

ATTACHMENT P.2

TECHNICAL SPECIFICATIONS



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**SECTION 101
SUMMARY OF WORK**

A. Description:

The context of this specification establishes the minimum performance requirements necessary for a passenger locomotive to operate without restriction throughout the Virginia Railway Express (VRE) theatre of operation. VRE currently operates on CSX, NS and Amtrak rights of way.

It is the manufacturer's responsibility to ensure that all of the performance criteria are met to VRE's satisfaction.

1. The Work consists of the design, engineering, manufacture, assembly and delivery of diesel-electric locomotives, including but not limited to: testing, manuals, mock-ups, training, software, licenses, and all other required deliverables and services complete with warranties and guarantees.
2. The locomotives shall be capable of operating at speeds up to 79 mph, in push pull passenger train operation, in single or multiple locomotive consists. A train consist shall include a cab car or trailer car at one end of the train and a locomotive at the other end, or may include 1 or more locomotives at both ends. The ends may be separated by up to 10 cars.
3. The locomotives shall be capable of sustaining extended intervals of repeated acceleration and braking, as well as limited station stop (express) operation.
4. The locomotives shall be provided with all the interfaces as necessary, so as to be capable of multiple operations with locomotives or cab control cars throughout all VRE equipment. VRE equipment can be found on VRE's Home Page (<http://www.vre.org>)
5. The design, layout and functionality of the locomotive is to maximize the tractive effort and head end power (HEP) capability necessary to maintain present schedules using up to ten (10) bi-level passenger cars. Schedules and routes are readily available on VRE's Home Page.
6. The locomotives shall possess the following criteria and capability but not limited to:
 - Power for traction – Maintain present day timetable schedules with (6), (8) and (10) bi-level car consists. Computer simulations will be required to substantiate claim.
 - Head End Power (HEP) – Capacity to ensure un-interrupted power on demand for up to (10) bi-level cars.
 - Truck type – To be service proven and able to incorporate (2) motorized axles.
 - Wheels – Consistent with standard sizes as readily available and found on US passenger locomotive fleets. Composition and other criteria to

be further detailed within the wheel & axle section of the specification.

- Physical dimensions, clearances and weights to be within all tolerances as defined by the governing railroads, where the locomotives will operate. (Currently operations are from Fredericksburg, VA, and Manassas, VA, to Washington, DC.)
- Brake equipment – Must be compatible with all present equipment and be able to maintain prescribed deceleration rates. Blended dynamic braking is mandatory and will have to be incorporated into any proposed arrangement.
- Fuel capacity to be consistent with requirements of (10) bi-level car consist being able to make two complete days of operation from VRE's furthest theatre of operation. (Cross Roads yard, Fredericksburg, Va. To Washington DC and return). Fuel capacity requirement to include all dwell time at Washington, DC and a safety factor margin for service disruptions.
- Noise – Both inside and out will adhere to all federally mandated requirements.

7. The prime mover shall be a service proven diesel engine, suitable for commuter service, and shall generate tractive and auxiliary power. The engine is to be compliant in every way to all regulations (Federal, State and Local governments).
8. The locomotives shall comply with all federal, state, and local laws, and ordinances, shall conform to FRA (including 49 CFR Part 238), EPA and OSHA regulations, APTA's Manual of Standards and Recommended Practices for Passenger Rail Equipment, and AAR recommended practices, and, unless otherwise specified, shall conform to standard industry practices. If a conflict is discovered among any of the above requirements, the following order of priority shall govern:
 - a. FRA
 - b. Laws of the State
 - c. Purchase Agreement and Specification
 - d. APTA – PRESS
 - e. AAR
 - f. NTSB
9. The locomotive is to be designed and engineered where applicable to allow for easy removal and change out of parts and components. Any component or part needing more than one shift for change-out must be identified and addressed with appropriate removal and work procedures. Note: one shift consists of 2 persons working 8 hours each.

B. Alternative Designs:

1. The specification reflects VRE's preferred requirements for the locomotives and associated supporting materials. Alternative proposals from the Contractor will be considered so long as:
 - (a) The proposed design remains in compliance with the regulatory requirements identified.
 - (b) The proposed design meets the intent and functionality of VRE's requirements.
 - (c) The proposed design does not increase the risk of delayed delivery of the vehicles.
 - (d) The proposed design does not adversely affect reliability and maintainability.
 - (e) Any alternative designs must be proposed in writing to VRE and approved in writing by VRE. VRE has instituted a specific form for such request (Specification Approval Request {SAR}). Approval is solely at the discretion of VRE. VRE will not approve alternatives prior to selection of Contractor.

C. Deliverables:

1. The completed locomotive, as specified, delivered to VRE's choice of yards, cleaned and ready for service with full complement of supplies.

**SECTION 102
TERMINOLOGY AND ABBREVIATIONS**

A. Description:

1. **Terminology:** Except as explicitly specified to the contrary, the technical specification shall be interpreted with the meaning of the following terms:
 - a. **Acceptance** – When all tests are completed in accordance with the contract, the required reports are received and approved, and the locomotive is totally responsive to the Contract, such that no corrective actions are required, and the Locomotive history books are received and approved, the locomotive shall be accepted by VRE.
 - b. **Adhesion, Coefficient of** - The ratio between maximum achievable longitudinal tangential force at the wheel-rail interface and normal force.
 - c. **Approval** – Review and acceptance, in writing, by VRE. Note: Approval does not relieve the contractor of its responsibility to supply locomotives in compliance with the contract.
 - d. **Approved or Approved Type** – Design, type of material, procedure, or method given approval by VRE.
 - e. **"B" End** - The end of the locomotive opposite the "F" end.
 - f. **Commissioning** – Pre-acceptance contractor activities involved in delivering, adjusting and testing the vehicles to demonstrate compliance with specification requirements.
 - g. **Conditional Acceptance** – Delivery of the locomotives at VRE yards, acceptable correction of all receiving report issues, successful completion of static and dynamic testing and preparation of the locomotives for certification for revenue service. Conditional Acceptance shall be determined by the VRE Project Manager, or designee.
 - h. **Delivery** – The transfer of the completed locomotive with all in-plant testing completed and results accepted by VRE to VRE property, ready for commissioning and acceptance testing.
 - i. **"F" End** - The cab end of the locomotive.
 - j. **Final Acceptance** – The successful completion of conditional acceptance testing and completion of all corrective actions, followed by the successful completion of 10 revenue round-trip service days. Additionally , final acceptance will not be granted for any locomotive prior to the submittal and approval of all deliverables, tests and inspections required before the delivery of the locomotives by this contract. This shall include but not limited to, deliverables, tests and inspections listed at the end of each section of the technical specification. Final Acceptance shall be determined by the VRE Project Manager, or designee.

SECTION 102 TERMINOLOGY AND ABBREVIATIONS

- k. **Furnish** - The planning, design, development, procurement, fabrication, delivery, unloading, storing, and handling activities required to prosecute the Work.
- l. **Indicated** - That which is specified through the written text and/or shown on the drawings.
- m. **Install** - The preparation, placement, assembly, erection, dismantling, demolition, connection, and other activities required to prosecute the Work.
- n. **Jerk Rate** - Time rate of change of acceleration and deceleration, equal to the second time derivative of velocity.
- o. **Locomotive** - A complete diesel-electric locomotive in ready-to-run condition.
- p. **No Motion** - The status of the locomotive when the velocity is less than 3 mph.
- q. **Noise** - Noise means sound pressure level (SPL) or sound level as defined in ANSI Standards S1.2 and S1.13. All noise levels specified are in decibels referred to 20 micropascals (0.0002 microbar) and are the A-weighted levels in decibels (dBA) as specified in ANSI Standard S1.4, Specifications for Sound Level Meters. The slow meter scale shall be used. For measurements under steady operating conditions, the period of observation shall be at least 5 seconds. The median sound level observed shall be utilized. Where octave band or 1/3 octave band measurements are specified, an analyzer meeting the requirements for Class II Filters, conforming to ANSI Standard S1.11, Specification for Octave, Half-Octave, and Third-Octave Band Filter Sets shall be used. Narrow-band noise or pure tones shall be identified using filters with a bandwidth of 1/3 octave.
- r. **Pilot** - The lead production unit, which will undergo certain special testing to ensure that the remaining production units conform to the specified requirements.
- s. **Slide Control Efficiency** - The ratio of the average brake rate achieved to the brake rate achievable with available adhesion fully utilized, expressed as a percentage.
- t. **Spin Control Efficiency** - The ratio of the average acceleration rate achieved to the acceleration rate achievable with available adhesion fully utilized, expressed as a percentage.
- u. **Standard Locomotive Cab Key** – That which locks and un-locks locomotive cab door – Key to be standard VRE.
- v. **Stop, Emergency** - The stopping of a train by an emergency brake application. Once initiated, the brake application cannot be released until the train has stopped.

- w. **Stop, Service (Full)** - The stopping of a train by application of service braking. Brake application can be released and reapplied. Brake applications may range from minimum application to full service braking.
 - x. **Unsafe Condition** - Any condition which presents a risk of injury to passengers, crew or bystanders, and/or damage to equipment.
 - y **Maximum Authorized Speed (MAS)** - The maximum speed allowed by the signal system, track warrants, general orders and equipment design.
 - z **Engineer** – VRE Project Manager or designee
 - zz **Service Proven** – That which has been successfully utilized in locomotive manufacturing.
2. **Abbreviations:** Except as explicitly specified to the contrary, the technical specification shall be interpreted with the meaning of the following abbreviations as listed herein below:

ABPI	- Air Brake Periodic Inspection
ATC	- Automatic Train Control
APTA	- American Public Transportation Association
AQL	- Acceptable Quality Level
AWG	- American Wire Gauge
cfm	- cubic feet per minute
CTCSS	- Continuous Train Control Signal System
dB	- Decibel
DB	- Dry Bulb
EMC	- Electromagnetic Compatibility
EPA	- Environmental Protection Agency
DTE	- Diagnostic Test Equipment
EMI	- Electromagnetic Interference
FAI	- First Article Inspection
gpm	- gallons per minute
HEP	- Head End Power
HSLA	- High Strength Low Alloy (Steel)
HVAC	- Heating, Ventilating and Air Conditioning
Hz	- Hertz
IEC	- International Electrical Code
IGBT	- Isolated Gate Bipolar Transistor
IPC	- Illustrated Parts Catalog
IPS	- Iron Pipe Size
LAHT	- Low Alloy High Tensile Strength (Steel)
LCD	- Liquid Crystal Display
LED	- Light Emitting Diode
LVS	- Low Voltage System
LVT	- Low Voltage Transformer

SECTION 102 TERMINOLOGY AND ABBREVIATIONS

MAS	- Maximum Authorized Speed
MOV	- Metal Oxide Varistor
mph	- Miles per hour
PIU	- Portable Interface Unit
PIV	- Peak Inverse Voltage
psi	- pounds per square inch
PTE	- Portable Diagnostic Equipment
PTS	- Positive Train Separation
PTU	- Portable Test Unit
RFI	- Radio Frequency Interference
TIR	- Total Indicated Runout and Traction Interlock Relay
UHF	- Ultra High Frequency
ULSF	- Ultra Light Sulfur Fuel
VHF	- Very High Frequency
Vac	- Volts Alternating Current
Vdc	- Volts Direct Current
VRE	- Virginia Railway Express
WB	- Wet Bulb
AAR	- Association of American Railroads
ADA	- Americans With Disabilities Act
AISI	- American Iron and Steel Institute
AMCA	- Air Movement and Control Association
ANSI	- American National Standards Institute
APA	- American Plywood Association
AREMA	- American Railway Engineering and Maintenance-of-Way Association
ASCE	- American Society of Civil Engineers
ASHRAE	- American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	- American Society of Mechanical Engineers
ASTM	- American Society for Testing and Materials
AWS	- American Welding Society
CFR	- Code of Federal Regulations
EIA	- Electronic Industries Association
FCC	- Federal Communications Commission
FRA	- Federal Railroad Administration
ICEA	- Insulated Cable Engineers Association
IEEE	- Institute of Electrical and Electronic Engineers
ISO	- International Organization for Standardization
JEDEC	- Joint Electronic Device Engineering Council
MIL	- Military Specification
NEC	- National Electrical Code
NEMA	- National Electrical Manufacturers' Association
VRE	- Virginia Railway Express
OSHA	- Occupational Safety & Health Act (or Administration)
SAE	- Society of Automotive Engineers
SCR;s	- System Change Request
UL	- Underwriters Laboratories, Inc.
USASI	- United States of America Standards Institute
USEPA	- United States Environmental Protection Agency (also "EPA")

End of Section

**SECTION 103
CONTRACT PROCEDURES AND DOCUMENTATION**

A. DESCRIPTION:

1. Written Communications:

- a. Unless otherwise specified in this document, the Contractor shall furnish four (4) copies of all correspondence, submittals, and transmittals addressed to VRE in the performance of the Contract. Two copies will be sent to VRE Director, Rail Equipment & Services and two to VRE's designated consultant, if assigned. Note: Approval may be granted by VRE for properly coded E-mail with correspondence identifiers.
- b. All documentation, including letters, drawings, procedures, reports, etc., shall be clearly marked with the notation "Diesel Electric Locomotive". Additional document identification conventions will be established at the inception of contract work.

2. Software:

- a. Unless otherwise specified in this document, software programs utilized by the Contractor to generate contract documentation shall be commercially available and capable of running on a PC. Drawings and schematics will be supplied in .PDF file format. In addition to other requirements all software shall be furnished to VRE on CD.
- b. Unless otherwise specified, all deliverables shall be prepared on either a database program (subject to the first sentence of A.2.a above) or in text and/or graphics format using Microsoft Word. In addition to other requirements, all such files shall be furnished to VRE on CD.

3. Contract Drawings

- a. Submittal Drawings
 - 1) The Contractor shall supply to VRE, within 60 days of its notice to proceed, a list of drawings to be utilized in the construction of the locomotives. These shall include outline and arrangement drawings of the whole locomotive and major items of apparatus.

The list must specifically include the following:

- a) Locomotive general arrangement drawings;
- b) Static and dynamic clearance outline diagrams;
- c) Cab layout drawings;
- d) End connection layout drawings;
- e) Electrical schematics with wire running lists and device identification list; and
- f) Wiring and conduit connection diagram.

- g) Electrical apparatus location diagram;
- h) Relevant electronic printed circuit boards;
- i) Air brake system schematic diagram;
- j) Air piping layout drawings; and
- k) All relevant subcontractor, vendor, and manufacturer's outline drawings.

This list shall be updated and submitted monthly to VRE.

- 2) The Contractor, in compliance with their approved Submittal Schedule, shall submit for review drawings required by the Specification or necessary to demonstrate compliance with the Specification requirements.
 - a) General arrangement, assemblies, calculation reports, and technical specifications shall be submitted to convey concept, design, dimensions, maintenance, operating, and overall assembly aspects and interfaces.
 - b) The Contractor will provide major component outline drawings for each component to evidence that the functional requirements are met. These drawings define the scope of the submittals to be provided for review regarding consistency with the Specification requirements.
 - c) Detailed drawings, catalogs, datasheets, and related materials will be required to the extent that they are used by the Contractor in lieu of other drawings to demonstrate compliance. VRE and its Technical Consultant (if used) may review the submitted materials for standard products or components for consistency with the specific technical specification.
 - d) In the event of dispute about a specific design or design principles, the standard of successful prior use in a locomotive and the standard of reasonableness will be adopted. There is no requirement to redesign standard products.
 - e) VRE and its Technical Consultant (if used) may review the more general drawing for consistency to the specifications. In the event of a dispute between various aspects of the specification, the more stringent shall apply. VRE and its Technical Consultant (if used) will reasonably interpret the specification and will manage the design review process to avoid an extended design approval process. Review and comments of the Contractor's submittals is to be attained before any manufacturing work proceeds.

Two copies of the letter of transmittal drawings shall be addressed

to: Virginia Railway Express
1500 King Street
Suite 202
Alexandria, Virginia 22314

Two copies of the letter of transmittal shall be sent to VRE's consultant, if assigned.

- 3) VRE will review all submitted drawings for this contract and return one copy of each drawing to the Contractor marked "Approved", "Approved with Comments", or "Not-Approved". VRE shall return each drawing within fifteen working days of the date the drawing was received. The Contractor shall not proceed with procurement or manufacture of material covered by any submitted drawing until it has been reviewed and approved, unless specifically authorized in writing to do so by VRE except that in the event that a time sensitive drawing is not returned within 15 working days, Contractor may proceed with the work on verbal approval, followed by the written approval.
- 4) Revised drawings shall be resubmitted following correction by the Contractor as soon as possible after receipt of VRE's comments. All details on drawings affected by any change shall be clearly indicated on copies of all drawings sent to VRE for approval.
- 5) Drawings submitted by Subcontractors or Suppliers developed exclusively for this contract shall be thoroughly checked by the Contractor to ensure that they conform to the intent of the Contract Documents (as to form, fit and purpose) and the Specification requirements before submittal to VRE for approval.
- 6) All drawing submittals shall include proper reference to the appropriate Specification Section, if appropriate. 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 review is requested. Identification of items shall be made in ink.
 - a) Symbols used shall conform to ANSI, AWS, ASME, IEEE, and ASTM standards. All terminology used in drawings and correspondence shall be conventional to the North American railroad industry or as commonly used in the Contractor's and/or sub-suppliers' standards.
 - b) All dimensions on drawings shall be expressed in the English system; all wording on drawings shall be in the English language.
 - c) Drawings submitted shall be full size to the scale specified on the drawings or to the scale appropriate for their purpose. Where relevant, drawings 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, which form a part of the assembly, sub-assembly, or piece depicted. Commercially available components will not contain a bill of material. Every assembly drawing shall include the weight of the assembly, where appropriate. Final as-built drawings shall be comprised of not more than 4 sizes with 24" x 36" being the largest drawing size permissible. "E" size drawings shall be allowed during design review only.

- d) Whenever reference is made on a drawing to a material or process by the Contractor's own specification number, he shall also give the commercial equivalent. If there is no commercial equivalent, he shall provide VRE with copies of his specification, to the degree necessary to demonstrate consistency with the Specification.
 - e) Except as otherwise allowed, all high-power semiconductors shall be identified by the manufacturer's part number.
- 7) Revisions to drawings, whether initiated by the Contractor or by a change order, shall be submitted for approval as they are issued. No more than three drawing alterations shall remain unincorporated on any drawing at any time.

Drawings on which any changes have been made, even though less than three, shall be revised to incorporate those changes no less frequently than at two-month intervals from the last change. The revision block shall give details of the changes made by that revision, or the numbers of change orders may be used instead of detailed descriptions. In the latter case, the change order shall have been submitted no later than the time of submittal of the revision and referenced to the drawing. The details of all changes shall be clearly indicated on the drawing(s) sent to VRE for review of the change.

- 8) 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 authority for that deviation or violation unless such deviations have been specifically requested in writing and granted in writing according to all contract requirements separate from the drawing approval.
- 9) Every Engineering Change, Deviation, Material Review Board (MRB) repair, or other variance affecting form, fit, or function shall be incorporated on the affected drawing whenever it applies to five or more locomotives, and the drawing shall be clearly labeled with the VRE road numbers applying to each configuration. Those

applying to fewer than five locomotives may also be incorporated on the affected drawings or the variances may be documented separately. If documented separately, they must also be listed in the Locomotive History book for each locomotive involved and cross-referenced to the affected drawings.

- 10) 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, the Contractor shall maintain all drawings of the locomotives for a period of 30 years. The Contractor shall make available, without charge, for a minimum of five years from the date of acceptance of the last locomotive, *.PDF files of drawings described in the point A.3.a.2) of this section, as well as assembly drawings of different components, and the drawings necessary for carrying out proper locomotive maintenance. The detail and as-built drawings need to make extraordinary repairs arising from accidents will be supplied at the Contractor's standard copy rates. During the remaining 25 years, VRE shall be provided with any prints required at Contractor's standard copy rates cost.

b. As-Built Drawings:

The Contractor shall supply to VRE for review and approval, within 60 days after delivery of the locomotives and all modifications, the final updated list defined in the point 103.A.3.a.1, and the drawings defined in the point 103.A.3.a.2.

The drawings shall have all engineering and manufacturing changes incorporated. Deviations shall also be incorporated or referenced with copies provided in a separate indexed section.

The Contractor shall deliver within 60 days of VRE's approval of the updated drawing list.

The Contractor shall at the same time deliver archive quality computer disks containing the following drawings in the latest release of AutoCAD, if available, or *.PDF. All lettering and symbols shall be recognized within AutoCAD.

- 1) Electrical schematics
- 2) Wiring and conduit connection diagram
- 3) Electrical apparatus location diagram
- 4) Air piping schematic
- 5) Air piping apparatus and location diagram

4. Samples

The Contractor shall furnish samples of locomotive exterior and interior paint chips, cab interior finish materials, number boards, and similar items for VRE inspection and acceptance. All samples shall be identified with the

manufacturer's name, part number, specification and/or drawing reference and intended use. Two sets shall be submitted to VRE and a copy of the transmittal to the Consultant, if assigned.

5. Photographs (Digital)

- a. Within sixty (60) days of conditional acceptance of the pilot locomotive, the Contractor shall furnish two sets of photographs of the locomotive.
- b. Photographs shall include black and white views showing each phase of construction progress as well as design features which will be hidden from view upon completion of the locomotives.
- c. Photographs shall include color views of the completed locomotive exterior from various angles and views of the interior of the locomotive showing all of the major equipment as well as the cab.
- d. The Contractor shall submit a list of the proposed views of the completed locomotive for review in advance of making the photographs.

6. Spare Parts

The Contractor shall provide a list of recommended spare parts to support base order, individual part pricing, and the lead times for each of these parts to VRE far enough in advance for VRE to select any or all of the listed items for purchase and delivery with the first locomotive. The list shall include detailed part information of consumable items, major components, electrical/electronic components and brake system components, as defined below, plus any other items necessary to maintain the locomotives for a period of three years.

a. Consumable Items

These items are parts that are commonly renewed during a daily or 92 day inspection. They include items such as filters, brake shoes, lamps, wiper blades, and brushes.

b. Major Components

These are high dollar, durable items not subject to routine changeout until a programmed overhaul of the locomotive, such as traction motors, engine power assemblies, turbochargers, injectors, main generators, inverters, high voltage circuit breakers, compressors, and wheel sets.

c. Electrical/Electronic Components

These include printed circuit boards, computer boards and components, high power semiconductor devices, relays, contactors,

master controllers, and power supplies.

d. Brake System Components

All pneumatic and electric components necessary to maintain and overhaul the entire locomotive brake system.

e. Warranty Spare Parts

Contractor shall provide, at its own cost, spare parts as shall be agreed between the parties, to support the locomotives through the warranty.

7. Contract Schedule

The Contractor shall supply a master program schedule for review and approval no later than 90 days after Notice to Proceed. The program schedule shall identify all milestones, the earliest possible and latest possible dates for accomplishing each milestone, the shortest and longest permissible time span between each dependent milestone, and major and minor paths which are critical to delivery of the locomotives within the Contract requirements.

The master program schedule shall be monitored and controlled by the Contractor's management team responsible for performance of the Contract and shall be updated and submitted to VRE at least monthly during the design, production and acceptance phases of the Contract.

8. Quality Assurance

- a. The Contractor shall establish and maintain a quality assurance program in compliance with the latest revision of ANSI/ASQC/ISO-Q9001-2000. The program shall ensure compliance with requirements of the Contract Documents and shall include provisions ensuring compliance with the Contract and Specification requirements by any subcontractors, suppliers or manufacturers, except upon approval of VRE the subcontractors may use their standard quality assurance plan in lieu of ISO 9001 certification. A progress payment will be keyed to approval of the Quality Assurance Program.
- b. Four (4) copies of the Contractor's quality assurance program shall be submitted to VRE and two (2) copies to the Consultant, if assigned, for review and approval within thirty (30) days of the date of Notice to Proceed. An audit of the Contractor's quality assurance program may be conducted by VRE. Work undertaken by the Contractor or any of his subcontractors or suppliers before VRE provides formal approval of the Contractor's program will be at the Contractor's risk and expense.
- c. The Contractor's approved quality assurance program for the Contract shall not be changed without the concurrence of VRE. Work undertaken by the Contractor before receipt of written concurrence from VRE concerning such changes to the Contractor's quality

assurance program will be at the Contractor's risk and expense.

- d. The Contractor's quality assurance operations shall be subject to verification by VRE at any time. Verification shall include, but not be limited to: audit of the quality assurance program; surveillance of operations to determine that practices, methods, and procedures of the program are being properly implemented; inspection to measure the quality of items offered for acceptance; and inspection of items prior to release for shipment to ensure compliance with requirements of the Contract Documents.
- e. Failure by the Contractor to promptly correct deficiencies following notification by VRE may be cause for suspension of the work until corrective action has been taken or until conformance of items to prescribed criteria has been demonstrated to and approved by VRE. All VRE or Technical Consultant (if used) personnel assigned to inspect shall act reasonably and apply consistent interpretations.

9. Inspection

Inspection of the locomotive and its equipment will be performed throughout the construction process.

- a. General Intent:

It is the intent of the Contract that inspection to assure compliance with the Contract requirements is fundamentally the responsibility of the Contractor. Inspection of supplier's components is also the responsibility of the Contractor and should be performed at the supplier's plant, giving him every opportunity to correct, under factory conditions, any inadequacies found. Further inspection at the Contractor's facility will determine any damage in transit, plus any unforeseen failure of the equipment that may become apparent. VRE may also make inspections of selected items, with or in addition to the inspections made by the Contractor or his Supplier, which will in no way negate or lessen the Contractor's responsibility to make proper inspections on parts he furnishes. The Contractor is solely responsible for ensuring that his suppliers provide the necessary inspections to meet the Quality Assurance requirements of the Contract.

- b. First Article Inspections:

The Contractor shall perform First Article Inspections (FAIs) on each piece of equipment for which it is listed in the following Sections and any others agreed upon.

- 1) The Contractor shall provide a plan which shall include a list and schedule of all FAI's to VRE for information not later than 90 days after Notice to Proceed.
- 2) At least thirty days before each FAI, the Contractor shall provide

VRE with an FAI package which shall include FAI notification, schedule of events, approved drawings, and any other pertinent information. VRE shall have the option of witnessing all FAI's. In the event the Contractor schedules qualification testing to take place as a part of the FAI, the qualification test procedures must be submitted as part of the FAI package.

c. Pilot Locomotive:

The first two locomotives shall precede the remaining locomotives in all stages of production. VRE shall have the right to examine and approve each assembled and completed part of the work before it is concealed or similar work is undertaken on the remaining locomotives. VRE inspections will be structured to avoid delays in the project. This procedure shall be continued until the first two locomotives are complete, ready for delivery. All other locomotives shall be completed in accordance with the pilot locomotive and no changes shall be made unless authorized in writing by VRE.

Major inspections of the pilot locomotive will be made at the following stages of completion, which are not necessarily in order:

- 1) All underfloor equipment, piping, and wiring in place and connected;
- 2) Carbody structure (or structure major assemblies) complete without any finish material installed;
- 3) All machinery and electrical equipment installed in the carbody;
- 4) Cab complete; and
- 5) Locomotive complete in all respects, ready to run in revenue service operation. All systems shall be functionally demonstrated during inspection period.

At least seven days notice shall be given by the Contractor for each of the listed stages of completion. Additional inspections of the pilot locomotive may be performed by VRE at its discretion. VRE will advise the Contractor of approval or corrections required at the time of the inspection. The remaining locomotives shall be constructed and assembled in accordance with the pilot locomotive and no changes shall be made unless authorized in writing by VRE.

The intent of this paragraph is that all locomotives shall be the same. Any engineering change shall be made on all locomotives unless permission to incorporate at an effective point later than the first locomotive is given by VRE. This is not intended to discourage the incorporation of design improvements as "effective point" changes, which may be done during construction with VRE approval.

d. Production Inspection:

VRE requires contractor to supply adequate facilities for a permanent VRE inspector. for the purpose of performing inspections of all the locomotives and their components at all stages of production from first article through release for shipment, at facilities of the Contractor, subcontractors, manufacturers, and suppliers. Inspection may cover work in process as well as at witness or hold points in the Contractor's plan of inspection. In circumstances where Contractor's production schedule may be affected, inspections will be done by mutual agreement between VRE and the Contractor. VRE inspectors shall use a standard of reasonableness.

VRE also reserves the right to reject items found which do not comply with the Contract or Specification, industry practices or procedures or applicable documentation relating to the Contractor, subcontractors, and suppliers. Non-compliant workmanship and materials shall be corrected promptly.

If VRE representative at either a Manufacturer's or Supplier's or the Contractor's plant finds conditions which require repeated rejection of materials or workmanship in order to maintain proper quality, this will be cause to withdraw such inspection, considering the work stopped until satisfactory changes are made in quality and an agreement is reached on how to proceed. VRE inspectors shall use a standard of reasonableness.

The contractor / Builder shall furnish appropriate office space for VRE inspectors. This space shall provide for the inspectors all necessary equipment, furnishings, health and welfare items as required to perform all related tasks (to include but not limited to phone lines, high speed internet lines, desks, chairs, conference table and room, computers, printers, modems etc.).

B. SUBMITTALS:

1. Drawing lists as specified in A.3.a.1) above.
2. Final as-built drawing list as specified in A.3.b above no more than 60 days after delivery of the locomotives.
3. Contract drawings as specified in A.3.a.2) above.
4. Samples of materials and paint chips as specified in A.4 above.
5. List of photographs as specified in A.5.d above.
6. Contract schedule in accordance with A.7 above.
7. Quality assurance program in accordance with A.8 above.
8. First Article Inspection plan as specified in A.9.b.1) above.

9. FAI packages as specified in A.10.b.2) above.

C. DELIVERABLES:

1. Software as specified in A.2 above.
2. CAD disks of as-built drawings in accordance with A.3.b above.
3. Photographs as specified in A.5 above.
4. Spare parts list as specified in A.6 above.

END OF SECTION

SECTION 104
SHOP / SYSTEM INTERFACE

A. DESCRIPTION:

This section is concerned with the ability of the vehicle to mesh with its environment in a safe, seamless way. The intent is to take advantage of previous lessons learned to make VRE's transition to a new vehicle as smooth and trouble-free as possible.

The Contractor shall meet with representatives of VRE or their designees and visit the VRE's or Subcontractors facilities to review, ascertain, and define the vehicle interfaces as they affect the operators, maintainers, equipment, shop infrastructure, and track infrastructure. The Contractor's investigation shall address issues of personnel safety, ergonomics, vehicle-equipment interfaces, vehicle-infrastructure interfaces, and vehicle-shop practice considerations.

B. SAFETY OF PERSONNEL AND ERGONOMICS

The contractor shall investigate and evaluate the design and arrangement of vehicle mounted equipment such that operators and maintenance personnel will interact with the equipment in a safe and efficient manner. Issues to be addressed shall include, but not limited to, the following:

1. Ability of personnel to board and debark locomotive safely;
2. Ability of personnel to traverse internal passage ways safely;
3. Electrical shock exposure;
4. Exposure to hot surfaces;
5. Head clearances;
6. Sharp corners;
7. Arrangement of Operator Controls;
8. Accessibility of Control Switches;
9. Visibility of Gages;
10. Visibility and use of IDU;
11. Visibility of Track and Wayside Signals;
12. Seating positions, adjustability;
13. Position of foot operated controls and footrests;
14. Windshield Sun Screen;

15. Windshield Window Tint;
16. Windshield Wiper Placement;
17. Accessibility of fasteners attaching onboard equipment;
18. Cab and Interior Lighting;
19. Weight and placement of portable equipment, i.e.: coupler adapter; and
20. Exposure to compressed air hazards.

C. INTERFACE OF VEHICLE TO MAINTENANCE EQUIPMENT

The Contractor shall inventory and assess shop maintenance equipment relative to the needs of the locomotive, assuring vehicle interfaces will be compatible with the VRE's or its Subcontractors equipment. Interfaces to be addressed shall include, but not be limited to the following:

1. Accessibility and Capacity of Overhead Crane Equipment;
2. Accessibility and Capacity of Mobile Lift Equipment, i.e.) fork trucks;
3. Wheel Truing Machine;
4. Jacking Equipment;
5. Car Wash System;
6. Accessibility of Sand Replenishment System;
7. Vehicle fueling station;
8. Water filling station;
9. Lubrication Maintenance Accessibility; and
10. Accessibility of Components Requiring Routine Replacement.

D. VEHICLE INTERFACE TO SHOP INFRASTRUCTURE

The Contractor shall assure there is adequate access and capacity to lift and remove heavy under floor mounted equipment. If special tools and/or lifting devices are required, they shall be furnished by the Contractor. Issues to be addressed shall include, but not limited to, the following:

1. Raised shop tracks and/or inspection pits; and

assure the under floor mounted equipment is fully accessible, without interferences to equipment cover removal, etc.

2. Accessibility of roof hatches and ability to lift and remove equipment: the Contractor shall assure there are lifting eyes available to lift and remove roof hatches and roof mounted equipment; and sufficient crane capacity to handle loads. If special tools and/or lifting devices are required, they shall be identified and furnished by the Contractor;
3. Ability to lift and remove underfloor mounted equipment;
4. Ability to access, open, and remove equipment covers; the Contractor shall assure that all removable equipment covers are readily accessible and free of obstruction for removal;
5. Accessibility of air and electric connections;
6. Accessibility of equipment cleaning tanks;
7. Accessibility and lift capacity of Crane equipment; and
8. Layover power access and availability.

E. INTERFACE WITH RIGHT-OF-WAY

The Contractor shall consider the following, but not limited to, the following:

1. Car Clearance Diagrams;
2. Track geometry;
3. Wayside structural clearances; and
4. Overhead Catenary clearances.

F. VEHICLE-SHOP PRACTICE CONSIDERATIONS

1. Compatibility of Shop Lubricants

The Contractor shall inventory the common shop lubricants that VRE and its Subcontractors currently have in use for servicing the vehicles. To the extent possible, the vehicle shall be compatible with those lubricants currently in use and not require the use of new special lubricants, chemicals, unless approved by the VRE.

2. Compatibility of Shop Chemicals and Cleaning Supplies

The Contractor shall inventory the common shop chemicals that the VRE and its Subcontractors currently use for cleaning or servicing their vehicles. To

the extent possible, the vehicle shall be compatible with those chemicals currently in use and not require the use of new special chemicals, unless approved by VRE.

3. Paint Compatibility

The Contractor shall inventory the paint type(s) and equipment used to maintain the vehicle fleet. The vehicle paint shall be compatible with that currently in use at VRE and its Subcontractors, unless approved by VRE.

G. SUBMITTALS:

1. A report discussing the result of the interface assessments made, as listed above. The report shall include a discussion of both the positive and negative lessons learned and the positive and negative impact on the vehicle design. The report shall also advise VRE of any new interface requirements affecting its infrastructure or equipment. This assessment to be submitted to VRE 120 days after notice to proceed.
2. Recommendations for improving system interfaces.