



**APTA RT-VIM-RP-016-03 Rev 1**

First Published September 28, 2003

First Revision January 6, 2015 (Reaffirmed)

APTA Rail Transit Vehicle Inspection &  
Maintenance Working Group

# Solid-State Auxiliary Power Unit Periodic Inspection and Maintenance

**Abstract:** This *Recommended Practice* provides guidance for the periodic inspection and maintenance of solid-state auxiliary power units (APUs) 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

**Summary:** 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 APUs mounted on rail transit vehicles. Individual rail transit systems should tailor these recommendations to accommodate their specific equipment and mode of operation.

**Scope and purpose:** This document establishes a recommended practice for the inspection and maintenance of the power supply for auxiliary subsystems on rail transit vehicles. This procedure may also be used in secondary subsystem power supplies. This document may not be applicable to disposable or non-serviceable units. This *Recommended Practice* is intended for use by rail equipment maintenance organizations.

This *Recommended Practice* 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 voluntary. In some cases, federal and/or state regulations govern portions of a transit system's operations. In those cases, the government regulations take precedence over this standard. NATSA (North American Transit Services Association) and its parent organization APTA recognizes that for certain applications, the standards or practices, as implemented by individual transit agencies, may be either more or less restrictive than those given in this document.

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## Introduction

This introduction is not a part of APTA RT-VIM-RP-016-03 First Revision January 6, 2016 *Recommended Practice for Solid State Auxiliary Power Unit Periodic Inspection and Maintenance*.

This *Recommended Practice* 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.


# Solid State Auxiliary Power Unit Periodic Inspection and Maintenance


## 1. Frequency of conduct


Periodic inspection and maintenance tasks on the solid-state auxiliary power units (APUs) should be performed on a regular schedule as determined by the rail transit system (RTS). The frequency of any task contained within this *Recommended Practice* for periodic inspection and maintenance of solid-state APUs shall comply with all applicable federal, state and local regulations. 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; and
- reliability-centered maintenance programs.

## 2. Requirements and specific tasks

 **WARNING:** Read and understand all relevant material safety data sheets (MSDSs) before proceeding with work to maintain the APU.

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

 **WARNING:** Verify that all power is removed from car. Wait for an 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.

## 2.1 Materials

The following materials are normally required for solid-state APU inspection and maintenance:

- OEM- and RTS recommended lubricants
- OEM- and RTS recommended cleaning supplies

Reference OEM maintenance manuals for additional materials.

## 2.2 Devices and tools

The following devices and tools are normally required for solid-state APU inspection and maintenance:

- standard tools carried by maintenance personnel
- special tools as recommended by the OEM and/or RTS
- digital voltmeter\*
- torque wrench\*
- portable test unit (PTU)\*

**NOTE:** Devices and tools marked with an asterisk (\*) require periodic calibration as specified by the RTS's practices.

## 2.3 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.

## 2.4 Training requirements

The RTS 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*.

## 2.5 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 agency 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 that will enhance the reliability and accountability of the process.

### **2.5.1 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 inspection, maintenance and/or troubleshooting. Remove the power, isolate the power supply to the APU and discharge the capacitors. Follow RTS practices for proper lockout and tag procedures.

### **2.5.2 APU 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 and 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.

### **2.5.3 APU interior inspection**

- a) Open enclosure and check for signs of moisture and debris. Wipe away any contaminants from components.
- b) Clean all insulators with an approved nonconductive 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.

### **2.5.4 Prepare APU 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 transit system procedures.
- e) Close and secure enclosure.

## **2.6 Correction of deficiencies**

Any deficiencies uncovered during the inspections in Sections 2.5.1 through 2.5.4 should be corrected and documented in accordance with established RTS procedures and OEM recommendations.

## **Related APTA Standards**

None at this time.

## References

- Code of Federal Regulations, 29 CFR 1910.242b, *Compressed Air Used for Cleaning*.

## Definitions

None at this time.

## Abbreviations and acronyms

<b>ANSI</b>	American National Standards Institute
<b>APU</b>	auxiliary power unit
<b>APTA</b>	American Public Transportation Association
<b>IVPS</b>	intermediate voltage power supply
<b>LVPS</b>	low-voltage power supply
<b>MSDS</b>	material safety data sheet
<b>NATSA</b>	North American Transit Services Association
<b>OEM</b>	original equipment manufacturer
<b>PTU</b>	portable test unit
<b>RTS</b>	Rail Transit System

## Summary of document changes

1. Document formatted to the new APTA standard format.
2. Sections have been moved and renumbered.
3. Scope and summary moved to the front page.
4. Sections of definitions, abbreviations and acronyms moved to the rear of the document.
5. Three new sections added: “Related APTA Standards”, “Summary of document changes” and “Document history.”
6. Some global changes to section headings and numberings resulted when sections dealing with references and acronyms were moved to the end of the document, along with other cosmetic changes, such as capitalization, punctuation, spelling, grammar and general flow of text.
7. Some minor edits and reaffirmation.

## Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	Rail CEO Approval	Rail Policy & Planning Approval	Publish Date
First published	Oct 21, 20102	-	-	Sept 28, 2013	Sept 28, 2003
First revision	April 2015	-	-	-	Jan 6, 2016

NOTE: This document was reaffirmed due to minor cosmetic changes and approved by the Rail Transit Vehicle Inspection & Maintenance Working Group at a meeting in Pittsburgh, PA November 3 & 4, 2015.