.6 grams of NaCl, 2.4 grams CaCl2 in one liter of water. Adjust pH to 7.8 - 8.2 with sodium carbonate. See SAE J1959. The compound shall inhibit corrosion.	Pass	X
3.3.9.8	Cyclic Environmental conditions. Test to SAE J1959 section 3.12. The coating shall inhibit corrosion.	SAE J2334 Cyclic: Pass	X
4	REGULATORY REQUIREMENTS	Material is recoverable	X
4.1	Attempt to utilize Recovered Material		
5	QUALITY ASSURANCE PROVISIONS	certified to ISO 9001	X
5.1	Contractor Required to perform all examinations and tests		
5.2	Same product as sold to the commercial market	same product	X

The above test results were obtained from validation testing to CID A-A-59295 Type II.

Ellis Breskman PhD Technical Officer

Date:

MAY 12, 2014



# GLAVAL UNIVERSAL

## SAFETY AND COMFORT, INSIDE AND OUT

The all new Universal is the perfect balance of safety, durability and value. The passenger compartment is surrounded by a fully welded aluminized steel structure. Standard 5/8" marine grade plywood flooring, stainless steel exterior screws and a fully undercoated chassis protects the bus from the most extreme conditions. The newly redesigned exterior features laminated straight sidewalls and a new one piece fiberglass front and rear cap, making it as

desirable as it is durable. If dependability and safety is your top priority, the new Universal by Glaval is exactly what you are looking for. Built on Ford's E-series chassis, the Universal has proven itself to be the vehicle of choice for the most demanding of customers. Glaval prides itself with quality fit and finish along with the flexibility to meet its customer's ever changing needs.



 **Glaval Bus**  
A Division Of Forest River, Inc.

# GLAVAL UNIVERSAL

## Standard Exterior Feature Highlights

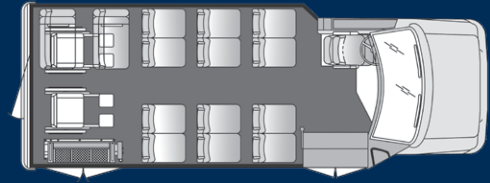
- Fully welded corrosion-preventative coated aluminized steel cage construction with laminated sidewall structure meeting all applicable FMVSS requirements
- "Starview" drivers visibility window in front of entry door
- Electric actuated passenger entry door with full length glass
- 36" wide x 36" high upper double T-Slider tempered safety glass windows with climate control tint
- Black powder coated steel rear bumper
- Rear mud flaps
- Molded wheel flares with no exposed fasteners
- Pre-painted white galvanized steel sidewalls and skirts
- Fiberglass front and rear caps
- One-piece seamless FRP (fiberglass reinforced plastic) roof
- Breakaway rearview mirrors with built-in convex
- Sealed LED stop, tail, and turn signal lights with reverse lights
- Exterior LED front and rear marker lights

## Standard Interior Feature Highlights

- 93" interior width
- 80" interior floor to ceiling height with standard floor (raised floor is 75")
- Floor and wall seat track for flexible seating
- Black slip resistant Gerflor floor covering
- 5/8" marine tech plywood flooring
- Coved flooring to bottom of seat track
- Gray padded vinyl or cloth interior
- White step nosing at passenger door
- 1.25" left hand vertical passenger assist rail at entry door
- LED entry door step well lights
- LED driver and passenger area lighting
- FlexTech Electrical System
- Backup camera system with 7" monitor/rearview mirror combo
- Non-retractable seat belts

## Popular Option Highlights

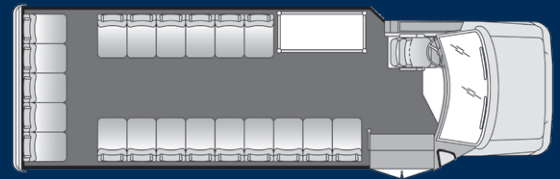
- Stainless steel wheel inserts
- Luggage storage areas (overhead luggage racks with reading lights, interior luggage racks, rear storage area)
- Rear emergency door with window(s)
- Passenger area rear heat and air conditioning
- Passenger grab rails
- Audio and video systems
- Mid back or high back seating
- ADA and FMVSS compliant wheel chair lifts and securement systems
- Fiberglass side walls and skirts



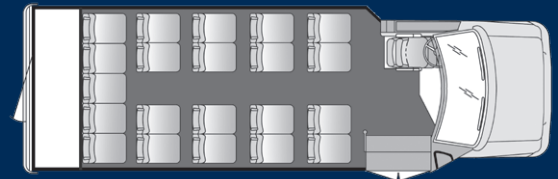
12 Passenger 2 Wheelchair  
4 Passenger Foldaway Seats Plus Driver



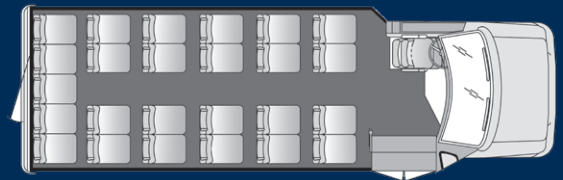
16 Passenger 2 Wheelchair  
4 Passenger Foldaway Seats Plus Driver



20 Passenger with Interior Luggage Plus Driver



21 Passenger with Rear Luggage Plus Driver



25 Passenger Plus Driver



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2367 Century Drive • Goshen, IN 46528 • Lit. No. GLB - 01/050719  
1.800.348.7440 • [www.glavalbus.com](http://www.glavalbus.com)

## DEALER INFO



### **3.38 Storage**

Due to the destination signs being overhead the storage compartment will have to be located on the floor. Final determination of its location can be discussed and finalized during a pre-build meeting.

# PRODUCT ANNOUNCEMENT



## FOREST RIVER BUS

**To:** Forest River Bus Dealers

**Re:** Discontinued Radio Jensen JBR550

**Date:** April 19, 2022

The Jensen JBR550 Deluxe AM/FM/CD radio/PA ready radio (Forest River Bus Option Code 8287) has been discontinued and replaced with the Jensen JHD1130 AM/FM/RBDS/WB radio. Attached is a brochure on the radio for detailed information.

Any units on order with the discontinued Jensen JBR550 radio will be automatically replaced with the Jensen JHD1130 radio at no additional charge.

The JHD1130 radio is not PA ready and will require the option for the JPA500 PA system to be used with this radio. We will add new options to the order form per below on the next order form revisions.

If you have any questions, please contact your Sales Representative.

Jensen JHD1130 AM/FM/RBDS/WB Radio With Clock & 4 Speakers	05	2707			\$ 400.00
JPA600 PA System w/ Hand Held Mic & Clip Integrated with JHD1130 Radio	05	2652			\$ 180.00





AM/FM/RBDS/WB Heavy Duty Radio

# JHD1130



## PRODUCT FEATURES

- 12V DC power
- Max output power: 40W x 4
- Electronic AM/FM tuner (US/Euro)
- NOAA 7-channel Weather band
- RBDS with PTY search
- Front AUX input
- Amber backlighted control panel buttons
- 12/24 hour selectable clock with Super-Cap 30 day power backup
- Encoder knob volume control
- Beep tone confirmation (user selectable On/Off)
- EQ presets (Flat, Rock, Pop, Classical, User settings)
- Conformal coated PCB
- Preset tuning
- Non-volatile memory
- Low battery alert (Voltage < 10.8 VDC)
- IR remote ready (remote sold separately)
- Channel lock

DESIGNED TO MOVE [YOU]<sup>TM</sup>

Features and specifications subject to change without notice.

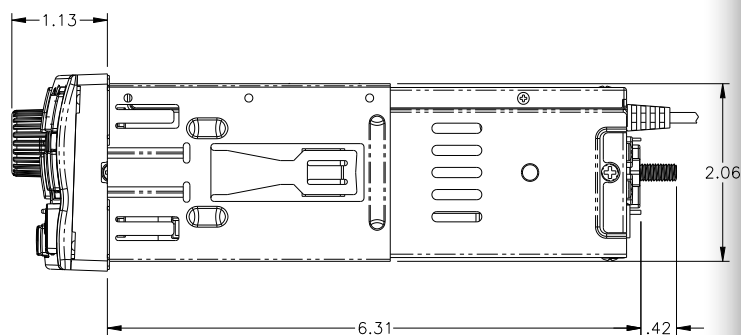
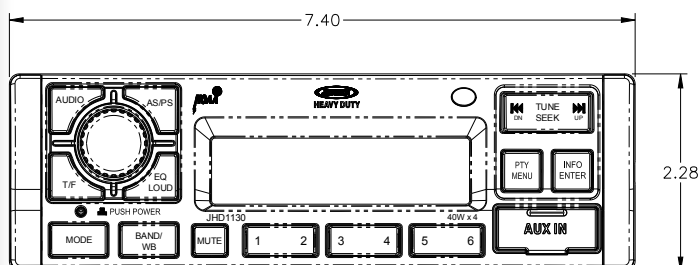
**asa**  
ELECTRONICS<sup>TM</sup>

2602 Marina Drive • Elkhart, IN 46514  
[www.asaelectronics.com](http://www.asaelectronics.com)



AM/FM/RBDS/WB Heavy Duty Radio

# JHD1130



## Specifications

### General Specifications

Power System		12 VDC
Operating Voltage Range		9 V to 18 V
Current Draw @ 12V	Standby	0 A
	Nominal	1.3 A
	Maximum	9.5 A
Operating Temperature Range		-22°F to 185°F    -30°C to 85°C
Storage Temperature Range		-40°F to 185°F    -40°C to 85°C
Maximum Relative Humidity		95%
Overall Dimensions		6.3" x 7.4" x 2.1"
Product Weight (unpacked)		2.75 lbs.

### Performance Specifications

FM Sensitivity		1 uV
AM Sensitivity		20 uV
Output Power	RMS	18 W x 4
	Maximum	40 W x 4
Total Harmonic Distortion @ 1 Watt		1%
Applied Test Suite		ASA ES0013
Regulatory Certification		FCC Part 15B / E-Mark



**Gateway**



**INTERMOTIVE**  
**VEHICLE**  
**CONTROLS**

An ISO 9001:2015 Registered Company

# Gateway

## High Idle and Shift Interlock System

### Overview

- All-in-one wheelchair interlock and high idle system to ensure full functionality of the vehicle's systems while using the lift
- Provides battery charge protection and improves air conditioning performance
- System is fully compliant with FMVSS 403/404 and the Americans with Disabilities Act (ADA) for wheelchair lift interlocks
- Simple plug and play connections to the OEM chassis

### Features

- Prevents vehicle movement while the lift is in use by locking the shifter in Park
- Monitors OEM sensor inputs from the transmission, engine, charging system and ambient air temperature
- Programmable RPM for high idle
- Prevents driving with the park brake set
- Can provide real-time chassis data
- Diagnostic trouble codes available
- Optional BrakeMax add-on: automatically places vehicle in "tow haul" mode for reduced brake wear
- Uses Intermittent Fault Filter™ (IFF) technology to eliminate erroneous lift door signals

*Product features may vary by make, model or year. See instructions for complete details.*

Proudly distributed by

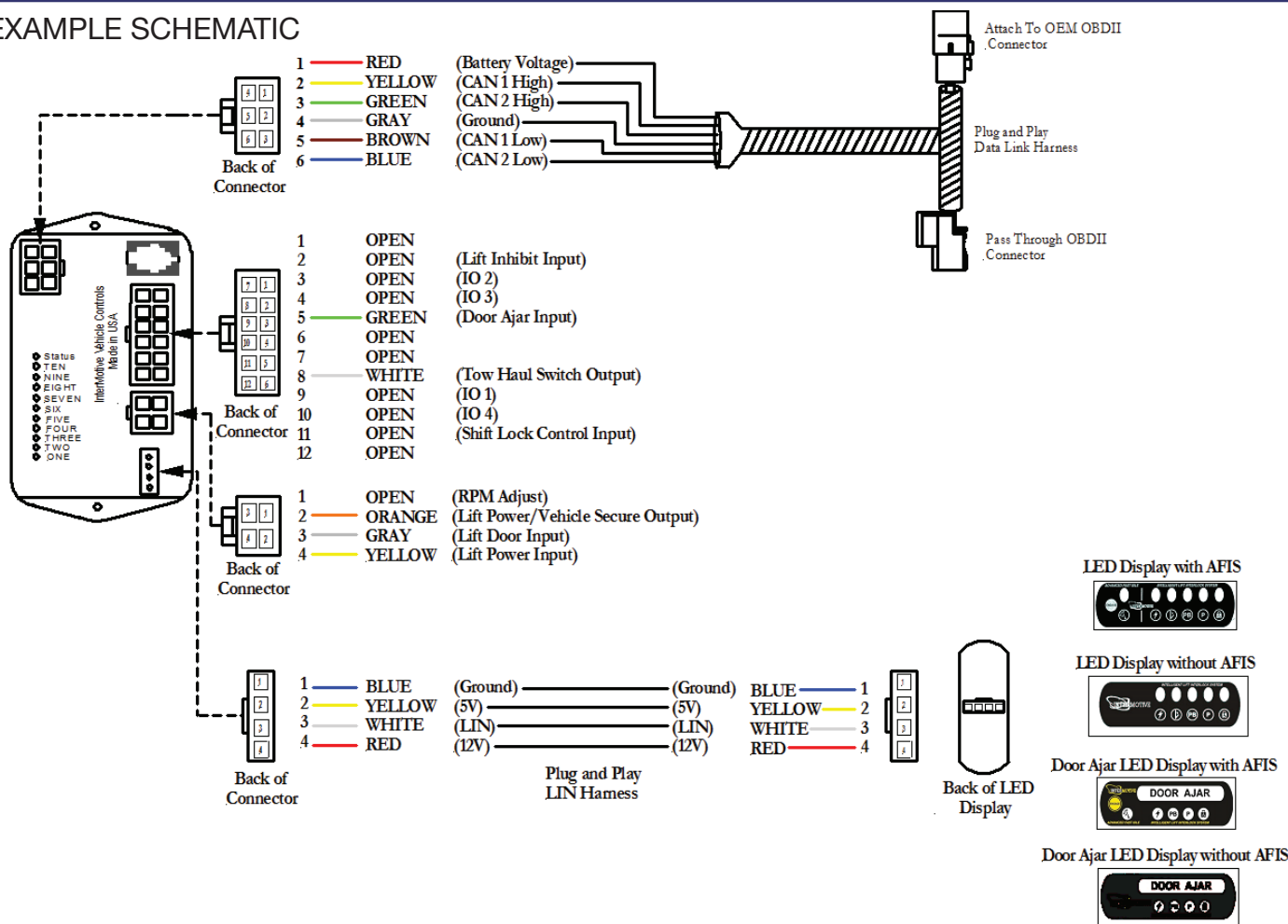
**LGS GROUP**  
AUTOMOTIVE TECHNOLOGIES

**(775) 831-2002**



# Details

## EXAMPLE SCHEMATIC



## SPECIFICATIONS

Number of Inputs	Five inputs (lift inhibit, door ajar, shift lock, lift door and RPM adjust)
Number of Outputs	Four configurable outputs, plus one lift power/vehicle secure output and one tow haul switch output
Current Draw	~120 mA
Quiescent Draw	~2 mA (sleep current)
CAN Speed	High and medium speed
Temperature Range	-40°C to 80°C
Dimensions	4" L x 2" W x 1" H

# LEADING THE INDUSTRY IN REAR VISION SAFETY


**STSK4750B KIT COMPONENTS:**

MONITOR: STSM244

CAMERA: STSC130B

HARNESSES: STSH349 (49FT BLACK), STSH130 (ADAPTER HARNESS)

Forest River, Inc. bus manufacturing companies will be the industry's first to offer a rear backup safety camera as standard equipment on every bus in 2019... Setting the safety tone and trend in the commercial and school bus market.

Forest River's hard stance on safety with the new 2019 rear backup safety program has selected Rosco Vision Systems in NY as the manufacturers of the STSK4750B backup camera system.


**STSM244 MONITOR SPECS**

SCREEN SIZE	7"
RESOLUTION	800*480 pixels
MONITOR BRIGHTNESS	700cd/m2
NUMBER OF CAMERA INPUTS	1
INPUT FORMAT	13-pin
VIEWING ANGLES	L/75°, R/75°, UP/60°, DOWN/60°
SHOCK RATING	2G
VIBRATION RATING	6G
POWER SUPPLY	12 ~ 32 VDC
OPERATING TEMPERATURE RANGE	-4°F to 158°F -20°C to 70°C

**STSC130B CAMERA SPECS**

TV LINES	420 TVL
FIELD OF VIEW (DIAGONAL)	150°
MINIMUM ILLUMINATION	0.2 LUX
DUST/WATER RATING	IP69K
POWER SUPPLY	12 Vdc
OPERATING TEMPERATURE	-22°F to 140°F -30°C TO 65°C


**1-800-227-2095**


## **RAIN BOOTH INFORMATION**

Constructed as part of a corporate-wide pre-delivery inspection facility, the Forest River 20' x 50' motorized vehicle rain booth utilized by Glaval Bus offers exceptional performance in the area of water leak detection.



The motorized vehicle rain booth adds front wall nozzles to the design of the towable rain booth, simulating the pelting of oncoming rain at highway speeds. Both booths include two 1200 gallon recycling tanks and utilize a 12Horsepower pump with multi-bank filters capable of delivering 40 – 60 p.s.i. That equates to 300 gallons per minute pushed through the spray heads, or the equivalent of a 24 inch-per-hour downpour!

With nozzles directed at the roof, sidewalls, front and undercarriage, nothing goes untouched in our quest for leak elimination. Using both velocity and volume in our test procedure ensures our valuable customers that we are doing the utmost to deliver a leak-free product to them.



Visitors are always welcome to witness the test booths whenever they are in operation.





## CENTURY SERIES NCL1000-2 WHEELCHAIR LIFTS

### THE ONE-STOP-SHOP FOR ALL YOUR MOBILITY TRANSPORTATION NEEDS

Since 1963, BraunAbility® has been the trusted industry leader. Our wheelchair accessible vehicles and lifts are designed to meet your specific needs, with performance, safety, and reliability that will keep your fleet up and running day after day, year after year. With the most diverse product portfolio of any mobility vehicle company in the industry, BraunAbility delivers the right solution to every commercial mobility need.



# NCL1000-2 CENTURY SERIES WHEELCHAIR LIFT

## STANDARD FEATURES

- **1,000-pound lifting capacity**
- NHTSA-compliant
- Fully automatic FMVSS 403-compliant lift, operated by an attendant
- Interfaces with OEM interlocks
- Long-lasting LED lift-mounted lights
- Side or rear door application\*
- Platform options up to 37" wide
- Floor to ground lift heights up to 48"
- Made in the USA

\* Vehicle suspension dynamics affect body roll and FMVSS 404 platform tilt allowance. Before selecting a lift with a 1000# rated capacity, ensure this load does not induce excessive platform tilt.

## SAFETY FEATURES

- Locking mechanical Inboard Barrier (IB), powder coated yellow for safety and high visibility, prevents operation if occupied
- Visual and audible warnings alert both passengers and attendants to unsafe conditions
- Interlocked gas spring activated outer barrier
- Dual handrails for security and convenience
- Pump design prevents platform folding when occupied

## EASE OF USE FEATURES

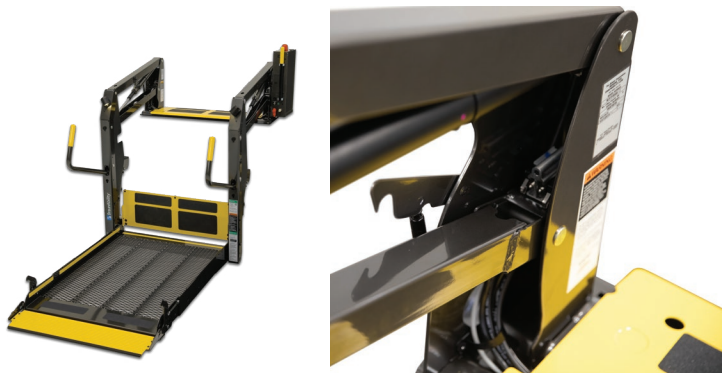
- Hand-held control box with illuminated functions
- Durable redesigned baseplate reduces lift weight, and allows for quicker and easier service
- Bridging feature permits the wheelchair user to board the lift from sidewalks
- Equipped with an adjustable anti-rattle feature
- Lift-Tite™ system stows the lift platform securely while the vehicle is in transit
- Pump module with removable cover offers easy access to all components
- Integrated back-up pump

## BRAUNABILITY'S UNRIVALED SERVICE

Every BraunAbility® commercial mobility product comes with our team of commercial mobility experts. They will work to find the ideal mobility transportation solution, no matter the requirements, complexity, or scale. And after you make a purchase, they will continue to work just as hard to offer you all the service and repair support you need.

## The NCL1000-2 Century Series Wheelchair Lift from BraunAbility

With dual hydraulic lift arms, and a design that has withstood the test of time, the Century Series offers all the benefits and quality of a BraunAbility wheelchair lift in a streamlined, economical package. The simplified electrical system offers trouble-free operation, while the non-hydraulic spring-loaded outer barrier keeps the wheelchair safely and securely on the wheelchair lift platform throughout the lifting cycle. In addition to all these standard features, the NCL1000-2 also comes equipped with an increased lifting capacity of 1000 pounds.



The NCL1000-2 Century Series also features new and improved inboard barriers, baseplates, vertical channels, and lower parallel arms for a more rigid and stable ride.

BraunAbility offers several models of the Century 2 Wheelchair Lift to address the right application, including usable platforms of 33" x 51", 34" x 51", 34" x 54", as well as 37" x 51" and 37" x 54". The models also vary based on the placement of the front or rear pump module, the lifting capacity (1,000 pounds), and the overall floor-to-ground lift height (up to 48"). The Century 2 Wheelchair Lift is available with or without the handrail belt. See your BraunAbility dealer or [braunability.com](http://braunability.com) for lift models available for your specific application.



**MADE IN THE USA**

631 West 11th Street • Winamac, IN 46996  
(574) 946-6153 | 1-800-THE-LIFT  
[www.braunability.com/commercial](http://www.braunability.com/commercial)

All illustrations, descriptions and specifications in this brochure are based on the latest product information at the time of publication. BraunAbility reserves the right to make changes at any time without notice. © 2019 The Braun Corporation 405245





**Gateway**



**INTERMOTIVE**  
**VEHICLE**  
**CONTROLS**

An ISO 9001:2015 Registered Company

# Gateway

## High Idle and Shift Interlock System

### Overview

- All-in-one wheelchair interlock and high idle system to ensure full functionality of the vehicle's systems while using the lift
- Provides battery charge protection and improves air conditioning performance
- System is fully compliant with FMVSS 403/404 and the Americans with Disabilities Act (ADA) for wheelchair lift interlocks
- Simple plug and play connections to the OEM chassis

### Features

- Prevents vehicle movement while the lift is in use by locking the shifter in Park
- Monitors OEM sensor inputs from the transmission, engine, charging system and ambient air temperature
- Programmable RPM for high idle
- Prevents driving with the park brake set
- Can provide real-time chassis data
- Diagnostic trouble codes available
- Optional BrakeMax add-on: automatically places vehicle in "tow haul" mode for reduced brake wear
- Uses Intermittent Fault Filter™ (IFF) technology to eliminate erroneous lift door signals

*Product features may vary by make, model or year. See instructions for complete details.*

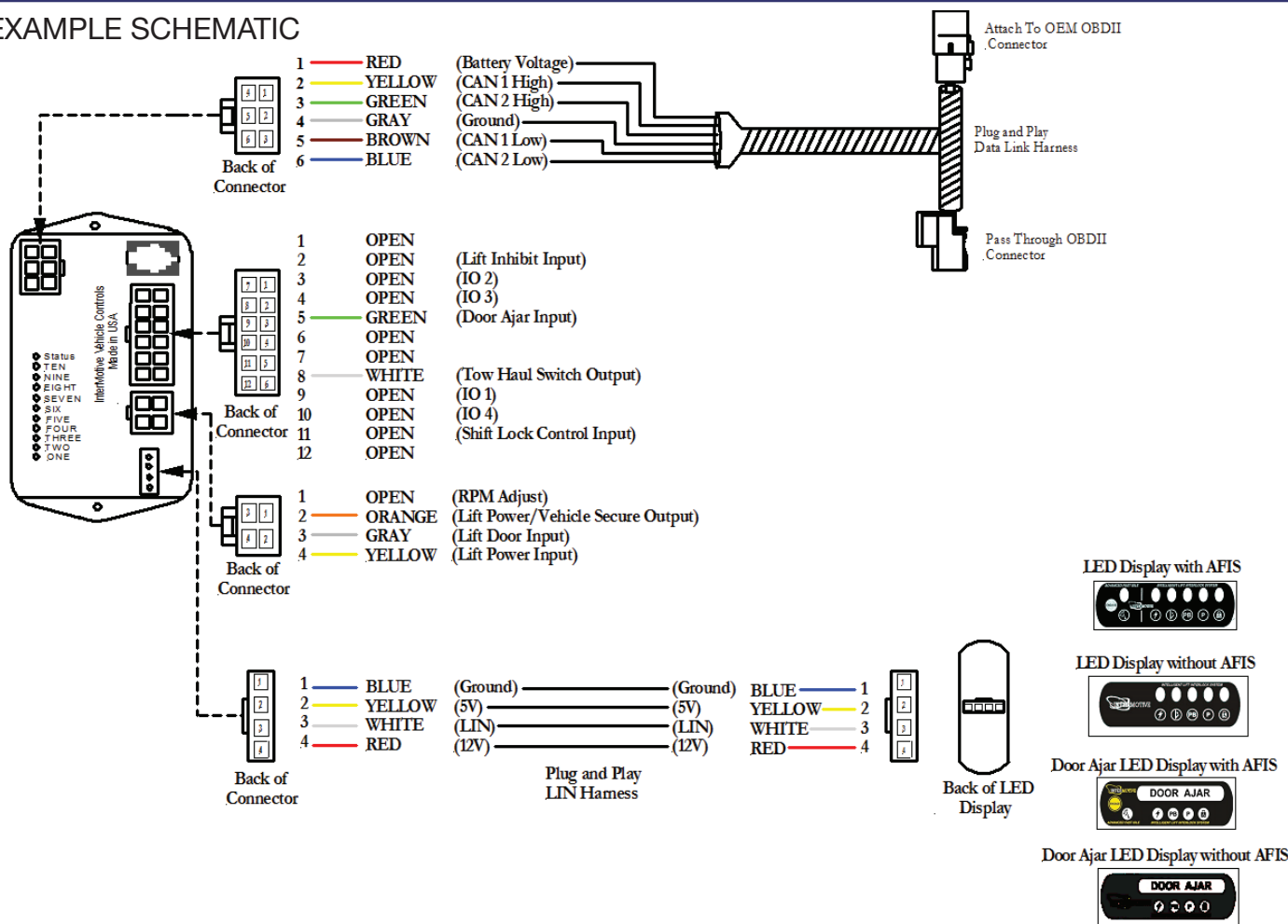
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AUTOMOTIVE TECHNOLOGIES

**(775) 831-2002**

# Details

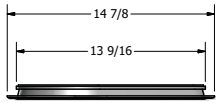
## EXAMPLE SCHEMATIC



## SPECIFICATIONS

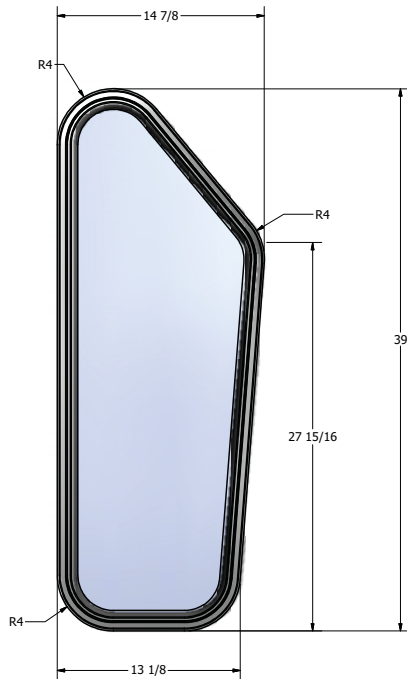
Number of Inputs	Five inputs (lift inhibit, door ajar, shift lock, lift door and RPM adjust)
Number of Outputs	Four configurable outputs, plus one lift power/vehicle secure output and one tow haul switch output
Current Draw	~120 mA
Quiescent Draw	~2 mA (sleep current)
CAN Speed	High and medium speed
Temperature Range	-40°C to 80°C
Dimensions	4" L x 2" W x 1" H



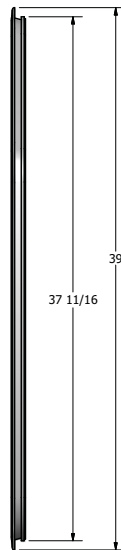


TOP VIEW

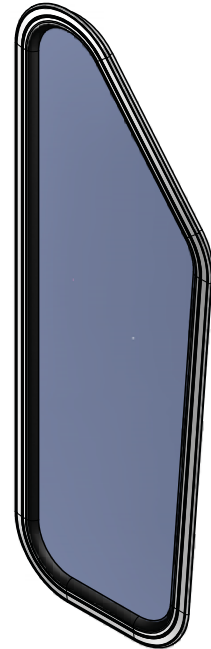
**CONFIDENTIAL**



FRONT VIEW



SIDE VIEW



ISOMETRIC VIEW

StarTrans CurbView Window  
361 Square Inches Viewing Area

REVISION HISTORY					DFTSN: <b>TAS</b>	TITLE: <b>More View Window 2011</b>		
ZONE	REV	DESCRIPTION	DATE	APPROVED		DATE: <b>5/11/10</b>	DWG NO <b>31-28-0525-10</b>	SHEET <b>1</b> OF <b>1</b>
31-28	"A"	Removed 3" from over all Height & Changed all Radius to 4"	06/22/10	tsmart				



# HEAVY DUTY ENERGY ABSORBING BUMPERS

PROTECTS VEHICLE IN LOW SPEED IMPACTS

**TRANSPEC**<sup>®</sup>  
A Safe Fleet Brand



**FRONT**



**REAR**



#### **SAFETY**

Protects vehicle from damage in low speed collisions



#### **EXTREME TEMP**

Specified on buses in extreme climates



#### **CORROSION RESISTANT**

Withstands years of harsh elements and road chemicals



#### **OPTIONS**

Available in various widths and custom end trims



#### **IMPACT AND SCRATCH RESISTANT**

Durable skin is puncture and tear resistant



#### **WARRANTY**

1 year

- **Outer Skin Can be Painted to Match or Compliment the Vehicle**
- **Two piece construction offers exchangeable symmetrical halves**
- **Less Parts Reduces Inventory Requirements and Cost**
- **Widths Available from 96" to 102**

13501 S Ridge Dr. • Charlotte, NC 28273 • Tel: 800 . 951 . 7867 • Fax: 704 . 889 . 2760 • sales@smiglobal.net  
W W W . S M I G L O B A L . N E T

NCL-7.2-6006 | Rev A | 6-18-15 | ISO 9001 Certified

# MEDIUM DUTY ENERGY ABSORBING BUMPERS

PROTECTS VEHICLE IN LOW SPEED IMPACTS

**TRANSPEC**<sup>®</sup>  
A Safe Fleet Brand



#### SAFETY

Protects vehicle from damage in low speed collisions



#### EXTREME TEMP

Specified on buses in extreme climates



#### CORROSION RESISTANT

Withstands years of harsh elements and road chemicals



#### OPTIONS

Available in various widths and custom end trims



#### IMPACT AND SCRATCH RESISTANT

Durable skin is puncture and tear resistant



#### WARRANTY

1 year

- **Two Piece Construction offers Exchangeable - Symmetrical Halves**
- **Fewer Parts Reduces Inventory Requirements and Cost**
- **Less Weight = Higher Fuel Efficiency**
- **Widths available 80" to 96"**

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W W W . S M I G L O B A L . N E T

NCL-7.2-6006 | Rev A | 6-18-15 | ISO 9001 Certified



# TA77 Evaporator

Industry  
exclusive 2  
year, unlimited  
mileage, limited  
warranty

**A rear mounted  
freeblow  
evaporator that  
can be used as  
a tie-in with OEM  
components  
or as part of a  
complete  
Trans/Air system**



Durable ABS cover with unique drain pan that promotes proper condensate removal (available in white, gray, and spring white)



Enhanced tube  
& fin design provides  
highest  
capacity



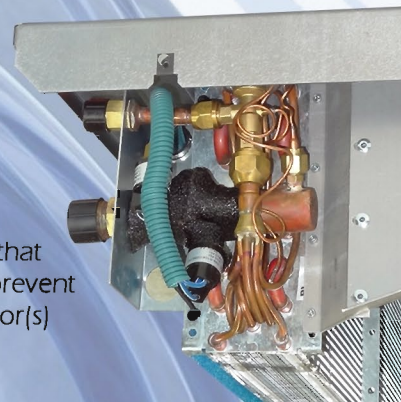
Blower assemblies come equipped  
with larger blower wheels for maximum  
air flow and motors utilize custom  
wound armatures for lower current  
draw and greater efficiency



Heavy Duty galvanized  
steel enclosure for reduced  
air leakage and maximum  
durability



4 Ton externally equalized,  
thermostatic expansion valves that  
precisely control refrigerant and prevent  
liquid slugging to the compressor(s)  
or starved evaporator(s)

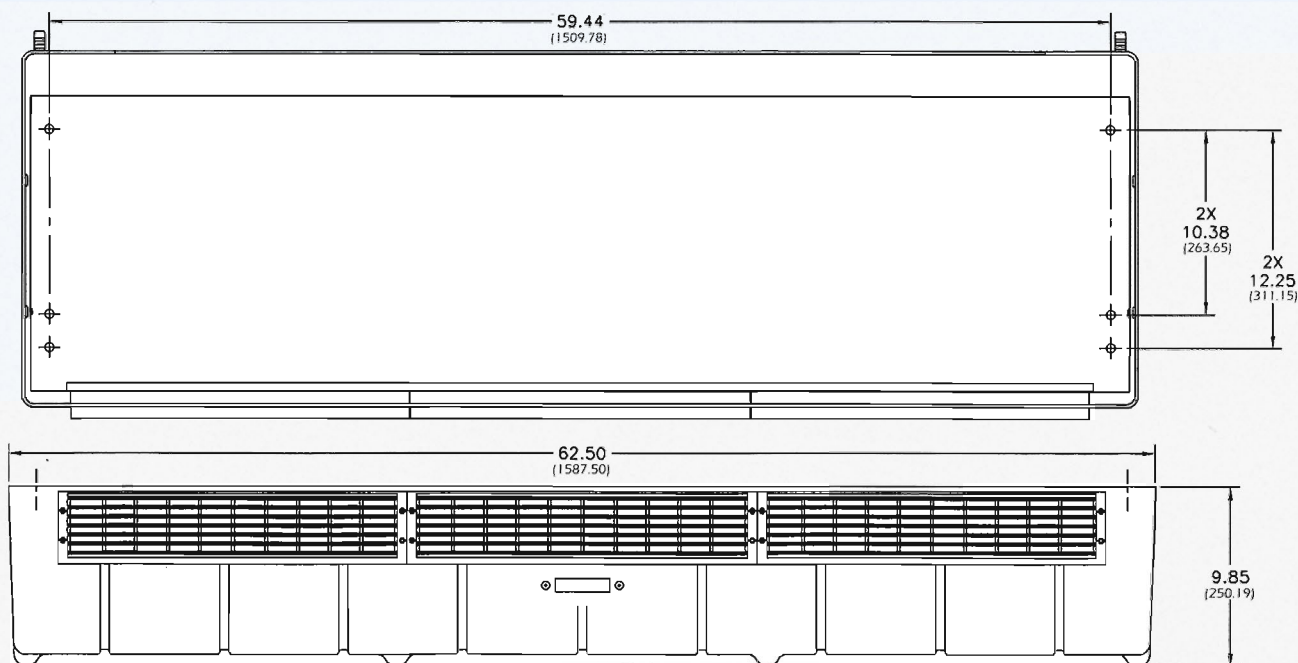


*School & Commercial Bus Climate Control* Design | Manufacture | Install | Service

Trans/Air Manufacturing Corporation is an ISO 9001 registered firm committed to providing world class climate control products and services to the bus and commercial vehicle markets.



# TA77 Evaporator



## General

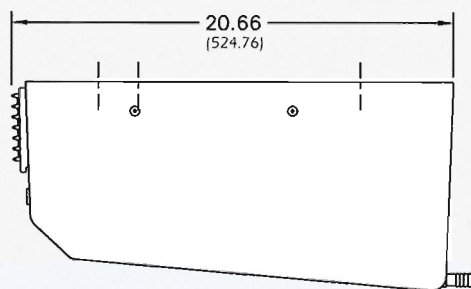
- Freeblow air distribution
- Weight lb (kg): 100 (45)
- Box Size in (mm): 66 x 20 x 16 (1676 x 508 x 406)
- Cube ft³ (m³): 12.22 (.34)

## Cooling Capacity

- BTU/hr: 57,458 (SAE) to 96,826 (IMACA) \*

## Heating Capacity

- BTU/hr: 67,374 (Actual capacity varies based on engine operating temperature and hot water flow rate)



## Cover

- ABS cover
- Integral drain pan
- (3) Multi-directional louvers
- Washable / reusable filter
- (2) 5/8 in ID drain hoses

## Blower Assemblies

- (6) 4.5 in diameter blower wheels
- Amperage draw: 20.0 Amps @ 13.5 Vdc (10.0 Amps @ 27 Vdc)
- Total air flow 2220 ft³/min (3772 m³/hr) @ 0 static
- (3) Double shafted, single speed, permanent magnet motors

## Evaporator Coil

- (2) Coils
- Each coil face area in² (cm²): 204 (1316)
- 3/8 in enhanced copper tubing
- Fins: 0.006 in raised lance, 10 FPI
- (3) Row

## Electrical

- Color coded in fire retardant loom
- Low and high pressure switches

## Expansion Valve

- (2) 4 Ton externally equalized thermostatic type

## Available Options

- Metal cover for use with OEM installation
- Heat coil used with positive isolator valve. Isolator valve and heater hose not included.
- Coil corrosion protection

## Warranty

- 2 year unlimited mileage limited warranty within the continental U.S. and Canada. Terms of Trans/Air's domestic and export warranty policies are available upon request.

\* Actual BTU/hr is dependent on system combination and rating conditions used

- Specifications subject to change without notice
- All measurements in standard (metric)
- Contact Trans/Air for more information



# TECHNICAL DATA SHEET



## COMPONENT SPECIFICATIONS

### ProAir 435 / 445 / 465 Low Profile Heaters

---

Where a smaller height is required and high heat is of utmost importance the 435, 445 and 465 Low Profile auxiliary heaters deliver maximum BTUs with outstanding CFMs.

**Features:** Long Life Motor, 3 Year Warranty, Standard Plug-In on Harness and Filter Option Available

#### 435 / 445 Heater Performance

35,000 Btu/hr 435 Heater and 45,000 Btu/hr 445 Heater Capacity

##### Power Requirement

12 Volts DC

Draw is 5.0 Amps @ 13.5 Volts

##### Air Flow

313 CFM @ 0 static Pressure

##### Weight

8 Lbs. 435 Heater 9 Lbs. 445 Heater

##### Physical Size

W 10.25" x H 7.5" x D 9.5"



#### 465 Heater Performance

65,000 Btu/hr Heating Capacity

##### Power Requirement

12 Volts DC

Draw is 10.0 Amps @ 13.5 Volts

##### Air Flow

640 CFM @ 0 static Pressure

##### Weight

15 Lbs.

##### Physical Size

W 21" x H 7.5" x D 9.5"



---

##### Warranty

ProAir systems are covered by an industry-leading two-year warranty. Complete terms are outlined in our Warranty Statement, Consult ProAir for detailed information.



**America's Largest Offshore Vehicle Lighting Manufacturer.**



## ILL31/32/35 Series

### LED Low Profile Dome Lights

- Low profile dome lights for semi-recess or surface mount
- Durable steel housing and replaceable polycarbonate lens
- Hard wired design includes power and ground wires
- Select from standard diode or SMD LED models

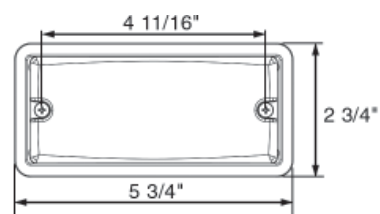


ILL31CB

<b>ILL31CB</b>	10 Standard LEDs, Recess Mount
<b>ILL32CB</b>	10 SMD LEDs, Surface Mount
<b>ILL32CPG</b>	10 SMD LEDs, Surface Mount, .180 Male Bullets
<b>ILL35CB</b>	10 SMD LEDs, Recess Mount

<b>MATERIALS</b>	Polycarbonate lens, plated steel housing
<b>VOLT/AMP</b>	12.8VDC - 0.024A
<b>WT/DIMS</b>	ILL31/35: 0.243 lbs. / 5.75" x 2.75" x .938"
	ILL32: 0.243 lbs. / 5.75" x 2.75" x .75"
<b>WARRANTY</b>	Lifetime LED Warranty

<b>Raw lumen output:</b>	70 lm
<b>Effective lumen output:</b>	53 lm



ILL31/32/35



ILL31/35 - recess mount



ILL32 - surface mount

**LED LIFETIME WARRANTY**  
NO BULBS TO REPLACE EVER!



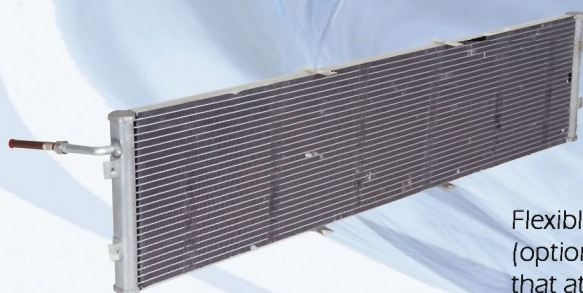
# SMC Condensers

Industry  
exclusive 2  
year, unlimited  
mileage, limited  
warranty

**SMC3L  
& SMC2S  
microchannel  
skirt mounted  
condensers  
that can be  
used with  
almost every  
standard  
Trans/Air  
evaporator/  
compressor  
combination**



Constructed of  
corrosion-resistant,  
powder-coated,  
galvannealed steel

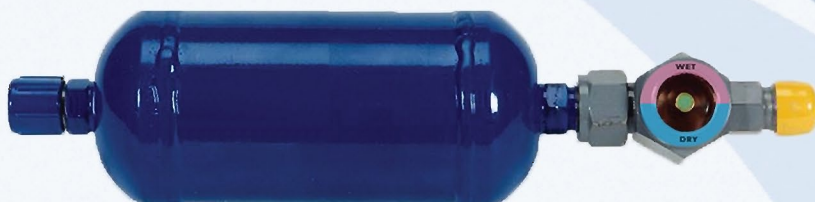


Lightweight  
microchannel coils  
increase condenser efficiency and  
require less refrigerant



Flexible mounting pattern  
(optional channels available  
that attach condenser to  
vehicle stringer in lieu of  
standard floor mounting)

Optional non-powder  
coated screens, stacking  
kits, and winter cover kits



24 cubic inch filter drier with sight glass  
mounted in the rear for easy serviceability



10" weather-proof condenser  
fans provide maximum air flow

*School & Commercial Bus Climate Control* Design | Manufacture | Install | Service

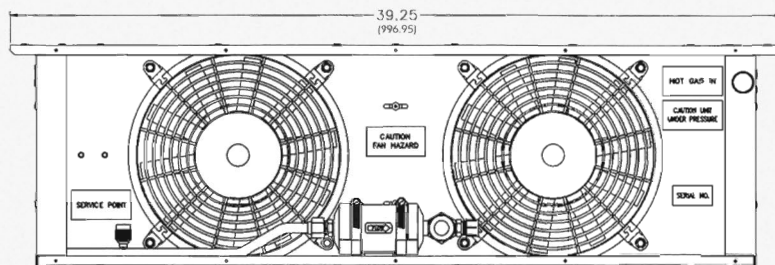
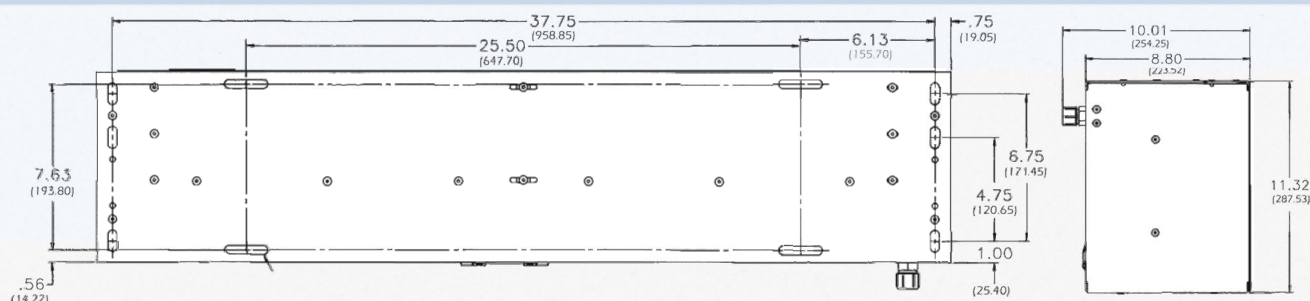
Trans/Air Manufacturing Corporation is an ISO 9001 registered firm committed to providing world class climate control products and services to the bus and commercial vehicle markets.



# SMC Condensers

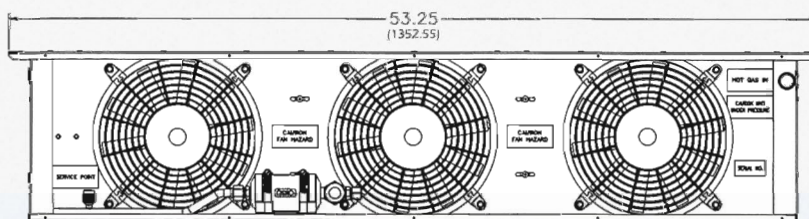
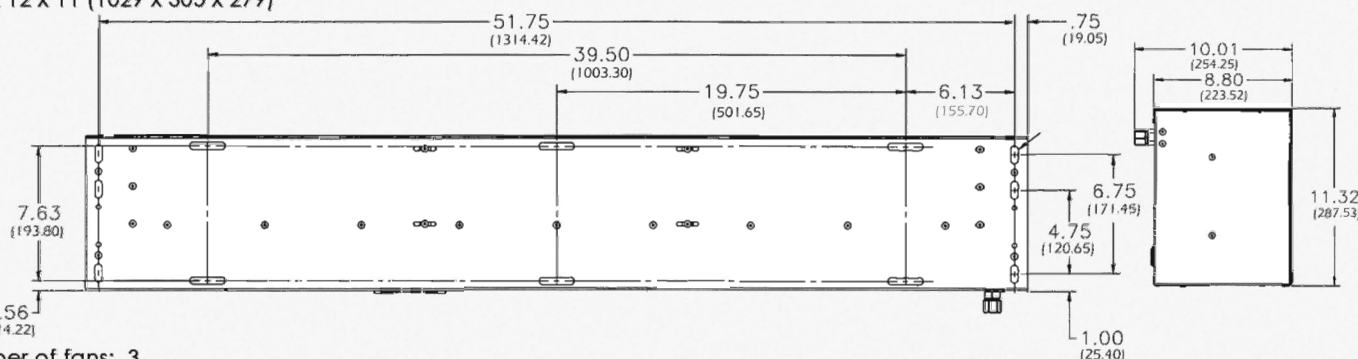
## SMC2S

- Number of fans: 2
- Fan diameter in (mm): 10 (254)
- Fan air flow ft<sup>3</sup>/min (m<sup>3</sup>/hr) @ 0 static: 1830 (3109)
- Amperage: 21.3 @ 13.5 Vdc / 10.7 @ 27 Vdc
- Heat rejection BTU/hr: 48,364 (SAE) to 59,112 (IMACA) \*
- Coil face area in<sup>2</sup> (cm<sup>2</sup>): 363 (2342)
- Unboxed weight lb (kg): 40.6 (18.4)
- Cube ft<sup>3</sup> (m<sup>3</sup>): 3.09 (.09)
- Boxed dimensions in (mm): 40.5 x 12 x 11 (1029 x 305 x 279)



## SMC3L

- Number of fans: 3
- Fan diameter in (mm): 10 (254)
- Fan air flow ft<sup>3</sup>/min (m<sup>3</sup>/hr) @ 0 static: 2745 (4664)
- Amperage: 31 @ 13.5 Vdc / 15.5 @ 27 Vdc
- Heat rejection BTU/hr: 71,325 (SAE) to 87,175 (IMACA) \*
- Coil face area in<sup>2</sup> (cm<sup>2</sup>): 484 (3123)
- Unboxed weight lb (kg): 53.3 (24.2)
- Cube ft<sup>3</sup> (m<sup>3</sup>): 4.16 (.12)
- Boxed dimensions in (mm): 54.5 x 12 x 11 (1386 x 305 x 279)



## General

- Skirt mounted
- 92% flow-through aluminum grill
- Coil fins: 0.008 in thick
- Filter drier: 24 in<sup>3</sup>

## Fan Motor Assembly

- Low profile surface mount
- Closed permanent magnet motor with ball bearings

## Sight Glass

- Moisture indicator
- Visible from outside of vehicle

## Warranty

- 2 year unlimited mileage limited warranty within the continental U.S. and Canada.
- Terms of Trans/Air's domestic and export warranty policies are available upon request.

\* Actual BTU/hr is dependant on system combination and rating conditions used

- Specifications subject to change without notice
- All measurements in standard (metric)
- Contact Trans/Air for more information



# FEATHER WEIGHT

## FOLDAWAY BV & AM STYLES

Freedman Seating gives you the largest selection of Foldaways in the industry. Whether you need space for luggage or wheel chairs, we have the right seat. Easy to install and easier to operate, our Foldaways will provide you with miles and miles of happy riders and drivers. Maybe we should say, "smiles and smiles". Freedman Seating, "Not just seats — seating solutions."



Notch-Back, standard Bench-Back and High-Back are shown.

Not Just Seats



THE FEATHER WEIGHT SERIES BY

**FREEDMAN**

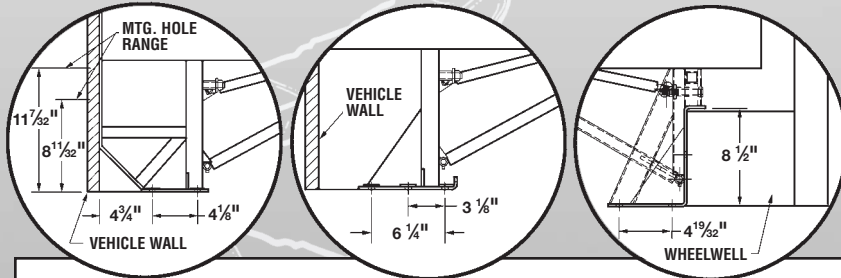
SEATING COMPANY

an ISO 9001:2000 certified company

Seating Solutions™

# FEATHER

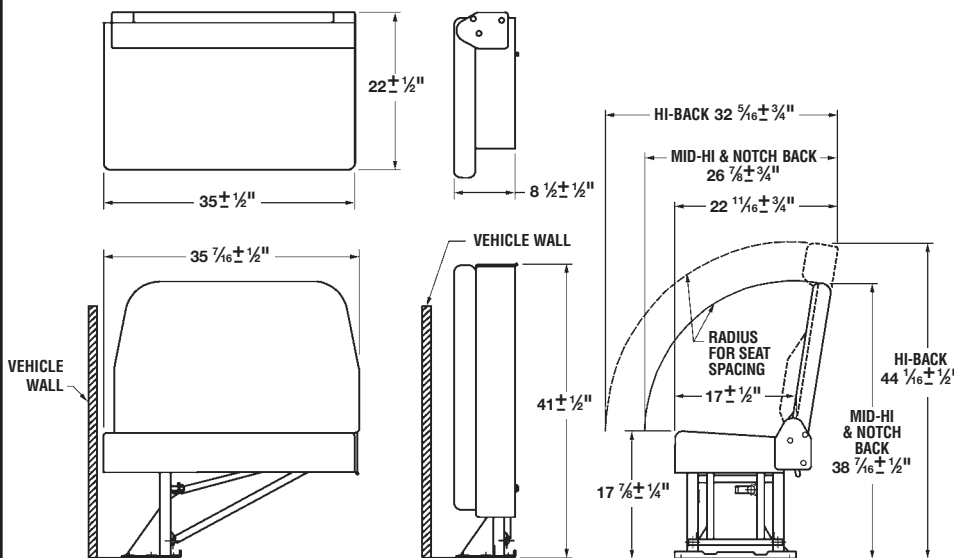
## Foldaway BV & AM STYLES



AM2 Floor/Wall Mount

BV Floor Mount

BVWW3 Floor Mount



Corner Grabs

TDSS with belts

TDSS without belts



Belts not included.

### Standard Features:

- BV Foldaways mount to the vehicle with four bolts to the floor (no wall mount)
- AM Foldaways mount to the vehicle with four bolts to the floor and two to the wall mount
- Seat belt ready (FMVSS 210 compliant with no leg or tether)
- Ultra-thin backrest for added hip-to-knee room and lumbar support
- High quality molded polyurethane seat and back cushions

- Folds up to less than 10" thick when in the stowed position
- Cantilever design provides reduced installation time; no floor cutting for aisle leg and easy vehicle clean up
- Wire mesh grid seat springs for even support
- 2 locking mechanisms to hold seat in stowed position

### Options:

- Single or double seats
- Bench back, notch back or high back
- Wheel well seats
- Wide variety of vinyl's or cloths
- Molded U.S. arms or upholstered arms
- Black or yellow top grabs (not on high backs)
- Black or yellow corner grabs (black only on high back)
- Vertical stitching
- FTA foam
- ABS backs (Notchback only)
- Adjustable headrests (Single and Notchback only)
- Shrouds to cover the Foldaway when stowed
- USR seat belts (Under Seat Retractors)
- CRS-225 hooks and tethers
- TDSS (Tie Down Storage System)

## Not Just Seats



THE FEATHER WEIGHT SERIES BY

**FREEDMAN**  
SEATING COMPANY

an ISO 9001:2000 certified company

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WWW.FREEDMANSEATING.COM  
e-mail: sales@freedmanseat.com

We are constantly updating and improving our seats; therefore we reserve the right to change or modify specifications or materials without notice. All Freedman Seating Company seats meet or exceed FMVS standards.

Seating Solutions™



# FEATHER WEIGHT

**MID-HI SEAT  
"ROCK SOLID"**



## Sustainable Seating Solutions

Freedman Seating Company's Feather Weight seats are designed to be like feathers on a bird: light and airy to satisfy weight restrictions and ensure a smooth ride, yet durable for years of service and low maintenance.

Freedman Seating Feather Weight seats are the most severely tested in the company's history, and meet all applicable federal motor vehicle safety standards for strength and safety (including 210 for seat belts).

Less weight means one thing to bus builders and operators: they can get more passengers per bus.

And when we say more passengers, ***we mean more happy passengers.***



Not Just Seats



Seating Solutions™

THE FEATHER WEIGHT SERIES BY

**FREEDMAN**  
SEATING COMPANY

an ISO 9001:2000 certified company

# FEATHER WEIGHT

## MID-HI SEAT "ROCK SOLID"



### Sustainable Seating Solutions

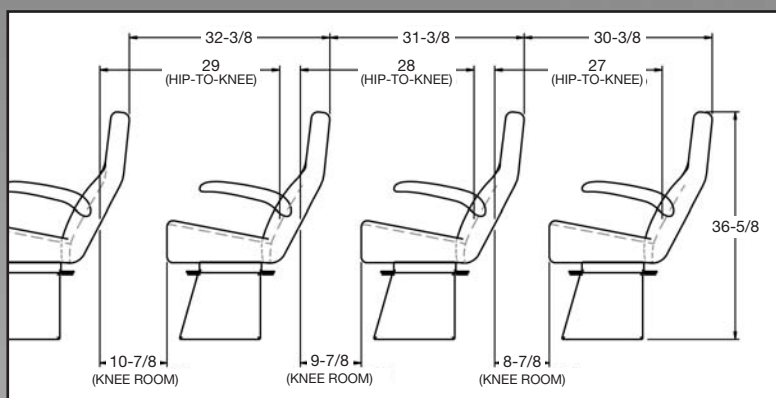
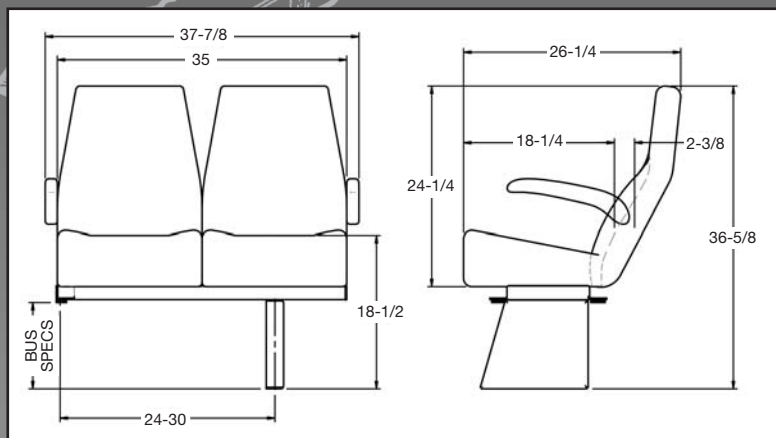
Whether your bus is for tour/charter, para-transit, or shuttle, Feather Weight Mid-Hi works for you. Optional adjustable headrests and reclining back-rests give you luxuries for long journeys, while grab rails and ABS plastic backs provide the function and safety required for shorter trips. The ultra-thin backrest gives outstanding support and creates more hip-to-knee room than any other seat in its class. The steel frame system meets or exceeds all applicable government standards for safety and durability. And, it's light as a feather!

#### Feather Weight Mid-Hi features include:

- An ultra-thin *Knee-Saver* type backrest for added hip-to-knee room and lumbar support
- Molded polyurethane seat and back cushions for comfort and long lasting support
- 17½" wide seat cushions
- 22½" back height off the seat cushion, 37" off the floor
- Wire mesh-grid seat springs for even support
- FMVSS 210 compliance—all *Feather Weight* seats are seat belt ready
- Transit style—rigid backrests (starting weight without options—43 lbs.)
- Touring style—reclining backrests (starting weight without options—47 lbs.)
- Covers that can be removed and replaced easily and without the use of special tools

#### Feather Weight Mid-Hi options include:

- Black molded *U.S. Arms* or upholstered flip-up armrests
- Adjustable headrests
- Black or yellow corner AV grab rails
- Black or yellow top AV grab rails
- ABS plastic backs
- Mesh map pockets
- Vertical stitching
- FTA foam
- Snack trays
- Aluminum folding footrests
- Pillow seat cushions
- Rear row quick disconnect
- Side sliders
- 16", 18" or 19" wide seats available
- Rigid or reclining backrests
- Seat belts
  - Non-retracting seat belts
  - Retracting seat belts
  - USR (Under Seat Retractors)
- S3 Bio-Cushions (Made with vegetable oil)
- A wide variety of cloths and vinyls
- S3 cloths (Made with recycled yarn)



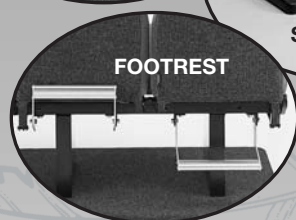
#### OPTIONS



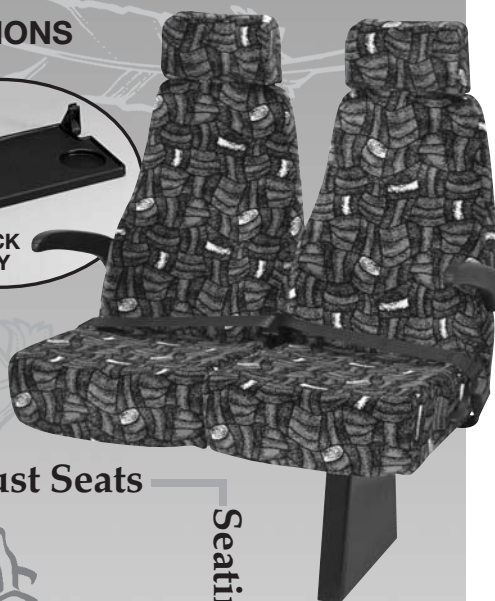
PILLOW SEAT



SNACK TRAY



FOOTREST



Not Just Seats



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SEATING COMPANY

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(773) 524-2440 (800) 443-4540 Fax (773) 252-7450  
e-mail: sales@freedmanseat.com  
WWW.FREEDMANSEATING.COM

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ISO 9001:2000 registered



# FREEDMAN SHIELD DRIVER SEATS

Shield  
Rigid  
Seat



**NOW  
AVAILABLE**

Sport Seat  
Upgrade



Shield  
Recliner  
Seat



LeMans Adjustable Arm



*Sustainable Seating Solutions*  
Freedman Seating Company

**Not Just Seats**



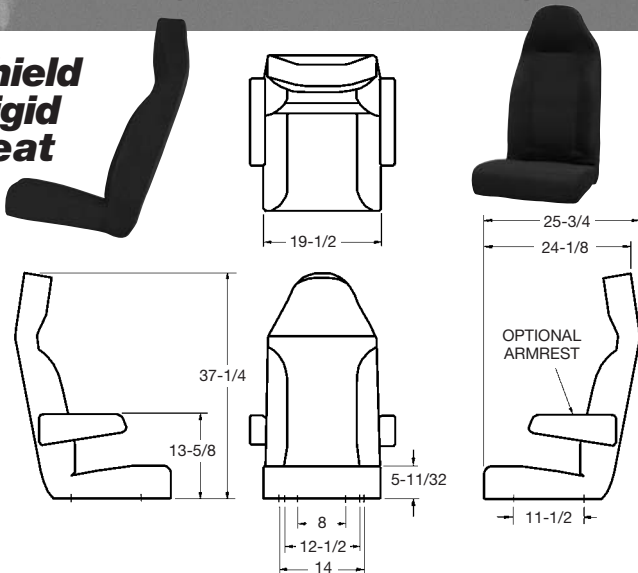
Seating Solutions™

**FREEDMAN**  
SEATING COMPANY

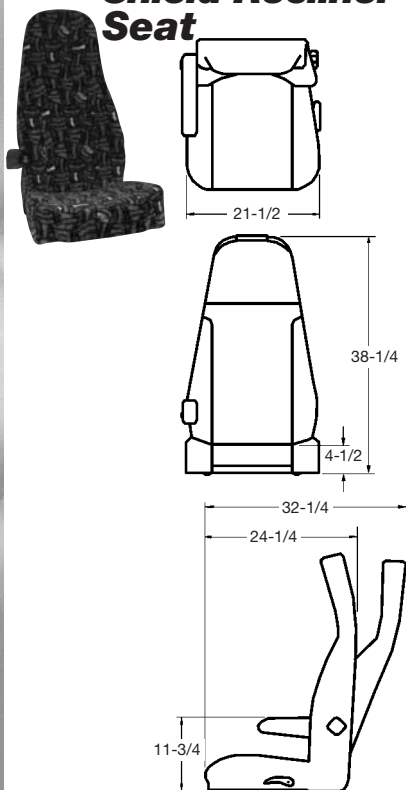


# FREEDMAN SHIELD DRIVER SEATS

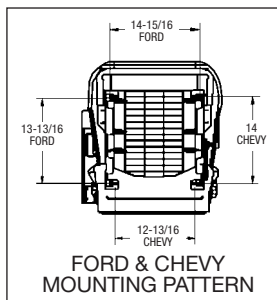
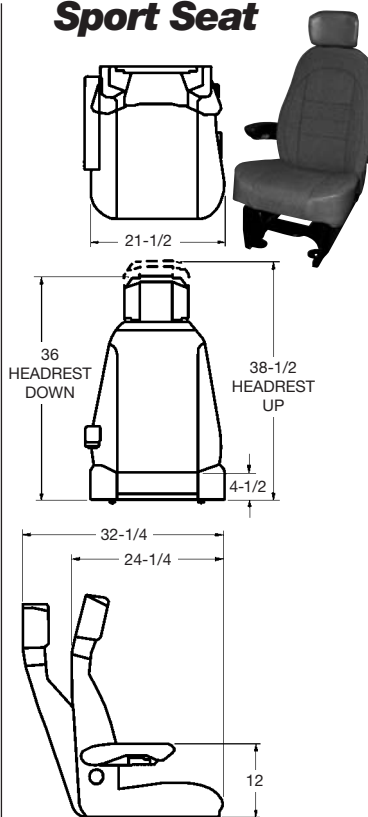
## Shield Rigid Seat



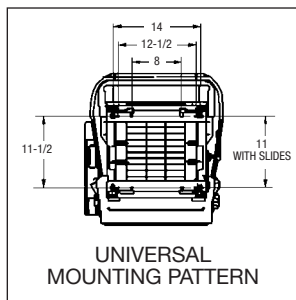
## Shield Recliner Seat



## Sport Seat



FORD & CHEVY MOUNTING PATTERN



UNIVERSAL MOUNTING PATTERN

## MARKETS



DELIVERY TRUCK



BUS



VAN



MARINE



SPECIALTY

We are constantly updating and improving our seats; therefore we reserve the right to change or modify specifications or materials without notice. All Freedman Seating Company seats meet or exceed FMVS standards.

## Shield Rigid Seat

### Standard features:

- Designed and tested to comply with all applicable FMVSS requirements including 202A headrest standard
- Taller and wider headrest with decreased backset
- "Cushier" headrest for dynamic impact headrest absorption
- Automotive grade 4-spring seat flex-o-later for even load support and long life
- J-clip upholstery fastening for quick change out with no special tools
- High quality molded polyurethane seat and back cushions
- Universal mounting holes to fit Freedman Seating pedestals and most aftermarket bases

### Rigid Seat optional features:

- Flip arms: US Arm, AMA upholstered or wide upholstered
- Mesh map pocket
- Vertical stitching
- Wide array of fabrics and vinyls
- 4-position adjustable lumbar support
- S3 Bio Cushions
- Fore/Aft slide tracks

## Shield Recliner and Sport Seats

### Standard features:

- Designed and tested to comply with all applicable FMVSS requirements including 202A headrest standard
- Taller and wider headrest with decreased backset
- "Cushier" headrest for dynamic impact headrest absorption
- Mesh map pocket
- Automotive grade 4-spring seat flex-o-later for even load support and long life
- J-clip upholstery fastening for quick change out with no special tools
- High quality molded polyurethane seat and back cushions

### Recliner Seat additional standard features:

- 4-position adjustable lumbar-LH lever (RH lever on copilot)
- RH Shield arm
- Heavy duty recliner mechanism
- Mounting brackets to fit Ford E-Series and Chevy cutaway seat delete bases

### Recliner Seat optional features:

- Vertical stitching (not for Sport)
- Wide array of fabrics and vinyls
- FTA foam
- S3 Bio Cushions
- Universal mounting kit to fit Freedman Seating pedestals and aftermarket bases
- Fore/Aft slide tracks (not for Ford or Chevy seats), required for universal mounting

### Sport Seat additional standard features:

- Infinitely adjustable 4-way lumbar (up/down and in/out)
- RH LeMans arm



Sustainable Seating Solutions  
Freedman Seating Company

Not Just Seats



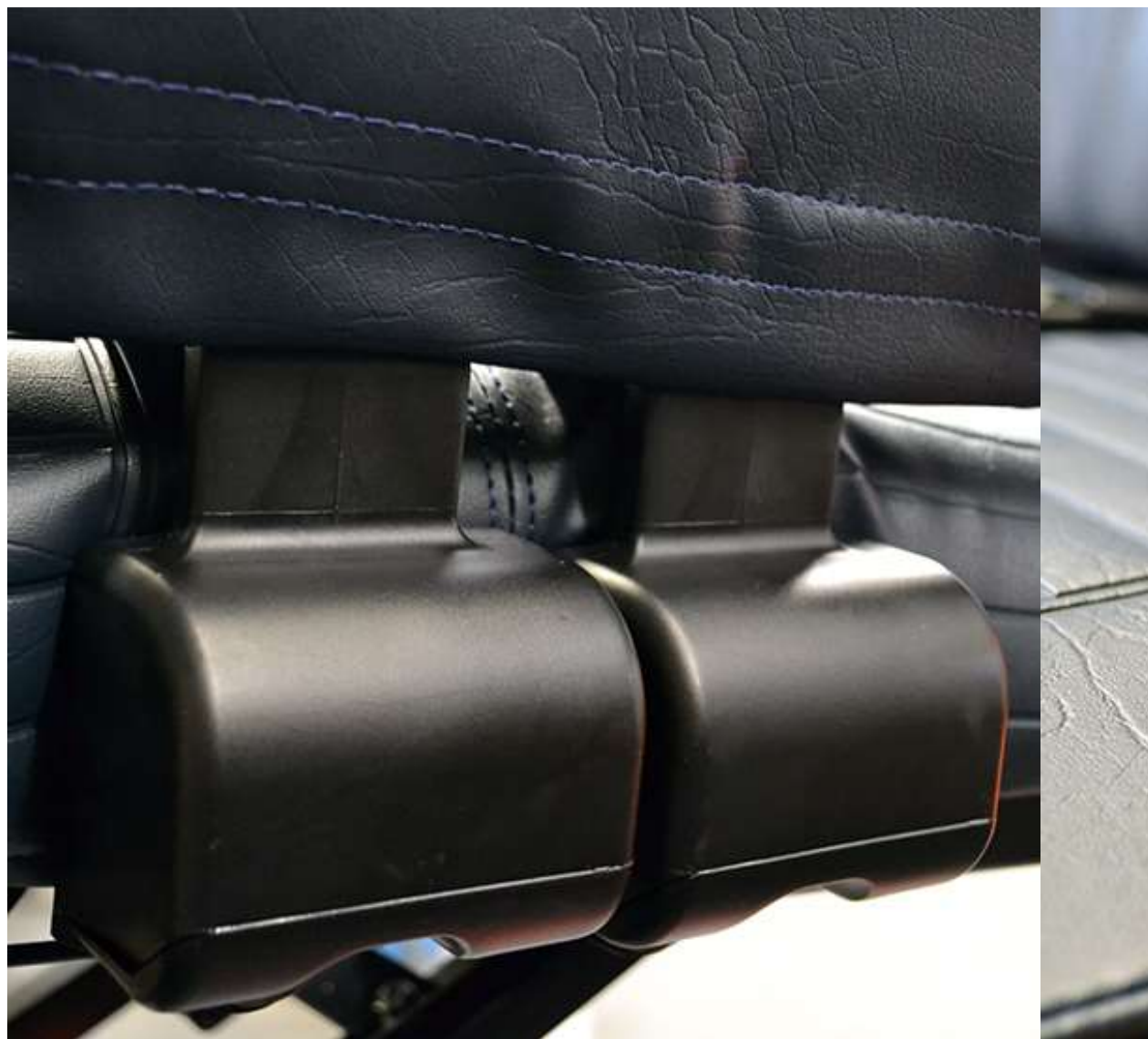
Seating Solutions™

**FREEDMAN**  
SEATING COMPANY

4545 W. Augusta Blvd., Chicago, IL 60651  
(773) 524-2440 (800) 443-4540 Fax (773) 252-7450  
WWW.FREEDMANSEATING.COM  
e-mail: sales@freedmanseat.com



**Product Line:** Options/Accessories



HOME / SEAT ITEMS / OPTIONS/ACCESSORIES /

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opt-out if you wish. [Cookie settings](#) [ACCEPT](#)







**FREEDMAN®**  
SEATING COMPANY

PROVEN SAFE FOR PASSENGERS & EASY TO MAINTAIN

The solution to your seat belt needs. Our system places the seat belts right where you expect them. No more belts falling to the floor, safety concerns, or maintenance hassles.

[FMVSS/CMVSS Notice](#)

California residents [see Prop 65 WARNINGS](#).

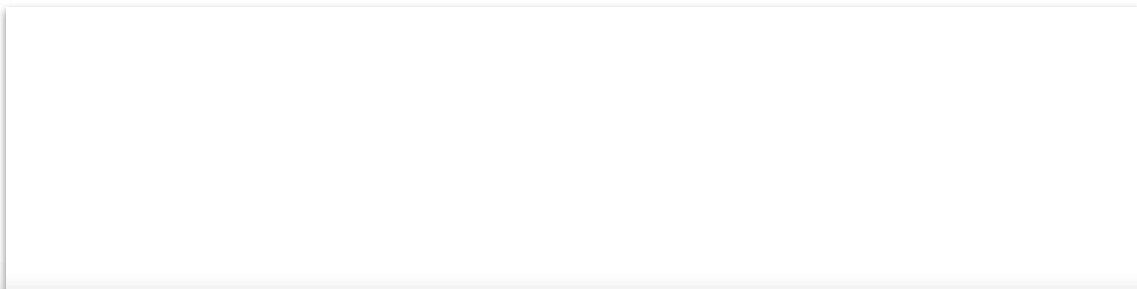
## Standard Features

- Designed to be FMVSS 210 compliant
- Works on forward-facing and existing Feather Weight frames
- Light weight and durable
- All belts are permanently kept in the correct position
- Belts stay off the floor

## Find Your Local Representative



## RELATED SEATS & PRODUCTS



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**WARRANTY:**

Freedman Seating Company warrants to the original buyer that its Passenger Seats are free from defects in material and workmanship for the following components:

- Metal Components – Five (5) years
- Plastic Components – Three (3) years
- Moving Components – Three (3) years
- Gas Shock Components – One (1) year
- Upholstered Components (foam) – Two (2) years

Cover Warranty is for defects in the material or sewing and is limited to replacement covers. It does not include labor:

- One (1) year for Level #1 in-stock FSC material and perforated vinyl
- Two (2) year for Level #3 in-stock FSC material and higher
- No warranty for COM (Customer Own/ supplied Material)

The warranty period begins at time of sales to customer or 180 days after shipment from the Freedman Seating Company's factory to the customer, whichever occurs first.

**NON-PRORATED REPLACEMENT:**

In the event that a warranty-covered failure should occur within the warranty period, Freedman Seating Company will repair or replace the seat without charge and without prorating, at Freedman Seating Company's option. This is the sole and exclusive remedy for breach of any warranty. Any replacement seat or part is only covered by this warranty for the remainder of warranty period applicable to the original seat.

**EXCLUSIONS:**

This warranty specifically excludes foam, upholstery material, belts, and items exposed to normal wear and tear such as metal finish and paint and does not apply to any seat that is damaged as result of accident, derailment, improper installation, structural defects, intentional damage, abuse, vandalism, negligence, misuse, improper operating conditions, lack of maintenance, or extreme natural phenomena. Seats exposed to toxic or corrosive materials are excluded from this warranty. Seats exposed to cleaning solutions that are not listed on the Freedman Seating Company Cleaning Guide are excluded from this warranty. This warranty is provided directly to the purchaser only and does not extend to any subsequent party and is solely for the Freedman Seating Company product as it is originally manufactured.

**INCIDENTAL, CONSEQUENTIAL DAMAGES, & LIMITATIONS:**

This warranty shall be in lieu of any other warranty or terms, expressed warranty or terms, expressed or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. The purchaser's sole and exclusive remedy against Freedman Seating Company shall be for the repair and replacement of the defective product as provided herein. No other remedy; including but not limited to incidental or consequential damages for lost profits, lost sales, injury to person or property, shipping, freight, installation, removal, or any other incidental or consequential loss shall be available to the purchaser.

**NOTIFICATION:**

All reports, claims, or notices required by the warranty to be provided to Freedman Seating Company must be in writing and delivered to: Attention – Freedman Seating Company, Warranty Claim Department, 4545 W. Augusta Blvd., Chicago, IL 60630. Repairs being claimed for warranty must be sent to Freedman Seating Company for prior approval and warranty acceptance before any warranty claims can be made. Parts are being claimed for warranty must be sent to Freedman Seating Company for prior approval and warranty acceptance before any warranty claims can be made.

**INSPECTION AND VERIFICATION:**

The owner must provide access to the failed seat so that Freedman Seating Company's authorized representative can perform an onsite inspection. Alternatively, Freedman Seating Company may ask the owner to ship the failed seat to Freedman Seating Company's laboratory for inspection. Within 30 days of the inspection, either on-site or in the laboratory, Freedman Seating Company will render an opinion as to whether or not the claimed failure is covered by the warranty.

**GENERAL MAINTENANCE:**

Freedman Seating Company provides the proper maintenance instructions, as well as recommended service intervals with each seat. Warranty is contingent upon documented performance of recommended maintenance and service. All replacement parts should be recommended or authorized Freedman Seating Company components. Failure to purchase proper components will null and void the warranty.

**DESIGN:**

Freedman Seating Company reserves the right to modify parts and design specifications without notice as long as the seats meet general specifications, unless otherwise committed per contract. In case further non-conforming changes have to be incorporated, Freedman Seating Company will submit such changes to customer for prior approval.

**OTHER:**

The terms and warranty are contingent upon customers meeting agreed upon payment terms as specified in Freedman Seating Company proposals. Terms and warranty supersede any other terms including but not limited to customer terms printed on the back of Purchase Orders, listed on websites, or other sources from customers.

# FEATHER WEIGHT

## HIGH-BACK SEAT

Freedman Seating Company's Feather Weight seats are designed to be like feathers on a bird: light and airy to satisfy weight restrictions and ensure a smooth ride, yet durable for years of service and low maintenance.

Freedman Seating Feather Weight seats are the most severely tested in the company's history, and meet all applicable federal motor vehicle safety standards for strength and safety (including 210 for seat belts). Less weight means one thing to bus builders and operators: they can get more passengers per bus. And when we say more passengers, ***we mean more happy passengers.***



Not Just Seats



THE FEATHER WEIGHT SERIES BY

**FREEDMAN**  
SEATING COMPANY

Seating Solutions™

# FEATHER WEIGHT

## HIGH-BACK SEAT

Cross-country or cross-town, the Freedman Feather Weight High-Back gets you there in safety and comfort. The headrest actually cradles your head, and provides unrestricted viewing. The ultra-thin backrest gives out-standing support and creates more hip-to-knee room than any other seat in its class. The steel frame system meets or exceeds all applicable government standards for safety and durability. And, it's light as a feather!

### Feather Weight High-Back features include:

- An ultra-thin *Knee-Saver* type backrest for added hip-to-knee room and lumbar support
- Molded polyurethane seat and back cushions for comfort and long lasting support
- 17½" wide seat cushions
- 27¼" back height off the seat cushion, 42¼" off the floor
- Wire mesh-grid seat springs for even support
- FMVSS 210 compliance—all *Feather Weight* seats are seat belt ready
- Covers that can be removed and replaced easily and without the use of special tools

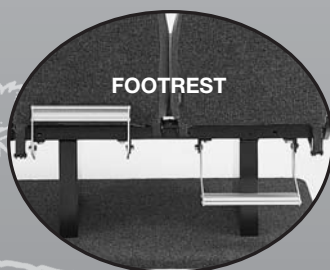
### Feather Weight High-Back options include:

- Black molded U.S. Arms or upholstered flip-up armrests
- Mesh map pockets
- Vertical stitching
- FTA foam
- Snack trays
- Aluminum folding footrests
- Pillow seat cushions
- Pillow headrests
- Side grab rail
- U.S.R.—Under Seat Retractors
- 16" or 19" wide seats available
- Rear row quick disconnect
- CRS-225 hooks and tethers
- Side sliders
- Cup holders
- Seat belt loops

### OPTIONS



PILLOW SEAT



FOOTREST



PILLOW HEADREST

GRAB RAIL



SNACK TRAY

Not Just Seats



Seating Solutions™

THE FEATHER WEIGHT SERIES BY

**FREEDMAN**  
SEATING COMPANY

4545 W. Augusta Blvd., Chicago, IL 60651  
(773) 524-2440 (800) 443-4540 Fax: (773) 252-7450  
WWW.FREEDMANSEATING.COM  
e-mail: sales@freedmanseat.com

We are constantly updating and improving our seats; therefore we reserve the right to change or modify specifications or materials without notice. All Freedman Seating Company seats meet or exceed FMVSS standards.



# QRT-360<sup>®</sup>



PREMIUM  
HEAVY-DUTY  
WHEELCHAIR RETRACTOR



# QRT-360<sup>®</sup>

## Introducing the QRT-3 SERIES Wheelchair and Occupant Securement System

The first 4-point, heavy duty, fully automatic retractable tie-downs **built to withstand the higher loads of the WC18 standard** and be compatible with WC19 wheelchairs



Meets all requirements of the newest WC18 standards.  
Also compatible with WC19 Wheelchairs.

## WC18/WC19 at a Glance

As WC19 wheelchairs become increasingly popular, new higher standards have been recommended for wheelchair tie-downs to be fully compatible.

The revised RESNA WC18 standard for Wheelchair Tie-downs and Occupant Restraint Systems (WTORS) was instituted in 2015 and is now in effect.

The most significant implication of the revised standard is that wheelchair tie-downs must be stronger. WC19 covers the design and testing of wheelchairs for use in passenger transportation, and it brings about much needed passenger protection as well as some challenges for WTORS manufacturers.

These crash tested wheelchairs will feature lap belts that are integrally mounted onto the wheelchair frame, as opposed to relying on traditional WTORS equipment where the passenger belts are mounted separately. During a collision, this new dynamic produces loads on the WTORS up to 60% higher.



# An All-New Design from the Floor Up

Stronger than any previous retractor, QRT-360 utilizes innovative energy management designs and material technologies to deliver the system's full strength for maximum load capacity.

QRT-360 retractors achieve a surrogate wheelchair rating that meets the requirements of WC18 with an energy-absorbing steel frame, new high strength 58mm webbing with fine-adjust self tensioning, and 25 high-strength teeth. A re-engineered Positive Locking Interface contributes to the system's ability to secure extremely heavy loads.



## A More Secure Connection, Every Time

With Q'STRAIN J-hook attachments, operators can achieve a secure attachment on virtually any wheelchair. An updated Positive Lock Indicator provides the operator with clear and certain visual confirmation that the retractor is locked and the vehicle is ready to go. Our patented design eliminates the guesswork when passenger safety is involved.

## Automatic Tightening Increases Safety

Q'STRAIN's industry-leading self-tensioning system automatically tightens the straps to eliminate any slack created by small wheelchair movements. The belts continue to tighten during low-g vehicle movements, which reduce the potential for dangerous excursions in the event of a collision.

## Automatic Release Makes it Easy to Use

Securement is simplified by the compact and ergonomically designed knob. Thanks to Q'STRAIN auto-release, operators and attendants can pull and secure the wheelchair hook in one step without having to press a release button.

## Compatible with Most Vehicles and Chairs

Like other Q'STRAIN systems, the QRT-360 is compatible with the widest variety of wheelchairs and scooters.





[WWW.QSTRAINT.COM/QRT360](http://WWW.QSTRAINT.COM/QRT360)

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Fax: +61 7 3892 1819  
Email: [info@tramanco.com.au](mailto:info@tramanco.com.au)



# TARABUS

## TARABUS NT Specification Sheet

### Product description and composition:

- The flooring shall be specially designed for buses.
- The flooring shall be flexible PVC flooring in 2.25 mm thickness, composed of a compact plasticized wear layer.
- The wear layer shall contain inlaid silicon carbide particles to improve slip resistance.
- The wear layer shall not contain aluminium oxide particles or quartz granules to prevent from maintenance and cleaning issues.
- The wear layer shall not contain fillers (fillers < 5phr).
- The design shall be inlaid through the whole thickness of the wear layer.
- The intermediate layer of the flooring shall be made of a glass fibre grid, providing outstanding dimensional stability:  $\leq 0.2\%$  according to EN 434.
- The flooring shall have a special textile backing designed for public transport vehicles, to enable bonding with acrylic glues onto plywood substrates or plywood with phenolic film substrates or aluminium.
- The flooring shall not crack and no white line shall appear when bended by 180 degrees.
- The welding rods shall be manufactured by the flooring manufacturer to enable a perfect weld.

### Environment:

- The flooring shall be free from heavy metals (Lead, Cadmium, Barium, Tin, Chromium...).
- The flooring shall be free from DEHP plasticizer.
- The manufacturer of the floor covering must be in possession of a valid ISO 14001 certificate.

### Technical characteristics:

- Fire class: the flooring material shall conform to the European Directive 95/28/EC
- Fire class: the flooring material shall conform to the FMVSS/CMVSS 302
- Fire class: the flooring shall have been tested to UTAC ST 18502/1 (Type A) and ISO 3795/76 (0mm/mn)
- Fire class: the flooring shall obtain CRF > 0.50 W/cm<sup>2</sup> when tested according to NFPA 253 – ASTM E648
- The manufacturer of the floor covering must be in possession of a valid quality systems certificate, showing compliance with ISO 9001.

### Installation:

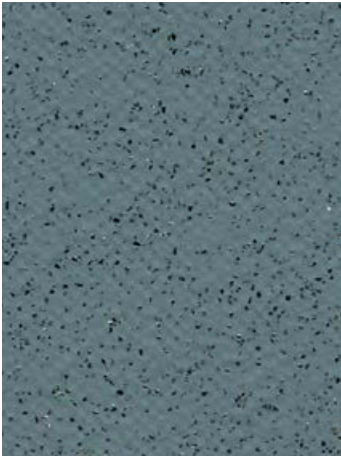
- All joints must be welded using a hot welding gun and PVC welding rods. To ensure the right watertightness of the flooring system, no sealant shall be used between 2 flooring sheets.

# SIRIUS



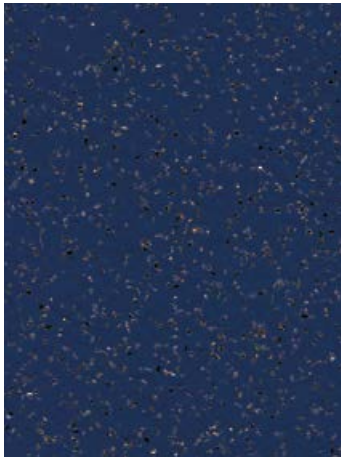
6768 Griffon

NT



6782 Dune

NT



6451 Corsaire

NT



6727 Anthracite

NT



6801 Graphite

NT

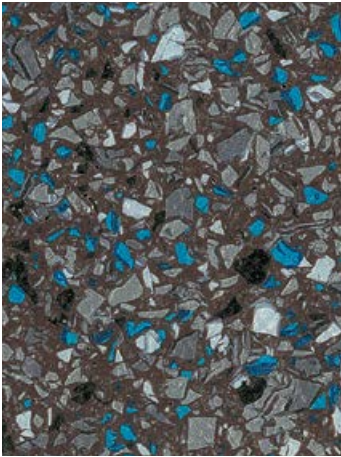
# APOLLO



4776 Masan

MK

NT



4479 Kilimanjaro

MK

NT

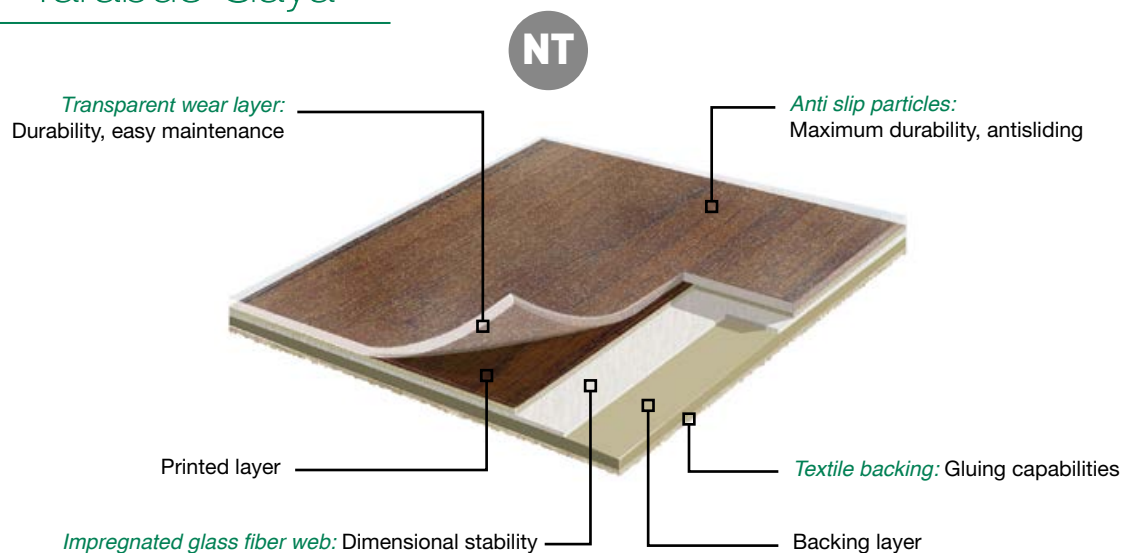


4517 Fuji

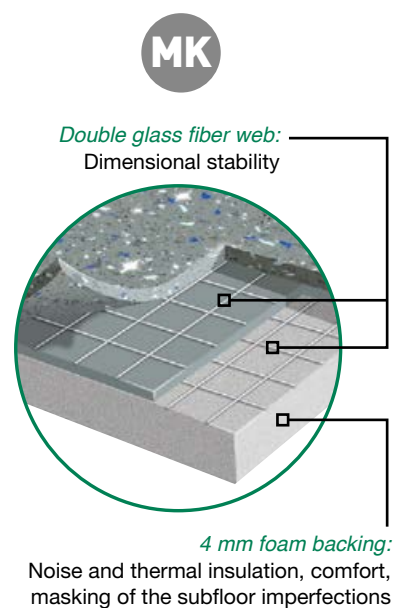
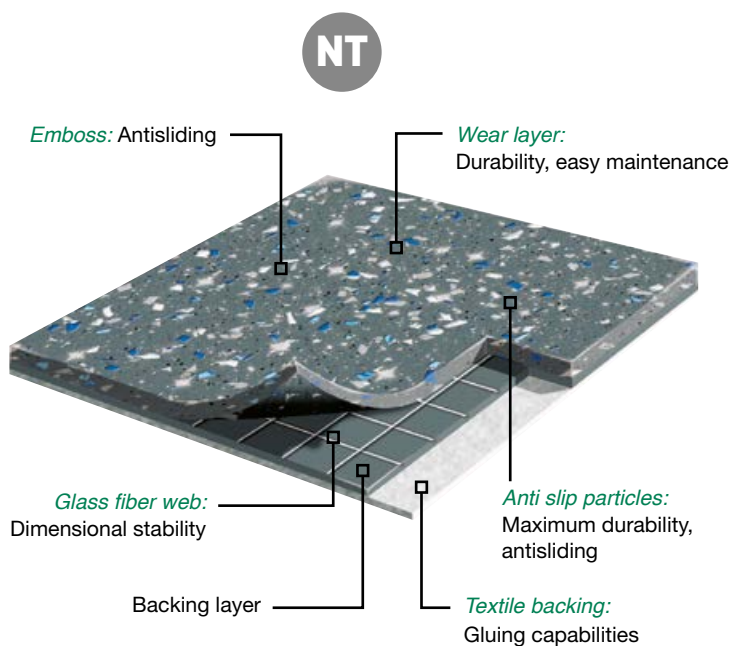
MK

NT

## ► Tarabus Gaya

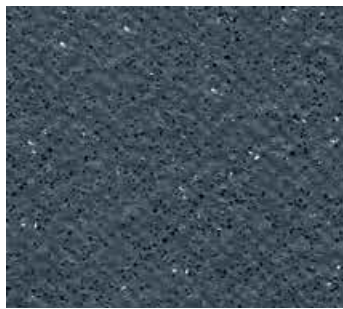


## ► Tarabus standard





## ► Safebus X'tra



6822 Dark Grey

NT

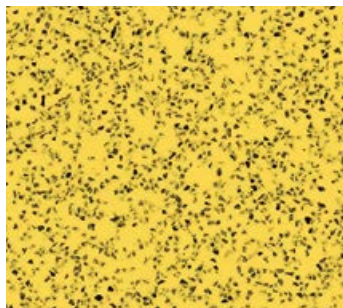
## ► Venus



6727 Anthracite

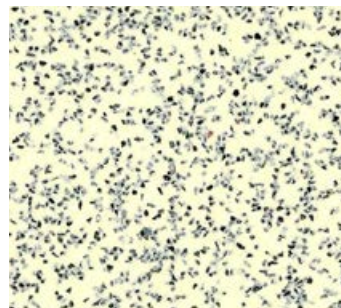
NT

## ► Safebus



6602 Caledonia

NT



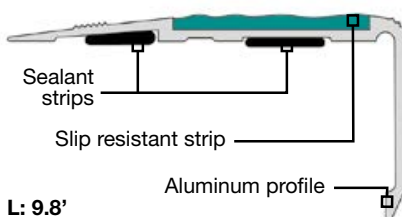
6203 Borneo

MK

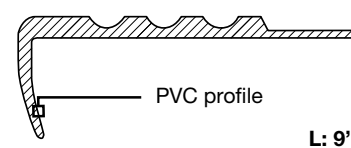
NT



## ► Stepbus



## ► Step nosing



Yellow

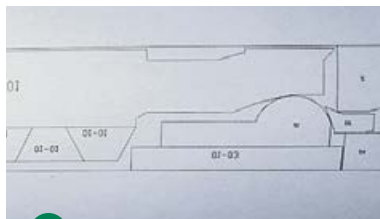


White



## KIT System

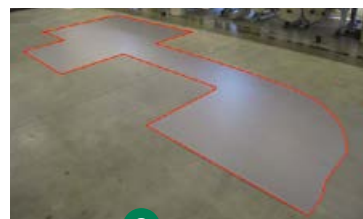
Pre-cut and pre-welded **TARABUS** floor covering system according to your drawings



**1** Send us your floor plan layout



**2** We cut with high precision



**3** ...and pre-weld if required

## TARABUS Self-Adhesive



**TARABUS** floor covering with self-adhesive backing

- > Environmental friendly bonding
- > Ready to bond
- > No curing time
- > Safer work conditions
- > Easy to use

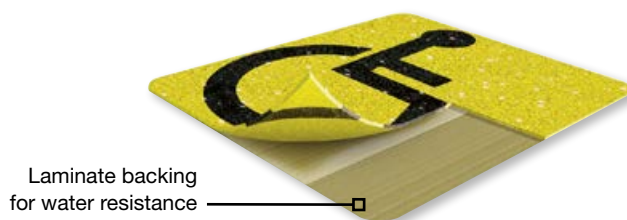
## TIME SAVING

## ► TARABUS LOGO

- Location for person with reduced mobility
- Advertising & Promotion



Almost unlimited possibilities of water-resistant logos



Laminate backing for water resistance



## Warranty Registration

TO REGISTER YOUR PRODUCT WARRANTY under the terms of Gerflor's North America Limited Product Warranty, please complete the form below and mail to:

**Gerflor USA Inc**  
595 Supreme Dr  
Bensenville 60106 IL USA.

I acknowledge having received and read GERFLOR's technical documents and specifications concerning the product warranty:

Product Type: \_\_\_\_\_

Roll numbers & Quantity (sq.yds/m<sup>2</sup>): \_\_\_\_\_

Installation Date: \_\_\_\_\_

Transit Authority: \_\_\_\_\_

Address: \_\_\_\_\_

State/Prov: \_\_\_\_\_ Zip/Postal Code: \_\_\_\_\_

OEM: \_\_\_\_\_

Address: \_\_\_\_\_

State/Prov: \_\_\_\_\_ Zip/Postal Code: \_\_\_\_\_

Represented by: \_\_\_\_\_

Signature: \_\_\_\_\_

## TARABUS PRODUCT WARRANTY



**TARABUS**  
TREND BOOK



## TARABUS FLOORCOVERINGS LIMITED WARRANTY AGREEMENT

### Warranty Terms and Conditions

GERFLOR, as a manufacturer, expressly warrants that TARABUS floorcoverings for buses and coaches are conform to the technical data sheet in force at the time of delivery.

GERFLOR further expressly warrants that the wear layer of TARABUS floorcoverings shall be free from defects in material for **12 years (twelve years)** from the date of sale, provided such floorcoverings are exclusively subject to normal use and service, and are installed and maintained in accordance exactly with GERFLOR's recommendations that the buyer declares to be aware of.

The wear layer consists of the material above the glass fiber web in the floorcovering. GERFLOR expressly warrants that the glass fiber web will not appear in the floorcovering for **12 years (twelve years)** from the date of sale.

This entire warranty will become null and void if conditions of the subflooring and method of installation do not conform exactly to GERFLOR's specifications.

This entire warranty does not cover damage caused, in whole or in part, by conditions beyond the control of GERFLOR, including but not limited to:

- Use for which material is not designated.
- Fire, explosion, or natural disasters.
- Faulty installation
- Casualties
- Ordinary wear and tear
- Abuse
- Faulty design or construction of the vehicles.
- Failure of the adhesive to adhere to the subfloor because of presence of moisture.
- Fault in the subfloor.
- Failure of the welding



- Uneven wear of sections of the floorcovering.
- Alteration of the initial appearance of the floorcovering, particularly in high traffic areas exposed to extreme heavy wear.
- Damage caused by negligent or improper maintenance procedures and other causes not specified but beyond the control of GERFLOR.
- Fading or discoloration from sunlight or heat.
- Mechanical damages, burns, chemical soiling or damage due to clamp or inadequate cleaning, not recommended by GERFLOR.

The presence of moisture between the TARABUS and the subfloor shall be considered proof of subfloor failure or faulty design or construction.

This warranty will be applied only if the product is admitted to be the only cause of disorder.

The sole and exclusive remedy against GERFLOR arising from the purchase or use of TARABUS is limited to supply of material in replacement of the sole defective part of material (after examination, verification and approval by GERFLOR) with material of equivalent quality –(colour shade between brand new material and existing one will be accepted by the owner)-. All other compensation of whatever nature will be excluded.

If the claim is accepted by GERFLOR, with respect to the warranty of the wear layer, for the first 2 (two) years from the date of sale, GERFLOR will supply the material, in replacement of defective one, free of charge. More than 2 (two) years from the date of sale, until the expiration of this express warranty of the wear layer, a depreciation of 7% (seven per cent) per year of the cost of supplied material will apply.

### WARRANTY AND LIABILITY LIMITS

THE ABOVE EXPRESSED MANUFACTURER'S WARRANTY SHALL BE THE EXCLUSIVE WARRANTY AND LIMITED TO THE QUALITY OF THE PRODUCT, AND GERFLOR MAKES NO OTHER WARRANTIES. GERFLOR EXPRESSLY DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE.

IT IS AGREED THAT GERFLOR SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, including but not limited to, loss of income, loss of use, damage to other property, the cost of removing and reinstalling TARABUS floorcoverings, attorney's fees, and any liability you may have with respect to any other person.



## TIME LIMIT FOR PLACING A CLAIM

To be admissible, all claims by means of this warranty contract must be carried out by **registered letter with return receipt** addressed to GERFLOR, at the address indicated at the top of this warranty contract, **accompanied by the purchase invoice** for the Product, within THIRTY DAYS following finding of irregularities and within the aforementioned warranty contract time limit. If any clauses of this Warranty Agreement conflicted with the law or a given jurisdiction, only said clause would be considered inapplicable, the remaining text of the Agreement remaining unaffected.

This Limited Warranty shall be governed and construed in accordance with the laws of the State of Illinois without regard to any choice of law principles: All disputes that may arise between You and GERFLOR relating in any way to this Limited Warranty Agreement, to the extent such disputes cannot be resolved by negotiation between You and GERFLOR, shall be decided by arbitration carried out in accordance with the Federal Arbitration Act and the Commercial Arbitration Rules of the American Arbitration Association. In the event of such a dispute, arbitration may be initiated by a request for arbitration by either party hereto addressed to the other party, and shall be completed within sixty (60) days of such request unless extended because of unavailability of an arbitrator or other events beyond the control either party. The arbitrator shall be chosen by mutual agreement of the parties and, in the event the parties cannot so agree, either party may file a written application to have the arbitrator designated by the American Arbitration Association. The arbitration proceeding shall take place in Chicago, Illinois or such other location as the parties shall agree and shall be conducted in accordance with the Commercial Arbitration "Expedited" Rules of the American Arbitration Association. The arbitrator shall have all powers necessary to determine the issues presented, including without limitation, but subject to the terms of this Limited Warranty, any damages. The decision of the arbitrator shall be final and conclusive, both as to costs and the merits, and the parties agree that they shall be bound by this decision.







## Q8-6326-A1

### Description

Retractable Lap & Shoulder Belt Combination Integrated Combination Belt with triangular fittings to attach lap belt to stud on rear wheelchair tie-down retract assemblies.

### Product Associations

Occupant Securements

### Includes:

(1) Q8-6323 Lap & Shoulder Belt Combo

(1) Q8-6340 Lap Belt Extension

---

## TRANSIGN®

YOUR DESTINATION BEGINS HERE



The LED Destinator® Series - perfect for fleets of all types - is available in a variety of sizes and colors to fit your installation and display needs. These versatile and highly adaptive signs offer full integration into Destination, Route, and Next Stop announcement services, always keeping your customers pointed towards their next destination.

**STANDARD FEATURES**

- Destination Messages
- Next Stop Announcements
- Public Relations Messaging
- Scrolling/Flashing/Stacked Messages

**SOFTWARE AND PROGRAMMING**

Our signs and control modules are pre-programmed and include FREE software. Advanced controllers are available for J1708/J1587 system integration and Hands-Free operation, ensuring the safest and most reliable performance for any fleet.

**AVAILABLE ADVANCED FEATURES INCLUDE:**

- Automated GPS message progression
- Hands-Free operation for safety
- Voice Announcements
- J1708/J1587 integration compatible
- Automatic brightness control
- Basic programming software included (USB)
- Maintenance free- ZERO cost of ownership
- Many OCU options to suit your needs

**BUY AMERICA - MADE IN U.S.A.**

Using the highest quality parts, our LED Destinator® Signs are proudly made in Detroit, Michigan USA in full compliance with the Buy America Act.

**LED DESTINATOR™ WARRANTY INFO**

With a lifetime warranty that outlasts the lifetime of most vehicles (100,000 hours at full brightness), our signs will exceed your expectations in reliability and performance.

**ABOUT TRANSIGN**

Established in 1959, Transign is a leading provider of high-quality signage for the transit industry. We remain committed to providing world-class U.S. based customer service and technical support.

Transign®, 281 Collier Road, Auburn Hills, Michigan 48326  
Toll Free: 855.535.7446 | Main: 248.623.6400 | Fax: 248.623.2930  
www.transignllc.com

## LED Destinator® Electronic Signs - Dimensions

Signs	Pixel Count H x W (pixels)	Display H x W (in)	Enclosure H x W x D (in)
LD16160	16 x 160	6 1/2 x 63 1/8	9 1/2 x 64 5/8 x 2 3/8
LD16128	16 x 128	6 1/2 x 50 1/2	9 1/2 x 52 x 2 3/8
LD16112	16 x 112	6 1/2 x 44 1/8	9 1/2 x 45 3/4 x 2 3/8
LD1696	16 x 96	6 1/2 x 37 7/8	9 1/2 x 39 3/8 x 2 3/8
LD1680	16 x 80	6 1/2 x 31 5/8	9 1/2 x 33 x 2 3/8
LD1632	16 x 32	6 1/2 x 12 3/4	9 1/2 x 14 x 2 3/8
LD12112	12 x 112	4 7/8 x 44 1/8	8 x 45 3/4 x 2 3/8
LD1280	12 x 80	4 7/8 x 31 5/8	8 x 33 1/8 x 2 3/8
LD1232	12 x 32	4 3/4 x 12 3/4	8 x 14 x 2 3/8
LD896	8 x 96	3 1/4 x 37 7/8	6 3/8 x 39 3/8 x 2 3/8
LD864	8 x 64	3 1/4 x 25 1/4	6 3/8 x 26 3/4 x 2 3/8

Be sure to check out our other great products!



**Stop Request Signs**

- Flush, ceiling or surface mount
- Any font/color combination
- Back-lit by efficient LED's



**Interior Passenger Information Sign**

- Easy to install
- ADA compliant
- LED's rated at 100K hours



**Roller Curtain Signs**

- High-res logos & graphics
- Perfect for large fleets
- Virtually maintenance free
- Reliable, efficient LED backlight
- Available in 12 and 24 VDC
- Up to 120 destinations



**Run Number Box**

- Metal or plastic frame
- Available in 2, 3, or 4 digits
- Easy to read 4" lettering
- Spring loaded return
- Reliable, efficient LED backlight
- Virtually maintenance free



**LED Run Number Box**

- Steel enclosure
- ADA compliant
- Reliable LED's
- Multiple colors
- Automatic brightness
- 12 and 24 VDC

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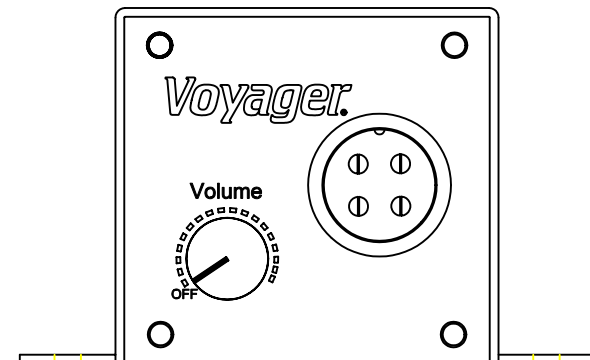
[www.transignllc.com/subscribe](http://www.transignllc.com/subscribe)

Transign®, 281 Collier Road, Auburn Hills, Michigan 48326  
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[www.transignllc.com](http://www.transignllc.com)

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# ***Voyager***®

## PA500 Owner's/Installation Manual



Universal Public Address System  
for use with Vehicle Radios

Revision: B  
Date: 5/17/01

Audiovox Specialized Applications, LLC  
23319 Cooper Dr.  
Elkhart, IN 46514  
1-800-688-3135  
[www.asaelectronics.com](http://www.asaelectronics.com)





# Optional Product List:

## Televisions

AVT988 9' Color Television with Remote (12V)	AVT988
AVT1498 13" Color Television with Remote (12V)	AVT1498

## VCP and DVD Players for use with TV's and LCD

AVP7000 Video Cassette Player (12V)	AVP7000
AVP7285 Video Cassette Player (12V)	AVP7285
Single Disc DVD Player	DVD2101

## Headphones

Wireless Headphones	WHRF01
Headphones with Pivoting Earcup	HP175
Headphones with Volume Control on Cord	HP275
Studio Quality Headphones	HP375

## Miscellaneous

Remote Controls	Please Call
Wallmount Family Radio Service with 4 Handsets	FRS4WM
Replacement Handset	FRS100Y
12V Corded Vacuum	VAC21
Rechargeable Flashlight	AVF1
Window Mount TV Antenna	AN350
2-Amp Adapter for use with AVP7000/7285 VCP	0891436
4-Amp Adapter for use with AVT988 9" & AVT1498 13" TV	0891412

## Wallmount Radios

AM/FM Wallmount Manual Tune w/Cassette Player	AWM710
AM/FM Wallmount Electronic Tune w/Cassette Player	AWM820
AM/FM Wallmount Stereo w/CD Player	AWM930

## Marine

AM/FM Stereo with CD Player	MS1000
AM/FM Weatherband Stereo w/Cassette Player	MS407
AM/FM Stereo w/Cassette Player (Analog Tuner)	MS220
AM/FM Stereo w/Cassette Player (Analog Tuner)	MS306
Weatherproof Housing	MRH211
50 Watt 6 1/2" Speakers (White/Black)	AMS6
30 Watt 5" Speakers (White/Black)	AMS5
30 Watt 4" Speakers	AMS4
Marine Radio Antenna	AN125

To order any of these products, please call 800-688-3135

OR

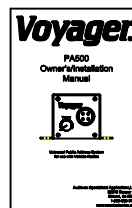
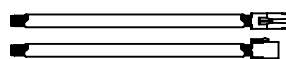
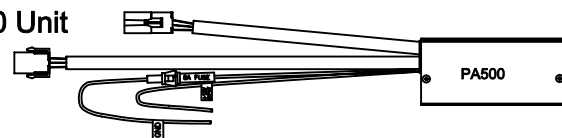
Visit our website at: [www.asaelectronics.com](http://www.asaelectronics.com)

# Manual Contents:

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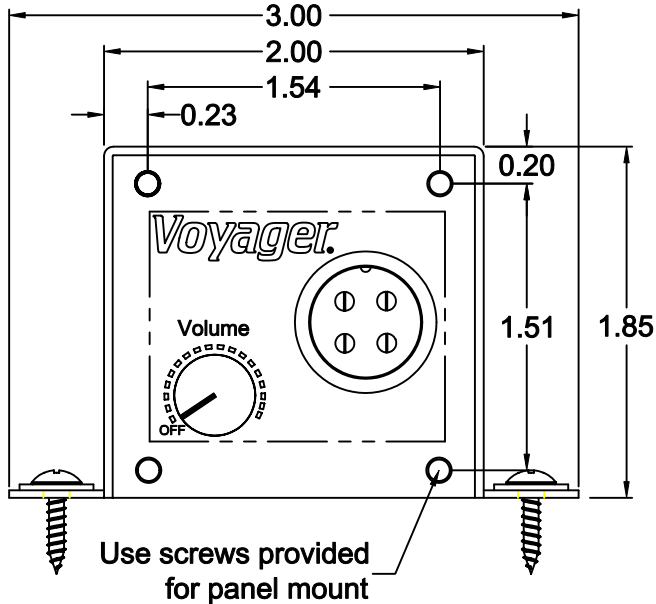
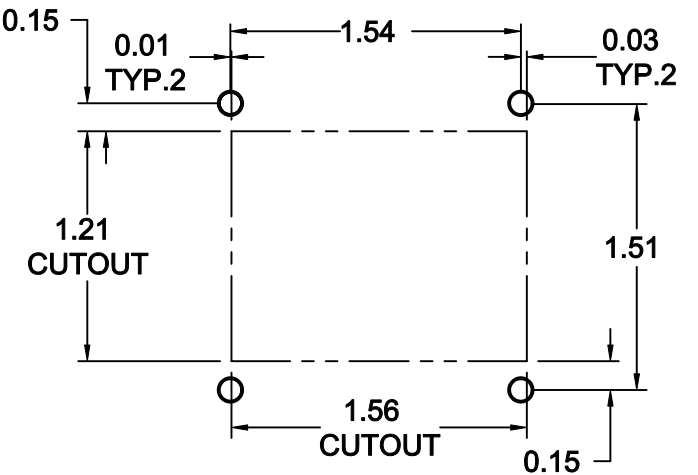
# Package Contents:

	Qty.
PA500 Unit	1
Harness	2
Hardware Package:	
Screws	4
Washers	4
Manual	1



# Panel Cutout (Optional Installation):

The PA500 may also be mounted through a panel (as shown below). In this method, the microphone volume may be adjusted or turned on/off to meet the operator's preference.



# Troubleshooting:

Symptom	Possible Cause	Possible Solution
Has audio from radio but not PA500  (With BVMB02) No audio, has popping sound on speakers	<ul style="list-style-type: none"><li>- PA not turned on</li><li>- Volume set too low on PA</li><li>- In-line fuse blown</li><li>- Input and output wired backwards</li><li>- Phantom PCB (P/N 8515245) not installed</li></ul>	<ul style="list-style-type: none"><li>- Turn PA on</li><li>- Adjust volume of PA to higher level</li><li>- Check and replace in-line fuse</li><li>- Reverse input and output wiring</li><li>- Need to install Phantom PCB</li></ul>
High pitched squeal (feed back)	<ul style="list-style-type: none"><li>- Volume on PA set too high</li></ul>	<ul style="list-style-type: none"><li>- Turn volume on PA down</li></ul>
Hand held MIC keyed and gets feed back	<ul style="list-style-type: none"><li>- Volume on PA set too high</li><li>- Volume on MIC set too high</li></ul>	<ul style="list-style-type: none"><li>- Turn volume on PA down</li><li>- Turn volume down on MIC</li></ul>
PA500 will not turn on, (does not have power)	<ul style="list-style-type: none"><li>- In-line fuse on PA blown</li></ul>	<ul style="list-style-type: none"><li>- Replace fuse</li></ul>

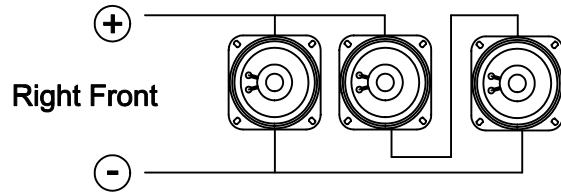
# Specifications:

4 Channels	22 Watts per channel, 4 ohm load
Current Draw	7 Amp Max.
Frequency Response	100-10,000
Size	3.08" x 1.85" x 4.0" (W x H x D)
Weight	15 oz.

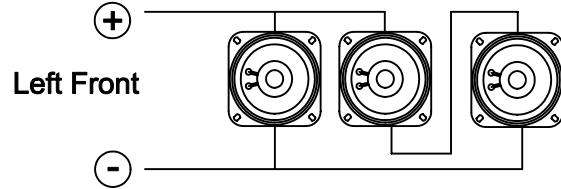
## Speaker Connections:

### 3 Pair- 4 Ohm Speakers

Curb Side  
6 Ohm  
Total Impedance



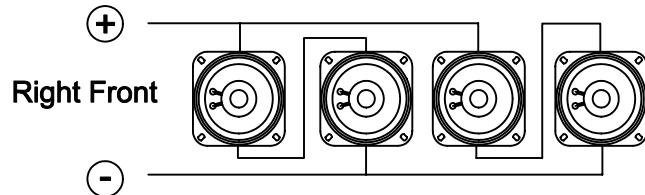
Driver Side  
6 Ohm  
Total Impedance



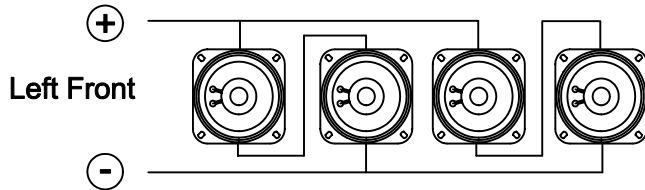
Align Speakers with "+" on top and "-" on bottom as shown

### 4 Pair- 4 Ohm Speakers

Curb Side  
4 Ohm  
Total Impedance



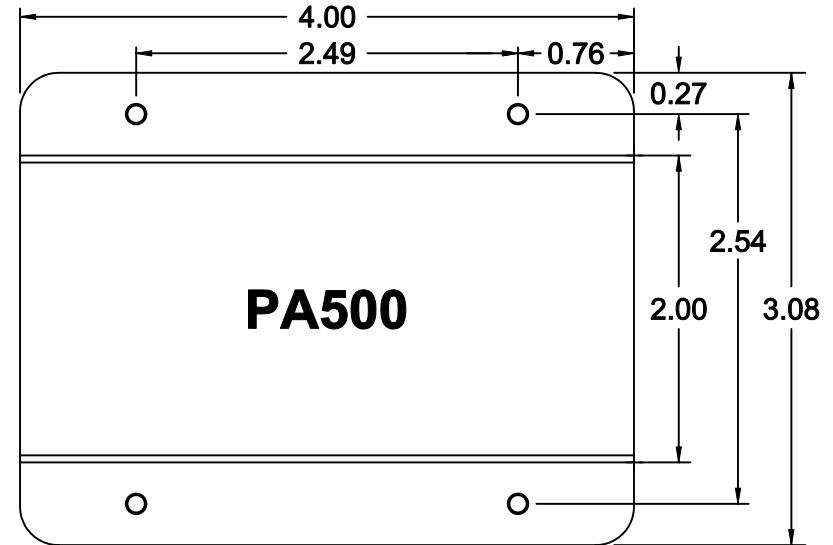
Driver Side  
4 Ohm  
Total Impedance



Align Speakers with "+" on top and "-" on bottom

## Optional Flange Mount Installation:

The PA500 may also be mounted in a "blind" location, using the mounting holes on the flanges. In this case, the microphone volume must be pre-set by the installer prior to the completion of the installation. The 30 ft. microphone extension/adaptor cable (P/N 1401035) or the 36" microphone extension/adaptor cable (P/N 1401040), is to be used to allow connection of a PTT (Push To Talk) type microphone by the operator.





# Typical Wiring Connections:

## INPUT NOTES:

Wire Radio according to Manufacturer Spec.

PA500 can accept any radio (up to 4 Channels).

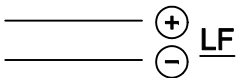
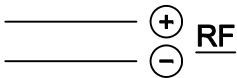
Maintain appropriate load requirements.  
(4 ohm minimum suggested)

## Radio to PA500

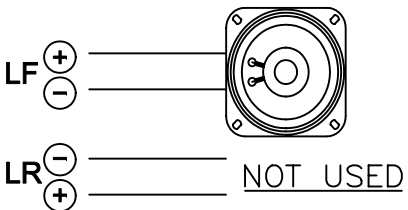
RA RF +	Gray
RA RF -	Gray/Black
RA LF +	White
RA LF -	White/Black
RA RR +	Violet
RA RR -	Violet/Black
RA LR +	Green
RA LR -	Green/Black

## Optional Examples:

### INPUT 4 Wire

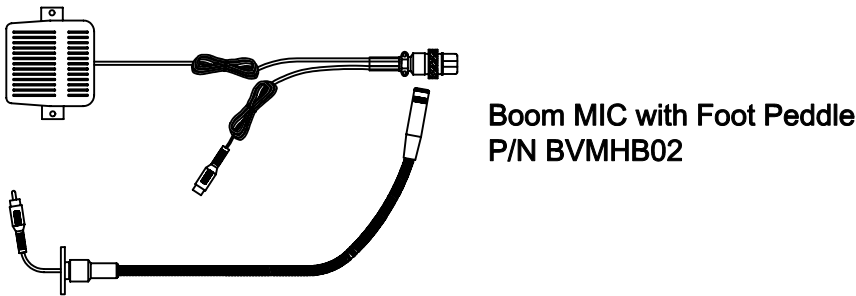
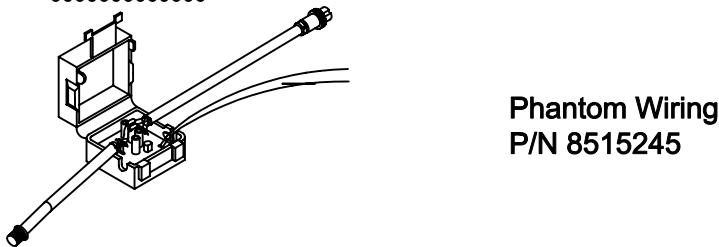


### OUTPUT 2 Speaker



# PA500 Applications con't.:

The PA500 may be used with the BVMH22 hand held microphone and either the 30' extension/adapter cable (P/N 1401035) or the 36" extension/ adapter cable(P/N 1401040). If the Boom MIC with Foot Peddle (P/N BVMH02) is used, the Phantom Wiring Harness (P/N 8515245) is required.



# PA500 Applications:

The PA500 may be used directly with the following microphones:

## BVMH01 Hand Held Microphone

## BVMH28 Boom Microphone

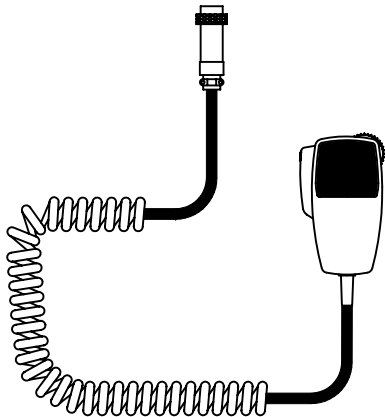
In applications which require remote mounting of the PA500, either the 20 foot extension/adapter (P/N 1401003) or the 36" extension/adapter cable (P/N 1401020) may be used



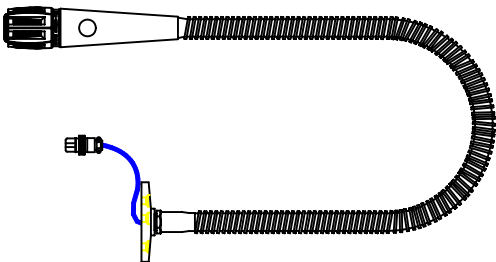
20 Ft Extension Cable  
P/N 1401003



36" Extension Cable  
P/N 1401020



Hand Held Microphone  
P/N BVMH01



28" Boom Microphone  
P/N BVMH28

## To PA500 Speakers

SP RF +
SP RF -
SP LF +
SP LF -
SP RR +
SP RR -
SP LR +
SP LR -

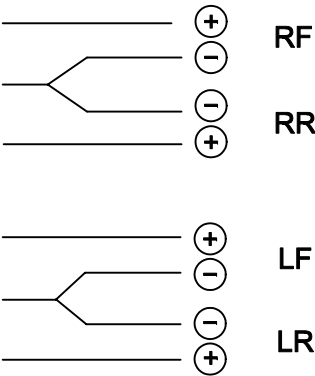
## OUTPUT NOTES:

Do not ground any leads.

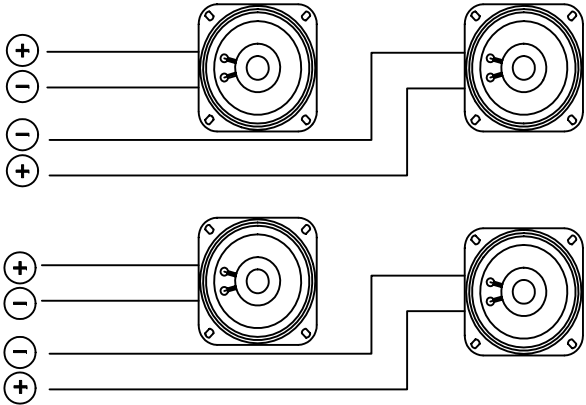
Do not tie output leads together.

It is permissible to use only Front or Rear Inputs and Outputs in 2 speaker /4 Wire Systems

## INPUT 6 WIRE



## OUTPUT 4 SPEAKER



# PA500 Wiring:

## Wiring Chart for Radio and Speaker Connections

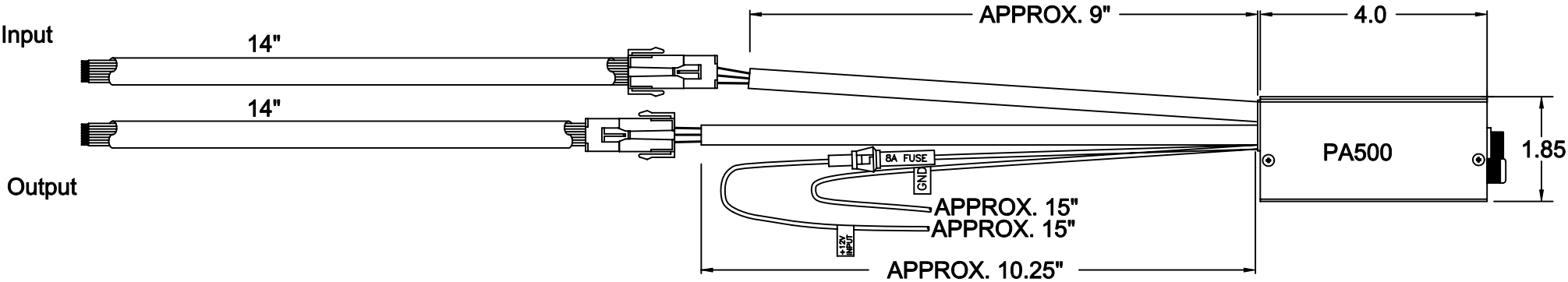
Wire Color	Speaker Connection
Gray	Right Front +
Gray/Black	Right Front -
White	Left Front +
White/Black	Left Front -
Violet	Right Rear +
Violet/Black	Right Rear -
Green	Left Rear +
Green/Black	Left Rear -

## Hardware Kit:

Quantity- Type  
4- M5 x 13mm Philips PH Tapping Screw



4- M3.5 Flat Washer





The following information is submitted for all Glaval Bus products proposed on this bid as supporting documentation of the structural soundness and impact resistance of the bodies manufactured. All vehicles are built using virtually the same materials with some minor differences in the height and width of cross members due to entry floor heights and/or body width variations.

A representative set of construction prints provided by engineering supplements this verbal accounting of our materials and assembly specifications.

If, in the reviewing of these written technical specifications and engineering frame prints submitted any questions arise, please contact us immediately for any clarification or help in interpretation and understanding.

### **3.0 Body Construction – General Frame Construction**

Manufactured from all aluminized steel products, the floor, roof, side walls, rear wall, driver halo assembly and entry door assembly are all wire welded (MIG) together to form an integral steel frame that is mounted with specified hardware to the rubber body mount points (pucks) supplied by the chassis manufacturer. Once joined to the chassis, the bus finishing process begins.

#### **3.0.1 Floor frame construction and assembly –**

- 3.0.1.1 Cross Members -- The floor cross members form the base structural support for the rest of the frame components. Our cross members are constructed of 14 gauge aluminized steel, formed to a capital “C” shape. Cross members over the fuel tank are made to provide the clearance needed to conform with FMVSS301, and include formed internal reinforcements welded in place for additional strength. All additional longitudinal and latitudinal structure is flush welded in place to form a one piece floor upon completion.
- 3.0.1.2 Aluminized steel “Hat Posts” – 1”x1”x4” run the length of the floor between cross members and are welded into place. This extremely strong form is used to weld our HSLA steel seat track in place.
- 3.0.1.3 Aluminized steel C Channel – 1”x1.5” C channel is welded in between cross members the full length of the floor in 5 places. Coupled with the Hat Posts this provides a one-piece strong “ladder” type frame for the flooring.
- 3.0.1.4 Seat Track – 12 gauge roll formed high strength/low alloy steel is wire welded in place for seat mounting down each side of the bus, with lengths predicated on the floor plan chosen. This is yet another stiffener in our extensive construction process.





- 3.0.1.5 Wheel Wells -- Constructed of 14 gauge ALUMINIZED steel, wheel wells are also welded in during the floor construction process. All seams in the wheel well are welded to create a one piece water resistant wheel housing structure. The wheel wells also provide additional strength to the body assembly, when welded in place.
- 3.0.1.6 Structural Aluminized steel Angle – 1/8” thick 1.5” x 2.5” structural aluminized steel angle is used the full perimeter length of each floor assembly, welded to the ends of all floor cross members. This provides not only a flat plane for joining the sidewall assembly, but also ties all cross members together and provides additional side impact resistance.
- 3.0.1.7 Additional structure – When adding vertical stanchions, wheel chair lifts and/or tie down options, additional structure is welded into the floor at locations specified by our engineering department on CAD drawings.

### **3.0.2 Sidewall Construction –**

- 3.0.2.1 Sidewall vertical member – The heart of our sidewall is the vertical structure, a roll formed 18 gauge aluminized steel 1.5" x 2" tube that provides strength and rigidity. The vertical member is installed in full lengths and in shorter sections below window frames. Additional vertical structure is used at both ends of the sidewall enabling the structure to withstand the forces applied by the vehicle when in motion.
- 3.0.2.2 Aluminized steel Tubing – 1.5”x1” lower and 1.5”x3” upper 16 gauge aluminized steel tubing is welded in horizontally between vertical members to frame in window openings. This adds front to rear reinforcement as well.
- 3.0.2.3 Seat Track – 12 gauge high strength/low alloy roll formed ALUMINIZED steel welded down each sidewall below the window frame. While serving as a seat attaching device, it adds excellent structure to the sidewall and also adds excellent side impact resistance.
- 3.0.2.4 Wheelchair Options – Add another layer of metal. Depending on track locations, another structure of 11 gauge thick aluminized steel is welded in place between each vertical member for attaching a shoulder belt mount. Also, additional structure is added to accommodate wheelchair door frames – either 1.5”x1” or 1.5”x2” 16 gauge wall aluinizd steel tubing..
- 3.0.2.5 Full length glavanized steel tubing – 1.5”x1” 16 gauge aluinizd steel tubing is stitch welded to the sidewall bottom and top at each vertical member for attaching to the floor and roof sections, respectively.

### **3.0.3 Rear Wall Construction –**

- 3.0.3.1 Rear wall vertical member – The vertical sidewall 1.5"x 2" aluminized steel tube is also used in the rear wall assembly. Full length structure is used at varying places,



depending on choice of rear window, or rear door. Shorter cut pieces are used above windows and doors. Additional side windows used with the rear door also change the configuration.

3.0.3.2 Aluminized steel Tubing – 1.5"x1" 16 gauge aluminized steel tubing is welded horizontally between vertical members to provide a window frame in the standard product, and used as an upper door frame in the optional rear assembly.

3.0.3.3 Full length aluminized steel tubing – 1.5"x1" 16 gauge aluminized steel tubing stitch welded to the rear wall top and bottom as in the sidewall

### assembly. **3.0.4 Roof Construction –**

3.0.4.1 Roof Bows – Radius formed one-piece 16 gauge aluminized steel roof bows formed as a modified hat post design with eight bends for exceptional strength and located on 16" centers (the closest in the industry), including 4 bends in the web that allows for the roof structure to be capable of taking severe loads. They are then capped with top flat pieces from flange to flange to provide abundant surface area for securing the exterior roof material.

3.0.4.2 aluminized steel Tubing – 1.5"x1" 16 gauge aluminized steel tubing is welded in horizontally to frame all lower window openings and 1.5" x 3" 16 gauge aluminized steel tubing to all upper window openings as required. A full perimeter is also welded on to mate the roof to the sidewall and rear wall, with short vertical pieces providing support on the front and rear ends. The 3" wide aluminized steel tube supplies a structural mounting surface for shoulder belt attachment and has been pull tested to federal standards.

### **3.0.5 Driver Compartment Overhead Halo –**

3.0.5.1 aluminized steel Tubing – 1"x1" 16 gauge aluminized steel tubing is cut and jig welded into an integrated one piece structure spanning from the front roof bow of the body to the newly cut roof line of the cab. Also created during the structure manufacture is the housing for mounting the electronic circuit board.

3.0.5.2 11 Gauge aluminized steel – formed to make brackets used to mount to the chassis roof.

### **3.0.6 False Floor (Cab to body transition) –**

3.0.6.1 aluminized steel Tubing – 2" x 2" 16 gauge aluminized steel tubing is welded together forming a flat body floor transition from the step area back to the actual body area. An overhang on the curbside provides a secure attach point frontally for the entry door frame added later.

3.0.6.2 Structural aluminized steel angle – 11 gauge 1.5"x1.5" structural angle is added in

short lengths five places to provide attachment points to the chassis floor.



### **3.0.7 Interior Vertical Transition Frames –**

3.0.7.1 aluminized steel Tubing – 1"x1" 16 gauge aluminized steel tubing is used vertically and a ladder type assembly is made welding the 1x 1 tube to .75"x.75" 11 gauge aluminized steel tube that is used horizontally in the assemblies. These pieces transition from the body fronts on each side to the driver halo side assembly and the entry door frame assembly on the curbside.

### **3.0.8 Entry Door & Step Assembly Frame –**

3.0.8.1 aluminized steel Tubing – 1"x1" 16 gauge and .75"x.75" 11 gauge aluminized steel tube is cut to length and welded together in a ladder type construction forming a rigid frame for attaching the entry door/step assembly.

### **3.0.9 Entry Door/Step Assembly –**

3.0.9.1 11 Gauge aluminized steel – The step riser/tread piece is manufactured from one-piece 11 gauge aluminized steel and uses 90° bends at all risers and treads. The bottom tread also adds an additional 90° bend for additional strength and safety. Upper and lower side pieces are then attached and an 11 gauge flat plate with holes is used to bridge the lower and upper side pieces, then is stitch welded and plug welded to form a strong one piece assembly prior to inserting and welding to the entry step framing.

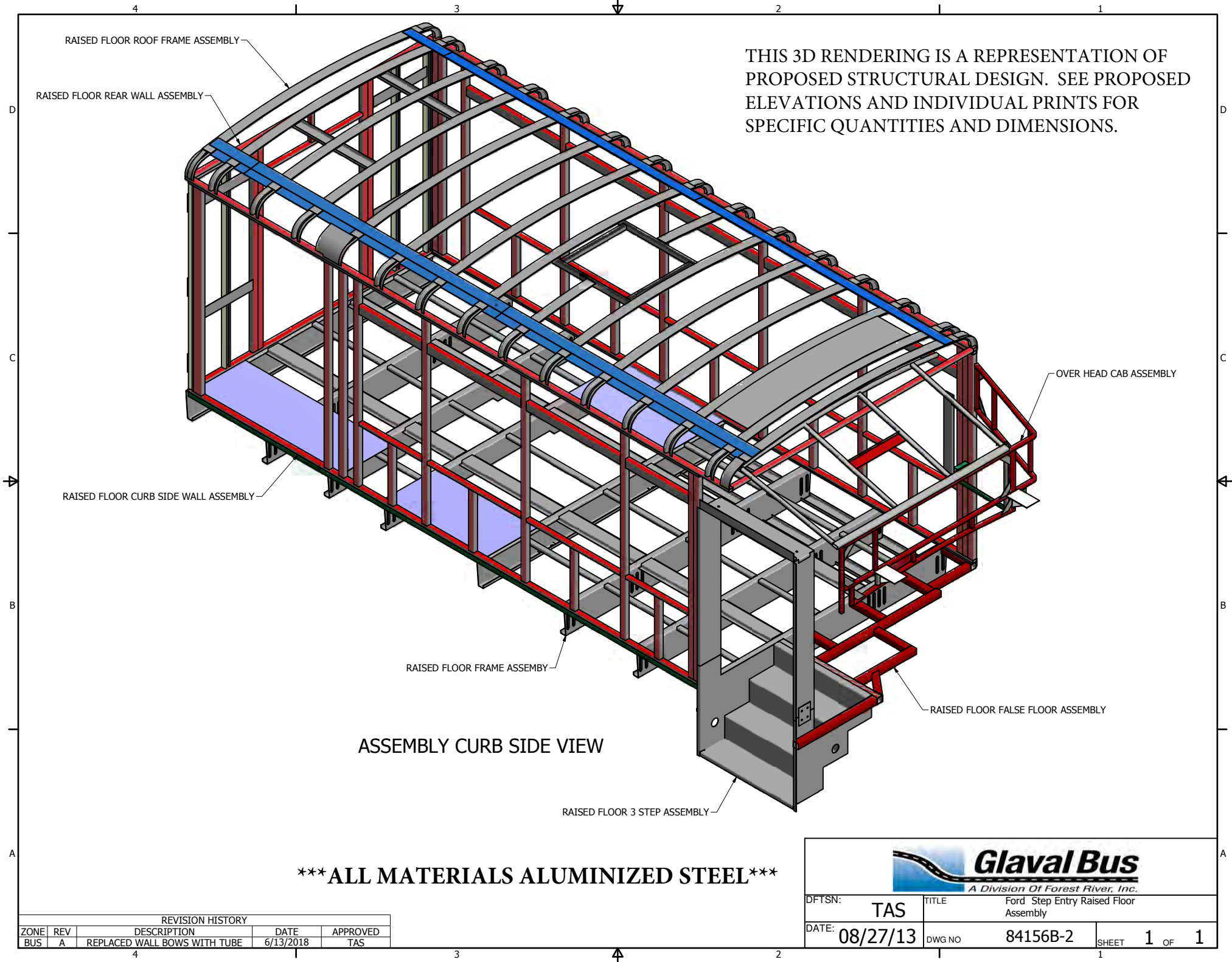
## **APPLICATION OF EXTERIOR SIDEWALL MATERIAL**

### **GALVAIZED STEEL SIDEWALLS OR OPTIONAL FIBERGLASS/FRP/COMPOSITE SIDEWALLS**

The exterior is .024" galvanized steel pre-painted white with an underlayment of 5/32" luan. The interior is 5/32" luan covered with a light gray FRP or padded vinyl. The foam filled aluminized steel cage is placed in the center and all layers are adhered using a cross linked polyurethane hot melt adhesive. The entire assembly is then laminated to assure adhesion.

Composite FRP exterior sidewall panels are installed using the same method.

Should any further questions arise, please contact your Glaval Bus representative.

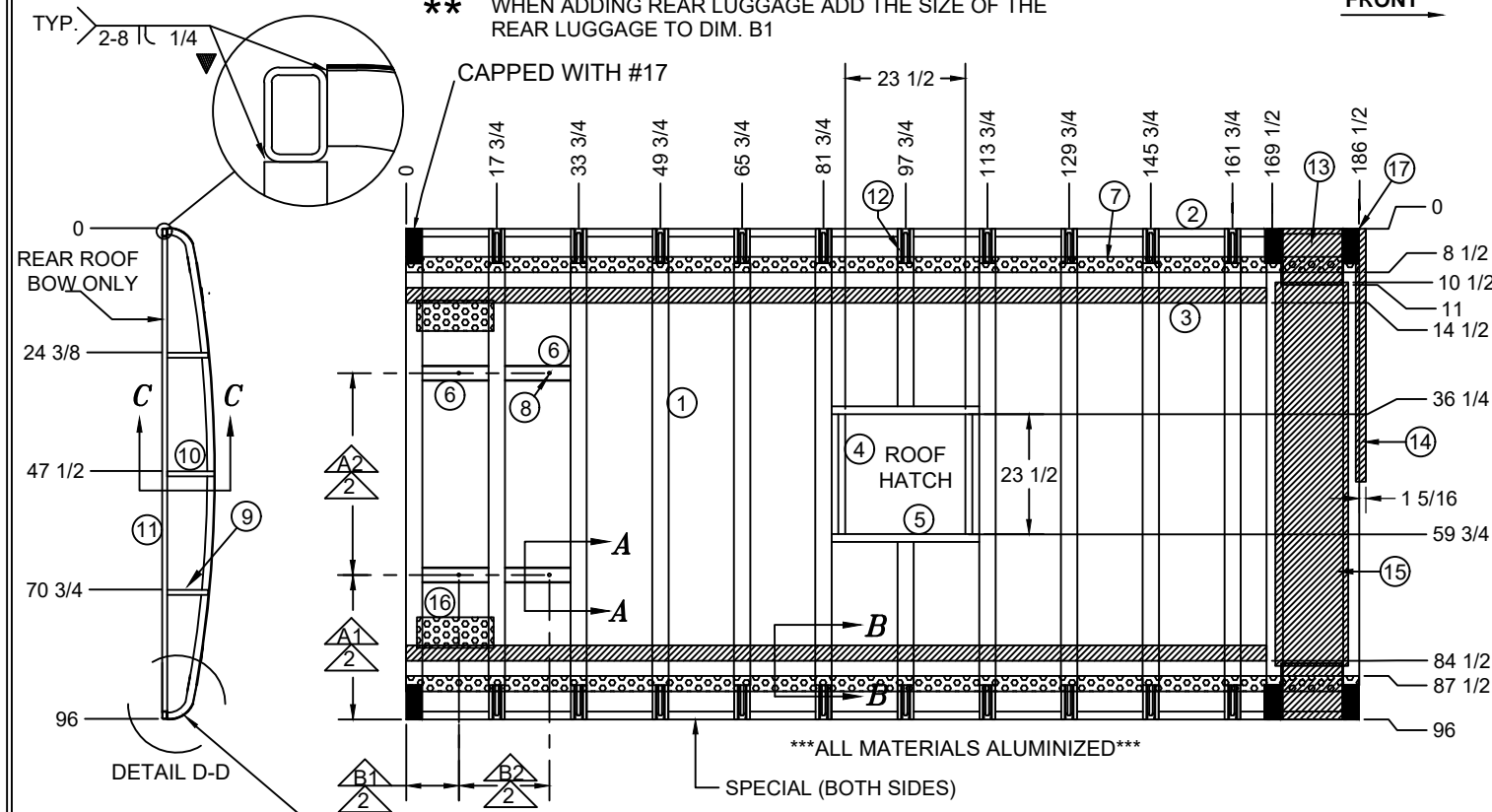




**USAGE: FORD MODEL 24**

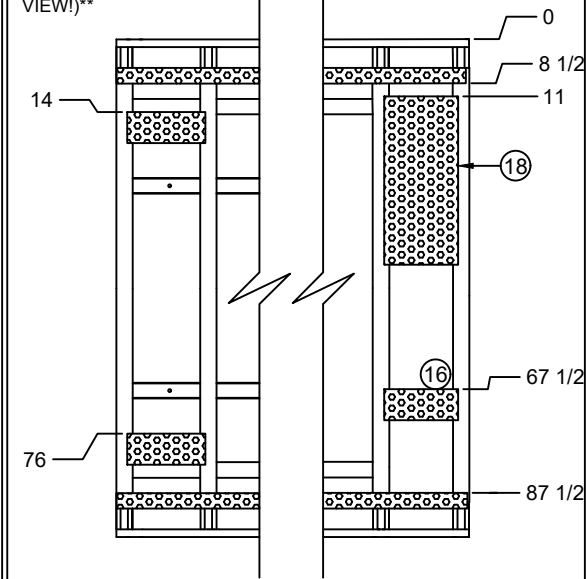
**\*\* WHEN ADDING REAR LUGGAGE ADD THE SIZE OF THE REAR LUGGAGE TO DIM. B1**

**FRONT**



BOTTOM PLATES FOR FRONT AND REAR IN DRIVER AND PASSENGER INTERIOR STANCHIONS.

**\*\*NOTE: THIS IS A TOP VIEW WITH THE BOTTOM PLATES PROJECTED THROUGH THE BEAMS! (THIS IS NOT A BOTTOM VIEW!)\*\***



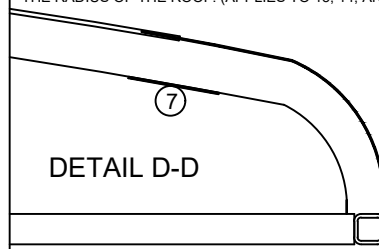
**NOTES:**

- 1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.
- 2- A/C BOLT PATTREN MAY VERY SEE SALES ORDER.
- 3- BEFORE CUT ROOF HATCH SEE SALES ORDER.
- 4- SCREW LOCATION AT SEAMS AND EDGES 8" ON CENTER  
ALL OTHER LOCATION 16" ON CENTER.
- 5- SEALANT USAGE: 1/4" MINIMUM 3/8" MAXIMUM BEAD ON ALL  
ROOF FRAME TO LUAN SURFACES.

\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

- SPECIAL (BOTH SIDES)

SHADED AREA SHOWS 16GA. PLATE FORMED AROUND THE RADIUS OF THE ROOF. (APPLIES TO 13, 14, AND 17)\*\*




5	2	70009047	"C" CHANNEL: 16ga. x 1-3/8" x 1-3/8" x 30-1/2" Lg.
4	2	70009047	"C" CHANNEL: 16ga. x 1-3/8" x 1-3/8" x 24-1/4" Lg.
3	2		SHEET STEEL: 16ga. x 3" x 168-1/2" Lg.
2	2		TUBE: 16ga. x 1" x 1.5" x 186-1/2" Lg. A-513
1	12	02062357	ROOF BOW W/CAP 16ga. x 3-3/16 x 96" Lg.

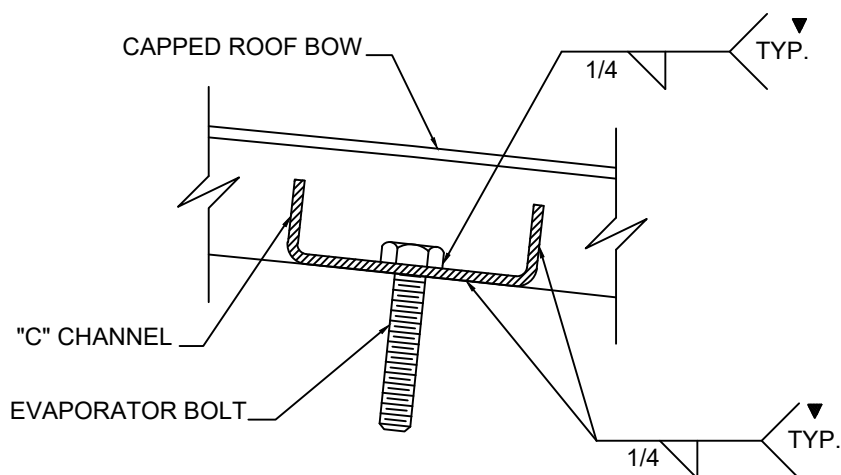
20	0		PLATE: 16ga. x 10" x 16" Lg.
19	0		SHEET STEEL: 16ga. x 3" x 77" Lg.
18	1		SHEET STEEL: 16ga. x 14-1/4" x 32-1/2" Lg.
17	6		PLATE: 16ga. x 1-1/2" x 9" Lg.
16	3		SHEET STEEL: 16ga. x 6" x 15" Lg.
15	1		PLATE: 16ga. x 14-1/4" x 75" Lg.
14	1		SHEET STEEL: 16ga. x 2" x 52-1/2" Lg.
13	2		SHEET STEEL: 16ga. x 12" x 15" Lg.
12	2	02062357	ROOF BOW W/CAP 16ga. x 3-3/16 x 35-1/4" Lg.
11	1		TUBE: 16ga. x 1" x 1" x 93" Lg. A-513
10	1		TUBE: 16ga. x 1" x 1" x 8-1/2" Lg. A-513
9	2		TUBE: 16ga. x 1" x 1" x 8" Lg. A-513
8	4		BOLT: 3/8-16 x 3" Lg. HEX HEAD
7	2		SHEET STEEL: 16ga. x 3" x 186-1/2" Lg.
6	4	70009046	"C" CHANNEL: 16ga. x 1" x 3-1/2" x 14-1/2" Lg.

REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION	REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION
----------	------	----------	----------------------	----------	------	----------	----------------------

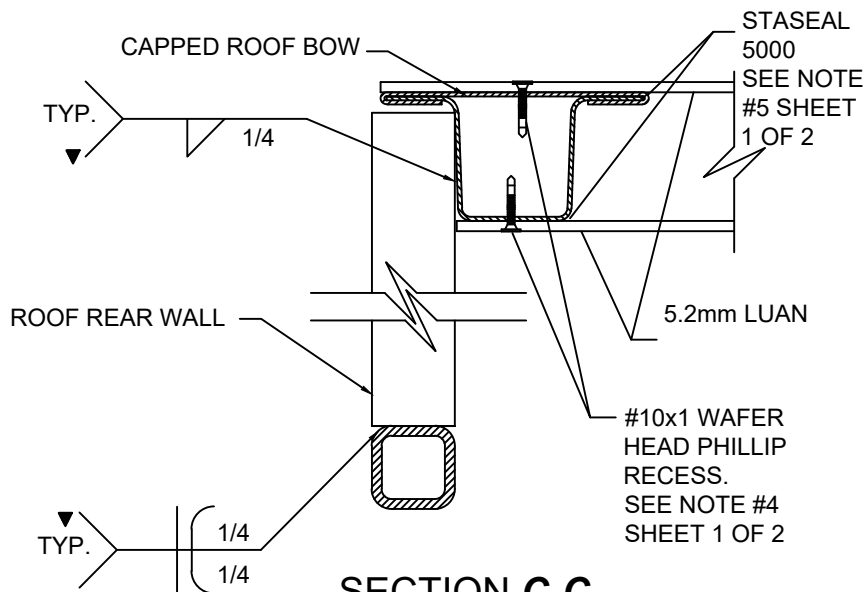
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						TOLERANCE UNLESS OTHERWISE SPECIFIED		 <b>Glaval Bus</b> a division of Forest River, Inc.	
						WOOD	OTHER	DATE: 06/11/18	TITLE: 158" WHEEL BASE MODEL 24 ROOF FRAME, STD. ROOF, SINGLE HATCH
REV.						+ 1/8"	+ 1/16"	NAME: MKLINE	
	DESCRIPTION OF CHANGE				BY	CHK	DATE	ECN No.	
								+ 1°	+ 1/2°
									32-13-0017-18
								DWG. No.	

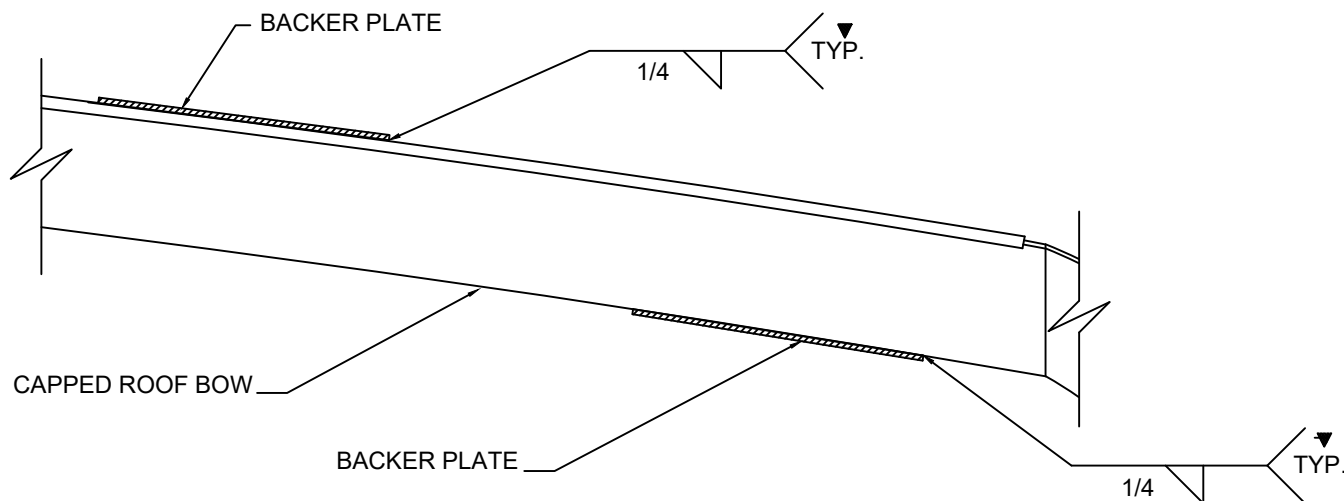
## ▼ CRITICAL CONTROL ITEM



## SECTION A-A



## SECTION C-C



## SECTION *B-B*

T/A-71 NEW STYLE	33-5/8	30	10	12-1/4
ACC 23022 SERIES	38	20	10	14-3/4
ACC 23023 SERIES	33-5/8	28-3/4	10	14-3/4
T/A-77	18-1/4	59-1/2	10	10-3/8
T/A-73	28-1/4	39-1/2	10	9-1/2
T/A-71 OLD STYLE	33-5/8	28-3/4	10	12-1/4
T/A-70	36-3/4	22-1/2	10	11-5/8
T/A-30	31	34	10	9-1/2
EM-14 & RE-29	30-3/4	34-1/2	10	9-1/2
EM-6 & RE-10	36	24	10	9-1/2
EM-3 & RE-30	28-1/4	39-1/2	10	16
RE-15 & RE-20	28-1/4	39-1/2	10	9-1/2
EM-1 & EM-2	28-1/4	39-1/2	10	9-1/2
EM-7 GEN 5	36-1/8	23-3/4	10	9-1/2
EM-2 GEN 5	32-3/8	31-1/16	10	9-1/2
EM-1 GEN 5	28-3/16	39-5/8	10	9-1/2
EVAPORATOR MODEL	A-1	A-2	B-1	B-2

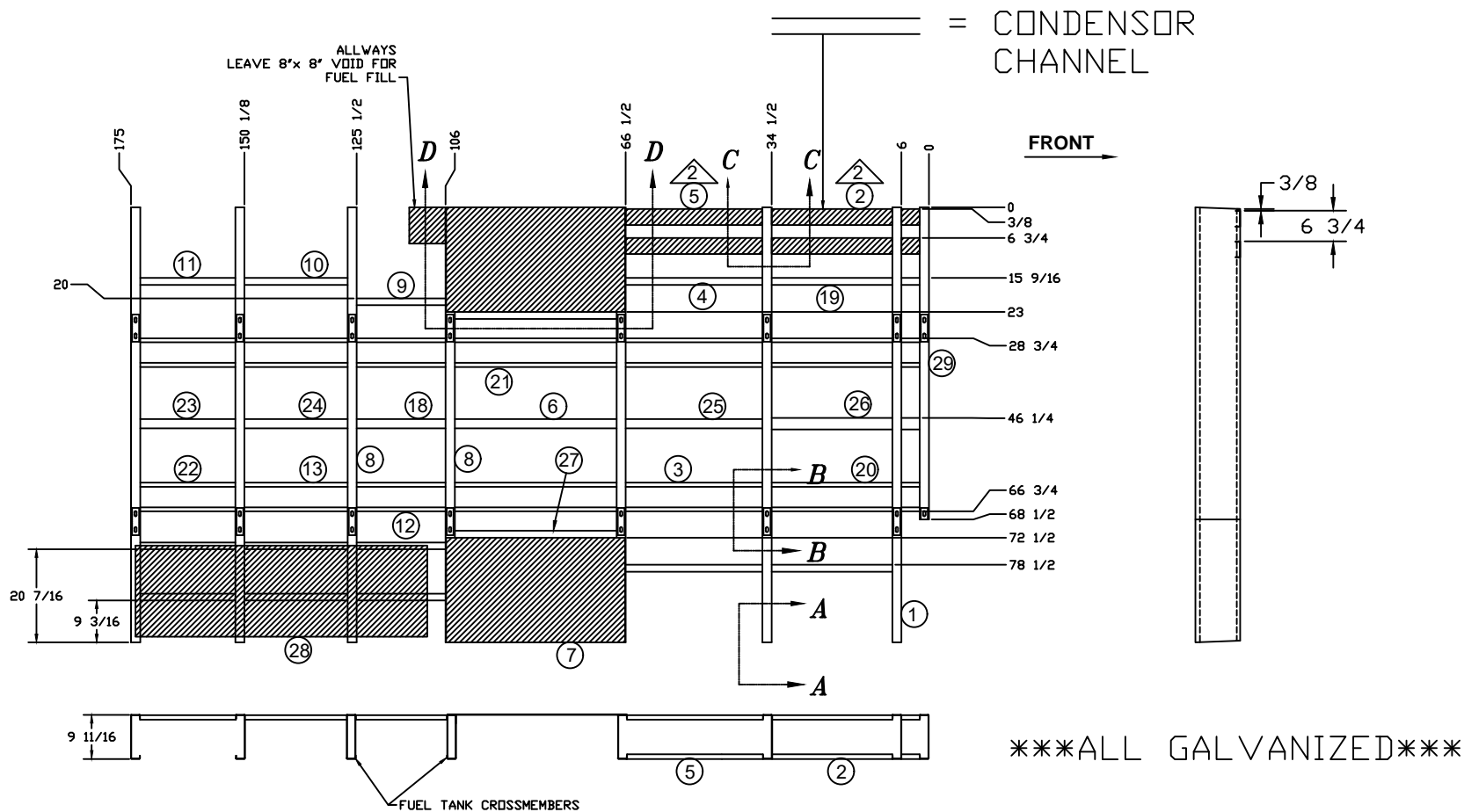
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REV.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		 <b>Glaval Bus</b> a division of Forest River, Inc.	
WOOD	OTHER	DATE: 06/11/18	TITLE: 158" WHEEL BASE MODEL 24
+ 1/8"	+ 1/16"	NAME: MKLINE	ROOF FRAME, DETAILS SINGLE HATCH
+ 1°	+ 1/2°	DWG. No	32-13-0017-18

▼ CRITICAL CONTROL ITEM

USAGE: FORD 158" WHEEL BASE, MODEL 24



### NOTES:

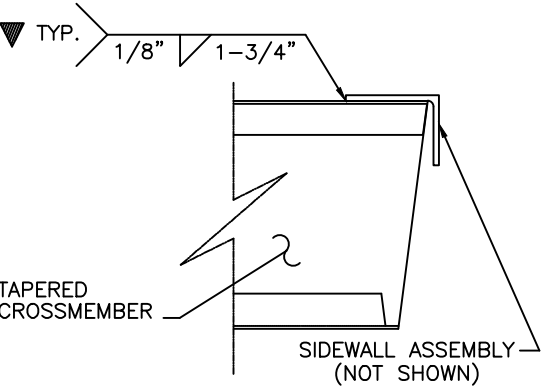
- 1- DRAWING VIEWED FROM INTERIOR SIDE OF UNIT.
- 2- LOCATION OF A/C BRACKETS: ONE MOUNT FLUSH WITH OUTSIDE EDGE OF CROSSMEMBER. THE OTHER MOUNTS 14-3/4" FROM OUTSIDE EDGE OF CROSSMEMBER.
- 3- SEE SHEET 2 OF 2 FOR DETAILS, TORQUE SPECIFICATIONS, SECTION VIEWS AND CUT LIST.

7	2	71002066	SHEET STEEL: 11ga. x 24" x 39-1/4" Lg. HRS
6	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 35-5/8" Lg.
5	2	70009046	"C" CHANNEL: 12ga. x 1" x 3-1/2" x 30" Lg.
4	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 30" Lg.
3	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 30" Lg. A-513
2	2		"C" CHANNEL: 12ga. x 1" x 3-1/2" x 26-1/2" Lg.
1	5	71009018	14ga. x 2 x 9-11/16 x 95-1/2 CROSSMEMBER A-365
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

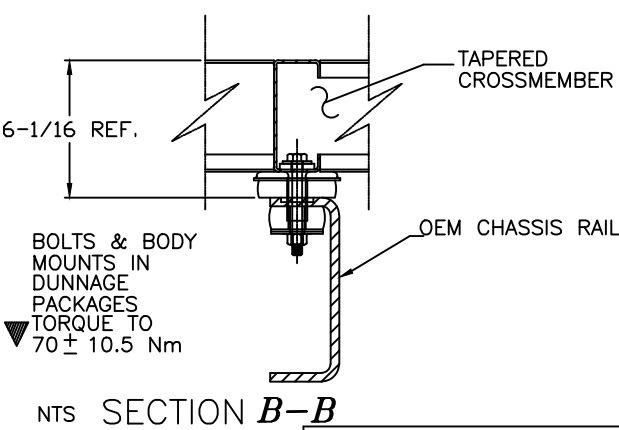
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REV.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.	TOLERANCE UNLESS OTHERWISE SPECIFIED	WOOD	OTHER	DATE	TITLE	NAME	DWG. No.
LET.						± 1/8"	± 1/16"	± 1/2"	6/14/18	158" WB MODEL 24 FLOOR FRAME, RAISED FLOOR	MKLINE	32-13-0031-18 SPECIAL

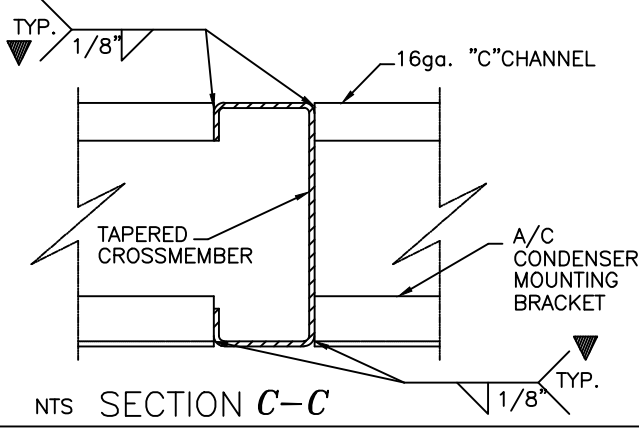
▼ CRITICAL CONTROL ITEM



NTS SECTION A-A



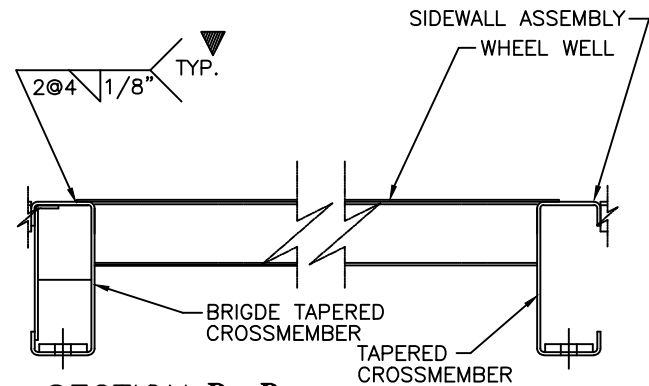
NTS SECTION B-B



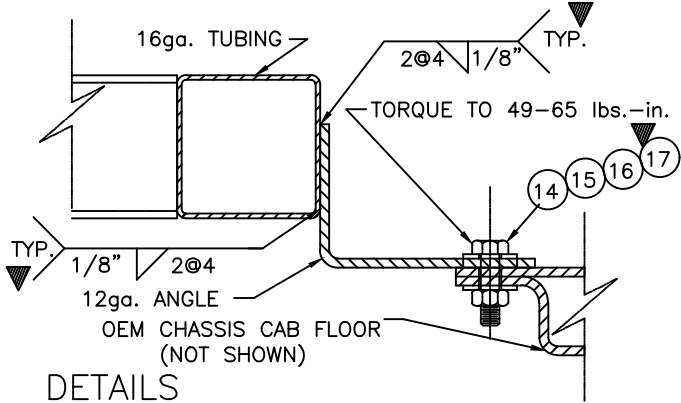
NTS SECTION C-C

\*\*\*ALL GALVANIZED\*\*\*

REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION
29	1		14ga. x 2 x 9-11/16 x 68-1/2 CROSSMEMBER A-365
28	2		PLATE: 11ga. 20" x 64" Lg.
27	2	71002028	TUBE: 16ga. x 1-1/2" x 1-1/2" x 35-5/8" Lg. A-513
26	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 26-1/2" Lg.
25	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 30" Lg.
24	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 22-3/8" Lg.
23	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 20-7/8" Lg.
22	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 20-7/8" Lg. A-513
21	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 35-5/8" Lg. A-513
20	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 26-1/2" Lg. A-513
19	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 26-1/2" Lg.
18	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 19-3/4" Lg.
17	7	80052007	NUT, HEX HEAD 3/8-16 UNC GRADE 5 ZINC
16	7	80042015	WASHER MED LOCK 3/8 ZINC
15	14	80042007	WASHER 3/8 USS ZINC
14	7	80112051	BOLT, HEX HEAD 3/8-16 X 1 UNC GRADE 5 ZINC
13	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 22-3/8" Lg. A-513
12	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 19-3/4" Lg. A-513
11	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 20-7/8" Lg.
10	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 22-3/8" Lg.
9	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 19-3/4" Lg.
8	2	70009055	14ga. x 2 x 4-13/16 x 95-1/2 bridge crossmember



NTS SECTION D-D



NTS DETAILS

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REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE		TITLE	
WOOD	OTHER	DATE		TITLE	
± 1/8"	± 1/16"	NAME: MKLINE		FLOOR FRAME, RAISED FLOOR	
± 1"	± 1/2"	DWG. No.	32-13-0031-18	SPECIAL	

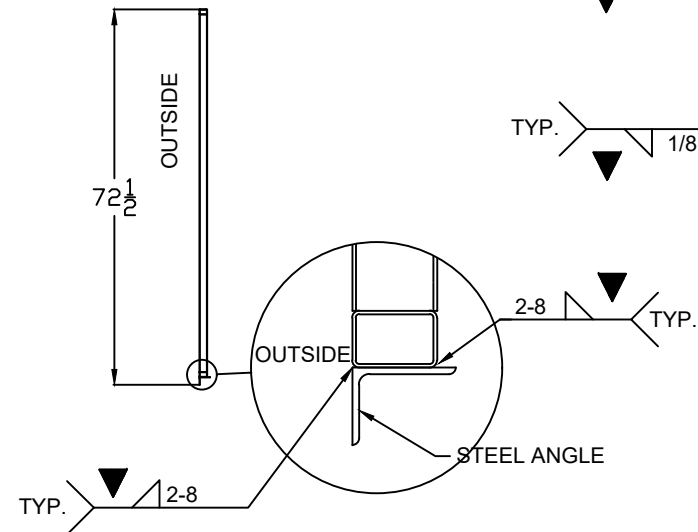
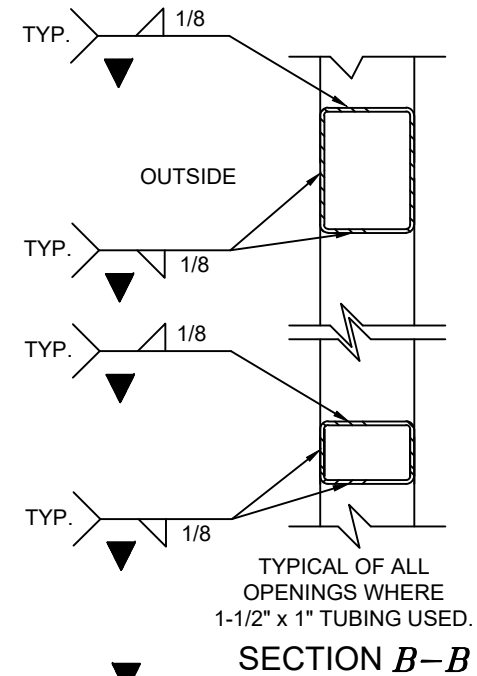
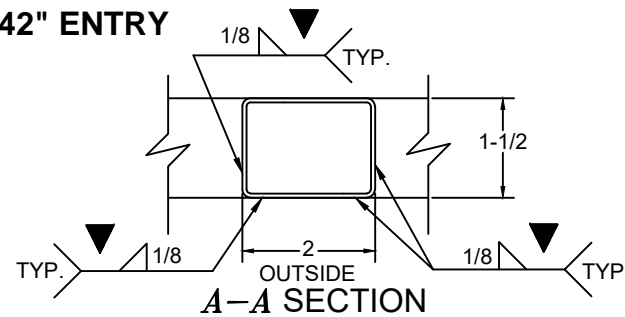
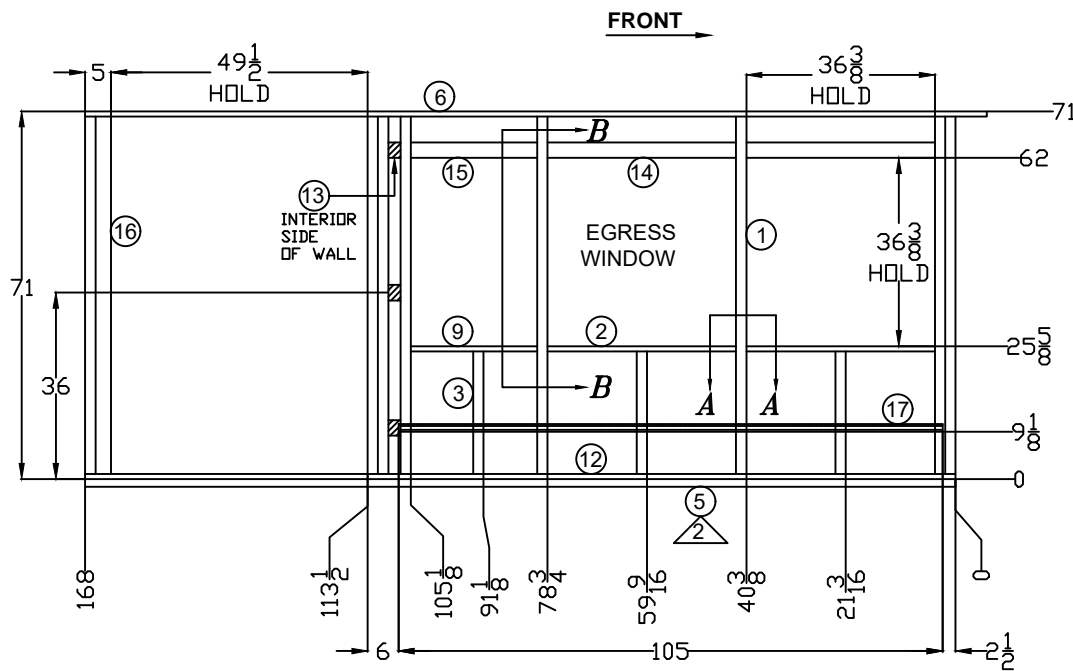


▼ CRITICAL CONTROL ITEM

# USAGE: FORD 158"WB/MODEL 24, 42" ENTRY

## NOTES:

- 1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.
- 2- ANGLE TO BE WELDED FLUSH WITH OUTSIDE EDGE OF WALL.



\*\*\*ALL MATERIALS GALVANIZED\*\*\*

8	0		FRAME, SIDEWALL WHEEL WELL FORD	17	1		SEAT TRACK: 105-1/2"Lg.
7	0		TUBE: 18ga. x 1-1/2" x 2" x 66-13/16"Lg. A-513	16	1		TUBE: 18ga. x 1-1/2" x 3" x 69"Lg. A-513
6	1		TUBE: 16ga. x 1-1/2" x 1" x 174"Lg. A-513	15	1		TUBE: 16ga. x 1-1/2" x 3" x 24-3/8"Lg. A-513
5	1		ANGLE: 11ga. x 1-1/2" x 2" x 168"Lg. A-513	14	2		TUBE: 16ga. x 1-1/2" x 3" x 36-3/8"Lg. A-513
4	0		TUBE: 16ga. x 1-1/2" x 1" x 46-3/4"Lg. A-513	13	3		STRAP: 11ga. x 3" x 2-3/8"Lg. A-513
3	4		TUBE: 18ga. x 1-1/2" x 2" x 23-5/8"Lg. A-513	12	1		TUBE: 16ga. x 1-1/2" x 1" x 168"Lg. A-513
2	2		TUBE: 16ga. x 1-1/2" x 1" x 36-3/8"Lg. A-513	11	0		ANGLE: 11ga. x 1-1/2" x 2" x 65-3/4"Lg. A-513
1	8		TUBE: 18ga. x 1-1/2" x 2" x 69"Lg. A-513	10	0		TUBE: 16ga. x 1-1/2" x 1" x 64-3/4"Lg. A-513
				9	1		TUBE: 16ga. x 1-1/2" x 1" x 24-3/8"Lg. A-513
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION	REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

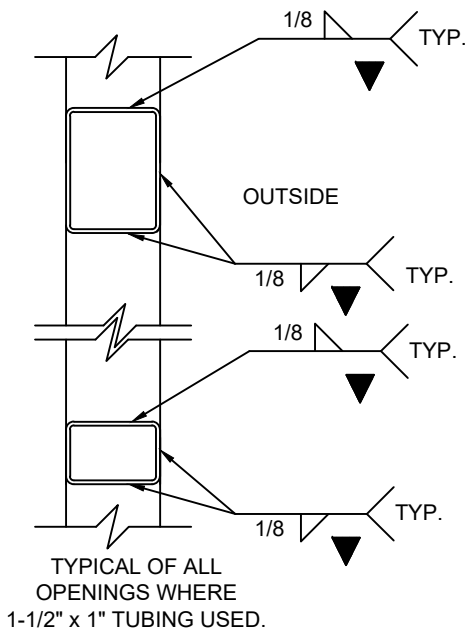
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REV.	LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.	TOLERANCE UNLESS OTHERWISE SPECIFIED	WOOD	OTHER	DATE: 6/14/18	TITLE: 158" WB MODEL 24, 42" ENTRY SIDEWALL, R. LIFT, RAISED FLOOR
							± 1/8"	± 1/16"	NAME: MKLINE		
							± 1"	± 1/2"	DWG. No. 32-13-0030-18	SPECIAL 42 ENTRY	

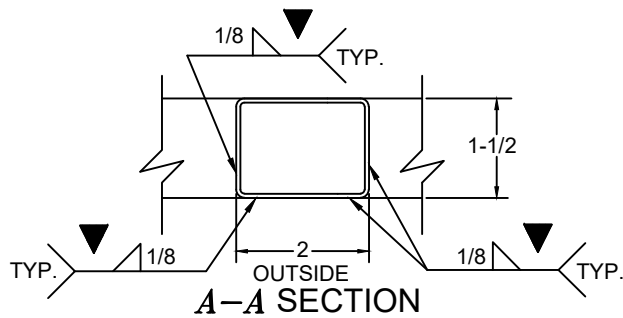
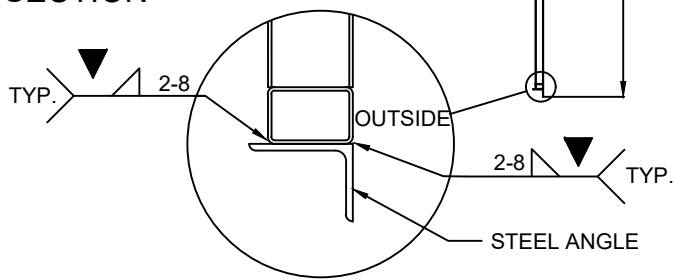
**Glaval Bus**  
a division of Forest River, Inc.

▼ CRITICAL CONTROL ITEM

USAGE: FORD 158"WB/MODEL 24

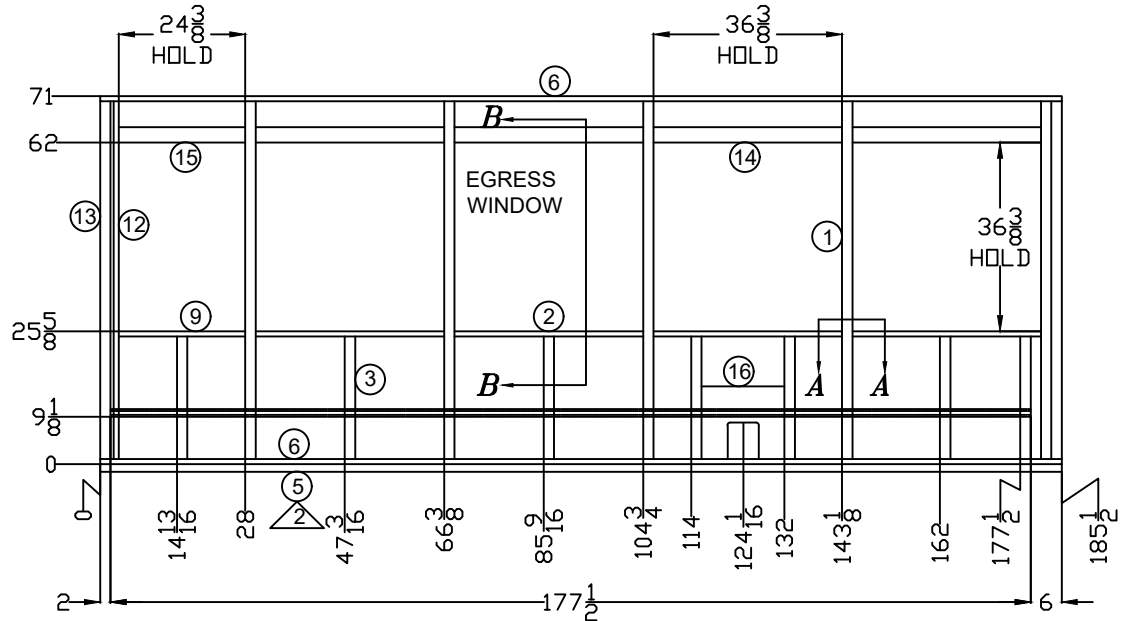


B-B SECTION



NOTES:

- 1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.  
2- ANGLE TO BE WELDED FLUSH WITH OUTSIDE EDGE OF WALL.



\*\*\*ALL MATERIALS GALVANIZED\*\*\*

8	0		FRAME, SIDEWALL WHEEL WELL FORD	17	1		SEAT TRACK: 177-1/2"Lg.
7	0		TUBE: 18ga. x 1-1/2" x 2" x 70-7/8"Lg. A-513	16	1		FUEL FILL BACKER BOARD
6	2		TUBE: 16ga. x 1-1/2" x 1" x 185-1/2"Lg. A-513	15	1		TUBE: 16ga. x 1-1/2" x 3" x 24-3/8"Lg. A-513
5	1		ANGLE: 11ga. x 1-1/2" x 2" x 185-1/2"Lg. A-513	14	4		TUBE: 16ga. x 1-1/2" x 3" x 36-3/8"Lg. A-513
4	0		TUBE: 16ga. x 1-1/2" x 1" x 79-9/16"Lg. A-513	13	2		TUBE: 16ga. x 1-1/2" x 2" x 69"Lg. A-513
3	7		TUBE: 18ga. x 1-1/2" x 2" x 23-5/8"Lg. A-513	12	1		TUBE: 16ga. x 1-1/2" x 1" x 69"Lg. A-513
2	4		TUBE: 16ga. x 1-1/2" x 1" x 36-3/8"Lg. A-513	11	0		ANGLE: 11ga. x 1-1/2" x 2" x 70-3/16"Lg. A-513
1	5		TUBE: 18ga. x 1-1/2" x 2" x 69"Lg. A-513	10	0		TUBE: 16ga. x 1-1/2" x 1" x 70-3/16"Lg. A-513
				9	1		TUBE: 16ga. x 1-1/2" x 1" x 24-3/8"Lg. A-513
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION	REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

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REV.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.
LET.					

TOLERANCE UNLESS OTHERWISE SPECIFIED

WOOD	OTHER
± 1/8"	± 1/16"
± 1"	± 1/2"

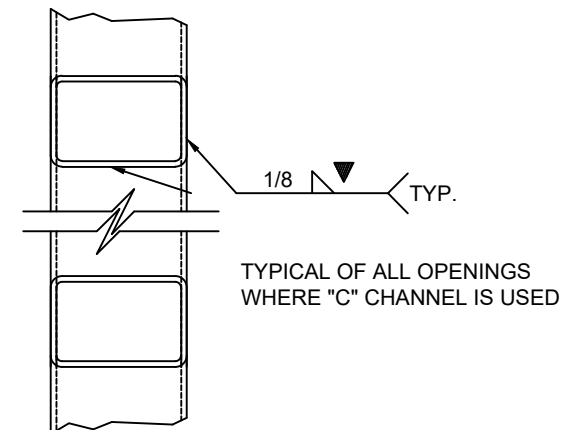
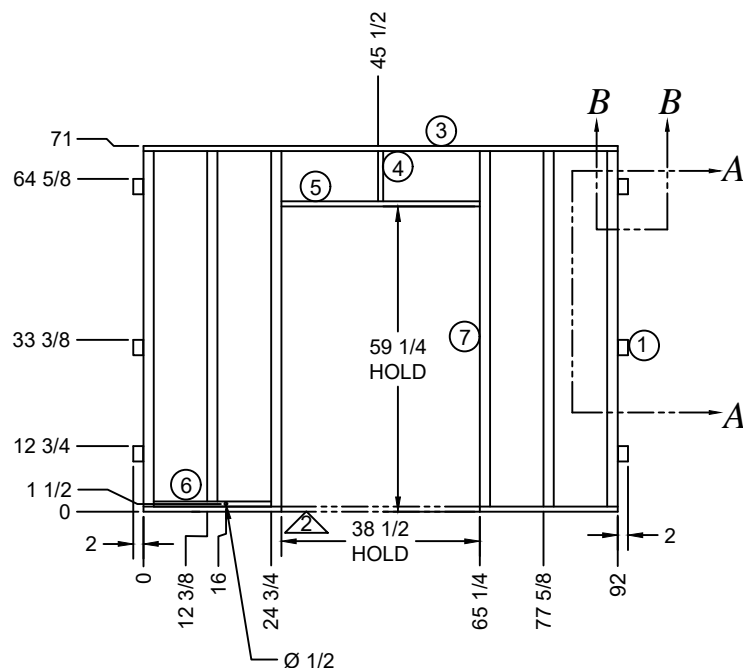
DATE: 6/13/18  
NAME: MKLINE  
DWG. No. 32-13-0002-10

**Glaval Bus**  
a division of Forest River, Inc.

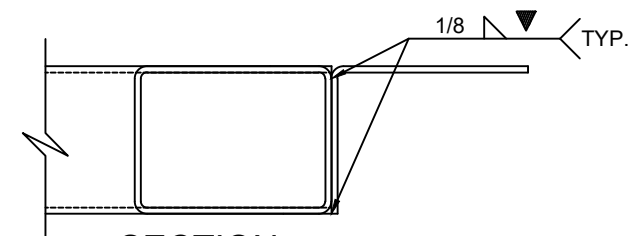
TITLE: 158" WB MODEL 24, DR. SIDEWALL, ALL PASS, RAISED FLOOR

▼ CRITICAL CONTROL ITEM

## USAGE: Raised Floor w/ Rear Door, SPECIAL 1-1/2" THICK WALL



SECTION A-A



SECTION B-B

\*\*\*ALL MATERIALS aluminized\*\*\*

### NOTES:

1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.

2- REMOVE STEEL TUBE IN DOOR AREA AFTER WALL MOUNT TO FLOOR BUT BEFORE INSTALLING DOOR JAM ASSEMBLY.

7	6		TUBE: 16ga. x 1-1/2" x 2" x 69"Lg. A-513
6	1	02071055	TUBE: 16ga. x 1-1/2" x 1" x 10-3/8"Lg. A-513
5	1	02071055	TUBE: 16ga. x 1-1/2" x 1" x 38-1/2"Lg. A-513
4	1	02071055	TUBE: 16ga. x 1-1/2" x 1" x 9-3/4"Lg. A-513
3	2	02071055	TUBE: 16ga. x 1-1/2" x 1" x 92"Lg. A-513
2	0		
1	6		ANGLE: 16ga. x 1" x 2" x 6"Lg. A-513

REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION
----------	------	----------	----------------------



a division of Forest River, Inc.

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REV. LET.

DESCRIPTION OF CHANGE

BY

CHK

DATE

ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED  
± .00 ± .030  
± .000 ± .015  
± .0000 ± .005

DATE: 06/14/18

DFTSN: MKLINE

CHKR:

APRVD:

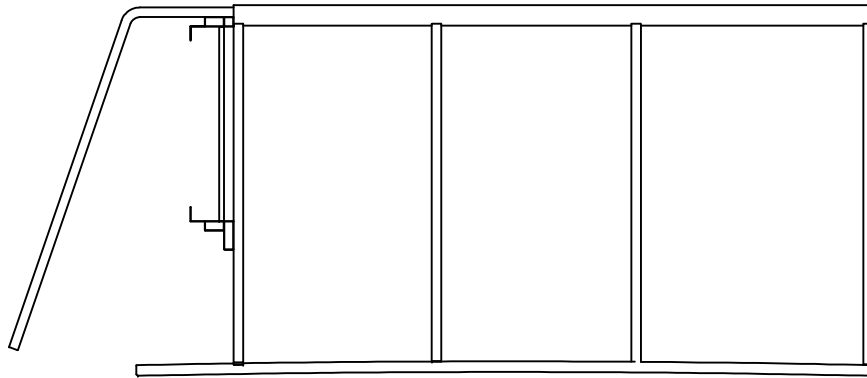
TITLE **Frame, Rear Wall Raised Floor With Door**

DWG. No.

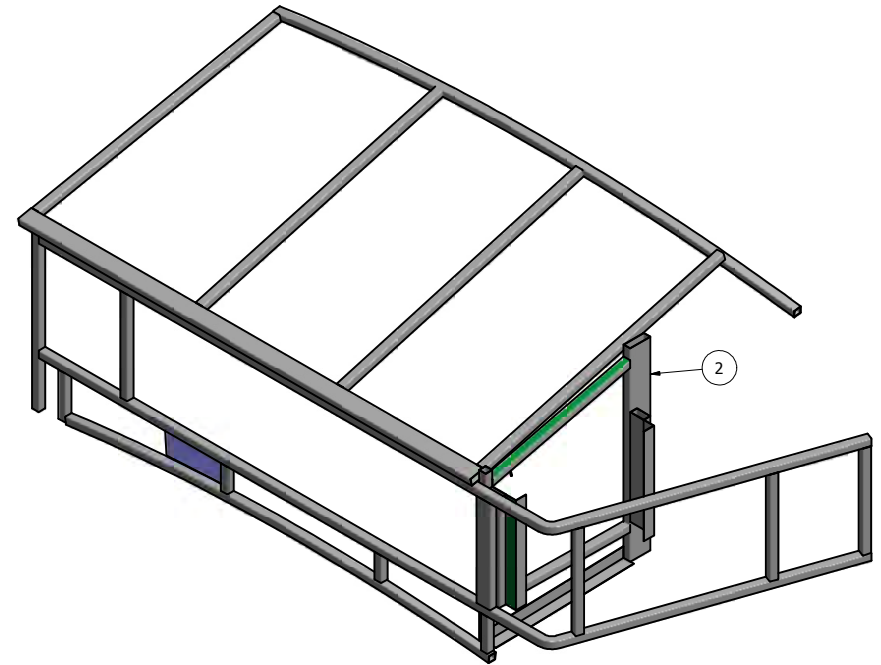
**31-28-0010-18 SPECIAL**

DISK No.

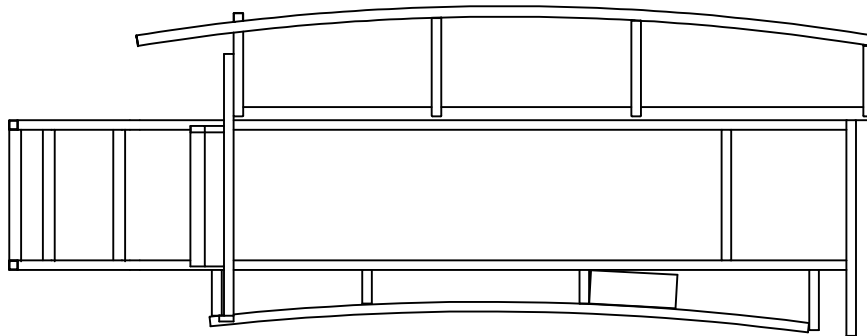
SHEET 1 OF 1



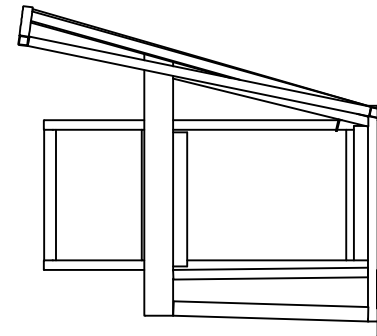
TOP VIEW



ISOMETRIC VIEW



BACK VIEW



SIDE VIEW

\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

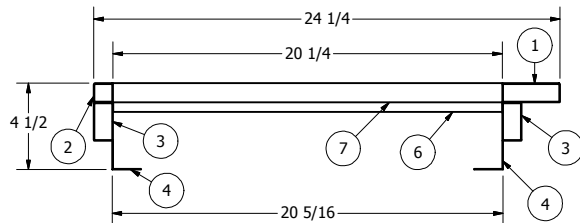
Note:

1). Viewed from Interior.

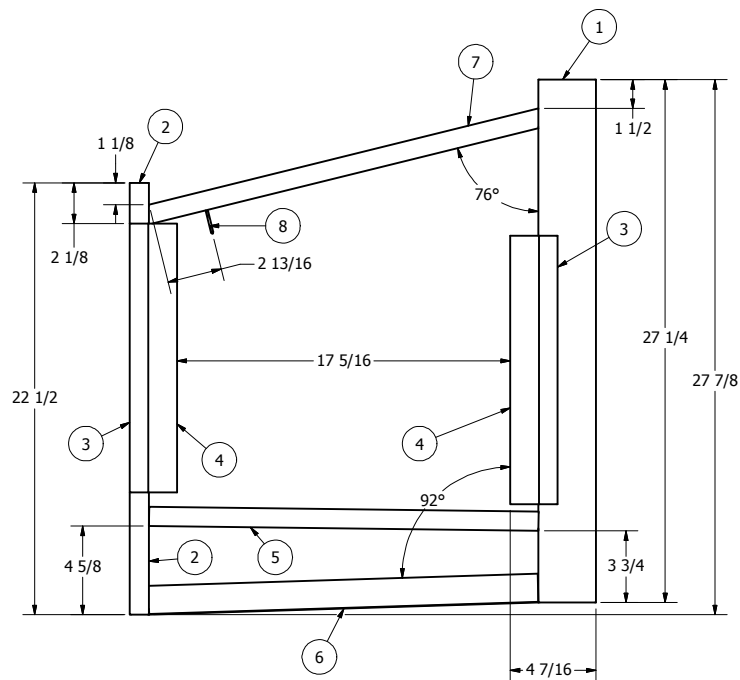
Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	31-28-0307-11	FORD Front Cab Wrap Around
2	1	31-28-0299-11	Ford Electrical Panel Frame
3	1	31-28-0745-11	FORD Cab Overhead

 <b>Glaval Bus</b> A Division Of Forest River, Inc.	
DFTSN: <b>TAS</b>	TITLE: Ford Front Cab, Over Head Cab, Electrical Panel Assembly
DATE: <b>02/04/15</b>	DWG NO: <b>31-28-0993-15</b>
SHEET <b>1</b> OF <b>1</b>	

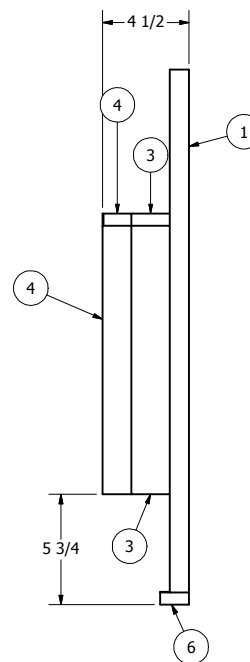




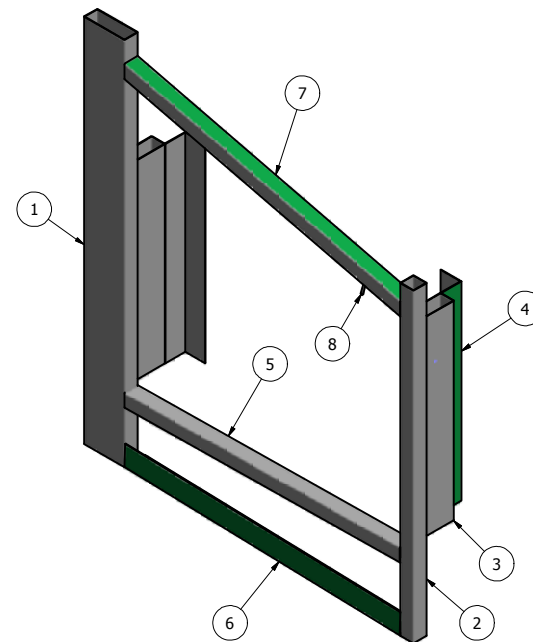
TOP VIEW



BACK VIEW



SIDE VIEW



ISOMETRIC VIEW

\*\*\* ALL MATERIALS ALUMINIZED \*\*\*

Note:

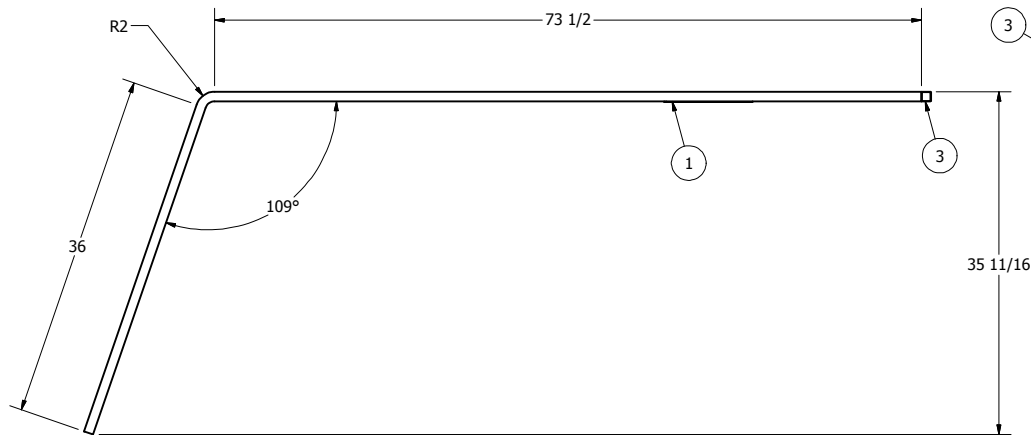
1). Viewed from Exterior.

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
31-28	"A"	Released For Production	9/21/07	ELF
31-28	"B"	Update From Auto Cad To Inventor... Updated To Match What Production Is Currently Building	11/14/07	TAS
31-28				

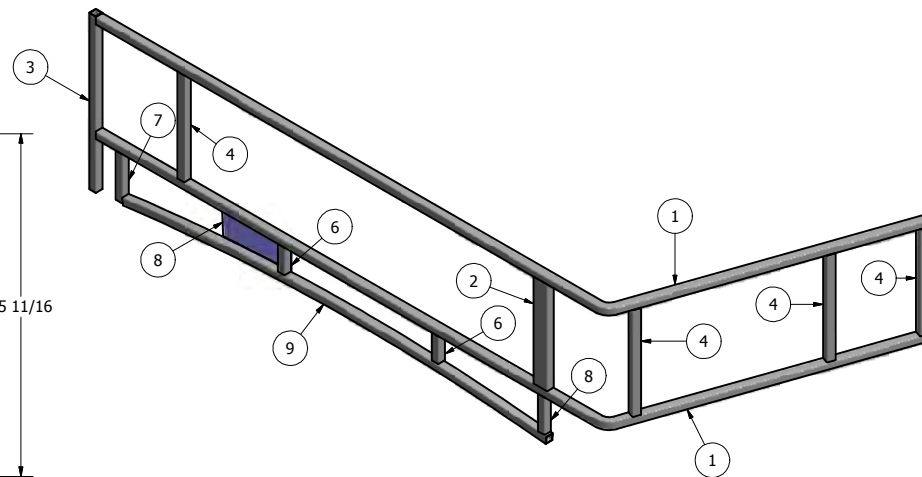
Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	1x3x27.25	Steel Tube 16ga. 1"x 3"x 27-1/4"
2	1	1x1x22.5	Steel Tube 16ga. 1"x 1"x 22-1/2"
3	2	1x2x14	Steel Tube 16ga. 1"x 2"x 14"
4	2	02071056-14	STEEL ANGLE 11ga.x 1-1/2"x 1-1/2"x 14" Ig. A-513
5	1	1x1x20.25	Steel Tube 16ga. 1"x 1"x 20-1/4"
6	1	02071056-20.25	STEEL ANGLE 11ga.x 1-1/2"x 1-1/2"x 20-1/4" Ig. A-513
7	1	1x1x21.125 Angle Cut	Steel Tube 16 ga. 1"x 1"x 15-1/4" Angle Cut
8	1	.25-20 x 1.25 Stud Grade 8	1/2" 13 x 2" Grade 8 Hex Head Bolt



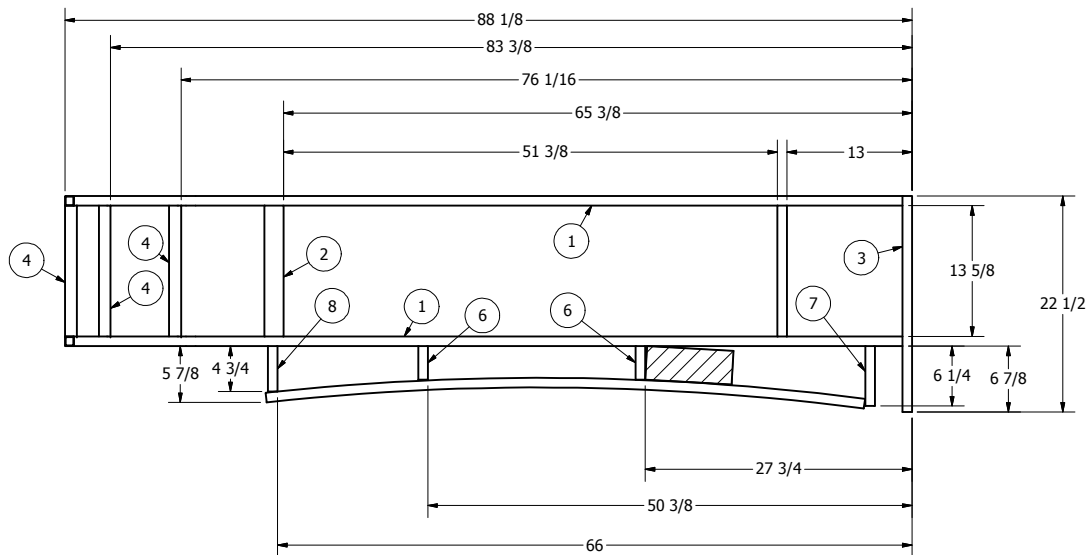
DFTSN:	TAS	TITLE	Ford Electrical Panel Frame
DATE:	11/07/11	DWG NO	31-28-0299-11
		SHEET	1 OF 1



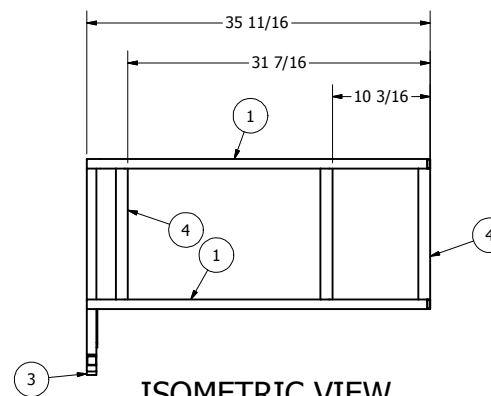
TOP VIEW



ISOMETRIC VIEW



BACK VIEW



ISOMETRIC VIEW

\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

Note:

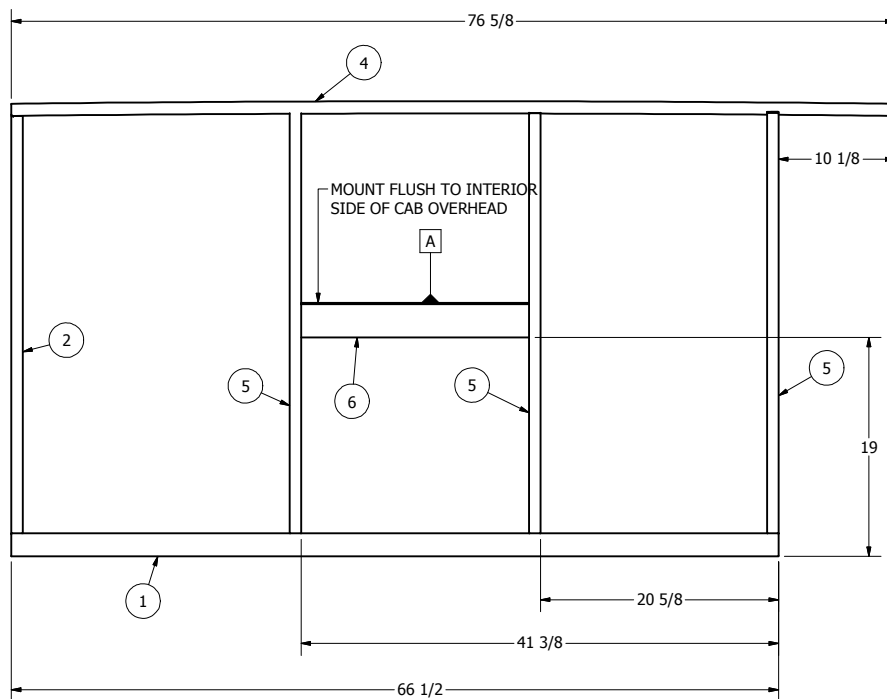
1). Viewed from Exterior.

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
31-28	"A"	Release To Production	10/26/2007	ELF
31-28	"B"	Changed Length of The Wrap Around Tubes	04/28/09	MDK
31-28	"C"	Update From Auto Cad Ton Inventor.. Updated To Match What Production Is Currently Building	11/14/2011	TAS
31-28	"D"	New Revised Standard 2015 Halo	02/05/2015	TAS

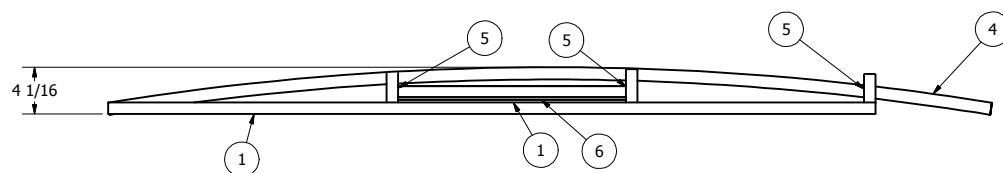
Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	31-28-0747-11	Ford 1"x 1"x 16ga. Front Wrap Steel Tube
2	2	1x2x13.625	Steel Tube 16ga. 1"x 2"x 13-5/8"
3	1	1x1x22.5	Steel Tube 16ga. 1"x 1"x 22-1/2"
4	5	1x1x13.625	Steel Tube 16ga. 1"x 1-1"x 13-5/8"
5	1	1x1x15.625	Steel Tube 16ga. 1"x 1"x 15-5/8"
6	2	1x1x3.5	Steel Tube 16ga. 1"x 1"x 3-1/2"
7	1	1x1x6.25	Steel Tube 16ga. 1"x 1"x 6-1/4"
8	1	1x1x4.75	Steel Tube 16ga. 1"x 1"x 4-3/4"
9	1	1 x 1 66.25 CAB CURVE	Ford 1"x 1"x 62-1/4" Steel Cab Radius Tube
10	1	1x1x4.375	Steel Tube 16ga. 1"x 1"x 4-3/8"



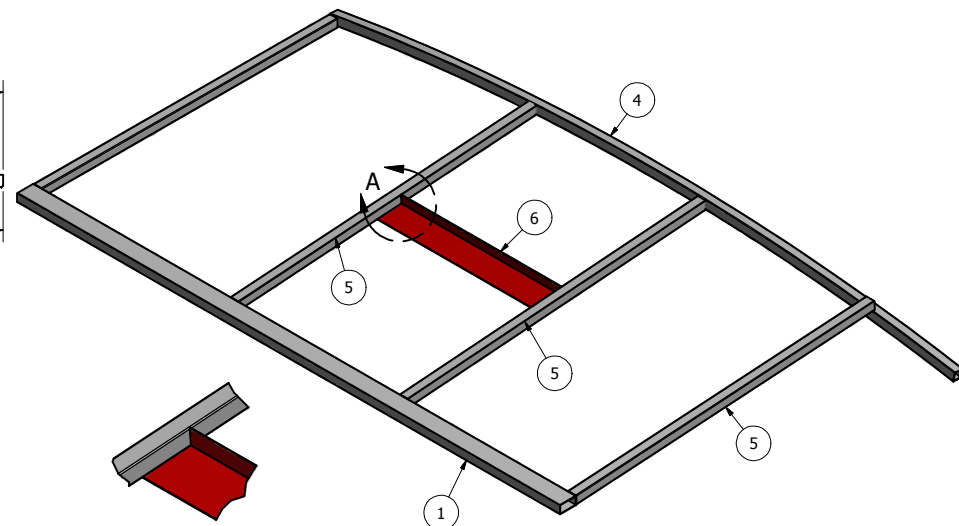
DFTSN:	TAS	TITLE	FORD Front Cab Wrap Around
DATE:	11/07/11	DWG NO	31-28-0307-11
		SHEET	1 OF 1



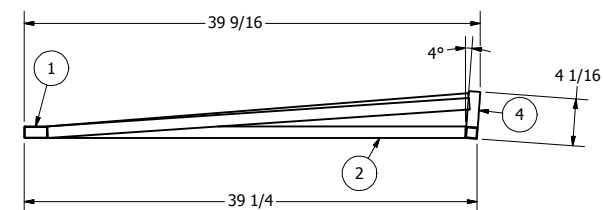
Top View



Front View



Isometric View



Side View

Note:

1). Viewed from Exterior.

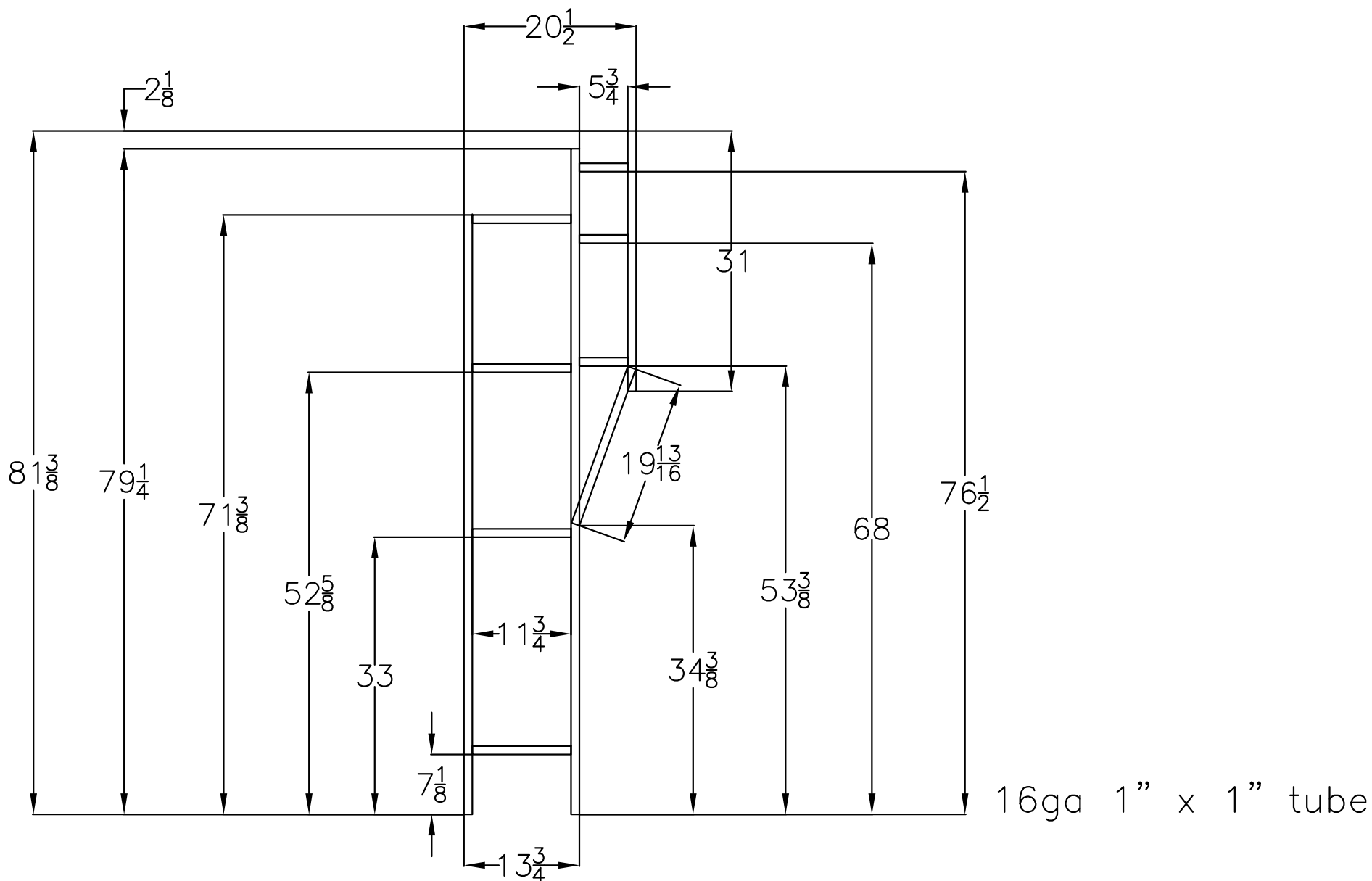
\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

Parts List				
ITEM	QTY	PART NUMBER	DESCRIPTION	
1	1	1x2x66.5	Steel Tube 16ga. 1"x 2"x 66-1/2"	
2	1	1x1x36.25	Tube 16ga. 1"x 1"x 36-1/4"	
3	1	1x3x7	Steel Tube 16ga. 1"x 3"x 7"	
4	1	31-28-0750-11	Ford Allstar Radius Tube 1"x 1"x 76-5/8"	
5	3	1x1x36.625	Aluminized Steel Tube 16ga. 1"x 1"x 36-5/8"	
6	1	3 x 1x 19.75	STEEL ANGLE 16ga.x 3"x 1"x 19-3/4" lg. A-513	
11	1	3 x 1x 19.75	STEEL ANGLE 16ga.x 3"x 1"x 19-3/4" lg. A-513	

DFTSN: TAS		TITLE: FORD New Syle Cab Overhead	
DATE: 11/07/11		DWG NO: 31-28-0745-11	SHEET 1 OF 1

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
31-28	"A"	ADDED ANGLE FOR BACKER CENTER CEILING STRIPE	3/22/2015	TAS



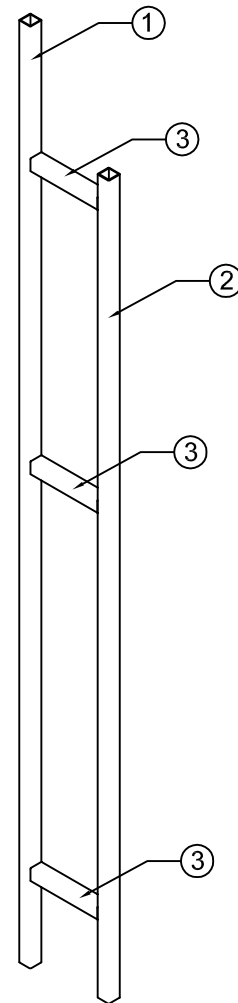
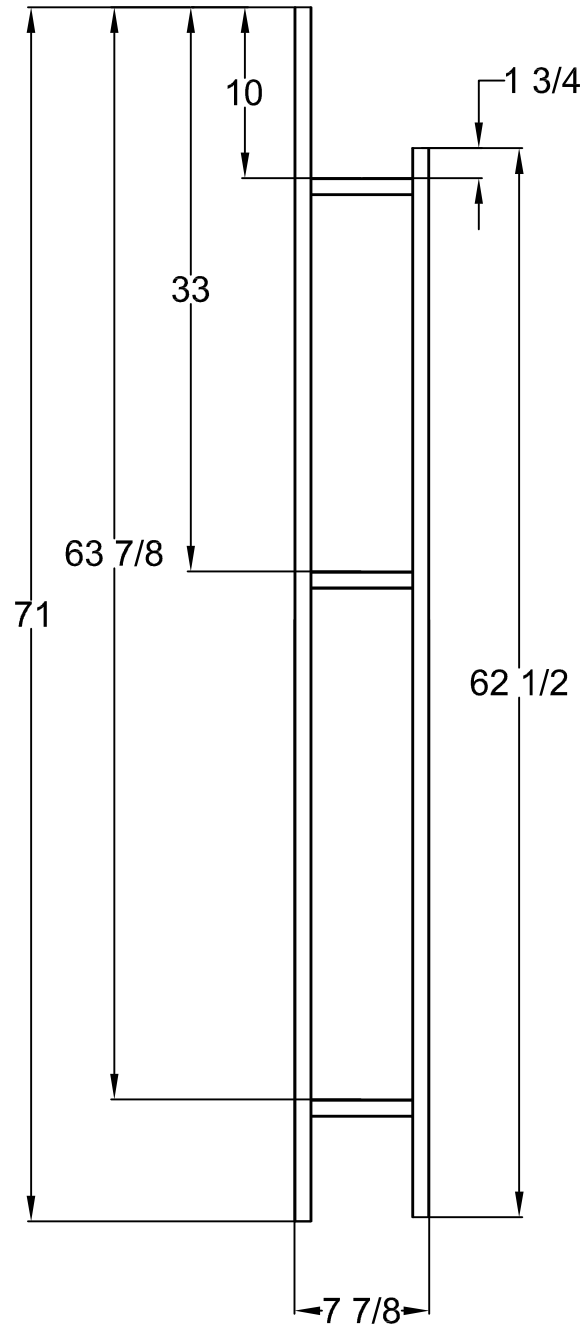
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REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		 a division of Forest River, Inc.	
WOOD	OTHER	DATE: 7/27/17	TITLE: streetside pillar
± 1/8"	± 1/16"	NAME: MK	DWG. No. 31-28-0955-14
± 1"	± 1/2"		





16ga 1" x 1" tube

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REV.  
LET.

DESCRIPTION OF CHANGE

BY

CHK

DATE

ECN No.

± 1"

± 1/2"

TOLERANCE UNLESS  
OTHERWISE SPECIFIED

WOOD

OTHER

± 1/8"


± 1/16"

DATE: 7/27/17  
NAME: MK  
DWG. No.

TITLE:

curbside pillar

**Glaval Bus** a division of Forest River, Inc.

					TOLERANCE UNLESS OTHERWISE SPECIFIED		 <b>Glaval Bus</b> a division of Forest River, Inc.	
					WOOD	OTHER	DATE, 06/30/17	TITLE: RAISED FLOOR-3 STEP FALSE FLOOR ASSEMBLY
					± 1/8"	± 1/16"	NAME, RTS	
REV. LET.	DESCRIPTION OF CHANGE	BY	DATE	ECN No.	± 1°	± 1/2°	DWG. No.	31-28-0531-17C



The following information is submitted for all Glaval Bus products proposed on this bid as supporting documentation of the structural soundness and impact resistance of the bodies manufactured. All vehicles are built using virtually the same materials with some minor differences in the height and width of cross members due to entry floor heights and/or body width variations.

A representative set of construction prints provided by engineering supplements this verbal accounting of our materials and assembly specifications.

If, in the reviewing of these written technical specifications and engineering frame prints submitted any questions arise, please contact us immediately for any clarification or help in interpretation and understanding.

### **3.0 Body Construction – General Frame Construction**

Manufactured from all aluminized steel products, the floor, roof, side walls, rear wall, driver halo assembly and entry door assembly are all wire welded (MIG) together to form an integral steel frame that is mounted with specified hardware to the rubber body mount points (pucks) supplied by the chassis manufacturer. Once joined to the chassis, the bus finishing process begins.

#### **3.0.1 Floor frame construction and assembly –**

- 3.0.1.1 Cross Members -- The floor cross members form the base structural support for the rest of the frame components. Our cross members are constructed of 14 gauge aluminized steel, formed to a capital “C” shape. Cross members over the fuel tank are made to provide the clearance needed to conform with FMVSS301, and include formed internal reinforcements welded in place for additional strength. All additional longitudinal and latitudinal structure is flush welded in place to form a one piece floor upon completion.
- 3.0.1.2 Aluminized steel “Hat Posts” – 1”x1”x4” run the length of the floor between cross members and are welded into place. This extremely strong form is used to weld our HSLA steel seat track in place.
- 3.0.1.3 Aluminized steel C Channel – 1”x1.5” C channel is welded in between cross members the full length of the floor in 5 places. Coupled with the Hat Posts this provides a one-piece strong “ladder” type frame for the flooring.
- 3.0.1.4 Seat Track – 12 gauge roll formed high strength/low alloy steel is wire welded in place for seat mounting down each side of the bus, with lengths predicated on the floor plan chosen. This is yet another stiffener in our extensive construction process.



- 3.0.1.5 Wheel Wells -- Constructed of 14 gauge ALUMINIZED steel, wheel wells are also welded in during the floor construction process. All seams in the wheel well are welded to create a one piece water resistant wheel housing structure. The wheel wells also provide additional strength to the body assembly, when welded in place.
- 3.0.1.6 Structural Aluminized steel Angle – 1/8” thick 1.5” x 2.5” structural aluminized steel angle is used the full perimeter length of each floor assembly, welded to the ends of all floor cross members. This provides not only a flat plane for joining the sidewall assembly, but also ties all cross members together and provides additional side impact resistance.
- 3.0.1.7 Additional structure – When adding vertical stanchions, wheel chair lifts and/or tie down options, additional structure is welded into the floor at locations specified by our engineering department on CAD drawings.

### **3.0.2 Sidewall Construction –**

- 3.0.2.1 Sidewall vertical member – The heart of our sidewall is the vertical structure, a roll formed 18 gauge aluminized steel 1.5" x 2" tube that provides strength and rigidity. The vertical member is installed in full lengths and in shorter sections below window frames. Additional vertical structure is used at both ends of the sidewall enabling the structure to withstand the forces applied by the vehicle when in motion.
- 3.0.2.2 Aluminized steel Tubing – 1.5”x1” lower and 1.5”x3” upper 16 gauge aluminized steel tubing is welded in horizontally between vertical members to frame in window openings. This adds front to rear reinforcement as well.
- 3.0.2.3 Seat Track – 12 gauge high strength/low alloy roll formed ALUMINIZED steel welded down each sidewall below the window frame. While serving as a seat attaching device, it adds excellent structure to the sidewall and also adds excellent side impact resistance.
- 3.0.2.4 Wheelchair Options – Add another layer of metal. Depending on track locations, another structure of 11 gauge thick aluminized steel is welded in place between each vertical member for attaching a shoulder belt mount. Also, additional structure is added to accommodate wheelchair door frames – either 1.5”x1” or 1.5”x2” 16 gauge wall aluinizd steel tubing..
- 3.0.2.5 Full length glavanized steel tubing – 1.5”x1” 16 gauge aluinizd steel tubing is stitch welded to the sidewall bottom and top at each vertical member for attaching to the floor and roof sections, respectively.

### **3.0.3 Rear Wall Construction –**

- 3.0.3.1 Rear wall vertical member – The vertical sidewall 1.5"x 2" aluminized steel tube is also used in the rear wall assembly. Full length structure is used at varying places,





depending on choice of rear window, or rear door. Shorter cut pieces are used above windows and doors. Additional side windows used with the rear door also change the configuration.

3.0.3.2 Aluminized steel Tubing – 1.5"x1" 16 gauge aluminized steel tubing is welded horizontally between vertical members to provide a window frame in the standard product, and used as an upper door frame in the optional rear assembly.

3.0.3.3 Full length aluminized steel tubing – 1.5"x1" 16 gauge aluminized steel tubing stitch welded to the rear wall top and bottom as in the sidewall

### assembly. **3.0.4 Roof Construction –**

3.0.4.1 Roof Bows – Radius formed one-piece 16 gauge aluminized steel roof bows formed as a modified hat post design with eight bends for exceptional strength and located on 16" centers (the closest in the industry), including 4 bends in the web that allows for the roof structure to be capable of taking severe loads. They are then capped with top flat pieces from flange to flange to provide abundant surface area for securing the exterior roof material.

3.0.4.2 aluminized steel Tubing – 1.5"x1" 16 gauge aluminized steel tubing is welded in horizontally to frame all lower window openings and 1.5" x 3" 16 gauge aluminized steel tubing to all upper window openings as required. A full perimeter is also welded on to mate the roof to the sidewall and rear wall, with short vertical pieces providing support on the front and rear ends. The 3" wide aluminized steel tube supplies a structural mounting surface for shoulder belt attachment and has been pull tested to federal standards.

### **3.0.5 Driver Compartment Overhead Halo –**

3.0.5.1 aluminized steel Tubing – 1"x1" 16 gauge aluminized steel tubing is cut and jig welded into an integrated one piece structure spanning from the front roof bow of the body to the newly cut roof line of the cab. Also created during the structure manufacture is the housing for mounting the electronic circuit board.

3.0.5.2 11 Gauge aluminized steel – formed to make brackets used to mount to the chassis roof.

### **3.0.6 False Floor (Cab to body transition) –**

3.0.6.1 aluminized steel Tubing – 2" x 2" 16 gauge aluminized steel tubing is welded together forming a flat body floor transition from the step area back to the actual body area. An overhang on the curbside provides a secure attach point frontally for the entry door frame added later.

3.0.6.2 Structural aluminized steel angle – 11 gauge 1.5"x1.5" structural angle is added in

short lengths five places to provide attachment points to the chassis floor.



### **3.0.7 Interior Vertical Transition Frames –**

3.0.7.1 aluminized steel Tubing – 1"x1" 16 gauge aluminized steel tubing is used vertically and a ladder type assembly is made welding the 1x 1 tube to .75"x.75" 11 gauge aluminized steel tube that is used horizontally in the assemblies. These pieces transition from the body fronts on each side to the driver halo side assembly and the entry door frame assembly on the curbside.

### **3.0.8 Entry Door & Step Assembly Frame –**

3.0.8.1 aluminized steel Tubing – 1"x1" 16 gauge and .75"x.75" 11 gauge aluminized steel tube is cut to length and welded together in a ladder type construction forming a rigid frame for attaching the entry door/step assembly.

### **3.0.9 Entry Door/Step Assembly –**

3.0.9.1 11 Gauge aluminized steel – The step riser/tread piece is manufactured from one-piece 11 gauge aluminized steel and uses 90° bends at all risers and treads. The bottom tread also adds an additional 90° bend for additional strength and safety. Upper and lower side pieces are then attached and an 11 gauge flat plate with holes is used to bridge the lower and upper side pieces, then is stitch welded and plug welded to form a strong one piece assembly prior to inserting and welding to the entry step framing.

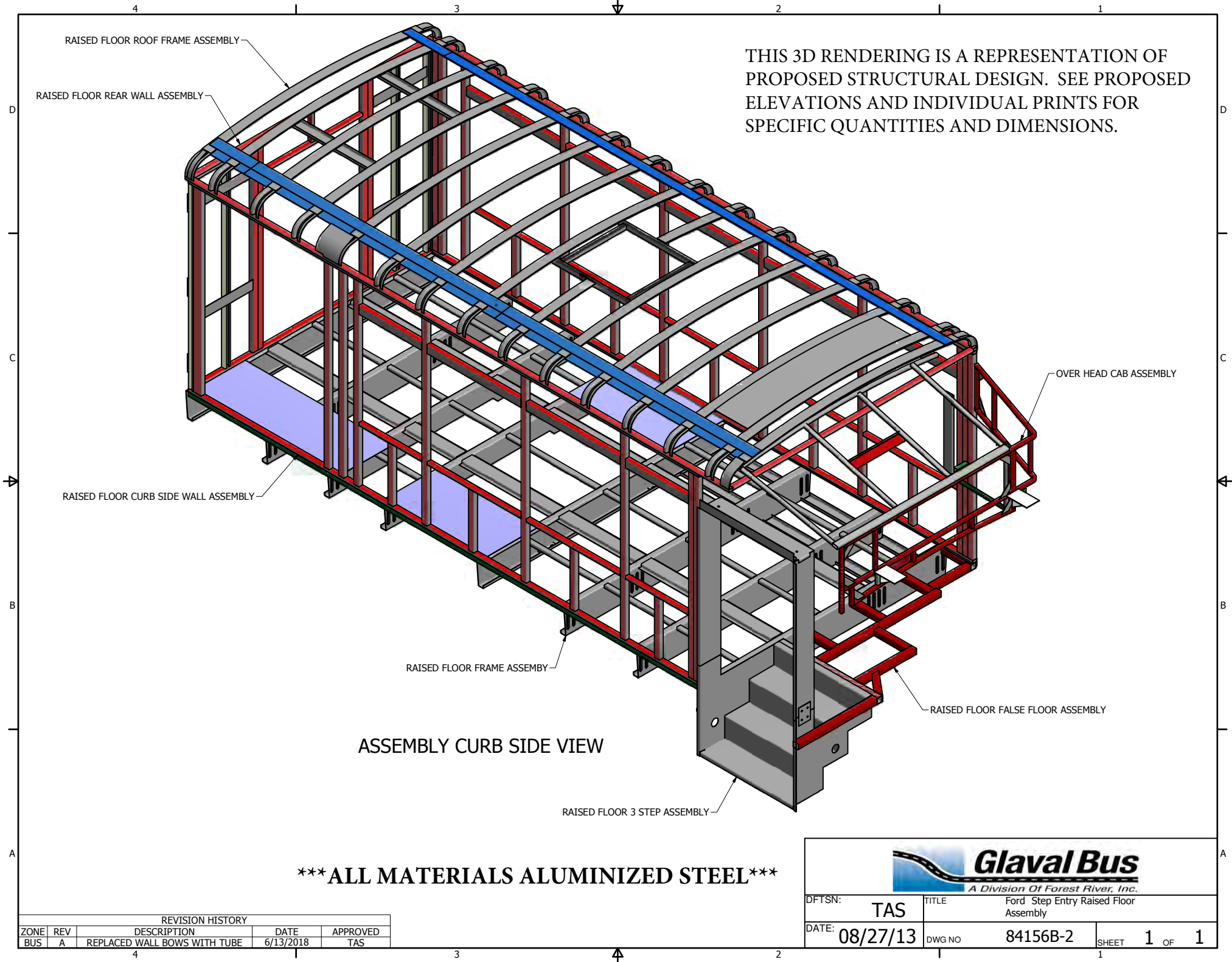
## **APPLICATION OF EXTERIOR SIDEWALL MATERIAL**

### **GALVAIZED STEEL SIDEWALLS OR OPTIONAL FIBERGLASS/FRP/COMPOSITE SIDEWALLS**

The exterior is .024" galvanized steel pre-painted white with an underlayment of 5/32" luan. The interior is 5/32" luan covered with a light gray FRP or padded vinyl. The foam filled aluminized steel cage is placed in the center and all layers are adhered using a cross linked polyurethane hot melt adhesive. The entire assembly is then laminated to assure adhesion.

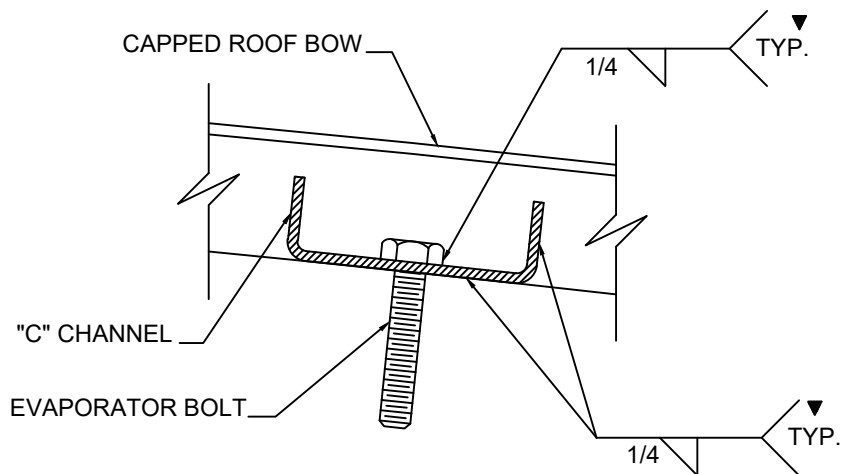
Composite FRP exterior sidewall panels are installed using the same method.

Should any further questions arise, please contact your Glaval Bus representative.

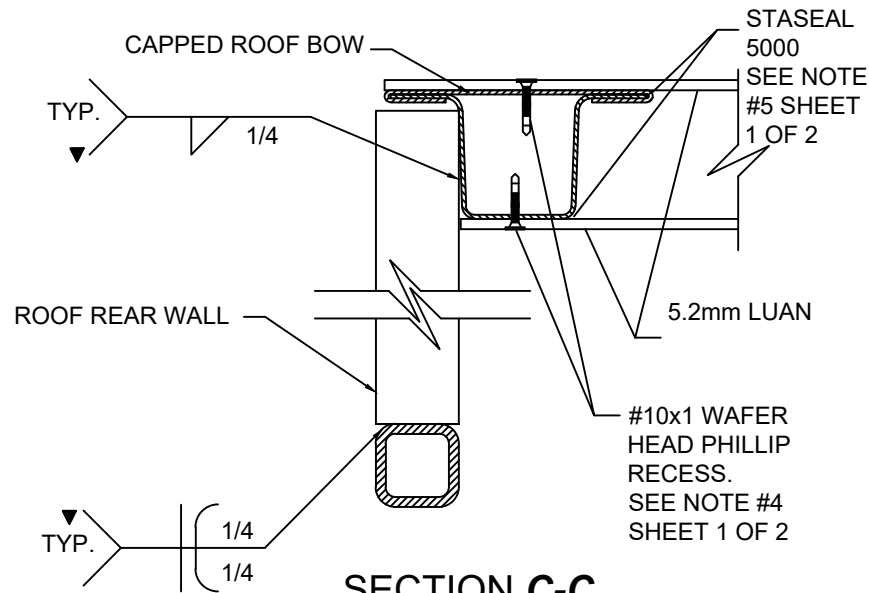




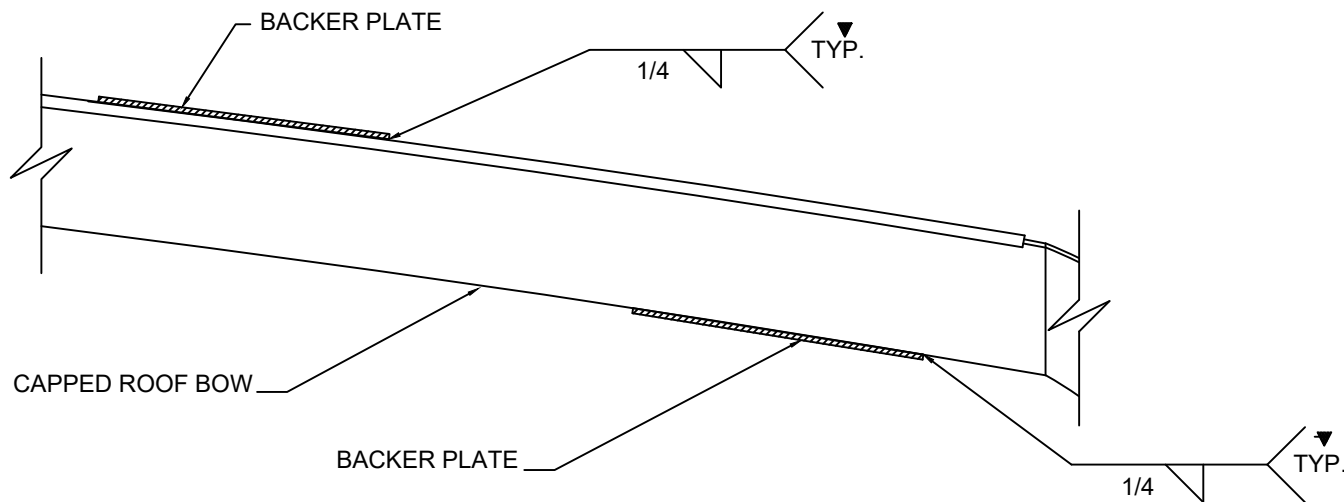
▼ CRITICAL CONTROL ITEM



SECTION A-A



SECTION C-C



SECTION B-B

T/A-71 NEW STYLE	33-5/8	30	10	12-1/4
ACC 23022 SERIES	38	20	10	14-3/4
ACC 23023 SERIES	33-5/8	28-3/4	10	14-3/4
T/A-77	18-1/4	59-1/2	10	10-3/8
T/A-73	28-1/4	39-1/2	10	9-1/2
T/A-71 OLD STYLE	33-5/8	28-3/4	10	12-1/4
T/A-70	36-3/4	22-1/2	10	11-5/8
T/A-30	31	34	10	9-1/2
EM-14 & RE-29	30-3/4	34-1/2	10	9-1/2
EM-6 & RE-10	36	24	10	9-1/2
EM-3 & RE-30	28-1/4	39-1/2	10	16
RE-15 & RE-20	28-1/4	39-1/2	10	9-1/2
EM-1 & EM-2	28-1/4	39-1/2	10	9-1/2
EM-7 GEN 5	36-1/8	23-3/4	10	9-1/2
EM-2 GEN 5	32-3/8	31-1/16	10	9-1/2
EM-1 GEN 5	28-3/16	39-5/8	10	9-1/2
EVAPORATOR MODEL	A-1	A-2	B-1	B-2

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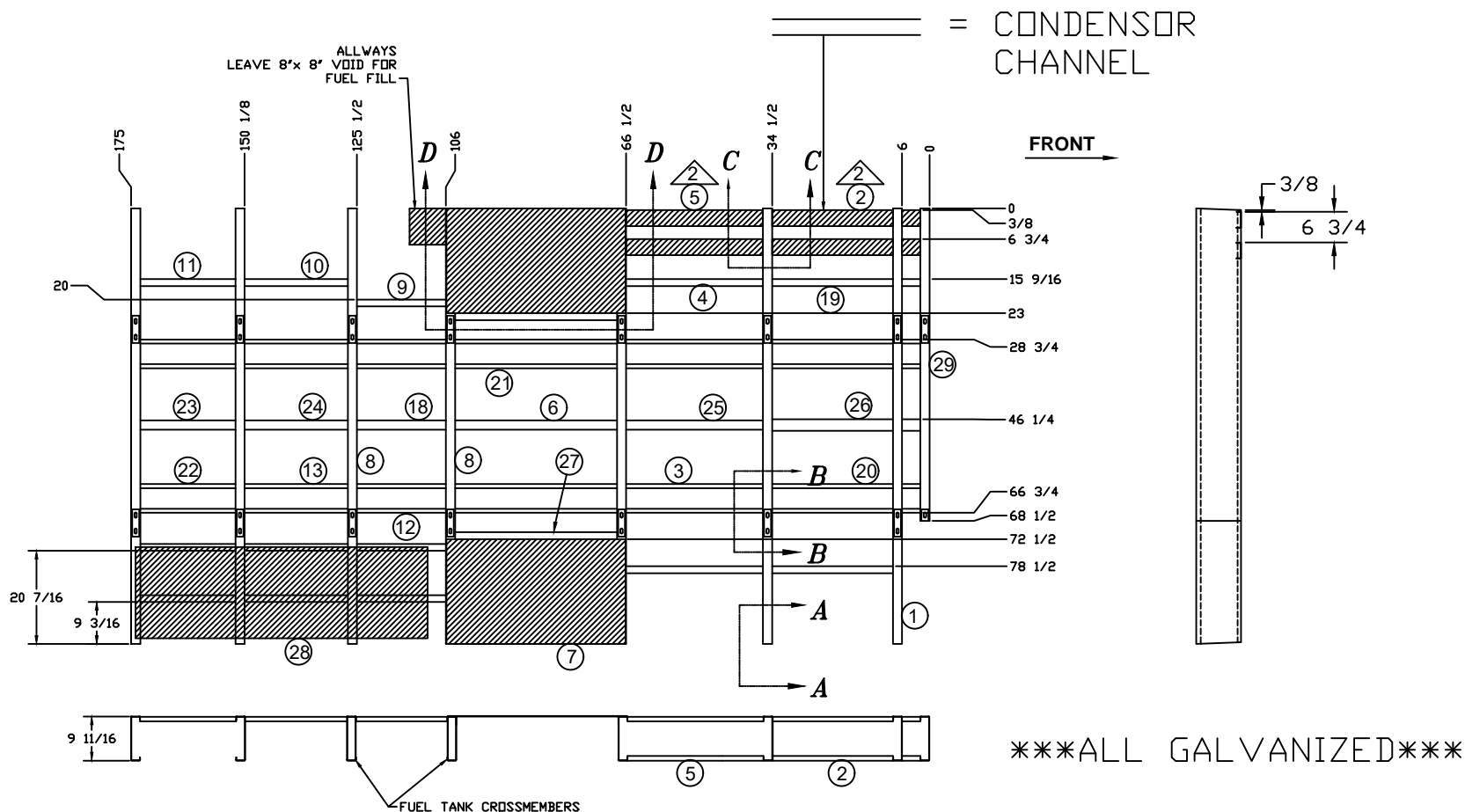
REV.	LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		 <b>Glaval Bus</b> a division of Forest River, Inc.	
WOOD	OTHER	DATE: 06/11/18	TITLE: 158" WHEEL BASE MODEL 24
± 1/8"	± 1/16"	NAME: MKLINE	ROOF FRAME, DETAILS SINGLE HATCH
± 1°	± 1/2"	DWG. No.	32-13-0017-18



▼ CRITICAL CONTROL ITEM

USAGE: FORD 158" WHEEL BASE, MODEL 24



NOTES:

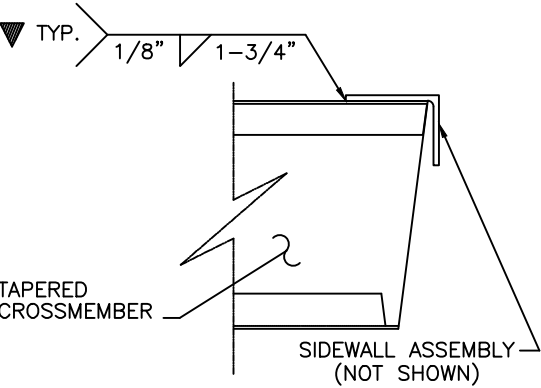
- 1- DRAWING VIEWED FROM INTERIOR SIDE OF UNIT.
- 2- LOCATION OF A/C BRACKETS: ONE MOUNT FLUSH WITH OUTSIDE EDGE OF CROSSMEMBER. THE OTHER MOUNTS 14-3/4" FROM OUTSIDE EDGE OF CROSSMEMBER.
- 3- SEE SHEET 2 OF 2 FOR DETAILS, TORQUE SPECIFICATIONS, SECTION VIEWS AND CUT LIST.

7	2	71002066	SHEET STEEL: 11ga. x 24" x 39-1/4" Lg. HRS
6	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 35-5/8" Lg.
5	2	70009046	"C" CHANNEL: 12ga. x 1" x 3-1/2" x 30" Lg.
4	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 30" Lg.
3	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 30" Lg. A-513
2	2		"C" CHANNEL: 12ga. x 1" x 3-1/2" x 26-1/2" Lg.
1	5	71009018	14ga. x 2 x 9-11/16 x 95-1/2 CROSSMEMBER A-365
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

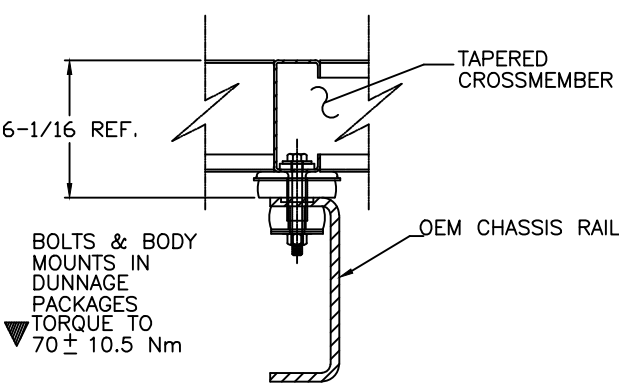
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REV.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.	TOLERANCE UNLESS OTHERWISE SPECIFIED	WOOD	OTHER	DATE	TITLE	NAME	DWG. No.
LET.						± 1/8"	± 1/16"	± 1/2"	6/14/18	158" WB MODEL 24 FLOOR FRAME, RAISED FLOOR	MKLINE	32-13-0031-18 SPECIAL

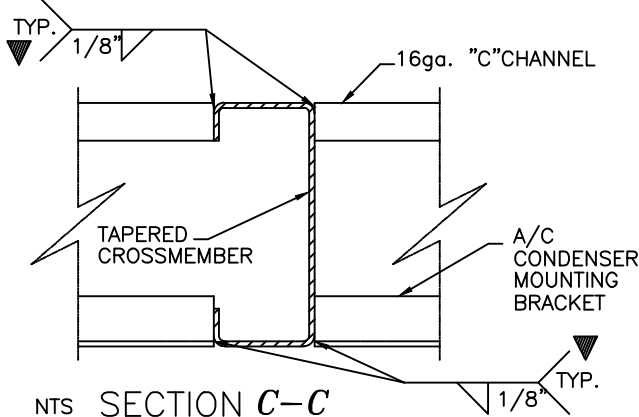
▼ CRITICAL CONTROL ITEM



NTS SECTION A-A



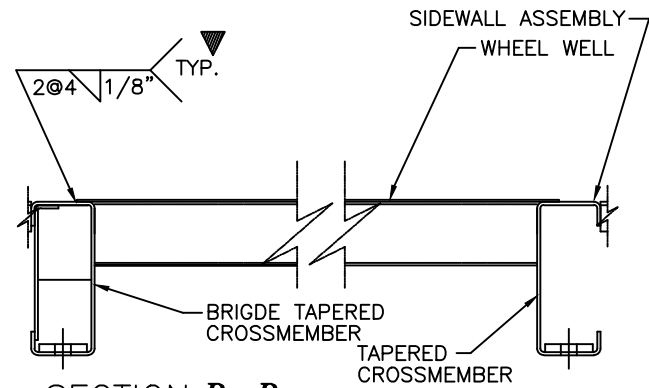
NTS SECTION B-B



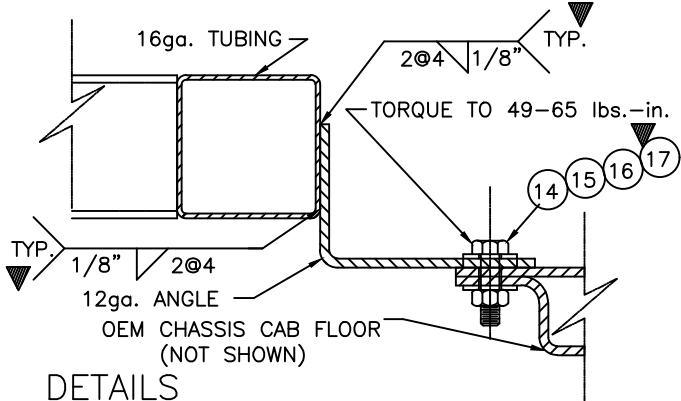
NTS SECTION C-C

\*\*\*ALL GALVANIZED\*\*\*

29	1		14ga. x 2 x 9-11/16 x 68-1/2 CROSSMEMBER A-365
28	2		PLATE: 11ga. 20" x 64" Lg.
27	2	71002028	TUBE: 16ga. x 1-1/2" x 1-1/2" x 35-5/8" Lg. A-513
26	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 26-1/2" Lg.
25	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 30" Lg.
24	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 22-3/8" Lg.
23	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 20-7/8" Lg.
22	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 20-7/8" Lg. A-513
21	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 35-5/8" Lg. A-513
20	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 26-1/2" Lg. A-513
19	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 26-1/2" Lg.
18	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 19-3/4" Lg.
17	7	80052007	NUT, HEX HEAD 3/8-16 UNC GRADE 5 ZINC
16	7	80042015	WASHER MED LOCK 3/8 ZINC
15	14	80042007	WASHER 3/8 USS ZINC
14	7	80112051	BOLT, HEX HEAD 3/8-16 X 1 UNC GRADE 5 ZINC
13	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 22-3/8" Lg. A-513
12	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 19-3/4" Lg. A-513
11	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 20-7/8" Lg.
10	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 22-3/8" Lg.
9	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 19-3/4" Lg.
8	2	70009055	14ga. x 2 x 4-13/16 x 95-1/2 bridge crossmember
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION



NTS SECTION D-D



NTS DETAILS

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REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE		TITLE	
WOOD	OTHER	DATE	6/14/18	TITLE	158' WB MODEL 24
± 1/8"	± 1/16"	NAME	MKLINE	FLOOR FRAME, RAISED FLOOR	
± 1"	± 1/2"	DWG. No.	32-13-0031-18	SPECIAL	

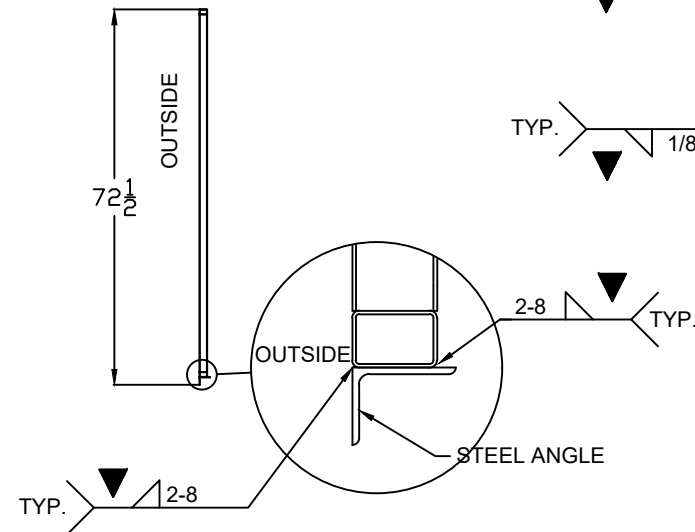
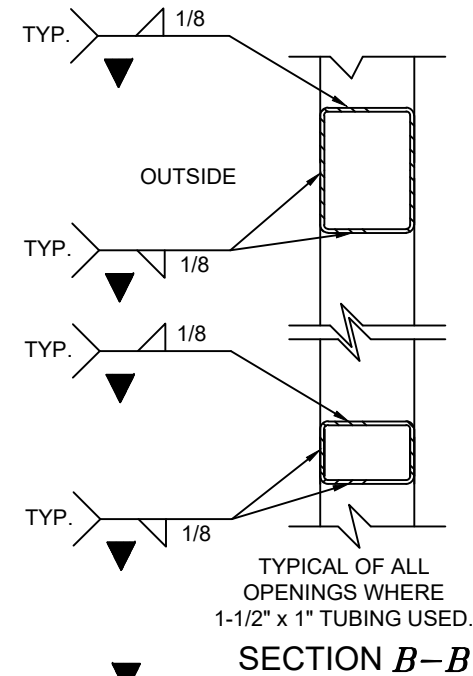
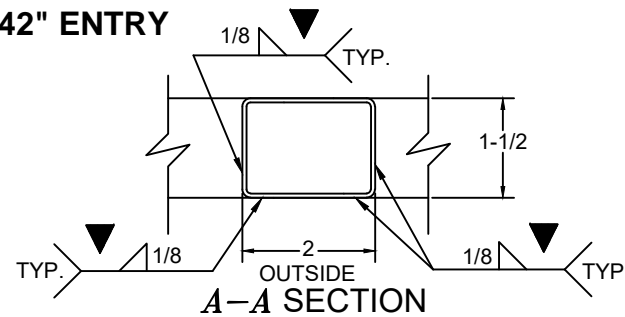
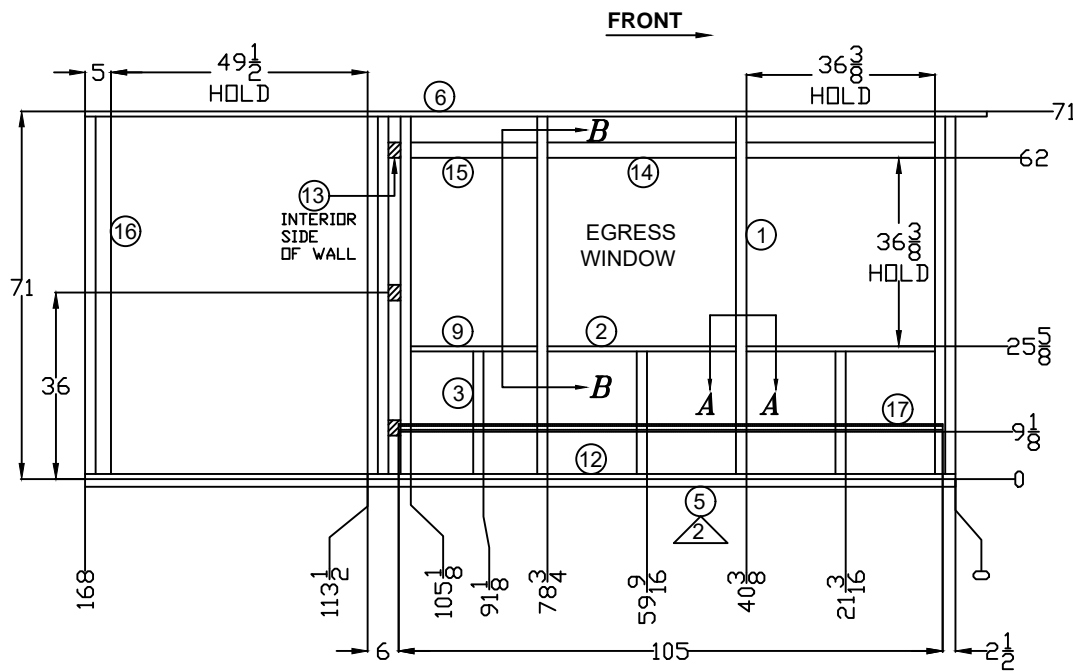


▼ CRITICAL CONTROL ITEM

# USAGE: FORD 158"WB/MODEL 24, 42" ENTRY

## NOTES:

- 1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.
- 2- ANGLE TO BE WELDED FLUSH WITH OUTSIDE EDGE OF WALL.



\*\*\*ALL MATERIALS GALVANIZED\*\*\*

8	0		FRAME, SIDEWALL WHEEL WELL FORD	17	1		SEAT TRACK: 105-1/2"Lg.
7	0		TUBE: 18ga. x 1-1/2" x 2" x 66-13/16"Lg. A-513	16	1		TUBE: 18ga. x 1-1/2" x 3" x 69"Lg. A-513
6	1		TUBE: 16ga. x 1-1/2" x 1" x 174"Lg. A-513	15	1		TUBE: 16ga. x 1-1/2" x 3" x 24-3/8"Lg. A-513
5	1		ANGLE: 11ga. x 1-1/2" x 2" x 168"Lg. A-513	14	2		TUBE: 16ga. x 1-1/2" x 3" x 36-3/8"Lg. A-513
4	0		TUBE: 16ga. x 1-1/2" x 1" x 46-3/4"Lg. A-513	13	3		STRAP: 11ga. x 3" x 2-3/8"Lg. A-513
3	4		TUBE: 18ga. x 1-1/2" x 2" x 23-5/8"Lg. A-513	12	1		TUBE: 16ga. x 1-1/2" x 1" x 168"Lg. A-513
2	2		TUBE: 16ga. x 1-1/2" x 1" x 36-3/8"Lg. A-513	11	0		ANGLE: 11ga. x 1-1/2" x 2" x 65-3/4"Lg. A-513
1	8		TUBE: 18ga. x 1-1/2" x 2" x 69"Lg. A-513	10	0		TUBE: 16ga. x 1-1/2" x 1" x 64-3/4"Lg. A-513
				9	1		TUBE: 16ga. x 1-1/2" x 1" x 24-3/8"Lg. A-513
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION	REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

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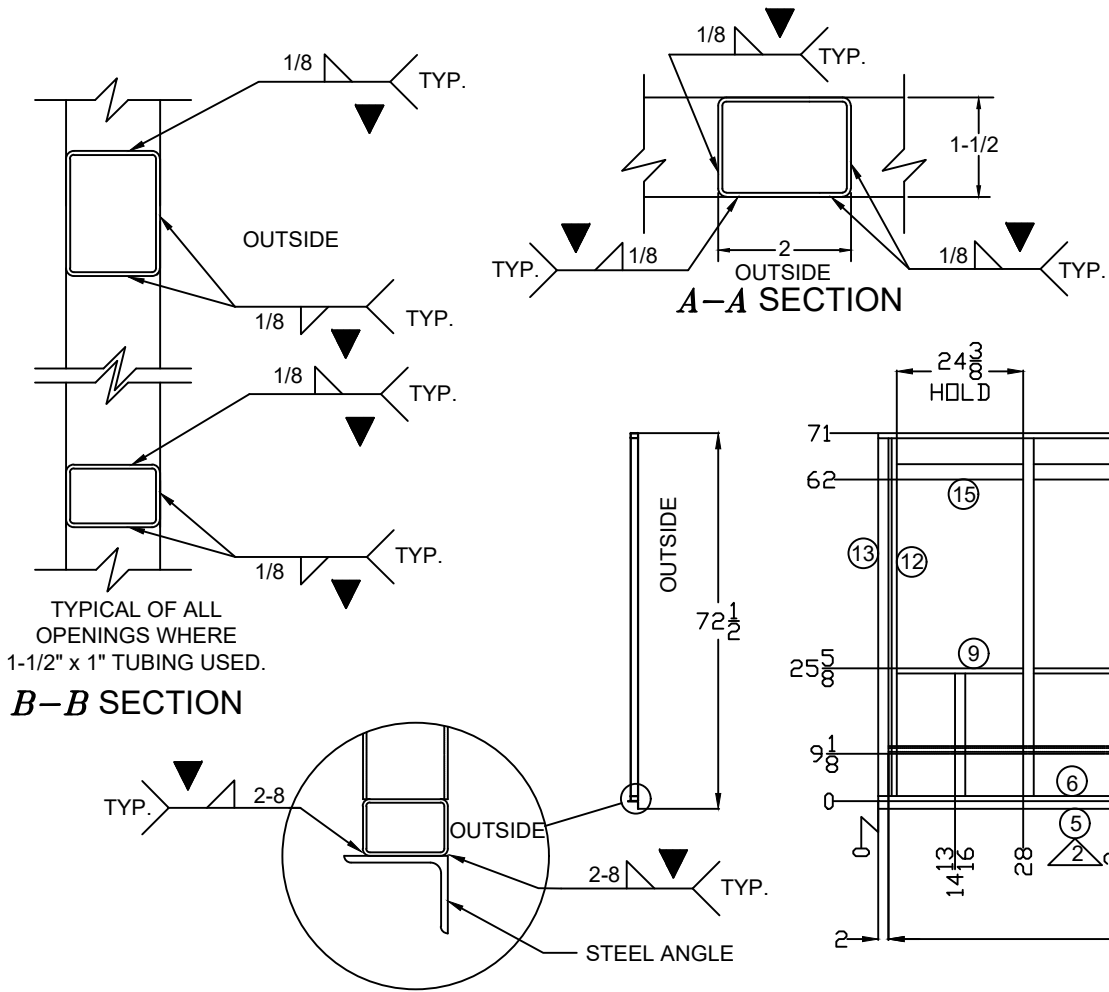
REV.	LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE: 6/14/18		TITLE: 158" WB MODEL 24, 42" ENTRY SIDEWALL, R. LIFT, RAISED FLOOR	
WOOD	OTHER	NAME:	MKLINE	DWG. No.	32-13-0030-18 SPECIAL 42 ENTRY
± 1/8"	± 1/16"				
± 1"	± 1/2"				



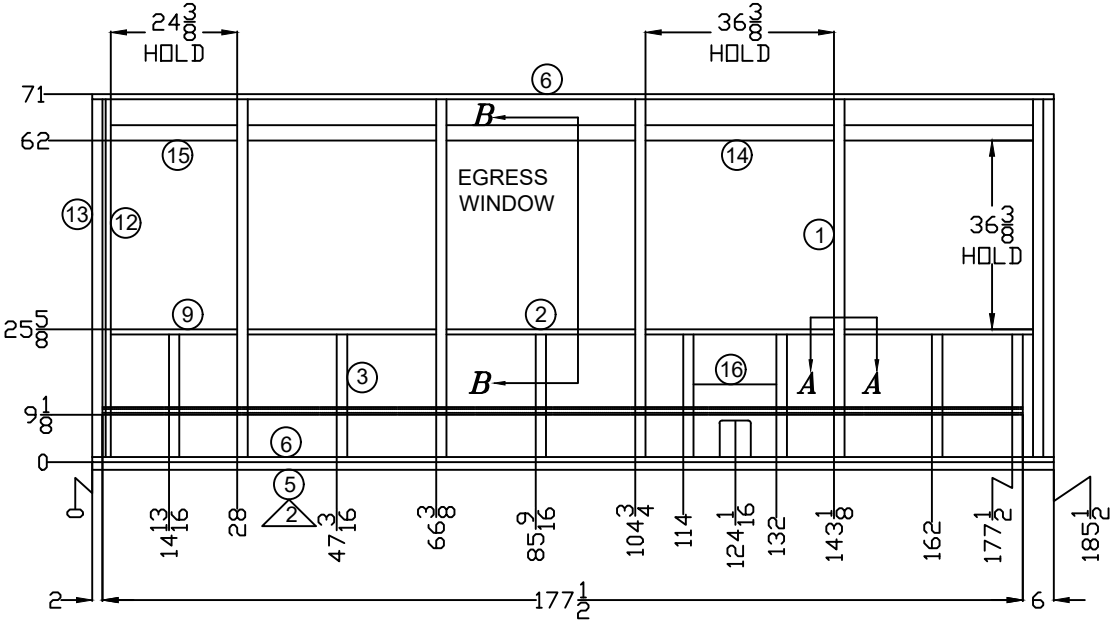
▼ CRITICAL CONTROL ITEM

USAGE: FORD 158"WB/MODEL 24



**NOTES:**

- 1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.  
2- ANGLE TO BE WELDED FLUSH WITH OUTSIDE EDGE OF WALL.




\*\*\*ALL MATERIALS GALVANIZED\*\*\*

8	0		FRAME, SIDEWALL WHEEL WELL FORD	17	1		SEAT TRACK: 177-1/2"Lg.
7	0		TUBE: 18ga. x 1-1/2" x 2" x 70-7/8"Lg. A-513	16	1		FUEL FILL BACKER BOARD
6	2		TUBE: 16ga. x 1-1/2" x 1" x 185-1/2"Lg. A-513	15	1		TUBE: 16ga. x 1-1/2" x 3" x 24-3/8"Lg. A-513
5	1		ANGLE: 11ga. x 1-1/2" x 2" x 185-1/2"Lg. A-513	14	4		TUBE: 16ga. x 1-1/2" x 3" x 36-3/8"Lg. A-513
4	0		TUBE: 16ga. x 1-1/2" x 1" x 79-9/16"Lg. A-513	13	2		TUBE: 16ga. x 1-1/2" x 2" x 69"Lg. A-513
3	7		TUBE: 18ga. x 1-1/2" x 2" x 23-5/8"Lg. A-513	12	1		TUBE: 16ga. x 1-1/2" x 1" x 69"Lg. A-513
2	4		TUBE: 16ga. x 1-1/2" x 1" x 36-3/8"Lg. A-513	11	0		ANGLE: 11ga. x 1-1/2" x 2" x 70-3/16"Lg. A-513
1	5		TUBE: 18ga. x 1-1/2" x 2" x 69"Lg. A-513	10	0		TUBE: 16ga. x 1-1/2" x 1" x 70-3/16"Lg. A-513
				9	1		TUBE: 16ga. x 1-1/2" x 1" x 24-3/8"Lg. A-513
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION	REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

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REV.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.
LET.					



a division of Forest River, Inc.

TOLERANCE UNLESS OTHERWISE SPECIFIED

WOOD	OTHER
± 1/8"	± 1/16"
± 1"	± 1/2"

DATE: 6/13/18

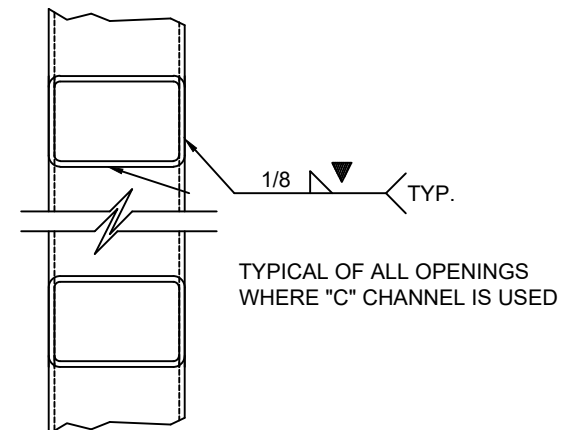
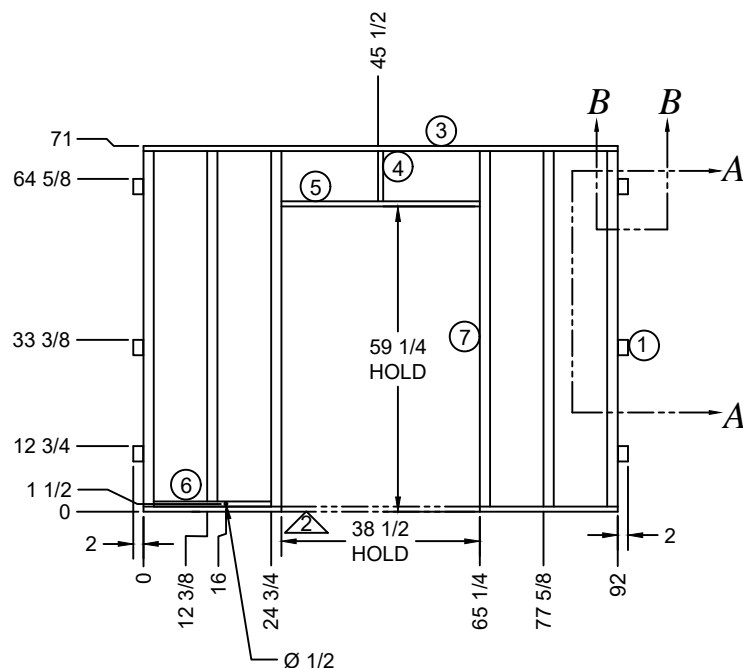
TITLE: 158" WB MODEL 24, DR. SIDEWALL, ALL PASS, RAISED FLOOR

NAME: MKLINE

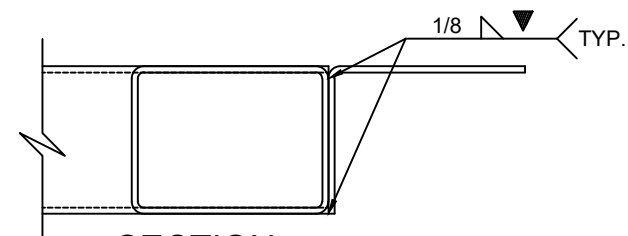
DWG. No. 32-13-0002-10

▼ CRITICAL CONTROL ITEM

## USAGE: Raised Floor w/ Rear Door, SPECIAL 1-1/2" THICK WALL



SECTION A-A



SECTION B-B

\*\*\*ALL MATERIALS aluminized\*\*\*

### NOTES:

- 1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.
- 2- REMOVE STEEL TUBE IN DOOR AREA AFTER WALL MOUNT TO FLOOR BUT BEFORE INSTALLING DOOR JAM ASSEMBLY.

7	6		TUBE: 16ga. x 1-1/2" x 2" x 69"Lg. A-513
6	1	02071055	TUBE: 16ga. x 1-1/2" x 1" x 10-3/8"Lg. A-513
5	1	02071055	TUBE: 16ga. x 1-1/2" x 1" x 38-1/2"Lg. A-513
4	1	02071055	TUBE: 16ga. x 1-1/2" x 1" x 9-3/4"Lg. A-513
3	2	02071055	TUBE: 16ga. x 1-1/2" x 1" x 92"Lg. A-513
2	0		
1	6		ANGLE: 16ga. x 1" x 2" x 6"Lg. A-513
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION



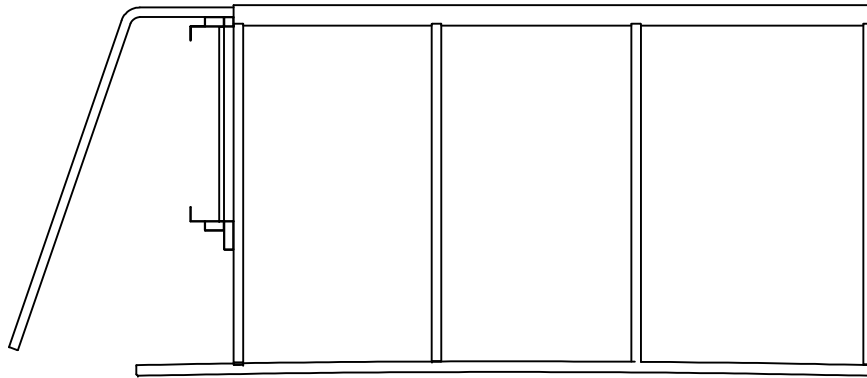
a division of Forest River, Inc.

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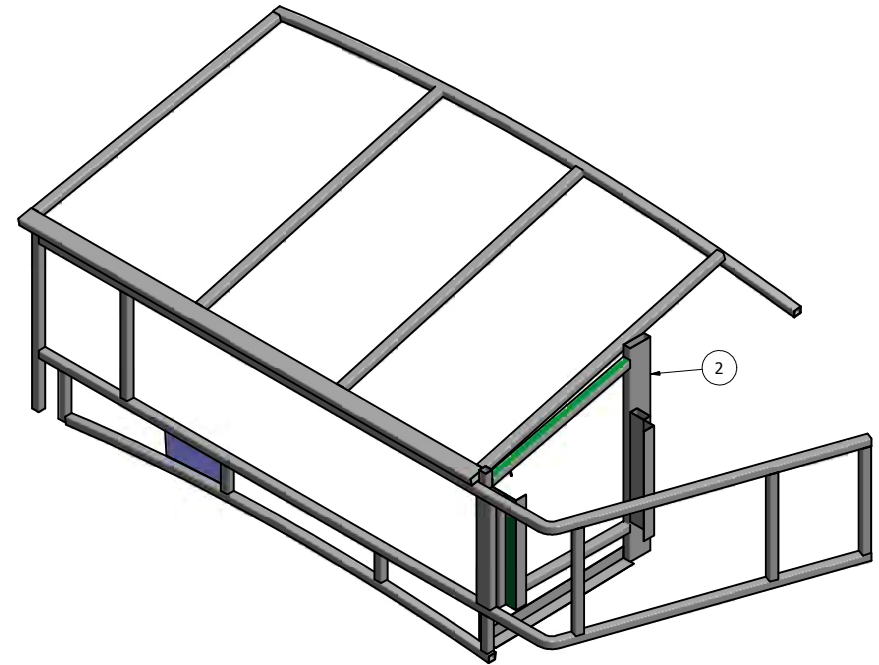
REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

DATE: 06/14/18	TITLE	Frame, Rear Wall Raised Floor With Door
DFTSN: MKLINE		
CHKR:	DWG. No.	31-28-0010-18 SPECIAL
APRVD:	SCALE	
	DISK No.	SHEET 1 OF 1

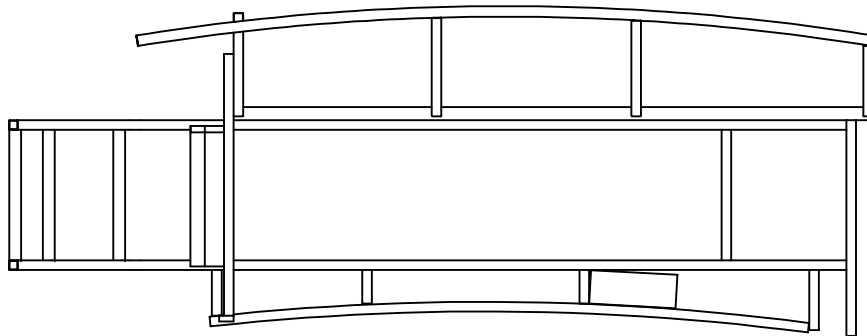




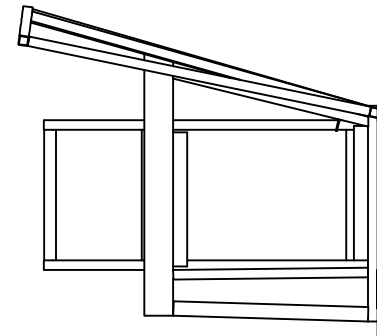
TOP VIEW



ISOMETRIC VIEW



BACK VIEW



SIDE VIEW

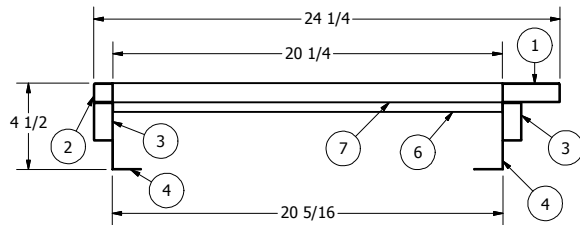
\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

Note:

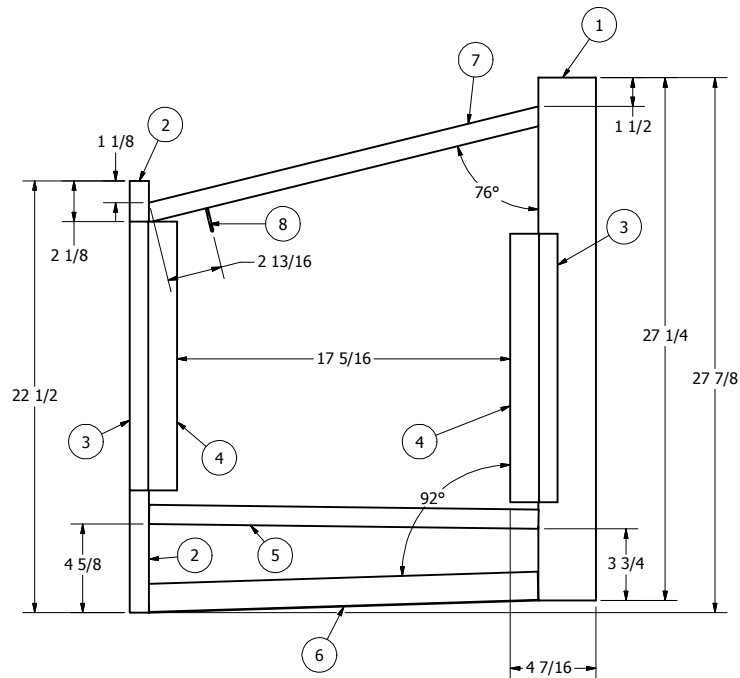
1). Viewed from Interior.

Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	31-28-0307-11	FORD Front Cab Wrap Around
2	1	31-28-0299-11	Ford Electrical Panel Frame
3	1	31-28-0745-11	FORD Cab Overhead

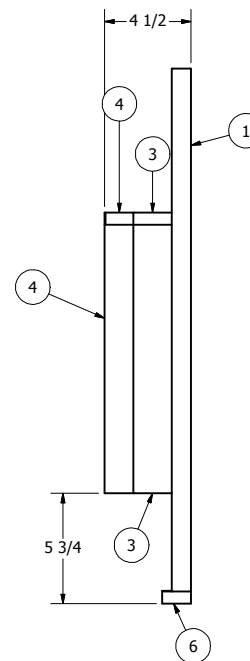
 <b>Glaval Bus</b> A Division Of Forest River, Inc.	
DFTSN: <b>TAS</b>	TITLE: Ford Front Cab, Over Head Cab, Electrical Panel Assembly
DATE: <b>02/04/15</b>	DWG NO: <b>31-28-0993-15</b>
SHEET <b>1</b> OF <b>1</b>	



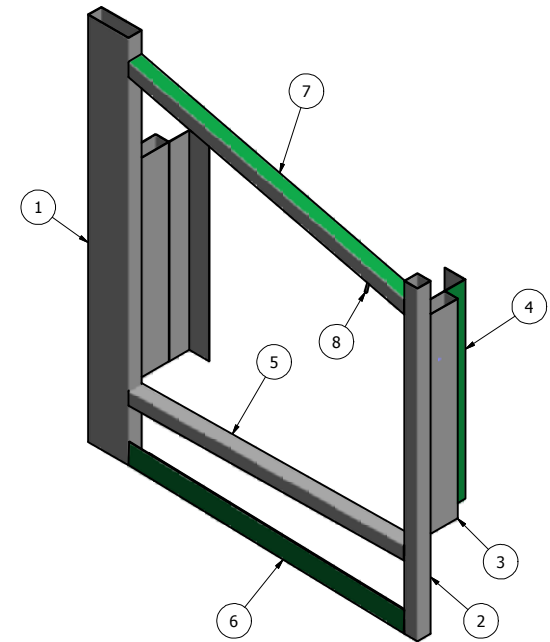
TOP VIEW



BACK VIEW



SIDE VIEW



ISOMETRIC VIEW

\*\*\* ALL MATERIALS ALUMINIZED \*\*\*

Note:

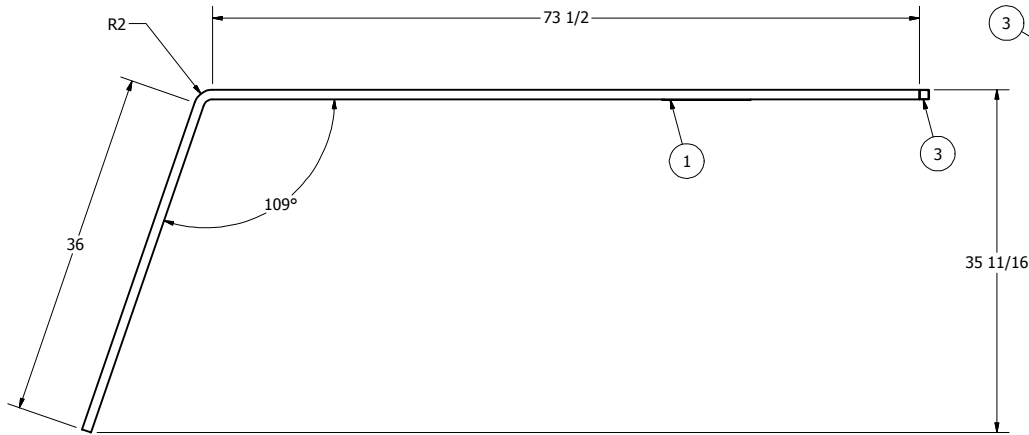
1). Viewed from Exterior.

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
31-28	"A"	Released For Production	9/21/07	ELF
31-28	"B"	Update From Auto Cad To Inventor... Updated To Match What Production Is Currently Building	11/14/07	TAS
31-28				

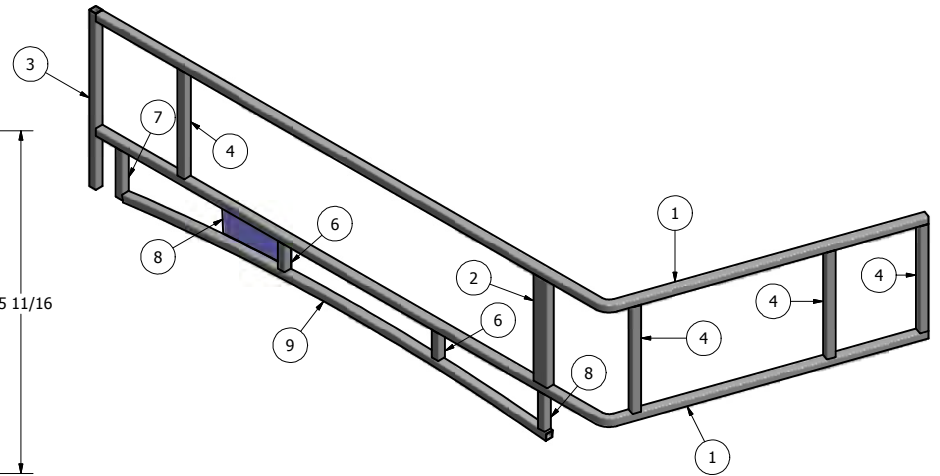
Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	1x3x27.25	Steel Tube 16ga. 1"x 3"x 27-1/4"
2	1	1x1x22.5	Steel Tube 16ga. 1"x 1"x 22-1/2"
3	2	1x2x14	Steel Tube 16ga. 1"x 2"x 14"
4	2	02071056-14	STEEL ANGLE 11ga.x 1-1/2"x 1-1/2"x 14" Ig. A-513
5	1	1x1x20.25	Steel Tube 16ga. 1"x 1"x 20-1/4"
6	1	02071056-20.25	STEEL ANGLE 11ga.x 1-1/2"x 1-1/2"x 20-1/4" Ig. A-513
7	1	1x1x21.125 Angle Cut	Steel Tube 16 ga. 1"x 1"x 15-1/4" Angle Cut
8	1	.25-20 x 1.25 Stud Grade 8	1/2" 13 x 2" Grade 8 Hex Head Bolt



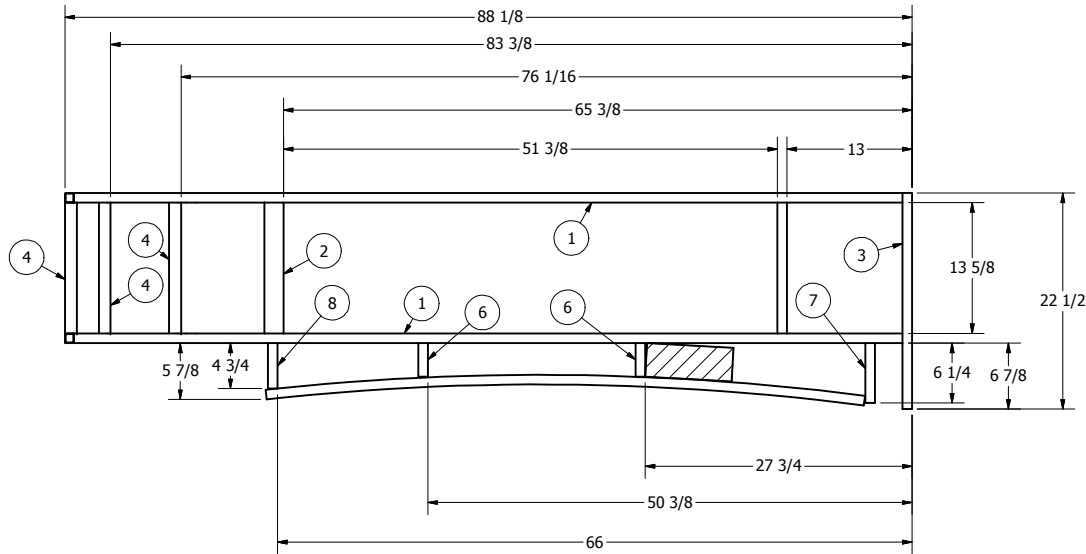
DFTSN:	TAS	TITLE	Ford Electrical Panel Frame
DATE:	11/07/11	DWG NO	31-28-0299-11
		SHEET	1 OF 1



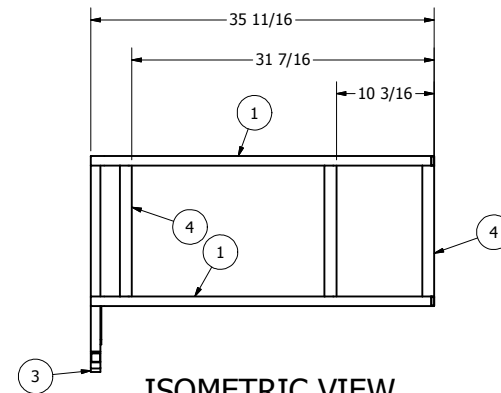
TOP VIEW



ISOMETRIC VIEW



BACK VIEW



ISOMETRIC VIEW

\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

Note:

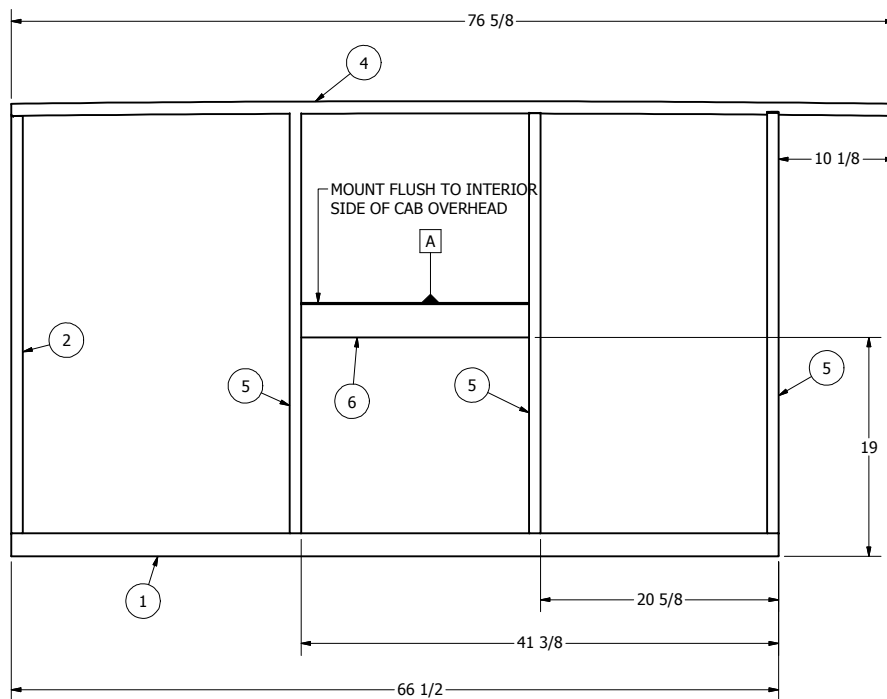
1). Viewed from Exterior.

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
31-28	"A"	Release To Production	10/26/2007	ELF
31-28	"B"	Changed Length of The Wrap Around Tubes	04/28/09	MDK
31-28	"C"	Update From Auto Cad Ton Inventor.. Updated To Match What Production Is Currently Building	11/14/2011	TAS
31-28	"D"	New Revised Standard 2015 Halo	02/05/2015	TAS

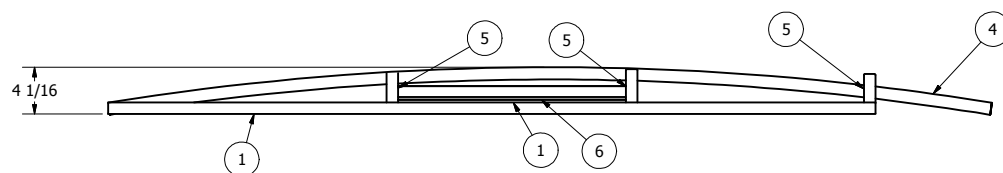
Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	31-28-0747-11	Ford 1"x 1"x 16ga. Front Wrap Steel Tube
2	2	1x2x13.625	Steel Tube 16ga. 1"x 2"x 13-5/8"
3	1	1x1x22.5	Steel Tube 16ga. 1"x 1"x 22-1/2"
4	5	1x1x13.625	Steel Tube 16ga. 1"x 1-1"x 13-5/8"
5	1	1x1x15.625	Steel Tube 16ga. 1"x 1"x 15-5/8"
6	2	1x1x3.5	Steel Tube 16ga. 1"x 1"x 3-1/2"
7	1	1x1x6.25	Steel Tube 16ga. 1"x 1"x 6-1/4"
8	1	1x1x4.75	Steel Tube 16ga. 1"x 1"x 4-3/4"
9	1	1 x1 66.25 CAB CURVE	Ford 1"x 1"x 62-1/4" Steel Cab Radius Tube
10	1	1x1x4.375	Steel Tube 16ga. 1"x 1"x 4-3/8"



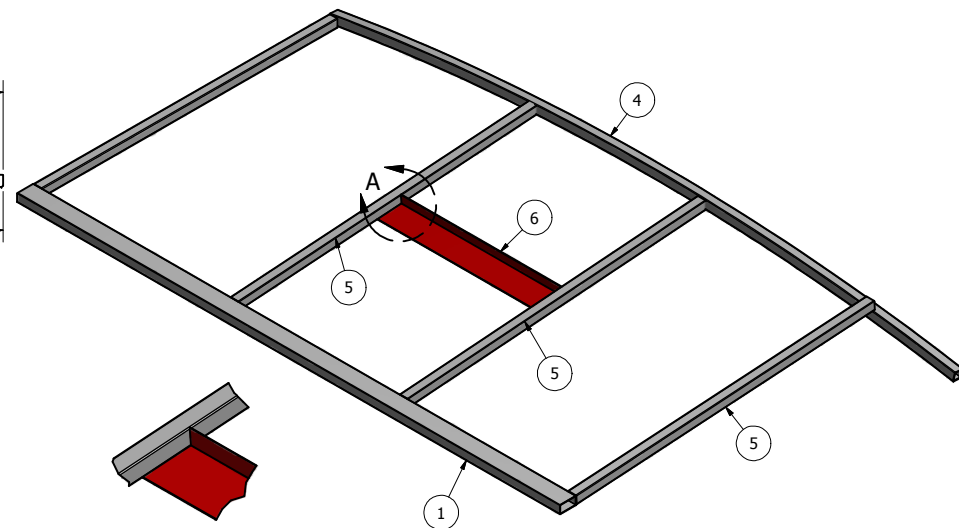
DFTSN:	TAS	TITLE	FORD Front Cab Wrap Around
DATE:	11/07/11	DWG NO	31-28-0307-11
		SHEET	1 OF 1



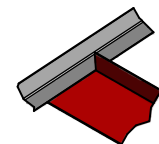
Top View



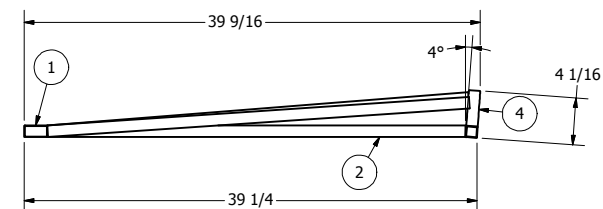
Front View



Isometric View



DETAIL A  
SCALE 0.24 : 1



Side View

Note:

1). Viewed from Exterior.

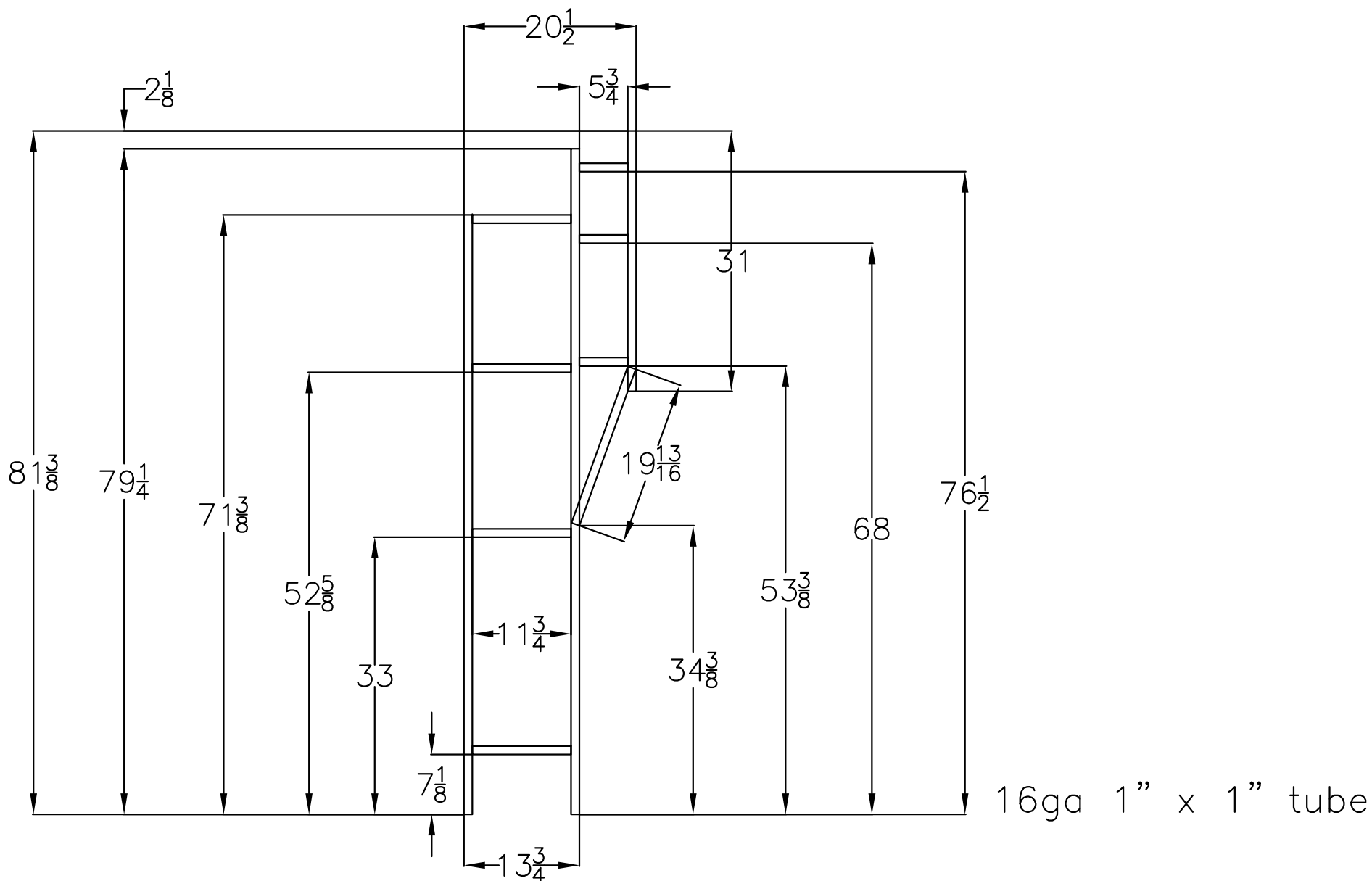
\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

Parts List				
ITEM	QTY	PART NUMBER	DESCRIPTION	
1	1	1x2x66.5	Steel Tube 16ga. 1"x 2"x 66-1/2"	
2	1	1x1x36.25	Tube 16ga. 1"x 1"x 36-1/4"	
3	1	1x3x7	Steel Tube 16ga. 1"x 3"x 7"	
4	1	31-28-0750-11	Ford Allstar Radius Tube 1"x 1"x 76-5/8"	
5	3	1x1x36.625	Aluminized Steel Tube 16ga. 1"x 1"x 36-5/8"	
6	1	3 x 1x 19.75	STEEL ANGLE 16ga.x 3"x 1"x 19-3/4" lg. A-513	
11	1	3 x 1x 19.75	STEEL ANGLE 16ga.x 3"x 1"x 19-3/4" lg. A-513	

DFTSN: TAS		TITLE: FORD New Syle Cab Overhead	
DATE: 11/07/11		DWG NO: 31-28-0745-11	SHEET 1 OF 1

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
31-28	"A"	ADDED ANGLE FOR BACKER CENTER CEILING STRIPE	3/22/2015	TAS



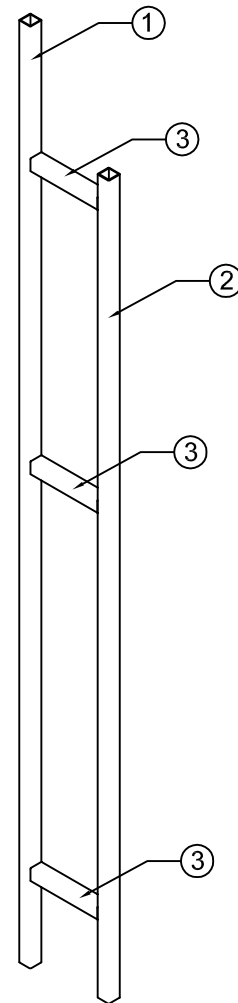
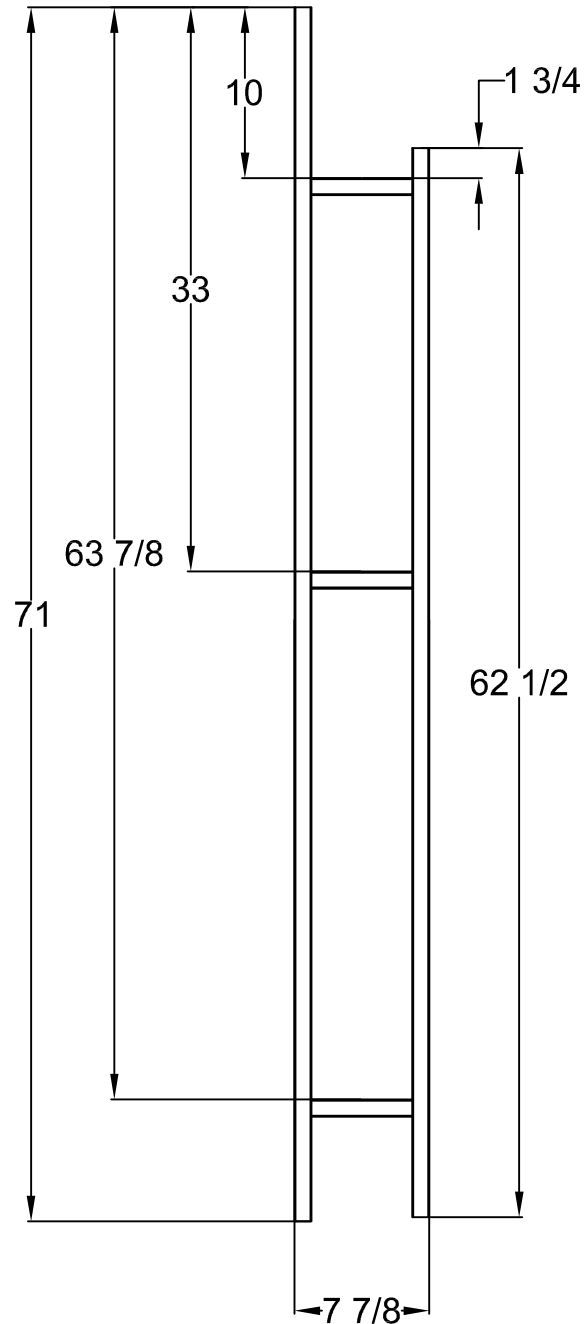
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REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		 a division of Forest River, Inc.	
WOOD	OTHER	DATE: 7/27/17	TITLE: streetside pillar
± 1/8"	± 1/16"	NAME: MK	
± 1"	± 1/2"	DWG. No. 31-28-0955-14	





16ga 1" x 1" tube

\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

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REV.  
LET.

DESCRIPTION OF CHANGE

BY

CHK

DATE

ECN No.

± 1"

± 1/2"

TOLERANCE UNLESS  
OTHERWISE SPECIFIED

WOOD

OTHER

± 1/8"

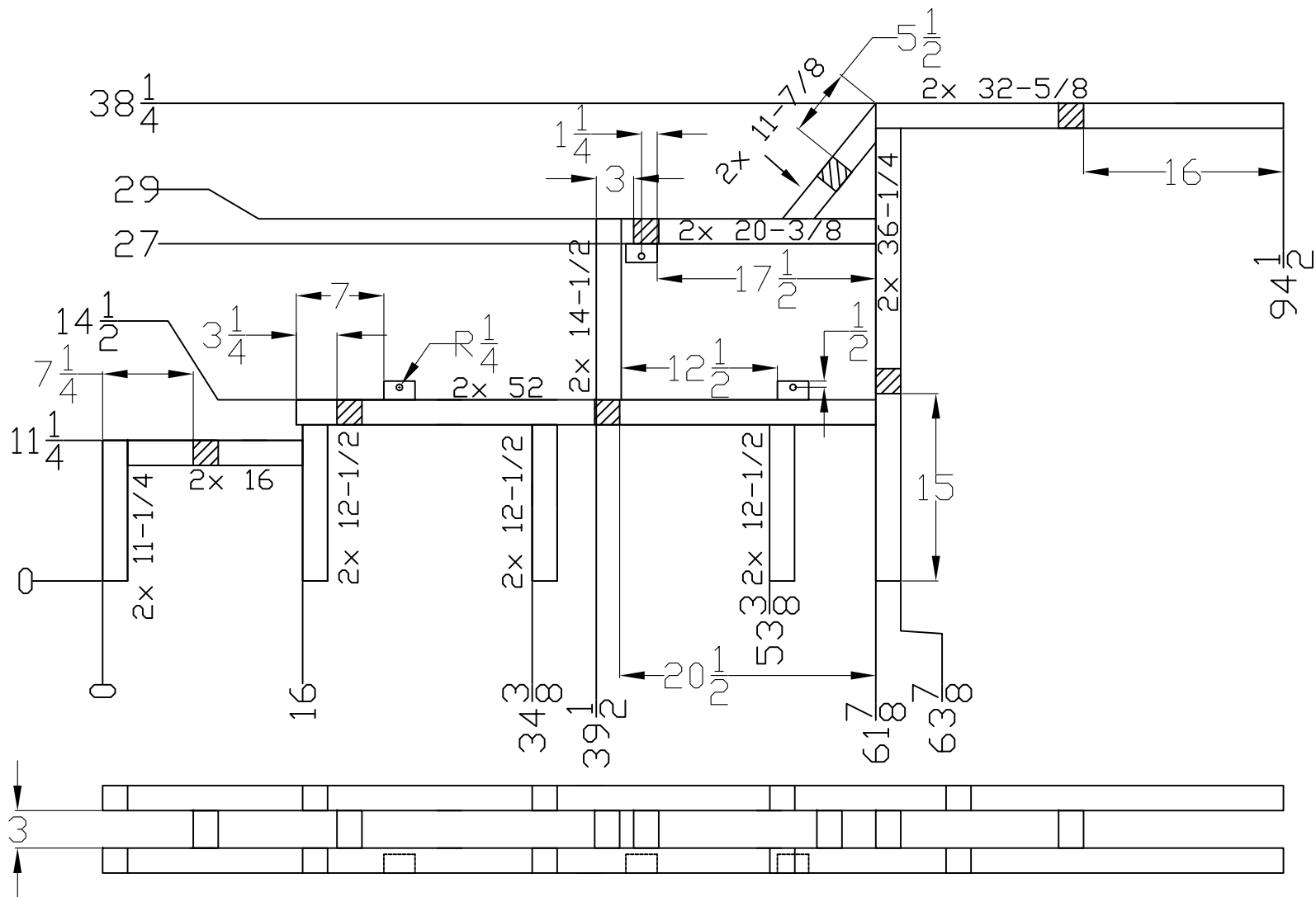
± 1/16"

DATE: 7/27/17  
NAME: MK  
DWG. No.

TITLE:

curbside pillar

**Glaval Bus** a division of Forest River, Inc.



MAT'L=2" x 2" x 16GA.

\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

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REV. LET.	DESCRIPTION OF CHANGE	BY	DATE	ECN No.	TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE: 06/30/17	NAME: RTS	TITLE: RAISED FLOOR-3 STEP FALSE FLOOR ASSEMBLY
					WOOD	OTHER			
					± 1/8"	± 1/16"			
					± 1°	± 1/2°	DWG. No.	31-28-0531-17C	



a division of Forest River, Inc.

## ADA STOP REQUEST INFORMATION



The ADA Occupant Stop Request Lights the Blue Side of the Sign and Signals Driver of an ADA Stop Request via Touch Tape Switches.

Ambulatory Stop Requests Light the Red Side of the Sign and Signals the Driver via Pull Cords.

**STURAA TEST**

**7 YEAR**

**200,000 MILE BUS**

**from**

**GLAVAL BUS/DIV. OF FOREST RIVER**

**MODEL UNIVERSAL CNG**

**NOVEMBER 2010**

**PTI-BT-R1008**

PENNSTATE



**The Pennsylvania Transportation Institute**

201 Transportation Research Building (814) 865-1891  
The Pennsylvania State University  
University Park, PA 16802

**Bus Testing and Research Center**

2237 Old Route 220 N. (814) 695-3404  
Duncansville, PA 16635

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## EXECUTIVE SUMMARY

Glaval Bus/Div. of Forest River submitted a model Universal, CNG-powered 17 seat/25-foot bus, built on a Ford E-450 chassis for a 7 yr/200,000 mile STURAA test. The odometer reading at the time of delivery was 2,913 miles. Testing started on June 28, 2010 and was completed on October 29, 2010. 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 June 28, 2010 and was completed on October 18, 2010.

The interior of the bus is configured with seating for 17 passengers including the driver and 2 wheelchair positions. Free floor space will accommodate 9 standing passengers resulting in a potential load of 26 persons plus 2 wheelchair positions. At 150 lbs per person, this load results in a measured gross vehicle weight of 15,000 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW of 15,000 lbs. **Note: at Gross Vehicle Load (GVL), the weight of the rear axle exceeds the rear GAWR by 850 lbs and exceeds the GVWR by 500 lbs.** The middle segment was performed at a seated load weight of 13,670 lbs and the final segment was performed at a curb weight of 10,000 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 is 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 six reported failures, five were Class 3 and one was a 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 16.70 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 28.20' at 20 mph, 50.76' at 30 mph, 85.73' at 40 mph and 110.97' at 45 mph. The average stopping distance for the Uniform Low Friction Test was 26.13'. 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 but did experience pull to the left 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.

The Shakedown Test produced a maximum final loaded deflection of 0.472 inches with a permanent set ranging between -0.004 to 0.006 inches under a distributed static load of 10,950 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 test bus was not equipped with any type of tow eyes or tow hooks therefore the Static Towing Test was not performed. 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 6.9 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 0.93 M/lb, 0.94 M/lb, and 1.76 M/lb respectively; with an overall average of 1.08 M/lb.

A series of Interior and Exterior Noise Tests was performed. These data are listed in Section 7.1 and 7.2 respectively. Emissions testing was also performed. These data are listed in Section 8.

## 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
PSBRTF	- Penn State Bus Research and Testing Facility
PTI	- Pennsylvania Transportation Institute
rpm	- revolutions per minute
SAE	- Society of Automotive Engineers
SCH	- test scheduler
SEC	- secretary
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 Glaval Bus/Div. of Forest River, model Universal CNG. The bus has an O.E.M. driver's door and passenger door rear of the front axle. The dedicated handicap entrance is equipped with a Ricon S Series hydraulic platform lift and is rear of the rear axle. Power is provided by a CNG-fueled, Ford 6.8 L engine coupled to a Ford transmission.

The measured curb weight is 3,840 lbs for the front axle and 6,160 lbs for the rear axle. These combined weights provide a total measured curb weight of 10,000 lbs. There are 17 seats including the driver, 2 wheelchair positions and room for 9 standing passengers bringing the total passenger capacity to 26 plus 2 wheelchair positions. Gross load is  $150 \text{ lb} \times 26 = 3,900 \text{ lbs}$ . plus 1,200 lbs (2 wheelchair positions) = 5,100 lbs. At full capacity, the measured gross vehicle weight is 15,000 lbs. **Note; at GVL the measured rear axle weight is over the rear GAWR by 850 lbs and 500 lbs over the GVWR.**

## VEHICLE DATA FORM

Bus Number: 1008	Arrival Date: 6-30-10
Bus Manufacturer: Glaval Bus/Div. of Forest River	Vehicle Identification Number (VIN): 1FD4E45588DB47803
Model Number: Universal CNG	Date: 6-30-10
Personnel: E.L., E.D. & B.L.	Chassis: Ford / E-450

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	1,950	1,890	N/A	N/A	3,300	2,860
SLW	1,910	2,280	N/A	N/A	4,700	4,780
GVW	2,120	2,530	N/A	N/A	5,130	5,220

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	3,840	4,190	4,650	5,000
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	6,160	9,480	10,350	9,500
Total	10,000	13,670	15,000	GVWR: 14,500

Dimensions:

Length (ft/in)	25 / 6.25
Width (in)	98.00
Height (in)	112.00
Front Overhang (in)	35.50
Rear Overhang (in)	80.25
Wheel Base (in)	190.50
Wheel Track (in)	Front: 68.4
	Rear: 77.8



Bus Number: 1008	Date: 6-30-10
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**CLEARANCES:**

Lowest Point Outside Front Axle	Location: Bumper	Clearance(in): 13.0
Lowest Point Outside Rear Axle	Location: CNG tank plate	Clearance(in): 10.8
Lowest Point between Axles	Location: CNG tank plate	Clearance(in): 8.5
Ground Clearance at the center (in)	9.0	
Front Approach Angle (deg)	20.4	
Rear Approach Angle (deg)	13.2	
Ramp Clearance Angle (deg)	5.1	
Aisle Width (in)	15.3	
Inside Standing Height at Center Aisle (in)	78.6	

**BODY DETAILS:**

Body Structural Type	Integral		
Frame Material	Steel		
Body Material	Steel		
Floor Material	Plywood		
Roof Material	Fiberglass		
Windows Type	<input checked="" type="checkbox"/> Fixed	<input type="checkbox"/> Movable	
Window Mfg./Model No.	KTG / 16 CFR 1201		
Number of Doors	<u>1</u> Front (driver's)	<u>1</u> Passenger	<u>1</u> Handicap
Mfr. / Model No.	A & M Systems Inc. / 68285		
Dimension of Each Door (in)	Front- 54.5 x 31.6	Passenger- 82.4 x 30.6 Handicap – 70.9 x 46.7	
Passenger Seat Type	<input type="checkbox"/> Cantilever	<input checked="" type="checkbox"/> Pedestal	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Freedman Seating Co. / 462133		
Driver Seat Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Freedman Seating Co. / O.E.M.		
Number of Seats (including Driver)	17 plus 2 wheelchair positions		

Bus Number: 1008	Date: 6-30-10
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BODY DETAILS (Contd..)

Free Floor Space ( ft <sup>2</sup> )	14.2				
Height of Each Step at Normal Position (in)	Front	1. <u>11.9</u>	2. <u>7.9</u>	3. <u>7.9</u>	4. <u>N/A</u>
	Middle	1. <u>N/A</u>	2. <u>N/A</u>	3. <u>N/A</u>	4. <u>N/A</u>
	Rear	1. <u>N/A</u>	2. <u>N/A</u>	3. <u>N/A</u>	4. <u>N/A</u>
Step Elevation Change - Kneeling (in)	N/A				

ENGINE

Type	<input type="checkbox"/> C.I.	<input checked="" type="checkbox"/> Alternate Fuel	
	<input type="checkbox"/> S.I.	<input type="checkbox"/> Other (explain)	
Mfr. / Model No.	Ford / 6.8 L		
Location	<input checked="" type="checkbox"/> Front	<input type="checkbox"/> Rear	<input type="checkbox"/> Other (explain)
Fuel Type	<input type="checkbox"/> Gasoline	<input checked="" type="checkbox"/> CNG	<input type="checkbox"/> Methanol
	<input type="checkbox"/> Diesel	<input type="checkbox"/> LNG	<input type="checkbox"/> Other (explain)
Fuel Tank Capacity (indicate units)	4,654 scf @ 3,600 psi		
Fuel Induction Type	<input checked="" type="checkbox"/> Injected	<input type="checkbox"/> Carburetion	
Fuel Injector Mfr. / Model No.	Ford / 6.8 L		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Ford / 6.8 L		
Alternator (Generator) Mfr. / Model No.	Penntex / 030982927		
Maximum Rated Output (Volts / Amps)	14 / 200		
Air Compressor Mfr. / Model No.	N/A		
Maximum Capacity (ft <sup>3</sup> / min)	N/A		
Starter Type	<input checked="" type="checkbox"/> Electrical	<input type="checkbox"/> Pneumatic	<input type="checkbox"/> Other (explain)
Starter Mfr. / Model No.	FoMoCo / 6C2T-11000-CA		

Bus Number: 1008

Date: 6-30-10

## TRANSMISSION

Transmission Type	<input type="checkbox"/> Manual	<input checked="" type="checkbox"/> Automatic	
Mfr. / Model No.	Ford / O.E.M.		
Control Type	<input checked="" type="checkbox"/> Mechanical	<input type="checkbox"/> Electrical	<input type="checkbox"/> Other
Torque Converter Mfr. / Model No.	Ford / O.E.M.		
Integral Retarder Mfr. / Model No.	N/A		

## SUSPENSION

Number of Axles	2		
Front Axle Type	<input checked="" type="checkbox"/> Independent	<input type="checkbox"/> Beam Axle	
Mfr. / Model No.	Ford / O.E.M.		
Axle Ratio (if driven)	N/A		
Suspension Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Motorcraft / 8024-18045-DA		
Middle Axle Type	<input type="checkbox"/> Independent	<input type="checkbox"/> Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	<input type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	<input type="checkbox"/> Independent	<input checked="" type="checkbox"/> Beam Axle	
Mfr. / Model No.	Dana / 4.56		
Axle Ratio (if driven)	4.56		
Suspension Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Motorcraft / 8C24-18080-Db		

Bus Number: 1008	Date: 6-30-10
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#### WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Arcwheel / 16 x 6
	Tire Mfr./ Model No.	Michelin / LT225/75R 16
Rear	Wheel Mfr./ Model No.	Arcwheel / 16 x 6
	Tire Mfr./ Model No.	Michelin / LT225/75R 16

#### BRAKES

Front Axle Brakes Type	<input type="checkbox"/> Cam	<input checked="" type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	FoMoCo / O.E.M.		
Middle Axle Brakes Type	<input type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	<input type="checkbox"/> Cam	<input checked="" type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	FoMoCo / O.E.M.		
Retarder Type	N/A		
Mfr. / Model No.	N/A		

#### HVAC

Heating System Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Water	<input type="checkbox"/> Other
Capacity (Btu/hr)	Front – 15,000    Rear – 35,000		
Mfr. / Model No.	Siemens / XC2H-19805-AA		
Air Conditioner	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Location	Front & rear		
Capacity (Btu/hr)	Front – 15,000    Rear – 69,000		
A/C Compressor Mfr. / Model No.	Front – Visteon / 8C24-190629-BC Rear – Carrier / 0558041050		

#### STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	FoMoCo / O.E.M.
Steering Wheel Diameter	15.5
Number of turns (lock to lock)	4.0

Bus Number: 1008	Date: 6-30-10
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#### OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: Rear	Type: Hydraulic platform
Mfr. / Model No.	Ricon / S Series	
Emergency Exit	Location:	Number:

#### CAPACITIES

Fuel Tank Capacity (units)	4,654 scf @ 3,600 psi
Engine Crankcase Capacity (gallons)	1.5
Transmission Capacity (gallons)	4.7
Differential Capacity (gallons)	1.125
Cooling System Capacity (gallons)	7.6
Power Steering Fluid Capacity (quarts)	Fill to line.



## VEHICLE DATA FORM

Bus Number: 1008	Date: 6-30-10
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**List all spare parts, tools and manuals delivered with the bus.**

[illegible]

## COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 1008	Date: 6-30-10
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Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	✓	
Body and Sheet Metal	✓	
Frame	✓	
Steering	✓	
Suspension	✓	
Interior/Seating	✓	
Axles	✓	
Brakes	✓	
Tires/Wheels	✓	
Exhaust	✓	
Fuel System	✓	
Power Plant	✓	
Accessories	✓	
Lift System	✓	
Interior Fasteners	✓	
Batteries	✓	

## **CHECK - IN**



## **GLAVAL BUS/DIV. of FOREST RIVER MODEL UNIVERSAL CNG**



## **CHECK - IN CONT.**



**GLAVAL BUS/DIV. of FOREST RIVER  
MODEL UNIVERSAL CNG  
EQUIPPED WITH A RICON MODEL S SERIES  
HANDICAP LIFT**





## **CHECK - IN CONT.**



**OPERATOR'S AREA**



**ENGINE COMPARTMENT**



## **CHECK - IN CONT.**



**INTERIOR FROM FRONT**



**INTERIOR FROM REAR**

# **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: 1008	Date: 10-22-10
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Component	Checked	Comments
<b>ENGINE :</b>		
Oil Dipstick	✓	
Oil Filler Hole	✓	
Oil Drain Plug	✓	
Oil Filter	✓	
Fuel Filter	✓	
Air Filter	✓	
Belts	✓	
Coolant Level	✓	
Coolant Filler Hole	✓	
Coolant Drain	✓	
Spark / Glow Plugs	✓	
Alternator	✓	
Diagnostic Interface Connector	✓	
<b>TRANSMISSION :</b>		
Fluid Dip-Stick	✓	
Filler Hole	✓	
Drain Plug	✓	
<b>SUSPENSION :</b>	✓	
Bushings	✓	
Shock Absorbers	✓	
Air Springs	N/A	
Leveling Valves	N/A	
Grease Fittings	✓	

## ACCESSIBILITY DATA FORM

Bus Number: 1008	Date: 10-22-10
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Component	Checked	Comments
<b>HVAC :</b>	✓	
A/C Compressor	✓	
Filters	✓	
Fans	✓	
<b>ELECTRICAL SYSTEM :</b>		
Fuses	✓	
Batteries	✓	
Voltage regulator	✓	
Voltage Converters	✓	
Lighting	✓	
<b>MISCELLANEOUS :</b>		
Brakes	✓	
Handicap Lifts/Ramps	✓	
Instruments	✓	
Axles	✓	
Exhaust	✓	
Fuel System	✓	
<b>OTHERS :</b>		

## **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. Table 1 is a list of the lubricating products used in servicing. 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**  
 Glaval #1008

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
07/14/10	1,053	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
07/20/10	1,984	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
07/27/10	3,044	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08/19/10	3,237	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08/25/10	4,250	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08/31/10	5,082	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09/03/10	6,021	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09/15/10	7,283	P.M. / Inspection Fuel Economy Prep	Linkage, tie rods, universals/u-joints all lubed. Oil changed. Oil, fuel, and air filters changed. Transmission oil and filter changed.	8.00	8.00

(Page 2 of 2)  
**SCHEDULED MAINTENANCE**  
 Glaval #1008

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
09/16/10	7,353	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10/18/10	7,537	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

**Table 1. STANDARD LUBRICANTS**

The following is a list of Texaco lubricant products used in bus testing conducted by the Penn State University Altoona Bus Testing Center:

<u>ITEM</u>	<u>PRODUCT CODE</u>	<u>TEXACO DESCRIPTION</u>
Engine oil	#2112	URSA Super Plus SAE 30
Transmission oil	#1866	Automatic Trans Fluid Mercon/Dexron II Multipurpose
Gear oil	#2316	Multigear Lubricant EP SAE 80W90
Wheel bearing & Chassis grease	#1935	Starplex II

## 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 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.

<u>MAN HOURS</u>	
Rear outside tire.	0.50
CNG vent hose.	2.00
2 battery terminals & 2 cable lugs.	2.00
Right rear spring hanger.	2.00
Both front tires.	0.50

At the end of the test, the remaining items on the list were removed and replaced. The transmission assembly took 8.0 man-hours (two men 4.0 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
Transmission	8.0 man hours
Wiper Motor	0.25 man hours
Starter	0.25 man hours
Alternator	0.75 man hours
Batteries	0.5 man hours

### **1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS**



#### **TRANSMISSION REMOVAL AND REPLACEMENT (8.0 MAN HOURS)**



#### **WIPER MOTOR REMOVAL AND REPLACEMENT (0.25 MAN HOURS)**

### **1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.**



#### **STARTER REMOVAL AND REPLACEMENT (0.25 MAN HOURS)**



#### **ALTERNATOR REMOVAL AND REPLACEMENT (0.75 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 5 Class 3 failures, 2 involved the electrical system and 1 each to the wheels/tires, fuel system, and suspension. These, and the 1 remaining Class 4 failure are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.



## RELIABILITY DATA FORMS

Bus Number: 1008	Date: 10/18/10
Personnel: Bob Reifsteck	

Failure Type			
Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety

[illegible]

### **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: 1008	Date: 9-15-10
Personnel: B.G., T.S., E.L. & E.D.	

Temperature (°F): 64	Humidity (%): 49
Wind Direction: W	Wind Speed (mph): 7
Barometric Pressure (in.Hg): 30.18	

<b>SAFETY TEST: DOUBLE LANE CHANGE</b>	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
<b>Comments of the position of the bus during the lane change:</b> A safe profile was maintained through all portions of testing.	
<b>Comments of the tire/ground contact patch:</b> Tire/ground contact was maintained through all portions of testing.	

### **3. SAFETY**



**LEFT - HAND APPROACH**



**RIGHT - HAND APPROACH**

## **4.0 PERFORMANCE**

### **4.1 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 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-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 16.70 seconds.



## PERFORMANCE DATA FORM

Bus Number: 1008	Date: 9-15-10
Personnel: B.G., T.S. & E.L.	
Temperature (°F): 64	Humidity (%): 49
Wind Direction: W	Wind Speed (mph): 7
Barometric Pressure (in.Hg): 30.18	
Air Conditioning compressor-OFF	✓ Checked
Ventilation fans-ON HIGH	✓ Checked
Heater pump motor-Off	✓ Checked
Defroster-OFF	✓ Checked
Exterior and interior lights-ON	✓ Checked
Windows and doors-CLOSED	✓ Checked

ACCELERATION, GRADEABILITY, TOP SPEED			
Counter Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	2.19	1.98	2.14
20 mph	4.38	4.14	4.30
30 mph	6.79	6.77	7.20
40 mph	11.29	11.36	11.42
Top Test Speed(mph) 50	17.98	17.36	17.23
Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	2.23	2.01	2.02
20 mph	4.29	4.07	4.27
30 mph	7.20	6.66	6.89
40 mph	11.29	10.88	10.98
Top Test Speed(mph) 50	16.10	15.63	15.92

# PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :Glaval  
 BUS MODEL :Universal

BUS NUMBER :1008  
 TEST DATE :09/15/10

## TEST CONDITIONS :

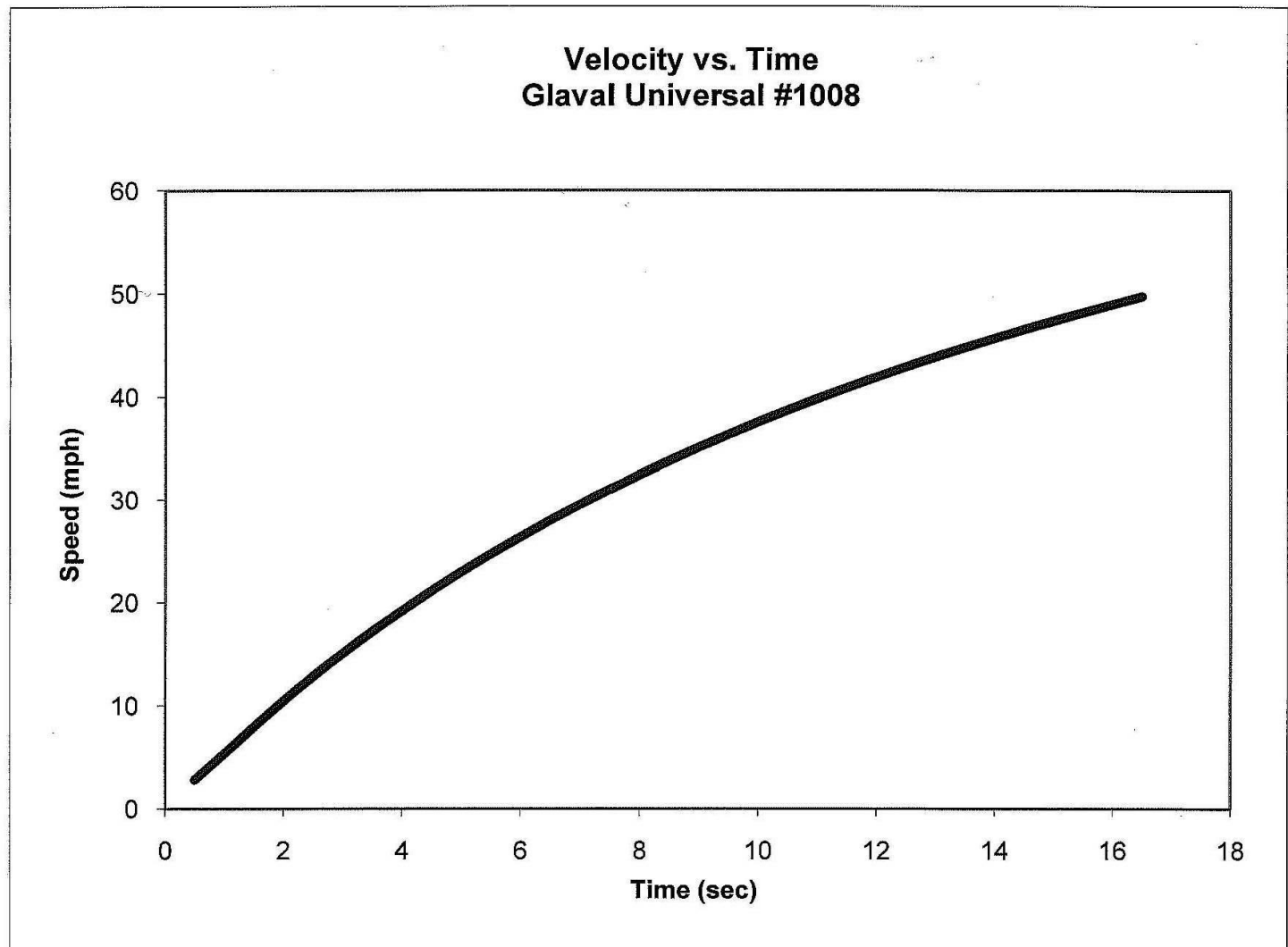
-----  
 TEMPERATURE (DEG F ) : 64.0  
 WIND DIRECTION : W  
 WIND SPEED (MPH) : 7.0  
 HUMIDITY (%) : 49  
 BAROMETRIC PRESSURE (IN. HG) : 30.2

VEHICLE SPEED (MPH)	AVERAGE TIME (SEC)		
	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	2.10	2.09	2.10
20.0	4.27	4.21	4.24
30.0	6.92	6.92	6.92
40.0	11.36	11.05	11.20
50.0	17.52	15.88	16.70

## TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.17	8.4	26.9
5.0	.90	7.8	24.9
10.0	1.89	7.1	22.5
15.0	2.98	6.3	20.1
20.0	4.21	5.6	17.8
25.0	5.59	5.0	15.7
30.0	7.17	4.3	13.6
35.0	8.99	3.7	11.7
40.0	11.11	3.2	9.9
45.0	13.63	2.7	8.3
50.0	16.69	2.2	6.7

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.



## 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).

(I) 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 28.20' at 20 mph, 50.76' at 30 mph, 85.73' at 40 mph and 110.97' at 45 mph. The average stopping distance for the Uniform Low Friction Test was 26.13'. 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 but did experience pull to the left 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 4.2-6. Braking Test Data Forms**

Bus Number: 1008	Date: 9-24-10
Personnel: B.G., B.L. & S.C.	
Amb. Temperature (°F): 70	Wind Speed (mph): 8
Wind Direction: SW	Pavement Temp (°F) Start: 67.6 End: 74.8

TIRE INFLATION PRESSURE (psi):				
Tire Type: Front: UniRoyal Laredo HD/H 225/75R Rear: UniRoyal Laredo HD/H 225/75R				
	Left Tire(s)		Right Tire(s)	
Front	80		80	
	Inner	Outer	Inner	Outer
Rear	80	80	80	80
Rear	N/A	N/A	N/A	N/A

AXLE LOADS (lb)		
	Left	Right
Front	2,530	2,120
Rear	5,220	5,130

FINAL INSPECTION	
Bus Number: 1008	Date: 9-27-10
Personnel: B.L. & S.C.	

**Table 4.2-7. Record of All Braking System Faults/Repairs.**

<b>Date</b>	<b>Personnel</b>	<b>Fault/Repair</b>	<b>Description</b>
9/27/10	S.C.	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)	26.44	27.13	29.00	30.22	28.20
30 (dry)	48.84	43.29	55.43	55.46	50.76
40 (dry)	79.90	81.68	90.80	90.51	85.73
45 (dry)	108.41	109.00	112.47	114.00	110.97
20 (wet)	24.75	25.15	27.63	26.96	26.13

**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 minutes			Yes	
	2					
	3					
Front down	1	5 minutes			Yes	
	2					
	3					

## 5. 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 26 people including the driver and 2 wheelchair positions. The resulting test load is  $(26 \times 375 \text{ lb}) = 9,750 \text{ lbs} + 1,200 \text{ (2 wheelchair positions)} = 10,950 \text{ lbs}$ . 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 0.472 inches at reference point 8. The maximum permanent deflection after the final loading sequence ranged from -0.004 inches at reference point 12 to 0.006 inches at reference points 5 and 8.

## STRUCTURAL SHAKEDOWN DATA FORM

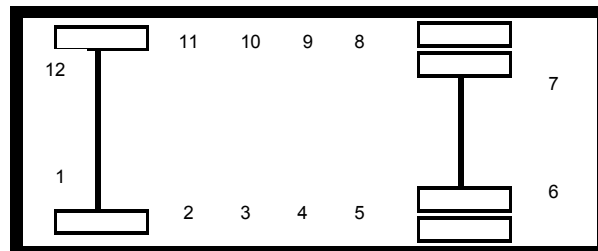
Bus Number: 1008	Date: 7-2-10
Personnel: E.D., E.L., P.D. & B.L.	Temperature (°F): 70
Loading Sequence: <input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3   (check one) Test Load (lbs): 10,950	

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	0	-.190	-.190	-.049	-.049
2	0	.149	.149	.016	.016
3	0	.361	.361	.067	.067
4	0	.434	.434	.085	.085
5	0	.485	.485	.102	.102
6	0	-.065	-.065	-.034	-.034
7	0	-.121	-.121	-.068	-.068
8	0	.585	.585	.163	.163
9	0	.533	.533	.145	.145
10	0	.399	.399	.101	.101
11	0	.215	.215	.056	.056
12	0	-.231	-.231	-.048	-.048



# STRUCTURAL SHAKEDOWN DATA FORM

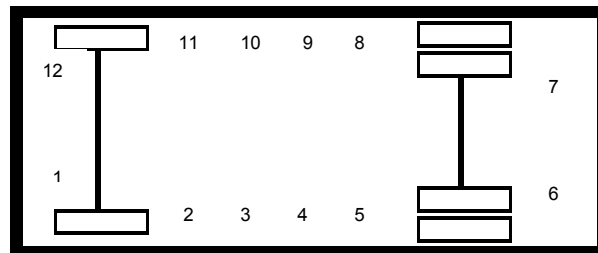
Bus Number: 1008	Date: 7-6-10
Personnel: E.L., E.D., B.L., B.L. & T.S.	Temperature (°F): 86
Loading Sequence: <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3    (check one) Test Load (lbs): 10,950	

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	-.049	-.190	-.141	-.052	-.003
2	.016	.154	.138	.016	.000
3	.067	.378	.311	.072	.005
4	.085	.462	.377	.090	.005
5	.102	.523	.421	.108	.006
6	-.034	-.076	-.042	-.035	-.001
7	-.068	-.196	-.128	-.071	-.003
8	.163	.635	.472	.169	.006
9	.145	.578	.433	.150	.005
10	.101	.380	.279	.106	.005
11	.056	.226	.170	.059	.003
12	-.048	-.235	-.187	-.052	-.004

## **5.1 STRUCTURAL SHAKEDOWN TEST**



**BUS LOADED TO 2.5 TIMES GVL  
(10,950 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: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input checked="" type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower

	Comments
<input checked="" type="checkbox"/> Windows	No deficiencies.
<input checked="" type="checkbox"/> Front Doors	No deficiencies.
<input checked="" type="checkbox"/> Rear Doors	No deficiencies.
<input checked="" type="checkbox"/> Escape Mechanisms/ Roof Vents	No deficiencies.
<input checked="" type="checkbox"/> Engine	No deficiencies.
<input checked="" type="checkbox"/> Handicapped Device/ Special Seating	No deficiencies.
<input checked="" type="checkbox"/> Undercarriage	No deficiencies.
<input checked="" type="checkbox"/> Service Doors	No deficiencies.
<input checked="" type="checkbox"/> Body	No deficiencies.
<input checked="" type="checkbox"/> Windows/ Body Leakage	No deficiencies.
<input checked="" type="checkbox"/> Steering Mechanism	No deficiencies.

**DISTORTION TEST INSPECTION FORM**  
(Note: Ten copies of this data sheet are required)

Bus Number: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input checked="" type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower

	Comments
<input checked="" type="checkbox"/> Windows	No deficiencies.
<input checked="" type="checkbox"/> Front Doors	No deficiencies.
<input checked="" type="checkbox"/> Rear Doors	No deficiencies.
<input checked="" type="checkbox"/> Escape Mechanisms/ Roof Vents	No deficiencies.
<input checked="" type="checkbox"/> Engine	No deficiencies.
<input checked="" type="checkbox"/> Handicapped Device/ Special Seating	No deficiencies.
<input checked="" type="checkbox"/> Undercarriage	No deficiencies.
<input checked="" type="checkbox"/> Service Doors	No deficiencies.
<input checked="" type="checkbox"/> Body	No deficiencies.
<input checked="" type="checkbox"/> Windows/ Body Leakage	No deficiencies.
<input checked="" type="checkbox"/> Steering Mechanism	No deficiencies.

**DISTORTION TEST INSPECTION FORM**  
(Note: Ten copies of this data sheet are required)

Bus Number: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input checked="" type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 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: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input checked="" type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 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: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input checked="" type="checkbox"/> 6 in higher	<input type="checkbox"/> 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: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input checked="" type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 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: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input checked="" type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 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: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input checked="" type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 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: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input checked="" type="checkbox"/> 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: 1008	Date: 7-7-10
Personnel: E.D., E.L., B.L. & B.L.	Temperature(°F): 92

Wheel Position : (check one)		
All wheels level	<input type="checkbox"/> before	<input checked="" type="checkbox"/> after
Left front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right front	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Right rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower
Left rear	<input type="checkbox"/> 6 in higher	<input type="checkbox"/> 6 in lower

	Comments
<input checked="" type="checkbox"/> Windows	No deficiencies.
<input checked="" type="checkbox"/> Front Doors	No deficiencies.
<input checked="" type="checkbox"/> Rear Doors	No deficiencies.
<input checked="" type="checkbox"/> Escape Mechanisms/ Roof Vents	No deficiencies.
<input checked="" type="checkbox"/> Engine	No deficiencies.
<input checked="" type="checkbox"/> Handicapped Device/ Special Seating	No deficiencies.
<input checked="" type="checkbox"/> Undercarriage	No deficiencies.
<input checked="" type="checkbox"/> Service Doors	No deficiencies.
<input checked="" type="checkbox"/> Body	No deficiencies.
<input checked="" type="checkbox"/> Windows/ Body Leakage	No deficiencies.
<input checked="" type="checkbox"/> Steering Mechanism	No deficiencies.

## 5.2 STRUCTURAL DISTORTION TEST



**RIGHT FRONT WHEEL SIX INCHES HIGHER**



**RIGHT 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 test bus submitted for testing was not equipped with any type of tow eyes or tow hooks, therefore the Static Tow Test was not performed.

## **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: 1008	Date: 10-7-10
Personnel: S.C. & T.S.	

Temperature (°F): 70	Humidity (%): 65
Wind Direction: SW	Wind Speed (mph): 8
Barometric Pressure (in. Hg): 30.05	

<b>Inspect tow equipment-bus interface.</b>
<b>Comments:</b> A safe and adequate connection was made between the tow equipment and the bus.
<b>Inspect tow equipment-wrecker interface.</b>
<b>Comments:</b> A safe and adequate connection was made between the tow equipment and the wrecker.
<b>Towing Comments:</b> A front lift tow was performed incorporating a hydraulic under lift wrecker.
<b>Description and location of any structural damage:</b> None damage or deformation was observed.
<b>General Comments:</b> No problems with the tow or towing interface 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 hack 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 6.9 inches to 12.6 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	12.6"
Rear axle – one tire flat	11.2"
Rear axle – two tires flat	11.3"

## JACKING TEST DATA FORM

Bus Number: 1008	Date: 6-30-10
Personnel: E.D., E.L. & B.L.	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	14.6" I 12.6" D	9.3" I 6.9" D	
Left front	12.4" I 12.6" D	9.3" I 7.0" D	
Right rear—outside	11.7" I 11.2" D	9.8" I 8.8" D	
Right rear—both	11.7" I 11.3" D	9.8" I 7.6" D	
Left rear—outside	14.3" I 14.0" D	9.8" I 9.5" D	
Left rear—both	14.3" I 12.0" D	9.8" I 8.2" D	
Right middle or tag—outside	NA	NA	
Right middle or tag—both	NA	NA	
Left middle or tag—outside	NA	NA	
Left middle or tag—both	NA	NA	
<b>Additional comments of any deformation or difficulty during jacking:</b>			
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: 1008	Date: 7-1-10
Personnel: E.D. & E.L.	Temperature (°F): 70

<b>Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:</b>
None noted.
<b>Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:</b>
None noted.
<b>Comments of any structural damage to the jacking pads or axles while both the front and rear wheels are supported by the jack stands:</b>
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 7,500 miles; approximately 5,000 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 3,000 miles with the bus operated at GVW. The second segment will consist of approximately 1,500 miles with the bus operated at SLW. The remainder of the test, approximately 3,000 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 June 28, 2010 and was conducted until October 18, 2010. The first 3,000 miles were performed at a GVW of 15,000 lbs. and completed on July 22, 2010. **Note: at GVL the load is 850 lbs over the rear GAWR and 500 lbs over the GVWR.** The next 1,500 mile SLW segment was performed at 13,670 lbs and completed on August 20, 2010, and the final 3,000 mile segment was performed at a CW of 10,000 lbs and completed on October 18, 2010.

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.

**GLAVAL TEST BUS #1008****MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS**

<b>DATE</b>	<b>TOTAL DURABILITY TRACK</b>	<b>TOTAL OTHER MILES</b>	<b>TOTAL</b>
06/28/10 TO 07/04/10	0.00	150.00	150.00
07/05/10 TO 07/11/10	171.00	66.00	237.00
07/12/10 TO 07/18/10	1120.00	142.00	1262.00
07/19/10 TO 07/25/10	876.00	124.00	1000.00
07/26/10 TO 08/01/10	383.00	39.00	422.00
08/02/10 TO 08/08/10	0.00	0.00	0.00
08/09/10 TO 08/15/10	0.00	0.00	0.00
08/16/10 TO 08/22/10	541.00	56.00	597.00
08/23/10 TO 08/29/10	934.00	115.00	1049.00
08/30/10 TO 09/05/10	992.00	677.00	1669.00
09/06/10 TO 09/12/10	0.00	742.00	742.00
09/13/10 TO 09/19/10	0.00	225.00	225.00
09/20/10 TO 09/26/10	0.00	36.00	36.00
09/27/10 TO 10/03/10	0.00	0.00	0.00
10/04/10 TO 10/10/10	0.00	50.00	50.00
10/11/10 TO 10/17/10	0.00	43.00	43.00
10/18/10 TO 10/24/10	0.00	55.00	55.00
<b>TOTAL</b>	<b>5017.00</b>	<b>2520.00</b>	<b>7537.00</b>



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

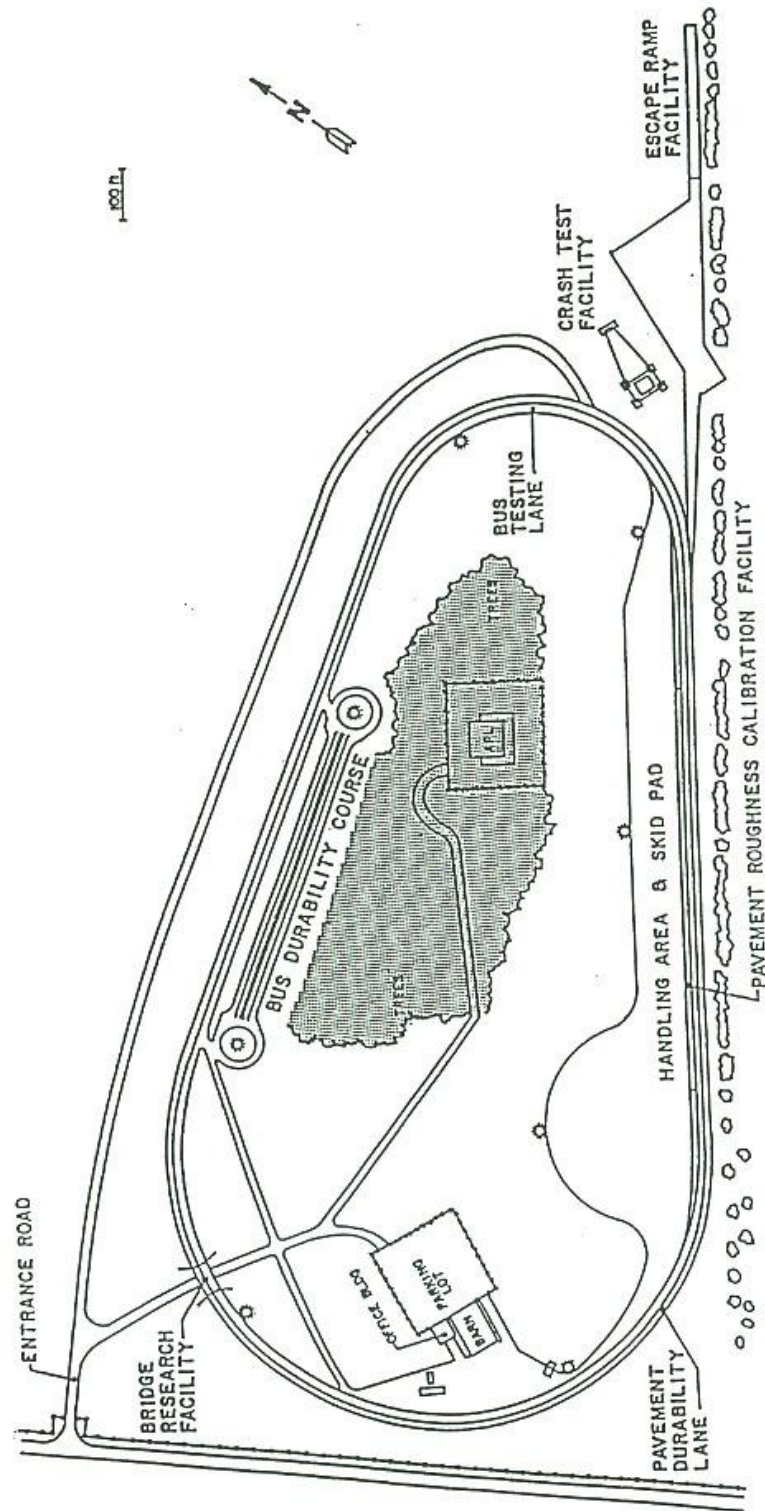
B—Break

C—Cycle all systems five times, visual inspection, driver's log entries

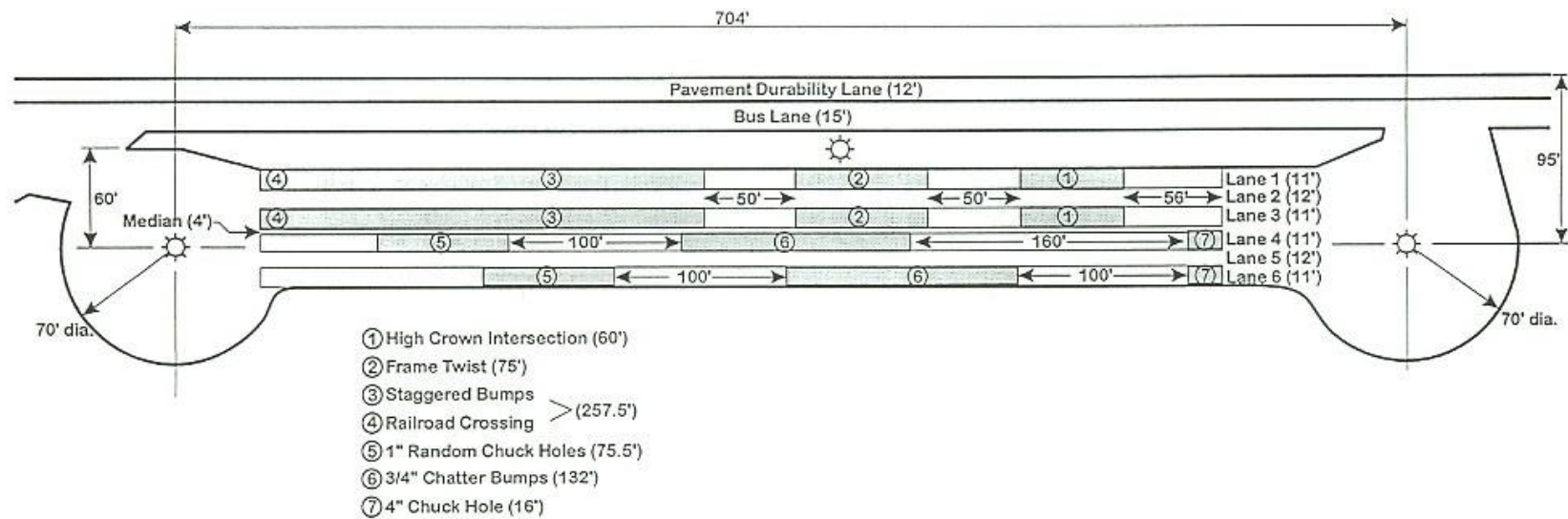
D—Drive bus as specified by procedure

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**

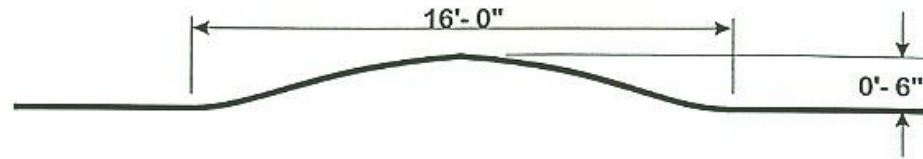


Plan View

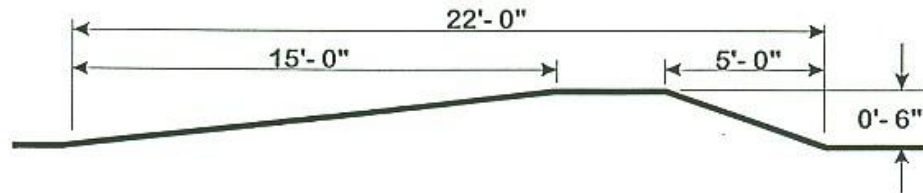
## Vehicle Durability Test Track

The Pennsylvania Transportation Institute  
Penn State

Staggered  
Bumps  
(10 mph)



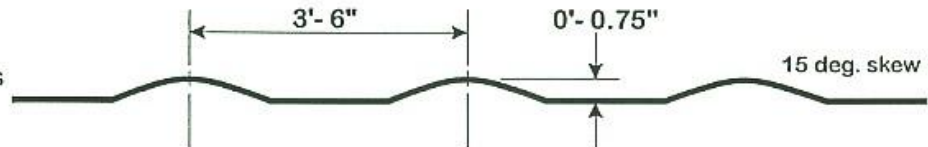
Railroad  
Crossing  
(8 mph)



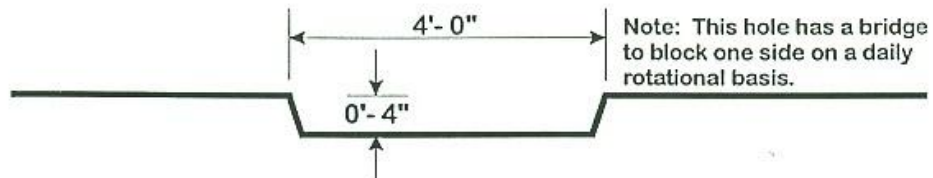
1" Random  
Chuck Holes  
(20 mph)



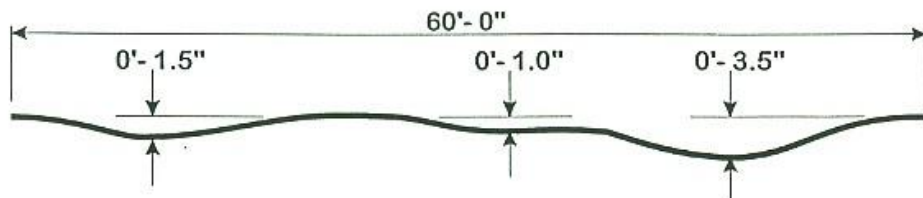
Chatter Bumps  
(20 mph)



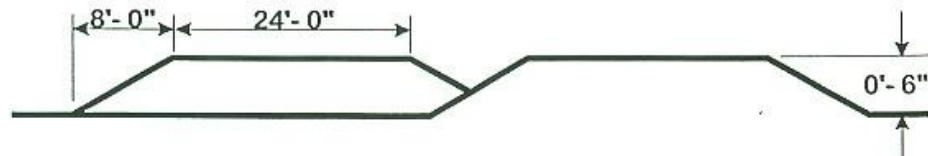
4" Chuck Hole  
(5 mph)



High Crown  
Intersection  
(20 mph)



Frame Twist  
(10 mph)



## Durability Element Profiles

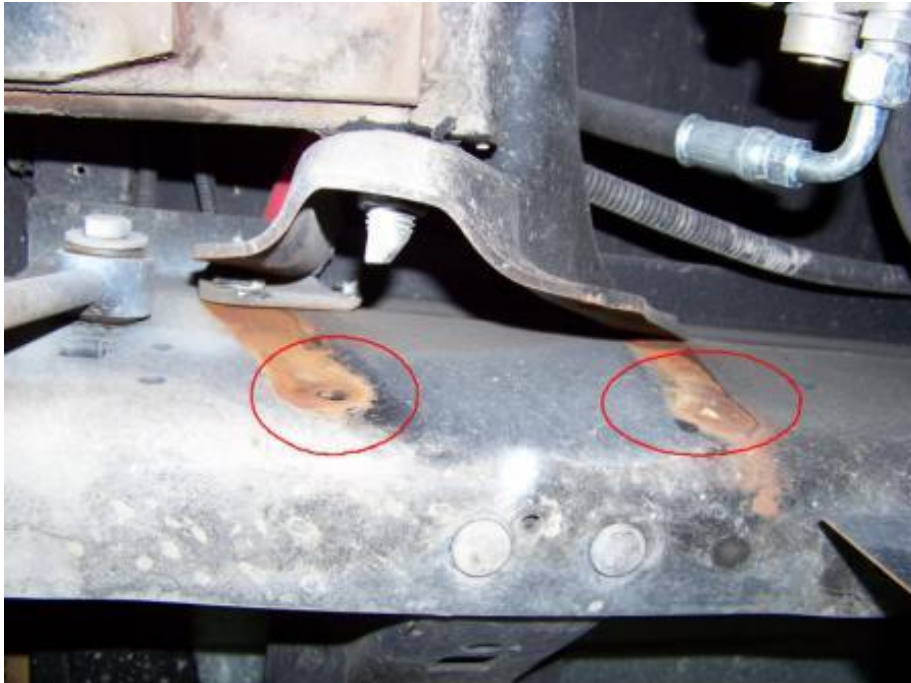
The Pennsylvania Transportation Institute  
Penn State

(Page 1 of 1)  
**UNSCHEDULED MAINTENANCE**  
**Glaval Bus #1008**

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
07/15/10	1,302	The right, rear, outside tire is flat.	Replaced tire.	0.50	3.00
07/23/10	2,515	The CNG vent hose by the right rear leaf spring is damaged due to contact with the leaf spring.	Replaced CNG vent hose and re-routed away from contact with the leaf spring.	2.00	16.00
07/26/10	2,743	Two +12V battery lugs were broken on the auxiliary battery.	Replaced two cable lugs and +12V battery terminal.	2.00	6.00
08/18/10	3,071	The right rear spring hanger is broken near the rear most, upper attaching rivet. Both lower rivets are broken.	Replaced right rear spring hanger.	2.00	379.00
08/26/10	4,292	Trouble shooting for shudder and engine miss at 40 mph.	Genisys reader found misfire on cylinders 4, 5 & 8. Located and repaired broken wires at the fuel injectors of cylinders 4, 5 & 8.	12.00	16.00
09/07/10	6,611	Both front tires are worn.	Replaced both front tires.	0.50	0.50



## **UNSCHEDULED MAINTENANCE**



**BROKEN RIVETS ON RIGHT REAR SPRING HANGER  
(3,071 TEST MILES)**



**BROKEN RIGHT REAR SPRING HANGER  
(3,071 TEST MILES)**



## **UNSCHEDULED MAINTENANCE CONT.**



**BROKEN WIRE AT FUEL INJECTOR  
(4,292 TEST MILES)**

## **6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE**

### **6-I. TEST OBJECTIVE**

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel 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 fuel economy test, as designated here, is a measurement of the fuel 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.

### **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 the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82. The procedure has been modified by elimination of the control vehicle and by modifications as described below. The inherent uncertainty and expense of utilizing a control vehicle over the operating life of the facility is impractical.

The fuel economy test will be performed as soon as possible (weather permitting) after the completion of the GVW portion of the structural durability test. It will be conducted on the bus test lane at the Penn State Test Facility. Signs are erected at carefully measured points which delineate the test course. A test run will comprise 3 CBD phases, 2 Arterial phases, and 1 Commuter phase. An electronic fuel measuring system will indicate the amount of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within  $\pm 4$  percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to and immediately after the driven portion of the fuel economy test. The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

The test procedure is the ADB cycle with the following four modifications:

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, and Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.
2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases (figure 6-1) are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.
3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the Penn State Test Track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.
4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to "full throttle acceleration to cruise speed".

Several changes were made to the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82:

1. Sections 1.1, and 1.2 only apply to diesel, gasoline, methanol, and any other fuel in the liquid state (excluding cryogenic fuels).

1.1 SAE 1376 July 82 requires the use of at least a 16-gal fuel tank. Such a fuel tank when full would weigh approximately 160 lb. It is judged that a 12-gal tank weighing approximately 120 lb will be sufficient for this test and much easier for the technician and test personnel to handle.

1.2 SAE 1376 July 82 mentions the use of a mechanical scale or a flow meter system. This test procedure uses a load cell readout combination that provides an accuracy of 0.5 percent in weight and permits on-board weighing of the gravimetric tanks at the end of each phase. This modification permits the determination of a fuel economy value for each phase as well as the overall cycle.

2. Section 2.1 applies to compressed natural gas (CNG), liquefied natural gas (LNG), cryogenic fuels, and other fuels in the vapor state.

2.1 A laminar type flow meter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each phase will be recorded on the Fuel Economy Data Form.

3. Use both Sections 1 and 2 for dual fuel systems.

#### FUEL ECONOMY CALCULATION PROCEDURE

##### **A. For diesel, gasoline, methanol and fuels in the liquid state.**

The reported fuel economy is based on the following: measured test quantities-- distance traveled (miles) and fuel consumed (pounds); standard reference values-- density of water at 60°F (8.3373 lbs/gal) and volumetric heating value of standard fuel; and test fuel specific gravity (unitless) and volumetric heating value (BTU/gal). These combine to give a fuel economy in miles per gallon (mpg) which is corrected to a standard gallon of fuel referenced to water at 60°F. This eliminates fluctuations in fuel economy due to fluctuations in fuel quality. This calculation has been programmed into a computer and the data processing is performed automatically.

The fuel economy correction consists of three steps:

- 1.) Divide the number of miles of the phase by the number of pounds of fuel consumed

phase	miles per phase	total miles
		per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\text{FE}_{\text{mi/lb}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{lb of fuel}}$$

- 2.) Convert the observed fuel economy to miles per gallon [mpg] by multiplying by the specific gravity of the test fuel  $G_s$  (referred to water) at 60°F and multiply by the density of water at 60°F

$$FE_{\text{mpg}} = FE_{\text{mi/lb}} \times G_s \times G_w$$

where  $G_s$  = Specific gravity of test fuel at 60°F (referred to water)  
 $G_w$  = 8.3373 lb/gal

- 3.) Correct to a standard gallon of fuel by dividing by the volumetric heating value of the test fuel ( $H$ ) and multiplying by the volumetric heating value of standard reference fuel ( $Q$ ). Both heating values must have the same units.

$$FE_c = FE_{\text{mpg}} \times \frac{Q}{H}$$

where

$H$  = Volumetric heating value of test fuel [BTU/gal]  
 $Q$  = Volumetric heating value of standard reference fuel

Combining steps 1-3 yields

$$\Rightarrow FE_c = \frac{\text{miles}}{\text{lbs}} \times (G_s \times G_w) \times \frac{Q}{H}$$

- 4.) Convert the fuel economy from mpg to an energy equivalent of miles per BTU. Since the number would be extremely small in magnitude, the energy equivalent will be represented as miles/BTU $\times 10^6$ .

$Eq$  = Energy equivalent of converting mpg to mile/BTU $\times 10^6$ .

$$Eq = ((\text{mpg})/(H)) \times 10^6$$

## B. CNG, LNG, cryogenic and other fuels in the vapor state.

The reported fuel economy is based on the following: measured test quantities-- distance traveled (miles) and fuel consumed (scf); density of test fuel, and volumetric heating value (BTU/lb) of test fuel at standard conditions ( $P=14.73$  psia and  $T=60$  EF).

These combine to give a fuel economy in miles per lb. The energy equivalent (mile/BTUx10<sup>6</sup>) will also be provided so that the results can be compared to buses that use other fuels.

- 1.) Divide the number of miles of the phase by the number of standard cubic feet (scf) of fuel consumed.

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$\text{FEO}_{\text{mi/scf}} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{scf of fuel}}$$

- 2.) Convert the observed fuel economy to miles per lb by dividing FEO by the density of the test fuel at standard conditions (Lb/ft<sup>3</sup>).

**Note: The density of test fuel must be determined at standard conditions as described above. If the density is not defined at the above standard conditions, then a correction will be needed before the fuel economy can be calculated.**

$$\text{FEO}_{\text{mi/lb}} = \text{FEO} / \text{Gm}$$

where Gm = Density of test fuel at standard conditions

- 3.) Convert the observed fuel economy (FEOmi/lb) to an energy equivalent of (miles/BTUx10<sup>6</sup>) by dividing the observed fuel economy (FEOmi/lb) by the heating value of the test fuel at standard conditions.

$$\text{Eq} = ((\text{FEOmi/lb})/\text{H}) \times 10^6$$

where

Eq = Energy equivalent of miles/lb to mile/BTUx10<sup>6</sup>

H = Volumetric heating value of test fuel at standard conditions



### 6-III. DISCUSSION

This is a comparative test of fuel economy using CNG fuel with a heating value of 1,008.1 btu/lb. The driving cycle consists of Central Business District (CBD), Arterial (ART), and Commuter (COM) phases as described in 6-II. The fuel consumption for each driving cycle and for idle is measured separately. The results are corrected to a reference fuel with a volumetric heating value of 127,700.0 btu/gal.

An extensive pretest maintenance check is made including the replacement of 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 sheet shows the correction calculation for the test fuel. The next four Fuel Economy Forms provide the data from the four test runs. Finally, the summary sheet provides the average fuel consumption. The overall average is based on total fuel and total mileage for each phase. The overall average fuel consumption values were; CBD – 0.93 M/lb, ART - .094 M/lb, and COM – 1.76 M/lb. Average fuel consumption at idle was 6.64 lb/hr (163.5 scf/hr).

## FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 1008	Date: 9-13-10	SLW (lbs): 13,670
Personnel: T.S. & S.C.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	✓	9/13/10	S.C.
Replace fuel filter	✓	9/13/10	S.C.
Check for fuel leaks	✓	9/13/10	S.C.
Specify fuel type (refer to fuel analysis)	CNG		
Remarks: None noted.			
BRAKES/TIRES	OK	Date	Initials
Inspect hoses	✓	9/13/10	S.C.
Inspect brakes	✓	9/13/10	S.C.
Relube wheel bearings	✓	9/13/10	T.S.
Check tire inflation pressures (mfg. specs.)	✓	9/13/10	T.S.
Remarks: None noted.			
COOLING SYSTEM	OK	Date	Initials
Check hoses and connections	✓	9/13/10	S.C.
Check system for coolant leaks	✓	9/13/10	S.C.
Remarks: None noted.			

## FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 1008	Date: 9-13-10		
Personnel: T.S. & S.C.			
ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	✓	9/13/10	S.C.
Inspect wiring	✓	9/13/10	S.C.
Inspect terminals	✓	9/13/10	S.C.
Check lighting	✓	9/13/10	S.C.
Remarks: None noted.			
DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	✓	9/13/10	T.S.
Replace filter/gasket	✓	9/13/10	T.S.
Check hoses and connections	✓	9/13/10	T.S.
Replace transmission fluid	✓	9/13/10	T.S.
Check for fluid leaks	✓	9/13/10	T.S.
Remarks: None noted.			
LUBRICATION	OK	Date	Initials
Drain crankcase oil	✓	9/13/10	T.S.
Replace filters	✓	9/13/10	T.S.
Replace crankcase oil	✓	9/13/10	T.S.
Check for oil leaks	✓	9/13/10	T.S.
Check oil level	✓	9/13/10	T.S.
Lube all chassis grease fittings	✓	9/13/10	T.S.
Lube universal joints	✓	9/13/10	T.S.
Replace differential lube including axles	✓	9/13/10	T.S.
Remarks: None noted.			

## FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 1008	Date: 9-13-10		
Personnel: T.S. & S.C.			
EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	✓	9/13/10	S.C.
Remarks: None noted.			
ENGINE	OK	Date	Initials
Replace air filter	✓	9/13/10	S.C.
Inspect air compressor and air system	✓	9/13/10	S.C.
Inspect vacuum system, if applicable	✓	9/13/10	S.C.
Check and adjust all drive belts	✓	9/13/10	S.C.
Check cold start assist, if applicable	✓	9/13/10	S.C.
Remarks: None noted.			
STEERING SYSTEM	OK	Date	Initials
Check power steering hoses and connectors	✓	9/13/10	S.C.
Service fluid level	✓	9/13/10	S.C.
Check power steering operation	✓	9/13/10	S.C.
Remarks: None noted.			
	OK	Date	Initials
Ballast bus to seated load weight	✓	9/13/10	S.C.
TEST DRIVE	OK	Date	Initials
Check brake operation	✓	9/13/10	S.C.
Check transmission operation	✓	9/13/10	S.C.
Remarks: None noted.			

## FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 1008	Date: 9-15-10
Personnel: T.S. & S.C.	
<b>PRE WARM-UP</b>	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	T.S. & S.C.
Cold tire pressure (psi): Front <u>80</u> Middle <u>N/A</u> Rear <u>80</u>	T.S. & S.C.
Tire wear:	T.S. & S.C.
Engine oil level	T.S. & S.C.
Engine coolant level	T.S. & S.C.
Interior and exterior lights on, evaporator fan on	T.S. & S.C.
Fuel economy instrumentation installed and working properly.	T.S. & S.C.
Fuel line -- no leaks or kinks	T.S. & S.C.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	T.S. & S.C.
Bus is loaded to SLW	T.S. & S.C.
<b>WARM-UP</b>	If OK, Initial
Bus driven for at least one hour warm-up	T.S. & S.C.
No extensive or black smoke from exhaust	T.S. & S.C.
<b>POST WARM-UP</b>	If OK, Initial
Warm tire pressure (psi): Front <u>82</u> Middle <u>N/A</u> Rear <u>82</u>	T.S. & S.C.
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°(-1°) and 90°F(32°C) Track surface is dry Track is free of extraneous material and clear of interfering traffic	T.S. & S.C.

### FUEL ECONOMY DATA FORM (Gaseous Fuels)

Bus Number: 1008		Manufacturer: Glaval		Date: 9-14-10	
Run Number: 1		Personnel: B.L., S.C., E.D. & B.G.			
Test Direction: <input type="checkbox"/> CW or <input checked="" type="checkbox"/> CCW		Ambient Temperature (°F): 65		Humidity (%): 50	
SLW (lbs): 13,670		Wind Speed (mph) & Direction: 7 / NNW		Barometric Pressure (in.Hg): 30.04	
Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°F)	Total Fuel Used (SCF)
	Start	Finish		Start	
CBD #1	0	8:23	8:23	76	55
ART #1	0	3:53	3:53	70	56
CBD #2	0	8:19	8:19	67	54
ART #2	0	3:50	3:50	65	51
CBD #3	0	8:20	8:20	70	50
COMMUTER	0	5:52	5:52	71	54
Total Fuel: 320 SCF					
20 minute idle : Total Fuel Used = 55 SCF					
No Load Flow Rate at Idle = 2.8 SCFM			No Load Flow Rate at Full Throttle = 9.6 SCFM		
Heating Value = 1,008.1 BTU/LB					
Comments: None noted.					



### FUEL ECONOMY DATA FORM (Gaseous Fuels)

Bus Number: 1008		Manufacturer: Glaval		Date: 9-14-10	
Run Number: 2		Personnel: B.L., S.C., E.D. & B.G.			
Test Direction: <input checked="" type="checkbox"/> CW or <input type="checkbox"/> CCW		Ambient Temperature (°F): 67		Humidity (%): 50	
SLW (lbs): 16,670		Wind Speed (mph) & Direction: 7 / NNW		Barometric Pressure (in.Hg): 30.04	

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°F)	Total Fuel Used (SCF)
	Start	Finish		Start	
CBD #1	0	8:20	8:20	73	50
ART #1	0	3:50	3:50	67	53
CBD #2	0	8:15	8:15	70	49
ART #2	0	3:55	3:55	71	50
CBD #3	0	8:10	8:10	74	50
COMMUTER	0	5:54	5:54	74	53
Total Fuel: 305 SCF					
20 minute idle : Total Fuel Used = N/A SCF					
No Load Flow Rate at Idle = N/A SCFM			No Load Flow Rate at Full Throttle = N/A SCFM		
Heating Value = 1,008.1 BTU/LB					
Comments: Wind picked up. Run 3 & 4 to be performed tomorrow.					

### FUEL ECONOMY DATA FORM (Gaseous Fuels)

Bus Number: 1008		Manufacturer: Glaval		Date: 9-15-10	
Run Number: 3		Personnel: B.G., T.S. & E.L.			
Test Direction: <input type="checkbox"/> CW or <input checked="" type="checkbox"/> CCW		Ambient Temperature (°F): 59		Humidity (%): 63	
SLW (lbs): 13,670		Wind Speed (mph) & Direction: Calm		Barometric Pressure (in.Hg): 30.18	
Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°F)	Total Fuel Used (SCF)
	Start	Finish		Start	
CBD #1	0	8:21	8:21	80	51
ART #1	0	3:48	3:48	73	50
CBD #2	0	8:19	8:19	76	49
ART #2	0	3:47	3:47	71	48
CBD #3	0	8:12	8:12	77	50
COMMUTER	0	5:51	5:51	74	55
Total Fuel: 303 SCF					
20 minute idle : Total Fuel Used = N/A SCF					
No Load Flow Rate at Idle = N/A SCFM			No Load Flow Rate at Full Throttle = N/A SCFM		
Heating Value = 1,008.1 BTU/LB					
Comments: None noted.					

### FUEL ECONOMY DATA FORM (Gaseous Fuels)

Bus Number: 1008		Manufacturer: Glaval		Date: 9-15-10	
Run Number: 4		Personnel: B.G., T.S. & E.L.			
Test Direction: <input checked="" type="checkbox"/> CW or <input type="checkbox"/> CCW		Ambient Temperature (°F): 59		Humidity (%): 63	
SLW (lbs): 13,670		Wind Speed (mph) & Direction: Calm		Barometric Pressure (in.Hg): 30.18	

Cycle Type	Run Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°F)	Total Fuel Used (SCF)
	Start	Finish		Start	
CBD #1	0	8:23	8:23	76	48
ART #1	0	3:48	3:48	72	47
CBD #2	0	8:14	8:14	78	50
ART #2	0	3:49	3:49	74	47
CBD #3	0	8:16	8:16	80	49
COMMUTER	0	5:54	5:54	79	52
Total Fuel: 294 SCF					
20 minute idle : Total Fuel Used = 54 SCF					
No Load Flow Rate at Idle = 2.7 SCFM			No Load Flow Rate at Full Throttle = 8.4 SCFM		
Heating Value = 1,008.1 BTU/LB					
Comments: None noted.					

# FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :Glaval  
BUS MODEL :Universal CNG

BUS NUMBER :1008  
TEST DATE :09/15/10

FUEL TYPE : NATURAL GAS  
SP. GRAVITY : .5570  
HEATING VALUE : 1008.10 BTU/cf  
FUEL TEMPERATURE : 60.00 deg F  
Standard Conditions : 60 deg F and 14.7 psi  
Density of Air : 0.0729 lb/scf

CYCLE	TOTAL FUEL USED (Scf)	TOTAL MILES	FUEL ECONOMY M/Scf (Measured)	FUEL ECONOMY M/Lb (Corrected)
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Run # :1, CCW

CBD	159.0	5.73	.04	.89
ART	107.0	3.82	.04	.88
COM	54.0	3.82	.07	1.74
TOTAL	320.0	13.37	.04	1.03

Run # :2, CW

CBD	149.0	5.73	.04	.95
ART	103.0	3.82	.04	.91
COM	53.0	3.82	.07	1.78
TOTAL	305.0	13.37	.04	1.08

Run # :3, CCW

CBD	150.0	5.73	.04	.94
ART	98.0	3.82	.04	.96
COM	55.0	3.82	.07	1.71
TOTAL	303.0	13.37	.04	1.09

Run # :4, CW

CBD	147.0	5.73	.04	.96
ART	94.0	3.82	.04	1.00
COM	52.0	3.82	.07	1.81
TOTAL	293.0	13.37	.05	1.12

## IDLE CONSUMPTION (MEASURED)

First 20 Minutes Data : 55.0 Scf Last 20 Minutes Data : 54.0 Scf  
Average Idle Consumption : 163.5 Scf/Hr

RUN CONSISTENCY: % Difference from overall average of total fuel used

Run 1 : -4.8 Run 2 : .1 Run 3 : .7 Run 4 : 4.0

## SUMMARY (CORRECTED VALUES)

Average Idle Consumption	: 6.64	LB/Hr
Average CBD Phase Consumption	: .93	M/Lb
Average Arterial Phase Consumption	: .94	M/Lb
Average Commuter Phase Consumption	: 1.76	M/Lb
Overall Average Fuel Consumption	: 1.08	M/Lb
Overall Average Fuel Consumption	: 43.49	Miles/ Million BTU

## 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 49.2 dB(A); ranging from 47.8 dB(A) at the driver's seat to 50.3 dB(A) in line with the rear speaker. The interior ambient noise level for this test was < 34.0 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 72.7 dB(A) at the rear passenger seats to 76.7 dB(A) at the driver's seat. The overall average was 74.1 dB(A). The interior ambient noise level for this test was <34.0 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: 1008	Date: 6-30-10
Personnel: E.L., E.D. & B.L.	
Temperature (°F): 72	Humidity (%): 42
Wind Speed (mph): 6	Wind Direction: NW
Barometric Pressure (in.Hg): 30.18	
Initial Sound Level Meter Calibration: ■ checked by: S.C.	
Interior Ambient Noise Level dB(A): < 34.0	Exterior Ambient Noise Level dB(A): 47.9
Microphone Height During Testing (in): 48	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	47.8
Front Passenger Seats	48.2
In Line with Front Speaker	49.6
In Line with Middle Speaker	49.0
In Line with Rear Speaker	50.3
Rear Passenger Seats	50.2

Final Sound Level Meter Calibration: ■ checked by: E.D.
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<b>Comments:</b> All readings taken in the center aisle.



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

Bus Number: 1008	Date: 9-15-10
Personnel: B.G., T.S., E.L. & E.D.	
Temperature (°F): 64	Humidity (%): 49
Wind Speed (mph): 7	Wind Direction: W
Barometric Pressure (in.Hg): 31.18	
Initial Sound Level Meter Calibration: ■ checked by: T.S.	
Interior Ambient Noise Level dB(A): < 34.0	Exterior Ambient Noise Level dB(A): 40.9
Microphone Height During Testing (in): 48	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	76.7
Front Passenger Seats	73.9
Middle Passenger Seats	73.1
Rear Passenger Seats	72.7

Final Sound Level Meter Calibration: ■ checked by: T.S.
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<b>Comments:</b> All readings taken in the center aisle.

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

Bus Number: 1008	Date: 9-15-10
Personnel: B.G., T.S., E.D. & E.L.	
Temperature (°F): 64	Humidity (%): 49
Wind Speed (mph): 7	Wind Direction: W
Barometric Pressure (in.Hg): 30.18	

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.

<b>Comment on any other vibration or noise source which may have occurred that is not described above:</b> 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 upshift.
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 40.9 dB(A), the average test result obtained while accelerating from a constant speed was 74.8 dB(A) on the right side and 74.3 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 40.9 dB(A), the average of the results obtained were 72.4 dB(A) on the right side and 72.4 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 55.1 dB(A) at low idle and 51.1 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 2.4 dB(A) lower at low idle and 0.5 dB(A) higher at wide open throttle. The exterior ambient noise level measured during this test was 40.9 dB(A).

## EXTERIOR NOISE TEST DATA FORM

### Accelerating from Constant Speed

Bus Number: 1008	Date: 9-15-10
Personnel: B.G., T.S., E.L. & E.D.	
Temperature (°F): 64	Humidity (%): 49
Wind Speed (mph): 7	Wind Direction: W
Barometric Pressure (in.Hg): 30.18	
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: T.S.	
Initial Sound Level Meter Calibration: ■ checked by: T.S.	
Exterior Ambient Noise Level dB(A): 40.9	

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	74.7	1	73.4
2	74.7	2	73.9
3	74.0	3	72.7
4	74.5	4	74.1
5	74.9	5	74.5
Average of two highest actual noise levels = 74.8 dB(A)		Average of two highest actual noise levels = 74.3 dB(A)	
Final Sound Level Meter Calibration Check: ■ checked by: T.S.			
<b>Comments:</b> None noted.			



# EXTERIOR NOISE TEST DATA FORM

## Accelerating from Standstill

Bus Number: 1008	Date: 9-15-10
Personnel: B.G., T.S., E.D. & E.L.	
Temperature (°F): 64	Humidity (%): 49
Wind Speed (mph): 7	Wind Direction: W
Barometric Pressure (in.Hg): 30.18	
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: T.S.	
Initial Sound Level Meter Calibration: ■ checked by: T.S.	
Exterior Ambient Noise Level dB(A): 40.9	

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	70.2	1	70.8
2	71.3	2	72.0
3	71.5	3	70.3
4	73.2	4	72.2
5	70.7	5	72.6
Average of two highest actual noise levels = 72.4 dB(A)		Average of two highest actual noise levels = 72.4 dB(A)	
Final Sound Level Meter Calibration Check: ■ checked by: T.S.			
<b>Comments:</b> None noted.			

**EXTERIOR NOISE TEST DATA FORM**  
**Stationary**

Bus Number: 1008		Date: 9-15-10	
Personnel: B.G., T.S., E.D. & E.L.			
Temperature (°F): 64		Humidity (%): 49	
Wind Speed (mph): 7		Wind Direction: W	
Barometric Pressure (in.Hg): 30.18			
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: T.S.			
Initial Sound Level Meter Calibration: ■ checked by: T.S.			
Exterior Ambient Noise Level dB(A): 40.9			
Accessories and Air Conditioning ON			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	850	59.1	51.1
High Idle	N/A	N/A	N/A
Wide Open Throttle	3,495	69.6	69.1
Accessories and Air Conditioning OFF			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	995	52.4	52.9
High Idle	N/A	N/A	N/A
Wide Open Throttle	3,505	60.8	69.0
Final Sound Level Meter Calibration Check: ■ checked by: T.S.			
<b>Comments:</b> None noted.			

## 7.2 EXTERIOR NOISE TESTS



**TEST BUS UNDERGOING EXTERIOR NOISE TESTING**



## **8. EMISSIONS TEST – DYNAMOMETER-BASED EMISSIONS TEST USING TRANSIT DRIVING CYCLES**

### **8-I. TEST OBJECTIVE**

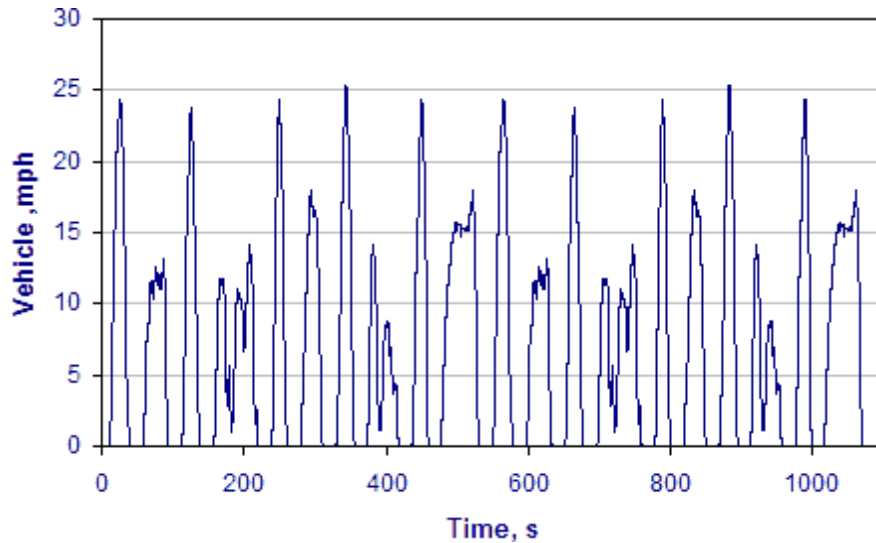
The objective of this test is to provide comparable emissions data on transit buses produced by different manufacturers. This chassis-based emissions test bears no relation to engine certification testing performed for compliance with the Environmental Protection Agency (EPA) regulation. EPA's certification tests are performed using an engine dynamometer operating under the Federal Test Protocol. This emissions test is a measurement of the gaseous engine emissions CO, CO<sub>2</sub>, NO<sub>x</sub>, HC and particulates (diesel vehicles) produced by a vehicle operating on a large-roll chassis dynamometer. The test is performed for three differed driving cycles intended to simulate a range of transit operating environments. The cycles consist of Manhattan Cycle, the Orange County Bus driving cycle, and the Urban Dynamometer Driving Cycle (UDDS) and. The test is performed under laboratory conditions in compliance with EPA 1065 and SAE J2711. The results of this test may not represent actual in-service vehicle emissions but will provide data that can be used by recipients to compare buses tested under different operating conditions.

### **8-II. TEST DESCRIPTION**

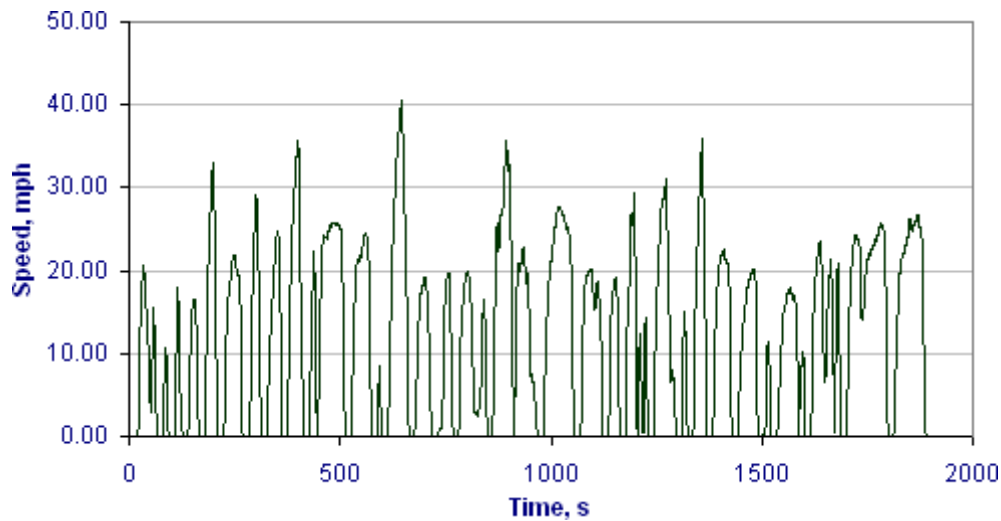
This test is performed in the emissions bay of the LTI Vehicle Testing Laboratory. The Laboratory is equipped with a Schenk Pegasus 300 HP, large-roll (72 inch diameter) chassis dynamometer suitable for heavy-vehicle emissions testing. The dynamometer is located in the end test bay and is adjacent to the control room and emissions analysis area. The emissions laboratory provides capability for testing heavy-duty diesel and alternative-fueled buses for a variety of tailpipe emissions including particulate matter, oxides of nitrogen, carbon monoxide, carbon dioxide, and hydrocarbons. It is equipped with a Horiba full-scale CVS dilution tunnel and emissions sampling system. The system includes Horiba Mexa 7400 Series gas analyzers and a Horiba HF47 Particulate Sampling System. Test operation is automated using Horiba CDTCS software. The computer controlled dynamometer is capable of simulating over-the-road operation for a variety of vehicles and driving cycles.

The emissions test will be performed as soon as permissible after the completion of the GVW portion of the structural durability test. 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 UDDS Cycle (Figure 3). An emissions test will comprise of two runs for the three different driving cycles, and the

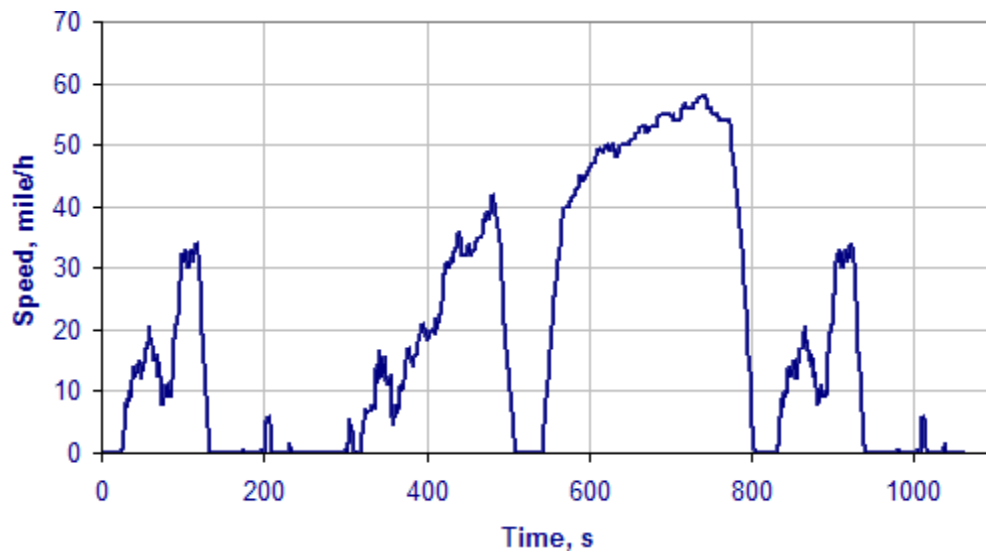
average value will be reported. Test results reported will include the average grams per mile value for each of the gaseous emissions for gasoline buses, for all the three driving cycles. In addition, the particulate matter emissions are included for diesel buses, and non-methane hydrocarbon emissions (NMHC) are included for CNG buses. Testing is performed in accordance with EPA CFR49, Part 1065 and SAE J2711 as practically determined by the FTA Emissions Testing Protocol developed by West Virginia University and Penn State University.



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



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



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

### 8-III. TEST ARTICLE

The test article is a Glaval Bus/Div. of Forest River model Universal CNG transit bus equipped with CNG fueled Ford 6.8 L engine. The bus was tested on October 18, 2010.

### 8-IV. TEST EQUIPMENT

Testing is performed in the LTI Vehicle Testing Laboratory emissions testing bay. The test bay is equipped with a Schenk Pegasus 72-inch, large-roll chassis dynamometer. The dynamometer is electronically controlled to account for vehicle road-load characteristics and for simulating the inertia characteristics of the vehicle. Power to the roller is supplied and absorbed through an electronically controlled 3-phase ac motor. Absorbed power is dumped back onto the electrical grid.

Vehicle exhaust is collected by a Horiba CVS, full-flow dilution tunnel. The system has separate tunnels for diesel and gasoline/natural gas fueled vehicles. In the case of diesel vehicles, particulate emissions are measured gravimetrically using 47mm Teflon filters. These filters are housed in a Horiba HF47 particulate sampler, per EPA 1065 test procedures.. Heated gaseous emissions of hydrocarbons and NO<sub>x</sub> are sampled by Horiba heated oven analyzers. Gaseous



emissions for CO, CO<sub>2</sub> and cold NO<sub>x</sub> are measured using a Horiba Mexa 7400 series gas analyzer. System operation, including the operation of the chassis dynamometer, and all calculations are controlled by a Dell workstation running Horiba CDCTS test control software. Particulate Filters are weighed in a glove box using a Sartorius microbalance accurate to 1 microgram.

#### 8-V. TEST PREPARATION AND PROCEDURES

All vehicles are prepared for emissions testing in accordance with the Fuel Economy Pre-Test Maintenance Form. (In the event that fuel economy test was performed immediately prior to emissions testing this step does not have to be repeated) This is done to ensure that the bus is tested in optimum operating condition. The manufacturer-specified preventive maintenance shall be performed before this test. The ABS system and when applicable, the regenerative braking system are disabled for operation on the chassis dynamometer. Any manufacturer-recommended changes to the pre-test maintenance procedure must be noted on the revision sheet. The Fuel Economy Pre-Test Inspection Form will also be completed before performing. Both the Fuel Economy Pre-Test Maintenance Form and the Fuel Economy Pre-Test Inspection Form are found on the following pages.

Prior to performing the emissions test, each bus is evaluated to determine its road-load characteristics using coast-down techniques in accordance with SAE J1263. This data is used to program the chassis dynamometer to accurately simulate over-the-road operation of the bus.

Warm-up consists of driving the bus for 20 minutes at approximately 40 mph on the chassis dynamometer. The test driver follows the prescribed driving cycle watching the speed trace and instructions on the Horiba Drivers-Aid monitor which is placed in front of the windshield. The CDCTS computer monitors driver performance and reports any errors that could potentially invalidate the test.

All buses are tested at half seated load weight. The base line emissions data are obtained at the following conditions:

1. Air conditioning off
2. Evaporator fan or ventilation fan on
3. One Half Seated load weight
4. Appropriate test fuel with energy content (BTU/LB) noted in CDTCS software
5. Exterior and interior lights on
6. Heater Pump Motor off
7. Defroster off
8. Windows and Doors closed

The test tanks or the bus fuel tank(s) will be filled prior to the fuel economy test with the appropriate grade of test fuel.

## 8-VI DISCUSSION

The following Table 1 provides the emissions testing results on a grams per mile basis for each of the exhaust constituents measured and for each driving cycle performed.

TABLE 1 Emissions Test Results

<b>Driving Cycle</b>	<b>Manhattan</b>	<b>Orange County Bus</b>	<b>UDDS</b>
<b>CO<sub>2</sub>, gm/mi</b>	1560	1116	882
<b>CO, gm/mi</b>	0.066	0.11	0.089
<b>THC, gm/mi</b>	2.302	1.368	0.894
<b>NMHC, gm/mi</b>	0.199	0.114	0.069
<b>NO<sub>x</sub>, gm/mi</b>	7.29	7.69	7.59
<b>Particulates. gm/mi</b>	NA	NA	NA
<b>Fuel consumption mpg</b>	28.1	20.1	15.9

## FUEL ECONOMY/EMISSIONS PRE-TEST MAINTENANCE FORM

Bus Number: 1008	Date: 9-13-10	SLW (lbs): 13,670
Personnel: T.S. & S.C.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	✓	9/13/10	S.C.
Replace fuel filter	✓	9/13/10	S.C.
Check for fuel leaks	✓	9/13/10	S.C.
Specify fuel type (refer to fuel analysis)	CNG		
Remarks: None noted.			
BRAKES/TIRES	OK	Date	Initials
Inspect hoses	✓	9/13/10	S.C.
Inspect brakes	✓	9/13/10	S.C.
Relube wheel bearings	✓	9/13/10	T.S.
Check tire inflation pressures (mfg. specs.)	✓	9/13/10	T.S.
Remarks: None noted.			
COOLING SYSTEM	OK	Date	Initials
Check hoses and connections	✓	9/13/10	S.C.
Check system for coolant leaks	✓	9/13/10	S.C.
Remarks: None noted.			

## FUEL ECONOMY/EMISSIONS PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 1008	Date: 9-13-10
Personnel: T.S. & S.C.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	✓	9/13/10	S.C.
Inspect wiring	✓	9/13/10	S.C.
Inspect terminals	✓	9/13/10	S.C.
Check lighting	✓	9/13/10	S.C.
Remarks: None noted.			
DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	✓	9/13/10	T.S.
Replace filter/gasket	✓	9/13/10	T.S.
Check hoses and connections	✓	9/13/10	T.S.
Replace transmission fluid	✓	9/13/10	T.S.
Check for fluid leaks	✓	9/13/10	T.S.
Remarks: None noted.			
LUBRICATION	OK	Date	Initials
Drain crankcase oil	✓	9/13/10	T.S.
Replace filters	✓	9/13/10	T.S.
Replace crankcase oil	✓	9/13/10	T.S.
Check for oil leaks	✓	9/13/10	T.S.
Check oil level	✓	9/13/10	T.S.
Lube all chassis grease fittings	✓	9/13/10	T.S.
Lube universal joints	✓	9/13/10	T.S.
Replace differential lube including axles	✓	9/13/10	T.S.
Remarks: None noted.			

# FUEL ECONOMY/EMISSIONS PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 1008		Date: 9-13-10		
Personnel: T.S. & S.C.				
EXHAUST/EMISSION SYSTEM		OK	Date	Initials
Check for exhaust leaks		✓	9/13/10	S.C.
Remarks: None noted.				
ENGINE		OK	Date	Initials
Replace air filter		✓	9/13/10	S.C.
Inspect air compressor and air system		✓	9/13/10	S.C.
Inspect vacuum system, if applicable		✓	9/13/10	S.C.
Check and adjust all drive belts		✓	9/13/10	S.C.
Check cold start assist, if applicable		✓	9/13/10	S.C.
Remarks: None noted.				
STEERING SYSTEM		OK	Date	Initials
Check power steering hoses and connectors		✓	9/13/10	S.C.
Service fluid level		✓	9/13/10	S.C.
Check power steering operation		✓	9/13/10	S.C.
Remarks: None noted.				
		OK	Date	Initials
Ballast bus to seated load weight		✓	9/13/10	S.C.
TEST DRIVE		OK	Date	Initials
Check brake operation		✓	9/13/10	S.C.
Check transmission operation		✓	9/13/10	S.C.
Remarks: None noted.				

## FUEL ECONOMY/EMISSIONS PRE-TEST INSPECTION FORM

Bus Number: 1008	Date: 9-15-10
Personnel: T.S. & S.C.	
PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	T.S. & S.C.
Cold tire pressure (psi): Front <u>80</u> Middle <u>N/A</u> Rear <u>80</u>	T.S. & S.C.
Tire wear: less than 50%	T.S. & S.C.
Engine oil level	T.S. & S.C.
Engine coolant level	T.S. & S.C.
Interior and exterior lights on, evaporator fan on	T.S. & S.C.
Fuel economy instrumentation installed and working properly.	T.S. & S.C.
Fuel line -- no leaks or kinks	T.S. & S.C.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TP and Driver.	T.S. & S.C.
Bus is loaded to SLW	T.S. & S.C.
WARM-UP	If OK, Initial
Bus driven for at least one hour warm-up	T.S. & S.C.
No extensive or black smoke from exhaust	T.S. & S.C.
POST WARM-UP	If OK, Initial
Warm tire pressure (psi): Front <u>82</u> Middle <u>N/A</u> Rear <u>82</u>	T.S. & S.C.
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°(±1°C) and 90°F(32°C)) Track surface is dry Track is free of extraneous material and clear of interfering traffic	T.S. & S.C.





FOREST RIVER BUS

2367 CENTURY DRIVE · GOSHEN, INDIANA 46528 · 1.800.348.7440

## FMVSS/CMVSS Compliance Summary 2022

**Starcraft Bus, StarTrans Bus, Glaval Bus, Eldorado Bus,  
Champion Bus, Elkhart Coach- Commercial Product Only**

This vehicle conforms to all applicable U.S Federal Motor Vehicle Safety Standards and Canadian Motor Vehicle Safety Standards in effect on the date of manufacture

C/FMVSS No.	Standard Description	Compliance Action
101	Control Location, Identification and Illumination	Forest River Bus does not alter the OEM controls or displays. Any aftermarket seats and/or controls or displays subject to the standard meet this standard. Test data on file.
102	Transmission Shift Lever Sequence, Starter Interlock & Transmission Braking Effect	Compliance is deferred to the chassis manufacturer.
103	Windshield Defrosting & Defogging Systems	Compliance is deferred to the chassis manufacturer.
104	Windshield Wiping & Washing Systems	Compliance is deferred to the chassis manufacturer.
105	Hydraulic Brake Systems	Test data kept on file for vehicles that have had the frame stretched, or have had other system modifications. For Non-stretched vehicles compliance is deferred to the chassis manufacturer.
106	Brake Hoses	Vehicles with stretched frames have additional lines installed by chassis modifiers using OEM components. Other vehicles that have had system modifications use OEM or OEM-approved components and are tested for compliance. For Non-stretched vehicles compliance is deferred to the chassis manufacturer.
108	Lamps, Reflective Devices & Associated Equipment	Forest River Bus does not alter OEM lighting. Additional lighting to include brake, turn, clearance and reverse lamps meet standard. Data on file.
108.1	Alternative Requirements for Headlamps	Forest River Bus does not alter OEM lighting. Compliance is deferred to the chassis manufacturer.
110	Tire Selection and Rim for Motor Vehicles with a GVWR of 4,536kg (10,000 lbs.) or Less	Forest River Bus does not manufacture vehicles with a GVWR of 4,536kg (10,000 lbs.) or Less.
111	Rear View Mirrors	All aftermarket mirrors installed by Forest River Bus meet this standard and DOT regulations. Data on file.
112	Headlamp Concealment Devices	Forest River Bus does not manufacture vehicles with headlamp concealment devices.
113	Hood latch systems	Compliance is deferred to the chassis manufacturer.
114	Theft Protection	Compliance is deferred to the chassis manufacturer.
115	Vehicle Identification Number	Compliance is deferred to the chassis manufacturer.
116	Hydraulic Brake Fluids	Forest River Bus does not alter brake systems. Vehicles with stretched frames have additional fluid added by chassis modifiers using OEM instruction and materials. All other system modifications utilize only OEM- approved fluid. For Non-stretched vehicles compliance is deferred to the chassis manufacturer.
118	Power Operated Window, Partition, and Roof Panel Systems	Compliance is deferred to the chassis manufacturer.
120	Tire Selection and Rim for Motor Vehicles with a GVWR of 4,536kg (10,000 lbs.) or More	Compliance is deferred to the chassis manufacturer.
121	Air Brake Systems	Vehicles with stretched frames have additional lines installed by chassis modifiers using OEM components. Other vehicles that have had system modifications use OEM or OEM-approved components and are tested for compliance. For Non-stretched vehicles compliance is deferred to the chassis manufacturer.
124	Accelerator Control Systems	Forest River Bus does not alter the OEM accelerator system, with the exception of the addition of aftermarket fast idle systems on some vehicles. These systems meet this standard when installed in accordance with instructions.
125	Warning Devices	All vehicles manufactured by Forest River Bus that are equipped with aftermarket (3) triangle kit meet this standard.
131	School Bus Pedestrian Safety Devices	All vehicles manufactured by Forest River Bus are not completed to be used as school buses.
135	Light Vehicle Brake System with a GVWR of 3,500kg (7,716lbs.) or Less	Forest River Bus does not manufacture vehicles with a GVWR of 3,500kg (7,716 lbs.) or Less.
201	Occupant Protection in Interior Impact	All vehicles applicable to the standard (under 10,000 lbs.) do not have alterations made that affect the compliance to this standard. Compliance is deferred to the chassis manufacturer.
202	Head Restraints	All vehicles applicable to the standard (under 10,000 lbs.) have seating installed that meets this standard. Compliance is deferred to the chassis manufacturer.

This vehicle conforms to all applicable U.S Federal Motor Vehicle Safety Standards and Canadian Motor Vehicle Safety Standards in effect on the date of manufacture

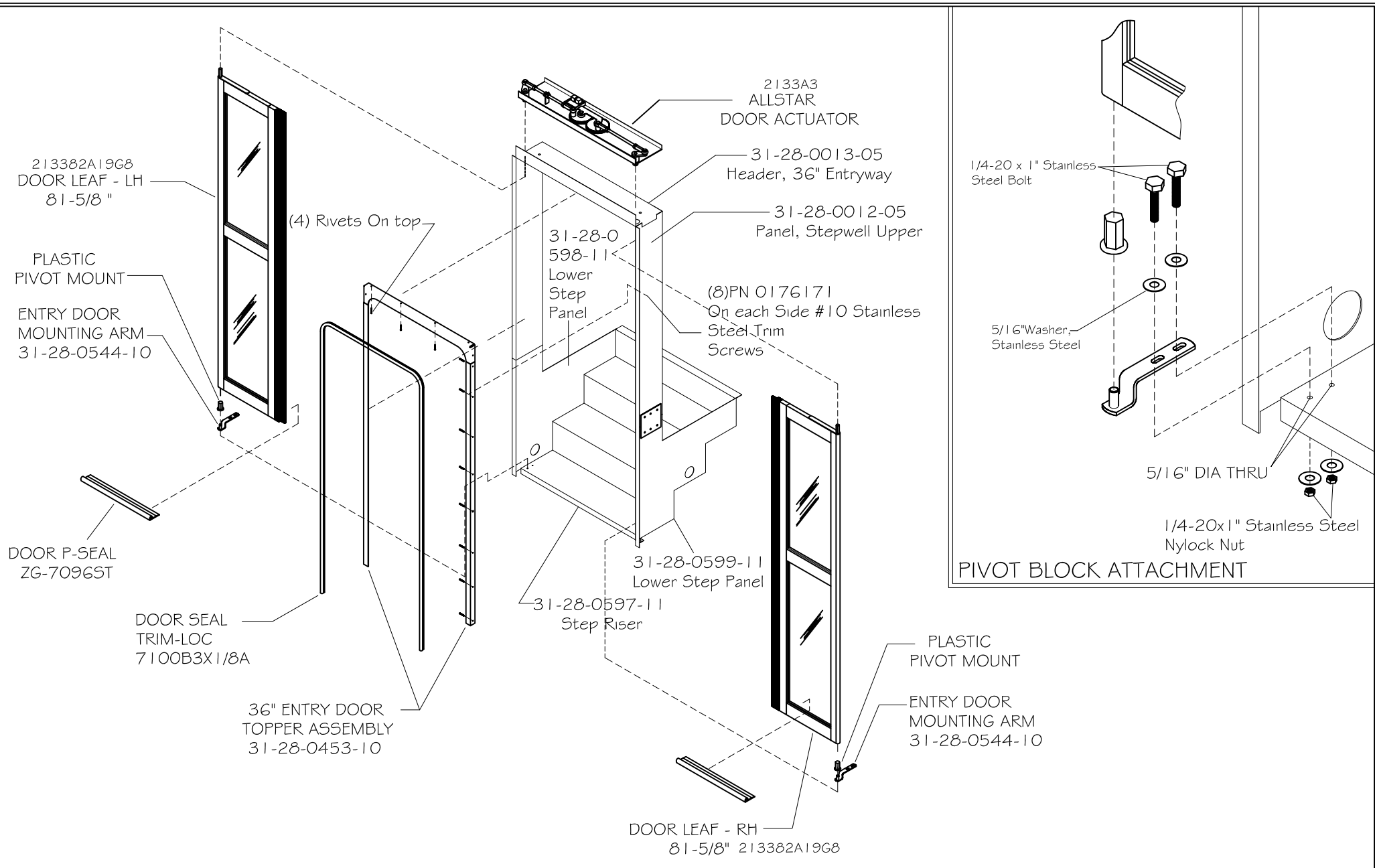
<b>203</b>	Impact Protection for the Driver from the Steering Control System	Compliance is deferred to the chassis manufacturer.
<b>204</b>	Steering Control Rearward Displacement	Compliance is deferred to the chassis manufacturer.
<b>205</b>	Glazing Materials	No modifications are made to the OEM Glazing materials. Additional glazing materials meet the standard. Data on file.
<b>206</b>	Door Locks and Door Retention Devices	All vehicles manufactured by Forest River Bus (non-buses) that are subject to this standard have no modifications made which affect compliance to the standard. Compliance is deferred to the chassis manufacturer.
<b>207</b>	Seating System	All seating installed by Forest River Bus meets this standard. Test data on file.
<b>208</b>	Occupant Crash Protection	No alterations are made to the OEM seat belts, air bag systems or associated hardware. Any seat belt systems added meet the standard. Test data on file.
<b>209</b>	Seat Belt Assemblies	No alterations are made to the OEM seat belts or associated hardware. Any seat belt systems added meet the standard. Test data on file.
<b>210</b>	Seat Belt Assembly Anchorage	No alterations are made to the OEM seat belts or associated hardware. Seat belt systems and their installation meet the standard. Test data on file.
<b>210.1</b>	User-ready Tether Anchorages for Restraint System	No alterations are made to the OEM seat belts or associated hardware. Seat belt systems and their installation meet the standard. Data on file.
<b>210.2</b>	Lower Universal Anchorage Systems for Restraint Systems and Booster Cushions	No alterations are made to the OEM seat belts or associated hardware. Seat belt systems and their installation meet the standard. Data on file.
<b>212</b>	Windshield Mounting	Compliance is deferred to the chassis manufacturer.
<b>213</b>	Child Restraint Systems	Vehicles manufactured by Forest River Bus that are subject to this standard (under 10,000 lbs.) have seating installed that meets this standard. Test data on file.
<b>213.4</b>	Built-in Child Restraint Systems and Built-in Booster Cushions	Vehicles manufactured by Forest River Bus that are subject to this standard (under 10,000 lbs.) have seating installed that meets this standard. Test data on file.
<b>214</b>	Side Impact Protection with a GVWR of 4,536kg (10,000 lbs.) or Less	Forest River Bus does not manufacture vehicles with a GVWR of 4,536kg (10,000 lbs.) or Less
<b>216</b>	Roof Crush Resistance	Forest River Bus does not manufacture vehicles that are subject to this standard.
<b>217</b>	Bus Window Retention and Release	No modifications are made to the OEM windows. Additional windows meet the standard. Test data on file.
<b>219</b>	Windshield Zone Intrusion	Compliance is deferred to the chassis manufacturer.
<b>220</b>	School Bus Rollover Testing	All vehicles manufactured by Forest River Bus are not completed to be used as school buses, however, Forest River Bus does test vehicles to meet standard.
<b>221</b>	School Bus Body Joint Strength	All vehicles manufactured by Forest River Bus are not completed to be used as school buses, however, Forest River Bus does test vehicles to meet standard.
<b>222</b>	School Bus Passenger Seating and Crash Protection	All vehicles manufactured by Forest River Bus are not completed to be used as school buses.
<b>225</b>	Child Restraint Anchorage Systems	Vehicles manufactured by Forest River Bus that are subject to this standard (under 10,000 lbs.) have seating installed that meets this standard.
<b>301</b>	Fuel System Integrity	Compliance is deferred to the chassis manufacturer.
<b>301.1</b>	LPG Fuel System Integrity	Compliance is deferred to the chassis manufacturer.
<b>301.2</b>	CNG Fuel System Integrity	Compliance is deferred to the chassis manufacturer.

This vehicle conforms to all applicable U.S Federal Motor Vehicle Safety Standards and Canadian Motor Vehicle Safety Standards in effect on the date of manufacture

302	Flammability of Interior Materials	Materials installed in the interior of Forest River Bus products meet the standard. Test data on file.
303	Fuel System Integrity of Compressed Natural Gas Systems	Forest River Bus does not typically produce vehicles with CNG systems. All vehicles equipped with CNG systems exceed the applicability (10,000 lbs. or less) of this standard.
304	Compressed Natural Gas Fuel Container Integrity	Forest River Bus does not typically produce vehicles with CNG systems. All vehicles equipped with CNG systems exceed the applicability (10,000 lbs. or less) of this standard.
305	Electrolyte Spillage and Electrical Shock Protection	Forest River Bus does not produce vehicles that use electricity as propulsion power.
403	Platform Lift System for Motor Vehicles	Forest River Bus does not alter the platform lift system. Forest River Bus install lift system in strict compliance with the manufacturers installation instructions. Forest River Bus meets strength requirements. Test data on file.
404	Platform Lift Installation on Motor Vehicles	Compliance is deferred to the lift manufacturer.
1106	Noise Emissions	Forest River Bus does not alter the OEM Chassis in the area which is stated in the incomplete vehicle documents. Data on file.

Signed: \_\_\_\_\_

Title: Compliance and Customer Service ManagerDate: 01/04/2022



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							TOLERANCE UNLESS OTHERWISE SPECIFIED	DATE:	2-25-13	TITLE	INST'L 36" ENTRYWAY RAISED FLOOR ALLSTAR			
								DFTSN:	MDK					
							± .00	± .030	CHKR:		DWG. No.	31-28-0880-13		
							± .000	± .015	APRVD:		SCALE			
	A	MODIFIED EDT DRAWING OF A STANDARD FLOOR		MDK		2/25/13	± .0000	± .005						
	REV. LET.	DESCRIPTION OF CHANGE		BY	CHK	DATE	ECN No.				DISK No.	SHEET	OF	



The following information is submitted for all Glaval Bus products proposed on this bid as supporting documentation of the structural soundness and impact resistance of the bodies manufactured. All vehicles are built using virtually the same materials with some minor differences in the height and width of cross members due to entry floor heights and/or body width variations.

A representative set of construction prints provided by engineering supplements this verbal accounting of our materials and assembly specifications.

If, in the reviewing of these written technical specifications and engineering frame prints submitted any questions arise, please contact us immediately for any clarification or help in interpretation and understanding.

### **3.0 Body Construction – General Frame Construction**

Manufactured from all aluminized steel products, the floor, roof, side walls, rear wall, driver halo assembly and entry door assembly are all wire welded (MIG) together to form an integral steel frame that is mounted with specified hardware to the rubber body mount points (pucks) supplied by the chassis manufacturer. Once joined to the chassis, the bus finishing process begins.

#### **3.0.1 Floor frame construction and assembly –**

- 3.0.1.1 Cross Members -- The floor cross members form the base structural support for the rest of the frame components. Our cross members are constructed of 14 gauge aluminized steel, formed to a capital “C” shape. Cross members over the fuel tank are made to provide the clearance needed to conform with FMVSS301, and include formed internal reinforcements welded in place for additional strength. All additional longitudinal and latitudinal structure is flush welded in place to form a one piece floor upon completion.
- 3.0.1.2 Aluminized steel “Hat Posts” – 1”x1”x4” run the length of the floor between cross members and are welded into place. This extremely strong form is used to weld our HSLA steel seat track in place.
- 3.0.1.3 Aluminized steel C Channel – 1”x1.5” C channel is welded in between cross members the full length of the floor in 5 places. Coupled with the Hat Posts this provides a one-piece strong “ladder” type frame for the flooring.
- 3.0.1.4 Seat Track – 12 gauge roll formed high strength/low alloy steel is wire welded in place for seat mounting down each side of the bus, with lengths predicated on the floor plan chosen. This is yet another stiffener in our extensive construction process.



- 3.0.1.5 Wheel Wells -- Constructed of 14 gauge ALUMINIZED steel, wheel wells are also welded in during the floor construction process. All seams in the wheel well are welded to create a one piece water resistant wheel housing structure. The wheel wells also provide additional strength to the body assembly, when welded in place.
- 3.0.1.6 Structural Aluminized steel Angle – 1/8” thick 1.5” x 2.5” structural aluminized steel angle is used the full perimeter length of each floor assembly, welded to the ends of all floor cross members. This provides not only a flat plane for joining the sidewall assembly, but also ties all cross members together and provides additional side impact resistance.
- 3.0.1.7 Additional structure – When adding vertical stanchions, wheel chair lifts and/or tie down options, additional structure is welded into the floor at locations specified by our engineering department on CAD drawings.

### **3.0.2 Sidewall Construction –**

- 3.0.2.1 Sidewall vertical member – The heart of our sidewall is the vertical structure, a roll formed 18 gauge aluminized steel 1.5" x 2" tube that provides strength and rigidity. The vertical member is installed in full lengths and in shorter sections below window frames. Additional vertical structure is used at both ends of the sidewall enabling the structure to withstand the forces applied by the vehicle when in motion.
- 3.0.2.2 Aluminized steel Tubing – 1.5”x1” lower and 1.5”x3” upper 16 gauge aluminized steel tubing is welded in horizontally between vertical members to frame in window openings. This adds front to rear reinforcement as well.
- 3.0.2.3 Seat Track – 12 gauge high strength/low alloy roll formed ALUMINIZED steel welded down each sidewall below the window frame. While serving as a seat attaching device, it adds excellent structure to the sidewall and also adds excellent side impact resistance.
- 3.0.2.4 Wheelchair Options – Add another layer of metal. Depending on track locations, another structure of 11 gauge thick aluminized steel is welded in place between each vertical member for attaching a shoulder belt mount. Also, additional structure is added to accommodate wheelchair door frames – either 1.5”x1” or 1.5”x2” 16 gauge wall aluinizd steel tubing..
- 3.0.2.5 Full length glavanized steel tubing – 1.5”x1” 16 gauge aluinizd steel tubing is stitch welded to the sidewall bottom and top at each vertical member for attaching to the floor and roof sections, respectively.

### **3.0.3 Rear Wall Construction –**

- 3.0.3.1 Rear wall vertical member – The vertical sidewall 1.5"x 2" aluminized steel tube is also used in the rear wall assembly. Full length structure is used at varying places,





depending on choice of rear window, or rear door. Shorter cut pieces are used above windows and doors. Additional side windows used with the rear door also change the configuration.

3.0.3.2 Aluminized steel Tubing – 1.5"x1" 16 gauge aluminized steel tubing is welded horizontally between vertical members to provide a window frame in the standard product, and used as an upper door frame in the optional rear assembly.

3.0.3.3 Full length aluminized steel tubing – 1.5"x1" 16 gauge aluminized steel tubing stitch welded to the rear wall top and bottom as in the sidewall

### assembly. **3.0.4 Roof Construction –**

3.0.4.1 Roof Bows – Radius formed one-piece 16 gauge aluminized steel roof bows formed as a modified hat post design with eight bends for exceptional strength and located on 16" centers (the closest in the industry), including 4 bends in the web that allows for the roof structure to be capable of taking severe loads. They are then capped with top flat pieces from flange to flange to provide abundant surface area for securing the exterior roof material.

3.0.4.2 aluminized steel Tubing – 1.5"x1" 16 gauge aluminized steel tubing is welded in horizontally to frame all lower window openings and 1.5" x 3" 16 gauge aluminized steel tubing to all upper window openings as required. A full perimeter is also welded on to mate the roof to the sidewall and rear wall, with short vertical pieces providing support on the front and rear ends. The 3" wide aluminized steel tube supplies a structural mounting surface for shoulder belt attachment and has been pull tested to federal standards.

### **3.0.5 Driver Compartment Overhead Halo –**

3.0.5.1 aluminized steel Tubing – 1"x1" 16 gauge aluminized steel tubing is cut and jig welded into an integrated one piece structure spanning from the front roof bow of the body to the newly cut roof line of the cab. Also created during the structure manufacture is the housing for mounting the electronic circuit board.

3.0.5.2 11 Gauge aluminized steel – formed to make brackets used to mount to the chassis roof.

### **3.0.6 False Floor (Cab to body transition) –**

3.0.6.1 aluminized steel Tubing – 2" x 2" 16 gauge aluminized steel tubing is welded together forming a flat body floor transition from the step area back to the actual body area. An overhang on the curbside provides a secure attach point frontally for the entry door frame added later.

3.0.6.2 Structural aluminized steel angle – 11 gauge 1.5"x1.5" structural angle is added in

short lengths five places to provide attachment points to the chassis floor.



### **3.0.7 Interior Vertical Transition Frames –**

3.0.7.1 aluminized steel Tubing – 1"x1" 16 gauge aluminized steel tubing is used vertically and a ladder type assembly is made welding the 1x 1 tube to .75"x.75" 11 gauge aluminized steel tube that is used horizontally in the assemblies. These pieces transition from the body fronts on each side to the driver halo side assembly and the entry door frame assembly on the curbside.

### **3.0.8 Entry Door & Step Assembly Frame –**

3.0.8.1 aluminized steel Tubing – 1"x1" 16 gauge and .75"x.75" 11 gauge aluminized steel tube is cut to length and welded together in a ladder type construction forming a rigid frame for attaching the entry door/step assembly.

### **3.0.9 Entry Door/Step Assembly –**

3.0.9.1 11 Gauge aluminized steel – The step riser/tread piece is manufactured from one-piece 11 gauge aluminized steel and uses 90° bends at all risers and treads. The bottom tread also adds an additional 90° bend for additional strength and safety. Upper and lower side pieces are then attached and an 11 gauge flat plate with holes is used to bridge the lower and upper side pieces, then is stitch welded and plug welded to form a strong one piece assembly prior to inserting and welding to the entry step framing.

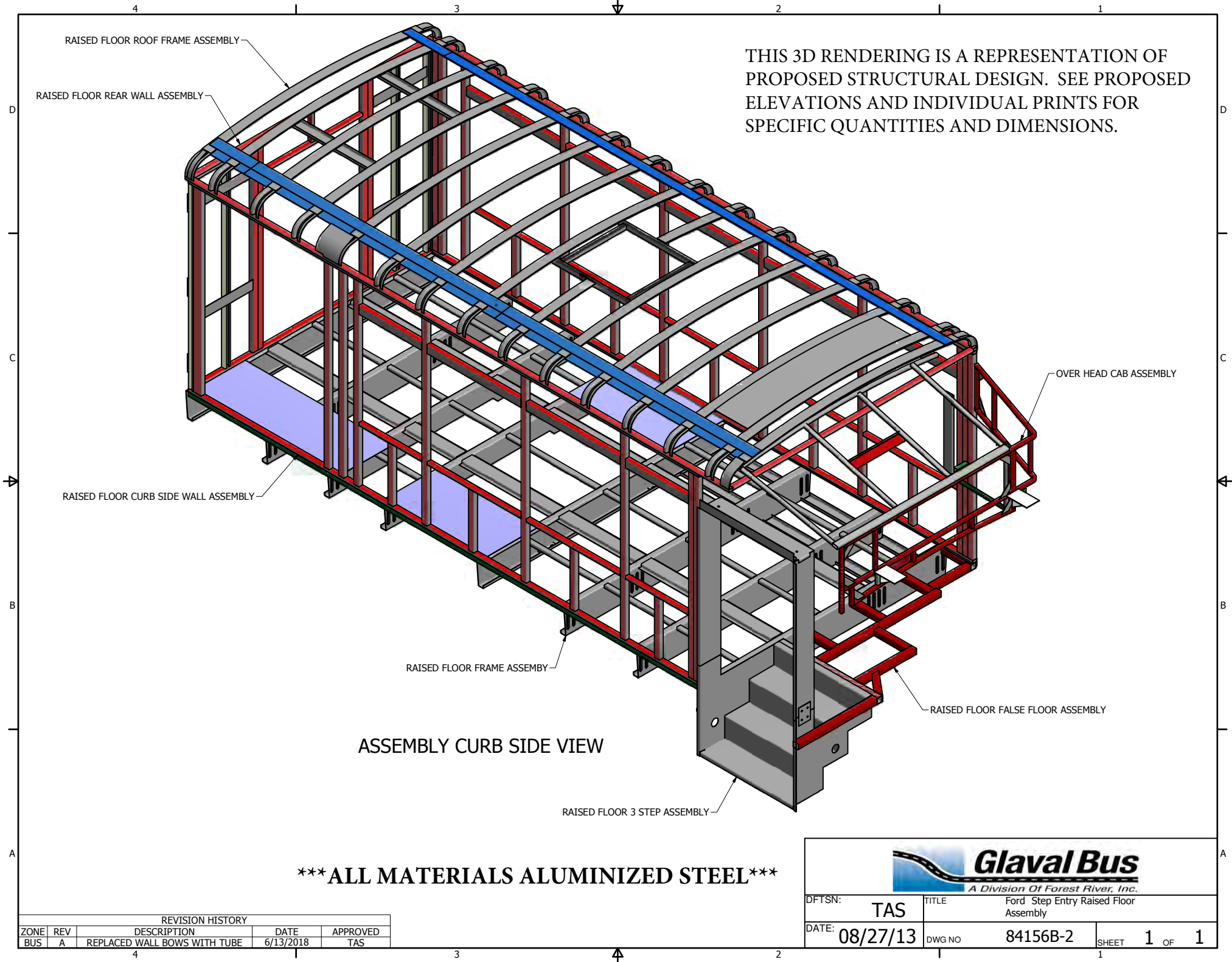
## **APPLICATION OF EXTERIOR SIDEWALL MATERIAL**

### **GALVAIZED STEEL SIDEWALLS OR OPTIONAL FIBERGLASS/FRP/COMPOSITE SIDEWALLS**


The exterior is .024" galvanized steel pre-painted white with an underlayment of 5/32" luan. The interior is 5/32" luan covered with a light gray FRP or padded vinyl. The foam filled aluminized steel cage is placed in the center and all layers are adhered using a cross linked polyurethane hot melt adhesive. The entire assembly is then laminated to assure adhesion.

Composite FRP exterior sidewall panels are installed using the same method.

Should any further questions arise, please contact your Glaval Bus representative.



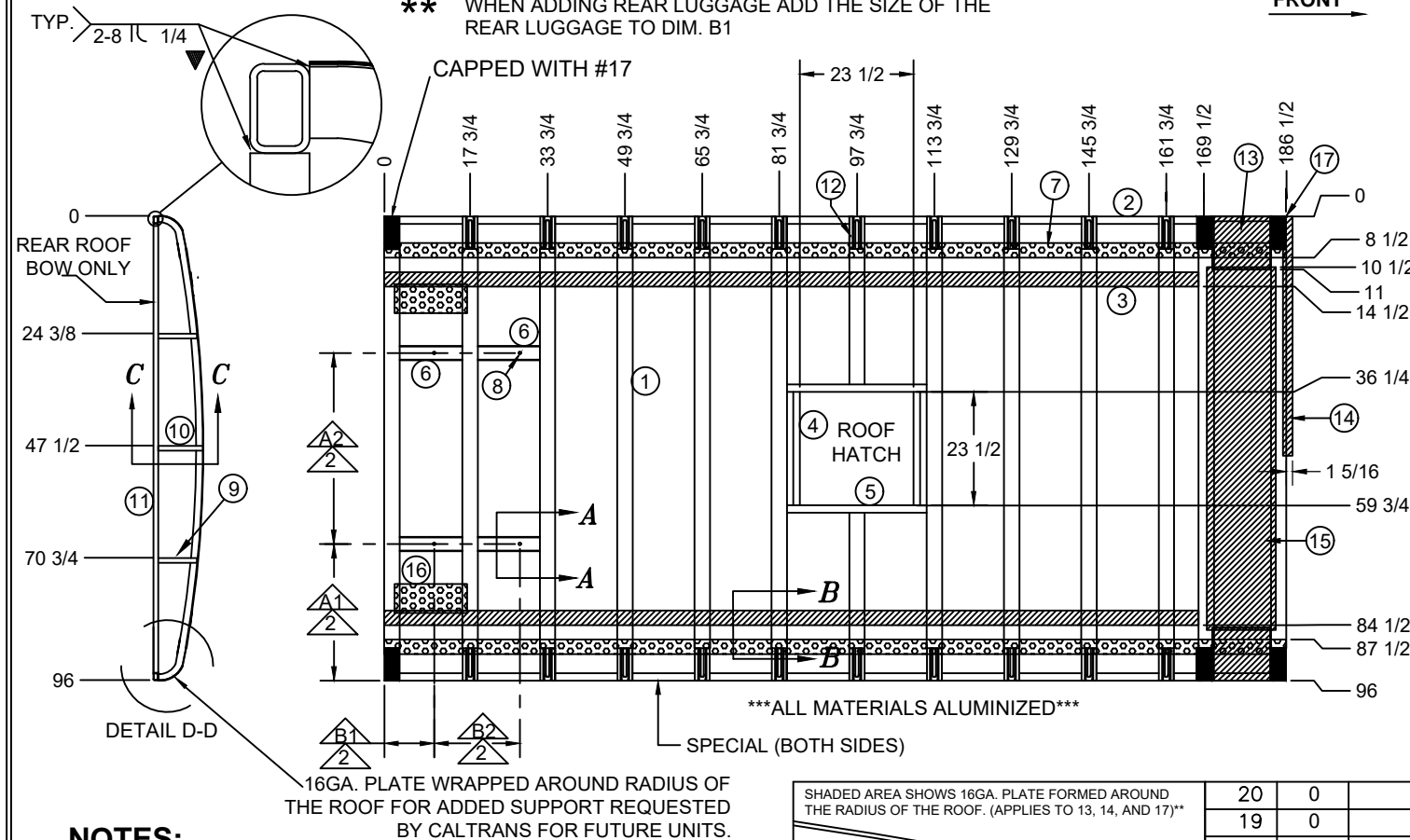
REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
BUS	A	REPLACED WALL BOWS WITH TUBE	6/13/2018	TAS

		<b>Glaval Bus</b> A Division Of Forest River, Inc.		
DFTSN:	TAS	TITLE	Ford Step Entry Raised Floor Assembly	
DATE:	08/27/13	DWG NO	84156B-2	SHEET 1 OF 1

**USAGE: FORD MODEL 24**

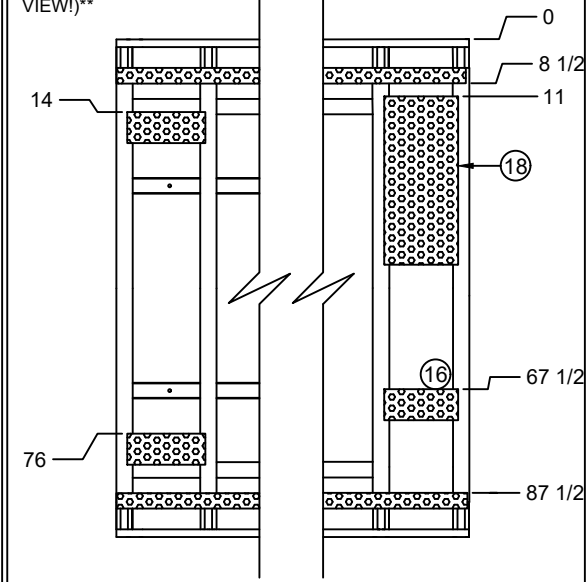
**\*\* WHEN ADDING REAR LUGGAGE ADD THE SIZE OF THE REAR LUGGAGE TO DIM. B1**

**FRONT**



BOTTOM PLATES FOR FRONT AND REAR IN DRIVER AND PASSENGER INTERIOR STANCHIONS.

**\*\*NOTE: THIS IS A TOP VIEW WITH THE BOTTOM PLATES PROJECTED THROUGH THE BEAMS! (THIS IS NOT A BOTTOM VIEW!)\*\***



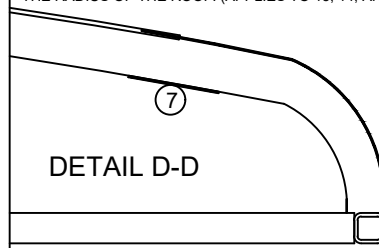
**NOTES:**

- 1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.
- 2- A/C BOLT PATTREN MAY VERY SEE SALES ORDER.
- 3- BEFORE CUT ROOF HATCH SEE SALES ORDER.
- 4- SCREW LOCATION AT SEAMS AND EDGES 8" ON CENTER  
ALL OTHER LOCATION 16" ON CENTER.
- 5- SEALANT USAGE: 1/4" MINIMUM 3/8" MAXIMUM BEAD ON ALL  
ROOF FRAME TO LUAN SURFACES.

\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

- SPECIAL (BOTH SIDES)

SHADED AREA SHOWS 16GA. PLATE FORMED AROUND THE RADIUS OF THE ROOF. (APPLIES TO 13, 14, AND 17)\*\*



5	2	70009047	"C" CHANNEL: 16ga. x 1-3/8" x 1-3/8" x 30-1/2" Lg.	10	1		TUBE: 16ga. x 1" x 1" x 8-1/2" Lg. A-513
4	2	70009047	"C" CHANNEL: 16ga. x 1-3/8" x 1-3/8" x 24-1/4" Lg.	9	2		TUBE: 16ga. x 1" x 1" x 8" Lg. A-513
3	2		SHEET STEEL: 16ga. x 3" x 168-1/2" Lg.	8	4		BOLT: 3/8-16 x 3" Lg. HEX HEAD
2	2		TUBE: 16ga. x 1" x 1.5" x 186-1/2" Lg. A-513	7	2		SHEET STEEL: 16ga. x 3" x 186-1/2" Lg.
1	12	02062357	ROOF BOW W/CAP 16ga. x 3-3/16 x 96" Lg.	6	4	70009046	"C" CHANNEL: 16ga. x 1" x 3-1/2" x 14-1/2" Lg.
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION	REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

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TOLERANCE UNLESS  
OTHERWISE SPECIFIED


**Glaval Bus**

*a division of Forest River, Inc.*

	WOOD	OTHER
--	------	-------

DATE: 06/11/18

8	TITLE: 158" WHEEL BASE MODEL 24
	ROOF FRAME, STD. ROOF, SINGLE HATCH

$\pm 1^\circ$	$\pm 1/2^\circ$
---------------	-----------------

32-13-0017-18

DESCRIPTION OF CHANGE

BY

CH

DATE \_\_\_\_\_

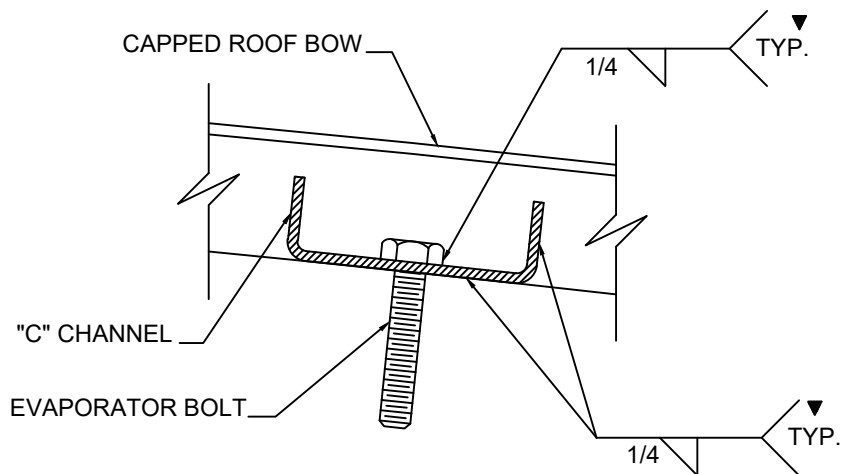
ECN No.

	$\pm 1^\circ$	$\pm 1/2^\circ$
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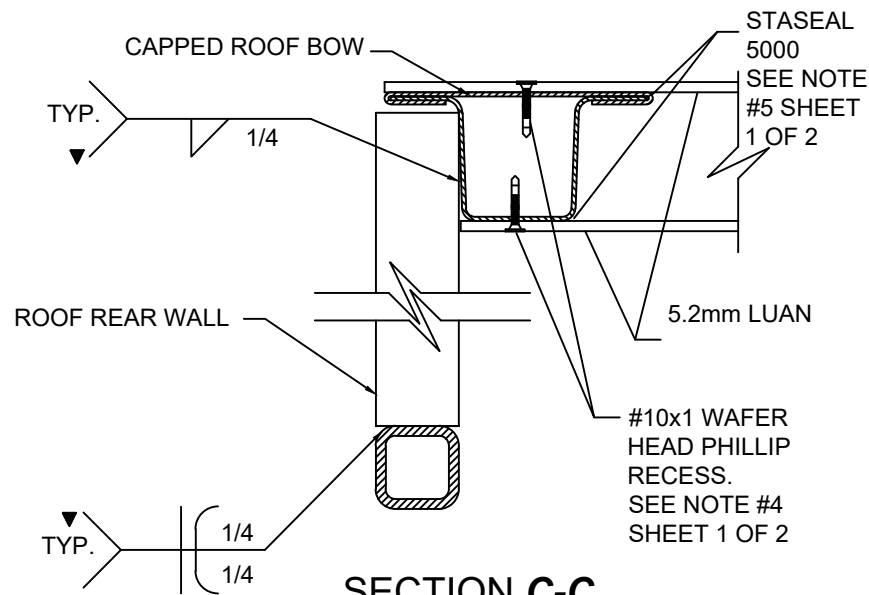
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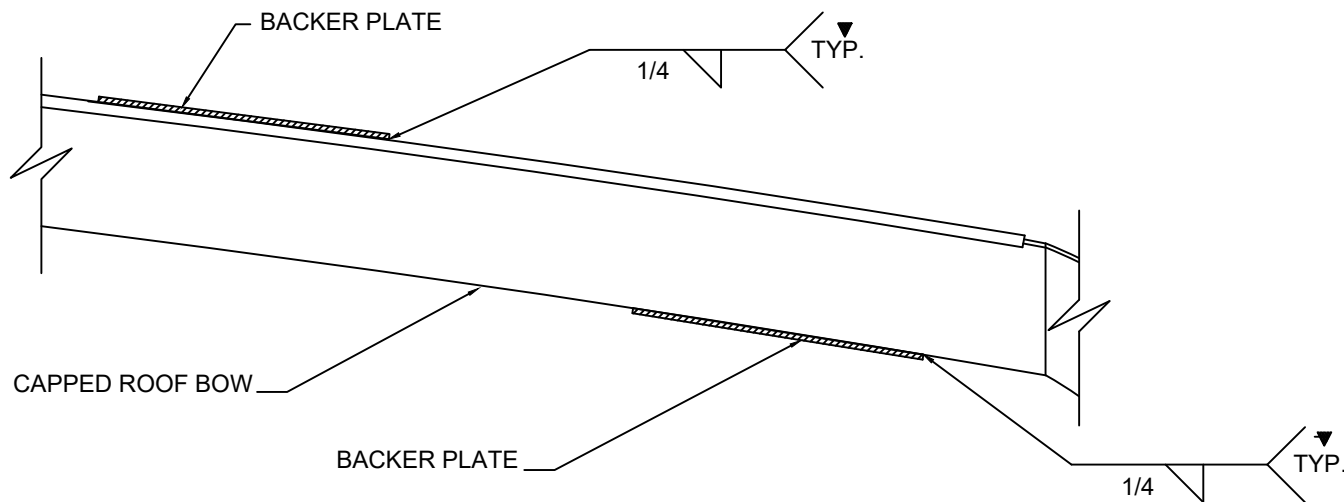
▼ CRITICAL CONTROL ITEM



SECTION A-A



SECTION C-C



SECTION B-B

T/A-71 NEW STYLE	33-5/8	30	10	12-1/4
ACC 23022 SERIES	38	20	10	14-3/4
ACC 23023 SERIES	33-5/8	28-3/4	10	14-3/4
T/A-77	18-1/4	59-1/2	10	10-3/8
T/A-73	28-1/4	39-1/2	10	9-1/2
T/A-71 OLD STYLE	33-5/8	28-3/4	10	12-1/4
T/A-70	36-3/4	22-1/2	10	11-5/8
T/A-30	31	34	10	9-1/2
EM-14 & RE-29	30-3/4	34-1/2	10	9-1/2
EM-6 & RE-10	36	24	10	9-1/2
EM-3 & RE-30	28-1/4	39-1/2	10	16
RE-15 & RE-20	28-1/4	39-1/2	10	9-1/2
EM-1 & EM-2	28-1/4	39-1/2	10	9-1/2
EM-7 GEN 5	36-1/8	23-3/4	10	9-1/2
EM-2 GEN 5	32-3/8	31-1/16	10	9-1/2
EM-1 GEN 5	28-3/16	39-5/8	10	9-1/2
EVAPORATOR MODEL	A-1	A-2	B-1	B-2

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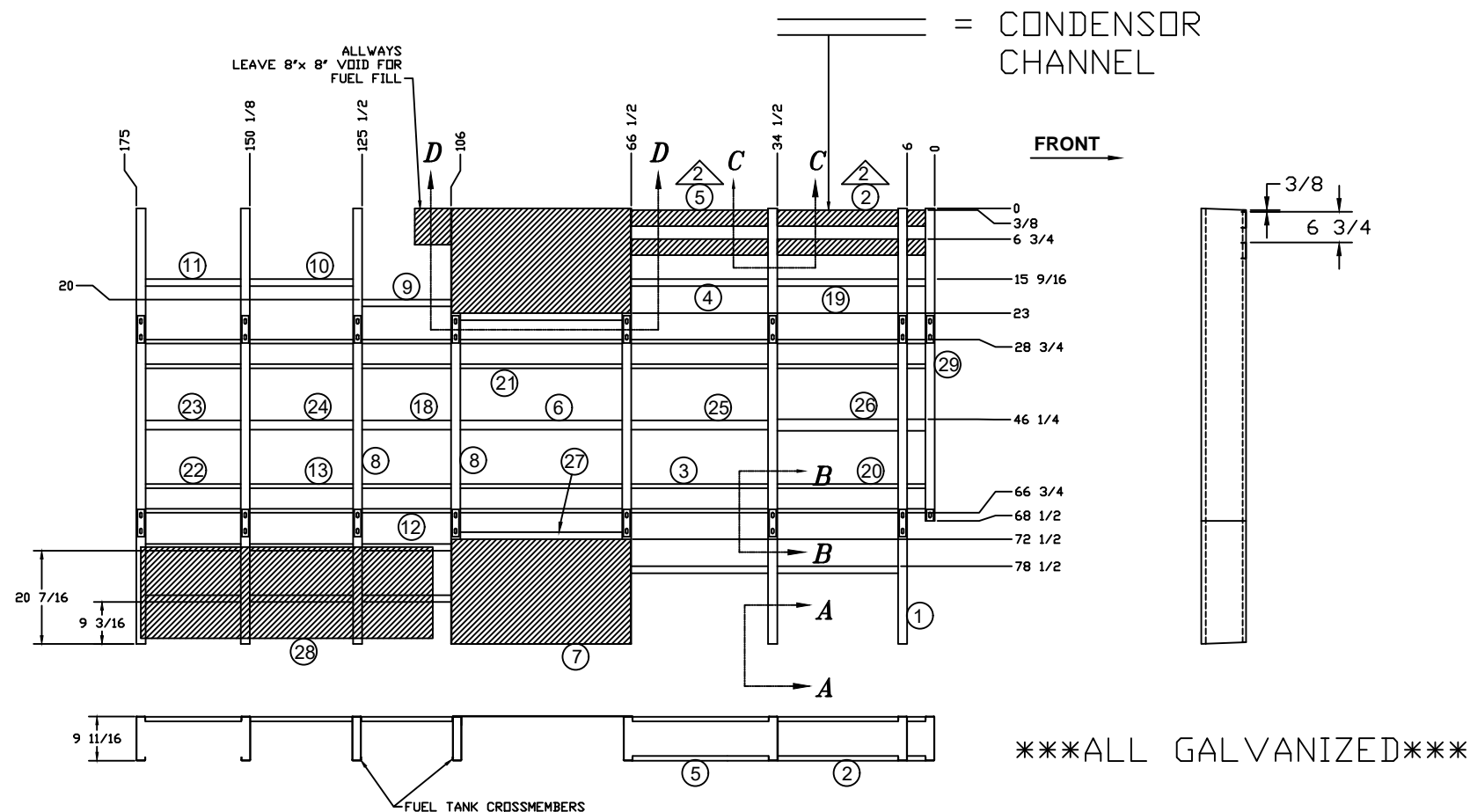
REV.	LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE: 06/11/18		TITLE: 158" WHEEL BASE MODEL 24	
WOOD	OTHER	NAME: MKLINE		ROOF FRAME, DETAILS SINGLE HATCH	
± 1/8"	± 1/16"	DWG. No. 32-13-0017-18			
± 1°	± 1/2°				



▼ CRITICAL CONTROL ITEM

USAGE: FORD 158" WHEEL BASE, MODEL 24



NOTES:

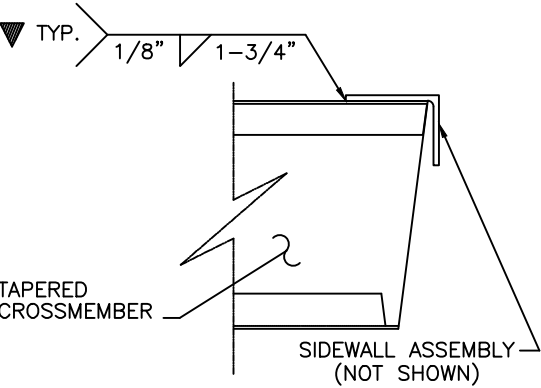
- 1- DRAWING VIEWED FROM INTERIOR SIDE OF UNIT.
- 2- LOCATION OF A/C BRACKETS: ONE MOUNT FLUSH WITH OUTSIDE EDGE OF CROSSMEMBER. THE OTHER MOUNTS 14-3/4" FROM OUTSIDE EDGE OF CROSSMEMBER.
- 3- SEE SHEET 2 OF 2 FOR DETAILS, TORQUE SPECIFICATIONS, SECTION VIEWS AND CUT LIST.

7	2	71002066	SHEET STEEL: 11ga. x 24" x 39-1/4" Lg. HRS
6	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 35-5/8" Lg.
5	2	70009046	"C" CHANNEL: 12ga. x 1" x 3-1/2" x 30" Lg.
4	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 30" Lg.
3	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 30" Lg. A-513
2	2		"C" CHANNEL: 12ga. x 1" x 3-1/2" x 26-1/2" Lg.
1	5	71009018	14ga. x 2 x 9-11/16 x 95-1/2 CROSSMEMBER A-365
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

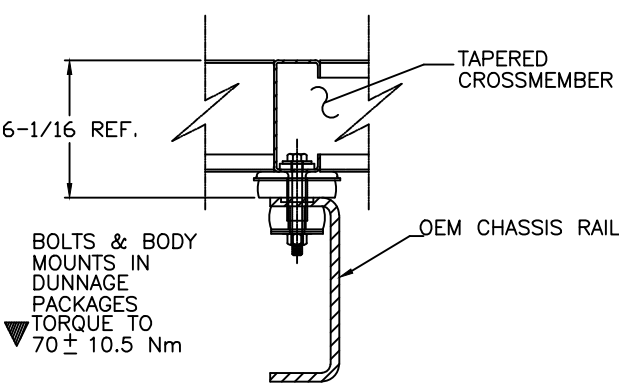
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REV.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.	TOLERANCE UNLESS OTHERWISE SPECIFIED	WOOD	OTHER	DATE	TITLE	NAME	DWG. No.
LET.						± 1/8"	± 1/16"	± 1/2"	6/14/18	158" WB MODEL 24 FLOOR FRAME, RAISED FLOOR	MKLINE	32-13-0031-18 SPECIAL

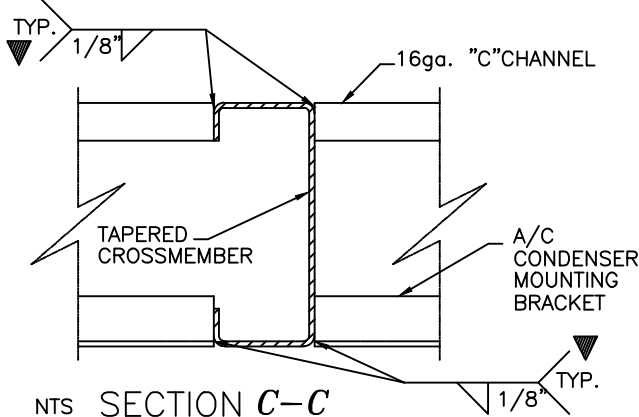
▼ CRITICAL CONTROL ITEM



NTS SECTION A-A



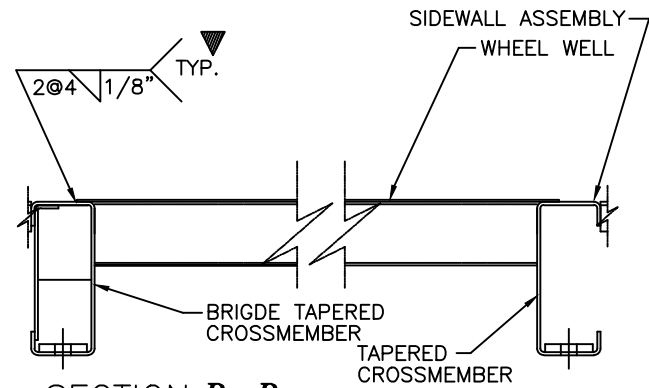
NTS SECTION B-B



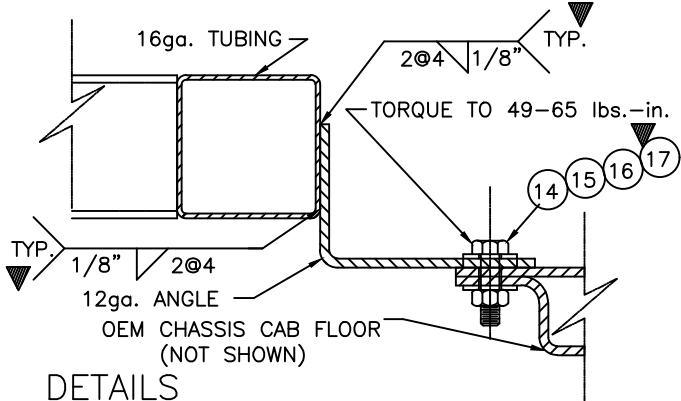
NTS SECTION C-C

\*\*\*ALL GALVANIZED\*\*\*

29	1		14ga. x 2 x 9-11/16 x 68-1/2 CROSSMEMBER A-365
28	2		PLATE: 11ga. 20" x 64" Lg.
27	2	71002028	TUBE: 16ga. x 1-1/2" x 1-1/2" x 35-5/8" Lg. A-513
26	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 26-1/2" Lg.
25	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 30" Lg.
24	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 22-3/8" Lg.
23	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 20-7/8" Lg.
22	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 20-7/8" Lg. A-513
21	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 35-5/8" Lg. A-513
20	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 26-1/2" Lg. A-513
19	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 26-1/2" Lg.
18	1		"U" CHANNEL: 16ga. 1" x 2" x 1" x 19-3/4" Lg.
17	7	80052007	NUT, HEX HEAD 3/8-16 UNC GRADE 5 ZINC
16	7	80042015	WASHER MED LOCK 3/8 ZINC
15	14	80042007	WASHER 3/8 USS ZINC
14	7	80112051	BOLT, HEX HEAD 3/8-16 X 1 UNC GRADE 5 ZINC
13	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 22-3/8" Lg. A-513
12	2	32-32-0060-11	HAT CHANNEL: 16ga. x 1" x 6-5/16" x 19-3/4" Lg. A-513
11	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 20-7/8" Lg.
10	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 22-3/8" Lg.
9	2		"C" CHANNEL: 16ga. 1" x 1-1/2" x 1" x 19-3/4" Lg.
8	2	70009055	14ga. x 2 x 4-13/16 x 95-1/2 bridge crossmember
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION



NTS SECTION D-D



NTS DETAILS

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REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE		TITLE	
WOOD	OTHER	DATE	158'	WB	MODEL 24
± 1/8"	± 1/16"	NAME	MKLINE	FLOOR FRAME, RAISED FLOOR	
± 1"	± 1/2"	DWG. No.	32-13-0031-18 SPECIAL		



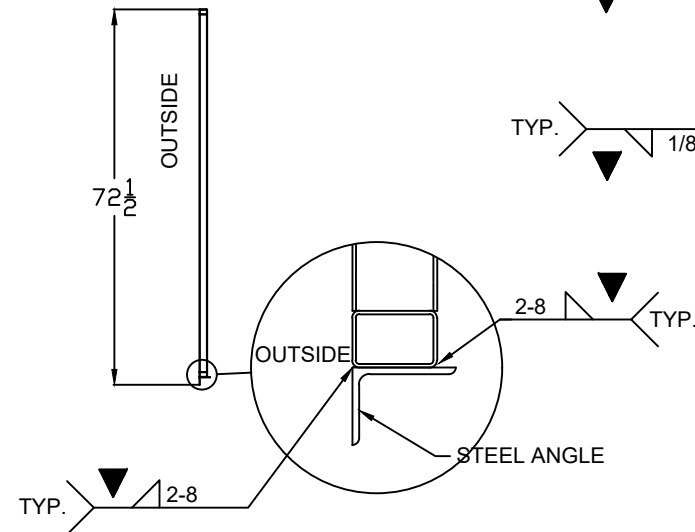
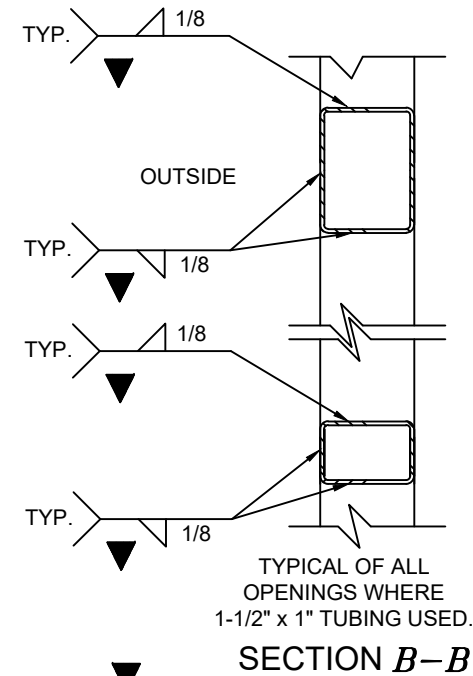
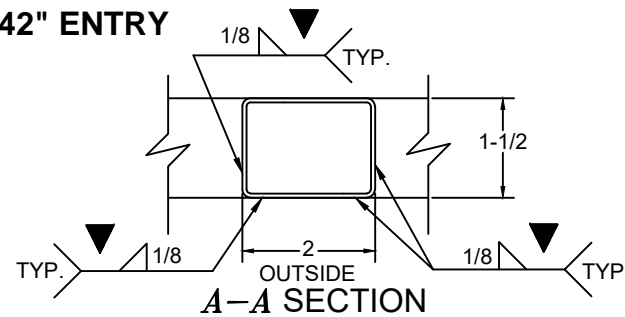
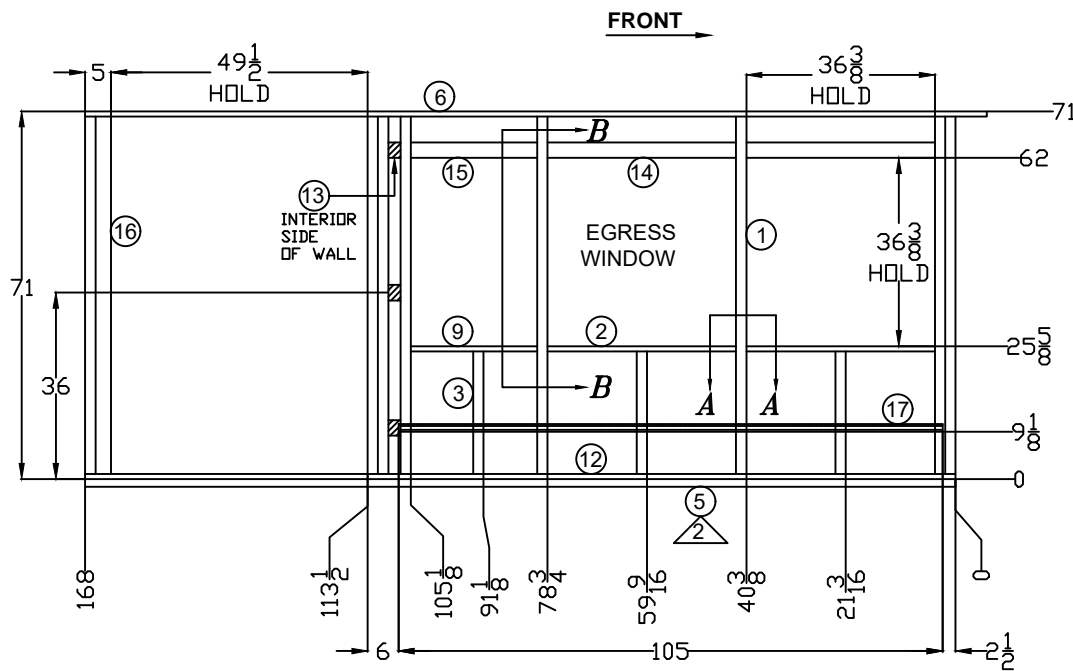


▼ CRITICAL CONTROL ITEM

# USAGE: FORD 158"WB/MODEL 24, 42" ENTRY

## NOTES:

- 1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.
- 2- ANGLE TO BE WELDED FLUSH WITH OUTSIDE EDGE OF WALL.



\*\*\*ALL MATERIALS GALVANIZED\*\*\*

8	0		FRAME, SIDEWALL WHEEL WELL FORD	17	1		SEAT TRACK: 105-1/2"Lg.
7	0		TUBE: 18ga. x 1-1/2" x 2" x 66-13/16"Lg. A-513	16	1		TUBE: 18ga. x 1-1/2" x 3" x 69"Lg. A-513
6	1		TUBE: 16ga. x 1-1/2" x 1" x 174"Lg. A-513	15	1		TUBE: 16ga. x 1-1/2" x 3" x 24-3/8"Lg. A-513
5	1		ANGLE: 11ga. x 1-1/2" x 2" x 168"Lg. A-513	14	2		TUBE: 16ga. x 1-1/2" x 3" x 36-3/8"Lg. A-513
4	0		TUBE: 16ga. x 1-1/2" x 1" x 46-3/4"Lg. A-513	13	3		STRAP: 11ga. x 3" x 2-3/8"Lg. A-513
3	4		TUBE: 18ga. x 1-1/2" x 2" x 23-5/8"Lg. A-513	12	1		TUBE: 16ga. x 1-1/2" x 1" x 168"Lg. A-513
2	2		TUBE: 16ga. x 1-1/2" x 1" x 36-3/8"Lg. A-513	11	0		ANGLE: 11ga. x 1-1/2" x 2" x 65-3/4"Lg. A-513
1	8		TUBE: 18ga. x 1-1/2" x 2" x 69"Lg. A-513	10	0		TUBE: 16ga. x 1-1/2" x 1" x 64-3/4"Lg. A-513
				9	1		TUBE: 16ga. x 1-1/2" x 1" x 24-3/8"Lg. A-513
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION	REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

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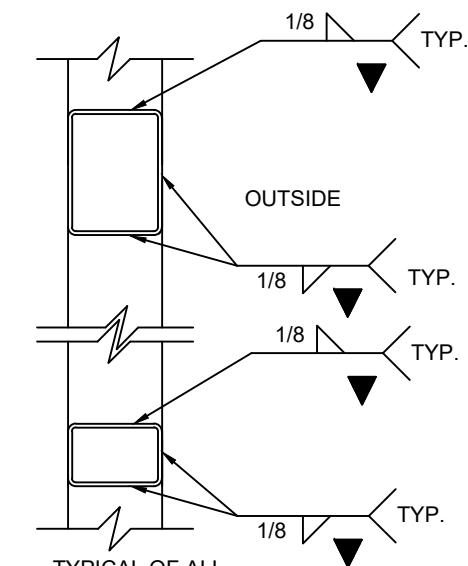
REV.	LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED	WOOD	OTHER	DATE: 6/14/18	TITLE: 158" WB MODEL 24, 42" ENTRY SIDEWALL, R. LIFT, RAISED FLOOR
± 1/8"	± 1/16"	NAME: MKLINE	DWG. No. 32-13-0030-18	SPECIAL 42 ENTRY
± 1"	± 1/2"			



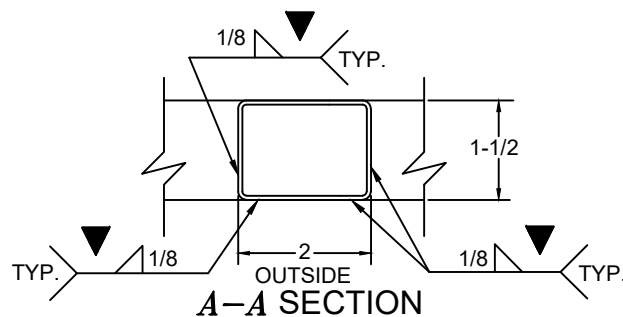
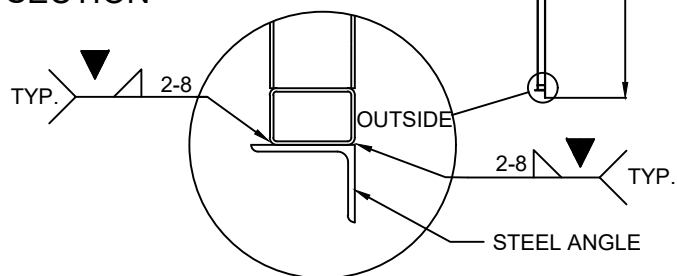
▼ CRITICAL CONTROL ITEM

# USAGE: FORD 158"WB/MODEL 24



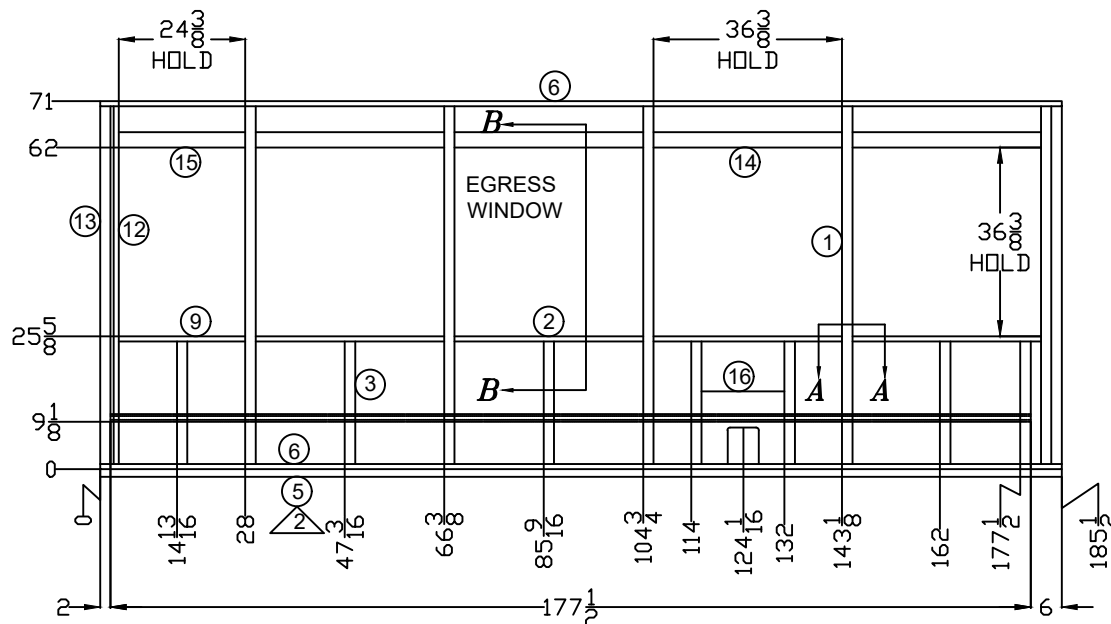
TYPICAL OF ALL  
OPENINGS WHERE  
1-1/2" x 1" TUBING USED.

## B-B SECTION



## NOTES:

- 1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.
- 2- ANGLE TO BE WELDED FLUSH WITH OUTSIDE EDGE OF WALL.



\*\*\*ALL MATERIALS GALVANIZED\*\*\*

8	0		FRAME, SIDEWALL WHEEL WELL FORD	17	1		SEAT TRACK: 177-1/2"Lg.
7	0		TUBE: 18ga. x 1-1/2" x 2" x 70-7/8"Lg. A-513	16	1		FUEL FILL BACKER BOARD
6	2		TUBE: 16ga. x 1-1/2" x 1" x 185-1/2"Lg. A-513	15	1		TUBE: 16ga. x 1-1/2" x 3" x 24-3/8"Lg. A-513
5	1		ANGLE: 11ga. x 1-1/2" x 2" x 185-1/2"Lg. A-513	14	4		TUBE: 16ga. x 1-1/2" x 3" x 36-3/8"Lg. A-513
4	0		TUBE: 16ga. x 1-1/2" x 1" x 79-9/16"Lg. A-513	13	2		TUBE: 16ga. x 1-1/2" x 2" x 69"Lg. A-513
3	7		TUBE: 18ga. x 1-1/2" x 2" x 23-5/8"Lg. A-513	12	1		TUBE: 16ga. x 1-1/2" x 1" x 69"Lg. A-513
2	4		TUBE: 16ga. x 1-1/2" x 1" x 36-3/8"Lg. A-513	11	0		ANGLE: 11ga. x 1-1/2" x 2" x 70-3/16"Lg. A-513
1	5		TUBE: 18ga. x 1-1/2" x 2" x 69"Lg. A-513	10	0		TUBE: 16ga. x 1-1/2" x 1" x 70-3/16"Lg. A-513
				9	1		TUBE: 16ga. x 1-1/2" x 1" x 24-3/8"Lg. A-513
REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION	REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION

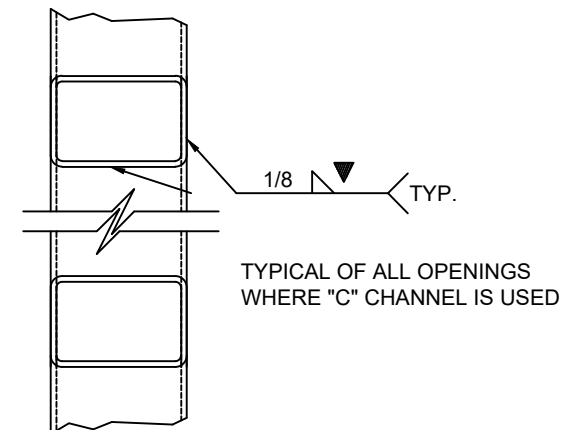
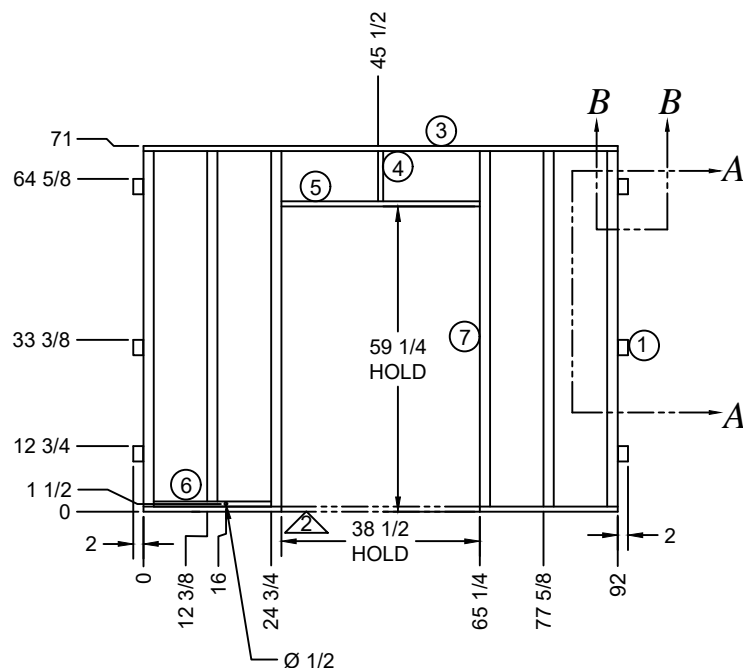
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REV.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.
LET.					

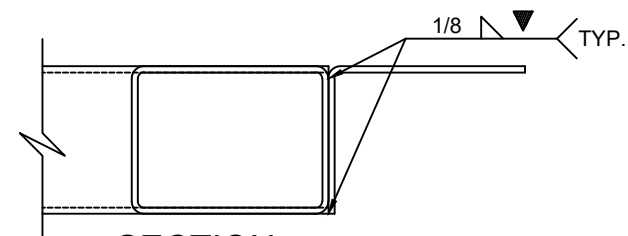
TOLERANCE UNLESS OTHERWISE SPECIFIED	WOOD	OTHER	DATE: 6/13/18	TITLE: 158" WB MODEL 24, DR. SIDEWALL, ALL PASS, RAISED FLOOR
± 1/8"	± 1/16"	NAME: MKLINE	DWG. No.	32-13-0002-10
± 1"	± 1/2"			

▼ CRITICAL CONTROL ITEM

## USAGE: Raised Floor w/ Rear Door, SPECIAL 1-1/2" THICK WALL



SECTION A-A



SECTION B-B

\*\*\*ALL MATERIALS aluminized\*\*\*

### NOTES:

1- DRAWING VIEWED FROM EXTERIOR SIDE OF UNIT.

2- REMOVE STEEL TUBE IN DOOR AREA AFTER WALL MOUNT TO FLOOR  
BUT BEFORE INSTALLING DOOR JAM ASSEMBLY.

7	6		TUBE: 16ga. x 1-1/2" x 2" x 69"Lg. A-513
6	1	02071055	TUBE: 16ga. x 1-1/2" x 1" x 10-3/8"Lg. A-513
5	1	02071055	TUBE: 16ga. x 1-1/2" x 1" x 38-1/2"Lg. A-513
4	1	02071055	TUBE: 16ga. x 1-1/2" x 1" x 9-3/4"Lg. A-513
3	2	02071055	TUBE: 16ga. x 1-1/2" x 1" x 92"Lg. A-513
2	0		
1	6		ANGLE: 16ga. x 1" x 2" x 6"Lg. A-513

REF. No.	QTY.	PART No.	MATERIAL DESCRIPTION
----------	------	----------	----------------------

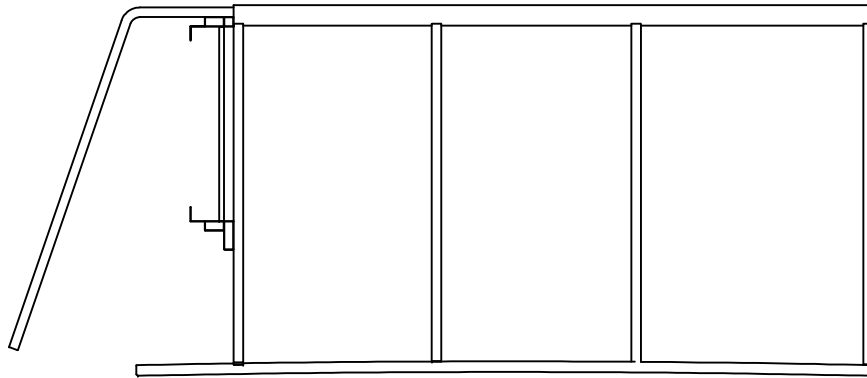


a division of Forest River, Inc.

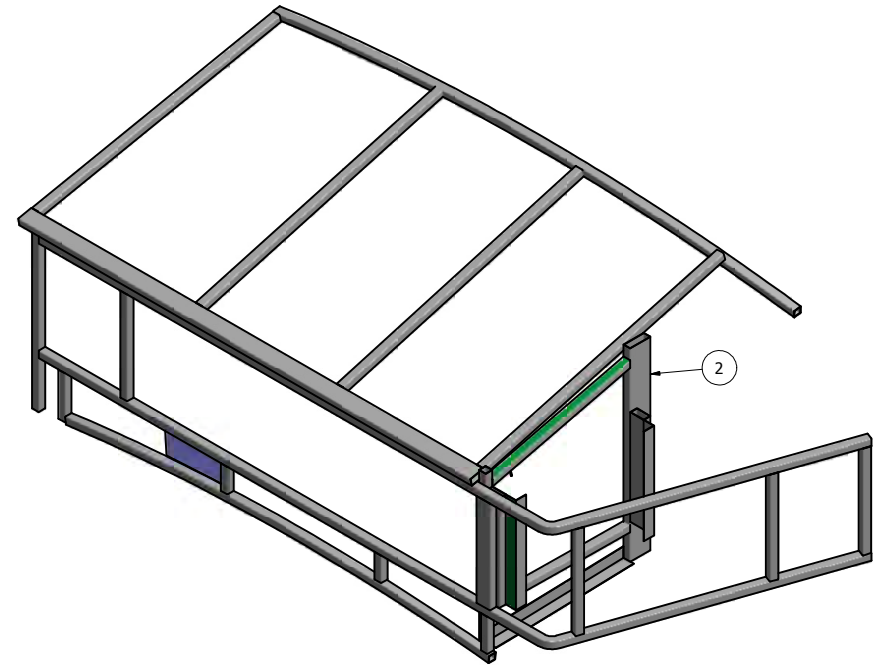
TOLERANCE UNLESS OTHERWISE SPECIFIED	DATE: 06/14/18	TITLE <b>Frame, Rear Wall Raised Floor With Door</b>	
	DFTSN: MKLINE		
	CHKR:		DWG. No.
	APRVD:	SCALE	31-28-0010-18 SPECIAL
		DISK No.	SHEET 1 OF 1
± .00 ± .030			
± .000 ± .015			
± .0000 ± .005			

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LOANED FOR USE WITH REFERENCE TO WORK  
UNDER CONTRACT WITH, OR PROPOSALS  
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FOREST RIVER.

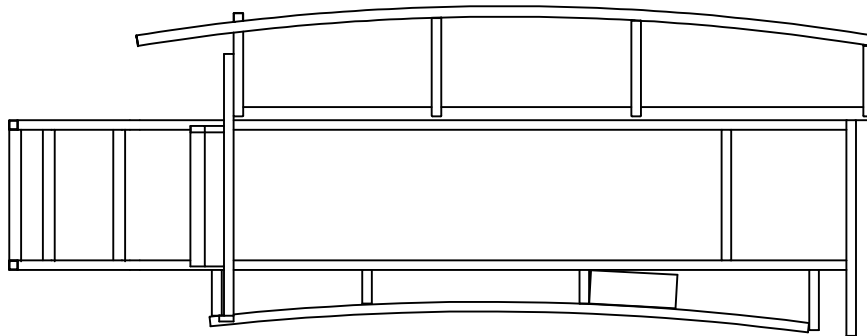
REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.
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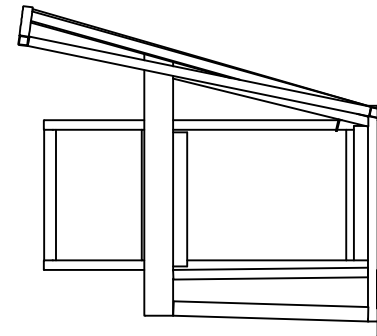
TOP VIEW



ISOMETRIC VIEW



BACK VIEW



SIDE VIEW

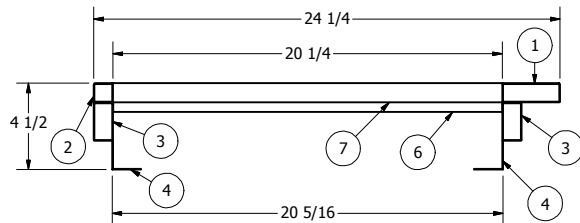
\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

Note:

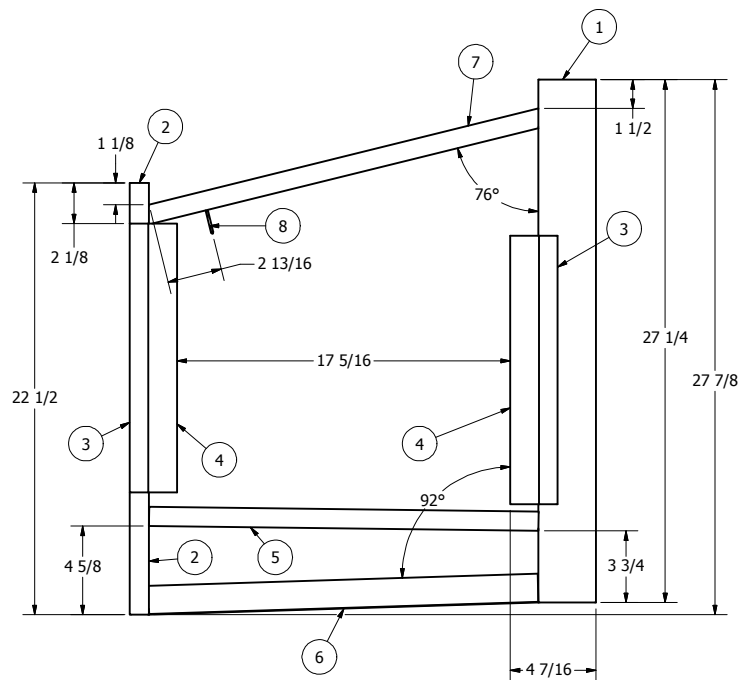
1). Viewed from Interior.

Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	31-28-0307-11	FORD Front Cab Wrap Around
2	1	31-28-0299-11	Ford Electrical Panel Frame
3	1	31-28-0745-11	FORD Cab Overhead

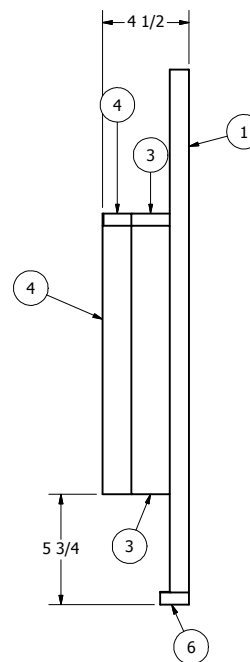
	
A Division Of Forest River, Inc.	
DFTSN: <b>TAS</b>	TITLE: Ford Front Cab, Over Head Cab, Electrical Panel Assembly
DATE: <b>02/04/15</b>	DWG NO: <b>31-28-0993-15</b>
SHEET <b>1</b> OF <b>1</b>	



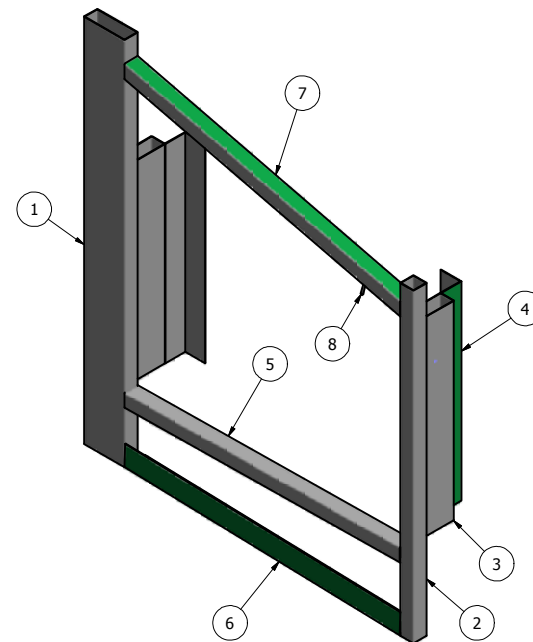
TOP VIEW



BACK VIEW



SIDE VIEW



ISOMETRIC VIEW

\*\*\* ALL MATERIALS ALUMINIZED \*\*\*

Note:

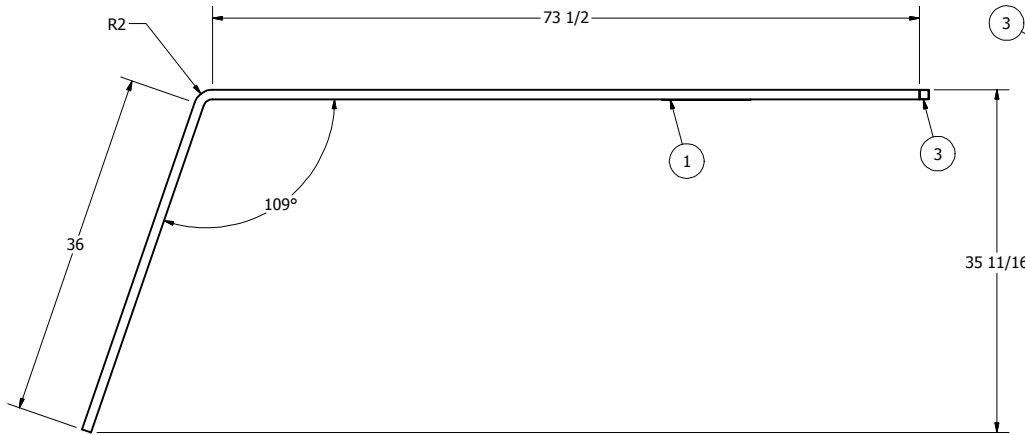
1). Viewed from Exterior.

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
31-28	"A"	Released For Production	9/21/07	ELF
31-28	"B"	Update From Auto Cad To Inventor... Updated To Match What Production Is Currently Building	11/14/07	TAS
31-28				

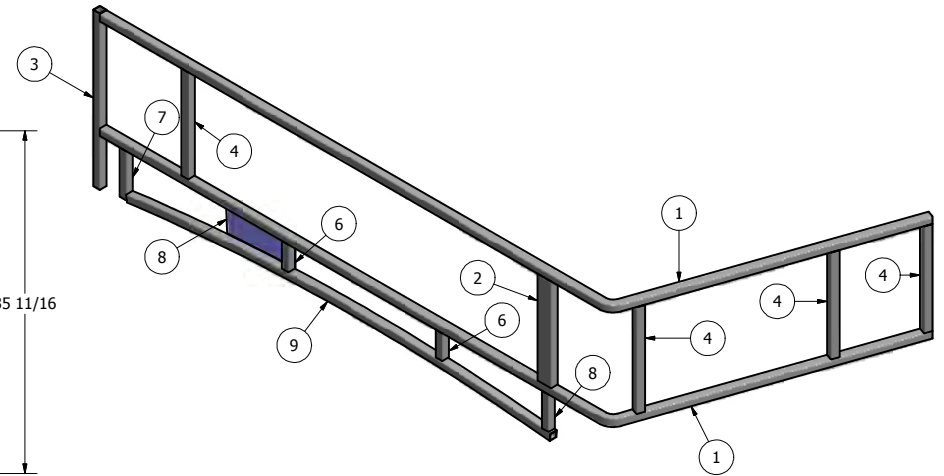
Parts List				
ITEM	QTY	PART NUMBER	DESCRIPTION	
1	1	1x3x27.25	Steel Tube 16ga. 1"x 3"x 27-1/4"	
2	1	1x1x22.5	Steel Tube 16ga. 1"x 1"x 22-1/2"	
3	2	1x2x14	Steel Tube 16ga. 1"x 2"x 14"	
4	2	02071056-14	STEEL ANGLE 11ga.x 1-1/2"x 1-1/2"x 14" lg. A-513	
5	1	1x1x20.25	Steel Tube 16ga. 1"x 1"x 20-1/4"	
6	1	02071056-20.25	STEEL ANGLE 11ga.x 1-1/2"x 1-1/2"x 20-1/4" lg. A-513	
7	1	1x1x21.125 Angle Cut	Steel Tube 16 ga. 1"x 1"x 15-1/4" Angle Cut	
8	1	.25-20 x 1.25 Stud Grade 8	1/2" 13 x 2" Grade 8 Hex Head Bolt	



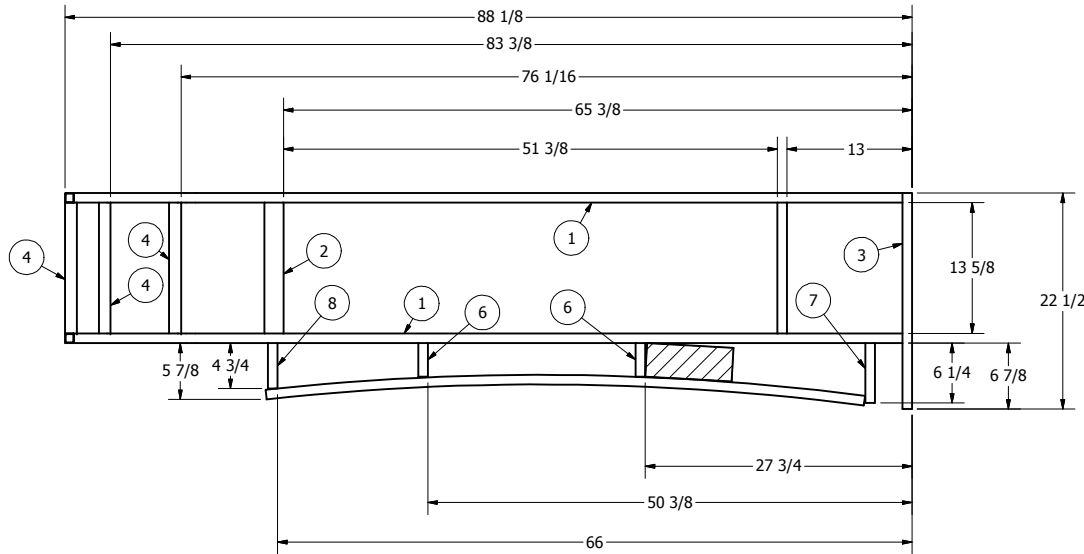
DFTSN:	TAS	TITLE	Ford Electrical Panel Frame	
DATE:	11/07/11	DWG NO	31-28-0299-11	SHEET 1 OF 1



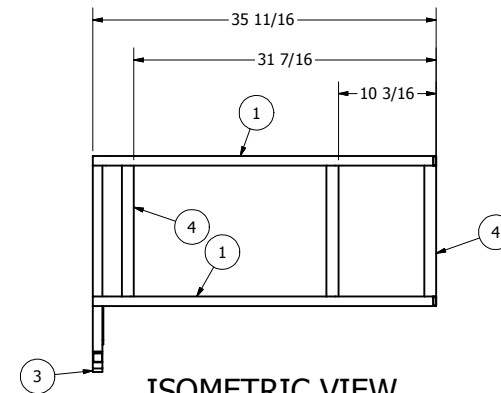
TOP VIEW



ISOMETRIC VIEW



BACK VIEW



ISOMETRIC VIEW

\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

Note:

1). Viewed from Exterior.

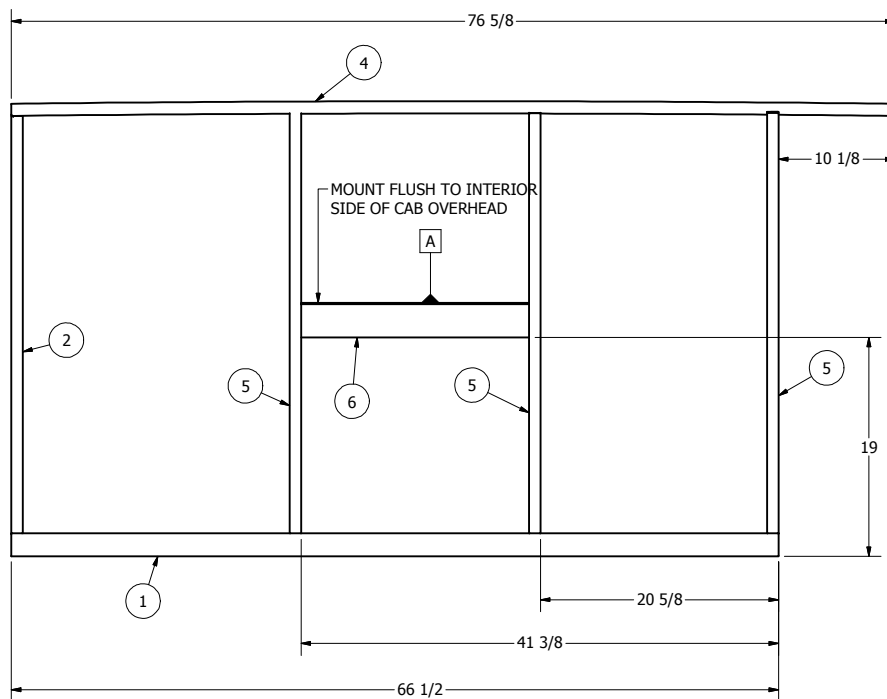
REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
31-28	"A"	Release To Production	10/26/2007	ELF
31-28	"B"	Changed Length of The Wrap Around Tubes	04/28/09	MDK
31-28	"C"	Update From Auto Cad Ton Inventor.. Updated To Match What Production Is Currently Building	11/14/2011	TAS
31-28	"D"	New Revised Standard 2015 Halo	02/05/2015	TAS

Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	31-28-0747-11	Ford 1"x 1"x 16ga. Front Wrap Steel Tube
2	2	1x2x13.625	Steel Tube 16ga. 1"x 2"x 13-5/8"
3	1	1x1x22.5	Steel Tube 16ga. 1"x 1"x 22-1/2"
4	5	1x1x13.625	Steel Tube 16ga. 1"x 1-1"x 13-5/8"
5	1	1x1x15.625	Steel Tube 16ga. 1"x 1"x 15-5/8"
6	2	1x1x3.5	Steel Tube 16ga. 1"x 1"x 3-1/2"
7	1	1x1x6.25	Steel Tube 16ga. 1"x 1"x 6-1/4"
8	1	1x1x4.75	Steel Tube 16ga. 1"x 1"x 4-3/4"
9	1	1 x 1 66.25 CAB CURVE	Ford 1"x 1"x 62-1/4" Steel Cab Radius Tube
10	1	1x1x4.375	Steel Tube 16ga. 1"x 1"x 4-3/8"

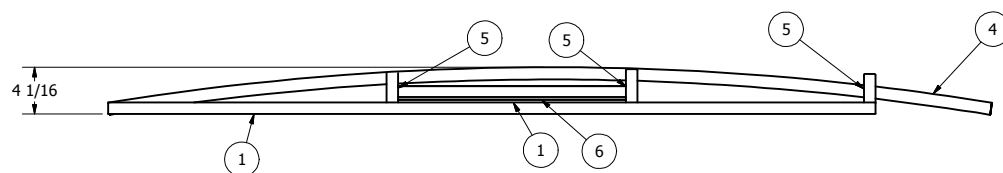


DFTSN:	TAS	TITLE	FORD Front Cab Wrap Around
DATE:	11/07/11	DWG NO	31-28-0307-11
		SHEET	1 OF 1

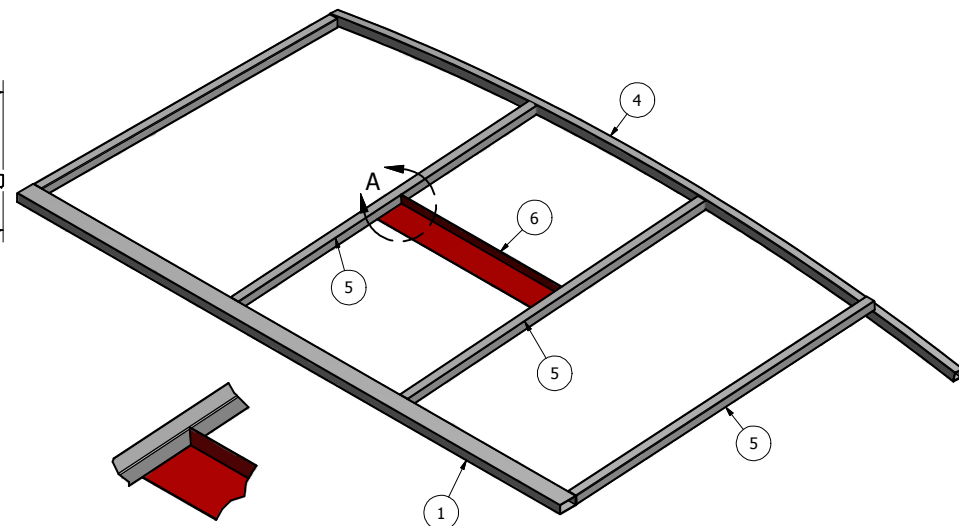




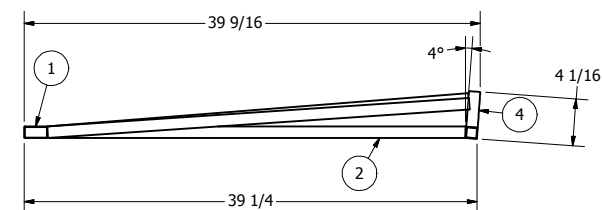
Top View



Front View



Isometric View



Side View

Note:

1). Viewed from Exterior.

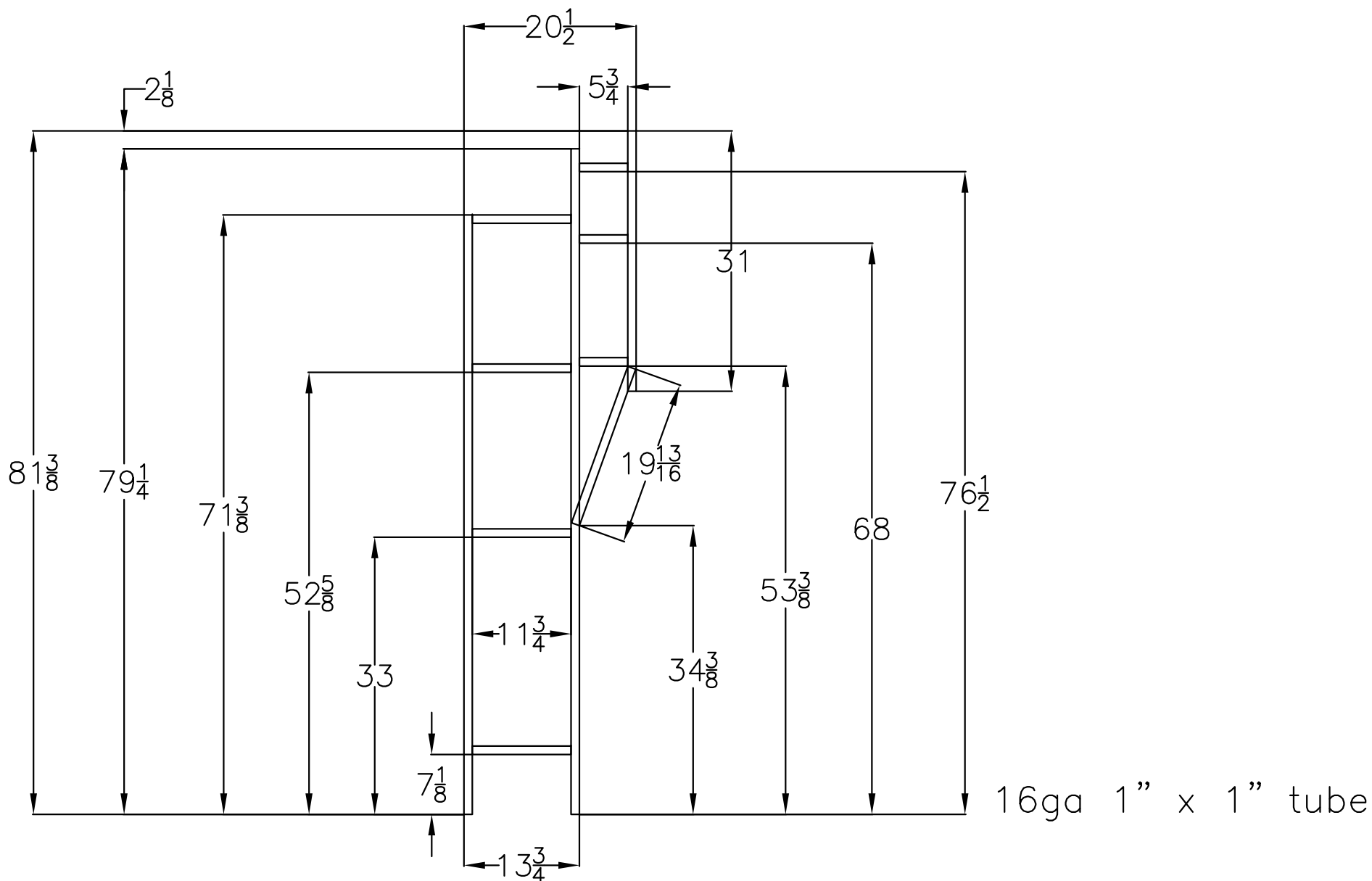
\*\*\*ALL MATERIALS ALUMINIZED\*\*\*

Parts List				
ITEM	QTY	PART NUMBER	DESCRIPTION	
1	1	1x2x66.5	Steel Tube 16ga. 1"x 2"x 66-1/2"	
2	1	1x1x36.25	Tube 16ga. 1"x 1"x 36-1/4"	
3	1	1x3x7	Steel Tube 16ga. 1"x 3"x 7"	
4	1	31-28-0750-11	Ford Allstar Radius Tube 1"x 1"x 76-5/8"	
5	3	1x1x36.625	Aluminized Steel Tube 16ga. 1"x 1"x 36-5/8"	
6	1	3 x 1x 19.75	STEEL ANGLE 16ga.x 3"x 1"x 19-3/4" lg. A-513	
11	1	3 x 1x 19.75	STEEL ANGLE 16ga.x 3"x 1"x 19-3/4" lg. A-513	

DFTSN: TAS		TITLE: FORD New Syle Cab Overhead	
DATE: 11/07/11		DWG NO: 31-28-0745-11	SHEET 1 OF 1


REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
31-28	"A"	ADDED ANGLE FOR BACKER CENTER CEILING STRIPE	3/22/2015	TAS

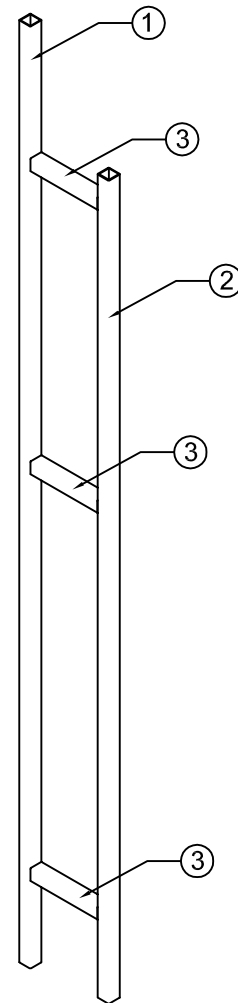
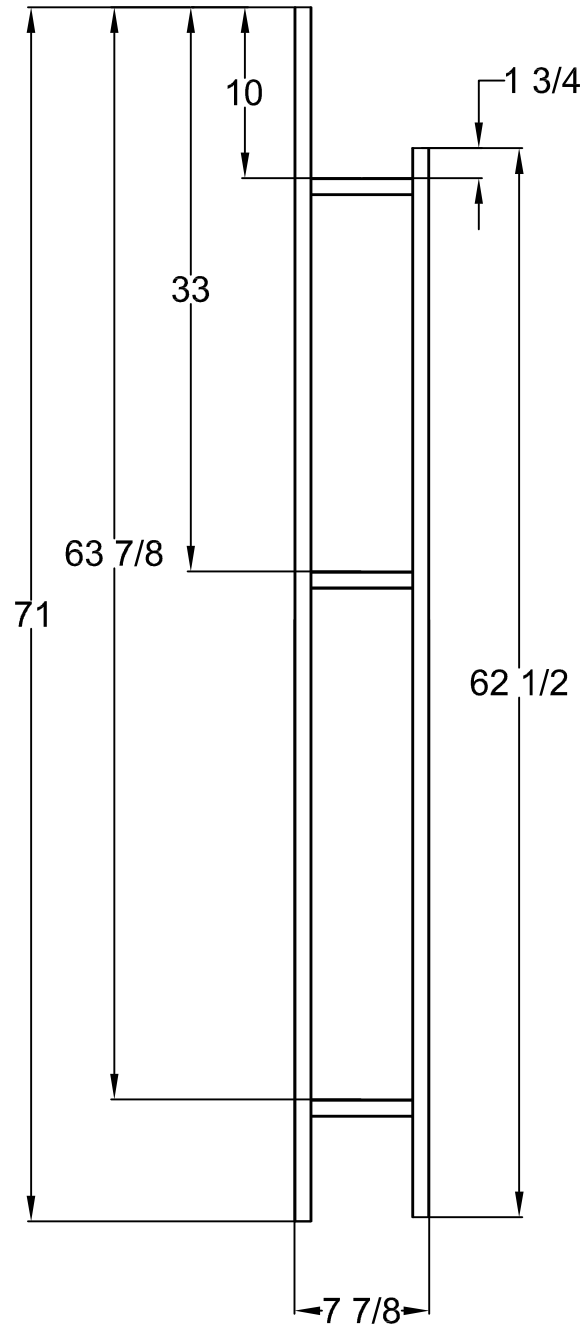


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REV. LET.	DESCRIPTION OF CHANGE	BY	CHK	DATE	ECN No.

TOLERANCE UNLESS OTHERWISE SPECIFIED		 a division of Forest River, Inc.	
WOOD	OTHER	DATE: 7/27/17	TITLE: streetside pillar
± 1/8"	± 1/16"	NAME: MK	
± 1"	± 1/2"	DWG. No. 31-28-0955-14	



16ga 1" x 1" tube

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REV.  
LET.

DESCRIPTION OF CHANGE

BY

CHK

DATE

ECN No.

± 1"

± 1/2"

TOLERANCE UNLESS  
OTHERWISE SPECIFIED

WOOD

OTHER

± 1/8"

± 1/16"

DATE: 7/27/17

NAME: MK

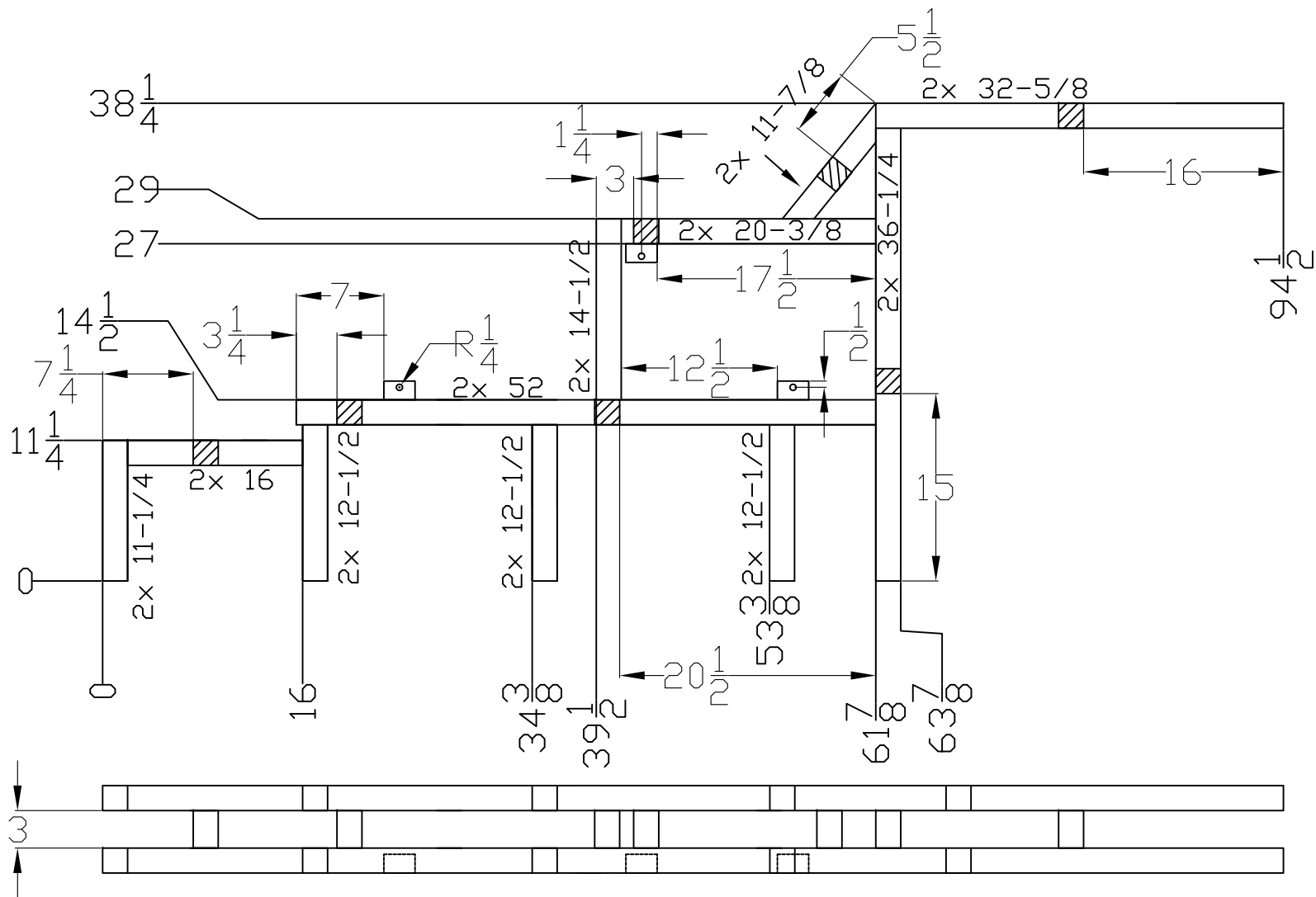
DWG. No.

**Glaval Bus**

a division of Forest River, Inc.

TITLE:

**curbside pillar**



MAT'L=2" x 2" x 16GA.

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REV.	DESCRIPTION OF CHANGE	BY	DATE	ECN No.
LET.				

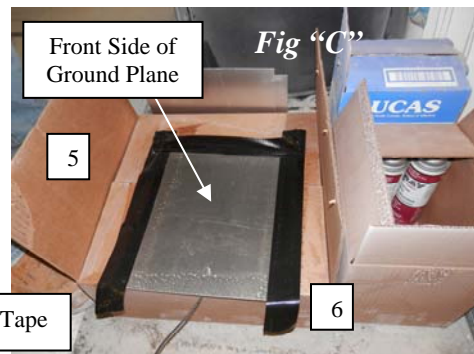
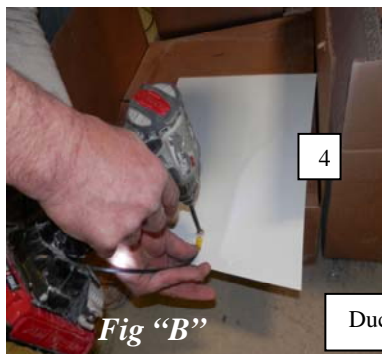
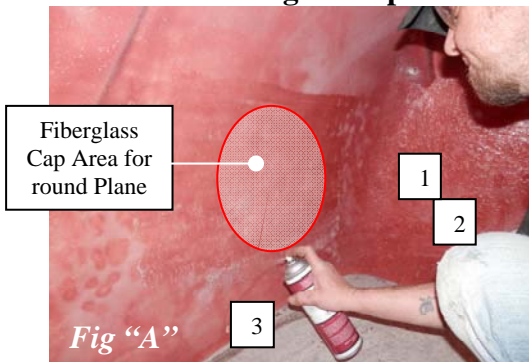
TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE: 06/30/17		NAME: RTS	TITLE: RAISED FLOOR-3 STEP FALSE FLOOR ASSEMBLY
WOOD	OTHER				
± 1/8"	± 1/16"				
± 1°	± 1/2°	DWG. No.	31-28-0531-17C		

 **Glaval Bus**  
a division of Forest River, Inc.

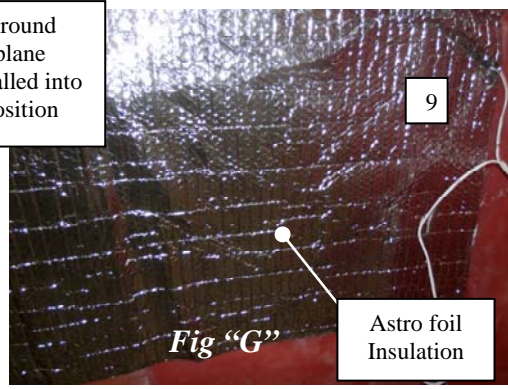
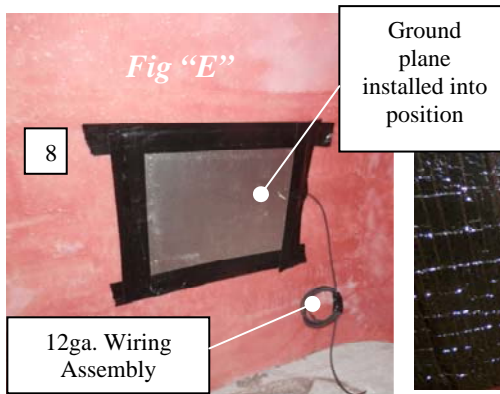
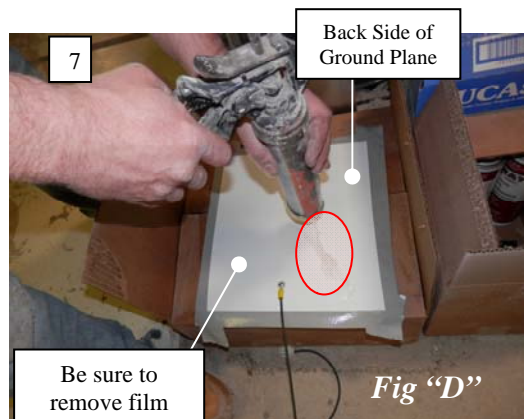
Rev. B		No. 32-01-0006-19
Implementation: 004/05/2019	Title: FRONT CAP GROUND PLANE	Written by: Tim Smart
Models Affected:	All	
Tools Necessary:	Screw Gun, 12"x 12" .063 Aluminum, Grinder, Duck Tape, Lucas Sealant, All-Purpose Spray Adhesive, Caulk Gun, 31-28-1023-15 Ground Plane Print	Total Pages: 01

**Process:**

1. Begin process by locating ground plane location for installation.
2. Clean inside fiberglass cap from all debris with air hose.



3. Spray all-purpose adhesive to interior side of fiberglass cap where ground plane will be located.
4. Let adhesive tack up, apply 12ga. wire assembly to 12" aluminum ground plane with self-tapper. *Fig "B"*
5. Apply all-purpose adhesive spray to backside all 4 outside edges of 12" aluminum.
6. Apply duct tape to backside all 4 outside edges of 12" aluminum.



7. Turn 12" aluminum over and apply lucas caulk to backside of ground plane. *Fig "D"*
8. Install ground plane as shown, run 12ga. wiring assembly to grounding plug in electrical box
9. Apply Astro foil insulation to front cap covering ground plane.
10. After cap installation a conduit w/ pull wire is ran from ground plane area down the B-pillar to behind the driver seat so a future antenna cable can be pulled through.
11. After completion of cab area, to complete this process circular access panel is installed in the cab ceiling immediately below the ground plane.






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## Electric Door Actuators



### Product Features

- ┌ Low-profile design
- ┌ Powder-coated base plate
- ┌ Plated push rods
- ┌ Permanently lubricated pivot points
- ┌ [Motor Control PC Board](#)
- ┌ [Proprietary, heavy-duty motor](#)
- ┌ [Available remote control](#)
- ┌ 1-year warranty
- ┌ New! Optional Auto Reopen Switch

### Harmony of Movement

- ┌ Our design produces completely [perpendicular door opening](#)--always.
- ┌ Forward door opens first and closes last--always.
- ┌ No need to rely on spring-loaded push-pull rods--ever.

### Secure Closing

- ┌ Our design ensure an unequalled, strong closing.
- ┌ The actuator will reliably hold the door shut, even at highway speeds.

### Serviceability

- ┌ The reliability of the design,
- ┌ together with the ease-of-access,
- ┌ and the documentation tools we provide,
- ┌ work together to create unparalleled serviceability.

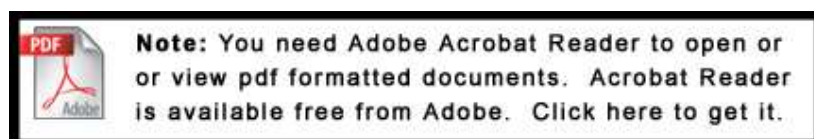
## Maintenance

Minimal periodic maintenance of this product is recommended. The frequency varies, of course, by climate and use. Periodically **inspect** the entire mechanism.

As a rule, **lubricate** all moving parts on a semi-annual basis using a white, lithium, aerosol grease.

## Support Documentation

- └ [DOC00066, A&M Systems Header Option Chart and Details](#) (pdf, 326 KB)
- └ Parts Lists
  - └ [Model 1000E Family](#) (pdf, 1.10 MB)
  - └ [Model 1100E Family](#) (pdf, 1.08 MB)
  - └ [Model 1200E Family](#) (pdf, 1.08 MB)
  - └ [Model 1300E Family](#) (pdf, 1.08 MB)
  - └ [Model 1400E Family](#) (pdf, 1.08 MB)
  - └ [Model 1500E Family](#) (pdf, 1.08 MB)
  - └ [Model 1600E Family](#) (pdf, 1.08 MB)
  - └ [Model 2100E Family](#) (pdf, 1.10 MB)
  - └ [Model 2100.1E Family](#) (pdf, 346 KB)
  - └ [Model 2200E Family](#) (pdf, 1.08 MB)
  - └ [Model 2300E Family](#) (pdf, 1.08 MB)
  - └ [Model 2400E Family](#) (pdf, 1.18 MB)
  - └ [Model 2729.X Family](#) (pdf, .81 MB)
  - └ [Model 2800E Family](#) (pdf, 1.08 MB)
  - └ [Model 2800.1E Family](#) (pdf, 1.00 MB)
  - └ [Model 3000E Family](#) (pdf, 362 KB)
  - └ [Model 3400E Family](#) (pdf, 1.08 MB)
  - └ [Model 3500E Family](#) (pdf, 931 KB)
  - └ [Model 3501E](#) (pdf, 461 KB)
  - └ [Model 3600E Family](#) (pdf, 1.43 MB)
  - └ [Model 4000E Family](#) (pdf, 679 KB)
  - └ [Model 4400E Family](#) (pdf, 678 KB)
  - └ [Model 5142E Family](#) (pdf, 834 KB)
  - └ [Model 5300E Family](#) (pdf, 637 KB)
  - └ [Model 5500E Family](#) (pdf, 362 KB)
  - └ [Model 6200E Family](#) (pdf, 535 KB)
  - └ [\\*\\*\\*NEW - PC Board and Wires Chart](#) (pdf, 171 KB)
- └ [Assembly & Rigging Instructions](#) (pdf, 98 KB)
- └ Replacements
  - └ [Actuator Arm Replacement](#) (pdf, 21 KB)
  - └ [Emergency Release Lever Replacement](#) (pdf, 21 KB)
  - └ [Forward Gear Replacement](#) (pdf, 21 KB)
  - └ [Motor Replacement](#) (pdf, 20 KB)
  - └ [PC Board Replacement, Quick Check™ Enabled](#) (pdf, 21 KB)
  - └ [PC Board Replacement, Standard](#) (pdf, 21 KB)
- └ Troubleshooting
  - └ [Motor Control PC Board with Auto Reopen](#) (pdf, 10 KB)
- └ [Simplified Schematic](#) (pdf, 75 KB)
- └ [Wireless remote option flyer](#) (pdf, 158 KB)



[About](#)[Products](#)[Support Resources](#)[Service Request](#)[Suggestions](#)

## Door Leaves



### Product Features

- ┌ Distinctive door leaf design
- ┌ [Key-lock joint](#)
- ┌ Corrosion resistance through use of aluminum, stainless steel, and zinc plating
- ┌ [Torque arm](#) on upper hinge
- ┌ [Tempered glass](#)
- ┌ Tough, clear coat, anodized finish (204 R1 rated)
- ┌ [Radiused edge](#) for clean mating to seal
- ┌ Ambidextrous! (Use in either forward or aft position)

### Harmony of Movement

- ┌ Our design produces completely [perpendicular door opening](#)--always.
- ┌ Forward door opens first and closes last--always.
- ┌ No need to rely on spring-loaded push-pull rods--ever.

### Secure Closing

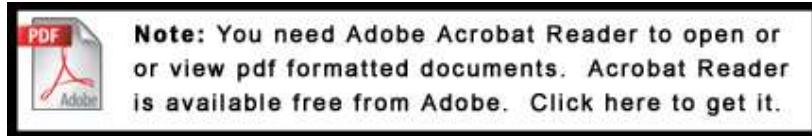
- ┌ Our design ensure an unequalled, strong closing.
- ┌ The actuator will reliably hold the door shut, even at highway speeds.

### Serviceability

- ┌ The reliability of the design,
- ┌ together with the ease-of-access,
- ┌ and the documentation tools we provide,
- ┌ work together to create unparalleled serviceability.

## Support Documentation

- ┌ [DOC00065, A&M Systems Door Option Chart and Details.pdf](#) (pdf, 1128 KB)
- ┌ [Glass Replacement](#) (pdf, 20 KB)
- ┌ [Door Parts List](#) (pdf, 262 KB)
- ┌ [D.O.T. Window Retention Certification](#) (pdf, 912 KB)



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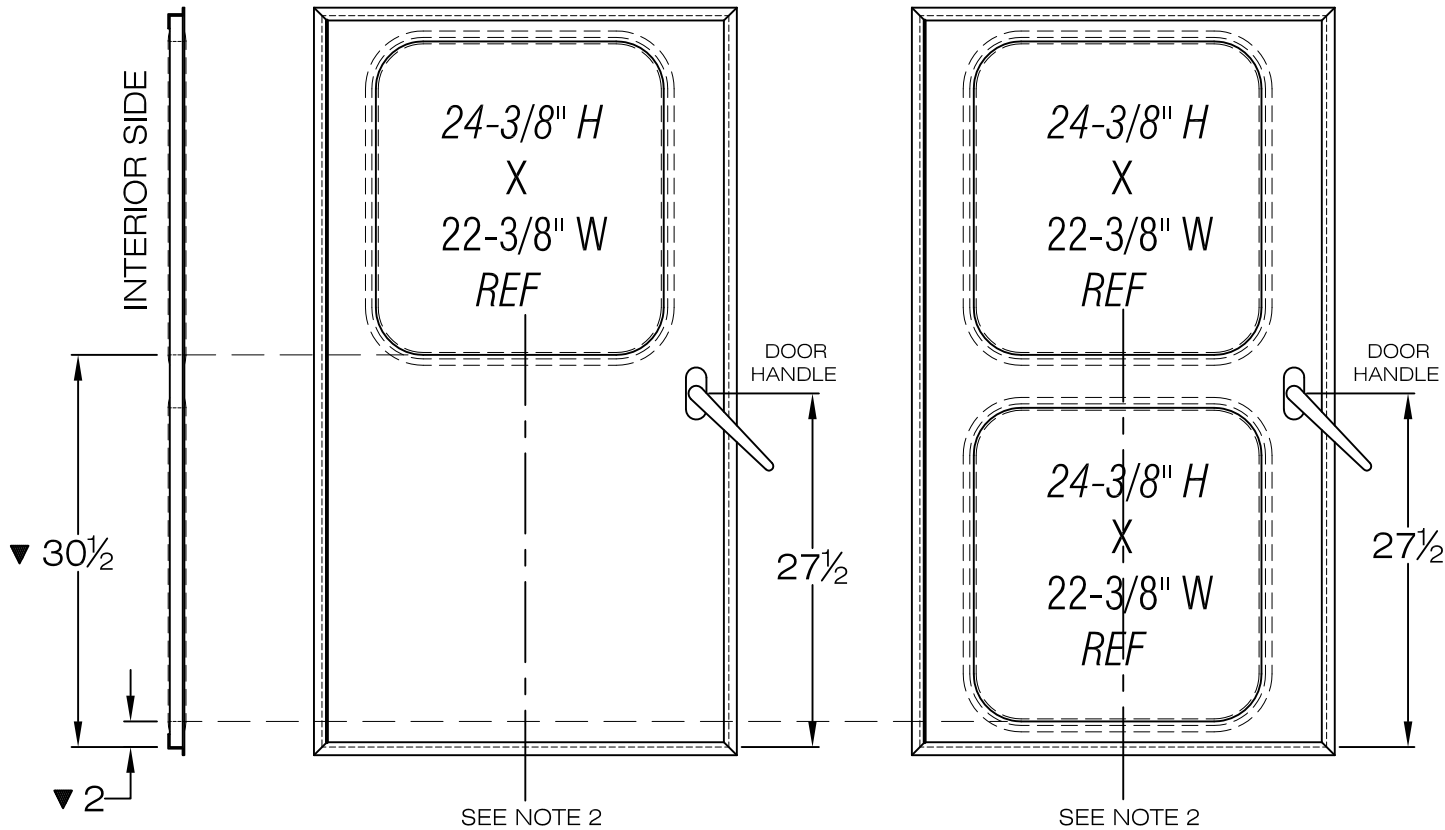
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# REAR DOOR

## SINGLE WINDOW

## DOUBLE WINDOW



REAR DOOR ROUGH FRAME OPENING 38-1/2" X 59"

### NOTES:

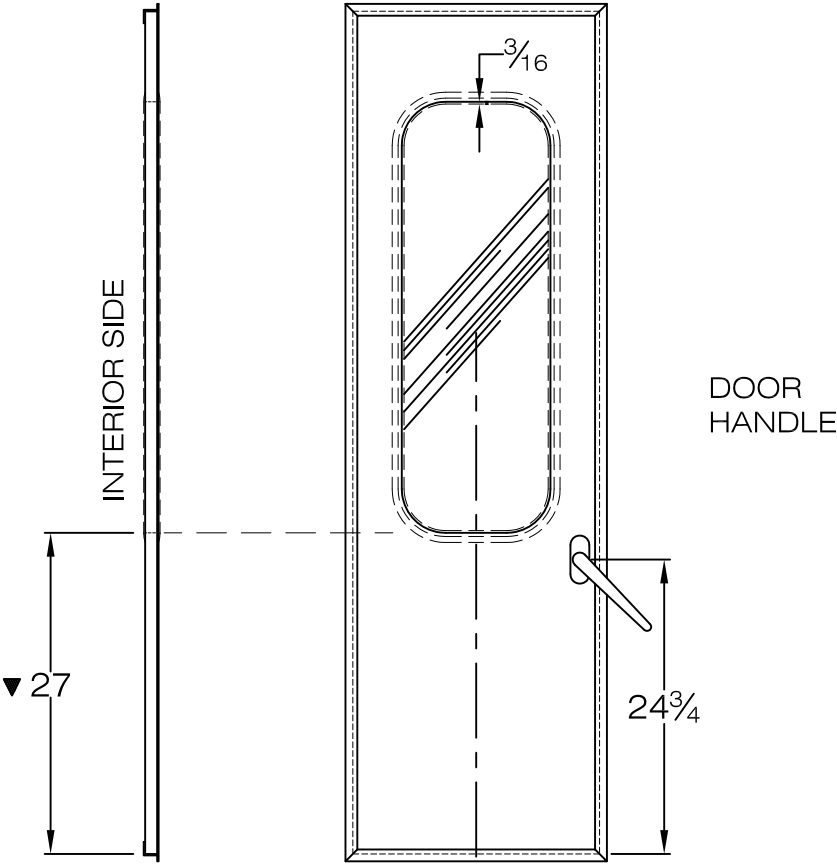
- 1- DIMENSIONS FOR THE WINDOW CUTOUT  
DO NOT INCLUDE DOOR OR WINDOW TRIM.
- 2 - CENTER WINDOW HORIZONTALLY IN DOOR.
- 3 - TWO (2) PANELS ARE REQUIRED FOR W/C DOOR.

▼ CRITICAL CONTROL ITEM

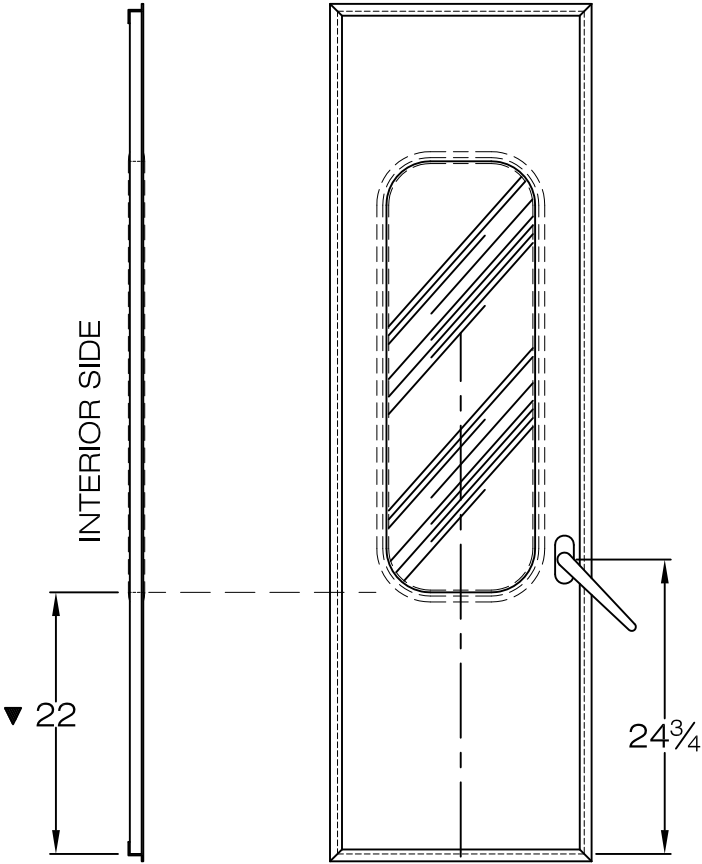
CAD DRAWING: DO NOT SCALE OR MANUALLY REVISE

TOLERANCE UNLESS OTHERWISE SPECIFIED		Forest River Bus	
WOOD	OTHER	DATE: 4-6-2006	TITLE: LOCATION, RR DR WINDOW
± 1/8"	± 1/16"	NAME: ET	
± 1°	± 1/2°	DWG. No. 31-28-0108-06	

STANDARD WIDE BODY BUS



NARROW BODY BUS AND  
RAISED FLOOR WIDE BODY BUS



NOTES:

- 1- DIMENSIONS FOR THE WINDOW CUTOUT  
DO NOT INCLUDE DOOR OR WINDOW TRIM.
- 2 - 36 1/4" X 12 1/2" ROUGH WINDOW OPENING
- 3 - CENTER WINDOW HORIZONTALLY IN DOOR.

SEE NOTE 3

Rough Opening for 33-34" Lifts 47.5" x 71.88"  
Rough Opening for 37" Lifts 49.9" x 71.88"  
Offset hinges are utilized, maximizing clear  
opening available.

SEE NOTE 3

▼ CRITICAL CONTROL ITEM

CAD DRAWING: DO NOT SCALE OR MANUALLY REVISE

TOLERANCE UNLESS OTHERWISE SPECIFIED		Forest River Bus	
WOOD	OTHER	DATE: 3-8-06	TITLE: LOCATION, W/C DOOR WINDOW
± 1/8"	± 1/16"	NAME: EDT	
± 1"	± 1/2"	DWG. No.	31-28-0105-06



**Gateway**



**INTERMOTIVE**  
**VEHICLE**  
**CONTROLS**

An ISO 9001:2015 Registered Company

# Gateway

## High Idle and Shift Interlock System

### Overview

- All-in-one wheelchair interlock and high idle system to ensure full functionality of the vehicle's systems while using the lift
- Provides battery charge protection and improves air conditioning performance
- System is fully compliant with FMVSS 403/404 and the Americans with Disabilities Act (ADA) for wheelchair lift interlocks
- Simple plug and play connections to the OEM chassis

### Features

- Prevents vehicle movement while the lift is in use by locking the shifter in Park
- Monitors OEM sensor inputs from the transmission, engine, charging system and ambient air temperature
- Programmable RPM for high idle
- Prevents driving with the park brake set
- Can provide real-time chassis data
- Diagnostic trouble codes available
- Optional BrakeMax add-on: automatically places vehicle in "tow haul" mode for reduced brake wear
- Uses Intermittent Fault Filter™ (IFF) technology to eliminate erroneous lift door signals

*Product features may vary by make, model or year. See instructions for complete details.*

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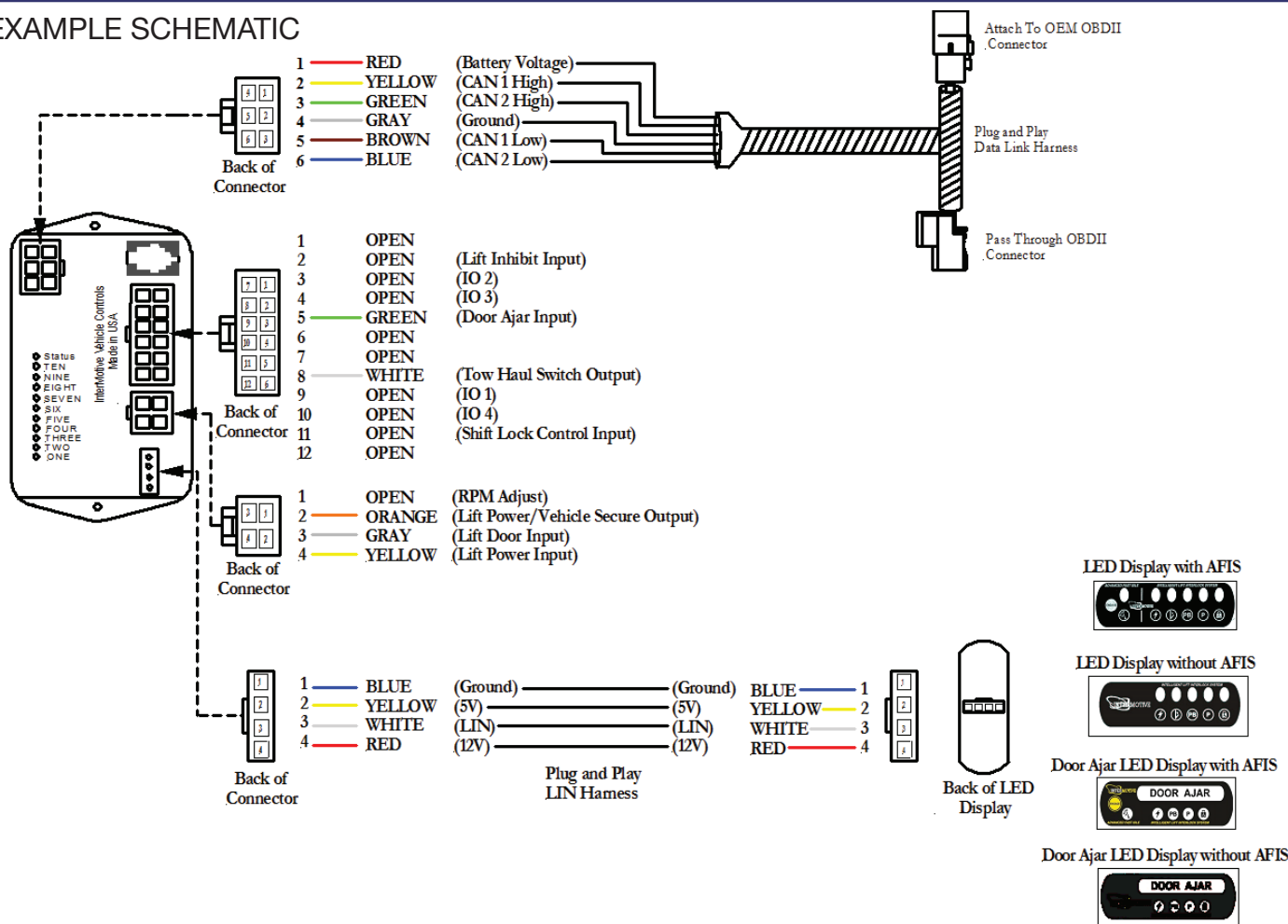
**LGS GROUP**  
AUTOMOTIVE TECHNOLOGIES

**(775) 831-2002**



# Details

## EXAMPLE SCHEMATIC



## SPECIFICATIONS

Number of Inputs	Five inputs (lift inhibit, door ajar, shift lock, lift door and RPM adjust)
Number of Outputs	Four configurable outputs, plus one lift power/vehicle secure output and one tow haul switch output
Current Draw	~120 mA
Quiescent Draw	~2 mA (sleep current)
CAN Speed	High and medium speed
Temperature Range	-40°C to 80°C
Dimensions	4" L x 2" W x 1" H

# AccuStyle® 815 Series

## Features and Benefits

- Lightweight, vibration reducing design.
- Certified by OEMs to meet FMVSS-111 requirements.
- Same model can be mounted as upright, overhang or two point mount.
- Reduces inventory of replacement parts.
- Aerodynamic, wind tunnel tested profile has lower drag coefficient for increased fuel economy.
- Available motorized or hand adjustable.
- Available with heated and LED turn signal options
- Each motorized mirror lens is four way adjustable.
- Hidden wire and connectors.
- Black or chrome finish is available.
- Full height rear entry cap allows for simple installation and ease of maintenance, including access to all wires and harnesses.



Model 815U  
Shown with E-Z Bracket  
combination assembly

## AccuStyle® 815 series 8"x15" Dual Mirrors

PART NO.	DESCRIPTION
815	8" x 15" dual mirror, two point mount, motorized, 12 volt
815ELU / 815ERU	8" x 15" dual mirror, upright mount, motorized 12 volt with left or right external signal LEDs
815OG	8" x 15" dual mirror, overhang mount, motorized, 12 volt
815SL / 815SR	8" x 15" dual mirror, two point mount, motorized 12 volt with left or right mirror lens signal LEDs
815SLU / 815SRU	8" x 15" dual mirror, upright mount, motorized 12 volt with left or right mirror lens signal LEDs
815SLOG / 815SROG	8" x 15" dual mirror, overhang mount, motorized 12 volt with left or right mirror lens signal LEDs
815U	8" x 15" dual mirror, upright mount, motorized, 12 volt
CBL815U	8" x 15" dual mirror, upright mount, motorized 12 volt with left or right integrated camera
CBR815U	8" x 15" dual mirror, upright mount, motorized 12 volt with left or right integrated camera
M815	8" x 15" dual mirror, two point mount, hand adjustable
M815OG	8" x 15" dual mirror, overhang mount, hand adjustable
M815U	8" x 15" dual mirror, upright mount, hand adjustable

For Heated Mirrors, Add "H" to the End of All Part Numbers Without a "/"  
or Add "H" in Front of the "/" When Present.

## Custom Wire Harnessing

- Harnesses can have custom lengths.
- Conductors available in various gauges.
- Durable connection systems for superior harnessing between mirror, arm and switch.
- Weather proof connectors are available and grommets pre-installed on harnesses.
- Connectors from various companies, including: Tyco/AMP, ITT Canon, Delphi Packard and Deutsch, as well as others.
- In house high speed termination equipment provides fast turnaround.
- UL certified wire.
- Miniature connectors allow smaller holes in vehicle body.
- Multi-conductor cabling available in 2-lead for heating only, 4-lead for single motor control and 8-lead for dual motor control and heating.

## Harness Types

1. Arm Harness- Concealed inside arm. Can be made very short to plug into a flush mount connector on the exterior of the vehicle or to pass just inside the vehicle skin. Can be made longer to be run all the way to the control switch.
2. Intermediate Harness- Joins the arm harness to the switch harness. Advantageous because it can be run before installation of the arm on the vehicle assembly line. Also allows arm to be removed from bus by disconnecting a connector instead of cutting a longer wire. More commonly used on passenger side.
3. Switch Harness- Attached to control switch. Often integrates heater control switch. Has leads for power and mirror heater circuits. Usually very short in length.

## Mirror Systems Testing For Compliance to FMVSS-111

Our AccuStyle® and EuroStyle® rearview mirror systems and front cross view mirror systems (Eye-Max® LP, HD, Hawk-Eye®), have been certified for compliance to FMVSS-111 by all the major school bus body builders. Companies including IC Corporation, Thomas Built Buses, Blue-Bird, Collins and Girardin, have shown time and again that Rosco mirrors not only meet, but exceed the requirements of FMVSS-111. However, we continue to test and improve our mirrors to make sure that they cover areas around the bus, beyond the requirements of FMVSS-111. We can not rest in this regard, because we know that the safety of our children depends on it.



## Proper School Bus Mirror Adjustment

You know your buses are being manufactured with FMVSS-111 compliant mirrors, but how do you know that your mirrors are being properly adjusted? Can you be sure that your drivers are seeing the blind areas around the bus? Are there blind areas around the bus beyond the FMVSS-111 mandated coverage? If these questions are bothering you, then you need to see "Field of Vision", the first video which teaches you how to keep your mirrors properly adjusted at all times. This free video guideline is a perfect addition to your driver training program. It not only shows how to keep your mirrors adjusted in compliance with FMVSS-111, but also how to see blind areas beyond FMVSS-111 regulations. Email us for your free copy: [info@roscomirrors.com](mailto:info@roscomirrors.com)



FIELD OF VISION  
A video guide to proper school bus  
mirror adjustment in accordance with  
FMVSS-111

[Info@Roscomirrors.com](mailto:Info@Roscomirrors.com)



# Creative Bus Sales

THE NATION'S LARGEST BUS DEALER SINCE 1980

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## Letter of Transmittal

RFP Number: PTR2200000008

Bid Title: 158" – 176" Wheelbase Cutaway Vehicle

Bid Due Date: April 26, 2022 at 1:30pm (ESDT)

Purchasing Division,

Thank you and the Department of Administration – Purchasing Division, for the opportunity to submit a response to this Solicitation.

Our understanding of the scope of work pertaining to this Solicitation is to provide The State of West Virginia proposals for the manufacture and delivery of products in accordance with the terms and conditions set forth in this Request for Quote, meeting all specifications and FMVSS laws.

CBS's proposal may include manufacturer's brochures, standard warranty information, and additional technical information within our bid submittal. Information shown on these documents indicates our manufacturer's standard equipment or specifications and does not necessarily reflect the exact equipment to be utilized or included with the bid vehicle(s). Our vehicle is built to meet all bid specifications and amendments unless otherwise noted in our exceptions list. Our submittal takes no exceptions to the solicitation terms and conditions.

The resulting contract will be for Ford E450 ADA buses with related necessary components, and selected options. The contract shall be for one year with two possible one-year extensions. The enclosed statements, details and quote are valid for sixty (60) days from bid opening, April 26, 2022. Your delivery date will be within 12-15 months after we receive a purchase order and executed contract documents.

The information contained in our proposal includes our qualifications to perform the required work, detailed specifications, warranties, and descriptions of our facilities and staff. Also Included are all the documentation and general forms required. If you need more information or clarification, please give us a call at 800.326.2877

Sincerely,

**Nick Corley | Sales Operations Manager**

Creative Bus Sales, Inc.

800-326-2877

[ncorley@creativebussales.com](mailto:ncorley@creativebussales.com)