

# Recommended Practice for Transit Bus Electrical System Requirements related to Fire Safety

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**Abstract:** This recommended practice provides guidelines for vehicle systems shut down in case of detected fire.

**Keywords:** fire, suppression, detection, fire suppression, bus fire, vehicle fire, engine fire, wheel fire, tire fire

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1666 K Street, N. W.  
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## **Introduction**

(This introduction is not a part of APTA BT-RP-002-07 Recommended Practice for Transit Bus Fire Safety Shutdown.)

This Recommended Practice for Transit Bus Fire Safety Shutdown reflects the consensus of the APTA Bus Standards Program members on the items, methods, and procedures that have provided the best practice based on the experiences of those present and participating in meetings of the Program Task Forces and Working Groups. Recommended practices are voluntary, industry-developed, and consensus-based practices that assist equipment suppliers, vehicle and component manufacturers, and maintenance personnel in the construction, assembly, operation, and maintenance of transit bus vehicles. Recommended practices may include test methodologies and informational documents. Recommended practices are non-exclusive and voluntary; they are intended to neither endorse nor discourage the use of any product or procedure. All areas and items included herein are subject to manufacturers' supplemental or superceding recommendations. APTA recognizes that for certain applications, the practices, as implemented by operating agencies, may be either more or less restrictive than those given in this document.

This recommended practice provides guidelines for transit bus vehicle systems shut down in conjunction with a vehicle fire. APTA recommends the use of this recommended practice by:

Individuals or organizations that inspect and maintain transit buses

Individuals or organizations that develop specifications for transit buses

Individuals or organizations that build or manufacturer fire suppression systems

Individuals or organizations that contract with others for the inspection and maintenance of transit buses

Individuals or organizations that influence how transit buses are inspected and maintained

Test results must meet or exceed federal, state, or other local regulatory agency requirements if different from the recommendations outlined in this document.

## **Participants**

The American Public Transportation Association (APTA) greatly appreciates the contributions of the Bus Transit Standards Bus Fire Working Group, who provided the primary effort in drafting the Recommended Practice for Transit Bus Shut Down.

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# Recommended Practice for Transit Bus Electrical System Requirements related to Fire Safety

## 1. Overview

This document identifies transit bus electrical control system recommended practice related to fire safety. Individual operating agencies may modify these guidelines to accommodate their specific equipment and mode of operation.

Fire protection systems should not be a substitute for proper engineering design and maintenance practices.

This recommended practice should be used in conjunction with the original equipment manufacturer (OEM) recommendations.

### 1.1 Scope

This recommended practice provides guidelines for transit bus electrical control system configuration for electrical circuits related to fire safety. This RP does not apply to high voltage systems of more than 12/24 volt systems such as those seen in hybrid/fuel cell electrical systems or all electric buses.

### 1.2 Purpose

The purpose of this recommended practice is to prevent, detect and reduce the occurrence of vehicle electrical fires. The practice covers vehicle electrical equipment that will provide detection and circuit shutdown of defective electrical components or systems.

## 2. References

This recommended practice shall be used in conjunction with the most recent edition of SAE Standards and Recommended Practices such as but not limited to: J1455, J1113, J1127, J1128, J1939, J1292, J1708, UL 935 type CC and NEC.

## 3. Definitions, abbreviations, and acronyms

For the purposes of this recommended practice, the following terms, definitions, abbreviations, and acronyms apply.

### 3.1 Definitions

For the purpose of this document the following words are used as defined.

**3.1.1 Electrical fire:** A thermal event that may result from one of the following: Incorrect

assembly, moisture leading to corrosion, wires pulled loose ,overheating due to over-current and over-voltage, arcing, chaffing/worn insulation, incorrect wire size, poor splices, poor electrical connection and/or failure of an electrical component .

**3.1.2 Arc detection:** The sensing of a possible arcing condition in a electrical or component circuit.

## **3.2 Abbreviations and acronyms**

**OEM** Original equipment manufacturer (vehicle manufacturer)

**SAE** Society of Automotive Engineers

**UL** Underwriters Laboratories, Inc.

**VNAS** Vehicle Network Access System

**NEC** National Electrical Code

## **4. Routing and Securement of Electrical Harnesses and Components**

All wiring, and cables must be properly routed, bracketed, insulated, and isolated to avoid chaffing and to protect from heat sources. Wiring should be routed to avoid damage from abrasion pinch points, heat, road debris, excessive stretching and damage from the exhaust system and turbocharger. Engine component connections should be water proofed or shielded to prevent the intrusion of moisture. UL listed or equivalent wire for fire suppression system applications must be used. Use heat shields where other alternatives are not possible. Heat shields should be designed and installed in accordance with applicable SAE and NFPA standards.

## **5. Detection/Notification Shut Down Processes**

### **5.1 Electrical System Detection and Protection Circuit Breaker - Baseline Protection**

All branch circuits, except battery-to-starting motor and battery-to-generator/alternator circuits, shall be protected by circuit breakers or fuses sized to the requirements of the load. Electronic circuit protection for the cranking motor shall be provided to prevent engaging of the motor for more than 30 seconds at a time to prevent overheating. The circuit breakers or fuses should be easily accessible for authorized personnel. Fuses should be used only where circuit breakers are not practical. Any manually re-settable circuit breakers shall provide visible indication of open circuits. Components should be protected to fail in a safe manner.

Circuit breakers or fuses shall be sized approximately 15 percent larger than the total circuit load current. The current rating for the wire used for each circuit must exceed the size of the circuit protection being used. Wire and cable amperage for wire sizes 18 AWG and larger shall be in accordance with the Wire amperage Chart found in Appendix B.

### **5.1.1 Optional Multiplex:- Enhanced Protection Technology**

Upon detection of an arcing condition, the vehicle multiplexing system will detect the arcing condition. The system shall provide visual and audible notification in the operator's area. The system will automatically shut down selected outputs when current draw exceeds preset limits. Data logger shall have the ability to recall multiplex system input/output/J1939 status settings for retrieval of system malfunctions. Where data logging exists consider the use of diagnostic data management software. Justification for system override to enable the operator to move or return the vehicle to the base of operation should be developed and maintained by the transit system.

### **5.1.2 Other Enhanced monitoring and protection devices- Emerging Technology**

#### **5.1.3.1 Lighting System Ballast Detection and Protection**

The Inverter Ballast may include circuitry that detects arcing within the lamp panels wiring harness as defined by UL 935 Type CC. Upon detection of an arcing condition the individual ballast detecting an arcing condition must automatically and immediately shutdown power to the circuit. The ballast shall provide a visible red LED indicator light identifying the ballast of concern. The vehicle restart procedure must not be able to supply power to the ballast if the arcing conditions still exist.