June 19, 2019

Metra Request For Proposal (RFP) 37383
New Push-Pull Commuter Rail Cars
Addendum No. 3, dated June 19, 2019

Dear Sir/Madam:

This Addendum No. 3 is being issued to correct, amend, add and/or delete certain words, phrases, sentences, or paragraphs in Metra’s RFP 37383.

Addendum No. 3 consists of:

1) The scheduling of a site visit to VRE facilities.
2) Questions received and responses from our agency.
3) Revised Instructions to Proposers, Title/Description of Work
4) Revised Contract Documents, Section 1, General Conditions
5) Revised Contract Documents, Section 2, Special Conditions
7) The addition to Contract Documents, Section 5, Exhibit VI, of:
   - Buy America Certification for VRE
   - Certification of Authority to Transact Business in the Commonwealth of Virginia.
8) Extending the Question Due Date from June 28, 2019 @ 4:00 L.P.T to July 26, 2019 @ 4:00 L.P.T.
9) Extending the Proposal Due Date from August 19, 2019 @ 4:00 L.P.T to September 27, 2019 @ 4:00 L.P.T.

A site visit to VRE’s Broad Run Maintenance and Storage Facility, located at 10637 Piper Lane, Bristow, VA 20136, will be held on Tuesday July 9, 2019 at 1:00 P.M. Eastern Time. Attendance at the site visit is encouraged but is not mandatory. Notification of persons planning to attend is requested to: jonesto@metrarail.com. VRE will provide high visibility lime green safety vests. Participants shall be responsible for providing all other PPE as specified below:

ALL ATTENDEES ARE REQUIRED TO WEAR A HARD HAT, SAFETY GLASSES (SIDE SHIELDS FOR PRESCRIPTION EYEWEAR), AND STEEL OR SIMILAR SAFETY TOE BOOTS.

Prospective proposers shall acknowledge receipt of each individual addendum in their proposals on the Proposal Form Provided in Exhibit II. Failure to acknowledge in their proposals receipt of addenda may, at Metra’s sole option, disqualify the Proposal.

Sincerely,

[Signature]
James Barker, Department Head
Construction and Facilities Maintenance Procurement
JO
RFP 37383 Questions and Answers

Q1 The specification reads:
“Exterior passenger entrance door systems shall utilize a linear door motor.”
For clarity, we believe that this sentence should read:
“Exterior passenger entrance door systems shall utilize a linear door operator.”
Please review and confirm.


Q2 The RFP Instructions to Proposers reads:
“...and a price adjustment index, found in General Conditions, Section 1, Item 2.8, Price Schedule,”
The reference appears to be incorrect, we believe that this sentence should read:
“...and a price adjustment index, found in Special Conditions, Section 2, Item 2.9, Price Schedule,”
We also mention that the Table of Contents for the Special Conditions Section 2 does not appear to match Section 2 that follows (e.g.: “Item 2.8 Price Schedule” instead of “Item 2.9 Price Schedule”).
Please review and confirm.

A2 The documents, including the Table of Contents for the Special Conditions, will be revised to match and reference the Price Schedule as Section 2.9.

Q3 Dear Mr. Onesto, we spoke briefly last week about the car type which remains unclear after reviewing the RFP unless I have missed something obvious. Please let me know if METRA accept proposals for single-level railcars?

A3 Metra will accept proposals for any railcar that meets the Technical Specification M-18-011, Revision B.

Q4 The introduction letter refers to May 22nd 4pm as the deadline for questions and RFAs while Section IV of the Instructions to Proposers refers to May 23. Could you please confirm the deadline to submit questions and RFAs?

A4 Addendum No. 2, issued 5/13/19, extended the question due date from May 23, 2019 to June 28, 2019, and this Addendum No. 3 has extended the question due date from June 28, 2019 to July 26, 2019.

Q5 METRA SPECIFICATION:
The cars shall be provided in two configurations: Cab Control Cars and Trailer Cars and shall be compatible in every respect with:
1.1.3.1: Metra's existing locomotives.

QUESTION:
Would METRA consider and accept the submission of an alternate proposal for different train-set configurations that may include a proposal for DMU's? We recognize and acknowledge that any alternate proposal being submitted would need to meet and/or exceed the salient characteristics of your solicitation. Please advise if METRA would consider the submission of an alternate proposal only, and if said proposal would be evaluated equally with proposals submitted in response to the baseline specification requirements.

A5 Metra will accept proposals for any railcar that meets the Technical Specification M-18-011, Revision B. All proposals will be evaluated using the same criteria as stated in Section XVII in the RFP Instructions to Proposers.
| Q6   | The document states on the second page of the coversheet (item #4 on the Notes section) that this RFP may be subject to Federal Transit Administration and/or the Illinois Department of Transportation funding, pursuant to financial assistance agreements with said agencies. We are familiar with the various FTA requirements; however, we could not find the IDOT requirements. We are especially interested in any guidelines related to Illinois content as we are a company based in the state. Also, when do you expect to have the FTA and/or IDOT funding and therefore their requirements to be clarified? |
| A6   | There are no requirements at this time beyond what is stated in the Request for Proposal. |
| Q7   | Does Metra want to keep ownership of the cars? |
| A7   | Yes. Metra wants to keep ownership of the cars. |
| Q8   | Does Metra want an off-balance sheet financing or does Metra accept to consolidate it in its books? |
| A8   | Metra does not require off-balance sheet funding. |
| Q9   | Does Metra want the full value of the cars to be amortized through the financing or should we consider a residual value at the end of the 20 years? |
| A9   | Metra wants the full value of the cars to be amortized. |
| Q10  | Can Metra share with us its 2018 audited financial statements? |
| A10  | These will be posted on Metra’s website when available. |
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I. TITLE/DESCRIPTION OF WORK

The Commuter Rail Board of the Regional Transportation Authority and its operating entity, the Northeast Illinois Regional Commuter Railroad Corporation (“Metra”) issues this request for proposals (“RFP”) as a joint procurement with the Northern Virginia Transportation Commission (NVTC) and the Potomac and Rappahannock Transportation Commission (PRTC), together the owners and operators of the Virginia Railway Express (“VRE”) for New Push-Pull Commuter Rail Cars, as further defined in Technical Specifications, Specification No. M-18-011. This RFP seeks to identify firms that can provide a maximum of 469 push-pull commuter rail cars (“cars”), up to 400 cars for Metra (Lead Agency) and up to 69 cars for VRE, to be available in three configurations: cab with toilet, trailer with toilet, and trailer without toilet, along with spare parts, accessories, equipment, training and services. Each agency (Metra and VRE) anticipates awarding its own individual fixed price contract with economic price adjustment (FP-EPA), in accordance with the terms, conditions, and guidelines set forth herein.

Contract would be for firm, fixed pricing for units ordered in year one (first 12 month period) of the contract and a price adjustment index, found in General Conditions, Section 1, Item 2.8, Price Schedule, for units ordered in years two though five (second through fifth 12 month periods). Metra intends to order a minimum quantity of 200 cars in year one. The remaining 200 cars will be ordered, at Metra’s option, any time between years 1 through 5, in quantities of no fewer than ten (10) per order. VRE intends to order a minimum quantity of 21 cars in year one. The remaining 48 cars will be ordered, at VRE’s option, any time between years 1 through 5, in quantities of no fewer than four (4) per order. Metra and VRE will only consider newly manufactured cars created with new and unused manufactured components, sub-components, and spare parts. Metra and VRE will not consider re-manufactured or re-conditioned cars, spare parts, components or sub-components.

II. CONTACT INFORMATION

All correspondence, communication, or contact in regard to any aspect of this RFP shall be directed to the individual listed below or his/her designated representative, if applicable.

Name: Joseph Onesto
Address: 547 W. Jackson Blvd. Chicago, IL 60661
Phone Number: 312-322-6659
E-mail: jonesto@metrarr.com

Prospective proposers and their representatives shall not make any contact with or communicate with any Metra or VRE Board Member, Metra’s and VRE’s employees or consultants, other than the designated contact person, in regard to any aspect of this RFP.
III. PRE-PROPOSAL MEETING INFORMATION

A pre-proposal meeting will be held over a period of two days at the dates and times specified below and in IV, Proposed Schedule for the Procurement. Attendance is encouraged but is not mandatory. The meetings will begin promptly at the stated times. Metra requests notification to the above email address the number of persons planning to attend.

Day one of the pre-proposal meeting will begin at 9:00 A.M. on Wednesday, April 24, 2019 at Metra’s headquarters at 547 W. Jackson Blvd., Chicago, IL 60661, on the 2nd Floor. Following this meeting at approximately 10:30 A.M will be a visit to Chicago Union Station, located at the northeast corner of West Jackson Boulevard and South Clinton Streets. Participants will assemble in the Great Hall. At 1:00 P.M., participants will meet at the BNSF Shop located at 432 West 14th Street, Chicago, IL 60607. Personal Protection Equipment (PPE) as specified below will be required for this part of the meeting. Day two of the pre-proposal meeting will be held at 6:30 A.M. on Thursday, April 25, 2019 at the BNSF Hill Yard, located at 525 North Broadway, Aurora, IL 60505. At approximately 8:00 A.M. the participants will meet at the Route 59 Station, located at 1090 North Route 59, Aurora, IL 60504.

A site visit to VRE’s Broad Run Maintenance and Storage Facility, located at 10637 Piper Lane, Bristow, VA 20136, will be held on Tuesday, July 9, 2019 at 1:00 P.M. Eastern Time. Attendance at the site visit is encouraged but is not mandatory. Notification of persons planning to attend is requested to: jonesto@metrarail.com. VRE will provide high visibility lime green safety vests. Participants shall be responsible for providing all other PPE as specified below.

ALL ATTENDEES ARE REQUIRED TO WEAR A HARD HAT, SAFETY VEST (CLASS II WITH REFLECTIVE STRIPING), SAFETY GLASSES (SIDE SHIELDS FOR PRESCRIPTION EYEWEAR), AND STEEL OR SIMILAR SAFETY TOE BOOTS ON THE DAY OF THE VRE SITE VISIT.

Prospective proposers are requested to submit written questions to the designated contact person identified in II. Contact Information, in advance of the pre-proposal meeting. Prospective proposers are reminded that any changes to the RFP will be by written addenda only, and that nothing stated at the pre-proposal meeting shall change or qualify in any way any of the provisions in the RFP and will not be binding to Metra.

IV. PROPOSED SCHEDULE FOR THE PROCUREMENT

The anticipated schedule for this procurement is outlined below for guidance. Metra reserves the right to modify the procurement schedule as circumstances may warrant. Modifications made after the RFP due date may not be provided via addenda or other notification.
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V. QUESTIONS, CLARIFICATIONS AND OMISSIONS

Prospective proposers may request, in writing, a clarification or interpretation of any aspect of the RFP, a change to any requirement of the RFP, or any addenda to the RFP up until the time specified in IV Proposed Schedule for the Procurement. Such written requests shall be made to the contact person. The prospective proposer making the request shall be responsible for its proper delivery to
Metra, as identified above, on the form “Pre-proposal Request for Change or Approved Equal” (RFA) provided in Exhibit I.

Any request for a change to any requirement of the RFP must be fully supported with other pertinent information showing evidence that the change will result in a condition equal to or better than that required by the RFP, without substantial increase in cost or time requirements.

If it should appear to a prospective proposer that any of the matters relating to the RFP or Contract are not sufficiently described or explained in the RFP or Contract Documents, or that any conflict or discrepancy exists between different parts of the RFP, Contract or any federal, state, local or Metra law, ordinance, rule, regulation or other standard or requirement, the prospective proposer shall submit a written request for clarification to Metra on or before the date and time specified in IV. Proposed Schedule for the Procurement.

All RFA questions and responses will be provided to all prospective proposers. Any response that is not confirmed by a written addendum shall not be official or binding on Metra.

VI. ADDENDA TO THE RFP

Metra reserves the right to amend the RFP at any time in accordance with IV. Proposed Schedule for the Procurement. Any amendments to or interpretations of the RFP will be described in written addenda. Notification of the addenda will be distributed to all such prospective proposers officially known to have received the RFP. Failure of any prospective proposer to receive the notification of addenda shall not relieve the proposer from any obligation under the RFP as clarified, interpreted, or modified. All addenda issued shall become part of the RFP. Prospective proposers shall acknowledge the receipt of each individual addendum in their proposals on the Proposal Form provided in Exhibit II. Failure to acknowledge in their proposals receipt of addenda may at Metra’s sole option disqualify the Proposal.

VII. PROPOSAL DUE DATE AND SUBMITTAL INSTRUCTIONS

Proposals must be received by the date and time specified in IV. Proposed Schedule for the Procurement.

Proposals shall be submitted to the following address:

Metra Attn: Materials Management Department, 11-E
547 W. Jackson Blvd.
Chicago, IL 60661

Envelopes or boxes containing proposals shall be clearly labeled with Metra’s RFP number and title.

RFP No. 37383- New Push-Pull Commuter Rail Cars
A proposal is deemed to be late if it is received by Metra after the deadline. Proposals received after the submission deadline may be rejected.

Detailed submittal requirements are provided in XVI. Preparation of Proposals.

VIII. VALIDITY OF PROPOSALS

Proposals and subsequent offers shall be valid for a period of 270 days from the proposal due date specified in IV. Proposed Schedule for the Procurement, as amended.

IX. FREEDOM OF INFORMATION ACT NOTICE

IX.1 GENERALLY

Metra is subject to the requirements of the Illinois Freedom of Information Act, 5 ILCS 140/7(1)(g) et seq. (“FOIA”), which enables the public to request and obtain records from Metra. FOIA requires, upon request, the public disclosure of any non-exempt information in proposals, contracts, invoices or payment records (among other records). See Section 7 and 7.5 of FOIA, 5 ILCS 140/7 and 7.5, for the available FOIA exemptions.

Please note that proposals become the property of Metra when submitted and cannot be returned. All proposals and any subsequent contract (including any later amendments thereto) will be subject to public disclosure under FOIA upon request after the successful proposer and Metra have executed a written contract. To the extent that proposer provides records to Metra that contain information exempt from public disclosure under FOIA, such as proprietary trade secrets or confidential commercial or financial information (see Section 7(1)(g) of FOIA, 5 ILCS 140/7(1)(g)), proposer must clearly identify and mark this information in the records and place it in the appropriate package described in these instructions.

Any proposals submitted to Metra in connection with this procurement that are not clearly marked, identified, and included in the appropriate package may be released by Metra with no further notice to proposer.

Proposer is solely responsible for the marking and identification of proposer’s proprietary, privileged, or confidential information, as well as placement within the appropriate package in the proposal before it is submitted to Metra. For purposes of this provision, all information provided by proposer in a proposal is considered by Metra to be proposer’s information, even if the information relates to one or more of proposer’s proposed subcontractors. Proposer is solely responsible for marking and identifying any proprietary, privileged, or confidential information, as well as placement within the appropriate package, of proposer’s subcontractors contained in proposer’s proposal before the proposals are submitted to Metra. Proposer will be required to indemnify, defend, and hold harmless Metra for any damages, costs, liabilities, and fees (including attorney’s fees) that result from the public disclosure by Metra of information from proposer that is not marked and identified by proposer as proprietary, privileged, or confidential and placed within the appropriate package at the time that the proposer submits its proposal of interest and qualifications to Metra.
IX.2 METRA FOIA REQUEST PROCEDURES

In the event that a FOIA request is made for records that contain information packaged and marked as “proprietary,” “privileged,” or “confidential,” Metra will notify the proposer of the request and will allow proposer an opportunity to review the records requested under FOIA so that proposer can confirm that all marked and identified proprietary, privileged, or confidential information has been removed. Before allowing information that proposer has identified and marked as “proprietary,” “privileged,” or “confidential” to be redacted from a proposal (or other record), Metra may require proposer to provide Metra with additional information regarding the materials marked and identified for redaction. Metra will not allow the redaction of any information that does not meet the statutory FOIA exemptions, thus redactions must be narrowly tailored to the statutory exemptions referenced above.

Once proposer has reviewed a particular proposal or contract and has confirmed that all proprietary, privilege, and confidential information has been removed, Metra will provide proposer with a redacted copy of the proposal or contract that will be publicly disclosed by Metra in connection with any pending or future FOIA requests and Metra will provide no further notice to proposer when that particular record is requested or publicly disclosed pursuant to a FOIA request. This redacted copy of the proposal or contract may also be published in whole or in part on Metra’s website or in any other format by Metra without further notice to the proposer.

Please note that proposer may also be required to provide Metra with additional information regarding information redacted from records if any proceeding arises that requires Metra to defend the non-disclosure of the information that proposer has marked and identified as “proprietary,” “privileged,” or “confidential.”

Please also note that, if proposer receives a contract in connection with this procurement, “public records” as defined in Section 2 of FOIA that are in proposer’s possession or control as a result of the contract may be requested under FOIA and the non-exempt portions of those records may be subject to public disclosure under FOIA. See 5 ILCS 140/2 and 7(2). Metra will notify proposer of any FOIA request that will require proposer to review and compile records in its possession or control.

Upon receiving notice from Metra that a FOIA request has been made for proposer’s proposal, contract, or other records provided to Metra or in proposer’s possession or control, proposer must produce and complete the review of all records requested pursuant to FOIA within two (2) business days or other time frame indicated in Metra’s notice to proposer. See 5 ILCS 140/3(d) and 3.1 for the statutory deadlines applicable to non-commercial and commercial FOIA requests. If proposer will require additional time to produce and review the records being requested, proposer must notify Metra immediately and provide Metra an explanation for the delay and the date when Metra can anticipate the records or the completion of proposer’s review.

If proposer fails to timely comply with any request by Metra to produce or review records necessary for Metra’s compliance with FOIA and proposer’s non-compliance results in any adverse consequences to Metra, including but not limited to, fines or penalties being imposed on Metra, proposer’s non-compliance will be an event of default on the underlying contract, if any,
and will further be deemed as a loss covered by any such underlying contract’s indemnification provisions.

IX.3 COMMONWEALTH OF VIRGINIA FOIA

The Virginia Freedom of Information Act, §2.2-3700 *et seq.* shall also govern the release of public records related to this procurement. Trade secrets or proprietary information related to a procurement may not be subject to public disclosure, provided the requirements of §2.2-4342F VA Code Ann. are met.

Trade secrets or proprietary information submitted by a proposer in connection with a procurement transaction submitted pursuant to Code of Virginia, subsection B of §2.2-4317 shall not be subject to the Virginia Freedom of Information Act (§ 2.2-3700 *et seq.*).

However, the proposer shall:

1. Invoke the protections of this section prior to or upon submission of the data or other materials;
2. Identify the data or other materials to be protected by clearly marking each individual page with “PROPRIETARY”; and
3. State the reasons why protection is necessary.

Except for the foregoing limitation, VRE may duplicate, use, and disclose in any matter and for any purpose whatsoever and have others do so, all data furnished in response to this RFP. VRE has the right to release trade secrets or proprietary information to a third party which may assist VRE in the review and evaluation of proposals.

X. CONFLICT OF INTEREST; GRATUITIES

Proposers are prohibited from engaging in any practice that may be considered as a conflict of interest under Metra’s and VRE’s policies and/or state law, and to refrain from receiving and/or participating in any gifts, favors, or other forms of compensation that may be viewed as a gratuity in accordance with existing policies and laws.

XI. IDENTIFICATION OF SOURCE FUNDING

Financial support of this project is provided through financial assistance grants from the Federal Transit Administration (FTA), State of Illinois, Commonwealth of Virginia, Virginia Department of Rail and Public Transportation (DRPT), Metra, and VRE.
XII. DBE REQUIREMENTS

Metra and VRE solicit and encourage disadvantaged business enterprise (DBE) participation as a prime Contractor, joint venture partner, and/or as a Subcontractor for the project. DBEs will be afforded full consideration and will not be subject to discrimination. All respondents will be required to comply with Metra’s and VRE’s DBE program.

In addition, this procurement is subject to the provision of 49 CFR 26.49. Accordingly, proposers are required to submit the Transit Vehicle Manufacturers (TVM) certification found in Exhibit III.

XIII. BUY AMERICA CERTIFICATION

This Contract is subject to the “Buy America” requirements of 49 U.S.C. §5323(j) and 49 CFR Part 661, as may be amended from time to time, and applicable federal regulations. Prospective proposers’ attention is directed to 49 CFR §661.11, “Rolling Stock Procurements.” Prospective proposers have the responsibility to comply with cited and any governing statutes and regulations, including official interpretations.

A proposer shall submit to Metra the appropriate Buy America certifications, included in Exhibit VI, with all offers on FTA-funded contracts. Proposals that are not accompanied by properly completed Buy America certifications are subject to the provisions of 49 CFR 661.13 and will be rejected as nonresponsive.

The two signature blocks on the Buy America certificates are mutually exclusive. Proposers shall sign only one signature block on each certificate. Signing both signature blocks will make the proposal nonresponsive. A false certification is a criminal act in violation of 18 USC §1001.

A proposer who has submitted incomplete Buy America certificates or incorrect certificates of noncompliance through inadvertent or clerical error (but not including failure to sign the certificate, submission of certificates of both compliance and noncompliance, or failure to submit any certification), may submit to the FTA Chief Counsel within ten (10) days of proposal opening a written explanation of the circumstances surrounding the submission of the incomplete or incorrect certification in accordance with 28 USC §1746, sworn under penalty of perjury, stating that the submission resulted from inadvertent or clerical error. The proposer will also submit evidence of intent, such as information about the origin of the product, invoices, or other working documents. The proposer will simultaneously send a copy of this information to Metra.

The FTA Chief Counsel may request additional information from the proposer, if necessary. Metra and VRE may not make Contract award until the FTA Chief Counsel issues his or her determination, except as provided in 49 CFR Part 661.15(m).

Certification based on ignorance of proper application of the Buy America requirements is not an inadvertent or clerical error.

A waiver from the Buy America provisions will be sought from the FTA by Metra, for the proposed awardee, if the grounds for a waiver exist. All proposers seeking a waiver must submit to Metra a
timely request in writing, which shall include the facts and justification to support the granting of the waiver. Such waiver from the Buy America provisions may be granted if the FTA determines the following:

Their application would be inconsistent with the public interest;

Materials are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

Inclusion of domestic material will increase the cost of the overall Contract by more than 25 percent.

Any party may petition the FTA to investigate a successful proposer’s compliance with the Buy America certification. The procedures are set out in 49 CFR Part 661.15. If the FTA determines the evidence indicates noncompliance, the FTA will require Metra to initiate an investigation. The successful Proposer has the burden of proof to establish compliance with its certification. If the successful Proposer fails to so demonstrate compliance, then the successful Proposer will be required to substitute sufficient domestic materials without revision of the original Contract terms. Failure to do so will be a breach of the Contract and may lead to the initiation of debarment proceedings under 49 CFR Part 29.

XIV. CONDITIONS, EXCEPTIONS, LIMITATIONS, OR DEVIATIONS

Prospective proposers are cautioned to limit exceptions, conditions, limitations, or deviations (Proposal Deviation) to the provisions of this RFP, as they may be determined to be so fundamental as to cause rejection of the proposal for not responding to the requirements of the RFP.

Any and all Proposal Deviations must be explicitly, fully, and separately stated in the proposal by completing Exhibit IV, Metra Proposal Deviation Form, setting forth at a minimum the specific reasons for each Proposal Deviation so that it can be fully considered and, if appropriate, evaluated by Metra. All Proposal Deviations will be evaluated in accordance with the appropriate evaluation criteria and procedures and may result in the proposer receiving a less favorable evaluation than without the Proposal Deviation.

A Proposer may propose any equipment, material, article or process that, in its opinion, is equal to that designated and not otherwise specifically prohibited. All Proposal Deviations shall clearly and completely specify how the deviation meets or exceeds the required fit and/or function described in the Technical Specifications, and/or how the deviation is equal to or superior to that described in the Technical Specifications.

The Proposal Deviation Form must be included in the applicable proposal package, depending on which sections of the RFP are affected. If the deviation affects multiple packages of the proposal, a Proposal Deviation Form must be included in each package it applies to.

All accepted proposal deviations will become a part of the Special Conditions in the resulting executed Contract.
XV. PROTEST PROCEDURES

All protests must be in writing, stating the name and address of a protestor, a contact person, RFP number and title. Protests shall specify in detail the grounds of the protest and the facts supporting the protest. For a complete copy of Metra’s protest procedures, please contact the person specified in II. Contact Information.

XVI. PREPARATION OF PROPOSALS

XVI.1 PROPOSAL FORMAT

Proposals shall be submitted in four separately sealed packages identified below. Each package shall be marked as specified below and shall contain all the proposal documents relevant to the package as marked. These same requirements shall apply to any Best and Final Offers (BAFOs) that may be requested.

Proposers shall submit one original (marked clearly as such), six hard copies, and two CDs/USBs, each containing an electronic Portable Document Format (PDF) copy of the proposal to Metra. In case of any discrepancies, the original will be considered by Metra in evaluating the proposal, and the electronic version is provided for Metra’s administrative convenience only.

The hard-copy proposals shall be prepared double-sided on 8½ × 11 in. paper in at least 11-point font. The hard copies shall be contained in three-ring binders, the contents of which are identified on the outside. Elaborate formatting is not necessary. Use of 11 × 17 in. foldout sheets for large tables, charts, or diagrams is permissible but should be limited. No restriction on drawing page size. Do not provide promotional or advertising information, unless this information is requested and/or is necessary to support the technical submittal.

Proposals shall be comprised of four packages, and submitted and ordered in the appropriate sections as outlined below:

Package 1: Eligibility and Certification Requirements Package
1. Transmittal Letter: Cover letter providing an executive summary of the proposal and table/list of contents contained in the proposal
2. Proposal Form (Exhibit II)
3. Proposal Deviation Form (Exhibit IV), if applicable
4. Pre-Award Evaluation Data Form (Exhibit V)
5. Buy America Certifications (Metra and VRE) (Exhibit VI)
6. Transit Vehicle Manufacturers (TVM) Certification (Exhibit III)
7. Debarment and Suspension Certification, Prospective Contractor (Exhibit VI)
8. Debarment and Suspension Certification, Subcontractor(s) (Exhibit VI)
9. Non-Collusion Affidavit (Exhibit VI)
10. Anti-Lobbying Certification (Exhibit VI)
11. DBE Approval Certification
12. Certification of Authority to Transact Business in the Commonwealth of Virginia
13. Upon request, proposers must provide a copy of the three most recent annual financial statements audited by an independent third party. Proposers must provide the requested information within 10 days from the date of request.
14. Letter indicating the proposer’s ability to obtain the insurance coverage in accordance with the RFP requirements
15. Letter indicating the proposer’s ability to obtain a 100% Performance and Payment Bond (Form AIA 311)

Package 2: Technical Proposal Package Requirements
1. Proposal Deviation Form (Exhibit IV), if applicable
2. Technical Proposal
   a. Section 1: Compliance with Specification (Metra Specification M-18-011), Technical Elements
      Order of importance of Technical Elements is below:
      • Seating Capacity (PDRL P-3-03)
      • Passenger Flow (PDRL P-3-04)
      • Audible Noise Proposal (PDRL P-17-01)
      • Car Level Monitoring System (PDRL P-11-02)
      • Infotainment Proposal (PDRL P-12-02)
      • Carbody Interior (PDRL P-8-01)
      • Door System (PDRL P-7-01)
      • HVAC System (PDRL P-9-01)
      • Ride Quality Simulation (PDRL P-14-02)
      • Car Weight (PDRL-P-3-05)
      • Accessibility (ADA) Provisions (PDRL P-8-02)
      • Electrical System and Load Study (PDRL P-11-01)
      • Functionality and Onboard Equipment of Complete Communication System (PDRL-P-12-01)
      • Lighting Plan and Description (PDRL P-10-01)
      • Exterior General Arrangement and Rendering (PDRL P-4-01)
      • Braking System (PDRL P-13-02)
      • Braking Performance Calculation (PDRL P-13-02)
      • Truck System (PDRL P-14-01)
      • LLEPM (PDRL P-10-02)
      • Car Height (PDRL P-3-01) Pass/Fail
      • Car Width (PDRL P-3-02) Pass/Fail
   
   b. Section 2: Firm Qualifications & Experience, Key Personnel Qualifications & Experience, Proposed Staffing Plan
      i. Documentation detailing recent examples of firms experience similar to Metra’s project and operating in North America. Each example should include:
1. Name of purchasing agency
2. Contact person/reference
   a. Name
   b. Title
   c. Email
   d. Phone Number
3. Size of Project
4. Scope of Project
5. Identification of differences from Metra scope
6. Contract schedule of performance vs. actual schedule of performance
7. Number of units manufactured and/or remanufactured
8. Type/Model numbers of units provided
9. Reliability statistics of rail cars provided in identified project

ii. Detailed staffing plan which includes:
   1. Program organization chart including definitions of each function
   2. Authority, decision making responsibilities, placement, and reporting structure of all key program personnel including Program Manager, key suppliers/subcontractors who will interface regularly with proposer
   3. Commitment level/% of time each proposed staff will be dedicated to Metra project

iii. Resumes of all key personnel listed on the organization chart including supplier/subcontractor personnel to include:
   1. Corporate title and affiliation
   2. Program title
   3. Number of years of relevant experience
   4. Number of years with firm
   5. Relevant education/training/certifications

c. **Section 3: Manufacturing/Remanufacturing Capabilities**
   i. Comprehensive description of its capability to complete the work to include:
      1. Current workload and backlog
      2. Proposed Business Continuity Plan in event of business interruption
   ii. Proposed location of where work will be performed to include:
      1. Size of facility
      2. Manufacturing equipment, resources, and capability
      3. Quality Control processes and procedures
      4. Number of years at facility
   iii. Quality Assurance plan
1. Ratio of inspection to production personnel
2. Total number of QA personnel assigned to Metra project
d. **Section 4: Production & Delivery Schedule**
   i. Detailed delivery schedule for Metra’s base order
   ii. Detailed delivery schedule for VRE’s base order
   iii. Delivery schedule for Metra’s option purchases, number of days after receipt of order/exercised option
   iv. Delivery schedule for VRE’s option purchases, number of days after receipt of order/exercised option
e. **Section 5: Warranty & Field Support**
   i. Detailed standard warranty policies & procedures
   ii. Proposed field service support
      1. Field Support Documentation Plan
      2. Field support practices
      3. Availability and quantities of major components and spare parts proposer plans to stock during warranty period
      4. Local availability of proposed personnel during warranty period
f. **Section 6: Training**
   i. Detailed training plan & approach
      1. Identify training requirement from both operational and maintenance standpoint
      2. Identify training requirement for any and all new technology which differs from Metra’s current equipment configurations
   ii. Sample training materials
   iii. Number of staff proposed for training and resumes of proposed training staff to include:
      1. Corporate title and affiliation
      2. Program title
      3. Number of years of relevant experience
      4. Number of years with firm
      5. Relevant education/training/certifications
g. **Section 7: Detailed Statement of Work/Car Specification (to be incorporated into Section 4 of the resulting Contract)**

**Package 3: Price Proposal Requirements**
Each price proposal shall be on the prescribed proposal form(s) and shall be for the entire Contract, including all proposal items.

1. Price Proposal (Special Conditions, Contract Section 2.7)
2. Form for Proposal Deviation, if applicable
The proposer is required to complete and execute Metra’s Price Proposal. The Contractor shall be liable for payment of all local taxes and should include these amounts in its price proposal.

**Package 4: Proprietary/Confidential Information Package Requirements**

Proposer is directed to collect and submit any information it deems to be proprietary or confidential in nature in a separate marked and sealed package. Any information that is provided in Package 4 that was requested as part of Packages 1, 2, or 3 should include a reference in the package of which it was requested, that the information was deemed to be proprietary/confidential and as such omitted from the requested package and provided in Package 4. If there is no confidential information, then the proposer should include a statement to that effect. Subject package shall be submitted in accordance with the terms and conditions governing the submittal of proposer’s proposal to this RFP. Blanket-type identification by designating whole pages or sections as containing proprietary information, trade secrets, or confidential commercial and financial information will not ensure confidentiality. The specific proprietary information, trade secrets, or confidential commercial and financial information must be clearly identified as such.

The Proposer is advised that Metra is a public agency and as such may be subject to certain state and/or local public records act provisions regarding the release of information concerning this RFP. If a request is received by Metra for the release of Proposer’s proprietary/confidential information, then the subject request will be referred to the Proposer for review and consideration. If Proposer declares the information proprietary/confidential and requests that it be withheld and Metra agrees to withhold the information, then the Proposer shall indemnify, defend, and hold Metra harmless from any legal action arising from such a declaration.

**XVI.2 SIGNING OF PROPOSAL FORMS**

Proposals shall include firm name (in the event the proposer is a joint venture, the names of the individual firms comprising the joint venture); business address; and the name, title, and business address of the responsible individual(s) with their telephone, e-mail, and address, who may be contacted during the proposal evaluation period. The proposer shall submit with its proposal a copy of the joint venture agreement. Proposals shall be signed by an official authorized to bind the proposer.

**XVI.3 MODIFICATION OR WITHDRAWAL OF PROPOSALS**

A modification of a proposal already received will be accepted by Metra only if the modification is received prior to the proposal due date, is specifically requested by Metra, or is made with a requested BAFO. All modifications shall be made in writing and executed and submitted in the same form and manner as the original proposal.

A proposer may withdraw a proposal already received prior to the proposal due date by submitting to Metra, in the same manner as the original proposal, a written request for withdrawal executed by the proposer’s authorized representative. The withdrawal of a proposal does not prejudice the right of a proposer to submit another proposal within the time set for receipt of proposals.
XVI.4 OWNERSHIP AND COST OF PROPOSAL DEVELOPMENT

All proposals will become property of Metra.

This RFP does not commit Metra or VRE to enter into a Contract, to pay any costs incurred in the preparation or presentation of a proposal, nor to procure or contract for the equipment.

XVII. PROPOSAL EVALUATION AND SELECTION PROCESS

XVII.1 GENERAL

This is a competitive negotiated procurement of which Metra may or may not conduct discussions with proposers. If Metra determines discussions are necessary prior to award, Metra will open discussions with proposers who are within the competitive range. Metra reserves the right to award without discussions, negotiations, or any request for BAFO. Therefore, initial proposals should be submitted on the most favorable terms the Proposer can submit to Metra.

Proposals will first be evaluated for responsiveness to the submittal requirements within this RFP as further discussed in XVII.4 Review of Proposals for Responsiveness and Proposer for Responsibility. Proposals that do not evidence compliance may not be considered beyond the preliminary review. Proposals found to be responsive will then be evaluated to determine those proposals that represent acceptable offers that are technically responsive to the requirements of the RFP.

The responsibility of the proposer will also be evaluated. In order to qualify as a responsible proposer and to be eligible for award, in addition to other requirements herein provided, a proposer must be prepared to prove to the satisfaction of Metra that it has the integrity, skill, and experience to faithfully and successfully perform the Contract and that it has the necessary facilities and financial resources to perform the work in a satisfactory manner and within the time specified.

Finally, a determination will be made to identify which proposals are within a competitive range, if the competitive range process is used. Proposers not within the competitive range will be notified that its proposal is no longer being considered for award. Discussions and negotiations may then be carried out with only and all proposers within the competitive range. BAFOs may be requested from all within the competitive range.

Metra will award to the responsible proposer whose proposal is most advantageous and provides the best value to Metra. Accordingly, Metra may not necessarily award to the proposer with the highest technical ranking, nor to the proposer with the lowest price proposal, if doing so would not be in the overall best interest of the agency.

XVII.2 CONFIDENTIALITY OF PROPOSALS

Proposals will not be publically opened. All proposals and evaluations will be kept strictly confidential throughout the evaluation, negotiation, and selection process, except as
otherwise required by applicable law. Only the members of the selection committee, evaluation team, and other Metra and VRE officials, employees, and agents that Metra and VRE deem to have a legitimate interest will be provided access to the proposals and evaluation results during this period.

**XVII.3 EVALUATION COMMITTEE**

An evaluation committee, which may include officers, employees, and agents of Metra and VRE, will be established. The evaluation committee will carry out the detailed evaluations, including establishing the competitive range (if applicable), carrying out negotiations, and making the selection of the proposer, if any, that may be awarded the Contract. The evaluation committee may report its recommendations and findings to the appropriate Metra individual or selection committee if one is utilized.

The selection committee shall review the evaluation committee’s findings and determine which proposal represents the most advantageous and best value to Metra. The selection committee will make a recommendation based on the evaluation criteria to the awarding authority – e.g., Board of Directors.

**XVII.4 REVIEW OF PROPOSALS FOR RESPONSIVENESS AND PROPOSER FOR RESPONSIBILITY**

Each proposal will be reviewed to determine if the proposal is responsive to the submission requirements outlined in this RFP and if the proposer is responsible.

A responsive proposal is one that follows the material requirements of this RFP, includes all documentation, is submitted in the format outlined in this RFP, is of timely submission, and has the appropriate signatures as required on each document. Failure to comply with these requirements may result in the proposal being deemed nonresponsive.

A responsible proposer is one that demonstrates the capability to satisfy the commercial and technical requirements set forth in this RFP. A proposer’s failure to demonstrate that it is responsible may result in the proposal being rejected.

Any proposal found to be nonresponsive or any proposer that is found to be not responsible will not be considered further for award. Proposals that do not comply with the RFP instructions and requirements or do not include the required information may be rejected as insufficient and may not be further considered. Metra will provide written notification to proposers if their proposal has been deemed non-responsive. Metra reserves the right to waive minor informalities or irregularities in the proposals received and reserves the right to request a proposer to provide additional information and/or to clarify information.

**XVII.5 PROPOSAL EVALUATIONS AND SELECTION PROCESS**

The following describes the general process by which proposals will be evaluated and a selection made for a potential award. Any such selection of a proposal shall be made by consideration of only the criteria set forth below in this section.

RFP Section XVII.5.1, Minimum Qualifications and Responsibility Requirements, specifies the minimum qualifications (pass/fail) and the requirements for determining
responsible proposers, all of which must be met by a proposer to be found qualified. Final determination of a proposer’s qualification will be made based upon all information received during the evaluation process and as a condition for award. Any proposal that does not meet these minimum qualifications criteria, and responsibility requirements will be eliminated from further evaluation.

RFP Section XVII.5.2, Evaluation Criteria, contains all the evaluation criteria, and their relative order of importance, by which a proposal from a qualified proposer will be considered for selection. An award, if made, will be to a responsible proposer for a proposal that is found to be in the best interest of Metra, based on the evaluation criteria considered. The procedures to be followed for these evaluations are provided in herein.

XVII.5.1 Minimum Qualifications and Responsibility Requirements
1. Demonstrated successful experience in the construction of new, or in the remanufacturing of, push-pull commuter rail cars.
2. Demonstrated capability, facilities, and personnel, to satisfactorily complete the specified work.
3. Evidence of sufficient financial strength, resources, and capability to finance the work to be performed and to complete the Contract in a manner satisfactory to Metra.
4. Ability to secure financial guarantees, if required, as evidenced by a letter of commitment from an underwriter, surety, or other guarantor confirming that the Proposer can meet and provide the required guarantee.
5. Ability to obtain required insurance with coverage values that meet minimum requirements, evidenced by a letter from an underwriter confirming that the Proposer can be insured for the required amount.
6. Evidence of sufficient human and physical resources to complete the Contract.
7. Evidence of satisfactory performance and integrity on contracts. Evidence shall be by client references.

XVII.5.2 Evaluation Criteria
The following are the complete criteria by which proposals from responsible proposers will be evaluated and ranked for the purposes of determining any competitive range and to make any selection of a proposal for a potential award.

Any exceptions, conditions, reservations or understandings explicitly, fully, and separately stated on the Proposal Deviation Form, which do not cause Metra to consider a proposal to be outside the competitive range, will be evaluated according to the respective evaluation criteria and sub-criteria that they affect.

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
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<tbody>
<tr>
<td>Technical Proposal</td>
<td>70%</td>
</tr>
<tr>
<td>Price Proposal</td>
<td>30%</td>
</tr>
</tbody>
</table>

These criteria are further detailed below.

Technical Proposal
The Technical Proposal will be evaluated based upon the required information identified in the Technical Specifications, to be supplied by the proposer as set forth below.

1. **Compliance with Metra Specification**

2. **Firm Qualifications & Experience, Key Personnel Qualifications & Experience, Proposed Staffing Plan**
   a. Firm’s years of experience with projects of similar or larger scope
   b. Firm’s number of projects of similar or larger scope and size
   c. Key Personnel years of experience with projects of similar or larger scope
   d. Education, training, certifications of key personnel

3. **Manufacturing/Remanufacturing Capabilities & Resources**
   a. Size of Firm’s current facility
   b. Manufacturing capabilities
   c. Quality Control processes
   d. Number of years at current facility
   e. Qualifications of Key Personnel
   f. Quality Assurance Plan
   g. Field Support Documentation Plan
   h. Availability of technical personnel

4. **Production and Delivery Schedule**
   a. Delivery/Acceptance of 1st commuter rail car within 36 months after Notice to Proceed
   b. Fulfillment of base order within 48 months after Notice to Proceed
   c. Proposed delivery schedule for option orders
   d. Proposed accelerated schedule for base and option orders

5. **Warranty & Field Support**
   a. Warranty policies and procedures, including field support for the proposed rail cars and availability of major components and spare parts
   b. Plan for stocking spare components for rail cars proposed

6. **Training**
   a. Plan and approach for training of Metra and VRE personnel to operate and maintain the proposed rail cars
   b. Qualifications of proposed training staff

**Price Proposal**

The Proposal will be evaluated based on the information submitted as part of the Price Proposal as well as the information submitted in response to M-18-011, including spare parts costs, tooling costs, and lifecycle costs to Metra and VRE.
XVII.5.3 Evaluation Procedures

All aspects of the evaluation of the proposals and any discussions/negotiations, including demonstration, correspondence and meetings, will be kept confidential during the evaluation and negotiation process, and disclosure will be subject to the regulations governing Metra.

Evaluation of Competitive Proposals

- **Qualification of responsible Proposers.** Proposals will be evaluated in accordance with requirements of set forth herein, to determine the responsibility of proposers. Any proposal from proposers whom Metra finds not to be responsible and finds cannot be made to be responsible may not be considered for the competitive range. Final determination of a proposer’s responsibility will be made upon the basis of initial information submitted in the proposal, any information submitted upon request by Metra, information submitted in a BAFO and information resulting from Metra inquiry into proposer’s references.

- **Detailed evaluation of proposals and determination of competitive range.** The Technical Proposal will be evaluated using qualitative/descriptive scoring system. The Technical Proposal will be compared with the proposal requirements, and the content against each of the requirements shall be evaluated according to the following qualitative/descriptive ratings:
  - **Exceptional (10):** The proposal significantly exceeds stated criteria in a way that is beneficial to Metra. This rating indicates a consistently outstanding level of quality with very little or no risk that this proposer would fail to meet the requirements of the RFP. There are essentially no weaknesses.
  - **Good (8):** The proposal is considered to exceed stated criteria. This rating indicates a generally better than acceptable quality with little risk that this proposer would fail to meet the requirements of the RFP. Weaknesses, if any, are very minor.
  - **Acceptable (6):** The proposal is considered to meet the stated criteria. This rating indicates an acceptable level of quality. The proposal demonstrates a reasonable probability of success. Weaknesses are minor or nonmaterial, and can be readily corrected.
  - **Marginal (4):** The proposal fails to meet stated criteria, as there are weaknesses and/or deficiencies, but the weaknesses and/or deficiencies are susceptible to correction through
discussions. The response is considered marginal in terms of the basic content and/or amount of information provided for evaluation, but overall the proposer is capable of providing an acceptable or better proposal.

- **Unacceptable (2):** The proposal contains significant weaknesses and/or deficiencies and/or unacceptable quality. The proposal fails to meet the stated criteria and/or lacks essential information and is conflicting and/or unproductive. There is no reasonable likelihood of success. Weaknesses and/or deficiencies are so major and/or extensive that a major revision to the proposal would be necessary.

**Clarifications**

After the initial evaluation, the results for all proposals will be gathered, and ranked for each of the evaluation criteria. With its initial proposal, the proposer shall ensure that it has provided accurate and complete information. If information is not complete, then Metra will either seek clarifications or declare the proposal non-responsive. Questions regarding any insufficient statements or incomplete affidavits will be sent to the proposer by Metra with a request for clarifications and/or submittal of corrected, additional, or missing documents. If a response is not provided prior to the deadline for submission of the response, then the proposal may be declared non-responsive.

Metra may waive technical irregularities in the form of the proposal that do not alter the quality or quantity of the information provided.

All requests and responses will be in writing. Responses must be submitted in accordance with the request for clarification and be limited to answering the specific information requested.

In the event an error which could affect price is discovered in the RFP during the proposal evaluation process, Metra will issue a solicitation amendment to all proposers that have submitted proposals requesting revised proposals based upon the corrected RFP.

**Communications**

Communications may be required during the proposal evaluation and selection process. The purpose of communications is to address minor or clerical errors in a proposal. During the process of evaluations, there may be instances in which meaningful evaluation
cannot take place or proceed or where an erroneous evaluation might occur without seeking additional information. In such cases, Metra will submit a request for communications in writing to the proposer stating the information needed and the procedure and a reasonable date and time by which the information must be provided. The proposer shall provide the requested information in writing in accordance with the procedure and by the date and time indicated. If communications are not received in a timely manner, then the proposer’s ratings may be adversely affected and/or the proposal may be declared non-responsive.

**Competitive Range**

Metra may determine the competitive range after a careful analysis of the technical and price proposals. The competitive range will include all proposers that have a reasonable chance of being selected. Such determination will be at Metra’s sole discretion.

The following are requirements that must be met for a proposal to be considered for the competitive range. The requirements are not listed by any particular order of importance. Any proposal that Metra determines is unable to meet these requirements will be excluded from further consideration. The requirements are as follows:

1. Proposer is initially evaluated as responsible in accordance with the requirements stated in the RFP, or as Metra finds it is reasonable that said proposal can be modified to meet the requirements. Final determination of responsibility will be made with final evaluations.
2. Proposer has followed the instructions of the RFP and included sufficient detailed information, such that the proposal can be evaluated. Any deficiencies in this regard must be determined by Metra to be either a defect that Metra will waive in accordance with the RFP, or that the proposal can be sufficiently modified to meet these requirements.
3. Proposal price would not render this procurement financially infeasible, or it is reasonable that such proposal price might be reduced to render the procurement financially feasible. Metra will carry out and document its evaluations in accordance with the criteria and procedures of this RFP. Any extreme proposal deficiencies that may render a proposal unacceptable will be documented. Metra will make
specific note of questions, issues, concerns, and areas requiring explanation by proposers and to be discussed in any meetings with proposers that Metra finds to be within the competitive range.

**Proposals Not Within the Competitive Range**
Proposers submitting proposals that have been determined by Metra to not be in the competitive range, and cannot reasonably be made to be within the competitive range, will be notified in writing in accordance with Metra procedures. Such proposals will receive no further consideration.

**Discussions with Proposers in the Competitive Range**
The proposers whose proposals are found by the Metra to be within the competitive range, or may be reasonably improved to be within the competitive range, will be notified of any questions or requests for additional information. Each such proposer may be invited for private interview(s) and discussion(s) with Metra to discuss answers to written or oral questions on any facet of the proposal.

In the event that a proposal that has been included in the competitive range contains conditions, exceptions, reservations or understandings to any Contract requirements as provided in this RFP then said conditions, exceptions, reservations or understandings may be negotiated during these meetings. However, Metra shall have the right to reject any and all such conditions and/or exceptions, and instruct the proposer to amend its proposal and remove said conditions and/or exceptions; and any proposer failing to do so may cause Metra to find the proposal to subsequently be outside the competitive range.

No information, financial or otherwise, will be provided to any proposer about any of the proposals from other proposers. Proposers will not be given a specific price or specific financial requirements that they must meet to gain further consideration, except that proposed prices may be considered to be too high with respect to the marketplace or otherwise unacceptable. Proposers will not be told of their rankings among the other Proposers.

**Site Visits**
Metra and VRE reserve the right to conduct site visits at their own cost to inspect the proposer's facilities and/or other agencies to which the proposer has supplied the same or similar product and/or service.

**Best and Final Offers (BAFOs)**
Although Metra reserves the right to issue a requests for clarifications, communications, discussions, proposal revisions and/or BAFOs, Metra is under no obligation to do so. Metra may make its selection and award based on the initial proposals submitted.

If a request for a BAFO is made, each of the proposers in the competitive range shall be afforded the following opportunity to amend its proposal and submit its BAFO. The request for BAFOs shall include the following:

- Notice that discussions/negotiations are concluded.
- Notice that this is the opportunity for submission of a BAFO.
- Identification of any revisions to the Technical Specifications or any revisions to any other aspects of the original RFP that are being made as a result of meetings with Proposers and also other considerations by Metra. For ease of administration, Metra reserves the right to reissue these documents in their entirety. Proposers shall modify their technical and/or price proposals in response to the changes identified in the request for a BAFO.
- A date and time for submission of written BAFOs, allowing a reasonable opportunity for preparation of the written BAFOs.
- Notice that if any modification to a BAFO is submitted, it must be received by the date and time specified for the receipt of BAFOs and is subject to the late submissions, modifications and withdrawals of proposals provisions of the RFP.
- Notice that if proposers do not submit a BAFO or a notice of withdrawal and another BAFO, then their immediate previous Proposal will be construed as their BAFO.

Any modifications to the initial proposals made by a proposer shall be identified in its BAFO. BAFOs will be evaluated by Metra and VRE according to the same requirements and criteria as for initial proposals as specified in this RFP. Metra will make appropriate adjustments to the initial evaluations for any sub-criteria and criteria that have been affected by any proposal modifications made by the BAFOs. These final evaluations and rankings within each criteria will again be arrayed by Metra and considered according to the relative degrees of importance of the criteria defined in this RFP.

Metra will then choose that proposal which it finds to be the most advantageous to Metra based upon the evaluation criteria. The
results of the evaluations and the selection of a proposal for any
award will be documented in a report.

XVIII. METRA RESPONSE TO PROPOSALS

XVIII.1 SINGLE PROPOSAL RESPONSE

If only one proposal is received in response to this RFP and it is found by Metra to be acceptable, then a detailed cost proposal may be requested of the single proposer. A cost analysis, possibly including an audit, may be performed by or for Metra at its expense. The cost analysis will establish if the price is fair and reasonable. The proposer has agreed to provide needed data by submitting a proposal in response to this RFP.

XVIII.2 AVAILABILITY OF FUNDS

This procurement is subject to the availability of funding. Sufficient funding to cover the maximum potential order for 469 cars is not currently available. Metra will not be obligated to any quantities which exceed the 200 car minimum. VRE will not be obligated to any quantities which exceed the 21 car minimum.

XVIII.3 AGENCY RIGHTS

Metra reserves the right to cancel the procurement in whole or in part, at Metra’s sole discretion, at any time before the Contract is fully executed and approved on behalf of Metra.

Metra reserves the right to accept or reject any or all proposals, or any parts therein, to undertake discussions with one or more proposers, and to accept that proposal or modified proposal which, in its judgment, will be most advantageous to Metra, considering price and other evaluation criteria. Metra reserves the right to determine any specific proposal that is conditional or not prepared in accordance with the instructions and requirements of this RFP to be nonresponsive. Metra reserves the right to waive any defects, or minor informalities or irregularities in any proposal that do not materially affect the proposal or prejudice other proposers.

If there is any evidence indicating that two or more proposers are in collusion to restrict competition or are otherwise engaged in anticompetitive practices, then the proposals of all such proposers shall be rejected, and such evidence may be a cause for disqualification of the participants in any future solicitations undertaken by Metra or debarment.

XVIII.4 EXECUTION OF CONTRACT

Metra and VRE shall separately deliver a written Notice of Intent to Award to the successful Proposer. The successful Proposer shall be required to execute separate contracts with Metra and VRE. Metra and VRE shall also separately issue Notice to Proceed for each order.

Within 15 calendar days after receipt of the Notice of Intent to Award the Contract to a proposer, the proposer shall provide a signed copy of the final negotiated contract, any performance security, and copies of the certificates of insurance pursuant to the Contract
Documents. In the event that proposer fails to fulfill these requirements within the specified time, Metra and VRE reserve all legal rights and remedies, including but not limited to disqualification of the proposer from this and future procurements.

Upon final approval from Metra Board of Directors, Metra will execute the Contract and issue the Notice to Proceed.

Upon final approval from VRE’s Operations Board and Parent Commissions, VRE will execute the Contract and issue Notice to Proceed. VRE’s contract with the successful Proposer shall be governed by the FTA Clauses, Special Conditions, General Conditions, Plans and Drawings, if any, and Detailed Specifications included in Sections 1 through 5 of this RFP. Any VRE requirements which differ from those of Metra are specifically identified and recited separately herein this RFP.

XIX AUTHORIZATION TO TRANSACT BUSINESS IN VIRGINIA

Proposers must be authorized to transact business in the Commonwealth of Virginia as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the Code of Virginia or as otherwise required by law. Each proposer shall include in its proposal the identification number issued to it by the Virginia State Corporation Commission (SCC). If the proposer is a joint venture which does not have a SCC identification number, then the name of the joint venture shall be provided, all members of the joint venture shall be identified by full name, and each member of the joint venture shall provide its SCC identification number or establish its exemption from such requirement.
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1 General Conditions

1.1 DEFINITIONS

The following are definitions of special terms used in this document.

Addenda/Addendum: Written modifications to the published solicitation issued by Metra.

Amendment: Any change to non-financial terms such as delivery and expiration dates, FOB terms, purchase order terms, and corrections of computer input errors.

Approved Equal or Equivalent: An item, material, or method offered as a substitute for that designated in the solicitation and/or contract documents, for which approval in writing has been obtained from Metra. The burden of proof that a substitute is in fact equal shall rest with the Contractor.

Authorized Representative: The person or firm authorized or empowered to act for, or on behalf of, the Parties in accordance with the terms of this Contract. For the Contractor, this party may be referred to as the Contractor’s Representative.

Authorized Signer: The person who is executing the Contract on behalf of the Contractor who is authorized to legally bind the Contractor.

Bid: Includes the term “offer” or “proposal” as used in the context of a procurement or sale. A submittal to Metra in response to a solicitation.

Bidder/Offeror: One who makes a bid or submits a proposal. One who offers to perform a certain contract for a specified price.

Breach: Failure to comply with any of the material terms and/or conditions of contract.

Change: Any alteration in the contract documents modifying the scope of work, price, equipment, materials, facilities, services, site, performance, schedule, other material provision of the Contract, or any term that creates a material effect on contractor’s performance of the Contract.

Change Order: A written document that alters the scope of work to be performed by the Contractor, changes the schedule of performance, increases or decreases the contract price, or increases or decreases the contract time.

Claim: A written demand or assertion by one of the contracting parties seeking, as a matter of right, the payment of money, the adjustment or interpretation of contract terms, or other relief arising under, or relating to, the Contract.

Contract: An agreement, including all exhibits and documents incorporated by attachment or reference, entered into by Metra for acquisition of supplies, services, construction, construction-related services, architectural services, engineering services, or the lease of real property.
Contract Modification: The term used for an interim action taken to extend the expiration date of a contract, or make other changes to the contract, prior to the issuance of a Change Order or Amendment.

Contract Time: The number of days, or portion thereof, allowed for completion of the Work, including all authorized time extensions. The date specified in the Notice to Proceed shall be the date on which the contract time begins, and the scheduled completion date shall be the date the Contract Time ends.

Contractor: The entity to whom the Contract is awarded.

Contractor’s Representative: The person designated by the Contractor to act on its behalf.

Cure Notice: Written notice from Metra to the Contractor to cure a default or deficiency or to correct Work performed not in conformance with the Contract.

Days: Calendar days unless otherwise indicated.

Delivery: The time when equipment and/or services are turned over and fully accepted by Metra at its designated acceptance facility.

Defect/Defective: The condition of any part of the Work that does not meet the contract document requirements; causes the good and/or service to cease operating or to operate in a degraded mode; or inflicts damage or harm on any other portion of the work, prior to Final Acceptance or during the period of any warranty.

Dispute: A disagreement between Metra and the Contractor as to the merits, amount or remedy arising out of a Claim or asserted default.

Drawings: All drawings necessary or required for the prosecution of the Work.

Effective Date: The date on which the Contract becomes fully executed by the parties’ Authorized Representatives in accordance with the terms of this Contract.

Equipment: Any and all machinery, vehicles, systems, assemblies, subassemblies, products, material fittings, devices, appliances, fixtures, apparatus, supplies and parts used by the Contractor or provided by the Contractor to Metra pursuant to, or in implementation of, the Contract.

Final Acceptance: Acceptance by Metra of all Work under the Contract, or a specified portion thereof, by the issuance of a Notice of Final Acceptance, or other appropriate document of acceptance, certifying that the Work, or portion thereof, has been fully completed in accordance with the Contract.

Final Payment: Payment made to the Contractor within 30 days of presentation of the Contractor’s final invoice and issuance of Notice of Final Acceptance by Metra.
FTA: “FTA” means Federal Transit Administration, an Agency of the Department of Transportation of the United States Government.

Government: Any federal, state or local government and any political subdivision or any governmental, quasi-governmental, judicial, public or statutory instrumentality, administrative agency, authority, body, or entity other than Metra.

IDOT: “IDOT” means Illinois Department of Transportation.

Metra: The Northeast Illinois Regional Commuter Railroad Division of the Regional Transportation Authority (RTA) (Lead Agency).

Notice of Intent to Claim: A written notice of a potential claim submitted by the Contractor to Metra within the time limits and under the circumstances specified in the Contract Documents.

Notice to Proceed (NTP): Written authorization from Metra to the Contractor that establishes the date that the Contractor is to start work and the Contract Time begins.

Notice of Termination: A written notice delivered by Metra to the Contractor terminating the Contract, either for convenience or for cause/default.

Parties: Term Contractor and Metra are sometimes collectively referred to as.

Pass-Through Warranty: A warranty provided by the Contractor but administered directly with the component supplier.

Project Manager: The individual designated by Metra or the Contractor to manage the Contract on a day-to-day basis.

Proposer: The legal entity that responds to Metra’s Request for Proposal.


Request for Proposal (RFP): The document issued by Metra and soliciting proposals with respect to the Work to be performed under the contract documents.

RTA: “RTA” means Regional Transportation Authority, a unit of local government, body politic, political subdivision and municipal corporation under the laws of the State of Illinois.

Specifications: All things described, stated, or referenced in the contract documents entitled Technical Specifications, Statement of Work, Scope of Work, or any other description of the Work.

Subcontractor: Any person, firm, partnership, corporation, or other entity, other than employees of the Contractor, that are hired or contracted for by the Contractor to perform work and/or furnish labor, or labor and materials, under the Contract.
**Sub-supplier:** Any manufacturer, company, or agency, providing components or parts to a Supplier for inclusion of work under the Contract.

**Submittal:** Any written or graphic document or sample prepared by or for the Contractor that is required by the contract documents to be submitted to Metra by the Contractor.

**Superior Warranty:** A warranty still in effect after all contractually required warranties have expired and administered directly between the Supplier and Metra.

**Supplier:** Any individual, partnership, firm, corporation, joint venture, or any combination thereof, who provides material or equipment, but not labor or services, to the Contractor and who is responsible to the Contractor by virtue of an agreement with the Contractor.

**Suspension:** A temporary stop, delay, interruption, or cessation.

**Total Contract Price:** The total amount payable to the Contractor plus the price of any options exercised, and/or Change Orders during the Contract Time.

**VRE:** The Virginia Railway Express, jointly owned and operated by the Northern Virginia Transportation Commission (NVTC) and the Potomac and Rappahannock Transportation Commission (PRTC).

**Work:** All designs, engineering, manufacturing, operations, materials, equipment, parts, and labor required to properly, timely, and to the satisfaction of Metra, provide all services and/or materials required in the Contract Documents, including all alterations, amendments, or extensions thereto made by Change Order; the successful completion of all required tests and all reliability periods; the remedy of all defects and completion of all necessary repairs and modifications resulting from the tests, the reliability periods, and warranties as required by the Contract Documents.

### 1.2 PERFORMANCE

Contractor shall provide everything necessary to complete this Contract on order and in compliance with all obligations under this Contract, including, but not limited to the following: all permits, labor, materials, manuals, training, components, tools, equipment, insurance, transportation, facilities, services, etc., necessary to furnish and deliver the equipment specified in the Contract.

### 1.3 AUTHORITIES AND LIMITATIONS

#### 1.3.1 Metra – Authorities and Limitations

This Contract is made and shall be interpreted under the laws of the State of Illinois, and Contractor, and each of Contractor’s sureties, agrees and consents that only the courts of the State of Illinois, the United States District Court for the Northern District of Illinois, the 7th Circuit Federal appellate courts, and the United States Supreme Court shall have jurisdiction over related controversies. Contractor and Contractor’s sureties irrevocably consent to jurisdiction of said courts and waive any objection based on venue or forum non conveniens.
The articles, sections, paragraphs or other headings shown are for convenience and reference only and in no way define, limit, or describe the scope or intent of this Contract.

The Contract is the entire agreement of the parties. It may not be modified or terminated orally, and no claimed modification, termination, or waiver shall be binding on Metra unless in writing signed by the Sr. Division Director, General Administration or his designee, collectively Metra’s Authorized Representative. No modification or waiver shall be deemed effected by the Contractor’s acknowledgement or confirmation containing other or different terms.

All work shall be performed under the direction of the Sr. Division Director, General Administration, or his/her designee, who alone shall have the power to bind Metra and to exercise the rights, responsibilities, authorities, and functions vested in him by the Contract. Wherever any provision in this Contract specifies an individual (such as, but not limited to, Engineer, Inspector, Site Manager, or Architect) or organization, whether Metra or private, to perform any act on behalf of or in the interests of Metra, that individual or organization shall be deemed to be Metra’s Sr. Division Director, General Administration’s Authorized Representative under this Contract, but only to the extent so specific. The Sr. Division Director, General Administration may, through written instrument, at any time during the performance of this Contract, vest in any such Authorized Representatives additional power and authority to act for him.

The Contractor shall perform the Contract in accordance with any order (including but not limited to instruction, direction, interpretation, or determination) issued by an Authorized Representative in accordance with the authority to act for Metra’s Sr. Division Director, General Administration. Contractor assumes all the risk and consequences of performing the Contract in accordance with any order (including but not limited to instruction, direction, interpretation, or determination) of anyone not authorized in writing to issue such order.

All Contract documents, conferences, letters, technical information, and drawings provided by the Contractor shall be conducted or offered solely in the English language using both the U.S. customary system of weights and measures and the Metric units of system of weights and measures. All payment shall be in United States currency.

1.3.2 VRE – Authorities and Limitations

This Contract is made and shall be interpreted under the laws of the Commonwealth of Virginia, and Contractor, and each of Contractor’s sureties, agrees and consents that any litigation with respect to this Contract shall be brought in an appropriate Circuit Court of the Commonwealth. Contractor and Contractor’s sureties irrevocably consent to jurisdiction of said courts and waive any objection based on venue or forum non conveniens.

The articles, sections, paragraphs or other headings shown are for convenience and reference only and in no way define, limit, or describe the scope or intent of this Contract.

The Contract is the entire agreement of the parties. It may not be modified or terminated orally, and no claimed modification, termination, or waiver shall be binding on VRE unless in writing signed by the VRE Contracting Officer or his/her designee. No modification or waiver shall be
deemed effected by the Contractor’s acknowledgement or confirmation containing other or different terms.

All work shall be performed under the direction of the VRE Contracting Officer, or his/her designee, who alone shall have the power to bind VRE and to exercise the rights, responsibilities, authorities, and functions vested in him/her by the Contract. Wherever any provision in this Contract specifies an individual (such as, but not limited to, Engineer, Inspector, Site Manager, or Architect) or organization, whether VRE or private, to perform any act on behalf of or in the interests of VRE, that individual or organization shall be deemed to be VRE’s Authorized Representative under this Contract, but only to the extent so specific. The VRE Contracting Officer may, through written instrument, at any time during the performance of this Contract, vest in any such Authorized Representatives additional power and authority to act for him/her.

The Contractor shall perform the Contract in accordance with any order (including but not limited to instruction, direction, interpretation, or determination) issued by an Authorized Representative of VRE. Contractor assumes all the risk and consequences of performing the Contract in accordance with any order (including but not limited to instruction, direction, interpretation, or determination) of anyone not authorized in writing to issue such order.

The Contractor, their agents and employees shall also comply with all covenants and provisions of the Virginia Department of Rail and Public Transportation (DRPT) Master Agreement for the Use of Commonwealth Transportation Funds with the Northern Virginia Transportation Commission (NVTC) dated April 24, 2012 and shall be made expressly a part of any subcontracts executed by the Contractor and shall be binding on all subcontractors, vendors, their agents and employees.

All Contract documents, conferences, letters, technical information, and drawings provided by the Contractor shall be conducted or offered solely in the English language using both the U.S. customary system of weights and measures and the Metric units of system of weights and measures. All payment shall be in United States currency.

1.4 ORDER OF PRECEDENCE

The order of precedence of the component parts of the Contract Documents, as amended, in accordance with this Contract shall be as follows:

   FTA Clauses,
   Special Conditions,
   General Conditions,
   Plans and Drawings, if any, and
   Detailed Specifications

Any issued Addenda or Change Order shall be a part of the Contract and shall take precedence over any other part of the Contract wherever they conflict. The foregoing order of precedence shall govern the interpretation of the Contract in all cases of conflict or inconsistency therein, except as may be otherwise expressly provided in other parts of the Contract.
1.5 MATERIALS AND WORKMANSHIP

1.5.1 Equipment/Supplies

The Contractor shall be responsible for all materials and workmanship for the equipment/supplies procured, whether manufactured by the Contractor, Subcontractor, or purchased from another supplier. This provision excludes any equipment leased or supplied by Metra, except insofar as such equipment is damaged by the failure of a part or component for which the Contractor is responsible, or except insofar as the damage to such equipment is caused by the Contractor during performance of the Work. Unless specifically provided for in the detailed specifications, all materials and parts furnished by the Contractor shall be new and free from defects.

1.5.2 Hazardous Material Identification and Safety Data Sheets

Hazardous material includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including any revisions adopted during the term of the contract).

The Contractor must identify any hazardous material to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Safety Data Sheet (SDS) submitted under this contract.

During performance of this Contract, the Contractor shall notify Metra in writing if the Contractor determines that any other material to be delivered under this contract is hazardous.

The Contractor agrees to submit, for each item as required, a SDS, meeting the requirements of 29 CFR 1910.1200(g) and the latest version of Federal Standard No. 313, for all hazardous material. If during performance of this contract, there is a change in the composition of the hazardous material(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate data on the SDS, the Contractor shall promptly notify Metra and resubmit the data.

1.6 CONFORMANCE WITH SPECIFICATIONS AND DRAWINGS

Materials furnished and Work performed by the Contractor shall conform to the requirements of the specifications and Contract. Notwithstanding the provision of drawings, technical specifications, or other data by Metra, the Contractor shall have the responsibility of supplying all parts and designs required to complete the Work as defined, even if such details may not be specifically mentioned in the drawings and specifications. Contractor is responsible for, and shall promptly notify Metra of, any omissions, discrepancies, or variations in the drawings and specifications. Items that are installed by Metra shall not be the responsibility of the Contractor unless they are included in the Contract (such as warranty repairs). Unless otherwise specified in the specification and/or Contract, all product(s) and material(s) shall be of new construction, new production, or manufactured new with all new sub-components. Metra will not accept refurbished, recycled, or remanufactured product(s) or material(s) as being of new construction, new production, or manufactured as new.
1.7 INSPECTION AND TESTING

1.7.1 General

Metra, VRE and the Virginia Department of Rail and Public Transportation (DRPT) shall at all times have access to the Work, the Contractor and, through the Contractor, its Subcontractors and Suppliers. The Contractor, Subcontractors, and Suppliers shall furnish every reasonable facility for ascertaining that the materials and the workmanship are in accordance with the requirements of the Contract. All Work done shall be subject to Metra’s and VRE’s inspection and approval.

The Contractor shall inspect all materials, supplies, and equipment that are to be used, or incorporated in the Work. In addition, the Contractor shall conduct a continuous program satisfactory to Metra of quality control for all Work performed under the Contract. The Contractor shall have the primary responsibility for inspecting the Work. Metra’s inspection is conducted to verify that the Contractor has performed its inspections properly. Any observation, verification, inspection, or approval of the Work by Metra shall not relieve the Contractor of any of its obligations to perform the Contract as prescribed. If, in the opinion of Metra, the Contractor fails to execute its responsibility for quality control and inspection on any part of the Work, then Metra, or its designee, may, at its option, conduct quality control and inspection activities in lieu of the Contractor at the Contractor’s expense. Such inspection shall not relieve the Contractor of its liability for defective or unsuitable Work, as described in Section 1.7.2 Non-Conforming Work.

1.7.2 Non-Conforming Work

If Metra determines that materials, equipment, or workmanship proposed for or used in the Work is non-conforming, then Metra shall have the right to reject such Work by giving the Contractor written notice that such Work is non-conforming. Metra, at its option, shall require the Contractor, within a designated time period as set forth by Metra, to either (1) promptly repair, replace, or correct all Work not performed in accordance with the Contract at no cost to Metra; or (2) provide a suitable corrective action plan at no cost to Metra for its acceptance. Once accepted by Metra, the Contractor shall implement the corrective action plan at no cost to Metra. If the corrective action plan as accepted by Metra does not remedy the defective or non-conforming Work, then the Contractor shall remain responsible for remediying the non-conforming Work to Metra’s satisfaction and at no additional cost to Metra. The Contractor shall also be responsible for repairing all property and Work damaged by the Contractor at no cost to Metra. Under no circumstances shall the Contractor be entitled to additional time or money for the correction of defective or non-conforming work, or for the repair of damaged property. Metra facilities may not be used for repair work by Contractor, unless authorized by Metra.

Metra’s inspection of the Work or right to reject non-conforming Work shall not relieve the Contractor of its full responsibility for performing the Work in full conformance with the Contract. No failure or forbearance of Metra in notifying the Contractor of non-conforming Work shall relieve the Contractor of its Contract responsibility to ensure that the Work is performed in accordance with the Contract.
1.7.3 Risk of Loss

Risk of loss and property damage to the equipment shall pass to Metra upon (1) arrival of the equipment and/or services at Metra’s location; (2) joint inspection by the parties; and (3) completion and execution of Conditional Acceptance. However, Metra shall not be responsible for, and Contractor shall retain all risk of loss or damage due to, equipment failure or failure due to design or workmanship deficiencies, as well as all damage caused by Contractor’s negligence or willful misconduct. Contractor resumes the risk of loss any time it removes the equipment from Metra’s possession and control for any actions prior to Final Acceptance. Transfer of risk of loss shall not be deemed to transfer title or to constitute conditional or final acceptance of the equipment and/or services.

1.8 DELIVERY

It is understood and agreed that time of delivery is of the essence of this contract. If the Contractor is delayed in the delivery of equipment or services purchased under the Contract by a cause beyond his control, it must immediately upon receiving knowledge of such delay, give written notice to Metra and request an extension of time for completion of the Contract. Metra will examine the request and determine if the Contractor is entitled to an extension. Metra will notify the Contractor of the decision in writing.

All materials shipped to Metra must be shipped F.O.B. destination. If prior delivery notification is specified, arrangements must be made by the Contractor with Metra’s designated receiving location at least twenty-four (24) hours in advance to arrange for receipt of the materials. The material must then be delivered where directed and as agreed upon.

1.9 LIQUIDATED DAMAGES

1.9.1 Generally

Metra’s need for equipment is of paramount importance to Metra’s continuance of successful public service. Operating Metra’s aging equipment increases capital costs, and thus Metra’s need for reliable equipment increases over-time. For this reason and others, time is of the essence, and acceptance and operation of the equipment as scheduled is of vital importance to Metra. It is agreed that the liquidated damages described in this Contract shall not be construed and treated by the parties as imposing a penalty upon the Contractor and its sureties for failing to complete the work in a timely manner or to deliver the equipment as agreed, but as liquidated damages to compensate Metra for failure to deliver operable equipment within a planned schedule that complies with the Contract such that it is accepted for service (hereinafter sometimes referred to as acceptable equipment). Liquidated damages shall be assessed separately for each piece of equipment. Liquidated damages under this section are solely for damages arising out of the delay in delivery of acceptable equipment, and do not compensate Metra for damages for breach of warranty or other breach of this Contract to which Metra otherwise may be entitled, whether before or after termination of this Contract by Metra, including the extra costs of obtaining substitute equipment or performance from others. Payment of liquidated damages, and acceptance thereof by Metra, does not constitute a waiver or settlement of any claim for damages for such breaches (other than for delay in delivering acceptable equipment), and nothing in this section is intended to limit such claims.
1.9.2 Delivery and Acceptance Factor

The Contractor shall provide a schedule for Metra approval based on the requirements in the solicitation. In the event Contractor fails to deliver equipment such that it is accepted on or prior to the date provided for in the approved schedule pursuant to this purchase order, Contractor or its sureties shall pay agreed liquidated damages at the rate of two-hundred fifty ($250) per day per Car until the Car is Conditionally Accepted. Permitting the Contractor to continue to deliver equipment after the required delivery dates or any extended dates shall in no way operate as a waiver by Metra of its rights to liquidated damages.

1.9.3 Accrued Liquidated DAMAGES

Metra may, but shall not be obligated to, deduct any liquidated damages payable to it from any money Metra otherwise owes or would owe Contractor. Liquidated damages are payable on Metra's demand. Additionally, Metra may, but shall not be obligated to, accept consideration in the form of additional quantities of Cars, parts, or other consideration. Liquidated damages for late delivery shall accrue over the term of the contract and shall be settled promptly thereafter, by wire transfer, unless Metra agrees to another form of payment. At Metra’s discretion, settlement of liquidated damages may occur prior to the term’s expiration. Liquidated damages will not exceed 20% of the Total Contract Price.

1.10 PAYMENT

1.10.1 General Payment Conditions

The amounts set forth in the price schedule are full compensation from Metra due Contractor for performance of this Contract. Contractor shall:

- Only accept orders accompanied by a Purchase Order from Metra.
- Provide timely invoicing for all purchases of products and services.
- Send all invoices to Accounts Payable and in contracts containing a Disadvantaged Business Enterprise Goal, include a copy to Metra’s Office of Diversity of Civil Rights.
- Invoices must include:
  - The Purchase Order Number provided by Metra (see below for Release Notices).
  - The Item Number, as it corresponds to the Purchase Order, if applicable.
  - The Product Part Number.
  - A description of each Product or Service, as stated in the Purchase Order.
  - Itemized Quantity, Unit Price, and Invoiced Amount.
  - The Hours and Rates used, when applicable.
  - The Time Period covered by the invoice.
  - The Total Invoiced Amount for the invoice.
  - The Remit-To-Address.
- Invoices must be billed according to the Pricing Exhibits and include any required documentation.
Work not meeting the requirements of the Contract shall be made acceptable by Contractor, and unsuitable Work may be rejected by Metra, notwithstanding that payment for such Work may have been previously authorized and included in a progress payment. A deduction may be made from subsequent payments and withheld until such time as the correction of such unsuitable Work. The amount of the deduction will be set by Metra and the amount should be in proportion to the value of the non-conforming work.

1.10.2 Invoicing

All invoices received by Metra will be approved or rejected and returned by Metra within 60 days. In the event the invoice is not directed to Accounts Payable, Metra may take an additional 30 days for handling. Metra will pay all invoices submitted in accordance with this Contract within 60 days of its approval of the Contractor’s invoice. Metra may request corresponding back-up documentation to corroborate any invoices.

1.10.3 Grant Funded Invoicing

Notwithstanding the invoicing provisions above, Metra may withhold payment until grant funds are received by Metra. Such withholding shall not exceed six (6) months. Once Metra receives the grant funding, outstanding invoices will be paid within 10 days of said receipt.

If Contractor fails to invoice within two years of its providing equipment or services, Contractor bears the risk that grant funding may no longer be available to pay said invoices. If grant funding is withdrawn as a direct result of Contractor’s performance under this Contract, Contractor will bear sole responsibility for its loss.

1.10.4 Prompt Payment to Subcontractors and Suppliers

1.10.4.1 Metra – Prompt Payment to Subcontractors and Suppliers

The Contractor agrees to pay each Subcontractor and Supplier under this contract for satisfactory performance of its contract no later than 15 days from the receipt of each payment the Contractor receives from Metra. Any failure to comply with this section will be a material breach of this contract, and Metra reserves all its rights in law and equity for such breach. In addition, such breach will be consideration for the Contractor’s responsibility status for future contracts with Metra. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of Metra. This clause applies to both DBE and non-DBE subcontracts.

The Contractor agrees to return retainage payments to each subcontractor and supplier within 15 days after the Subcontractors and Suppliers work is satisfactorily completed. Any delay or postponement of payment from above referenced time frame may occur only for good cause following written approval of Metra. This clause applies to both DBE and non-DBE Subcontractors and Suppliers.

Contractor’s failure to promptly pay its Subcontractors is subject to the provisions of 50 ILCS 505/9.
1.10.4.2 VRE – Prompt Payment to Subcontractors and Suppliers

In the event that the Contractor utilizes a Subcontractor for any portion of the work under this contract, the Contractor hereby agrees to take one (1) of the two (2) following actions within seven (7) days after receipt of amounts paid to the Contractor by VRE for work performed by a Subcontractor under this contract:

a. Pay a Subcontractor for the proportionate share of the total payment received from VRE attributable to the work performed by that Subcontractor under this contract; or

b. Notify VRE and any Subcontractors, in writing, of its intention to withhold all or a part of the Subcontractor's payment with the reason for nonpayment.

The Contractor shall be obligated to pay interest to a Subcontractor on all monies owed by the Contractor that remain unpaid after seven (7) days following receipt by the Contractor of payment from VRE for work performed by a Subcontractor under this contract, except for amounts withheld under subsection b. of this section. The Contractor's obligation to pay an interest charge to a Subcontractor pursuant to the provisions of this section may not be construed as an obligation by VRE. A contract modification may not be made for the purpose of providing reimbursement for any such interest charge. A cost reimbursement claim may not include any amount for reimbursement for such interest charge.

1.10.5 Taxes

The Contract price shall not include, and Metra shall not pay, taxes or fees from which Metra is exempt. Metra is exempt from various federal taxes, all state and unit of local government taxes, and registration and license fees. Contractor shall promptly notify Metra, and afford it the opportunity before payment of any taxes, to contest said claims in the manner and to the extent it may elect, and to settle or satisfy such claims.

1.11 TITLE AND WARRANTY OF TITLE

The Contractor warrants that title to the equipment purchased will pass to Metra free and clear of all liens, claims, and encumbrances upon the first of either Metra’s Conditional or Final Acceptance, and upon the associated payment.

The Contractor warrants that all articles of materials delivered hereunder shall be free from defect of material and workmanship and that all parts furnished will conform to samples, specifications and/or drawings as may be applicable, and will fit for the purpose for which purchased. The warranty period shall be for one (1) year, unless otherwise provided for in the Contract, from the date of delivery or date of final acceptance, whichever is later. Metra may return any nonconforming or defective items to the Contractor or require correction or replacement of the item at the time the defect is discovered, all at the Contractor’s risk and expense. Acceptance of items by Metra or payment therefore shall not relieve the Contractor of its responsibilities hereunder.
1.12 LEGAL CLAUSES

1.12.1 Award Process

All written information which Contractor has furnished to Metra in connection with Metra's RFP is part of the basis on which Metra has evaluated award of this Contract. Contractor represents to Metra that all facts, plans, or promises contained therein, other than such as may be contradicted by or expressly superseded by Contractor's offer, are true, and Contractor acknowledges that Metra is entitled to rely thereon.

1.12.2 Notices

Except as otherwise specified elsewhere in the Contract, all requests, notices, demands, authorizations, directions, consents, waivers, or other documents required or permitted under this Contract shall be in writing. Such communications shall be deemed to have been sufficiently served if sent by certified or registered mail with proper postage pre-paid, or hand delivered, or when received if sent by any other means, at the respective addresses shown below, or to such other address as either party may from time to time furnish to the other in writing.

If to Metra, a copy to both:

Metra
547 W. Jackson Blvd., 16th Floor
Chicago, Illinois 60661
Attn: Chief Mechanical Officer

Metra
547 W. Jackson Blvd., 11th Floor
Chicago, Illinois 60661
Attn: Contracting Agent

If to VRE, a copy to both:

VRE
1500 King Street, Suite 202
Alexandria, Virginia 22314
Attn: Chief Operating Officer

VRE
1500 King Street, Suite 202
Alexandria, Virginia 22314
Attn: Manager of Purchasing and Contract Administration

If to Contractor, to its address set forth on its offer.

1.12.3 Indemnification

1.12.3.1 Metra - Indemnification

To the full extent permitted by law, Contractor agrees to assume all risk and to indemnify, defend, and hold harmless Metra, the Regional Transportation Authority ("RTA"), and the Northeast Illinois Regional Commuter Railroad Corporation ("NIRCRC"), and their respective directors, officers, employees, and agents (collectively referred to as "Indemnitees") from and against all claims, liabilities, losses, damages, demands, liens,
encumbrances, judgments, awards, costs, suits, actions, proceedings, fees, expenses, and attorney's fees and other expenses of litigation or arbitration, which any of them may incur, sustain, or be subject to on account of:

a) injury to person or death or property damage, arising out of, in whole or in part, the Contractor's performance of the Contract (including warranty work) or Contractor's failure to perform under the Contract;

b) injury to any person or death or property damage arising out of, in whole or in part, any defect or alleged defect of design, workmanship, or materials contained in the equipment purchased by Metra hereunder, regardless of whether the relevant work, materials, or design was made by Contractor, Subcontractor, or Supplier, or any unreasonably dangerous condition contained in such equipment, regardless of the extent to which Metra may have participated in any design work, and regardless of any inspections or approvals by Metra; or

c) injury to any person or death or property damage arising out of, in whole or in part, intentional misconduct, negligent acts, errors, or omissions of Contractor’s officers, employees, servants, agents, Subcontractors, and Suppliers;

provided, however, that the Contractor shall not indemnify, defend, or hold harmless the Indemnitees to the extent such injury or damage is caused by the gross negligence or willful misconduct of any of the Indemnitees, as determined by court and accepted by Metra.

Each party shall promptly notify the other in writing of the notice or assertion of such claim, demand, lien, encumbrance, judgment, award, suit, action, or other proceeding hereunder. The Contractor shall have sole charge and direction of the defense of such suit, action, or proceeding. Metra shall not make any admission that might be materially prejudicial to the Contractor unless the Contractor has failed to take over the conduct of any negotiations or defense within a reasonable time after receipt of the notice and authority above provided. Metra shall at the request of the Contractor furnish to the Contractor all reasonable assistance that may be necessary for the purpose of defending such suit, action or proceeding, and shall be repaid all reasonable costs incurred in doing so. Metra shall have the right to be represented therein by advisory counsel of its own selection at its own expense.

1.12.3.2 VRE - Indemnification

The Contractor shall not seek to hold liable VRE, the Commonwealth of Virginia, the Virginia Department of Rail and Public Transportation, the Virginia Department of Transportation, or any of its officers, agents and employees for any claims, judgments, losses, and expenses of any nature whatsoever arising out of the Contract or arising out of the activities funded in whole or in part by the Contract. The Contractor shall defend, indemnify, save, and hold harmless VRE, and its officers, agents and employees against all claims and liability, including cost and expenses, arising out of, in whole or part, the acts or omissions of the Contractor or the acts or omissions of the Contractor’s Subcontractors, agents or employees. The foregoing obligations shall survive termination of this Agreement with respect to liabilities arising during its term. The Contractor agrees to maintain adequate insurance in an amount and form herein specified and approved by VRE to protect VRE and its officers, agents, and employees from liability arising out of the Contract.
1.12.4 Indemnitee Negligence

The obligations of the Contractor under the above paragraph shall not extend to circumstances in which the injury, death, or damages are caused solely by the gross negligence or willful misconduct of the Indemnitees.

1.12.5 Suspension of Work

Metra may, at any time and for any reason within its sole discretion, issue notice to the Contractor suspending, delaying, or interrupting all or any part of the Work for a specified period of time.

The Contractor shall comply immediately with any such written order and take all reasonable steps to minimize costs allocable to the Work covered by the suspension during the period of Work stoppage. Contractor shall continue the Work that is not included in the suspension and shall continue such ancillary activities as are not suspended. The Contractor shall resume performance of the suspended Work upon expiration of the notice of suspension, or upon written direction from Metra’s Authorized Representative.

The Contractor shall be allowed an equitable adjustment in the Contract price (excluding profit) and/or an extension of the Contract time, to the extent that cost or delays are shown by the Contractor to be directly attributable to any suspension. However, no adjustment shall be made under this section for any suspension, delay, or interruption due to the fault or negligence of the Contractor. As soon as reasonably possible after receipt of the written suspension of work notice, the Contractor shall submit to Metra’s Authorized Representative a detailed price and schedule proposal for the suspension, delay, or interruption.

1.12.6 Notice of Labor Dispute

Whenever the Contractor or Metra has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of the Contract, they shall immediately give written notice thereof to the other party, including all relevant information.

In addition, the Contractor agrees to insert the substance of this clause in any subcontract in which a labor dispute may delay the timely performance of the Contract.

1.12.7 Force Majeure

If the Contractor is delayed at any time during the progress of the Work by a cause as described below, then the time for completion and/or affected delivery date(s) shall be extended by Metra subject to the following cumulative conditions:

1. Such cause may include force majeure events such as any event or circumstance beyond the reasonable control of the Contractor, including but not limited to acts of God; earthquake, flood, and any other natural disaster; civil disturbance, strikes, and labor disputes; fires and explosions; war and other hostilities; embargo; or failure of third parties, including Suppliers or Subcontractors, to perform their obligations to the Contractor due to a force Majeure event described above;
2. The Contractor demonstrates that the completion of the Work and/or any affected deliveries will be actually and necessarily delayed;

3. The Contractor has taken measures to avoid and/or mitigate the delay by the exercise of all reasonable precautions, efforts and measures, whether before or after the occurrence of the cause of delay; and

4. The Contractor makes written request and provides other information to Metra as described below.

None of the above shall relieve the Contractor of any liability for the payment of any liquidated damages owing from a failure to complete the Work by the time for completion that the Contractor is required to pay for delays occurring prior to, or subsequent to the occurrence of an excusable delay.

Metra reserves the right to rescind or shorten any extension previously granted, if subsequently Metra determines that any information provided by Contractor in support of a request for an extension of time was erroneous; provided, however, that such information or facts, if known, would have resulted in a denial of the request for an excusable delay.

Notwithstanding the above, Metra will not rescind or shorten any extension previously granted if the Contractor acted in reliance upon the granting of such extension and such extension was based on information which, although later found to have been erroneous, was submitted in good faith by the Contractor.

No extension or adjustment of time shall be granted unless: (1) written notice of the delay is filed with Metra within 14 calendar days after the commencement of the delay, and (2) a written application therefore, stating in reasonable detail the causes, the effect to date and the probable future effect on the performance of the Contractor under the Contract, and the portion or portions of the Work affected, is filed by the Contractor with Metra within thirty (30) calendar days after the commencement of the delay. No such extension or adjustment shall be deemed a waiver of the rights of either party under the Contract. Metra shall make its determination within thirty (30) calendar days after receipt of the application.

1.12.8 Termination for Convenience

Metra may terminate this contract, in whole or in part, at any time by written notice to the Contractor when it is in Metra’s best interest. The Contractor shall be paid its costs, including contract close-out costs, and profit on work performed up to the time of termination. The Contractor shall in no less than 30 days unless otherwise approved by Metra, submit its termination claim to Metra to be paid the Contractor. If the Contractor has any property in its possession belonging to Metra, the Contractor will account for the same, and dispose of it in the manner Metra directs.

1.12.9 Termination for Breach

If the Contractor does not deliver equipment in accordance with the contract delivery schedule, or if the Contractor fails to comply with any other provision of the contract, Metra
may terminate this contract for breach. Termination shall be effected by serving a notice of termination on the Contractor setting forth the manner in which the Contractor is in breach. The Contractor will only be paid the contract price for supplies delivered and accepted in accordance with the manner of performance set forth in the Contract in excess of Metra’s actual or liquidated damages. Any such termination for breach shall not in any way operate to preclude Metra from also pursuing all available remedies against Contractor and its sureties for said breach.

Metra, prior to a termination for breach, will give notice allowing the Contractor an opportunity to cure. In such case, the opportunity to cure notice will state the time period in which cure is permitted and other appropriate conditions. Failure to abide by such notice, may in Metra’s discretion, result in breach with no further cure opportunity.

If it is later determined by Metra that the Contractor had an excusable reason for not performing, such as a strike, fire, or flood, events which are not the fault of or are beyond the control of the Contractor, Metra, after setting up a new delivery of performance schedule, may allow the Contractor to continue work, or treat the termination as a termination for convenience.

1.12.10 Waivers of Remedies for Any Breach

In the event that Metra elects to waive its remedies for any breach by Contractor of any covenant, term or condition of this Contract, such waiver by Metra shall not limit Metra's remedies for any succeeding breach of that or of any other term, covenant, or condition of this Contract.

1.12.11 Compliance with Laws and Regulations

The Contractor shall at all times observe and comply with all applicable statutes, ordinances, regulations and codes of the Federal, State, City, and other local government agencies, which may in any manner affect the performance of the Contract.

1.12.12 Changes of Law

Changes of law that become effective after the solicitation due date may result in changes that affect price. If a price adjustment is indicated, either upward or downward, then it shall be negotiated between Metra and the Contractor, and the final Contract price will be adjusted upward or downward to reflect such changes in law. Such price adjustment may be audited, where required.

1.12.13 Maintenance of Records; Access by Metra; Right to Audit Records

1.12.13.1 Records Retention

The Contractor will retain, and will require its Subcontractors and Suppliers of all tiers to retain, complete and readily accessible records related in whole or in part to the contract, including, but not limited to, data, documents, reports, statistics, sub-agreements, leases, subcontracts, arrangements, other third party agreements of any type, and supporting materials related to those records.
1.12.13.2 Retention Period

The Contractor agrees to comply with the record retention requirements in accordance with 2 C.F.R. § 200.333. The Contractor shall maintain all books, records, accounts and reports required under this Contract for a period of at not less than ten (10) years after the date of termination or expiration of this Contract, except in the event of litigation or settlement of claims arising from the performance of this Contract, in which case records shall be maintained until the disposition of all such litigation, appeals, claims or exceptions related thereto.

1.12.13.3 Access to Records

The Contractor agrees to provide sufficient access to Metra, VRE, their grantors, and their contractors to inspect and audit records and information related to performance of this contract as reasonably may be required.

1.12.13.4 Access to the Site(s) of Performance

The Contractor agrees to permit Metra, its grantors and its contractors access to the sites of performance under this contract as reasonably may be required.

1.12.14 Conflicts of Interest; Gratuities

1.12.14.1 Metra – Conflicts of Interest; Gratuities

The Contractor is prohibited from engaging in any practice that may be considered as a conflict of interest under existing Metra policies and/or state law, and to refrain from participating in any gifts, favors or other forms of compensation that may be viewed as a gratuity in accordance with existing policies and laws.

The Contractor shall take all reasonable measures to preclude the existence or development of an organizational conflict of interest in connection with its performance. An organizational conflict of interest occurs when, due to other activities, relationships or contracts, a firm or person is unable, or potentially unable, to render impartial assistance or advice to Metra; a firm or person’s objectivity is or might be impaired; or a firm or person has an unfair competitive advantage in proposing for award of a Contract as a result of information gained in performance of the Contract.

Members of the Board, officers and employees of Metra, their spouses, their children, their parents, their brothers and sisters and their children, are prohibited from having or acquiring any Contract or any direct pecuniary interest in any Contract which will be wholly or partially performed by the payment of any funds or the transfer of property of Metra. Any firm, partnership, association or corporation from which any member of the Board, officer or employee of Metra is entitled to receive more than seven and one-half percent (7 ½) of the total distributable income, is prohibited from having or acquiring any contact or direct pecuniary interest in any contract which will be performed in whole or in part by payment of funds or the transfer of property of Metra. Any firm, partnership, association or corporation from which members of the Board, officers, employees of Metra, their spouses, their children, their parents, their brothers and sisters and their children are
entitled to receive in the aggregate more than fifteen percent (15%) of the total distributable income, is prohibited from having or acquiring any Contract or direct pecuniary interest in any Contract which will be performed in whole or in part by the payment of funds or the transfer of property of Metra.

1.12.14.2 VRE – Conflicts of Interest; Gratuities

The Contractor and its officers and employees shall comply with the provisions of the Virginia Conflict of Interest Act (Section 2.2-3100 et. seq., VA Code Ann.), the State and Local Government Conflict of Interests Act, Section 2.2-4300 et seq. of the Code, the Virginia Public Procurement Act, the terms of which are incorporated herein by reference.

VRE is intent on avoiding conflicts of interest associated with the award of this Contract. To these ends, prospective Contractors must identify existing and prospective contractual relations they have (or could have) with agencies which could present sources of conflict as part of the proposal submission.

VRE standards of conflict prohibit VRE employees, officers, board members, or agents from participating in the selection, award, or administration of a third-party contract or subagreement supported by federal funds if a real or apparent conflict of interest would be involved. Such a conflict would arise when any of the following parties has a financial or other interest in the entity selected for award (a) an employee, officer, board member or agent (b) any member of his or her family (c) his or her partner or (d) an organization that employs or intends to employ any of the above.

VRE standards of conflict also prohibit real or apparent organizational conflicts of interest. An organizational conflict of interest exists when the nature of the work to be performed under a third-party contract or subagreement may, without some restriction on future activities, result in an unfair competitive advantage to the third-party Contractor or subrecipient or impair its objectivity in performing the Contract work.

1.12.15 State of Illinois Gift Ban Act

The Contractor shall comply with the applicable provisions of the State of Illinois Gift Ban Act, 5 ILCS 425/1 et. seq., and refrain from providing gifts to Metra’s employees in violation of either the Act or Metra’s Gift Ban Policy.

1.12.16 General Nondiscrimination Clause

In connection with performance of the Contract, the Contractor agrees that it will not, on the grounds of race, religious creed, color, national origin, ancestry, disability, marital status, sex, sexual orientation, or age, discriminate or permit discrimination against any person or group of people in any manner prohibited by federal, state or local laws.

1.12.17 Modification of Contract; Waiver

1.12.17.1 Modification

Any modification or amendment of any provisions of any of the Contract Documents shall be effective only if in writing, signed by Authorized
Representatives of both Metra and the Contractor, and specifically referencing the Contract.

1.12.17.2 Waiver

In the event that either party elects to waive its remedies for any breach by the other party of any covenant, term or condition of the Contract, such waiver shall not limit the waiving party’s remedies for any succeeding breach of that or of any other term, covenant or condition of the Contract.

1.12.18 Remedies Not Exclusive

The rights and remedies of Metra provided herein shall not be exclusive and are in addition to any other rights and remedies provided by law.

1.12.19 Counterparts

The Contract may be executed in any number of counterparts. All such counterparts shall be deemed to constitute one and the same instrument, and each of said counterparts shall be deemed an original thereof.

1.12.20 Severability

Whenever possible, each provision of the Contract shall be interpreted in a manner as to be effective and valid under applicable law. However, if any provision, or part of any provision, should be prohibited or invalid under applicable law, such provision, or part of such provision, shall be ineffective to the extent of such prohibition or invalidating the remainder of such provision or the remaining provisions of the Contract.

1.12.21 Third Party Beneficiaries

No provisions of the Contract shall in any way inure to the benefit of any third party, including the public at large, so as to constitute such person a third-party beneficiary of the Contract or of any one or more of the terms and conditions of the Contract or otherwise give rise to any cause of action in any person not a party to the Contract, except as expressly provided elsewhere in the Contract.

1.12.22 Set-off Rights

Metra may, but shall not be obligated to, withhold from and set off against any payment otherwise due and payable by Metra under the Contract, any amount payable by Contractor to Metra under or in connection with the Contract.

1.12.23 Assignment of Contract and Subcontracting

The Contractor agrees that neither this Contract nor any part of it or any of the monies due from this Contract may be assigned without the prior consent of Metra. Any successor or assignee under this Contract will be required to accede to all of the terms, conditions and requirements of this Contract as a condition precedent to such succession or assignment. Assignment of any portion of the work by subcontract must be approved in advance by Metra, in writing. Metra reserves the right to assign performance of all or part of the Contract as advertised, competed, evaluated, and awarded including base and option quantities.
Contractor shall not enter into any subcontract for Work to be performed under this Contract in excess of One Million ($1,000,000) (“Major Subcontractor”) without Metra’s prior written consent. For such Major Subcontractors, the Contractor shall submit to Metra, the intended scope, the dollar value, and whether the subcontractor is a DBE. Metra may, at its sole discretion, request additional information, conduct interviews with the Major Subcontractor, or visit the Major Subcontractor’s place of manufacture, in determining whether such written consent is acceptable. Any consent by Metra to subcontracting any part of the Work will not be construed as an acceptance of the subcontract of any of its terms. Such consent shall only operate as an acceptance of the making of a subcontracting between Contractor and subcontractor.

Subcontracting will not release the Contractor from any of its liability under the Contract or release Contractor or any of its sureties from any liability under the sureties. All subcontractors must look only to the Contractor for the payment of claims of any nature whatsoever arising out of the subcontract. The Contractor shall include in all agreements with subcontractors, as pertaining to the Contract, that its subcontractor shall make no claim whatsoever against Metra, its employees, officers, or agents, for any Work performed or thing done by reason of the subcontract, or for any other cause whatsoever that may arise by reason of the relationship created between the Contractor and the subcontractor by the subcontract.

A subcontractor shall be recognized by Metra only in the capacity of an employee, agent, or contractor of the Contractor. Metra is to be notified of all subcontractors so employed regardless of size or amount of the subcontract. The Contractor is to provide Metra a listing of said subcontractor(s) employed and the product(s) supplied for the performance of the Contract on a quarterly basis with updates.

The Contractor shall be responsible for the compliance of its subcontractors with the requirements with all federal, state, and local/municipal laws, ordinances, rules, and regulations (including those of Metra) as may be applicable.

Contractor shall take no action or enter into any agreement which would prevent or prohibit any of its subcontractors from communicating with Metra concerning, and Metra may communicate with any of the Contractor’s subcontractors concerning, any matter relevant to the performance of the Contract or to the possible replacement of Contractor with a substitute in the case of an event of default.

Contractor shall cause each Major Subcontractor to file with Metra a debarment certification similar in form and substance to that required of the Contractor. Metra reserves the right to require the Contractor or any Major Subcontractor to reissue an updated certificate from time to time.

1.12.24 Independent Parties

The Contractor is an independent contractor with respect to the performance under this Contract, retaining control over the detail of its own operations, and the Contractor shall not be considered the agent, employee, partner, fiduciary or trustee of Metra.
1.12.25 Survival

The following sections shall survive the nominal expiration or discharge of other Contract obligations, and Metra may obtain any remedy under law, Contract or equity to enforce the obligations of the Contractor that survive the manufacturing, warranty and final payment periods:

- Intellectual Property
- Data Rights
- Indemnification
- Governing Law and Choice of Forum
- Disputes
- Maintenance of Records; Access by Agency; Right to Audit Records
- Confidential Information
- Parts Availability Guarantee
- Warranty and Reliability
- Liquidated Damages

1.12.26 No Obligation by the Regional Transportation Authority

Metra and the Contractor acknowledge and agree that, notwithstanding any concurrence by the Regional Transportation Authority ("RTA") in or approval of the solicitation or award of this Contract, and absent the express written consent by the RTA, the RTA is not a party to this Contract and it shall not be subject to any obligations or liabilities imposed on Metra, Contractor, or any other party (whether or not a party to this Contract).

1.13 INTELLECTUAL PROPERTY

1.13.1 Intellectual Property Indemnification

The Contractor shall indemnify, defend and hold harmless Metra (and its officers, directors, agents or employees) to the maximum extent permitted by law from and against any and all claims, liabilities, losses, damages or expenses (including attorneys’ fees and related costs, whether or not litigation has commenced), whether direct or indirect, arising out of, relating to or in connection with any claim or allegation that the ownership, possession or use of any software, materials, equipment, devices, processes or other materials provided by the Contractor under this Agreement infringe or violate the patent, copyright, trade-secret or other intellectual-property or proprietary rights of any third party. In case any such software, materials, equipment, devices, processes or other materials are held to constitute an infringement and their use enjoined, then the Contractor, at the Contractor’s sole cost and expense, shall do one of the following:

1. Secure for Metra the right to continue using the software, materials, equipment, devices or processes by suspension of the injunction or by procuring a royalty-free license, or licenses;
2. Replace such software, materials, equipment, devices or processes with non-infringing software, materials, equipment, devices, or processes; or
3. Modify them so that they become non-infringing.
If the amount of time necessary to proceed with one of these options is deemed excessive by Metra, then Metra may direct the Contractor to select another option or risk Metra terminating for breach.

Metra shall advise the Contractor of any pending patent suit related to the Contract against Metra and provide all information available. The Contractor’s obligations under this section are discharged and Metra shall hold the Contractor harmless with respect to the equipment or part if it was specified by Metra and all requests for substitutes were rejected, and the Contractor advised Metra of a potential infringement.

1.13.2 Intellectual Property Warranty
The Contractor represents and warrants that any use of the equipment, or any part thereof, by Metra (or its officers, directors, agents, employees or transit users) will not infringe or violate the patent, copyright, trade-secret or other intellectual-property or proprietary rights of any third party.

The Contractor further represents and warrants that it has or will have all appropriate licenses, agreements or ownership rights pertaining to all patent, copyright, trade-secret or other intellectual-property or proprietary rights needed for the performance of its obligations under the Contract — including without limitation that it will have all necessary rights to use patentable or copyrightable materials, equipment, devices, or processes not furnished by Metra used on or incorporated in the Work under the Contract. The Contractor assumes all risks arising from the use of any such patented or copyrighted materials, equipment, devices or processes.

1.13.3 Tooling Rights
The Contractor, its Subcontractors, and Suppliers shall not sell, destroy, or otherwise dispose of their rights to the use of, the unique castings, patterns and forming or extrusion dies after their use in the production of the equipment without first offering them to Metra, with reasonable costs associated with the transfer to be borne by Metra, or, in the case of a proposed sale to another, without first offering them for sale to Metra at a fair market price.

The Contractor shall be liable to Metra to the extent that the failure of the Contractor, its Subcontractors and Suppliers, to comply with this Section causes Metra to incur costs to have the tooling replicated.

For purposes of this Section the terms “sell” and “sale” shall not include transfer of these assets to a successor corporation or other entity that assumes the business and obligations of any Contractor, Subcontractor, Supplier or Manufacturer herein, including obligations arising under the Contract. Upon Contractor’s offer of any of the materials described above and Metra’s refusal, the Contractor’s obligation with regard to Tooling Rights, as it relates to the specific materials offered and refused, shall cease.

1.13.4 Publicity
Metra reserves the right to review and approve all Metra-related material prior to publication. Published information shall be factual and shall in no way imply that Metra endorses the Contractor’s firm, service, or product.
1.14 DATA RIGHTS

1.14.1 Proprietary Rights/Rights in Data

The Contractor hereby grants to Metra on behalf of itself and its Subcontractors, and Suppliers, (as to whom the Contractor represents and warrants that it has the power and authority to grant such sublicense), an irrevocable, perpetual, royalty-free, nonexclusive license and sublicense (“Technology License”) to use, itself or through its agents or assigns, for the approved purposes described below, without recourse to the original Contractor, Subcontractor, Supplier or Manufacturer all patented, copyrighted and unpatented technology, know-how, trade secrets and other proprietary rights, and documentation thereof (except manufacturing detailed drawings and software, which is separately defined at and licensed as described below, which is included in the Material and/or Equipment, including but not limited to all systems, subsystems, assemblies, subassemblies, components and interface systems and controls which are necessary for the operation, maintenance and repair, overhaul of the Material and/or Equipment, and for the manufacture of parts which are unavailable for purchase, as defined below, all of which shall be designated the “Licensed Technology.”

1.14.1.1 Uses

Metra’s rights under this Technology License shall be limited to its use for the following:

1. Evaluation and qualification for the purposes of future material and/or equipment procurements of systems, subsystems and components of subsystems on the material and/or equipment to be delivered under the Contract;
2. Preparation of specifications for future purchases employing some or all of the Licensed Technology;
3. Maintenance and repair of the material and/or equipment;
4. Overhaul of the material and/or equipment;
5. Manufacture of parts for the material and/or equipment that become unavailable for purchase. The term “unavailable for purchase” means that a part is no longer being manufactured; or an inventory of the part in sufficient quantities to meet Metra’s needs is not available for purchase; or no supplier will sell a part to Metra or cannot supply the part according to a delivery schedule that meets Metra’s needs; or that no supplier will offer the part at a commercially reasonable price. “Unavailable for purchase” can be demonstrated through a public solicitation receiving no responsive and responsible bids or proposals.

1.14.1.2 Limits

Metra shall not have the right under this Technology License either to use the Licensed Technology to manufacture itself, or to have manufactured for it by a third party as a sub-licensee of Metra, either the material and/or equipment, systems, subsystems or components thereof, except as specified above.
1.14.2 Software Escrow Account

Prior to payment, the Contractor shall provide Metra a list of all software comprising proprietary works ("Proprietary Software"). Source code for the Proprietary Software and all related documentation required for the use and modification thereof, and any revisions or derivative works based on the Proprietary Software developed pursuant to the Contractor’s performance of the Contract (collectively, “Escrow Materials”) shall be deposited in an escrow account with a third party for no less than forty (40) years. The Contractor shall pay all initial and future costs related to the escrow account. The escrow materials shall immediately be obtainable and usable by Metra in the event that Contractor fails to support the continued use of the Proprietary Software by Metra, or upon termination or expiration of the term of the escrow.

1.15 CHANGES

1.15.1 Contractor Changes

If the Contractor chooses to propose changed scope, then the Contractor must submit a notice of proposed change to Metra for its prior written approval. The notice should describe the proposed change, identifying the proposed change and stating the reasons for the change, including relevant circumstances, impacts on the schedule, and estimated cost impacts.

Upon receipt of the proposed change notice, Metra may choose to either reject the notice or to request Contractor to submit a detailed Proposal within a specified time period. If Metra accepts the proposed change notice, it may issue an Interim Change Notice specifying the proposed change and action that the Contractor should undertake. The Interim Change Notice may include a not-to-exceed amount for the change based upon the Contractor’s estimate. If Metra requests a proposal, then the Contractor’s proposal shall set forth any changes to the Total Contract Price, including, if applicable, a line item breakdown and per unit increases, Contract delivery schedule, and/or any technical requirements of the Contract.

Any Interim Change Notice issued by Metra must be formalized in a written Change Order approved by the Agency. Oral Change Orders are not permitted. Metra shall have the right to conduct a cost/price analysis prior to approving any Change Order.

The Contractor shall be liable for all costs resulting from, and/or for satisfactorily correcting, any specification change not properly ordered by written modification to the Contract and signed by the Metra’s Authorized Representative.

1.15.2 Metra Changes

Metra may obtain changes to the Contract by notifying the Contractor.

Metra may issue an Interim Change Notice specifying the proposed change and action that the Contractor should undertake. Upon receipt of the Interim Change Notice and as soon as reasonably possible, but no later than thirty (30) calendar days, or a date agreed to by the parties, the Contractor shall submit to Metra’s Authorized Representative a detailed price and schedule proposal for the Work to be performed. The Contractor’s proposal shall
set forth any changes to the Total Contract Price, contract delivery schedule, or any technical requirements of the Contract. This Proposal shall be accepted or modified by negotiations between the Contractor and Metra’s Authorized Representative. At that time, a Change Order shall be executed in writing by both parties. Disagreements that cannot be resolved within negotiations shall be resolved in accordance with the Disputes clause. Regardless of any disputes, the Contractor shall proceed with the Work ordered.

Oral Change Orders are not permitted.

1.15.3 Claims

1.15.3.1 Notice of Intent to Claim

The Contractor shall give to Metra a written notice of Intent to Claim within fifteen (15) calendar days after the parties have been unable to negotiate a pending change related to any act or event for which it intends to seek adjustment in the contract price, contract time, terms, or schedule. The notice shall set forth the basis of the claim and an estimate of any costs and time impacts involved.

The written notice of Intent to Claim shall set forth the following:

1. The reasons the Contractor believes additional compensation and/or allowance of additional time may be due;
2. The nature of the costs involved or time needed;
3. The Contractor’s plan for mitigating such cost and delay; and
4. The Contractor’s best estimate of the amount of potential claim and time extension, and basic facts supporting the amount and time claimed.

1.15.3.2 Claim Submittal

The Contractor shall submit its claim within thirty (30) calendar days after submitting the Notice of Intent to claim. The following must be provided with the Claim:

1. Detailed factual statement of the claim, with all necessary facts, events, locations, and affected Work.
2. Date of the event giving rise to the claim; if there are continuing or multiple events, provide all dates necessary to support the claim.
3. Names of all persons who made any statements with respect to, or are knowledgeable of, the facts and events giving rise to the claim.
4. Specific provisions of the Contract supporting the claim, with a statement of supporting rationale.
5. Identification of all documents including meeting minutes, transcriptions of oral communications, photographs, videos, tapes, and any other evidence supporting the claim.
6. Detailed analysis of a request for an extension of item.
7. Detailed breakdown of request for additional compensation.
Failure to submit sufficient detail to permit Metra to conduct a review of the claim may result in rejection of the claim.

Each claim the Contractor submits for an adjustment that is related to a delay for any cause shall include the following:

1. A time impact analysis and a revised schedule demonstrating how the delay is incorporated into the schedule;
2. Alternative proposal(s) and a revised schedule that demonstrate how the delay will be eliminated or mitigated.

The Contractor shall maintain cost records of all Work, which is the basis of any claim, in the same manner as is required for Changed Work in the Changes clause of this agreement.

1.15.3.3 Claims Process

Within 30 calendar days after the receipt of the claim, Metra shall either render a decision, provide an estimated date when a decision will be made, or request that the Contractor submit additional information and details to establish the facts and contentions involved in the claim.

If Metra does not make a decision within 30 days after it receives all information required to evaluate the claim, or within any extended period mutually agreed to in writing by the parties, the claim shall be deemed rejected by Metra, and the Contractor shall be notified in writing. If the Contractor fails to comply with any provision of this Article in the time and manner specified, it shall waive any relief that might otherwise be due with respect to such claim.

Metra may at its discretion, unilaterally or in agreement with the Contractor, make payments or grant extensions of time on any part of a claim it determines to have been substantiated to its satisfaction. If the Contractor agrees to a final payment or extension of time related to a certain, described portion of its claim, such agreements shall constitute an unconditional release of Metra from any further obligations related to that described portion of the claim.

If Metra finds the claim to have merit, in whole or in part, then Metra and Contractor will negotiate the terms of a Change Order in the Work in compliance with the Changes clause. If the Contractor and Metra are unable to reach agreement on a Change Order, then Metra may issue a unilateral Change Order. The unilateral Change Order shall constitute a final decision by Metra.

If any claim or portion thereof remains in dispute following a final decision by Metra, then the Contractor may pursue further resolution through the Disputes clause.
Pending final resolution of a claim, the Contractor shall proceed diligently with the performance of its obligations under the Contract in accordance with the written directions of Metra.

1.15.3.4 No Claims after Final Payment

In no event shall any claims be made after Final Payment. Failure by the Contractor to submit claims in a timely manner shall result in a waiver by the Contractor as to such claims.

1.15.4 Disputes

1.15.4.1 Metra – Disputes

Except as otherwise provided in the Contract, any dispute concerning a question of fact arising under or related to the Contract that is not disposed of by agreement shall be decided in accordance with the following steps. However, by mutual agreement the matter may be taken immediately to any higher step in the dispute resolution process, or mutually agreed-to alternative dispute resolution process (which may include structured negotiations, mediation or arbitration) or litigation. Pending final resolution of a dispute hereunder, the Contractor shall proceed diligently with the performance of the Contract and in accordance with Metra’s decision, as the case may be.

Nothing in this Section shall prohibit Metra from pursuing the resolution of a dispute with the Contractor independently from VRE, and nothing in this Section shall prohibit VRE from pursuing the resolution of a dispute with the Contractor independently from Metra.

Notice of Dispute. All disputes shall be initiated through a written dispute notice submitted by either party to the other party within fourteen (14) calendar days of the determination of the dispute.

Negotiation between Authorized Representatives. The parties shall attempt in good faith to resolve any dispute arising out of or relating to the Contract promptly by negotiation between individuals who have authority to settle the controversy and who are at a higher level of management than the people with direct responsibility for administration of the Contract. Any party may give the other party written notice of any dispute not resolved in the normal course of business as provided. Within fourteen (14) calendar days after delivery of the dispute notice, the receiving party shall submit to the other party a written response. The dispute notice and written response shall include: (1) a statement of the party’s position and a summary of the arguments supporting that position; (2) any evidence supporting the party’s position; and (3) the name of the individual who will represent that party and of any others who will accompany the executive in negotiations. Within twenty-eight (28) calendar days after delivery of the dispute notice, the Authorized Representatives of both parties shall meet at a mutually acceptable time and place, and thereafter as they reasonably deem necessary, to attempt to resolve the dispute. All reasonable requests for information by one party to the other shall be honored.
Referral to executive management. If the matter has not been resolved by the Authorized Representatives within twenty-eight (28) calendar days of the dispute notice, then the dispute may be referred to executive management to settle the dispute and who shall likewise meet to attempt to resolve the dispute. Should the dispute not be resolved by negotiation between Authorized Representatives, Metra’s Authorized Representative shall submit a written request for decision to the Metra’s Executive Officer along with all documentation and minutes from the negotiations. The Executive Officer shall issue a written decision within fourteen (14) calendar days or a date mutually agreed upon receipt of a request. Within thirty (30) calendar days of the issuance of any administratively final and conclusive decision under this paragraph, the Contractor shall notify in writing of the Contractor’s agreement with the final decision. Any dispute that is not resolved by the parties through the operation of the provisions of this paragraph, or any mutually agreed-upon alternative disputes resolution process pursuant, may be submitted to any court in Circuit Court of Cook County, Illinois. Pending final resolution of a dispute hereunder, the Contractor shall proceed diligently with the performance of its obligations under the Contract in accordance with the written directions of Metra.

Alternative dispute resolution. If agreed to by both parties, disputes may be resolved by a mutually agreed-to alternative dispute resolution process that may include structured negotiations different from above, such as mediation or arbitration.

1.15.4.2 VRE – Disputes

Disputes by the Contractor with respect to this Contract shall be decided in the first instance by the Contract Administrator or designee who shall reduce his/her decision to writing, and mail or otherwise furnish a copy thereof to the Contractor. This decision shall be final and binding unless within thirty (30) days from the date of such decision the Contractor institutes legal action in accordance with the Code of Virginia. Pending a final determination of a properly appealed decision of the Contract Administrator, the Contractor shall proceed diligently with the performance of the Contract, including the disputed portions, in accordance with that decision.

1.16 ILLINOIS FREEDOM OF INFORMATION ACT (FOIA)

1.16.1 Generally

Metra is subject to the Illinois Freedom of Information Act (FOIA), 5 ILCS 140/1 et seq. Contractor should assume any materials provided to Metra will be subject to public disclosure. Under FOIA, Metra may exempt trade secrets and commercial or financial information marked as proprietary, privileged or confidential, if such disclosure of the information would cause competitive harm to the Proposer and only as the claim directly applies to the records requested. To the extent Contractor provides Metra records it believes are subject to this provision, it must clearly mark the header or footer of each page of the applicable material as “confidential.” If Metra agrees the exemption is applicable, it will withhold the material unless and until it is directed to disclose the information pursuant to law, a court order, subpoena, or decision from the Illinois Attorney General.
1.16.2 Confidential Information

Metra shall employ sound business practices no less diligent than those used for Metra’s own confidential information to protect the confidence of all licensed technology, software, documentation, drawings, schematics, manuals, data and other information and material provided by the Contractor pursuant to the Contract that are marked in accordance with Section 1.16.1, to protect against disclosure of such information and material to third parties except as permitted by the Contract and required under law. The Contractor shall be responsible for ensuring that confidential commercial or financial information, trade secrets or proprietary information, bears appropriate notices as described above.

During the performance of the Work under the Contract, it may be necessary for either party (the “Discloser”) to make confidential information available to the other party (the “Recipient”). The Recipient agrees to use all such information solely for the performance of the Work under the Contract and to hold all such information in confidence and not to disclose same to any third party without the prior written consent of the Discloser. Likewise, the Recipient agrees that all information developed in connection with the Work under the Contract shall be used solely for the performance of the Work under the Contract, and shall be held in confidence and not disclosed to any third party without the prior written consent of the Discloser.

1.17 COMMONWEALTH OF VIRGINIA FREEDOM OF INFORMATION ACT (FOIA)

The Virginia Freedom of Information Act, §2.2-3700 et seq. shall also govern the release of public records related to this procurement and the resultant contract with VRE. Trade secrets or proprietary information related to a procurement may not be subject to public disclosure, provided the requirements of §2.2-4342F VA Code Ann. are met.

Trade secrets or proprietary information submitted by a proposer in connection with a procurement transaction submitted pursuant to Code of Virginia, subsection B of §2.2-4317 shall not be subject to the Virginia Freedom of Information Act (§ 2.2-3700 et seq.).

However, the proposer shall:

1. Invoke the protections of this section prior to or upon submission of the data or other materials;

2. Identify the data or other materials to be protected by clearly marking each individual page with “PROPRIETARY”; and

3. State the reasons why protection is necessary.

Except for the foregoing limitation, VRE may duplicate, use, and disclose in any matter and for any purpose whatsoever and have others do so, all data furnished in response to this RFP. VRE has the right to release trade secrets or proprietary information to a third party which may assist VRE in the review and evaluation of proposals and administration of the resultant contract with VRE.
1.18 AMERICANS WITH DISABILITIES ACT

The Contractor agrees to comply with, and assure that any subcontractor complies with all applicable requirements of 42 USC 12101 et seq.

1.19 APPROPRIATION

Consistent with Metra’s enabling statute, if this Contract is for a period of longer than one year, it is subject to the appropriation of funds by Metra’s Board of Directors for each year beyond the first year of the Contract.

1.20 CERTIFICATIONS

As a Condition of award the Contractor and all Subcontractors executed a set of certifications provided by Metra attached in Appendix A. Metra conditioned award of this Contract on the veracity of the executed certifications. If it is discovered that the Contractors’ certificates were false at the time of execution, Metra may terminate the Contract and require Contractor reimburse Metra for its costs in identifying and selecting a replacement contractor. In the event a Subcontractors’ certificates were false at the time of execution, Metra may require Contractor replace the Subcontractor at no additional cost to Metra.
1.21 INSURANCE REQUIREMENTS

1.21.1 Requirements

Requisition Number: PR37383

Event: New Push-Pull Commuter Rail Cars

Effective concurrently with the commencement of the Work, the contractor/vendor shall obtain and maintain throughout the life of the work, the insurance coverage as noted here. With the exception of Products Liability, all coverage needs to be written on an occurrence form. All insurers must carry an AM Best Rating of A-/VII or better.

<table>
<thead>
<tr>
<th>TYPE OF COVERAGE</th>
<th>AMOUNT REQUIRED</th>
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</thead>
<tbody>
<tr>
<td>1. COMPREHENSIVE GENERAL LIABILITY (BROAD FORM): Bodily Injury Liability &amp; Property Damage Liability (combined)</td>
<td>$ 10,000,000 Each Occurrence $ 10,000,000 Aggregate</td>
</tr>
<tr>
<td>2. EXCESS COMPREHENSIVE GENERAL LIABILITY-EXCESS OF PRIMARY LIMITS (1), (2), and (4) Bodily Injury Liability &amp; Property Damage Liability (combined)</td>
<td>$ 10,000,000 Each Occurrence $ 10,000,000 Aggregate</td>
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<tr>
<td>3. AUTOMOBILE LIABILITY: Bodily Injury Liability &amp; Property Damage Liability (combined)</td>
<td>$ 1,000,000 Combined Single Limit</td>
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<tr>
<td>4. PRODUCTS LIABILITY</td>
<td>$ 10,000,000 Each Occurrence $ 10,000,000 Aggregate</td>
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For Metra, Additional Insureds shall be as follows: The Commuter Rail Division of the Regional Transportation Authority, a division of an Illinois municipal corporation, and its affiliated separate public corporation known as the Northeast Illinois Regional Commuter Railroad Corporation, both operating under the service mark Metra as now exists or may hereafter be constituted or acquired, and the Regional Transportation Authority, an Illinois municipal corporation.

For VRE, Additional Insureds shall be as follows: The Northern Virginia Transportation Commission and the Potomac and Rappahannock Transportation Commission, together known as the Virginia Railway Express, the Commonwealth of Virginia, the Virginia Department of Rail and Public Transportation, the Virginia Department of Transportation and their officers, employees and agents shall be named as additional insureds on any insurance policy issued for the work to be performed. The Contractor shall present satisfactory evidence of insurance coverage before commencing with any work, so that they are protected for losses to the extent caused by the negligence or willful misconduct of such entity or person, from third party claims that are directly related to or arise out of: (a) any failure by the Contractor to comply with, to observe or to perform in any material respect any of the covenants, obligations, agreements, terms or conditions of this Contract,
or any breach by Contractor of its representations or warranties; (b) any actual or willful misconduct or negligence of the Contractor, its employees or agents in direct connection with the work; (c) any actual or alleged patent or copyright infringement or other actual or alleged improper appropriation or use of trade secrets, patents, proprietary information, know-how, trademarked or service-marked materials, equipment devices or processes, copyright or invention by the Contractor in direct connection with the work; (d) inverse condemnation, trespass, nuisance or similar taking of harm for all damage to life and real property committed or caused by the Contractor, its employees or agents in direct connection with all activities in connection to the work; or (e) any assumed liabilities.

All policies must:

1. Include a waiver of subrogation, thereby waiving Contractors’ rights of subrogation against Metra, VRE and any additional insureds.
2. Include the Additional Insured Endorsement for all coverages including products and completed operations.
3. Be primary and non-contributory on all coverages.
4. All deductibles applicable to the insurance coverage shall be borne by the contractor/vendor. The certificate of insurance shall clearly state how defense costs, also known as “allocated loss adjustment expenses,” shall apply in terms of the deductible and the insurance limits. Self-insurance reserve programs are prohibited, unless approved by Metra’s Risk Management Department or VRE’s Contracting Officer.
5. All Subcontractors retained or hired for the Work shall be required to maintain limits and term equivalent to those required of the prime contractor.

Should any of the above described policies be canceled before the expiration date thereof, notice will be delivered in accordance with the policy provisions. Contractor/Vendor will immediately notify Metra and VRE of the cancellation, non-renewal, material change or reduction in coverage of any required insurance policy. Such notice shall be sent certified mail to Metra, care of the Director of Risk Management, 547 W. Jackson, Suite 1500, Chicago, IL 60661 and to VRE, care of the Manager of Purchasing and Contract Administration, 1500 King Street, Suite 202, Alexandria, VA 22314.

Contractor shall provide Metra and VRE will separate certificates of insurance. In no event shall the failure by Metra or VRE to receive certificates of insurance required hereunder, or to receive them by the date(s) required hereunder, be construed as a waiver of the contractor/vendor’s obligation to obtain the required insurance coverages. Failure by Metra or VRE to demand any certificate of insurance or other evidence of full compliance with the insurance requirements set forth herein, or failure by Metra or VRE to identify a deficiency in the evidence provided, shall not be construed as a waiver of the obligation to procure or maintain the insurance required hereunder. The acceptance of delivery by Metra or VRE of any certificate of insurance does not constitute approval or agreement that the insurance requirements have been met or that the insurance policies identified in the certificates of insurance are in compliance with such requirements.
1.21.1.1 Commercial General Liability Insurance

The Commercial General Liability policy shall include the following coverage limits when limits are indicated:

$10,000,000 per occurrence

$10,000,000 aggregate

$10,000,000 aggregate for completed operations and products liability

1.21.1.2 Automobile Liability Insurance

The Automobile policy shall include the following additional coverage limits:

Include all autos owned by the contractor/vendor as well as hired and non-owned autos used by the contractor/vendor and autos used by the contractor/vendors’ employees while on Metra or VRE property.

$1,000,000 for Property Damage (if not combined in single limit)

1.21.1.3 Workers Compensation and Employers Liability Insurance

Workers Compensation Insurance coverage should be at statutory limits.

As a minimum, the Employers Liability policy shall include coverage limits of:

$1,000,000 for bodily injury by accident

$1,000,000 for bodily injury by disease, each employee

$1,000,000 Aggregate liability
2 Special Conditions

2.1 TERM AND ORDER PROCESS
This Contract shall remain effective for all services described herein for a period of 60 months from the date Metra issues Notice to Proceed. The Contractor agrees to complete each phase of the Work in accordance with the schedule and timelines described within this Contract. The Contractor shall complete all services described herein within 144 months of the date Metra issues Notice to Proceed.

The Contractor shall supply a minimum of two hundred (200) and up to a maximum of four hundred (400) new Cars and the specified parts in accordance with Section 4, Technical Specifications. Metra may issue orders for specified quantities any time within the 60 month period. All orders will be made in writing, and require signed authorization of Metra’s Executive Director, or his designee as appointed in writing by either the Executive Director or Metra’s Board Chairman. Absent such written authorization, or designation if applicable, no order shall be fulfilled. Further, Metra reserves the right to cancel or modify an initial order and will only be obligated to cover Contractor’s reasonably incurred costs in fulfillment of that order. For each order received in compliance with this Section, Contractor shall respond with a delivery schedule.

2.2 PAYMENT AND PERFORMANCE BONDS
Both a labor and material payment bond, and a performance bond shall be provided under this Contract, prior to NTP, each individually in the amount of one hundred (100%) of the base order total. Additional bonds, in the amount of one hundred (100%) of each option, shall be provided within thirty (30) days of Metra exercising an option. The surety on each bond must be responsible for one hundred percent (100%) of damages up to one hundred percent (100%) of the total. For any increase in the actual contract price throughout the duration of the contract, as amended, additional bonding in the amounts stated above must be provided within thirty (30) days’ notice from Metra for Metra’s review and approval. The surety must be on the most recently published Department of the Treasury’s Listing of Approved Sureties (Department Circular 570) throughout the contract, and the surety will be required to assure, in writing, performance of the Contract. Additionally, any attorney-in-fact who signs any bond must attach to that bond an effective copy of his/her power of attorney, as well as a Jurat page. The acceptable bond forms are the February 1970 Edition of AIA Document A311, Performance Bond, and Labor and Material Payment Bond.

Unless otherwise agreed, the bonds shall be continuously in effect until completion of all of Contractor’s obligations.

The Contractor’s sureties shall be jointly and severally liable under its performance bond to Metra in the event that the Contractor shall breach any of its obligations under this Contract. Contractor acknowledges and agrees that for purposes of this Contract Metra shall not be deemed a merchant pursuant to the Uniform Commercial Code Section 2104.

2.3 KEY PERSONNEL
Contractor must, and where applicable must cause its Major Subcontractors to, include among staff assigned to the Work the persons in the capacities identified in its proposal (the "Key
Personnel”). Key Personnel shall devote all of their respective time and efforts to completing their respective tasks in connection with the Work when their respective responsibilities so require, and shall otherwise be reasonably available when and as required by Metra without material conflict with other duties, until completion of the Work. Contractor shall not reassign or replace or permit reassignment or replacement of any Key Personnel without the prior written consent of Metra in each case. Within four (4) weeks after the position of any Key Personnel becomes vacant, Contractor shall replace or cause the replacement of the person previously holding the vacant position with another person who has at least equivalent qualifications, experience, and knowledge as that of the person replaced and who is acceptable to Metra. Metra may require Contractor to replace or cause to be replaced any Key Personnel whom Metra deems in its reasonable discretion to be unsatisfactory.

2.4 QUALITY ASSURANCE PROGRAM

The Contractor shall establish a quality assurance program conforming to Exhibit 1-J of the RFP (Mechanical Department Quality Assurance Requirements and Mechanical Quality Plan (MQP)) and the FTA Quality Management System Guidelines (FTA PA 27 5194 12.1 issued December 2012. In addition, these requirements shall be imposed on all entities within the Contractor’s organization and on all manufacturers, subcontractors, and suppliers who will perform work under the Contract to ensure that the quality standards are consistent throughout the entire supply chain and throughout the life of the Contract. The Contractor shall submit their quality assurance program documents with their proposal for review and approval by Metra. Metra shall be the sole judge as to compliance of the Contractor’s quality assurance program with Metra’s requirements and the appropriate quality assurance standards.

2.5 DELIVERY AND ACCEPTANCE

2.5.1 Generally

The contractor bears full responsibility for all costs for transport of Cars to Metra, as well as for delivery of spare parts or components, training materials, manuals, and any related materials shipped to Metra’s designated destinations.

All cars must be delivered to:

Metra’s Blue Island Yard
Attn: Director – Mechanical
Metra’s Blue Island Division
Chicago, Illinois 60406 USA

All spare parts must be delivered to:

Metra Rock Island District
Attn: Storekeeper
147 W. 47th St.
Chicago, Illinois 60609 USA

All maintenance and parts manuals, drawings, and any other final deliverables must be delivered to:
The contractor will use good-faith efforts to effectively manage third-party transportation with a carrier on a daily basis for Cars destined for Metra. Contractor shall update Metra on a daily basis with respect to movement of Cars.

Testing, issuance of the Certificate of Fitness for Delivery, Conditional, or Final Acceptance will not abrogate any other requirement of the Contract, or estop Metra from asserting its rights with respect to any defect or incompletion in a car, whether or not then known.

2.5.2 Pre-Shipment Inspection and Fitness for Delivery

A Fitness for Delivery certificate will be issued for each Car once it has successfully undergone pre-shipment inspection and testing through a Metra approved procedure. All non-conformities shall be addressed prior to shipment and the Car history book shall be complete and ready for review and approval by Metra or its designated representative. The Pre-Shipment Inspection report shall be forwarded to Metra and shall be recorded in the Vehicle History Book.

2.5.3 Notice of Arrival

On arrival, each Car will be carefully inspected by representatives of Metra, the Contractor, and the carrier for damage, loss, vandalism, or other discrepancies incurred during shipping. The Contractor will be responsible for resolution of any noted issues prior to Metra issuing a notice of arrival and before the Car will be allowed to undergo testing. Use of Metra facilities to resolve any issue is at Metra’s sole discretion. Any generated report and resolution shall be included in the Vehicle History Book.

2.5.4 Operational Testing

After the notice of arrival, each Car will undergo operational performance tests. Testing will consist of shop testing the Car’s subsystems and track testing with all subsystems operating. If Metra determines, in its sole discretion, that the Car does not pass one, all, or any combination of tests, Metra shall issue the Contractor a notice of rejection for the Car listing the items to be remedied or repaired (“Open Items”). The cost of any retest shall be borne by Contractor.

2.5.5 Conditional Acceptance

If there are no Open Items, Metra will issue Conditional Acceptance. In lieu of a notice of rejection, Metra may issue Conditional Acceptance where the Cars may, in Metra’s sole discretion, operate in supervised revenue service while Contractor remedies or repairs the Open Items. Metra’s Conditional Acceptance of a car does not constitute a waiver, nor shall such acceptance obligate Metra to accept any other car with the same or any other non-compliance. Notwithstanding the foregoing, Metra shall not be obligated to Conditional Acceptance until and unless: (i) all defects and damage which may render the
car unfit for revenue service, have been remedied according to the repair procedures defined above and the car passes all re-tests; (ii) any unapproved materials or components have been replaced, and (iii) the car contains no other defects, non-compliances, or incompletions which significantly affect the value of the car.

2.5.6 Final Acceptance

Final Acceptance will be issued when all initial corrective actions and any retrofits have been fully completed in response to any remaining Open Item(s), successful operational test runs have been completed, and the vehicle is considered to be fully compliant with the Contract by Metra and consequently ready to be released for general revenue service.

2.5.7 Repairs by Contractor

Unless Metra exercises its option to make repairs, the Contractor must begin repair work within five (5) working days of Metra’s notice of the car's failure to pass any of Metra’s tests or inspections. Metra shall make the car available to timely complete repairs. Unless directed otherwise by Metra, the Contractor will be required to remove the car from Metra’s property while repairs by the Contractor are being affected.

If the Contractor fails or refuses to initiate the repairs within five (5) working days of Metra’s notice of rejection, Metra may return the car at Contractor's risk and expense.

2.5.8 Repairs by Metra

Metra may, at its sole option, and as Contractor’s agent, endeavor to make repairs on behalf of the Contractor at any stage prior to a car’s Final Acceptance. All repairs made by Metra will be made under the direction of the Contractor.

2.5.9 Parts Used

If Metra performs the repairs on a car, it shall endeavor to do so using Contractor-specified parts available from its own stock or those supplied by the Contractor specifically for this repair. Monthly, or at a frequency to be mutually agreed upon, reports of all repairs covered by this procedure shall be submitted by Metra to the Contractor for reimbursement.

2.5.10 Contractor Supplied Parts

If the Contractor supplies parts for repairs being performed by Metra, these parts shall be shipped prepaid to Metra from any source selected by the Contractor within five (5) Working Days after receipt of the request for said parts.

2.5.11 Return of Defective Components

The Contractor may request that defective components removed be returned to the manufacturing plant at Contractor’s sole cost.

2.5.12 Reimbursement for Labor

Metra shall be reimbursed by the Contractor for labor. The amount shall be determined by multiplying the number of man-hours actually required to correct the defect, rounded to the nearest half-hour, by: (1) Metra's per hour, mechanic, straight time, or overtime wage rate in effect at the time, and (2) Metra's additive for in-shop repairs in effect at the time.
2.5.13 Reimbursement for Parts

The Contractor shall reimburse Metra for parts that Metra supplies or replaces to correct the defects. The reimbursement amount shall be the sum of: (1) Metra's direct purchase cost, (2) material additive cost (Metra's purchase cost or Contractor's catalog price, when parts are supplied by Contractor, multiplied by Metra's additive rate for material handling in effect at the time), and (3) freight charges, where applicable. The material additive rate is subject to an annual adjustment.

2.6 PARTS AVAILABILITY

The Contractor agrees to continuously offer to supply, either directly or through a designated source, within a commercially reasonable period of time in the case of each part ordered, the spare parts and customer-accessible software necessary to maintain and repair the Cars supplied under this Contract, at the then-current or last published in Contractor’s catalogs, price list, or other general sales materials, for a period of forty (40) years after the date of the Final Acceptance of the last Car; provided, however, that if Contractor discontinues the general distribution of such part, it shall notify and give Metra the opportunity to make a one-time buy of its requirements. Parts shall be interchangeable with the original equipment.

On receipt of Metra’s notice that Contractor has failed to comply with this section, then the Contractor shall provide Metra, within eight (8) hours of Metra’s verbal or written request, the original suppliers’ and/or manufacturers’ part numbers, company names, addresses, telephone numbers, and contact persons’ names for all of the specific parts not received by Metra so that Metra may attempt to produce or make such parts, and Contractor shall be responsible to Metra for the damages caused by Contractor’s, its Subcontractors’, or Suppliers’, breach of this provision during performance of the Contract, including the subsequent warranty periods. In addition, Contractor must provide to Metra, for such production and within seven (7) days of Metra’s verbal or written request, the design plans, manufacturing location, and documentation necessary for those parts manufactured by the Contractor and the original suppliers’ and/or manufacturers’ part numbers, company names, addresses, telephone numbers, and contact persons’ names for all of the specific parts not received by Metra. Contractor hereby grants to Metra an irrevocable license to use the Contractor’s design and manufacturing documentation for the purpose of Metra procuring parts for the Cars agreed to under this Contract and for no other purpose.

2.7 WARRANTY AND RELIABILITY

2.7.1 General Warranties

1) The Contractor warrants that, at the time of acceptance, all Cars, equipment, Work, components and parts, (including and without limitation and as an example, data, manuals, and reliability information), furnished under the Contract shall be:

a. In full conformance with all requirements of all provisions of the Contract;

b. Free of any and all defects and Deficiencies;
c. Fit for their particular purpose;

d. Fit for the ordinary purposes for which such Cars, equipment, Work, components and parts are used;

e. Free from any and all liens and other encumbrances;

f. Component data or information of the latest configuration employed by the Contractor, Subcontractor, or Supplier in commercial service;

g. Accurate, complete, and current.

2) The Contractor further warrants that, for the periods of time defined in this Section, all Cars, equipment, Work, components and parts shall be, remain and perform free of any and all deficiencies, and shall be, remain and perform in full conformance with all requirements of all provisions of the Contract, and all warranties which extend to the future performance of each of such items.

3) Warranties By Others: All warranties and guarantees of any Subcontractor, or Supplier with respect to any Cars, equipment, Work, components or parts, whether expressed or implied, are deemed to be for the benefit of Metra and to be obtained by the Contractor for the benefit of Metra, regardless of whether or not such warranties and guarantees have been transferred or assigned to Metra by separate agreement. The Contractor shall enforce such warranties and guarantees on behalf of Metra; provided, however, that if directed by Metra, the Contractor shall require such Subcontractors, and Suppliers to execute such warranties and guarantees directly to Metra. The Contractor shall be jointly and severally liable for any such warranties or guarantees. To the extent that any such warranty or guarantee would be voided by reason of the Contractor's negligence in incorporating any equipment, component or part into the Work, the Contractor shall be responsible, at its sole cost, for correcting such error or omission, without cost or expense to Metra.

4) Equipment failures or performance deficiencies due to breach of the Contractor's or third party warranties described above is referred to in this Contract as a "Deficiency."

2.7.2 Availability and Reliability Warranty

1) Availability is defined as the ability of the Car to be assigned to a train at the commencement of the calendar day, following the calendar day inspection pursuant to 49 CFR Part 238.303 and 238.305, with no defects found that prevent the Car from being dispatched. Reliability is defined as the ability to complete the train assignments of the calendar day without Car failure or degradation of performance such that it causes a train or trains to lose time or result in a schedule delay.
A Car delay is defined as a Car related, mechanical failure causing a revenue service train to be more than 5 minutes late at its destination terminal; or annulled either at its originating point or en route.

2) In addition to the other warranties provided under this Contract, the Contractor further warrants the availability and reliability of the Cars, equipment, components, Work and parts in accordance with the Contract availability and reliability requirements set forth below. Failure to meet the Contract availability or reliability requirements shall also constitute a “Deficiency”, and Contractor shall, at its sole cost and without cost or expense to Metra, take all actions required to correct as promptly as possible the Deficiency and to achieve the specified availability and reliability requirements. In cases where a “Fleet Deficiency” exists, the Contractor shall incorporate at its sole cost such correction into all previously delivered Cars, equipment, components, Work and parts before it may resume deliveries of new Cars or affected components. Such correction shall be incorporated into all undelivered Cars, equipment, components, Work and parts prior to delivery.

3) The anticipated availability is 97% exclusive of days when a car is undergoing periodic inspection, programmed maintenance, or is out of service for any reason other than mechanical failure, as determined by Metra.

4) The anticipated reliability is 98% for a car that is dispatched, from time of dispatch until the next calendar day inspection, at which time it becomes again subject to the availability target. This requirement is applicable only to mechanical failures, as determined by Metra.

5) Achievement of reliability targets will be calculated by dividing the number of days that each Car was available for service in any 184 day Federal Railroad Administration (FRA) inspection period into the number of days or part of a day that the Car became unavailable due to a failure. For example, if the Car was available for service for 88 days between inspections and periodic maintenance, but failed after entering service on 2 days, the reliability rate is 98%, calculated by dividing 86 days by 88 days.

2.7.3 Time Periods of the Warranties

Basic Warranty: The warranty period will commence on Conditional Acceptance, unless there are Open Items. The warranty period as to each car or any part or subsystem relating to an Open Item shall not commence until all Open Items have been corrected to Metra's satisfaction. The warranty period shall be effective for a time period of three (3) years (except as extended elsewhere in the Contract) after such Conditional Acceptance. The warranty for Special Tools, as defined in the technical specifications, including, without limitation, Diagnostic and Test Equipment shall be for a time period of three (3) years after Final Acceptance by Metra. For any Car or component that is Conditionally Accepted, the warranty shall commence on the date of Final Acceptance.
1) Warranty for Certain Components: Warranties shall commence upon Acceptance as provided in the Paragraph herein entitled Basic Warranty, but shall have time periods as follows:

   a. Warranted for a period of (10) years:
      i. Carbody;
      ii. Door Panels;
      iii. Floor materials and/or coverings, if applicable;
      iv. Truck frame, bolster, equalizers, hangers, and spring plank.

   b. Batteries shall be warranted for a three (3) year period, plus three (3) years prorated, for a total period of six (6) years.

   c. The warranty on any component that Metra designates prior to Contract award as being non-service proven shall be for five (5) years. Non-service proven is defined as a component or system that has been used less than three (3) years in North American commuter rail and/or freight railroad applications, or less than five (5) years in North American rail transit or light rail applications.

   d. The warranty for spare parts shall be for the lesser of three (3) years after delivery of the parts or two (2) years after the part is put into service, unless the part is a component or part thereof to which an Extended Warranty defined by this Section

2) Subcontractor Warranties: Any warranty from a Subcontractor or Supplier or manufacturer to the Contractor, which exceeds the above time periods, shall be extended to Metra for the same time period as given to the Contractor.

2.7.4 Warranty Notice

Metra will provide the Contractor with notice of breach of any warranty, including, without limitation, notice of a Deficiency, within a reasonable time after Metra observes and verifies any failure, malfunction, or condition of, any Car, equipment, Work, component or part, that the failure, malfunction or condition arises from a Deficiency or other breach of warranty existing or occurring within any of the applicable warranty periods ("Notice").

2.7.5 Engineer & Service Representatives

Within seventy-two (72) hours of verbal or written notice from Metra, the Contractor shall at its own expense, have a competent engineering representative(s) available to assist Metra in the solution of engineering or design problems within the scope of the specifications that may arise during the warranty period. In addition, a service representative shall be available, on Metra property, within twenty-four (24) hours of verbal or written notification from Metra. These
requirements do not relieve the Contractor of any other responsibilities under this Contract. The obligation to provide engineering services applies for the warranty period starting from the time the last Car is conditionally accepted.

2.7.6 Corrective Work Requirements

1) Promptly upon receipt of notice from Metra, but in any event not later than forty-eight (48) hours thereafter, unless Metra agrees to a longer interval, the Contractor, at its sole cost, and without cost or expense to Metra, shall commence and thereafter prosecute with due diligence using qualified personnel, all activities necessary to investigate, analyze, diagnose and determine the cause and extent of the Deficiency or other breach of warranty, and the proper correction action, in conformance with the provisions of this Contract and shall promptly report the causes, extent and proposed corrective action to Metra in writing.

2) Promptly upon the approval of Metra, the Contractor, at its sole cost, and without cost or expense to Metra, shall commence and thereafter prosecute with due diligence, using qualified personnel, appropriate action, within the time period and in the manner provided for in this section to correct the Deficiency. Corrective action shall include without limitation, adjustment, repair, replacement, reengineering and redesign as appropriate to fully and completely address and remedy the Deficiency or other problem in each affected Car, equipment, Work, component or part, so that the item and the Car shall perform as specified by the Contract, and to ensure that the Deficiency will not recur. The Contractor shall promptly and diligently pursue all corrections to their complete, satisfactory conclusion. All corrections shall comply with all requirements of the Contract and shall not result in any Car, equipment, Work, component or part failing to comply with any requirement of any provision of the Contract. All corrections shall employ and require only parts that perform comparably to that originally intended by the Contract, and of cost comparable to the cost of the deficient part prior to correction. The Contractor shall perform, at its sole cost, any tests that Metra may reasonably require to verify that any correction made by the Contractor will correct the Deficiency and that the correction will comply with all requirements of the Contract.

3) All corrections shall be without cost or expense to Metra. All costs and expenses of any correction shall be at the Contractor’s sole cost. Contractor shall also bear all costs and expenses of removal, replacement and reinstallation and testing of other equipment, components, Work and parts necessary to gain access to the Deficiency or to accommodate the correction. The Contractor shall also bear all transportation costs for or associated with any Deficiency or correction.

4) The Contractor shall provide, at its sole expense and at no cost or expense to Metra, all facilities and equipment necessary to carry out the
investigations, analyses and diagnoses needed to determine the cause and extent of the Deficiency or other breach of warranty, and to complete all correction thereof and all associated Work.

5) The Contractor shall promptly provide to Metra, without cost or expense to Metra, all updated parts manuals and maintenance manuals that include all information related to any correction.

6) The Contractor shall reimburse Metra for all Metra costs and expenses reasonably incurred in the investigation, analysis, diagnosis or correction of any Deficiency.

7) The Contractor shall be solely liable for any and all injury, loss or damage to any person, or to any Car, equipment, Work, component or part, or other Metra property, caused by any Work performed to make any correction. While on Metra’s premises, the Contractor shall keep such premises in a neat and orderly condition and, unless otherwise specified in the Contract Documents, title to any demolished materials and equipment, waste, and rubbish is vested in Contractor and such material shall be disposed of off the premises by Contractor at its sole expense.

8) In addition to correction of any Deficiency, the Contractor, at its sole cost, shall correct without cost or expense to Metra any other Car, equipment, component, Work or part that was caused to be damaged or adversely affected by a Deficiency.

9) All corrected components and parts used, and repairs made, to correct deficiencies shall be subject to acceptance by Metra and shall be subject to the same requirements as are set forth in the Contract for the original components.

10) If a correction hereunder has required the Contractor to reengineer or redesign a component, the Contractor shall, without cost to Metra and at Contractor’s sole cost, replace all Metra owned spare parts comprising that component with the corrected items or detail parts.

2.7.7 Fleet Deficiency Remedy

1) A Fleet Deficiency exists when a warranty repair or redesign to similar components, equipment or materials is required for twenty percent (20%) or more of the Cars then accepted by Metra under this Contract. Upon Metra’s notice to the Contractor that a Fleet Deficiency exists, the Contractor shall promptly, but in any event not later than forty-eight (48) hours after such notice, unless Metra agrees to a longer interval, commence and thereafter prosecute with due diligence and using qualified personnel, all activities necessary to investigate, analyze and diagnose the cause and extent of the Fleet Deficiency and the proper correction thereof. The
Contractor shall promptly provide a written report to Metra describing the cause and extent of the Fleet Deficiency and the Contractor's proposed correction thereof. The Contractor shall submit for Metra's approval and, following Metra approval, shall promptly implement and satisfactorily complete Metra approved corrections of all affected components, at the Contractor's sole cost and at no cost or expense to Metra, as promptly as practicable and in no event later than three (3) months after Metra's initial notice to Contractor of the Fleet Deficiency, and in compliance with the requirements Section 2.6.6 Corrective Work Requirements. The Contractor shall make the correction to all equivalent components in the fleet, not just those in which a failure or malfunction has occurred, including without limitation, all components for which any warranty period has expired, and to all equivalent Metra-owned spare parts.

2) The Fleet Deficiency remedy provided for in this paragraph is in addition to, and shall not be construed as a limitation of, any other rights or remedies provided for by this Article or any provision of this Contract or the law.

2.7.8 Timeliness

Time is of the essence in the corrections of all Deficiencies to be undertaken under all applicable warranties. Unless otherwise directed in Metra's notice to Contractor of a Deficiency, the Contractor shall commence correction of the Deficiency at the time specified by Metra, but in no event later than forty-eight (48) hours after the Notice, unless Metra agrees to a longer interval. To ensure timely corrections, the Contractor shall make provisions to have available all necessary facilities and special equipment, and shall use such qualified engineers and product and system specialists as are necessary, including diversion of such persons from the Contractor's other operations or from the operations of its Subcontractors and Suppliers. Contractor shall also use additional shifts and Work on weekends and holidays, as necessary, to complete timely corrections in accordance with this Section.

2.7.9 Use of Metra-Owned Spare Parts

At the sole discretion of Metra, as determined on a case-by-case basis, Metra owned spare parts may be utilized by the Contractor for correction purposes if the Contractor’s replacement part is not immediately available. The Contractor must replace each borrowed part with an equivalent (like-for-like) part within thirty (30) calendar days. Consequently a new part must be replaced with new, a UTEX part replaced with UTEX or new. All costs associated with replacing the spare parts shall be borne by the Contractor. In some cases, a Metra-owned replacement part may be manufactured or remanufactured by a different source than that of the Contractor. In instances where “non-OEM” components are utilized in the repair due to unavailability of an immediate contractor-supplied replacement, the Contractor will be responsible for all costs arising from the removal of a borrowed part and subsequent installation of the contractor’s part following the initial repair operation. Consequently, to avoid compensating Metra for repetitive repair
operations, the Contractor is encouraged to maintain a sufficient quantity of spare replacement parts available for prompt delivery to Metra.

2.7.10 Delays and Disruption

To prevent delays and disruption to Metra’s operations, Metra shall have the right to the continued use of any deficient Car, equipment, component, Work or part, until it can be taken out of service and made available to Contractor to correct the Deficiency.

2.7.11 Repairs by Metra

At Metra's sole discretion and option, Metra may investigate, analyze, diagnose and perform the redesign, replacement, or repair of any Deficiency, as Contractor's agent, and Contractor shall pay Metra for such Work. Contractor shall, if required by Metra, supply components, materials, or equipment within ten (10) days after Metra's request in each case. Contractor shall pay Metra the cost of the warranty Work for: (a) outside engineering fees and (b) labor supplied by Metra by multiplying the number of man-hours of Metra labor actually supplied to correct the defect by the wage rate and percent shop overhead. The cost of moving the Cars(s) if such action is necessary, all applicable freight charges, and Metra's material additives in effect at the time on components, materials, supplies, or equipment furnished by Contractor (subject to yearly adjustment by Metra, based on Metra's material additive rate(s) in effect at time of Work), within thirty (30) days of Metra's invoice.

2.7.12 Warranties of the Corrected Components

The Contractor warrants each corrected component for the remainder of the warranty originally applicable to the component, or for a period of one (1) year from the date of Metra’s acceptance of the corrected component, whichever is greater.

2.7.13 No Waiver

No inspection, test, acceptance of, or payment to the Contractor for, any Car, equipment, component, Work or part, or for any other purpose shall relieve the Contractor from any duty under, or be deemed to be a waiver of any Warranty, or other right or remedy pursuant to, this Article, the Contract or the law.

2.7.14 No Increase in Maintenance or Operating Costs

In no case shall any correction of any Deficiency, whether pursuant to any warranty or otherwise, call for, require or result in any increase in any maintenance, inspection or test requirement or frequency, or in any additional maintenance, inspection or test requirement, or operating costs beyond that specified in the Contract or in the original edition of the maintenance manual.

2.7.15 Metra Warranty Claim

Where Metra undertakes its own repairs, Metra may file claims consistent with the notice provision no later than 90 days after performing said repairs. Metra shall submit to the Contractor a claim in writing for such costs and expenses ("Warranty
Claim”). The Warranty Claim shall identify the Deficiency and the correction to which such costs and expenses are related, and shall provide such other information necessary to document the costs and expenses incurred by Metra and their relationship to the Deficiency and the correction. The Contractor shall reimburse Metra in a timely manner for all such costs and expenses within thirty (30) days after the Contractor's receipt of Metra’s Warranty Claim.

2.8 LIQUIDATED DAMAGES

2.8.1 Generally

This Section is controlled by and intended to supplement the Liquidated Damages provision found in the General Conditions. Cars that unexpectedly have to be removed from revenue service and remain out of service cause significant damages to Metra’s operations and reputation, and to the traveling public which depends upon Metra for timely and reliable daily service.

2.8.2 Removal from Service

For all Cars removed from service, Contractor or its sureties shall pay agreed liquidated damages at the rate of five hundred dollars ($500) per day per Car until the Car is accepted back into service. Those damages are not readily susceptible to calculation. The parties to this Contract therefore agree that liquidated damages are appropriate compensation to Metra. These liquidated damages cover only damages associated with the loss of use of Cars and do not compensate Metra for damages for breach of warranty or other breach of contract, such as damages for the cost of warranty work or the extra costs of obtaining substitute goods or performance from others. Payment of liquidated damages under this section, and acceptance thereof by Metra, does not constitute a waiver or settlement of any claim (other than for delay in delivering acceptable Cars or delay in providing a warranty response or correction as required under this Contract) for damages for such breaches, and nothing in this section is intended to limit such claims.

2.8.3 Delayed Warranty Response or Effective Corrective Action

In the event the Contractor breaches Section 2.6.6 Corrective Work Requirements, and the affected Metra Car remains out of service for more than 48 hours, Contractor shall pay to Metra as liquidated damages the sum of five hundred dollars ($500) per day for every full day thereafter until Contractor provides the services and equipment otherwise required by Section 2.6.6 to be provided within 48 hours after Metra’s notice of a Deficiency, or until the Car is returned to revenue service, whichever is first.

In any instance in which a Deficiency causes a Car to become unavailable for service, and the Contractor fails to complete a Warranty correction to such Deficiency within a time sufficient to enable the Car to be tested and returned to service within ten (10) calendar days after the Deficiency caused the Car to become unavailable for service, the Contractor shall pay to Metra as liquidated damages the sum of Five Hundred Dollars ($500.00) for each day that the Car is out of service, commencing with the first full out-of-service day after the expiration of the ten (10)
day period. The ten (10) day period calculated pursuant to this paragraph shall not include reasonable transportation time to transport the Car from Metra to Contractor's repair facility. Note there is no cap or maximum on the amount of liquidated damages under this provision.

2.8.4 **Accrued Liquidated Damages**

For purposes of liquidated damages for this section, payable on Metra’s demand. Metra may, at its discretion, choose to accrue liquidated damages under this provision until there is no further possibility of additional liquidated damages.
2.9 PRICE SCHEDULE

2.9.1 Generally

Pricing includes design, manufacture, construction, fabrication, assembly, delivery, and all associated costs. No additional costs will be allowed, except for actual performance and payment bond costs. Price will be fixed for the base order of the contract. A price adjustment will be allowed for Cars ordered in years 2 through 5 based on the Producer Price Index for Railroad rolling stock manufacturing, published by the United States Department of Labor’s Bureau of Labor Statistics (Series ID: PCU3365103365102Z; Base Date: 198406).

The proposed unit price and the index value for the month and year of the date proposals are received will serve as the Base Index Value to determine the unit pricing for the Cars released in years 2 through 5. The Current Published Index Value will be the index value for the month and year of the date an option order is received. The unit pricing will be adjusted in accordance with the following example equation.

For Example: If the current published Index Value is 122.5, the Base Index Value is 122.1, and the base unit price is $1,000,000, then the release order unit price would be:

\[
\frac{122.5}{122.1} \times 1,000,000.00 = 1,003,276.00
\]

which represents a 0.3276% increase.

2.9.2 Base Index

| Producer Price Index for Railroad Rolling Stock Manufacturing; Cars, new and rebuilt, including parts; (Series ID: PCU3365103365102Z; Base Date: 198406) |

2.9.3 Unit Pricing

The pricing table below must be completed in its entirety. Incomplete pricing proposals may be rejected. Actual quantities will consist of the base order, plus any options ordered.
2.9.4 Prices

All costs, except surety costs, are fixed firm prices and cannot be changed except as allowed by Metra.

The Engineering Costs referenced in this table are the costs required to:

A. Prepare all drawings required for submittal and approval by the technical specifications;
B. Prepare all engineering/technical documents required for submittal and approval by the technical specification;
C. Prepare all test/inspection procedures required for submittal and approval by the technical specification; and
D. Perform and prepare reports for submittal and approval of all proof of design tests required by the technical specification.

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Unit Price</th>
<th>Quantity</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailer Car with Toilet</td>
<td>$</td>
<td>170</td>
<td>$</td>
</tr>
<tr>
<td>Cab Car with Toilet</td>
<td>$</td>
<td>100</td>
<td>$</td>
</tr>
<tr>
<td>Trailer Car without Toilet</td>
<td>$</td>
<td>130</td>
<td>$</td>
</tr>
<tr>
<td>Engineering Costs</td>
<td>N/A</td>
<td>N/A</td>
<td>$</td>
</tr>
<tr>
<td>Training Costs</td>
<td>N/A</td>
<td>N/A</td>
<td>$</td>
</tr>
<tr>
<td>Payment &amp; Performance Bond at 100% for all 400 Cars (for evaluation only)</td>
<td>$</td>
<td>N/A</td>
<td>$</td>
</tr>
<tr>
<td>Documents &amp; Warranty Costs</td>
<td>$</td>
<td>N/A</td>
<td>$</td>
</tr>
</tbody>
</table>

**Car Option Items (If Proposed)**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Unit Price</th>
<th>Quantity</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heated Floor [Exhibit 1-M COPL CO-8-01]</td>
<td>$</td>
<td>400</td>
<td>$</td>
</tr>
<tr>
<td>USB/Outlets in Seats [Exhibit 1-M COPL CO-8-02]</td>
<td>$</td>
<td>400</td>
<td>$</td>
</tr>
<tr>
<td>Foot Rests for Seats [Exhibit 1-M COPL CO-8-03]</td>
<td>$</td>
<td>400</td>
<td>$</td>
</tr>
<tr>
<td>Tray Table for Seats [Exhibit 1-M COPL CO-8-04]</td>
<td>$</td>
<td>400</td>
<td>$</td>
</tr>
<tr>
<td>Ticket Verification at Seats [Exhibit 1-M COPL CO-8-05]</td>
<td>$</td>
<td>400</td>
<td>$</td>
</tr>
<tr>
<td>Service Description</td>
<td>Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>--------</td>
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<td></td>
</tr>
<tr>
<td>Seat Reservation</td>
<td>$400</td>
<td></td>
<td></td>
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<tr>
<td>[Exhibit 1-M COPL CO-8-06]</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Convenience Items</td>
<td>$400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Exhibit 1-M COPL CO-8-07]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic Dimming</td>
<td>$400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Exhibit 1-M COPL CO-10-01]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional LLEPM Options</td>
<td>$400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Exhibit 1-M COPL CO-10-02]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trainline Battery System</td>
<td>$400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Exhibit 1-M COPL CO-11-01]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated Digital Trainline</td>
<td>$400</td>
<td></td>
<td></td>
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<tr>
<td>[Exhibit 1-M COPL CO-11-02]</td>
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<td></td>
</tr>
<tr>
<td>Additional Infotainment Options</td>
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<td></td>
<td></td>
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<tr>
<td>[Exhibit 1-M COPL CO-12-01]</td>
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<tr>
<td>ADA Passenger Enhancement Options</td>
<td>$400</td>
<td></td>
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<tr>
<td>[Exhibit 1-M COPL CO-12-02]</td>
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<td></td>
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<tr>
<td>Exterior Digital Signage</td>
<td>$400</td>
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<tr>
<td>[Exhibit 1-M COPL CO-12-03]</td>
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<tr>
<td>Passenger Wi-Fi</td>
<td>$400</td>
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<tr>
<td>[Exhibit 1-M COPL CO-12-04]</td>
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<tr>
<td>Exterior Digital Display Sign</td>
<td>$400</td>
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<tr>
<td>[Exhibit 1-M COPL CO-16-01]</td>
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<td></td>
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<tr>
<td>Possible System Proposed Above Requirements of</td>
<td>$400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibit 1-M</td>
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<td></td>
</tr>
<tr>
<td>Possible System Proposed Above Requirements of</td>
<td>$400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibit 1-M</td>
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<tr>
<td>Possible System Proposed Above Requirements of</td>
<td>$400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibit 1-M</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Possible System Proposed Above Requirements of</td>
<td>$400</td>
<td></td>
<td></td>
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<tr>
<td>Exhibit 1-M</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Possible System Proposed Above Requirements of</td>
<td>$400</td>
<td></td>
<td></td>
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<tr>
<td>Exhibit 1-M</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Possible System Proposed Above Requirements of</td>
<td>$400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhibit 1-M</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Quantity</td>
<td>Price</td>
<td>Total</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Possible System Proposed Above Requirements of Exhibit 1-M</td>
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<tr>
<td>Possible System Proposed Above Requirements of Exhibit 1-M</td>
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<td>Possible System Proposed Above Requirements of Exhibit 1-M</td>
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<tr>
<td>Possible System Proposed Above Requirements of Exhibit 1-M</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Spare Parts**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbody Roof Section</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part # ______________________</td>
<td></td>
<td>10</td>
<td>$10</td>
</tr>
<tr>
<td>Carbody Side Section</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part # ______________________</td>
<td></td>
<td>20</td>
<td>$20</td>
</tr>
<tr>
<td>Carbody End Section</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part # ______________________</td>
<td></td>
<td>20</td>
<td>$20</td>
</tr>
<tr>
<td>Wheelchair Lift</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part # ______________________</td>
<td></td>
<td>10</td>
<td>$10</td>
</tr>
<tr>
<td>Low Voltage Power Supply</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part # ______________________</td>
<td></td>
<td>10</td>
<td>$10</td>
</tr>
<tr>
<td>A/C Unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part # ______________________</td>
<td></td>
<td>16</td>
<td>$16</td>
</tr>
<tr>
<td>Truck Complete “B” End</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part # ______________________</td>
<td></td>
<td>5</td>
<td>$5</td>
</tr>
<tr>
<td>Truck Complete “A” End</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part # ______________________</td>
<td></td>
<td>5</td>
<td>$5</td>
</tr>
<tr>
<td>Specialty Tools and Test &amp; Diagnostic Equipment (Per Section 20.9 of Exhibit 1-M)</td>
<td></td>
<td>4</td>
<td>$4</td>
</tr>
</tbody>
</table>

**Grand Total Cost** $
2.9.5 Financing

Bidders are requested to provide financing options in addition to the unit prices above, with clear title to the Cars being provided on final payment. Bidders may decide not to provide financing options or bidders may provide a financing option with monthly payments for twenty (20) years, commencing on Conditional Acceptance. Financing institutions may be a part of multiple bids; they need not limit themselves to partnering with a single bidder.

It is assumed that bidders would offer financing terms based upon a spread over an established benchmark in place at the time of Conditional Acceptance of each Car with payments to begin in the following month. Each proposed financing option shall include a description of the financing terms (such as “prime rate plus 0.5%”) and a schedule of payments as if the deal had been executed Jan 1, 2019 with rates in place at the close of that business day, so Metra has a numerical example of the exact calculation.

Metra will discount the proposed payments, using internal discount rates it determines, and value the options accordingly. The purchased Rail Cars would be the sole collateral for this purchase.

2.9.6 Milestone Payment Schedule

Payments for the surety costs and line items A through C shall be made in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Item</th>
<th>Payment %</th>
<th>Cumulative %</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Reimbursement of actual Metra approved surety costs.</td>
</tr>
<tr>
<td>A.1</td>
<td>75</td>
<td>75</td>
<td>Metra’s approval of all design submittals and drawings.</td>
</tr>
<tr>
<td>A.2</td>
<td>25</td>
<td>100</td>
<td>Delivery of acceptable as-built drawings in electronic format, drawing list and Bill of Material, as-built updates of all manuals, as-built specifications, and photographs.</td>
</tr>
<tr>
<td>B.1</td>
<td>50</td>
<td>100</td>
<td>Metra’s approval of all training materials.</td>
</tr>
<tr>
<td>B.2</td>
<td>50</td>
<td>100</td>
<td>Successful performance of training obligations.</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>100</td>
<td>Approval of Technical and Warranty Support plan.</td>
</tr>
</tbody>
</table>
Payment for individual Cars, whether the base order or optional cars, shall be made in accordance with the following schedule:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D.1/E.1</td>
<td>10</td>
<td>10</td>
<td>Issued after Contractor's receipt and acceptance of both: a) the following items: Trucks; Couplers; Diaphragms; Doors; Door Operators; HVAC System; Seating; Lighting; Brakes; Communications; Low Voltage Power Supply/Battery Charger; Batteries; Alerter/Event Recorder; Camera Systems; Car Monitoring System; and Windows and Glazing; and b) any other systems supplied by a Major Subcontractor, as determined by Metra.</td>
</tr>
<tr>
<td>D.2/E.2</td>
<td>10</td>
<td>20</td>
<td>Issued after the Contractor’s completion of the car shell and Metra's witness of car shell final dimension inspection.</td>
</tr>
<tr>
<td>D.3/E.3</td>
<td>10</td>
<td>30</td>
<td>Issued after the Contractor releases the car for in-process testing under Section 19.2.3 of the Detailed Specifications.</td>
</tr>
<tr>
<td>D.4/E.4</td>
<td>3</td>
<td>33</td>
<td>Issued after Contractor delivers and Metra approves Operating Manuals, Maintenance Manuals, Parts Manuals, electronic complete set of all drawings for production under Section 20.1.1 of the Detailed Specifications, Exhibit 1-M, delivery of Training Program Phase I under Exhibit 1-S and Test Equipment under Section 20.9 of the Detailed Specifications, Exhibit 1-M.</td>
</tr>
<tr>
<td>D.5/E.5</td>
<td>60</td>
<td>93</td>
<td>Issued after Conditional Acceptance for each Car.</td>
</tr>
<tr>
<td>D.6/E.6</td>
<td>5</td>
<td>98</td>
<td>Issued after Final Acceptance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Contractor shall, provide Metra, pursuant to Sections 20.1.2, 20.2, 20.3, 20.4, 20.5, 20.6 and 20.7 of the Detailed Specifications, Exhibit 1-M, as-built drawings in editable electronic format, drawings list and Bill of Material, as-built updates of all manuals, as-built specifications, and photographs, and complete Phase II of the Training Program under Exhibit 1-S.</td>
</tr>
<tr>
<td>D.7/E.7</td>
<td>2</td>
<td>100</td>
<td>Completion of the basic warranty.</td>
</tr>
</tbody>
</table>
3  FTA Clauses

3.1  NO GOVERNMENT OBLIGATIONS TO THIRD PARTIES

Metra and the Contractor acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be subject to any obligations or liabilities to Metra, the Contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract. The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by the FTA. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions. The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by the FTA. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

3.2  PROGRAM FRAUD AND FALSE OR FRAUDULENT STATEMENTS AND RELATED ACTS

The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 et seq. and U.S. DOT regulations, "Program Fraud Civil Remedies," 49 C.F.R. Part 31, apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.

The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 U.S.C. chapter 53, the Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5323(l) on the Contractor, to the extent the Federal Government deems appropriate.

The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

3.3  ACCESS TO RECORDS AND REPORTS


3.4  FEDERAL CLAUSES

Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Master Agreement between Metra and FTA, as they may be amended or promulgated from time to time.
during the term of this contact. Contractor’s failure to so comply shall constitute a material breach of this contract.

3.5 CIVIL RIGHTS REQUIREMENTS

Metra is an Equal Opportunity Employer. As such, Metra agrees to comply with all applicable Federal civil rights laws and implementing regulations. Apart from inconsistent requirements imposed by Federal laws or regulations, Metra agrees to comply with the requirements of 49 U.S.C. § 5323(h)(3) by not using any Federal assistance awarded by FTA to support procurements using exclusionary or discriminatory specifications.

Under this Agreement, the Contractor shall at all times comply with the following requirements and shall include these requirements in each subcontract entered into as part thereof.

1. **Nondiscrimination.** In accordance with Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, religion, national origin, sex, disability, or age. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

2. **Race, Color, Religion, National Origin, Sex.** In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e et seq., and Federal transit laws at 49 U.S.C. § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 C.F.R. chapter 60, and Executive Order No. 11246, "Equal Employment Opportunity in Federal Employment," September 24, 1965, 42 U.S.C. § 2000e note, as amended by any later Executive Order that amends or supersedes it, referenced in 42 U.S.C. § 2000e note. The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, national origin, or sex (including sexual orientation and gender identity). Such action shall include, but not be limited to, the following: employment, promotion, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.


that it will not discriminate against individuals on the basis of disability. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

### 3.6 DISADVANTAGED BUSINESS ENTERPRISES (DBE)

The contractor, subrecipient, or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 C.F.R. part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

- Withholding monthly progress payments;
- Assessing sanctions;
- Liquidated damages; and/or
- Disqualifying the contractor from future bidding as non-responsive. 49 C.F.R. § 26.13(b).

### 3.7 INCORPORATION OF FEDERAL TRANSIT ADMINISTRATION (FTA) TERMS

The provisions herein include, in part, certain Standard Terms and Conditions required by DOT, whether or not expressly set forth in the preceding contract provisions. All contractual provisions required by DOT, as set forth in FTA Circular 4220.1F or most recent version are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this Agreement. The Contractor shall not perform any act, fail to perform any act, or refuse to comply with Metra requests which would cause Metra to be in violation of the FTA terms and conditions.

### 3.8 CARGO PREFERENCE

The Contractor agrees:

- To use privately owned United States-Flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved whenever shipping any equipment, material, or commodities pursuant to the underlying contract to the extent such vessels are available at fair and reasonable rates for United States-Flag commercial vessels;

To furnish within 20 working days following the date of loading for shipments originating within the United States or within 30 working days following the date of leading for shipments originating outside the United States, a legible copy of a rated, “on-board” commercial ocean bill-of-lading in English for each shipment of cargo described in the preceding paragraph to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DB 20590 and to the FTA recipient (through the Contractor in the case of a subcontractor’s bill-of-lading);

To include these requirements in all subcontracts issued pursuant to this contract when the subcontract may involve the transport of equipment, material, or commodities by ocean vessel.
3.9 FLY AMERICA REQUIREMENTS

a) Definitions. As used in this clause-

“International air transportation” means transportation by air between a place in the United States and a place outside the United States or between two places both of which are outside the United States.

“United States” means the 50 States, the District of Columbia, and outlying areas.

“U.S.-flag air carrier” means an air carrier holding a certificate under 49 U.S.C. Chapter 411.

b) When Federal funds are used to fund travel, Section 5 of the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 40118) (Fly America Act) requires contractors, recipients, and others use U.S.-flag air carriers for U.S. Government-financed international air transportation of personnel (and their personal effects) or property, to the extent that service by those carriers is available. It requires the Comptroller General of the United States, in the absence of satisfactory proof of the necessity for foreign-flag air transportation, to disallow expenditures from funds, appropriated or otherwise established for the account of the United States, for international air transportation secured aboard a foreign-flag air carrier if a U.S.-flag air carrier is available to provide such services.

c) If available, the Contractor, in performing work under this contract, shall use U.S.-flag carriers for international air transportation of personnel (and their personal effects) or property.

d) In the event that the Contractor selects a carrier other than a U.S.-flag air carrier for international air transportation, the Contractor shall include a statement on vouchers involving such transportation essentially as follows:

Statement of Unavailability of U.S.-Flag Air Carriers

International air transportation of persons (and their personal effects) or property by U.S.-flag air carrier was not available or it was necessary to use foreign-flag air carrier service for the following reasons. See FAR § 47.403. [State reasons]:

The Contractor shall include the substance of this clause, including this paragraph (e), in each subcontract or purchase under this contract that may involve international air transportation.

3.10 TRANSIT EMPLOYEE PROTECTIVE AGREEMENTS

Omitted.

3.11 DRUG AND ALCOHOL TESTING

The Contractor agrees to participate in Metra’s drug and alcohol program established in compliance with 49 CFR 655.
3.12 PATENT RIGHTS

The following requirements apply to each contract involving experimental, developmental, or research work:

General - If any invention, improvement, or discovery is conceived or first actually reduced to practice in the course of or under the contract to which this Attachment has been added, and that invention, improvement, or discovery is patentable under the laws of the United States of America or any foreign country, Metra and Contractor agree to take actions necessary to provide immediate notice and a detailed report to the party at a higher tier until FTA is ultimately notified.

Unless the Federal Government later makes a contrary determination in writing, irrespective of the Contractor's status (a large business, small business, state government or state instrumentality, local government, nonprofit organization, institution of higher education, individual), Metra and the Contractor agree to take the necessary actions to provide, through FTA, those rights in that invention due the Federal Government as described in U.S. Department of Commerce regulations, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," 37 C.F.R. Part 401.

The Contractor also agrees to include the requirements of this clause in each subcontract for experimental, developmental, or research work financed in whole or in part with Federal assistance provided by FTA.

3.13 COPYRIGHT AND RIGHTS IN DATA

The following requirements apply to each contract involving experimental, developmental or research work:

The term "subject data" used in this clause means recorded information, whether or not copyrighted, that is delivered or specified to be delivered under the contract. The term includes graphic or pictorial delineation in media such as drawings or photographs; text in specifications or related performance or design-type documents; machine forms such as punched cards, magnetic tape, or computer memory printouts; and information retained in computer memory. Examples include, but are not limited to: computer software, engineering drawings and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog item identifications, and related information. The term "subject data" does not include financial reports, cost analyses, and similar information incidental to contract administration.

The following restrictions apply to all subject data first produced in the performance of the contract to which this Attachment has been added:

Except for its own internal use, the Purchaser or Contractor may not publish or reproduce subject data in whole or in part, or in any manner or form, nor may the Purchaser or Contractor authorize others to do so, without the written consent of the Federal Government, until such time as the Federal Government may have either released or
approved the release of such data to the public; this restriction on publication, however, does not apply to any contract with an academic institution.

In accordance with 49 C.F.R. § 18.34 and 49 C.F.R. § 19.36, the Federal Government reserves a royalty-free, non-exclusive and irrevocable license to reproduce, publish, or otherwise use, and to authorize others to use, for "Federal Government purposes," any subject data or copyright described in subsections (2)(b)1 and (2)(b)2 of this clause below. As used in the previous sentence, "for Federal Government purposes," means use only for the direct purposes of the Federal Government. Without the copyright owner's consent, the Federal Government may not extend its Federal license to any other party.

Any subject data developed under that contract, whether or not a copyright has been obtained; and

Any rights of copyright purchased by the Purchaser or Contractor using Federal assistance in whole or in part provided by FTA.

When FTA awards Federal assistance for experimental, developmental, or research work, it is FTA's general intention to increase transportation knowledge available to the public, rather than to restrict the benefits resulting from the work to participants in that work. Therefore, unless FTA determines otherwise, the Purchaser and the Contractor performing experimental, developmental, or research work required by the underlying contract to which this Attachment is added agrees to permit FTA to make available to the public, either FTA's license in the copyright to any subject data developed in the course of that contract, or a copy of the subject data first produced under the contract for which a copyright has not been obtained. If the experimental, developmental, or research work, which is the subject of the underlying contract, is not completed for any reason whatsoever, all data developed under that contract shall become subject data as defined in subsection (a) of this clause and shall be delivered as the Federal Government may direct. This subsection (c), however, does not apply to adaptations of automatic data processing equipment or programs for the Purchaser or Contractor's use whose costs are financed in whole or in part with Federal assistance provided by FTA for transportation capital projects.

Unless prohibited by state law, upon request by the Federal Government, the Purchaser and the Contractor agree to indemnify, save, and hold harmless the Federal Government, its officers, agents, and employees acting within the scope of their official duties against any liability, including costs and expenses, resulting from any willful or intentional violation by the Purchaser or Contractor of proprietary rights, copyrights, or right of privacy, arising out of the publication, translation, reproduction, delivery, use, or disposition of any data furnished under that contract. Neither the Purchaser nor the Contractor shall be required to indemnify the Federal Government for any such liability arising out of the wrongful act of any employee, official, or agents of the Federal Government.

Nothing contained in this clause on rights in data shall imply a license to the Federal Government under any patent or be construed as affecting the scope of any license or other right otherwise granted to the Federal Government under any patent.
Data developed by the Purchaser or Contractor and financed entirely without using Federal assistance provided by the Federal Government that has been incorporated into work required by the underlying contract to which this Attachment has been added is exempt from the requirements of subsections (b), (c), and (d) of this clause, provided that the Purchaser or Contractor identifies that data in writing at the time of delivery of the contract work. Unless FTA determines otherwise, the Contractor agrees to include these requirements in each subcontract for experimental, developmental, or research work financed in whole or in part with Federal assistance provided by FTA.

Unless the Federal Government later makes a contrary determination in writing, irrespective of the Contractor's status (i.e., a large business, small business, state government or state instrumentality, local government, nonprofit organization, institution of higher education, individual, etc.), the Purchaser and the Contractor agree to take the necessary actions to provide, through FTA, those rights in that invention due the Federal Government as described in U.S. Department of Commerce regulations, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," 37 C.F.R. Part 401.

The Contractor also agrees to include these requirements in each subcontract for experimental, developmental, or research work financed in whole or in part with Federal assistance provided by FTA.

3.14 ENERGY CONSERVATION REQUIREMENTS

The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

3.15 ASSIGNABILITY CLAUSE

See General Conditions 1.12.23

3.16 TERMINATION

See General Conditions 1.12.8 and 1.12.9

3.17 RECYCLED PRODUCTS

The Contractor agrees to provide a preference for those products and services that conserve natural resources, protect the environment, and are energy efficient by complying with and facilitating compliance with Section 6002 of the Resource Conservation and Recovery Act, as amended, 42 U.S.C. § 6962, and U.S. Environmental Protection Agency (U.S. EPA), “Comprehensive Procurement Guideline for Products Containing Recovered Materials,” 40 C.F.R. part 247.

3.18 SUSPENSION AND DEBARMENT

The Contractor shall comply and facilitate compliance with U.S. DOT regulations, “Nonprocurement Suspension and Debarment,” 2 C.F.R. part 1200, which adopts and supplements the U.S. Office of Management and Budget (U.S. OMB) “Guidelines to
Agencies on Governmentwide Debarment and Suspension (Nonprocurement),” 2 C.F.R. part 180. These provisions apply to each contract at any tier of $25,000 or more, and to each contract at any tier for a federally required audit (irrespective of the contract amount), and to each contract at any tier that must be approved by an FTA official irrespective of the contract amount. As such, the Contractor shall verify that its principals, affiliates, and subcontractors are eligible to participate in this federally funded contract and are not presently declared by any Federal department or agency to be:

a) Debarred from participation in any federally assisted Award;
b) Suspended from participation in any federally assisted Award;
c) Proposed for debarment from participation in any federally assisted Award;
d) Declared ineligible to participate in any federally assisted Award;
e) Voluntarily excluded from participation in any federally assisted Award; or
f) Disqualified from participation in any federally assisted Award.

By signing and submitting its bid or proposal, the bidder or proposer certifies as follows:

The certification in this clause is a material representation of fact relied upon by Metra. If it is later determined by Metra that the bidder or proposer knowingly rendered an erroneous certification, in addition to remedies available to Metra, the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment. The bidder or proposer agrees to comply with the requirements of 2 C.F.R. part 180, subpart C, as supplemented by 2 C.F.R. part 1200, while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

3.19 CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

The Contractor agrees:

a) It will not use any violating facilities;
b) It will report the use of facilities placed on or likely to be placed on the U.S. EPA “List of Violating Facilities;”
c) It will report violations of use of prohibited facilities to FTA; and
d) It will comply with the inspection and other requirements of the Clean Air Act, as amended, (42 U.S.C. §§ 7401 – 7671q); and the Federal Water Pollution Control Act as amended, (33 U.S.C. §§ 1251-1387).

3.20 BUY AMERICA REQUIREMENTS

The contractor agrees to comply with 49 U.S.C. 5323(j) and 49 C.F.R. part 661, which provide that Federal funds may not be obligated unless all steel, iron, and manufactured products used in FTA funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 C.F.R. § 661.7. Separate requirements for rolling stock are set out at 49 U.S.C. 5323(j)(2)(C) and 49 C.F.R. § 661.11.

A bidder or offeror must submit to the FTA recipient the appropriate Buy America certification with all bids or offers on FTA-funded contracts, except those subject to a
Bids or offers that are not accompanied by a completed Buy America certification must be rejected as nonresponsive.

3.21 BREACHES AND DISPUTE RESOLUTION

See General Conditions 1.12.9 and 1.15.4.

3.22 ADA ACCESS AND ACCESSIBILITY

A third party contractor providing public transportation services must operate its services in compliance with 42 U.S.C. Sections 12101 et seq.; DOT regulations, “Transportation Services for Individuals with Disabilities (ADA)” using facilities and equipment that comply with 49 CFR Part 37; and Joint ATBCB/DOT regulations, “Americans with Disabilities (ADA) Accessibility Specifications for Transportation Vehicles,” 36 CFR Part 1192 and 49 CFR Part 38. Private entities must comply with the requirements of 49 CFR Part 37 applicable to public entities with which they contract to provide public transportation services. The recipient should advise its third party contractors operating public transportation services to review the requirements for public entities in this context.

3.23 PRE-AWARD AND POST-DELIVERY AUDIT REQUIREMENTS

The Contractor agrees to comply with 49 USC § 5323(m) and FTA’s implementing regulation at 49 CFR Part 663. The Contractor shall comply with the Buy America certification(s) submitted with its proposal/bid. The Contractor agrees to participate and cooperate in any pre-award and post-delivery audits performed pursuant to 49 C.F.R. part 663 and related FTA guidance.

3.24 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT


The Contractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three (3) years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid.

Such records maintained under this paragraph shall be made available by the Contractor for inspection, copying, or transcription by authorized representatives of the FTA and the Department of Labor, and the Contractor will permit such representatives to interview employees during working hours on the job.

The Contractor shall require the inclusion of the language of this clause within subcontracts of all tiers.
3.25 SAFE OPERATION OF MOTOR VEHICLES

3.25.1 Seat Belt Use

The Contractor is encouraged to adopt and promote on-the-job seat belt use policies and programs for its employees and other personnel that operate company-owned vehicles, company-rented vehicles, or personally operated vehicles. The terms “company-owned” and “company-leased” refer to vehicles owned or leased either by the Contractor or Metra.

3.25.2 Distracted Driving

The Contractor agrees to adopt and enforce workplace safety policies to decrease crashes caused by distracted drivers, including policies to ban text messaging while using an electronic device supplied by an employer, and driving a vehicle the driver owns or rents, a vehicle Contractor owns, leases, or rents, or a privately-owned vehicle when on official business in connection with the work performed under this agreement.
2 SPECIAL CONDITIONS

2.1 TERM AND ORDER PROCESS

This Contract shall remain effective for all services described herein for a period of 60 months from the date Metra issues Notice to Proceed. The Contractor agrees to complete each phase of the Work in accordance with the schedule and timelines described within this Contract. The Contractor shall complete all services described herein within 144 months of the date Metra issues Notice to Proceed.

The Contractor shall supply a minimum of two hundred twenty-one (221) and up to a maximum of four hundred sixty-nine (469) new Cars and the specified parts in accordance with Section 4, Technical Specifications. Metra and VRE may issue orders for specified quantities any time within the 60 month period. All orders will be made in writing, and require signed authorization of Metra’s Executive Director, or his designee, or VRE’s Contracting Officer, or his designee, as appointed in writing by either the Executive Director or Board Chairman for Metra or VRE’s Contracting Officer. Absent such written authorization, or designation if applicable, no order shall be fulfilled. Further, Metra and VRE reserve the right to cancel or modify an initial order and will only be obligated to cover Contractor’s reasonably incurred costs in fulfillment of that order. For each order received in compliance with this Section, Contractor shall respond with a delivery schedule.

2.2 PAYMENT AND PERFORMANCE BONDS

Both a labor and material payment bond, and a performance bond shall be provided under this Contract, prior to NTP, each individually in the amount of one hundred (100%) of the base order total. The base order shall total 200 Cars for Metra and 21 Cars for VRE. Contractor shall provide Metra and VRE with separate payment and performance bonds. Additional bonds, in the amount of one hundred (100%) of each option, shall be provided within thirty (30) days of Metra or VRE exercising an option. The surety on each bond must be responsible for one hundred percent (100%) of damages up to one hundred percent (100%) of the total. For any increase in the actual contract price through the duration of the contract, as amended, additional bonding in the amounts stated above must be provided within thirty (30) days’ notice from Metra or VRE for Metra’s or VRE’s review and approval. The surety must be on the most recently published Department of the Treasury’s Listing of Approved Sureties (Department Circular 570) throughout the contract, and the surety will be required to assure, in writing, performance of the Contract. Additionally, any attorney-in-fact who signs any bond must attach to that bond an effective copy of his/her power of attorney, as well as a Jurat page. The acceptable bond forms are the February 1970 Edition of AIA Document A311, Performance Bond, and Labor and Material Payment Bond.

Unless otherwise agreed, the bonds shall be continuously in effect until completion of all of Contractor’s obligations.

The Contractor’s sureties shall be jointly and severally liable under its performance bond to Metra and VRE in the event that the Contractor shall breach any of its obligations under this Contract.
Contractor acknowledges and agrees that for purposes of this Contract Metra and VRE shall not be deemed a merchant pursuant to the Uniform Commercial Code Section 2104.

2.3 KEY PERSONNEL

Contractor must, and where applicable must cause its Major Subcontractors to, include among staff assigned to the Work the persons in the capacities identified in its proposal (the "Key Personnel"). Key Personnel shall devote all of their respective time and efforts to completing their respective tasks in connection with the Work when their respective responsibilities so require, and shall otherwise be reasonably available when and as required by Metra without material conflict with other duties, until completion of the Work. Contractor shall not reassign or replace or permit reassignment or replacement of any Key Personnel without the prior written consent of Metra in each case. Within four (4) weeks after the position of any Key Personnel becomes vacant, Contractor shall replace or cause the replacement of the person previously holding the vacant position with another person who has at least equivalent qualifications, experience, and knowledge as that of the person replaced and who is acceptable to Metra. Metra may require Contractor to replace or cause to be replaced any Key Personnel whom Metra deems in its reasonable discretion to be unsatisfactory.

2.4 QUALITY ASSURANCE PROGRAM

The Contractor shall establish a quality assurance program conforming to Exhibit 1-J of the RFP (Mechanical Department Quality Assurance Requirements and Mechanical Quality Plan (MQP)) and the FTA Quality Management System Guidelines (FTA PA 27 5194 12.1 issued December 2012. In addition, these requirements shall be imposed on all entities within the Contractor's organization and on all manufacturers, subcontractors, and suppliers who will perform work under the Contract to ensure that the quality standards are consistent throughout the entire supply chain and throughout the life of the Contract. The Contractor shall submit their quality assurance program documents with their proposal for review and approval by Metra. Metra shall be the sole judge as to compliance of the Contractor’s quality assurance program with Metra’s requirements and the appropriate quality assurance standards.

2.5 DELIVERY AND ACCEPTANCE

2.5.1 Generally

The contractor bears full responsibility for all costs for transport of Cars to Metra and VRE, as well as for delivery of spare parts or components, training materials, manuals, and any related materials shipped to Metra’s designated destinations.

All cars ordered by Metra must be delivered to:

Metra’s Blue Island Yard
Attn: Director – Mechanical
Metra’s Blue Island Division
Chicago, Illinois 60406 USA

All spare parts for Metra must be delivered to:

Metra Rock Island District
Addenum No. 3
Issued 6/19/19

Attn: Storekeeper
147 W. 47th St.
Chicago, Illinois 60609 USA

All maintenance and parts manuals, drawings, and any other final deliverables for Metra must be delivered to:

Metra
Attn: Chief Mechanical Officer
547 W. Jackson Blvd.
Chicago, Illinois 60661 USA

All cars ordered by VRE must be delivered to:

VRE Broad Run Maintenance and Storage Facility
10637 Piper Lane
Bristow, VA 20136

All spare parts for VRE must be delivered to:

VRE Crossroads Maintenance and Storage Facility
9400 Crossroads Parkway
Fredericksburg, VA 22408

All maintenance and parts manuals, drawings, and any other final deliverables for VRE must be delivered to:

VRE Crossroads Maintenance and Storage Facility
Attn: Mechanical Operations Manager
9400 Crossroads Parkway
Fredericksburg, VA 22408

The contractor will use good-faith efforts to effectively manage third-party transportation with a carrier on a daily basis for Cars destined for Metra and VRE. Contractor shall update Metra or VRE as appropriate on a daily basis with respect to movement of Cars.

Testing, issuance of the Certificate of Fitness for Delivery, Conditional, or Final Acceptance will not abrogate any other requirement of the Contract, or estop Metra and VRE from asserting their rights with respect to any defect or incompletion in a car, whether or not then known.

2.5.2 Pre-Shipment Inspection and Fitness for Delivery

A Fitness for Delivery certificate will be issued for each Car once it has successfully undergone pre-shipment inspection and testing through a Metra approved procedure. All non-conformities shall be addressed prior to shipment and the Car history book shall be complete and ready for review and approval by Metra or its designated representative. The
Pre-shipment Inspection report shall be forwarded to Metra and shall be recorded in the Vehicle History Book.

2.5.3 Notice of Arrival

On arrival, each Car will be carefully inspected by representatives of Metra, the Contractor, and the carrier for damage, loss, vandalism, or other discrepancies incurred during shipping. The Contractor will be responsible for resolution of any noted issues prior to Metra issuing a notice of arrival and before the Car will be allowed to undergo testing. Use of Metra facilities to resolve any issue is at Metra’s sole discretion. Any generated report and resolution shall be included in the Vehicle History Book.

2.5.4 Operational Testing

After the notice of arrival, each Car will undergo operational performance tests. Testing will consist of shop testing the Car’s subsystems and track testing with all subsystems operating. If Metra determines, in its sole discretion, that the Car does not pass one, all, or any combination of tests, Metra shall issue the Contractor a notice of rejection for the Car listing the items to be remedied or repaired (“Open Items”). The cost of any retest shall be borne by Contractor.

2.5.5 Conditional Acceptance

If there are no Open Items, Metra will issue Conditional Acceptance. In lieu of a notice of rejection, Metra may issue Conditional Acceptance where the Cars may, in Metra’s sole discretion, operate in supervised revenue service while Contractor remedies or repairs the Open Items. Metra’s Conditional Acceptance of a car does not constitute a waiver, nor shall such acceptance obligate Metra to accept any other car with the same or any other non-compliance. Notwithstanding the foregoing, Metra shall not be obligated to Conditional Acceptance until and unless: (i) all defects and damage which may render the car unfit for revenue service, have been remedied according to the repair procedures defined above and the car passes all re-tests; (ii) any unapproved materials or components have been replaced, and (iii) the car contains no other defects, non-compliances, or incompletions which significantly affect the value of the car.

2.5.6 Final Acceptance

Final Acceptance will be issued when all initial corrective actions and any retrofits have been fully completed in response to any remaining Open Item(s), successful operational test runs have been completed, and the vehicle is considered to be fully compliant with the Contract by Metra and consequently ready to be released for general revenue service.

2.5.7 Repairs by Contractor

Unless Metra exercises its option to make repairs, the Contractor must begin repair work within five (5) working days of Metra’s notice of the car's failure to pass any of Metra’s tests or inspections. Metra shall make the car available to timely complete repairs. Unless directed otherwise by Metra, the Contractor will be required to remove the car from Metra’s property while repairs by the Contractor are being affected.
If the Contractor fails or refuses to initiate the repairs within five (5) working days of Metra’s notice of rejection, Metra may return the car at Contractor's risk and expense.

2.5.8 Repairs by Metra

Metra may, at its sole option, and as Contractor’s agent, endeavor to make repairs on behalf of the Contractor at any stage prior to a car’s Final Acceptance. All repairs made by Metra will be made under the direction of the Contractor.

2.5.9 Parts Used

If Metra performs the repairs on a car, it shall endeavor to do so using Contractor-specified parts available from its own stock or those supplied by the Contractor specifically for this repair. Monthly, or at a frequency to be mutually agreed upon, reports of all repairs covered by this procedure shall be submitted by Metra to the Contractor for reimbursement.

2.5.10 Contractor Supplied Parts

If the Contractor supplies parts for repairs being performed by Metra, these parts shall be shipped prepaid to Metra from any source selected by the Contractor within five (5) Working Days after receipt of the request for said parts.

2.5.11 Return of Defective Components

The Contractor may request that defective components removed be returned to the manufacturing plant at Contractor’s sole cost.

2.5.12 Reimbursement for Labor

Metra shall be reimbursed by the Contractor for labor. The amount shall be determined by multiplying the number of man-hours actually required to correct the defect, rounded to the nearest half-hour, by: (1) Metra's per hour, mechanic, straight time, or overtime wage rate in effect at the time, and (2) Metra's additive for in-shop repairs in effect at the time.

2.5.13 Reimbursement for Parts

The Contractor shall reimburse Metra for parts that Metra supplies or replaces to correct the defects. The reimbursement amount shall be the sum of: (1) Metra's direct purchase cost, (2) material additive cost (Metra's purchase cost or Contractor's catalog price, when parts are supplied by Contractor, multiplied by Metra's additive rate for material handling in effect at the time), and (3) freight charges, where applicable. The material additive rate is subject to an annual adjustment.

2.6 PARTS AVAILABILITY

The Contractor agrees to continuously offer to supply, either directly or through a designated source, within a commercially reasonable period of time in the case of each part ordered, the spare parts and customer-accessible software necessary to maintain and repair the Cars supplied under this Contract, at the then-current or last published in Contractor’s catalogs, price list, or other general sales materials, for a period of forty (40) years after the date of the Final Acceptance of the last Car; provided, however, that if Contractor discontinues the general distribution of such part, it shall notify and give Metra the opportunity to make a one-time buy of its requirements. Parts shall be interchangeable with the original equipment.
On receipt of Metra’s notice that Contractor has failed to comply with this section, then the Contractor shall provide Metra, within eight (8) hours of Metra’s verbal or written request, the original suppliers’ and/or manufacturers’ part numbers, company names, addresses, telephone numbers, and contact persons’ names for all of the specific parts not received by Metra so that Metra may attempt to produce or make such parts, and Contractor shall be responsible to Metra for the damages caused by Contractor’s, its Subcontractors’, or Suppliers’, breach of this provision during performance of the Contract, including the subsequent warranty periods. In addition, Contractor must provide to Metra, for such production and within seven (7) days of Metra’s verbal or written request, the design plans, manufacturing location, and documentation necessary for those parts manufactured by the Contractor and the original suppliers’ and/or manufacturers’ part numbers, company names, addresses, telephone numbers, and contact persons’ names for all of the specific parts not received by Metra. Contractor hereby grants to Metra an irrevocable license to use the Contractor’s design and manufacturing documentation for the purpose of Metra procuring parts for the Cars agreed to under this Contract and for no other purpose.

2.7 WARRANTY AND RELIABILITY

2.7.1 General Warranties

1) The Contractor warrants that, at the time of acceptance, all Cars, equipment, Work, components and parts, (including and without limitation and as an example, data, manuals, and reliability information), furnished under the Contract shall be:

   a. In full conformance with all requirements of all provisions of the Contract;

   b. Free of any and all defects and Deficiencies;

   c. Fit for their particular purpose;

   d. Fit for the ordinary purposes for which such Cars, equipment, Work, components and parts are used;

   e. Free from any and all liens and other encumbrances;

   f. Component data or information of the latest configuration employed by the Contractor, Subcontractor, or Supplier in commercial service;

   g. Accurate, complete, and current.

2) The Contractor further warrants that, for the periods of time defined in this Section, all Cars, equipment, Work, components and parts shall be, remain and perform free of any and all deficiencies, and shall be, remain and perform in full conformance with all requirements of all provisions of the Contract, and all warranties which extend to the future performance of each of such items.
3) Warranties By Others: All warranties and guarantees of any Subcontractor, or Supplier with respect to any Cars, equipment, Work, components or parts, whether expressed or implied, are deemed to be for the benefit of Metra and to be obtained by the Contractor for the benefit of Metra, regardless of whether or not such warranties and guarantees have been transferred or assigned to Metra by separate agreement. The Contractor shall enforce such warranties and guarantees on behalf of Metra; provided, however, that if directed by Metra, the Contractor shall require such Subcontractors, and Suppliers to execute such warranties and guarantees directly to Metra. The Contractor shall be jointly and severally liable for any such warranties or guarantees. To the extent that any such warranty or guarantee would be voided by reason of the Contractor's negligence in incorporating any equipment, component or part into the Work, the Contractor shall be responsible, at its sole cost, for correcting such error or omission, without cost or expense to Metra.

4) Equipment failures or performance deficiencies due to breach of the Contractor's or third party warranties described above is referred to in this Contract as a "Deficiency."

2.7.2 Availability and Reliability Warranty

1) Availability is defined as the ability of the Car to be assigned to a train at the commencement of the calendar day, following the calendar day inspection pursuant to 49 CFR Part 238.303 and 238.305, with no defects found that prevent the Car from being dispatched. Reliability is defined as the ability to complete the train assignments of the calendar day without Car failure or degradation of performance such that it causes a train or trains to lose time or result in a schedule delay.

A Car delay is defined as a Car related, mechanical failure causing a revenue service train to be more than 5 minutes late at its destination terminal; or annulled either at its originating point or en route.

2) In addition to the other warranties provided under this Contract, the Contractor further warrants the availability and reliability of the Cars, equipment, components, Work and parts in accordance with the Contract availability and reliability requirements set forth below. Failure to meet the Contract availability or reliability requirements shall also constitute a “Deficiency”, and Contractor shall, at its sole cost and without cost or expense to Metra, take all actions required to correct as promptly as possible the Deficiency and to achieve the specified availability and reliability requirements. In cases where a “Fleet Deficiency” exists, the Contractor shall incorporate at its sole cost such correction into all previously delivered Cars, equipment, components, Work and parts before it may resume deliveries of new Cars or affected components. Such correction shall be incorporated into all undelivered Cars, equipment, components, Work and parts prior to delivery.
3) The anticipated availability is 97% exclusive of days when a car is undergoing periodic inspection, programmed maintenance, or is out of service for any reason other than mechanical failure, as determined by Metra.

4) The anticipated reliability is 98% for a car that is dispatched, from time of dispatch until the next calendar day inspection, at which time it becomes again subject to the availability target. This requirement is applicable only to mechanical failures, as determined by Metra.

5) Achievement of reliability targets will be calculated by dividing the number of days that each Car was available for service in any 184 day Federal Railroad Administration (FRA) inspection period into the number of days or part of a day that the Car became unavailable due to a failure. For example, if the Car was available for service for 88 days between inspections and periodic maintenance, but failed after entering service on 2 days, the reliability rate is 98%, calculated by dividing 86 days by 88 days.

### 2.7.3 Time Periods of the Warranties

Basic Warranty: The warranty period will commence on Conditional Acceptance, unless there are Open Items. The warranty period as to each car or any part or subsystem relating to an Open Item shall not commence until all Open Items have been corrected to Metra's satisfaction. The warranty period shall be effective for a time period of three (3) years (except as extended elsewhere in the Contract) after such Conditional Acceptance. The warranty for Special Tools, as defined in the technical specifications, including, without limitation, Diagnostic and Test Equipment shall be for a time period of three (3) years after Final Acceptance by Metra. For any Car or component that is Conditionally Accepted, the warranty shall commence on the date of Final Acceptance.

1) Warranty for Certain Components: Warranties shall commence upon Acceptance as provided in the Paragraph herein entitled Basic Warranty, but shall have time periods as follows:

   a. **Warranted for a period of (10) years:**
      i. Carbody;
      ii. Door Panels;
      iii. Floor materials and/or coverings, if applicable;
      iv. Truck frame, bolster, equalizers, hangers, and spring plank.

   b. Batteries shall be warranted for a three (3) year period, plus three (3) years prorated, for a total period of six (6) years.

   c. The warranty on any component that Metra designates prior to Contract award as being non-service proven shall be for five (5) years. Non-service proven is defined as a component or system that...
has been used less than three (3) years in North American commuter rail and/or freight railroad applications, or less than five (5) years in North American rail transit or light rail applications.

d. The warranty for spare parts shall be for the lesser of three (3) years after delivery of the parts or two (2) years after the part is put into service, unless the part is a component or part thereof to which an Extended Warranty defined by this Section.

2) Subcontractor Warranties: Any warranty from a Subcontractor or Supplier or manufacturer to the Contractor, which exceeds the above time periods, shall be extended to Metra for the same time period as given to the Contractor.

2.7.4 Warranty Notice

Metra will provide the Contractor with notice of breach of any warranty, including, without limitation, notice of a Deficiency, within a reasonable time after Metra observes and verifies any failure, malfunction, or condition of, any Car, equipment, Work, component or part, that the failure, malfunction or condition arises from a Deficiency or other breach of warranty existing or occurring within any of the applicable warranty periods ("Notice").

2.7.5 Engineer & Service Representatives

Within seventy-two (72) hours of verbal or written notice from Metra, the Contractor shall at its own expense, have a competent engineering representative(s) available to assist Metra in the solution of engineering or design problems within the scope of the specifications that may arise during the warranty period. In addition, a service representative shall be available, on Metra property, within twenty-four (24) hours of verbal or written notification from Metra. These requirements do not relieve the Contractor of any other responsibilities under this Contract. The obligation to provide engineering services applies for the warranty period starting from the time the last Car is conditionally accepted.

2.7.6 Corrective Work Requirements

1) Promptly upon receipt of notice from Metra, but in any event not later than forty-eight (48) hours thereafter, unless Metra agrees to a longer interval, the Contractor, at its sole cost, and without cost or expense to Metra, shall commence and thereafter prosecute with due diligence using qualified personnel, all activities necessary to investigate, analyze, diagnose and determine the cause and extent of the Deficiency or other breach of warranty, and the proper correction action, in conformance with the provisions of this Contract and shall promptly report the causes, extent and proposed corrective action to Metra in writing.

2) Promptly upon the approval of Metra, the Contractor, at its sole cost, and without cost or expense to Metra, shall commence and thereafter prosecute
with due diligence, using qualified personnel, appropriate action, within the
time period and in the manner provided for in this section to correct the
Deficiency. Corrective action shall include without limitation, adjustment,
repair, replacement, reengineering and redesign as appropriate to fully and
completely address and remedy the Deficiency or other problem in each
affected Car, equipment, Work, component or part, so that the item and the
Car shall perform as specified by the Contract, and to ensure that the
Deficiency will not recur. The Contractor shall promptly and diligently
pursue all corrections to their complete, satisfactory conclusion. All
corrections shall comply with all requirements of the Contract and shall not
result in any Car, equipment, Work, component or part failing to comply
with any requirement of any provision of the Contract. All corrections shall
employ and require only parts that perform comparably to that originally
intended by the Contract, and of cost comparable to the cost of the deficient
part prior to correction. The Contractor shall perform, at its sole cost, any
tests that Metra may reasonably require to verify that any correction made
by the Contractor will correct the Deficiency and that the correction will
comply with all requirements of the Contract.

3) All corrections shall be without cost or expense to Metra. All costs and
expenses of any correction shall be at the Contractor’s sole cost. Contractor
shall also bear all costs and expenses of removal, replacement and
reinstallation and testing of other equipment, components, Work and parts
necessary to gain access to the Deficiency or to accommodate the
correction. The Contractor shall also bear all transportation costs for or
associated with any Deficiency or correction.

4) The Contractor shall provide, at its sole expense and at no cost or expense
to Metra, all facilities and equipment necessary to carry out the
investigations, analyses and diagnoses needed to determine the cause and
extent of the Deficiency or other breach of warranty, and to complete all
correction thereof and all associated Work.

5) The Contractor shall promptly provide to Metra, without cost or expense to
Metra, all updated parts manuals and maintenance manuals that include all
information related to any correction.

6) The Contractor shall reimburse Metra for all Metra costs and expenses
reasonably incurred in the investigation, analysis, diagnosis or correction of
any Deficiency.

7) The Contractor shall be solely liable for any and all injury, loss or damage
to any person, or to any Car, equipment, Work, component or part, or other
Metra property, caused by any Work performed to make any correction.
While on Metra’s premises, the Contractor shall keep such premises in a
neat and orderly condition and, unless otherwise specified in the Contract
Documents, title to any demolished materials and equipment, waste, and rubbish is vested in Contractor and such material shall be disposed of off the premises by Contractor at its sole expense.

8) In addition to correction of any Deficiency, the Contractor, at its sole cost, shall correct without cost or expense to Metra any other Car, equipment, component, Work or part that was caused to be damaged or adversely affected by a Deficiency.

9) All corrected components and parts used, and repairs made, to correct deficiencies shall be subject to acceptance by Metra and shall be subject to the same requirements as are set forth in the Contract for the original components.

10) If a correction hereunder has required the Contractor to reengineer or redesign a component, the Contractor shall, without cost to Metra and at Contractor’s sole cost, replace all Metra owned spare parts comprising that component with the corrected items or detail parts.

2.7.7 Fleet Deficiency Remedy

1) A Fleet Deficiency exists when a warranty repair or redesign to similar components, equipment or materials is required for twenty percent (20%) or more of the Cars then accepted by Metra under this Contract. Upon Metra’s notice to the Contractor that a Fleet Deficiency exists, the Contractor shall promptly, but in any event not later than forty-eight (48) hours after such notice, unless Metra agrees to a longer interval, commence and thereafter prosecute with due diligence and using qualified personnel, all activities necessary to investigate, analyze and diagnose the cause and extent of the Fleet Deficiency and the proper correction thereof. The Contractor shall promptly provide a written report to Metra describing the cause and extent of the Fleet Deficiency and the Contractor's proposed correction thereof. The Contractor shall submit for Metra's approval and, following Metra approval, shall promptly implement and satisfactorily complete Metra approved corrections of all affected components, at the Contractor's sole cost and at no cost or expense to Metra, as promptly as practicable and in no event later than three (3) months after Metra's initial notice to Contractor of the Fleet Deficiency, and in compliance with the requirements Section 2.6.6 Corrective Work Requirements. The Contractor shall make the correction to all equivalent components in the fleet, not just those in which a failure or malfunction has occurred, including without limitation, all components for which any warranty period has expired, and to all equivalent Metra-owned spare parts.

2) The Fleet Deficiency remedy provided for in this paragraph is in addition to, and shall not be construed as a limitation of, any other rights or remedies provided for by this Article or any provision of this Contract or the law.
2.7.8 Timeliness

Time is of the essence in the corrections of all Deficiencies to be undertaken under all applicable warranties. Unless otherwise directed in Metra's notice to Contractor of a Deficiency, the Contractor shall commence correction of the Deficiency at the time specified by Metra, but in no event later than forty-eight (48) hours after the Notice, unless Metra agrees to a longer interval. To ensure timely corrections, the Contractor shall make provisions to have available all necessary facilities and special equipment, and shall use such qualified engineers and product and system specialists as are necessary, including diversion of such persons from the Contractor's other operations or from the operations of its Subcontractors and Suppliers. Contractor shall also use additional shifts and Work on weekends and holidays, as necessary, to complete timely corrections in accordance with this Section.

2.7.9 Use of Metra-Owned Spare Parts

At the sole discretion of Metra, as determined on a case-by-case basis, Metra owned spare parts may be utilized by the Contractor for correction purposes if the Contractor’s replacement part is not immediately available. The Contractor must replace each borrowed part with an equivalent (like-for-like) part within thirty (30) calendar days. Consequently a new part must be replaced with new, a UTEX part replaced with UTEX or new. All costs associated with replacing the spare parts shall be borne by the Contractor. In some cases, a Metra-owned replacement part may be manufactured or remanufactured by a different source than that of the Contractor. In instances where “non-OEM” components are utilized in the repair due to unavailability of an immediate contractor-supplied replacement, the Contractor will be responsible for all costs arising from the removal of a borrowed part and subsequent installation of the contractor’s part following the initial repair operation. Consequently, to avoid compensating Metra for repetitive repair operations, the Contractor is encouraged to maintain a sufficient quantity of spare replacement parts available for prompt delivery to Metra.

2.7.10 Delays and Disruption

To prevent delays and disruption to Metra’s operations, Metra shall have the right to the continued use of any deficient Car, equipment, component, Work or part, until it can be taken out of service and made available to Contractor to correct the Deficiency.

2.7.11 Repairs by Metra

At Metra's sole discretion and option, Metra may investigate, analyze, diagnose and perform the redesign, replacement, or repair of any Deficiency, as Contractor's agent, and Contractor shall pay Metra for such Work. Contractor shall, if required by Metra, supply components, materials, or equipment within ten (10) days after Metra's request in each case. Contractor shall pay Metra the cost of the warranty Work for: (a) outside engineering fees and (b) labor supplied by Metra by multiplying the number of man-hours of Metra labor actually supplied to correct the defect by the wage rate and percent shop overhead. The cost of moving the
Cars(s) if such action is necessary, all applicable freight charges, and Metra's material additives in effect at the time on components, materials, supplies, or equipment furnished by Contractor (subject to yearly adjustment by Metra, based on Metra's material additive rate(s) in effect at time of Work), within thirty (30) days of Metra's invoice.

2.7.12 Warranties of the Corrected Components

The Contractor warrants each corrected component for the remainder of the warranty originally applicable to the component, or for a period of one (1) year from the date of Metra’s acceptance of the corrected component, whichever is greater.

2.7.13 No Waiver

No inspection, test, acceptance of, or payment to the Contractor for, any Car, equipment, component, Work or part, or for any other purpose shall relieve the Contractor from any duty under, or be deemed to be a waiver of any Warranty, or other right or remedy pursuant to, this Article, the Contract or the law.

2.7.14 No Increase in Maintenance or Operating Costs

In no case shall any correction of any Deficiency, whether pursuant to any warranty or otherwise, call for, require or result in any increase in any maintenance, inspection or test requirement or frequency, or in any additional maintenance, inspection or test requirement, or operating costs beyond that specified in the Contract or in the original edition of the maintenance manual.

2.7.15 Metra Warranty Claim

Where Metra undertakes its own repairs, Metra may file claims consistent with the notice provision no later than 90 days after performing said repairs. Metra shall submit to the Contractor a claim in writing for such costs and expenses ("Warranty Claim"). The Warranty Claim shall identify the Deficiency and the correction to which such costs and expenses are related, and shall provide such other information necessary to document the costs and expenses incurred by Metra and their relationship to the Deficiency and the correction. The Contractor shall reimburse Metra in a timely manner for all such costs and expenses within thirty (30) days after the Contractor's receipt of Metra’s Warranty Claim.

2.8 LIQUIDATED DAMAGES

2.8.1 Generally

This Section is controlled by and intended to supplement the Liquidated Damages provision found in the General Conditions. Cars that unexpectedly have to be removed from revenue service and remain out of service cause significant damages to Metra’s operations and reputation, and to the traveling public which depends upon Metra for timely and reliable daily service.
2.8.2 Removal from Service

For all Cars removed from service, Contractor or its sureties shall pay agreed liquidated damages at the rate of five hundred dollars ($500) per day per Car until the Car is accepted back into service. Those damages are not readily susceptible to calculation. The parties to this Contract therefor agree that liquidated damages are appropriate compensation to Metra. These liquidated damages cover only damages associated with the loss of use of Cars and do not compensate Metra for damages for breach of warranty or other breach of contract, such as damages for the cost of warranty work or the extra costs of obtaining substitute goods or performance from others. Payment of liquidated damages under this section, and acceptance thereof by Metra, does not constitute a waiver or settlement of any claim (other than for delay in delivering acceptable Cars or delay in providing a warranty response or correction as required under this Contract) for damages for such breaches, and nothing in this section is intended to limit such claims.

2.8.3 Delayed Warranty Response or Effective Corrective Action

In the event the Contractor breaches Section 2.6.6 Corrective Work Requirements, and the affected Metra Car remains out of service for more than 48 hours, Contractor shall pay to Metra as liquidated damages the sum of five hundred dollars ($500) per day for every full day thereafter until Contractor provides the services and equipment otherwise required by Section 2.6.6 to be provided within 48 hours after Metra's notice of a Deficiency, or until the Car is returned to revenue service, whichever is first.

In any instance in which a Deficiency causes a Car to become unavailable for service, and the Contractor fails to complete a Warranty correction to such Deficiency within a time sufficient to enable the Car to be tested and returned to service within ten (10) calendar days after the Deficiency caused the Car to become unavailable for service, the Contractor shall pay to Metra as liquidated damages the sum of Five Hundred Dollars ($500.00) for each day that the Car is out of service, commencing with the first full out-of-service day after the expiration of the ten (10) day period. The ten (10) day period calculated pursuant to this paragraph shall not include reasonable transportation time to transport the Car from Metra to Contractor's repair facility. Note there is no cap or maximum on the amount of liquidated damages under this provision.

2.8.4 Accrued Liquidated Damages

For purposes of liquidated damages for this section, payable on Metra’s demand. Metra may, at its discretion, choose to accrue liquidated damages under this provision until there is no further possibility of additional liquidated damages.
2.9 PRICE SCHEDULE

2.9.1 Generally

Pricing includes design, manufacture, construction, fabrication, assembly, delivery, and all associated costs. No additional costs will be allowed, except for actual performance and payment bond costs. Price will be fixed for the base order of the contract. A price adjustment will be allowed for Cars ordered in years 2 through 5 based on the Producer Price Index for Railroad rolling stock manufacturing, published by the United States Department of Labor’s Bureau of Labor Statistics (Series ID: PCU3365103365102Z; Base Date: 198406).

The proposed unit price and the index value for the month and year of the date proposals are received will serve as the Base Index Value to determine the unit pricing for the Cars released in years 2 through 5. The Current Published Index Value will be the index value for the month and year of the date an option order is received. The unit pricing will be adjusted in accordance with the following example equation.

For Example: If the current published Index Value is 122.5, the Base Index Value is 122.1, and the base unit price is $1,000,000, then the release order unit price would be:

$$\frac{122.5}{122.1} \times 1,000,000 = 1,003,276.00$$

which represents a 0.3276% increase.

2.9.2 Base Index

| Producer Price Index for Railroad Rolling Stock Manufacturing; Cars, new and rebuilt, including parts; (Series ID: PCU3365103365102Z; Base Date: 198406) |

2.9.3 Unit Pricing

The pricing table below must be completed in its entirety. Incomplete pricing proposals may be rejected. Actual quantities will consist of the base order, plus any options ordered.
2.9.4 Prices

All costs, except surety costs, are fixed firm prices and cannot be changed except as allowed by Metra or VRE.

The Engineering Costs referenced in this table are the costs required to:

A. Prepare all drawings required for submittal and approval by the technical specifications;
B. Prepare all engineering/technical documents required for submittal and approval by the technical specification;
C. Prepare all test/inspection procedures required for submittal and approval by the technical specification; and
D. Perform and prepare reports for submittal and approval of all proof of design tests required by the technical specification.

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<td></td>
</tr>
<tr>
<td>Possible System Proposed Above Requirements of Technical Specification M-18-011</td>
<td>$</td>
<td>400</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>Possible System Proposed Above Requirements of Technical Specification M-18-011</td>
<td>$</td>
<td>400</td>
<td>$</td>
<td></td>
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<tr>
<td>Possible System Proposed Above Requirements of Technical Specification M-18-011</td>
<td>$</td>
<td>400</td>
<td>$</td>
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<td>$</td>
<td>400</td>
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<td>$</td>
<td>400</td>
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<td>Possible System Proposed Above Requirements of Technical Specification M-18-011</td>
<td>$</td>
<td>400</td>
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<td>$</td>
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<tr>
<td>Possible System Proposed Above Requirements of Technical Specification M-18-011</td>
<td>$</td>
<td>400</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>Possible System Proposed Above Requirements of Technical Specification M-18-011</td>
<td>$</td>
<td>400</td>
<td>$</td>
<td></td>
</tr>
</tbody>
</table>

**Spare Parts**

| Carbody Roof Section Part # ____________________________ | $   | 10   | $   |
# Addenum No. 3
## Issued 6/19/19

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Unit Price</th>
<th>Quantity</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbody Side Section</td>
<td>$</td>
<td>20</td>
<td>$</td>
</tr>
<tr>
<td>Carbody End Section</td>
<td>$</td>
<td>20</td>
<td>$</td>
</tr>
<tr>
<td>Wheelchair Lift</td>
<td>$</td>
<td>10</td>
<td>$</td>
</tr>
<tr>
<td>Low Voltage Power Supply</td>
<td>$</td>
<td>10</td>
<td>$</td>
</tr>
<tr>
<td>A/C Unit</td>
<td>$</td>
<td>16</td>
<td>$</td>
</tr>
<tr>
<td>Truck Complete “B” End</td>
<td>$</td>
<td>5</td>
<td>$</td>
</tr>
<tr>
<td>Truck Complete “A” End</td>
<td>$</td>
<td>5</td>
<td>$</td>
</tr>
<tr>
<td>Specialty Tools and Test &amp; Diagnostic Equipment</td>
<td>$</td>
<td>4</td>
<td>$</td>
</tr>
<tr>
<td><strong>Grand Total Cost – Metra</strong></td>
<td><strong>$</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Unit Price</th>
<th>Quantity</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailer Car with Toilet</td>
<td>$</td>
<td>65</td>
<td>$</td>
</tr>
<tr>
<td>Cab Car with Toilet</td>
<td>$</td>
<td>4</td>
<td>$</td>
</tr>
<tr>
<td>Engineering Costs</td>
<td>N/A</td>
<td>N/A</td>
<td>$</td>
</tr>
<tr>
<td>Training Costs</td>
<td>N/A</td>
<td>N/A</td>
<td>$</td>
</tr>
<tr>
<td>Payment &amp; Performance Bond at 100% for all 69 Cars</td>
<td>$</td>
<td>N/A</td>
<td>$</td>
</tr>
<tr>
<td>Documents &amp; Warranty Costs</td>
<td>$</td>
<td>N/A</td>
<td>$</td>
</tr>
<tr>
<td><strong>Grand Total Cost – VRE</strong></td>
<td><strong>$</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## 2.9.5 Financing

Bidders are requested to provide financing options in addition to the unit prices above, with clear title to the Cars being provided on final payment. Bidders may decide not to provide financing.
options or bidders may provide a financing option with monthly payments for twenty (20) years, commencing on Conditional Acceptance. Financing institutions may be a part of multiple bids; they need not limit themselves to partnering with a single bidder.

It is assumed that bidders would offer financing terms based upon a spread over an established benchmark in place at the time of Conditional Acceptance of each Car with payments to begin in the following month. Each proposed financing option shall include a description of the financing terms (such as “prime rate plus 0.5%”) and a schedule of payments as if the deal had been executed Jan 1, 2019 with rates in place at the close of that business day, so Metra has a numerical example of the exact calculation.

Metra will discount the proposed payments, using internal discount rates it determines, and value the options accordingly. The purchased Rail Cars would be the sole collateral for this purchase.

### 2.9.6 Milestone Payment Schedule

Payments for the surety costs and line items A through C shall be made in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Item</th>
<th>Payment %</th>
<th>Cumulative %</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Reimbursement of actual Metra approved surety costs.</td>
</tr>
<tr>
<td>A.1</td>
<td>75</td>
<td>75</td>
<td>Delivery of acceptable as-built drawings in electronic format, drawing list and Bill of Material, as-built updates of all manuals, as-built specifications, and photographs.</td>
</tr>
<tr>
<td>A.2</td>
<td>25</td>
<td>100</td>
<td>Metra’s approval of all design submittals and drawings.</td>
</tr>
<tr>
<td>B.1</td>
<td>50</td>
<td>100</td>
<td>Metra’s approval of all training materials.</td>
</tr>
<tr>
<td>B.2</td>
<td>50</td>
<td>100</td>
<td>Successful performance of training obligations.</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>100</td>
<td>Approval of Technical and Warranty Support plan.</td>
</tr>
</tbody>
</table>

Payment for individual Cars, whether the base order or optional cars, shall be made in accordance with the following schedule:

| D.1/E.1 | 10 | 10 | Issued after Contractor's receipt and acceptance of both: a) the following items: Trucks; Couplers; Diaphragms; Doors; Door Operators; HVAC System; Seating; Lighting; Brakes; Communications; Low Voltage Power Supply/Battery Charger; Batteries; Alerter/Event Recorder; Camera Systems; Car |

2-20
Monitoring System; and Windows and Glazing; and b) any other systems supplied by a Major Subcontractor, as determined by Metra.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D.2/E.2</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Issued after the Contractor’s completion of the car shell and Metra's witness of car shell final dimension inspection.</td>
<td></td>
</tr>
<tr>
<td>D.3/E.3</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Issued after the Contractor releases the car for in-process testing under Section 19.2.3 of the Technical Specification M-18-011.</td>
<td></td>
</tr>
<tr>
<td>D.4/E.4</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>D.5/E.5</td>
<td>60</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>Issued after Conditional Acceptance for each Car.</td>
<td></td>
</tr>
<tr>
<td>D.6/E.6</td>
<td>5</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Issued after Final Acceptance Contractor shall, pursuant to Sections 20.1.2, 20.2, 20.3, 20.4, 20.5, 20.6 and 20.7 of the Technical Specification M-18-011, as-built drawings in editable electronic format, drawings list and Bill of Material, as-built updates of all manuals, as-built specifications, and photographs, and complete Phase II of the Training Program under Exhibit 1-S.</td>
<td></td>
</tr>
<tr>
<td>D.7/E.7</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Completion of the basic warranty.</td>
<td></td>
</tr>
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</table>
Technical Specification for
New Push-Pull Commuter Car

SPECIFICATION No. M-18-011

REVISION: B

DATE: 05/21/2019
### RECORD OF REVISIONS

<table>
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<tr>
<th>REVISION</th>
<th>PREPARED BY</th>
<th>DATE</th>
<th>DESCRIPTION</th>
<th>APPROVED BY</th>
<th>DATE</th>
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<tr>
<td>First Issue</td>
<td>F. Mascarenhas</td>
<td>12/18/2018</td>
<td>New Push-Pull Commuter Car Specification</td>
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<tr>
<td>A</td>
<td>S. Cronin</td>
<td>03/19/2019</td>
<td>Revised Sections 1.1.10.3.1; 3.1.6; 8.3.2; 8.3.3; 11.6.4</td>
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<td>03/19/2019</td>
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<tr>
<td>B</td>
<td>S. Cronin</td>
<td>05/21/2019</td>
<td>Revised Sections 1.1.2; 2; Added Sections 1.1.3.2; 1.1.3.3; 1.1.5</td>
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<td>Revised Sections 1.1.10.3.2; 3.1.2; 3.1.3; 3.1.9; 3.2.2; Added Sections 3.2.2.7; 3.2.28</td>
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<td>Revised Sections 4.1.10; 7.2.1; 8.1.1.1; 8.3.1.5; 8.3.5.5; 8.5.1; 8.5.5; 8.6.2.2; 8.6.2.4; 8.6.2.6; Added Section 8.6.2.13</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Revised Sections 8.6.3.1; 8.7.4; 8.7.6; 8.7.7; 8.7.8; 8.7.10; 8.8.8.9; 9.2.4; 9.3.2; 10.4.7; 11.5; 11.6.4 Added/Edited Section 11.9.1 and 11.9.2; Added CO-11-03</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Revised Sections 12.5; 12.6.11; 12.6.13.5; 12.6.13.6 Added Section 12.6.13.15</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Revised Sections 12.8.23; 13.1.1; 13.3.1; 14.12.3; 15.5.2; 15.7; 15.8; 16.1.2; 16.1.4; 16.1.14; 16.2.9; 17.2; 21; 18.1.9.3; 18.1.9.4 Add Section 23</td>
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**NOTE:** This document is to be considered “uncontrolled” when printed as a hardcopy from the network. The revision level must be verified prior to use.
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Date: 05/21/19  Document No. M-18-011  Page: 3 of 160  Prepared By: S. Cronin  Revision: B  Approved By: 
1 GENERAL REQUIREMENTS

1.1 GENERAL REQUIREMENTS

1.1.1 This specification covers commuter passenger cars to be used in push-pull type passenger service transporting passengers in the greater Chicago Metropolitan Area and its environs. The cars are to be operated in trains of from one to twelve cars. The design of the cars shall provide a safe, comfortable ride at all speeds up to Metra’s maximum authorized operating speed (79 mph). The car shell and trucks shall be designed for speeds up to 100 miles per hour.

1.1.2 The cars shall be constructed so that they may be, in emergency situations, coupled to other conventional passenger cars, except that provision of hotel power and locomotive control train line, and car control train line features shall not be required. [VRESD V-1-01] The cars shall be constructed so that they may be coupled to other conventional passenger cars, to include hotel power and locomotive control train line, and car control train line features. [VRESD V-1-01]

1.1.3 The cars shall be provided in two configurations: Cab Control Cars and Trailer Cars and shall be compatible in every respect with:

1.1.3.1 Metra’s existing locomotives
1.1.3.2 [VRESD V-1-02] VRE’s existing locomotives [VRESD V-1-02]
1.1.3.3 [VRESD V-1-03] VRE’s existing Cab Control/Trailer Cars [VRESD V-1-03]

1.1.4 The cars are to be built in accordance with the requirements described in these specifications, and shall comply with all Federal Railroad Administration (FRA) regulations in effect at the time the Notice to Proceed is issued as well as the applicable standards of the Association of American Railroads (AAR) and/or American Public Transportation Association (APTA) in effect at the time the Notice to Proceed is issued.

1.1.5 All documents, correspondence, meetings, and technical information shall be offered and conducted in the English Language and using US customary system of weights and measures.

1.1.6 Drawings and other data contained herein are considered part of these specifications. In case of conflict, these specifications shall govern. Where these specifications conflict with FRA regulations and/or AAR & APTA standards (or conflict between regulations and standards) the following hierarchy shall apply: 1) FRA Regulations, 2) these Specifications, 3) APTA Standards, and 4) AAR Standards. The Contractor and Metra will jointly resolve any conflicts that exist.

1.1.7 As part of the design review the Contractor shall submit the drawings and documentation as required in sections 1.6, 1.7 and elsewhere in this specification where terms “approved”, “approved manner”, “approved by Metra”, “subject to approval” and “Metra approval” appear. Without limitation, the Contractor shall also provide additional information or documentation related to the design and production of the vehicles if requested to do so by METRA. Metra shall review all documents submitted. All submittals will be documented as:

1.1.7.1 Approved: defined as METRA concurs with the information in its submitted form. The material may be incorporated into the program.
1.1.7.2 Approved/Conditionally: defined as METRA agrees in principle with the submitted information. However some details must be revised to make the information fully approved. The material must be resubmitted in revised form for approval.

1.1.7.3 Disapproved: defined as METRA does not concur with the submitted details. The Contractor shall not incorporate the material into the program. METRA’s objections must be reconciled and the material must be resubmitted in revised form for approval.

1.1.7.4 Insufficient Information: defined as the information provided was illegible or insufficient to enable a complete review.

Metra will respond within 20 working days to any review submittal, calculated from the date of receipt of documents by Metra to the date a response is sent to the Contractor, provided the Contractor submits such review material in a reasonable time sequence and manageable volume.

Revisions to Metra approved documents and the Contractor's internal change requests affecting Metra approved documents, shall be submitted to Metra for approval as they are issued. No more than three approved drawing alterations (change requests) shall remain unincorporated on any drawing at any time, and no approved change request shall remain unincorporated into a drawing for a period greater than two months from the date of approval. Metra's approval of a drawing or document is for a limited purpose and it is not an approval for a deviation. Approval does not relieve the Contractor of the obligation of meeting all the requirements of this Contract. Approval of a drawing which contains a deviation from, or violation of these Specifications does not constitute authority for that deviation or violation unless such deviations have been specifically requested in writing and specifically granted by Metra in writing according to all contract requirements.

1.1.8 The Contractor shall prepare and submit to Metra for approval, prior to construction of the cars, copies (electronically in searchable PDF format and two (2) hard copies) of each drawing required by these specifications and all drawings necessary to demonstrate compliance with these specifications. This shall include, but not be limited to: clearance drawing, arrangement drawings, structural drawings, assembly drawings, sub-assembly drawings, integrated wiring schematics, and drawings of major equipment and apparatus. [CDRL C-1-01]

Drawings submitted by Subcontractors and Suppliers shall be thoroughly checked by the Contractor to ensure that they conform with the requirements of these specifications prior to submittal to Metra.

Drawings shall be comprised of not more than four (4) sizes with "D" size (22" X 34") being the largest drawing size permissible.

1.1.9 The Contractor shall submit, prior to the car body testing, a stress analysis of the complete car body structure and supports for equipment weighing over two hundred (200) pounds. This analysis shall show the calculated stresses, allowable stresses and the margin of safety for all elements for the specified load conditions. All critical joints shall be included in this analysis (manual calculations if necessary). In addition conformance to all referenced standards shall be demonstrated. The analysis shall, as a minimum, consist of a finite element analysis using recognized computer programs (Nastran, Ansys, etc.). [CDRL C-1-02]

1.1.10 A post-award conference shall take place no later than 20 working days after Notice To Proceed, at Metra’s or the Contractor’s facilities, as directed by METRA, to accomplish the following:

1.1.10.1 Introduce Metra’s key personnel to the Contractor

1.1.10.2 Confirm the Contractor's management team and key staff and the scope of supply of subcontractors
Establish formal channels of, and procedures for, communication (e.g. letter and meeting numbering)

Establish an understanding of the Contractor’s project control methodology and plans for initial activities before the start of formal progress reporting

Discussion to familiarize the Contractor with Metra’s intended operations and maintenance environment

Identify the early information needs and decisions required by the Contractor from METRA

The Contractor shall hold formal design review meetings with Metra. The purpose of these meetings is to insure that the requirements of these specifications are being met by the design. The schedule and location for these meetings shall be by mutual agreement. Design review material shall be submitted no later than 15 working days prior to each review meeting, and shall include the drawings, technical data, analyses, calculations and other items required for the review. Four types of design reviews shall be held:

1.1.11.1 Preliminary design review (PDR): Preliminary design review of system components shall be made at the 30% level of designs. The PDR shall include a review of the design concept, written descriptions of the functionality, schematics of the system wiring and drawings of each component showing dimensions and structural elements. Metra retains the right to redline, comment, and request changes to improve design and/or functionality.

1.1.11.2 Intermediate design review (IDR): An intermediate design review (IDR) shall be held when the design of the car is approximately 60% complete. This shall represent an advancement of design of the car from the preliminary design stage to development of draft production drawings, arrangements, component and material specifications and schematics for all systems, subsystems and components, which will be used by Metra to evaluate the proposed design of the car to a level of detail sufficient that the Contractor shall be able to proceed with the development of the car design to the 95% draft final stage.

1.1.11.3 Mockup development and review: Upon completion of the IDR stage of the design review process, the Contractor shall complete the assembly of full size mockups hard mockups of the following areas and systems of the cars; according the drawings as reviewed and approved at the IDR, for Metra review and comment:

1.1.11.3.1 Passenger seats
1.1.11.3.2 Workstation table between facing seats (if proposed) [VRESD V-1-04] No work table or facing seats [VRESD V-1-04]
1.1.11.3.3 Overhead baggage rack
1.1.11.3.4 Wall panels, window and window mask
1.1.11.3.5 ADA lift unit
1.1.11.3.6 Lavatory
1.1.11.3.7 Electrical locker
1.1.11.3.8 Door operator systems
1.1.11.3.9 Cab compartment

1.1.11.4 Final design review (FDR): Final design review (FDR) of system components shall be held at 95% or greater level of design. The FDR shall include a review of all documents and plans for the design as revised, including the written descriptions of the functionality, schematics of the system wiring, drawings of each component showing dimensions and structural elements. Redlines and comments from the IDR and mockup review shall be reviewed. Metra retains the right to provide additional comments during this process as production progresses and concerns are brought to the Customer’s attention.
1.1.12 Progress review meetings shall be held at mutually agreed to time periods either at Metra’s headquarters or at the Contractor's (or its subcontractors') facilities as deemed necessary.

1.1.13 Whenever in this specification one or more brands, trade names, or catalog numbers of specific manufacturers are mentioned, it is in the intent of establishing identification, a basis of quality and durability and though the term "or approved equal" may not be inserted, it may be implied. Only substitutions equal to the specified items will be allowed and only when such substitution is necessary. Before furnishing and/or installing any product that is a substitution for the specified item, proof of equality shall be furnished by the Contractor, and the approval of Metra's Chief Mechanical Officer must be obtained in writing before any such substitution is made.

1.2 PROJECT DRAWING DELIVERABLES

Project drawing deliverables shall comply with project specific specifications, the applicable Metra quality management plans, contractually required procurement documents, and this document. All contract drawing submittals to Metra shall consist of both hardcopy and electronic formats, which shall conform to the requirements of this section.

1.2.1 Disposition for Problems, Questions, and Discrepancy

When problems, questions, and/or discrepancies are identified between this document, contractual documents, etc., the Contractor must inform Metra and the work must be performed in accordance with the instruction for disposition from Metra's Project Manager.

1.2.2 Submittal Intervals

As drawings for a project are developed, the Contractor shall periodically submit drawing set(s) to Metra for review and comment. The submittal intervals shall be defined by the contract documents and/or agreement by Metra with the Contractor.

1.2.3 Reviews and Approvals

Drawings will only be approved or accepted by Metra as to arrangement and conformance to the specifications and related drawings. Approval or acceptance shall not be construed as relieving or mitigating the Contractor of their responsibility for design verification, dimensional accuracy, adequacy and suitability of materials and/or the equipment represented thereon, or for compliance with contract requirements.

1.2.4 Electronic Delivery Media.

Electronic delivery media shall be coordinated with Metra’s Project Manager to ensure compatibility with the Metra’s hardware and software. Accepted media or file transfer methods:

- USB 2.0 Drive or better
- Establishment of a secure FTP site

1.2.5 Media Labeling.

All media shall have a label containing, but not limited to:

1.2.5.1 Preparation date of the media.
1.2.5.2 The project description.
1.2.5.3 Contractor name and contract reference.
1.2.5.4 Contract transmittal number.
1.2.5.5 Quantity of files.
1.2.5.6 Operating System and version, and application software used to create the files.
1.2.5.7 The utility or command used to write the files to the media.

1.2.6 Electronic File Preparation.
All electronic files shall be delivered in Metra approved formats. Deliverable file format shall be coordinated with Metra’s Project Manager to ensure the Metra’s ability to use the delivered files. Before a file is placed on the electronic delivery media, the following procedures shall be performed:

1.2.6.1 Drawing files shall be in their native format, not DXF, or other neutral format. File format must be approved by Metra.
1.2.6.2 Only one drawing or one model shall be included in each CADD file.
1.2.6.3 Remove all unnecessary graphics outside the drawing border area and set the active parameters to a standard setting of those in the seed or prototype file.
1.2.6.4 Ensure all external reference files are attached without device or directory specifications. Include a list of files included in the deliverable in a text document on the media.
1.2.6.5 All deliverables shall be certified virus-free.

1.2.7 Documentation.
All drawing packages submitted to the Metra shall include, but not be limited to, a transmittal containing the same information as on the external media label, and:

1.2.7.1 A hardcopy list of files included in the deliverable.
1.2.7.2 A full size hard copy plot of each drawing file submitted on the media.
1.2.7.3 Person designated as point of contact.
1.2.7.4 Certification in the form of a signed statement, that the delivery data is free of known computer viruses, including the name(s) and release date(s) of the virus scanning software used to check the media.

1.2.8 Quality
As part of their contractual requirements to Metra, the Contractor will be responsible for the quality assurance and quality control of the drawings, CADD files and other documents submitted to Metra as part of the contract. The Contractor shall ensure compliance to this document, Metra project specifications, applicable Metra quality management plans, and other contractually required documents. Metra’s review of the submittals shall not be construed as relieving or mitigating the Contractor of this responsibility.

1.2.9 Ownership.
The following shall apply to Metra contracts with electronic drawing deliverables:
Metra shall have UNLIMITED RIGHTS to all information and materials developed for Metra contracts and furnished to the Metra and documentation thereof, reports and listings, and all other items pertaining to the work and services pursuant to this agreement including any copyright. Unlimited rights are rights to use, to use, duplicate, or disclose text, data, drawings, and information, in whole or in part in any manner and for any purpose whatsoever without compensation to or approval from the Contractor. Metra will at all reasonable times have the right to inspect the work and will have access to and the rights to make copies of the above-mentioned items. All digital files and data, and other products generated under a Metra contract shall become the property of Metra. In no event shall the Contractor, Consultant or Vendor use its obligation to recognize and protect subcontractor or supplier as an excuse for failing to satisfy its contractual obligations to Metra.

1.3 QUALITY ASSURANCE
1.3.1 The Contractor shall have a quality assurance program conforming to the Mechanical Department Quality Plan (MQP), the FTA Quality Management System Guidelines, FTA-PA-27-5194-12.1 issued December 2012 and the attached Quality Assurance Requirements. On a case by case basis, Metra may approve the use of other quality guidelines recognized in the United States such as the quality assurance guidelines published by the Association of American Railroads. In addition, the Contractor’s management's shall submit a declaration of their commitment to quality and the implementation of the contractually required MQP and FTA QMS guidelines.

1.3.2 The contractor shall submit a copy of their quality assurance plan to Metra for review. Metra shall be the sole judge of compliance of the Contractor’s quality assurance plan and program to Metra’s requirements and the appropriate quality assurance standards.

1.3.3 The Contractor shall provide an organizational chart to Metra. The organizational chart shall depict the Contractor's overall management structure, reporting lines, authority and accountability among the Contractor’s staff, subcontractors and the interfacing relationships between Metra and the Contractor. A list of personnel assigned to Metra’s contract, their education, experience, accountability, and authority level shall also be provided.

1.3.4 Upon review by Metra, any deviation or deficiencies in the quality assurance plan may render the bid non-responsive.

1.3.5 Submission of a bid gives Metra the authority to perform assessments and inspections of the Contractor’s and their subcontractor’s facilities in order to perform a quality audit (s). Audit (s) shall be scheduled no later than 14 days from Metra’s notice to perform the audit.

1.3.5.1 Metra may inspect tooling, procedure manuals, training programs, worker certification records, test gauges, inspection procedures, and subcontractor qualifications.

1.3.5.2 The audit will be styled after and include the items described in AAR Specification M-1003.

1.3.6 Metra’s authorized representative(s) shall have, at all reasonable times, access to the Contractor’s and their subcontractor’s facilities for the purpose of inspecting materials, workmanship, quality, and compliance to this specification. Refusal to permit such inspection may be construed as non-compliance with Metra’s specification and risks in cancellation of the bid.

1.3.7 The presence of Metra’s representative(s) at the contractor’s facility shall not in any manner supplant the contractor’s own inspection, nor lessen the responsibility to meet all requirements of this specification. Metra shall have the right to reject all products, material and/or workmanship that does not conform to this specification or accepted practices.

1.3.8 The Contractor shall submit the following with their Bids for review, Metra shall be the sole judge of compliance of the Contractor’s submittals to Metra’s requirements and the appropriate quality assurance standards:

1.3.8.1 Contractor’s Quality Assurance Manual and Procedures [CDRL C-1-03]

1.3.8.2 Contractor’s organizational chart with personnel assigned to Metra’s contract [CDRL C-1-04]

1.3.8.3 Contractor’s management’s declaration of their commitment to quality and the implementation of the contractually required MQP and FTA QMS guidelines [CDRL C-1-05]
1.3.8.4 Contractor’s Project Quality Plan and Procedures [CDRL C-1-06]
1.3.8.5 Contractor’s ratio of Inspection to Production Personnel [CDRL C-1-07]
1.3.8.6 Contractor’s Software Quality Assurance Plan [CDRL C-1-08]
1.3.8.7 Contractor’s Supplier and Subcontractor Qualification, Quality Compliance, and Management Plan and Procedures [CDRL C-1-09]
1.3.8.8 Contractor’s List of all supplier and subcontractors, their qualifications, and quality certifications (ANSI-ASQ ISO) [CDRL C-1-10]
1.3.8.9 Contractor's First Article Inspection (FAI) Plan and Procedures [CDRL C-1-11]
1.3.8.10 Contractor’s MRB Plan and Procedures [CDRL C-1-12]
1.3.8.11 Corrective and Preventative Plan and Procedures [CDRL C-1-13]

1.3.9 The bidder shall correct all deviations or deficiencies determined by Metra. Failure to correct such deficiencies or repetitive notation of deficiencies shall be cause for cancellation of the contract.

1.3.10 Only substitutions equal (or better in comparison) to the specified items will be subject for approval by Metra’s Chief Mechanical officer and only when such substitution is necessary. Before furnishing and/or installing any product that is a substitute for the specified item, proof of equality and quality shall be furnished by the Contractor. Then the written approval of Metra’s Chief Mechanical Officer must be obtained before any such decision is made. Metra shall have the right to reject or accept the proposed substitution.

1.4 CONTRACT DELIVERABLES REQUIREMENTS LIST

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<td>Car-Body Stress Analysis</td>
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<tr>
<td>C-1-03</td>
<td>Contractor's Quality Assurance Manual and Procedures</td>
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<tr>
<td>C-1-04</td>
<td>Contractor’s Organizational Chart with Personnel Assigned to Metra’s Contract</td>
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<td>C-1-05</td>
<td>Contractor’s Management's Declaration of their Commitment to Quality and the Implementation of the Contractually Required MQP and FTA QMS Guidelines</td>
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<td>C-1-13</td>
<td>Corrective and Preventative Plan and Procedures</td>
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## 2 ABBREVIATIONS AND DEFINITIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>AAR</td>
<td>Refers to the Association of American Railroads</td>
</tr>
<tr>
<td>ADA</td>
<td>Americans with Disabilities Act of 1990 as amended</td>
</tr>
<tr>
<td>ACORN</td>
<td>Automated Communications and On-Board Reporting Network</td>
</tr>
<tr>
<td>AISI</td>
<td>Refers to the American Iron and Steel Institute</td>
</tr>
<tr>
<td>AMOLED</td>
<td>Active-Matrix Organic Light-Emitting Diode</td>
</tr>
<tr>
<td>ANSI</td>
<td>Refers to the American National Standards Institute</td>
</tr>
<tr>
<td>APTA</td>
<td>Refers to the American Public Transportation Association (formally known as the American Public Transit Association)</td>
</tr>
<tr>
<td>ASME</td>
<td>Refers to American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>ASTM</td>
<td>Refers to American Society for Testing Materials</td>
</tr>
<tr>
<td>AWS</td>
<td>Refers to American Welding Society</td>
</tr>
<tr>
<td>AW0</td>
<td>Actual weight of empty car, ready for revenue service, but with neither crew nor passengers aboard. Includes full fresh water supply and empty waste system.</td>
</tr>
<tr>
<td>AW1</td>
<td>Car at seated load and no standees. Seated load is defined as all the passenger seats occupied plus one crew member per car.</td>
</tr>
<tr>
<td>AW2</td>
<td>Car at normal full load. Normal full load is defined as seated load plus one standee per 3 ft$^2$ of clear floor space.</td>
</tr>
<tr>
<td>AW3</td>
<td>Car at crush load. Crush load is defined as seated load plus one standee per 1.5 ft$^2$ of clear floor space.</td>
</tr>
<tr>
<td>BNSF RR</td>
<td>Refers to the Burlington Northern Santa Fe Railroad</td>
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<tr>
<td>FDR</td>
<td>Final Design Review</td>
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<tr>
<td>FRA</td>
<td>Refers to the Federal Railroad Administration of the United States Department of Transportation</td>
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<tr>
<td>ICDB</td>
<td>Refers to the Illinois Capital Development Board</td>
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<tr>
<td>IDR</td>
<td>Intermediate Design Review</td>
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<tr>
<td>IDOT</td>
<td>Refers to the Illinois Department of Transportation</td>
</tr>
<tr>
<td>IEEE</td>
<td>Refers to the Institute of Electrical and Electronic Engineers</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>LCD</td>
<td>Liquid Crystal Display</td>
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<tr>
<td>LED</td>
<td>Light-Emitting Diode</td>
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<tr>
<td>Low Voltage DC</td>
<td>Low voltage DC refers to nominal DC voltages of less than or equal to 80 VDC</td>
</tr>
<tr>
<td>Metra</td>
<td>Refers to the Commuter Rail Division of the Regional Transportation Authority</td>
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<tr>
<td>NEMA</td>
<td>Refers to the National Electrical Manufacturers Association</td>
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<tr>
<td>OLED</td>
<td>Organic Light-Emitting Diode</td>
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<tr>
<td>PDR</td>
<td>Preliminary Design Review</td>
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<tr>
<td>RTA</td>
<td>Refers to the Regional Transportation Authority</td>
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<tr>
<td>TFT</td>
<td>Thin-Film-Transistor</td>
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<tr>
<td>UP RR</td>
<td>Refers to the Union Pacific Railroad</td>
</tr>
<tr>
<td>US</td>
<td>United States of America</td>
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<tr>
<td>VRE</td>
<td>Virginia Railway Express or their designated representative</td>
</tr>
<tr>
<td>Contractor</td>
<td>Refers to the firm with whom a contract is made by Metra for the construction of the cars described in this specification</td>
</tr>
<tr>
<td>OEM</td>
<td>Refers to the manufacturer of one or more components to be applied to the subject cars during the work performed under this specification</td>
</tr>
<tr>
<td>Sub-Contractor</td>
<td>Refers to any shop, manufacturer, or other company or agency performing work on the subject cars under this specification, under contract to, or for, the Contractor.</td>
</tr>
</tbody>
</table>
3 DIMENSIONS AND CLEARANCES

3.1 PRINCIPAL DIMENSIONS
The principal dimensions and dimensional requirements shall be as follows:

3.1.1 Coupled length: Not to exceed 85’ on single unit

3.1.2 Width of Car: Not to exceed Metra Clearance Diagram M-544. Car width shall be submitted as required. [PDRL P-3-01] [VRESD V-3-01] Width of Car: Not to exceed Amtrak Clearance Diagram B-066-0050 Rev. C. Car width shall be submitted as required. [PDRL P-3-01] [VRESD V-3-01]

3.1.3 Height of Car: Not to exceed Metra Clearance Diagram M-544. Car height shall be submitted as required. [PDRL P-3-02] [VRESD V-3-02] Height of Car: Not to exceed Amtrak Clearance Diagram B-066-0050 Rev. C. Car height shall be submitted as required. [PDRL P-3-02] [VRESD V-3-02]

3.1.4 Centerline of Coupler above top of rail: 2’ – 10 ½”

3.1.5 Track Gauge: 4’ – 8 ½”

3.1.6 Seating Capacity: Seated capacity to be maximized [PDRL P-3-03]
3.1.6.1 Cab Cars with Toilets: Seating diagram shall be submitted counting total seats and total seats + 2 ADA positions occupied.
3.1.6.2 Trailer Cars with Toilets: Seating diagram shall be submitted counting total seats and total seats + 2 ADA positions occupied.
3.1.6.3 Trailer Cars without Toilets: Seating diagram shall be submitted counting total seats and total seats + 2 ADA positions occupied.

3.1.7 General Arrangement: Interior layout design of seating, stairway(s), aisle(s), and door(s) shall be designed to allow the most efficient passenger flow possible. Along with providing general arrangement drawing, the proposer shall provide a passenger flow analysis for five different scenarios estimating the station stop time from the time doors open and passengers begin detraining/entraining until last person entrains/detrains and door closes. The five scenarios are below:[PDRL P-3-04]
3.1.7.1 80 passengers entraining/ 0 detraining
3.1.7.2 80 passengers detraining/ 0 entraining
3.1.7.3 80 passengers entraining/ 1 ADA passenger entraining
3.1.7.4 60 passengers entraining/ 20 passengers detraining
3.1.7.5 60 passengers entraining/ 1 ADA passenger entraining/ 20 detraining

3.1.8 Crush Passenger Load: AW3.

3.1.9 Weight: Car total weight shall be minimized. Car weights shall be submitted at AW0, AW1, AW2 and AW3. All cars shall be weighed at Contractor’s facility. Car estimated weight shall be submitted in proposal at AW0, AW1, AW2, and AW3. [PDRL P-3-05]
3.1.9.1 Car weight end-to-end balance shall be within 5%
3.1.9.2 All cars shall be within 300 lbs. of the first production car of each type of car.

3.1.10 Passenger Weight: 180 lbs. per passenger, includes seated or standees.
3.2 CLEARANCES

3.2.1 The cars, when coupled to each other shall be able to negotiate the following:
3.2.1.1 A 250’ radius curve
3.2.1.2 A No. 8 crossover, having 12’ - 2” track centers when coupled to each other, or to Metra locomotive equipped with alignment control couplers
3.2.1.3 All yard or station tracks negotiated by existing equipment when coupled to each other, or to Metra locomotive equipped with alignment control couplers

3.2.2 The cars, and all appliances, shall conform to the clearance outlined in Metra drawing M-544 as well as the clearance outlines for the following carriers within Metra’s jurisdiction:

[VRES D V-3-03] The cars, and all appliances, shall conform to the clearance outlined in Amtrak B-066-0050 Rev. C as well as clearance outlines for the for the following carriers within VRE’s jurisdiction: [VRES D V-3-03]
3.2.2.1 Amtrak (Chicago Union Station)
3.2.2.2 Burlington Northern Santa Fe
3.2.2.3 Canadian National (Illinois Div.)
3.2.2.4 Norfolk Southern (including Conrail)
3.2.2.5 Union Pacific
3.2.2.6 Canadian Pacific
3.2.2.7 [VRES D V-3-04] Amtrak (Washington DC) Union Station [VRES D V-3-04]
3.2.2.8 [VRES D V-3-05] CSX [VRES D V-3-05]

It is the responsibility of the Contractor to obtain current copies of the clearance outlines from these railroads. The clearance diagram for the car shall be submitted to Metra for review and approval. [CDRL C-3-01]

3.2.3 Under worst condition of fully worn wheels, defective springs, crush passenger load, and maximum wear of parts, minimum allowable clearance above rail for car body and truck parts is as follows:
Truck parts
0’ – 2 ½”

3.3 CAMBER
The cars shall be constructed so that when fully loaded (AW1), the center of the car shall not deflect below zero camber for the life of the car. Nor shall the camber have more than 3/4” symmetrical camber between bolsters when it is light (AW0).

3.4 PROPOSAL DELIVERABLES REQUIREMENT LIST

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<td>Car Height</td>
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<td>P-3-02</td>
<td>Car Width</td>
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<td>P-3-03</td>
<td>Seating Capacity</td>
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<td>P-3-04</td>
<td>Passenger Flow</td>
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<td>P-3-05</td>
<td>Car Weight</td>
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3.5 CONTRACT DELIVERABLES REQUIREMENT LIST
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<tr>
<td>C-3-01</td>
<td>Clearance Diagram</td>
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Prepared By: S. Cronin  
Revision: B  
Approved By: [Signature]
4 CAR BODY EXTERIOR

4.1 STRUCTURAL EXTERIOR FRAMING

4.1.1 The car exterior shall be constructed of stainless steel or other approved corrosion resistant material. The contractor shall submit as part of the proposal, a general arrangement drawing of proposed design and artist rendering of the exterior of car. The drawing shall include views to show details of end car arrangement and identify location of major components/systems. [PDRL P-4-01]

4.1.2 The structural members of the car framing shall be of American Iron and Steel Institute Types 301L stainless steel for concealed components, and 301L or 304L stainless steel for exposed components with carbon content not exceeding 0.03%. Non-structural stainless steel parts, not exposed, shall utilize similar types of stainless steel such as 300 or 400 series. Metra will review alternate stainless steel types for non-welded structural application on a case-by-case basis as part of the design review. The Contractor shall include a structural diagram of the car body showing the locations of the principal framing members, their cross sectional area, and metal thickness. [CDRL C-4-01]

The ultimate tensile strength of the materials shall vary from 80,000 pounds per square inch to 150,000 pounds per square inch, according to the imposed stresses on the individual member and the amount of formation required during manufacture. Critical buckling shall be considered in the design of all structural members.

4.1.3 All parts of the structure of the car shall equal or exceed the requirements of FRA Regulation 49 CFR Part 238 Subpart C and the latest revision of APTA Standard SS-C&S-034-99 Rev 2 and any other applicable requirements in the CFR. Buff loading of 800,000 pounds shall be resisted without permanent deformation. Alternative compliance as specified in 49 CFR Part 238.201(b) may be proposed. The Contractor shall submit a test procedure that describes in detail the steps taken to prove the car-body structure is compliant with APTA and FRA regulations. [CDRL C-4-02]

4.1.4 All parts of the roof shall have sufficient strength to support concentrated loads of 250 lbs., applied 30 inches apart in a 12” x 4” area without permanent deformation. Emergency roof access shall be provided via structural weak points complying with the requirements of FRA Regulation 49 CFR Part 238 section 238.123. Design and layout of the emergency roof access shall be provided to Metra for review and approval. [CDRL C-4-03]

4.1.5 Side sheets shall be secured to the side posts and other side structural members by welding or any other approved method. If utilized, any exterior exposed welds made by a spot-welding process shall be arranged in regularly spaced patterns and shall be free of discoloration.

4.1.6 The car end structure shall be provided with two vertical collision posts constructed of high tensile stainless steel, one at either side of the end opening and located outboard of the end sheets. All end collision posts shall be made in accordance with the requirements for the control end of cab cars of APTA standard SS-C&S-034-99 Rev. 2 by designing these members for an ultimate horizontal load of 200,000 pounds, which can be applied to each post vertically between the top of buffer sill and a plane 30 inches above the top of buffer sill and a 500,000 pound horizontal load at the top of the buffer sill. The applied loading can be angled, zero to
fifteen degrees, with respect to the longitudinal axis through the post. Final design review of the end structure shall be submitted to Metra for review and approval. [CDRL C-4-04] The welding of collision posts to the buffer sill shall carry the end reaction developed by the collision post under the above loading. The torsional strains developed in the collision post shall be resisted by the buffer sill and a transverse beam constructed into the end frame. Corner posts shall comply with the APTA Standard SS-C&S-034-99 Rev. 2.

4.1.7 The underframe shall be an integral unit conforming to the latest standards and recommended practices of APTA and the AAR. The draft sill arrangement and coupler shall be such as to meet the clearance requirements of section 3.2.1. Final design review of the underframe shall be submitted to Metra for review and approval. [CDRL C-4-05] All welds shall be inspected in accordance with the Contractor's quality control plan which shall be approved by Metra.

4.1.8 Both ends of cars shall have anti-climbing mechanism complying with FRA regulation 49 CFR Part 238.205 (a) & (b).

4.1.9 Eight (8) jacking pads shall be provided, one at both ends of each body bolster and one near each corner of the car body. The location of the jacking pads will be submitted to Metra for approval. [CDRL C-4-06] In addition, reinforced lifting lugs will be provided in the upper portion of each collision post in an approved manner, suitable for attaching gear for lifting with a wrecking derrick.

4.1.10 Rain gutters shall be provided over the passenger side entrance doors, any exterior electronic devices, and over each diaphragm. The rain gutter shall be of such design to withstand the action of car washing machines. In addition, suitable baffles shall be placed at the ends of the roof to prevent the flow of water from running off onto the top of the diaphragm.

4.2 INSULATION

4.2.1 Thermal and acoustical insulation shall be provided in order to ensure reasonable operating costs and compliance with Sections 9.0 and 17.0 of these specifications. Samples of insulating materials shall be submitted to Metra for review and approval. [CDRL C-4-07]

4.2.2 Insulation must not support combustion, must not absorb moisture beyond its own weight, and when wet, must not cause corrosion. Insulation must not be subject to shaking down in long service and retained by a means adequate to ensure this requirement. Insulation used must be non-corrosive to aluminum and must not require special surface treatment of aluminum. Insulation shall preferably be light in weight, and type and density shall be approved by Metra.

4.2.3 All cars shall be well insulated against sound transmission inside car to greatest extent practicable. The inside surface of the outer shell of the car, including sides, ends, roof and floor areas and the underside of all metal steps shall be coated in accordance with manufacturers recommendations. For certain specific discreet areas, other materials approved by Metra may be used.

4.2.4 The floor, roof, sides and ends of the cars shall be insulated. The heat transfer through the carbody shall not exceed 1,200 Btu/hr°F. The Contractor shall supply a thermal analysis of
a completed stationary car for Metra review and approval based on the environmental conditions that will be mutually agreed upon between the Contractor and Metra. [CDRL C-4-08]

4.2.5 Installation of HVAC duct and piping insulation shall be subject to Metra approval. [CDRL C-4-09]

4.3 DIAPHRAGM/BUFFER

4.3.1 An inner car diaphragm shall be provided at both ends of the cars. The diaphragm shall be black tubular rubber design or alternative method, which shall be subject to Metra design review and approval. Diaphragm shall be: water and oil resistant; acid and alkali resistant; and shall comply with the fire safety requirement of section 18.16 of these specifications.

4.3.2 A buffing device, meeting all horizontal loading requirements for a buffer beam contained in AAR Specifications for New Passenger Equipment Cars. In addition, the car structure under the diaphragm shall be designed to resist the vertical coupler loads specified in the same AAR Specifications. Buffer supports shall be designed to prevent binding.

4.3.3 A full height vertical curtain of suitable vinyl plastic coated/impregnated material, equipped with safety release handles shall be provided at each end of car, with hardware for retention of a mating curtain from a coupled car. Engagement of curtains shall be designed for silence during train movement.

4.3.4 Slip resistant walkway plates shall be provided at each end of each car to provide a continuous walkway from car to car when coupled together. Plates shall be arranged to provide minimum overlap of 2 inch when the car is not coupled and buffer is fully extended.

4.3.5 The entire diaphragm/buffer arrangement, including construction details shall be subject to review and approval of Metra. [CDRL C-4-10]

4.4 WINDOWS

4.4.1 All windows including emergency sash, cab sliding sash and windshields shall be capable of withstanding external and internal pressure differentials caused by head-on pressures and passing trains, while the cars are at maximum operating speed. All glazing shall meet or exceed the requirements of FRA Regulations 49 CFR Part 223 and Part 238.

4.4.2 Passenger compartment side windows shall be single or double-paned, set in one piece and continuous. If a double-paned window arrangement is proposed, a metal tube style breather shall be provided. The arrangement shall utilize abrasion resistant material, gray tinted, complying with Section 18.8.1 of these specifications. The arrangement shall comply with FRA Type II requirements.

4.4.3 Ingress emergency windows shall be provided per 49 CFR Part 238.114. A decal providing instruction for window removal (ref. section 16.1.11) shall be applied to the exterior of the car, adjacent to each window. Location of these windows is subject to Metra approval. [CDRL C-4-11]
4.4.4 Egress emergency windows utilizing a bottom pivot escape sash, meeting the requirements of FRA Regulation 238.113 and 223 (Type II), shall be installed in each car. The egress windows shall be prominently identified to passengers, and in readily accessible locations. The sash shall be designed to be opened in an emergency with fifteen (15) pounds plus/minus three (3) pounds of force, but shall not be dislodged except through emergency procedure.

Final location and design of the escape sash is subject to approval. [CDRL C-4-12]

The glazing material for these sash shall be the same type as used in passenger compartment side windows (Section 4.4.2).

Instruction on the procedures to open the escape sash shall be posted on the operating bar of each escape sash in photo luminescent material along with pictorial instructions adjacent to the sash. The photo luminescent instructions shall comply with APTA Standard PR-PS-S-002-98, Rev. 3, Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment.

4.4.5 The toilet room shall not be provided with a window

4.4.6 On cab control cars, single glazed, electrically heated windshields, complying with Section 18 of these specifications shall be provided in the end-sheet in front of the operator's and observer's positions. The arrangement shall comply with FRA Type I requirements. The windshields should preferably be replaceable from inside the car.

4.4.7 On cab control cars, a horizontal sliding sash assembly shall be provided at the upper level on each side of the control station. The sash assembly shall suit the minimum structural opening. Left and right hand versions shall be provided such that the out board sliding section is forward to prevent air infiltration.

The sash shall meet FRA Type II requirements

4.4.8 All window components shall meet the flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

4.5 PROPOSAL DELIVERABLES REQUIREMENT LIST

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5 SAFETY APPLIANCES AND INTERIOR HANDHOLDS

5.1 GENERAL REQUIREMENTS

5.1.1 All safety appliances and interior handholds shall comply with all FRA requirements.

5.1.2 Side sill steps shall be installed at each corner of each car, along with lower side sill. Side sill steps shall be of forged stainless steel with a satin finish, and shall be applied with stainless steel bolts. Stepping surfaces of sill steps shall not have a satin finish, but a finish designed to minimize slipping.

5.1.3 Exterior handholds shall be provided in an approved manner and must be of approved design. The location, application and arrangement of all these assemblies are subject to approval by Metra. [CDRL C-5-01]

Handholds finished ground size shall be 5/8” minimum diameter, type 302 stainless steel rod or equivalent, given polishing treatment after forging to remove burrs, surface defects and discoloration and shall be applied with stainless steel bolts or cap screws. The following handholds shall be installed on the outside of car:

5.1.3.1 Two (2) vertical handholds at each side entrance door opening
5.1.3.2 Two (2) horizontal handholds above each set of side sill steps;
5.1.3.3 Two (2) horizontal handholds on each end of each car at approximately 44” above top of rail on each side of coupler;
5.1.3.4 Two (2) vertical handholds at each end door opening;

5.1.4 A safety device shall be supplied at car ends that a crew member can utilize to prevent unauthorized entry into another car, but shall not prevent emergency egress. Design of the safety device shall be subject to Metra design review and approval. [CDRL C-5-02]

5.1.5 The car interior must be provided with handholds, railings and stanchions as are required for safety and convenience of passengers and crew. The location, application and arrangement of all these assemblies are subject to approval by Metra. [CDRL C-5-03]

All installations shall be free of rattles and squeaks and, comply with APTA standards for attachment of interior fittings, APTA Standard SS-C&S-006-98.

5.1.5.1 The passenger boarding/alighting area, immediately adjacent to each set of side doors, shall be provided with stanchions and/or handholds for passenger safety. The stanchions and handrails shall meet current ADA requirements.

5.1.5.2 The stairwells shall have a vertical full height continuous handrail, subject to approval by Metra. Each wall of the stairwell shall be equipped with an appropriately angled handrail. This handrail shall be surface mounted in order to maintain stepwell width.

5.2 CONTRACT DELIVERABLES REQUIREMENT LIST

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6 DRAFT ARRANGEMENT

6.1 GENERAL REQUIREMENTS

6.1.1 Couplers and apparatus, including attachment to the car body and underframe, shall meet or exceed the requirements of FRA Regulation 49 CFR 238.207. Coupler, yoke, draft gear, and carrier design and their integration into the vehicle shall be submitted for approval. [CDRL C-6-01]

6.1.2 Both ends of the car shall have one (1) twin cushion type rubber draft gear.

6.1.3 The couplers shall be type "H" tightlock, short shank, grade C high tensile steel coupler.

6.1.4 An AAR No. 6 coupler operating mechanism shall be provided at each end of the car. Operation of the coupler shall be from the left side of the car only when viewing either end of the car from outside.

6.1.5 The yoke shall be designed accommodate the twin cushion draft gear. Yoke material shall be grade C steel per AAR Specification M-211. Wear plates shall be applied to the upper and lower yoke straps. The wear plates shall be constructed of type 304L stainless steel with stiffeners applied as appropriate.

6.1.6 Each end underframe shall be fitted with a coupler carrier in accordance with AAR Manual of Standards and Recommended Practices, latest revision, and FRA regulations. The carrier shall keep the coupler level at all positions of coupler swing. Stops shall be applied to keep the carrier level. A means of maintaining optimal coupler height shall be provided. The bearing surface between the coupler shank and the coupler carrier shall be type 309 stainless steel.

6.1.7 The Contactor shall comply with AAR S920 (AAR CID) for draft arrangements and all required data fields shall be provided with each car history book electronically in Microsoft Excel or CSV format.

6.2 CONTRACT DELIVERABLES REQUIREMENT LIST

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7 DOORS

7.1 GENERAL REQUIREMENTS

7.1.1 All side and end door systems shall be designed and manufactured with an emphasis on addressing the following areas of concern:
- Unsafe conditions for passengers or crew members
- Train delays from malfunctioning side door equipment
- System reliability in adverse operational and environmental conditions
- Time and effort required for troubleshooting and repairs

7.1.2 A proposal shall be submitted of all doors systems addressing the four bullet points above in 7.1.1. [PDRL P-7-01]

7.2 EXTERIOR PASSENGER ENTRANCE DOORS

7.2.1 Passenger side entrance doors are to be electrically operated bi-parting sliding type doors located on the side of the car. The doors shall slide in a straight line into door pockets placed on the inside or outside of the side walls. Exterior passenger entrance door systems shall utilize a linear door operator. The door system shall comply with the latest revision of APTA specification APTA PR-M-S-018-10, Standard for Powered Exterior Side Door System Design for New Passenger Cars. The door design configuration for side loading doors shall be submitted to Metra for review and acceptance. [CDRL C-7-01]

Minimum clear door openings shall be designed to load or unload a ADA bound passenger along with a regular passenger simultaneously. As a minimum, the door header shall provide no less than 5'-10" clearance over the mobility aid lift platform when in the raised position. Door openings shall be designed in compliance with ADA & FRA requirements and allow safe passenger loading.

Door panels shall be constructed of stainless steel type 304 sheathing spot welded to an internal framing structure and joined into an integral unit by resistance welding to a peripheral framing structure. A composite panel that is a proven system used in other transit door applications, comprised of inner and outer fiberglass fabric reinforced skins impregnated with either polyester or a phenolic thermosetting resin and affixed to a balsa ‘wood core shall be considered as an alternate. An aluminum panel that is a proven system used in other transit door applications may also be proposed. Door surfaces must be flat and in plane within 1/8". The door panels shall have a window of clear abrasion resistant polycarbonate or equivalent set in one piece, vulcanized, rubber glazing strips or aluminum sash, as required to comply with FRA Type II regulations.

Doors shall be designed to provide sufficient strength and rigidity to withstand a force of 200 lbs. perpendicular to the door surface applied on an area 24" x 12", with a maximum deflection of 0.3" with the area's long axis parallel to that of the door, 2" from the door edge and centered within the height of the door.

All door edges and openings shall be thoroughly sealed against moisture ingress. Each door shall be equipped with an interlocking rubber nosing, extending the full height of the door on the leading edge. When doors are closed the two interlocking nosing shall mate and form a weather-tight joint. Static seals shall be provided in the door opening to seal the door trailing edges when the doors are closed.
An approved recessed door pull shall be provided on each side of each door leaf. The door pulls shall be installed in such a manner as to prevent moisture from entering into the core of the door panel.

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Issued 6/19/19

7.2.3 The doors shall be supported from the top by means of a hanger/track assembly and shall be guided at the bottom in a manner providing freedom from rattles and squeaks. The door support and guide arrangement shall be easily available for adjustment and maintenance through the use of access doors or removable panels. Stops shall be provided at both ends of travel to protect the door and the operating mechanism. The stops shall be strong enough to withstand repeated 8 g. impact of the door mass without damage. The door bottom guides shall be of a suitable type and the surface of the step tread shall be designed to minimize passenger slipping and tripping while allowing free movement of the doors. The design of both step tread and door guide shall provide for free drainage of moisture to the outside.

7.2.4 The linear door operator provided to operate the side doors shall be concealed so that it is not directly visible when the door is in the fully closed or open position.

7.2.5 The motion of the doors shall approximate simple harmonic motion and thereby provide cushioning in both opening and closing. A sensitive edge mechanism, per APTA specification PR-M-S-018-10, shall be provided in the door system to immediately reactivate the opening cycle upon striking any object. The speed of the doors shall be such that from the moment of actuating the appropriate door control buttons until the completion of the operation, including cushioning, the following times are obtained:
- Opening 2.0 to 3.0 seconds
- Closing 3.5 to 4.5 seconds, after time delay (reference section 7.1.7)
Adjustment shall be provided to enable these items to be maintained throughout the door operator life and shall be readily accessible.

7.2.6 The side entrance door control system shall be trainlined to permit operation of all side entrance doors on one side of the train from any individual car door control switch panel on the same side of the train. Each switch panel shall be fitted with six (6) push buttons arranged in two rows. Buttons shall be paired for opening and closing doors: 1) forward from the position, 2) locally and, 3) rearward from the position. Pairs of buttons shall be marked as follows: "LEFT", "LOCAL", and "RIGHT".
The control panel shall be equipped with a key (Metra's standard coach key, Drawing M-250) operated mechanism to lock the buttons thus protecting against unauthorized operation of the doors and should have an escutcheon for the key per Metra drawing M-1952. The construction of the mechanism shall allow the key to be removed in the “OFF” position only and shall not cause the train door to change their position.
The door control system shall feature a time delay for door closing. When a closing command is made (locally or trainlined) a door closing warning system consisting of an audio and visual alarm shall be activated immediately. The doors will begin closing four (4) seconds later. The door closing timing and announcement should match Metra’s current fleet configuration. The Contractor shall submit a design to Metra for review and approval. [CDRL C-7-02]

7.2.7 A door lock function shall positively retain the door panel in the closed position without relying on electrical power. The lock shall automatically engage when the door panels at a doorway reach the closed position. A manual release device accessible to passengers shall be
provided at each door location to release the door lock and allow the door panels to be manually opened in an emergency. Instructions for opening doors in an emergency shall be provided adjacent to the handle/device. Instructions shall be printed on photo luminescent material compliant with APTA Specification PR-PS-S-002-98, Rev. 3 or latest revision, Standard for Emergency Signage for Egress/Access of Passenger Rail Equipment.

7.2.8 External access for manual release of the door lock shall also be provided. Instructions for opening doors in an emergency shall be provided adjacent to the handle/device. Instructions shall be printed on retro-reflective material. The design and location of external manual releases shall be subject to Metra review and approval. [CDRL C-7-03]

7.2.9 Traction interlock with door controls is required. The Contractor shall submit a design to Metra for approval. [CDRL C-7-04]

7.2.10 Doors shall not open unless at zero speed, except a “This Door Only” or “Local” button shall function at all speeds when the Master Door Controller is keyed up. All doors shall close automatically when train motion is detected, except a door which has been opened by the “This Door Only” or “Local” button shall remain open if the Master Door Controller remains keyed on.

7.2.11 The exterior passenger side loading doors shall have an emergency release mechanism that shall not require the availability of electric or pneumatic power per APTA standard APTA-PR-CS-S-012-02 latest revision. Neither shall the emergency release mechanism require the presence of any interlock signals (e.g. “low speed” or “zero speed” signals) for actuation. When actuated, the emergency release mechanism shall override any locks and it shall be possible to manually open the released door with a force not to exceed 35 lbf. The emergency release mechanism shall require manual resetting.

7.2.12 A system shall be provided to detect when the car is in motion per APTA Standard APTA-PR-M-S-018-10. Motion detection may be local or trainlined. When motion is detected, opening of all doors on the car (except crew doors) shall be prevented. The Contractor shall submit a design to Metra for approval. [CDRL C-7-05]

7.3 BODY END DOORS

7.3.1 Body end doors shall be capable of automatically opening and closing, sliding type. Door system shall have a manual feature to open and close in case of loss of power. The automatic door shall operate the adjacent end door to enable passengers or crew members to move between cars. The doors shall slide in a straight line into door pockets placed on the inside of the end walls.

7.3.2 Door panels shall be stainless steel type 304 or of the same general construction as the side loading door panels. All doors and edges shall be sealed against moisture ingress. The door panel shall have a window of clear abrasion resistant polycarbonate set in one piece, vulcanized, rubber glazing strips or aluminum sash as required to comply with FRA Type I regulations. Glazing retention shall meet FRA type I large object impact requirements per 49 CFR 223. Glazing/elastomer materials shall meet the flammability and smoke emission standards per FRA regulation 49CFR part 238.103 and toxicity requirements per Bombardier specification SMP 800-C.
Doors shall be designed to provide sufficient strength and rigidity to withstand a force of 200 lbs. perpendicular to the door surface applied on an area 24” x 12”, with a maximum deflection of 0.3” with the area’s long axis parallel to that of the door, 2” from the door edge and centered within the height of the door.

Each door shall be equipped with rubber nosing, extending the full height of the door on the leading edge. When the door is closed, the nosing shall form an air tight seal with the door jamb.

7.3.3 The door closing and opening device (or door operator) must be provided in a concealed but readily accessible for maintenance.

7.3.4 The doors shall be hung from the top by a hanger/track assembly and guided in a threshold track of a self-clearing design, providing minimum foot obstruction.

7.3.5 Body end doors shall be lockable from either side only by Metra’s standard coach key (Drawing M-250).

7.3.6 An approved manually operated, rattle-free latching device shall be provided such that when in use, the device shall hold the doors in an open position.

7.4 PASSENGER COMPARTMENT DOORS (IF APPLICABLE TO DESIGN)

7.4.1 Door panels shall be stainless steel type 304 sheathing bonded to an internally reinforced stainless steel honeycomb core conforming to Military Standard MIL-STD-401, latest revision or alternative construction subject to Metra design review and approval. The design and testing criteria for the passenger compartment door panels shall be subject to Metra review and approval if applicable. [CDRL C-7-06] The panels shall not be less than one inch thick. All doors and edges shall be thoroughly sealed against moisture ingress.

7.4.2 The doors are to be hung from the top by a hanger/track assembly. The assembly shall incorporate a rack and pinion arrangement for the synchronous opening of each door leaf. The thresholds shall be of an approved self-clearing design providing minimum obstruction for the movement of mobility aids.

7.4.3 An operator shall open and close each pair of doors. A sensitive edge mechanism shall be provided to immediately reactivate the opening cycle upon striking any object. The operator shall be low voltage DC and shall also incorporate a sensitive edge and timing circuit. The door operating mechanism shall be locally controlled by push buttons located on both sides of one panel of each pair of doors. The push buttons shall be located such that they may be operated by both ambulatory and mobility aid confined patrons. The push buttons shall be of water proof design.

7.4.4 The doors and associated mechanisms shall be rattle-free.

7.4.5 A device shall be provided to hold the doors in the open position. The design of such device is subject to the review and approval of Metra if applicable. [CDRL C-7-07]

7.5 ELECTRIC LOCKER DOORS/CREW LOCKER DOOR

Lockable doors shall be provided for all electric lockers and crew lockers. Aesthetics of the doors shall match interior design of the car. A recessed door pull shall be provided on the exterior face of each door. Electric locker doors shall be equipped with grilles at the top and
bottom to allow circulation of air. Design of electric/crew locker doors shall be subject to Metra design review and approval. [CDRL C-7-08]

7.6 CONTROL STATION DOORS
On cab control cars, a door(s) shall be provided from the passenger area of the car to the control station. These door(s) shall be operable from outside the cab by a rotating handle and shall be operable from the inside by a panic crash bar, requiring no turning of a handle. The door(s) shall be lockable from the cab side with a manual slide, and on the passenger side by Metra's standard coach key. Each of the control station door(s) shall be designed with intrusion resistance that meets or is greater than that listed in Federal Aviation Administration (FAA) Advisory Circular (AC) 25.795-1A, dated 10/24/08. The Contractor shall submit the design of the control station door(s) for Metra review and approval. [CDRL C-7-09]

The door shall have a decal on the outside (facing into passenger compartment) per Metra drawing M-1968 stating "Warning – No Unauthorized Personnel Beyond This Point – Violators Will Be Prosecuted".

7.7 TOILET ROOM DOOR
The door from the passageway to the toilet room shall be automatically open/close sliding type. Doors shall be designed to open and close manually in the event of power loss. The Contractor shall submit the design of the toilet room door system for Metra review and approval. [CDRL C-7-10] Minimum clear door opening per current ADA requirements, ANSI A117.1. The door pull/passage set shall be lockable on the toilet side manually, and on the other side by Metra's standard coach key.

7.8 WEATHERSTRIPPING
Adequate weather stripping shall be provided to provide satisfactory seals at door openings where airtight weatherproof conditions are required.

7.9 HARDWARE
Recessed rubber bumpers are to be used on all hinged doors to prevent rattling. The bumpers are to be mounted with screws, or by other approved means. All exterior and interior lock sets, including cases, handles, pulls and escutcheons shall be of unpainted white bronze unless otherwise specified. Hinges shall be stainless steel.

7.10 FIRE SAFETY
All door components shall meet the flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

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8 CAR BODY INTERIOR

8.1 INTERIOR FINISH

8.1.1 GENERAL
8.1.1.1 Interior renderings of all levels of the car shall be submitted with the proposal cross sectional views of the car interior (both longitudinal and transverse) shall be included. Proposer shall note plan on how small passenger baggage (computer bags, backpacks, purses) will be accommodated for in the car design, including what percentage of seated passengers will have a location that can accommodate small baggage. [PDRL P-8-01]

8.1.1.2 Plastic and plastic faced material shall be integrally colored in the exposed face. It shall be of low glare, suede, or equal finish unless otherwise specified. Samples of all surface treatments that are exposed to Metra’s passengers or operating crews shall be submitted for approval. [CDRL C-8-01]

8.1.1.3 All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

8.1.2 SIDE FINISH
8.1.2.1 A formed panel made of thermoform plastic material, or alternative material meeting specified flammability and smoke emission standards, as stated in Section 18.16 shall form the window frame. The design and construction of the panel shall be subject to Metra review and approval. [CDRL C-8-02]

8.1.2.2 The interior surface of all toilet room walls are to be lined with stainless steel or a material suitable for this environment. Wall material shall be resistant to cleaner solutions, water, salt, other corrosive agents, etc.

8.1.2.3 The interior surface of all walls of the operator's stations in cab cars shall be lined with a non-glare material. Any area not conducive to non-glare material application, including desk and upper console, shall be painted flat black.

8.1.3 PARTITIONS, LOCKERS, ETC.
8.1.3.1 The air ducts in the vicinity of the overhead heaters (if used) shall be constructed of stainless steel.

8.1.3.2 A crew locker shall be provided in a location approved by Metra. One coat hook shall be provided inside wall in the crew locker.

8.1.3.3 Cab lockers shall be lockable with a Metra standard coach key. The Contractor shall submit design specifications and drawings of each internal design of both the Engineer’s side and observer’s side locker for Metra approval. [CDRL C-8-03]

8.1.3.4 On cab control cars, a locker to house cab signal protective system and other equipment shall be installed. The lockers shall be lockable with a Metra standard coach key.

8.2 FLOORING

8.2.1 The flooring shall meet the 49CFR238 Appendix B and Bombardier SMP 800-C for toxicity, including a thirty-minute fire resistance test (testing to ASTM E119) per NFPA 130 with the car builder’s structural configuration. All floor panels shall be capable of withstanding the requirements of ASTM E119 when exposed for 30 minutes or greater on the carbody underside. Test reports must refer to 49CFR238 Appendix B testing condition and criteria, as well as the ASTM codes, and must be provided to Metra for review and approval. [CDRL C-8-04]

Floor panels shall be as large as possible, but should only be as wide as the compartment it is in. Cab floor panels shall be able to stay if replacing adjacent floor panel and vice versa.
Lavatory floor panel(s) shall not extend beyond the lavatory compartment. Floors shall be able to be replaced without cutting around lockers and compartments. Lower level panels shall extend full width of the car (where possible) with all joints located over structural members. Floor panels shall be bonded to the floor beams to isolate them from the carbody structure. The floor shall be leveled to provide a flat surface. Height variations between panels shall be no greater than 0.030 inch. Gaps between panels shall be sealed against incoming dirt, moisture, and water using appropriate flexible sealant that allows for thermal expansion and contraction of panels.

Design and details of the floor system shall be submitted to Metra for review and approval. [CDRL C-8-05]

8.2.2 The floor panels shall not deflect more than 1/250 of the shorter span between supports, up to a maximum of 0.170 inch, whichever is less, with a uniformly distributed AW3 load state.

8.2.3 Floor surfaces on all passenger and crew sections shall conform ASTM D2047 and ASTM C-1028 coefficient of friction shall be greater than or equal to 0.8 for both wet and dry conditions. Test reports must be provided to Metra for approval.

The floor surface shall be hard and highly durable in order to last 40 years in service without major repair.

Floor surface shall be easy to repair. Repaired area shall not be visibly detectable. Mechanical integrity of the floor panel shall be maintained after repair.

ADA passenger locations in the car shall be designated with the proper ADA signage embedded into the floor. Signage areas shall have the same wear and slip characteristics as the main floor and be flush. Signage shall not be able to delaminate separately from main floor for the life span of the floor.

8.2.4 All stair risers in the interior shall have the upper 4 inch covered by yellow, retro-reflective warning material, applied so as to resist peeling.

All step treads shall have a full length, 3 inch wide yellow strip of anti-skid material on the outer edge, applied in an approved manner by Metra. [CDRL C-8-06]

A center tactile finish strip in order to provide guidance for visually impaired passengers shall be done by showing a continuous path through the car’s center, as well as a path to each doorway. The tactile finish shall not create a tripping hazard.

Cove moldings shall be either stainless steel or made of the same material and color as the floor surface. Cove shall have a minimum radius of 1" (25 mm) to ease cleaning, and shall be sealed to the floor surface.

Low level exit path marking (LLEPM), if supplied on flooring, shall be fully integrated into and flush with the floor surface to present no tripping hazard and not delaminate separate from the floor surface. LLEPM may be either active or passive and be compliant with APTA standards PR-PS-S-004-99 Revision 2. Passive LLEPM marking lines shall be High Performance Photo Luminescent material (HPPL) that complies with APTA standard PR-PS-S-002-98 Revision 3.

Wear resistance of the HPPL locations shall be the same as the floor covering and integrated in order to be flush with the floor surface and to prevent any separation, delamination and water infiltration.

Floor surface inside the electric lockers need not conform to ADA guidelines for surface slip resistance.

The Contractor shall submit floor surface specifications and samples for Metra review and approval.

8.2.5 Floor layout of passenger areas for entraining and detraining shall be designed such that water drains out of car to prevent slip surfaces to the extent possible.
8.2.6 Heated flooring (if provided), shall be of construction with an integrated heating system. The heated flooring system shall be controlled and integrated into the vehicle’s main HVAC system. The performance of the heating system shall be demonstrated through a dielectric test in dry conditions (no default after 100 cycles of 1 minute at 2500 V), a dielectric test in wet conditions (conditioning in brine water for 60 min, no default at 2500 V for 1 minute), an electrical fatigue test (no default after 200,000 on/off cycles of 30 seconds each), a high-voltage insulation test (electric shock protection, resistance of more than 6 MΩ at 2500 V in dry conditions and more than 500 kΩ at 2500 V in wet conditions after 1 hour), and an impact test according to the UL 1693 standard (impact test with a 2” steel ball of 1.1 lbs dropped from a height of 79”). Then, dry dielectric test requirements must be met. Ground fault/shock hazard requirements per APTA requirements.

To the greatest extent possible, these panels shall be repairable without removing radiant floor heat panels from the car. An additional protection system LCDI - Leakage Current Detector Interrupter – shall be installed.

Design and details of the heated floor system shall be submitted to Metra for review and approval. [COPL CO-8-01]

8.3 PASSENGER SEATING

8.3.1 GENERAL REQUIREMENTS

8.3.1.1 All seats shall conform to APTA Standard PR-CS-S-016-99, latest revision. Seats shall also conform to the FRA’s requirements for retention of seat components, 49 CFR Part 238.

8.3.1.2 All components used in the seat and cushion assemblies shall meet the flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

8.3.1.3 An engineering design and ergonomic analysis shall be performed by the Contractor in conjunction with the seat manufacturer on the proposed seat design arrangement and installation and shall be submitted for Metra’s approval. The analysis shall take into account all aspects of the seat design, including as a minimum the materials used in the seat construction, human factor related dimensions, passenger ingress and egress, cushion contours including lumbar support, seat pitch, cushion comfort, seat attachment method, and maintenance. Final approval of the detail design of the seat shall be after review of proposed samples. [CDRL C-8-07]

8.3.1.4 Contractor shall submit an in-depth analysis on life-cycle cost and comfort level for passenger with an average ride length of 1 hour to a maximum passenger ride of 2 hours. [CDRL C-8-07]

8.3.1.5 Seats shall either face each other at all emergency sash locations or have provisions to move seat to allow correct size unobstructed opening per 49 CFR Part 238.113. [VRESD V-8-01] Seats shall not face each other nor need to move to allow correct size unobstructed opening to meet 49 CFR Part 238.113. [VRESD V-8-01]

8.3.1.6 All seat bottom cushion and backrest assemblies shall be secured to the frame in accordance with FRA Regulation 49 CFR Part 238.233 (as clarified by the FRA in their January 30, 2008 letter). When installed, cushion and backrest assemblies shall be secure in place insuring that they shall not cause any noise during car operation whether occupied or unoccupied. Seat cushions shall not be removable by passengers, but shall be removable by maintenance personnel within one minute with the use of nothing more than simple hand tools. Each seat cushion assembly shall be interchangeable with like assemblies.
Seat cushion covering shall be transportation grade material subject to Metra approval. Seat covering material shall be able to be cleaned by at least three widely available commercial industrial cleaning agents that are known to be chemically compatible. [CDRL C-8-08] Seat covering physical properties shall be tested in accordance to the tests listed in Table 1. Alternate testing methods with supporting documentation to superior testing methods can be submitted for Metra review and approval in lieu of listed tests.

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Test Method</th>
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</thead>
<tbody>
<tr>
<td>Total Weight</td>
<td>CFFA-700D</td>
</tr>
<tr>
<td>Thickness</td>
<td>CFFA-700C</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>CFFA-17</td>
</tr>
<tr>
<td>Tearing Strength (Trapezoid)</td>
<td>CFFA-16C</td>
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<tr>
<td>Coating Fabric Bond</td>
<td>CFFA-3A</td>
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<tr>
<td>Stretch</td>
<td>CFFA-15</td>
</tr>
<tr>
<td>Abrasion Resistance</td>
<td>CFFA-1a Wyzenbeek</td>
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<tr>
<td>Crocking</td>
<td>CFFA-7, dry</td>
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<tr>
<td>Blocking</td>
<td>CFFA-4</td>
</tr>
<tr>
<td>Cold Resistance</td>
<td>CFFA-6A, 5# roller</td>
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</table>

Metra will indicate the colors to be provided after notice to proceed. Covers (both bottom cushions and backrests) shall not require the use of tacks or staples for attachment nor shall they become disengaged under normal use (including patrons placing their feet between the cushion and backrest).

8.3.2 SEAT DESIGN
8.3.2.1 All seating parts and hardware shall be corrosion resistant to but not limited to: water, commercially available cleaners, road salt, etc.
8.3.2.2 Seat assembly weight shall be minimized to the extent practical by the seat manufacturer. Two passenger seat assembly weight shall not exceed 127 pounds. Single passenger seat assembly weight shall not exceed 88 pounds.
8.3.2.3 Tops of seatbacks shall have a headrest for each passenger position. A diagonal slope at the aisle end shall accept a handgrip. The handgrip shall be rubber coated steel or alternate approved transit grade material suitable for the commuter car environment, subject to review and approval by Metra, and positioned such that no striking hazard to face or head of seated passengers is presented, even in the case of an emergency stop or other unusual condition. The aisle side handgrip should be attached to the seat such that the mounting hardware is recessed or hidden.
8.3.2.4 All passenger seatbacks shall be equipped with a stainless steel ticket holder to hold two separate tickets. Ticket holder placement shall be reviewed and approved by Metra.
8.3.2.5 Armrests shall be provided for all seating locations and may be static or foldable. The foldable armrest(s), if supplied, shall be able to rotate in between the up and down positions and shall be flush with the seat back while in the up position. Aisle side armrests shall be static and of close loop design as to prevent injury to passenger from catching passenger bags, clothing, etc.
The armrest shall be removable without requiring the disassembly of the seat in order to replace a damaged or defective armrest.

The armrest shall be approved transit grade material suitable for the commuter car environment and pass APTA and 49 CFR Part238.103 requirements. Design is subject to Metra review and approval.

8.3.2.6 A cup holder shall be provided for each seating location. The cup holder opening shall be able to accommodate a range of beverage containers readily used the food industry and travel style containers up to a diameter of 3-1/2 inches.

8.3.2.7 Seat backrest cushion assembly design shall be submitted to Metra for review and approval.

The seatback cushion assembly-to-frame latching mechanism shall be easily disengaged by hand without tools. The latch/release mechanism shall be easily accessible to Metra personnel but concealed from passenger view. The latch mechanism shall be demonstrated for approval after award of the contract.

8.3.2.8 Low Level Exit Path Marking (LLEPM) shall be incorporated on the seat assembly.

Marking design and high performance photo luminescent (HPPL) material shall meet all APTA requirements and must be submitted to Metra for review and approval.

8.3.3 FOLDING SEAT

Folding seats shall be provided where necessary and subject to all APTA and FRA tests. Design is subject to review and approval by Metra.

8.3.4 Seat construction, components, and attachments shall be of sufficient strength to withstand without permanent deformation (defined as + 0.125 inches) the testing requirements of APTA Standard PR-CS-S-016-99, latest revision or the loads listed below, whichever is more stringent [CDRL C-8-09]:

8.3.4.1 APTA 5.1.1 Backrest Strength: 300 lbs. per passenger uniformly distributed perpendicular to the plane of the seat back in the rearward and forward direction, three (3) inches below the top of the back or 36 inches above floor, whichever is lower

8.3.4.2 APTA 5.1.2 Grab Handle Strength: 300 lbs. on hand grip in a horizontal direction, rearward and forward.

8.3.4.3 APTA 5.1.3 Vertical Seat Strength: 450 lbs. per passenger uniformly distributed vertically downward on the front edges of the seat cushion.

8.3.4.4 APTA 5.1.4 Armrest Strength: 250 lbs. horizontal to the armrests in both directions on the armrests. 150 lbs. for folding center armrest(s) if applicable.

8.3.4.5 APTA 5.1.4 Armrest Strength: 250 lbs. vertically downward on the armrests. 150 lbs. for folding center armrest(s) if applicable.

8.3.4.6 APTA 5.1.5 – 5.1.7: As applicable with optional supplied equipment. Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.4.7 APTA 5.2 Dynamic Sled Testing: Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.4.8 APTA 5.3.2 Lateral Seat Attachment Test: Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.4.9 APTA 5.3.3 Vertical Seat Attachment Test: Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.4.10 APTA 5.3.4 Forward-Facing Seat Attachment Test: Performed as dictated in APTA Standard PR-CS-S-016-99, latest revision

8.3.4.11 APTA 6.1 Mechanisms: As applicable with optional supplied equipment. Life cycle test criteria shall be submitted to Metra for review and approval prior to APTA testing.

8.3.4.12 APTA 6.2 Cushions and Upholstery: Each unique seat assembly shall be dynamically tested, jounce and squirm as follows:
180 pound load on bottom cushion
110 pound load on back cushion
200,000 jounce cycles @ 100 cycles per minute
4,000 squirm cycles @ 4 cycles per minute
Foam should show no signs of tearing, shearing, or significant loss of height. Cushion covering shall show no signs of tearing or ripping and should remain attached to cushion pan or structure. Seat covering stitching should show no signs of unraveling or breakage.

8.3.5 Contract Optional Proposal Equipment List

8.3.5.1 The seat shall have an option to incorporate USB ports, location subject to Metra approval (reference Section 11.6.3). The USB parts shall be removable without having to disassemble the seat. [COPL CO-8-02]

8.3.5.2 A foot rest can be provided in each seating location as applicable. The design is subject to Metra review and approval [COPL CO-8-03]

8.3.5.3 A tray table can be provided in each seating location as applicable. The tray table shall be able to be locked and stowed when not in use. The design is subject to Metra review and approval [COPL CO-8-04]

8.3.5.4 Future provisions for expansion of equipment for passenger in seating location detecting, automatic ticketing verifying. [COPL CO-8-05]

8.3.5.5 A seat reservation system that will give status of train seats through an LED lighting system such as free, reserved, or occupied (Not an option for VRE Cars) [COPL CO-8-06]

8.3.5.6 Other technologies available in the transit industry.

8.4 PARCEL RACKS

8.4.1 A continuous closed type parcel rack, extending to the longest length practical, shall be provided in each side of the lower and upper level coach sections (if applicable) and shall incorporate longitudinal restraints, with mounting brackets providing lateral restraints. Parcel racks shall be sized to fit a typical computer bag, back pack, small carryon luggage, etc that passengers may bring in revenue service. A parcel racks should be sized to accommodate storage for a maximum amount of seated passengers. The Contractor shall submit the parcel rack design to Metra for review and approval. [CDRL C-8-10]

8.5 ACCESSIBILITY PROVISIONS

8.5.1 The cars built to these specifications shall comply with regulation 49 CFR Part 38, subpart E. All provisions for passengers with disabilities must be documented, including passage and turning routes, and all clearances for mobility aids shall be submitted with proposal. [PDRL P-8-02] The Contractor shall also be guided by the latest issue of the following, to the extent that the following do not conflict with the above requirements, which shall govern:

8.5.1.1 Title 49, Code of Federal Regulations, Part 37 Transportation for Individuals with Disabilities.

8.5.1.2 Title 49, Code of Federal Regulations, Part 609 (Transportation for Elderly and Handicapped Persons)

8.5.1.3 ICDB Accessibility Standards Illustrated manual.

8.5.1.4 ANSI A117.1, American National Standard for buildings and facilities - providing accessibility and usability for physically handicapped people.
8.5.2 All entry and exit, passage, and turning routes to and from mobility aid positions shall conform to the requirements of the ANSI A117.1 as to clearances, turning radii and pathway impediments. All requirements for reaching, control and device activation, and other use of manual dexterity imposed by car-borne equipment shall also comply with ANSI A117.1. In all cases, the Contractor shall take into account all potential hazards related to hand, knuckle and finger clearances of persons operating mobility aids, as well as potential hazards to others created by mobility aid operation. Bulkheads and partitions in the route of mobility aids between the entryway and the mobility aids positions shall not incorporate any wings protruding into the aisle.

8.5.3 The lower level of the car shall have provisions for two (2) ADA designated locations. An approved number of retractable jump seats, or alternative design, as described in section 8.3, shall be provided in each ADA position for use by ambulatory passengers when mobility aids are not present.

8.5.4 The width of each passageway shall be dictated by the needs of the ADA lift mounting. The stanchion assembly shall be located in such a manner as to avoid potential hazards related to the hands of patrons while the mobility aid lift is in use. The mobility aid lift shall be installed such that a continuous threshold/lower track is maintained for the entire width of the side entrance door opening.

8.5.5 An mobility aid lift shall be provided on each side of each car, to permit the raising and lowering of passengers in mobility aids, or between station platform level and car level floor height. The ADA lift system and setup shall be subject to Metra review and approval. [CDRL C-8-11]

The station platform height shall be assumed by the Contractor to range from between top of rail to 8” above top of rail. The lift shall stow in an enclosure when not in use. The entire lift shall be modular in design to facilitate removal of the lift for servicing. Weather resistant enclosure(s), with provisions to drain any accumulation of moisture shall be provided to protect components. The enclosure supporting frame should be designed to allow full access of the ADA lift for maintenance. The lift platform shall conform to the length and width requirements of 49 CFR Part 38 Subpart E Paragraph 38.95[b][6]. The surface of platform shall be treated with an approved skid resistant material. The lift platform shall be equipped with a barrier at both the inner and outer ends, which shall automatically rise to contain a mobility aid and prevent roll off during operation (either in powered or manual modes). When lift platform has been fully lowered, the outer barrier flap shall lower and shall serve as a transition surface between the mobility aid lift and the station platform. When the lift is fully raised, the inner barrier shall lower and aid in transition between lift and vestibule. Side rails shall be permanently fixed to the platform to prevent side roll off. The platform shall be capable of safely lifting and lowering loads of up to 800 pounds (363 Kilograms) in either powered or manual modes, without lift platform deflection in excess of 3 degrees. There shall be no failure mode, in either manual or powered, loaded or unloaded operation, in which the lift platform is capable of uncontrolled free fall. Handrails shall be provided on both sides of the platform for safety of the rider when the lift is in use and for the safety of other passengers when it is not. The handrails shall not contain any electrical circuitry or switches.

8.5.6 The mobility aid lifts shall be circuit breaker protected. Control of the lifts shall be local and side-specific. The lift controls shall be interlocked with the car's air brake system and locomotive control system.
A switch, keyed to Metra's standard coach key, shall be provided for each lift in an approved location. When in the "on" position, power is provided to the lift (enabling its controls), a magnet valve is energized to apply brakes to the individual car, a signal is provided to the controlling cab and the amber indicator lights (one next to the switch, with sun shield and the exterior pilot lights) are energized. These events will also be triggered when the key switch is in the off position and the lift is manually deployed (pulled out).

Two (2) sets of operating controls shall be provided for each lift. The first set of operating controls shall be mounted in the enclosure or interior of the car. The second set of operating controls shall be the same as above but mounted in an enclosure in the carbody in the vicinity of the doors (when facing the doors from the outside).

The enclosure shall have a weatherproof cover. A lock, keyed to Metra’s standard coach key shall retain the cover in the closed position. When the cover is opened, the controls in the enclosure shall be activated, with the controls in the enclosure or interior disabled.

An audible signal shall be activated when the mobility aid lift is activated.

The logic circuitry of the mobility aid lift shall prevent a lift platform from being lowered unless it has been fully deployed. It shall be possible, however to stow a lift in powered mode in any position.

When raising the lift under power from the lowered position the outer barrier shall automatically close and will operate normally regardless if the barrier was lowered automatically or manually. No manual correction will be required to reposition the barrier.

In the event of a lift failure or a power failure, it shall be possible to operate the lift to and from any position in the raise/lower cycle, whether loaded or unloaded, and to stow and deploy the lift platform by hand if it is unloaded. Operation in this manual mode shall not damage the lift or any of its components.

Under powered operation, a complete cycle of deploying the platform, lowering the lift platform to station platform height, raising it to floor height, and stowing the lift platform, shall take a minimum amount of time.

In manual mode, this operation shall take no longer than three times the maximum time allowed for the powered cycle, when operated by a person of average manual dexterity. Any operation in manual mode, including operation under load, shall require no more than average strength, with no more than the equivalent of 40 pounds (18 kilograms) lifting force required, except that the force required to initially breakaway to deploy can be up to 60 pounds (27 kilograms).

8.5.7 A pilot light (reference section 10.4.2) shall be installed on each side of the car directly below door open indicator. These shall illuminate on both sides of the car when a wheel-chair lift is energized, regardless of the actual position of the lift.

8.6 TOILET ROOM

8.6.1 The toilet room shall be in a location that is easily accessible for ADA passengers.

8.6.1.1 The spatial arrangement and equipment provided shall conform to the requirements of regulation 49 CFR Part 38 and ANSI Standard A117.1 latest revision and is subject to approval of Metra. [CDRL C-8-12] A hinged access door shall be provided in the toilet room for servicing of the water tank and other related equipment.

8.6.2 One (1) set of equipment, as listed below, shall be provided in the toilet room:

8.6.2.1 One (1) toilet, meeting latest U.S. Public Health standards. The flush button shall be wall mounted.

8.6.2.2 One (1) retention tank having a minimum usable capacity of 40 gallons. The tank shall be heated and the heaters activated when ambient temperature is less than 40 degrees Fahrenheit, see section 9.6.2. The tank shall be constructed of 12 gage stainless steel and
equipped with clean-outs and emptying provisions. The tank shall also have an approved sight or liquid level meter to indicate an approximately full retention tank. In addition, the tank shall be equipped with a sensor that will illuminate an LED indication in the vicinity of the toilet empty line that will indicate when the toilet retention tank is at 75% capacity. The design of the system provided shall be subject to Metra approval. [CDRL C-8-13] [VRES V-8-02] One (1) waste treatment tank having a minimum usable capacity of 40 gallons. The tank shall be heated and the heaters activated when ambient temperature is less than 40 degrees Fahrenheit, see section 9.6.2. The tank shall be constructed of 12 gage stainless steel and equipped with clean-outs and emptying provisions. The tank shall also have an approved sight or liquid level meter to indicate an approximately full retention tank. In addition, the tank shall be equipped with a sensor that will illuminate an LED indication in the vicinity of the toilet empty line that will indicate when the toilet retention tank is at 75% capacity. The design of the system provided shall be subject to VRE approval. [VRES V-8-02]

8.6.2.3 Lines between the tank and the toilet shall be stainless steel pipe, with stainless steel fittings. Lines shall be as short as possible, pitched toward the tank and free of "traps". The tank, the lines between the tank and the toilet, plus the emptying line shall be heated to prevent freeze-up. Emptying line shall be equipped with a 4 inch "Camloc" fitting and dust cover.

8.6.2.4 One (1) approved wall mount dispenser for waterless hand cleaner. Hand cleaner dispenser should be mounted above the soiled towel receptacle. [VRES V-8-03] One (1) approved wall mount soap dispenser. Soap dispenser should be mounted near the sink. [VRES V-8-03]

8.6.2.5 One (1) approved 2 roll toilet paper holder.

8.6.2.6 One (1) center pull dispenser for roll towels [VRES V-8-04] One (1) approved Dyson hand dryer [VRES V-8-04]

8.6.2.7 One (1) soiled towel receptacle

8.6.2.8 One (1) approved folding type coat and hat hook.

8.6.2.9 One (1) mirror of 1/4" coated polycarbonate set in a rolled stainless steel frame. The mirror shall be at least 9" wide by 12" high.

8.6.2.10 Stainless steel, 1-1/2 in. dia. Handholds properly oriented for ADA passenger use

8.6.2.11 One (1) fold-down transfer seat designed per ADA requirements.

8.6.2.12 One ionization sensor type smoke alarm operating from 120 VAC with a 9V battery back-up.

8.6.2.13 [VRES V-8-05] One (1) approved wall mount stainless steel sink [VRES V-8-05]

8.6.3 Water Supply

8.6.3.1 The supply side of the water system shall be designed for potable water. Water shall also be provided for flushing the toilet and supplying the sink (if applicable). The water system and tank are to be cleaned before the cars are delivered in accordance with United States Public Health regulations.

8.6.3.2 The entire system, with the exception of the water tank (which is to be isolated) shall be pressurized to 150 lbs. and checked for leaks.

8.6.3.3 A single stainless steel water tank shall be furnished. Service water capacity shall be a minimum of approximately thirty five (35) gallons. The tank shall be suitably insulated to prevent the formation of condensate on its exterior. The tank shall be vented to the roof, permitting the fill pipes to drain. Access to the tank shall be provided for maintenance. A grille, will permit circulation of heated or cooled air around the water tank. The water tank shall be designed to withstand a hydrostatic test of fifty (50) pounds per square inch.
8.6.3.4 Two (2) approved water filling nozzles shall be provided. They should be located at the toilet end of the car, one on each side. One nozzle is to be used as a fill and the other to act as an overflow drain. These shall be enclosed in a self-draining stainless steel box, covered by a spring-loaded hinged stainless steel door for sanitary protection.

8.6.3.5 A suitably-sized interconnecting network of insulated copper piping shall be furnished, using sweat type fittings except where removal of components dictates the use of compression fittings. Piping shall be joined, using silver solder or approved equal. It shall be suitably clamped to prevent rattles.

8.6.3.6 A combination shut-off / drain valve with metal identification tag shall be provided adjacent to the toilet. Location of the valve is subject to Metra approval. [CDRL C-8-14]

8.6.3.7 All piping must be installed in such a manner as to avoid formation of air pockets or, water pockets when the system is drained.

8.7 MISCELLANEOUS INTERIOR

8.7.1 Coat hooks shall be provided for as many seating locations as possible. Style and location subject to review and approval by Metra.

8.7.2 Ticket clips shall be provided for passenger seating (one holder for every two seats) and for the flip seats at the mobility aid positions. The location and design of ticket clips shall be approved by Metra. [CDRL C-8-15]

8.7.3 Waste receptacles, a minimum of two (2), shall be installed in each car. The receptacle location and mounting is subject to the approval of Metra. [CDRL C-8-16]

8.7.4 Two Metra Standard Coach Keys (drawing M-250) per car shall be provided. Two (2) appropriate keys shall be provided per car for any other locking devices used other than pencil locks. [VRESD V-8-06] Two VRE Standard Coach Keys per car shall be provided. Two (2) appropriate keys shall be provided per car for any other locking devices. Pencil locks shall not be utilized. [VRESD V-8-06]

8.7.5 Each car shall be equipped with two (2) emergency tool kits, one on each end of the car or level consisting of the following: 1 ea. dry chemical type fire extinguisher; 1 ea. 18 inch ripping chisel, 1 ea. LED Flashlight, and 10-pack box of glow sticks. On B-end only, 1 ea. Hot box stick shall be included in emergency tool kit. The tools shall be mounted in a case with a clear plastic front. The clear plastic shall be etched in an "X" to facilitate access in emergency situations. The case shall be sized to accommodate the above equipment plus Metra’s standard first aid kit (applied by Metra.). The chisel and flashlight kit shall be marked with "Property of Metra".

8.7.6 Two announcement holders, per Metra Drawing M-166 and made of polycarbonate shall be provided on each car. [VRESD V-8-07] VRE shall provide two announcement holders made of polycarbonate for each car. [VRESD V-8-07]

8.7.7 Two schedule holders, per Metra Drawing M-599, shall be provided on each car. [VRESD V-8-08] VRE shall provide two schedule holders for each car. [VRESD V-8-08]

8.7.8 On cab control cars, provision shall be made for the installation of a flush mount enclosure for an automated external defibrillator. Defibrillator enclosure shall primarily be constructed of stainless. Any glazing shall be mounted to allow replacement of the glazing.
Appropriate signage shall identify the location of the AED unit. Details of location and installation of the defibrillator shall be submitted to Metra for review and approval. [CDRL C-8-17] The alarm of the defibrillator cabinet shall be designed to accommodate standard AA or AAA batteries that easily can be replaced on an annual basis. [VRESD V-8-09] On cab control cars, provision shall be made for the installation of a flush mount enclosure for an automated external defibrillator. Defibrillator enclosure should primarily be constructed of stainless. Any glazing shall be mounted to allow replacement of the glazing. Appropriate signage shall identify the location of the AED unit. Details of location and installation of the defibrillator shall be submitted to VRE for review and approval. [CDRL C-8-17] The alarm of the defibrillator cabinet shall be designed to use car battery power. [VRESD V-8-09]

8.7.9 The Contractor shall propose a bicycle rack system that shall be able to handle between two and five (5) bicycles in the Priority Seating Areas if those areas are not being utilized for passengers. The bicycle racks shall be capable of storing bicycles without any bicycle component interfering with passenger circulation in the main lower level aisle way. Bike racks shall have the capability to lock the frame of a bicycle to the rack assembly using a standard U-shaped type lock. Bike racks shall designed to accommodate bicycles with tires up to 2.5 in. wide. The Contractor shall submit the design of this system to Metra for review and approval. [CDRL C-8-18]

8.7.10 As an option, Proposer may propose convenience items for passengers. Items could include baby changing stations in toilet room or devices that can allow passengers to do in train purchases, i.e. beverage or food (Not an option for VRE Cars) [COPL CO-8-07]

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8.9 CONTRACT DELIVERABLES REQUIREMENT LIST

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9 HEATING, VENTILATION AND AIR CONDITIONING

9.1 GENERAL REQUIREMENTS
Each car shall be equipped with a heating, ventilation and air conditioning system to automatically provide the specified interior temperatures specified herein. These systems shall perform this function with or without the variable internal heat loads such as passengers, lighting and miscellaneous electrical apparatus, or external factors such as solar heat gain and frequency of door openings. All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification. Proposer shall propose general description and requirements for the HVAC section specified herein. [PDRL P-9-01] The HVAC system shall maintain the car’s interior temperature, including the engineer’s cab (if applicable), to a specified programmable temperature range parameter in all circumstances specified above. The car temperature shall recover within 2 degrees F of the required interior vehicle temperature within three minutes maximum following a two minute door opening of all doors on one side of the car. It shall be demonstrated that this requirement can be met during two hours of continuous door cycling of thirty seconds open and 2 minutes closed for 1 hour at the design conditions in both heating and cooling modes. All system components shall be service-proven and supported by design and test data, adequate to demonstrate compliance with the specified requirements. Details of the system capacity and performance calculation, design, arrangement, installation, and operation of the HVAC system shall be submitted to Metra for review and approval. [CDRL C-9-01]

9.2 HEATING

9.2.1 The cars shall be electrically heated using 480 volt, 3-phase, 60 Hz A.C. supplied from a source outside of the car. The system shall be thermostatically controlled having floor level radiant heat operating in conjunction with forced air heaters.

9.2.2 The heating system shall be designed and adequately sized to maintain interior temperature as specified herein. Main heat shall be divided into stages, or shall be a single stage operating with a modulating switching device. If multi-stage heat is chosen, the stages shall be designed to minimize the cycling of heat contactors. Floor heat shall be provided either by electric heaters mounted behind heater guards, or an industry proven floor surface heating solution. If a floor surface heating solution is proposed, details of the design, installation, and arrangement of the floor surface heating solution shall be submitted to Metra for review and approval. [CDRL C-9-02] If conventional floor heating is utilized, the heater guards shall be of special design to prevent the surfaces coming in contact with passengers from exceeding 125 degrees F and shall be designed to maximize passenger foot space to the greatest extent possible. The forced air heaters and radiant floor heaters shall be protected against over temperature.

9.2.3 Layover heat will be manually activated after the car is parked, and is connected to a source of head end power. Layover heat control is to be part of the HVAC automatic controls. Layover heat shall be provided by the radiant floor heaters and shall close the fresh air damper. Layover heat shall not operate the evaporator fans for forced air heat. Layover heat shall maintain an interior temperature of 50 degrees F ± 5 degrees F. This set layover temperature shall be made programmable through the control panel.
9.2.4 On cars with a control station at one end, two manually controlled heaters shall be provided, one on each side. These heaters shall be controlled by a single switch located on the operator's side. The Contractor shall propose a method of heating and cooling the control station by using the car’s main HVAC system. [VRESD V-9-01] On cars with a control station at one end, two manually controlled heaters shall be provided, one on each side. These heaters shall be independently controlled switch located on each side. The Contractor shall propose a method of heating and cooling the control station by using the car’s main HVAC system. [VRESD V-9-01]

9.3 VENTILATION

9.3.1 The ventilation system shall be designed to maintain a uniform temperature throughout the car. The temperature within that unit measured at 30 inches above seat cushion shall not vary between any two seat locations by more than 5 degrees F under all ambient conditions (-20° F. to + 120°F).

All ducts and plenum chambers shall be insulated to prevent the formation of condensate on their exterior.

9.3.2 Fresh air shall enter through openings in the car body. Thermostatically controlled dampers shall be provided to control the amount of fresh air. A switch shall be incorporated to override the fresh air vent control to close the vents. The fresh air car body openings shall be designed to prevent infiltration of snow and water.

9.3.3 Flexible transition ducts of approved material shall connect the passenger supply distribution ducts to each evaporator blower.

All flexible transition ducts shall be installed so that it is not under stress and shall be clear of surrounding obstruction when units are in operation. The ducts shall be equipped to allow it to clip on at least one end to ensure ease of replacement or HVAC unit removal.

These ducts shall withstand, without damage, the minimum and maximum temperatures and the flexing experienced.

9.3.4 Air ducting shall be insulated and constructed of an approved material. All insulation shall be applied to the outside of the duct.

9.3.5 All air diffusers shall be integrated with the tube light fixture and designed for the minimization and ease of required cleaning, and so as not to accumulate dust, soot, and debris.

Air flow values through the diffusers and their final design shall be subject to approval.

9.3.6 Ventilation system shall be balanced so as to provide pressurization for the car body (body doors closed) of 0.025" of water at 0 mph and positive pressure at any speed, with the dampers open and the evaporator blowers for both ends of the car operating.

9.3.7 Filter elements (filters) shall be provided in the air intake of each unit and shall be located just ahead of the evaporator blower unit so that re-circulated air and fresh air are filtered before being passed through the blowers. The filters shall be accessible for replacement without requiring the opening of any pipe fittings, shall not be located in inaccessible locations for routine maintenance access, and shall be removable from inside the car. The filters shall be

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disposable pleated, MERV 13 rated or better and shall be common production variety easily available through various sources. The filters shall meet MERV 13 performance characteristics when tested in accordance with ASHRAE Standard 52.2 (latest revision). The size of these filters shall be 2" x 16" x 20". The Contractor may propose other solutions for air filtration that meets or exceeds a MERV 13 rated filtration. ASHRAE® 52.2 (latest revision) test reports, performed by an independent lab, which also includes results of conditioning steps outlined in ASHRAE® 52.2-2012 Appendix J (or latest revision) shall be submitted. The test reports shall include the MERV rating in addition to the MERV-A rating that indicates the performance of the filters after conditioning. In addition, the test reports shall include the average arrestance and dust holding capacity as outline in ASHRAE® 52.2 (latest revision).

9.3.8 A fan-driven exhaust outlet above the toilet shall be provided. The fan shall be grounded, and mounted resiliently to minimize noise and vibration. The exhaust air shall pass through a grille in the toilet room ceiling and be ducted to atmosphere. The design, location and size of the exhaust fan shall be subject to Metra review and approval. [CDRL C-9-03]

9.4 AIR CONDITIONING

9.4.1 All subject cars shall be equipped with air conditioning equipment comprising of a minimum of two (2) self-contained compact units. The units shall be roof mounted or located in a location for ease of maintainability and replacement. Each self-contained unit shall be removable in less than 4 hours and require minimal tooling and facilities. Each unit shall consist of one or more compressor/condenser sections and one or more evaporator sections with electric heating, and an independent control panel. Each occupied area of the car supplied by the HVAC units shall be arranged such that conditioned air will be evenly distributed to all areas in the event of a failure of one of the HVAC units. Each of the units shall be capable of serving a minimum of half the required capacity for the area served, in the event of failure of either unit. The total refrigeration capacity for the car shall be not be less than 244,000 B.T.U. per hour. The air conditioning system shall be designed and adequately sized to maintain interior car temperature as specified measured at the return air grille at the normal ambient conditions. For ambient temperatures at or above 110°F Dry Bulb / 76°F Wet Bulb, with air entering the condenser above 120°F, the air conditioning system shall be capable of maintaining cooling at a reduced capacity, but in no case shall the average interior temperature be more than 25°F below the outside temperature. Refrigerant for these units may be R-407C or an approved alternative refrigerant that conforms to 40 CFR Part 42. Type of refrigerant shall be subject to Metra review and approval.

9.4.2 The units shall be constructed using stainless steel or aluminum to the greatest extent possible. They shall be mounted resiliently, such that in the event of failure of a bolt, the unit shall be retained by a support bracket of approved design. The safety support bracket shall not interfere with maintenance or normal unit removal. The mounting bolts shall be secured with safety wire to prevent loosening and shall be appropriately torqued, with provision for ease of bolt removal in the case of bolt failure and cracking. The mounting of the air conditioning units shall incorporate damping to cushion and limit longitudinal movement. The units shall be equipped with vibration isolator, sized to eliminate transmission of vibration of the units to the car body. Each package air conditioning unit shall be individually removable by either one of two methods. Either the Contractor shall propose an option to remove the air conditioning unit
through an opening on the sides of the car-body, or the air conditioning units shall be individually removable by a lifting apparatus through a pair of hatches in the car roof. Metra would prefer an option where the air conditioning units could be removed by forklift and not by overhead crane. It is preferred that electrical connections be made through the use of quick disconnect type connectors. The installation and removal process, including removing and installing all mounting hardware, and electrical connections, shall be included in submittal 9-04 listed below. The structure of the units shall permit the entire unit to be removed without damage, and appropriate lifting lugs or eyes shall be incorporated. HVAC unit shall be designed to remove condenser fan, compressor, filter dryer, expansion valves and solenoid valves without the removal of entire unit from car. The entire arrangement is subject to Metra review and approval. [CDRL C-9-04]

9.4.3 The power for the air conditioning system shall be 480 volt, 3 phase, 60 Hertz alternating current. Power for the control of the air conditioning system shall be 120 volt single phase alternating current. Low voltage DC control power may be used with the approval of Metra. All motors for the evaporator, condenser and compressor shall have overload protection of all three phases, mechanically interlocked to remove all power to the devices on activation in order to prevent a single phase condition. All component and devices must operate satisfactorily within the voltage variation parameters as established by the National Electrical Code, without any effect on the longevity of the components or devices.

9.4.4 The refrigerant compressors shall be accessible hermetic (semi-hermetic) reciprocating or scroll type, sized to the proper capacity required of the HVAC system. The Contractor may propose an HVAC unit with multiple compressors working in tandem. Eliminators shall be provided in an approved manner to prevent transmission of compressor vibration to the air conditioning unit frame and suspension.

9.4.5 Condenser and evaporator coils shall be constructed of seamless copper tubing, copper headers with copper fins or aluminum and stainless steel side plates and framing. No crevices or closures shall be permitted, which would hinder cleaning. The Contractor may propose alternative coil materials and fin layouts. The condenser car body inlet shall be screened to preclude entry of debris and shall be hinged to provide access for inspection and cleaning.

9.4.6 The condenser fan shall be powered by 480 VAC totally enclosed motor of a standard NEMA frame and be of washdown type for hostile environment. Motor shall have a stainless steel shaft. The bearings shall be double sealed with an L-10 rating of 26,000 hours minimum. Motor shall be protected against corrosion, including both end plates' rabbets sealed. Contacting lipseal and shaft slinger shall be provided.

9.4.7 Direct (not belt driven) driven condenser fan and evaporator blower utilizing a 480 VAC standard NEMA frame motor shall be provided. The blower assembly shall be balanced in accordance with IEEE standard 11. Evaporator blower housings shall be fastened in manner that focuses on secureness and ease of replacement.

9.4.8 The units shall also have within the self-contained assembly at least the following:

9.4.8.1 Filter drier;
9.4.8.2 Moisture indicator;
9.4.8.3 Suction and discharge shutoff valves (liquid line);
9.4.8.4 Refrigeration charging valves;
9.4.8.5 Receiver tank;
9.4.8.6 Solid state high and low safety pressure switches and modulation pressure switch (or sensors with a microprocessor control system);
9.4.8.7 Test gauges, liquid filled, suitable for vibration and shock of the railroad environment;
9.4.8.8 A test switch with a test position to override temperature control signals;

All refrigeration piping shall be type K quarter-hard temper copper tubing. The tubing shall be pre-formed where possible and shall be assembled with as few fittings as practical.

9.4.9 If roof mounted units are proposed, the bottoms of each unit shall have removable collection pans under the evaporator section and the condensing section. A 1 1/4 inch minimum, inside diameter stainless steel pipe shall be provided to the evaporator pan and two such lines to the condenser pans. Each pipe shall be routed to the nearest side of the car. Horizontal runs shall have a downward pitch. The drain lines shall be routed to the underside of the car, located so that the condensate shall drain clear of all underfloor equipment and running rails. The number of fittings and bends shall be minimized and, where used, shall be of large radii for ease of unplugging. The drain piping shall be insulated to preclude condensation. A flexible hose transition shall be provided between the drain pan outlet and the carbody drain line, using approved hose clamps and hose fittings to avoid any leakage. The evaporator and condenser pans, along with all surfaces of the unit shall be insulated to prevent condensation.

9.5 TEMPERATURE CONTROL

9.5.1 The heating and cooling controls shall consist of a single heating and cooling control panel. The control panels shall be arranged for automatic changeover from heating to cooling.

9.5.2 Each temperature control panel shall be equipped with a crew-operated switch that toggles the HVAC system between the normal “ON” operating mode, the layover mode, and an off mode. The off mode shall not disable the operation of the anti-freeze protection circuits. The target temperature for the normal operating mode shall be set to achieve an interior temperature of 72 degrees F. The target temperature shall be programmable by personnel with privileges within the range of 68 degrees F to 76 degrees F, if alterations are necessary.

9.5.3 The controls shall be an electronic based, positive, non-hunting type to ensure proper operation of the air comfort sub-systems. The design and arrangement of the controls shall be subject to Metra review and approval. [CDRL C-9-05] The use of programmable logic controllers and/or microprocessors is preferred. The controls should be equipped with non-proprietary Portable Test Equipment (PTE) software/ports that would enable personnel with higher levels of access to adjust the temperature parameters for heating, modulated cooling and cooling, and accessing diagnostic data such as fault and download history. Temperature sensors shall be located behind the return air screen in the return air duct, at the fresh air inlet (may be used for anti-freeze protection), supply air sensor at the HVAC main duct, and at minimum one in the passenger area. Evaporator coil sensors shall be used to detect the build-up of ice on the evaporator coil. All sensors shall be properly utilized by the controller to optimize temperature control and provide diagnostic data for maintenance, servicing, and testing. Pressure transducers shall be provided to allow the temperature controller to monitor and indicate the suction and discharge line pressures. The temperature controller shall be capable
of displaying diagnostic data or uploading diagnostic data via the PTE software program. Faults and download history shall be logged and accessible to technicians. Automatic damper controls shall be furnished as part of the temperature control system.

9.5.4 An indicator and monitor panel shall be furnished in to indicate the status of the heating and cooling equipment. Digital displays may be proposed. The panels shall be located in the same locker or lockers as the climate control panels. The panel or panels shall indicate which stages of heating or cooling have been called for by the settings of the climate control panels, and shall indicate whether the heating or cooling being called for is functioning. The panel or panels shall also indicate fresh air temperature, supply air temperature, return air temperature, suction line pressure and discharge pressure, and any on-going faults.

9.6 ANTI-FREEZE PROTECTION

9.6.1 Anti-freeze protection shall be provided at each side entrance door and shall be of sufficient capacity to prevent the formation of ice at these locations (> 40° F. surface temperature @ -20° F.). The design of such system shall be included in door system design review and shall be subject to Metra design review and approval. [CDRL C-7-01]

9.6.2 Anti-freeze protection shall be provided in the door pockets of each side loading door and shall be of sufficient capacity to prevent the formation of ice at these locations (> 40° F. surface temperature @ -20° F.). The design of such system shall be included in door system design review and shall be subject to Metra design review and approval. [CDRL C-7-01]

9.6.3 Anti-freeze protection shall also be provided for the water tank, piping from the tank to the basin and toilet, the drain from the water basin in the toilet room, water filling pipes, and the water line and retention tank under the car. Design for heating of the retention tank shall either be an immersion heater, Metra preferred, or a heating pad. Design of system shall be subject to Metra design review and approval. [CDRL C-9-06]

9.6.4 A water freeze dump valve shall be provided for the toilet water system. This freeze dump valve shall be designed in a location to separate it from the outside weather as much as possible and shall be kept heated with either an external heat tape or a 120VAC heater on the valve itself. The location and the specific heating system used for the water freeze dump valve shall be subject to Metra review and approval. [CDRL C-9-07]

9.6.5 All heaters shall be 120 VAC and shall activate antifreeze circuits at ambient temperatures of 40 degrees F or below, and shall de-activate antifreeze circuits when ambient temperatures rise above 50 degrees F.

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10 LIGHTING

10.1 GENERAL REQUIREMENTS

10.1.1 This section describes interior and exterior lighting that shall be provided on both trailer type and cab car type railcars.

10.1.2 Interior lighting shall be designed to enhance passenger comfort visually, and illuminate areas evenly without glare or dark areas at critical locations. The lighting shall enhance the appeal of interior furnishings, while providing for maximum passenger and crewmember safety. All interior and exterior lighting shall conform to the latest applicable APTA standards and FRA regulations. All interior and exterior lighting shall have proven service in North American railroad operations.

10.1.3 Exterior lighting shall feature maximum and efficient illumination and indication to passengers and crew members.

10.1.4 Lighting shall be provided in a minimum of two modes: Normal and Emergency.

10.1.5 Lighting shall be provided using energy efficient Light Emitting Diode (LED) technology in all instances with the possible exception of exterior cab headlights and ditch lights.

10.1.6 All lighting components shall use efficient and environmentally sustainable components, as well as being recyclable to the greatest extent practicable.

10.1.7 For each type of car proposed, the Contractor shall provide Metra a detailed interior and exterior lighting plan for Metra to review. The plan shall include the type of lighting, lighting arrangement (including any switches, ballast, control, lamp styles), fixture type, voltage, color temperatures, illumination levels in the interior of the car at specified locations for all lighting modes, and compliance with appropriate emergency lighting and signage regulations, standards, and recommended practices. A description of power consumption and voltage levels in the various modes of operation shall be included in the proposal. The details of the design, installation, and arrangement of the lighting solution shall be submitted to Metra for review and approval. [CDRL C-10-01]

10.1.8 The proposer shall detail at a minimum in their proposal: description of interior, exterior, and emergency lighting system; diagram of lighting arrangement; description of all light fixtures. Diagram containing voltage and operating modes of all lighting. [PDRL P-10-01]

10.1.9 All lighting and associated lighting electronics shall be tested and conform to all applicable sections of Standard EN 50155 (including EN 50121-3-2), IEC 61373, 49 CFR 238 Appendix B, and NFPA 130. Certification to FRA and/or AAR criteria shall be provided by the contractor upon the request of Metra. [CDRL C-10-02]

10.2 INTERIOR AND PASSENGER COMPARTMENT LIGHTING

10.2.1 The upper and lower coach sections shall be provided with an approved arrangement of LED fixtures. Alternate lighting technology, such as service-proven OLED lighting, may be proposed for Metra review and approval.
10.2.2 The lighting system shall: not produce objectionable glare, not deteriorate rapidly in effectiveness through the collection of dirt, permit easy cleaning and renewal of lighting elements, and be free of rattles and vibration when in service.

10.2.3 If a proposed lighting system is equipped with a lighting control circuit that will automatically dims main lighting to compensate for adequate ambient lighting in the car, the dimming functionality shall be able to be cut out by Metra personal at any time to ensure nominal lighting levels. If such a system is proposed, the contractor shall ensure charging of HPPL material is maintained to meet APTA requirements. If proposed, the contractor shall list as an option. [COPL CO-10-01]

10.2.4 The passenger compartment lighting system proposed shall be tested to meet or exceed main light levels specified in the latest revision of APTA specification APTA PR-E-RP-012-99, Recommended Practice for Normal Lighting System Design for Passenger Cars. All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 Appendix B as well as Section 18.16 of this specification. [CDRL C-10-03]

10.2.5 The material of all lenses shall be described and proposed to Metra, including any compliance certification received previously. Metra will require material test reports and certification letters for all lens materials prior to FAI.

10.2.6 The fixtures shall be mounted with non-exposed hardware and shall resist undesired opening to the maximum extent possible. Re-lamping and/or ballast replacement shall be accomplished readily from the exposed fixture face, with tamper resistant closing devices used. Lighting elements shall be supported by mechanical restraints to relieve mechanical loading on the power pins.

10.2.7 An “Occupied” LED light fixture, viewable from the aisle in either direction shall be provided above the toilet room door. A switch or sensor shall be provided in the door jamb to energize the light when the door is fully closed and the passage set is “locked.”

10.2.8 Electrical lockers shall be provided with LED light fixtures. The light shall be operated by a door switch located so as to turn the locker light off when the door is closed.

10.2.9 Ceiling mounted LED light fixtures shall be provided in the cab of cab control cars. Control switches shall be provided.

10.2.10 LED reading lights shall be provided in cab of cab control cars. Control switches shall be provided.

10.3 EMERGENCY LIGHTING

10.3.1 Emergency lighting shall conform to the requirements of FRA Regulation 49 CFR Part 238 as well as APTA SS-E-013-99. The emergency lighting system shall be tested to exceed emergency light levels specified in the latest revision (at the time of delivery) of APTA PR-E-S-013-99 Standard for Emergency Lighting System Design for Passenger Cars. The emergency light system shall be designed to maintain acceptable illumination for a minimum 120 minutes. For The emergency lighting solution that is proposed, details of the design, installation, and arrangement of the emergency lighting solution shall be submitted to Metra for review and approval. Test reports shall be submitted to Metra. [CDRL C-10-04]
10.3.2 Emergency lights shall be located in the main seating area, in stairways (if applicable), in the toilet room, in the cab, in each end passageway, above all escape sash locations with additional fixtures provided in the passenger compartments as required to comply with the lighting levels specified in FRA Regulation 49 CFR Part 238 and APTA PR-E-S-013-99 Standard for Emergency Lighting System Design for Passenger Cars.

10.4 EXTERIOR LIGHTING

10.4.1 Exterior lighting fixtures installed on the vehicle exterior, and in the interior within 2 ft. of a doorway, shall be watertight, except for interior ceiling lights. All lighting lamps and fixtures shall be suitable for rough duty service found in the railroad environment throughout North America. All exterior lighting plans and design is subject to Metra and approval. [CDRL C-10-05]

10.4.2 End passageways outside body end doors shall be illuminated with LED fixtures. The fixtures shall be activated with the general interior lighting along with emergency light.

10.4.3 Exterior platform lighting shall be provided at side exits that meet or exceed APTA Standard PR-E-EP-012-99, Recommended Practice for Normal Lighting System Design for Passenger Cars. The lights used to satisfy the above requirements shall be separate spotlights, LED lighting is preferred, on the exterior of the car (as stated in 49 CFR Part 38.101(b) and 49 CFR Part 38.157(b)) and mounted in the vicinity of the vestibule side loading doors. The exact location of the light used to illuminate the exterior platform shall be subject to Metra design review and approval, included in [CDRL C-10-05].

10.4.4 One (1) door open and one (1) lift activated light of differing colors shall be installed on the exterior adjacent to each set of side entrance doors. These lights shall be operated on battery or independent power source voltage. The fixtures shall have redundant LED lamps in each fixture, each showing to the front and to the rear. The lamps shall have sufficient brightness that a person of normal visual acuity may tell, from a distance of six-hundred (600) feet on a sunny day, whether the light is on or off, even if one of the lamps in the fixture is inoperative. The fixtures shall fall within clearance limitations. The lights shall be circuit breaker protected.

10.4.5 On the control end of cab cars only, two headlights (2) either sealed beam incandescent lamps or halogen low voltage D.C. sealed PAR 56, compliant with 49 CFR Part 229.125, shall be mounted in an enclosure. If lights are proposed with LED technology, they shall not be prone to ice or snow buildup and shall be reviewed by Metra. The headlamp shall be accessible in the control station, for re-lamping of the headlight. The light beams may be adjusted both vertically and horizontally. The headlight shall be protected against lamp burnout due to high battery charging voltage. A headlight dimming resistor, or dimming mechanism subject to Metra review and approval, shall also be provided. The wiring within the enclosure shall be of the heat-resistant type and the enclosure shall be provided with adequate ventilation holes. [CDRL C-10-06]

10.4.6 On the control end of cab cars only, two ditch lights (low voltage D.C. sealed beam incandescent lamps or halogen lamps compliant with 49 CFR Part 229.125) shall be installed one each side of the cab control end. If lights are proposed with LED technology, they shall not be prone to ice or snow buildup and shall be reviewed by Metra. The lights shall be aligned to cross at approximately 300 feet down the track and illuminate the roadbed approximately 800 feet down the track.
Lights shall operate in one of the following modes: steady, flashing, or flashing after horn or bell only. The control unit shall be incorporated into the event recorder/alarter system. Installation location shall be subject to approval of Metra. Methods to protect the lamp from overvoltage (such as a resistor) and methods to dim the lamp (such as with a dimming resistor) shall be included in the design.

The contractor shall propose an additional mode of operation. A momentary push button or Metra approved alternative device located adjacent to the headlight/ditch light switches that when depressed will momentarily turn off the ditch lights, dim the headlights, and leave Mars light on or off (if Mars light proposed). When the momentary push button is let go the headlights, ditch lights, and Mars light (if Mars light proposed) revert back to whatever mode of operation the headlight/ditch light switches were set to.

10.4.7 On the control end of cab cars only, a single oscillating light, or LED light that can follow an oscillating pattern, shall be located in the vicinity of the headlight. A low voltage D.C. sealed beam incandescent lamp, halogen lamp or LED lamp shall be utilized, LED lighting is the preferred option. The oscillating light circuit shall be protected against burnout due to high battery charging voltage. A dimming resistor, or dimming mechanism subject to Metra review and approval, shall also be provided, included in CDRL 10-06. A control switch assembly shall be provided. The oscillating light system design shall be subject to Metra review and approval, included in CDRL 10-05.

A rotary selector switch, with "OFF", "DIM" and "BRIGHT" positions shall be provided to control the headlights, ditch lights and oscillating light. [VRESD V-10-01] Not required on VRE cars. [VRESD V-10-01]

10.4.8 On the control end of cab cars only, two (2) lights shall be operated from a low voltage D.C. power source. Each lamp shall be LED PAR 46 lamp. Red lenses must be used. The entire arrangement shall comply with FRA regulations, as stated in 49 CFR Part 221.

10.4.9 In the control section on cab cars, the cab shall be equipped with a light burnout detection panel that notifies operating crew and/or Mechanical personnel that an exterior lamp has failed. The burnout detector panel shall have provisions to monitor the oscillating light, both headlights, and both ditchlights. The Contractor shall submit the design of this system for Metra review and approval. [CDRL C-10-07]

10.5 LOW LOCATION EXIT PATH MARKING (LLEPM)

10.5.1 Each car shall be equipped with a passive or active illumination low location and exit path marking system that complies with the requirements of APTA SS-PS-004-99 Rev 2 and APTA PR-PS-S-002-98, Rev. 3. If a passive system is proposed, the system shall use HPPL marking material as specified in Section 16.2.22 of this specification. The system shall be detailed in the proposal. [PDRL P-10-02]

The system chosen by the Contractor shall be arranged to provide visual guidance for evacuation of the car when overhead lighting and the emergency lighting system has failed or has been obscured. The low location exit path marking system shall clearly identify the primary path to be followed for exiting the car under emergencies. The primary exit path shall be designed to evacuate the passengers to the next car and not onto the right-of-way.

The Contractor shall propose the techniques and options for integration of passive HPPL elements or active elements into floor coverings, seat frames, door, exit path, stairways and bulkhead elements to achieve the APTA standard requirements. The system design shall be reviewed and approved by Metra and demonstrated on the Pilot Car. [CDRL C-10-08]
If additional LLEPM options are proposed, they shall be listed as options. **[COPL CO-10-02]**

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11 ELECTRICAL

11.1 GENERAL REQUIREMENTS

11.1.1 The electrical power, except for the low voltage battery circuits, shall be supplied from a locomotive not included in this specification, supplying 480VAC, 3-phase, 60 Hz A.C., 750 Amps per phase maximum continuous current rating, 500 kW power output, for a maximum of twelve cars or from a wayside 480VAC power source.

11.1.2 Complete circuit diagrams shall be submitted to Metra for approval prior to construction. [CDRL C-11-01] All wiring not explicitly referenced in other parts of this specification shall meet at a minimum the latest revision of APTA specification PR-E-RP-009-98, Recommended Practice for Wire Used on Passenger Equipment.

11.1.3 An electrical load study detailing the electrical loads on each AC phase for 480 VAC and 120 VAC, low voltage DC circuits and Battery circuits shall be provided to Metra for reference and approval. [CDRL C-11-02] A basic load study and overview of the electrical systems proposed in this section shall be included in the proposal. [PDRL P-11-01]

11.1.4 Where applicable, software or firmware shall be developed in accordance with and meet the latest revision of IEEE standard 1558 “IEEE Standard for Software Documentation for Rail Equipment and System”. [CDRL C-11-03]

11.2 VOLTAGES

11.2.1 The A.C. trainline voltage shall be 480 volts, 3-phase, 60 Hz A.C. for heating, air conditioning, ventilation and battery charging. Where applicable, equipment connecting to the 480VAC trainline should follow guidelines in accordance with the latest revision of IEEE standard 519 “Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems”.

11.2.2 Trainline voltage reduced by transformers to 120 volts A.C. shall be provided for lighting if applicable, air conditioning controls, heating controls, mobility aid lifts, power to USB ports, passenger outlet receptacles and Train Information Management System (TIMS) signs. Where applicable, equipment connecting to the 120VAC circuit should follow guidelines in accordance with the latest revision of IEEE standard 519 “Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems”.

11.2.3 The batteries and battery charger shall provide D.C. voltage for exterior lights, door closing lights, mobility aid lift indicator lights, TIMS controls, PA System, door controls, door motors, lighting if applicable, and cab operational equipment if applicable. The contractor shall propose a D.C. system voltage, and in the proposal shall justify the recommendation based on documented proven reliable design and prevailing industry standards in the United States commuter rail market. The DC voltage power system design shall be subject to Metra review and approval. [CDRL C-11-04]

As an option, the battery circuit shall be trainlined in order to distribute DC power for redundancy in case of adjacent car’s battery charger & battery failure. If such a design is included in the proposal, the trainlined battery voltage shall be protected by a circuit breaker. The DC voltage power system design shall be subject to Metra review and approval. [COPL CO-11-01]
11.2.4 64 volts D.C. trainline from locomotive battery (72 - 76 volts from the locomotive auxiliary generator) in the 27 conductor traction control trainline shall be used for the electric signal buzzer circuit and the Train Communications System.

11.3 LOW VOLTAGE DC POWER SUPPLY

11.3.1 Battery Requirements

11.3.1.1 All loads under emergency conditions must be maintained for a minimum of two hours from loss of 480 VAC hotel power. At a minimum but not limited to, these loads include items such as: pilot lights, TIMS, door closing lights, TIMS destination signs, PA System, door control circuits, door motors, cab operational equipment, and additional loads as agreed upon between the contractor and Metra. In addition, there shall be an additional 25% extra capacity for future installation of additional battery loads by Metra.

It is the responsibility of the Contractor to calculate the emergency condition load and verify the size the batteries specified below is adequate to maintain all loads for two hours until the calculated aging life of the batteries has been exceeded.

11.3.1.2 Selection and sizing shall meet the load and duration requirement of this specification for each type of car under the following conditions and considerations:

- Battery temperature ranging from -5° F to +130° F
- The recommended state of charge (S.O.C.) from the battery manufacturer based as it relates to the application and the experience of the battery supplier.
- Frequent HEP power interruptions in typical train operation and servicing. Batteries cycle frequently between charging and discharging modes while in service.

11.3.1.3 Batteries for this application are nickel cadmium, or approved equal subject to Metra review and approval. The clear see-through battery case is preferred. Interval between water toppings shall not be less than 6 months at average Chicago temperature conditions without using recombination vents. Vent caps shall be spring loaded to open with positive latching to close.

11.3.1.4 The battery design and battery charging shall be sufficient to return fully discharged batteries to the S.O.C. condition in 2 to 5 hours duration based on the recommendation from the battery manufacturer. Charging profile, such as single rate or dual rate, shall also be based on the recommendation of the battery manufacturer.

11.3.1.5 A load shedding device shall be provided to protect battery from complete discharge and to retain vital loads such as lighting, cab radio, and cab signals, etc. The device shall operate when battery voltage drops to its rated discharge voltage as specified by the battery manufacturer. A plan for the vital loads and the loads to be shed shall be submitted to Metra for review and approval. [CDRL C-11-03]

11.3.2 The batteries shall be installed in a ventilated box. The boxes shall be so arranged that no product of normal battery charging or any products of combustion, in the event of such occurring in the battery box may enter the car body.

The battery box shall be designed to accommodate the batteries selected, shall be easy to access for maintenance, readily allow for visual inspection of the batteries, and shall be constructed of stainless steel, subject to Metra design review and approval. [CDRL C-11-05]

11.3.3 Battery Charger
A static battery charger shall be provided. The charger shall convert the 480 VAC / 3φ input voltage to a constant DC voltage to supply the onboard electrical DC loads and to charge the car batteries. The charger shall be self-regulating and circuit breaker protected. The tolerance on output voltage and current output is ± 0.5%. Current limit shall be as recommended by the battery manufacturer. A reasonable amount of additional output capacity of 25% shall be allocated in order to support future installation of additional DC power loads by Metra. Upon loss of 480VAC, the loads shall be transferred automatically to the batteries instantaneously in order to prevent electrical power interruption to electronic equipment. In case of complete battery charger failure, the DC loads shall automatically continue to be powered by the batteries without interruption. The battery charger shall have the ability to automatically recharge the battery from any state of discharge, including 0 volts across the battery terminals. PTE software shall be provided along with the battery charger. Settings shall be adjustable with provided PTE software. An example of adjustable settings are the ability to adjust output voltage set points, adjust output current limits, ability to set a user defined voltage and current limit and time duration for the purpose of completing a maintenance charge, and adjustment of temperature sensor compensation parameters. Temperature compensation and low voltage shutdown features are to be provided.

The battery charger shall meet at minimum the performance standards:

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<td>External air temperature</td>
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<td></td>
<td>-Vertical +4g</td>
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<tr>
<td></td>
<td>-Lateral +4g</td>
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<tr>
<td>Inrush Current Limitation</td>
<td>&lt;2*I n (nominal input current)</td>
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<tr>
<td>IP Mechanical Protection</td>
<td>Minimum IP 65 or better, with the requirement of no permitted water or dust ingress</td>
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<tr>
<td>Insulation Test</td>
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phases of the 480VAC input, between ground and battery charger output (s). Minimum insulation test requirement shall be 2500VRMS, 60Hz, 60 seconds between input connections connected together and the ground.

The design of the battery charger is subject to Metra review and approval. [CDRL C-11-06]

11.3.4  Batteries and battery compartments shall comply with APTA PR-E-RP-007-98 Recommended Practice for Storage Batteries and Battery Compartments.

11.4 SWITCHBOARD AND CONTROL FEATURES

11.4.1  Switchboards and equipment for the control of the various electrical circuits, such as circuit breakers, etc., shall be provided in the Main Circuit Breaker Locker and the Electric Lockers on each end of the car.
All switches, circuit breakers, relays, resistors, etc., shall be identified by plastic nameplates clearly identifying the electrical circuit it controls. The ampere rating for each circuit breaker shall be indicated on the toggle lever. All circuit breakers and switches shall be indicated ON with toggle up and OFF with toggle down.
All electric lockers shall be designed with provisions to prevent, to the greatest extent possible, the ingress of snow, moisture and heavy debris. Electric lockers shall be large enough to allow ergonomical access for railroad maintenance personnel. Each circuit breaker panel shall carry apparatus arranged to be easily accessible to connections and designed to prevent an operator form coming in contact with live voltage when operating switches or circuit breakers. In addition, a reasonable amount of locker footprint shall be open for future installation of new equipment by Metra. Inside each electrical locker a reasonable amount of spare terminal points and DIN rail shall be allocated for future expansion.
The circuit breaker panels shall be dead front type, with removable front covers, of a design such that all components are front serviceable. Circuit breakers shall be arranged so that the handles move vertically, with the ON position up. Breaker covers are to be provided on operational sensitive controls to prevent inadvertent use of breaker. If utilized, bus bars shall be arranged to have tapped holes along their entire length, and be of a design such that all phase combinations are available at each breaker site.
The panels shall be conveniently located, in the electrical locker, for ease of access by service personnel. Reduced wiring and ease of maintenance shall be of prime consideration. If it is impractical to house all circuit breakers in the electrical locker, additional circuit breaker panels may be proposed for Metra approval.
For electrical panels, a wiring gutter shall be provided along the top, sides, and bottom, for the routing of high voltage leads to their designated circuit breakers.
Circuit breakers shall each be grouped with their respective voltage and be labeled according to the appropriate voltage. A master circuit breaker shall be provided for each voltage level. The circuit breaker panel shall be configured for easy removal so that maintenance and repair action are not impeded. Design of the electric lockers shall be subject to Metra review and approval. [CDRL C-11-07]

11.5 480 VOLT AND CONTROL TRAINLINES
All trainline systems described below in Sections 11.5.1-11.5.7 shall be subject to Metra design review and approval. [CDRL C-11-08] It may be proposed to integrate the 27 wire locomotive control trainline, door control trainline, and communications trainline systems into the digital IP based trainline system. The proposal shall exhibit solutions for built-in trainline redundancy and
interfacing with Metra’s current locomotive trainline configuration. [COPL CO-11-02] [VRESPD V-11-01] All trainline systems described below in Sections 11.5.1-11.5.7 shall be subject to VRE design review and approval. [CDRL C-11-08] The 27 wire locomotive control trainline, door control trainline, and communications trainline systems may not be built into the digital IP based trainline system. [VRESPD V-11-01]

11.5.1 480 Volt Trainlines

11.5.1.1 A 480 volt nominal, 3-phase, 60 Hz A.C. power trainline consisting of six 500 MCM cables arranged as two parallel 3-phase circuits shall be provided per car. All 480VAC jumpers and receptacles in material composition and construction shall meet or exceed specifications in latest revision of APTA PR-E-RP-018-99 and shall be compatible with existing locomotives.

A power control trainline consisting of two 6-conductor 12 AWG cables shall also be provided on each car.

11.5.1.2 Two 3/3 pole receptacles shall be provided at both ends of the cars. The receptacles shall be mounted on the car ends, one on each side of the car with the jumper assemblies adjacent to each receptacle.

11.5.1.3 Two 3/3 pole hard wired jumper assemblies shall be provided at both ends of the car. The jumper plugs shall be yellow in color.

11.5.1.4 At the end of the car in the train, the two jumper plugs must be inserted into the adjacent receptacles to complete the control circuit, permitting the main trainline contactor in the head-end power car to close.

11.5.2 Door Control Trainline

11.5.2.1 The cars relevant door circuits shall be trainlined for door control to accomplish proper door operation.

11.5.3 27 Wire Locomotive Control Trainline

11.5.3.1 All cars shall be provided with one (1) 27 wire trainline to control the operation of the locomotive from the operator's station in cab control cars. The wire size, functions and pin assignments are shown in Appendix "A". In addition, four spare conductors shall be provided, except in jumpers. All 27 wire locomotive control trainline jumpers and receptacles in material composition and construction shall meet or exceed applicable specifications in latest revision of APTA PR-E-RP-017-99 and/or APTA PR-E-RP-019-99.

11.5.3.2 This trainline shall be arranged in conduit under the floor of all cars and terminate in a weatherproof junction box located at each end of the car.

11.5.3.3 The locomotive control current shall be trainlined between cars, and between cars and locomotives, by means of a jumper cable on the left side of the longitudinal center line of car when facing car exterior on "B" end. The jumper shall be hard-wired to the "B" end of each car.

A dummy receptacle, with pins, shall be provided adjacent to the hard-wired jumper. The jumper head shall be integrally colored orange. The dummy receptacle shall be integrally colored white.

11.5.3.4 A locomotive control receptacle, including male connections and weatherproof housing shall be provided on the "A" end of each car. The receptacle shall be integrally colored orange.

11.5.4 Communications Trainlines

11.5.4.1 The cars PA system shall be trainlined for all cars in a train consist.
11.5.5 All junction boxes shall be stainless steel, water tight and weather proof. The inside of the box shall be painted with an insulating paint or varnish. All wires shall be terminate using ring tongue lugs, mounted onto terminal blocks in the junction boxes. The face of all end junction boxes shall be angled such all receptacles are angled downward 30 degrees.

11.5.6 Where applicable, all connections between car trainlines and, receptacles and jumpers shall be made in the end junction boxes by means of terminal boards.

11.5.7 Digital Trainlines

11.5.7.1 The cars shall have an IP based digital trainline. This trainline may be used for such 3rd party systems as Train Information Management Systems (TIMS), passenger Wifi, PA announcements, digital monitoring systems, and other systems as agreed to by Metra and the Contractor.

11.5.7.2 Fiber cable (digital trainline) backbone
The car shall have two multimode fiber optic cables (digital train line) to make the communication backbone in the car. Each fiber optic cable will extend from one optical switch to the location of the next optical switch on the opposite end of the car. The fiber cables shall be placed in conduit in the car between the points of connection.

11.5.7.3 Ethernet cable (Digital trainline)
On each end of the car shall be a digital trainline receptacle. Cabling shall go from the receptacle to the ends of the car on the upper level inside of the carbody where it will terminate at the optical switch. This cable shall be Full-Duplex Gigabit Ethernet compliant with IEEE Standard 802.3-1999. The digital trainline shall be two separate Ethernet links. The contractor shall supply a jumper cable to go between cars from the receptacle of one car to the receptacle of the adjacent car for car-to-car communications. The jumper and receptacle shall be at a minimum an IP67 grade connector when mated. The jumper and receptacle shall feature a locking mechanism for quick coupling and un-mating and shall be tolerant to high vibrations. The jumpers will be designed with keyways to ensure that there is only one way to connect the jumper and so prevent damage to internal connectors. The jumper or receptacle shall be provided with a retention mechanism that will prevent the jumper from falling outside the acceptable gauge envelope of the vehicle and fouling any trackside equipment. The fixed receptacle will have a cover plate that will automatically close to prevent water ingress to the connector surface and damage to the connectors. The conductor size shall be selected to ensure that this will be capable of withstanding the daily operation of the harness including the flexing that can be expected in normal vehicle operation. Each jumper cable shall be protected with an industrial woven, close fitting, sleeve that will ensure mechanical protection along the length of the cables external jacket against abrasion that may occur during installation or normal vehicle operation. The jumper cables shall be screened over the length of the cables and the screen shall be continuous over the connector. The screen connection will not be continuous over the full length of the assembly to prevent providing a common earth connection between adjacent vehicles. The screen of each cable shall be capable of being connected to the vehicle body at one point only. All other connector and parts of the assembly shall be constructed to prevent multiple point earth points on the cable screen. The contractor shall clearly indicate in design documentation the earthing point that should be used and this shall be approved by Metra. The digital trainline shall have a total bandwidth of no less than 1000 Mb/s.

11.5.7.4 In each car, there shall be a minimum of one PoE (Power over Ethernet) equipped network switch located in a minimum of one electrical locker. The network switch shall contain a minimum number of ports to provide connectivity to the digital (Ethernet) trainline as well as on-board compatible digital systems and spare ports for provisioned digital systems. The switches chosen shall also include a bypass feature to ensure the physical
connection between the 2 end-point connections on the car remains continuous even when the car is not powered. Network equipment used must meet or exceed any current industry protocol standards. Each car shall feature network redundancy such as ring network technology in order that failure of onboard communication systems will not affect the digital trainline. The digital trainline design, network equipment and equipment placement within the electrical locker shall be subject to Metra approval. [CDRL C-11-09]

11.5.7.5 Trainline Optical Switch

The Contractor will make provision for the installation of the trainline optical switches (2 per car) located at each end of the car near the access points. Low voltage D.C. or 120VAC power shall be supplied for each optical switch. The optical switches shall be less than 10 in. by 10 in. by 4 in. (254 mm by 254 mm by 101.6 mm) in size. The trainline optical switches will be the terminating point for digital communications equipment as agreed to by Metra and the Contractor.

11.6 120 VAC POWER SUPPLY

11.6.1 Three, single-phase, 480/120 volt A.C. transformers connected delta to delta shall be provided to supply 120 volt, single-phase A.C. for lighting, temperature control, etc. from head end power source on all cars. Calculations shall be provided to demonstrate that the transformers have the sufficient capacity to supply their intended loads. All inputs and outputs shall be circuit breaker protected. Transformers shall be derated at least 10% for current, or other appropriate approved factor based upon duty cycle. The contractor shall demonstrate by calculation that there is sufficient ventilation to prevent transformer failure and/or damage resulting from excessive heat buildup, during all operating conditions.

11.6.2 A surge protective device (SPD) shall be provided to offer overvoltage/transient suppression on 120 volt A.C. line to line and line to chassis circuitry. The SPD shall be at minimum UL 1449 3rd Edition Listed and provide an LED protection status light that indicates when the device is functioning properly. The design of this device shall be subject to Metra review and approval. [CDRL C-11-10]

11.6.3 A 120 volt A.C. receptacles shall be provided in passenger area or electric locker area on each end of each car. The receptacles shall be equally dispersed on both levels of each passenger compartment. 120 volt A.C. receptacles shall be provided on cab control cars located within the cab signal locker to provide power for the water cooler and for downloading event recorder data. Location and arrangement of all receptacles are subject to Metra approval. All receptacles shall be hospital grade. Passenger outlets supplying 120 Volt, 60 Hz type power shall be protected via a UL-approved GFCI circuit breaker intended for personal protection and shall have a ground pin that shall be grounded to the chassis of the car-body per the latest revision of APTA specification APTA PR-E-S-005-98.

11.6.4 USB and/or 120VAC outlet charging port shall be provided for each seating position, except flip seats where not possible. The ports shall be located on the side wall just below the window, or should fixed seating be provided, the USB ports may as an option be provided on the seat back of each multiple passenger seat (except for bulkhead and back to back seats). USB ports shall also be provided adjacent to the ADA position area on the locker wall. Final position of the USB ports and design of the USB system is subject to Metra design review and approval. [CDRL C-11-09] USB port shall be a minimum of dual 5 amp (shared) outlets and shall be compatible with all Apple and Android mobile devices. [VRESD V-11-02] USB and/or 120VAC outlet charging port may be proposed for each seating position, except flip seats where
not possible. USB port shall be a minimum of dual 5 amp (shared) outlets and shall be compatible with all Apple and Android mobile devices. [VRES D V-11-02]

11.7 CONDUIT

11.7.1 Conduits shall be in accordance with APTA PR-E-RP-002-98 “Recommended Practice for Wiring of Passenger Equipment”. An exception may apply for trainline cables which may be cleated to the underfloor structure, in such manner as to prevent wire chafing. Aluminum conduit is not acceptable for this application.

11.7.2 All conduit located overhead within the car body shall be arranged so that it is not located in the air duct. The car shall be provided with thin wall conduit within the car body.

11.8 ELECTRICAL GROUNDS

All electrical equipment, with a voltage of greater than 24 volts nominal shall be grounded to the car body.

11.9 CAR LEVEL MONITORING SYSTEM

11.9.1 A car level monitoring system shall be proposed. [PDRL P-11-02] The monitoring system shall be Internet Protocol (IP) based, and a device with an Ethernet port or ad-hoc Wi-Fi capability shall be able to view real-time information, review saved logs, and download saved logs when connected to the monitoring system. The car level monitoring system shall acquire and aggregate data from the following car subsystems (at a minimum): Door system, HVAC (including interior temperature), LVPS/Battery Charger, water and waste system, brake/wheel slide system, PA/IC/Communications (including interior audio levels), TIMS (Train Information Management System), lighting, CDVRS, passenger seating area camera systems, ADA systems, event recorder, data link, and other sub systems on the car as agreed upon between Metra and the contractor. The diagnostic system shall have spare interfaces for future systems, such as I/O and POE ports. The parameters and subsets of data from each system to be stored onto the monitoring system shall be agreed upon between Metra and the contractor. The design of the car level monitoring system shall be agreed upon between Metra and the contractor. The graphical user interface shall be clean, easy to use, and intuitive. The monitoring system shall include a removable 120GB or larger capacity solid state drive (SSD). The data shall be capable of being securely transmitted to Metra storage servers through Wi-Fi when in range of wireless access points in depots and maintenance yards. The data shall be accessible via non-proprietary formats, such as .csv files. The design and infrastructure of the car-level monitoring system shall be subject to Metra design review and approval. [CDRL C-11-10]

11.9.2 The contractor shall propose, as an option, a condition-based remote monitoring and diagnostic system. This system shall capture and analyze data from components and subsystems aboard the railcar and report a course of recommended action (such as inspection, repair, maintenance, or replacement) in order to prevent a breakdown or failure of Metra Equipment while in service. The remote monitoring and diagnostic system shall be able to update software on the systems on the railcar without having to physically access the units. This
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system shall have a flexible software interface to allow integration into a wide variety of Back Office based systems. The data that is monitored shall apply to the systems described in 11.9.1 and shall include: process data such as temperature, amperage, and pressure; counter data, such as start/stop, door opening cycles, loads cycles, and number of brake releases; Incident-based data such as emergency brake application, power unavailable, door failure to open; time and location stamps for event-based and process-based data from various sources. The monitoring system shall issue automatic alerts based on a specific event trigger and/or based on calculations of data. Archiving criteria shall be adjustable according to Metra’s needs. There shall be a set of pre-defined reports, analysis and graphical tools. In addition, Metra shall be able to set up its own analysis, and reports and shall be able to edit the analytics provided without the involvement of a third party. There shall be a system of authorization profiles on the control center software. The data shall be accessible via non-proprietary formats, such as .csv files. All asset data shall be the property of Metra. [CO-11-03]

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12 COMMUNICATION SYSTEMS

12.1 GENERAL REQUIREMENTS

12.1.1 The system shall communicate between railcars using trainline connections described in Section 11.5. Single points of failure along the trainline(s) shall be analyzed and mitigated.

12.1.2 The system shall feature redundancy to the greatest extent possible.

12.1.3 All critical subsystems, including Public Address, Emergency Intercom, Train Radio, and portions of the Train Information Management Systems shall utilize backup power and function in emergency situations.

12.1.4 A complete train communications system shall be installed. The system shall comply with FRA Regulations 49 CFR Parts 229 and 238. The details of the design, equipment, arrangement, and installation of the complete communication package shall be submitted to Metra for review and approval during the design review process. [CDRL C-12-01] It shall provide passenger cars with the following functions:

12.1.4.1 One-way communication from the train crew or engine control station to the passengers (Public Address System, Paging);

12.1.4.2 Two-way private communication between the engine control station and the train crew (Intercommunication System Function);

12.1.4.3 Two-way communication between passengers and the train crew/engine control station (Emergency Passenger Intercommunication System Function);

12.1.4.4 Two way communication between the Train Information Management system servers and the Train information Management system on the train.

The proposer shall include the detail the functionality and the onboard equipment of the above systems in their proposal to the greatest extent practicable [PDRL P-12-01].

12.1.5 All Communication System electronics shall be tested and conform to all applicable sections of Standard EN 50155 (including EN 50121-3-2), IEC 61373, 49 CFR 238 Appendix B, and NFPA 130. Certification to FRA and/or AAR S-9401 criteria shall be provided by the contractor upon the request of Metra.

12.1.6 The communications system shall be 100% compatible with Metra’s ACORN (Automated Communications and Onboard Reporting Network) in terms of interfaces, transmission, and receiving of messages, signals, and data. The system shall meet all the technical and functional Requirements of Metra’s ACORN system. The system shall demonstrate compatibility with Metra’s existing ACORN communication system. [CDRL C-12-02]

12.2 PUBLIC ADDRESS / INTERCOMMUNICATION SYSTEM

12.2.1 The public address and intercommunication equipment shall meet all applicable environmental tests specified in section 18.16 as well as other applicable standards for Sound and PA Equipment including those for Temperature Range, High Humidity, Vibration Stability, and Shock Stability.

12.2.2 All circuits shall be physically isolated and protected against any circuit that can cause or induce electromagnetic interference. Circuit breakers shall be provided for circuit protection.
The PA system shall comply with all applicable aspects of 49 CFR 238.121, including emergency back-up power requirements.

12.2.3 The complete system shall utilize the following components installed on each car with alternative designs, subject to Metra approval:

12.2.3.1 Conductor Control Unit (CCU), designed to provide audio input, amplification, audio output, intercom and public address (PA) functions. An indicator light or LED shall notify a conductor that a handset has gone off-hook (or conductor’s microphone has been activated) and an intercommunication link has been made. When intercom is selected, loudspeakers in cars shall be muted. Switch arrangement shall be provided to allow selection of PA and Intercom mode. Any mode selected (PA or IC) shall remain selected until the mode is changed. Conductor voice input (microphone) capable of at least 1,000,000 operations. Handset microphone (or alternate microphone design) shall be subject to Metra review and approval.

The CCU shall be mounted in a "Coach Key" locked compartment.

12.2.3.2 The public address system in each car shall include an ambient noise controlled amplifier monitored throughout the car. The unit will allow for automatic volume control, enabling announcements to be heard over the ambient noise level within the car. One power amplifier shall be required for each car and designed to provide audio input, amplification, audio output and regulated voltage for control units. The power amplifier shall be capable of: Transient suppression, Power supply line isolation (DC/DC Converter), Regulated voltage supply, Compressor pre-amplifier, and Power amplifier. The output level adjustment and shall remain consistent throughout the specified temperature range.

The power amplifier must provide protection against transient voltage. Short and open circuits shall not impose damage to the power amplifier.

With speech and sound input, the amplifier shall operate continuously with full output at rated voltages and without damage or degradation to the PA components.

12.2.3.3 There shall be a minimum of one (1) speaker in each compartment where a passenger may reside in, including passenger seating areas (which likely require more than one speaker) and in each passenger boarding/alighting area. The contractor shall conduct a detailed audio sampling and study of all passenger areas of the car, ensuring volume consistency between areas, as well as optimal sound levels. [CDRL C-12-03]

There shall be a minimum of one (1) speaker on the exterior on each side of the car. They shall be high performance loudspeakers.

Exterior speakers must be outdoor rated and weatherproof. The external speakers shall be installed to prevent ingress of water and dust. The loudspeakers and their assembly shall be immune to the chemicals and detergents used normally during washing, as well as any normal abrasive cleaning that may occur during washing.

The external speakers shall feature a wide dispersion angle and be able to be heard and understood by passengers on the platform area.

The volume levels of each passenger area, including the exterior speakers, shall be adjustable independently by a maintenance person.

The PA system shall feature minimal Total Harmonic Distortion over their entire operating frequency range.

The audio communication systems and PA systems shall exhibit a Speech Transmission Index (STI) rating of 0.7 or above according to the latest revision of IEC-602682-16.

12.2.3.4 An AAR Base, if required for the design, shall be provided in each car, to serve as a junction box for wiring to the P.A. System. The car and train wiring shall terminate on
barrier terminal strips. The AAR Base may also serve as an amplifier mounting base. An alternate mounting arrangement may be proposed to Metra for approval.

12.2.3.5 An Emergency Passenger Intercom Unit (EPIU) shall be provided per Federal regulation, 49 CFR Part 238.121. The units shall be flush mounted with the locations subject to Metra approval. [CDRL C-12-04]

The units shall feature the following:

12.2.3.5.1 One-touch shall activate the intercom. The emergency intercom shall be recessed and otherwise protected against accidental activation.
12.2.3.5.2 Once activated, an alert will play to notify the crew that a passenger has activated an EPIU and state the car number and location within the car from which the EPIU was activated.
12.2.3.5.3 Upon Intercom initiation, the EPIU will become hands free. The passenger will not need to hold the push button down.
12.2.3.5.4 The EPIU shall allow crew members to respond via any CCU or OCU located on any car of a train consist including the locomotive.
12.2.3.5.5 Each EPIU shall be equipped with indicators: one to indicate the EPIU is successfully connected to the train intercom, one instructing a passenger to “wait/listen” and one indicating when the passenger can talk.
12.2.3.5.6 The EPIU shall auto-disconnect after a predetermined time subject to Metra approval beyond completion of the conversation.
12.2.3.5.7 The EPIU shall have provisions to filter out ambient noise to ensure clear communication and also to prevent ambient noise from preventing the EPIU to disconnect after the call has ceased.
12.2.3.5.8 The face of the EPIU shall be labeled “Emergency Intercom” in luminescent material per APTA Standard PR-PS-S-001-98 and shall have instructions for operation. The car number shall be permanently and legibly applied to the car immediately above each EPIU.
12.2.3.6 In addition to the above, the following equipment shall be provided in the cab of cab control cars:
12.2.3.6.1 An Operator’s Control Unit (OCU) located in an approved location on the cab lower console. The OCU shall be designed to provide: audio input amplification; audio output; control of the radio, intercom and public address functions. The OCU shall have the following:
12.2.3.6.2 An indicator light or LED shall indicate that the handset has gone off-hook (or engineer’s microphone has been activated) and an intercommunication link has been made. When the intercom is selected, loudspeakers in cars shall be muted.
12.2.3.6.3 A three (3) push button switch arrangement shall be provided to allow selection of PA, Radio PA and Intercom mode. Logic shall be such that the radio receiver is always on regardless of function selected. When selected the PA or IC mode shall remain selected until the mode is changed. The Radio PA switch must be depressed to enable the radio to be transmitted on the PA.
12.2.3.6.4 A handset microphone with coiled cord shall feature a push-to-talk switch capable of 1,000,000 operations. Handset microphone design (or alternate modern microphone design), will be subject to Metra review and approval.
12.2.3.6.5 A speaker assembly shall be provided on the operator’s side of the cab. The assembly shall have a control to adjust the output volume of the speaker.

12.2.4 The contractor may propose a fully digital Public Address system. If proposed, the system shall utilize the digital trainline(s) described in 11.5.7 or a standalone digital PA trainline.
12.2.5 The Public Address/Intercom system shall feature radio to PA capability, with the design and details subject to Metra review and approval.

12.3 TRAIN RADIO

12.3.1 Cab Control cars shall be equipped with a narrow band train radio. The radio shall comply with AAR Standards and with any Federal Communications Commission or other regulations.

The radio shall be capable of adjustment to clarify reception and alter volume.

12.3.2 The radio shall be a >100 channel radio, with an internal microphone, remote audio connector and remote control head. The radio shall take power from the locomotive battery power source or (other approved independent power source) and the circuit shall be suitably protected. Power must be filtered if appropriate.

12.3.2.1 Clean cab mounting plate to be provided.

12.3.2.2 One handset (or alternate Metra-approved microphone) with push-to-talk switch, coiled cord, and AAR connector shall be provided at the operator's station.

12.3.2.3 The handset hang-up cup (or alternate Metra-approved design) shall include a radio control reverting switch.

12.3.3 A standard railroad style antenna shall be supplied. The location shall be subject to Metra approval.

12.3.4 The cab radio shall feature a ruggedized housing, ruggedized display, and ruggedized keypads.

12.3.5 The cab radio shall meet AAR S-9401 Vehicle Interior Cab standards (or Metra approved equivalent) for Humidity, Vibration, Mechanical Shock, and Abrasive Environment.

12.3.6 The cab radio shall conform to all applicable AAR standards for cab radio and radio transmission, including the capability of transceiving on all AAR channels.

12.3.7 The cab radio shall be set up to transmit and receive on all channels used by Metra. These channels shall be easily selectable.

12.3.8 The details of the cab radio shall be proposed to Metra for review and approval. [CDRL C-12-05]

12.4 BUZZER SYSTEM

A trainlined electric signal system shall be provided in all cars. Pushbuttons and buzzers shall be located approximately as follows:

12.4.1 One (1) low tone buzzer located in the control station of cab-control cars;

12.4.2 Two (2) pushbuttons located in the passenger boarding/alighting area of all cars, one adjacent to each door control panel;

12.4.3 One (1) pushbutton in a Metra approved location near the body end door opening at one end of all cars

12.5 TRAIN INFORMATION MANAGEMENT SYSTEM/ACORN
[VRESD V-12-01] Compatible with the VREs current system provided by ISC, or the contractor may propose a different solution that can be adapted on the existing fleet of 100 Gallery IV cars. [VRESD V-12-01]

12.5.1 The Contractor shall furnish and install a Train Information Management System (on train equipment only) in accordance with 49 CFR 38.103, Public Information System. The details of the design, equipment, arrangement, and installation of the complete train information management system shall be submitted to Metra for review and approval during the design review process. [CDRL C-12-06]. Proposal functionality and hardware details of this system shall be provided as part of [PDRL P-12-01].

12.5.2 The train information system shall be fully compliant with all applicable ADA regulations and recommendations.

12.5.3 The system shall monitor train location via the Global Positioning System and use this information to provide on-train text and audio messages regarding train arrivals and delays. The system shall transmit location information (within ten (10) meters) to Metra’s existing base station servers. The system shall demonstrate compatibility with Metra’s communication system back office and GPS operation.

12.5.4 The onboard train system will be linked via cellular communication to a Metra base station server. The system shall also be Wireless Fidelity (WiFi) equipped to allow for base station communication via Wi-Fi if in range. The system shall be independent from PTC Wi-Fi.

12.5.5 Metra personnel onboard shall be able to connect for troubleshooting and maintenance purposes.

12.5.6 The onboard train system shall be capable of sending customized messages from the user application to be displayed/announced aboard individual trains in real-time.

12.5.7 There shall be a user interface to allow the programmable control on its car; and the interior signs on its car. The interface shall allow for control, testing, and adjustment of the text (signs) and audio announcements. The programmable interface shall feature a numeric keypad and a ruggedized screen display or proposed alternative, subject to Metra approval. The interface shall allow a trainman to specify the following:

12.5.7.1 Specify train number;
12.5.7.2 Specify operating characteristics;
12.5.7.3 Specify reason for delay and;
12.5.7.4 Specify manual announcements.

The programmable controller unit is to be mounted in the vicinity of the passenger boarding/alighting areas, adjacent to the door control panel, in a secure enclosure. A lock keyed to Metra’s standard coach key is preferred.

12.5.8 The terminal shall store train schedules and train numbers in a database (approximately 245 stations, 482 trains inbound to and 482 trains outbound from Chicago traveling on 12 rail lines). Actual train performance is compared to scheduled performance and is used to alert passengers when a train is behind schedule. The system allows a trainman to select a reason for the delay. The up-dates to the database shall be made via a portable computer. The system shall be capable of updating the database from the base station computer. In addition to this information the database would also contain the voice files for the prerecorded commuter information and the safety messages.
12.5.9 The system shall allow for live announcements sent directly from the base station server.

12.5.10 The contractor shall include infotainment subject to Metra approval. This shall include features such as: dedicated digital display areas for advertisements that can be triggered based on location, time of day, Metra line, and date range. These signs/screens shall allow for animated graphic displays, including entertainment and advertising. These areas shall not interfere with displaying important passenger information including “next station stop,” delay messages, conductor announcements, and messages sent from GPS operators. Importing and removing of advertisements shall be easily controlled by Metra. Infotainment details shall be included in the Proposal. [PDRL P-12-02]

The contractor shall propose additional infotainment options to Metra if they are available. [COPL CO-12-01]

12.5.11 The communication system shall be seamlessly interfaced with the PA system, and all necessary equipment to interface with the public address system shall be provided. The system shall be configurable to select whether generated audio and text messages yield precedence to conductor PA announcements. The system shall allow all cars on a train to play and display announcements simultaneously.

12.5.12 The system shall feature advanced features to assist ADA passengers with hearing and visual impairments, such as: speech to text of announcements, text-to-speech of announcements, and assistive listening or induction loop systems.

Optional ADA passenger enhancements which go well-beyond local, state, and federal requirements shall be proposed as options. [COPL CO-12-02]

12.5.13 The system will provide the following announcements automatically over the train’s public address system and signage system for the selected train number:

Train destination and scheduled station stops prior to departure from the initial terminal;

12.5.13.1 Train destination and scheduled station stops repeated along with emergency exit announcement after exiting the initial terminal;

12.5.13.2 Emergency exit announcement prior to the arrival at the final destination;

12.5.13.3 Announce an upcoming station prior to arrival;

12.5.13.4 Announce the next station stop upon departure from a station (The signs shall continuously display this until the next arrival message is prompted);

12.5.13.5 Announce delay when a train is behind schedule and announce the reason for the delay if available and;

12.5.13.6 Announce any modifications to the normal schedule and any special announcements programmed.

The contractor may be responsible for the creation of the digitized audio files for the above, and the system shall allow loading of existing audio and text data and have the ability to schedule playback.

12.5.14 Interior/Exterior Signs

12.5.14.1 The contractor shall provide LED, LCD, TFT-LCD, OLED, or AMOLED (or any combination thereof) interior signage technology which has proven service in passenger transit applications. The signage shall be multipurpose, for simultaneous display of route/destination information and infotainment.

12.5.14.2 The interior signs shall display the text messages/animations that are coordinated with the on-train audio announcements. Text displays include: time and date, train number, final destination, on-time / delay information, and emergency procedures. In addition
to GPS location triggering of station stops, messages shall be initiated via back office of the
train information management system and the programmable interface onboard.

12.5.14.3 The interior signs shall refresh at rate indiscernible to the human eye. The interior
signs shall be capable of producing smooth animations. The interior signs shall be capable of
producing multicolored text and animations.

12.5.14.4 The signs shall feature a wide viewing angle, and the signs shall be readable by
a maximum number of passengers in each passenger area. The sign shall be clearly readable
in all ambient light conditions from total darkness to direct sunlight. The signs shall adhere to
all current and applicable ADA and APTA required and recommended standards at the time of
the contract award.

12.5.14.5 For messages able to be entirely displayed on the screen at once, the text shall
statically display, and not scroll or disappear. The interior signs shall continuously display next
station stop announcements upon departure from the previous station until the arrival at the
following station.

12.5.14.6 The signs shall function nominally during input voltage fluctuation ranges seen in
passenger rail operation. The signs shall feature input protection for electrical inputs outside of
the normal operating range. The signs shall function nominally in the vibrations seen in a
normal railroad operating environment.

12.5.14.7 The interior signs shall be capable of featuring emergency messages and run off
a backup power source in the event of a power failure situation.

12.5.14.8 The signs shall be applied in locations subject to Metra approval in anti-theft
enclosures. The signs shall be housed in durable enclosures. The sign shall be accessible for
maintenance crews to replace the sign or adjust settings.

12.5.14.9 The signs shall be tested in accordance with other tests required for onboard
equipment in this specification, such as: vibration; flame, toxicity, and low smoke;
electromagnetic compatibility; temperature and humidity.

12.5.14.10 It is preferable that the contractor provides exterior information sides on the car.
These signs shall provide information to passengers on the platforms such as train number, car
passenger load, restrooms onboard, ADA areas full, and advertisements. Exterior signs shall
by proposed as an option. [COPL CO-12-03]

12.5.14.11 The design, placement, and testing requirements for the passenger information
signs shall be subject to Metra approval. [CDRL C-12-07]

12.5.15 The system shall utilize an open architecture to provide for future expansions and
upgrades. The system shall be designed to easily add new functions and upgrades from
different manufacturers. All input/output modules, control and data transfer protocols shall be
non-proprietary to the greatest extent possible. The system shall also be designed for
adaptation to wireless local area networks (WLAN) for the purpose of automatic file update
downloads.

12.6 PASSENGER COMPARTMENT DIGITAL VIDEO RECORDING SYSTEM

12.6.1 A secure, railroad-grade Passenger Compartment DVR system shall be proposed. It shall
reliably capture and securely archive video for retrieval. The system shall be composed of one
central dedicated recorder; a suitable number of cameras for each passenger compartment and
the or passenger boarding/alighting areas and all applicable interconnections. The DVR system
shall be powered from a separate circuit breaker (on the breaker panel). A terminal board panel
will be applied in a dry location near the DVR for all DVR (power and signal) connections to be
made. The design and arrangement of the DVR system, including camera locations shall be
proposed and subject to design review and approved by Metra. [CDRL C-12-08]
12.6.2 Each component must be modular, interchangeable, and replaceable without affecting the rest of the DVR system. The DVR system shall have capability of automatic detection when a camera is plugged into the DVR system and automatic configuration of the camera for plug and play functionality. To the greatest extent possible, the passenger camera system hardware and software shall be non-proprietary in nature, such that Metra will not be hindered from expansion, upgrading, or replacing certain components.

12.6.3 It is required that the DVR recorder be a digital IP (Internet Protocol) based system and support digital IP cameras. The DVR recorder shall, at a minimum, be designed to meet all applicable FRA, AAR and APTA regulations in place at the time of Contract Award. The DVR recorder video channels shall be used to capture and record video from multiple connected cameras simultaneously. The DVR recorder audio channels shall be used to capture audio from multiple connected microphones simultaneously. Microphones internal to the camera are acceptable for passenger compartment video monitoring system, provided that they can be enabled or disabled through the DVR software. It is preferable that the DVR recorder shall feature video motion detection to trigger recording. If proposed, the video motion detection sensitivity shall be adjustable, customizable, and shall be capable of being enabled or disabled by Metra. The DVR shall have the capability of remote live viewing of video and remote downloading. Video data transmission through digital trainlines may be proposed.

12.6.4 The cameras shall be capable of clearly recording in all types of temperature and humidity experienced on the car, day, or nighttime conditions, with normal nighttime illumination from the main LED lights of the rail car. The cameras are required to be a high definition digital IP type camera. The cameras are required to be powered by PoE. The cameras shall be capable of recording in color with a minimum resolution of 1080p and 20 FPS. The DVR shall have user adjustable resolution and FPS settings. The settings shall be made accessible to Metra. The settings shall be adjustable for each individual camera connected to the DVR. Each camera shall have 1 adjustable lens. The camera lens focal length shall be selected during the design. Each camera shall be housed in a compact vandal resistant enclosure. The cameras shall be suitable for interior railcar installations. The camera shall be adjustable to allow for camera positioning.

12.6.5 At least one camera shall capture clear, unobstructed, and consistent views of passenger’s faces to enable Metra police forces to utilize facial recognition software using a still image from the camera feed.

12.6.6 All cameras and camera system components shall be electrically isolated to not cause a ground fault on the carbody.

12.6.7 The DVR shall have a visual indicator system that indicates the system is properly functioning and recording. The visual indicator system shall alert personnel upon failure of any camera, hard drive, or other type of fault.

12.6.8 The Passenger camera system components shall be moisture, dirt, and vandal resistant. The components shall comply with all applicable environmental standards for onboard electronic equipment mentioned elsewhere in this specification.

12.6.9 The lifecycle of the DVR system shall be a minimum of 8 years. Any components with an estimated lifespan of less than 8 years shall be field-replaceable. The contractor shall provide a
parts list for the field-replaceable components in the maintenance manual and/or illustrated parts catalog.

12.6.10 The DVR shall feature an interface to enable for a direct computer connection. An Ethernet interface is preferred.

12.6.11 The DVR shall contain built-in Wi-Fi hardware (if possible, the contractor shall utilize Metra’s ACORN Mesh Networks) to enable access and perform downloads from the system via ad hoc or peer-to-peer Wi-Fi such that will facilitate Metra in performing DVR data dumps via Wi-Fi/Mesh at maintenance facilities and outlying points. Metra shall retain the ability to enable or disable the Wi-Fi capability features on the DVR system.

12.6.12 The video archive is desired to be a minimum 10 calendar days.

12.6.13 Passenger Camera DVR Software
12.6.13.1 The contractor shall enable security measures to prohibit unauthorized DVR downloads, including, at a minimum, password protection configurable by Metra.
12.6.13.2 The DVR system shall include computer software that allows for downloading and onboard viewing of video directly from the DVR recorder without removing the hard drive.
12.6.13.3 The software shall allow the user to specify specific dates and times in order to control the length of the video clips downloaded.
12.6.13.4 When downloading a video/audio clip, the user shall have the ability to select or deselect which video and audio channels are to be downloaded.
12.6.13.5 The software shall have the capability to export all video and audio channels on the railcar into 1 file with all video and audio channels synchronized.
12.6.13.6 Each audio/video clip shall contain at minimum a time stamp with date, time, name of DVR system (car number), and associated video channel names that are overlaid onto the image and synchronized with video and audio.
12.6.13.7 Upon starting the software, the main screen shall automatically (and without user interaction) display in real time live video viewports of all the cameras simultaneously. The viewports of all the video channels shall be visible simultaneously and without obstructions to the user on the main screen. The user shall not be required to make any clicks, minimize or maximize windows to cycle through to view video camera channels. The software interface design shall be subject to Metra approval.
12.6.13.8 The DVR system shall include computer software allowing for video downloads for a hard drive removed from the DVR recorder that is connected to a laptop or desktop computer. The software interface design shall be subject to Metra approval.
12.6.13.9 The ability for Metra personnel to install and configure all supplied software without contractor assistance or interaction shall be required.
12.6.13.10 Future software updates to any computer software shall be provided free of charge to Metra for the duration of the contract.
12.6.13.11 The Contractor shall supply Metra with all computer software archived on electronic media. The software shall be archived along with the DVR documentation.
12.6.13.12 The operating system requirements for all computer software supplied to Metra by the Contractor shall be compatible with currently supported Windows Operating Systems.
12.6.13.13 Any software supplied shall have the ability to be configurable to meet the requirements outlined in this section. Metra shall have the ability to reconfigure the software as needs change and shall not be locked into the requirements as defined in this section.
12.6.13.14 If 360° or fisheye cameras are included, the software shall have a pre-configured set of four views automatically de-warped (or four raw feed views) when downloading footage. The software shall feature automatic (when configured) de-warping of the video footage. These

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views shall each appear as normal single camera footage and shall not exhibit any distortion or
cropping. The capability, ease, and desirability of the aforementioned will be evaluated during
the technical evaluation. The de-warping and/or view customization of any 360° camera and
camera software shall be subject to Metra review and approval as part of \[CDRL\ C-12-08\].

12.6.13.15 Video footage shall be able to be exported with the contractor’s software into
commonly used or non-proprietary video formals, such as .avi.

12.7 PASSENGER WI-FI PROVISIONS

12.7.1 The proposer may proposer passenger Wi-Fi as an option. [COPL CO-12-04] If the
proposal does not include passenger Wi-Fi, provisions for passenger Wi-Fi shall be built into the
car.

12.7.2 Provisions for a future Wi-Fi installation shall be made to include: spare power wires to
where the future router may be provisioned, create a designated area where a hole can be
drilled/used for the Wi-Fi exterior antenna. This area would ease the installation process when/if
Metra decides to install the Wi-Fi system and in some way have existing safeguards to prevent
water intrusion if a hole in the roof is utilized. The design and arrangement of this provision shall
be subject to design review and approved by Metra. [CDRL C-12-09]

12.8 AUTOMATED PASSENGER COUNTING

12.8.1 The Contractor shall provide an Automated Passenger Counting (APC) system. The
design, placement, and functionality shall be submitted to Metra for approval during the design
review process. [CDRL C-12-10]

12.8.2 The APC shall have the ability to integrate with Metra’s Computer Aided Dispatch and
Automatic Vehicle Location (CAD/AVL) system.

12.8.3 The APC system shall have the ability to count every passenger of size and shape,
boarding and alighting a train at each station.

12.8.4 The APC system shall have the ability to record passenger count data in a manner that
allows for reporting as required by the National Transit Database (NTD) Certification Checklist.

12.8.5 The APC system shall accurately count passenger loads during high volume peak times
for boarding and alighting.

12.8.6 The APC system shall be able to count passenger loads across the entrances and exits
in each car, including end-doors.

12.8.7 The APC system shall have the ability to accurately count regardless of the size of the
passenger from small child to large adult without requiring a passenger to carry an identifying
ticket or other object to board or alight the train.

12.8.8 The APC system shall be able to reasonably distinguish an individual human passenger
from non-human objects such as luggage, briefcases, service animals, strollers, walkers and
bicycles.
12.8.9 The APC system shall have the ability to account for passengers boarding and alighting only, and not count after the doors have closed.

12.8.10 The APC system shall have the ability to associate APC datum with its date and time, accurate to at least the minute.

12.8.11 The APC system shall have the ability to associate APC datum with its geolocation.

12.8.12 The APC system shall have the ability to associate APC datum with entities such as train, station, and route.

12.8.13 The APC system shall have the ability to report total ridership count for entities such as train, station, and route.

12.8.14 The APC system shall provide APC data in a non-proprietary (open data) format. This data shall automatically be offloaded to the railcar’s data storage unit or be automatically offloaded to Metra’s database when in Wi-Fi range at Metra’s facilities/yards.

12.8.15 The APC system shall have the ability to identify when an APC system aboard a train is not functioning normally.

12.8.16 The APC system accuracy shall be greater than 95%, based on a minimum of 1000 boarding and 1000 alighting events, accounting for different ridership and lighting conditions, and to be representative of Metra’s operating conditions. The 95% accuracy level shall be reached on raw data without any post processing of the data and without use of any adjustments factor.

12.8.17 The APC system shall retain its normal accuracy in all lighting conditions and regardless of the speed of passengers.

12.8.18 The APC shall require no manual correction after installation and initial activation, regardless of its application and the season it is operating in.

12.8.19 The APC units shall have certification of counting accuracy.

12.8.20 The APC system shall require little to no calibration after it is installed. If calibration is required after a certain amount of years, this calibration procedure shall be as effortless as possible.

12.8.21 The APC system shall be modular with simple architecture and minimal wiring required.

12.8.22 The APC system shall feature clear and easy diagnostic indicators, such as LEDs or via quick and simple PTE or diagnostic interfaces.

12.8.23 The APC system shall integrate seamlessly into Metra’s existing ACORN reporting tool and user interface. The software shall require no additional license fee and shall be used by an unlimited number of Metra users.

12.8.24 The APC shall be protected against and function in conditions seen in its operating environment, including: rain, snow, humidity, high and low temperature, condensation, dust, and vibration.
12.9 PROPOSAL DELIVERABLES REQUIREMENT LIST

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13 BRAKE SYSTEM

13.1 GENERAL REQUIREMENTS

13.1.1 A conventional pneumatic brake system with microprocessor controls shall be provided on all cars unless specified otherwise by Metra. The braking system shall include a system for service and emergency brake applications for all cars in the train, control equipment to be installed on the cab car to provide braking control for the train brakes and a parking or hand brake. Brake system proposal shall include brake system schematics and basic system description.  [PDRL P-13-01]

All brake equipment shall be completely compatible with Type 26C/26L air brake equipment and all North American locomotive electronic air brake equipment systems, currently in use in Metra & VRE commuter rail service. The air brake system shall be capable of running in conventional service in graduated release mode.

The Contractor shall provide detailed description of proposed brake system (including all components), its functionality and interaction with other systems for Metra review and approval.  [CDRL C-13-01]

The air brake equipment shall be arranged in the car so that there is sufficient clearance to remove the valve portions of the equipment. It shall be rack mounted.

13.2 BRAKING POWER AND PRESSURE

13.2.1 The braking ratio shall be equal to that of existing cars. The braking ratio of existing cars with composition shoes is 42.4% at the emergency pressure of 92 P.S.I. and 27.6% at 60 P.S.I. full service. Brake system proposal shall include design calculations of the proposed system brake ratios for emergency and full service application  [PDRL P-13-02]

13.2.2 Anti-skid/wheel slide provisions in regards to braking are not required, but can be proposed by the Contractor. If a wheel slide system is proposed, the system and its installation shall be submitted to Metra for review and approval.  [CDRL C-13-02]

13.2.3 The following shall be the nominal working pressures of the air brake system, in pounds per square inch:

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<tr>
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<tr>
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<td>Minimum Brake Pipe</td>
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13.2.4 Variable load or load weigh equipment may be provided.

13.3 TRUCK COMPONENTS

13.3.1 The car shall be equipped with a combination disc and tread brake equipment. The axle mounted brake disc shall incorporate cooling ribs that are arranged between the friction surfaces in order to provide adequate heat dissipation while the train is moving. Friction surfaces shall have a shoulder or indicator around the edge to show when the disc surface is worn to the condemning limit. The disc shall be manufactured from material suitable for the expected temperatures experienced under operating conditions, which shall be demonstrated
via a brake disc thermal calculations for the rates, conditions, and vehicle weights as specified in Section 3.1.8.

The actuators for the disc brakes and tread brakes shall operate at the same air pressure from the same air source.

Brake effort contributions from disc and tread brakes shall be specified to avoid wheel thermal cracking and brake disc damage. Under all circumstances, the brake performance defined in this specification shall be achieved. [VRESD V-13-01] The car shall be equipped with tread brake equipment only. [VRESD V-13-01]

13.3.2 Disc Brake Actuator
An air actuated caliper mounted on the truck frame shall be used in conjunction with each disc to develop braking effort. Automatic slack adjusters shall maintain a 0.03 in. to 0.06 in. clearance between the pad and the disc when brakes are released.

Pad holders and disc pads shall be equipped with a locking device. The slack adjuster shall have sufficient capacity to maintain nominal shoe clearance and piston travel through the full range of new to worn discs and brake pads.

Disc brake actuators shall be capable of handling pressure up to 140 psig without damaging the actuator, disc, brake rigging or any other system or component on the vehicle.

13.3.3 Tread Brake Units
A truck mounted air actuated tread brake unit, with integral single acting slack adjuster shall be applied at each wheel. The tread brake unit shall operate in conjunction with the adjacent disc brake caliper from the same air source.

Tread and disc brake system shall be designed for the equivalent of 150% braking of the ready-to-run weight of the car. All cars shall be provided with truck mounted (4 per truck) unit tread brakes operated by diaphragms. Installation and design shall be subject to Metra review and approval [CDRL C-13-03].

The slack adjuster shall have sufficient capacity to maintain nominal shoe clearance and piston travel through the full range of new to worn wheels and brake shoes, and shall provide sufficient clearance to install a 2 inch brake shoe against a new wheel.

One tread brake unit on each axle of the B-end truck shall be equipped with hand brake linkage.

13.4 PIPING AND FITTINGS

13.4.1 Brake pipe shall be 1 1/4 inch AAR standard pipe, or equivalent. Each car shall receive a brake pipe restriction test.

13.4.2 The main reservoir equalizing pipe shall be one (1) inch AAR standard pipe.

13.4.3 All branch air piping shall be AAR standard pipe below floor level. Type "K" copper tubing may be used above the floor level as an alternate.

All fittings shall be of AAR type malleable iron or copper to suit the particular pipe application requirements and shall be socket weld type.

Prior to installation of any air brake system valves and accessories, the piping shall be cleaned. After all cutting, fabrication, and bending is complete, piping must be deburred, blown out with steam, and simultaneously pounded to remove scale or dirt before application to car. All pipe openings must be capped or plugged until connected into the system.

During application to the car and prior to connection to the brake equipment, all piping must be blown out with air using a minimum pressure of 50 psi and a minimum duration of 20 seconds.

All pipe routes shall be designed to eliminate water traps.
13.4.4 AAR standard test gauge fittings, for single car testing shall be supplied in the brake cylinder pipe, one at each end of the car.

13.4.5 Reservoirs of the capacity necessary to meet the performance requirements shall be provided. On cab cars, the possible need for air for the horn and bell shall be recognized and additional main reservoir capacity shall be provided for this purpose and to permit fast recharge of Brake Pipe. They shall be mounted with a slope toward one end where a self-locking drain valve shall be installed, accessible for draining. All reservoirs at main reservoir pressure shall be drilled according to FRA standards. The main reservoirs shall be designed with a safety factor of five times the normal working pressure. All other reservoirs shall be designed with a safety factor of four times the normal working pressure in accordance with ASME pressure vessel standards. The details of size and installation of all reservoirs shall be reviewed and approved by Metra. [CDRL C-13-04]

13.5 END CONNECTIONS

13.5.1 All cars shall be provided with two (2) 1 1/4" self-locking ball type cocks on the brake pipe trainline.

13.5.2 The following hoses shall be provided for the brake pipe trainline:
   13.5.2.1 Two (2) hoses (Brake pipe intermediate)
   13.5.2.2 Two (2) hoses with FP-5 coupling (Brake pipe end);

13.5.3 All cars shall be provided with the following equipment in order to charge the main reservoir on the last car of the train (cab control car) based on a train consisting of up to twelve (12) cars:
   13.5.3.1 Two (2) 1" self-vented ball type cut-out cocks with locking handle (MRE pipe), with cock open handle perpendicular to the pipe;
   13.5.3.2 Two (2) hoses (MRE pipe intermediate);
   13.5.3.3 Two (2) hoses with LS-4 coupling (MRE pipe end);

13.5.4 Brake pipe and main reservoir hoses shall be AAR approved and dated. The hoses shall not part or distort when coupled with a car or locomotive and negotiating the curves described in section 3.2.1.

13.5.5 A suitable pipe rack shall be furnished to keep the inter-car connections from fouling under all operating conditions, when such connections are not independent of the coupler.

13.5.6 E & L vented type and F dummy couplings shall be provided.

13.6 EMERGENCY BRAKE VALVE

13.6.1 The car shall be provided with two valves located in diagonally opposite corners of passenger boarding/alighting areas. The valves, when actuated, shall cause an emergency brake application to all cars in the train. They shall be marked “Emergency Brake Valve”.

13.6.2 An emergency brake valve shall be provided in the observer’s side of the cab of cab control cars.

13.7 HANDBRAKE
13.7.1 All cars shall be provided with one (1) electric handbrake with lever-type handle for manual operation. Handbrake shall be located at a position to be agreed upon between Contractor and Metra in CDRL C-13-01.

13.7.2 Each handbrake with associated rigging must be capable of applying the brakes on each axle of the adjacent truck, and of holding a fully loaded (AW3) car on a four and one-half percent (4.5%) grade with a force of not more than 125 pounds applied on the handbrake handle. As part of the design review, the Contractor shall provide to Metra a calculation of braking forces to demonstrate compliance with these specifications. [CDRL 13-05] These calculations shall conform to APTA Standard PR-M-S-006-98 Rev. 2, Standard for Parking Brakes for New Passenger Locomotives and Cars.

13.7.3 The hand brake rigging, both car body and truck, shall clear all piping, conduit and undercar equipment. Rigging components shall be sized and arranged to prevent binding.

13.8 BACK-UP FEATURE
A permanent back-up pipe and valve shall be provided on the cab control end. The valve shall consist of a valve and whistle in one assembly.

13.9 AAR S920 COMPLIANCE
The Contactor shall comply with AAR S920 (AAR CID) for and all required data fields shall be provided with each car history book electronically in Microsoft Excel or CSV format.

13.10 PROPOSAL DELIVERABLES REQUIREMENT LIST

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13.11 CONTRACT DELIVERABLES REQUIREMENT LIST

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14 TRUCKS

14.1 GENERAL REQUIREMENTS

The trucks shall be cast steel inside swing hanger type single equalized, or fabricated outside frame type. They shall be four wheel trucks with coil spring primary and secondary suspension. The trucks shall be equipped for truck frame mounted unit tread brakes and outboard axle mounted disc brakes. The roller bearings shall be of a rotating end cap design. The Contractor shall follow all of the guidelines provided in APTA Standard RP-M-009-98, to demonstrate thorough design, analysis, and testing that the truck conforms to the requirements of this Specification. Details of the design, arrangement, installation, and testing of the truck components and assembly shall be submitted to Metra for review and approval. [CDRL C-14-01] Truck system proposal shall include a basic general arrangement drawing, service history, and basic description of system function. [PDRL P-13-01]

Only trucks manufactured by a supplier with successful experience in railway passenger truck design and manufacture shall be acceptable. Final assembly needs not be done at an AAR certified shop, however, manufacture of wheels and axles and their mounting shall be performed at AAR certified facilities. Trucks and components shall be only of a service proven design, which has operated in similar service in the United States. The Contractor shall submit the service history of the truck, noting any deviation for this application to Metra for review and approval, prior to selection of truck. [CDRL C-14-02]

The trucks shall provide a safe and secure support and guidance system, transmitting accelerating and braking forces to the car body, and must provide comfortable riding quality at all speeds up to 100 miles per hour on track appropriately certified by FRA. The design, arrangement and equipment of the trucks shall be such as to prevent "hunting" or "nosing" at all speeds, and to minimize rocking of truck frame on equalizer springs at critical speeds. The design stresses in truck parts shall be chosen to provide a conservative factor of safety, consistent with proven truck design practice for heavy duty railway passenger service. In the design of all truck parts, all forces and combinations of forces, including braking forces, must be taken into account. Multiplication of forces due to accelerations and shocks, and non-uniform distribution of vertical loading due to track irregularities and super elevation, must be considered. The design center bearing load for both trucks shall be determined from the heaviest end of the car, using AW3 load, plus train supplies, less truck weight. To this dead weight must be added all dynamic loads and multiplying factors. The trucks shall be designed and manufactured to perform satisfactorily for a minimum of 40 years. All structural components of truck assembly shall have a minimum design life of 40 years of operation at full seated passenger load (AW1). The design and the selection of materials shall prevent corrosion damage, including the effects of extreme weather conditions, during the 40-year design life. For fabricated trucks, all structural and load bearing members of the truck shall be of steel. The maximum stress recorded at any location shall not exceed: 80% of the yield strength in the truck static test; yield strength in the truck overload (AW3 vertical load, + lateral load = 25% vertical, & + longitudinal = 15% vertical) analysis; and 60% of the endurance limit (50% to 85% AW1 vertical load, + lateral load = 25% vertical, & + longitudinal = 15% vertical) for the fatigue analysis. For cast trucks, truck castings are to be radiographically inspected in accordance with ASTM E71. Metra will accept statistical method of radiographically inspecting truck castings as an alternate to inspecting all truck castings upon Metra's review and approval of the Contractor's (or Subcontractor's) inspection plan. All castings shall be visually inspected using Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.'s standard MSS-SP-55 latest revision as pass/fail criteria, or the bidder shall provide an equivalent inspection plan with pass/fail criteria to Metra for
approval. For machined surfaces, the bidder shall provide inspection procedures with pass/fail
criteria to Metra for approval. For truck castings other than truck frames, bolsters, and spring
plank, both Radiographic and Magnetic Particle Inspections are required per ASTM E-446 and
ASTM E-125. The bidder shall provide procedures pass/fail criteria to Metra for approval.
The arrangement of the trucks must provide for maintenance of the design center bearing
height for any condition of normal wheel and suspension system wear. The Contractor shall be
allowed to shim only on the bolster springs, the equalizer springs and when approved by Metra
on the center plate to correct car height or lean. In no case will the Contractor be allowed to
shim on the journal housing
The Contractor shall ensure that manufacturers of truck and brake components coordinate to
provide full compatibility.

14.2 DIMENSIONS
The following truck dimensions shall be incorporated in the truck designs:

14.2.1 Wheel Base 8'- 6"
14.2.2 Journal Bearing Size 6-1/2" x 12"
14.2.3 Pedestal Opening (cast truck) 13-3/8"
14.2.4 Wheel Size 33" or 36"
14.2.5 Center Bearing Diameter 16"
14.2.6 Minimum Clearance of Truck Parts above top of Rail (worst case) 2-1/2"

14.3 TRUCK FRAME

14.3.1 Truck frames shall be stress relieved; cast alloy steel, normalized and tempered, or
welded steel fabrication of adequate cross sectional area at all locations. Junction of cross
members to side members must be proportioned and shaped to eliminate stress points. Truck
frame shall have as much strength and capability of resisting twisting and uneven distribution of
loading as possible.

14.3.2 Truck pedestals, shall have austenitic manganese steel liners welded to pedestals. Lugs
or projections cast integral with frame for support of pin connected parts (such as swing
hangers) must have hardened steel bushings. Pedestal stops shall be secured in an approved
manner.

14.3.3 The hangers, brackets and bolts by which the brake equipment is attached to the truck
frame shall have an adequate factor of safety for withstanding forces to which equipment will be
subjected. The trucks shall accommodate tread brake units. The dimension between the center
of brake shoes shall be at least 60" and the brake shoes shall not touch the wheel flange.

14.3.4 The first truck frame shall be tested as described in Section 19.2.2.A.

14.4 TRUCK BOLSTER

14.4.1 The truck bolster shall be an alloy/steel casting, stress relieved, normalized and
tempered or welded steel fabrication, of adequate cross sectional area at all locations. The
junction of cross members to side members must be proportioned and shaped to eliminate stress points. A longitudinal bolster anchor on each side shall stabilize the bolster with respect to horizontal movement, utilizing rubber cushioned truck frame and bolster attachments.

14.4.2 The bolster shall include an integral center plate. A three piece locking center pin shall be accommodated. A manganese steel vertical wear liner shall be applied to center plate. A composition or polyolefin horizontal wear liner shall be provided.

14.4.3 The first truck bolster shall be tested as described in Section 19.2.2.A.

14.5 SPRING PLANK, SWING HANGERS AND CROSS AXLES (IF UTILIZED)

14.5.1 Swing hangers shall be forged carbon steel to AAR Specification M-126, latest revision, Grade F. Swing hanger pins and bushings shall be of case hardened carbon steel.

14.5.2 Swing hanger cross bars and bearings (cast trucks) shall be forged alloy steel.

14.5.3 Spring planks shall be one piece, cast alloy steel normalized and tempered, or welded steel fabrication, of adequate cross sectional area. No bolster roll stabilizer is to be provided.

14.5.4 Two spring plank safety straps, bolted to lugs in the truck frame, shall be provided per truck.

14.6 SIDE BEARINGS

The truck shall be provided with two friction type side bearings per truck, having a cast base and rubber insert supporting a cast manganese steel bearing surface. Side bearings shall be designed to contact the car body wear liner but not be under load.

14.7 EQUALIZERS (CAST TRUCKS)

14.7.1 Equalizer bars shall be "I" beam type. The equalizer shall be drop forged, alloy steel and shall conform to AAR Specification M-127, Grade A, latest revision. The equalizer must be normalized and tempered as called for in that specification.

14.7.2 Equalizer spring seats must be made from low carbon cast steel conforming to AAR Specification M-201, latest revision, Grade B. Design must provide ample strength, and all fillets and corners must have large radii. Equalizer spring seats must be a good fit on equalizer and be attached thereto with adequate size tight fit bolts and lock units.

14.8 SUSPENSION

14.8.1 The truck shall be provided with primary and secondary springs of adequate capacity to suit the car weight and loading distribution. Trucks are to be designed for coil primary and secondary springs of suitable proportions for attainment of good riding quality and long life. To this end, springs must be designed on basis of conservative working load stress. Working load for spring design shall be taken as dead load of end of car and truck parts plus proportion of seated load. There must be an adequate reserve of deflection remaining in the springs. Solid load stress in springs must be well below yield strength of material. Spring material shall be alloy steel, in accordance with AAR Specification M-114 and AISI Specification 5160H.
Springs must have stamped marking indicating manufacturer and date of manufacture on the outside surface.

14.8.2 At a minimum, each truck shall be provided with two shock absorbers to control the vertical motion of the truck bolster.

14.9 TRUCK-TO-CAR ATTACHMENT MECHANISM
The truck-to-car attachment mechanism shall be designed with a minimum 250,000 pounds ultimate shear strength in locked configuration, for locking bolster to car body. The arrangement shall provide for lifting of trucks when the car body is lifted without disengagement of the mechanism.
Entire mechanism shall be in accordance with FRA Regulation 49 CFR Part 238 and APTA Standard PR-CS-S-034-99 Rev. 2, Section 5.6.

14.10 SOUND DEADENING
Fiber reinforced elastomeric sound deadening pads shall be provided in an approved manner between equalizer feet and journal bearing mounting seats (cast trucks). Sound deadening pads, 1/4" thick shall be provided at the top and bottom of all coil springs.

14.11 JOURNAL NUMBER PLATES
The trucks of all cars shall be provided with cast number plates applied at the center of the pedestal opening on truck frames above the journal boxes. The journals shall be numbered according to the AAR Standard "Designation of Sides, Ends, Journals and Journal Box Locations on Passenger Train Cars", alternate (a), such that facing the "B" end of the car from the exterior, the journals shall be numbered, from the "B" end to the "A" end, with Number 1 on the right and Number 2 on the left, and Number 7 on the right and Number 8 on the left at the extreme "A" end.

14.12 WHEEL AND AXLE ASSEMBLIES

14.12.1 AXLES
The axles shall be AAR Class F (except for journal centers and overall length). The Contractor shall confirm the size of the axle by an approved stress analysis.
The axles shall be manufactured in accordance with AAR Specification M-101, latest revision, and finished in accordance with AAR Recommended Practice. Axles must have a fine grain structure. Axles shall have standard AAR end stamping for passenger car roller bearing axles.
A record of all heat numbers shall be included in car serial records. Certified copy of chemical and physical tests as specified in AAR Specification M-101, latest revision, Grade F, Item 17, must be made and results sent to Metra. Axles shall be ultrasonically tested according to AAR Specification M-101A, latest revision.
The wheel seats shall be machined in accordance with AAR Wheel and Axle Manual. Both ends of all axles shall be furnished with a spline.

14.12.2 JOURNAL BEARINGS
The cars shall receive 6 ½ X 12, AP-Class F, or equal, integrally housed, rotating end cap, Timken ECO-Turn© or equivalent hydrodynamic labyrinth type back seal, grease lubricated roller bearings. Roller bearing races, fingers, seal rings, cones, spacers and other parts placed on axles must be properly assembled or pressed in place, in accordance with bearing manufacturer's and AAR recommendations.
Bearings and all subcomponents (including seals) shall be fully approved by the AAR and shall be service proven with at least 5 years of passenger railroad service in the US.
End cap shall have a 1-1/2 inch hole with a pipe plug applied to facilitate wheel truing. If required, for wheel slide detection system, one hundred toothed magnetic pick-up end caps shall be applied to both ends of all axles. Wiring to journal pickup sensors shall be carefully arranged to permit ready replacement of sensors, and to resist breakage from truck motion and wayside debris. A one-piece integral cable and connector assembly shall be provided to connect between the car-body wiring and the speed transducer assemblies installed on both axles of each truck. Arrangement and details of sensor and lead wiring shall be submitted to Metra for review and acceptance. [CDRL C-14-03] The bearings shall be designed with a minimum B-10 life of 500,000 miles. The Contractor shall confirm the size by an approved analysis, in conformance with AAR size, weight, and speed relationship.

An appropriate bearing housing shall be provided by the bearing manufacturer to accommodate a 13 3/8 inches pedestal opening. There shall be no metallic rubbing surfaces other than journal pedestals. The housing shall be equipped with manganese steel liners. The bearings shall be grease lubricated in accordance with latest AAR specifications, and shall require no field lubrication between scheduled bearing overhauls. The bearings shall be able to be overhauled to OEM and AAR requirements in the US by Metra at multiple companies and shops.

14.12.3 WHEELS
Wheels shall be 36" or 33" diameter, wrought steel, multiple wear, heat-treated, curved plate design conforming to AAR Specification M-107/M-208, latest revision for Class B wheels, with 2 ½" minimum rim thickness, as specified in the AAR Manual of Standards and Recommended Practices. Mill scale shall be removed from the entire wheel so that inspection can be made before application. The wheel profile shall be a narrow flange APTA 220 wheel profile as specified in APTA PR-M-S-015-06 based on AAR-1B (AAR S-669), 1:20 taper, modified for 5.5 inch wheel width. Wheels shall be balanced to the design requirements in accordance with the procedures specified in recognized industry standards. [VRES V-14-01] Wheels shall be 36" or 33" diameter, wrought steel, multiple wear, heat-treated, curved plate design conforming to AAR Specification M-107/M-208, latest revision for Class B wheels, with 2 ½" minimum rim thickness, as specified in the AAR Manual of Standards and Recommended Practices. Mill scale shall be removed from the entire wheel so that inspection can be made before application. The wheel profile shall be a Wide flange AAR type P33 or K36 respectively with 1:20 taper. [VRES V-14-01]

14.12.4 Before assembling wheel and axle sets, the pairs of wheels must be matched as to tape size according to AAR Wheel and Axle Manual, and all operations of boring wheels, assembly, and pressing same on axle, and press tonnages obtained, must be in accordance with recommendations in AAR Wheel and Axle Manual.

Wheels must be statically balanced to with 1.3 Lbs at outside rim diameter and the amount of imbalance to be marked or stenciled on the back of rim face at point of maximum imbalance. Radial, plane and parallelism for the mounted wheels shall be per AAR requirements. In the absence of such requirements the following shall apply: Radial - .008", Plane - .015", Parallelism - 0.150".

Bearing press charts shall be provided with each mounting wheelset report in addition to the reporting requirements specified in the AAR Wheel and Axle Manual.

14.13 TRUCK GROUNDS
A Metra approved flexible ground strap system shall be provided between the car body and each truck frame. The design and placement of truck ground strap shall be subject to Metra review and approval. [CDRL C-14-04]
14.14 AAR S920 COMPLIANCE
14.15 The Contactor shall comply with AAR S920 (AAR CID) for wheelsets as well as truck, draft arrangements, and brake components. Scanned Data shall be provided with each car history book electronically.

14.16 PROPOSAL DELIVERABLES REQUIREMENT LIST

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15 CAB CONTROL STATION

15.1 GENERAL REQUIREMENTS
An operating station shall be located on the lead end of all cab control cars. It shall have an Engineer's position on the right side (when looking out the windshield) and an observer's position on the left side.
The control station shall conform to the FRA and AAR standards for cab arrangements, to the greatest extent possible, considering the requirements of this specification.
The Engineer's operating controls shall be arranged in and on a desk-top console to the front of the engineer's seat and immediately below the windshield. All switches, circuit breakers and alike shall be arranged to permit a one man operation from the engineer's position. Details of the design of the cab, arrangement of the cab, and the locomotive controls, to include a mock-up of the cab, shall be submitted to Metra for review and approval. [CDRL C-15-01]

15.2 CAB SEATS
The control cab shall be equipped with two seats, one on each respective side. The seats shall comply with the requirements of APTA Standard PR-CS-S-011-99, latest revision and FRA Regulations 49 CFR Part 238.103 and 49 CFR Part 229.119. In addition to the two seats in the cab, a jump seat may be proposed as a third seat in the cab. The cab seat design and layout shall be subject to Metra review and approval. [CDRL C-15-02]

15.3 AIR BRAKE EQUIPMENT

15.3.1 The air brake system shall have an application portion to provide single reduction full service penalty applications in conjunction with speed control, train stop, overspeed and safety control features, and shall have necessary equipment to establish suppression of speed control, train control, overspeed and safety control applications. Suppression shall be established with a full service brake pipe reduction, if such reduction has been commenced within the eight second time period, the condition acknowledged, if required, and if such reduction is maintained until the condition is corrected.
Recovery from an emergency brake application shall be delayed 30 seconds. There shall be no delay on recovery from a penalty application.

15.3.2 Equipment to be provided as follows:
15.3.2.1 One (1) desk top automatic brake valve and appropriate control unit;
15.3.2.2 One (1) duplex air gauge (main reservoir and equalizing reservoir) with test gauge fitting;
15.3.2.3 One (1) duplex air gauge (brake pipe and brake cylinder) with test gauge fitting;
15.3.2.4 One (1) duplex air gauge (application and suppression) with test gauge fitting
15.3.2.5 One (1) B-3-B emergency brake valve (on left side, looking out windshield);
15.3.2.6 One (1) Type D-1 diaphragm foot valve;
15.3.2.7 One (1) P-2-A brake application valve;
15.3.2.8 One (1) Power knock down pressure switch.

15.3.3 Appropriate safety control, train stop, locomotive overspeed and speed control interface equipment shall be provided. The E.P. Valve shall be equipped with a lock. This lock shall be a multi-blade tumbler type, and shall allow the key to be removed in both the "Cut-in" and "cut-out" positions. The key shall be single bitted. Distinct keying shall be used for each car, with no master keying required.
Three (3) keys shall be provided for each cab-control car.
"Deadman" feature shall be provided with appropriate sealable cutout switch.
15.4 CONTROL EQUIPMENT

15.4.1 A master, non-dynamic Electro-Mechanical controller shall be provided in the control station to permit forward or reverse control of the train and throttle control of the diesel locomotive through the 27-wire TRAINLINE.

15.4.2 Power Knock/Out (PKO) will occur in response to emergency or penalty brake application. Automatic unloading and return to idle speed of engine, or unloading of locomotive traction power without affecting engine speed, as appropriate to head end power supply requirements, will occur in the event that emergency brake application is made, or a service application is instituted through the safety control, overspeed, train stop or speed control systems. The MU propulsion system will receive the PKO signal from the brake system and immediately remove traction power by deenergizing the GF, A, B, C, and D valve control trainlines. Also, a light shall be provided to indicate when the "PC" switch is open.

15.4.3 Equipment to be provided as follows:
- One (1) generator field switch;
- One (1) engine run switch;
- One (1) attendant call switch (pushbutton or spring return switch);
- One (1) Control and Fuel Pump Switch.
- One (1) Head End Power Trainline Control (TLC) Reset

15.5 SPEED INDICATOR/ALERTER/EVENT RECORDER

15.5.1 A solid state speed indicator shall be provided. The indicator shall be mounted in the lower console in the general line of sight, while facing forward. The indicating system shall include multiple overspeed (underspeed) settings. Overspeed shall be set for 82 MPH and underspeed set for 3 MPH.

15.5.2 An event recorder shall be installed to record operating parameters of the car to interface with the PTC event recorder. The event recorder shall be fully compliant with 49 CFR Part 229.135. [VRES V-15-01] VRE will provide its event recorder system kit. The Contractor shall be responsible for all ancillary equipment and materials needed to complete the installation of the event recorder system. Contractor will be responsible for the successful completion of the on-board diagnostic testing prior to delivery to VRE. The Contractor shall work with VRE to determine the best locations for event recorder equipment and submit a final design for review and approval by VRE. [VRES V-15-01]

The following parameters, at a minimum, shall be measured:

<table>
<thead>
<tr>
<th>CHANNEL</th>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digital</td>
<td>BCP &lt; 15 PSI</td>
</tr>
<tr>
<td>2</td>
<td>Digital</td>
<td>Manual Reset</td>
</tr>
<tr>
<td>3</td>
<td>Digital</td>
<td>Equalizing Reservoir</td>
</tr>
<tr>
<td>4</td>
<td>Digital</td>
<td>Not used</td>
</tr>
<tr>
<td>5</td>
<td>Digital</td>
<td>Bell</td>
</tr>
<tr>
<td>6</td>
<td>Digital</td>
<td>Horn</td>
</tr>
<tr>
<td>7</td>
<td>Digital</td>
<td>Self Test</td>
</tr>
<tr>
<td>8</td>
<td>Digital</td>
<td>Override Switch</td>
</tr>
<tr>
<td>9</td>
<td>Digital</td>
<td>Radio</td>
</tr>
</tbody>
</table>
15.5.3 The event recorder shall include an alerter system which monitors the action of the operator. If the alerter is not reset, a visual and an audible warning shall be made on the systems alarm panel (flashing visual light and increasing level of audible alarm). After the initial allowance time of 20 seconds upon system activation, the reset time shall inversely relate to speed. The alerter penalty application shall be capable of reset with a “running release”. The details of the alerter system shall be submitted to Metra for review and approval. [CDRL C-15-03]

The alerter shall be reset through the following operator's actions:

15.5.3.1 Throttle Change
15.5.3.2 Horn Use
15.5.3.3 Change in Direction of Travel
15.5.3.4 Independent Brake Application
15.5.3.5 Automatic Brake Application or release (more than 5 psi)
15.5.3.6 Alerter Reset Button
15.5.3.7 Bell Use
15.5.3.8 Change of State of the Headlight Switch

15.5.3.9 Radio Use

A dedicated cutout function, with seal, shall be provided in a visually accessible location to cutout the alerter magnet valve in case of failure.

Alerter reset intervals shall be speed dependent; as locomotive speed increases, the alerter must be acknowledged more frequently. Per 49 CFR Part 229.140, alerter warning timing cycle interval shall be within 10 seconds of the calculated setting utilizing the formula (timing cycle specified in seconds = 2400 ÷ track speed specified in miles per hour). For locomotives operating at speeds below 20 mph, the interval shall be between 110 seconds and 130 seconds.

The reset timing shall be as follows:

<table>
<thead>
<tr>
<th>SPEED (MPH)</th>
<th>TIME (SEC.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5-1.9</td>
<td>120</td>
</tr>
<tr>
<td>2.0</td>
<td>120</td>
</tr>
<tr>
<td>10</td>
<td>120</td>
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<td>20</td>
<td>120</td>
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<td>70</td>
<td>35</td>
</tr>
<tr>
<td>80</td>
<td>30</td>
</tr>
</tbody>
</table>

15.5.4 The event recorder shall provide, through solid state relays, control for the following ditch light operating modes:

1. Continuous
2. Flashing
3. Flashing after horn/bell.

15.6 CAB SIGNAL SYSTEM

15.6.1 A microprocessor based cab signal and speed control system shall be provided. In addition an intermittent inductive train stop system shall also be provided. Details of the design, installation and arrangement of the cab signal system shall be submitted to Metra for review and approval. [CDRL C-15-04] The arrangement shall provide for complete operation of the following systems:

1. Four aspect cab signal system, using 0-75-120-180 codes, as operated on the BNSF RR between Chicago, IL and Aurora, IL.
2. Four aspect cab signal system, using 0-75-120-180 codes, as operated on Metra's Rock Island District between Chicago, IL and Joliet, IL.
3. Two aspect non-coded cab signal and automatic train control system, as operated on the UP RR between Chicago, IL and Elburn, IL.
4. Intermittent inductive train stop system as operated on the UP RR between Chicago, IL. and Harvard, IL, and between Chicago, IL and Kenosha, WI.

15.6.2 An aspect display similar to the display on Metra 8500 and 8600 series cab cars and incorporating a white motion light shall be installed behind the head light housing. Final location shall require Metra approval. The display shall provide the connections for the event recorder inputs.
15.6.3 An audible warning device to indicate an overspeed condition due to a change in aspect shall be provided.

15.6.4 Penalty brake application system and the necessary equipment to suppress a penalty application by acknowledging and/or service brake application, within a time period shall be included for the signal systems operated on the UPRR.

15.6.5 Speed signal to the cab signal system shall come from the speed indicator's axle generator through an isolation amplifier.

15.6.6 Power for the operation of these systems shall come from the low voltage power source through a continuous duty solid state converter. The converter shall be used exclusively for the cab signal system.

15.6.7 A cab signal/train stop mode selector switch incorporating seven pin tumbler type cylinder lock shall be provided. Two keys are to be provided per cab car, one attached by a chain to storage box adjacent to the selector switch, the other shipped loose to Metra. All cars are to be keyed alike.

15.7 POSITIVE TRAIN CONTROL
Metra will provide its Wabtec I-ETMS Positive Train Control System kit, with Graham White PTC Air Brake Interface Module, data radio, antennas and filters. The Contractor shall be responsible for all ancillary equipment and materials needed to complete the installation of the PTC system. Contractor will be responsible for the successful completion of the on-board diagnostic testing prior to delivery to Metra. The Contractor shall work with Metra to determine the best locations for PTC equipment and submit a final design for review and approval by Metra. [CDRL C-15-05] [VRES D V-15-02] VRE will provide its Wabtec PTC-IETMS Positive Train Control System kit, with Graham White PTC Air Brake Interface Module, data radio, antennas and filters. The Contractor shall be responsible for all ancillary equipment and materials needed to complete the installation of the PTC system. Contractor will be responsible for the successful completion of the on-board diagnostic testing prior to delivery to VRE. The Contractor shall work with VRE to determine the best locations for PTC equipment and submit a final design for review and approval by VRE. [VRES D V-15-02]

15.8 CAB DIGITAL VIDEO RECORDING SYSTEM
[VRES D V-15-03] VRE will provide its cab digital video recording system kit. The Contractor shall be responsible for all ancillary equipment and materials needed to complete the installation of the cab digital video recording system. Contractor will be responsible for the successful completion of the on-board diagnostic testing prior to delivery to VRE. The Contractor shall work with VRE to determine the best locations for cab digital video recording system equipment and submit a final design for review and approval by VRE. [VRES D V-15-03]

15.8.1 The Contractor shall propose a new CDVRS system. The Contractor will provide its Cab Digital Video Recording System kit, with LDVR, microphones and cameras. The Contractor shall be responsible for all ancillary equipment and materials needed to complete the installation of the CDVRS. Contractor shall be responsible for the successful completion of the on-board diagnostic testing prior to delivery to Metra. The Contractor shall work with Metra to determine the best locations for CDVRS equipment and submit a final design for review and approval by Metra. [CDRL C-15-06]
15.8.2 The CDVRS shall be composed of one central recorder, dual forward-facing cameras, two rearward-facing cameras, one on engineer’s side and one on fireman’s side, at a minimum two inward facing cab camera(s), two exterior mounted microphones, one cab mounted microphone and all applicable interconnections with an option for a fatigue recognition system [COPL CO-15-01]. The CDVRS system shall be powered from a separate low voltage circuit breaker (on the breaker panel). A terminal board panel will be applied in a dry location near the central recorder for all CDVRS (power and signal) connections to be made. The design and arrangement of the CDVRS shall be approved by Metra prior to build of the first cab car.

15.8.3 The DVR recorder shall be a digital Internet Protocol (IP) based system and support digital IP cameras. The recorder shall have no less than 8 IP video channel inputs. The recorder shall have no less than 3 audio channel inputs. The DVR recorder video channels shall be used to capture and record video from multiple connected cameras simultaneously. The recorder audio channels shall be used to capture and record bell sounds, horn sounds, and have the ability to record cab compartment audio from multiple connected microphones simultaneously. The recorder shall feature video motion detection to trigger recording. The DVR recorder shall have the storage capacity to record at least 12-hour continuous recording capability per 49 U.S.C 20168(b)(1) and the recordings must accessible for review during an accident or incident investigation per 49 U.S.C 20168(b)(3). The DVR recorder shall have Wi-Fi capabilities for ease of downloading in the case of accident or incidents when the DVR cannot be safely accessed in the rolling stock. The DVR recorder shall have crash and fire protections for any in-cab image recordings that are stored in the cab car operating compartment per 49 U.S.C 20168(b)(2).

The video motion detection sensitivity shall be adjustable, customizable, and shall be capable of being enabled or disabled by Metra. The recorder shall have an internal power converter with an input voltage range of 20VDC-90VDC.

15.8.4 The forward facing camera shall be capable of clearly recording railroad signal aspects in all types of weather, day, or nighttime conditions. The railroad signal aspects (colors) shall be clearly discernible during video playback. The camera shall be a high definition digital IP type camera. The camera shall be powered by Power over Ethernet (PoE). The forward facing camera shall feature a dual lens, one for wide view, and one for narrow view. The focal length of the wide lens shall be 6mm. The focal length of the narrow lens shall be 16mm. Alternative focal lengths may be considered. The camera shall be mounted inside the cab, on the engineer’s side dash-board in a Metra-approved enclosure. The camera shall be adjustable to allow for camera positioning.

15.8.5 The rear-facing camera shall be a high definition digital IP type camera. The camera shall be powered by PoE. The focal length shall be determined during the design review. The camera shall be mounted outside the cab near the wind deflector on the observer’s side in a weather-proof enclosure.

15.8.6 Two cameras shall be “inward facing” and used to record the cabin compartment of a cab car. Each inward facing camera shall be adjustable to allow for camera positioning. Each inward facing camera shall be a high definition digital IP type camera. Each inward facing camera shall be powered by PoE. The inward facing cameras shall be capable of recording black and white, as well as color. The settings shall be made accessible and adjustable to Metra. Each inward facing camera shall have 1 lens. Each inward facing camera shall have an adjustable lens. The camera lens focal length shall be set at 2.5mm. Each inward facing camera shall be housed in a compact vandal resistant enclosure. The inward facing cameras shall be suitable for indoor and
outdoor installations. The inward facing cameras shall be capable of recording in any weather, day, or nighttime conditions. Each inward facing camera shall include an Infrared illumination (IR) feature for night vision video capture capability.

15.8.7 The dedicated microphones will have a “quick-disconnect” threaded, environmental-rated circular connector. The contractor will use the appropriate mating connector as well as non-metallic flexible ½” conduit, ½” NPT connectors and UNEF circular connector adaptor for the final two (2) feet of conduit connection to each microphone. Each dedicated microphone shall be rated for exterior outdoor use.

One dedicated microphone will be mounted within three (3) feet of the bell. A new rigid metal ½” conduit will be run from the recorder location to the location of the microphone. The second dedicated microphone will be mounted on the roof within three (3) feet of the air-horn. A new rigid metal ½” conduit will run from the recorder location to the location of the microphone. The roof microphone and associated conduit will not interfere with any removable roof panels.

A third microphone will be mounted in the cab and shall be capable of recording cab compartment audio.

15.9 CONTROL CONSOLE AND CONTROL ARRANGEMENT

15.9.1 A desk top console and a console above the windshield shall be provided. The consoles shall be of steel construction with a matte finish. The Car Contractor may propose alternative materials, which are subject to approval. The console shall be readily removable to permit access to mounted components, wiring and piping. The console shall not loosen during normal operations, move, or creep. No recesses, crevices or joints, which shall permit the incursion or accumulation of dirt, dust, or liquids, shall be permitted.

It is desired that the console surface shall be of one-piece construction. As an alternative, the console may have separately removable inserts to contain and enclose the various controls and indications.

The console shall not interfere with the Engineer’s vision in any direction, nor with replacement of or maintenance to the windshield or other appurtenances. It shall provide a clear view of all indications and ease of reach and manipulation of all controls and switches.

15.9.2 Controls:

15.9.2.1 Controller, with single throttle handle;
15.9.2.2 Reverser, with removal handle (integral with the controller);
15.9.2.3 Brake valve with automatic & park brake handles;
15.9.2.4 Sand operating push button;
15.9.2.5 Bell operating valve;
15.9.2.6 Horn Operating valve;
15.9.2.7 Alerter reset switch;
15.9.2.8 Headlight/ditch light control switch;
15.9.2.9 Ditch light selector switch;
15.9.2.10 Signal (Mars) light selector switch;
15.9.2.11 PA/IC control panel;
15.9.2.12 Cab signal cutout switch;
15.9.2.13 Lift over-ride switch;
15.9.2.14 Desk light switch;
15.9.2.15 Radio Control Head;
15.9.2.16 Attendant Call Switch;
15.9.2.17  Engine RUN/STOP Switch:
15.9.2.18  Gage Light Switch;
15.9.2.19  Gage Light Dimmer Switch;
15.9.2.20  Engine Run Switch;
15.9.2.21  Generator Field Switch:
15.9.2.22  Control & Fuel Pump Switch;
15.9.2.23  Defroster Switch.
15.9.2.24  Cab Signal Selector Switch;
15.9.2.25  Cab Signal On-Board Test Unit;
15.9.2.26  Rear Warning Light Switch;
15.9.2.27  Door Mode Indicator Switch;
15.9.2.28  Cab Signal System Switch;
15.9.2.29  Video System Switch;
15.9.2.30  Door Mode Indicator Circuit Breaker;
15.9.2.31  Speed Indicator System Circuit Breaker;
15.9.2.32  Cab Signal System Circuit Breaker;
15.9.2.33  Train Radio Circuit Breaker;
15.9.2.34  Video System Circuit Breaker;
15.9.2.35  Train Control reset push button;
15.9.2.36  Train Control acknowledge push button

15.9.3  Indicators:
15.9.3.1  Speed indicator;
15.9.3.2  Air Gages;
15.9.3.3  Ground Relay light;
15.9.3.4  PCS Open light;
15.9.3.5  Wheel Slip light;
15.9.3.6  Door Closed light;
15.9.3.7  Lift Deployed light;
15.9.3.8  Lift Override light.
15.9.3.9  PTC Display
15.9.3.10 Rear View Monitor;
15.9.3.11 Crew Alertness Display;
15.9.3.12 No Battery Charge Tri-Color (G-Y-R) Light;

All indicator lights shall be of the "push to test" variety and shall be shielded from sunlight to greatest extent possible.

15.10  BUZZERS

15.10.1  An approved high tone buzzer shall be furnished in the control console to convey the following warnings:
15.10.1.1  Low propulsion engine oil;
15.10.1.2  Hot propulsion engine;
15.10.1.3  Low engine water;
15.10.1.4  No battery charge (locomotive);
15.10.1.5  Ground relay tripped;
15.10.1.6  Attendant's call;
15.10.1.7  Main generator fault relay tripped;
15.10.1.8  Head end power fault relay tripped (alarm sounds for six seconds only).
15.10.2 An override circuit shall be provided to allow the engineer to silence a continuous warning.

15.11 MISCELLANEOUS CAB EQUIPMENT

Equipment to be provided as follows:

15.11.1 Two (2) sun visors (one on each windshield) shall be provided. Each visor shall have 3 leafs hinged together. The lower leaf shall be transparent with an approved tint.

15.11.2 An electrostatic chest type cooler for bottled water shall be mounted in the control station within reach of the engineer’s position. Water cooler shall be equipped with a drain to the outside of the car. The water cooler shall be powered by a 120 VAC.

15.11.3 Two (2) single cup holders integral to the raised area over the lower level aisle shall be provided, one on the operator’s side and one on the observer’s side.

15.11.4 Two (2) sun visors (one over each sliding sash) shall be provided.

15.11.5 Two spring-clip holders with a writing pad shall be desk mounted; one on the operator’s console and one on the observer’s desk.

15.11.6 One (1) stainless steel enclosure with keyed lock for the storage of reverser handles.

15.11.7 A total of two (2) cab card holders shall be provided in the cab. A 9 inch x 12 inch card holder, and a 3-slot holder shall be applied in an approved location on the operator’s side cab door.

15.11.8 A waste container, capable of holding a plastic liner, shall be provided in the cab behind the operator.

15.11.9 One (1) paper towel holder shall be provided in the cab.

15.11.10 One dry chemical type fire extinguisher shall be applied in an approved location.

15.11.11 One Emergency Response Book Holder per Metra Drawing M-524 shall be provided on the back wall of the cab.

15.12 HORN

15.12.1 A chime horn shall be provided. The horn shall be mounted over the observer’s side, such that the horn fits within the clearance limits described in Section 3.0 of these Specifications. A three (3) chime horn shall be used. The horn shall be removable from a flange. A horn heating system shall be provided. At a minimum, the center chime must be heated. The heating system for the horn assembly shall be subject to Metra review and approval. [CDRL C-15-07] The portion of the horn that protrudes over the roof line shall be protected by a stainless steel guard.

15.12.2 The horn shall be pneumatically activated by two (2) valves, one on the engineer’s console and one on the observer’s desk.
15.12.3 The horn on all cab cars shall be tested in accordance to and comply with FRA regulation 49 CFR Part 229.129. All test reports must be submitted to Metra.

15.13 EXTERIOR BELL

15.13.1 One electric bell shall be provided, mounted under the floor as high as possible, under the "B" end of the car. The bell type and the installation location of the bell shall be subject to Metra review and approval. [CDRL C-15-08]

15.13.2 The bell shall be operated by two (2) operating switches, one switch located on each side of the cab. Controls shall be arranged so that the bell operated manually at any time or actuated by horn operation. If the horn is blown from the operator's side, the bell must be manually shutoff on the operator's side. If the horn is blown from the observer's side, the bell must be manually shutoff on the observer's side.

15.14 WINDSHIELD WIPERS

15.14.1 One (1) pneumatically or electrically operated windshield wiper system (motor and arm assembly) shall be located at each window in front of the control station. An electric windshield wiper system is the Metra preferred option. The windshield wiper system proposed shall be subject to Metra review and approval. [CDRL C-15-09] If pneumatic, noise from the motor's exhaust shall be reduced in an approved manner. The wipers shall operate satisfactorily at speeds up to 100 mph in a thirty-five (35) mph opposing head wind. The wipers shall have a parallel motion covering the full width of the glass and utilizing the largest blade that can be accommodated. Each wiper assembly should contain a lever that allows manual operation of wiper by operator in cab in the event of a pneumatic or electric failure.

15.14.2 A windshield wiper control switch or valve, depending on the system proposed, shall be provided in the operator's console and on the observer's work desk. The operator shall have the ability to control both the engineer's side and fireman's side wiper assemblies. The wiper operating mechanisms shall be easily accessible, and the controls located in the operating compartment. The mechanism shall provide for variable speed and for a "park" position. The park position shall be approved by Metra. The wiper shall return to the park position each time the wiper system is turned off regardless of the position of the wiper blade.

15.15 REAR VIEW MIRRORS

A rear view mirror shall be provided at the front of the sliding sash cab windows on each side of the cab control car.

15.16 PILOT

At the lead end of cab control cars, a body mounted, high profile, snow plow type pilot of Metra approved design, shall be provided. [CDRL C-15-10] The pilot shall be securely attached to the car structure and shall be adjustable for height. The design of the pilot shall accommodate and afford maximum protection for the cab signal receivers and TRAINLINE junction boxes.

15.17 CONTRACT DELIVERABLES REQUIREMENT LIST

<table>
<thead>
<tr>
<th>CDRL</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>C-15-01</td>
<td>Locomotive Control – Design and Arrangement of Cab Car</td>
</tr>
<tr>
<td>C-15-02</td>
<td>Cab Seating</td>
</tr>
</tbody>
</table>

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C-15-03   Alerter Operation
C-15-04   Cab Signal System
C-15-05   PTC Installation
C-15-06   Cab Digital Video Recording System
C-15-07   Horn Heating System
C-15-08   Electric Bell
C-15-09   Windshield Wiper System
C-15-10   Pilot Design
16 PAINTING, SIGNAGE, AND EXTERIOR

The decorative treatment (interior and exterior) of all cars shall be agreed upon between Contractor and Metra. A signage plan shall be submitted to Metra for review and approval. [CDRL C-16-01]

Edge sealer shall be used on all exterior vinyl decals.

16.1 INTERIOR

16.1.1 If the roof, sides, ends, and floor are constructed of stainless steel shall be unpainted. Parts under the floor or attached to the car which are constructed of metal other than stainless steel, such as underfloor equipment and trucks (except for wheel treads, axles, rubber parts, etc.), shall receive one (1) coat of primer and one (1) color coat of light bodied paint to a dry film thickness of three (3) mils. The end underframe assemblies shall receive one (1) coat of primer on both the inside and outside surfaces. Where one of the above items requiring paint is furnished by a vendor, a coat of primer shall be applied at the vendor's plant and the color coat shall be applied by the Contractor. Exterior paint shall be supplied and applied to commercial acceptable standards. All paint and primer used shall be lead free.

16.1.2 Metra's standard 12' x 2' letter boards shall be applied in an approved location, adequately sealed and secured with reasonably theft proof fasteners. The letter board shall be stainless steel covered blue film. A white Metra logo (15" over the "M") per drawing M-271 shall be applied in an approved location. [VRESD V-16-01] Virginia Railway Express standard letter boards shall be applied in an approved location and secured with reasonably theft proof fasteners. Flag banners shall be applied in an approved location [VRESD V-16-01]

16.1.3 The car number shall be applied to in an approved location to exterior side of car. All numbers shall be ten (10) inches high, black vinyl film. The style of the numerals shall be as agreed between Contractor and Metra.

16.1.4 A black eight inch RTA logo per drawing M-272 shall be applied to an approved location of the car exterior. [VRESD V-16-02] Not required on VRE cars [VRESD V-16-02]

16.1.5 A stainless steel sign with the car number, 2" high, sand etched and painted black shall be provided on each body end door, both inside and outside, located immediately below the window.

16.1.6 All cars shall be provided with two "Owner Plates" per Metra drawing M-318. The plates shall be located to the left of each side entrance doorway when facing car from the exterior, on the skirting.

16.1.7 The water filling boxes located under the floor shall be marked by use of vinyl signs located on the side sill adjacent to the box or valve location.

16.1.8 All valves on the underside of car shall be tagged with a stainless steel plate having depressed letters. The plates shall be securely fastened to a suitable bracket adjacent to the valve.

16.1.9 An instructional decal for emergency door operation per APTA and FRA requirements shall be applied on the exterior of the car where applicable.
An instructional decal for removing windows in an emergency per APTA and FRA requirements shall be applied on the car body below each emergency ingress/egress window equipped with a pull grip on filler strip.

A decal with the words "Step Down Ahead" per drawing M-551 shall be applied on each end door adjacent to the window.

A decal with the words "Door Opens Quickly" per drawing M-359 shall be applied on each exterior lift switch cover.

A black letter "F" per drawing M-286 shall appear in an approved location on lower deadlight or side sill, directly under the side cab windows of cab control cars, visible to a person on the ground. It shall be applied to resist peeling in the normal operating environment.

The B-end of cab control cars shall receive alternate red and white 12 inch wide reflective striping arranged in 45 degree diagonal pattern. The B-end of cab control cars shall receive alternate black and orange 12 inch wide reflective striping arranged in a 45 degree diagonal pattern.

All decorative interior surfaces shall not require painting except where an approved application of interior finish material requires painting, as the application dictates. The material shall be primed and finished with two coats of approved synthetic enamel to commercially acceptable standards. On all cars, carbon steel parts located in the electric lockers shall be galvanized or prime painted prior to installation.

Electrical lockers shall be finished inside with a top coat of white insulating paint. The edges of grille cutouts and hardware located on the inside surfaces of the locker doors shall be painted with aluminum colored synthetic enamel.

Two (2) Contractor's nameplates may be provided in the car. These shall be located above the passenger side entrance openings in an approved location.

The car number shall be applied in an approved manner, using two (2) inch high numbers near the car Contractor's plate, over each set of side entrance doors inside the car.

Aluminum plates painted black with engraved white lettering shall be provided at the switchboard and panels to designate the switches, circuit breakers, relays, resistors, etc.

Interior of electric locker door shall contain stainless steel plate with car number, identity and class, date built and location of manufacture, etched and painted black. Inside of locker door shall be furnished with Yellow Card holders.

Four (4) stainless steel "No Smoking Please" signs, per drawing M-384 shall be provided in locations approved by Metra.

A stainless steel "Watch Your Step" sign shall be provided on the top riser of each section of each set of passenger entrance steps on both sides of the car. Letters shall be sand etched and painted black.
16.2.9 The cover of the emergency tool cases shall be labeled with appropriate access instructions. An “Illinois Law” decal, per drawing M-1186 shall be placed adjacent to each emergency tool case. **[VRESD V-16-04] The cover of the emergency tool cases shall be labeled with appropriate access instructions, shall be placed adjacent to each emergency tool case. [VRESD V-16-04]**

16.2.10 “Watch Your Step” signs with black letters on yellow vinyl film per drawing M-281 shall be applied to the stairway walls.

16.2.11 A “Priority Seating” decals per drawing M-1681 and M-1682 shall be provided in an approved location on each side of the car at the ADA positions.

16.2.12 Electric Locker Doors shall be labeled “Danger 480-Volts” vinyl decal per drawing M-282.

16.2.13 A decal with the words “Emergency Exit” per drawing M-310 shall be provided at each emergency window per APTA & FRA requirements.

16.2.14 The following decals of photo luminescent material complying with FRA requirements and APTA standards shall be provided:

16.2.14.1 Exit, per drawing M-1145 above each end door;

16.2.14.2 Emergency sash operating instructions on each emergency sash, braille sign shall be applied in addition;

16.2.14.3 Pictorial emergency sash operating instructions adjacent to each emergency sash;

16.2.14.4 Instruction for opening side entrance door in an emergency. Braille sign shall be applied in addition to.

16.2.15 One (1) “Emergency Brake Valve” decal and one (1) “Danger Do Not Touch” decal, shall be applied adjacent to each B-3-B valve.

16.2.16 Two (2) emergency exit placards shall be applied. Placard graphics and location are subject to Metra's approval.

16.2.17 Two (2) International Handicap Symbol Decals shall be applied where applicable.

16.2.18 The following items shall be labeled with an approved vinyl decal:

16.2.18.1 Overhead Heaters;

16.2.18.2 Air Filters;

16.2.18.3 Electrical Lockers (labeled with designation only).

16.2.19 “Please Keep Feet on Floor” decals per drawing M-307 or approved equal shall be placed where applicable.

16.2.20 “WARNING” decals, per drawing M-537 or approved equal shall be applied where applicable.

16.2.21 A “Caution Please Do Not Lean On The Doors” decal, per drawing M-532 shall applied to the inside surface of each side loading door leaf, just below the door window.
16.2.22 Low-Location Exit Path Marking (LLEPM), complying with APTA-SS-PS-004-99 shall be provided using High Performance Photo Luminescent Material. End doors, passenger compartment doors and entrance doors shall be marked in accordance with Sections 6.2 and 6.3 of APTA Standard SS-PS-004-99. The entire arrangement shall be subject to Metra’s approval.

16.2.23 On cab control cars, all controls and indicators shall be labeled in an approved manner.

16.2.24 On cab control cars, a stainless steel nameplate with the wording "Emergency Brake Valve", etched and painted red, shall be provided adjacent to the emergency brake valve on the observer's side of the control station.

16.2.25 A stainless steel sign with the car number, 2" high, sand etched and painted black, shall be provided in an approved location in the cab.

16.2.26 A "Please Do Not Put Personal Belongings In Front Of Door" sign, per drawing M-225 shall be applied in an approved manner to passenger compartment side of each cab door and end doors.

16.2.27 A "Lavatory" sign, per drawing, M-397, shall be applied to the toilet room door in an approved manner.

16.2.28 A digital display sign shall be used on the exterior of the car body to display the “Metra” logo and other advertisements. Display shall be easily programmable and link to the cars GPS, passenger counting, and infotainment system. [COPL CO-16-01]

16.3 CONTRACT DELIVERABLES REQUIREMENT LIST

<table>
<thead>
<tr>
<th>CDRL</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>C-16-01</td>
<td>Signage Plan</td>
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</table>

16.4 CONTRACT OPTIONAL PROPOSAL LIST

<table>
<thead>
<tr>
<th>COPL</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-16-01</td>
<td>Exterior Digital Display Sign</td>
</tr>
</tbody>
</table>
17 ENVIRONMENTAL EFFECTS

17.1 GENERAL REQUIREMENTS
The Contractor shall ensure that the railcar and its equipment are designed and built so that the noise criteria outlined in this section of the specifications are not exceeded. Methods shall be incorporated into the car design to attenuate equipment noise which does not meet the noise level limitations indicated.

Unless otherwise stated, noise herein shall mean a sound pressure level as defined in the latest revision to American National Standards Institute (ANSI) S1.4 for General Purpose Sound Level Meters. All noise levels listed are in decibels referred to 0.0002 microbar as measured on the "A" scale of a standard sound level meter, abbreviated "dbA" respectively. Unless otherwise specified, the "slow" meter scale shall be used.

Noise criteria specified are based on measurements taken in essentially a free field environment, as per the U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C., Railroad Noise Emission Standards, Title 40, Part 201, Subpart C, entitled "Measurement Criteria". The free field environment, such as outdoors, will be away from any reflective surfaces other than ballast and tie track bed and the adjacent ground. The subject cars shall comply with any FRA noise criteria which may be in effect at the time of construction.

For tests and measurements, the Contractor shall use a sound level meter which complies with the requirements of the latest revision of ANSI S1.4, Specifications for General Sound Level Meters.

17.2 AUDIBLE NOISE REQUIREMENTS
The Contractor shall verify to Metra that all cars built to the specification set forth herein, meet the requirements for noise abatement of this section. Sound insulation should be a continuous improvement task in the design of new vehicles.

An audible noise proposal shall include estimated noise levels at a location one (1) foot away from any car body surface, while the car is parked, without any passengers on board, and all systems operating (including the air conditioning system at maximum capacity) and estimated interior noise levels at a location one (1) foot away from any car body surface, excluding the return air grill, while the car is operating at 65 MPH without any passengers on board, and all systems operating (including the air conditioning system at maximum capacity). In addition, Proposal shall include documentation demonstrating the ability to have designed and built passenger Cars with low interior noise levels (and improvements over specified maximums).

The subject cars shall comply with any FRA noise criteria which may be in effect at the time of construction, including, but not limited to, 49 CFR 210 and 49 CFR 229.

Builder shall develop and submit for Metra’s approval, the procedures for conducting this test.

Verification exterior sound level measurements shall be taken at one hundred (100) feet perpendicular to the longitudinal centerline of the car, on both sides of the car, at a point five (5) feet above top of rail, while the car is parked, with all systems operating (including the air conditioning system at maximum capacity). The noise levels shall not exceed 70 dbA.

Interior noise levels shall not exceed 65 dbA at a minimum at a location one (1) foot away from any car body surface, while the car is parked, without any passengers on board, and all systems operating (including the air conditioning system at maximum capacity). Metra would prefer that that noise levels inside the compartment not exceed 60dBa in a steady and/or
steady but intermittent sound level classification and a preference that noise levels not exceed 70dBA in a time varying and impulsive sound classification.

17.2.3 Below is an example of sound classifications and operational activities:
17.2.3.1 Steady sound levels (such as from onboard HVAC equipment).
17.2.3.2 Steady, but intermittent sound levels (such as from consist locomotive).
17.2.3.3 Time varying sound (such as trains passing on an adjacent track, wheel squeal through curved track, movement over switches, frogs and at grade crossings).
17.2.3.4 Impulsive sound signals (such as consist stopping, starting and coupling).

17.2.4 Interior noise levels shall not exceed 70 dbA at a location one (1) foot away from any car body surface, excluding the return air grill, while the car is operating at 65 MPH without any passengers on board, and all systems operating (including air conditioning system at maximum capacity).

17.2.5 The passenger boarding/alighting area is to be included as part of the car interior for audible noise criteria. The noise level for the passenger boarding/alighting area (with the car standing and all systems operating) shall not exceed 75 dbA.

17.2.6 All equipment shall be designed to eliminate rattling and resonance at all speeds up to the maximum running speed by the use of damping, gaskets, resilient mounts or similar methods. Included in this requirement, but not limiting the generality thereof, are the following accessories:
17.2.6.1 Windows
17.2.6.2 Seats
17.2.6.3 Wiring
17.2.6.4 Ventilating Ducts
17.2.6.5 Doors
17.2.6.6 Parcel Racks
17.2.6.7 Light Fixtures
17.2.6.8 Stanchions
17.2.6.9 Partitions
17.2.6.10 Fire Extinguishers
17.2.6.11 Panels
17.2.6.12 Air Conditioning Units

17.3 PROPOSAL DELIVERABLES REQUIREMENT LIST

<table>
<thead>
<tr>
<th>PDRL</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>P-17-01</td>
<td>Audible Noise Proposal</td>
</tr>
</tbody>
</table>

17.4 CONTRACT DELIVERABLES REQUIREMENT LIST

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<tr>
<th>CDRL</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-17-01</td>
<td>Noise Level Test Procedure</td>
</tr>
</tbody>
</table>
18 MATERIALS AND WORKMANSHIP

18.1 GENERAL REQUIREMENTS

18.1.1 Workmanship and Quality shall conform to the best manufacturing practices in all respects. All work shall be performed by qualified personnel, using correct tooling and procedures, and be properly trained and skilled in the tasks they will be performing.

18.1.2 Surfaces exposed to passengers, crew, or maintainers shall be smooth and free of burrs, sharp edges or corners, and dangerous protrusions. The vehicle design shall avoid pinch points, tripping hazards, snagging points, water traps, and debris accumulation points.

18.1.3 Car body structural parts that are permanently covered and concealed after assembly shall not be made of copper, copper bearing aluminum alloys, brass, bronze, silver, or nickel.

18.1.4 Foreign matter, such as shavings, chips, etc., shall be completely removed from all parts of the vehicle, its components, assemblies and subassemblies, whether hidden or exposed.

18.1.5 Materials for the construction of the vehicle shall be in accord with the stated specification or cited standard, unless the Contractor obtains Metra’s approval for a substitution in writing. Alternate standards may be proposed, but must be supplied in English, with a narrative comparing both standards, and citing justification why the substitution is equivalent.

18.1.6 All materials shall perform safely and satisfactorily within their operating environment and in accordance with their intended function.

18.1.7 Whenever a commercial material is not covered by a specification or standard, the Contractor shall identify the material by the commercial trademark, name, and address of the supplier. The Contractor shall submit a description, and the technical data specifications, of the material composition for approval. The Contractor shall maintain records that trace all materials to their manufacturers, and shall verify compliance with quality standards specified or cited in these Provisions.

18.1.8 Single-source materials shall not be permitted unless approved by Metra. Approval shall be determined on a case-by-case basis. Specification equivalency and benefit data for any substitution to a cited standard shall be submitted to Metra for review and approval.

18.1.9 The following materials shall not be used in the construction of the vehicle:

| 18.1.9.1 | PVC |
| 18.1.9.2 | Asbestos |
| 18.1.9.3 | Cadmium (except for battery) |
| 18.1.9.4 | Lead (except for lead solder on the printed circuit boards) |
| 18.1.9.5 | PCBs |
| 18.1.9.6 | Carcinogenic materials as listed by current Publication of American Conference of Governmental Industrial Hygienists (ACGIH) |
| 18.1.9.7 | Materials listed in 29 CFR 1910.19 |
| 18.1.9.8 | All CFC and HCFC compounds except R-22 and R134a |
| 18.1.9.9 | Urethane Foam |
18.1.9.10 Chlorinated fluorocarbons that may cause environmental problems or handling hazards
18.1.9.11 Materials that, in their normal installed state, emit products that are known to be toxic or irritants
18.1.9.12 Materials that, in their normal installed state, emit products that are known to be toxic or irritative
18.1.9.13 Beryllium
18.1.9.14 In addition, Metra does not accept other restricted materials (restricted due to safety, environmental, and/or regulatory reasons) as well as materials that require stringent Personal protective equipment (PPE) such as face protection, special cloths during handling, removal and/or application by Metra. On a limited and case by case basis, Metra may approve the use of such material and in these cases the Contractor shall be required to submit a waiver in writing to Metra for approval prior to any use of such material. The Contractor’s waiver request shall include the justification(s) for using the material, total weight of the material, location(s) and distribution on the vehicles, material safety and data sheets, and current test reports. In addition, the Contractor shall submit a letter from an independent material safety professional indicating their review of the Contractor’s waiver request and their professional conclusions regarding the request and the safety, environmental and regulatory implications involved for Metra throughout the life of the vehicles.

18.1.10 The Contractor shall keep on file Safety Data Sheets (SDS) for all chemical materials (paints, solvents, adhesives, caulking, etc) used in the manufacture of the vehicle, and provide SDS information as requested by Metra for any additional material in question. A copy of each SDS shall be submitted to Metra for review and approval.

18.1.11 All materials utilized in the construction of the vehicle shall be subject to the approval of Metra. The Contractor shall keep a running list of all materials used in the vehicle in matrix format (matrix shall contain; material name, specification or material ID number, application, approval status, correspondence number, etc.). The Contractor shall submit this matrix along with material certifications and material property test reports to Metra for review. [CDRL C-18-01]

18.1.12 The Contractor shall submit for approval joining and fastening data, specifications, and standards for all types and methods of fastening and joining used.

18.1.13 All name and rating plates shall be permanently attached using mechanical fasteners. Exceptions may be made for small components and circuit boards.

18.1.14 All materials shall be new and of recent manufacture. Material, which is found to be defective and subsequently repaired, cannot be used unless specific approval is granted by Metra.

18.1.15 All materials used shall be inherently corrosion resistant, or be suitably finished with a corrosion resistant finish to minimize corrosion and degradation of appearance or function.

18.1.16 Materials that require overhaul/reconditioning periodically shall be available in the United States and overhaul/reconditioning shall be performed in the United States. All repair for major electric/electronic equipment shall be completed within one (1) months.

18.2 STORAGE OF MATERIAL

Date: 05/21/19  Document No. M-18-011  Page: 102 of 160  Prepared By: S. Cronin  Revision: B  Approved By: [Signature]
18.2.1 All stored material subject to corrosion shall be adequately protected by waterproof covers, coatings, or packaging to prevent damage.

18.2.2 Equipment covers, cable entrances, and openings shall be suitably closed to prevent ingress of water or dirt.

18.2.3 All dated material shall have the expiration date clearly marked. Expired material shall not be used.

18.2.4 Material or components, which require maintenance during storage, shall be properly maintained per the component(s) manufacturer’s instructions. The Contractor shall document such maintenance, and provide these records as requested by Metra. [CDRL C-18-02]

18.2.5 Rejected or damaged material shall be clearly marked, dispositioned, and stored separately from all other material.

18.3 STAINLESS STEEL
When used, types and grades of stainless steel shall be stated in all drawings. Material certifications and test reports including chemical analysis, physical properties shall be submitted to Metra. [CDRL C-18-03]

18.3.1 Certified copies of test reports covering each coil of steel to be used shall be submitted to Metra by the Contractor. Each test report shall list chemical analysis, physical properties, weight, mill coil number, invoice number, date and mill order number of each coil. For sheet stock, a ladle analysis and single physical property test on each heat and each size shall be made and shall be submitted. [CDRL C-18-04] All austenitic stainless steel shall be free from precipitated carbides, and all stainless steel shall be free from scale.

18.3.2 General requirements for stainless steel are:
18.3.2.1 Gauge tolerance (standard for industry);
18.3.2.2 Color and finish (must match samples);
18.3.2.3 Flatness - coil stock (standard mill flatness);
18.3.2.4 Flatness - sheet stock (stretcher level quality);
18.3.2.5 Camber (standard for industry).

18.3.3 Buffing and polishing of stainless steel, if required, shall be done without any use of composition containing iron or iron oxide.

18.4 LOW ALLOY HIGH TENSILE STEEL
Low alloy, high tensile steel sheet shall be of the Cr-Si-Cu-Ni-P composition, corrosion resistant types, conforming to SMA570WQ per JIS G 3114 (Japanese Industrial Standard), ASTM Specification A656 Grade 80 or equivalent specification approved by Metra.

Types and grades of steel shall be stated in each drawings. Material certifications and test reports including chemical analysis, physical properties shall be submitted to Metra.

18.5 STEEL/STAINLESS STEEL CASTINGS (if used)
The contractor shall provide casting specifications/procedures, requirements, test requirements/methods and acceptable criteria including cast surface and machining surface if steel or stainless castings are used. Metra may add extra requirements.

18.5.1 Weld repairs of castings shall be allowed, provided that repairs are performed in accordance with an approved written procedure, and by welders qualified to ASTM A488. For stainless steel casting, provide written procedure and its justification.

18.6 ALUMINUM (if used)
When used types and grades of aluminum shall be stated in each drawing. Metra may request the material certification and test report including chemical analysis, physical properties. Aluminum forgings shall comply with ASTM B247 or Aluminum Association Standards for Aluminum Mill Products, alloy, and temper 6061-T6. Aluminum castings shall comply with ASTM B26, ASTM B85, ASTM B108, or Aluminum Association Standards for Aluminum Mill Products alloy and temper 356-T6, 364-T5, or 356-T6 respectively, and shall be free from blowholes, cracks, shrinkage, and other defects. Dissimilar materials such as aluminum and stainless steel may not contact directly. Bolts and nuts, screws or other fasteners used with aluminum alloys shall be aluminum alloy (not containing copper) or shall be well galvanized, unless otherwise approved.

18.7 ELASTOMERS
The Contractor shall submit test reports for all elastomers proposed. Glazing strips for side and end windows shall be molded or extruded Neoprene conforming to ASTM C-542, with ends vulcanized together to form one continuous piece. Elastomers must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

18.8 GLAZING MATERIALS
Glazing materials shall be proposed and approved by Metra. Window glazing facing to outside of the car shall meet 49 CFR 238 Part 223. The end door under/next to the cab control room if any, the end door shall meet 49 CFR 238 Part 223 large impact test with retention. All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

18.9 WOOD, PLYWOOD, PLYMETAL, COMPOSITE MATERIALS (if used)

18.9.1 Wood
Any pieces of wood entering into construction of cars shall be select grade, shall be thoroughly seasoned by air of kiln drying, and shall be dressed on all surfaces to dimensions.

18.9.2 Plywood
All plywood must be exterior "BB" grade, DFPA marked, 100% waterproof bond, formed from Group II wood species for inside finish panels, as described in the American Plywood Association, Specification PS 1-83 (or later revision). Except where used in the construction of plymetal panels, all plywood must be treated to resist decay and mold. Treatment materials must be nontoxic to man and non-corrosive to car body materials.

18.9.3 Metal Faced Plywood - Plymetal
The term plymetal refers to metal faced plywood (described above) which conforms to the last published revision of Bombardier Plymetal Specification SMP 209-D. Whenever the metal surface of a plymetal panel is faced Melamine, it shall be applied in accordance with Section 18.10 of these specifications.

Plymetal panels shall also meet the test criteria listed in Table 18-2 below:

<table>
<thead>
<tr>
<th>Minimum Metal to Wood Test</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Shear</td>
<td>250 lbf/in2 (1.72N/mm2) to 80% wood failure</td>
</tr>
<tr>
<td>Boil shear, 3 hrs boil, tested at 68°F</td>
<td>150 lbf/in2 (1.03N/mm2) to 80% wood failure</td>
</tr>
<tr>
<td>Wet shear, 48 hrs. soak, 68°F</td>
<td>150 lbf/in2 (1.03N/mm2) to 80% wood failure</td>
</tr>
<tr>
<td>Creep, under static load for 48 hrs, 68°F</td>
<td>250 lbf/in2 (1.72N/mm2) to 80% wood failure</td>
</tr>
</tbody>
</table>

All exposed edges of the panels, drilled holes, fastener heads, openings, or cutouts within the panels shall be waterproofed and sealed with an approved epoxy paint/coating as soon as possible after fabrication, and prior to installation. The overall flatness shall not exceed a maximum deviation of 0.015” per lineal foot, with a maximum of 0.125” deviation of any point on the panel measured from a reference plane taken from any three corners. The overall deviation of the panel thickness shall not exceed 0.031” (1/32”).

All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

18.9.4 Metal Faced Composite Materials

Metal faced composite materials shall perform ASTM C297 testing for bonding strength to avoid delamination. A minimum of 6 samples shall be tested each category. The metal faced panels shall meet the test criteria listed in Table 18-XX below:

<table>
<thead>
<tr>
<th>Minimum Metal to Composite Test</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry</td>
<td>250 lbf/in2 (1.72N/mm2)</td>
</tr>
<tr>
<td>Wet, 48 hrs. soak, 68°F</td>
<td>150 lbf/in2 (1.03N/mm2)</td>
</tr>
<tr>
<td>Creep, under static load for 48 hrs, 68°F</td>
<td>250 lbf/in2 (1.72N/mm2)</td>
</tr>
</tbody>
</table>

18.10 PLATICS (if used)

18.10.1 Thermoplastics

Thermoplastic sheet shall be homogeneous and extruded from virgin stock which does not include any regrinding of vacuum formed parts. Color pigments shall be UV stabilized. The color and surface finish of parts, manufactured from this material, shall be approved by Metra prior to a production run of parts. [CDRL 18-09] Finished parts shall be free of waves and quilting. Voids, lumps and contamination shall be no larger than 0.01 in with a maximum of one defect in a 4.0 ft2 area.

Thermoplastic materials shall comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification, and with the requirements listed in Table 18-3 below:
### Table 18-4

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Test Method</th>
<th>Performance Requirement Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td>ASTM D792</td>
<td>1.20 to 1.36</td>
</tr>
<tr>
<td>Hardness, Rockwell</td>
<td>ASTM D785</td>
<td>90 to 100, R-Scale</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D638</td>
<td>5,500 psi (38 MN/m²) minimum at 73°F (23°C)</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>ASTM D790</td>
<td>320,000 psi (2206 MN/ m²) minimum elasticity at 73°F (23°C)</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>ASTM D790</td>
<td>10,000 psi (68,947.6 kPa) minimum @ 73°F (23°C)</td>
</tr>
<tr>
<td>Impact Strength</td>
<td>ASTM D256</td>
<td>6.6 foot pounds per inch of notch minimum.</td>
</tr>
<tr>
<td>Heat Shrinkage</td>
<td>None</td>
<td>15% maximum, 10 minutes @ 380°F (193°C)</td>
</tr>
<tr>
<td>Thickness</td>
<td>None</td>
<td>3/32 inch (2.38 mm) minimum</td>
</tr>
</tbody>
</table>

Independent laboratory test certificates shall be provided stating that the thermoplastic sheet complies with the requirements of the following standards. [CDRL C-18-10]

#### 18.10.2 Fiberglass Reinforced Plastics

This material shall be laminated polymeric reinforced material. Resins shall be thermosetting, fire-resistant polyester. Fiberglass content by weight shall be 25% minimum unless otherwise specified. Parts may be produced by resin transfer molding or compression molding.

Exposed fiberglass surfaces shall have a smooth matte finish. Embossed surface will be permitted in order to assure that finished surfaces are resin rich to obtain uniform color without visible glass fibers.

All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

The Contractor shall submit for approval certificates verifying that reinforced plastic materials comply with the minimum requirements specified in Table 18-4 below. [CDRL C-18-11]

Pre-test conditioning of test specimens shall conform to ASTM D618.

### Table 18-5

<table>
<thead>
<tr>
<th>Mechanical Property</th>
<th>Test Method</th>
<th>Method #1</th>
<th>Method #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM D638</td>
<td>13,000 psi</td>
<td>18,000 psi</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>ASTM D695</td>
<td>22,000 psi</td>
<td>32,000 psi</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>ASTM D790</td>
<td>21,000 psi</td>
<td>28,000 psi</td>
</tr>
<tr>
<td>Impact</td>
<td>ASTM D256</td>
<td>10 ft-lbs/ in of notch</td>
<td>13 ft-lbs/ in of notch</td>
</tr>
<tr>
<td>Hardness</td>
<td>ASTM D2583</td>
<td>45 Barcol</td>
<td>45 Barcol</td>
</tr>
<tr>
<td>Heat</td>
<td>None</td>
<td>175°F Continuous</td>
<td>-</td>
</tr>
<tr>
<td>Thickness</td>
<td>None</td>
<td>0.125 in, minimum</td>
<td>0.125 in, minimum</td>
</tr>
<tr>
<td>Gelcoat Thickness</td>
<td>None</td>
<td>0.014” or 14 mils, ± 2 mils.</td>
<td>N/A</td>
</tr>
</tbody>
</table>

#### 18.10.3 Melamine

Melamine shall be laminated to aluminum sheets. The melamine impregnated, colored papers shall be directly molded to aluminum sheets at a temperature not less than 270 degrees F and at a pressure not less than 1,000 psi. The characteristics shall not be less than that required of general purpose type in NEMA Standard LD-3-2005 (or latest revision). Gloss finish melamine shall not be used unless otherwise approved, and melamine with a rough textured finish is likewise restricted.
All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification. The Contractor shall submit for approval certificates verifying that bond between the melamine and the aluminum complies with the minimum requirements specified in Table 18-5 below.

[CDRL C-18-12]

### Table 18-6

<table>
<thead>
<tr>
<th>Mechanical Property</th>
<th>Test Method</th>
<th>Performance Requirement Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM D638</td>
<td>with grain: 22,300 psi minimum cross grain: 20,300 psi minimum</td>
</tr>
<tr>
<td>Modulus of Elasticity</td>
<td>ASTM D790</td>
<td>with grain: 2.8 x 10^6 psi minimum cross grain: 3.1 x 10^6 psi minimum</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>ASTM D790</td>
<td>with grain: 15,000 psi minimum cross grain: 25,300 psi minimum</td>
</tr>
<tr>
<td>Internal Bond</td>
<td>ASTM D952</td>
<td>2,600 psi</td>
</tr>
</tbody>
</table>

Un-backed balanced melamine panels may be used in the car interior. The characteristics shall not be less than that required of general purpose type in NEMA Standard LD-3-2005 (or latest revision).

The bond between the melamine and the aluminum shall meet the following:

<table>
<thead>
<tr>
<th>Test Category</th>
<th>Test Method</th>
<th>Min. Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Bond</td>
<td>ASTM Test D952</td>
<td>2,600 pounds per square inch</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM Test Properties D638</td>
<td>22,300 lbs per square inch, with the grain</td>
</tr>
<tr>
<td>Flexural Properties</td>
<td>ASTM Test D790-71</td>
<td>Flexural modulus of elasticity, 2.8 x 10^6 pounds per square inch, with grain</td>
</tr>
</tbody>
</table>

### 18.11 UPHOLSTERY MATERIAL

Upholstery material for vehicle seats shall be approved transportation grade material and shall be able to be cleaned by at least three widely available commercial industrial cleaning agents that are known to be chemically compatible. The contractor shall propose the material with technical information including physical properties. All material must comply with applicable flammability and smoke emission requirements of FRA Regulation 49 CFR Part 238 as well as Section 18.16 of this specification.

### 18.12 PIPING, TUBING AND PRESSURE VESSELS

Air or hydraulic hose applications shall not be permitted in locations where adequate visual inspections cannot be made. Hose installations shall be located/arranged in such a manner as to prevent accidental cross connections to other hoses located in the same general area. Hose installations shall be such that kinking, rubbing, straining, and unnecessary swinging are precluded. Routing that requires other piping, or cables, as the sole means of support shall not be accepted.

The Contractor shall perform a leak test on the final air or hydraulic piping system, with all components installed, on each vehicle in accordance with IEC 61133. The Contractor shall...
submit a copy of the test procedure for approval. [CDRL C-18-13] A copy of the test report for each vehicle, including retest reports if appropriate, shall be included with each Vehicle History Book.

Loss of main reservoir air pressure due to cumulative leakage in the entire pneumatic system, not including that required for system functioning, per vehicle, shall not exceed 10 psig in 15 minutes, following a 5-minute settlement period from the point at which the system was fully charged and the air compressor was shut off.

The Contractor shall submit piping, tubing, and pressure vessel specifications and data for approval. [CDRL C-18-14]

18.12.1 Piping and Tubing

Piping and tubing shall be adequately supported at least every 24 inches [610 mm] throughout its length and at connections, and must not interfere with the removal of or access to other components. A minimum clearance of 3 mm [0.125 in] shall be maintained on all piping and tubing used in the vehicle.

Attachment shall be by securely fastening with elastomeric or polymeric lined, steel clamps, or an approved equivalent, between the pipe and clamp to prevent chafing and vibration.

All piping shall be seamless stainless steel or precision steel as determined by the application. All brake piping shall be seamless stainless steel pipe.

Stainless steel fittings must be used with stainless steel piping and tubing. Forged steel fittings, zinc plated to ASTM B633, Type II, Yellow, SC3 / SC4, may be substituted upon Metra approval.

All piping, tubing, valves, fittings, installation and testing methods, shall comply with ASME B31.1.

Joints that serve the sole purpose of connecting straight runs of pipe shall not be used. Unavoidable joints in piping shall be made in an approved manner. All inaccessible runs of tubing or piping shall be without joints.

Piping segments shall be deburred and blown out after cutting, and thoroughly cleaned and capped after fabrication. Metra reserve the right to verify piping cleanliness is to its satisfaction at any time during the production process.

After full installation on the vehicle, and before connection or installation of system components, the piping system shall be completely flushed with a suitable liquid solution, using appropriate pressure and velocity to fully dissolve all contaminants from manufacture and installation. The piping systems shall be cleaned a second time, following completion of component installation, using approved procedures. The Contractor shall submit for approval by Metra the proposed flushing and cleaning procedures for the piping and piping system. [CDRL C-18-15]

Following installation, piping systems shall be pressure tested in accordance with ASME B31.1 or other approved method.

All leaks, which appear during pressure testing, shall be repaired to the Metra's approval and re-tested until acceptable under the approved test criteria.

All hoses used shall comply with AAR M-618. All hose fittings shall be of an approved reusable type. Iron pipe fittings used with steel piping shall be AAR approved, with additional corrosion resistance as approved by Metra.

All piping shall be installed in accordance with AAR 2518 as incorporated in Standard S-400 (AAR Manual E) and in such a manner as to provide drainage to prevent freezing.

18.12.2 Air Filters

The filter element shall be a common production type, commonly available through various sources.
Access to the filter element for replacement purposes shall be possible without requiring the opening of any pipe fittings. Filters shall not be located in inaccessible locations for routine maintenance access.

18.12.3 Pressure Vessels
Unfired pressure vessels shall comply with Section VIII and IX of the ASME Boiler and Pressure Vessel Code for Unfired Pressure Vessels.
A test report shall accompany each pressure vessel received by the Contractor, and a copy of the test report shall be included in the appropriate Vehicle History Book. Each pressure vessel shall be stamped by the testing facility, whether it is the manufacturer or a third party, as verification of unit testing. Any data plates mounted to a pressure vessel must be sealed to prevent corrosion between the pressure vessel and the data plate mounted to it.

18.12.4 Drain cocks shall be provided at the low points of all reservoirs.

18.13 BEARINGS AND LUBRICATION

18.13.1 All bearings and lubricants shall be readily available in the United States. US Standard grease fittings or plugs shall be provided for all bearings not internally splash- or bath-lubricated.

18.13.2 All rotary shafts shall be supported by cylindrical or tapered roller bearings where practicable. Ball bearings may be used, subject to approval. Rotary / Motor shafts shall be suitably protected against corrosion to allow unencumbered removal of bearings.

18.13.3 Bearings subject to atmospheric or liquid contamination shall be sealed by labyrinth, lip, or face seals. Bearings installed in a vertical application shall have suitable protection to prevent moisture or contaminants from accumulating on, or entering, bearing.

18.13.4 Bearings that are not splash- or bath-lubricated shall be provided with standard grease fittings and drain plugs or pressure-release devices for re-lubrication. Ball bearings of 25 mm [1-in] shaft size and smaller may be factory lubricated-for-life, subject to approval.

18.13.5 Bearings shall be installed and removed without major disassembly of related components. Thrust style bearings shall be used whenever there is an axial load on the rotating shaft carried across rolling elements.

18.13.6 Sleeve bearings shall be used for shafts with rotary motion of less than one full revolution. Sleeve bearings shall be adequately lubricated. Sleeve bearings supporting ferrous shafts shall be composed of bronze, brass, or aluminum alloys as approved. Sleeve bearings may be used to support rotary shafts if space limitations preclude the use of anti-friction bearings.

18.13.7 Self-lubricated bushings (sintered metal) shall be used in accordance with the manufacturer’s recommendations, but shall not be used for shafts with speeds greater than 500 rpm.

18.13.8 The Contractor shall submit bearing specifications and data for approval. [CDRL C-18-16]
18.13.9 All lubricants shall be products approved by the supplier of the parts on which the lubricant is to be used. All lubricants shall, as a minimum, conform to applicable ANSI and ASTM specifications. Multi-purpose lubricants shall be used where possible. The Contractor shall submit for approval data on lubricants recommended for bearings and bushings.

18.14 CURED MATERIALS
All materials that are applied prior to curing shall be applied according to the OEMs full recommendations, including surface preparation, mixing criteria, application temperature, shelf life limits, pot life limits, curing temperature, curing exposure (before handling, or loading), etc. All uncured material shall be stored and applied according to the OEM’s full recommendations. All materials shall be used within the specified shelf life limits; material that has exceeded the shelf life shall not be used. Preparation prior to bonding or painting the surface shall be prepared according to ASTM D2651.

18.14.1 Paint & Primer
All paint with the exception of powder coat must be compatible with the Authorities’ present paint application apparatus and system, and must be fully repairable within the parameters of restrictive air quality zones and the local, governing air quality management authority. The Contractor shall submit for approval data on all paints, primers, and application processes or procedures to be used for the Authorities vehicle. The undercoating material shall be applied according to the manufacturer's instructions. All dents, roughness, or other surface imperfections shall be corrected prior to the application of the priming coat. Primer, finish paint, and related components shall be supplied as a complete system, manufactured by a single manufacturer. All mixed paint materials shall be used within the first 70% of the mixed pot-life time. Paint shall be applied within the manufacturer's recommended temperature range, but at a temperature no less than 55°F. Preparation for paint application shall follow the paint manufacturer's recommendations. As a minimum, prior to paint application, surfaces shall be cleaned to remove all traces of contamination, and properly treated to promote paint adhesion. Paint shall be applied evenly, and the finished surface shall be free of dirt, runs, "orange peel", or other imperfections. Paint inspection and acceptance criteria subject to Metra approval. [CDRL C-18-17] Paint quality control samples may be proposed to establish Cosmetic coatings of paint shall have specified gloss levels for the appearance desired. The gloss levels shown in Table 18-7 are defined according to common terminology, with the following criteria based upon the ASTM D 523 – 60° axis angle with equivalents shown for 80° and 20°.visual acceptance criteria, subject to Metra approval.

<table>
<thead>
<tr>
<th>Gloss Level Definition</th>
<th>Glossmeter Setting and Gloss Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 degree</td>
</tr>
<tr>
<td>- High Gloss</td>
<td>85-90%</td>
</tr>
<tr>
<td>- Semi Gloss</td>
<td>0-10%</td>
</tr>
<tr>
<td>- Flat Gloss</td>
<td>0%</td>
</tr>
</tbody>
</table>

At least two coats of finish paint shall be applied, with appropriate surface preparation between coats. Touch-up paint shall be identical in all respects to the original paint. Color chips for color match may be provided by the contractor for Metra approval, to establish acceptable color match tolerances. It is the Contractor's responsibility to ensure that the color match is acceptable. It may be required that the color match be made according to ASTM D 2244. In no case shall color mismatch detract from the overall appearance of the equipment.
Prior to assembly, all low-alloy steel areas shall be painted with one coat of an approved etching primer followed by one coat of an approved sealer to prevent rusting. All coatings used are to be EPA compliant. Painted surfaces shall develop full adhesion to the substrate to which they are applied. Testing for adhesion between the paint and the substrate surface will be done on a random basis and shall conform to ASTM D 3359, 3a Classification, using Permacell #99 adhesion test tape.

18.14.2 Powder Coating
Powder coating if used, shall be epoxy based for interior surfaces and polyester based for exterior surfaces. Finished film thickness shall be 3.5 mil (0.089mm) 1.0 mil (0.025mm). The surface preparation and pre-treatment shall be according to the powder manufacturer’s recommendations. Powder coating finish gloss level for cosmetic surfaces shall be according to Powder Coating Institute, Gloss Level Standard(s) – 7 to 10.

18.14.3 Adhesives
Adhesives to be used for installation of floor covering, panels, insulation, and vibration isolation materials shall have a satisfactory history of performance in a rail transit environment. A list of all adhesives to be used, including location, material safety data sheets, technical data & specification sheets, and flammability properties, shall be submitted for approval. [CDRL C-18-18] Adhesives used in small quantities may not require flammability data, subject to Authorities approval.

Joining of components by adhesives shall be completed within the maximum working times as follows; the application and aligning of bonded components shall be completed within 70% of the adhesives maximum working time, considering application conditions. When two-part compounds are being used, only the amount of adhesive that can be used within 70% of the maximum recommended pot life shall be mixed.

Adhesives that use atmospheric or humidity cure shall be installed such that the air circulation to fully cure the adhesive is possible.

Adhesive selection and bonded joint design shall consider MIL-HDBK-691B.

18.14.4 Sealants and Caulking
The use of caulking and sealing compounds shall be minimized.
Caulking and sealing compounds shall be applied in accordance with the manufacturer's instructions and recommendations, shall be non-staining, and shall be supplied in colors closely matching those of adjacent materials and surfaces. Caulking used in exterior applications shall be ultraviolet light (UV) resistant. If butyl-type is used, it shall be extruded polyisobutylene sealer compound of 100 percent solids.

Caulking primers shall be quick-drying, colorless, non-staining sealers of a type and consistency recommended by manufacturers of caulking materials for the particular surface involved.

Packing (backstop) shall be non-staining, resilient material, such as fiberglass roving, neoprene, butyl, closed-cell foams, or other compressible materials compatible with the caulking compound used. Joints, spaces, and junctures to be packed and caulked or sealed shall be completely cleaned of dirt, dust, oil, and other foreign materials that would adversely affect caulking quality. Suitable primer shall be used to achieve full adhesive bond.
Surfaces shall be thoroughly dry before caulking compounds are applied. Caulking compound application shall be compatible with prior or subsequent paint application. When so stipulated by the sealant manufacturer, paint and other protective coatings shall be removed from surfaces to be caulked prior to priming and application of sealants.
Compounds shall be applied with pneumatic guns. Where the use of a caulking gun is impracticable, suitable hand tools shall be used. Unless otherwise indicated, the entire perimeter of each opening shall be caulked. The finish of caulking joints on flush surfaces and in internal corners shall be neatly pointed; excess material shall be removed; and, where exposed, the caulking shall be free of wrinkles and uniformly smooth.

Application of polysulfide or silicone compounds shall be in accordance with the OEM's instructions and recommendations. Compounds shall not be used when they become too gelled to be discharged in a continuous flow or exceed their stated shelf life, and they shall not be modified by addition of liquids, solids, or powders. Compounds shall be installed within the manufacturer's defined temperature range. Installation and working of compounds shall be completed within the maximum working times as follows; the application and working of caulking material shall be completed within 70% of the minimum "skin" time, considering application conditions. When two-part compounds are being used, only the amount of caulking that can be installed within 70% of the maximum recommended pot life shall be mixed.

Adjoining surfaces, finishes, and fixtures shall be carefully protected throughout caulking operations. Stains, marks, or damage as a result of caulking and sealing work shall be removed.

18.15 INSULATION

Insulating materials shall be fire-retardant, non-carcinogenic, non-hygroscopic, resistant to fungus, and provided with a vapor barrier as required to prevent the entry of moisture, oil, gases, and dust. The materials shall not absorb fluids and gases and shall possess the required properties to meet the noise and vibration requirements of this specification. The method of insulation retention in the car-shell, for all insulating materials, shall be subject to Metra approval.

The Contractor shall submit for approval data on thermal and acoustic insulation materials and application processes. [CDRL C-18-19]

18.15.1 Acoustic Insulation

Sound damping material used in the fabrication of the vehicle shall be resistant to diluted acids, greases, gasolines, fuel oils, aliphatic oils, and vermin; and must be resistant to fungus; and must not support combustion. The material shall not be affected by sunlight or ozone, and shall not become brittle with age.

18.15.2 Thermal Insulation

Thermal insulation materials shall be transportation grade of the rigid, non-rigid, or spray-on type. Insulation shall be installed with a vapor barrier to preclude moisture accumulation. The type of thermal insulation to be used shall not be susceptible to mold or rot and shall not absorb water. Metals, which are attached to the insulation, shall be corrosion resistant, and not settle under vehicle vibration. The vehicle thermal insulation shall not have an odor or be capable of absorbing odors, and shall not sustain vermin. Urethane foam insulation is expressly prohibited.

Thermal insulation material shall have a thermal conductivity of not greater than 13,000 J/hr-m2-Co/cm (0.25 Btu/hr-ft2-Fo/in) when tested in accordance with ASTM C177.

18.16 FIRE SAFETY

18.16.1 All materials used in the cars shall be selected to minimize combustion and propagation of fire both inside and outside cars. The Contractor shall ensure that all materials which are
subject to specific fire safety requirements and guidelines in 49 CFR Part 238.103[c] and NFPA 130 have been properly tested and certified by a recognized independent laboratory. All test reports shall be submitted to Metra for approval and shall include Pass/Fail conclusions per the applicable performance criteria and shall include certification from the recognized independent laboratory that the test results were obtained after testing in accordance with the procedures and equipment specified in the test methods.

18.16.2 All test reports shall also be accompanied by a certification from the Contractor that representative samples of combustible materials has been tested by a recognized independent testing laboratory and that the results show the representative samples comply with the 49 CFR Part 238.103[c] and NFPA 130 requirements as well as the Toxicity requirements of this specification.

18.16.3 The name, address, qualifications, and contacts of all laboratories used shall be provided to Metra in advance of testing and the laboratory selected shall be subject to Metra’s approval.

18.16.4 Additional testing would be required if the test reports submitted by the Contractor are not accepted by Metra. Reasons for Metra not accepting test reports may include, testing of representative material was not performed, compliance criteria and conclusions are not provided in the test reports, certifications not provided, test reports are over 5 years old, regulations/requirements have changes since testing was conducted etc. Metra has the sole right to determine if test reports are acceptable or if additional testing is required.

18.16.5 All materials used in the subject cars shall be in compliance and be tested in accordance with FRA Regulation 49 CFR Part 238, Section 238.103 and NFPA 130. The fire safety and flammability tests shall also be performed for sealants, caulking, and adhesive materials. In case materials are not listed in these standards, the Contractor shall contact Metra for approval with the proposed performance criteria they plan to use. In addition the Contractor shall conduct the fire safety analysis as required by Section 238.103[c].

18.16.6 All test results should be completed and submitted to Metra prior to delivery of the first vehicle in the order. No vehicle will be utilized in revenue service until all test results have been submitted, reviewed and approved by Metra and a complete fire safety analysis per 238.103[c] and NFPA 130 has been submitted, reviewed and approved by Metra.  [CDRL C-18-20]

18.16.7 All materials used in car construction shall be tested for the emission of toxic gases during combustion using the NBS Smoke Chamber, bellows pump, and the appropriate Draeger tubes for the gases involved. Bombardier SMP 800-C maximum values shall be used to determine the acceptability of products.

18.16.8 The tests are to be run in the flaming mode, with sampling done after 240 seconds. The test report shall show the maximum concentration (ppm) for each of the following gases:

| 18.16.8.1 | Carbon Monoxide (CO) |
| 18.16.8.2 | Sulfur Dioxide (SO2) |
| 18.16.8.3 | Hydrogen Cyanide (HCN) |
| 18.16.8.4 | Carbon Dioxide (CO2) |
| 18.16.8.5 | Hydrogen Chloride (HCl) |
| 18.16.8.6 | Oxides of Nitrogen (NOX) |
| 18.16.8.7 | Hydrogen Fluorine (HF) |
| 18.16.8.8 | Hydrogen Bromide (HBr) |
18.16.9 On a limited and case by case basis, Metra may approve the use of material that have been verified as not having alternatives and have not passed the specified performance requirements. In these cases the Contractor shall be required to submit a waiver in writing to Metra for approval prior to any use of such material. The Contractor’s waiver request shall include the justification(s) for using the material, total weight of the material, location(s) and distribution on the vehicles, material safety and data sheets, and current test reports. In addition, the Contractor shall submit a letter from an independent material fire safety professional indicating their review of the Contractor’s waiver request and their professional safety analysis and conclusions regarding the request and the safety, environmental and regulatory implications involved for Metra throughout the life of the vehicles.

18.17 JOINING AND FASTENING

No protruding screws, rivets, mounting bolts, or similar items shall be permitted on the exterior of the vehicle, except where approved by Metra. The use of exposed fasteners on the vehicle interior shall be minimized. Interior fasteners shall be countersunk where possible or low profile heads where countersink is not possible. Interior fasteners shall not protrude enough to become a tripping or snagging hazard.

18.17.1 Fastening to Structural Members
Fastening to structural members shall be done only on the low stress portion of the member and shall not be located within 3/4” (17mm) from the open edge of the structural member. The Contractor shall ensure that any fastening or joining to structural members does not result in moisture accumulation within any structural member. To this end, fastenings to hollow, closed section structural members shall not be accomplished using drilled holes in the structural member.

18.17.2 Threaded Fasteners
The number of different sizes and styles of fasteners used shall be minimized. A single standard, US (ANSI/SAE/IFI), shall be adopted for the fasteners used. Fasteners shall be properly marked per the system adopted. All threaded fasteners shall comply with ANSI B1.1 class 2 requirements, unless otherwise specified or approved. All structural threaded fasteners shall have rolled threads.

Self-tapping or thread forming screws may be used with Metra approval only, on a case-by-case basis.

Use of threaded inserts or special or non-standard fasteners shall require Metra approval.

At least 1 1/2 threads shall be visible beyond all nuts. Bolts smaller than 6 mm [0.25 in] shall not project more than 1 1/2 thread plus 6 mm [0.25 in]. Bolts 6 mm [0.25 in] or larger shall not project by more than 8 threads.

Fasteners exposed to public view shall be treated as follows:

18.17.2.1 On the vehicle interior, all exposed fasteners shall be stainless steel with flat or oval heads, properly countersunk.

18.17.2.2 On the vehicle exterior, all exposed fasteners shall be stainless steel, unless otherwise specified.

18.17.2.3 Exposed screws shall be of an approved tamper-proof type.

18.17.2.4 Fasteners and fastener components used on the vehicle underfloor or roof areas shall be stainless steel except in cases where high strength fasteners such as SAE grade 8 are required. The contractor shall provide a list of all threaded fasteners, fastener classification, material, finish, and location used, for Metra approval. [CDRL C-18-21]

18.17.3 Fastener Materials
Fastener component materials (screws, nuts, washers, etc.) shall be properly selected for the application and shall not be mixed within an assembly unless approved by Metra. All fasteners shall be stainless steel, or steel finished with protective coating such as passivation, dichromate, or zinc plating, depending on the specific application. Threaded aluminum fasteners shall not be used except in tapped holes in solid aluminum structures, subject to approval. Stainless steel nuts and bolts shall be used for stainless-to-stainless joints. Anti-seize compounds shall be used on all stainless steel fasteners threaded into stainless steel, or using stainless steel nuts.

18.17.4 US Standard
Threaded fasteners shall conform to current SAE J429 standards for externally threaded fasteners and SAE J995 standards for internally threaded fasteners. Steel fasteners ¼” diameter and above shall be SAE grade 5 minimum. Stainless steel fasteners shall be manufactured from austenitic stainless steel alloys, according to ASTM F 593, with a nominal tensile strength of 100 ksi. All fasteners shall be clean and free of manufacturing scale. Non-structural screws, such as Phillips or slotted head screws smaller than ¼” diameter may be SAE grade 2 minimum.

18.17.5 Locking Requirements
All threaded fasteners shall be self-locking or provided with locking devices. Locking devices shall be lockwire, lock washers, torque patch, or prevailing torque type locknuts as appropriate for the application or service. Lockwire, if used, shall be stainless steel. Prevailing torque locknuts shall be of the nylon collar insert type. Previously installed and removed locknuts shall not be re-used. High temperature applications may use metallic distorted thread locknuts upon Metra approval. Bolts for use with locknuts shall not be drilled for cotter pins or in heat related applications. All locknuts shall comply with the Industrial Fasteners Institute requirements regarding to locking ability. When oversized or slotted holes are provided for installation tolerance allowance, flat washers, of suitable size to cover oversized holes, or slots shall be used in all locations adjacent to the hole. In this case, at least one hole shall be of close tolerance to ensure accurate positioning of component. If slotted holes are provided as a means of adjusting a piece of equipment, a secure method of fixing the adjustment shall be provided, such as adjustment screws, ribbed or toothed adjustment washers, Drilled holes and pins, etc.

18.17.6 Plating & Treatment of Fasteners
All steel fasteners shall be zinc plated with the highest protective service condition available per thread configuration. Stainless steel fasteners shall be passivated. If stripping and re plating of fasteners is required to meet the aforementioned criteria, documentation must be made available to verify that all applicable post plating treatments and standards have been met. Metra may require batch testing of stripped and re-plated fasteners to ensure there is no hydrogen embrittlement. After manufacturing, steel fasteners shall be electroplated, zinc with a yellow chromate conversion per ASTM B633, Type II - Yellow (please refer to table for thickness). After manufacturing, steel fasteners shall be electroplated, zinc with a yellow chromate conversion per ISO 4042, (refer to Table 18-8 for plating thickness).
### Plating Thickness for Steel Fasteners, Zinc, Yellow Chromate Conversion

<table>
<thead>
<tr>
<th>Bolt size</th>
<th>Metric DIN 267</th>
<th>US ASTM B633</th>
<th>Thickness (Micro meter / inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dia. up to #8 (M3)</td>
<td>A1L</td>
<td>-</td>
<td>3μm / .00012&quot;</td>
</tr>
<tr>
<td>Dia. &gt;#8 (M3) to 5/16&quot; (M8)</td>
<td>A2C or A2L</td>
<td>SC1</td>
<td>5μm / .00020&quot;</td>
</tr>
<tr>
<td>Dia. &gt;5/16&quot; (M8) to 7/8&quot; (M22)</td>
<td>A3C</td>
<td>SC2</td>
<td>8μm / .00031&quot;</td>
</tr>
<tr>
<td>Dia. &gt;7/8&quot; (M22) to 1-1/8&quot; (M33)</td>
<td>A4C</td>
<td>SC3</td>
<td>13μm / .00051&quot;</td>
</tr>
<tr>
<td>Dia. &gt;1-1/8&quot; (M33) and greater</td>
<td>A5C</td>
<td>-</td>
<td>15μm / .00059&quot;</td>
</tr>
</tbody>
</table>

#### 18.17.7 Hydrogen Embrittlement
Fasteners or fastener components with hardness greater than or equal to 320 HV (32 HRC) are susceptible to hydrogen embrittlement when these parts are pickled and/or electroplated. This may cause these fasteners to fail at relatively low loads even if stress relief annealing (baking) is performed after plating. Examples of hardened fasteners are steel bolts - US Grade 8, hardened steel washers, spring washers, etc. These types of fasteners shall be mechanically plated to avoid hydrogen embrittlement.

#### 18.17.8 Torque Marking/Indexing
The Contractor shall ensure the proper application of all threaded fasteners. Torque marks or stripes extending from the secured hardware to the surrounding surface shall be applied to all safety related hardware, including truck, door, and brake equipment bolts. Tightening indication may be required on other non-safety related hardware upon the Authorities' request.

#### 18.17.9 Bolts and Nuts
All threaded fasteners falling into this category used in this project shall require a submittal of Certifications of Compliance (C of C) with each shipment of hardware to the end user. The C of C shall be traceable to a manufacturer.
High strength fasteners such as SAE grade 8 hardware shall be used for mounting the traction motors to the trucks, and for all truck mounted appurtenances, unless specifically allowed otherwise by Metra.

#### 18.17.10 Electrical and High Temperature Connections
Plated steel screws or bolts, nuts, flat washers, and lock-washers used in mounting and in making connections to resistors and other heat-producing apparatus shall be suitable for high temperatures without degradation of the strength of the hardware or its corrosion resistance. Flat washers shall be used on both sides of all electrical connections (under bolt head and under nut).

#### 18.17.11 Riveting
Rivet holes shall be accurately sized, located, and aligned for the intended rivet. Rivet holes that have been repaired, or the rivet removed shall be reamed to the next larger rivet size, and the next larger rivet installed. Rivets exposed to passengers on the outside of the vehicle shall be stainless steel.
Hand-driven steel rivets shall be driven hot and shall completely fill the holes.
Two part rivets consisting of a pin and collar (such as Huck-Bolt types) shall be installed such that the pin breaks flush with the end of the collar.
Blind rivets may be used subject to Metra approval. Blind rivet materials may be stainless steel, or plated carbon steel with plated steel or stainless steel mandrels compliant with SAE...
18.18 WELDING, BRAZING AND SOLDERING
All welding practice not specifically covered in this Section shall be in accordance with the applicable requirements and recommendations of the American Welding Society (AWS), as contained in the latest revisions of the "Structural Welding Code" (AWS D1.1), "Aluminum Welding Code" (AWS D1.2), "Structural Welding Code - Sheet Steel" (AWS D1.3), Structural Welding Code – Stainless Steel (AWS D1.6), "Sheet Metal Welding Code" (D9.1), "Recommended Practices for Resistance Welding" (AWS C1.1), "Railroad Welding Specification" (AWS D15.1) and the AWS "Welding Handbook" (AWS WHB). Where non-AWS welding is used, the supplier shall demonstrate equivalence. The contractor shall demonstrate compliance with AWS welding requirements and standards.

The Contractor shall be responsible for the quality of all welding and brazing, including the welding and brazing of its suppliers and subcontractors.

Prior to welding, all surfaces shall be thoroughly cleaned to remove corrosion, rust, scale, slag, grease, oil, water, paint, and other foreign materials in accordance with applicable parts of D1.1, Section 8.5 on Workmanship and Technique.

Parts to be joined by welding shall be supported and held in position by tables, jigs, or fixtures to prevent warping. Weld joint design and welding method shall be selected to include provisions for shrinkage and warping due to the welding process. Welding shall be applied in a manner to minimize distortion. Acceptable distortion levels shall be submitted for Metra approval.

All Weld quality shall be in accord with acceptable weld criteria as defined in AWS welding Codes.

The Contractor shall submit welding procedures specifications (WPS) and Procedure Qualification Records (PQR) to Metra for review and approval. [CDRL C-18-22]

18.18.1 Welder Qualification

Welders shall be tested and certified to verify their proficiency for producing sound welds, for each weld type performed by the welder to each applicable Welding Procedure Specification (WPS). Welder qualification tests shall be performed in accordance with the applicable requirements of AWS standards, or other approved equivalent standards. Welder qualification tests for pressure vessel welding shall be in accord with applicable requirements of ASME Section IX, or other approved specifications.

Welders shall be certified to AWS or equivalent welding societies and an identification number from the society shall be provided.

The Contractor and all suppliers and subcontractors shall retain records of welder qualifications and shall make these records available to Metra upon request.

Metra shall have the right to require the making of test welds by any welder, whether under the direct control of the Contractor or a supplier or subcontractor, to ascertain his/her competence and to determine the suitability of the welding procedure used.

18.18.2 Welding Procedures
All welding practices not specifically covered in other sections shall comply with AWS-D1.1, AWS-D1.2, or AWS-D1.3 and the AWS Welding Codes as appropriate to the applicable AWS welding standard(s). Requirements for dynamically loaded structures shall be applied. Resistance welding shall be in accordance with SAE-AMS-W-6858. Resistance welding operations shall be undertaken using only equipment fitted with meters or readouts and adjustments for time, current, and pressure. The method used in depositing weld metal shall be one that reduces warping and residual stresses. To achieve this, tack welding, offset welding, skip welding, and other devices and sequences well known to the craft shall be used where appropriate. Machine welds of any thickness may be made with one or more passes as per the Procedure Qualifications Record (PQR) for the weld joint.

The Contractor shall submit a procedure qualification record (PQR) for all weld joints to be used or pre-qualified per AWS codes and all Weld Procedure Specifications (WPS) for the project. Procedures used for the welding of metal combinations not specifically covered by the AWS standards (i.e. stainless steel to steel) shall be approved by Metra. Stainless steel to steel welds shall use austenitic stainless steel filler metal.

18.18.3 Welding Electrodes
The choice of welding rod or wire filler metal shall be made with consideration of the make, type, size, composition, and suitability to the application and shall be in accordance with "Specification for Filler Metal" AWS A5.0. Welding electrodes shall be stored in a dry, closed environment to prevent contamination in accordance with AWS recommended practices for filler material storage. Welding electrodes shall be clearly marked. All low-hydrogen electrodes shall be kept in a dry-rod oven to keep moisture from the electrodes. The electrodes shall now be exposed to the atmosphere for longer than a period of four hours. Low-hydrogen electrodes soak atmospheric moisture and stay in the flux. When welding with an electrode with moisture in the flux can cause excessive surface and/or subsurface porosity and can cause slag entrapment.

18.18.4 Weld Repairs
Weld repairs shall be performed in accordance with approved procedures, which comply with AWS D1.1 or the AWS Code applicable to the welded material. When a production weld has been determined to be substandard, all production since the previous acceptable production quality control test shall be segregated, and disposition shall be recommended to Metra for approval. All parts with substandard welds shall be rejected or repaired by weld removal, re-weld, and inspection. Re-weld, inspection, and any Non-Destructive Examinations (NDE) required by the applicable AWS welding standard regarding repairs.

18.18.5 Welding Inspection and Examination
The Contractor shall inspect all welds. Welds shall be inspected to verify compliance with these provisions and specifications. Welding inspection procedures and welding inspector qualification tests shall be performed in accordance with the applicable requirements of the AWS standards for weld inspection. The Contractor shall use and demonstrate the use of personnel qualified to perform weld inspection. An AWS Certified Senior CWI shall lead all welding matters. An AWS Certified Welding Inspector (CWI) shall be utilized for inspection and oversight of welding inspection. All welding must be inspected by a CWI and the CWI stamped inspection reports shall be provided. This requirement applies to all welding work performed under the contract. Non-destructive examination and testing of welds and welder qualification tests shall be performed in accordance with the applicable requirements of the AWS Welding and Brazing
Handbook and the requirements of the applicable AWS standard the Welding Procedure Specification (WPS) is written to.

Personnel performing NDT shall have documented qualifications in accordance with American Society of Non-destructive Testing (ASNT), TC-1A.

In addition to visual inspection requirements specified by the AWS welding codes, non-destructive surface inspection (dye penetrant or magnetic particle methods, as appropriate) shall be used to inspect all first-production welds.

The Contractor shall specify additional non-destructive inspection requirements for subsequent welds. If the Contractor elects to inspect less than 100 percent, then the Contractor shall submit a random sampling inspection plan for approval by Metra. In no case shall the length of weld non-destructively inspected be less than one percent of the total weld length.

All welds designed to carry primary stresses in members such as side sills, end frames, bolsters and other important truck and frame members, shall be inspected by the Contractor for defective welding.

Critical areas of all such welds shall be magnetic particle or dye penetrant or ultrasonic tested and radiographic tests shall be used on a random sample basis.

The following defects in excess of limits indicated or established in the approved procedures shall be cause for rejection of the work affected: cracks, regardless of length, magnitude or location; overlaps; lack of penetration; incomplete fusion; inclusions except if they do not materially affect the strength of the welded joint and do not indicate improper technique or an unsatisfactory procedure; undercuts; poor surface appearance; or improper size of weld.

On the first structure or component, all full-penetration welds shall be non-destructively, volumetrically inspected (ultrasonic or radiographic methods). The Contractor shall specify a random sampling plan for volumetric inspection of subsequent full-penetration welds for approval by Metra. [CDRL C-18-23]

With the approval of Metra, destructive sectioning and metallurgical examination may be substituted for some or all of the required volumetric inspection requirements.

18.18.6 Heat Treatment
Where required by specifications or drawings, welded assemblies shall be stress-relieved by heat-treating in accordance with AWS D1.1. Chapter 4, Part A. Heat treatment procedures shall be documented and submitted for review for first piece/part processing. All heat treatment documentation (results) shall be retained by the Contractor.

18.18.7 Brazing
The Contractor shall maintain a brazing program similar to the welding program specified in the welding portion of this specification.

All brazing, qualification of brazers, and repair of brazing defects shall be in accordance with the requirements and recommendations specified in the AWS Welding and Brazing Handbook. The Contractor shall maintain quality control procedures necessary to ensure high-quality brazing. The Contractor shall submit brazing specifications, procedures, and certifications to Metra for review and approval. [CDRL C-18-24]

18.18.8 Soldering
Soldering of electronic equipment shall comply with the requirements of ANSI J-STD-001B. The Contractor shall submit soldering specifications, procedures, and certifications for approval.

18.19 CORROSION CONTROL

18.19.1 All materials used shall be either inherently corrosion resistant, or suitably treated, or coated to resist corrosion. Equipment located in areas highly susceptible to corrosion shall be
made from inherently corrosion resistant materials. Areas exposed to corrosive fluids or
cleaning solutions shall be protected with coatings resistant to those fluids. The Contractor shall
be responsible for verifying that all such areas are protected through communications with
Metra.

18.19.2 Except as otherwise indicated, all aluminum exposed to view in finished work in the
interior of the vehicle shall have a protective anodized coating.

18.19.3 The recommendations contained in "a Corrosion Control Manual for Rail Rapid Transit",
UMTA-DC-06-0152-83-1, shall be used, except as otherwise directed by Metra.

18.19.4 The Contractor shall prepare a Corrosion Control Plan, which shall locate all materials
that require treatment to prevent corrosion due to atmospheric exposure, and areas of dissimilar
metal or other material joining which could result in galvanic action and material deterioration.
This plan shall document the methods used to preclude failure due to corrosion for any of the
above conditions. The Contractor shall update this document as materials and treatments
change. The Corrosion Control Plan shall be submitted to Metra for review and comment.

[CDRL C-18-25]

18.20 DISSIMILAR METAL TREATMENT

18.20.1 Direct contact between electrically dissimilar metals is prohibited except as approved by
Metra for electrical connections between copper and aluminum where appropriate joint
compounds are used as specified herein. Isolating and moisture-proofing materials, appropriate
to the materials being joined, shall be used at all times.

18.20.2 All metals used in the fabrication process shall be surface treated with corrosion-resistant
materials prior to assembly, with consideration being given to the severity of exposure to which
the surface shall be subjected.

18.20.3 The joining of incompatible metals and materials shall be minimized as much as possible.
When such metals must be joined, provision shall be made in accordance with MIL-STD-889 to
prevent chemical reactions between the metals.

18.20.4 Surfaces of aluminum alloy parts secured to ferrous parts shall be protected with one-part
polysulfide or silicone sealant used as joint compound, or with joint material that is non-
hygroscopic and is free from chlorides and heavy metal ions.

18.20.5 Fibrous joint material shall be impregnated with bitumen or other water-repellant
substance, which shall completely cover interfacing surfaces.

18.20.6 All ferrous metal surfaces, other than stainless steel, shall be protected by painting or
zinc plating as defined in this specification, unless otherwise specified. Steel surfaces not
requiring protection shall be galvanized by the methods and requirements described in ASTM
A123. Minor damage to galvanized coatings shall be repaired with an approved zinc rich paint.

18.21 WIRING REQUIREMENTS

Wire sizes, insulation requirements, materials, shielding methods, and identification of wire and
cable used for primary, auxiliary, control, and communications applications shall be based on
the current carrying capacity, voltage drop, mechanical strength, temperature, and flexibility
requirements of AAR, ASTM, ICEA, NFPA, MIL, or NFPA 70 specifications. Wire, cable, and
bus bars shall be copper. All wiring not explicitly referenced in other parts of this specification shall meet at a minimum the latest revision of APTA specification PR-E-RP-009-98, Recommended Practice for Wire Used on Passenger Equipment.

All wire and cable insulation shall meet the flame and smoke test requirements of the Flammability, Smoke Emission & Toxicity section of this specification, and shall be substantially free of halogens. The wire and cable selected shall be rated by the manufacture to last the life of the vehicle.

The Contractor shall mark each wire, by wire type, at an interval of 12 inches, and mark each wire end with a function code using a scheme subject to approval by Metra.

Metra shall approve all electrical wire and cable used in the vehicle. The Contractor shall submit samples and specifications of each size and type of wire and cable proposed for use in the vehicle for Metra approval. [CDRL C-18-26]

Braided copper wire, or wire rope, shall be used in all ground strap applications. Flexible stranded copper wire is acceptable in other applications. All conductors of multi-conductor cables shall be terminated.

18.21.1 Conductors

Maximum current capacities shall conform to National Electric Code, NFPA 70, ampacity table 310-16.

Except as otherwise specified, conductors shall be of soft, annealed, tinned copper stranded in accordance with ASTM B33.

Stranding and conductor construction for all wires and cables No. 18 AWG and larger shall comply with of NEMA WC 70, NEMA WC 71, and AAR RP-585, as is appropriate for the application. Stranding shall be per ASTM B174; Class I or equivalent - 10 to 7 AWG, and Class K or equivalent - 18 to 12 AWG.

Stranding and conductor construction for wires and cables No. 20 and No. 22 AWG shall be of 19-strand construction as appropriate for the usage requirements.

18.21.2 Wire & Cable Insulation

Each conductor shall be separately covered with insulation. Flat cables are prohibited, except for specific data/communications applications where other arrangements are impractical.

Wire and cable insulation used for car-body wiring shall be flexible, crosslinked polyolefin, or equivalent. Wire and cable shall comply with the requirements of NFPA 130. Wire and cable shall comply with applicable sections of NEMA WC 70, NEMA WC 71, and AAR RP-585 as is appropriate for the application and subject to Metra review.

Wires within enclosed equipment or suitably protected locations shall comply with MIL-W-81044, or as otherwise approved.

For general-purpose wire and cable, the insulation shall be of heat and moisture proof material suitable for a continuous temperature rating of 167 °F (75 °C) minimum in dry and wet locations. For high-temperature applications, such as connecting to heaters and resistors, the insulation shall be suitable for a maximum conductor temperature of 230 °F (110 °C).

Asbestos, urethane, and polyvinylchloride (PVC) based insulations or jacket materials shall not be used.

Outer jacket material of multi-conductor cable shall be the same as that used to insulate individual conductors, unless physical considerations indicate a different material with superior characteristics.

Multi-conductor cables shall provide at least 10 percent spare wires and at least one spare of each wire type and size.

Shielding shall be used over multi-conductor cable for safety-critical circuits. Shielding material shall be woven wire providing not less than 60 percent coverage and shall be soft, annealed, tinned copper of an area equal to or greater than the largest conductor.
Non-conducting separators and fillers may be applied between conductor and insulation on conductor sizes greater than No. 5 AWG.

Leakage between primary wiring and vehicle body shall be measured in accordance with IEEE 11. The leakage shall be at least 10 megOhms when measured with 1,000-volt megOhmeter. Hi-Pot shall be accomplished on all primary power wiring at 2,500 VAC for 1 minute per IEEE 11.

General car-body wiring insulation shall be flame-retardant, extra-flexible, cross-linked polyolefin material. General ca-body wiring insulation and/or jacketing shall be free of halogens, phosphorus, sulphur, and nitrogen (combined to less than 1% by weights), or otherwise be subject to Bombardier SMP 800-C test criteria.

18.21.3 High-Temperature Wire & Cable
Insulation for all wires in high-temperature applications, including but not limited to those connecting with heaters, resistors, or lights shall conform to the following:
For wire sizes No. 16 AWG and larger, the insulation shall be silicone rubber in accordance with AAR RP-587, RP-588 and RP-589, 110°C irradiated cross-linked polyolefin, or abrasion-resistant extruded PTFE (polytetrafluoroethylene) Teflon meeting MIL-W-22759/6B
For wire sizes No. 18 AWG and smaller, the insulation shall be abrasion-resistant extruded TFE Teflon meeting MIL-W-22759/6B. When used for interconnecting pieces of apparatus, this type of wire shall be bundled and shall have a protective covering.

18.21.4 Communications Wire & Cable
The communications system manufacturer shall approve all car-body wire and cable applicable to the communications equipment.
All communications wire and cable shall be installed in raceways, conduits or as otherwise approved.
The jacket shall be waterproof and abrasion-resistant, and shall provide insulation resistance greater than 1 MOhm/ft between shield and water.

18.21.5 Conduit & Wire Channel
All conduits and wire ways shall be free of burrs, sharp edges, and square corners. Conduit welded into the ca-body shall not have any burn-through of weld, or any other penetration into the interior of the conduit. The ends of the conduits and wireways shall be suitably rounded to prevent edge contact with the wire. Conduit radius shall be sufficiently large enough to allow easy pulling of the wire.
Wires and cables installed in flexing applications shall be housed in abrasion resistant, flexible conduit or sheathing designed for the application, and installed such that there is no pinching, stretching, or kinking under all ranges of motion.
The Contractor shall ensure that wireways, conduits, and piping, that is susceptible to corrosion shall be suitably protected from corrosion such as zinc plating per ASTM B633 Type II yellow, SC4, or receive a minimum of two coats of primer and two coats of an approved paint. This priming and painting can be accomplished either before or after installation of the item on the car-body.

18.21.6 Application & Installation
All wiring shall be performed and directed by experienced personnel using appropriate tools for stripping insulation, cutting, soldering, and attaching mechanical crimp-type terminals with correct dies.
All car wiring connected to a given piece of electrical apparatus shall be insulated for the highest voltage supplied to that apparatus. Wires operating with potential differences of 50
volts or more shall not be cabled or routed together. Signaling, LVDC, AC, and HVDC wiring shall be separated. Wiring for any communications system equipment shall be done in an approved manner to conform to the requirements established by the supplier of that equipment. All circuits shall be adequately protected and insulated from ground. All circuits and branches must be separable by a switch or terminal board to isolate their grounds when trouble-shooting is required. Wiring shall be fabricated into standard harnesses, and installed in prefabricated groupings, and standardized locations in the vehicles. Car wiring shall comply with NEC Code, Chapter 3 (NFPA 70), and with the AAR Manual of Standards, Section F, S-538, Wiring Practice, and Rolling Stock Standard, except where otherwise specified. Circuit protection shall comply with NEC Code, Chapter 2. Electrical circuits and associated cabling shall be designed with clearance and creepage distance between voltage potentials and car-body ground in accordance with the environmental conditions to which the circuits and cabling will be subjected, and in accordance with NFPA 130, Chapter 4 or equivalent IEC standards. Electric apparatus shall be housed in sealed enclosures to remain clean and dry. Cooling air shall be filtered to remove all conductive and non-conductive dust. The layout of wiring shall be designed in advance of its installation and in cooperation with those furnishing the related equipment.

18.21.7 Undercar and Roof Wiring Installation
All wiring shall be run in insulated metal raceways and wire ducts with securely fastened but easily removable metal covers. Wire and cable shall be securely anchored in an approved manner in the ducts to prevent chafing from relative motion. Minimum wire size for under car wiring shall be 14 AWG for power and 16 AWG for control circuits. Within equipment enclosures, minimum wire size shall be 22 AWG. When physical strength is required, No. 6 AWG or larger wires may be used and supported in place without any type of enclosure by using molded rubber cable support blocks. This method is also acceptable in protected areas that may be subject to damage or vandalism. The wire ducts and conduits shall be of waterproof construction. Watertight strain-relief bushings with insulated throat liners shall be provided at duct entrance and exit points. Bushings shall be sized such that the wire and lug may be removed through the bushing. Wires or cables shall not pass over or through the battery compartment. Floor wiring shall be run in conduits or ducts and may be run through partitions, but only if suitable bushings are provided at such points of passage. Sufficient slack and wire length shall be provided to prevent breaking or pulling out of bushings or terminals, and to allow for a serviceability loop long enough for three re-terminations. Drip loops shall be provided where appropriate.

18.21.8 Power Cables
HVDC power cables (with the exception of cables passing through or above the floor) that are No. 6 or larger shall be cleated in place. The cleats shall be positioned at intervals no greater than 257 mm (1.5 ft), and adequate clearance shall be maintained between cables and any structural members, components, or items of equipment. Where mechanical protection is required, short lengths of conduit may be employed, one conduit per wire, subject to approval.
18.21.9 Cable Connectors
All cable connectors shall be of watertight design, unless enclosed in interior watertight cabinets and approved by Metra, with removable / replaceable crimp contacts of the correct size for the wire being terminated.
Cable connectors shall be equipped with sealing gaskets. Extension bodies shall be used if necessary to ensure that there is sufficient room to terminate the cable wires within the connector body.
The cable jacket shall extend within the body, shall be held by a clamp, and shall have a gasket seal at the entrance.
Unused connector pin positions shall be sealed with either connector contacts or plastic sealing plugs designed for that purpose.
Adjacent connectors shall either use different inserts or different insert orientations to prevent erroneous connections.
Connectors installed in exterior locations shall comply with MIL-DTL-5015. All other connectors shall comply with an equivalent standard, as approved by Metra.

18.21.10 Terminals
Terminations and connections throughout the vehicle shall be with insulated ring tongue connectors of the compression (crimp) type.
Quick-disconnect (fast-on) terminals with locking features may be used, subject to approval, provided that the type of fast-on has demonstrated a satisfactory service in a similar fashion.
Materials such as phosphor bronze shall be shown to be suitable for repeated use.
Terminals shall not utilize PVC insulation.
Terminals shall be attached to the wiring with the crimping tools and dies recommended by the connector manufacturer.
The terminal used shall be of the type that securely grips and holds the insulation of No. 10 AWG wire or smaller. The crimp terminal shall be rated to match the wire conductor diameter and the insulation diameter.
Conductors that will be subjected to motion shall utilize the proper strain relief mechanism recommended by the manufacturer.
Spare terminals shall be provided for each terminal assembly in an amount equal to at least 10 percent of all terminals, with at least one spare terminal provided for each terminal size. Spare conductors in a multi-core cable need not be terminated at spare terminal strip locations.

18.21.11 Conduit and Raceway Requirements
All car wiring shall be housed in metal raceways. Open metal raceways and their elbows, couplings, nipples, bushings, locknuts, universal joints, expansion joints, and other conduit fittings shall be so designed that the sections can be mechanically and electrically coupled, while the wires are protected from abrasion.
High voltage wiring, (i.e., wiring in excess of 120 volts) shall not be run in the same cable ducts, conduits, or raceways as low voltage wiring.
All conduits shall be arranged to prevent moisture traps and shall drain toward control boxes, and shall be supported to the car body at least every 610 mm (24 in).
Wires in conduits, ducts, and raceways shall be free of kinks, insulation abrasions, and insulation skinning.
If a conduit is designed to come through the flooring of the vehicle and into equipment boxes located at the passenger compartment level, the conduit must extend 25 mm (1 in) above floor level to prevent water or cleaning chemicals from draining onto the below-floor cables.

18.21.12 Wire Harness
The layout of wiring, for both vehicles and equipment, shall be designed in advance of its installation and in cooperation with the suppliers of the related equipment. Wiring shall be prefabricated into standard harnesses, wrapped and tied with nylon wire ties or a high strength, waxed lacing cord designed not to invade the wire insulation. Harnesses shall be installed with identical arrangement and location in each vehicle having similar equipment. Separate harnesses shall be provided for major circuit groups or types, or as required for specified circuit separation. All circuits and branches shall be separable by means of terminal boards to isolate portions from others for troubleshooting. All circuits subject to periodic high potential tests shall be arranged so that they can be conveniently isolated for the tests. Alternative methods for fabricating and installing wiring, which are standard car builder practice, will be submitted for consideration at the appropriate design review. Harnessed wires shall not be installed in conduit. Wires from different conduits or other openings shall not be harnessed together with wires running within the box or entering the box through another entrance point. Each harness or group of wires between equipment enclosures shall contain a minimum of 10% spares, but no fewer than 2 spares for each wire size.

18.21.13 Cleating
Split block cleats of molded neoprene rubber or an approved equivalent shall cleat all cable and wiring not installed in conduits. A nonflammable insulating material with a durometer reading of 50 to 60 Shore A hardness, shall be used for cleating. The holes in the cleat shall be sized for the individual wires and cables. Hole edges shall be radiused to prevent square edge contact with cable insulation. Each cleat shall have a stiffener on the side away from the mounting bracket that will act to spread the bolt clamping force over the entire length of the cleat. Bolts shall have lock nuts of approved design. Cable and wiring, other than HVDC, using cleating shall be supported to the car body at least every 610 mm (24 in).

18.21.14 Equipment Enclosures & Junction Boxes & Fittings
Boxes, covers, and fittings of ferrous metal shall be galvanized inside and outside after fabrication. All box covers shall be marked with the vehicle number, all like covers shall be interchangeable. The box covers shall be held in place with latches or blunt end screws. Self-tapping screws shall not be used for box covers. Screws and other hardware shall be made of stainless steel. All undercar and roof-mounted junction boxes shall be waterproofed and vented, and shall protect enclosed equipment and connected conduits from water seepage. The interiors of all equipment enclosures and junction boxes shall be protected with an electrically insulating; white, or light color paint.

18.21.15 Wire Identification & Terminal Markings
Wire terminal designations shall be assigned to all electrical conductors, whether individual wires or cables, within the entire car. All wires and cable shall be marked within 305 mm (12 in) of the end of the wire and every 305 mm (12 in) along the entire length of the wire. Wires shall be identified according to circuit function, wire number, wire segment, and gauge. Wire identification shall be subject to approval by Metra.

18.21.16 Splicing and Taping
Splicing and taping shall not be allowed unless expressively approved by Metra on a case by case basis.
18.22 CIRCUIT PROTECTION

18.22.1 Handles shall indicate ON, OFF, and TRIPPED positions. Circuit breakers shall be molded-case type, single- or multi-pole, with frame size suitable for continuous current and interrupting duty.

18.22.2 Each pole shall be equipped with a trip mechanism consisting of an inverse time element for overload protection and an instantaneous magnetic element for short circuit protection.

18.22.3 Each pole shall be equipped with adequate means of arc extinction to prevent flashover.

18.22.4 Multi-pole breakers shall operate contacts simultaneously.

18.22.5 Breaker current rating shall be clearly visible after installation and shall comply with NEMA AB1, ANSI C37.13, C37.14, or C37.16.

18.22.6 Continuous current rating shall be selected in accordance with NFPA 70 for load and type of service indicated.

18.22.7 Electrically controlled breakers shall be equipped for operation from the LVPS.

18.22.8 Circuit breakers shall be properly coordinated with protective devices.

18.22.9 Other than high speed circuit breakers (HSCBs) used for HVDC circuits, circuit breakers shall not be used for protection on HVDC circuits.

18.22.10 Fuses shall not be used except for indicator type fuses within electronic assemblies, high voltage circuit protection, and special applications with approval.

18.23 GROUNDING

18.23.1 Grounding connections shall be made through copper or bronze pads, tinned, and silver soldered to the car body.

18.23.2 The copper pads shall be tinned or silver electroplated after attachment. Stainless steel ground pads may also be used, subject to Metra approval.

18.23.3 Low voltage and high voltage circuits shall not be grounded to the same grounding pad, if such grounding is permitted by this specification.

18.23.4 All ground pads shall be visible and accessible for inspection and troubleshooting. The ground connections shall be attached by an approved bolt, washer, and nut designed for the purpose.

18.23.5 Resiliently-mounted equipment shall be grounded with flexible strap-type grounding leads bolted between a car body grounding pad and the equipment's grounding pad. Strap flexibility and length shall be sufficient to prevent failure from fatigue. Fixed equipment may be grounded by flexible straps or properly terminated wire of the same type used for car wiring.
18.23.6 The ground strap termination method shall form a gas-tight, uniformly distributed connection with the conductive surface. Current density shall not exceed bonding requirements below.

18.23.7 All grounding and bonding jumpers and straps shall be sized to handle fault current and lightning discharge current, for which the voltage drop shall not exceed 50 volts. The bonding method employed shall not produce a DC resistance in excess of 0.0025 ohms, or more than 0.025 ohms at 150 kilohertz for any applied AC voltage.

18.23.8 All ground pads shall be readily visible and accessible for inspection and troubleshooting.

18.23.9 All equipment enclosures and shock-mounted equipment shall be grounded with tinned, braided copper, flexible strap grounding leads bolted to a car body grounding pad.

18.23.10 Ground cables and shunts shall be extra-flexible, tinned, non-insulated, stranded copper cable meeting the additional requirements of TP19.11.2, and shall be terminated by approved crimped ring terminals on both ends.

18.23.11 Ground cables and shunts shall be sized to withstand, without failure, the maximum failure current that could be anticipated should the return wiring totally fail.

18.23.12 In no case shall the size of a ground cable or shunt be less than No. 10 AWG.

18.23.13 The Contractor shall ensure that all metal parts inside and outside the vehicle that could be touched by passengers or operating personnel, including equipment boxes, panels, and test receptacles in the passenger or operator areas, shall never exceed car body potential.

18.24 ELECTRICAL COMPONENTS

Electrical components, which are singly replaceable, shall be connected to car wiring through individual, removable connections, or "pigtails" with connectors. Replaceable components shall not be connected to car wiring using soldered connections. Electrical components installed on the vehicle without protective enclosures, including, but not limited to inductors, transformers, resistors and capacitors, shall be designed, selected and installed to make them impervious to the effects of Metra's railroad environment and operations. This shall include, as a minimum, the effects of extreme weather, water, snow and ice, extreme temperature swings and possible impact by debris. Exceptions to this requirement may be granted on a case-by-case basis, upon approval by Metra.

18.24.1 Relays and Contactors

Contactors and relays shall meet or exceed IEC 60077.

Low-current relays (less than 10 Amp per pole) shall have silver-alloy contacts.

Very low current relays (1 Amp and less) shall have gold-plated, silver-alloy contacts.

Relays and contactors that have not been proven in rail service shall comply with MIL-PRF-6106.

Relays shall be capable of at least one million electrical operations at rated contact capacity with the exception of those operating on the order of 1000 times per day being capable of at least ten million electrical operations at rated capacity.

Plug-in relays shall be secured in their sockets by mechanical restraint.

Relay and contactor coils shall be suppressed to mitigate transient voltage spikes, with the suppressing network mounted as close to the coil as possible.
Relays and contactors, except low-power miniature relays mounted on printed-circuit boards, shall incorporate means of visually determining whether contacts are picked up or dropped out. Relays used in safety-critical circuits with single point failures shall comply with the AAR Signal Manual, Volume 2, Section 6, unless otherwise approved. Contactors used to interrupt HVDC circuits shall be equipped with blowout coils or other means of arc suppression in accordance with TP 12.

18.24.2 Pushbutton Switches and Indicators
Switches shall be heavy-duty, with electrical characteristics, ratings, and accessories as required for circuit application.
Pushbutton (including illuminated) switches shall have silver-plated or silver-alloy terminals. Indicators and pushbutton switches shall have insulation resistance of at least 1 MΩ to case at 500 VDC. Re-lamping of indicators shall be from front.
Contacts shall have maximum resistance of 0.10 ohm at 3 VDC and 10ma load. Minimum open contact resistance shall be 50 MΩ.
Contact shall be rated for inductive loads. The contacts shall normally operate at not more than 20 percent of the manufacturer's inductive rating for 25,000 cycles of operation at 25°C. The electrical-contact material shall be silver or silver with a gold flash or gold plate, and be normally a break-before-make type.
Indicators shall be LED type where possible.

18.24.3 Inductors
Power inductors shall have vacuum-impregnated windings and be rated to withstand at least twice the maximum peak-to-peak voltage expected in normal operation.

18.24.4 Transformers
Transformers shall have vacuum-impregnated windings and have a minimum inter-winding breakdown voltage of 1,500 VDC. Exceptions to this requirement may be granted on a case by case basis, upon approval by Metra.

18.24.5 Resistors
Resistors other than power/braking resistors shall be derated 50 percent minimum.

18.24.6 Capacitors
Capacitors shall be rated for transients of at least twice the maximum peak voltage expected in normal operation and be applied at continuous voltages not greater than 80 percent of rated working voltages. Exceptions to this requirement may be granted on a case-by-case basis, upon approval by Metra.

18.24.7 Motor Starters
Starters shall be rated for continuous duty at service indicated, shall be equipped with magnetic holding coils, and shall be capable of resetting automatically upon loss of supply voltage. Starters shall be equipped with sufficient auxiliary contacts to comply with requirements for annunciator circuits, as indicated. Thermal overload protection shall be provided. Three-phase starters shall be three-pole.

18.24.8 Environmental Conditions for Electronic Systems
When not in conflict with or specified otherwise in component portions of this specification, “normal railroad operating environment” for electronic systems shall be defined by referring to criteria in relevant sections of standard EN 50155 Railway applications – Electronic equipment used on rolling stock, including:

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IEC/EN 61373 Railway applications – Rolling stock equipment – Shock and vibration tests
EN 50121-3-2 Railway applications – Electromagnetic compatibility: Rolling stock – Apparatus
Metra will not require test reports for the above standards unless stated at the
component/system level.
APTA, AAR, and applicable North American standards take precedence where any conflicts
arise.

18.25 ELECTRONIC COMPONENTS
Electronic components shall be free of storage and handling damage. Where possible,
components shall be clearly and permanently labeled with values or type identification.
Semiconductor devices shall be available from two or more qualified manufacturers. Exceptions
to this requirement may be granted on a case-by-case basis, upon approval by Metra.
Carbon resistors shall not be used on printed circuit boards. Metra may grant the use of carbon
resistors on printed circuit boards that have previously been approved by Metra and are currently
being supplied to Metra.
Components as applied in their circuits shall be derated by at least 25 percent from
manufacturer's ratings.
For power semiconductors, derating of current shall be such that manufacturer's maximum
junction temperature is not exceeded with 25 percent increase in semiconductor current above
that required for performance

18.25.1 Printed Circuit Boards
Printed circuit boards (PCBs) shall be of glass epoxy construction, complying with NEMA LI1,
grade FR-4, or equivalent standard such as IEC 249.
PCBs shall be uniformly coated.
Conductor materials shall be determined on the basis of current carrying capacity and in
accordance with IEC 326-3.
Edge connectors and boards shall be keyed to prevent insertion of any board in wrong a
position, and mounted for ease of board removal and replacement.
To the greatest extent practicable, component labeling shall be provided on PCBs.

18.25.2 Semiconductor/Integrated Circuits Requirements
The Contractor shall be responsible for ensuring that all electrical and electronic circuitry,
including those of suppliers and subcontractors, as a minimum meet the criteria for the use of
semiconductors and/or integrated circuits listed in this section, unless otherwise approved.
Suppression devices shall be provided to protect the devices and limit the circuit voltage.
Non-JEDEC registered devices which carry more than 100 Amps may be used with prior
approval, based on submission of complete procurement specifications defining each such
device and evidence of availability from two or more manufacturers.
All semiconductor/integrated circuits shall be rated to properly perform in the range -40 to +85
C [-40 to +185 F].
Transistors and other solid-state power devices operated from nominal battery supply shall
have minimum breakdown ratings of four times the maximum circuit voltage. Suppression
deVICES shall be provided to protect the devices and limit the circuit voltage.
All integrated circuits shall be screened for defects. The Contractor shall submit for approval
screening methods based on a minimum of a 48-hour burn-in for the completed assembly.
Alternate screening methods may be submitted to Metra for review and approval.

18.25.3 Microprocessor-Based System Requirements
Microprocessor-based components, assemblies, and power supplies shall be provided with
voltage/current regulation and protection to ensure proper operation.
All interfacing wiring shall be protected against interference from other on-car or wayside electrical radiation.

The microprocessor shall be of a family shown to be suitable for the rugged environmental conditions encountered in rail applications, and shall be supported by software development language and diagnostic programs, which are acceptable to Metra.

The microprocessor assembly shall be housed in an enclosure, which shields the microprocessor assembly and the surrounding circuits from EMI radiation and interference. The microprocessor shall have external buffers provided, and shall be protected from external voltage and current transients and EMI.

18.25.4 Software Requirements

Where the software is essentially a modification of an existing product to meet the Metra’s requirements, the design process, and documentation, shall be submitted for review and approval by Metra.

For newly developed software, the Contractor and/or supplier shall submit a Software Quality Assurance Plan [CDRL C-18-27] for approval complying with IEEE 730 or equivalent, and containing, as a minimum, the following documentation requirements:

18.25.4.1 Software Requirements Specification
18.25.4.2 Software Design Description
18.25.4.3 Software Verification and Validation Plan
18.25.4.4 Software Verification and Validation Report
18.25.4.5 User Documentation

Source code shall be written in a high-level language such as C. All source code, properly documented, shall be placed in Agency approved third-party escrow when the last vehicle exits its warranty period.

The Software Design Description, in (b) above, shall comply with IEEE 1016 or equivalent. The requirements of this section shall be presented to Metra at the Design Reviews. Metra shall be properly notified of meetings and reviews scheduled to determine progress with respect to the software requirements and the software design description by the Contractor. It is recommended that the Contractor establish a Software Management Plan.

The contractor shall support a software compatibility on future operating system on laptop.

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19 INSPECTION AND TESTS

19.1 INSPECTION

19.1.1 It is the intent of these Specifications that inspection of the car and its components be the responsibility of the Contractor and the Manufacturers, and that inspections be performed at the plants of the Contractor and the Manufacturers so that corrections can be made under factory conditions.

19.1.2 Metra shall have one or more duly authorized inspectors in the Contractor's plant or any sub-contractor’s plant to check on and review all details involved in the construction of the cars and to be responsible for engineering liaison between Contractor and Metra and for approval of designated changes as necessary.

The Contractor shall provide adequate work space and provide copies of all designs and drawings (minimum two sets of 11" X 17" prints in three ring binders), and testing facilities, as necessary for execution of representative's inspection.

The scheduling of Metra personnel for station inspection and in-process testing shall be done in a timely fashion, with not less than 24 hours notice (written or oral) being given by the Contractor. Requests for weekend coverage shall be made only when absolutely necessary. Such requests must be made in writing by 3:00 PM of the preceding Thursday, and must contain eight (8) hours of inspection and/or test work for Metra personnel.

The Contractor’s gauges and other measuring and testing devices shall be made available for use by Metra to verify that the cars conform to all specification requirements. If necessary, the Contractor's personnel shall be made available to operate the devices and to verify their condition and accuracy.

19.1.3 Inspection stations shall be at the best locations to provide for the work contents and characteristics to be inspected. Stations shall provide the facilities and equipment to inspect structural, electrical, pneumatic, and other components and assemblies for compliance with the design requirements. Stations shall also be at the best locations to inspect or test characteristics before they are concealed by subsequent fabrication or assembly operations. Metra reserves the right to establish as many inspection stations it deems necessary. Metra also reserves the right to conduct such inspections independent of the manufacturer’s representative or with a restricted number of the Contractor’s personnel.

19.1.4 The presence of Metra’s representative in the plants of the Contractor shall not in any way supplant the Contractor's own inspection nor lessen the responsibility of said Contractor in respect to meeting all requirements of these Specifications.

19.1.5 Metra shall have the right to reject any design, workmanship or material which does not conform to accepted practice, to the design of the Contractor or any subcontractor supplying materials or components to the Contractor, or to these Specifications. Any such rejection shall be corrected by the Contractor to the satisfaction of Metra. Repetitious rejections may be the cause for Metra to order discontinuance of all or a portion of the design and/or manufacturing work. Such discontinuance shall not relieve the Contractor from schedule compliance requirements, pending resolution satisfactory to Metra.

19.1.6 Inspections of the first article produced, of certain major components and assemblies shall be made at the Manufacturer or Subcontractor source or at the Contractor's shop. The
Contractor shall notify Metra at least ten (10) working days in advance of the date on which inspection by representatives of Metra may be made, of the first article produced at the source plant or Contractor's shop, of the following components and assemblies: wheel and axle assemblies; truck frames; truck bolsters; complete trucks: couplers and coupler parts; coupler yokes; draft gear; air conditioning units; seats; door controls; door panels; climate controls; lighting; batteries; battery chargers; air brake equipment; and mobility aid lifts.

19.1.7 The Contractor shall notify Metra at least twenty (20) working days prior to completion of the first car at which time a sample car inspection will be made at the plant of all parts and performance, including such running tests as can be made at the Contractor's plant. All clearances and dimensions shall also be checked.

Representatives of the manufacturers and subcontractors, and any others, Contractor or Metra feels are necessary, shall be present at the sample car inspection at Contractor's shop.

19.1.8 Metra's Chief Mechanical Officer, Program Manager, Project Manager or their duly authorized representative shall be authorized to release the cars for delivery and shall be authorized to approve the pre-delivery acceptance tests. Upon request to the quality assurance supervisors, Metra inspectors shall have access to the Contractor's quality assurance files related to this procurement. These files shall include drawings, assembly procedures, material standards, parts lists, inspection processing and reports, and record of defects.

19.1.9 All requests from regulatory and other agencies to inspect any of the work shall be made through Metra rather than directly to Contractor.

19.1.10 Inspection costs incurred by Metra shall be borne by Metra, and no provision for such costs shall be made by Contractor in its bid price.

19.2 TESTS

19.2.1 The Contractor shall perform all tests specified herein unless the Contractor can furnish test reports acceptable to Metra which indicate that the equipment furnished under this contract is identical to equipment which has been tested for the same application and that these tests demonstrate compliance with the requirements of these specifications.

The Contractor shall prepare and submit a Master Test Plan to Metra for review and acceptance. [CDRL C-19-01] It shall be the Contractors responsibility to prepare a test plan, which includes all necessary testing to prove compliance with all requirements of this Specification.

The Contractor and his subcontractors may, at their option, conduct additional tests as part of their Quality Assurance program.

Unless indicated otherwise, all costs associated with any of the tests performed shall be borne by the Contractor. In the event of failure to meet the specification requirements in any test, the Contractor, at his expense shall make the necessary correction and rerun the test in its entirety (again at his expense). The Contractor shall give at least a twenty (20) working day notice to Metra prior to the start of any test.

The cost for train crews and alike used to perform qualification tests shall be borne by Metra for the first set of such tests. For any re-testing required, Metra shall invoice the Contractor for such services.

The Contractor shall prepare detailed procedures for all tests described herein. Each procedure shall be submitted to Metra for review and approval not less than sixty (60) calendar days prior to the first test. [CDRL C-19-02]
The Contractor shall provide a written report of each test, including all test data, to Metra. In the case of tests which are performed on all cars or all components, the report of tests shall be included in the appropriate car history book. All testing shall be for this contract. (Previous test reports not accepted). Pass/Fail conclusions must be stated in each test report.

19.2.2 QUALIFICATION TESTS (One Time Tests)

19.2.2.1 The first truck frame and bolster shall be stress tested under load conditions to approximate the conditions to be encountered in service (including impact loads, curving forces and braking forces). A minimum of one hundred (100) strain gauges shall be used. Strain gauges shall be located based on stress calculations, stress-coat testing and previous experience. Measured stress exceeding 80% of the yield strength of the material used, permanent deformation, cracks and fractures shall be cause for rejection. Metra shall be advised at least twenty (20) days prior to this test.

19.2.2.2 The first car body structure shall be compression tested to ensure that cars will meet AAR Standards and FRA Regulations. The test load of 800,000 lbs. shall be applied to the rear draft stops at the centerline of draft. The load shall be applied horizontally on the car longitudinal centerline and shall be applied in 100,000 lb. increments. There shall be no visible permanent deformation, fractures, cracks or separation in car structure. A structural member shall be considered as having developed permanent deformation if the yield strength in the appropriate direction (tension or compression) is reached or exceeded. In addition to the above, the following tests as described in APTA standard APTA SS-C&S-034-99 shall be conducted on the first car shell: Compression Load Test on the buffer beam, with a load test of 500,000 lbs.; Elastic Test on collision posts with loads as detailed in section 5.3.1.3.1 of the APTA Standard; and; Elastic Test on end corner posts with loads as detailed in section 5.3.2.3.2 of the APTA Standard.

19.2.2.3 An electric heating system test (Cold Room Test) shall be conducted on a single car to demonstrate continuous operation and specification compliance of the heating system under the extreme ambient environment for at least eight (8) hours continuous. The test chamber shall be capable of maintaining any temperature from 50°F to -20°F for this test. Electrical power consumption shall be recorded.

19.2.2.4 An air conditioning (Hot Room) Test shall be conducted on a single car to demonstrate continuous operation and specification compliance of the air conditioning and ventilation system under extreme ambient environment for at least eight (8) hours continuous. The test chamber shall be capable of maintaining any temperature from 110°F to 70°F and a relative humidity of 30% to 90%. Electrical power consumption shall be recorded.

19.2.2.5 An air flow test shall be conducted with all of the car's doors and windows closed and the ventilation system operating at normal capacity. Total Fresh Air Flow, Total Return Air Flow and Pressurization shall be recorded.

19.2.2.6 In conjunction with both the Hot Room and Cold Room the mobility aid lift (if equipped) shall be tested to verify operation at extreme temperatures.

19.2.2.7 The intensity of the various lighting systems, including emergency lighting, shall be measured and verified with the illumination levels specified herein.

19.2.2.8 The sound levels in the cab and in the passenger seating area shall be measured and verified with the levels specified herein. Tests shall be conducted with all systems running. Tests shall be run both statically and as part of a running test.

19.2.2.9 In addition, an air brake system performance test of a six-car consist, shall be conducted on Metra property to demonstrate compliance with specified braking performance parameters and to verify system design and component interaction characteristics. Testing shall be scheduled at times convenient for Contractor and Metra jointly. If equipped, a wheel slide system test shall be performed. In order to provide a test of the operation of the wheel
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slide protection system under actual operation conditions, facilities shall be provided for a test of this system during the road brake tests. Wheel slides shall be induced by apparatus installed on the vehicle that will spray a water soap solution on the track ahead of the lead wheels on each truck.

19.2.2.10 A curve negotiating and clearance test shall be conducted on three coupled cars and the cars shall successfully pass this test to comply with the requirements as described in Section 3.2.

19.2.2.11 Metra shall request to verify conformance to the ride quality requirements, one of the first pilot cars shall be subjected to ride quality road tests. At a minimum, the ride quality tests shall consist of testing of one or more cars on minimally compliant track that conforms with all FRA track standards for the classes of track over which the cars are designed to operate. The car or cars shall also be tested on a major segment of track over which the cars are intended to operate in revenue service, making all local stops while operating at normal scheduled speed, under AW0 and AW1 load conditions. The Contractor shall submit a Ride Quality Testing Plan for submittal to Metra for review and approval, specifying the start and end points, speeds, test methodology, measurement parameters and criteria, and method of instrumentation for the ride quality tests. Results from previous ride quality tests that closely simulate Metra’s revenue service environment may, at the sole discretion of Metra, be accepted in lieu of additional ride quality testing.

Instrumentation capable of measuring and charting the magnitude and frequency of the vertical and lateral shocks expected, up to 1.00 g (0.04 oz) and 0.5 to 50 Hertz, shall be provided and operated by the Contractor, who shall reduce the raw data for presentation to Metra. Sensing units shall be located on the car floor above the intersection of the car longitudinal center line and each truck transverse center line. Weights used in simulating the AW1 load, as well as their loading and unloading, shall be provided by the Contractor.

In the event, the dynamic behavior of the cars is non-compliant in any respect with requirements, the Contractor shall submit to Metra within 30 calendar days, a program containing mathematical analysis of the problem and a course of action for its correction. If Metra approves the analysis and corrective measures, those corrective measures shall be made effective on the pilot cars within 90 calendar days at the expense of the Contractor, the car shall be retested, and if the measures are successful, they shall be applied to all cars. If not, the analysis and correction steps shall be repeated, resubmitted and retested until success is attained.

19.2.2.12 EMI/EMC Test.

Metra may add additional qualification tests.

19.2.3 IN-PROCESS TESTS (All Cars)
Each car shall successfully pass the following tests conducted in accordance with an approved test procedure:

19.2.3.1 Car body water tightness tests shall be conducted on the car body shell and the completed car. The shell test is intended to demonstrate water tightness or car body construction before application of thermal insulation and finish panels. Complete car test shall demonstrate water tightness of finished car simulating passage through rainstorm at maximum speed of 79 MPH.

19.2.3.2 Air brakes shall be statically tested per FRA Regulations to verify all functions of the brake system under all conditions (service, emergency, release, and charging, function, conductor's valves, and all other combinations).
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19.2.3.3 All circuits, including locomotive and car control elements, are to be tested for continuity, grounds, voltage drop, and function. Tests shall be conducted individually as well as simultaneously. Megger and high potential tests will be conducted on all circuits and equipment as appropriate.

19.2.3.4 Functional tests of the following systems shall be conducted to demonstrate compliance with these specifications. Metra may add additional functional tests:

19.2.3.4.1 Communication System
19.2.3.4.2 Air Conditioning
19.2.3.4.3 ADA System
19.2.3.4.4 Heating System
19.2.3.4.5 Emergency Lighting System
19.2.3.4.6 Pressurization
19.2.3.4.7 Door operation
19.2.3.4.8 Handbrake
19.2.3.4.9 Anti-Freeze System
19.2.3.4.10 Video System (cab cars)
19.2.3.4.11 Dimensional Testing
19.2.3.4.12 Cab Signal System (cab cars)
19.2.3.4.13 Alerter/Event Recorder (cab cars)
19.2.3.4.14 Locomotive Control (cab cars)
19.2.3.4.15 Headlights, Ditch lights, Oscillating light, Marker lights (cab cars, includes aiming of headlight & ditch lights)
19.2.3.4.16 Horn Testing per 49 CFR Part 229.129 (cab cars) using Metra Horn Sound Level Test Form
19.2.3.4.17 Emergency Signage for Egress/Access of Passenger Rail Equipment per APTA Standard PR-PS-S-002-989 Rev. 3 (Batch of Cars) Batteries and Battery Charger (& LVPS on cab cars)
19.2.3.4.18 Positive Train Control System (cab cars)
19.2.3.4.19 Emergency Lighting Standards per APTA standard PR-E-S-013-99 Rev. 1 (Batch of Cars) using Metra Form RC100212, latest revision
19.2.3.4.20 LLEPM Standards per APTA Standard PR-PS-S-004-99 Rev. 2 (Batch of Cars)
19.2.3.4.21 Wheel Slide System (If Equipped)
19.2.3.4.22 Electrical Function
19.2.3.4.23 Water System/Toilet System
19.2.3.4.24 TIMS
19.2.3.4.25 Trainline
19.2.3.4.26 Carbody Dimensional Measurement

19.2.4 POST-DELIVERY TESTS: CONDITIONAL ACCEPTANCE

19.2.4.1 In accordance with 49 CFR Part 238.111 Metra will conduct acceptance tests on each delivered car. Metra shall complete these tests completed within fifteen (15) calendar days after notice of fitness for testing is issued and shall be conducted in accordance with written test plans. These tests will also identify defects that have become apparent between the time of the car's release and delivery to Metra. The post-delivery tests shall include visual inspection and operations. Generally, post-delivery test shall apply criteria that are similar to the criteria applied in an analogous IN-PROGRESS test (if any). However, Metra reserves the right to conduct any additional test to ensure that the completed cars have attained the desired quality and have met the requirements of these specifications.

Reports covering Conditional Acceptance testing shall be prepared by the Contractor.

19.2.4.2 Tests will include, but are not limited to the following:
19.2.4.2.1 Communication Equipment (including Information Systems)
19.2.4.2.2 Trainline Compatibility
19.2.4.2.3 HVAC System Functions
19.2.4.2.4 ADA System Functions
19.2.4.2.5 Running Tests
19.2.4.2.5.1 Curve Clearance Verification Test
19.2.4.2.5.2 Brake Test
19.2.4.2.5.3 Riding Quality Test
19.2.4.2.5.4 Audible Noise Test
19.2.4.2.5.5 Cab Signal Qualification Test
19.2.4.2.5.6 PTC Qualification Test
19.2.4.2.5.7 TIMS Qualification Test

Metra may add additional post-delivery qualification tests.

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20 PRODUCT SUPPORT

All manuals, drawings, photographs, and training material ("Material") shall include an irrevocable license to reproduce such Material for Metra's internal purposes. Metra has rights to use above documentation in the bid package for overhaul, parts procurement without notifying OEM.

Manuals, Drawings, etc. shall be shipped to:

Metra
547 W. Jackson Boulevard
Chicago, Illinois 60661
Attention: Chief Mechanical Officer
Mechanical Department 16th floor

20.1 DRAWINGS AND REPRODUCTIONS

20.1.1 The Contractor shall furnish before the first car is delivered a complete and correct electronic (pdf) set of drawings, covering all assemblies, subassemblies, and all detail parts, manufacturing/shop/parts drawings prepared by the Contractor and Subcontractors that are necessary for the construction of equipment. The inspection (visual/dimensional) criteria, casting/forging material criteria shall be provided.

20.1.2 A formatted in Autodesk AutoCad (.dwg files) of the complete editable as-built version of the drawings above shall be provided thirty (30) days after the conditional acceptance of the last car. [CDRL C-20-01]

20.1.3 Metra shall have unlimited rights to use these drawings and documentation specifically issued to Metra for this project.

20.2 PHOTOGRAPHS

20.2.1 Electronic version (jpg) of the following color photographs shall be provided [CDRL C-20-02]:

20.2.1.1 Side elevation of the car;
20.2.1.2 Combination front and side (three-quarter) view of the car;
20.2.1.3 Head-on view of each end;
20.2.1.4 Car seating, both upper and lower (if applicable), taken from three (3) different angles;
20.2.1.5 Stairways
20.2.1.6 Both trucks in the ready to run condition, but not applied to car;
20.2.1.7 Mobility aid lift, completely lowered and completely raised;
20.2.1.8 Ten (10) miscellaneous photographs illustrating the construction of the cars;
20.2.1.9 Communication and door control station;
20.2.1.10 ADA positions;
20.2.1.11 Interior of all lockers and control panels;
20.2.1.12 Passenger boarding/alighting area;
20.2.1.13 Undercar equipment;
20.2.1.14 Major underframe connections (bolster at side and center sill, etc.);
20.2.1.15 Underframe, inverted, before addition of superstructure;
20.2.1.16 Roof, before addition to car;
20.2.1.17 Details of side panels;
20.2.1.18 Details of all communications equipment;
20.2.1.19 Details of door control stations and door operators.
20.3 DRAWING LISTS AND BILLS OF MATERIALS

20.3.1 Two (2) copies of a complete drawing list and bill of materials, which should include all Contractor's construction drawings and specialty manufacturers' drawings applicable to the cars shall be furnished. [CDRL C-20-03]

20.3.2 An electronic version, Microsoft Excel file, of each document shall be provided thirty (30) days after conditional acceptance of the last car.

20.4 SPARE PARTS CATALOGS AND MAINTENANCE MANUALS

20.4.1 There shall be two (2) comprehensive manuals: 1) Maintenance and 2) Parts. The Contractor shall deliver, in searchable, electronic form drafts of the Maintenance manual and of the Parts Manual to Metra prior to the shipment of the first production car. As-built updates, including car affectivity shall be provided through the life of the contract.

The Contractor shall deliver to Metra the final, editable electronic version of each manual within thirty (30) days after conditional acceptance of the last car. [CDRL C-20-04] [CDRL C-20-05]

All manuals shall be divided into fourteen (14) sections as follows:

20.4.1.1 Introduction (How to Use)
20.4.1.2 Car Body
20.4.1.3 Truck System
20.4.1.4 Electrical System
20.4.1.5 Braking System
20.4.1.6 Coupler System
20.4.1.7 Door System
20.4.1.8 Air Comfort System
20.4.1.9 Lighting System
20.4.1.10 Communication System
20.4.1.11 Mobility Aid Lift
20.4.1.12 Seats
20.4.1.13 Cab Equipment
20.4.1.14 Miscellaneous Systems

Each section shall have a table of contents.

The contractor shall provide the manufacture name and part number for drop replacement parts.

In all manuals, Contractor developed and Vendor supplied information shall be integrated into a unified presentation for each system addressed. For clarity of presentation the same data may be presented twice but shall use the same views and diagrams with the same reference numbers in each manual.

20.4.2 The Maintenance Manual shall address components to the lowest level identified in the parts catalog. The manuals shall contain a detailed analysis of each component so that maintenance personnel can effectively service, inspect, maintain, adjust, troubleshoot, repair, replace and overhaul the equipment. Where interfaces occur, a cross reference shall be made to the appropriate location.

The manuals shall be divided into the following sections and address the following topics:

20.4.2.1 Introduction - This shall include the purpose of the manual, special tools, technical guidance including torque requirement, sealing requirement etc., and equipment and safety precautions.
20.4.2.2 **Theory of Operation** - This shall include the general theory and the specifics of this system and the relationship of assemblies, subassemblies and components with an explanation and analysis of their functions to the smallest replaceable components.

20.4.2.3 **Operating Procedures** - This shall include the location and functional descriptions of all controls, monitors and indicators.

20.4.2.4 **Troubleshooting** - This shall include a list, in tabular format, of symptoms, causes of malfunction or improper operation, and probable remedies to the smallest line replaceable component or printed circuit board level. Logic/flow charts may be used to assist troubleshooting, but must reflect the most efficient and effective logic and not be simply tracing of schematics.

20.4.2.5 **Corrective Maintenance** - This shall include step-by-step removal, replacement, and adjustment procedures to the smallest line replaceable component or printed circuit board level. Detailed procedures shall be provided to adjust any unit that has been replaced.

20.4.2.6 **Preventive Maintenance** - This shall include a list, in tabular format, of all lubrication requirements, types of lubricants, frequency of application, inspection requirements and limits, component replacement and repair schedule, required adjustments, limits and tolerances, optimum test point readings, calibration charts and procedures in performing the preventive maintenance.

20.4.2.7 **Corrective Repair (Shop)** - This shall include detailed troubleshooting procedures for subassemblies as well as complete assemblies, step-by-step removal, overhaul, replacement and adjustment procedures to the smallest replaceable component. Detailed test and adjustment procedures shall be provided for all subassemblies and for the complete assemblies/units.

As part of the overhaul procedure, details for rebuilding, reclaiming or replacing all wearing or moving parts with comprehensive information on the limits and tolerances sufficient to determine the best approach to follow must be included.

20.4.2.8 **Appendix** - This shall include a list of reference drawings, interface drawings, circuit diagrams, symbols, cross references and revisions.

20.4.3 The parts manuals shall enumerate and describe every part to the lowest level of replaceable component. They shall include component name, symbol, function, rating, tolerance, manufacturer name and address, manufacturer's part number, commercial equivalents and quantity per assembly or sub-assembly. The manuals shall contain exploded-view diagrams illustrating and indexing every removable/replaceable part.

Each diagram shall be accompanied by a page listing every item indexed in the associated diagram and providing complete ordering data for every item. Diagrams and exploded views shall be provided to identify the appropriate location of parts within a sub-assembly and of the sub-assembly within the next larger assembly.

**OPERATING INSTRUCTION BOOK**

20.5.1 The Contractor shall furnish fifty (50) copies of instruction books, of a convenient size for handling and carrying, for train crew information on the operation of the cars. The book shall provide general information for the train crew duties, including troubleshooting information in case of breakdown or failure, and safety aspects related to train crew duties. Diagrams and photographs shall be used where applicable.

20.5.2 All copies of the book covering the Metra cars shall be delivered sixty (60) calendar days before delivery of the first production car to Metra. The text of the operating instruction book shall be submitted to Metra for approval prior to printing. [CDRL C-20-06] In addition, an electronic version (format to be agreed upon) of this book shall be provided.
20.6 RECORD OF CONSTRUCTION/CAR HISTORY BOOKS

Car Contractor shall furnish in electronic form (pdf Files) to Metra a complete record of
construction for each car consisting of the following information [CDRL C-20-07]:

20.6.1 All serial numbers on (and not limited to) trucks and related components (bolsters,
equalizer beams etc.) and all heat numbers of truck forgings and castings; axles, wheels,
bearings, journal boxes, brake components, cab components and related components, HVAC
systems and related components, Positive Train Control (PTC) equipment and related
components, Cab signal and related components, display units, battery chargers and power
supplies, Communications systems and related components, ADA systems and related
components, pressurized components, toilet systems and related components yolk and coupler,
and any other serialized parts. In addition, all software and firmware part numbers and
revisions shall be provided.

20.6.2 Serial numbers, software and firmware part numbers and revisions shall be provided with
each car history. In addition, an electronic version of a master list of serial numbers per vehicle
shall be provide to Metra in Microsoft Excel format that can be uploaded into Metra’s asset
tracking database (Maximo).

20.6.3 Wheel and axle mounting reports;

20.6.4 Contractor’s standard test sheets;

20.6.5 Two copies of "Certificate of Reservoir Construction" specifying minimum tensile strength
of the material used, thickness of the shell and heads, outside dimensions and serial number;

20.6.6 Written reports, tests, and approved contract changes made by the Contractor during car
construction;

20.6.7 Specification sheets as required by FRA shall be completed and delivered to Metra no
later than delivery date of each car.

20.7 AS BUILT SPECIFICATION

Car Contractor shall furnish an electronic version of an as built specification showing all details
of car, all components used and naming supplier and model of all equipment on cars. These
books shall be furnished to Metra no later than 30 calendar days after delivery of final car. If
any changes were made during construction, the as built specification shall detail the changes,
and indicate to which cars changes were made or different equipment was applied during
construction. [CDRL C-20-08]

20.8 FIELD SERVICE

The Contractor shall provide for field support facilities and personnel during the periods of
performance testing, warranty, and retrofit programs (if any). The details and plans for field
service shall be submitted to Metra for review and approval. [CDRL C-20-09] Where
manufacturers' systems require specialist support, the Contractor shall arrange with the
manufacturer for qualified personnel. Metra may require the Contractor to replace any field
service personnel whom Metra deems in its discretion to be unsatisfactory.
Metra will accommodate field support personnel with a minimum of two parking spots at one of
its main shops/yards, either Burlington Northern Santa Fe 14th St. Coach Yard or Rock Island
District 47th St. yard. The specific location for field personnel will be decided at a later date
depending on Metra’s needs and distribution of the newly purchased cars. The Contractor will be required to provide its own office space (trailer or other temporary office space, not to exceed 60 foot length by 12 foot wide by 12 foot height and office supplies (desks, chairs, computers, etc.). The field support office, including all furnishings, shall be covered under the Contractor’s Risk Insurance. The Contractor shall be responsible for its own security of the office space and space provided for material storage. Material storage space will also be provided for the contractor. Metra will provide a minimum of one hundred and fifty (150) square feet of space for the Contractor to store material. Metra will provide utilities (electrical) for the office and material storage space.

20.9 TEST EQUIPMENT
The Contractor shall supply, sixty (60) calendar days prior to delivery of the first production car, four (4) sets of Specialty Tools and any test and diagnostic equipment necessary to support and maintain the cars and their sub-systems. A Specialty Tool shall be considered any tool, gage, die, etc. called out for inspection, repair, maintenance or overhaul of the vehicles that is not readily, commercially available. Special Tools shall not include fixed shop equipment. Test equipment will troubleshoot down to electronic board level (qualify boards for functionality).

20.10 TRAINING

20.10.1 General
The Builder must provide a modular training program using methodologies and formats which follow Instructional Systems Design (ISD) standards or equivalent Metra-approved formats recognized by American Society for Training and Development (ASTD). Training programs will be provided for the specified number of Metra’s designated Instructors, Supervisors, Operating, Maintenance, and Engineering personnel, and be of a quality and depth sufficient to permit such personnel to train others in the operation and maintenance of the cars and to safely and satisfactorily operate, service, and maintain the cars and all their ancillary equipment. The training shall be based on Metra’s “Train the Trainer” philosophy to allow future training programs to benefit fully from the training materials provided. Safety and FRA inspection compliance are of the utmost importance.

The Contractor must provide modular training materials using Metra’s Word-based template and style (active voice, present tense). The Contractor must be familiar with Information Mapping methods and techniques. An additional requirement is that all written materials (course guides, tests, practical exercises) must allow for immediate and invisible integration into Metra Workforce Education and Training’s (WFET) current training materials. This will allow for comprehensive training with respect to all aspects of operation and maintenance of the new equipment.

If the Builder intends to use a subcontractor for training, the Builder should identify the subcontractor. If a subcontractor is used, Metra’s issuance of the Notice to Proceed is conditioned upon Metra’s receipt of an executed copy of the Builder’s contract with the trainer identified. The Builder should also specifically designate by name the project manager who will oversee the entire training process, oversee the training subcontractor, and who will interface directly with Metra’s Director of Training & Development.

The ultimate objective of all training materials is that the trainees will be able to safely, accurately, completely, and successfully perform their assigned job tasks. Assigned job tasks include operations, maintenance, and repairs. Safety and FRA inspection compliance are critical to the success of the project. The training must include thorough explanations, operating, and maintenance instruction for any and all new technology. Metra requires that the training define with sufficient detail, accuracy, and completeness the operating and
maintenance practices, procedures, and requirements associated with the supplied rolling stock.

Specifically, the Contractor must develop materials and deliver training that includes:

- Comprehensive conceptual information
- Functional descriptions
- System descriptions
- Component descriptions
- Installation and removal instructions
- Scheduled maintenance instructions
- Running maintenance instructions
- Comprehensive diagnostics and testing information
- Explicitly defined terminology for new technologies
- Comprehensive information for all new technologies, including system interfaces

Developing and delivering training requires that the Contractor:

- Obtain broad and deep knowledge of Metra equipment and supporting components
- Understand Metra’s operations and operational goals
- Obtain a thorough understanding of all regulations that govern Metra operations

The training shall be conducted in two phases. The first phase shall commence prior to the first production unit being available for revenue service. The second phase shall commence sixty (60) calendar days after the conditional acceptance of the last car of the initial order, in order to provide adequate training of Metra’s designated personnel to allow them to become proficient with the equipment. Phase one consists of vehicle orientation, operation and running repair. Phase two consists of vehicle heavy repair procedures and requirements.

Training shall include instructor led classroom and hands-on instruction through the use of actual equipment, mock-ups, models, manuals, diagrams, and parts catalogs.

The Builder shall conduct a task analysis that is craft and location specific and includes an assessment of Metra’s designated employees’ baseline skills (knowledge, skills, abilities) to determine the appropriate level of content assumed in the training materials. The Builder shall assume the attendees have no knowledge of the features of the new cars, and using results of the assessment, shall design the training program to bring the level of student knowledge to one fully adequate for the stated objectives. The Builder’s approach to this effort shall be based on the assumption that the builder’s own interests, immediate and future, are best served by a high quality program.

All courses of instruction shall be presented in the English language.

Prior to the initiation of classroom instruction, all instructors to be utilized by the Builder shall attend an orientation at a Metra-designated location to become familiar with Metra’s safety regulations and facilities, and to be advised of student qualifications and expectations.

A complete training plan including manuals and other training materials to be used by the Builder during training shall be delivered to Metra sixty (60) calendar days before initial training is conducted. The manuals shall be accurate, complete, of professional quality, and shall have been approved by Metra. Drawings shall be the most recent version reviewed and approved by Metra.

In addition to the above requirements, the Builder shall submit as part of the BAFO, in detail a projected training plan clearly linking each individual activity and deliverable to the car production schedule, providing clear project management documents (Gantt charts, etc.), which link the various time lines. Note: the clarity of the information and level of detail will be important factors in this evaluation.

The program shall be conducted in a Contractor provided facility, at or near Metra’s facilities in the Chicago, Illinois metropolitan area and shall include classroom and hands-on instruction (including practical exercises on actual equipment). The Builder shall provide an adequate
supply of high quality, professionally prepared material on paper and such other training aids as may be necessary to impart the essential information to the people involved and leave them with authoritative and up-to-date reference material. The program shall include pre and post tests and hands-on practical exercises to determine the proficiency of the students in meeting the course objectives.

The training shall provide in-depth instruction covering all subjects and systems and their location, removal, replacement, and interfaces with other systems and parts of the car. Special emphasis shall be placed on job aids and instruction that compare and contrast the differences in new car systems with Metra’s existing car systems. Metra will provide the Contractor with a set of maintenance manuals on typical existing equipment.

The Builder shall, within ninety (90) calendar days after the Notice to Proceed, submit an Overall Training Program Outline with clearly defined Terminal Learning Objectives and a schedule for Metra’s approval that identifies milestones for submitting the course outlines, lesson plans, instructor and student guides, audiovisual and other training aids, simulators, written and practical skills evaluations, and conducting classes. The training outline shall identify each module of instruction and the general topics to be taught, and indicate the order in which modules will be presented. [CDRL C-20-11]

Training materials including manuals, audio/visual aids, reference documents, computer hardware and software, mock-ups, models, simulators, check lists, and related items shall be as described in Section 20.10.9.

Prior to training materials being developed for a given module, the Builder shall submit a set of clearly defined Module Enabling Learning Objectives being developed, and shall not proceed with development until the Module Enabling Learning Objectives are approved by Metra’s Training and Development Division. As training materials are being developed, the builder shall work closely with Metra’s staff to ensure Metra’s standards with respect to the course organization, content, and overall quality of written documents and audio/visual aids are being met.

All training materials such as training aids and lesson plans shall become the property of Metra at the completion of the training program. The Builder shall be responsible for the condition of these materials for the duration of the training program and shall replace all damaged materials unless the damage results from Metra’s negligence. Lesson plans shall be updated as required during the course of instruction. Metra shall be given full copyrights to reproduce and modify training materials for Metra’s use.

20.10.2 Instructor Qualifications

Prior to the development of any training materials, all contracting instructors must attend an orientation at a Metra-designated location. The objective of the orientation is to familiarize the contracting instructors with Metra’s safety regulations and facilities. At the orientation, Metra will also advise the instructors about student qualifications and expectations. The orientation will be a one-day session. In the event that more than one session is necessary, Metra will host multiple sessions in order to accommodate all instructors.

All of the instructors provided by the Builder shall be fully capable of delivering in-depth technical information that can be understood by participants. A detailed resume for each instructor shall be provided to Metra for approval sixty (60) calendar days prior to commencement of scheduled course instruction. [CDRL C-20-12] Metra reserves the right to disqualify any of the builder’s instructors for reasonable cause at any time. Metra will recognize the instructor as qualified when the individual:

- Can communicate, in English, in a manner that allows the participants to understand;
- Has been trained in adult teaching principles and methods and has had experience in conducting technical training courses;
• Has an in-depth knowledge of the system under discussion, how it interfaces with other systems or subsystems, the procedures for isolating faults, if applicable, and troubleshooting, and is able to communicate that information to students in an effective manner.
• Is able to design practical written tests, according to the approved course objectives, to determine the extent to which students understand and can apply the information that has been taught.

As part of the BAFO, the Builder should define and explain the specific person(s) for each subcontractor who will be designated as the contact to implement that portion of the training.

20.10.3 Training Schedules, Class Size, and Program Plan

The Contractor must, within ninety (90) calendar days of receiving the Notice to Proceed, submit an overall initial Training Program Plan that contains a detailed outline and a project schedule for Metra’s approval. The program plan must contain:
• All assigned project team members including:
  o The tasks to which they are assigned
  o Company name
  o Location
  o Contact information
• Project Objectives.
• Detailed project phases, tasks, and deliverables (scope).
• A detailed schedule of delivery dates, specifying milestones such as draft delivery dates, edited materials delivery dates, and final delivery dates.
  • The course modules and corresponding lessons.
  • The types of deliverables for each course module (CBT, hard copy materials, etc).
• Project team hierarchy, sign-off authority, and delivery process.
• Communication and reporting plan.
• Change management plan.

The training must provide in-depth instruction, covering all equipment and components and their relevancy to the operation, maintenance/troubleshooting, and repairs. Training requirements include familiarity with new equipment systems, location, removal, and replacement. It is critical that all materials and instruction focus on the new passenger car components.

Prior to submitting draft versions of training materials, the Contractor must submit detailed outlines and/or storyboards for approval. No development can commence without the approval of outlines and/or storyboards. Course and lesson objectives must be a part of the detailed outlines and/or storyboards.

The Contractor must submit all training materials for review to the Metra project team. The Metra project team requires fifteen (15) working Days (as defined in Exhibit 1-A) to review, edit, and return the training materials. The Contractor must have the ability to produce and submit materials according to a predetermined training plan and schedule.

Once the Contractor receives the edits from Metra, they must resubmit the edited version within ten (10) working days for approval. All materials must be finalized within a three-version cycle. During materials development, the Contractor must work closely with Metra’s project team to ensure the Contractor is meeting Metra’s and project standards.

All final versions must be ready for delivery thirty (30) working days prior to the date scheduled training date.

All training materials will become the property of Metra at the completion of the development and training program validation. Metra will retain all materials utilized in the training program, and will use these for future internal training.

The Contractor must be responsible for the condition of all training materials and equipment for
the duration of the training program, and must replace all damaged materials unless the
damage results from Metra's negligence. The Contractor must update all materials, training
aids, and mock-ups as necessary during development and course validation. Metra must have
full copyrights to reproduce and modify training materials for future use at Metra.
Course duration (hours of instruction) and class size (number of trainees) will be clearly defined
for each topic, depending upon the craft and topic involved. In addition, the proposal must
clearly estimate the number of hours for development per hour of classroom instruction, for
each module.
All ancillary equipment should be proposed to maximize the training objectives.
Operator field instruction of at least 4 hours is acceptable as an estimate; with more specific
estimates of duration to be determined in the project plan.
The proposal must clarify whether proposed CBT modules are to support classroom modules or
if they are to act as a stand-alone modules.
Metra will determine the class size. In general, class sizes will be from five (5) to ten (10)
people.
Metra acknowledges the variances (experience and technical skills) in the workforce. The
Contractor must work with the Metra project team to determine the appropriate number of pilot
and validation classes.
After Metra accepts the lessons, and objectives for each module, the Contractor must deliver a
pilot class to verify content and presentation. After making additional necessary revisions, the
Contractor must deliver a validation class to allow Metra to verify and approve content and
delivery. In order to validate the class, the audience in validation class must be at least 50% of
the pilot class audience. Changes to the validation course content must be included with the
final deliverables.
Requests for revisions will be made by the Metra project team. The project team can determine
the correctness and accuracy of the content. They can also judge the quality of the content
based on their extensive design and development experience.
The Contractor must supervise all classes and must comply with all of Metra’s labor
agreements, safety rules, other work rules, and policies. The Contractor must conduct classes
during Metra’s normal daytime hours of operation, Monday through Friday. The classes cannot
be more than 8 hours per day, with total course duration to be mutually agreed upon by the
Contractor and Metra.
Metra is planning for a three-phase training approach. Phase I is described as the Introductory
Phase, and will include:
  • Overview and conceptual information about the equipment.
  • Operation of the equipment.
  • Daily inspections.
Phase II is described as the Qualification phase, and will include:
  • Maintenance.
  • Troubleshooting.
  • Repair.
Phase III is described as the Heavy Maintenance phase, and will include:
  • Equipment breakdown and rebuilding.
  • Equipment overhaul.
As part of this contract, Metra requires that the Contractor provide training on specific topics for
employee specializing in specific crafts. This table contains the topics, the craft, and the
number of employees that must be trained in each topic.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Craft and Number of Trainees</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA Equipment</td>
<td>• Carmen – 276 trainees (M)</td>
<td>605 Trainees</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Section</th>
<th>Addendum No. 3</th>
<th>Issued 6/19/19</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Subject</th>
<th>Description</th>
<th>Trainees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Brake System Equipment</td>
<td>Carmen – 276 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>371 Trainees</td>
</tr>
<tr>
<td>Air Brake System Operations</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>905 Trainees</td>
</tr>
<tr>
<td>Automatic Train Control</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>329 Trainees</td>
</tr>
<tr>
<td>Low Voltage Power Supply / Battery Charger</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>329 Trainees</td>
</tr>
<tr>
<td>Car Body Identification</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>905 Trainees</td>
</tr>
<tr>
<td>Communications System Equipment</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M)</td>
<td>321 Trainees</td>
</tr>
<tr>
<td>Communications System Operation</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>1,218 Trainees</td>
</tr>
<tr>
<td>Door Systems Operation</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>1,218 Trainees</td>
</tr>
<tr>
<td>Door Systems Equipment</td>
<td>Carmen – 276 trainees (M) Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>605 Trainees</td>
</tr>
<tr>
<td>Electrical Cabinet Identification</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>905 Trainees</td>
</tr>
<tr>
<td>Electrical Systems</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>329 Trainees</td>
</tr>
<tr>
<td>HVAC System Equipment</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>329 Trainees</td>
</tr>
<tr>
<td>HVAC System Operation</td>
<td>Electricians – 234 trainees (M) Managers – 87 trainees (M) Instructors – 8 trainees (W)</td>
<td>1,218 Trainees</td>
</tr>
</tbody>
</table>
Lighting Systems Equipment
- Electricians – 234 trainees
- Instructors – 8 trainees (W)
- Managers – 87 trainees (M)
329 Trainees

Lighting Systems Operation
- Instructors – 10 trainees (T)
- Managers – 35 trainees (T)
- Engineers – 313 trainees (T)
- Trainmen – 860 trainees (T)
1,218 Trainees

Truck and Coupler System
- Carmen – 276 trainees (M)
- Managers – 87 trainees (M)
- Instructors – 8 trainees (W)
371 Trainees

480 Volt Electrical System
- Instructors – 10 trainees (T)
- Managers – 35 trainees (T)
- Engineers – 313 trainees (T)
- Trainmen – 860 trainees (T)
1,218 Trainees

(M) – Mechanical Department Employees
(T) – Transportation Department Employees
(W) - Workforce Education and Training

Note: This matrix contains a tentative list of topics and an approximate number of trainees. Actual topics and the number of employees requiring training in each topic will vary based on the equipment Metra ultimately purchases.

The training modules must be customized for the various technical, operational, and support staff impacted by the new equipment. The trainee groups include the following classifications and current number of existing employees:

- Workforce Education and Training (WFET) Instructors
- Mechanical
  - Apprentices
  - New Employees
  - Journeymen (Carmen, Electricians, Machinists, Sheet Metal Workers)
  - Foremen
  - Management Staff
  - Engine Watchmen
- Transportation
  - Engineers (Operators)
  - Trainmen
  - Instructors
  - Management Staff
  - Dispatchers

Note: The Contractor must provide training to the assigned Metra employee population on all components, systems, and subsystems that comprise the operation and maintenance of the new equipment. For example, all Metra electricians must attend those specific training classes for each topic related to electrician job tasks.

Training must include CBTs, instructor-led classroom, and hands-on instruction using actual equipment, mock-ups, models, manuals, diagrams, and parts catalogs. All equipment must be located and the training conducted at Metra’s Rock Island District 47th Street yard. At the conclusion of the training as set forth herein, all actual equipment, mock-ups, models, and other training materials are to become Metra’s property. The property is necessary for Metra to train new employees in the future.

As part of this contract, Metra requires that the Contractor provide training aids (mock-ups) for, but not limited to, the following equipment:
All courses must include a combination of classroom and hands-on instruction. For most course topics, Metra expects 40%-60% of the classroom time to be allocated to hands-on activities. In-class exercises, written exams, and practical skills evaluations must be designed and developed for each course in order to determine the extent to which students have learned and can apply the information identified in the course. Metra requires the Contractor to make recommendations for test frequency and methods.

Classroom instruction for preventative maintenance courses must include not only the details and functioning of parts under discussion, but the essentials of their routine or periodic care, including lubrication schedules and materials. When methods of access, removal, dismantling, or application are not evident, the instruction must cover these matters.

The Builder shall make recommendations for test frequency, tolerance limits, and methods for testing, including instruments required, when applicable. The Builder shall assist Metra personnel in developing suitable preventative maintenance, daily and periodic inspection forms, and shall instruct Metra employees how these inspections are performed.

The Contractor must give special attention in the instructions, to matters relating to current and proposed safety and FRA inspection requirements and must provide detailed checklists to assure compliance.

It is important that the Contractor recommend, develop, and provide the most appropriate training aids and equipment in response to the Metra workforce needs and the passenger equipment subsystems being proposed.

After Metra accepts the Terminal and Enabling Learning Objectives for each module, the builder shall deliver a Module Executive Overview to verify module concept. In addition, for each module, a presentation will be made to selected members of the Labor/Management Committee involving the pertinent labor and management representatives affected by the subject matter or topic. After making revisions, if necessary, the Builder shall deliver a Module Pilot Class to verify content and presentation. After making revisions, if necessary, the Builder shall deliver a Module Validity Class to verify and approve content and delivery. After approval, the module will be accepted for delivery to the general population.

The Builder shall supervise all classes and shall comply with all of Metra’s labor agreements, safety rules and other work rules. Classes will generally be conducted during Metra’s normal daytime hours of operation, Monday through Friday, and no more than 8 hours per day with total course duration to be mutually agreed upon by the Builder and Metra.

The Builder shall provide all necessary training equipment. The Builder will equip a classroom approved by Metra with standard audio-visual equipment (overhead projector, slide projector, DVD video player, projection screen, dry erase marker board) and furniture (desks, chairs, and tables) as needed. Instruction, practical exercises, multimedia presentations or computer based instruction requiring use of computers, large screen video projection (PowerPoint® for example), audio equipment, specialized tools, or test equipment are acceptable. All such hardware and software used will be provided by the Builder and will become the property of Metra upon completion of the training.

Cost of any such hardware and software shall be borne by the Builder. Computer hardware and software compatibility shall be in accordance with the Training Materials Section.

### Operator and Inspector Training

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The operations training program shall include, but not be limited to, the following: specifications; controls and indicators; systems (brakes, train control, instrumentation, audible & visual signaling and communications); operations (i.e., actual operation of the car in maintenance yards and on the main tracks or operational simulator); troubleshooting procedures, and recovery operations (recovery from the situation, as in resolving the problem discovered when troubleshooting, i.e., fixing the problem).

Engineers must be trained in a fully operational cab simulator. Instruction will include comparisons to passenger cars currently in Metra service, with concentration on changes in operation, functions, features, locations and indication. A Metra supervisor or qualified instructor must accompany all Contractor instructors to ensure that the training complies with all Metra’s safety and operational policies.

Operational instructions must follow a logical progression involving the details of the Cars, the manipulation of all controls, and actual operation of the Car components and systems. Actual operation must be conducted under Metra’s operating rules and must be performed by Metra’s qualified employees under the direction of the Contractor’s representative. Operating instruction must include trouble indications, their proper reporting, and corrective measures available to the engineers and operators.

All bid respondents must take note of the provisions of 49 CFR § 238.109 in its entirety, and in particular § 238.109(b)(12), ‘Training, Qualification, and Designation Program.’ As part of this program, the railroad should, at a minimum: “Add new equipment to the qualification and training program prior to its introduction into service.”

If bid respondents propose an alternative to fully functional passenger equipment, given the training objectives and the federal requirements of CFR § 238.109; bid respondents should stipulate the alternative very clearly.

Phase I – Overview and Operations Training

Phase I training must address topics and content capable of being effectively delivered prior to the availability of the first production unit. Examples of Phase I topics might be, but are not limited to:

- New equipment orientation (similarities, differences, safety)
- New equipment operation training (normal and emergency operations)
- New equipment maintenance training (craft specific classes on items such as an introduction to Daily Inspections).

20.10.5 Maintenance Training

Metra’s employees (a total of 597 employees, 4 crafts and their supervisors) shall be exposed to the depth of detail that is necessary for the performance of all preventive (scheduled) and corrective (unscheduled) maintenance operations for all aspects of the cars. Students shall be afforded the opportunity to perform the more complex maintenance functions on the car and in the shop, in addition to troubleshooting systems with faults artificially introduced in the equipment while using the appropriate subsystem test devices.

The program shall emphasize the details of performing heavy maintenance repair and rebuilding of major components. Metra performs complete car overhauls. Metra will accept and may approve modules pertaining to heavy maintenance within the acceptance parameters of this Contract.

Metra may, however, defer the classroom delivery of heavy maintenance training to a selected population on a date to be determined which is closer to Metra’s performance of that work. As part of the BAFO, the Builder should specifically define mock-ups or simulator equipment to be used in any training module to maximize the learner’s “hands-on” operation and skills. Required mock-ups must include but are not limited to the following systems:

- A fully functional, ADA compliant lift, enabling both operational and maintenance training; and therefore, including related equipment, such as but not limited to exterior control panel,
electrical pump enclosure, lift cassette and enclosure, manual pump operation apparatus.
A communications mock-up demonstrating TIMS (Train Information Management System)
primarily for operating crew orientation and practical exercises. This mock-up should be
designed to allow crew members to learn and practice proper modulation when making
announcements. Ancillary equipment should allow evaluation of performance through audible
output and may also include (for the purpose of practice) visual metering or other devices
showing an acceptable range.
A cab mock-up with all controls with all dimensions and detail appropriate to train and orient
operators and other trainees on newly located controls/devices.
An operational braking system mounted on a training rack must be provided for the related
training exercises.
Builder must provide, for purposes of HVAC training, an air comfort system (a/c unit) which will
include but is not limited to a maintenance rack, including a frame, unit and control panel. This
mock-up should be developed to allow training on the new system, maintenance training,
troubleshooting and any appropriate OSHA certification issues as they relate to the new
system.
The Builder will provide the appropriate mock-ups required for training of the exterior passenger
entrance doors and control system and the passenger compartment doors and control system.
The exterior passenger entrance door mock-up must be capable of simulation including, but not
limited to, such items as: a single door panel; a door hanger; door operator assembly; power
supply; wire harnesses and piping; relay panel, emergency release handle(s); door open light;
door closing light and audible alerters; etc. Likewise, the passenger compartment door mock-up
must be capable of simulation including, but not limited to, such items as: door panels; door
hanger; door operator assembly; sensitive door edges; kick plate; power supply; wire
harnesses; etc.
The Builder must provide a functional mock-up of the toilet system. This mock-up must include
but is not limited to the following sub-assemblies or items: actual toilet; air filter regulator; waste
retention tank; freeze dump valve; etc. The mock-up must employ some type of water tank
allowing sufficient water so that demonstrations can be conducted for the appropriate
mechanical personnel.
Wherever possible, maintenance course modules and content shall be divided into two
classifications: Electrical and Electronic Systems, and Mechanical Systems. To allow student
participation during the demonstration and performance of maintenance functions, each course
shall be separated into one of these classifications. It is understood that certain new systems
may combine these disciplines, and there may be exceptions to this requirement.
Phase II - Maintenance Training
Training must be broad enough and deep enough to allow for the simulation of ‘real life’
activities that maintenance workers typically experience. This activity includes preventative,
periodic (such as Air Brake System component rebuilds), and corrective maintenance
operations for all new components on the passenger equipment. The procedures must also
include the changes to existing systems as the result of changes in equipment and/or
components. Students must have the opportunity to perform the more complex maintenance
functions on the equipment and in the shop. The training must also include troubleshooting
systems. Troubleshooting training must include artificially induced defects so the trainees will
have the opportunity to repair them.
Metra requires that the bid respondents include actual component training aids as part of their
training modules. When components are not possible, photograph and ‘exploded’ graphics are
necessary to the program.
Phase III – Heavy Maintenance Training
Metra performs complete equipment overhauls and rehabs. The program must, therefore,
provide the details of performing heavy maintenance, repair, and rebuilding of components.
Metra further requires CBT modules pertaining to heavy maintenance within the parameters of this Contract.

20.10.6 Engineering and Supervisory
An overview course shall be provided familiarizing generalists (approximately eighty seven (87) participants total, from Mechanical, Operating, Engineering and Materials) with the new equipment. The course shall cover, in executive overview fashion, all subjects to be covered in all other training courses, and shall be provided prior to those courses being conducted. Class size will be between ten (10) to twelve (12) participants.

20.10.7 Parts Catalog Seminar
The Builder shall also include, as a part of its overall training program, a parts catalog seminar (or course of instruction) covering car and car component familiarization for material planners and operations support personnel (20 Materials Management personnel and from one hundred (100) to one hundred twenty (120) Mechanical personnel). This course of instruction shall be comprised of a number of classes with each class given to not more than ten (10) people per class. These classes shall be held during Metra's normal daytime hours of operation at a location in the Chicago, Illinois, metropolitan area designated by Metra. The course given to each class shall be of a total duration approved by Metra and shall include both classroom and field car and component familiarization. An outline of this course of instruction shall be included in the Training Program Outline.

20.10.8 Field Instruction and Warranty Field Instruction
In addition to the formal training described above, regularly scheduled field instruction must be provided by the builder during the warranty period for selected Metra personnel. This instruction must be hands-on instruction, using the standards described above, with the intent of producing Journeyman level mastery of the troubleshooting and repair tasks encountered. This activity shall be in addition to normal builder warranty efforts. Field instruction involving use of the cars, including both maintenance and operation, shall be presented by qualified and approved instructors (in accordance with Section 20.10.2) having thorough experience in maintenance, service, or operation as the case may require. Instructors must be capable of communicating their knowledge to others and must have their subjects properly organized prior to commencement of the class. Instruction in operation shall follow a logical progression involving the details of the cars, the manipulation of all controls, and actual operation. Actual operation shall be conducted under Metra's operating rules and shall be performed by Metra's qualified employees under the direction of the Builder's representative. Operating instruction shall include trouble indications, their proper reporting, and corrective measures available to the operator.

If desired, the Builder may request to provide some of the field instruction in its own and its subcontractors' facilities. If the builder elects to provide this type of instruction as part of the formal instruction identified in Section 20.10.3, it must identify the number of hours and dates of the proposed training sixty (60) days prior to the date the training is to occur and obtain Metra's approval. Upon request of Metra, the Builder shall make these shops available for a limited number of Metra's supervisory and technical personnel to familiarize themselves with assembly methods. The Builder shall provide digital video and/or photograph portions of the car which would normally be inaccessible or concealed on the delivered units solely for use in Metra's internal training programs.

20.10.9 Training Material Standards
The following are standards for training materials that should be followed to assure compatibility.
with Metra’s current methods of editing, production, duplication, storage, distribution, and delivery capabilities:

Minimum computer hardware configuration:
IBM compatible, Pentium III CPU, Intel Processor, 2 GHz processor or equivalent, 500 GB or greater hard drive

Software:
MS Windows 7 operating system
MS Office Suite (2010 or better)
MS Project

Graphics Format:
1 GB video memory capacity, type DDR3

Digital Storage and Distribution:
USB 2.0 or better

Tools for developing written materials must be:
• Microsoft Windows Office-based products, including:
  o Word
  o PowerPoint
  o Excel
  o Visio
  o Publisher
• Picasa (for graphics)
• Adobe Acrobat

Tools for developing CBTs:
• Captivate

Tools for developing web-based materials:
• Captivate
• Dreamweaver

Any web-based applications proposed as CBT (Computer Based Training) should be clearly detailed including such items as: previous or current direct involvement with such applications; specific advantages this would provide in this training effort; updating capabilities including a definition of the webmaster; linkage, if any, to other interactive training products being proposed (e.g., the cd-rom program on x will later migrate to the web, since this will improve...); etc.

Video Format:
Digital

Computer Based Instruction/Training:
Metra standard not yet established for authoring software (submit recommendation)

Photographs:
35 mm color negatives (master)
35 mm slides, horizontal/landscape orientation only (master/copy)
8 X 10 print (copy)
Digital .bmp (master)
Digital .jpg (copy)

Overhead Projection Transparencies:
N/A. All presentations should be in digital format, MS Powerpoint or .pdf

Training Manuals:
Type set in 14 pt. san serif font (Arial True Type preferred)
High quality B&W printed (copied)
Masters shall be provided on USB drives in Microsoft Word or .pdf format

Blueprints (prints):
Readable paper copies

Reference Materials:
Copies of all reference materials will be provided by Contractor (i.e., FRA Regulations)

**Tests:**
4 answer, multiple-choice, with answer keys and references to student manual location with a minimum of three banks of equivalent questions

**Job Aids/Check Lists:**
Pocket-sized and plastic or heavy weight paper laminated in plastic

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**Date:**
05/21/19

**Document No.:**
M-18-011

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**Prepared By:**
S. Cronin

**Revision:**
B

**Approved By:**
[Signature]
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## 23 VIRGINIA RAILWAY EXPRESS (VRE) SPECIFICATION DEVIATIONS

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Buy America Certification (Rolling Stock) for VRE

The bidder/proposer must submit for VRE the appropriate Buy America certification below with its bid/proposal. Bids or proposals that are not accompanied by a completed Buy America certification will be rejected as nonresponsive.

In accordance with 49 CFR § 661.12, for the procurement of rolling stock (including train control, communication, and traction power equipment) use the following certifications:

Certificate of Compliance with Buy America Rolling Stock Requirements

The bidder/proposer hereby certifies that it will comply with the requirements of 49 U.S.C. 5323(j), and the applicable regulations of 49 CFR § 661.11.

Date:___________________________________________________________________
Signature:___________________________________________________________________
Company:_______________________________________________________________
Name:____________________________________________________________________
Title:____________________________________________________________________

Certification of Non-Compliance with Buy America Rolling Stock Requirements

The bidder/proposer hereby certifies that it cannot comply with the requirements of 49 U.S.C. 5323(j), but may qualify for an exception to the requirement consistent with 49 U.S.C. 5323(j)(2)(C), and the applicable regulations in 49 C.F.R. § 661.7.

Date:___________________________________________________________________
Signature:___________________________________________________________________
Company:_______________________________________________________________
Name:____________________________________________________________________
Title:____________________________________________________________________
CERTIFICATION OF AUTHORITY TO TRANSACT BUSINESS IN THE COMMONWEALTH OF VIRGINIA

Proposers must be authorized to transact business in the Commonwealth of Virginia as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the Code of Virginia or as otherwise required by law. Each proposer shall include in its proposal the identification number issued to it by the Virginia State Corporation Commission (SCC). If the proposer is a joint venture which does not have a SCC identification number, then the name of the joint venture shall be provided, all members of the joint venture shall be identified by full name, and each member of the joint venture shall provide its SCC identification number or establish its exemption from such requirement.

Check (☑) which of the following applies and provide the requested information:

☐ Proposer is a Virginia business entity organized and authorized to transact business in Virginia by the SCC. The Proposer's identification number issued by the SCC is: ______________________

☐ Proposer is an out-of-state (foreign) business entity that is authorized to transact business in Virginia by the SCC and the Proposer’s identification number issued to it by the SCC is: ______________________

☐ Proposer is a Virginia joint venture organized and authorized to transact business in Virginia by the SCC and the Proposer’s identification number issued to it by the SCC is: ______________________

☐ Proposer is a joint venture which does not have an identification number issued to it by the SCC, but each member of the joint venture is authorized to transact business in Virginia and the SCC identification numbers issued to each member of the joint venture are as follows: ________________________________________________________

☐ Proposer does not have an identification number issued to it by the SCC and such Proposer is not required to be authorized to transact business in Virginia by the SCC for the following reason(s): ________________________________________________________

Proposer shall attach additional sheets to explain in further detail why the Proposer is not required to be authorized to transact business in Virginia. Proposer’s failure to submit support may result in its proposal being deemed non-responsive.

CERTIFICATION

I hereby certify that the responses to the above representations, certifications and other statements are accurate and complete.

Company: ________________________________________________________________

Signature: ____________________________ Date: ____________________________

Name (Printed): _______________________ Title: ____________________________