16. Recommended Practice for Solid State Auxiliary Power Unit Periodic Inspection and Maintenance

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Abstract: The recommended practices described in this document provide guidance for the periodic inspection and maintenance of Solid State Auxiliary Power Units mounted on rail transit vehicles. It provides a set of useful practices that can be selected and applied during the inspection and maintenance process as the particular design warrants.

Keywords: rail transit vehicles, periodic inspection and maintenance
Introduction

(This introduction is not a part of APTA RT-VIM-RP-016-03, Recommended Practice for Solid State Auxiliary Power Unit Periodic Inspection and Maintenance)

This Recommended Practice for Solid State Auxiliary Power Unit Periodic Inspection and Maintenance for rail transit vehicles represents a common viewpoint of those parties concerned with its provisions, namely, transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any standards, practices or guidelines contained herein is purely voluntary. In some cases, federal and/or state regulations govern portions of a rail transit system’s operations. In those cases, the government regulations take precedence over these recommended practices. APTA recognizes that for certain applications, the standards or practices, as implemented by individual rail transit systems, may be either more or less restrictive than those given in this document.

This document describes the basic inspection and maintenance functions for auxiliary power supply systems mounted on rail transit vehicles. APTA recommends the use of these practices by:

- Individuals or organizations that maintain Auxiliary Power Supply Systems on rail transit vehicles;

- Individuals or organizations that contract with others for the maintenance of Auxiliary Power Supply Systems on rail transit vehicles; and

- Individuals or organizations that influence how Auxiliary Power Supply Systems are maintained on rail transit vehicles.
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Recommended Practice for Solid State Auxiliary Power Unit Periodic Inspection and Maintenance

1. Overview

The auxiliary power unit is a solid state device that conditions primary vehicle power and supplies power to the auxiliary loads. This Recommended Practice provides guidance for the periodic inspection and maintenance of Solid State Auxiliary Power Units (APU) mounted on rail transit vehicles. Individual rail transit systems (RTS) should tailor these recommendations to accommodate their specific equipment and mode of operation.

1.1 Scope

This document establishes a recommended practice for the power supply for the auxiliary subsystems inspection and maintenance. This procedure may also be used in secondary subsystem power supplies. This document may not be applicable to disposable or non-serviceable units.

1.2 Purpose

This recommended practice is intended for use by rail equipment maintenance organizations. It establishes procedures for periodic inspection and maintenance of auxiliary power units used on rail transit vehicles.

2. References

Original Equipment Manufacturer’s (OEM) Inspection and Maintenance Manuals.


3. Definitions, abbreviations, and acronyms

3.1 Definitions

With a diversity of manufacturers and properties, it is necessary to establish a common vocabulary to describe components that are identical or similar in nature and function. For the purposes of clarity, the following terms and definitions will be used in this document:

3.1.1 dc – dc converter: Converts high voltage direct current (dc) to low voltage dc.

3.1.2 inverter: Device used to convert dc voltage to alternating current (ac) voltage.
3.2 Abbreviations and acronyms

APU  Auxiliary Power Unit  
OEM  Original Equipment Manufacturer  
PTU  Portable Test Unit  
RTS  Rail Transit System

4. Frequency of conduct

Periodic inspection and maintenance tasks on the solid state auxiliary power units should be performed on a regular schedule as determined by the RTS. The frequency of any task contained within this recommended practice for periodic inspection and maintenance of solid state auxiliary power units document shall comply with all applicable federal, state and local regulation. Further, in the conduct of a RTS’s periodic inspection and maintenance programs, the frequencies for individual tasks should be established based on a number of additional factors, including but not limited to:

- OEM – recommended intervals  
- Industry Experience  
- Operating Environment/Conditions  
- Historical Data  
- Performance Requirements  
- Failure Analysis  
- Reliability centered maintenance programs

5. Requirements and specific tasks

**WARNING:** Read and understand all relevant Material Safety Data Sheets (MSDS) before proceeding with work to maintain the auxiliary power unit.

**WARNING:** Do not wear metallic clothing or jewelry when working on live electrical circuits or components. Use tools with insulated handles only.

**WARNING:** Verify all power is removed from car. Wait for appropriate time as specified by the OEM before opening auxiliary power supply cover to allow components to discharge.

**WARNING:** Follow all OEM recommendations with respect to discharging residual voltages and grounding procedures.

5.1 Materials

The following materials are normally required for solid state auxiliary power unit inspection and maintenance:

- OEM and RTS recommended lubricants.
- OEM and RTS recommended cleaning supplies.
- Reference OEM maintenance manuals for additional materials.

5.2 Tools

The following tools are normally required for solid state auxiliary power unit inspection and maintenance:

- Standard tools carried by maintenance personnel.
- Special tools as recommended by OEM and/or RTS.
- Digital voltmeter *
- Torque wrench (0-250 in.-lb.) *
- Portable Test Unit (PTU) *

*These tools require periodic calibration as specified by the RTS’s practices.

5.3 Safety/personal protective equipment

Appropriate personal protective equipment, meeting minimum American National Standards Institute (ANSI) standards and as required by the RTS, shall be worn at all times in the performance of this maintenance task.

Established RTS safety practices, rules and procedures shall be followed at all times in the performance of these inspections.

5.4 Training requirements

Rail transit systems and/or their maintenance contractors should develop and execute training programs that provide employees with the knowledge and the skills necessary to safely and effectively perform the tasks outlined in this Recommended Practice.

5.5 Inspection and maintenance

In all of the following procedures and recommended practices, the OEM maintenance manuals should be referred to for such items as torque values, voltage settings, pass/fail criteria, clearance measurements, and specific procedure methodology. These procedures cover only the visual inspection, gauging, adjustment, and functional testing of solid state auxiliary power units mounted on a rail transit vehicle. Some procedures may require the use of heavy lifting and support devices due to the size and weight of the equipment. Some procedures may require more than one individual.

Some procedures will not be applicable due to design variations. Methodologies for the resolution of deficiencies noted while inspecting, gauging, adjusting, or functionally testing the auxiliary power supply and associated devices should be tailored by the RTS in conjunction with the OEM.
Documentation of the inspection and maintenance process as to interval, deficiencies, and resolution of those deficiencies found should be done in a comprehensive manner so as to create a useful database, which will enhance the reliability and accountability of the process.

5.5.1 Prepare auxiliary power unit for inspection

Prior to inspection, fault directory should be downloaded and checked, if so equipped. Record and document faults to assist in the inspection, maintenance and/or trouble shooting. Isolate the power supply to the APU. Follow RTS practices for proper lockout and tag procedures.

5.5.2 Auxiliary power unit enclosure and connection inspection

   a) Inspect enclosure and brackets for loose or missing mounting hardware. Repair or replace as required. Check all cover latches for correct operation and fit. Verify proper latch and lock function.

   b) Check enclosure for damage.

   c) Clean as required per OEM/RTS procedures.

   d) Inspect door gaskets for breaks and cracks. Replace as required.

   e) Inspect ventilation blower motor (if equipped) for proper operation, replace filters as required.

   f) Check cables for chafed or cut insulation. Repair or replace as required.

   g) Check cables for broken strands. Repair or replace as required.

   h) Check cables for loose terminals and tighten as required.

5.5.3 Auxiliary power unit interior inspection

   a) Open enclosure and check for signs of moisture, debris, wipe away any contaminants from components.

   b) Clean all insulators with an approved, non conductive, cleaning agent.

   c) Check for discoloration, burning marks or odor of burning from components. Check capacitors to make sure they are not bulging or leaking, replace as required.

   d) Inspect fuses and circuit breakers for evidence of blown or tripped status, replace fuses/reset breakers as required.

NOTE: The reasons for a blown fuse or tripped circuit breaker should be found and corrected.

   e) Inspect all related control relays and power contactors for evidence of damage, burned contacts and loose connections. Repair or replace as required.

   f) Check bolted connections and tighten as required.
5.5.4 Prepare auxiliary power unit for operation

a) Remove tags, and restore the power to the APU.

b) Run diagnostic tests via portable test unit (PTU) if applicable. Check for proper annunciator light indication.

c) Use voltmeter or PTU to verify proper output voltage/frequency from intermediate voltage power supply (IVPS) and low voltage power supply (LVPS). If possible apply maximum electrical loading to APU when checking voltage/frequency.

d) Check Time/Date and car number information using PTU. Save Event data as per RTS procedures.

e) Close and secure enclosure.

5.6 Correction of deficiencies

Any deficiencies uncovered during the inspections in sections 5.5.1 through 5.5.4 should be corrected and documented in accordance with established RTS procedures and OEM recommendations.