Doc copy

Spec/Fire/0010 Rev.

DRAFT is finalised

SPECIFICATION FOR AUTOMATIC DETECTION AND SIMULTANEOUS EXTINGUISHING FIRE FIGHTING SYSTEM FOR FIRES ON ELECTRIC LOCOMOTIVES

सत्यमेव
जयते

ELECTRICAL DIRECTORATE

SPECIFICATION NO. ELRS/SPEC/FIRE/0010, REV. '0'

JANUARY - 2000

अनुसंधान अभिकल्प और मानक संगठन
लखनऊ – २२६ ०११

Research Designs & Standards Organisation
LUCKNOW –226 011

Copy for Doc. Section

Spec/Fire/0010 Rev '0'

SPECIFICATION FOR AUTOMATIC DETECTION AND SIMULTANEOUS EXTINGUISHING FOR FIGHTING THE SYSTEM FOR FIRES ON ELECTRIC LOCOMOTIVES

1. SCOPE :

This specification covers design, manufacture, supply and commissioning of automatic fire detection cum simultaneous extinguishing system for controlling fires on 25 KV AC Electric Locomotives. This specification applies to installation system employing suitable fire extinguishing media based on gas/ DCP to be released manually/automatically consequent upon indication of an alarm from the fire sensing annunciate equipment or even otherwise.

1.1 It is indented that in the event of or in likelihood of out brake of fire the monitored parameters ie. smoke/ temperature will cause control unit to annunciate alarm for authorized personnel to verify if there is any fire in case of manual arrangement and to release fire extinguishing medium with a pre-set time delay in case of pre-set automatic arrangement. It should have the facility for the authorized personnel to cancel the fire alarm and subsequent operation of release of fire extinguishing medium in case of alarm proves to be false.

1.2 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 and availability of fire extinguishing medium. In event of any abnormality, the annunciator and control units shall flash this information suitably. It shall be possible isolate and bypass the fire detection system. However, facility of manual release of fire extinguishing medium to extinguish fire shall not ever got bypassed.

2. FUNCTIONAL REQUIREMENTS :

The system should comprise of one control unit which will receive a control signal from the fire sensors and process the same to judge the extent for sending an alarm/control signal to activation unit mounted in each cab. The control unit is to be mounted in a empty space located in cab I of the locomotive near hand brake. The space available is approximately 200 mm x 200 mm x 300 mm. It is to be mounted on steel plate with nuts and bolts of suitable sizes.

2.1 Two audio visual alarm annunciators to be controlled by control unit will have to be provided one in each driving cab of the locomotive. The construction of annunciators should be such that it can be mounted on the locomotive falling either in the vertical position or on the sealing of the locomotive in inverted condition.

2.3 The fire extinguishing medium should be housed in up to 4 cylinders connected together with manifold apprataus and appropriate release mechanism. The total quantity of the fire extinguishing medium should be sufficient to flood the entire space inside the locomotive between the two cabs to effectively control and extinguish the fire of any extent.

2.4 The supply and release arrangement of fire extinguishing medium in the HT compartment should comprise of seamless stainless steel pipe conforming to IS : 6630 – 1985 and discharge nozzles in required number at the pre-identified locations. The design of the fire extinguishing medium release nozzle should be such that they should not get choked in the operating condition prevailing on Indian Railways. The manual release of fire extinguishing medium in the HT compartment should be possible from both the driving cabs. The laying of the pipeline along with fitment of nozzles and mounting of fire extinguishing medium holding cylinders should be such that it should not hamper the normal maintenance work inside the locomotive. The replacement of either the cylinders or any other equipment of the complete system should not require disturbances to existing equipments of the locomotives.

2.5 The system should be able to operate with 110V DC input supply which is normally available in the Electric Locomotives. However, suitable protections in the form of fuse at the input as well as other desired locations will have to be incorporated by the supplier.

2.6 The control unit shall incorporate self check indication by way of LEDs which will normally remain extinguished except when unit is not in order. The test button for manual operation corresponding to specification IS: 4794 (push button) shall be provided to test the health of the alarm and all indicating lamps and LEDs. The audio visual alarm shall comprise of high illumination red colour LEDs in matrix of 2 x 2 cm2 so as to be visible from any position in the cab. The alarm shall also generate sufficiently audible sound of appropriate intensity and frequency in order to draw attention of a normal human being at around 30 mtrs. Distance measured from the centre of the locomotive in any direction.

2.7 The control unit shall have spare contact available to be used for locomotive shut down if considered necessary at a later stage. It should also be capable of accepting as well as process a signal generated from

pressure or temperature transducers if decided for fitment in the tap changer or transformer at a later stage.

2.8 The control unit shall illuminate the red indication light on the driver's desk of the driving cab and shall activate the audible. After acknowledgement to silence the alarm a push button switch conforming IS: 4794 shall be provided in each cab to silence audible alarm. However, this push button shall not cancel the red indication lamp till the fire conditions inside the HT compartment have become normal.

2.9 The control panel mounted near the control unit shall also incorporate and over ride the switch to activate the release of fire extinguishing medium in case the fire sensing arrangement fails to operate the audio visual alarm and the fire comes to the notice of the driving crew through some other means.

2.10 The complete system comprising of fire detection as well as controlled arrangement shall comprise of self diagnostic feature that means any wiring brake or discontinuity in the fire detection circuit/ will not disable to transmit fire alarm signal. Similarly, spurious alarm signal of less than 10 secs. Duration shall not be processed. The cables to be used for all external wiring should confirm RDSO's Specification No. E-14/01 (Part-I) Rev II 1993 for control cable and they are to be supervised for open circuits. Trouble conditions shall be indicated by audible signal and arrange trouble LED. Alarm conditions shall over ride all trouble conditions.

3. DETECTION OF FIRE :

The sensors to be used for detection of fire conditions in the HT compartment should work on the principle of ;

i) Consideration of smoke,
ii) Temperature as well as rate of rise of temperature.

3.1 The total number of sensors will have to be as per pre determine nos. shown in the enclosed sketch.

3.2 The output of the sensors should confirm industry standards so as to match with any other signals generated by sensor of some other make if required to be incorporated in future. Similarly, the control unit meant for processing the control signal should conform industry standards and should be able to process output signals received from sensors of any other make confirming to industry standards.

3.3 In case of setting of the system on automatic mode if audio visual alarm comes and is not resetted within 90 secs. Sounding of the alarm, fire extinguishing medium shall get released automatically.

3.4 The no. and location of the nozzles through which gas extinguishing medium shall be released will be as per arrangement shown in the enclosed sketch. A appropriate design manifold appratus will have to be provided to enable selection of a particular set of nozzle or all the nozzles. This information shall be furnished along with offer for examination by the purchaser.

3.5 The tenderer has to specify the rate of flow of gas from the nozzle and has to be agreed to by the purchaser. However, it should be possible to flood the entire HT compartment with fire extinguishing medium within 60 to 90 secs. Of manual/ automatic release command. The tenderer shall have to provide the details of pipeline being used to no. of bands and nozzles details to support the above release timings.

3.6 The control system of activation for release of gas from the cylinders interconnected in the manifold system shall be so designed that it should be possible to discharge gas from one cylinder only at a time if so required.

4. <u>OPERATING CONDITIONS</u> :

4.1 As the fire detection cum fire protection system are mounted on locomotives, they shall be subjected to considerable vibrational and buffers shocks during services. The vibrations and shocks normally encountered in service as indicated below;

a) Maximum vertical acceleration --- 1.0 g

b) Maximum longitudinal acceleration due to stock --- 3.0 g

c) Maximum transverse acceleration --- 2.0 g

4.2 The vibrations are of sine wave form and the frequency of vibration is between 1 Hz to 50 Hz. The amplitude 'a' expressed in millimeters is given as a function of f, by the equations

$a = 25/f$ for values of f from 1 Hz to 10 Hz.

$a = 250/f^2$ for values of f exceeding 10 Hz and up to 50 Hz.

4.3 In the direction corresponding to the longitudinal movement of the vehicle, the equipment is subjected for 2 min. to 50 Hz. Vibrations of such a value that the maximum acceleration is equal to 3 g.

Note : The vibration levels as indicated in clauses 2.2 & 2.3 has been proposed, the manufacturer shall take these factors into consideration while designing various components like control equipment panel, pressure & temperature sensor, fire fighting nozzles, pipeline etc. and other necessary mechanical features.

4.4 Ambient temperature :

The general ambient temperature of the engine room will be 0 degree to 65 degree (maximum) with relative humidity varying up to 100%

4.5 Maximum altitude :

1000 meters above sea level.

4.6 Terminal & Connections :

All electrical connections external to the unit shall be provided with terminals employing Hexagonal head bolts, nuts, washer and standards threaded lugs suitable to accommodate standard dowells cables lugs for 3 mm2 cross section of wiring with insulated cover for terminals.

4.7 All the terminals shall be of non ferrous high conducting metal, suitably plated with cadium to avoid corrosion and ensure good electrical contact.

4.8 It shall be possible to connect and disconnect cables from terminals with aid of standard & ordinary spanners and tools. No special tools shall be required. Adequate margin along with insulated separators will have to be provided to avoid short circuiting between terminals due to creepage.

4.9 Power availability 110 V DC nominal supplied from 72 Amps. hour lead acid battery fed by the battery charger is available in the locomotive. DC input voltage may vary from 120V to 70V. Negative terminal of the battery grounded on the locomotive chassis. The battery charger is fed from the auxiliary winding of the locomotive main transformer. The system being supplied shall employ its own fuse on the input side. In the event of this fuse failure, there shall be an indication by way of flash of red LED of 5mm size of annunciator and control unit.

4.10 The entire system being supplied shall have its own grounding arrangement without relying loco chassis ground.

5. OTHER CONDITIONS :

The control unit shall have electronic circuitry without moving parts relays etc. The PCBs shall be of fiber glass spread with a suitable protective compound to avoid damage by moisture fungi etc. PCBs in general shall conform to the clauses contained in IEC: 571-1. The system should have suitable protective device encountered during switches surges arise from the power circuit, traction circuit, auxiliary circuit and also the control circuit of the locomotive.

6. MECHANICAL FEATURES & ENCLOSURES :

The equipment shall be housed in a metallic enclosure, preferably cadmium plated and chrome passivated and shall be capable of mounting on any position including inverted position The equipment shall be also suitable to withstand vibrations that may be present in a locomotive running at 130 KMPH.

7. DEVIATION :

Any deviation from the standards laid down with a view for improving the performance, may be given due consideration provided, full particulars with justification, thereof, are furnished. It may, however, be noted that due to limited availability of space in the locomotives and the necessity to ensure interchangeability. Increase in the overall and mounting dimensions shall not be allowed normally.

8. DESIGN & WORKMANSHIP :

The equipment offered shall be ;

(a) Simple in design.
(b) Of good workmanship.
(c) Easy for maintenance and operation.
(d) Robust and Rugged in construction.

9. INSPECTIONS & TESTS :

9.1 The supply shall make available at least one prototype of the system proposed to be supplied by him for inspection and tests at his works and advise DG/RDSO/Lucknow or his authorised representative as and when he is ready with the prototype and necessary testing facilities for carrying out the tests.

9.2 The first stage of inspection shall comprise of the following;

i) Visual inspection.

ii) Testing of specified parameters in terms of related specification and /or OEMs illustrated catalouge /literature of all equipments, components and allied material.

iii) Testing of the whole system with regard to functional requirement and hauling conditions as specified in the specification.

9.3 The second stage of inspection will be conducted by the authorized representative of DG/RDSO/Lucknow after successful commissioning of the prototype system into one of the nominated locomotives. The equipment, components and allied material of the supplied system will be again inspected after inspection and commissioning of the locomotive for their efficacy and suitability in locomotive environment and purchaser will have right for not accepting a part or whole of the equipment system if it is considered to be causing infringement in normal working of the locomotive. During installation and commissioning, under no circumstances, major modification inside the locomotive will be permitted for installing the equipment by the tenderer. It shall be the responsibility of the supplier to suitably alter his layout if required in consultation with the purchaser.

9.4 The following tests will be carried out extra after installation and commissioning of the system on the locomotive;

i) <u>High Voltage Test</u> :

The terminal shall be short circuited and voltage of 110V AC RMS 50 Hz. will be supplied to the terminals and metallic portion connected to the earth for one minute which the equipment should able to stand .

ii) <u>Insulation Resistance Test</u> :

The insulation resistance shall be measured with the terminals shorted by using a 500V meger. The resistance value shall not be less than 1 mega ohm between line terminal and body earth.

9.5 After the above tests if it is considered necessary by DG RDSO Lucknow or authorized representative to carry out any tests or trials in the prototype on locomotive, the supplier will arrange for the same in the shorted possible time.

9.6 For checking the functional efficacy for the first prototype fire will be simulated inside the locomotive and operation of the system will be checked as per functional requirement laid down in the specification.

9.7 After the above inspection and tests, any shortcomings or defects in the design & workmanship of the system if pointed out, tenderer will have to incorporate the necessary improvements before bulk supply is commenced without affecting the gauranteed performance characteristics.

9.8 Supplier shall provide all facilities to the inspecting officer at his works to inspect and test the equipment at various stages of manufacture. For installation and commissioning of the system in the nominated locomotive at a nominated shed, supplier will arrange all necessary tools and plants required for the same, however electricity connections pneumatic supply and assistance of other minor tools and plants will be provided by the Railway at respective shed.

9.9 Any test or the approval by the purchaser during design and prototype shall in no way absolve the supplier of his responsibilities under the terms of the contract for the equipment supplied.

10. DESPATCH OF MATERIAL :

Supplier will arrange for supply of material for road transport at his own cost and risk. Any damage , defect , loss etc. during the transit shall be made good free of cost by the supplier. Materials so replaced /repaired will be further inspected as detailed above.

11. INSTALLATION & COMMISSIONING :

The installation of the equipment system will be done by tenderer under his own supervision/guidance or under the supervision/guidance of his nominated personnel.

12. TECHNICAL DOCUMENTS & DRAWINGS TO BE SUPPLIED BY SUCCESSFUL TENDERER AS A PART OF CONTRACT :

12.1 Drawing :

The supplier shall submit 6 copies of drawing for the complete unit of the equipment ordered on him within 5 weeks of receipt of purchase order to DG/RDSO/Lucknow for approval. Any discrepancy/ correction

considered necessary will be indicated on the drawing and the supplier shall take due note of them and affect supplies accordingly

12.2 Documentation:

The supplier shall prepare a maintenance instructions in the form of booklet in standard A4 size of paper for his equipment ordered. Beside maintenance instructions, these books must include full technical particulars, detailed dimensional drawings and description of every components which may require replacement before preparation of the final copy maintenance manual, a draft copy shall be submitted in duplicate within two months of the clearance of prototype system to DG/Electrical, RDSO/Lucknow for examination and incorporating corrections. One copy of the corrected draft shall be returned to the supplier duly signed by the DG/RDSO/Lucknow or his authorized representative. In all, supplier will have to supply one copy of maintenance manual for every two system supplied. Maintenance manual must incorporate details of recommended spared and consumeables along with their sources of supply for 3 years running maintenance.

After first stage of inspection as well as second stage of inspection, test report/test certificate will have to be prepared and will be jointly signed by the tenderer as well as purchaser. Duly signed test report/test certificate will only serve as a final acceptance of the supplied system by the purchaser.

13. PRICES & PAYMENT :

13.1 The tenderer shall quote prices separately for supply of material and installation/commissioning thereof. Also, a tenderer shall indicate prices of individual sub-assemblies , components and allied material he proposes to supply for the entire equipment system.

13.2 80% payment of accepted prices of equipments, components and allied material will be released upon acceptance of the same by the consignee. Balance 20% payment for equipments, components for inspection and commissioning will be released upon successful commissioning of the entire equipment system in the locomotive. However, such payments in part may also be released for successful commissioning on each individual locomotive.

14. GAURANTEE :

A supplier shall furnish a bank gaurantee warranty normal functioning of the equipment system supplied by him for an amount equal to 100% of supply and installation /commissioning of the equipment system along

with his bill claiming the payment for installation/commissioning. The bank gaurantee will remain valid for a period of 18 months from the receipt date of commissioning of the entire equipment system for its full ordered quantity.

15. CHECK LIST TO ACCOMPANY TENDER QUOTATION :

The tenderer shall inter- alia furnish the following information along with the quotation :

List - i) Clause-wise comments on the specification and test programmes

List - ii) List of recommended spares for maintenance of the *equipment.*

List - iii) Documentation and drawings.

List - iv) Credentials of the supplier/manufacturer in regard to facilities and capacity to manufacture and test the equipment offered, to meet fully the technical requirements of the specification and quality of material and workmanship.

List - v) Test programme for equipment to be offered for inspection, indicating threshold values of the sensors and scheme of tests to be conducted at supplier's premises, during inspection to prove the equipment.

List - vi) Layout of the proposed pneumatic & electric lines – in the locomotive for functioning of the fire detection/protection/extinguishing equipment.

List - vii) Details of the mechanical dimensions and weights of the equipment proposed to be supplied, Viz. ;

(a) Gas Cylinders - Numbers of cylinders, pressure of stored gas. volume of gas under pressure, weight (empty), weight (full) and dimensions.

(b) Control Unit - Length, breadth, height, weight.

©	Annunciators	-	Length, breadth, height, weight
(d)	Cables including heat sensing Cable	-	* Cross sections, * length * external diameters, * number / length of cables used.