"I.G." TRANSFORMERS

Instructions for Underground Transformer Submersible Type

Cía. Manufacturera de Artefactos Eléctricos, S. A. de C. V.

User's Manual I.G.: **ITDSS-01** Review: **January 2017**

Content

I Instructions for reception, installation, operation and maintenance

1 Introduction and field of application

First of all, the company **Manufacturera de Artefactos Eléctricos, S.A. de C.V.** appreciates your preference for having an "IG" transformer, which has been designed and carefully manufactured according to the national standards and / or specifications of the customer or final user in order to provide you with a product that meets your needs and expectations.

By means of this manual we provide you with a guide with instructions for use, operation and precautions, as well as the most common recommendations and warnings that you should take into account, from the acquisition of your transformer, as it requires an appropriate installation, handling and proper usage, and a program of maintenance and tests that allow to evaluate and to extend its useful life.

Therefore, before receiving, installing or assembling your "**I.G.**" transformer, it is essential that you carefully read these instructions to ensure safe handling and use and to avoid any damage or loss. It is also important that you take into account that the installation, commissioning and maintenance of your transformer are carried out exclusively by qualified personnel and with the necessary expertise. Otherwise, you take unnecessary risks that could damage your transformer and void your warranty.

This instruction includes the underground distribution of submersible transformers that are manufactured in accordance with NOM-002-SEDE / ENER-2014 and NMX-J-287-ANCE standards and / or specifications of the customer or final user. It covers transformers of the following capacities and insulation class:

Single-phase:	from 25 to 167 kVA, until 25 kVA
Three-phase:	from 75 to 500 kVA, until 25 kVA

2 Reception

"I.G." transformers are thoroughly inspected and tested before leaving the factory to ensure that they comply with the standards and specifications set by the customer or final user. However, once you have received your transformer you need to follow the recommendations below to check the status or conditions in which you receive it. Use the list on *page 22* to record this verification.

- **a.** Check that your transformer is mounted on a wooden platform that protects it during transport, handling and storage before installation. Keep the platform until you arrive at the place where it will be installed.
- **b.** Check transformer capacity and series against plate and document data.
- **c.** Check that both the medium and low voltage nozzles have no cracks.
- **d.** Check that all accessories such as valves, levers or operation handles, tap changer, etc., are not damaged or have oil leaks.
- **e.** The joints or gaskets of the medium and low voltage nozzles, connectors and tap changer, disconnectors, etc. must be free of oil stains (insulating liquid); otherwise, it may be an indication of leakage.

3 Handling

The "**I.G.**" transformers are provided with lifting hooks, as well as necessary accessories for the sliding and levering maneuvers. For lifting, preferably use woven fiber straps rather than steel chains or cables to avoid deterioration of the coating on the lifting hooks. If using metal chains or strobes, protect the contact area with the lifting hooks to avoid deterioration of the coating (see *figure 1*).

The wooden platform on which its transformer "**I.G.**" is mounted is intended to protect it from damage or deterioration in its accessories and coating. If you remove it before bringing your transformer to the site where the coating or accessories will be installed, it may be damaged. Also, prevent your transformer from being directly dragged onto the floor as it can deteriorate the coating and thus start the corrosion process.

If it is not possible to move your transformer with a crane or hoist, alternatively you can slide it on rollers. To do this, use the same base of the transformer, which is designed to slide your transformer in both directions parallel to its axes; be careful not to tilt it too much.

In the case of three-phase transformers, these have reinforcements that allow the use of levers or jacks for handling. Use these attachments to take the device to the installation site and prevent the bottom from deforming by making improper maneuvers.

WARNING: Never lean, pull, push or leverage radiators, if any, or any other accessory to move your transformer. Prevent damage, deformation, breakage or leakage due to improper maneuvering. Only use the attachments provided for this purpose (see *Figures 2, 3 and 4*).

4 Storage

All "**I.G.**" transformers are hermetically sealed for leakage and moisture penetration, so they can be stored indoors or in the open. In any case, always store your transformer on its wooden board and poles and place it on a solid, leveled, clean floor free of puddles, and protect it from vandalism or any other physical damage.

5 Installation / Assembly

Before installation, assembly and / or commissioning of your "**I.G.**" transformer, it is essential that you carry out and register. The checks indicated in the list on *page 23* and the others listed below:

5.1 The characteristics of your transformer must correspond to the required operating conditions (Line voltage and requested capacity). Check this on the data plate.

5.2 Check that the gear ratio is correct in the 5 positions of the tap changer. Make sure that your transformer is not out of order, short, or that one of its windings is open.

5.3 Check insulation resistance (1 000 MΩ per kV @ 20 ° C minimum) and ensure that the windings are not shorted to each other or grounded. If your transformer is star-star connection, it is required to disconnect internal bridge, so you must request authorization from the factory or that one of its windings is open.

5.4 Check the earth resistance and make sure that the earth system is suitable for the installation site of your transformer.

5.5 Be sure to ground your transformer properly.

5.6 Verify that your transformer leak-free and has no damaged nozzles or accessories.

5.7 Make sure your transformer is leveled.

5.8 Check that the protections or accessories not included in your transformer are appropriate in accordance with the required technical or coordination specifications.

5.9 Check that the disconnector(s) operate freely in all their positions.

5.10 Make sure that the well or vault where you install your transformer has adequate provisions so that the heat produced by the transformer is properly led to the outside. Likewise, checkthat the surrounding water is naturally dislodged.

NOTE: **"I.G."** transformers are shipped with the internal connections established in the Mexican standard NMX-J-287-ANCE or, as specified by the customer, indicated on the data plate. Do not allow unqualified personnel or unauthorized technicians to access the inside of your transformer to remove connections nor to touch it or introduce tools or any other objects that do not belong to the transformer as it will risk an unsafe condition and will void your warranty.

6 Operation

Your "**I.G.**" transformer is an electrical equipment that has been designed and built to the highest quality standards. By its nature, it has no moving parts, it practically operates alone and its chances of failure are minimal. However, in order to avoid faults, damage or shortening the life of your transformer, as well as to ensure a reliable, safe and continuous service of electrical energy we recommend taking into account the following aspects:

6.1 Properly install your transformer in accordance with point 5 and other practices that your technical expert considers relevant.

6.2 To extend the life of your transformer, make sure that the installation and its protections are appropriate. Never use protections that do not correspond to the coordination required by your transformer.

6.3 Before operating the transformer under load, you must first connect it in a vacuum to ensure that it is energized normally. Therefore, it is essential to follow the following indications:

- **a.** The verification must be done with completely available low voltage terminals (do not connect any load). If your transformer has low voltage switch, make sure it is in the "**C**" position (see *switch operation in section II, point 5*).
- **b.** When energizing it must do it quickly to avoid any arcing or surges that could cause damage to your transformer.
- **c.** Once the transformer has been energized, there should be no strident sound, abnormal hum or vibration. In such a case, immediately switch off the power supply of your transformer and check the earth system again, connections and protections, and check the recommendations already mentioned. Make sure it is leveled or has no evidence of low oil level. If the guards operate, follow the recommendations given here.
- **d.** Once your transformer has been energized, check the secondary voltage (phase - phase and phase - neutral). If the measured voltage differs by more than ± 2.5% from nominal or expected, make sure that the tap changer is in the correct position. If you need to change position, deenergize the transformer and make the calculation to determine the correct position or "tap" to use to get the voltage closest to the nominal or desired voltage.

6.4 When commissioning your transformer ensure that the load is as balanced as possible in each phase and avoid overloading one phase more than the others. Always keep it under normal operating conditions and never exceed its capacity.

WARNING: If overheating frequently and / or for prolonged periods your transformer overheating will cause a decrease in the properties of its insulation (accelerated aging), which can cause a failure.

6.5 Do not forget that your transformer requires an effective preventive maintenance, as well as protections and installation site in order to detect or avoid possible major faults or damages.

7 Maintenance

The maintenance tables *1, 2 and 3 of section 11* of this instruction manual indicate the inspections, tests and specifications for the general preventive maintenance that you should at least give your "**I.G.**" transformer. However, it is further recommended that you make the necessary checks and actions as directed by your maintenance expert, including the transformer and installation site protections, as well as the periodic checks below. Make sure that your transformer is deenergized before carrying out maintenance operations.

7.1 Low Voltage Nozzles

Check for cracks, chips or fractures. If they have these defects, replace them. In case of oil leaks, slightly tighten the locking bolt nuts. Be careful not to fracture the nozzle.

7.2 Medium Voltage Nozzles

Check for leaks. In case of leak, slightly tighten the fixing clamp nuts.

Verify that there are no traces of current leaks such as charred or marked trajectories. If they exist, replace the nozzle. An authorized technician must do this operation.

7.3 Derivation Changer

Check that the gaskets are free of oil leaks. If this is the case, slightly tighten the changer nut. If the leak persists, replace the gasket for which it is necessary to remove the main lid or inspection register and lower the oil level until you can access the exchanger. Do this in a closed, clean and moisture-free place. After repair, fill with oil to the "oil level" mark.

In case of any repairs to your transformer, request that the tests of voltage of dielectric rupture and power factor of the oil be carried out, as well as the measurement of the resistance of the insulation and proof of tightness. This should be done in order to check that both the oil and its transformer are in good condition, and that it is moisture-free and hermetically sealed.

The values of these tests shall be in accordance with Table 3 of this manual. If these values are not reached, remove the transformer, give the coils a drying and oil change treatment. The short circuit or oven drying method is recommended.

WARNING: If your transformer is still within the warranty period, request factory repair or a workshop authorized by **C. M. A. E. (Mexican Industrial Classification System) - I.G.**

7.4 Anticorrosive Coating

The tank of the "**I.G.**" submersible distribution transformers is protected with a high quality coating to provide the best guarantee of resistance to the most aggressive environments. However, if damage occurs in which the metal is exposed, it is necessary to coat the area with the purpose of inhibiting the corrosion process.

7 Maintenance

7.4 To coat the damaged area, properly prepare the surface and apply a layer of 50 to 75 µm (2 to 3 mils) of dry thickness of an organic epoxy-polyamide zinc primer (CFE-P9); Once dry, apply a high solids vinyl finish coat (CFE-A5) with a thickness of 75 to 100 µm (3 to 4 mils). The color with which normally the submersible type transformers are supplied is No. 5 light gray, according to specification CFE L0000-15.

Before servicing the coating, carefully check the welding and accessories to repair any oil leakage. In case of oil leaks in welds, these can be repaired by soldering them with tin, annealed wire or brass, applied with a torch. It is recommended to use electric welding only if the point to be welded is below the oil level.

8 General Recommendations

a. Do not energize the transformer if the oil level is low. For three-phase 225 kVA and larger transformers, check the oil level in the dial indicator. In the case of transformers that do not carry this indicator, you can slightly tilt the transformer to where the nipple for filter press is located and carefully remove the female plug slowly to check for oil draining; If this does not happen, fill the oil to the same level as the nipple.
For tilt, carefully lift the transformer on the opposite side to the nipple by no more than 5 cm.

b. Do not open the inspection log (if worn) in humid environments. When closing, take special care to correctly position the gaskets in their position and be sure to seal them tightly.

c. Do not approach the transformer de-energized (on the line) without first checking that the tank and the low voltage are connected to ground and you are sure that it is de-energized. Connect the primary side to ground before making any maneuver.

d. Never operate the shunt changer with the transformer energized. Once you are in the corresponding bypass, make sure it is correctly in position.

e. Do not operate the transformer if it has signals of internal failure such as bulging of the tank or leaks of the insulating liquid by the cap, nozzles, overpressure valve, expulsion fuses, etc.

f. When a damaged nozzle is detected, replace it immediately.

g. All repairs to "**I.G.**" transformers that are covered by warranty must be made in accordance with specifications of C.M. A. E. and authorized workshops.

h. All claims must be made directly with your dealer.

WARNING: If your transformer is still within the warranty period, any repair or opening not authorized by C.M. A. E. invalidates the warranty.

9 Expected working life and Warranty

"**I.G.**" transformers are designed and manufactured to achieve an expected service life of at least 20 years under the conditions and provisions set forth herein.

When purchasing your "**I.G**." transformer, be sure to receive the warranty policy, which sets out the terms and conditions to request your guarantee, if this is the case. In order to make the guarantee effective, the conditions and provisions established in the warranty policy and in the instructions in this manual must be complied with. Likewise, according to what is established in the norm **NOM-002-SEDE / ENER-2014** the following will be additional cause of exemption of the warranty:

- **a.** When the transformer has been installed by unqualified personnel.
- **b.** When there is no evidence of satisfactory results of the tests performed prior to being energized (see checklist before installation or commissioning in *section III*).
- **c.** By adverse environmental or weather conditions.
- **d.** Not protecting the transformer against overcurrent, overload or overvoltage.

10 Figures

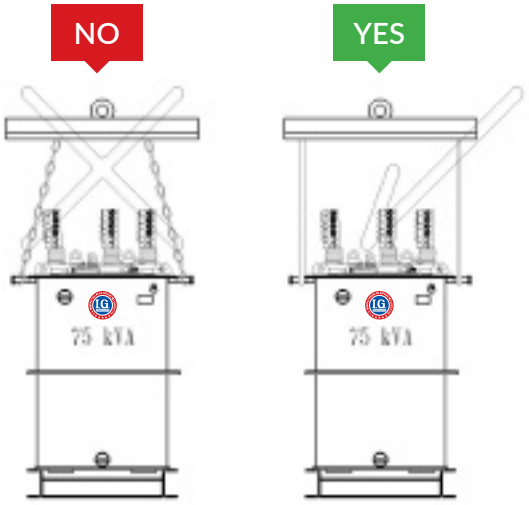

Figure No. 1

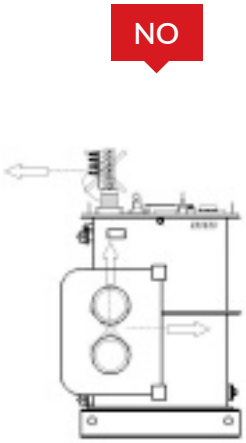

Figure No. 2

10 Figures

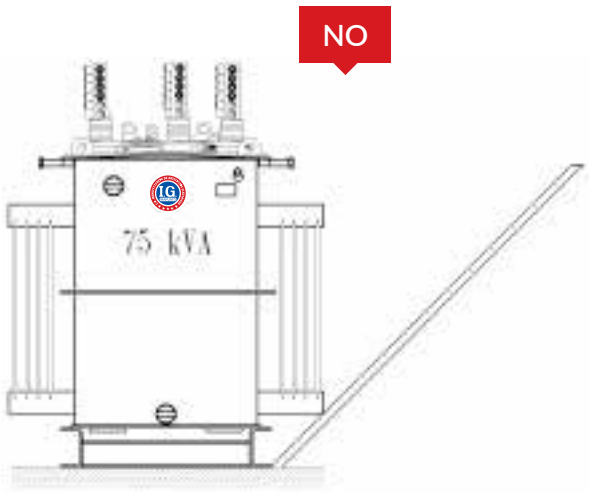

Figure No. 3

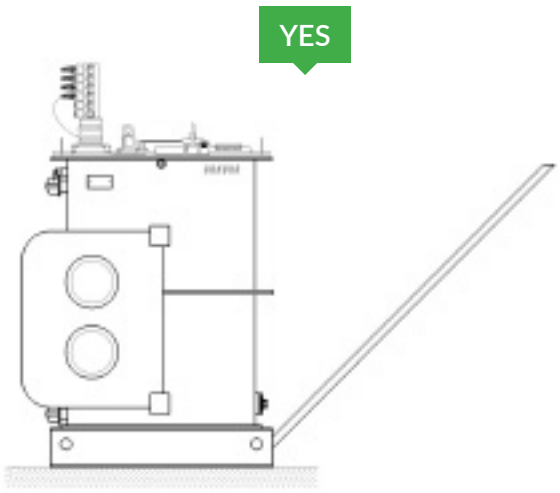

Figure No. 4

11 Maintenance Tables

Table 1
Critical Maintenance

Points for inspection	Frequency
1. Medium and low voltage nozzles	Annual
2. Accessories in general	Annual
3. Airtightness	Annual
4. Tank (recoating)	Every 2 years
5. Grounding connection	Annual

Table 2
Maintenance Tests

Test	Frequency
1. Isolating oil: **a.** Dielectric voltage **b.** Power factor at 25 °C **c.** Color ASTM D-1500	Every 2 or 3 years
2. Resistance of Insulation @ 20 °C	Every 2 or 3 years
3. Resistance ohmic of the Wound @ 75 or 85 °C	Every 2 or 3 years
4. Power factor of the Windings @ 20 °C	Every 2 or 3 years

11 Maintenance Tables

Table 3 Isolating Oil Approval Limits			
Test (*)	**Satisfactory**	**Filter**	**Replacement**
1. Dielectric Voltage	Plain electrodes: 30 kV minimum	25 to 29 kV	Less than 25 kV
2. Power factor @ 25 °C	Semi-spherical: 28 kV minimum	22 to 27 kV	Less than 22 kV
3. Neutralization number	0,05% Maximum	0,05 to 0,06%	More than 0,06%
4. Color	0,3 Maximum	0,4 to 0,9	More than 0,9
5. Grounding Connections	0,5 Maximum	More than 1	

Windings Approval Limits		
Test	**Satisfactory**	**Research**
1. Resistance of isolations @ 60 s; 20 °C	More than 1 000 MΩ for kV	Less than 1 000 MΩ for kV
2. Absorption level	1 to 1,2%	Less than 1%
3. Power factor @ 20 °C	1,5% maximum	More than 1,5%

(*) Trial method according to the Mexican norm NMX-J-123-ANCE

II Instructions for the main accessories and devices

1 Definitions

a. **Submersible Type Transformer:** It is a transformer that is designed to be installed in a well or vault that occasionally can undergo flooding, so it must have a dead front panel and accessories to connect to underground distribution systems.

b. **Transformer for Radial Operation Systems:** It is one that is equipped with a medium voltage terminal per phase and a 2 position disconnector for medium voltage.

c. **Transformer for Ring Operating Systems:** It is one that is equipped with two terminals of medium voltage per phase and that has a disconnector of 4 positions or 2 disconnectors of 2 positions each.

d. **Dead Front Transformer:** It is the one that has no live parts exposed in medium voltage; it is energized.

2 Introduction

Submersible transformers are provided with accessories and protective devices, such as bayonet ejection fuse and current limiting fuse. They also have a disconnector to interrupt or restore power to the transformer and, as requested by the customer or final user, they are supplied with a switch for low voltage o other options.

The following points describe the functions, instructions, precautions and recommendations of the main accessories and devices integrated in underground distribution, submersible transformers.

3 Disconnector

Both single-phase and three-phase submersible distribution transformers have integrated sectionalizing. That is, they are supplied with a manual operation disconnector capable of interrupting or restoring the power supply of the transformer from one or the other medium voltage line. These disconnectors are submerged in the insulating liquid and their operating handles are located in the medium voltage section to be operated under load.

According to their operation, there are two types:

a. **Radial disconnector:** This is two-position **(open-closed)** and can be used only to energize or de-energize the transformer of the single power line.

3 Disconnector

b. Disconnector for ring operation: This can be of four positions or can be composed of 2 disconnectors with 2 positions each and independent handles.

This disconnector is used to interrupt or continue the power line to which two or more transformers (ring) are connected; In addition, it can isolate each transformer from the ring by faults by itself or in the power cables, for maintenance or replacement.

Figure No. 5
Ring Disconnector Positions
(two positions each)

The following are instructions for the operation of disconnectors:

3.1 Ring operating transformers: If your transformer is supplied with 2 2-position disconnectors each, they have metal plates that indicate the "**open-closed**" positions on line "**A**" and line "**B**", in addition of the direction of rotation of the operating handles (see *figure No. 5*). The 4-position disconnector switch does this in a clockwise direction only

The ring operation transformers have 2 nozzles per medium voltage phase. For example, three-phase transformers have 3 nozzles in line "**A**" identified as H1A, H2A and H3A and 3 nozzles in line "**B**" identified as H1B, H2B and H3B. In such a case, the disconnector or disconnectors may have the following positions:

Position 1. - Line **A** and line **B** in "**closed**" position. This position allows the ring feed to adjacent transformers.

Position 2. - Line **A** in "**closed**" position and line **B** in "**open**" position. In this position only the ring line **A** is connected to the transformer windings.

Position 3. - Line **A** in "**open**" position and line **B** in "**closed**" position. In that position, only the ring line **B** is connected to the transformer windings.

Position 4. - Line **A** and line **B** in "**open**" position. In this position, both sides of the ring (line **A** and **B**) are disconnected, whereby the transformer windings are isolated and de-energized from the power supply.

3 Disconnector

3.2 Radial operating transformers: In these transformers, a single **"open-closed"** 2-position disconnector is used which de-energizes or energizes the transformer, respectively.

WARNING: These devices are designed to interrupt load currents only. They are not suitable for interrupting fault currents. Do not exceed the voltage and current limits specified on the data plate.

4 Fuses

Single-phase and three-phase submersible distribution transformers up to 225 kVA are provided with two phase fuses connected in series and coordinated with one another (an ejection fuse and a current limiting fuse). In the case of 300 and 500 kVA three-phase transformers, these are supplied with a full-range limiting fuse per phase to be removed from the outside.

4.1 Expulsion Fuse: This is a double bayonet type fuse. Operates in case of a low internal current fault and / or a fault in the low voltage network. If the fuse blower operates, follow the following steps for replacement (see *figure 6*).

a. Deenergize the transformer by driving the disconnectors to the "open" position by means of a pole.

b. Release the internal pressure of the transformer by slowly pulling the ring of the overpressure valve located in the low voltage section.

c. Unlock bayonet eye using shotgun pole.

d. Release the bayonet lock by pushing the ring down and turning 90 ° in the direction of the clock hands.

e. Remove the bayonet a little (10 to 15 cm) giving enough time to drain the oil and not letting it fall on the rest of the accessories.

f. Remove the bayonet slowly so that no more oil is removed from the transformer and take the lower end of the bayonet with a rag or tow to prevent residual oil from falling on other accessories.

g. Remove the damaged fuse by unscrewing the ends of the fuse holder. If the Teflon tube is not burned, it is necessary to straighten the tabs of the fuse end to be able to extract it.

h. Inspect the fuse cartridge to make sure it is clean.

4 Fuses

4.1 **i.** Insert the new fuse into the fuse holder cartridge. Thread the fuse holder or cartridge into the bayonet so that the fuse tabs are toward the end of the bayonet.

j. Insert the bayonet with the new fuse in place and turn the ring 90 ° counterclockwise hands of the watch by means of the pole with which the safe is activate.

WARNING: Find out the cause of the operation and damage of the replaced fuse. After replacing the exhaust fuse, perform tests to ensure that the transformer is undamaged as the operation of the fuse indicates a possible failure.

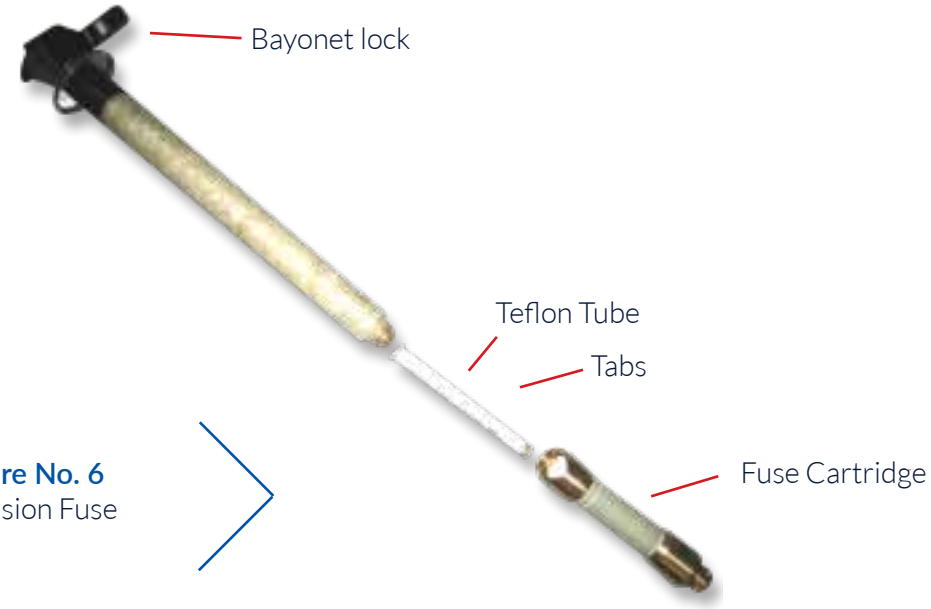

Figure No. 6
Expulsion Fuse

4.2 **Current Limiter Fuse:** This is a highly interruptible capacity fuse that can be full or partial range as specified. Operates in case of an internal transformer fault or high currents in the primary to protect the distribution system or power supply.

This fuse limits the interruption time under nominal voltage conditions to an interval equal to or less than the duration of the first half cycle of fault current, limiting the peak leakage current to a value less than the peak current that would flow if it were a solid conductor of the same impedance.

4 Fuses

4.2 The partial-range fuse is placed inside the transformer and can be replaced through the hand-held register or the main cover. While the full range fuse may be a bayonet type, in which case it may be removed from the outside of the transformer. In this case, it has a mechanism so that the fuse cannot be removed until the radial disconnector of the transformer is opened. To remove it, follow the steps below for replacement:

a. Position the radial disconnector in the "**open**" position whereby the transformer is disconnected and unlocked to the current limiting fuse holder.

b. Slowly activate the relief valve to release the internal pressure of the tank.

c. Attach the fuse holder ring with a shotgun type pole.

d. Pull quickly to remove the fuse completely.

e. Replace the fuse.

f. Insert the fuse again by pushing it inwards. Make sure it is in the correct position.

WARNING: Find out the cause of fuse operation and perform the necessary tests to verify that the transformer is not damaged.

5 Secondary Switch

This device is located submerged in the insulation liquid and is connected by the secondary or low voltage to protect your transformer against overload and instantaneous trip for protection of external short circuit.

It works by means of temperature-sensitive bimetallic sheets which, when heated by the combined effect of the current and the temperature of the insulating liquid, flex in a proportional way to the temperature until the triggering, leaving the secondary open. The service can be restored even if the bimetals get to their firing temperature.

5 Secondary Switch

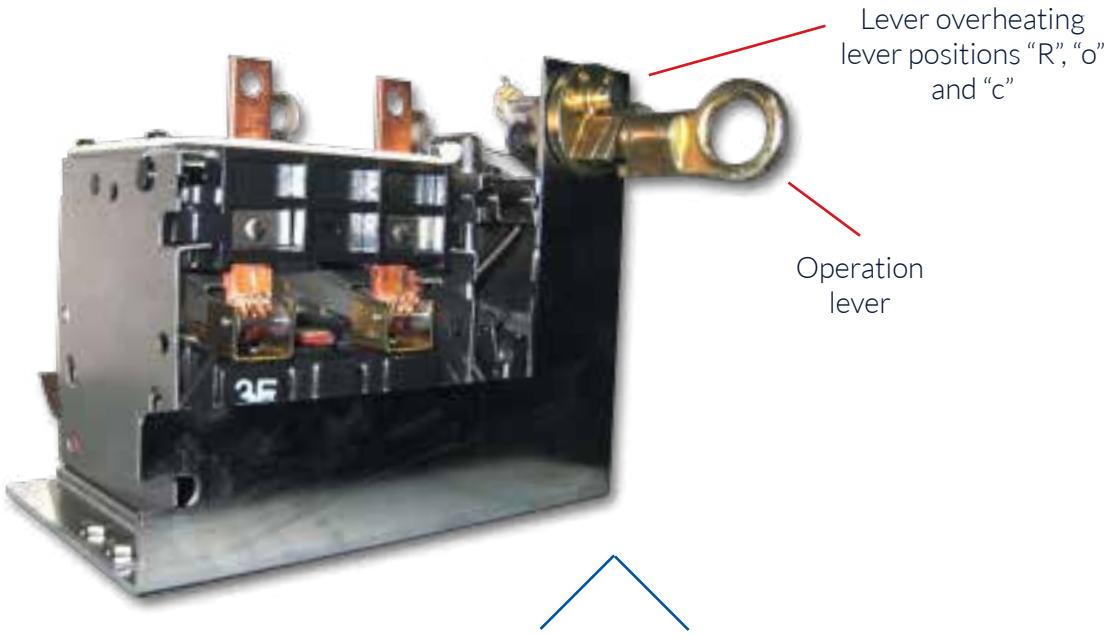

Figure No. 7
Secondary Switch

5.1 **Operation Lever:** This lever is located in the low voltage section and serves to manually **"open", "reset"** and **"close"** the switch. On its cover, the following 3 positions are indicated on the roof:

1. **"R"** for reset;
2. **"O"** for opening, and
3. **"C"** para close.

This lever can be operated even when the transformer is under load.

The following are the instructions for each of the functions of this lever or handle:

a. If the switch activates or trips automatically, first move or turn the lever or handle counterclockwise to the "R" (Reset) position and then turn clockwise to **"C".**

WARNING: Do not attempt to move the lever directly from the "**O**" position to the "**C**" position without resetting it first, as it may damage or disengage the switch mechanism!

5 Secondary Switch

b. If you need to open manually, just move the lever from position "**C**" to "**O**". If you need to close the circuit, you can return the lever directly to the "**C**" position. In this case, it is not necessary to reset. It should only be reset when the switch operates or is triggered automatically.

5.2 Emergency overload device: This allows you to operate your transformer under overload conditions approximately 10% above its rated capacity without the switch tripping. This element consists of a small lever located on the axis of the switch operating lever that is secured by a lead or marking. If you decide to operate it, remove the safety catch and push the lever upwards. As soon as the load returns to its nominal or lower load, return the emergency overload lever to its original position and secure it again.

WARNING: The permanent use of this device is at the user's own risk given that the operation of the transformer under these operating conditions degrades the insulation faster and, consequently, reduces the working life of your transformer.

6 Tap Changer

This device allows selecting the most appropriate shunt of the primary winding in order to obtain the desired secondary voltage. Normally the transformers are supplied with 2 leads up and 2 down from the rated voltage, with a voltage difference between adjacent leads of 2.5% of the rated voltage. The changer has a handle for operating it externally but only when the transformer is deenergized. If you need to change position, make sure the transformer is de-energized.

7 Overpressure Relief Valve

It is a mechanical operation device that by means of a spring and a packing allow to release the internal pressure of the tank of the transformer in manual form when pulling the ring of the valve from the outside or, automatically when the pressure rises gradually to pressures of between 0, 5 and 0.7 kg / cm^2. It is not a sudden overpressure protection device.

WARNING: Before performing any maneuver, manually actuate the relief valve to release the internal pressure. After the valve actuates, be sure to return to its position and seal tightly to prevent moisture penetration.

III Verification Lists

List for verification during the reception
Location:
Date:
Transformer description:
Transformer type:
Series number:

No.	Element for Revision	Good / Yes	Bad / No
1	Stencil of capacity (kVA)		
2	Data Plate		
3	Identification of nozzles (M. T. and B. T.)		
4	Connectors (M. T. and B. T.)		
5	Broken or cracked nozzles (M. T. and B. T.)		
6	Nozzle leaks (M.T. and B. T.)		
7	Tap Changer Lever		
8	Opener switch B. T. (if fitted)		
9	Operation of disconnectors		
10	Expulsion fuses		
11	Thermometer		
12	Oil level indicator (if equipped)		
13	Bar and / or ground connections		
14	Overpressure Relief Valve		
15	Drain Valve - Sampling (if fitted)		
16	Leaks in the main lid or log		
17	Leakage in welded joints or packaging		
18	Radiators in good condition (if fitted)		
19	Coating in good condition		

OBSERVATIONS: _____

_____

_____

_____

_____

INSPECTED BY: _____

Checklist before installation or commissioning	
Location:	Date:
Assigned installer:	

No.	Inspection Realized				
1	Description of Transformer:				
	Type of Transformer:				
	Serial Number:				
	Medium and low voltage connection:				
2	Transformer relation:	**Pos.**	**Phase A**	**Phase B**	**Phase C**
		1			
		2			
		3			
		4			
		5			
3	Isolation Resistance (megohms):		**Temperature: °C**		
			H-XT	X-HT	H-X
4	Grounding Resistance (ohms):		**Temperature: °C**		
			1	2	3
5	Omic Resistance - Medium Voltage(1) (ohms):		**Temperature: °C**		
			H1-H2	H1-H3	H2-H3
6	Omic Resistance - Low Voltage(1) (ohms):		**Temperature: °C**		
			X1-X2	X1-X3	X2-X3
7	Other (specify):				

OBSERVATIONS: _____

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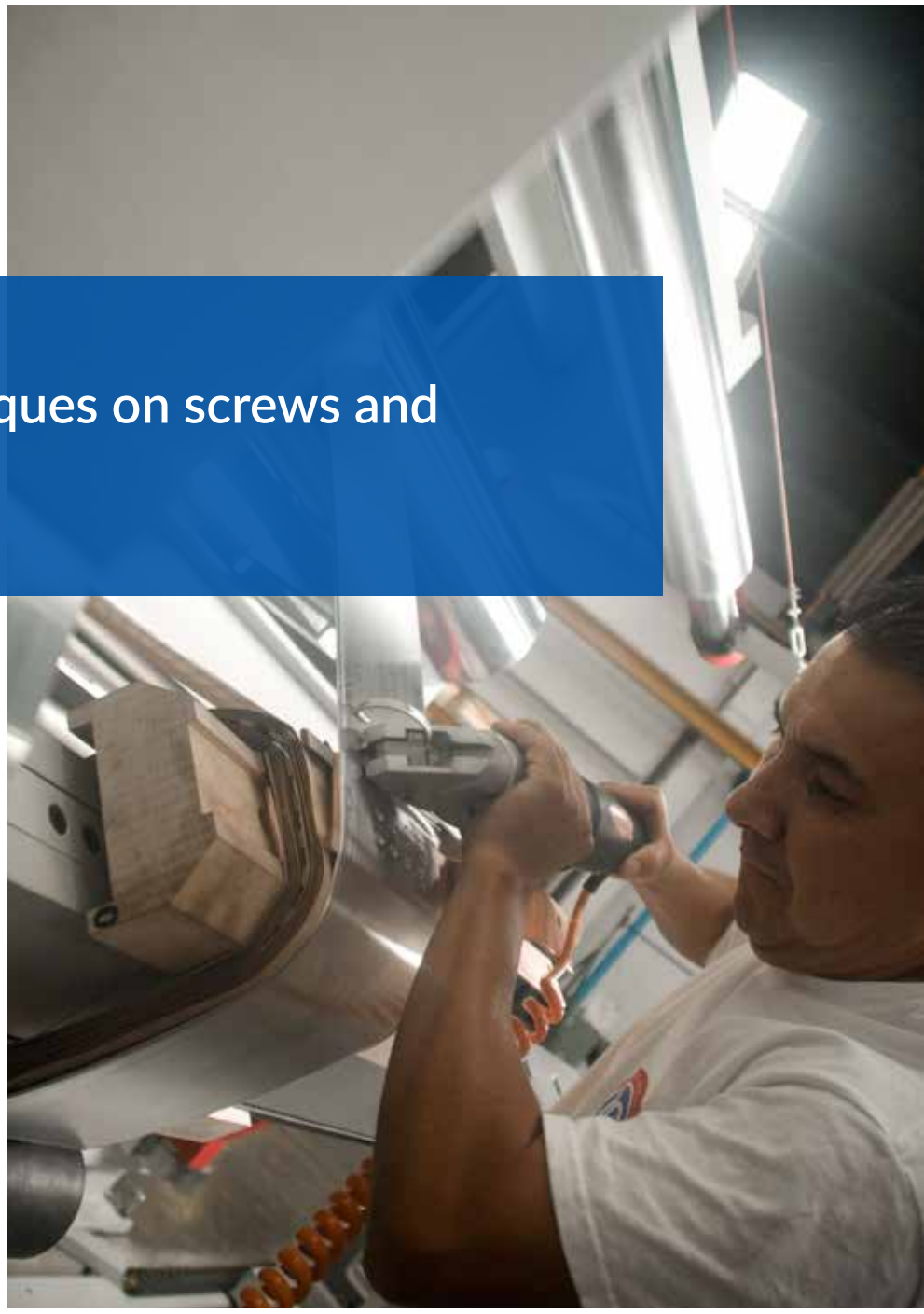
(1) For future reference.

IV Tightening torques on screws and accessories



Tightening torques on screws and accessories				
Description		Minimum torque	Maximum torque	Given for measurement
M10 screws used in medium tension nozzle clamping presses		10,17 N·m	11,30 N·m	17 mm
M10 bolt nuts used for external fastening of low voltage nozzles		9 N·m	11,3 N·m	17 mm
M10 stud nuts used for inspection record covers		7,9 N·m	10,17 N·m	17 mm
M10 rod nuts used in low voltage nozzle fittings		14,7 N·m	16,95 N·m	17 mm
M12 rod nuts used in nozzle fittings		22,6 N·m	26 N·m	19 mm
M20 rod nuts and more used in low voltage nozzle fittings		16,95 N·m	20,34 N·m	30 mm
Tightening nut used in external operation changers	Orto	10,1 N·m	12,4 N·m	NA
	Abb	11,3 N·m	13,5 N·m	NA
	Cooper	9 N·m	13,5 N·m	NA
	Moloney	6,7 N·m	6,7 N·m	NA
	Termomanufacturing	10,8 N·m	10,8 N·m	NA
Tightening nut used in signal pilot light		5,65 N·m	9 N·m	NA
Tightening nut used in the operating lever of the low voltage switch		16,95 N·m	20,34 N·m	NA
Bayonet Expulsion Fuse Holder Nut		11,3 N·m	13,6 N·m	NA

V Customer Support

Customer Support

The following information is provided so that you can contact us in case of any doubt or for any care or service that you may require:

General Offices:

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36559 Irapuato, Gto.

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Webpage: **www.ig.com.mx**
e-mail: **cmaesa@ig.com.mx**

Likewise, we are at your disposal through our branches or our distributors that are indicated in our web page.

Thank you for your preference