



## “I.G.” TRANSFORMERS



Guide for the installation, operation and maintenance of Dry-Type Transformers for interior use, utilizing CH cabinets.

## Safety precautions

- 1** Do not lift or transport a transformer without adequate equipment or experienced personnel. In some larger capacity distribution transformers, booster devices are provided in the nucleus and coils set.
- 2** Do not install the transformer until a complete inspection has been realized.
- 3** Use only terminals for electrical connections. Flexible connectors are recommended for the connections in the collector bars. The transformer terminals are not designed to support the weight of the feed or charge wiring. Support beams may be added in the field, maintaining the adequate separation distances.
- 4** The connections may only be realized following the diagram in the identification plate or in the connection diagrams.
- 5** Before beginning any work in a transformer or inside a control panel, ensure that all the power has been disconnected and that all the windings are grounded.
- 6** Ensure that all the ground connections are complete and adjusted before energizing the transformer.
- 7** Do not try to change a primary or secondary tap while the transformer is energized.
- 8** Do not change the connections while the transformer is energized.
- 9** Do not alter the control panels, the alarms, the safety switches or the control circuits.
- 10** Do not adjust or remove accessories or protective covers while the transformer is energized. No feeder cable should have contact with the transformer core or any live part, other than the terminal to which it is connected.

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## 1 General

Dry-type transformers are manufactured to provide an optimum uninterrupted service performance. We recommend that the following instructions be observed to the letter in order to obtain their safe and reliable operation.

The installation, operation and maintenance of the transformers should be realized by authorized personnel who are knowledgeable in regard to electrical apparatus and the possible risks they present.



**WARNING: Danger!** There is always the danger of electric shock when working with or near electrical equipment such as transformers. The electrical energy should be disconnected before realizing any work on a transformer.

As with any electrical device, the transformers should be installed in accordance with the requirements in the national and local electrical codes. The **ANSI/IEEE C57-94** standard may also be consulted in order to learn the rules recommended for the installation, application, operation and maintenance of dry-type transformers.

## 2 Handling

The transformers are shipped on palettes and they can be raised with a front loader, or hoisted by the hoisting rings provided.

The appropriate hoisting equipment must be utilized according to the size of each transformer. The use of separator bars is recommended, for safety purposes and to protect the transformer.

You should not try to lift or move a transformer using any point on the unit other than the points indicated.

## 3 Reception and inspection

Immediately after receiving the transformer it must be inspected for any damage that might have occurred during its transportation, and to verify its data against the shipping documents.

The unit must be examined for any breakage in the packaging, dent or damage in the cabinets, or pieces missing from the packing list.

If any damage is found, a claim must be submitted immediately to the transportation company, with a copy to the local sales office with all the pertinent information in respect to the requisition and the circumstances.

If this examination of the unit is realized outdoors, care must be taken to ensure that inclement weather does not present a danger.

## 4 Storage

The transformers that will not be immediately installed or energized must be kept in a clean and dry environment, away from any environmental contaminant in the atmosphere.

It is recommended that the transformers be kept in a place with heating, with the protective plastic wrapping still in place.

## 5 Installation

The dry-type transformers can be placed in a vertical position, supported on walls, floors, posts, beams or other supports that can bear their weight with the appropriate accessories in place.

It is important that the ventilated transformers be installed in a dry area, where the air is clean and free of dust, dirt, corrosive gas, humidity, heat or other adverse conditions. They should not be installed in places where water could get into the box.

If a transformer has been exposed to humidity before its installation, make sure it is totally clean and dry before it is energized. It is recommended that it be blown dry with hot air to dry its internal components. Read the section that deals with the drying of the transformers.

## 6 Ventilation

The transformers should be installed in an area where they can be cooled by the free circulation of air and where the average atmospheric temperature is 30 °C (86 °F) and not higher than 40 °C (104 °F) at any time.

An adequate ventilation is essential in order for the transformers to perform at the kVA capacity shown on the ID tag. All the transformers for general use must be placed away from walls or other obstructions to allow the clean and free circulation of air through the ventilation apertures, or around the unit in the case of units without ventilation.

## 7 Accessibility

The NEC standards require that the transformers be accessible to inspection and that they be adequately located for that purpose.

However, they must not be located in areas where stored elements could interfere with the natural convection of the air or with the ability to inspect them. Nor should they be located in passageways or other areas where persons passing through could be exposed to energized parts during the inspection. Adequate protection should be provided under all circumstances.

## 8 Noise levels of the transformer

Transformers are electrically energized devices that, by their nature and by the materials of which they are composed, emit noise.

The transformers must comply with the NEMA standards for the maximum noise levels allowed. These noise levels vary from 40 to 60 DB and they can therefore be bothersome if they are located near places where people live or work.

Therefore, the places where they will be installed must be carefully chosen, taking care to avoid sensitive areas such as hospitals, schools, medical centers or offices.

### The following guidelines can be useful:

- a. The units should be installed away from corners or reflecting walls or ceilings.
- b. Flexible cables or other conduits must be taken into account when realizing connections.
- c. All the dry-type transformers are provided with rubber mountings for insulation between the winding and core set and the cabinet. However, vibration insulators to absorb the noise may also be installed between the transformer and its mounting surface.
- d. Noise-absorbing materials for installation in walls and ceilings around the unit may also be considered.
- e. The unit should be installed as far away as possible from the areas in which high noise levels are undesirable.

## 9 Connection of the cables

The size of the connection cable is determined by the current of the transformer's primary and secondary windings, and it may be selected with the information that appears in **Appendix A** (page 13). It is recommended that the cables be for at least 90 °C (194° F), since the connectors are ALC9CU.

Pre-marked drill hole locations for piping are provided in all the cabinets for the ventilated three phase transformers of up to 225 KW and for the single phase 150 KW transformers, to facilitate the introduction of the cables.



**WARNING:** Do not try to change the connections or the taps unless the transformer is disconnected and all the windings are connected to the ground.

## 9 Connection of the cables

It is recommended that the entrance of the cables be from the side, in order to avoid the obstruction of the ventilated areas.

Copper- or aluminum-coated cable connectors may be used for connection to the transformer terminals. The terminals must be cleaned, and the use of cleaning compounds for electrical connections in all the connections is recommended.

Consult the transformer's ID tag to find the connection combinations for the primary and secondary voltages and the positions for the primary and/or secondary taps, as the case may be.

The transformers delivered from the factory should have the conductor cables connected in the nominal – or 100% - voltage tap position. The other tap positions will be coated with insulation material.

To change the taps, all the contaminating and insulating material must be gently removed from the upper and lower surface of the taps (omegas or lugs), by sanding the lugs until they are clean.

The surface of the tap must be clean and covered with electrical compound for every non-platinized contact between the jumper terminal and the tap. Assemble the jumper to the tap in accordance with **Appendix B** (*Drawing 1* for a simple omega and lugs tap conductor or *Drawing 2* for a double omega tap conductor).

**NOTE:** After the installation of the cables and the connectors, a minimum separation of 2.54 cm (1 inch) should be kept between the energized parts and all the parts of the cabinet.

## 10 The ground connection

All the core and winding sets are solidly connected to the ground internally in the cabinet, to guarantee that all the metallic conductor parts will have the same potential.

The transformer cabinet should also have a safe and efficacious ground connection as a safety precaution.

This ground connection must comply with the National Electricity Code standards.

## 11 Inspection before energizing

For the safe and proper operation of the transformer, verify the following:

- a. The insulation resistance, from the core to the primary winding, from the core to the secondary winding, and from the primary to the secondary winding, must be greater than 10k ohms.
- b. Before energizing and connecting any charge, measure and verify that the output voltage coincides with the specifications in the ID tag.
- c. Verify that the phase connections are correct. Consult the vector diagram in the ID tag.
- d. The charge in a delta secondary winding with a central shunt of 120 volts must not exceed the normal current for the winding. This central tap is designed for a maximum of 5% of the KW stipulated in the ID tag.
- e. When the windings are connected parallel to each other (such as in the case of double voltage primaries), the primary taps of all the windings must be connected in the tap positions with an identical percentage, to avoid a short circuit of the turns. To learn the tap positions consult the transformer's ID tag.
- f. The cabinet must be connected to the ground with a conductor of the appropriate size.
- g. The total charge among all the phases must be balanced as accurately as possible for the optimum performance of the transformer windings. Any three-phase or single-phase load can be connected to the transformer, but the KW load of each phase must not exceed 1/3 of the KW power that is stipulated in the ID tag.
- h. It must be verified that all the electrical connections observe the safety distance, and that they are adjusted.
- i. If there is any reason to suspect that the transformer has been exposed to moisture during its shipping or storage, it must be verified that it is dry before it is energized. This can be done by means of an insulation resistance test. The drying procedures can be read in *page 10*.

## 12 Operation

The dry-type transformers will function in a satisfactory manner in all relatively normal and clean facilities under normal energization and load conditions.

The totally charged dry-type transformer may be hot to the touch, especially on its cover.

The standards allow the cover's temperature to be 65 °C (149° F) above the ambient temperature. This temperature represents a normal charge, and should not be a cause for worry.



## 12 Operation

The dry-type transformers are designed to function in a continuous manner at the kVA power shown on the ID tag.

**The ANSI/IEEE C57.96 standard offers guidelines for the charging of transformers, among them:**

- a. Ambient temperatures that vary from the ambient temperature required for the operation of the transformers.
- b. An over-charge of short duration, related to the time and the temperature and the corresponding shortening of the useful life of the transformer.
- c. Overcharge that causes a reduction in the expectation of the useful life of the transformer.

**If the transformer shows an increase in temperature, the following load characteristics should be immediately considered:**

- d. Rigorous startup loads of the motor or other loads producing an impact for which a specific transformer is required.
- e. Excessive excitation of the unit due to an excess of voltage or of the current in the feed line.
- f. Ambient temperature that is above the standard temperature.
- g. Overload in excess of the load indicated in the ANSI/IEEE C57.96 guidelines.
- h. Harmonic distortions of the voltage and of the currents in the feed line.

If overheating is observed, any effort to add supplemental cooling ventilators must comply with the manufacturer's installation guidelines. Incorrectly installed ventilators can misdirect the air flow and cause a serious deterioration in the useful life of the insulation in a transformer's windings.

Dry-type transformers can be turned off and stored for prolonged periods of time without any deterioration. Care must be taken to clean and dry the units before they are turned on again, as has been previously described.

## 13 Maintenance

Under normal environmental and operating conditions, dry-type transformers do not require maintenance. However, it is good practice to carry out periodic care and inspection, depending especially on the environmental conditions under which the unit has been installed.

Peripheral inspection and the external cleaning of dust can be carried out while the transformer is in operation. However, the access covers must not be opened if the transformer is energized.

**NOTE:** The internal maintenance must be realized with the transformer de-energized, insulated, and with the terminals connected to the ground

The maintenance must include internal cleaning, the adjustment of loops and screwed connections, and the inspection and repair of auxiliary devices.

The air conduits must not have accumulations of dust or debris, and the screwed connections of the terminals must be in good condition.

The vacuuming or blowing of compressed air from top to bottom is an acceptable practice for removing the dust from the conduits of a transformer's windings. Dry air at a low pressure should be used in order to avoid the contamination of the windings with foreign material.

The ground connection must also be checked, to ensure that it is a low impedance connection. The accumulation of ice, snow or any object blocking the ventilation must be cleaned immediately during the operation of the transformer.

## 14 Drying of the transformers

If the transformers have been exposed to moisture such as condensation or rain, it is recommended that all the units be dried before their energization.

The drying can be realized with hot air, radiant heat or internal heat through the windings. Hot air should be allowed to rise through the windings for a minimum of twenty-four (24) hours after the evidence of condensation is no longer visible.

It is possible that transformers that have been exposed to flooding, direct rainfall or sprinklers cannot be adequately dried. In such a case, contact the manufacturing company to determine what measures can be taken.

## 15 Accessories

There is a wide variety of accessories to facilitate the installation of dry-type transformers. Consult your local agent or distributor in order to purchase any of these elements that might be in stock.

### 1 Supports for mounting on the wall

Dry-type transformers with ventilation are normally designed for mounting only on the floor. However, some ventilated units of up to 75 kVA are supplied in cabinets that can be mounted on the wall. These units are practical for mounting on walls, beams or posts.

### 2 Noise insulating cushion

All the dry-type transformers have rubber cushions for the absorption of noise, installed internally between the core and winding set and the cabinet.

For the maximum absorption of vibration and noise, we recommend the installation of additional noise insulation cushions between the transformer and the mounting surface.

These molded sets made of neoprene and sheet metal practically eliminate the noise caused by the vibration between the transformer and the surface it is mounted on.

Consult the manufacturer's catalogue to obtain the correct part number of the insulation cushion required.

## 16 Mounting

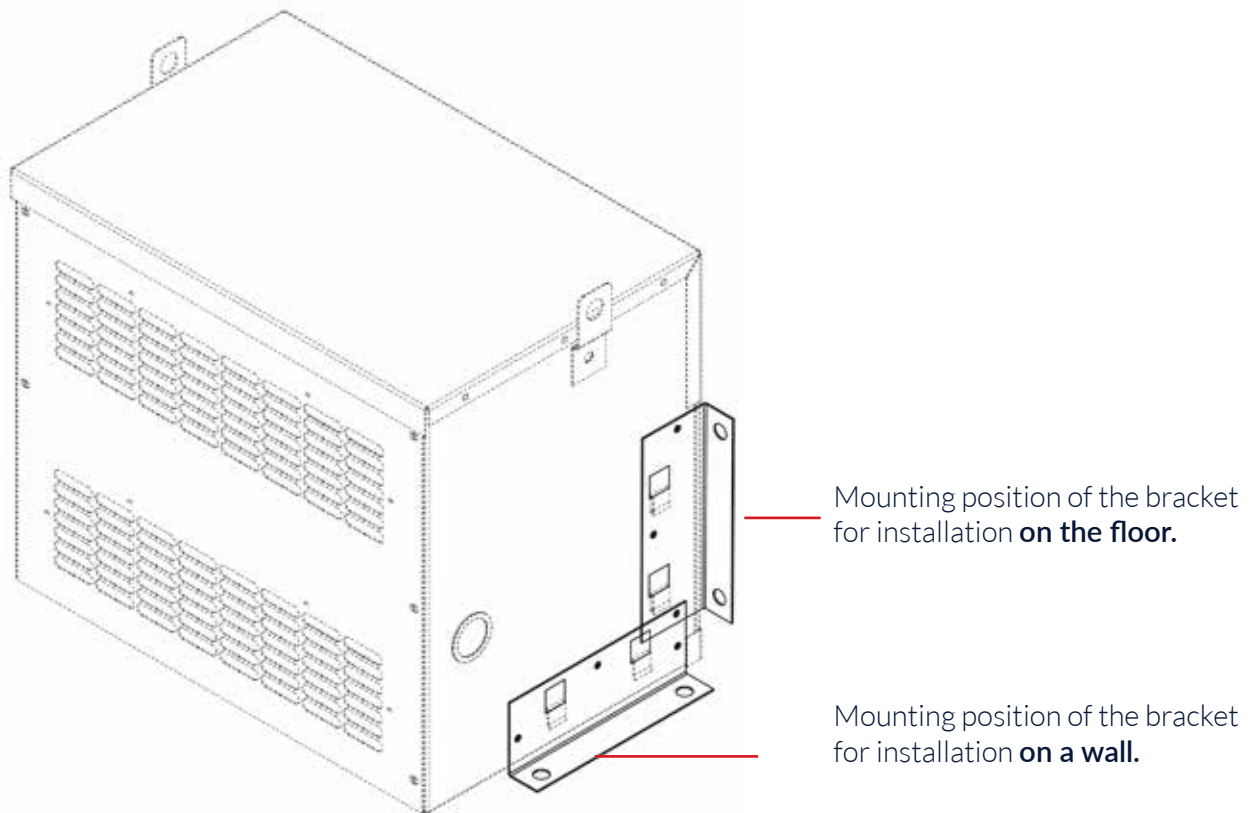
### Mounting metal work (2 positions)

The commercially distributed transformers of from 15 KW to 45 KW (cabinet styles CH1 to CH3) are delivered with a metal bracket for installation on floors, which can be removed. To install these transformers on a wall, rotate and reinstall the metal bracket utilizing the mounting orifices found on the cabinet.

*Drawing 1* shows the 2 positions in which the mounting bracket can be installed to allow its installation on a wall or on the floor.

**NOTE:** Please review the electricity codes of the building in which you will install a commercially distributed transformer.

Drawing 1



**17** Appendix A  
Classification of amperages for the connections

**A. For a single phase transformer**

$$\text{Amperes in line} = \frac{\text{Volt-amperes}}{\text{Line voltage}}$$

**Complete charge current table – Single phase transformer**

Current in amperes					
kVA Power	120V	240V	416V	480V	600V
3	25.0	12.5	7.21	6.25	5.00
5	41.6	20.8	12.0	10.4	8.33
7.5	62.5	31.2	18.0	15.6	12.5
10	83.3	41.6	24.0	20.8	16.6
15	125	62.5	36.0	31.2	25.0
25	208	104	60.0	52.0	41.6
37.5	312	156	90.1	78.1	62.5
50	416	208	120	104	83.3
75	625	312	180	156	125
100	833	416	240	208	166
150	1250	625	360	312	250
167	1391	695	401	347	278
250	2083	1041	600	520	416
333	2775	1387	800	693	555

**17** Appendix A  
Classification of amperages for the connections

**B. For a three phase transformer**

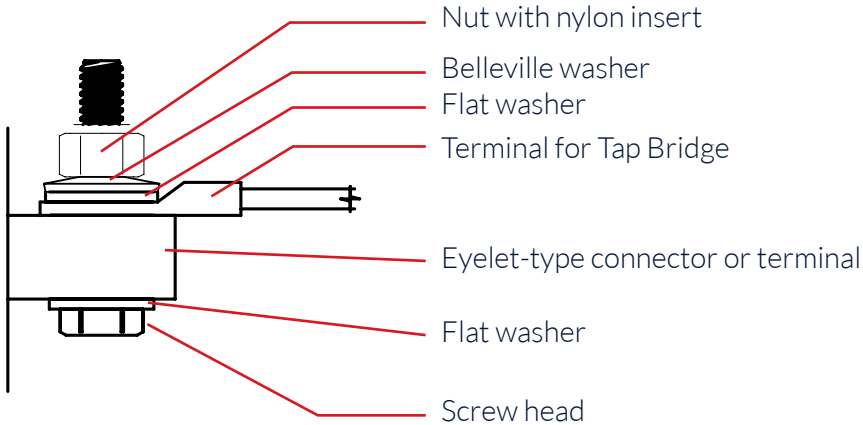
$$\text{Amperes in line} = \frac{\text{Volt-amperes}}{\sqrt{3} \times \text{Line voltage}}$$

**Complete charge current table – Three phase transformer**

Current in amperes								
kVA Power	208V	220V	240V	380V	416V	440V	480V	600V
2	5.55	5.25	4.81	3.03	2.77	2.62	2.40	1.92
3	8.32	7.87	7.21	4.55	4.16	3.94	3.60	2.88
6	16.6	15.75	14.4	9.11	8.32	7.87	7.21	5.77
9	24.9	23.62	21.6	13.6	12.4	11.81	10.8	8.66
15	41.6	39.37	36.0	22.7	20.8	19.68	18.0	14.4
30	83.2	78.73	72.1	45.5	41.6	39.37	36.0	28.8
45	124	118.10	108	68.3	62.4	59.05	54.1	43.3
75	208	196.83	180	113	104	98.41	90.2	72.1
112.5	312	295.24	270	170	156	147.62	135	108
150	416	393.66	360	227	208	196.83	180	144
225	624	590.49	541	341	312	295.24	270	216
300	832	787.32	721	455	416	393.66	360	288
450	1249	1180.98	1082	683	624	590.49	541	433
500	1387	1312.20	1202	759	693	656.10	601	481
600	1665	1574.64	1443	911	832	787.32	721	577
750	2081	1968.30	1804	1139	1040	984.15	902	721

**18** Appendix B  
Drawing of the Jumper assembly

**Drawing 1**  
**Omega Tap Lugs – Single Conductor**



**Drawing 2**  
**Omega Tap Lugs – Double Conductor**

