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सत्यमेव जयते

भारत सरकार
रेल मंत्रालय

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

अनुसंधान अभिकल्प एवं मानक संगठन

RESEARCH DESIGNS AND STANDARDS ORGANISATION


**SPECIFICATION OF SWITCH BOARD CABINET (SBC)
FOR LHB EOG/HOG TYPE AC COACHES
OF INDIAN RAILWAYS**



आर.डी.एस.ओ./पी.ई./एसी/0184-2015 (परिषोधन.1)

Spec. No. RDSO/PE/SPEC/AC/0184- 2015(Rev. 1)

S. No.	Date of amendment	Revision	Reason
1	August 2019	Rev. 1	Use of unpainted SS-304 L , Fire prevention features , Reduction in depth , Standardization of Electrical scheme, bill of material and test procedure etc .incorporated.

अनुमोदित
APPROVED



 02.09.19
कार्यकारीनिदेशक/पी एस एण्ड ई एम यू
ED/PS & EMU

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1.0 FORWARD

At present, RDSO specification no. RDSO/PE/SPEC/AC/0184-2015(Rev-0) exist for Design, Manufacture, Testing and Supply of Switch Board Cabinet (SBC) consisting of all the power/control switchgear for coach lighting, air conditioning, pantry, pump control, sanitary system and public address system etc. of LHB type AC EOG/HOG Coaches working on 3 phase, 750 volts AC, 50 Hz system.

Need has been felt to incorporate the latest technical concept/features based on experience to optimize the size, incorporate fire prevention features, standardized bill of material & the wiring scheme and to improve the user interface of the switch board cabinet.

Current revision to specification is according being issued.



2.0 SCOPE OF SUPPLY

Switch board cabinet (SBC), fabricated as per RDSO drawing no. RDSO/PE/SK/AC/0205-2019(Rev-0) Sheet 1 to Sheet 16 equipped with switchgear given in Bill of material attached as Annexure B and wired according to electrical wiring scheme as per attached RDSO drawing no. RDSO/PE/SK/AC/0206-2019(Rev-0) Sheet 1 to Sheet 48(Details given in Annexure C).

3.0 OPERATING AND SERVICE CONDITIONS

The equipment shall be sturdy and suitable for the following service conditions normally to be met in Railway rolling stock service:

- i) Ambient: -5 to +55 deg Celsius
- ii) Train speed (Max): 200 Kmph
- iii) Relative Humidity: Up to 98% during rainy season
- iv) Altitude: Max 1700 meter above sea level
- v) Atmosphere: Extremely dusty, foggy, and desert terrain in certain areas. The dust concentration in air may reach at high value of 1.6mg/cubic meter
- vi) Rainfall: Very heavy in certain areas.
- vii) Coastal area: The equipment shall be designed to work in humid salt laden and corrosive atmosphere. The maximum values of the condition shall be as under:
 - a. Maximum Ph value : 8.5
 - b. Sulphate : 7 mg/litre
 - c. Max. concentration : 6 mg/litre of chlorine
 - d. Max. conductivity : 130 micro Siemens/cm
- viii) Vibration: The equipment, system and their mounting arrangement shall be designed to satisfactorily withstand the vibration and shocks encountered in service as specified below:

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- (a) Maximum vertical acceleration : 3.0 g.
(b) Maximum lateral acceleration : 3.0 g.
(c) Maximum longitudinal acceleration : 5.0 g.

('g' being the value of acceleration due to gravity)



4.0 RELEVANT SPECIFICATIONS/STANDARDS

Referenced specification/Document	Description
RDSO specification no. RDSO/PE/SPEC/AC/0139-2009.	Specification of microprocessor based microcontroller of Roof Mounted Package Unit for AC LHB EOG coaches.
RDSO SPEC. NO. ELRS/SPEC/SI/0015.	Reliability of electronics used in rolling stock application.
IS:10118	Code of practice for selection, installation and maintenance of the switchgear and the control gear.
IS:13703	Specification for low voltage fuses for voltages not exceeding 1000 volts or 1500 volts dc.
IS: 1248 PT.II	Direct acting indicating analog electrical measuring instruments and their accessories (ammeter and voltmeters).
IS:1364	Hexagon head bolts, screws and nuts of product grades a & b.
IS : 2500	Sampling procedure for inspection.
IS : 8623	Specification for low voltage switchgear and control gear assemblies.
IS : 6911	Stainless steel plate, sheet and strip
EN : 45545	European railway standard for fire safety
IEC : 60529	Degrees of protection provided by enclosures (IP code).
IEC : 60947	Specification for low voltage switchgear and control gear.
IEC : 60571	Railway applications - electronic equipment used on rolling stock
IEC : 61000	Electromagnetic compatibility (EMC/EMI compatibility test)
UIC : 550	Power supply installation for passenger stock.

Note: Latest editions/version of the above specification / standards shall be applicable and shall be available with the firm before commencement of the prototype testing.

5.0 TECHNICAL REQUIREMENTS

- 5.1 The Switch Board Cabinet (SBC) shall house power and control switchgear, measuring/indicating instruments, protection devices, light, fan, sanitary control, water pump controller, controller of the air conditioning unit, switchgear for the pantry equipment, Disconnecting and Earthing Device, DC-DC converters,

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measuring monitoring relay, insulation monitoring devices, PIS/PA system , Fire detection & suppression system etc. duly wired , (PIS/PA system, RMPU controller , Pump controller, CCTV controller are however not in scope of supply).

5.2 Switch Board cabinet is vertically divided into 3 portions:-

5.2.1 Lowest portion

- (i) On the right lowest portion of switch board cabinet, disconnecting and earthing device shall be located. The main function of this device is to electrically connect the coach equipment with the two input feeder supplies in 'ON' position and provide isolation and earthing to consumer in 'OFF' position.

Incoming feeder cables from coach under frame junction boxes shall be directly connected to this unit. Electrical cables for termination in this unit shall enter from the rear side. Device will have drawl type arrangement for ease of maintenance/attention. Top cover of the unit shall be detachable for terminating the cables. End fittings as per RDSO specification no. RDSO/PE/SPEC/AC/0138-2009(Rev-0) or latest shall be provided on the rear side of the device for cable entries in 4 (3 Power and 1 Control) groups.

- (ii) The left lowest portion of Switch Board Cabinet shall be kept free for provision of third party equipment as and when required. Suitable terminal blocks shall however be provided for under-frame mounted Regulated Battery Charger in this part.

5.2.2 Middle Portion



The middle portion of switch board cabinet shall be divided vertically into two parts for feeder selection i.e. Main contactors assembly and main fuses assembly as per RDSO Drawing no. RDSO/PE/SK/AC/0206-2019(Rev-0). Mounting plates for these shall be drawl type for easy access and replacement/checking. Access to this portion shall be possible after removing the 4 mm thick polycarbonate sheet provided on the front. This compartment shall be closed from all sides and provision of end fittings as per RDSO specification no. RDSO/PE/SPEC/AC/0138-2009(Rev-0) or latest shall be made for outgoing cables to 60 kVA transformer.

5.2.3 Top portion

Depth wise, top portion shall have 3 layers.

- (i) The first layer of top portion (or back panel) houses contactors, relays, low voltage fuses, insulation monitoring and terminal blocks for the incoming and outgoing 415 V /230 V AC, 110V AC circuits, cable alleys/trays and terminals for other layers as per sheet 3 and sheet 4 of RDSO Drawing no. RDSO/PE/SK/AC/0206-2019(Rev-0).

4 mm thick transparent fire retardant polycarbonate sheet shall be provided to prevent accidental contact. The dimensions and layout shall be as per the drawing.

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(ii) The second layer of top portion shall consist of following three swivel frames as indicated in drawing.

(a) On the upper left swivel frame, MCBs/MPCBs shall be arranged in two rows with a voltage level of 415V/240 V AC for feeding the RMPU load and part of the pantry load. MCBs/MPCBs shall not be accessible without opening the SBC front door.

(b) On the second swivel frame on left side, following items shall be mounted

- Wheel skid protection (not in scope of supply). Clear space of 450 mm (lengthwise) to be maintained for Anti-skid device.
- PIS controller (not in scope of supply) as per sheet 11 of RDSO Drawing no. RDSO/PE/SK/AC/0206-2019(Rev-0).

(c) The third swivel frame on the right side shall be suitable for mounting MCBs arranged in two rows with a voltage level of 110V ac/dc for lighting etc.

(iii) The third layer of top portion consists of the swivel doors of the Switch Board Cabinet with following provisions:


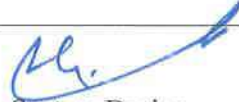
(a) Voltmeter, Ammeter and supply network selector switch shall be provided on the left door. Since the voltmeter shall be connected directly to 750V ac network, therefore, backside shall be covered with a polycarbonate sheet to prevent direct contact as indicated in drawing no. RDSO/PE/SK/AC/0206 (Rev.0) sheet 7 of 16.

(b) Devices such as meters for battery voltage, charging and discharging current along with various push buttons for faults of important devices (bus-bar network, local network, 415V network, battery charger) etc. with a voltage level under or equal to 110V shall be arranged on the right door. Underneath these devices LED (10 mm dia) diagnostic PCB accessible from the outside shall be located. Details are given in drawing no. RDSO/PE/SK/AC/0206(Rev.0). Cut out for Pump controller and RMPU display Unit (S1U4) of sizes 190mm(H)x130mm(W) and 130mm(H)x430mm(W) shall also be provided for their mounting subsequently.

5.3 Crimping of all cable/connector pins shall be done with suitable crimping tools to avoid any crimping failure in service.

5.4 All wiring shall be secured with fire retardant cable ties and provided with cable protection sleeves made up of polyamide .



5.5 The internal wiring shall be done with Halogen free electron beam irradiated cables voltage grade 1.8 kV /3 kV for 750 V circuit and 750 V for 415/230/110 V Circuit conforming to RDSO specification No. ELRS/SPEC/ELEC/0019 latest revision. The sizes of cables shall be as indicated in schedule of cable given in Annexure F. All cables/wiring shall be color coded according to phases for easy identification. Control wiring and power cables shall be segregated according to the voltages and adequately secured with cable ties.

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5.6 For proper cabling/wiring, following need to be given due attention:

- i) The outgoing/incoming terminal connections from coach equipment/sub-assemblies shall be brought out to adequate rated cage clamp type terminal block/MCB.
 - ii) The terminal blocks shall be located for easy access as indicated in the drawing.
 - iii) Separators/intermediate plates shall be provided between adjacent terminal blocks, wherever required.
 - iv) All cables leading to a terminal block shall be properly secured /clamped before termination to the extent feasible.
 - v) It shall be ensured that not more than two wires are terminated at one point.
 - vi) The ends of the internal wiring of the panel shall be fitted with crimping sockets (wherever required) and designated ferrules. Rings/tubular crimping sockets shall be used with appropriate palm & hole size to prevent loose connections during vibrations. Only copper crimping sockets of approved make shall be used. Crimping sockets of sizes smaller than 16 mm² shall be with metal reinforcement. Hole of crimping sockets shall match fixing screw/ bolt without any widening/ alteration.
 - vii) Marking ferrules shall be of computer generated for easy identification of the cables with the help of heat shrinking sleeves (self-fire extinguishing) of suitable size horizontally printed or having multi mark carrier/label of approved make.
 - viii) All cut-outs through which internal cables/wires transverse from one portion of the switch board cabinet to other shall be provided with V-grooved, neoprene rubber grommets/edge protection sleeves for protection against sharp edges.
 - ix) All external cables/wires shall enter/exit to/from SBC through end fittings as per RDSO specification no. RDSO/PE/SPEC/AC/0138-2009(Rev-0) or latest duly provided with cable fire barrier to prevent propagation of fire through insulation of cable/wires. Details of fire barrier shall be finalized at design approval stage.
- 5.7 Two earthing terminals shall be provided on top and bottom of the panel on diagonally opposite ends. For earthing SBC with coach body two braided copper cable of 70 sq mm and 300 mm in length each, duly crimped at both ends shall be supplied with the panel. Earthing of the metal parts/sub- assemblies inside the panel shall be done with suitable size braided copper cable as determined in accordance with 7.4.3.1.7 (a) of IS: 8623 (Pt-I) – latest.
- 5.8 Screen printed component code list shall be provided at backside of left front door suitably, which should be visible after opening of front door. Laminated copy of Schematic power and control circuit on A0 size paper after suitable fold shall be placed in pocket provided at inner side of left lower front door.
- 5.9 Suitable zero halogen polyamide alleys/trays with snap-in element of approved make shall be provided for cable transverse as indicated in the drawings. Whenever the cables shall cross the door/passage area, the cables shall be covered by self-extinguishing and halogen free braided /nylon jacket (material- polyamide 6.6)
- 5.10 All the switchgear devices fitted in the switch board cabinet shall be easily accessible for maintenance from the front of the panel.

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- 5.11 One compact LED type B-2light fitting with a working voltage (nominal) of 110V DC to RDSO Specification no. RDSO/PE/SPEC/AC/0091-(Rev-2) ICF drawing no. ICF/STD- 7-6-050 and procured from approved sources along with a switch& socket shall be provided inside the switch board cabinet for ease of the maintenance staff. The light fitting shall be mounted/screwed suitably to avoid damage due to vibrations in service.
- 5.12 H.T fuses and 750 V MMRs (Measuring & monitoring Relay i.e. phase control relay) shall be mounted on minimum 3 mm epoxy/ Bakelite/SMC (FRP) sheet. There shall be minimum 100 mm gap between two MMR's.
- 5.13 The Power/Control wiring of the Switch Board Cabinet shall be as per wiring diagramsNo. RDSO/PE/SK/AC/02062019(Rev-0) Sheet no 1 to 48 listed in Annexure-C.
- 5.14 Care shall be taken to achieve a neat and symmetrical layout.
- 5.15 Only approved make of components mentioned in the bill of material as per Annexure-D shall be used. For any deviation prior approval from RDSO shall be taken.
- 5.16 All rotary switches shall conform to IEC 60947 and shall be suitable for universal mounting& operational voltage.
- 5.17 General and safety requirements shall be governed by IEC 60947 and IS:8623-latest.

6.0 CONSTRUCTIONAL FEATURES

- 6.1 The switch board cabinet shall be fabricated from standard welded stainless steel -304Ltube& sheets conforming to IS 6911.Only TIG (Tungsten inert gas) welding shall be used for fabrication of frames. Overall dimensions shall not exceed the following dimensions:

Height	1850 mm
Width	1295 including drain tube.
Depth	620 mm including door.



- No positive tolerances are allowed. However, negative tolerances shall be governed by MDG 0008.
 - Making of structure with L-channel welded to form a tube is not permitted.
- 6.2 The steel sheet used for all the front doors shall be 1.6 mm thick stainless steel -304Lconforming to IS 6911.
- 6.3 The dimensions/switchgear mounting/general layout of the switch board cabinet shall be as per RDSO drawing no. RDSO/PE/SK/AC/0205-2019(Rev-0).

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For change in layout aiming at ease in manufacturing, improving the aesthetics or ease in maintenance of switch gears, the manufacturer shall take prior approval of RDSO.

- 6.4 SS- 304L cover tray(sheet thickness 1.6 mm) of 25mm depth with slope towards left shall be provided on the top of switch board cabinet to prevent water ingress inside the SBC as shown in RDSO drawing No RDSO/PE/SK/AC/0205-2019(Rev-0) sheet- 1.
- 6.5 All internal partition frames, plate, swiveling frames and complete switch board cabinet including bottom doors and top sheet shall be of stainless steel -304L conforming to IS 6911.
- 6.6 All fasteners used shall be of stainless steel to IS 1364 Part 2.
- 6.7 Switch Board Cabinet shall be covered on left and right side with 1.0 mm thick stainless steel -304 conforming to IS 6911 fixed with SS fasteners. Under door closed condition of SBC no possibility should remain to enter any rodent to avoid short circuit.
- 6.8 The general construction of the switch board cabinet shall be such as to keep the various voltage levels segregated against each other as far as possible. There shall be no criss-crossing of cables/wires within same voltage or different voltage levels.
- 6.9 Suitable eye bolts shall be provided at the top four corners for lifting the SBC during mounting/dismounting from the coach.
- 6.10 Polycarbonate sheet used shall be fire retardant, 4 mm thick, scratch free and shall be of approved make.
- 6.11 Each door leaf shall be provided with snap lock of approved make.
- 6.12 The doors shall be fixed to the main frame by means of heavy duty hinges duly fixed on appropriate size back piece to provide adequate strength sustaining vibrations in door open conditions and of approved make as shown in drawings.
- 6.13 For fixing DIN rails and other switchgear viz. power contactors, power fuses etc., minimum 3 mm back-piece with tapped hole or nut shall be provided behind mounting plate/sheet. Mounting screw for DIN rails shall not be less than M6. Suitable Mounting screw for body mounted switch gear shall be as per OEMs stipulations. Interspacing between two fixing screws for DIN rails should not be more than 200 mm. Good engineering practices shall be adopted. The depth of the tapped hole shall be more than the diameter of the screw.
- 6.14 Metallic end locking plates shall be used for securing of switch gears on DIN rail & minimum 35 mm free length of DIN rail should be available on ends, unless not feasible due to space constraints.
- 6.15 All switch gear component used in SBC shall comply to following requirements:

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- (i) Components material provided in SBC shall conform to EN 45545 with hazard level HL-2, pollution category 3, vibration shock to IEC 61373 and suitable to work in temperature range -5 Deg C to 70 Deg C & relative humidity up to 98 % and suitable for rolling stock application.
- (ii) Stipulated current rating for all switch gears items shall be at rated voltage, specified utilization category and at 70°C.
- (iii) Rated voltage for components used on 750 Volts AC & 415 Volts AC side shall be 1000 volts AC & 690 Volts AC respectively.
- (iv) Surface mounted switchgear such as Feeder selection contactor K01 & K02 , K44 shall be fitted on unified mounting plate of adequate thickness & strength so as to ensure full interchangeability amongst at least four approved makes i.e. ABB, Siemens, Schneider, L&T. Firm shall submit details and shall have RDSO's prior approval before type test.

6.16 Fire standard- IEC 45545 HL-2 shall be followed for all materials used in SBC.

6.17 Complete stainless steel SS -304 structure and partition etc are not required to be painted but outer sheets& doors shall be finished for proper appearance and aesthetics .Finishes of SS-304 L sheet shall be scotch brite/No. 4 i.e. smooth, polished with finish grit/fine line finish.

6.18 For fire detection & suppression system ,condensed aerosol fire extinguishers conforming to technical requirements given in Annexure G shall be installed with suitable anti-pilferage arrangements. Tentative numbers & weights shall be as under:-

- (i) 2 Nos. , 8/10 gm units , one in each Disconnecting & Earthing Device cubicle & 750 V power contactors&fuses compartment.
- (ii) 2 Nos. , 100 gm each in upper most portions.

Exact details shall be finalized at design approvalstage. OEM/authorized representative of system shall certify the adequacy of number of units ,weight and location of each unit , so as to effectively cover entire switch board cabinet.


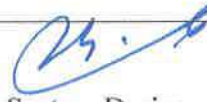
7.0 INSPECTION AND TESTING

Firm manufacturing SBC for the first time shall get test plan/protocol approved from RDSO.

7.1 TYPE TEST

7.1.1 Only after the detail drawings and the 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 at the expense of firm.

Placement of switchgears and component in switch board cabinet shall be undertaken by new vendor after getting clearance of dimensional and visual check of structural frame from RDSO.

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- 7.1.2 If so desired, RDSO shall repeat some or all type tests once in three years on sample basis, so as to confirm the quality of the product to meet the specified requirements.
- 7.1.3 The type tests shall be carried out by RDSO representative on prototype unit either totally or in part under the following conditions without any additional cost:
- (i) A manufacturer undertakes to manufacture for the first time.
 - (ii) An important /major change in design details of machines has been introduced.
 - (iii) Specification is modified necessitating re-designing of equipment.
 - (iv) Unsatisfactory performance reported from user Railways.
 - (v) Resumption of production after an interruption of more than two years.
- 7.1.4 Investigation tests are intended to obtain additional information regarding the performance of the product. They shall be specially requested either by the RDSO or Purchaser or by the manufacturer.
- 7.1.5 RDSO may conduct surprise checks on manufacturing process and quality control along with any of the tests to ensure consistent quality of product and its conformance to RDSO specification.
- 7.1.6 The tests shall be carried out at the works of the manufacturer in presence of Indian Railway representative on the prototype unit as per the relevant governing specifications modified or amplified. The manufacture shall have all possible necessary arrangement for testing. Unless otherwise stated, tests specified in RDSO specification and for which facilities are not available with the firm shall be conducted at NABL/NABCB accredited lab.
- 7.1.7 The test protocol indicating relevant clause of the test, condition of the test, specified value and observed value of the parameter shall be submitted by the firm before offering the prototype for type testing.
- 7.1.8 The SBC shall successfully pass all the type tests for proving conformity with this document. If any one of the equipment fails in any of the type tests, the inspecting agency at his discretion, may call for another equipment of the same type and subject it to all tests or the test(s) in which failure occurred. No failure shall be permitted in the repeat test.

7.2 Routine test:

Routine tests are to be carried out on each unit by firm to verify that properties & design of the product correspond to those measured during type test. Proper documentation of routine test results should be available with the firm and should be produced before inspecting official on demand. Tests shall be conducted as per test schedule given.

7.3 Acceptance test:

Each offered lot of supply shall be subjected to acceptance tests as per RDSO approved sampling plan or as per sampling plan specified in IS 2500 GIS S-2, at manufacturer's works. Acceptance test shall be witnessed by inspecting

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official nominated by purchaser/RDSO. Manufacturer, on demand by inspecting official shall produce the internal/routine test report carried out by him.

8.0 TESTS

8.1 Tests as mentioned in table below shall be carried out as per respective clause of this specification indicated against each.

SN	Clause of spec	Tests	Type Test	Acceptance Test	Routine Test
1.	9.1	Visual inspection of Structure before wiring	Yes	No	No
2.	9.2	Visual inspection of placement of switchg wiring and electrical operation test	Yes	(a) to (h) only	Yes
3.	9.3	Check for BOM and proof of material as per spec.	Yes	Yes	Yes
4.	9.4	Test for verification of dielectric properties	Yes	Yes	Yes
5.	9.5	Test for verification of insulation resistance	Yes	Yes	Yes
6.	9.6	Mechanical operation and sequence test	Yes	Yes	Yes
7.	9.7	Test for verification of clearance and cree age distances	Yes	Yes	Yes
8.	9.8	Checking of electrical continuity	Yes	9.8(g) only	Yes
9.	9.9	Verification for effectiveness of protective Circuits	Yes	Yes	Yes
10.	9.10	Temperature rise test	Yes	No	No
11	9.11	Shock &Vibration test from NABL/NABCE Accredited Lab	Yes	No	No
12	9.12	Test on fire suppression system	Yes	Yes	No
13	9.13	Test on cable fire barrier	Yes	Yes	No

The accuracy of measuring instruments used for all type of tests shall be of class 0.5.



9.0 DESCRIPTION OF TESTS ON SBC:

9.1 Visual inspection of structure before wiring

Prototype structure of SBC shall be checked as per RDSO drawing No. RDSO/PE/SPEC/AC/0205-2019(Rev-0) or latest sheet 1 to sheet 16 attached as Annexure B of this specification.

9.2 Visual inspection of complete SBC after wiring and electrical operation test:

The test shall include the following checks: -

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- a) General workmanship of Switch Board Cabinet and its accessories such as MPCB, MCB, fuse, relay, contactor, connector, cable etc.
- b) Name plate
- c) Codification chart
- d) Interface dimensions with coach and overall and mounting dimension of cabinet.
- e) Provision of Earthing cables
- f) Sticker /Marking plate of components
- g) Marking and general layout of housing,
- h) Color coding of cables as mentioned in the specification & drawings.
- i) Detailed dimensions
- j) Electrical operations as per applicable drawings and prepared test protocol.

Sr. No (a) to (h) shall be checked during acceptance test&routine test also.

9.3 Check for BOM and proof of material as per specification.

- (i) Firm shall submit BOM with clear details of actual part number and make used in the SBC. Firm shall bring out clearly the variations in actual part number and that approved by RDSO during type test.
- (ii) Firm shall have to provide switchgears as per catalog no. mentioned in the BOM. For those items where catalog no. is not mentioned, firm shall obtain RDSO prior approval.
- (iii) In case of updating of the various catalogue/technical data sheets resulting in discontinuation/Non-availability of a particular make/part no; the firm shall take prior approval from RDSO for alternate part no. of a particular make before effecting supplies.
- (iv) The test shall include visual inspection of component and material of SBC as per Bill of material.
- (v) Invoice, test certificates and data sheets of the following shall be checked:
 - a) MCBs/MPCBs
 - b) Contactors
 - c) Rotary switches & Overload relays
 - d) Insulation Monitoring Relay & Phase control relay(MMR)
 - e) RC filter
 - f) Control transformer
 - g) Earthing& disconnecting device
 - h) H.T fuses
 - i) Cables
 - j) Cable alley

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- k) Polycarbonate sheet
- l) Door hinges & locks
- m) Fire detection & suppression system
- n) Cable fire barrier.

9.4 Test for verification of di-electric properties:

The SBC shall be tested with 3 kV test set between live parts and earthed body.

S N	Rated circuit voltage	Applied voltage	Time	Result	Condition	Leakage current
1	750 volts AC and 415 volts AC	3 kV	60 seconds	Should withstand the test.	Disconnected equipment- DC-DC converter, MMR, Electronic timers, Insulation monitoring relays and other electronic equipment.	shall be noted
2	230 /190/110volts AC 110 /24 V DC	1 kV				

The HV test shall be done with AC (50 Hz) which shall be gradually increased (applied for one minute). The test is considered pass, if no electric breakdown or flashover occurs.

9.5 Test for verification of insulation resistance



During testing, insulation monitoring relay have to be disconnected. All the MPCBs/MCBs shall be kept in the ON position. Insulation resistance shall be measured with direct current.

Insulation resistance test shall be carried out on all the circuits. The meggering voltage and the value of the insulation for the various circuits shall be given as under-

SN	Rated circuit voltage	Meggering voltage	Insulation resistance value
1	750 volts AC	1000 V DC	Not less than 5 M ohms
2	415 volts AC	500 V DC	Not less than 3 M ohms
3	230 & 190 volts AC	500 V DC	Not less than 2 M ohms
4	190 volts AC & DC	500 V DC	Not less than 2 M ohms

9.6 Mechanical operation and sequence test:

Satisfactory mechanical operation shall be verified after installation. The number of the operating cycles shall be 20 on all rotary switches, disconnecting & earthing switch, sliding tray, rotating frame & all doors. The

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operation of the mechanical interlocks associated with these movements shall be checked.

The test is considered to have been passed, if the operating conditions of the apparatus, interlocks etc. have not been impaired and if the effort required for operation is practically the same as before the test.

In the case of withdraw-able functional units, the cycle shall be from the connected to the disconnected position and back to the connected position.



9.7 Test for verification of clearance and creepage distances:

This test includes the following checks;

- (i) Checking of clearances;
 - a) 100 mm between two MMRs(K03& K04)
 - b) 20 mm between 750 V circuit current transformers on contactor plate assembly.
 - c) 20 mm between 125 A fuses on fuse plate assembly.
 - d) 50mm neutral terminal on fuse plate assembly.
- (ii) Electrical switchgears/cable alley shall be mounted keeping in mind the clearance given in drawings mentioned in Annexure B for maintaining clearance and creepage distance.

9.8 Checking of electrical continuity:

- (i) Continuity of protective circuits shall be ensured by effective interconnections either directly or by means of protective conductors. In particular, screwed connections shall be checked for adequate contact, possibly through random checks.
- (ii) When a part of Switch Board Cabinet is removed from the enclosure, for routine maintenance, the protective circuits for the remainder of the Switch Board Cabinet shall not get interrupted.
- (iii) Means used for assembling the various metal parts of Switch Board Cabinet shall be sufficient for ensuring the following: -
 - a) Continuity of protective circuits (if the precautions taken),
 - b) Permanent good conductivity
 - c) A current carrying capacity sufficient to withstand the earth fault current that may flow in Switch board cabinet.
- (iv) For lids, doors, cover plates etc. the usual metal screwed connections and metal hinges are considered sufficient to ensure continuity provided that no electrical equipment is attached to them.
- (v) All parts of protective circuit within the Switch Board Cabinet shall be so designed that they are capable of withstanding the highest thermal and dynamic stresses that may occur at the place of installation in Switch Board Cabinet.

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(vi) During prototype test continuity of all live components shall be checked as per wiring diagram attached with specification.

(vii) During acceptance/routine test continuity of any 5 of following circuit shall be checked: -

- a) 750 V circuit D&ED, K01, K02 contactors
- b) MMR K03 & K04 circuit
- c) 415 circuit K44, IMR A6& A7 circuit
- d) Pre-cooling circuit K41, K42, K43
- e) MMR K45 circuit
- f) Pantry circuit
- g) pump circuit,
- h) RMPU1 power circuit
- i) RMPU 2 power circuit
- j) Exhaust fan circuit
- k) K49 lighting control circuit
- l) Lighting power circuit (100 & 50%)
- m) Laptop & Mobile charging circuit
- n) Capacitor bank circuit
- o) Manual bypass circuit for air conditioning controller

During acceptance test inspecting agency shall examine the testing of pervious lot of the SBC and it shall be ensured that the above 5 tests are not repeated with previous lot.

9.9 Verification for effectiveness of protective circuits:

(i) Following interlocking shall be checked during this test


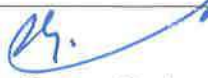
- a) Interlocking between feeder contactors K1& K2.
- b) Interlocking between local supply contactors K41& K42.
- c) Interlocking between contactors K43& K44.

(ii) Following component shall be tested on test bench

- a) D& ED.
- b) Single phasing, Phase sequence reversal, Unbalancing of phase voltages, under voltage, Overvoltage of Phase control relay (MMR).
- c) Contactors K1, K2, K44 pick up and drop out voltage.
- d) All MPCBs/ and minimum 3 MCBs of each rating for different voltage grades.
- e) IMR A6 & A7
- f) DC-DC converter

These tests shall be carried out during type test and routine test. In acceptance test any 2 of the above randomly picked up shall be tested on test bench.

(iii) Tripping of relevant MCB/MPCB of different circuit of after creating fault at the output terminal of SBC shall be carried out during type test and routine test. In

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acceptance test any 5 MPCB/MCB randomly picked up shall be tested for tripping.

- (iv) It shall be verified that the different exposed conductive parts of the assembly are effectively connected to the protective circuit in accordance with safety requirements. A protective circuit in an assembly consists of either a separate protective conductor or the conductive structural parts or both. It provides the following-
 - (a) Protection against the consequences of faults within the assembly.
 - (b) Protections against the consequences of faults in external circuits supplied through the assembly.

9.10 Temperature rise test:

Temperature rise test of the Switch Board Cabinet shall be carried out as per clause no. 8.2.1 of IS 8623 Pt -1. The reading at various points of switchgears conductors & insulators, HT fuses, bus bar, SBC body, doors, handles etc. shall be measured at an interval of 30 minutes till the temperature gets stabilized. The firm shall submit the test scheme for temperature rise test in advance to RDSO as per schematic given with this specification and get it approved before type test.

9.11 Shock and Vibration test:

Shock & vibration test of complete SBC shall be conducted as per category 1, class B given in Annexure B of IEC 61373 – 2010 from any NABL/NABCB accredited agency. Performance tests shall be carried out after shock & vibration tests and firm shall submit internal performance test results after vibration and shock test to RDSO.

9.12 Test on fire detection & suppression system



One unit of each size randomly picked up from offered lot of SBC shall be tested for its triggering at stipulated temperature.

9.13 Test on cable fire barrier

Test on one randomly picked up sample along with cable shall be conducted by putting one side of cable on fire. Fire shall not propagate on other side of cable end fitting.

10.0 TECHNICAL DATA TO BE SUBMITTED

- 10.1 The firm manufacturing switch board cabinet for first time shall submit the mechanical & GA drawings of SBC for approval to RDSO before starting production as per RDSO/PE/SK/AC/0205-2019(Rev-0).
- 10.2 The manufacturer shall submit complete design details of SBC and its accessories, sub-assemblies, necessary calculation of rating of major components used.
- 10.3 Manufacturer shall develop and submit the 3D model of SBC for better appreciation.

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- 10.4 The manufacturer shall also supply one set of operating and trouble-shooting manual with every 10 units.

11.0 COMMISSIONING:

Firm shall be responsible for commissioning of prototype unit in one coach at Production Units (Pus). The SBC shall be compatible with the coach harness provided for various circuits. Firm shall prove out the scheme in one coach for proper functioning of all related equipment.

For the commissioning of first panel, panel manufacturer shall depute his staff at production unit (PUs) .


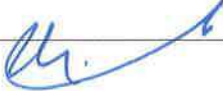
12.0 SUPPLIER'S RESPONSIBILITY

- 12.1 The supplier shall be fully responsible for ensuring that all equipment forming part of the supply are entirely fit for the purpose and no part of this specification shall, in any way remove or reduce his obligation in this respect. In addition, it is the supplier's responsibility to underwrite the complete switchgear system design and ensure that it is compatible with and will, in no way, compromise the design and performance of switch board cabinet of his supply.
- 12.2 The supplier shall provide "in the field" service support during the guarantee/warranty period.
- 12.3 The supplier shall supply any purpose built or special tools or equipment that may be necessary for the correct operation, servicing, testing or installation of the equipment of the switch board cabinet.
- 12.4 The supplier will provide assistance, both in terms of material and technical, in development of the system as a whole to ensure that when this switch board cabinet is installed as part of the integrated vehicle system, the performance of the system meets or exceeds the requirements specified.
- 12.5 If the Switch Board Cabinet fails to achieve any of the stipulated requirements, the same shall be modified at the supplier's expense and within a time line to be agreed with purchaser/consignee/RDSO.

13.0 MARKING AND PACKING

- 13.1 All the switch board cabinets and its main component/accessories shall be provided with a name/rating plate of bright anodized aluminum on the enclosure. The following information shall be available either by etching process or by engraving or durable screen- printed with black letters on white background and shall be fitted with riveting at the front door on each panel:

- i) Name and Address of the manufacturer.
- ii) Month of the manufacture.
- iii) Serial number of panel.

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The first two digits shall indicate the year of manufacture and next two digits shall indicate month. Further next four digits shall indicate manufacturing serial number.

iv) Specification number.

v) Schematic/Connection diagram /fittings arrangement of the equipment at the suitable location on the inner side of the cover/body.

13.2 All components provided inside the SBC shall be identified by screen/photo printed or computer generated designation labels/legend marking plates. These should be mounted near the concerned component duly ensuring visibility. Labels provided on component will not be acceptable. Components shall also be provided with the name plates indicating the operation/function of the switches/circuits. Contactors and circuit codification diagram shall be identified by aluminum anodized legend plates by adhesive of approved make on back side of left hand front doors in place of pump controller and AC control display area. Balance indicating/measuring switchgear /devices installed on front door shall be identified by aluminum anodized legend plates by adhesive of approved make on the front doors itself. No riveting for these items is allowed on front door.

13.3 Danger Notice plate shall be screen printed or sticker shall be provided on front of the lower panel door conforming to IS:2551-82 for 750V.

13.4 The switch board cabinet and its sub-assemblies shall be packed in suitable packing material such as suitable sheets/bubble sheet and filling material as suited to protect the various components and subassemblies to prevent damage in transport/storage. The SBC shall be finally packed in a wooden case of sufficient strength, so that it can withstand bumps and jerks encountered in road/rail journey.



14.0 GUARANTEE/WARRANTY

Guarantee/Warranty obligation of the complete Switch Board shall be as per IRS condition of contract.

15.0 TRAINING& AFTER SALES SERVICES

15.1 The contractor shall undertake to train, free of cost, the supervisors & staff of the Indian Railways for operation, maintenance, fault finding, trouble shooting, repair of the offered Switch Board Cabinet under the guidance of the skilled engineers as and when asked for by Railways.

15.2 The manufacturer shall be required to make available the services of his engineers free of cost to watch/monitor the performance of the equipment in service periodically and also carry necessary repairs or replacement under warranty obligations. The necessary spares needed for replacement during service should be available with the service engineers at all the zonal Railways, Divisions Head Quarter & Production Units, Workshops and Coaching Depot to

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cover entire Indian Railways network. The service engineers shall be fully conversant with Switch Board Cabinet & its electrical circuitry.

16.0 INFRINGEMENT OF PATENT RIGHT



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

17.0 CARTEL FORMATION

The firm will not engage in cartel formation with other firms and will also submit a declaration in this regard as per attached Annexure –A.

18.0 ANNEXURES

SN	Annexure	Description
1	Annexure A	Undertaking against Cartel Formation.
2	Annexure B	List of layout drawings
3	Annexure C	List of wiring diagrams
4	Annexure D	Bill of Material
5	Annexure E	Particulars of connectors
6	Annexure F	Schedule of cable sizes
7	Annexure G	Technical requirements of aerosol fire detection and suppression system.

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Annexure- A



UNDERTAKING AGAINST CARTEL FORMATION

We,hereby, give an undertaking that as a Registered Vendor for manufacture and supply of will not be a part of a cartel with other vendors and will be quoting competitive rates in the tenders invited by the Indian Railway/Production Units.

We are aware of the fact that the Registering Authority i.e. RDSO may de-list the name of our firm from the Master List of Approved Vendors, if complaint is received about such cartel formation from any of the Railways/Production Units.

Seal and Signature
(Authorized signatory of the firm)

Date:
Place:
Seal



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Annexure-B

List of Drawings for fabrication of Switch Board Cabinet-S1

SN	Drawing no.	Description
1	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 1/16	Switch Board Cabinet-S1
2	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 2/16	Frame Complete
3	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 3/16	Mounting Plate- Right
4	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 4/16	Mounting Plate- Left
5	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 5/16	MPCB/MCB Holder- Left
6	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 6/16	MCB Holder- Right
7	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 7/16	Door Complete (Upper) –Left
8	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 8/16	Door Complete (Upper) – Right
9	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 9/16	Door Complete (Lower)- Left
10	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 10/16	Door Complete (Lower)- Right
11	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 11/16	Rotating frame for sub rack
12	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 12/16	Contactors (K1 & K2) and Bottom fuse mounting plate- Left & Right
13	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 13/16	Frame for HVAC controller
14	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 14/16	Connecting block Right –X1.2, Left X1.1and X3 RBC cum EBC
15	RDSO/PE/SK/AC/0205-2019(Rev-0) sheet 15/16	Codification chart and Name plate



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Annexure C

List of wiring diagrams

SN	Group No.	Description	Sheet /Page number of	
			RDSO Drawing No. RDSO/PE/SK/0206-2019(Rev.'0')	Page(sheet) no of Reference Drawing No. RCF (3) 11.0788.101
1	00	General Single line diagram for power & control circuits	sheet 1 of 48	01
2	00	Designation of components and system of wiring	Sheet 2 of 48	02
3	12	High voltage 750 V circuit	Sheet 3 of 48to sheet 4 of 48	01,02
4	21	High voltage control wiring diagram MMR 1&MMR 2	sheet 5 of 48to sheet 6 of 48	01
5	23	Anti-skid device	sheet 7 of 48	01
6	32	Battery distribution	sheet 8 to 13 of 48	01,02,03,04,05,06
7	33	3x240/415volts,50Hz circuits	sheet 14 to 21 of 48	01,02,03,04,05,06,07,08
8	42	Diagnosis	sheet 22 to 24 of 48	01,02,03
9	43	Emergency brake	sheet 25 of 55	01
10	45	Loudspeaker system	sheet 26 to 28 of 48	01,02,03
11	46	Train control line		
12	52	Lighting circuit		
13	61	Air conditioning system	sheet 29 to 34 of 48	01,02,03,04,05,06
14	72	Sanitary system	sheet 35 to 39 of 48	01,02,03,04,05
15	93	Insulation control	40 of 48	01
16	94	Telephone	sheet 41 of 48	01
17		Connecting blocks- Left (X-1.1)	sheet 42 to 44 of 48	RCF (3) 11.0788.101
18		Connecting Blocks- Right (X-1.2)	sheet 45 to 47 of 48	RCF (3) 11.0788.101
19		Connecting Blocks- X3	sheet 48 of 48	RCF (3) 11.0788.101

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Annexure- D

Bill of Material (BOM) for Switchboard Cabinet (S1)



For abbreviations in columns refer drawing no. RDSO/PE/SK/0206-2019(Rev.'0')

S.N	Gr	Item Code	Description	Quantity	Drawing/Catalogue no.	Make	Place of Installation
1	12	S1	Disconnecting and earthing device, 8pole , 2 way, without OFF , on load 125A at 1000V AC , 2 NO+2NC and with heavy duty handle and pad locking arrangement in off position, mounted in a stainless steel enclosure, suitable for AC 23 duty and conforming to IEC 60947, Max depth including handle 480 mm	1	74188SLB 32LOGBS SO(2NO+2 NC)	L&T-Salzer	S1A2
					M137.0827 407.R1	Schaltbau	
2	12	F01 F02 F03 F04 F05 F06	High voltage fuse (with holder) net 1 and net 2 Rated Current: 125 A, Rated Voltage: 1000 V AC Breaking Capacity: 80kA	6	2028003.1 25 + 2128001	Siba	S1F50 to S1 F55
					*	EFEN	
					*	Ferraz	
					*	ETI	
					125NH2IR- 1000 + SD1-D- 1000	Eaton Bussmann	
3	12	K01 K02	Contactor for Net 1& 2, Rated Voltage : 1000 V AC, Rated kVA - 100 at rated voltage & 70° C and utilization category 6 a. Main Pole: 4 Aux. contact: 2 NO + 2NC Control Voltage: 415 V AC+/- 15%. Breaking Current With surge suppressor	2	LC1D1150 046N5 + LA4DA2N + LADN22	Schneider	S1K01 S1K02
					AF190B- 40-22	ABB	
					3RT13636 AR36	Siemens	
					MCX-34	L&T	

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4	12	T8 T9	100 VA single phase, H class, insulation – 6 kV, 750/415V control transformer .	2		Bhasin Packard NACEI AEL RAMYAA Trolex ABROL Trinitron	S1T8 S1T9
5	12	S1F1 S1S1 F152 S1F1 53 S1F1 54 S1F1 55S1 F156	Fuses (with holder) 2 A, 500V AC for secondary of 100 VA control transformer and for K43 LMS contactor coil .	6	C10G2+B MM6031S Q 184000.2+ 7103401(B ASE) BMM603- 1SQ + C10G2 1SCA8330 01R2001 ST30725 with HD32 Base 3 NWNS2+3 NW20NNS F OFAFN000 GG2+ OFAFN000 GG2	Eaton Siba Bussman ETI L & T Siemens ABB	S1F151S1F 152 S1F153 S1F154 S1F155S1F 156
6	12	S7	Power supply on/off Switch	1	3SB50002 AB01+3SB 54000E EMNCSK1 +EC1C XB5AD33N	Siemens L&T- Salzer Schneider	S1S01
7	12	S1	Feeder selection Rotary switch with marking "I-0-II" net1 – Local main supply – net 2 (change over switch with 0-position 3-pole) Rated voltage 690 V AC Rated current 16 A	1	3SB5000- 2DB01+3S B5400-0A EMNCSL1 +EC1C K2F022QC H	Siemens L&T SCHNEID ER	S1S02
8	12	F10 F11 F12	Fuse (with holder) for 60 kVA transformer (secondary) Rated Current : 100 A,	6	3NA78300 RC + 3NH30300 RC	Siemens	S1F44 S1F45 S1F46

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			Rated Voltage: 500 V AC Breaking Capacity: 100kA		OFAFN00 GG100+ 1SCA8330 01R2001	ABB	SIF47 SIF48 SIF49
					03919, 03760	Wohner-	
					*	Eaton	
					100NHG00 0B-SB00- PB	Bussman	
					SF94942 +SK90405	L & T	
					*	AE	
9	12	P01	Analog AC Ammeter Ammeter NP72 0-100A: Cl.1.5	1	*	Muller+Zei gier	S1P1
					*	Rishab	
					SR - 72	Yokins	
10	12	S2	Ammeter selection Rotary switch with marking "L1-L2-L3-0 -L1-L2-L3"	1	3LD40014 DC200RC0	Siemens	S1S12
					61325	L&T- Salzer	
					K10F003M CH	SCHNEID ER	
11	12	T2 T3 T4	Current transformer 100A/1A :2.5VA:class1, UN800V; 50 Hz	3	4NC5117- 0CC21	Siemens	S1T2 S1T3 S1T4
					CM-CT 100/1	ABB	
					YOK-SR- 21-100/1	Yokins	
12	12	RC1 RC2	RC filter consist of 1 ohm, 6 W resistor connected in series with parallel connected 1.5 Micro Farad , 850 V capacitor of Vishay or Epcos make in each arm of 415 V circuit between phase to neutral and phase to earth circuit.	2		Bhasin Packard	S1RC1
						NACEI	
						AEL	
						RAMYAA	
						Trolex	
						ABROL	S1RC2
						NEC	
						ISG	
						Trinitron	
13	21	F01 F02 F03 F04 F05 F06	Fuse (with holder) 4A , 1.2 kV for voltage control	6	HVW-4 + HVW	Bussman	S1F90 S1F91
					*	Siba	S1F93
					*	Wohner	S1F94
					*	Ferraz	S1F95 S1F96
14	21	K01 K02	Voltage phase control (MMR-Measuring Monitoring Relay)	2	*	Carlo Gavazzi	S1K03 S1K04
					BD9080	Dold	

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			Net 1&2 3AC, 1000V aux. Voltage 110 V AC/DC				
15	21	P01 P02	Voltmeter NW 72 Net 1 & 2 0-1000V AC	2	*	AE	S1P2 S1P3
					*	Muller + Zeigler	
					*	Rishab	
					*	L&T	
					SR - 72	Yokins	
16	21	RSW- V1 RSW- V2	Voltmeter selector switch with marking L1- L2, L2-L3 ,L3-L1 Rated Voltage – 1000 V AC	2	61312SAB 13TDYR	L&T- Salzer	S1S13 S1S14
					3LD40014 DC300RC0	Siemens	
					K10D024M CH	SCHNEID ER	
17	23	K01	Drop out time delay relay for Anti skid true OFF delay control supply voltage 110-240V AC/DC	1	CT- ARS.21S	ABB	S1K05
					3RP25401 AW30	Siemens	
					RE22R2K MR	Schneider	
					23GDT0	L&T	
					MK7873N	DOLD	
18	32	F01 F02	Fuse (with holder) for battery circuit Rated Current: 25 A, Rated Voltage: 500 V AC, Breaking Capacity: 100kA,	2	3NA78100 RC+3NH30 300RC	Siemens	S1F42 S1F43
					03912, 03760	Wohner- italweber	
					OFAFN00 GG25+ 1SCA8330 01R2001	ABB	
					25NHG000 B + SB00- PB	Eaton	
					SF90152+ SK9114	L&T	
19	32	01	MCB for RBC cum EBC Rated Current : 25 A, Curve: C, Rated Voltage : 415 V AC, Pole: 3 P, Breaking Capacity: 10 kA	1	5SL43257 RC	Siemens	S1F160
					S203MT- C25	ABB	
					BB30250C	L & T	
					FAZ-C25/3	Eaton	
					A9N3P25C	Schneider	
20	32	K17	Contactor for Lighting control	1	3RT20181 BF42+3RT	Siemens	S1K49

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			Contacts: 3 NO + 1 NC Rated current 16 A Rated voltage 690 V AC Control Voltage: 110 V DC +/-15 % With surge suppressor		29161JL00 +3RT2911 1HA31		
					TKC6-31Z-62	ABB	
					MDX25	L & T	
					LC1D18FD	Schneider	
21	32		Miniature circuit breaker (MCB) for following purpose , Voltage rating: 200 V DC , 2 pole, Current rating: 6A, Breaking capacity: 10 kA	19 (1 for each application)	BJ2006DC	L&T	S1F24, S1F25, S1F26, S1F27, S1F28, S1F29, S1F31, S1F30, S1F32, S1F34, S1F36, S1 162, S1F39, S1F40, S1F35, S1F164, S1F168, S1F169, S1F15
	32	F6	Main lights entrance & sanitary area		5SY52067 CC	Siemens	
	32	F7	Spare		A9N61526	Schneider	
	32	F8	50% Reading Light passenger area		S202MT-C6UC	ABB	
	32	F9	50% Reading Light passenger area		FAZ-C6/2-DC	Eaton	
	32	F10	DC /DC converter				
	32	F11	Spare				
	32	F12	Telephone(In First AC coach only)				
	32	F13	Diagnosis Indications				
	32	32/F15	Night light passenger area				
	32	F20	Pump control				
	32	F162	Accidental Emergency Light				
	32	F39	50% Main Light passenger area				
	32	F40	50% Main Light passenger area				
	61	F35	Air conditioning Microprocessor controller unit A1				
	32	F164	CCTV				
	32	F168	LED light for SBC				
	32	F169	Spare				
22	32	F163	MCB 2 POLE 16 Amp for light contactor S1K49 200 V DC	1	BJ2016DC	L&T	S1F163
					5SY52167 CC	Siemens	
					A9N61531	Schneider	
					S202MT-	ABB	

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					C16UC		
					FAZ-C16/2	Eaton	
					BJ2010DC	L&T	
					5SY5210-7CC	Siemens	
					A9N61528	Schneider	
					S202M-C 6 DC	ABB	
					FAZ-C10/2-DC	Eaton	
					S202MT-C10UC	ABB	
23	32	F33 F37 F38, F165 F166 F167	MCB 2 Pole, Current rating: 10A, Breaking capacity: 10kA Voltage rating: 200V DC , for (i) Power supply (F33) (ii) Sanitary control (F37) (iii) Loud speaker system- /PIS (F38), (iv) Automatic sliding Door 1 rating 10 Amp (F165) (v) Automatic sliding Door 2 rating 10 Amp (F166) (vi) Infotainment system rating 10 Amp (F167)	6 (1 for each application)			S1F33 S1F37 S1F38, S1F165 S1F166 S1F167
24	32	U1	DC/DC converter 110V/24V, 240W, 10A	1	CP-C.1 24/10	ABB	
					TRIO-PS-2G/1AC /24DC/10-2903149	Phoenix	S1U2.1
					LGA240A-24-HSNTY	COSEL	
					6EP13363 BA10	Siemens	
25	32	S10	Push button (Red) 110 V DC, dia 22.5 mm for switching OFF K49 Light contactor and for checking AEL Emergency light unit	2	3SB5000-0AC01+3S B5400-0A	Siemens	
					EMNRFD1 +EC1C +EC2C	L&T	
					M22-D-G-X1/K10 ; LED-G + M22 ; A+M22-K10	Eaton	S1S10 S1 S09
					CP1-10 R01+ NO/NC	ABB	
					XB5AA42N + NO/NC	Schneider	

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26	32	S08	Push button(Green) to switch on K49 Light contactor 110 V DC, Dia 22.5 mm	1	3SB5000-0AE01+3S B5400-0A EMNGFD1 + EC1C + EC2C M22-D-G-X1/K10 ; LED-G + M22 ; A+M22-K10 CP1-10 G10+ NO/NC XB5AA31N + NO/NC	Siemens L&T Eaton ABB Schneider	S1S08
27	32	S05	Push button (Green) for test Indication lamp 110 V DC	1	3SB5000-0AG01+3S B5400-0A XB5AA11N + NO/NC EMNGFD1 + EC1C + EC2C CP1-10G-10 M22-D-G-X1/K10 ; LED-G + M22 ; A+M22-K10	Siemens Schneider L&T ABB Eaton	S1S05
28	33	F98 F99 F100	MCBs for mobile/laptop charging circuit Rated Current : 16 A, Curve: C, Rated Voltage : 230 V AC, Pole: 1 P, Breaking Capacity: 10 kA	3	5SL41167 RC S201MT-C16 BB10160C A9N1P16C FAZ-C16	Siemens ABB L & T Schneider Eaton	S1F100S1F101S1F102
29	33	F41	Miniature Circuit Breaker (MCB) for electrical socket : Rated Current : 6 A Rated Voltage : 230 V AC Pole: 2 P Breaking Capacity: 10 kA	1	S202MY-C6 A9N2P06C FAZ-C6/2 BB20060C 5SL42067 RC	ABB Schneider EATON L&T SIEMENS	S1F41

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30	33	F97	MCB for 5 KVA transformer(secondary) for mobile/laptop charging circuit Rated Current : 25 A, Curve: C, Rated Voltage : 230 V AC, Pole: 4 P, Breaking Capacity: 10 kA	1	5SL4425-7RC S204MT-C25 BB40250C A9N4P25C FAZ-C25/4	Siemens ABB L & T Schneider Eaton	S1F106
31	33	F92	MCB for 5 KVA transformer (primary) Rated Current : 16 A, Curve: D, Rated Voltage : 415 V AC Pole: 3 P, Breaking Capacity: 10 kA	1	5SL73168 RC S202MT-D16 BB30160D FAZ-D16/3 A9N3P16D	Siemens ABB L & T Eaton Schneider	S1F107
32	33	K02 K03	Contactor for Local main supply 1& 2, Rated Current : 95 A (at rated voltage and AC-3 utilization category) Rated Voltage : 690 V AC Main Pole: 4 Aux. contact: 2NO+1NC Control Voltage: 230 V +/-15% AC With surge suppressor	3	AF116B-40-22 LC1D1150 046P7 + LADN22 MCX34 3RT23461 NP30 4AA0 + 3RH29111 HA10 +3RT2936 1JL00	ABB Schneider L&T Siemens	S1K42 S1K41 S1K43
33	33	K08	Voltage phase control 400/480V AC +/-15%, 50-60Hz Control 300-500 V AC	1	CM-MPS.41S DPC01DM 48.400/480 7UG0753-1AA20 RM22TR33 BD 9080	M/s ABB, M/s Carlo Gavazzi SIEMENS Schneider DOLD	S1K45
34	33	K01	Contactor for 60 kVA Transformer	1	AF116B-40-00+CAL 19-11 LC1D1150	ABB Schneider	S1K44

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			Rated Current : 100 A at AC-3 Rated Voltage : 690 V AC Main Pole: 4 , Aux. contact: 1NO+1NC Control Voltage: 230 V AC +/- 15%) With surge suppressor		046P7+ LADN11		
					3 RT13556A P36	Siemens	
					MCX33	L&T	
35	33	F05 F06	MPCB for ventilation fan unit 1 & 2 Thermal release range(Rated Current) 1.6- 2 A Class: 10 Breaking Capacity: 50kA Pole: 3 P Rated Voltage: 415 V AC 1NO+1NC auxiliary contact block	2	MS132- 2.5B+ HK1-11 GV2ME07 ST41895O OOO PKZM01- 1.6 + NHI- E-11-PKZ0 3VS1300- 0MH00 1NO+1NC: 3VU9131- 3AA00	ABB Schneider L&T Eaton Siemens	S1F01 S1F02
36	33	F12 F18	MCB for Heater 1& 2 with auxiliary contact block Thermal release range(Rated Current : 16 A) Breaking Capacity: 10kA Pole: 3 P Rated Voltage : 415 V AC	2	S203MT- C16+ S2C- H6-11R A9N3P16C BB30160C +AUX BZA11006 5SL43167 RC+55ST3 010 FAZ-C16/3	ABB Schneider L&T Siemens Eaton	S1F08 S1F14
37	33	F07 F09 F13 F15 F10 F11 F16 F17	MPCB for ventilation fan unit 1 & 2 & for condenser fan unit 1.1 & 1.2, 2.1 & unit 2.2 Thermal release range. Rated Current 1.1-1.6 A Class: 10 Breaking Capacity: 50kA	6	MS132- 1.6B GV2ME06 ST41894O OOO 3RV2011- 1AA10 PKZM0-2.5	ABB Schneider L&T Siemens Eaton	S1F01 S1F02 S1F06 S1F07 S1F12 S1F13

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			Pole: 3 P Rated Voltage: 415 V AC				
38	33	F27	Miniature Circuit Breaker (MCB) for Water Boiler and Coffee maker : Rated Current : 16 A Rated Voltage : 230 V AC Curve: C Pole: 2 P Breaking Capacity: 10 kA	2	S202MT-C16	ABB	S1F16 S1F150
					A9N2P16C	Schneider	
					BB20160C	L&T	
					5SL42167 RC	Siemens	
					FAZ-C16/2	Eaton	
39	33	F28	Miniature Circuit Breaker (MCB) for Soup Boiler: Rated Current : 6 A Rated Voltage : 230 V AC Curve: C Pole: 2 P Breaking Capacity: 10 kA	1	S202MT C6	ABB	S1F17
					A9N2P06C	Schneider	
					BB20060C	L&T	
					5SL4206-7RC	Siemens	
					FAZ-C6/2	Eaton	
40	33	F26	Miniature Circuit Breaker (MCB) for Hot case: Rated Current : 10 A Rated Voltage : 230 V AC Curve: C Pole: 2 P Breaking Capacity: 10 kA	1	S202MT-C10	ABB	S1F18
					A9N2P10C	Schneider	
					BB20100C	L&T	
					5SL4210-7RC	SIEMENS	
					FAZ-C10/2	EATON	
41	33	F29 F34 F161	Miniature Circuit Breaker (MCB) for Bottle Cooler Refrigerator Mini Printer : Rated Current : 6 A Rated Voltage : 230 V AC Curve: C Pole: 2 P Breaking Capacity: 10 kA	3	S202MT-C6	ABB	S1F19 S1F20 S1F161
					A9N2P06C	Schneider	
					BB20060C	L&T	
					5SL4206-7RC	SIEMENS	
					FAZ-C6/2	EATON	
42	33		Miniature circuit breakers (MCBs) for Power Factor correction of	6	5SY7303-8CC S203MT-D3	Siemens ABB	S1F120S1F121 S1F122 S1F123S1F

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			Condenser fan 1.1, 1.2, 2.1, 2.2 and ventilation motors 1 & 2 Rated Current : 2.5 /3 A, Curve: D, Rated Voltage : 415 V AC Pole: 3 P, Breaking Capacity: 10 kA		BB30030D FAZ-D3/3 A9N3P03D	L & T EATON Schneider	126S1F127
43	33		Miniature circuit breakers (MCBs) for Power Factor correction of Compressor 1.1, 1.2, 2.1, 2.2 Rated Current : 6 A, Curve: D, Rated Voltage : 415 V AC Pole: 3 P, Breaking Capacity: 10 kA,	4	5SY7306- 8CC S203MT- D6 BB30060D FAZ-D6/3 A9N3P06D	Siemens ABB L & T EATON Schneider	S1F124 S1F125S1F 128 S1F129
44	33	K06 K07	Auxiliary Contactor (with diode) for Water Pump1&2 : Contacts: 3 NO + 1 NC Control Voltage: 77- 143 V DC Rated Voltage : 690 V AC Rated Current : 10A (at rated voltage & AC- 3 utilization category)	2	AF9ZB-30- 01 CA4KN31F W3 3RH2131- 1BF40+3R T29161JL0 0 MO0DC *	ABB Schneider Siemens L&T C&S	S1K24 S1K25
45	33	Q1 Q2 Q3 Q4 Q5	MPCB for Exhaust Fan 1, 2 AND 3 WC MBS 25 withauxiliary contact (1NO+1NC) and terminal block And MPCB for water pump 1 & 2 MBS 25 with aux. contact Rated Voltage : 415 V AC Rated Curent : 0.63 A Thermal release range:	5	MS132- 0.63B, HK1-11 GV2- ME04+GV- AE11 3VS1300- 0ME00 1NO+1NC: 3VU9131- 3AA00 PKZM01- 0.63 + NHI- E-11-PKZ0	ABB Schneider Siemens EATON	SIF85 SIF86 SIF87 S1F21 S1F22

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			0.4-0.63 A Class: 10 Breaking Capacity: 50kA Pole: 3 P		ST41892O OOO +ST41945 OOOO	L&T	
46	33	33/F1 5	Miniature circuit breaker (MCB) for Exhaust fan 6 Amp , Voltage rating: 415 V AC , 3 pole, Current rating: 6A, Breaking capacity: 10 KA C Curve	2	5SL3067R C BB30060C A9N3P06C S203MT- C6	Siemens L & T Schneider ABB	S1F15
47	42	P01	Ammeter NP72 for DC load current And Ammeter NP72 for Charge /Discharge of battery 50-0-50A	2	* * * * * MR - 72	AE Muller Zeigler Rishabh L&T Yokins	S1P8 S1P9
48	42	P03	Voltmeter NW72 Battery 0-150V DC	1	* * * * MR - 72	AE Muller+ Zeigler Rishabh L&T Yokins	S1P10
49	42	S01 S02	Push button Insulation test battery net + White, Red, dia 22.5 mm	2	3SB50 00- 0AG01 + 3SB54 00- 0A XB5AA11N (White) EMNWFD1 +EC1C+E C2C CP1- 10W10 M22-D- R+M 22- A+M22- K01	Siemens Schneider L&T ABB Eaton	S1S03 S1S04
50	42	I11 H2	Net 1 working (Green Light On) Net 2 working (Green	1 1	PCB mounted 10 mm	Samsung, Cree,	I101 H02

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			Light On)		LED on right upper door of SBC	Everlight, Nichia, MLS, AVAGO make with prior approval of RDSO	
		H3	RBC OK (Green Light On)	1			H03
		H4	Local main supply 1 working (Green Light On)	1			H04
		H5	Local main supply 2 working (Green Light On)	1			H05
		H6	Battery Not Healthy (Red Light On)	1			H06
		H7	Anti-skid defect (Red Light On)	1			H07
		H8	LED type Indicator Insulation control 110V ac Fail (Red Light On)	1			H08
		H9	Insulation control 415 V Fail (Red Light On)	1			H09
		H10	415V Not OK (Green Light On)	1			H10
		H11	MMR 1 OK (Green Light On)	1			H11
		H12	MMR 2 OK (Green Light On)	1			H12
		H13	Spare (Green Light On)	1			H13
		H14	Spare (Green Light On)	1			H14
		H15	RMPU fault (Red Light On)	1			H15
51	43	K01	Time delay relay External power supply/emergency brake 110 V DC blinking interval 2s	1	CT-MFS.21 7PV07231 AZ20 or 3RP15051 AW308K RE22R2M MW 2A8DT6	ABB SIEMENS SCHNEIDER L&T	S1K18
52	61	MCB	MCB, 2.5/3 A, 200 V DC, single pole, C curve for ventilation fan 1(F131), controller ok (F132), ventilation fan 2(F133), spare (F134), condenser fan 1.1 (F135), condenser fan 1.2 (F136), compressor 1.1 (F137), compressor 1.1 (F138),	14	S201M-C3 UC 5SY5103- 7CC BJ1003DC FAZ-C3- DC A9N61503	ABB Siemens L & T EATON Schneider	S1F131 to S1F144

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			heater 1 (F139) condenser fan 2.1(F140), condenser fan 2.2(F141), compressor 2.1(F142), compressor 2.2(F143), heater 2 (F144)				
53	61	K03 K05 K12 K13 K17 K18 K16 K21	Contactor (with diode) for ventilation fan unit 1 & 2 Condenser CD1.1,,CD1.2 , CD 2.1 CD 2.2 Heater 1 & 2 : Rated Current : 16 A (at rated voltage & AC- 3 Utilization Category) Rated Voltage : 690 V AC Main Pole: 3 NO Aux contact: 1NC, Control Voltage: 77- 143 V DC With surge suppressor	8	AF16ZB- 30-01	ABB	S1K26 S1K28 S1K31 S1K32 S1K36 S1K37 S1K35 S1K40
					LC1D18FD	Schneider	
					MDX25	L&T	
					3RT20181 BF42+3RT 29161JL00	Siemens	
54	61	K04	Auxiliary contactor, for Controller OK Contacts: 3 NO + 1 NC Control Voltage: 77- 143 V DC With surge suppressor	2	TKC631Z- 62	ABB	S1K27
					MO0DC	L&T	
					CA4KN31F W3	Schneider	
					3RH21311 BF40+3RT 2916- 1JL00	Siemens	
					*	C&S	
55	61	K14 K15 K19 K20	Contactor (with diode) for Compressor unit CP1.1 CP1.2,CP2.1,CP 2.2 Rated Current : 32 A (at rated voltage & AC- 3 Utilization Category) Rated Voltage 690 V Main Pole: 3 NO Aux. contact: 1NC Control Voltage: 110 V DC +/-15% With surge suppressor	4	AF30ZB- 30-00+ CA4-01	ABB	S1K33 S1K34 S1K38 S1K39
					LC1D32FD	Schneider	
					MDX50	L&T	
					3RT20271 BF40+3RT 29261JL00	Siemens	

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56	61	U1	DC/DC converter 110V/24V, 1.5 A	1	LGA50A- 24SN (2.1 A) CP-E- 24/2.5 CP-E 24/2.5 ABL8REM 24030 6EP33216 SB100AY0	Cosel- Powertech ABB Phoenix Schneider Siemens	S1A08
57	61	Front right door	Auto-Manual Bye-pass Rotary switch for Air- conditioning; Rated Current : 16 A, Position : 3 (Auto, Manual, Off), No. of Poles : 7	2	16A-D16- 61031- B13-FHYR	L&T- Salzer	S1S15, S1S16
58	61	Front right door	On/Off switch for Air- conditioning; Rated Voltage: 110 V DC +/-30% Rated Current : 6 A, Position : 2	1	61198 *	L&T- Salzer Siemens	S1S17
59	61	R1	Resistor (resistor clamp at the X1.2) Air Condition Humidity circuit 10 kohm, +-1%,0.25W	1	281-665/ 281-663	WAGO	S1R2
60	61	R2	Resistor (resistor clamp at the X1.2) Air Condition Humidity circuit 1 kohm, +-1%,0.25W	1	281- 665/281- 559	WAGO	S1R3
61	61	V1 V2 V3	Diode 1N4007 (diode clamp at the X1.2)	3	281-665/ 281-400	WAGO	S1V1 S1V2 S1V3
62	93	A1	Insulation control 110V AC Measuring range 1- 100 k Ohm Control voltage 24-240 V AC/DC Output 1 C/O (SPDT) Contact System leakage capacitance 10 Micro Farad	1	IR 140Y-4, RI-R22 * * CM- IWS.2S Vigil Ohm/IMD- IM10 3UG4581- 1AW30 IL 5880	Contrel Bender Woka ABB Schneider SIEMENS DOLD	S1A6

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63	93	A2	Insulation control 415V AC Rated voltage 0-500 V AC Control voltage 24-240 V AC/DC	1	IR 470LY-21A, RI-R138	Control	S1A7
					*	Woka	
					*	Bender	
					CM.IWS.2 S	ABB	
					Vigil Ohm/IMD-IM10	Schneider	
64	93	F1 F2	Miniature circuit breakers (MCBs) in place of Glass fuse for A6 110 V IMR 2 Nos Current Rating: 2 A, Curve: D, Voltage Rating: 230 V AC Pole: 1 P, Breaking Capacity: 10 kA	2	3UG4581-1AW30	SIEMENS	SIF58 S1F59
					IL 5880	DOLD	
					*	Siemens	
					S203MT-D2	ABB	
					BB10020D	L & T	
65	93	F3 F4 F5	Miniature circuit breakers (MCBs) instead of Glass fuse for A7 415 V IMR 3 Nos Current Rating: 4 Amp Curve: D, Voltage Rating: 230 V AC Pole: 1 P, Breaking Capacity: 10 kA	3	FAZ-C2-DC	EATON	S1F60 S1F61 S1F62
					A9N1P02D	Schneider	
					*	Siemens	
					S203MT-D2	ABB	
					BB10040D	L & T	
66	32	F3 F4	Miniature circuit breakers (MCBs) 6 Amp for Anti skid device Rated Current : 6 A Rated Voltage : 200 V DC Pole: 1 P,	2	A9N1P04D	Schneider	S1F63 S1F65
					S202MT-C6UC	ABB	
					BJ1006DC	L&T	
					FAZ-C6-DC	EATON	
					*	SIEMENS	

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			Breaking Capacity: 6/10 kA				
67	33	F2 F3 F30 F31 F32 F1	Miniature circuit breakers (MCBs) in place of Glass fuse for K41 Local main supply -1 and for K42 Local main supply-2 For K45 MMR 415 V -3 Nos For K44 contactor 415 V AC Current Rating: 2 Amp, Curve: D, Voltage Rating: 415 V AC Pole: 1 P, Breaking Capacity: 10 kA	6	5SL71028 RC	Siemens	S1F67 S1F68 S1F69 S1F70 S1F71 S1F72
					S203MT- D3	ABB	
					BB10030D	L & T	
					A9N1P03 D	Schneider	
68		X1	Terminal block X1.1	LO T	As per Annoxuro F of this specificatio n and as per RDSO drawing no. RDSO /PE/SK/AC /0206- 2019(Rev- 0) sheet 42 of 48 to sheet 48 of 48	Wago	S1X1.1 S1X1.2 S1X3
69		X2	Terminal block X1.2			Phoenix	
70		X3	Terminal block X3			Weidmuller	
71			Halogen free polycarbonate /ABS alleys	LO T	*	L&T	
					*	Phoenix	
					*	Trinity touch	
72			E beam cables for control and Power	LO T	As per RDSO Specificatio n no. ELRS/SPE C/ELC/001 9, Rev.2 or latest	RDSO approved sources	



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73		Multiple accessories like locks, hinges, handles etc.	LOT		Dirak	
					Southco (For limited Quantity)	
74		Braided copper cable of 70 sq mm and 300 mm in length each duly crimped at both ends.	2		As per clause 6.13	
75		Cable fire barrier for incoming & outgoing cables	Lot		With prior approval of RDSO	
76		Fire suppression Cartridge (100gm+100gm + 8/10gm +8/10gm)	4 pieces		As per Annexure G and with prior approval of RDSO	
77		Computer generated ferrules class R22/R23 in EN 45545-2 with HL-2 category.	LOT		Tyco	
					Phoenix	
78		Cable Jackets class R22/R23 in EN 45545-2 with HL-2 category.	LOT		PMA Jack	
					Federal Mogul	
					Werner Hahn	
					ISG	
					Tyco	
					MV Electro System	
79		Schematic laminated drawings in A0 Size to be kept in each SBC	1		With prior approval of RDSO	



Note:

1. * Part number shall be decided at design approval stage before prototype manufacturing.
2. The part numbers mentioned in the above Bill of Material (BOM) are based on information furnished by respective OEMs. Change of any shall be brought out at design approval stage of prototype.
3. Firm has to obtain prior approval of part numbers at the design stage before use in prototype SBC.
4. All contactors for RMPU motors shall be of AC-III utilization category.
5. Inspection agency will check all the components and maintain record for future reference.
6. The DIN rail used shall have minimum depth of 15mm.

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7. All materials including switchgears (Contactors, MCB & MPCB) provided in SBC shall conform to EN 45545 with hazard level HL-2 , vibration shock to IEC 61373 and suitable to work in temperature range -5°C to 70°C & relative humidity up to 98 % and suitable for rolling stock application.
8. Stipulated current rating for all switchgears items shall be at rated voltage and specified utilization category and at 70°C temperature.
9. Rated voltage for components used on 750 Volts AC & 415 Volts AC side shall be 1000 volts AC & 690 Volts AC respectively.
10. All auxiliary contacts to be suitable for 3Ampere inductive load & for 415 V AC.
11. All switchgears shall be accepted after verification of compliance for HL-2 , vibration & shock and stipulated rating on rated voltage at given utilization category on 70 Deg C as per respective governing standards.

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Annexure E



Reference drawing no RDSO/PE/SK/AC/0206-2009(Rev-0) Sheet 42 of 48 to sheet 48 of 48 for connecting block X1.1 X1.2 and X3 .Part of terminal blocks are as under:-

Left side block fitment position

Block No.	Wago number	
Stopper	249-117	
Earth Block	2016-7691	
End Plate	280-317	
End Plate	280-314	
1 to 18, 24-39, 41-89, 91-109	280-833	PA System Sanitary ,PIS, Pump Anti Skid, light control Spare 45-84 RBC Diagnosis , Emergency brake Diagnosis, Lighting
19-22	281-901	Pump control
End Plate	280-315	
40,90,110,111	280-837	Earth Block
112-119, 124-185, 351,352,353, 355,356,357 359,360,361	280-833	Lighting Temperature, Gr 61 Controller output Exhaust fan 1 Exhaust fan 2 Exhaust fan 3
120-123	281-652	Lighting
End Plate	281-334	
350,354,358	280-837	Earth Block
Stopper	249117	



Right side block fitment position

Block No.	Wago number	
Stopper	249-117	
Earth Block	2016-7607 2016-7691	
186-200 203-228 231-233 235-237 239-241 243-245 247-261	280-833	controller output A6/A7 IMR Battery sanitary controller output Vent 1 Vent 2 Compressor 1.1 Compressor 1.2 Heater, Condensers ,Compressor 2.1

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263-265 267-281 283-284 286-287 289-290 292-293 295-296 298-300 302-304		Compressor 2.2 Condensers A11 Water Boiler A12 Soup boiler A10 Hot case A13 Bottle Cooler A22 Refrigerator Water pump Water pump
201-202 234,238,242,262,266, 285,288, 291,294, ,297, ,301, 305	280-837	Earth Block
229-230 306 ELV1+ 307308 ELV1-309	285-634 280-833	Neutral of K41& K42
311-313 DIODE	8000-100/000-1329	TOP ventilation
314-315 RESISTANCE 10 K	281-665/281-559	Humidity control
316-317 RESISTANCE 1K	281-665/281-663	Humidity control
End Plate	281-334	
320-323	280-833	Telephone, Power supply
324-330	281-652	5 kVA transformer mobile charging
End Plate	281-334	
331-334	281-652	
F58-59		A6 2 Nos. 2 Amp MCB
F60-62		A7 3 Nos. 4 Amp MCB
F63-65		Anti Skid 3 Nos. 6 Amp MCB
F67		K41 1 No. 2 Amp MCB
F68		K42 1 No. 2 Amp MCB
F69-71		K45 3 Nos. 2 Amp MCB
F72		K44 1 No. 2 Amp MCB
End Plate	281-334	
End Plate	282-311	



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Annexure-F Schedule of cable sizes

S N	Size of cable in sq mm	Power/control circuit
1	50	D&ED → 125 A Fuse→S1K01 /S1K02 &Transformer secondary →100 A Fuse → K44
2	25	S1K41/ S1K42→100 A Fuse→S1K43→K44
3	2x16	K44/K43→busbar→RMPU MCB
4	6	For looping between 415 V RMPU MCBs.
5	4	Battery charger
6	4	Mobile charging socket RMPU Compressors Heaters
7	2.5	RMPU other motors, Pantry appliances, 5 kVA 415/190V transformer primary
8	1.5	<p>All control wires</p> <p>Pump and any other power circuit</p> <p>Anti skid device Pump control</p> <p>AC package control</p> <p>Pre-cooling contactor wiring S1K43</p> <p>Feeder contactor wiring S1K 44</p> <p>Internal wiring S1K41 & S1K42</p> <p>AC package internal power wiring</p> <p>Pump control cables</p> <p>MCB outer cable (right side upper side)110V DC</p> <p>MCB outer cable(right side down side DC MCB)</p> <p>AC package power wiring MCB outer cable (left side upper MCB) ventilation fan</p> <p>AC package power wiring MCB outer cable (left side down MCB) soup boiler refrigerator bottle cooler water pump</p> <p>LHS door outer cable</p> <p>voltmeter selector switch RSW1 RSW 2</p> <p>Capacitor bank wiring detail</p> <p>Loud speaker loose wire</p> <p>AC Package Outer cable loose wiring Loose Bunch</p> <p>AC Package Outer Loose wire for door</p> <p>Any other control wire</p>



- Note:-
1. Red Yellow Blue & black colour shall be used for 750 V, 415 V ,110 V AC cable R,Y,B & N respectively.
 2. White(Positive) , Chocklate (negative) shall be used for 110/24 V DC cable.
 3. Earth wire shall be of green colour.

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Annexure-G
Technical requirement of aerosol fire detection & suppression system



	Technical requirement of aerosol fire detection & suppression system
1	Type of system - Thermal type & suitable for fires arising out of electrical abnormalities (Class E fire).
2	Important features- Automatic triggering , zero maintenance , zero depletion potential (ODP), Non corrosive & non toxic, zero global warming potential(GWP) & zero atmospheric life time .
3	The aerosol generator should be UL-2775 certified and certificate from 3 rd party to be furnished at the time of inspection of Switch board cabinet.
4	Action temperature of device should be 94-104 Deg C.
5	Technology should meet the requirements of NFPA -2010 standards. 3 rd party certification to be furnished at the time of inspection of switch board cabinet.
6	Shell life of the system should be 10 years(min).
7	System shall not require any battery/electric supply for operation.
8	System with mounting arrangements shall be suitable for installation in switch board cabinet (Electrical panel) installed on Railway passenger coach(non passenger area).

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DISTRIBUTION LIST

CHIEF ELECTRICAL ENGINEER:	
1	Northern Railway, Baroda House, New Delhi – 110 001.
2	Central Railway, II Floor, Parcel office, CST Mumbai – 400 001.
3	Eastern Railway, Fairlie Place, Kolkata – 700 001.
4	South Eastern Railway, Garden Reach, Kolkata – 700 043
5	Southern Railway, ParkTown, Chennai – 600 003.
6	Western Railway, Churchgate, Mumbai – 400 020.
7	South Central Railway, Rail Nilayam, Secunderabad – 500 371.
8	East Central Railway, DighiDistt- Vaishali, Hajipur Bihar- 844 101.
9	North Central Railway, North Central Railway, Block A, Subedarganj, Allahabad-211033
10	South Western Railway, 1 st Floor, DRM Office, Hubli 580 020
11	South East Central Railway, Bilaspur.495004
12	North East Frontier Railway, Maligaon, Guwahati - 781001
13	North Eastern Railway, Gorekhpur – 273001
14	North Western Railway, Jaipur – 302006
15	West Central Railway, Jabalpur - 482001
16	East Coast Railway, Bhuvneshwar, Orrisa – 751016
17	Konkan Railway, BelapurBhavan, Sector-11, Belapur, Mumbai - 400614
18	Metro Railway, 33 /1 J.L. Nehru road, Kolkata- 700071
19	Integral coach factory, Perambur, Chennai - 600038
20	Rail Coach Factory, Kapurthala (Punjab) – 144 602
21	Modern Rail Coach Factory, Lalgaon, Raibareilly(UP)-229120
CHIEF WORKS MANAGER:	
1	Matunga Workshop, Central Railway, Mumbai 400 019.
2	Liluah Workshop, Eastern Railway, Howrah
3	C&W Workshop, Northern Railway, Alambagh, Lucknow-226 05
4	C & W Workshop, N. Rly., Jagdhari – 135 002
5	Mechanical Workshop, NER, Gorakhpur – 273 012
6	Carriage Workshop, Southern Railway, Perambur, Ayanavaram, Chennai – 600023.
7	SCR, Lallagudda Workshop, Lallaguda, Secunderabad - 500017
8	Carriage Workshop, Western Railway, Lower Parel, Mumbai-400013
9	CRWS, W. C. Railway, Nishatpura, Bhopal-462010
10	Carriage Workshop, NW Rly, Ajmer - 305001
11	Carriage Repair Workshop, Gadag Road, SWR, Hubli – 580 020
12	Carriage Workshop, S.W. Railway, MysoreVishwanath.
13	Carriage Workshop, SE Rly., Kharagpur - 721301
14	New Bongaigaon, Railway Workshop, Danttal, Distt. Bongaigaon, Assam-783380
15	Carriage and Wagon Workshop, N. C. Rly., Jhansi – 248003
16	Carriage and Wagon Workshop, WC Rly., Kota - 324002
17	Carriage and Wagon Workshop, Eeastern Rly., Liluha - 711204
18	Carriage and Wagon Workshop, W. Rly., Pratap Nagar, Vadodara - 390004
19	Carriage and Wagon Workshop, N Rly., Amritsar - 143001
20	Central Workshop, Goldenrock, S. Rly., Trichi - 620004
1	Director, IRIEEN, Nasik Road (Maharashtra). - 422101
2	Senior Professor (Elect.), RailwayStaffCollege, Lalbaug, Vadodara. - 390004
3	Director, IRCAMTECH, Maharajpur, Gwalior – 474 020.

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