INDIAN RAILWAYS

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Controlling Officer..... Anurag .....
Signature.....
Designation..... 05/09/24

Document content	Technical Specification	Yes
	Schedule of Technical Requirement	Yes
Description of item	SPECIFICATION FOR SUPPLY, INSTALLATION AND COMMISSIONING & MAINTENANCE OF "AUTOMATIC FIRE DETECTION CUM SUPPRESSION SYSTEM" (HIGH PRESSURE WATER MIST SYSTEM) FOR PANTRY CAR & GENERATOR CUM BRAKE VAN OF INDIAN RAILWAYS COACHES (ICF AND LHB DESIGN)	
Remarks	Nil	

S. No.	Month/Year of issue	Revision / Amendment	Page No.	Reason for Amendment
1.	February - 2023	-	-	First issue
2.	September-2024	Amendment No.1	All	• Standard data format and error codes. • Common USB port for data downloading. • Extension of Suppression system in luggage area and escorting staff area. • Annexure-A Schedule of technical requirements added.

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Research Designs and Standards Organization
Manak Nagar, Lucknow - 226011.

Signature	Nayan	Shyam	Anurag
Name & Designation	Prepared By:-Nayan Kumar SSE(D)/Carriage	Checked By:-Shyam Sankar SSE(D)/Carriage	Approved By:-Anurag Malik Jt. Director/Carriage

Amendment slip No. 1 of September 2024 to Specification No. Spec No. IS/RDSO/CG/S/22001 (Rev.-0) for Supply, Installation and Commissioning & Maintenance of "Automatic Fire Detection cum Suppression System" (High Pressure Water Mist System) for Pantry Car & Generator cum Brake Van of Indian Railways Coaches (ICF and LHB Design).

1. **Clause No. 4.1 modified and shall be read as under:**

The System designed shall be a proven and established technology/system on repute National/ International Railway systems. Documentary evidence along with proof of supply and satisfactory performance certificate (minimum 3 months successful functioning) from user Railway(s)/Rolling Stock manufacturer shall be provided by the Supplier/OEM.

In case, a supplier/OEM offering product which has not been fitted by any repute International Railway and product prima facie appears suitable and meeting technical and functional requirements, the same can be referred to RDSO to judge suitability of system for trial order to encourage the indigenous sources as per Make in India program. The system will be subjected to a 3 months' field trial after commissioning on IR system on minimum 2 coaches for checking and verifying the fitment, design and requirements as specified in this specification.

2. **Clause No. 4.2 table modified and shall be read as under:**

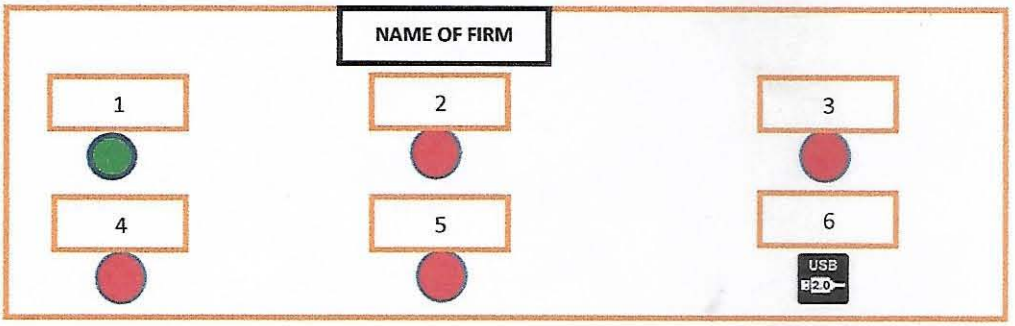
Documents Name/No	Description
ARGE Guideline Part 1	Fire Detection in Rolling Stock
ARGE Guideline Part-2	Fire Fighting in Rolling Stock
EN 50 121-3-2 2007	Railway applications – Electromagnetic compatibility – Rolling stock – Apparatus
EN 50 125-1 – 2014	Railway applications – Environmental conditions for equipment – Equipment on board rolling stock
EN 50 126 - 2017	Railway applications – The specification and demonstration of reliability, availability, maintainability and safety (RAMS);
EN 50 128 – 2012	Railway applications – Communications, signaling and processing systems – Software for railway control and protection systems;
EN 50 153 – 2014	Railway applications – Rolling stock – Protective provisions relating to electrical hazards
EN 50 155 – 2017	Railway applications – Electronic equipment used on rolling stock
IEC 61373-2010	Railway applications – Rolling stock equipment – Shock vibration tests
EN 50159-1 2010	Railway applications – Communication, signaling and processing systems – Part 1: Safety-related communication in closed transmission systems;
BS EN 45545-6:2013	Railway applications – Fire protection on railway vehicles – Part 6: Fire control and management systems
NFPA 750	Standard on Water Mist Fire Protection Systems
IS/ISO 7240-5 or EN 54-5	Point - type heat detectors
IS/ISO 7240-7 or EN 54-7	Point-type smoke detectors using scattered light, transmitted light or ionization
BS EN 50200:2015	Method of test for resistance to fire of unprotected small cables for use in emergency circuits.

3. **Clause No. 4.3.3 modified and shall be read as under:**

The water shall be stored in the suppressing agent reservoirs under a pressure of 200 ± 10% bars at the time of installation & commissioning and therefore, the reservoirs shall be filled with water along with nitrogen to generate the requisite pressure. Water mist as fire-fighting agent shall be insensitive enough against the influences of air coming into

the Pantry Cars/Generator-cum-Brake Van through the windows/doors. Alternatively, the system may also have two or more cylinders filled with water & with Nitrogen; the cylinders used in system should be certified by Petroleum and Explosives Safety Organization (PESO certified/approved agencies) against safety. The supplier/OEM will submit valid certificate to PUs/Zonal Railways during commissioning and should have validity minimum 4.5 years from the date of supply. The quantity of Nitrogen gas and Water used shall be suitable to cater to the fire load as detailed in para 4.3.5.

4. **Clause No. 4.3.3 modified and shall be read as under:**
For monitoring the readiness for working, the reservoirs shall be provided with pressure gauges. Further, there should also be provision for audio indication on control panel whenever solenoid coil or solenoid valve is disconnected with Nitrogen cylinder head. The display needs to be uniform across all OEM's. tentative layout of common screen/ interface is as below.



150mmX100mm

1. POWER ON
2. ISOLATION OF NITROGEN CYLINDER
3. SMOKE ALERT
4. HEAT ALERT FROM DG AREA
5. HEAT ALERT FROM LUGGAGE AREA
6. USB 2.0 port

5. **Clause No. 4.3.4(viii) modified and shall be read as under**
The luggage compartment of power car will be protected with Linear Heat Detector (LHD) cable (UL or EN approved, 105-110 deg C, approx. 20 meters). The system should be so designed that on receiving a fire signal from luggage compartment, the buzzer should sound and DG set(s) should shutdown. Activation of suppression system should take place automatically in luggage portion whenever fire signal is received from luggage compartment. Sensor installation/protection should be robust enough to prevent damage during luggage loading/unloading. Provision of High pressure water mist based fire suppression system along with associated piping, solenoid valves, sectioning valves, nozzles etc. in luggage area of Power car.

6. **Clause No. 4.3.4 (x) (new clause) added.**
Provision of High pressure water mist based fire suppression system along with associated piping, solenoid valves, sectioning valves, nozzles is also to be provided in escorting staff area/storage area of Pantry car. On activation of smoke alarm through smoke detector in escorting staff area/ storage area of Pantry car, the fire suppression is to be activated manually in the escorting staff area/ storage area of Pantry car only after shutting down of DG set/power supply. Thus the system should have the capability to differentiate the location of fire alarm and sectioning valves should be so programmed that suppression system should activate only in the area from where fire alarm is generated.

7. **Clause No. 4.3.11 (New clause) added.**

Two-digit Error code for FDSS system should be as per following format:

S. No.	For FSDS System Error codes are as per below	
	Error Description	Error Code
1.	Wiring Break/Electrical discontinuity within the system	E1
2.	Networking fault in Smoke & Fire detection circuit	E2
3.	Nitrogen cylinder Solenoid coil disconnected mechanically	E3
4.	Nitrogen cylinder Solenoid coil disconnected electrically	E4
5.	Alert due to Smoke detector with location	A1
6.	Alert due to Heat detector or LHD with location	A2
7.	System functional without any error	00

8. **Clause No. 4.3.12 (New clause) added.**

Data downloaded from Fire Detection cum Suppression System (FDSS) shall be as per following format along with details of coach no and FDSS make:

S. No.	Date and time of activation of suppression	Trouble /Error id	Message address etc.
1.			

9. **Clause No. 5.3 of (New clause) added.**

USB 2.0 output port for data downloading on Fire Detection cum Suppression System (FDSS) Control Panel at suitable location to be provided for event log extraction during service & maintenance. It should be possible to download the data through Pen-drive also.

10. **Clause No. 5.4 of (New clause) added.**

All Manual activation switches should be provided with protective covering to avoid any un-intentional activation of suppression system.

11. **Clause No. – 8.3.1 (New clause) added.**

The price proposal for refilling of Nitrogen cylinder, water cylinder and recertification-cum-refilling of Nitrogen cylinder should be quoted along with the tender. PUs to advise these details to Zonal Railways along with coach details. Further, filling of Nitrogen cylinder will be allowed to be carried out by PESO certified/approved agencies. Suppliers/OEM will provide the training to field staff towards taking out as well as re-installation of Nitrogen cylinder including written guidelines for the same for ready reference of Zonal Railways.

12. **Clause No. 10.1 modified and shall be read as under:**

The prototype approval of the complete system will be done by RDSO. Prototype approval shall be done by actual fitment on a coach and successful functional test as per this specification.

13. **Clause No. 10.4 deleted:**

14. **Clause No. 12.0 (12.3.4) (new clause) added.**
Real Time Clock (RTC) battery to be changed after every 36 months.

ANNEXURE-A

[RDSO SPECIFICATION No. IS/RDSO/CG/S/22001amend-1]
(INFRASTRUCTURAL REQUIREMENT)

1. **Scope:**

This section covers the infrastructural requirement for Supply, Installation and Commissioning & Maintenance of "Automatic Fire Detection cum Suppression System" (High Pressure Water Mist System) for Pantry Car & Generator cum Brake Van of Indian Railways Coaches (ICF and LHB Design).

2. **Requirements:**

All the vendors seeking registration with Indian Railways shall comply with all the requirements mentioned below:

3. **Manufacturing Facilities:**

3.1. The manufacturer shall have adequate space and covered area with cemented floor to accommodate the following.

a) Damp free place for storage of raw material and finished products.
b) Independent Manufacturing area
c) Inspection area

3.2. Firm shall have following minimum M&P and Infrastructure at their works:

i) In Circuit Debugger / tester.
ii) Regulated DC power supplies.
iii) Microcomputer based and computer aided design system with workstations for R&D which will be, needed for failure investigation and future up-gradation
iv) Other regular tools like Hot Air gun, Thermocouple, Measuring tape, measuring scale, magnifying glass, screw drivers, cutting tools, crimping tools etc. used for manufacturing, electronic assembly line, inspection and testing of FDSS working.

3.3. Clean room for electronic product manufacturing/assembly.

3.4. Ultrasonic cleaner (suitable for volume production cleaning) for assembled PCB's to prevent field failure of assemblies due to PCB surface impurities in high moisture/ humidity environments.

3.5. Dust free environment for assembly of electronic modules. Assembly area should have electro static discharge protection in line with IS:10087-1981(Anti-static mat in assembly area and wrist band earthed with anti-static mat)

4. **Testing Facilities:**

4.1. Firm should have following minimum testing facilities at their works:

i) Smoke generator test equipment as per "ARGE Guideline-Part 1" for functional test on smoke detectors.
ii) Hot wire testing facility as per Annexure-1 of RDSO spec RDSO/2008/CG-04.
iii) Insulation tester.
iv) Digital Multi-meter with basic DC Voltage accuracy of at-least 0.5%.
v) Test Jigs.
vi) Any other test equipment considered necessary for product's reliability.
vii) Instruments to measure static charges.

4.2. The firm should have either in-house arrangement or tie-up with accredited agency for periodical calibration of all the equipment and test instruments.

5. INSPECTION TESTING:

5.1. General

5.1.1 Only after the detail drawings/documents and Design have been approved and the clearance given to this effect, the manufacturer shall take up the manufacture of the prototype. It is to be clearly understood that any changes, required to be done in the prototype or any additional tests other than specified herein are required to be conducted on the prototype unit or its components, they shall be done expeditiously. During the process of manufacture of the equipment, if the approving authority so desires, it may conduct/repeat any of the routine or additional tests to satisfy that the quality of the module being manufactured is of the required standards.

5.1.2 The test protocol indicating relevant clause of the test, condition of the test, specified value and observed value of the parameter for FDSS shall be submitted by the firm before offering the sample for testing.

5.1.3 Vendor Approving Authority may conduct surprise check on manufacturing process and quality control along with any of the tests to ensure quality of product and its conformance to this specification.

5.2. Inspection Testing

The tests shall be carried out at the works of the manufacturer in presence of Indian Railway representative on a prototype system as per relevant governing specifications modified or amplified. The manufacturer shall have all possible necessary arrangements for inspection and testing of the system.

5.2.1 Routine Tests:

The following shall comprise the routine tests and shall be conducted by the manufacturer in-house on every equipment and the test results will be submitted to the inspection authority before the inspection. The application software in proper format shall also be submitted to the inspection authority in advance.

5.2.1.1 Insulation Resistance Tests:

Insulation test shall be done between shorted terminals of supply port and the metallic portion of the enclosure at 500V DC.

Apply AC voltage of 1000V, 50Hz between the metal rack and the short-circuited points of power supply connector for one minute. (Neither disruptive discharge nor flash-over shall occur).

Functionality test shall also be performed subsequent to these tests.

5.2.1.2 Performance test:

All the units shall be tested for their functionality as required in service condition as per this specifications design requirements. To simulate such condition in test lab a PC based simulator shall be specially developed for this purpose by the manufacturer. '

5.2.1.3 Reverse Polarity test:

The system shall be functional after applying 160V DC for one minute in the correct polarity as well as in the reverse polarity to check the polarity of connection in case of 110 V DC supply. In case a DC-DC converter is used the same shall be applied to the DC-DC converter with full connected load.

5.2.1.4 System level functional tests:

a) Constructional details.
b) Dimensional check.
c) General Workmanship.

d) Configuration.
e) Cables for electrical connections should be properly harnessed with cable channel/tray or into ducts having adequate fire retardancy.

5.2.1.5 Visual inspection of complete system:

During visual test general workmanship, connector, cable and wiring shall be checked of the system. Dimensions shall as per approved drawing. The visual inspection shall broadly include:

a) Indications and displays.
b) Mounting and clamping of connectors.
c) Proper housing of cards.
d) Visual inspection system (with magnifying lens/CCD camera) or Automatic optical inspection unit.

Any other tests shall be carried out as considered necessary by the purchaser.

5.2.2 Acceptance Test:

As per clause 11.0 of this specification.

5.2.3 Installation & Commissioning testing:

The contractor shall carry out Commissioning test on completed coach at Railways. The contractor shall submit all test documents, test procedures and check sheets. Proforma to be followed for installation & commissioning tests as per clause 11.0 of this specification.

5.3. **Batch Testing of FDSS.**

i) Certificate of conformance to be provided for FDSS from OEM. Lot wise test record shall be maintained which may be verified by the inspecting officials.
ii) Manufacturer shall maintain proper account of FDSS being used. The record shall include various details like source of supply, procurement invoice no. and date, quantity, incoming rejection, lot-wise consumption etc. which may be verified by the inspecting officials.

6. **QUALITY CONTROL REQUIREMENTS**

6.1 The firm should have acquired ISO: 9001certification from the agency accredited by an accreditation body which is a part of International Accreditation Forum (IAF), and the product for which the approval is sought should be broadly covered in the scope of the certification for manufacture and supply.

6.2 The Quality manual of the firm for ISO: 9001 should clearly indicate at every stage the control over manufacturing and testing of the said railway product.

6.3 There should be a system to ensure the traceability of the product from raw material stage to finished product stage. The system should also facilitate to identify the raw material composition from the finish product stage.

6.4 It should be ensured that there is a Quality Assurance Plan for the product detailing the following various aspects.

- Organization chart
- Process flow chart
- Process control chart
- Stage inspection details from the raw material stage to finish product stage.
- Various Parameters to be checked and level of acceptance of such parameters indicated and method to ensure control over them.
- Disposal system of rejected raw material and components

6.5 There should be at least one full time technologist having a minimum Master's degree in relevant field with experience of at least 3 years or Bachelor's degree in relevant field with experience of at least 5 years or a person with Diploma in relevant field with 12 years' experience. He should be free from day-to-day production, testing and quality control responsibilities. He should be mainly responsible for development of a product, analysis of products, control over raw material, and corrective action in case of difficulties in achieving the parameters.

6.6 Ensure that the in-charge of the Quality Control Section is having a qualification of minimum Master's degree in relevant field with experience of at least 3 years or Bachelor's degree in the relevant field with a minimum of 5 years' experience or alternatively he should be a Diploma holder with minimum of 12 years' experience. He should be actively involved in day-to-day activities of quality control / stage inspection / compliance of QAP etc.

6.7 The firm must ensure that proper analysis is being done on monthly basis to examine the rejections at various internal stages and it is documented.

6.8 The firm should ensure that latest version all the relevant specifications, IS Standards are available with the firm.

Note: - SN 3.4 can be outsourced to ISO certified firm. MOU with sub vendor along with QAP and M&P shall be submitted to RDSO for prior approval RDSO official may visit to the premises of sub vendor for physical verification.

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1. INTRODUCTION:

Generator-cum-Brake Van and Pantry Car of IR Coaches (AC and Non-AC) of both ICF & LHB Design shall be equipped with automatic fire detection cum suppression system.

As per Technical Description of Generator cum brake van, Fire suppressing equipment is based on the use of high pressure water mist to fight a fire. Accordingly, the fire suppressing system shall be a high pressure water mist system. The fire suppression effect of water mist shall be due to the large total surface area of the droplets and the high rate of speed at which they shall turn to water mist, thus absorbing the energy of fire. The average droplet of the system, yield a total surface area at least 100 times greater than conventional sprinkler droplets for the same volume of water. Therefore, much smaller amount of water shall be required by mist system to absorb the equivalent amount of energy from the fire. The water shall have to be forced at high velocity through specially designed nozzles arranged on spray heads and covering highly inflammable areas including DG set, filters of power car and cooking area of pantry car etc. In addition to automatic fire suppression there will also be a provision of manual actuation of fire suppression system in case of Pre-alarm or other exigencies.

(Note: Railway Board has already advised for prohibition of flame cooking in Pantry Car and to modify Pantry Cars to flame free cooking, thus it is expected that all pantry cars will be modified to electricity based cooking system to facilitate the retro fitment of automatic fire detection cum suppression system)

2. SCOPE OF WORK:

Scope of work covers the provision of automatic fire detection cum suppression system in Power /Pantry cars of LHB and ICF design coaches. Supply, installation & commissioning of the complete system will be in the scope of tenderer.

The main system components of the supply would include following:

a) Smoke detectors (point type) for detecting smoke in generator area, escorting staff compartment and Guard compartment etc. of power car and Smoke detectors (point type) for detecting smoke in Store room, manager's room and pantry staff area etc. of Pantry car.
b) Heat detectors (point type) in Generator area of Power car and in pantry area of Pantry car
c) Linear Heat detection (LHD) cable in Generator area as well as luggage area of Power car and in pantry area of Pantry car.
d) High pressure water mist based automatic fire suppression system along with associated piping, solenoid valve, nozzles etc. in generator area of Power car and in pantry area of Pantry car.
e) Control panel along with associated accessories for system operation.

f) Buzzer (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), flasher light, electrical wiring etc.

g) Any other material required to make the system fully functional and operational without any constraints.

h) The cables used shall be fire survival cables.

i) The supplier/OEM will ensure provision of following signage in bilingual form (Hindi and English) at locations where operator attention is required:

1) Operating instructions in the form of information boards or inscriptions are to be intelligible to everyone. These information boards or inscriptions are to be made in the form of pictographs to the extent possible. If written instructions are required, these are to be provided in a bilingual version, i.e. Hindi and English.
2) Danger signs for high pressure vessels and high pressure pipeline.
3) Step by step detailed instructions to operate the system manually.

3. OPERATING CONDITIONS:

The system supplied should work satisfactorily under the following operating conditions of IR coaches:

3.1 COACH DYNAMICS:

Equipment shall withstand satisfactorily the vibrations and shocks normally encountered in service as indicated below:

i)	Maximum vertical acceleration	1.0g
ii)	Maximum longitudinal acceleration	3.0g
iii)	Maximum transverse acceleration	2.0g

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

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

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

3.2 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 3g.

3.3 Coach-body displacement encountered under dynamic conditions:

i)	Vertically-	±100 mm
ii)	Laterally -	±55 mm
iii)	Longitudinally-	±10 mm
iv)	Bogie rotation about center pivot-	$\pm 4^0$

3.4 Ambient Conditions:

(i) Ambient temperature : 1° C to 50° C
Max. temperature under Sun: 70° C
Relative humidity : 20% to 95%

(ii) The rainfall is fairly heavy.

(iii) During dry weather, the atmosphere is likely to be dusty.

(iv) Temperature variations can be quite high in the same journey or short period of time.

(v) Coaches operate in coastal areas with continued exposure to salt laden air.

3.5 Coach Inside Condition:

Inside condition of the coach may be considered as under:

i) The ambient conditions may be similar as mentioned under para 3.4 above. The system should cater both Air Conditioned & Non Air Conditioned versions of Generator cum brake van/Pantry car coaches. There is no control in temperature for non-AC Pantry Cars/Generator-cum-Brake Van. In summers the value of upper range of the temperature may go up to 70^0C near the roof ceiling above the cooking Hobs in Pantry Cars. There may be remarkable variation in temperature inside of the coach from floor to roof level in both these types of coaches.

ii) Wind flow speed nearby the window portion (for Non-AC stock) may be considered more than the specified speed of the non-AC Pantry Cars /Generator-cum-Brake Van, as windows may remain opened.

iii) The coach length over coupler is approximately 24 meter for LHB coaches and 22.3 meters in ICF type coaches.

iv) Area to be covered by the system for fire suppression is cooking area in pantry car & DG set area in Generator Car which are having approx. dimensions tabulated as under:

Coach Type	ICF Design			LHB Design		
	Length	Width	Height	Length	Width	Height
Pantry Car	8034	3045	2400	10740	3070	2400
Generator cum Brake Van (with two DG Set)	7440	3045	2400	10230	3070	2400
Generator cum Brake Van (with Single DG Set)	-	-	-	5720	3070	2400

Necessary detailed layout drawing indicating the areas to be covered are enclosed at Annexure –I, II, III, IV, V & VI.

3.6 Power, Supply:

110±30% Volt DC supply with 15% ripple content is available from the coach circuits. For main source of supply to The System the supplier/OEMs shall convert the voltage from coach circuit as per their requirements. For standby source of supply, battery and battery charger or other means of standby source of supply to The System shall be used.

4.0 DESIGN REQUIREMENTS:

4.1 The System designed shall be a proven and established technology/system on repute National/ International Railway systems. Documentary evidence along with proof of supply and satisfactory performance certificate (minimum 3 months successful functioning) from user Railway(s)/Rolling Stock manufacturer shall be provided by the Supplier/OEM.

In case, a supplier/OEM offering product which has not been fitted by any repute International Railway and product prima facie appears suitable and meeting technical and functional requirements, the same can be referred to RDSO to judge suitability of system for trial order to encourage the indigenous sources as per Make in India program.

4.1.1 Application for registration shall be considered from OEMs or from companies entering into a valid MOU/Agreement with OEM as defined above. The MOU should clearly state that the OEM undertakes to fulfill the warranty and support obligations with respect to technology up-gradations as and when required for the system assembly, even in case the MOU is rescinded at some later stage.

4.2 Following relevant standards (latest version) may be referred unless specified otherwise, the latest version of the relevant standards shall be taken as reference:

Documents Name/No.	Description
ARGE Guideline Part 1	Fire Detection in Rolling Stock
ARGE Guideline Part-2	Fire Fighting in Rolling Stock
EN 50 121-3-2 2007	Railway applications – Electromagnetic compatibility – Rolling stock – Apparatus
EN 50 125-1 – 2014	Railway applications – Environmental conditions for equipment – Equipment on board rolling stock
EN 50 126 - 2017	Railway applications – The specification and demonstration of reliability, availability, maintainability and safety (RAMS);
EN 50 128 – 2012	Railway applications – Communications, signaling and processing systems – Software for railway control and protection systems;
EN 50 153 – 2014	Railway applications – Rolling stock – Protective provisions relating to electrical hazards

EN 50 155 – 2017	Railway applications – Electronic equipment used on rolling stock
IEC 61373 - 2010	Railway applications – Rolling stock equipment – Shock and vibration tests
EN 50159-1 2010	Railway applications – Communication, signaling and processing systems – Part 1: Safety-related communication in closed transmission systems;
BS EN 45545-6 :2013	Railway applications – Fire protection on railway vehicles – Part 6: Fire control and management systems
NFPA 750	Standard on Water Mist Fire Protection Systems

The supplier/OEM should be a member of ARGE or NFPA and the product(s) should have IBS or IFAB or Vds or TUV or FM or UL or LPCB/LPS approvals/certificates.

4.3 The System shall be designed to detect smoke particles/elevated heat for detection cum automatic suppression of all type of fires and shall be capable to protect adequately Generator-cum-Brake Van/Pantry car. The system shall be compact, lightweight and highly reliable & robust in design.

The working of the fire suppressing equipment shall be as follows:

4.3.1 The water shall be stored in the suppressing agent reservoirs under a pressure of 200 ± 10% bars at the time of installation & commissioning and therefore, the reservoirs shall be filled with water along with nitrogen to generate the requisite pressure. Water mist as fire-fighting agent shall be insensitive enough against the influences of air coming into the Pantry Cars/Generator-cum-Brake Van through the windows/doors. Alternatively, the system may also have two or more cylinders filled with water & with Nitrogen; the cylinders used in system should be certified by Petroleum and Explosives Safety Organization (PESO) against safety. The supplier/OEM will submit valid certificate to PUs/Zonal Railways during commissioning and should have validity minimum 4.5 years from the date of supply. The quantity of Nitrogen gas and Water used shall be suitable to cater to the fire load as detailed in para 4.3.5.

4.3.2 The fire suppressing equipment shall be automatically operated in the event of fire incidence. The pressure on the reservoir shall push the water from the reservoirs through the hoses, the manifold and the fire suppressing pipes to the nozzles. The nozzles shall produce fine water mist of 0.01 mm to 0.1mm diameter typically. The arrangement should ensure that the droplets of mist have a huge reaction surface compared to the volume of water (typically 200 m^2/litre of water) and absorb large amounts of energy from the fire which shall lead to an immediate drop in temperature in the surroundings. Due to the rapid transformation of the droplets into stream, large quantities of energy should be

additionally absorbed. The volume of the water should increase by evaporation (typically 1640-fold) and reduce the amount of oxygen at the source of the fire.

4.3.3 For monitoring of the readiness for working, the reservoirs shall be provided with pressure gauges.

4.3.4 The requirements of Automatic fire detection cum suppression system shall be as below:

(i)

a) Generator cum brake van having two onboard DG set: Provision of separate point type smoke detectors (to EN 54-7, ~3%obs/m) and heat detectors (to EN 54-5, ~90 deg C) over each DG set A and B (total 2 + 2 =4 nos.) as well as Linear Heat Detector (LHD) cable (UL or EN approved, 105-110 deg C, approx. 30 meters) in ceiling above Gen-sets. Smoke detectors will provide pre-alarm, while heat detectors or LHD cable will provide fire alarm as well as automatic actuation of Fire Suppression System.

b) Generator cum brake van having one onboard DG-set: Provision of separate point type smoke detector (to EN 54-7, ~3%obs/m) and heat detector (to EN 54-5, ~90 deg C) over DG set (total 1 + 1 =2 nos.) as well as Linear Heat Detector (LHD) cable (UL or EN approved, 105-110 deg C, approx. 18 meters) in ceiling above Gen-set. Smoke detector will provide pre-alarm, while heat detector or LHD cable will provide fire alarm as well as automatic actuation of Fire Suppression System.

c) Pantry car: Heat detectors (to EN 54-5, ~90 deg C) two nos. in Hot Buffet/Pantry area, as well as Linear Heat Detector (LHD) cable (UL or EN approved, 105-110 deg C, approx. 30 meters) in ceiling of hot buffet/pantry car. Heat detectors or LHD cable will provide fire alarm as well as automatic actuation of Fire Suppression System.

d) There shall be provision of point type smoke detector (to EN 54-7, ~3%obs/m) in escorting staff room compartment, Guard room etc. in Power car and Manager room, pantry staff room, store room etc. in Pantry car. Smoke detection in these areas will provide Pre-alarm at control panel.

(ii) For Automatic actuation of the Fire Suppression System, electrically operated solenoid valve duly rated for at-least 200 bar +10% interfaced to the control unit shall be fitted on actuation cylinder(s). The supplier shall submit the documents to demonstrate that the valve supplied is suitable for application. The health / continuity of wiring to the solenoid valve shall be continuously monitored by the control unit.

(iii) After 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 shutdown

signal to DG set controller through potential free relay contacts and thereafter initiate automatic fire suppression system. In any case, automatic activation should be initiated within 30 seconds of sending shutdown command to DG set.

(iv) 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. For it, 02 pair of auxiliary NC contacts (suitable for 430V AC 02 Amp inductive load) from the fire detection cum suppression system to be terminated on terminal block of adequate size similar to X1 of switch board cabinet as per RCF specification no. EDTS- 134 in fire detection cum suppression system cubicle for switching the supply in case of fire/smoke. Wiring (4 wire) from these terminal blocks of fire detection cum suppression system shall be terminated on spare terminal blocks X1 of switch board cabinet.

Further, wiring between terminal block X1 of SBC and respective switchgear (K1 & amp; K2 – 750V AC feeder contactor) for tripping/interlock with main feeder selection contactors supply shall be carried out in supervision of concerned Electrical Department of Workshop/PUs.

(v) During fitment of the system following to be ensured:

a) Positive and negative wire of 110 V DC supply shall be segregated by placing them in separate conduits.

b) All equipment/ materials shall be UL 94 V0 Grade fire retardant as per approved sources of RDSO/RCF/ICF/MCF.

c) "Code of practice for prevention of fire in AC coaches" No. RDSO/PE/0/0008- 2005(Rev.'0') for wiring shall be followed.

d) "System specification and code of practice for wiring for 110 V DC self-generation train lighting system" no. EL/TL/48-2005(Rev.'1') and "Code of practice for Train Lighting Maintenance on Prevention of fire" no. EL/TL/56 shall be strictly followed for wiring circuit of Fire Detection System.

e) All cables shall be E-beam irradiated with copper conductor as per RDSO Spec no. ELRS/SPEC/ELC/0019(Rev'4') up to 750 V grade and procured from RDSO approved sources.

(vi) Automatic fire detection cum suppression system will be operated in manual mode in ICF pantry cars till such time the flame based cooking is modified to flame free cooking.

(vii) In case of Fire detection, an acoustic signal shall be generated by a buzzer located on the appropriate position such as managers room/escorting staff

cabin etc. The staff in the manager's room/ escorting staff compartment will then check whether there is a fire in the Pantry Car/Generator-cum-Brake Van.

(viii) The luggage compartment of power car will be protected with Linear Heat Detector (LHD) cable (UL or EN approved, 105-110 deg C, approx. 20 meters). The system should be so designed that on receiving a fire signal from luggage compartment, the buzzer should sound and DG set(s) should shutdown. Activation of suppression system should not take place automatically. Sensor installation/protection should be robust enough to prevent damage during luggage loading/unloading.

(ix) The System shall be designed for self-diagnostic to any failure/trouble within The System i.e. wiring break within the system, discontinuity in the smoke and fire detection circuit etc.

4.3.5 The capacity of fire suppressing system in the Pantry Car/Generator-cum-Brake Van should be such that the fire occurring in these coaches can be suppressed. The discharge time calculation should be tested and proven according to ARGE Guidelines. The fire load should be minimum 1.8 MW. The supplier/OEMs who wish to supply against the specification will be required to prove the efficacy of their system by submitting lab report according to ARGE Guidelines during prototype approval.

4.3.6 It may be noted that apart from other reasons, fire may occur in the Pantry Car/Generator-cum-Brake Van on account of following:

- Combustion engines due to combustible liquids (Diesel, motor oil etc.)
- Electrical components,
- Cables& cable ducts,
- Control cabinets
- Batteries in plastic casings

4.3.7 The fire suppressing system shall be suitable for the use in railway vehicles, i.e. a safe functioning should be ensured for all operating conditions. It shall be ensured that the operating/running conditions of railway coaches do not result in unintentional release of the fire suppressing system i.e. system shall be operative only for automatic suppression/manual activation.

4.3.8 The refilling of used suppressing agent shall be easy and simple. Sources and method of filling should be clearly indicated. The water cylinders should have special plastic lining/coating from inside the cylinder to avoiding corrosion. The related documentary evidence in the form of self-certification to be attached along with offer.

4.3.9 The fire suppressing system shall have automatic and an easy manual control and release. The operating mechanism shall be easily accessible. Operating instructions in the form of information boards or inscriptions are to be intelligible to everyone. These information boards or inscriptions shall be made in the form

of pictographs to the extent possible. Written instructions shall be provided by the supplier/OEM in a bilingual version, i.e. Hindi and English.

4.3.10 During installation & commissioning as well as during preventive maintenance visits, the supplier/OEM will give a certificate about proper securing of pressure vessels and pipelines etc. duly declaring that it will not behave in any dangerous manner when subjected to high pressure during operation. Supplier/OEM will also ensure that protective covers are used wherever required, however, no hindrance to operation should be there and a certificate for the same to be submitted at the time of installation.

5.0 Interface with the Car-body:

5.1 The supplier/OEM will be required to submit the general layout drawing including the fixing dimensions, tolerances and mounting arrangement of fire detection & suppression system showing all components.

5.2 **Control panel:**

The control panel (term also includes any sub panel for main/standby source of power supply if separately provided) will display indication of various alarms used during detection of fire incidence. The design of Control Panel should be modular, compact and should have easy fitment. The supplier shall indicate its size, location and fixing arrangement. The control panel should have minimum IP54 protection from dust and water. All the supplier/OEMs will have to obtain EN50155 certification for control panel.

6.0 System Description:

6.1 The minimum 50 litre 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 to meet the criteria in para 4.3.5. Alternatively, the system may also have two or more cylinders filled with water & with Nitrogen.

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.

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.

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.

6.2 The supplier/OEM shall submit detailed calculation for the size of pressuring cylinder, water cylinder and no. of nozzles along with the offer.

7.0 Mechanical strength requirements:

i) Fire suppression system shall meet the mechanical strength requirements as the Pantry Cars/Generator-cum-Brake Van running on Indian Railways are designed for a service life of 35 years. The fire suppression system is to be developed and assembled accordingly.

ii) **Resistance to vermin**:

Selection of the materials (insulation, sealant, rubber, etc.) should be done with due consideration to their resistance to vermin (e.g. termites).

iii) **Climatic conditions**:

During normal operation, the generator room is forced-ventilated so the temperature reaches≥65°C. However, temperatures may rise in the generator room when the vehicle stops because of compressive heat. Furthermore, rise of temperature may occur at unfavourable places (especially due to closing of the exhaust system of the diesel engine).

During normal operation, the kitchen area is used for cooking food etc. so the temperature reaches ≥70°C.

8.0 Warranty

8.1 Supplier/OEMs shall be liable for warranty of 36 months from the date of commissioning/48 months from date of supply whichever is earlier. During warranty the supplier/OEM shall rectify the equipment by repairing or replacing the components with original spares at his cost. The warranty period would get extended on a pro-rata basis if warranty repairs/replacements are not provided within 5 days of notice. If the supplier/OEMs fail to provide warranty services within 5 days of notice, Railway reserves the right to take the action as per extant rules. Supplier/OEM will replace the standby source of power supply at his/her own cost during warranty if the codal life of the standby source happens to be less than 48 months.

8.2 Supplier/OEMs shall ensure the availability of spare parts of supplied system for a period of at least 10 years. The price proposal for spares/consumables shall also be submitted, with the offer, separately.

8.3 In case of fire incidence, or testing (other than testing during prototype approval) done by Railways causing fire suppressing agent to get exhausted then Zonal Railways in co-ordination with OEM will get it recharged and the cost of refilling will be borne by Railways. However, loss of fire-suppressing agent due to poor workmanship, manufacturing defects, leakages, poor design etc., warranty

replacement shall be provided by the supplier/OEM at its own cost during warranty.

8.4 Two preventive maintenance visits during warranty period by the supplier/OEM has to be undertaken at the time of 1st and 2nd POH (for ICF coaches) or during SS1 and SS2 schedule (for LHB coaches).

9.0 Documentations & Training:

9.1 **The supplier/OEM shall provide the following documents:**

i) Operating and maintenance instructions.
ii) Periodic maintenance schedule (daily/trip/monthly) if any.
iii) Any recommended test instructions/procedures to be followed.
iv) Schematic diagram of installation & commissioning and their instructions.
v) List of spare parts.
vi) List of consumables if any.
vii) Details of critical items and their Technical data sheets e.g. smoke/heat detectors, nozzles, pipes and fitting, cylinders etc.
viii) List of do's and don'ts.

9.2 **Training:**

(i) The supplier/OEM will provide theoretical and practical training to the staff of Workshop and Divisions for a period of one day and will also explain the function of the system installed.

(ii) The supplier/OEM shall also submit the list and details of testing equipments required for testing of the system periodically.

10.0 Testing of Prototype

10.1 The prototype approval of the complete system will be done by PUs/Zonal Railways. Prototype approval shall be done by actual fitment on a coach and successful functional test as per this specification.

10.2 During prototype approval supplier/OEM will also submit all relevant certificates along with documentation mentioned at Para 9.1.

10.3 Suppliers, whose prototype approval has already been done by ICF/MCF/RCF (any one or more), will not require prototype approval by Zonal Railways.

10.4 For supplier whose prototype approval is not done by any of the PUs and are supplying to Zonal Railways, the prototype approval will be conducted by Zonal railways and the prototype approval by that Zonal Railways will be considered for future references by other Zonal Railways.

11.0 Proforma for testing of automatic fire detection cum suppression system against RDSO spec No. RDSO/2013/CG06 during installation & commissioning

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/cm^2		
2.	Smoke/Heat detector physical condition	Sensor 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: 1. Buzzer and flasher light should activate 2. Controller should give indication of Smoke alarm		
4*.	Demonstration of manual activation of suppression system	On simulating smoke: 1. Buzzer and flasher light should activate 2. Controller should give indication of Smoke alarm 3. 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 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: 1. Buzzer and flasher light should activate 2. 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: 1. Buzzer and flasher light should activate 2. 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 and 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: 1. Buzzer and flasher light should activate 2. Controller should give indication of Fire alarm and controller should give potential free signal for shutting down the Gen-set/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.		
10.	Demonstration of Faults	Self-diagnostic feature in system to be demonstrated		

*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 electrical continuity of coil of solenoid valve to be also checked with multimeter.

Note:-

(i) Smoke should be simulated by Smoke Generator / Burning Incense Stick etc.

(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°C temperature at sensor.

(iii) Functionality of high pressure water mist suppression system is to be checked (100% during prototype approval, on sample basis otherwise) 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. Zonal Railways/Workshops may ensure that empty cylinders are recharged before dispatch of Power/Pantry cars.

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

11.1 **Proforma for testing by open-line for regular maintenance:**

FOR LHB COACHES

S. No.	Schedule	Details
1.	D2	i) Check suppression system pressure in Nitrogen cylinder. If pressure is less than 150kg/cm^2, inform the supplier/OEM for further guidance. ii) Check smoke and heat detectors physical condition if required, clean it with soft cloth in-situ.
2.	D3	i) Carryout smoke detection test for point type smoke detector ii) Check condition of pipe line. Pipe line should be securely clamped. Check the condition of nozzles. Nozzles should be free from deposition of dust soot etc.
3.	SS1	Carryout heat detection test for point type heat detectors. System integrity at least up to activation signal of solenoid valve to be ensured
4.	POH	Complete testing of the system

All activities of preceding schedule must be carried out during succeeding schedule.

FOR ICF COACHES

S. No.	Schedule	Details
1.	A	i) Check suppression system pressure in Nitrogen cylinder. If pressure is less than 150kg/cm^2, inform the supplier /OEM for further guidance. ii) Check smoke and heat detectors physical condition if required, clean it with soft cloth in-situ.
2.	B	i) Carryout smoke detection test for point type smoke detector ii) Check condition of pipe line. Pipe line should be securely clamped. Check the condition of nozzles. Nozzles should be free from deposition of dust soot etc.
3.	IOH	Carryout heat detection test for point type heat detectors. System integrity at least up to activation signal of solenoid valve to be ensured
4.	POH	Complete testing of the system

All activities of preceding schedule must be carried out during succeeding schedule.

12.0 MAINTENANCE:

12.1 The supplier/OEM shall be liable for all scheduled and un-scheduled repairs of all The Systems installed by them for the satisfactory performance of The System for the entire warranty period.

12.2 The supplier/OEM shall also give an offer for carrying out the Annual maintenance of The System beyond the warranty period if consignee/Indian Railway so desires.

12.3 The comprehensive maintenance during warranty shall include the followings:

12.3.1 Thorough checking of the entire system during preventive maintenance visits as defined in maintenance manual of firm for proper functioning of The System at the nominated maintenance depot by consignee/IR.

12.3.2 The fault noticed or complaints during warranty period shall be rectified by the supplier/OEM free of cost by next trip or at first availability of the train at maintenance depot or within 48 hours of the receipt of the complaint.
The supplier/OEM shall also ensure the functionality of the battery used for standby source of supply to the System; the electrically discharged/faulty battery shall be replaced during maintenance of the train.

12.3.3 The supplier/OEM shall have adequate and well qualified service engineers and technicians at his own cost to ensure proper functionality of The System during warranty period.

13.0 **Packing**:

The supplier/OEM shall ensure that all outer parts and exposed threaded portions of the various items of The System equipment(s) are suitably covered with protection caps to prevent ingress of foreign matter/ damage to thread during transportation, handling and storage. The equipment and its sub-assemblies shall be suitably packed in a wooden / synthetic box so that it can withstand bumps and jerks encountered in road/ rail transportation.

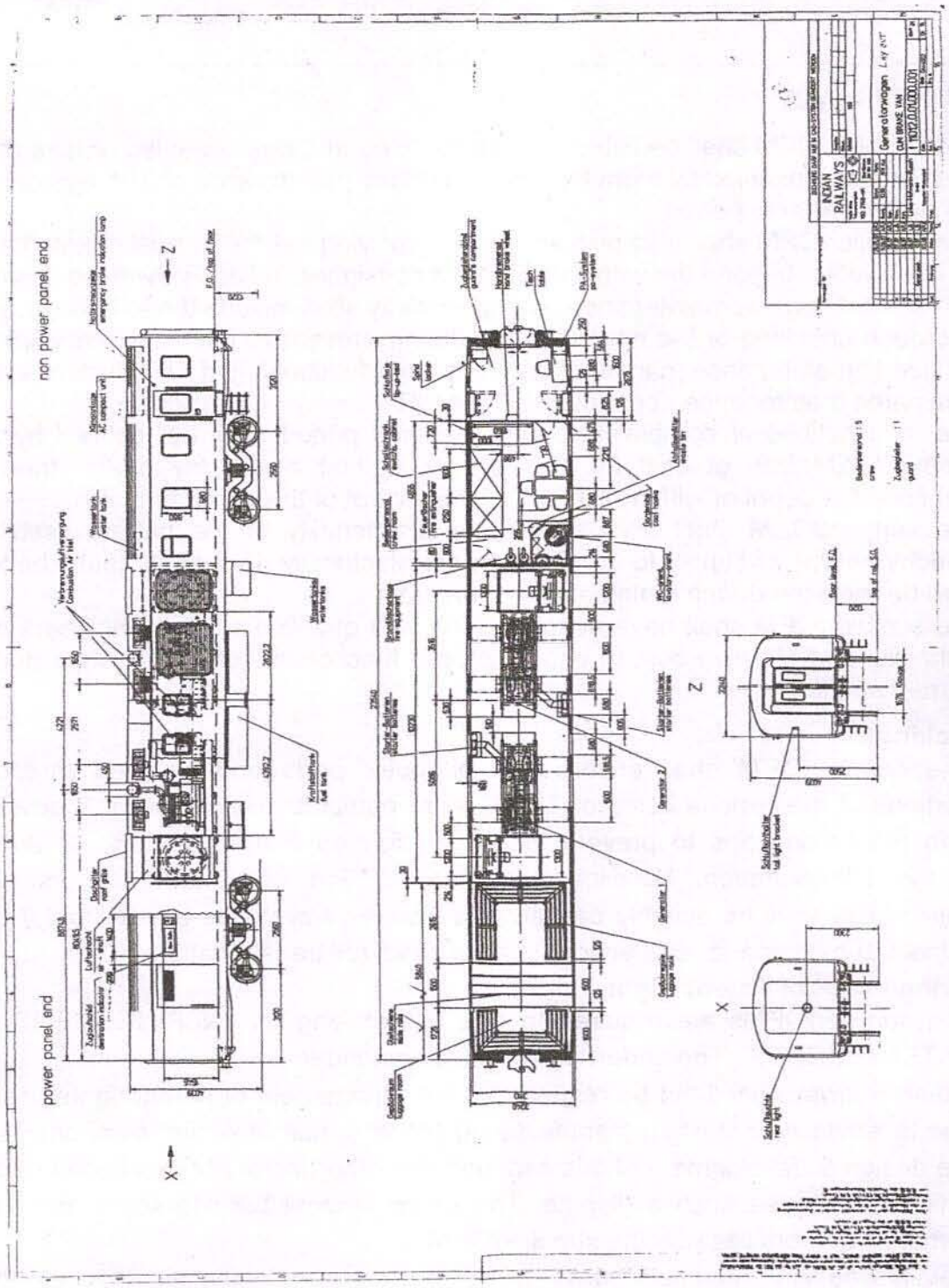
14.0 **Infringement of Patent Right**:

The supplier/OEMs are required to give undertaking on "INFRINGEMENT OF PATENT RIGHTS". The undertaking shall be as under:

Indian Railways shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of similar components in the design & development of this item and any other factor not mentioned herein which may cause such a dispute. The entire responsibility to settle any such disputes/ matters lies with the supplier/OEM.

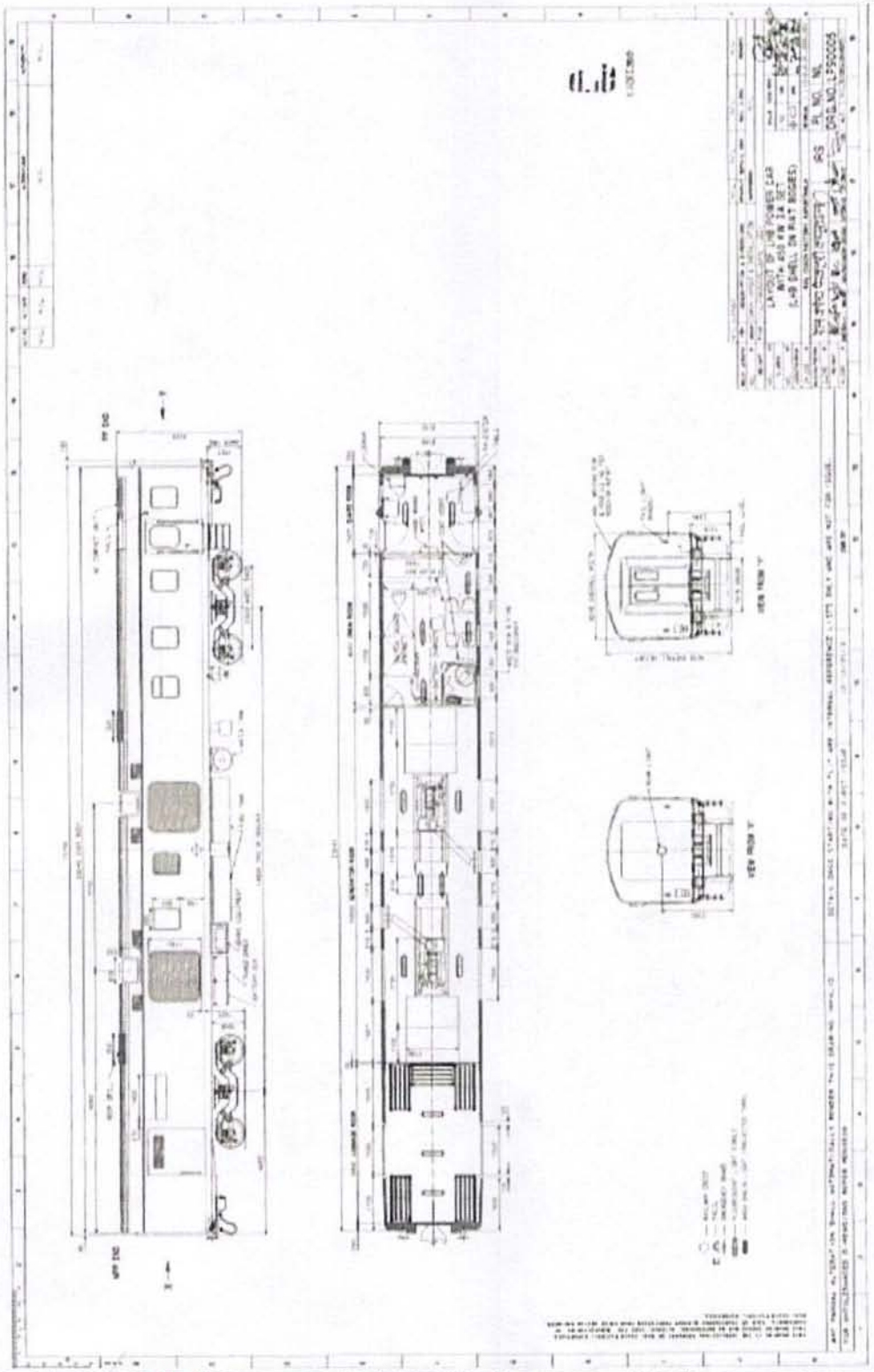
Details / design/ documents given by them are not infringing any IPR and they are responsible in absolute and full measure instead of railways for any such violations. Data, specifications and other IP as generated out of interaction with railways shall not be unilaterally used without the consent of RDSO and right of Railways/ RDSO on such IP is acceptable to them.

Annexure-I



Signature			
Name & Designation	Prepared By:-Shyam Shankar SSE(D)/Carriage	Checked By:- A. S. Dugtal ADE/CD/Carriage	Approved By:-G. K. Singh Exec. Director/Carriage-II

Annexure-II



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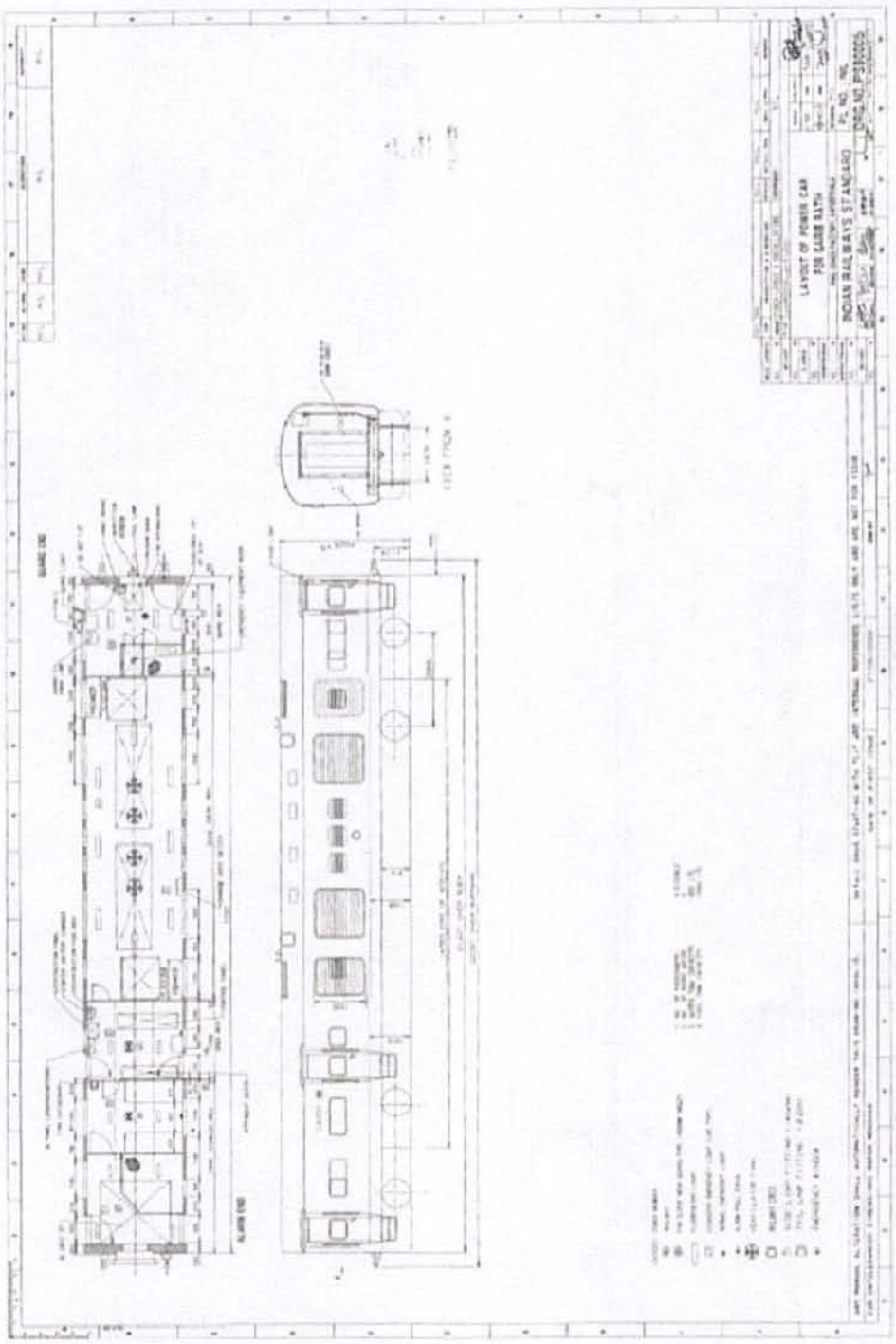
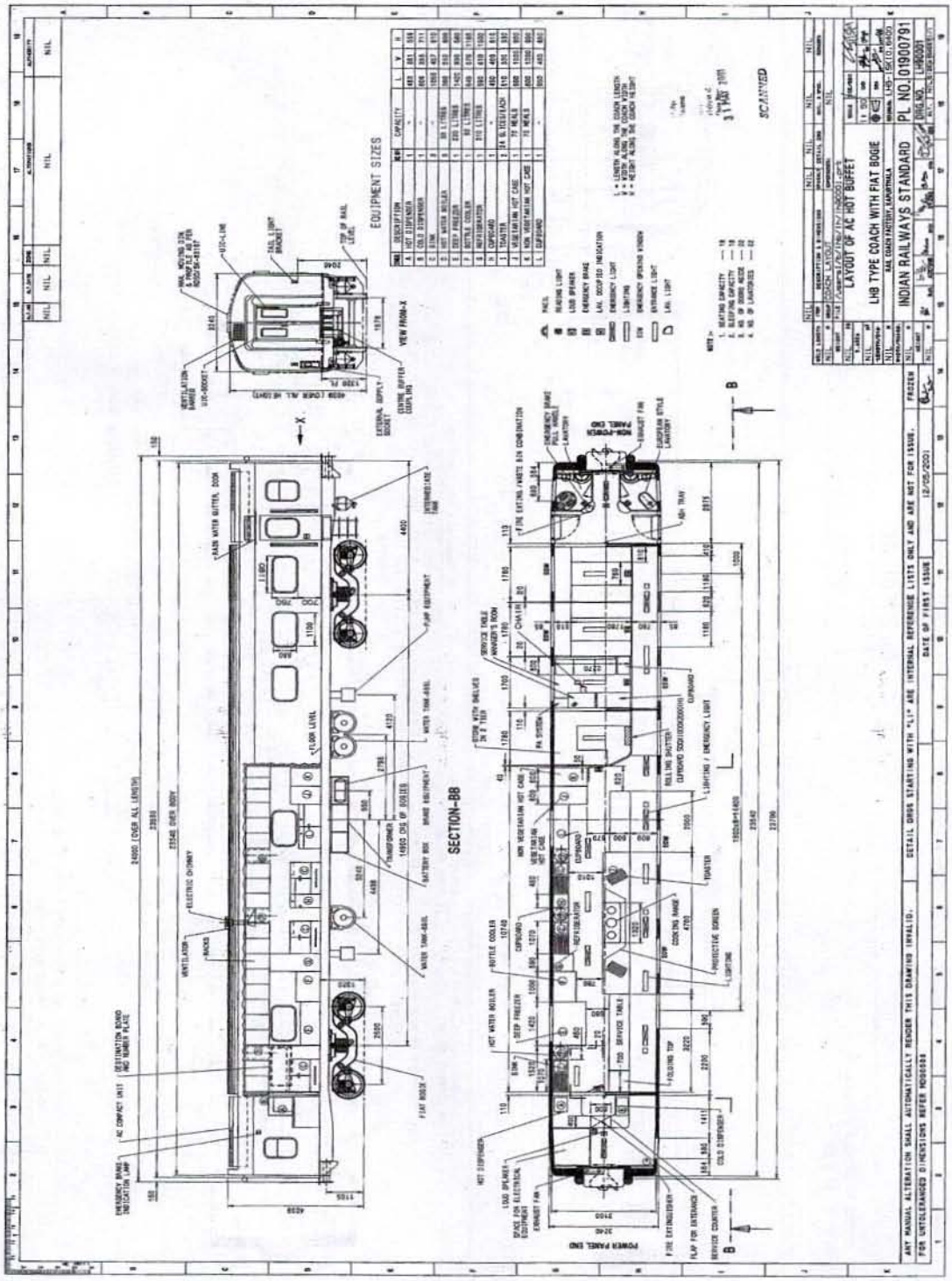
Name & Designation	Prepared By:-Shyam Shankar SSE(D)/Carriage	Checked By:- A. S. Dugtal ADE/CD/Carriage	Approved By:-G. K. Singh Exec. Director/Carriage-II

Annexure-III



Signature			
Name & Designation	Prepared By:-Shyam Shankar SSE(D)/Carriage	Checked By:- A. S. Dugtal ADE/CD/Carriage	Approved By:-G. K. Singh Exec. Director/Carriage-II

Annexure-IV



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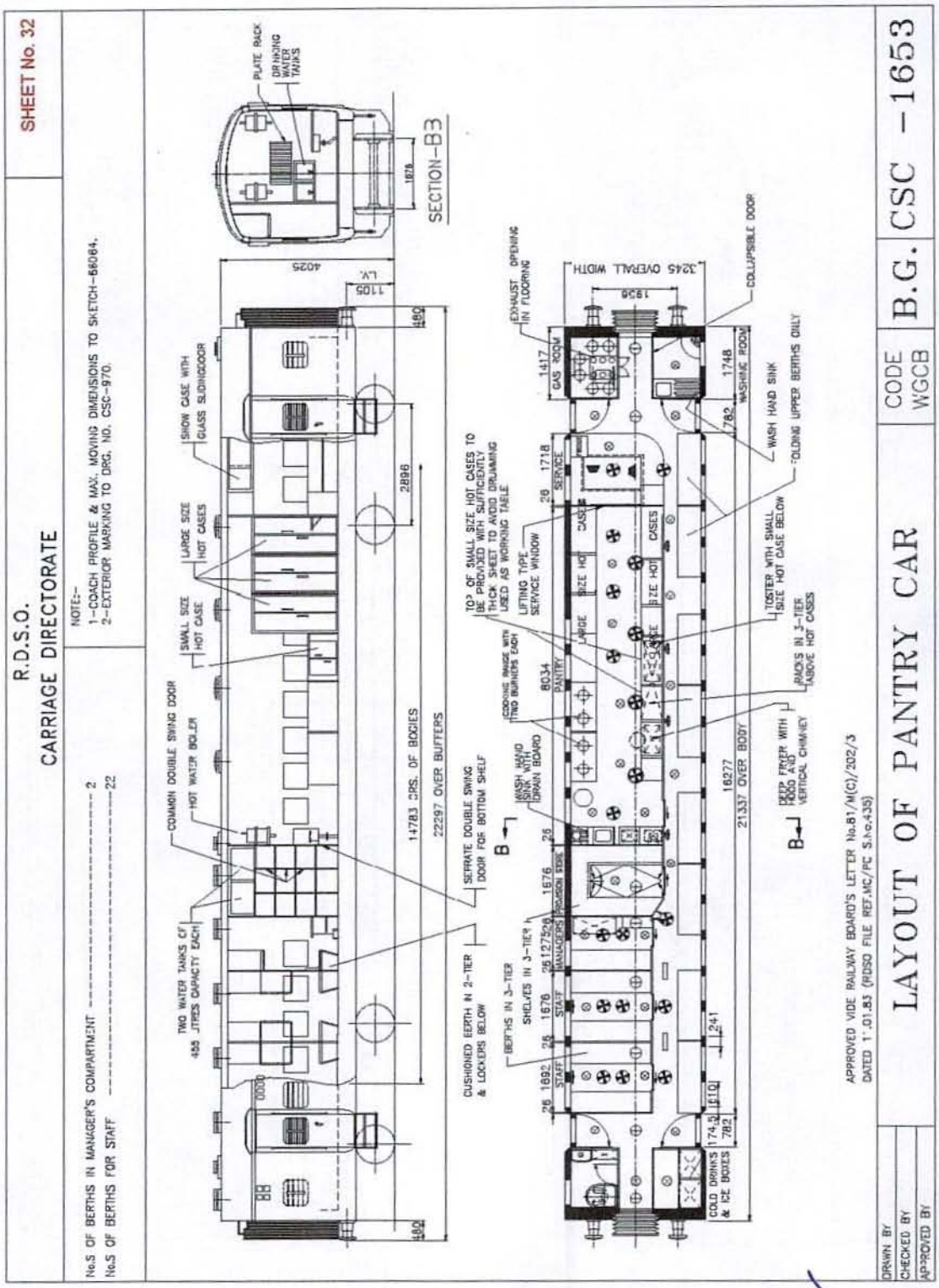
Name & Designation	Prepared By:-Shyam Shankar SSE(D)/Carriage	Checked By:- A. S. Dugtal ADE/CD/Carriage	Approved By:-G. K. Singh Exec. Director/Carriage-II

Annexure-V



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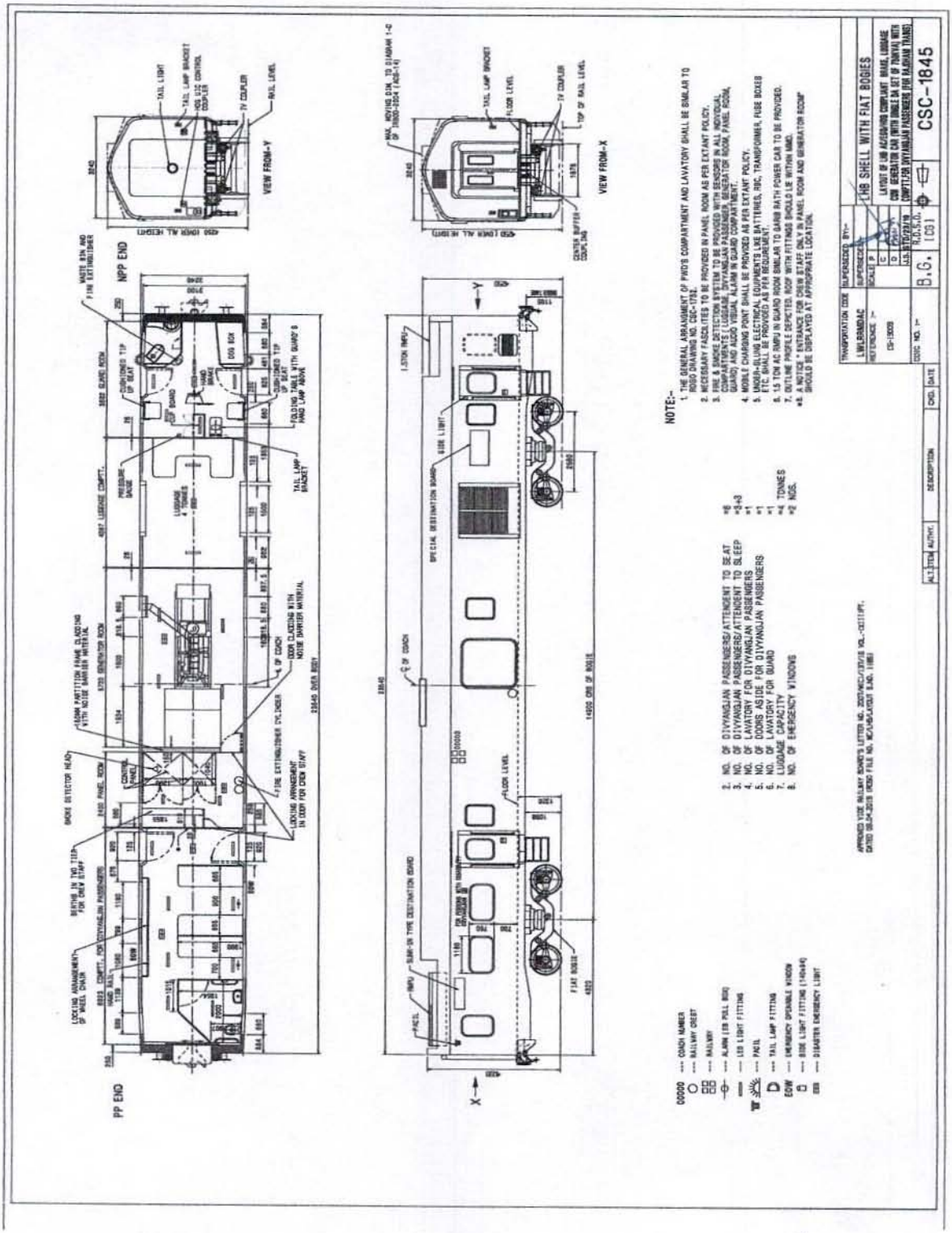
Annexure-VI



Signature			
Name & Designation	Prepared By:-Shyam Shankar SSE(D)/Carriage	Checked By:- A. S. Dugtal ADE/CD/Carriage	Approved By:-G. K. Singh Exec. Director/Carriage-II