

**LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY
- LIGO -**

**CALIFORNIA INSTITUTE OF TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY**

Technical Note LIGO-T980012-00 - W 2/26/98

**INSTRUCTIONS FOR OIL-IMMERSED
DISTRIBUTION TRANSFORMERS**

Padmounted, 75-2500 kVA, 3 ϕ

**ABB Power T&D Company Inc.
Instruction Booklet I.B. 46-060-1, Section D**

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1.0 INTRODUCTION

The three phase padmounted distribution transformer is designed to provide electrical service on underground distribution systems. The transformer is designed for outdoor mounting on a pad. Primary and secondary cables enter the transformer compartment from below, through openings in the pad. All exposed live parts are completely enclosed in tamper-resistant cabinets with provisions for padlocking.

The transformers described herein are designed for the conditions normally encountered on electric utility power distribution systems. As such, they are suitable for use under the "usual service conditions" described in ANSI C57.12.00 (General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers). All other conditions are considered unusual service and should be avoided.

2.0 SAFETY

WARNING: READ THIS INSTRUCTION BOOK CAREFULLY BEFORE ATTEMPTING TO INSTALL, MAINTAIN, OPERATE OR SERVICE THE TRANSFORMER. FAILURE TO FOLLOW INSTRUCTIONS CAN CAUSE SEVERE INJURY, DEATH, OR PROPERTY DAMAGE.

Keep this Instruction Book available to those responsible for the installation, maintenance, operation, and service of the transformer. Safety as defined in this Instruction Book involves two conditions.

1. Personal injury.
2. Product or property damage.

SEE IMPORTANT "DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY" ON PAGE 12.

Safety notations, intended to alert personnel of possible personal injury, death or property damage, have been inserted in the instructional text prior to the step in which the condition is cited. These safety notations are headed by one of three hazard intensity levels which are defined as follows:

1. DANGER — Immediate hazard which will cause severe personal injury, death, or substantial property damage.

2. WARNING — Hazard or unsafe practice which can cause severe personal injury, death or substantial property damage.

3. CAUTION — Hazard or unsafe practice which will or can cause minor personal injury or minor property damage.

The transformer should be operated and serviced only by competent personnel, familiar with good safety practices. These instructions are written for such personnel and are not intended as a substitute for adequate training and experience in the use of this equipment. Should clarification or further information be required, or should problems arise which are not covered sufficiently for the user's purpose, refer the matter to the ABB Power T&D Company Inc. When communicating with ABB regarding the product covered by this Instruction Book, always include the following items of information from the transformer's nameplate: Serial number, style number, KVA rating, high voltage and low voltage ratings.

Additionally, all applicable safety procedures such as OSHA requirements, regional and local safety requirements, safe working practices and good judgement must be used by such personnel.

3.0 RECEIVING

WARNING: DO NOT LIFT THE TRANSFORMER BY USING CRANES OR JACKS ON ANY PART OF THE TRANSFORMER OTHER THAN THE LIFTING HOOKS OR JACKING PADS PROVIDED FOR THIS PURPOSE. IMPROPER LIFTING OR JACKING CAN CAUSE SEVERE INJURY AND PROPERTY DAMAGE.

The transformers are normally shipped completely assembled and ready to install. Each transformer should be carefully inspected upon receipt and the transportation company notified of any damage that has been incurred. The shipping list should be checked for possible shortages.

Three-phase transformers are normally shipped on a pallet. Palletized transformers in these ratings may be moved readily by a lift truck, crane, or cart. The lifting hooks supplied on the sides of the transformer enable it to be lifted by crane.

Be sure the device chosen has the capacity to lift, or move, the complete unit. (Weight is shown on the nameplate.)

Lift the transformer utilizing all the hooks and use proper spreaders to obtain a vertical lift.

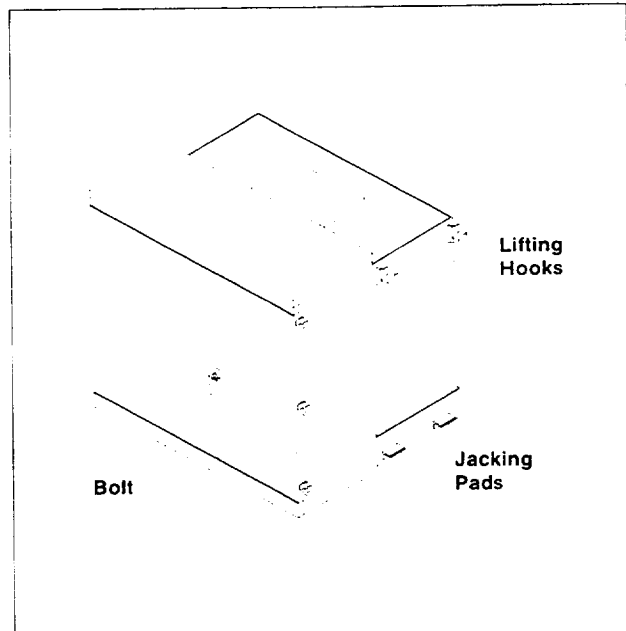


Fig. 1

This transformer has been furnished with a "penta-head" locking bolt that must be loosened to open the compartment. This bolt can be turned with a standard pentahead socket (wrench), as used widely in the utility industry. Sockets can be obtained from the Snap-On Company (tool #B2191), or equivalent.

4.0 EXTERNAL INSPECTION

WARNING: THE OIL MUST BE AT THE PROPER LEVEL BEFORE VOLTAGE IS APPLIED TO THE TRANSFORMER. FAILURE TO MAINTAIN THE PROPER OIL LEVEL CAN CAUSE SEVERE PERSONAL INJURY, DEATH OR SUBSTANTIAL PROPERTY DAMAGE.

The oil level should be checked by removing the oil level plug located at the 25 °C level. Any unit which does not have the proper oil level should be checked for leaks and refilled through the vent plug before placing in service. Use only quality oil per ASTM D3487 when adding oil to the transformer. The transformer was filled or processed at the factory with non-PCB dielectric fluid in accordance with Federal Polychlorinated Bi-phenyl (PCB) Regulations 40 CFR 761, et seq. The non-PCB fluid contained less than 1ppm at time of processing or filling. The owner should take the necessary precautions so that PCB contamination is not introduced during field filling or maintenance of the transformer (refer to Fig. 2)

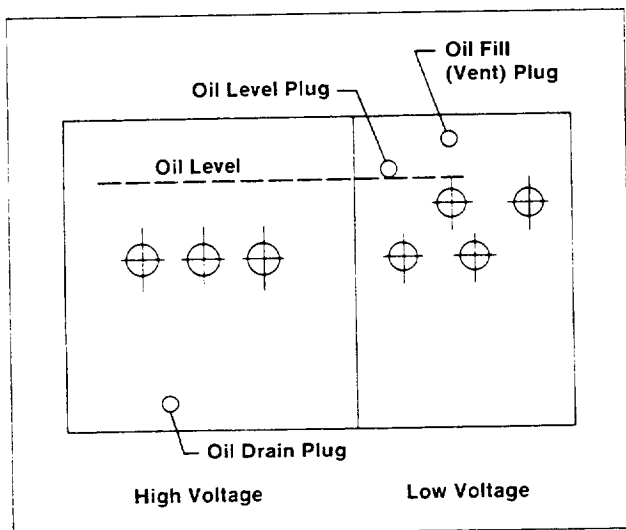


Fig. 2

5.0 INTERNAL TANK INSPECTION

WARNING: ALWAYS VENT THE TRANSFORMER BY FOLLOWING THE INSTRUCTIONS IN SECTION 7.3. FAILURE TO DO SO CAN CAUSE SEVERE PERSONAL INJURY, DEATH OR SUBSTANTIAL PROPERTY DAMAGE.

CAUTION: WHEN A TRANSFORMER IS OPENED, USE CARE TO PREVENT ENTRANCE OF MOISTURE OR FOREIGN OBJECTS. MOISTURE, DIRT OR FOREIGN OBJECTS CAN WEAKEN THE INSULATION OF A TRANSFORMER AND GREATLY SHORTEN ITS LIFE.

The transformer covered by this instruction is shipped ready for installation and does not require internal inspection; however, if the transformer must be opened, prevent the entrance of moisture or other foreign material.

6.0 STORAGE

The transformer should be stored completely assembled (tank sealed and cabinetry closed) as though it were energized and at its permanent location. Transformers should not be stacked on top of one another, and care must be exercised to prevent submersion in water. The transformer should be stored on a solid, level foundation.

In the event a transformer is to be held in storage for a period in excess of one (1) year, it is recommended the space above the oil be pressurized with dry air to two (2) to three (3) psig. This will prevent moisture ingress due to negative pressure.

The transformer will be ready for service at any time provided it has received the inspections outlined in Sections 4.0 and Section 7.0 thru 7.7.

7.0 INSTALLATION

Installation should comply with the latest edition of the National Electrical Code.

7.1 Mounting

WARNING: FAILURE TO PROPERLY MOUNT THE TRANSFORMER CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

The transformers should be mounted on a flat level pad strong enough to support the weight of the transformer. The unit should not be tilted in any direction greater than 1.5 degrees, as a greater tilt will cause deviations in liquid level near fuses, pressure relief devices, or other accessories specifically located at or near the 25 degree C liquid level.

CAUTION: DEVIATIONS IN OIL LEVEL CAN INCREASE THE POSSIBILITY OF A DISRUPTIVE FAILURE.

When supplied, hold down cleats or brackets should be used to bolt the transformer securely to the pad (refer to Fig. 3).

The transformer cabinet should sit flush on the pad allowing no gaps which would compromise the tamper-resistance of the transformer.

7.2 Location

Since these transformers contain a flammable insulating fluid (mineral oil), transformer failure can cause fire and/or explosion. This possibility should be considered when locating these transformers in close proximity to buildings or public thoroughfares. Refer to the latest edition of the National Electrical Code.

7.3 Venting

Vent the transformer by manually operating the pressure relief device normally provided, or by removing the vent plug. The transformer should be vented before it is energized if it has been pressurized for leak test or if the unit has been opened and resealed.

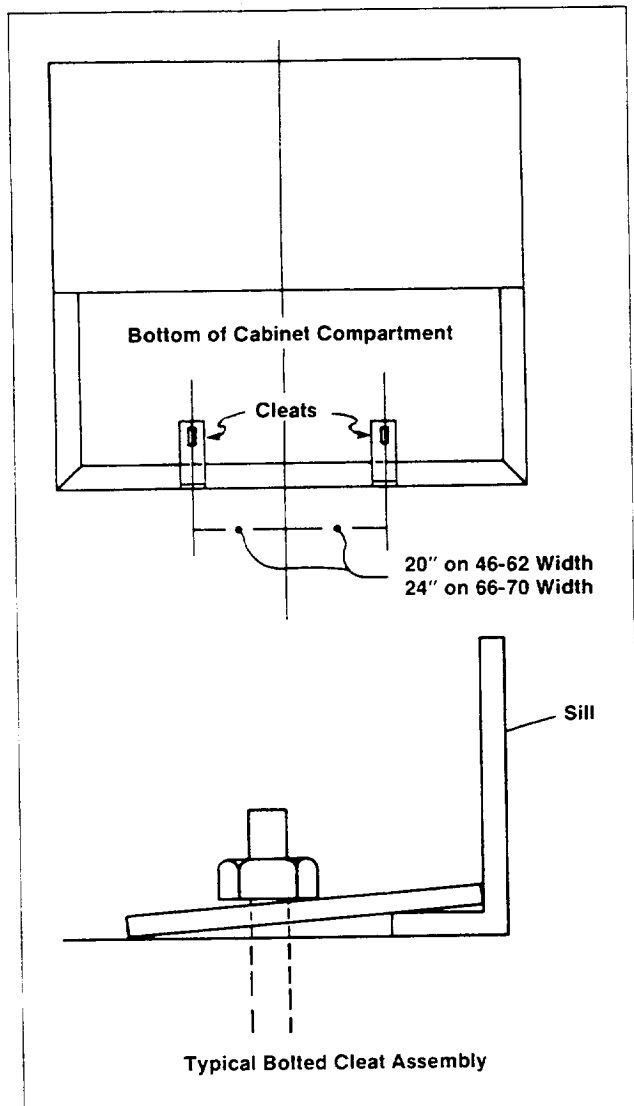


Fig. 3

7.4 Grounding

WARNING: THE TRANSFORMER MUST BE PROPERLY GROUNDED PRIOR TO ENERGIZING. FAILURE TO PROPERLY GROUND CAN CAUSE SEVERE INJURY OR DEATH.

A good, permanent low impedance ground connection must be made to the tank by using the ground pad(s) provided near the bottom of the tank for this purpose.

Transformers which are designed for use on a grounded wye system, that is, one having a solidly grounded neutral, must have the tank and other available neutrals permanently and solidly grounded to the common neutral of the system before the transformer is energized.

7.5 Connections

During installation, the recommended sequence of connections is to first make all ground connections, then the low voltage connections, and finally the high voltage connections. The transformer should be removed from service by reversing the above sequence of connections. Carefully check the transformer nameplate for its rating and the connections that can be made to it. Avoid excessive strain on the

bushing terminals or insulators. This could loosen the contact joints or damage the insulators.

7.6 Liquid Level

WARNING: ENERGIZATION OR OPERATION OF THE TRANSFORMER WITH THE INSULATING LIQUID LOWER THAN ½ INCH BELOW THE 25°C LEVEL (½ INCH BELOW THE BOTTOM EDGE OF THE LIQUID LEVEL PLUG) CAN CAUSE SEVERE INJURY, DEATH, OR PROPERTY DAMAGE.

Never operate or apply voltage to transformer if the liquid level is below the 25 degree C liquid level plug more than ½ inch. Check the liquid level *before* the transformer is energized to ensure the proper liquid level.

NOTE: Cold temperatures can cause the liquid level to drop, through contraction, by more than ½ inch. When this happens, the liquid should be heated to allow for expansion to the proper liquid level or additional liquid is to be added to bring the liquid level up to within ½ inch of the liquid level plug. This liquid will then have to be removed when the unit has reached normal operating temperature. Follow the maintenance information in Section 10.0 when adding and removing any liquid.

7.7 Cabinet Security

WARNING: FAILURE TO PROPERLY SECURE THE CABINET MAY ALLOW ACCESS BY UNAUTHORIZED PERSONNEL WHICH CAN CAUSE SEVERE INJURY, DEATH, OR PROPERTY DAMAGE.

Before leaving the site of an energized transformer, make sure that any protective or insulating barriers are in place, the cabinet is completely closed, and all locking provisions are properly installed.

The following procedure should be used to assure cabinet security.

- A. Close the high voltage (left) door and secure it in place with the captive bolts supplied (pentahead or hexhead).
- B. Close the low voltage (right) door and secure it in place by rotating the handle in a clockwise direction until seated (handle should then be in a vertical orientation).
- C. Tighten the safety bolt (pentahead or hexhead) located in the locking tube until fully seated.
- D. Install a padlock through the door handle and locking tube and secure.
- E. Check both the high and low voltage doors for proper fit and security.

8.0 OPERATION

This transformer was built and tested in accordance with the latest version of the following standards of American National Standards Institute:

ANSI C57.12.00 — General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.

ANSI C57.12.90 — Test Code for Liquid-Immersed Distribution, Power and Regulating Transformers, and Guide for Short-Circuit Testing of Distribution and Power Transformers.

The pad-mounted transformer is an integral part of the distribution system and consideration must be given to proper protection from system disturbances. Protection from excessive voltage transients and severe overcurrents should be provided. To allow proper operation of overcurrent devices that may be supplied with the transformer, coordination with system overcurrent protection must be achieved.

9.0 ACCESSORIES AND COMPONENTS

9.1 Bushings

CAUTION: REMOVE ALL DIRT AND FOREIGN MATERIAL FROM ALL BUSHINGS BEFORE PLACING TRANSFORMER IN SERVICE. READ AND FOLLOW THE MANUFACTURER'S INSTRUCTIONS FOR INSTALLING SEPARABLE-INSULATED HIGH VOLTAGE CONNECTORS. DO NOT ENERGIZE THE TRANSFORMER WITH THE SHIPPING CAPS ON THE BUSHINGS OR INSERTS. DO NOT OPERATE THE TRANSFORMER BEYOND THE MANUFACTURER'S RATING. FAILURE TO DO SO CAN CAUSE MINOR PERSONAL INJURY OR PROPERTY DAMAGE.

9.1.1 Separable Insulated Connectors

Separable insulated connectors may be universal bushing wells, integral bushings or bushing wells with inserts installed. They may be either loadbreak or non-loadbreak. All connectors must be dry and clear of any contamination before installation. Unused terminals should be properly terminated to prevent possible contamination. Follow the manufacturer's instructions and warnings on the use of these terminations.

9.1.2 Porcelain Bushings

High voltage porcelain bushings (when provided) are externally clamped, gasketed bushings with eyebolt-type terminals. The primary cables enter the compartment from below and attach to the bushing terminals. The eyebolt-type terminals will accommodate No. 8 through 250 kcmil cable.

9.2 Fuses

WARNING: OPERATION OF A FUSE MAY INDICATE A FAULTED TRANSFORMER. DO NOT REPLACE THE FUSE UNLESS THE CAUSE OF THE FUSE OPERATION IS POSITIVELY IDENTIFIED AND CORRECTED. IF THE CAUSE OF THE FUSE OPERATION CANNOT BE POSITIVELY IDENTIFIED AND CORRECTED, THE TRANSFORMER SHOULD BE REPLACED OR RE-ENERGIZED FROM A REMOTE LOCATION. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

WARNING: FUSES SHOULD BE OPERATED WITHIN THEIR RATINGS AND REPLACED WITH FUSES HAVING EQUIVALENT VOLTAGE AND TIME-CURRENT CHARACTERISTICS. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

9.2.1 Protective Link

DANGER: DE-ENERGIZE THE TRANSFORMER BEFORE INSPECTING OR REPLACING THE PROTECTIVE LINK. FAILURE TO DO SO WILL CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

WARNING: VENT THE TRANSFORMER BEFORE DISTURBING THE TANK SEAL. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

The protective link is an oil-immersed high voltage expulsion fuse designed to isolate the transformer from the distribution system in the event of a transformer fault inside the tank on the load side of the link. It is not designed to provide overload or secondary fault current protection for the transformer.

When inspecting or replacing protective links, always vent the transformer before disturbing the tank seal as outlined in section 7.3. Care should be taken to prevent the entrance of moisture or foreign material.

For further technical information, refer to ABB TPL 44-839.

9.2.2 Bayonet Oil Fuse

WARNING: VENT THE TRANSFORMER BEFORE OPERATING THE BAYONET FUSEHOLDER. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

The bayonet oil fuse is a device which permits replacement of an under-oil expulsion fuse in the field, and has loadbreak capability allowing it to energize and de-energize a transformer.

To operate or replace the fuse, follow the instructions in Fig. 4.

For further technical information, refer to ABB TPL 44-835.

9.2.3 Loadbreak Drawout Fuseholder

This device combines the high interrupting capability of a general purpose, current-limiting fuse with a dry-well fuseholder. The loadbreak drawout utilizes the rod and bore principle to accomplish loadbreak and loadmake within the Fuseholder.

To operate or replace the fuse, follow the instructions shown in Figs. 5 and 6.

For further technical information, refer to ABB TPL 44-837.

9.2.4 Deadbreak Drawout Fuseholder

DANGER: DE-ENERGIZE THE TRANSFORMER BEFORE REMOVING OR INSTALLING THE DEADBREAK DRAWOUT FUSEHOLDER ASSEMBLY. FAILURE TO DO SO WILL RESULT IN SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

(Text Continued on page 9)

To operate the bayonet Loadbreak Fuseholders, it is necessary to raise the Hinged Weathercover (Flip-top).

With both cabinet doors fully open (over 90 degrees), push upward on the front edge of the cover assembly. Tilt the hinged cover backward until the supporting arm, con-

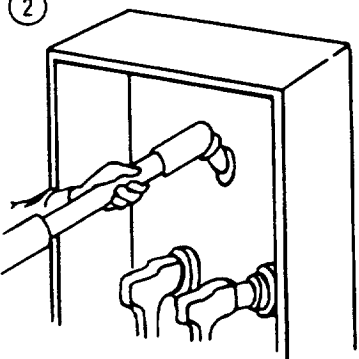
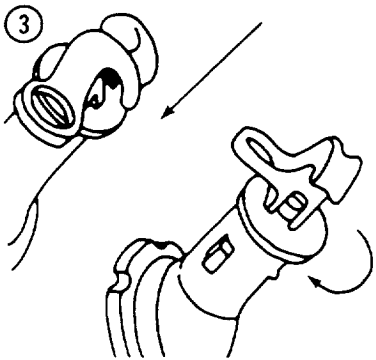
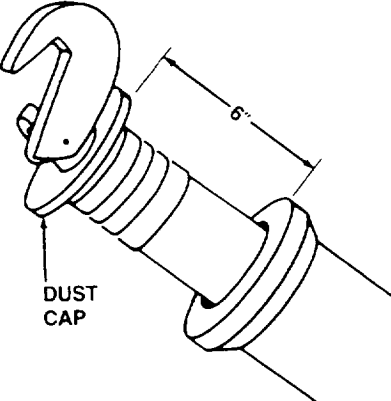
nected to the high-low barrier, can be securely latched in place on the inside of the cover.

Proceed with the operating instructions for the Bayonet Loadbreak Fuseholder (below).

BAYONET LOADBREAK FUSEHOLDER

WARNING: OPERATE THE FUSEHOLDER PER THESE INSTRUCTIONS. FAILURE TO DO SO CAN RESULT IN SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

OPERATING INSTRUCTIONS

<p>①</p> <p>WARNING: VENT THE TRANSFORMER BEFORE OPERATING THE BAYONET FUSE HOLDER. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.</p> <p>VENT THE TRANSFORMER AS OUTLINED IN SECTION 7.3</p>	<p>②</p>  <p>ATTACH HOT-LINE TOOL TO HANDLE EYE. STAND TO ONE SIDE AND UNLOCK THE HANDLE.</p>	<p>③</p>  <p>PUSH DOWN AND ROTATE THE HANDLE 90° CLOCKWISE IN THE HOUSING TO BREAK ANY ADHESION BETWEEN THE GASKET AND THE HOUSING.</p>
<p>④</p>  <p>DUST CAP</p> <p>JERK THE FUSEHOLDER OUT APPROXIMATELY 6" TO OPEN THE CIRCUIT. WAIT A FEW SECONDS FOR OIL TO DRAIN BACK INTO THE TANK, THEN COMPLETELY WITHDRAW FUSEHOLDER.</p>	<p>⑤</p> <p>TO REPLACE FUSE:</p> <p>INSTRUCTIONS FOR REPLACING FUSE ELEMENT ARE PACKED WITH EACH REPLACEMENT FUSE. FOLLOW THE FUSE MANUFACTURER'S INSTRUCTIONS.</p>	<p>⑥</p> <p>TO REINSTALL FUSEHOLDER:</p> <p>ATTACH HOT-LINE TOOL TO HANDLE EYE, STAND TO ONE SIDE AND PLACE THE FUSEHOLDER END JUST INSIDE THE HOUSING.</p> <p>RAPIDLY PUSH THE FUSEHOLDER IN UNTIL DUST CAP SEATS AGAINST HOUSING.</p> <p>PUSH DOWN AND ROTATE THE LOCKING HANDLE, HOOKING IT OVER THE SHOULDER OF THE HOUSING.</p>

When the bayonet operations are completed, release the latch on the Hinged Weathercover by tilting the cover slightly backwards. Lower the cover, making sure it is all the way

down. (The upper high-voltage door bolt should engage THROUGH the hole in the Hinged Weathercover.)

Fig.4

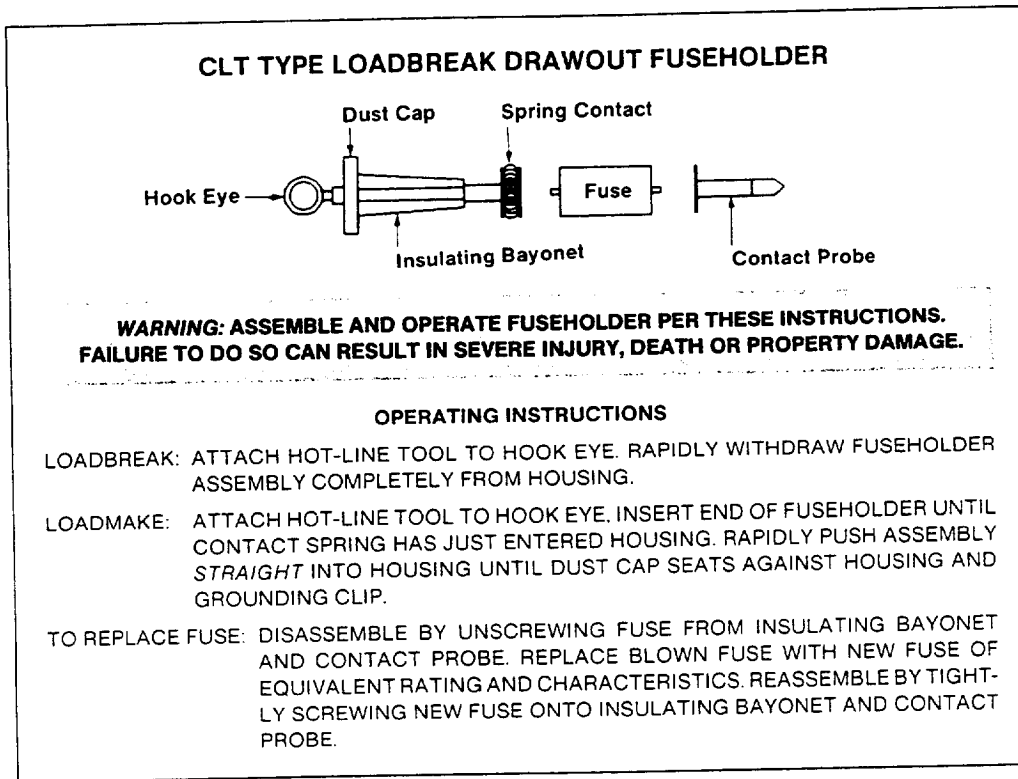


FIG. 5

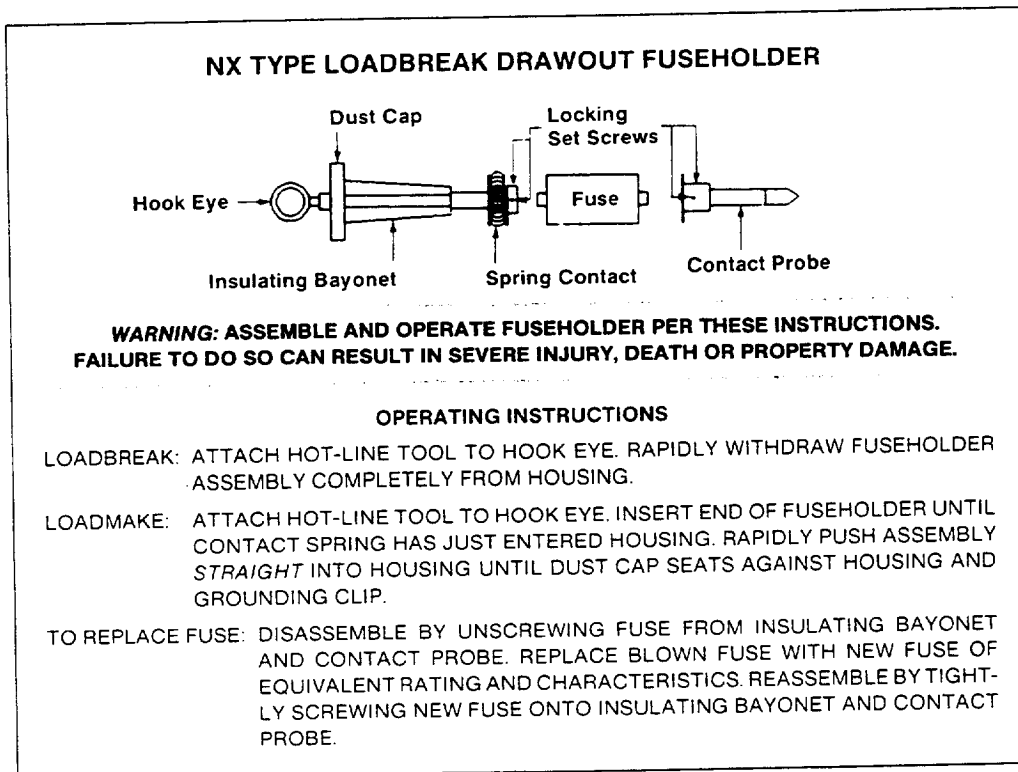


FIG. 6

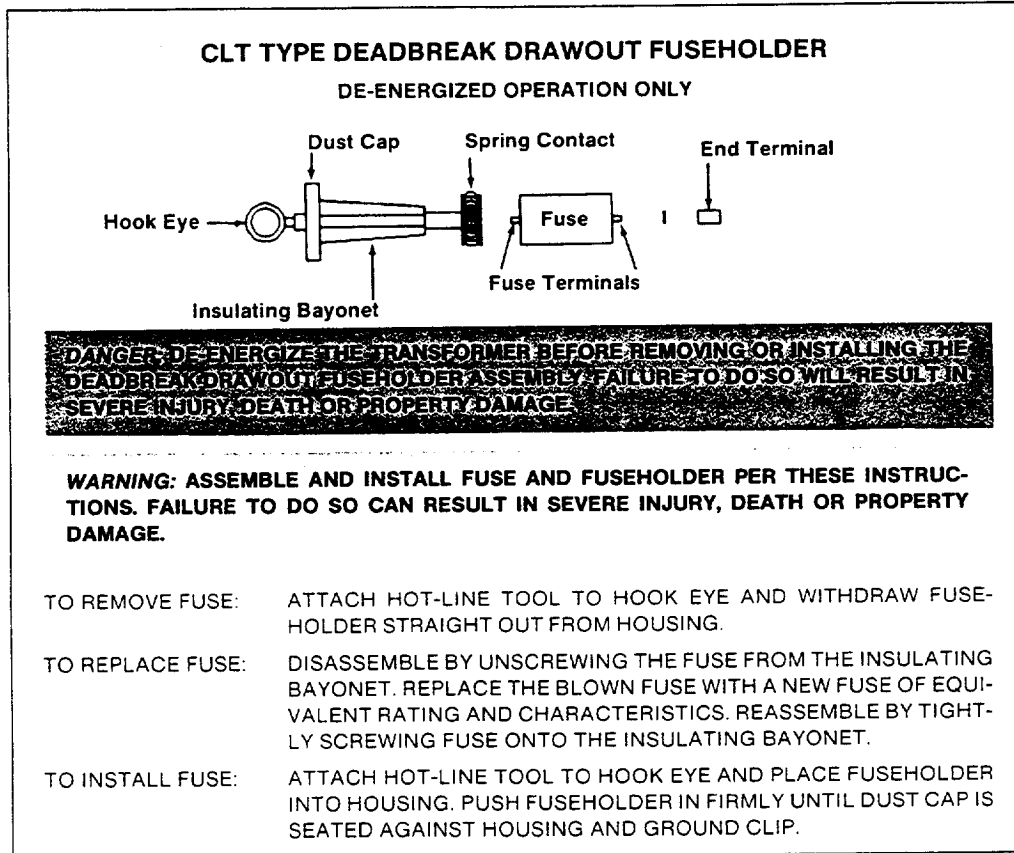


Fig. 7

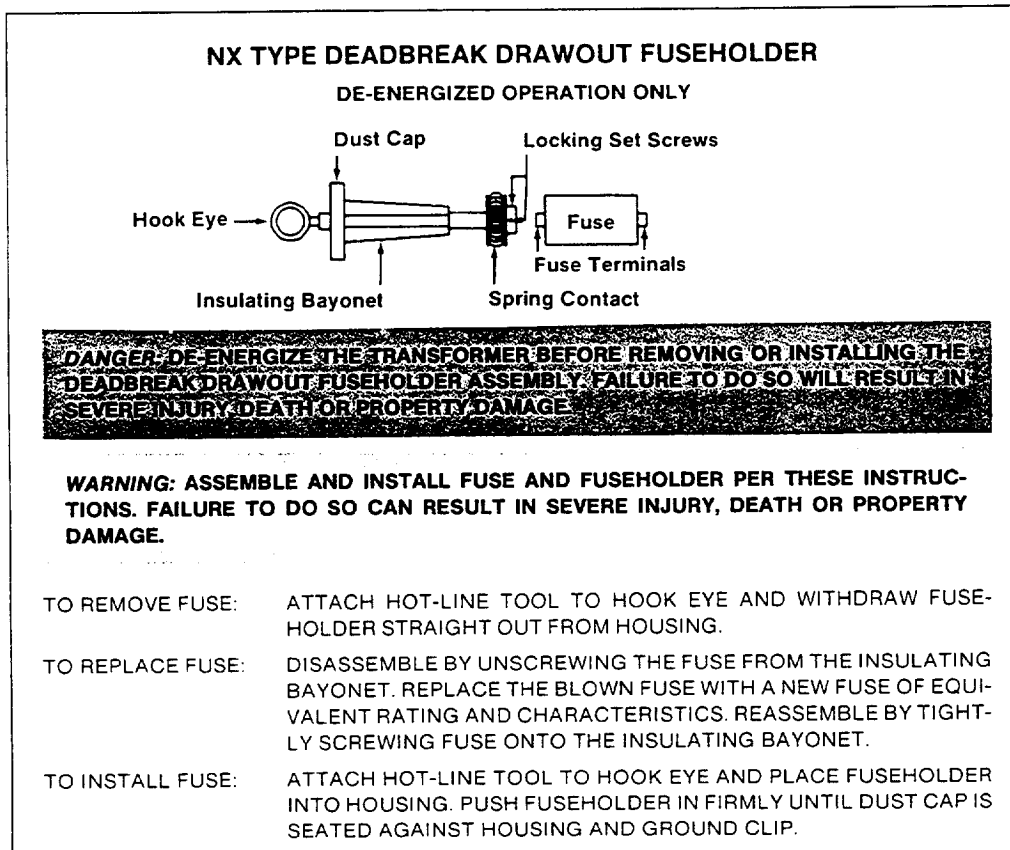
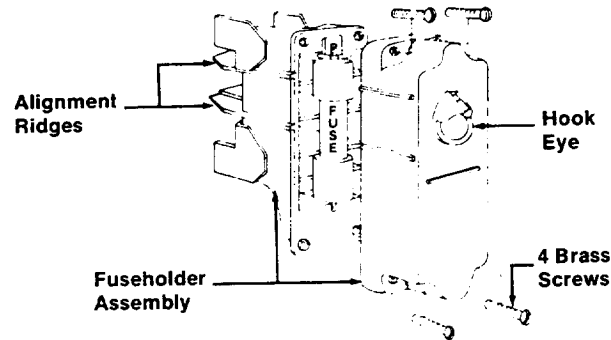


Fig. 8

EFD LOADBREAK DRAWOUT FUSEHOLDER



DANGER: DO NOT ATTEMPT TO REPLACE FUSES WITHOUT FIRST WITHDRAWING THE FUSEHOLDER ASSEMBLY FROM THE HOUSING. FAILURE TO DO SO WILL RESULT IN SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

WARNING: ASSEMBLE AND OPERATE FUSEHOLDER PER THESE INSTRUCTIONS. FAILURE TO DO SO CAN RESULT IN SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

OPERATING INSTRUCTIONS

LOADBREAK: ATTACH HOT-LINE TOOL TO HOOK EYE. RAPIDLY WITHDRAW FUSEHOLDER ASSEMBLY COMPLETELY FROM HOUSING.

LOADMAKE: ATTACH HOT-LINE TOOL TO HOOK EYE. CAREFULLY POSITION ALIGNMENT RIDGES IN THE CORRESPONDING GROOVES OF THE HOUSING. RAPIDLY PUSH THE ASSEMBLY INTO THE HOUSING UNTIL BASE OF HOOK EYE IS FLUSH WITH HOUSING.

TO REPLACE FUSE: ONLY REPLACE FUSE WITH FUSEHOLDER WITHDRAWN FROM HOUSING, DISASSEMBLE BY REMOVING THE 4 BRASS SCREWS AND SHROUD. REPLACE BLOWN FUSE WITH A NEW FUSE OF EQUAL RATING AND CHARACTERISTICS. REASSEMBLE WITH PARTS ORIENTED AS SHOWN. RETIGHTEN THE 4 BRASS SCREWS.

Fig. 9

This device combines the high interrupting capabilities of a general purpose, current-limiting fuse with a dry-well fuseholder. The deadbreak drawout is normally mechanically interlocked with a loadbreak switch. Once the transformer is de-energized by operation of the loadbreak switch, the safety baffle may be slid to the side, permitting access to the fuseholder.

To replace the fuse, follow the instructions shown in Figs. 7 and 8.

For further technical information, refer to ABB TPL 44-837.

9.2.5 Internal Partial Range Current-Limiting Fuse

The internal partial range current-limiting fuse is used in series with a low current interrupting device, such as a protective link or bayonet. The partial range fuse is designed to clear low impedance (high-current) faults, with the expulsion fuse clearing any high impedance faults or overloads. When properly applied, the partial range fuse will only operate for internal transformer faults. Upon operation of a partial range fuse, it is recommended the unit be removed from service and returned to the ABB Power T&D Company Inc. for repair.

9.3 High Voltage Switches

WARNING: WHEN DE-ENERGIZING THE TRANSFORMER, DO NOT RELY ON SWITCH POSITION OR OTHER VISUAL INDICATORS. ALWAYS ASSUME THAT TERMINALS ARE ENERGIZED UNLESS CHECKED AND GROUNDED. CONTACT WITH AN UNGROUNDED TERMINAL CAN CAUSE ELECTRICAL SHOCK, BURN OR DEATH.

9.3.1 EFD Switch

The EFD (Externally Fused Disconnect) is an air insulated loadbreak switch available for radial feed (single pole). A general purpose current limiting fuse or a solid blade is provided in the transformer connecting pole. The switch contacts are opened by drawing out the connecting pole so that they are completely free of the switch housing, leaving a visible disconnect.

To operate or replace the fuse, follow the instructions shown in Fig. 9.

9.3.2 LBOR Switch

The ABB LBOR is a gang-operated, two position rotary oil switch. The switch is operated by attaching a hot-line tool to the external hook eye handle and rotating to either the "open" or "closed" position (refer to Fig. 10). Circuit connections are shown on the transformer nameplate.

For further technical information, refer to ABB TPL 44-834.

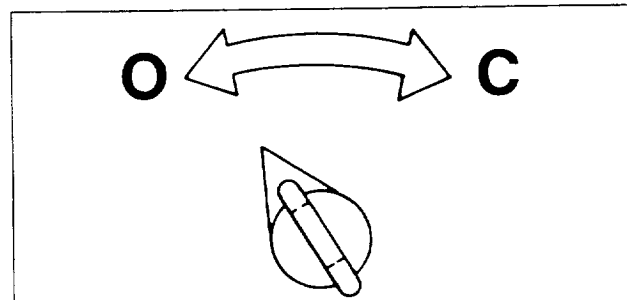


Fig. 10

9.3.3 Tap Changer (Hookstick-operable)

WARNING: DE-ENERGIZE THE TRANSFORMER BEFORE OPERATING THE TAP CHANGER. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

The tap changer provides a means of changing the voltage ratio of a transformer. The transformers are normally supplied with an externally operated high voltage tap changer, located near the high voltage bushing. To change taps proceed as follows (refer to Fig. 11):

- A. De-energize the transformer.
- B. Back out the locking screw until it is clear of the locking hole.
- C. Turn the handle to the desired tap position.
- D. Tighten the locking screw to minimize the possibility of unintentional movement.

Some large-size units are furnished with a power-transformer tap changer drive which requires pulling of a locking pin and a full turn of the handle for each change in tap position.

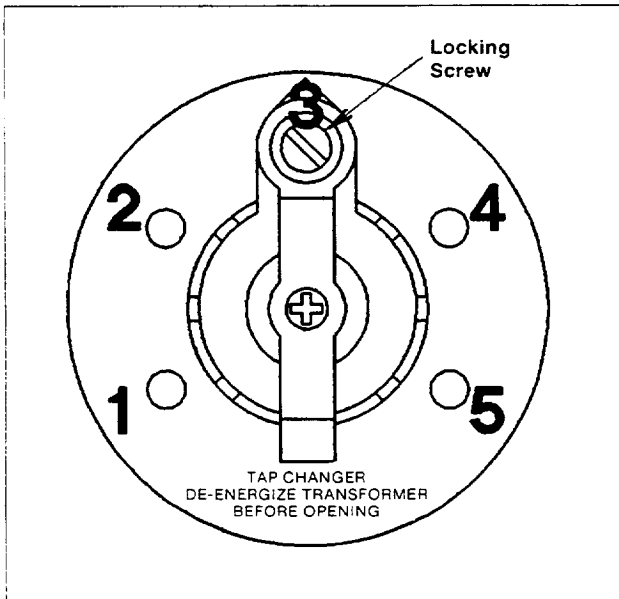


Fig. 11

9.3.4 Dual Voltage Switch (Hookstick-operable)

WARNING: DE-ENERGIZE THE TRANSFORMER BEFORE OPERATING THE DUAL VOLTAGE SWITCH. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

WARNING: WHEN CHANGING VOLTAGE POSITION, FUSES MAY HAVE TO BE REPLACED WITH THOSE OF THE PROPER RATINGS. THE USE OF AN IMPROPERLY RATED FUSE CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

On a dual voltage switch, Position 1 is the low or multiple connected position while position 2 is the high or series connected position. To change the voltage position, proceed as follows (refer to Figure 12):

- A. De-energize the transformer.
- B. Back out the locking screw until it is clear of the locking hole.
- C. Pull out on the handle until it will rotate.
- D. Rotate the handle to the new position.
- E. Release the handle.
- F. Tighten the locking screw to minimize the possibility of unintentional movement.

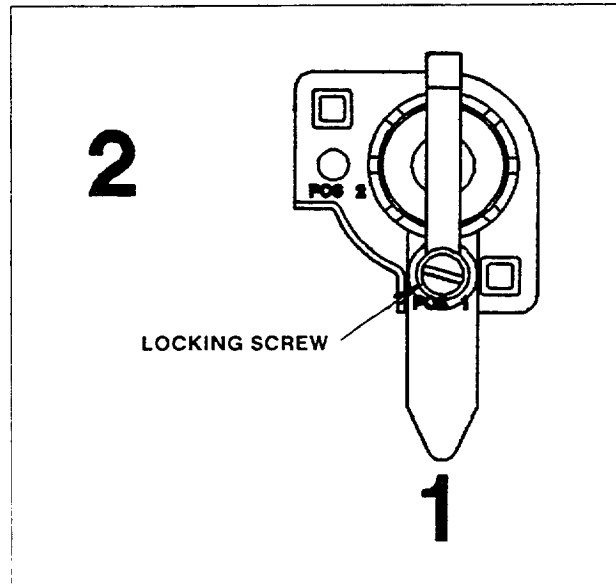


Fig. 12

9.3.5 Arc-Strangler Fused Switch

Arc-Strangler fused switch is mounted in the high voltage compartment. The fused disconnect(s) will have NX current-limiting fuses. Follow the McGraw Edison (Cooper Industries) instructions for operating these devices.

9.3.6 S & C Fused Switch

WARNING: USE THE S & C LOADBUSTER TOOL TO OPERATE THE DISCONNECT. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

When an S & C fused switch is used, follow the manufacturer's instructions for operating this equipment. When operated with the S & C loadbuster tool, this disconnect functions as a loadbreak switch.

9.3.7 Surge Arresters

The function of a surge arrester is to intercept and divert to ground various overvoltage transients (such as lightning surges) which occur on the distribution system.

The arresters must be disconnected whenever high potential or induced potential tests are made on transformers with arresters.

9.4 Low Voltage Oil-Immersed Circuit Breaker

The low voltage oil-immersed circuit breaker is designed to open the low voltage circuit on secondary faults or excessive overloads. The low voltage breaker is not intended to protect secondary (low voltage) circuits and connected apparatus (meters, service entrance equipment, etc.) from thermal and magnetic effects due to short circuit and overloads. The breaker is primarily a protective device designed for only occasional switching operations: as such it is not intended for frequent (weekly or daily) switching duty. The handle is located in the low voltage compartment and should be operated with a hot-line tool.

CAUTION: WITH THE SECONDARY CIRCUIT OPEN, THERE MAY BE SUFFICIENT COUPLING TO THE WINDING TO CAUSE SHOCK FROM THE SECONDARY TERMINALS. GROUND THE OPEN SECONDARY TERMINALS BEFORE WORKING ON THE SECONDARY SERVICE.

Prior to transformer installation, reset the breaker by opening and closing it as follows (refer to Fig. 13):

- To open the breaker manually, rotate the handle so that the pointer moves from the closed to the open position.
- To close the breaker, rotate the handle past the open position (to reset the breaker), then back through the open position to the closed position.

If a fault or excessive overload exists, the breaker will trip out even though the handle is held in the closed position.

Following a breaker tripout due to a long term overload, the transformer oil may not have had time to cool sufficiently to allow the breaker latch to be set, making it impossible to reclose the breaker immediately.

CAUTION: AN EMERGENCY CONTROL HANDLE IS PROVIDED TO RECALIBRATE THE BREAKER TO A HIGHER TRIP TEMPERATURE. THIS HANDLE SHOULD BE USED ONLY WHEN ABSOLUTELY NECESSARY AND FOR AS SHORT A DURATION AS POSSIBLE, BECAUSE ITS USE CAN CAUSE A SIGNIFICANT REDUCTION IN TRANSFORMER LIFE.

The breaker can be recalibrated to the emergency position by removing the meter seal and rotating the emergency control handle clockwise. To reset the breaker to its previous setting, return the emergency control handle to the original position. It is recommended that a new seal be applied to the handle when it is returned to the normal position to avoid inadvertent operation of the emergency control.

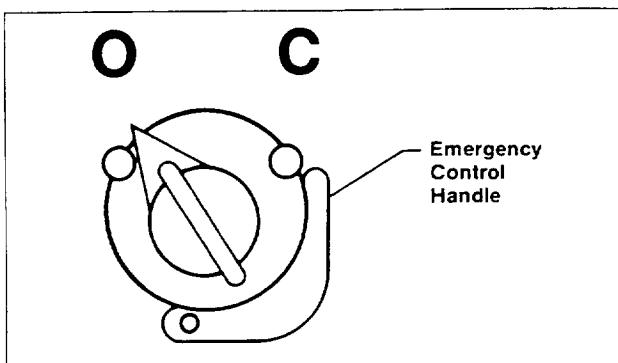


Fig. 13

9.5 Pressure Relief Device

The standard pressure relief device, located on the tank above the liquid level, relieves excessive internal tank pressure and reseals at a lower positive pressure. The pressure relief device is manually operated by grasping the end-cap (or ring, if provided) and slowly pulling the cap away from the tank until pressure is relieved.

9.6 Thermometer

When supplied, a thermometer indicates the liquid temperature near the top of the tank. The temperature sensitive element is mounted in a leakproof well, permitting removal of the thermometer without lowering the liquid level. The device is furnished with an additional pointer, red in color, to show the highest temperature attained since last reset.

9.7 Liquid Level Gauge

When supplied, a liquid level gauge is located in the low voltage compartment to indicate the variation from the 25 degree C liquid level.

9.8 Pressure-Vacuum Gauge

When supplied, a pressure gauge is located in the low voltage compartment above the bushings in the air space. The gauge indicates whether the gas space in the tank is under positive or negative pressure.

9.9 Nameplate

A nameplate is supplied on each transformer according to ANSI standard C57.12.00-1980, Section 5.12. Refer to the nameplate for transformer ratings and for proper connections of the transformer to the system. No internal connections should be made inside the transformer other than those shown on the nameplate.

10.0 MAINTENANCE

A periodic visual inspection of the transformer is recommended. At such times, the general condition of the following should be noted:

- A. High voltage bushings.
- B. Low voltage bushings.
- C. Arresters (if provided).
- D. Enclosure integrity (hinges, locking provisions, corrosion, etc.)
- E. Evidence of oil leakage.
- F. Ground connections.
- G. Accessories.
- H. Safety labels.
- I. Transformer tilt.

WARNING: WHEN BROKEN PARTS, LEAKING OIL OR OTHER POTENTIALLY HAZARDOUS CONDITIONS ARE OBSERVED, REMOVE THE TRANSFORMER FROM SERVICE UNTIL REPAIRS CAN BE COMPLETED. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

Where tanks show evidence of rusting or deterioration of the finish, they may be cleaned and then retouched with paint available for that purpose. When bare metal is exposed, a primer should initially be applied, then retouching paint applied.

A periodic check of the load should be made to ensure that the transformer is not being subjected to excessive overload. Planned overloading should be in accordance with the ANSI Loading Guide (C57.91).

When adding oil to the transformer, the owner should take the necessary precautions so that PCB contamination is not introduced.

WARNING: OIL SAMPLES SHOULD BE TAKEN FROM THE TRANSFORMER ONLY AFTER DE-ENERGIZING AND MANUALLY VENTING THE TRANSFORMER. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH OR PROPERTY DAMAGE.

Whenever replacement parts or information regarding existing transformers are required. COMPLETE NAME-PLATE data including KVA rating, STYLE NUMBER, SERIAL NUMBER, and a DESCRIPTION of the part should be given to ABB.

11.0 REPAIR

WARNING: BEFORE ATTEMPTING REPAIRS, DE-ENERGIZE AND VENT THE TRANSFORMER. FAILURE TO DO SO CAN CAUSE SEVERE INJURY, DEATH, OR PROPERTY DAMAGE.

It is the responsibility of the owner to inspect, maintain and keep the transformer in good repair.

Report all failures during the warranty period to your ABB Sales Office. All warranty repairs must be made by ABB or an approved service facility.

To assure proper operation, use only ABB approved replacement parts.

It is recommended that the owner limit repairs to replacing broken parts unless the owner has well-trained repair personnel.

Some internal parts can be replaced without completely draining the tank. In such cases, only the fluid necessary to expose the part should be drained. There may also be occasions when complete draining of the transformer tank will be necessary.

The core and coil assembly can be repaired or replaced by ABB personnel at either the factory or at an authorized repair facility. Refer to Service Policy 46-315 for details, or contact the ABB Power T&D Company Inc.

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