

# LS CAST RESIN TRANSFORMER

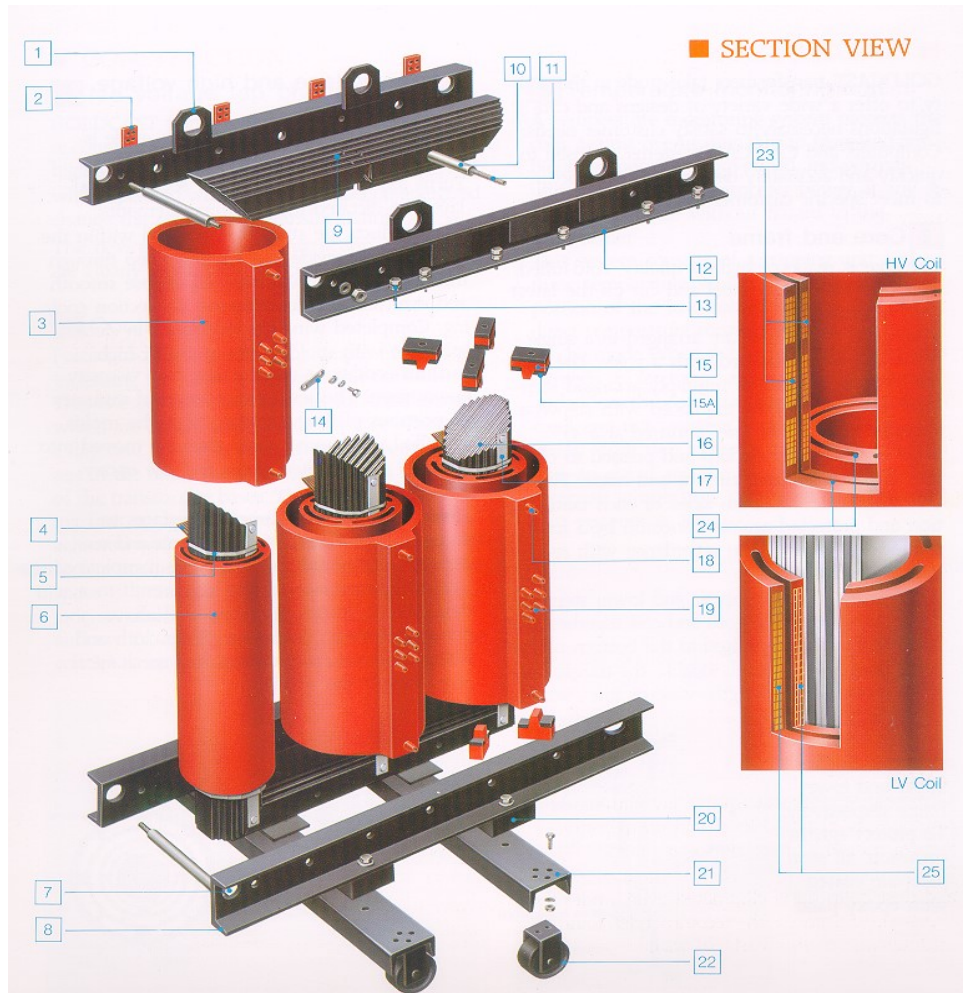
## INSTRUCTION MANUAL



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## 1.1 Structure



1	Lifting Lugs	2	LV Terminals
3	HV Coil	4	LV Coil Termination
5	Core Bandage	6	LV Coil
7	Pulling Holes	8	Lower Frame
9	Core Yoke	10	Core Bolt Insulation
11	Core Pressing Bolts	12	Upper Frame
13	Coil Clamp Adjuster	14	Tapping Link
15	Resin Support Block	16	Core Leg
17	Tie Bars	18	HV Terminals
19	HV Tappings	20	Anti-Vibration Rubber
21	Trolley Frame	22	Bi-Directional Wheel
23	HV Conductors	24	Air Ducts for Cooling
25	LV Conductors		

## 1.2 Conditions

LS Cast Resin Transformer must be operated in locations where

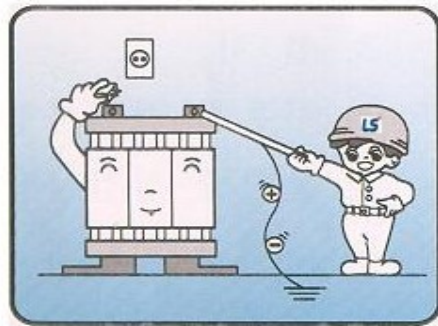
- Average temperature of a day is below 40°C.
- Within 1000 meters above the sea level.
- Indoor (When using in some outdoor locations, perfect protection is needed to prevent the entrance of small animals and foreign objects.)
- Relative humidity is below 90 %.

## 1.3 Safety

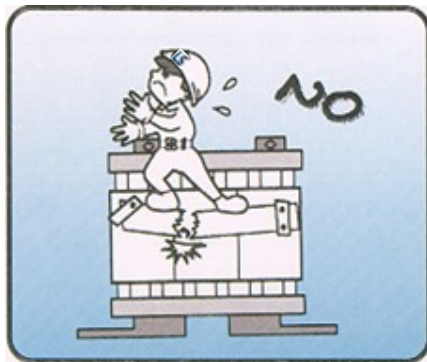
For personnel and public safety, the following factors should be taken into consideration.



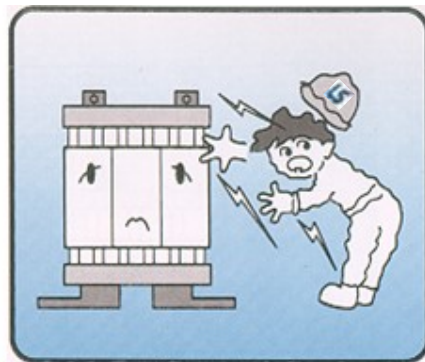
Check the clothes and equipment



Work after De-energized



Don't step on the phase bus-bar



Don't touch transformer on operation

## 2. INSTALLATION

### 2.1 Receiving

Upon receipt, new transformers should be inspected (while still on cars or trucks) for evidence of damage or indication of rough handling (megohmmeter and ratio tests may be performed as part of the procedure).

If damage is evident, a claim should be filled with the carrier at once and the manufacturer notified.

The factors should be inspected are as follows

Part	Factors
Structure And Attachment	<ul style="list-style-type: none"><li>- Name Plate (Phase, Voltage, Capacity, Connection etc.)</li><li>- Accessories (Normal and Optional)</li><li>- Fastening of Bolts and Nuts in Frame parts</li><li>- Appearance of Transformer</li></ul>
Core or Coil	<ul style="list-style-type: none"><li>- Damage of Core</li><li>- Appearance of Coil</li><li>- Tap Changer including Insulation caps</li><li>- LV Terminal and HV Terminal</li><li>- Bus-Bar for connection of phases</li></ul>

### 2.2 Handling

*For safety of personnel and transformer, please request the specialist to move and install transformer.*

Transformers require greater care during handling because of the lighter case and higher center of gravity (equipment is subject to tipping over). If reasonable care is taken during handling, equipment damage and/or injury of personnel can be prevented.

Transformers are designed with provisions for lifting, skidding or rolling. Handling methods vary depending on the physical characteristics of the unit (dimensions, size and mechanical configuration).

Lifting eyes are present on the core clamp channel. The transformer may be lifted with appropriate cables.(the top cover in part is removed when lifting from the top core clamps.).

Great care should be taken when lifting or skidding enclosure to prevent bus bars or insulators from damage. **Please refer to Figure 1 for further details.**

**Before energizing the transformer, all lifting devices and shipping braces must be removed.**

## **2.3 Storage**

If transformers are going to be stored for long time before connection, it is necessary to store in the clean indoor room having a normal temperature. And transformers should be covered with vinyl sheet to prevent external pollution.

When using transformer after storage of long time, water and dust should be removed.

## **2.4 Installations**

### **2.4.1 Location**

The place where transformer will be installed should be finished flat, clean, dry and no allow the water coming in.

Also, following factors should be taken into consideration

- Personnel and public safety
- Ventilation
- Accessibility

**The procedure of Anchoring** is as follows,

Step 1, Removing a Door plate,

Step 2, Removing a Hole Cover,

Step 3, Anchoring,

Step 4, Reassembling the Hole Cover,

Step 5, Reassembling the Door Plate,

Step 6, Do the same jobs for other three Door Plates.(total 2 at front, 2 at rear)

**Please refer to Figure 2 for further details.**

### **Personnel and public safety**

The transformers should be protected from physical contact of person and a possible damage by cranes, trucks, etc. Warning signs should be visible at all entrances to the transformer area. If possible, fences of other means to prevent entrance by unauthorized persons should be installed.

## Ventilation

Transformers should be located where there is enough area to allow for sufficient space between units, walls, and other obstructions, to permit the free circulation of air around each unit. Adequate ventilation is essential for the proper cooling of transformers and safe operation.

## Accessibility

There should be sufficient clearances from walls and other obstructions and sufficient spacing between transformers to permit unrestricted access (doors, covers, panels) for the purpose of inspection, maintenance and testing.

### 2.4.2 Protection against Disruptive Discharges

To avoid disruptive discharges between active parts and earthed parts, the minimum distances described in the following table should be considered.

(IEC 71 Standard)

Voltage (kV)	BIL (kV)	Phase – Ground (mm)	Phase – Phase (mm) ; Including Insulation Tubes	Surface of Epoxy Resin – Ground (mm)
11	95	160	95	60
6.6	75	120	80	50

### 2.4.3 Connection

*When connecting terminals, confirm the sign of each phase.*

When connecting transformer terminals with cable, the cable should be supported to cubicle or other place solidly without moving.

### 2.4.4 Grounding

*Permanent and adequate grounding is essential for the case, core and coil Assembly of transformers.*

Grounding is required to remove static charges that accumulate, as well as protect the equipment should the transformer windings accidentally come in contact with the core or enclosure.

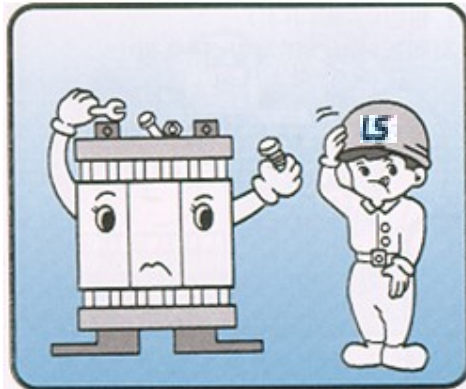
To ensure a solid core ground, transformers have copper straps embedded in the core Laminations and securely connected to the core clamps.

### 3 INSPECTION BEFORE OPERATION

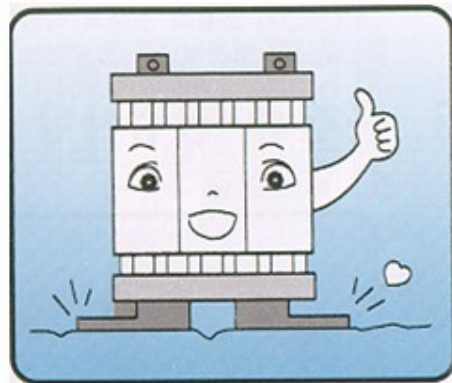
Before operating transformer, the following factors should be taken into consideration once more.

- Check that transformer has a no damage when handling and installation.
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- Check the fastening of each connection.
- Check the operation of each accessory.
- Remove all shipping hardware and installation equipment.  
(It becomes cause of noise and insulation failure)
- When operating after long time of storage, eliminate dust and inspect insulation resistance once more.
- Check that the frame of transformer is stuck on the ground.

Remove the tools and objects



Stick on the ground





## **4 OPERATION**

The resin surface of the cast resin transformer must never be touched during operation. The potential on the surface of epoxy resin is almost the same as the coil voltage as induced by electrostatic capacitance. Since the resistance between the resin layer and ground is extremely large the leakage current is small but in spite of this an electric shock will be experienced if the coil surface is touched. Any adjustment of the voltage ratio must be done by changing the tapping position when the transformer is switched off and properly earthed.

### **4.1 Loading**

The maximum continuous load a transformer can supply is indicated on the nameplate. But if transformer is operated in state of frequent overloading, the life of transformer becomes reduced and the insulation failure may be occurred. Therefore for safety and long life, if possible, transformer should be operated in normal state.

### **4.2 Parallel Operation**

Considering increasing of load and economical operation, specifying transformers may be operated in parallel. For operating of transformers in parallel, the following parameters should be the same:

- Phase relationships
- Rated voltage of input and output
- Turn ratio
- Impedance (the difference in impedance should not exceed 10%)

When above conditions are satisfied, it is possible to operate for transformers in parallel. But even if not satisfied perfectly, parallel operation may be possible.

# 5 MAINTENANCE

## 5.1 INSPECTION

Transformers, like other electric equipment, require maintenance periodically to ensure successful operation. Inspections should be scheduled at regular intervals and corrective measures taken when necessary. There are two kinds of inspection as following

### **Routine Inspection**

This is to check state in which transformers is operating

And the check points are as follows

- Record load condition (Voltage, Current, kW, etc.)
- Record temperature and humidity
- Check for abnormal noise, smell and evidence of overheating

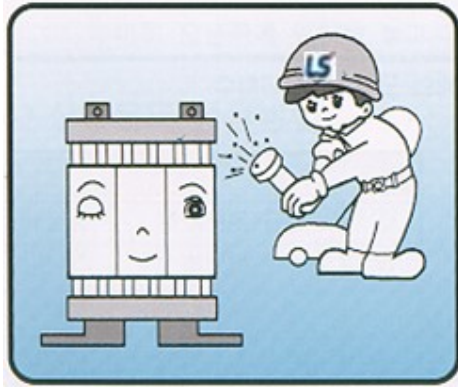
### **Periodical Inspection**

The period of these checks depends on the environmental conditions in which the unit operates.

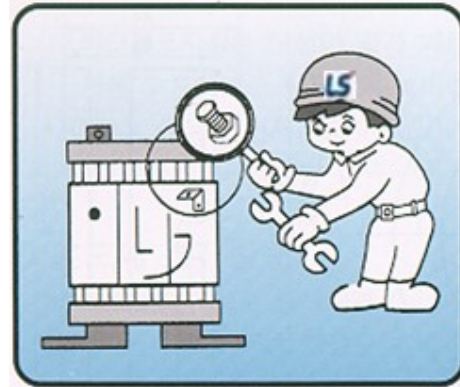
- 1) Remove the dust and dirt on the winding and in the cooling duct that could hinder the cooling and weaken the insulation.
- 2) Check electrical insulation with megger
- 3) Check the every connection
- 4) Check the tightness of the tap changer

Accumulations of dirt on the windings or insulators should be removed to permit free circulation of air and to guard against the possibility of insulation failure. Particular attention should be given to cleaning the top and bottom ends of the winding assemblies and the ventilation ducts.

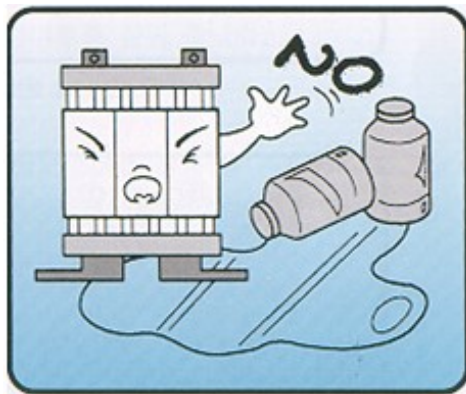
Adequate ventilation should be maintained while cleaning. The windings may be cleaned with a vacuum cleaner, a blower, or with compressed air. The use of a vacuum cleaner is recommended as the first step in cleaning followed by the use of compressed air or nitrogen.



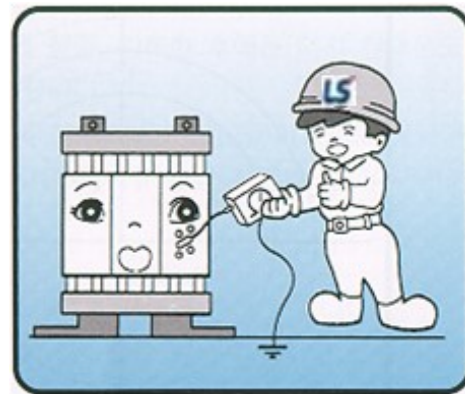
Check the connect parts



Remove the dirt



Don't use benzene or chemicals



Insulation test with megohmmeter

## 6. TAP CHANGER

### 6.1 Translating

- 1) Turn off the power of transformer.
- 2) De-energize the charged part of transformer.
- 3) Separate connect bar of tap changer from transformer.
- 4) Confirm the sign you want to connect from name plate of transformer.
- 5) After changing connect bar, please fasten the bolt.

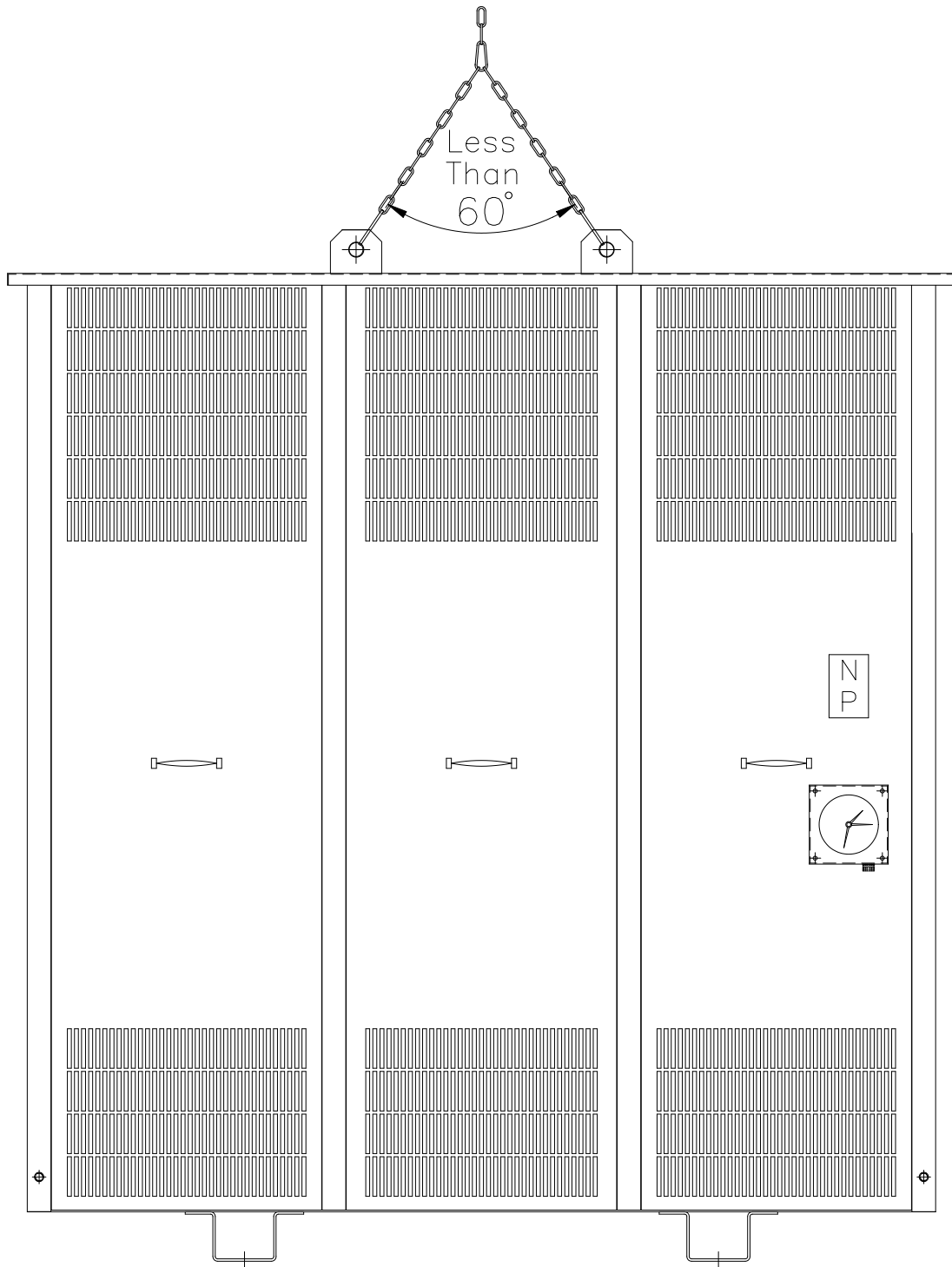
## 6.2 Caution

- 1) Working of changing tap should be taken after confirming that transformer was de-energized. (It is not Tap Changer in state of **off-load**, but **off-voltage**)
- 2) Check the tightness of bolt. The tightening torque is as follows.

Bolt Size	Part of Terminal	Part of Tap-Terminal
	Tightening Torque	Tightening Torque
M 8	135 kg-cm	-
M 10	270 kg-cm	205 kg-cm
M 12	480 kg-cm	360 kg-cm
M 14	-	885 kg-cm
M 16	1180 kg-cm	-

## 7. TROUBLESHOOTING

Symptom / Problem	Cause
Overheating	Continuous overload, Wrong external connections. Poor ventilation. High surrounding air temperature. (Rating is based on 30°C average ambient temp. over a 24-hour period with peaks not to exceed 40°C)
Reduced or Zero Voltage	Shorted turns. Loose primary tap connections.
Excess Secondary Voltage	High input voltage. Improper primary tap connections.
High Conductor Loss	Overload. Tap connections not on identical tap positions.
Coil Distortion	Coils shorted circuit.
Insulation Failure	Continuous overload. Dirt accumulation on coils. Mechanical damage in handling. Lightning surge.
Excessive Cable Heating	Improper bolted connection.
High Voltage to Ground	Normally a static charge condition.
Vibration and Noise	Low frequency. High input voltage. Core clamps loosened in shipment or handling. Improper primary tap connection.
High Exciting Current	Low frequency. High input voltage. Shorted turns.
High Core Loss	Low frequency. High input voltage.
Insulation Failure	Very high core temperature due to high input voltage or low frequency.
Smoke	Insulation Failure
Burned Insulation	Lightning surge. Switching or line disturbance. Broken bushings, taps or arrestors. Excess dirt or dust on coils.
Breakers or Fuse Open	Insulation Failure. Short circuit. Overload.

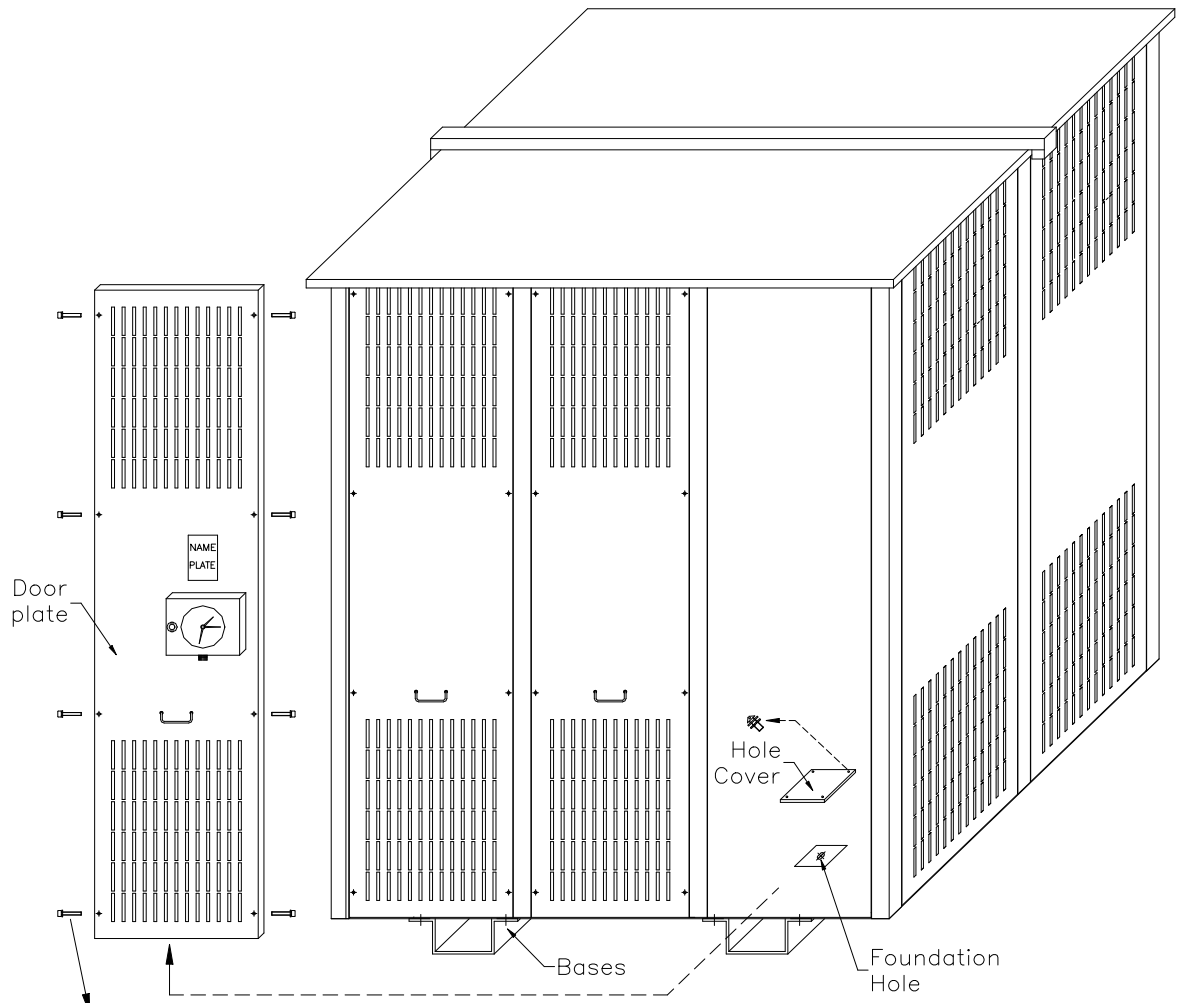


**Figure 1**

**Lifting with slings**

Lifting is carried out using the 4 lifting holes on an enclosure.

The slings should not form an inside angle greater than 60 Deg.



Caution

When reassembling this Doors,  
Do not tighten up  
Bolts of Doors strongly.

Procedure of Anchoring

1. Removing a Door plate,
2. Removing a Hole Cover,
3. Anchoring,
4. Reassembling the Hole Cover,
5. Reassembling the Door Plate,
6. Do the same jobs other three  
Door Plates.  
(total 2 at front, 2 at rear)

**Figure 2**  
**Procedure of Anchoring**