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सत्यमेव जयते

भारत सरकार GOVERNMENT OF INDIA

रेल मंत्रालय MINISTRY OF RAILWAYS



MAINTENANCE MANUAL FOR FIRE AND SMOKE DETECTION SYSTEM AND FIRE DETECTION AND SUPPRESSION SYSTEM

VOLUME-2
(LHB & ICF COACHES)

IRCAMTECH/GWL/M/FSDS/FDSS/1.0
OCTOBER, 2024

An ISO 9001-2015 Certified Organisation
उच्च अनुरक्षण प्रौद्योगिकी केन्द्र
EXCELLENCE IN MAINTENANCE
Indian Railways
Centre for Advanced Maintenance Technology

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FOREWORD

In an effort to enhance passenger safety and safeguard equipment, Indian Railways has adopted fire and smoke detection system, along with fire detection and suppression system, for its coaches. These technologies represent a significant advancement in train safety, addressing a critical need for prompt and reliable detection and suppression of potential fire hazards.

By incorporating these advanced fire safety technologies, Indian Railways is taking a proactive stance on ensuring the safety and well-being of the passengers traveling in its network. This forward-looking approach not only boosts passenger confidence but also contributes to a safer, more secure rail travel experience across the nation.

The Railway Board has advised IRCAMTECH to develop a maintenance schedule, troubleshooting guidelines, and material requirements to streamline the maintenance of fire and smoke detection system and fire detection and suppression system.

As advised, IRCAMTECH has prepared the maintenance manual for the fire and smoke detection system and fire detection and suppression system. I extend my gratitude to the teams from ICF, RDSO, and the OEMs for their valuable contributions in developing this document.

Please feel free to write us with any suggestions for further improvements.

RDSO, Lucknow
Date: October 2024

H.K.Raghu
Principal Executive Director

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PREFACE

The safety and well-being of passengers traveling on the Indian Railways are of paramount importance, especially in air-conditioned coaches where fire hazards can pose significant risks. To address these concerns, Indian Railways has implemented fire and smoke detection systems alongside fire detection and suppression systems.

These technologies are designed to ensure early identification of potential fire threats, enabling prompt alerts and rapid response to mitigate risks. By incorporating sensitive smoke and heat detectors, along with automatic suppression capabilities, these systems significantly enhance passenger safety, minimize equipment damage, and ensure compliance with stringent safety regulations.

The integration of such advanced systems not only fosters a safer travel environment but also reinforces Indian Railways' commitment to maintaining high standards of operational safety and passenger protection.

On advice of the Railway Board IRCAMTECH has prepared the maintenance manual for the fire and smoke detection system and fire detection and suppression system.

To simplify the maintenance instructions, the Maintenance Manual for FSDS and FDSS is divided into two volumes. Volume-1 contains details of the FSDS & FDSS systems in Vande Bharat Chair Car Coaches (Ver. 2.0) and Amrit Bharat Coaches. Volume-2 contains details of the FSDS & FDSS systems in ICF and LHB Coaches.

We welcome any suggestions from our readers for further improvement.

IRCAMTECH, Gwalior **Brij Mohan**
Date: October 2024 **Director / Mechanical**

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Amendments and Revisions

The correction slips to be issued in the future for this report will be numbered as follows:

IRCAMTECH/GWL/M/FSDS/FDSS/1.0# XX date .....

Where “XX” is the serial number of the concerned correction slip (starting from 01 onwards).

Version	Date	Corrections	Remarks
1.0	October 2024	--	First Version



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All technical information and guidelines are latest at the time of publishing and are subjected to change due to technology updates and requirements.

1. INTRODUCTION

Fire and Smoke Detection System (FSDS)

The Fire and Smoke Detection System (FSDS) is a critical safety feature designed to detect and alert the presence of fire and smoke within the Air-Conditioned coach. Below mentioned are the key details of the system:

I. Design: The FSDS is designed for very early warning for smoke/fire incidents in air-conditioned coaches.

II. Sampling Nozzles and Pipe Network: These include Sampling Nozzles, capillary tubes and PVC pipeline strategically placed throughout the coaches to collect air samples to analyze the existence of fire/ smoke.

III. Control Panel / Fire Detection Panel and Power Panel: This panel, available in each coach, contains the *Aspirating Smoke Detection Unit and Power panel for 24V battery backup and DC-DC Convertor to convert 110VDC to 24VDC*. The Aspiration smoke detection Unit collects air samples from throughout the coach, analyses in the detection panel for existence of fire/smoke and initiates appropriate responses.

IV. Alarms: Audible and visual alarms alert passengers and train staff to the presence of smoke or fire, enabling swift evacuation and response.

V. Automatic Response: The FSDS has provision of integration with the train's braking system to automatically stop the train in case of a fire emergency.

Fire Detection and Suppression System (FDSS)

It is an advanced safety system designed to detect the presence of fire/smoke and automatically suppress it to prevent the spread and minimize damage.

I. Detection: The system uses point type smoke detectors, point type heat detectors and linear heat detection cable placed suitably inside the coach.

II. Alarm:

a) When the smoke is detected through smoke detector, it will raise pre- alarm in detection panel.

b) When the heat/fire is detected through heat detector, it will raise fire- alarm in detection panel.

c) When the heat/fire is detected through LHD cable, it will raise fire- alarm in detection panel.

III. Suppression: The Power Cars / Pantry coaches are equipped with a *High Pressure Water Mist Fire Suppression System*. In case of a fire, alarm raised by detection unit, the system is designed to suppress the fire and prevent it from spreading.

Documentation Structure of Maintenance Manual

To simplify the maintenance instructions, the Maintenance Manual for FSDS and FDSS is divided into two volumes:

Volume-1: This volume contains details of the FSDS & FDSS unit in Vande Bharat and Amrit Bharat Coaches.

Volume-2: This volume contains details of the FSDS & FDSS unit in ICF and LHB Coaches.

2. TERMS OF REFERENCE

Railway Board vide letter no. 2022/M(C)/137/7 dated 11.06.2024 advised CAMTECH to prepare the Maintenance Schedules, troubleshooting guidelines, and material requirements (must change and condition basis) for FSDS and FDSS units in LHB/ICF and Vande Bharat coaches and issue necessary documentation.

3. ABBREVIATIONS

ACP	Automatic Control Panel
ASD	Aspiration Smoke Detector
CCU	Central Control Unit
FDSS	Fire Detection and Suppression System
FDS	Fire Detection System
Fn	Normal Airflow Value
FSDS	Fire and Smoke Detection System
HD	Heat Detector
LHD Cable	Linear Heat Detection Cable
MCB	Miniature Circuit Breaker
PA Module	Public Announcement Module
SBC	Switch Board Cabinet
SD	Smoke Detector
SMPS	Switch Mode Power Supply
TB	Terminal Block
UPVC	Un-plasticized Poly Vinyl chloride
% Obs/m	Percent obscuration/meter

4. FIRE AND SMOKE DETECTION SYSTEM (FSDS)

4.1. Aspiration Type Automatic Smoke / Fire Detection with Alarm System for LHB/ICF AC Coaches

4.1.1. Technical Details

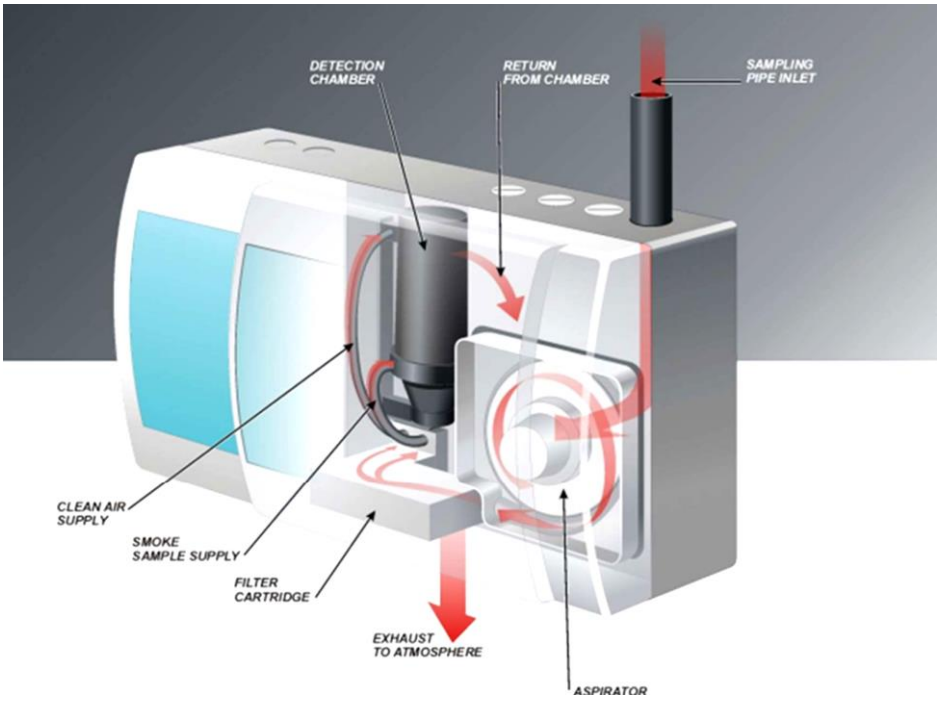
An *Aspiration Type Automatic Smoke / Fire Detection with Alarm System* gives early warning against any smoke/fire.

In this system, *Sampling pipe/ Sampling points* network is designed to cover entire coach's passenger area including lavatories, doorway & gangway of coach. A system of intake pipes with defined sampling orifices performs active air sampling and sends the smoke levels to the Central Control Unit (CCU).

Working Principle of FSDS System

Air is drawn into the pipe network through the sampling points (Aspiration System) from a close surrounding and traverses to a very sensitive smoke detector consisting of an aspirator, detection chamber, dual stage filter and necessary networking card. The negative pressure of an aspirator helps in drawing ambient air to a detection chamber where scattering of light occurs and detection of smoke takes place.

FSDS system works on the principle of actively drawing air samples from the coach through sampling points and directed to a detection chamber in the detector. The presence of smoke in the sample air results in the scattering of the laser that is instantly detected by a configuration of light receiver. Depending upon the smoke level, an output signal is processed and displayed on the detector chamber. The system is designed as a multi-level alarm system with each level of smoke threshold resulting in a different alarm warning for the passengers.



VESDA Module

Table 1: Smoke Threshold Value			
Stage	**Alarm**	**Threshold (% obs/m)**	**Delay Period (Seconds)**
1	Alert	0.35 ± 0.05	20
2	Action	0.6 ± 0.05	30
3	Fire	1.6 ± 0.05	45

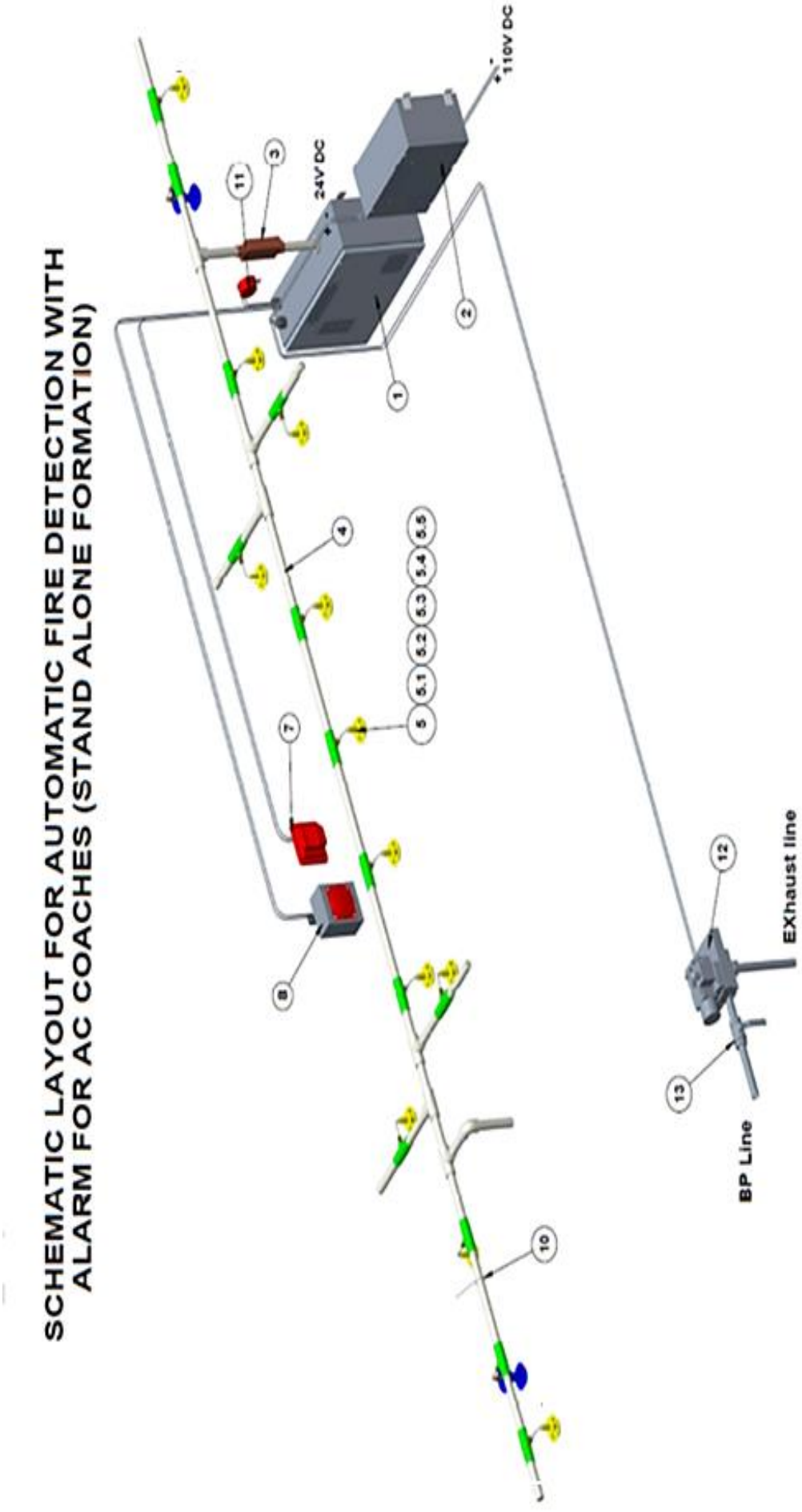
Indication of alarms shall be as under:

a) System for Complete Rake:

- **Alert:** Flasher light to be activated at CMS, no indication to the passengers in the affected coach
- **Action:** Flasher light to be activated on fire detection panel of affected coach
- **Fire:** Brake application shall take place automatically. After a time, delay of 55 seconds after activation of brake application, an audio visual alarm like a hooter or buzzer etc. along with flashing lights should be activated in affected coach. Audio visual (Hooter & Flasher Light) indication to be continued at CMS

b) System for Stand-alone Coach:

- **Alert:** LED to flash on fire detection panel, no indication to the passengers in the affected coach
- **Action:** Flasher light to be activated on fire detection panel of affected coach
- **Fire:** Brake application shall take place automatically. After a time, delay of 55 seconds after activation of brake application, an audio visual alarm like a hooter or buzzer etc. along with flashing lights should be activated in affected coach.


SCHEMATIC LAYOUT FOR AUTOMATIC FIRE DETECTION WITH ALARM FOR AC COACHES (STAND ALONE FORMATION)
110V DC
24V DC
BP Line
EXhaust line

4.1.1.1. Components of System

<table>
<tr><th>SN</th><th>Description</th></tr>
<tr><td>01</td><td>Fire Detection Panel consisting of:
FDS System has one of the following module as per OEM
<table>
<tr><th>MAKE</th><th>System</th></tr>
<tr><td>XTRAILIS</td><td>VESDA COMPACT LASER DETECTOR</td></tr>
<tr><td>FOGTECH</td><td>SMOKE ASPIRATING SYSTEM SAS 7532 CP</td></tr>
<tr><td>QUARTAS</td><td>ASPIRATING SMOKE DETECTION ASD SYSTEM</td></tr>
<tr><td>HOCHIKI</td><td>ASPIRATING SMOKE DETECTOR – FIRELINK-25</td></tr>
<tr><td>WAGNER</td><td>TITANUS PRO-SENS AUTOMATIC SMOKE & FIRE DETECTION SYSTEM</td></tr>
</table>
Power and Signal Terminal
Public Announcement Module
Inter Connecting Cables</td></tr>
<tr><td>02</td><td>Power Unit Panel consisting of: -
DC/DC Power Converter [110V to 24V]
2X7AH (12V) Maintenance Free Battery
Charger Unit-Power Terminal
Inter Connecting Cable</td></tr>
<tr><td>03</td><td>Inline Filter</td></tr>
<tr><td>04</td><td>Aspirating PVC Pipe Fitting and their Mounting Accessories</td></tr>
<tr><td>05</td><td>Capillary Sampling Points Assembly</td></tr>
<tr><td>5.1</td><td>Trunk Adapter For Capillary Aspirating PVC Pipes</td></tr>
<tr><td>5.2</td><td>Capillary Sampling Connectors</td></tr>
<tr><td>5.3</td><td>Capillary Sampling Aspirating PVC Pipes</td></tr>
<tr><td>5.4</td><td>Capillary Sampling Point</td></tr>
<tr><td>5.5</td><td>Safety Cover For Capillary Sampling Point</td></tr>
<tr><td>06</td><td>-</td></tr>
<tr><td>07</td><td>Strobe Light With Hooter</td></tr>
<tr><td>08</td><td>Electronic Voice Message Sounder</td></tr>
<tr><td>09</td><td>Signal Cable/Power Cable</td></tr>
<tr><td>10</td><td>Mounting Clamp</td></tr>
<tr><td>11</td><td>Flasher Light (24V LED Based)</td></tr>
<tr><td>12</td><td>Brake Application Valve Consisting of: -
Magnet Valve
Pilot Valve</td></tr>
<tr><td>13</td><td>Isolating Cock</td></tr>
</table>

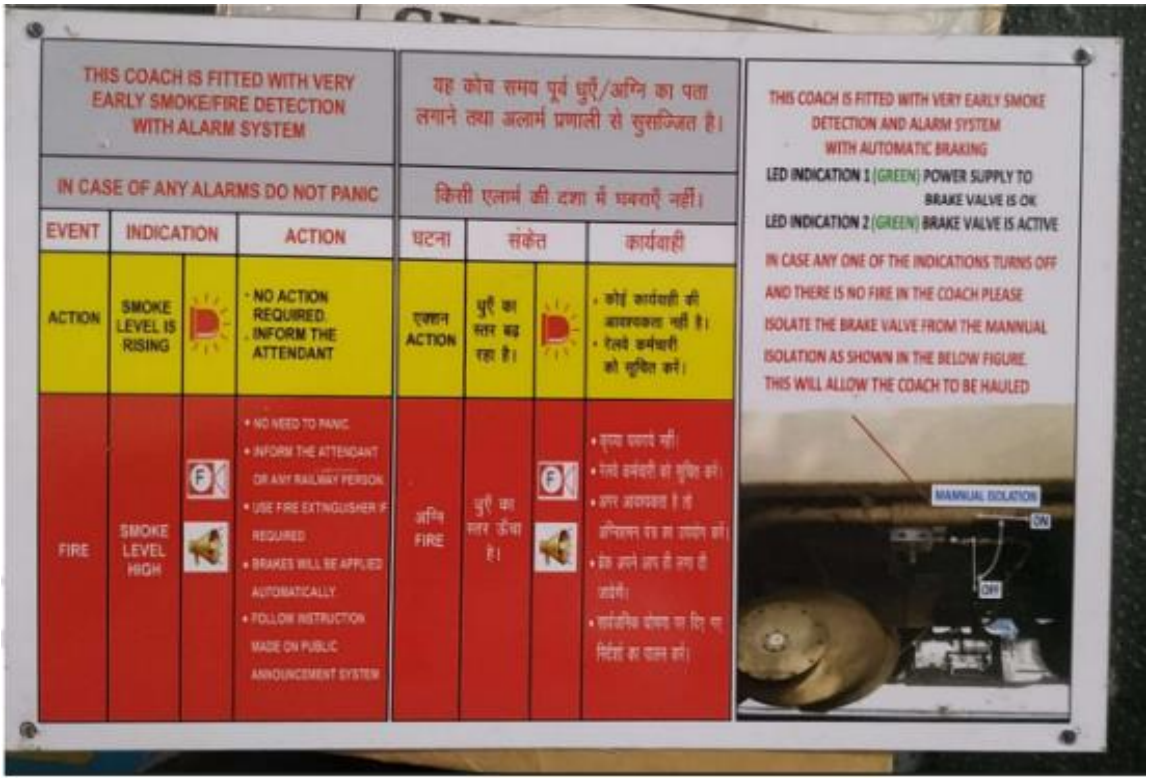
FIRE DETECTION PANEL



RDSO/2008/CG-04 Rev. 4



RDSO/2008/CG-04 Rev. 5

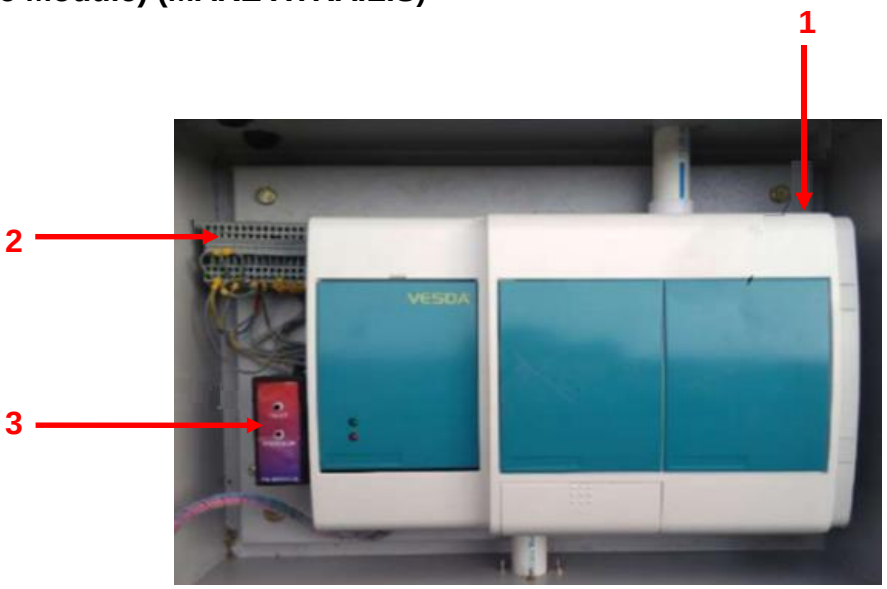


RDSO/2008/CG-04 Rev. 5



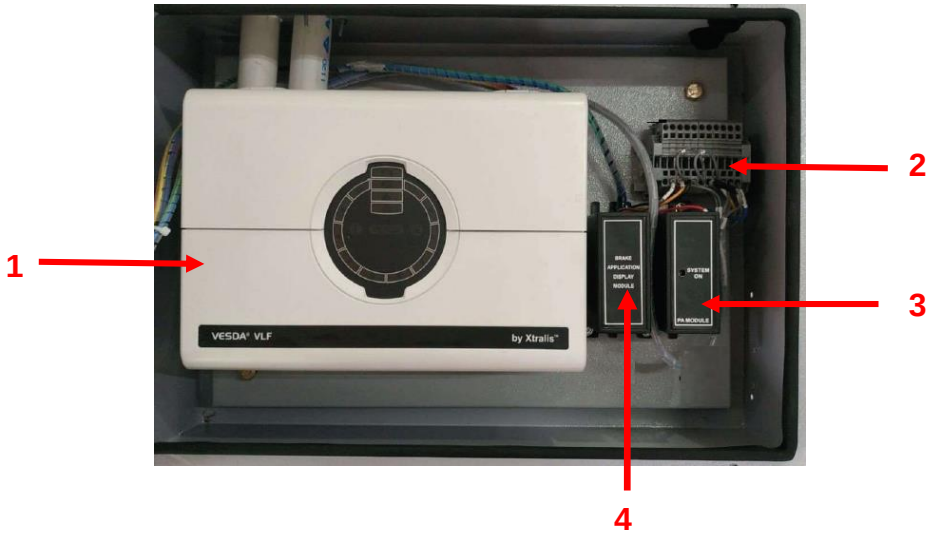
Table 2: Display Indications		
Display Indications	**Description (RDSO/2008/CG-04 rev.4)**	**Description (RDSO/2008/CG-04 rev.5)**
Brake Valve Power On (Indicator 1)	Brake Valve is powered up (Indicator 1)	Brake Valve is powered up
Brake Valve Connected (Indicator 2)	Feedback from valve to panel to check brake valve connected. (Indicator 2)	Feedback from valve to panel to check brake valve connected.
Power ON	System is powered up	System is powered up
Fire 1	Fire 1 Indication in system, Flasher Light, Strobe Light with Hooter and Public Announcement also brake application	Fire 1 Indication in system, Flasher Light, Strobe Light with Hooter and Public Announcement also brake application
Fire 2	Same as Fire 1	Not Applicable
Action	Action Indication in system and Flasher Light	Action Indication in system and Flasher Light
Alert	Alert Indication in system	Alert Indication in system
Fault	Check by connecting software setup	Check by connecting software setup
Reset	Press RESET to acknowledge the alarm.	Press RESET to acknowledge the alarm.
Alarms will reoccur till the time smoke is present in the system.		

VLP-400: Automatic Smoke and Fire Detection with Alarm System (without Brake Module) (MAKE XTRAILIS)



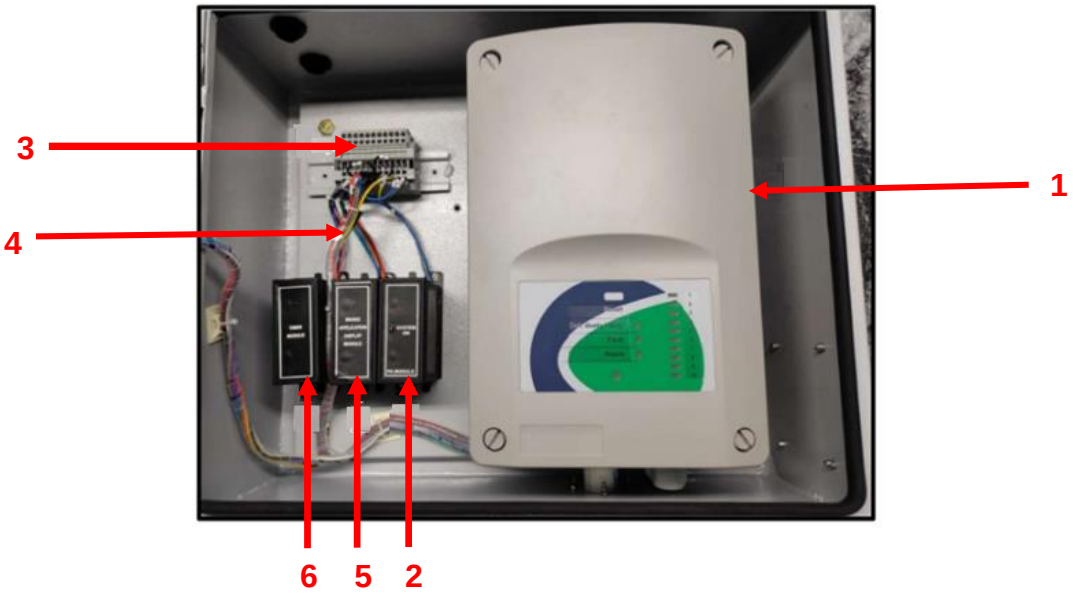
SN	ITEM DESCRIPTION	Qty (Nos.)
1	VESDA Compact Laser Detector	01
2	Power And Signal Terminal	01
3	Public Announcement Module	01

VLF-500: Automatic Smoke and Fire Detection with Alarm System (With Brake Module) (MAKE XTRAILIS)



SN	ITEM DESCRIPTION	Qty (Nos.)
1	VESDA Compact Laser Detector	01
2	Power And Signal Terminal	01
3	Public Announcement Module	01
4	Brake Application Module	01

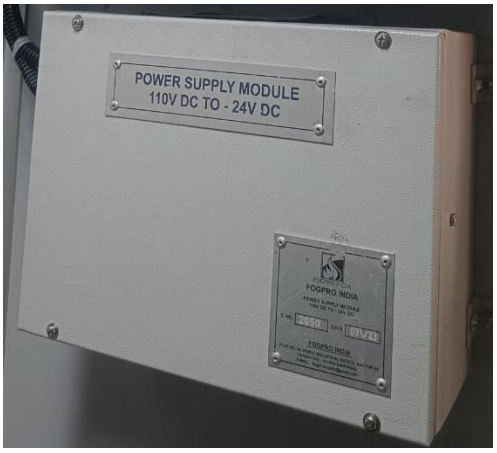
SMOKE ASPIRATING SYSTEM SAS 7532 CP (MAKE FOGTECH)



SN	ITEM DESCRIPTION	Qty (Nos.)
1	Smoke Aspirating System SAS 7532CP	01
2	Public Announcement Module	01
3	Power And Signal Terminal	01
4	Inter Connecting Cables	-
5	Brake Application Module	01
6	Time Module	01



Control Panel



Power Supply Module

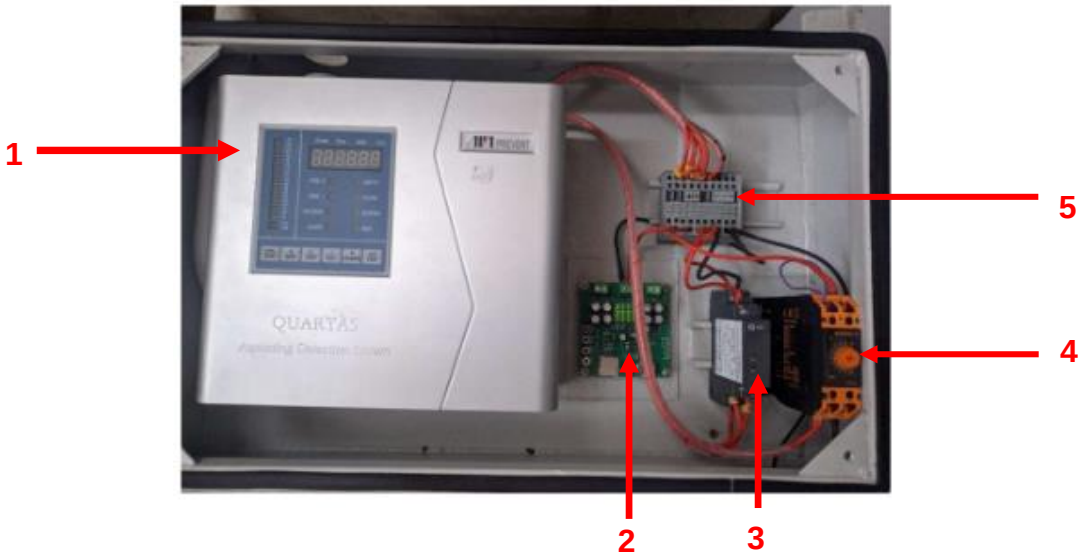


Component of Control Panel



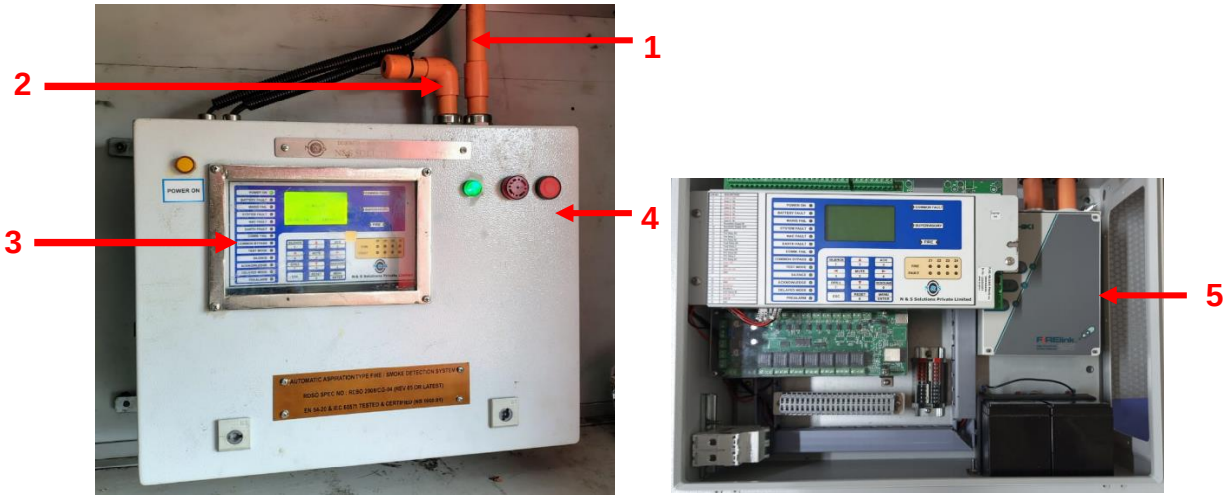
Power Supply Module Component

ASPIRATING SMOKE DETECTION ASD SYSTEM (MAKE QUARTAS)



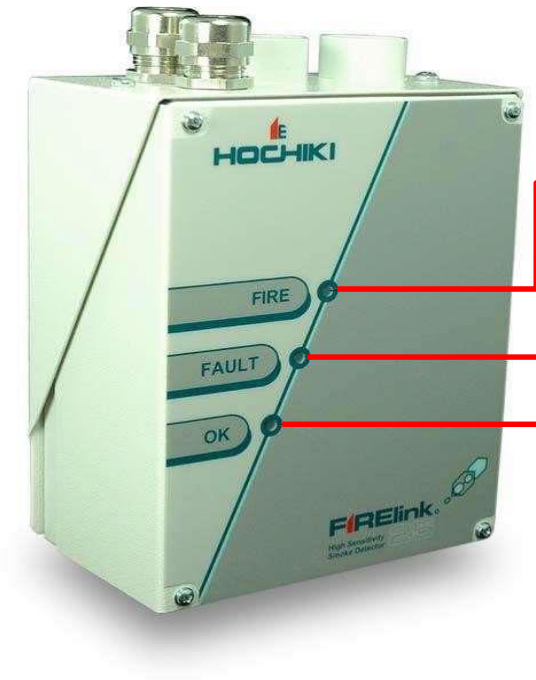
SN	ITEM DESCRIPTION	Qty (Nos.)
1	Aspirating Smoke Detection Panel	01
2	Audio Card (Sound Card)	01
3	Brake Valve Relay	01
4	Timer Relay	01
5	WAGO Connector	01

ASPIRATING SMOKE DETECTOR – FIRELINK-25 (MAKE HOCHIKI)



SN	ITEM DESCRIPTION
1	Sampling Pipe
2	Exhaust Pipe
3	Fire Panel
4	Control Panel
5	Aspirating Smoke Detection Unit (HOCHIKI - FIRELINK 25)

LED Indication on HOCHIKI FIRELINK-25



Fire - Illuminates when the alarm level has been reached and the appropriate time delays have expired.

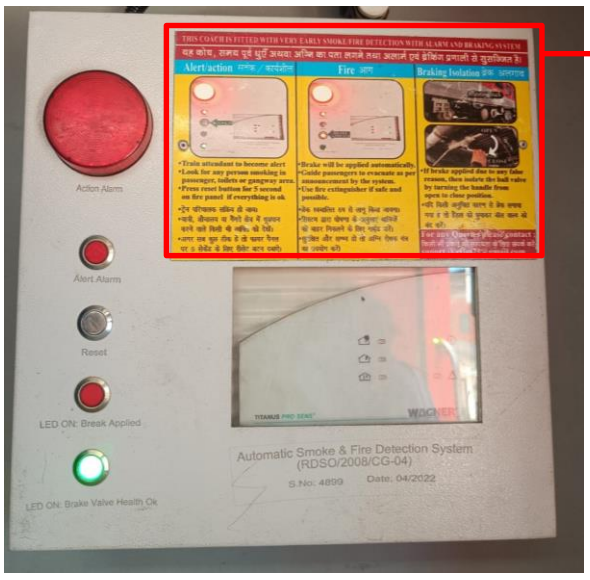
Fault - Illuminates when the unit has a fault and a fault signal is being sent to the fire panel.

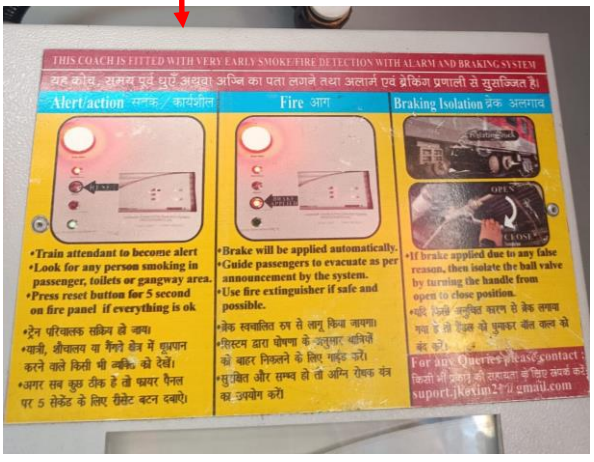
OK - Illuminates to show normal operation when there are no faults.

OK (Flashing) - The OK lamp will flash during the period when the detector is first learning about its environment.

TITANUS PRO-SENS AUTOMATIC SMOKE & FIRE DETECTION SYSTEM (MAKE WAGNER)

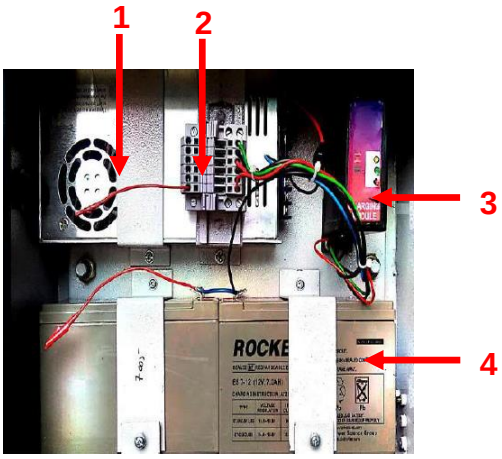






Power Unit Panel





SN	Item Description	Qty (Nos.)
1	DC-DC Converter [110 V To 24 V]	01
2	Power And Signal Terminal	01
3	Charging Unit	01
4	Maintenance Free Batteries	02

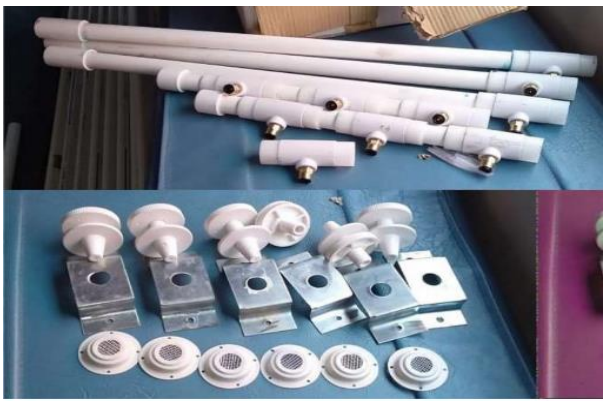
Inline Filter (Air Filter Box)



Inline Filter (air filter box) is a component used in ventilation systems to remove contamination and particulate matter from the air before it enters a specific area or equipment. It is typically installed in the air supply line to filter out dust.

Note: In N & S SOLUTIONS PVT. LTD (Make- HOCHIKI), Inline filter is not used.

Aspirating PVC Pipe Fitting and their Mounting Accessories



Capillary Sampling Point Assembly



Capillary Sampling Aspirating Pipe



Strobe Light with Hooter



Electronic Voice Message Sounder



Flasher Light





Brake Valve in LHB Coaches

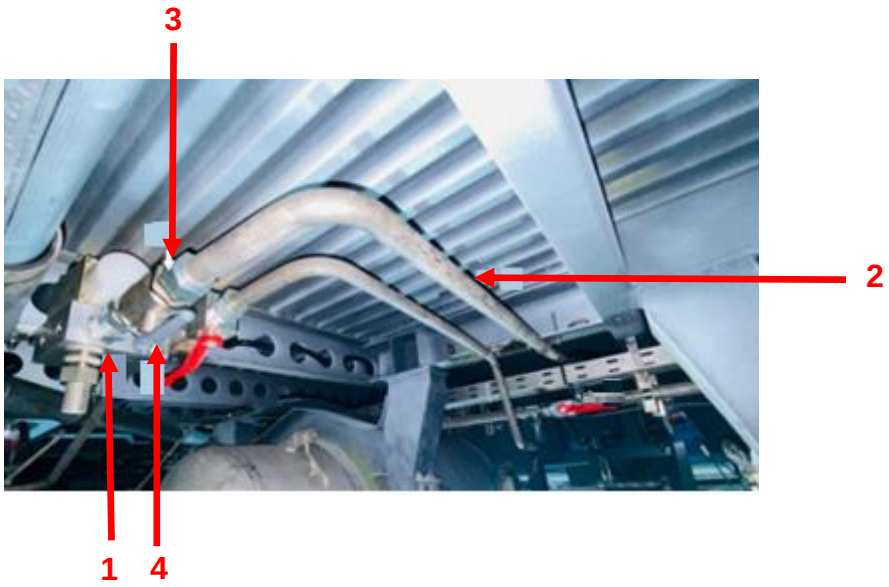




Brake Valve Application: During fire condition (stage-3), the brake valve application will be activated, causing the brakes to be applied within the coach. Additionally, the flasher lights and hooter in the passenger area will be activated to provide alerts to the passengers.

After duration of 55 seconds, when the train comes to a complete stop, an announcement is made to inform passengers about the safe disembarkation from the coaches.

Brake Valve Sub System: The brake valve subsystem plays a critical role in the braking system of trains, ensuring safe and controlled deceleration or stopping of the train.



SN	Item Description
1	Brake Application Valve
2	Stainless Steel Pipe
3	Straight Connector
4	Isolating Cock

- The isolation cock is positioned in such a way that it indicates the brake valve is in active condition and connected to the panel system



Brake Valve - Active Condition (Open)

- When the isolation cock is rotated 90 degrees, it will isolate the brake application with the coach. The following pictorial view illustrates this action



Brake Valve - Isolated Condition

4.1.2. Location of the Sampling Points in the Coach

Table 3: Location of Sampling Points	
SN	Location
1	Lavatory (All AC Coaches)
2	Doorway (All AC Coaches)
3	Passenger Area (All AC Coaches)
4	Electrical cabinet (LWSCZAC -AC CHAIR CAR & LWFCZAC - EXECUTIVE CHAIR CAR)



Sampling Point in Lavatory



Sampling Point in Doorway





Sampling Point in Passenger Area

4.1.3. Maintenance

SN	Parameters	Procedure	Acceptable Criteria
1	Visual Inspection of Fire Detection Panel	1. Check for Power-ON on Display Panel. 2. Check for Brake Valve on Display Panel. 3. Check for any Physical Damage of the items and deficiency	1. Power LED should glow. 2. Brake Valve LED's (Both) should glow. 3. There should be no Physical Damage to the Panel and any missing or deficient component.
2	Visual Inspection of Power Supply Panel	1. There shall be no physical damage to the Panel or deficiency 2. The components inside the Panel are Intact including Batteries.	1. There should be no physical damage. 2. No component inside the Panel should be deficient.
3	Visual Inspection of Hooters and Electronic voice message sounder**.**	1. Check for Presence/Intactness of these items. 2. Check for any Physical Damage to the items	1. There should be no physical damage. 2. No component should be deficient.
4	Visual Inspection of Pipe Network/ Sampling Points	Check the Piping Network near the FDS Panel and Sampling Points for any damage or deposition of dust or soot.	1. There should be no breakage of Pipe Network FDS Panel. 2. No Pipe joint network FDS Panel should be loose. 3. There should be no excessive deposition of Dust or soot on the sampling point.

<table>
<tr><td>5</td><td>Check Pipe Integrity And Smoke line</td><td>By simulating smoke at the farthest sampling point; check the response of the system for all levels of Alarms including
<table><tr><td>Flasher Light</td><td>Alert</td></tr><tr><td>Strobe Light and Hooter</td><td>Action</td></tr><tr><td>Public Announcement</td><td rowspan="2">Fire</td></tr><tr><td>Brake Application (By Checking the LED on the Panel)</td></tr></table></td><td>1. The system should function by Alarm and Subsequent actions like Flasher Light, Strobe Light, Public Announcement and Brake Application (to be checked by LED on Display Panel).

2. Relevant LED should glow at the Display Panel.</td></tr>
<tr><td>6</td><td>Check Air Flow Value</td><td>By connecting the FDS to the software through the help of HLI/Serial cable or equivalent standard cable to check the air flow value</td><td>The Air flow value should be between
Fn ± 20%
In case the values are beyond the range, the same should be re-checked after Pipe Flushing</td></tr>
<tr><td>7</td><td>On Board Filter Reading</td><td>By connecting the FDS to the application software through the help of cable to check on board Air Filter Life Reading</td><td>There should be
3-months life remaining</td></tr>
<tr><td>8</td><td>Flushing Pipe</td><td>1. By Blocking the inlet of the FDS Panel from the Inline Filter, Air Blow the sampling points.

2. After the flushing check functionality of the System by simulating artificial smoke in any of the sampling points</td><td>The System should function properly after flushing</td></tr>
</table>

4.1.3.1. Over Heated Wire Test

A. <u>General</u>

1 This test conforms to BS 6266 with minor modification of using one piece of 800mm wire in one piece instead of 1m wire, which was designed for testing in environments with forced ventilation, such as telecommunication facilities.

2 System performance test using electrically overloaded PVC coated wire (800mm). This method is suitable for the testing of high sensitivity of smoke/fire

detection unit. To simulate the early stages of a fire, a length of wire is electrically overloaded so that smoke or vapor is driven off.

B. Apparatus

1. Wire 800mm length, of 10/0.1mm strands insulated with PVC to a radial thickness of 0.3mm, the cross sectional area of the conductor being 0.078mm2.

2. Transformer 240V to 6V, capable of supplying at least 30 A.

3. Insulating board of non – combustible material, of minimum size 600mm x 600mm.

4. Stop watch capable of measuring in 1 second intervals

C. Procedure

1. Set the system under test at highest sensitivity.

2. Connect the wire to the 6V output terminal of the transformer. Ensure that the wire is laid on the insulating board so that there are no kinks or crossovers. Connect 240V mains electricity supply to the primary terminals of the transformer for a period of 60 seconds for energization.

D. Requirement

In all possible conditions of the coach environment, the system shall respond within 60 seconds after the cessation of energization.

4.1.3.2. Air Flow Monitoring Test

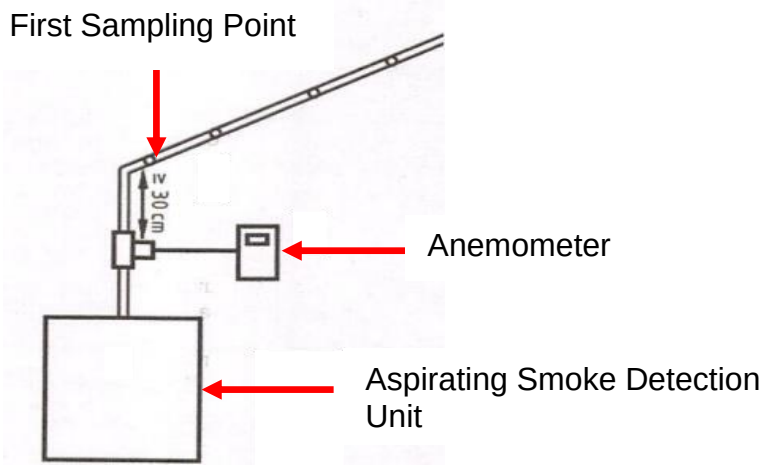
A. General

1. The airflow through the aspirating smoke detection unit shall be monitored to detect leakage or obstruction on the sampling device or sampling point(s).

B. Apparatus

1. Aspirating Smoke Detection Unit - The aspirating smoke detection unit under test is set up in accordance with the manufacturer's instructions.

2. Anemometer- To measure the normal airflow value (Fn) by a calibrated flow meter such as an anemometer with the worst-case sampling device. The minimum distance between the anemometer and the first sampling point is 30 cm. No sampling point shall be made between the aspirating smoke detection unit and the anemometer.



C. Procedure

1. The normal airflow (Fn)(Lt./min.) shall be determined from the sampling configuration used for the fire test with the help of application software or anemometer

2. The aspirating smoke detection unit under test shall be tested at the test flow rate (Ft) (i.e. Ft = Fn ± 10%) for testing the airflow monitoring.

3. For an aspirating smoke detection unit under test that has a memorized normal flow, The Fn shall be entered to the memory in accordance with normal operating instruction for the detection system. This shall only be done once at the start of each test and shall not be done during/after the conditioning.

4. For decreased flow, the volumetric airflow is decreased from Fn by 20%, which shall be observed through application software or anemometer installed between the sampling pipe and aspirating smoke detection unit

5. For increased flow the volumetric airflow is increased from Fn by 20%, which shall be observed through application software or anemometer installed between the sampling pipe and detection system unit.

D. Requirement

1. When the volumetric air flow reading in the system reaches the value of Fn - 20%. the aspirating smoke detection unit shall generate an airflow fault signal.

2. When the volumetric air flow reading in the system reaches the value of Fn + 20%, the aspirating smoke detection unit shall generate an airflow fault signal.

4.1.3.3. Smoke Test

1. Conduct smoke test by simulating smoke generation from any source i.e. smoke generator etc. at the farthest end from the system and verify detectors performance

2. **Stage-1**: When the smoke reaches the threshold of ***Alert (0.35 ± 0.05 % obs/m, Delay – 20 seconds)*** in the Automatic Smoke / Fire Detection System, the system will display Alert LED indications only at Local Control Panel / Detection Panel of the coach.

3. **Stage – *2:*** When the smoke reaches the threshold of ***Stage – 2, Action (0.6 ± 0.05 % obs/m, Delay – 30 seconds)*** in the Automatic Smoke / Fire Detection System, the Action LED will glow in the panel and Flasher Light will be ON

4. ***Stage –3:*** When the smoke reaches the threshold of ***Stage – 3, Fire (1.6 ± 0.05 % obs/m, Delay – 45 seconds)*** in the Automatic Smoke / Fire Detection System, the below mentioned indications will be observed:

    - Fire indication in the Panel
    - Brake Application will take place automatically.
    - After a time, delay of 55 seconds after activation of brake application, an audio visual alarm like a hooter or buzzer etc. along with Flasher light and Public Announcement will be there

4.1.3.4. Procedure for Data Download

1. Connect the FSDS using a PC/laptop to the OEMs application software through the help of HLI/RS232 Serial Cable/ OEMs Specified Cable/USB Cable.
2. Open the OEMs application Software
3. Click on Connection/View.
4. Follow the instruction of OEMs for further detail data status and data downloading.

4.1.4. Instruction for FSDS during dead coach movement

A. If the coaches are detached for sick-line attention, SS-I/SS-II/SS-III schedule or any dead attach movement for parent depot, following activities to be followed:

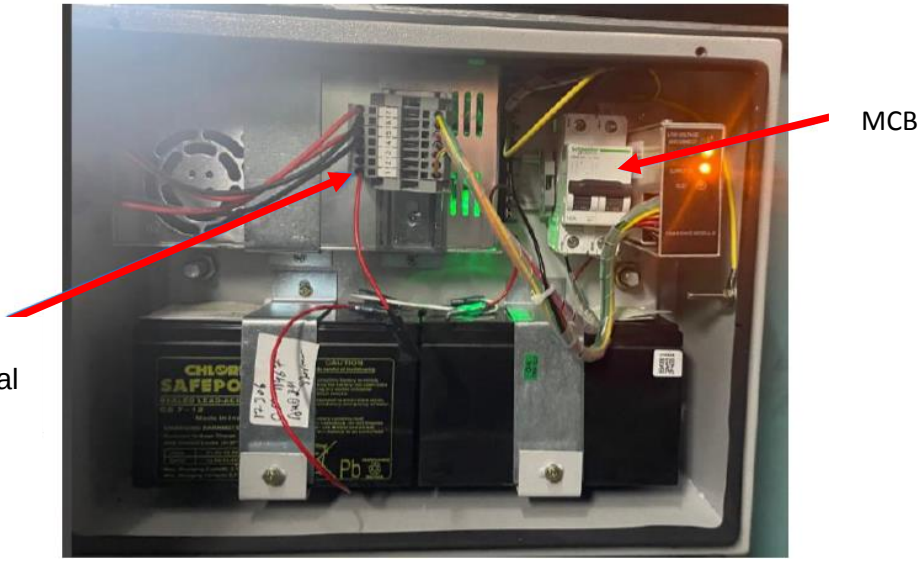
i. Coach to be moved as empty in a locked condition.
ii. MCB of FSDS is to be switched "OFF"
iii. The connection of FSDS with its battery (Wago terminal no. 1) should be disconnected.
iv. Brake valve of FSDS is to be isolated.
v. A sticker is also to be pasted on FSDS panel. The sticker shall be as under:

"***MCB of FSDS is switched "OFF" and Wago (Terminal no. 1) connection is disconnected. Brake valve is also isolated"***

B. Whenever coaches are fit to be attached again with rake, following needs to be ensured during attachment in rake**:**

i. Brake valve to be in normal functioning position (Handle position to open)
ii. Cable to be connected to Wago terminal no. 1 and MCB of FSDS is to be Switched "ON".
iii. Sticker pasted on FSDS panel etc. to be removed.

Steps for Isolating the Battery of the Power panel (FDS)



I. Drop the MCB to down position to switch off 110 V power supply

II. Remove Cable form Wago terminal No 1 and apply insulation tape on the exposed end

III. For reinstating the Battery re-join same cable at Wago terminal No 1 and switch on the MCB for reinstating 110 V DC power supply.

Isolate the Brake Valve pneumatically situated on the under frame as shown in the figure Below:



Open Position



Isolated Position

4.1.5. Power Supply arrangement

The control supply to the Fire Detection System will be provided from Terminal Block (TB) X1 of Switch Board Cabinet (SBC) for LHB AC coaches and TB-4 for ICF AC coaches through DC MCB of adequate rating as under

SN	Type of Coach	Place of Installation
1	LHB variant of AC coaches.	Supply may be taken from the place of installation of MCB S1F33 with 2A, 2P, C-curve, 110V DC MCB. The indication of MCB as per RDSO drawing no. RDSO/PE/SK/AC/0206-2019 (Rev.0) (attached as **ANNEXURE A)**
2	ICF Type SG AC coaches.	Supply shall be taken from Dedicated 2A, 2P, C-curve 110V DC MCB provided after the common 40A DC MCB as per RCF Drawing No. CC7040. The MCB to be placed in the Power Panel besides other DC MCBs. New 2A MCB provided to be marked as FSDS (attached as **ANNEXURE B)**

Note:
Maximum electrical load of FSDS @110V DC, current taken by FSDS System comes out to be 1.36A and the maximum current taken by FSDS is lower than this in deep discharge condition of internal battery (24V, 7AH).

4.1.6. Maintenance Schedule

For LHB Coaches

SN	Activity	D1	D2	D3	SS1	SS2	SS3
1	Visual Inspect: • Fire Detection Panel, • Power Supply Panel, • Hooters and Electronic voice message sounder. *Note:* *Please refer para- 4.1.3*	✔	✔	✔	✔	✔	✔
2	• Ensure provision of locking/clamping of isolation brake valve. • Check for Unauthorized isolation of Brake Valve and attend.	✔	✔	✔	✔	✔	✔

3	FSDS data log must be downloaded in every monthly schedule. One-month data must be preserved. *Note:* *1. Please refer para 4.1.3.4* 2. *Download data log and check for any fault, if any fault attend it.*		✔	✔	✔	✔	✔
4	Check the airflow reading. It should be within the range, i.e. **Fn ± 20%**, where Fn is the normal airflow value. ● If less than Fn - 20%, clean the filter and re-check. ● If still less than Fn - 20%, flush the pipeline with a vacuum cleaner and check. If the problem persists, seek further guidance from Supplier/OEM. ● If more than Fn + 20%, check the intactness of the pipe & capillary network and seek further guidance from the Supplier/OEM. *Note:* *Please refer Para 4.1.3 Sr. No. 6 For Checking Air Flow*		✔	✔	✔	✔	✔
5	Check the intactness of the power supply input voltage from the DC power supply to the detector and output voltage from the detector to other devices. **Power Supply Input from the Coach**: 110 ± 30 % Volt DC **Converted Voltages for FSDS**: 24 ± 6 Volt DC		✔	✔	✔	✔	✔
6	Check the backup battery voltage. If the backup battery voltage is less than 18 VDC, seek further guidance from the Supplier/OEM.		✔	✔	✔	✔	✔
7	Conduct the smoke test by simulating smoke generation from any source (e.g. smoke generator) at the farthest end from the system and verify detector performance. If any discrepancies are observed, investigate with OEMs consultation.			✔	✔	✔	✔

	Note: *Please refer para 4.1.3.3*						
8	I. Clean the sampling points, sampling pipe, and capillaries by vacuum-cleaning II. Replace any defective/ malfunctioning parts on condition basis				✔	✔	✔
9	I. Check the fitting and clamping arrangement of sampling pipe/sampling point and capillaries II. Place an artificial smoke source near each sampling point in the coach. Verify that every aspiration point in the system is functioning correctly and smoke is detected by the system.					✔	✔
10	Perform Over Heated Wire Test. *Note:* *Please refer Para- 4.1.3.1 for the Over Heated Wire Test.*					✔	✔
11	Brake Valve Overhauling (As per OEM's Maintenance Manual)					✔	✔
12	Replacement of must-change items. <u>Note</u>*:* *Please refer Para- 4.1.8*					✔	✔
	<u>*Note:*</u> *Clean the system panel, aspirating smoke detection unit as needed (conditions-based)*						

For ICF Coaches

SN	Activity	Trip Sch	A	6th Monthly	1st POH	2nd POH
1	Visual Inspect: • Fire Detection Panel, • Power Supply Panel, • Hooters and Electronic voice message sounder. *Note:* *Please refer para- 4.1.3*	✔	✔	✔	✔	✔
2	• Ensure provision of locking/clamping of isolation brake valve. • Check for Unauthorized isolation of Brake Valve and attend.	✔	✔	✔	✔	✔
3	FSDS data log must be downloaded in every monthly schedule. One-month data must be preserved *Note:* *1. Please refer para 4.1.3.4* 2. *Download data log and check for any fault, if any fault attend it.*		✔	✔	✔	✔
4	Check the airflow reading. It should be within the range, i.e. **Fn ± 20%**, where Fn is the normal airflow value. • If less than Fn - 20%, clean the filter and re-check. • If still less than Fn - 20%, flush the pipeline with a vacuum cleaner and check. If the problem persists, seek further guidance from Supplier/OEM. • If more than Fn + 20%, check the intactness of the pipe & capillary network and seek further guidance from the Supplier/OEM. *Note:* *Please refer Para 4.1.3 Sr. No. 6 For Checking Air Flow*		✔	✔	✔	✔

5	Check the intactness of the power supply input voltage from the DC power supply to the detector and output voltage from the detector to other devices. **Power Supply Input from the Coach:** 110 ± 30 % Volt DC **Converted Voltages for FSDS**: 24 ± 6 Volt DC		✔	✔	✔	✔
6	Check the backup battery voltage. If the backup battery voltage is less than 18 VDC, seek further guidance from the Supplier/OEM.		✔	✔	✔	✔
7	Conduct the smoke test by simulating smoke generation from any source (e.g. smoke generator) at the farthest end from the system and verify detector performance. If any discrepancies are observed, investigate with OEMs consultation. *Note:* *Please refer para 4.1.3.3*			✔	✔	✔
8	I. Clean the sampling points, sampling pipe, and capillaries by vacuum-cleaning II. Replace any defective/ malfunctioning parts				✔	✔
9	I. Check the fitting and clamping arrangement of sampling pipe/sampling point and capillaries II. Place an artificial smoke source near each sampling point in the coach. Verify that every aspiration point in the system is functioning correctly and smoke is detected by the system				✔	✔
10	Perform Over Heated Wire Test. *Note:* *Please refer Para- 4.1.3.1 for the Over Heated Wire Test*				✔	✔

11	Brake Valve Overhauling (As per OEM's Maintenance Manual)				✔	✔
12	Replacement of must change items. *<u>Note</u>:* *Please refer Para- 4.1.8*					✔
	<u>Note:</u> *Clean the system panel, aspirating smoke detection unit as needed (condition based)*					

4.1.7. Troubleshooting

SN	Trouble / Fault	Possible Cause	Solution
1	No Power in Fire Detection System	Loose/ Disconnected/ Damaged Wire	Ensure that the wires are not loose, disconnected, or damaged, and that the 110V power supply is properly connected to the panel.
		Defective Fuse	After ensuring a proper supply of 110V, check that the fuse is not defective. If the fuse is blown, replace it with a new one.
		Battery Draining	Check the voltage of the batteries. If the voltage is low, replace the charging module. If the charging module is working properly then replace the defective battery. If charging module is found defective, replace it with new one.
		Defective DC-DC Convertor	If all wires are connected properly & power is still not available, check the DC-DC Convertor. Replace the DC-DC Convertor if it is found to be defective.
2	System is not working even after the proper Power Supply.	Sensors not working due to dust accumulation or blockage	Clean the safety cover of Nozzles.
		Clogged Filter	Clean the filters through back airflow and put them back in place properly.
		Leakage in pipe line	Sometimes, pipes/joints are disconnected during the coach maintenance. Ensure all the sampling points, pipes/joints are connected properly with the system and there

			should be no leakage.
		Suction fan not working	Sometimes suction fan of FDS is found defective, in such case change the fan in consultation with OEM.
3	Pressure Drop	Loose/ Disconnected / Damaged wire.	Ensure wires are not loose/ disconnected/damaged If all wires are connected properly, check the Brake Module
		Brake Module is Defective	In case of defective Brake Module, change it with new one.
		Brake Valve is defective	If Brake Module is found okay, then change the Brake Valve
4	Speaker/ Flasher Lights not working.	Loose/ Disconnected/ Damaged Wire.	Ensure wires are not loose / disconnected /damaged. If all wires are connected properly & Speaker/Flasher still not working, check the PA Module.
		PA Module is Defective	In case of defective PA Module, change it with new one.
		Speaker/ Flasher Light are defective	If PA Module is found okay, then replace the speaker/flasher light
5	Air Flow Error	Low Flow Error	
		Dust Filter is chocked	Replace the filter.
		Sampling Pipe network is obstructed	Clear the sampling pipe of any obstructions.
		Sampling Point(s) obstructed	Clear the sampling points of any obstructions using hole suction gun or the air compressor
		High Flow Error	
		Intactness of capillary or sampling pipe is compromised	• If the capillaries are found loose or open. Refit/ replace as required. • Pipe joints if found loose, refit. The intactness of clamping/ securing arrangement for the aspiration pipe network needs to be ensured. • Inlet pipe if found broken or crack, needs to be replaced.
		End Cap in the pipe is missing.	Provide End Cap in the sampling pipe. Ensure it is fixed properly

6	False Alarm	Aspirating Smoke Detection Unit setting required.	Seek guidance from the Supplier/OEM

4.1.8. Material Requirement

I. Tools and Equipment

Regular Tools:

SN	Item Description	Specification
1	Multimeter	Digital Multimeter DC V= 0- 600 V AC V= 0- 600 V
2	Plier	Standard Plier
3	Nose Plier	Standard Nose Plier
4	Allen Key Set	Standard Allen Key Set
5	Screw Driver	Standard (13.0 x 1.9 mm) Flat Tip Screw Driver
6	Screw Driver Set	Heavy Duty C812 Combination Screw Driver Set
7	WAGO Screw Driver	Standard Aligner
8	Line Tester	Standard live line Tester
9	Wire Cutter	Standard Wire Cutter
10	Square Locked Key	Standard Locking Key
11	Pipe Wrench	Standard pipe wrench (250 mm)

Special Tools:

SN	Item Description	Specification
1	Vacuum Cleaner/ Blower	Standard Bosch/ Equivalent 650 Watt Approx.
2	Smoke Generator	As suggested by RDSO/OEMs
3	USB to Serial Converter/ USB Key Dongle	OEM Make
4	Connecting Cable	OEM Make
5	Laptop with Pre-loaded OEM Software	Minimum i3, 4GB RAM and 128 GB Storage, 14” with RJ-45 an USB Port, WIN10 OS
6	Over Heat Wire Test Setup	As suggested by RDSO/OEMs
7	Battery Tester	As suggested by RDSO/OEMs

II. List of Must Change Items during SS-II (LHB) / 2nd POH (ICF) (36 Months)

SN	Item Description	Qty per Coach
1	Maintenance Free 7 AH 12V Battery Unit	02 Nos.
2	Inline Filter (Air Filter)	01 Nos.
3	Real Time Clock battery	--

III. List of Condition Based Item

SN	Item Description
1	**XTRAILIS Make** - VESDA COMPACT LASER DETECTOR
2	**FOGTECH Make** - SMOKE ASPIRATING SYSTEM SAS 7532 CP
3	**QUARTAS Make-** ASPIRATING SMOKE DETECTION ASD SYSTEM
4	**FIRELINK25** 1 PIPE HSSD& Dock Station (Air RFLOW Suction Fan)
5	FIRELINK25 1 PIPE Air RFLOW Suction Fan
6	**WAGNER Make** TITANUS PRO-SENS Automatic Smoke & Fire Detection System
7	Relay Communication Card
8	Public Announcement Module (PA Module)
9	Brake Module
10	DC-DC Converter (110 V to 24 V)
11	Charging Unit
12	Inline Filter/Air Filter Box
13	Aspirating UPVC Pipe
14	Pipe Fitting (Elbow, Socket, End Cap)
15	Capillary Sampling Point
16	Capillary Sampling Aspirating Pipes PU/NYLON
17	Trunk Adapter for Capillary Aspirating Pipes
18	Strobe Light with Hooter
19	Electronic Voice Message Sounder
20	Flasher Light
21	Brake Application Valve
22	Isolating Cock(1” BSP)
23	Straight Connector and fittings
24	Conduit Pipe
25	Connecting Cable
26	Fire Detection Panel
27	Power Unit Panel
28	Panel Display Card & Voice Card
29	Signal Cable/ Power Cable
30	Brake Relays

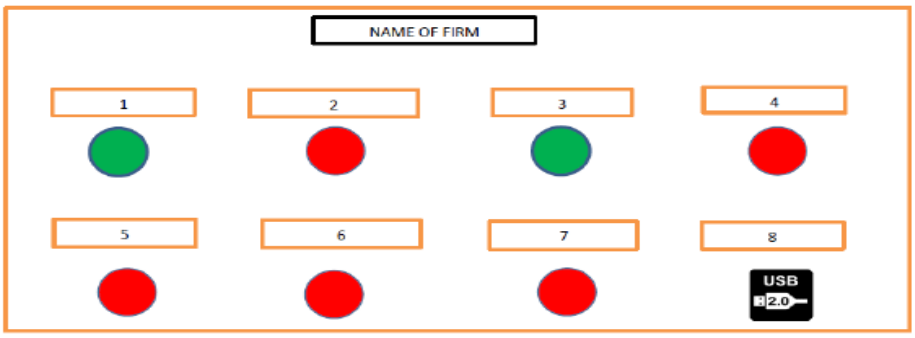
Note:

The lists mentioned above are according to the OEMs recommendation and are subject to revision based on technological advancements/upgrades and field experience gained by Zonal Railways.

4.1.9. Upgradation of FSDS System in Existing AC Coaches

(Ref: Amendment-1 of RDSO Specification no. RDSO/2008/CG-04 Rev-06)

1. Provision of Common interface/screen for status monitoring & data downloading having provision for various indications. Schematic of the same is as under:



1. POWER ON
2. FAULT
3. BRAKE VALVE ELECTRICALLY CONNECTED
4. BRAKE VALVE PNEUMATICALLY ISOLATED
5. ALERT
6. ACTION
7. FIRE
8. DATA DOWNLOADING PORT

The size of common interface panel should be within 300X250 for indications & data download panel. Indicators should be 22mm Panel mounted LED indicators (pilot light) and USB port should be covered with protective cover to avoid ingress of dust.

2. Provision of mechanical clamp for isolating cock and proximity/limit sensor (or any other suitable mechanism) to prevent isolation of brake valve & in cases of isolation, to capture and display on common interface/screen.

3. Lithium-ion battery having higher back-up i.e. in range of 10-12 hrs with inbuilt safety measures adopted globally including fire safety measures.

4. Modified audio message and all other works required for upgradation of FSDS system as specified in Amendment-1 of spec no. RDSO/2008/CG-04(Rev-06) or latest RDSO specification.

5. Common interface/screen panel along with associated accessories for system operation shall be EN 50155 compliant.

6. All software, hardwares etc. and any other material required to make the system fully functional without any constraints and for regular maintenance.

7. Cables used in the system shall be fire survival cables according to EN 50200.Survival duration classification of PH30 (30min) or higher is desirable.

8. Power supply of 110 V DC is available. The system should work with this supply. However, the system should continue to work with voltage in range between 77V-137.5 V DC

9. MCB, Connector & battery make (Brand name) shall be ensured as specified in Amnedment-1 of RDSO/2008/CG-04(Rev-06) or latest RDSO specification.

10. 2 Amp MCB with Limiter module to be used in FSDS system.

11. Positive and Negative wire of 110V DC supply shall be segregated by placing them in separate conduits.

12. FSDS System Error Codes

Table 4: Error Codes (FSDS)		
SN	**Error Description**	**Error Code**
1	Choking /overflow in sampling pipes.	E1
2	Wiring Break/Electrical discontinuity within the system	E2
3	Power Failure to Brake valve	E3
4	Brake valve isolated	E4
5	Automatic brake application	E5
6	System functional without any error	00

13. Format for Data Download

Data downloaded from Fire and Smoke Detection System (FSDS) to be maintained as per following format along with details of coach no. and FSDS make:

SN	**Date and time of alarm**	**Trouble /Error id**	**Alarm type with threshold value (%obs/m)**	**Message address etc.**

5. FIRE DETECTION AND SUPPRESSION SYSTEM (FDSS)

5.1. Fire Detection and Suppression System for LHB & ICF Power Car/ Pantry Car Coaches

5.1.1. Technical Details

The System is known as Fire Detection and Suppression System (FDSS), it is an integration of two systems one is Fire detection and another one is Fire suppression / extinguishing system.

The Fire Detection System consists of Fire and Smoke Detectors placed suitably inside the Generator area/pantry area. The Detectors are connected in a redundant loop to the control module.

The Control module is connected to an Audio-Visual Sounder beacon for Alarm in case of a fire.

The Fire Suppression System works on the Principle of High Pressure Water Mist System

Principle of High Pressure Water Mist System

The most important effects of fire fighting with water mist are the cooling and oxygen displacement effect. Through the atomization of water under high pressure, the reaction surface available for the cooling process is significantly enlarged in comparison to conventional low pressure systems. The water mist generated has a total surface area, at least 100 times greater than a conventional sprinkler.

The FDSS consists of water cylinders and a nitrogen cylinder, which are the source of the pressurized water mist system. FDSS System has Heat Detectors and Smoke Detectors.

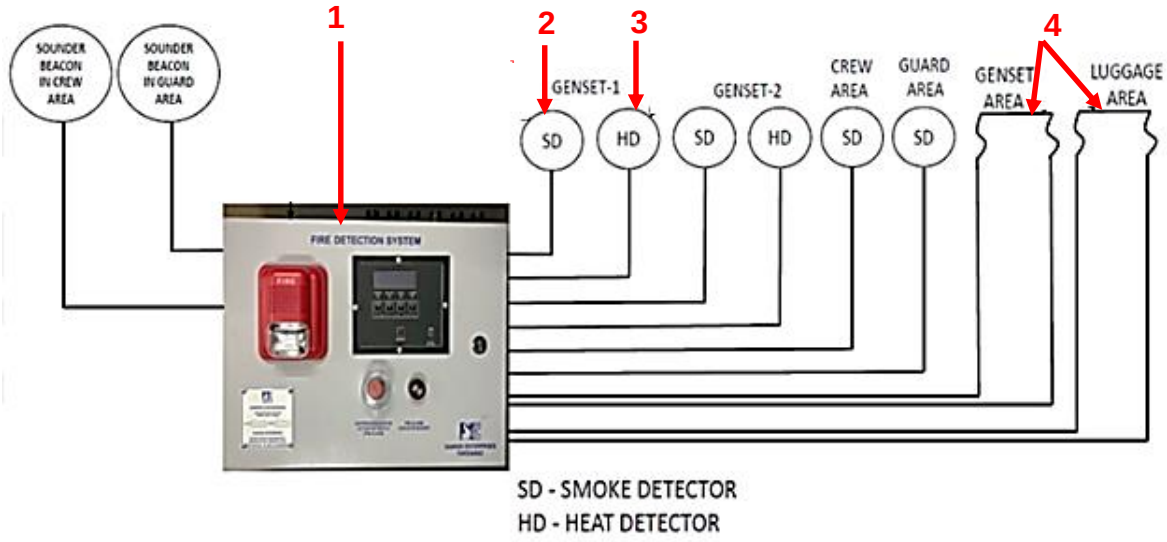
Smoke Detectors will provide pre-alarm, and after pre-alarm, manual activation of the system is done through an activation switch provided on the control panel.

Heat Detector provides fire alarm as well as automatic actuation of Fire Suppression System. On receiving the Fire Alarm (through Heat Detectors/LHD Cable), an automatic fire suppression system is operated.

Fire detection unit constantly monitors and controls the fire protection system and is also protected by a UPS with battery backup. The Control unit displays the ready status, relevant faults and alarms. The water mist system is activated by an electrically operated solenoid valve/magnetic valve on the nitrogen cylinder.

If a fire is detected, a message is sent accordingly to the fire detection evaluation unit and the generator cars vehicle control system, after which ventilation is shut down and the fuel supply to the engines cut off. Visual and acoustic alarms are activated in the guards' compartment.

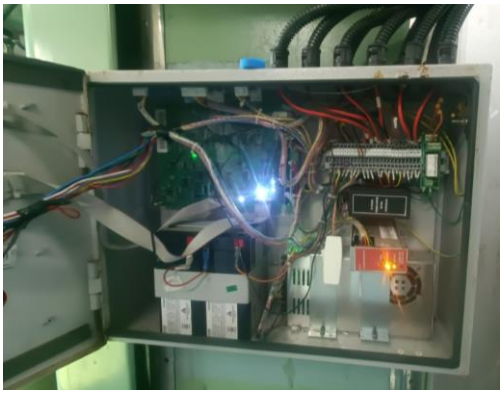
Schematic for Fire/Smoke Detection System (For Power Car)



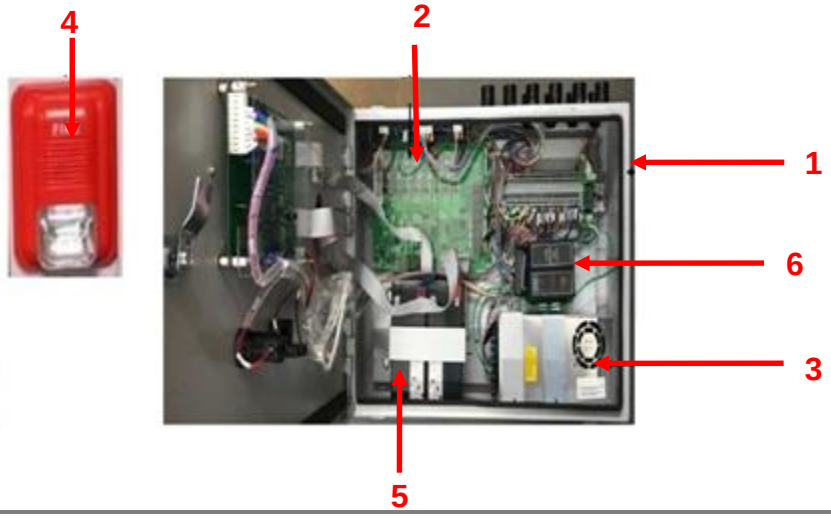
SN	Part Name	Qty
1	Main Control Module	1
2	Smoke Detector	04
3	Heat Detector	02
4	Linear Heat Detection Cable	50m Approx.



Fire Detection System

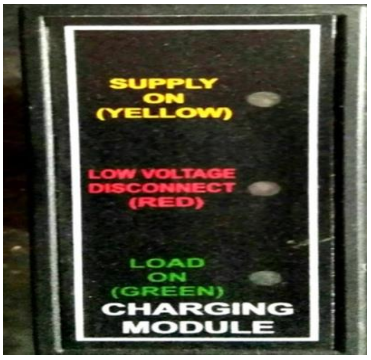

Fire Detection System (Inside)

Main Control Module



SN	Part Name	Qty
1	Panel Box	01
2	Main Control Unit	01
3	DC-DC convertor 110V- 24V and power supply Module (Charger Module)	01
4	Sound Beacon	02
5	Maintenance Free 7Ah 12V battery Unit	02
6	Nitrogen Module	01

Charger Module



DC- DC convertor

DC-DC convertor converts the supplied 110V DC power to 24V DC.



Sounder Beacon/Buzzer

Buzzer of rating 90-100 dBA at a distance of 1 meter. Tone of pre-alarm generated by smoke detector and fire alarm generated by heat detector should be different.



Heat Detector (Point Type)

They are installed in the Generator area of the Power car & pantry area of the pantry car.

After pre alarm (smoke detection) manual activation of system is also possible through activation switch provided in control panel.

On receiving fire alarm (through heat detector), the system sends the shut down single to DG set controller through potential free relay contacts and thereafter initiate automatic fire suppression system.

In any case, automatic activation system should be initiated within 30 seconds of sending shut down command to DG set.

Smoke Detector (Point Type)

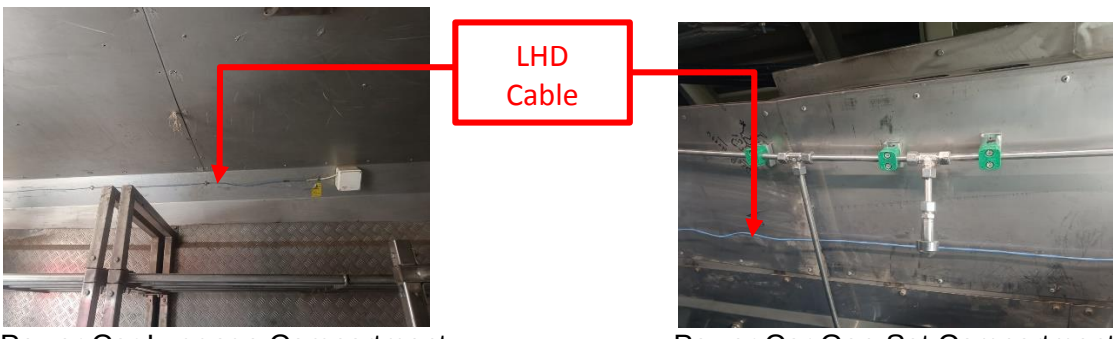
They are installed for detecting smoke in generator area, escorting staff compartment & guard compartment etc. of power car and for detecting smoke in store room, manager room & pantry staff area etc. for pantry car. Smoke detection in these area provides pre alarm at control panel.



LHD CABLE –

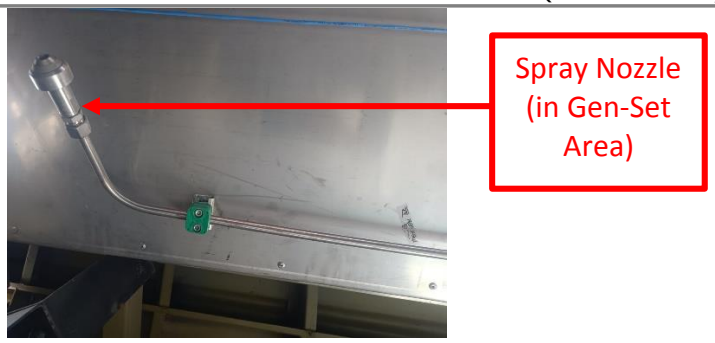
Linear Heat Detector cable installed in the generator area as well as the luggage area of the Power car & in the pantry area of the Pantry car.

LHD cable provides fire alarm as well as initiates actuation of fire suppression system.



Power Car Luggage Compartment

Power Car Gen-Set Compartment



Nitrogen & Water Cylinder



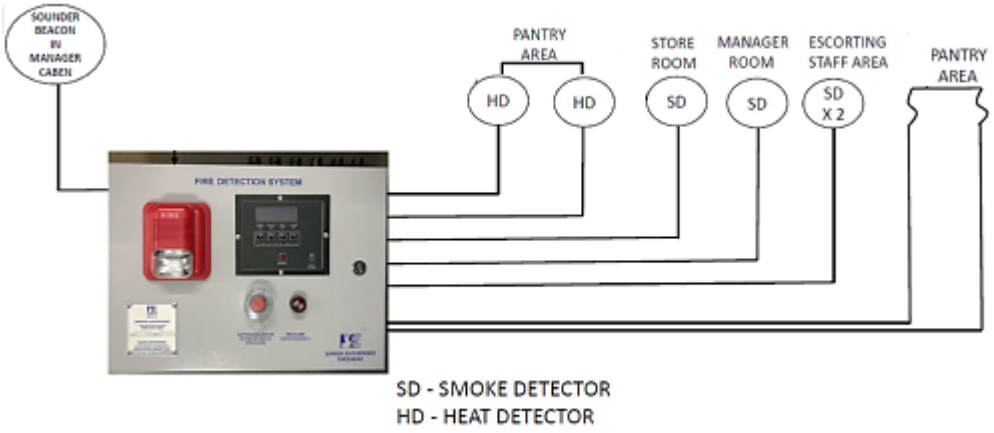


NOTE:

1. *Protect LHD CABLE from physical damage.*
2. *In case of physical damage of LHD CABLE, water mist is operated automatically.*
3. *The minimum 50 litres cylinders shall be filled with 33 litres of water (drinking water quality) and adequately pressurized with Nitrogen. However, supplier/ OEM has to ensure the quantum of Water and Propellant Gas required based on system sizing calculations on actual fire test results conducted as per ARGE Guidelines. Alternatively, the system may also have two or more cylinders filled with water & with Nitrogen.*
4. *The distribution pipe system shall be made of stainless steel pipes to DIN-2462 of 12 OD x 1.5 mm thick. The pipes shall be fixed to the roof construction.*
5. *There should be sufficient nozzle spray heads (minimum 4 nozzle spray heads) Spray pattern of nozzles should be such that it covers highly inflammable areas including DG sets filters of power car and pantry area of pantry car. The nozzle should be made of Stainless Steel AISI 316 or better grade.*
6. *The supplier/OEM shall provide a droplet spectrum for the selected nozzle and verify that it confirms to NFPA 750 for high pressure water mist system.*

Pantry Coaches:

The main system components of the Pantry Car of LHB /ICF Coaches are the same as in the Power Car Coaches (i.e. 02 nos. of point type Heat Detectors in hot buffet / pantry area, Linear Heat Detector (**LHD**) cable is there on the ceiling of hot buffet / pantry area and point type Smoke Detectors in manager room, pantry staff room, store room). Only difference is in the installed location of Heat Detector which is shown below in the figure

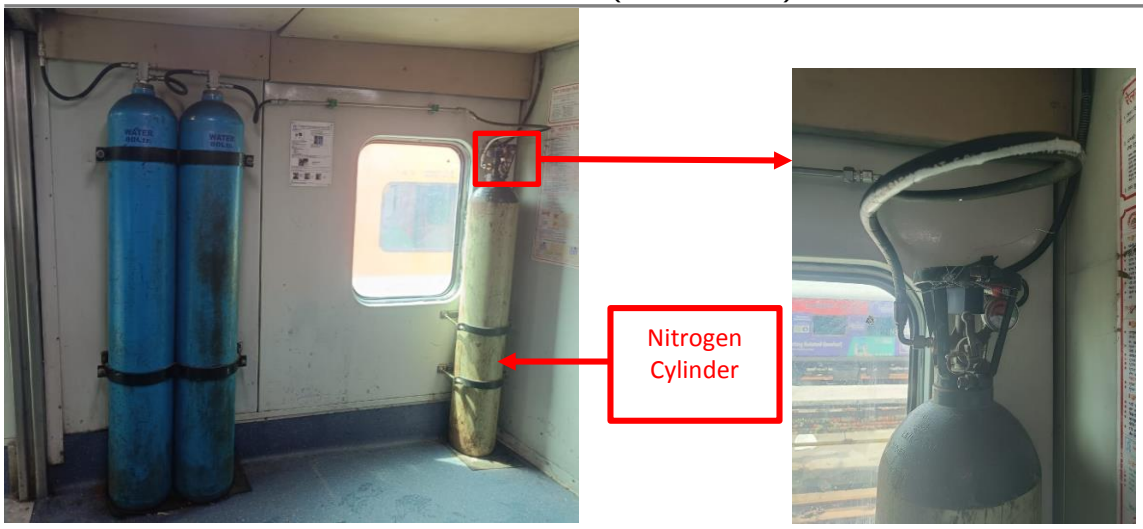


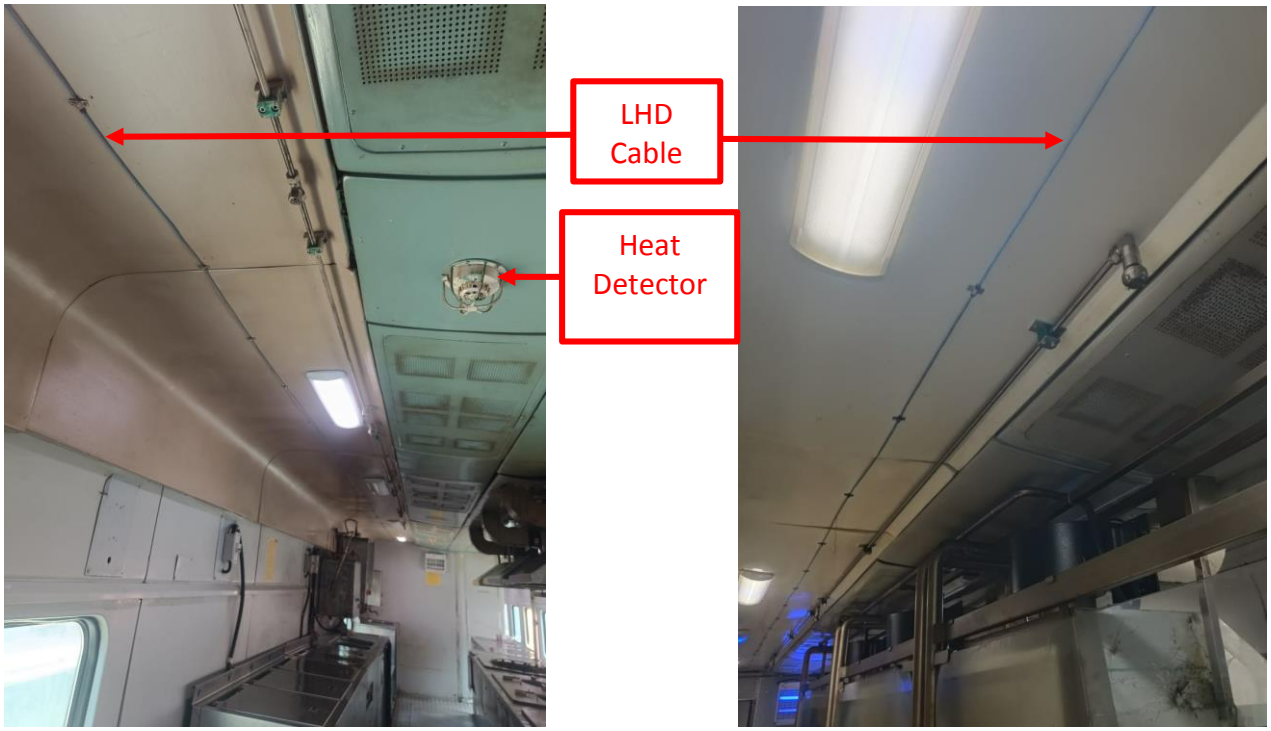
For LHB Hot Buffet/ Pantry car, pre-alarm (smoke detection), manual activation of the system will also be possible through an activation switch provided in the control panel. On receiving Fire alarm (through Heat Detectors), the system will send signal to cut off power supply to Electric Hob and thereafter initiate automatic fire Suppression system.

Automatic FDSS will be operated in manual mode in ICF Pantry cars till flame based cooking is modified into flame free cooking.



Fire Detection System







Smoke Detector
(Catering Staff Bay)

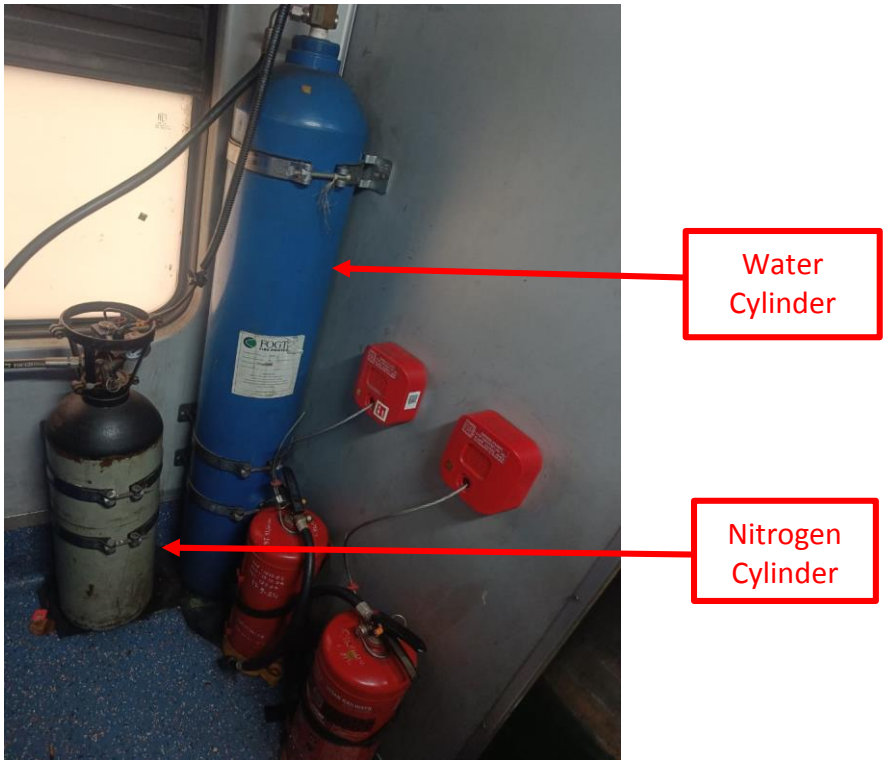


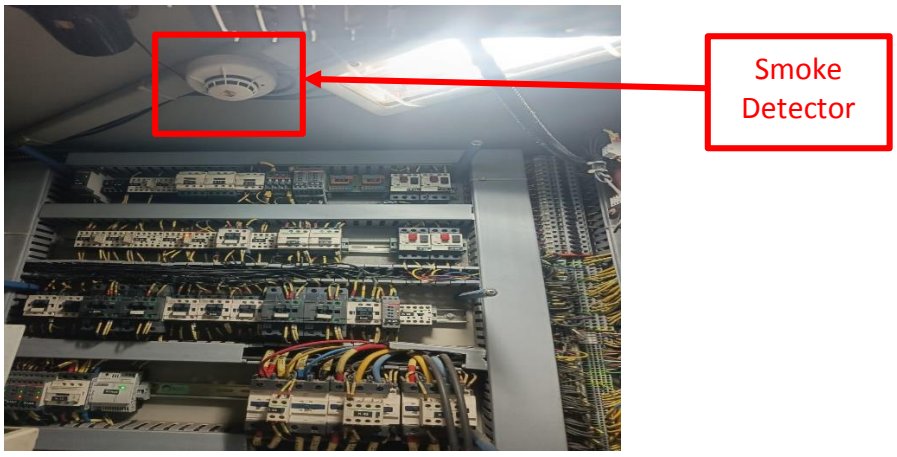
Smoke Detector
(Electrical Staff Bay)



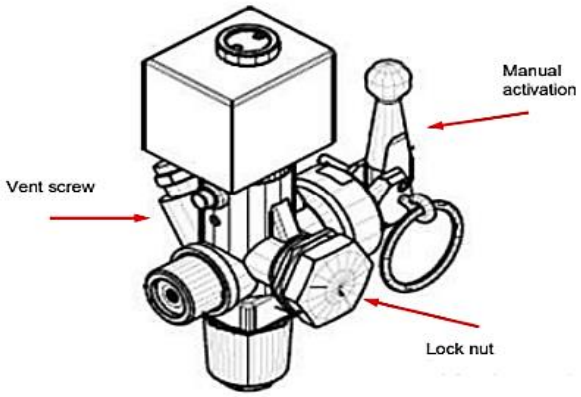
Smoke Detector
(OBHS Staff Bay)


FIRE
MANUAL ACTIVATION SWITCH
RESET
OGPRO INDIA
F RE ALARM EVALUATION UNIT
POWER
PRE ALARM
ALARM
FAULT
SUPPRESSION ON
RESET


Water Cylinder
Nitrogen Cylinder


Smoke Detector

5.1.2. Procedure for Testing and Checking of Magnetic Valve



Magnetic Valve

The activation procedure is to be simulated as part of inspection. Every magnetic valve is to be activated once, and checked mechanically.

The procedure is as follows:

1. Remove the solenoids from the gas valves belonging to the nitrogen cylinders.
2. Apply voltage to the system.
3. Check whether the solenoids are producing magnetic fields, there should not be any magnetic field yet.
   This can be checked using a metallic object, by inserting it inside the coil (e.g. a screw driver).
4. Check the pressure in the nitrogen cylinders using the manometer fitted. Log the pressure and the position of the area valves.
5. Simulate detection.
6. The processes defined in the system should take place automatically:
   a) Alarm signal produced.
   b) Check manual activation using the lever
   c) Disconnect the connection line.
   d) Close the valve outlet using the lock nut
7. Reset the fire alarm system.
8. Next, perform a mechanical inspection of the magnetic valve (to do this put back the solenoid):

   To perform a mechanical function test, a conventional Allen key as well as a lock nut with vent hole is required.

   a. Activate the valve electronically for two to three seconds, then switch off the current or deactivate manual activation.
   b. Undo the vent screw using the Allen key, turning it through half a rotation, which will vent the valve area involved, causing the valve to close audibly. The pressure, however, will remain in the valve outlet.
   c. By carefully undoing the lock nut by about half a turn, then vent the valve outlet. A short, audible emission of gas signals that the valve has opened correctly as a result of electrical or manual activation. This escape of gas, however,

should cease immediately, otherwise the valve has not closed properly. If that happens, do not remove the lock nut.

d. If the valve does not close, then it must be replaced. To do this, empty the container through the valve outlet by turning the lock nut by no more than half a turn. Secure the container appropriately before emptying.
e. If the valve is working properly, then screw up the vent screw again so that it seals.
f. Return the system to its functional state.

5.1.3. Maintenance Schedule

I. For LHB Power Car & Pantry car

S.N	Activity	D1	D2	D3	SS1	SS2	SS3
1	Visual inspection & Verify that all control panel indicators and alarms are functional.	✔	✔	✔	✔	✔	✔
2	Checking of water level & ensure that gas cylinder valves are open.	✔	✔	✔	✔	✔	✔
3	Check Sealing of Solenoid Valve and its intactness and same shall be acknowledged.	✔	✔	✔	✔	✔	✔
4	Check Suppression System pressure in Nitrogen cylinder. If pressure is less than 150kg/cm², inform to supplier/OEM for further guidance.		✔	✔	✔	✔	✔
5	Check smoke and heat detection physical condition if required, clean it with soft cloth in-situ.		✔	✔	✔	✔	✔
6	Carryout smoke detection test for point type smoke detector.			✔	✔	✔	✔
7	Check the condition of pipeline. Pipeline should be securely clamped. Check the condition of nozzles. Nozzles should be free from deposition of dust soot etc.			✔	✔	✔	✔
8	Carryout heat detection test for point type heat detection.				✔	✔	✔
9	System integrity at least up to activation signal of solenoid valve to be ensured.				✔	✔	✔

10	Complete testing of the system. Note: Please refer Annexure-I for the Testing of the system.					✔	✔

Note: *Sealing of Solenoid Valve and its intactness shall be acknowledged especially by Pantry Manager in pantry car before departure of train from originating station*.

II. For ICF Power Car & Pantry car

S.N	Activity	Trip Sch.	A	B	IOH	POH
1	Visual inspection & Verify that all control panel indicators and alarms are functional.	✔	✔	✔	✔	✔
2	Checking of water level & ensure that gas cylinder valves are open.	✔	✔	✔	✔	✔
3	Check Sealing of Solenoid Valve and its intactness and same shall be acknowledged.	✔	✔	✔	✔	✔
4	Check suppression system pressure in Nitrogen cylinder. If pressure is less than 150kg/-cm², inform to supplier/OEM for further guidance.		✔	✔	✔	✔
5	Check smoke and heat detection physical condition if required, clean it with soft cloth in-situ.		✔	✔	✔	✔
6	Carryout smoke detection test for point type smoke detector.			✔	✔	✔
7	Check the condition of pipeline. Pipeline should be securely clamped. Check the condition of nozzles. Nozzles should be free from deposition of dust soot etc.			✔	✔	✔
8	Carryout heat detection test for point type heat detection.				✔	✔
9	System integrity at least up to activation signal of solenoid valve to be ensured.				✔	✔
10	Complete testing of the system. Note: Please. refer Annexure-I for the Testing of the system.					✔

Note: *Sealing of Solenoid Valve and its intactness shall be acknowledged especially by Pantry Manager in pantry car before departure of train from originating station*.

5.1.4. Troubleshooting

SN	Trouble / Fault	Possible Cause	Solution
1	No Power in Fire Detection System	Loose/ Disconnected/Damaged Wire	Ensure that the wires are not loose, disconnected or damaged and that the 110V power supply is properly connected to the panel.
		Defective Fuse	After ensuring a proper supply of 110V, check that the fuse is not defective. If the fuse is blown, replace it with a new one.
		Battery Draining	Check the voltage of the batteries. If the voltage is low, replace the charging module. If the charging module is functioning properly, then replace the defective battery. If the charging module is found to be defective, replace it with a new one.
		Defective DC-DC Convertor	If all wires are connected properly & power is still not available, check the DC-DC Convertor. Change the DC-DC Convertor if it is found to be defective.
2	System is not working even after the proper Power Supply.	Control Card not working	Display is not showing. Replace display card. Get it checked with OEM.
		Sensor Disconnected	Sometimes, wire is disconnected during the coach maintenance. Ensure all the connection are connected properly with system.
		Sensor Defective	Clean the dust/dirt on detector. Put them back in place properly. If required consult with OEM.
3	Nitrogen Cylinder Pressure Low (Minimum Acceptable	Loose/ Disconnected /Damaged wire.	Ensure that the wires are not loose, disconnected, or damaged. If all wires are connected properly, check the brake module.
		Low Nitrogen Pressure	Refill/ replace Nitrogen Cylinder

	Pressure =150kg/-cm²)	Pressure Gauge Defective	Check Pressure Gauge with Another Cylinder, if defective replace it.
4	Nitrogen Cylinder Not Connected	Loose/ Disconnected/ Damaged Wire.	Ensure wires are not loose/disconnected/damaged. If all wires are connected properly.
		Relay Defective	Replace the relay in coordination with OEM.
5	False Alarm	Fire Detection System Unit setting required.	Seek guidance from the Supplier/OEM

5.1.5. Material Requirement

I. Tools and Equipment

Regular Tools:

SN	Item Description	Specification
1	Multimeter	Digital Multimeter DC V= 0- 600 V AC V= 0- 600 V
2	Plier	Standard Plier
3	Nose Plier	Standard Nose Plier
4	Allen Key Set	Standard Allen Key Set
5	Screw Driver	Standard (13.0 x 1.9 mm) Flat Tip Screw Driver
6	Screw Driver Set	Heavy Duty C812 Combination Screw Driver Set
7	WAGO Screw Driver	Standard Aligner
8	Line Tester	Standard live line Tester
9	Wire Cutter	Standard Wire Cutter
10	Square Locked Key	Standard Locking Key
11	Spanner Set 18-19, 21-22,22-23 & 30-32	Standard Spanner Set
12	Pipe Wrench	Standard pipe wrench (250 mm)

Special Tools:

SN	Item Description	Specification
1	Water Pump	Standard 1 HP Pump with Hose Connector
2	Vacuum Cleaner/ Blower	Standard Bosch/ Equivalent 650 Watt Approx.
3	Heat Gun	400 Watt Approx.
4	Artificial Smoke Generator	As suggested by RDSO/OEMs
5	Pressure Hydraulic Test Setup	As suggested by RDSO/OEMs

II. List of Must Change Items during SS-II (LHB) / 2nd POH (ICF) (36 Months)

SN	Item Description	Qty.
1	Maintenance Free 7 AH 12V Battery Unit	02 Nos.
2	Nitrogen Gas Cylinder with Activation Valve	01 No.
3	Water Cylinder with Dip Stick	2 Nos.
4	Hose Pipe suitable for fitment on Adapters/Fittings 10-L according to ISO8434-1, Length- 800mm, end 1: 10L 90º, end 2: 10L 90º, Stainless steel ends V4A, Working Pressure- 200 Bar	1 No.
5	Hose for interconnection suitable for Adapters/Fittings 12-L according to ISO-8434-1, Length- 400mm, end 1: 12-L 0º (Straight), end 2: 12L-0º (Straight), Stainless steel ends V4A, Working Pressure- 200 Bar	03 Nos

III. List of Condition Based Items

SN	Item Description
1	Water Cylinder with Dip Stick Assembly
2	Nitrogen Gas Cylinder with Pressure Gauge and Activation Valve
3	Nitrogen Gas Cylinder with Pressure Gauge Fitted with Fire Rated Automatic Fire Suppression Activation Solenoid Valve with Manual Override Lever Duly Filled with Nitrogen at 200 Bar ± 10%
4	Manual Release Valve for Manual Fire Suppression System
5	Fire Rated Activation Solenoid Valve for Automatic Fire Suppression System
6	Pressure Gauge for Manual Fire Suppression System
7	Pressure Gauge for Automatic Fire Suppression System
8	Stainless Steel Pipe OD 12 mm

9	Fittings for Gas Actuator Valve
10	Straight Connector with Nut (G-Union) 12 L (M18X 1.5) X 10L (M16X1.5)
11	End Plug Stainless Steel G 3/8" V4A Elastic Sealing VST13/ 8ED71
12	Hose Pipe suitable for fitment on Adapters/Fittings 10-L according to ISO8434-1, Length- 800mm, end 1: 10L 90º, end 2: 10L 90º, Stainless steel ends V4A, Working Pressure- 200 Bar
13	Hose for interconnection suitable for Adapters/Fittings 12-L according to ISO-8434-1, Length- 400mm, end 1: 12-L 0º (Straight), end 2: 12L-0º (Straight), Stainless steel ends V4A, Working Pressure- 200 Bar
14	Nozzle with Clamping ring
15	Clamp for Nitrogen Cylinder
16	Clamp for Water Cylinder
17	Back Plates for Water Cylinder
18	Back Plates for Nitrogen Cylinder
19	Tie Rods for water Cylinder
20	Tie Rods for Nitrogen Cylinder
21	Nylock Nut (M12) with Flat Washer
22	Charging Unit for FDSS
23	Linear Heat Detection Cable
24	Refilling of Nitrogen Gas cylinder
25	Refilling of Water cylinders
26	Display Card
27	Nitrogen Module
28	Protection Card
29	Push Button
30	Relay
31	Coil of Fire-Rated Activation Solenoid Valve
32	Pre- Alarm
33	LOOP MX
34	M Charger
35	LHD Box
36	Audio-Visual Alarm/Sounder Beacon
37	Power and Signaling Terminal Block with Interconnecting Cables & Hardware for Panel
38	Smoke Detector
39	Heat Detector
40	Signal Cable (For Fire Detection)- Fire Survival Cable
41	Main Control Module
42	Fire Rated Activation Solenoid Coil

Note:

The lists mentioned above are according to the OEMs recommendation and are subject to revision based on technological advancements/upgrades and field experience gained by Zonal Railways

6. PREVENTION OF FIRE

A. Coaches:

- All protective equipment such as fuses, contactors, MCBs etc. should be intact and with proper rating. No bypassing and paralleling to be done
- Fire extinguishers as per guidelines with proper validity to be provided.
- Fire detection and alarm system provided in the coaches must be in working condition
- Thermal scanning of Power panels of all coaches on load to done as per extant guideline
- FDSS (Fire Detection and Suppression System) provided in pantry cars should be in working condition and magnet valve for operating the suppression.
- FSDS (Fire Smoke Detection System) should be in working condition. The angle cock connecting the penalty brake application should not be in isolated condition.
- WSP should be in working order.
- Only metal (preferably stainless-steel) dustbins should be provided in coaches.
- Garbage evacuation to be ensured at designated stations.
- Escorting staff should be properly trained and counseled for handling fire incidents.
- Cleaning of LHB ACP panels

B. Pantry / Power Cars:

- FDSS (Fire Detection and Suppression System) provided in Power Cars/Pantry Car should be in working condition.
- Leakage/Seepage of Lube and fuel oil in the engine room should be arrested before putting in service.
- All safety equipment including sensors should be in working condition
- Radiator as well as side body filters to be cleaned properly.
- Thermal scanning of power panels of Power Cars on load to done as per extant guideline.
- Escorting staff should be counseled and trained
- Engine room and panel room should be dry.

7. POST FIRE MAINTENANCE

- After discharge, allow for appropriate holding time before ventilating the hazard space.
- Always have backup portable fire extinguishers on hand for use in the unlikely event of fire re-ignition.
- Ventilate the hazard area thoroughly by forced ventilation or by opening doors and windows.
- Inspect that all fires have been extinguished and that there are no localized hot spots or other sources of re-ignition present.

Caution:

- Ensure *the fire is completely extinguished before ventilating the hazard space.*
- *Ventilate thoroughly or use a self-contained breathing apparatus before entering.*
- *For areas with sensitive electronic equipment, recovery activities should begin immediately after system discharge and the area is secured from fire re-ignition. This will help protect electronic assets from possible damage.*

Note: In case of fire incidence, detailed investigation/inspection is to be done jointly with OEM as per the condition of the system.

8. Do's & Don'ts

Do

- Use appropriate PPEs.
- Follow the prescribed inspection, maintenance and testing schedule for the system.
- Proper record keeping of the system.
- Check the indication LEDs in the control/detection panel.
- Ensure that smoke is detected by the aspiration sampling point when it is cleared of blockage due to vandalism or dust/dirt accumulation.
- Ensure that no smoke/fire source is present in the coach if an alarm/alert indication is observed.

Don't

- Remove or connect the wire/connections when the system is powered up
- Hard reset the system for resetting the alarm.
- Use Solvents for cleaning.
- Ignore re-occurring faults.
- Allow unqualified/untrained personnel to operate/test/service the system

9. REFERENCES

1. RDSO Specification for Aspiration Type Automatic fire / Smoke Detection with Alarm System for AC Coaches {RDSO SPEC. NO: RDSO/2008/CG-04 (REV-6)}
2. RDSO Letter MC/ACF/Fire Suppression/PC dated 08.02.2023_Spec No. IS/RDSO/CG/S/22001 Rev./Amend Issue: Feb-2023
3. RDSO Specification No. RDSO/2008/CG-04 (Rev.- 6) Draft Issue: Jul 2024
4. Over Heated Wire Test for FSDS fitted in IR AC Coaches, RDSO letter no. MC/ACF/Fire Detection/AC dated.13.06.2024
5. RDSO Specification No.MC/ACF/Fire Detection/AC dated 06.06.2024
6. RDSO Specification No.MC/ACF/Fire Detection/AC dated 05.08.2024
7. RDSO Specification No.MC/ACF/Fire Detection/AC dated 27.07.2024
8. RDSO Specification No.MC/ACF/Fire Supprn/PC dated 22.07.2021
9. RDSO Specification No.MC/ACF/Fire Detection/AC dated 22.07.2021
10. RDSO Specification No.MC/ACF/Fire Supprn/PC dated 06.06.2024
11. RDSO Ref. No.: El/6.8.21 dated 15.07.2024
12. Rev-2 MC ACF Fire Detection AC_En Hm_Guideline_FSDS_Annexure-A
13. RDSO Specification No.MC/ACF/Fire Detection/AC dated 03.10.2024
14. SANROK Enterprises Maintenance Manual for Fire Detection System DMM/FDS/001REV 01 Issue: 01.01.2021
15. FOGPRO India Descriptive, Operation & Maintenance Manual for Standalone Automatic Smoke/Fire Detection with Alarm System
16. ADVANCE HITECH Descriptive, Operation & Maintenance Manual for Standalone Automatic Smoke/Fire Detection with Alarm System
17. JK EXIM Operation & Maintenance Manual for Standalone Automatic Smoke/Fire Detection with Alarm System
18. SANROK Enterprises Letter Number SE: CAMTECH/GWL/FDS/FDSS/GK dated 03.08.2024
19. FOGPRO India Letter Ref: FPI.CAMTECH dated 05.08.2024
20. SANROK Enterprises Maintenance Manual for Fire Detection and Suppression System DMM/FDAS/002 REV 01 Issue: 01.06.2020
21. JK EXIM - ULTRA FOG Document No: UFTD-703 dated: 20 AUG 17
22. FOGTEC Brand schutz GmbH & Co. Document Number: 55080419_ICF_Generator-Car_EN dated 28.05.2016
23. N & S SOLUTIONS PVT. LTD _User Manual for Aspiration Type Automatic Smoke/ Fire Detection with Alarm System for INDIAN RAILWAYS AC Coaches Rev Date/ No.: 14.09.2023 /02

ANNEXURE – I

Proforma for Testing of Automatic Fire Detection cum Suppression System

(Installation & Commissioning)
(Ref: RDSO spec No. RDSO/2013/CG06)

Coach No.				
Supplier Name				
Inspection Date				
S.N	**Parameter**	**Specified**	**Observation**	**Remarks**
1.	Suppression System Pressure in Nitrogen Cylinder	During Installation: 200 ±10% kg/cm^2 Working range: 150-200 kg/cm2		
2.	Smoke/Heat detector physical condition	Sensors should not exhibit deposition of Dust/soot etc. If required, it should be cleaned in-situ with soft cloth. Under no case, pressurized air be used.		
3.	Smoke test for all point type smoke detectors of Pantry Car/ Power Car	On simulating smoke: Buzzer and flasher light should activate Controller should give indication of Smoke alarm		
4*	Checking of manual activation of suppression system	On simulating smoke: Buzzer and flasher light should activate Controller should give indication of Smoke alarm On pressing the activation switch on control panel, controller should give potential free signal for shutting down the Gen-sets of Power car/cutting off of power supply to electric hobs of Pantry car. System should be activated within 30 sec or earlier if the shut down signal is received by the controller.		

5*.	Heat detection test for all Point type heat detectors of Pantry car/Power car	On simulating Heat: Buzzer and flasher light should activate. Controller should give indication of fire alarm and should give potential free signal for shutting down the Gen-sets of Power car/cutting off of power supply to electric hobs in pantry car. System should be activated within 30 sec or earlier if shut down signal is received by the controller.		
6*	Linear Heat Detector Cables fitted in Generator room of Power car/ Pantry area of Pantry car	On simulating Heat: Buzzer and flasher light should activate. Controller should give indication of fire alarm and should give potential free signal for shutting down the Gen-sets of Power car/cutting off of power supply to electric hobs in pantry car. System should be activated within 30 sec or earlier if shut down signal is received by the controller.		
7	Linear Heat Detector Cables fitted in luggage room of power car	On simulating Heat: Buzzer and flasher light should activate. Controller should give indication of fire alarm and should give potential free signal for shutting down the Gen-sets.		
8	Condition of pipelines, wiring, fasteners	Pipelines should be securely clamped. Check that there is no loose wiring. Fasteners should be tight (Visual check).		
9	Nozzles	Nozzles to be free of deposition of soot, dust etc.		

* **During tests (at S. No. 4, 5 & 6) Solenoid valve should be electrically disconnected temporarily so that actual suppression should not take place automatically. However, activation signal of solenoid valve should be checked through test-lamp/ multimeter and electric continuity of coil of solenoid valve to be also checked with multimeter.**

Note:

(i) Smoke should be simulated by Smoke Generator.

(ii) Heat should be simulated by a hot air gun (400 Watt Approx.) placed at least 250 mm from the detector's surface for ~ 90 deg C temperature at sensor.

(iii) Functionality of high pressure water mist suppression system is to be checked along with Supplier/OEM. During checking, the DG sets/ Electrical Panels to be covered suitably to avoid any ingress of water mist into DG Sets/Electrical Panel. Checking shall include complete functionality tests as per above proforma including actual activation of the water mist suppression system.

(iv) It must be ensured that instructions for operation of the system are prominently displayed and training to escorting staff is provided.

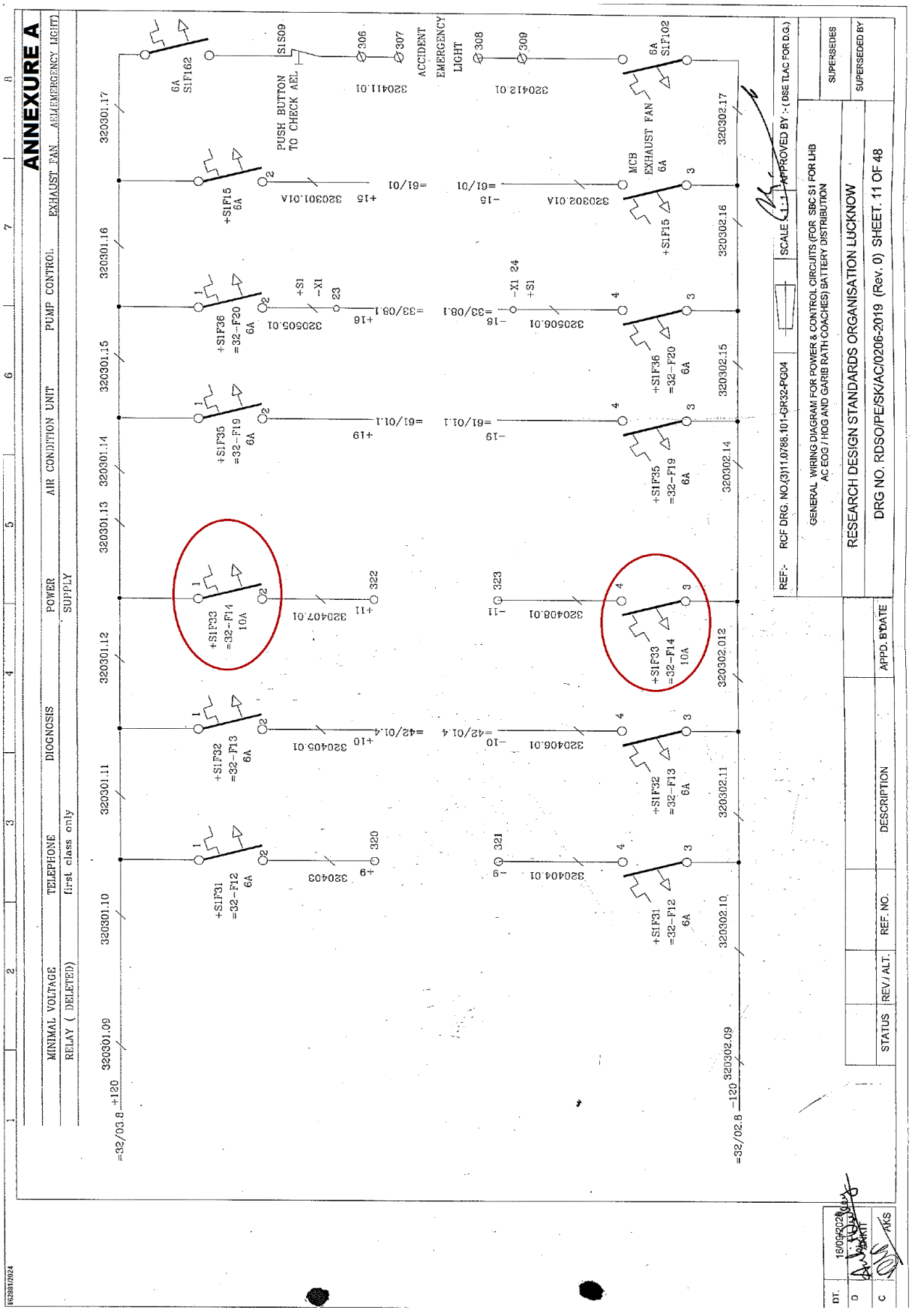
ANNEXURE – II

Proforma for Testing of Automatic Smoke/Fire Detection System

<table>
<tr><th>SN</th><th>Description</th><th>Requirements of spec no. RDSO/2008/CG-04</th><th>Observation</th><th>Remark</th></tr>
<tr><td>1</td><td>Check the Number of Air Sampling Points in the Coach</td><td>Sampling pipe/sampling point and capillaries shall be fitted and secured by suitable anticorrosive fastenings arrangements. There shall not be any sagging in sampling pipe</td><td></td><td></td></tr>
<tr><td>2</td><td>Check the threshold values of the system for Alert, Action and Fire settings</td><td>
<table>
<tr><th>Stage</th><th>Alarm</th><th>Threshold (obs/m)</th><th>Delay Period (Sec.)</th></tr>
<tr><td>1</td><td>Alert</td><td>0.35 ± 0.05</td><td>20</td></tr>
<tr><td>2</td><td>Action</td><td>0.6 ± 0.05</td><td>30</td></tr>
<tr><td>3</td><td>Fire</td><td>1.6 ± 0.05</td><td>45</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>3</td><td>Over Heated Wire Test</td><td>Please Refer Para 4.1.3.1</td><td></td><td></td></tr>
<tr><td>4</td><td>Air Flow Monitoring Test</td><td>1. When the volumetric air flow reading in the system reaches the value of Fn - 20%. the aspirating smoke detection unit shall generate an airflow fault signal.
2. When the volumetric air flow reading in the system reaches the value of Fn + 20%, the aspirating smoke detection unit shall generate an airflow fault signal</td><td></td><td></td></tr>
<tr><td>5</td><td>The artificial smoke (smoke generator) to be created near each sampling points to verify the aspiration of the system</td><td>For verification of functionality of all sampling points</td><td></td><td></td></tr>
<tr><td>6</td><td>Performance of brake application</td><td>The brake application should activate at stage 3 (Fire)</td><td></td><td></td></tr>
</table>

ANNEXURE- A

Power Supply Arrangement for LHB AC Coaches



ANNEXURE- B

Power Supply Arrangement for ICF Type AC Coaches

