SPECIFICATION FOR SMOKE DETECTOR AND FIRE ALARM SYSTEM

1.0 SCOPE:

This specification covers design, selection, manufacture and supply of fire detection and alarm systems. The specification covers fire detection and alarm system to detect fire at the earliest practicable moment and to give an alarm for information of authorised personnel so that appropriate action can be taken to prevent loss of life and property in passenger coaches.

It is intended that the control scheme employed will lend itself to monitor continuity of circuit, health and integrity of any fuses, sensors and after logic unit. In the event of abnormality, the annunciator and control units shall flash this information suitably. It shall be possible to isolate and bypass the fire detection system in case of its malfunctioning.

2.0 SCOPE OF SUPPLY :

The following shall constitute the scope of supply:

a) Control Unit - 1 nos.

b) Detector head - 1 set.

c) Alarm unit - 1 nos.

d) Wire harness - Electron beam multicore and multicolour cable to spec. No. EDTS132 Rev.'B' compatible with the system shall be supplied as follows:

Length required for LHB type coaches - 2.0 m

Length required for LHB type Power car - 5.0 m

Length required for MEMU coaches - 10.0 m

3.0 GENERAL PRINCIPLES :

The general principals of the fire detection system shall be as follows:

i) Detection of fire quickly enough to fulfil its intended functions.
ii) Reliably transmit the detected signal to control panel.
iii) Translate this detected signal into clear and unmistakably identifiable alarm signal.
iv) Remain in-sensitive to phenomena other than actual fire conditions.

4.0 SERVICE CONDITIONS:

The equipment shall be fit for rolling stock duty and perform satisfactorily on the conditions prevalent on Indian Railways.

4.1 ENVIRONMENTAL CONDITIONS:

Ambient Temperature	: 5°C to 55°C
Maximum Relative Humidity	: upto 98% during the rain season
Altitude	: Maximum 1000 Meters
Atmosphere	: Extremely dusty with fog
Coastal areas	: The equipment shall be designed to work in coastal areas in humidity salt laden & corrosive atmosphere.

4.2 WORKING CONDITIONS:

Train Speed	: 160KMPH
Vibration and Shocks:	
Maximum Vertical Acceleration	: 1.0g
Maximum lateral Acceleration	: 0.5g
Maximum longitudinal acceleration	: 3.0g

d) Frequency and amplitude :

Sinusoidal form of vibration, the frequency `f' lies between 1 Hz and 100 Hz and their amplitude `a' expressed in mm is given as function of `f' by the equation:

a =25/f for values of `f' between 1 and 10Hz

$a=250/f^2$ for values of `f' between 10 and 100 Hz

5.0 GOVERNING STANDARDS/SPECIFICATIONS:

References shall be made to following standard/specifications:

1	IS:2189-1999	Selection Installation & maintenance of automatic fire detection and alarm system-code of practice
2	IS:8757	Glossary of terms associated with fire safety
3	ELRS/Spec/Fire/0010 Rev.0	Specification of the system for automatic detection and simultaneous extinguishing of fires on electronic locomotives
4	ICF/ELECT/913	Microprocessor based fire alarm system for passenger trains

6.0 GENERAL REQUIREMENTS:

6.1 SMOKE DETECTOR

The smoke detector shall be multiple optical cum thermal detector in compliance with spec. No. DIN EL/54 Pt.-7 . The smoke detector shall incorporate state of the art optical chamber providing efficient & accurate detection of fire with high level of resilience to non fire environmental influences. The detector shall be able to detect smoke, temperature and the rate of rise of temperature as per the following conditions:

1. When the rate of temperature rise at the detector exceeds 15 °C per minute regardless of the actual temperature.

2. When temperature at the detector exceeds a pre-determined value of 57°C.

3. When optical density of smoke exceeds 0.1 dB/m (10 m visibility) ≤ 500 ppm

Detector shall be suitable for surface mounting & equipped with theft protection to protect against unauthorized removal. The detector shall incorporate integral LED indicator to show the status of the detector i.e

Red LED indication - Normal mode - 'OFF' or Flash
- Alarm mode - Steady

6.2 CONTROL PANEL

The fire detector shall be designed according to DIN EN/54-2 and EN/54-4 with the following features:

a) The control panel shall be microprocessor controlled to detect the signal emanating from the detector head.

b) The overall dimensions of the control panel shall be within the following limits:
   i) Width = 100 mm
   ii) Height = 150 mm
   iii) Depth = 150 mm

c) The system shall be designed to operate on DC supply source with a nominal voltage of 110V and the voltage varying from 90 V DC to 130 V DC with a ripple content of 15 % maximum. The system shall be so designed that it is immune to the effects of electromagnetic and electrostatic interference on account of 25 KV AC /1500 V DC over head lines and PWM inverter driven equipment installed on coaches.

d) The control panel shall have interface with pre-calibrated sensor and sensitivity adjustment if any shall be provided inside the controller unit and shall be factory preset.

e) The max. power consumption shall not exceed 2.0 Watts.

f) The control unit shall be capable for processing data signals from at least 2nos. of detectors simultaneously.

g) Two sets of contacts 1 NO and 1 NC suitable for 230 V and of min 5.0A rating shall be provided for 'Fire' / 'Fault' conditions.

h) The complete system shall comprise of self diagnostic features that means in case of any discontinuity/malfunctioning of the unit the control panel shall reflect it by way of fault indications on the front panel. The panel shall automatically reset after trouble shooting and shall not require reprogramming of the controller.

i) The control unit shall be provided with self check indication by way of different coloured LED indications. A test button shall be provided to test the health of the system, smoke detectors, audio alarm and the indicating lamps.

j) Once the signal is received from the detector head the control unit shall maintain the fire alarm irrespective of the state of the detector and wiring afterwards. A control switch shall be provided for muting the alarm manually after its acknowledgement.

k) Real time clock with data logging shall be provided to retrieve after event for any analysis purpose.

l) Degree of protection of the unit shall be IP-30.

6.3 SOUNDER:

a) An external compact, flush mounted type, flat design audio signaling device shall be provided compatible with the control unit. The sounder shall be suitable for operation on 110 V DC supply.

e) The max. power consumption shall not exceed 2.0 Watts.

b) The maximum sound output of the sounder device shall be 100 dB pulsed tone when measured at a distance of 10 feet from the source in an unechoic room. The intensity of the hooter shall be graduated as first 2 pulses shall be of 50 % of maximum intensity and the remaining pulses shall be of full intensity. It shall have two level of sound (max.) i.e 100dB and 70dB, which shall be controllable by a toggle switch with indication high/low dB.

~~The unit shall be capable for processing data signals from at least~~

c) The frequency of the alarm shall be adjusted between 500-1000 Hz in order to draw attention of a normal human being a distance of 25.0 m in the coach. The frequency of pulsed tone shall be fixed as 1.0 Hz.

d) Degree of protection of the unit shall be IP-54.

7.0 INDICATIONS:

The following indications shall be provided:

CONTROL UNIT :	
Power supply ON	GREEN
System ON	GREEN
System TRIP	YELLOW/AMBER
Fire detected	RED
Detector cable SHORT	YELLOW/AMBER
Detector OPEN/disconnected	YELLOW/AMBER
ELECTRONIC HOOTER:	
Hooter ON	RED
DETECTORS:	
Normal	RED - Flashing
Detector ON	RED - Steady

8.0 PROTECTIONS:

a) **Reverse polarity at the input :**
The system shall be able to withstand 200V for one minute with both forward and reverse polarity. Alternatively the system shall work on reverse polarity also.

b) **Input over voltage:**
At voltages exceeding 130 V the system shall trip with high traces.

c) **Input under voltage:**
At voltages below 90 V no damage to the system shall occur.

d) **Short circuit protection:**
Short circuit in any of the sensors shall not damages the system.

9.0 TESTS:

9.1 TYPE TEST
All the type tests mentioned in Clause 4.4 shall be carried out on a prototype unit. The firm manufacturing for the first time shall get the prototype approved from CEE/RCF.

9.2 ROUTINE TEST
Routine tests mentioned in clause 4.4 shall be carried out on each unit by the manufacturer at his works to ensure compliance with the specification and the drawings.

9.3 ACCEPTANCE TEST
Acceptance test mentioned in clause 9.4 are to be carried out by an inspecting authority nominated by the purchaser at the works of the manufacturer, on the samples picked up by the inspecting authority. All the acceptance tests shall be carried out at firm's premises at the manufacturer's cost. Inspecting officer will witness the tests.

A copy of the internal tests conducted by the firm shall be supplied to inspecting/purchasing authority. Inspecting agency shall maintain record of all the tests conducted for future reference and will check the authenticity and the originality of the bill of material for each item by seeing the invoices invariably to avoid spurious material being safety involved.

9.4 TABLE FOR TESTS:

S.No	Tests	Type Test	Accept. Test	Routine Test	Clause
1	Visual inspection, including inspection of internal wiring	√	√	√	9.5
2	Performance test	√	√	√	9.6
3	Test for verification of insulation resistance. (>100MΩ with 500 V meggar)	√	√	√	9.7
3	Test for verification of dielectric properties. (shall withstand 2.0 KV for 1 minute)	√	√	x	IEC571-21
4	Reverse polarity test	√	√	x	8.0 (a)
5	Input over voltage protection test	√	√	x	8.0 (b)
6	Input under voltage protection test	√	√	x	8.0 (c)
7	Short circuit protection test	√	√	x	8.0 (d)
8	Degree of protection	√	√	x	6.2 (I)
9	Voltage surge test	√	x	x	IEC571-22

The accuracy of measuring instruments used for both type and routine tests shall be of class-1.5.

9.5 VISUAL INSPECTION:

i) Visual inspection of the system/ equipment as well as examination of test certificates conducted by Govt. Approved Lab.

ii) Check for general workmanship, overall dimensions, mounting details, fabrication, finish and internal wiring shall be checked.

9.6 PERFORMANCE TEST:

i) Testing of the whole system with regard to functional requirements and hauling conditions as specified in the specification shall be checked.

ii) Testing of specified parameters in terms of related specification and/or OEM's illustrated catalogue / literature of all equipments components and allied materials.

This test will be conducted, as type test by simulating the conditions of fire and operation of the system will be checked as per functional requirements in the coach.

9.7 INSULATION RESISTANCE TEST:

The insulation resistance between earth (enclosure) and the current carrying parts shorted together shall be more than 10 M Ohms when measured with 500 V meggar.

NOTE :

1. The equipment shall have guarantee of at least 18 months from the date of installation or receipt whichever is earlier.
2. A complete maintenance and operating manual shall be supplied with each system.
3. The complete system shall be got tested from govt. Approved testing agency for fire alarm systems.

CORRIGENDUM NO.-1 TO SPEC. NO. EDTS087 REV. 'B'.

This corrigendum is issued to specification no. EDTS 087 Rev 'B' "SPECIFICATION FOR SMOKE DETECTOR AND FIRE ALARM SYSTEM " to rectify the typographical error by modifying following clauses:

Cl.No.	Existing	May be read as
4.2	d) frequency and amplitude: Sinusoidal form of ----------10 and 100Hz.	frequency and amplitude: Sinusoidal form of ----------10 and 100Hz.
9.1	All the type tests mentioned in clause 4.4 shall be carried out on a prototype unit. The firm manufacturing fcr the first time shall get the prototype approved from CEE/RCF.	All the type tests mentioned in clause 9.4 shall be carried out on a prototype unit. The firm manufacturing for the first time shall get the prototype approved from CEE/RCF.
9.2	Routine tests mentioned in clause 4.4 shall be carried out on each unit by the manufacturer at his works to ensure compliance with the specification and the drawings.	Routine tests mentioned in clause 9.4 shall be carried out on each unit by the manufacturer at his works to ensure compliance with the specification and the drawings.

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