

PRIIA 305 Next-Generation Equipment Committee



Requirements Document

For

PRIIA Diesel-Electric Passenger Locomotives

Revision A

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Requirements Document Change Sheet

** Missing DCR numbers represent submitted DCRs that were not accepted for inclusion or accepted, but superseded by later DCRs.*

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DCR	Section(s)	Description
005-0054	1.2	Clarified HEP requirements.

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1.0 Diesel-Electric Passenger Locomotive Requirements

1.1 Introduction

The Next-Generation Equipment Committee (NGEC) was established under the provisions of section 305 of the Passenger Rail Investment and Improvement Act of 2008 (PRIIA). This legislation tasked the Committee with the responsibility for creating procurement specifications for standardized next-generation intercity corridor equipment, as well as other responsibilities related to rolling stock procurement. Under the PRIIA 305 language, the Committee may also determine the number of types of equipment required, taking into account variations in operational needs and corridor infrastructure.

A technical subcommittee was created specifically to develop and evaluate passenger rail car and propulsion (locomotive) system designs and technologies, evaluate proposed vehicle subsystems, and establish performance and safety criteria standards. Subsequent discussions and meetings of the technical subcommittee developed additional objectives for the specification development process:

- Coordination with a National and Regional Fleet Strategy
- Accommodation of the needs of individual States and other operators
- Flexible deployment through standardization of clearances and environmental conditions
- Developing a vehicle suitable for operation up to 125 mph on FRA approved track
- Minimize time and costs of turning trains at terminals (push-pull)
- Minimize station dwell times
- Maximize reliability and ease of maintenance
- Ensure equipment compatibility
- Compliance with safety objectives, including crashworthiness, energy absorption, structural strength, emergency egress
- Modularity and ease of configuration changes to meet the needs of individual States

Consistent with the NGEC mandate, and the objectives of the technical subcommittee, the PRIIA 305 Diesel Locomotive Specification is intended for use to procure, design and manufacture a fleet of intercity locomotives for use in intercity corridor service throughout the United States where operational conditions permit.

1.2 Key Performance Requirements

In order for the locomotives acquired to meet the needs of operations across the United States, there are a series of key performance requirements that need to be met. In generating the specification, detailed requirements for the performance of the locomotives will be defined. Below are listed top level performance requirements that are necessary to meet the overall performance requirements of operators.

These performance goals are:

- Top speed up to 125mph in operational service
- Fuel capacity to allow a range performance as follows for an assumed stopping pattern and route profile shall be 1800 U.S. Gallons. The fuel operating range shall be determined by the different operating agencies. The operators fuel operations shall include the factors of miles traveled, speed, number of passenger cars in train consist, train layover time, and the geographical terrain operated
- Head End Power (HEP) capacity of 600kW @ at 85% power factor

- Minimum starting tractive effort of 65,000 lbs
- Maximum cant deficiency of 6 inches
- Incorporation of CEM features to the locomotive
- Clearance profile to meet PRIIA's Clearance Diagram 305-800, latest revision
- Ability to start a train of 1,900,000 lbs on a 2% grade
- Capability to be controlled from a Cab-Car in push-pull operation
- Operate in environmental conditions defined in PRIIA Specification 305-912

The performance requirements do not necessarily have to be achieved by a single locomotive. Compliance can be achieved by the use of multiple locomotives if doing so will provide a reduced life cycle cost.

In addition, the team should identify whether there are changes that can be easily embodied within the locomotive design to increase its operational flexibility. These might include changes to reflect the operational usage such as gearing changes for top speed versus acceleration and traction.

NOTE: The following considerations will be evaluated when assessing the adequacy of the specifications created.

1.3 Operational Considerations

The primary consideration of the PRIIA 305 Diesel Locomotive Specification should be the adequacy of the Specification in addressing the operational considerations needed to procure, design and build a fleet of passenger locomotives that will be:

- Designed for use without restriction under a wide spectrum of environmental and physical conditions that are found throughout the United States;
- Specified in configurations and containing features to allow potential users of these locomotives to create new fleets of equipment for establishment of new services, replacement of existing equipment, or addition of new locomotives to existing fleets without major impact;
- Designed and built to meet the needs of the traveling public, the operations and maintenance providers and the passenger rail agencies by creating attractive, safe equipment that is reliable, cost-effective, maintainable, easy to operate and durable; and
- Operationally and functionally compatible with existing trains and train sets currently in production

The technical subcommittee has conducted a survey of potential users of this equipment to determine what, if any, operational restrictions may have an effect on the development of this Specification. The basis for the clearance analysis was PRIIA's Standard Single Level Clearance Diagram (Drawing 305-800), which delineates the static and dynamic outline of the single level vehicles currently in use or proposed for use on Amtrak-provided services.

The PRIIA 305 locomotives must be designed and built so that they can be integrated into an existing fleet of locomotives with minimal impact on the existing fleet, as well as be able to create a stand-alone fleet of locomotives for the purposes of starting new services, replacement of existing fleets and placement of new locomotives into service.

- Will these locomotives be operable without restriction in the United States
- Has the technical subcommittee identified all locations and/or conditions that restrict, affect or prevent the operation of these locomotives, based on feedback received from the States? What is the proposed resolution for these locations and/or conditions?

- Does the Specification identify all environmental and operational requirements necessary to assure the locomotive's performance as specified throughout the United States?
- Will this Specification create a fleet of PRIIA locomotives that can be operable either as a new fleet, or be integrated into an existing fleet of locomotives?
- Are the locomotives functionally compatible with existing fleets of passenger cars and intercity locomotives?
- Will there be an impact to an existing fleet of passenger cars when the PRIIA locomotives are delivered and commissioned into service?
- Are all necessary configurations included in the Specification so that users can order diesel locomotives they may need for new services, additional frequencies and fleet expansions?

1.4 Design Considerations

There are many design requirements that go into a specification of this size and complexity, whether through identification of specific system design technology or through identification of performance-based system requirements. The Committee's evaluation of the Specification should focus on the Specification's compliance with the Committee's mandates and stated objectives, as well as additional requirements such as compliance with regulations regarding safety, accessibility and operations.

- Does the Specification meet the safety objectives of the PRIIA 305 Committee, the FRA, Amtrak and the States?
- Does the Specification meet requirements for maximum operating speed, braking, track geometry, cant deficiency, etc?
- Will the design of the locomotives allow for individual variations that individual States may need for their operations?
- Does the Specification contain objectives for the reliability and maintainability of the locomotives? Are the reliability and maintainability provisions measurable and obtainable?
- Does the Specification contain adequate provisions for design verification testing, as well as quality assurance testing?
- Does the Specification promote environmentally sensitive initiatives, such as energy efficiency, waste reduction and recycling?

1.5 Summary of the PRIIA 305 Diesel Locomotive Specification

The Specification for the PRIIA 305 diesel locomotive will be a detailed technical document. In order for the Executive Committee and potential users to evaluate the overall Specification and the major systems and design considerations of the locomotive, the Specification should include a summary document that describes the basic concept and features of the equipment.

1.6 Specification Development and Approval Process

The process, by which the diesel locomotive Specification was developed, reviewed and approved in preparation for submittal to the Executive Committee is almost as important a component of the PRIIA 305 Committee's mandate and mission as is the specification that the Committee will approve. The adequacy of the Specification is determined by its technical merit as well as by the soundness of the process by which it was created. The makeup of the Committee and the technical subcommittee, the methodology by which a specification was developed, reviewed, edited and approved by the subcommittee, and the documentation of the

process and the Committee makeup will provide the Executive Committee with means by which it may determine if the Specification was developed using sound procedures, and will create a lasting record of the way the Specification was written and finalized.

- Who was involved in the development and approval of the Specification, and who did they represent?
- What organizations were the major participants and what role did they play?
- What was the process for development, review and approval of the Specification?
- How were comments evaluated?
- Was the Specification approved by consensus vote?

1.7 FRA-Specific Issues Regarding this Specification

It is assumed that this Specification will not only be used to acquire and operate locomotives that are compliant with all applicable FRA regulations and safety standards, but that this Specification will also form the basis for grant applications for rolling stock procurement funding under a variety of Federal funding programs. The establishment of the PRIIA 305 equipment standardization process has given the intercity rail passenger community an opportunity to create a sustainable rail car and locomotive design, and current Federal funding programs point back to the PRIIA 305 Committee as a requirement for funding of intercity rail rolling stock acquisitions. Therefore, it is essential that the FRA's consent and approval of this Specification be achieved and documented; so that potential users of this Specification can be assured that the vehicle as specified meets the FRA's intent both for design and procurement as well as for funding and grant application.

- Has the FRA reviewed this Specification in its current form?
- Has the FRA voted to accept this specification?
- Will the FRA support the use of this Specification for rolling stock acquisition using federal funds (PRIIA/HSIPR funds, and other potential funding sources)?
- Is this Specification fully compliant with all applicable regulations? Will waivers of any sort be required in order for these cars to be built as specified?

Appendix A: Questions to be Addressed When Reviewing Specification Against the Diesel Locomotive Requirements Document

1. Describe how the base specification was developed, what was used as a starting point and how this conforms to the needs and objectives as determined by the Committee and technical subcommittee.
2. Clearances and Deployment
 - 2.1. Provide assessment of the extent to which these locomotives will be operable without restriction in the United States.
 - 2.1.1. Identify all locations and/or conditions that restrict, affect or prevent the operation of these vehicles, based on feedback received from the States. Describe the proposed resolution for these locations and/or conditions.
 - 2.1.2. Summarize how the Specification identifies all environmental and operational requirements necessary to assure the vehicle's performance as specified throughout the United States.
3. Fleet Considerations
 - 3.1. Will this Specification create a fleet of PRIIA locomotives that can be operable either as a new fleet, or be integrated into an existing fleet of cars?
 - 3.2. Describe how the locomotives shall be functionally compatible with existing fleets of single level cars and intercity locomotives. Include a discussion of trainlines, HEP loads, operational compatibility and consistency of maintenance.
 - 3.3. Describe any potential for impact (such as the requirement for modifications) to an existing fleet of diesel locomotives when the PRIIA locomotives are delivered and placed into service.
 - 3.4. Describe the way in which the Specification allows for variation in the locomotive design to accommodate the needs of individual States or other customers.
4. Safety Objectives
 - 4.1. Document the Specification's compliance with the safety objectives of the PRIIA 305 Committee, FRA, Amtrak and the States.
 - 4.1.1. Describe how the objectives for the safety-related features of the Specification were determined
 - 4.1.2. Describe how this Specification represents an advancement of safety.
 - 4.1.3. Provide a summary of compliance with all applicable safety regulations and standards.
5. Performance Requirements
 - 5.1. Confirm that the locomotives shall be capable of passenger operation at speeds up to 125 mph (assuming all track quality and certification issues are addressed), under existing Tier 1 equipment requirements.
 - 5.2. Describe the braking rate specified for the new locomotive, and how this compares to existing locomotives.

6. Reliability and Maintainability

- 6.1. Describe the Specification objectives for the reliability and maintainability of the locomotives, and the means by which they are measurable and obtainable.

7. Testing and Inspection Requirements

- 7.1. Provide a summary of the Specification provisions for design validation testing, as well as quality assurance testing.
- 7.2. Provide a summary of the provisions in the Specification for Customer participation in the design review, production inspection and acceptance of the new locomotives.

8. Environmental Initiatives

- 8.1. Describe how the Specification promotes:

8.1.1. Energy efficiency

8.1.2. Use of sustainable or recycled materials, and lessen the impact from the manufacturing process

8.1.3. Environmental sustainability of materials such as refrigerants

9. Describe the process by which the Specification was developed.

- 9.1. Provide a list of those individuals involved in the development and review of the Specification, including their affiliation.

9.2. Describe the organization of the subgroups, and their responsibilities regarding review of the Specification.

9.3. Describe the criteria that were used to evaluate comments from the subgroups, and how the comments were dispositioned.

9.4. Describe the roles of the major groups involved:

- Amtrak
- FRA
- APTA
- States
- Industry and consultants.

9.5. Summarize other stakeholder involvement.

9.5.1. Describe the process by which the public and other stakeholder groups were able to have input into this Specification.

9.6. Describe the process by which the technical subcommittee finalized the Specification for presentation to the Executive Committee.

9.6.1. Specify the method by which the Specification was approved. Include a discussion of any dissenting votes or issues of disagreement.