



**DELTA STAR**  
**Power Mfg. Corp.**



POWER TRANSFORMERS  
DISTRIBUTION TRANSFORMERS

# DELTA STAR THREE/SINGLE PHASE DISTRIBUTION TRANSFORMERS

**D**ELTA STAR three/single-phase distribution transformers, manufactured in accordance with NEMA standards, are economical power equipment with advanced winding design features for reducing no-load and load losses.

High-grade silicon steel is used for the core. Special treating methods to obtain greater di-electric and insulating strength ensures durability.

## Features

### A. Low Transformer Loss

High-quality cold rolled, grain-oriented silicon steel is used core designed for the most efficient power transformation, resulting in greatly reduced values of no-load losses.

### B. Special design for continuous overload

Highly heat resistant insulation paper is used in between windings. Though the rated temperature rise of these transformers is 65° C at 100% continuous load operation. The actual temperature rise of Delta Star Distribution Transformers by test is only 55° C at full load operation. Thus these transformers can be operated under continuous overload until the temperature reaches 65° C.

# Construction:

## A. Core

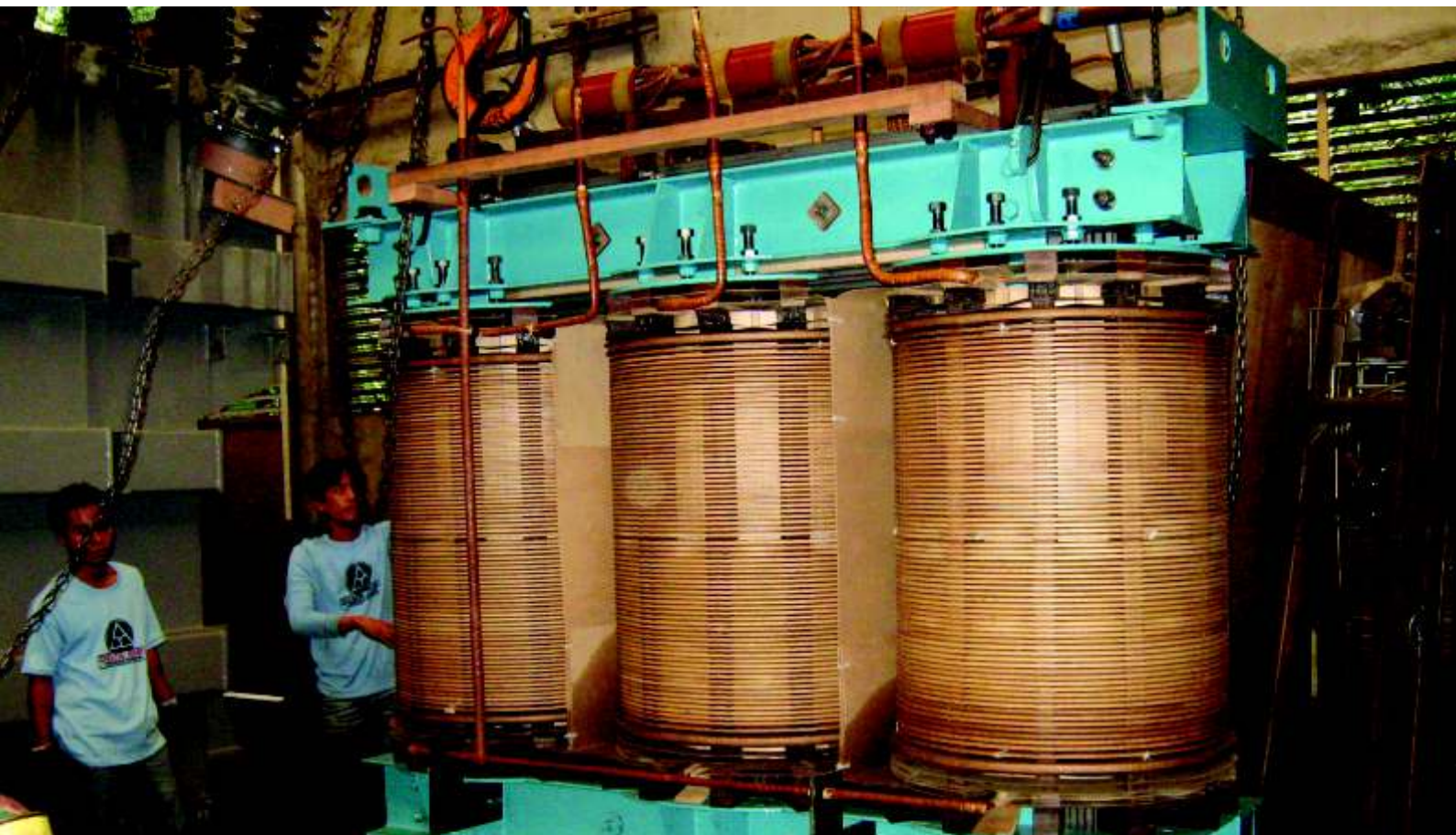
The magnetic circuit consists of coil-rolled, none-aging, grain oriented silicon steel laminations which feature low core loss and high permeability in the rolling direction.

Each unit utilizes a core with a cruciform or rectangular cross sections in both legs and yokes. The core is designed and built to provide the lowest possible losses from the effects of magnetic hysteresis and eddy currents. All possible steps are taken to prevent local circulating currents and avoid construction bending stresses.

## B. Coil

Copper wire, coated with polyvinyl formvar or taped with heat resistant insulating paper is used. The windings may be either of rectangular or circular construction depending on the basis of engineering consideration.

Oil ducts are distributed between the coils to prevent occurrence of localized hot spots. The coils are thoroughly impregnated with varnish for greater mechanical strength and moisture resistance. The high voltage coil is wound over the low voltage coil and separated by an insulating barrier.



### C. Tap Changer

Tap voltages on the primary side are varied by means of no-load tap changer. The tap changer, which is built-in, is installed inside the tank and operated by means of a handle, either externally or internally. Internal tap changers can be manually operated by opening the cover or through the handhole provided thereon. Its contact elements are pressed together by springs. The tap changer is located above the oil level for easy and convenient operation. External tap changers are manually operated by simple operations on the side of the tank without the need of opening the cover.

### D. Bushings

The two methods of mounting the primary and secondary bushings are cover mounting and side wall mounting. Conventional transformers are top-mounted while live front padmount transformer are side mounted and covered by a compartmental enclosure.

Both the primary and secondary bushings are of the stud type. Their terminals are of cast bronze which have an electro-tin plated for compatibility with copper and aluminum.

### E. Tank

The tank is made of steel plate. The metal cover is bolted all around the tank upper lid pressing the rubberized gasket between them to ensure perfect sealing. Prior to painting, the tank surface is first thoroughly cleaned and degreased. Then a primer coating is applied before the final coat of paint is sprayed on. After painting, the tank is baked in an infrared oven.



## F. Oil

The insulation oil used is mineral oil. Its characteristics are as follows:

- Specific gravity 0.865-0.910
- Flash point 145° C min.
- Viscosity 37.8° C (100° F) 62 sec. max.
- Interfacial tension dynes/cm. 40 min.
- Pour point -40 max.
- Dielectric strength 2.5mm 30 min.
- Tan  $\delta$  (%) 25° C 0.5 max.  
100° C 0.3 max.
- Reaction neutral
- Color 0.5 max.
- Corrosive none
- Neutralization number (KOH mg/g.) 0.03 max.

## Standards

### A. Tests

Each Delta Star Distribution Transformer is given the following tests to ensure high quality.

1. Voltage ratio and polarity test.
2. Insulation resistance test.
3. No-load test (Exciting Current and Core Loss)
4. Load test (Impedance and Winding Loss).
5. Temperature rise test.
6. Noise level test
7. Oil-tightness test.
8. Construction Check



## B. Basis of performance

### 1. Service condition

For best performance the ambient air temperature should not exceed  $50^{\circ}\text{C}$  and the average ambient air temperature for any 24-hour period should not exceed  $30^{\circ}\text{C}$ . The transformers are designed for operation at an altitude of 1,000 meters or less.

### 2. Temperature rise

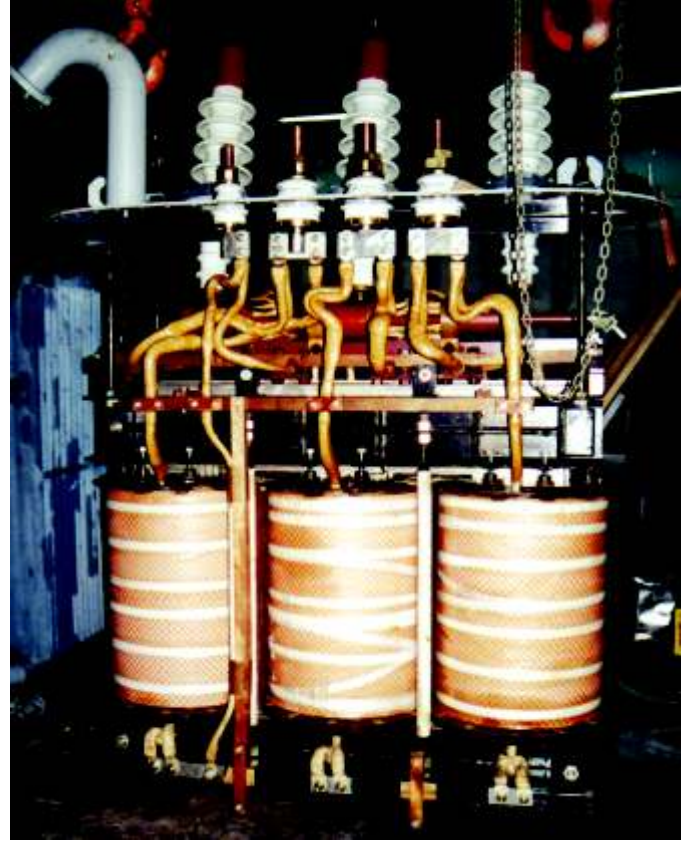
The temperature rise above the ambient temperature will not exceed the next value.

Winding Resistance method  $65^{\circ}\text{C}$

### 3. Vector Symbol/Primary-Secondary Winding Connection.

Primary to secondary winding connections can be chosen on any of the following configurations as per customer's specifications:

- a.) delta-delta
- b.) delta-wye
- c.) wye-delta
- d.) wye-wye



# Instruction Manual

## A. Inspection

When a Delta Star Distribution Transformer is received, please check the following:

- Whether the ratings on the name plate such as the capacity, voltage, frequency, etc. are the same as those you requested.
- Whether there were any damages caused during transport.

If there exists a part which malfunctions, please contact immediately the agent where you purchased this transformer.

## B. Operation

After wiring and installation have been completed examine the following items prior to energizing the transformer.

- Are the fuses on the line side adequate?
- Double check all connections, especially for short circuits and grounds on the load side.
- Is the grounding wire securely connected?
- Is the voltage tap changer on the correct tap?
- Check connections of the high tension lines to the transformer terminals
- Finally, measure the insulation resistance between primary and secondary, primary to ground and secondary to ground.

After the above procedures have been completed, energize the transformer.

## C. Maintenance

Periodical Maintenance should be conducted as follows:

- Check for abrasion of painted surface or oil leaks. Determine causes and remedy.
- Clean the surfaces of both the primary and secondary bushings.
- Retighten primary and secondary terminals.
- Retighten cover clamping eye bolts.
- Check whether the grounding wire is still securely fastened.
- Measurement of insulation resistance: Measurement of insulation resistance is one of the easiest methods for determining the condition of the insulation materials.
- Check that the insulating oil has not deteriorated. A breakdown Voltage of 30 KV for insulating oil is ideal. However, a value over 23 KV is acceptable for use. Measurement of this breakdown voltage is carried out by means of a pair of spherical electrodes, 12.5 mm in diameter, having a gap of 2.5mm between them.
- Add oil, if necessary, to bring level to the mark indicated on the oil level gauge.



# DELTA STAR

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DISTRIBUTION TRANSFORMER



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