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TECHNICAL SPECIFICATION – SECTION 4

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4.1 Drawings

4.1.1 General

The Contractor, in compliance with its approved Program Schedule, shall transmit in electronic form to VRE for approval each drawing required by the Specification or necessary to demonstrate compliance with Specification requirements. Acceptable electronic formats for review drawings include and are limited to Adobe Acrobat PDF version 8.0 or greater and AutoCad DWG files. Drawings are defined as Submittals for this Contract. This shall include outline and arrangement drawings of the major items of apparatus as well as detail drawings of all assemblies, sub-assemblies, integrated wiring schematics and wiring list, equipment and apparatus. Review and approval of the Contractor's drawing Submittals are to be attained before any manufacturing. Sufficient drawings shall be submitted to convey: concept; design; dimensions; maintenance, operating, and overall assembly aspects; and, interfaces. All detail part drawings shall be submitted for each assembly. Arrangements and details of all apparatus including apparatus within equipment boxes shall be submitted for review; outline or incomplete drawings will not be sufficient. This applies particularly to subcontractor-furnished items.

[CDRL 4-01]

4.1.2 Review

VRE will review all drawings submitted. All submitted drawings will be documented as “Approved”, “Conditionally Approved” containing comments/questions/requirements to be met to obtain approval status, or “Not Approved” containing comments/questions/requirements to be met. The Contractor shall not proceed with procurement or manufacture of any parts or with construction until a drawing has been Approved or Conditionally Approved, unless specifically authorized in writing to do so by VRE. Proceeding without the requisite approval will be at the Contractor’s risk to cost and schedule and any work so performed will be subject to being discarded or redone at the Contractor’s expense.

4.1.3 Drawing Format

All drawings shall be properly referenced to indicate clearly the location, service and function of each particular item, and shall include proper reference to the appropriate Specification section including Drawing number and detail. Where manufacturer's publications in the form of catalogs, pamphlets, or other data sheets are submitted in lieu of prepared shop drawings, such submissions shall specifically indicate the item for which approval is requested. Identification of items shall be made in ink, and submissions showing only general information are not acceptable.

- a. Drawings shall conform to the requirements of ASME Y14.
- b. Drawing and graphic symbols shall conform to the requirements of ANSI Y32. The Contractor may use its own in-house standard symbols as long as it provides a table that references those symbols to ANSI Y32.
- c. All dimensions on drawings shall be expressed in the English system; and all wording on drawings shall be in the English language. All terminology used in drawings and

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correspondence shall be conventional to the North American railroad industry. Drawings shall be made to the third-angle projection system.

- d. Both English and metric units must be shown. Metric dimensions shall be in meters or millimeters and English dimensions shall be in feet or inches.
- e. The Contractor shall supply to VRE a drawing list of all drawings to be supplied per this section. The initial submittal shall be with the Preliminary Design package and shall be updated every 90 days. However, a current version shall be submitted at the final Design Review and shall be available for First Article Inspections. **[CDRL 4-02]**
- f. All drawings submitted shall be full size to the scale specified on the drawings. No reduced size copies shall be permitted. Every drawing shall include a complete bill of material and parts list on the field of the drawing, or on a separate sheet of the same drawing, describing all parts or sub-assemblies, including subcontractor-furnished items, which form a part of the assembly, sub-assembly, or piece depicted. The weight of each assembly or part shall be indicated on the assembly drawing or outline drawing of that assembly or part. All drawings shall reference the number of the drawing showing the next higher sub-assembly or assembly on which it is used. This requirement does not apply to standard hardware, electrical or electronic components. Final drawings shall be comprised of not more than 4 sizes with 24-in. x 36-in. being the largest drawing size permissible. "E" size drawings shall be allowed during design review only.
- g. Whenever reference is made on a drawing to a material or process by the Contractor's own specification number, it shall also give the commercial equivalent. If there is no commercial equivalent, it shall provide VRE with copies of its specification. Except as otherwise allowed, all semiconductors shall be identified by JEDEC numbers.
- h. Revisions to drawings, and drawing change orders affecting submitted drawings, shall be submitted for approval as they are issued. No more than three drawing alterations shall remain unincorporated on any drawing at any time. The revision block shall give details of the changes made by that revision, or the numbers of the drawing change orders may be used instead of detailed descriptions. In the latter case, the drawing change orders shall have been submitted no later than at the time of submittal of the revision and referenced to the drawing. The details of all changes shall be highlighted or bolded on drawing(s) sent to VRE for review of the change.
- i. Approval of a drawing does not relieve the Contractor of the obligation of meeting all the requirements of the Contract. Approval of a drawing, which contains a deviation from, or violation of, the Specification does not constitute approval for that deviation or violation unless such changes have been specifically requested in writing and granted in writing according to all Contract requirements separate from the drawing approval.
- j. All deviations from approved drawings shall be approved by VRE prior to release of the drawing for installation.
- k. Every engineering change, deviation, Material Review Board (MRB) repair, and similar variance affecting form, fit, or function (as defined in Section 20) shall be incorporated on the affected drawing(s) whenever it applies to five or more cars, and the drawing shall be clearly labeled with VRE's car numbers which are impacted by each configuration. Those changes applying to fewer than five cars may also be incorporated on the affected drawings

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or the variances may be furnished separately. If furnished separately they must also be listed in the Car History Book described in Section 4.2.2 for each car involved and cross-referenced to the affected drawings.

- l. If the Contractor's drawing system is such that drawings of details are not included in the assembly, sub-assembly, and arrangement drawings referred to above, it shall deliver copies of all detail drawings to VRE. The Contractor shall maintain all drawings of the cars for a period of five (5) years after conclusion of the Warranty period for all cars. It shall make available, without charge, during that time period, prints of any details required for extraordinary repairs arising from accidents, mandated changes or unanticipated changes.
- m. VRE will be amenable to the submittal of electronic files of all drawings, letters, attachments, CDRLs, and other documents via a Project Extranet system. The Project Extranet would be a designated URL address on the World Wide Web (www) to which all submittals to VRE could be uploaded. All transmittals from VRE to the Contractor would also be via the Project Extranet. VRE regards such an approach as an Approved Equal for this Contract, the details of which approach would need to be resolved and approved by VRE.

4.1.4 Integrated Schematic Diagram

The Contractor shall prepare and submit, for acceptance by VRE, a totally integrated schematic diagram package relating all electrical systems and including all components and all wiring on the car. [CDRL 4-03]

- a. The schematic diagram shall be one which can be readily followed by anyone with basic electrical knowledge.
- b. Both an alphabetic tabulation and pictorial locator of all electrical components and devices and the physical location of these components shall be included with the integrated schematics. This tabulation should also identify the circuits where components are used, and the location of each circuit in the schematic package. Graphic symbols for components, devices, and circuits shall conform to IEEE Std 315/ANSI Y32.
- c. The Draft Schematic format to be submitted to VRE for review and acceptance.
- d. Schematic shall be accompanied by a complete Wire Running List. The list shall include for each wire as a minimum:
 - 1) Origin equipment
 - 2) Destination equipment
 - 3) Wire size and type
 - 4) Conduits through which the wire runs
 - 5) Wire number

This list shall be provided in an electronic database format (with database software and license provided). The database shall be arranged in logical fields that will allow various sorts of the information (such as by equipment, wire number, conduit, etc.). Both hardcopy and electronic media file shall be provided.

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- e. Complete wiring diagrams shall also be provided for all car wiring. These diagrams shall be arranged logically and all text shall be clearly legible. Diagrams shall identify all conduits and raceways in which wires are run, identify all wires in each conduit/raceway, and shall clearly denote all connections at terminal blocks and connectors.
- f. The schematics shall be provided both as full-size drawings and an 11-in. by 17-in. package to be used for troubleshooting. All schematics shall be prepared so that all text and other items on the drawings are clearly legible on the 11-in. by 17-in. sheets.
- g. Samples of the schematic, electrical component/device table, wiring diagram, and wire run list shall be submitted to VRE for review and acceptance before manufacturing begins. Hand-drawn drawings shall not be permitted.
- h. In addition to electrical schematics, the Integrated Schematic shall also provide physical schematic of electrical system.
- i. The draft Integrated Schematic shall be submitted before the arrival of the Pilot Cars. An Interim Integrated Schematic shall be submitted for review with the last vehicle. A Final Integrated Schematic shall be submitted as a Record Drawing. The Packages shall be stamped – DRAFT, INTERIM and FINAL, as appropriate.
- j. The Integrated Schematics shall include all electronic and electrical components on the car. Any minor subsystem components on PC boards or housed in “black boxes” shall also be included in the Record Drawings Schematic Package, and for the Integrated Schematic Package, shall be treated as black boxes, showing the box. Microprocessors will show list of outputs.
- k. The intent of the 11-in. x 17 in. format is that it shall be the same schematics as submitted as full size engineering drawings. It is not intended that the full size drawings are to be re-drawn in small scale, only that the larger drawings can be reproduced and legible on a smaller sheet of paper.

4.1.5 As-Built Drawings

The Contractor shall supply to VRE for review and approval, within 60 days after completion of cars and all modifications, a drawing list of all "as-built" drawings to be supplied per this section. These as-built drawings shall consist of one set of hard-copy prints and two sets of electronic media thereof. The as-built drawings shall have all engineering and manufacturing changes incorporated. [CRDL 4-04]

- a. The Contractor shall supply two (2) sets of as-built (record) drawings on 0.004-in. thick polyester film, matte both sides, Kueffel & Esser Herculene, or equal.
- b. The Contractor shall provide four flat file cabinets for storage of Mylar drawings.
- c. In addition to hardcopies, five (5) sets of as-built drawings, including the integrated schematic, shall be submitted in electronic format on CD-ROMs, capable of being copied.
- d. Drawings shall be in AutoCAD format with version level to be mutually agreed with VRE.
- e. Coincident with the submittal of the electronic drawings, the Contractor shall provide two copies of a commercially available viewing and mark-up software package to facilitate the display, review, mark-up and printing of the electronic drawings. The software shall be

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capable of running on an Intel-processor based personal computer under the Microsoft Windows operating system. [CDRL 4-05]

4.2 Documents

4.2.1 General

The Contractor shall be responsible for preparation of documents throughout the life of the Contract. All documents, including those prepared by subcontractors, shall be in the English language and shall be written in a style suitable for a ninth grade reading level. Such documents shall include: manuals and catalogs, training guides, Car History Books, test procedures and reports, system plans and special reports. The requirements thereof are identified elsewhere throughout this Specification, especially so in Sections 18 and 19. Car History Books are shown immediately below.

4.2.2 Car History Books

The Contractor shall furnish to VRE one loose leaf Car History Book for each car, the pages of which shall be reproducible by the xerographic process and two copies on electronic medium. It shall record the following information **CDRL [4-06]**:

- a. Car Number (Contractor's Number and VRE NUMBER), Type and Class.
- b. Written report of each test performed on the car and its apparatus.
- c. Serial numbers of all wheels, axles, cab signal/ATC, and all other apparatus with serial numbers.
- d. Weight and balance of car, as delivered.
- e. Wheel and axle mounting records.
- f. Heat run numbers for wheels and axles.
- g. Mill reports applying to material on the car.
- h. Main reservoir certification sheets.
- i. Duplicate of blue forms for cab cars.
- j. All approved Contract changes, engineering changes and deviations incorporated into the car, which are not on all cars.
- k. All modifications on the car not on all cars.
- l. List of all MRB repairs applying to the car.
- m. Copy of each test report log sheet for all tests performed on equipment on the car and the car per Section 19.
- n. Car actual dimension record sheets.
- o. All other information required by the Specification to be in the Car History Book.

The Car History Books shall be kept up-to-date by the Contractor and shall record all changes, retrofits, and additions made to each car until cars are accepted by VRE. Documentation on

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changes made to the car by the Contractor during the warranty period shall be furnished to VRE (printed and electronic medium) for inclusion in the Car History Book.

A copy of each vehicle's Car History Book shall also be provided on a CD ROM in Adobe Acrobat format. The CD shall be limited to a single car and shall be replaced or updated for each revision of the car history book during the Contract. It shall be possible to copy files from the CD to other electronic storage media. [CDRL 4-07]

4.3 Referenced Standards

- ANSI Y32, Graphic Symbols Series
- ASME Y14, Drafting Manual Series
- IEEE Std. 315, Graphic Symbols for Electrical and Electronic Diagrams

4.4 Contract Deliverable Line Items

CDRL	Item
4-01	Drawing Submittals
4-02	Drawing List
4-03	Integrated Schematic Diagram
4-04	As-built Drawings
4-05	CAD Software
4-06	Car History Books
4-07	Car History Book, Electronic Format