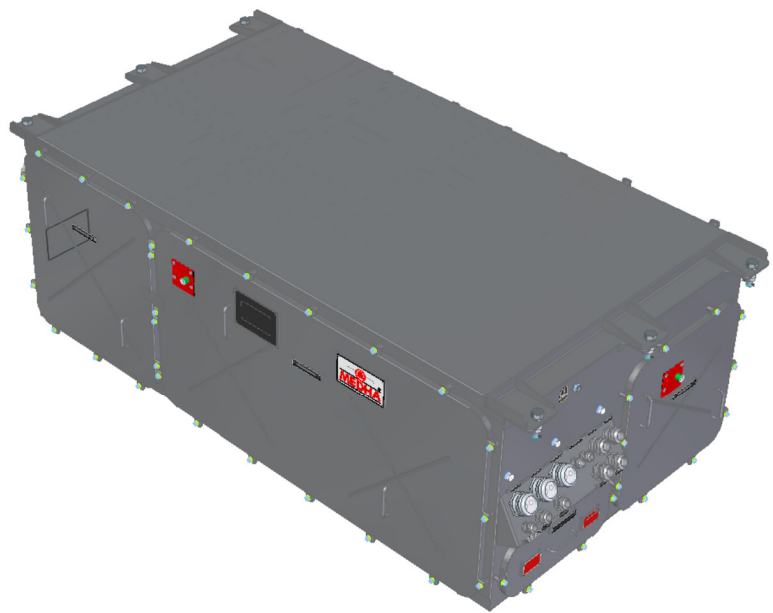




LINE AND TRACTION CONVERTER FOR TRAIN SET

TYPE MAE675UV2



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LINE AND TRACTION CONVERTER (LTC)

1.1 Introduction

One basic unit with 4-cars, is the building block for Trainset rake formation. Each basic unit consists of one Driving Trailer Coach (DTC) at the end, two Motor Coaches (MC) and one Trailer Coach (TC). Each middle basic unit consists of Non driving Trailer Coach (NDTC), two motor coaches (MC) and one Trailer Coach (TC).

Four such basic units can be coupled together to form one rake of 16 coaches. As the Line and Traction Converter (LTC) Unit is fixed in the Motor Coach only focus is given on the Motor Coach in this document.

1.2 Motor Coach (MC)

MC is a powered coach with four axles and one Traction Motor drives one axle. The Motor Coach consists of a Line and Traction Converter Unit (LTC) for each Bogie and is mounted underslung. Also Brake chopper resistor is mounted underslung in the MCs. Transformer secondary cable for both LTC unit from power transformer comes from Trailer Coach through underslung mounted IV Coupler to MC. MC also consists of passenger saloon area, Pantry, RMPU, Mono block pump controller, Electrical cabinet and various End wall panels.

Each MC coach of 25kV AC EMU consists of two IGBT based Line and Traction Converter Cubicles. Each LTC Cubicle consists of one Line Converter and one Traction Inverter. Line Converter input is connected to single phase AC (one of the secondary of Traction Transformer) through main contactor and pre-charging contactor. The output of Line converter is connected to DC Link capacitors. This DC link is connected to the Traction Inverter and it converts this DC voltage into AC voltage of variable voltage and variable frequency (VVVF) and these three phase outputs shall be connected to two Traction Motors (TMs) each. The cooling system for Line converters and Traction Converter is Liquid Cooling. The Salient points of LTC units are

- The active switching device used in the LTC unit is IGBT.
- LTC unit ensures that energy can either flow from the OHE line to the traction motors (Motoring mode) or in the opposite direction (Regeneration mode).
- The pre-charging circuit is used to charge the DC Link capacitors during initial start up condition (or whenever DC Link voltage falls below certain threshold).
- Brake Chopper circuit is used to reduce the over voltages on the DC link during transients and non reception of line during regeneration.
- The earth fault detection circuit is used to detect the earth fault.
- DC Link earthing switch is connected across the DC Link of LTC units for safety of the operating personnel. The DC Link earthing switch is provided in a separate cubicle besides the LTC units in a MC under frame and has two independent circuits accommodated in a single unit.



Figure 01: End Basic Unit

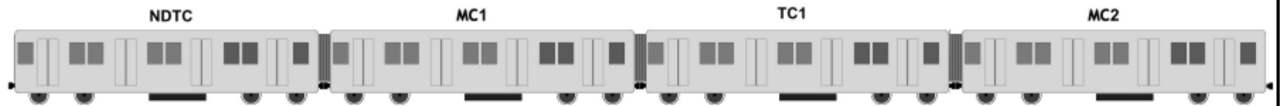


Figure 02: Middle Basic Unit

Activities to be done Before Stating the Maintenance of LTC unit:

Before doing any maintenance activity related to Line and Traction Converter unit or any activity in the under frame, the following sequence of steps to be followed for human safety against dangerous high voltages.

- Make sure that the all the pantographs are in down conditions in the rake. If not down the pantographs and open all the VCB's in the system. Wait for 10 minutes from the **instant** the VCB's are open.
- Take out the blue key from all the pantographs in the rake. This gives guarantee that the pantographs will not be raised in the rake during maintenance periods
- Use the blue key to operate the VCB Earthing switch into Earth position in the respective (all 4) basic units . This ensures the OHE to earth condition under all situations even if any body operates. Release the Yellow key from the VCB Earthing switch. This Yellow key will be used to operate the DC link Earthing switch of the LTC units.
- Insert the Yellow key in the DC link Earthing of the Motor Coach and rotate it. Then rotate the DC Link Earthing switch handle as per the direction given on the Earthing Switch panel to connect the DC link connection to Earth. Then Green colour key can be removed from the DC link Earthing switch. By using the Green key LTC converter unit door can be opened.
- After completion of maintenance work follow the opposite sequence to restore the normal conditions. Otherwise the system will not get the OHE power supply.

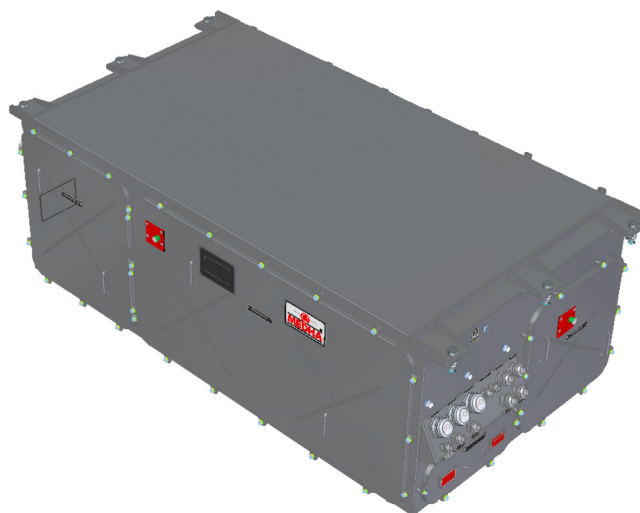


Figure : 03



Figure : 04

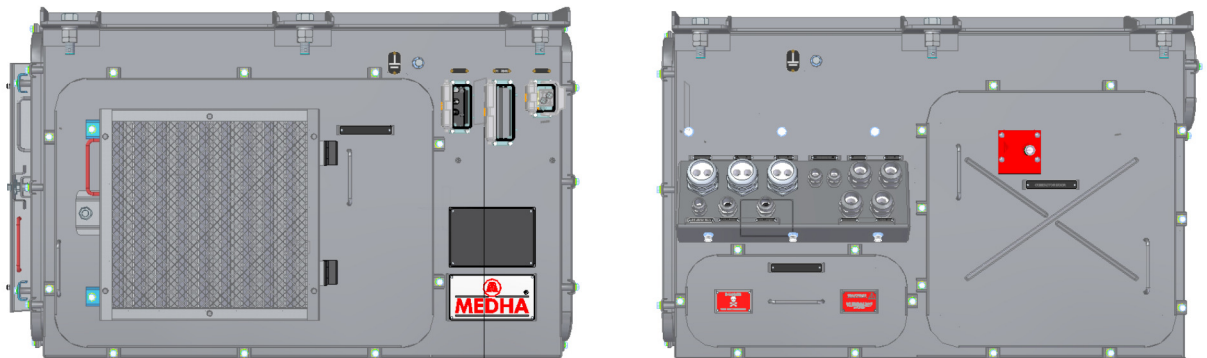


Figure : 05

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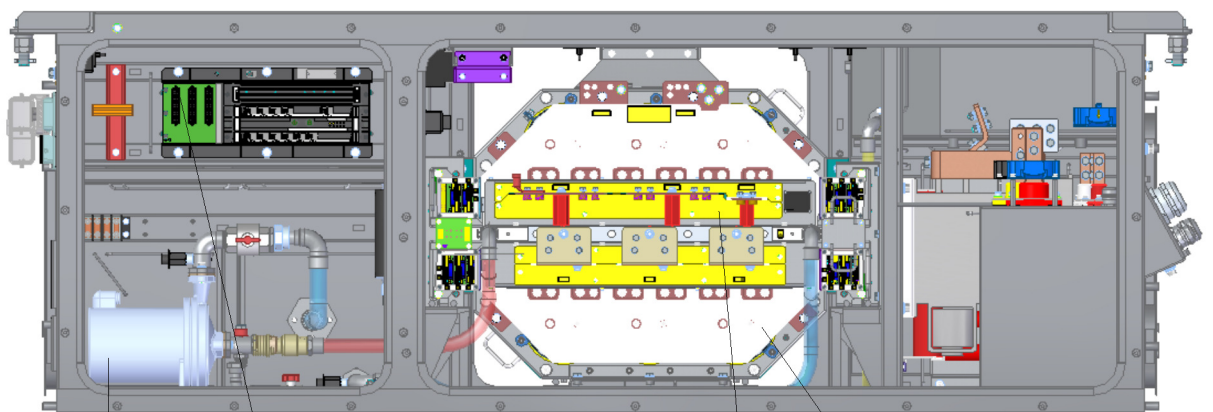


Figure : 06

9

3

1

2

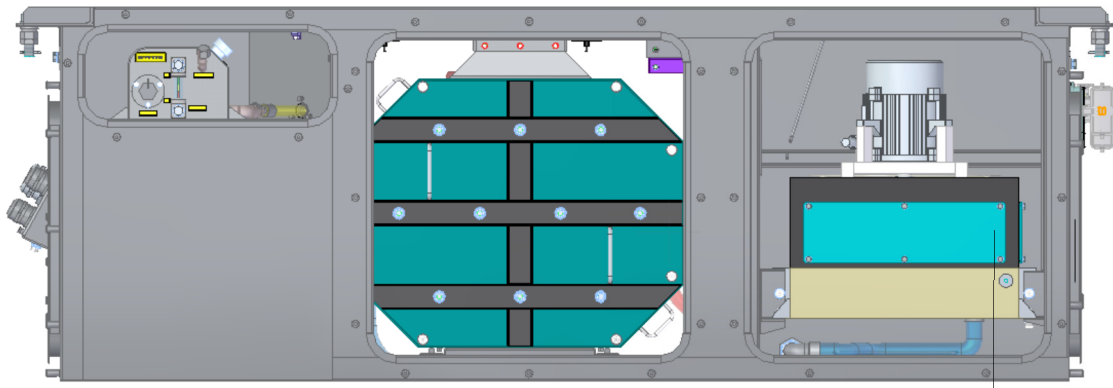


Figure : 07

10

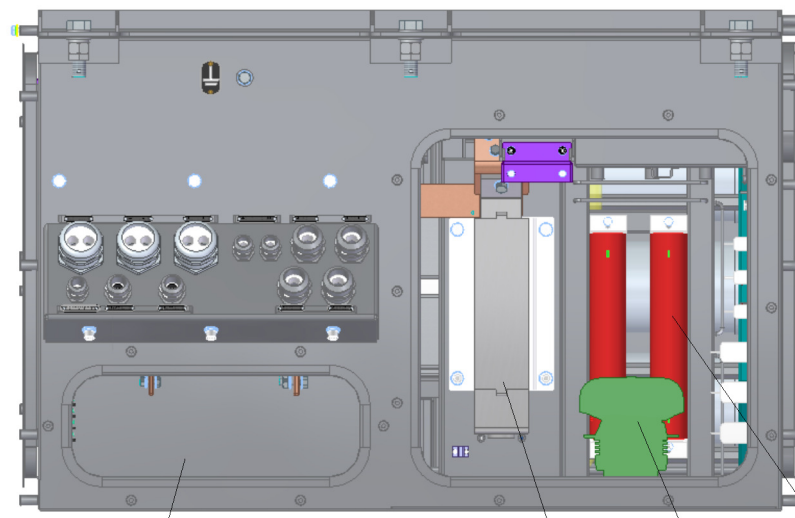


Figure : 08

8

4

5

7

1.3 Component Details

S. no.	Description
1	Power Module
2	DCL Capacitor Bank with DCL Bus bars
3	LTC Control Unit
4	Main Contactor
5	Pre-charging Contactor
6	Harting Connectors
7	Resistors
8	IP/OP Terminals
9	Pump
10	Cooling Unit with blower motor

Table 1: Component Details

1.4 Cleaning

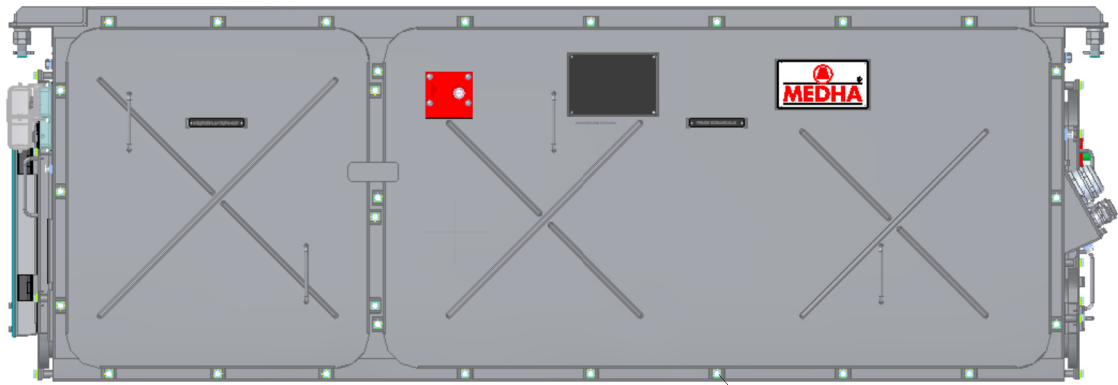


Figure : 09

Door Mounting Bolts

Spanner Size	
M6	10-11 mm
M8	12-13 mm

Cleaning the Un-Ventilated sections

- Do not use water, solvents or compressed air.
- Dust and dirt deposits must be vacuumed up.
- Remove all unventilated doors.
- Vacuum or brush out the equipment sections and components, lint free cloth may be used if required.

Cleaning the Ventilated Sections :

- Do not use steam or water jets
- Do not use aggressive solvents
- Use oil free or acid free compressed air only
- For cleaning filters open the filter as shown in figure : 10 and blow the compressed air.

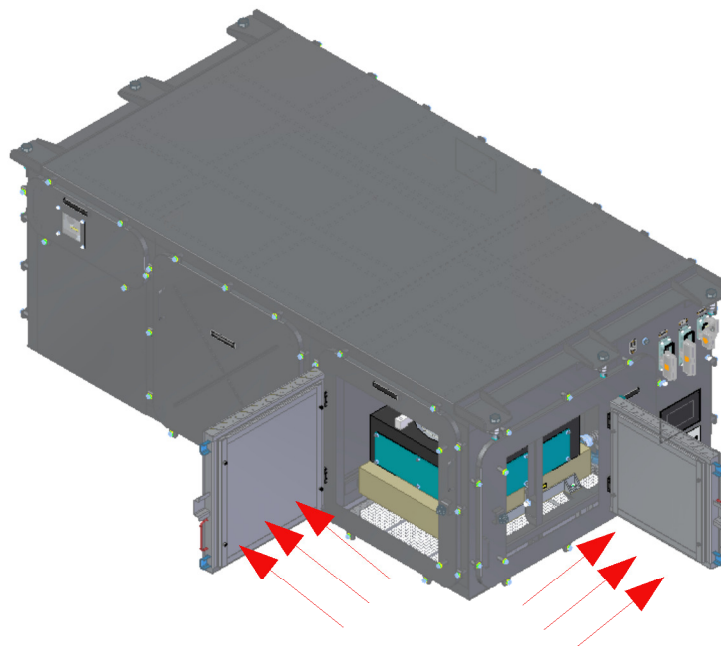


Figure : 10

Cooling Unit Cleaning :

Clean the Cooling Unit Core by blowing oil & acid free compressed air through the fins by vacuum blower. Cooling Unit shutting covers need to be removed as shown in figure 11 and core need to be cleaned by using the hair brush. While performing this activity dust should not enter into the Electronics Zone.

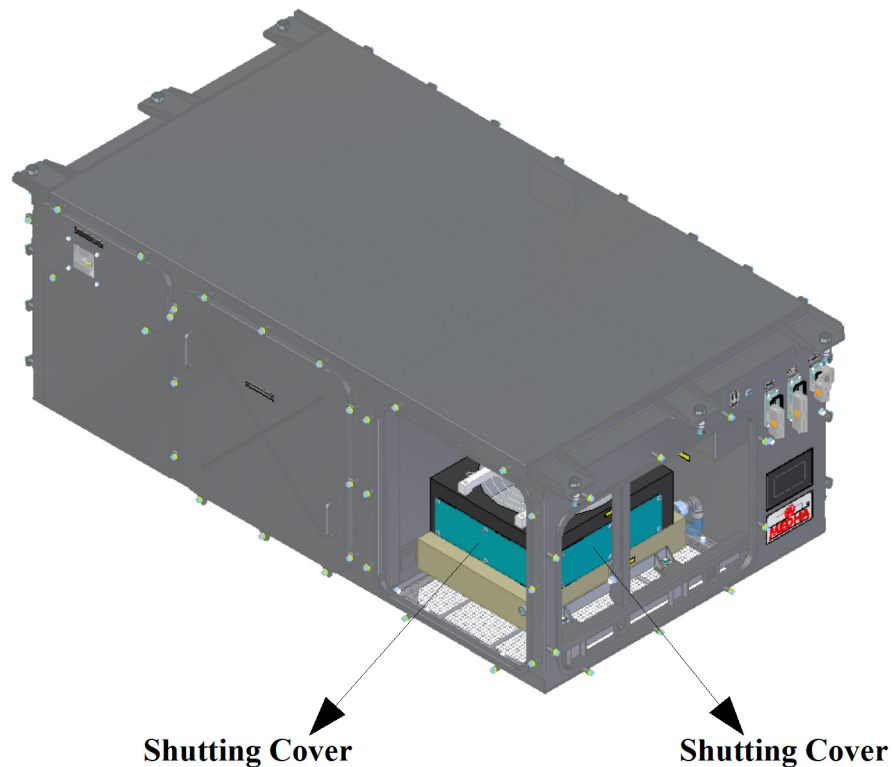


Figure : 11

Maintenance of Doors and Gaskets :

- Due to exposure to the moist and hot ambient Traction converter door mountings and gaskets get deteriorated.
- Periodically all the Door mountings shall be checked for total Presence /availability and in good condition
- On identifying any missed hardware strictly to be added and maintained further
- On identifying any jammed hardware shall be properly removed and to be replaced by new hardware with anti seize compound applied by using screw extractor;
- Periodically all Door gaskets shall be checked for total presence /availability and in good condition
- On identifying any missed gasket strictly to be added and maintained further,
- On identifying any damaged gasket strictly to be replaced with new one and maintained further

1.5 Coolant Filling

- Total Hydraulic loop should be properly connected / tightened enough to avoid any Leakages before starting the coolant filling operation.
- **pH of the coolant must be checked before the filling operation.**
- **Ensure that the pH meter is calibrated with a standard liquid of defined pH value or to read 7.0 when used with distilled water (by taking the average value of 3 readings).**
- **Acceptable pH ranges are listed below**
 - 7.7 to 8.3 during filling (Fresh coolant)
 - 7.1 to 8.9 while in service (coolant from running circuit)
- Before filling the coolant, ensure that the Ball Valve directions of the coolant Kit are as shown in below image.

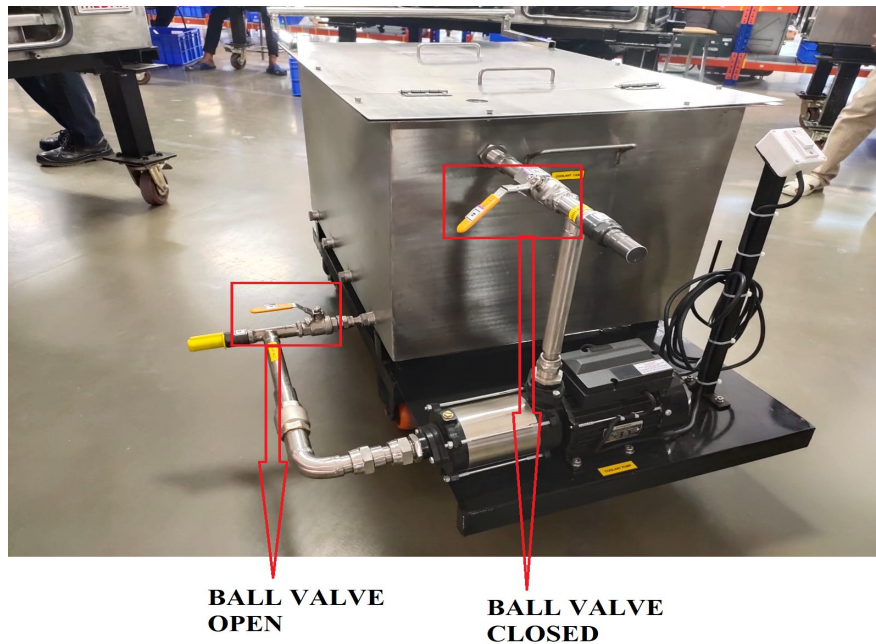
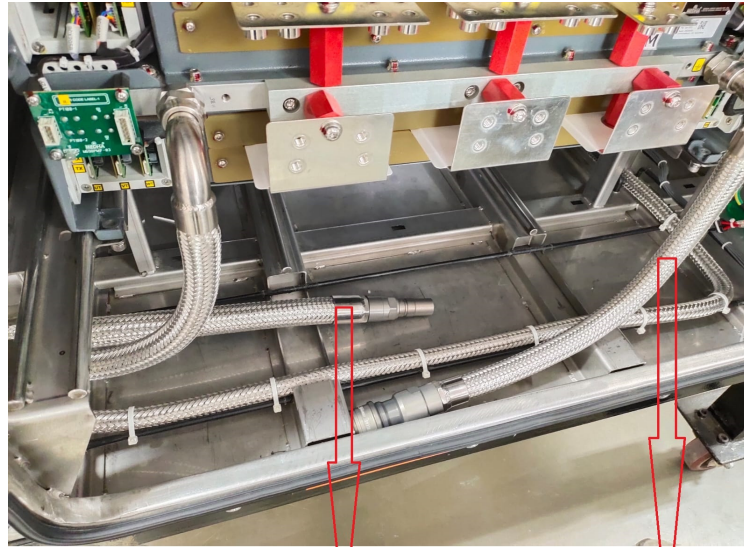


Figure:12

- Remove the Module inlet hose connection from Radiator Outlet connection as shown in the images.



Figure:13



RADIATOR OUTLET HOSE

MODULE INLET HOSE

Figure:14

- Connect the hose pipe one end to Coolant Kit pump outlet as shown in below image.



Figure:15

- Connect the hose other end to the Radiator outlet hose of the unit as shown in the images.

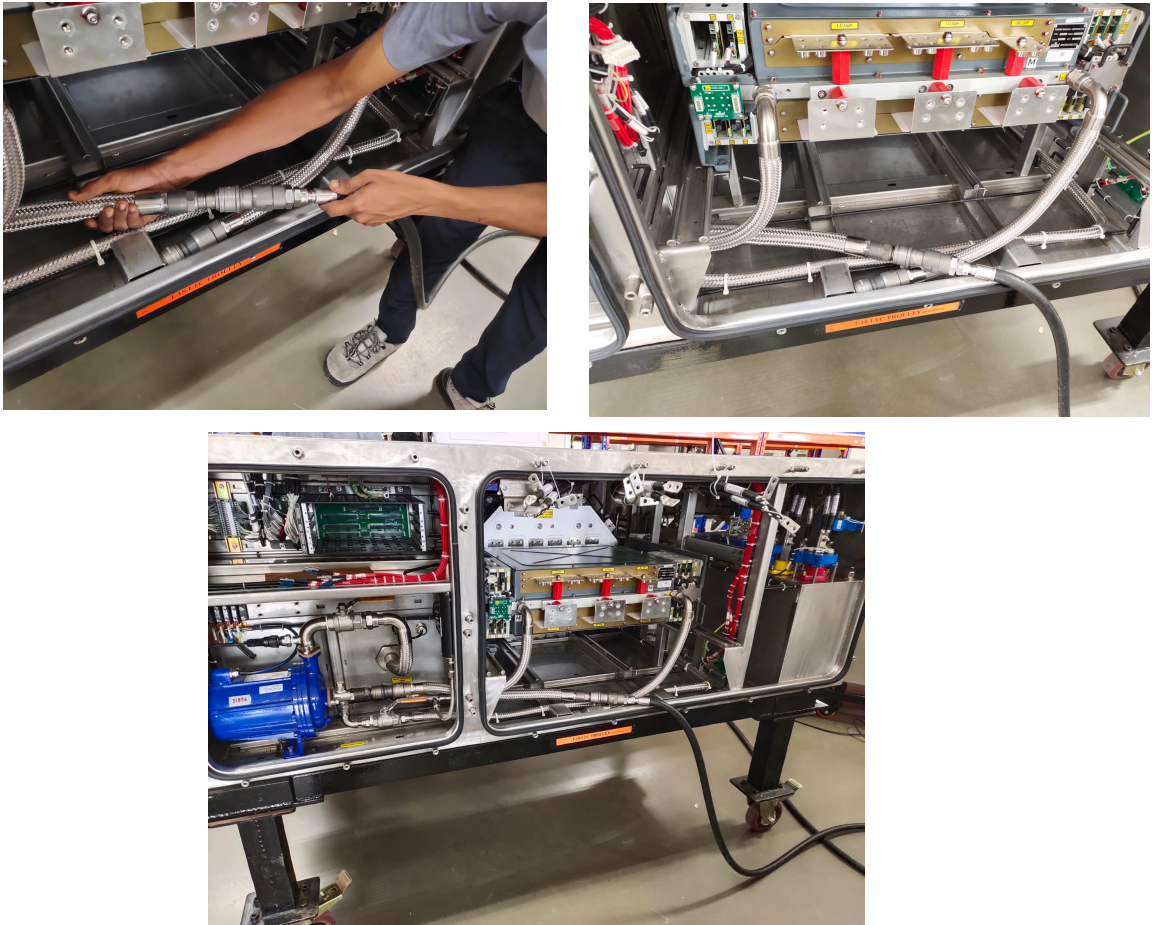


Figure:16

- Ensure all the Hydraulic connections are secure. Now plug the power cable of filling pump to the supply.
- Switch ON the supply.
- Observe the coolant filling by observing the level in the Level indicator located in Converter Expansion tank.
- Coolant level in the tank should be observed every 10 seconds by switching off the pump.
- Switch off the pump after the coolant reached the middle of Green and Yellow level as shown in the image.



Figure:17

- After filling the coolant disconnect the Coolant Kit connections to the unit and connect module inlet hose to the Radiator outlet hose as shown in below image.



Figure:18

- Utmost care should be taken while filling the coolant, as the coolant will be filled in 2-3 minutes only, hence person should attend the coolant kit compulsory.

1.5 Visual Inspection of Liquid Connections:

Cleanliness

- Ensure that the system and its surroundings are clean. Note that most (and major) hydraulic faults are caused by dirt.
- Ensure that the system is free from contaminants like dirt and dust, grease from cleaning rags, paint flakes, pipe thread compounds, rust particles, etc.
- Ascertain that all traces of cleaning agent are removed prior to filling.

Hoses

- Inspect all the hoses and fittings for damage before filling.
- Check the hoses for abrasion, blisters, nicks, cracks, cuts, and colour changes.
- Make sure that the hoses do not rub against each other and any metal parts.
- There should not be any twists and kinks in the hoses.
- Ensure that there is enough slack and sufficient bend radius to accommodate for any changes in length.

Leakage

- Remember that leaks are pathways for a variety of contaminants.
- Look for puddles of fluid around the equipment while inspecting leaks.
- Ensure that no leakages are present in the piping, i.e., at radiator Hose connections, pump inlet / outlet connections, pump casing, ball valves, pressure sensor connection, temperature sensor connections, expansion tank connections, spill-proof connectors, level indicator connection, level switch connection etc.
- Check the level of fluid in the expansion tank. Low levels indicate fluid leakage.

Coolant

- Concentration of Antifrogen N in the coolant should be checked annually, and during each top-up.
- Indications of fouling coolant are listed below.
 - Low pH
 - High TDS
 - High conductivity
 - Colour change to black or dark grey
 - Presence of an oily layer
 - Burnt odour
 - Heavy sludge

Valves and other fittings

- Ascertain that the valves in the system are not seized.
- Teflon tape on the threaded ends of connectors, should be wound in the same direction as the thread.
- Check the seals of all fittings for cracks. Cracks occur in the seals due to over torque during assembly or due to excessive vibrations and shock.
- Check the seals for swelling, shrinking, or distortion.
- In the event that the breather on the expansion tank is clogged, or dirty, clean it.
- Remove protective caps and dummy plugs from the hydraulic components only just before connecting them to their mating parts.
- Listen to the pump during test runs. If the pump rattles, or if it sounds as if it were filled with contamination or Bled air, it is indicative of cavitation.

Visual Inspection & Coolant Refilling:

- The system should be thoroughly checked for corrosion, scale, and sedimentation before filling it with the coolant.
- The colour and pH of the coolant (Antifrogen N) has to be monitored during every quarterly shed level maintenance.
- Ensure that the pH meter is calibrated with a standard liquid of defined pH value or to read 7.0 when used with distilled water (by taking the average value of 3 readings).
- Acceptable pH ranges are listed below
 - 7.7 to 8.3 during filling (Fresh coolant)
 - 7.1 to 8.9 while in service (coolant from running circuit)
- The coolant has to be changed either when the pH crosses the acceptable range, or after every three years.

Spill Proof Connectors Maintenance:

- Check the threads of connectors for any damage, dings, and burrs.
- Check the couplings for corrosion.
- Plug in and plug out of the spill proof connectors (connecting the cold plates to the Pump & Radiator Hoses) should be done once in every three months for cleaning and to avoid clogging and thermal seizing. This activity has to be done by Medha's service engineers and technicians only.
- Ensure that the mating surfaces of spill-proof connector plug and socket are not damaged while plugging in and out.
- In the event that quick couplings or spill-proof connectors have torn seals, or are damaged, very dirty, clogged, corroded, leaking, they have to be replaced.
- Do not over-tighten connectors. Over-tightening is the primary cause of damage in threaded connectors.
- Ensure that the mating connectors belong to the same make.
- Maintain shed level spare stock of each make connectors for maintenance and replacement needs.



Figure : 19

1.6 Mechanical Data

Converter Size	2175 x 1240 x 740 (LxWxH)
Cabinet Material	SS304
Mass	720 Kgs(Approx.)
Degree Of Protection	IP65 (Electronics zone) IP20 (Cooling Zone)

1.7 MAINTENANCE SCHEDULE :

- AIR INLET and OUTLET FILTERS : Cleaning should be done for every three months.
- Cooling Unit : cleaning should be done for every six months
- DOOR GASKETS : Gasket should be replaced after 5 years

1.8 Maintenance Schedule Check List:

S. no.	Connection Name	10 Days	45 Days	180 Days
1	Ensure that the converter unit is bolted tightly to the vehicle	√	√	√
2	Check the converter unit for any damage	√	√	√
3	Ensure that the air inlet and outlet openings are UN- obstructed.	√	√	√
4	Air blowing for inlet air filter and outlet air filter to be done		√	√
5	Remove inlet and outlet doors and clean the inlet and outlet chambers.		√	√
6	Check the healthiness of all the cooling unit, there should not be any abnormal sound.	√	√	√
7	Open and clean all converter unit doors. Remount properly with all bolts.			√
8	Clean information and warning labels on doors.		√	√
9	Check the healthiness (color) of silica gel, they should be blue, replace silica gel if found pink.		√	√
10	Visual inspection of all the manufacturing hardware for the doors for any slackness by seeing changes in torque marking	√	√	√
11	Ensure that the door sealing gaskets are free from from cut marks and physical damages.			√
12	Visual Inspection of all the mounting hardware for the mechanical and electrical components for any slackness by seeing changes in torque markings.			√
13	Check electrical connections and ground connections for corrosion to resolve. Ensure that connections are tight.			√
14	Check components and cables for damage. If found address them.			√
15	Do visual inspections for evidence of excessive temperature and arcing (Voltage flash overs) and resolve it.			√
16	Ensure that all the cable ties are tight and intact.			√
17	While doing maintenance if any abnormality / damage found, it should be addressed on need (issue severity) basis.	√	√	√