SUNGROW
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# User Manual

## The Pad-mounted Transformer

PMT-UEN-Ver13-202404

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**Reversion History**

| Version | Date | Content |
|---|---|---|
| Initial | 20210430 | Initial release |
| Ver10 | 20210726 | Detail in “ Recommended torque” |
| Ver11 | 20220802 | 1 add requirement to cable fixture<br>2 add operation in internal devices<br>3 reorganize chapters structures from flat to pyramid. |

| Version | Date | Content |
|---|---|---|
| Ver12 | 20240110 | 1 Updated transformer-related drawings<br>2 Added information related to cold start<br>3 Added the below notices:<br>• It is recommended to use tin plated aluminum terminals or tin plated copper terminals.<br>• Do not operate the load switch when the transformer is under load.<br>• Remove the cover on the pressure relief valve<br>• Cable clips are provided for the standard equipment<br>• Reserve sufficient length in HV cables<br>4 Add cable clamp fixing diagram and related description<br>5 Add transformer loss information<br>6 Modified torque requirements<br>7 Added information about how to deal with oil leakage<br>8 Added web address |
| Ver13 | 20240403 | 1 Added Cable Clamp Installation<br>2 Added Double end threaded studs 8~10N.M<br>3 Replace Tin-plated copper stud with Tin- plated copper double-end threaded studs<br>4 Unify and modify word descriptions |

# Contents

# 1 About This Manual

This manual describes the transportation and storage, electrical connection, troubleshooting, and maintenance of the pad-mounted transformer.

## 1.1 Validity

This manual applies to the following models:

- Pad-mounted transformer

## 1.2 Target Group

This manual is intended for professional technicians who are responsible for the installation, operation, and maintenance of MV grid-connected inverters. The professional technician is required to meet the following requirements:

- Know electronic, electrical wiring, and mechanical expertise, and be familiar with electrical and mechanical schematics.
- Should be familiar with the composition and working principles of the PV system and its front- and rear-level equipment.
- Have received professional training related to the installation and commissioning of electrical equipment.
- Be able to quickly respond to hazards or emergencies that occur during installation and commissioning.
- Be familiar with the relevant standards and specifications of the country/region where the project is located.

## 1.3 How to Use This Manual

Please read this manual carefully before using the product and keep it properly at a place for easy access.

The products and product manuals are always in the process of improvement and upgrade. If the manual received is slightly inconsistent with the product, it may be a result of a product version upgrade, and the actual product shall prevail. For any questions, please contact Sungrow Customer Service.

## 1.4 Symbol Explanations

To ensure the safety of the users and their properties when they use the product and to make sure that the product is used optimally and efficiently, this manual provides users with

the relevant safety information which is marked by the following symbols. The symbols that may be used in this manual are listed below. Please read carefully to make better use of this manual.

**DANGER**

**DANGER indicates high-risk potential hazards that, if not avoided, may lead to death or serious injury.**

**WARNING**

**WARNING indicates moderate-risk potential hazards that, if not avoided, may lead to death or serious injury.**

**CAUTION**

**CAUTION indicates a slightly hazardous situation which, if not avoided, may result in minor or moderate injury.**

NOTICE

**NOTICE indicates potential risks that, if not avoided, may lead to device malfunctions or financial losses.**

NOTE indicates additional information, emphasized contents or tips to help you solve problems or save time.

# 2 Product Description

This chapter describes the exterior appearance and main components of the transformer.

## 2.1 Four Views

MVT of SG4400UD-MV-US as reference, The four views of the transformer are shown in the figure below.

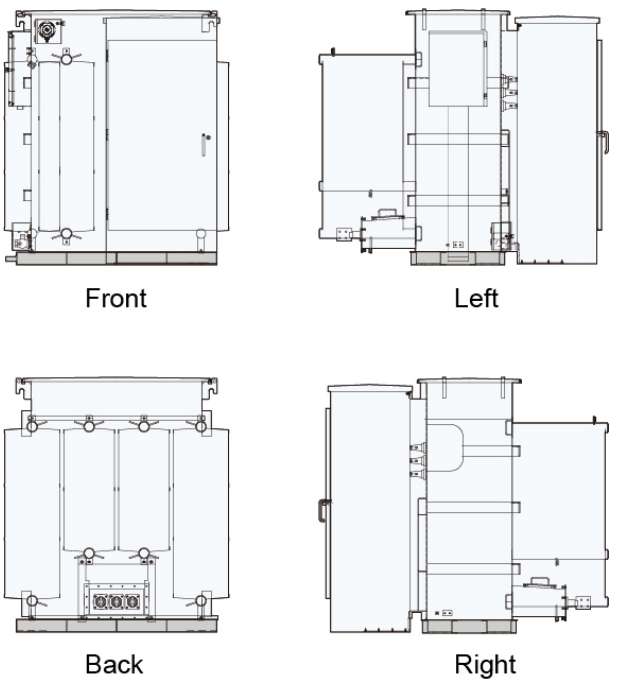



**figure 2-1** Four Views of SG4400UD-MV-US

## 2.2 Exterior Dimensions

The dimensions of the transformer are shown in the figure below.

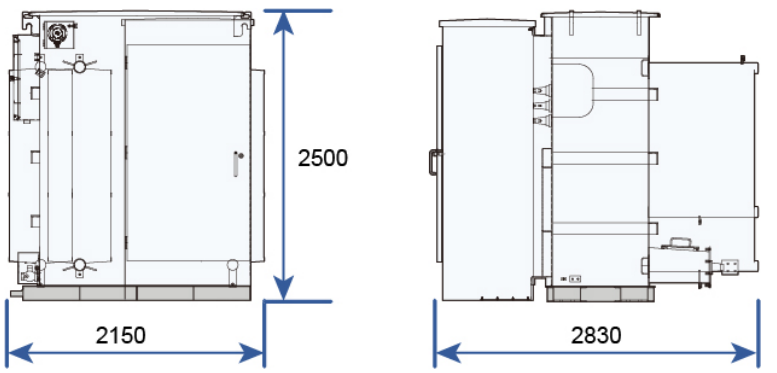



**figure 2-2** Exterior Dimensions of SG4400UD-MV-US

MVT of SG4400UD-MV-US as reference, differ for other MVT size.

# 3 Electrical Connection

**WARNING**

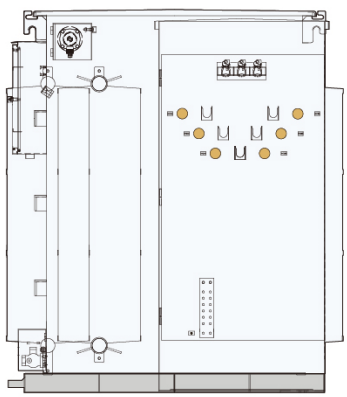
**Medium-voltage connections should only be made by a qualified person who is authorized to make medium voltage connections.**

**Perform cable connections in strict accordance with the terminal phase sequence.**

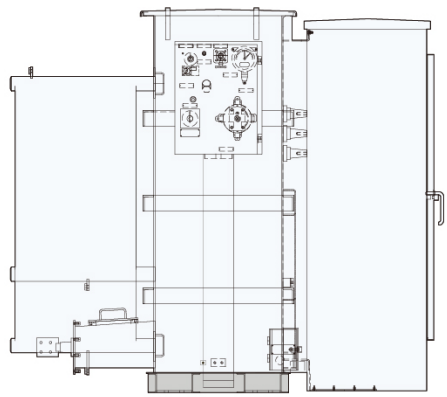
This chapter mainly describes the locations of cable connection terminals and recommended cable specifications.

## 3.1 Connection Area

MVT of SG4400UD-MV-US as reference , connection area for the medium-voltage elbow connectors and the cables are shown in the following figure.



Front



Left

Dimensions of the cable connection terminal are shown in the figure below.

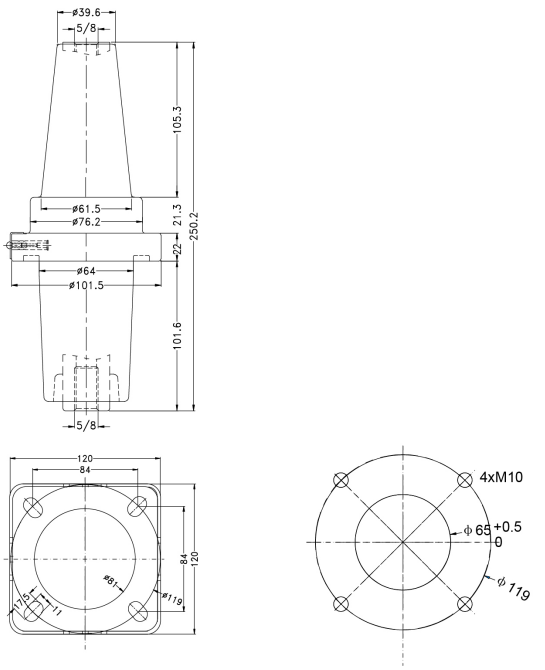



**figure 3-1** Cable connection terminal

* The figure above only takes 34.5kV as an example. If the voltage level of the purchased transformer is not 34.5kV, please contact Sungrow for corresponding information.

**Requirement**

The medium-voltage cables must be fitted with type C connection plugs.

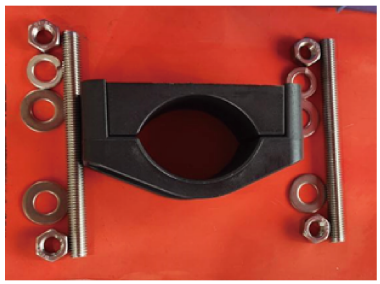
**WARNING**

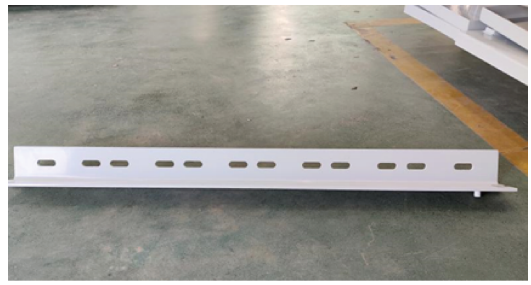
**Use only tin- plated copper double-end threaded studs provided by Sungrow. Substitution of the threaded stud is not allowed or shall be reviewed by SUNGROW technicians otherwise it shall void manufacturer warranty.**

## 3.2 Cable Clamp Installation

**Tools**

Tols include but are not limited to the following recommended ones. Use other auxiliary tools on site as needed.



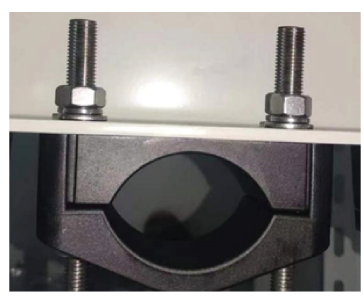


| No. | Name | Source |
|---|---|---|
| 1 | Cable clamp | Scope of supply |
| 2 | Support | |
| 3 | Supporting M12X140 screw | |
| 4 | M12 nut | |
| 5 | M12 flat washer | |
| 6 | M12 spring washer | |
| 7 | Yellow-green ground cable supporting M6X10 bolt | |
| 8 | Adjustable wrench | Beyond the scope of supply |

**Step 1** The high voltage cable clamp and bracket pre-assembly.

Use a wrench to assemble the screw, nut, gasket and cable clamp to the bracket, 6 cable clamp evenly distributed. Use nuts and flat washers on the front, and nuts, spring washers, and flat washers between the back and the support. Shown in the following figure.

Front



Back

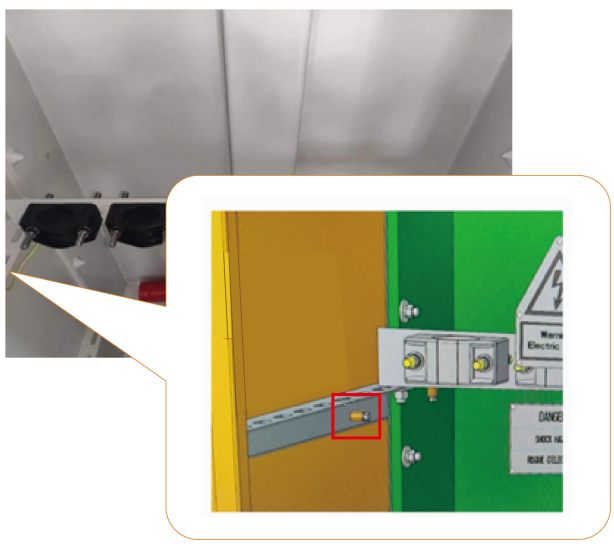
**Step 2** Install the pre-assembled cable clamp and bracket into the high-pressure bin.

Using M12X35 bolts, flat washers, spring washers and nuts. Shown in the following figure.

**figure 3-2** The support is installed in the high pressure chamber

**Step 3** Install ground cables.

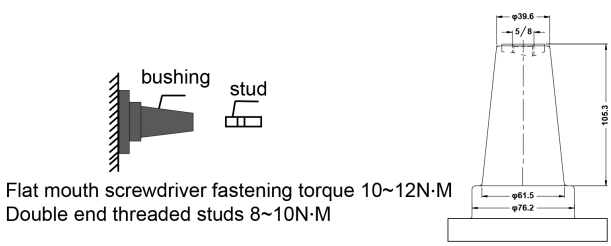
Use bolts, spring washers, and flat washers of the corresponding specifications to connect the yellow-green bottom line support to the nearby ground hole.



**- - End**

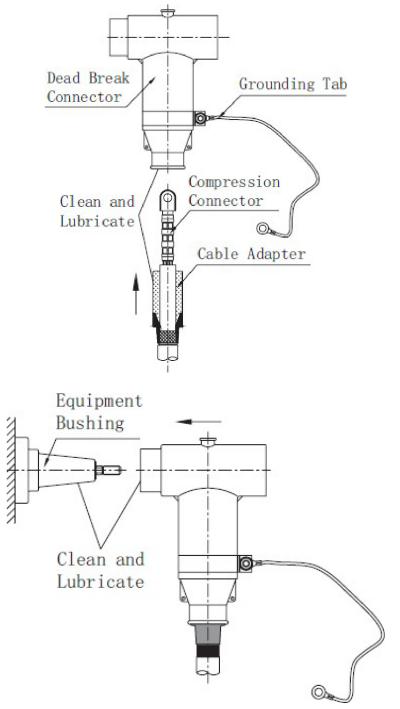
## 3.3 Connection Procedure

Rotate threaded pin into bushing nut eye until bottom.



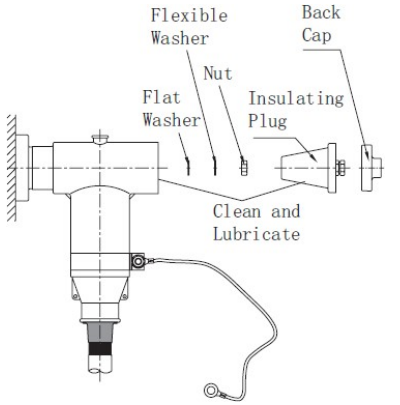
It is recommended to use tin plated aluminum terminals or tin plated copper terminals.

**Step 1** Clean cable adapter and dead break connector. Lubricate cable adapter outer surface, dead break connector inner surface. Insert compression connector into dead break connector. Until compression connector eye is in the center of dead break connector.

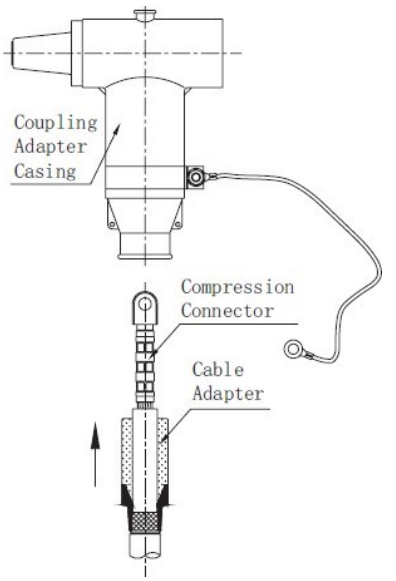



**Step 2** Clean and lubricate the bushing then install the dead break connector.

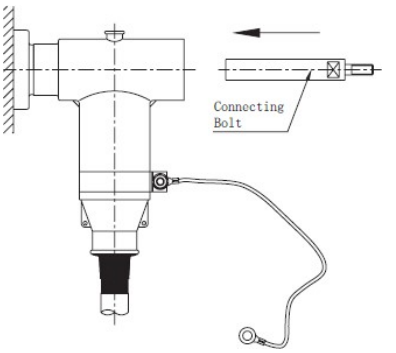
**Step 3** Install the back cap.



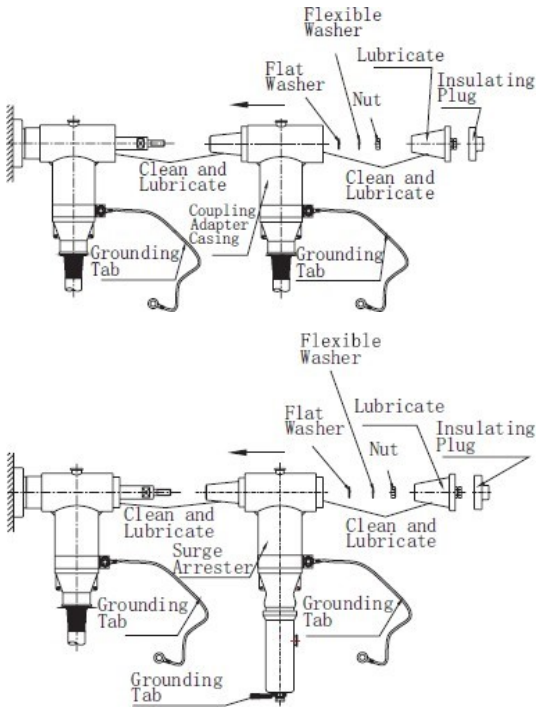
**Step 4** Connect the coupling adapter casing to cable adapter.




**Step 5** Install the connecting bolt, torque 45-50N·M.



**Step 6** Clean and lubricate dead break connector, coupling adapter and insulating plug, then connect them.




**WARNING**

**When wiring, reserve sufficient length in HV cables to avoid the impact of stress. Meanwhile, make sure the cable labels are correct.**

**- - End**

## 3.4 Cable Fixture

After completing wiring, fix the cable on the beam to avoid excessive stress on the bushing.

1 Drill holes at the bottom of the MVT.

2 Install cable clamp crossbeam.

3 Lead cables through holes into the MVT.

When the wiring is completed, seal the gap between cables and holes with fireproof/ waterproof materials such as fireproof mud to prevent foreign matter or moisture from entering and affecting the long-term normal operation of the MVT!

**WARNING**

**Use cable plugs to plug the unused high-voltage conduit.**

SUNGROW provides one set of cable clip and beam for the standard equipment. Additional sets of cable clips and beams will be provided based on the actual size of the project.

Sungrow has supplied channel steel on both left and right side, to allow customer attach its own beam(s), cable clips.

It must be assured that the weight and alignment of the cables connected to the bushing will not bring about mechanical stress that can cause crack, failures or to provoke the presence of leakages through the gaskets.

# 4 Logistic & Handling

## 4.1 Shipment

Three phase pad-mounted transformers are shipped hermetically sealed.

## 4.2 Oil Level

The three phase pad-mounted transformer is filled with oil up to its nominal level from factory, taking in consideration the ambient temperature at the moment of being filled.

## 4.3 Hoisting

The transformer is used inside the SUNGROW containerized solution, and it can only be moved with a crane from the top.
The transformer always must be lifted or held from the four lifting lugs in vertical position unless it is indicated in any other way.
The lifting lugs are designed to allow the lifting with a maximum angle of 30° between the sling and the vertical.
When lifting with wider than 30° angles regarding the vertical, an extension bar must be used for the vertical rising, between the slings.

⚠ CAUTION

**The cover tank lifting lugs must be used only to raise the cover tank in individual form. The lifting lugs be used never to lift the complete transformer.**
**To avoid transformer damage, lift the pad-mounted transformer from the four lifting lugs.**
**Do not raise the transformer from drain valves, pipeline connections or radiators.**

## 4.4 Storage

This chapter mainly introduces the storage requirements and cold start related content of pad-mounted transformer.

### 4.4.1 Storage Requirements

If pad-mounted transformer is not immediately installed, it is advisable to locate it in a safe place, complying with the following points during its storage:

- Look for chips or flaws in the surface and apply painting in damaged surfaces, preparing the surface with sandpaper.
- Avoid contact with vapors or corrosive gases as the chlorine and sulfur ones.
- The spare parts that are given with the three phase pad-mounted transformer have to be kept on a clean and dry place.

### 4.4.2 Cold Start

A cold start shall be conducted if all the following three requirements are met:

1 The transformer is not running;

2 The ambient temperature is below -20℃;

3 The equipment has been stored for over 3 days.

**Cold Start Procedure**

1 The transformer operates at no load for 8 hours.

2 Increase the load in 20% increments, and keep the transformer operating for at least 30 minutes at each step, until reaching the full load.

Cold start is completed.

# 5 Inspection

## 5.1 Receiving Inspection

An inspection of the three phase pad-mounted transformer during reception should be done before unloading from transportation (trailer platform or truck). Check that the transformer requested characteristics match those indicated in the nameplate.

Immediately after equipment reception, and before putting it into service, inspect the transformer for any damage that may have occurred during shipment or storage. If rough handling is evident, fill out a damage claim with the transport company immediately and notify SUNGROW.

NOTE: A visual inspection will be requested of the interior of the three phase pad-mounted transformer only when there is evidence of physical damages from the exterior, and in such situation, it will be necessary to communicate the requirement to SUNGROW, and to a transporter representative, before beginning with the inspection works.

In case of having a bolt lock, it is needed to hexagonal socket ( which is shipped with the transformers ) to open the cabinet for the HV voltage side and the accessory cabinet.

A report of the conditions in which the equipment and its accessories were received must be done for any claim.

## 5.2 Internal Transformer Inspection

It will only be carried out in the presence of SUNGROW or with authorization written.

# 6 Design Consdieration

## 6.1 Space for handling and ventilation

The three phase pad-mounted transformer location should provide enough space:

- Allow the installation maneuvers.
- Pad-mounted transformer can perform inspection and maintenance tasks.
- Please refer to SUNGROW container inverter/container PCS and check the gaps required for unit maintenance to ensure good ventilation.

## 6.2 Ambient Temperature

The limits specified by the standards by which the transformer was manufactured shall not be exceeded (usually-30°C to 60°C).
If the site temperature is below -30°C or either above 60 °C, this need to be specified during the technical discussion before the technical contract is signed.

## 6.3 Altitude

To be able to have the pad-mounted transformer nominal capability, in kVA, it is very important at the time of installation to respect the maximum height over the sea level for which was designed, whose reference is shown in the nameplate.
At high altitudes the air density decreases, reducing the cooling system efficiency as well as the air dielectric strength.
The standard offer transformer Sungrow provide is of 1000m/3300ft, the transformer which is used above this altitude need to specify the altitude and the ambient temperature when place an order.

## 6.4 Voltage Variation

The transformer can be operated in a continuous way to nominal or smaller capability if the primary voltage is between 0 and 5% smaller to the nominal value.

## 6.5 Audible Sound Emissions

All the transformers generate audible sounds when they are energized; this is due to the mechanical vibrations generated by the magneto-striction phenomenon present in the core.

However, the noise level should not reach levels which is specified in the inverter / PCS specs.

# 7 Service Preparation

## 7.1 Low Voltage and High Voltage Electrical Connections

The cables that are connected to the transformer bushings should be long enough to allow their expansion and contraction due to temperature changes.
It is important to verify that the connections are very tight to avoid hot spots generation, or the transformer terminals are disconnected due to pad-mounted transformer characteristic vibrations. On the other hand, it must be assured that the weight and alignment of the cables connected to the bushing will not bring about mechanical stress that can cause crack, failures or to provoke the presence of leakages through the gaskets.

## 7.2 Connections

The connections that are not shown in the nameplate must not be realized.

## 7.3 Ground Connections

The transformer must be permanently ground connected in order to avoid electrical discharge by an induced voltage. The connection has to be made through the tank ground pad. For the containerized solution Sungrow supply, the transformer has been grounded via the container grounding cables. Please make sure the container grounding pad are well connected to the grounding network onsite.
The ground system must be carried out with the particular regulations of the area where the transformer has been installed.

**⚠ CAUTION**

**Never make connections that are not authorized by the manufacturer or are not indicated in the Nameplate.**

## 7.4 Pre-Commissioning Check

Before applying voltage to the transformer check the following:

- The neutral terminals on HV side (For YNy or YNd type transformers) are properly ground connected. Exception: the Dy1 or Dy11 transformer does not have the neutral terminals on HV side.
- The tank is solidly grounded.
- The tap changer has the adequate position to provide the relation of needed voltage

- All the tools or strange objects have been removed from the transformer.
- Any bolted connection i.e., H.V. bushings flange, etc are properly tightened.
- No oil leakages or stains are present
- The oil level is the correct one.
- All levels, oil and temperature are correct.
- All the electric connections are properly tightened.
- General cleaning is made and especially the bushings porcelain (see maintenance chapter).
- The bushings are in good condition (without blows or fissures).
- People are not near to the three phase pad-mounted transformer previous to be energized.

If the transformer has been stored more than six months it is recommended to run the following field tests:

- Verify the isolation resistance of each winding to ground and between windings.
- Verify power factor of each winding to ground and between windings.
- Turn ratio shall be determined for all taps and for the full windings.
- Verify that the dielectric strength of the insulating liquid remains with values superiors to 30kV/mm.

# 8 Components and Accessories

## 8.1 General

The knowledge of the accessories and the way in which they protect to the three phase pad-mounted transformer, will give a bigger security to operatives and a long field life.

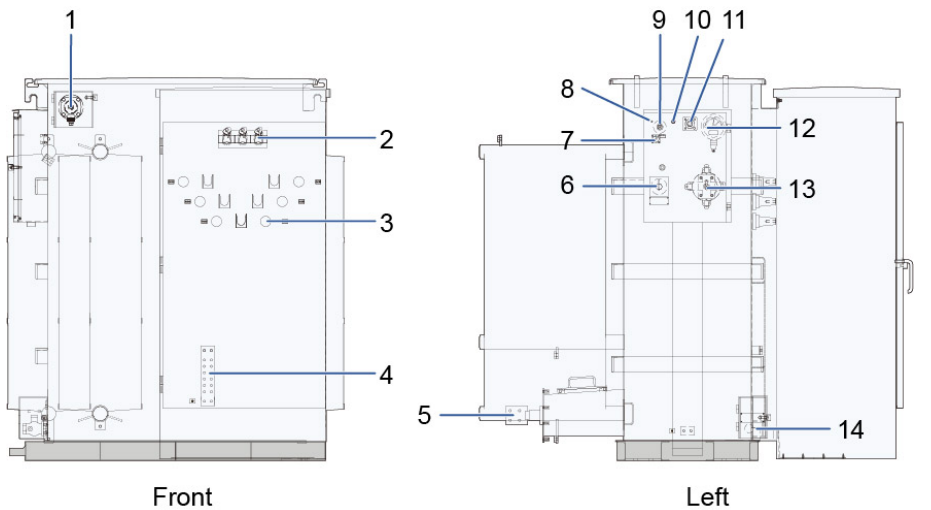



**figure 8-1** Pad-Mounted Transformer Sungrow supply

table 8-1 Accessories

| No. | Description |
|---|---|
| 1 | Cover mounted pressure relief |
| 2 | Expulsion fuse |
| 3 | HV Bushing |
| 4 | Earthing plate |
| 5 | LV bushing(beyond the scope of delivery) |
| 6 | Off- load tap changer |
| 7 | Oil Level indicator |
| 8 | Schrader valve |
| 9 | Vacuum pressure gauge |
| 10 | Pressure relief valve with manual pull ring |
| 11 | Oil filling valve |
| 12 | Oil temperature indicator |

| No. | Description |
|---|---|
| 13 | Load break switch |
| 14 | Oil drain valve |

## 8.2 Cover Mounted Pressure Relief

This pressure relief is used to protect the transformer when there is a severe fault for the transformer such as internal short circuit, the cover mounted pressure relief is to release the pressure immediately under those fault conditions.


**figure 8-2** Cover Mounted Pressure Relief

**WARNING**

**A large amount of gas generated by internal faults in the transformer is discharged through the pressure relief valve. please remove the cover locking device on the pressure relief valve.**

## 8.3 Expulsion fuse

### 8.3.1 Bay-O-Net type

Bay-O-Net fuse is used as the expulsion fuse, and it is accessible from the exterior of the tank. The expulsion fuse acts in fault cases in the secondary side of pad-mounted transformer or for overloads higher to the acceptable for the Norm NOM-J-409 and ANSI C-57.91. To replace the fuse from the exterior, follow the next instructions:

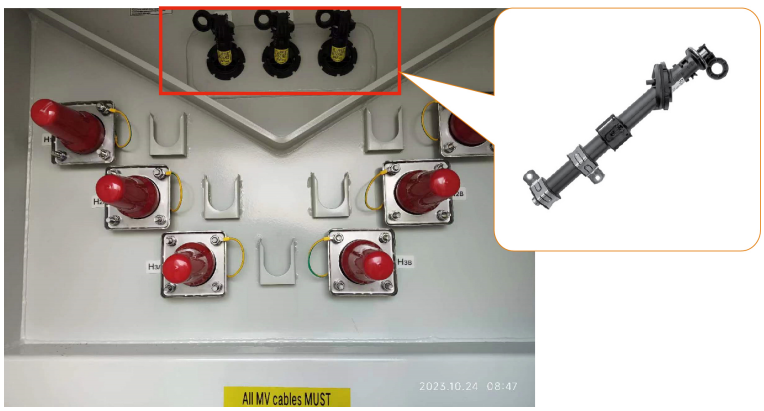



**figure 8-3** Bay-O-Net fuse

### 8.3.2 Remove Fuse Holder

If transformer tank has a pressure relief valve, use hot stick and complete the following steps to relieve tank pressure.

1 Pull pressure relief valve open, keeping it held open for 30 seconds after pressurized air can no longer be heard evacuating audibly through the valve.

2 Close pressure relief valve and wait 30 seconds.

3 Pull pressure relief valve open. Keep it open until audible pressure stops and hold it open for an additional 5 seconds. Pulling the valve open again allows any residual pressure to be removed from the tank.

**⚠ WARNING**

**Transformer tank pressure must be relieved prior to Bay-O-Net operation. Failure to properly vent the transformer tank pressure can result in violent ejection of the Bay-ONet stab assembly along with hot oil. This can cause impact injury, burns and environmental contamination.**

**Step 1** Unlock fuse holder.

Standing to one side of the transformer, attach hot stick to fuse holder eye and twist hot stick to unlock fuse holder.

**Step 2** Break seal.

Turn fuse holder 90° in the Bay-O-Net housing to break the seal between the seal gasket and the Bay-O-Net housing.

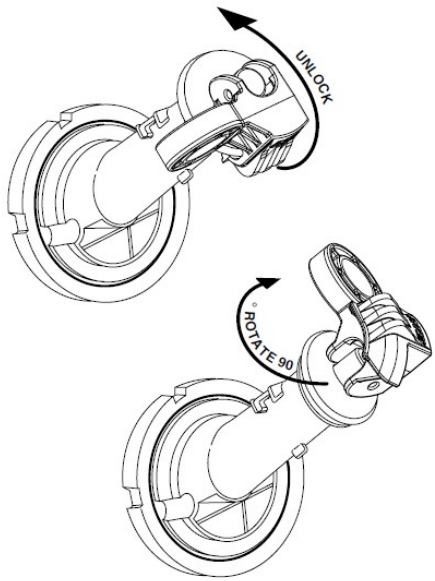



**figure 8-4** Unlock and turn fuse holder 90° in the Bay-O-Net housing.

**Step 3** Draw fuse holder out.

Draw the fuse holder out rapidly in one motion 6 to 8 inches (152 to 203 mm) to interrupt transformer load.

**⚠ WARNING**

**Moving the fuse holder the first 6 to 8 inches (152 to 203 mm) rapidly is critical to the Bay-O-Net successfully switching the transformer off. Movement in this region should be as fast and smooth as possible. If the movement is slow or interrupted, the current may continue in the form of an arc, which could damage the transformer, requiring its replacement. A fire could result, as could death or moderate injury.**

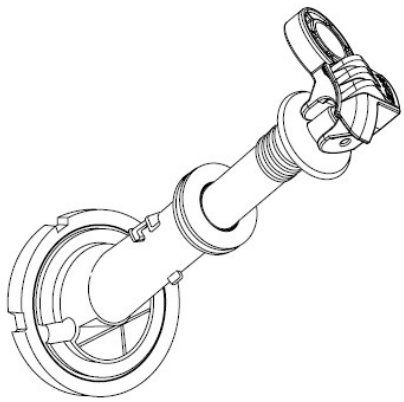


**figure 8-5** Draw fuse holder out 6 to 8 inches (152 to 203 mm)

**Step 4** Remove fuse holder from Bay-O-Net housing.

If a drip guard (metal or plastic) is present, it is recommended to rest the Bay- O-Net holder on the drip guard for 30 seconds to 1 minute to minimize the potential of oil spillage onto rubber terminators.

Wipe off fuse cartridge holder and fuse cartridge using a clean cloth

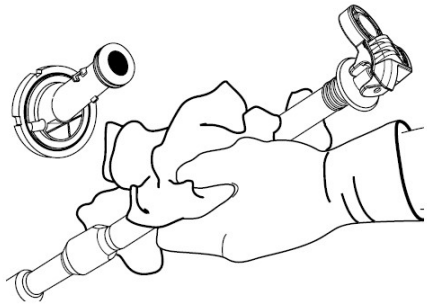


**figure 8-6** Remove fuse holder from Bay-O-Net housing and wipe clean of insulating fluid

If any fluid is coming out of Bay-O-Net Assembly, pull pressure relief valve again to equalize pressure inside the tank. (Refer to Step 1 for instructions.)

**- - End**

### 8.3.3 Replace Fuse Link

For all Eaton's Cooper Power series Bay-O-Net fuses

| | | | |
|---|---|---|---|
| 12kV | 12.47kV | 13.2kV | 13.8kV |
| 21.6kV | 23kV | 24.94kV | 34.5kV |

For the above listed integral cartridge fuses follow Step 6 and then tighten new cartridge/ fuse/end plug against fuse holder using 50-70 in-lbs (5.65-7.9 Nm) of torque.

**⚠ CAUTION**

**Prior to installing the new cartridge verify that the kV rating and length matches the cartridge being replaced. Failure to use the correct length integral cartridge will result in poor electrical contact between the cartridge and Bay-O-Net housing terminals, resulting in possible equipment damage.**

For pad-mounted transformer, the load loss and no-load loss are the same for transformers with the same capacity, which have nothing to do with the voltage rating.

table 8-2 Correspondence between Transformer Capacity and Loss

| Capacity (KVA) | No-load losses@20C (KW) | Load losses@85C (KW) |
|---|---|---|
| 4480 (MVS4480-US ) | 5 | 39.8 |
| 4400 (SG4400UD-MV-US) | 4.4 | 33.44 |
| 3600 (SG3600UD-MV) | 4.8 | 31.2 |
| 3425 (SG3425UD-MV) | 4.3 | 29.9 |
| 3200 (MVS3200-US) | 4.1 | 27.9 |
| 3150 (SG3150UD-MV-US) | 4.1 | 27.4 |
| 2750(SC2750UD-MV-US) | 3.0 | 22.3 |
| 3150(SC3150UD-MV-US) | 4.8 | 27.4 |
| 3450(SC3450UD-MV-US) | 3.9 | 29 |
| 4000(SC4000UD-MV-US) | 4.0 | 36.1 |
| 5000(SC5000UD-MV-US) | 4.1 | 28.3 |
| 5140(MVS5140-LS-US) | 5.5 | 45 |

**Step 1** Remove fuse cartridge

Use a 3/4 inch (19 mm) wrench to remove fuse cartridge from fuse cartridge holder. Carefully inspect the fuse cartridge.

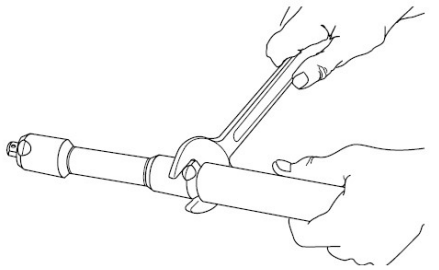


**figure 8-7** Remove fuse cartridge from fuse cartridge holder

**⚠ WARNING**

**Damage to the cartridge (such as severe erosion of the brass end piece, or burning on the interior or exterior surface of the insulation) may prevent the fuse from proper operation. Inspect the cartridge carefully to ensure there is no erosion greater than small pitting on any of the brass pieces, or blackening or burning of the insulating members longer than 1/2" (13 mm). If damage exceeds this level, the damaged cartridge should be replaced with a new one. If large amounts of melting of the brass have occurred, or burning extends more than half the length of the cartridge, the Bay-O-Net holders should also be replaced. This should be done in a transformer repair facility by qualified and trained personnel. If the assemblies are damaged, a failure to interrupt a later fault could result. This may cause injury to the operator or to the public.**

**Step 2** Remove end plug and fuse link from fuse cartridge

Use 3/4 inch (19 mm) and 1/2 inch (13 mm) wrenches to remove end plug.
Use screwdriver or other tool to straighten the tulip tip end of fuse link and push fuse link out of fuse cartridge.

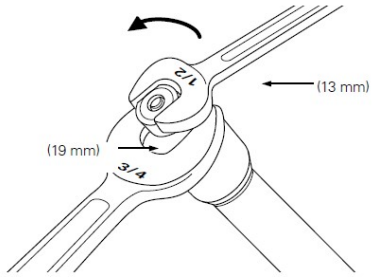



**figure 8-8** Remove end plug from fuse cartridge

**Step 3** Insert replacement fuse link into fuse cartridge, see "figure 8-9 Fuse link replacement"

- A slight resistance may occur when inserting fuse link into cartridge. Refer to A and B in "figure 8-8 Remove end plug from fuse cartridge"
- If the catalog number of the fuse being replaced is not known or is illegible on the fuse, consult equipment specifications or manufacturer.

**⚠ WARNING**

**Using a Bay-O-Net link with a higher amp rating could result in improper coordination with the backup current limiting fuse inside the transformer or elsewhere on the system. This may result in a much larger outage in the event of failure within the transformer or a fire or explosion of the transformer. Installing a Bay-O-Net link with smaller than recommended amp rating may cause an unnecessary fuse operation and service interruption. Always follow the equipment specifications when replacing a fuse link.**

**Step 4** Tighten cartridge to fuse cartridge holder.

- Tighten fuse contact flare end against fuse cartridge holder using 50-70 in-lbs (5.65-7.9 Nm) of torque.(Refer to C in "figure 8-8 Remove end plug from fuse cartridge").
- Replace end plug on other end of fuse cartridge and tighten to 50-70 in-lbs (5.65-7.9 Nm) torque.(Refer to D and E in "figure 8-8 Remove end plug from fuse cartridge").
- Remove end plug and ensure that leaves of tulip tip have spread uniformly (Refer to F in "figure 8-8 Remove end plug from fuse cartridge").
- Replace end plug applying 50-70 in-lbs (5.65-7.9 Nm) torque to both connections (Refer to D and E in "figure 8-8 Remove end plug from fuse cartridge").

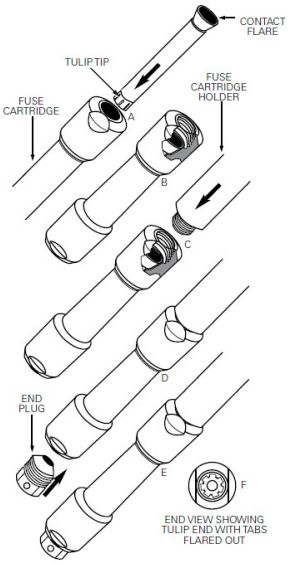



**figure 8-9** Fuse link replacement

**⚠ CAUTION**

**Failure to properly tighten the fuse cartridge holder and the end plug to the fuse cartridge will result in a poor electrical connection, resulting in damage to the Bay-O-Net and the transformer. The steps detailed in "figure 8-9 Fuse link replacement" should be followed in proper order to ensure a good electrical connection.**

**Step 5** Check fluid level.

- Refer to the equipment manufacturer's instruction book for correct oil level.
- The fluid level in the transformer should be approximately at the base of the protruding plastic threads of the Bay-O-Net housing at 25° C (77° F) with the transformer on a level surface. (See "figure 8-10 Check fluid level").

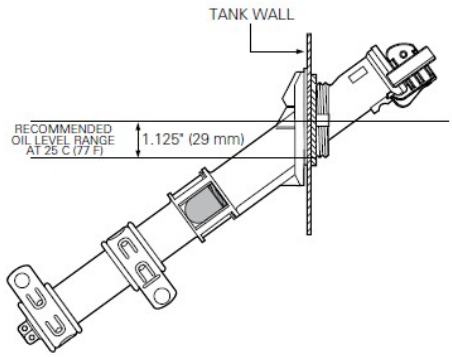



**figure 8-10** Check fluid level

**⚠ WARNING**

**Inadequate oil in the tank can result in a dielectric failure of the transformer causing an outage, damage to the transformer, fire or explosion. If the transformer has excess oil, spillage may result when the Bay-O-Net fuse holder is removed.**

**Step 6** Install fuse holder

- Pull pressure relief valve, keeping it held open until audible pressure evacuation stops and then hold open for another 5 seconds.
- Attach end of fuse holder assembly to hot stick and insert holder assembly firmly into the Bay-O-Net housing.
- Twist the locking handle so that the latch engages the Bay-O-Net housing's shoulder and the steel washer seats tightly on the end of the tube of the Bay-O-Net holder assembly. (See "figure 8-10 Check fluid level").

**⚠ CAUTION**

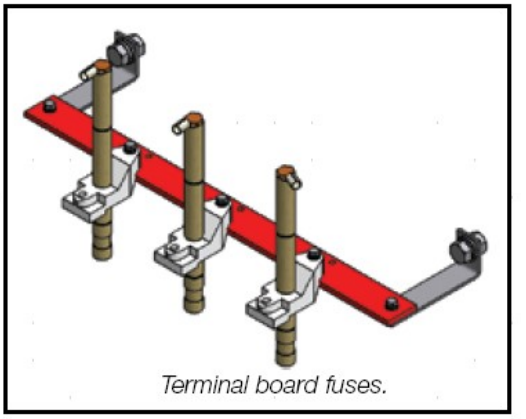
**The last 6 to 8 inches (152 to 203 mm) of movement are critical to the Bay-O-Net successfully switching the transformer on. Movement in this region should be as fast and smooth as possible. If the movement is slow or interrupted, damage to the Bay-O-Net assembly could result.**

**Visually inspect the entire fuse holder assembly to be sure it is installed correctly. Ensure that the fingers of the latch are entirely under the latch ring of the housing. This ensures that the contacts inside the assembly are fully engaged. If the contacts are not fully engaged, damage and eventual failure of the fuse holder and cartridge will result.**

**- - End**

### 8.3.4 Terminal board type

This type of expulsion fuse is placed in the rear wall of the tank, and is not accessible from outside the tank. The expulsion fuse acts in fault cases in the secondary side of pad-mounted transformer or for overloads higher to the acceptable for the Norm NOM-J-409 and ANSI C-57.91. To replace the fuse from the inside, please reach out to SUNGROW technicians for the fuse replacement.



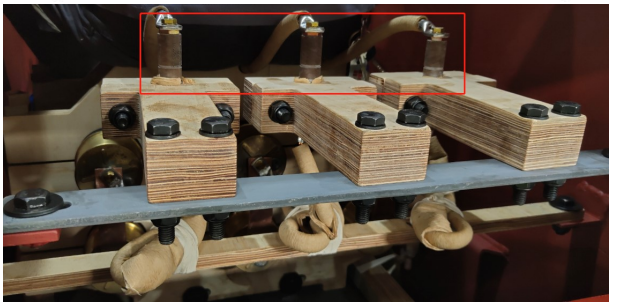



**figure 8-11** Replace the fuse

## 8.4 HV Bushing

The HV bushing is of a loop feeder design as below. The bushing rating is varies based on different voltage, current, materials request.

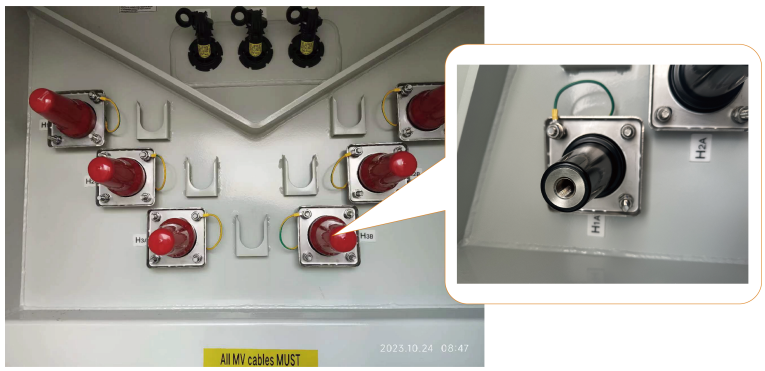



**figure 8-12** HV Bushing

## 8.5 Earthing Plate

The earthing plate is used for grounding AC shielded cables, as shown in the following figure.

**figure 8-13** Earthing Plate

## 8.6 LV Bushing

The LV bushing is tined copper and used for connecting the Inverter or PCS output busbar as below figure shows.

**figure 8-14** LV Bushing

## 8.7 Off-Load Tap Changer

The tap changer is a device that allows making windings adjustments to compensate deviations in nominal voltage.

The tap changer operation could be made with hot-line tool or using the operation handle. To operate the tap changer, you must follow the next instructions:

1. De-energize the Transformer and prove that there is not voltage in low and high voltage bushings.
2. Remove the screw which is used to lock the operation handle.
3. Attach the hot line tool to handle eye tap changer.
4. Place the handle in the desired position. To increase the voltage in the low voltage terminal it is required to rotate it in clockwise.
5. Replace the screw to lock the operation handle.
6. Once finished the above mentioned, proceeds to energize the transformer.
7. Finally, it should be verified that the voltage value is inside of the design values indicated in the nameplate, typically +/-5% about the nominal value. Superior values can generate transformer over-heating, increment the noise level, or a bad operation of the equipment that the transformer feeds.

Never try to put the tap changer in intermediate positions or any other position that is not clearly indicated in the nameplate.

**DANGER**

**De-energize the transformer before operating the Tap Changer.**
**Verify that the tap changer is in a correct and firmly position preventing any unwanted displacement.**

**figure 8-15** Tap changer

## 8.8 Oil Level Indicator

Oil level gauge is a device that has a float that is in direct contact with the insulating liquid, and it allows to know which is the nominal level, minimum level and maximum level allowed in the transformer operation.

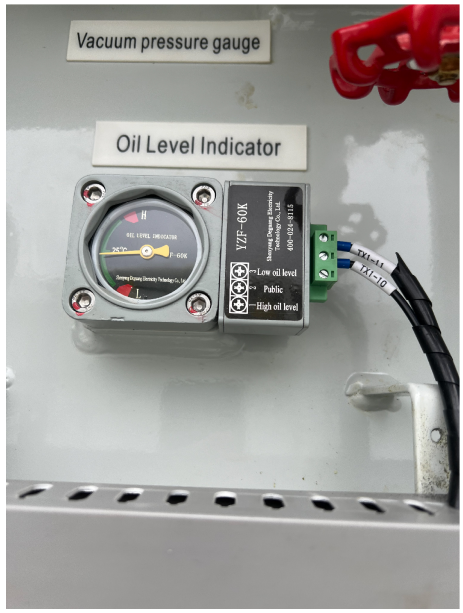



**figure 8-16** Oil Level Indicator

The dial is divided in levels:
Under - (MIN)
Nominal - (25°C)
High - (MAX)
The transformer is equipped with an oil level indicator. The transformer will stop operating if the oil level falls below the lowest scale on the oil level indicator or below the oil level scale required for safe operation of the transformer.
When the oil level is excessively high, open the drain valve to lower the oil level.
When the oil level is excessively low, disconnect the transformer and check the oil tank for leakage. If so, open the oil filling valve to fill the oil tank.

## 8.9 Schrader valve

The schrader valve is used to fill the nitrogen blanket.


**figure 8-17** schrader valve

## 8.10 Transformer Pressure Gauge

The transformer pressure gauge is designed according to ANSI C57.12.34. It indicates the real pressure condition inside the transformer oil tank.


**figure 8-18** Pressure Gauge

Pressure Gauge

In order to ensure the quality, the product shall be filled with N2 in the oil tank and positive pressure before delivery. Pressure range: 3-4 psig (PRESS)

The pressure in the fuel tank must be adjusted before the product is put into operation. The specific requirements are as follows:

| # | When the oil temperature is | the pressure shall be adjusted to |
|---|---|---|
| 1. | 20 ℃ or less | zero |
| 2. | 25 ℃ | 0 ~ 0.5 psig (PRESS) |
| 3. | 30 ℃ | 0.5 ~ 1.0 psig (PRESS) |
| 4. | 35 ℃ | 1.0 ~ 1.5 psig (PRESS) |

| # | When the oil temperature is | the pressure shall be adjusted to |
|---|---|---|
| 5. | 40 ℃ | 1.5 ~ 2. 0 psig (PRESS) |
| 6. | 45 ℃ | 2.0 ~ 2. 5 psig (PRESS) |
| 7. | 50 ℃ | 2.5 ~ 3.0 psig (PRESS) |

During operation, if it is found that the pressure gauge always shows "0", it must check whether there is air leakage in the tank or the pressure gauge damaged. And timely repair it.

## 8.11 Overpressure Relief Valve

This pressure relief is used to relief transformer internal pressure when it exceeds design limits, this pressure can be pulled to release the pressures which is above the limit. This valve does not operate under conditions of sudden over-pressure, as those generated in short circuit presence.


**figure 8-19** Pressure Relief valve

## 8.12 Oil Filling Valve

The Oil filling valve is used to refuel the transformer, as shown in the following figure.

**figure 8-20** Oil filling valve

## 8.13 Oil Temperature Gauge

It is an accessory that indicates the oil temperature in the transformer tank superior part. Their graduation is in centigrade degrees (°C), and it has 4 needles:

GREEN one is tripping threshold

RED one is warning threshold

SILVER one is instantaneous temperature

RED one is historical high

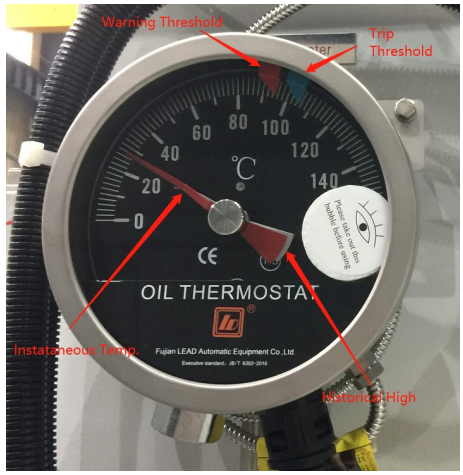



**figure 8-21** Oil Temperature Gauge

Before delivery, the alarm temperature and tripping temperature have been set on the oil temperature indicator.

The alarm temperature is set to 100℃. When the oil temperature reaches the value, alarm signals will be sent to the intelligent power distribution cabinet or a communication unit provided by the Sungrow.

The tripping temperature is set to 105℃. When the oil temperature reaches the value, tripping signals will be sent to the intelligent power distribution cabinet or a communication unit provided by the Sungrow. At the same time, the transformer will be disconnected from the upstream and downstream devices.

## 8.14 Load Switch

The pad-mounted transformers Sungrow supply have the load switch. This switch is on-load operated switches. To operate the switch the hot stick tool is placed in the feed-switch and turned to the desired position.
There are normally 2 kind of load switches for the transformer.

NOTICE

**Do not operate the load switch when the transformer is under load.**

### 8.14.1 Two Position Load Switch

The two position load switch shown in below.

The two position load switch is a gang operated load break switch. It is operated by hot stick and uses a manually charged over toggle storage spring assembly that is independent of operator speed. The spring loaded operating mechanism ensures quick load breaking and load making operation. It can be used to de-energize the transformer.

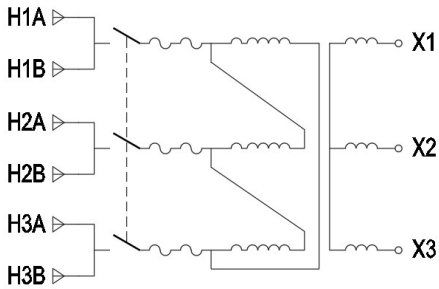
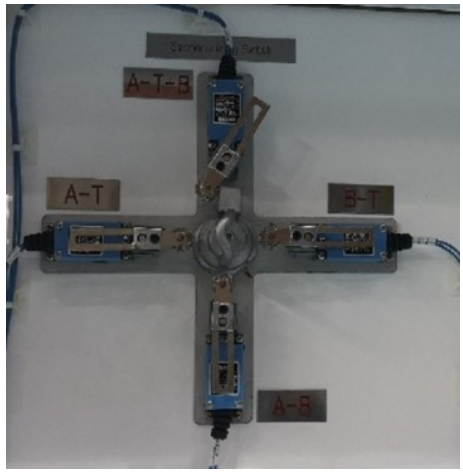



**figure 8-22** Schematic of the two position load switch transformer

### 8.14.2 Four Position Load Switch

The four position load switch arrangement shown in below.




Consist of 4 positions, gang operated, internal oil switches. It may be used for sectionalize and loop connections, such as selection of power sources in a loop feed primary distribution system, isolating faulted cables or transformers, or isolating transformer when changing it out or during maintenance. Six high voltage bushings are furnished with a typical application. Three bushings are identified as A source and three as B source.

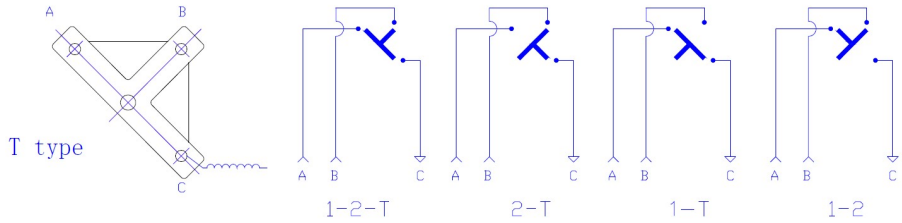



**figure 8-23** Position switch working schema

Position switch working schema

The detail working schema of the four position switch is described as below.

A and B is for the loop feeders, C is connected to the transformer.

When the switch is turned to A-T-B position, the loop feeders are connected with the transformer be energized.
When the switch is turned to A-T position, only one side of the transformer loop (A bushing) is connected with the transformer be energized.
When the switch is turned to B-T position, only one side of the transformer loop (B bushing) is connected with the transformer be energized.
When the switch is turned to A-B position, both sides of the transformer loop (A and B bushings) are connected with the transformer de-energized.

## 8.15 Oil Draining Valve

Close to the base of the transformer, there is a valve which is used for the oil sampling and drainage as below figures show. The drainage valve might be locked in a box which need to be accessed with a key.


**figure 8-24** Oil draining valve

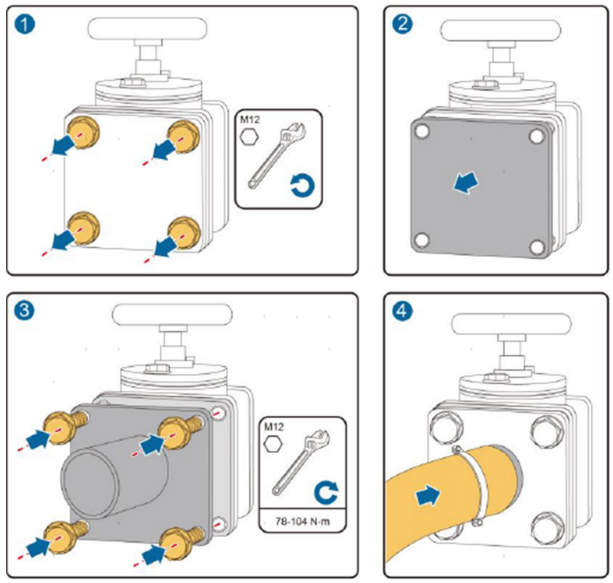
If the transformer is transported with a full oil tank, drain some oil from the transformer after the product is transported to the site.

**Drain Oil**

1 Ensure that the drain valve is closed.

2 Remove the cover plate of the drain valve.

3 Remove the cover plate of the drain valve.




4 Open the drain valve and the oil in the transformer slowly flows from the transformer into the tank.

5 Check the position of the oil level gauge according to the temperature-level curve according to the local ambient temperature. Stop draining when the oil in the transformer is reduced to the required level.

6 Close the drain valve and remove the drain hose connector and the hose.

7 Re-install the cover plate of the drain valve.

# 9 Transformer Maintenance Guide

The transformer disconnection from an electric system causes considerable production losses, as well as other inconveniences. For this reason, it is important to assure a transformer operation free of faults, through a maintenance program that is well structured and that it is faithfully carried out.

The periodic inspection helps to detect abnormal conditions of transformer and in their parts, before the damages get upgraded.

## 9.1 Security

The inspection works and maintenance will be made carefully in such way that their execution is planned in detail having in mind the security of the human life and the equipment, therefore a series of recommendations is included for the realization of inspection works or maintenance.

The basic rule of security is to disconnect the transformer of all the electric power sources and ground the terminals.

To disconnect the transformer, follow the next instructions:

a) Disconnect the pad-mounted transformer electric circuit from the primary and secondary terminals.

b) Assure that the disconnection mean is in open position. In case of using fuses, the fuses should be retired and placed in a location not easily accessible, in such way that cannot be accidentally reinstalled.

c) Ground the primary and secondary windings using the transformer bushings, with the purpose of discharging any energy that could be stored in the transformer due to the capacitances. These connection cables to ground should be retired until the whole maintenance work concludes.

If it is necessary to work inside the tank, the internal pressure of the tank should be relieved operating the relief valve.

Special care should be had for not to throw or to leave forgotten any tool inside the transformer tank. Once the work has been finished, it is necessary to make sure that everything is clear before energizing.

## 9.2 Maintenance Plan

To achieve a good maintenance program, it is necessary to take the inspections and repairs register carried out to the transformer.

A preventive maintenance system is effective when the following registrations are taken:

a) An equipment log, which can be a card that contains basic transformer information, just as serial number, location, nameplate, etc.

b) A repair log. It is an essential diagnosis register to eliminate future difficulties.
c) An inspection revision list. It is simply a listing of points that have to be revised, dates and/or frequencies in that will be taken to effect.
Without these logs it will be very difficult that a program of preventive maintenance works, so the inspection knowledge got will get lost quickly.

**⚠ WARNING**

**The transformer maintenance operations described in this manual should only be carried out by competent technicians that are familiarized with the pertinent security practices with the handling of dangerous electric equipment.**
**The instructions contained here are directed to this personal and not substitute the appropriate training and the experience in safe procedures for handling this type of product.**
**The maintenance procedures described in this section do not replace the client's maintenance practices.**

In case that some protection relay has worked and alarm, it is important to investigate the cause of the problem. It is essential to detect which relay has operated and in combination with which protection device made it.
It must be fully investigated, any other abnormal symptom just as excessive level of audible sound, high or low oil level, etc.

## 9.3 Maintenance Procedures

Being the transformer a static device, it can be subject to operation conditions that exceed those specified as normal conditions. Depending on the duration of the same ones, a decrease of its expectation of useful life can be generated. In this section practical procedures are provided about of how to maintain and give service to the transformer.

| Procedure | Time | Check Method |
|---|---|---|
| Oil leakage | When necessary | • The oil leaked out within 2 hours can be re-used directly.<br>• For the oil that has leaked out for over 2 hours, you may test it for voltage withstand, water content, and dielectric loss based on the actual situation.<br>You may refer to the requirements specified in the IEEE Std C57.147-2018.<br>1 Oil breakdown voltage is not lower than 45kV.<br>2 The water content of the oil does not exceed ≤300ppm.<br>3 Oil dielectric loss does not exceed ≤0.5 ( 25℃ ) . |
| Loads voltages and currents | Every three weeks | Register each phase operation values. |
| Oil temperature gauge | Every three weeks | Register oil temperatures. |
| | Yearly | • Verify gauge temperature calibration.<br>• Verify and clean the gauge. |
| Tank and radiators | Every three weeks | • Revise noises or strange vibrations.<br>• Revise oil leakages (radiators, inspection registers, instruments, valves, etc.). |
| | Yearly | • Clean the heat dissipation surface (adjust the frequency of this activity according to the atmosphere conditions peculiar of the installation place).<br>• Apply painting where be necessary.<br>• Tightly screwing all vibration parts.<br>• Check radiators valves operation. |
| Valve and stopper | Every three weeks | • Inspect all the valves, stopper and oil pipeline.<br>• If leakages exist, it is important to program an out of service maintenance.<br>• Revise draining valves that can be operated without keys to prevent miss-operation. |

| Procedure | Time | Check Method |
|---|---|---|
| Oil level gauge | Every three weeks: | Check the oil level. Register variations in the oil level, taking into account the level change due to changes in the oil temperature. |
| | Yearly | • Clean the mask.<br>• Fill of mineral oil for transformer, in case the level is under the normal level for a 25° C temperature or smaller. |
| Insulating liquid | Yearly | In order to continuously monitor the transformer and detect and prevent possible failures it must be done at least once a year the next test:<br>• DGA Dissolved gas analysis (ANSI C57-104)<br>• Dielectric Strength (ASTM D-1816)<br>• Water content (ASTM D-1533)<br>For more information, please refer to ANSI C57-106 standard (current version) |

**Temperature Values**

The transformer is usually designed to operate continually to 100% of load to a temperature ambient average of 30° C (to above sea level indicated in the nameplate). The winding hottest spot temperature will be, in general, 15°C bigger than the oil temperature.

Example: For a transformer with a 55° C of temperature over-elevation indicated in the nameplate:

table 9-1 Nameplate

| Name | Temperature |
|---|---|
| T. Ambient | = 26°C |
| T. Oil (nominal load) | = 74°C |
| T. Honest spot | = 86°C |

So it can be inferred that the transformer is operating normally, because the oil temperature is smaller than the permissible of 85°C (30 °C of ambient temperature plus 55°C of oil over-elevation). The hottest spot temperature must not be higher than 105° C, so an 86° C temperature is acceptable.

# 10 Fast Reference for Troubleshooting

| Suggested action | Fuse and switches operation | Fuse operation | Different voltage between phases | Transformer test ratio no match with nameplate | Oil stains in cover tank or accessories |
|---|---|---|---|---|---|
| Verify that the surge arrester is not faulty. | × | | | | |
| Verify that the surge arrester is the correct one. | × | | | | |
| Verify the correct transformer grounded. | | | × | | |
| Revise that the ground connection systems are the correct ones. | | | × | | |
| Revise that the bridge X0 to ground is good connected. | | | × | | |
| Verify that the tank has a good physical ground. | | | × | | |
| Verify that the capacitors bank is disconnected. | | | × | | |
| Revise that all terminals cables are tighten to bushings. | | | × | | |
| Verify that there is not low voltage. | | | × | | |
| Check that the cables size is adequate. | × | | × | | |

| Suggested action | Fuse and switches operation | Fuse operation | Different voltage between phases | Transformer test ratio no match with nameplate | Oil stains in cover tank or accessories |
|---|---|---|---|---|---|
| Verify that the bushing blade are appropriately connected. | | | × | | |
| Verify that the fuses are not operated. | | | | × | |
| Verify the fuses capacity. | × | × | | | |
| Revise that there are not faults in the primary of secondary system. | × | × | | | |
| Check that the motors or starters are good coordinated with protection system. | × | × | × | | |
| Verify that the transformer is not being used for up of their nominal capability. | × | × | × | | |
| Revise that the tap changer is not in different position. | | | | × | |
| Revise that the tap changer is making good contact. | | | × | × | |
| Verify that the load type is not variable. | | | × | | |
| Revise the primary voltage. | | | × | | |
| Clean and adjust all the screws. | | | | | × |

# 11 Contact Information

In case of questions about this product, please contact us.

We need the following information to provide you the best assistance:

- Model of the device
- Serial number of the device
- Fault code/name
- Brief description of the problem

North American Regional Telephone: +1 833 747 6937

For detailed contact information, please visit: **https://en.sungrowpower.com/contactUS**

SUNGROW

Sungrow Power Supply Co., Ltd.

www.sungrowpower.com