

Functional Requirements Specification for 'Self Regulating Heat Tracer and Specialised heating solution for winterisation of water pipeline System in coaches'

(For Jammu & Kashmir and Hilly areas of Indian Railways)

1.0 Scope:

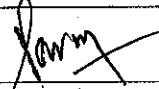

The train services shall be started in J&K and other hilly area over Indian Railways and the trains shall encounter varied range of temperature zones varying from as high as upto +50°C and lowest upto -10 °C. Also at terminating stations the coaches shall be stabled in yards or platforms for upto 10 to 15 hours and the water in the pipelines/associated equipments provided in the coaches may freeze in sub zero ambient temperatures. The water supply system mainly comprise of under slung mounted stainless steel water tanks, water pump and stainless steel water pipe line running in the underframe upto the lavatories on both ends of the coach. To prevent ice build up and bursting of pipes, the pipe temperatures can be regulated by providing anti freeze heating system which will heat the pipes when the power supply is "ON" and retain the temperature during the stabling period of coaches at sheds, yards or platform while the coaches are un-energised for long durations.

This specification incorporates the functional requirements of 'Self regulating heat tracer and specialised heating solution for winterisation of water pipeline' in Railway coaches operating in Jammu & Kashmir and Hilly areas of Indian Railways.

2.0 Scope of supply:

The scope of supply shall comprise of the heating system and heat retention system along with its installation, testing and commission in coaches as follows:

- i) Supply and Installation of High quality Self regulating heat tracer for specialised heating solutions for winterisation of water pipeline including all accessories complete with Power control panel (with thermostatic control range 4°C to 35°C (continuous), Power connectors, WP type splice connector, WP type T connector, End seal, Mounting hardware, Adhesive tape roll etc. of M/s Danfoss/Chromalox or any other equally reputed make with prior approval of RCF.
- ii) Supply and Installation of Nitrile insulation tube (or any other insulation suitable for Railway application) for water pipe line of Armaflex, class-0, Armacell or any other equally reputed make with prior approval of RCF with Aluminium duct cladding.
- iii) Fully insulated Stainless steel pump enclosure with min 2.0mm thickness SS sheet of 304S2 grade with thermal insulation inlay to meet the specific requirement of this specification to be provided without dismantling the pump equipment from the coach.

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- iv) Multiple circuits for heating shall be required alongwith suitable junction boxes and connectors for thermally insulated section for ease in maintainability.
- v) Thermostatic sensors shall be provided at suitable locations along the thermally insulated pipe lines for ON/OFF as per preset temperature range through the control panel.
- vi) Installation , testing and commissioning of the complete system in LHB coaches and system validation for the prototype unit. Prototype clearance shall be given by RCF before commencing bulk supplies.
- vii) Total Electrical load proposed shall not exceed 3KW.

3.0 Reference specifications:

FM	FM Approvals LLC
IEEE 515	Institute of Electrical and Electronics Engineers
NEC	U.S. National Electric Code (NFPA 70)
NECA 202-2013	Installing and Maintaining Industrial heat Trace Systems
NEMA	National Electrical Manufacturers Association
UL 746B	Underwriters' Laboratories, Inc.
ANSI	American National Standards Institute
CSA	Canadian Standards Association

4.0 Service Conditions:

Ambient temp.

Maximum temp. : + 50°C
 Minimum temp. : - 10°C



Altitude:

At any altitude between 0 and 1776 m above mean sea level

5.0 Water supply arrangement in coaches:

Fresh water tanks of the following capacities are provided on the underframe of the coaches:

- i) Externally insulated Stainless steel 650 Litres Under slung mounted - 2 nos. (*)
- ii) Externally insulated Stainless steel 450 Litres Under slung mounted - 1 no. (*)
- iii) Externally insulated Stainless steel 30 litres mounted over lavatories - 4 nos. (*)
- iv) Single pipe line and double pipeline alongwith the joints/pipe connectors shall be as follows. The interconnecting joints of the pipe lines shall be insulated and cladding done in such a way that they are accessible to attend while maintenance by User Railways.:
 - Size and length of double water pipe line = 18mm (OD) for each 20 Mtr. (#)
 - Size and length of single water pipe line = 18mm (OD) 7.4 Mtr. (#)
 - No of joints in the pipe line = T-Joint-1No. & Connector-6Nos. (#)

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(*) No heating cable or insulation is in the scope of supply for externally insulated water tanks.

(#) Firm shall submit complete design details including the length and other parameters of heating cable, insulation and accessories involved in the design to achieve desired performance/results duly supported by detailed design data/design calculations.

A mono block pump fixed on stainless steel cradle is also provided in the underframe for raising the water from under slung mounted water tanks to Auxiliary water tank of 30 Litres capacity over each lavatory. The overall sizes and mounting arrangement of water tanks and pipe line is as per the following drawings (for reference):

Reference drawings:

1. MI006025 (Pipe laying for water under the coach for LHB AC and Non AC coaches). (#)
2. EDTS 186 (latest) for Self priming mono block pump assembly with controller. (#)

6.0 Air conditioning arrangement in coaches (for reference only):

Each coach shall have the provision of centralized heating system to take care of cold climatic conditions as follows (not in the scope of supply of this specification):

LHB coaches:

Each coach shall have the provision of Roof Mounted Package AC Unit (RMPU) to RDSO specification RDSO/PE/SPEC/AC/0061 alongwith modification sheet no. RDSO/PE/MS/AV/0088-2022(Rev.0) which shall provide heating for the coach.

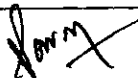

MEMU coaches:

Each DMC shall be provided with one set of (RMHU + blower) arrangement and one cab heating unit and trailer coach shall be provided with 2 sets of (RMHU + Blower) arrangement

- Each RMHU shall consist of heating coil of 12 KW (2 banks each of 6KW) and shall deliver 4000 m³/Hr air at 20mm static pressure.
- Cab heating unit shall be with cab heating element of 2.0 KW rating with 300 m³/Hr at 20 mm static pressure

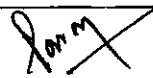

The inside temperature of coaches shall be maintained in Jammu & Kashmir and Hilly areas as follows:

Outside temp. : - 10°C
Inside temp. : + 17 to 21°C

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7.0 Functional Requirements:

1. The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on Stainless Steel pipes provided on the underframe of the coach and flexible connector hose with SS protection for flexible connections of the pump assembly and pump enclosure for mono block pump provided on the underframe.
2. The nominal power rating of the heating cables shall be not less than 15W per feet at nominal temperature of 10°C with self regulating features and minimum in-rush current.
3. The heating cable shall have a tinned copper braid with additional protection from chemical attack and mechanical abuse by an additional outer jacket of polyolefin or any other polymer suitable for Railway applications. Details to be submitted by the vendor during approvals.
4. The heating cable shall have self-regulating properties to prevent rapid heat-up and overheating of water in pipelines.
5. The heating cable shall withstand a maximum continuous exposure of 135 °C in power OFF condition.
6. The heating cable shall be FM (factory manual) approved for installation in hostile environments with minimum service life of 20 years.
7. All connection components used to terminate self-regulating heating cables, including power connectors, splices, tees, and connectors, shall be procured from the OEM of the heating cables and under no circumstances manufactured by a vendor other than the OEM of heating cables. Any other electrical wiring shall be done with electron beam irradiated cables to RDSO specification ELRS/SPEC/ELC/0019(REV-4) and procured from RDSO approved sources only.
8. All Power, Splice, Tee and End connections kits shall be NEMA 4X/IP66 (min) rated and shall offer High Service temperature, corrosion resistant, non flammable, high strength and rigidity. OEM of heating cable shall supply these kits from their own product range.
9. The system shall be designed for operation at 110 V (± 10%) AC 50Hz fed through a separate 5.0/9.0 KVA, 3Phase 190V transformer provided on the underframe. The coaches shall be stalled in the yard during night hours in un-energized condition with no power source available during the stabling period. Pre heating of the pipes shall be done for adequate period before the coaches are de-energized to ensure anti freezing of the pipe lines and pump equipment for the entire stabling period of approx. 10 hrs. in the yard during the worst weather conditions encountered at site.
10. Thermal insulation (min. 25mm) over the water piping, Monoblock pump equipment and accessories shall be provided and the complete system shall be so designed and thermostatically controlled that it can continuously and effectively withstand and retain heat during night for a period of 10-15 hours without interruption. The duty cycle of heating cable and thermal insulation design along with calculations to meet the above requirement shall be submitted to CEDE/RCF for obtaining prior approval and prototype manufacturing.

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11. All materials used shall be fire retardant and suitable for Railway Applications only.
12. The system shall not get damaged or the efficacy of the system shall not deteriorate due to leakages in the water pipe line or during maintenance of the water supply system. It shall be possible to reinstall the system in its original condition after carrying out maintenance work of the water supply system without any major extra cost.
13. Protection against grounding of the heat tracer cable (ELCB) shall be provided which shall be in the scope of supplier. The conceptual protection scheme of the heat tracer system is shown in SKED-888, however the actual scheme shall be submitted by the supplier and prior approval shall be got from RCF.

8.0 PROTOTYPE APPROVAL:

- 8.1 The manufacturer shall submit a prototype sample along with the datasheets/design calculations which shall be submitted to CEDE/RCF for approval. The prototype sample shall be installed in the coaches at RCF or anywhere in J&K region to prove out the system for its functionality as per the stipulated requirements of Indian Railways. Commissioning report along with the results obtained shall be jointly witnessed by Railway official and representative of supplier before submitting to CEDE/RCF for further scrutiny of the compliance with the specification and according the prototype approval of the system.
- 8.2 During type testing/system validation of the prototype unit, any changes required to be done in the prototype or any additional tests other than specified are required to be conducted on the prototype unit or its components, they shall be done expeditiously.
- 8.3 During the process of manufacture of the equipment, if the purchaser so desires, he may conduct/repeat any of the routine or additional tests to satisfy himself that the quality of the system being manufactured is of the required standards.

9.0 TESTS:

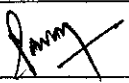

The firm shall submit the QAP alongwith test protocol for approval before commencing testing of the system as per Table-1 below.

9.1 Type tests:

The type tests shall be carried out by RCF representative on prototype unit either totally or in part without any additional cost. The tests shall be carried out at the works of the manufacturer or a reputed testing laboratory in presence of Indian Railway representative or test certificate issued by accredited test laboratory on the prototype unit as per relevant governing specifications modified or amplified. The manufacture shall have all possible necessary arrangement for testing of the system.

9.2 Routine test:

Routine test shall be carried out on each unit to verify that properties & design of the product of corresponding to those measured during type test. Proper documentation of routine tests

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results should be available with the firm and will be produced before inspecting official on demand.

9.3 Acceptance test:

Every unit shall be subjected to acceptance tests at manufacturer's works and witnessed by an inspecting official nominated by purchaser. Manufacturer on demand by inspecting official shall produce the routine test report carried out by manufacturer.

9.4 Test description

Table-1

S.N.	Description of test	Type test	Routine test	Acceptance test
1.	Dimensional and visual inspection	Yes	Yes	Yes
2.	Outer jacket and sheath integrity check.	Yes	Yes	Yes
3.	Performance test	Yes	-	-
4.	Protection scheme	Yes		Yes
5.	Insulation resistance test	Yes	-	Yes
6.	High voltage test	Yes	-	Yes

Note : Testing/measuring instruments shall be duly calibrated from any NABL recognized laboratory shall be furnished during type test.

9.4.1 Dimensional and visual inspection and verification of documents:

The unit shall be checked visually for general workmanship and rating /make of sub assembly items. Documents/data sheets shall also be verified.

9.4.2 Outer jacket and sheath integrity check:

OEM Certificate of compliance from accredited lab/FAT (Factory Acceptance Test) to be submitted for verification of this requirement.

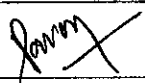

9.4.3 Performance test:

Verification of rated output of the heating cable/insulation from the data sheet shall be done. OEM Certificate of compliance from accredited lab shall also be verified. The overall performance/validation shall be carried out after installation in the coach to establish compliance with the requirements of this specification.

Procedure for verification of performance:

For checking the performance of heating cable;

1. Specimen pipes (similar to as used in LHB coaches) of size 18mm OD of length 0.75 m (or any other suitable length as agreed between the supplier and purchaser) shall be taken with water inside and sealed at both ends in the form of U-shape.

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2. The sample of self regulating heating cables submitted for the prototype testing/validation shall be wrapped or aligned with the water pipes and insulation shall be wrapped around to maintain the temp. of water/water pipe during extreme cold conditions of the order of -10°C.
3. Temperature sensor shall be placed alongside for measurement of the temperature of water/water pipe.
4. The test specimen shall be sealed with aluminum foil on outside as per design stipulated by the supplier.
5. The specimen shall be placed inside a climate chamber to maintain simulated cold ambient conditions for USBRL section. The following shall be recorded:
 - a) Specimen prepared with heating cable with insulation placed in climatic chamber with power supply to the specimen 'OFF' :

S. No.	Time	Temp. inside the climatic chamber	Temp. of water pipe in °C	Remarks

- b) Specimen prepared with heating cable with insulation placed in climatic chamber with power supply to the specimen 'ON' to reach the design value or till stabilized :

S. No.	Time	Temp. inside the climatic chamber	Temp. of water pipe in °C	Remarks

- c) Specimen prepared with heating cable with insulation placed in climatic chamber with power supply to the specimen 'OFF' immediately after stabilization to reach the freeze limit (shall withstand for minimum 10 hrs @ -10°C ambient):

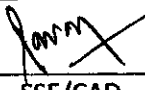

S. No.	Time	Temp. inside the climatic chamber	Temp. of water pipe in °C	Remarks

Note :-

1. Thermostat settings can be used to control ON/OFF requirement on minimum and maximum temperature settings.
2. Power consumption shall be recorded and shall not exceed the limits as per this specification.
3. Check for Self regulating properties Thermal output vs Pipe temperature shall be done as per IEEE 515.

9.4.4 Protection scheme:

To be verified as per the SKED-888 and also actual protection scheme approved by RCF shall be verified for its effectiveness.

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9.4.5 Insulation resistance test:

The insulation resistance of the system shall be not be less than 100MΩ at 60%RH when megged with 500V meggar before and after HV test

9.4.6 High voltage test:

Immediately after IR test, an AC voltage of 1.72 KV rms of sine wave form of 50HZ shall be applied for 1 minute between live parts and coach body. There shall not be any kind of breakdown flashover or tripping of supply.

10.0 Installation and Commissioning:

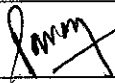

The system shall be installed and commissioned in coaches at RCF workshop or at yards over Indian Railways by the vendor/authorized representative.

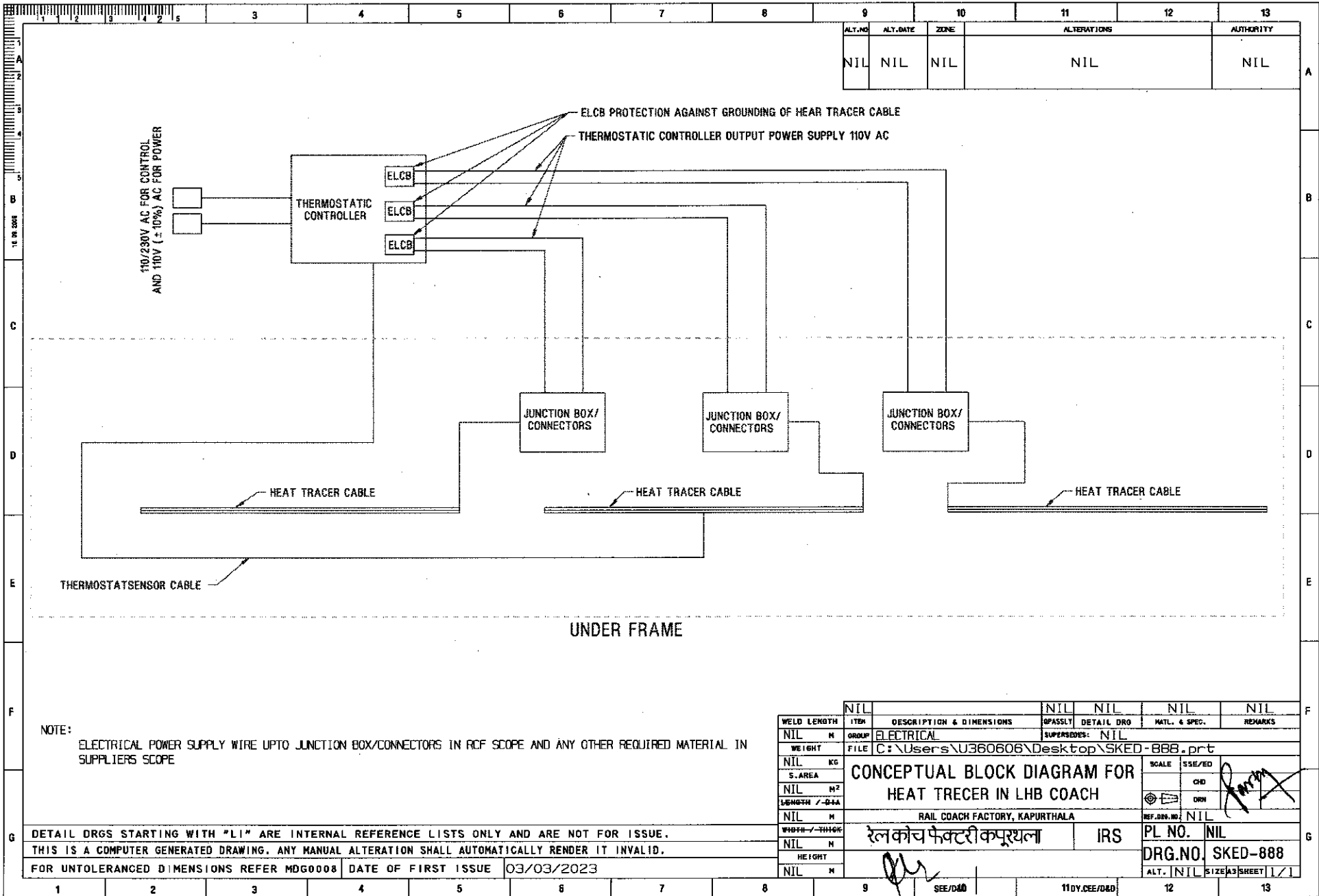
11.0 Warranty:

Standard IRS conditions shall be applicable.

12.0 Enclosures:

1. Drg. No. MI006025 (Pipe laying for water under the coach for LHB AC and Non AC coaches).
2. SKED-887: Conceptual drawing for Heat Tracer in LHB coach.
3. SKED-888: Conceptual block wiring diagram for Heat Tracer in LHB coach.
4. EDTS 186 (latest) for Self priming mono block pump assembly with controller.

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ALT. NO.	ALT. DATE	ZONE	ALTERATIONS	AUTHORITY
NIL	NIL	NIL	NIL	NIL

ELCB PROTECTION AGAINST GROUNDING OF HEAT TRACER CABLE
 THERMOSTATIC CONTROLLER OUTPUT POWER SUPPLY 110V AC

110/230V AC FOR CONTROL
 AND 110V (± 10%) AC FOR POWER

THERMOSTATIC
 CONTROLLER

ELCB
 ELCB
 ELCB

JUNCTION BOX/
 CONNECTORS

JUNCTION BOX/
 CONNECTORS

JUNCTION BOX/
 CONNECTORS

HEAT TRACER CABLE

HEAT TRACER CABLE

HEAT TRACER CABLE

THERMOSTAT SENSOR CABLE

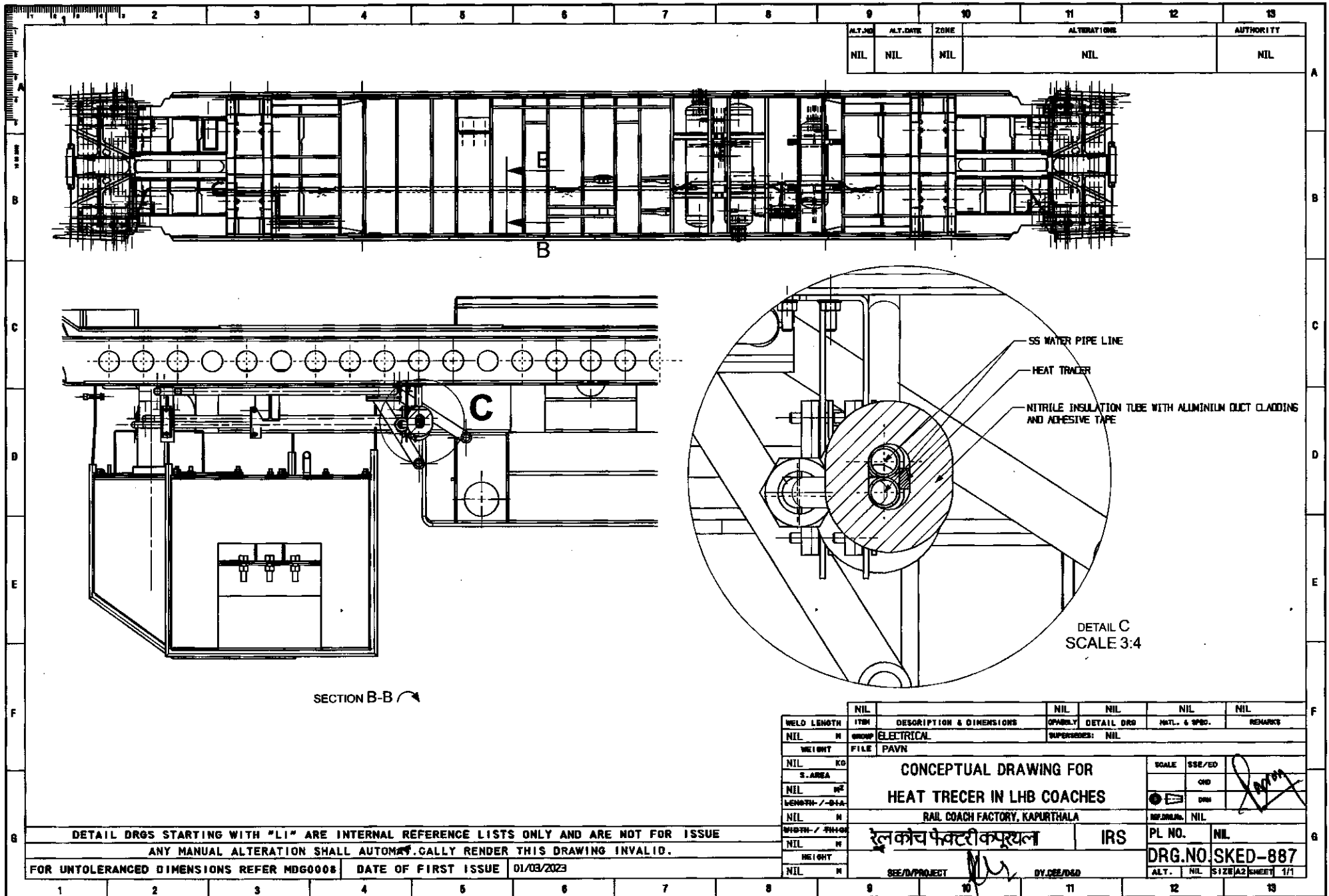
UNDER FRAME

NOTE: ELECTRICAL POWER SUPPLY WIRE UPTO JUNCTION BOX/CONNECTORS IN RCF SCOPE AND ANY OTHER REQUIRED MATERIAL IN SUPPLIERS SCOPE

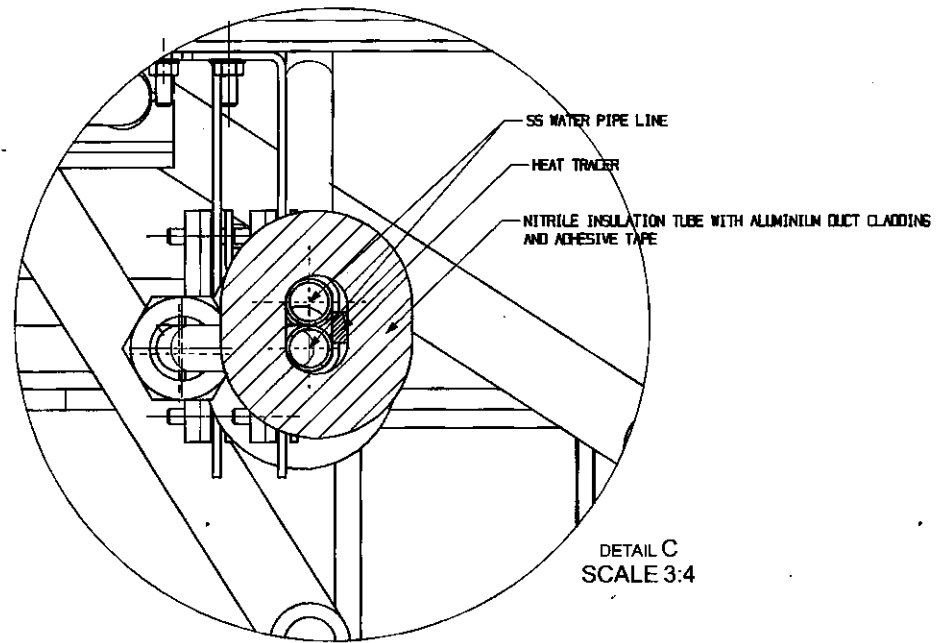
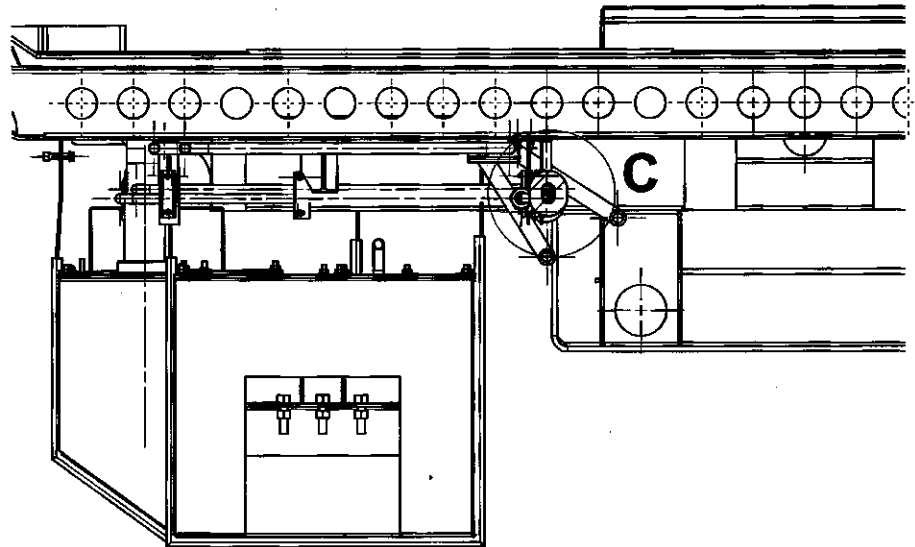
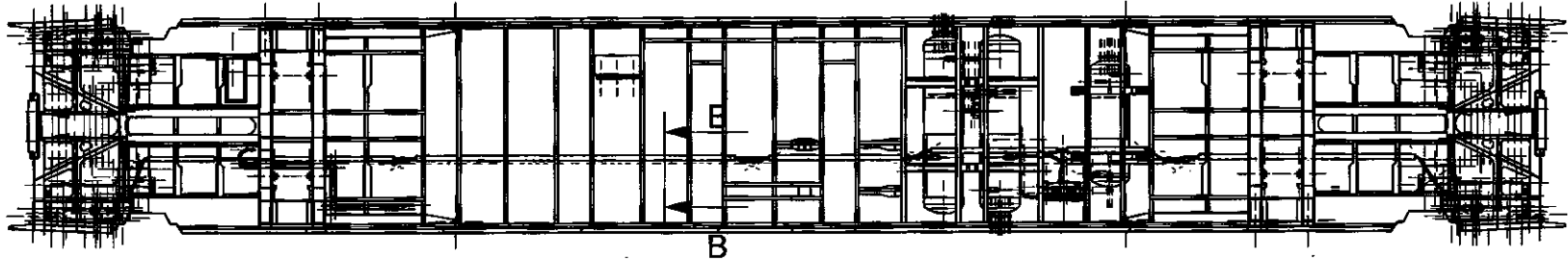
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NIL	KG	CONCEPTUAL BLOCK DIAGRAM FOR HEAT TRECR IN LHB COACH				
S. AREA	SCALE					SSE/ED
NIL	M ²	DRN				
LENGTH	-GAA					DRN
NIL	M	RAIL COACH FACTORY, KAPURTHALA				
WIDTH	REF. DRG. NO.					NIL
NIL	M	रेल कोच फेक्टरी कपुरथला		IRS	PL NO.	NIL
HEIGHT	DRG. NO.					SKED-888
NIL	M	ALT. NIL				
						SIZE A3 SHEET 1/1

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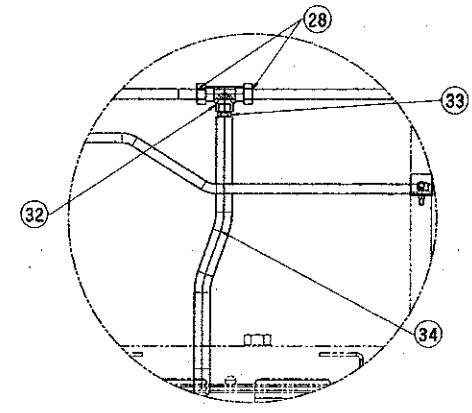
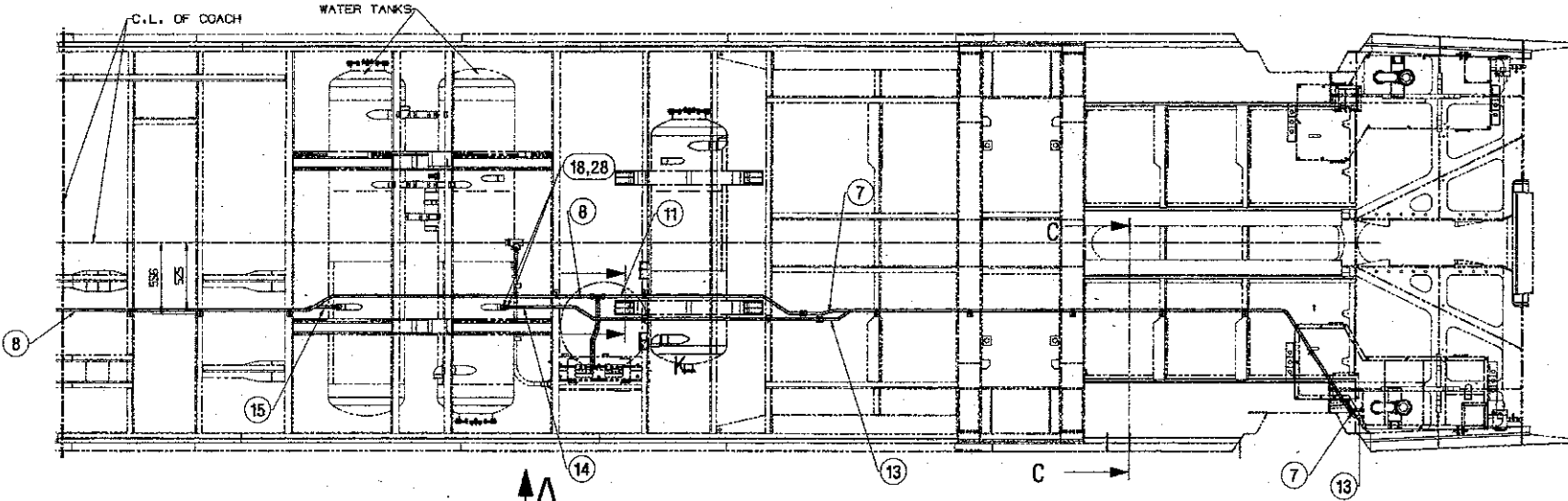
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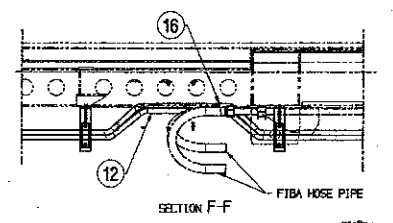
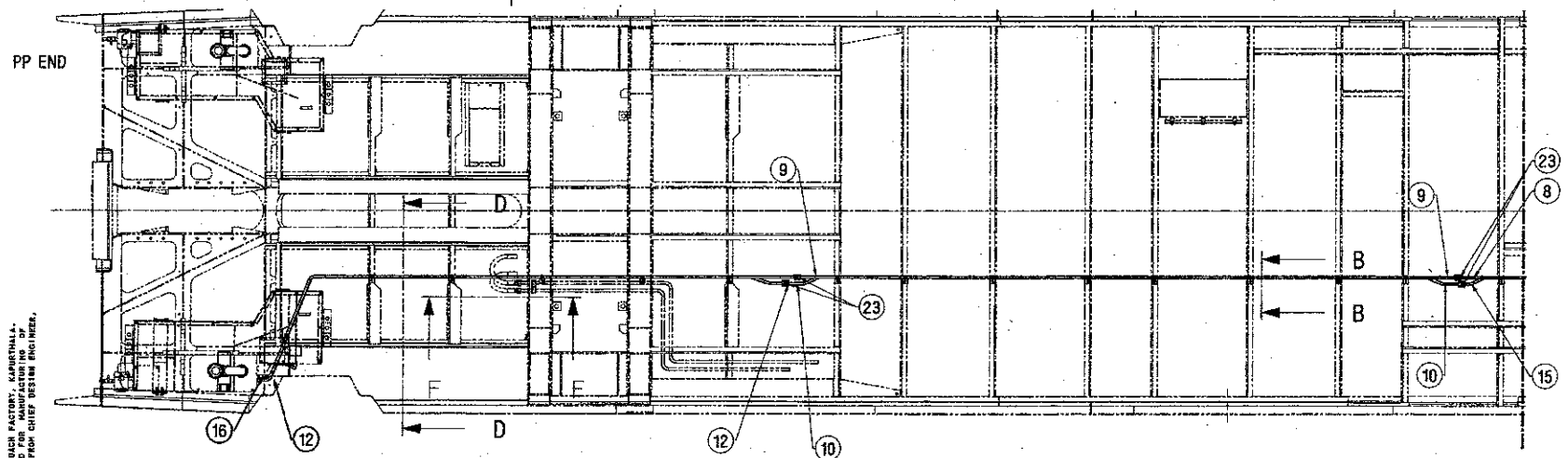
SECTION B-B

WELD LENGTH	ITEM	DESCRIPTION & DIMENSIONS	OPANELY	DETAIL DRG	MATL. & SPEC.	REMARKS	
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NIL	KG	CONCEPTUAL DRAWING FOR HEAT TRACER IN LHB COACHES RAIL COACH FACTORY, KAPURTHALA				SCALE	SSE/ED
NIL	S. AREA					OND	
NIL	M ²					DRW	
LENGTH / -DIA						REF./MATERIAL	NIL
NIL	M	PL NO.	NIL	DRG. NO. SKED-887			
WEIGHT / -DIA		ALT.	NIL	SIZE	A2	SHEET	1/1
NIL	M	SEE/D/PROJECT		BY	CSE/DSD		

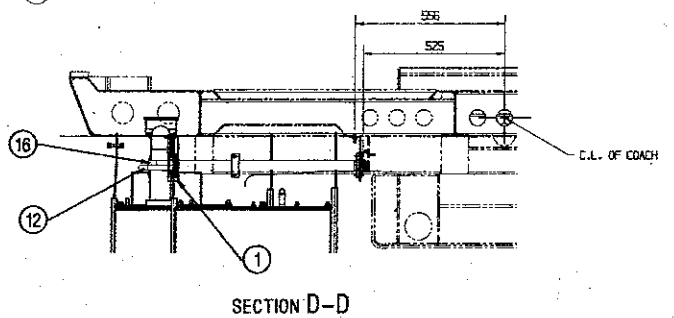
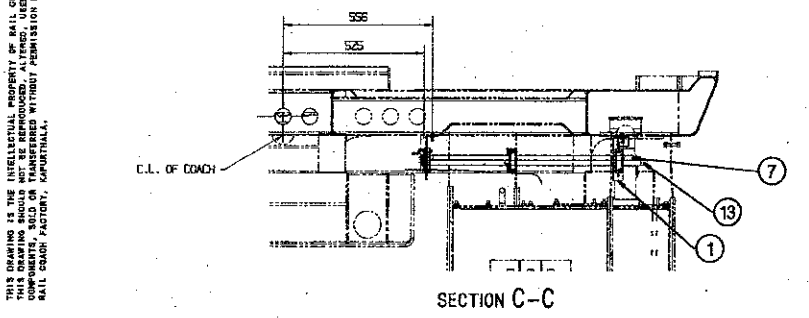
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DETAIL K
SCALE 1:5



SHOULD BE ENTERED INTO DRAWING BOOK
31 MAY 2021

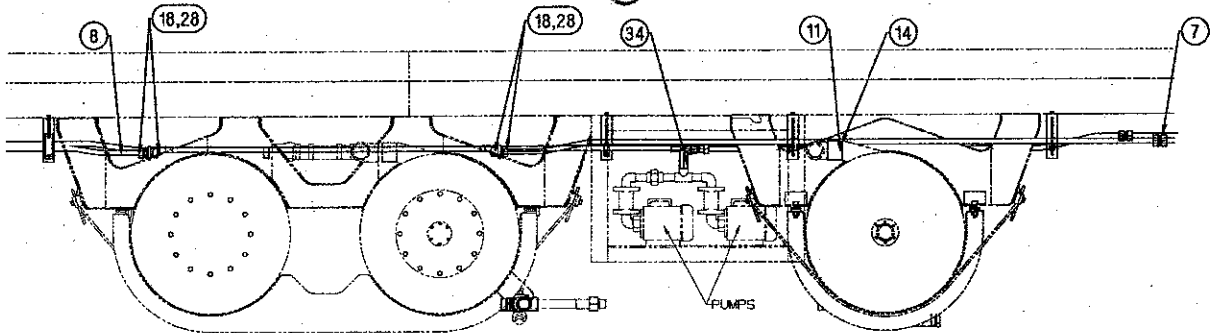


THIS DRAWING IS THE INTELLECTUAL PROPERTY OF RAIL COACH FACTORY, KAPURTHALA. THIS DRAWING SHOULD NOT BE REPRODUCED, ALTERED, USED FOR MANUFACTURING OF RAIL COACH OR PARTS THEREOF WITHOUT PERMISSION FROM CHIEF DESIGN ENGINEER, RAIL COACH FACTORY, KAPURTHALA.

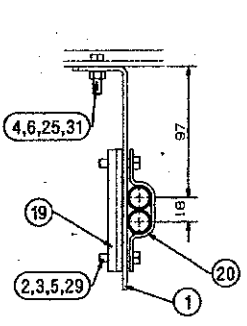
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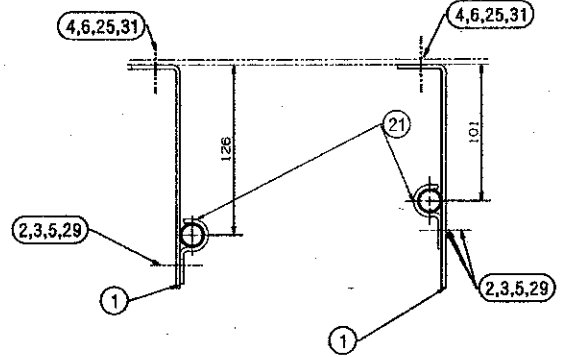
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42.500	KG	PIPE LAYING FOR WATER UNDER THE COACH				
S. AREA		FOR AC 2 TIER, 3 TIER, GARB RATHL, GS AC AND SCH 500 COACH				
NIL	M	RAIL COACH FACTORY, KAPURTHALA				
WATER TOWER		रेलकोच फैक्ट्री कपूरथला		IRS	PL NO. 00000000	
NIL	M				DRG. NO. M1008025	
HEIGHT						
NIL	M					



VIEW A



SECTION B-B



SECTION E-E

NOTE - 1

- ALL SCREW CONNECTIONS/BOLT CONNECTIONS, WITH OR WITHOUT NUTS, OF STAINLESS STEEL THAT ARE TO BE SECURED WITH ACRYLESTER SCREW PROTECTION (LOCTITE) HAVE TO BE GREASED WITH MOLYBDENUM DISULPHIDE (MOLYKOTE) PRIOR TO BE SCREWED IN.
- FOR ALL CONNECTIONS BETWEEN THE THREAD FITTINGS OF NON CORRODING STEEL THE EXTERNAL THREADS HAVE TO BE WRAPPED WITH (HEMP) AND COVERED WITH SEALING PASTE BEFORE THEY ARE SCREWED IN.

ALT. NO.	ALT. DATE	ZONE	ALTERNATION	AUTHORITY
0	27/05/2021	ALL	1. ITEMS 17,22,24,26,27 & 30 DELETED. 2. ITEMS 32 TO 34 ADDED. 3. QPA OF ITEM-21 & 28 WERE 11 & 2 RESPECTIVELY. 4. VIEWS ARE REARRANGED AND DRG. MADE IN TWO SHEETS. 5. WEIGHT ADDED. 6. FOR ITEM-21, DRG. NO. ADDED AND DESCRIPTION CHANGED.	DIC MD210012

ITEM NO.	DESCRIPTION & DIMENSIONS	QTY	UNIT	STANDARD	MATERIAL	REMARKS
34	FLEXIBLE CONNECTOR HOSE WITH SS PROTECTION 3/4" 20 BORE	1	AE3201	NIL	NIL	
33	NIPPLE 20 BORE	1	NIL	IS: 1281(P)-2192 TAB-28 AISI 304	NIL	
32	TEE INCREASING 15X20 BORE	1	NIL	IS: 1281(P)-2192 TAB-12 AISI 304	NIL	
31	PLAIN WASHER A6.4	30	NIL	IS: 2016-1957 140M-A2	NIL	
30	CONNECTION HOSE FLEXIBLE 20 BOREX 350	1	WESH12	NIL	ITEM NO. 1	
29	HEX HEAD BOLT M6X25	66	NIL	IS: 1364 PT.1-52 A2-70	NIL	
28	MALE STUD CONNECTOR (85PT THREAD)	4	NIL	SEIBERL/2K65 -A30X	ERMETO OR EQUIVALENT	
27	TUBE END RUBBER	1	NIL	RE022/10-LABE	ERMETO OR EQUIVALENT	
26	GRIND WHEEL	1	NIL	TR8LABE	ERMETO OR EQUIVALENT	
25	HEX HEAD BOLT M6X25	30	NIL	IS: 1364 PT.1-52 A2-70	NIL	
24	MALE GRIND CONNECTOR	1	NIL	GE22-LABE	ERMETO OR EQUIVALENT	
23	UNION	6	NIL	618LABC	ERMETO OR EQUIVALENT	
22	PIPE BRACKET 20	11	NIL	QIN1997 XSC-HI 1810	DIN17440 1,4301	
21	CLAMP	6	LN53111	NIL	ITEM-5	
20	TUBE CLIP	26	LEG200	NIL	NIL	
19	BRACKET	30	3 10113.0, 30.055.188	NIL	NIL	
18	HEXAGON REDUCING 32X15 BORE	2	NIL	IS: 1281(P)-2192 TAB-27 AISI304	NIL	
17	PIPE	1	LEG3182	NIL	NIL	
16	PIPE	1	MI06049	NIL	NIL	
15	PIPE	1	LEG3120	NIL	NIL	
14	PIPE	1	LEG3119	NIL	NIL	
13	TUBE	1	MI06041	NIL	NIL	
12	PIPE	1	MI06044	NIL	NIL	
11	PIPE	1	LEG3116	NIL	NIL	
10	PIPE	1	LEG3113	NIL	NIL	
9	PIPE 1800X1.5X255	1	NIL	DIN2381C XSC-HI 1810	DIN17456 1.4301	
8	TUBE	1	LEG3112	NIL	NIL	
7	PIPE	1	MI06042	NIL	NIL	
6	NYLOC NUT M6	45	NIL	IS: 7002-91 A2-70	NIL	
5	NYLOC NUT M6	60	NIL	IS: 7002-91 A2-70	NIL	
4	WASHER 8.4	30	NIL	IS: 2016-1957 140M-A2	NIL	
3	WASHER 6.4	60	NIL	IS: 2016-1957 140M-A2	NIL	
2	PLAIN WASHER A6.4	60	NIL	IS: 2016-1957 140M-A2	NIL	
1	BRACKET	30	3 10113.0, 30.055.077	NIL	NIL	

ENTERED INTO DATA BASE 31 MAY 2021

WELD LENGTH	ITEM	DESCRIPTION & DIMENSIONS	QTY	UNIT	STANDARD	MATERIAL	REMARKS
NIL	M001	LAVATORY & ITS FITTING					
42.500	KG	FILE					
PIPE LAYING FOR WATER UNDER THE COACH							
RAIL COACH FACTORY, KAPURTHALA							
रेल कोच फैक्टरी कपूरथला							
SCALE: 1:5							
FOR AC 2 TIER, 3 TIER, BARB RATH, 68 AC AND 80W EGG COACH							
PL NO. 00000000							
DRG. NO. MI060025							
DATE OF FIRST ISSUE: 17/08/2013							
CGM BY: [Signature]							

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ANNEXURE-1 to Description – “SITC of Self Regulating Heat Tracer And Specialised Heating Solution for winterisation of Water Pipeline System In Coaches”.

Schedule of Items :

Sno.	Description	QPC
1	High quality Self regulating heat tracer for specialised heating solutions water tank pipelines, Size 2x18mm(Clubbed) & 1x18mm (Single) including covering with spiral heating cable laying and jacketing with Nitrile insulation tubing 25mm Thick and alongwith Aluminium duct cladding alongwith other accessories details & makes as specified in Cl. 2(i) , 2(ii) & 7.0 of the Spec. EDTS442 Rev.-A respectively. Refer drawings as per Cl.12.0 of spec. EDTS442 Rev.-A.	40Mtrs
2	Fully insulated Stainless Steel Pump Enclosure with min 2.0mm thickness SS sheet of 304S2 grade with thermal insulation inlay for Pump assembly to specification no. as per Cl. 12.0(4) of the spec. EDTS442 Rev.-A.	1no.
3.	Electrical Control Panel (with SS enclosure 2.0 thickness sheet of 304S2 grade) for Three out going feeders at working Voltage 110VAC as per spec. EDTS442 Rev.-A. comprising of following with suitable Ratings: <ul style="list-style-type: none"> • MCB(DP) • ELCB (sensitivity 30mA) • Contactor • Temperature Controller • Indication Light • Hooter • Accessories: WAGO type connectors , Cable ties, SS Hardware's of suitable sizes. <p>The complete Schematic diagram, Design details and drawings shall be got approved from office of CEDE/RCF before manufacture of item.</p>	1no.
4.	Stainless Steel Junction boxes (IP65) with min 2.0mm thickness SS sheet of 304S2 grade, with overall size 150x150x100 alongwith WAGO type connectors of suitable size & SS hardware's for fixing in coach.	03nos.
5.	Thermostatic Sensors (RTD-PT-100 or similar) as per Cl. 2 (v)	02nos.
6.	Installation of all above items alongwith accessories and testing in coach as per spec. EDTS442 Rev.-A.	

- Requirement of any other accessory for meeting the functional requirement as per Spec. EDTS 442 Rev.-A if any during prototype/FAI approval of the system in coach will be in firms scope of supply.

20.05.23	<i>Bam</i>	<i>Bam</i>	<i>Sankhu</i>	
Date	SSE/CAD	SEE/D&D	DYCEE/D&D	Pg. 1 of 1