

Recommended Practice for Installation of Transit Vehicle Fire Protection Systems

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Abstract: This recommended practice provides guidelines for vehicle fire protection system including detection and suppression systems in case of detected fire.

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

Introduction

(This introduction is not a part of APTABTS-BS-RP-003-08, Recommended Practice for Installation of Transit Vehicle Fire Protection Systems.)

This Recommended Practice for Installation of Transit Vehicle Fire Protection Systems 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 superseding 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 fire suppression systems 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) Safety Working Group, who provided the primary effort in drafting the Recommended Practice for Transit Bus Installation of Transit Vehicle Fire Protection Systems.

Recommended Practice for Installation of Transit Vehicle Fire Protection Systems

1. Overview

This document establishes a recommended practice for installation of transit vehicle fire protection systems. Individual operating agencies may modify these guidelines to accommodate their specific equipment and mode of operation.

Fire protection system includes a fire detection system which may or may not include a fire suppression system.

This practice is to be used in addition to the fire protection equipment manufacturer's installation recommendations.

1.1 Scope

This recommended practice applies to the installation of a fire protection system on heavy duty transit vehicles and over the road coaches. This document is not inclusive of systems installed on small transit vehicles such as cutaways and vehicles used in paratransit. Vehicles used in paratransit may require additional design consideration above and beyond this document.

1.2 Purpose

The purpose of this recommended practice is to define the minimum performance requirements for detection of and suppression of thermal events on transit vehicles. The resulting fire protection system shall be capable of detecting and minimizing potential damage of fire events in those zones of the vehicle identified in this document.

2. References

This guideline is to be used in conjunction with the original equipment manufacturer (OEM), fire protection equipment manufacturer service manuals and any authorities having regulatory jurisdiction. It is the responsibility of the user of this document to reconcile any discrepancies or conflicts that may arise between these guidelines, manuals and applicable codes or regulations.

NFPA, SAE, NEC, DOT,
BT-RP-007-05, Bus Shutdown

3. Definitions, abbreviations, and acronyms

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

3.1 Definitions

3.1.1 Original equipment manufacturer is the vehicle manufacturer.(this document only)

3.1.2 Listed : Equipment, materials or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production labeled equipment or materials, and by whose labeling the manufacturer indicated compliance with appropriate standards or performance in a specified manner.

3.1.3 Transit Vehicle: A transit operated heavy-duty vehicle used in transit or over the road service with the exception of vehicles used in paratransit service.

3.1.4 Fire Protection: Fire detection system with or without a fire suppression system.

3.1.5 Fire Suppression: A system designed to suppress or mitigate damage from a fire.

3.1.6 Pilot vehicle: First article of an order.

3.1.7 Zones: Location within the vehicle

Zone 1 Engine compartment

Zone 2 Exhaust Systems (external to engine compartment)

Zone 3 Battery

Zone 4 Wheel Well

Zone 5 HVAC Compartment

Zone 6 Operator's Work Station

Zone 7 Articulated Turn Table

Zone 8 Fuel Storage (inclusive of roof mounted hybrid battery)

Zone 9 Electrical Junction Boxes

Zone 10 Interior

3.2 Abbreviations and acronyms

HVAC Heating Ventilation Air Conditioning System

OEM Original Equipment Manufacturer

AFSS Automatic Fire Suppression System

3.3 Potential Causes of Fire or Ignition Sources for Each Zone

- Zone 1 Engine Compartment - electrical, combustible or flammable liquids/solids/gases, hot surfaces, belts, clutches, turbo fire, ignition of exhaust blankets, catalytic converter, particulate diesel filter/trap
- Zone 2 Exhaust Systems (external to engine compartment) – high temperatures, exhaust leak, tail pipe fire, ignition of exhaust blankets, catalytic converter, particulate diesel filter/trap, and monitoring systems
- Zone 3 Low Voltage Battery – electrical, flammable liquids/solids/gases, cables, equalizers, circuit breakers, fusible link malfunction, corrosion, overcharge, battery box
- Zone 4 Wheel well – under inflated tire, overheated bearings, leaky wheel seal, flammable liquids/solids, high heat in brake area, road debris
- Zone 5 HVAC Compartment – electrical, flammable liquids/solids/gases, high heat
- Zone 6 Operator’s Work Station – electrical, flammable liquids/solids/gases, high heat, tobacco smoking, debris build up
- Zone 7 Articulated Turn Table – friction, debris build up, electrical cabling, vandalism, tobacco smoking
- Zone 8 Fuel Storage/High Voltage Energy Storage – Fuel leaks, arcing, debris, flammable liquids/solids/gases, cables, equalizers, circuit breakers, fusible link malfunction, corrosion, overcharge
- Zone 9 Electrical Junction Boxes – shorts, electrical, flammable liquids/solids, cables, equalizers, circuit breakers, fusible link malfunction, corrosion, chaffing
- Zone 10 Interior – tobacco smoking, debris, HVAC duct, fluorescent light ballast, corrosion, cabling, chaffing, signage, wire harnesses, vandalism, advertisements

4. Fire Detection System

4.1 Sensors

There are two basic sensor devices that are used to provide early warning of fires. Thermal sensors detect heat and optical sensors detect flame.

4.1.1 Thermal Sensors:

Three common thermal sensors utilized in transit applications are

Fixed Temp: A thermal sensor detects heat above a given set point

Rate of Rise: A thermal sensor detects a rapid rise

Linear Thermal: A wire or tube that detects heat

4.1.2 Optical Sensors:

An optical flame sensor detects the energy produced by a flame and must be suitable for the operating environment of a transit vehicle.

4.1.3 Recommended Sensor Technology

Vehicle configurations vary, it is recommended that the detection system be designed based on a transit property's specific configuration in consultation with the OEM and AFSS supplier. .

Location	Historical Frequency	Base Line	Enhanced = baseline + _____
Zone 1	High	4 spot thermal or equivalent length of linear thermal	Mix of thermal sensors and optical infrared sensor
Zone 2	High	System that provides early warning of over heat conditions that would alert driver to minimize potential for combustion.	Consult with OEM & AFSS supplier to further address individual transit concerns
Zone 3	Medium	No baseline sensor protection.	1 spot thermal or equivalent length of linear thermal
Zone 4	High	No baseline sensor protection.	Any system that includes sensors to provide early warning of over heat conditions that would alert driver to minimize potential for combustion. Consult with OEM, AFSS & brake suppliers to further address individual transit concerns or identify emerging technologies.
Zone 5	Medium	No baseline sensor protection.	Consult with OEM & AFSS supplier to further address individual transit concerns
Zone 6	Low	No baseline sensor protection.	Consult with OEM & AFSS supplier to further address individual transit concerns
Zone 7 Low			
Low			
Zone 8 Low			
Low			
Zone 9 Low			
Zone 10 Medium			
Medium			

4.2 Display and/or Control Panel

4.2.1 System Controls

A control panel should be provided for all detection and/or suppression systems. The control panel should provide, at a minimum, electrical supervision of system power and detection; and system actuation wiring circuits if so equipped. The control panel should be visible and accessible to the seated driver/operator.

It is recommended that a separate manual means of activation of the suppression system be provided regardless of availability of system power. Manual actuators shall include operating instructions and shall be located within easy view and reach of the vehicle operator without requiring movement from the normal seated position. The manual actuator shall have a protected device to avoid accidental activation (guard, pin etc.). They should require a minimal amount of force or movement to activate and in no case more than 40lbs of force or movement no more than 14in to secure operation. A means of remotely

monitoring the agent cylinder pressure is available if desired.

4.2.2 Alarm and Signal

At a minimum the system control panel should include an alarm and signal system. Both a fire and a fault should activate a visual and audible alarm.

Lights:

System OK light: (Green)
Fault/Trouble light: (Yellow)
Fire Indicator: (Red)

Audible Alarm:

Detection or fault.
Means shall be provided to silence the alarm.
Distinct and recognizable by the operator.

4.3 Wiring, Cabling and Connectors

All lines, wiring, hoses, cables, and lines must be properly bracketed, insulated, and isolated to avoid chaffing and to protect against heat sources, using heat shields. Wiring should be routed to avoid damage from abrasion pinch points, heat, road debris, excessive stretching and damage from the exhaust system and turbo charger. 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.

4.4 Auxiliary Outputs

Auxiliary outputs may be required to meet the requirements of APTA BS-RP-008-05 Recommended Practice for Transit Bus Fire Safety Shutdown for additional information.

4.5 Power Requirements/Options

Baseline: Power for the fire protection system shall be provided by the bus electrical system directly from the vehicle battery terminals or through dedicated power and ground buss bars. Nominal power consumption of the system should not exceed 300mA. If the system is connected to the switched side of a battery disconnect switch, system performance may be compromised when the switch is in the off position.

Enhanced: A battery-backup system may be used to provide limited-to-full system functionality in the event primary system power is interrupted.

5. Fire Suppression Systems

In addition to all of the above requirements, the following components are required for an integrated

detection and suppression system. Integrated systems must be approved by an accredited third party.

5.1 Storage Containers

Stored-pressure type containers shall be designed to meet the requirements of the U.S. Department of Transportation (DOT) and Transport Canada (TC).

Containers shall be corrosion resistant.

Each container shall have an indicator (pressure gauge) to show that it is in a ready condition or in need of recharging. The gauge should be readily visible to an operator during a pre-trip inspection with out the use of tools. In the event that the gauge is inaccessible remote monitoring is acceptable.

Containers may be mounted in interior or exterior locations provided the location will not exceed the manufacturer's operating temperatures or be subject to excessive environmental extremes.

5.2 Distribution System

Distribution system should be designed and approved in accordance within the AFSS manufacture's design and installation parameters.

5.3 Nozzles

Quantity, location and orientation of nozzles shall be in accordance with AFSS design specifications and determination of hazard zones to be protected. A typical installation has a minimum of three nozzles protecting an engine compartment.

Nozzles should be mounted in such a fashion that normal maintenance practices do not require the removal or adjustment of any system discharge nozzle.

Discharge nozzles shall be provided with blow-off caps or other suitable devices or materials to prevent the entrance of moisture or other environmental materials into the distribution piping. The protective device shall blow off, open or out upon agent discharge.

5.4 Suppression Agent

The amount and type of suppression agent shall be determined based on a transit property's specific configuration in consultation with the OEM and AFSS supplier. The typical installation for a Zone 1 (engine compartment) is 20-25 pounds of dry chemical or equivalent. Due diligence should be applied to atypical installations utilizing alternative agents.

6. Certifications

The system design and pilot vehicle installation shall be reviewed and approved by the AFSS manufacturer in accordance with their requirements. A copy of the written approval must be provided to the procurement agency.

Any modification that may effect the performance of the AFSS shall require recertification by the AFSS supplier.