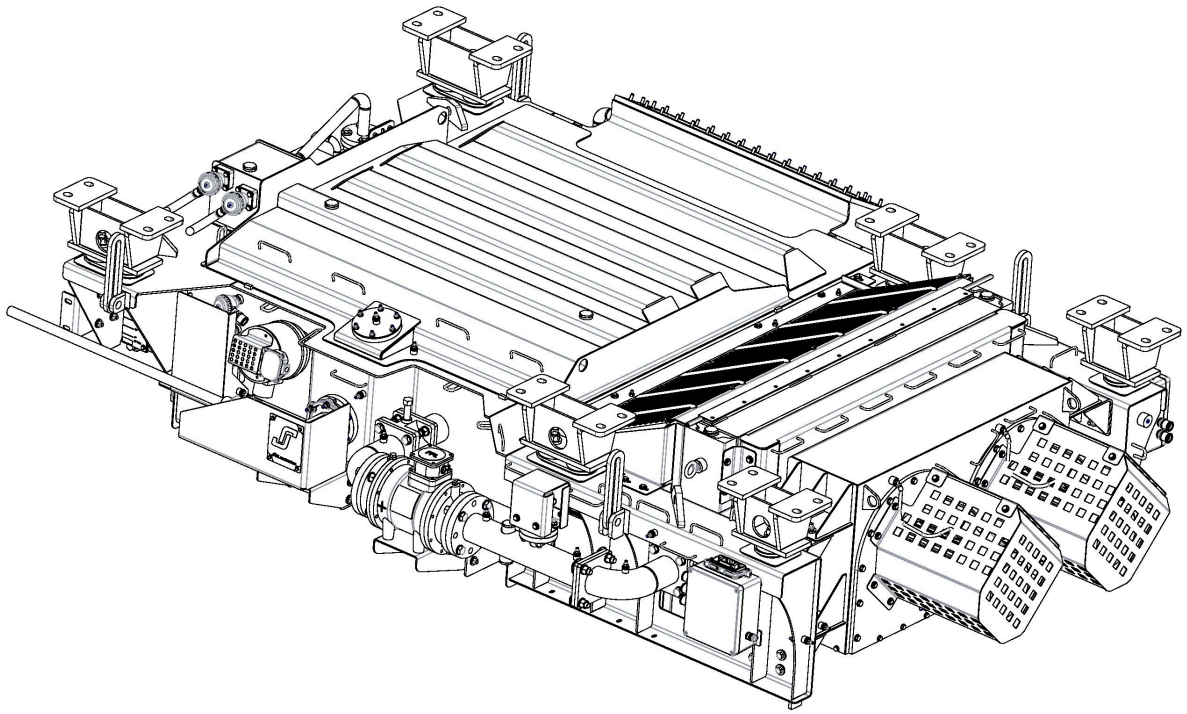
Installation and Maintenance Manual for Train Sets Main Transformer



TFOTEL001.jpg

1075617 - A

FAURE Olivier Ingénierie Traction 02/06/2022

Update of the document

Rev.	Name	Approval	Date	Modifications
0	R.BOUCHARD	O.FAURE	12/2021	First edition
A	R.BOUCHARD	O.FAURE	04/2022	Modified GM1 and PM11

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1. General

The Transformer is an electro technical element of the whole traction system which is in charge to propel the train. It is mounted underneath the carbody of the train.

The Transformer main function is to transfer energy coming from the catenary to the traction converters.

Power (=voltage x current) coming from catenary is quite conserved (except the losses) but voltage is decreased and current is increased in order to be at level needed by converters to supply motors.

This Transformer is used to supply 4 traction converters and 2 auxiliary converters.

The overhaul Transformer is composed by three main elements:

- Transformer itself: a steel Tank containing the Active part immersed in Synthetic Ester oil.
- Cooling system: KDAF:
    - One aluminium Cooler + two fans supported by steel Frame
    - an hydraulic network and one axial Pump for oil circulation
    - an Oil expansion tank allows oil volume variation due to variation of oil temperature. Through the air dryer, air can enter or exit the transformer oil expansion tank.
- Monitoring: several sensors (temperature, flow, oil level, etc…) linked by wires to connectors.

The interfaces are:

- Electrical interfaces: 13 Low voltage bushings, 1 High voltage bushing and 2 Earth terminals.
- Mechanical interfaces: 6x4 fixing points on the transformer for fixing to train carbody.
- 3 phases equipements (Motor-fan/ Pump) : 1 Connector.
- Monitoring interfaces: 1 Connector.

1.1. Main specifications

Winding			
	HT	TR	AUX
Qty	1	4	2
Capacity (kVA)	2556	522	234
Voltage (V)	22500	858	343
Current (A)	114	609	682
Frequency (Hz)	50		
Thermal class	H on conductors		

1.2. Dimensions and weights

See drawing 1075262 for outline details

Length	3200
Width	2432
Height	713
Total weight with oil	4450 kg ±3%
Weight of oil	445 kg

1.3. Applicable documents

1.3.1. Customer Documentation List

General arrangement drawing	1075262
Schematic electrical diagram	1075829

2. Safety instructions

2.1. Legal compliance requirements

Ensure to comply with regulations and standards, whether national, regional or local.

2.2. Safety of persons

2.2.1. Warning about electrical hazards

Deadly voltages are present inside the Transformer and on all electrical connection points, creating a risk of electric shock without the need for direct contact with live parts.

Equipment installation and maintenance operations must always be performed by authorized and trained personnel to interventions on high voltage electrical equipment.

Before working on the electrical connections, it is mandatory to:

- Before working in an electrical box, carry out an analysis of potential risks and take adequate and appropriate measures.
- Before working on the device, turn off the train supply and secure the electrical installations by earthing and short circuit as well as equipotential bonding.
- Observe the minimum safety distances with airlines and energized busbar (risk of ignition).

2.2.2. Warning about handling/lifting

The equipment and all its sub-component must be handled with an appropriate lifting equipment regarding the weight.

Lifting operations must always be performed by authorized and trained personnel.

During lifting/handling operations, ensure that no damage will be done to the surface protection.

2.2.3. Warning about hot surface

Before any maintenance operation, operating personnel must leave the time to the equipment to cool down to avoid injury.

2.3. Inspection

Inspection, level and frequency of preventive maintenance of Transformers and their equipment are closely related to the equipment operating conditions.

This document is intended to provide the operator with a list of the minimum recommendations of monitoring and maintenance to maintain the level of quality necessary for optimal operation of the equipment under normal operating conditions.

Traceability and up recording of surveillance and maintenance activities are the input data required for the efficient operation of the monitoring equipment.

Every situation operating out of normal service conditions or situations that may cause damage to the equipment should be immediately notified to the manufacturer during the warranty period.

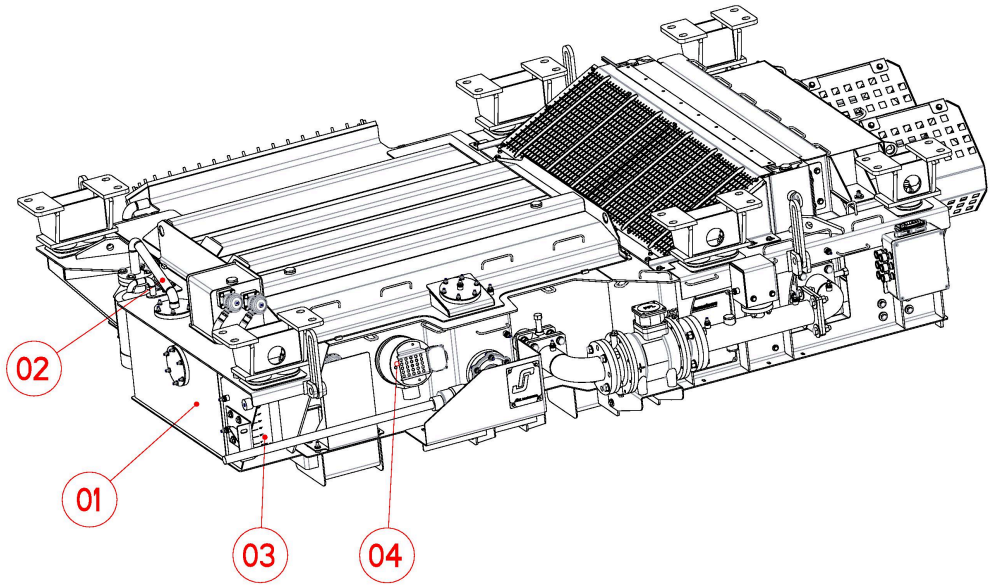
2.4. General remarks

Oil used to fill or adjust the level in the Transformer must be exclusively the same than the initial oil.
The manufacturer will not be responsible for damage to the Transformer when mixed with oil other than the one specified in this maintenance manual.

During all operations on the Transformer, any removed gasket must be replaced by a new one to avoid leakage.

3. Description

3.1. Transformer



TFOTEL002.jpg

The active part of the Transformer is placed in a Tank, immersed in Synthetic Ester oil which ensures insulation and cooling.

The Tank has a welded Cover.

The Oil expansion tank (1) communicates with the Tank by a siphon system.

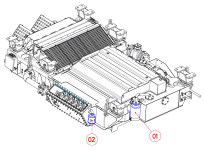
The Oil expansion tank is connected to the atmosphere through an Air dryer (2).

An Oil level indicator (3) graduated in °C, with max and min labels, is placed on the side of the Oil expansion tank for reading oil level.
The Transformer is protected from overpressure through a Pressure relief device (4).
This valve has an operating indicator and a contact signalling that it is open.

The Tank has earthing terminals for electrically bonding the unit.

An Identification plate and Manufacturer plate are arranged on the Transformer and give the Transformer main characteristics.

3.1.1. Air dryer



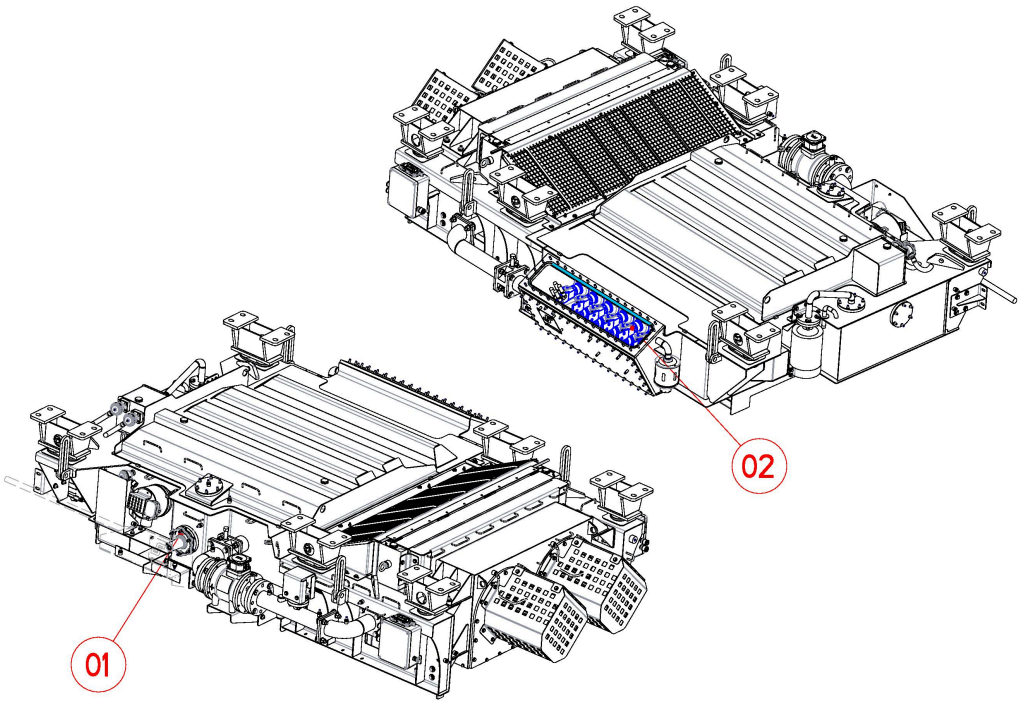
ADRTEL001.jpg

When the oil inside the Transformer is cooled or heated, the pressure inside the Transformer changes. Through the main Air dryer (1), air could enter or leave the Transformer's oil expansion tank and avoid over or under pressure. This air is dehumidified by a desiccant.

The Air dryer is connected to the Oil expansion tank by the Air dryer pipe.

The second air dryer (2) is placed on the LV bushings box to dry the air inside the box.

3.1.2. Bushings



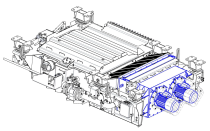
BUSTEL001.jpg

Bushing position

There are two types of bushings located on the Transformer :

- 1 high voltage plug-in bushing for 25kV input (1).
- 13 identical low voltage ceramic bushings (2) : 12 low voltage outputs, 1 neutral output.

3.2. Cooling system

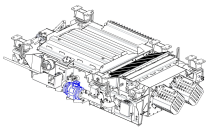


CGSTEL001.jpg

The Transformer assembly is cooled by the mean of one Cooler fed with oil by an Oil pump. The Cooler is equipped with two Motor fans, sucking air through the Radiator and blowing air on the bottom side of the carbody.

The refrigeration assembly can be isolated by the mean of two isolating valves DN80. This makes it possible to change the Cooler by limiting the draining of oil to the volume of these parts.

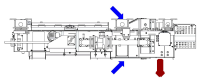
3.2.1. Motor pump set



PMPTEL001.jpg

The immersion type Pump which ensures the flow of the oil starts as soon as the railcar is powered up. Oil pump flows is greater than 35 m³/h into the Coolers.
The Oil pump is supplied with 415 V three-phase 50Hz, directly connected to the train inside the Terminal box.

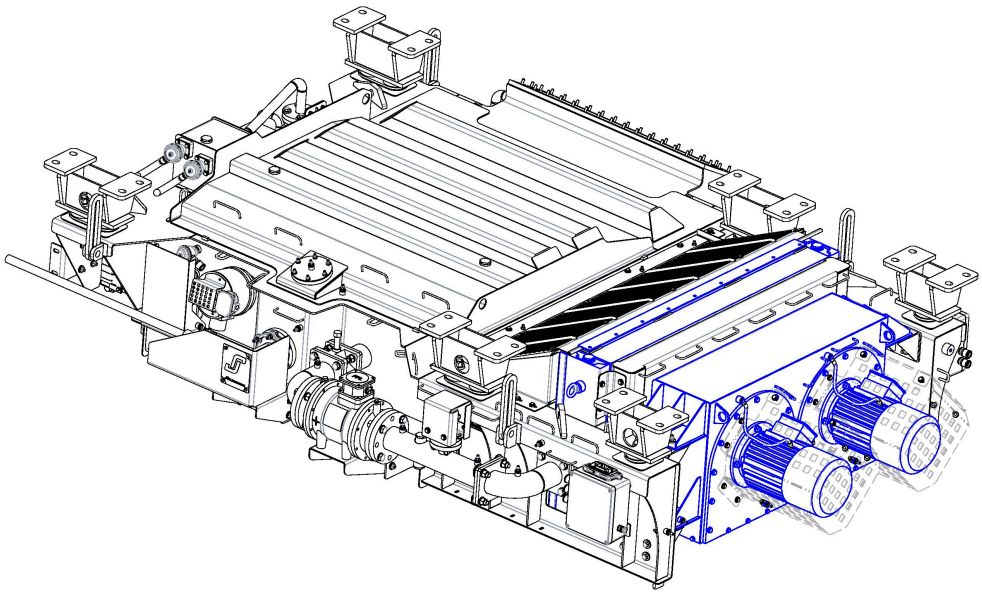
3.2.2. Coolers and motor fan sets



CGSTEL002.jpg

The Cooler is operating as follows:

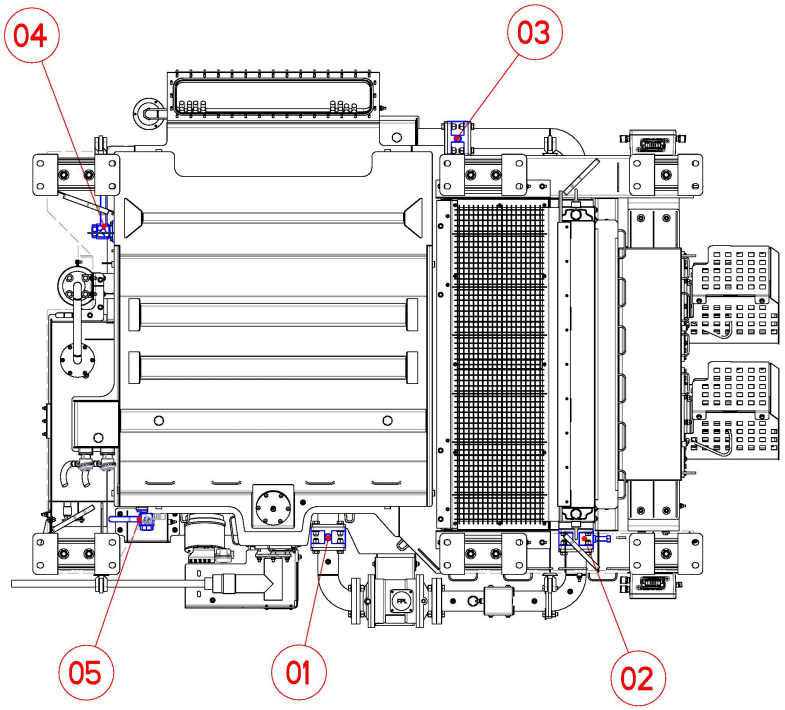
- Fresh air get from external side of the carbody
- Then this air get through coolers made of aluminium plates and bars cools the oil inside
- Finally the air now heated is sucked by the Motor fan and blown on bottom side



CGSTEL001.jpg

The Motor fan sets are supplied with 415 V three phases 50Hz, connected to the train by Harting connectors.

3.2.3. Valves



BFVTEL001.jpg

Two DN32 valves are arranged at the top (4) and at the opposite side of the tank (5), allowing the oil to be filtered through a treatment device. The valves are used for oil sampling, as well as for filling/draining the Transformer.

Three isolating valves DN80 (1), (2), (3) isolate the cooling circuit.

3.3. Monitoring

Different information are available on the Transformer, with two main functions :

Oil cooling monitoring :

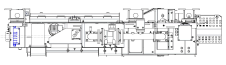
- PT100
- Oil flow indicator

Oil level monitoring :

- Visual Oil level indicator
- Oil level switch

The auxiliary connections (Oil flow indicator, Pressure relief device, PT100 sensor, Oil level switches) are grouped in an electrical box with Harting connector for rapid safe connection.

3.3.1. Oil level indicator



OLITEL001.jpg

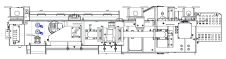
A graduate glass on the Oil expansion tank indicates oil level in °C: because of oil expansion, level of the Oil expansion tank is directly related to oil temperature.

To check the good quantity of oil in the Transformer, compare the temperature from the Oil level indicator with oil temperature (or ambient temperature if the Transformer has been resting for a long time): it should be the same.

Make sure that the Transformer is horizontal and the Oil level indicator is at eye level when reading the oil temperature.

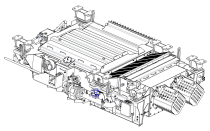
3.3.2. PT100 sensors

Two PT100 are mounted on the tank. The signals are sent to the supervision, which regulate the oil temperature with the fans motor speed.



PT1TEL001.jpg

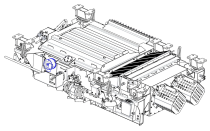
3.3.3. Oil flow indicator



Oil flow indicator is a paddle type.
It detects the minimal oil flow.
This equipment monitors oil circulation and proper functioning of the Oil pump.

OFITEL001.jpg

3.3.4. Pressure relief device (or Overpressure valve)

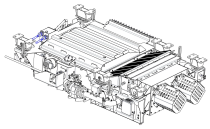


Pressure relief device, rated at one dry contact 0.7 bar, protects the transformer from accidental overpressure. A valve opening indicator (red pushbutton) is directly mounted on the pressure relief device cover.

Warning : do not reset the valve contact prior to adequate fault finding process

PRDTEL001.jpg

3.3.5. Oil level switch



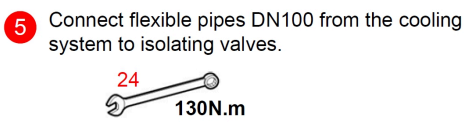
Two oil level switches are mounted on the oil box between the oil tank and the expansion tank in order to monitor the oil level.
The two oil level switches are mounted on two different levels. The top one indicates a low level of oil, the bottom one indicates critical level of oil.

OLSTEL001.jpg

3.4. About this manual

This operation manual contains important information for the safe and proper operation of the Transformer.
It must be read and used by every person who operates the Transformer.

Work instructions give the direct action to do.
For each instruction, tool needed is represented below the instruction.
For wrench and socket, size in mm and torque to apply is given on the picture.



instructions.jpg

In that case : Use a wrench of 24mm and apply a torque of 130N.m

Category and number of person needed for the operation is given at start of the operation.
There are 3 categories:

- G : for general mechanical operation

- E : for operation which need electrical capabilities in order to disconnect/connect electrical devices
- H : for hydraulic operations

Additional mechanical and electrical good practices must be applied. These are not described in this manual and are implied:

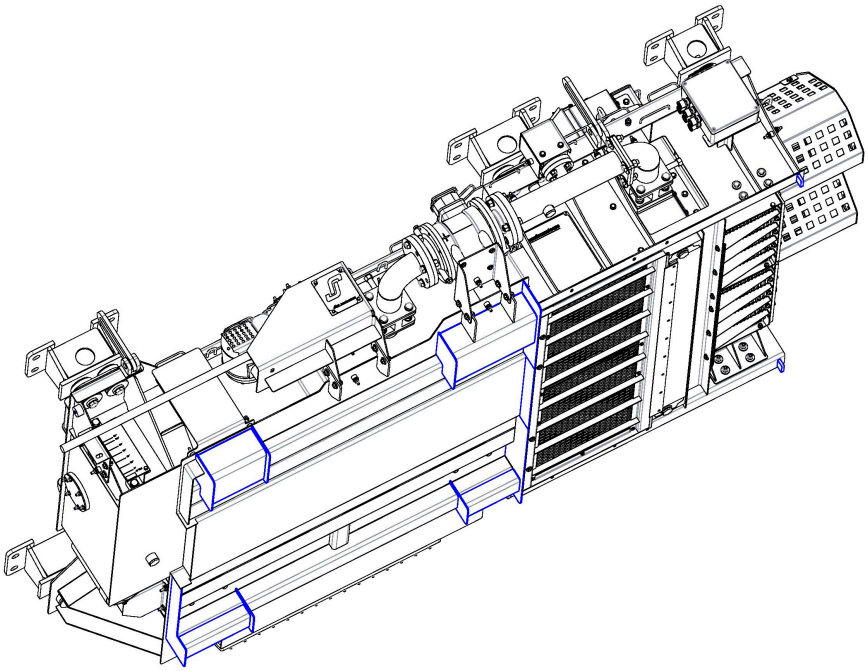
- Use of appropriate tools in good condition
- Cleanliness of equipment and components used
- Application of torques with torque wrench
- Moderate application of grease on each screwed element before reassembly
- Use a grease suitable for the screwed element
- Absence of filings, shavings, knocks on the screwed elements before reassembly
- Do not reuse gaskets dismantled from a transformer that has already worked .
- Do not reuse marked screws
- Good exchange surface on electrical contact
- Cleaning of the seal groove before reassembly
- No shock on the transformers and its accessories for maintenance operations.
- Not-exhaustive list as the rules of art should be applied.

4. Storage

The unit must be stored under shelter, full of oil and laid on its rest pads. Wood shims should be placed between rest pads and ground as well to avoid paint deterioration that could lead to rust in working conditions. Do not apply any charge on the cooling system that could make the transformer tilt, to avoid contact between the frame and by-pass pipe and the floor.

Store the unit in a dry and tempered location. Storage out of doors is prohibited.
Protect the unit against mechanical damage (impacts, etc) during storage.
The permissible storage temperature is between 0°C and +50°C.

Check that no other part of the Transformer is in contact with the ground.



TFOTEL003.jpg

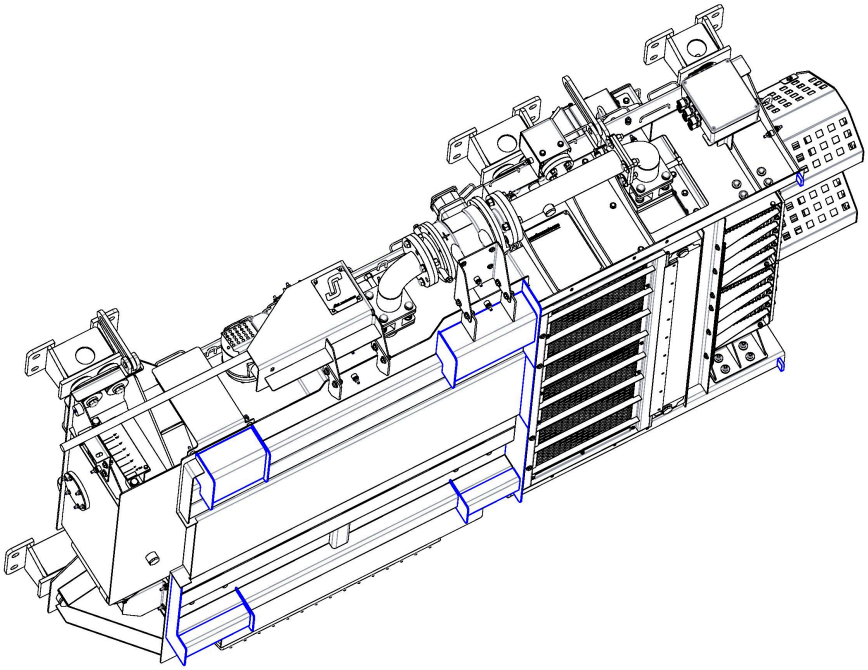
Load bearing areas

When stored, an inspection of the Transformer must be done every 6 months: see commissioning maintenance procedure.

5. Handling instructions

5.1. With a forklift

The Transformer is designed to be transported by a forklift, also if needed it can be moved by putting it onto a wood pallet via the rest pads.
The pallet have to be designed to support the weight of the Transformer (4450 kg ±3%).



TFOTEL003.jpg

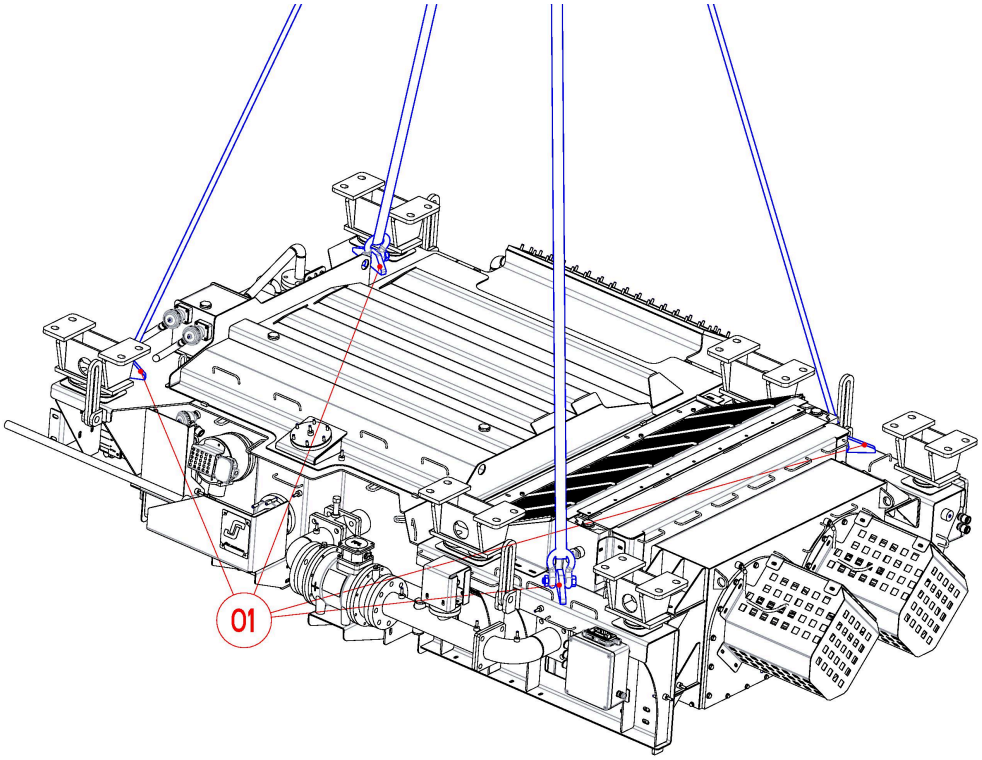
Rest pads

5.2. With an overhead crane

The Transformer can be lifted with an overhead crane.
Insert 4x lifting eyes + nuts (1) in the lifting areas as defined below. Handling points are defined on the image bellow. Insert slings of 4 meters long between these lifting eyes and the lifting hook. The lifting eyes and the slings must support the total transformer weight.

The Transformer can also be lifted with a forklift by lifting it sideway using the rest pads.

Check that no part, except lifting parts, of the Transformer (cooling unit, pipes, protective covers…) is in contact with the slings or the forklift to avoid damage.



TFOTEL004.jpg

Lifting

DANGER

Always use a lifting equipment according to the weight of the Transformer and the load bearing areas described in section "Storage instructions".

WARNING

The Transformer must always be laid on its supporting areas.

6. Fault finding instructions

Event / Fault	Immediate action	Diagnostic / Action to be perform
Presure relief device tripping	Stop Transformer / Do not reenergize Transformer. Visual checking of Pressure relief device, bushings and tank. Ckeck circuit breaker tripping. Check oil level. Perform electrical measurements. Perform dissolved gas analysis. Do not reenergize without full diagnostic. Contact main Transformer manufacturer.	Check if Air dryer is not blocked (disassemble it) Electrical measurements (ratio, winding resistances, insulation resistances). Visual checking of Pressure relief device, bushings and tank. Perform dissolved gas analysis. Analyse train parameters records.
Circuit breaker tripping	Check Pressure relief device tripping, visual checking of Pressure relief device, bushings, and tank. Check oil level. Do not reenergize Transformer if some anomaly is detected during above checks. Perform electrical measurements Perform dissolved gas analysis Contact main Transformer manufacturer.	Electrical measurements (ratio, winding resistances, insulation resistances). Visual checking of Pressure relief device, bushings, and tank. Perform dissolved gas analysis. Analyse train parameters records.
Current Transformer overcurrent	Check Pressure relief device tripping, visual checking of Pressure relief device, bushings, and tank. Check oil level. Do not reenergize Transformer if some anomaly is detected during above checks. Perform electrical measurements. Perform dissolved gas analysis. Contact main Transformer manufacturer.	Electrical measurements (ratio, winding resistances, insulation resistances) Visual checking of Pressure relief device, bushings, and tank Perform dissolved gas analysis Analyse train parameters records
Overtemperature tripping (temp. sensor or Thermostat)	Reduce power, if not sufficient stop Transformer. Check Pressure relief device tripping, visual checking of Pressure relief device, bushings, and tank. Check oil level. Do not reenergize Transformer if some anomaly is detected during above checks. Contact main Transformer manufacturer.	Check load and other train parameters records. Check cooling system : oil flow, air flow, and radiator cleaning. Check temperature sensors. Check for any oil presence in Air dryer.
Different reading from temp. sensors or Tripping of one Thermostat without tripping of lower range Thermostat	Check temperature sensor / Thermostat and change device if necessary.	
Visual oil level too low	Check for any leakage. Add dry and filtered oil.	Look for any leakage including tank, pipe, gasket assembly, air plug, cracks … Clean suspected area, and check if oil appear again (preferably with hot oil). When located repair leakage.
Low oil level sensor tripping	Check for any leakage. Add dry and filtered oil.	Look for any leakage including tank, pipe, gasket assembly, air plug, cracks … Clean suspected area, and check oil

Event / Fault	Immediate action	Diagnostic / Action to be perform
		appear again (preferably with hot oil). When located repair leakage.
Very low oil level sensor tripping	Stop Transformer. Check visual oil level. Check for any leakage. Check for consistency of sensors : low oil sensor tripping before very low level.	Check recorded load and oil temperature (train parameters). Perform dissolved gas analysis. Look for any leakage including tank, pipe, gasket assembly, air plug, cracks … Clean suspected area, and check if oil appear again (preferably with hot oil). When located repair leakage.
Oil leakage	Check Oil level. If very low oil level stop Transformer. Look also for other train equipments in the vicinity.	Look for any leakage including tank, pipe, gasket assembly, air plug, cracks … If gaskets are mounted with vaseline lubrification and Transformer being heated, it could be sometime misinterpreted as leakage. Clean suspected area, and check if oil appear again (preferably with hot oil). When located repair leakage.
Oil flow stop tripping	Stop Transformer. Check Oil level. Check if Pump is running. Check for every Valves position .	If pump is running and valves are ok, check Oil flow indicator contactor, if necessary change Oil flow indicator. if not, check Pump supply and windings, if necessary change the Pump.
Air dryer change of color start on opposite site of air entrance	Check oil water content, if below limit oil needs to be dried. Change gasket or Air dryer.	Check for any crack on Air dryer.
Bushing color change	Look for any loosening of connection, and correct it. Look for any crack, if any stop Transformer and advise manufacturer.	Check possible overheating from loosening connection or possible damage creating electrical ageing
Bushing crack	Check for any leakage. Advise manufacturer.	
Abnormal noise	Try to locate area involved : • Pump • Hydraulic noise • Fans • Main tank • Some loosing equipment • Other train component	• Check there isn't any loosed equipment and correct immediatly if necessary • Pump : check rotation and if necessary correct phases supply. Check bearings and replace them if necessary. • Hydraulic : try to evacuate air by air drain plugs • Fans : looks for some friction or any external part blocking fan rotation. Check rotation and if necessary correct phases supply. Check bearings and replace if necessary. • Main tank : advise manufacturer.
Paint damage or corrosion	Paint repair	According to maintenance manual.
Shocks	• On bushings : replace. • On accessories : replace. • On main tank : advice manufacturer.	Check for any leakage.

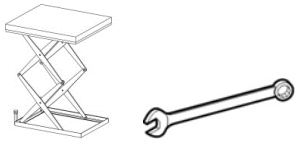
Fault finding instructions

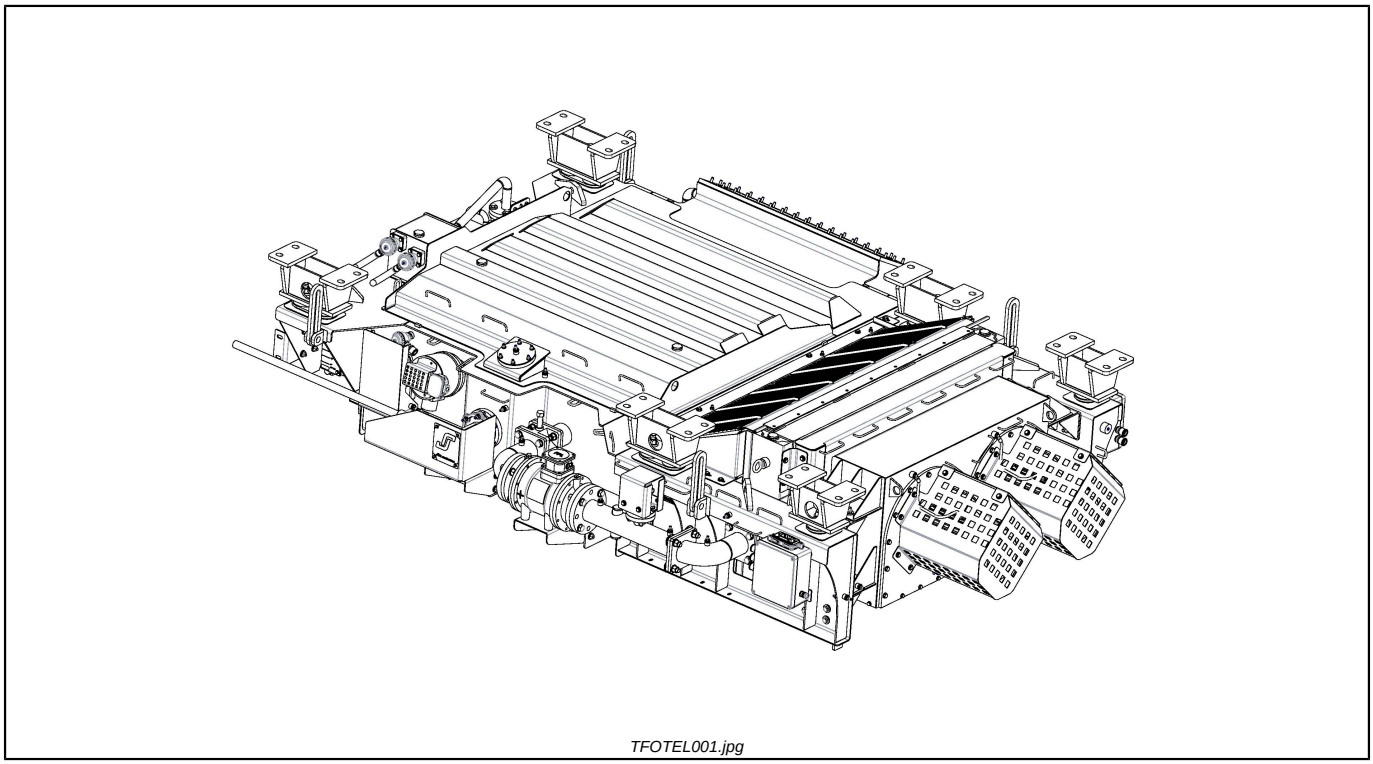
Event / Fault	Immediate action	Diagnostic / Action to be perform
	• On flexible pipe : replace. • On auxiliary connectors : replace.	
Physical properties of oil (water content, breakdown voltage)	Refer to maintenance manual.	Check Air dryer.
DGA indicating fault	Consult expert to decide.	Expert diagnostic and sampling interval.

7. Installation

Transformer - Installation procedure

Installation of Transformer is described in the procedure below. See outline drawing 1075262 for overall dimensions of the Transformer.

Number and category	Tools	Activity time
		



TFOTEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
Transformer	981677FLEX	

DANGER

Dangerous voltage 25 000 V

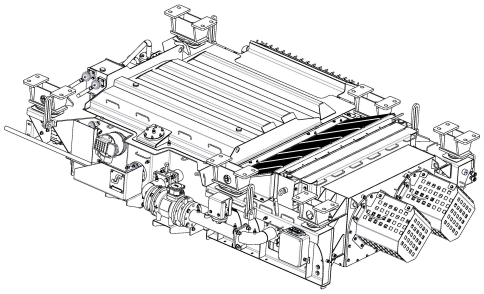
Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

This equipment has a mass of 4450 kg ±3% – Can cause serious personal injury or death

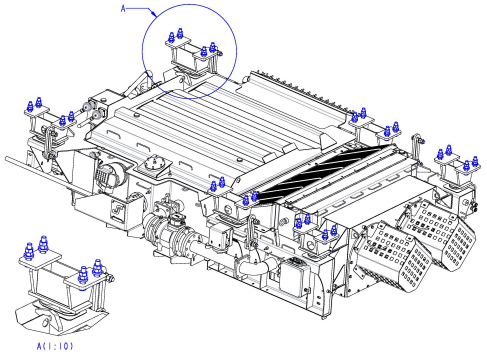
- Use appropriate lifting equipment.

Fixing the Transformer on the train



TFOTEL001.jpg

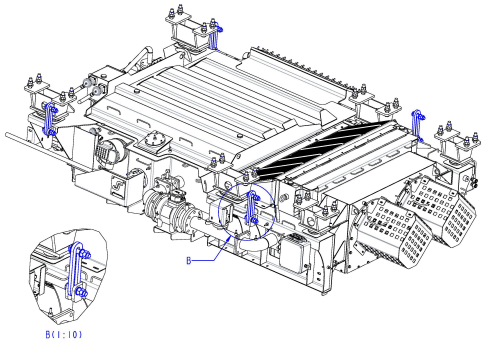
1 Bring the Transformer under the train (see section "Handling instructions").
Lift it to bring it near to the Carbody.
For this operation, use an adapted lifting equipment (Lifting table for example, or see section "Handling instructions").



TFOTEL005.jpg

2 Screw the 4 bolts on the 6 dampers boxes to fix the transformer to the train. Maintain the transformer lifted during this operation.

Screws HM20x90 A4-80
Nuts M20 A4-80
Washers LE20 A4

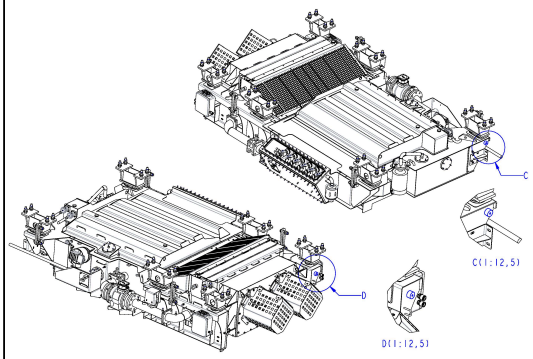


TFOTEL006.jpg

3 Screw the 4 rods to the transformer and train carbody secondary retention eyes.

Screws HM20x100 A4-80
Nuts M20 A4-80
Washers LE20 A4

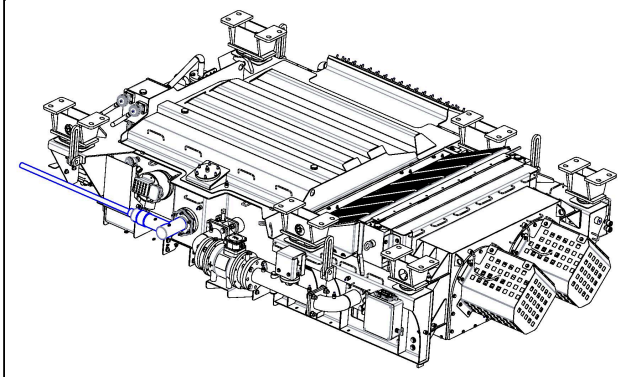
Fixing the Transformer on the train



EARTEL001.jpg

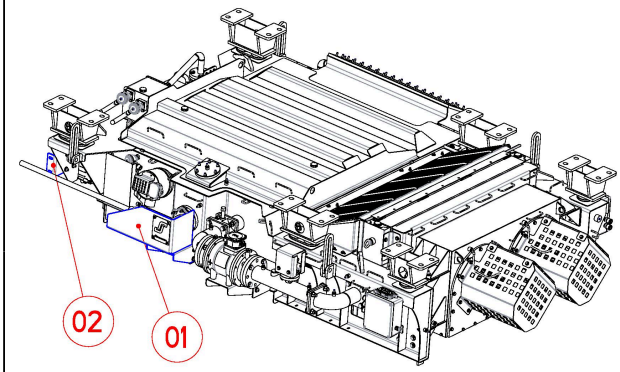
4 Connect the transformer to the carbody earthing point throught the two M10 bosses placed on the Transformer tank and frame.

Fitting the electrical connections



BUSTEL010.jpg

1 Connect the T-connector to the HV bushing following the MEDHA instructions.



BUSTEL011.jpg

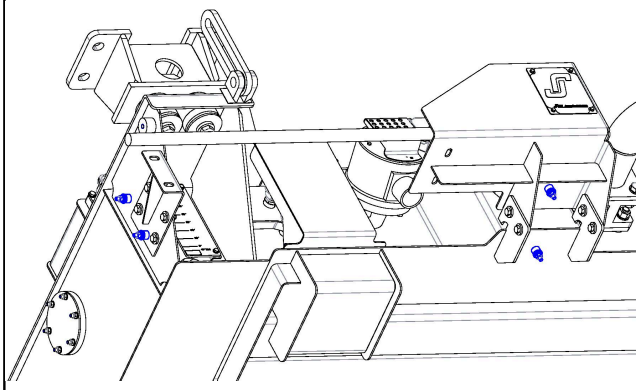
2 Place the two HV cable supports on the tank.

17

Screws HM10x30 A4-80
Nuts M10 A4-80
Washers LE10 A4

3 Mount the cable clamp with the HV cable inside following the MEDHA instruction. Tighten the screws of the supports.

17 **34N.m**



BUSTEL012.jpg

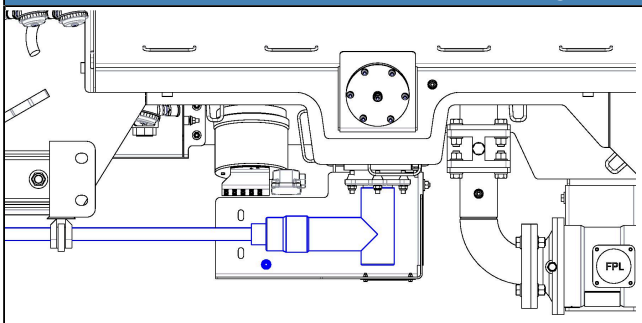
4 Screw the earthing straps of the two HV cable supports.

13 **10N.m**

17 **20N.m**

Washers TREP 3L8 A4
Washers L8 A4
Nuts M8 A4-80

Fitting the electrical connections



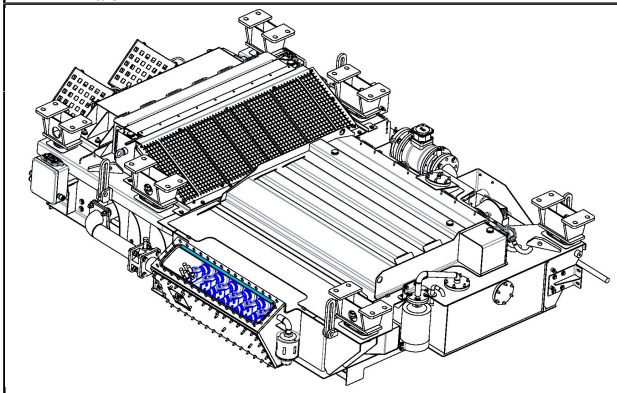
BUSTEL013.jpg

5 Screw the earthing straps of the T-connector.

13 **10N.m**

17 **20N.m**

Washers L8 A4
Washers TREP 3L8 A4
Nuts M8 A4-80

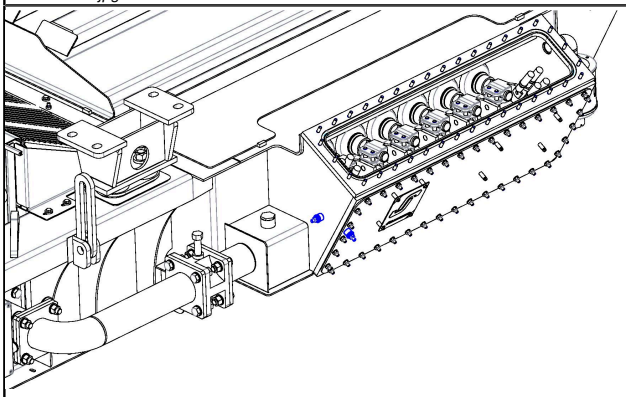


BUSTEL014.jpg

6 Connect the LV bushings following the MEDHA instructions.

7 Close the LV box without damaging the air sealing gaskets.

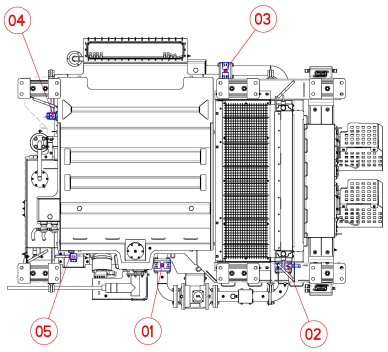
Nuts M8 A4-80
Washers M8 A4



BUSTEL015.jpg

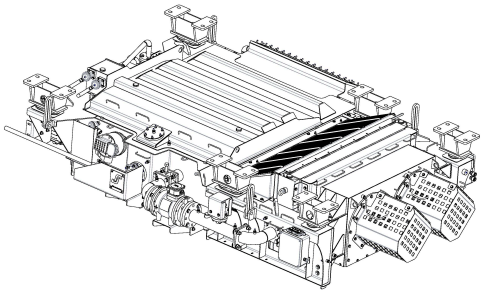
8 Verify the tightening of the earthing of the LV bushings box cover.

13 **16N.m**



BFVTEL001.jpg

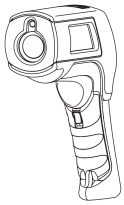
9 Check that butterfly valves (1), (2) and (3) are opened.

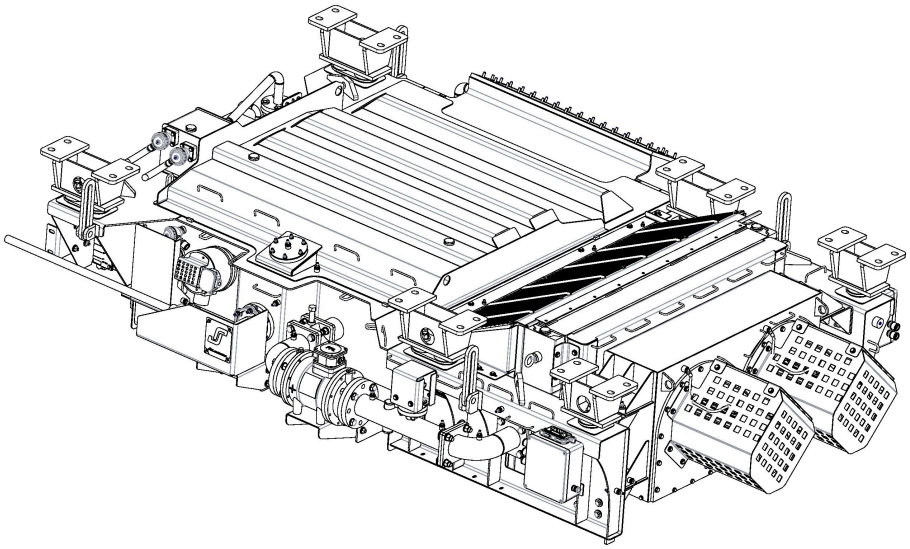
Fitting the electrical connections	
 TFOTEL001.jpg	10 Connect the harting plugs following the electrical scheme.

8. Commissioning

Transformer - Commissioning procedure

This procedure must be followed before the first use or after 6 months storage / non-use.

Number and category	Tools	Activity time
		



TFOTEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
Transformer	981677FLEX	0

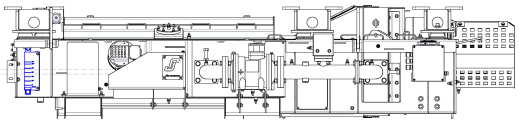
DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

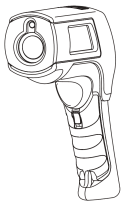
- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

Transformer commissioning

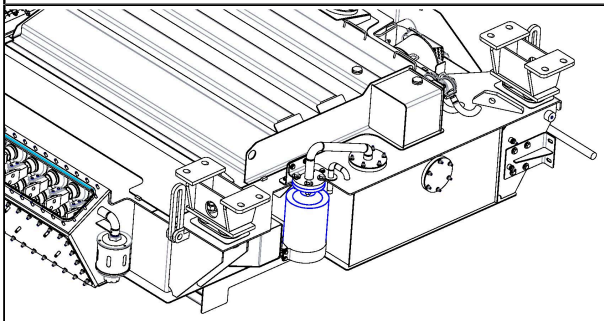


OLITEL001.jpg

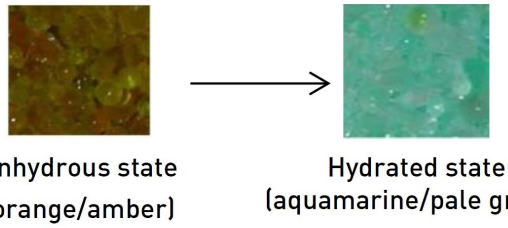
1 Check the Transformer oil level. Transformer should be perfectly horizontal to get correct value. Use a laser thermometer on the tank to get temperature of oil.Compare oil level with oil temperature (or ambient temperature if not available and Transformer at rest).
If the temperature differs by more than 10 °C, look for leaks: visually check the Transformer appearance (weld accessories, connections).



Note: *If leakage found, refer to "Fault finding instructions".*



ADRTEL010.jpg

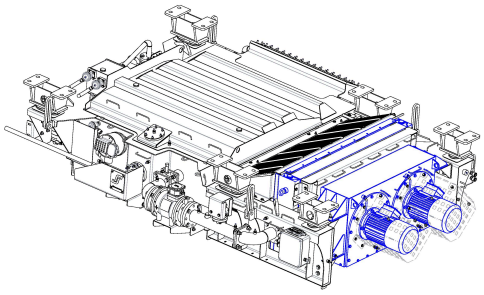


DESCOM001.jpg

2 Check colour of the Desiccant inside the Air dryer. If colour has switched from brown/amber to aquamarine/green or if Oil is present in the Air dryer, replace the desiccant.

Note: *See "Air dryer - Dehydrating agent" procedure*

Transformer commissioning



CGSTEL001.jpg

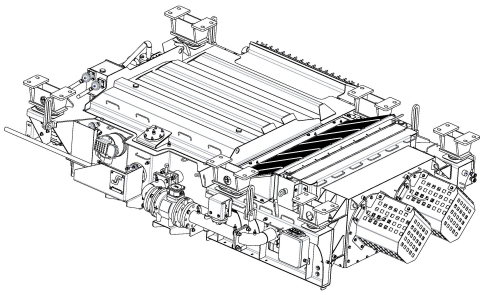
3 Check Cooler and clean them if necessary.

Note: *See "Cooling system - Dry cleaning" procedure*

4 Checking fans' rotation direction:

- Start fans at full speed
- Stop fans.
- When speed is sufficiently low, check correct rotation through the outlet grid of the fan (direction is indicated by a label plate on the motor).

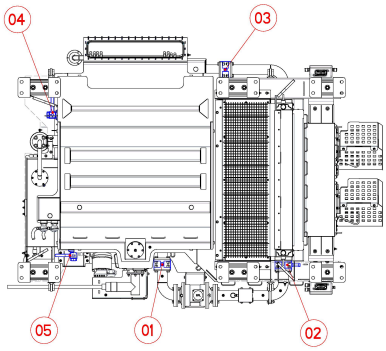
Note: *If rotation direction is not the right one, refer to 1075829 and fault finding instructions.*



TFOTEL001.jpg

5 Check that there is no paint damage in any location.

Note: *If not, refer to "Fault finding instructions" (Chapter 6)*



BFVTEL001.jpg

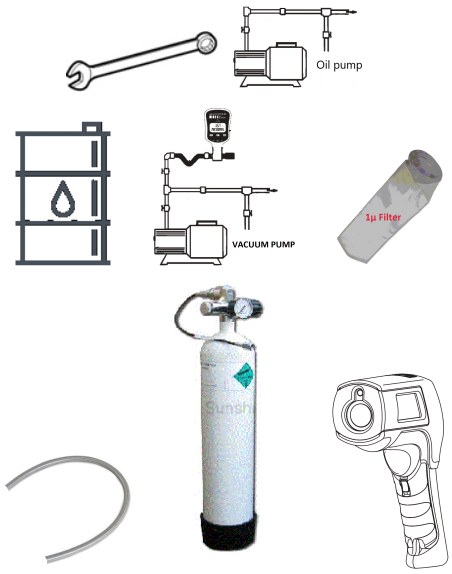
6 Check that butterfly valves (1), (2) and (3) are opened.

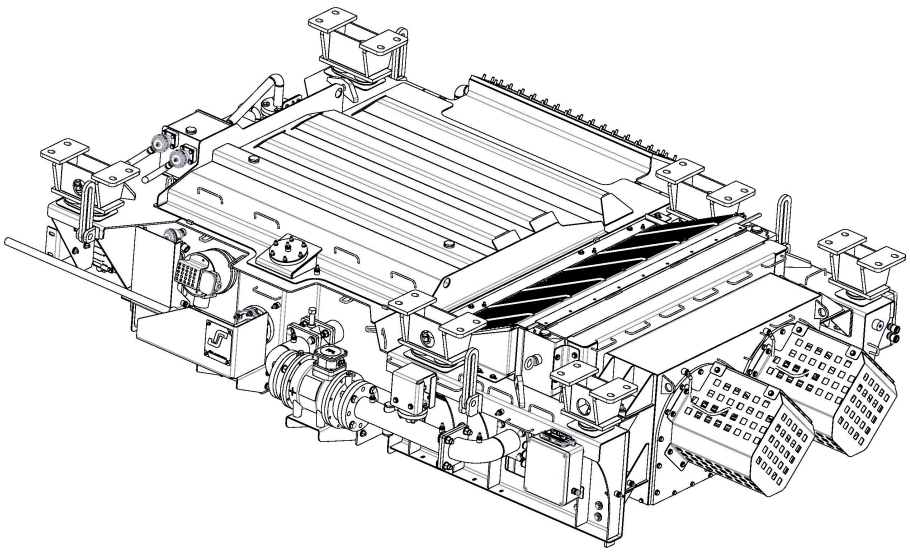
9. Maintenance

9.1. General Maintenance Procedures

Maintenance procedure number	Activity type	Identity of item	Maintenance activity	Activity time (hours)	Pers. cat
GM1		Oil	Complete Draining and Filling	4	H
GM2		Oil	Partial Draining and Filling	2	H
GM3		Paint	Restoring surface protection		G

Oil - Complete Draining and Filling

Number and category	Tools	Activity time
		



TFOTEL001.jpg

Equipments involved

Designation	JST Art. Num.	Customer Art. Num.
Transformer	981677FLEX	0
Air dryer with flange	1068209R000	
Air dryer with flange gasket	1075890R000	

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Synthetic Ester oil		1069836R000	
Cooler vent plug gasket	4	1075898R000	

Consumables needed for operation
Designation
Loctite 577

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

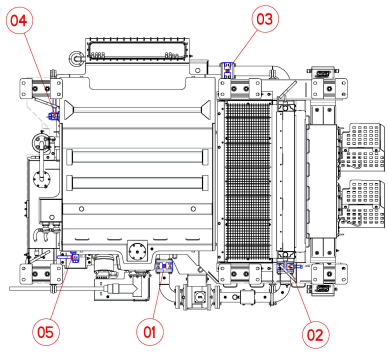
WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

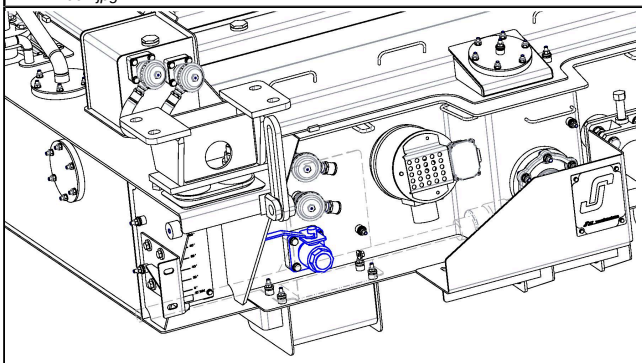
- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

CONNECTING DRAINING PIPE ON DRAINING VALVE



BFVTEL001.jpg

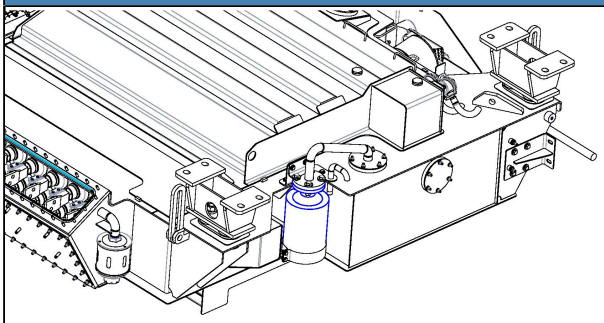
1 Remove the cap on the draining valve (5).



DFVTEL010.jpg

2 Connect a flexible pipe to the draining valve.

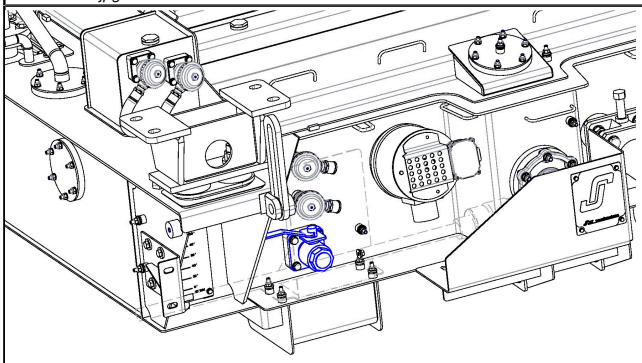
DRAINING



ADRTEL010.jpg

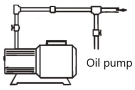
1 Unscrew the Air dryer. Separate the Air dryer from the pipe flange.

19



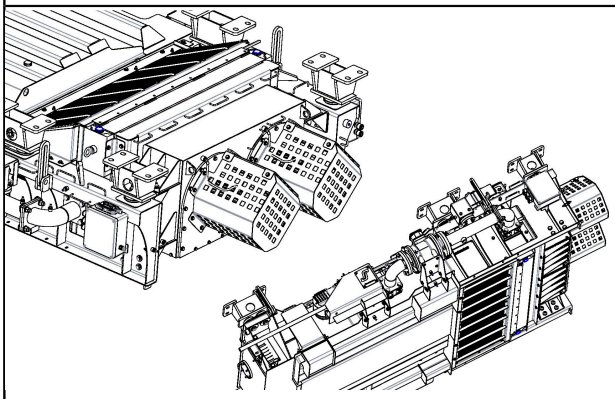
DFVTEL010.jpg

2 The other part of the flexible pipe is connected to an Oil tank through a Pump and a Filter 1µ.
Open the draining valve (5). Start the Pump.



3 Drain Oil until no more Oil is flowing.

4 Stop the Pump.
Close the opened valve (5).

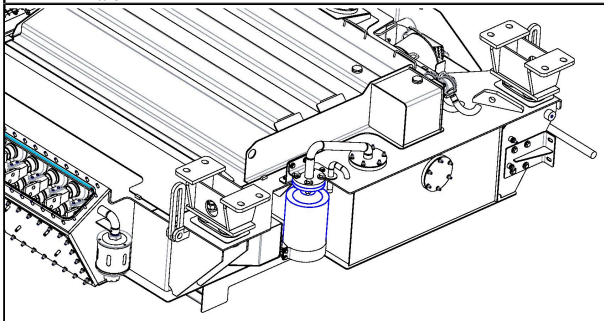


CGSTEL014.jpg

5 If necessary, finish the draining by opening the drain plug located on the cooler

36

75N.m



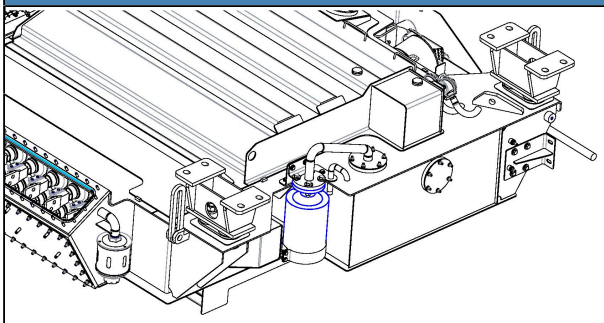
ADRTEL010.jpg

6 Screw back the Air dryer.

46

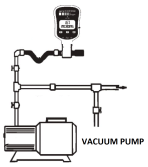
50N.m

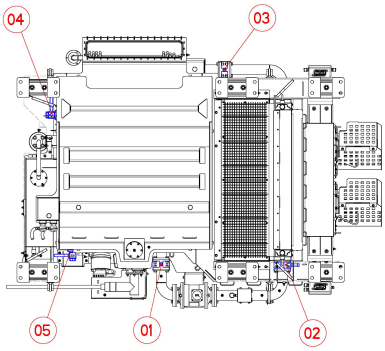
PREPARATION VACUUM



ADRTEL010.jpg

1. Unscrew the Air dryer. Separate the Air dryer from the pipe flange.
2. Connect the vacuum pump to the Air dryer pipe.

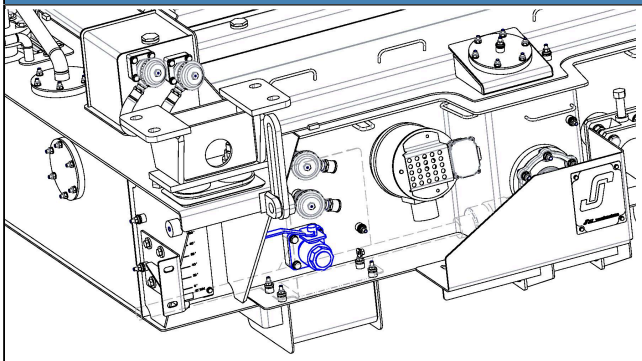




BFVTEL001.jpg

3. Connect a vacuum sensor on valve (4) and open it.
4. Start the Air vacuum pump let it run until it reaches an absolute pressure of 5 mbar.
5. Close valve (4).
6. Screw back the cap of the valve (4).

COMPLETE FILLING



1. Connect the Flexible pipe to the Filter 1 micron and to the filling valve (5).

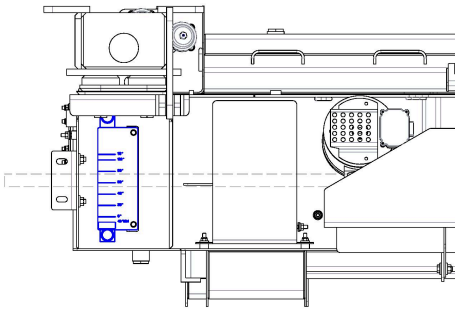
COMPLETE FILLING

DFVTEL010.jpg

2 Then, connect the Filter and the Oil container. The Oil inside the container has to be Synthetic Ester oil and has to be already treated (no humidity and no dust).

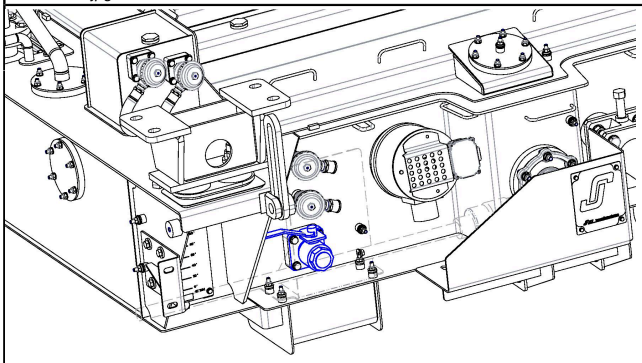
Note: *The oil inside the container has to be heated at 50°C at least before filling.*

3 Open the valve (5) : filling of the Transformer is starting.



OLITEL010.jpg

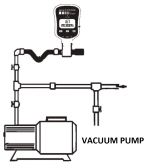
4 Check oil level during the filling.



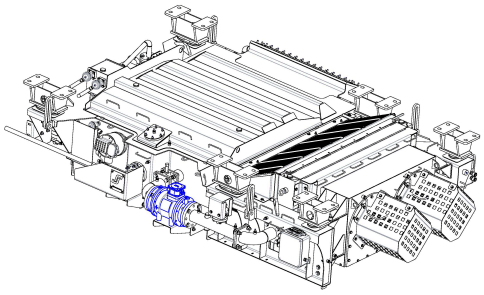
DFVTEL010.jpg

5 Close the valve (5) when the oil level is at 100°C.

6 Break the vacuum in Oil expansion tank by stopping the vacuum pump. Disconnect the Flexible pipe from the Air dryer pipe.

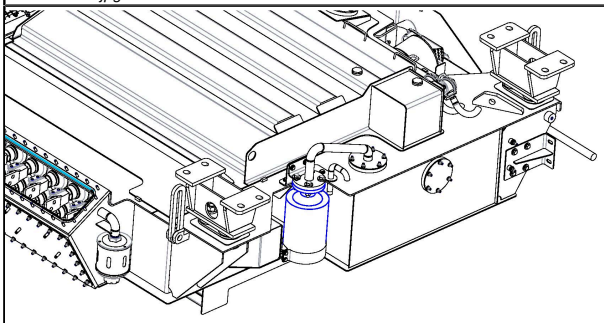


PURGE



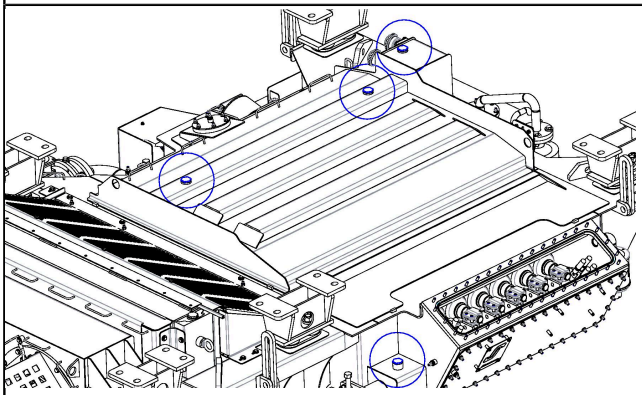
PMPTEL001.jpg

1 Run the pump during 5 minutes.



ADRTEL010.jpg

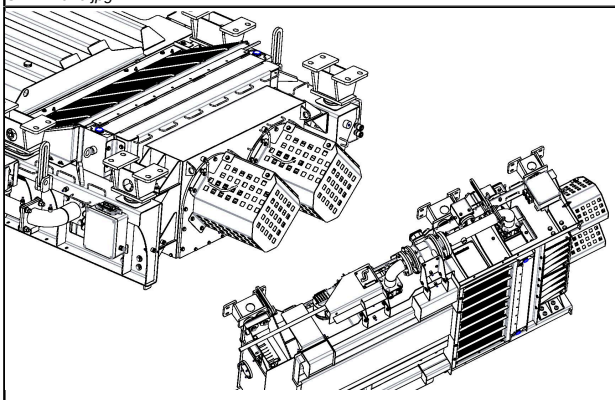
2 Connect a pipe between the pressure regulator of the Dry air bottle and the Air dryer pipe.
To purge the highest altitude points, apply a 50 to 200mBar pressure by using the Pressure regulator.



OILTEL010.jpg

3 Proceed to the purge by opening venting plugs on the Transformer one by one.

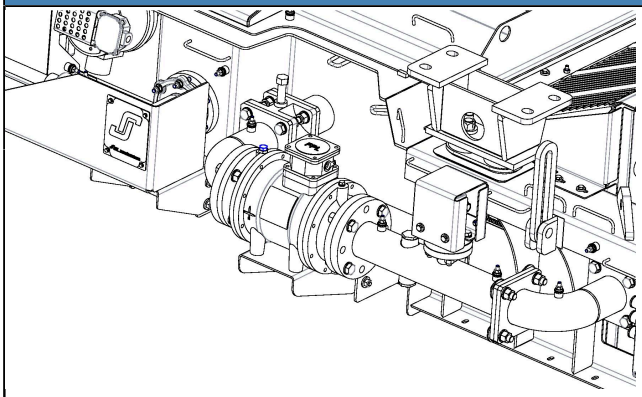
Note: *For each plug, open it until oil appears and let oil draining for 2-3 seconds, then close the plug and go to the next one.*



CGSTEL014.jpg

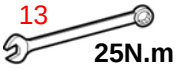
4 Proceed to the purge by opening all air vent caps on the Coolers one by one.

PURGE



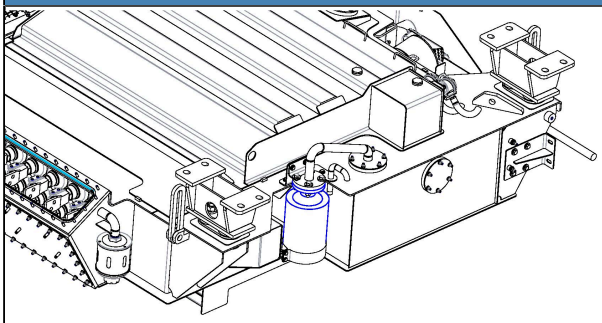
PMPTEL013.jpg

5 Proceed to the Pump purge.



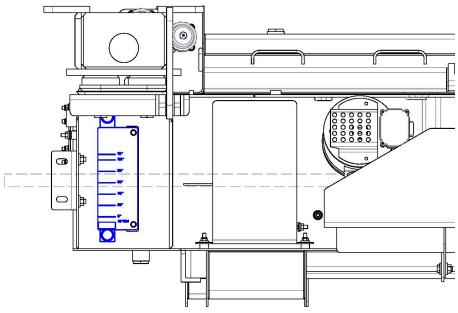
6 Close the Dry air bottle and disconnect it.

ADJUSTEMENT OF OIL LEVEL



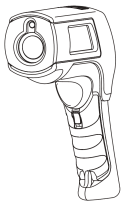
ADRTEL010.jpg

1 Connect a pipe between the pressure regulator of the Dry air bottle and the Air dryer pipe.
Apply a 50 to 200mBar pressure by using the Pressure regulator.



OLITEL010.jpg

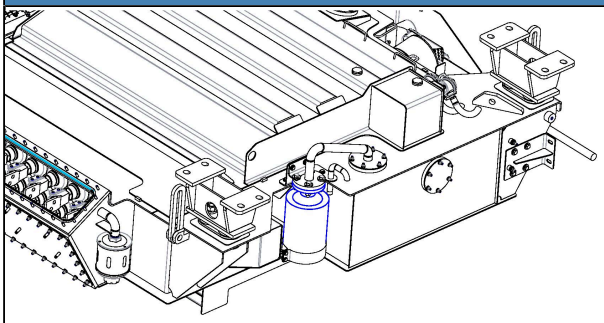
2 Adjust oil level in the Oil level indicator when Oil Transformer temperature is equal to the ambient temperature or by measurement of the temperature on the Cover of the Transformer.
Drain oil through valve until the oil level is reached.



Note: *The Transformer must be at stabilized temperature for at least 6 hours in order that oil temperature is homogeneous within the device.*

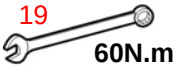
3 Close the dry air bottle and disconnect it.

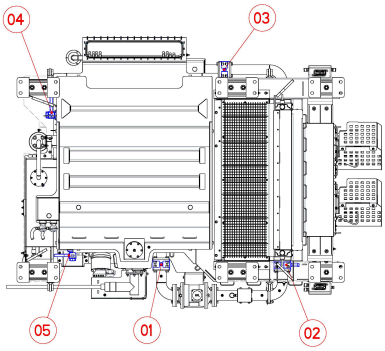
FINAL OPERATION



ADRTEL010.jpg

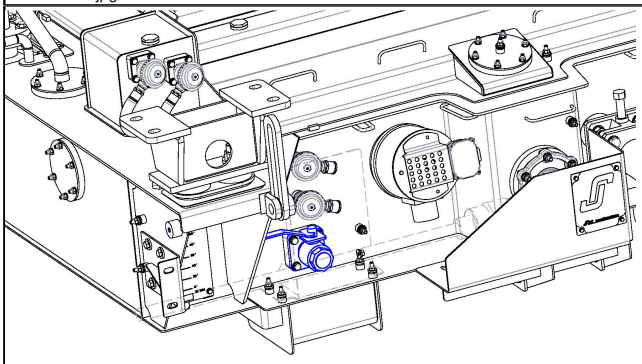
1. Screw the Air dryer on the Air dryer pipe.





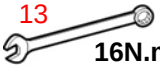
BFVTEL001.jpg

2. Close the valve (5).
3. Disconnect the flexible pipe.
4. Put the cap back on the draining valve (5).

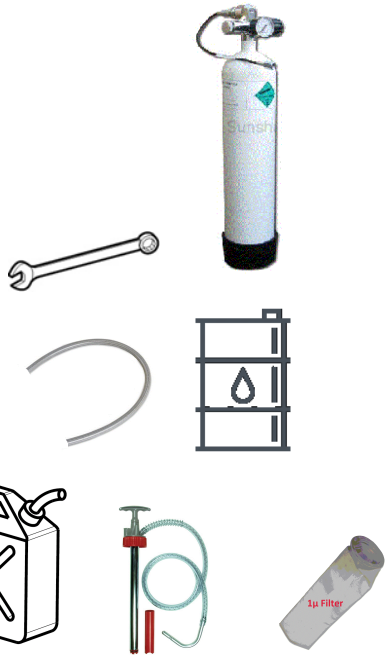


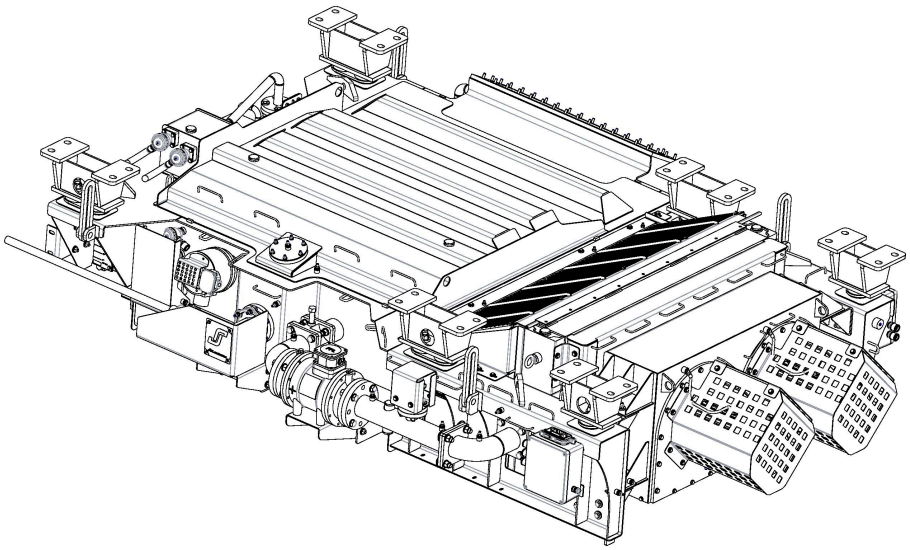
DFVTEL010.jpg

5. Screw back the valve cover.



Oil - Partial Draining and Filling

Number and category	Tools	Activity time
		



TFOTEL001.jpg

Equipments involved

Designation	JST Art. Num.	Customer Art. Num.
Transformer	981677FLEX	0
Air dryer with flange	1068209R000	0
Air dryer with flange gasket	1075890R000	

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Synthetic Ester oil		1069836R000	0

Consumables needed for operation
Designation
Loctite 577

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

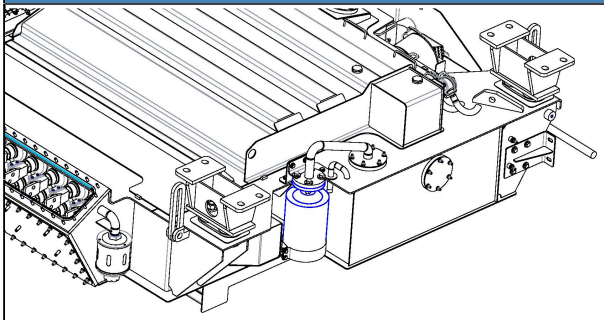
WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

PARTIAL DRAINING

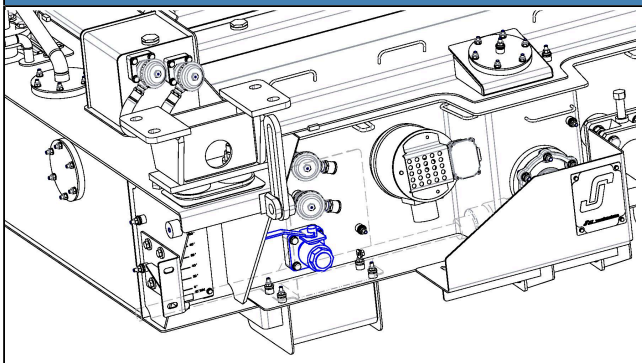


ADRTEL010.jpg

1. Unscrew the Air dryer. Separate the Air dryer from the pipe.

2. Connect a pipe between the pressure regulator of the Dry air bottle and the Air dryer pipe.
Apply a 50 to 200mBar pressure by using the Pressure regulator.

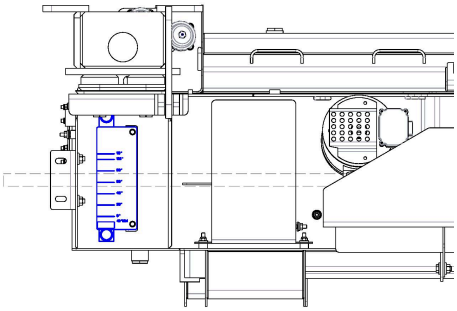
PARTIAL DRAINING



DFVTEL010.jpg

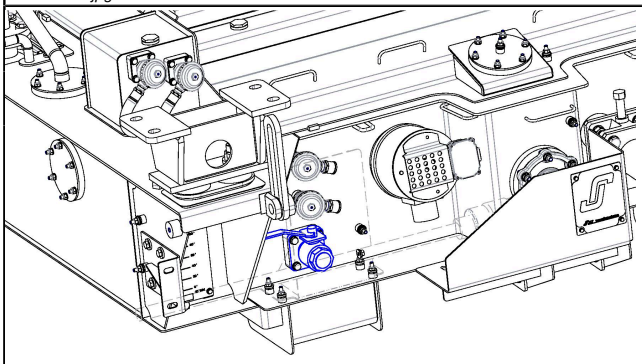
3 Connect a flexible pipe to the valve (5). The other part of this pipe is connected to an oil tank.
Open the draining valve (5).

Note: *The tank has to be clean before draining.*



OLITEL010.jpg

4 Drain oil until the 0°C oil level is reached. Drain 15L (Tolerance 0/+2L) more.

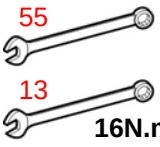


DFVTEL010.jpg

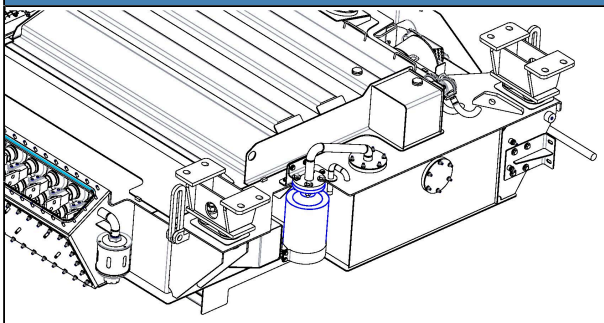
5 Close the opened valve (5).

6 Close the Dry air bottle and disconnect it.

7 Screw back the cap and the cover of the valve (5).



PARTIAL FILLING



ADRTEL010.jpg

1. Unscrew the Air dryer. Separate the Air dryer from the pipe.

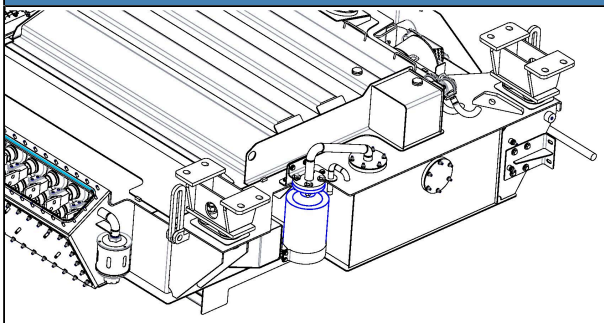
2. Enter the flexible pipe of the manual pump inside the air dryer pipe. The other part of this pipe is connected to an oil tank.

Note: *The tank has to be clean before draining.*

3. Fill the Oil expansion tank through the air dryer pipe by using a manual pump and a jerrycan or a drum.
The Jerrycan has to be filled by the Oil pump and through the Filter 1µ.

Note: *If the oil inside tank is the oil of the Transformer drained just before, and if this oil is outside the Transformer from less than 6 hours, then, this oil can be used without treatment before filling. In the opposite case the oil should be treated.*

OIL LEVEL ADJUSTEMENT

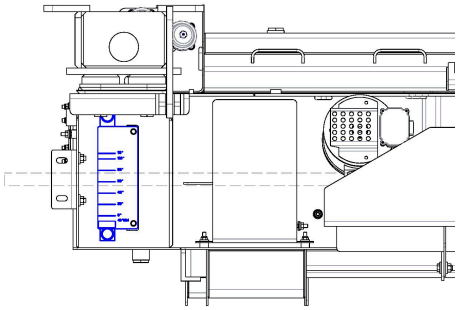


ADRTEL010.jpg

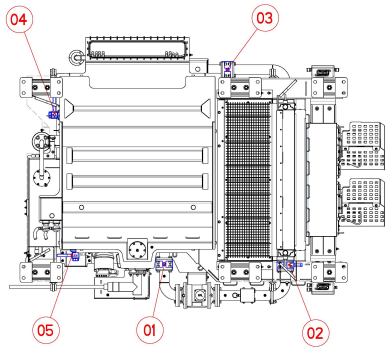
1. Connect a pipe between the pressure regulator of the Dry air bottle and the Air dryer pipe.
Apply a 50 to 200mBar pressure by using the Pressure regulator.

2. Proceed to the Purges.

Note: *See "Purges" Chapter in "Complete Draining and Filling" section.*



OLITEL010.jpg

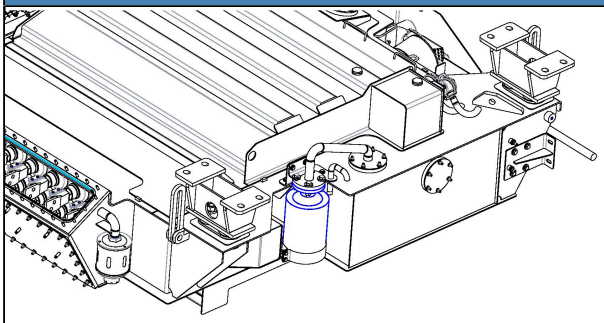


BFVTEL001.jpg

3. Connect a flexible pipe to a tank and valve (5).
Adjust oil level in the Oil level indicator when oil Transformer temperature is equal to the ambient temperature or by measurement of the temperature on the cover of the Transformer.
Drain oil trough valve until the oil level is reached.

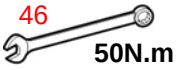
Note: *The Transformer must be at stabilized temperature for at least 6 hours in order that oil temperature is homogeneous within the device. The tank has to be clean before draining.*

FINAL OPERATION

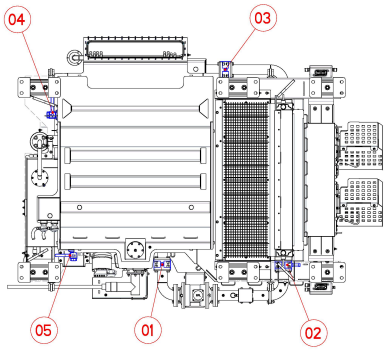


ADRTEL010.jpg

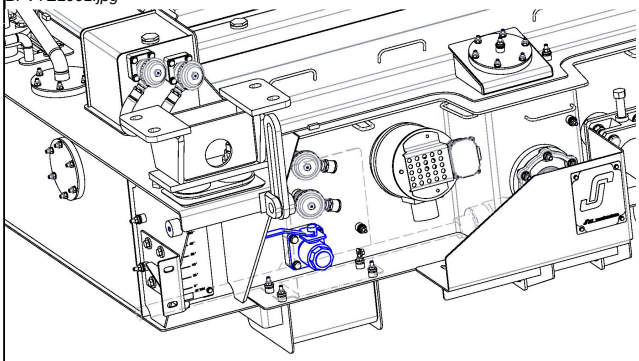
1 Screw the Air dryer on the Air dryer pipe.



Note: *Loctite 577*

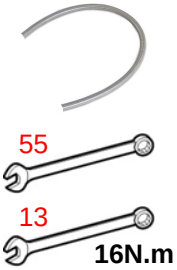


BFVTEL001.jpg

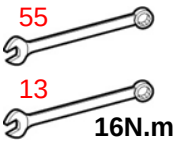


DFVTEL010.jpg

2 Disconnect pipes.
Lock valve (5).
Screw back the valve cap and the valve cover.

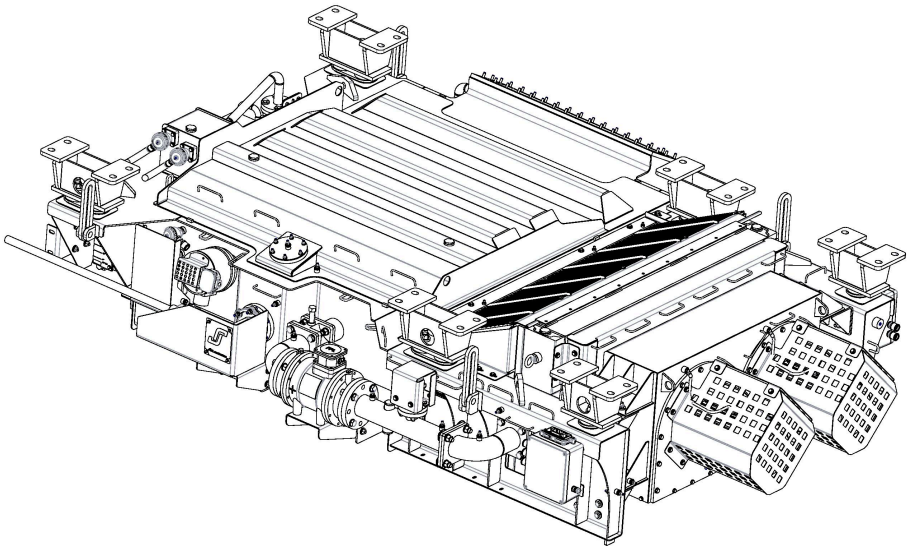


3 Lock valve (4).
Screw back the valve cap and the valve cover.



Paint - Restoring surface protection

Number and category	Tools	Activity time
		



TFOTEL001.jpg

Equipments involved

Designation	JST Art. Num.	Customer Art. Num.
Transformer	981677FLEX	0

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Primer INTERPLUS 356		PE5PRI-INTER356	
Hardener INTERPLUS 356		DU5PRI-INTER356	
Thinner GTA220		1038636R001	
Finish paint INTERFINE 979 RAL 9005		PE5FI-I979-9005	
Hardener INTERFINE 979		DU5FI-INTER979	
Thinner GTA007		1038640R001	

Consumables needed for operation

Designation
Degreasing products
Clothes and cleaning equipment
Protection equipment
Stirrer for paint
Rollers
Brushes

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

1. Restoring surface protection on damaged areas

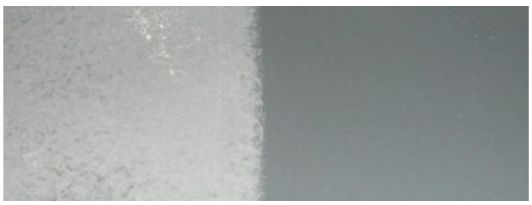
1.1. Preparing the parts

- Check that all the device openings are sealed.
- Thoroughly clean and degrease all the surfaces. Visible oil, grease and dirt shall be removed. This operation reveals any damage to the protection system (impacts, scratches, oxidation, etc.).
- Prior to hand or power tool cleaning, or machine abrading, any layers of rust shall be removed by chipping.
- Hand or power tool clean or machine abrade the damaged areas. This step can be done by scrapping, brushing, grinding or machine abrading (disc with abrasive paper) or special rotating wire brush.
- All poorly adhering paint coatings, rust and foreign matter shall be removed.
- Surfaces must be treated to give a metallic sheen arising from the metallic substrate.

These levels of preparation agree with grades P St3 and P Ma according to ISO 8501-2. For comparison, see photographs showing examples of preparation grades in the standard.

By using the same means, all intact remaining coatings that have to be recoated, shall be sufficiently roughened in order to ensure correct adhesion of the next coating. Finish paint cannot be recoated without this preparation.

Left side of the picture is an example of partial preparation of intact remaining coating, done by disc with abrasive paper:



paint.jpg

Note: *all areas which cannot be prepared adequately by chipping, hand or power tool cleaning or machine abrading, shall be spot blasted. On intact remaining coatings, roughness can be created by sweep abrasive blast-cleaning.*

- Remove the impurities.
- Protect all intact remaining coatings that don’t have to be recoated.

If necessary, protect paint-free areas:

- All the light towers
- All the plastic parts
- All the accessory parts made of stainless steel, aluminum, bronze or galvanized steel.
- All the copper pipes and plates.
- The sections of all the insulating plates.
- The current Transformers.
- The insulators of bushings, surge arresters and spark gaps.
- All labels, name and rating plates.
- The cubicle insulator dampers.
- The earthing braids and terminal connection pads.
- The motor-driven fan sets (blades and fans).
- The cooling tower harnesses.

1.2. Painting

1.2.1. General points

Check the paint application conditions, complying with the specifications in the product technical datasheets:

- Temperature and viscosity of paint
- Temperatures of substrate and atmosphere
- Relative humidity of atmosphere
- Proportions of the paint base + hardener mix
- Reaction time before application
- Application time after mixing
- Air dew point temperature

Temperature of substrate must be greater than or equal to the air dew point temperature + 3°C.

Reconstitution must take place coat by coat, complying with the overcoating drying times between each coat. Apply also the paint on all the screws if they are not stainless steel made of.

1.2.2. System to be applied

INTERNATIONAL PAINT SA (AKZO NOBEL) painting system, certified NORSOK M-501 (rev.4) system 1 on steel, conforms to ISO
12944, for C5-I corrosivity category and high durability (> 15 years).

Note: *Other systems must be conform to MEDHA specification.*

1.2.2.1. On damaged areas

Previously prepared as described in § "Preparing the parts" :

Product name	Binder	Application method	NDFT micron	Thinner
INTERPLUS 356	Polyamin epoxy	Airless spray, Brush, Roller, Air spray	150 (emax = 350)	GTA220
INTERFINE 979 RAL 9005	Acrylic polysiloxan	Airless spray, Brush, Roller, Air spray	125 (emax = 250)	GTA007

1.2.2.2. Aesthetic coat on all other accessible intact surfaces

If necessary, after touch-up, apply a finish coat on all the surfaces, previously degreased and roughened, as described in § "Preparing the parts" :

Product name	Binder	Application method	NDFT micron	Thinner
INTERFINE 979 RAL 9005	Acrylic polysiloxan	Airless spray, Brush, Roller, Air spray	125 (emax = 250)	GTA007

1.3. Remove the protections

1.4. Acceptance criterias

1.4.1. Preparation grade

- P St 3 according to ISO 8501-2 after hand or power tool cleaning.
- P Ma according to ISO 8501-2 after machine abrading.
- P Sa2 1/2 according to ISO 8501-2 after blast-cleaning.

1.4.2. Roughness

The average arithmetical gap compared with the mean line (Ra) defined by the ISO 4287 standard shall be:

- after blast-cleaning: 12.5 microns for sheeting greater or equal than 3 mm thick, 6.3 to 12.5 microns for sheeting < 3 mm thick
- after hand or power tool cleaning, machine abrading or sweep abrasive blast-cleaning, the Ra shall permit to satisfy adhesion criteria defined below.

1.4.3. Thickness

Follow the standards:

- ISO 19840 for rough surfaces (mechanical blast cleaning)
- ISO 2808 for smooth or galvanized surfaces
- ISO 19840 for amount of measurement points.

For calibration of measurement apparatus, adjust on smooth surfaces, according to §6.2 of ISO 19840.
For rough surfaces, roughness of the substrate will be taken into account by deducting of values read, the correction value of 25µm.

i.e. "e" the nominal dry film thickness (NDFT) required,
i.e. “emax” the maximum thickness applicable (defined in § "System to be applied")

- no value measured < 0,8 e
- no more than 20 % of values measured are between e and 0,8 e
- the arithmetic mean of all values measured must be >= e
- all measured values must be <= emax

1.4.4. Adhesion by cross hatch (ISO 2409) or pull-off (ISO 4624)

Not required

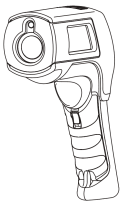
1.4.5. Checking of appearance

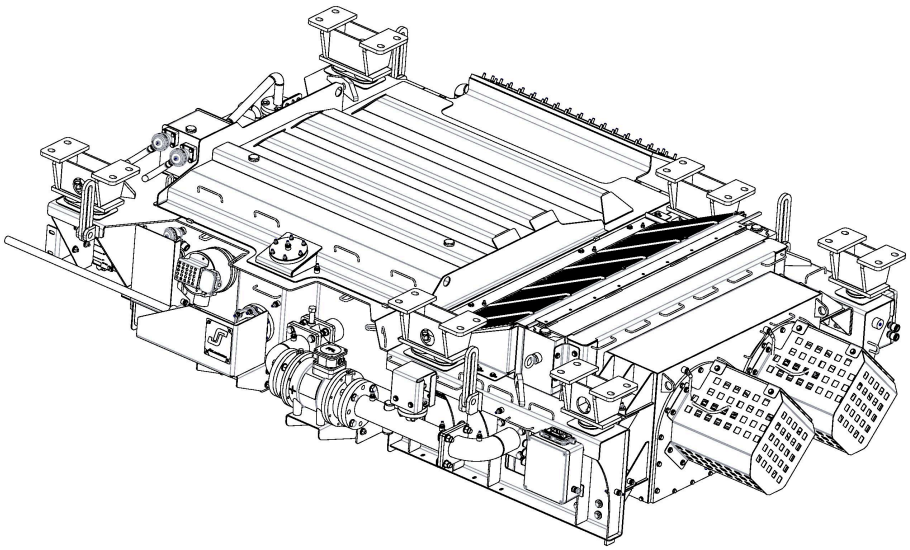
- Blistering, cracking, flaking: degree 0 (S0) - ISO 4628-2, 4, 5.
- Uniformity of the color, no running, no bubbling, no ropy finish, no crater.

9.2. Preventive Maintenance

Maintenance procedure number	Activity type	Maintenance interval	Identity of item	Maintenance activity	Activity time (hours)	Pers. cat
PM1	CHK/CLN	4 Months	Transformer	General visual check	1.5	G
PM2	CLN	1 Month	Cooling system	Dry cleaning	0.5	G
PM3	CLN	3 Months	Cooling system	Wet cleaning	0.5	G
PM4	CHK	6 Months	Cooling system	Vibration measurement	0.1	G
PM5	CHK	1 Year	Cooling system	Megger test = Dielectrical test	0.5	E
PM6	CHG	50000h of working time	Cooling system	Motor fan bearings replacement	3	G
PM7	CHG	6 Months	Air dryer	Dehydrating agent	0.2	G
PM8	CHK	1 Years	PT100 sensor	Electrical information check	0.5	E
PM9	CHK	1 years	Pressure relief device	Electrical contact check	0.5	E
PM10	CHG	8 Years	Oil pump	Bearing replacement	3	GE
PM11	CHK	1 Year	Oil	Oil sampling	0.5	H
PM12	CHG	15 Years	Oil	Oil replacement	4	H
PM13	CHG	6 Years	Damper (all)	Replacement	3	G

Transformer - General visual check

Number and category	Maintenance interval	Tools	Activity time
	 4 Months		



TFOTEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
Transformer	981677FLEX	0

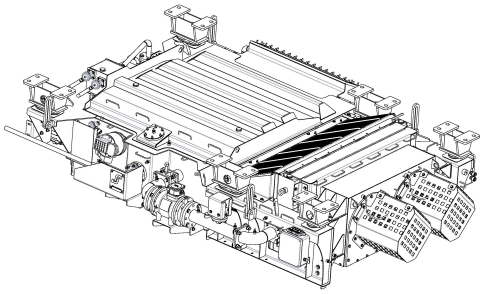
DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

Transformer - General visual check

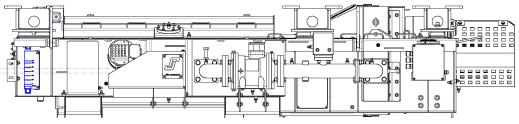


TFOTEL001.jpg

1. Check for any apparent damage, oil leakage or rust on the tranformer and all the equipment.
2. Check the Transformer oil level. Transformer should be perfectly horizontal to get correct value. Use a laser thermometer on the tank to get temperature of oil.Compare oil level with oil temperature (or ambient temperature if not available and Transformer at rest).
   If the temperature differs by more than 10 °C, look for leaks: visually check the Transformer appearance (weld accessories, connections).

Note: *If leakage found, refer to "Fault finding instructions".*

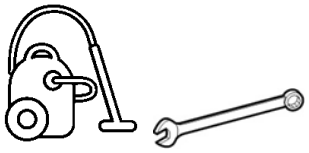
3. Check if all screws are well tightened.
4. Check if all warning signs are not damaged. Change it, if needed.
5. Check silicagel color. For more information about the color please refer to the preventive maintenance of the air dryer.

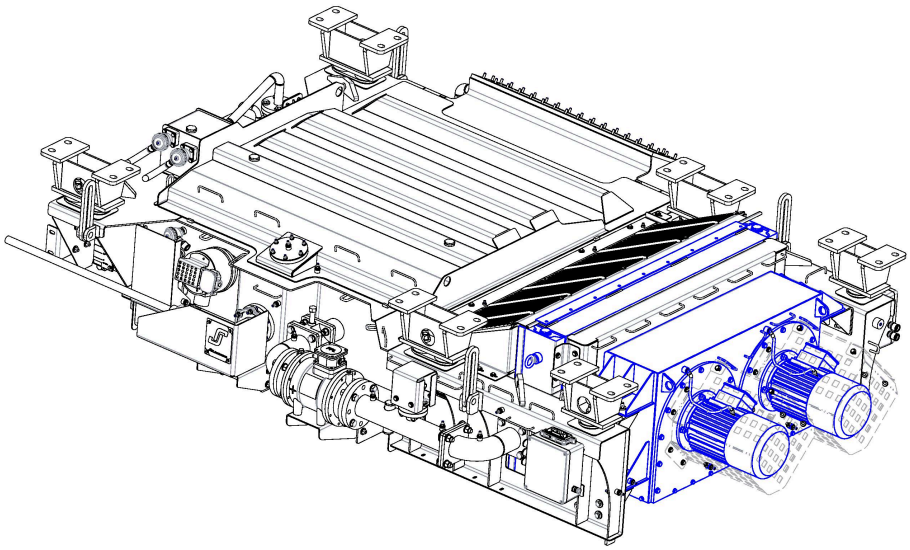


OLITEL001.jpg

6. If the oil level indicator is dirty, it is recommended to clean it with a clean rag.

Cooling system - Dry cleaning

Number and category	Maintenance interval	Tools	Activity time
	 1 Month		 0.5



CGSTEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
Cooling system	1075369R000	0

Consumables needed for operation
Designation
Loctite 243

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

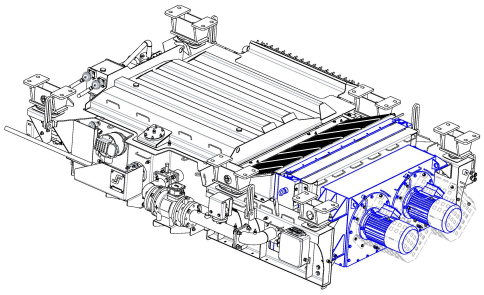
- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

⚠ WARNING

System may be under pressure.
Skin irritations and damage to eyes from escaping fluids.

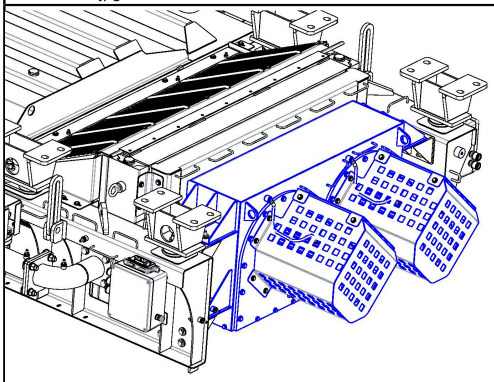
- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

Cooling system - Dry cleaning



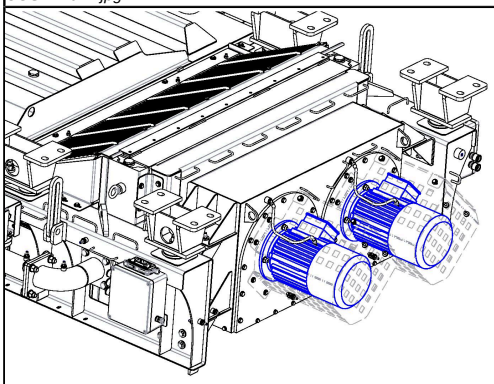
CGSTEL001.jpg

1 Since contamination can lead to malfunction or damages of the cooling unit it has to be cleaned more often when operated in heavy contamination.



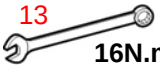
CGSTEL011.jpg

2 Clean the fan housing.



CGSTEL010.jpg

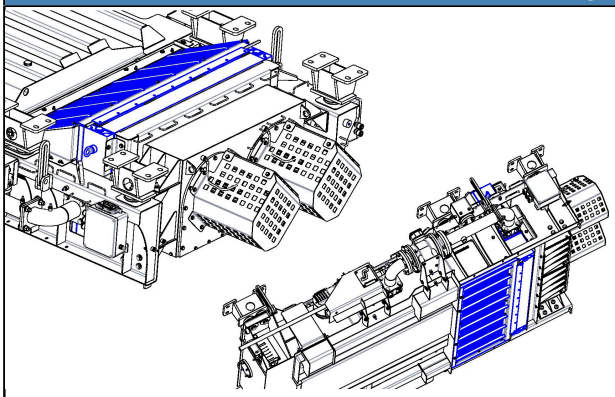
3 Clean the three-phase motor only with a vacuum cleaner. Dismount the motor protections, if needed (Be careful not to damage the electrical cables during the protection manipulation).



16N.m

Note: *Screws HM8x30 A4-80 Washers LE8 A4*

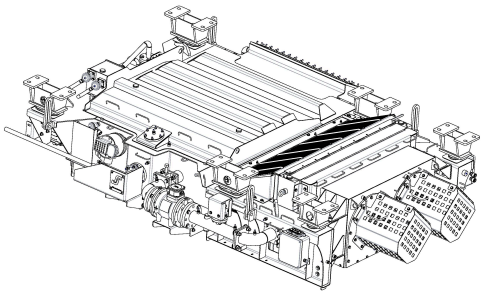
Cooling system - Dry cleaning



CGSTEL012.jpg

4 Clean the Top and Bottom cooler grid with a vacuum cleaner and the cooler with a vacuum cleaner.

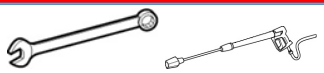
5 It is also necessary to check the state of contamination of the radiator. To do this, you must remove one of the protective grids (top or bottom) in order to access the radiator for cleaning it.

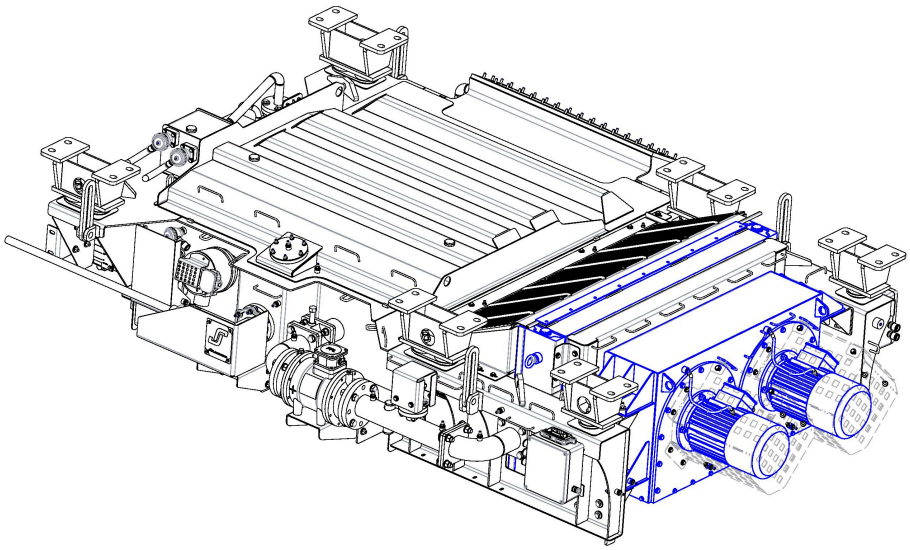


TFOTEL001.jpg

6 In case of oily and greasy contaminations, refer to "Wet cleaning" procedure.

Cooling system - Wet cleaning

Number and category	Maintenance interval	Tools	Activity time
	 3 Months		



CGSTEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
Cooling system	1075369R000	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

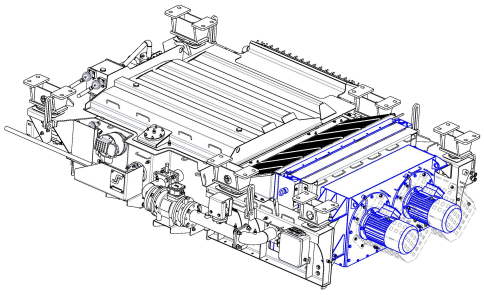
WARNING

System may be under pressure

Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

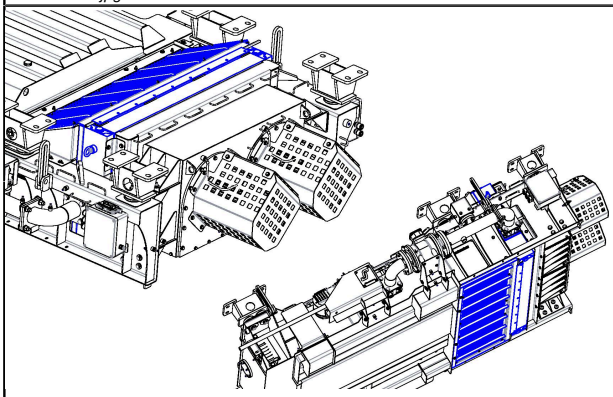
Cooling system - Wet cleaning



CGSTEL001.jpg

1 Since contamination can lead to malfunction or damages of the cooling unit it has to be cleaned more often when operated in heavy contamination.

Note: *See cooling system manufacturer manual for more informations.*

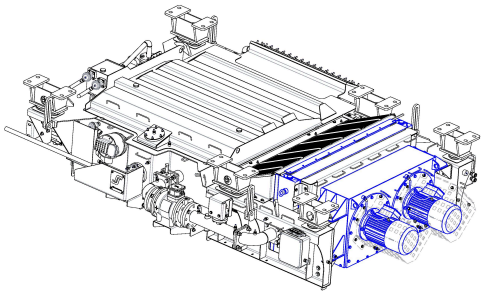


CGSTEL012.jpg

2 Remove the Top and Bottom cooler grid. Clean them.

3 Clean the cooler and the other external components with a wash station. You can add the cleaner TRAINCARE Heavy Duty (1) or another gentle cleaner (pH value 5 to 8) which does not attack the materials and coatings to the water. Oily and greasy contaminations can be washed off with a steam or hot water jet. Please observe the following instructions and figures to avoid damage:

Note: *Take care to not damage the fans of the cooler.*

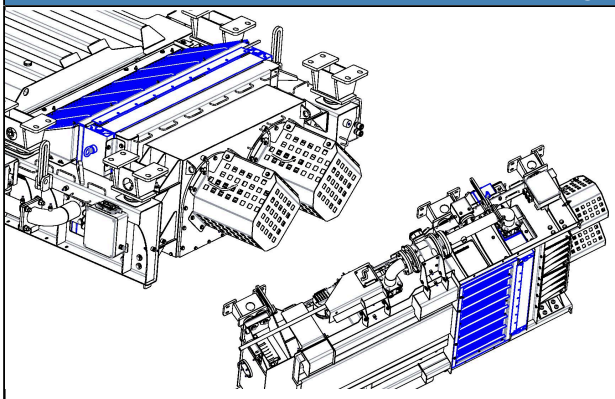
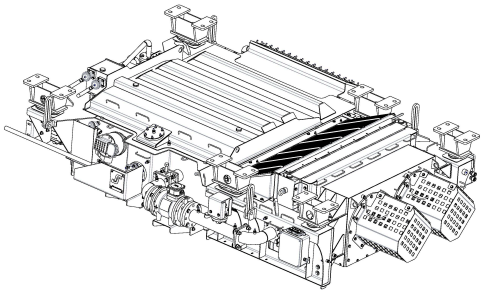


CGSTEL001.jpg

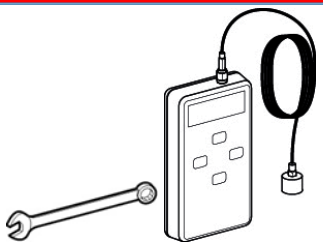
4 General:

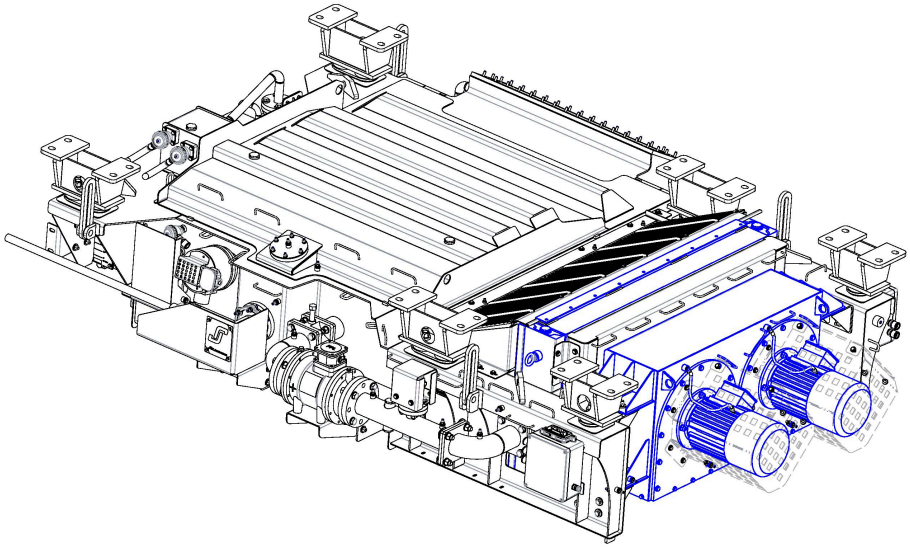
- Use a wash station with no sharp-edged brushes.
- Use a cleaning device which builds up a pressure of maximum 50 bar so that the lamellas of the cooler core especially are not damaged.
- Fan out the water jet to at least 20 mm.
- Clean the cooler core with a horizontal water jet from a distance of at least 50 mm in flow direction of the cooling air.
- Begin at the outside at the uppermost point so that the dirt is washed downwards.
- Flush the cooling unit with pure water after the cleaning.
- Do not block the drain holes

Note: *In order to avoid physical injury and material damage when adding chemical cleaning agents, the processing guidelines of the detergent manufacturer have to be respected precisely.*

Cooling system - Wet cleaning	
 CGSTEL012.jpg	5 Mount back the grids. 13 **16N.m**
 TFOTEL001.jpg	6 After completion of the cleaning, remove all loose parts from the workplace. Clean the working place.

Cooling system - Vibration measurement

Number and category	Maintenance interval	Tools	Activity time
	 6 Months		



CGSTEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
Motor fan group	1075369R010	

DANGER

Dangerous voltage 25 000 V

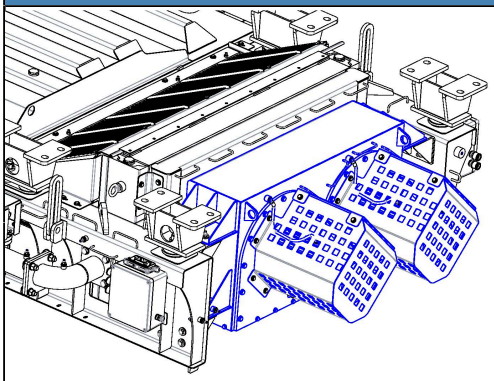
Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

WARNING

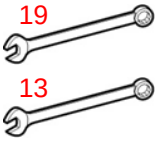
Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

Cooling system - Vibration measurement

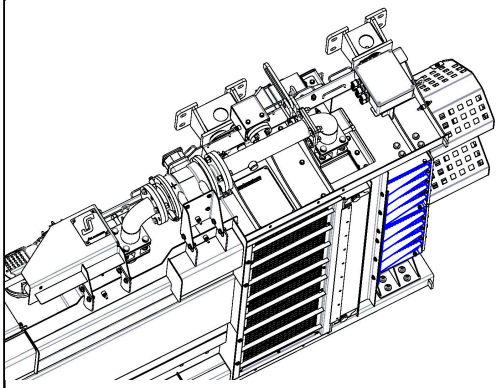


CGSTEL011.jpg

1. Check motor fan group fixation

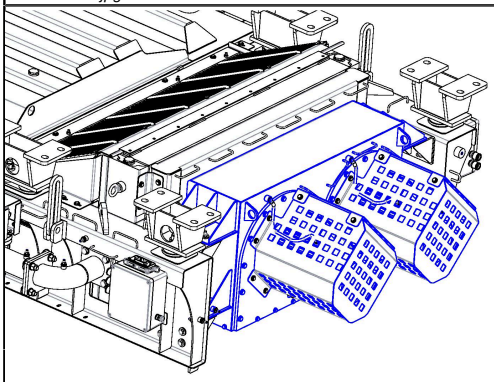


2. Disconnect the motor electrical supply.



CGSTEL013.jpg

3. Dismount the bottom grids

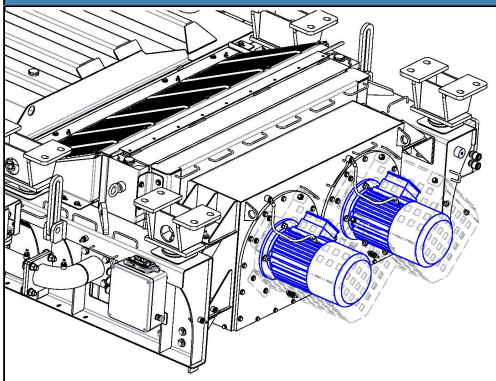


CGSTEL011.jpg

4. Check impeller :
   - Clean the impeller (blade by blade) with a cleaning rag or by air blasting.
   - Turn the impeller over by hand and check that there is no friction and/or interference with the rotating elements. Also check that no suspect noise occurs.
   - Check the inlet cone positioning (see cooling system maintenance manual) and clean it.

5. Reconnect the motor supply.

Cooling system - Vibration measurement

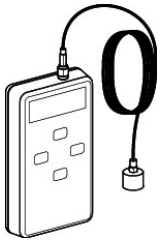


CGSTEL010.jpg

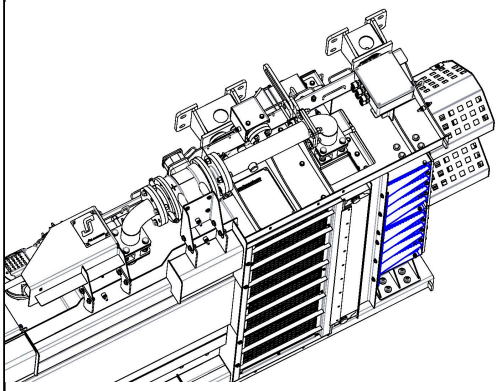
6 Check level of vibration:

- Energize the motor fan.
- Make 2 different vibration measurements on the motor body close to the bearings. Follow the procedure delivered with your vibration meter.

If this level reach 1.3mm/s we recommend to proceed as soon as possible with bearing replacement.
For safety reasons, shut-down and lock-out the ventilator if the vibration levels on any one of the bearings exceeds 9mm/s.



Note: *Always record the measurements.*



CGSTEL013.jpg

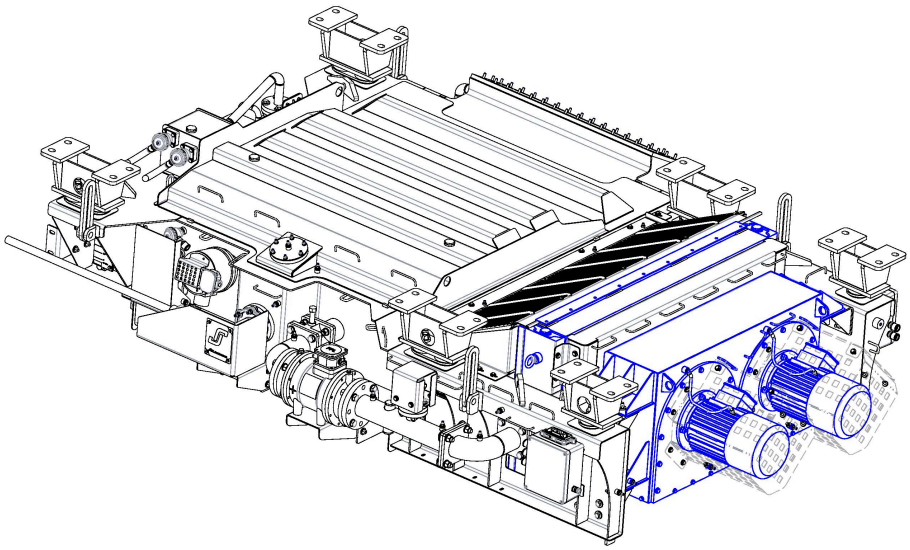
7 Mount back the bottom grids.

16N.m

Note: *Screws HM8x35 A4-80 Screws HM8x25 A4-80 Nuts M8 A4-80 Washers M8 A4 Washers LE8 A4*

Cooling system - Megger test = Dielectrical test

Number and category	Maintenance interval	Tools	Activity time
	 1 Year		



CGSTEL001.jpg

DANGER

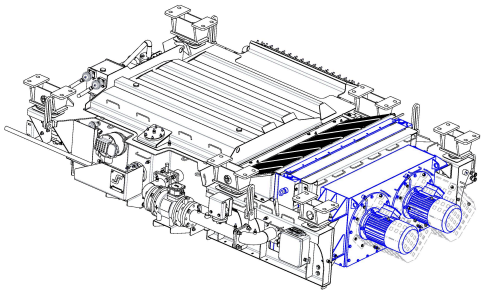
Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

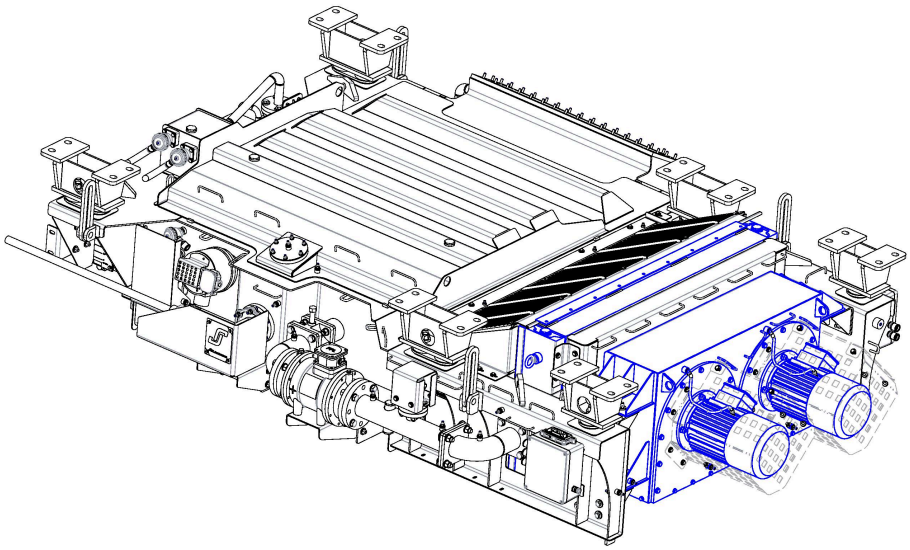
WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

Cooling system - Megger test = Dielectrical test	
 CGSTEL001.jpg	1 Please refer to supplier maintenance manual for other information.

Cooling system - Motor fan bearings replacement

Number and category	Maintenance interval	Tools	Activity time
	 50000h of working time		



CGSTEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Motor Bearing Replacement Set Non Driving End Bearing		1075369R002	
Motor Bearing Replacement Set Driving End Bearing		1075369R003	

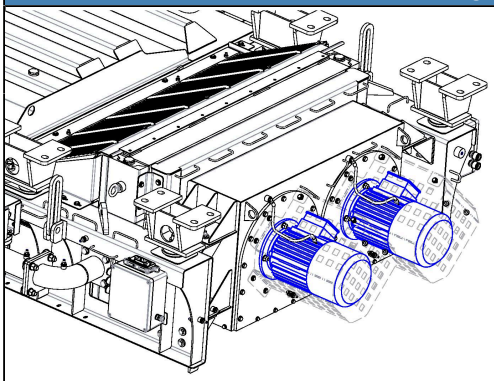
DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

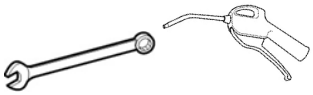
Cooling system - Motor fan bearings replacement

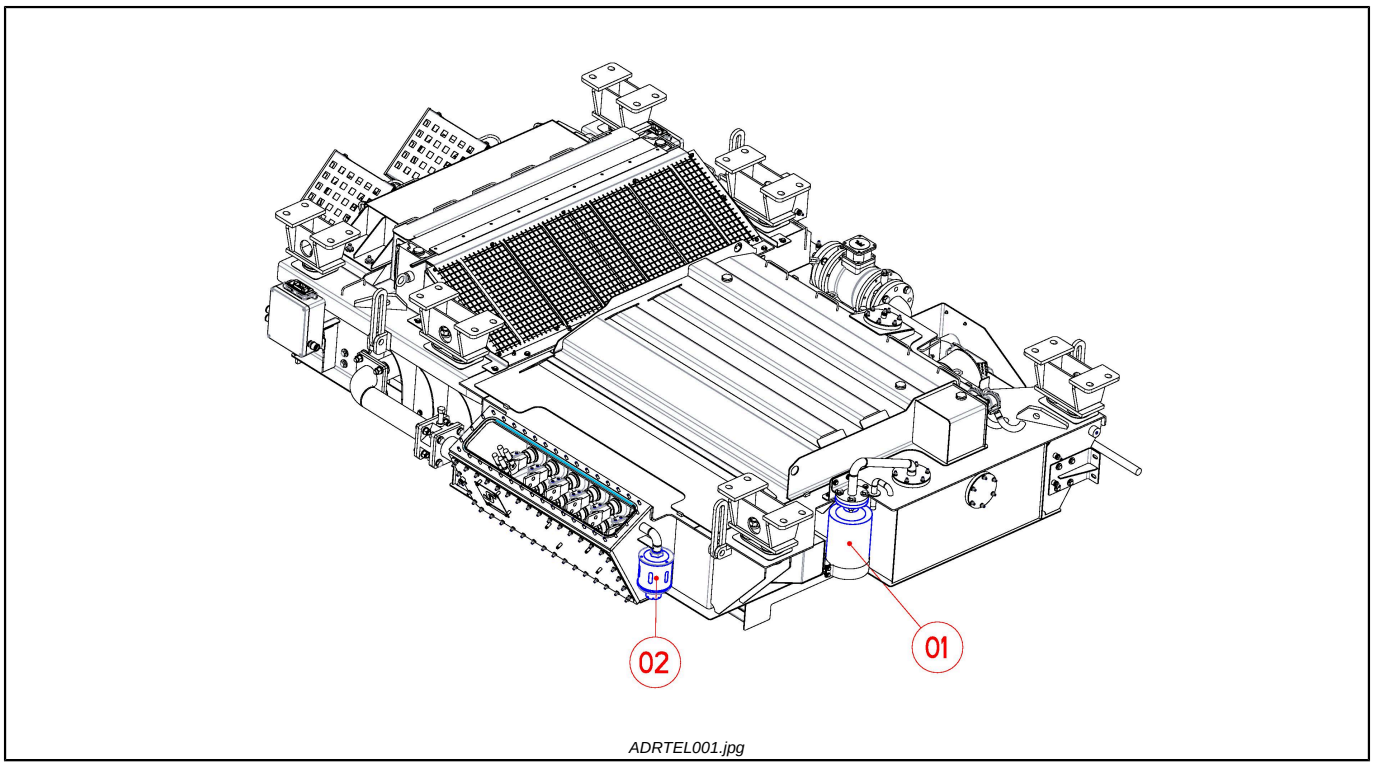


CGSTEL010.jpg

1. Follow the CM13 instructions of this maintenance manuel in order to dismount the motors.
2. Follow the CM13 instructions of this maintenance manuel in order to mount back the motors.

Air dryer - Dehydrating agent

Number and category	Maintenance interval	Tools	Activity time
	 6 Months		



ADRTEL001.jpg

Equipments involved

Designation	JST Art. Num.	Customer Art. Num.
Air dryer with flange	1068209R000	
Air dryer without flange	1068208R000	

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Brown Silicagel - 800g	0,8kg	1017087R000	
Air dryer with flange gasket	1	1075890R000	

Consumables needed for operation

Designation
Loctite 577

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

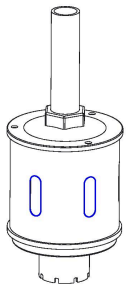
- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

WARNING

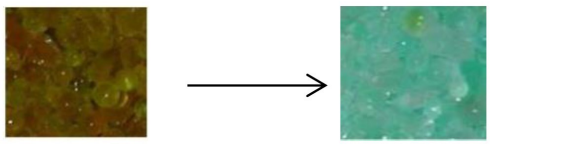
Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

All inside surfaces of pipes should be covered against air pollution during long maintenance operations

Air dryer - Dehydrating agent check



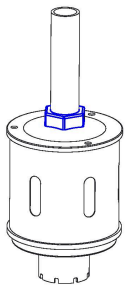
ADRCOM001.jpg



DESCOM001.jpg

1 Check colour change of the desiccant through Air dryer window. If colour has switched from brown/ amber to aquamarine/green or if oil is present in the Air dryer, replace the desiccant.

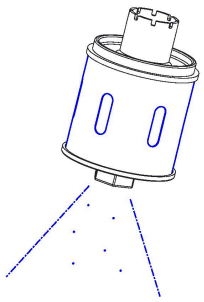
Air dryer without flange (LV bushings box) - Dehydrating agent replacement



ADRCOM002.jpg

1 Unscrew Air dryer. Slowly separate the Air dryer from the threaded pipe.

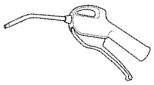
Air dryer without flange (LV bushings box) - Dehydrating agent replacement

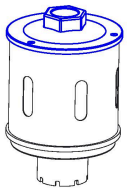


ADRCOM003.jpg

2 Empty silicagel from the body of the dryer by reversing the Air dryer.

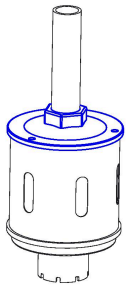
3 Clean inside the Air dryer body by blowing compressed air.





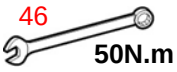
ADRCOM004.jpg

4 Slowly put a charge of silicagel (regenerated or new) through top opening.



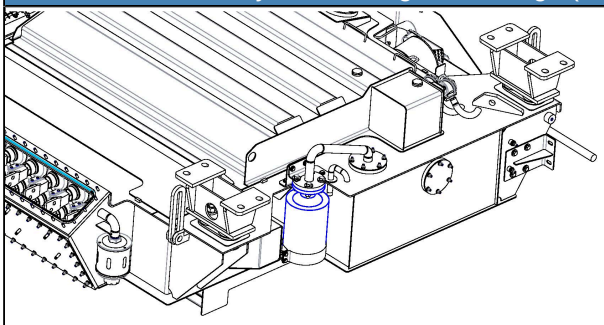
ADRCOM005.jpg

5 Screw back the Air dryer on the Air dryer pipe.



Note: *Loctite 577*

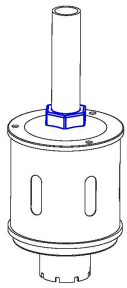
Air dryer with flange with flange (conservator) - Air dryer without flange replacement



ADRTEL010.jpg

1 Unscrew the air dryer collar.

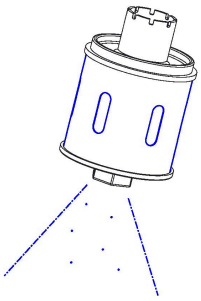
Air dryer with flange with flange (conservator) - Air dryer without flange replacement



ADRCOM002.jpg

2 Unscrew Air dryer. Slowly separate the Air dryer from the frange.

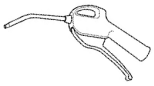
19

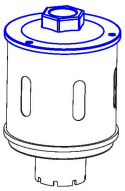


ADRCOM003.jpg

3 Empty silicagel from the body of the dryer by reversing the Air dryer.

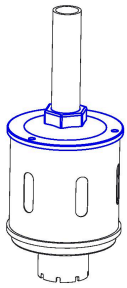
4 Clean inside the Air dryer body by blowing compressed air.





ADRCOM004.jpg

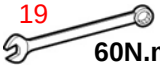
5 Slowly put a charge of silicagel (regenerated or new) through top opening.



ADRCOM005.jpg

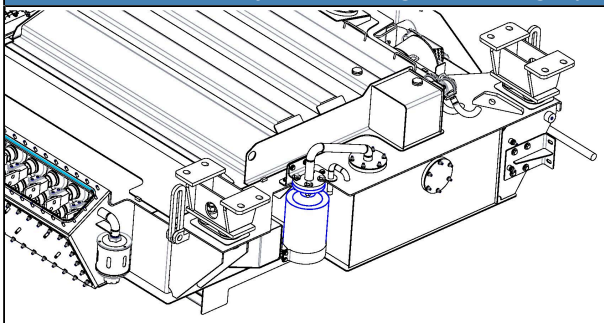
6 Check the condition of the gasket. Change it if necessary. Screw back the Air dryer on the flange.

19



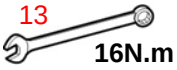
60N.m

Air dryer with flange with flange (conservator) - Air dryer without flange replacement



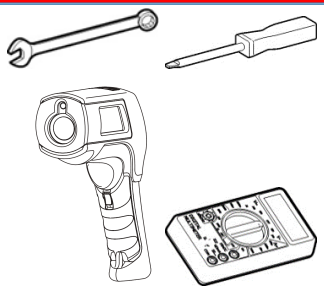
ADRTEL010.jpg

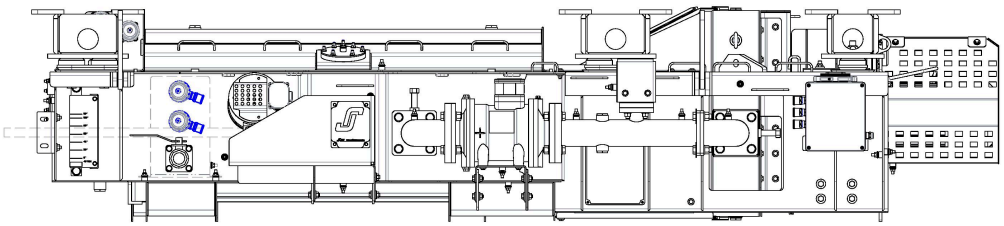
7 Mount back the air dryer collard/



Note: *Screws HM8x25 A4-80 Nuts M8 A4-80 Washers M8 A4*

PT100 sensor - Electrical information check

Number and category	Maintenance interval	Tools	Activity time
	 1 Years		



PT1TEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
PT100 temperature sensor	1075428R000	

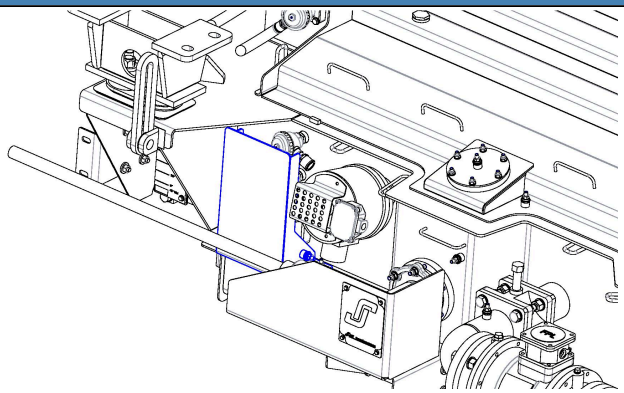
DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

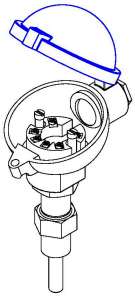
PT100 sensor - Electrical information check



PT1TEL010.jpg

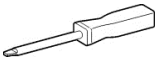
1. Unscrew the PT100 cover earthing strap.

2. Unscrew the PT100 cover.



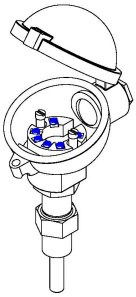
PT1COM001.jpg

3. Open cover of sensor.



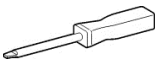
4. Check the condition of the connection head gasket (cut, porosity, …) and pollution inside the housing (water or dust ingress). In case of pollution or gasket damage, replace the PT100.

Note: *See "PT100 sensor - Housing replacement" procedure.*

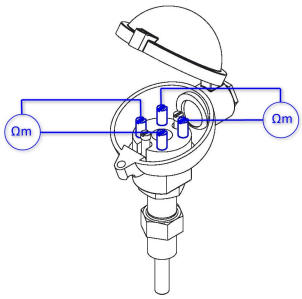


PT1COM002.jpg

5. Disconnect wires



6. Measure the temperature of the tank wall in a small area around PT100 sensor with a laser thermometer. Take 4 measurements and note the average value "Tref".



PT1COM005.jpg

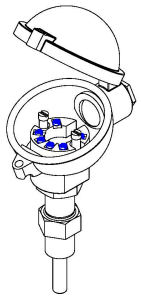
7. Measure the resistance of each individual sensor (2 by PT100 unit), R1, R2 by the mean of a multimeter.

PT100 sensor - Electrical information check

t/°C	0	1	2	3	4	5	6	7	8	9	t/°C
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51	0
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40	10
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.28	20
30	111.67	112.06	112.45	112.83	113.22	113.61	113.99	114.38	114.77	115.15	30
40	115.54	115.93	116.31	116.70	117.08	117.47	117.85	118.24	118.62	119.01	40
50	119.40	119.78	120.16	120.55	120.93	121.32	121.70	122.09	122.47	122.86	50
60	123.24	123.62	124.01	124.39	124.77	125.16	125.54	125.92	126.31	126.69	60
70	127.07	127.45	127.84	128.22	128.60	128.98	129.37	129.75	130.13	130.51	70
80	130.89	131.27	131.66	132.04	132.42	132.80	133.18	133.56	133.94	134.32	80
90	134.70	135.08	135.46	135.84	136.22	136.60	136.98	137.36	137.74	138.12	90
100	138.5	138.88	139.26	139.64	140.02	140.39	140.77	141.15	141.53	141.91	100
110	142.29	142.66	143.04	143.42	143.80	144.17	144.55	144.93	145.31	145.68	110
120	146.06	146.44	146.81	147.19	147.57	147.94	148.32	148.70	149.07	149.45	120
130	149.82	150.20	150.57	150.95	151.33	151.70	152.08	152.45	152.83	153.20	130
140	153.58	153.95	154.32	154.70	155.07	155.45	155.82	156.19	156.57	156.94	140

PT1CHA006.jpg

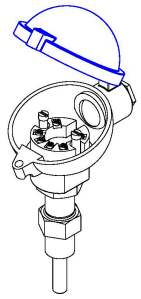
8 Example : if you measure 124.6 Ohm, closest value in the table is 124.77 Ohm.
Equivalent temperature is 64 °C.



PT1COM002.jpg

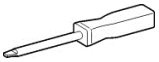
9 Connect the wires on the terminals.

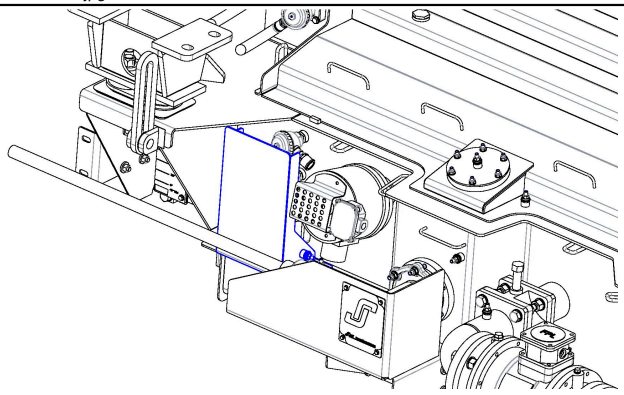
Note: *See document 1075829 for schematic diagram details*



PT1COM001.jpg

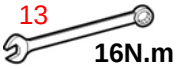
10 Close the cover of sensor.



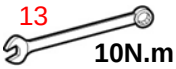


PT1TEL010.jpg

11 Screw back the PT100 cover.

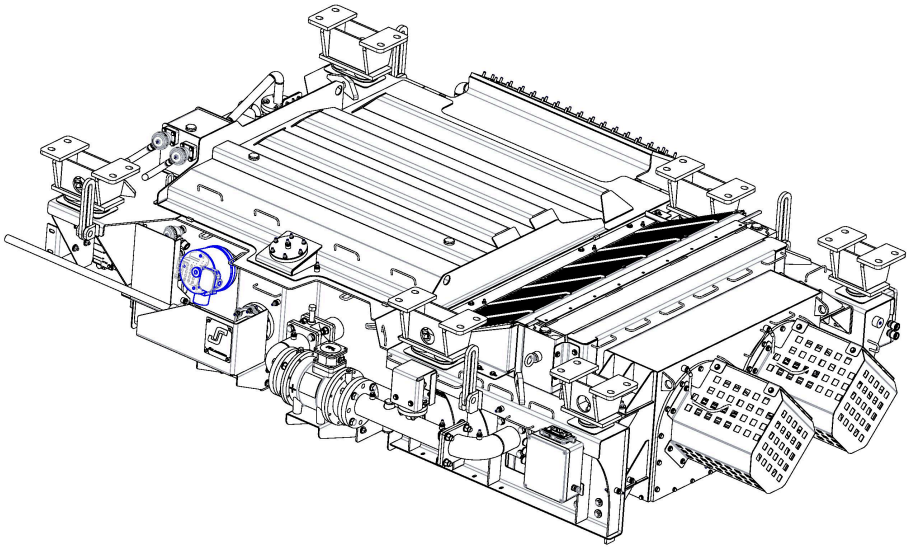


12 Screw back the PT100 cover earthing strap.



Pressure relief device - Electrical contact check

Number and category	Maintenance interval	Tools	Activity time
	 1 years		



PRDTEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
Pressure relief device	1068210R000	

DANGER

Dangerous voltage 25 000 V

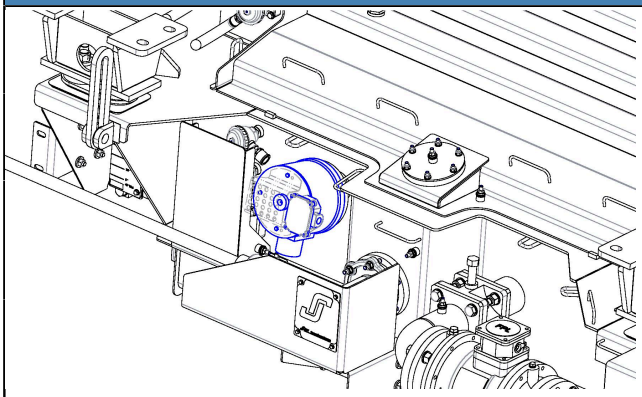
Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

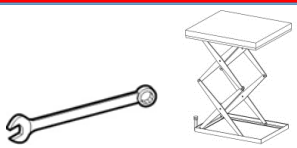
Pressure relief device - Electrical contact check

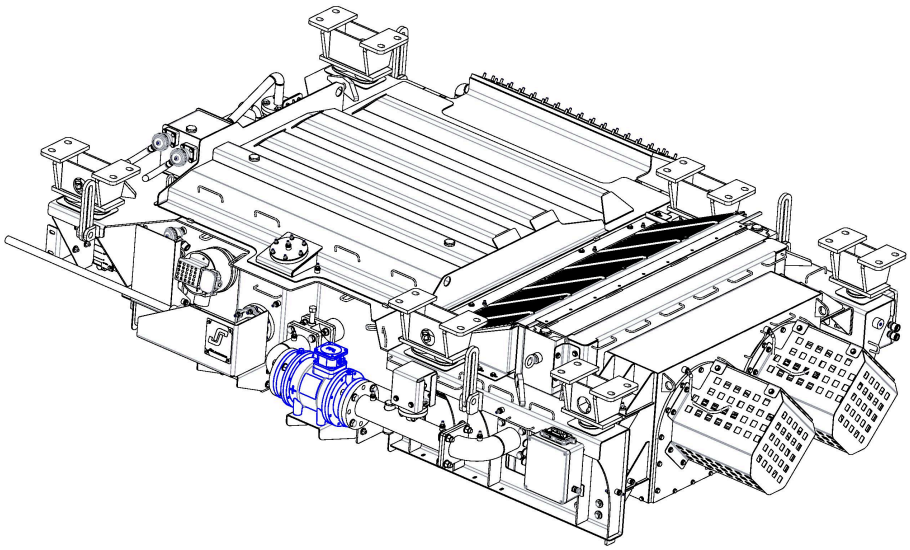


PRDTEL010.jpg

1. Unscrew the 4 electrical cover screws with Number 4 BTR screw driver.
2. Remove the cover and check the connection tightening.
3. Clean the micro switch contact, remove any dust or particule. Check that the contact operates correctly.
4. Mount back the PRD electrical cover.

Oil pump - Bearing replacement

Number and category	Maintenance interval	Tools	Activity time
	 8 Years		



PMPTEL001.jpg

Spare parts needed for operation			
Designation	Qty	JST Art. Num.	Customer Art. Num.
Oil pump-O-ring gasket	2	1075890R000	0
Isolating Valve -O-ring Gasket	1	1075890R000	0

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

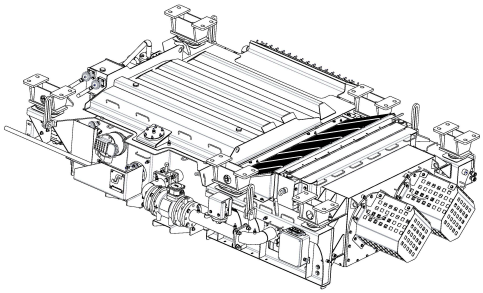
All inside surfaces of pipes should be covered against air pollution during long maintenance operations

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

Pump weight is 32kg.

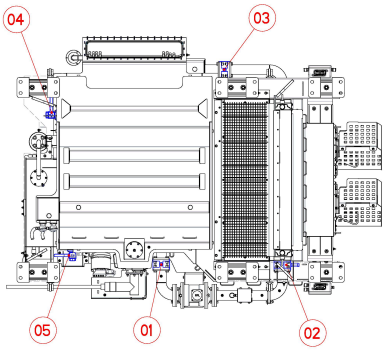
Oil pump - Bearing replacement



TFOTEL001.jpg

1 Fill the oil expansion tank until the maximum temperature indicated.

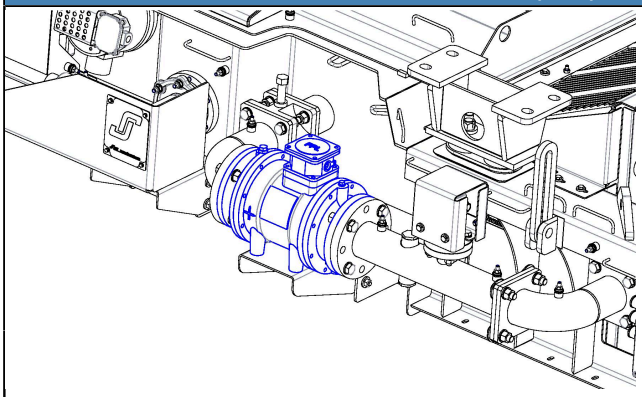
Note: *Refer to the "Partial filling" procedure.*



BFVTEL001.jpg

2 Close valve (1).
Close valve (2).

Oil pump - Bearing replacement



PMPTEL010.jpg

3 Disconnect the Earth strap between the Pump and the pipe.

13

Washers TREP 3L8 A4
Washers L8 A4
Nuts HM8 A4-80
Screws HM8x35 A4-80

4 Open Motor terminal box.

13

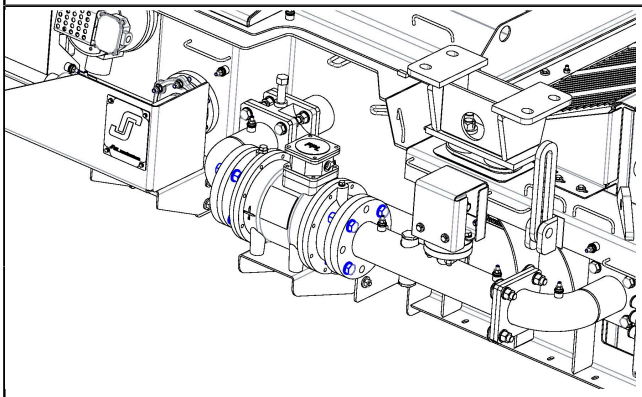
0

5 Disconnect the cables.

13

0

6 Open the drain plug under the Oil pump and vent plug on top of the Oil pump to drain oil of the pipe. When the oil don't flow anymore, close the vent and drain plugs.



PMPTEL011.jpg

7 Unscrew the 4x M16 screws, on Pump inlet side.

24

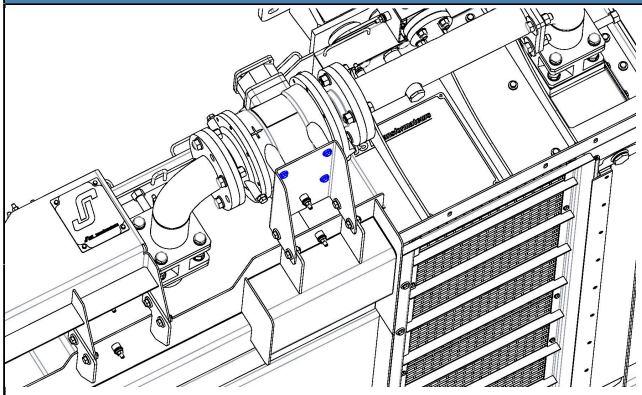
Screws HM16x60 A4-80
Washers M16 A4
Nuts M16 A4-80

8 Put an elevating table to support the Pump outlet pipe (Oil Flow Indicator side).
Unscrew the 4x M16 screws, on Pump outlet side.

24

Screws HM16x60 A4-80
Washers M16 A4
Nuts M16 A4-80

Oil pump - Bearing replacement



PMPTEL012.jpg

9 Unscrew the 4 screws of the Pump support to remove the Oil pump.

13

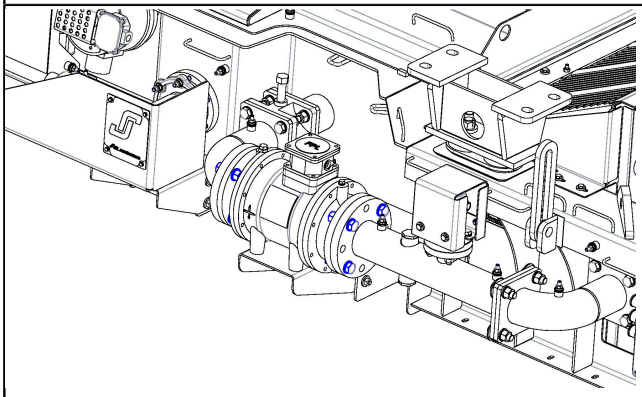
Screws HM8x20 A4-80
Washers LE8 A4

10 Please contact JST for the bearing replacement.

11 Remove old O-ring gasket(s).
Degrease gasket surface.
Clean gasket surface (remove old glue parts).

Note: *Do not use a metallic tool and take care at the gasket groove . Do not insert pollution inside pipes/holes (obstruct holes if necessary).*

12 Put new Pump gaskets on the pipes flanges.



PMPTEL011.jpg

13 Install the Oil pump on the bracket.
Pre-mount the earth strap on Pump as there will be less access once mounted on support.
Also check mounting positions before tightening screws.
Once done, install back the Inlet pipe and the earth strap (if necessary) and tighten the 4x M16 screws on Pump inlet side.

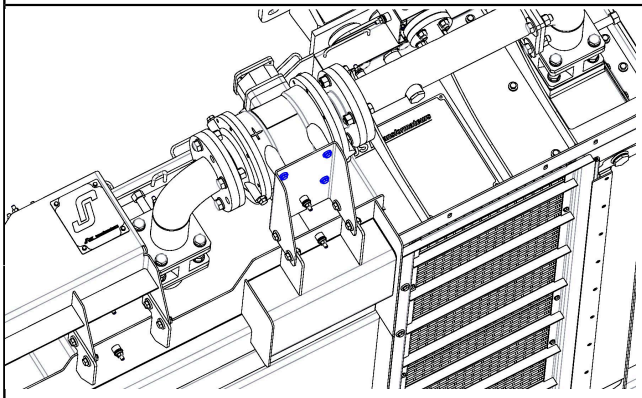
24 **130N.m**

Screws HM16x60 A4-80
Washers M16 A4
Nuts M16 A4-80

14 Screw the 4x M16 screws, on Pump outlet side.

24 **130N.m**

Screws HM16x60 A4-80
Washers M16 A4
Nuts M16 A4-80



PMPTEL012.jpg

15 Screw the 4x screws of the Pump bracket.

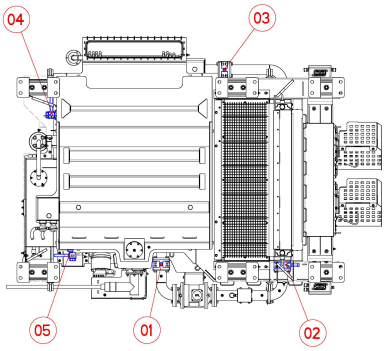
13 **16N.m**

Screws HM8x25 A4-80
Washers TREP 3L8 A4
Washers L8 A4

16 Connect the cables.

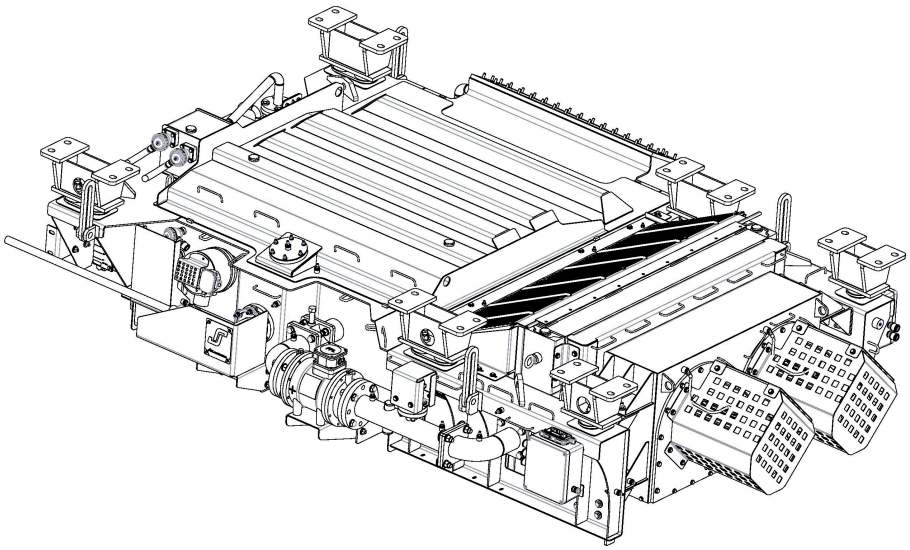
13 **7N.m**

Nuts HM8 A4-80

Oil pump - Bearing replacement	
	17 Install the cover on the Terminal box and screw it back.  *HM8 cap nut A4-80*
 *BFVTEL001.jpg*	18 Open valve (2). 19 Proceed to the purge of the Pump. ***Note:*** *See "oil - partial draining and filling" procedure* 20 Proceed to the purge of the Cooling system. ***Note:*** *See "oil - partial draining and filling" procedure* 21 Open valve (1). 22 Run the Pump during 5 minutes. 23 Proceed to the purge of the Transformer one more time. Adjust the oil level. ***Note:*** *See "oil - partial draining and filling" procedure*

Oil - Oil sampling

Number and category	Maintenance interval	Tools	Activity time
	 1 Year		



TFOTEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
Transformer	981677FLEX	0

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

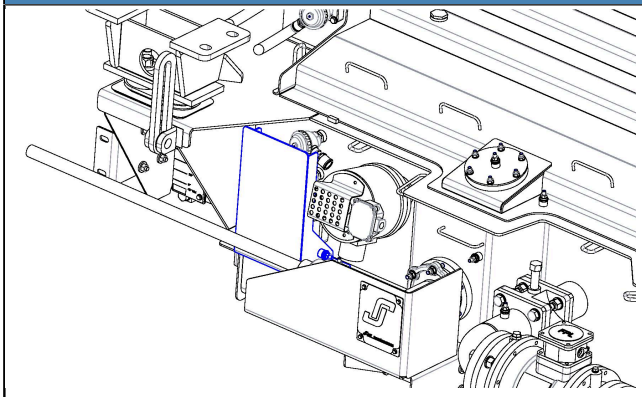
⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

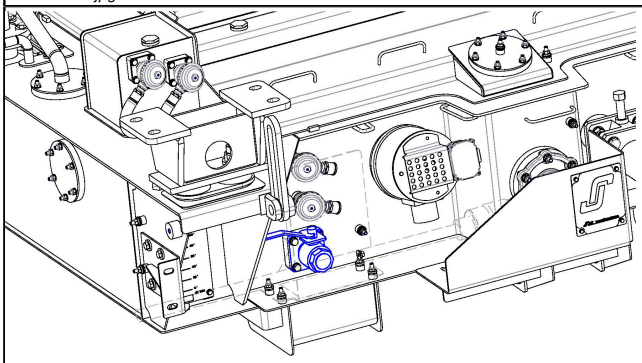
- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

CONNECTING PIPE ON VALVE



PT1TEL010.jpg

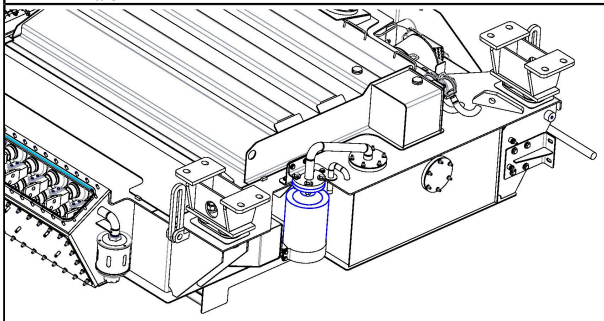
1 Dismount the valve and PT100 cover.



DFVTEL010.jpg

2 Unscrew the sampling screw cap until the sampling hole is visible.

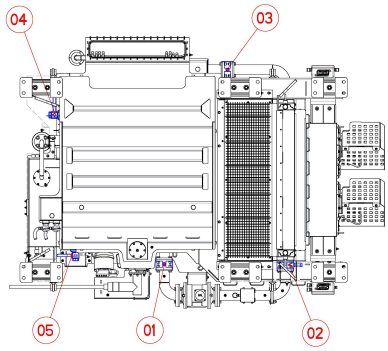
Note: *It is not necessary to remove completly the cap.*



ADRTEL010.jpg

3 Connect a pipe between the pressure regulator of the Dry air bottle and the Air dryer pipe.
To purge the highest altitude points, apply a 50 to 200mBar pressure by using the Pressure regulator.

CONNECTING PIPE ON VALVE



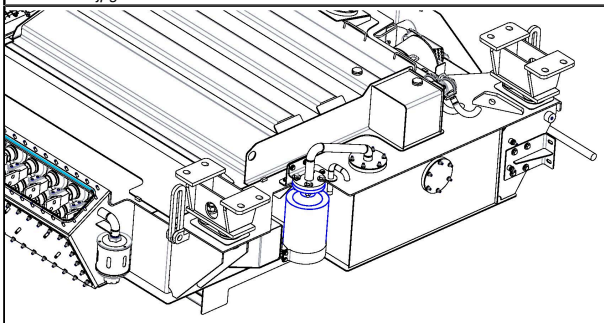
BFVTEL001.jpg

4 Open the valve (5).

5 Run off between 1 and 2L of oil to rinse the sampling bottle.

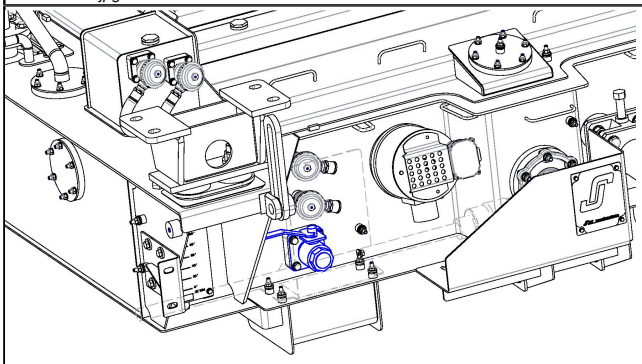
6 Drain the required quantity of oil for the sampling into the bottle.

7 Close valve (5).



ADRTEL010.jpg

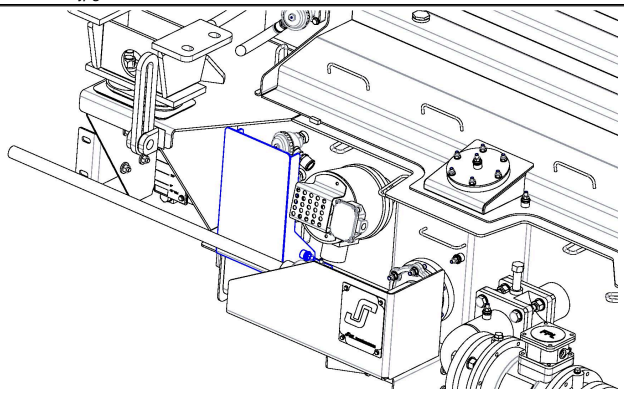
8 Close the dry air bottle and disconnect it. Refit the air dryer.



DFVTEL010.jpg

9 Refit the screw cap and tighten it.

55



PT1TEL010.jpg

10 Screw back the valve and PT100 cover.

13

16N.m

Note: *After each oil analysis, check the level and top up if necessary. See "Partial draining and filling" procedure.*

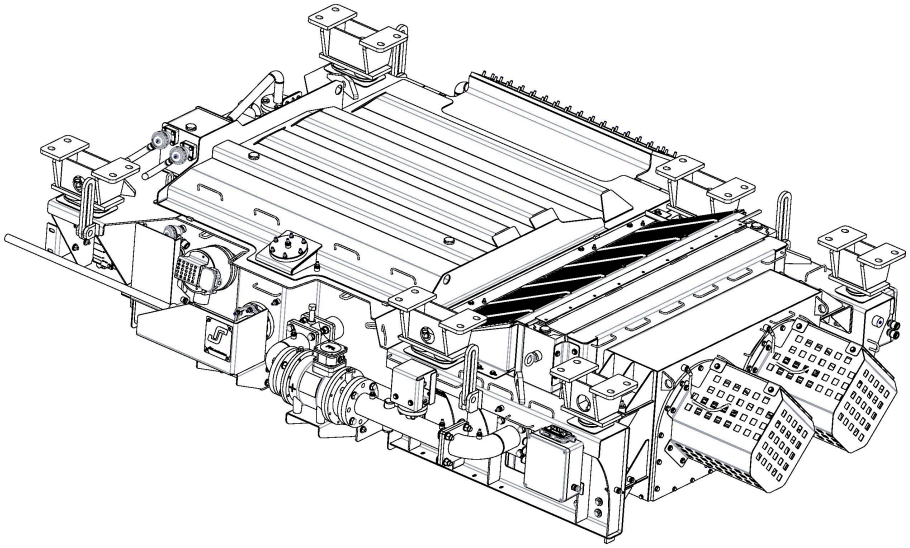
1. Acceptance criteria

Oil must be analyzed by an accredited laboratory according to following standards.

- Key parameters for basic oil follow-up are breakdown voltage, water content, and acidity.
- Filling oil is Synthetic Ester oil conform to IEC 61099 type T1:
  - Breakdown voltage > 30 kV (measured according IEC 60156 with fig. 1 spherical electrodes shape, 12.5mm diameter and 2.5mm gap).
    - If breakdown voltage < 30 kV, Transformer should be stopped, and measurement confirmed with a second sample. Oil treatment could be performed to restore correct value.
  - Water content < 400 ppm (measured according IEC 60814 with Karl Fischer method).
    - If 400 ppm < water content <= 700 ppm and breakdown voltage is ok, perform a new sampling for result confirmation. And later on, check general evolution by additional samples.
    - If water content > 700 ppm, contact JST for recommendation. In case breakdown voltage is additionally < 30 kV, Transformer should be stopped. In any case, confirm result with a second sample. Oil treatment could be performed to restore correct value.
  - Acidity < 1.5 mgKOH/gOil (measured according IEC 62021).
    - If acidity > 1.5 mgKOH/gOil, recommendation is to plan for an oil replacement with new oil (in a shorter delay if acidity >2 mgKOH/gOil).

Oil - Oil replacement

Number and category	Maintenance interval	Tools	Activity time
	 15 Years		 4



TFOTEL001.jpg

Equipments involved		
Designation	JST Art. Num.	Customer Art. Num.
Transformer	981677FLEX	0

Consumables needed for operation
Designation
Synthetic Ester oil

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

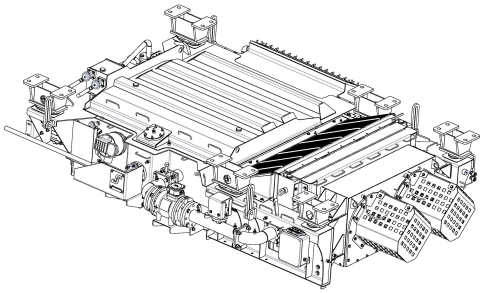
⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

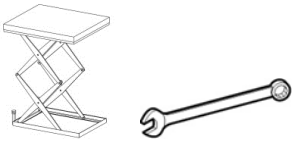
Oil - Oil replacement

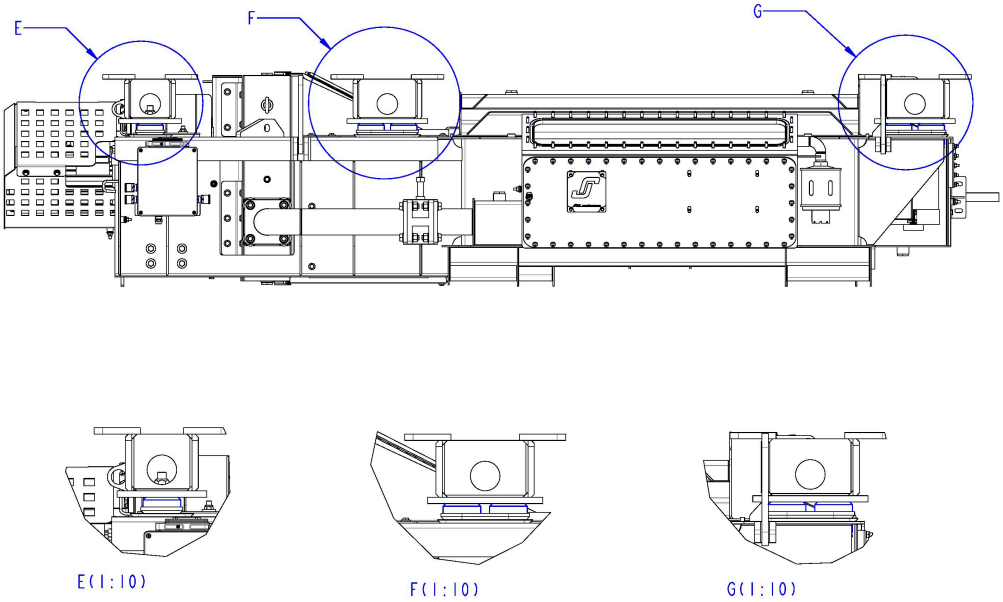


TFOTEL001.jpg

1 See Complete Draining / Filling procedure to replace completely the oil in the Transformer.

Damper (all) - Replacement

Number and category	Maintenance interval	Tools	Activity time
	 6 Years		



DMPTEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Damper ref. 1	8	1075615R000	
Damper ref. 2	2	1075616R000	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

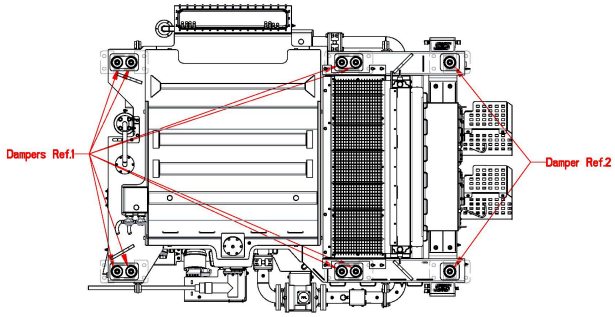
⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

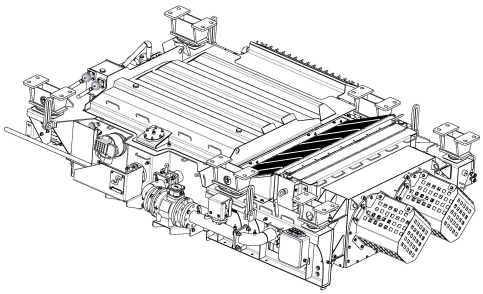
Damper (all) - Replacement



DMPTEL010.jpg

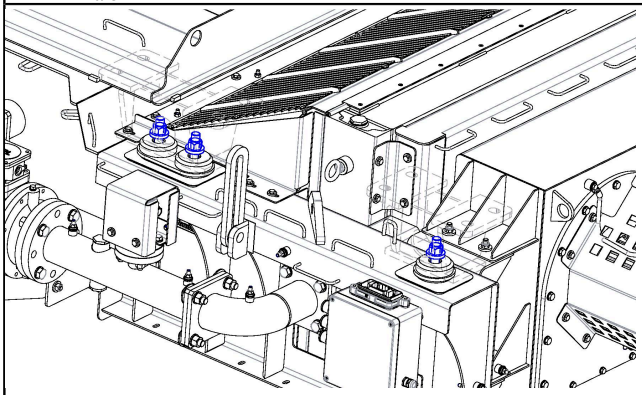
1 Localize the damper that need to be changed and prepare the right damper reference.

Note: *ATTENTION : If the wrong reference if mounted, it can cause serious damage during the functionning.*



TFOTEL001.jpg

2 If the transformer cannot be dismantled from the train, an elevating table (or equivalent) must be placed under the transformer to support the entire transformer mass. The next steps can be applied on each of the 6 dampers boxes.

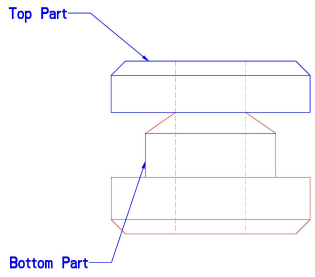


DMPTEL011.jpg

3 Unscrew the damper screw.
Preserve the 5mm thick round plate that is between the screw/washer and the bottom part of the damper.

Note: *Use the holes in the damper boxes to place the screwing tool on the nuts.*

Damper (all) - Replacement

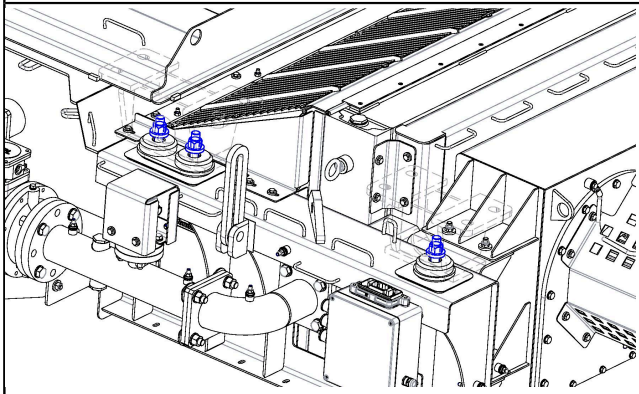


DMPTEL012.jpg

4 Remove the bottom part of the damper and then the top part (H-mount type).
If there is 1 or more 1mm thick plate between the top part of the damper and the damper box, preserve it.

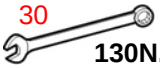
5 Install the new damper without damaging the rubber part. Use the same number of 1mm thick plate found on the previous step. There might not be any.

Note: *Take care to mount the right reference on the right place.*



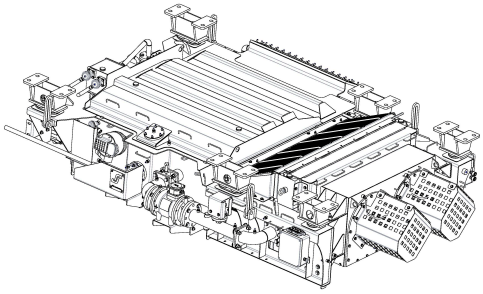
DMPTEL011.jpg

6 Place the 5mm thick damper washer under the damper and screw the assembly.



130N.m

Screws HM20x150 A4-80
Washers LE20 A4
Nuts Nylstop M20 A4-80



TFOTEL001.jpg

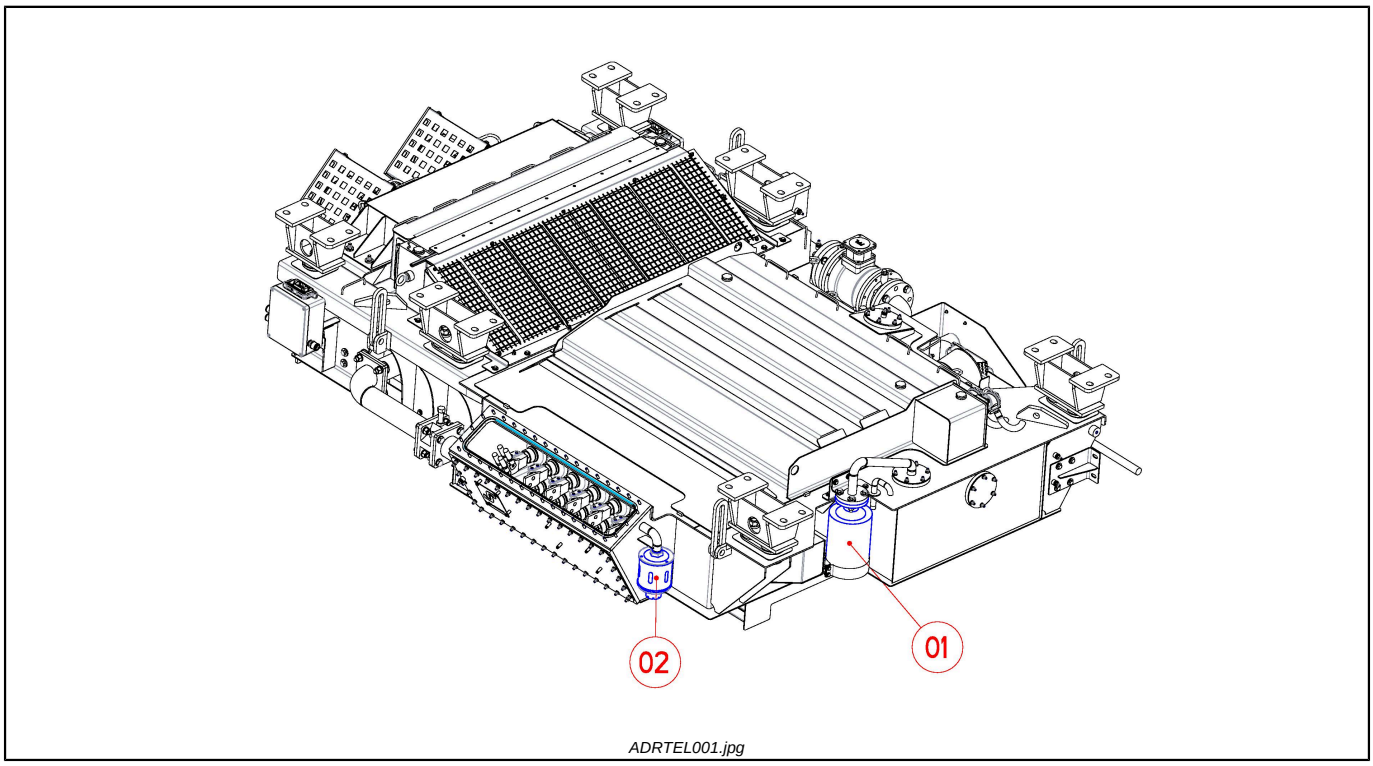
7 Put aside the elevating table slowly.

9.3. Corrective Maintenance

Maintenance procedure number	Activity type	Identity of item	Maintenance activity	Activity time (hours)	Pers. cat
CM1	CHG	Air dryer	Replacement	0.5	G
CM2	CHG	PT100 sensor	Sensor Replacement	0.5	GE
CM3	CHG	PT100 sensor	Housing Replacement	0.5 + Complete draining/filling	E
CM4	CHG	Oil level indicator	Replacement	0.5 + Partial draining/filling	GH
CM5	CHG	Oil level sensor	Replacement	0.25 + complete draining/filling	GE
CM6	CHG	Pressure relief device	Replacement	2 + Complete draining/filling	GE
CM7	CHG	Oil pump	Replacement	2 + Pipe draining/filling	GE
CM8	CHG	Oil flow indicator	Replacement	0.5	GE
CM9	CHG	HV bushing	Replacement	1.5 + Partial draining/filling	GE
CM10	CHG	LV bushing	Gasket replacement	1.5 + complete draining/filling	GE
CM11	CHG	Radiator	Radiator replacement	2 + Radiator Draining/Filling	GH
CM12	CHG	Cooling system	Cooling box replacement	1.5	G
CM13	CHG	Cooling system	Motor replacement	1.5	G
CM14	CHG	Draining and filling Valves	Replacement	0.5 + Complete draining and filling	GH
CM15	CHG	Damper	Replacement	2	G

Air dryer - Replacement

Number and category	Tools	Activity time
		



ADRTEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Air dryer with flange	1	1068209R000	0
Brown Silicagel - 800g	0,8kg	1017087R000	0
Air dryer without flange		1068208R000	
Air dryer with flange gasket		1075890R000	

Consumables needed for operation

Designation
Loctite 577

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

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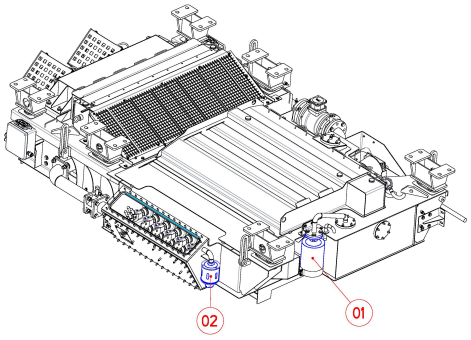
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

Air dryer without flange (LV bushings box) - Replacement



ADRTEL001.jpg

1. Unscrew Air dryer. Slowly separate the Air dryer from the threaded pipe.

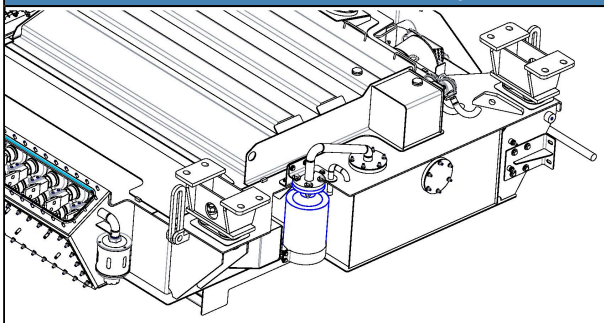
46

2. Screw back the new Air dryer on the Air dryer pipe.

46
50N.m

Note: *Loctite 577*

Air dryer with flange (conservator) - Replacement



ADRTEL010.jpg

1. Unscrew the Air dryer collar.

13

2. Unscrew the Air dryer. Slowly separate the Air dryer from the threaded pipe.

46

3. Change the gasket
4. Screw back the Air dryer on the Air dryer pipe.

46
50N.m

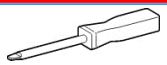
Note: *Screws HM12x60 A4-80 Nuts M12 A4-80 Washers M12 A4 Washers LE12 A4*

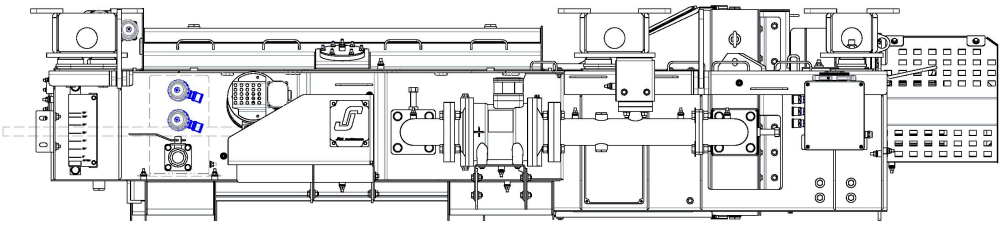
5. Screw the Air dryer collar.

13

Note: *Screws HM8x25 A4-80 Nuts M8 A4-80 Washers M8 A4*

PT100 sensor - Sensor Replacement

Number and category	Tools	Activity time
		



PT1TEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Temperature sensor (sensor only)	1	1075428R001	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
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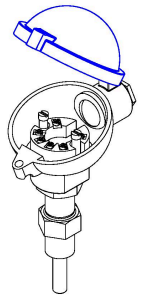
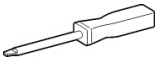
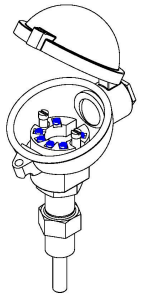
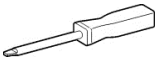
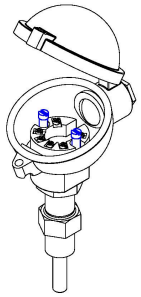
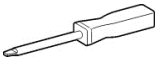
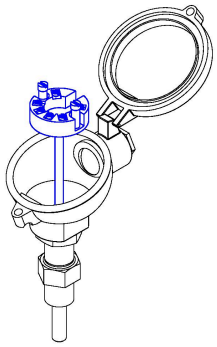
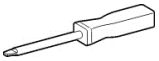
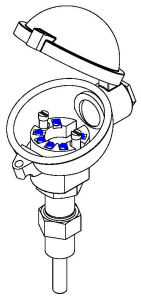
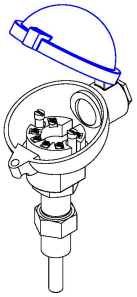
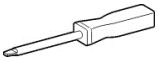
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

WARNING

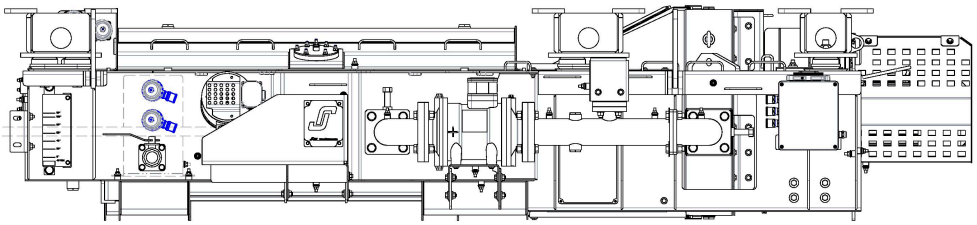
Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

PT100 sensor - Sensor Replacement	
 PT1COM001.jpg	1 Open the cover of the PT100.  ***Note:*** *See temperature sensor manufacturer manual for more informations. Take a picture of the electrical assembly to reassemble it identically.*
 PT1COM002.jpg	2 Disconnect wires. 
 PT1COM003.jpg	3 Unscrew the 2 screws with spring and remove the sensor. 
 PT1COM004.jpg	4 Screw back a new sensor until springs are between 30 and 70% compression.  ***Note:*** *The screws are delivered with the new sensor.*

PT100 sensor - Sensor Replacement	
 PT1COM002.jpg	5 Connect the wires on the terminals. ***Note:*** *See document 1075829 for schematic diagram details*
 PT1COM001.jpg	6 Close the cover of the PT100. 

PT100 sensor - Housing Replacement

Number and category	Tools	Activity time
		 0.5 + Complete draining/filling



PT1TEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
PT100 temperature sensor (housing + gasket)	1	1075428R000	

Consumables needed for operation

Designation
Loctite 577

DANGER

Dangerous voltage 25 000 V

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⚠WARNING

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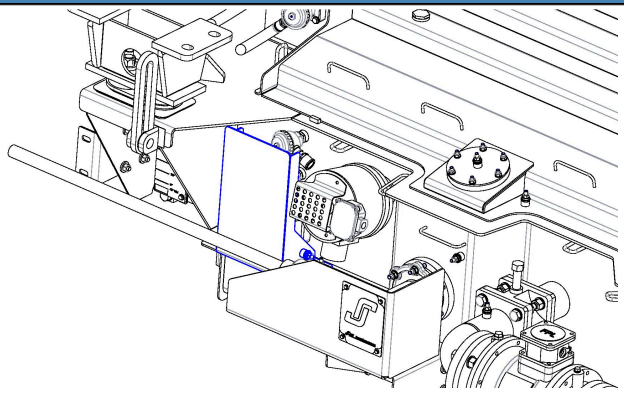
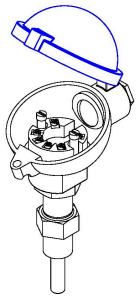
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

PT100 sensor - Housing Replacement



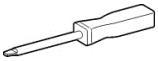
PT1TEL010.jpg

1. Dismount the PT100 cover.

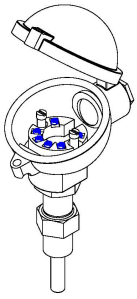


PT1COM001.jpg

2. Open the cover of the PT100.

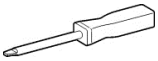


Note: *See temperature sensor manufacturer manual for more informations. Take a picture of the electrical assembly to reassemble it identically.*

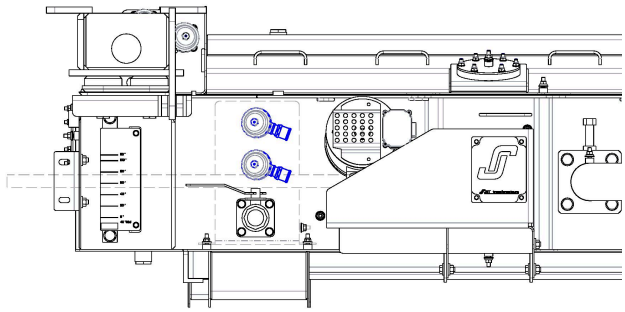


PT1COM002.jpg

3. Disconnect wires.



PT100 sensor - Housing Replacement



PT1TEL011.jpg

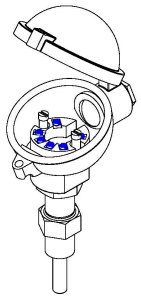
4 Remove the Housing and install a new one with new gasket.
Use Loctite 577 on the threads.

Note: *Clean the threads to remove old glue and oil before applying Loctite. Refer to directions for use of Loctite's datasheet to assemble the component.*

5 Orient the head of Housing with upper nut (approximately 20°) and screw the whole component with main nut.

41 **32N.m**

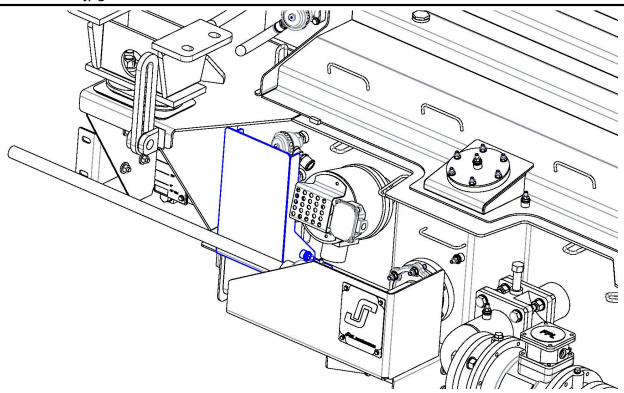
Note: *Both nuts have the same size and the same torque value*



PT1COM002.jpg

6 Connect the wires on the terminals.

Note: *See document 1075829 for schematic diagram details*



PT1TEL010.jpg

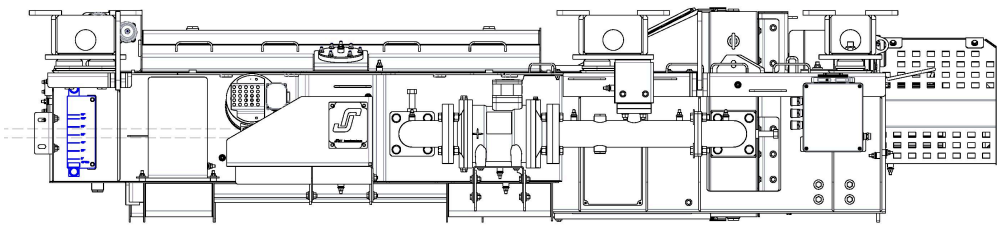
7 Screw back the PT100 cover.

13 **16N.m**

Note: *Nuts Nylstop M8 A4-80 Washers LE8 A4*

Oil level indicator - Replacement

Number and category	Tools	Activity time
		



OLITEL001.jpg

Spare parts needed for operation			
Designation	Qty	JST Art. Num.	Customer Art. Num.
Visual Oil level indicator (gaskets included)	1	1075427R000	
Oil Level Plate with graduation	1	1075587R000	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

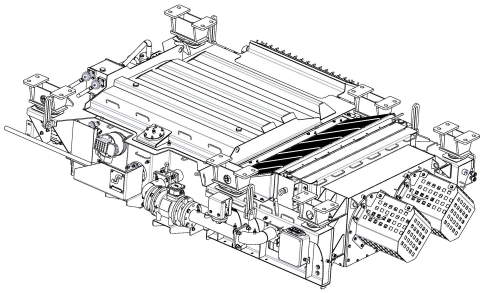
⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

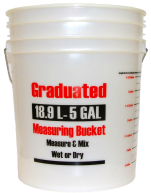
- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

Oil level indicator - Replacement

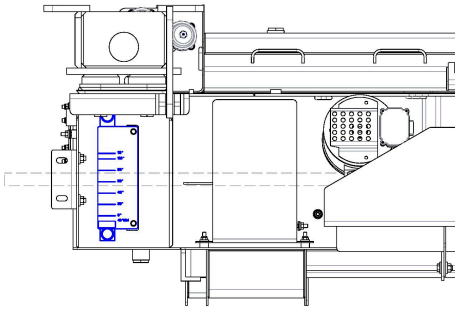


TFOTEL001.jpg

1 Drain oil until no oil is visible inside of oil level.



Note: *See "oil - partial draining and filling" procedure.*



OLITEL010.jpg

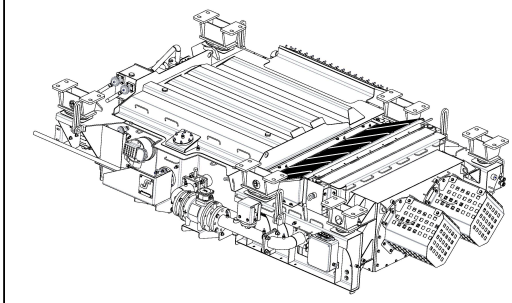
2 Remove the oil level plate.

3 Remove oil level indicator by unscrewing the 2 screws.
Install a new one.

10N.m

Note: *New fixing screws and gaskets are delivered with the new oil level indicator.*

Oil level indicator - Replacement



TFOTEL001.jpg

4 Install back and adjust the oil level plate by comparing oil temperature and oil level on the plate. Both temperatures need to be equal.

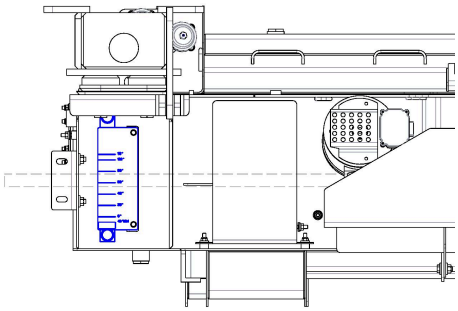
Note: *Make sure that Transformer is horizontal and that oil level plate is at eye level.*

Screws HM6x20 A4-80
Washers M6 A4

5 Refill the oil expansion tank.

Note: *See "oil - partial draining and filling" procedure. The Transformer must be at stabilized temperature for at least 6 hours in order that oil temperature is homogeneous within the device.*

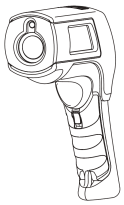
Oil level indicator - Oil level plate with graduations replacement

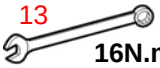


OLITEL010.jpg

1. Remove oil level plate.

2. Install back and adjust the new oil level plate by comparing oil temperature and oil level on the plate. Both temperatures need to be equal.





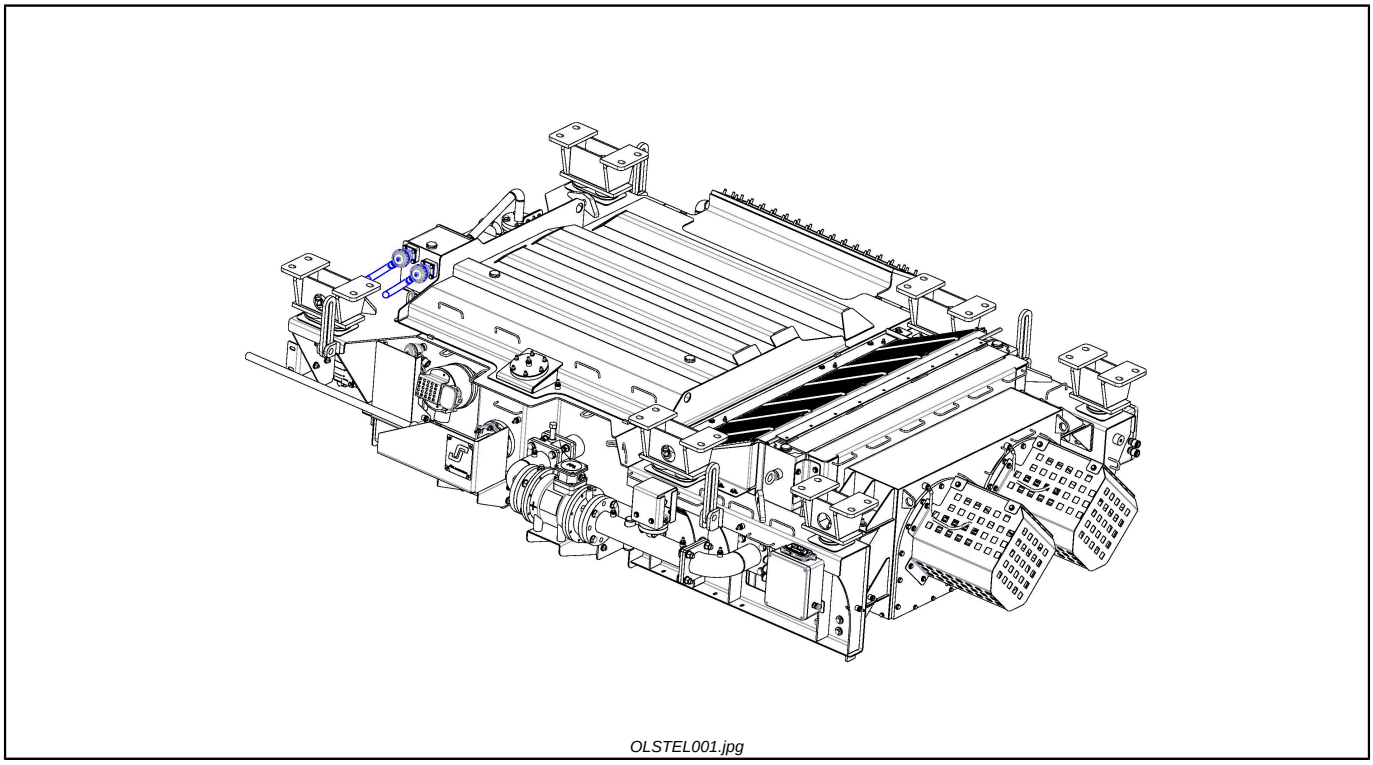
16N.m

Note: *Make sure that Transformer is horizontal and that oil level plate is at eye level. See "Partial and Filling" procedure.*

Screws HM6x20 A4-80
Washers M6 A4

Oil level sensor - Replacement

Number and category	Tools	Activity time
		0.25 + complete draining/filling



OLSTEL001.jpg

Spare parts needed for operation			
Designation	Qty	JST Art. Num.	Customer Art. Num.
Oil level switch	1	1075758R000	
O-ring gasket (flange/sensor)	1	1075892R000	

Consumables needed for operation
Designation
Loctite 577
Oil

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

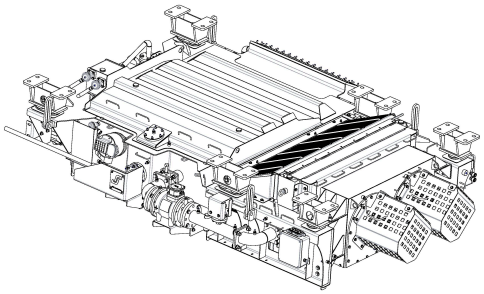
WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

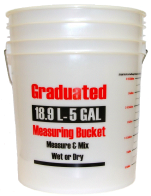
- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

Oil level sensor - Replacement

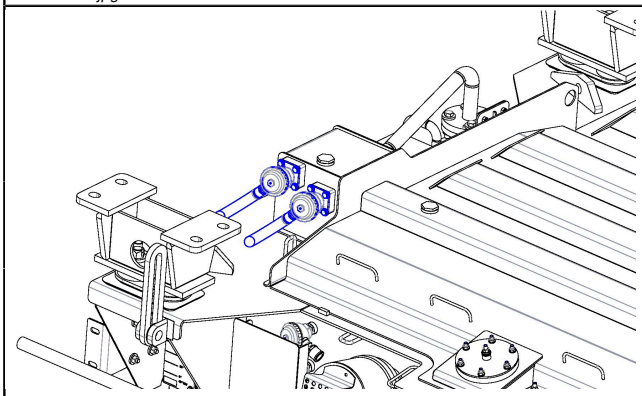


TFOTEL001.jpg

1 Drain oil.



Note: *See "Complete partial draining" procedure.*



OLSTEL010.jpg

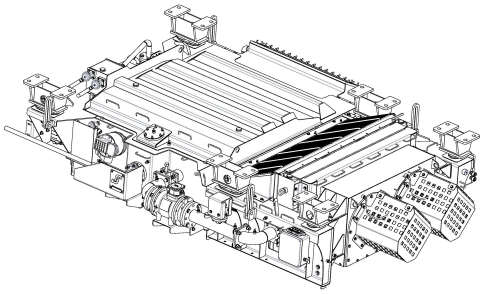
2 Disconnect the Electrical connector and remove the Oil level switch by unscrewing the 4x screws.

3 Change the gaskets between the sensor and the tank flange.

4 Install a new one and reconnect the Electrical connector.

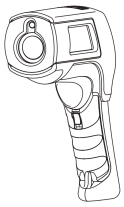
Screws HM6x18 A4-80
Washers Z6 A4

Oil level sensor - Replacement



TFOTEL001.jpg

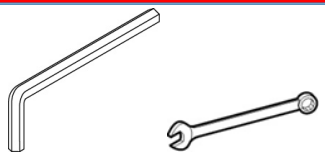
5 Perform a complete filling procedure, purges, oil level adjustment and final operation points.

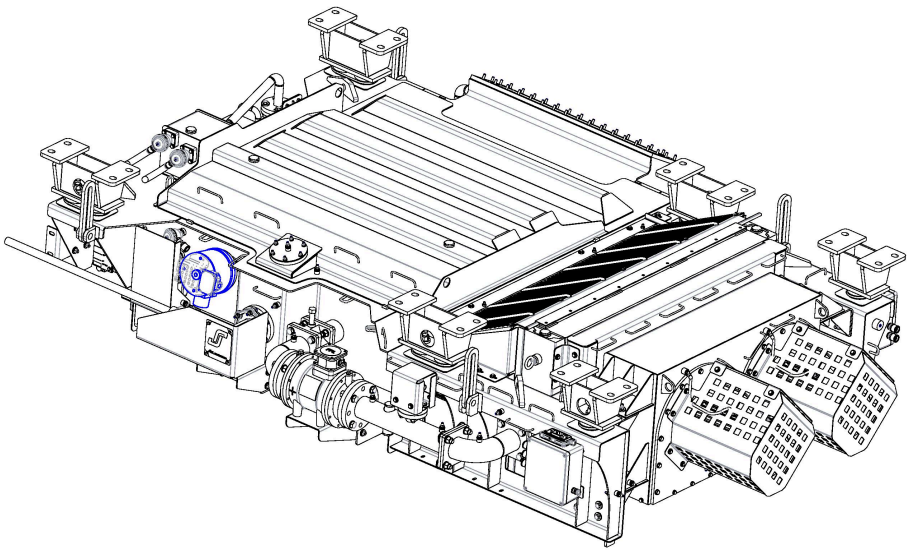


Note: *See "oil - partial draining and filling" procedure. The Transformer must be at stabilized temperature for at least 6 hours in order that oil temperature is homogeneous within the device. Make sure that the Transformer is horizontal and that the Oil level plate is at eye level.*

6 Use the graduated temperature plate on the expansion tank to make sure the oil level is correct.

Pressure relief device - Replacement

Number and category	Tools	Activity time
		2 + Complete draining/filling



PRDTEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Pressure Relief Device	1	1068210R000	0
Pressure Relief Device-O-ring Gasket	1	1075894R000	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

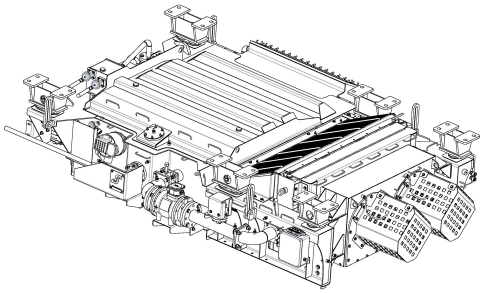
⚠ WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

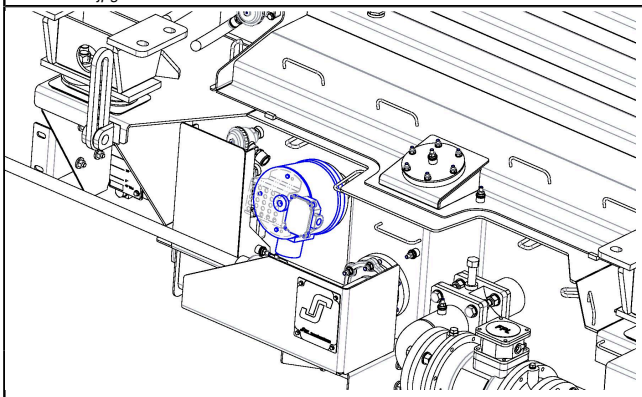
Pressure relief device - Replacement



TFOTEL001.jpg

1 Drain completely oil inside the Transformer.

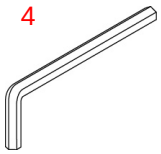
Note: *See "Oil - complete draining and filling" procedure*



PRDTEL010.jpg

2 Remove the upper cover of the Pressure relief device by unscreing the 4 screws.

4

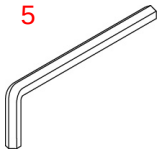


Screws CHC M5 A4-80
Washers Z5 A4

3 Disconnect the contactor cables.

4 Remove the lower cover of the Pressure relief device by unscrewing the 4x M6 screws.

5



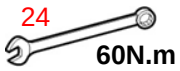
Screws CHC M6 A4-80
Washers M6 A4

Pressure relief device - Replacement

5 Unscrew the 4x M16 screws and remove the flange of the Pressure relief device.

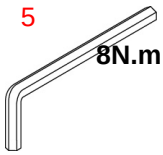
Screws HM16x40 A4-80
Washers W6 A4

6 Replace the O-ring gasket.
Screw back the new flange.



Screws HM16x40 A4-80
Washers W16 A4

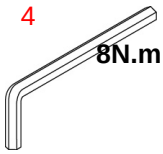
7 Screw back the lower cover of the new Pressure relief device.



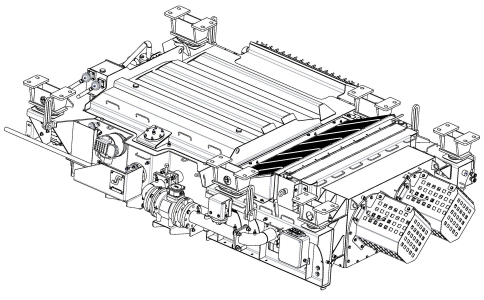
Screws CHC M6 A4-80
Washers M6 A4

8 Reconnect the contactor cables.

9 Screw back the upper cover.



Screws CHC M5 A4-80
Washers Z5 A4

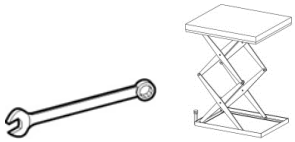


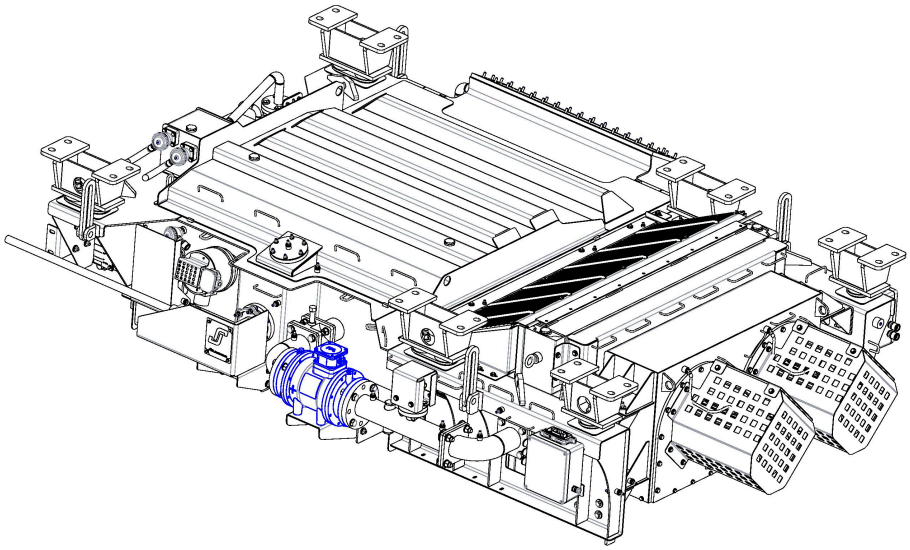
TFOTEL001.jpg

10 Fill the Transformer with oil.

Note: *See "Oil - complete draining and filling" procedure*

Oil pump - Replacement

Number and category	Tools	Activity time
		2 + Pipe draining/filling



PMPTEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Oil pump	1	1075479R000	
Oil pump-O-ring gasket	2	1075890R000	
Isolating Valve -O-ring Gasket	1	1075890R000	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

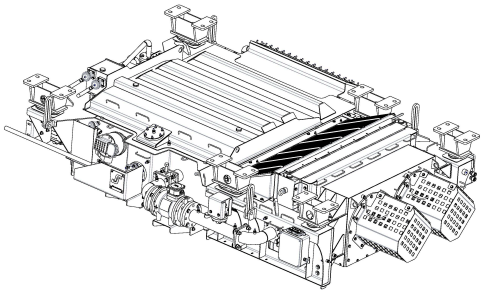
All inside surfaces of pipes should be covered against air pollution during long maintenance operations

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

Pump weight is 32kg.

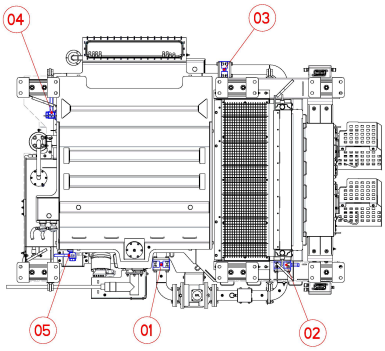
Oil pump - Replacement



TFOTEL001.jpg

1 Fill the oil expansion tank until the maximum temperature indicated.

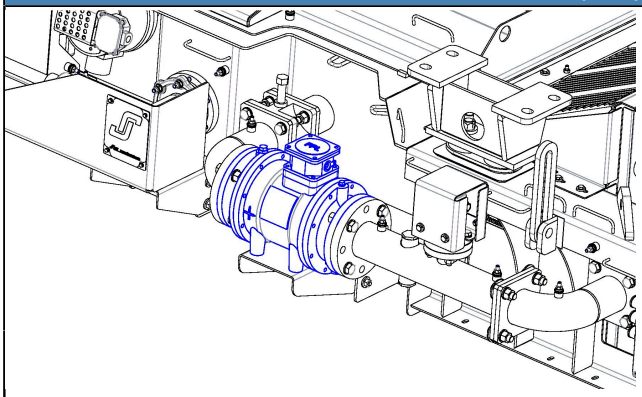
Note: *Refer to the "Partial filling" procedure.*



BFVTEL001.jpg

2 Close valve (1).
Close valve (2).

Oil pump - Replacement



PMPTEL010.jpg

3 Disconnect the Earth strap between the Pump and the pipe.

13

Washers TREP 3L8 A4
Washers L8 A4
Nuts HM8 A4-80
Screws HM8x35 A4-80

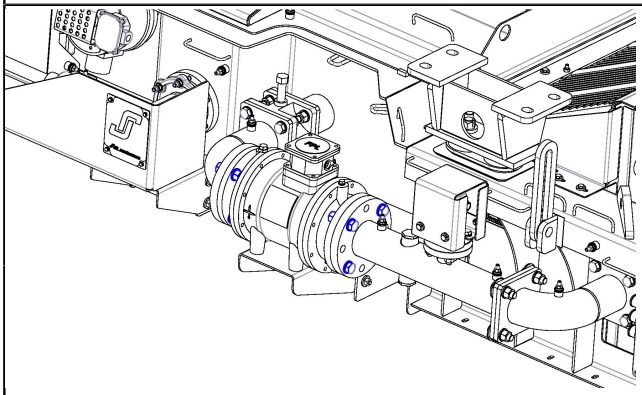
4 Open Motor terminal box.

13

5 Disconnect the cables.

13

6 Open the drain plug under the Oil pump and vent plug on top of the Oil pump to drain oil of the pipe. When the oil don't flow anymore, close the vent and drain plugs.



PMPTEL011.jpg

7 Unscrew the 4x M16 screws, on Pump inlet side.

24

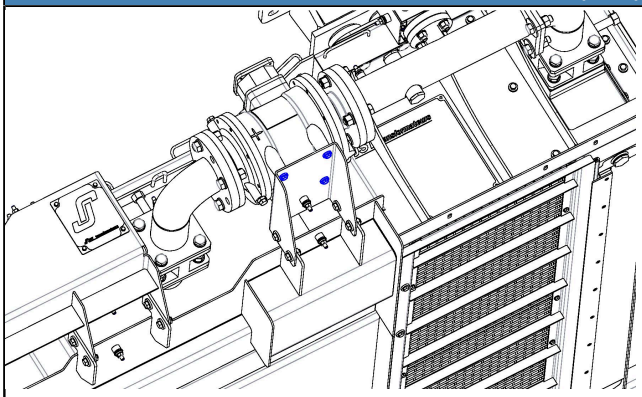
Screws HM16x60 A4-80
Washers M16 A4
Nuts M16 A4-80

8 Put an elevating table to support the Pump outlet pipe (Oil Flow Indicator side).
Unscrew the 4x M16 screws, on Pump outlet side.

24

Screws HM16x60 A4-80
Washers M16 A4
Nuts M16 A4-80

Oil pump - Replacement



PMPTEL012.jpg

9 Unscrew the 4 screws of the Pump support to remove the Oil pump.

13

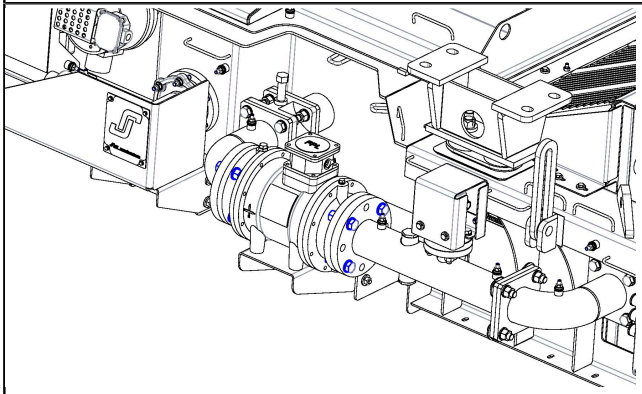
Note: *If Bearings have to be replaced, please follow the procedure "Oil pump - Bearing replacement" of this manual. For more information see manufacturer documentation in appendix.*

Screws HM8x20 A4-80
Washers LE8 A4

10 Remove old O-ring gasket(s).
Degrease gasket surface.
Clean gasket surface (remove old glue parts).

Note: *Do not use a metallic tool and take care at the gasket groove . Do not insert pollution inside pipes/holes (obstruct holes if necessary).*

11 Put new Pump gaskets on the pipes flanges.



PMPTEL011.jpg

12 Install the Oil pump on the bracket.
Pre-mount the earth strap on Pump as there will be less access once mounted on support.
Also check mounting positions before tightening screws.
Once done, install back the Inlet pipe and the earth strap (if necessary) and tighten the 4x M16 screws on Pump inlet side.

24 **130N.m**

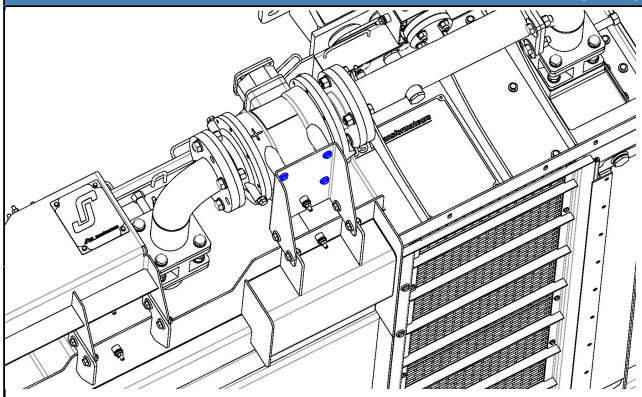
Screws HM16x60 A4-80
Washers M16 A4
Nuts M16 A4-80

13 Screw the 4x M16 screws, on Pump outlet side.

24 **130N.m**

Screws HM16x60 A4-80
Washers M16 A4
Nuts M16 A4-80

Oil pump - Replacement



PMPTEL012.jpg

14 Screw the 4x screws of the Pump bracket.

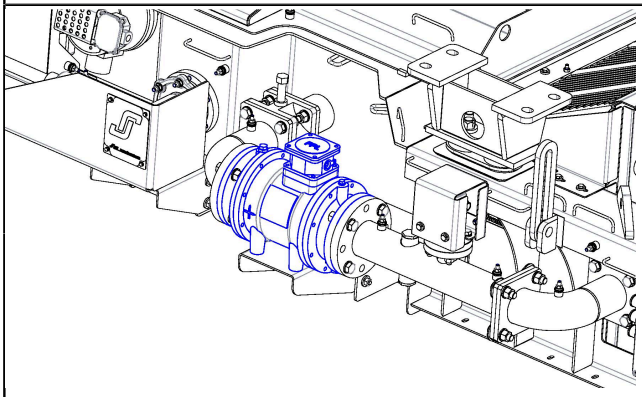
13 **16N.m**

Screws HM8x25 A4-80
Washers TREP 3L8 A4
Washers L8 A4

15 Connect the cables.

13 **7N.m**

Nuts HM8 A4-80



PMPTEL010.jpg

16 Install the cover on the Terminal box and screw it back.

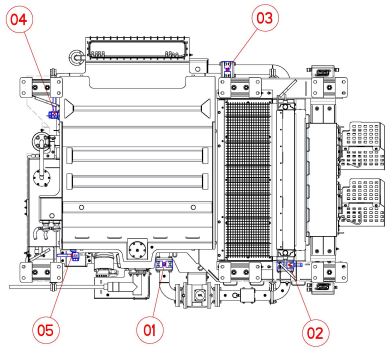
13 **8N.m**

HM8 cap nut A4-80

17 Install the earthing straps between the Pump and the cooling pipe.

13 **10N.m**

Nuts HM8 A4-80
Washers TREP 3L8 A4
Washers L8 A4



BFVTEL001.jpg

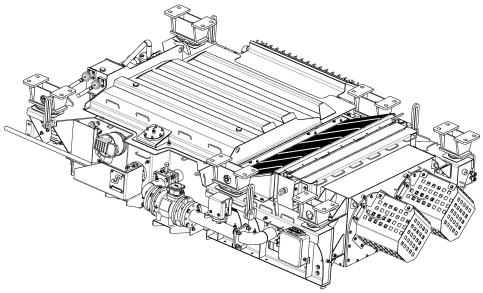
18 Open valve (2).

19 Proceed to the purge of the Pump.

Note: *See "oil - partial draining and filling" procedure*

20 Proceed to the purge of the Cooling system.

Note: *See "oil - partial draining and filling" procedure*



TFOTEL001.jpg

21 Open valve (1).

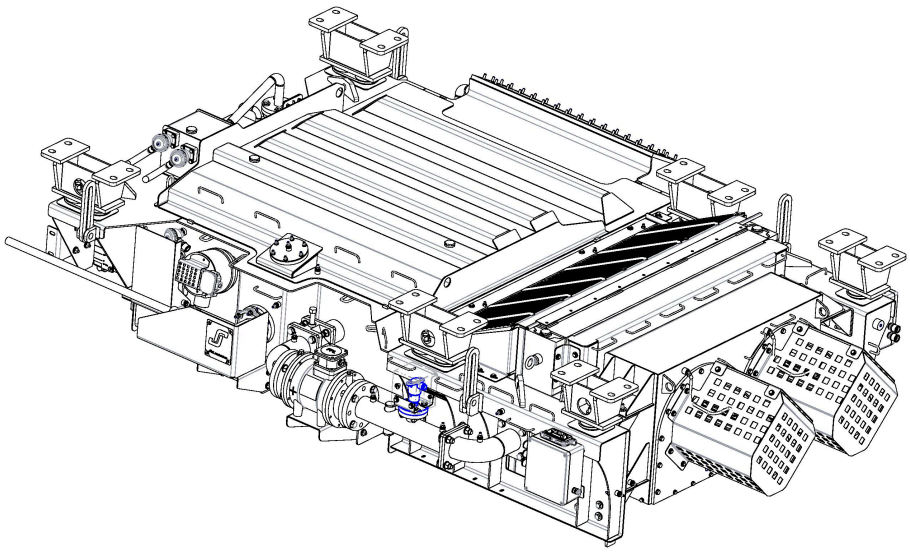
22 Run the Pump during 5 minutes.

23 Proceed to the purge of the Transformer one more time. Adjust the oil level.

Note: *See "oil - partial draining and filling" procedure*

Oil flow indicator - Replacement

Number and category	Tools	Activity time
		



OFITEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Oil flow indicator	1	1068817R000	
Oil flow indicator gasket	1	1075891R000	

Consumables needed for operation

Designation
Loctite 577

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

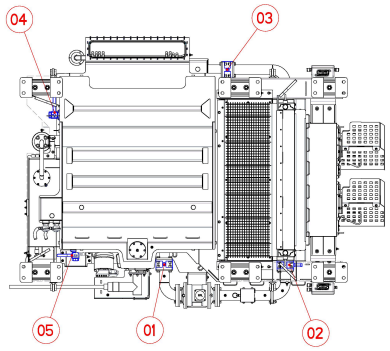
WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

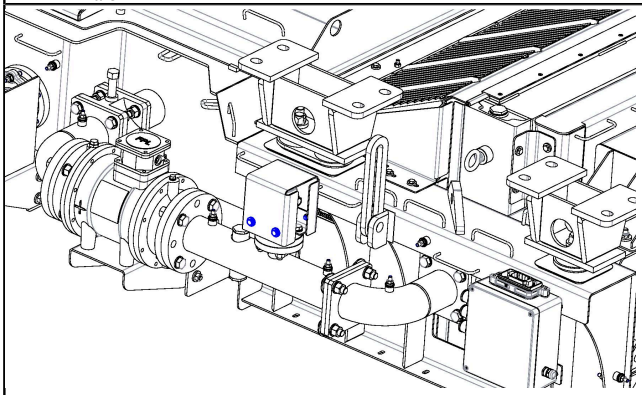
- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

Oil flow indicator - Replacement



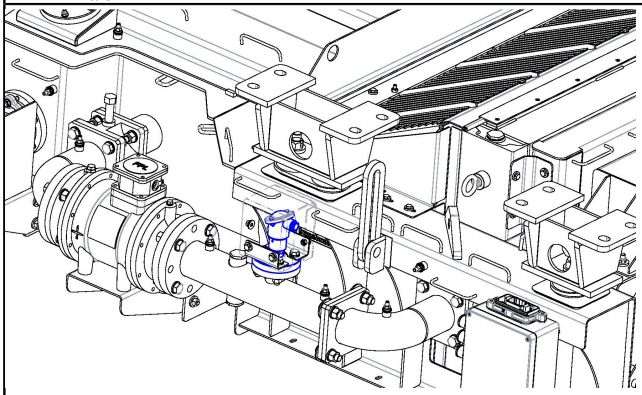
BFVTEL001.jpg

1 Close valves (1) and (2).


OFITEL011.jpg

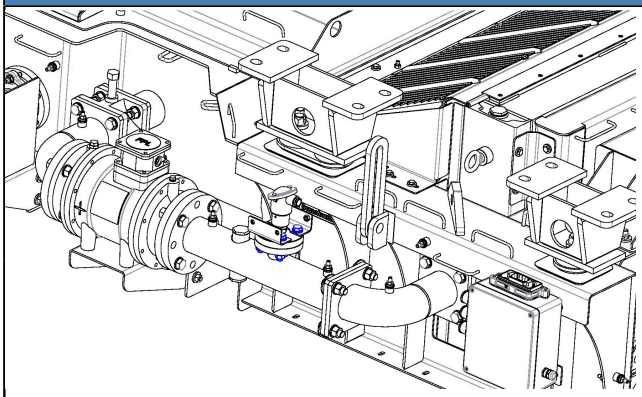
2 Remove the Oil flow indicator cover

13
16N.m


OFITEL010.jpg

3 Disconnect the Oil flow indicator cable.

Oil flow indicator - Replacement



OFITEL012.jpg

4 Remove the Oil flow indicator

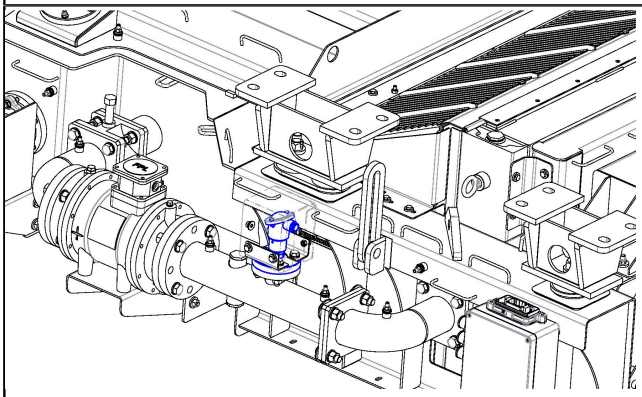
19

Note: *As the pipe is still full of oil, be careful of the small amount of oil that could spill out of the pipe when removing the Oil flow indicator.*

5 Screw back the new indicator

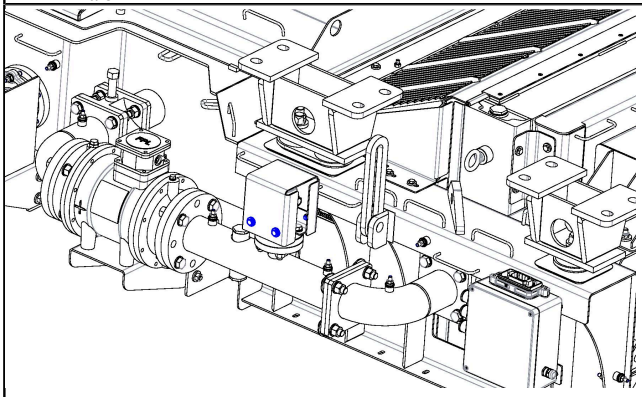
19 **60N.m**

Screws HM12x60 A4-80
Nuts M12 A4-80
Washers M12 A4



OFITEL010.jpg

6 Reconnect the Oil flow indicator cable.

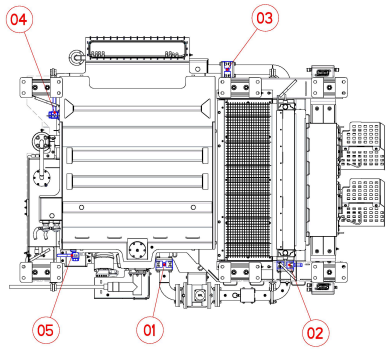


OFITEL011.jpg

7 Mount back the Oil flow indicator cover.

13 **16N.m**

Screws HM8x20 A4-80
Washers LE8 A4



BFVTEL001.jpg

8 Open valves (1) and (2) at each side of the piping.

9 Run the Pump during 5 minutes.

10 Proceed to the purges.

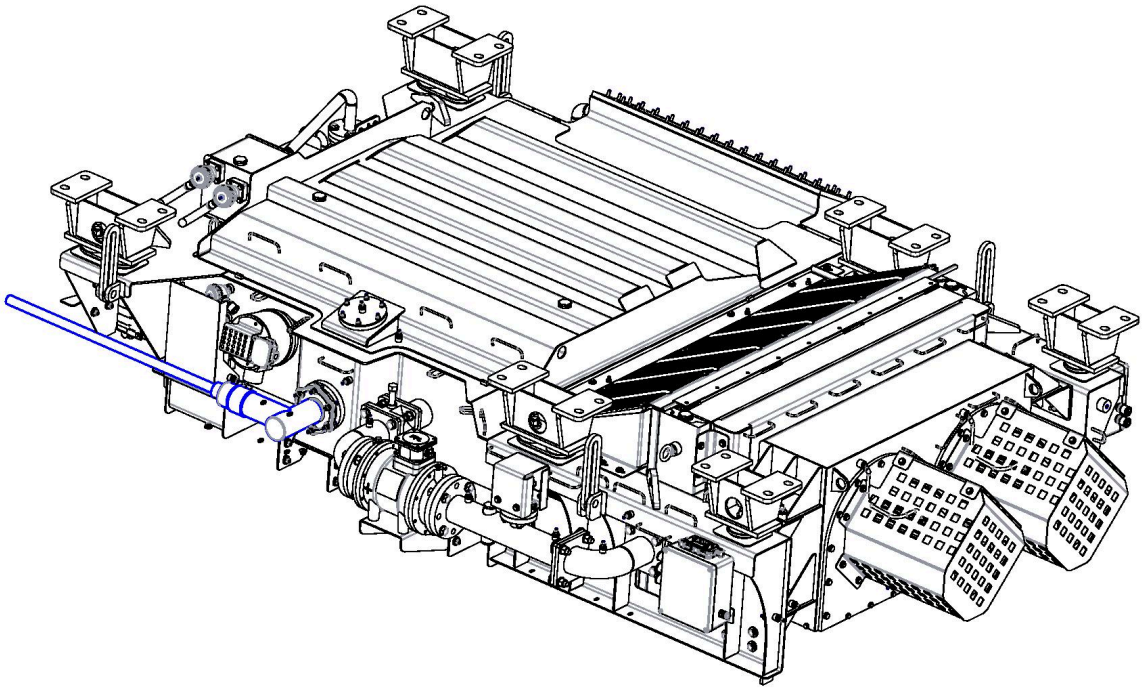
Note: *See "oil - partial draining and filling" procedure.*

11 Check oil level.
If necessary fill the Transformer with oil.

Note: *See "oil - partial draining and filling" procedure.*

HV bushing - Replacement

Number and category	Tools	Activity time
		 1.5 + Partial draining/filling



BUSTEL010.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
HV Bushing 36kV	1	1067989R000	
HV bushing O-ring gasket	1	1075893R000	
HV access hatch O-ring gasket	1	1075890R000	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

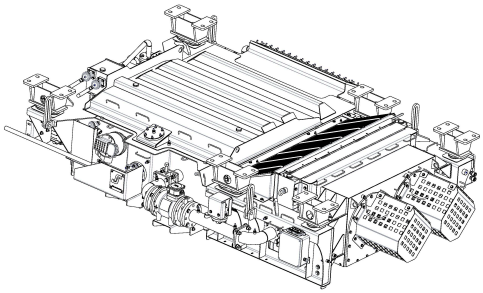
⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

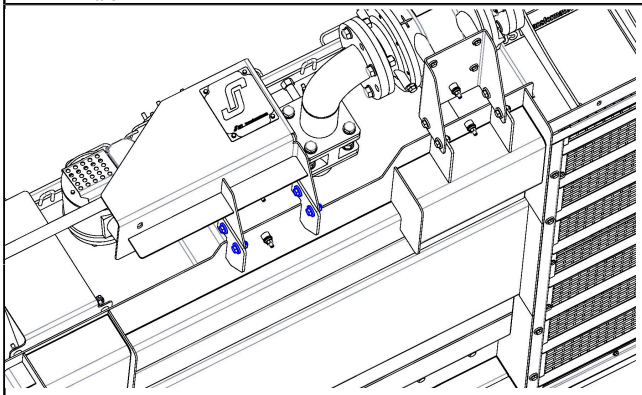
HV bushing - Replacement



TFOTEL001.jpg

1 Perform a complete draining.

Note: *See "Oil - complete draining and filling" procedure.*



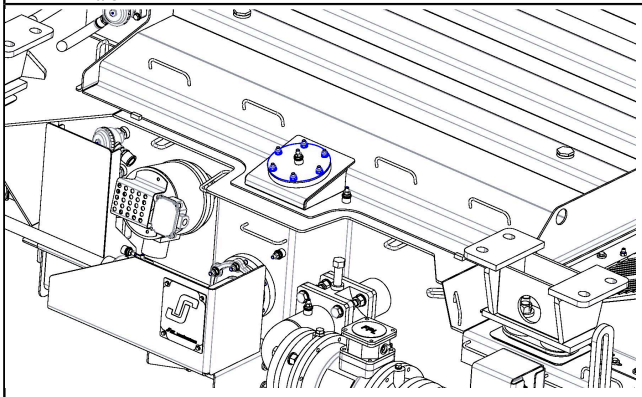
BUSTEL018.jpg

2 Unscrew the HV bushing protection

19

Screws HM10x30 A4-80
Washers LE10 A4
Nuts M10 A4-80

3 Remove the T-connector following the MEDHA instructions.



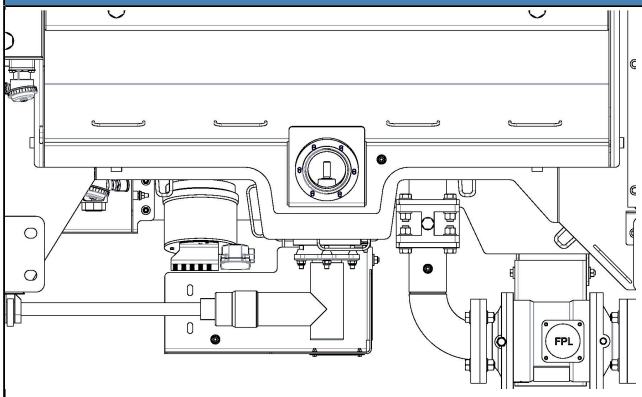
BUSTEL016.jpg

4 Remove HV access hatch by unscrewing the 6x nuts and the earthing nut.

13

Nuts Nylstop M8 A4-80
Washers M8 A4

HV bushing - Replacement



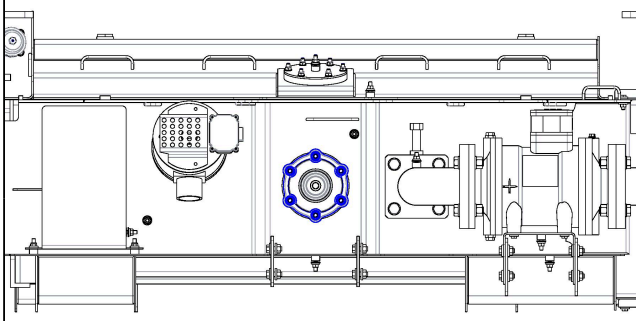
BUSTEL017.jpg

5 Unscrew internal cable from the bushing.

24

Note: *Don't leave anything fall inside the Transformer.*

Nuts HM16 Brass



BUSTEL019.jpg

6 Remove HV bushing by removing the 6x nuts.

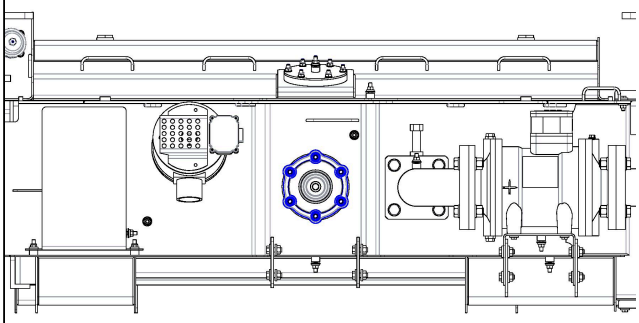
17

Nuts Nylstop M10 A4-80
Washers M10 A4

7 Remove old O-ring gasket(s).
Degrease gasket surface.
Clean gasket surface (remove old glue parts).

Note: *Do not use a metallic tool and take care at the gasket groove . Do not insert pollution inside pipes/holes (obstruct holes if necessary).*

8 Install a new gasket and a new HV bushing.

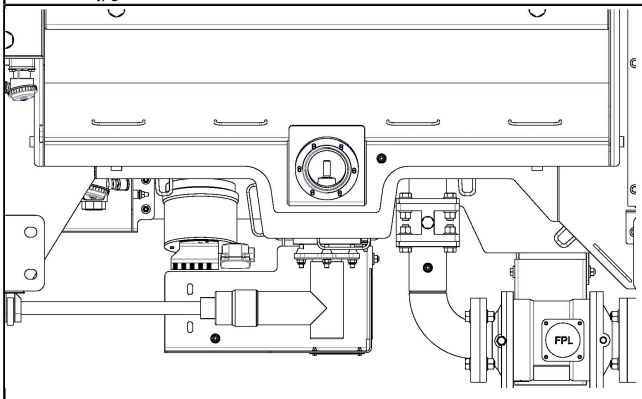


BUSTEL019.jpg

9 Screw back the 6x nuts to fix the HV bushing.

17 **34N.m**

Nuts Nylstop M10 A4-80
Washers M10 A4



BUSTEL017.jpg

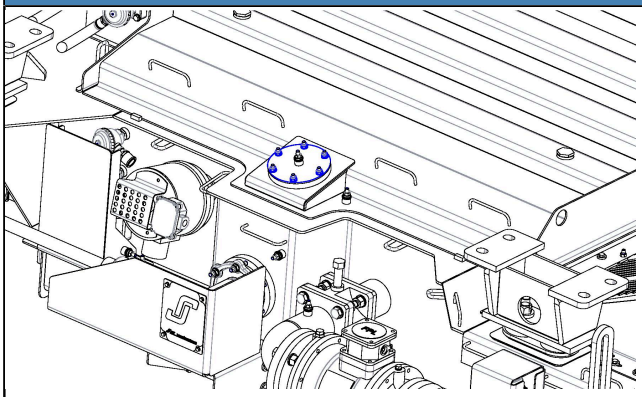
10 Screw internal cable on the Bushing.

24 **50N.m**

Note: *Don't leave anything fall inside the Transformer.*

Nuts HM16 Brass

HV bushing - Replacement



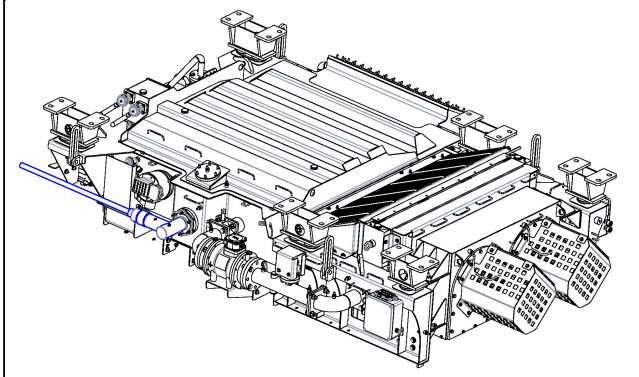
BUSTEL016.jpg

11 Install a new gasket on the HV access hatch and screw back the 6x nuts.

13 **16N.m**

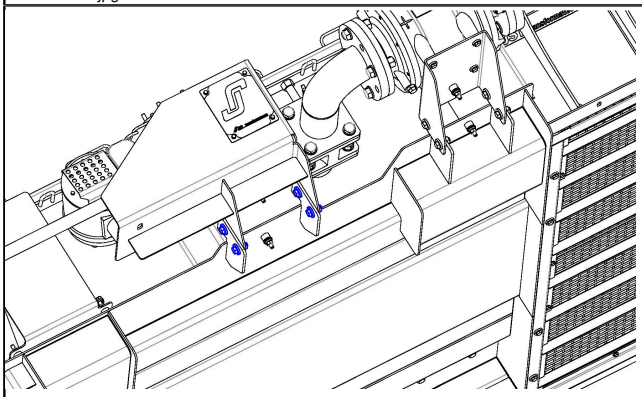
Note: *Gasket : 1075890R000*

Nuts Nylstop M8 A4-80
Washers M8 A4



BUSTEL010.jpg

12 Install back the T-connector on the HV plug following the MEDHA instructions.

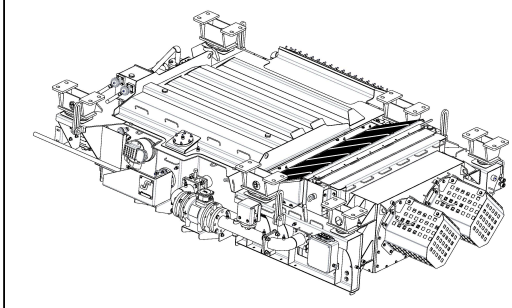


BUSTEL018.jpg

13 Screw back the T-connector cover.

19 **60N.m**

Screws HM10x30 A4-80
Washers LE10 A4
Nuts M10 A4-80



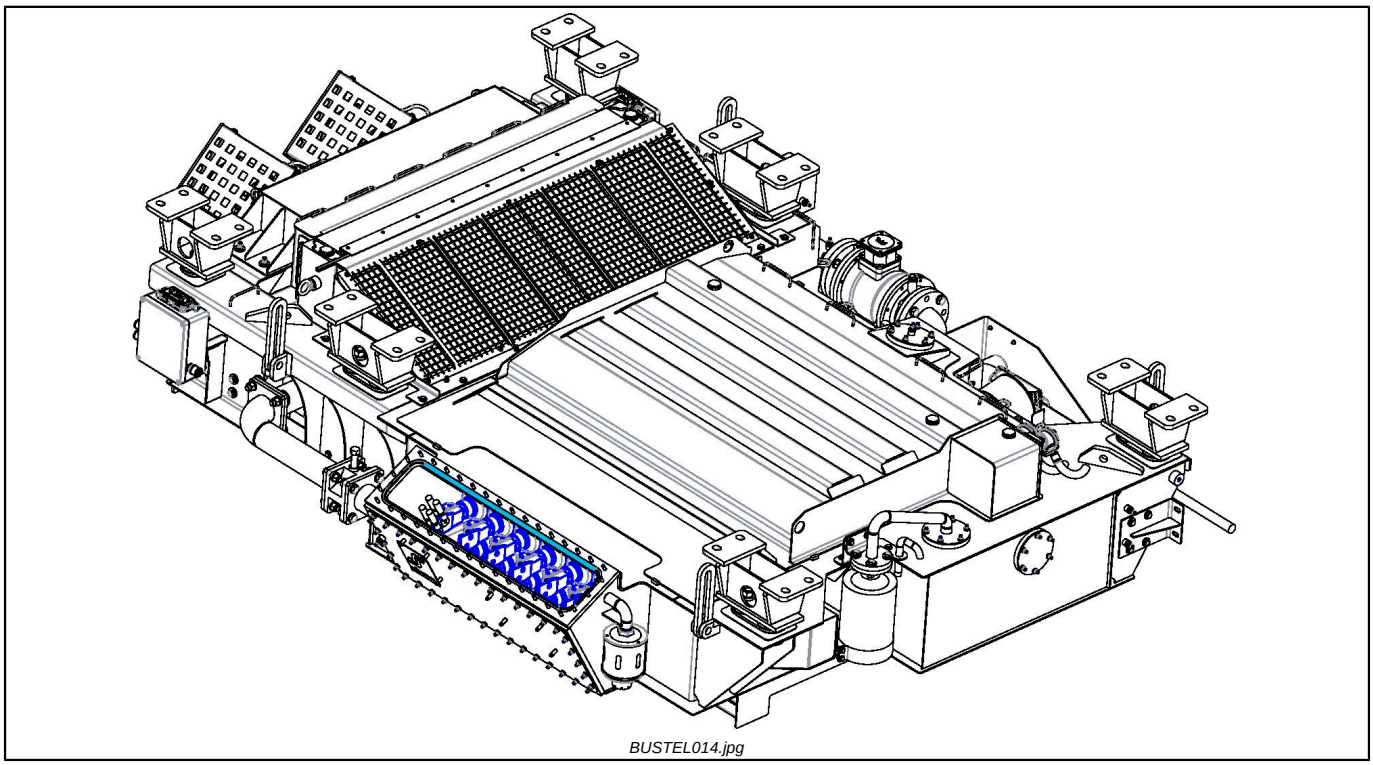
TFOTEL001.jpg

14 Fill the Transformer with oil.

Note: *See "Oil - complete draining and filling" procedure*

LV bushing - Gasket replacement

Number and category	Tools	Activity time
		 1.5 + complete draining/filling



BUSTEL014.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
LV Bushing first gasket	1	1075801R000	
LV Bushing second gasket	1	1075802R000	
LV Bushing third gasket	1	1075803R000	
LV Bushing fourth gasket	1	1075804R000	

Consumables needed for operation

Designation
Grease Magnalube-G

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

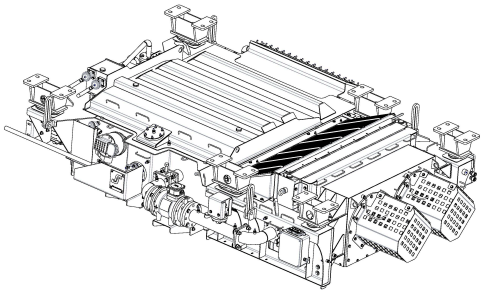
⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

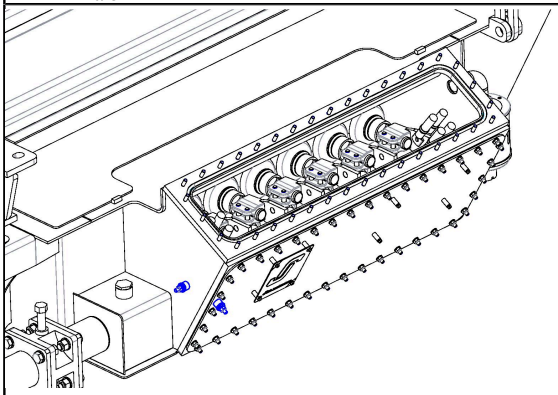
LV bushing - Gasket replacement



TFOTEL001.jpg

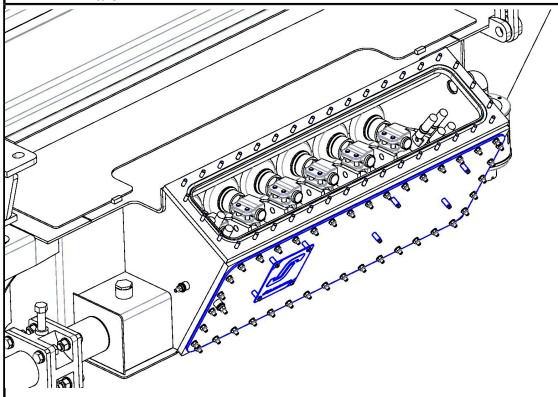
1 Proceed to a complete draining of the Transformer.

Note: *See "Oil - complete draining and filling" procedure.*



BUSTEL021.jpg

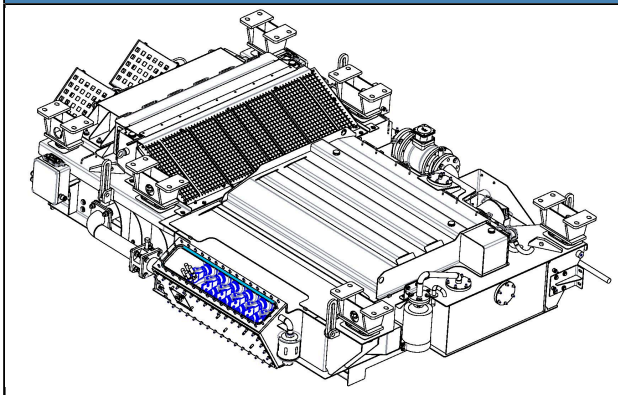
2 Disconnect the earthing straps between the LV bushing box and its cover.



BUSTEL022.jpg

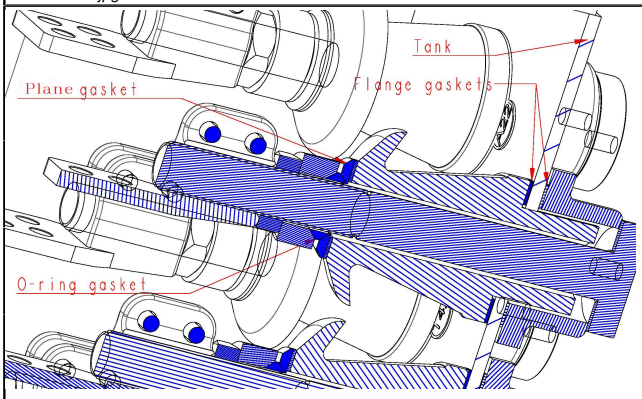
3 Open the LV bushing box front cover.

LV bushing - Gasket replacement



BUSTEL020.jpg

4 Disconnect the cables from the metalic electrical connection and remove the cable gland plate, if necessary.



BUSMED019.jpg

5 Dismount the bushing as showed on the picture.

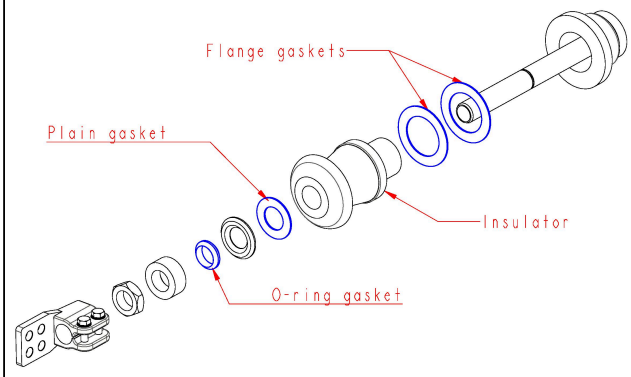
Note: *The bushings rods must not be rotated during the entire operation.*

6 Replace the first (o-ring) and second (plain) gasket.

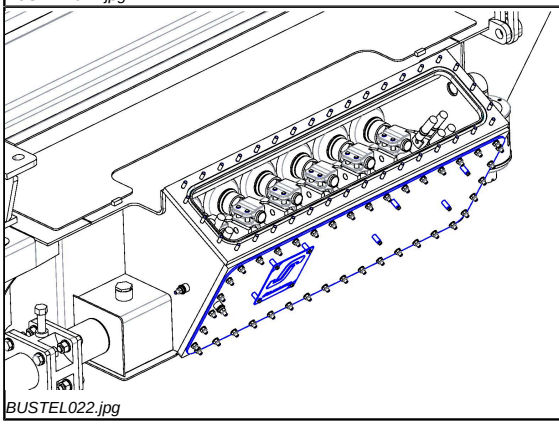
7 Screw back the bushing. Check that the bushing rod do not rotate during the operation.

8 Screw back the metalic electrical connection on its initial angular position. Check that the bushing rod did not rotated during the operation.

Note: *Angular orientation of the electrical connection must be done carefully. Dielectric distance must be respected. Important electrical issues may occur if the dielectric distance in not respected between the connections and the protection box.*



BUSMED021.jpg



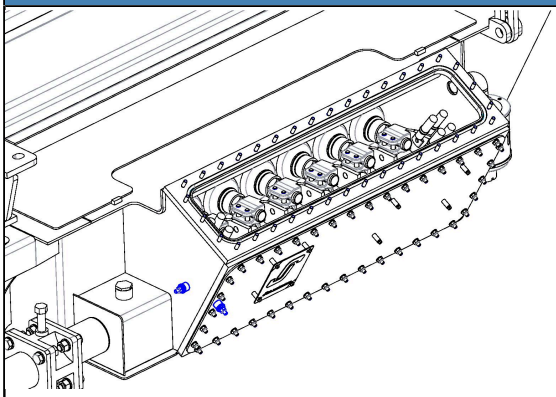
BUSTEL022.jpg

9 Close the LV box cover without damaging the air sealing gaskets.

13
16N.m

Nuts Nylstop M8 A4-80
Washers M8 A4

LV bushing - Gasket replacement

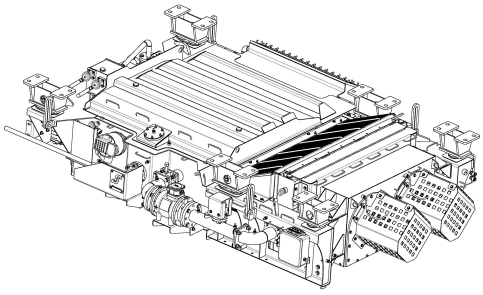


BUSTEL021.jpg

10 Screw back the earthing straps of the LV bushings box cover.

13 **10N.m**

Nut HM8 A4-80
Washers L8 A4
Washers TREP 3L8 A4



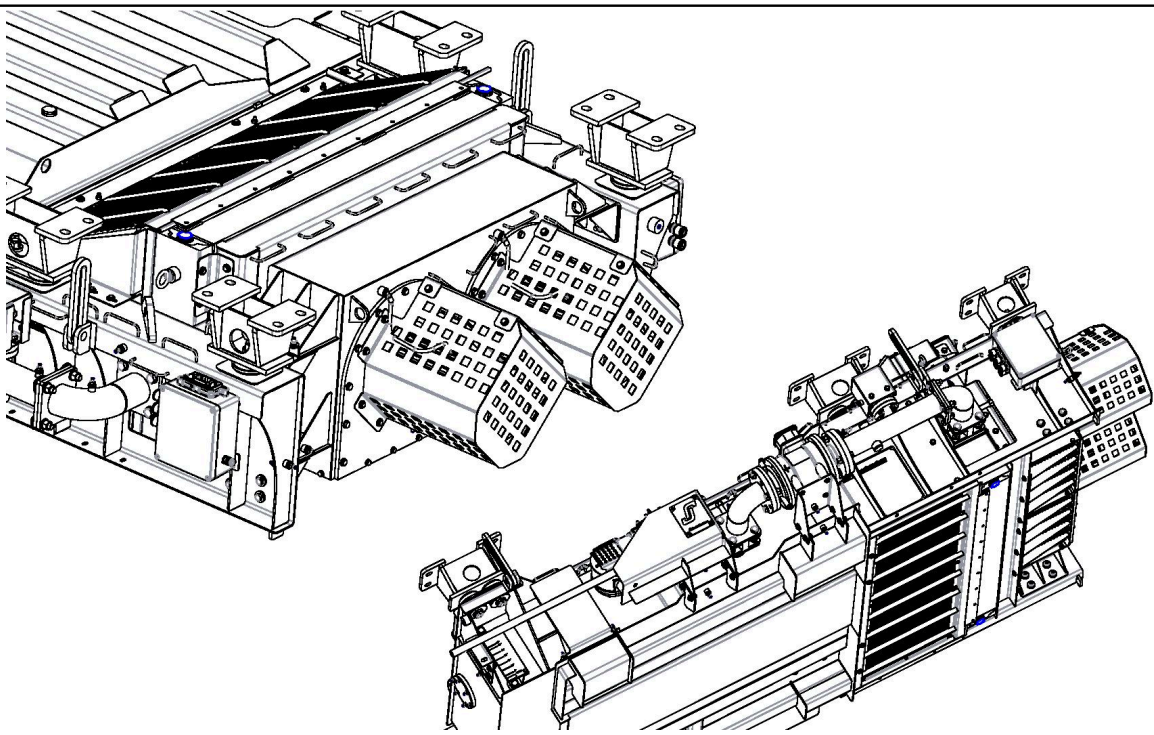
TFOTEL001.jpg

11 Fill the Transformer with oil.

Note: *See "Oil - complete draining and filling" procedure*

Radiator - Radiator replacement

Number and category	Tools	Activity time
		2 + Radiator Draining/Filling



CGSTEL014.jpg

Spare parts needed for operation			
Designation	Qty	JST Art. Num.	Customer Art. Num.
Radiator	1	1075369R005	
Radiator O-ring gasket	2	1075890R000	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

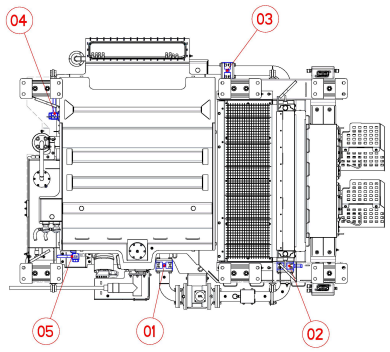
All inside surfaces of pipes should be covered against air pollution during long maintenance operations

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

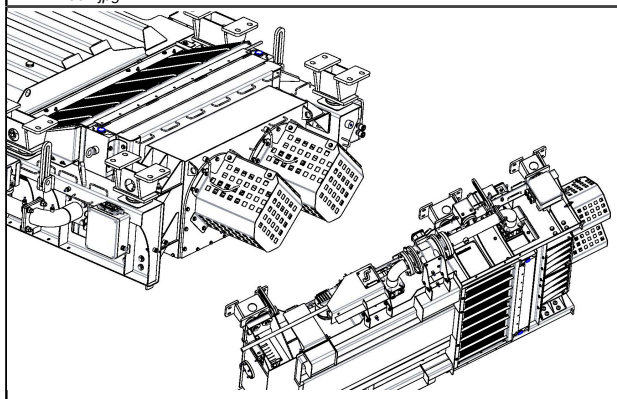
Radiator weight is 130kg (without oil/with the filter).

Radiator - Radiator replacement



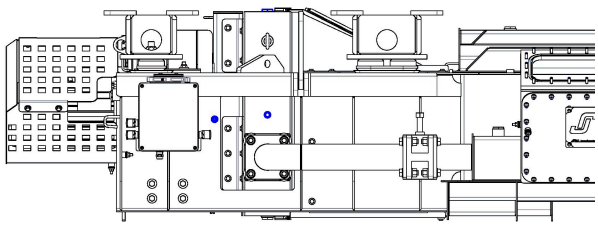
BFVTEL001.jpg

1 Close valves (2) and (3).



CGSTEL014.jpg

2 Open Radiators venting plugs.
Open the drain plug under the Radiator to change and drain oil.

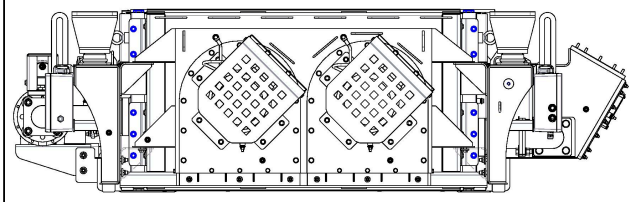


CGSTEL015.jpg

3 Disconnect the Earth strap between the radiator and the frame

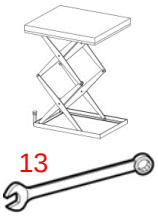
Screws HM8x20 A4-80
Washers TREP 3L8 A4
Washers L8 A4

Radiator - Radiator replacement

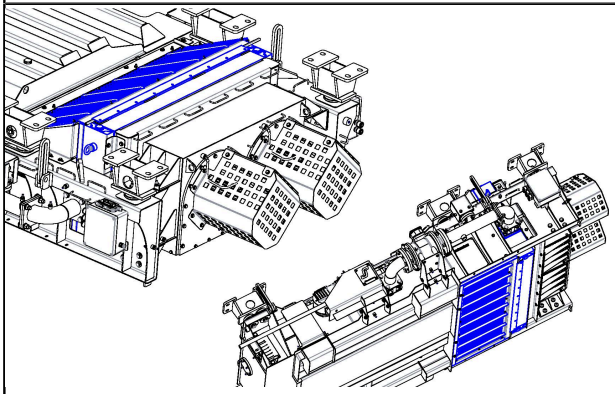


CGSTEL016.jpg

4 Put an elevating table under the radiator.
Unscrew the 2x5 screws on each side of the radiator which fix the radiator to its supports.



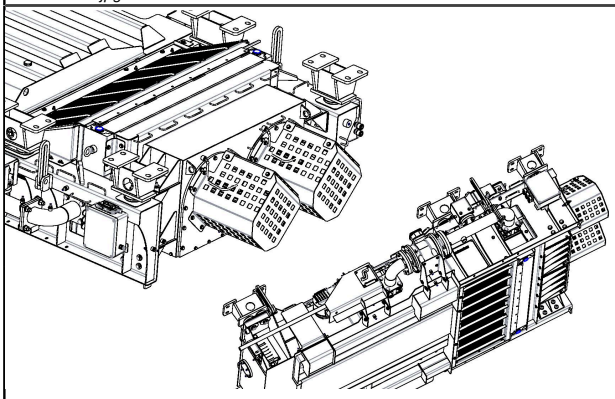
Screws HM8x30 A4-80
Washers LE8 A4



CGSTEL012.jpg

5 Remove the top and bottom radiator grid.

Screws HM8x30 A4-80
Washers LE8 A4



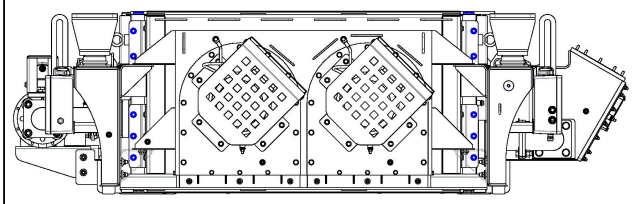
CGSTEL014.jpg

6 Unscrew the radiator from the cooling pipes flanges on both sides.

Screws HM16x45 A4-80
Washers M16 A4

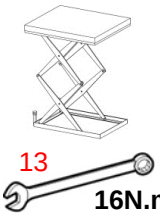
7 Install new O-ring gaskets between Coolers / Inlet pipes and between Coolers / Outlet pipes.

Note: *O-ring gasket : 1075890R000*



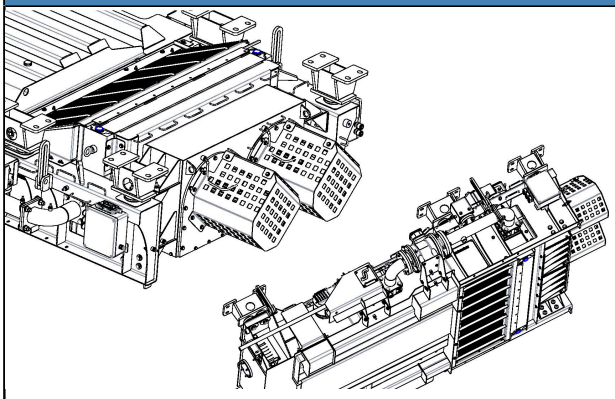
CGSTEL016.jpg

8 Install carefully a new Radiator
Screw it on the supports.



Note: *Make sure the Cooler if centered and the foam gasket well compressed. If it not correctly installed, adjust the position of the cooler supports.*

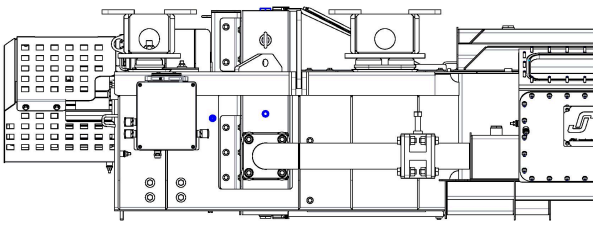
Radiator - Radiator replacement



CGSTEL014.jpg

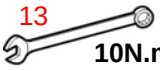
9 Screw back the cooler to the cooling pipes flanges.

Screws HM16-45 A4-80
Washers M16 A4

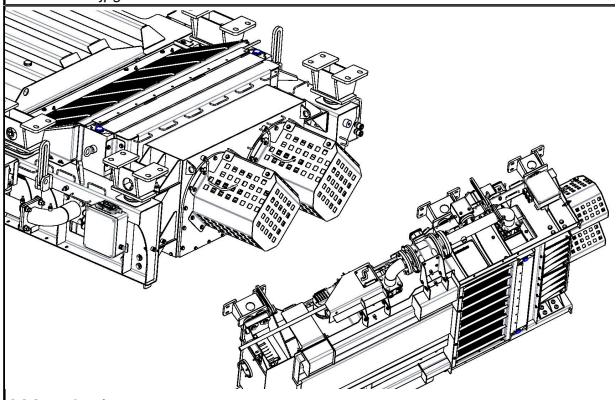


CGSTEL015.jpg

10 Screw back the Earth strap between the radiator and the frame

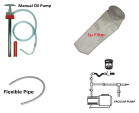


Screws HM8x20 A4-80
Washers TREP 3L8 A4
Washers L8 A4



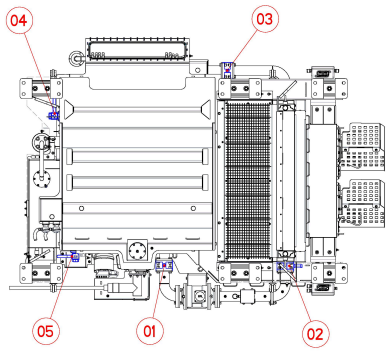
CGSTEL014.jpg

11 Fill the Cooler through air vent hole by using a Jerrycan or an equivalent tool.
The Jerrycan has to be filled by the Oil pump and through the Filter 1µ.



Note: *If the oil inside tank is the oil of the Transformer drained just before and if this oil is outside the Transformer from less than 6 hours, then, this oil can be used without treatment before filling. In the opposite case the oil should be treated.*

Radiator - Radiator replacement

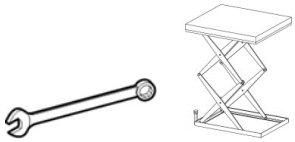


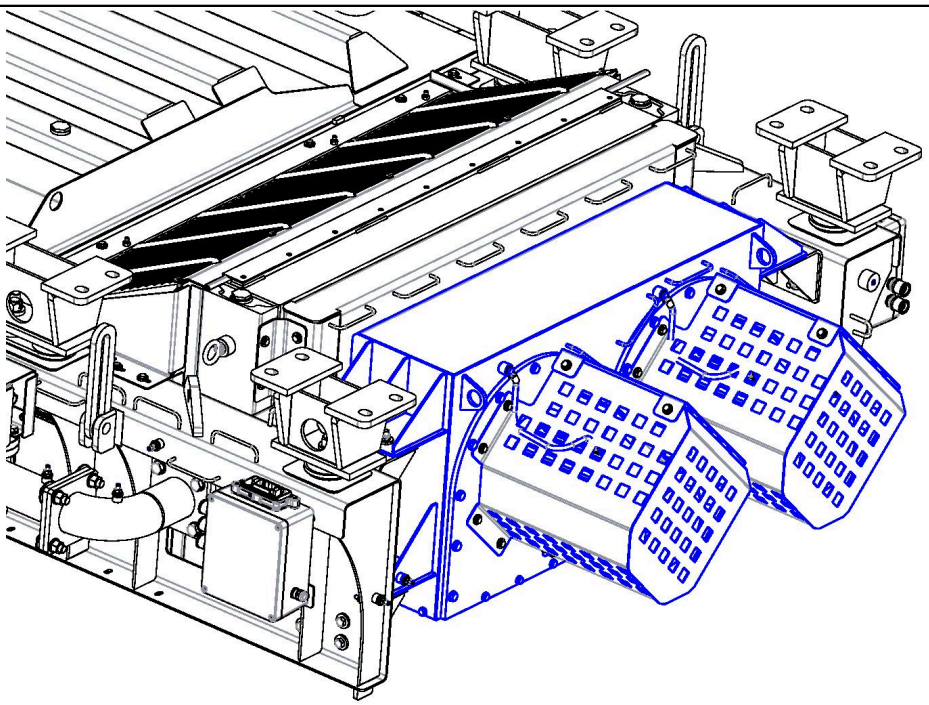
BFVTEL001.jpg

12 Open valves (2) and (3).

13 Follow the "Complete draining and filling procedure" to purge, adjust oil level and perform final operation.

Cooling system - Cooling box replacement

Number and category	Tools	Activity time
		



CGSTEL011.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Motor fan group		1075369R010	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

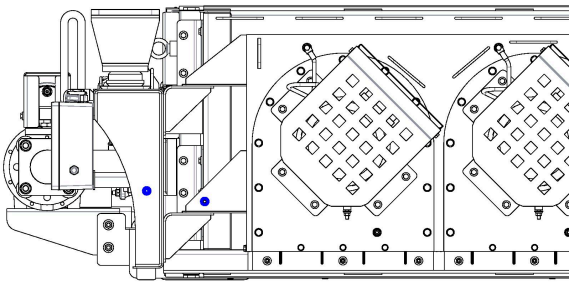
⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

All inside surfaces of pipes should be covered against air pollution during long maintenance operations

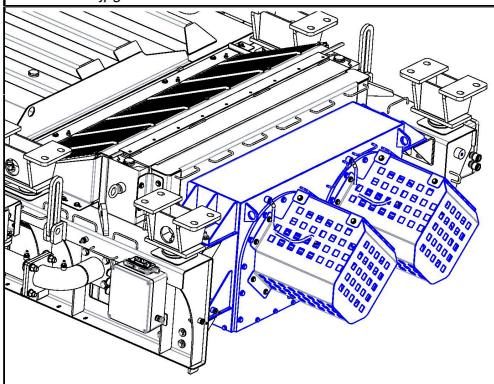
Total motor-fan weight is 212kg.

Cooling system - Cooling box replacement



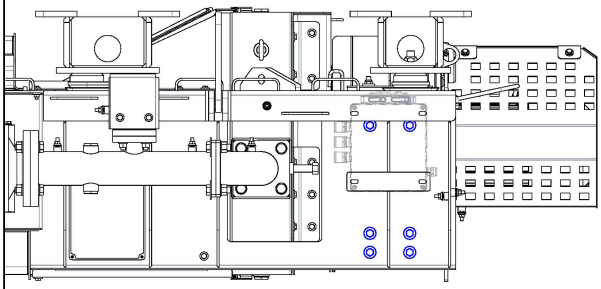
CGSTEL018.jpg

1. Disconnect the Earth strap between the cooling box and the frame.



CGSTEL011.jpg

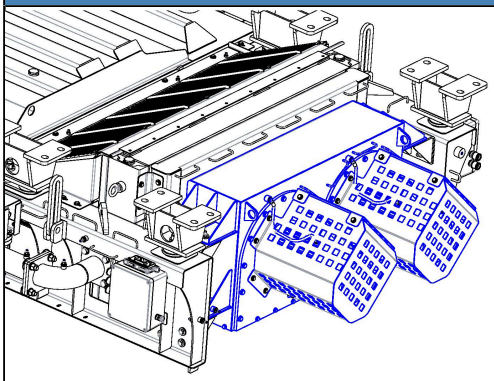
2. Disconnect the cables between the motor terminals and the power junction box.
3. Put an elevating table under the cooling box.



CGSTEL019.jpg

4. Unscrew the 4 cooling system supports from the frame and move the cooling box down.

Cooling system - Cooling box replacement



CGSTEL011.jpg

5 Unscrew the cooling box from the cooling system supports.

19

6 Screw the new cooling box to the cooling system supports.

19 **60N.m**

Screws HM12x35 A4-80
Washers LE12 A4

7 Install the Motor protections on the new cooling system.

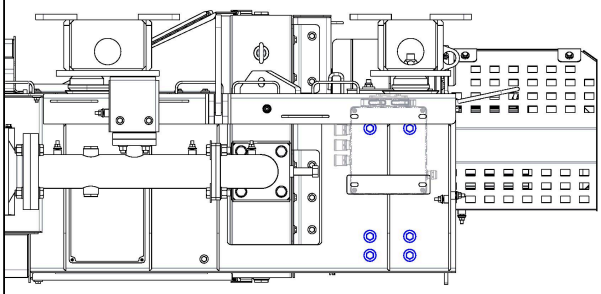
13 **16N.m**

Screws HM8x30 A4-80
Washers LE8 A4

8 Connect the earthing straps between the motor protections and the cooling system.

13 **10N.m**

Nuts HM8 A4-80
Washers TREP 3L8 A4
Washers L8 A4

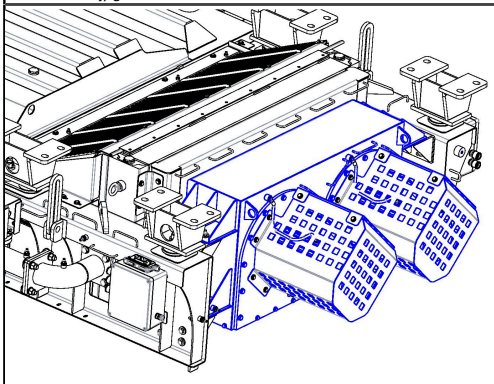


CGSTEL019.jpg

9 Install the new cooling box. Screw the cooling system supports to the frame.

19 **60N.m**

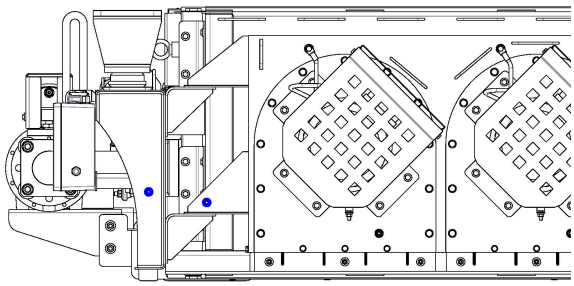
Screws HM12x40 A4-80
Washers LE12 A4
Nuts Nylstop M12 A4-80



CGSTEL011.jpg

10 Connect the motor cables to the power junction box.

Cooling system - Cooling box replacement



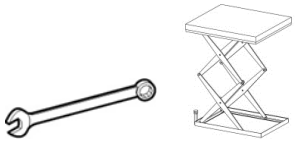
CGSTEL018.jpg

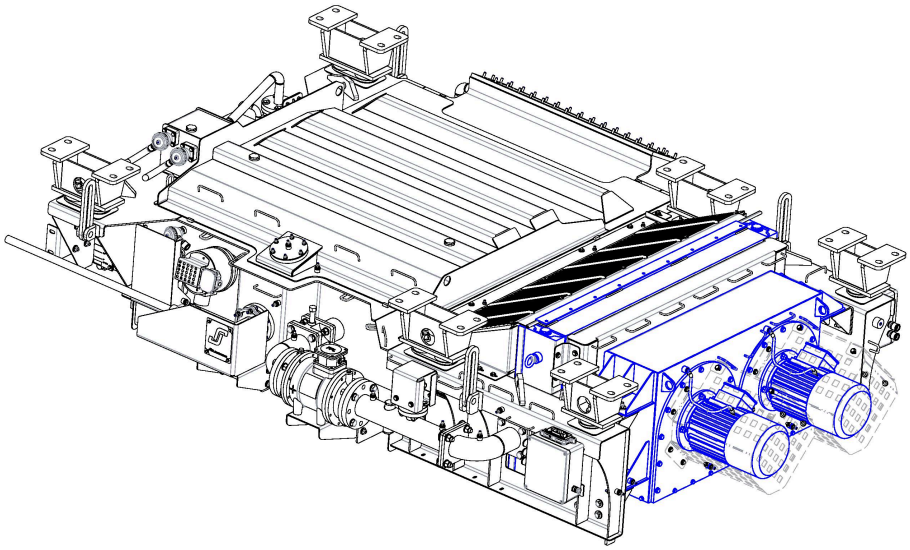
11 Reconnect the Earth strap between the cooling box and the frame.

13
10N.m

Nuts HM8 A4-80
Washers TREP 3L8 A4
Washers L8 A4

Cooling system - Motor replacement

Number and category	Tools	Activity time
		



CGSTEL001.jpg

Spare parts needed for operation			
Designation	Qty	JST Art. Num.	Customer Art. Num.
Motor	1	1075369R001	

DANGER

Dangerous voltage 25 000 V

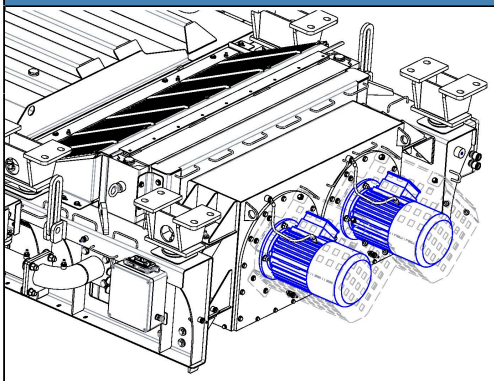
Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

WARNING

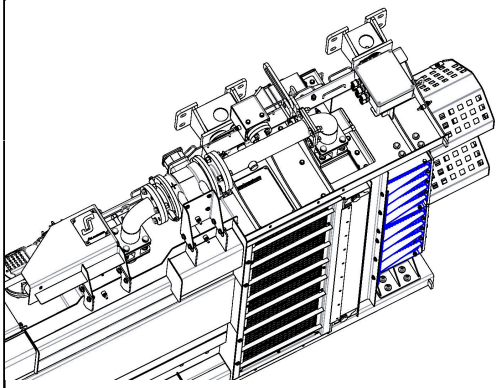
Motor weight only is approx. 30kg.

Cooling system - Motor replacement



CGSTEL010.jpg

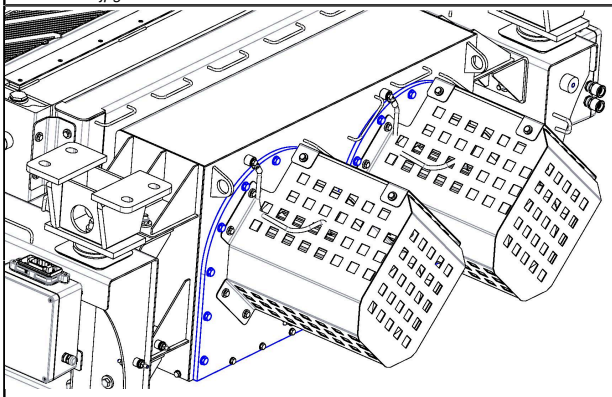
1. Disconnect the cables between the motor terminal and the power junction box
2. Disconnect the earthing cable of the motor.



CGSTEL013.jpg

3. Remove the grid under the corresponding motor.

4. Install an elevating table under the motor flange to support it.



CGSTEL020.jpg

5. Unscrew the main motor flange and remove the motor-fan downside carefully.

Note: *Be careful with the balance due to the motor weight*

6. Dismount the fan from the motor axis.

Note: *Follow the cooling system maintenance manual : ref. 2-21-671-SR . This document is available in appendix.*

7. Remove the motor protection earthing strap.

8. Remove the motor protection.

9. Separate the motor from its flange.

Note: *Follow the cooling system maintenance manual : ref. 2-21-671-SR . This document is available in appendix.*

Cooling system - Motor replacement

10 Install the new motor and screw it on the main plate.

Note: *Follow the cooling system maintenance manual : ref. 2-21-671-SR. This document is available in appendix.*

11 Install the motor protection

13 **16N.m**

Screws HM8x30 A4-80
Washers LE8 A4

12 Install the motor protection earthing strap.

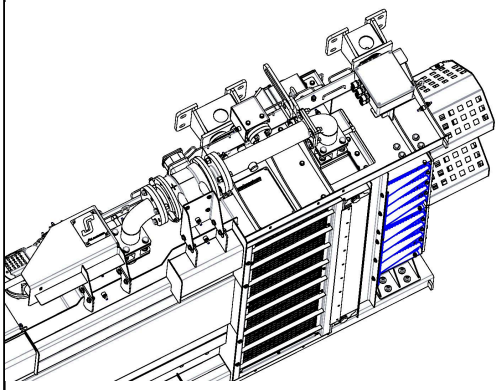
13 **10N.m**

Nuts HM8 A4-80
Washers TREP 3L8 A4
Wahers L8 A4

13 Mount back the fan on the new motor axis.

14 Install back the main plate with the motor and the fan.

Screws HM10x30 A4-80
Washers M10 A4

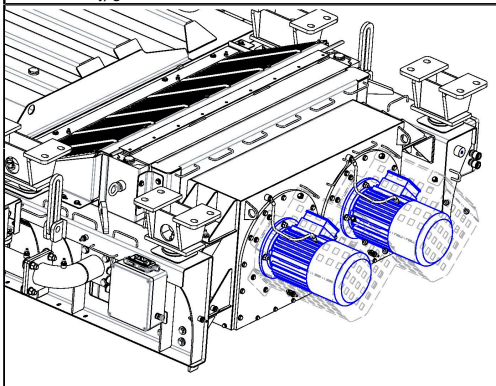


CGSTEL013.jpg

15 Install back the grid under the motor.

13 **16N.m**

Screws HM8x30 A4-80
Screws HM8x35 A4-80
Washers M8 A4
Washers LE8 A4
Nuts HM8 A4-80



CGSTEL010.jpg

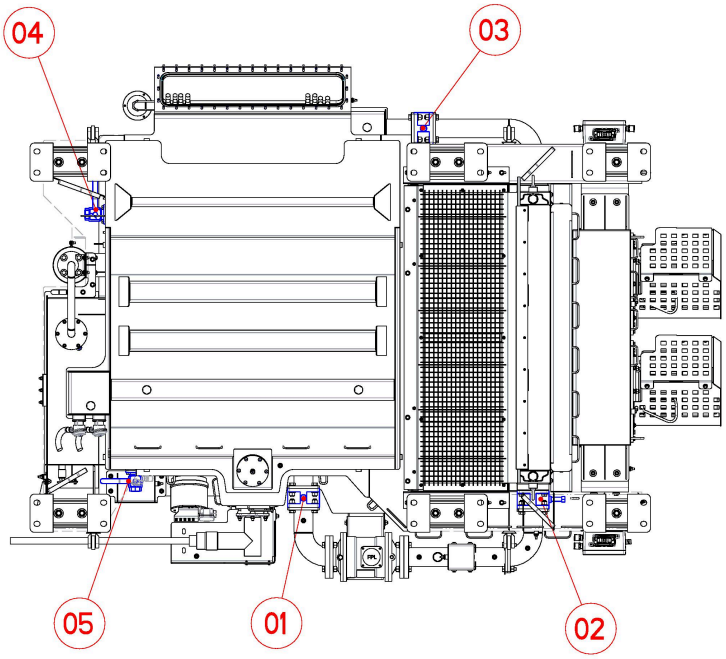
16 Connect the earthing cable of the motor.

13 **10N.m**

17 Connect the cables between the motor terminal and the power junction box.

Draining and filling Valves - Replacement

Number and category	Tools	Activity time
		 0.5 + Complete draining and filling



BFVTEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Filling/Draining Valve	1	1075613R000	
Filling/Draining Valve gasket	1	1075891R000	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

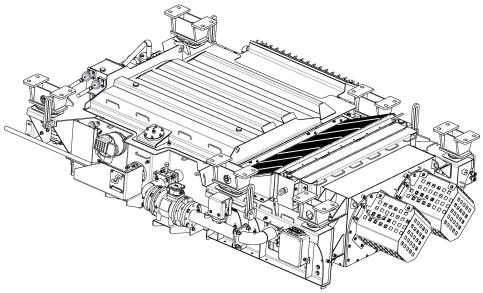
⚠WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

Draining and filling Valves - Replacement

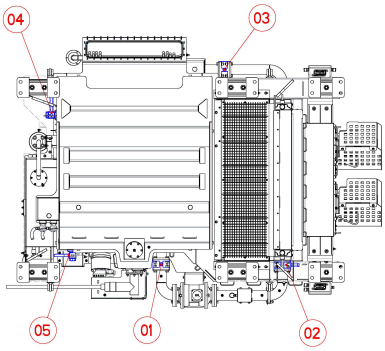


TFOTEL001.jpg

1 Perform a complete draining.

Note: *See Complete draining procedure*

2 Unscrew the cover of valve (4) or (5)



BFVTEL001.jpg

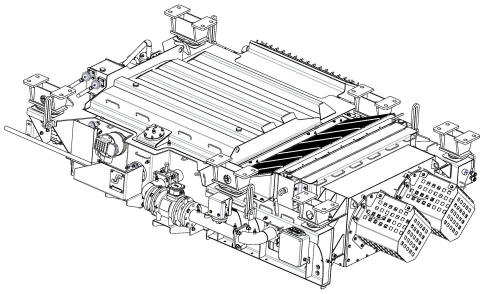
3 Unscrew the valve (4) or (5)

4 Replace the gasket and screw back the new valve.

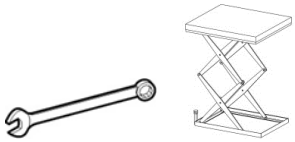
Screws HM10x30 A4-80
Washers M12 A4

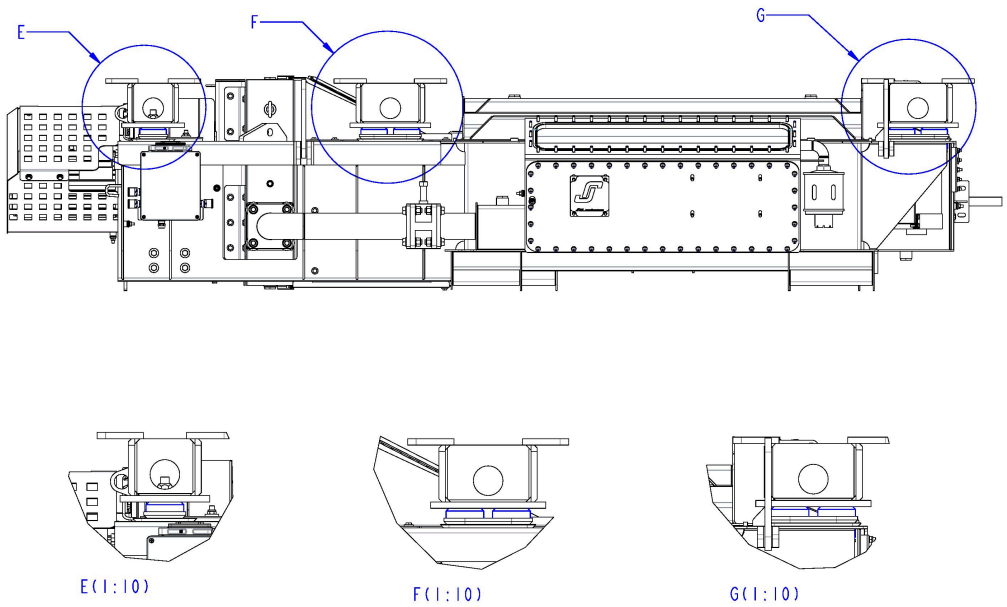
5 Screw back the valve cover.

Nuts Nylstop M8 A4-80
Washers LE8 A4

Draining and filling Valves - Replacement	
 TFOTEL001.jpg	6 Perform a complete filling of the tank. ***Note:*** *See Complete filling procedure*

Damper - Replacement

Number and category	Tools	Activity time
		



DMPTEL001.jpg

Spare parts needed for operation

Designation	Qty	JST Art. Num.	Customer Art. Num.
Damper ref. 1	8	1075615R000	
Damper ref. 2	2	1075616R000	

DANGER

Dangerous voltage 25 000 V

Contact with high voltage components can cause serious personal injury or death

- Position of the vehicle shall be located in a "dead" zone with no catenary voltage
- Ensure that the shore supply is not connected to the workshop power input
- Verify that there is no voltage left in any bushing (LV and HV) by measuring with a voltmeter

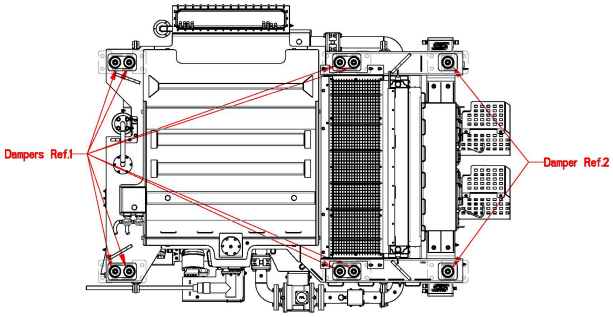
WARNING

Before a complete filling, oil has to be heated at 50°C at least.
During an intervention requiring a partial oil draining operation not exceeding 6 hours, treatment of oil is not necessary.
If intervention time exceeds 6 hours or if oil is polluted, treatment of oil is necessary.

System may be under pressure
Skin irritations and damage to eyes from escaping fluids

- Switch off the cooling unit.
- Relieve pressure from the system before disconnecting the hoses for cleaning and maintenance.
- Wear protective gloves and protective goggles.

Damper - Replacement

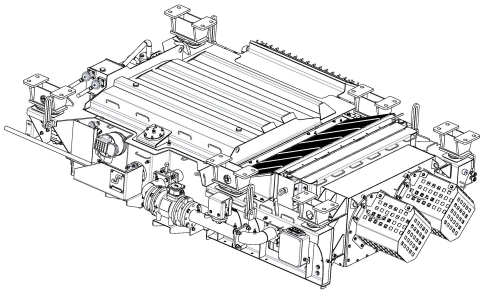


DMPTEL010.jpg

1 Localize the damper that need to be changed and prepare the right damper reference.

Note: *ATTENTION : If the wrong reference if mounted, it can cause serious damage during the functionning.*

0

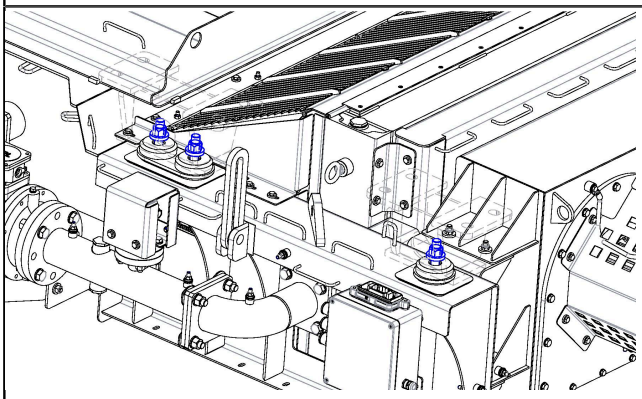


TFOTEL001.jpg

2 If the transformer cannot be dismantled from the train, an elevating table (or equivalent) must be placed under the transformer to support the entire transformer mass. The next steps can be applied on each of the 6 dampers boxes.

Note: *0*

0



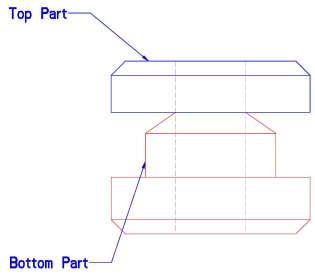
DMPTEL011.jpg

3 Unscrew the damper screw.
Preserve the 5mm thick round plate that is between the screw/washer and the bottom part of the damper.

Note: *Use the holes in the damper boxes to place the screwing tool on the nuts.*

0

Damper - Replacement



DMPTEL012.jpg

4 Remove the bottom part of the damper and then the top part (H-mount type).
If there is 1 or more 1mm thick plate between the top part of the damper and the damper box, preserve it.

17

Note: *0*

0

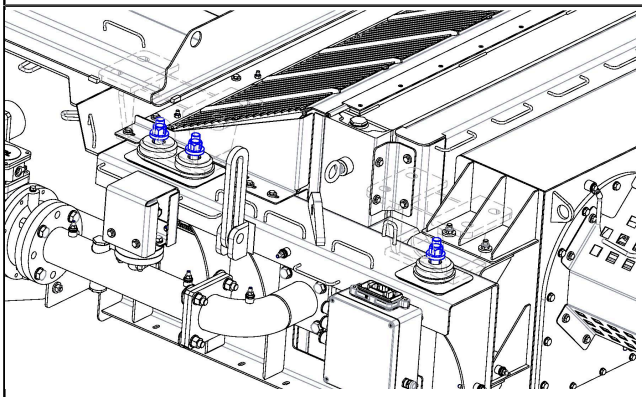
0.jpg

5 Install the new damper without damaging the rubber part. Use the same number of 1mm thick plate found on the previous step. There might not be any.

17

Note: *Take care to mount the right reference on the right place.*

0



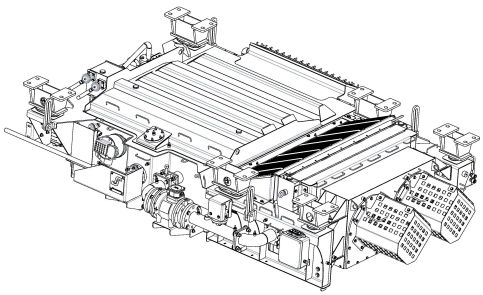
DMPTEL011.jpg

6 Place the 5mm thick damper washer under the damper and screw the assembly.

30 **130N.m**

Note: *0*

Screws HM20x150 A4-80
Washers LE20 A4
Nuts Nylstop M20 A4-80



TFOTEL001.jpg

7 Put aside the elevating table slowly.

17

Note: *0*

0

10. Spare Parts List

Item	Designation	Qty	JST Art. Num.
Air dryer	Brown Silicagel - 800g	0,8kg	1017087R000
	Air dryer with flange gasket	1	1075890R000
	Air dryer with flange	1	1068209R000
	Brown Silicagel - 800g	0,8kg	1017087R000
	Air dryer without flange		1068208R000
	Air dryer with flange gasket		1075890R000
Cooling system	Motor Bearing Replacement Set Non Driving End Bearing		1075369R002
	Motor Bearing Replacement Set Driving End Bearing		1075369R003
	Motor fan group		1075369R010
	Motor	1	1075369R001
Damper	Damper ref. 1	8	1075615R000
	Damper ref. 2	2	1075616R000
Damper (all)	Damper ref. 1	8	1075615R000
	Damper ref. 2	2	1075616R000
Draining and filling Valves	Filling/Draining Valve	1	1075613R000
	Filling/Draining Valve gasket	1	1075891R000
HV bushing	HV Bushing 36kV	1	1067989R000
	HV bushing O-ring gasket	1	1075893R000
	HV access hatch O-ring gasket	1	1075890R000
LV bushing	LV Bushing first gasket	1	1075801R000
	LV Bushing second gasket	1	1075802R000
	LV Bushing third gasket	1	1075803R000
	LV Bushing fourth gasket	1	1075804R000
Oil	Synthetic Ester oil		1069836R000
	Cooler vent plug gasket	4	1075898R000
	Synthetic Ester oil		1069836R000
Oil flow indicator	Oil flow indicator	1	1068817R000
	Oil flow indicator gasket	1	1075891R000
Oil level indicator	Visual Oil level indicator (gaskets included)	1	1075427R000
	Oil Level Plate with graduation	1	1075587R000
Oil level sensor	Oil level switch	1	1075758R000
	O-ring gasket (flange/sensor)	1	1075892R000
Oil pump	Oil pump-O-ring gasket	2	1075890R000
	Isolating Valve -O-ring Gasket	1	1075890R000
	Oil pump	1	1075479R000
	Oil pump-O-ring gasket	2	1075890R000
	Isolating Valve -O-ring Gasket	1	1075890R000
PT100 sensor	Temperature sensor (sensor only)	1	1075428R001
	PT100 temperature sensor (housing + gasket)	1	1075428R000
Paint	Primer INTERPLUS 356		PE5PRI-INTER356
	Hardener INTERPLUS 356		DU5PRI-INTER356
	Thinner GTA220		1038636R001
	Finish paint INTERFINE 979 RAL 9005		PE5FI-I979-9005
	Hardener INTERFINE 979		DU5FI-INTER979
	Thinner GTA007		1038640R001
Pressure relief device	Pressure Relief Device	1	1068210R000
	Pressure Relief Device-O-ring Gasket	1	1075894R000

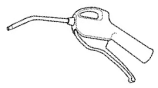
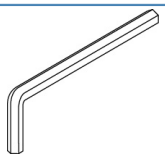
Item	Designation	Qty	JST Art. Num.
Radiator	Radiator	1	1075369R005
	Radiator O-ring gasket	2	1075890R000

11. Consumables List

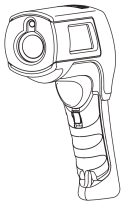
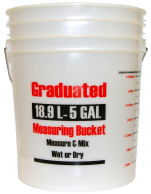
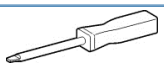
Designation
Loctite 577
Degreasing products
Clothes and cleaning equipment
Protection equipment
Stirrer for paint
Rollers
Brushes
Loctite 243
Synthetic Ester oil
Oil
Grease Magnalube-G

12. Tools List

12.1. Standard Tools List

Item	
	Air gun
	Dry air bottle with pressure regulator 50 to 200mbar
	Elevating table
	Filter 1µm
	Flexible pipe
	Funnel
	Hexagon key - size : 4mm Hexagon key - size : 5mm
	High pressure washer
	Jerrycan

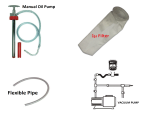
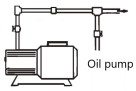
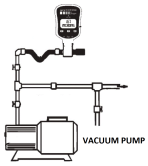
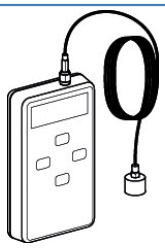
Tools List

Item	
	Laser thermometer
	Measuring bucket
	Multimeter
	Screwdriver
	Spirit level
	Tank - 1000L
	Vacuum cleaner
	Wrench - size : 10mm Wrench - size : 13mm Wrench - size : 17mm Wrench - size : 19mm Wrench - size : 24mm Wrench - size : 30mm Wrench - size : 36mm Wrench - size : 41mm Wrench - size : 46mm Wrench - size : 55mm

12.2. Special Tools List

Item		JST Art. Num.	Customer Art. Num.
	Manual pump for Draining / Filling	1074788R000	

Tools List

Item		JST Art. Num.	Customer Art. Num.
	Oil Filling/Draining tool kit (oil pump, vacuum pump, filter, flexible pipes)	1066463G000	
	Oil pump	1074789R000	
	Vaccuum Pump (treatment)	1074790R000	
	Vibration meter Ref PCE VT204	1066465R000	

13. Screw List

Screws

Screws CHC M5 A4-80
Screws CHC M6 A4-80
Screws HM10x30 A4-80
Screws HM12x35 A4-80
Screws HM12x40 A4-80
Screws HM12x60 A4-80
Screws HM16-45 A4-80
Screws HM16x40 A4-80
Screws HM16x45 A4-80
Screws HM16x60 A4-80
Screws HM20x100 A4-80
Screws HM20x150 A4-80
Screws HM20x90 A4-80
Screws HM6x18 A4-80
Screws HM6x20 A4-80
Screws HM8x20 A4-80
Screws HM8x25 A4-80
Screws HM8x30 A4-80
Screws HM8x35 A4-80

Washer

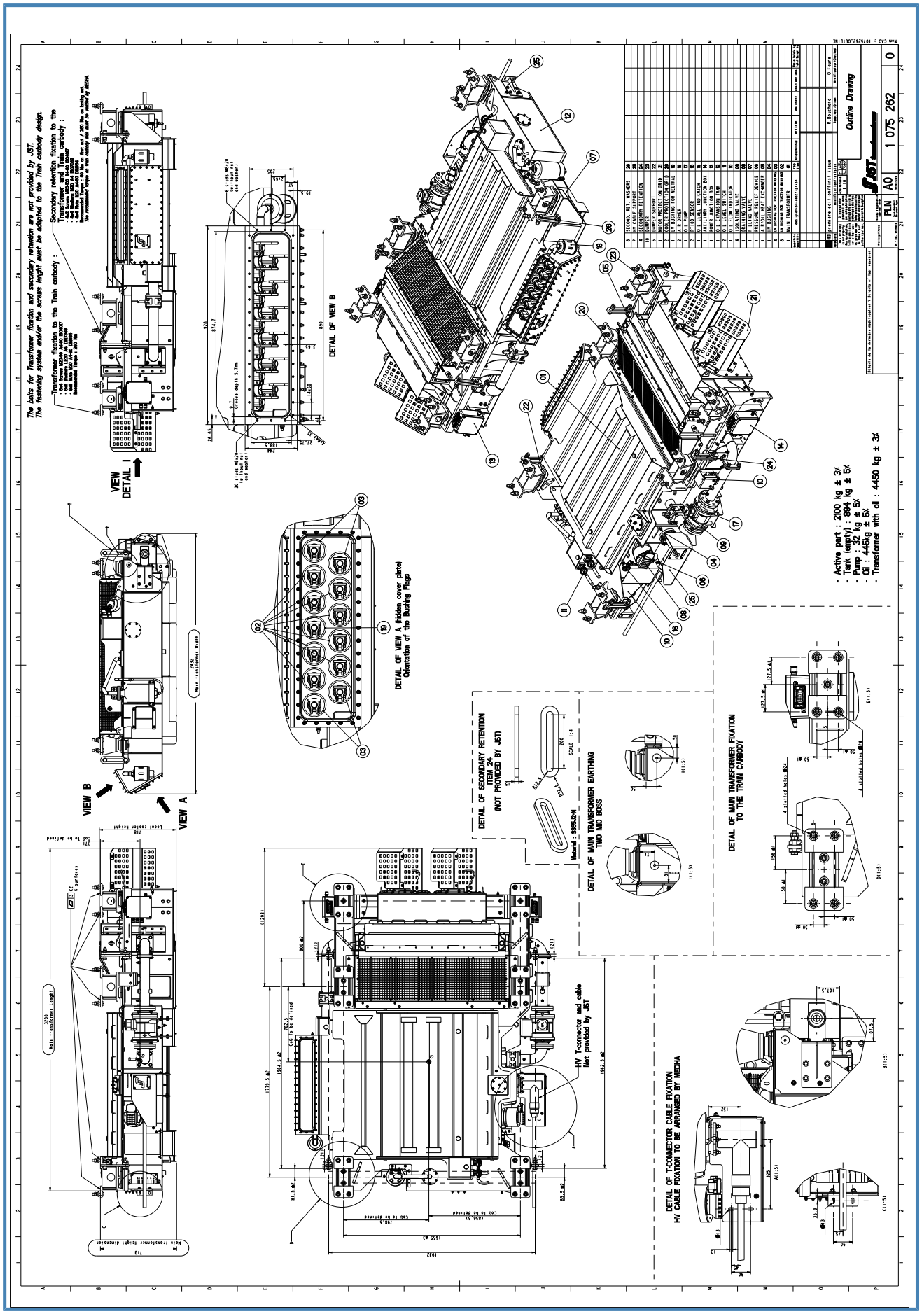
Washers L8 A4
Washers LE10 A4
Washers LE12 A4
Washers LE20 A4
Washers LE8 A4
Washers M10 A4
Washers M12 A4
Washers M16 A4
Washers M6 A4
Washers M8 A4
Washers TREP 3L8 A4
Washers W16 A4
Washers W6 A4
Washers Z5 A4
Washers Z6 A4

Nut

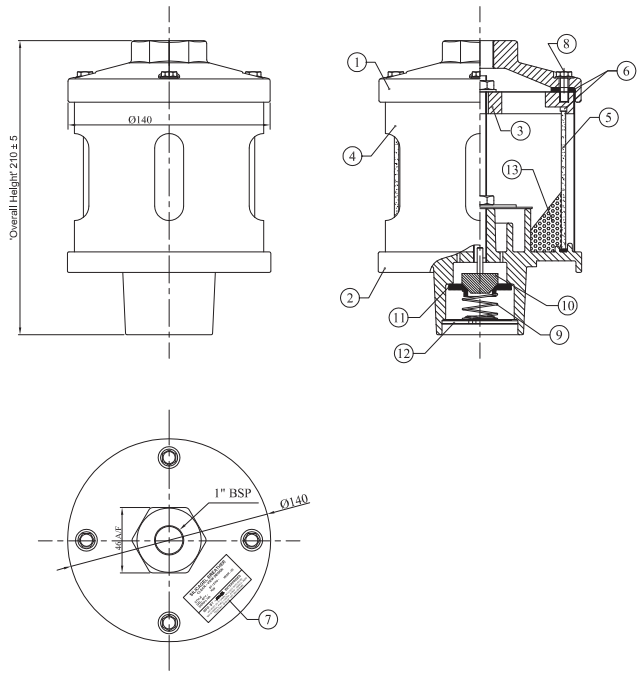
Nut HM8 A4-80
Nuts HM16 Brass
Nuts HM8 A4-80
Nuts M10 A4-80
Nuts M12 A4-80
Nuts M16 A4-80
Nuts M20 A4-80
Nuts M8 A4-80
Nuts Nylstop M10 A4-80
Nuts Nylstop M12 A4-80
Nuts Nylstop M20 A4-80
Nuts Nylstop M8 A4-80

APPENDICES - TABLE OF CONTENTS

APPENDIX 1
2D Drawing and parts list


Outline Drawing
1 075 262
A0
PLAN
0
VIEW A
VIEW B
DETAIL I
DETAIL OF VIEW B
DETAIL OF VIEW A (hidden cover plate)
Orientation of the Bushing Flags
DETAIL OF SECONDARY RETENTION
ITEM 24
(NOT PROVIDED BY JST)
DETAIL OF MAIN TRANSFORMER EARTHING
TWO M10 BOSS
DETAIL OF MAIN TRANSFORMER FIXATION
TO THE TRAIN CARBODY
HV T-connector and cable
Not provided by JST
DETAIL OF T-CONNECTOR CABLE FIXATION
HV CABLE FIXATION TO BE ARRANGED BY MEDHA
Active part : 2100 kg ± 3%
Tank (empty) : 884 kg ± 5%
Pump : 32 kg ± 5%
Oil : 445kg ± 5%
Transformer with oil : 4450 kg ± 3%

APPENDIX 3
Air dryer - LV Box



Notes:

1. Breather aluminium parts are shot blasted and powder painted to light grey.
2. Breather assembly is pressure tested at 0.35 kg/cm² for 30 minutes.
3. Top and Bottom part are sealed off for shipping.
4. Silicagel is supplied with breather. Change of Color - Orange to Green.
5. Spring Loaded Valve Arrangement : (Normally in Closed Position)
   Item No. 10 Counter Weight, lets air intake during breath-in.
   Item No. 11 Gate, lets air flow out during breath-out.

BILL OF MATERIAL

Item No.	Description	Qty.	Material
01	Top Cover	01	Aluminium Alloy
02	Bottom Cover	01	Aluminium Alloy
03	Ring for Tube Clamping	01	Aluminium Alloy
04	Gel Container Armour	01	Stainless Steel
05	Gel Container Tube Transparent	01	Polycarbonate
06	Sealing Gasket	03	Nitrile
07	Description Plate	01	Aluminium
08	Hardware	5 Set	Stainless Steel - 304
09	Spring	01	Spring Steel
10	Counter Weight	01	Nylon
11	Gate Breathing	01	Nylon
12	Air Filter Sieve	01	Stainless Steel
13	Orange Round Ball Ø3-5	1.0 Kgs.	Silicagel

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Index	Date / modification/revision	Redacteur/Drawn	Verificateur/Checked

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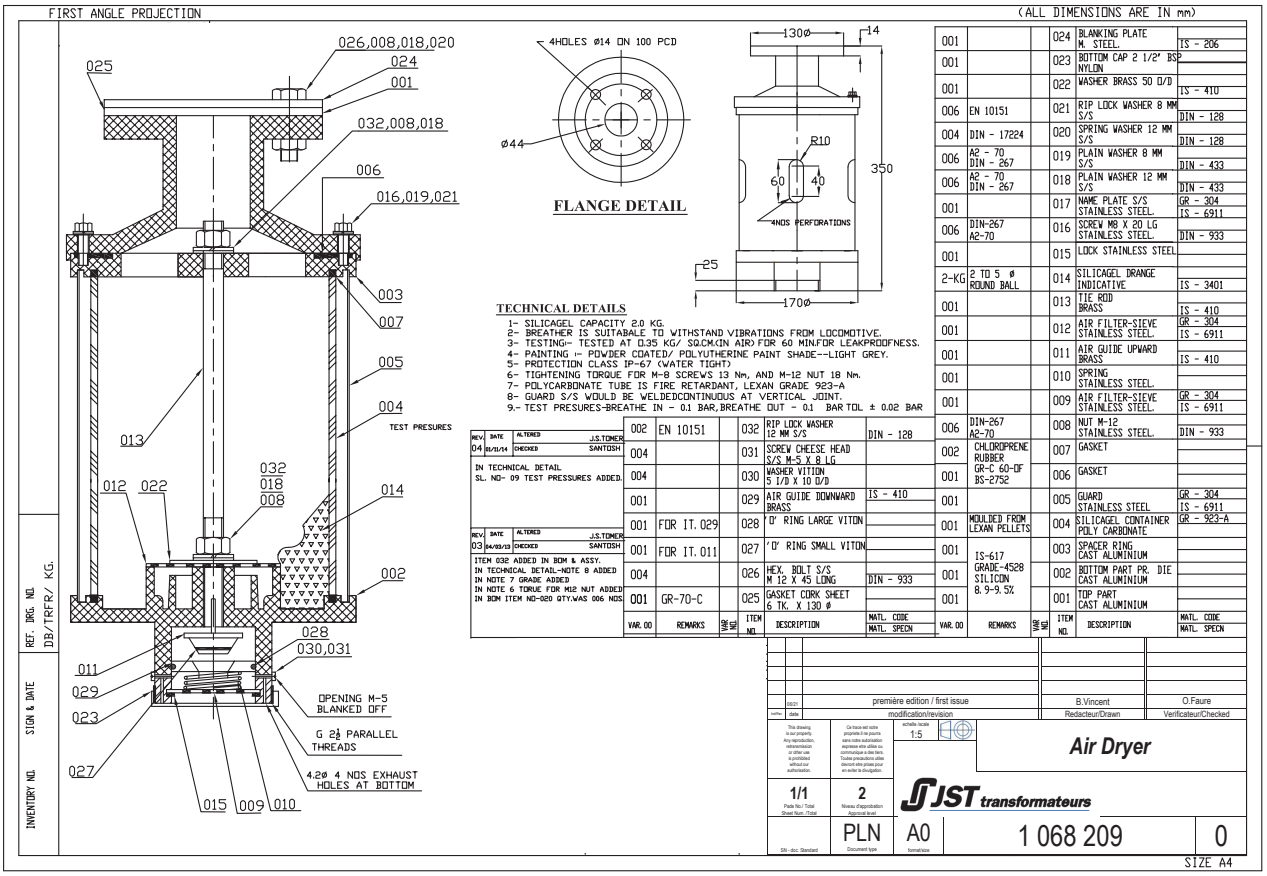
Air Dryer - Small

JST transformateurs

1/1	2			
Plans No. / Total Sheet Num. /Total	Niveau d'approbation Approval level			
SN - doc. Standard	PLN Document type	A0 format/size	1 068 208	0

ALL DIMENSIONS ARE IN mm.

APPENDIX 4
Air dryer - Conservator


FIRST ANGLE PROJECTION
(ALL DIMENSIONS ARE IN mm)
026,008,018,020
024
025
001
032,008,018
006
016,019,021
003
007
005
004
TEST PRESURES
013
012
022
032
018
008
014
002
028
030,031
011
029
023
027
015
009
010
OPENING M-5 BLANKED OFF
G 2¼ PARALLEL THREADS
4.2ø 4 NOS EXHAUST HOLES AT BOTTOM
4HOLES ø14 ON 100 PCD
ø44
FLANGE DETAIL
130ø
14
R10
60
40
350
4NOS PERFORATIONS
25
170ø
TECHNICAL DETAILS
1- SILICAGEL CAPACITY 2.0 KG.
2- BREATHER IS SUITABALE TO WITHSTAND VIBRATIONS FROM LOCOMOTIVE.
3- TESTING:- TESTED AT 0.35 KG/ SQ.CM.(IN AIR) FOR 60 MIN.FOR LEAKPROOFNESS.
4- PAINTING :- POWDER COATED/ POLYUTHERINE PAINT SHADE--LIGHT GREY.
5- PROTECTION CLASS IP-67 (WATER TIGHT)
6- TIGHTENING TORQUE FOR M-8 SCREWS 13 Nm, AND M-12 NUT 18 Nm.
7- POLYCARBONATE TUBE IS FIRE RETARDANT, LEXAN GRADE 923-A
8- GUARD S/S WOULD BE WELDEDCONTINUOUS AT VERTICAL JOINT.
9.- TEST PRESURES-BREATHE IN - 0.1 BAR,BREATHE OUT - 0.1 BAR TOL ± 0.02 BAR
REV. 04 DATE 15/11/14 ALTERED J.S.TOMER CHECKED SANTOSH
IN TECHNICAL DETAIL SL. NO- 09 TEST PRESSURES ADDED.
REV. 03 DATE 24/03/15 ALTERED J.S.TOMER CHECKED SANTOSH
ITEM 032 ADDED IN BOM & ASSY.
IN TECHNICAL DETAIL-NOTE 8 ADDED
IN NOTE 7 GRADE ADDED
IN NOTE 6 TORQUE FOR M12 NUT ADDED
IN BOM ITEM NO-020 QTY.WAS 006 NOS.
REF. DRG. NO. DB/TRFR/ KG.
SIGN & DATE
INVENTORY NO.
ITEM NO. | DESCRIPTION | MATL. CODE / MATL. SPECN | VAR NO. | REMARKS | VAR. 00
001 | BLANKING PLATE M. STEEL. | IS - 206
001 | BOTTOM CAP 2 1/2" BSP NYLON
001 | WASHER BRASS 50 O/D | IS - 410
006 | EN 10151 | RIP LOCK WASHER 8 MM S/S | DIN - 128
004 | DIN - 17224 | SPRING WASHER 12 MM S/S | DIN - 128
006 | A2 - 70 DIN - 267 | PLAIN WASHER 8 MM S/S | DIN - 433
006 | A2 - 70 DIN - 267 | PLAIN WASHER 12 MM S/S | DIN - 433
001 | NAME PLATE S/S STAINLESS STEEL. | GR - 304 IS - 6911
006 | DIN-267 A2-70 | SCREW M8 X 20 LG STAINLESS STEEL. | DIN - 933
001 | LOCK STAINLESS STEEL
2-KG | 2 TO 5 ø ROUND BALL | SILICAGEL DRANGE INDICATIVE | IS - 3401
001 | TIE ROD BRASS | IS - 410
001 | AIR FILTER-SIEVE STAINLESS STEEL. | GR - 304 IS - 6911
001 | AIR GUIDE UPWARD BRASS | IS - 410
001 | SPRING STAINLESS STEEL.
001 | AIR FILTER-SIEVE STAINLESS STEEL. | GR - 304 IS - 6911
006 | DIN-267 A2-70 | NUT M-12 STAINLESS STEEL. | DIN - 933
002 | CHLOROPRENE RUBBER GR-C 60-OF BS-2752 | GASKET
001 | GASKET
001 | MOULDED FROM LEXAN PELLETS | GUARD STAINLESS STEEL | GR - 304 IS - 6911
SILICAGEL CONTAINER POLY CARBONATE | GR - 923-A
001 | IS-617 GRADE-4528 SILICON 8.9-9.5% | SPACER RING CAST ALUMINIUM
001 | BOTTOM PART PR. DIE CAST ALUMINIUM
001 | TOP PART CAST ALUMINIUM
004 | GR-70-C | GASKET SHEET 6 TK. X 130 ø
001 | FOR IT. 029 | 'O' RING LARGE VITON
001 | FOR IT. 011 | 'O' RING SMALL VITON
004 | HEX. BOLT S/S M 12 X 45 LONG | DIN - 933
004 | WASHER VITION 5 I/D X 10 O/D
001 | AIR GUIDE DOWNWARD BRASS | IS - 410
004 | SCREW CHEESE HEAD S/S M-5 X 8 LG | DIN - 128
002 | EN 10151 | RIP LOCK WASHER 12 MM S/S
001 | première edition / first issue | B.Vincent | O.Faure
modification/revision | Redacteur/Drawn | Verificateur/Checked
Air Dryer
JST transformateurs
1/1 | 2 | PLN | A0 | 1 068 209 | 0
SIZE A4

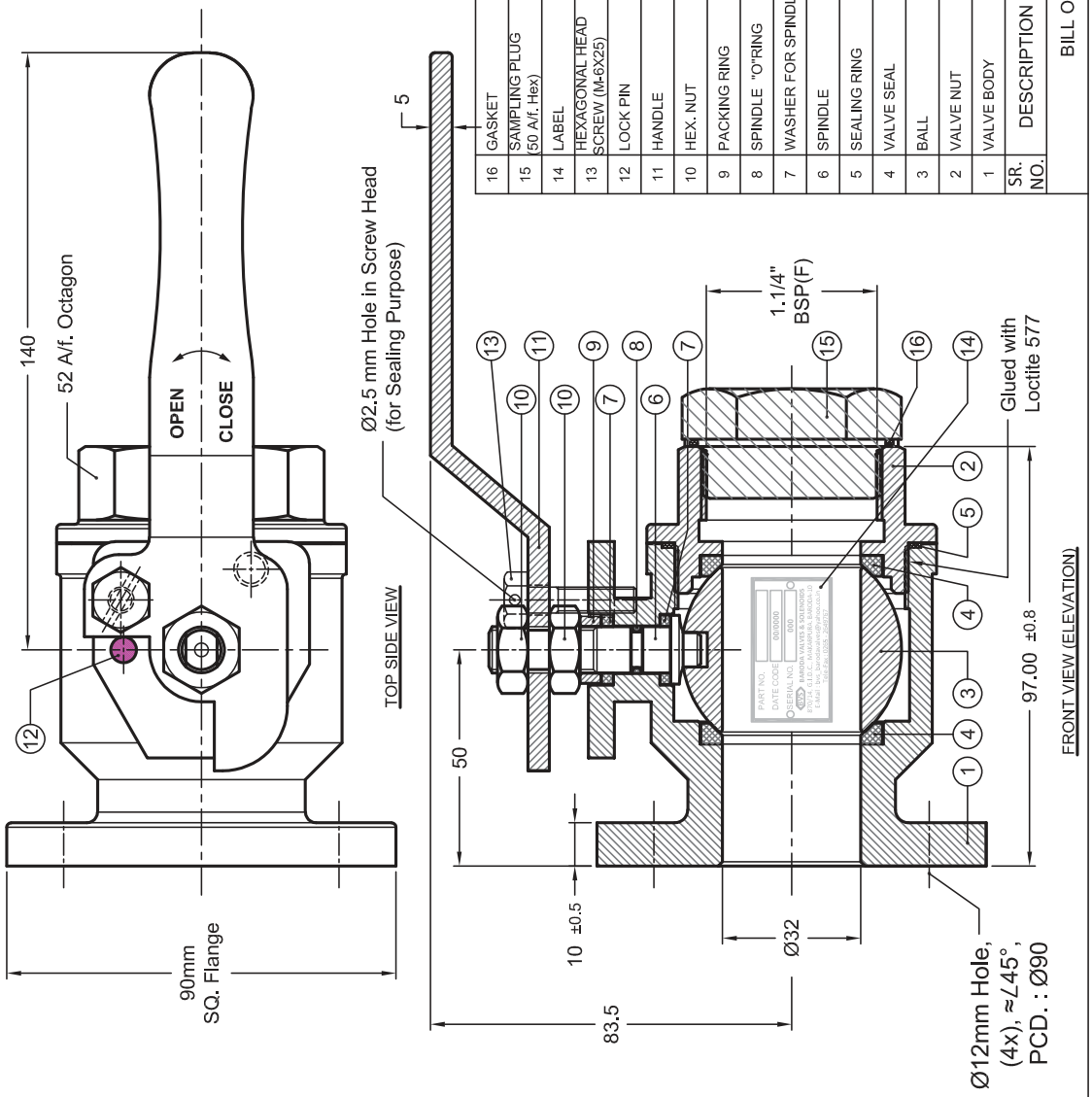
APPENDIX 5
Isolating valve

LOCABLE BALL VALVE (ND-32)

OPERATING TEMP. : -50° to 140° [C]
MEDIA : MINERAL / ESTER OIL

BILL OF MATERIALS

SR. NO.	DESCRIPTION	MATERIAL	QTY.	WEIGHT (KG.)
16	GASKET	HNBR	1	0
15	SAMPLING PLUG (50 A/f. Hex)	S.S.316	1	0.350
14	LABEL	ALUMINIUM	1	0
13	HEXAGONAL HEAD SCREW (M-6X25)	S.S. A2-70	1	0.015
12	LOCK PIN	S.S.316	1	0.005
11	HANDLE	S.S.316	1	0.150
10	HEX. NUT	S.S.316	2	0.040
9	PACKING RING	S.S.316	1	0.010
8	SPINDLE "O"RING	HNBR	1	0
7	WASHER FOR SPINDLE	P.T.F.E.	2	0.008
6	SPINDLE	S.S.316	1	0.035
5	SEALING RING	P.T.F.E.	1	0.002
4	VALVE SEAL	P.T.F.E.	2	0.005
3	BALL	S.S.316	1	0.130
2	VALVE NUT	ASTM A-351 Gr. CF8M	1	0.350
1	VALVE BODY		1	1.300



06/21	première edition / first issue	B.Vincent	O.Faure
indice	date	modification/revision	Redacteur/Drawn	Verificateur/Checked

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Draining Valve

1/1 Page No. / Total Sheet Num. / Total	2 Niveau d'approbation Approval level	JST transformateurs		
SN - doc. Standard	PLN Document type	A0 format/size	1 075 613	0

* All Dimensions Are In M.M.

APPENDIX 6
Pressure relief device

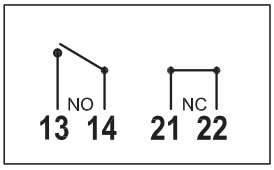
PROVISIONAL DRG.

PARTS LIST :

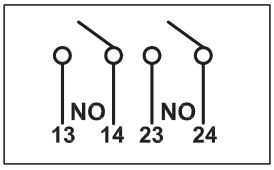
PART NO.	DESCRIPTION	MATL.
1	BODY	ALUMINIUM ALLOY
2	TOP PLATE	ALUMINIUM ALLOY
3	BASE	ALUMINIUM ALLOY
4	TIE ROD	STAINLESS STEEL
5	NUT	BRASS/SS
6	SPRING	SPRING STEEL
7	MOUNTING RUBBER RING&ALL RUBBER COMP.	NBR
8	ROD	STAINLESS STEEL
9	SWITCH BOX	ALUMINIUM ALLOY
10	VISUAL INDICATOR	ALUMINIUM (RED)
11	M20 GLAND	BRASS

CONTACT TYPE :

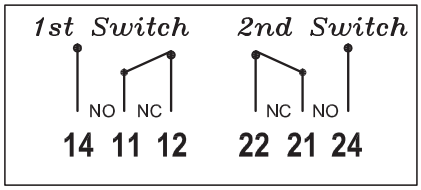
1NO + 1NC Contact

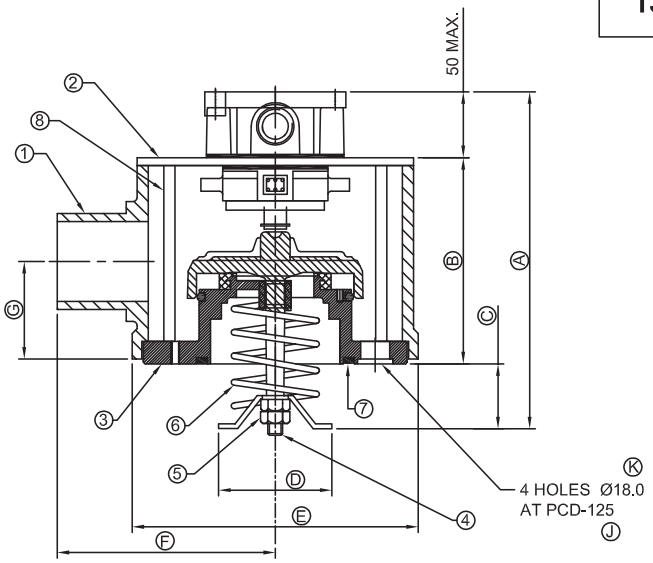


2NO Contact



2NO + 2NC Contact





Type	A	B	C	D	E	F	G	H	I	J	K
T50	230 MAX	132 MAX	60 MAX	61	180	138 MAX	61	240 MAX	60	125 PCD	4HOLES ø18
T80	250 MAX	156	60	103	218	153 MAX	69	233 MAX	90	160 PCD	4HOLES ø18

NOTE :- THE DIRECTION OF SHROUD AND THE VENT PIPE CAN BE ROTATED IN ANY DIRECTION TO ANY DIGREE. KEEPING THE POSITION OF

This Product is CE certified.

Type	Size	Model No	CONTACT	Cover
T50	50	306XX14	1NO + 1NC	YES
T50	50	306XX14-2	2NO + 2NC	YES
T50	50	306XX14-2NO	2NO	YES
T80	80	307XX14	1NO + 1NC	YES
T80	80	307XX14-2	2NO + 2NC	YES
T80	80	307XX14-2NO	2NO	YES

GENERAL INFORMATION:
FINISH : RAL 7001 POWDER COATED

SWITCH RATING – 10 Amps , 240 V AC
DEGREE OF PROTECTION – IP 67

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Ind/Rev	date	modification/revision	Redacteur/Drawn	Verificateur/Checked

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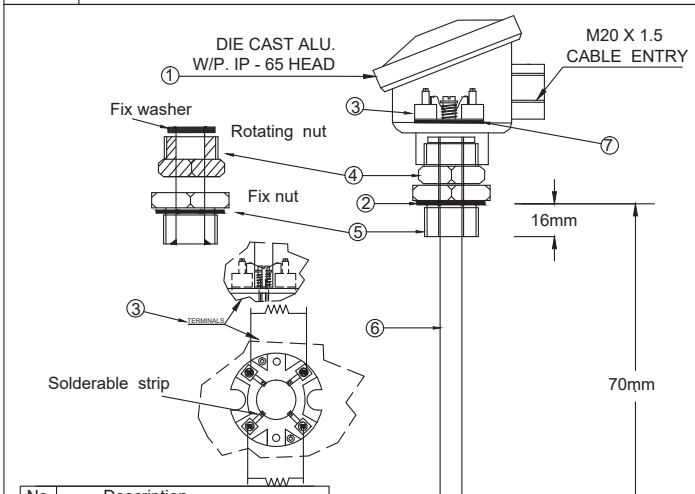
echelle /scale 1:5

PRD

1/1 Pade No./ Total Sheet Num. /Total	2 Niveau d'approbation Approval level	JST transformateurs		
SN - doc. Standard	PLN Document type	A0 format/size	1068210	0

APPENDIX 7
PT100 sensor

CLIENT	JST STESALIT RANSFORMERS Pvt. Ltd,	SOR - 27301 B
		Date : 22-09-18



No	Description
1	Enclosure Aluminium WP
2	Neoprene Rubber 'O' Ring
3	4 Terminal on ceramic block
4	1/4" BSP SS 304 Fitting for sensor
5	1/2" BSP SS 304 Fitting
6	Temp. Sensor Tube
7	Ceramic block mounting SS base

Tollrance : ± 0.1mm in OD
±1mm in Length

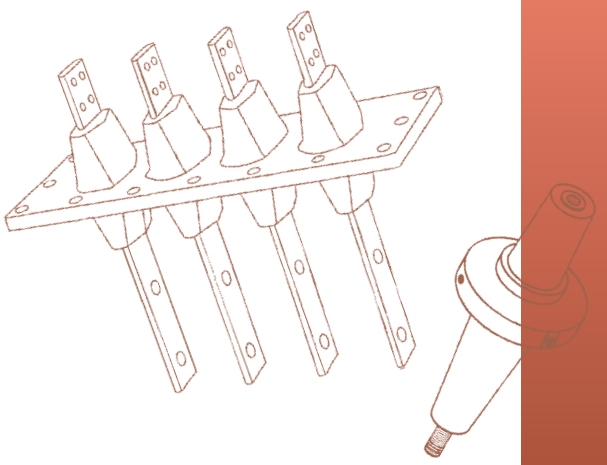
	première edition / first issue	B.Vincent	O.Faure
	modification/revision	Redacteur/Drawn	Verificateur/Checked

PT100

JST transformateurs

1/1	2	1:5	
	PLN	A0	1075428	0

APPENDIX 8
HV Bushing



PPS-PPQ-BT-PIAS

RESIN INSULATORS
FOR OIL INSULATED
ELECTRICAL MACHINES

comem

BUSHING WITH PLUG CONNECTION WITH OUTER CONE *PPS*

CHARACTERISTICS

The PPS® bushing can be used as a fixed section for the entry of medium voltage on oil filled machines such as switch gears or transformers. It is fitted with a coupling interface according to table 1.

APPLICATION

Indoors for vertical or horizontal mounting; outdoors both with and without tension making use of the fitting rubber connector, for vertical or horizontal mounting.

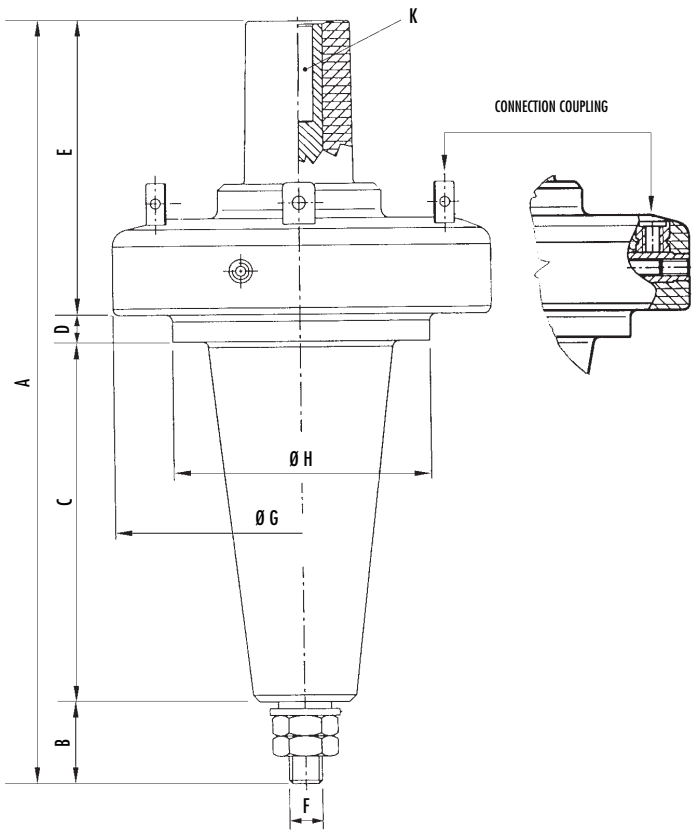
ACCESSORIES (ON REQUEST)

Fastening kits for insulators with DIN flanges or with French blocks can be ordered.
The kit includes:
- NBR gasket
- UNI 6592 flat washer made of galvanized steel
- UNI 5588 nuts made of galvanized steel
- flange (DIN 42538) or French blocks (DIN 42542/HD 506 S1) made of galvanized steel.

The purchase code for these sets is subdivided as follows:

DESCRIPTION	CODE
250 A WITH FLANGE DIN 42538	1I10020085
250 A WITH FRENCH BLOCKS DIN 42542 / HD 506 S1	1I10020086
400-630 A WITH FLANGE DIN 42538	1I10020083
400-630 A WITH FRENCH BLOCKS DIN 42542 / HD 506 S1	1I10020084
1250 A A WITH FRENCH BLOCKS DIN 42542 / HD 506 S1	1I24120900

2



INSULATOR TYPE	DIMENSIONS								CONTACT TYPE	CONNECTION COUPLING	
	A	B	C	D	E	F	G	H	K	TYPE	Q.tà
PPS 24/250	224	22	108	8	86	M10	Ø111	Ø76	LAMELLAR	FIXING SHOE	6
PPS 24/250-R	189	22	73	8	86	M10	Ø111	Ø76	LAMELLAR	FIXING SHOE	6
PPS 24/250-R with M6 threaded inserts	189	22	73	8	86	M10	Ø111	Ø76	LAMELLAR	THREAD M6 x 12	2
PPS 24/250-L	284	22	168	8	86	M10	Ø111	Ø76	LAMELLAR	FIXING SHOE	6
PPS 24/1250	252	33	76	10	133	M16	Ø150	Ø99	M16	/	/
PPS 36/250	240	22	80	8	130	M10	Ø111	Ø75	LAMELLAR	FIXING SHOE	4
PPS 36/400	330,5	41,5	147	10	132	M16	Ø128	Ø87	LAMELLAR	FIXING SHOE	4
PPS 36/630	332	41,5	147	10	133,5	M16	Ø128	Ø87	M16	/	/

3

IDENTIFICATION		STANDARDS			OIL LEVEL	VERSION WITH FLANGE
TYPE	CATALOG Nr:	INTERFACE	INTERFACE YPE	COMPLETE INSULATOR	DIMENSION "X" (fig. 3)	TYPE
24 kV / 250 A	PPS 24/250 COD. 1G17424023	EN 50180 / UTE C 66-555 IEEE Std 386	A	EN 50180 / DIN 47636 HN 52-S-61	6 - 10 kV 40 mm 12 - 20 kV 50 mm	"A" DIN 42538
24 kV / 250 A (Short)	PPS 24/250-R COD. 1G17424024	EN 50180 / EN 50181 HN 52-S-61 IEEE Std 386	A	UTE C 66-555	Total	"A" DIN 42538
24 kV / 250 A (Short)	PPS 24/250-R with threaded inserts COD. 1G17424025	EN 50180 / EN 50181 HN 52-S-61 IEEE Std 386 UTE C 66-555	A	COMEM	Total	"A" DIN 42538
24 kV / 250 A (Long)	PPS 24/250-L COD. 1G17424022	EN 50180 / EN 50181 HN 52-S-61 IEEE Std 386	A	COMEM	6 - 10 kV 40 mm 12 - 20 kV 50 mm	"A" DIN 42538
24 kV / 1250 A	PPS 24/1250 COD. 1617024120	EN 50180 / EN 50181	D	COMEM	Total	DIN 42542
36 kV / 250 A	PPS 36/250 COD. 1G17436020	EN 50180 / HN 52-S-61 EN 50181	B	UTE C 66-555	Total	*
36 kV / 400 A	PPS 36/400 COD. 1G17436040	EN 50180 EN 50181 / HN 52-S-61	B	EN 50180 / DIN 47636	6 - 10 kV 40 mm 12 - 20 kV 50 mm 18 - 30 kV 70 mm	"B" DIN 42538
36 kV / 630 A	PPS 36/630 COD. 1G17436041	EN 50180 / EN 50181	C	EN 50180	6 - 10 kV 40 mm 12 - 20 kV 50 mm 18 - 30 kV 70 mm	"B" DIN 42538

* Mount using only the special blocks supplied.

Tab. 1

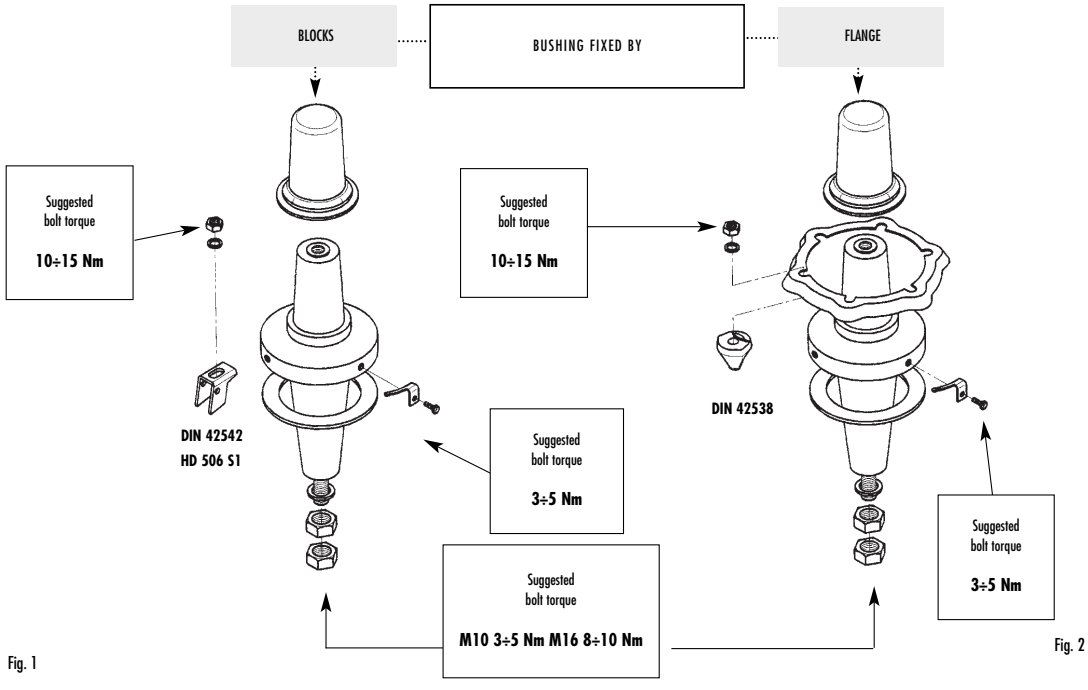


Fig. 1

Fig. 2

4

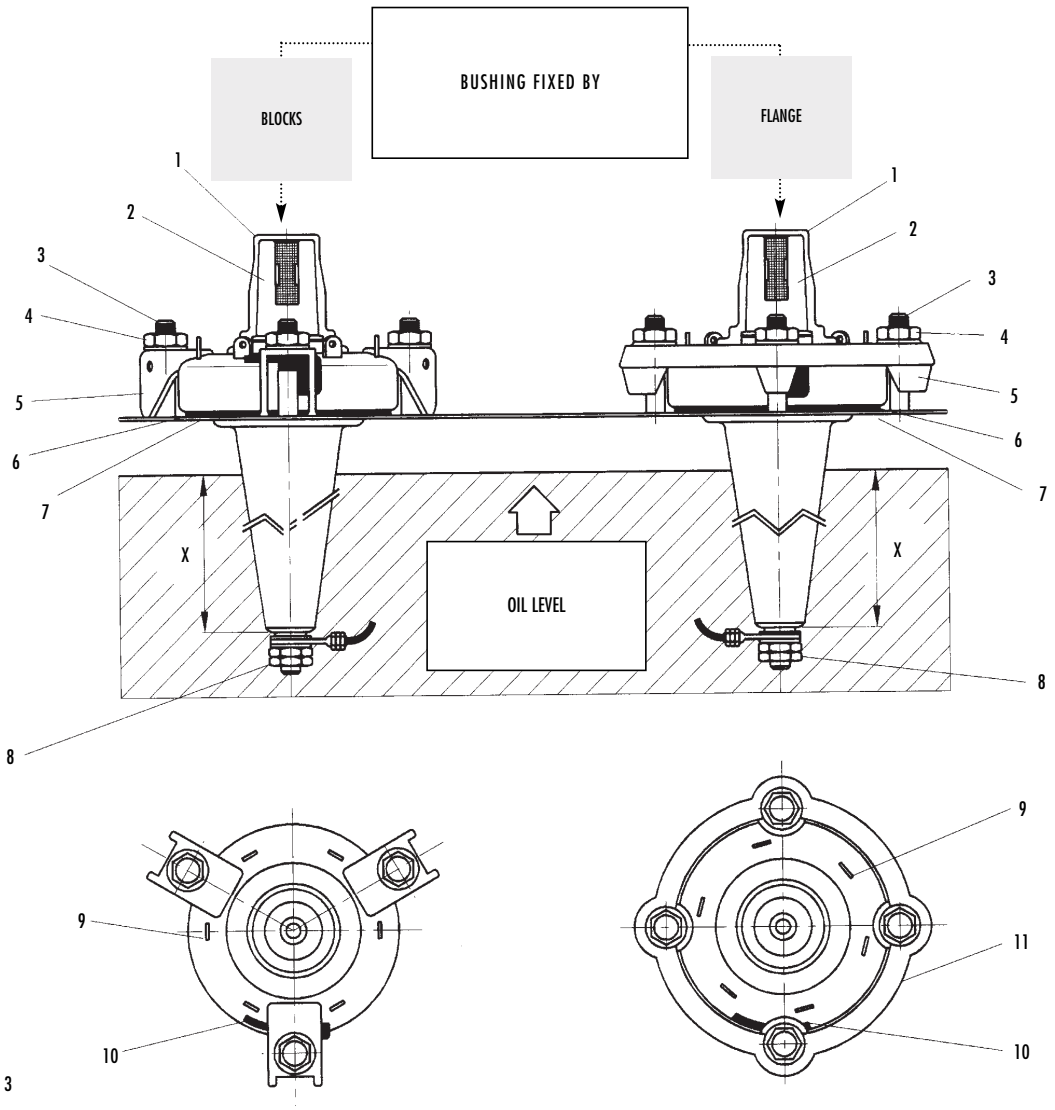


Fig. 3

N.	DESCRIPTION
1	PROTECTIVE COVER
2	CONNECTION INTERFACE
3	STUD SCREW
4	FIXING BOLTS
5	BLOCK
6	TRANSFORMER
7	GASKET
8	CONNECTION BOLTS
9 *	FIXING SHOE
10	GROUND PLATE
11	FIXING FLANGE

* 250 A - 400 A

INSTALLATION INSTRUCTIONS

- Position the insulator on the lid of the transformer after having inserted the gasket.
- Earth the bushing screen through the ground plate fixing it to one of the three threads as indicated in figures 1 and 2, then connect it to one of the fixing blocks.
- Set the blocks, or eventual flange in position, with the washers and nuts, which should be tightened uniformly (recommended torque 10 ÷15 Nm).
- In alternative to the ground plate, as an optional accessory, a conductor cable may be requested for the same function.

IMPORTANT RECOMMENDATIONS

- Do not coat or pollute the connection interface in any way whatsoever.
- When the bushing is not connected to other equipment through the rubber terminal, the plastic protective cover must always be set firmly in place.
- Carefully clean the protective cover before replacing it on the bushing after having removed the mobile terminal.
- Remove the protective cover before actuating the bushing.
- At least one of the three lateral plugs of the screen must be earthed as shown in figures 1 and 2.

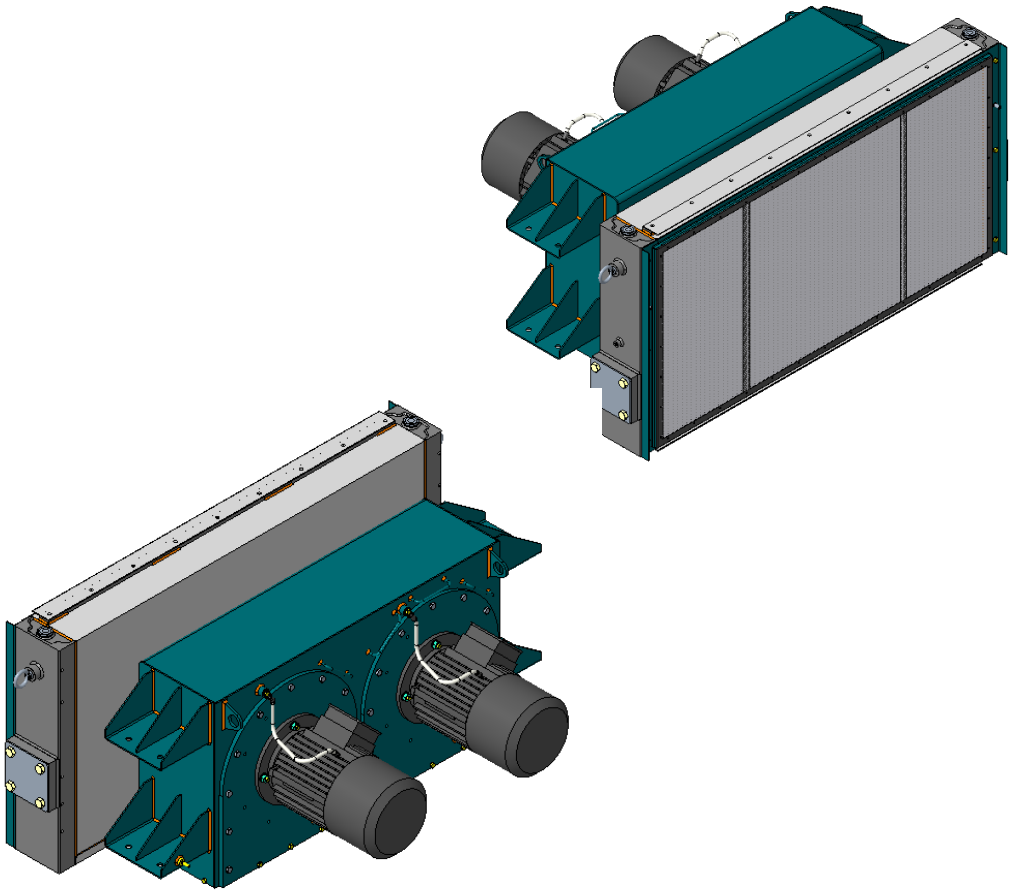
5

APPENDIX 9
Cooling system

Operation and Maintenance Manual for cooling system

2-21-671-SR _REV-01

01/Nov/2021
STANHEX



539003001064- Rev01

MAINTENANCE MANUAL | Cooling System

Contents

Contents

Introduction:

This operating instruction is published as a guide for installing, operating and maintenance of cooling system. Following these guidelines ensures an optimum performance and maximum service life of the equipment.

To obtain the maximum efficiency, optimize the performance and prevent incorrect use, we strongly recommend that this entire manual is read carefully and all safety precautions are implemented before starting installation and putting the cooler into service. This manual must be available at all times: it is a part of the product. If lost, the manual should be replaced immediately. The cooler may not be used for any purpose other than cooling fluids in accordance with the guidelines and instructions set out in this manual.

This manual illustrates a typical installation procedure for a cooling system. Some common options are also included. Refer to separate installation drawings for additional optional equipment. Review all manuals and drawings prior to assembly. Contact your STANHEX representative if questions arise.

If the instructions laid down in this guide are not observed, the manufacturer cannot be held responsible in case of damage.

We draw your attention to the fact that it is quite impossible to treat herein all probabilities. This means that the user is not exempted of the usual responsibilities connected with the use of technical machinery. It is, therefore, taken as granted that the operating staff is well instructed and knows how to handle this installation. No claims whatsoever could be enforced by the contents of this guide.

General Safety Information:

Unpacking:

Prior to installation, unpack the unit and check for loose or missing pieces. Caps should be removed from the fluid connections and visually inspected to check for any debris or corrosion that may have occurred during storage or shipment.

Never exceed the maximum allowable temperature or pressure ratings. Never exceed the maximum flow rate allowed by the size of the fluid ports. Be sure the system pressure is relieved prior to opening the cooler. Disconnect the electrical power and follow designated lock-out tag-out procedures before servicing. The fluid being cooled should be compatible with aluminum.

Installation and Mounting:

When installing cooler in an enclosed space, sufficient ventilation must be provided to exhaust the hot air and replenish with cool air. Recirculation of the exhaust air can occur as well as reduce the fan performance due to increased resistance. All of the above will result in decreased cooler performance.

Standard motors are totally enclosed fan cooled (TEFC) motors which provide protection from normal weather. Motors must be shielded when exposed to direct jets of water as any moisture ingress has the

potential to short the motor. For high ambient temperature environments, the motor must have an insulation rating suitable for operation in those conditions.

When exposed to low outside temperatures, over pressurization of the cooler can occur due to the oil or fluid becoming highly viscous. To avoid this, sound engineering practices must be employed. This could include manual, pressure, or temperature controlled bypasses and other hydraulic safety measures to reduce the strain on the cooler in cold start-up conditions.

Mounting in Dirty Ambient Conditions

Coolers installed in environments that have particulates, debris or oil droplets within the airflow will be need to be cleaned regularly to ensure free flow through the cooling fins on the heat exchanger. Blocked air passages will reduce the heat exchange efficiency of the unit. Failure to clean the cooler will result in decreased performance.

Manner of Mounting

The cooler must be mounted in the manner it was designed to fit the application. The cooler assembly must be fully secured before operation. Improper mounting can result in damage to the cooler and the surrounding environment or bodily harm. It is recommended that a filter be used ahead of the cooler to prevent debris or foreign material from causing blockage in the fluid rows in dirty environments. All piping must be properly supported to prevent strain on the cooler. Pipe sizes should be based on the oil flow and pressure drop requirements, not the oil coolers connection size. Where excessive vibration may be a concern, flexible connectors are recommended to be used to eliminate stress.

Electrical Connection

Installation should be completed by a certified electrician, and must comply with all local codes. The fan motor must be connected to a power supply that matches that of the motor nameplate. Voltage may vary 10% of what is posted on the motor nameplate. Be sure to provide proper fusing to prevent a possible motor burnout.

☞ The connection of electric motors to the electric supply may only be performed by trained electrician only.

☞ It is important and advisable to read the operating instruction of electric motor used.

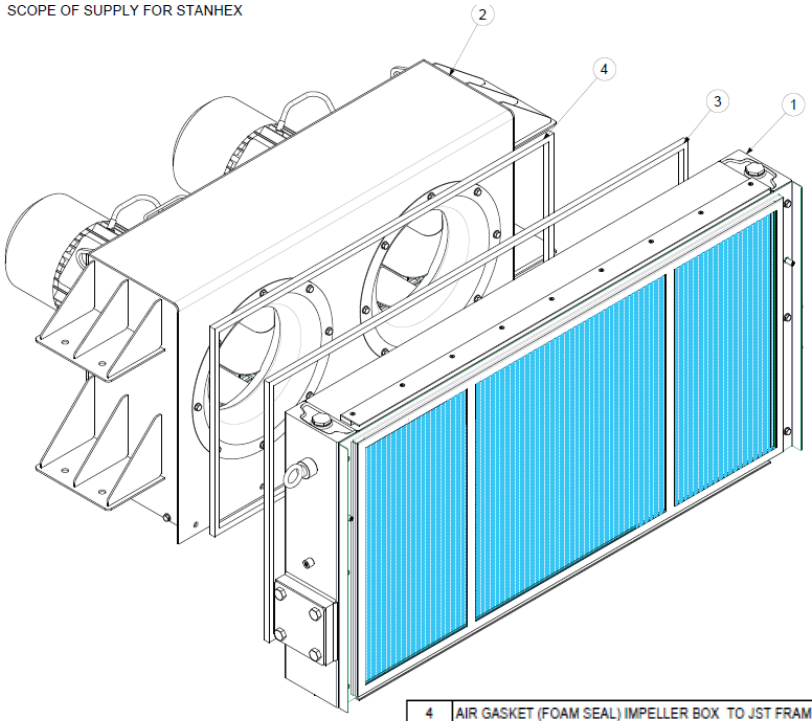
☞ It is recommended to use overload protection on the electric motor.

CHECKS
before Start-up…
1. Speed and direction of fan
2. Fan engagement within shroud
3. Electrical connection
4. Coolant/ oil quantity
5. Cooling air flow restrictions
6. Soiling condition of cooling surface
7. Entering temperatures of cooling air and coolant

Cooling System Structure Details:

In general the cooling system consists of the following parts:

SCOPE OF SUPPLY FOR STANHEX



NO.	ITEM	PART NO.	QTY.
4	AIR GASKET (FOAM SEAL) IMPELLER BOX TO JST FRAME	209117000067	1
3	AIR GASKET (FOAM SEAL) COOLER TO JST FRAME	209117000066	1
2	IMPELLER BOX ASSY	257113000866	1
1	COOLER WITH FINE MESH (DUST GUARD)	539003001063	1

Maintenance:

STANHEX cooling systems require no particular maintenance. However, in operation with heavy soiling, regular cleaning must be carried out. Be sure to disconnect the power supply and follow any designated lockout and tag out procedures prior to servicing. Inspect the system regularly for corrosion and clogged heat transfer surfaces.

Preventive maintenance check points

Preventive maintenance shall be performed at a regular interval by the users and following points needs to be checked and addressed to remove any abnormality in the functions,

- Check the cooler is not damaged. Replace damaged components immediately
- Unusual noise or vibration must not be there
- All the fasteners are properly tightened; Ensure the cooler is securely mounted.
- Dirt on the cooler reduces cooling performance & needs to be cleaned (refer cleaning procedure)
- Inspect oil / Air cooler for any damages, defective components need to be replaced
- Ensure that the cooler is free from leaks. Damaged cores or damaged seals must be replaced or repaired immediately
- Make sure that the warning labels are in good condition; Replace any damaged/missing label immediately
- Check the electrical installation. This must be done by a qualified electrician only

Leakages needs to be removed immediately

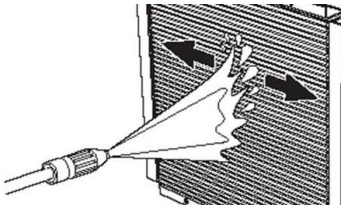
Cleaning of Coolers

- ***Before cleaning ensure all the electrical parts are switched off and cooler is cooled down, touching the hot components causes burns***
- ***Remove the stone Guard by removing the bolts/ screws before starting of cleaning of cooler***

For cleaning with light water jet, make sure to remove the current supply and the electrical parts are protected from water.

External Cleaning:

This can be done by either washing the cooler with a mild cleaner (compatible with aluminum), or with compressed air.
A power spray washer works well. Care should be taken not to damage the fins. The direction of stream shall be parallel to the fins in order not to damage. Cooler needs to be dried completely before restarting operation.



Internal Cleaning of Oil Side

The cooler must be disconnected from the cooling circuit and flushed with clean oil compatible with the cooling system. Flushing in the opposite direction of typical flow is recommended to remove any blockages.

Storage

Product should be stored in a dry area that has a constant temperature. Temperature changes in the storage area cause condensation to form inside the heat exchanger. This condensation then causes corrosion which causes product failure. This failure is not covered by the guarantee. If these criteria cannot be met, the cooler should be stored in a sealed plastic bag with desiccant added to absorb the moisture.

Storage conditions:

***6 Months**: No specific internal corrosion protection procedures are required. All openings should be sealed with plastic plugs*

***7-24 Months**: Coolers should be flushed with oil and all openings re-sealed with plastic plugs.*

***25+ Months**: Coolers should be completely filled with oil and sealed. These coolers should be flushed, inspected and re-sealed every 24 Month.*

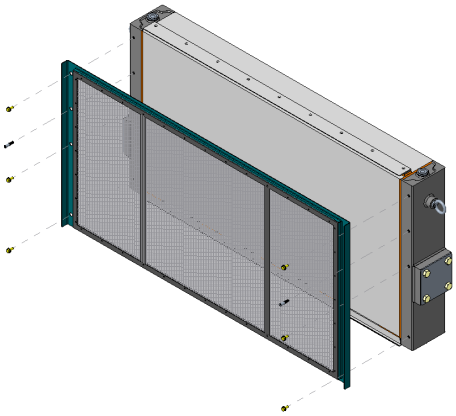
Generic Maintenance / check points

Sr No.	Item Name	Task No.	Task Description	Checking interval Days
1	Cooler Assly. Transformer	1	Remove all dust, dirt and debris from the cooler face and fins by using vacuum cleaner and non metallic soft brush	45
		2	Clean the cooler with hot water jet and measure the air delivery before and after cleaning through Anemo Meter	365
		3	Visually check the cooler for any oil leakage /External damage	45
		4	Check all bolt joints for any loose joint/ If found loose tighten the joint	45
2	Drain Plug/ Vent Plug	4	Check for tightness and leakage if any. If found loose or leak then tighten the same.	45
3	Fan checking	5	Check all bolt joints for any loose joint/ If found loose tighten the joint	45
4	Electric Motor	6	Megger test - (it should be more than or equal to 10 M-ohm	12- 15 months or whenever it submerged in the water(water splashes is not an issue)
		7	Check for any abnormal noise	once every 6 month
		8	Bearing vibration checking (vibration limit 1.3mm/s)	Every 6 months
		9	Bearing replacement	50,000 hrs

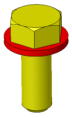
Cooling System Assembly instruction:

Cooler With Fine Mesh Guard

To Mount the Fine Mesh (Dust Guard) with Cooler Assy



1) **Assemble to cooler by inset Bolt & Pin in Cooler As Shown.**

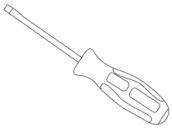


M8x1.25x30L bolts

M8x1.25 Pin (2 Nos.)

13

Torque Value: M8 = 21.4 Nm



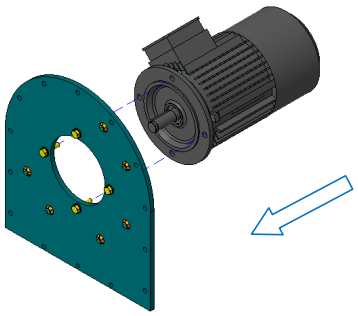
Tool for Pin M8x1.25

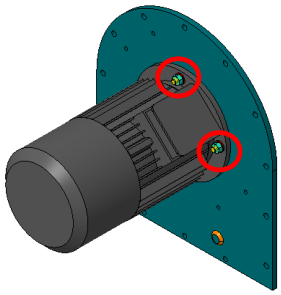
MAINTENANCE MANUAL

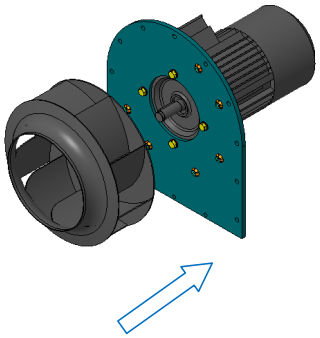
Cooling System

Motor Mounting Plate Assy

To Mount the Motor with Motor Mounting Plate



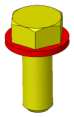


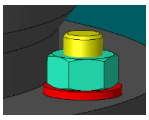


First we need to assemble Motor on the Motor Mounting Plate as shown below.

Slide the Motor in the direction as shown.

- **Insert M12 Bolts – From welded nuts side as shown**
- **Bolt M12x1.75x40L & Plain Washer (4 Nos.)**





Put the plain M12 washer & M12 nut on the Bolts and tighten it.

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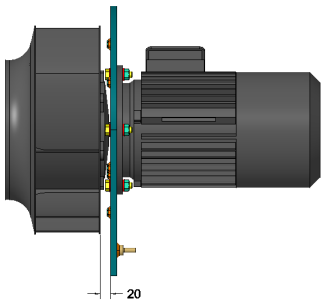
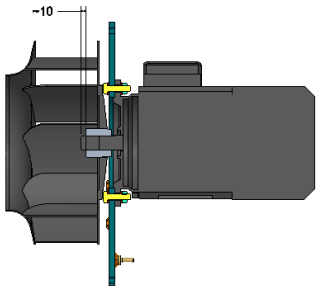
- **Fix the Impeller in the motor shaft.**



- Distance from Impeller base to mounting Plate to be kept as min : 20mm

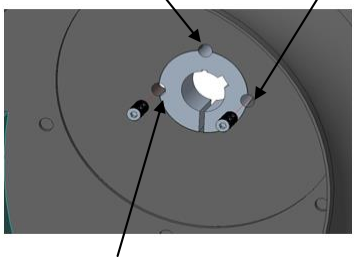


- After the assy of the impeller & motor shaft projected dimension is approx 10mm for reference only.

Connect the fan impeller from the electric motor shaft .
fix the fan by fixing the taper lock with the tightening grub screws.

Plain hole on Impeller Side

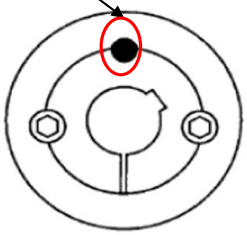
Threaded hole on Impeller Side



Threaded hole on Impeller Side

For Removing from Shaft: -

Tapper Lock, half of hole threaded Impeller, Half of hole not threaded



Installation of taper lock:

(1) Clean all oil, dirt and paint from shaft, taper lock bore, outside taper lock and impeller box.

(2) Insert Taper lock in Impeller as shown in image. Match the hole pattern as plain hole in impeller to threaded hole in taper lock
Note: - Each hole will be threaded at one side only

(3) Insert the assembly on motor shaft, Ensure the key is there on shaft and please ensure that Taper lock & Impeller to be align as below Picture.

Please ensure the taper lock & Impeller hub face is flushed, if not a protrusion of taper lock 2mm max. Above Impeller surface is allowed.

(4) After drive has been running under load for a short time stop and check tightness of grub screws.

(5) Fill empty holes with grease to exclude dirt.

Removal of taper lock

(1) Loose all grub screws by several turns, remove both grub screw.

(2) Insert grub screw into the removal hole and tighten down until the assembly loosens. If the taper lock dose not loosens immediately, lightly tap the impeller.

(3) Remove assembly from shaft.

Tool for Grub screw
3/8- 16 socket set screw

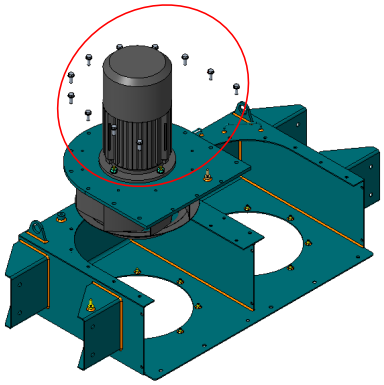
MAINTENANCE MANUAL

Cooling System

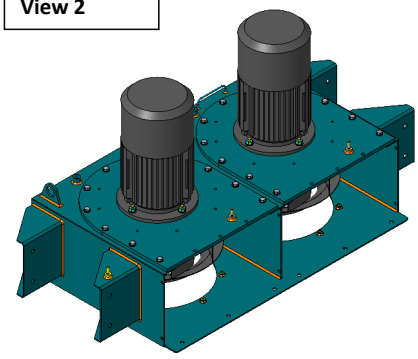
Impeller Box Assy

To Mount the inlet Cone , Grill Assy& Motor Mounting Plate Assy with Impeller Box Assy

View 1

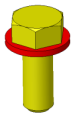


View 2



After Assy

Tighten the bolts & Washer
For impeller Case to Motor Mounting Plate



M10X1.5X30L Bolts A-70 (11x2)
Plain washer A4 (11x2 Nos.)

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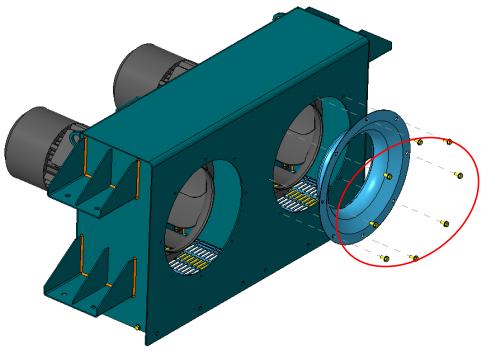
Tightening torque for M10 – 44 N-m

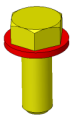
Both impeller box assemblies will be mounted in the same way (view 1)

Final mounting of both impeller boxes is shown in (view 2)



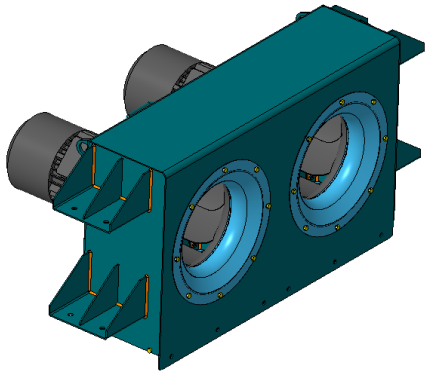
Inlet Cone

Tighten the inlet cone fixing bolt by cross tightening to avoid movement.



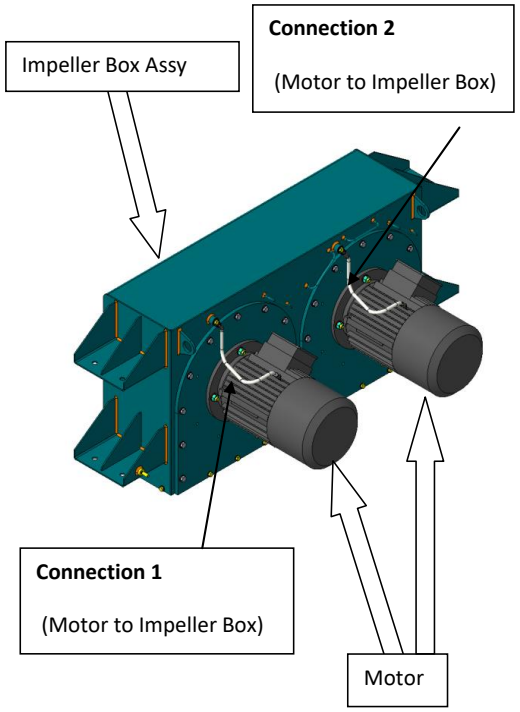
M8X1.25X25L Bolts (8x2Nos)(A4 -70)
Plain Washer A4 (8x2 Nos.)

Before full tightening the bolts & Washer, check the free rotation of Fan Impeller with hand rotation of impeller.



13

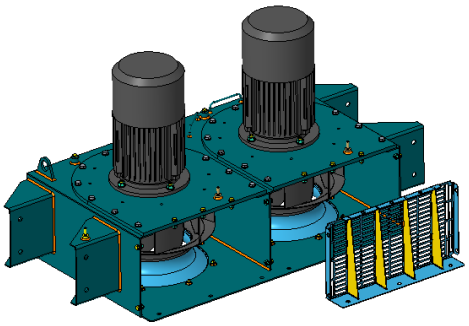
Torque the bolts to 21.4 N-m



Earthling connections are to be made as shown

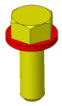
Tighten the bolts as shown in picture.

Earthling connection for both motors will be the same as shown

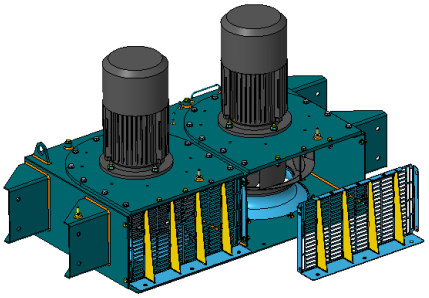


Grill assembly to assembled with Impeller Case Assy

Fix Grill assy with impeller Case Assy as Shown with M8 Bolt & Washer as Shown.

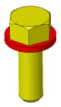


Torque the bolts to 21.4 N-m

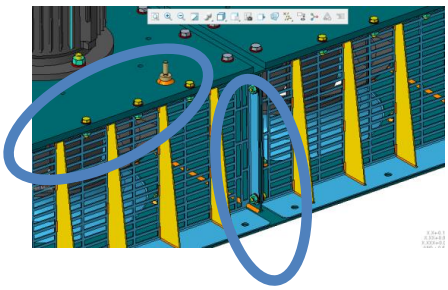


Grill to Impeller Bolt M8 x25 (6Nos) & Washer towards Motor side

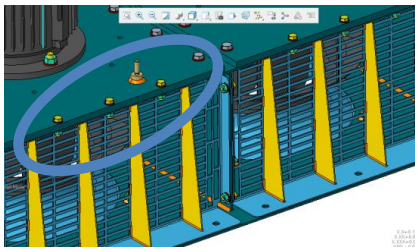
Side walls and Common wall Bolt M8x20 & Plain Washer (6 Nos)



Torque the bolts to 21.4 N-m

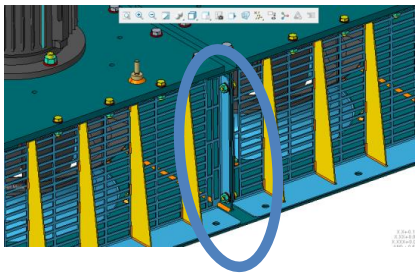


To Dismount Impeller & Motor

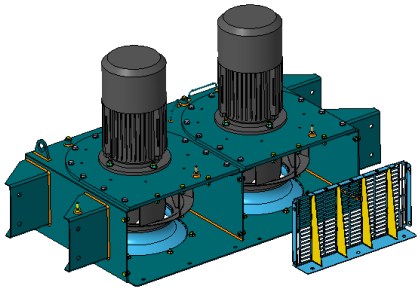


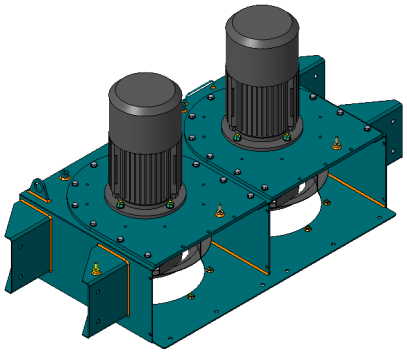
Removed hex bolt M8 x25 (6Nos)
Grill to Impeller towards Motor side as shown in figure

13

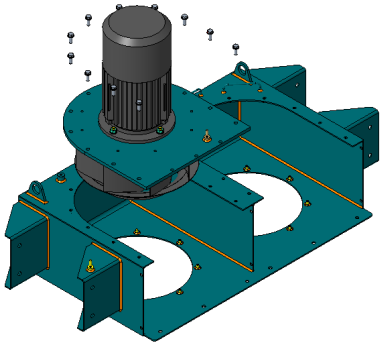


Removed Hex Bolt M8x20 (6 Nos)
Side walls and Common wall as shown in figure





Motor mounting bracket assy remove one by one

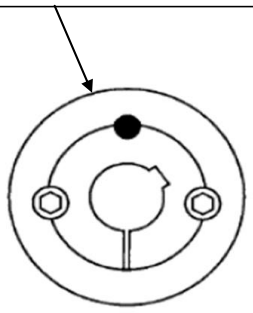


Removed M10X1.5X30L Bolts A-70 (11x2) with Plain washer A4 (11x2 Nos.) as shown in figure

17

For Removing from Shaft: -

Tapper Lock, half of hole threaded
Impeller, Half of hole not threaded



Removal of taper lock

(1) Loose all grub screws by several turns, remove both grub screw.

(2) Insert grub screw into the removal hole and tighten down until the assembly loosens. If the taper lock dose not loosens immediately, lightly tap the impeller.

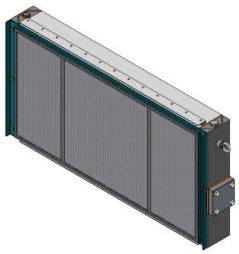
(3) Remove assembly from shaft.

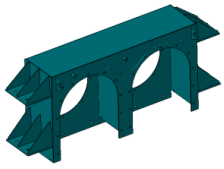
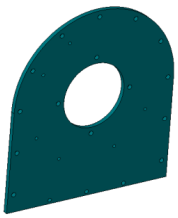
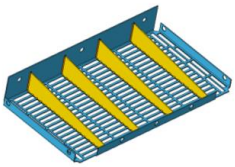
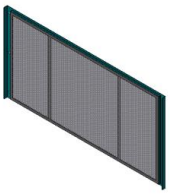
Note:- The dismantling of the machine must be carried out or supervised by a trained and qualified staff.

Refer dismantling Sequence

- Disconnect the machine from the mains all and remove all cables.
- If necessary, remove all liquids, such as oil and remove this according to the local requirements.
- Transport the machine to a suitable location for disassembly.

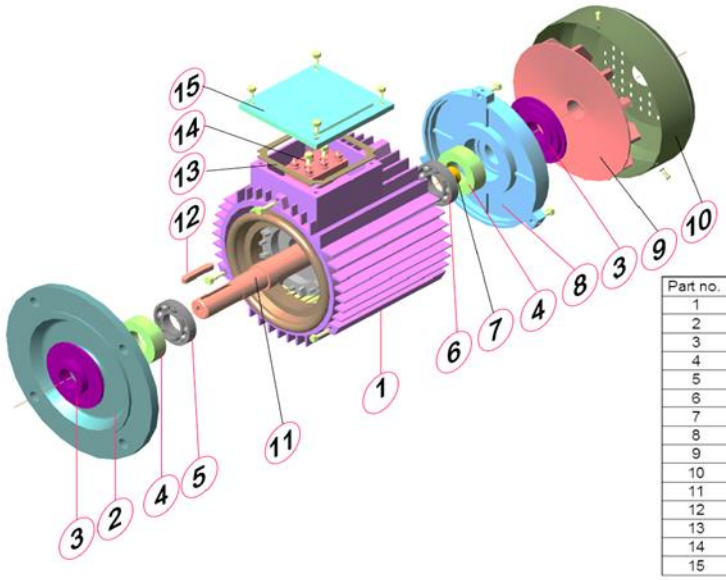
List of Serviceable/ replaceable items in the assembly

SR.No.	Item Name	Item Code	Picture
1	Motor	209122000276	
	Motor Bearing Replacement Set Non Driving End Bearing	ND230_M112_SR	
	Motor Bearing Replacement Set Driving End Bearing	D330_M112_SR	
2	Impeller	209122000261	
3	Cooler Assy With Fine Mesh(Front Dust guard)	539003001075	

4	Impeller Box Sub Assy (Cooling Box)	257113000863	
	Motor Mounting Plate	257113000879	
5	Grill Assy (Bottom Stone Guard)	257113000865	
6	Fine Mesh (Front Dust Guard)	257144000958	
7	Air Gasket (Cooler – JST Frame)	209117000066	
8	Air Gasket (Cooling Box – JST Frame)	209117000067	

Electric Motor Maintenance

Generic View – Motor



Part no.	Description
1	Body
2	Flange – DE side
3	Librinth
4	Mechanical Seal
5	Bearing – DE side
6	Bearing – NDE side
7	Isolater bush
8	End cover – NDE side
9	Fan
10	Fan cover
11	Rotor with shaft
12	Key
13	Gasket
14	Terminal plate
15	Terminal box cover

GENERAL INSTRUCTIONS FOR INSTALLATION & MAINTENANCE FOR MOTOR

Thank you for selecting "MOTOTEK" motors. "MOTOTEK" motors are robust is construction with an intension to satisfy your needs, manufactured as IS 12615: 2011

1. RECEIVING AND STORAGE

A. ON RECEIPT: Check that the motor arrived is as per your order and requirement. Also check for any Physical Damage during transit. Any damage to be reported to us immediately.

B. STORAGE: If the motor is not to be put in service immediately after receipt, it should be stored in a clean, dry and vibration free place. When stored for a longer period, to avoid pitting of bearing, periodically rotate the shaft manually.

2. INSTALLATION

MOST IMPORTANT: Ensure to use proper cable gland and secure terminal covers with gasket / silicon or equivalent sealant to protect the motor as per IP protocols (Popularly IP55, IP67 ....)

A. GENERAL:

(I) Blow out all the Dirt/Dust before putting the motor in operation. Also check the Rating, Enclosure, Duty Cycle & Degree of protection as per requirement.

(II) In no circumstance should a motor be enclosed by any covering or placed in a position in which the Ventilator air is restricted or allowed recirculation. Such conditions can result in burning of motor due to overheating.

B. **FOUNDATION:**

Foundation of concrete / steel rigid base with a perfect level is recommended. To install the motor on steel structure, care should be taken to protect the motor from vibrations & shocks generated from external sources.

C. **COUPLING THE MOTOR :**

(I) **DIRECT COUPLED MOTOR**

It is recommended to use suitable flexible coupling. When required to couple the motor directly with the Drive equipment, if the rigid coupling cannot be avoided. The shaft alignment has to be very accurate otherwise it can damage the shaft and/or bearing.

(II) BELT DRIVE

It is advisable to keep the belts as close as possible to the bearing of the motor, which reduces over hang and radial load. Verify the belt tension. Loose as well as over tight belts can damage the motor or equipment.

D. MOUTING

Foot mounted motors should preferably be mounted on slide rails. If mounted on flat base plates motors to be raised at least 13 mm to allow free passage of air underneath. Flange / Face mounted motors mounted directly; care should be taken for selecting proper tolerance of matching hollow shaft and perpendicularity.

E. INSULATION RESISTANCE

On all new motors or where an existing motor has been stored for any length of time in a damp situation, the insulation resistance of the winding both between phases and to earth, should be tested by means of a 500 volts DC Megger BEFORE THE MOTOR IS PUT INTO SERVICE. The insulation resistance should be more than one mega ohm when the motor is cold. If it is lower due to moisture it should be dried before full voltage is applied to the terminals of the motor.

F. Generally *"**MOTOTEK**"* motor up to 3kw are connected in star above 3kw Delta connections. Depending upon rating and customer's specific requirements, either three or six terminals are provided and if required, suitable link are provided. Ensure proper connection as mentioned on the nameplate of the motor / diagram provided inside the terminal cover.

3. **Motor Protection**

A. Use proper starter of any renown make to protect the motor. See that the relay setting is proper with respect to the current mentioned on the name plate of motor. Always provide proper earthling to the terminal provided on the motor.

B. Check the Voltage and current initially & periodically and see that the motor is not overloaded.

4. **MAINTANCE**

A. CLEANING OF MOTORS

Motors should be cleaned at regular intervals by blowing dry air (Pressure not be exceed 3.5 kg/CM2) to keep ventilating passage clean.

B. INSULATION RESISTANCE

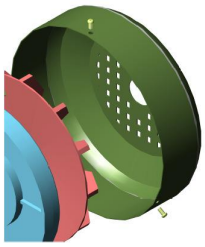
Periodic checking during service is to be done. If found less than one mega ohm, motor is to be dried out and then put in to operation.

C. BEARING AND LUBRICATION

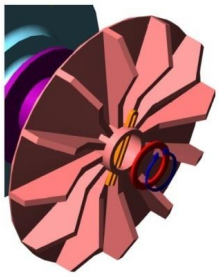
Please check the name plate for bearing. Normally "MOTOTEK" motors are with double sealed bearings hence, it does not need to lubricate it. If open type bearings are used, the bearings are filled with correct qty. of grease (lithium soap base) when to run for 5000 to 10000 hr. based on speed and working conditions. For replacing fresh grease, lithium soap based grease is to be used (contact "MOTOTEK" for proper grade). To prevent loss of lubricating properties MIXING OF DIFFERENT BASE GREASE SHOULD BE AVOIDED.

Removal and fitting of bearing: Bearings are fitted with precision fits and tolerance for better services care is to be taken during removal and to fitment of bearings. Pullers are to be used for extracting the bearings.

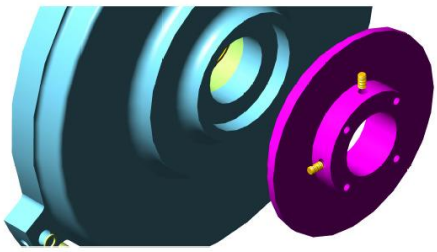
Step 1:
Remove Fan cover by unscrewing three screw provided to secure fan cover.



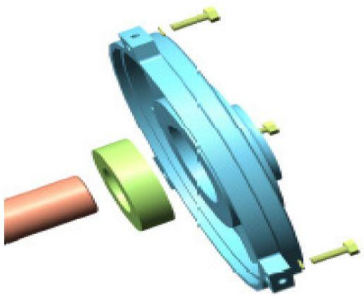
Step 2:
Now remove circlip on NDE end provided to secure fan. Remove
Cotter pin if it is provided then remove fan by pulling it on the back side.
Pulling force should be adequate just to pullout the fan.
Please ensure that the fan does not break.

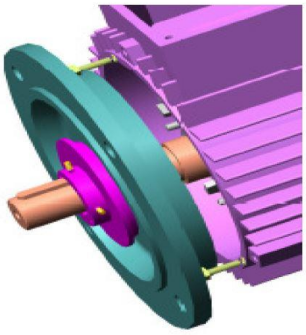


Step 3:
For IP protection, rotating armatures are provided on DE and NDE side of the shaft. 4 tapings are provided on The armatures to fix the pulling fixture. The armatures are secured but Ellen grub screw on the periphery. Loosen the grub screw by three to four turns minimum. Now remove armatures from the DE and NDE shafts.

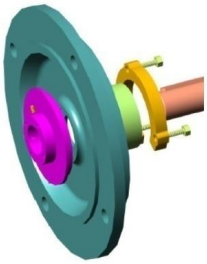


Step 4:
Loosen and unsecure the bolts used for securing DE and NDE side end covers. Remove NDE side end covers. Special seals have been provided inside the end covers. Utmost care is to be taken while removing and assembling the end covers so that the seals do not get damaged.

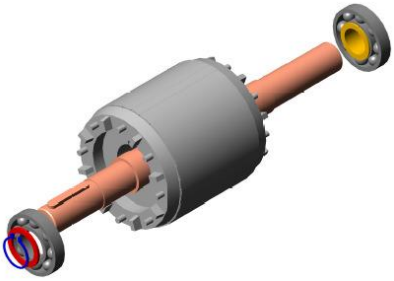




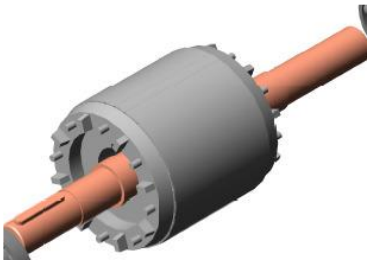
Step: 5
Take out the rotor shaft with DE end cover. A bearing cover is provide to locate the bearing axially. Remove the bearing cover by loosening and unsecuring three bolts.



Step 6:
Now remove DE side end cover.
Remove circlip and washer provided on DE side bearing.
Remove DE and NDE bearings by bearing pullers or on suitable press. Ensure the centre taping on the DE side do not get damages while using puller.



Step 7:
Clean the rotor shaft from dirt and other
Foreign material.



Step 8:
Install DE bearing on press or suitable bearing fit kit. Care should be taken so that there is no cross load or impact so that balls or races do not get damage.

Step 9:
There is an isolator bush on NDE bearing. First mount this isolator bush on the bearing and then mount the bearing with isolator bush assembly on the NDE side of the shaft so that the flange/ collar of the isolator bush is on the rotor side. DO NOT mount the isolator bush on the shaft and then the bearing on the isolator bush. This may lead to damage of the isolator bush. Feel the cavity of the seals with grease. Mount the DE side end cover on the bearing and secure bearing cover.

Step 10:
Clean the body and all part with dry air to remove dirt and any foreign material inside the motor body oron the rotor shaft or on the end covers and other components.

Step 11:
Mount rotor shaft with DE end cover on the body and secure the bolts. Care should be taken while putting rotor shaft in the body so it does not touch the winding as it might damage the winding.

Step 12:
Now mount the NDE end cover and secure the bolts.

Step 13:
Mount NDE armature and tighten grub screw.

Step 14:
Mount a circlip and then the washer to mount the fan and secure cotter pin. Widen the cotter pin ends so that it does not fly off while putting the motor under operation. Now mount the fan and then washer and secure it with the circlip.

Step 15:
Now mount the fan cover and secure it with fasteners.

Step 16:
Install DE side armature and secure it with grub screw.

Step 17:
Rotate the shaft with hand and observe that it is free. Due to seals, it will not rotate freely but mechanical freeness can be felt.

Step 18:
Now test the motor for insulation resistance to ensure that winding has not been damaged.

Step 19:
Energise the low speed winding and observe the motor working, free from noise and smooth.

Step 20:
Now de-energise the low speed and energise high speed winding and observe the motor running.

Maintenance instructions for Rosenberg fans

SAFETY INFORMATION

1. Working instructions
Before any work whatsoever on the fan, the following must be in compliance:
Tasks must be carried out only by qualified specialist personnel in compliance with these instructions and the applicable regulations.

- Use an isolator to disconnect the drive motor from the mains! , If there is no isolator, disconnect all the drive motor's terminals from the mains.
- Ensure that it is not possible for the fan to be started unexpectedly during maintenance or repair work (e.g. use a lockable isolator switch).
- Wait until the rotor has come completely to a standstill!
- Check the surface temperature for the danger of burns.

- Before maintenance work, use suitable media to remove harmful or dangerous materials which may have entered the fan in combination with the conveyed material.
- Carry out re-commissioning only after execution of the necessary safety tests.

Excluded from the above are tasks which can be carried out only in the operational state while complying with the applicable safety and accident prevention regulations, e.g., measurement of oscillation or shock pulses, the use of lubrication equipment to re-lubricate bearings during operation.

Failure to comply with these items may result in risk to life and limb for the maintenance personnel. If the state of the fan means that suitable repair measures are no longer possible, and then the fan must immediately be taken out of use, and possibly replaced.

2. Maintenance intervals

To maintain operation and safety, we recommend that at regular intervals fans are inspected for their functioning and condition by qualified expert personnel or by a specialist company, and that this is documented.

For this, the directives and safety regulations applicable to the specialist application must be complied with. Failure to comply may result in risk to life and limb for the maintenance personnel. Maintenance and inspection of fans, as per VDMA 24186-1:

The operator must specify and carry out regular inspections and cleaning, depending on the local conditions, especially if:

- The conveyed material can cause imbalance in the rotor, e.g. through corrosion, abrasion, or material build-up.
- wear or contamination of the housing (corrosion, abrasion, material build-up) occurs
- There are particular environmental conditions, e.g. environmental temperatures >40°C or <-20°C, temperature variations > 20K, sea air, or temperatures/humilities at which the creation of condensation may be expected.
- frequent changes in loads arise (! design of the motors for permanent operation S1) **operation is not in a fixed location**, e.g., railway operations

Maintenance tasks

Type, scope, frequency, and other additional necessary activities, must be decided according to the use of the fans in the conditions predominant at the installation location. The check list below provides points of reference for the tasks to be carried out.

Measures on the fan / motor

	At Regular Intervals	As Required
Confirm that the equipment is being used as intended.		X
General inspection for obvious defects	X	
Inspect the intake area, e.g. for contamination or loose parts	X	
Inspect equipment and its surface protection for contamination, damage, or corrosion, and correct it appropriately if required	X	
Inspect the rotor for damage and imbalance, and carry out oscillation measurements if necessary (see below)	X	
Ensure correct installation	X	
Inspect bearings, especially - ease and evenness of running, and lack of play - atypical running noises - grease collars, loss of oil	X	
Inspect flexible connections for leaks	X	
Confirm the correct functioning of electrical and mechanical protective devices	X	
Where necessary, confirm that the condensate drain functions correctly	X	
When cleaning to maintain correct functioning, do not use high pressure or steam jet cleaners, or aggressive cleaning agents		X
Inspect screwed connections, and tighten if required, complying with the specified tightening torques		X
Check that connection terminals and cables or sockets are tight, and that they operate correctly; fix faults appropriately where required - tightness of fit - corroded parts - damp - visible damage		X
Ensure an even gap between the rotor and the intake nozzle	X	
Ensure that maker's plate data is legible	X	

Impeller Maintenance

Prior to first commissioning check:

- Installation and electrical installation properly completed.
- safety devices fitted - protective guards
- assembly residue and foreign particles re-moved from fan area
- continuous protective conductor connection present
- fan must not rub on fixed housing components
- cable entry sealed tight
- connection data correspond to data on type plate

Attenition- after fan was running the housing of the electronics can be hot .

Maintenance of the fan only through qualified and supervised workers

At normal operation conditions our fans are extensive maintenance free.

When operating the fan at its limit maintenance work could be necessary! On harder operating conditions (e. g. higher temperature, polluted air, usage of frequency converter, non horizontal shaft…) the bearing lifetime is reduced and therefore bearings for regreasing can be used. These have to be regreased according to the requirements of the manufacturer of the motor.

The incorporated ball bearings are designed for a lifetime of 20.000h and maintenance free under ordinary operating conditions.

For all maintenance and service works ensure:

- Fan impeller has stopped!
- Electrical circuit has been disconnected and protected against reconnection!
- Observe health and safety regulations!
- The air passages of the fan must be un-obstructed.
- Regular cleaning prevents distortions.
- clean fan inlet
- clean impeller (if necessary dismount the inlet guard)

- Never use high pressure cleaning equipment (“steam cleaners”)! Directly Fan & Motor
- Do not bend fan blades!

Use only commercial cleaning material paying attention to the prescribed safety measures and do not use any abrasive tools.

- Beware of unusual noise during operation
- After the life time lubricant the bearings must be exchanged in accordance to the maintenance instructions of the motor manufacturer.
- After maintenance follow the assembly sequence procedure as above given.

Attenition – Danger to Life !

- The drive unit must operate absolutely true and jolt-free at all speeds. Equipment faults in the fan can damage the fan unit.
- Any deviation from normal operating conditions of the fan is an indication of a fault and must be checked by service personnel.
- The following table provides an overview of the possible causes of faults and actions to be taken.
- All work on the fan must be carried out in compliance with the safety regulations in the chapter on Maintenance.

Product Warranty:

All the systems manufactured by STANHEX are guaranteed against defective material or workmanship for one year of service after purchase by validated. Warranty will not apply after 38 months from original ship date from STAHEX.

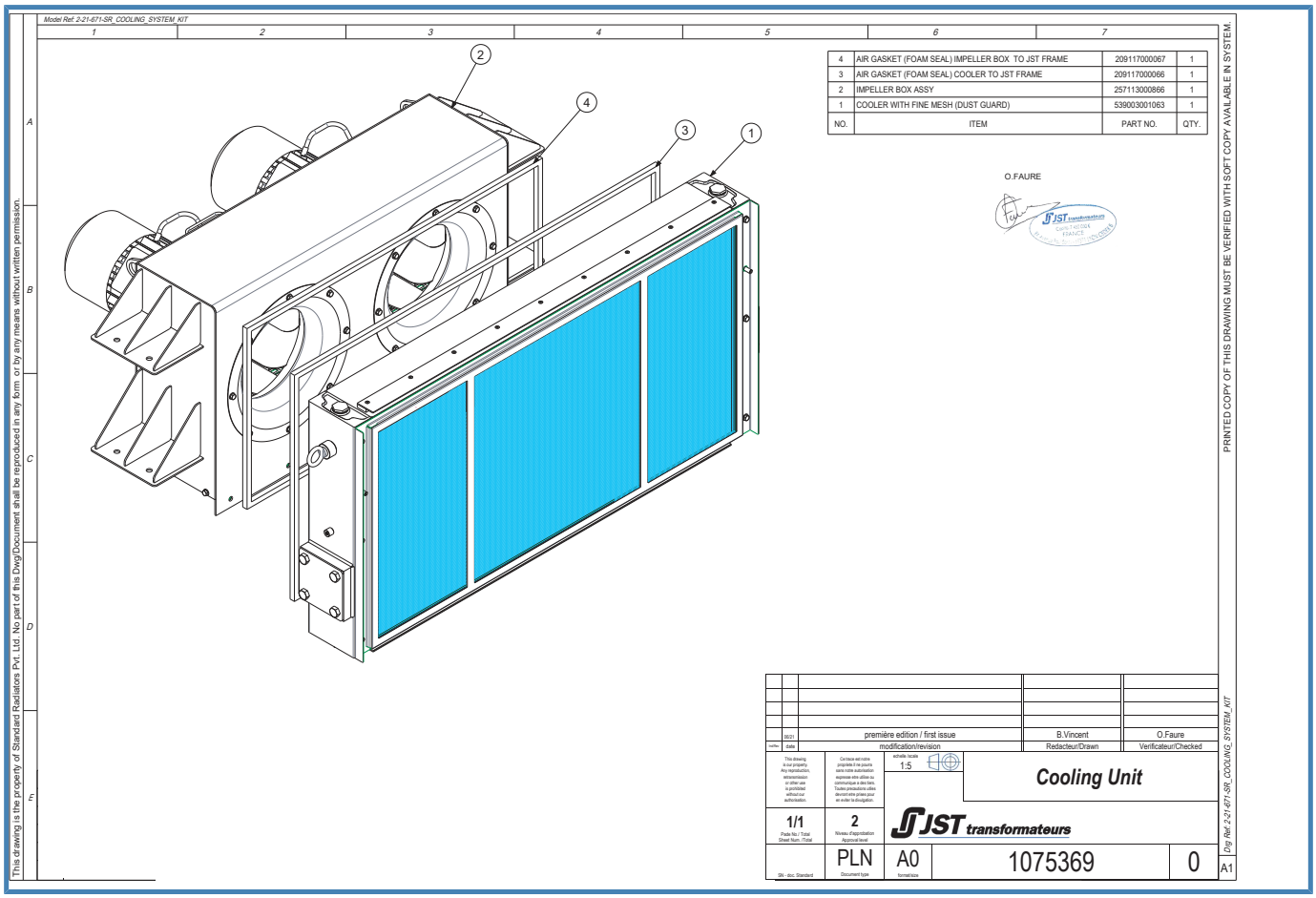
Back to Back Warranty is given for all bought out proprietary components such as Electric Motor, Fan and Filters etc. STANHEX may be the point of contact for quality of all such components, however, the warranty will be provided by the proprietary component suppliers. In this regards the contents of this document pertaining to the service and maintenance of bought-out proprietary compiled in consultation of the suppliers of these components

Any product alleged defective under the warranty period must be returned to STANHEX. Unless otherwise specified by STANHEX. Warranty consideration is subject to factory inspection. STANHEX is not responsible or liable for products damaged through carelessness or abuse. Careful inspection of products should be made by the customer before returning to STANHEX for warranty.

If factory inspection proves any parts defective, repair or replacement of defective parts will be made without charge to the customer. Liability under this guarantee is limited to the repair or replacement of the defective parts, and shall in no event include consequential damages of any nature. STANHEX WARRANTY IS "AS IS" AND WILL BE BOUND BY NO OTHER WARRANTY, EXPRESSED OR IMPLIED, EXCEPT THOSE HEREIN SET FORTH. Any attempt at local repairs automatically cancels this warranty. Returned products must be properly packaged. Adjustments cannot be made on any returned product which is damaged in transit due to poor packaging, and a charge will be made to cover cost of repair. If after factory inspection, product is found not to be defective, an inspection and packaging charge will be made and return freight is not prepaid.

Contact Details:
Standard Radiators Pvt.Ltd.
1/12 BIDC, Gorwa, Vadodara
Email: Sales@standardradiators.com

APPENDIX 10
Cooling system


Model Ref: 2-21-671-SR_COOLING_SYSTEM_KIT
1
2
3
4
5
6
7
A
B
C
D
2
4
3
1
4 AIR GASKET (FOAM SEAL) IMPELLER BOX TO JST FRAME 209117000067 1
3 AIR GASKET (FOAM SEAL) COOLER TO JST FRAME 209117000066 1
2 IMPELLER BOX ASSY 257113000866 1
1 COOLER WITH FINE MESH (DUST GUARD) 539003001063 1
NO. ITEM PART NO. QTY.
O.FAURE
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PRINTED COPY OF THIS DRAWING MUST BE VERIFIED WITH SOFT COPY AVAILABLE IN SYSTEM.
première edition / first issue
B.Vincent
O.Faure
modification/revision
Redacteur/Drawn
Verificateur/Checked
échelle /scale
1:5
Cooling Unit
1/1
2
PLN
A0
1075369
0
A1
Dig Ref: 2-21-671-SR_COOLING_SYSTEM_KIT

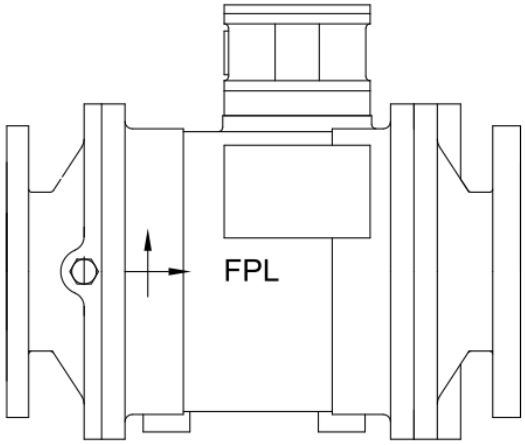
APPENDIX 11
Oil pump

FLOWOIL PUMPS PVT LTD
DOC NO: FPL/D/00021/REV-0, DATE- 20/SEP/2020

MAINTENANCE INSTRUCTIONS

OF

TRANSFORMER OIL PUMP
CENTRIFUGAL IN-LINE- CIL30/JST



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FLOWOIL PUMPS PVT LTD

DOC NO: FPL/D/00021/REV-0, DATE- 20/SEP/2020

CONTENTS

Section

FLOWOIL PUMPS PVT LTD

DOC NO: FPL/D/00021/REV-0, DATE- 20/SEP/2020

Section 1.0 General Information and Safety Instructions

Flow oil pumps products are designed to reduce hazards to safety. Some hazards cannot be guarded against and the instructions below MUST be complied with for safe use. These instructions cannot cover all circumstances. YOU are responsible for safe working.

1.1 Flow oil pumps are designed for installation in the oil cooling circuits of electrical transformers.

A **Pump Data Plate** is fitted to each unit and **must not be removed**. Loss of this plate could make identification impossible. This in turn could affect safety and cause difficulty in obtaining spare parts. Should accidental loss or damage occur, contact Flow oil pumps, immediately.

1.2 Check that all personnel installing, operating or maintaining pumps are adequately qualified, trained and issued with the correct tools. Limit access to those persons only.

1.3 The above persons must study the instruction manual BEFORE any work is done. They must first confirm that the manual is the correct copy by comparing the serial number on the Pump Data Plate with that on the manual. Personnel must also comply with all local and industry based safety instructions and regulations, in addition to those in this manual.

1.4 Always wear ear protection where the equipment noise level exceeds locally defined safe limits. Use eye and other protection when working with pressurised systems and hazardous substances. Use any other personal protection equipment where local rules apply.

1.5 Do NOT wear loose or frayed clothing or jewellery that could catch or become trapped in any moving parts.

1.6 Note the 'Limits of Product Application - Permissible Use' specified at the beginning of the manual. If the equipment is operated outside these limits there will be an increased risk to safety and premature and hazardous pump failure.

1.7 Do NOT touch surfaces that may be hot. Surfaces known to be hot in normal running will be marked with a HOT warning symbol. Be cautious, high surfaces temperatures can also occur where hot fluids are being pumped, or a fault is developing.

1.8 IMPROPER HANDLING, INSTALLATION, OPERATION OR MAINTENANCE OF THIS FLOWOIL PUMPS' PRODUCT COULD RESULT IN INJURY OR DEATH.

1.9 Pumps are designed to be installed using specific mounting points. When pumps are not mounted take care that units are safely chocked and supported, with no risk to the pumps themselves and no hazard to people.

1.10 Ensure that the equipment to which the pump is mounted is sufficiently strong to withstand all static and dynamic loads. In the case of axial (in-line) pumps this will be the pipe work itself.

1.11 Safety instructions within this manual are marked with symbols, as follows:

This symbol refers to general mechanical aspects of safety.

This symbol refers to electrical safety.

ATTENTION

This symbol refers to electrical safety.

This symbol gives warning of a hazard to the pump itself, which in turn could cause a risk to personal safety

Section 2.0 Transport Handling and Storage

2.1 Transport
Pumps are dispatched fully assembled. They are protected against corrosion and the ingress of internal contamination and packed for transport by normal road, rail and sea carriers.

2.2 STORAGE PROCEDURE:

- For long period of storage, pump should be filled with clean Transformer Oil and it is advisable to cover with 3mm Blanking plate on both sides.

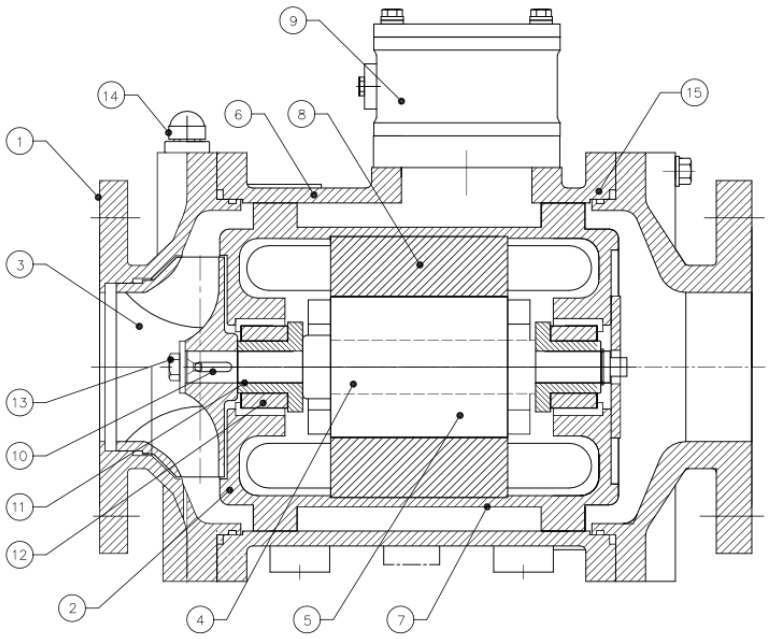
FLOWOIL PUMPS PVT LTD

DOC NO: FPL/D/00021/REV-0, DATE- 20/SEP/2020

Section 3.0 GENERAL DESCRIPTION:

Flowoil pump Centrifugal type In-line Pump is suitable for circulating the oil. The pump has Inline Suction and Delivery flanges. The pumpset is driven by 3 Phase, 50Hz, AC supply. The pumpset is compact and construction suitable for outdoor applications. The unique design of these pumps ensure minimum maintenance and trouble free operation.

3.1 DESIGN



SI NO:	DESCRIPTION	MATERIAL SPECIFICATION
1	END COVER	AL/LM6
2	BEARING HOUSING	SS
3	IMPELLER	SS
4	SHAFT	SS
5	ROTOR	M45, AL
6	FRAME	AL/LM6
7	HOUSING STATOR	AL/ MS
8	STATOR WOUND	M45/Cu/INSL
9	TERMINAL BOX ASSEMBLY	AL
10	KEY PARALLEL	IS 2048
11	SHAFT SLEEVE	SILICON CARBIDE
12	BUSH BEARING	SILICON CARBIDE
13	IMPELLER LOCKING SCREW	SS
14	AIR/DRAIN PLUG	SS
15	'O' RINGS	VITON/ NITRILE

Section 4.0 Installation

BEFORE ATTEMPTING TO INSTALL, OPERATE OR MAINTAIN A PUMP, READ THIS MANUAL CAREFULLY AND ENSURE THAT THE CONTENTS ARE FULLY UNDERSTOOD, ESPECIALLY THE PROCEDURES RELATING TO THE WORK BEING DONE. FAILURE TO DO SO MAY RESULT IN DAMAGE TO THE PUMP AND RISK TO LIFE.

Shearing Hazard

DO NOT put fingers or hands etc. into the suction or discharge outlets. Keep the protection covers in place until removal is necessary for installation. Always replace the covers after inspection.

4.1 Initial Inspection for Damage

If any damage is found on receipt, notify the carrier and Flow oil pumps. as soon as possible. Do not use the pump until cleared to do so by Flowoil pumps.

Before installation carefully check that the pump was not damaged during delivery or storage.

4.2 Oil Circuit Preparation

Make sure the entire oil circuit is perfectly clean and free from moisture and foreign matter. The motor and bearings are designed for working in clean oil only. Any contact with contaminants will cause serious damage.

To achieve the necessary cleanliness requirements and to remove any particle contamination, NEW oil must be **filtered** into the system and flushed through the circuit to waste. A witness filter can be fitted to the waste outlet to determine when the system is clean.

4.3 Preparation for Mounting

Before installation, check that the pump mounting location is suitable for accepting the pump unit. Ensure that the equipment to which the pump is mounted can safely withstand all static and dynamic loads.

4.4 TERMINAL BOX CONNECTION:

a. Terminals in the Terminal- Box marked U,V,W are connected in phase sequence to the power supply.
b. Terminal Box can also be rotated to set the position of cable entry.

4.5 OPERATING INSTRUCTIONS:

Before switching on the pump, make sure that the unit is completely filled with oil,
"It should never run without oil".

Valves on either side of the pump be kept open. Connect the power terminals as.

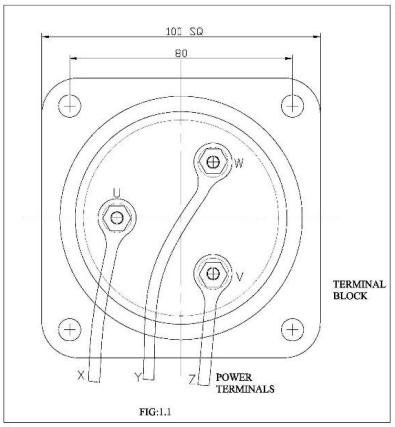


FIG:1.1

Ensure that the motor rotates in the correct direction and the pump set runs quietly and gives the rated discharge at the specified head.

Guide lines to confirm Proper Direction of Rotation

1) Keep the pump horizontally as shown. (Impeller is at suction side).
2) Power Terminals to be connected as shown in drawing.
3) Then switch on the pump for a fraction of second just to know the impeller direction of rotation (From suction (impeller) side pump should rotate counter clock wise direction.)
4) If impeller is rotating in proper power terminals connection is ok.
5) If impeller is not rotating in the proper direction then power terminals connection to be changed.

FLOWOIL PUMPS PVT LTD

DOC NO: FPL/D/00021/REV-0, DATE- 20/SEP/2020

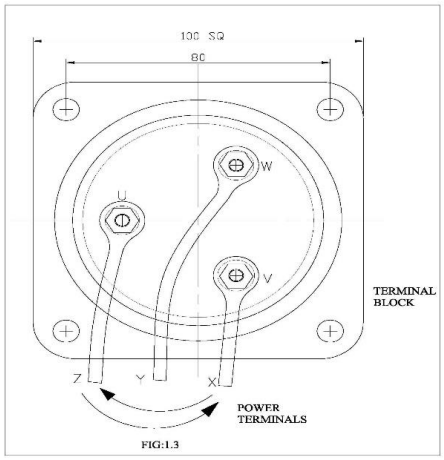


FIG:1.3

Section 5.0 Maintenance and Service :

The pump motor is directly cooled and lubricated by the transformer oil. The pump requires no special maintenance other than control of joints to ascertain that no oil leaks exist.
A damaged bearing shall be exchanged if the noise is more.

- Pump should be filled with clean oil for longer storage.
- Pumpset require no special maintenance. Bearings also get lubricated by the pumping oil itself.

In case of dismantling, examine the Bearings.

- **5.1 To remove the pump unit.**
  - Isolate the electrical power supply and position a warning notice to prevent the supply being accidentally re-energised.
  - Remove the terminal box cover, tag the supply cables for later reconnection, and then disconnect.
  - Close the pump isolating valves in the pipeline. Drain the oil from the pump by removing the pump drain plug, if fitted. After draining, refit the plug.
  - Where no drain is provided on the pump, the oil will need to be drained via the system drain valves. In this case the pump isolating valves should be open.

- Attach lifting slings to the pump unit as described in Section 2, and carefully take the weight with the lifting device. Take care not to strain the pipe work.

- Remove the bolts from the pump/pipe flanges and remove the pump unit from the system. Immediately fit protection covers to the exposed pump and pipe flanges. Dispose of old flange gaskets in the correct manner. New gaskets should always be fitted on re-assembly.

5.2 REMOVAL OF BEARING & IMPELLER

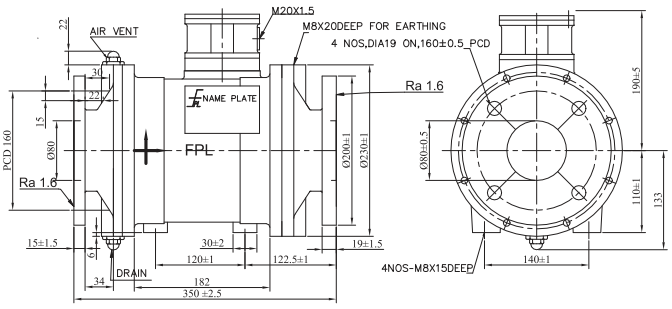
1. Remove the End cover bolts and eject the End cover using ejection bolts. Remove the impeller lock nut and washer. The dis-assembly procedure of impeller using a puller.
2. The bearings can be removed easily which is provided with anti rotation lock screw.

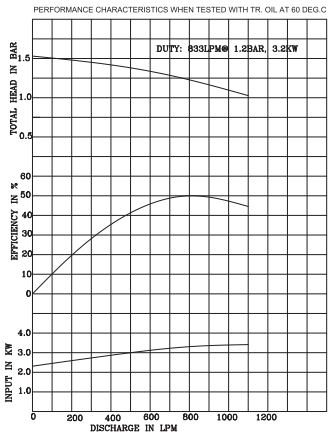
Section 6.0 TROUBLES SYMPTOMS, POSSIBLE CAUSES AND REMEDIES.

Trouble Symptoms	Possible Causes	Remedies
Motor does not Start	No Supply. Loose Connection. Defective Phase.	Correct the Supply. Tighten the Connection. Rectify the phase and ensure the same.
Pump making noise	Wrong direction of Rotation Defective Bearings.	Interchange the two Terminals. Renew the Bearings.
Insufficient Pressure	Wrong direction of Rotation. Insufficient inlet to the Pump.	Interchange the two Terminals. Correct the Inlet condition.
Insufficient Discharge	Wrong direction of Rotation. Insufficient inlet to the Pump	Interchange the two Terminals. Correct the Inlet condition.
Pump set draws more Current.	Defective Bearings.	Renew the Bearings.

APPENDIX 12
Oil pump

REF	REV	ZONE	DESCRIPTION	BY	APPD	DATE
	01		AIR/ DRAIN PLUG POSITION MODIFIED	DR	DR	19.06.21





TECHNICAL DATA

TYPE	: CENTRIFUGAL IN-LINE,GLANDLESS, MONOBLOC
MODEL	: CIL 30/ JST
SUCTION X DELIVERY	: 80 X 80
HEAD/ DISCHARGE	: 1.2BAR/ 833LPM
MOTOR	: 3KW, STAR, 400V, 50HZ, 3PH, AC, 2POLE
RATED CURRENT	: 7
METHOD OF STARTING	: D O L
INSULATION	: CLASS 'H'
BEARINGS	: CERAMIC (BALL/ SLEEVE)
LEAK TEST PR.	: 5 BAR
PROTECTION	: IP 67
APPLICATION	: OIL CIRCULATION (-25°C TO +115°C)
TOTAL WEIGHT	: 32KG±3%
PAINT	: AS REQD

08/21	première edition / first issue	B.Vincent	O.Faure
date	modification/revision	Redacteur/Drawn	Verificateur/Checked

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échelle /scale 1:5

Pump

JST transformateurs

1/1 Feuille No / Total Sheet Num. /Total	2 Niveau d'approbation Approval level			
SN - doc. Standard	PLN Document type	A0 format/size	1 075 479	0

APPENDIX 13
Oil

Safety Data Sheet

According to OSHA Hazard Communication Standard, 29 CFR 1910.1200

Initial preparation date: 01.23.2020

ENVIROTEMP™ 360 Fluid

SECTION 1: Identification

Product identifier

Product name: ENVIROTEMP™ 360 Fluid
Product code: 187-1670, 110032654

Recommended use of the product and restriction on use

Relevant identified uses: Dielectric fluid
Uses advised against: Not determined or not applicable.
Reasons why uses advised against: Not determined or not applicable.

Manufacturer or supplier details

Manufacturer:
United States
Cargill Incorporated
15407 McGinty Rd W
Wayzata, MN 55391
1-800-227-4455

Emergency telephone number:

ChemTel Inc
1-800-255-3924 (North America)
01-813-248-0585 (International)

SECTION 2: Hazard(s) identification

GHS classification: Not a hazardous substance or mixture
Label elements

Hazard pictograms: None

Signal word: None

Hazard statements: None
Precautionary statements: None
Hazards not otherwise classified: None

SECTION 3: Composition/information on ingredients

Identification	Name	Weight %
CAS number: N/A	Polyol ester	>99

Additional Information: None

SECTION 4: First aid measures

Description of first aid measures

General notes:

First responders should wear gloves and other self protection when performing treatment.

After inhalation:

Get medical advice if you feel unwell.
If inhaled, remove to fresh air.

After skin contact:
Wash with plenty of water / soap and rinse thoroughly.
Get medical advice if you feel unwell or concerned.

After eye contact:
Rinse cautiously with water for several minutes.
Remove contact lenses, if present and easy to do. Continue rinsing.
Get medical advice/attention.

After swallowing:
Rinse mouth and do not induce vomiting.
Get medical advice if you feel unwell or concerned.

Most important symptoms and effects, both acute and delayed

Acute symptoms and effects:
May cause minimal irritation or no effect. Any additional important symptoms and effects are described in Section 11: Toxicological information.

Delayed symptoms and effects:
Not determined or not applicable.

Immediate medical attention and special treatment

Specific treatment:
Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

Notes for the doctor:
Not determined or not applicable.

SECTION 5: Firefighting measures

Extinguishing media

Suitable extinguishing media:
Use Water (fog only), dry chemical, chemical foam, carbon dioxide, or alcohol-resistant foam.

Unsuitable extinguishing media:
Do not use a water stream as an extinguisher. May spread fire.

Specific hazards during fire-fighting:
Thermal decomposition can lead to release of irritating gases and vapors.

Special protective equipment for firefighters:
Use typical firefighting equipment, self-contained breathing apparatus, special tightly sealed suit.

Special precautions:
Not determined or not applicable.

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures:
Wear recommended personal protective equipment.
Ensure adequate ventilation.
Ensure air handling systems are operational.

Environmental precautions:
Avoid release into the environment.

Prevent from reaching drains, sewer, or waterway.

Methods and material for containment and cleaning up:

Absorb with non-combustible liquid-binding material (sand, diatomaceous earth (clay), acid binders, universal binders).

Wear protective eye wear, gloves and clothing.

Dispose of contents / container in accordance with local regulations.

Reference to other sections:

Not determined or not applicable.

SECTION 7: Handling and storage

Precautions for safe handling:

Use appropriate personal protective equipment (see Section 8).
Avoid breathing mist or vapor.
Use with adequate ventilation.
Wash thoroughly after handling.
Do not eat, drink, smoke or use personal products when handling chemical substances.

Conditions for safe storage, including any incompatibilities:

Store in a cool, well-ventilated area.
Keep container tightly sealed.
Protect from freezing and physical damage.

SECTION 8: Exposure controls/personal protection

Only those substances with limit values have been included below.

Occupational Exposure limit values:

No occupational exposure limits noted for the ingredient(s).

Biological limit values:

No biological exposure limits noted for the ingredient(s).

Information on monitoring procedures:

Monitoring procedures should be chosen according to the indications set by national authorities or recognized standards.

Appropriate engineering controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Personal protection equipment

Eye and face protection:

Use safety glasses (with side shields).

Skin and body protection:

Hands: Wear impervious gloves. Gloves must be periodically inspected and changed in case of wear, perforations or contaminations.

Respiratory protection:

Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines.
If there are no applicable exposure limit requirements or guidelines, use a NIOSH-approved respirator. The following should be effective types of air-purifying respirators: Organic vapor cartridge with a particulate pre-filter.

General hygienic measures:
Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing. Wash hands before breaks and at the end of work. Wash contaminated clothing before reusing.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Appearance	Liquid
Odor	Not determined or not available.
Odor threshold	Not determined or not available.
pH	Not determined or not available.
Melting point/freezing point	≤ -45 °C at ca. 1013 hPa, pour point
Initial boiling point/range	Not determined or not available.
Flash point (closed cup)	>250 °C / >482 °F (closed cup (Pensky-Martens)
Evaporation rate	Not determined or not available.
Flammability (solid, gas)	Not determined or not available.
Upper flammability/explosive limit	Not determined or not available.
Lower flammability/explosive limit	Not determined or not available.
Vapor pressure	Not determined or not available.
Vapor density	Not determined or not available.
Density	0.96 g/ml at 20 °C
Relative density	Not determined or not available.
Solubilities	Not miscible in water.
Partition coefficient (n-octanol/water)	Not determined or not available.
Auto/Self-ignition temperature	Not determined or not available.
Decomposition temperature	Not determined or not available.
Dynamic viscosity	Not determined or not available.
Kinematic viscosity	≤35 mm²/sec at 40 °C; 7 mm²/sec at 100 °C
Explosive properties	Non-explosive
Oxidizing properties	Not determined or not available.

Other information

SECTION 10: Stability and reactivity

Reactivity:
Does not react under normal conditions of use and storage.
Chemical stability:
Stable under normal conditions of use and storage.
Possibility of hazardous reactions:
None under normal conditions of use and storage.
Conditions to avoid:
Excessive heat. Avoid temperatures exceeding the flash point.
Incompatible materials:
Strong oxidizing agents.
Strong Acids.

Hazardous decomposition products:
Carbon monoxide. Carbon dioxide.

SECTION 11: Toxicological information

Acute toxicity

Assessment: Based on available data, the classification criteria are not met.

Product data:

Route	Result
Oral	LD50 Rat: >2000 mg/kg
Dermal	LD50 Rat: >2000 mg/kg

Substance data: No data available.

Skin corrosion/irritation

Assessment: Based on available data, the classification criteria are not met.

Product data:

For similar material, brief contact may cause slight skin irritation.

Substance data: No data available.

Serious eye damage/irritation

Assessment: Based on available data, the classification criteria are not met.

Product data:

For similar material, may cause moderate eye irritation.

Substance data: No data available.

Respiratory or skin sensitization

Assessment: Based on available data, the classification criteria are not met.

Product data:

For the similar material, did not cause allergic skin reactions when tested in guinea pigs.

Substance data: No data available.

Carcinogenicity

Assessment: Based on available data, the classification criteria are not met.

Product data: No data available.

Substance data: No data available.

International Agency for Research on Cancer (IARC): None of the ingredients are listed.

National Toxicology Program (NTP): None of the ingredients are listed.

OSHA Carcinogens: Not applicable

Germ cell mutagenicity

Assessment: Based on available data, the classification criteria are not met.

Product data:

For similar material, in vitro genetic toxicity studies were negative.
For similar material, animal genetic toxicity studies were negative.

Substance data: No data available.

Reproductive toxicity

Assessment: Based on available data, the classification criteria are not met.

Product data:

For similar material, in animal studies, did not interfere with reproduction.
For similar material, in animal studies, did not cause birth defects.

Substance data: No data available.

Specific target organ toxicity (single exposure)

Assessment: Based on available data, the classification criteria are not met.

Product data:

Single exposures are not anticipated to cause significant adverse effects.

Substance data: No data available.

Specific target organ toxicity (repeated exposure)

Assessment: Based on available data, the classification criteria are not met.

Product data:

Repeated exposures are not anticipated to cause significant adverse effects.

Substance data: No data available.

Aspiration toxicity

Assessment: Based on available data, the classification criteria are not met.

Product data:

No data available.

Substance data: No data available.

Information on likely routes of exposure:

Low toxicity if swallowed. Skin and eye contact may result in irritation or no effect. At room temperature, exposure to vapor is minimal due to low volatility; vapor or mists from heated materials or spraying may cause respiratory irritation.

Symptoms related to the physical, chemical and toxicological characteristics:

Repeated or prolonged skin contact may cause drying, reddening, itching and cracking. Eye contact may cause redness, tearing, and blurred vision. If ingested, may cause gastrointestinal upset with possible nausea, vomiting and diarrhea.

Other information:

No data available.

SECTION 12: Ecological information

Acute (short-term) toxicity

Assessment:

Material is practically non-toxic to aquatic organisms on an acute basis (LC50/EC50/EL50/LL50 >100 mg/L in the most sensitive species tested).

Product data:

Fish	LC50 rainbow trout (Oncorhynchus m: >100 mg/L (96 hour)
Aquatic Invertebrates	EC50 water flea (Daphnia magna): >1000 mg/L (48 hour)
Aquatic Plants	LC50 Daphnia magna: >100 mg/L (72 hour)

Substance data: No data available.

Chronic (long-term) toxicity

Assessment: Based on available data, the classification criteria are not met.

Product data:

Aquatic Plants	NOEC green algae Scenedesmus subspicatus : >100 mg/L (72 hour)

Substance data: No data available.

Persistence and degradability

Product data: No data available.

Substance data:

Name	Result
Polyol ester	The substance is considered to be readily biodegradable.

Bioaccumulative potential

Product data: No data available.
Substance data: No data available.

Mobility in soil

Product data: No data available.
Substance data: No data available.

Other adverse effects: No data available.

SECTION 13: Disposal considerations

Disposal methods:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities

Contaminated packages:

Not determined or not applicable.

SECTION 14: Transport information

United States Transportation of dangerous goods (49 CFR DOT)

UN number	Not regulated
UN proper shipping name	Not regulated
UN transport hazard class(es)	None
Packing group	None
Environmental hazards	None
Special precautions for user	None

International Maritime Dangerous Goods (IMDG)

UN number	Not regulated
UN proper shipping name	Not regulated
UN transport hazard class(es)	None
Packing group	None
Environmental hazards	None
Special precautions for user	None

International Air Transport Association Dangerous Goods Regulations (IATA-DGR)

UN number	Not regulated
UN proper shipping name	Not regulated
UN transport hazard class(es)	None
Packing group	None
Environmental hazards	None
Special precautions for user	None

SECTION 15: Regulatory information

United States regulations

Inventory listing (TSCA):

N/A	Polyol ester	Listed

Significant New Use Rule (TSCA Section 5): Not determined.
Export notification under TSCA Section 12(b): Not determined.
SARA Section 311/312 hazards:

Acute	Chronic	Fire	Pressure	Reactive
No	No	No	No	No

SARA Section 302 extremely hazardous substances: Not determined.
SARA Section 313 toxic chemicals:

N/A	Polyol ester	Not Listed

CERCLA: Not determined.
RCRA: Not determined.
Section 112(r) of the Clean Air Act (CAA): Not determined.
Massachusetts Right to Know:

N/A	Polyol ester	Not Listed

New Jersey Right to Know:

N/A	Polyol ester	Not Listed

New York Right to Know:

N/A	Polyol ester	Not Listed

Pennsylvania Right to Know:

N/A	Polyol ester	Not Listed

California Proposition 65: None of the ingredients are listed.

SECTION 16: Other information

Abbreviations and Acronyms: None
Disclaimer:
This product has been classified in accordance with OSHA HCS 2012 guidelines. The information provided in this SDS is correct, to the best of our knowledge, based on information available. The information given is designed only as a guidance for safe handling, use, storage, transportation and disposal and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials, unless specified in the text. The responsibility to provide a safe workplace remains with the user.
NFPA: 0-1-0
HMIS: 0-1-0
Initial preparation date: 01.23.2020

End of Safety Data Sheet

APPENDIX 14
Oil

Envirotemp™ 360
Synthetic Ester

Envirotemp™ 360 Synthetic Ester

Product Description

Envirotemp 360 Synthetic Ester fluid was developed to be a dielectric coolant liquid for applications requiring high performance under extreme temperature conditions. Envirotemp Synthetic Ester fluids are alternatives to mineral oil, silicone and PCB's. They are classified as K-Class dielectric liquids, offering great advantages regarding fire safety. They are ideal for use in transformers where fire safety is a top priority, such as enclosed spaces, and in transformers positioned in close proximity to people and/or other equipment.

Advantages

- The high fire point (316°C vs 160°C for mineral oil) allows its classification as a K-Class fluid, also named previously as "fire-resistant" dielectric liquids
- Envirotemp 360 is optimized for oxidative stability. It surpasses the required performance of the oxidative stability test of synthetic ester liquids[a] even when tested for a period almost 5x longer
- It is suitable for use in free-breathing applications and at high-temperatures, being a high thermal class dielectric liquid
- It continues to flow even at extremely cold conditions, as low as -45°C

Envirotemp E360 Property	Test Method	IEC 61099 Acceptance Values	Typical Results
PHYSICAL			
Colour	ISO 2211	≤ 200 Hazen	≤ 200 Hazen
	ISO 2049		0.1
Appearance	Visual clear, free from water, suspended matter and sediment ISO	Clear	Clear
Density at 20˚C (kg/dm^3)	3675, ISO 12185	≤ 1000	960
Kinematic viscosity (mm^2/s)	ISO 3104	---	
100˚C			7
40˚C		≤ 35	34
-20˚C		≤ 3000	≤ 3000[b]
Flash point (˚C)	ISO 2719	≥ 250	277
Fire point (˚C)	ISO 2592	≥300	316
Pour point (˚C)	ISO 3016	≤ -45	-48
CHEMICAL			
Water content (mg/kg)	IEC 60814	≤ 200[c]	≤ 50
Acidity (mg KOH/g)	IEC 62021 -1, IEC 62021 -2	≤ 0.03	0.01
Oxidation stability, 164 h @120°C	IEC 61125, Method C		
Total acidity (mg KOH/g)		≤ 0.3	0.19
Total sludge (% mass)		≤ 0.01	0.003
Oxidation stability, 800 h @120°C	IEC 61125, Method C		
Total acidity (mg KOH/g)		---	0.21
Total sludge (% mass)		---	0.004
ELECTRICAL			
Breakdown voltage (kV)	IEC 60156	≥45[c]	> 60
Dielectric Dissipation factor (tan δ) at 90 ˚C and 50 Hz	IEC 60247, IEC 61620	≤ 0.03[c]	0.004[c]
DC resistivity at 90 ˚C (GΩ·m)	IEC 60247	≥ 2	24

[a] IEC 61099 requires testing synthetic ester liquids according to IEC 61125 method C for 164h. Envirotemp 360 was tested for 800h.
[b] Current value based on extrapolation. Precise value to be measured
[c] for untreated liquid, as received

Envirotemp™ 360 Synthetic Ester

Material Compatibility

Envirotemp 360 fluid is compatible with most materials used in conventional mineral oil filled transformers. Some restrictions may exist with materials such as PVC's, certain silicone rubber formulations, and polyurethanes. It is recommended to verify the chemical compatibility for each application.

Storage Location

Indoor tank storage is preferable. Since the fluid viscosity increases at low temperatures, indoor controlled temperatures reduce the need for heating the fluid to proper pumping and filtering temperatures.

For outdoor installations, a thermal insulating backfill should be considered for economic advantages. Despite having a low pour point temperature, increased fluid viscosity at low temperatures may make it difficult to handle.

Storage Temperature

Envirotemp 360 fluid can be pumped directly from storage tanks. If suction line lengths or suction lift heights are excessive, warming of the Envirotemp 360 fluid may be desired to reduce the viscosity.
If heating of Envirotemp 360 fluid is required, the following systems are recommended:

- A circulating pump and piping with a low watt density electric heater (in line) can be attached to the storage tank to maintain temperatures of 38°C (100°F) or higher (i.e., a 76 liter/min (20 GPM) pump with a 10 kW heater will maintain a temperature of 43°C (110°F) in a 19 m^3 (5,000 gal) storage tank if heat losses to the environment are not excessive). The tank and piping should be insulated if ambient temperatures are low, to minimize heating costs.

Tanks

Standard steel storage tanks used conventionally used for transformer oil are satisfactory. Tanks should conform to local codes and standards. New tanks are preferred, should have at least one manhole, and should be protected from moisture by nitrogen blanketing. Before use, the inside of tanks should be sandblasted and primed with a coating compatible with synthetic ester fluid. Primers used for transformers' interiors are recommended -. Existing storage tanks that have been used for conventional transformer oil can be used for Envirotemp 360 fluid if the following conditions are met:

- The tank is of proper capacity and the lines for filling and suction are adequate.
- The tank is thoroughly cleaned and inspected closely for any rusting condition or leakage.

Drum Handling Storage

- The Envirotemp 360 fluid-filled drums are sealed at the factory to protect against foreign material and moisture contamination during shipping. Seals over the bung plugs assure that the drum has not been opened.
- When drums of Envirotemp 360 fluid are to be stored over a long period of time, it is good practice to store them in a dry, preferably heated building. If long term storage outdoors cannot be avoided, it is recommended the drum be stored horizontally with the bungs of the drum below the level of the fluid inside.
- A drip pan or basin is always recommended for drum storage.

CONTACT

Contact your sales representative for pricing and availability of the product

Cargill Industrial Specialties
13400 15th Ave N, Suite B
Plymouth, MN 55441
1-800-842-3631
NAenvirotemp@cargill.com
www.envirotempfluids.com

APPENDIX 16
Silicagel

AN ISO 9001:2000 CERTIFIED COMPANY
INFRONT OF 'A' CABIN, A/C LOCO SHED ROAD, MAHAVEERANPURA, NAGRA, JHANSI(U.P.) – 284003 INDIA
Telefax No: 0510 2311097, Mobile No: 09415030985
Website : www.yogyaenterprises.com E-mail : yogyaenterprises@sify.com
Manufacturers: Silicagel Breathers, Gas Collecting Device, Magnetic Oil Gauge, Buchholz Relay

MATERIAL SAFETY DATA SHEET

Trade name: Yogya Enterprises

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1. Identification of the substance/preparation and of the company

Identification of the substance or preparation

Trade name:	Yogya Enterprises
Post address:	Infront of 'A' Cabin, A/c Loco Shed Road, Mahaveerapura
Place:	Nagra, Jhansi – 284003 INDIA
Tele fax:	+91-0510-2311097

2. Composition/Information of ingredients

Description	Silica gel orange
Dangerous substance	Not present
CAS NO.	1343-98-2
Un-identification NO.(HS-Code)	28112200

3. Hazards identification

Specific hazards for humans and environment

The product is very absorbent and may have a drying effect on skin and eyes. In contact with water heat development but burning of the skin and mucous membrane is impossible.

4. First-aid measures

After inhalation	Fresh air
After skin contact	Wash with water
After eye contact	Flush with water

5. Fire-fightening measures

Suitable extinguishing media	This material will not burn Use media appropriate for surrounding fire.

6. Accidental release measures

Personal precautions	Respiratory protection eye protection
Methods for cleaning up	Sweep the spill area, avoid rising dust

7 .Handling and storage

Precautions for safe handling	Handling in air tight container Avoid freezing or exposing to the sun.
Measures to prevent fire-and explosion	Not fired and explosion

AN ISO 9001 : 2000 CERTIFIED COMPANY
INFRONT OF 'A' CABIN, A/C LOCO SHED ROAD, MAHAVEERANPURA, NAGRA, JHANSI(U.P.) – 284003 INDIA
Telefax No: 0510 2311097, Mobile No: 09415030985
Website : www.yogyaenterprises.com E-mail : yogyaenterprises@sify.com
Manufacturers: Silicagel Breathers, Gas Collecting Device, Magnetic Oil Gauge, Buchholz Relay

8.Exposure controls / personal protection

General See 7.

9. Physical and chemical properties

Appearance	orange bead
Odor	odorless
Boiling point	not applicable
Melting point	1708-1718 0C
Flash point	not applicable
Solubility(water,20.)	insoluble

10. Stability and reactivity The product is stable and inert

11. Toxicological information Non-toxic

12. Ecological information

Silica gel orange is chemically and biological inert

13. Disposal considerations

Landfill according to federal, state and local regulations

14. Transport information Not dangerous goods according to the Transport regulations.

15. Regulatory information

Silica gel Orange is not a dangerous substance according to EEC Council Directive 67/548/EC (Classification, Packaging and Labelling of Dangerous Substances) as last amended.

16. Other information

The applicable regulations and industrial hygiene standards have to be considered

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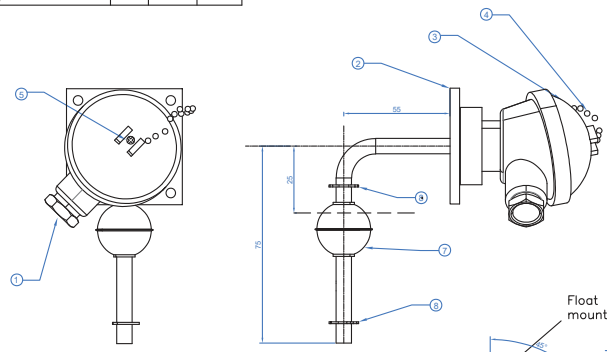
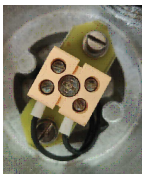
The date is based on the state of knowledge and experience, without a claim being made for completeness.

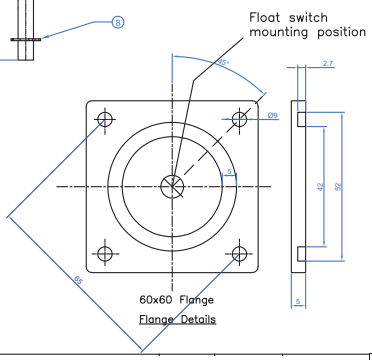
The Safety Data Sheet serves to describe the product only with regard to the safety requirement. These data do not constitute a specification.

APPENDIX 17
Oil level sensor

REVISION HISTORY				
REV	ECN	DESCRIPTION	BY	DATE	APPV'D
01		Views added with TC head at 45°	AAP	23/06/2021	MAK







NOTE :
THREAD INTO THE CONNECTION BOX FOR THE CABLE GLAND IS P.G.11

FLOAT SWITCH GENERAL SPECIFICATIONS:–

TABLE 1 : PART NUMBER SPECIFICATIONS:–

Part Number	Material	Temperature range	MIN S.G.
SS28YSJTC/L	As per Table 2	–55°C to +105°C	0.80

TABLE 2 : MATERIAL SPECIFICATIONS:–

Sr.No	Description	Material	Size	Qty
1	Blind stop/Cable gland	Standard	P.G.11	1
2	Mounting Flange	S.S.	Sq. 60x60	1
3	T.C.Head	Aluminium	Std	1
4	Chain	Brass	Std	1
5	Chain mounting screws	S.S.	Std	2
6	Stem	S.S.	ø8	1
7	Float	S.S.	ø28	1
8	Circlips	S.S.	1.5 mm	2
9	Lugs	Sta–kon Insulated wire Ferrule, 20AWG stranded copper conductor,0.531In L,Copper,White		2

TABLE 3: ELECTRICAL SPECIFICATIONS:–

Level	Contact form	VA rating	Breakdown Voltage	Switching Current	Switching Voltage
D	A25 S.P.S.T.	25VA	400 V DC	0.5 A	210 V DC

TABLE 4: SWITCHING LOGIC:–

Sr no	Distance	Switching mode
1	At 25	NC
2	Below 25	NO

Note: Product of voltage & current should never exceed v/v wattage.

1. Burr free
2. Remove all sharp edges.
3. UNLESS & OTHERWISE STATED ALL DIMENSIONS ARE IN mm. If in doubt ask!

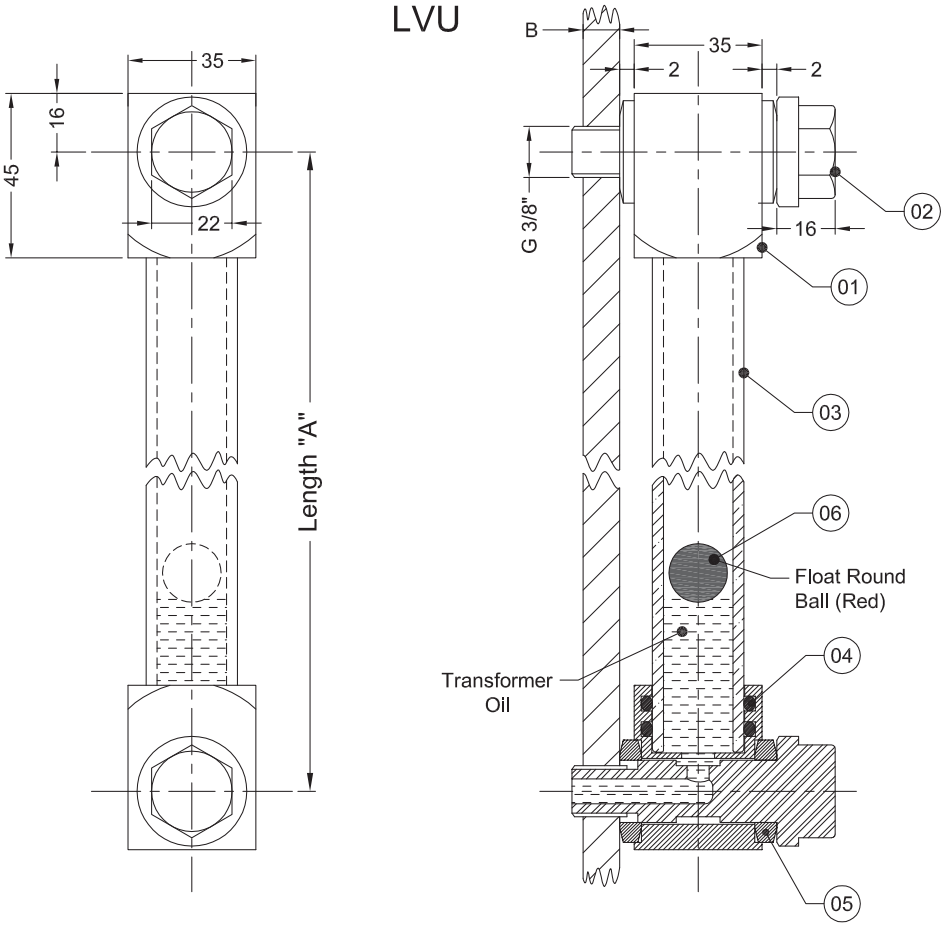
	première edition / first issue	B.Vincent	O.Faure
	modification/revision	Redacteur/Drawn	Verificateur/Checked

Oil Level Sensor

JST transformateurs

1/1	2	PLN	A0	1075758	0

APPENDIX 18
Oil level indicator



NORMAL		
Pos.	A (mm)	B (mm)
1	500	15
2	1000	15
3	1500	15
4	2000	15
5	360	15
6	490	15
7	130	15
8		15
9		15
10		15

SPECIAL		
Pos.	A (mm)	B (mm)
11	500	25
12	1000	25
13	1500	25
14	2000	25
15	970	25
16	810	25
17	1070	25
18	530	25
19	280	25
20		25

Gasket Ref. Drg.		
S.No.	Description	Drg. No.
4	'O' Ring	42002482
5	Special Taper Gasket	42002482

IMP :
Use Fixture to check Centres of Mtg. Dim (A).

NOTE:
1). Position 15 used on ABB Transformer.
2). Polycarbonate Tube is U/V Stabilized & Unbreakable.
3). Pressure Test at 1.0 Kg/cm² for 30 min. with Air.

Bill of Material				
S.No.	Description	Material	Qty.	Standard
1	Gauge Body	Al. (Gr.63400)	2	IS-733
2	Mtg. Special Bolt	S. Steel (Gr.304)	2	IS-6603
3	Transparent Tube	Polycarbonate	1	IS-14443
4	'O' Ring	Viton (BOSCO)	4	IS-11149
5	Special Taper Gasket	Viton (BOSCO)	4	IS-11149
6	Round Float Moulded	Nitrophyl	1	No Std.

	première edition / first issue	B.Vincent	O.Faure
	modification/revision	Redacteur/Drawn	Verificateur/Checked

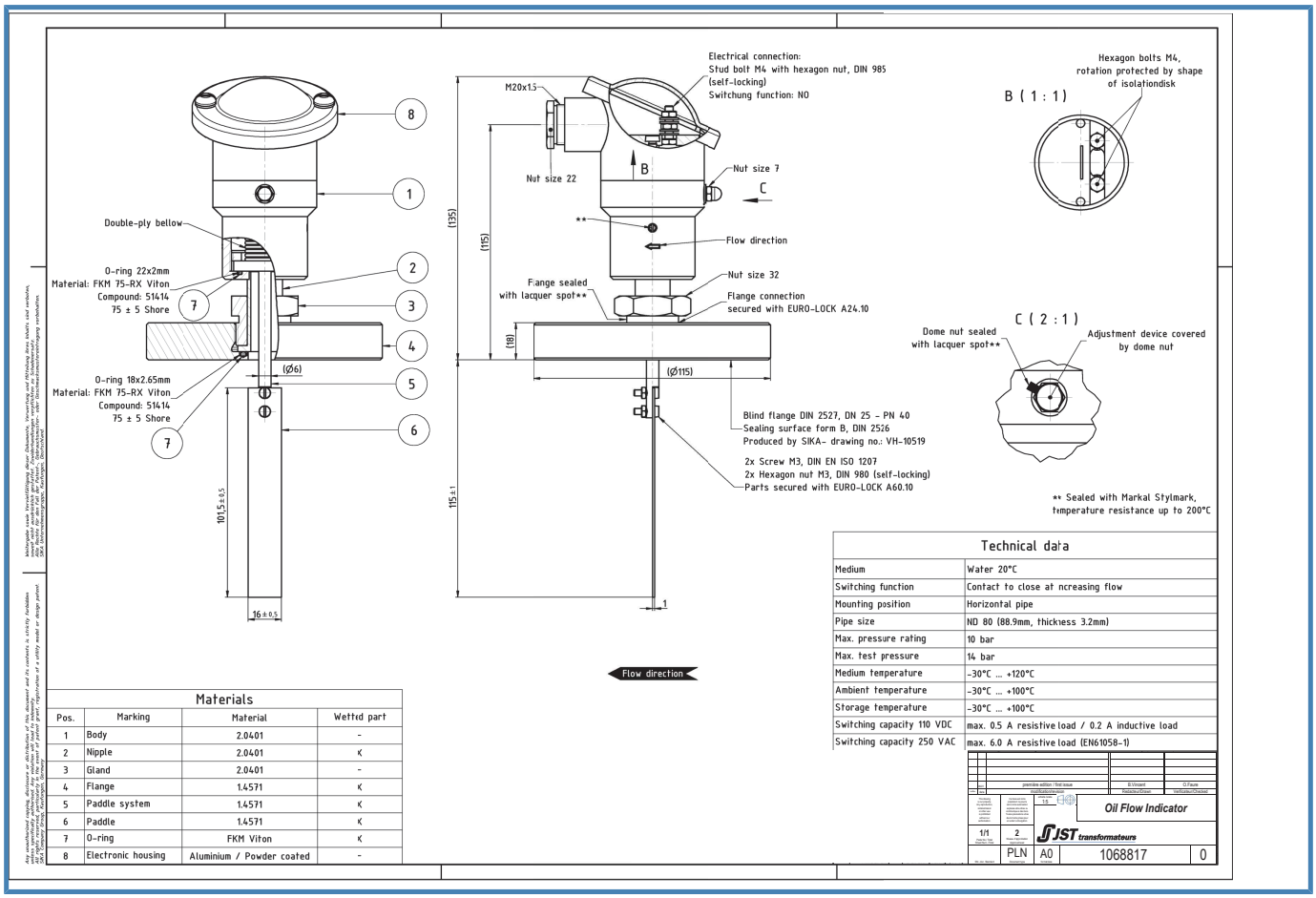
Visual Oil Level

JST transformateurs

1/1	2			
	PLN	A0	1075427	0

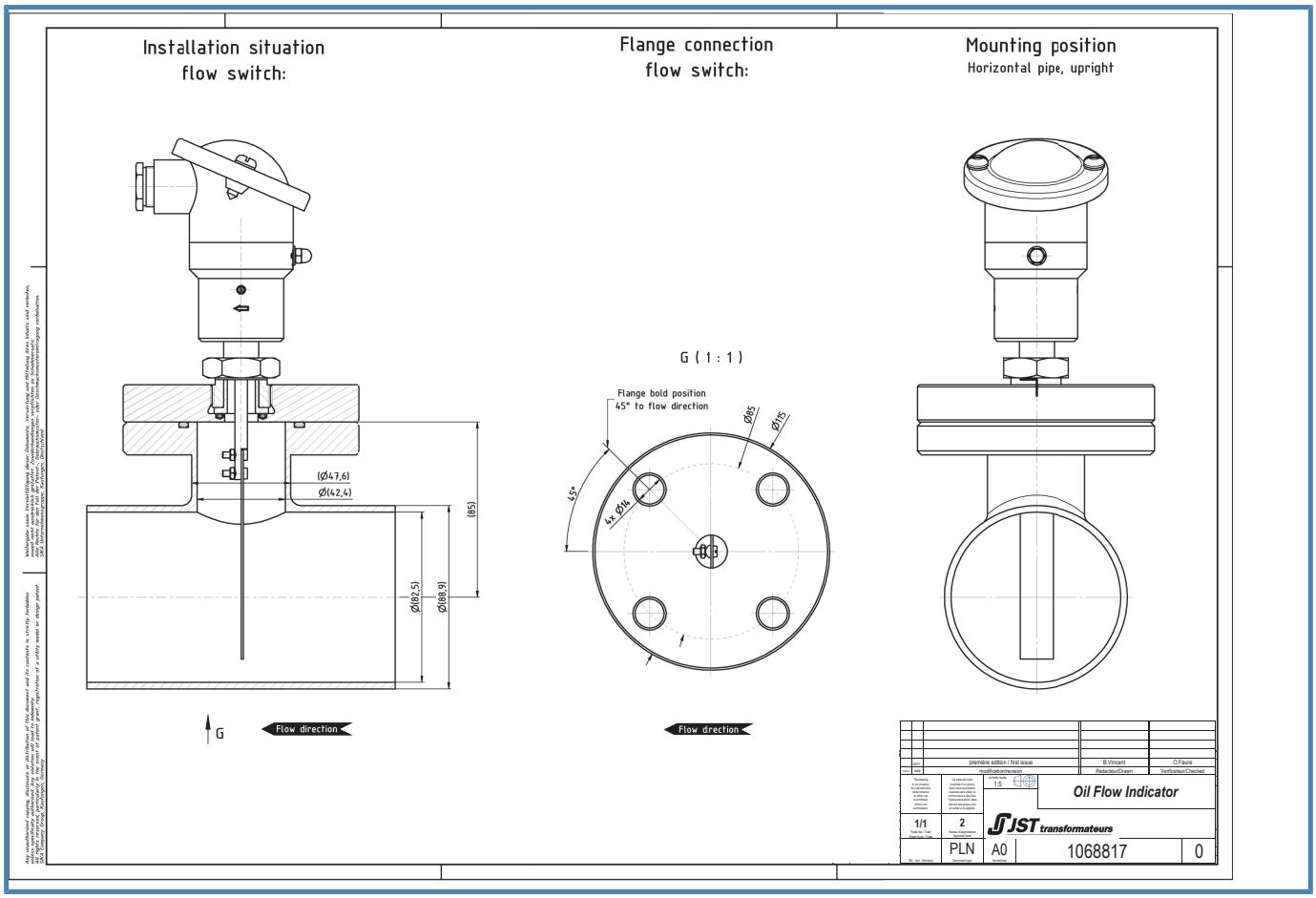
ALL DIMENSIONS ARE IN mm.

APPENDIX 19
Oil Flow Indicator



Technical data	
Medium	Water 20°C
Switching function	Contact to close at ncreasing flow
Mounting position	Horizontal pipe
Pipe size	ND 80 (88.9mm, thickness 3.2mm)
Max. pressure rating	10 bar
Max. test pressure	14 bar
Medium temperature	-30°C ... +120°C
Ambient temperature	-30°C ... +100°C
Storage temperature	-30°C ... +100°C
Switching capacity 110 VDC	max. 0.5 A resistive load / 0.2 A inductive load
Switching capacity 250 VAC	max. 6.0 A resistive load (EN61058-1)

Materials			
Pos.	Marking	Material	Wetted part
1	Body	2.0401	-
2	Nipple	2.0401	K
3	Gland	2.0401	-
4	Flange	1.4571	K
5	Paddle system	1.4571	K
6	Paddle	1.4571	K
7	O-ring	FKM Viton	K
8	Electronic housing	Aluminium / Powder coated	-


Installation situation
flow switch:
Flange connection
flow switch:
Mounting position
Horizontal pipe, upright
G (1 : 1)
Flange bold position
45° to flow direction
Ø85
Ø115
45°
4x Ø14
(Ø47,6)
Ø(42,4)
(85)
Ø(62,5)
Ø(68,9)
G
Flow direction
Flow direction
première edition / first issue
B.Vincent
O.Faure
Redacteur/Drawn
Verificateur/Checked
1:5
Oil Flow Indicator
JST transformateurs
1/1
2
PLN
A0
1068817
0

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