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सत्यमेव जयते

भारत सरकार GOVERNMENT OF INDIA

रेल मंत्रालय MINISTRY OF RAILWAYS

VANDE BHARAT EXPRESS TRAINSET (V2.0) MAINTENANCE MANUAL

Volume 3 – Part V
Train Lighting & Air Conditioning

IRCAMTECH/GWL/2022-23/T-18/MM/2.0
SEPTEMBER, 2022

अग्रगामी RDSO
रेल अग्रदूत Transforming Railways

An ISO 9001:2015 Certified Organisation
उच्च अनुरक्षण प्रौद्योगिकी केन्द्र
EXCELLENCE IN MAINTENANCE

Indian Railways
Centre for Advanced Maintenance Technology

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26 Maintenance Manual (Battery Box Unit) – Medha
Document No - IM 254 Rev.0 Date: August 2022

Amendment and Revisions

The correction slips to be issued in future for this report will be numbered as follows:

IRCAMTECH/GWL/2022-23/T-18/MM/2.0# XX date .....

Where “XX” is the serial number of the concerned correction slip (starting from 01 onwards).

Version	Date	Corrections	Remarks
1.0	AUGUST 2020	First Release	For first and second rake of the VBE trainset manufactured by ICF.
2.0	SEPTEMBER 2022	Second Release	For 44 rakes of VBE trainset (Third rake onwards)

Introduction

This volume of the maintenance manual contains maintenance/ operational/ installation related document from various OEM associated with different system and components of Trainset. For ease of understanding and for simplification the document, this volume has been divided into 5 parts to divide the large document for ease of download and navigation. These are:

PART - 1

- Bogie
- Couplers

PART - 2

- Electro-Pneumatic Brakes and Air Supply

PART - 3

- Furnishing Items
- Passenger Amenities

PART - 4

- Propulsion System

PART - 5

- Train Lighting & Air-conditioning

AMIT ENGINEERS
Smart Solution for Better Future

OPERATION AND MAINTENANCE MANUAL

FOR ROOF MOUNTED AIR-CONDITIONING UNIT MADE FOR TRAIN-18 DRIVER CAB

AMIT ENGINEERS

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REVISION LOG

REVISION	DATE	DESCRIPTION
00	02-07-2022	First Issue

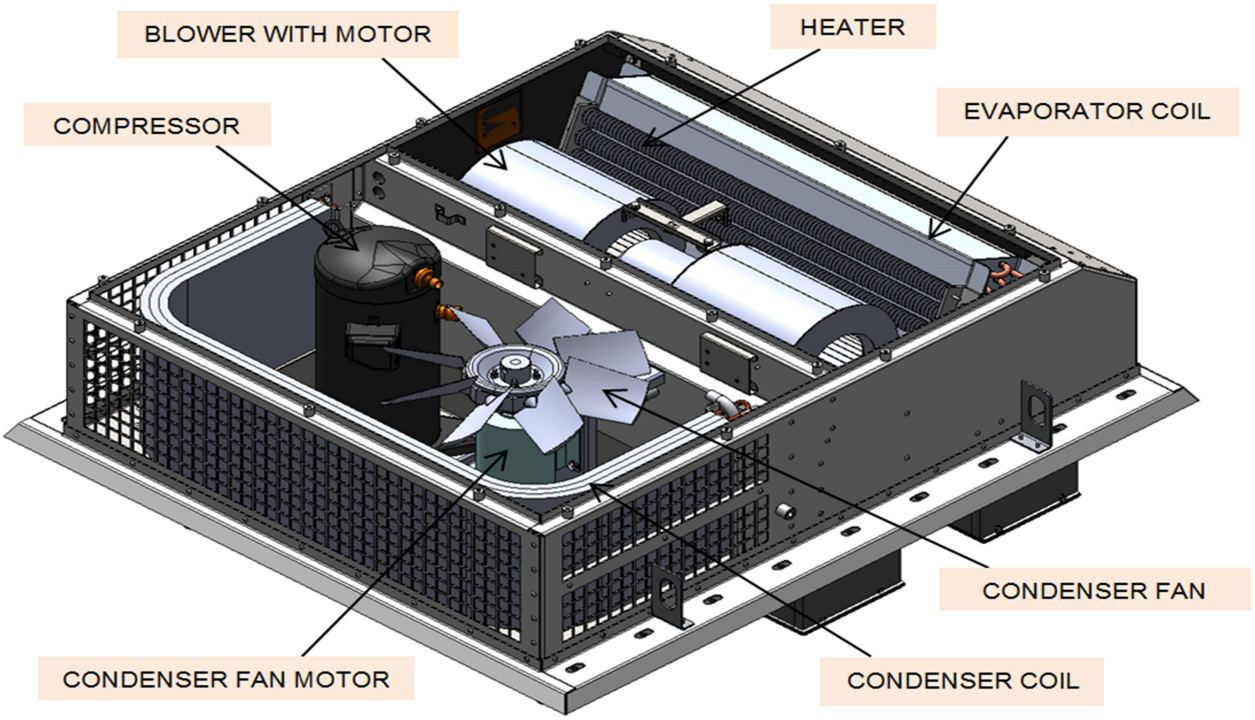
ABOUT US

Amit Engineers is an IRIS (International Railway Industry Standards) certified company based on ISO/TS 22163:2017, established in 2001. Its manufacturing unit is situated at Baddi (Himachal Pradesh). It has state-of-the-art Design & Manufacturing facilities to ensure product quality for greater customer satisfaction. It is one of the leading manufacturers of Rail Coach Components. It also provides PAN India Services Support to Indian Railways for the HVAC, Mechanical, Electro-Mechanical and Electrical & Electronics products.

It has developed a Roof Mounted Driver's Cab Air Conditioning Unit with capacity of 1.5 TR as per the requirements of the Indian Railways. The Roof Mounted Driver's Cab Air Conditioning unit design is reliable, which gives low-maintenance operations and keeps the atmosphere under control of Driver's cab, hence this product is a long-term asset to Indian Railways.

CONTENTS

1 MAJOR COMPONENTS



Control Panel

Switch Board

2 WORKING PRINCIPLE

The Amit make heating and air conditioning unit for driver cabin is direct expansion type packaged unit. When the roof mounted cab air conditioning unit is switched on and temperature is kept at desired set point, the thermostat senses the cabin temperature. If cabin temperature is more than the desired set point, cooling circuit starts.

The warm cabin air is drawn in through a return air grill located at bottom of the HVAC unit. This warm air is then passed over the cooling coil (fin & tube type heat exchanger). The fluid (refrigerant) inside the tube absorbs the heat from hot air, evaporating itself. This also results in cooling of warm air passing over it. While cooling the temperature of the cabin air passing through the heat exchanger falls below the dew point temperature and results dehumidification of air. Thus, during cooling both temperature and humidity of air inside the cabin decrease, which helps in maintaining the comfort condition for the driver.

The evaporated refrigerant from the cooling coil (evaporator) is the compressed into compressor to raise its saturation temperature above the outdoor temperature. After that this high pressure superheated vapors refrigerant is passed through another heat exchanger (condenser), where it cooled below its saturation temperature to convert it in to liquid.

This condensed liquid refrigerant is then passed though the expansion valve where the pressure of the refrigerant decreases along with temperature. The state of the refrigerant is returned to its initial state, completing the vapour compression refrigerant cycle. This cycle continues until the desired temperature is achieved.

Being the packaged air conditioning unit, all refrigeration components at enclosed within the single shell only, and it is supplied at ready to installed condition.

3 INTERFACE REQUIREMENTS

3.1 POWER SUPPLY

Auxiliary supply 415 Volts AC 50 Hz 3 phase and 110 Volts AC single phases are available for the power and control supply feeding to air-conditioning unit.

4 FUNCTIONAL DESCRIPTION OF CAB HVAC SYSTEM

The roof mounted cab heating and air conditioning units can be controlled by user with the help of the rotary switches mounted in the switch gear panel. Unit can be run in to 3 modes based on the selection using rotary switch.

4.1 OPERATIONAL MODES

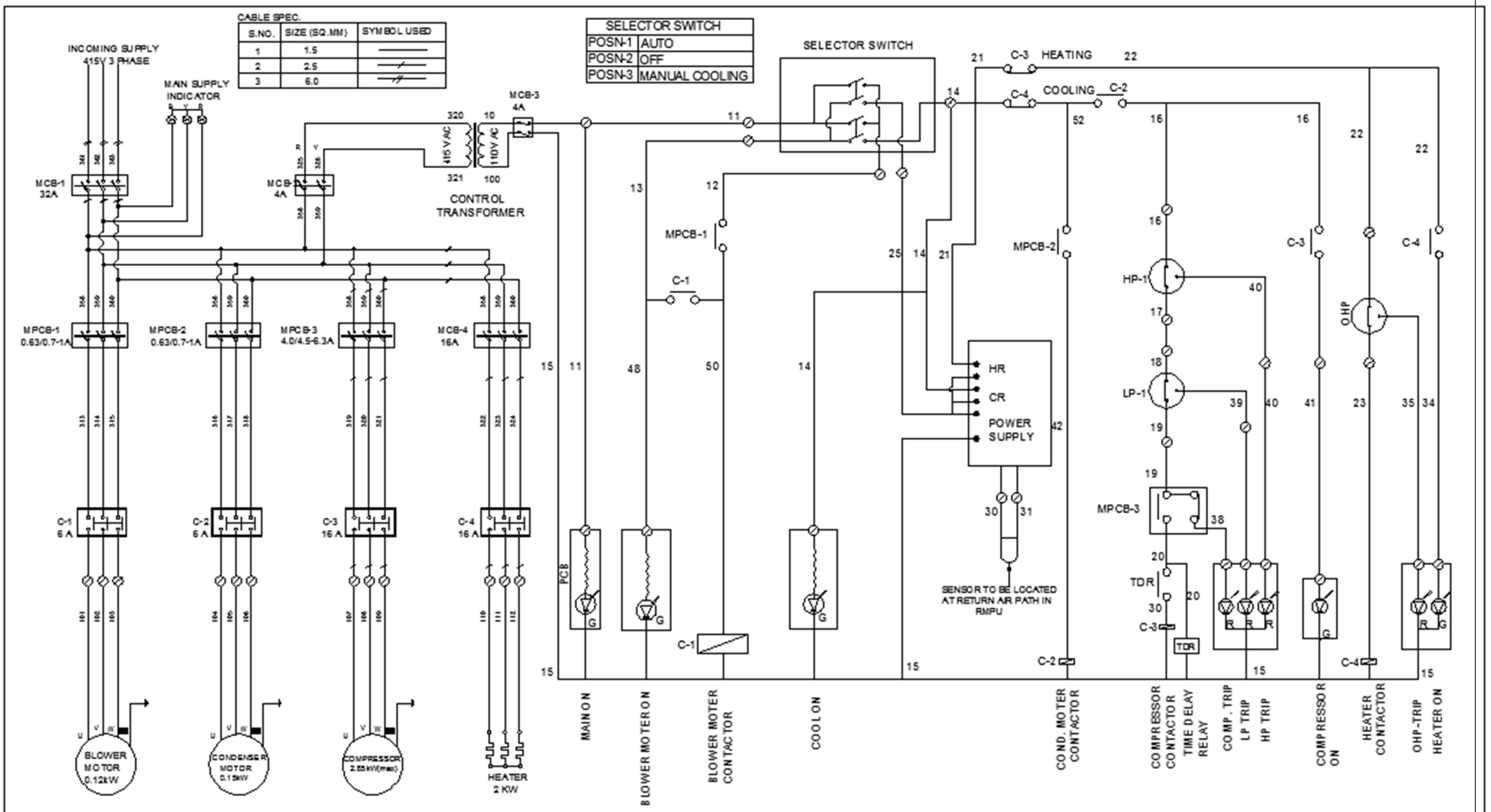
POSITION	MODES		WHAT IS ON/OFF
1	AUTO	AUTO COOLING	Blower Motor + Condenser Fan Motors + Compressor will be ON according to Room Temperature.
		AUTO HEATING	Blower Motor + Heater will be ON according to Room Temperature.
2	OFF		AC OFF
3	MANUAL COOLING		Blower Motor + Condenser Fan Motors + Compressor will be ON without any Temperature control.

4.2 SOLID STATE TEMPERATURE CONTROLLER TEMPERATURE SETTING

There are two Setting in Solid state Temperature Controller.

MODE	CUT IN	CUT OFF
Cooling	26 ℃	24 ℃
Heating	19 ℃	21 ℃

5 ELECTRICAL DIAGRAM



MCB-1 - MAIN CIRCUIT BREAKER (32A)	C-1 - BLOWER MOTOR CONTACTOR (6A or higher as per availability, COIL SUPPLY-110 VAC)
MCB-2 - CONTROL INPUT CIRCUIT BREAKER (4A)	C-2 - COND. MOTOR CONTACTOR (6A or higher as per availability, COIL SUPPLY-110 VAC)
MCB-3 - CONTROL OUTPUT CIRCUIT BREAKER (4A)	C-3 - COMPRESSOR CONTACTOR (16A, COIL SUPPLY-110 VAC)
MCB-4 - HEATER CIRCUIT BREAKER (16A)	C-4 - HEATER CONTACTOR (16A, COIL SUPPLY-110 VAC)
MPCB-1 - BLOWER MOTOR CIRCUIT BREAKER (0.63/0.7-1A)	TDR - TIME DELAY RELAY (COIL SUPPLY-110VAC)
MPCB-2 - COND. MOTOR CIRCUIT BREAKER (0.63/0.7-1A)	COND. - CONDENSER
MPCB-3 - COMPRESSOR CIRCUIT BREAKER (4.0/4.5-6.3A)	COMP. - COMPRESSOR

6 MAINTENANCE SCHEDULE

Sr. No.	Equipment / Fittings	Activities	Trip / Weekly	Monthly	Six Monthly	IOH 18 Months	POH 36 Months
1.	General	a) Check the log sheet maintained in each AC coach and attained the defects recorded by escorting staff during run.	√	√	√	√	√
		b) Clean all dust by vacuum or compressed air from the switch board cabinet and tighten the cable terminals, if found loose.	√	√	√	√	√
		c) Replace/connect defective/by passed components.	√	√	√	√	√
		d) Remove fresh and return air filters by opening the access doors of the unit. Clean these filters with vacuum or compressed air taking out the filters and place them gently in their place or replace with pre-cleaned/new filter/filter media and close the doors properly. A cleaning jig should be available with AMC holder/Railways for this activity. Note: After this activity, the service doors shall be latched properly in case of return air filter.	√	√	√	To be replaced	To be replaced
		e) Check working of rotary switches by rotating forward and backward, provided on switch panel for temperature selection and Air. Co. ON. Replace if required.	√	√	√	√	√
		f) Check working of set point generator rotary switch provided for temperature setting.	√	√	√	√	√
		g) Check the tripping of Heaters i.e., OHP. The OHP setting is 65°C. The testing of OHP setting shall be done by switching off the blower. During testing, the probe of digital thermometer shall be placed near the sensor of OHP & the display shall be kept outside. NOTE: It shall be checked twice a year. In addition, it shall also be checked as a pre-winter precaution before the onset of winter season.			√	√	√
		h) Run the CAB AC for half an hour and then check the current drawn by various equipment's with the help of clamp tester (tongue tester) duly calibrated. Normal currents for various equipment's and mode of operation are as under: • CAB AC in cooling mode. 8.5 Amps Max. • Compressor 7 Amps Max. • Condenser fan motor 1.1 Amps Max. • Blower motor 1.1 Amps Max.			√	√	√

		• CAB AC in heating mode 1.4 Amps Max. NOTE: The current also depends on the ambient temperature.					
		i) Check visually condenser fan blade and ensure that there is no crack on the blade or hub.		√	√	√	√
		j) Check and tighten mountings of blower, compressor and blower motor and ensure that they are in good condition.			√	√	√
		k) Ensure that no capillary tubes are in hanging position.		√	√	√	√
		l) Check capillary tubes provided for HP/LP cutout for proper support/clamping. Their nuts should be properly tightened.		√	√	√	√
		m) Check for proper tightening of cover provided over evaporator compartment.			√	√	√
		n) Check the earthing shunts in CAB AC are provided. Earthing shunts should be earthed with coach body.			√	√	To be replaced
		o) Check mountings of compressor in position.			√	√	
		p) If less cooling is noticed, check the leakage of refrigerant from the system by using soap solution or leak detector. If leak is detected, it should be attended and re-charging of refrigerant in the system shall be made as per RDSO SMI No. ELPS/AC/SMI/14. Filter drier must be replaced during this activity.	√	√	√	√	√
		q) Check insulation resistance of all the motors & compressors by the duly calibrated 1000 V megger, Attend the motors, if insulation resistance of motor is found less than 2 M ohm. IMPORTANT: Disconnect control devices during this activity.				√	√
		r) Check for physically damaged/jointed cables. Replaced if needed.				√	√
		s) Check for the physically damaged conduits. Replace them, if needed.				√	To be replaced
2.	Refrigerant pipe line/ capillary checks	a) Check for proper clamping/support				√	√
		b) Rubbing of capillary with SS sheet/channel or other parts of CAB AC.				√	√
		c) Leakage from the flare nut of HP/LP conduits with soap solution			√	√	√
		d) Leakage from Feeler tube of OHP				√	√

3.	Compressors checks	a) Holding clamps from top are properly tightened.			√	√	√
		b) Mounting fasteners are properly tightened.			√	√	√
		c) Leakage from suction and discharge port.			√	√	√
		d) Accumulators holding/mounting, if provided.			√	√	√
		e) Condensing area covers are properly tightened & not touching top of compressor body.			√	√	√
		f) Electrical terminal box is properly tightened & cables are terminated with lugs.			√	√	√
4.	Condenser fans motor / blades and Blower motor / impeller checks	a) Mounting fasteners are properly tightened.			√	√	√
		b) Electrical terminal box of motors is properly tightened & cables are terminated with lugs.			√	√	√
		c) Double earthing shunts are provided.			√	√	To be replaced during POH
		d) Condition of blade for its fixing/cracking/damage or touching with its cover. Rectify/replace, if needed.			√	√	√
		e) Ensure proper clamping of cable conduits.			√	√	√
		f) Overhauling of Blower and condenser fan motors shall include the following during POH. • The incoming motors shall be checked for abnormal noise and vibration. • Check bearing make and replace with specified make, if found defective. • The IR value of Motor stator shall be measured between motor terminal and frame before and after overhauling. The value of IR shall not be less than 10 M ohm, when measured with 1000-volt megger. • Winding resistance of motors shall be measured between RY, YB & BR phases. The winding resistance shall be ±10% of resistance declared by OEM in cold condition. • Check closely terminal block and connecting lead for any physical damage or any flash mark over it. Replace the same, if not satisfactory. • Perform HV (Di-electric test) on stator by applying 1.5 kV ac supply for one minute. During test the leakage current shall not be more than 1.0 mA. • Run motor on no load for 15 minutes and check for following:					√

		I. Bearing noise – Normal noise II. Bearing temperature rise above ambient - 10°C III. SPM reading - 20 dBN max. (Green zone)					
		• Measure starting current of motors on no load. It shall not be more than 10 times of normal running current. Similarly, the running current of motors shall be measured and it shall not be more than 1.1 A.					√
		• Ensure that impellers are properly tightened.			√	√	√
		• Electrical terminal box is properly tightened & cables are terminated with lugs.			√	√	√
5.	A) Return Air filters	a) Ensure that filters are not damaged.	√	√	√	√	√
		b) Ensure that there is a provision to avoid wrong fitment in the filter as well as in CAB AC.				√	√
	B) HP/LP/OHP cutout switch	a) Check that the mounting fasteners are properly tightened.			√	√	√
		b) Ensure proper clamping/support of capillary tube connected to HP/LP/OHP cutout switch.			√	√	√
		c) Ensure that flare nuts are properly tightened.			√	√	√
		d) Ensure that control wires to HP/LP/OHP cutout switches are properly clamped.			√	√	√
		e) Ensure that covers of these HP/LP/OHP cutouts switches are properly screwed.	√	√	√	√	√
		f) Ensure proper clamping of feeler tube of OHP switch.				√	√
		g) Remove the accumulated dust over feeler tube of OHP switch.			√	√	√
		h) There should be cover (canopy) on top HP/LP switch (provided with capillary tubes) to prevent water entry.		√	√	√	√
	C) Heater	a) Ensure proper mounting of heater.			√	√	√
		b) Ensure proper clamping of electrical wires to heater.			√		√
		c) Check dust accumulation on heating element. Remove gently, if required.			√	√	√
	D) NTC sensors	a) Ensure that the sensors provided at return air path and supply air are firmly mounted.			√	√	√
		b) Ensure sensor wires are properly clamped.			√	√	
		c) Remove the dust accumulated over sensor gently.			√	√	√
	E) Expansion Valve /	a) Ensure that the bulb is mounted in the suction line just after evaporator coil and in a position corresponding to between 1 O'clock and 4 O'clock.		√	√	√	√

	capillary tubes	Ensure that it is properly insulated.					
		b) Ensure that the equalizing line is connected in the suction line immediately after the bulb.			√	√	√
		c) Ensure that the bulb is not connected at the bottom of the pipe line.			√	√	√
		d) Ensure that bulb/equalizing line/capillary tubes are not chocked.		√	√	√	√
	H) Evaporator coil	a) Ensure that there is no damage to fins.				√	√
		b) Ensure that capillaries of distributors to evaporator coil are not having any sharp bend or kinks. They should also be clamped properly.				√	√
		c) Ensure that air passes only through evaporator coils and no air is bypassed directly to blower chamber.				√	√
		d) Clean the coil, if found dirty.				√	√
		e) Check that the mounting fasteners are properly tightened.				√	√
	I) Filter drier & sight glass	a) Ensure that drier is installed with flow in the direction of the arrow marked on the filter drier label.			√	√	√
		<u>NOTE:</u> 1) Never use 'antifreeze liquids' like methyl alcohol together with a filter drier. Such liquid can damage the filter. 2) Never re-use a filter drier. 3) To avoid chances of moisture ingress in the system. Filter drier & compressor should be installed immediately after evacuation and charging the system.			√	√	√
	J) Access Doors	a) Insulate service doors, lower portion and side wall from inside of the evaporator compartment.				√	√
		b) Ensure that latches to lock the service doors are not defective / damaged.	√	√	√	√	√
	K) Drip tray	a) Ensure that there is no leakage of condensate water from drip tray to electrical box & blower housing area.			√	√	√
		b) Ensure free flow of condensate water		√	√	√	√
	L) Condenser area	a) Clean the condenser coil from inside with compressed air/water jet after opening the cover of condenser area.		√	√	√	√
		b) Ensure that there is no damage to fins.			√	√	√
		c) Check that the mounting fasteners are properly tightened.				√	√

		d) Provide fire retardant thermal insulation over suction line.				√	√
		e) Ensure that there is no damage/crack in structure frame of RMPU.				√	√
		f) Ensure proper clamping of electrical conduit.				√	√

7 **FAULTS**

ABBREVIATIONS

1. BLR ON - Blower ON
2. COMP. ON - Compressor ON
3. HTR ON - Heater ON
4. COOL ON - Cooling ON
5. HP TRIP - High Pressure Trip
6. LP TRIP - Low Pressure Trip
7. OHP TRIP - Over Heat Protection Trip
8. COMP. TRIP - Compressor Trip

8 MAINTENANCE PROCEDURE

Maintenance work on the refrigerating circuit should be completed before the summer season.

Caution

Before starting any inspection or maintenance work on components working with power supply, turn off the main power supply and ensure again turning on once the maintenance is done.

Caution

If the coach is running in servicing areas with heavy air pollution, the filter requires more frequent inspection and cleaning.

Most components of the compact air conditioner unit will be replaced when defective.

Sr. No.	Equipment	Maintenance Procedure
1	Condenser fan motor	- Open Top Cover. - Remove CD fan blade. - Remove electrical connection. - Open mounting nuts & bolts. - Change motor with same rating.
2	Compressor	- Open Top Cover. - Loosen compressor clamp. - Remove power connection - Drain refrigerant. - DE brazes refrigerant piping and cap them properly to avoid entering of moisture and foreign particles inside the system. - Open mounting base nut. - Change compressor as per recommended procedure. - Use same rating of compressor.
3	Filter Drier	- Open Top Cover. - Pump down system using service valve provided in liquid line of Refrigeration circuit. - DE braze filter drier and cap refrigerant pipelines properly to avoid Entering of moisture and foreign particles inside the system. - Change filter drier with same size.
4	Hand Shut Off Valve	- Open Top Cover. - Remove Hand shut off valve. - Drain refrigerant. - DE braze Hand shut off valve and cap refrigerant pipelines properly to Avoid entering of moisture and foreign particles inside the system. - Change Hand shut off Valve with same size.
5	Return air filter	Open Top Cover. Take out filter. Clean filter media, replace if necessary.

6	Blower motor	- Open Top Cover. - Remove blower runners. - Open electrical connections. - Open mounting base nut & bolts. - Change blower motor with same rating.
7	Heater	- Open Top Cover. - Take out heater bank. - Inspect the safety element.
8	Evaporator Coil	- Open Top cover. - De-Braze evaporator coil from the refrigerant line. - Avoid entering of moisture and foreign particles inside the system. - Remove Evaporator coil from the unit carefully. - Change Evaporator coil with same specifications. - After proper Brazing and leak testing, close all the covers of the unit.
9	Condenser Coil	- Open Top cover. -De-Braze Condenser coil from the refrigerant line. -Avoid entering of moisture and foreign particles inside the system. -Remove Condenser coil from back side after loosen the mut bolts. -Change Condenser coil with same specifications. -After proper Brazing and leak testing, close all the covers of the unit
10	Blower Fan	- Open Top cover. - Loosen nut bolts and remove Blower fan. - Replace the Blower fan with new one having same model/specifications.
11	Condenser Fan	- Open Top Cover. - Loosen nut bolts and remove Condenser fan. - Replace with new one having same model.

8.1 SAFETY DEVICES

All current-carrying components such as Motors, Heaters and Compressor etc. should be positively earthed.

8.2 OVERLOAD AND SHORT CIRCUIT PROTECTION OF MOTORS

Power Supply provided to all Motors and Compressor through suitable Amperage Motor protection Circuit Breaker (MPCB) according to device power ratings, for protection against Overload, short circuit and grounding. (Kindly refer to Electrical Diagram for proper ratings of MPCB)

8.3 THERMAL PROTECTION FOR HEATERS

The electric heaters are protected with OHP against over temperature. If the supply air temperatures reach 65°C, O.H.P. switches Off the Heater via control Circuit.

8.4 COOLING CIRCUIT PRESSURE PROTECTION

To prevent from High pressure or Low pressure in the refrigerant circuits of an air conditioning unit-, High- and Low-pressure switches are used.

8.4.1 Cause of HP tripping in refrigeration circuit. (Higher Activ. pressure [psi] 450±15)

1. Condenser motor defective / not working.
2. Condenser fan motor running in reverse direction. Air should be sucked through condenser coils.

3. Condenser fan blade defective / broken.
4. Condenser coil clogged with dirt & dust.

8.4.2 Cause of LP tripping in refrigeration circuit. (Lower Activ. Pressure [psi] 30±5)

1. Blower motor defective / not working.
2. Blower motor running in reverses direction. Air should be sucked through Evaporator coils.
3. Blower runner defective / broken.
4. Evaporator coil clogged with dirt & dust.
5. Air filters clogged with dirt, dust or any other obstructions in evaporator Section.
6. Less refrigerant or leakage in the refrigeration circuit.
7. Drier filter or Capillary chocked.

9 PROBLEMS FACED

9.1	Filters	One of the typical reasons air conditioners don't work properly is a clogged or dirty filter. Follow the manufacturer's suggestions as to how often to change your air filter. Some are monthly, others every three months, while some are reusable and should be cleaned when they are dirty. One way to determine if a filter needs to be cleaned is to check if any light passes through it. If not, it's time to clean it. Dirty filters not only reduce the flow of air but can also cause the AC unit to freeze.
9.2	Solid State Temperature Controller	Another easy fix is to make sure your Solid-state temperature controller (which controls the temperature setting in your CAB area) is turned on, the inside is clean, its level, it's not being affected by sunlight, and it's on the correct setting. If problems persist, there may be another issue.
9.3	Refrigerant Leaks	When the coolant starts leaking in the air conditioner, the unit will not perform correctly, and the temperature will fluctuate. The location of the leak will affect the cost of the repair so having this examined yearly by a trained AC technician is advised.
9.4	Drainage	Like the filter, the drain line can become clogged with dirt, dust, and lint. If it becomes clogged, the drain pan will fill up, and water will leak out potentially causing damage to the AC unit or whatever is around your pan.
9.5	Circuit Breakers	The breakers and fuses safeguard the AC unit's motor or compressor from overheating. Often when a motor dies, one of the first parts the HVAC technician checks is the breaker.
9.6	Compressor	The compressor applies energy to the refrigerant and propels it through the coils to carry out heat exchange. If the compressor is not working, the AC unit will not cool your house. If there's not enough refrigerant, the compressor will run hot and eventually seize. If there's too much, the refrigerant will return to the compressor, which can cause it to fail.
9.7	Evaporator Coils	Evaporator coils absorb heat in the air and send it back into the cabinet as cold air using a blower fan. Coils can become corroded, but if they are located inside, they typically only require maintenance every three years.
9.8	Condenser Coils	Condenser coils are located with the compressor so they can become dirty due to the elements. They can usually be cleaned with a water hose once a year, but if they get too dirty, an HVAC technician will have to clean them with a chemical cleaner.
9.9	Worn Contactor	In a CAB AC unit, there are contactors for the compressor, the blower motor, and the condenser fan motor. They make an electrical connection that starts the motors and compressor. If there's arcing and pitting on the contactor, it becomes difficult for electric current to start the motors.

10 INSTALLATION

10.1 TRANSPORTATION / SHIPMENT

1.5 TR CAB Air Conditioners are supplied preassembled on truck frame. The air conditioning units are fastened with bolts to the truck frame. All assemblies are carefully tested and packed prior to shipment (With refrigerant charged)

Caution

For loading and unloading, overhead crane shall be used. It enables the unit to be transported safety.

10.2 STORAGE

The Roof Mounted CAB AC units shall be stored in their undamaged transport skids. Do not store them in open. Make sure that units are not damaged.

10.3 INSTALLATION

Install Roof Mounted CAB AC on the Cabin of the Driver's CAB.

Caution

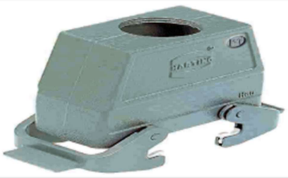
For transporting the air conditioning unit to the Driver's Cabin for the purpose of Installation, overhead crane shall be used.

Installing the Roof Mounted CAB air conditioning unit

Caution

Lift the air conditioner for the specified lifting points gently.

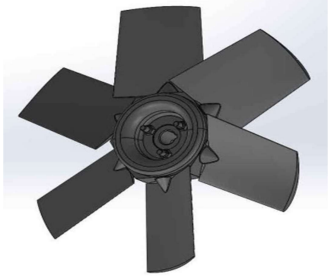
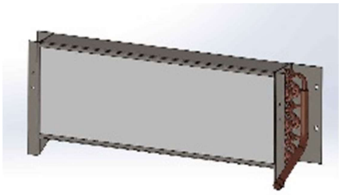
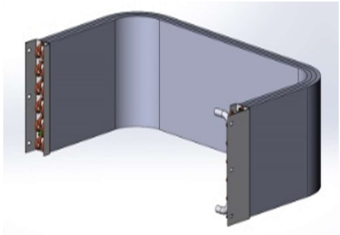
SR.NO.	COMPONENT	ACTIVITY
1	AC UNIT	Remove Packing
		Perform visual check for any transit damage.
		Undo transport screws used for fixing unit to frame
		Lift unit with crane onto Driver CAB.
		Lower down unit on the installation trough
		Tighten fastening screws
		Connect earthling connections
		Establish plug-and-socket connections for power supply

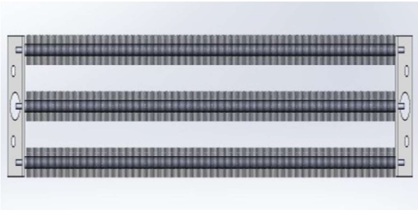
Electrical Installation Parts			
Sr. No.	**Component Code**	**Quantity**	**Shape**
1	LHB 119	23	
2	LHB 150	9	
3	T18 141	4	
4	T18 152	4	
5	T18 156	4	
6	T18 158	4	

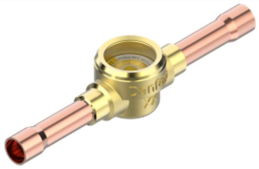
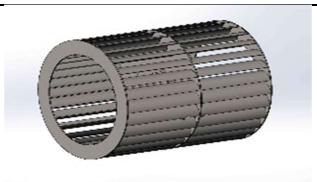
11 INSTRUCTIONS TO USERSSAFETY CONSIDERATIONS

Installing, starting up, and servicing air-conditioning equipment can be hazardous due to system pressures, electrical components and equipment location. Only trained, qualified installers and service technicians should install, start up, and service this equipment. When working on air-conditioning equipment, observe precautions in the literature, on tags, stickers, and labels attached to the equipment. Follow all safety codes. Wear safety glasses and work gloves. Use care in handling equipment.

12 SPARE PART LIST

Sr. No.	Name	Product Code	Component Photograph
1	Compressor	ACR15 008	
2	CONDENSER MOTOR	ACR15 030	
3	BLOWER MOTOR	ACR15 030	
4	CONDENSER FAN	T18 288	
5	EVAPORATOR COIL	T18 286	
6	CONDENSER COIL	T18 287	

Sr. No.	Name	Component Code	Component Photograph
7	FILTER DRIER	ACR 15 003	
8	EXPANSION VALVE	ACR15 001	
9	Heater	T18 275	
10	RETURN AIR FILTER	T18 272	
11	HIGH PRESSURE SWITCH (AUTO)	AMC 068	
12	LOW PRES. CUTOUT SWITCH	LHB 009	

Sr. No.	Name	Component Code	Component Photograph
13	THERMOSTAT SWITCH (OHP)	LHB 010	
14	Distributor	ACR15 052	
15	Refrigerant Sight Glass	ACR15 002	
16	BLOWER RUNNER	MRV 018	
17	Hand Shut Valve	LHB 051	

13 TECHNICAL QUERY AND SUPPORT

For technical enquiry or technical support, kindly contact or write a mail.

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AMIT ENGINEERS

Smart Solution for Better Future

OPERATION & MAINTENANCE MANUAL FOR ROOF MOUNTED PACKAGED AIR-CONDITIONING UNITS SUPPLIED FOR TRAIN 18 EMU COACHES

AMIT ENGINEERS

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REVISION LOG

REVISION	DATE	DESCRIPTION
00	10-05-2022	First Issue

ABOUT US

Amit Engineers is an IRIS (International Railway Industry Standards) certified company based on ISO/TS 22163:2017, established in 2001. Its manufacturing unit is situated at Baddi (Himachal Pradesh). It has state-of-the-art Design & Manufacturing facilities to ensure product quality for greater customer satisfaction. It is one of the leading manufacturers of Rail Coach Components. It also provides PAN India Services Support to Indian Railways for the HVAC, Mechanical, Electro-Mechanical and Electrical & Electronics products.

It has developed a Roof Mounted Saloon HVAC Unit with capacity of 7.5TR as per the requirements of the Indian Railways. The Roof Mounted Packaged Air Conditioning unit design is reliable, which gives low-maintenance operations and keeps the atmosphere of Saloon passenger area under control, hence this product is a long-term asset to Indian Railways.

TABLE OF CONTENTS

ABBREVIATION AND DEFINITION

ABBREVIATION	DEFINATION
AC	Alternating Current
AIP	Analog Input
AVM	Anti-Vibration Mounting
DC	Direct Current
DDU	Driver Desk Unit
DIP	Digital Input
DOP	Digital Output
EMU	Electric Multiple Unit
HP	High Pressure
HVAC	Heating Ventilation & Air-Conditioning
LP	Low Pressure.
MCB	Miniature Circuit Breaker
MPCB	Motor Protection Circuit Breaker
NC	Normally Closed
OHP	Over Heat Protection
RDSO	Research Designs and Standards Organization, Lucknow
RMPU	Roof Mounted Packaged Unit.
Unit	Air Conditioning Unit.
UV	Ultraviolet
VFD	Variable Frequency Drive
VVVFD	Variable Voltage Variable Frequency

1 INTRODUCTION

This booklet contains the Installation, operation and service instruction manual for self-contained air conditioning packaged unit supplied to Indian Railways for Train 18 EMU coaches. This Unit is based on RDSO specification no. RDSO/PE/SPEC/D/EMU/0196-2019 (Rev. 0). There are a few precautions that should be taken to derive maximum satisfaction and healthy lifecycle of the equipment. Improper installation can result in unsatisfactory operation or dangerous conditions.

Read this booklet and any instructions packaged with separate equipment required to make up the system prior to installation. Give this booklet to the owner and explain its provisions. The owner should retain this booklet for future reference.

2 UNIT SPECIFICATION

2.1 GENERAL

The packaged unit supplied by Amit Engineers is roof mounted ducted type. It has nominal cooling capacity > 7 TR and having heating capacity of 9 kW. The Conditioned air is supplied from an end of the unit whereas return air from conditioned space is sucked from bottom of unit. Fresh air is sucked and filtered from the opening provided on both side of the unit.

Two identical units are installed on either side of the coach complimenting each other for maintaining the comfort condition for passengers in car. Unit is weatherized for mounting in outside ambient and has designed to survive and perform at its full capacity under the traction environment even in worst ambient conditions.

2.2 MAJOR COMPONENTS

The unit includes Two hermetically-sealed scrolled refrigerant compressors, two fin-tube type air cooled condensers, two direct expansion type evaporators, Thermostatic expansion valve. Unit also consist of a centrifugal type fan as blower, a propeller type fan for forced condensation, and all necessary components in refrigerant tubing for control and regulation along with internal electrical wiring.

The cooling system of unit is factory-evacuated, charged and performance tested and provided in ready to install condition. Refrigerant amount and type are indicated on rating plate.

SL.NO	PART NAME	QTY
1	Condenser Coil	2
2	Condenser Fan	2
3	Fixed Speed Compressor	1
4	Variable Speed Compressor	1
5	Emergency Fan Inverter	1
6	Compressor VFD	1
7	Pressure Differential Sensor	2
8	Blower Assembly	1
9	Return Air Filter	2
10	Fresh Air Filter	2
11	Evaporator Coil	2

SL.NO	PART NAME	QTY
12	Smoke Detector	1
13	Heater Assembly	1
14	Condenser Motor	2
15	Fresh Air Sensor	1
16	Actuator Return Air	2
17	CO_2 Sensor	1
18	Actuator Fresh Air	2
19	Supply Air Sensor	1
20	Return Air Sensor	1
21	Hygrostat	1
22	UV Lamp	2

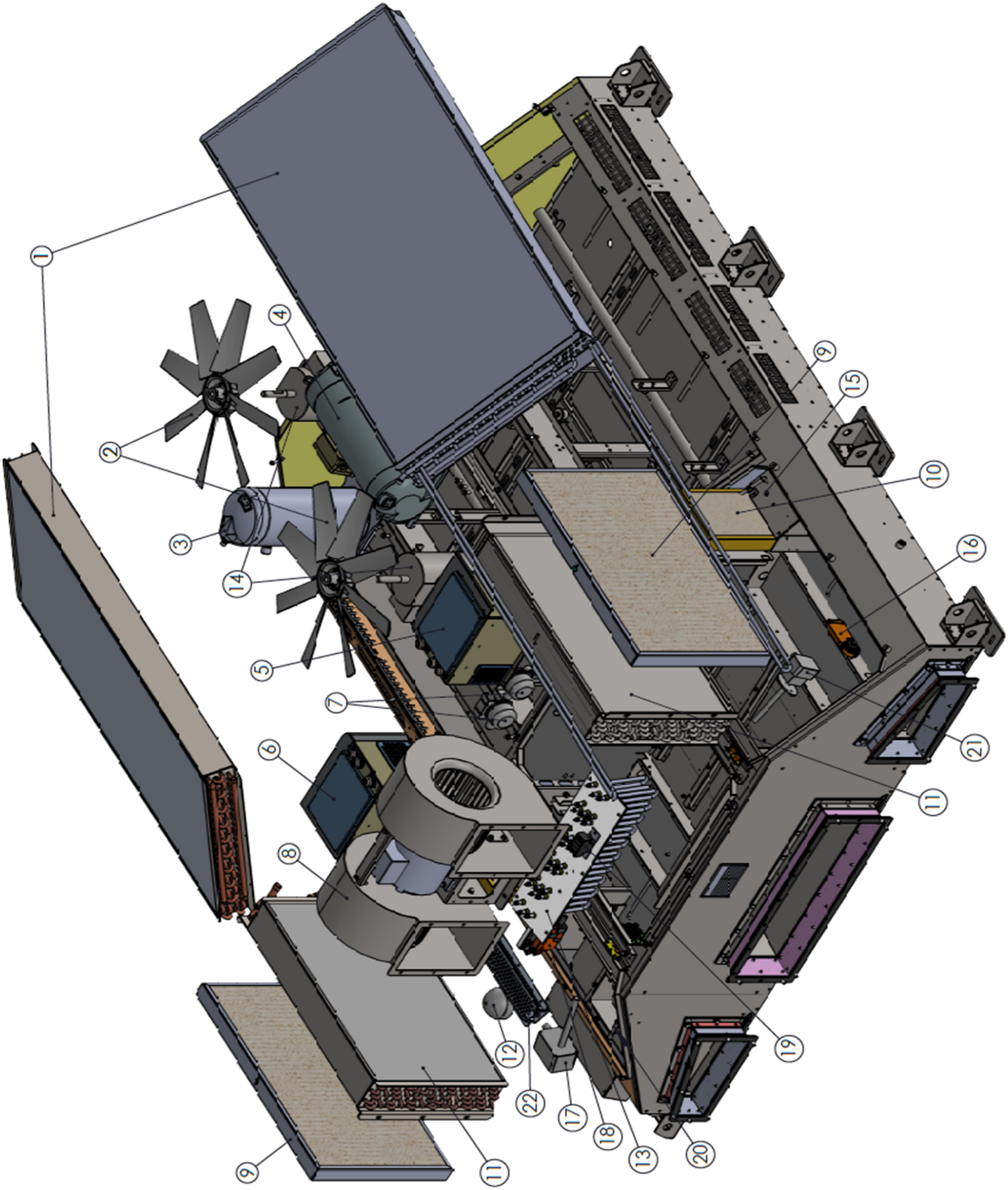
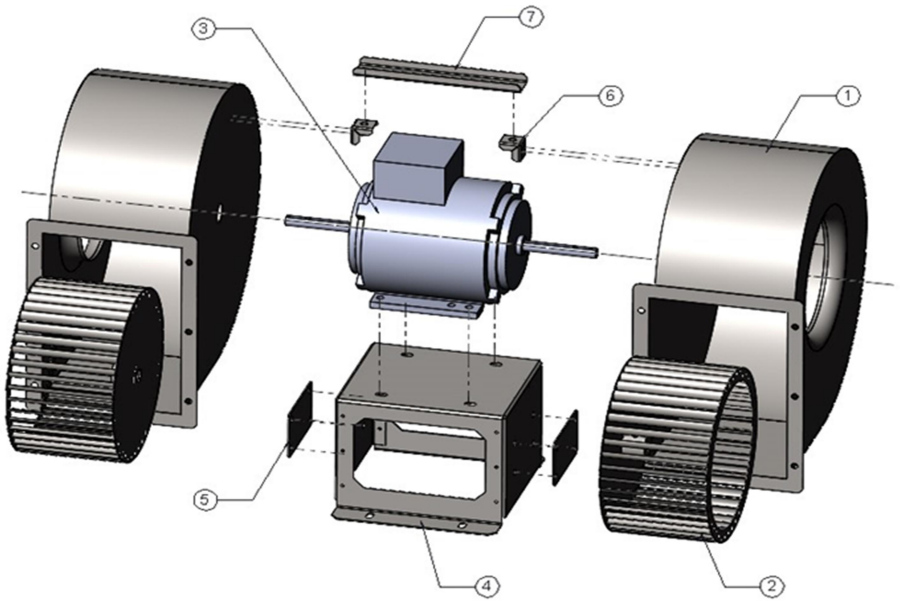
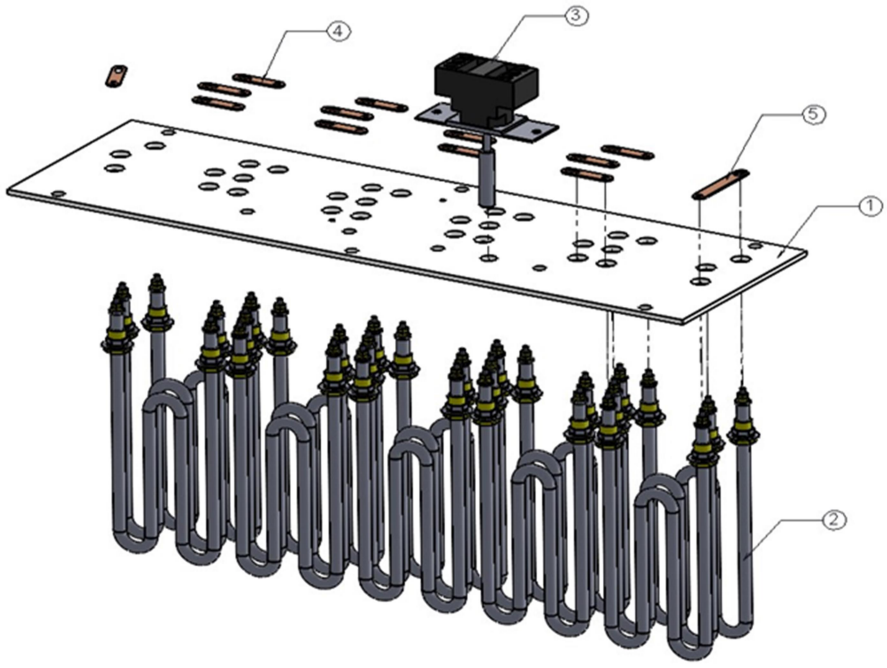


FIGURE 2-1: Extruded Unit View



SL.	PART NAME	QTY.
1	Blower Housing	1L+1R
2	Blower Runner	1L+1R
3	Blower Motor	1
4	Motor Base	1
5	Motor Base Plate	2
6	Angle for Blower Support	2
7	Blower Support	1

FIGURE 2-2 : Blower Assembly



SL.	PART NAME	QTY.
1	Heater Plate	1
2	Heater Element	15
3	ESTI (OHP)	1
4	Heater Cu Strip 1	13
5	Heater Cu Strip 2	1

FIGURE 2-3 : Heater Assembly

The HVAC unit is mainly divided into three main sections, Air Handling Section, Compressor-Condenser Section and Air-Conditioning Control Section. Followings are the list of component consists by each section along with their quantity and article code#.

2.2.1 AIR HANDLING SECTION

Sr. No.	Item Name	Article Code	UOM	Quantity
01	Evaporator Coil	T18 186	Nos.	02
02	Heater Assembly	LHB 007	Set	01
03	Supply Air Blower Motor	LHB 002	No.	01
04	Supply Air Blower runner with Housing (L+R)	T18 166	Nos	02
05	Thermostatic Expansion Valve	RVC 006	Nos	02
06	Fresh Air Filter	T18 164	Nos	02
07	Return Air Filter	T18 165	Nos	02
08	Fresh Air Damper with actuator	EMU 031	Nos	02
09	Return Air Damper with actuator (Right)	T18 018	No	01
10	Return Air Damper with actuator (Left)	T18 019	No	01
11	Smoke Detector	T18 009	No	01
12	NTC -Temperature sensors	LHB 013	Nos	03
13	Hygrostat	LHB 026	No	01
14	ESTI Cartridge	LHB 011	No	01
15	CO_2 Sensor	T18 017	No	01
16	UV Lamp	T18 007	Nos	02
17	Emergency Inverter With VFD	T18 343	No	01
18	Programmable Logic Controller	-	No	01
19	Compressor VVVFD	T18 344	No	01

2.2.2 COMPRESSOR CONDENSOR SECTION

Sr. No.	Item Name	Article Code	UOM	Quantity
01	Variable speed compressor	ACR 029	No.	01
02	Fixed speed compressor	ACR 033	No.	01
03	Condenser coil	T18 185	Nos.	02
04	Condenser motor	LHB 001	Nos.	02
05	Condenser fan	T18 010	Nos.	02
06	Refrigerant filter drier	T18 003	Nos.	02
07	Sight glass	T18 162	Nos.	02
08	High pressure switch	EMU 010	Nos.	02
09	High pressure transducer	LHB 015	Nos.	02
10	Low pressure switches	LHB 124	Nos.	02
11	Low pressure transducer	LHB 014	Nos.	02

for parts placement during maintenance, the article code shall be provided.

2.2.3 UNIT DIMENSION AND WEIGHT

Length	Width	Height	Weight
2565 mm	2100 mm	545 mm	690 kg

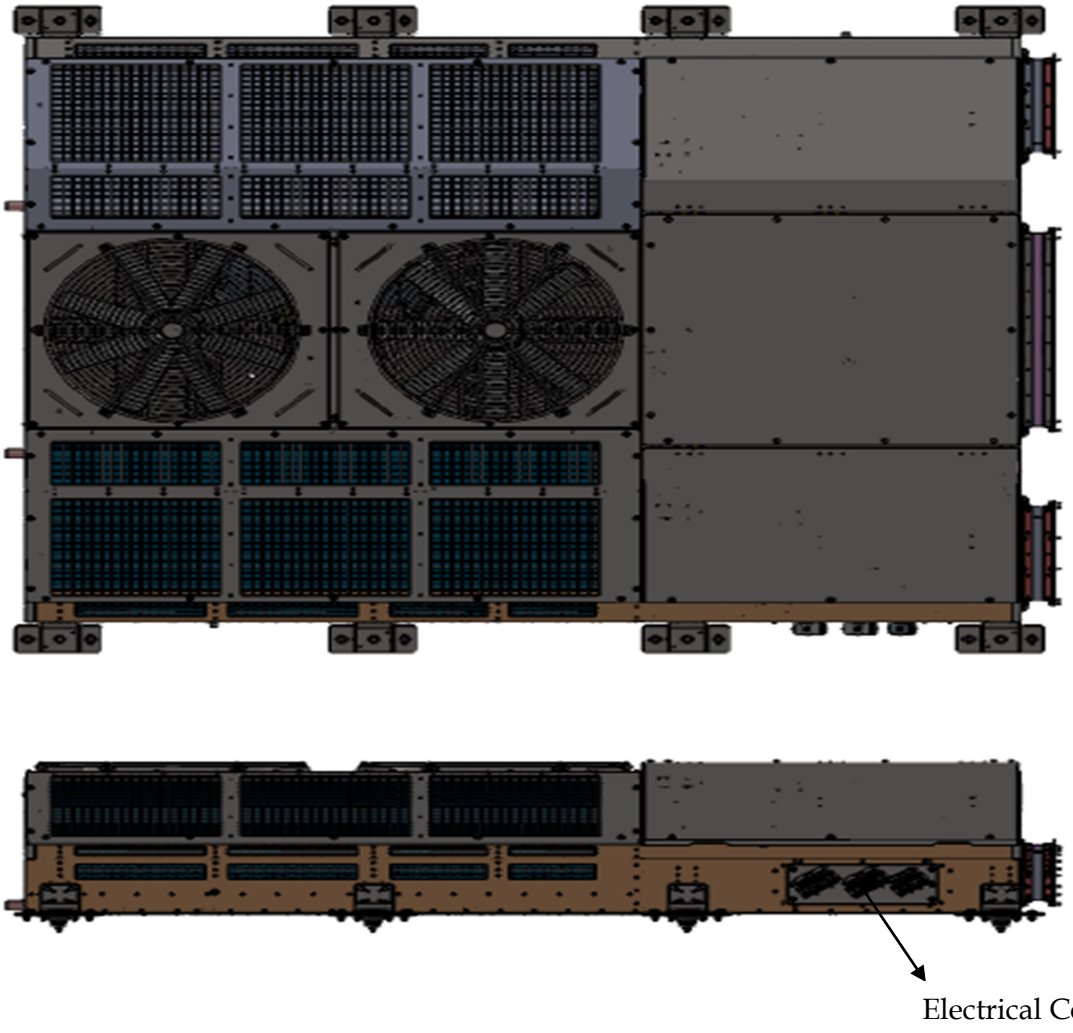
2.2.4 OPERATING VOLTAGE

Variable Speed Compressor	150-380V, 3 Ph, 30-60 HZ
Fixed Speed Compressor	415V AC, 3 Ph, 50 Hz
Condenser Motors	415V AC, 3 Ph, 50 Hz
Blower Motors	415V AC, 3 Ph, 50 Hz
Electric Heaters	415V AC, 3 Ph, 50 Hz
Control Voltages	110V DC, 24V DC

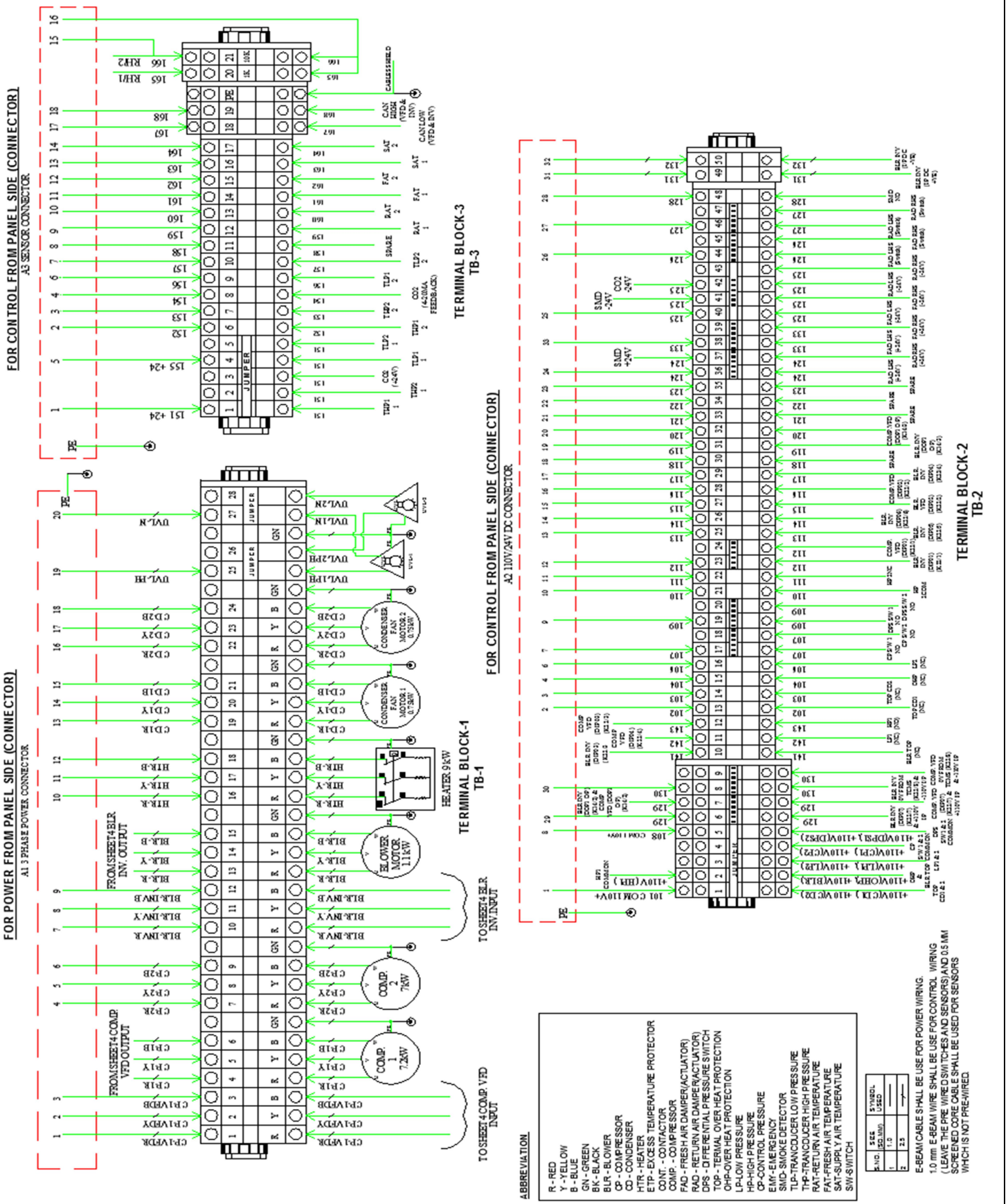
2.2.5 ELECTRICAL CONNECTOR

TYPE	PART NUMBER	PART NAME	UOM	QTY
A1 Connector	T18 142	Crimp terminal male	No.	1
	T18 138	Housing	No.	1
	LHB 149	Crimp contacts male 2.5 mm^2	No.	32
	EMU 008	Guide pin	No.	2
	EMU 089	Guide bush	No.	2
A2	T18 144	Crimp terminal male	No.	1
	LHB 142	Housing	No.	1

Connector	T18 147	Crimp contacts male 1.00sqmm, With 50 Meting cycle	No.	38
	LHB 149	Crimp contacts male 2.5 mm^2	No.	2
	EMU 088	Guide pin	No.	2
	EMU 089	Guide bush	No.	2
A3 Connector	T18 140	Crimp terminal male	No.	1
	T18 138	Housing	No.	1
	T18 150	Crimp contacts male 0.5sqmm, with 500 Mating Cycle	No.	16
	T18 149	Crimp contacts male 0.75sqmm, Silver Plated , 500 Meting cycle	No.	2
	EMU 008	Guide pin	No.	2
	EMU 089	Guide bush	No.	2



2.2.6 ELECTRICAL DRAWING:



3 MICROPROCESSOR CONTROLLER FOR HVAC UNIT

- HVAC Controller is a fully automated microprocessor based control system which is used to monitor and operate the HVAC system from DDU.
- The system incorporates a self- diagnostic check in order to keep a track of its own performance. In case of critical failure, the system shuts down itself.
- It regulates the temperature and humidity conditions inside the coach using temperature sensor and humidity sensor and helps to obtained desired temperature level by switching on and switching off the compressors.
- It monitors the Parameters like high pressure, low pressure, voltage, high temperature, CO_2 level, smoke contains etc.

3.1 PRE–SEQUENCE CHECKING

Before switching the, Power ON the Microprocessor Controller, the following points are to be checked:

a) Continuity between 110V DC.
   - -ve & earth should not be there.
   - +ve & earth should not be there.
   - Also check for any leakage current between microprocessor controller box & 24V DC.

b) External connections of all connectors specially –ve one must show 110V DC with +ve.

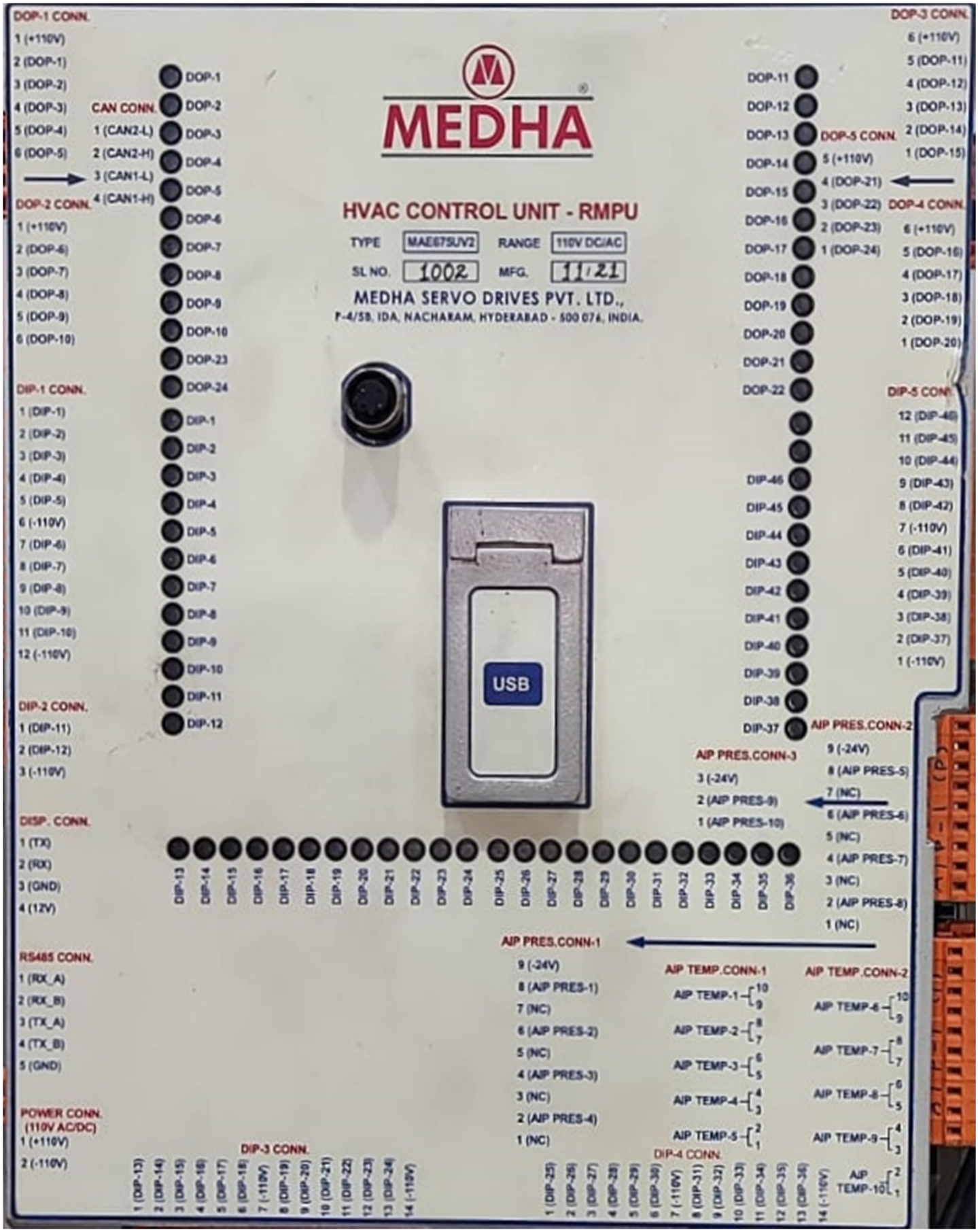
c) Check all motors TOP and both circuit LP, HP in healthy condition. Check all breakers input are in healthy condition.

Now, if all above conditions (a, b, c & d) are fulfilled then microprocessor controller is in healthy condition and ready to start.

3.2 OPERATING SEQUENCE OF MICROPROCESSOR CONTROLLER

1. Switch Air-CO Turned ON.
2. Blower 1 ON.
3. After 30 sec. Condenser fan 1/1 ON.
4. After 120 sec. Compressor 1/1 ON.
5. After 30 sec. Compressor 1/2 ON.
6. If Control Pressure switch gets energized then only Cond 1/2 gets ON.

3.3 SYSTEM DIGITAL INPUTS, OUTPUTS & ANALOG INPUT WIRING DETAILS



3.3.1 ANALOG INPUTS (AIP) PRESSURE (X204)

SL. NO.	CHANNEL	FUNCTION
1	--	NC
2	AIP-0	High Pressure Sensor-1/2
3	--	NC
4	AIP-1	High Pressure Sensor-1/1
5	--	NC
6	AIP-2	Low Pressure Sensor-1/2
7	--	NC
8	AIP-3	Low Pressure Sensor-1/1
9	-24VDC	Common -24VDC

3.3.2 ANALOG INPUTS (AIP) PRESSURE (X205)

SL. NO.	CHANNEL	FUNCTION
1	--	NC
2	AIP-4	High Pressure Sensor-2/1
3	--	NC
4	AIP-5	Low Pressure Sensor-2/2
5	--	NC
6	AIP-6	Low Pressure Sensor-2/1
7	--	NC
8	AIP-7	CO2-1
9	-24VDC	Common -24VDC

3.3.3 ANALOG INPUTS (AIP) PRESSURE (X206)

SL. NO.	CHANNEL	FUNCTION
1	AIP-19	CO2-2
2	AIP-18	High Pressure Sensor-2/2
3	-24VDC	Common -24VDC

3.3.4 ANALOG INPUTS (AIP) NTC (X207)

SL. NO.	CHANNEL	FUNCTION
1	AIP-12	Room Temperature Sensor (RT1)
2		
3	AIP-14	Outdoor / Ambient Temperature Sensor (AT1)
4		
5	AIP-16	Duct / Supply Temperature Sensor (ST1)
6		
7	AIP-8	Hygrostat 1 (HGS)
8		
9	AIP-10	Spare-01
10		

3.3.5 ANALOG INPUTS (AIP) NTC (X208)

SL. NO.	CHANNEL	FUNCTION
1	AIP-13	Room Temperature Sensor (RT2)
2		
3	AIP-15	Outdoor / Ambient Temperature Sensor (AT2)
4		
5	AIP-17	Duct / Supply Temperature Sensor (ST2)
6		
7	AIP-9	Hygrostat 2 (HGS)
8		
9	AIP-11	Spare-02
10		

3.3.6 DIGITAL INPUTS (DIP) (X210)

SL. NO.	CHANNEL	FUNCTION
1	DIP-01	AC-On Unit
2	DIP-02	Manual IN (RLY)-1
3	DIP-03	Temp Condenser Motor 1/1 OK
4	DIP-04	Temp Condenser Motor 1/2 OK
5	DIP-05	Spare-1
6	0V BN	Common- 110 VDC
7	DIP-06	Temp Heater 1 OK
8	DIP-07	Spare-3
9	DIP-08	LP 1/2 OK
10	DIP-09	CP 1/1 & ½ OK
11	DIP-10	Auto SW ON 1
12	0V BN	Common-110 VDC

3.3.7 DIGITAL INPUTS (DIP) (X211)

SL. NO.	CHANNEL	FUNCTION
1.	DIP-11	Spare-5
2.	DIP-12	Blower VFD 1 Status
3.	0V BN	Common- 110V DC

3.3.8 DIGITAL INPUTS (DIP) (X212)

SL. NO.	CHANNEL	FUNCTION
1	DIP-13	Earth Leakage fault 1
2	DIP-14	Blower 1 MPCB Fault
3	DIP-15	Condenser 1/1 MPCB Fault
4	DIP-16	Condenser 1/2 MPCB Fault

5	DIP-17	Compressor 1/1 MPCB Fault
6	DIP-18	Compressor 1/2 MPCB Fault
7	0V BN	Common- 110 VDC
8	DIP-19	Heater 1 MPCB Status
9	DIP-20	Air Pressure Switch 1
10	DIP-21	Smoke Detector 1
11	DIP-22	Compressor 1 VFD Status
12	DIP-23	AC-Off Unit
13	DIP-24	Manual IN (RLY)-2
14	0V BN	Common- 110V DC

3.3.9 DIGITAL INPUTS (DIP) (X213)

SL. NO.	CHANNEL	FUNCTION
1	DIP-25	Temp Condenser Motor 2/1 OK
2	DIP-26	Temp Condenser Motor 2/2 OK
3	DIP-27	Spare-2
4	DIP-28	Temp Heater 2 OK
5	DIP-29	Spare-4
6	DIP-30	LP 2/2 OK
7	0V BN	Common-110V DC
8	DIP-31	CP 2/1 & 2/2 OK
9	DIP-32	Auto SW ON 2
10	DIP-33	Spare-6
11	DIP-34	Blower VFD 2 Status
12	DIP-35	Earth Leakage fault 2
13	DIP-36	Blower 2 MPCB Fault
14	0V BN	Common- 110V DC

3.3.10 DIGITAL INPUTS (DIP) (X214)

SL. NO.	CHANNEL	FUNCTION
1	DIP-37	Condenser 2/1 MPCB Fault
2	DIP-38	Condenser 2/2 MPCB Fault
3	DIP-39	Compressor 2/1 MPCB Fault
4	DIP-40	Compressor 2/2 MPCB Fault
5	DIP-41	Heater 2 MPCB Status
6	0V BN	Common -110V DC
7	DIP-42	Air Pressure Switch 2
8	DIP-43	Smoke Detector 2
9	DIP-44	Compressor 2 VFD Status
10	DIP-45	Spare-7
11	DIP-46	Spare-8
12	0V BN	Common- 110V DC

3.3.11 DIGITAL OUTPUTS (DOP) (X215)

SL. NO.	CHANNEL	FUNCTION
1	110V BN	Common +110V DC
2	DOP-01	RMPU Controller OK
3	DOP-02	RMPU1 Fault
4	DOP-03	Spare-1
5	DOP-04	Compressor 1/2 Cont
6	DOP-05	Condenser 1/1 Cont

3.3.12 DIGITAL OUTPUTS (DOP) (X216)

SL. NO.	CHANNEL	FUNCTION
1	110V BN	Common +110 DC
2	DOP-06	Condenser 1/2 Cont.
3	DOP-07	Heater-1 Cont
4	DOP-08	UV-1 Relay
5	DOP-09	FA-1 Close
6	DOP-10	RA-1 Close

3.3.13 DIGITAL OUTPUTS (DOP) (X217)

SL. NO.	CHANNEL	FUNCTION
1	DOP-15	Spare-2
2	DOP-14	RMPU Status Relay
3	DOP-13	VFD Compressor-1 ON Command
4	DOP-12	RMPU2 Fault
5	DOP-11	Blower-1 ON Command
6	110V BN	Common +110V DC

3.3.14 DIGITAL OUTPUTS (DOP) (X218)

SL. NO.	CHANNEL	FUNCTION
1	DOP-20	UV-2 Relay
2	DOP-19	Heater-2 Cont.
3	DOP-18	Condenser 2/2 Cont.
4	DOP-17	Condenser 2/1 Cont.
5	DOP-16	Compressor 2/2 Cont.
6	110V BN	Common +110V DC

3.3.15 DIGITAL OUTPUTS (DOP) (X219)

SL. NO.	CHANNEL	FUNCTION
1	DOP-24	VFD Compressor-2 ON Command
2	DOP-23	Blower-2 ON Command

3	DOP-22	RA-2 Close
4	DOP-21	FA-2 Close
5	110V BN	Common +110V DC

3.3.16 SUPPLY 110V AC / DC (X201)

SL. NO.	CHANNEL	FUNCTION
1	110V BN	Power Supply (110V+)
2	0V BN	Ground (110V-)

4 MAINTENANCE

Maintenance work on the refrigerating circuit should be completed before the summer season.

CAUTION

- *Before starting any inspection or maintenance work on components working with power supply, turn off the main power supply and ensure against turning on.*
- *If the coach is running in servicing areas with heavy air pollution, the filter requires more frequent inspection i.e. cleaning etc.*
- *The shutdown of over headline should be ensured during operation, maintenance, repairs etc.*

Most components of the packaged air conditioner unit will be replaced when defective.

SR. NO.	EQUIPMENT	MAINTENANCE PROCEDURE
01	Condenser fan motor	• Open center top cover of compressor-condenser motor unit. • Remove Condenser fan blade. • Remove electrical connection. • Open mounting nuts & bolts. • Change motor with same rating.
02	Fixed Speed Compressor	• Open center top cover of compressor-condenser motor unit. • Loosen compressor clamp • Remove power connection • Drain refrigerant. • De-braze refrigerant piping and cap them properly to avoid entering of moisture and foreign particles inside the system. • Open mounting base nut. • Change compressor as per recommended procedure. • Use same rating of compressor.
03	Variable Speed Compressor	• Open center top cover of compressor-condenser motor unit. • Loosen compressor clamp • Remove power connection • Drain refrigerant. • De-braze refrigerant piping and cap them properly to avoid entering of moisture and foreign particles inside the system. • Open mounting base nut. • Change compressor as per recommended procedure. Use same rating of compressor.
04	Filter Drier	• Open condenser coil side cover. • Pump down system using service valve provided in liquid line of refrigeration circuit. • DE braze filter drier and cap refrigerant pipelines properly to avoid entering of moisture and foreign particles inside the system. • Change filter drier with same size.
05	Return air filter	• Open right-hand & left-hand side maintenance covers of evaporator section. • Take out filter. Clean filter media, replace if necessary.

06	Fresh air filter	• Visual inspection for dirt accumulation. Remove the accumulated dirt by air blower.
07	Blower motor	• Open evaporator center top cover. • Remove blower runners. • Open electrical connections. • Open mounting base nut & bolts. • Change blower motor with same rating.
08	Electric Heater	• Open evaporator center top cover • Take out heater bank. Inspect the safety element as per clause 4.2
09	Fresh Air Damper Actuator	• Remove RHS & LHS cover of evaporator section. • Remove the electric connection. • Remove flapper shaft of the FA damper actuator. • Remove the Fasteners. • Replace the FA damper Actuator with same rating of actuator.
10	Fresh Air Damper Actuator	• Remove RHS & LHS cover of evaporator section. • Remove the electric connection. • Remove flapper shaft of the RA damper actuator. • Remove the Fasteners. • Replace the RA damper Actuator with same rating of actuator.
11	Differential Pressure Switch	• Ensure setting 120 Pascal, if not adjust to 120 Pascal. • Open evaporator center top cover. • Remove electrical connections. • Remove adaptor tubes connected for reading points. • Loose and remove the Fasteners. • Remove the DP switch. • Replace it with new DP switch of same rating
12	Smoke Detector	• Open evaporator Left hand side top cover. • Remove smoke detector Box Shield. • Open the upper lid of Smoke Detector. • Remove electrical connections. • Loose and remove the Fasteners. • Remove the Smoke Detector. • Replace it with new smoke detector of same rating
14	UV Lamp	• Open LHS & RHS maintenance cover of Evaporator Section. • Open Aluminum Shield cover. • Remove electrical connection • Remove UV lamp.
15	Hygrostat	• Open evaporator section Right hand side cover. • Remove Electrical connections. • Loose and Remove fasteners. • Remove the Hygrostat. • Replace with new one with same rating.
16	Heater OHP	• Open Evaporator center cover. • Remove OHP thermostatic bulb form front of heater. • Open the upper lid of OHP. • Remove the electrical connections. • Loose and remove the fasteners.

		• Remove the OHP. • Replace with new one having same rating.
17	CO_2 Sensor	• Open evaporator section Left hand side cover. • Remove the electrical connections. • Loose and remove the fasteners. • Remove the CO_2 Sensor. • Replace the sensor with new one having same rating.
18	Emergency Inverter	• Remove evaporator section center top cover. • Remove the electrical connections. • Loose and remove the fasteners • Remove and replace the inverter having same rating.
19	VVVF Drive	• Remove evaporator section center top cover. • Remove the electrical connections. • Loose and remove the fasteners. • Remove and replace the drive having same rating.
20	Pressure Transducer	• Open Condenser center roof. • Remove electrical connections. • De-Braze the copper lines. • Loose & remove the fastness. • Remove the Transducer. • Replace with new one having same rating.
21	SA. Temperature Sensor	• Open Evaporator center roof. • Loose & Remove the bolts and heater cover. • Remove electrical connections. • Loose & remove nut of sensor. • Remove the Temperature sensor. • Replace with new one having same rating.
22	RA. Temperature Sensor	• Open Evaporator left hand side roof. • Remove electrical connections. • Loose & remove nut of sensor. • Remove the Temperature sensor. • Replace with new one having same rating.
23	FA Temperature Sensor	• Open Evaporator left hand side roof. • Remove electrical connections. • Loose & remove nut of sensor. • Remove the Temperature sensor. • Replace with new one having same rating.

4.1 SAFETY DEVICES

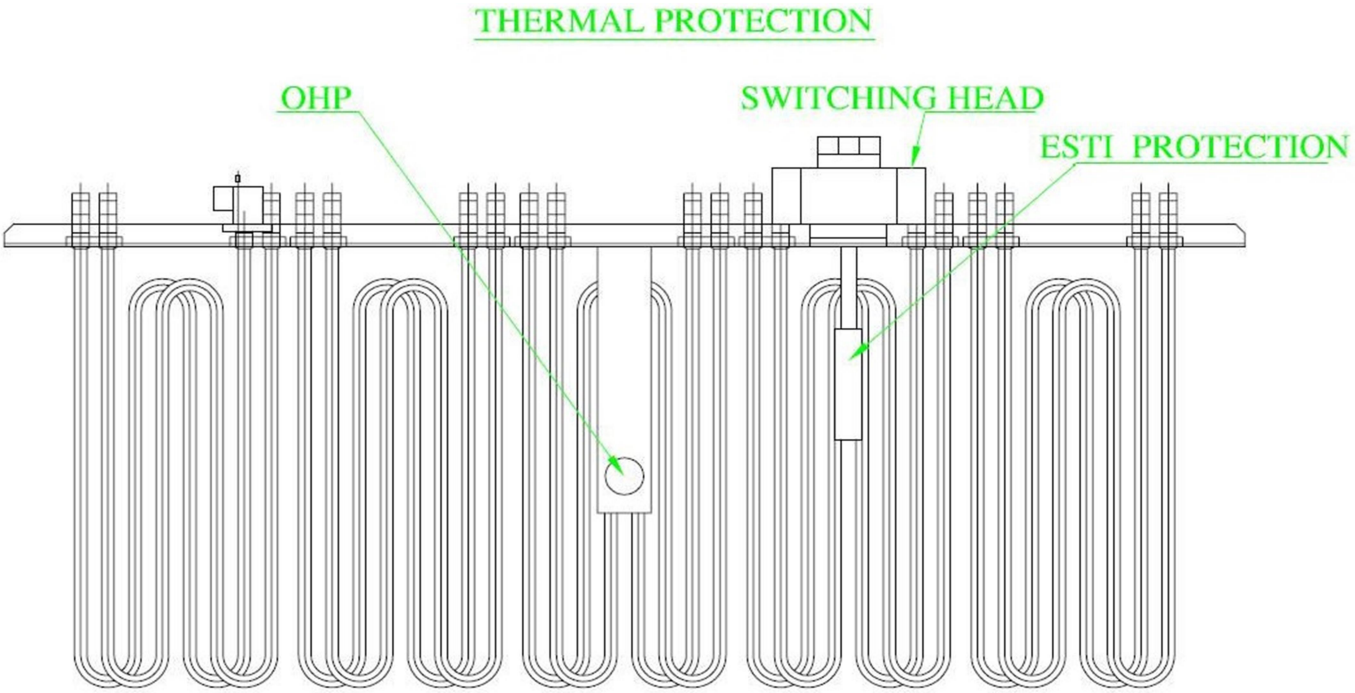
All current carrying components such as motors, heaters and compressors are positively earthed

4.1.1 THERMAL PROTECTION OF MOTORS

All motors are provided with thermal protection device. If a motor heats up impermissibly, the thermal protection system switches the motor off via the controller.

4.1.2 THERMAL PROTECTION FOR HEATERS

The electric heaters are protected in two ways against over temperature. If the supply air temperatures reach an impermissible level, O.H.P. switches the heater off via the control system. If this safety feature fails, the heater is finally switched off by a fusible link (ESTI).

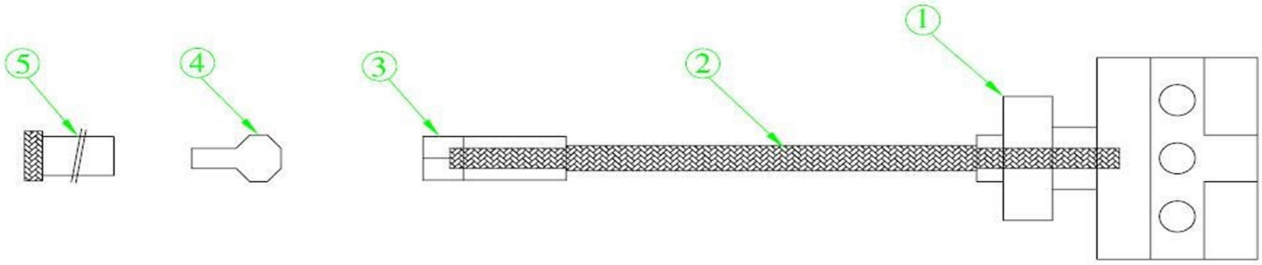


a) OHP & ESTI PROTECTIONS ONE EACH FOR HEATER BANK.

Cause of OHP tripping of heater is less air flow through heater due to:

- Blower motor defective or blower motor running in reverse direction.
- Air Filter or evaporator coils clogged with dirt, dust or any other obstruction in evaporator compartment.

b) INSPECTING AND MAINTENANCE OF ELECTRIC HEATER SAFETY ELEMENTS



The heater bank is controlled by a thermostat (O.H.P.) and protected from overheating by a temperature protection switch (ESTI)

c) FAILURE OF THE SAFETY ELEMENTS

- If the temperature of the heating element is too high more than 65 deg. C the thermostat (O.H.P) send a signal to the controller, which turns off the heater bank.
- If O.H.P. fail and the temperature continuous to rise, fusible link interrupts the power supply mechanically.
- The temperature protection switch (ESTI) contains fusible link (a small glass ball with a liquid), the glass ball bursts at a certain temperature (above 130 ^{O}C). This releases a spring-loaded pin which opens the three phase power supply contacts of heaters.
- The broken glass ball must be removed before installing a new ball in the fusible link switch. The cause of the overheating must be located and repaired.

d) REPLACEMENT OF FUSIBLE LINK

- Remove split pin '3' screw out cartridge holders '5'.
- Remove the broken glass pieces of the old ball (fusible link) and install a new ball '2' of the same type in the cap inspect the motion of the spring loaded release rod '1'. (If it is reluctant to move, install a new temperature switch).
- Slowly screw in cap '5' (the release rod is pressed down when the cap is screwed in place) and secure with split pin.

,

When the cartridge bursts, carefully remove all glass pieces from the cartridge before a new cartridge is installed.

Cartridge carrier with the installed cartridge must be secured with a split pin.

4.1.3 COOLING CIRCUIT PRESSURE PROTECTION

To prevent from high pressure or low pressure in the two parallel connected refrigerant circuits of an air conditioning unit, high, low and control pressure switches are used.

Pressure transducers are connected in the high pressure and low pressure line to determine refrigerant pressures. Transducers give current signal equivalent to pressure in refrigeration line to bar meters/gauges provided in switch panel of air conditioner.

CAUSE OF HP TRIPPING IN REFRIGERATION CIRCUIT

a) Condenser motor defective/not working.
b) Condenser fan motor running in reverse direction. Air should be sucked through condenser coils.
c) Condenser fan blade defective/ broken.
d) Condenser coil clogged with dirt & dust.

e) Cause of LP tripping in refrigeration circuit.
f) Blower motor defective/not working.
g) Blower motor running in reverses direction. Air should be sucked through Evaporator coils.
h) Blower runner defective/broken.
i) Evaporator coil clogged with dirt & dust.
j) Air filters clogged with dirt, dust or any other obstructions in evaporator Section.
k) Less refrigerant or leakage in the refrigeration circuit.
l) Drier filter or capillary chocked.

NOTE: Proper quantity of gas refrigerant (6.55 kg/circuit) should be charged in the system.

5 CHECK PRODUCT RECEIVED

Upon receiving the unit, inspect it for any damage from shipment. Claims for damage, either shipping or concealed, should be filed immediately with the shipping company with proper image proof of damage. Check the unit model number, electrical characteristics, and accessories to determine if they are correct. Also check the loose item packing box for damage and quantity.

6 SHIPMENT, STORAGE & INSTALLATION

6.1 TRANSPORTATION / SHIPMENT

Roof Mounted Package Air Conditioners are supplied preassembled on truck frame. The air conditioning units are fastened with bolts to the truck frame. All assemblies are carefully tested and packed prior to shipment (With refrigerant charged).

6.2 STORAGE & PACKING

The system components shall be stored in their undamaged transport skids. Do not store them in the open. Make sure that they cannot become damaged.

6.3 INSTALLATION

Install RMPU above in the roof space at both extreme ends of the coach. The duct connections for the supply air and re-circulating air point in the direction of the coach.

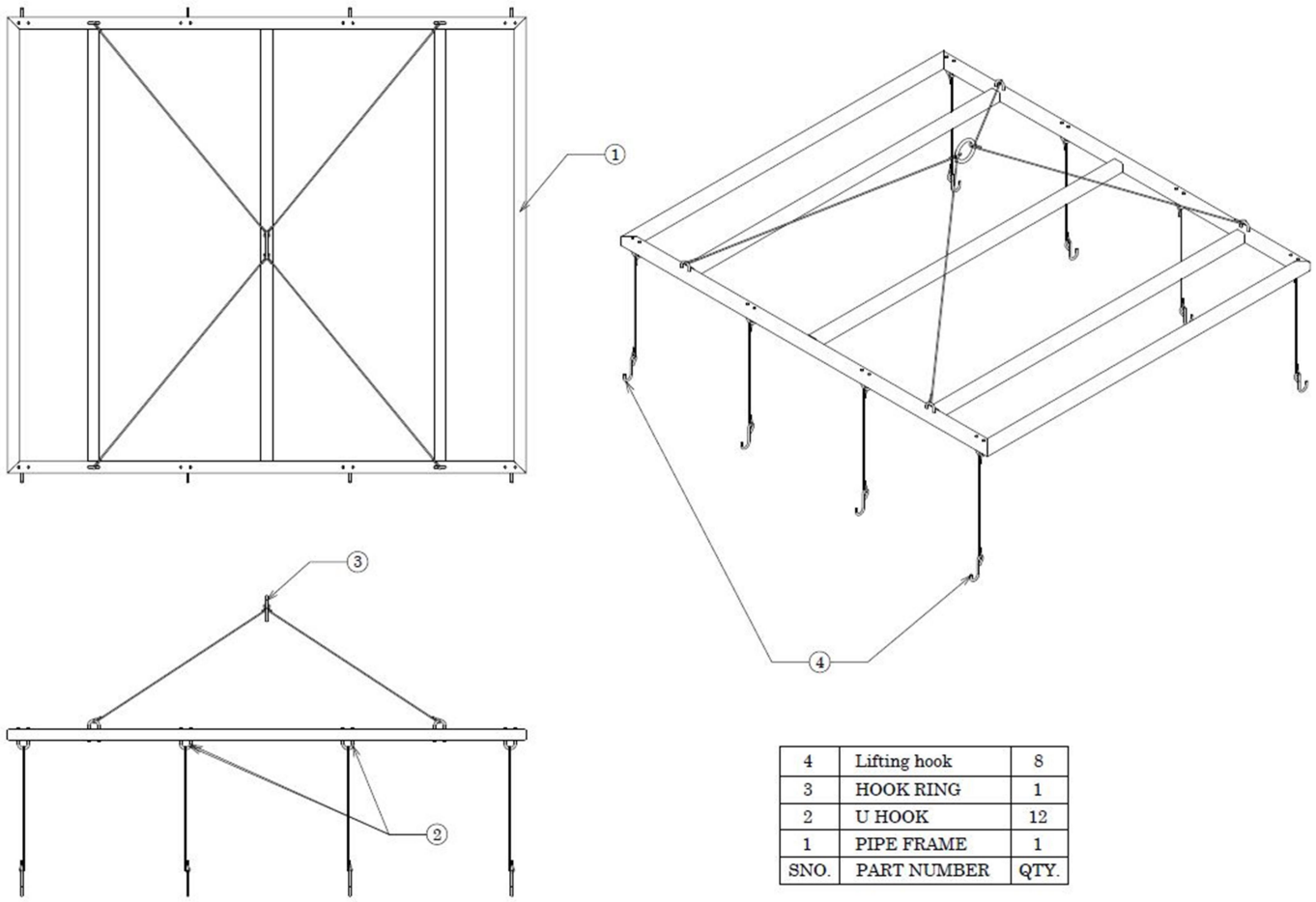
CAUTION

For transporting the air conditioning unit to the coach for the purpose of installation, overhead crane shall be used and Lift the air conditioner for the specified lifting points gently.

Process of Installation for the Roof mounted air conditioning unit

a) Remove Packing
b) Perform visual check for any transit damage
c) Undo transport screws used for fixing unit to frame
d) Lift unit with crane into coach (refer lifting instructions given in section 6.3.1)
e) Lower down unit into installation trough
f) Adjust unit in position with AVM
g) Tighten fastening screws (refer tightening instruction in section 6.3.2 for torque values)
h) Connect earthling connections
i) Establish plug-and-socket connections for power, Control & Sensors supply
j) Connect duct system.

6.3.1 LIFTING INSTRUCTION



SNO.	PART NUMBER	QTY.
1	PIPE FRAME	1
2	U HOOK	12
3	HOOK RING	1
4	Lifting hook	8

Figure 6-1: LIFTING FRAME

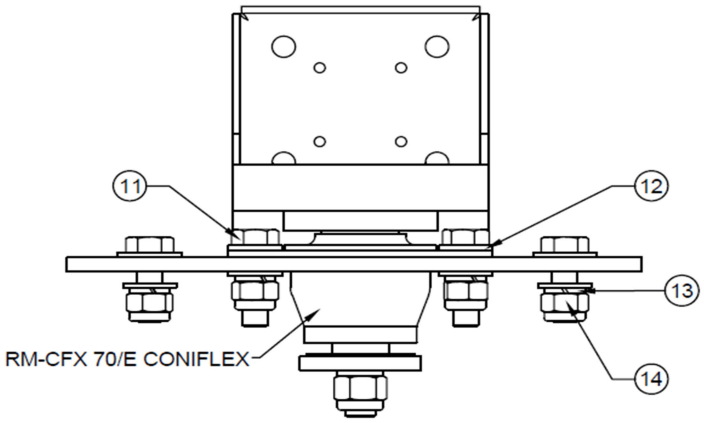
The following instructions shall be followed while lifting the Saloon HVAC Unit.

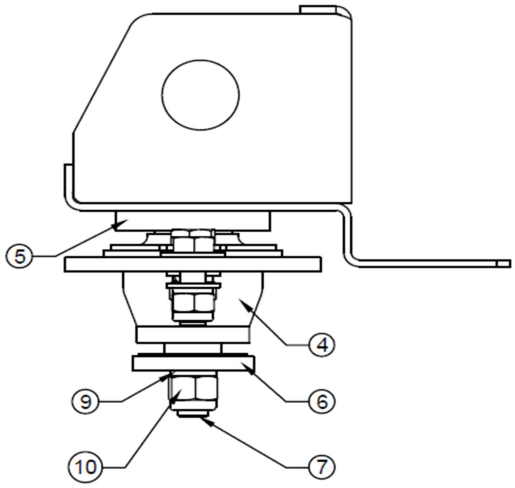
1. 8 hooks should be used to lift the machine.
2. Ensure sufficient strength of rope/belt supporting the hook.
3. Avoid slack lifting members.
4. Ensuring sufficient marching/transit space shall be available
5. Ensure no person shall be positioned underneath the load.

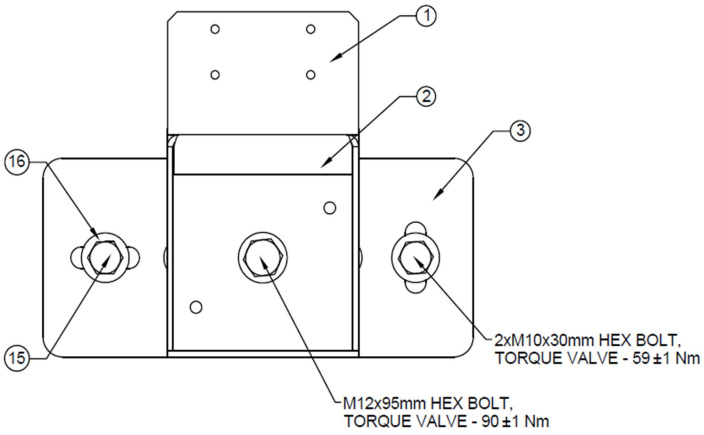
6.3.2 TIGHTING INSTRUCTION

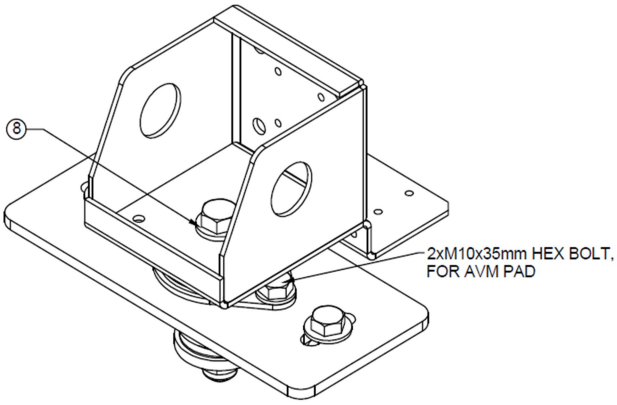
Proper tightening of bolts at is important as under torqued bolt will deform and be unable to provide as much fastening force as needed. An over torqued bolt will break.

A. MOUNTING DETAILS









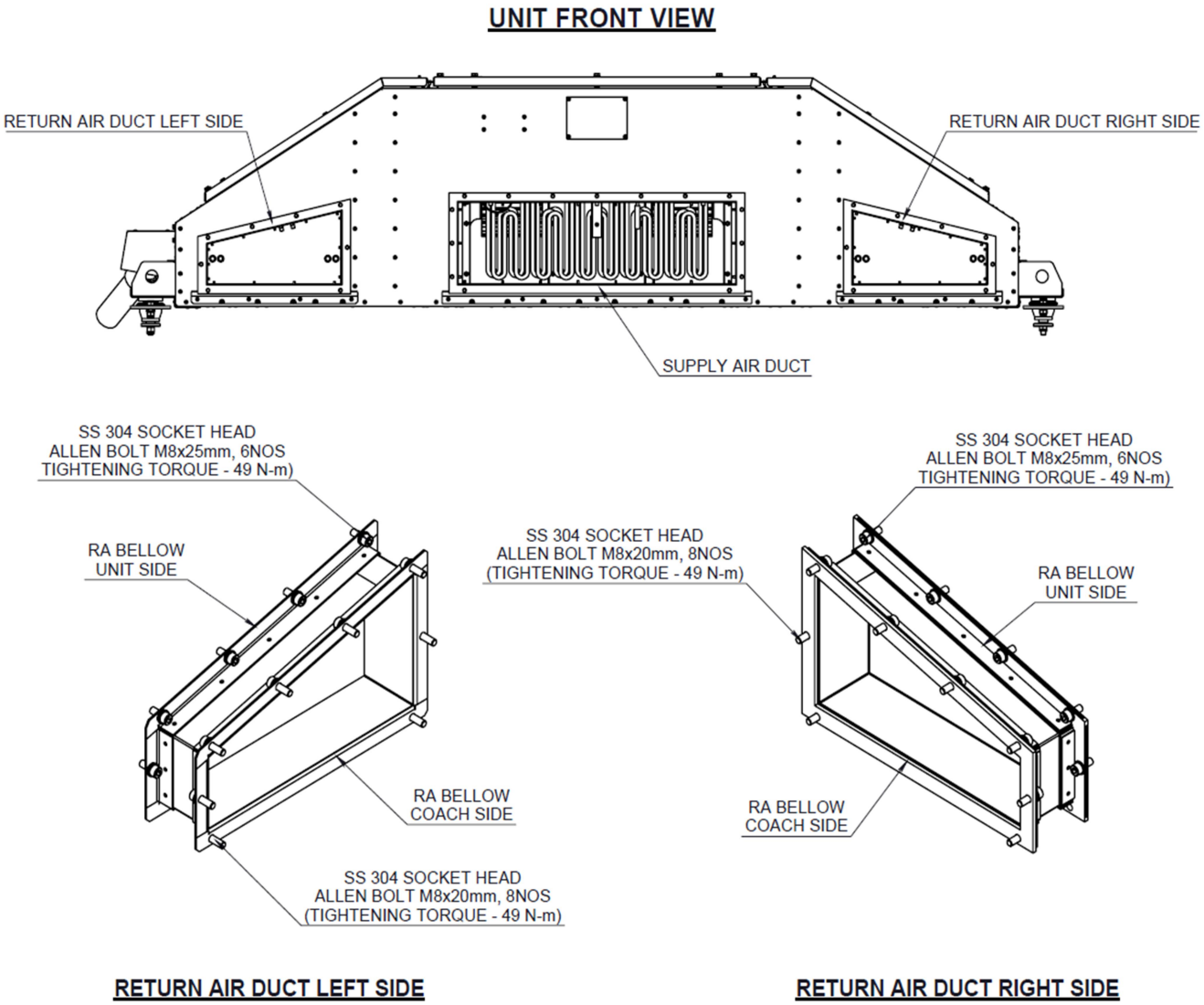
Sr. No.	Part Name	Qty	Sr. No.	Part Name	Qty
1	Base Mounting Bracket	1	9	SS 304 Spring Washer M12	1
2	Main Mounting Bracket	1	10	SS 304 Nylock Nut M12	1
3	Main Holding Plate	1	11	SS 304 Hexagon head Bolt M10 x 35mm	2
4	AVM Pad	1	12	SS 304 M10 Plain Washer	6
5	SS Upper Washer	1	13	SS 304 M10 Spring Lock Washer	4
6	SS Lower Washer With Rubber Coating	1	14	SS 304 Nylock Nut M10	4
7	SS 304 Hexagon head Bolt M12 x 95mm	1	15	SS 304 Hexagon head Bolt M10 x 30mm	2
8	SS304 Plain Washer M12	1	16	SS 304 Plan Washer M10 (Customised)	2

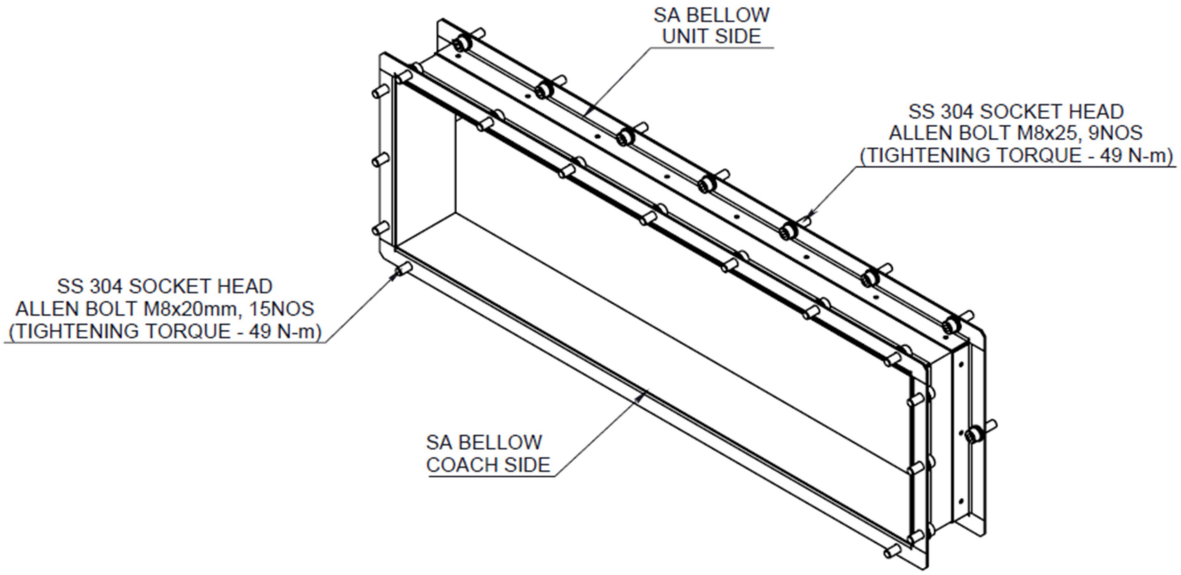
TIGHTENING TORQUE PARAMETERS FOR *SS304 FASTNERS*

S No.	Size	Quality Class	Torque Required (Nm)		Ratchet Wrench Knob Setting
			Dry	Lubricant	
1	M04	A2-70	04±1	NA	3
2	M05	A2-70	07±1	NA	3
3	M06	A2-70	12±1	NA	0
4	M08	A2-70	29±1	26±1	3
5	M10	A2-70	59±1	53±1	3
6	M12	A2-70	99±1	89±1	3

Note: Tightening Torque value for SS A2-70 as per ISO 3506-1.

B. BELLOW BOLTING





SUPPLY AIR DUCT

6.3.3 INSTALLATION PARTS

Sr. No.	Name	Quantity	Shape
1	Crimp terminal Female for A1 Connector , Part No. 09 32 032 3101	1	
2	Hood Side entry for A1 Connector, Part No. 19 30 016 0537	1	
3	Crimp contacts female for A1 & A2 Connector, Part No. 09 33 000 5202	34	
4	Guide bush for A1, A2 & A3 Connector, Part No. 09 33 000 9909	12	
5	Crimp terminal Female for A2 Connector, Part No. 09 32 040 3101	1	
6	Hood Side entry, With M50 for A2 Connector, Part No. 19 30 0160 529	1	
7	Crimp contacts female 1.00 mm^2, with 50 Meting cycle for A2 Connector, Part No. 09 33 000 5205	38	
8	Crimp terminal Female for A3 Connector, Part No. 09 32 018 3101	1	
9	Hood Side entry for A3 Connector, Part No. 19 30 010 0537	1	
10	Crimp contacts female 0.5mm^2, with 500 Mating Cycle for A3 Connector, Part No. 09 33 000 6220	16	

11	Crimp contacts female 0.75sqmm, Silver Plated , 500 Meting cycle for A3 Connector, Part No. 09 33 000 6214	2	
12	Fitting of Conduit M32 ,SQFR-M32B23	1	
13	Fitting of Conduit M50, SQFR-M50B48	1	
14	Conduit fitting SQFR-M32B29 M32 x 1.5	1	
15	SS Hex Bolt M10 X 30	16	
16	SS Hex Nylock Nut M10	32	
17	SS Plain washer M10	48	
18	SS Spring washer M10	16	
19	Anti-Vibration Mounting Pad	8	
20	SS M12 Nylock Nut	8	
21	SS Plain washer M12	8	

22	SS Spring washer M12	8	
23	SS Hex Bolt M10 × 35 mm	16	
24	Air Bellow	1	
25	SS Washer, OD- 60mm, ID- 13mm, Length- 9mm	8	
26	SS Washer, OD- 47.5mm, ID- 12mm, Length- 4mm	8	
27	SS Hex Bolt M12 x 95mm	8	
28	SS Washer M10, OD 25 mm, ID 11 mm	8	

7 TROUBLESHOOTING

Sr. No	Trouble	Trouble Shooting
1	110V DC main MCB of RMPU Control supply 'ON', but, HVAC Unit does not work.	• Check availability of 110V DC at MCB • Check AIR.CO. Switch 'ON' status on DDU (Driver Desk Unit). • Check availability of 415V AC at MCB
2	Controller 'ON', But AC not working.	
a	No cooling	• Check AIR.CO. Switch 'ON' status on DDU (Driver Desk Unit). • Check availability of 415V AC at MCB • Check HP fault status on DDU (Driver Desk Unit).
b	Compressors not working	1. Refer clause no. 4.1.3 for causes of HP tripping. • Check LP fault status on DDU (Driver Desk Unit). 2. Refer clause no. 4.1.3 for causes of LP tripping. • Check supply air fan 1 or 2 thermal protection for tripping. • All measuring sensors failed. • Check working of Blower motor. • Check 415V AC, 3 Ph. Available at Compressors terminals.
c	No Heating	• Check AIR.CO. Switch 'ON' status on DDU (Driver Desk Unit). • Check availability of 415V AC at MCB • Check OHP cut for tripping. In healthy condition LED indications in controller DIP-06 & DIP-28 should glow. • Refer clause no.6.2 for causes of OHP tripping. • Check supply air fan 1 or 2 thermal protection for tripping. • Check EST1 cartridge fusible link is not broken. • Check working of Blower motor. • Check 415VAC, 3 Phase available at Heater terminals.
3	In cooling mode Condenser motor does not work.	• Check thermal protection inside motor for tripping. In healthy condition LED indications in controller DIP-03, DIP-04, DIP-25, DIP-26 should glow. • Check supply air fans thermal protection for tripping. • All measuring sensors failed. • Check 415V AC, 3 Ph. available at Condenser motor terminals.
4	Supply air fan motors not working.	• Check AIR.CO. Switch 'ON' status on DDU (Driver Desk Unit). • Check availability of 415V AC at MCB • Check supply air fans thermal protection for tripping. • Check 415V AC, 3 Ph. available at Blower motor terminals.

8 PROTECT THE ENVIRONMENT FROM E-WASTE

This product at its end of usable life should not be mixed with household domestic waste or any general waste. It must be stored separately and disposed of through an authorized recycler of electrical and electronic appliance waste since it is categorized under Schedule I of E-Waste Management Rules promulgated by the Government of India.

As guided by these rules, this product needs to be disposed of after its useful life in a scientific and prescribed manner. As a responsible citizen of India, we request your cooperation in helping conserve the environment for future generations.

9 DO's AND DON'Ts

DO's:

- Run and Maintain machine as per instructions given in the User Manual.
- Engage only an authorized person to attend to repairs of your machine.
- Engage only an authorized person for DE-INSTALLATION.

DON'Ts:

- Do not try to repair/dismantle your machine by yourself.
- Do not engage any unauthorized person to repair/dismantle your machine or any of its parts.
- Do not sell or dispose of your machine or its parts to a local scrap dealer.
- Do not dispose of E-Waste in landfills or leave it outside unattended.
- Do not put the air conditioner to any other use post its end-of-life

10 MAINTENANCE SCHEDULE

Sr. No.	Equipment /Fittings	Activities	Trip / Weekly	Monthly	Six Monthly	IOH 18 Months	POH 36 Months
1.	General	a) Check the log sheet maintained in each Air-Conditioning coach and attained the defects recorded by escorting staff during run.	√	√	√	√	√
		b) Clean all dust by vacuum or compressed air from the switch board cabinet and tighten the cable terminals, if found loose.	√	√	√	√	√
		c) Replace/connect defective/by passed components.	√	√	√	√	√
		d) Remove fresh and return air filters by opening the access doors of the unit. Clean these filters with vacuum or compressed air taking out the filters and place them gently in their place or replace with pre-cleaned/new filter/filter media and close the doors properly. A cleaning jig should be available with AMC holder/Railways for this activity. Note: After this activity, the service doors shall be latched properly in case of return air filter.	√	√	√	To be replaced	To be replaced
		e) Check working of rotary switches by rotating forward and backward, provided on switch panel for temperature selection and Air. Co. ON. Replace if required.	√	√	√	√	√
		f) Check working of set point generator rotary switch provided for temperature setting.	√	√	√	√	√
		g) Check the tripping of Heaters i.e., OHP. The OHP setting is 65°C. The testing of OHP setting shall be done by			√	√	√

		switching off the blower. During testing, the probe of digital thermometer shall be placed near the sensor of OHP & the display shall be kept outside. NOTE: It shall be checked twice a year. In addition, it shall also be checked as a pre-winter precaution before the onset of winter season.					
		h) Run the HVAC for half an hour and then check the current drawn by various equipment's with the help of clamp tester (tongue tester) duly calibrated. Normal currents for various equipment's and mode of operation are as under: • Cooling mode • Heating Mode NOTE: The current also depends on the ambient temperature.			√	√	√
		i) Check visually condenser fan blade and ensure that there is no crack on the blade or hub.		√	√	√	√
		j) Check and tighten mountings of blower, compressor and blower motor and ensure that they are in good condition.			√	√	√
		k) Ensure that no capillary tubes are in hanging position.		√	√	√	√
		l) Check capillary tubes provided for HP/LP cutout for proper support/clamping. Their nuts should be properly tightened.		√	√	√	√
		m) Check for proper tightening of cover provided over evaporator compartment.			√	√	√
		n) Check the earthing shunts in HVAC are provided. Earthing shunts should be earthed with coach body.			√	√	To be replaced

		o) If less cooling is noticed, check the leakage of refrigerant from the system by using soap solution or leak detector. If leak is detected, it should be attended and re-charging of refrigerant in the system shall be made as per RDSO SMI No. ELPS/AC/SMI/14. Filter drier must be replaced during this activity.	√	√	√	√	√
		p) Check insulation resistance of all the motors & compressors by the duly calibrated 1000 V megger, Attend the motors, if insulation resistance of motor is found less than 2 M ohm. IMPORTANT: Disconnect control devices during this activity.				√	√
		q) Check for physically damaged/jointed cables. Replaced if needed.				√	√
		r) Check for the physically damaged conduits. Replace them, if needed.				√	To be replaced
2.	Refrigerant pipe line/capillary checks	a) Check for proper clamping/support				√	√
		b) Rubbing of capillary with SS sheet/channel or other parts of Train 18				√	√
		c) Leakage from the flare nut of HP/LP conduits with soap solution			√	√	√
		d) Leakage from Feeler tube of OHP				√	√
3.	Compressors checks	a) Holding clamps from top are properly tightened.			√	√	√
		b) Mounting fasteners are properly tightened.			√	√	√
		c) Leakage from suction and discharge port.			√	√	√
		d) Accumulators holding/mounting, if provided.			√	√	√

		e) Condensing area covers are properly tightened & not touching top of compressor body.			√	√	√
		f) Electrical terminal box is properly tightened & cables are terminated with lugs.			√	√	√
4.	Condenser fans motor/ blades and Blower motor/ impeller checks	a) Mounting fasteners are properly tightened.			√	√	√
		b) Electrical terminal box of motors is properly tightened & cables are terminated with lugs.			√	√	√
		c) Double earthing shunts are provided.			√	√	To be replaced during POH
		d) Condition of blade for its fixing/cracking/damage or touching with its cover. Rectify/replace, if needed.			√	√	√
		e) Ensure proper clamping of cable conduits.			√	√	√
		f) Overhauling of Blower and condenser fan motors shall include the following during POH. • The incoming motors shall be checked for abnormal noise and vibration. • Check bearing make and replace with specified make, if found defective. • The IR value of Motor stator shall be measured between motor terminal and frame before and after overhauling. The value of IR shall not be less than 10 M ohm, when measured with 1000-volt megger. • Winding resistance of motors shall be measured between RY, YB & BR phases. The winding resistance shall be ±10% of resistance declared by OEM in cold condition. • Check closely terminal block and connecting lead for any					√

		physical damage or any flash mark over it. Replace the same, if not satisfactory. • Perform HV (Di-electric test) on stator by applying 1.5 kV ac supply for one minute. During test the leakage current shall not be more than 1.0 mA. • Run motor on no load for 15 minutes and check for following: I. Bearing noise – Normal noise II. Bearing temperature rise above ambient - 10°C III. SPM reading - 20 dBN max. (Green zone)					
		• Measure starting current of motors on no load. It shall not be more than 10 times of normal running current. Similarly, the running current of motors shall be measured and it shall not be more than 1.1 A.					√
		• Ensure that impellers are properly tightened.			√	√	√
		• Electrical terminal box is properly tightened & cables are terminated with lugs.			√	√	√
5.	A) Return Air filters	a) Ensure that filters are not damaged.	√	√	√	√	√
		b) Ensure that there is a provision to avoid wrong fitment in the filter as well as in CAB AC.				√	√
	B) HP/LP/OHP cutout switch	a) Check that the mounting fasteners are properly tightened.			√	√	√
		b) Ensure proper clamping/support of capillary tube connected to HP/LP/OHP cutout switch.			√	√	√
		c) Ensure that flare nuts are properly tightened.			√	√	√

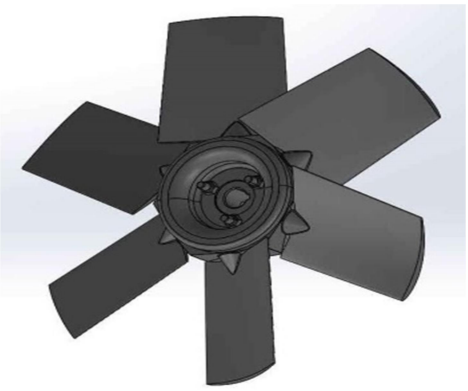
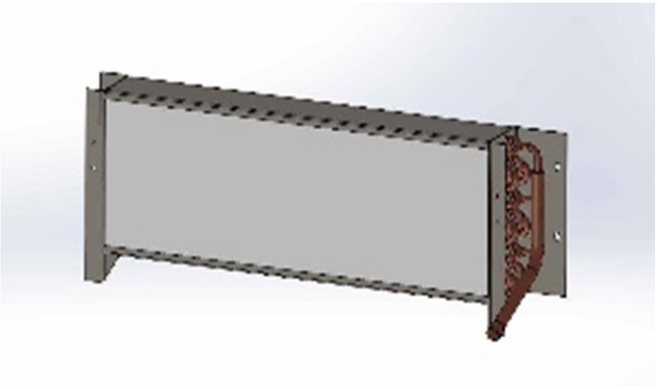
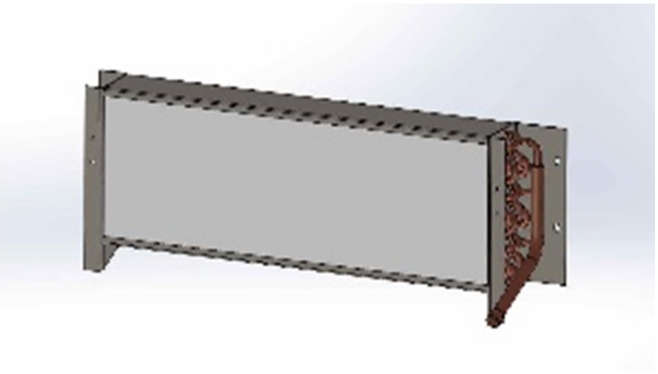
		d) Ensure that control wires to HP/LP/OHP cutout switches are properly clamped.			√	√	√
		e) Ensure that covers of these HP/LP/OHP cutouts switches are properly screwed.	√	√	√	√	√
		f) Ensure proper clamping of feeler tube of OHP switch.				√	√
		g) Remove the accumulated dust over feeler tube of OHP switch.			√	√	√
		h) There should be cover (canopy) on top HP/LP switch (provided with capillary tubes) to prevent water entry.		√	√	√	√
	C) Heater	a) Ensure proper mounting of heater.			√	√	√
		b) Ensure proper clamping of electrical wires to heater.			√		√
		c) Check dust accumulation on heating element. Remove gently, if required.			√	√	√
	D) NTC sensors	a) Ensure that the sensors provided at return air path and supply air are firmly mounted.			√	√	√
		b) Ensure sensor wires are properly clamped.			√	√	
		c) Remove the dust accumulated over sensor gently.			√	√	√
	E) Expansion Valve/capillary tubes	a) Ensure that the bulb is mounted in the suction line just after evaporator coil and in a position corresponding to between 1 O'clock and 4 O'clock. Ensure that it is properly insulated.		√	√	√	√
		b) Ensure that the equalizing line is connected in the suction line immediately after the bulb.			√	√	√
		c) Ensure that the bulb is not connected at the bottom of the pipe line.			√	√	√

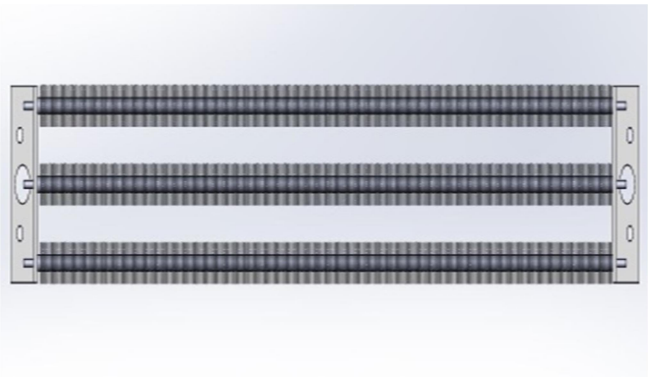
		d) Ensure that bulb/equalizing line/capillary tubes are not chocked.		√	√	√	√
	H) Evaporator coil	a) Ensure that there is no damage to fins.				√	√
		b) Ensure that capillaries of distributors to evaporator coil are not having any sharp bend or kinks. They should also be clamped properly.				√	√
		c) Ensure that air passes only through evaporator coils and no air is bypassed directly to blower chamber.				√	√
		d) Clean the coil, if found dirty.				√	√
		e) Check that the mounting fasteners are properly tightened.				√	√
	I) Filter drier & sight glass	a) Ensure that drier is installed with flow in the direction of the arrow marked on the filter drier label. NOTE: 1) Never use 'antifreeze liquids' like methyl alcohol together with a filter drier. Such liquid can damage the filter. 2) Never re-use a filter drier.			√	√	√
		3) To avoid chances of moisture ingress in the system. Filter drier & compressor should be installed immediately after evacuation and charging the system.			√	√	√
	J) Access Doors	a) Insulate service doors, lower portion and side wall from inside of the evaporator compartment.				√	√
		b) Ensure that latches to lock the service doors are not defective/ damaged.	√	√	√	√	√
	K) Drip tray	a) Ensure that there is no leakage of condensate water			√	√	√

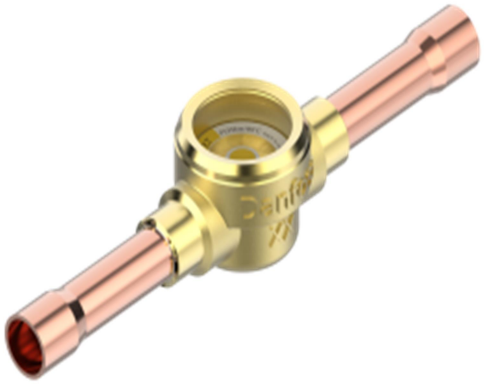
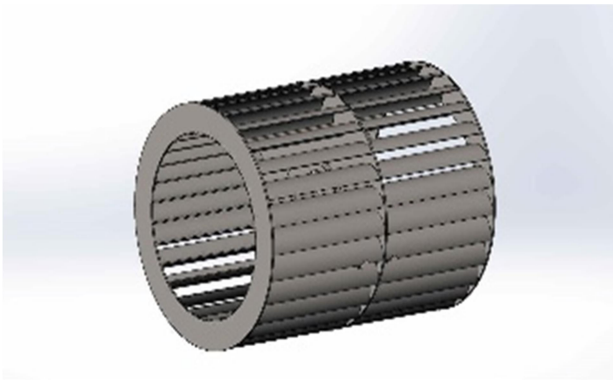
		from drip tray to electrical box & blower housing area.					
		b) Ensure free flow of condensate water		√	√	√	√
	L) Condenser area	a) Clean the condenser coil from inside with compressed air/water jet after opening the cover of condenser area.		√	√	√	√
		b) Ensure that there is no damage to fins			√	√	√
		c) Check that the mounting fasteners are properly tightened.				√	√
		d) Provide fire retardant thermal insulation over suction line.				√	√
		e) Ensure that there is no damage/crack in structure frame of RMPU.				√	√
		f) Ensure proper clamping of electrical conduit.				√	√

11 SPARE PART LIST

Sr. No.	Name	Part Code	Component Photograph
1	Fixed Speed Compressor	ACR 033	
2	Variable Speed Compressor	ACR 029	
2	Condenser motor	LHB 001	
3	Blower motor	LHB 002	

4	Condenser fan	T18 185	
5	Evaporator coil	T18 186	
6	Condenser coil	T18 185	
7	Filter drier	T18 003	

8	Expansion valve	RVC 006	
9	Heater	LHB 007	
10	Return air filter	T18 165	
11	High pressure switch (auto)	EMU 010	

12	LOW PRES. CUTOUT SWITCH	LHB 124	
13	THERMOSTAT SWITCH (OHP)	LHB 010	
14	Refrigerant Sight Glass	T18 162	
15	BLOWER RUNNER	T18 166	

16	Hand Shut Valve 1/4"	ACH 086	

12 INSTRUCTION TO USERS

SAFETY CONSIDERATIONS

Installing, starting up, and servicing air-conditioning equipment can be hazardous due to system pressures, electrical components and equipment location. Only trained, qualified installers and service technicians should install, start up, and service this equipment. When working on air-conditioning equipment, observe precautions in the literature, on tags, stickers, and labels attached to the equipment. Follow all safety codes. Wear safety glasses and work gloves. Use care in handling equipment.

HARTING

Pushing Performance

People | Power | Partnership

Train 18 inter-car jumper systems installation and maintenance manual

Pushing Performance

Contents

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2. INTRODUCTION

Individual Solutions

Due to the modularity of modern rail vehicles, production increasingly takes place in the form of assemblies and this at different locations. In addition, the finished vehicles must nowadays be equipped for worldwide use. In order to meet the growing requirements associated with this, customized solutions for vehicle technology are indispensable.
It is often not enough to offer only standardized products. Rather, there is a demand for problem solutions, i.e. for components or systems that fulfil individual tasks quickly and reliably. Standard components, modifications but also completely new developments are used in these systems. The range of HARTING's customer-specific solutions extends from simplified handling through demand-oriented commissioning to the customized development of complex products and systems, e.g. the retrofitting of international train control systems such as ETCS, Eurobalise, Euroloop, DMI and GSM-R or computer-assisted train control such as CBTC. In addition to product development, HARTING also performs comprehensive engineering tasks. In order to develop the best solution for the customer, a team of engineers, qualified technical draughtsman and a high-performance, in-house, independent and accredited laboratory are used. Material procurement is independent and exclusively subject to customer requirements. This offers customers a flexibility that cannot be taken for granted. Above all, the requirement for reliability with the highest quality stands.

Your partner for jumper solutions

A variety of different data, signal and power lines run through railway vehicles. The wagon couplings between rail vehicles are a vital component of this "central nervous system". Many components – such as the internal MVB rail bus, the low-voltage power supply, the power transmission for the battery or air conditioning, and the video signal transmission – must be properly connected. The connectivity solution must be pluggable because service technicians need to disconnect the cables during maintenance. HARTING has designed and implemented a wagon-to-wagon cable assembly in cooperation with several of our railway customers. We are a single-source provider – starting with CAD-based design all the way to quality-certified delivery. The complete pre-assembled and tested wagon-to-wagon cable solution includes the following:

- ***Connectors***
- ***Cable glands***
- ***System cable***
- ***Protective cable conduits***
- ***Mechanical hanger and strain relief, in part with special lever systems***
- ***Stainless-steel connector plate with strain relief mechanism***
- ***Complete assembly***
- ***Electrical inspection + documentation***
- ***Suitable packaging for transport***

Jumper systems on the interior and exterior of a train are subject to different requirements. The requirements regarding protection against water and dust are lower for indoor installation than for outdoor applications. Thus, systems with protection class IP20 are used for wagon crossovers mounted indoors, and systems up to protection class IP68 are used outdoors. Generally, the wagon crossover cables are installed between the end walls of wagon bodies or as roof or underfloor systems in rail vehicles. There you will find jumper cable constructions for power, data bus, coaxial cables or even fiber optic connections. The system cables must withstand ¬high loads in the area between the vehicles. For the system cables to transmit the various voltages, signals, and data safely, reliably, and permanently, all vehicle- and track-specific requirements must be met. A multitude of other factors, such as the electrical, mechanical, and climatic conditions, must be considered during project planning.

Our service & your advantages

- ***Conceptual design & responsibility of jumper solutions based on our decades of experience in the railway market.***
- ***Selection of the right components according to the latest railway standards, e.g., connection technology, cables, mechanical fastenings.***
- ***Qualified consulting from our worldwide network of experts.***
- ***Complete jumper solutions adapted to your individual requirements.***
- ***Individual simulations and tests by our own accredited laboratory.***
- ***Cost reduction & time saving due to the final approval of inter-car jumper solutions in our independent test laboratory.***

3. GENERAL INFORMATION

Read and follow the instructions in this maintenance manual. Regular inspections and maintenance must be carried out to ensure operational safety! Working safely and successfully requires that several basic rules and procedures are followed. Please note the following points:

- ***Always follow all safety notices and instructions carefully!***
- ***Observe all applicable national regulations concerning health protection and accident prevention in the workplace.***
- ***Observe the general and local environmental regulations.***
- ***Observe the corresponding national regulations and other applicable safety regulations concerning the usage and assembly of connectors and plug-in equipment.***

3.1 PROPER AND INTENDED USE

HARTING's inter-car jumper cables are low-voltage facility components for use in systems in railway vehicles. They may only be used for the intended applications in the permissible and coordinated ambient conditions.

All work required for the installation, commissioning, maintenance, transport, and ongoing operations must be carried out by qualified personnel with the appropriate specialist expertise.

It is the responsibility of the user / operator to comply with all local, state, and federal laws, rules, and regulations regarding inter-car jumper systems for each application.

HARTING's inter-car jumper cables are intended only for detachable connections between components, devices and systems. They are designed for transmitting electrical signals and electrical energy.

In accordance with DIN EN IEC 61984, connectors or sockets must be configured with female contacts on the live-voltage side.

Connectors are components which, according to DIN EN 60309-1, may not be plugged in while under electrical voltage when being used properly.

3.2 QUALIFICATION OF THE USER

Any work relating to the installation, commissioning and maintenance may only be carried out by appropriately qualified staff. In the EU, only qualified technicians, in accordance with DIN EN 50110-1/-2 (VDE 0105 part 100) and IEC 60 364 or HD 384, may carry out such work. The relevant national accident prevention regulations must also be observed.

4. SAFETY INSTRUCTIONS

4.1 SPECIAL SAFETY MEASURES AND SAFETY PRECAUTIONS WHEN HANDLING ELECTRICAL DEVICES

Electric shock from live components!

Inter-car jumper cables contain live (energized) components. There is a risk of electric shock! Before starting work on electrical systems, always observe the following safety rules:

- ***De-energies the facility, the system and any auxiliary systems.***
- ***Ensure that there is an effective safeguard in place so that electrical devices or components that have been switched off cannot be switched on again.***
- ***Label and clearly mark your work area.***
- ***Determine that there is no voltage applied.***
- ***Strictly adhere to the applicable earthing and short-circuit regulations.***
- ***Cover any neighboring, live components.***
- ***Have a qualified electrician determine that there is no voltage.***

Electric shock caused by contamination, dirt, moisture, ice and snow!

Coupling a contaminated or dirty inter-car jumper plug to the inter-car jumper socket can lead to a life-threatening electric shock.

- ***Before inserting an inter-car jumper plug into the inter-car jumper socket or the dummy socket, check that the interiors of the components are free of dirt, dirt, moisture, snow, and ice.***
- ***Remove any dirt, moisture, snow or ice from the interior of the inter-wagon jumper plug, the inter-wagon jumper socket or the dummy socket so that no residue remains.***
- ***RISK OF INJURY! Never connect a contaminated or dirty inter-car jumper plug to the inter-car jumper socket or dummy socket.***

4.1.2 Risk of fire and explosion from flammable materials

Fire and explosion hazards!

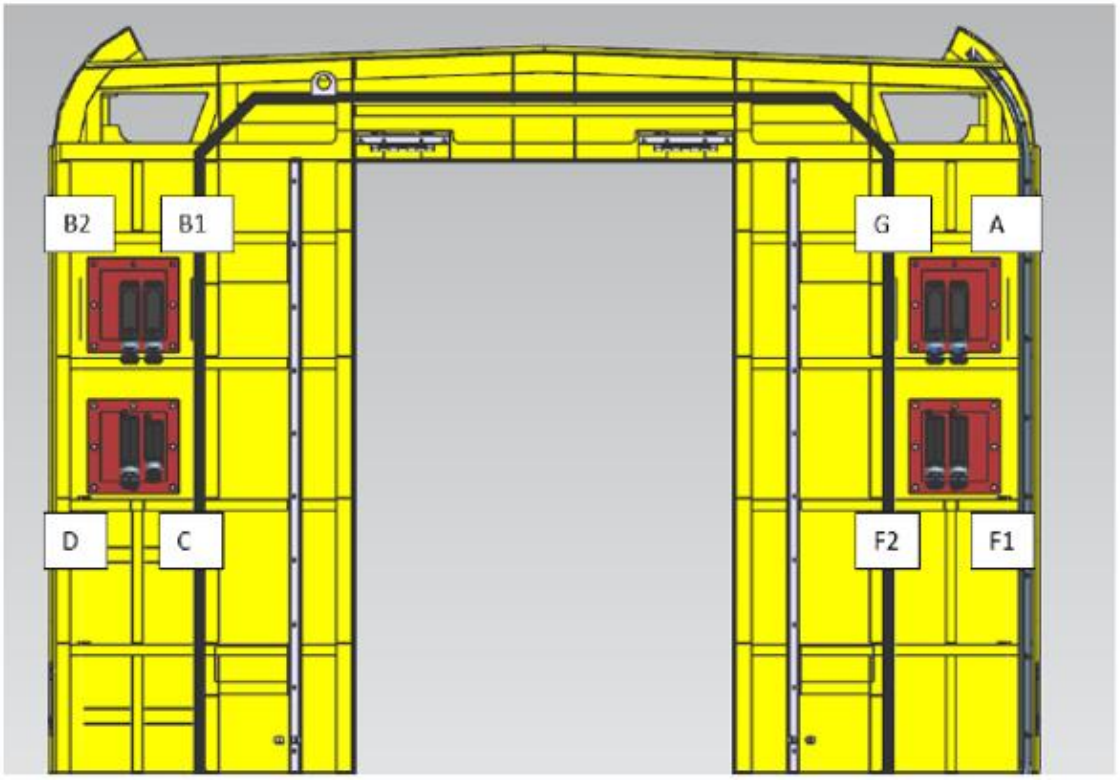
Disconnecting and plugging in the inter-car jumper cables while they are live (energized) can cause an electric arc. There is a risk of fire and explosion if explosive or highly flammable substances or any other ignition sources are in the vicinity!

Never plug or disconnect the inter-car jumper cable while it is live (energized)!

5. INTER-CAR JUMPER SYSTEMS MAINTENANCE AND ASSEMBLY DETAILS

5.1 JUMPER AND SOCKET ASSEMBLY COACH POSITION.

Before removing the jumper cable from socket assembly check the mounting of the coach location and position. Refer the below image (Pic-5.1) for (TC NAE) jumper and socket position.



Pic-5.1

5.2 JUMPER CABLE MAINTENANCE AND ASSEMBLY DETAILS

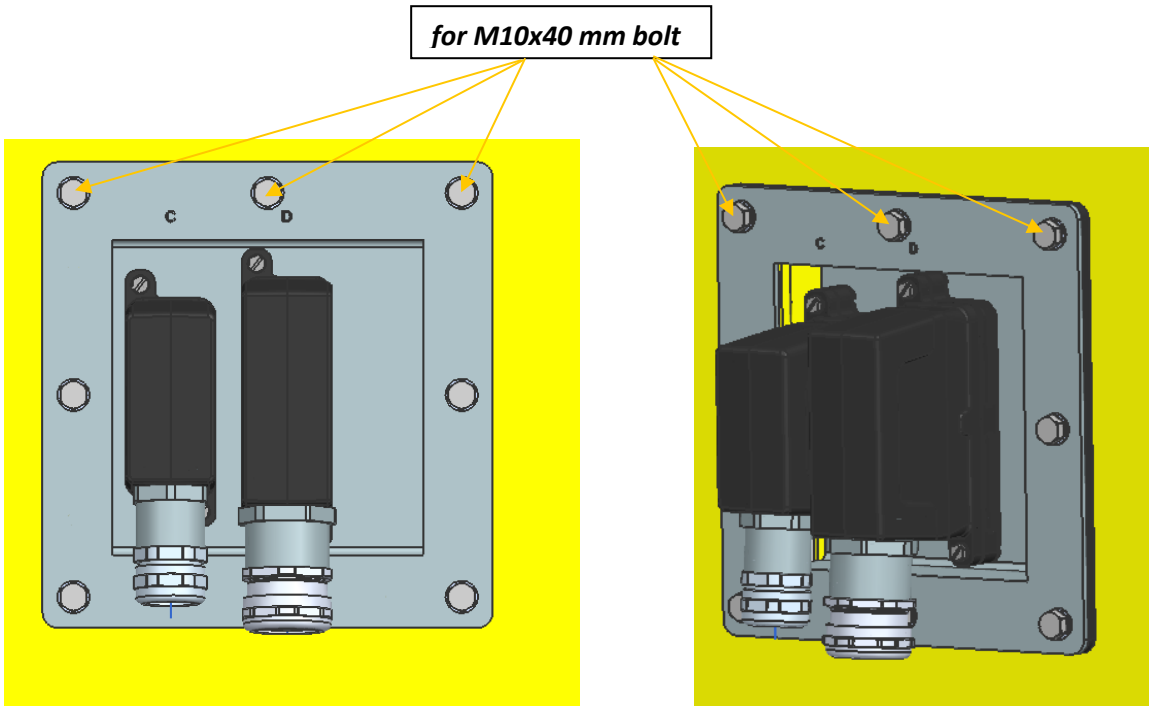
Improper use of the inter-car jumper cables (such as a hard impact on the floor) can severely damage them (cracks, deformation, etc.) and lead to personal injury. HARTING's inter-car jumper cables may only be used for the purpose specified in the maintenance instructions. Refer to the "Proper and intended use" chapter.

- ***Make sure that the inter-car jumper cables are handled properly.***
- ***Do not throw the inter-car jumper cables on the floor.***
- ***Check the inter-car jumper cables regularly for damage.***
- ***Replace any damaged components of the inter-car jumper cables immediately.***
- ***Risk of material damage! There is a risk of material damage from the tensile, compressive, bending and torsion forces placed on the cable/hose screw connection.***

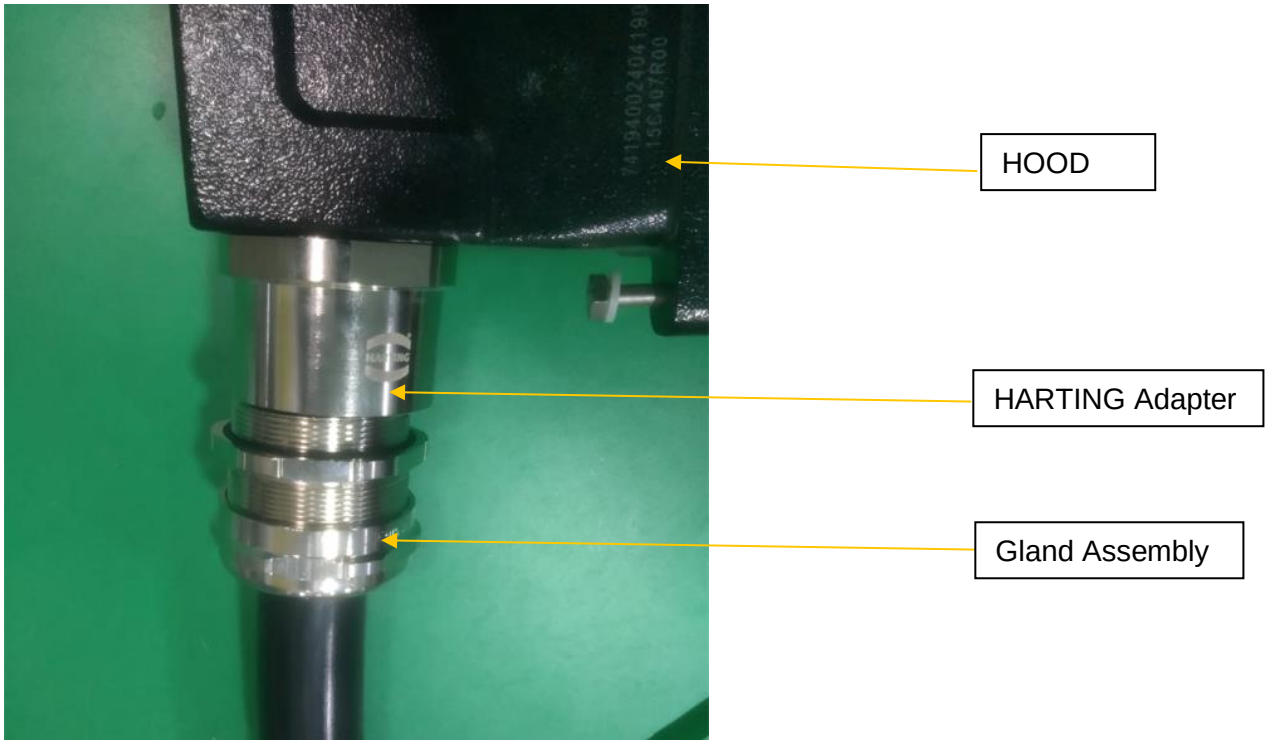
5.3 <u>SOCKET PLATE ASSEMBLY TORQUE DETAILS</u>

The recommended torque for M10x40 mm bolt, washer, and spring washer along with EPDM gasket is 35 Nm.

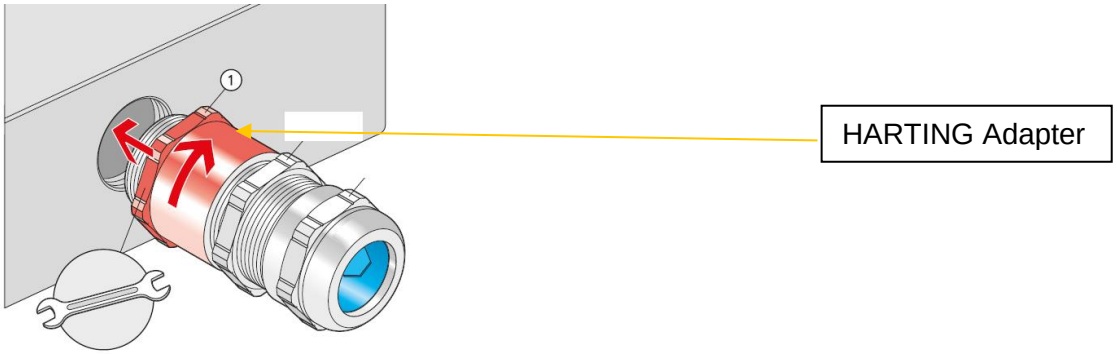
We are using 8 Bolts / per bolt 35 Nm is applied = 280 Nm or 28 Kg is applied across End wall plate.



5.4 JUMPER CABLE ASSEMBLY DETAILS



Pic-5.3



Pic-5.3.1

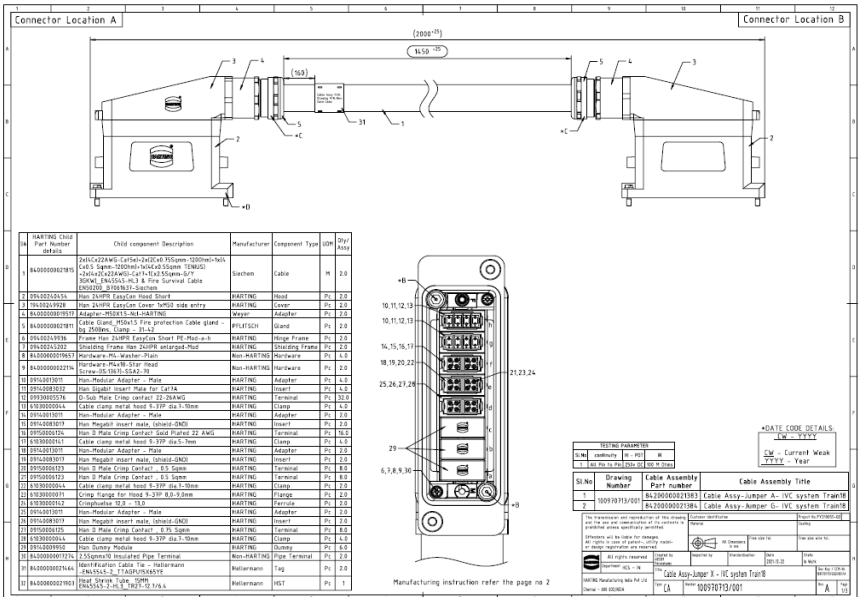
5.4.1 HOOD WITH ADAPTER ASSEMBLY

Before Gland assembly with Hood part, Refer the above picture 5.3 and 5.3.1 for adapter position.

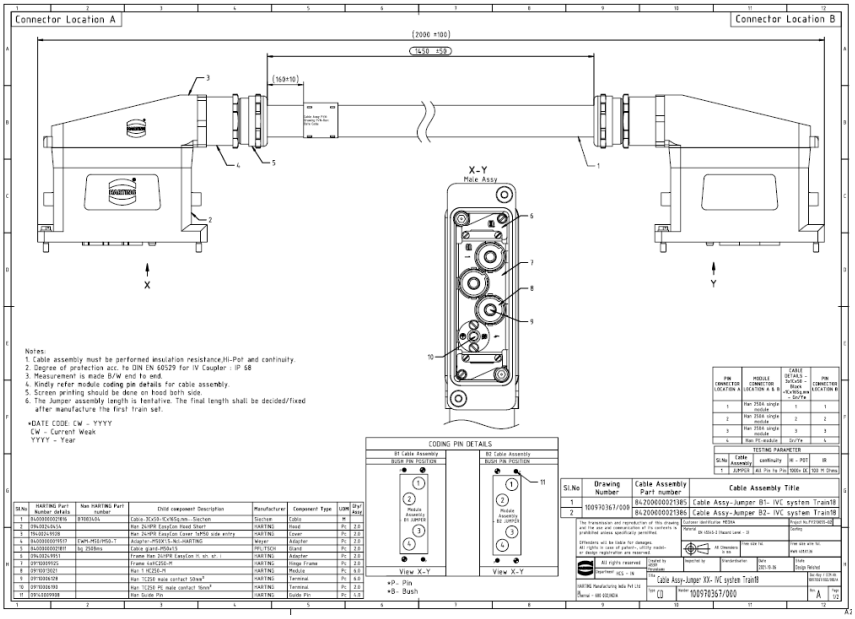
5.4.2 A, G, B1, B2 CABLE AND MODULE ASSEMBLY DETAILS

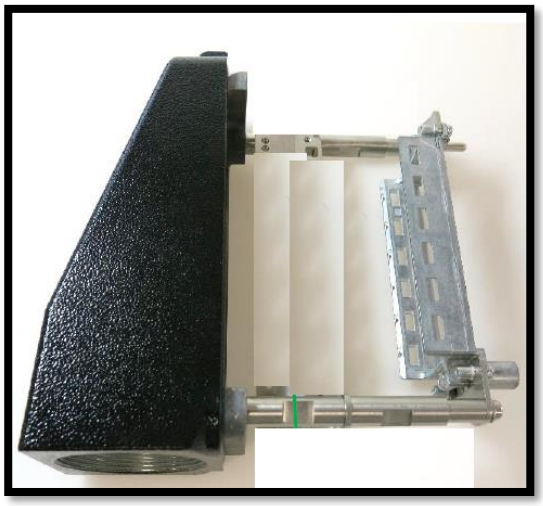
A G cable assembly before removing the Hood from closing cover refers the cable assembly 84200000021383 and 21384 drawing for module position details. After removing the Hood Refer the picture 5.3.2 and 5.3.3 for cable assembly and Hood with closing cover details.

JUMPER A, G, CABLE ASSEMBLY DRAWING

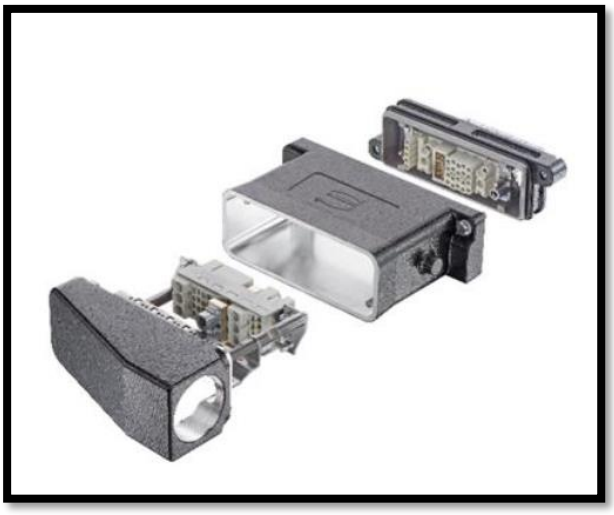


JUMPER B1, B2, CABLE ASSEMBLY DRAWING





Pic- 5.3.2



Pic- 5.3.3

Refer the picture 5.3.2 for closing cover with hinged frame assembly view and refer picture 5.3.3 for module assembly with closing cover and hood assembly position details, after hinged frame assembly refer the cable assembly drawing for hood assembly points are *A, *B and before both end hood assembly check the gland-to-gland assembly should be 1450 (+25 and -0) mm.

5.4.3 A, G, MODULE AND HINGED FRAME ASSEMBLY DETAILS

A G MODULE ASSEMBLY

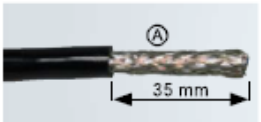
Han GIGABIT MODULE ASSEMBLY

There are two ways to connect the shielding of the cable to the connector:

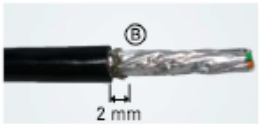
- Using the crimp flange
- Using the cable clamp

The following describes the required steps for both types of assembly.

Assembly with crimp flange

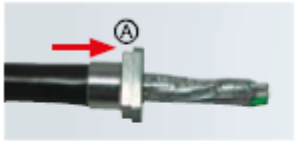


1. Strip the cable over 35 mm, release the screening braid Ⓐ and expose the screen foil Ⓑ.

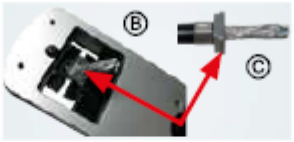


2. Push the crimp barrel Ⓒ over the outer jacket of the cable. Fold the screen backwards and cut it off, leaving approx. 2 mm of the screening braid.

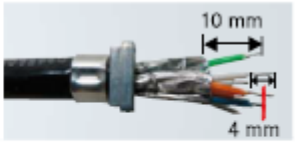
3. Push the crimping flange Ⓓ over the cable and screen foil and press it between the screening braid and foil. Slide the crimping flange so that the cable insulation lies on the flange.*



4. Now slide the barrel back over the cable. The barrel should be positioned as near as possible to the flange* for the best crimping process.



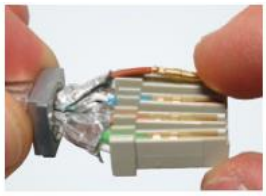
5. Crimp the barrel with the crimp tool Ⓑ **61 03 600 0020**. Hold the tool closed until it opens by itself. Remove the crimped cable Ⓒ.



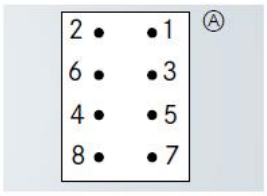
6. Shorten the screen foil to 10 mm. Strip all individual wires to 4 mm.

* Insert the support of the flange as far as possible under the cable shield.
Notice: The assembly tool 61 03 600 6017 makes it easier to insert the flange.

7. Guide the stripped wires into the contact and crimp them in accordance with the tool's instructions (red arrow). Recommended tool: **09 99 000 0501**



8. Place the contacts sideways into the Han® Gigabit insert. The contact chambers 1, 3, 5 and 7 are on one level, the chambers 2, 4, 6 and 8 are on the other.



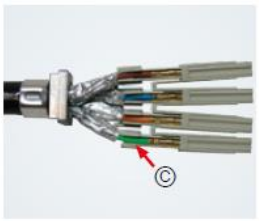
Ⓐ Contact assignment acc. to EIA / TIA 568A (view from termination side):

2 = green	1 = white / green
6 = orange	3 = white / orange
4 = blue	5 = white / blue
8 = brown	7 = white / brown

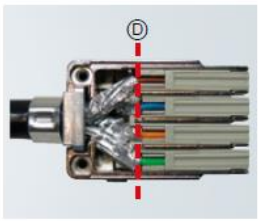
Ⓐ Contact assignment acc. to EIA / TIA 568B (view from termination side):

2 = orange	1 = white / orange
6 = green	3 = white / green
4 = blue	5 = white / blue
8 = brown	7 = white / brown

Ⓑ Contact chamber marking: Female insert (F), Male side (M) assigned similarly.

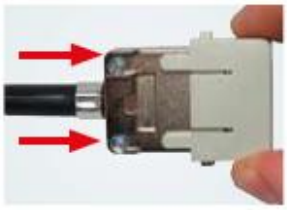


9. Insert the crimped contacts until they lock securely with an audible click. To achieve optimal transmission characteristics, the screen foil must reach to the insert. Push the insert upper part onto the insert Ⓒ.



10. Lay the assembled insert into the chamber of the housing bottom part.
To achieve optimal transmission characteristics, the screen foil must reach to the metal ribs of the housing bottom part – red line Ⓓ.

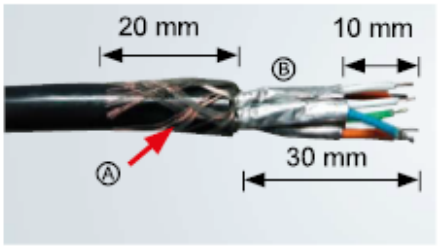
11. Screw the housing cover onto the housing bottom part (0.5 Nm).



12. Insert the assembled insert into the Han® module adapter (in the direction of the arrow).

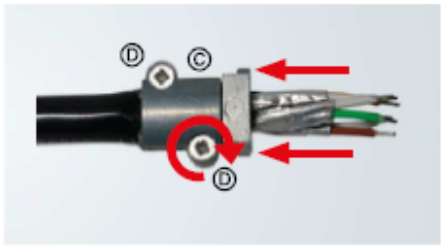
13. The module is now assembled.

Assembly with cable clamp



1. Strip the jacket of the cable and lay the screening braid Ⓐ according to the requirements (20 mm).

2. Strip all individual wires to 4 mm. Shorten the shield foil Ⓑ of the wires to 10 mm.



3. Push the cable clamp Ⓒ over the wires until the foil is completely enclosed by the cable clamp.

4. Close the cover of the cable clamp and tighten up the M3 screws Ⓓ (recommended: PH 1 screwdriver, 0.5 Nm).

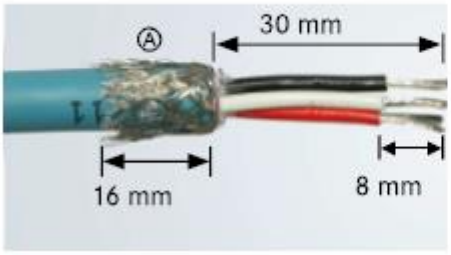
The wires can now be further processed (refer to **Assembly with crimp flange**, step 7).

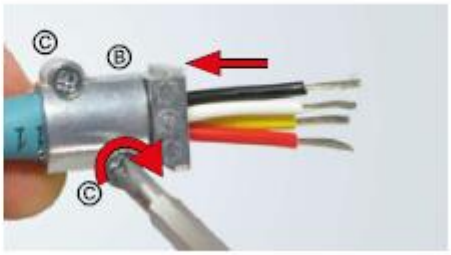
Han MEGABIT MODULE ASSEMBLY

There are two ways to connect the shielding of the cable to the connector:
- Using the cable clamp
- Using the crimp flange

The following instructions describe the steps required for both types of assembly. They are limited to the assembly of the male contacts. The female contacts are assembled in the same way.

Assembly with cable clamp



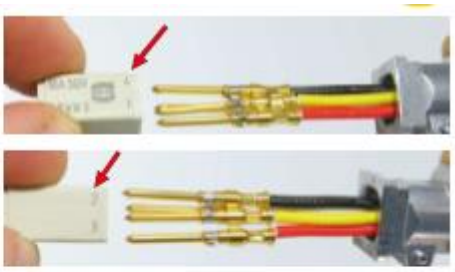


1. Strip the jacket of the cable and lay the screening braid Ⓐ according to the requirements. Strip all the individual wires to 8 mm (6 mm with Han D® 2.5 mm² contacts).

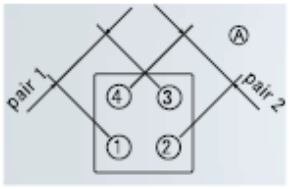
2. Push the cable clamp Ⓒ over the wires until the foil is completely enclosed by the cable clamp.

3. Close the cover of the cable clamp and tighten up the M3 screws Ⓓ. (Recommended: PH 1 screwdriver, 0.5 Nm).

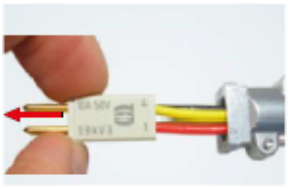
4. Guide the stripped wires into the contact and crimp them in accordance with the respective crimp tool's instructions (red arrow). (Recommended tools: 09 99 000 0110, 09 99 000 0001, 09 999 000 0021)



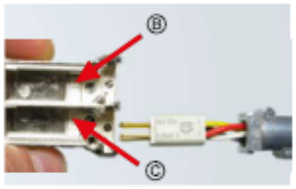
5. Before inserting the contacts, check the contact chamber marking. The contact chambers 1 and 4 are on one side (with the HARTING logo), chambers 2 and 3 on the other side.



6. Insert the contacts into the Han® Megabit module (assignment acc. to the sketch Ⓐ). Push in the crimped contacts until they lock securely with an audible click.

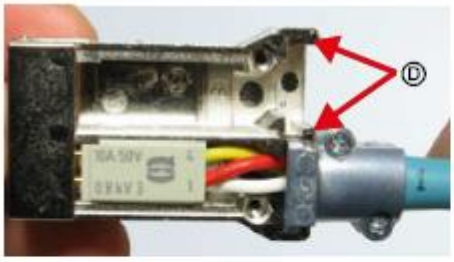


7. Then check the crimp contact for firm seating by pulling in the direction of the arrow.

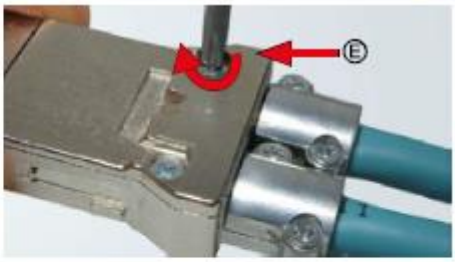


8. Place the assembled insert into the respective chamber of the housing bottom part. So that the allocation is clear, the letters B and A are formed in the housing chambers (Ⓑ, Ⓒ).

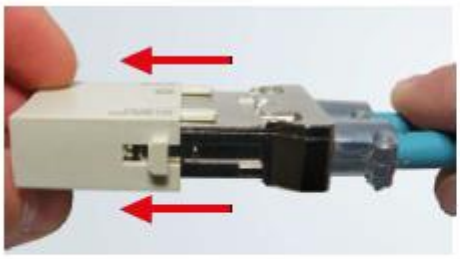
- **The insert is placed so that the HARTING logo is visible from above. The insert fits exactly into the insertion area provided.**



9. Place the clamping piece for the shield connection exactly in the guides of the housing bottom part Ⓓ.



10. Assemble and mount the second insert in accordance with the instructions for the first insert and insert it into the empty contact chamber. Screw on the housing cover Ⓔ. (Recommended: PH 1 screwdriver, 0.5 Nm).

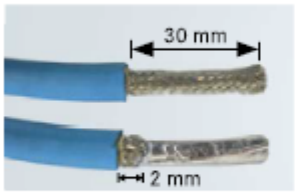


11. Insert the assembled housing into the Han® Module adapter (in the direction of the arrows).

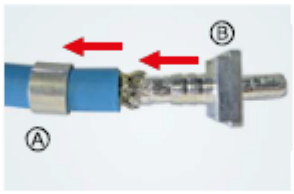
12. The module is now assembled.

Pushing Performance

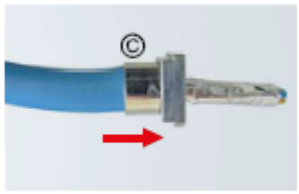
Assembly with crimp flange



1. Strip the cable to 30 mm, release the shielding and expose the shield foil.
2. Fold the screen to the rear, and cut off. Leave approximately 2 mm of the screening braid.



3. Push the crimp barrel Ⓐ over the outer jacket of the cable. Push the flange Ⓑ over the cable and the screen foil. Press it between the screening braid and the insulation (if necessary, turn it slightly).
Insert the support of the flange as far as possible under the cable shield.*



Slide the crimping flange so that it lies on the cable insulation.

4. Push the crimp barrel Ⓒ back over the cable. The barrel should be positioned as near as possible to the flange for the best crimping process.

5. Crimp the barrel and flange (e.g. using crimp tool **61 03 600 0020**). Keep pressing the crimp tool until the die opens itself again Ⓓ.
Remove the crimped cable Ⓔ.

6. Remove the shield foil and insert the crimp flange Ⓕ in the housing opening Ⓖ.

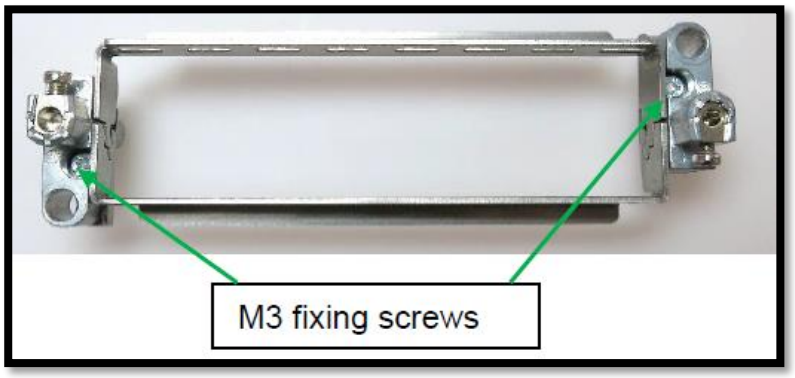
7. The wires are now ready for further processing – as described in the instructions for assembly with the cable clamp, steps 4 to 11.

A G HINGED FRAME ASSEMBLY

24 HPR EasyCon Frames with PE for Han-Modular® Modules assembly Features

- For up to 8 single modules in size 24B Size Hood and Base Panel assembly

- For pre-assembling the adapters can be fixed by a M3 screw to the hinged frame (Pic- 5.3.4)



Pic- 5.3.4

After removing the M3 screw, Remove the Additional zinc die-cast adapters with PE contacts for Assembling the connector modules.

Pic- 5.3.5

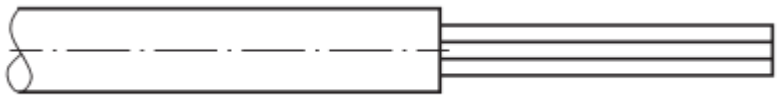
5.4.4 B1, B2, (250 A) MODULE ASSEMBLY DETAILS

250 A MODULE ASSEMBLY TECHNICAL SPECIFICATION

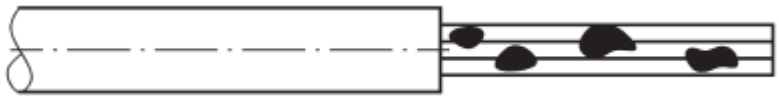
i) Cable Stripping Length details.

	Cross-section	Crimping jaw acc. to DIN 46235	ø	Stripping length
Crimping jaws in accordance with DIN 46235	10 mm^2	6	4.3 mm	22 mm
	16 mm^2	8	5.5 mm	22 mm
	25 mm^2	10	7.0 mm	22 mm
	35 mm^2	12	8.45 mm	22 mm
	50 mm^2	14	10.25 mm	22 mm
	70 mm^2	16	11.75 mm	22 mm

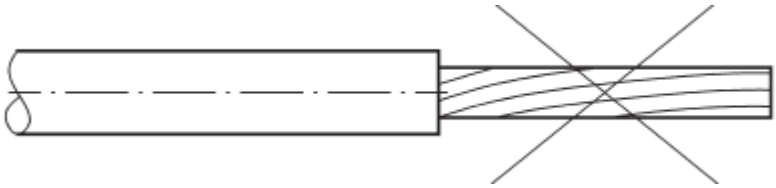
Table 5.1



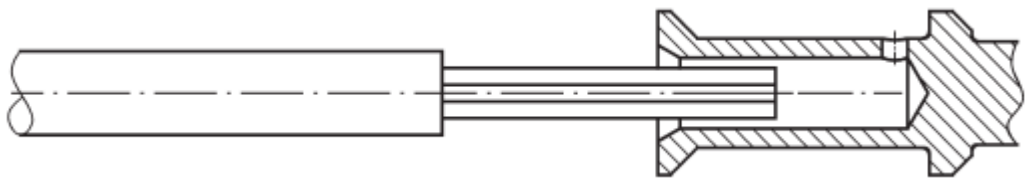
Cut the cable head square and strip the insulation as per the Table 5.1



The copper strands must be clean from dirt and oxid film.

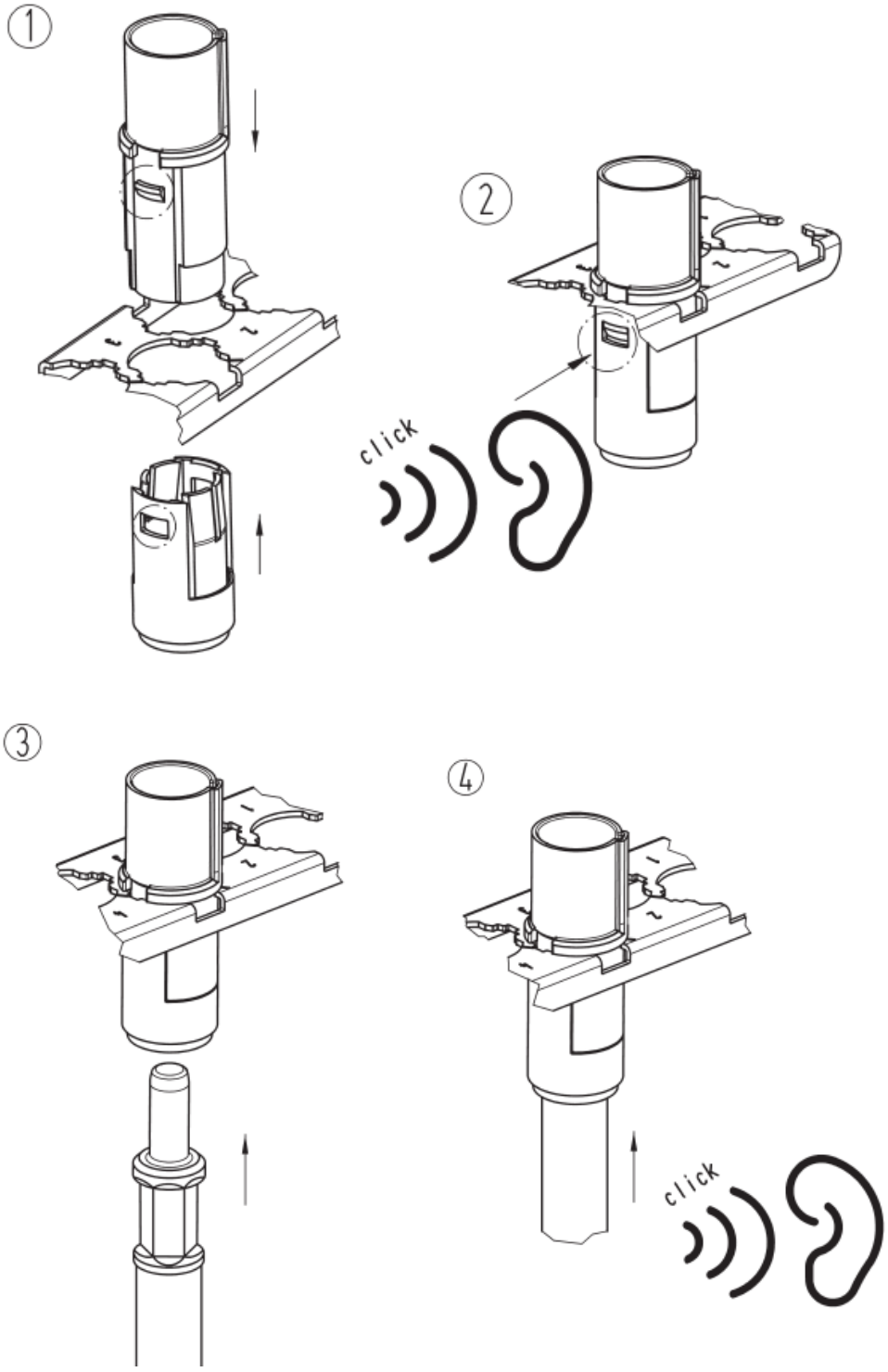


Copper strands must not be drilled.

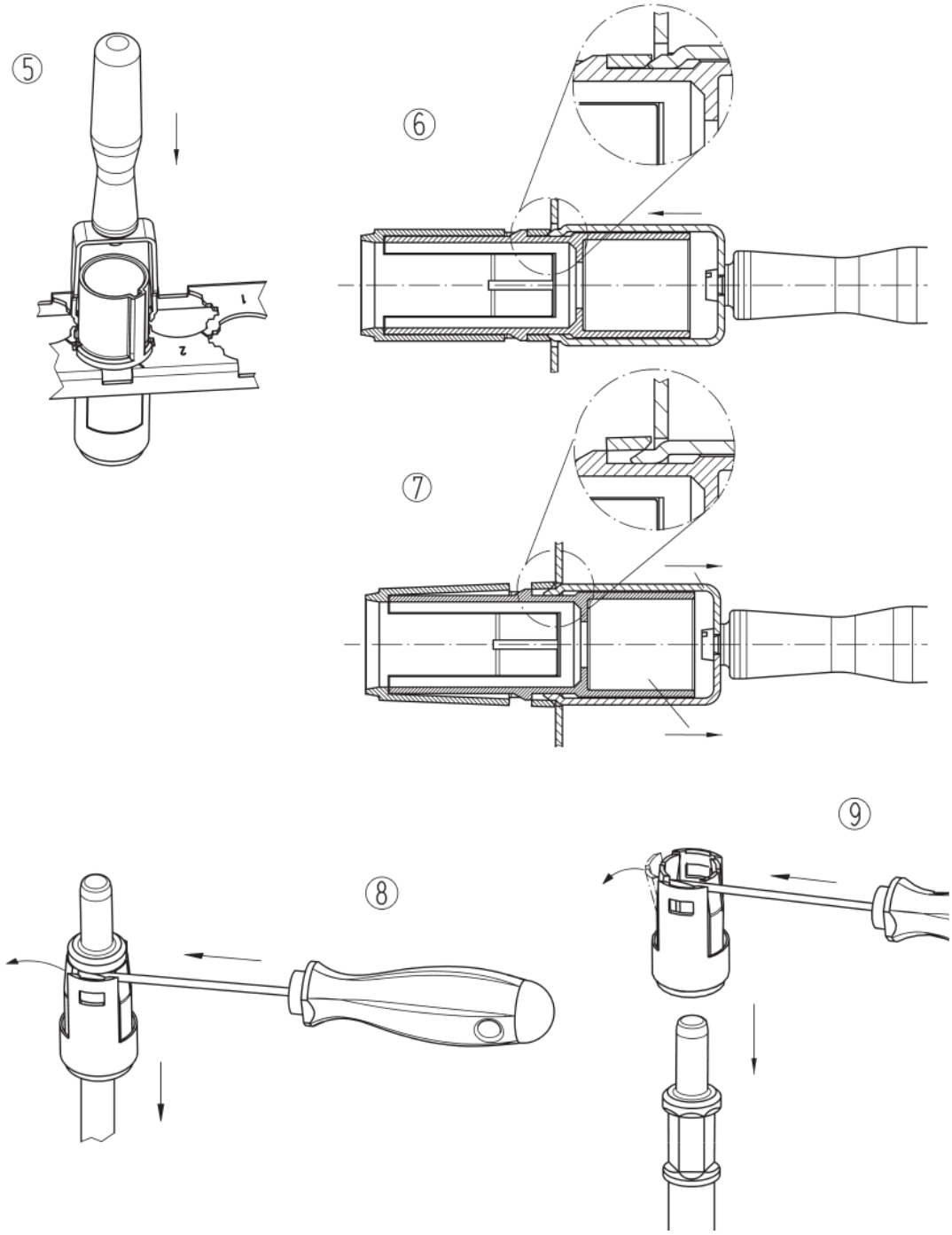


Insert the cable strand completely into the crimp ferrule. Insertion checks via inspection hole.

ii) 250 A Module with 250A frame and cable - *Assembly.



iii) 250 A Module with 250A frame and cable - Removal.



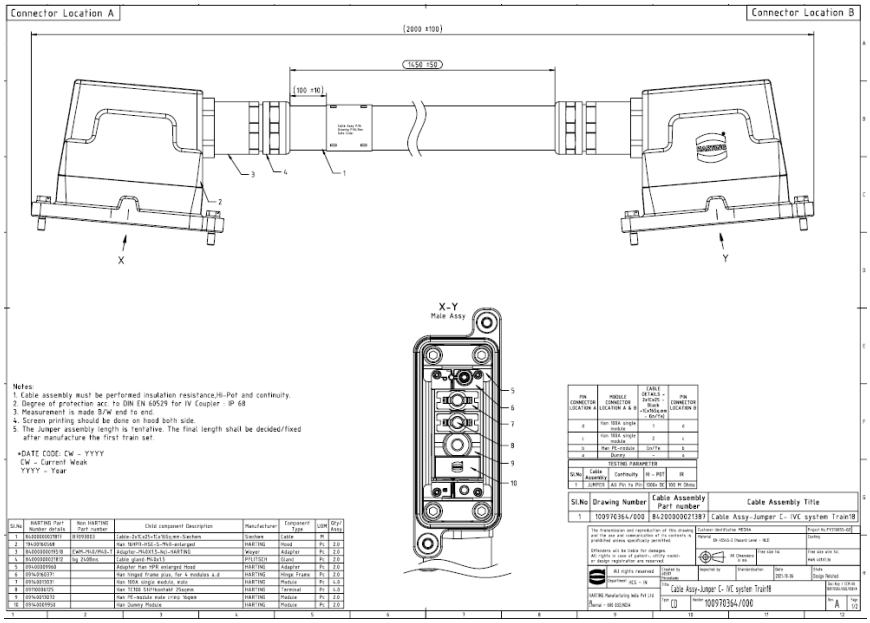
- ***Above details are Applicable for both male and female 250A connector assembly***
- ***Must use the removing tool 09 99 000 0332 for module removing process.***
- ***Coding pin and hinged frame module position refer the cable assembly 84200000021385 and 21386 drawing details.***

5.4.5 C, D, F1, F2 CABLE AND MODULE ASSEMBLY DETAILS

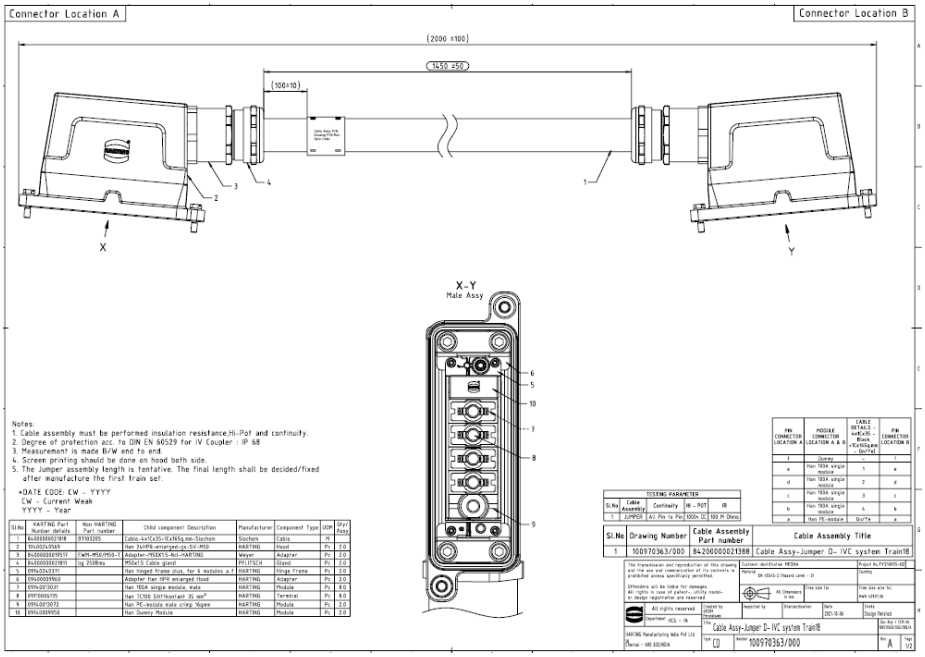
1. C, D MODULE ASSEMBLY DETAILS

After Hood adapter (Pic-5.3) assembly refer the cable assembly drawing 84200000021387 and 21388 for module and hinged frame assembly positions.

Jumper C cable assembly drawing.

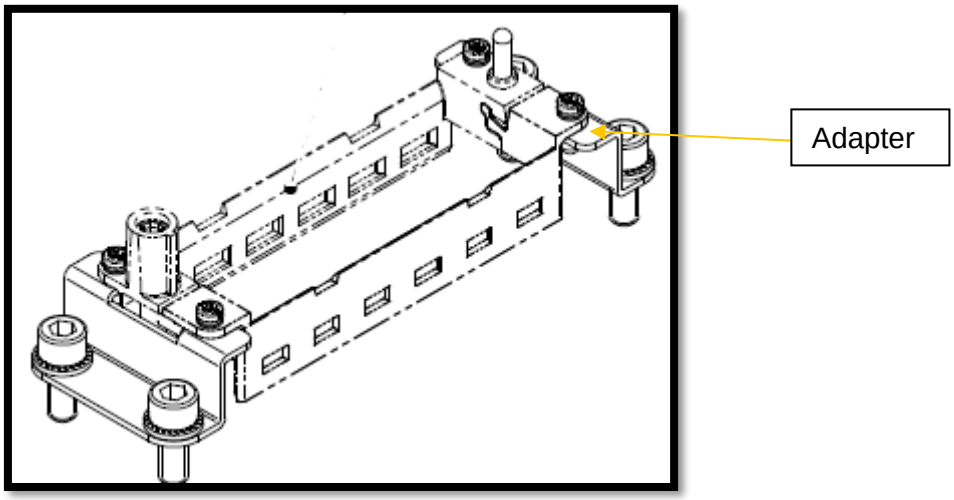


Jumper D Cable assembly drawing



2. C and D - Hinged Frame and module assembly details

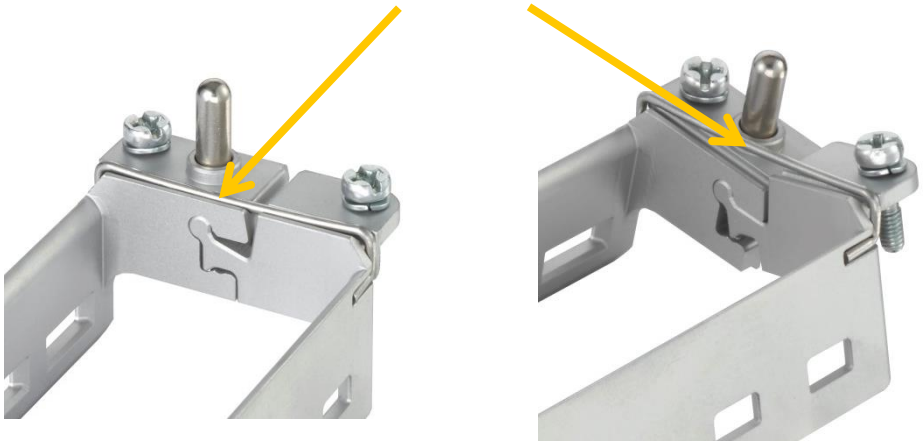
i) Hinged Frame assembly with Han HPR Hood adapter (09400009960) and Housing Adapter (09400009961) for male and female connector assembly.



Pic-5.3.5

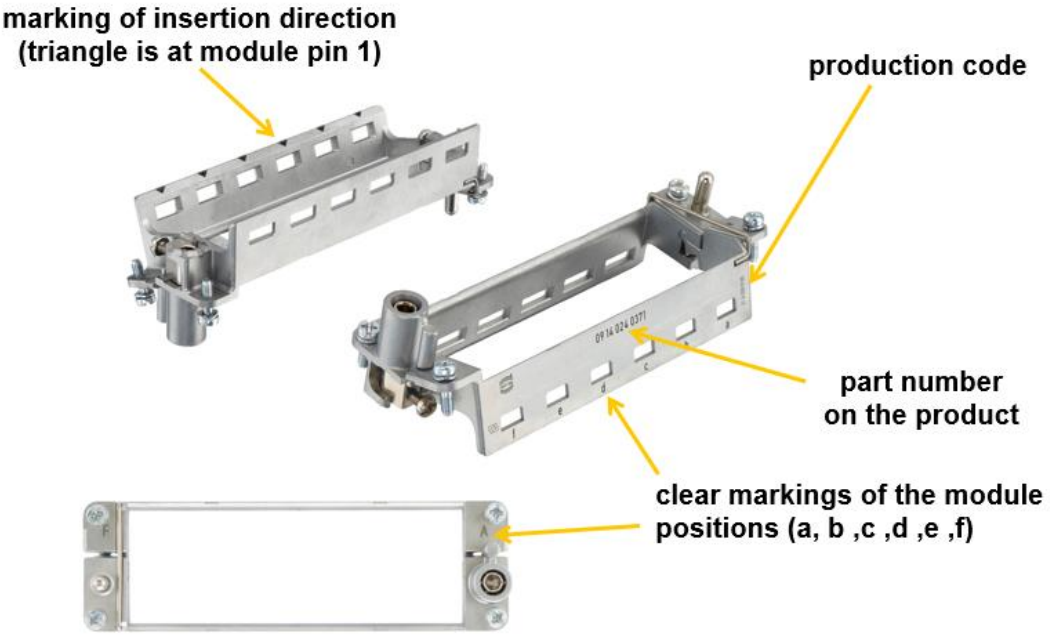
ii) Hinged Assembly

spring force in open and close position



- ***stainless steel spring with double retaining function***
- ***supported by an audible "click"***
- ***quick and easy assembly of the modules***

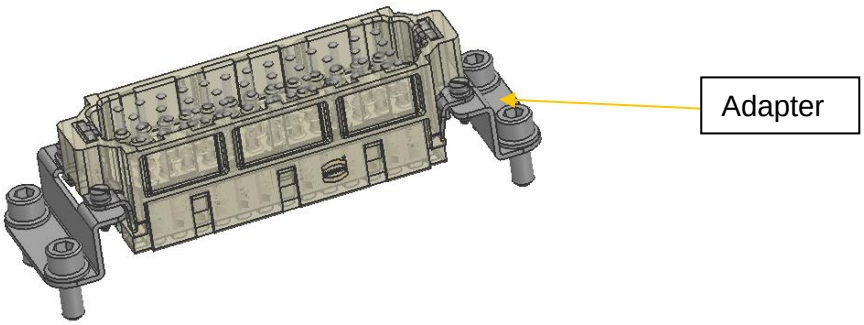
iii) Hinged Frame – Marking Details.

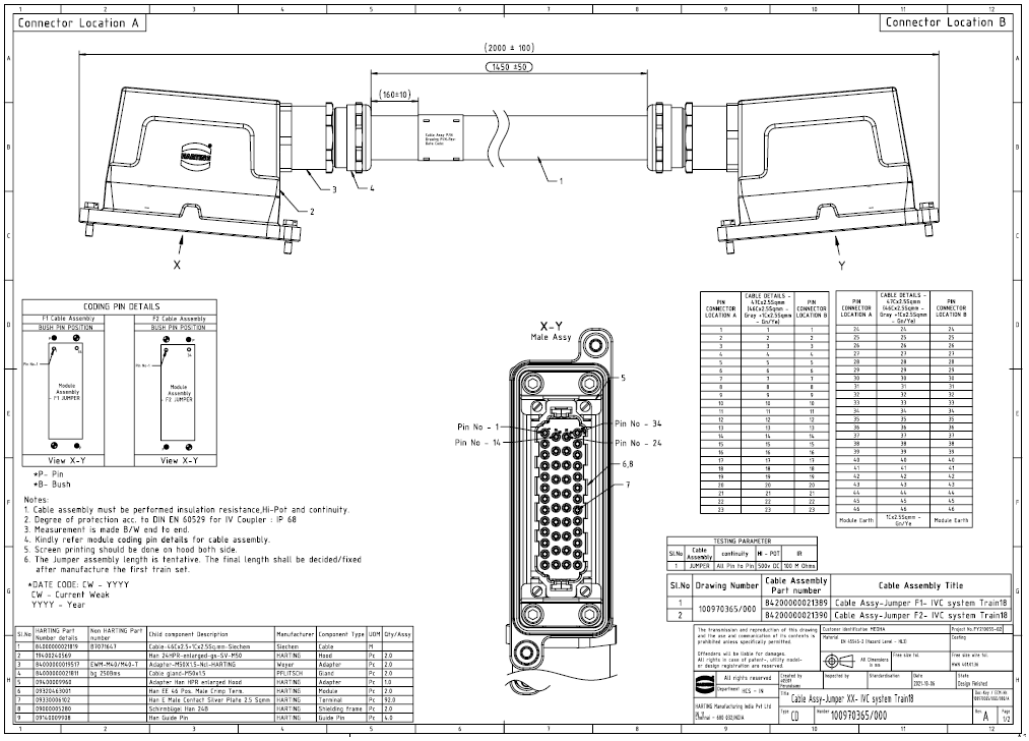


5.4.6 F1, F2 MODULE ASSEMBLY DETAILS:

After Hood adapter (Pic-5.3) assembly refer the cable assembly drawing 84200000021389 and 21390 for module and hinged frame assembly positions.

i) 46 Pin Module assembly with Han HPR Hood adapter (09400009960) and Housing Adapter (09400009961) for male and female connector assembly.





ii) ***46 Pin connector with crimp wire connection are classified as "solder free electrical connections". The specifications for this connection method are define in DIN EN 60352-2. Electrical connection using hand crimp tool or crimp machines which fulfill the specified mechanical, electrical and climatic requirements.***

iii) ***The test of a good crimp connection is the wire pull out force. This force is specification is DIN EN 60352-2 for standard wire with cross selection up to 10 Sqmm. This specified pull to force for the crimp contact are maintained when HARTING crimping tools are used in a proper fashion. The wire pull-out forces are listed in the following table 5.2. VDE 0220 is valid for crimp connections of conductors with wire cross section above 10 sqmm.***

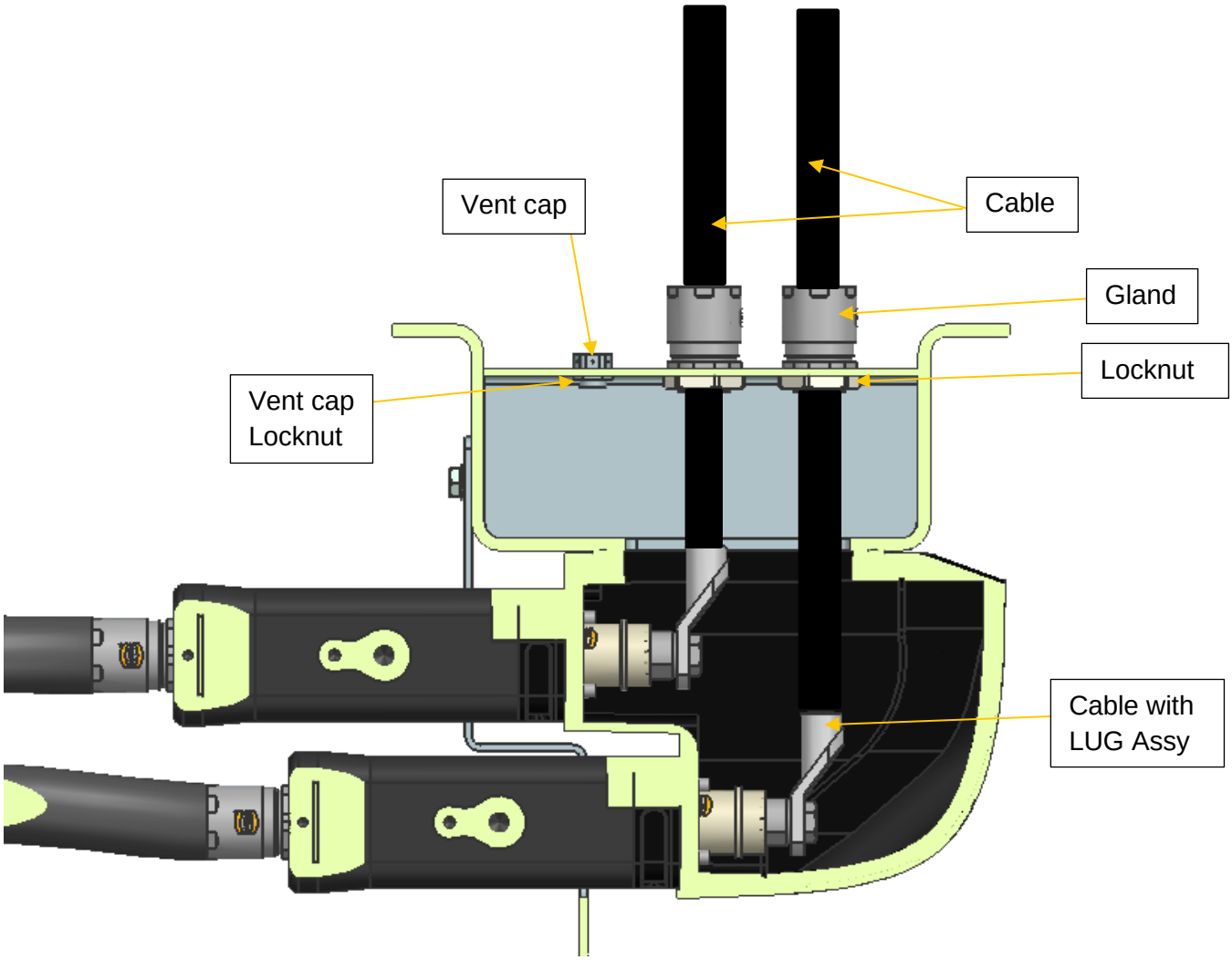
Pull-out forces for crimp connections in accordance with DIN IEC 60 352-2, A2

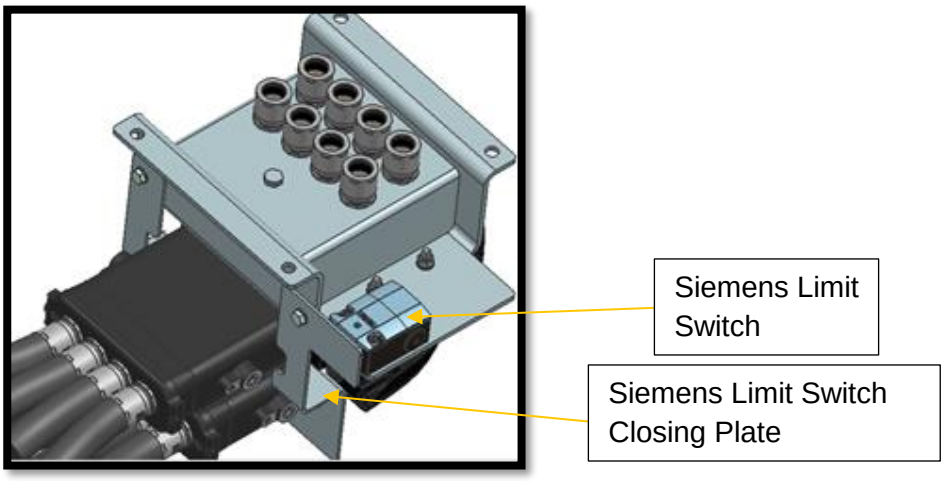
Cross-section / wire gauge mm²	AWG	Pull-out force N	HARTING contacts
0.14	26	18	Han D®, Han E®, D-Sub, DIN 41612
0.22	24	28	Han D®, Han E®, D-Sub, DIN 41612
0.25		32	Han D®, Han E®, D-Sub, DIN 41612
0.32	22	40	Han D®, Han E®, D-Sub, DIN 41612
0.50	20	60	Han D®, Han E®, D-Sub, DIN 41612
0.75		85	Han D®, Han E®, D-Sub, DIN 41612
0.82	18	90	Han D®, Han E®, DIN 41612
1.00		108	Han D®, Han E®, DIN 41612
1.30	16	135	Han D®, Han E®, DIN 41612, Han® C
1.50		150	Han D®, Han E®, DIN 41612, Han® C
2.10	14	200	Han D®, Han E®, Han® C
2.50		230	Han D®, Han E®, Han® C
3.30	12	275	Han E®, Han® C
4.00		310	Han E®, Han® C
6.00	10	360	Han® C
10.00	8	380	Han® C

Table 5.2

6. UNDERFLOOR POWER COUPLER BOX AND SOCKET ASSEMBLY

6.1 UNDERFLOOR POWER SOCKET BOX ASSEMBLY





6.2 HAN® 24 HPR VARIOSHELL ASSEMBLY - UNDERFLOOR POWER COUPLER

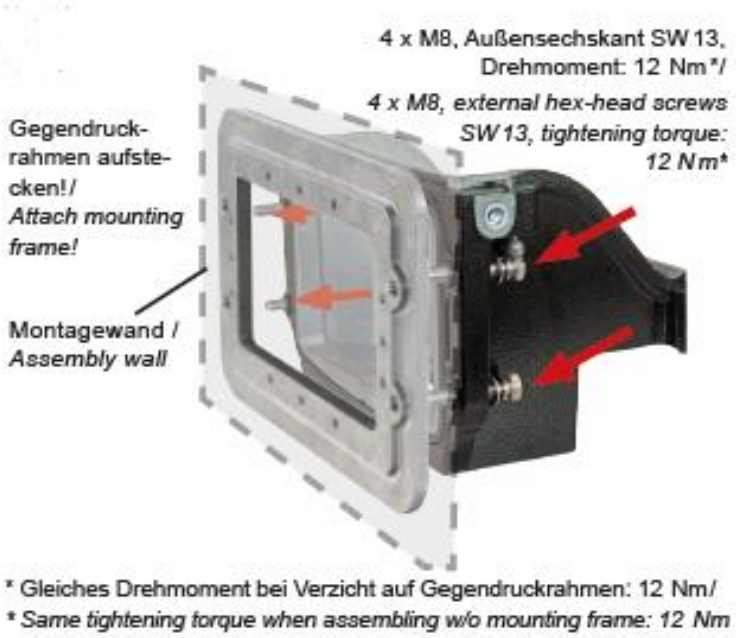
INSTALLATION PROCEDURES:

WARNING! ***Inside the connector are components and conductors which can store perilous high voltage. Inappropriate use may result in an electric shock, serious burns or death. Switch off the connector before working on it! Secure the connectors – Han® inserts or Han-Modular® modules – against unintentional restart!***

- ***In accordance with EN 50 110-1 /-2 (VDE 0105 Part 100), only qualified personnel are allowed to carry out transport, installation, commissioning and maintenance tasks. Guidelines contained in IEC 60 364 and HD 384 (DIN VDE 0100) as well as relevant national regulations must be observed.***
- ***No changes to the installation may be made while the unit is in operation.***
- ***Only work with the connecting terminals at zero voltage.***

i) HAN® 24 HPR VARIOSHELL - Scope of delivery.

**** Screw set with spring washer, washer, and rubber seal.***

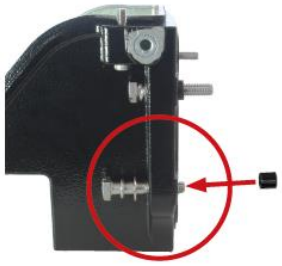


ii) HAN® 24 HPR VARIOSHELL - Product check

**** Pre-assembled cover fixing hexagon socket screws SW 5***

**** Check circumferential profile seal for proper positioning and damage***

iii) HAN® 24 HPR VARIOSHELL – Assembly



- ***Push screw from the front into the through hole, fix rubber seal from the wall side and Push rubber seal properly into the through hole.***
- ***Now HAN® 24 HPR VARIOSHELL ready for Wall mounting or Box mounting.***
- ***After box mounting refer the housings assembly for 350A female connector assembly.***

iv) HOUSINGS ASSEMBLY WITH (350A FEMALE CONNECTOR) HAN® 24 HPR VARIOSHELL ASSEMBLY.

- ***350A female connector Housing assembly with Varioshell Assembly.***
- ***Refer the assembly of 350A connector frame with female module assembly details.***

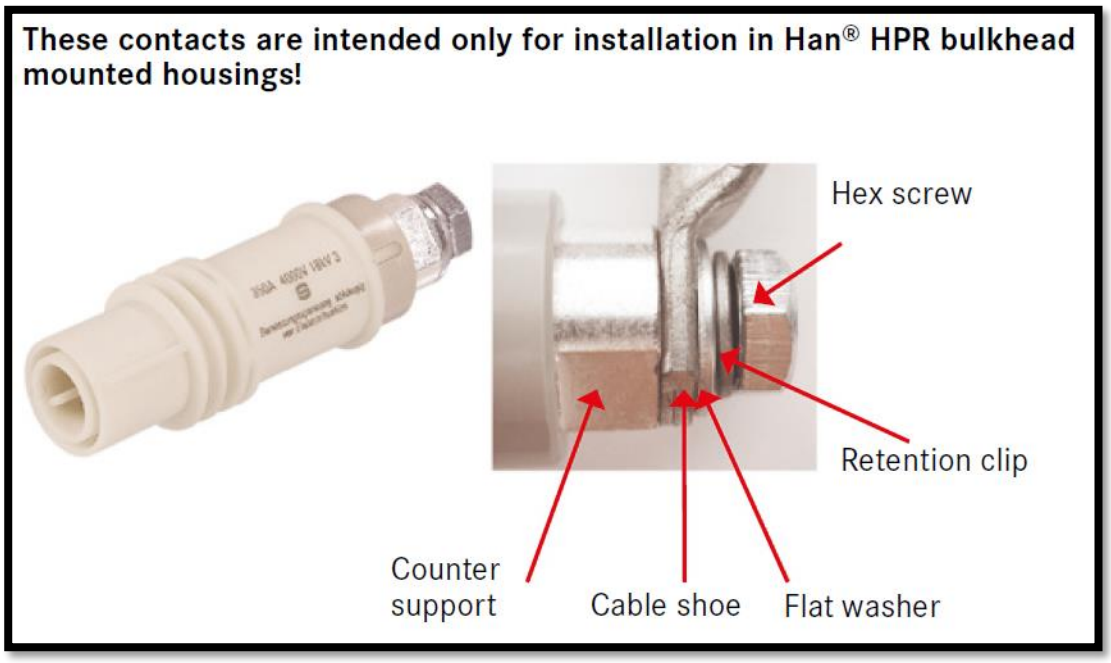
6.3 350A CONNECTOR FRAME WITH FEMALE MODULE ASSEMBLY.

1. In accordance with EN 50 110-1 /-2 (VDE 0105 Part 100), qualified personnel only are allowed to carry out transport, installation, commissioning, and maintenance tasks. Guidelines contained in IEC 60 364 and HD 384 (DIN VDE 0100) as well as relevant national regulations must be observed.

2. No changes to the installation may be while the unit is in operation and refer the below "STEP" for connector assembly procedure.

STEP 1:

Refer the below assembly details for socket female module assembly using with cable lug connection.

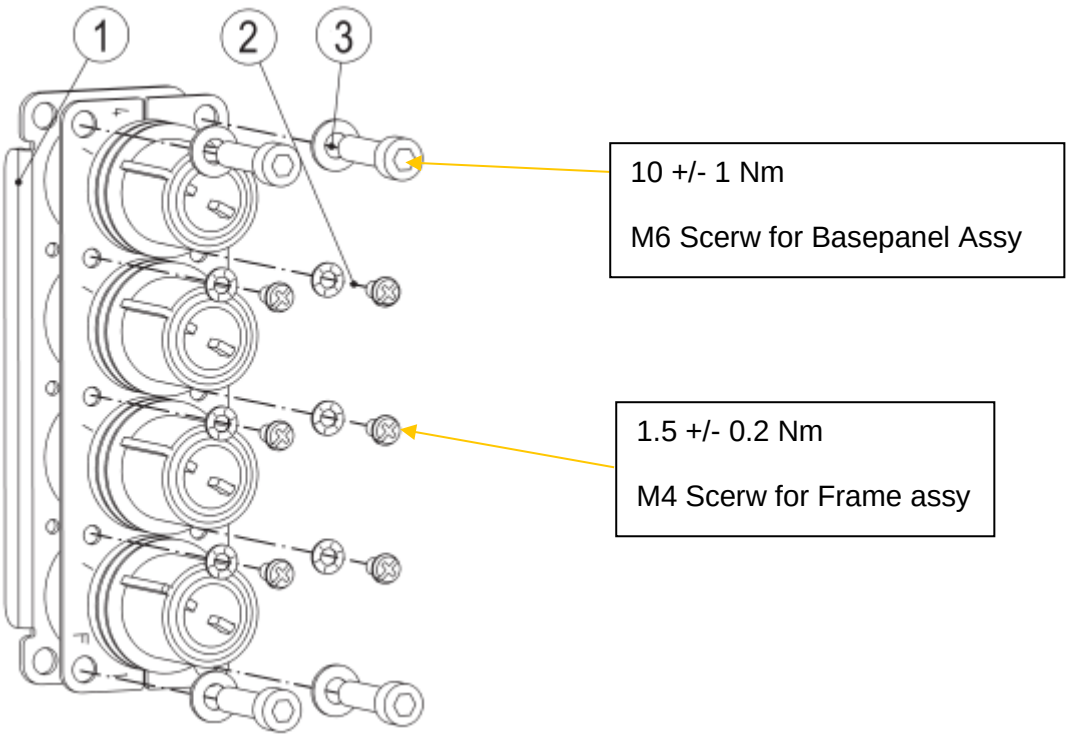


On above connection side, they consist of a flat washer a retention clip and a hex screw (M10). During installation of the cable lug or shoe, be sure the components that are placed over the hex screw are placed on in the proper order, first cable Lug or Shoe assembly after Flat washer and retention clip with M10 screw and must also apply counter pressure to the counter support of the contact using a spanner wrench (Han HC modular 350A). This will stop the spread of the torque. If you do not take this step, the insert can be damage and the interface may malfunction.

The recommended torque is 14 Nm for the Han HC modular 350A.

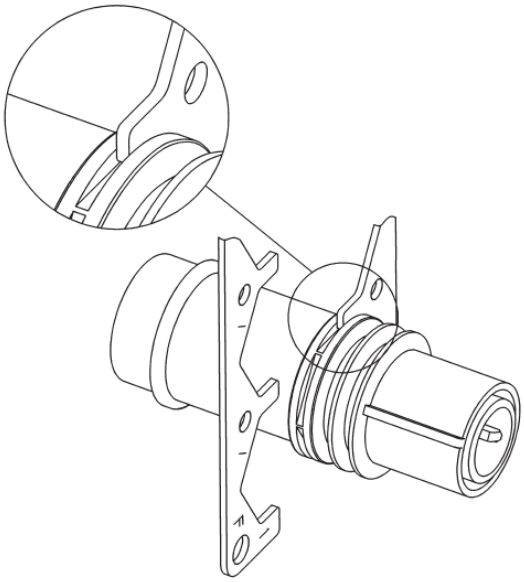
STEP 2:

Assemble the inserts into the frame. Note the indicated tightening torques!



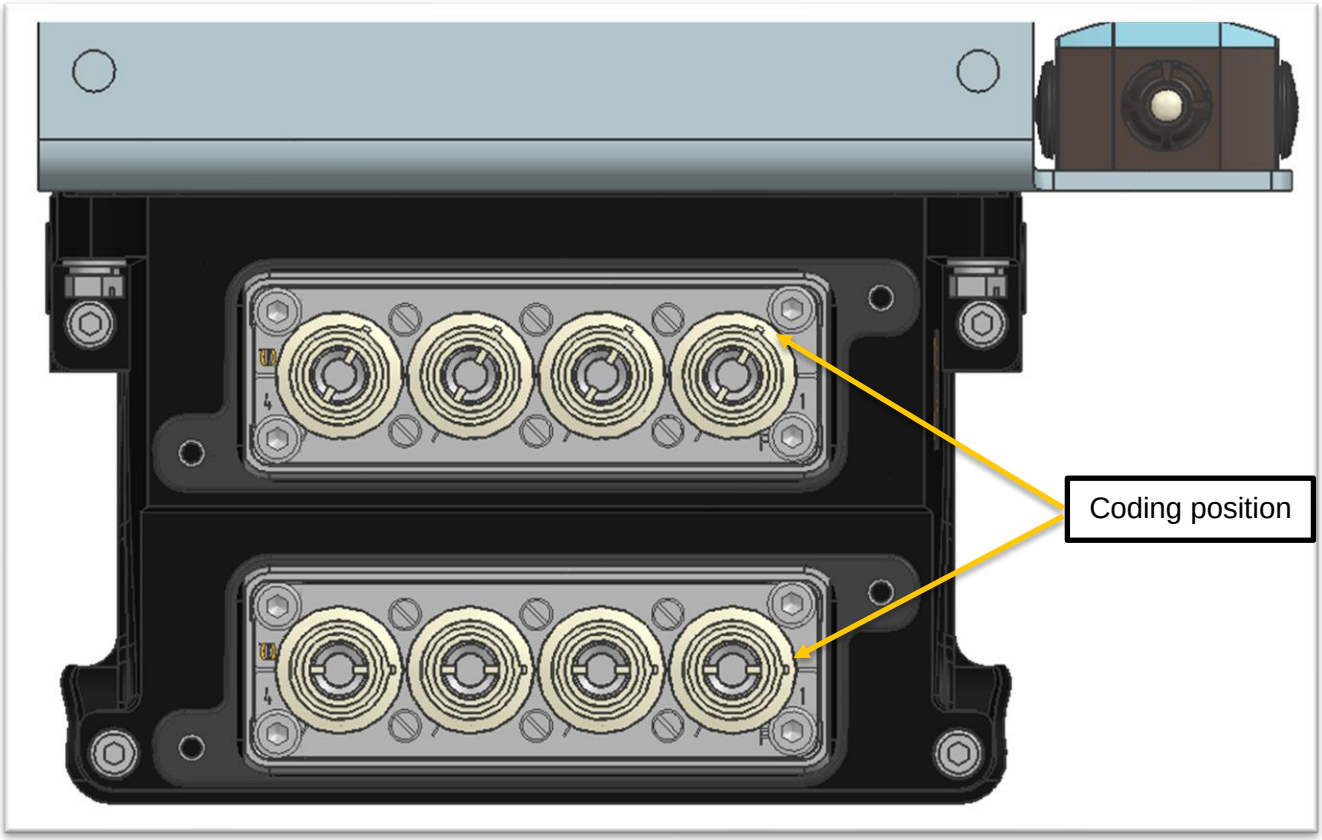
STEP 3:

The inserts are correct mounted in the frame.

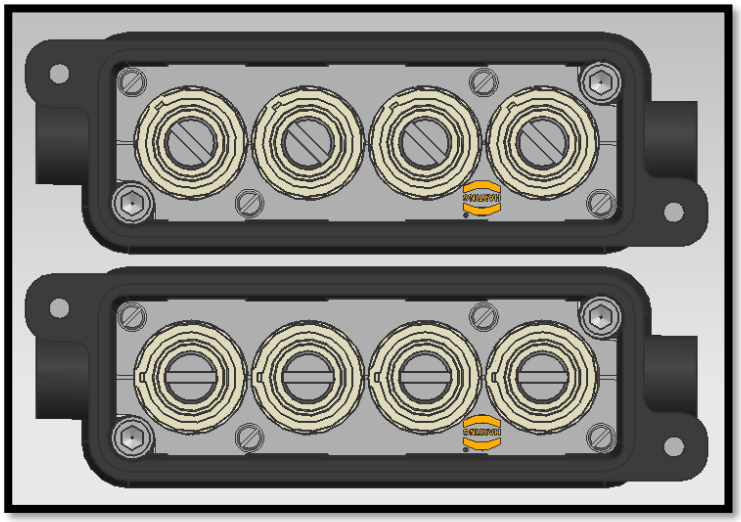


STEP 4:

<u>Bio Tank Side - Connector Coding Pin Assembly</u>

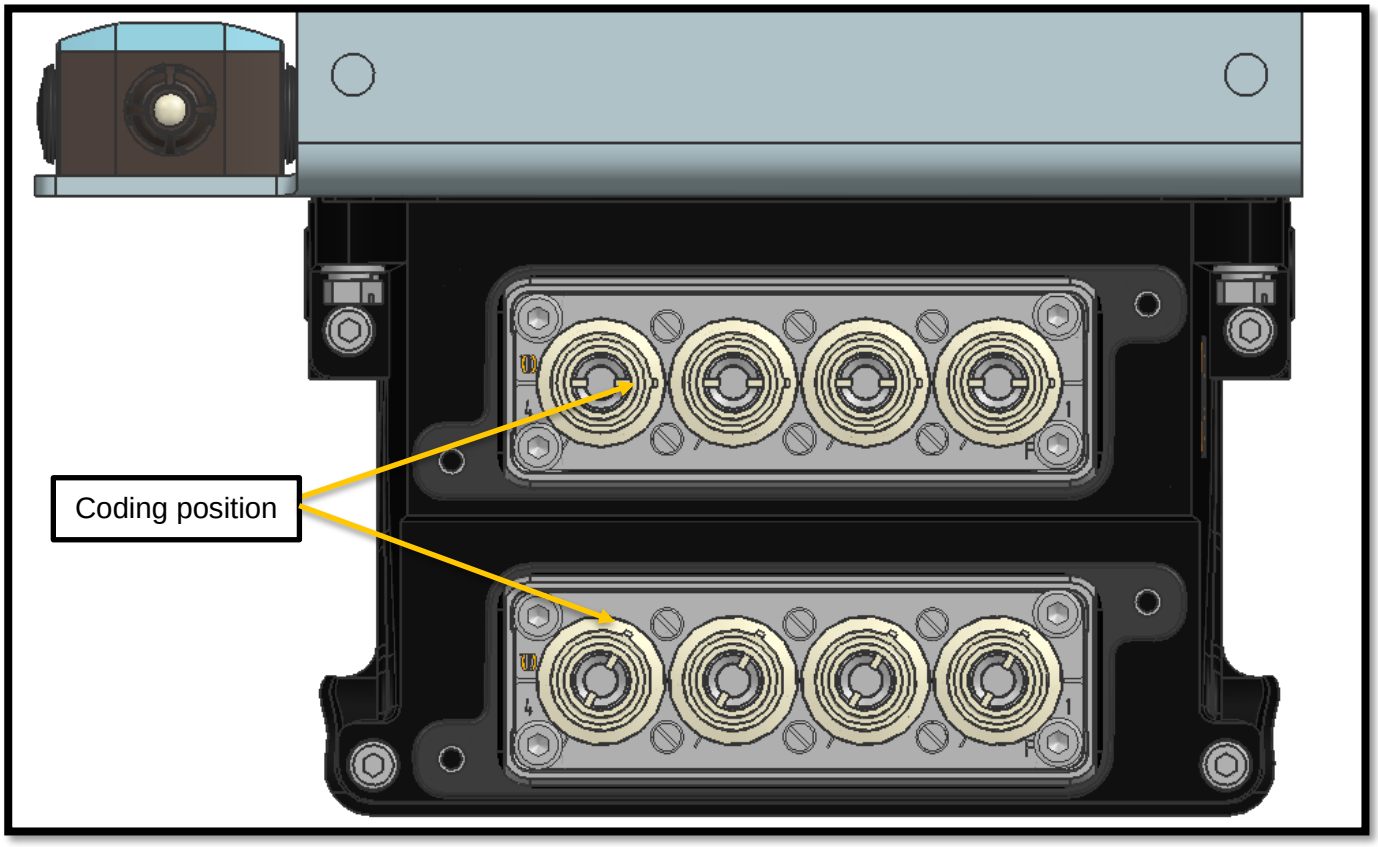


Refer the below jumper coding pin assembly for Socket connection.

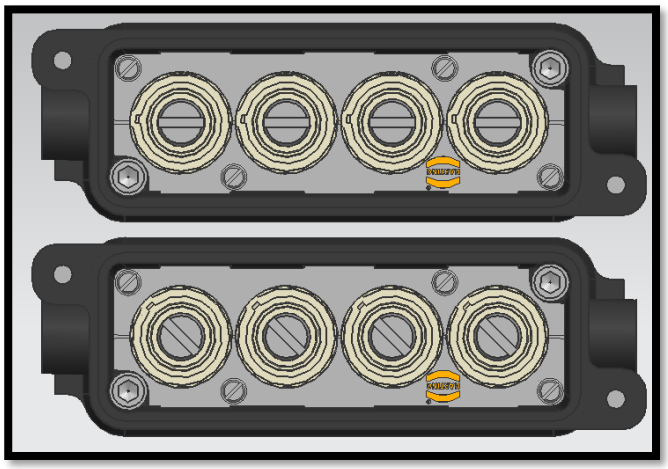


STEP 5:

<u>Non-Bio Tank Side - Connector Coding Pin Assembly</u>

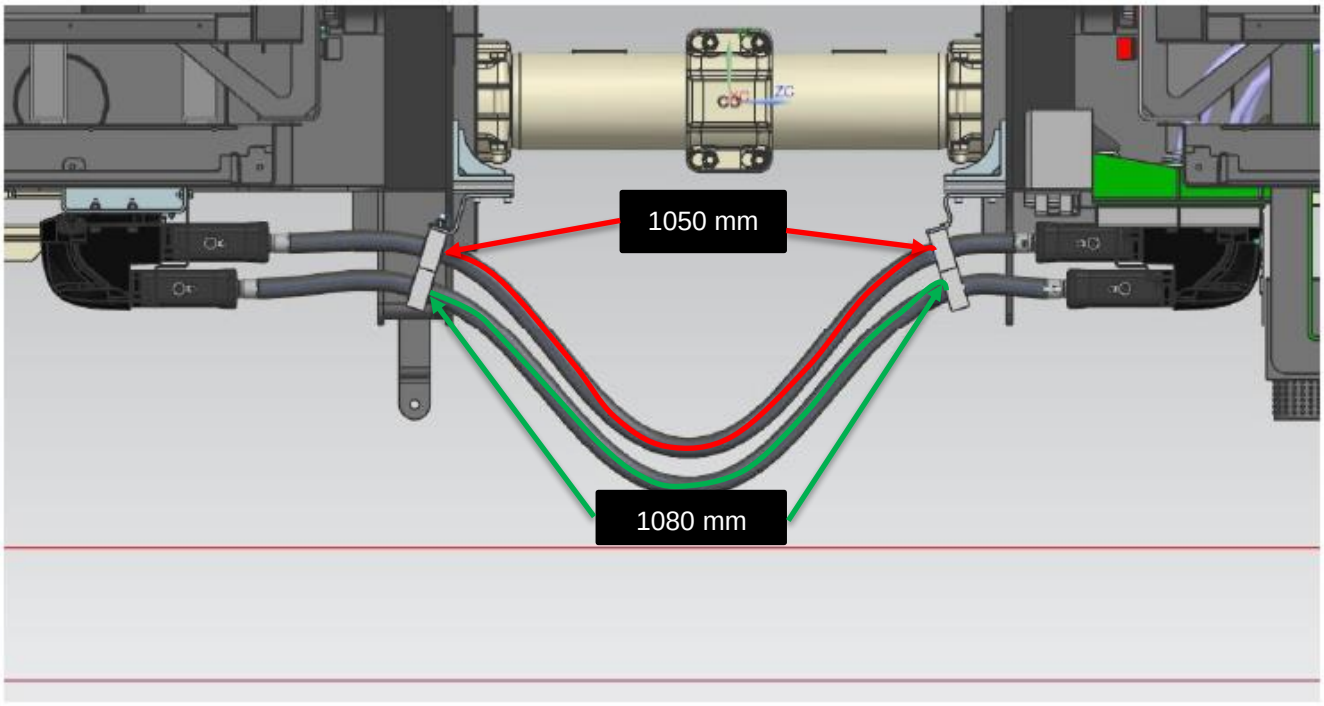


Refer the below jumper coding pin assembly for Socket connection.



STEP 6:

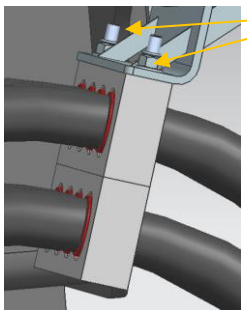
After Jumper Assembly or after re-work in the jumper, Check the Power Jumper cable length between the conduit holding adapter. Refer the below image for length details.



Description Han® HC Modular 350

Han® HC Modular 350 in crimp termination technology for the railroad industry. The high-current connector Han® HC Modular 350 impresses with its small footprint, flexible configuration options and reliable transmission of high currents for applications in the railroad sector. The one-piece crimp contact Han® HC Modular 350 can be assembled in different frame geometries as required in the Han® HPR housing. Reliable, easy to assemble.

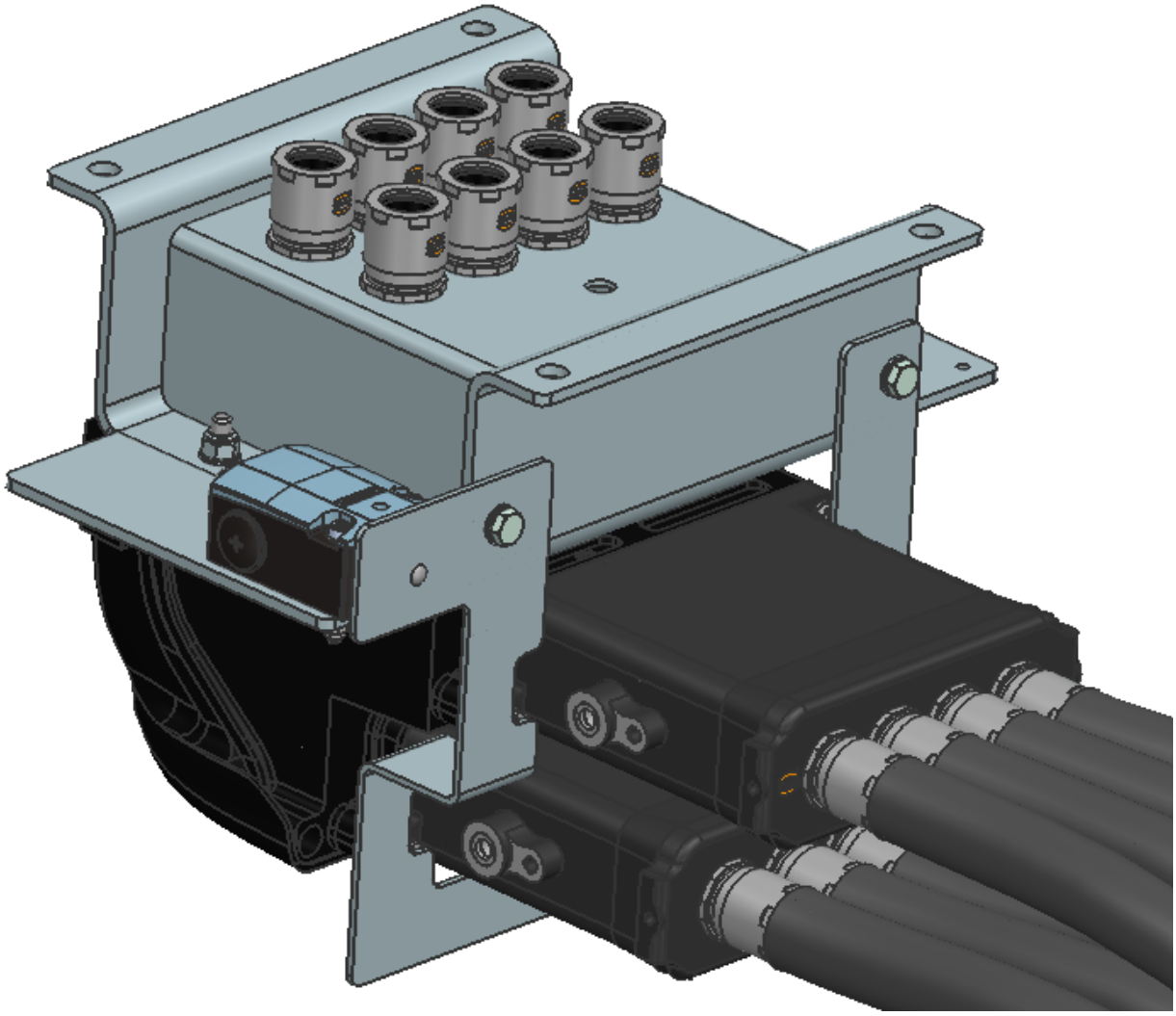
Conduit Adapter assembly torque details:



M8 x160mm length scerw assembly torque is 10Nm

6.4 AFTER JUMPER ASSEMBLY VIEW WITH SOCKET BOX ASSEMBLY

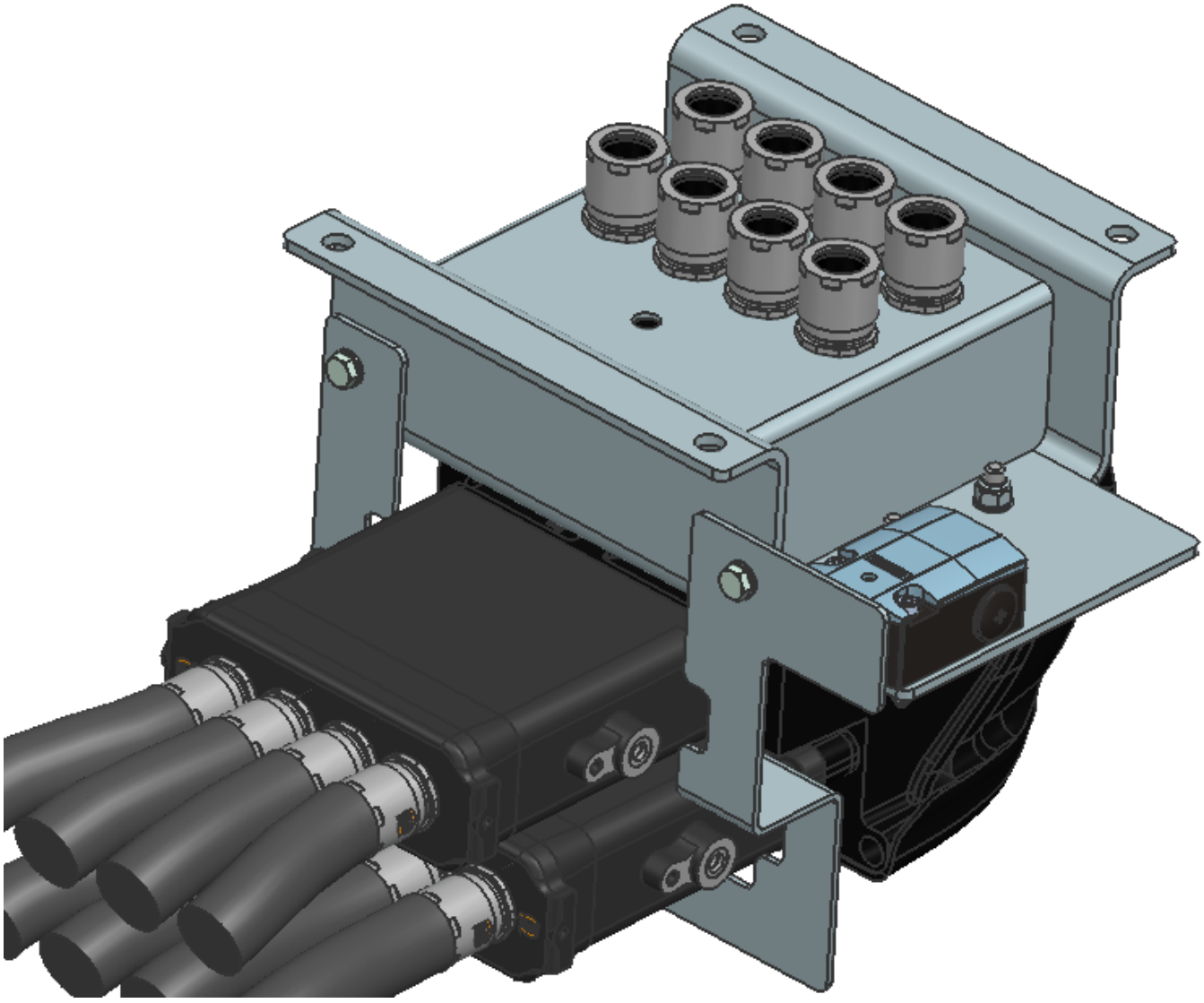
1. NON-BIO TANK SIDE ASSEMBLY



Gland Torque Details:

1. ***The recommended torque is 20 Nm for the cable gland assembly.***

2. BIO TANK SIDE ASSEMBLY



Gland Torque Details:

1. ***The recommended torque is 20 Nm for the cable gland assembly.***

6.5 Power Coupler Installation procedure:

Step 1:

Cut the cables after finalizing the length between the plate and varioshell Lug Fixing position.

Insert the required ferrule as per the drawing

Make sure there is no crosscut at the end

Step 2:

Strip the cable as per the required length for Crimping the Lugs.

Make sure the stripping are fully covers the Lug crimping area.

Tinned copper strands should be fully inserted and visible through the inspection hole.

Step 3:

Crimping should be in the middle of Crimping area.

Make sure the Pull-out force achieved after crimping.

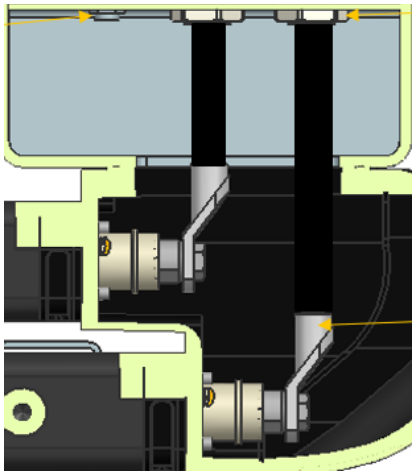
There should be no catier formed in lug after crimping

Step 4:

The lugs must be tightened to the connector as per the Wiring chart and 14 Nm must be maintained.

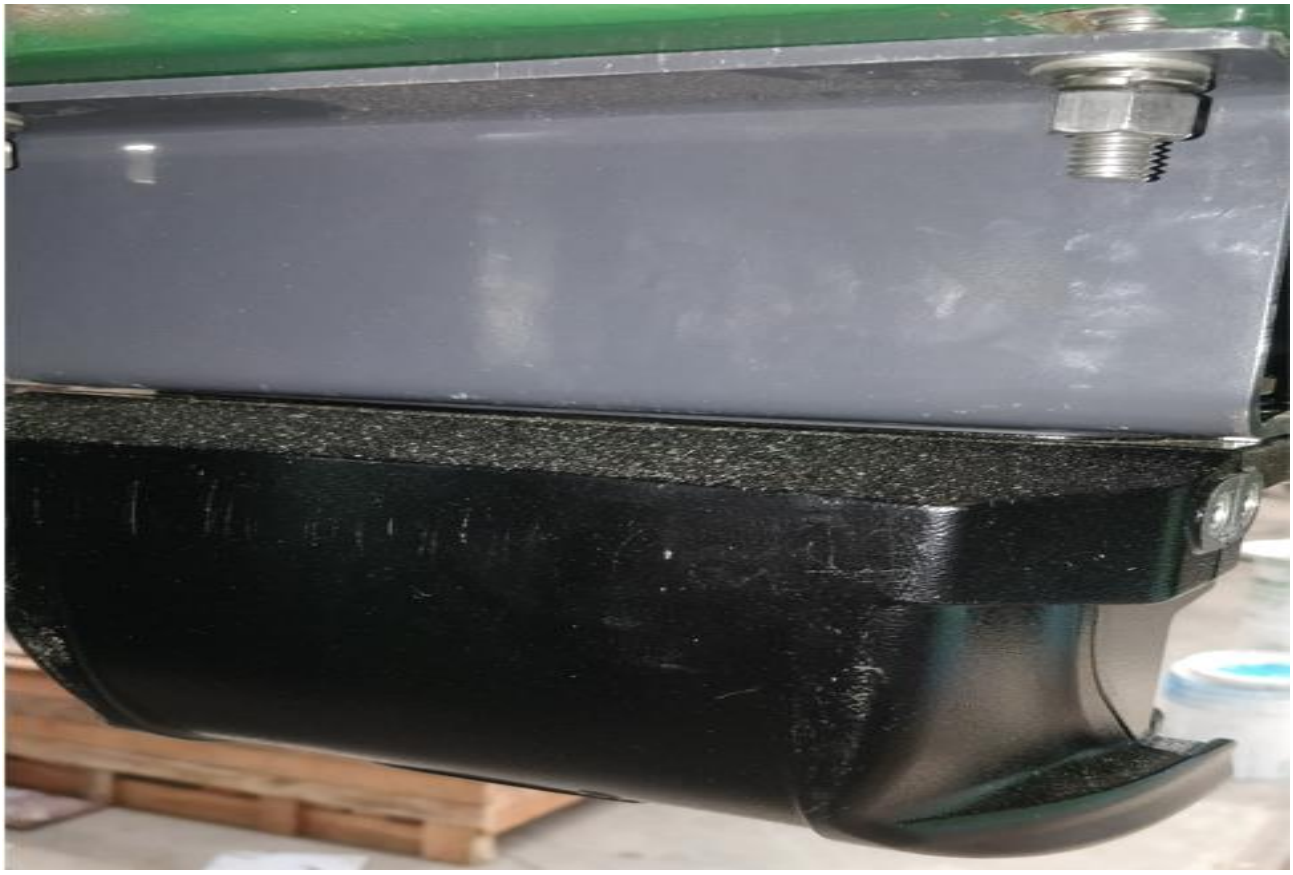
First Assemble the first module (Upper part) then go to the other connector.

After fixings the Lugs the cap should be inserted in order to isolate each lug to avoid short circuit between the Lugs.



Step 5:

Close the cover in the Varioshell after fixing all the assembly

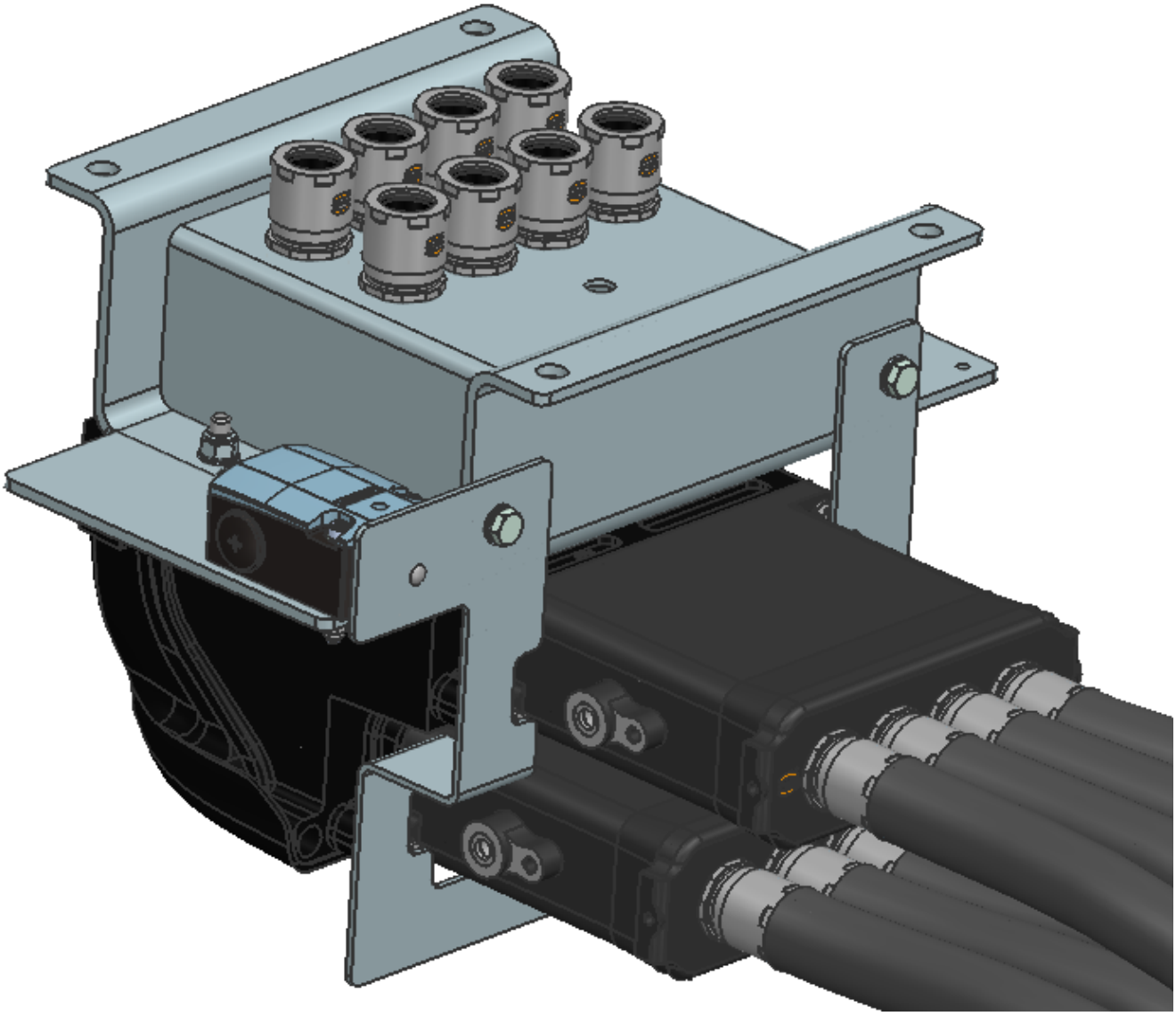


Step 6:

Tighten the gland in the plate after finishing all the assembly procedure in Varioshell. Gland should be tightened in-order to comply the IP requirement, after tightened the gland assembly only mounting box to assemble at train side with M12 bolt (Torque – 73Nm).

Step 7:

Siemens Limit switch should be mounted and fixed with respective hardware's and tightened with torque (M5x50mm length screw torque is 5.5Nm). Front cover plate should be fixed after fixing the Siemens switch and after Mating of Jumpers in Socket coupler.



OPERATION & MAINTENANCE MANUAL

संचालन एवम् रखरखाव मॅन्युअल

OF

EMERGENCY LIGHTING UNIT

FOR

RAILWAY COACHES

इमरजेन्सी लाईट युनिट रेल्वे कोचेस के लिए

As per
RDSO Spec.
RDSO / PE/SPEC/AC/0180-2016 (Rev. 0)
Dated 16/04/16

Our Model No. : PELU1110 R & PELU1110RL
& drg. No. RDSO / PE /SK/TL/0180 (Rev "0")
& RDSO /PE/SK/TL/0181 (Rev "0")
Issue No. : 00 Rev. No. : 00
Issued Date : 24/02/2018

आर.डी. एस. ओ. / पी.ई./ एस.पी.ई.सी/ए.सी/०१८०-२०१६ (रिव्ह-०)
तारीख : १६/४/२०१६

मॉडेल नं. PELU1110 R & PELU1110RL
और ड्रॉईंग नं. RDSO / PE /SK/TL/0180 (Rev "0")
& RDSO /PE/SK/TL/0181 (Rev "0")
इश्यू नं.: 00 Rev. No. : 00
इश्यु ता. : 24/02/2018

इंट्रा इंडस्ट्रीज प्रा. लि.
गट नं.३११/०२, प्लॉट नं. ७,
पोस्ट:- कासार अंबोली, ता. मुळशी
जि. पुणे-४१२११५
फोन : ०२० -२५४६७७९२

Issued by
INTRA INDUSTRIES PVT. LTD.
Office & Factory : Gat No. 311/02,
Plot No. 07, A/P: Kasar Amboli,
Tal : Mulshi, Dist.: Pune-412115
Phone : 020-25467792

1.0 Scope :

Emergency Lighting Unit is designed as per RDSO specification No. RDSO / PE/SPEC/AC/ 0180-2016 (Rev. 0) to operate automatically in case normal supply system of the coach fails, or falls below 80V (for 110V system) to give light to passengers.

१.० स्कोप :

इमरजेन्सी लाईट युनिट आरडीएसओ. स्पेक : आरडीएसओ/पीई/एसपीईसी/एसी/०१८०-२०१६ (रिव्ह ०) के हिसाबसे डिझाईन किया गया है । यह स्वयंचलीत है और कोच का नॉरमल सप्लाय फेल होने के बाद, या ८० व्हो. के निचे (११० व्होल्ट सिस्टम के लिए) यात्रियोंको लाईट देता है ।

2.0 Main Parts of Emergency Lighting Unit (ELU)

२. ० इमरजेन्सी लाईट युनिट के मुख्य भाग

1) Electronic PCB - Charger + Protections - 1 No.

१) इलेट्रॉनिक पीसीबी– चार्जर + प्रोटेक्शन –१ नं

2) LED Clusters PCB's - 3 Nos.

२) एलइडी क्लस्टरर्स पीसीबी – ३ नं.

(3) Battery - SMF type - 12 V, 7AH - 1 No.

३) बॅटरी एसएमएफ टाईप – १२ व्होल्ट , ७ एएच–१ नं.

4) Deep drawn - Type Enclosure - 1 No.

४) डीप ड्रॉन – इनक्लोजर – १नं.

5) Input terminal 2 way Wago - 1 No.

५) इनपुट टर्मिनल २ वे वॅगो – १ नं.

6) Battery bye-pass lock type connector - 1 No.

६) बॅटरी बाय–पास लॉक कनेक्टर १ नं

3.0 Principle of Operation

The schematic diagram of ELU is enclosed. High frequency - SMPS Type Mosfet based charger is used. The charger is suitable to operate on 110 VDC Voltage range 85 to 143V. Below 80 V DC LED's cluster will turn 'ON' automatically. After battery voltage goes below 10.5 V, the LED cluster will turn 'OFF', for deep discharge protection. After battery voltage goes below 9 V all indication LED's will turn off. When 110 V supply comes then battery will charge automatically. The circuit has overcharge protection which monitors & charges the battery constantly. The ELU will give light after input failure for minimum 12 hours continuously.

३.० ऑपरेशन के सिध्दांत

इएलयुका स्कीमॅटीक डायग्राम संलग्न किया है । हाय फ्रिकव्हेन्सी एसएमपीएस टाईप मॉस्फेट बेस्ड चार्जर इस्तमाल किया है। यह चार्जर ११० व्होट्स डि सी पर चलता है । रेंज ८५-१४३ वो । ८० व डिसी के निचे एलइडी क्लस्टर स्वयंचलीत चालू होते है । बॅटरी व्होल्टेज १०.५ वो के निचे आने के बाद एलइडी क्लस्टर

डीप डिस्चार्ज प्रोटेक्शन के लिए बंद हो जाते है। बॅटरी व्होल्टेज ९ वो. के निचे आने के बाद सारे इंडिकेशन्स बंद हो जाते है । ११० वो सप्लाय आने के बाद बॅटरी स्वयंचलीत चार्ज होती है । इस सर्किट मे ओव्हरचार्ज प्रोटेक्शन है. जो लगातार बॅटरी मॉनिटर और चार्ज करता है। यह इएलयू इनपुट फेल के बाद लगातार कम से कम १२ घंटे लाईट देता है ।

4.0 Technical Specifications :

४.० तकनिकी स्पेसिफिकेशन

I) Input voltage : a) 85 to 145VDC, Nominal Voltage 110 VDC.

1) इनपुट व्होल्टेज : ८५ - १४५ वो डिसी, नॉमिनल व्होल्टेज ११० वो. डिसी

ii) Output voltage : 14.4 VDC for charger in boost mode & 13.5 in trickle mode.

२) आऊटपुट व्होल्टेज : १४.४ वो डिसी चार्जर बुस्ट मोडमे, १३.५ ट्रिकल मोडमे

iii) Connected Load : 3 nos. of LED PCB's on battery

३) कनेक्टेड लोड : ३ नं एलइडी पीसीबी बॅटरी पर

iv) Enclosure : Deep drawn

४) एनक्लोजर : डिप ड्रॉन

5.0 Protections

५.० प्रोटेक्शन्स

a) Input over voltage auto re-setable

ए) इनपुट ओव्हर होल्टेज ऑटो रिसेटेबल

b) Input reverse polarity

बी) इनपुट रिव्हर्स पोलॅरिटी

c) Output short circuit

सी) आऊटपुट शॉर्ट सर्किट

d) Input fuse

डी) इनपुट फ्यूज

e) 200 V for 1 min

इ) २०० वो १ मिनिट

f) 12 V Battery reverse polarity

एफ) १२ वो बॅटरी रिव्हर्स पोलॅरिटी

g) Battery overcharge

जी) बॅटरी ओव्हरचार्ज

h) Battery deep discharge protection

एच) बॅटरी डीप डिस्चार्ज प्रोटेक्शन

I) High Voltage

आय) हाय व्होल्टेज

(j) Insulation Resistance Protection

जे) इन्सुलेशन रेझिस्टन्स प्रोटेक्शन ।

(k) The LED clusters have fail safe protection so even if 1 No. LED fails

के) एलइडी क्लस्टर्स में फेल सेफ प्रोटेक्शन जिसे यदी एक एलइडी भी फेल हो तो बाकी चलेंगे ।

(l) The Emergency lighting unit withstands all environmental protections like Dust, Vibration etc. as per RDSO specification RDSO / PE/SPEC/ AC/0180-2016 (Rev. 0)

एल) यह इमरजेन्सी लाईट यूनिट सारे एनव्हिरॉनमेंटल प्रोटेक्शन्स को चलता है। उ.धुल, व्हायब्रेशन्स इ, आरडीएसओ. स्पे. आरडीएसओ/पीई/एसपीईसी/एसी/०१८०-२०१६ (रिव्ह ०) के अनुसार ।

6.0 LED Indication ६.० एलईडी इंडिकेशन्स

CONDITION स्थिती	GREEN हरा LED	RED लाल LED	AMBER अंबर LED	LED LIGHT CLUSTERS एलईडी क्लस्टर्स
Unit Battery connection intact 110 V DC applied युनिट बॅटरी कनेक्शन सही 110 वो डिसी अप्लाईड	ON चालू	OFF बंद	OFF बंद	OFF बंद
Unit Battery connection intact 110 V DC not applied युनिट बॅटरी कनेक्शन सही 110 वो डिसी अप्लाईड नही ।	ON चालू	ON चालू	OFF बंद	ON चालू
Unit Battery Discharging at 20% युनिट बॅटरी डिस्चार्ज @20 %	Flashing फ्लॅशिंग	OFF बंद	OFF बंद	OFF बंद
Input DC < 80V इनपुट डिसी < 80 वो	ON चालू	ON चालू	OFF बंद	ON चालू
Input DC > 80V इनपुट डिसी > 80 वो	ON चालू	OFF बंद	OFF बंद	OFF बंद
Unit Battery unhealthy युनिट बॅटरी अनहेल्दी	—	Flashing फ्लॅशिंग	OFF बंद	OFF बंद
Battery Voltage < 10.5V बॅटरी व्होल्टेज < 10.5 वो	OFF बंद	OFF बंद	Flashing फ्लॅशिंग	OFF बंद
Battery Voltage > 10.5V बॅटरी व्होल्टेज > 10.5 वो	ON चालू	ON चालू	—	ON चालू
Microprocessor Failure मायक्रोप्रोसेसर फेल्यूअर	—	—	ON चालू	—
Charging Circuit Failure चार्जिंग सर्किट फेल्यूअर	ON चालू	ON चालू	OFF बंद	OFF बंद

Essential Component List :
महत्वपुर्ण भाग यादी :

No.	Item आयटम	Rating रेटिंग	Make मेक
1.	Populated Electronic PCB पॉप्यूलेटेड इलेक्ट्रॉनिक पीसीबी	- - -	Intra Industries Pvt. Ltd. इंट्रा इंडस्ट्रीज प्रा. लि.
2.	3Amp Glass Fuse (Fast Blow) 3 एम्प ग्लास फ्यूज (जलद ब्लो)	- 3A - -3 ए-	EI or equivalent EI या समान
3.	Green LED - 5 mm हरा LED - 5 एमएम Red LED - 5 mm लाल LED - 5 एमएम Amber LED - 5 mm अंबर LED - 5 एमएम	- - -	Nichia or as per Specification निचिया या स्पेसि. के तरह
4.	Input Connector - 2 way इनपुट कनेक्टर - 2 वे	- - -	Wago (261 -102) Blue for 110 V DC वॅगो (261 -102) निला 110 वो डिसी के लिए
5.	Battery By-Pass power Lock Connector बॅटरी बायपास पॉवर लॉक कनेक्टर	- - -	Molex मोलेक्स
6.	Battery SMF type बॅटरी एसएमएफ टाईप	12V, 7AH 12 वो, 7,एएच	Exide or as per RDSO specification एक्साईड या आरडीएसओ स्पेक से
7.	LED cluster 3Nos. with drivers एलईडी क्लस्टर 3 नं. ड्रायव्हर सहित	High intensity LED's हाय इंन्टेसिटी एलईडीज्	Intra Industries Pvt. Ltd. with Nichia / Osaram LED's or RDSO approved makes इंट्रा इंडस्ट्रीज प्रा. लि. निचिया / ओसराम एलईडीज् संग या आरडीएसओ मान्य मेक्स

Operating Instructions :

इस्तमाल की सुचना :

1) First open the top cover with 'key' & connect battery connector (power lock) provided inside to switch on ELU. If batter polarity is not correct Red LED on PCB will glow, then connect proper polarity. Now it will be ready for installation.

१) पहले मकीफ से टॉप कव्हर को खोले और बॅटरी कनेक्टर (पॉवर लॉक) को जोडे । जो इएलयू के अंदर है । इससे क्लस्टर एलईडी चालू हो जायेगा । यदी बॅटरी पोलॅरीटी सही नही है । तो पीसीबी पर लाल एलईडी जलेगा, सही पोलॅरीटी से कनेक्ट करे। अब ये लगानेके लिए तैयार है ।

2) Now provide input supply 110 V DC as per coach type to wago connectors provided as per wiring diagram given on the ELU.

२) अब इनपुट ११० वो डिसी चालू करे कोच के टाईप से वॅगो कनेक्टर को इएलयू पर बताए वायरिंग डायग्राम के जैसे जोडे ।

3) Always disconnect battery connector when Light is not required, so that battery will not be drained unnecessarily.

३) हमेशा लाईट की जरुरत ना हो तो बॅटरी कनेक्टर को निकाले, इससे बॅटरी बिनावजह से ड्रेन नही होगी ।

4) For better battery life, the battery is automatically discharged by 20% of its capacity between 7.00 AM to 12.00 PM of every 1st & 16th date of month.

४) अच्छी बॅटरी लाईफ के लिए, बॅटरी स्वयंचलीत २०% कपॅसिटी डिस्चार्ज होगी यह सुबह ७ बजे से १२ बजे तक हर १ व १६ तारीख को होगी ।

5) Do not apply 110 V DC on the ELU without connecting its inside power lock connector.

५) ११० वो. डिसी बॅटरी पॉवर लॉक कनेक्टर लगानेके बाद ही जोडे ।

6) If Power lock connector is open & input 110 VDC supply is applied then blinking of all indications is observed. Please connect power lock connector & apply 110 VDC.

६) जब पॉवरलॉक कनेक्टर ओपन रहेगा और ११०वोल्ट डिसी सप्लाय देंगे तब सारे इन्डिकेशन LED's ब्लिंक होंगे । पॉवरलॉक कनेक्टर कनेक्ट करे और ११० वोल्ट डिसी इनपुट सप्लाय अप्लाय करे ।

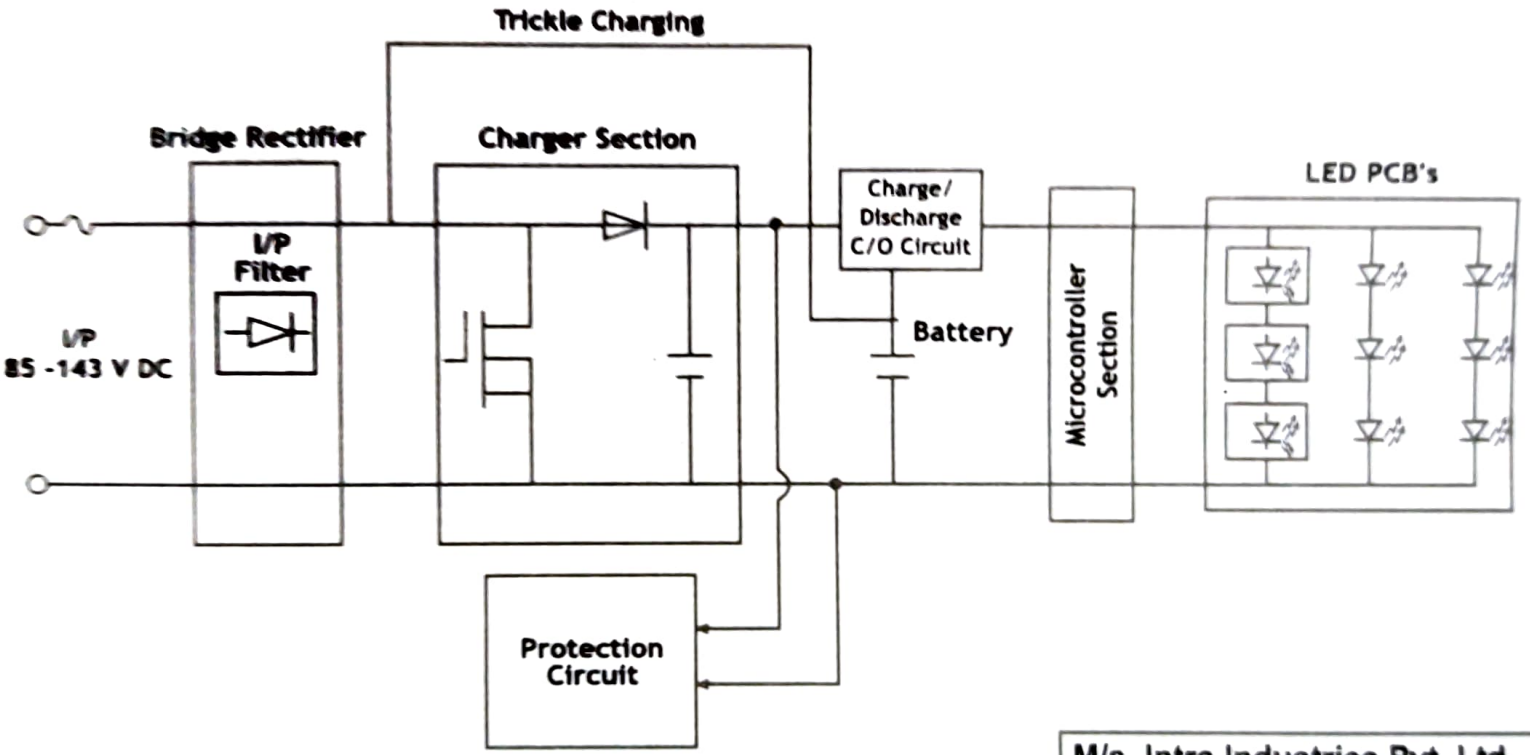
7) Idle storage of ELU should be kept minimum for better battery life.

७) अच्छे बॅटरी लाईफ के लिए बिना इस्तेमाल करे इएलयू कम से कम समय के लिए रखे ।

8) For any major problems & maintenance please contact company.

८) कोई कठीनाईया या देखभाल के लिए कंपनीसे संपर्क करे ।

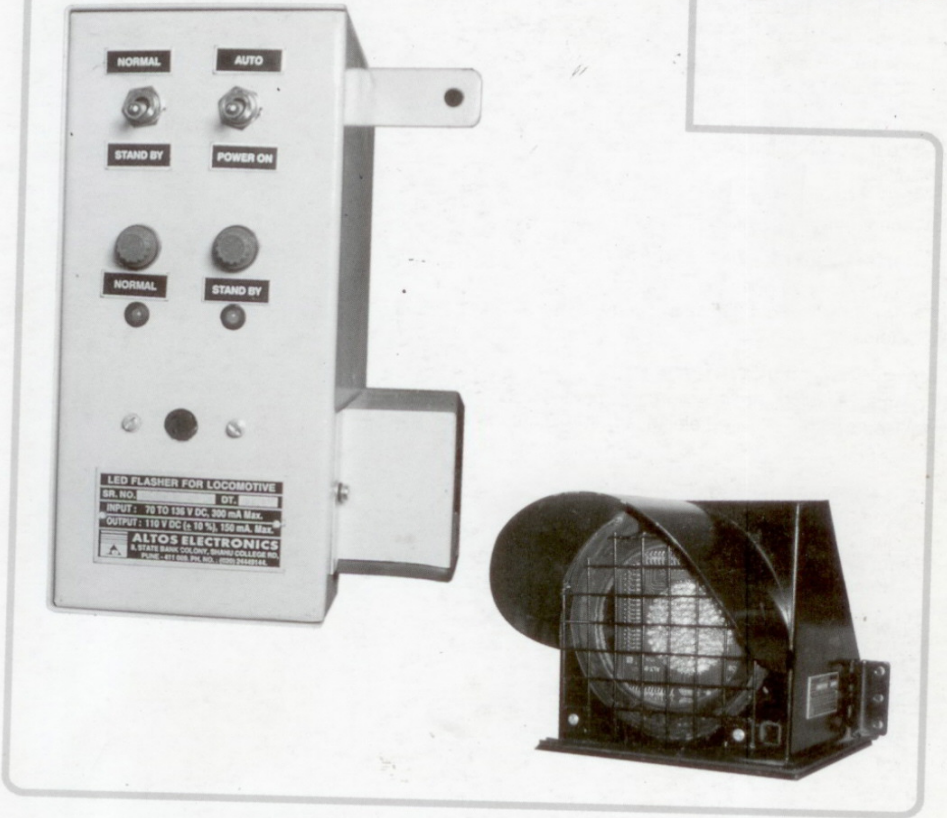
Block Diagram for Emergency Lighting Unit - PELU 1110R & PELU1110 RL



M/s. Intra Industries Pvt. Ltd., Pune	
Title : Block Diagram of ELU	
Date 08/11/2016	Rev:-00
Drawn by	

ISO 9001: 2000 Company

ALTOS
ELECTRONICS



Operation and maintenance manual for LED based Flasher Light system for EMUs DMUs as Per RDSO specification

No. ELRS/SPEC/LFL/0017(Rev.1, Sep.2004)

GUIDE LINE FOR TROUBLE SHOOTING

LAMP UNIT

1) If voltage at i/p side is 110V+/-5% DC but Lamp is not glowing Check the fuse link & connection to lamp card there on .If fuse link is burnt out, replace the fuse link with proper size and proper rating.(500mA, 5mmx20mm)

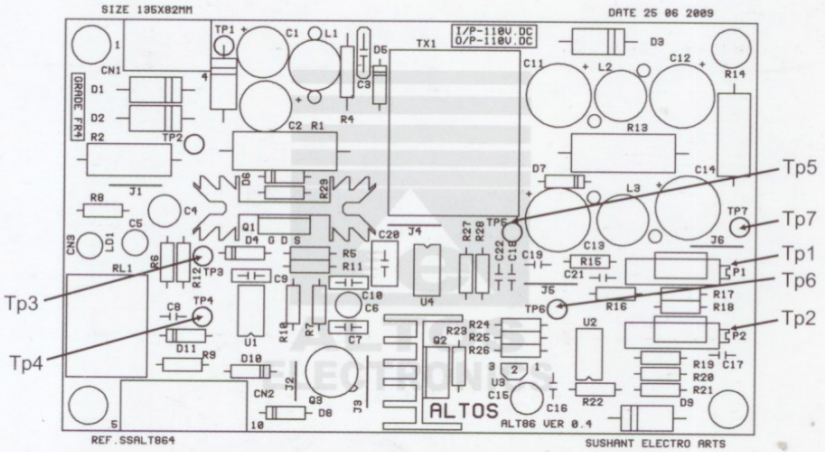
CONTROL UNIT

1) If controller is dead see the fuse link. If fuse link is burnt out , replace it with 1A.

2) If lamp is glowing but if there is no buzzer sound and status indication i.e. red led is not flashing, then check Lamp Unit is connected & all LEDs are glowing.
If the problem persists, then rotate the preset p2 in clockwise direction till buzzer sound. If still there is no buzzer sound, rotate preset p1 in clockwise direction till buzzer sound and status indication glow's .

3) If status indication is glowing but if there is no buzzer sound, buzzer is faulty replace it by new one.

4) For troubleshooting at card level refer table.

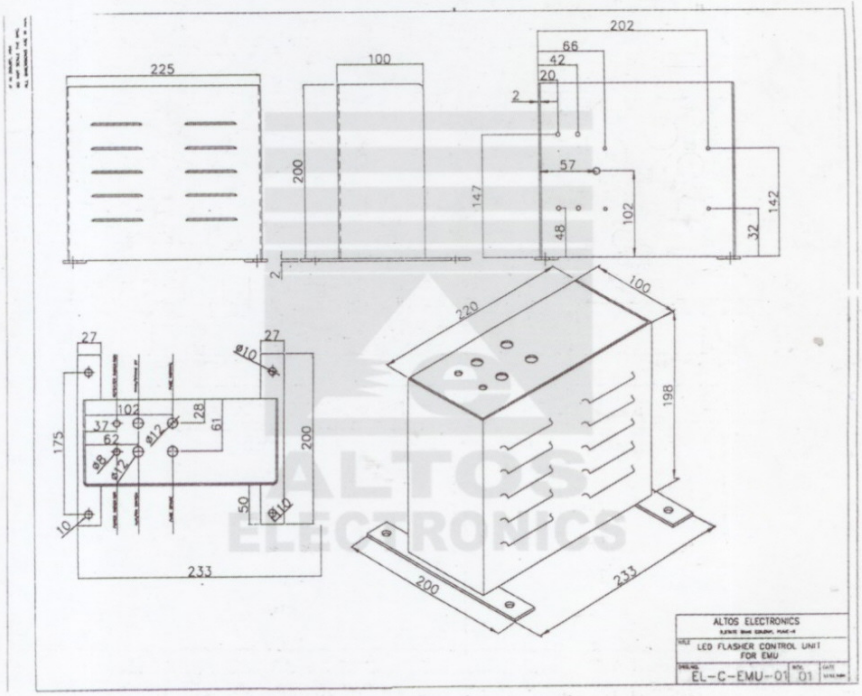


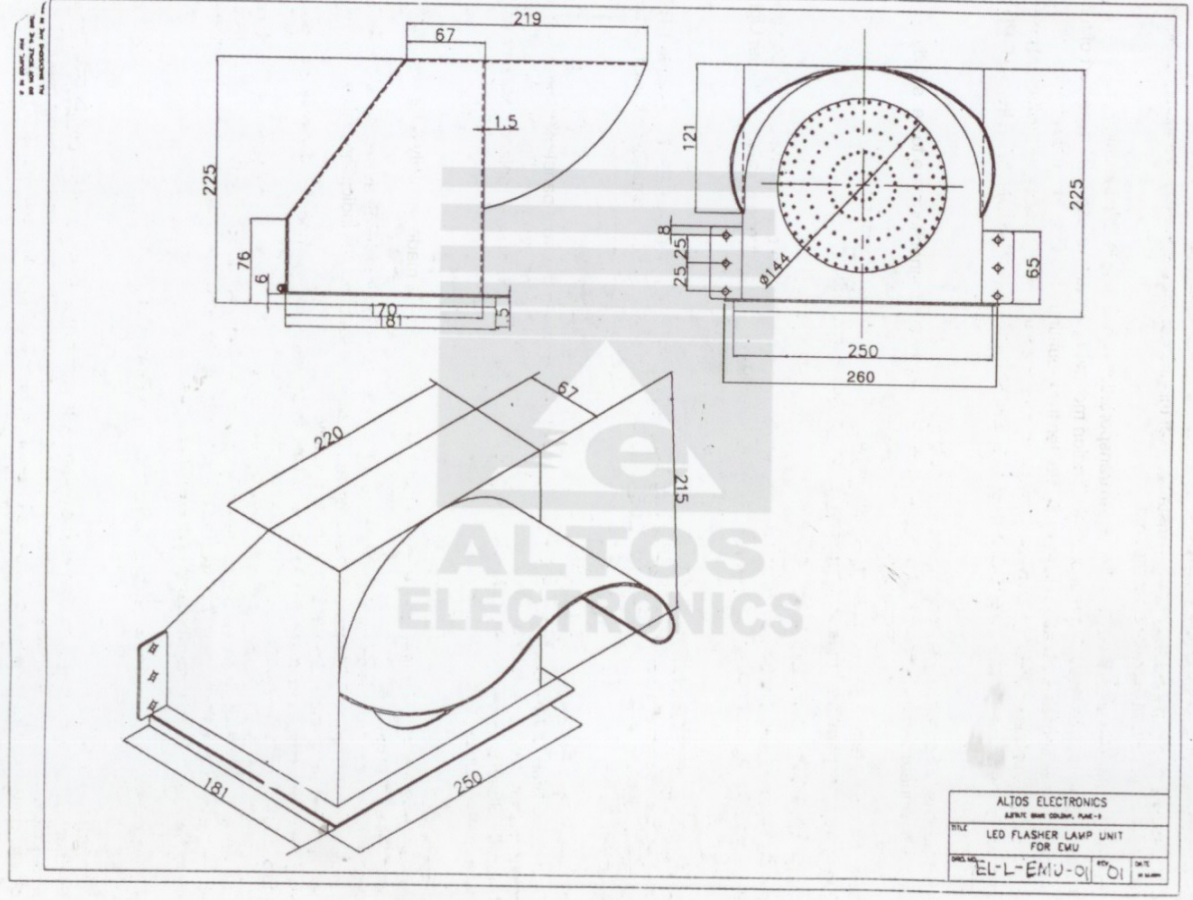
TEST POINTS	RESPECTIVE VOLTAGES
TP1	110V+VE
TP2	110V-VE
TP3	12V-16V
TP4	5V
TP5	2.5V
TP6	12V
TP7	110V

Note: TP1, TP3, TP4, TP5, TP6, TP7 all voltages are w.r.t. TP2

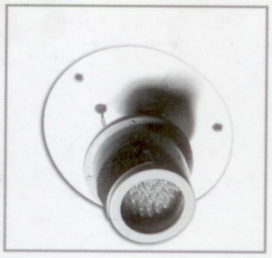
Spare For Led Based Flasher Light system (for EMUs DMUs)

Description	Part No
Flasher Controller Card	ALT-E-86 VER 03
LED Lamp Card	ALT-92
Auto / POWER ON Switch	~~ALT-SW-01~~ ALT-SW-MTA 102
Normal / Stand by Switch	~~ALT-INT-SW-02~~ ALT-SW-MTA201E
Status Indicator assembly	ALT-BI-05
Fuse for controller	ALT-F-1A
Fuse for lamp unit	ALT-F-500mA
Lamp enclosure with front glass	ALT-ENCL-LM-M – EMU
Terminal block for electrical connections	ALT-TB-08
Gasket for Lamp Base Plate	ALT-ELB-01
Gasket for front glass of Lamp	ALT-LUG-NO1

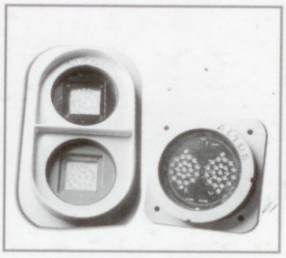



219
67
1.5
225
76
6
170
181
15
121
225
8
25.25
Ø144
65
250
260
67
220
215
181
250
ALTOS ELECTRONICS
LED FLASHER LAMP UNIT
FOR EMU
EL-L-EMU-01
01

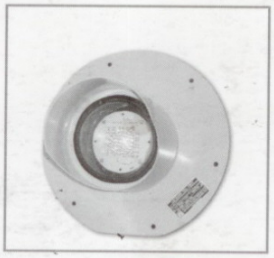
OUR OTHER PRODUCTS FOR LCOMOTIVES



DRIVER'S READING LAMP



MARKER LIGHTS



TAIL LIGHT

OUR OTHER PRODUCTS

AVIATION OBSTRUCTION LAMP

STREET LIGHT

INDICATING LAMP

WARNING LAMP

ALTOS ELECTRONICS
ISO 9001: 2000 Company

ALTOS ELECTRONICS PVT. LTD.

Plot No.8,State Bank Colony Shahu College Road, Pune-9
Ph. No.020-24449144,24445245. Tele.FAX :020- 24440573.
E-mail: sales.altos@gmail.com
Website : www.altoselectronics.com

INSTALLATION INSTRUCTIONS

It is assumed that being the safety gadget, installation of this flasher will be done by technically qualified personal having relevant experience of the field.

1. Unpack the unit. Ensure no physical damage in transportation has taken place to the unit.
2. It is recommended to install the unit on Anti vibration mounts or on rubber pads (Not the part of this supply) to avoid shocks & vibrations to the unit. Tighten the mounting bolts with adequate torque.
3. Ensure that supply is off. Wiring is to be done by 1.5sq. mm or 2.5sq. mm size cable, as the current in the system is maximum 1Amp only. CONSIDERING SHORT CKT. CONDITION AT THE OUT PUT TERMINALS.

Termination is to be done by suitable round lugs or U type lugs.
Make the connections as indicated on terminal block. Polarity of the connections are to be strictly followed
Power on the systems by keeping Normal / Stand by switch on Normal Position,
(During normal operations, these switches are to be on the same position)

Interfacing with other Equipments

Two (02) Nos. of potential free contacts are provided on terminal block to communicate activation and failure of flasher light. These two contacts are normally opened and closed during working of Flasher Light Systems.

OPERATING INSTRUCTIONS

The Flasher System is designed as per the spec. no. : ELRS/SPEC/LFL/0017(REV-1 Sep-2004) This revised system, IF wired electrically, the flasher system gets switched ON automatically if train parting takes place.

Man-Machine Interface:
The unit consists of two independent circuits Normal & Stand By On the front panel of the unit, two bi-colour (Red & green) indications are provided. The unit has two control switches 'Power ON' switch & 'Normal' / 'Stand By' switch. The unit has two nos. of fuses on front panel, for easy replacement. One each for Normal & Stand By ckt.

Power ON:
Before switching `ON` for first time, ensure electrical connections are made correctly & fuse in working condition exist in the unit.
Now, flip 'Power ON' switch to `Power ON` position. If 110V supply at I/P is available, unit will start functioning. The main LED Lamp will start flashing, Buzzer will sound status indication LED on controller start flashing showing red & green indication alternately.
Here red indication shows that the LED lamp Unit is connected & working satisfactorily. And green indication shows the respective Ckt. Is healthy & working normal.
If for any reason, the LED Lamp Unit is not connected or not working, buzzer will not sound & repeater red indication will not flash. It shows only green indication near 'Normal/Stand By switch, indicating, flasher controller is healthy & power at I/P exists but Lamp is not glowing. Also, the same symptoms will appear if more than 20% of LED's from the lamp card are failed.

To switch off, flip 'Power ON' switch to position opposite to 'Power ON'.

Normal / Stand by :
Flasher unit, being a safety device should be fail proof. To ensure this, the controller is provided with Stand by circuit. If for any reason Normal function circuit fails the green indication from the bi-colour Indicator will go off. In this case Turn the switch to stand by position, bi-colour indicator near Stand by mode will start glowing, the unit will resume functioning on Stand by mode.

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Installation / Operation Manual for LED Based Electric Marker Light

ALTOS ELECTRONICS,

Plot No.8,State Bank Colony Shahu College Road, Pune-9

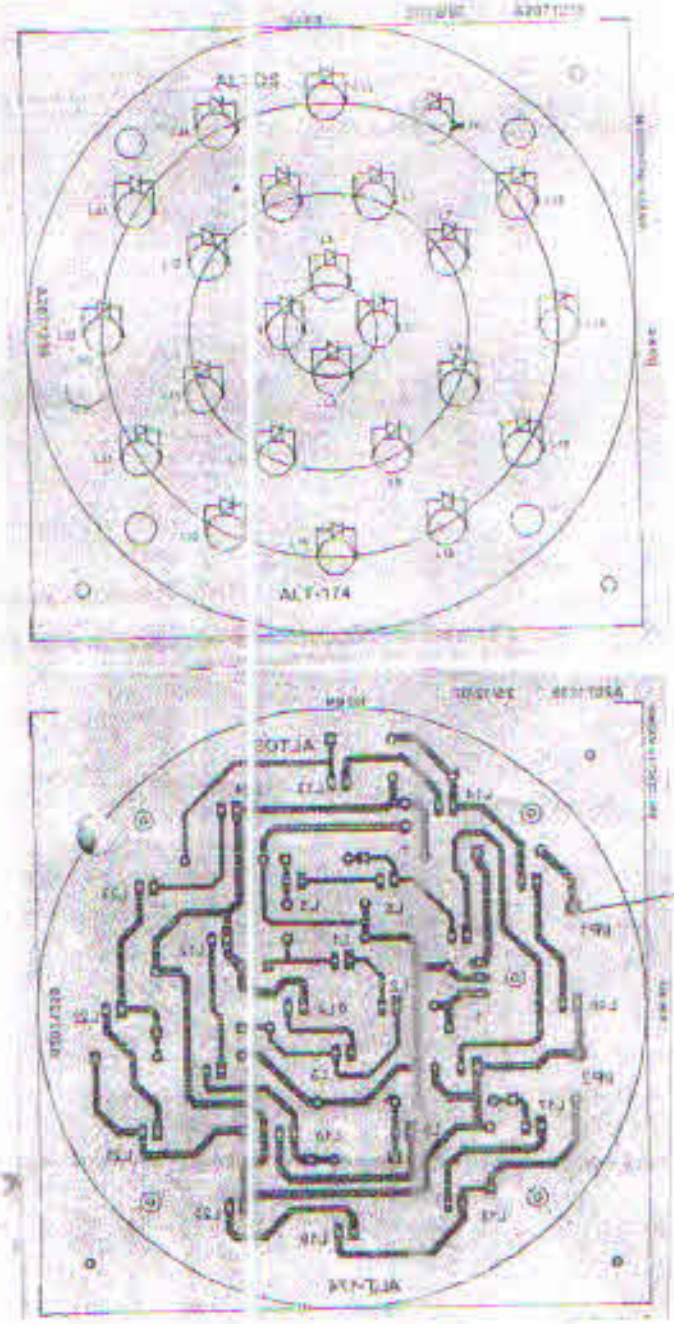
Ph. No.020-24449144,24445245. Tele.FAX :020- 24440573.

sales.altos@gmail.com

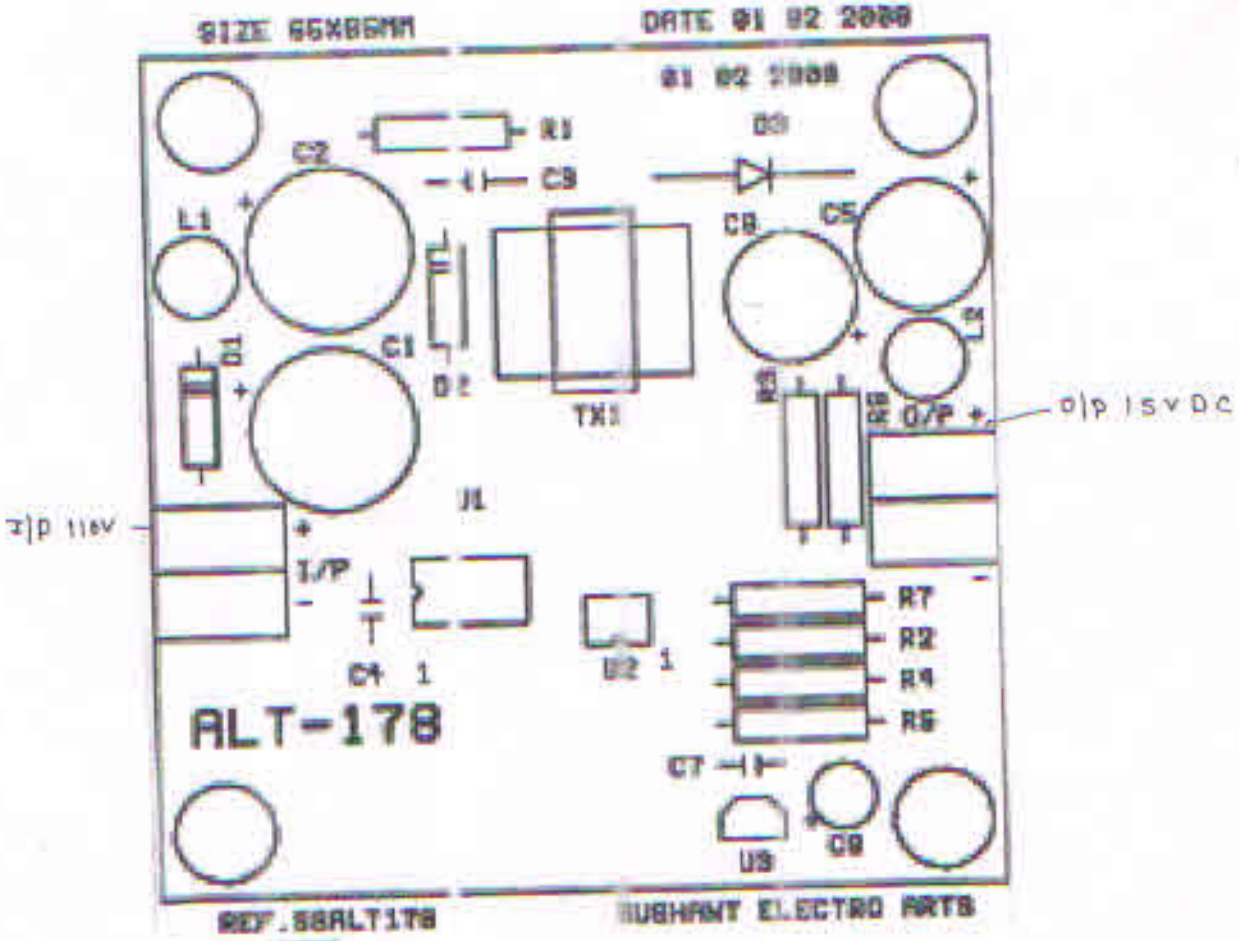
Manual No. ML-E-OPI-REV 00

Total no. of pages 6 Nos.

PCB LAY OUT FOR TROUBLE SHOOTING (PCB NO.ALT-174)



PCB LAY OUT FOR TROUB .E SHOOTING (PCB NO.ALT-178)



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INSTALLATION / OPERITING INSTRUCTIONS

Led based Marker Tail light Light is designed as per spec. No ELRS / spec / PR / 0022 (Rev.1 Oct-2004)

It is assumed that being the safety gadget, installation of this Marker Light will be done by technically qualified personal having relevant experience of the field.

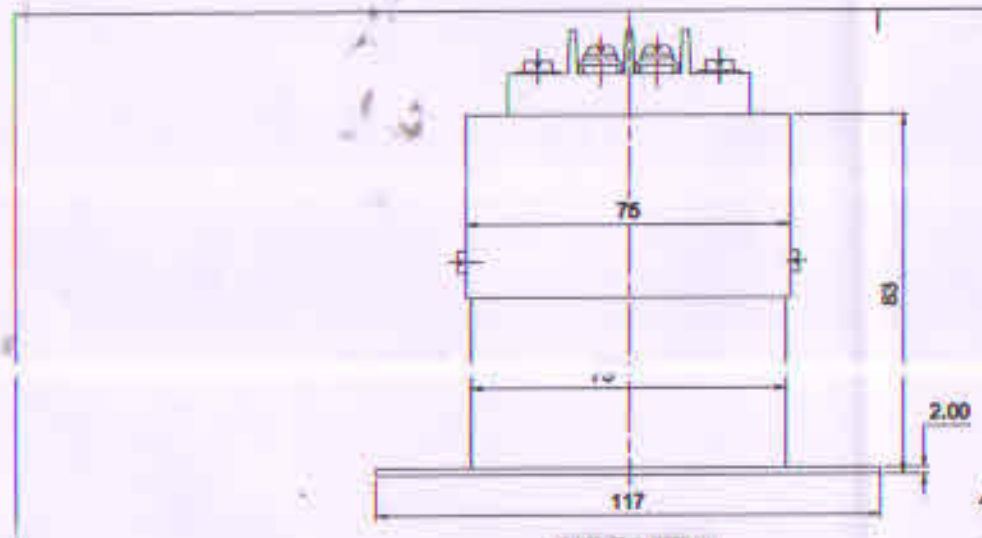
Lamp unit with in built power supply :

1. Unpack the unit. Ensure no physical damage in transportation has taken place to the unit.
2. Tighten the mounting bolts with adequate torque.
3. Ensure that supply is off. Wiring is to be done by 1.5sq. mm or 2.5sq. mm size cable, Termination is to be done by suitable round lugs or U type lugs.
4. Make the connections as indicated on terminal block. Electrical connections are at bottom side of the lamp unit. For electrical connections, terminal block with polarity marking is provided. Polarity of the connections is to be strictly followed

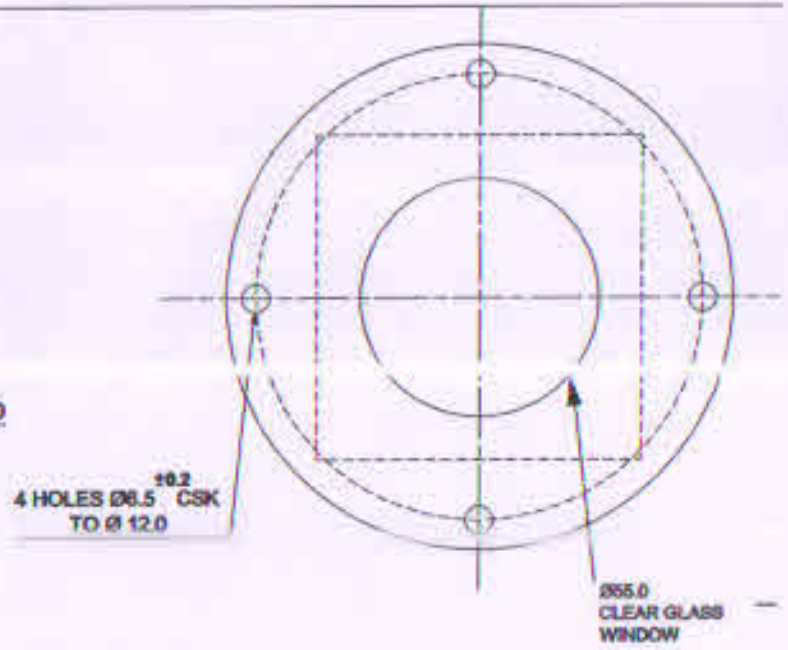
altos

Spare For Led Based Electric Marker Light ,

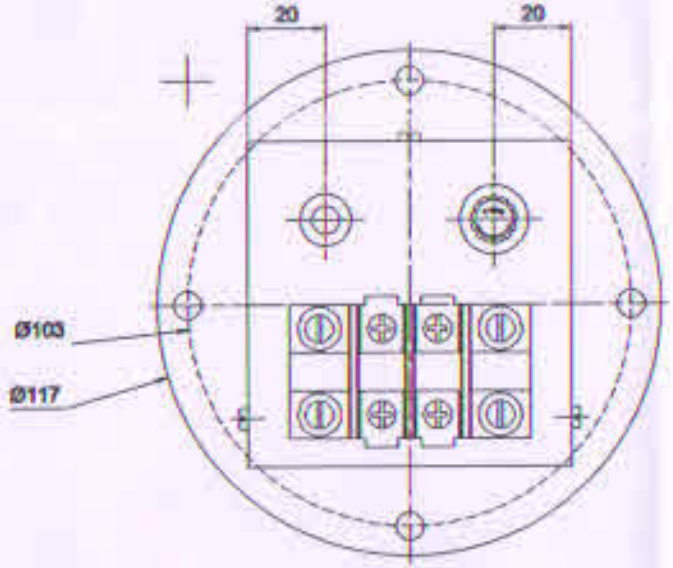
Description	Part No.
Controller Card	ALT-178
LED Lamp Card	ALT-174
Fuse 1A	ALT-F-IA
Lamp enclosure with front glass	ALT-ENCL-DLM-M
Terminal block for electrical connections	ALT-TB-02
Glass Gaskets	ALT-EM-21
Gasket for mounting plate	ALT-FBZM-22



SIDE VIEW



FRONT VIEW



BACKVIEW

TITLE:-	LED MARKER LIGHT FOR METRO
REV. NO:- 00	
DATE: 24-12-2015	
Drawn By : KSS	
Checked By: NB	
Approved By: DRK	

ALTOS ELECTRONICS
S.NO.36/10/1, NARHE, NARHE-AMBEGAON, ROAD,
NEAR ZEAL EDUCATION SOCIETY, PUNE-41.
www.altoselectronics.com

Drawing No.: ALT-MLE-M-02

ENSAVE
Evergreen Engineering Co. Pvt. Ltd.
Plot No. 3, Seth Atmaram Shah Road, Range Office,
Behind Johnson Motors, Village Gokhivare, Vasai, (East),
Vasai, Palghar, MAHARASHTRA, 401208

INSTALLATION INSTRUCTION

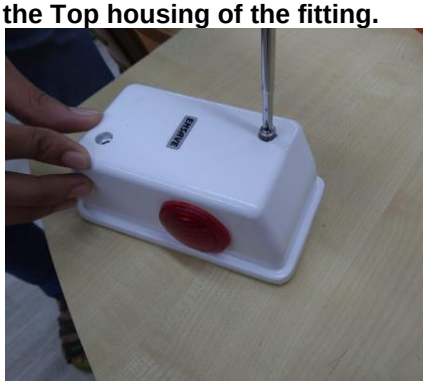
INSTALLATION AND MAINTENANCE MANUAL

1)

Take out the Luminaire from packing box. Remove Luminaire from polybag.

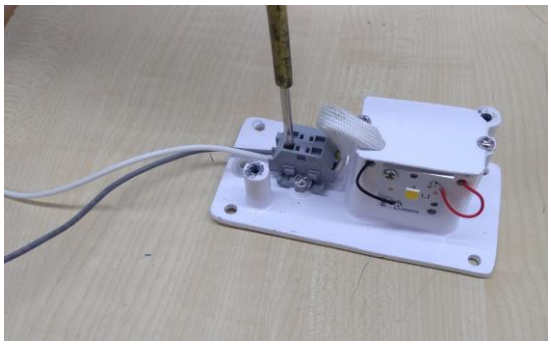
2)

Remove the screws M4 X 35 mm, 2 nos and remove the Top housing of the fitting.



3)

Make the Input-Output Terminal connections.



4)

Remove the wire from the silicon grommet.

5)

Fix the luminaire to the coach surface with the help of Screws.

6)

Secure the top housing on the bottom plate of the luminaire using screws

NOTE:- Ensure Earthing is done properly after connecting L & N Wires on to the connector

Recess Mounting Luminaire	**ENSAVE DEVICES PVT.LTD.**	
Cat . Ref. Type-I (Pail Light)3W	**DATE:-16/02/2022**	**RVE:-00**

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Evergreen Engineering Co. Pvt. Ltd.
Plot No. 3, Seth Atmaram Shah Road, Range Office,
Behind Johnson Motors, Village Gokhivare, Vasai, (East),
Vasai, Palghar, MAHARASHTRA, 401208

INSTALLATION INSTRUCTION

MAINTENANCE SHEET

TYPE-I (PAIL LIGHT) 3W

Periodic Maintenance	Break Down Maintenance
The diffuser lens should be cleaned. The cleaning interval may vary from 2 to 3 months based on the condition of the diffuser, determining of which should be done during visual checks.	The Led array should be replaced if it is found burnt or fused or open circuit.

SR. NO	Fault	Problem Cause	Remedial Action
1	LED array does not glow or strike.	a) Improper LED array fitment and soldering of it to the input point b) LED array unit is defective. c) Loose wiring at led terminal and at driver unit output terminal. Driver unit is malfunctioning.	a) Ensure correct terminal soldering and the fitment with LED array. b) Replace defective unit with working one. c) Replace loosened contacts at LED array and driver output terminal. Replace defective driver unit with working driver.
2	Driver unit is not working	a) Loosed wire contacts at driver output and the input terminal. b)Driver unit defective. c) Improper LED array insertion into MCPCB board to no load condition.	a) Ensure positive wire contacts at driver and also input terminal. b) Replace defective unit with good and working one. c) Ensure LED array insertion and positive tightness of the screw.
3	Low Lux Level	a) LED array is at the end of its life. b) Dust accumulation on front diffuser.	a) Ensure aged LEDs over 50,000 burning hours need to be replaced. b) Periodic frequency to clean the diffuser surface externally.
4	Dust / insect / water ingress into the luminaire housing.	a) Loosed fasteners at the main diffuser frame assembly.	a) Ensure adequate tightening of the diffuser frame assembly fasteners

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Behind Johnson Motors, Village Gokhivare, Vasai, (East),
Vasai, Palghar, MAHARASHTRA, 401208

INSTALLATION INSTRUCTION

INSTALLATION AND MAINTENANCE MANUAL

1)

Take out the Luminaire from packing box.
Remove Luminaire from Bubble Sheet.

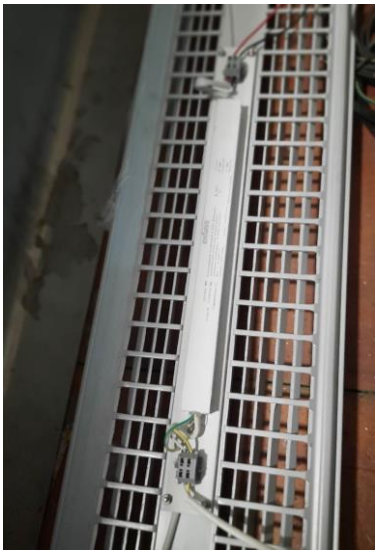
2)

Insert Luminaire in Diffuser Grill Extrusion Cut out.

Fixed Luminaire with Extrusion with the help of M4X20mm Screws & M4 Hex. Nut.

3)

Fix Driver gear tray to the extrusion and make the Input-Output Terminal connections.



4)

Fix the male-female connector to the extrusion using screws.

Recess Mounting Luminaire **Cat . Ref. Saloon Light- Direct/Indirect (1960mm/1710mm/1440mm/1213mm/1150mm)**	**ENSAVE DEVICES PVT.LTD.**	
	DATE:-16/02/2022	**RVE:-00**

5)

Secure the Click-fit Opal Diffuser on the locking area of diffuser grill extrusion.

6)

Install the extrusion on the coach ceiling.

NOTE:- Ensure Earthing is done properly after connecting L & N Wires on to the connector

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INSTALLATION INSTRUCTION

MAINTENANCE SHEET

SALOON LIGHT- Direct/Indirect (1960mm/1710mm/1440mm/1213mm/1150mm)

Periodic Maintenance	Break Down Maintenance
The front visor diffuser should be cleaned. The cleaning interval may vary from 2 to 3 months based on the condition of the diffuser, determining of which should be done during visual checks.	The Led array should be replaced if it is found burnt or fused or open circuit. During breakdown maintenance, End caps provided at the end sides of the luminaire housing shall be checked and the property refitted, If not to prevent dust and water ingress.

SR. NO	Fault	Problem Cause	Remedial Action
1	LED array does not glow or strike.	a) Improper LED array fitment and soldering of it to the input point b) LED array unit is defective. c) Loose wiring at led terminal and at driver unit output terminal. Driver unit is malfunctioning.	a) Ensure correct terminal soldering and the fitment with LED array. b) Replace defective unit with working one. c) Replace loosened contacts at LED array and driver output terminal. Replace defective driver unit with working driver.
2	Driver unit is not working	a) Loosed wire contacts at driver output and the input terminal. b)Driver unit defective. c) Improper LED array insertion into MCPCB board to no load condition.	a) Ensure positive wire contacts at driver and also input terminal. b) Replace defective unit with good and working one. c) Ensure LED array insertion and positive tightness of the screw.
3	Low Lux Level	a) LED array is at the end of its life. b) Dust accumulation on front diffuser.	a) Ensure aged LEDs over 50,000 burning hours need to be replaced. b) Periodic frequency to clean the diffuser surface externally.
`4	Dust / insect / water ingress into the luminaire housing.	a) Removal of end caps provided at the end sides of the luminaire housing.	a)Ensure end caps are repositioned after breakdown maintenance at the end sides of the luminaire housing.

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Plot No. 3, Seth Atmaram Shah Road, Range Office,
Behind Johnson Motors, Village Gokhivare, Vasai, (East),
Vasai, Palghar, MAHARASHTRA, 401208

INSTALLATION INSTRUCTION

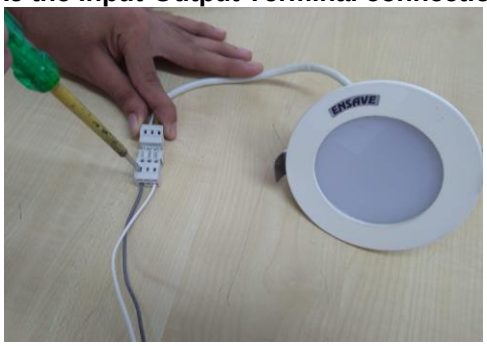
INSTALLATION AND MAINTENANCE MANUAL

1)

Take out the Luminaire from packing box.
Remove Luminaire from polybag.

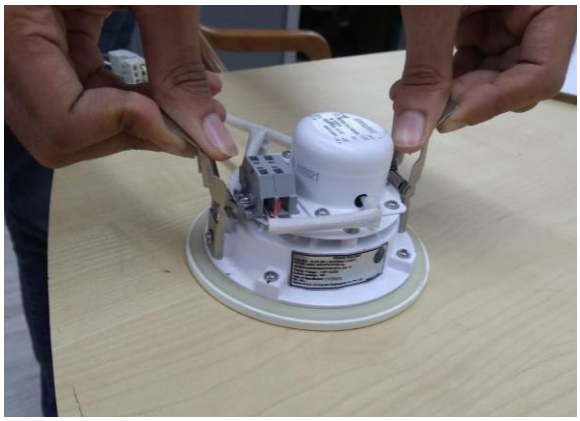
2)

Make the Input-Output Terminal connections.



3)

Open the toggles as shown in the below figure.



4)

Install the luminaire in the coach ceiling cutout

NOTE:- Ensure Earthing is done properly after connecting L & N Wires on to the connector

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Plot No. 3, Seth Atmaram Shah Road, Range Office,
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Vasai, Palghar, MAHARASHTRA, 401208

INSTALLATION INSTRUCTION

MAINTENANCE SHEET

DRIVER CAB LIGHT/GANGWAY LIGHT

Periodic Maintenance	Break Down Maintenance
The front visor diffuser should be cleaned. The cleaning interval may vary from 2 to 3 months based on the condition of the diffuser, determining of which should be done during visual checks.	The Led array should be replaced if it is found burnt or fused or open circuit.

SR. NO	Fault	Problem Cause	Remedial Action
1	LED array does not glow or strike.	a) Improper LED array fitment and soldering of it to the input point b) LED array unit is defective. c) Loose wiring at led terminal and at driver unit output terminal. Driver unit is malfunctioning.	a) Ensure correct terminal soldering and the fitment with LED array. b) Replace defective unit with working one. c) Replace loosened contacts at LED array and driver output terminal. Replace defective driver unit with working driver.
2	Driver unit is not working	a) Loosed wire contacts at driver output and the input terminal. b)Driver unit defective. c) Improper LED array insertion into MCPCB board to no load condition.	a)Ensure positive wire contacts at driver and also input terminal. b) Replace defective unit with good and working one. c) Ensure LED array insertion and positive tightness of the screw.
3	Low Lux Level	a) LED array is at the end of its life. b) Dust accumulation on front diffuser.	a) Ensure aged LEDs over 50,000 burning hours need to be replaced. b) Periodic frequency to clean the diffuser surface externally.
4	Dust / insect / water ingress into the luminaire housing.	a) Loosed fasteners at the main diffuser frame assembly.	a) Ensure adequate tightening of the diffuser frame assembly fasteners

S.T.E. S.r.l.

Via Cavour, 66
20040 Usmate-Velate (MI)
Tel.: 039-68.29.450 - Fax: 039-68.29.455
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Cap. Soc. € 110.000 i.v. - Tribunale Monza 21325
C.C.I.A. 1086796 - Meccanogr.MI040903
C. Fisc. 06271510155 - P. IVA IT00821070968

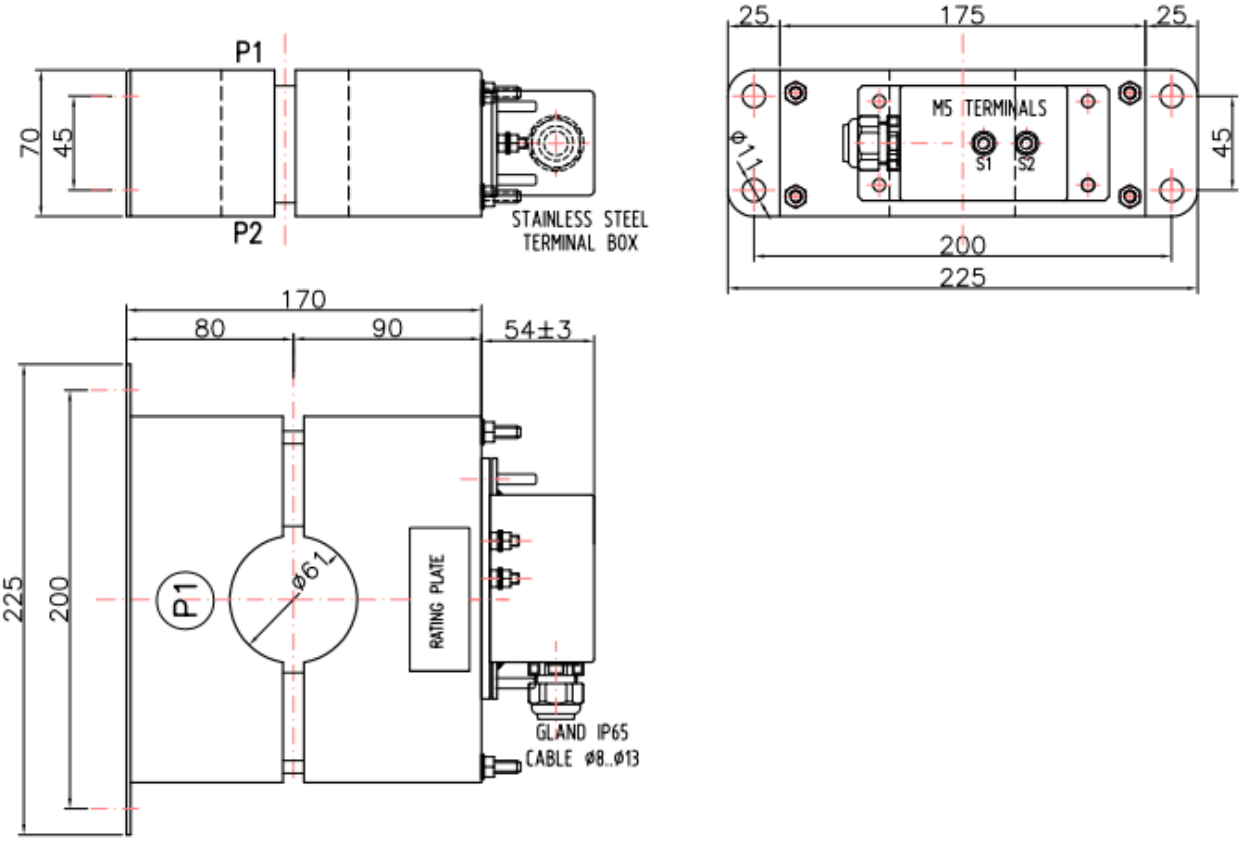
UNI EN ISO
9001:2000

LOW VOLTAGE OUTDOOR SPLIT CORE RING CURRENT TRANSFORMERS – TCE/1860-A and TCE/1592-A

- HANDLING, STORAGE, ERECTION, COMMISSIONING AND MAINTENANCE INSTRUCTION -

1. FOREWORD:

All our current transformers comply with IEC 61869-2 Standards.
The models TCE/1860-A and TCE/1592-A are a split core ring type low voltage current transformer for outdoor installation, composed by two semi cores: the part without secondary terminal box called “fixed part” and the part with terminal box called “mobile part”. TCE/8160-A and TCE/1592-A is supplied with the two parts assembled.



2. RECEIPT OF THE GOODS:

On receipt of the goods, check carefully the packing conditions and after unpacking check the integrity of the product. If it has been damaged, issue a claim to the forwarder and inform us.

S.T.E. S.r.l.
Via Cavour, 66
20040 Usmate-Velate (MI)
Tel.: 039-68.29.450 - Fax: 039-68.29.455
www.stesrl.it - e-mail: ste@stesrl.it
Cap. Soc. € 110.000 i.v. - Tribunale Monza 21325
C.C.I.A. 1086796 - Meccanogr.MI040903
C. Fisc. 06271510155 - P. IVA IT00821070968

3. HANDLING AND ERECTION:

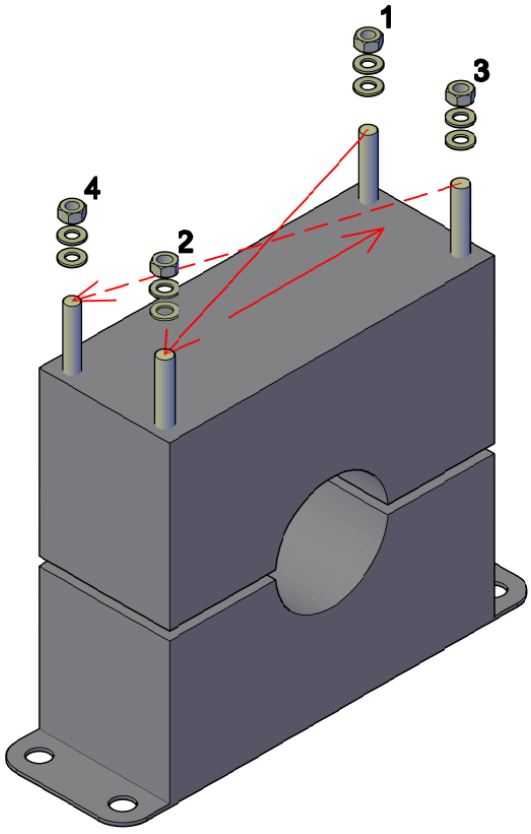
Avoid any shocks. Shifting and transport of this light weight item can be done by hands.

4. COMMISSIONING:

The operations must be done with disconnected circuits, by expert and qualified technicians, respecting the a.m. IEC standards and European safety prescription.
Installation can be done outdoor, ambient air temperature must be included between -5°C and +55°C and altitude must not exceed 1000m.
To identify the product and to properly connect the current transformer check the relevant drawing, rating plate on the current transformer and the terminal markings.

To mount properly the product:

4.01 remove the four lateral M6 nuts and washers
4.02 gently separate the mobile part from the fixed part, shifting along the M6 threaded bars axis
4.03 fasten the fixed part to the customer's support structure using appropriate screws or tie rods
4.04 position the primary cables in the semi circumference of fixed part
4.05 check that the two contact surfaces of the two semi cores are perfectly clean (dust and dirt will compromise accuracy). It is possible to use pure alcohol for cleaning.
4.06 reassembly the fixed part to the mobile parts using M6 nuts (part of the supply): tighten the screw above on the left, the screw down on the right, the screw down on the left, the screw above on the right. Repeat this sequence increasing gradually the tightening torque from 1 Nm up to 1,5 Nm, taking care of the alignment of the semi cores surfaces
4.07 Pay attention to maintain the perfect alignment of the two parts, and to do not stress and move the contact between the two parts.
4.08 Use Thread-locking fluid, applied before or after assembly, depending on the type.



Fasten in crossed counterclockwise order (sequence 1-2-3-4)

Each joint place:
N°1 M6 washer
N°1 M6 splt washer
N°1 M6 self locking nuts in crossed counterclockwise order (1Nm tightening)

After all four nuts are set, tight up to 1,5 Nm

Apply thread locking fluid, before or after the assembly, depending on the type

Before putting in working the current transformer make sure that all connections have been properly made; in particular check that:

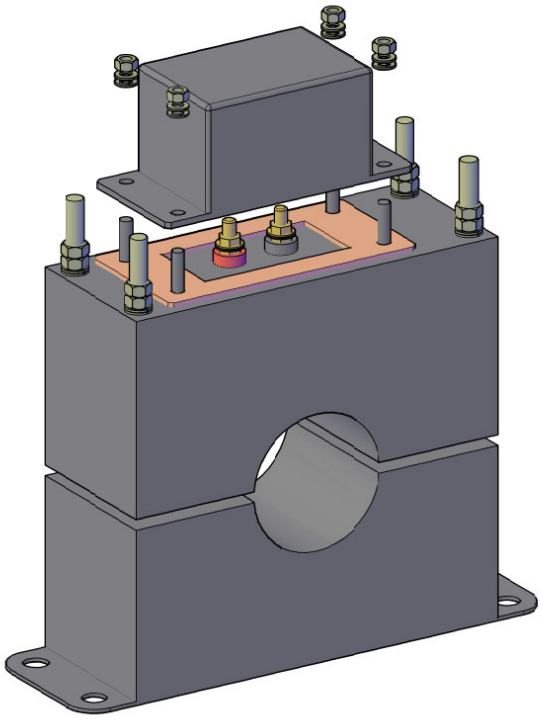
- secondary terminals are connected to the rated load or that they are short-circuited.
(AVOID WORKING WITH OPEN CIRCUIT ON SECONDARY TERMINALS)

- one of the secondary terminals is earthed

- reassembly secondary teminals box using a torque 2 Nm for the M5 self locking nuts (provided) and using thread-locking fluid, applied before or after assembly, depending on the type

-all the data indicated in the rating plate (rated primary and secondary current, rated frequency, rated burden, accuracy class) have been respected.

-PRIMARY CABLE MUST BE INSULATED, OR RATED VOLTAGE OF PRIMARY CIRCUIT MUST BE LOWER OR EQUAL TO 0,72KV



5. MAINTENANCE:

Annual check of:

5.01 external aspect of the current transformer,
5.02 tightening of the screws or the tie rods of the fixing structure
5.03 tightening of the screw of the fixing screws of the two parts
5.04 tightening of terminals and connections
5.05 cleaning of the external surface

6. STORAGE:

To be stocked indoor, in not polluted air and with normal level of humidity. Air temperature must be included between -40°C and +80°C.

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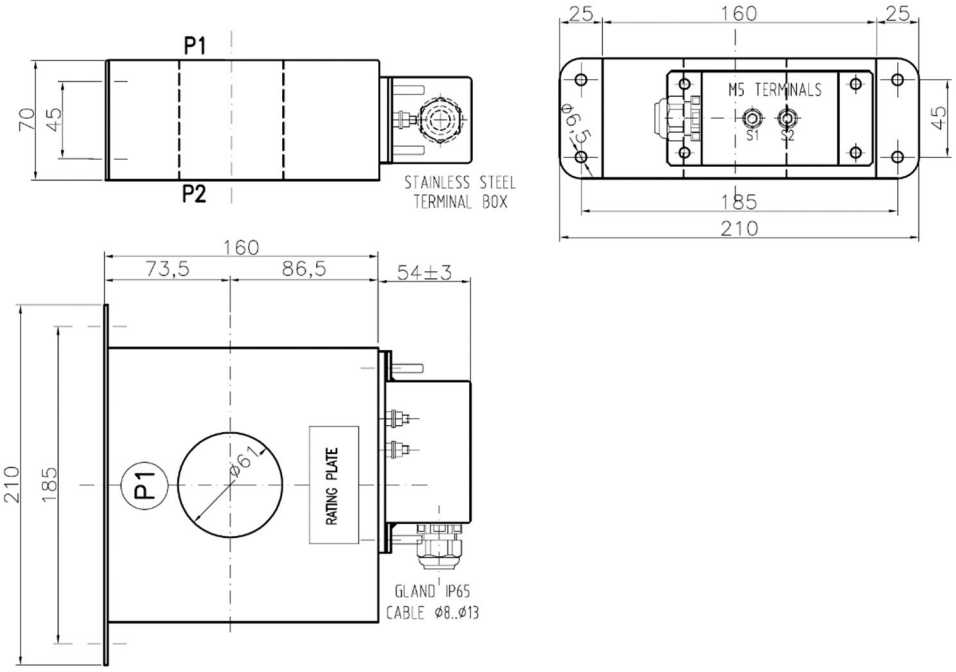
9001:2015

LOW VOLTAGE TYPE TCE/1593
RING CURRENT TRANSFORMER - OUTDOOR INSTALLATION

HANDLING, STORAGE, TESTING, INSTALLATION and MAINTENANCE INSTRUCTIONS

INTRODUCTION
These instructions apply to TCE/1593 ring type low voltage current transformer for outdoor installation. These current transformers are compliant to IEC 61869-2 Standards.



RECEIPT OF THE GOODS
On receipt of the goods, carefully verify the packing conditions and after unpacking verify the integrity of the product. If there are damages, a claim must be raised to the forwarder. S.T.E. must be informed as well.

STORAGE and HANDLING/MOVING:
Storage indoor, in not polluted air and with normal level of humidity. Air temperature must be included between -40°C and +80°C.
Avoid any shocks. Shifting and transport can be done by hand due to lighjt weight of the product.

INSPECTION BEFORE INSTALLATION
Before installation, transformers should be inspected for physical damage that may have occurred during shipment or handling. Transformers should be dry and the surface should be clean.

TESTING AND INSTALLATION:
The operations must be done by expert and qualified technicians, respecting the a.m. IEC standard and relevant safety prescriptions.
To identify the product and properly connect the CT, check the rating plate and the terminal/polarity markings.

Before putting in operation the current transformer, check the following points:

1. Always consider an instrument transformer as a part of the circuit to which it is connected, and do not touch the leads and terminals or other parts of the transformer unless they are known to be adequately grounded.

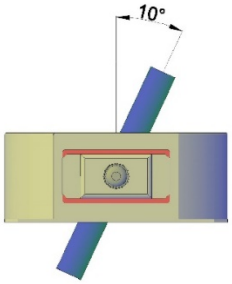
2. Always ground the metallic cases, frames, bases, etc., of instrument transformers. The secondaries should be grounded close to the transformers. However, when secondaries of transformers are interconnected, there should be only be one grounded point in this circuit to prevent accidental paralleling with system grounding wires.

3. Do not open the secondary circuit of a current transformer while the transformer is energized and do not energize while the secondary circuit is open. Current transformers may develop open-circuit secondary voltages which may be hazardous to personnel or may damage the transformer or equipment connected in the secondary circuit.

4. Identify the product, check the rating plate and terminal markings on the current transformer and properly connect the current transformer.

5. Check that connections were properly performed:
   a. Secondary terminals are connected to the rated load or that they are short-circuited.
   b. one secondary terminal is earthed
   c. all the data indicated in the rating plate (rated primary and secondary current, rated frequency, rated burden, accuracy class) are respected.

Primary cable positioning:

The primary cable has to be placed in the center of the primary hole of the CT. Cable position should be perpendicular to the CT, if it isn't possible, the maximum allowed inclination is 10 degrees from the perpendicular.	 *(sample picture)*

MOUNTING
Make sure that the secondary leads are twisted closely together and carried out without passing through the field of the primary conductors. It is not necessary that the primary conductors exactly fill the window, but the primary conductors should be centralized.

POLARITY
When wiring instrument transformer circuits, it is necessary to maintain the correct polarity relationship between the line and the devices connected to the secondaries. For this reason, the relative instantaneous polarity of each winding of a transformer is indicated by a marker.
Where taps are present, all terminals are marked in order. The primary terminals are P1 and P2. The secondary terminals S1 and S2. The marker P1 always indicates the same instantaneous polarity as S1.
When connecting instrument transformers with meters, relays or other devices, refer to the instructions furnished with the device involved.

MAINTENANCE:
Annual check:
- External aspect of the current transformer,
- Tightening check of terminals and connections,
- Normal cleaning of the external surface.

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9001:2015

MV VOLTAGE TRANSFORMERS

OUTDOOR INSTALLATION

TYPE

TVM/38-E

Installation and Maintenance Manual

Date	Version	Isued:	Approved:	Nr. Pag.
16/09/2021	4	F.Romanenghi	L.Cesari	1 di 4
20/02/2018	3	L.Cesari	A. Romanenghi	
31/10/2017	2	L.Cesari	A. Romanenghi	
24/10/2017	1	L.Cesari	A. Romanenghi	

SCOPE
This is the user's and maintenance manual for integrators, installer and maintenance personnel of systems based on TVM/38-E voltage transformer. Observe the provisions of local legislation regarding the competence criteria for personnel working with or in vicinity of electrical installations.

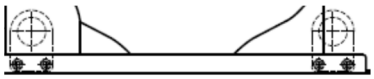
INTRODUCTION:
Our voltage transformers are compliant with IEC 61869-3 and EN 50124-1 Standard
Our product model TVM/38-E is a phase-earth medium voltage transformer for outdoor installation.

RECEIPT OF THE GOODS:
On receipt of the goods, carefully verify the packing conditions and after unpacking verify the integrity of the product. If there are damages, a claim must be raised to the forwarder. S.T.E. must be informed as well.

STORAGE:
TVM/38-E must be stored indoor, in not polluted air and with normal level of humidity between -45°C and +75°C.

INSPECTION BEFORE INSTALLATION
Before installation, transformers should be inspected for physical damage that may have occurred during shipment or handling. Transformers should be dry and the surface of the bushings should be clean.

HANDLING AND MOVING:
Avoid any shocks. Shifting and transport must be done using lifting lugs connected to the M6x16 bolts placed in the side of the plate (maximum torque 6 Nm). **Do not move the transformer using the active parts (like terminals or insulating silicone).**



COMMISSIONING AND INSTALLATION:

SAFETY INTRUCTIONS:
The operations must be done by expert and qualified technicians, respecting the IEC standards and European safety prescription.

ENVIRONMENTHAL CONDITIONS
Installation can be done outdoor, ambient air temperature must be included between -45°C and +75°C.

WARNING

NEVER SHORT CIRCUIT THE SECONDARY TERMINALS

INSTALLATION INSTRUCTION
Before putting in operation the voltage transformer, check the following points:

1. Always consider an instrument transformer as a part of the circuit to which it is connected, and do not touch the leads and terminals or other parts of the transformer unless they are known to be adequately grounded.

2. Always ground the metallic cases, frames, bases, etc., of instrument transformers. One end of the secondary of the VT should be grounded close to the transformers. However, when secondaries of transformers are interconnected, there should be only be one grounded point in this circuit to prevent accidental paralleling with system grounding wires.

3. Check with care if both terminals of the same secondary winding are not grounded by accident. Grounding both terminals of secondary winding can result in damage of voltage transformer over a short period of time. Any claims for resulting transformer damages will be void.

4. Do not short circuit the secondary terminal of a voltage transformer while the transformer is energized. Voltage transformers with secondary terminals short-circuited may be hazardous to personnel or may damage the transformer or equipment connected in the secondary circuit. Any claims for resulting transformer damages will be void.

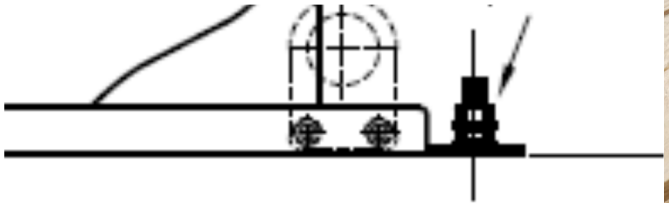
5. Identify the product by the releavnt drawing/datasheet. Check the rating plate and terminal markings on the voltage transformer and properly connect them. Check that all data indicated in the rating plate (rated primary and secondary voltage, rated frequency, rated burden, accuracy class) have been respected.

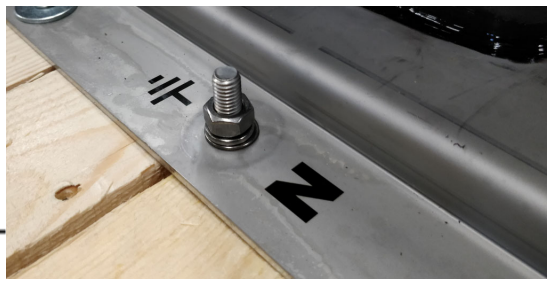
6. Check that connections are properly performed:
   a. Secondary terminals are connected to the rated load or they are not connected (open circuit).
   b. All secondary windings are correctly earthed

FIXING TO THE STRUCTURE
Use the four holes on the base plate: please see the relevant drawing.
TVM/38-E voltage transformer may be mounted in vertical position only (with HV terminal of primary winding facing the top). Other mounting positions are not allowed.

CONNECTION OF EARTH CABLE
The earth cable must be tightened up to 20 Nm between the base plate and the M8 nut placed in the base of the transformer. The earth screw is properly marked. Remove nuts and washers, put the cable lug of the earth cable in the screw and close by means of provided washers and nuts.

FOR SAFETY REASONS, EARTH CONNECTION MUST ALWAYS BE CONNECTED FIRST.



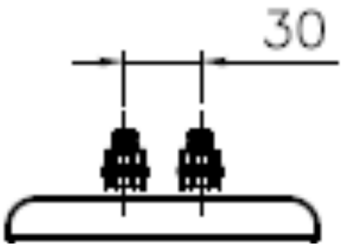


CONNECTION OF SECONDARY CABLE
The secondary cables must be connected to the secondary M6 terminals nuts tightening up to 2,5 Nm.
After connection of secondary cable, close the secondary terminal box with the proper red gasket and the steel plate. The four screws must be tightened to 3Nm.
The marking of the secondary terminal is engraved inside the cover plate of secondary terminal box.

IMPORTANT: n *terminal of every secondary winding must be connected to ground.*
The voltage transfomer must work with secondary circuit opened or loaded maximum with the rated burden indicated on the rating plate.

CONNECTION OF PRIMARY BUSBAR

The primary phase cable must be tightened up to 20 Nm between the steel plate and the two M8 upper nuts placed in the top of the transformer. Remove all nuts and washers, put the cable lug or the bar in touch with the steel plate and close by provided washers and nuts. On the second nut, thread locking fluid (suggested Loctite 243 or Loctite 2400, or other approved by the train builder) may be applied.



Note: The voltage transformer TVM/38-E needs the flowing of only a few milliAmps of current to read the voltage value of the primary circuit. For this reason it is designed to withstand only the static and dynamic load of an HV flexible connection.
In case of use of a solid busbar to connect the VT to the 25 kV line, supporting insulators should be used.

POLARITY

When wiring instrument transformer circuits, it is necessary to maintain the correct polarity relationship between the line and the devices connected to the secondaries. For this reason, the relative instantaneous polarity of each winding of a transformer is indicated by a marker.
The primary terminals are “A” and “N” (capital letter). The secondary terminals are “a”, “n” (lowercase). The marker “A” always indicates the same instantaneous polarity as “a”.
When connecting instrument transformers with meters, relays or other devices, refer to the instructions furnished with the device involved.

VOLTAGE TRANSFORMER REMOVAL

In order to remove the voltage transfomer, please proceed as follows:

- ***Make sure that the primary circuit is disconnected from the network, and, effectively grounded***
- Disconnect the the primary busbar
- Disconnect the secondary lead from the secondary terminals of voltage transformer
- Disconnect the the earthing cable
- Remove the fixing screws from the voltage transfomer plate
- Remove the voltage transformer

MAINTENANCE:

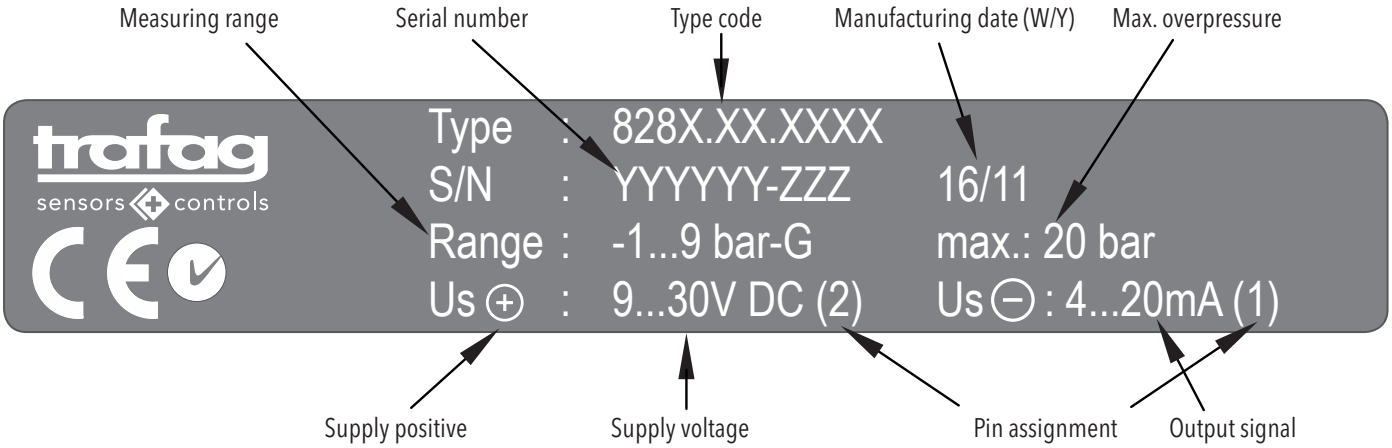
Annual check of:

- the external aspect of the voltage transformer,
- the tighten of terminals and connections
- normal cleaning of the external surface

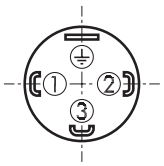
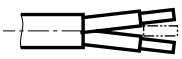
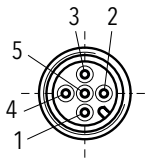
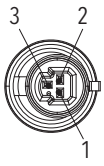
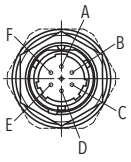
Technical specification

Mounting torque:	25 Nm
Ambient temperature:	–40°C ... +125°C
	Cable PVC: –5°C ... +60°C / Cable PUR: –20°C ... +70°C / Cable Raychem: –20°C ... +100°C
Media temperature:	–40°C ... +125°C,
	–25°C ... +125°C, –18°C ... +125°C, depending on seal material

Type label description



Electrical connections

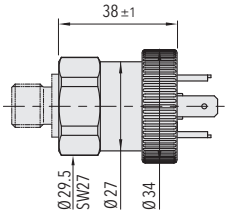
Ingress Protection	IP65 [2] IP67 [1]	IP68 max. 3m	IP67 [2]	IP67 [2]	IP67	IP69K [2]
Designation	EN175301-803A (DIN43650-A)	Cable* (PVC) (PUR) 4 x 0.25mm²	M12x1 5–pol.	Packard Metri Pack 3–pol.	MIL-C 26482	DIN 72585 Code 1
Type code	**828X**.XX.XXXX.**05**	**828X**.XX.XXXX.**24/22/08**	**828X**.XX.XXXX.**35**	**828X**.XX.XXXX.**51**	**828X**.XX.XXXX.**02**	**828X**.XX.XXXX.**25**
Pin configuration						

Output	**Load resistance**	**I_{SUPPLY}**	**U_{SUPPLY}**
4 ... 20 mA	(U_{SUPPLY} –9V) / 20mA		9 ... 32 VDC
0 ... 5 VDC	> 2.5 kΩ	<10 mA	9 ... 32 VDC
0.5 ... 5 VDC	> 5.0 kΩ	<10 mA	9 ... 32 VDC
1 ... 6 VDC	> 5.0 kΩ	<10 mA	9 ... 32 VDC
0 ... 10 VDC	> 5.0 kΩ	<10 mA	15 ... 32 VDC
0.5 ... 4.5 VDC ratiom.	≥ 5.0 kΩ	≤ 10 mA	5 (4.75 ... 5.25) VDC

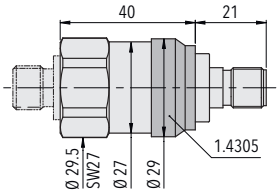
[1] With Trafag IP67 connector only
[2] Provided female connector is mounted according to instructions
* Ventilation via connector. Shield in the device is not connected

H73317k *Trafag AG 06/2021*

Electrical connections



828X.XX.XXXX.**05**.XX.XX



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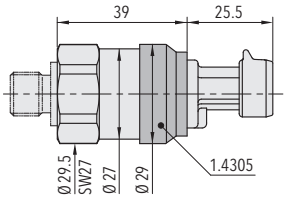

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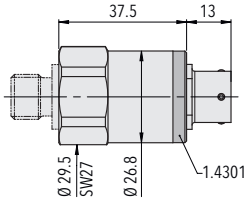

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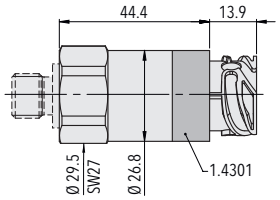
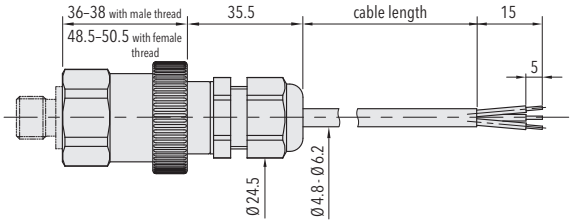
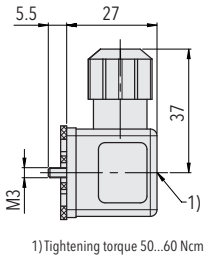


828X.XX.XXXX.**25**.XX.XX

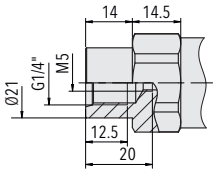


828X.XX.XXXX.**24/22/08**.XX.XX

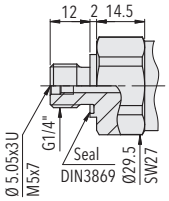


828X.XX.XXXX.XX.XX.**46/56**

Pressure connections



828X.XX.XX**10**.XX...



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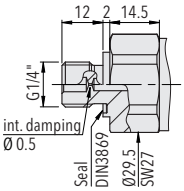
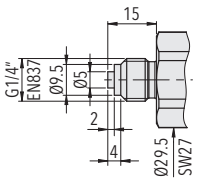
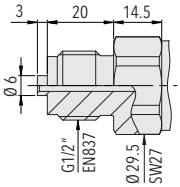


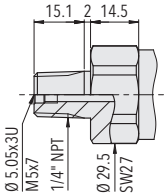
828X.XX.XX**15**.XX...



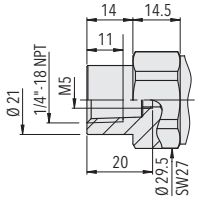
828X.XX.XX**53**.XX...



828X.XX.XX**11**.XX...



828X.XX.XX**30**.XX...



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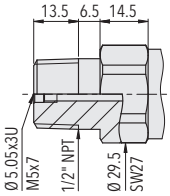

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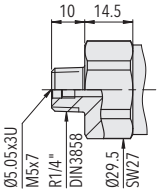

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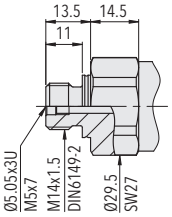

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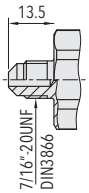

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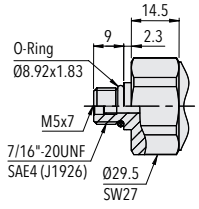

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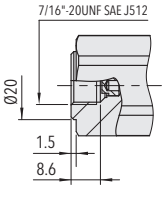

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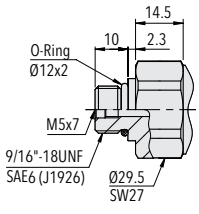
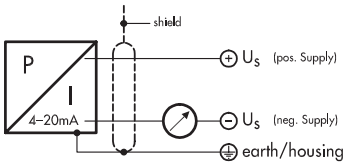


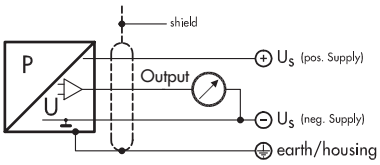
828X.XX.XX**61**.XX...

Connection of the measuring equipment

Current output
2-wires

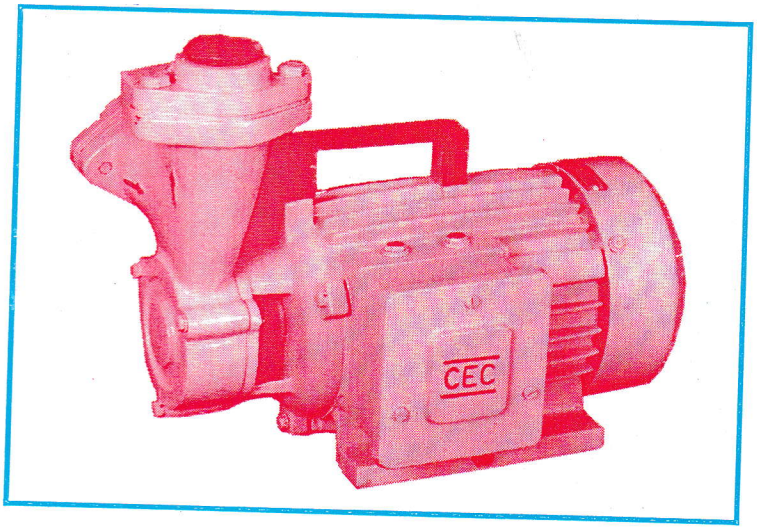


Voltage output
3-wires



CEC
Smart

Operation, Maintenance Manual and Parts Catalogue



WATER RAISING SELF PRIMING MONOBLOC PUMP

MODEL : SPM - 05

Supplied by :

COIMBATORE COMPRESSOR ENGINEERING CO. PVT. LTD.,

S.F. No. 429, Thanneerpandal, Peelamedu, Coimbatore - 641 004.

Ph : 0422 - 2512323, 2513567, Fax : 2513447

Railway Products : 94426 09902

E-mail : cecganga@dataone.in

ABOUT us.....

ISO 9001 REGISTERED FIRM

GCAS MGMT. SYS. RvA C 402

Certificate No. : IN / 07 / 1067

Coimbatore Compressor Engineering Company Private Limited is one of the reputed manufacturers of air compressors and electric motors in Coimbatore since 1988.

The company is focussed in air compressor, AC / DC motors and allied line of activities.

The company has sufficient manufacturing infrastructure with 10000 sq.ft. built up area, machinaries and a qualified team of committed engineers and administrators.

Being a SSI Unit, the company is flexible enough to venture into specialised products to cater customers specific needs.

The Company has wide sales network and support for prompt after sales & service. The Company always strives to stay ahead of customer's reasonable expectations at all times.

The company has been certified as meeting quality standards as per ISO 9001:2000 by M/s. GCAS Quality Certification Pvt.Ltd., Chennai.

GENERAL INSTRUCTIONS

1. **Use recommended Grade of Insulating varnish for winding.**
2. **Use genuine spare parts only.**
3. **Always keep the pump neat and clean.**

GENERAL DESCRIPTION
WATER RAISING SELF PRIMING MONOBLOC PUMP

The Water raising self priming pump is driven by 3 phase, 0.5 HP squirrel cage induction motor. It is specially developed as per RDSO / RCF Drg. & specifications for lifting water from under-slung water tanks located in AC rail coaches.

The motor body, pump casing, rear cover and front end bracket are moulded out of high quality cast iron. The stator portion is constructed with best quality electrical grade silicon steel laminated stamping. The rotor is made out of high conductivity aluminium by pressure die casting. The shaft for rotating rotor is dynamically balanced, (with impeller) to minimize vibration at the highest allowed speed and to ensure smooth running and increased life of the bearings. The winding wires used for our motor is 200° C temperature clause of dual coated polyesterimide grade. The stator winding is vacuum impregnated with best quality Elmotherm H 71A grade varnish to obtain good insulation resistance throughout the service period.

The pump casing (Volute) is made of FG 200 Grade cast iron and it is hydrostatic pressure tested for any tiny air holes. The impeller is made of brass. The entry of water from pump to motor is prevented by providing high quality Nitrile rubber seal. The pump shaft is made of stainless steel of AISI 410 Grade. The fasteners used in the pump are of hardened steel material supplied by reputed make like TVS, Unbrako or Forbes Gokak.

The ball bearings used for our pump is 6203 - 2RZ of SKF / FAG indogeneous make. The oil seal used in this pump is made of Nitrile Rubber.

The terminal board is moulded out of reinforced glass fibre material. The cable joints are silver brazed.

The terminal cover and lid are die-cast aluminium components. The entire motor portion in protected as per IP55 standards.

TECHNICAL SPECIFICATIONS

Water Raising Self Priming Mono Bloc Pump set.

Model	:	SPM - 05. Self Priming Mono Bloc Pump.
Speed	:	2800 RPM

Specifications as per :

RDSO	:	RDSO / PE / Specn / D / AC / 0022 (Rev.0) 2002 Amdt. 1
RCF	:	EDTS 186 Rev. 'A' (Pump with cradle arrangement and micro controller)

Dimensions as per :

RDSO Drg.	:	RDSO / PE / SK / AC / 0066 (Rev.0) 2004
RCF Drg.	:	CC 73005 Alt. A.

Motor :

Make	:	CEC - Smart
Type	:	TEFC, Squirrel cage Induction motor.
Rated Output	:	0.5 HP / 0.37 Kw.
Roted Voltage	:	415 v+ 6%, 3 Phase, 50 Hz ± 3%. AC
Maximum full load current	:	2.5 Amps
Speed	:	2800 RPM
Frame Size	:	1071
Insulation Class	:	"H"
Type of mounting	:	Foot Mounted
Degree of Protection	:	IP55

Standards (Motor Portion) :

Testing	:	as per IS : 325
Dimensions	:	as per IS : 1231
Performance	:	as per IS : 8789

Pump

Make	:	CEC Smart
Type	:	Self Priming
Head	:	Suction 8 mts. Delivery : 22 mts
Discharge	:	0.7 lps / 2520 lph minimum
Suction Flange size	:	1" BSP
Delivery Flange size	:	1" BSP

Standards (Pump Portion)

Testing	:	As per IS : 8418 of clause 10
Performance	:	As per IS : 9542

PERFORMANCE CHART FOR SELF PRIMING MONO SET PUMP

Suction Lift		Suction & Delivery size	Total Head in Meters							
			6	8	12	16	20	24	28	32
M	Ft.	1" BSP	Discharge in liters per minute (LPM)							
8	25		50	46	40	32	26	20	14	10

Electrical Installation :

The pump should be connected to three phase, 50Hz, AC supply with voltage range of 380 - 440 Volts. The supply terminal RYB are connected as delta star connection. Ensure the proper earthing, to avoid shock during handling. Switch on the pump and check the direction of rotation is as per the arrow mark fixed in the pump body.

Care should be taken before the pump put into service :

1) Remove the cooling fan cover and check for free rotation of the rotor.
2) Check the supply voltage
3) Check the water level in the tank.

Operation of self priming mono set pump :

It is necessary to fill water into the casing through the filler cap hole, once during installation which is known as priming. After filling water, shut the filler cap tightly. After filling with water inside the casing, switch on the pump. Care should be taken to avoid any air hole in the suction line. It will take minimum 2- 3 minutes before the water begins to flow. During subsequent operation, water will be discharged immediately on switching on the pump.

DISMANTLING AND ASSEMBLING PROCEDURE FOR SELF PRIMING MONOBLOC PUMP

Motor Portion

1) Unscrew the cooling fan cover and remove the fan cover.
2) Loosen the screws and remove the cooling fan from the shaft.
3) Remove the rear (end) cover.

Pump Portion

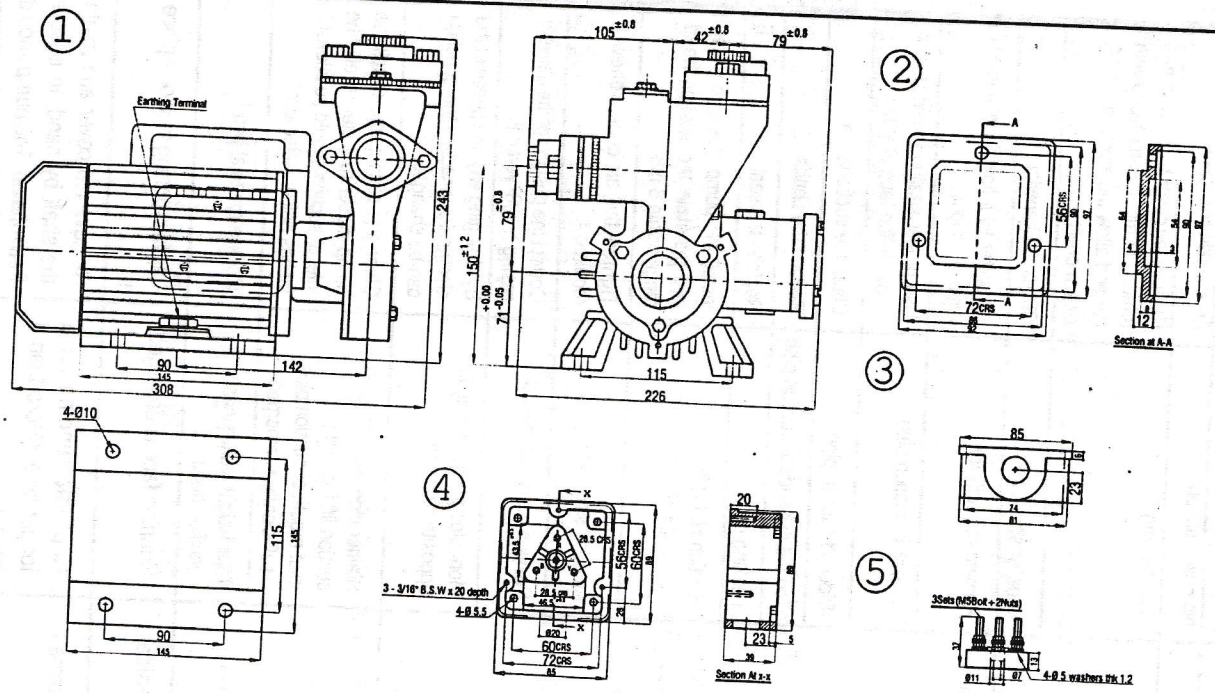
1) Remove the casing bolts and pull out the casing from the motor body.
2) Loosen the impeller nut and remove the impeller from the rotor shaft.
3) After removing the impeller, gently pull out the rotor assembly from the motor body.
4) Remove the seals.

To assemble, follow the same procedure in the reverse order.

Spare parts shall be ordered indicating the model and part list numbers.

TROUBLE SHOOTING

TROUBLE	CAUSE	REMEDY
Motor does not rotate	No power supply	Ensure power supply
	Over heating	Remove fan cover & Check for free rotation of motor shaft along with fan and allow the motor to cool & switch on.
	Impeller struck up	Check the impeller
Pump does not lift water	Priming not sufficient	Fill water till it flows continuously without air lock.
	Air leak in suction pipe	Use proper sealing to arrest leak or use leflon tape at joints.
	Blocked suction pipe	Clean the suction pipe.
	Too many bends in suction pipe	Reduce the bends
	Leaking seal	Replace the seal
	Suction lift too high	Install the pump closer to water, and maintain the suction head range within 8 mts.
	Air cock side leaking	Tighten the air cock, renew if required.
	Position of casing altered	Correct the position of the delivery casing at 90° vertical.
	Monobloc pump running in opposite direction.	By changing any one phase of the electrical connection the direction can be changed.
Capacity decrease	Stainer clogged; suction lift too high; inlet mouth of suction pipe insufficiently submerged.	Clean the stainer and install the pump closer to water level. The inlet of suction should be atleast 2 inches below water level.
	Total height higher than specified head.	Reduce the total head.
Leaking mechanical seal	Running face is damaged	Lap the running face or replace it.
Monobloc get jammed	Kept idle running for a longer time. (More than 8 hours)	Remove fan cover and rotate the shaft by hand, to ensure free rotation. The pump should be run for a few minutes atleast once in two days.



Mounting Dimensions		
7	Lengthwise	: 90
6	Widthwise	:115
5	Mounting holes	: Ø10
4	Cable entry hole	: Ø 20
3	Over all width	: 220
2	Over all length	: 308
1	Over all height	: 243

8	voltage 415 v ±6%, Ins. class H 3 phase, 50 Hz ±3%,Conn.Y	
7	Rated Speed	: 2800 RPM
6	Discharge	:2520 LPH
5	Suction head	: 3meters
4	Delivery head	: 5 rheters
3	Pump(suction&delivery)	: 1" x 1" BSP
2	Current	: 1.2 Amps
1	Rating	: 0.5 HP

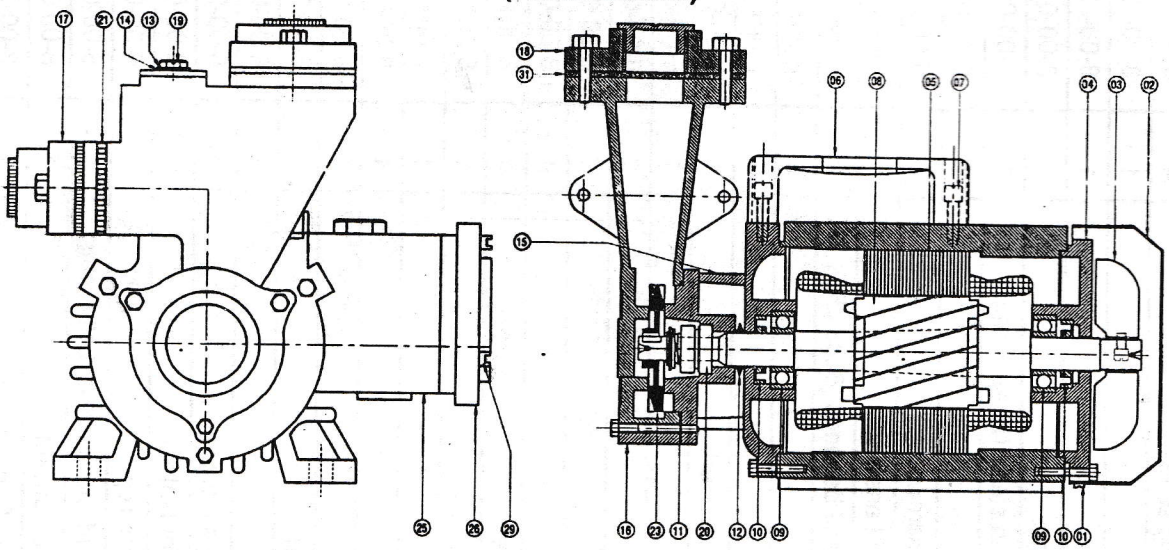
S No	Description
5	Terminals
4	Terminal box
3	Connection box
2	Connection box cover with gasket
1	Front Elevation & Side view

Self Priming MonoSet Pump(AC)
(For use in Indian Railways)

MODEL : SPM - 05

SCALE	NTS	PRODUCT CODE	REV
		8-00-00-00	00

Self Priming Mono Set Pump
(Parts Details)



sl.no	Description	sl.no	Description	sl.no	Description	sl.no	Description
10	Oil seal	20	Water seal	30	Terminal box fixing screw *	31	Packing suction & Delivery flange
09	Rear & drive end bearings	19	Air cock	29	Terminal cover fixing screw		
08	Rotor with shaft assembly	18	Delivery flange	28	Terminal cover gasket *		
07	Handle fixing screw	17	Suction flange	27	Terminal board with terminal bolt & nuts *		
06	Handle	16	Casing	26	Terminal cover top		
05	Motor body with stator	15	Bracket	25	Terminal cover bottom		
04	End (rear) cover	14	Washer	24	Terminal box assly *		
03	Cooling fan	13	Asbestor washer	23	Impeller		
02	Fan cover	12	Water cutter	22	Earth terminal *		
01	Fan cover fixing screw	11	'O' Ring	21	NRV		

Note : -

* Not visible in this sketch

0-5HP Self Priming mono block Pump

SPARE PARTS LIST

S.No.	Description	Qty	Part No.
1.	Fan cover fixing screw	4	8-00-02-08
2.	Fan cover	1	8-00-02-06
3.	Cooling Fan	1	8-00-02-04
4.	End (Rear) Cover	1	8-00-01-03
5.	Motor body with stator (Base Frame)	1	8-00-01-02
6.	Handle	1	8-00-01-11
7.	Handle fixing screw	2	8-00-02-12
8.	Rotor with shaft assembly	1	8-00-02-00
9.	Rear & drive end bearings (6203 2RZ)	2	8-00-02-11
10.	Oil Seal	2	8-00-02-09
11.	'O' Ring	1	8-00-02-10
12.	Water cutter (thrower)	1	8-00-02-07
13.	Fiber washer	1	8-00-02-14
14.	Washer	1	8-00-02-15
15.	Bracket	1	8-00-03-01
16.	Casing	1	8-00-03-02
17.	Suction flange	1	8-00-03-03
18.	Delivery flange	1	8-00-03-04
19.	Air Cock	1	8-00-03-05
20.	Water Seal	1	8-00-03-06
21.	NRV	1	8-00-03-07
22.	Earth terminal	2	8-00-02-13
23.	Impeller	1	8-00-02-05
24.	Terminal box assembly	1	8-00-04-00
25.	Terminal cover bottom	1	8-00-04-01
26.	Terminal cover Top	1	8-00-04-02
27.	Terminal board with terminal bolt & nuts.	1	8-00-04-03
28.	Terminal cover Gasket	1	8-00-04-04
29.	Terminal cover fixing screw	4	8-00-04-05
30.	Terminal box fixing screw	3	8-00-04-06
31.	Packing, Suction & Delivery Flange	2	8-00-03-08
32	Shaft Key	1	8-00-02-01

DETAILS FOR WARRANTY PURPOSE

Bill No. :

Date :

Motor Sl. No. :

Commissioned on :

Customer :

SERVICE SUPPORT OUTSIDE COIMBATORE

Chennai : **Mr. B. Chandra Sekaran**
No.6, Ist Street,
North Thirumalai Nagar, Villivakkam
Chennai - 600 049.
Phone : 044 - 26176530

Bangalore : **CEC INDUSTRIAL ASSOCIATES**
73, 7th Main, 50 Feet Road,
Hanumantha Nagar, Bangalore - 560 050
Mr. P. Sridhar
Phone : 080 - 26608057
Mobile : 098454 - 45259

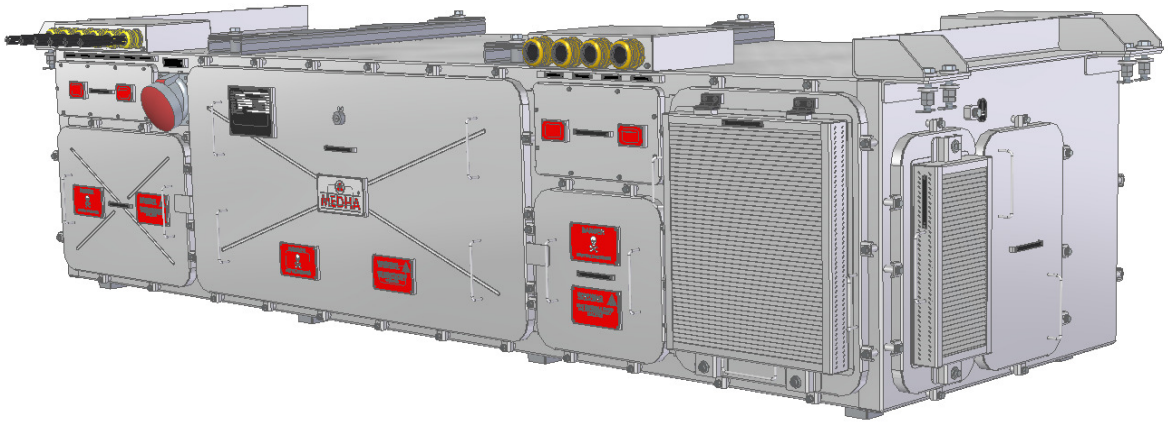
Cochin : **CEC EQUIPMENTS**
39/3245, Anjiparambil House,
Manikkath Cross Road,
Ravipuram, Cochin - 682 016
Mr. D. Selvam
Phone : 0484 - 2358173
Mobile : 0936 3103105

Mumbai : **BBC INTERNATIONAL**
5, Gundecha Chamber, N. Master Road,
(Medows Street), Fort, Mumbai - 400001
E - mail : bbc_int@vsnl.net
Mr. C.S. Kamdar
Off : 022 - 22675253
Fax : 022 - 22656814

Maintenance Manual

AUXILIARY CONVERTER FOR TRAIN18-V2

TYPE MAE675UV2



MEDHA SERVO DRIVES PVT. LTD.

Information in this document is subject to change without notice.

Document No:

XXXXX Released:

Table of Contents

AUXILIARY CONVERTER UNIT (ACU)

1.1 Introduction

Auxiliary Converter is used to supply power for 3-phase 415V loads and 110V DC loads.

ACU is mounted at under frame of TC coach of each basic unit and consists of 2nos. 415Vac 3phase Inverter modules and 1no. 110V DC Converter module.

1.2 Technical Data & Description of the Interface

1.2.1.1 Mechanical Data

Converter Size	3000 (L) X 1000 (W) X 700 (H)
Cabinet	SS-304
Mass	1200 kg (approx.)
Degree of protection	a) ELECTRONICS ZONE: IP68 UP TO FLOOD LEVEL ELECTRONICS ZONE: IP65 ABOVE FLOOD LEVEL b) COOLING ZONE: IP20

1.2.2 Electrical Data

AC1:

Requirements	Parameters
Input Voltage	Single phase 285V AC to 450V AC input from Auxiliary secondary winding of Main transformer
Control Supply	77 V to 137.5 V DC from battery (110 V DC nominal)
Output capacity	**Output:** 186kVA, 415V±5% (L-L), 50Hz±3%, 3Phase, Sine wave (at >19kVac OHE) At <19kVac OHE, output voltage shall drop by maintaining V/F ratio constant.
Short time rating	For 415Vac output: 150% of rated current for 10 Seconds without increasing active power.
Efficiency	> 94%
Noise Level	< 80dB(A) at 1 meter away from the unit
Voltage-THD	≤8%

AC2 & DC Converter:

Requirements	Parameters
Input Voltage	Single phase 285V AC to 450V AC input from Auxiliary secondary winding of Main transformer
Control Supply	77 V to 137.5 V DC from battery (110 V DC nominal)
Output capacity	**Output-1:** 186kVA, 415V±5% (L-L), 50Hz±3%, 3Phase, Sine wave (at >19kVac OHE) At <19kVac OHE, output voltage shall drop by maintaining V/F ratio constant. **Output-2:** 110V to 125VDC (It is varying as per DC load sharing current requirement) DC Power: 30.5kW at 110V DC (BN, BD & Battery Charger loading on this).

Short time rating	For 415Vac output: 150% of rated current for 10 Seconds without increasing active power. For 110Vdc output: 37.5kW for 20 seconds
Efficiency	> 94%
Noise Level	< 80dB(A) at 1 meter away from the unit
Voltage-THD	≤ 8%

1.3 External Interface

1.3.1 Input/Output Terminals and connections

S. no.	Connection Name	Terminal	Ferrule no.	Recommended wire size
1	AC1 Input Phase	AC1 I/P Ph	031005.700	1wire, 185mm2
2	AC1 Input Neutral	AC1 I/P N	031006.700	1wire, 185mm2
3	AC2 Input Phase	AC2 I/P Ph	031007.700	1wire, 185mm2
4	AC1 Input Neutral	AC2 I/P N	031008.700	1wire, 185mm2
5	AC1 Output R-Phase	AC1-O/P-Rph	033001.700 033001.701	2wires, 50mm2
6	AC1 Output Y-Phase	AC1-O/P-Yph	033002.700 033002.701	2wires, 50mm2
7	AC1 Output B-Phase	AC1-O/P-Bph	033003.700 033003.701	2wires, 50mm2
8	AC2 Output R-Phase	AC2-O/P-Rph	033004.700 033004.701	2wires, 50mm2
9	AC2 Output Y-Phase	AC2-O/P-Yph	033005.700 033005.701	2wires, 50mm2
10	AC2 Output B-Phase	AC2-O/P-Bph	033006.700 033006.701	2wires, 50mm2
11	DC Output (BN) +Ve	BN +VE	082001.700 082001.701	2wires, 70mm2
12	DC Output(BN) -Ve	BN -VE	082002.700 082002.701	2wires, 70mm2
13	DC Output (BD) +Ve	BD +VE	081001.700 081001.702	2wires, 25mm2
14	DC Output(BD) -Ve	BD -VE	081002.700 081002.702	2wires, 25mm2

CON3 is used for 415V Shed supply connection.

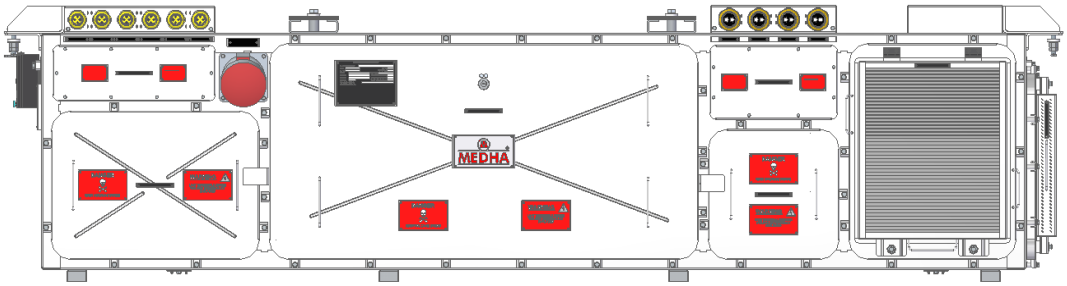
1.3.2 Control connectors (CON1 & CON2)

There are two control connectors (CON1 & CON2). CON2 is used for 110 V DC control supply and for digital signals and CON1 is used for interface between TCMS and ACU with Ethernet communication.

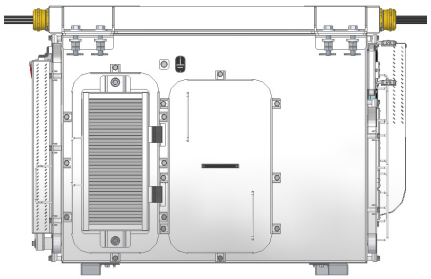
1.4 Design

1.4.1 Structural Design

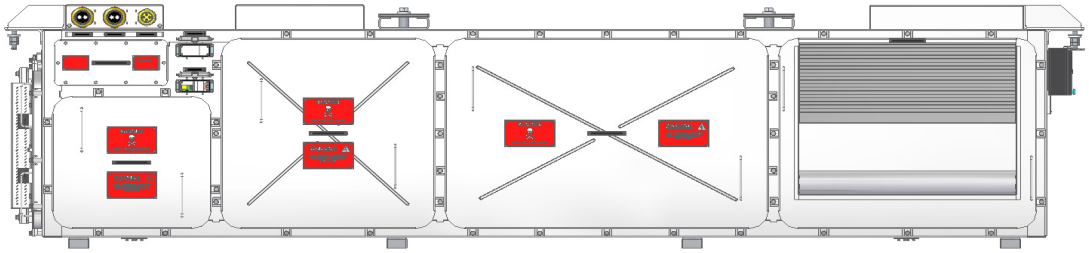
ACU Cabinet is designed to be installed in under slung of TC coach .
LHS, RHS, front and rear views are shown below.



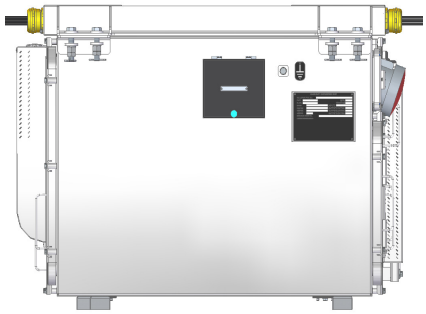
Front View



Right Side View



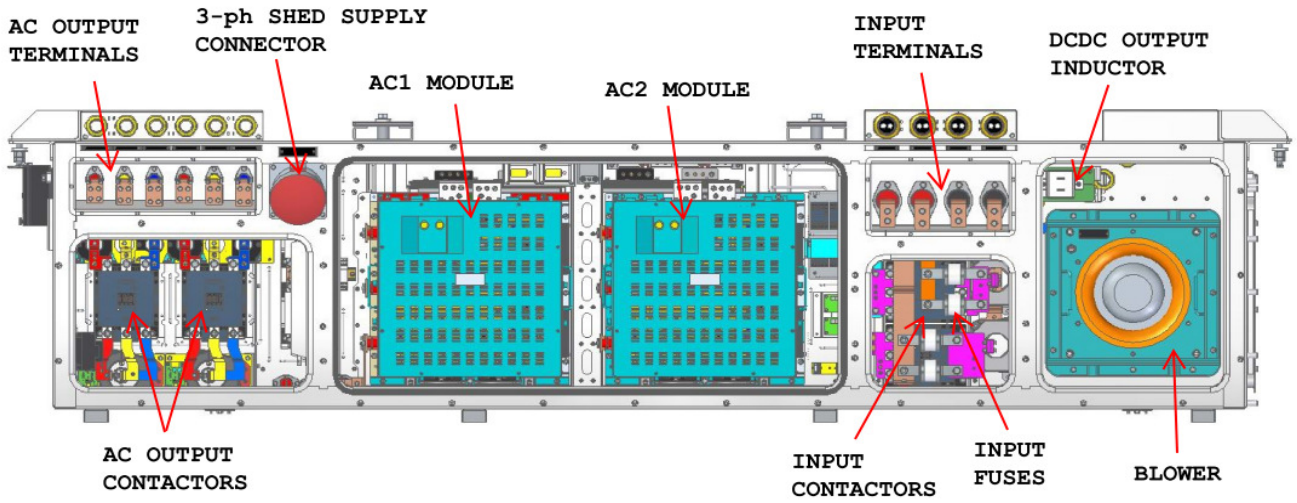
Rear View

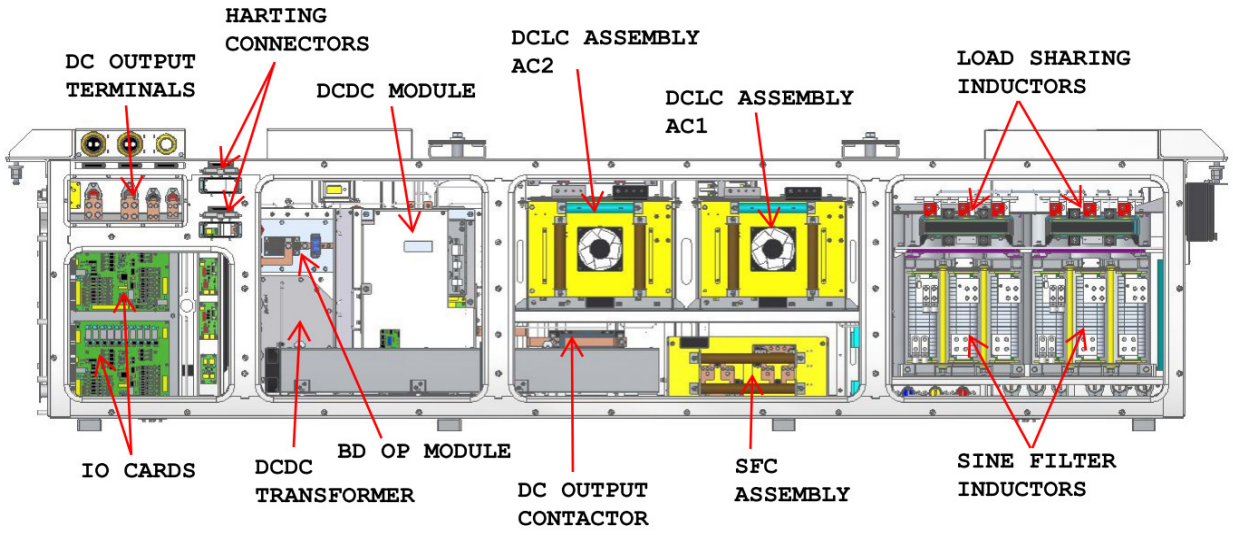


Left Side View

1.5 Component Layout in the Cabinet

The following diagram show the position of the major components in the ACU.



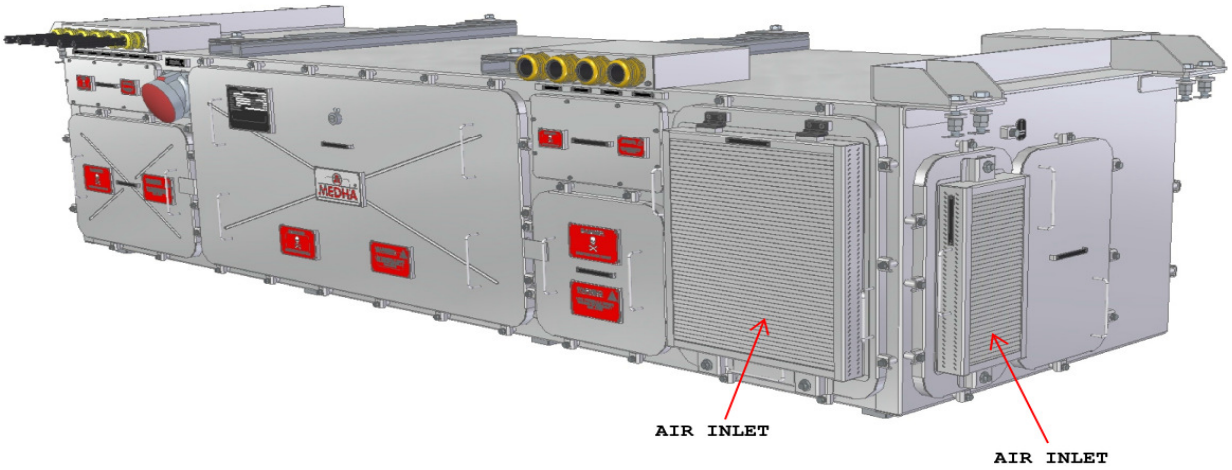


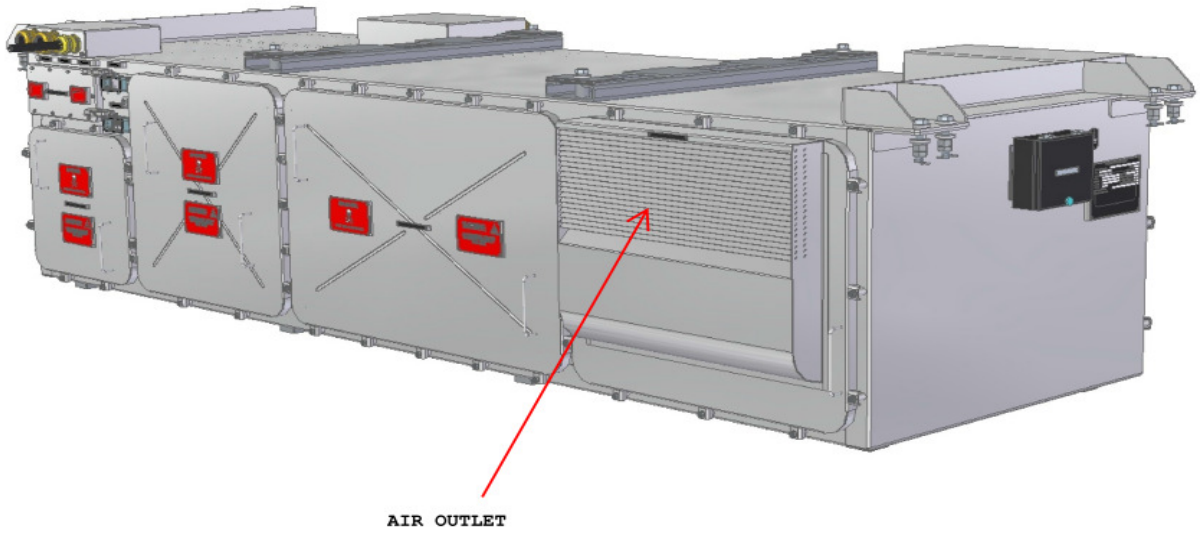
1.6 Accessibility

The Auxiliary Converter's modular system can be accessed and serviced quickly and easily.

1.7 Cooling

Auxiliary converter cooling is achieved by means of forced convection. Inside the auxiliary converter one blower is used for cooling the modules and magnetics, it draws air from the inlet air filter on front and right side of unit and forces it over module heat sinks, the air then flows over the magnetics and finally leaves outside through louvered door.





1.8 Safety Instructions

To prevent accidents follow these steps:

- Put the train in duty position
- Verify that there is no voltage remaining between DC+ and DC- by measuring with a voltmeter.
- Ensure that adequate cooling time has been allowed, if train has recently been running.
- Use appropriate depot Personal Protective Equipment (PPE) when working with hot components and dusty environment.
- Always wear a dust mask when working in dusty environment.

1.8.1 Personal safety

- Before commencing any work on the vehicle the personnel shall always: Set the vehicle to the correct operating position for the task to be performed
- Study the necessary safety precautions within the documentation and on the vehicle

1.8.2 Work on vehicle

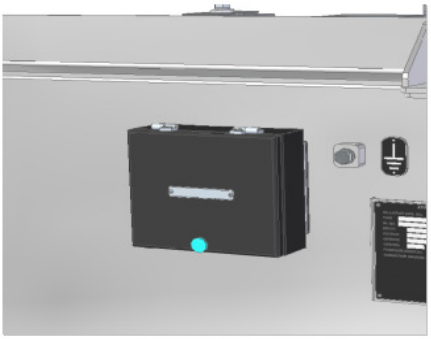
When carrying out maintenance work on the vehicle, the instructions should be followed carefully.

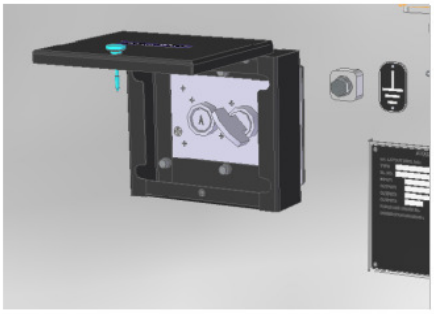
- Always use protective clothing and protective equipment.
- Make sure you have wore the safety shoes, gloves
- Set the placard “Work in progress” or follow the employer instruction.
- Before commencing work on the vehicle, ensure that all voltage is disconnected.

1.9 Interlocking

Interlocking System: The propulsion equipment is secured by the key interlock system. It ensures that the high voltage supply is always earthed before it is possible to get in contact with the equipment.

1. Open the isolation switch guard cover by unscrewing the knob.
2. Place the key-A in to the isolation switch and rotate clockwise for accessing key-B. Rotate the key-B anti-clockwise and remove it. With Key-B Main door lock to be opened.





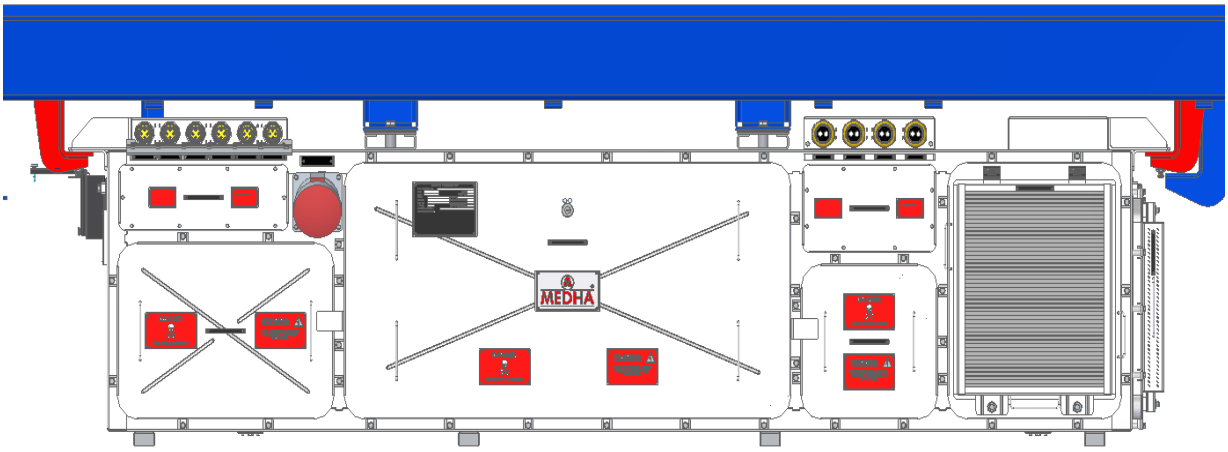
1.10 Maintenance Schedule Check list

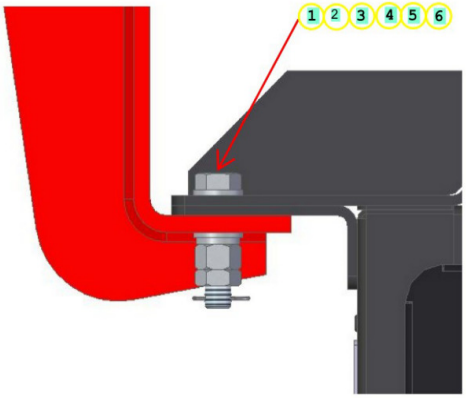
S. no.	Connection Name	Every 15 Days	Every 30 Days	Every 90 Days	Every 180 Days
1	Inspection of unit mounting hardware as per chapter 1.11.1	√	√	√	√
2	Inspection of converter unit as per chapter 1.11.2	√	√	√	√
3	Ensure isolation switch box cover is properly closed when accessed.	√	√	√	√
4	Ensure 3-ph shed supply connector cap is properly closed when accessed.	√	√	√	√
5	Air inlet & outlet openings inspection as per chapter 1.11.3	√	√	√	√
6	Inspection of air inlet louver frames snap locks as per chapter 1.11.7	√	√	√	√
7	Air filter cleaning with forced air as per chapter 1.12.1.1		√	√	√
8	Inspection of unit doors hardware as per chapter 1.11.10			√	√
9	External name plates & outer surfaces cleaning as per chapter 1.12.4			√	√
10	Inspection of external electrical connections and ground connections as per chapter 1.11.9				√
11	Intumescent seal inspection as per chapter 1.11.4				√
12	Inspection of silica gel as per chapter 1.11.5				√
13	Inspection of door gasket as per chapter 1.11.6				√
14	Air filter cleaning with forced water as per chapter 1.12.1.2				√
15	Inspection of blower as per chapter 1.11.11				√
16	Blower cleaning as per chapter 1.12.3				√
17	Magnetics cleaning as per chapter 1.12.2				√
18	Inspection of internal mounting hardware as per chapter 1.11.8				√
19	Inspection of internal components and cables as per chapter 1.11.12				√
20	Inspection of excessive temperature and arcing (Voltage flash overs) as per chapter 1.11.13				√
21	Inspection of cable ties as per chapter 1.11.14				√
22	Inspection of all internal electrical connections as per chapter 1.11.15				√
23	While doing maintenance if any abnormality / damage found, it should be addressed on need (issue severity) basis.				√

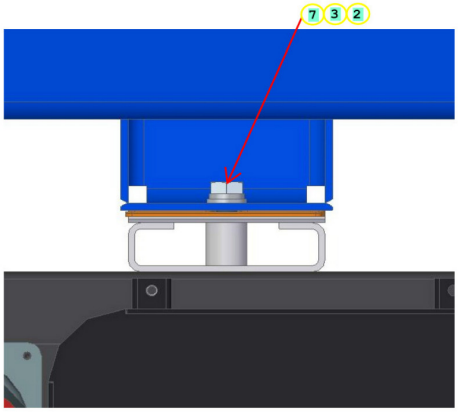
1.11 Inspection

1.11.1 Inspection of unit mounting hardware

- Ensure that the converter unit bolted tightly, There should not be any slackness in mounting fasteners and also split pin should be intact with lock nut. If any hardware is loose, Re-tight the hardware, apply the torque & mark with nail paint.
- If any hardware is missing, Assemble new hardware & apply the torque.







1.11.2 Converter unit inspection

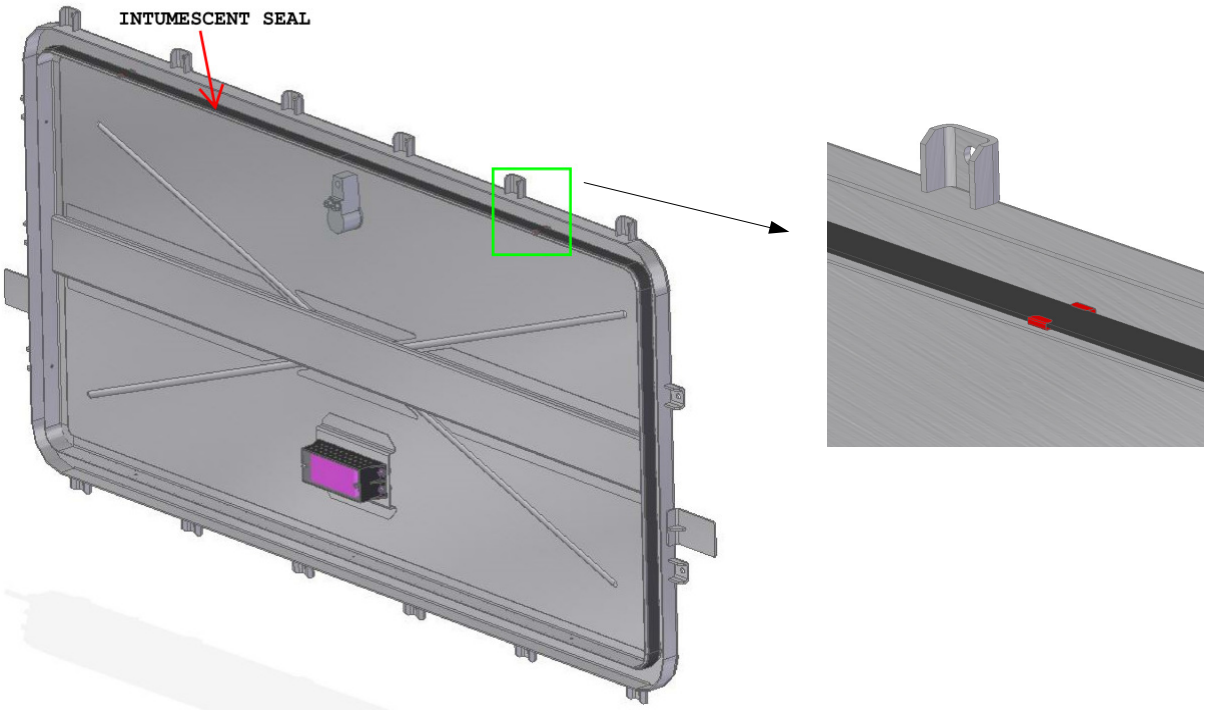
- *Visually verify the converter unit for any damages.*

1.11.3 Air inlet & outlet openings inspection

- Ensure that the air inlet and outlet openings are not obstructed by papers, covers or any other large foreign objects etc.

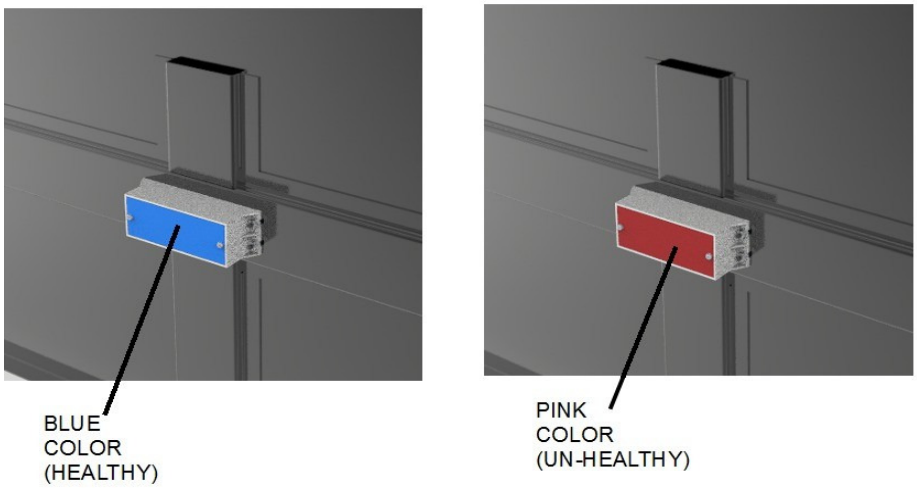
1.11.4 Inspection of intumescent seal

- Ensure Intumescent seals are free from cut marks and physical damages, If found replace with new one.



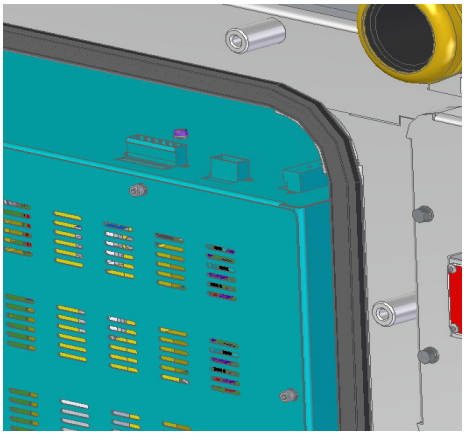
1.11.5 Inspection of silica gel

- Check the color of silica gel inside the doors AC MODULES CHAMBER, AC OUTPUT CONTACTORS CHAMBER, IO CARDS CHAMBER, DC MODULE CHAMBER & DC LINK CHAMBER. They should be blue, Replace silica gel if found pink.



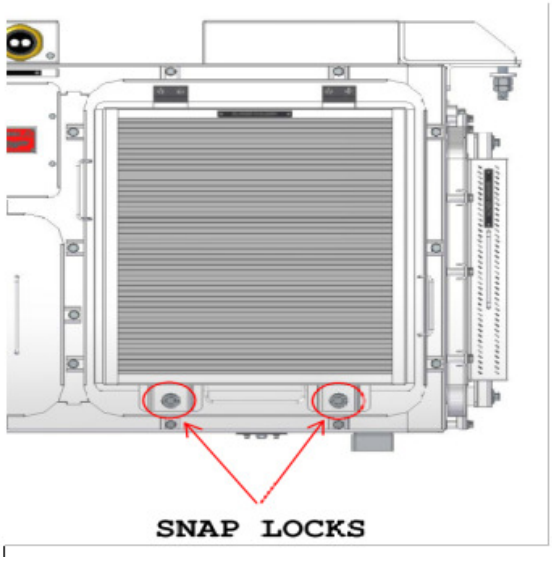
1.11.6 Inspection of door gasket

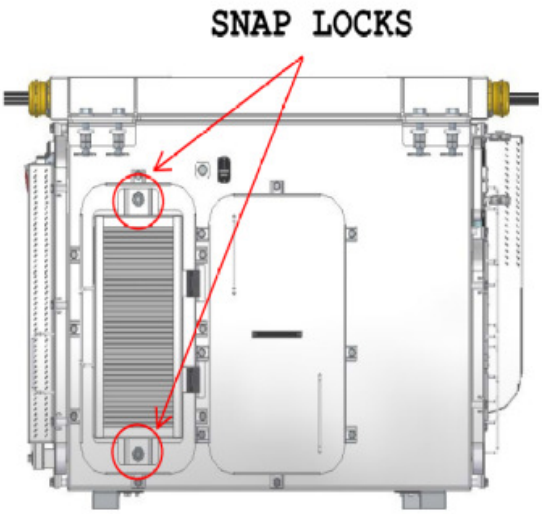
- *Ensure that all door sealing gaskets are free from cut marks and physical damages, If found replace with new one.*



1.11.7 Inspection of air inlet louver frame snap locks

- Ensure air inlet louver frames are properly snapped.



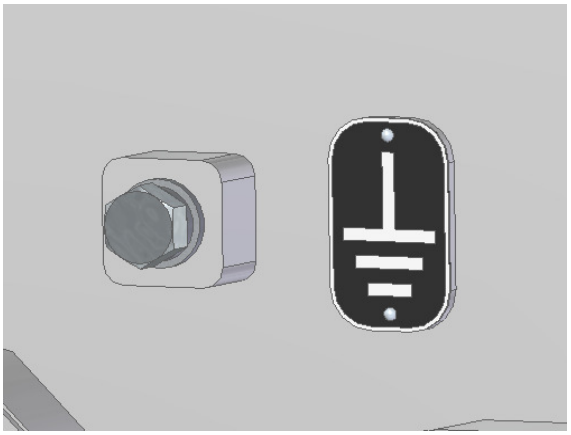


1.11.8 Inspection of internal mounting hardware

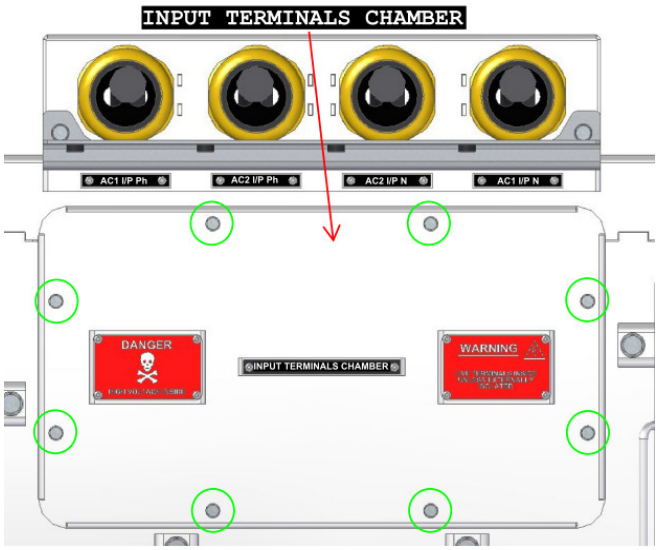
- Visually inspect mounting hardware of modules, sub assemblies & their electrical connections for any slackness by seeing changes in torque markings, if any disturbance found in torque markings, re-tight the hardware & mark with nail paint.
- If any hardware is missing, Assemble new hardware & apply required torque.

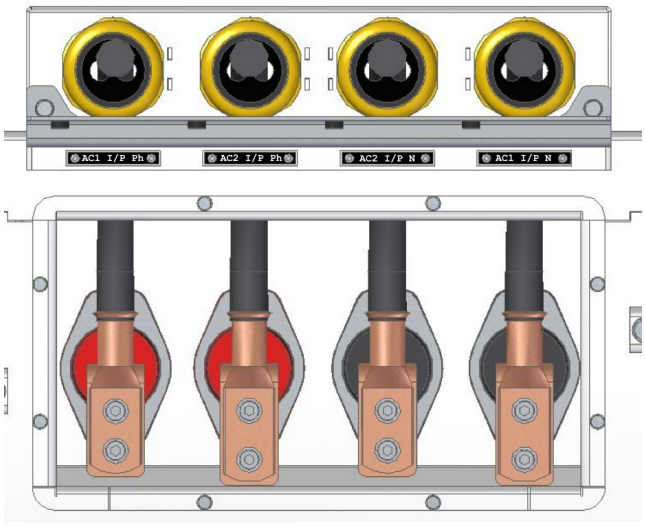
1.11.9 Inspection of external electrical & ground connections

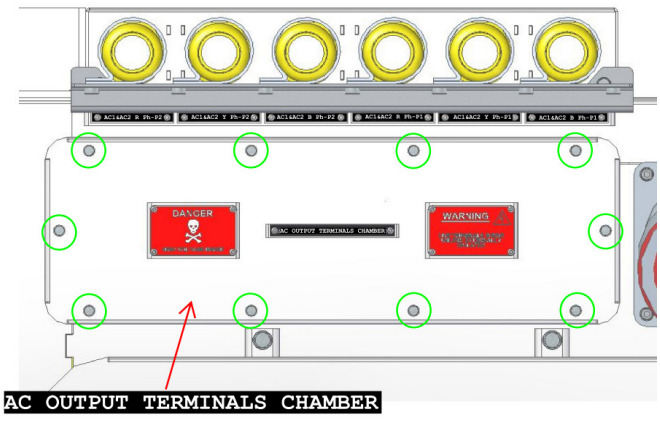
- Check all external electrical connections and ground connections for corrosion to resolve. Ensure connections are tight.

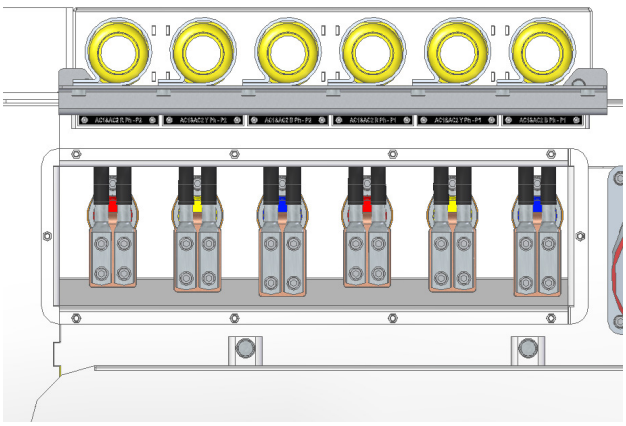


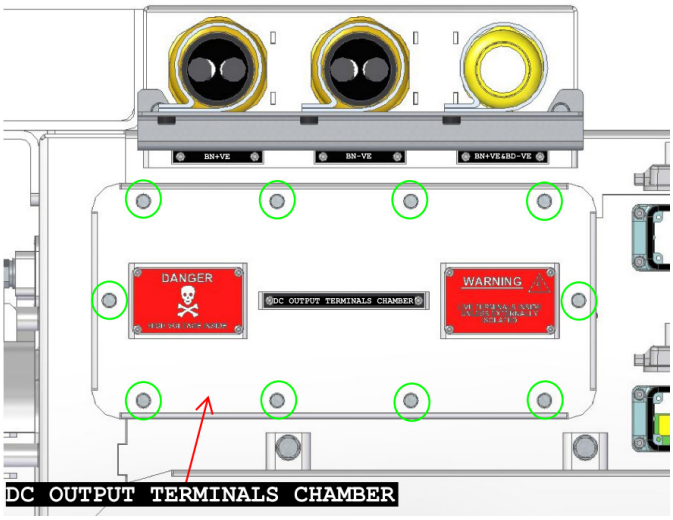
- For accessing external electrical connections, Open the Input terminal chamber, AC output terminals chamber & DC output terminals chamber.
- Open the terminal cover mounting hardware as shown below.

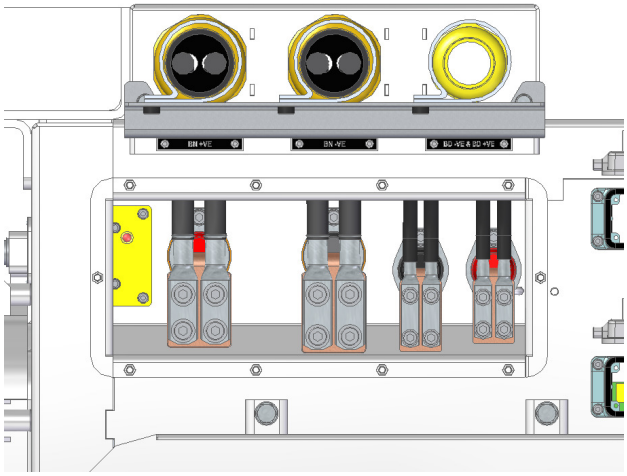










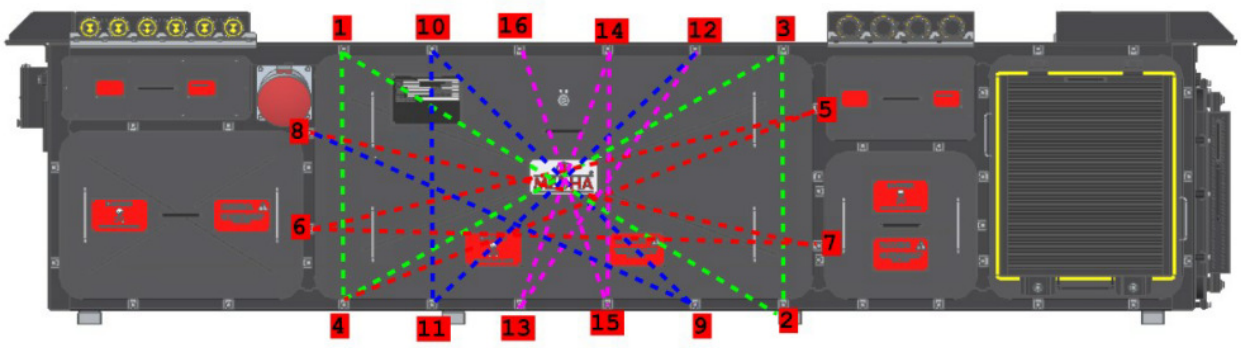


- Visually inspect lug mounting hardware for any slackness by seeing changes in torque markings, If any disturbance found in torque markings, re-tight the hardware, Apply required torque & mark with nail paint.
- Close the terminal cover, assemble the hardware & apply the required torque

1.11.10 Inspection of unit doors hardware

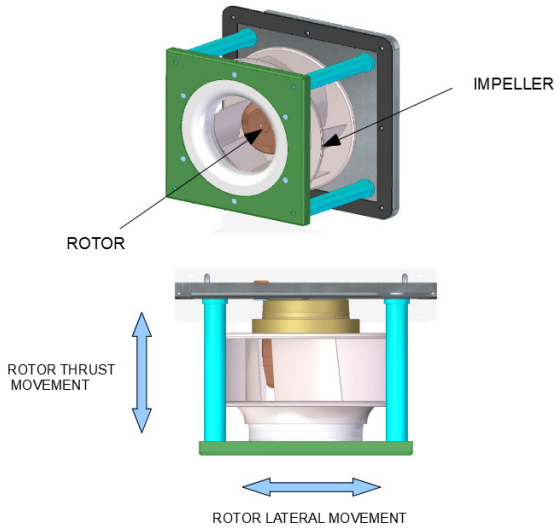
- Check all unit doors hardware are tight & intact with the unit. If any hardware is missing, assemble new hardware & Apply the torque.
- If hardware is loose, Tight it & apply torque.

Note: Follow below mentioned sequence for tightening door hardware & applying torque.



1.11.11 Inspection of blower

- Open blower service chamber door by following chapter 1.16.
- Ensure that thrust moment of the Rotor to be examined by pushing the rotor towards the stator, thus any abnormal action / loose moment (week spring action) will be found.
- Relative lateral movement of Rotor over the Stator to be verified by moving the Rotor assembly To and Fro (or) left to right direction, thus any abnormal action / loose moment, (Increased Bearing clearance / Bearing deterioration action) will be found.
- After examining the above points, If any occurrences are noticed then replace with new blower.



- Clean the blower by following chapter 1.12.3.
- Collect the accumulated dust from the blower service chamber.
- Close blower service chamber door by following chapter 1.16.

1.11.12 Inspection of components & cables

- Ensure all components & cables are free from damage. If found, replace them.

1.11.13 Inspection of excessive temperature and arcing (Voltage flash overs).

- Do visual inspections for evidence of excessive temperature, burns and arcing (Voltage flash overs) and resolve it.

1.11.14 Inspection of cable ties

- Ensure all cables ties are tight & intact. If any cable tie found loose, replace it with new one.

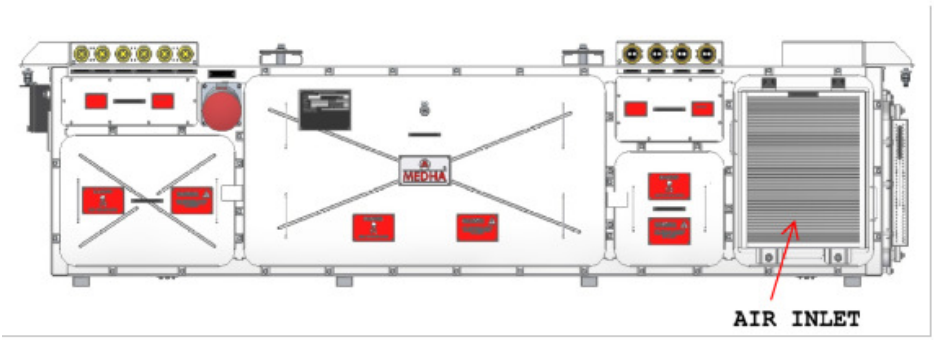
1.11.15 Inspection of all internal electrical connections

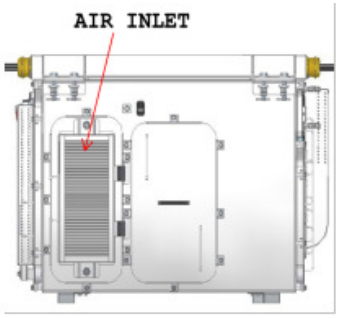
- Ensure all internal electrical connections (Terminals, lugs) are tight & intact. If found, tight them & apply required torque.

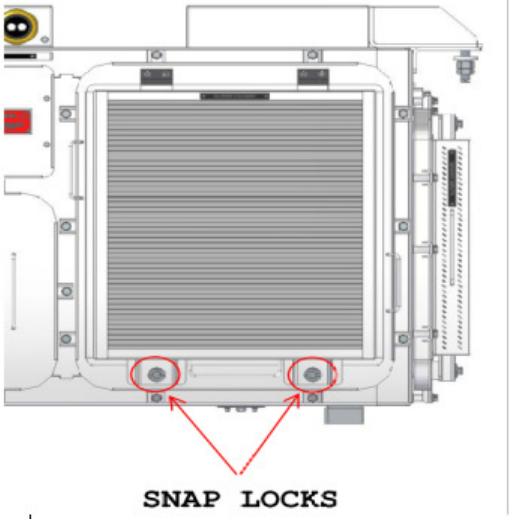
1.12 Cleaning

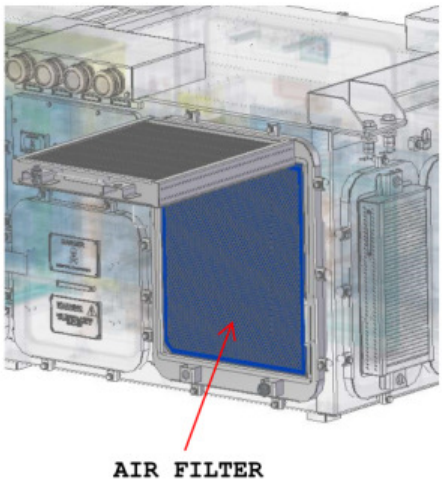
1.12.1 Filters cleaning procedure

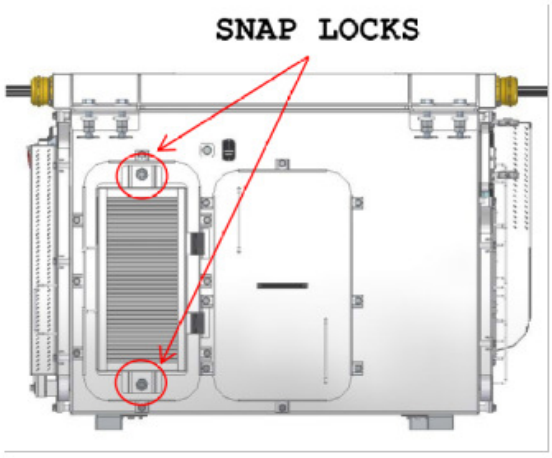
- For accessing filters, Press the snap locks shown below & open the louver assembly doors.
- Remove the filters from the unit.
- Ensure inlet air filters are not torn out or damaged. If found damaged, replace with new one.
- If filters are OK, Clean the filters.

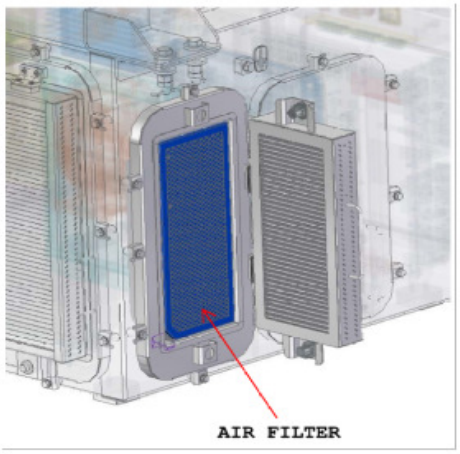






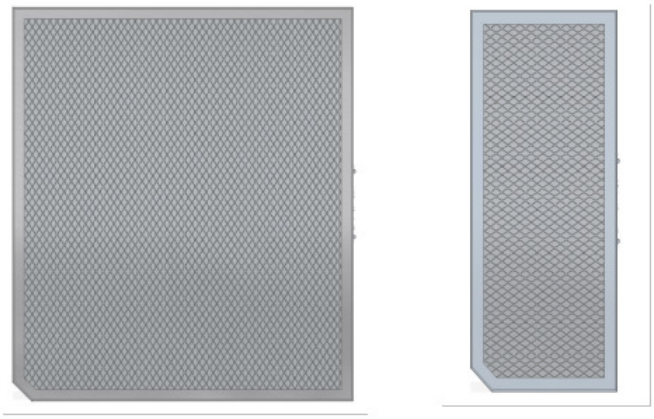




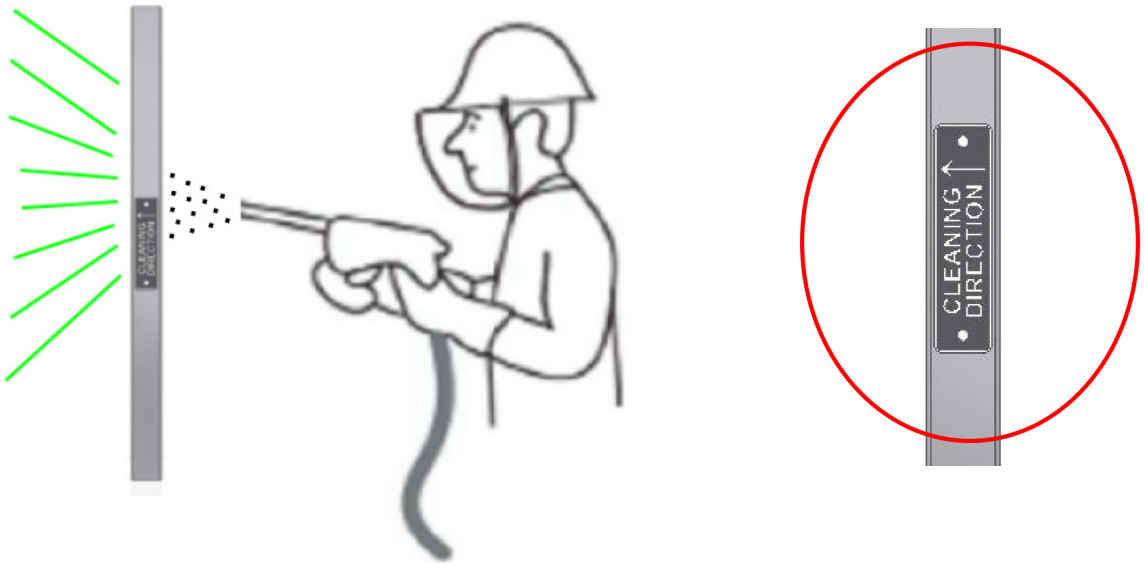


1.12.1.1 Cleaning with forced air

Note: Ensure electronics zone is closed while cleaning of filters.



- For every 30 days clean the inlet filters with forced air as shown below
  Note: Cleaning direction should be as shown below otherwise it will choke the filter further.



- After cleaning, Place the filters in the door pockets, close the louver assembly & push it till the snap locks gets engaged with the door properly.

1.12.1.2 Cleaning with forced water

Note: Ensure electronics zone is closed while cleaning of filters.

- For every 180 days clean the inlet filter with pressurized water in the direction shown below, till the filter is free from dirt, dust & other debris. Apply pressurized air on to filter to remove entrapped water particles.
  Note: Cleaning direction should be as shown below otherwise it will choke the filter further.

- After cleaning, Place the filters in the door pockets, close the louver assembly & push it till the snap locks gets engaged with the door properly.

1.12.2 Magnetics cleaning procedure

- Clean the magnetic surface (i.e.,outer surface, terminals and other accessible dust deposited surfaces) with soft brush only.
- Remove the accumulated dust with vacuum cleaner.

Note: Ensure electronics zone is closed with door while cleaning of magnetics.

1.12.3 Blower cleaning procedure

- Open blower service chamber door by following chapter 1.16.
- Clean the Impeller blades, Rotor surface and cone assembly with soft brush.
- Collect the accumulated dust from the blower chamber.
- Take lint free cloth dipped in isopropyl alcohol & wipe the Impeller blades, Rotor surface and cone assembly.
- Close blower service chamber door by following chapter 1.16.

1.12.4 Name plates & external cleaning

- Clean all doors, name plates & all external components.

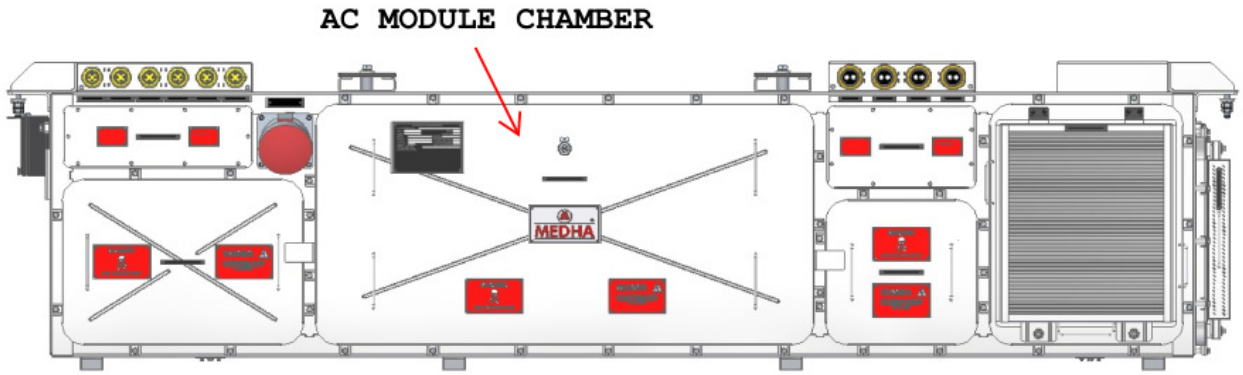
1.13 List of Line Replaceable Units (LRU's)

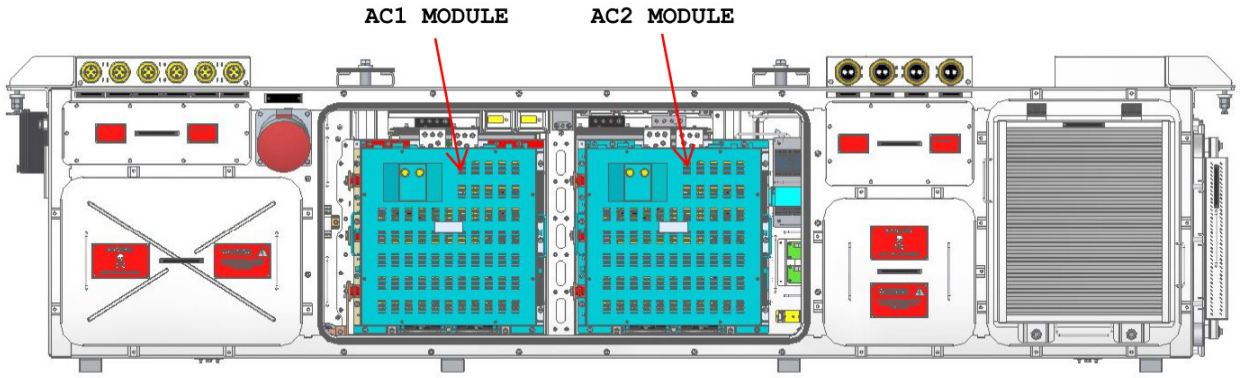
1. AC module
2. DC-DC module
3. Blower
4. Load sharing inductor
5. Sine filter inductor
6. DC-DC transformer
7. DC output inductor
8. IO cards

1.13.1 AC module

1.13.1.1 AC module replacement procedure

- For accessing key-B refer Interlocking section 1.9
- Open the door lock with key-B.
- Open the door mounting hardware and Place the door aside (AC module chamber door is shown in below image.)





a) Unplug the electrical connectors

b) Remove electrical busbar connections

c) Remove earth connection

d) Remove the module mounting hardware (M8 socket screws) using extended Allen key

e) Remove the module mounting stays hardware & remove the stays.

f) Remove the module and replace with the new module

g) Mount the module mounting hardware & apply required torque.

h) Plug all electrical connectors.

i) Mount all electrical bus-bar & earth connections & apply torque.

j) Do the inspection of door gasket as per chapter 1.11.6

k) Do the inspection of intumescent seal as per chapter 1.11.4

l) Do the inspection of silica gel as per chapter 1.11.5

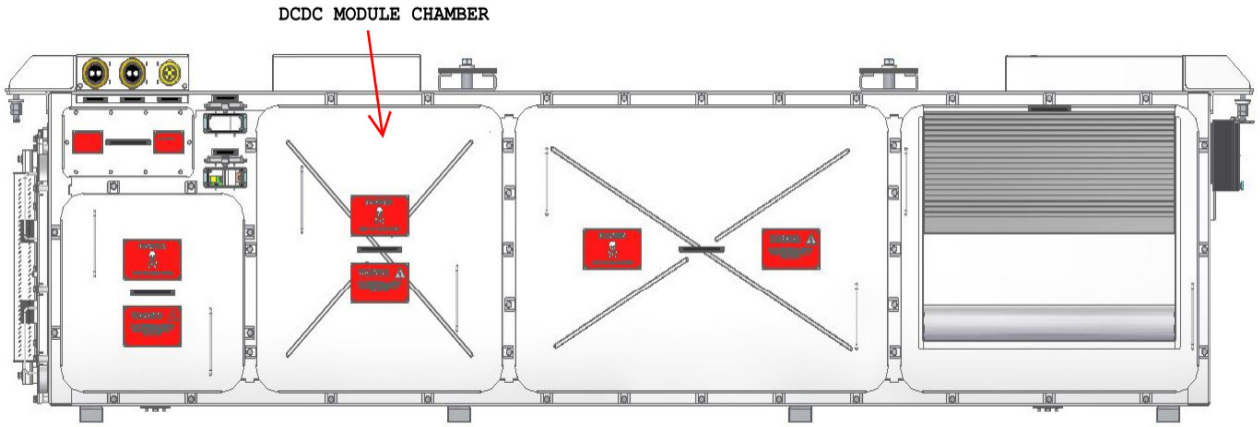
m) Clean & assemble the AC module chamber door & apply required torque.

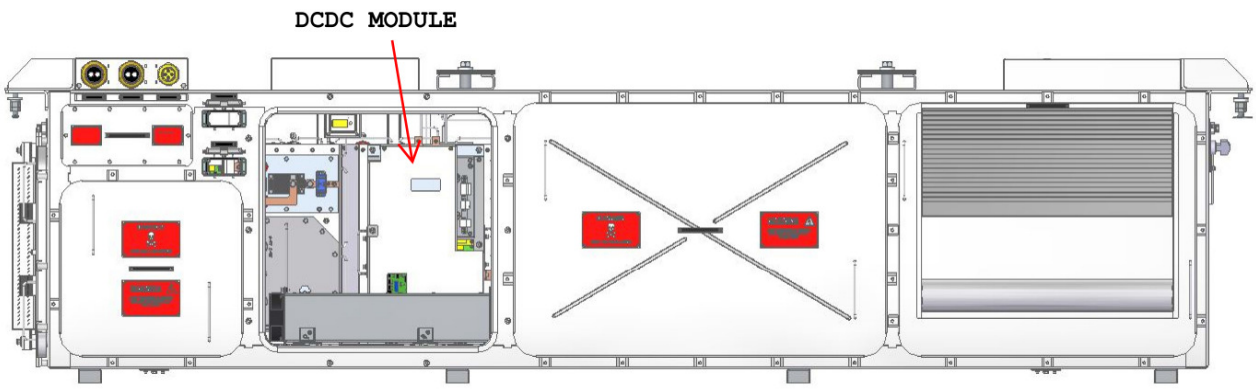
n) Do the inspection of unit doors hardware as per chapter 1.11.10

1.13.2 DC-DC Module

1.13.2.1 *DC-DC Module replacement procedure*

- Open the door mounting hardware and Place the door aside (DCDC module chamber door is shown in below image.)
- Disconnect the churning fan wires & open the churning fan duct assembly hardware & remove churning fan duct assembly from the unit.



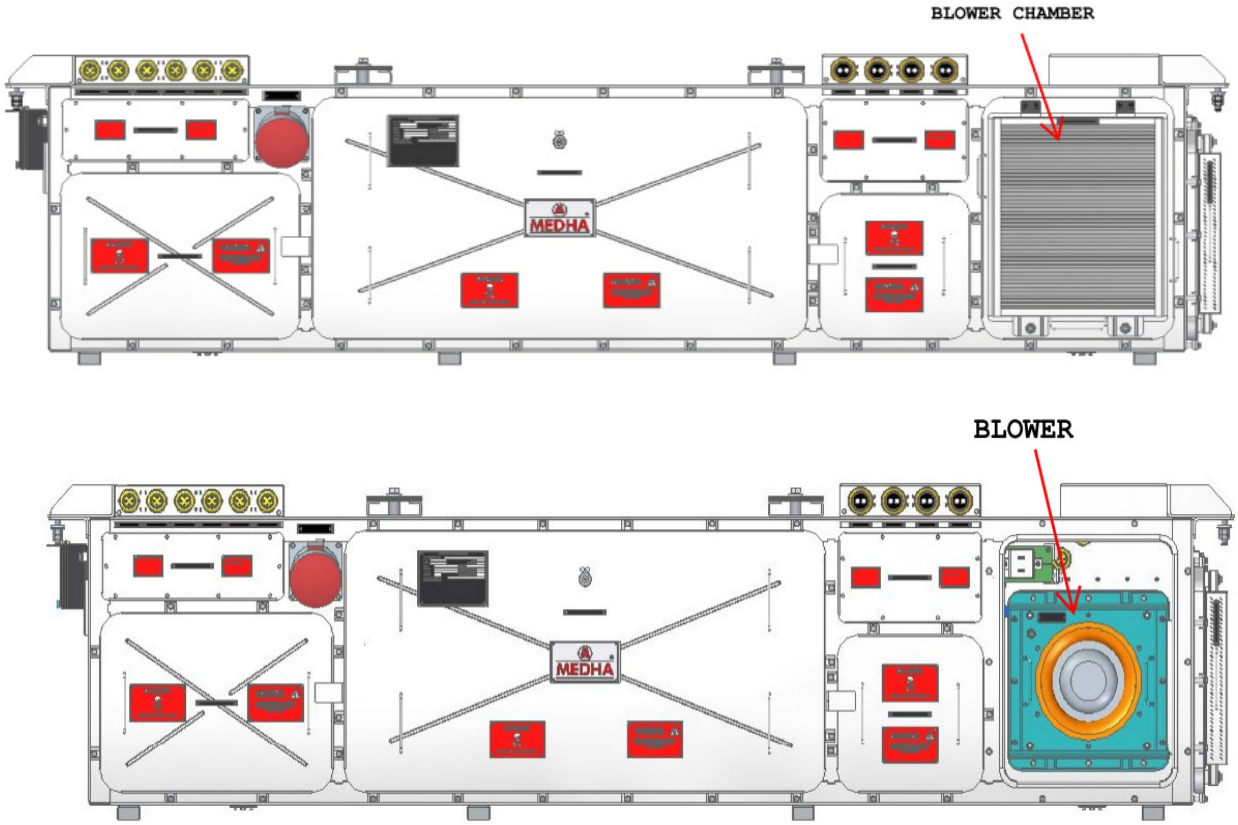


a) Unplug the electrical connectors
b) Remove electrical bus-bar connections
c) Remove earth connection
d) Remove the module mounting stays hardware & remove the stays.
e) Remove the module mounting hardware using extended allen-key.
f) Remove the module and replace with the new module
g) Mount the module mounting hardware & apply required torque.
h) Mount module mounting stays, its hardware & applied required torque.
i) Plug all electrical connectors.
j) Mount all electrical bus-bar & earth connections & apply torque.
k) Mount the churning fan duct assembly, its hardware & apply required torque.
l) Connect the churning fan wires.
m) Do the inspection of door gasket as per chapter 1.11.6
n) Do the inspection of intumescent seal as per chapter 1.11.4
o) Do the inspection of silica gel as per chapter 1.11.5
p) Assemble the DCDC module chamber door & apply required torque.
q) Do the inspection of unit doors hardware as per chapter 1.11.10

1.13.3 Blower

1.13.3.1 *Blower replacement procedure*

- Open the door mounting hardware and Place the door aside (Blower chamber door is shown in below image.)

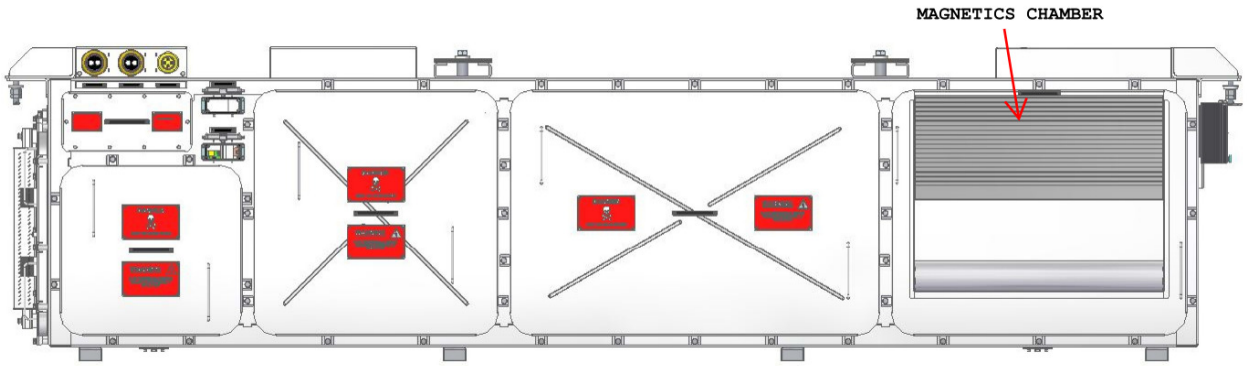


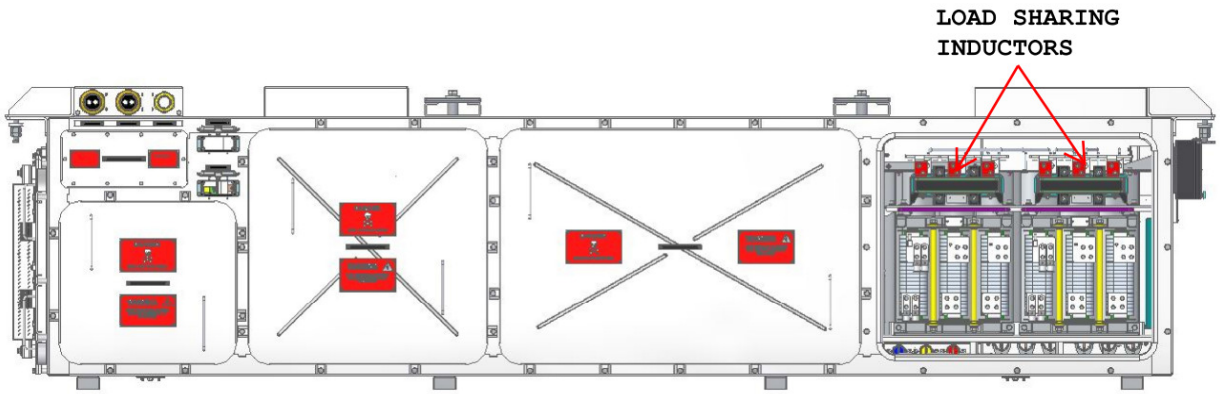
a) Disconnect the blower cables from the TB.
b) Open the blower mounting hardware using extended allen-key.
c) Remove the blower from the unit & replace with new one.
d) Assemble the mounting hardware of blower & apply necessary torque.
e) Connect the blower cables at their respective locations.
f) Clean & collect the accumulated dust from the blower chamber.
g) Do the inspection of door gasket as per chapter 1.11.6
h) Clean & assemble the blower chamber door & apply necessary torque.
i) Do the inspection of unit doors hardware as per chapter 1.11.10

1.13.4 Load sharing inductor

1.13.4.1 Load sharing inductor replacement procedure

- Open the door mounting hardware and Place the door aside (magnetics chamber door is shown in below image.)



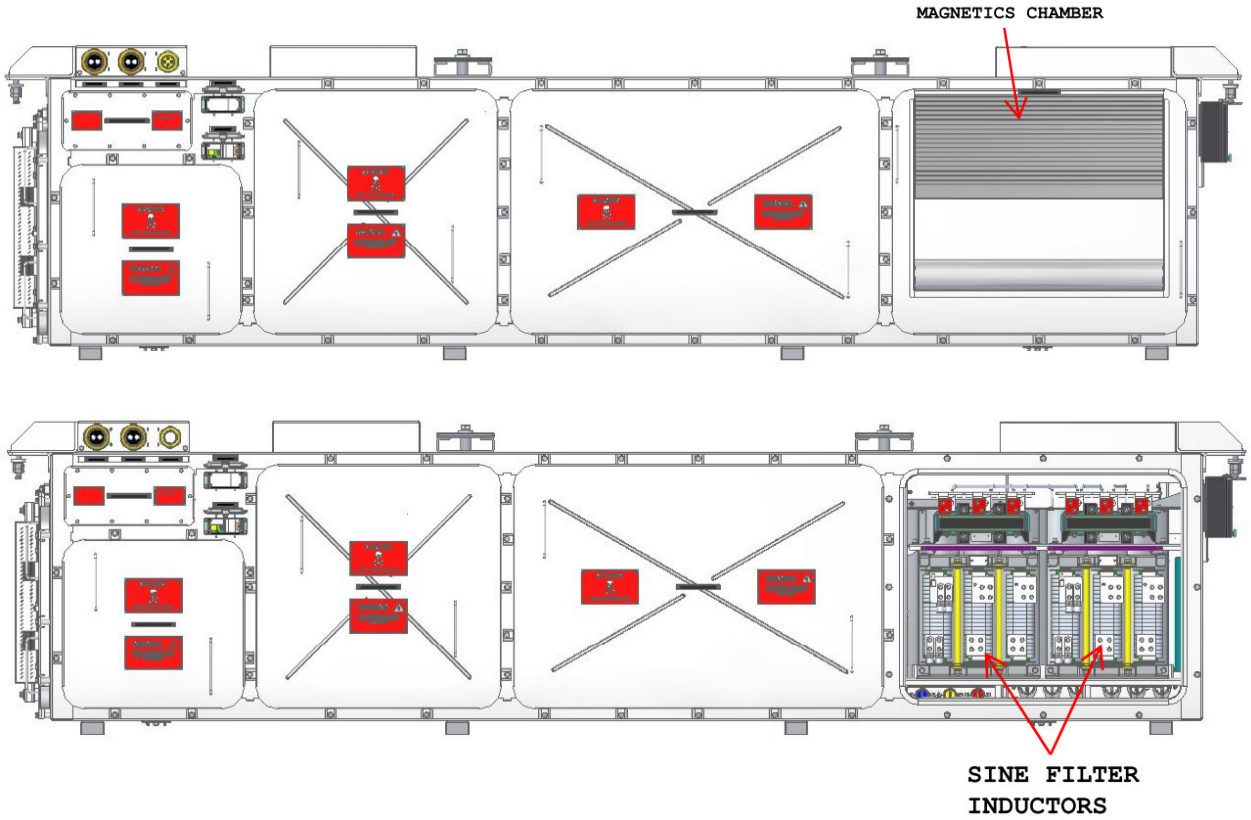


a) Open the load sharing inductor cables hardware.
b) Open the load sharing inductor mounting hardware.
c) Remove the load sharing inductor from the unit & replace with new one.
d) Assemble the mounting hardware of load sharing inductor & apply necessary torque.
e) Assemble the cables mounting hardware of load sharing inductor & apply necessary torque.
f) Do the inspection of door gasket as per chapter 1.11.6
g) Clean & assemble the Magnetics chamber door & apply necessary torque.
h) Do the inspection of unit doors hardware as per chapter 1.11.10

1.13.5 Sine filter inductor

1.13.5.1 *Sine filter inductor replacement procedure*

- Open the door mounting hardware and Place the door aside (magnetics chamber door is shown in below image.)

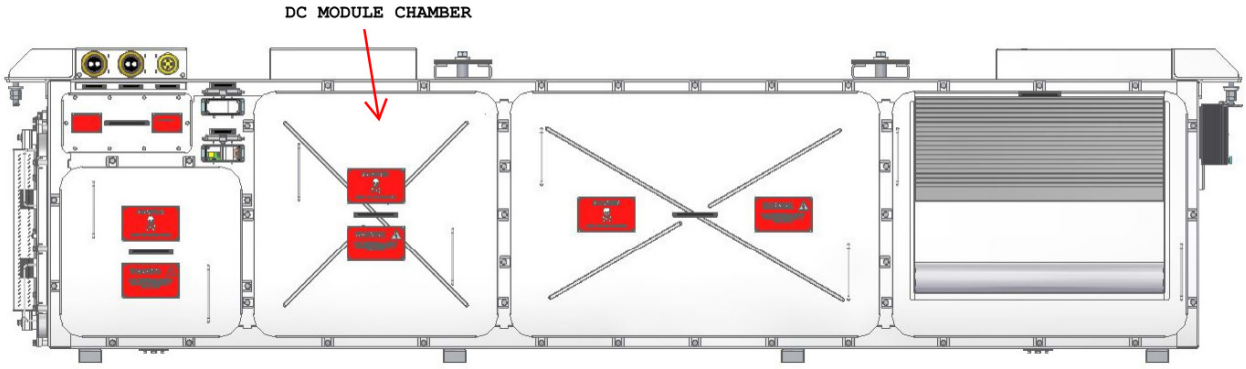


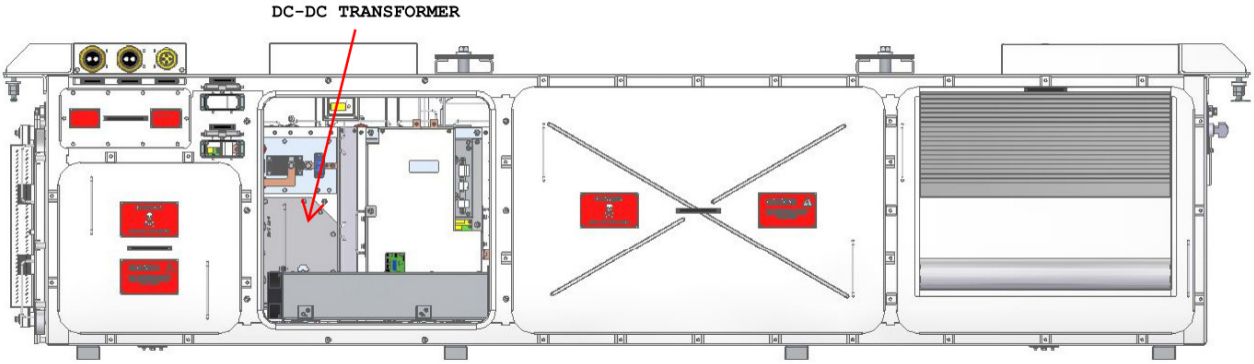
a) Open sine filter inductor cables hardware.
j) Open sine filter inductor mounting hardware.
k) Remove the sine filter inductor from the unit & replace with new one.
l) Assemble the mounting hardware of sine filter inductor & apply necessary torque.
m) Assemble the cables mounting hardware of sine filter inductor & apply necessary torque.
n) Do the inspection of door gasket as per chapter 1.11.6
o) Clean & assemble the Magnetics chamber door & apply necessary torque.
a) Do the inspection of unit doors hardware as per chapter 1.11.10

1.13.6 DC-DC transformer

1.13.6.1 *DC-DC transformer replacement procedure*

a) Open the door mounting hardware and Place the door aside (DC chamber door is shown in below image.)



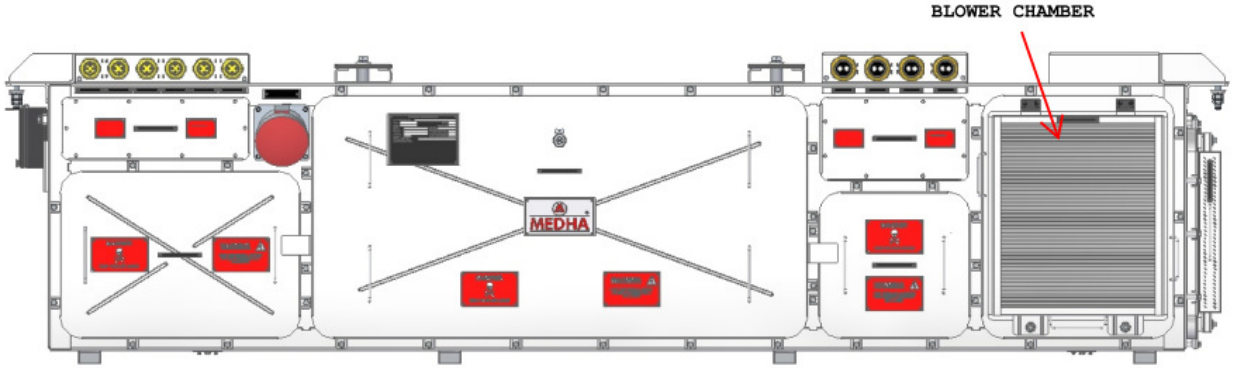


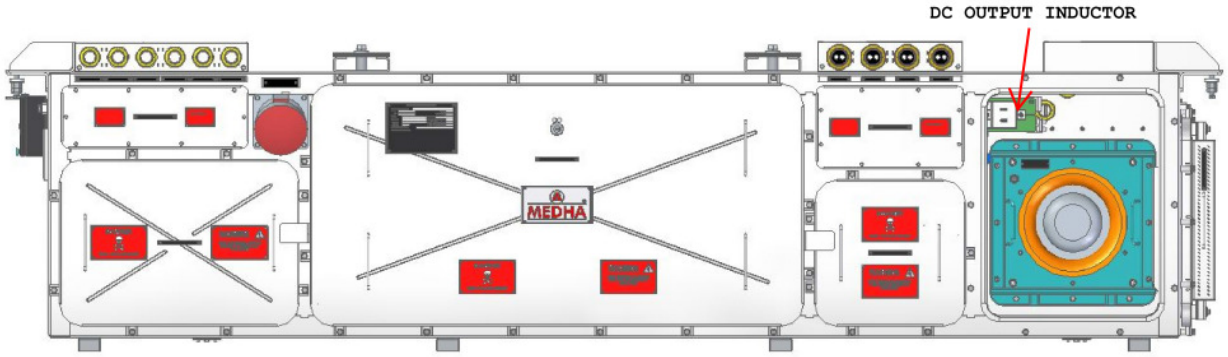
a) Open the DC-DC transformer cables hardware.
b) Open DC-DC transformer mounting hardware.
c) Remove the DC-DC transformer from the unit & replace with new one.
d) Assemble the mounting hardware of DC-DC transformer & apply necessary torque.
e) Assemble the cables mounting hardware of DC-DC transformer & apply required torque.
f) Do the inspection of door gasket as per chapter 1.11.6
g) Do the inspection of intumescent seal as per chapter 1.11.4
h) Do the inspection of silica gel as per chapter 1.11.5
i) Clean & assemble the Blower chamber door & apply required torque.
j) Do the inspection of unit doors hardware as per chapter 1.11.10

1.13.7 DC output inductor

1.13.7.1 *DC output inductor replacement procedure*

- Open the door mounting hardware and Place the door aside (Blower chamber door is shown in below image.)



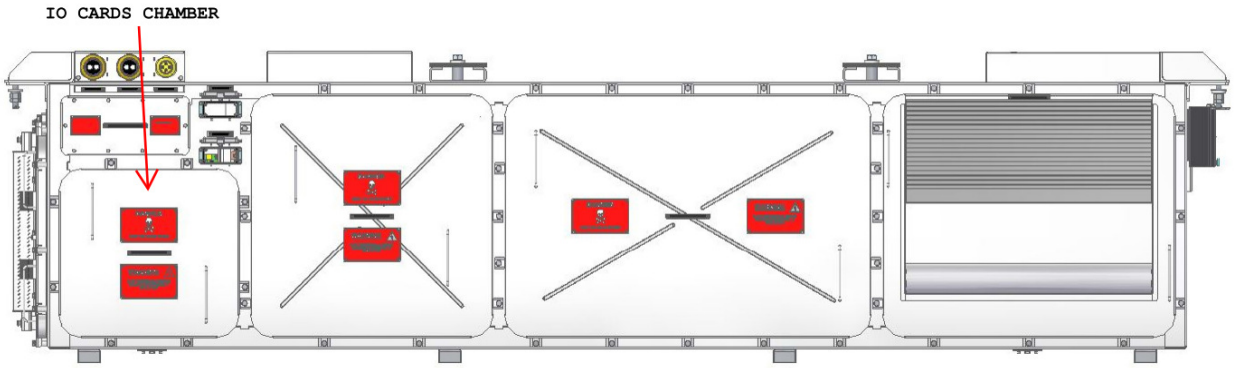


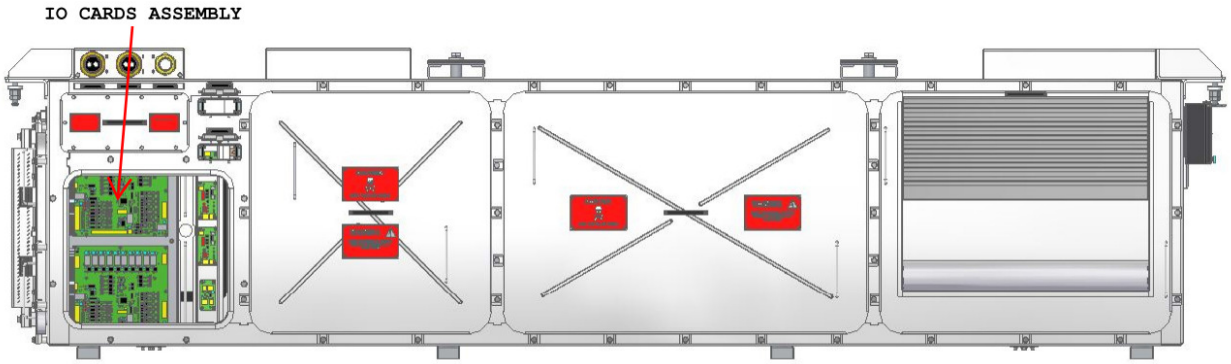
k) Open the DC output inductor cables hardware
l) Open DC output inductor mounting hardware.
m) Remove the DC output inductor from the unit & replace with new one.
n) Assemble the mounting hardware of DC output inductor & apply necessary torque.
o) Assemble the cables mounting hardware of DC output inductor & apply necessary torque.
p) Do the inspection of door gasket as per chapter 1.11.6
q) Clean & assemble the Blower chamber door & apply necessary torque.

1.13.8 IO cards

1.13.8.1 *IO cards replacement procedure*

- Open the door mounting hardware and Place the door aside (IO cards chamber door is shown in below image.)



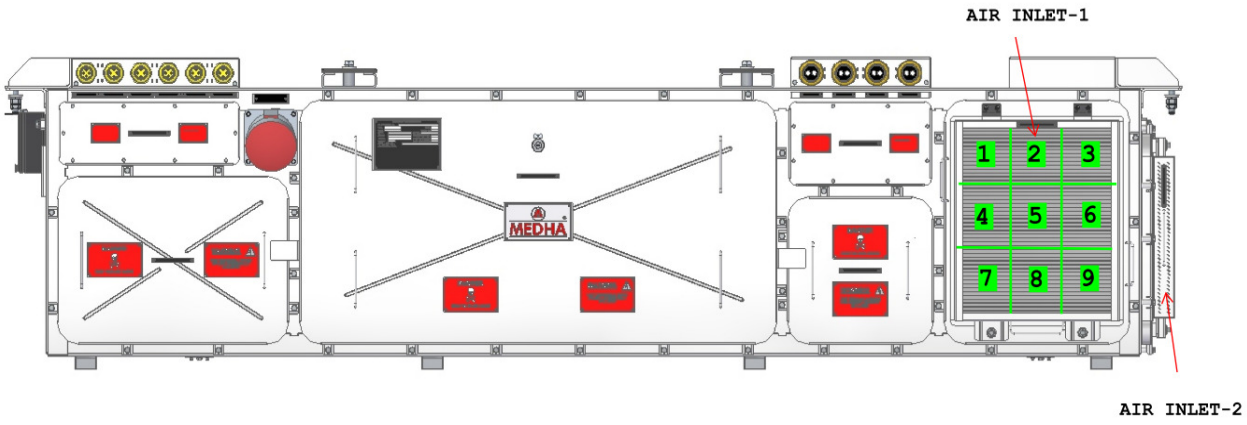


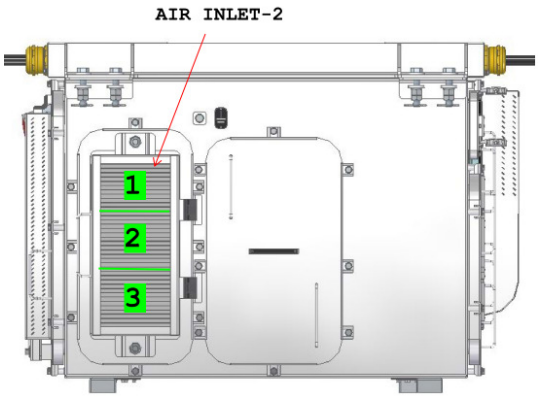
a) Disconnect the IO cards cables, unplug connectors
b) Remove IO cards assembly mounting hardware.
c) Remove the IO cards assembly from the unit & replace with new one.
d) Assemble the mounting hardware of IO cards assembly & apply necessary torque.
e) Connect the IO cards cables & plug the connectors in their respective locations.
f) Do the inspection of door gasket as per chapter 1.11.6
g) Do the inspection of intumescent seal as per chapter 1.11.4
h) Do the inspection of silica gel as per chapter 1.11.5
i) Clean & assemble the IO cards chamber door & apply necessary torque
j) Do the inspection of unit doors hardware as per chapter 1.11.10

1.14 Maintenance of Heat Sinks

No maintenance is required for the Heat sinks. In case if any Heat Sink thermal performance degradation is identified through temperature rise or shutdowns in the converter even if the blower motor is running in the right direction, Then measure the inlet air velocities as per below,

- Average air velocities should as follows,
- Check the inlet air velocity at 9 locations on the air inlet-1 door & ensure average velocity should be ≥ **2 m/s**.
- Check the inlet air velocity at 3 locations on the air inlet-2 door & ensure average velocity should be ≥ **1.5 m/s**.





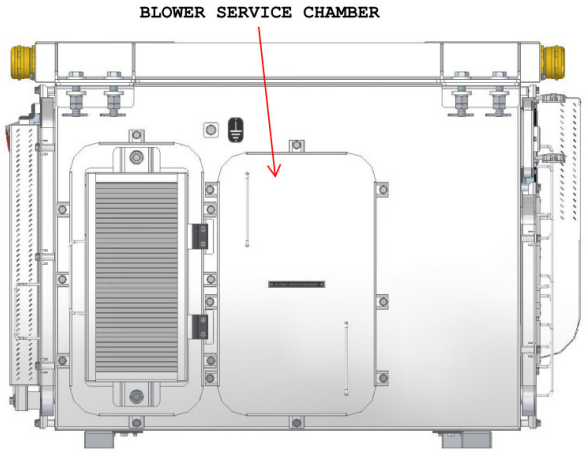
- If average inlet air velocities are less than the specified limit, Then remove the Heat Sink module and clean it as per the procedure given below.

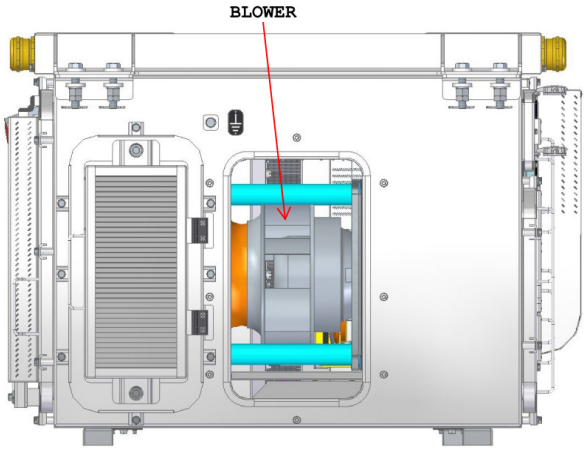
1.15 Heat sink cleaning

- Remove the modules from the unit as per procedure mention for removing and replacing LRU's
- Clean the Heat sink fins with brush.
- Clean the fins with vacuum cleaner for removing the dirt from fins.
- Clean the fins with lint free cloth dipped in ISO-propyl alcohol. While performing this activity dust & ISO-propyl should not enter into the Electronics Zone.
- Verify all modules gaskets & intumescent seals, Replace them if any damages found.

1.16 Blower service door opening & closing procedure

- Open blower service chamber door hardware, remove the door & keep aside.





- Perform the task & ensure accumulated dust is collected.
- Clean & assemble the blower service chamber door & apply necessary torque.

AUXILIARY CONVERTER FOR TRAIN 18V2

TYPE MAE 675 UV2

Medha Servo Drives Pvt.Ltd.

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Doc No.: SD-8627	Rev. No.: 00	Pages: 18	Product Code: MAE675UV2	
Title: Maintenance Manual of Driver Console – TRAIN 18				
Prd By: HANMA	Chkd By: KALYAN	Appd By: RAMARAJU	Date	Date
Sign: HANMA	Sign: KALYAN	Sign: RAMARAJU	18.08.2022	18.08.2022

Tables of figures

TYPE MAE675UV2

DRIVER CONSOLE

1. Introduction

This document deals with the maintenance of the Train 18 Driver Console , which is located in nose

cone of the Driving trailer coach of the train 18 (Figure 1). Within the document it is described in detail which and how the maintenance activities shall be carried out.

1.1 Overview

Figure 1 shows driver cab where the driver console and driver seat are located.

The driver console is located at the front side of the drive cab.

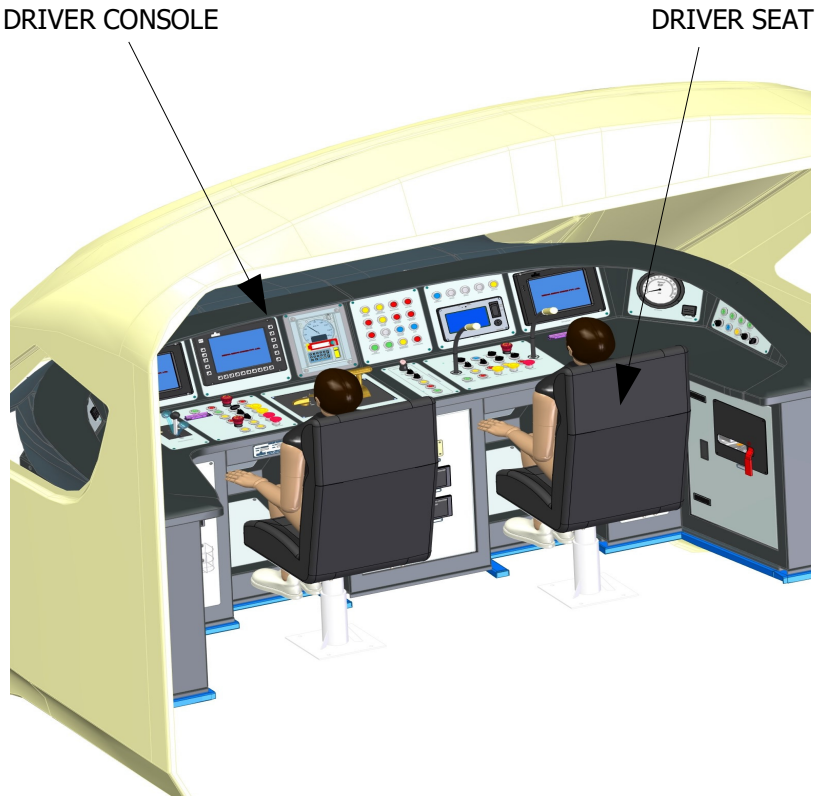


Figure 1: Overview of driver cab

Driver console is divided into two parts one is driver side and second is the guard side. Driver side contains the left operating panel, front operating & indication panel and right communication panel whereas guard side contains the front operating panel and side operating panel.

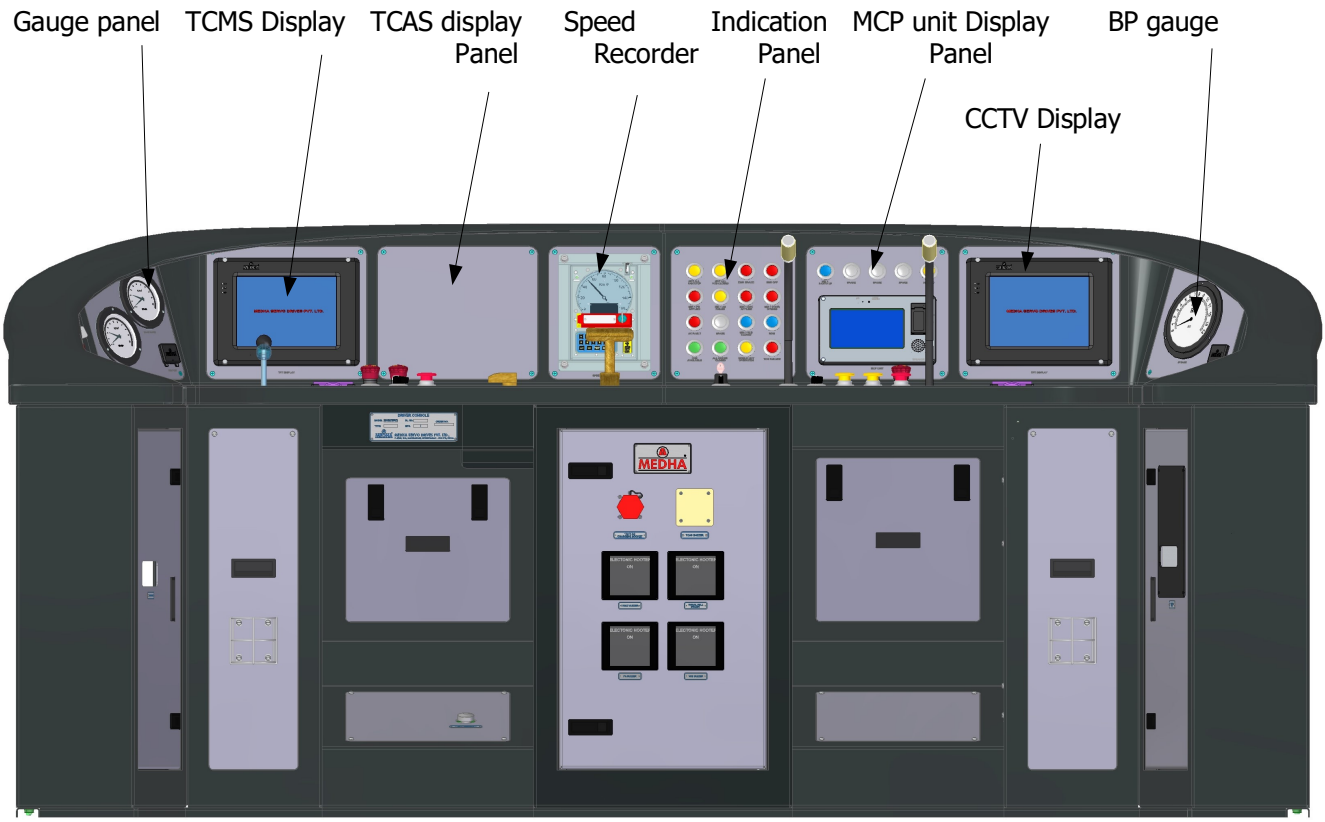


Figure 2 : Overview of components in Driver Console

1.2 Covers for maintenance

The different components of the driver console can be accessed through the covers tagged in figure 3 below.

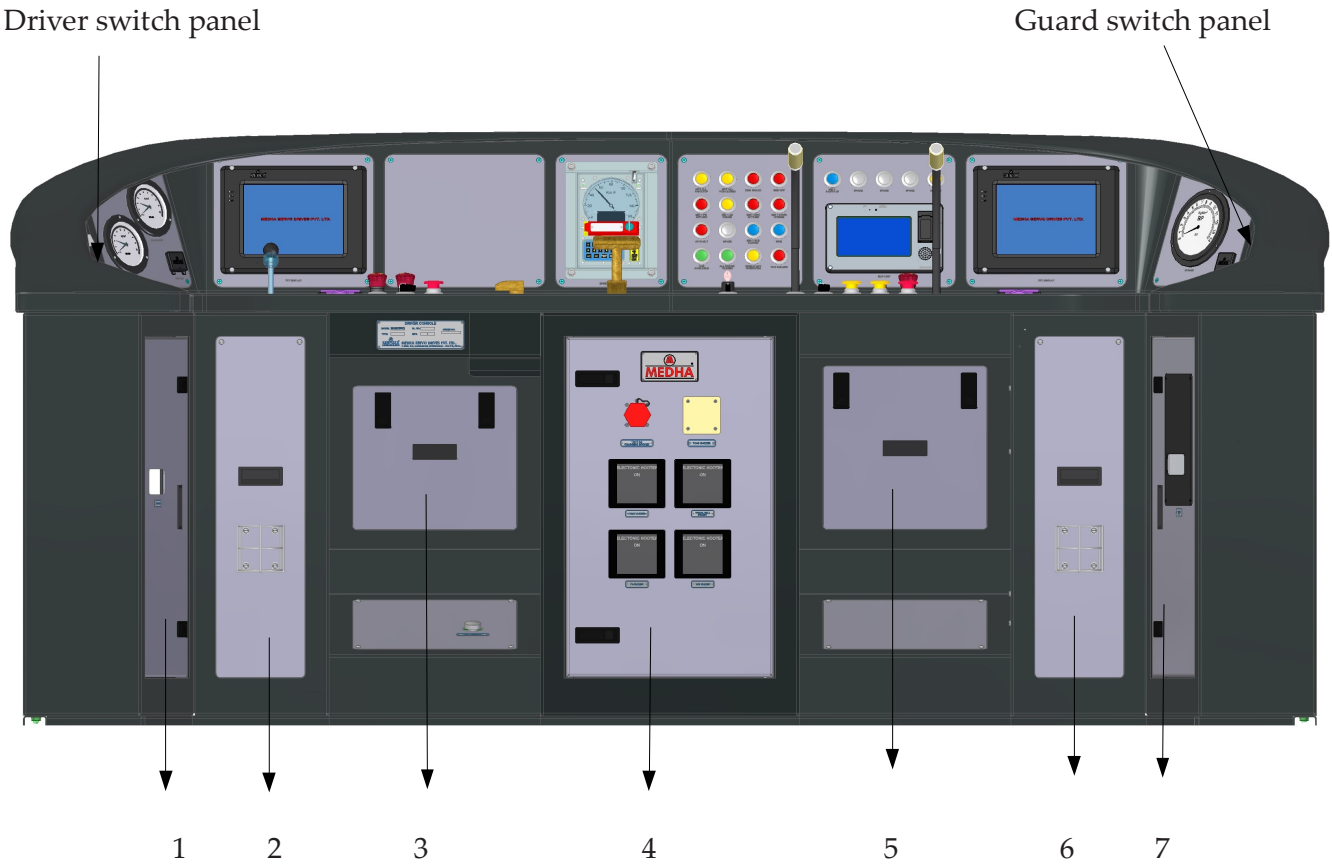


Figure 3: Covers for Maintenance

1.3 Covers 1, 2, 3, 4,5,6 and 7

Removing covers

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Open all Compression latches (Figure 4) by hand press

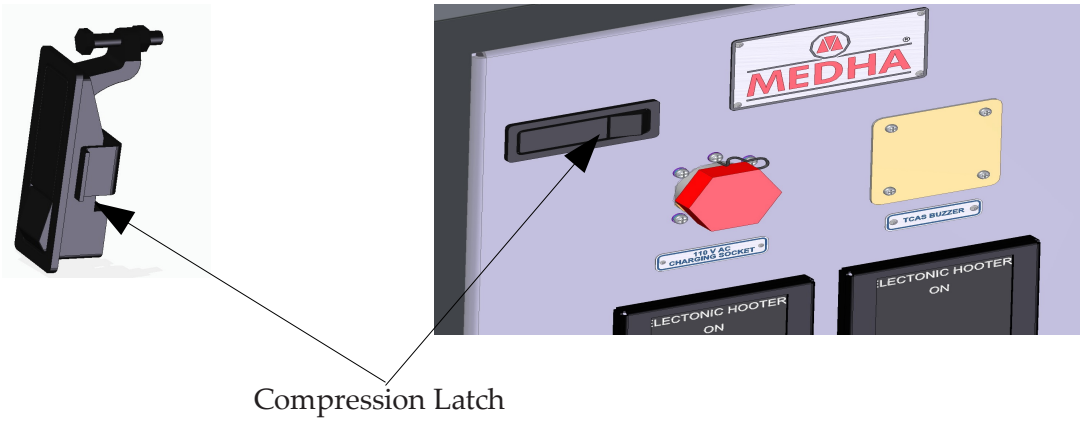


Figure 4: Example of Compression latches

1.4 Mounting of covers

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Close all Compression latches (Figure 4) by hand press.

1.5 Tools

Every special tool which is required for maintenance will be specified within the chapter
describing the activity. If no tools are specified only standard tools are required.

1.6 List of Tools

1. M4 allen key _ for Harting connectors
2. M5 allen key _ for TFT Display units
3. M6 allen key _ for FGU, Flasher light unit
4. M8 allen key _ for wiper motor
5. M10 allen key _ for D0 panels assy.
6. Star screw driver_for switch panels & Indicaton panels

1.7 References

The document references listed under each maintenance activity should be treated as guidance. These documents contain information that simplifies the maintenance, but they are not always required in order to be able to perform the activity.

1.8 Cable ties

All cable ties (straps) removed during the maintenance work shall be replaced by new ones of the same type and size.

2. Safety instructions

WARNING - High voltage 3000 V

WARNING - Burns - Risk of skin burns from hot components

WARNING - Particle contamination - Inhaling dust particles causes respiratory problems

To prevent accidents - do the following:

1. Put the train in duty position
2. Verify that there is no voltage remaining between DC+ & DC- by measuring with voltmeter.
3. Ensure the adequate cooling time has been allowed, if train has recently been running.
4. Use appropriate depot Personal Protective Equipment (PPE) when working with hot components and dusty environment.
5. Always wear a dust mask when working in dusty environments.

2.1 Personal safety

Before commencing any work on the vehicle the personnel shall always:

- Set the vehicle to the correct operating position for the task to be performed
- Study the necessary safety precautions within the documentation and on the Vehicle

2.2 Work on vehicle

When carrying out maintenance work on the vehicle, the instructions should be followed carefully.

1. Always use protective clothing and protective equipment.
2. Set the placard “Work in progress” or follow the employer instruction.
3. Before commencing work on the vehicle, ensure that all voltage is disconnected.
4. Lock switches, isolators, fuses etc. where work applicable.

Note!

Many systems can be operated from another location, which can lead to serious injury,

sometimes fatal, and cause damage to personnel and equipment.

2.3 Interlocking system

The propulsion equipment is secured by the key interlocking system. It ensures that the high voltage supply is always earthed before it is possible to get in contact with the equipment.

2.4 Stored charge checked

Attention!

Working with the high voltage equipment is potentially lethal!

Always ensure before starting to work that the stored charge in the equipment has been discharged.

3. Cleaning of Drivers Console

Tools Description Quantity

- Soft brush Local supply
- Dust mask Local supply
- Vacuum cleaner Local supply, ESD protected type

Consumption material Description Quantity

Lint-free cloth Local Supply Description

1. Attention! Examine the safety instructions within chapter 4 ahead of any activity
2. Clean Driver Console externally using cloth soaked with tap water. No additional detergents should be used.
3. Remove the covers 1-7 (see chapter 1.2).
4. Clean the entire internal housing and the equipment with the vacuum cleaner.
5. Visually inspect the entire box, enclosure walls, covers & welds for any damage or cracks.
6. Visually inspect all internal and external cable connections of the Driver console for damage.

7. Ensure that all glands and connectors are in good condition.

8. Visually inspect the screws securing the Driver console to the supporting beams. Ensure that all screws are present and tightened.

9. Refit the covers 1-7

10. Check the condition of hinges/brackets for the hinged assembly.

11. Note and report any defects found during the observations to the supervisor.

4. Maintenance of components

Within the following it is described how the maintenance activity of each component is carried out in detail.

4.1 Brake Controller

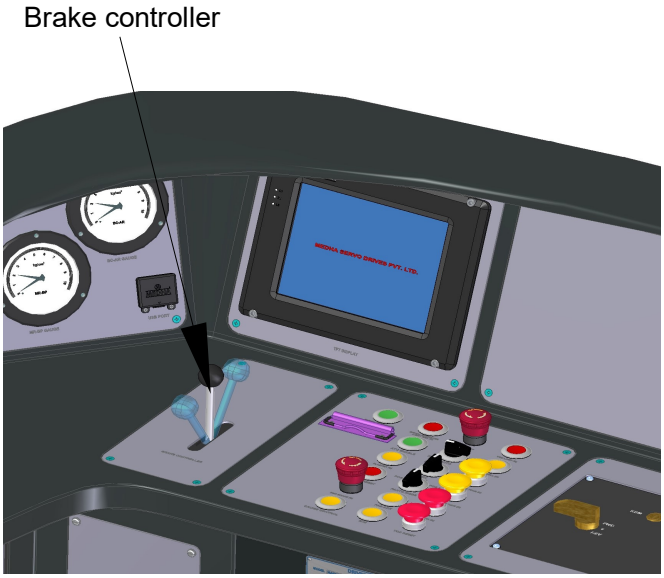


Figure 5: Brake controller

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Unscrew and remove the mounting panel.
3. Unscrew the fixing screws of Brake Controller.
4. Remove and replace the Brake Controller

4.2 Master controller

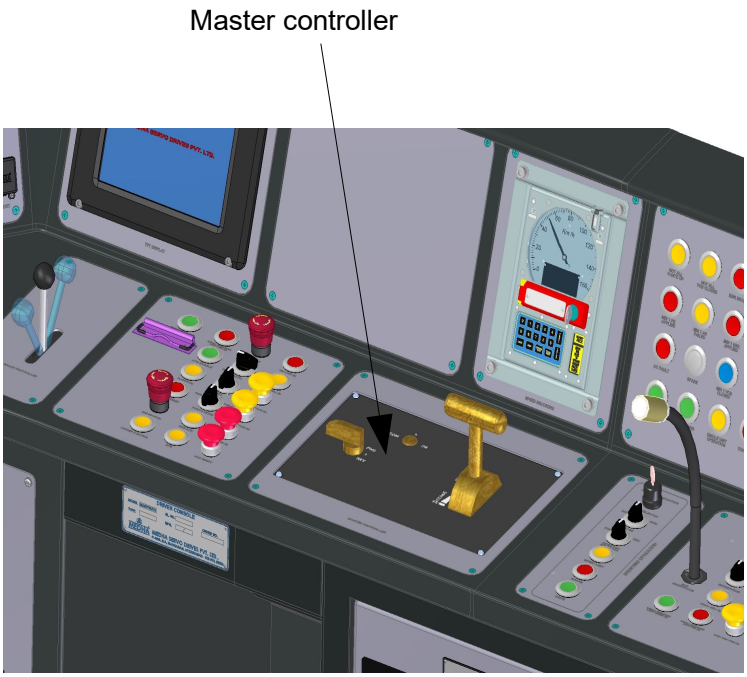


Figure 6: Master controller

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Unscrew and remove master controller from the mounting panel.
3. Remove and replace the Master Controller

4.3 TFT Display

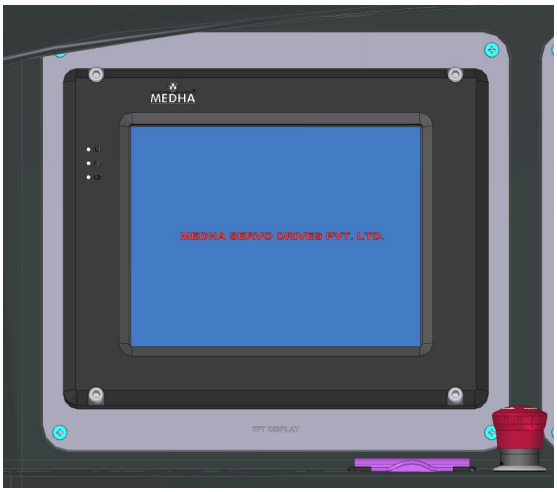
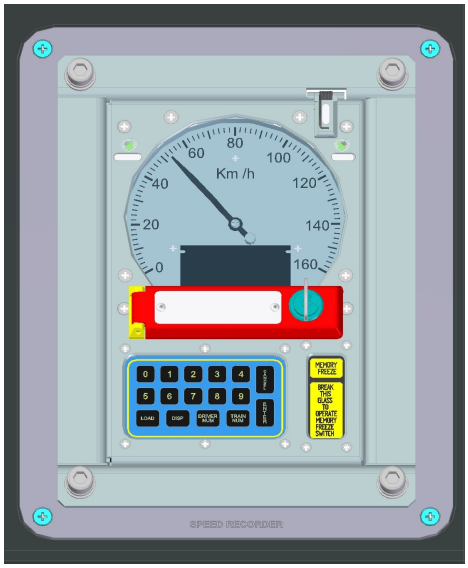


Figure 7: TFT Display

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Unscrew and remove TFT Display from the mounting panel.
3. Remove and replace the TFT Display



4.4 Speed recorder

Figure 8: Speed recorder

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Unscrew and remove Speed recorder from the mounting panel.
3. Remove and replace the Speed recorder

4.5 PIS Display

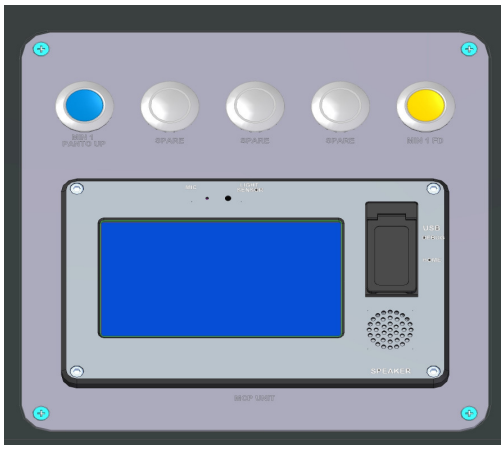


Figure 9: PIS Display

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Unscrew and remove PIS Display from the mounting panel.
3. Remove and replace the PIS Display

4.6 Pressure gauges

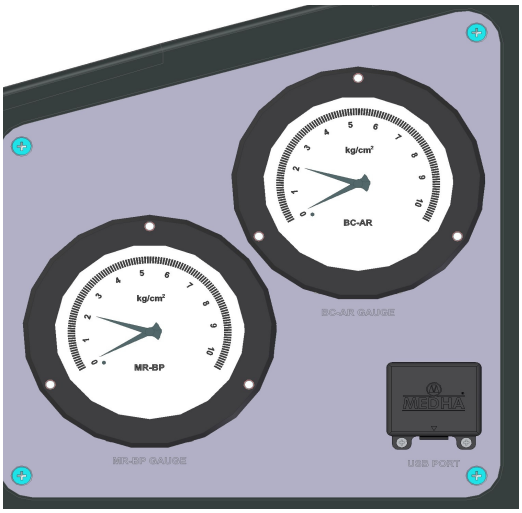
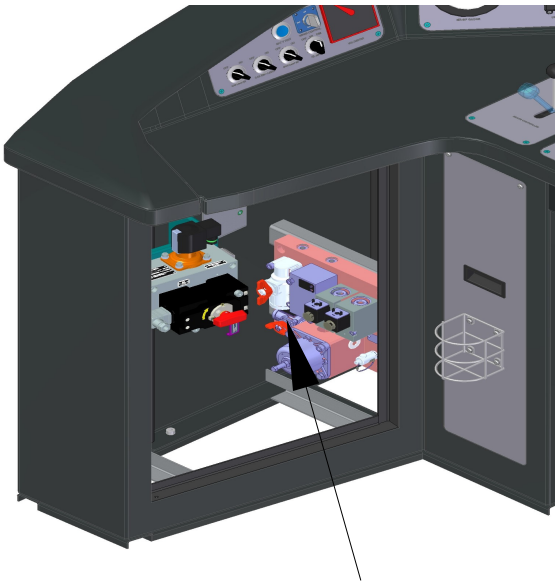


Figure 10: Pressure gauges

4. Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Unscrew from the mounting panel and remove pneumatic pipe connection.
3. Remove and replace the pressure gauges, which is required to change

4.7 Replacement of D0 panel assy.



D0 panel

Figure 11: D0 Panel

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Remove the Cover 1 & 2
3. Unlock and remove the cover plate from the bottom structure.
4. Unscrew the fixing screws of structure channel and D0 panel.
5. Remove and replace the D0 panel

4.8 Replacement of Flasher light control unit

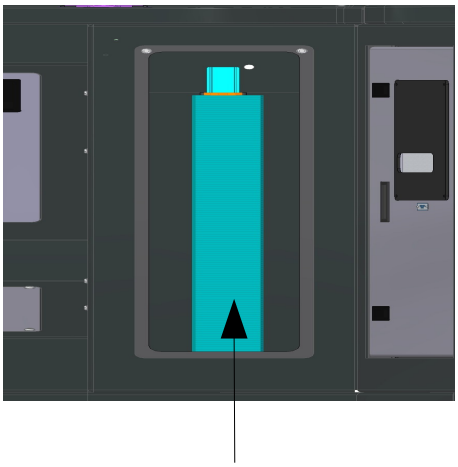
Flasher light unit

Figure 12: Flasher light unit

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Unlock and Remove the Cover 4
3. Unscrew and remove the Flasher light unit.
4. Remove and replace the Unit.

4.09 Repleacement of Terminal blocks



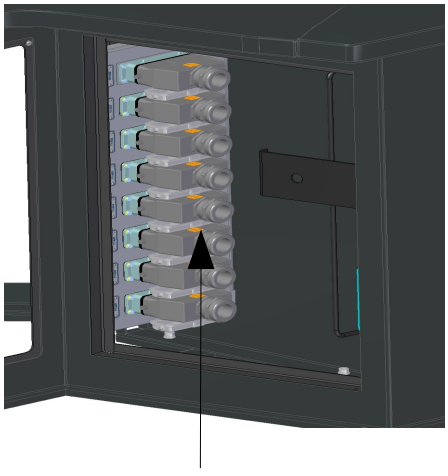
6.7. Terminal blocks

Figure 13: Terminal blocks

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Remove the Cover 6
3. Unclamp and remove the terminal blocks.
4. Remove and replace the same.

4.10 Repleacement of Harting connectors



Harting connectors

Figure 14: Harting connectors

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.

2. Remove the Cover 7

3. Unclamp and remove the Harting connectors.

4. Remove and replace the same.

4.11 Repleacement of TCAS EMY. ISO COCK

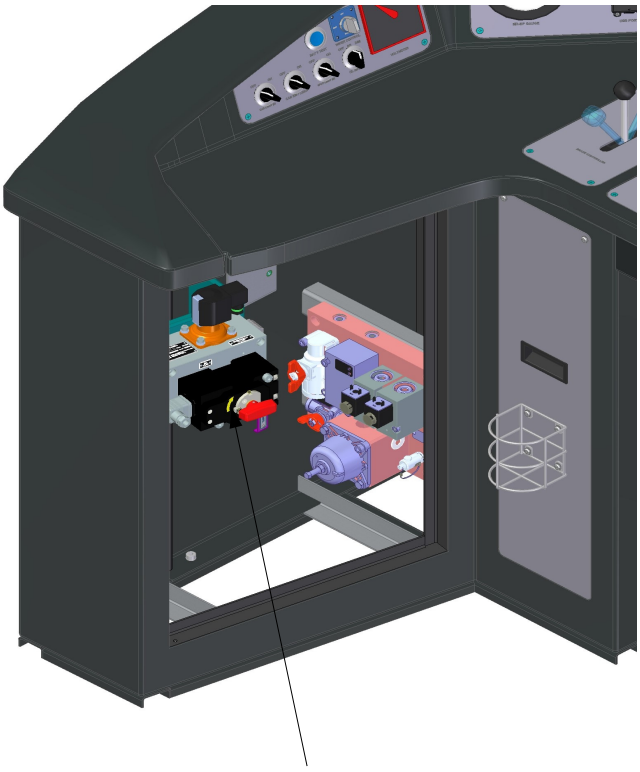


Figure 15: TCAS EMY. ISO COCK

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.

2. Remove the Cover 7

3. Unclamp and remove the Harting connectors.

4. Remove and replace the same

5. Replacement of operation & indication panels

Figure 16: Panels on Driver Side

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Unscrew and remove the panels from FRP top console.
3. Check and remove the connections.
4. Remove and replace the switch or component.
5. Do the proper connection
6. Mount and screw the panels.

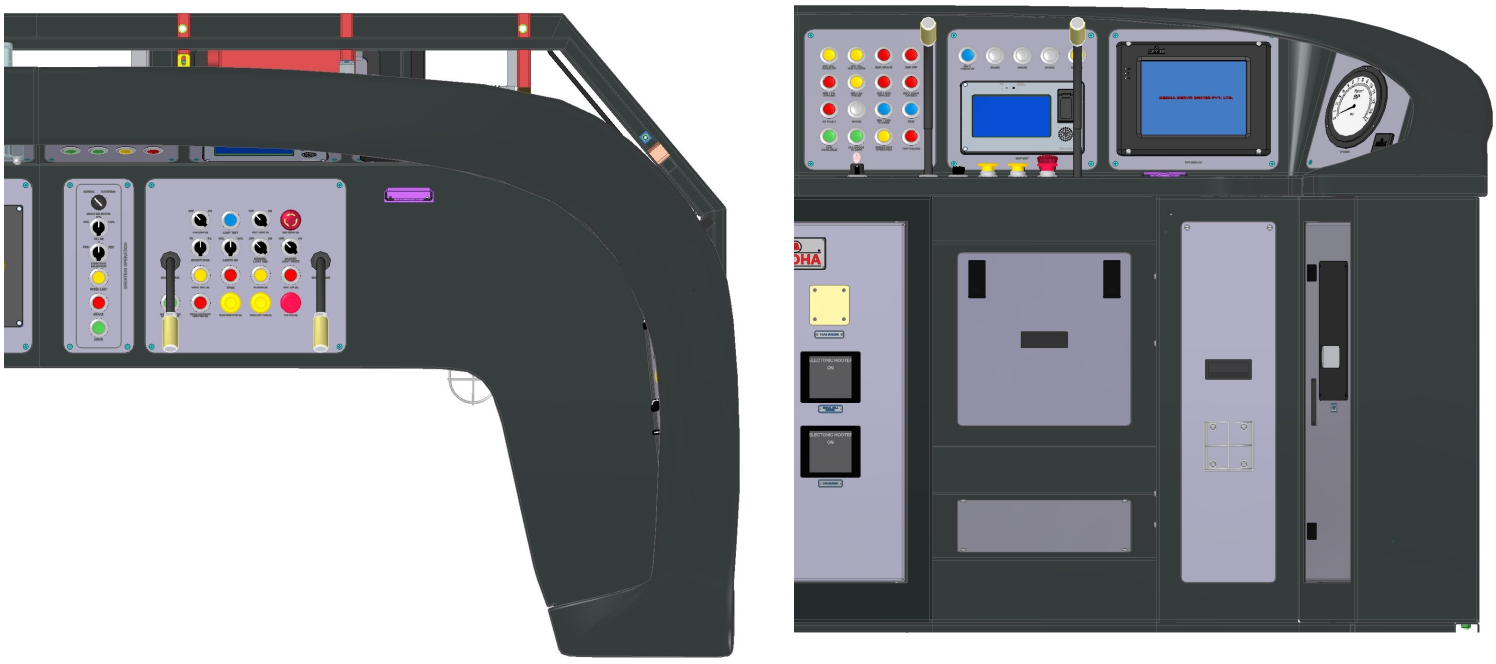


Figure 17: Panels on Guard side

Description

1. Attention! Examine the safety instructions within chapter 2 ahead of any activity.
2. Unscrew and remove the panels from FRP top console.
3. Check and remove the connections.
5. Remove and replace the switch or component.
6. Do the proper connection
7. Mount and screw the panels.

Medha Servo Drives Pvt. Ltd.

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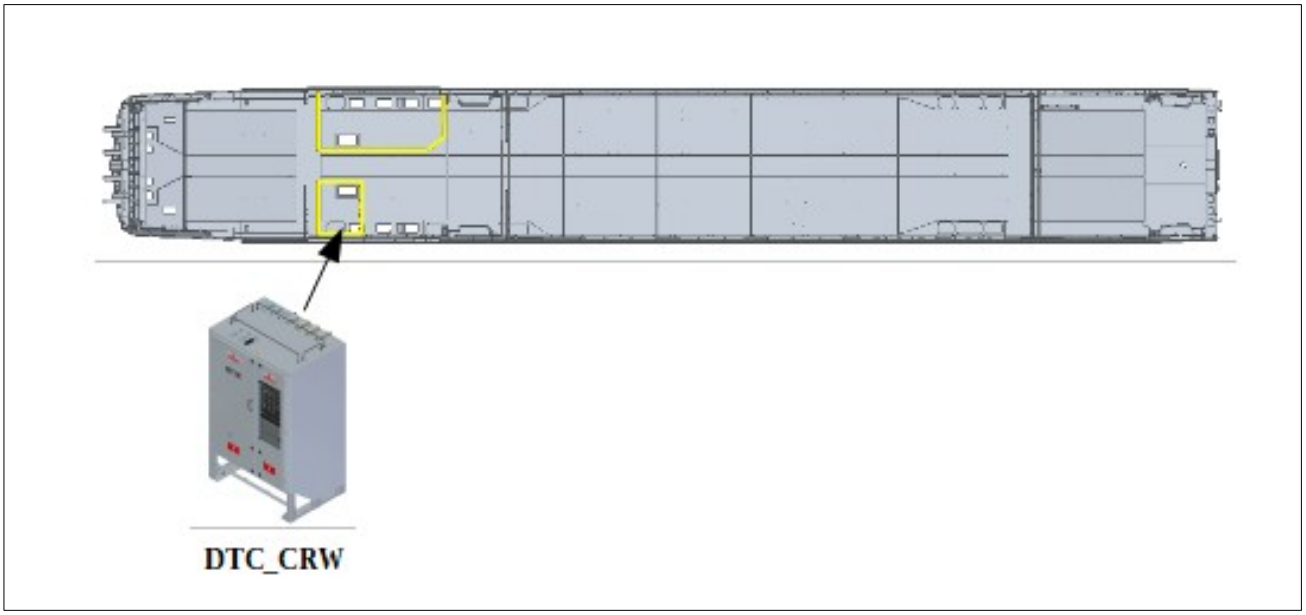
Title: Maintenance Procedure of Cab Rear Wall Panel - Electric Train set			
Prepared by	**Checked by**	**Approved by**	**Initiated date**
Lakshmi Singh	**Sushmitha**	**BOC Reddy**	**22.08.2022**

Overview of CRW location in the Locomotive:

Every Driving Trailer coach has one Cab Rear Wall Panel. It is located behind the train driver, who operates circuit breakers and accesses the switches of CRW panel. Weight of CRW panel is around 490 Kgs approximately. The below picture shows the layout of CRW in Driving Trailer Coach.



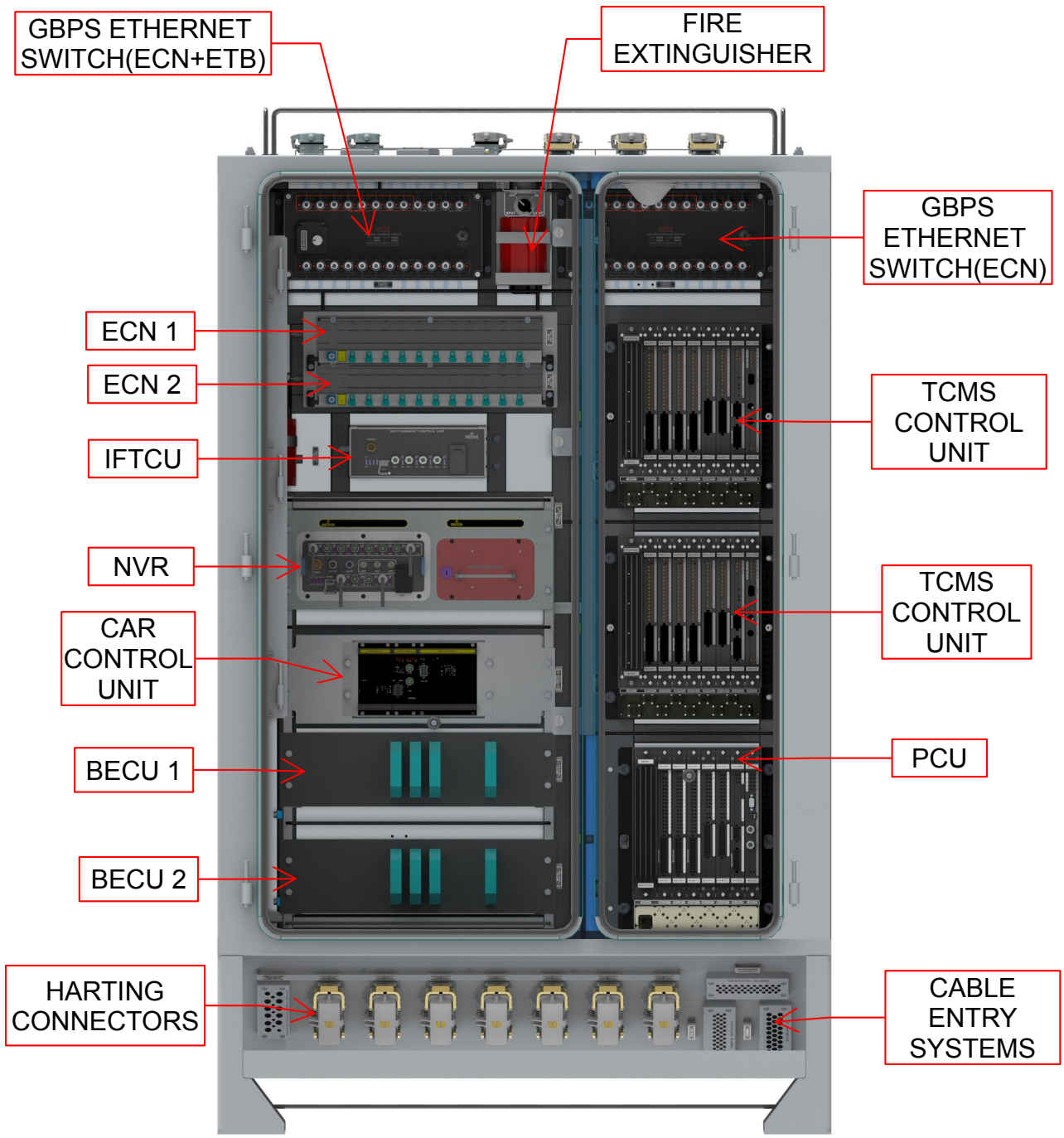
Cab Rear Wall Panel consists of Central Coach Unit , Ethernet Consist Switch, Contactors,Relays, Breakers, Terminal blocks, Harting connectors, Power TBs etc.

Position of Electronics inside CRW:

Equipment layouts are shown in below section.

Title: Maintenance Procedure of Cab Rear Wall Panel - Electric Train set

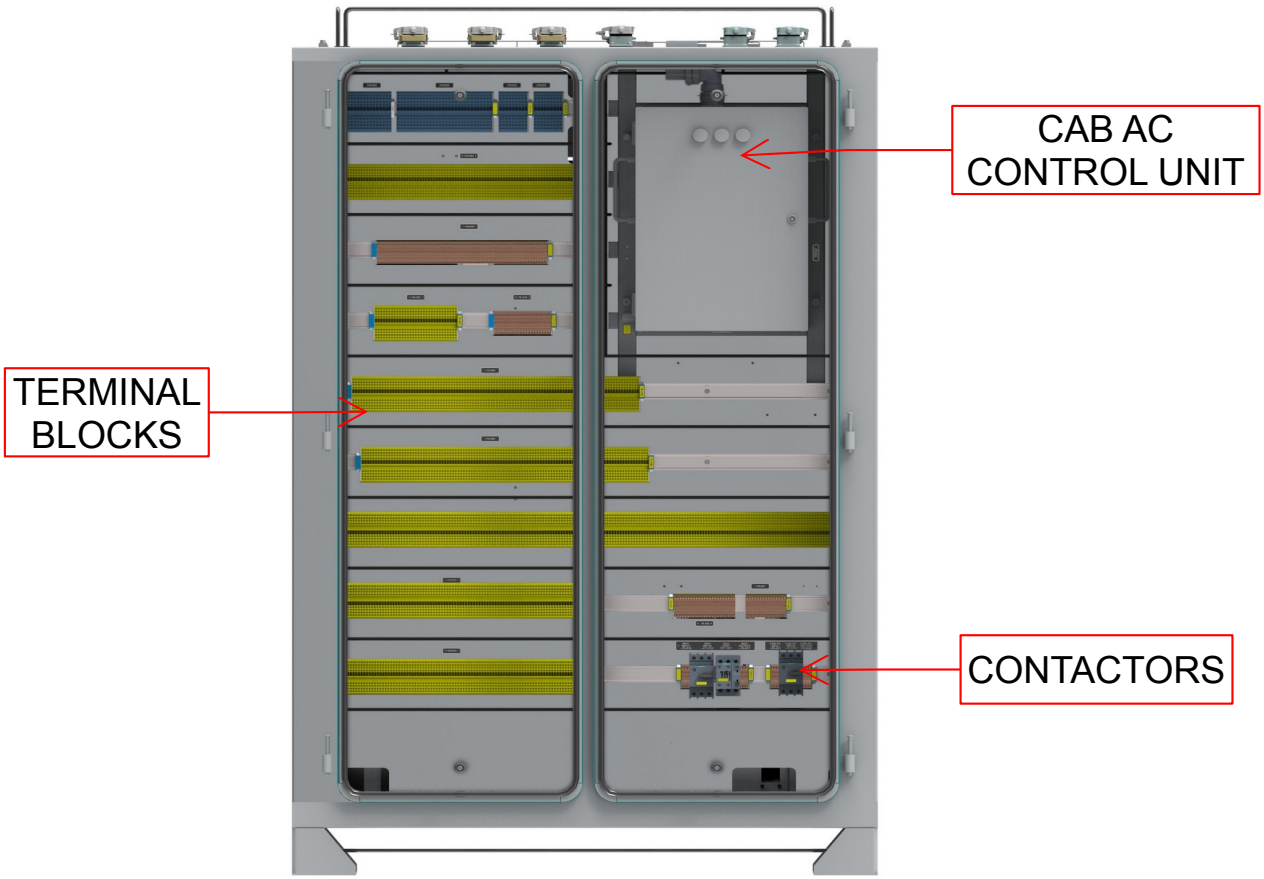
Prepared by	Checked by	Approved by	Initiated date
Lakshmi Singh	Sushmitha	BOC Reddy	22.08.2022



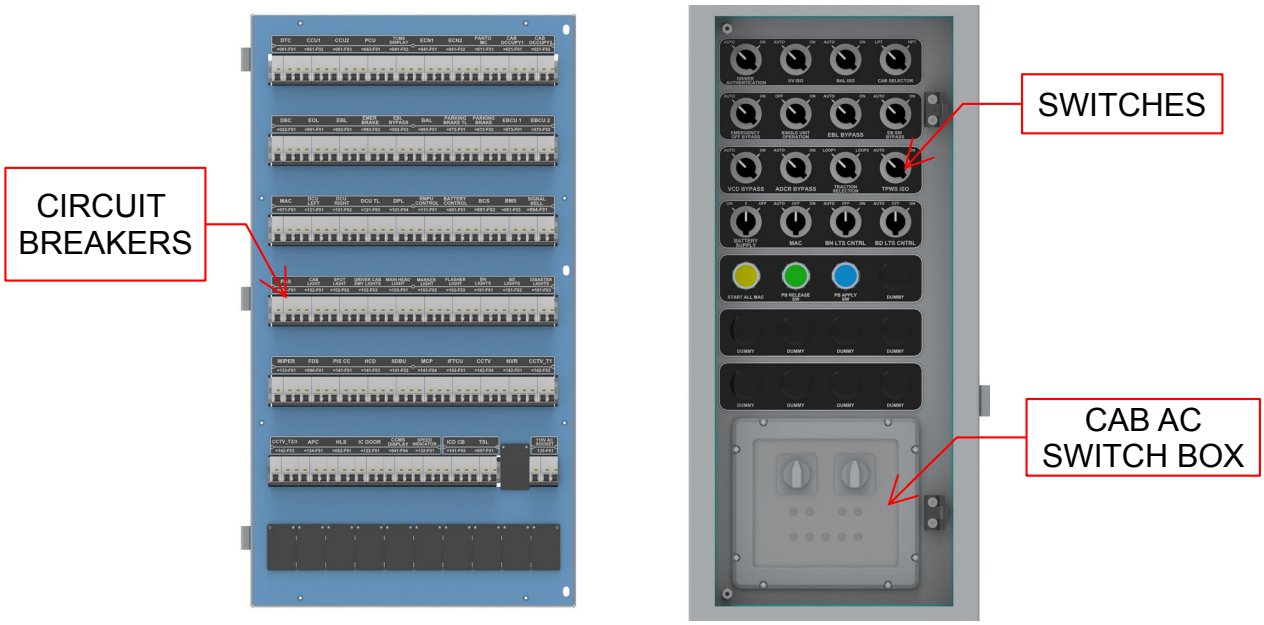
CRW WITHOUT FRONT DOOR

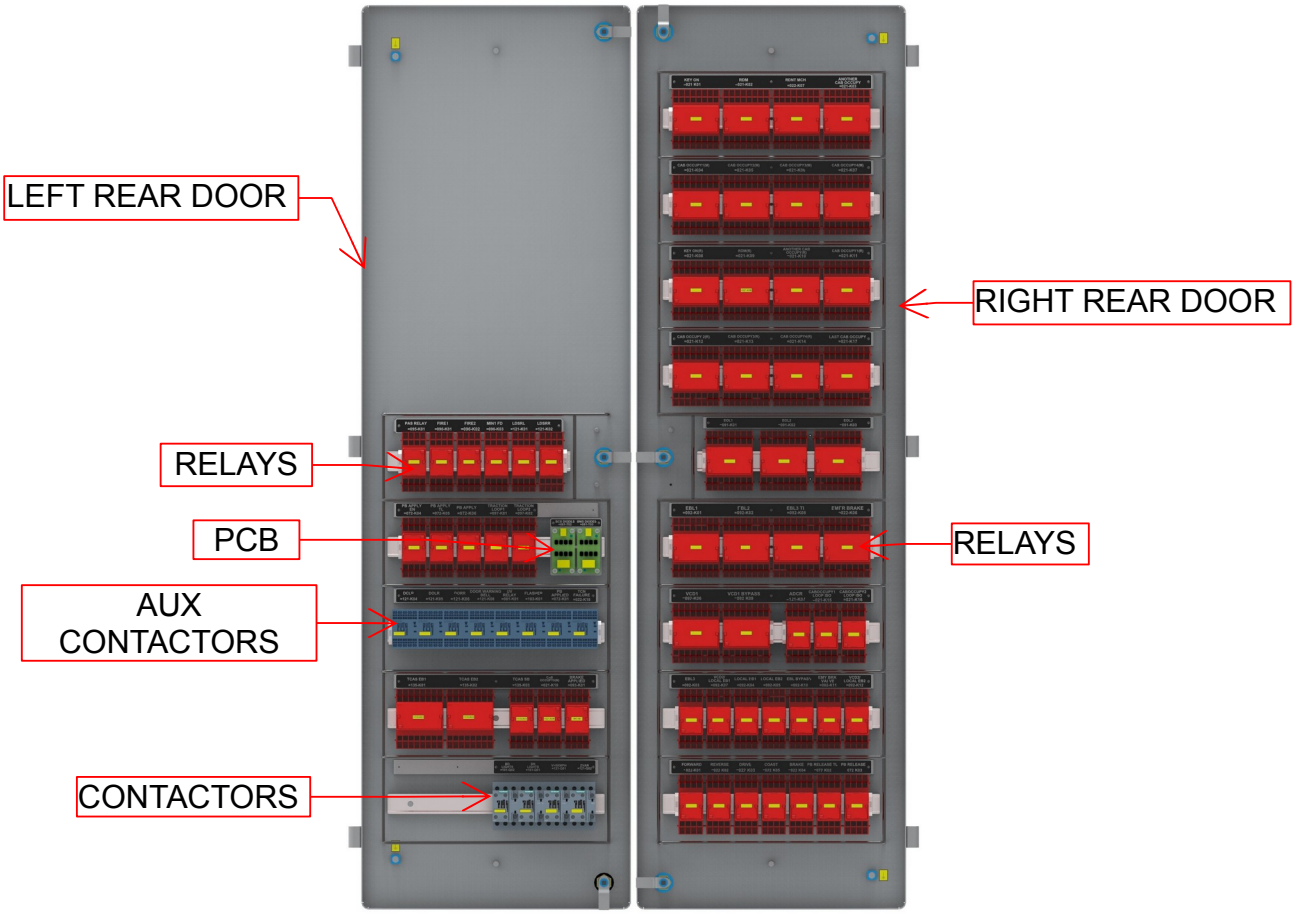
Title: Maintenance Procedure of Cab Rear Wall Panel - Electric Train set

Prepared by	Checked by	Approved by	Initiated date
Lakshmi Singh	Sushmitha	BOC Reddy	22.08.2022



CRW WITHOUT REAR DOOR





CRW REAR DOORS

Mounting Hardware of CRW :

S. no.	Code	Description	Qty / panel	Torque
1	69001201801	Plain washer M12 HTS,Geo-silver	6	---
2	69001211001	Spring washer M12 HTS,Geo-silver	6	---
3	65056084006	Bolt M12 Hex head 40LG HTS,Geo-silver	6	102 N-m
4	69001204082	Plain washer M12,SS	4	---
5	69001214076	Spring washer M12,SS	4	---
6	65124254001	Bolt M12 Hex head 25 LG SS	2	62 N-m
7	56550210001	M12 bolt with rail nut	2	---
8	68012214089	Hex nut M12 SS	2	62 N-m
9	513522520001	Top anchoring mtg. Bkt.-A675UV2	2	---
10	62060000001	CRW panel floor cable EPDM plate	1	---

11	69000804035	Plain washer M8 SS	6	---
12	69000814029	Spring washer M8 SS	6	---
13	65084304074	Bolt M8 Hex head 30 LG SS	6	20 N-m
14	69001004010	Plain washer M10 SS	4	---
15	69001014004	Spring washer M10 SS	4	---
16	65104204074	Bolt M10 Hex head 20 LG SS	4	50 N-m

Safety instructions:

- CRW contains electrical equipments which use / carry high voltage. This can be highly dangerous .
- Any maintenance/ installation work is to be carried out by trained staff with appropriate precaution only.
- Always use protective clothing and protective equipment.
- Set the placard “Work in progress” or follow the employer instructions.
- Before commencing work on the vehicle, ensure that all voltage is disconnected.
- Lock the switches, isolators, fuses etc. where possible.

Visual Inspection & Cleaning:

- Open the doors of the unit by unlocking with a square key.
- Clean the entire internal housing and the equipment with the vacuum cleaner.
- Visually inspect the entire box, enclosure walls, covers & welds for any damage or cracks.
- Visually inspect all internal and external cable connections for damage.
- Ensure that all Cable entry frames ,glands and connectors are in good condition.
- Visually inspect the bolts used for mounting the unit to bottom and top mounting frames Ensure that all bolts are present and tightened.
- Ensure that the door gasket is in good condition without holes, cracks. If the gasket is damaged, replace it with new gasket.
- Check the condition of hinges
- Close the doors of the unit after compressing the gasket properly.
- Lock the doors with the square key.
- Ensure all the doors of the unit are tightly closed during cleaning/water wash of coach.

Maintenance of electronics inside the unit:

No specific maintenance is required for electronics in the unit. If there is any faulty component , then there are to be replaced by taking proper precautions.

Replacement of Contactors :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the contactor from the adjacent tie rod.

- Remove the screws of the contactor and remove the cables.
- Remove the contactor from dinrail & replace the contactor.
- Refit the cables and tighten the screws.
- Tie the hanging cables to the adjacent tie rod.

Replacement of Relays :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the relay from the adjacent tie rod.
- Remove the relay from dinrail & replace the relay.
- Refit the cables to the relay.
- Tie the hanging cables to the adjacent tie rod.

Replacement of Circuit Breakers :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the circuit breaker from the adjacent tie rod.
- Remove the screws of the circuit breaker and remove the cables.
- Untie the Auxiliary contact block if fixed
- Remove the circuit breaker from dinrail & replace the circuit breaker.
- Refit the Auxiliary contact block
- Refit the cables and tighten the screws.
- Tie the hanging cables to the adjacent tie rod.

Replacement of Terminal Blocks :

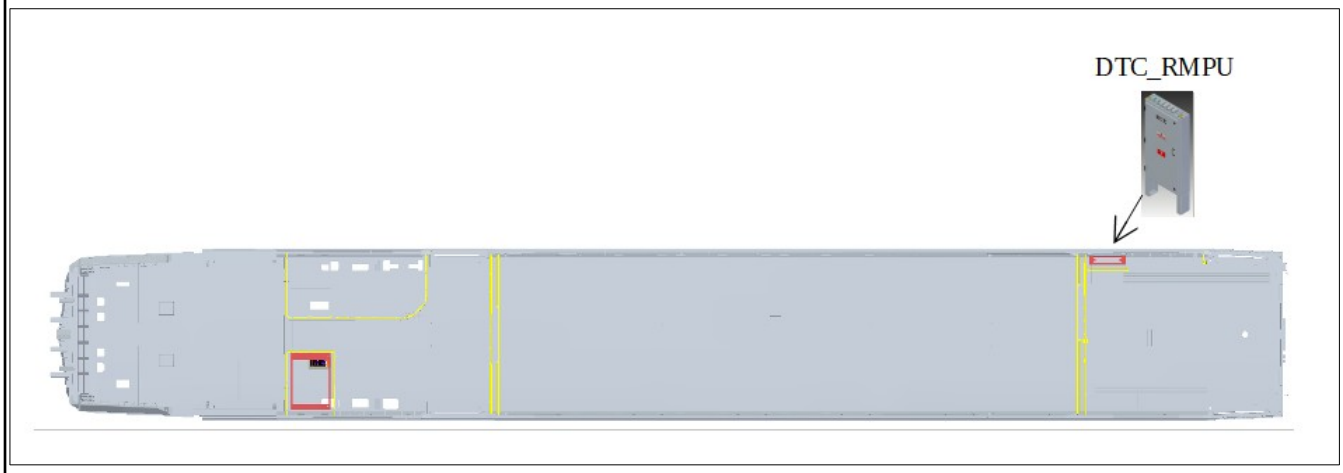
- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the terminal block from the adjacent tie rod.
- Remove the cables and replace the terminal block on the dinrail.
- For weidmuller TBs with bus bars, untighten the screws of the bus bars first.
- After the replacement of TB, refit the busbar and tighten the screws.
- Refit the cables of the TB.
- Tie the hanging cables to the adjacent tie rod.

REV. NO.	DATE	ECR NO.	DESCRIPTION OF REVISION

Title: Maintenance Procedure of RMPU Panel- Electric Train set			
Prepared by	**Checked by**	**Approved by**	**Initiated date**
Lakshmi Singh	Sushmitha	BOC Reddy	22.08.2022

Overview of RMPU Panel location in the Locomotive:

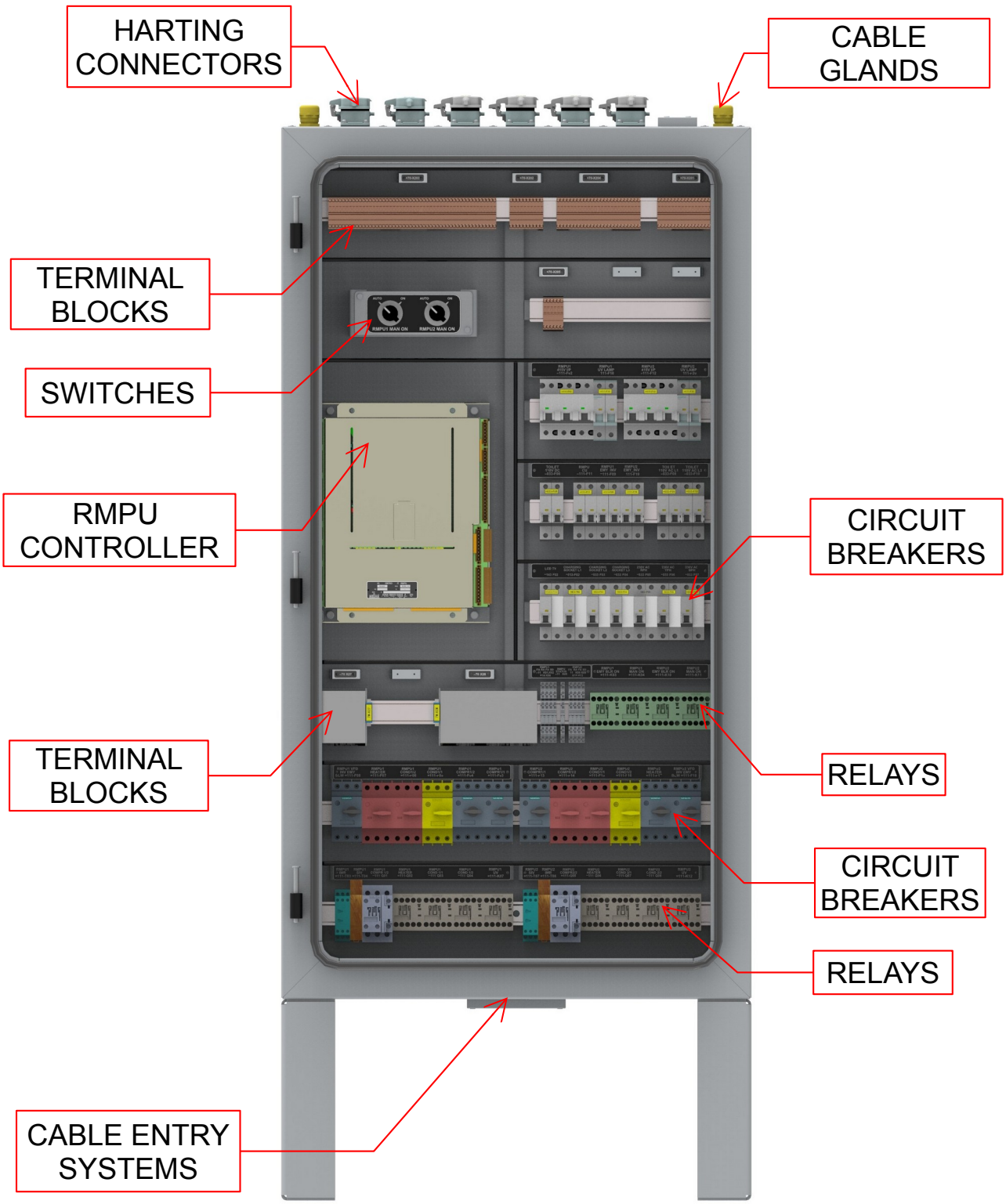
Every Driving Trailer coach has one RMPU Panel. It is located beside left door on Non driving end. Weight of RMPU panel is around 100 Kgs approximately. The below picture shows the layout of RMPU in Driving Trailer Coach.



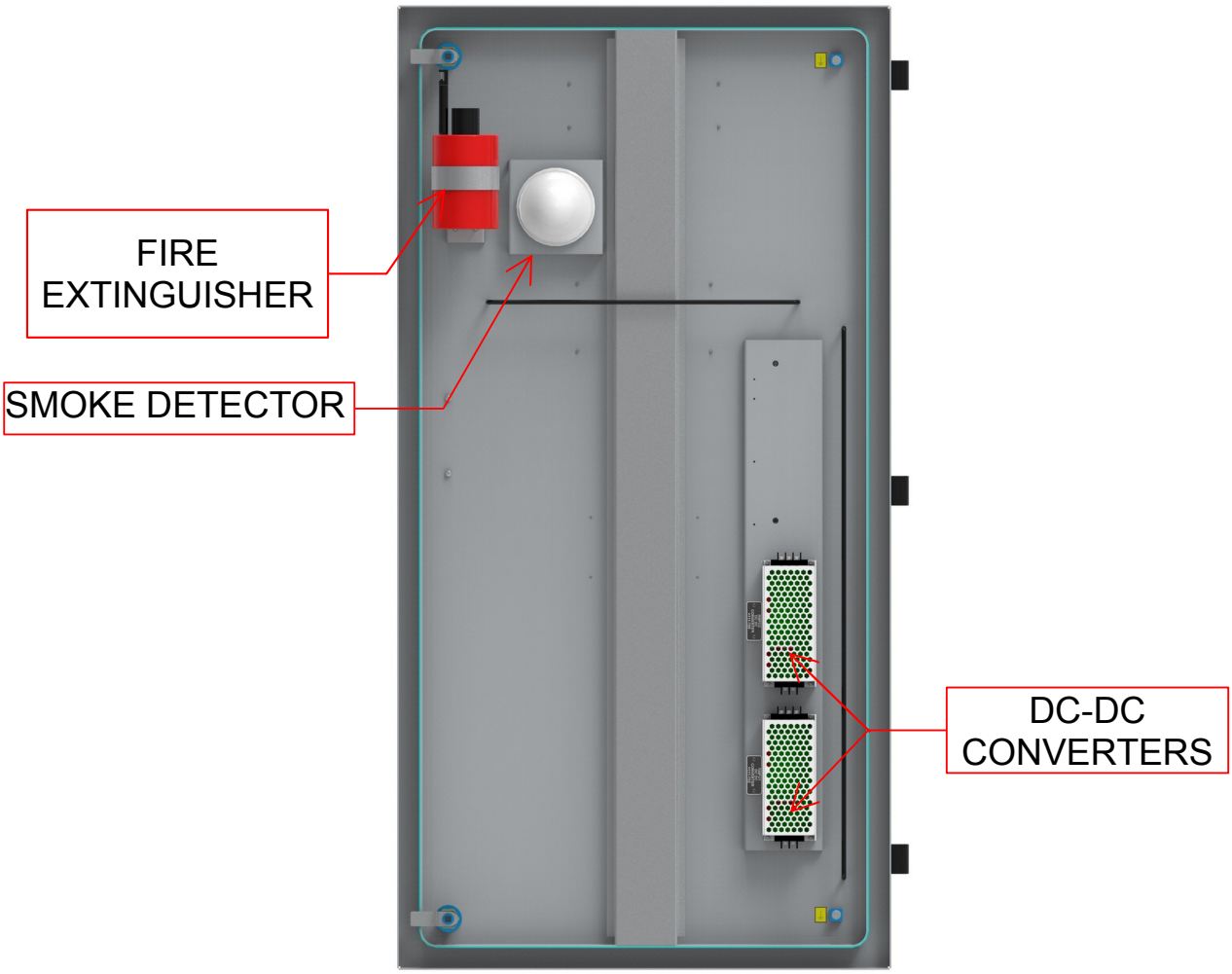
RMPU Panel consists of RMPU control Unit , DC-DC Converters, Contactors Relays, Breakers, Terminal blocks, Harting connectors, Power TBs etc.

Position of Electronics inside RMPU:

Equipment layouts are shown in below section.



RMPU WITHOUT DOOR



DOOR

Mounting Hardware of RMPU Panel:

S.no.	Code	Description	Qty / panel	Torque
1	69001204082	Plain washer M12,SS	6	---
2	69001214076	Spring washer M12,SS	6	---
3	65124404001	Bolt M12 Hex head 40 LG SS	2	62 N-m
4	65124254001	Bolt M12 Hex head 25 LG SS	2	62 N-m
5	56550210001	M12 bolt with rail nut	2	---
6	68012214089	Hex nut M12 SS	2	62 N-m
7	513355220001	Top Anchoring Mtg Bkt- A675UV2	2	---

8	69001004010	Plain washer M10 SS	2	---
9	69001014004	Spring washer M10 SS	2	---
10	65104204074	Bolt M10 Hex head 20 LG SS	2	50 N-m

Safety instructions:

- RMPU contains electrical equipments which use / carry high voltage. This can be highly dangerous .
- Any maintenance/ installation work is to be carried out by trained staff with appropriate precaution only.
- Always use protective clothing and protective equipment.
- Set the placard “Work in progress” or follow the employer instructions.
- Before commencing work on the vehicle, ensure that all voltage is disconnected.
- Lock the switches, isolators, fuses etc. where possible.

Visual Inspection & Cleaning:

- Open the doors of the unit by unlocking with a square key.
- Clean the entire internal housing and the equipment with the vacuum cleaner.
- Visually inspect the entire box, enclosure walls, covers & welds for any damage or cracks.
- Visually inspect all internal and external cable connections for damage.
- Ensure that all glands ,Cable entry frames and connectors are in good condition.
- Visually inspect the bolts used for mounting the unit to bottom and top mounting frames Ensure that all bolts are present and tightened.
- Ensure that the door gasket is in good condition without holes, cracks. If the gasket is damaged, replace it with new gasket.
- Check the condition of hinges
- Close the doors of the unit after compressing the gasket properly.
- Lock the doors with the square key.
- Ensure all the doors of the unit are tightly closed during cleaning/water wash of coach.

Maintenance of electronics inside the unit:

No specific maintenance is required for electronics in the unit. If there is any faulty component , then there are to be replaced by taking proper precautions.

Replacement of Contactors :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the contactor from the adjacent tie rod.
- Remove the screws of the contactor and remove the cables.
- Remove the contactor from dinrail & replace the contactor.
- Refit the cables and tighten the screws.
- Tie the hanging cables to the adjacent tie rod.

Replacement of Relays :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the relay from the adjacent tie rod.
- Remove the relay from dinrail & replace the relay.
- Refit the cables to the relay.
- Tie the hanging cables to the adjacent tie rod.

Replacement of Circuit Breakers :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the circuit breaker from the adjacent tie rod.
- Remove the screws of the circuit breaker and remove the cables.
- Untie the Auxiliary contact block if fixed
- Remove the circuit breaker from dinrail & replace the circuit breaker.
- Refit the Auxiliary contact block
- Refit the cables and tighten the screws.
- Tie the hanging cables to the adjacent tie rod.

Replacement of Terminal Blocks :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the terminal block from the adjacent tie rod.
- Remove the cables and replace the terminal block on the dinrail.

- For weidmuller TBs with bus bars, untighten the screws of the bus bars first.
- After the replacement of TB, refit the busbar and tighten the screws.
- Refit the cables of the TB.
- Tie the hanging cables to the adjacent tie rod.

REV. NO.	DATE	ECR NO.	DESCRIPTION OF REVISION

Title: Maintenance Procedure of RMPU Panel- Electric Train set

Prepared by	Checked by	Approved by	Initiated date
Lakshmi Singh	Sushmitha	BOC Reddy	22.08.2022

Overview of ECC location in the Locomotive:

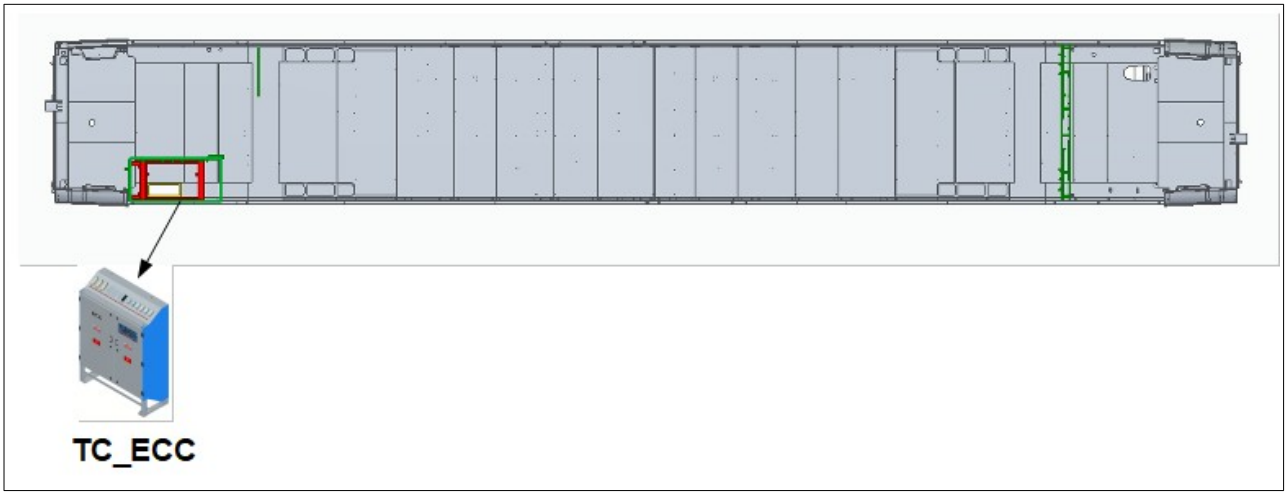
Every coach other than DTC has one Electrical control cabinet (ECC) each.There are three types of Electrical Control Cabinets named according to the coach in which they are located.

- TC ECC
- MC ECC
- NDTC ECC.

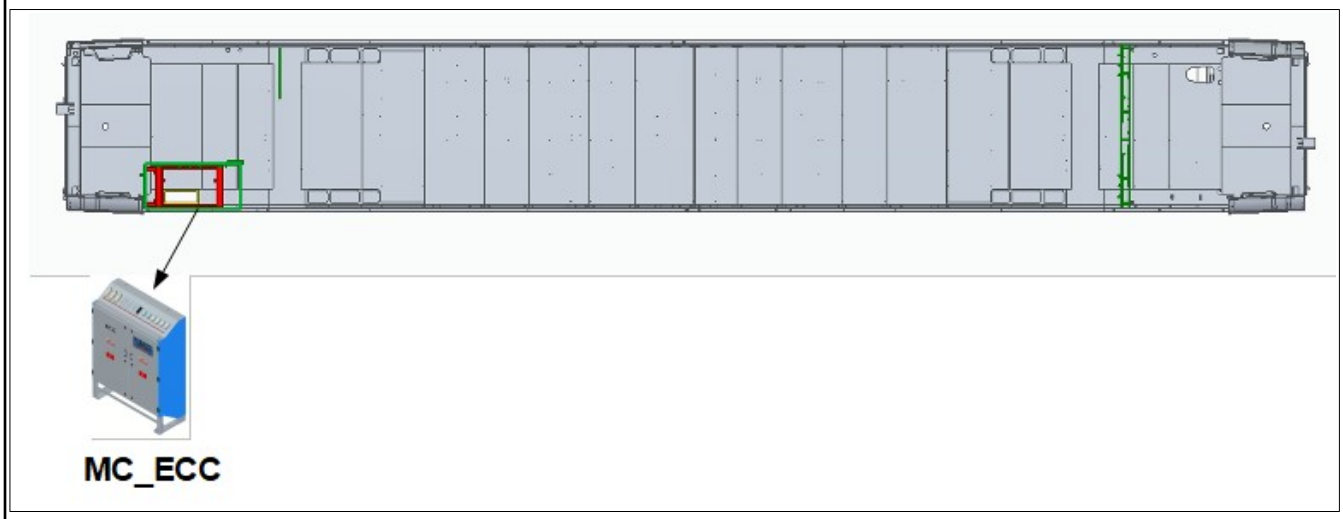
Weights of these three variants of Cabinets are mentioned below.

- Weight of TC ECC is around 400 Kgs approximately.
- Weight of MC ECC is around 350 Kgs approximately.
- Weight of NDTC ECC is around 360 Kgs approximately.

The below picture shows the layout of TC ECC in Trailer Coach.



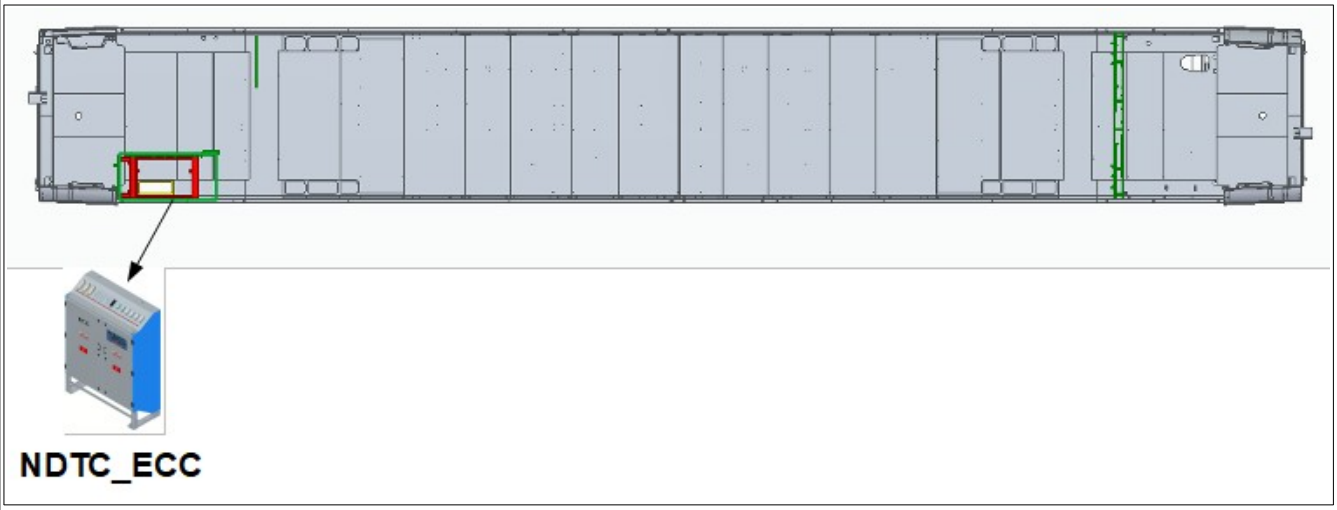
The below picture shows the layout of MC ECC in Motor Coach.



The below picture shows the layout of NDTC ECC in Non Driving Trailer Coach.

Title: Maintenance Procedure of Electrical Control Cabinet- Electric Train set

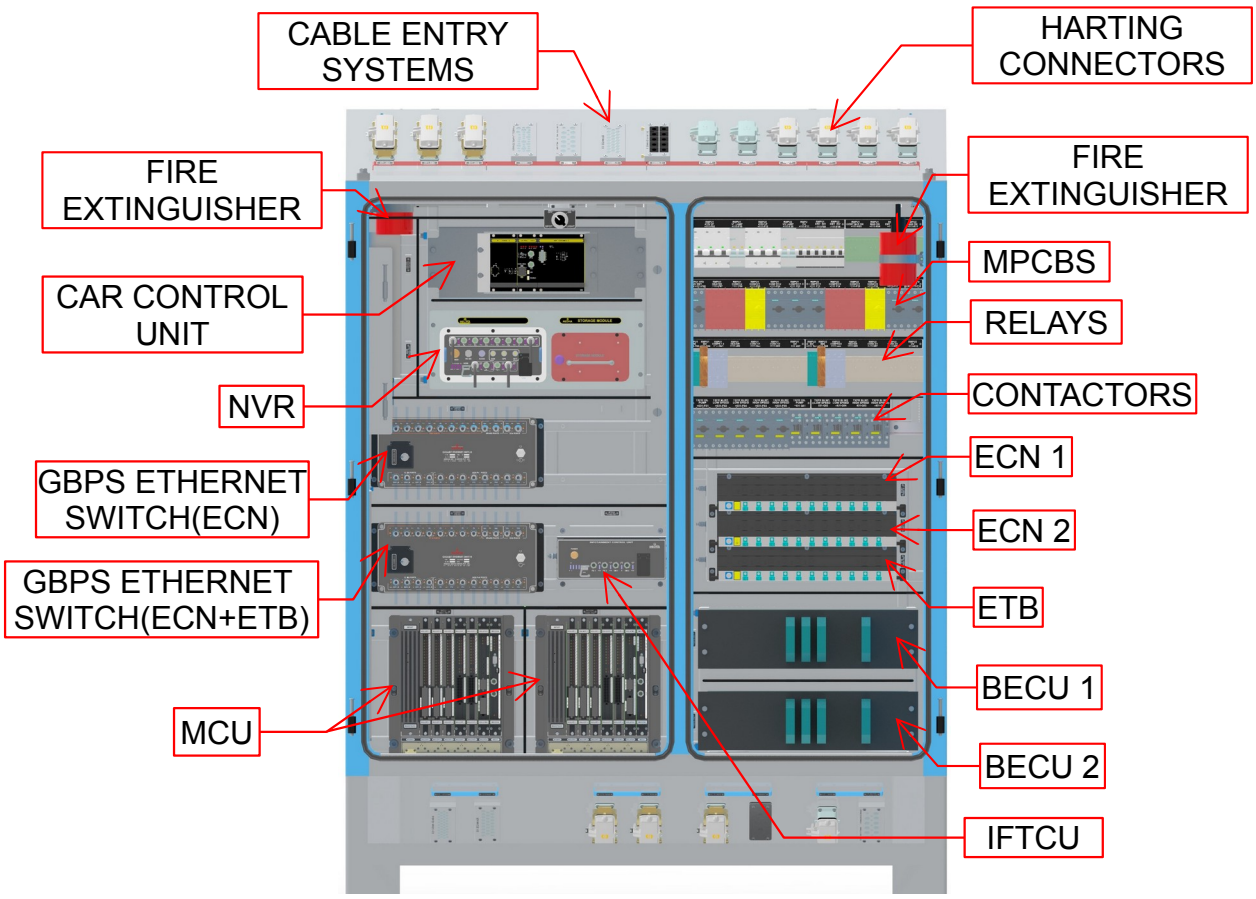
Prepared by	Checked by	Approved by	Initiated date
Lakshmi Singh	Sushmitha	BOC Reddy	22.08.2022



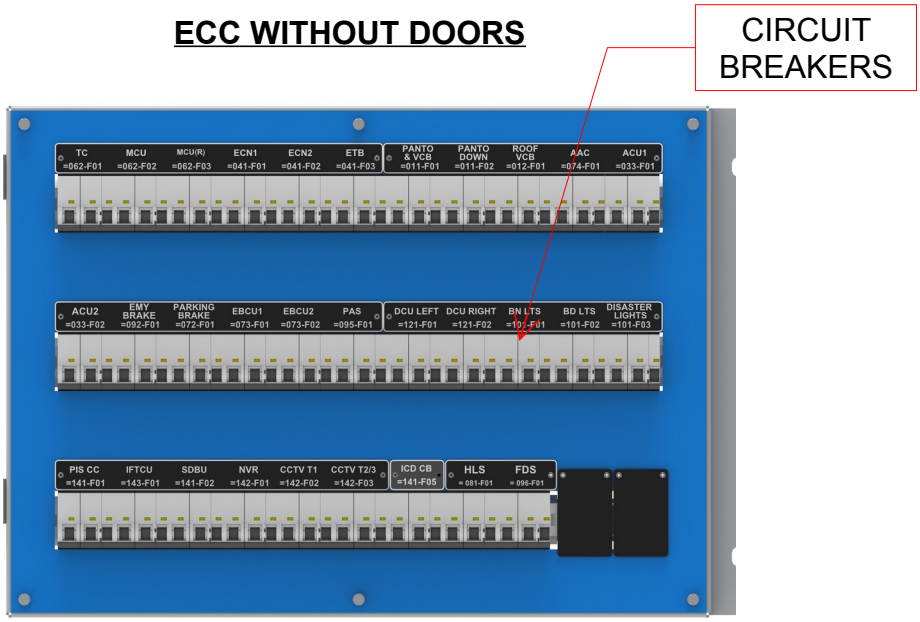
These Electrical Cabinets consist of Control Units , Ethernet Train Bus, Ethernet Consist Switch, Passenger Information System , Car Control Unit, Brake Electronics, Contactors, Relays, Breakers, Battery disconnector, Terminal blocks, Harting connectors, Power TBs etc.

Position of Electronics inside ECC:

Equipment layouts are shown in below section.



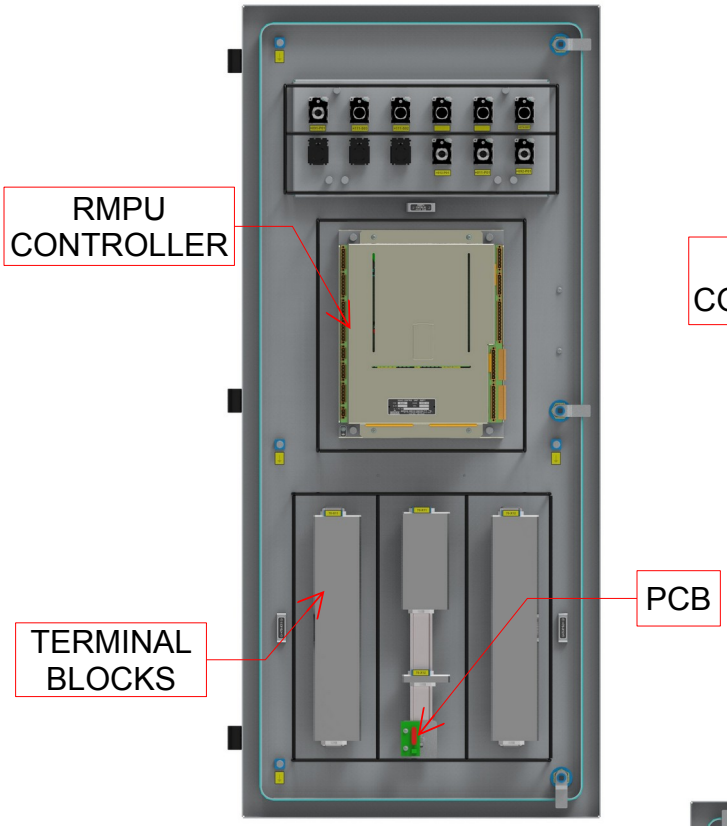
ECC WITHOUT DOORS

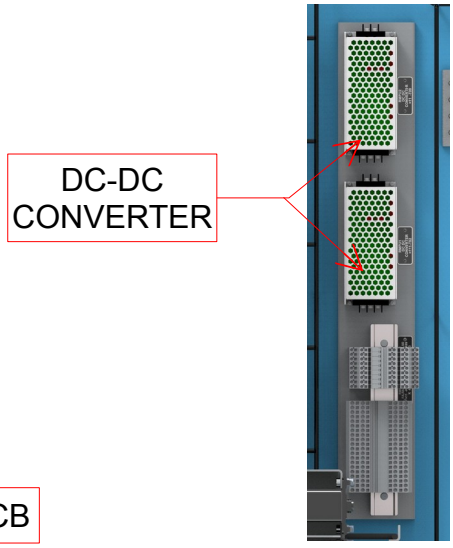


MCB DOOR

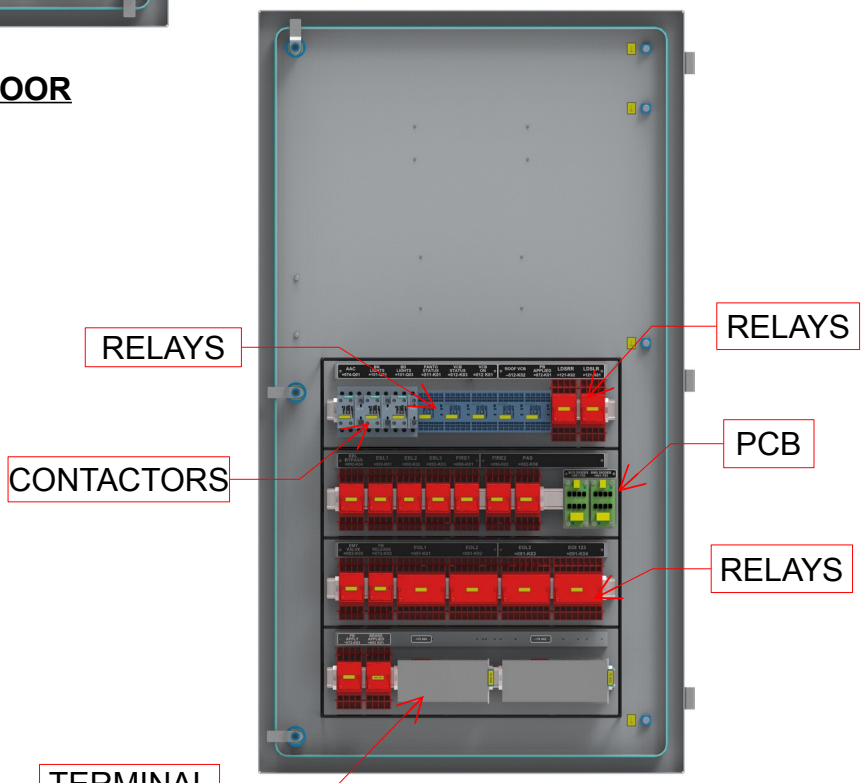
Title: Maintenance Procedure of Electrical Control Cabinet- Electric Train set

Prepared by	Checked by	Approved by	Initiated date
Lakshmi Singh	Sushmitha	BOC Reddy	22.08.2022





RIGHT DOOR



LEFT DOOR

Mounting Hardware of ECC :

S. no.	Code	Description	Qty /panel	Torque
1	69001204082	Plain washer M12 SS	8	---
2	69001214076	Spring washer M12 SS	8	---
3	65124404001	Bolt M12 Hex head 40 LG SS	4	62 N-m
4	65124254001	Bolt M12 Hex head 25 LG SS	2	62 N-m
5	56550210001	M12 bolt with rail nut	2	---
6	68012214089	Hex nut M12 SS	2	62 N-m
7	513355220001	Top anchoring bracket -TC-675UV2	2	---
8	62060000003	MC ECC floor cable EPDM plate-A675UV2	1	---
9	69000804035	Plain washer M8 SS	8	---
10	69000814029	Spring washer M8 SS	8	---
11	65084304074	Bolt M8 Hex head 30 LG SS	8	20 N-m
12	69001004010	Plain washer M10 SS	4	---
13	69001014004	Spring washer M10 SS	4	---
14	65104204074	Bolt M10 Hex head 20 LG SS	4	50 N-m

Safety instructions:

- ECC contains electrical equipments which use / carry high voltage. This can be highly dangerous .
- Any maintenance/ installation work is to be carried out by trained staff with appropriate precaution only.
- Always use protective clothing and protective equipment.
- Set the placard “Work in progress” or follow the employer instructions.
- Before commencing work on the vehicle, ensure that all voltage is disconnected.
- Lock the switches, Isolators, fuses etc. where possible.

Visual Inspection & Cleaning:

- Open the doors of the unit by unlocking with a square key.
- Clean the entire internal housing and the equipment with the vacuum cleaner.
- Visually inspect the entire box, enclosure walls, covers & welds for any damage or cracks.
- Visually inspect all internal and external cable connections for damage.
- Ensure that all Cable entry frames and connectors are in good condition.
- Visually inspect the bolts used for mounting the unit to bottom and top mounting

frames Ensure that all bolts are present and tightened.

- Ensure that the door gasket is in good condition without holes, cracks. If the gasket is damaged, replace it with new gasket.
- Check the condition of hinges
- Close the doors of the unit after compressing the gasket properly.
- Lock the doors with the square key.
- Ensure all the doors of the unit are tightly closed during cleaning/water wash of coach.

Maintenance of electronics inside the unit:

No specific maintenance is required for electronics in the unit. If there is any faulty component , then there are to be replaced by taking proper precautions.

Replacement of Contactors :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the contactor from the adjacent tie rod.
- Remove the screws of the contactor and remove the cables.
- Remove the contactor from dinrail & replace the contactor.
- Refit the cables and tighten the screws.
- Tie the hanging cables to the adjacent tie rod.

Replacement of Relays :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the relay from the adjacent tie rod.
- Remove the relay from din rail & replace the relay.
- Refit the cables to the relay.
- Tie the hanging cables to the adjacent tie rod.

Replacement of Circuit Breakers :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the circuit breaker from the adjacent tie rod.
- Remove the screws of the circuit breaker and remove the cables.
- Untie the Auxiliary contact block if fixed
- Remove the circuit breaker from din rail & replace the circuit breaker.
- Refit the Auxiliary contact block
- Refit the cables and tighten the screws.
- Tie the hanging cables to the adjacent tie rod.

Replacement of Terminal Blocks :

- Refer circuit diagram to understand wiring before disconnecting the wires.
- Untie the cables of the terminal block from the adjacent tie rod.
- Remove the cables and replace the terminal block on the dinrail.
- For weidmuller TBs with bus bars, untighten the screws of the bus bars first.

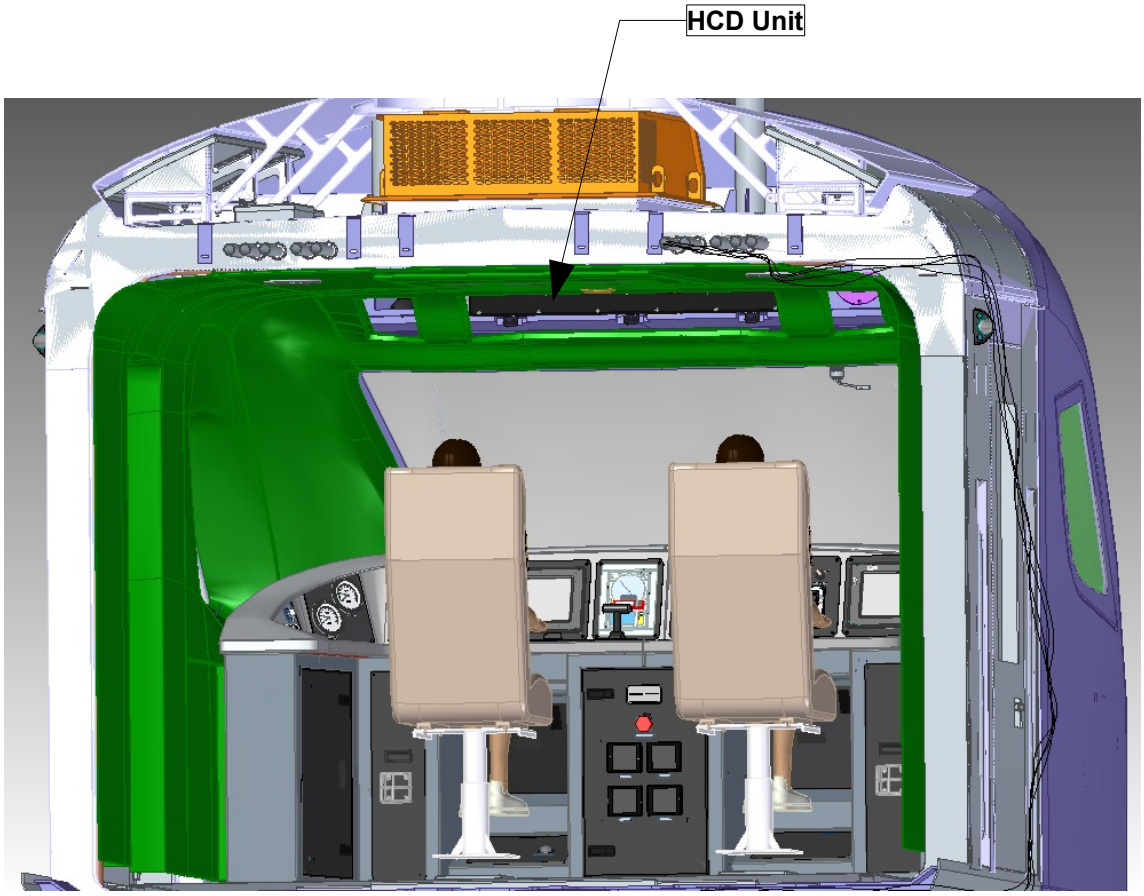
- After the replacement of TB, refit the busbar and tighten the screws.
- Refit the cables of the TB.
- Tie the hanging cables to the adjacent tie rod.

REV. NO.	DATE	ECR NO.	DESCRIPTION OF REVISION

1. Visual inspection of Head Code Unit (HCD)

1.1 Inspection and cleaning

1) Check the status of LED's in the HCD at the out side of the Cab
2) Open the cover (Nose cone) for HCD accessing
3) Check the power Connections, Ensure they are tightly connected
4) Check whether there is dust particle settled on the Screen. Clean the dust particle with a cloth (if required)
5) Check the damage of HCD
6) If found any damage such as Cracking , distortion, deformation replace the HCD
7) Check the fasteners for tightness. If loosened, tighten the fasteners to the torque of 8.5Nm
8) Close the cover (Nose cone) for HCD



2. Replacement of Head Code Unit (HCD)

2.1 Removal

1) Power of the all Circuit Breakers
2) Open the cover for HCD access
3) Disconnect the Power, Ethernet and Earthing Cables from the Unit
4) Loosen and remove M6X25LG (6no's) Screws of HCD
5) Remove the HCD from the Cab

2.2 Installation

1) Locate the HCD in the Proper location of the Cab
2) Install the HCD Unit by using M6X25LG (6No's) screws
3) Tighten the Screws to the torque of 8.5Nm
4) Connect the Power, Ethernet and Earthing Cables to the Unit
5) Close the Hinged Cover for HCD on upper front panel of the cab
6) Power on the all Circuit Breakers.

3. Visual inspection of Side Destination Board (SDBU)

3.1 Inspection and cleaning

1) Check the status of LED's in the SDBU from out side of the Coach
2) Open the side panel for SDBU accessing
3) Check the power Connections, Ensure they are tightly connected
4) Check whether there is dust particle settled on the Screen. Clean the dust particle with a cloth (if required)
5) Check the damage of SDBU
6) If found any damage such as Cracking , distortion, deformation replace the SDBU
7) Check the fasteners for tightness. If loosened, tighten the fasteners to the torque of 5Nm
8) Close the side panel for SDBU

4. Replacement of Side Destination Board (SDBU)

4.1 Removal

1) Power of the all Circuit Breakers
2) Open the side panel for SDBU access
3) Disconnect the Power, Ethernet and Earthing Cables from the Unit
4) Loosen and remove M5X16LG (5no's) Screws of SDBU
5) Remove the SDBU from the Cab

4.2 Installation

1) Locate the SDBU in the Proper location in side panel (From inside)
2) Install the SDBU Unit by using M5X16LG (5No's) screws
3) Tighten the Screws to the torque of 5Nm
4) Connect the Power, Ethernet and Earthing Cables to the Unit
5) Close the side panel for SDBU
6) Power on the all Circuit Breakers.

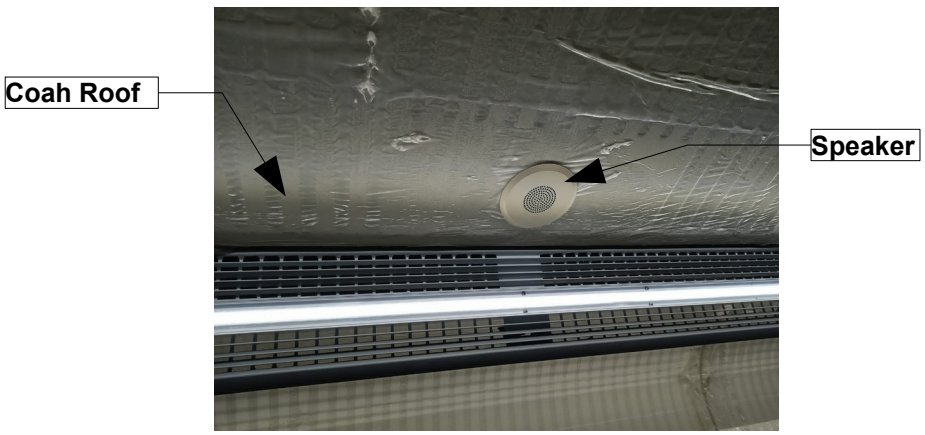
5. Replacement of Speaker Unit

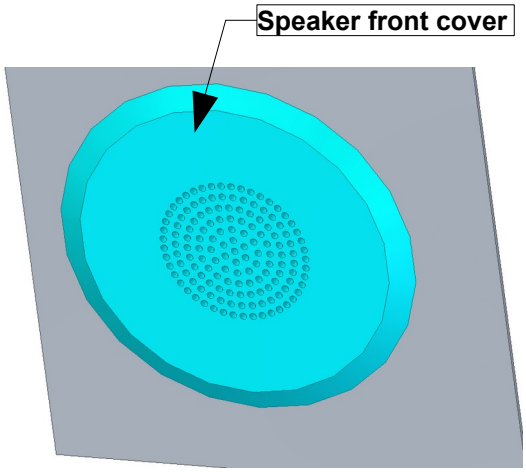
5.1 Removal

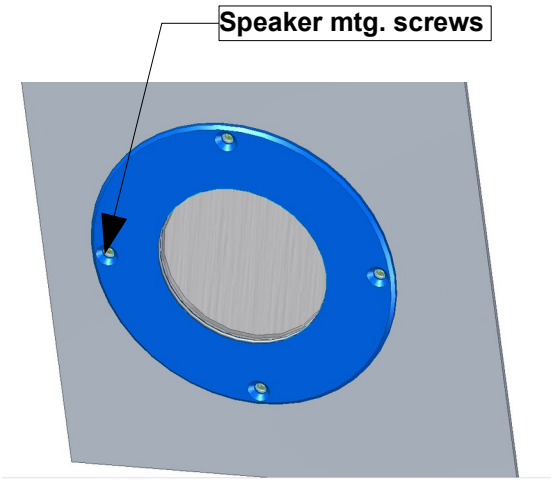
1) Power of the all Circuit Breakers
2) Remove the speaker front cover
3) Loosen and remove four M5X25LG (4no's) Screws
4) Disconnect the Wago and Earthing Cables from the Unit
5) Remove the Speaker from the Coach

5.2 Installation

1) Connect the Wago and Earthing Cables to the Unit
2) Locate the Speaker in the Proper location of the Coach
3) Install the Speaker Unit by using M5X25LG (4No's) screws
4) Tighten the Screws to the torque of 5 Nm
5) Close the speaker unit with front cover
6) Power on the all Circuit Breakers.







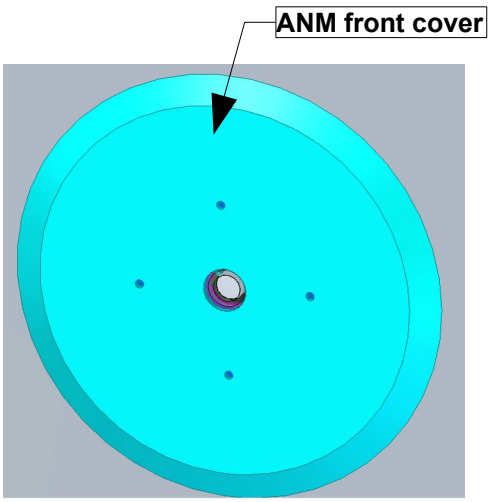
6. Replacement of AMBIENT NOISE MEASUREMENT MODULE (ANM)

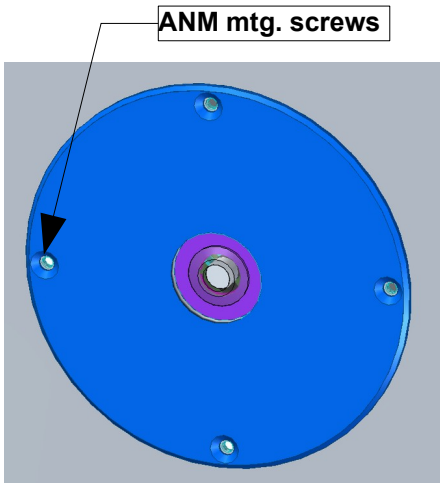
6.1 Removal

1) Power of the all Circuit Breakers
2) Remove the ANM front cover
3) Loosen and remove four M5X25LG (4no's) Screws
4) Disconnect the Wago and Earthing Cables from the Unit
5) Remove the ANM from the Coach

6.2 Installation

1) Connect the Wago and Earthing Cables to the Unit
2) Locate the ANM in the Proper location of the Coach
3) Install the ANM Unit by using M5X25LG (4No's) screws
4) Tighten the Screws to the torque of 5 Nm
5) Close the ANM unit with front cover
6) Power on the all Circuit Breakers.





7. Visual inspection of Main Communication panel (MCP)

7.1 Inspection and cleaning

1) Visually inspect the damage LCD of MCP
2) Remove MCP from installed location (Driver Desk)
3) Visually inspect the damage on the connector and cable
4) Remove the foreign substance and dirt
5) Install MCP
6) Check the fasteners for tightness. If loosened, tighten the fasteners to the torque of 5Nm
7) Clean the relevant components, after careful inspection
8) If found any damage such as Cracking , distortion, deformation replace the MCP

8. Replacement of Main Communication panel (MCP)

8.1 Removal

1) Power of the all Circuit Breakers
2) Loosen and remove four M5X25LG (4no's) Screws of MCP
3) Disconnect the Power, Comm. and Earthing Cables from the Unit
4) Remove the MCP from the Desk

8.2 Installation

1) Connect the Power, Comm. and Earthing Cables to the Unit
2) Locate the MMI in the Proper location of the Desk
3) Install the MCP Unit by using M5X25LG (4No's) screws
4) Tighten the Screws to the torque of 5 Nm
5) Power on the all Circuit Breakers.

9. Visual inspection of Emergency Talk Back Unit (ETBU)

9.1 Inspection and cleaning

1) Check the status of LED's & LCD in the ETBU from out side
2) Loosen and remove four M5X25LG (4no's) Screws of ETBU
3) Check whether there is dust particle settled on the gland area
   Clean the dust particle with a cloth (if required)
4) Check the damage of ETBU
5) If found any damage such as Cracking , distortion, deformation replace the ETB
6) Check the fasteners for tightness. If loosened, tighten the fasteners to the torque of 5Nm

10. Replacement of Emergency Talk Back Unit (ETB)

10.1 Removal

1) Power of the all Circuit Breakers
2) Loosen and remove Seven M5X20LG (4no's) Screws of ETB
3) Disconnect the Wago and Earthing Cables from the Unit
4) Remove the ETB from the Coach Side Wall

10.2 Installation

1) Connect the Wago and Earthing Cables to the Unit
2) Locate the ETB in the Proper location of the Coach Side Wall & door ways area
3) Install the ETBU Unit by using M5X25LG (4No's) screws
4) Tighten the Screws to the torque of 5 Nm
5) Power on the all Circuit Breakers.

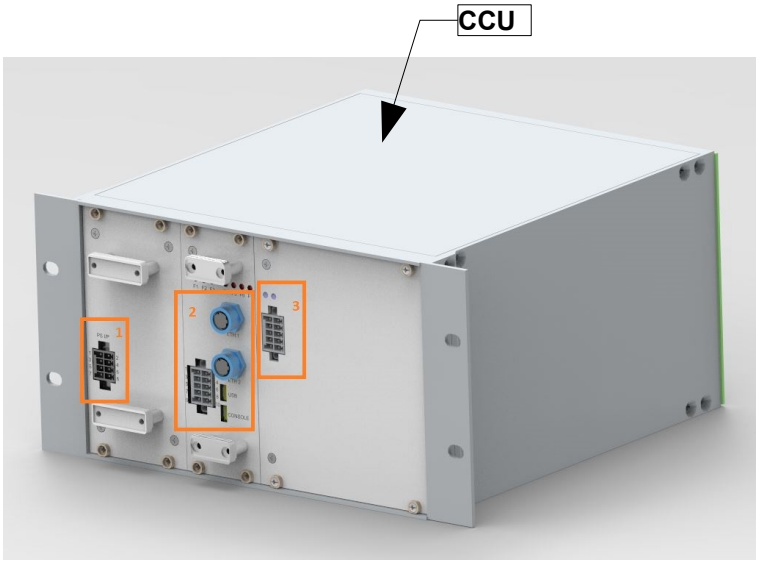
11. Visual inspection of Car Control Unit (CCU)

11.1 Removal

1) Power of the all Circuit Breakers
2) Open the ECC panel door
3) Disconnect the Wago and Earthing Cables from the Unit
4) Loosen and remove four M5X25LG (4no's) Screws
5) Remove the CCU from the Coach

11.2 Installation

1) Locate the CCU in the Proper location of the ECC panel
2) Install the CCU Unit by using M5X25LG (4No's) screws
3) Tighten the Screws to the torque of 5 Nm
4) Connect the Wago & Ethernet and Earthing Cables to the Unit
5) Power on the all Circuit Breakers.



12. Visual inspection of MIC

12.1 Removal

1) Power of the all Circuit Breakers
2) Loosen and remove four M3X25LG (2no's) Screws
3) Disconnect the Cables from the Unit
4) Remove the MIC from the Desk

12.2 Installation

1) Locate the MIC in the Proper location of the Desk panel
2) Connect the Cable to the Unit
3) Install the MIC Unit by using M3X25LG (2No's) screws
4) Tighten the Screws to the torque of 4 Nm
5) Power on the all Circuit Breakers.

REV NO	DATE	DESCRIPTION OF REVISION
ECR No:	ISSUED TO: SR, IC.	

Doc No.: SD-8619	Rev. No.: 00	Page 1 of 2	Product Code: MAE675UV2	MEDHA
Title: Maintenance instructions for Isolation Transformer-MAE675UV2				
Prd By: C.Pavan	Chkd By: Mallikarjuna	Appd By: V R Rao	Date	
Sign: C.Pavan	Sign: Mallikarjuna	Sign: V R Rao	18/08/22	

The following steps are involved for the maintenance of Isolation Transformer

- Visual Check
- Safety Operations
- Rate of Maintenance Operations
- Operations

1. VISUAL CHECK:

Check the Isolation Transformer visually for damages.

2. SAFETY OPERATIONS :

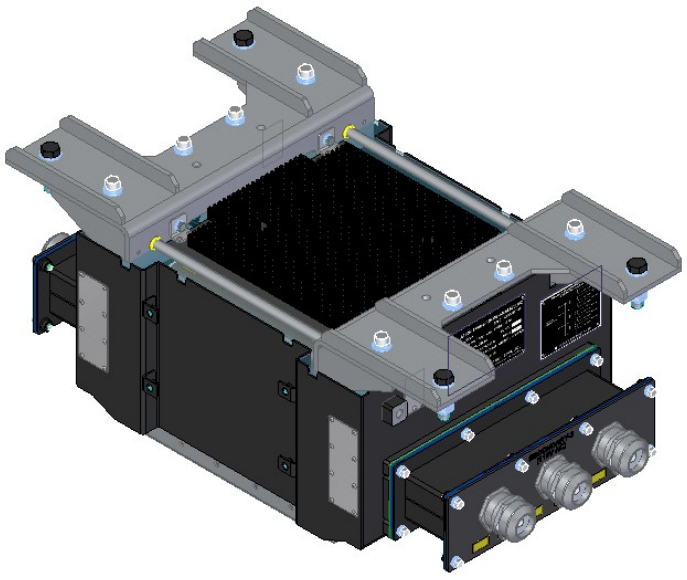
Before starting any maintenance operations, make sure to follow local safety rules & regulations. Make sure that the power supply should be off.

3. RATE OF MAINTENANCE OPERATIONS :

- The Transformer can operate with little maintenance, approximately for every six months under normal environment, but with a higher frequency under severe pollution conditions or vibrations.
- In order to determine the normal rate of maintenance operations, they should be carried on a more frequent basis during the first year, approximately every month.

4. OPERATIONS:

- **CLEANING**



Isolation Transformer

- Check that heat sink guard is not clogged (any foreign material should be removed by hand).
- Blow compressed air over the Transformer (especially on heat sink guard) to remove the dust on mesh).

- **TIGHTENING :**
  Check the visual aspect and the tightening torque of 102N-m on Transformer mounting frame at 4 locations.

REV NO	DATE	DESCRIPTION OF REVISION
ECR No:	ISSUED TO:	

S.T.E. S.r.l.
Via Cavour, 66 - 20865 Usmate-Velate (MI)
Tel.: 039-68.29.450 - Fax: 039-68.29.455
www.stesrl.it - e-mail: ste@stesrl.it
Cap. Soc. € 110.000 i.v. - Tribunale Monza 21325
C.C.I.A. 1086796 - Meccanogr.MI040903
C. Fisc. 06271510155 - P. IVA IT00821070968

LOW VOLTAGE TYPE TCE-A SPLIT-CORE RING CURRENT TRANSFORMERS OUTDOOR INSTALLATION

HANDLING, STORAGE, ERECTION, COMMISSIONING AND MAINTENANCE INSTRUCTION

INTRODUCTION
These instructions apply to TCE-A slpit core ring type low voltage current transformer for outdoor installation. These current transformers are compliant to IEC 61869-2 Standards.

TCE-A iscomposed by two semi cores:

- FIXED PART: the part without secondary terminal
- MOBILE PART: the part with secondary terminal box

TCE-A is supplied with the two parts assembled.

RECEIPT OF THE GOODS
On receipt of the goods, carefully verify the packing conditions and after unpacking verify the integrity of the product. If there are damages, a claim must be raised to the forwarder. S.T.E. must be informed as well.

STORAGE
Indoor, in not polluted air and with normal level of humidity. Air temperature must be included between -5°C and +55°C.

INSPECTION BEFORE INSTALLATION
Before installation, transformers should be inspected for physical damage that may have occurred during shipment or handling. Transformers should be dry and the surface of the bushings should be clean.

HANDLING AND MOVING:
Avoid any shocks. Shifting and transport must be done using hoisting belt passed around the body of current transformer.

COMMISSIONING AND INSTALLATION:
The commissioning operations must be done by skilled and qualified technicians, respecting the IEC standards and European safety prescription.
Installation can be done outdoor, ambient air temperature must be included between -25°C and +70°C.

WARNING

WHILE CURRENT TRANSFORMER IS ENERGIZED, ALL SECONDARY TERMINALS MUST BE SHORT CIRCUITED AND GROUNDED OR PROPERLY CONNECTED TO THE CIRCUIT.

DO NOT OPEN THE SECONDARY CIRCUIT WHILE CURRENT TRANSFOMER IS ENERGIZED.

AVOID WORKING WITH OPENED CIRCUIT ON SECONDARY TERMINALS

Before putting in operation the current transformer, check the following points:

1. Always consider an instrument transformer as a part of the circuit to which it is connected, and do not touch the leads and terminals or other parts of the transformer unless they are known to be adequately grounded.

2. Always ground the metallic cases, frames, bases, etc., of instrument transformers. The secondaries should be grounded close to the transformers. However, when secondaries of transformers are interconnected, there should be only be one grounded point in this circuit to prevent accidental paralleling with system grounding wires.

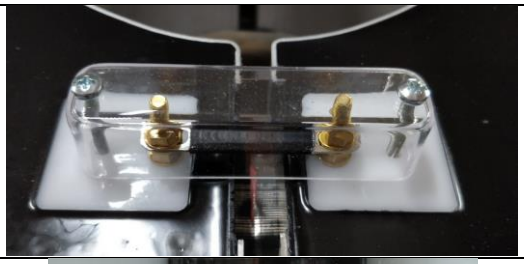
3. Do not open the secondary circuit of a current transformer while the transformer is energized and do not energize while the secondary circuit is open. Current transformers may develop open-circuit secondary voltages which may be hazardous to personnel or may damage the transformer or equipment connected in the secondary circuit.

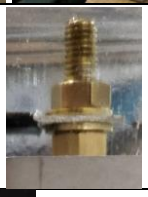
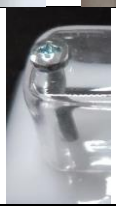
4. Identify the product, check the rating plate and terminal markings on the current transformer and properly connect the current transformer.

5. Check that connections were properly performed:
   a. Secondary terminals are connected to the rated load or that they are short-circuited.
   b. one secondary terminal is earthed
   c. all the data indicated in the rating plate (rated primary and secondary current, rated frequency, rated burden, accuracy class) have been respected.

MOUNTING

To mount properly the product:

A	remove the two lateral transparent boxes fixed by M5 screws, if present.	
B	Remove the two connecting plates fixed by M5 bolts, if present.	
C	Fasten the fixed part to the customer's support structure (i.e. angle brackets) using appropriate screws or tie rods	
D	Position the primary cables in the semi circumference of fixed part. It is not necessary that the primary conductors exactly fill the window, but the primary conductors should be centralized.	
E ⚠	Check that the two contact surfaces of the two semi cores are perfectly clean. If needed, clean the surface with a soft towel. **Debris will increase the magnetic gap, decreasing accuracy.**	

F	Reassembly the mobile part to the fixed part using the appropriate tie rod or screws. **Take great care of the alignment of the semi cores surfaces.**	  
G	If present, assembly the two plates by means of M5 bolts using torque of 3Nm. Use the same nuts and whashers provided in the same order.	 
F	If present, fasten the plastic transparent cover by means of M5 screws.	
H	Fasten the mobile part to the customer's structure using appropriate screws or tie rods. **Pay attention to maintain the perfect alignment of the two parts**, and to do not stress and move the contact between the two parts.	

Make sure that the secondary leads are twisted closely together and carried out without passing through the field of the primary conductors. It is not necessary that the primary conductors exactly fill the window, but the primary conductors should be centralized.

WARNING

PRIMARY CABLE MUST BE INSULATED, OR RATED VOLTAGE OF PRIMARY CIRCUIT MUST BE LOWER OR EQUAL TO 0,72KV

POLARITY

When wiring instrument transformer circuits, it is necessary to maintain the correct polarity relationship between the line and the devices connected to the secondaries. For this reason, the relative instantaneous polarity of each winding of a transformer is indicated by a marker.
Where taps are present, all terminals are marked in order. The primary terminals are P1 and P2. The secondary terminals 1S1, 1S2, 1S3, etc. (and 2S1, 2S2, 2S3, etc., if another secondary is used). The marker P1 always indicates the same instantaneous polarity as S1.
When connecting instrument transformers with meters, relays or other devices, refer to the instructions furnished with the device involved.

MAINTENANCE:

Annual check:

- external aspect of the current transformer
- tightening of the screws or the tie rods of the fixing structure
- tightening of the screw of the fixing screws of the two parts
- tighten of terminals and connections
- normal cleaning of the external surface

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MAINTENANCEMANUALFORPANTRY(Vande Bharat)

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Kalakkal village,
Manoharabadmandal, Medakdist
Telanagna-502336

<u>Office</u>: Plot No.136, Venugopal Nagar,
Near Yadamma Nagar,
Military Diary Farm Road, Alwal,
Secunderabad- 500 015 (T.S.)
Mob: 9014516003
e-mail: himansu909@gmail.com

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MAINTENANCEMANUALOFPANTRY(Vande Bharat)

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MAINTENANCEMANUALOFPANTRY(Vande Bharat)

INTRODUCTION:

Vande Bharat express have mini-pantry in each coaches with heating chambers for food and refrigerating units for beverages. The Pantry equipment provided are for serving hot food items and cold beverages to the passengers. Pantry equipment include hot cases, refrigerating unit, water boiler, washing module sink etc. The ModularPantrysethasbeendesigned &Manufacturedasperrequirement ofTrainset-18 Vande Bharatcoaches for Indian Railways. These equipment are manufactured with stainless steel for a long life. Safety devices are available in all the equipment.

SCOPEOFSUPPLY:

Sl.No.	Description	Size
1	Hot Case	455Wx600 Dx715H
2	RefrigeratingUnit	1050Wx505Dx1050H
3	WaterBoiler	400Wx325Dx550H
4	WashingModuleSink	410Wx380 Dx875 H
5	Stainless steel Rack arrangement for storage and equipment fixing	As per space availability

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MAINTENANCEMANUALOFPANTRY(Vande Bharat)

PRODUCTSPECIFICATION:

- **HOT CASE UNIT:** 2 nos. per DTC car & 3 nos. per TC coach of Executive chair car & Chair car Coaches

Heatingcapacity	0.95KWeach
ElectricalPowerUnit	230VAC,50Hz
Pancapacity	
Volume	47.0Ltr.
Dimensions:	
Height	715 mm
Width	455 mm
Depth	600 mm
Weight	50kg.eachappx.

SafetydevicesSpecification:

Thermostat	SolidstateElectroniccontrolwithtemperaturesetting50°Cto 90 °C with LED display

- **REFRIGERATINGUNIT:**

Operatingvoltage	230VAC,50Hz
Wattage	1000Watt
Refrigerant	R134A
Dimensions	
Height	1050mm
Width	1050mm
Depth	505mmincludingdoor thickness
Weight	150 kg appx.

SafetydevicesSpecification:

Thermostat	(+)5°C to(-)5°Cforbottlecooler area
	(-)25°Cto(-)20°CforDeepFreezerarea

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MAINTENANCEMANUALOFPANTRY(Vande Bharat)

- **WATERBOILER:**

OperatingVoltage	230V AC,50Hz
Heatingelement	2Nos(1500W+1500W)
Dimensions	
Height	550mm
Width	400mm
Depth	325 mm
Weight	39Kgs

SafetydevicesSpecification:

Thermostat	40°Cto 120°C

- **WASHINGSINKMODULE:**

Dimensions	
Height	875mm
Width	410 mm
Depth	380 mm

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MAINTENANCEMANUALOFPANTRY(Vande Bharat)

PRODUCTCONSTRUCTION;

- **HOTCASE**

- StainlessSteelconstruction.
- CorrosionResistStainlessSteelInterio r/ Exterior body.
- Soliddoors,hingedonright
- CompactDesigntoSaveSpace.
- SimpleOn/OffControlSystem.
- DigitalTemperatureController.
- Good Heating Application Maintain Ideal servingtemperaturethroughoutthe cabinet.
- EasytoReadLEDDisplay.
- TemperatureRange50°Cto90°C.
- HeatIndicatorLight,TemperatureDisplay Button.
- ChromePlatedHandle.
- ChromePlateWireShelves2Nos.
- Doorwithmagneticlatch

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MAINTENANCEMANUALOFPANTRY(Vande Bharat)

REFRIGERATINGUNIT:

- StainlessSteelCabinet
- TemperatureRange(+)5°Cto (-)5°Cfor Bottle Cooler
- TemperatureRange(-)15°Cto(-)20°Cfor Deep Freezer
- RefrigerantGasR134a.
- Power– 1000W/230V
- Weight:-150KGS.

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MAINTENANCEMANUALOFPANTRY(Vande Bharat)

WATERBOILER:

- Inner tank made out of 2 mm thk AISI 304 SS
  Outer made out of 1.0 thk AISI 304 SS.
- Fillinglevelindicator.
- Mineral wool insulated.
- Capacity30Litres.
- Adjustablethermostat40°$C$to 120°C.
- Anti-driptype hot water faucet.

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- Water Boilers are provided with immersion type water heaters controlled by thermostat.
- The water filled in the boiler must be low in hardness to avoid scaling on the heater which causes localized heating and failure of heaters.
- Thermostat setting should not be repeatedly tampered to avoid its failure.
- Water Boiler must be de-scaled at least once in six month with de-scaling compound and proper care to be taken not to damage the heaters.

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WASHINGSINKMODULE:

Washingmodulewithsinkisfabricatedfrom1.0mmthickstainlesssteelsheet. It will be fitted below the Hot water Boiler of the modular pantry compartment. A stainless steel work surface with a surrounding raised edge and a drawn type sink is provided. The sink will be positioned in the center suitably covered by a sink panel.

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MAINTENANCEMANUALOFPANTRY(Vande Bharat)

CLEANING& MAINTENANCEINSTRUCTIONS:

HOTCASE:

- Disconnectthepowersupplybeforecleaning.
- Use non-abrasive cleaning products suitable for stainless steel surfaces.
- Cleaning agents must be chloride-free compounds.
- Useasoft,cleancloth/ScrubPads.
- Don'tusemetalwirebrush
- Don'tusemetalscraperorpads
- Don'tusehydrochloricacid(muriaticacid)onstainlesssteel
- Do the cleaning of hot case time to time, to avoid deposits of grease or food residue inside it, which may catch fire.
- Donotusewaterjetforcleaning
- Donotcleanthe electricalequipment&connectionwithwater,use drycloth.
- Ensure the door lock and gaskets are properly used.
- Do not switch on the unit when doors are open.
- Ensure to connect the equipment with it's rated power without surge.

REFRIGERATINGUNIT:

- Disconnectthepowersupplybeforecleaning.
- Use non-abrasive cleaning products suitable for stainless steel surfaces. Cleaning agents must be chloride-free compounds.
- Useasoft,cleancloth/ScrubPads.
- Don'tusemetalwirebrush
- Don'tusemetalscraperorpads
- Don'tusehydrochloricacid(muriaticacid)onstainlesssteel
- Cleanthecoilbysplashingthewater
- Donotusewaterjetforcleaning.
- Donotcleanthe electricalequipment&connectionwithwater,use drycloth.
- Do not obstruct the air vent area putting water crates or any other obstacle, which will reduce its performance and lead to compressor burn out.
- Do not open the doors frequently to avoid cooling losses.
- Close the door gently to avoid damage to it.
- Do not store any item in front of the unit and restrict free ventilation to the compressor compartments to avoid failure.
- Ensure to connect the equipment with it's rated power without surge.

WATERBOILER:

- Disconnectthepowersupplybeforecleaning.
- Use non-abrasive cleaning products suitable for stainless steel surfaces. Cleaning agents must be chloride-free compounds and must not contain quaternary salts.
- Useasoft,cleancloth/ScrubPads.
- Don'tusemetalwirebrush
- Don'tusemetalscraperorpads
- Don'tusehydrochloricacid(muriaticacid)onstainlesssteel
- To clean the water tap of boiler, pour the tank with warm water and open the tap to let the water draw away.
- Tapcanbedismantledtobecleanedwithsoapandwater
- Donotimmersewaterboilerinwater.
- Donotusewaterjetforwashing
- Donotcleanthe electricalequipment&connectionwithwater,use drycloth.
- Descalingto be done every six month with de-scaling compound without any damage to the inner tank and heater elements.
- Ensure to connect the equipment with it's rated power without surge.

PREVENTATIVEMAINTENANCE:

HOTCASE:

On Dailybasis by Pantry users:

- Performdailycavitycleaning.
- Checkthecompleteunitvisuallyforanydamageoranywirecut.

On Monthlybasis by trained technicians:

- Inspectdoorgasket
- InspectdoorwindowgasketofHotcase
- CleanoutcoolingfanintakeandexhaustventsofHotCase
- Inspectcavitydoorventslidesforproperoperation

On Yearlybasisby OEM trainedTechnicians:

- Opencontrolareaandinspect/tightenallwiring.
- Inspectallelectricalcomponents.
- Testelementsforelectricalshorttoground.Replace/repairasneeded.
- Visuallyinspectthecavityforstructuralintegrity.
- Inspectdoorgasket.Replaceifneeded.
- Visuallyinspectanydoorhandlesandhinges.Replace/repairasneeded.
- Remove any loose handle and hinge screws. Loctite and then properly secure the screws.
- Inspectandtestcontrolandcontrolfunctions.
- Inspecttemperatureorthermostatcontrolknobs.Replaceifneeded.
- Inspectpowercord.Tightencordconnectioninsidetheappliancecontrolarea.
- Test/Replaceindependentindicatorlights(whereapplicable).
- InspectHeatingelement.
- Confirmpropercurrentdrawofheatingelements.

REFRIGERATINGUNIT:

On Dailybasis by Pantry users:

- Performdailycavitycleaning.
- Checkthecompleteunitvisuallyforanydamageoranywirecut.
- Checkforanyabnormalsoundinunit.

On Monthlybasis by trained technicians:

- Inspectdoorgasket
- InspectElectricalComponent&Wiring.
- CleandrainagePipe

On Yearlybasisby OEM trained technician:

- Opencontrolareaandinspect/tightenallwiring
- Inspectallelectricalcomponents
- Testelementsforelectricalshorttoground.Replace/repairas needed.
- Visuallyinspectthecavityforstructuralintegrity
- Inspectdoorgasket.Replaceifneeded.
- Visuallyinspectanydoorhandlesandhinges.Replace/repair asneeded.
- Remove any loose handle and hinge screws. Loctite and then properly secure the screws.
- Inspecttemperatureorthermostatcontrolknobs.Replaceifn eeded.
- Inspectpowercord.Tightencordconnectioninsidetheapplia ncecontrolarea
- Test/Replaceindependentindicatorlights(whereapplicable)

WATERBOILER:

On Dailybasis by Pantry users:

- Performdailycleaning.
- Checkthecompleteunitvisuallyforanydamageoranywirecut .

On Monthlybasis by trained technicians:

- Cleanthewatertankandtap.
- Inspectandtestcontrolandcontrolfunctions.
- Confirmpropercurrentdrawofheatingelements.
- InspectWiringconnection,tightifanylooseconnection.

On Yearlybasisby OEM trainedTechnician:

- Cleanthewatertankandtap.
- Opencontrolareaandinspect/tightenallwiring.
- Inspectallelectricalcomponents,replace/repairifrequired.
- InspectWiringconnection,tightifanylooseconnection.
- InspectHeatingelement.
- Inspectandtestcontrolandcontrolfunctions.
- Confirmpropercurrentdrawofheatingelements.
- Perform De-scaling of the equipment without affecting or damaging the heating elements, thermostat probe…etc

FoodProductTemperatures		
HotFoods		
Unhealthy Zone	40°Fto140°F	4°Cto60°C
CriticalZone	70°Fto120°F	21°Cto49°C
SafeZone	140°Fto165°F	60°Cto74°C
ColdFoods		
Unhealthy Zone	Above40°F	Above4°C
SafeZone	36°Fto40°F	2°Cto4°C
FrozenFoods		
Unhealthy Zone	Above32°F	Above0°C
CriticalZone	0°Fto32°F	0°C to -18°C
SafeZone	0°ForBelow	-18°CorBelow

Foods maintained at temperatures as per the safe zone of above table are healthy for our Consumption. Proper maintenance of the Pantry equipment and Periodic training by the user through OEM will be desirable to achieve this goal.

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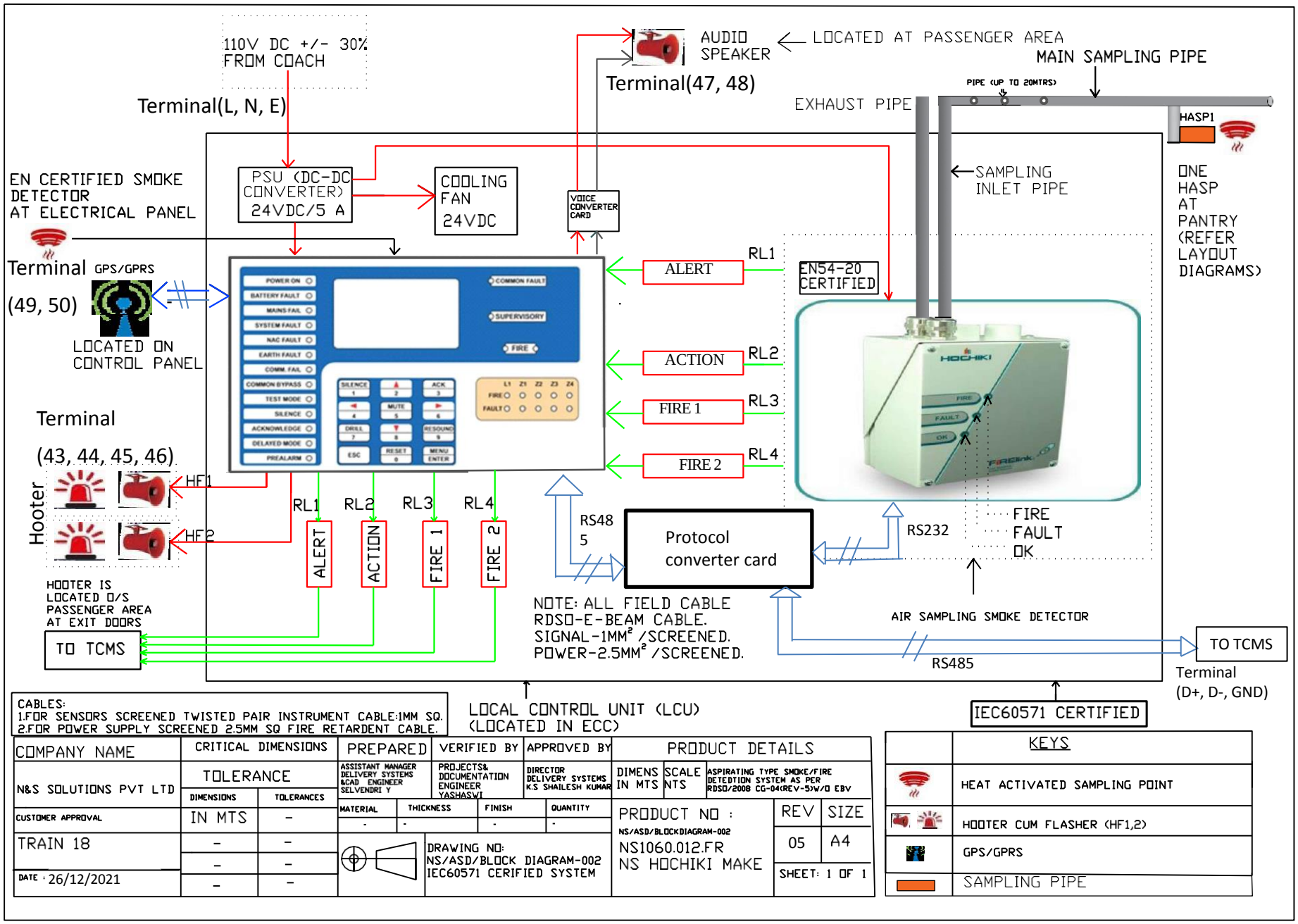
MAINTENANCEMANUALOFPANTRY(Vande Bharat)

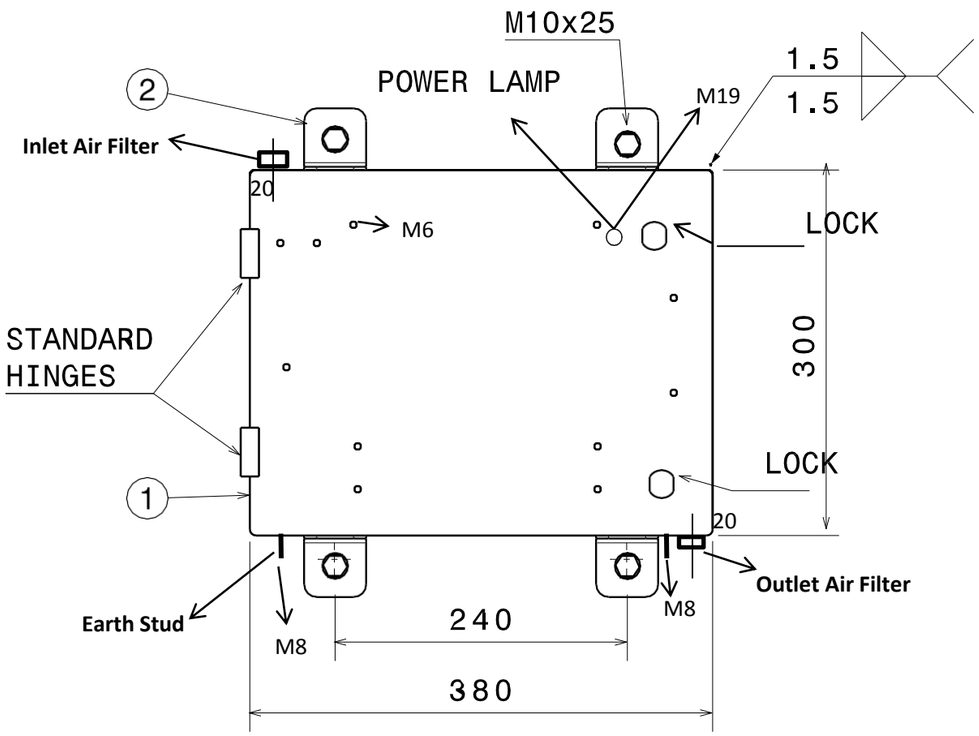
PART- B

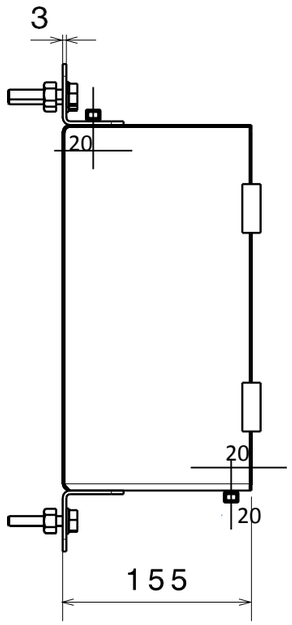
ASPIRATION TYPE AUTOMATIC SMOKE/ FIRE DETECTION WITH ALARM SYSTEM FOR INDIAN RAILWAYS AC COACHES TO RDSO SPECN No. RDSO/2008/CG-04, Rev-05 (SYSTEM FOR STAND ALONE/RAKE FORMATION COACH CLAUSE-2.4 OF SECTION-A AND WITH TCMS FOR TRAIN 18 APPLICATION SYSTEM)

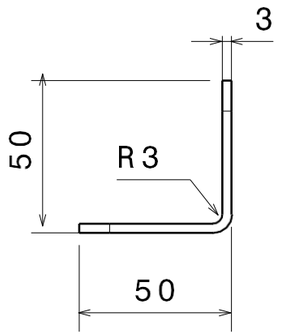
BLOCK DIAGRAM MAINTENANCE MANUAL FOR TRAIN 18- FDS SYSTEM –DRAWINGS AND BOMS

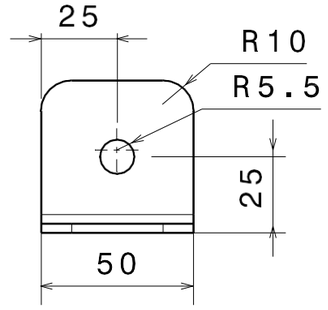
NSSPT PART NO. : NS1060.01 FIRELINK-25 RDSO
SPEC. NO. : RDSO/2008/CG-04(REV5)

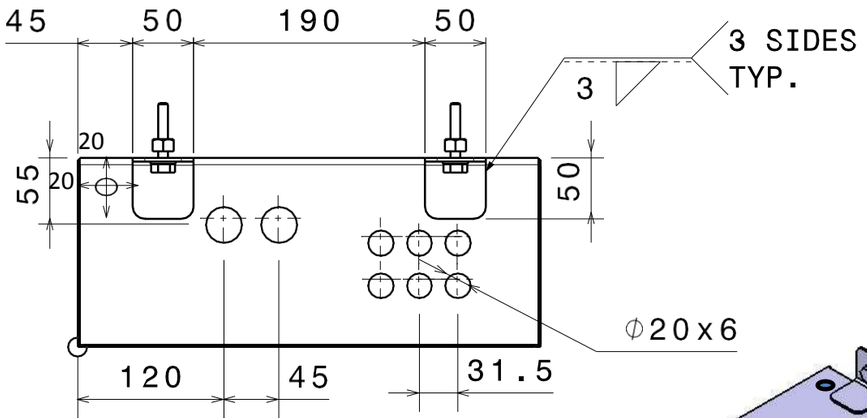

110V DC +/- 30%
FROM COACH
Terminal(L, N, E)
AUDIO SPEAKER
LOCATED AT PASSENGER AREA
Terminal(47, 48)
MAIN SAMPLING PIPE
PIPE (UP TO 20MTRS)
EXHAUST PIPE
HASP1
ONE HASP AT PANTRY (REFER LAYOUT DIAGRAMS)
SAMPLING INLET PIPE
EN CERTIFIED SMOKE DETECTOR AT ELECTRICAL PANEL
PSU (DC-DC CONVERTER) 24VDC/5 A
COOLING FAN 24VDC
VOICE CONVERTER CARD
Terminal GPS/GPRS (49, 50)
LOCATED ON CONTROL PANEL
ALERT
ACTION
FIRE 1
FIRE 2
RL1
RL2
RL3
RL4
EN54-20 CERTIFIED
Terminal (43, 44, 45, 46)
Hooter
HF1
HF2
RL1
RL2
RL3
RL4
ALERT
ACTION
FIRE 1
FIRE 2
RS485
Protocol converter card
RS232
FIRE
FAULT
OK
HOOTER IS LOCATED O/S PASSENGER AREA AT EXIT DOORS
TO TCMS
NOTE: ALL FIELD CABLE RDSO-E-BEAM CABLE.
SIGNAL-1MM² /SCREENED.
POWER-2.5MM² /SCREENED.
AIR SAMPLING SMOKE DETECTOR
RS485
TO TCMS
Terminal (D+, D-, GND)
CABLES:
1.FOR SENSORS SCREENED TWISTED PAIR INSTRUMENT CABLE:1MM SQ.
2.FOR POWER SUPPLY SCREENED 2.5MM SQ FIRE RETARDENT CABLE.
LOCAL CONTROL UNIT (LCU) (LOCATED IN ECC)
IEC60571 CERTIFIED
COMPANY NAME
N&S SOLUTIONS PVT LTD
CUSTOMER APPROVAL
TRAIN 18
DATE : 26/12/2021
CRITICAL DIMENSIONS
TOLERANCE
DIMENSIONS
TOLERANCES
IN MTS
PREPARED
ASSISTANT MANAGER DELIVERY SYSTEMS &CAD ENGINEER SELVENDRI Y
VERIFIED BY
PROJECTS& DOCUMENTATION ENGINEER YASHASWI
APPROVED BY
DIRECTOR DELIVERY SYSTEMS K.S SHAILESH KUMAR
PRODUCT DETAILS
DIMENS IN MTS
SCALE NTS
ASPIRATING TYPE SMOKE/FIRE DETEDTION SYSTEM AS PER RDSO/2008 CG-04(REV-5)W/O EBV
MATERIAL
THICKNESS
FINISH
QUANTITY
DRAWING NO: NS/ASD/BLOCK DIAGRAM-002 IEC60571 CERIFIED SYSTEM
PRODUCT NO : NS/ASD/BLOCKDIAGRAM-002
NS1060.012.FR
NS HOCHIKI MAKE
REV 05
SIZE A4
SHEET: 1 OF 1
KEYS
HEAT ACTIVATED SAMPLING POINT
HOOTER CUM FLASHER (HF1,2)
GPS/GPRS
SAMPLING PIPE

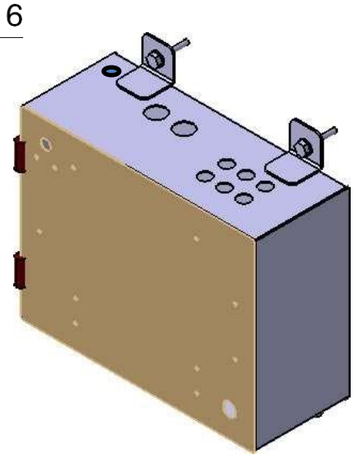












Notes:
1)Material Thickness - 1.5mm
2)Mounting Bracket (SS304) - 3mm Thick
3)Finish: MATT Finish
4)Material : 304 ss steel
5)Boss hinges used for front door on left side of the control panel
6)PG 29 Stainless steel gland used for inlet and outlet of the sampling pipe (sampling pipe Ø27mm)
7)Cam lock is used for locking front door
8)Legend lables refer drawing number NSSPT/ASD/CONTROL PANEL/006-LABLES
9)PG 13.5 STAINLESS STEEL GLANDS AS FOLLOWS
   1) 1x2.5sqmm and 8x1.5sqmm
   2) 1x2.5sqmm
   3) 2x0.75 SCR
   4) 2X1.5sqmm
   5) 2x1.5sqmm
   6) SPARE

DRAWN BY	JAGADISH	DATE 23/11/2021
CHECKED BY	SELVI	DATE 23/11/2021
APPROVED BY	KSSK	DATE 23/11/2021

N&S SOLUTIONS PVT LTD

DRAWING TITLE: NS-HOCHIKI-CONTROL PANEL - TRAIN18

SIZE	DRAWING NUMBER	REV
A3	NSSPT/ASD/CONTROL PANEL/006	06

SCALE	WEIGHT(kg)	SHEET
1:5	-	1/4

N&S SOLUTIONS PVT LTD No:37-38 Reliable Residency ,HSR Layout,Harlur,Banglore-560102

TITLE-**ASPIRATING TYPE FIRE/SMOKE DETECTION WITH ALARM SYSTEM TO RDSO SPEC-RDSO/2008/CG-04/REV-05**

DOC NO :**NSSPT/PDE/ASD/Material composition** REV-04

INDEX

Sl.no	Description	Qty/PerCoach	Part No. / MAKE/OEM	COMPONENTS	MATERIAL COMPOSITION	Material being used as per Clause No:8.1.2
1	NS Make Aspiration smoke/fire Detectors with Alarm System for Indian Railways AC coaches along with accessories as per RDSO Spec no :RDSO/2008/CG-04 [REV 5] -NS PART NO NS1060.01 along with FIRELINK-25 ASD (% obscurtion Better than 0.05%) With Multi Level Alarm setting & additional Relay Facilities.	01no.	FIRE LINK-25 , HOCHIKI ,UK / JAPAN (NS1060.01 FR-NS INTERNAL PART NUMBER)	1(a) Fire link external box 1(b)PCB 1(c)Sensor assembly. 1(d)Sub -D connector 1(e)Fasteners	1(a)Metal 1(b) FR 4 GRADE 1(c)Metal 1(d) Will confirm 1(e)Metal	a) FIRELINK 25 is EN54-20 certified to BRE Global Certificate No : 0832- CPR-F1279 b) Test Reports, Guarantee Certificate, WTC / Certificate of conformance from OEM c) Purchase Invoice / Delivery challan
2	Local Control Unit/ Fire Panel with LCD ,Programming ,configuration Keypad WithHindi , English display , GSM MODULE ,GPS MODULE , SMS FEATURE with data storage capacity of 10000 readings. (user settable upto 200 -20000 reading) .RS232-RS485 coms port.Battery Back up -12v, 7Ah(Optional) Electronic voice message sounder (Optional)	01 no.	NS1060.01 ,NS MAKE , INDIA	3(a)Control Panel ,Metal Enclosure 3(b)PCB 3(c)Fan 3(d)Back Plate 3(e)Power Supply 3(f)Cable Tray 3(g)Name plates 3(h)PG Cable Gland	3(a)SS304 3(b) FR4 GRADE 3(c)Metal (Di cast Alluminium) 3(d)Metal 3(e)Metal enclosure 3(f) Polyimide material , Will confirm 3(e)Stainless Steel/Brass 3(h)Metal PG Cable Gland	a) Enclosed Control Panel Drawing . no: (1)NSSPT/ASD/CONTROL PANEL-006
3	AUDIO VISIUAL ALARAM	02 no.	EMX- 7T05SP , HOCHIKI, UK / JAPAN OR EQUIVALENT	4(a)External Enclosure 4(b)PCB	4(a) FR Polymer ABS 4(b) FR 4 Grade	a) Refer Enclosed certificate no:7324 b) Test Reports, Guarantee Certificate, WTC / Certificate of conformance from OEM c) Purchase Invoice / Delivery
4	Fire Retardant Main Sampling Pipe Specification Diameter : 3/4 inch nominal bore(27mm O/D),. Material: CPVC with capillary pipe, T reducer joints and fixtures as per coach requirement.	25 Mts	NSSPT/1060.01/CONPIPE, -(NS INTERNAL PART NUMBER) APPROVED MAKE	6(a)Sampling Pipe 6(b)Capillary Pipe 6(c)Sampling Nipple/Nozzle 6(d)T Reducer Joints	CPVC, UL certified Aluminium Powder coated RAL 1009005	a) Enclosed Supreme datasheet certified to UL listed (UL 1821). b) Invoice of a local Dealer
5	Female 9 pin SUB-D Connector for data download	02 no's	APPROVED LOCAL MAKE , INDIA	NA	NA	a) Metal Enclosure b) Invoice of a local Dealer
6	Clamps & Brackets for pipe Mounting : 3/4 size	LUMPSUM as required	NSSPT/1060.01/CLR-BRC,NS MAKE , INDIA(NSINTERNAL PART NUMBER)	Metal Parts	METAL PARTS Finish Powder coated to RAL 1009005	a)Metal Zinc or chromium Passivated. b) Invoice of a local Dealer
7	User manual - NSSPT/PDE/NS1060.01/USER-MANUAL	06 set	NA , NS MAKE LOCAL, INDIA	NA	NA	NOT Used in Coach
8	Smoke /Heat detector SIL-2 Certified	01Nos	Hochiki Make	SIL-2 Certified	Drawing No: SLR-E-(IS) & base YBN-R/4(IS)	SIL-2 Certified
9	Heat Activated Sampling point	01Nos	NS Make	SS304 Housing	Drawing No:NS/ASD/HASP-001	SS304 Hochiki

B-Scope of Services

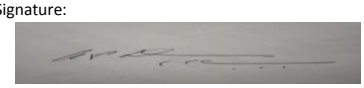
1. **Installation and commissioning per coach**
2. **Commissioning Spares/coach**
3. **Guaranteed spares for 3 years /coach**

N&S SOLUTIONS PVT. LTD. BANGALORE 560102

Date : 14-12-2021

PREPARED BY : K S S K | CHECKED BY: | APPROVED BY : Director Delivery Systems K S S K

Signature:



N&S SOLUTIONS PVT LTD No:37-38 Reliable Residency ,HSR Layout,Harlur,Banglore-560102

TITLE-**ASPIRATING TYPE FIRE/SMOKE DETECTION WITH ALARM SYSTEM TO RDSO SPEC-RDSO/2008/CG-04/REV-05**

DOC NO :**DOC NO:NSSPT/PDE/ASD-PIPE** REV-04

INDEX

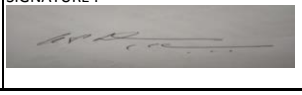
MAIN BOM DOC NO:NSSPT/PDE/ASD- QAP, SL NO:05 SAMPLING PIPE DETAILS

Sl.no	Description	Qty/PerCoach	Part No. / MAKE/OEM	Material being used as per Clause No:8.1.2
5	Fire Retardant Main Sampling Pipe Specification Diameter : 3/4 inch nominal bore(27mm O/D),. Material: CPVC with capillary pipe, T reducer joints and fixtures as per coach requirement.	25 Mts	SUPREME SAP NO:PCPZSW3M002E (NSSPT/1060.01/ PIPE-MAIN -NS INTERNAL PART NUMBER) .	Enclosed Supreme datasheet certified to UL listed (UL 1821). a) Test Reports, Guarantee Certificate, WTC / Certificate of conformance from OEM. b) Purchase Invoice / Delivery challan
5(a)	Inline Trunk Adapter for capillary Aspirating CPVC pipes	As per number of sampling points	SUPREM PRODUCT CODE:4206-007 NSSPT/1060.01/ PIPE-TA (NS INTERNAL PART NUMBER) .	Enclosed Supreme datasheet certified to UL listed (UL 1821). a) Test Reports, Guarantee Certificate, WTC /Certificate of conformance from OEM. b) Purchase Invoice / Delivery challan
5(b)	CPVC Capillary sampling Tubes (8mm TO 11mm)- 1.5 mts Length	As per number of sampling points	NSSPT/1060.01/ PIPE-ST (NS INTERNAL PART NUMBER)	a) Test Reports, Guarantee Certificate, WTC /Certificate of conformance from OEM. b) Purchase Invoice / Delivery Challan
5(c)	AL Capillary sampling points Nozzels (Concealed)	As per number of sampling points	NSSPT/1060.01/ PIPE-SN (NS INTERNAL	NS Make a)To Suit Sampling Pipe OD diameter. b)Dimensions to Meet Drawing No: NSSPT/ASD/NS/008. c)Refer Layout Drawing no.: b)Refer Layout Drawing no.: NSSPT/ASD/SAMPLING/LAYOUT/TC .Rev.05 NSSPT/ASD/SAMPLING/LAYOUT/MC .Rev.05 NSSPT/ASD/SAMPLING/LAYOUT/DTC .Rev.05 for TC/DTC/MC
5(d)	Safety Mesh cover for capillary sampling points Nozzels	3 nos	NSSPT/1060.01/ PIPE-MC (NS INTERNAL PART NUMBER)	METAL PART Enclosed Drawing no: NSSPT/ASD/SN NETTED COVER/04 a) Invoice of a local Dealer b)Refer Layout Drawing no.: NSSPT/ASD/SAMPLING/LAYOUT/TC .Rev.05 NSSPT/ASD/SAMPLING/LAYOUT/MC .Rev.05 NSSPT/ASD/SAMPLING/LAYOUT/DTC .Rev.05 for TC/DTC/MC
5(e)	Solvent Cement - Size Pint (473.17ml)	One pint box.	SUPREM PRODUCT CODE:FS5-020 NSSPT/1060.01/ PIPE-SC (NS INTERNAL PART NUMBER)	CONSUMABLE a) Invoice of a local Dealer
5(f)	Clamps & Brackets for pipe Mounting : 3/4 size	LUMPSUM as required	NSSPT/1060.01/CLR- BRC,NS MAKE , INDIA(NSINTERNAL PART NUMBER)	Ms Zinc or chromium Passivated. b) NS Make
	Coupler - Size 3/4" (20mm)	5 nos	SUPREM PRODUCT CODE:4229-007 (NSSPT/1060.01/PIPE-C NS INTERNAL PART NUMBER)	Enclosed Supreme datasheet certified to UL listed (UL 1821). a) Test Reports, Guarantee Certificate, WTC /Certificate of conformance from OEM. b) Purchase Invoice / Delivery challan
5(g)	CPVC Elbow Joints - 45° Elbow - Size 3/4" (20mm)	4 nos	SUPREM PRODUCT CODE:4206-007 (NSSPT/1060.01/PIPE-EJ NS INTERNAL PAR- NUMBER)	Enclosed Supreme datasheet certified to UL listed (UL 1821). a) Test Reports, Guarantee Certificate, WTC /Certificate of conformance from OEM. b)Purchase Invoice / Delivery challan
5(h)	CPVC EndCap	1 nos	SUPREM PRODUCT CODE:4206-007 (NSSPT/1060.01/PIPE-EJ NS INTERNAL PAR- NUMBER)	Enclosed Supreme datasheet certified to UL listed (UL 1821). a) Test Reports, Guarantee Certificate, WTC /Certificate of conformance from OEM. b)Purchase Invoice / Delivery challan
5(i)	AL Capillary sampling points Nozzels (Visible)	3 no.	NSSPT/1060.01/ PIPE-SN (NS INTERNAL	NS Make a)To Suit Sampling Pipe OD diameter. b)Dimensions to Meet Drawing No: NSSPT/ASD/NS/008. c)Refer Layout Drawing no.:b)Refer Layout Drawing no.: NSSPT/ASD/SAMPLING/LAYOUT/TC .Rev.05 NSSPT/ASD/SAMPLING/LAYOUT/MC .Rev.05 NSSPT/ASD/SAMPLING/LAYOUT/DTC .Rev.05 for TC/DTC/MC

DOC NO :NSSPT/PDE/20-21/QAP Date :14-12-2021

PREPARED BY : KSSK CHECKED BY: APPROVED BY : Director Delivery Systems K S S K

SIGNATURE :



Document Number : NS/PDE/ICF/21-22/I&C/002

Date: 27-10-2021

PLANING ACTIVITY WORKSHEET FOR ASD I & C For ICF/LHB Coaches

1	**Tender Number /Date**	**Tender number: 06211506 Closing Date/Time: 28/10/2021 14:15**
2	**Consignee**	**M/S ICF/Chennai**
3	**Paying Authority**	**M/S ICF/Chennai**
4	**Latest M.A.No. & Date**	**Not Applicable**

START DATE	END DATE	SL NO	PROCESS ACTIVITY	DRAWING DOCUMENTS
Required Documents for Reference				
		1	General schematic diagram of sampling pipe layout for 3 coaches (DTC, TC and MC) with dimensions in reference to main sampling pipe line.	1) TC onboard equipment 2) DTC onboard equipment 3) MC onboard equipment
		2	Sampling Nozzle	NSSPT/ASD/SN/008
		3	Sampling Nozzle cover	NSSPT/ASD/SN NETTED COVER/004
		4	Heat activated sampling point.	NS/AASD/HASP-001 (IEC60571 CERTIFIED SYSTEMS)
		5	control pannel	NSSPT/ASD/CONTROL PANEL/006
		6	Bend pipe for main sampling point to avoid infringement	NSSPT/1060.01/CON-PIPE
		7	sample 3D pictures of sampling pipe layout and sampling nozzle capillary pipe	ENCLOSED 3D PICTURES
		8	Approved Bill of Material for sampling pipe layout.	BOM SL. NO. 6 (SAMPLING PIPE DETAIL)
ROUTING OF SAMPLING PIPE INSIDE ROOF OF COACH				
		1	Required material for coach(Upvc pipe,elbow, T joint, approved cabels , clamps & Brackets, Buzzer, cappillary tube,Nipple, Sealeant, as per BOM).	Refer BOM NO 2
		2	The approved UPVC pipe to be laid through the false ceiling from ASD outlet to the termination on the other end for the coach as per the layout drawing .	Refer respectice 2D/3D layout drawing
		3	Main sampling pipe will be laid as per coach layout diagram, for specific coach and T-joint or capillary point offtake wil be as per layout diagram.(enclosedd Sample 3D pictures)	Refer 3D pictures
		4	Capillary pipe 10mm dia of 2.5mts and 1.5mts (Or as per customer requirement) with additional slack of 0.5mts to be provided from each capillary point offtake.	Refer Diamentional layout drawing for respective coaches
		5	The terminal end of each capillary pipe will be tied with 1.0 mmsquare flexible steel wire of 2mts length.	Refer Diamentional layout drawing for respective coaches
		6	As the ceiling panel is mounted with pre drilled sampling holes of 16mm dia. The corresponding sampling capillary pipe steel guide wire is inserted into the ceiling sampling holes and gently pulled from below.	Refer Diamentional layout drawing for respective coaches

		7	As the ceiling panel is locked in the place the guide wires are fully pulled till the sampling capillary pipe protrudes out from the respective sampling hole.	Refer Diamentional layout drawing for respective coaches
		8	The steel guide wire is is removed from the capillary pipe the terminal end of the capillary pipe is dressed.	Refer Diamentional layout drawing for respective coaches
		9	Now the capillary pipe is inserted into the sampling nozzle after a coat of adhesive compound[Refer BOM SL. No. 6(e)] simaltaneously the sampling nozzle is press fitted on to the ceiling through the 16mm hole so as to lock both mechanically and adhesively .	Refer Diamentional layout drawing for respective coaches
		10	In reference to the sampling nozzle cover drawing is fitted concentric to the sampling nozzle by means of 2 self threading screws to protect the samplig nozzle.	Refer Sampling Nozzle cover drawing number.: NSSPT/ASD/SN NETTED COVER/004
		11	The above same process is repeated is repeated for all the sampling nozzle holes as per the the sampling layout diagram for the respective coach.	
		12	Control Cabinet as per drawing number NSSPT/ASD/CONTROL PANEL/006 is mounted at far end of 4no. M10 bolting system.	
		13	precaution to be taken care of mounting the control panel along with the anti vibrating rubber with the control panel kit.	
		14	After the control panel is fitted the inlet point on the control panel for the sampling pipe is connected to main main sampling pipe line to ensure an air tight fit through the control pannel provided on the inlet pipe mounted on control panel.	
		15	A half meter to 1meter sampling pipe is fit into the outlet exhaust pipe fitted on the control panel and left open to the same pressure area .	
		16	power supply cable 110volt DC is drawn from the coach control panel through the coach cable tray and terminate through 110volts PG 16 glands inside the control panel.	
		17	The TCMS data cable from the control panel is drawn through PG16 gland on the control panel to the TCMS termination points provided near the control panel installation.	
		18	The 4 relay output NC/NO contact cabling is drawn from the control panel PCB termiantion (Refer wiring chart drawing number: NSSPT/PDE/WIRING -CHART/001) through the PG16 gland and provide to the TCMS systems.	
		19	please refer to the routine test procedure for the full system to RDSO clause no. 6.4 to test the system.	

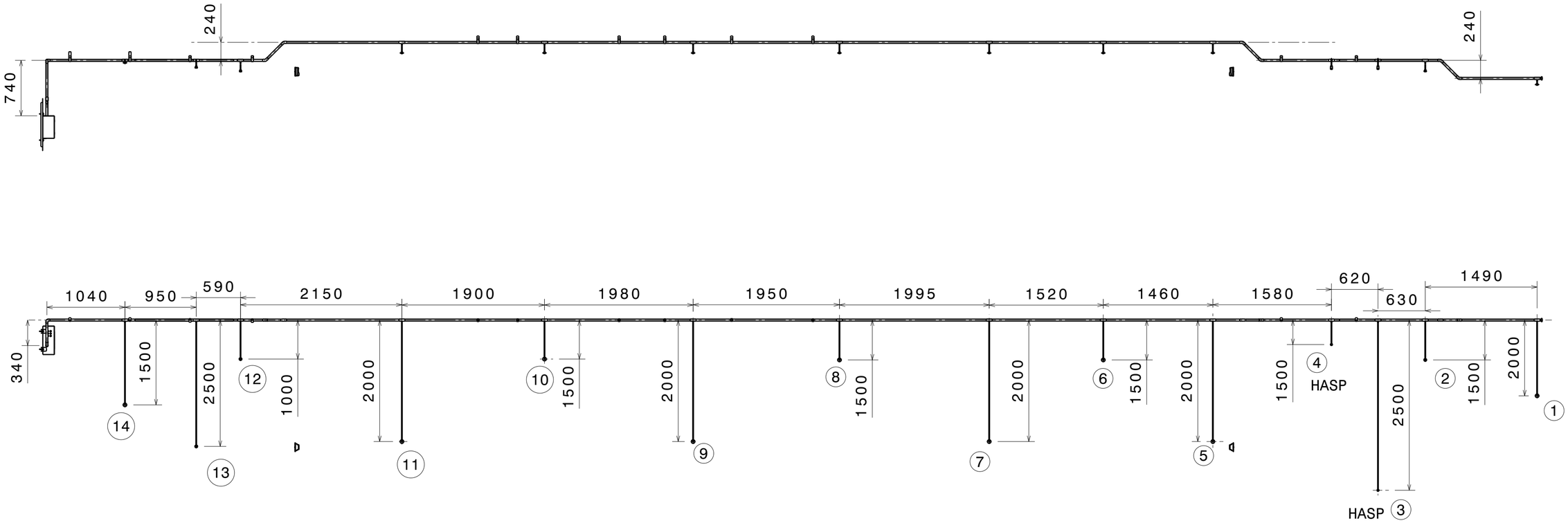
		20	Refer test plane for sensors to RDSO Specification no. RDSO/2008/CG-04/REV-05	
		21	Refer to test plan result tabulation for recording the various parameters once commisioning of the system is done.	
ROUTING OF FIELD CABLES INSIDE COACH				
		1	From Buzzer audio visual at mounted on ceiling outside both end A .C Coach door visible to passenger.	Refer to the fitment chart for the individual parts
		2	Drawing 110 v DC, A.C Coach or supply from electrical panel through false ceiling via cabel tray with 2.5 mm square fire retardent.	I & C User Manual
		3	Continuity checking end for each cable to ensure signal transmission.	I & C User Manual
		4	To connect data download cabel from Hochiki ASD box with sub -d cabels to TCMS point from control pannel.	I & C User Manual
Powering on and calibration				
		1	Check continuty of every cabel.	
		2	Check power supply from electric panel 110v DC.	
		3	Power on fire panel.	
		4	verify fire panel an ASD Instalization.	
		5	Now follow N & S Solution document for user setup procedure.	

Precautions	
1	Use always approved adhesive compound (as per BOM) for all pipe joints to ensure no leakage.
2	Ensure thin film of adhesive compound is applied specifically for capillary pipe inserted to sampling nozzles to avoid or prevent excessive adhesive compound accumulating in sampling nozzles.
3	as every lenth of pipe is being layed, ensure that there is no dust, greese, oil and foreign material in the pipes being laid.
4	All the sampline pipe line to be layed and harnessed as per the layout diagram for the specific coaches with mounting brackets as shown.

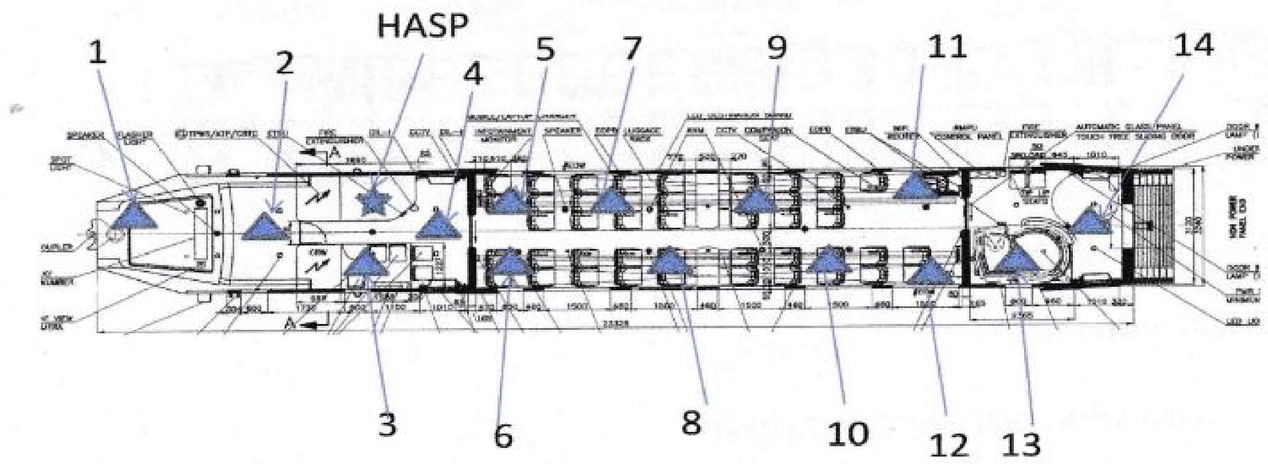
Note:1. For each coach 2 manpower is required, 1 person is electrical and another person is mechanical technicians and one Supervisior or manager.

Note: 2. Superviser from Bangalore office should remain.

Prepared :Ramya (Customer Contract Management)	**Checked : I & C Team**	**Approved: K. S. Shailesh Kumar (Director)**



TS/DTC REQUIREMENTS :



▲ ASPIRATION TYPE SAMPLING POINT

★ HASP (HEAT ACTIVATED SAMPLING POINT)

NOTES:
1.10MM DIA PIPE IS FLEXIBLE PIPE,
KEEP +15CM TOLERANCE (EXTRA LENGTH) FOR ADJUSTMENTS

2.REFER DETAILED BOM FOR SAMPLING PIPE SYSTEM.

SAMPLING POINTS AND TYPES :

1) IN PASSENGER AREA : 6 SAMPLING POINTS (CONSEALED) - FROM 6 TO 11

2) SAMPLING POINTS IN DOOR WAY : 3 CONSEALED - (1 ,5, 14)

3) 2 HASP IN PANTRY: (VISIBLE)

4) NO OF SAMPLING IN ELECTRICAL PANEL: 1(VISIBLE) - 2

5) 2 SAMPLING POINTS IN TOILETS (VISIBLE TO PASSENGER) - 12 AND 13

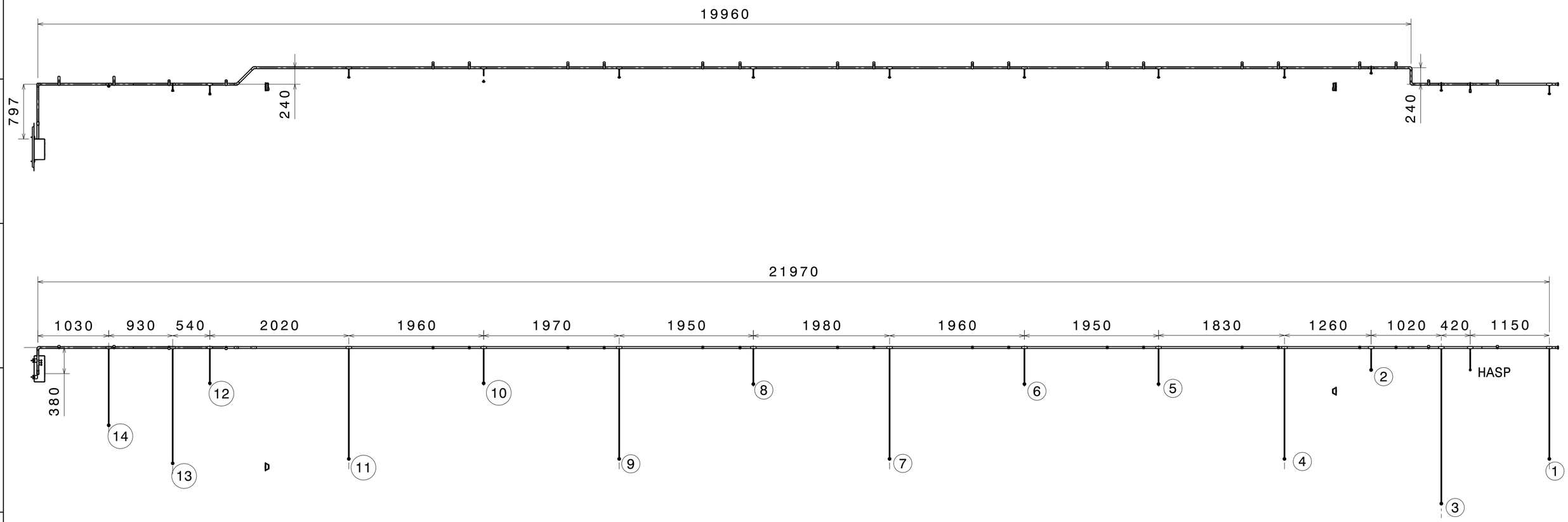
MEASUREMENT OF MAIN SAMPLING PIPE AND TEE JOINTS ARE AS MEASURED FROM THE PHYSICAL COACH.

NOTE: REFER DRW NO NSSPT/ASD/SN/008 (REVISION 04) FOR CONSEALED SAMPLING POINT ASSEMBLY

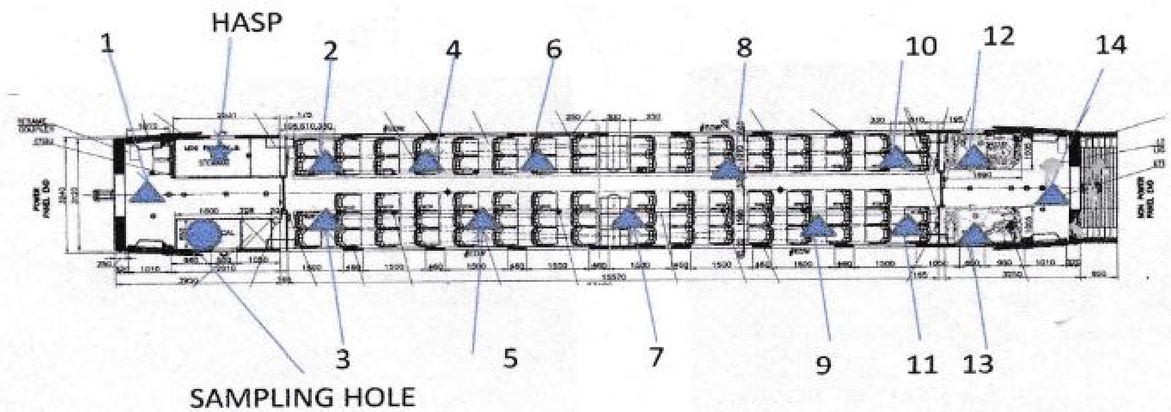
NOTE: REFER DRW NO NSSPT/ASD/SN/008 (REVISION 03) FOR VISIBLE SAMPLING ASSY

N&S SOLUTIONS PVT LTD

DRAWN BY	DATE	DRAWING TITLE: MAIN SAMPLING PIPELAYOUT ALONG WITH CAPILLARY PIPES - DTC			
JAGADISH	22/02/2022				
CHECKED BY	DATE	SIZE	DRAWING NUMBER		REV
SHIV KUMAR	22/02/2022	A2	NSSPT/ASD/SAMPLING/LAYOUT/DTC		06
APPROVED BY	DATE	SCALE 1:40	WEIGHT(kg)		SHEET 1/1
KSSK	22/02/2022				



TS/MC REQUIREMENTS :



SAMPLING POINTS AND TYPES :

1) IN PASSENGER AREA : 10 SAMPLING POINTS (CONSEALED) - FROM 2 TO 11

2) SAMPLING POINTS IN DOOR WAY : 2 CONSEALED - (1 AND 14)

3) 1 HASP IN PANTRY: (VISIBLE)

4) NO OF SAMPLING IN ELECTRICAL PANEL: 1(VISIBLE)

5) 2 SAMPLING POINTS IN TOILETS (VISIBLE TO PASSENGER) - 12 AND 13

MEASUREMENT OF MAIN SAMPLING PIPE AND TEE JOINTS ARE AS MEASURED FROM THE PHYSICAL COACH.

NOTE: REFER DRW NO NSSPT/ASD/SN/008 (REVISION 04) FOR CONSEALED SAMPLING POINT ASSEMBLY

NOTE: REFER DRW NO NSSPT/ASD/SN/008 (REVISION 03) FOR VISIBLE SAMPLING ASSY

NOTES:
1.10MM DIA PIPE IS FLEXIBLE PIPE,
KEEP +15CM TOLERANCE (EXTRA LENGTH) FOR ADJUSTMENTS

2.REFER DETAILED BOM FOR SAMPLING PIPE SYSTEM.

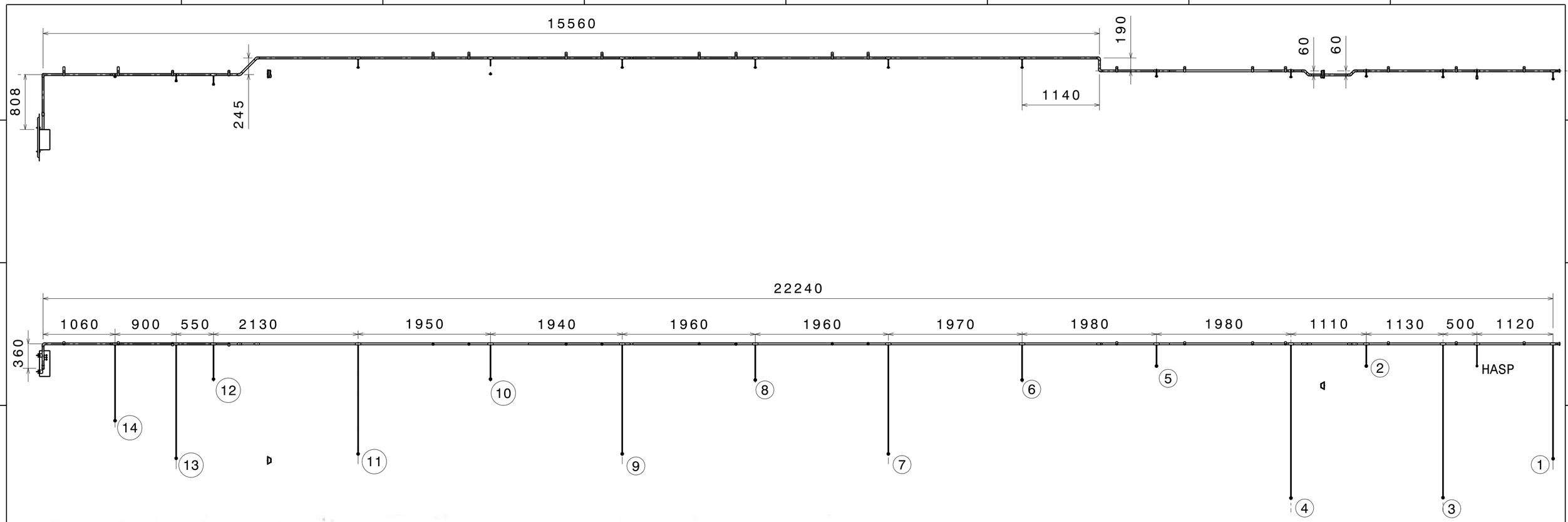
DRAWN BY	JAGADISH	DATE 25/12/2021
CHECKED BY	SHIV KUMAR	DATE 25/12/2021
APPROVED BY	KSSK	DATE 25/12/2021

N&S SOLUTIONS PVT LTD

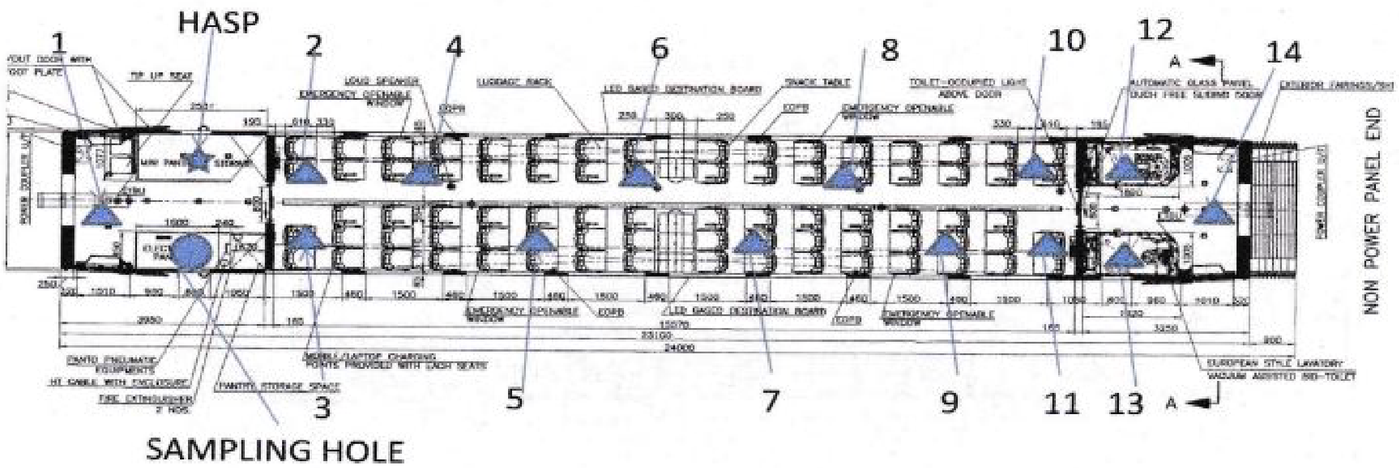
DRAWING TITLE
MAIN SAMPLING PIPELAYOUT ALONG WITH CAPILLARY PIPES - MC

SIZE	DRAWING NUMBER	REV
A2	NSSPT/ASD/SAMPLING/LAYOUT/MC	05

SCALE 1:40 | WEIGHT(kg) | | SHEET 1/1



TS/TC REQUIREMENTS :



ASPIRATION TYPE SAMPLING POINT

HASP (HEAT ACTIVATED SAMPLING POINT)

SAMPLING HOLE

NOTES:
1.10MM DIA PIPE IS FLEXIBLE PIPE,
KEEP +15CM TOLERANCE (EXTRA LENGTH) FOR ADJUSTMENTS

2.REFER DETAILED BOM FOR SAMPLING PIPE SYSTEM.

SAMPLING POINTS AND TYPES :

1) IN PASSENGER AREA : 10 SAMPLING POINTS (CONSEALED) - FROM 2 TO 11

2) SAMPLING POINTS IN DOOR WAY : 2 CONSEALED - (1 AND 14)

3) 1 HASP IS PANTRY: (VISIBLE)

4) NO OF SAMPLING IN ELECTRICAL PANEL: 1(VISIBLE)

5) 2 SAMPLING POINTS IN TOILETS (VISIBLE TO PASSENGER) - 12 AND 13

MEASUREMENT OF MAIN SAMPLING PIPE AND TEE JOINTS ARE AS MEASURED FROM THE PHYSICAL COACH.

NOTE: REFER DRAWING NO NSSPT/ASD/SN/008 (REVISION 04) FOR CONSEALED SAMPLING POINT ASSEMBLY

NOTE: REFER DRAWING NO NSSPT/ASD/SN/008 (REVISION 03) FOR VISIBLE SAMPLING ASSY

N&S SOLUTIONS PVT LTD

DRAWN BY	JAGADISH	DATE	25/12/2021
CHECKED BY	SHIV KUMAR	DATE	25/12/2021
APPROVED BY	KSSK	DATE	25/12/2021

DRAWING TITLE: MAIN SAMPLING PIPELAYOUT ALONG WITH CAPILLARY PIPES - TC

SIZE	DRAWING NUMBER	REV
A2	NSSPT/ASD/SAMPLING/LAYOUT/TC	05

SCALE 1:40 | WEIGHT(kg) | | SHEET 1/1

	N&S SOLUTIONS PVT LTD No:37-38 Reliable Residency ,HSR Layout,Harlur,Banglore-560102	Document number: NSSPT/PDE/21-22/QAP/IO/002	Date: 18-12-2021
	TITLE-ASPIRATING TYPE FIRE/SMOKE DETECTION WITH ALARM SYSTEM TO RDSO SPEC-RDSO/2008/CG-04/REV-05		Rev.03

External Terminal Connection and Wiring Details Outside The Control Panel

		Source			Destination			
SL NO	ASD External Interface	Terminal Connection/Components	Terminal /Pin No	Signal Name	Terminal Connection/Components	Number on terminals	Signal Name	Wiring Details
1	Control Panel To Flasher Hooter 1	Control Panel wago Terminal	21	FH1(+) (RED)	Direct Termination through lugs	43	FH1(+) (RED)	2C X 1.0 mm 2 Twisted Pair EBEAM Cable Length As Required
			22	FH1(-) (BLACK)		44	FH1(-) (BLACK)	2C X 1.0 mm 2 Twisted Pair EBEAM Cable Length As Required
2	Control Panel To Flasher Hooter2	Control Panel wago Terminal	21	FH2(+) (RED)	Direct Termination through lugs	45	FH2(+) (RED)	2C X 1.0 mm 2 Twisted Pair EBEAM Cable Length As Required
			22	FH2(-) (BLACK)		46	FH2(-) (BLACK)	2C X 1.0 mm 2 Twisted Pair EBEAM Cable Length As Required
3	Control Panel To Audio Announcement	Control Panel wago Terminal	3	SP(+)(Red)	Direct Termination through lugs	47	SP(+)(Red)	2C X 1.0 mm 2 Twisted Pair EBEAM Cable Length As Required
			4	SP(-)(Yellow)		48	SP(-)(Yellow)	2C X 1.0 mm 2 Twisted Pair EBEAM Cable Length As Required
4	Inlet power Supply from Coach	LNE OF COACH	LNE		LNE of Panel	L	L(RED)	2.5mm2 2C+1 Twisted Pair EBEAM Cable
						N	N(BLACK)	2.5mm2 2C+1 Twisted Pair EBEAM Cable
						E	E(GREEN)	2.5mm2 2C+1 Twisted Pair EBEAM Cable
5	RS485 MODBUS	Control Panel wago Terminal	D+	RS1	TCMS			
			D-	RS2				
			GND	RS3				
6	Control Panel Relay to TCMS							
6A	RL1	Control Panel wago Terminal	35	ALT 1				2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required
			36	ALT2				2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required
6B	RL2	Control Panel wago Terminal	37	ACT1				2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required
			38	ACT2				2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required
6C	RL3	Control Panel wago Terminal	39	FR1				2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required
			40	FR2				2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required
6D	RL4	Control Panel wago Terminal	41	FR3				2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required
			42	FR4				2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required
7	Smoke Sensor	Control Panel wago Terminal	29	SS1	Direct Termination through lugs	49	SS1(RED)	2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required
			30	SS2		50	SS2(BLACK)	2C X 1.0 mm2 Twisted Pair EBEAM Cable Length As Required

PREPARED BY : Projects & Design Engineer- | CHECKED BY : K S S K

HEPWORTH RAIL
INTERNATIONAL

Installation & Maintenance Manual

PERFORMANCE DESIGNED WIPER SYSTEMS
for ***The Rail Industry***

CONTENTS

HEPWORTH RAIL INTERNATIONAL

IRIS Certification

2-4 Merse Road, North Moons Moat, Redditch,
Worcestershire B98 9HL England
Web site – www.b-hepworth.com Tel: +44(0)1527 60146 Fax: +44(0)1527 66836
Email – customerservice@b-hepworth.com

Installation and Maintenance

INSTRUCTIONS

TRAIN 18

PROJECT NO. – 1036446

Creation Date	1ST November 2018	
Revision Level	Revision Date	Revision Details
2	19/12/2018	UPDATED ELECTRICAL CONECTIONS TABLE (PAGE 18)
3	28/09/2021	PAGE 6, 7 & 39 UPDATED

GENERAL INFORMATION AND SAFETY SUMMARY

As we will have no influence on the installation of complete windscreen wiper systems if installation is to be carried out by the customer, we are unable to accept liability for installation errors.

If you require any additional information or any special problems arise which the installation/maintenance instructions do not treat in sufficient detail please contact Customer Service at Hepworth Rail International directly.

Safety Precautions

CAUTION! BEWARE OF INJURY!

BEFORE WORKING ON THE WIPER SYSTEM, OBSERVE THE FOLLOWING REMARKS WITHOUT FAIL!

Most wiper motors have a park setting, which permits them to default to the parked position if connected to the vehicle electrical system, even when the wiper is switched off. FOR THIS REASON, AT THIS POINT IN TIME, NEITHER MAY THE WIPER ARM BE MOUNTED, NOR MAY ANY PERSON HAVE HANDS, FINGERS, ETC ANYWHERE NEAR THE WIPER SYSTEM. Even small wiper motors can neither be braked nor stopped by hand.

NEVER REACH INTO THE AREA OF THE ROD LINKAGE WHEN THE SYSTEM IS RUNNING!

When putting into service (i.e. when connecting the wiper motor to the vehicle electrical system, even if the wiper switch is in the 0 position), never leave any loose items such as screwdrivers in the area of the wiper system, as flying objects could lead to injury.

Please ensure the equipment is handled with care. Do not drop or bang the equipment down on a hard surface taking extra care around the area where the motor shaft is situated. Do not hammer the motor shaft when installing the equipment, as this will cause the motor gear plate to deform causing premature failure of the unit.
BEFORE WORKING ON THE WIPER SYSTEM, OBSERVE THE FOLLOWING REMARKS WITHOUT FAIL!

Introduction

The Windscreen Wiper system utilised is detailed on the following pages. The primary components that form the Windscreen Wiper System are the wiper motor linkage, the wiper arms and the wiper blades.

Abbreviations and Definitions

Abbreviation	*Definition*
Assy	Assembly
Brk	Bracket
D. Crk	Drive Crank
DS	Drivers Side
G.R.P.	Glass Reinforced Plastic

Abbreviation	*Definition*
NDS	Non-Drivers Side
LH	Left Hand
RH	Right Hand
S.A.	Sub Assembly
SS	Stainless Steel

SCOPE OF SUPPLY

Wiper Linkage Assy – S613255VM/S613256VM

The wiper motor is mounted on a fabricated steel bracket which is polyester powder coated black to prevent corrosion. The motor is connected electrically by means of a multi-pin connector.

The drive crank is secured to the wiper motor shaft and connected through a double bearing or a tie-bar/bearing assy, to the main spindle lever assy. These components transfer the motor shaft rotation to the wiper arm assy.

The drive mechanism transfers the rotary output from the motor to a reciprocating motion of the spindles. This mechanism is zinc plated and is sized to give the correct angle of arc for the windscreen wiper arm being driven.

A main spindle and idler spindle are used on pantograph units. These pass through the bulkhead, connecting the drive mechanism to the wiper arm. These are manufactured from stainless steel, to prevent corrosion.

Wiper Arm Assy – 805528/805529

The wiper arm is manufactured from stainless steel with brass castings and is polyester powder coated to prevent corrosion and to be of good appearance.

One wiper arm assy is used on each unit. The wiper arm assy mounts directly onto the spindles protruding through the cab structure.

The wiper arm is secured to the spindles with a series of nuts and washers.

Wiper Blade – B140 39 B

The blade is secured to the arm assy using the blade clip arrangement on the arm with a blade retaining screw and Nylock nut.

Wash Tank/Pump Assembly – 150A19500

The 9.6L water tank is fabricated from stainless steel. Mounting is achieved by bolting via four slotted brackets on the side of the tank.

The wash pump is mounted on the inside of the wash tank, it is powered by a 24v DC supply, and when energised, the pump supplies washer fluid to the wash jet mounted on the wiper arm, through suitable tubing.

Filler spout with wash hose – 150A19600

The external filler spout is fabricated form stainless steel, and polyester powder coated black mounting brackets. Mounting is achieved by bolting via 4 holes on the two welded brackets.

Off/Int/Slow/Fast & Push Wash Switch – 10171000

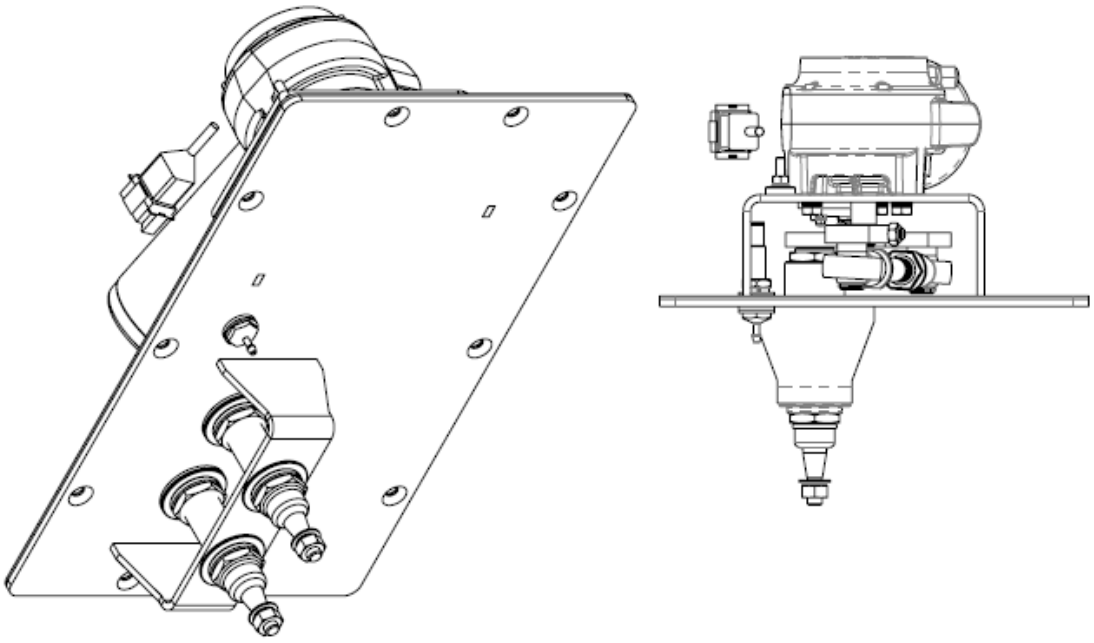
4 position, 90º switching angle, – Off; Intermittent; Slow; Fast & Push to Wash

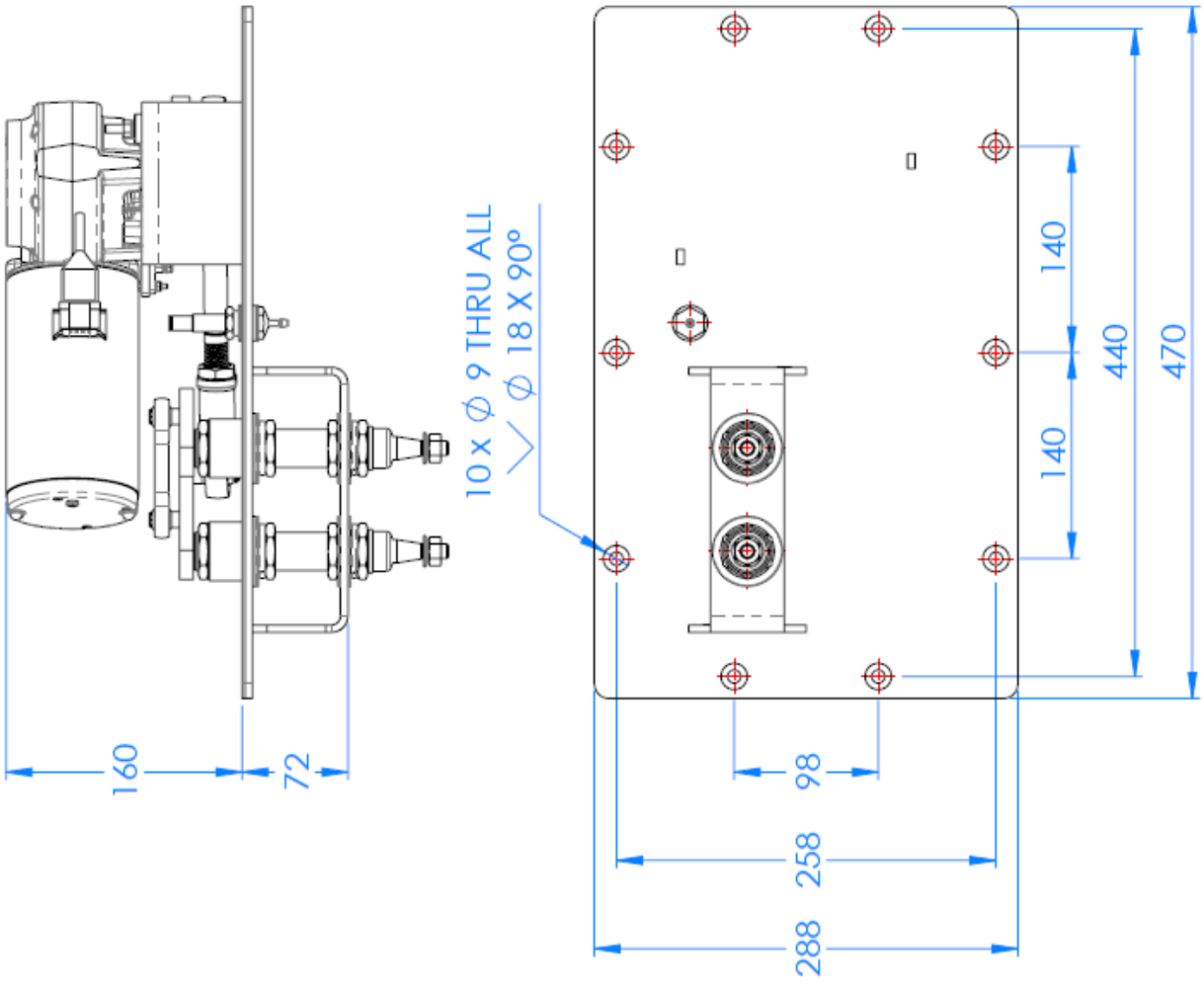
Control Unit – HE0714-04

The control box is fabricated from stainless steel, and polyester powder coated black to be of good appearance. Mounting is achieved by bolting via flanges welded to the sides of the box.

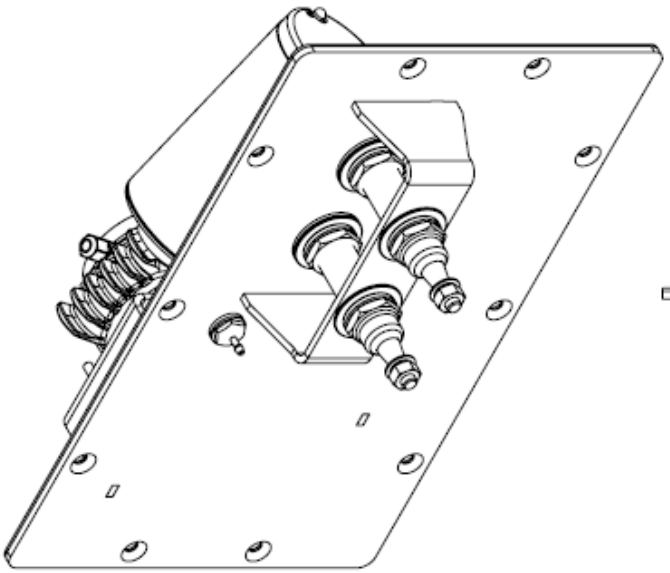
Electrically connected by means of a multi-pin connector via a harness to the two motors, switch, pump and train interface.

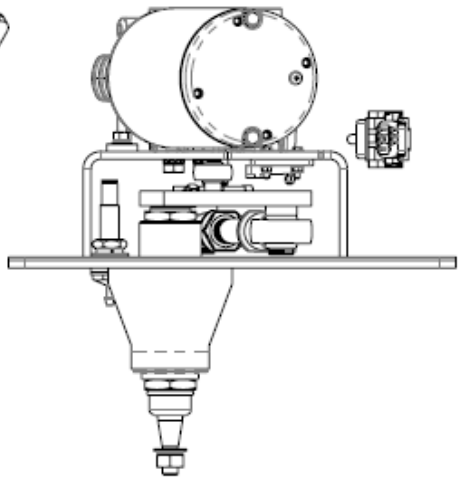
WIPER LINKAGE ASSY – S613255VM

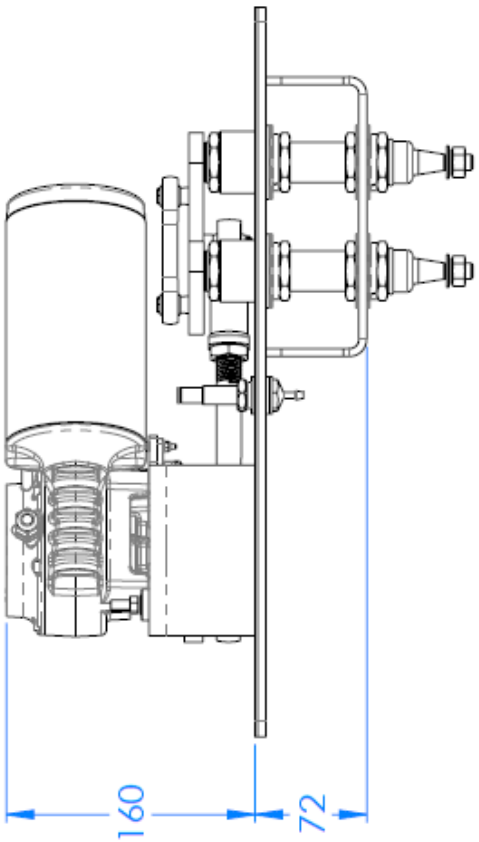


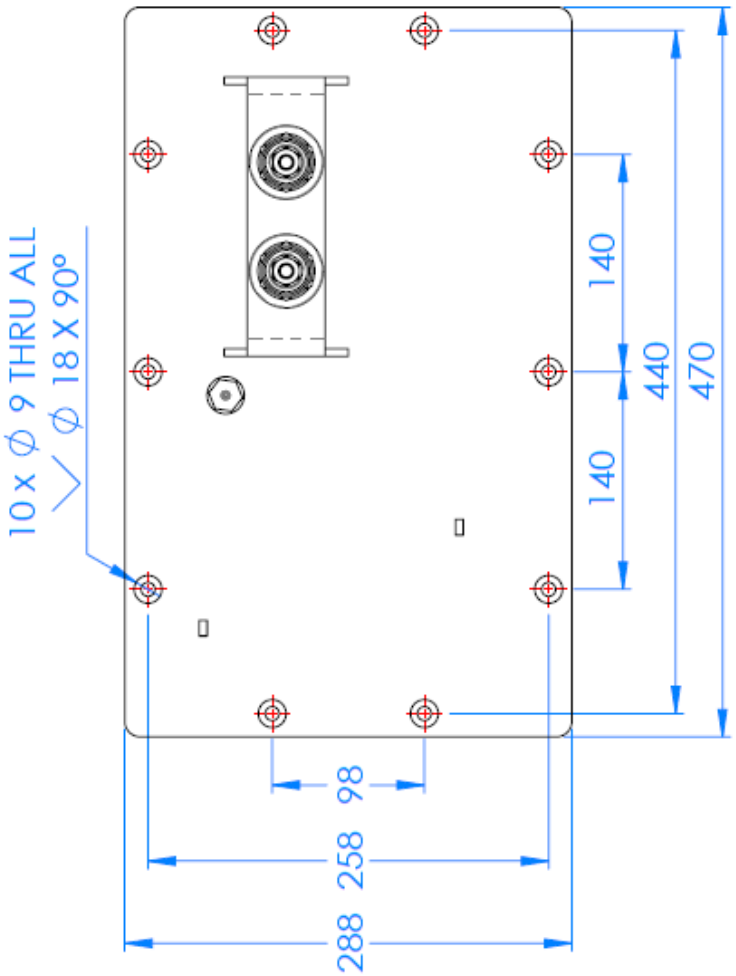


WIPER LINKAGE ASSY – S613256VM

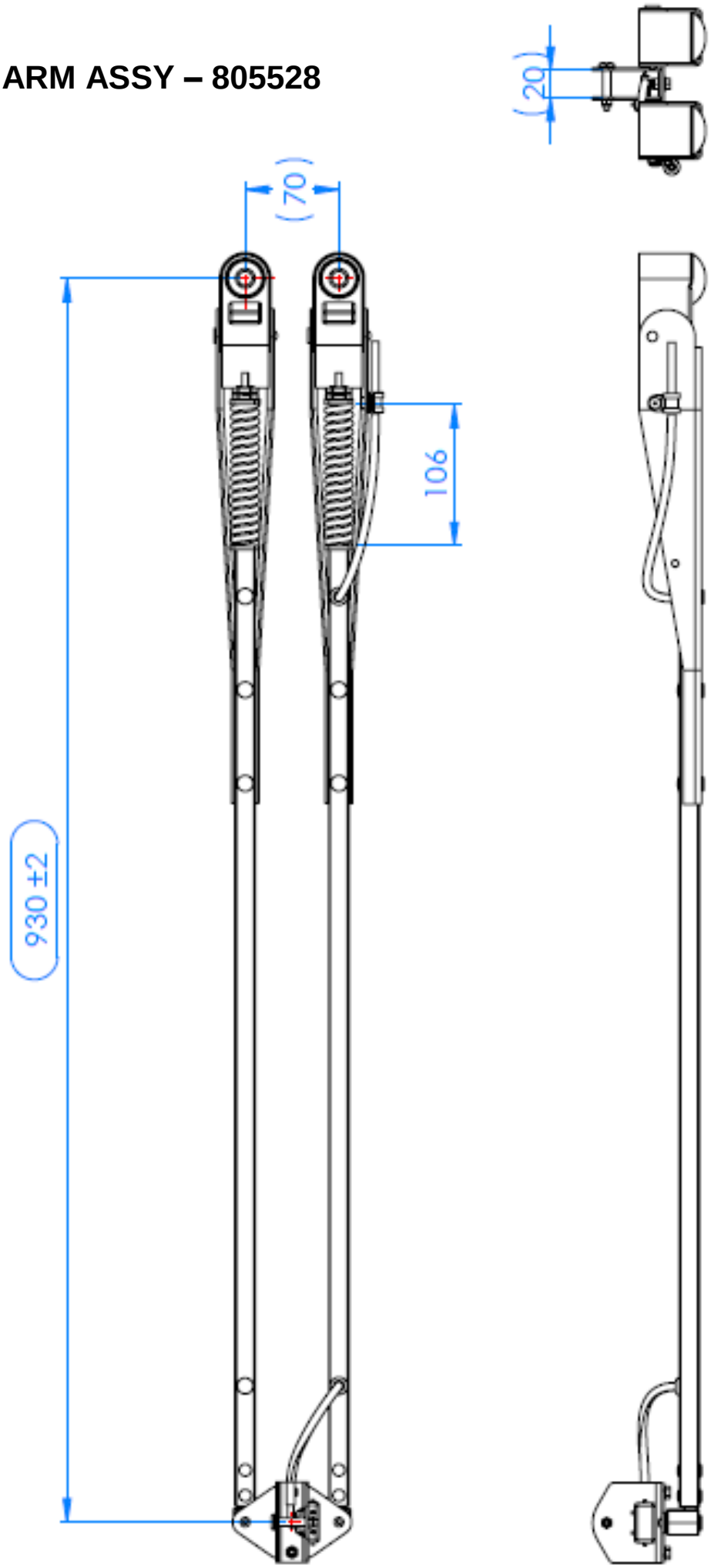




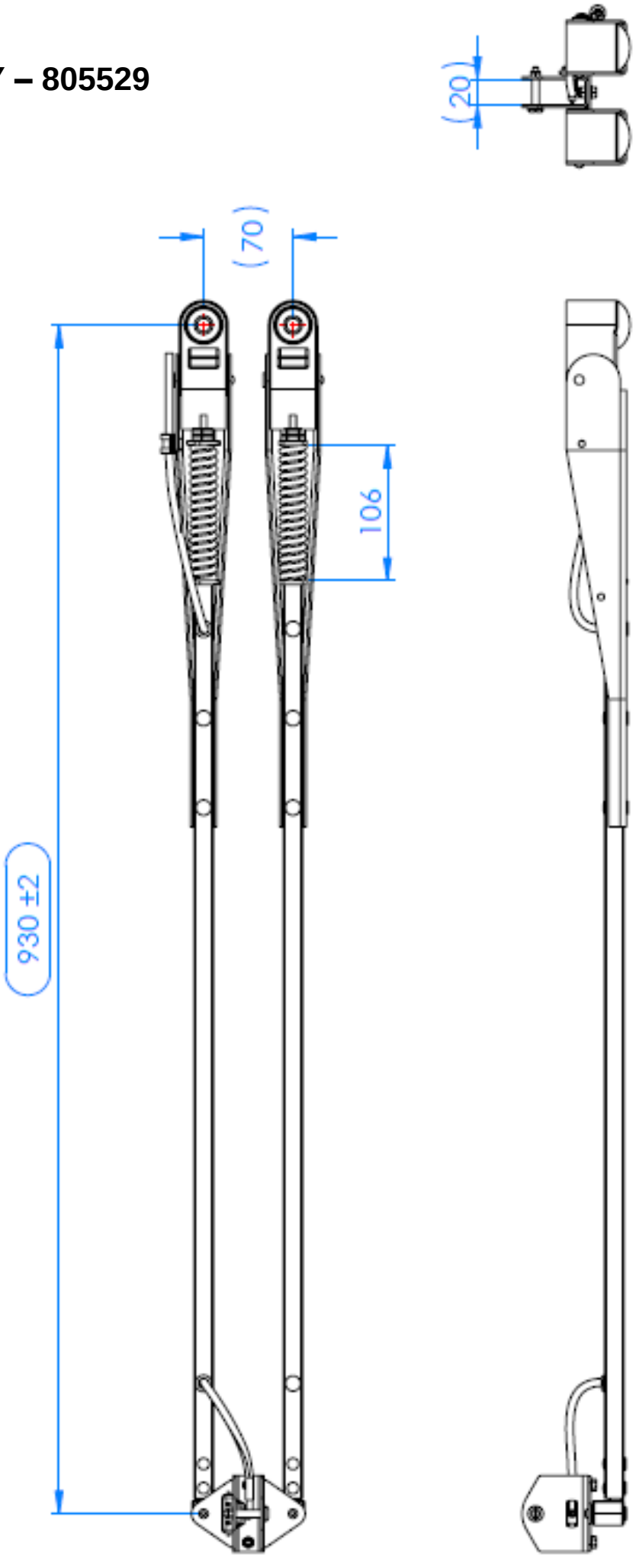




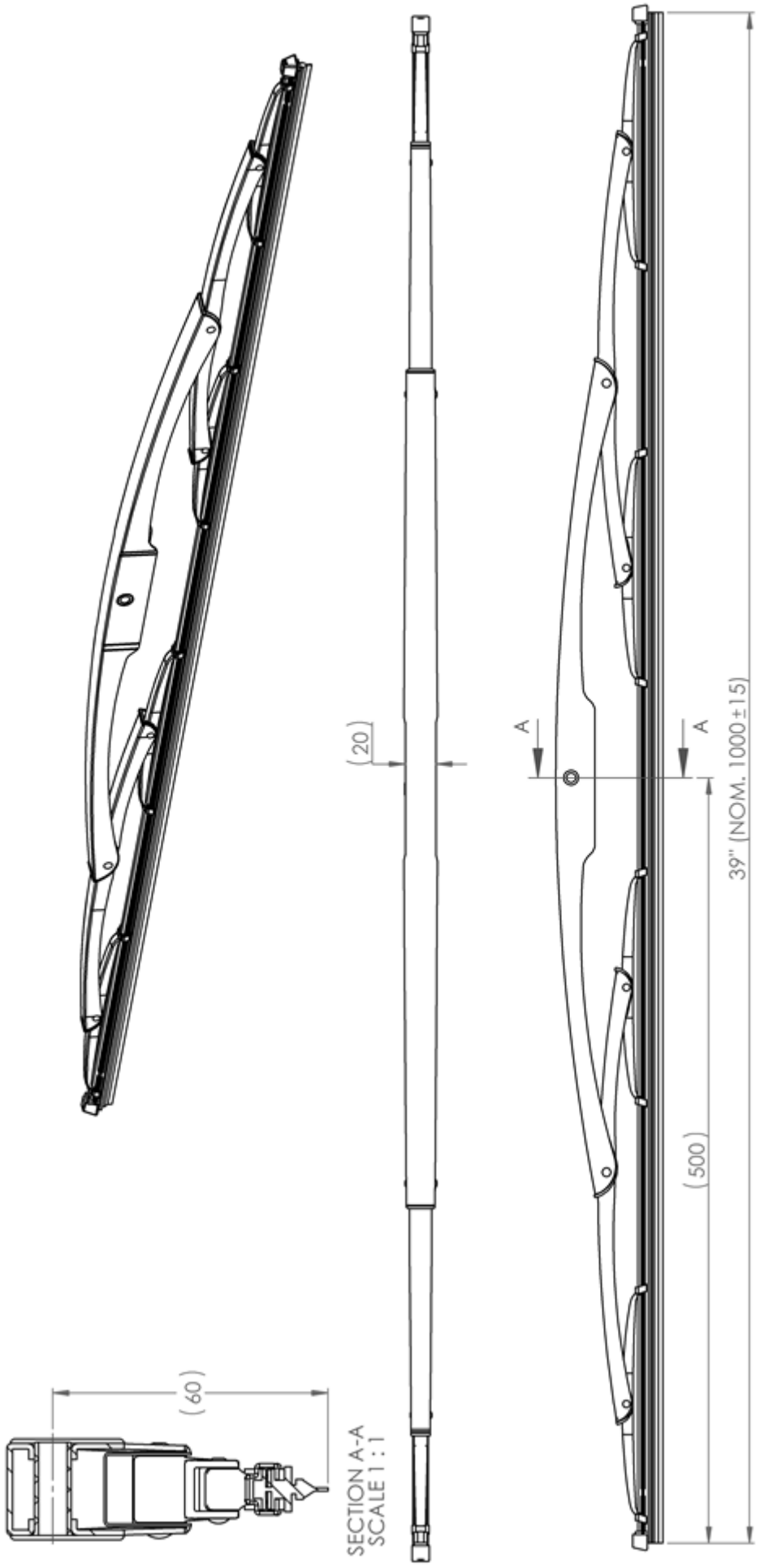
WIPER ARM ASSY – 805528



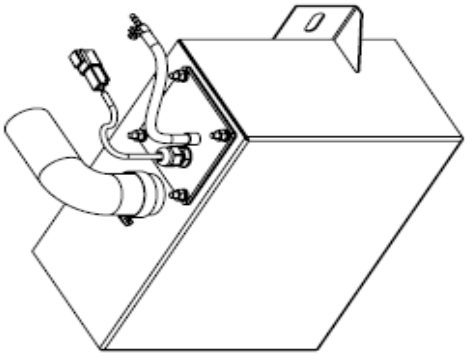
WIPER ARM ASSY – 805529

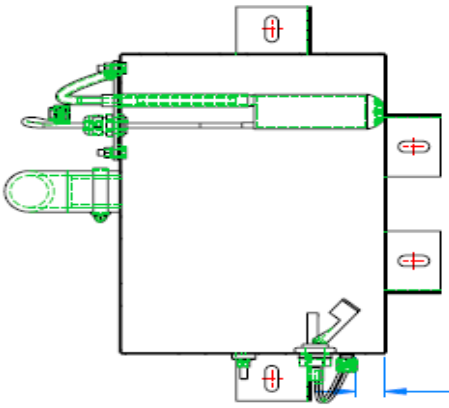


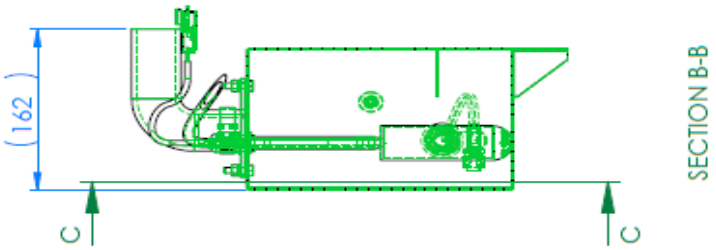
ARTICULATED BLADES – B140 39 B

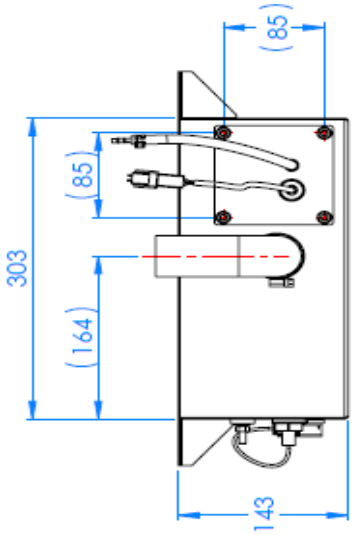


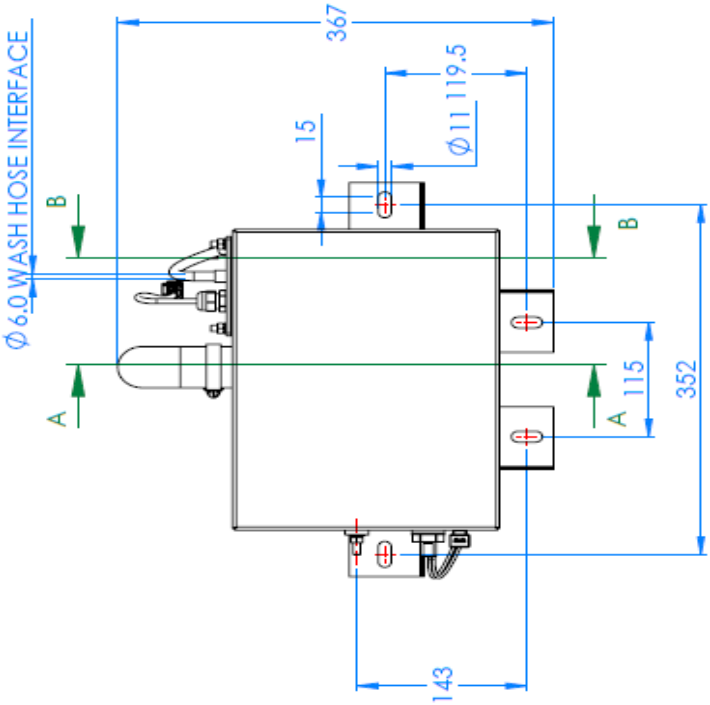
WASH TANK WITH SUMBMERSIBLE PUMP – 150A9500

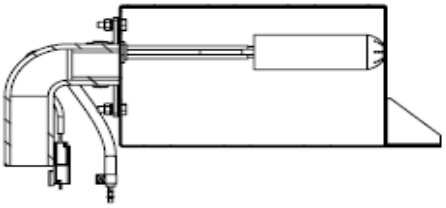




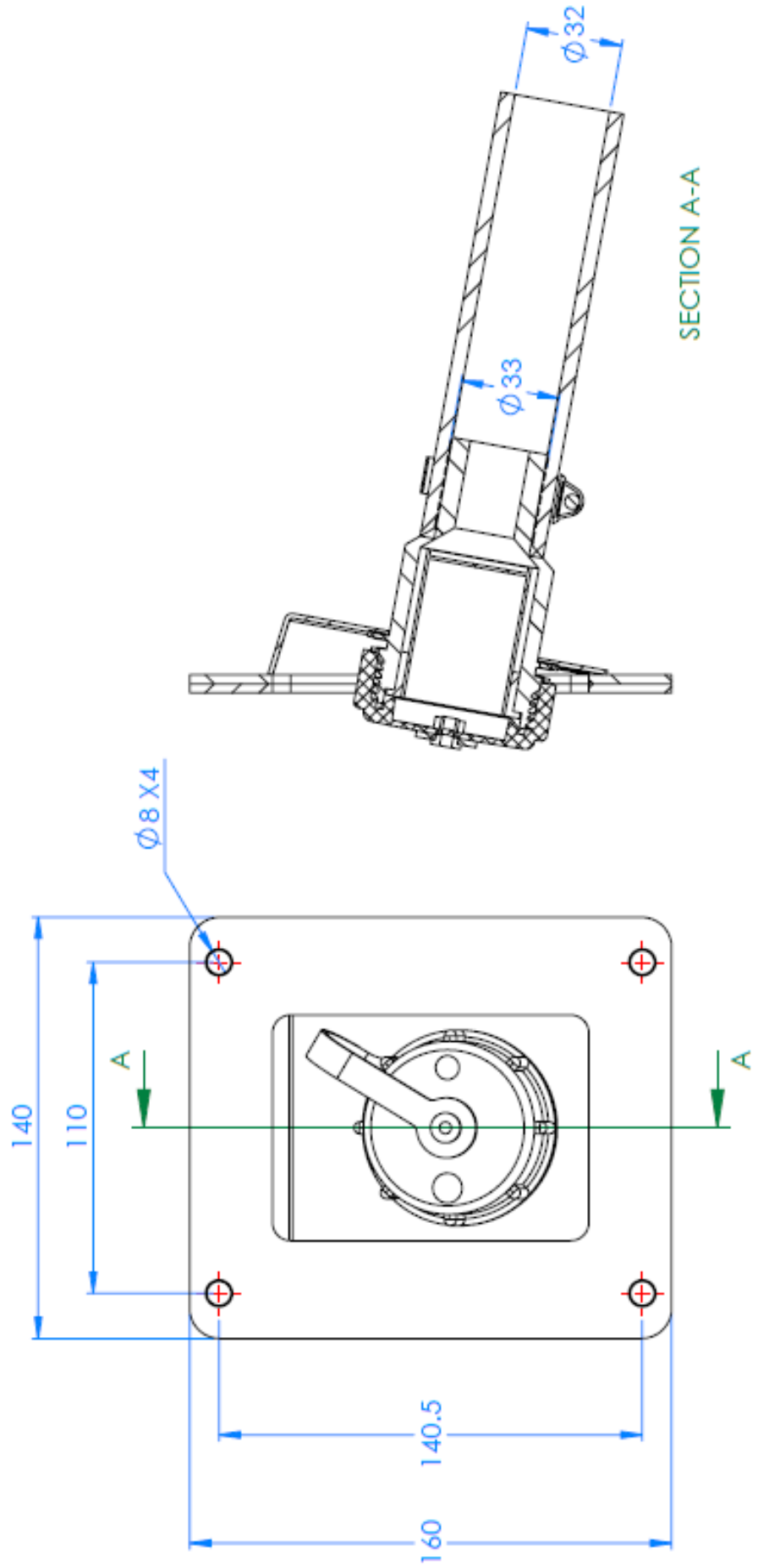




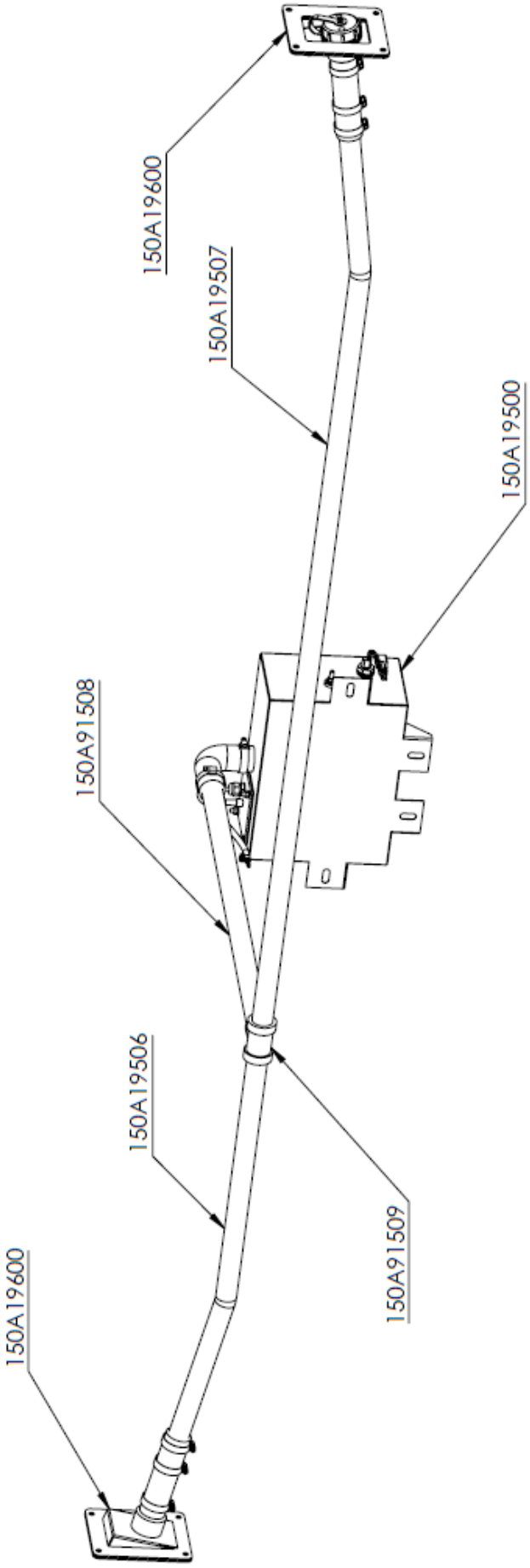




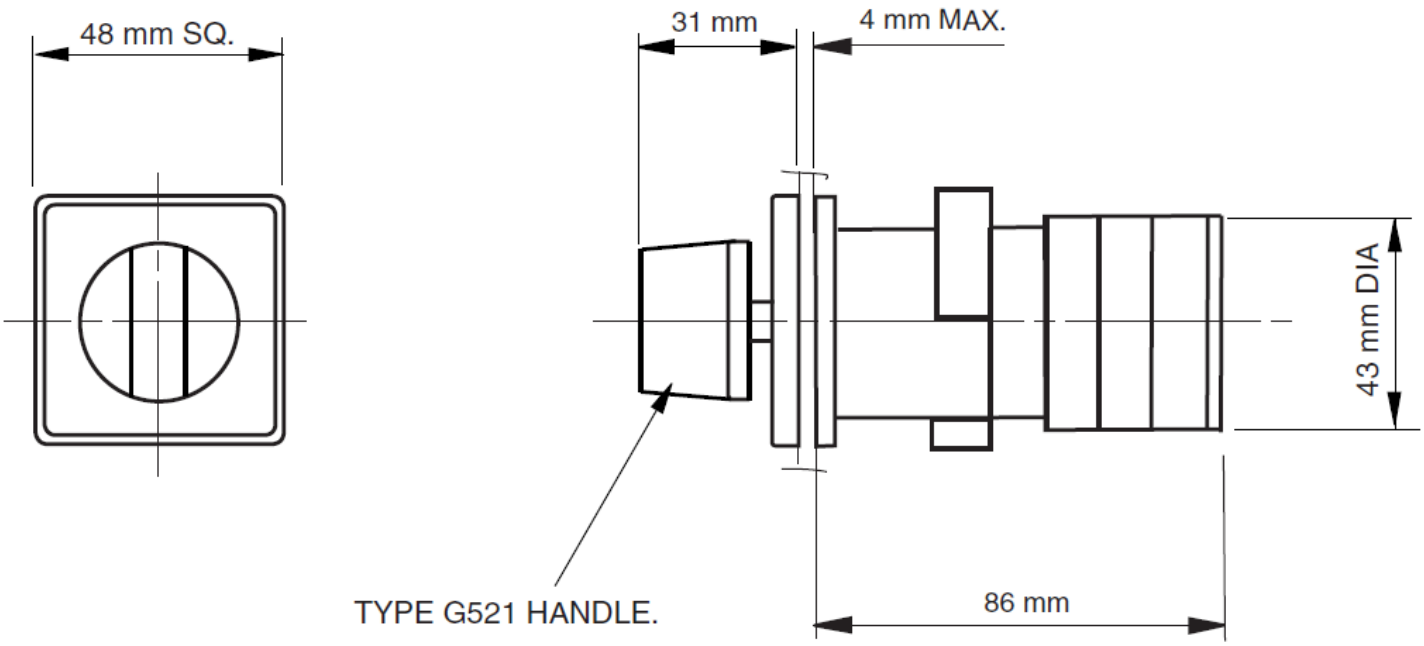
EXTERNAL FILLER SPOUT – 150A19600

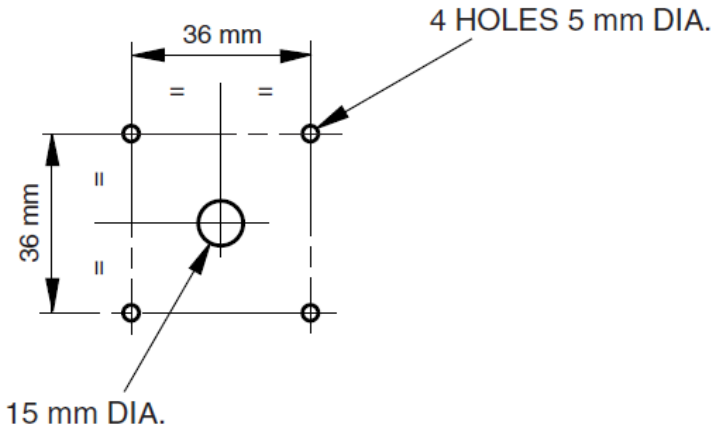


WASH SYSTEM SCHEMATIC



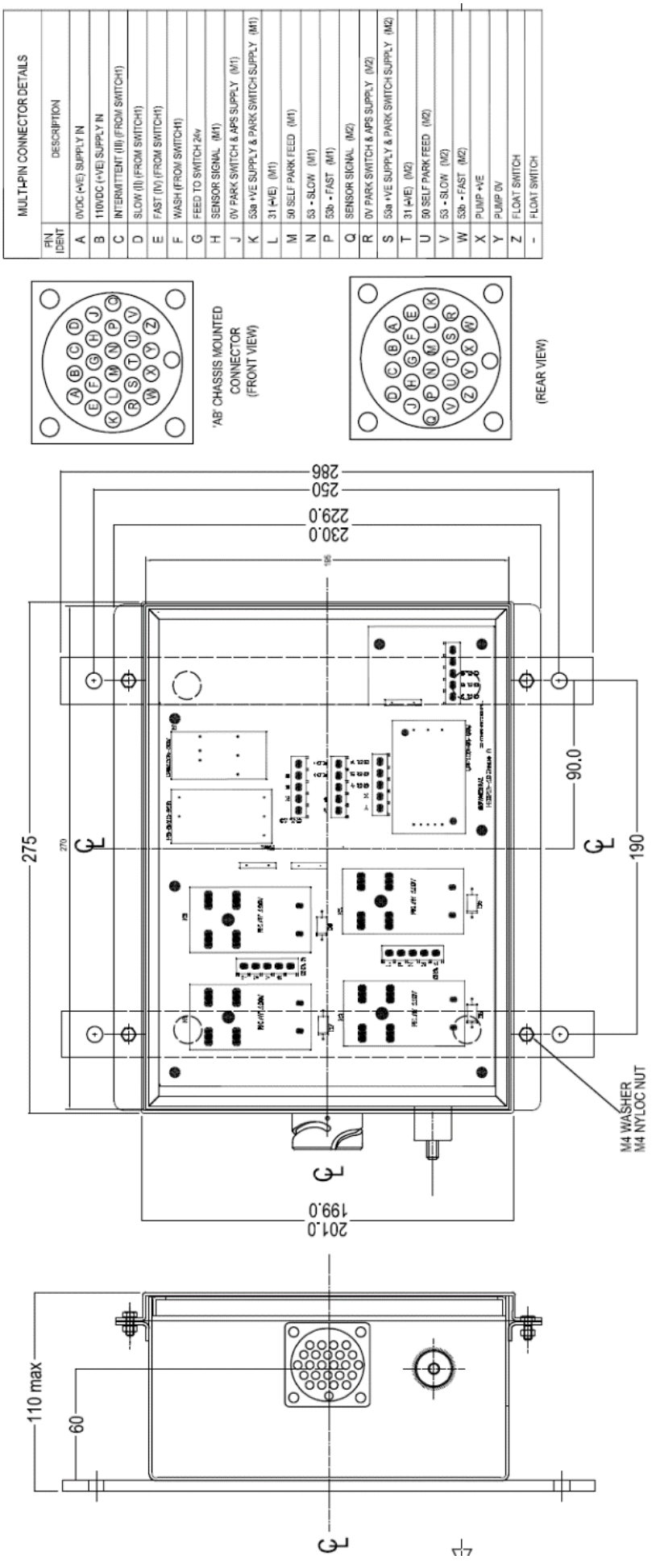
CONTROL SWITCH – 10171000





FRONT MTG HOLES

CONTROL BOX


MULTI-PIN CONNECTOR DETAILS
PIN IDENT
DESCRIPTION
A 0VDC (-VE) SUPPLY IN
B 110VDC (+VE) SUPPLY IN
C INTERMITTENT (IB) (FROM SWITCH1)
D SLOW (IB) (FROM SWITCH1)
E FAST (IV) (FROM SWITCH1)
F WASH (FROM SWITCH1)
G FEED TO SWITCH 24v
H SENSOR SIGNAL (M1)
J 0V PARK SWITCH & APS SUPPLY (M1)
K 53a +VE SUPPLY & PARK SWITCH SUPPLY (M1)
L 31 (-VE) (M1)
M 50 SELF PARK FEED (M1)
N 53 - SLOW (M1)
P 53b - FAST (M1)
Q SENSOR SIGNAL (M2)
R 0V PARK SWITCH & APS SUPPLY (M2)
S 53a +VE SUPPLY & PARK SWITCH SUPPLY (M2)
T 31 (-VE) (M2)
U 50 SELF PARK FEED (M2)
V 53 - SLOW (M2)
W 53b - FAST (M2)
X PUMP +VE
Y PUMP 0V
Z FLOAT SWITCH
- FLOAT SWITCH
'AB' CHASSIS MOUNTED CONNECTOR (FRONT VIEW)
(REAR VIEW)
286
250
229.0
230.0
275
90.0
190
M4 WASHER
M4 NYLOC NUT
201.0
199.0
110 max
60

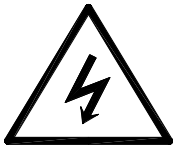
INSTALLATION INSTRUCTIONS

NOTE
Retain all items removed in a safe place, as they will be required on reassembly.

Any item to be discarded must be done in accordance to vehicle manufacturer described task guidelines

If you experience any difficulty in the fitting of any of the units/components, please do not hesitate to contact Customer Service at Hepworth Rail International for advice.

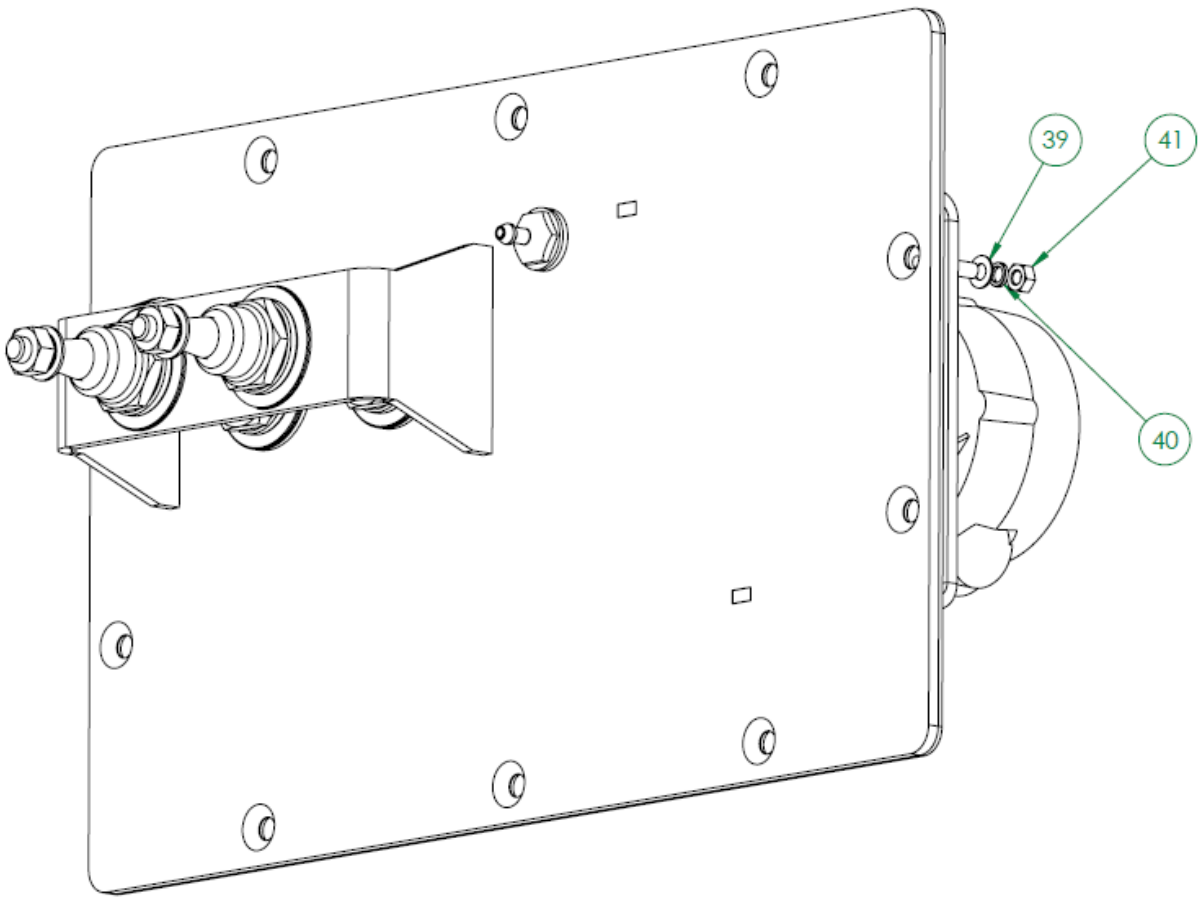
Use the drawings for reference.



WARNING:
Isolate the electrical supply before commencing any fitting work on any part of the wiper system.

FITTING THE WIPER LINKAGE ASSY – M26

Figure – Exploded Diagram



NOTE
The motor unit is MOUNTED from OUTSIDE the cab structure.

Ref Figure – Exploded Diagram

1. Remove and retain from earth boss one M6 nut ***(41),*** one 6mm washer – single coil ***(40),*** and two 6mm washers – flat ***(39)***

IMPORTANT
Remove front G.R.P. cover from area of unit mounting.
(This is a vehicle manufacturer described task)

2. Onto earth boss fit one 6mm washer – flat ***(39),*** one earth lead (***not supplied),*** one 6mm washer – flat ***(39),*** one 6mm washer – single coil ***(40),*** and one M6 nut ***(41)***
   Torque M6 = 12Nm (on Earth Boss – Nut)

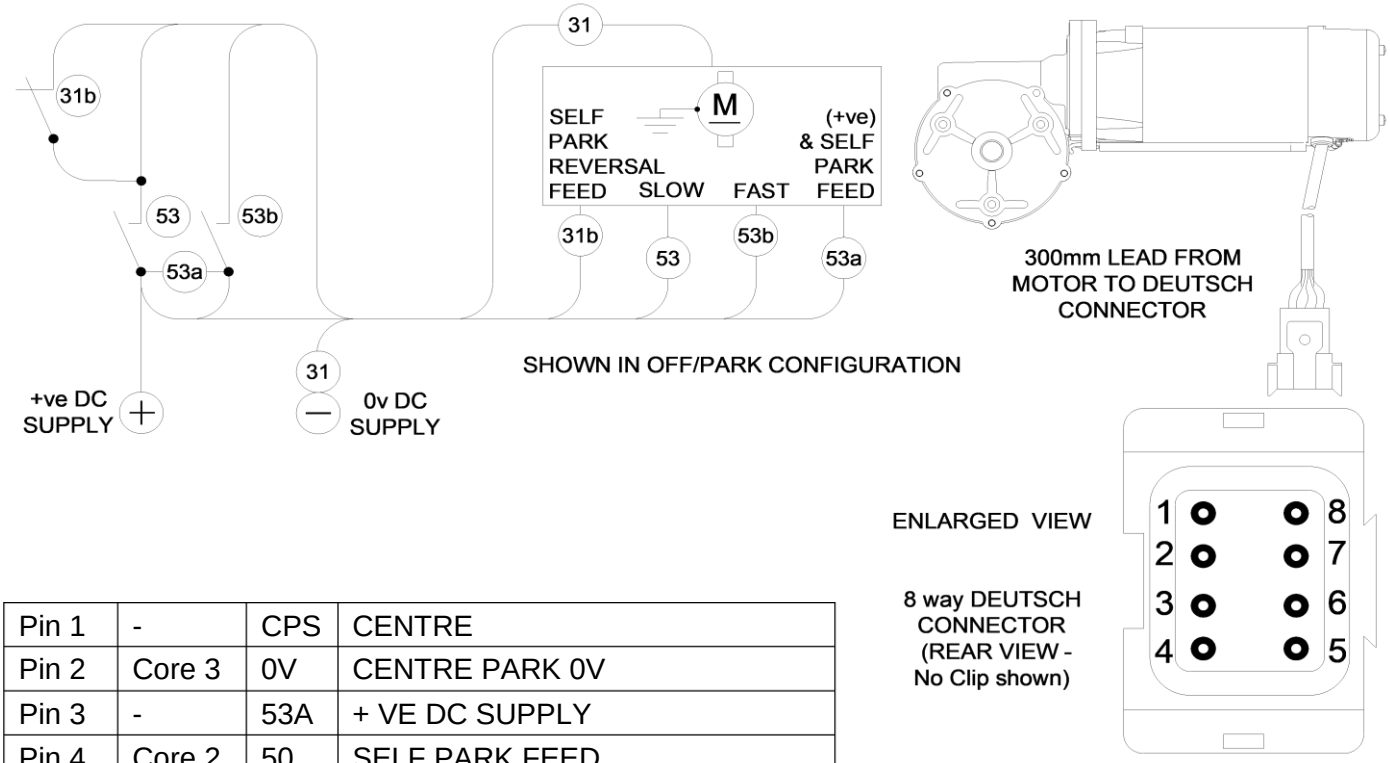
3. ***Externally –*** ENSURE a proprietary sealant ***(Not supplied)*** is used around all points of entry through cab structure.

4. Wire motor to cab electrics via switch/controller. ***(Not supplied)***
   In accordance with Installation Instructions – Electrical Connections

5. Fit wiper arm and blade
   In accordance with Installation Instructions – Fitting the Wiper Arm and Blade Assy

ELECTRICAL CONNECTIONS

Figure – Electrical Connections



8 way DEUTSCH CONNECTOR (REAR VIEW - No Clip shown)

Pin 1	-	CPS	CENTRE
Pin 2	Core 3	0V	CENTRE PARK 0V
Pin 3	-	53A	+ VE DC SUPPLY
Pin 4	Core 2	50	SELF PARK FEED
Pin 5	Core 4	53	SLOW SPEED
Pin 6	Core 5	53B	FAST SPEED
Pin 7	Core 1	31	MOTOR 0V DC
Pin 8			

FITTING THE WIPER BLADE

The wiper blades should be changed every 6 months but this is dependent on use and operating conditions

With reference to the Maintenance Table and the Troubleshooting Table – Continued

Ref Figure – Blade Fittings

1. Remove and retain one blade retaining screw ***(3),*** and one M4 nylock nut ***(4),*** from blade clip on arm.

NOTE
No plastic spacers required – if supplied with blade**.**

If only one end of the wiper blade rubber is captive, it must be fitted so it will be at the top of the screen when the arm is in the vertical position.

Ref Figure – Blade Captive End

2. Place wiper blade into blade clip on arm ***(1)***

3. Ensure that all fixing holes align.

4. Secure in place with one blade retaining screw ***(3),*** and one M4 nylock nut ***(4)***

IMPORTANT
DO NOT over tighten blade retaining screw and nut, as blade is required to pivot on glass.

Ref Figure – Nut Tightening

5. Secure nut until tight – then 1/4 turn back.

Figure – Blade Fittings

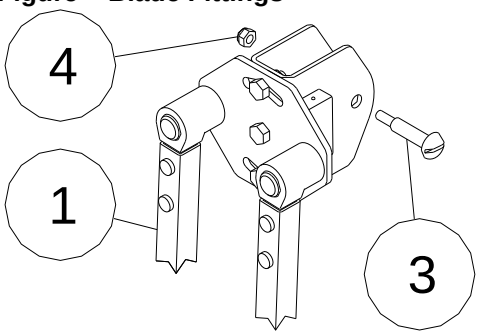
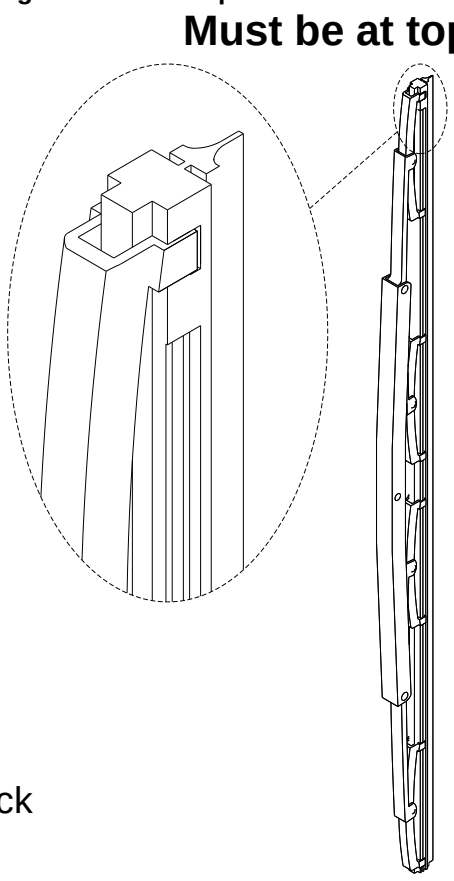
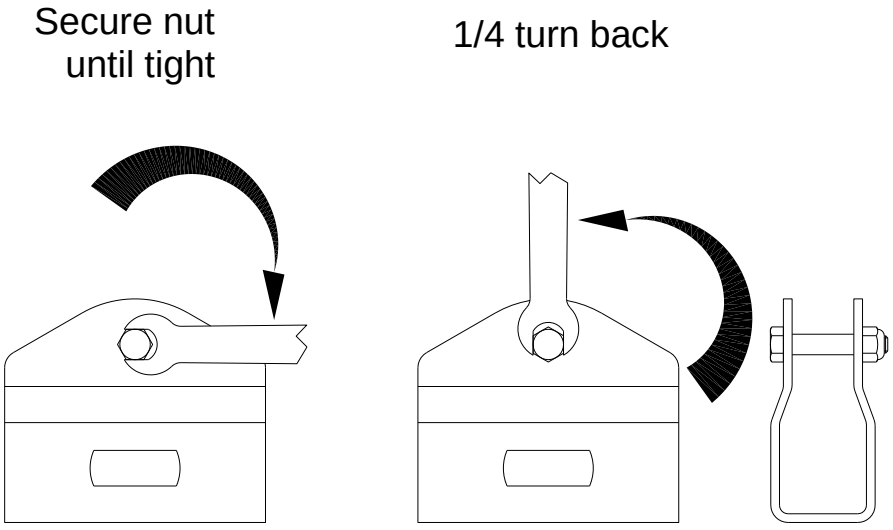


Figure – Blade Captive End





FITTING THE WIPER ARM ASSY HD

IMPORTANT
The blade must be fitted to the arm prior to the arm being fitted. (This is to prevent the blade clip damaging the screen)

1. ***Internally –*** Run motor to insure it is parked correctly. Disconnect all electrical power.

IMPORTANT
Externally – watch the unit whilst it runs, to observe the direction the drive spindle rotates in immediately before the unit stops. This direction will confirm the PARK POSITION.

Ref Figure – Spindle/Arm Fittings

2. Remove one weather cap ***(5)*** from each arm head.

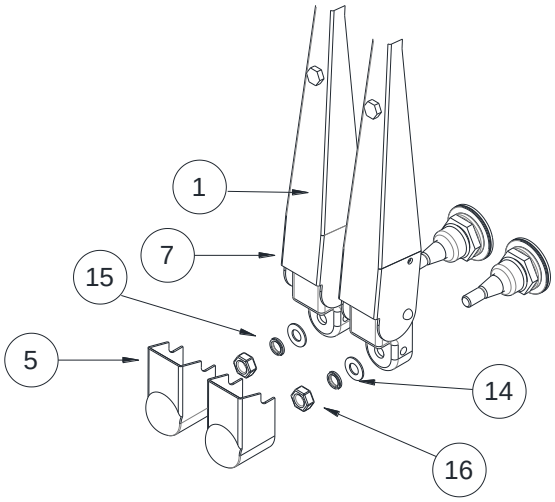
Ref Figure – Arm Position

3. Fit arm ***(1),*** onto spindle so blade lies in position shown.

4. Fit one washer – plain ***(14),*** one washer – single coil ***(15),*** and one spindle nut ***(16)***

NOTE
Spindle nuts do not need to be torque tightened at this stage as arm may have to be removed to correct any misalignment.

Figure – Spindle/Arm Fittings



5. Tighten spindle nut sufficiently to allow wiper arm and blade to travel across glass when motor is run.

6. De-isolate electrical supply to motors. Spray washer fluid on screen and briefly run wipers, checking area covered.

CAUTION
Do not attempt to rotate or twist the wiper arm on the spindle it will cause damage to the spline on the spindle, resulting in the wiper arm and blade slipping in operation.

7. If blades position needs adjusting, isolate electrical supply to motors

Ref Figure—– – Arm Extractor Tool

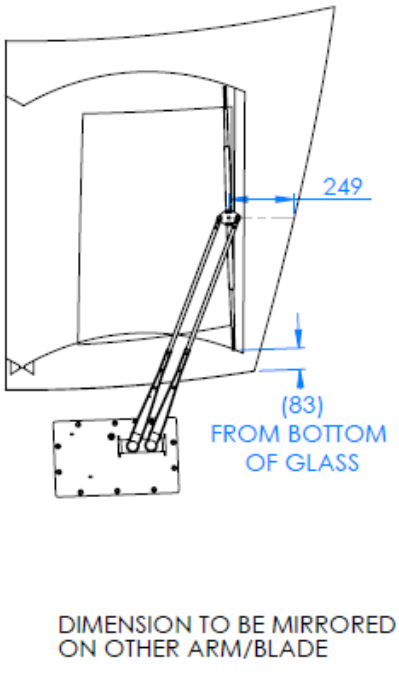
8. Loosen one spindle nut ***(16),*** on each spindle. Carefully pull arm ***(1),*** up spindle ***(2),*** and realign.
Use arm extractor tool to help pull wiper arm up spindle, if required

9. When correctly aligned, isolate electrical supply to motor. Tighten one spindle nut ***(16).***
Torque M10 = 38Nm (on Spindle Nut)

Ref Figure – Spindle/Arm Fittings

10. Fit one arm weather head cap ***(5)*** onto each arm head.

Figure – Arm Position



Ref Figure – Bulkhead Connector

11. Carefully push black wash hose attached to wiper arm onto external end of bulkhead connector.

12. Fix in place with tie wrap.

IMPORTANT
On first fitting, check the force on the blade in parked position, it must NOT exceed recommended pressure.1.75-2.25 kg

IMPORTANT
Replace front G.R.P. cover over area of unit mounting.
(Fixings not supplied – this is a vehicle manufacturer described task)

Figure – Bulkhead Connector

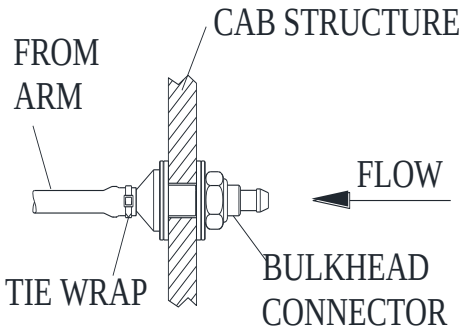
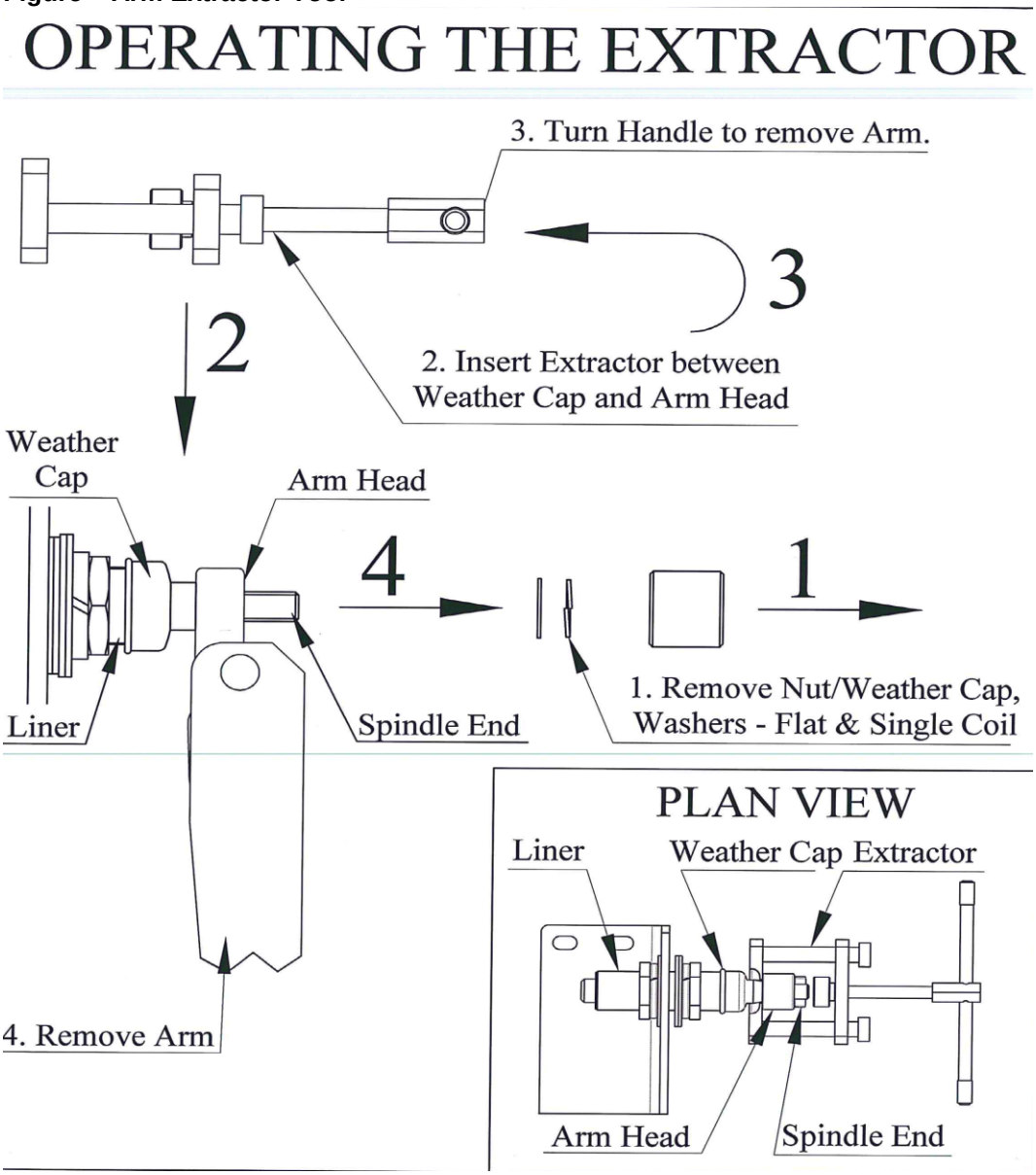
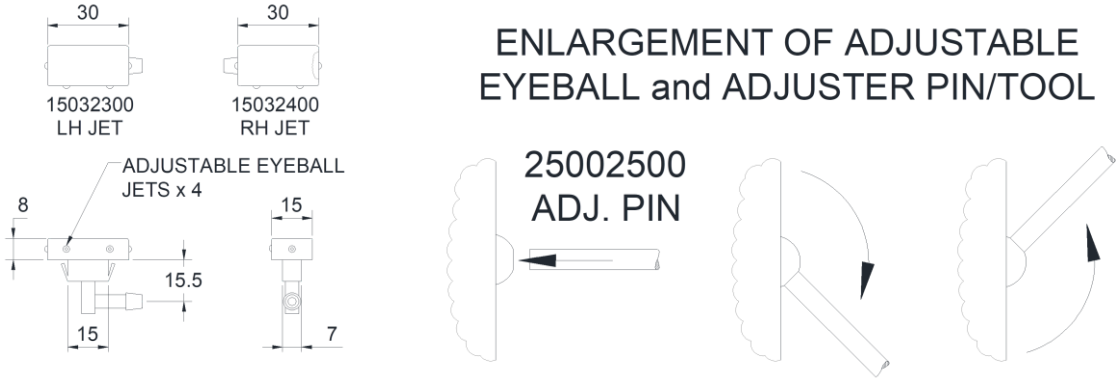


Figure – Arm Extractor Tool



THE WASH JET SPRAY AREA

Figure – Adjusting the Wash Jet



Ref Figure – Adjusting the Wash Jet

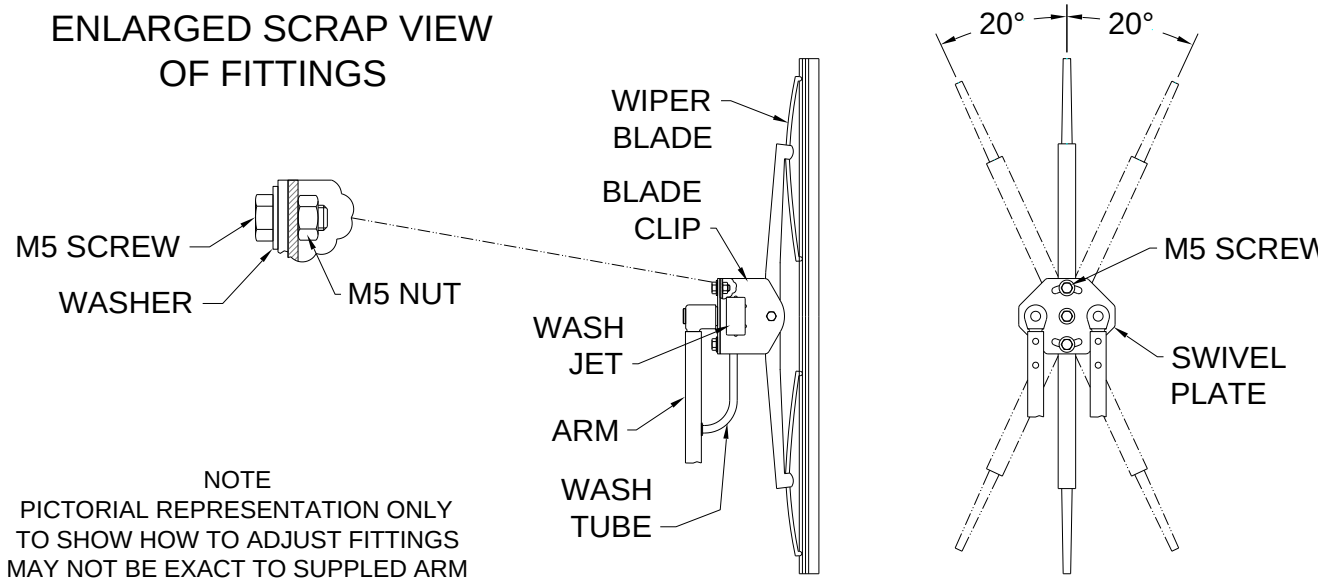
1. There are four adjustable eyeball jets on each jet body. Jet bodies are handed to suit leading edge of blade.

2. Ensure the windscreen is wet before operating wipers. Make sure flow of washer fluid from jet nozzle, on wiper arm is directed onto windscreen within sweep of wiper.

3. Using adjuster pin/tool provided, adjust eyeball jets, so that the spray pattern on screen is within sweep of wiper.

ADJUSTING THE WIPER BLADE ANGLE

Figure – Adjusting the Wiper Blade Angle



Ref Figure – Adjusting the Wiper Blade Angle

1. On back of adjustable swivel plate, slacken all M5 screw and nut assy's to allow movement of blade clip on plate.

2. Rotate blade clip and blade to correct angle. Max 20° about centre.

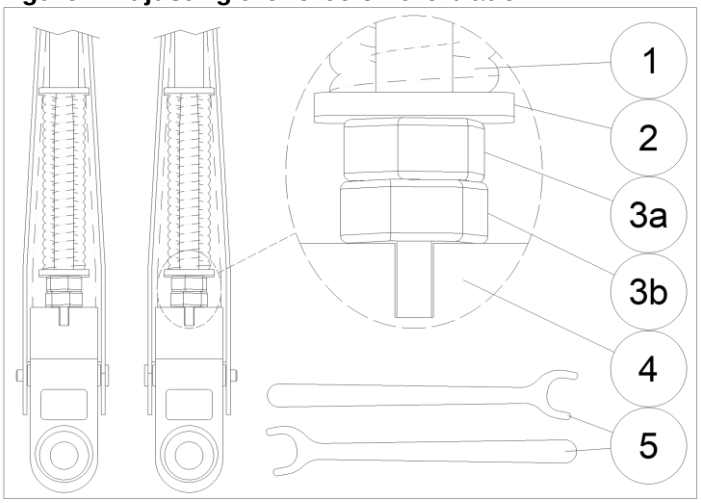
3. Re-tighten all M5 screw and nut assy's
   Torque M5 = 4.5Nm (on Arm – Swivel Plate/Blade Clip)

ADJUSTING THE FORCE ON THE BLADE

IMPORTANT
The arm is set to optimum pressure for the length of arm and blade relative to cab position, if pressure is incorrect for any reason; the following operations apply to alter spring tension on the wiper arm to correct it

Item	Description	QTY (per Arm)
1	Spring	2
2	Spring Retention Plate	2
3a	Retention Plate Nut	2
3b	Head Nut	2
4	Arm Head	2
5	Adjustment Spanners	2

Figure – Adjusting the force on the blade



NOTE
Moving the nuts upwards to compress the wiper arm spring increases the pressure on the wiper blade. Due to space restriction it is not possible to torque set the nuts once reset.

1. ***Externally –*** Remove arm and blade.
   In accordance with Maintenance Instructions: to Replace the Wiper Arm – Removal

To Increase Pressure

Ref Figure – Adjusting the Wiper Blade Angle

2. Using adjustment spanners ***(5),*** slacken head nut ***(3b),*** away from spring retention nut ***(3a)***

3. Move retention plate nut ***(3a),*** one half turn TOWARDS spring retention plate ***(2)***

4. Move head nut ***(3b),*** to lock tightly against it.

5. Repeat as necessary till correct pressure is achieved

To Decrease Pressure

Ref Figure – Adjusting the Wiper Blade Angle

2. Using adjustment spanners ***(5),*** slacken head nut ***(3b),*** away from spring retention nut ***(3a)***

3. Move retention plate nut ***(3a),*** one half turn AWAY FROM spring retention plate ***(2)***

4. Move head nut ***(3b),*** to lock tightly against it.

5. Repeat as necessary till correct pressure is achieved.

NOTE
To test spring pressure – use spring balance on centre of blade clip till blade begins to lift off glass. –
With reference to arm drawing for pressure settings

IMPORTANT
DO NOT wind linkage liner/spindles in or out to adjust spring tension, they are set to tolerance.
THIS MAY INVALIDATE FUTURE WARRANTY CLAIMS, as adjustment may cause damage to the linkage/motor, increased stresses in arm and give premature wear on bearings

TROUBLESHOOTING – TABLE

Introduction

This chapter provides all the instructions and information necessary to locate problems and conduct tests on the windscreen wiper system components. The trouble-shooting table is provided for logical isolation of faults.

Safety Precautions

Always disconnect the power when servicing the Windscreen Wiper System, or on any ancillary components. Serious damage to the Equipment and/or Personal Injury may occur if the power is not disconnected.

Troubleshooting Procedures

Typical windshield wiper system troubleshooting procedures are contained in the Table. These troubleshooting and repair procedures should be followed when encountering operational problems with the windshield wiper system

Troubleshooting Table

SYMPTOM	***PROBABLE CAUSE***	***TESTS AND CHECKS***	***CORRECTIVE ACTION***
Wiper motor fails to start	On/off switch	Check position of switch	Turn switch to on position
	Voltage Level	Check supply voltage to switch. Check wiring and switch connections	Replace switch. Correct loose wiring connections. Replace broken wires
	System Jammed	Check wiper linkage	Release linkage. Release wiper arm
	Defective wiper motor		Replace motor
	Defective control Box		Replace control Box
Motor shaft turns but linkage & arm remain static	Defective or loose drive crank	Check linkage for a loose drive crank	Secure or replace drive crank. Clean motor output shaft with wire brush before replacing. ***Reference torque settings table***
System operates but wiper arm remains static	Wiper arm	Check for loose wiper arm connection onto drive spindle	Secure or replace wiper arm after cleaning spindle spline with wire brush. ***Reference torque settings table***
Erratic Motor	Voltage level	Check supply voltage to wiper system	Correct voltage supply problem
	Switch	Check for loose or broken wires	Replace faulty switch
	Wiring		Repair or replace wiring up to motor. Replace motor if this wiring is damaged

Troubleshooting Table – Continued

SYMPTOM	***PROBABLE CAUSE***	***TESTS AND CHECKS***	***CORRECTIVE ACTION***
Slow Motor Operation	Voltage Level	Check supply voltage to wiper system	Correct voltage supply problem
	On/off switch		Replace faulty switch
	Motor Bracket	Check for broken bracket	Replace defective bracket
	Linkage	Check to see if Linkage is free moving	Free linkage replace worn or damaged components
	Defective Wiper Motor		Replace Wiper Motor
Arm and blade not operating correctly or over sweep operation	Voltage level	Check supply voltage to wiper system	Correct voltage supply problem
	Linkage	Check for worn or broken linkage	Replace linkage
	Spindle	Check for excessive wear in spindle	Replace spindle
	Arm	Check that arm is not loose on spindle	Re-tighten spindle
		Check for excessive wear on arm	Replace wiper arm after cleaning spindle spline with wire brush. ***Reference torque settings table***
	Blade	Check fixing for wear	Replace blade
		Check blade for wear	Replace blade
		Check for excessive smearing on screen	Replace blade
Excessive wear on blade.	Spring pressure.	Use spring balance on centre of blade clip till blade begins to lift off glass. 1.75-2.25 kg	Replace spring/arm.
Washer system not working correctly	No washer fluid from jets	Check washer fluid level in tank	Fill tank
		Check for damage to tank	Replace tank
		Check Pump is operational	Replace pump if faulty

NOTE
Tank and / or Pump may not be supplied by Hepworth's, but we recommend checking of these items in any case as lack of washer fluid on screen may lead to damage or premature failure of Windscreen Wiper equipment

INSPECTION / MAINTENANCE – TABLES

Introduction

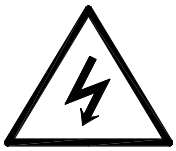
This chapter contains daily inspection and all preventative maintenance details for the windscreen wiper components. Preventative maintenance procedures include the information required for when to replace the wiper blades.

IMPORTANT
Refer to Maintenance Instructions for removal and replacement for procedures.

Safety Precautions

Always disconnect the power when servicing the Windscreen Wiper System, or on any ancillary components. Serious damage to the Equipment and/or Personal Injury may occur if the power is not disconnected.

Scheduled Maintenance Action Check



WARNING:
Isolate the electrical supply before commencing any fitting work on any part of the wiper system.

The Inspection and Maintenance Tables are a Scheduled Maintenance Action Index. The index provides a list of all performance tests if applicable and preventative maintenance procedures. The tables have three columns: Periodicity, Equipment and Task

The Periodicity column indicates the intervals between the maintenance tests and preventative maintenance procedures.

The equipment column lists the equipment, assembly or subassembly that corresponds to the maintenance action.

The task column lists the maintenance task to be performed.

Inspection Table

IMPORTANT
Where internal fixing screws and/or nuts are factory set and paint marked, leave untouched unless required to be changed or paint mark is damaged.

PERIODICITY	***EQUIPMENT***	***TASK***
Daily	Wiper Blades	Inspect wiper blades for damage, torn or missing rubber blades. Replace wiper blades as required
Daily	Windscreen Wiper System	Perform function test of wiper washer system. Do not carry out function test on a dry screen
Daily	Washer Tubing and Spray Nozzle	Inspect tubing for damage or loose connection on nozzle. Check operation of spray nozzle on windscreen
Daily	Wash Tank *	Ensure wash tank is filled with washer fluid to prevent wipers being used on a dry screen.

MAINTENANCE TABLE

IMPORTANT
Where internal fixing screws and/or nuts are factory set and paint marked, leave untouched unless required to be changed or paint mark is damaged.

PERIODICITY	*EQUIPMENT*	*TASK*
Once after three months or As required	Fixings of wiper arm to wiper spindle	Check torque settings (Set torque wrench to correct setting. Fit on nut, turn, if correct, wrench should click.) ***Reference torque setting table***
Twelve monthly or as required	Wiper blades	Non serviceable item Replace wiper blades
Once after first six months. Then visually check annually	Complete System	Check for wear, Replace/overhaul parts if necessary Check all torque settings for complete wiper system. ***Reference torque setting table*** Carry out a visual check for wear in rod end. ***Reference Figure – Rod End Bearing***

TORQUE SETTINGS

NOTE
If required – Set torque wrench to correct setting, fit on nut, turn, if correct, wrench should click.

*WHERE USED (*May Not be fitted on this*	*DESCRIPTION*	*SIZE*	*TORQUE*
Arm -Swivel Plate/Blade Clip	Nut & Bolt	M5	4.5Nm
Earth Boss (*)	Nut	M6	12Nm
Wiper Motor	Bolt	M8	25NM
SS Bulkhead Connector (*) – Stainless Steel	Nut	M8	20Nm
Splined Drive Crank	Nut & Bolt	M8	25Nm
Ø16 Spindle	Nut	M10	38Nm
Threaded Bearing Pin	Nut	M16	25Nm
SS Liner – Metal Structure	Nut	M26	80Nm

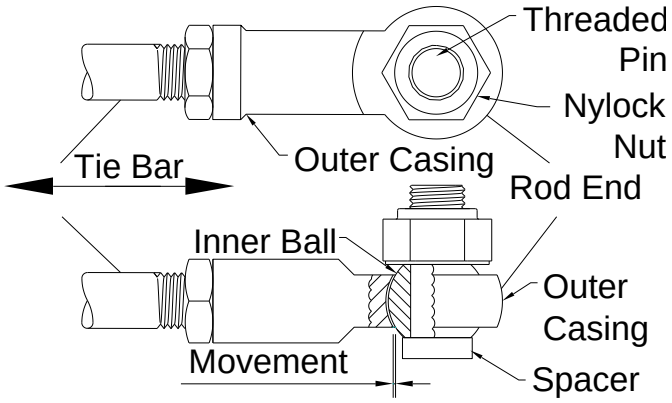
How to check for wear on the Rod End

Ref Figure – Rod End Bearing

1. Pull on tie-bar to see if any movement in rod end bearing at inner ball on outer casing.

2. If excessive movement – replace.

Figure – Rod End Bearing



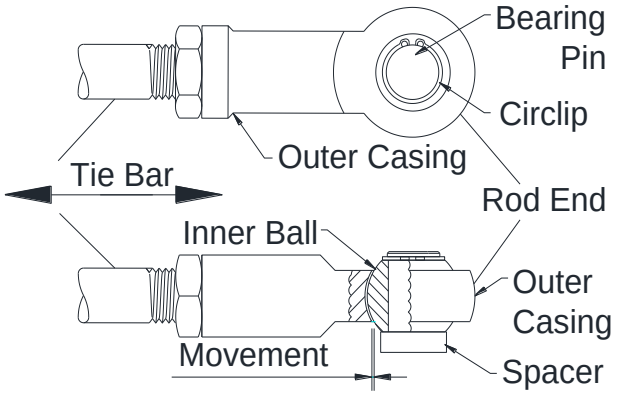
How to check for wear on the Rod End (16mm)

Ref Figure – Rod End Bearing

1. Pull on tie-bar to see if any movement in rod end bearing at inner ball on outer casing.

2. If excessive movement – replace.

Figure – Rod End Bearing



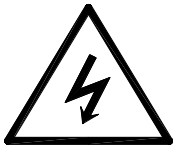
MAINTENANCE INSTRUCTIONS

NOTE
Retain all items removed in a safe place, as they will be required on reassembly.

Any item to be discarded must be done in accordance to vehicle manufacturer described task guidelines

If you experience any difficulty in the removal/replacement of any of the units/components, please do not hesitate to contact Customer Service at Hepworth Rail International for advice.

Use the drawings for reference.



WARNING:
Isolate the electrical supply before commencing any fitting work on any part of the wiper system.

TO REPLACE THE WIPER BLADE

The wiper blades should be changed every 12 months but this is dependent on use and operating conditions

With reference to the Maintenance Table and the Troubleshooting Table – Continued

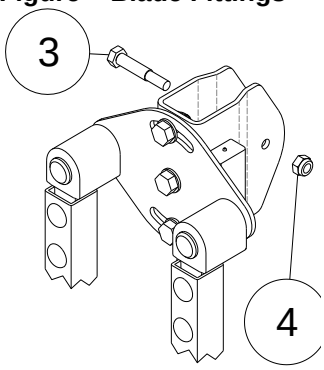
Removal

1. ***Internally –*** Run motor to ensure it is parked correctly. Disconnect all electrical power.

2. ***Externally*** – Carefully pull wiper arm assy away from windscreen to enable access to wiper blade.

Ref Figure – Blade Fittings

Figure – Blade Fittings



3. Remove one blade retaining screw ***(3),*** and one M4 nylock nut ***(4),*** from blade clip on arm.

4. Remove wiper blade from blade clip on wiper arm.

Reassembly

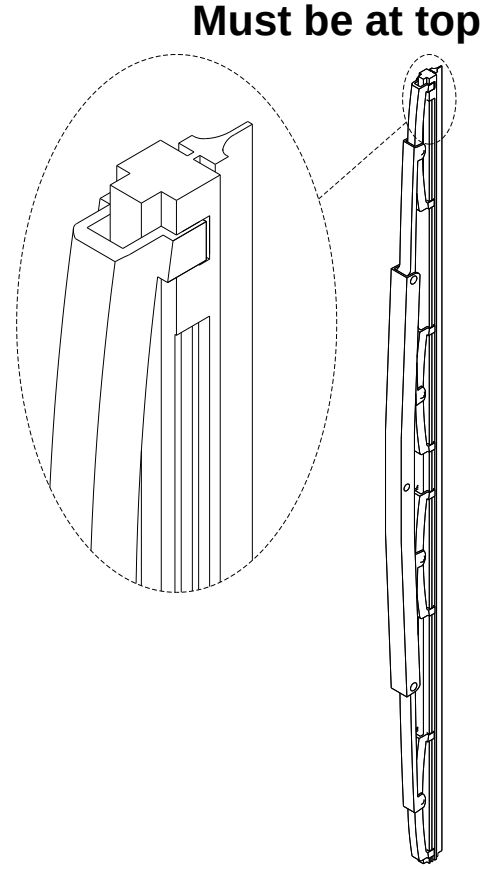
NOTE
No plastic spacers required – if supplied with blade**.**

If only one end of the wiper blade rubber is captive, it must be fitted so it will be at the top of the screen when the arm is in the vertical position.

1. Place wiper blade into blade clip on wiper arm.

Ref Figure – Blade Captive End

Figure – Blade Captive End



2. Ensure that all fixing holes align.

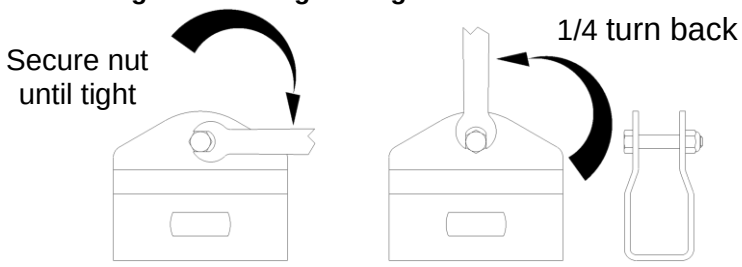
3. Secure in place with blade retaining screw ***(3),*** and nut ***(4)***

IMPORTANT
Do not over tighten blade screw and nut, as wiper blade is required to pivot on glass.

Ref Figure – Nut Tightening

4. Secure nut until tight – then 1/4 turn back.

Figure – Nut Tightening



NOTE
Pictorial representation only, May not be exact to supplied arm

5. Lower wiper blade carefully back onto windscreen.

TO REPLACE THE WIPER ARM

IMPORTANT
Remove front G.R.P. cover from area of unit mounting.
(Fixings not supplied – this is a vehicle manufacturer described task)

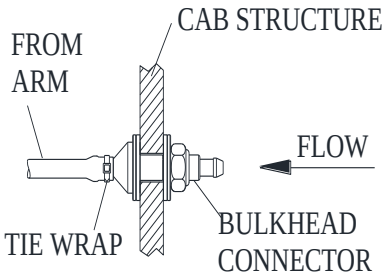
Removal

1. ***Internally –*** Run motor to ensure it is parked correctly. Disconnect all electrical power.

IMPORTANT
Externally – watch the unit whilst it runs, to observe the direction the drive spindle rotates in immediately before the unit stops. This direction will confirm the PARK POSITION.

Ref Figure – Bulkhead Connector

Figure – Bulkhead Connector



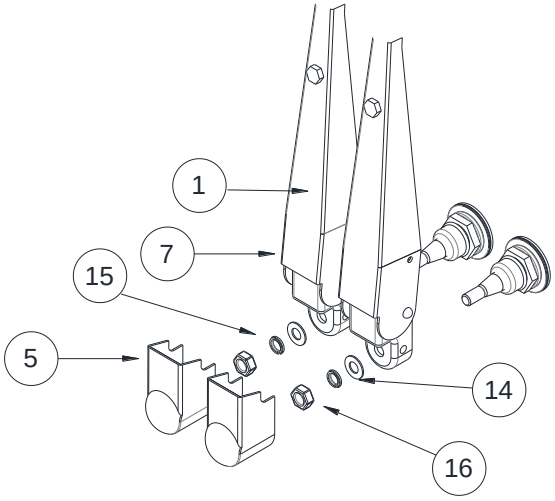
2. Remove tie wrap from wash tube ***(7),*** on external end of bulkhead connector.

NOTE.
The wash hose may leak washer fluid on removal from the bulkhead connector. Keep washer fluid away from any electrical and/or mechanical part that could be affected by it.

3. Carefully remove wash hose on arm from end of connector.

Ref Figure – Spindle/Arm Fittings

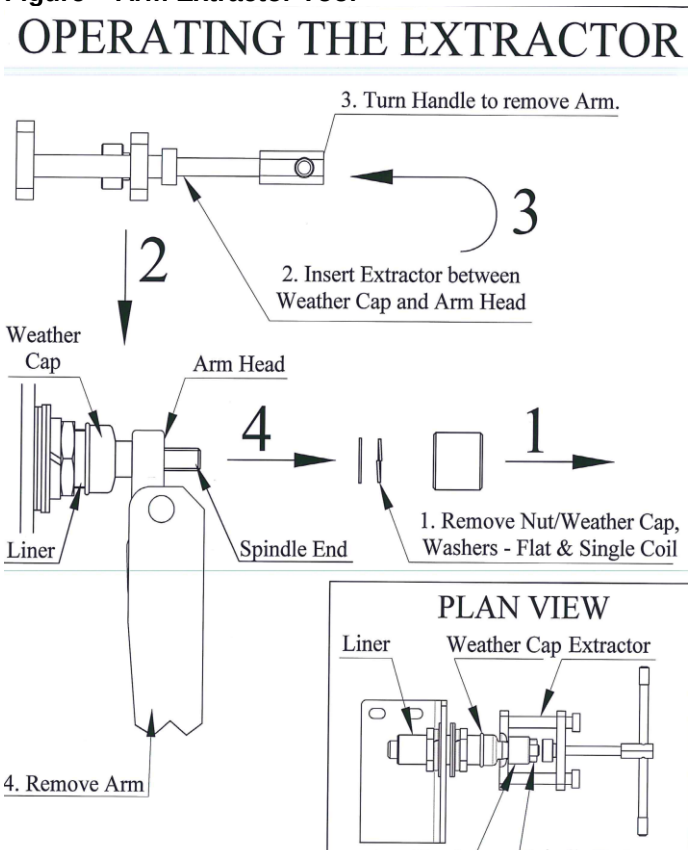
Figure – Spindle/Arm Fittings



4. Remove one weather cap ***(5)*** from each arm head.

5. Remove from each spindle one spindle nut ***(16),*** one washer – single coil ***(15),*** one washer – flat ***(14)***

Figure – Arm Extractor Tool



Ref Figure – Arm Extractor Tool

6. Using arm extraction tool carefully remove wiper arm.

Replacement

1. Replace wiper arm and blade assy
In accordance with Installation Instructions – Fitting the Wiper Arm Assy

IMPORTANT
Replace front G.R.P. cover over area of unit mounting.
(Fixings not supplied – this is a vehicle manufacturer described task)

TO REPLACE THE ENTIRE WIPER LINKAGE ASSY

Figure – Entire Linkage Assy

IMPORTANT
Before replacing the wiper motor or wiper mechanism, it is necessary to remove the entire wiper linkage assy from the cab structure.

IMPORTANT
Remove front G.R.P. cover from area of unit mounting.
(Fixings not supplied – this is a vehicle manufacturer described task)

Removal

1. ***Internally –*** Run motor to ensure it is parked correctly. Disconnect all electrical power.

2. ***Externally –*** Remove arm and blade.
   In accordance with Maintenance Instructions – To Replace the Wiper Arm – Removal

NOTE
Keep safe as will be required on assembly.

3. ***Internally*** – Remove all cab wiring connections from motor ***(6)***

4. Remove from earth boss, one M6 nut ***(41),*** one 6mm washer – single coil ***(40),*** one 6mm washer – flat ***(39),*** one earth lead, and one 6mm washer – flat ***(39)***

5. Unscrew and remove fixings from mounting bracket position to cab structure.
   (Fixings not supplied – this is a vehicle manufacturer described task)

6. Carefully remove entire wiper linkage assy from cab structure, complete with fittings.

7. Carefully remove entire wiper linkage assy from cab structure.

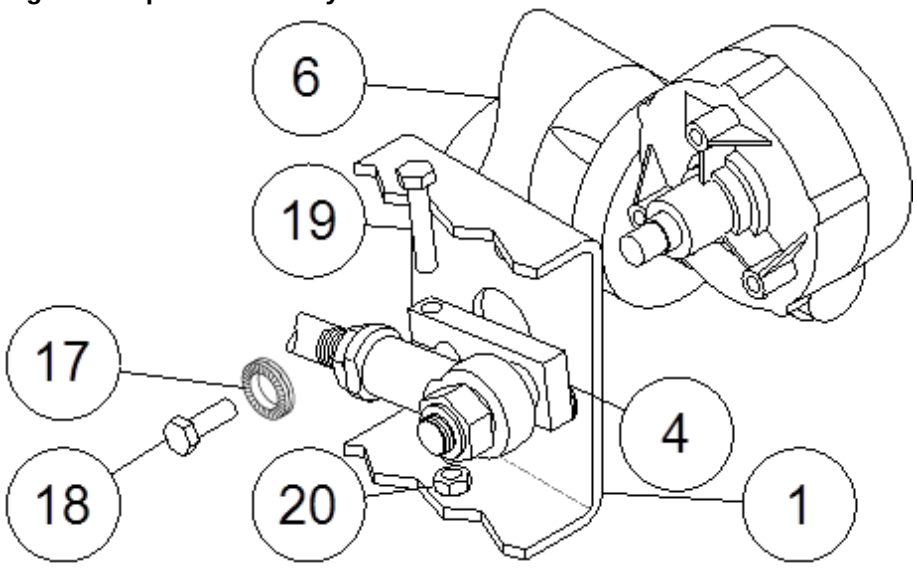
Replacement

1. Replace entire wiper linkage assy
   In accordance with Installation Instructions – Fitting the Wiper Linkage Assy

2. Replace wiper arm and blade
   In accordance with Installation Instructions – Fitting the Wiper Arm Assy

TO REPLACE THE WIPER MOTOR ASSY

Figure – Wiper Motor Assy



NOTE
Pictorial representation only, May not be exact to supplied linkage

Removal

1. Carefully remove entire wiper motor linkage assy from cab structure
   In accordance with Maintenance Instructions – To Replace the Entire Wiper Motor Linkage Assy – Removal

IMPORTANT
Please make a note of drive crank position relative to spindle lever, as this will affect park position for wiper arms and blades, i.e. spindle lever facing towards motor or away from motor

Ref Figure – Wiper Motor Assy

2. Slacken drive crank nut ***(20),*** and bolt ***(19),*** carefully remove drive crank assy ***(4),*** ***(complete with bearing, bearing nut and tie-bar (5),)*** from motor drive shaft

3. Unscrew three fixing bolts ***(18)*** and remove with three Nordloc washers ***(17).*** Remove wiper motor ***(6),*** from bracket ***(1).***

Replacement

NOTE
If required clean the motor drive shaft, with wire brush

Ref Figure – Wiper Motor Assy

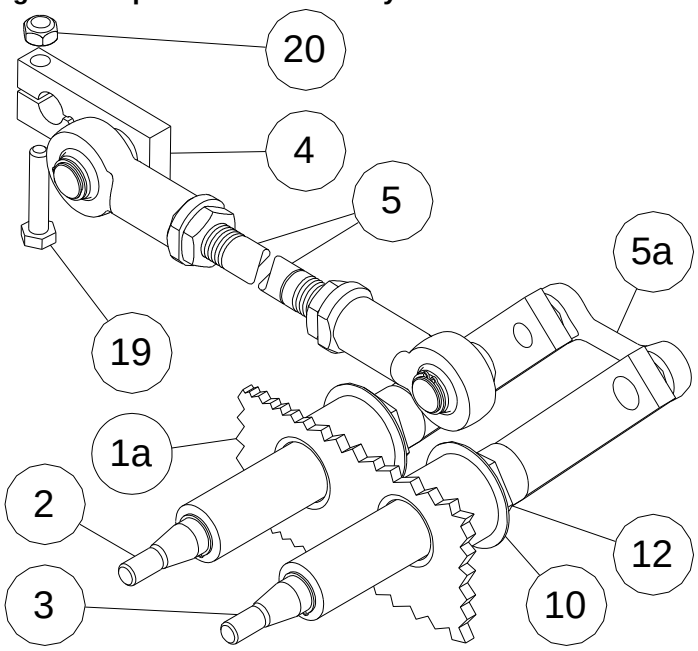
1. Replace wiper motor ***(6)*** into bracket ***(1),*** fit three Nordloc washers ***(17),*** and three fixing bolts ***(18)***
   Torque M8 = 25NM (on Motor Bolts)

2. Carefully fit drive crank assy ***(4),*** ***(complete with bearing, bearing nut and tie-bar (5),)*** over motor drive shaft, ***(Refer to note after operation 2)*** on 'removal' for position. Tighten drive crank nut ***(20),*** and bolt ***(19).***
   Torque M8 = 25Nm (on Splined D. Crk Nut & Bolt)

3. Replace entire wiper motor linkage assy
   In accordance with Installation Instructions – Fitting the Wiper Linkage Assy

TO REPLACE THE WIPER MECHANISM ASSY

Figure – Wiper Mechanism Assy



NOTE
Pictorial representation only, May not be exact to supplied linkage

Removal

1. ***Internally –*** Run motor to ensure it is parked correctly. Disconnect all electrical power.

2. Carefully remove entire wiper linkage assy from cab structure.
   In accordance with Maintenance Instructions – To Remove the Entire Wiper Motor Unit Assy

IMPORTANT
Please make a note of drive crank position relative to spindle lever, as this will affect park position for wiper arm and wiper blade i.e. spindle lever facing towards or away from motor.

Ref Figure – Wiper Mechanism Assy

3. Slacken drive crank nut ***(20),*** and bolt ***(19),*** carefully remove drive crank assy ***(4(complete with bearing, bearing nut and tie-bar (5),)*** from motor drive shaft.

IMPORTANT
There is one washer – flat *(10),* and one hex nut *(12),* fitted on each liner inside the bracket. Take care on removal that the washers do not fall off.

4. Carefully remove both main liner/lever assy ***(2),*** and driven idler liner/lever assy ***(3),*** ***(complete with connecting bar (5a),)*** from mounting bracket weld assy ***(1A)***

Replacement

NOTE
If required clean the motor drive shaft, with wire brush

Ref Figure – Wiper Mechanism Assy

IMPORTANT
There is one hex nut *(12),* fitted onto each liner *(2 & 3),* so that the front of the nut is 2.5mm from end of liner.

1. Fit one hex nut ***(12),*** onto each liner. . ***(As stated in Important note for distance)***

2. Insert both main liner/lever assy ***(2),*** and driven idler liner/lever assy ***(3),*** ***(complete with connecting bar (5a),)*** into liner bracket/mounting boss weld assy ***(1a)*** till each nut fits flush with liner mounting boss for correct setting distance.

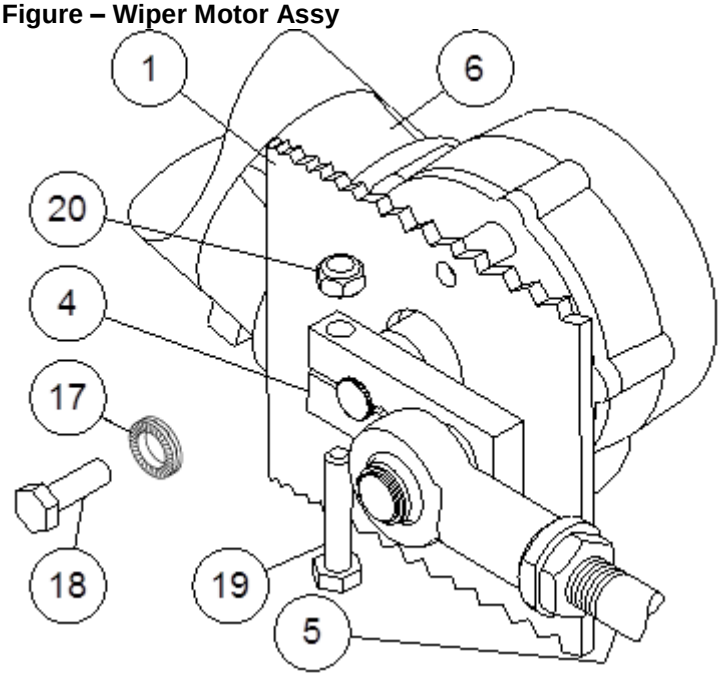
3. Screw both main liner/lever assy ***(2),*** and driven idler liner/lever assy ***(3),*** ***(complete with connecting bar (5a),)*** into bracket ***(1)*** till each nut fits flush with inside of bracket for correct setting distance.

4. Carefully fit drive crank assy ***(4),*** ***(complete with bearing, bearing nut and tie-bar (5),)*** over motor drive shaft, ***(Refer to note after operation 2)*** on 'removal' for position. Tighten drive crank nut ***(20),*** and bolt ***(19).***
   Torque M8 = 25Nm (on Splined D. Crk Nut & Bolt)

5. Replace entire wiper motor linkage assy
   In accordance with Installation Instructions – Fitting the Wiper Linkage Assy

TO REPLACE THE WIPER MOTOR ASSY

Figure – Wiper Motor Assy



NOTE
Pictorial representation only, May not be exact to supplied linkage

Removal

1. Carefully remove entire wiper motor linkage assy from cab structure
   In accordance with Maintenance Instructions – To Replace the Entire Wiper Motor Linkage Assy – Removal

IMPORTANT
Please make a note of drive crank position relative to spindle lever, as this will affect park position for wiper arms and blades, i.e. spindle lever facing towards motor or away from motor

Ref Figure – Wiper Motor Assy

2. Slacken drive crank nut ***(20),*** and bolt ***(19),*** carefully remove drive crank assy ***(4),*** ***(complete with bearing, bearing nut and tie-bar (5),)*** from motor drive shaft

3. Unscrew three fixing bolts ***(18)*** and remove with three Nordloc washers ***(17).*** Remove wiper motor ***(6),*** from bracket ***(1).***

Replacement

NOTE
If required clean the motor drive shaft, with wire brush

Ref Figure – Wiper Motor Assy

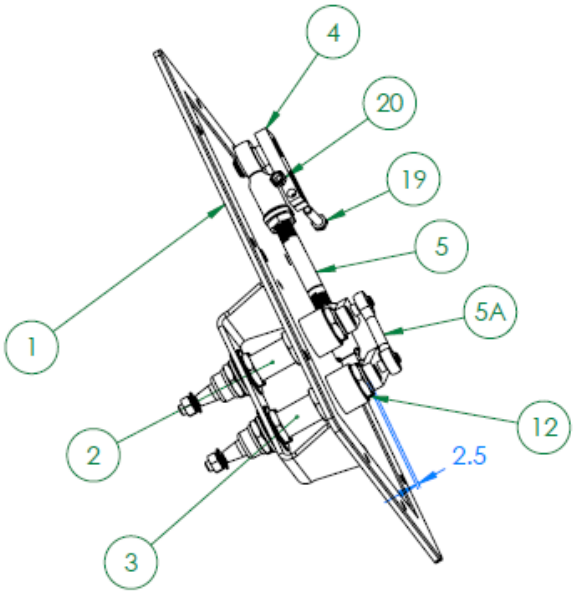
1. Replace wiper motor ***(6)*** into bracket ***(1),*** fit three Nordloc washers ***(17),*** and three fixing bolts ***(18)***
   Torque M8 = 25NM (on Motor Bolts)

2. Carefully fit drive crank assy ***(4),*** ***(complete with bearing, bearing nut and tie-bar (5),)*** over motor drive shaft, ***(Refer to note after operation 2)*** on 'removal' for position. Tighten drive crank nut ***(20),*** and bolt ***(19).***
   Torque M8 = 25Nm (on Splined D. Crk Nut & Bolt)

3. Replace entire wiper motor linkage assy
   In accordance with Installation Instructions – Fitting the Wiper Linkage Assy

TO REPLACE THE WIPER MECHANISM ASSY

Figure – Wiper Mechanism Assy



NOTE
Pictorial representation only, May not be exact to supplied linkage

Removal

1. ***Internally –*** Run motor to ensure it is parked correctly. Disconnect all electrical power.

2. Carefully remove entire wiper linkage assy from cab structure.
   In accordance with Maintenance Instructions – To Remove the Entire Wiper Motor Unit Assy

IMPORTANT
Please make a note of drive crank position relative to spindle lever, as this will affect park position for wiper arm and wiper blade i.e. spindle lever facing towards or away from motor.

Ref Figure – Wiper Mechanism Assy

3. Slacken drive crank nut ***(20),*** and bolt ***(19),*** carefully remove drive crank assy ***(4)*** ***(complete with bearing, bearing nut and tie-bar (5),)*** from motor drive shaft.

IMPORTANT
There is one hex nut *(12),* fitted on each liner inside the bracket. Take care on removal.

4. Carefully remove both main liner/lever assy ***(2),*** and driven idler liner/lever assy ***(3),*** ***(complete with connecting bar (5a),)*** from mounting bracket weld assy ***(1)***

Replacement

NOTE
If required clean the motor drive shaft, with wire brush

Ref Figure – Wiper Mechanism Assy

IMPORTANT
There is one hex nut *(12),* fitted onto each liner *(2 & 3),* so that the front of the nut is 2.5mm from end of liner.

1. Fit one hex nut ***(12),*** onto each liner. ***(As stated in Important note for distance)***

2. Screw both main liner/lever assy ***(2),*** and driven idler liner/lever assy ***(3),*** ***(complete with connecting bar (5a),)*** into bracket ***(1)*** till each nut fits flush with inside of bracket for correct setting distance.

3. Carefully fit drive crank assy ***(4),*** ***(complete with bearing, bearing nut and tie-bar (5),)*** over motor drive shaft, ***(Refer to note after operation 2)*** on 'removal' for position. Tighten drive crank nut ***(20),*** and bolt ***(19).***
Torque M8 = 25Nm (on Splined D. Crk Nut & Bolt)

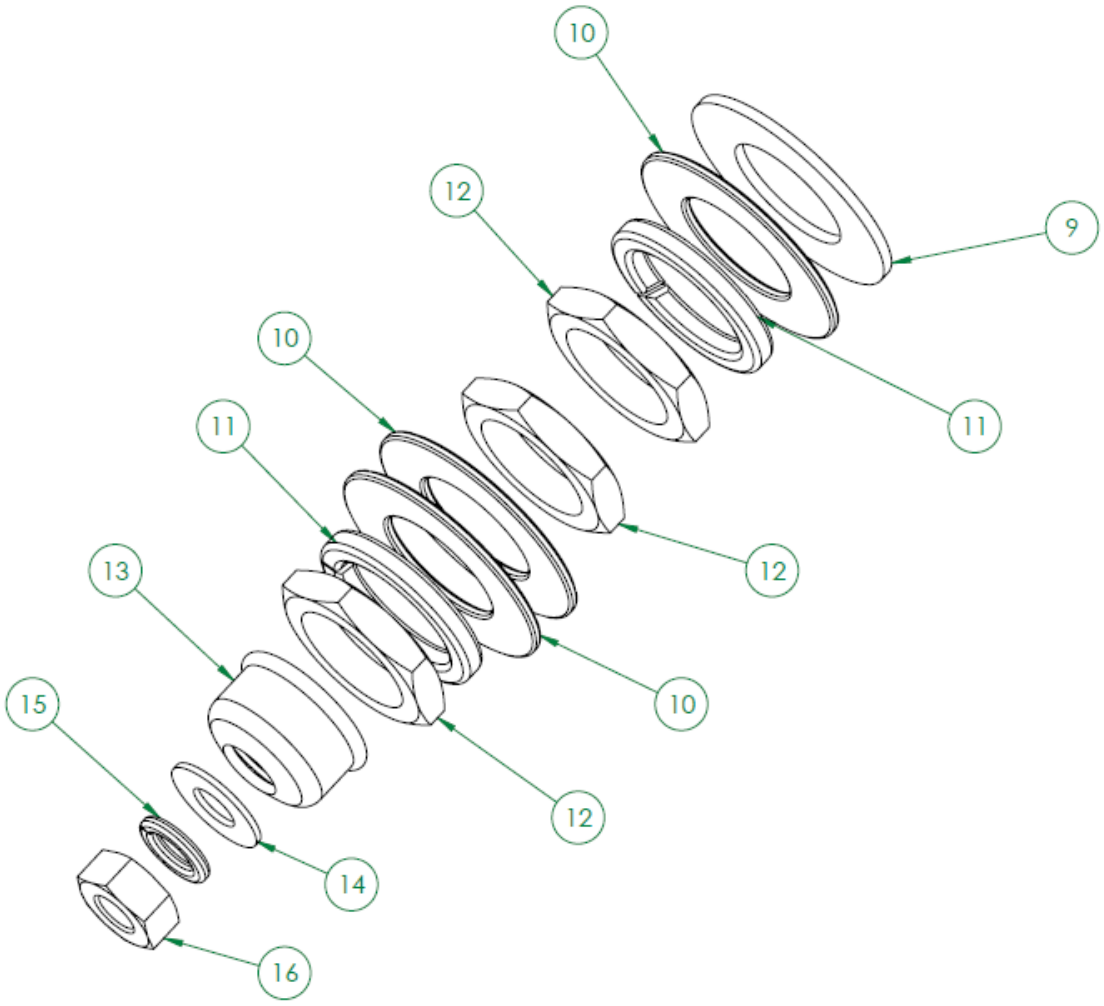
4. Replace entire wiper motor linkage assy
In accordance with Installation Instructions – Fitting the Wiper Linkage Assy

SUPPLY LIST

Note – 1 Train = 2 Cabs

Part No.	*Description*	*Qty*
S612255VM	120NM 110v 30/45RPM PANTO LINKAGE WITH SENSOR & BH CONNECTOR – LH	1 per cab
S612256VM	120NM 110v 30/45RPM PANTO LINKAGE WITH SENSOR & BH CONNECTOR – LH	1 per cab
805528	H/DUTY PANTO ARM - 930MM - LH	1 per cab
805529	H/DUTY PANTO ARM - 930MM - RH	1 per cab
B140 39 B	39" CANTILEVER WIPER BLADE	2 per cab
150A19500	9.6L ST/ST WASH TANK WITH SUBMERSIBLE PUMP	1 per cab
150A19600	FILLER SPOUT ASS'Y WITH WASH HOSE	2 per cab
150A19700	WASH KIT	1 per cab
10171000	CONTROL SWITCH	1 per cab
HE0714-04	CONTROL BOX	1 per cab
HE0714-05	MATING HALF KIT	1 per cab

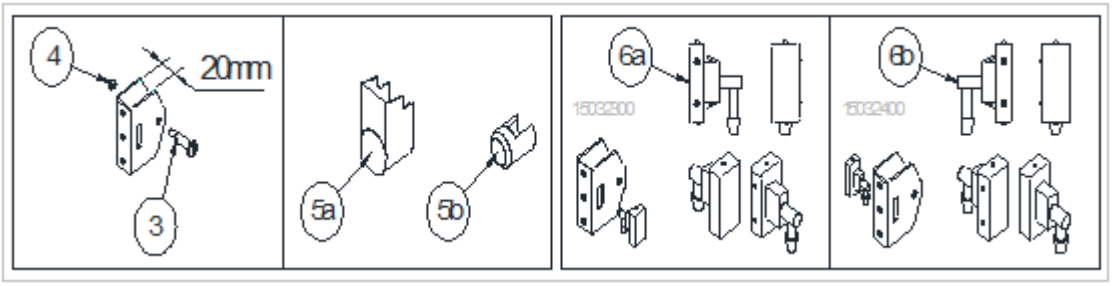
Fittings for M26 Liners and 16mm Spindles protruding outside the Cab structure



Part No.	*Description*	*Qty*
10029100	26mm Washer – Neoprene ***(9)***	1 per liner
10026100	26mm Washer – Plain ***(10)***	3 per liner
10026600	26mm Washer – Single Coil ***(11)***	2 per liner
10018500-B	M26 Hex Nut ***(12)***	3 per liner
60054600	26mm Weather Cap ***(13)***	1 per liner
10027801	10mm Washer – Plain ***(14)***	1 per liner
10024400	10mm Washer – Single Coil ***(15)***	1 per liner
10015400	M10 Hex. Nut ***(16)***	1 per liner

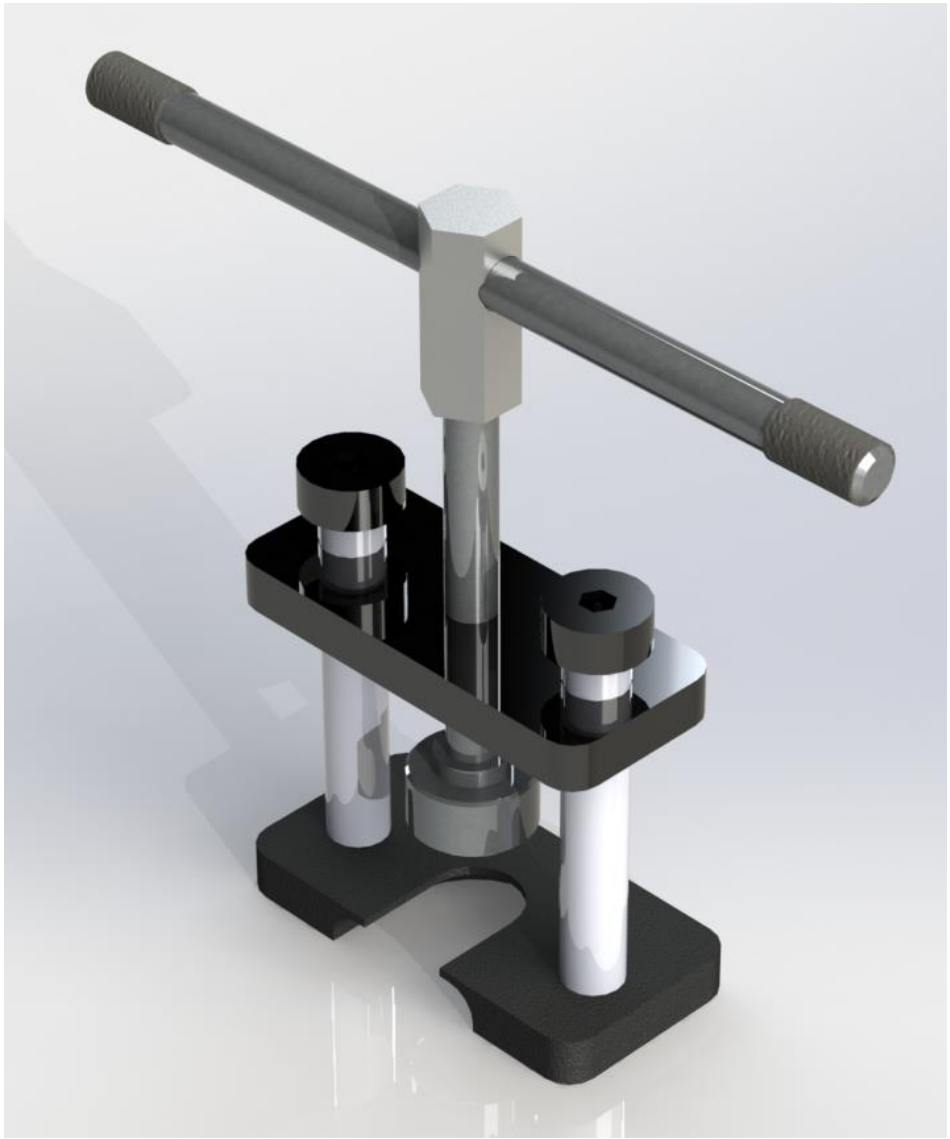
External Fittings – Arms

Fittings for Arm and Blade



Part No.	*Description*	*Qty*
80010700	Blade Retaining Screw ***(20mm B. Clip)*** ***(3)***	1 per arm
10011400	M4 Nylock Nut ***(4)***	1 per arm
80005100	Heavy Duty Cap ***(5A)***	2 per arm
80200400	Wash Hose – 3mm I/D x 6mm O/D ***(7)*** ***(Not shown)***	1.5 Metres
15032300	Wash Jet (RH) (6)	1 per arm
15032400	Wash Jet (LH) (6)	1 per arm

Part No.	*Description*
60680600	Arm Extractor Tool – All Head Types As Required



WIPER SYSTEM OVERHAUL PERIOD

NOTE
The Overhaul Periodicity is a recommended scale of time not definitive date.

It is advised to get a condition report at within this time scale and if it is found that wear is less than or greater than expected periodicity can be upgraded in the manuals to suit.

PERIODICITY	***EQUIPMENT***	***TASK***
No later than 1 year before the major overhaul period.	System Assessment	The first 2 full train sets of wiper systems should be returned to the supplier for evaluation. It is at this time we will assess the wear on the system and provide an assessment on how many potential years operating life the system has.
At first major overhaul or based on the recommendations of the condition assessment	Motors	Based on the outcome of the condition assessment the motor brushes should be replaced at the first major overhaul period. The linkage may also be serviced. It will get stripped down, cleaned and reassembled.
At first major overhaul or based on the recommendations of the condition assessment	Linkage Assembly	Parts returned to B.Hepworth for major overhaul. Motors and linkage bearings will be replaced as well as all fixings. The linkage will also be serviced. It will get stripped down, cleaned and reassembled.
At the first major overhaul period	Wiper Arms	Wipers arms should be replaced at the first major overhaul period, as required or as indicated by the outcome of the condition assessment.
At the second major overhaul period	Wash Pump	Wash pump should be replaced at the second major overhaul period, as required or as indicated by the outcome of the condition assessment.
At the second major overhaul period (midlife overhaul)	Control Unit	Parts should be returned to supplier for overhaul at the second major overhaul period or as indicated by the outcome of the condition assessment. All relay contacts & power convertors will be replaced and connections checked.
At the second major overhaul period	Tank	Parts should be returned to supplier for de-silting and leak test at the second major overhaul period.

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HEPWORTH RAIL
INTERNATIONAL

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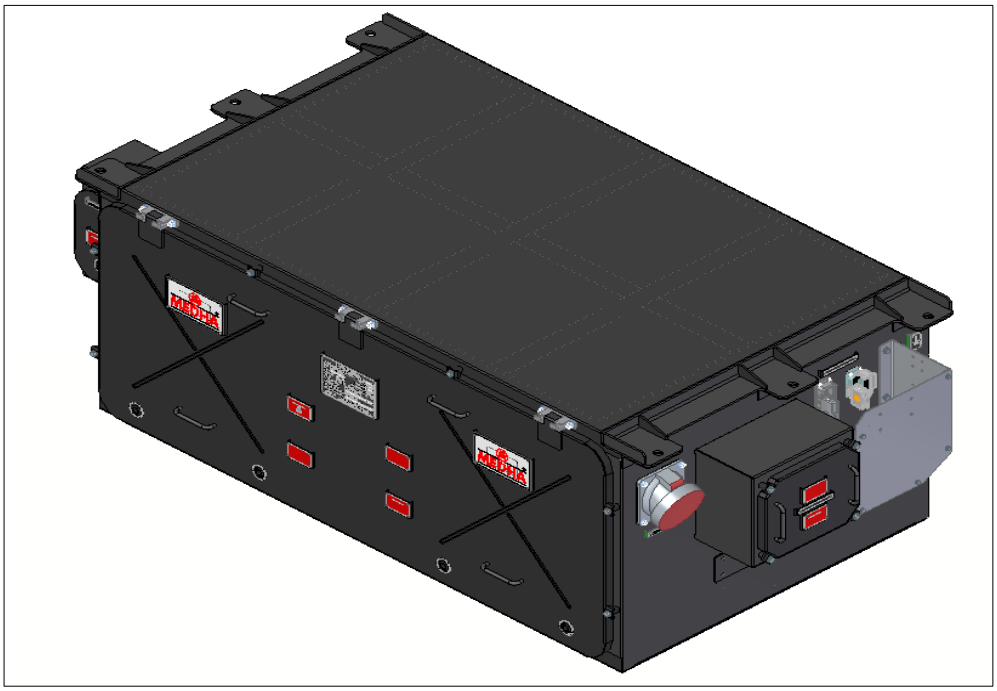
Maintenance Manual

TYPE MAE675UV2



IM-254 rev
0

MEDHA SERVO DRIVES PVT. LTD.

Information in this document is subject to change without notice.

Document No: IM -

XXX rev 0 Released:

August 2022.

Table of Contents

BATTERY BOX UNIT (BBU)

1.1 Introduction

Regulated Static battery Charger fed from three phase auxiliary supply shall be provided. Its rating and charging characteristics shall be matched to the battery, by monitoring of charging current and voltage shall have provision for fine adjustment and good stability with current limitation to avoid overcharging or undercharging of batteries Battery Box Unit (BBU) is proposed in each basic unit

1.2 Technical Data & Description of the Interface

1.2.1 Mechanical Data

Converter Size	2150 X 1060 X 740 (LXWXH)
Cabinet	SS-304
Mass	990 kg (approx.)
Degree of protection	IP65

1.2.2 Electrical Data

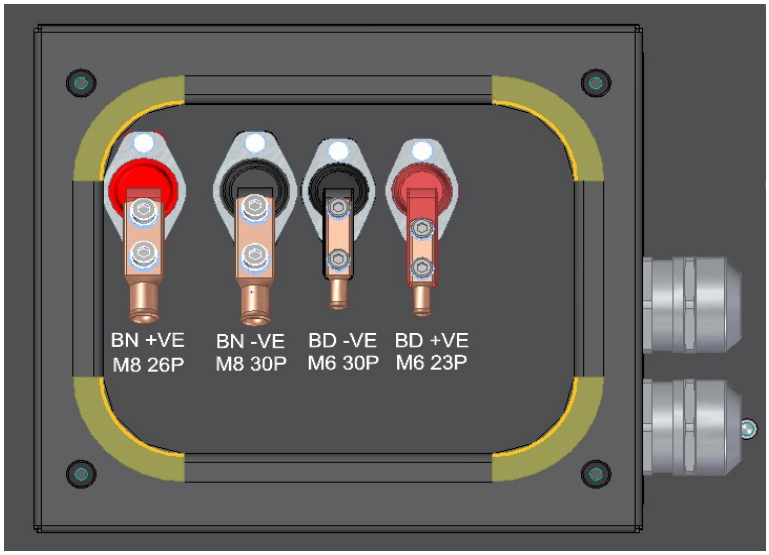
BBU:

Requirements	Parameters
Battery Type	LFP
Battery Capacity	3 x 228 Ah
Battery Energy	70.4 kWh
Nominal Voltage	103 VDC
Voltage Range	86 VDC to 116VDC
Battery Module Arrangement	8S3P
Battery Designation	IF P54/174/208[((4S)8S)3P]E-10+65/80

1.3 External Interface

1.3.1 Input/Output Terminals and connections

S. no.	Connection Name	Terminal	Recommended wire size
1	Battery N +Ve	BN +Ve	70mm2
2	Battery N -Ve	BN -Ve	70mm2
3	Battery D -Ve	BD -Ve	35mm2
4	Battery D +Ve	BD +Ve	35mm2



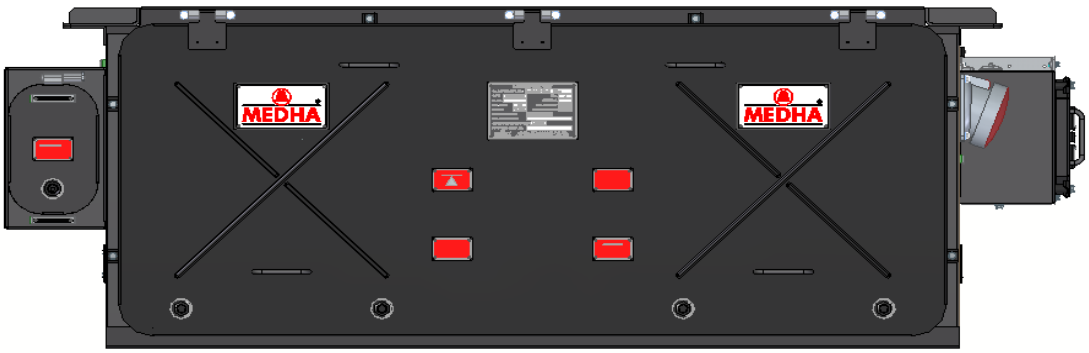
1.3.2 Control connectors (CON1 & CON2)

There are two control connectors (CON1 & CON2). CON2 is used for 110 V DC control supply and for digital signals and CON1 is used for interface between TCMS and BBU with Ethernet communication.

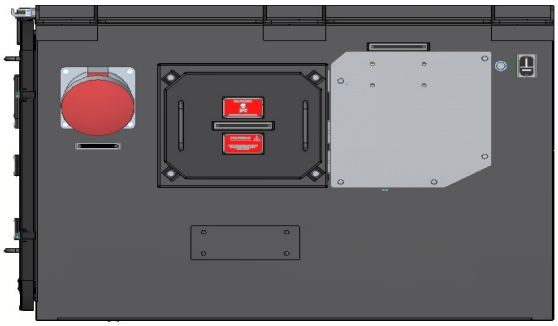
1.4 Design

1.4.1 Structural Design

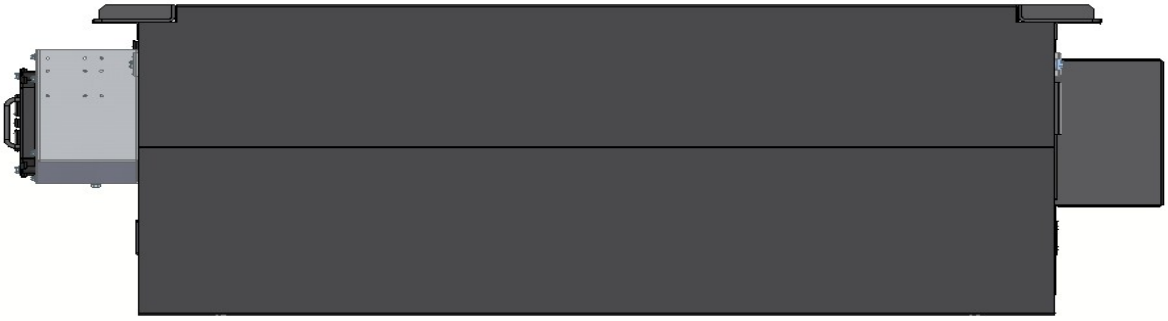
BBU Cabinet is designed to be installed in under slung of NDTC coach . LHS, RHS, front and back views are shown below.



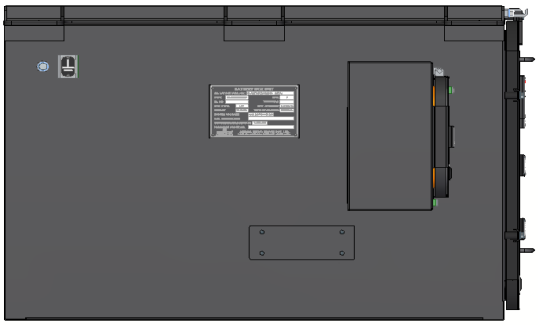
Front View



Right Side View



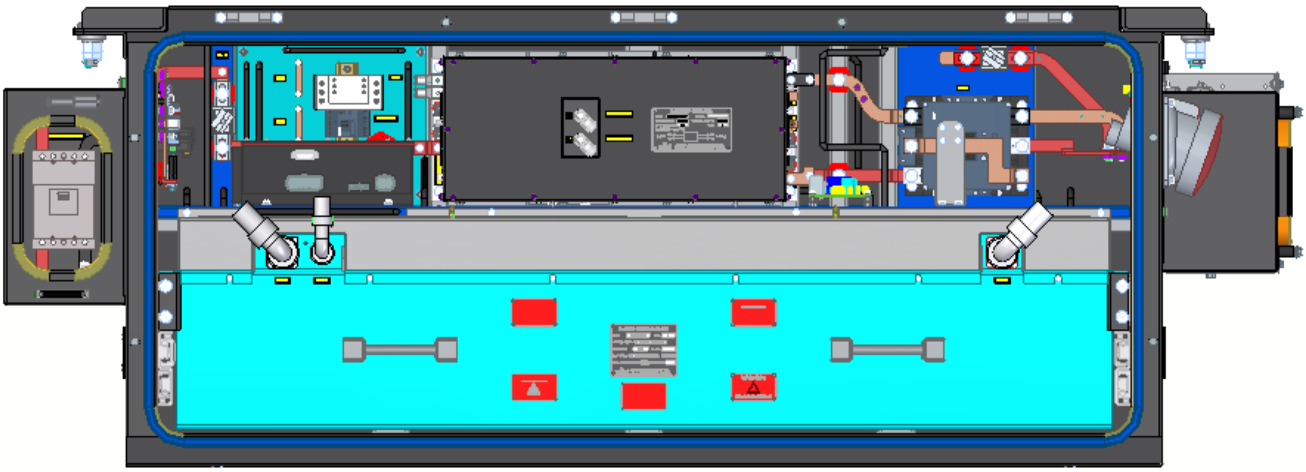
Rear View

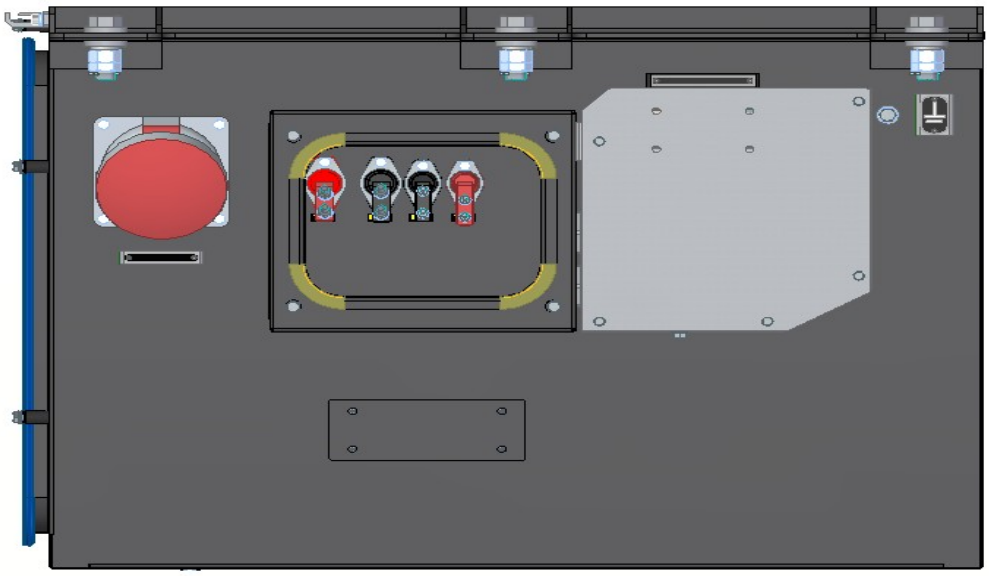


Left Side View

1.5 Component Layout in the Cabinet

The following diagram show the position of the major components in the BBU.





1.6 Accessibility

The Battery Box modular system can be accessed and serviced quickly and easily.

1.7 Cooling

The BBU is Natural-Cooling Unit

1.8 Safety Instructions

To prevent accidents follow these steps:

1. Put the train in duty position
2. Verify that there is no voltage remaining between DC+ and DC- by measuring with a voltmeter.
3. Ensure the adequate cooling time has been allowed, if train has recently been running.
4. Use appropriate depot Personal Protective Equipment (PPE) when working with hot components and dusty environment.
5. Always wear a dust mask when working in dusty environment.
6. Please follow safety instructions on related assembly.

1.8.1 Personal safety

Before commencing any work on the vehicle the personnel shall always:

- Set the vehicle to the correct operating position for the task to be performed
- Study the necessary safety precautions within the documentation and on the vehicle

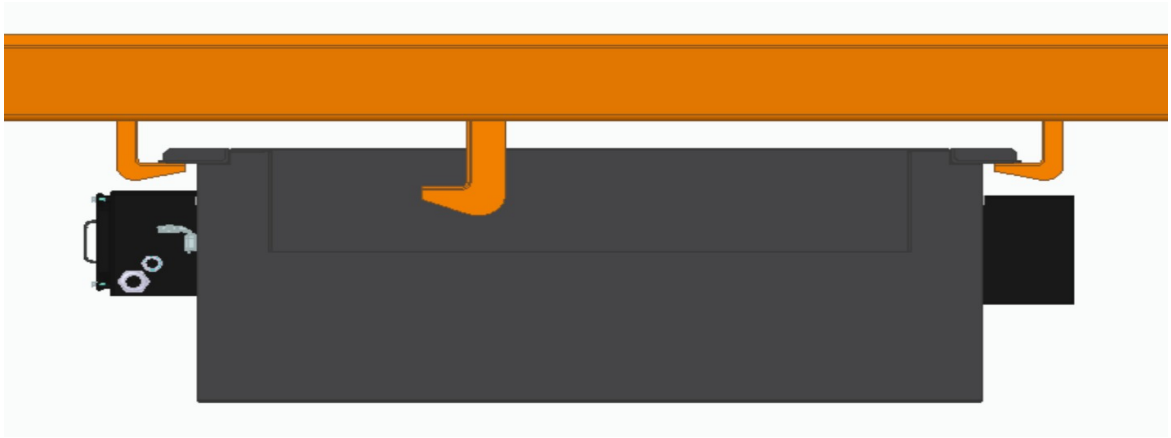
1.8.2 Work on vehicle

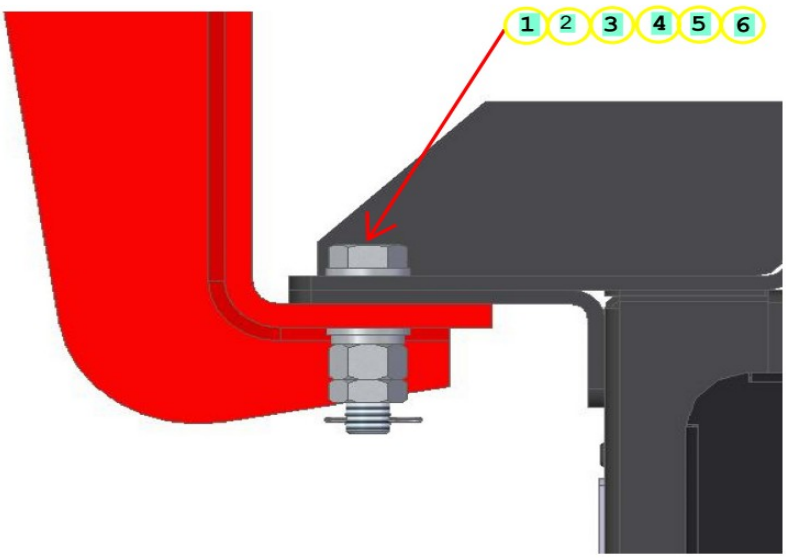
When carrying out maintenance work on the vehicle, the instructions should be followed carefully.

- Always use protective clothing and protective equipment.
- Make sure you have wore the safety shoes, gloves
- Set the placard “Work in progress” or follow the employer instruction.
- Before commencing work on the vehicle, ensure that all voltage is disconnected.

1.9 Mounting:

1. Ensure that the unit bolted tightly there should not be any slackness of mounting fasteners and cotter pin should be intact to lock nut.
2. Check the converter unit for any damage.





1.10 Maintenance Schedule Check list

S. no.	Connection Name	10 Days	30 Days	180 Days
1	Ensure that the Battery Box unit is bolted tightly to the vehicle	√	√	√
2	Check the unit for any damage	√	√	√
3	Clean information and warming labels on doors.		√	√
4	Check the healthiness (color) of silica gel, they should be blue, replace silica gel if found pink.			√
5	Ensure that the door sealing gaskets are free from from cut marks and physical damages.			√
6	Visual Inspection of all the mounting hardware for the mechanical and electrical components for any slackness by seeing changes in torque markings.			√
7	Check electrical connections and ground connections for corrosion to resolve. Ensure that connections are tight.			√
8	Check components and cables for damage. If found address them.			√
9	Do visual inspections for evidence of excessive temperature and arcing (Voltage flash overs) and resolve it.			√
10	Ensure that all the cable ties are tight and intact.			√
11	Check the healthiness of Fan, there should not be any abnormal sound.			√
12	Open and clean unit doors. Remount properly with all bolts.			√
13	While doing maintenance if any abnormality / damage found, it should be addressed on need (issue severity) basis.			√

1.10.1 Cleaning

- After cleaning reassemble the Doors to the unit.

1.10.2 Batteries cleaning procedure

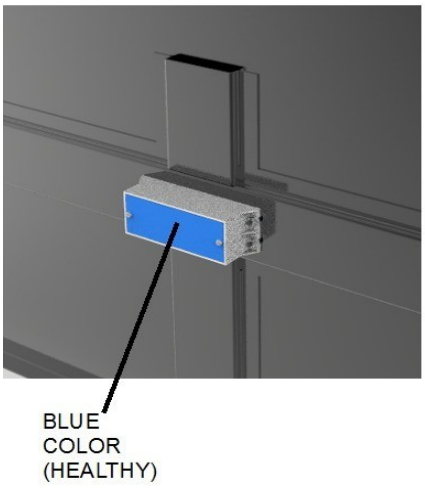
- Clean the Batteries surface (i.e.,outer surface, terminals and other accessible dust deposited surfaces) with soft brush only.
- Suck the dust with vacum cleaner .
- Blow the forced air on the Batteries

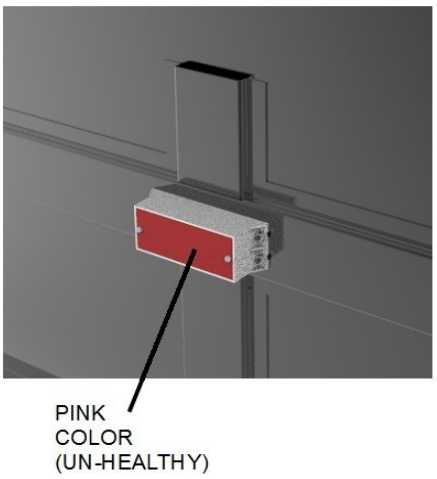
  Note: Ensure Cradle locking position

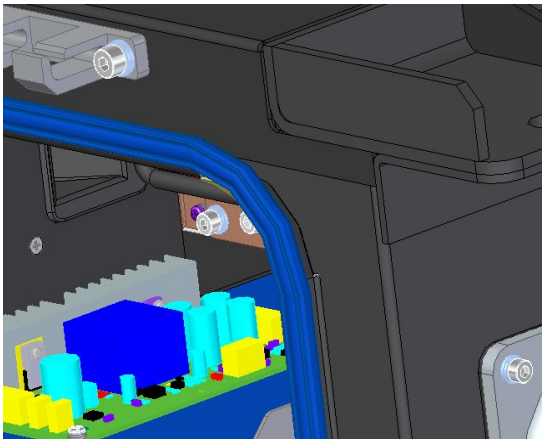
1.10.3 Common Checklist

1. Clean all doors & its name plates.

2. Check healthiness(color) of Silica gel (Inside the doors), they should be Blue, Replace silica gel if found Pink.

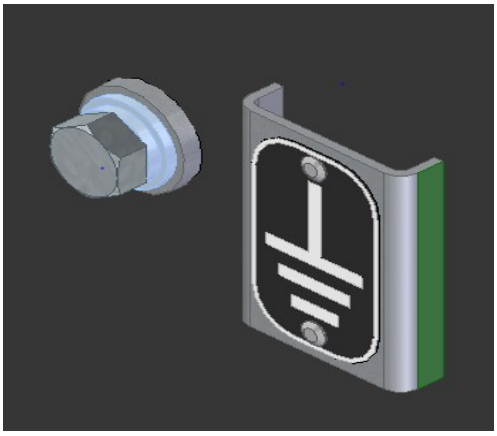






3. Ensure that all door sealing gaskets are free from cut marks and physical damages, If found replace with new one.

4. Visual Inspection of all the mounting hardware for the mechanical and electrical components for any slackness by seeing changes in torque markings.



5. Check electrical connections and ground connections for corrosion to resolve. Ensure that connections are tight.

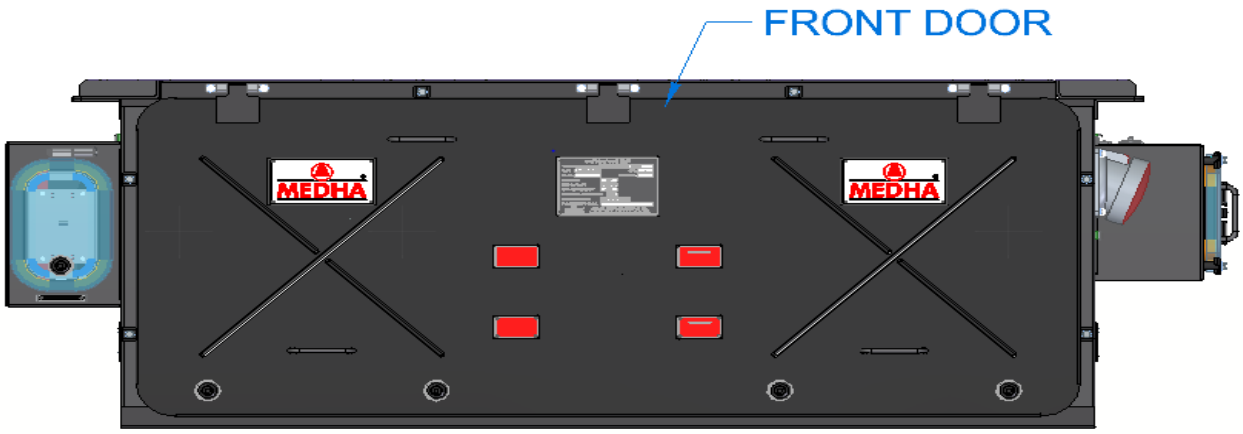
6. Clean all Batteries surface (i.e.,outer surface, terminals and other accessible dust deposited surfaces) with soft brush only. Suck the dust with vacum cleaner & blow the magnetics with blower.

1.11 List of line Replaceable Units (LRU's)

Battery charger module
BMS module
Battery module

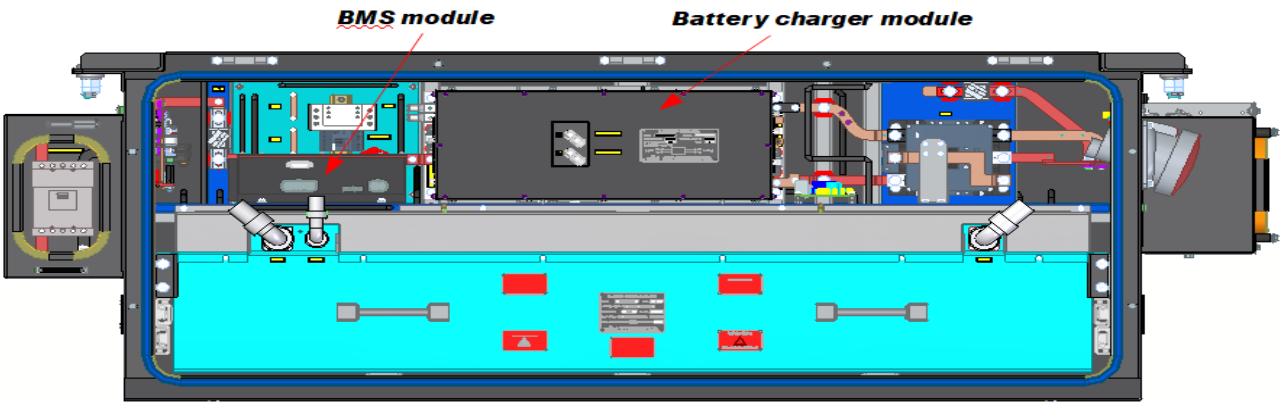
1.12 Modules replacement procedure

1. For accessing key-B refer Interlocking section 1.10



2. Open the Front door lock with key-B and Place the door aside(Module chamber door is shown in below image.)

BBU FRONT VIEW WITH DOOR



BBU FRONT VIEW WITH OUT DOOR

1.13 Battery charger module replacement procedure

Unplug the electrical connectors

Remove electrical busbar connections

Remove earth connection

Remove the module mounting hardware (M8 socket screws) using extended allen key

Remove the module and replace with the new module

Reconnect/ Remount all components & apply required torque If any abnormality/ damage found, it should be addressed on need basis, by following the common check list mentioned in Section 1.10

1.14 BMS Module replacement procedure

a) Unplug the electrical connectors

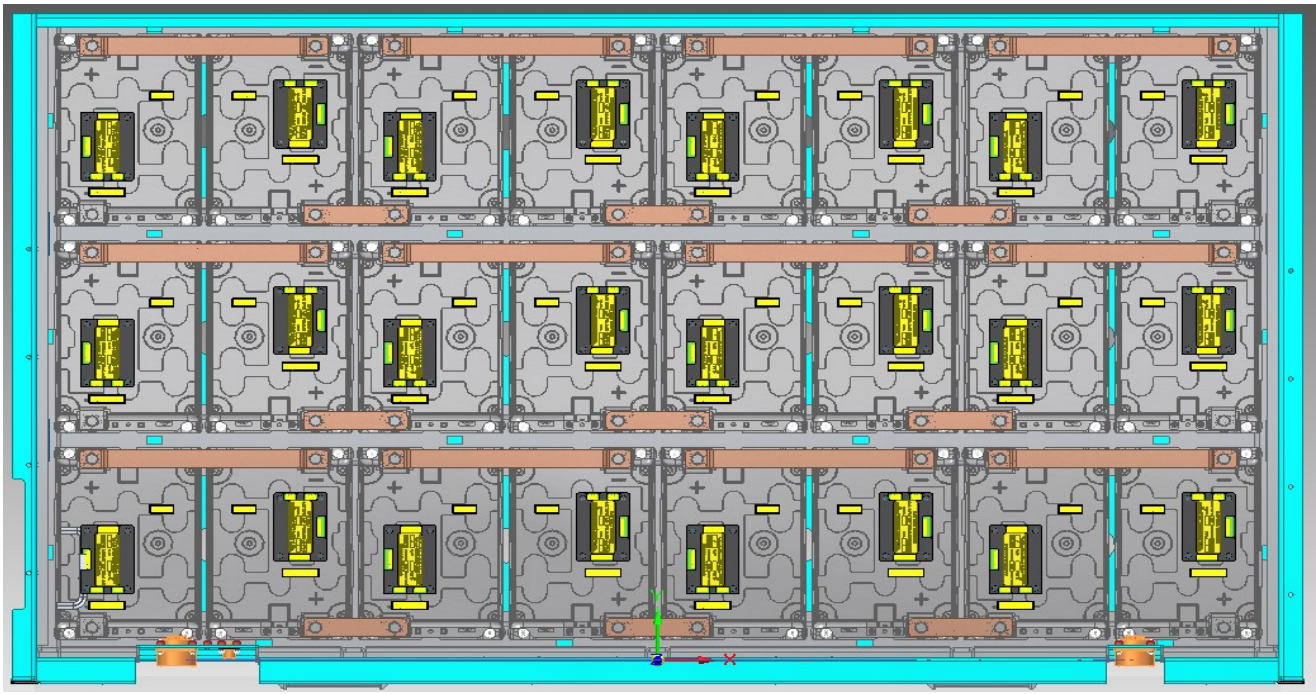
b) Remove earth connection

c) Remove the module mounting hardware (M8 socket screws) using extended allen key

d) Remove the module and replace with the new module

e) Reconnect/ Remount all components & apply required torque If any abnormality/ damage found, it should be addressed on need basis, by following the common check list mentioned in Section 1.10

1.15 Battery Module replacement procedure



a) Unplug the electrical connections

b) Remove Cradle assembly top cover.

c) Remove the Cradle assembly mounting hardware

d) Pull the Cradle assembly by holding two handles.

e) Unplug the electrical connections between batteries.

f) Unscrew the hardware of Lugs & Busbars

g) Remove the Lugs & Busbars between batteries.

Unscrew the hardware of battery.

h) If any abnormality/ damage found, it should be addressed on need basis, by following the common check list mentioned in Section 1.10

1.16 Maintenance of Heat Sinks

No maintenance is required for the Heat sinks. In case if there is any Heat Sink thermal performance degradation is identified through temperature derations or shutdowns in the converter even if the blower motor is running in the right direction, then remove the Heat Sink module and clean it as per the procedure given below.

1.16.1 Heat sink cleaning

- Remove the modules from the unit as per procedure mention for removing and replacing LRU's
- Clean the Heat sink fins with ISO-prophlye alcohol by using lint free cloth and brush. Suck the air through fins by vacum blower for removing the dirt from fins.

Maintenance Manual

BATTERY BOX UNIT FOR TRAIN 18 TYPE MAE 675 UV2

BATTERY BOX UNIT FOR TRAIN18

MEDHA

Medha Servo Drives Pvt.Ltd.

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