Kidde Dual Spectrum

OPERATION & MAINTENANCE MANUAL FOR FIRE PROTECTION SYSTEM AS INSTALLED ON PREVOST H345 & EPA10 VEHICLES

Manual Number 160339
Revision 04OCT10

TABLE OF CONTENTS

INTRODUCTION

This manual describes the operation and maintenance of the Kidde Dual Spectrum® Automatic Fire Detection and Suppression System (AFSS) as installed on Prevost H345 & EPA10 series buses manufactured at Prevost Car Inc, Sainte-Claire, QC, Canada.

SYSTEM OPERATION

When a fire is detected inside the engine or auxiliary heater compartment, the system sends a fire alarm signal to the Protection Panel located in the operator's area.

immediately

- The Protection Panel fire "ALARM" lamp illuminates and audio alarm sounds
- The dash-mounted 'FIRE' and 'ENGINE STOP' telltale lamps illuminate
- The dash-mounted audio alarm sounds
- The HVAC, engine fan and auxiliary heater turn off
- The vehicle horn sounds (with ignition off only)

after 15 seconds

- The engine turns off
- The Extinguisher discharges

At any time before or after automatic fire detection, the Manual Activation Switch may be used to immediately initiate or complete the above sequence with no 15-second delay.

The Protection Panel continuously monitors system integrity and displays the information via the "SYSTEM OK", fire "ALARM" and fire "TROUBLE" indicators.

A system block diagram is shown in Figure 1.

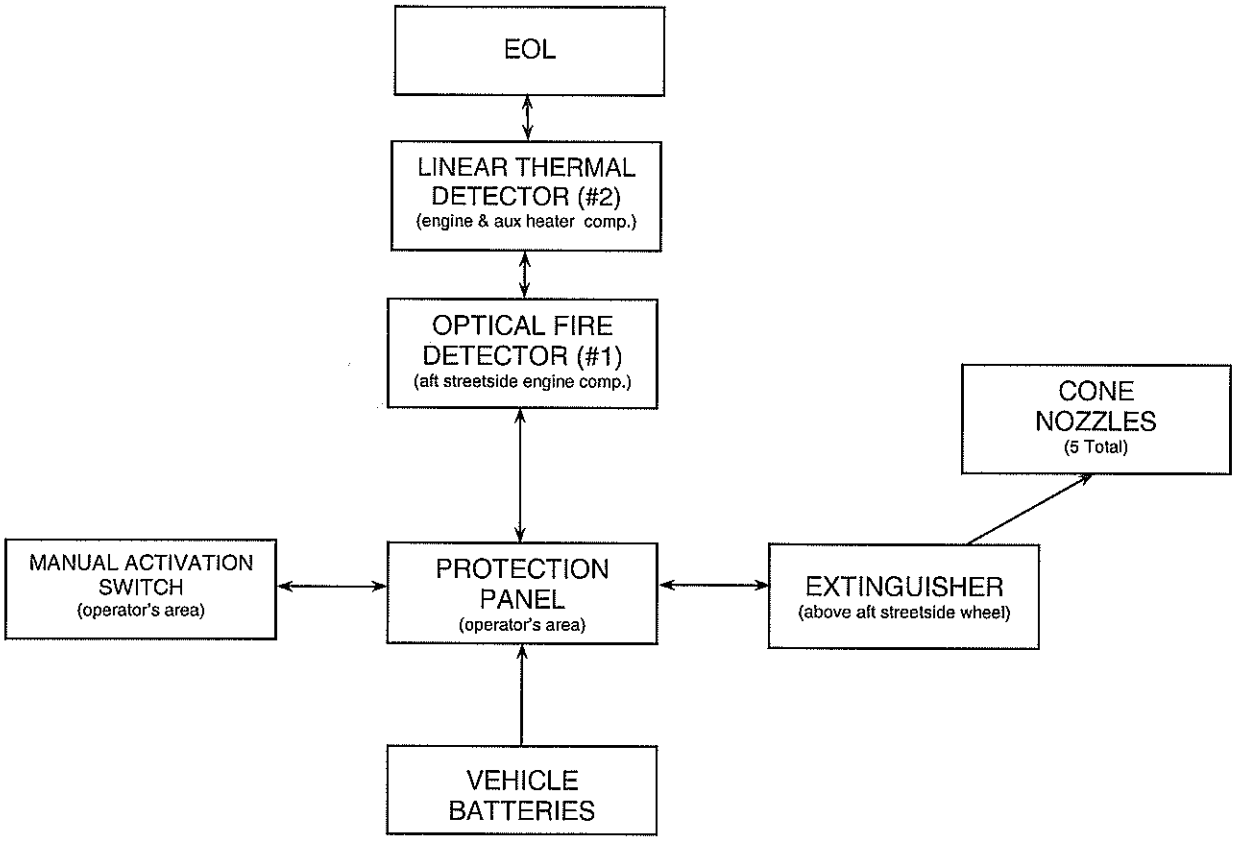

FIGURE 1 - SYSTEM BLOCK DIAGRAM

OPERATIONAL SEQUENCE (FIRE)

FIRE:

1. The Optical Fire Detector or Liner Thermal Detector detects a fire in the engine or auxiliary heater compartment and sends a signal to the Protection Panel in the operator's area.
2. The fire "ALARM" lamp on the Protection Panel illuminates solid red and the audio alarm sounds.
3. The dash-mounted "FIRE" and "ENGINE STOP" telltale lamps illuminate.
4. The dash-mounted audio alarm sounds.
5. The HVAC, engine fan and auxiliary heater turn off.
6. The horn sounds (ignition off only).
7. The operator shall bring the vehicle to a safe stop.
8. The system automatically shuts down the vehicle engine and discharges the Extinguisher into the engine compartment 15 seconds after the fire alarm starts unless advanced or delayed by the operator.
    - If the operator presses the Manual Activation Switch, all delays will terminate and the engine shutdown and extinguisher discharge will occur immediately.
    - If the operator presses and releases the "DELAY ENGINE STOP" switch on the Protection Panel or "ENGINE STOP OVERRIDE" switch on the dash once, the engine shutdown and Extinguisher discharge will be delayed by an *additional* 15 seconds (30 seconds total delay).

WARNING

THE ENGINE WILL STOP 15 SECONDS AFTER THE FIRE ALARM STARTS. THE OPERATOR MUST BE PREPARED TO BRING THE VEHICLE TO A SAFE STOP AS SOON AS THE ALARM SOUNDS. STEERING MAY BECOME DIFFICULT AFTER ENGINE SHUTDOWN. IF MORE TIME IS REQUIRED, THE "DELAY ENGINE STOP" SWITCH MAY BE PRESSED AND RELEASED FOR AN ADDITIONAL 15 SECOND DELAY (30 SECONDS TOTAL DELAY).

WARNING

THE EXTINGUISHER DISCHARGE MAY CAUSE AN OBSCURING CLOUD BEHIND AND NEAR THE VEHICLE

9. The Protection Panel's red fire "ALARM" lamp and audible alarm will stay on. The yellow fire "TROUBLE" lamp will also be on solid indicating a discharged Extinguisher.

10. The system must be reset and the Extinguisher removed and replaced in accordance with the 'SYSTEM RESET' portion of this manual.

NOTE: If the vehicle ignition has been off for greater than 2 hours, the fire protection system will power off. The system will power on again coincident with the vehicle ignition or when an overheat condition is detected by any one the vehicle's overheat detectors, whichever occurs first.

COMPONENT DESCRIPTIONS

PROTECTION PANEL

The Protection Panel is located in the operator's area and displays the current system status. The Protection Panel contains "SYSTEM OK", fire "ALARM" and "TROUBLE" lamps, the audio alarm, the "TEST/RESET" switch, and the "ALARM SILENCE" switch.

The "SYSTEM OK" lamp illuminates solid green to indicate power is on to the system and there are no trouble conditions present. The "SYSTEM OK" lamp will blink green when the system has low on power applied (<22Vdc). The "TROUBLE" lamp blinks yellow if there is a fault in the detection circuitry and illuminates solid yellow if there is a fault in the extinguishing circuitry. When the "TROUBLE" lamp is on, the "SYSTEM OK" lamp will be off and the audio alarm will sound intermittently. Pressing the "TEST/RESET" switch tests the Protection Panel's lamps and audio alarm. Pressing the "ALARM SILENCE" switch disables the audio alarm.

When a fire detector automatically detects a fire, the fire "ALARM" lamp illuminates solid red and the audio alarm sounds. When the Manual Activation Switch is pressed, the fire "ALARM" lamp blinks red and the audio alarm sounds; the lamp will remain blinking until power is cycled to the system.

The vehicle interface outputs are normally open contacts (1 Amp maximum) which short to ground immediately upon fire detection (pin 3) and 15 seconds after fire detection (pin 11) unless advanced or delayed by the operator.

The Protection Panel also has other features which can be enabled via internal configuration switches.

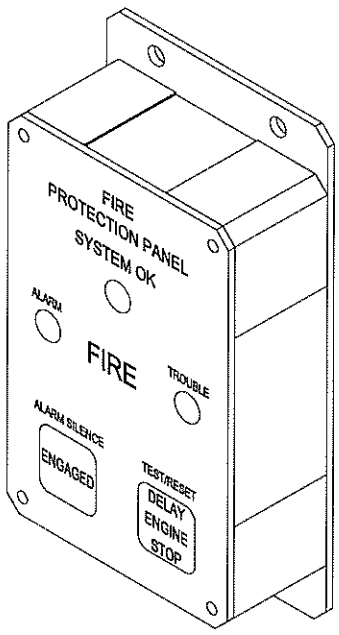

FIGURE 2 - PROTECTION PANEL

OPTICAL FIRE DETECTOR

The Kidde Dual Spectrum® model PM-3M fire sensor operates by sensing two separate bands of infrared energy. A fire signal is generated when the sensors see a fire fueled by gasoline, diesel, CNG, LNG, LPG, methanol, oils, lubricants, and other types of hydrocarbons.

The fire sensor has a 100° solid cone field-of-view. It has a response time to explosive fires of one half of a second maximum. The PM-3M has a detection threshold of 42 inches for a one square foot pan fire fueled by diesel.

The fire sensor is immune to false alarms from sunlight, flashlights, lightning, vehicle headlights, incandescent lights (100W at 2 inches), and welding arcs (30 inches).

Each fire sensor has a green status light in the center of its front surface. The status light is illuminated when the fire sensor has electrical power. The status light will blink after the sensor has responded to a fire. The blinking will not stop with system reset, but is cleared when power has been cycled to the sensor. This feature can be used to help pinpoint the source of the fire.

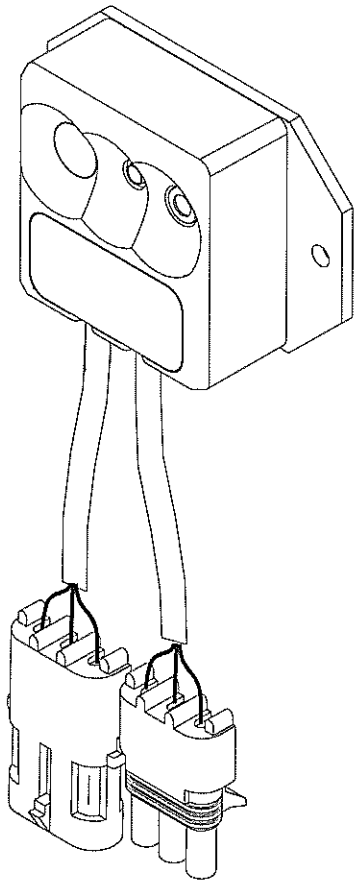

FIGURE 3 – OPTICAL FIRE DETECTOR

LINEAR THERMAL DETECTOR (LTD)

The Linear Thermal Detector (LTD) is a twin conductor cable with temperature-sensitive insulation protected by an outer sheath. It operates by short-circuiting in a fire or overheat condition. The LTD provides economical detection in vehicle engine bays, fuel storage tanks and any other location where the threat of fire exists. The LTD is capable of detecting a fire at any point along its length and will react to a fire situation within approximately 20 seconds. The cable cannot be reset; if the wire alarms to a fire, the wire must be replaced or the damaged section cut out and a new section added prior to returning the system to service.

FIGURE 4 – LINEAR THERMAL DETECTOR

END-OF-LINE DEVICE

The End-of-Line device is required for supervision of the fire detection circuits. It consists of a resistor installed into a connector and is environmentally sealed with potting compound. The End-of-Line device is installed on the last detector in each series of detectors.

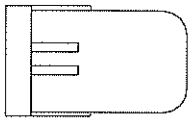

FIGURE 5 – END-OF-LINE DEVICE

MANUAL ACTIVATION SWITCH

The Manual Activation Switch allows immediate system activation (extinguisher discharge and engine shutdown) by the vehicle operator at any time. Activation of the switch is accomplished by twisting and pulling the tamper seal (not shown) to remove, lifting the cover and pressing the red "FIRE" button for more than half a second. After the Manual Activation Switch has been activated, the Protection Panel will blink the fire "ALARM" indicator until power has been cycled to the system.

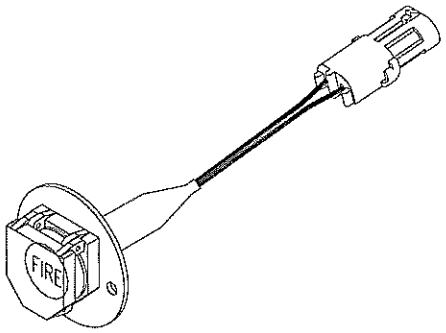

FIGURE 6 – MANUAL ACTIVATION SWITCH (DEPICTED WITHOUT TAMPER SEAL)

CONE NOZZLE

The Cone Nozzle is constructed of plated steel and contains a 45° steel cone, causing the nozzle to disperse a cone shaped spray of dry chemical. The nozzle has a silicone rubber protective cap that is blown off by the dry chemical discharge.

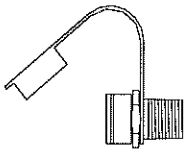

FIGURE 7 – CONE NOZZLE

FIRE EXTINGUISHER

The Fire Extinguisher is an electrically operated, stored pressure type extinguisher that contains 25 pounds of BC rated 'Purple k' dry chemical extinguishing agent pressurized with nitrogen. The cylinder is constructed of steel and meets DOT and TC specifications. The Valve is constructed of nickel-plated brass and is equipped with a fusible pressure relief plug. The valve also contains an easy to read go/no-go type pressure gauge that is protected by a gauge guard.

The Extinguisher is mounted horizontally and the gauge must be oriented perpendicular to the ground and facing to the right as looking from the valve end of the cylinder.

CAUTION

THE EXTINGUISHER WILL NOT FUNCTION AS INTENDED IF ORIENTED INCORRECTLY

WARNING

THE ANTI-RECOIL CAP SHALL BE INSTALLED ON THE VALVE OUTLET PORT AT ALL TIMES EXCEPT WHEN THE EXTINGUISHER IS CONNECTED TO THE DISTRIBUTION PIPING OR WHILE THE EXTINGUISHER IS BEING FILLED.

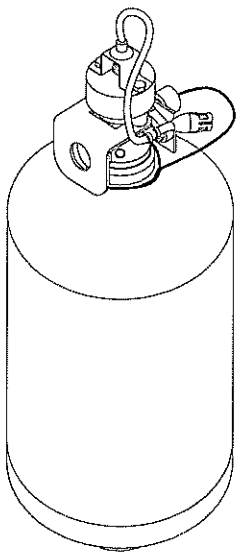

FIGURE 8 – FIRE EXTINGUISHER (DEPICTED IN VERTICAL ORIENTATION)

COMPONENT LOCATIONS

The major system components consist of a Protection Panel, a Manual Activation Switch, an Optical Fire Detector, a 35ft Linear Thermal Detector, an End-of-Line Device, a 25lb Fire Extinguisher and 5 Cone Nozzles. See figure 9.

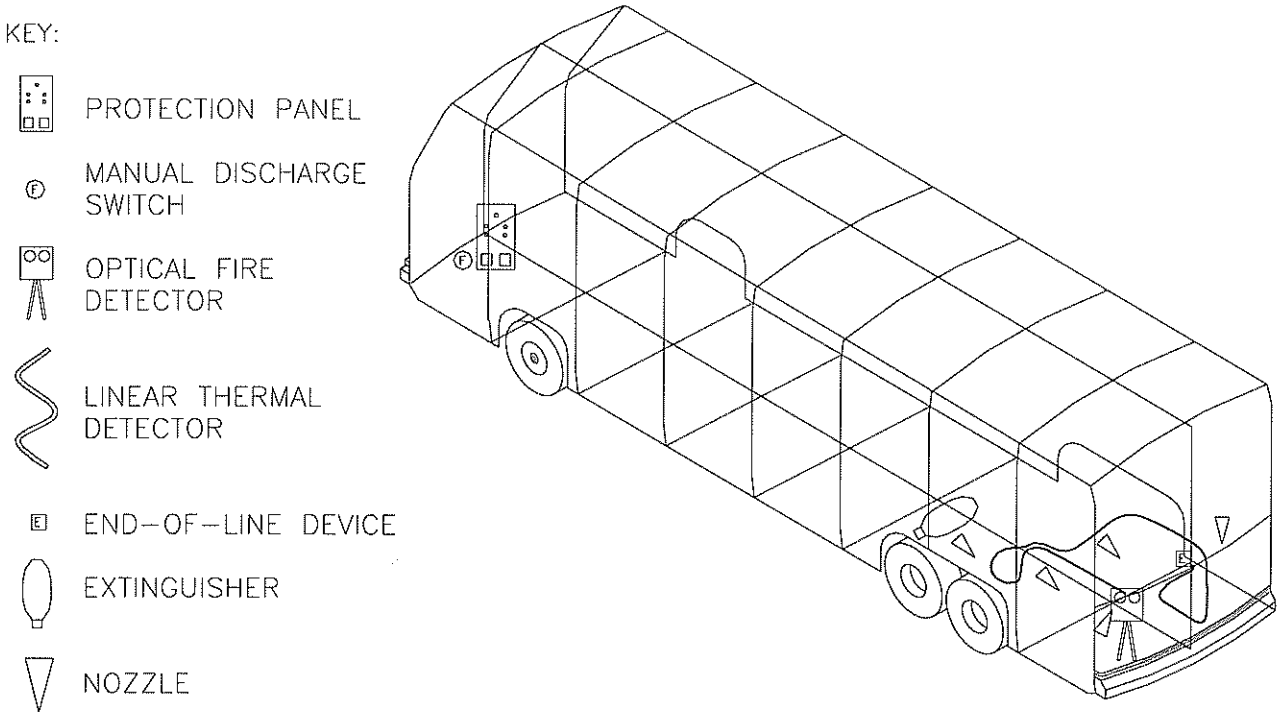

FIGURE 9 – MAJOR SYSTEM COMPONENTS

ELECTRICAL INTERCONNECTIONS

An electrical harness provides system power from the vehicle batteries and interconnects system components including the Protection Panel, Manual Activation Switch, Optical Fire Detector and Extinguisher. The Linear Thermal Detector and End-of-Line Device are connected in series, subsequent to the Optical Fire Detector. The harness also connects the Protection Panel's vehicle interface outputs to the vehicle's multiplex system to control HVAC, engine fan, auxiliary heater and engine shut-off as well as provides remote control of the engine shut-off delay input. See figure 10.

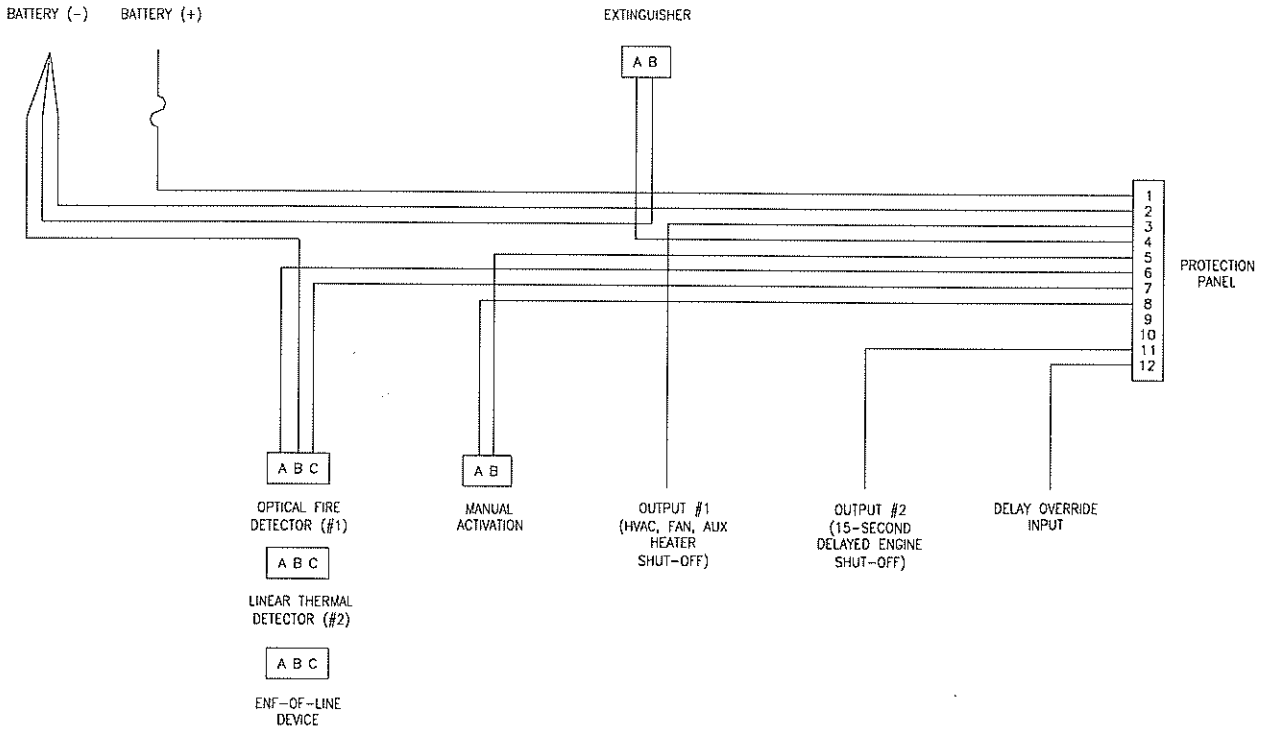

FIGURE 10 - VEHICLE HARNESS

SYSTEM RESET

FIRE:

After a fire, the system is restored to operational status as follows:

1. Disconnect system power by removing system fuse located in battery compartment.
2. Repair and/or replace any damaged detection devices and/or electrical harnessing.
3. Remove the Fire Extinguisher:
   a) Disconnect the electrical connector on the extinguisher valve from the vehicle harness.
   b) Install a shorting plug to the electrical connector on the extinguisher valve.
   c) Remove the distribution piping from the valve outlet port and install the anti-recoil cap.

WARNING

THE ANTI-RECOIL CAP SHALL BE INSTALLED ON THE VALVE OUTLET PORT AT ALL TIMES EXCEPT WHEN THE EXTINGUISHER IS CONNECTED TO THE DISTRIBUTION PIPING OR WHILE THE EXTINGUISHER IS BEING FILLED.

   d) Loosen the mounting clamps and remove the extinguisher.

CAUTION

DO NOT ATTEMPT TO REBUILD THE EXTINGUISHER. HAVE THE FIRE EXTINGUISHER REBUILT BY A QUALIFIED FIRE PROTECTION EQUIPMENT COMPANY FAMILIAR WITH KIDDE DUAL SPECTRUM EQUIPMENT. REBUILD SHALL INCLUDE ACTUATOR, O-RING SEALS AND DRY CHEMICAL REPLACEMENT.

4. Remove the dry chemical nozzles from the distribution tubing for inspection and cleaning.
5. Blow out the distribution tubing with dry compressed air to insure the tubing is dry and free of debris and/or residual agent.
6. Reinstall the dry chemical nozzles wrench tight. NOTE: Do not use pipe dope or Teflon tape on the threads.
7. Replace the Fire Extinguisher:

a) Inspect the new Extinguisher; verify it is the correct part number to ensure it is the correct configuration for the application and verify the anti-recoil cap and the shorting plug are installed.

b) Install the Extinguisher in the mounting bracket and oriented per the instructions on the extinguisher nameplate. Tighten the mounting clamps. Do NOT connect the electrical connector at this time.

CAUTION

THE EXTINGUISHER WILL NOT FUNCTION AS INTENDED IF ORIENTED INCORRECTLY

c) Remove the anti-recoil cap and immediately connect the distribution piping.

d) Connect system power by replacing the system fuse located in the battery compartment and verify the red fire 'ALARM' lamp on the Protection Panel is NOT on. NOTE: The fire 'TROUBLE' lamp will be on solid yellow because the electrical connector on the extinguisher valve is not connected.

CAUTION

IF THE PROTECTION PANEL IS IN ALARM CONDITION, THE EXTINGUISHER MAY DISCHARGE IF IT IS CONNECTED TO THE SYSTEM. BE SURE THE RED FIRE 'ALARM' LAMP ON THE PROTECTION PANEL IS NOT ILLUMINATED BEFORE PROCEDING FURTHER.

e) Remove the shorting plug from the electrical connector on the extinguisher valve.

f) Attach the vehicle harness to the electrical connector on the extinguisher valve.

8. Verify the green 'SYSTEM OK' lamp on the Protection Panel and green status lamp on the Optical Fire Detector is on solid.

NOTE: The vehicle may be *started* after a fire without resetting the system by cycling the ignition switch (key) on-off twice within two seconds. This will not reset the system, rather it will instruct the vehicle's multiplex system to ignore vehicle interface outputs from the Protection Panel. This feature is intended to be used only in emergency situations that require the vehicle to be moved a short distance prior to proper system reset. It should not be performed if the cause of the fire has not been clearly identified and corrected.

PERIODIC MAINTENANCE

The maintenance intervals specified are for typical transit bus applications and may be modified in accordance with the rigors of the application (equipment type and/or environmental circumstances). Maintenance should be performed more frequently when circumstances require. Refer to NFPA-17 for further information.

PRE-TRIP

- Verify the Protection Panel 'SYSTEM OK' lamp is on solid green

EVERY 3000 MILES OR MONTHLY (whichever occurs first)

General

- Verify neither the protected equipment nor the hazard has changed
- Verify no obvious physical damage or condition exists that might prevent system operation

Protection Panel

- Verify all warning lamps and the audible alarm are operational by pressing the 'TEST/RESET' button

Manual Activation Switch

- Verify tamper seal is intact and access to switch is unobstructed

Fire Detectors

- Optical
    - Verify status lamp on the detector face is on solid green
    - Verify nothing is blocking the detector's field of view
    - Verify the windows on the face of the detector are free of excess contamination (dirt, oil, grease, etc) - if necessary, clean using water soaked non-abrasive towel
- Linear Thermal
    - Verify there is no obvious physical damage and that unit is free of excess contamination (dirt, oil, grease, etc) - if necessary, clean using water soaked non-abrasive towel
    - Verify mounting is secure and taught

Electrical Harness

- Verify electrical connectors and electrical wiring have no visible damage and all connectors are securely seated

Extinguisher & Distribution System

- Verify the extinguisher pressure gauge pointer is in the green arc at room temperature
- Verify distribution piping and nozzles are intact and unobstructed and that nozzle blow-off caps are in place

EVERY 18000 MILES OR SEMI-ANNUALLY (whichever occurs first)

- Perform a comprehensive fire system test using a Kidde Dual Spectrum System Test Set (Optical Test Kit P/N 420871-2)
- Service the Extinguisher in accordance with KDS Document 160296, "KDS-25 Pre-Engineered Fire Suppression System: Installation, Operation and Maintenance Manual"

EVERY SIX YEARS

- Have the Extinguisher rebuilt by a qualified fire protection equipment company familiar with Kidde Dual Spectrum equipment and in accordance with KDS Document 160296, "KDS-25 Pre-Engineered Fire Suppression System: Installation, Operation and Maintenance Manual. Rebuild shall include actuator, o-ring seals and dry chemical replacement.

EVERY TWELVE YEARS

- Have the Extinguisher cylinder hydrostatically tested by a qualified fire protection equipment company familiar with Kidde Dual Spectrum equipment and in accordance with KDS Document 160296, "KDS-25 Pre-Engineered Fire Suppression System: Installation, Operation and Maintenance Manual..

TROUBLE SHOOTING GUIDE

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
All Protection Panel lamps off.	No power to system	Check connections to & voltage of vehicle batteries. Check system fuse (15A). Below 9 volts the system will not function
Protection Panel green "SYSTEM OK" lamp blinking.	Low battery voltage	Check connections to & voltage of vehicle batteries. Between 9 and 22 volts the system will provide low voltage indication but remains fully functional.
Protection Panel green "SYSTEM OK" lamp off, yellow fire "TROUBLE" lamp on solid, red fire "ALARM" lamp on solid and audible alarm on.	System automatically discharged	Correct the cause of the fire and reset the system as described in the system reset portion of this manual
Protection Panel green "SYSTEM OK" lamp off, yellow fire "TROUBLE" lamp on solid, red fire "ALARM" lamp on blinking and audible alarm on.	System manually discharged	Correct the cause of the fire and reset the system as described in the system reset portion of this manual
Protection Panel green "SYSTEM OK" lamp off, yellow fire "TROUBLE" lamp on solid and audible alarm beeping.	Component not connected or damaged harness in the extinguisher circuit	Check harness connections at extinguisher Check electrical interconnections (Figure 10)
Protection Panel green "SYSTEM OK" lamp off, yellow fire "TROUBLE" lamp on blinking and audible alarm beeping.	Component not connected or damaged harness in the fire detection circuit	Check harness connections at fire detectors Check connection at EOL Check electrical interconnections (Figure 10)

Bus will not start, Protection Panel red fire "ALARM" lamp on solid and audible alarm on	System not reset after fire	Correct the cause of the fire and reset the system as described in the system reset portion of this manual
Extinguisher pressure gauge reading is low	Extinguisher cold	Let extinguishers warm up to room temperature (about 70°F) and recheck the gauge. If the pointer is then within the green arc no corrective action is required
	Extinguisher leaking or discharged	Have the fire extinguisher serviced by a fire protection equipment company familiar with KDS equipment

REPLACEMENT PARTS LIST

Protection Panel, P/N 413410-146 (H345)

Protection Panel, P/N 413410-14 (EPA10)

Manual Activation Switch Kit, P/N 421317

Manual Activation Switch Tamper Seal, P/N 421317-2

Optical Fire Detector, P/N 420010

Linear Thermal Detector (LTD), 35ft, P/N 421430-35 (H345)

Linear Thermal Detector (LTD), 10ft, P/N 421430-10 (EPA10)

Linear Thermal Detector (LTD), 20ft, P/N 421430-20 (EPA10)

End-of-Line Device (EOL), P/N 420241

KDS-25 Fire Extinguisher, 25lb, BC, Gauge Right, P/N 421220-22 (H345)

KDS-25 Fire Extinguisher, 25lb, ABC, Gauge Right, P/N 421220-12 (EPA10)

KDS-25 Extinguisher Rebuild Kit, P/N 424766

Extinguisher Bracket Assembly, P/N 421222

Nozzle, Dry Chemical, P/N 474946

TEST EQUIPMENT

Optical Fire System Test Kit, P/N 420871-2