SUB 1

Instruction Book

TYPE ASL COREFORM GAS INSULATED POWER CENTER TRANSFORMER

CLASS AA, 1500 KVA, 13200 Δ - 480 Δ VOLTS

THREE PHASE, 60 CYCLES, 120°C RISE

I. B. WBR-7803

FOR

FISHER BODY DIVISION, G. M. C.

CUSTOMER'S ORDER NO. FWD-15159

G. O. DT-88675-R S. O. WBR-7803

MARCH, 1969

Westinghouse Electric Corporation
Power Transformer Division, Sharon, Pa.

Table of Contents

INSTRUCTION BOOK WBR-7803

Introduction

INSTRUCTION BOOK   WBR-7803

This instruction book has been prepared to provide the purchaser with sufficient information to properly install, operate and maintain the apparatus supplied on his order. The methods and recommendations presented herein are based on the best practical judgment of Westinghouse engineers, from their experience in design and installation, and reports from purchasers of similar or related equipment.

Since this book is composed of individual leaflets as listed in the Table of Contents it should be recognized that some of these include more information on details of construction and accessories than applies to the apparatus supplied on this order. Note particularly the following applies:

1. The high voltage winding has continuous type coil.
   The low voltage winding has cylindrical type coil.

2. The high voltage bushings are RFW type.
   The low voltage bushings are RFW type.

3. The transformer cover is welded on.

4. The temperature indicator has alarm contacts.

5. Drawings:
   Outline drawing - 5760-D-54
   Instruction plate - 194-P-574 HO1
   Wiring diagram - 603-A-002 & 601-A-465

DESCRIPTION OF FLUOROCARBON GAS FILLED TRANSFORMERS

CONSTRUCTION:

The transformer is a standard core form design similar to a sealed ASL unit with clearances modified for use in fluorocarbon gas. The high voltage winding has continuous type coils with static plates on the coil ends. The low voltage winding has cylindrical type coils with static shields next to the outer layer.

The tank is hermetically sealed with metallic seals throughout, and is factory tested at 15 PSI pressure and 8 mm HG vacuum. All pressure tight welds are covered inside and out with epoxy paint. The final weld is made at the top. The transformer is cooled and insulated with C_4F_8 fluorocarbon gas.

FLUOROCARBON GAS:

Fluorocarbon gas is a colorless, odorless, dense gas, nonflammable, inert, thermally stable and non-toxic. The dielectric strength and cooling characteristics are appreciably greater than for nitrogen.

TAP CHANGER:

The tap changer is essentially a standard type WSB-4 modified to substitute high temperature materials. The packing gland seals the shaft at the tank wall. The external housing with soldered cover prevents gas loss due to permeability through the packing material. In order to operate the tap changer, remove the soldered cover from the tap changer housing. Since the shaft is sealed, the cover may be left off for short periods during startup, testing, etc. It should, however, be replaced when the tap changer is not in use.

VACUUM PRESSURE GAUGE AND HOT SPOT:

A vacuum pressure and hot spot thermometer with alarm contacts are provided to assist in field checks. Wiring diagrams for the gauges show factory alarm settings.

OPERATION OF FLUOROCARBON GAS FILLED TRANSFORMERS

RECEIVING:

The transformer is shipped ready for installation, complete with bushings and accessories in place, and filled with gas to a gauge pressure of approximately 4 PSI (at 30°C ambient and 26.9 Hg barometer).

INSPECTION:

New transformers should be inspected when received for damage during shipment. Examination should be made before removing from cars or trucks and if any damage or indication of rough handling is evident, a clami should be filed with the carrier at once and the manufacturer notified.

INSTALLATION:

For indoor installation the room in which the transformer is placed should be well ventilated to permit heated air to escape. The ambient temperature should never exceed 40°C (104°F) with an average over 24 hours not exceeding 30°C (86°F). The transformer should be at least 24 inches from wall, partitions, etc., to allow free circulation of air.

As soon as the transformer is received, check the pressure adjusted for the existing ambient, against the information on the instruction plate.

ALARM LEADS:

Alarm leads on the gauges can be used for remote indication of high temperature.

BUSHINGS:

Care should be taken that heavy cable or bus leads are not supported from the bushings.

MAINTENANCE OF FLUOROCARBON GAS FILLED TRANSFORMERS

Small leaks may be repaired by welding or soldering without removing the gas. If it becomes necessary to open the tank or to make repairs, the gas should be salvaged by transformer to an evacuated tank or to an inflatable container.

When the tank has been repaired and sealed up, pressure test with 15 PSIG of dry nitrogen using soap solution on joints and fittings for leak indication. After the pressure test, evacuate the tank to 10 mm Hg and fill with fluorocarbon gas to 4 PSIG pressure.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

NO LOAD TAP CHANGER TYPE WSB-4

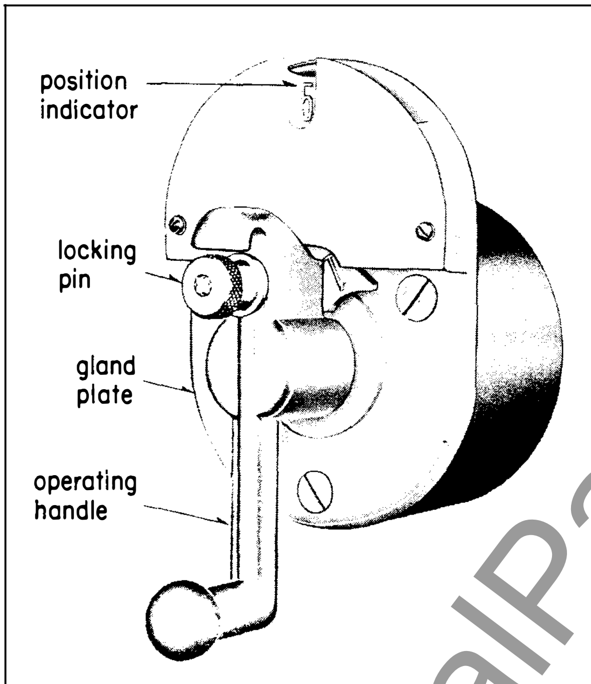


FIG. 1. Operating Mechanism and Position Indicator

THE TYPE WSB-4 TAP CHANGER provides an adequate and convenient method for changing transformer tap connections from outside the transformer case. The tap changer is mounted under oil in the transformer case and is intended for operation only when the transformer is disconnected from the line.

IMPORTANT. **No-load tap changers must not be operated with the transformer energized; the transformer must not be energized unless the tap changer is locked on an operating position (see transformer nameplate).**

The Type WSB-4 Tap Changers are made in a variety of sizes and arrangements to meet voltage and current requirements. When more than one tap changer deck is operated from a single mechanism, the individual decks are mounted axially with a polyester glass shaft passing through each deck. The stationary contacts, with provision on the opposite end for connecting the leads, are through type studs mounted in a thermoset plastic base, and are arranged on a radius equal to that of the moving contacts. Good connections are assured by silver plated wiping contact surfaces, and by either high pressure indentation or swaging of the stud onto the tap leads. See Fig. 2.

INSTALLATION

Tap changers are usually shipped mounted on the core and coil assembly and connected to the external operating mechanism. Hence, when shipment of the core and coil assembly is made separately from the tank and fittings, it is necessary to make the connection of the tap changer drive shaft to the external operating mechanism on assembly in the field.

Before pinning the shaft, when installing a new tap changer, it is essential that the position indicated by the external position indicator agree with the actual position of the tap changer contacts. See Figs. 1 and 5.

The position of the contacts is indicated on the internal operating mechanism. A match mark on the Geneva gear bracket lines up with the position number on the internal Geneva gear corresponding with the actual position of the contacts.

Another match mark is located on the side of the bracket near the Geneva pinion on the centerline for the Geneva pinion shaft bearing. When this match mark is in line with a match mark on the Geneva pinion, the Geneva pinion is in the center of the locked on "On-Position" zone of the mechanism.

The external operating mechanism is connected to the tap changer drive shaft through a shaft and slip joint. This slip joint plus universal joints permit tank expansion and slight shaft misalignment without hindrance to operation. When a tap changer or external operating mechanism is installed in the field, a check of the slip joint for free operation should be made (see Fig. 5).

WESTINGHOUSE

EQUIPMENT • PROCEDURE

INSTRUCTIONS

REMOVING AND REPLACING WELDED-ON COVERS AND TANKS

REMOVING THE WELD

There are times when it becomes necessary to remove a welded-on cover from a transformer tank or the top section from the bottom section of a form-fit tank. This may be done by either chipping out the joining weld or cutting out the weld with a gas cutting torch. The equipment required and a suggested procedure to remove the weld is described below.

FIG. 1. Recommended Equipment

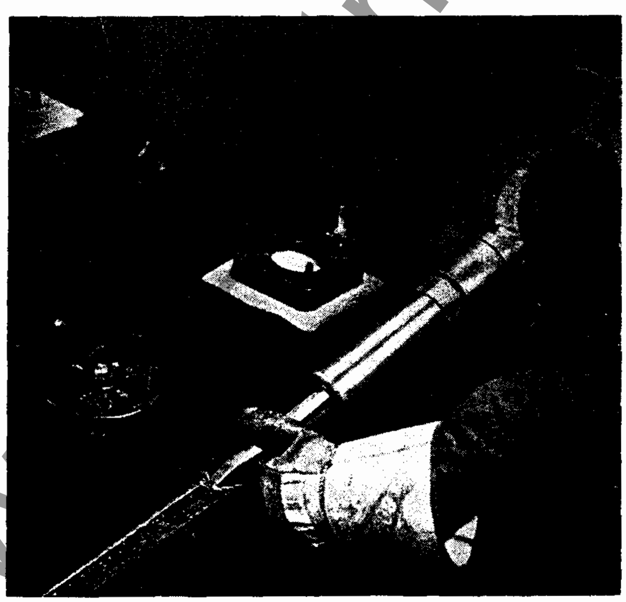


FIG. 2. Removal Procedure

CHIPPING OUT A WELD

Equipment. The equipment recommended to remove a weld by chipping is:

1. A heavy pneumatic chipping hammer.

2. Three-eighths and 1/8 inch diamond-pointed chisels. The chisels should be forged tools, hardened and tempered so that the edges will not turn or spall. The cutting edges of the diamond-pointed chisels should be ground straight with no chamfer.

3. Flat chisels. The flat chisel should have the flat side relieved 1/64", approximately 1/8" back from the cutting edge. This prevents the chisel from "digging-in" and allows the operator better control of its cutting.

4. Gloves and safety glasses should be worn by the operator for his personal protection.

Procedure. It is important to cover any openings into the tank, to avoid entry of chips. To remove a weld by chipping, apply machine oil or grease to the surface of the weld to lubricate the cutting. A 3/8 inch diamond-point chisel is used in the pneumatic hammer and the chisel is held so that the diamond is pointed into the root of the joint. The chisel should cut 1/8" back of the vertical edge of the weld and along the face of the horizontal

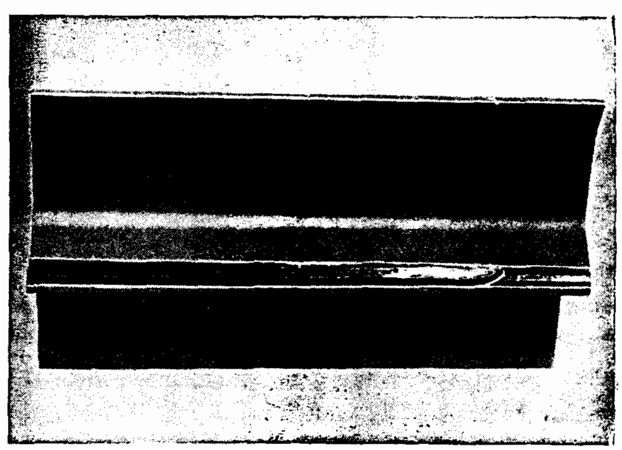


FIG. 3. Weld Partially Removed

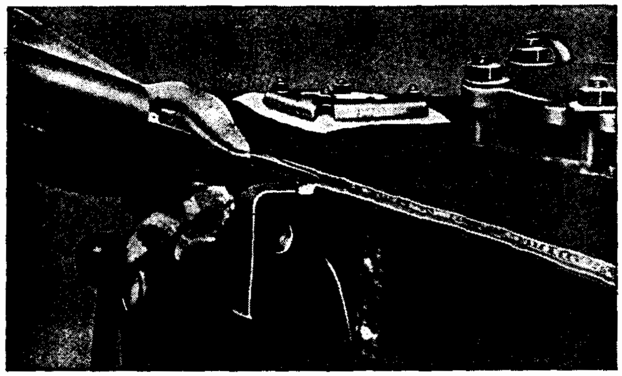


FIG. 4. Carefully Breaking the Seal

flange to remove as much of the weld as possible. Should the weld not be completely removed in one pass with the 3/8 inch diamond-point chisel, more oil or grease should be spread over the remaining weld and the flat chisel used to cut the weld flush with the horizontal and vertical surfaces of the joint. The small diamond-point chisel should then be used to remove any remaining weld metal from the root of the joint.

The flat chisel is then driven directly into the root of the joint to crack the seal, as shown in Fig. 4. To prevent the chisel from being driven between the joint and deforming the plates, it is moved slowly along the joint. A lifting force upon the cover or the top section will help to break the seal.

WELD REMOVAL BY GAS CUTTING

Equipment. The equipment recommended to remove a weld by gas cutting is:

1. A heavy duty gas cutting torch, preferably of the oxy-acetylene type.

2. Heavy duty flame cutting tips or Airco #6 or #8, Style 183 or Oxweld #19, Style 1511 gouging tips.

3. A number of C-clamps.

4. A heavy machinist's or pneumatic hammer and a flat chisel to break the weld seal.

5. Protective equipment such as gloves and colored goggles for safety protection of the operator, nitrogen to purge the transformer tank and hand operated carbon dioxide fire extinguishers.

Procedure. To remove a weld by gas cutting the following procedure is suggested. Connect a bottle of dry nitrogen to the filling plug opening and flush the gas space with nitrogen. Keep nitrogen flowing into the gas space while the weld is being removed to blanket the core and coils and to prevent combustible gases collecting within the transformer case.

The cutting or gouging tip is assembled to the cutting torch. The gas pressures should be adjusted to the recommended pressures for the size tip used. Usually 60 to 80 psi oxygen pressure and 5 to 6 psi acetylene pressure. The torch is lighted and the flame adjusted to give a neutral flame. Heat the weld at one corner of the tank to a white heat, then simultaneously set the torch in motion along the weld and release the cutting oxygen. Move the torch axially along the weld with an oscillating motion, forward slowly an inch or two, then backward quickly about one-half inch, to permit the flame to fan out and wash the molten weld metal from the root of the joint. Continue along the weld in this manner, gauging the depth of the cut so that the entire cross-section of the weld is removed in one pass.

Apply C-clamps to clamp the side or sides from which the weld has been removed to prevent the joint opening prior to complete weld removal.

After the weld has been removed completely around the tank, remove the C-clamps and drive the flat chisel directly into the root of the joint to break any remaining weld seal, as shown in Fig. 4.

REPLACING A WELDED-ON COVER

To replace a welded-on cover that has previously been removed as described above, the following is recommended:

Preparing the Cover for Replacement.

1. Chip or grind any irregularities around the cover edge left during the weld removal operation when the cover was removed from the case. The cover edge should be square and expose clean metal.

2. Clean the underside of the cover three inches back from the cover edge to a smooth surface. A disc grinder is recommended for this operation.

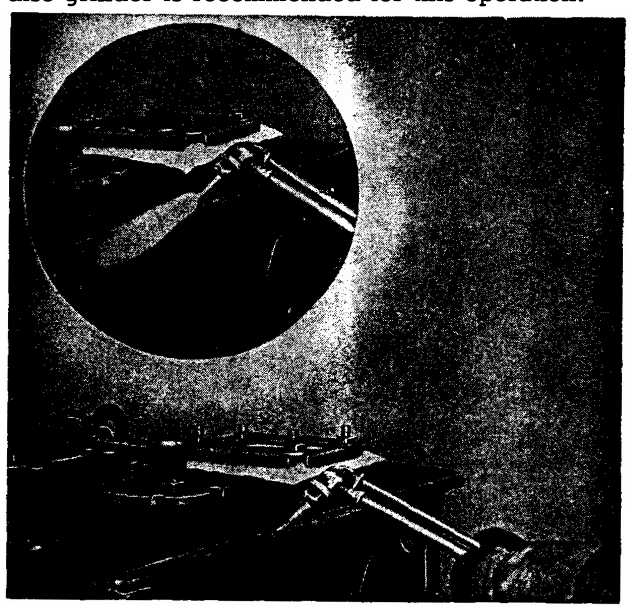


FIG. 5. Removing Weld by Gas Torch

3. Remove and wipe all foreign material from the cover, especially from the underside to prevent dirt falling into the transformer when the cover is placed in position on the transformer case.

Preparing the Case Flange to Receive the Cover.

1. Place a blanket of clean paper or cloth over the entire transformer a few inches below the case flange. This blanket should be attached and continuously sealed with wide masking tape around the entire interior of the case. This is necessary to prevent any foreign material falling into the transformer.

2. Remove any raised irregularities from the top surface of the flange by chipping or grinding. A sanding disc will do the job very effectively, or a grinder may be used; in either case, it should be used so that the material removed from the flange will be thrown away from the transformer case rather than into it. This surface must be smooth to permit the cover to fit tightly and uniformly around the case.

3. Gently brush cuttings and debris collected on the blanket over the transformer to the center of the blanket. Remove this debris, then carefully pull the sealing tape from the case walls to free the blanket. Make certain that the edges of the blanket are kept above the center of the blanket at all times so that any foreign material on the blanket will not roll into the transformer.

Applying the Asbestos Sealing Gasket to the Case Flange.

1. Brush a $1/2''$ wide coating of #7386 red cement $1\frac{1}{2}''$ to $2''$ back from the edge of the flange completely around the case. Care must be observed to prevent any cement extending onto the weld area as it will cause weld porosity.

2. Place a $1/8''$ diameter asbestos rope #3879 completely around the case flange in the center of the freshly applied cement. There must not be any openings in the gasket. Use a good butt joint, or allow one end to extend a little in back of the other.

Positioning the Cover and Preparing for Welding.

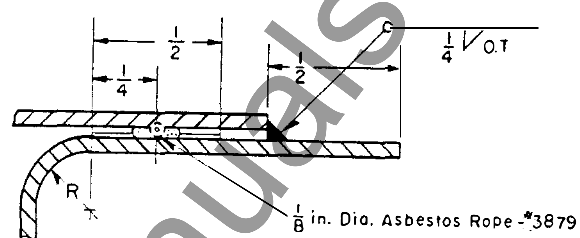
1. Lower the cover onto the case flange so that it is in its approximate final position without sliding across the asbestos gasket. Normally the flange will extend approximately $1/2''$ beyond the cover edge.

2. Clamp the cover and flange tightly together around its entire periphery with C-clamps. Place the C-clamps near the edge of the cover so that the welding operator can weld under the clamps. The cover edge should be tight against the flange before any welding is done at that point.

Welding the Cover to the Flange.

1. Cover all openings in the cover.

2. Apply a $1/8''$ fillet sealing weld around the cover starting at one corner of the case and welding around it. Use Westinghouse $5/32''$ diameter DH-coated electrodes (#972 076 for 50# packages). This is an American Welding Society Type E-6020 electrode and is recommended for horizontal fillets or downhand welding. It is recommended for this weld because of its high penetrating properties. Either a-c or d-c (reverse polarity preferred) current may be used with a current setting of 155 to 175 amperes.



1. APPLY A 1/2 IN. WIDE COATING OF #7386 CEMENT TO THE TANK FLANGE.
2. PLACE THE GASKET (ASBESTOS ROPE) IN THE CENTER OF THE STRIP OF CEMENT.
3. CLAMP COVER AND FLANGE TIGHTLY TOGETHER BEFORE WELDING.
4. BE SURE THERE IS NO OPEN SPACE NOT FILLED WITH GASKET MATERIAL.

FIG. 6. Method of Joining Cover to Flange

3. Remove the C-clamps from the cover and flange.

4. Remove the slag from the weld bead and wire brush.

5. Weave a $1/4''$ fillet weld over the $1/8''$ fillet weld using Westinghouse $5/32''$ diameter FP electrodes and a welding current of 150 to 160 amperes. This electrode (S#1528 912 in 50# packages) is also a coated electrode. It is an American Welding Society Type E-6012 and may be used with a-c or d-c (straight polarity preferred) current.

6. Clean the slag from the weld and brush.

Paint the weld, the flange and the edge of the cover with primer and touch-up paint.

FORM-FIT TANK TOP SECTIONS

To replace the top section of a form-fit tank that has been previously removed as described above, the following is recommended:

Preparing the Top Section for Replacement.

1. Chip or grind any remaining irregularities left along the bottom face and edge of the flange

of the top section. The flange edge should be square and expose clean metal. The bottom side of the flange should be smooth.

2. Wipe all foreign material from the flange.

Preparing the Flange of the Bottom Section to Receive the Top Section.

1. Wrap and attach with masking tape an 8″ to 12″ wide strip of heavy paper or cloth around the iron directly above the flange.

2. Remove any irregularities from the top surface of the flange by chipping or grinding. When grinding, one should use the grinder so that the material removed is thrown away from the transformer rather than against the iron core. Brush and wipe all foreign material from the flange with a dry cloth. This surface must be smooth to permit the top section to fit tightly and uniformly around the case.

3. Remove the 8″ to 12″ wide protecting material previously placed around the iron.

Applying the Sealing Gasket to the Flange of the Bottom Section.

1. Brush a 1½″ wide coating of #7386 red cement 2″ back from the edge of the flange of the bottom section. Care must be observed to prevent any cement extending onto the weld area as it will cause weld porosity.

2. Place the sealing gasket #1598 upon the freshly applied cement with the tape edges outward, completely around the flange. There must not be any openings in the gasket. Use a good butt joint or allow one end to extend a little in back of the other.

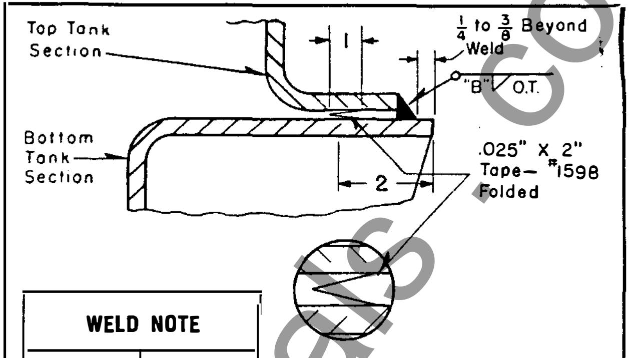
Positioning the Top Section and Preparing for Welding.

1. Lower the top section slowly over the transformer assembly until it is seated on the flange of the bottom section.

2. Clamp the flanges of the top and bottom sections together tightly around its entire periphery with C-clamps. Place the C-clamps near the edge of the flange so that the welding operator can weld behind the C-clamps. The two flanges must be tight together before any welding is done at a given point.

Welding the Top Section to the Bottom Section.

1. Apply a ⅛″ fillet sealing weld around the top section starting at one corner of the case and weld around it. Use Westinghouse 5/32″ diameter DH-coated electrodes S#972 076 for 50# packages.



WELD NOTE

Top Tank Section Thickness	Weld Size "B"
¼	¼
5/16	¼
⅜	5/16
7/16 + ½	⅜

1. BRUSH A 1½" WIDE COATING OF #7386 CEMENT ON THE FLANGE OF THE BOTTOM TANK SECTION 2" BACK FROM THE TANK EDGE.
2. FOLD THE 2" WIDE ASBESTOS TAPE ALONG ITS CENTER AND PLACE ON THE FRESHLY APPLIED CEMENT WITH THE TAPE EDGES OUTWARD.
3. CLAMP FLANGES TOGETHER TIGHTLY BEFORE WELDING.
4. BE SURE THERE IS NO OPEN SPACE NOT FILLED WITH GASKET MATERIAL.

FIG. 7. Joining of Flanges, "Form-Fit" Tank

This is an American Welding Society Type E-6020 electrode and is recommended for horizontal fillets or downhand welding. It is recommended for this weld because of its high penetrating properties. Either a-c or d-c (reverse polarity preferred) current may be used with a current setting of 155 to 175 amperes.

2. Remove the C-clamps from the cover and flange.

3. Remove the slag from the weld bead and wire-brush.

4. Weave a ¼″ fillet weld over the ⅛″ fillet weld for top sections made of ¼″ and 5/16″ thick plate, a 5/16″ weld for ⅜″ thick top sections and a ⅜″ weld for 7/16″ or ½″ thick top sections. Deposit this weld with Westinghouse 3/16″ diameter FP electrodes and a welding current of 190 to 210 amperes. This electrode is a coated electrode S#1528 913 in 50# packages. It is an American Welding Society Type E-6012 and may be used with a-c or d-c (straight polarity preferred) current.

5. Clean the slag from the weld and brush.

6. Paint the weld and the flanges with primer and touch-up paint.

WELD AT BOTTOM OF TANK WALL

Many transformer designs will have a bottom weld between the tank wall and the tank bottom. This arrangement, which is not of the form-fit design, is illustrated in Fig. 8. It is necessary to remove this

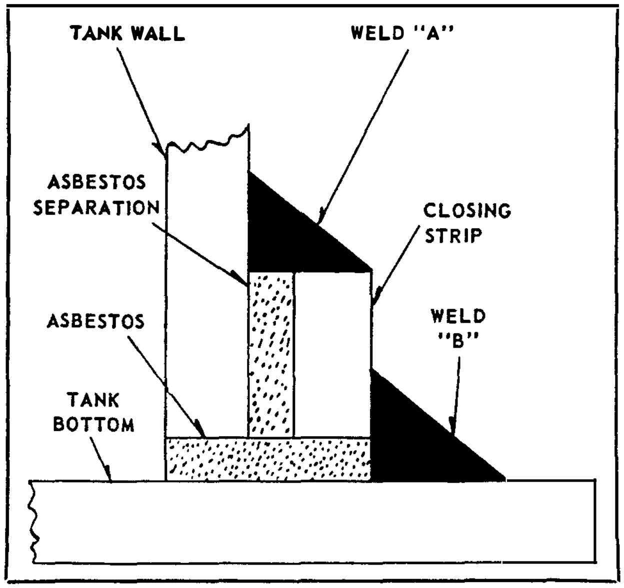


FIG. 8. Weld between Tank Wall and Tank Bottom

weld to lift the tank away from the bottom so that the core and coil assembly can be removed. Because of limited space beneath the coolers it is recommended that the weld be removed by gas cutting.

Removing a Weld at the Bottom of the Tank.

The procedure for the removal of a bottom weld is similar to removing a welded-on cover by gas cutting except as follows:

1. Weld "A" of Fig. 8 must be removed, not weld "B". This is to prevent the gas flame from reaching the oil that has dripped from the core and coil assembly and collected on the tank bottom.

2. Remove the weld completely as well as approximately 1/8" of the closing strip to insure adequate separation between the closing strip and the tank wall.

3. Use on Oxweld #13, Style 1511 tip, directing the flame in the direction of the weld as shown in Fig. 5.

4. Remove the tank from the bottom by lifting after all the internal connections between the core and coil assembly and tank are removed.

Replacing Tank and Weld.

1. Before replacing the tank on the base, remove irregularities from the tank surface and the inside of the closing strip by grinding.

2. After replacing the tank, close up the clearance between the tank wall and closing strip. This is to be done by calking with 3/16" diameter asbestos rope #3879 all around the tank. Care should be taken that there are no asbestos fibers protruding that might produce a defective weld.

3. Proceed with welding the tank wall to the closing strip using the same method as specified in welding the cover to the flange, except that clamping is not required.

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INSTRUCTIONS

PARALLEL OPERATION

The theoretically ideal conditions for paralleling transformers are:

1. Identical turns ratios and voltage ratings.
2. Equal percent impedances.
3. Equal ratios of resistance to reactance.
4. Same polarity.
5. Same phase angle shift.
6. Same phase rotation.

Single Phase Transformers. For single phase transformers only the first four conditions apply as there is no phase rotation or phase angle shift due to voltage transformation.

If the turns ratios are not the same a circulating current will flow even at no load. If the percent impedance or the ratios of resistance to reactance are different there will be no circulating current at no load, but the division of load between the transformers when applied will no longer be proportional to their KVA ratings.

Three Phase Transformers. The same conditions hold true for three phase transformers except that in this case the question of phase rotation and phase angle shift must be considered.

Phase Angle Shift. Certain transformer connections as the wye-delta or wye-zigzag produce a 30° shift between the line voltages on the primary side and those on the secondary side. Transformers with these connections therefore cannot be paralleled with other transformers not having this shift such as wye-wye, delta-delta, zigzag-delta, or zigzag-zigzag.

Phase Rotation. Phase rotation refers to the order in which the terminal voltages reach their maximum values. In paralleling, those terminals whose voltage maximums occur simultaneously are paired.

Power Transformer Practice. The preceding discussion covered the theoretically ideal requirements for paralleling. In actual practice good paralleling is obtained even though the actual transformer conditions deviate by small percentages from the theoretical ones.

Good paralleling is considered as attainable when the percentage impedances of two winding transformers are within 7.5% of each other. For multi-winding and auto-transformers the generally accepted limit is 10%.

Furthermore, in power transformers of normal design the ratio of resistance to reactance is generally sufficiently small to make the requirement of equal ratios of negligible importance in paralleling.

When it is desired to parallel transformers having widely different impedances, reactors or auto-transformers having the proper ratio should be used. If a reactor is used it is placed in series with the transformer whose impedance is lower. It should have a value sufficient to bring the total effective percent impedance of the transformer plus the reactor up to the value of the percent impedance of the second transformer. When an auto-transformer is used, the relative currents supplied by each transformer are determined by the ratio of the two sections of the auto transformer. The auto-transformer adds a voltage to the voltage drop in the transformer with the lower impedances and substracts a voltage from the voltage drop in the transformer with the higher impedance. Auto-transformers for use in paralleling power transformers are designed especially for each installation. The method of connecting the auto-transformer is shown in a wiring diagram furnished with each installation.

In general, transformers built to the same manufacturing specifications as indicated by the nameplate may be operated in parallel.

In connecting transformers in parallel when the low tension voltage is comparatively low, care should be taken to see that corresponding connecting bars or conductors have approximately the same impedance, otherwise the currents will not divide properly.

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SUPERSEDES I.L. 47-600-4 AUGUST, 1955
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Instructions for Inert-Arc Welded Bushing, Type RFW

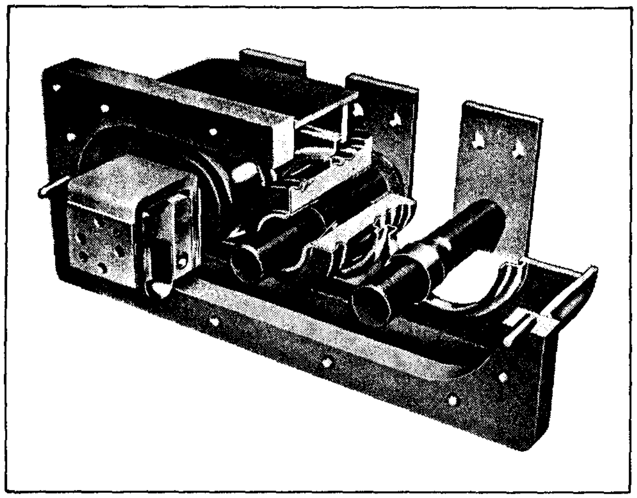

Fig. 1. Cut-away view of Type "RFW" Bushing

Inert-arc welded bushing, type "RFW" is of the type where the two seals of stud to bushing cap and bushing flange to mounting surface are by means of inert- arc welds. See Figure 1.

This method is accomplished by a rolled flange as shown in Figure 2. The copper bushing cap and flange are attached to the porcelain by being rolled into grooves in the porcelain over silicone rubber "Silastic" rings. This seal is made at the factory and cannot be repaired in the field. If the intermediate seal is defective, replacement bushings must be obtained from the factory.

INERT-ARC WELDING

Inert-arc welding is a D.C. electric-arc welding process in which the metal joining is accomplished in an atmosphere of inert gas so as to prevent oxidation of the weld. Where the two metals joined are copper, the inert arc gas used is helium.

This method of welding is ideally suited for the mounting of bushings as its high concentration of localized heating gives a quick weld while at the same time it does not cause excessive overheating to adjacent "Silastic" seals.

Repair of Leaks to Inert-Arc Welded Bushings. If there is a leak at the welded joints, it may be repaired by sealing it with solder. This may be done using the following procedure:

1. Wrap wet asbestos packing or cord around the porcelain to protect intermediate seal from excessive heat.

2. Clean the point of leak by filing with the corner of a three square file.

3. Preheat welded joint at point of leak to about 350°F with an oxy-acetylene torch (a). A stick of solder (60-40) (b). Solder will flow at about this temperature.

4. Apply solder and acid flux to joint at point of leak, playing flame on the welded joint and never on the porcelain or intermediate seal.

5. Allow to cool and rinse thoroughly to remove residual flux. Test for tightness by applying 7 p.s.i. pressure to the transformer tank.

If the leak is at the intermediate seal or if the bushing is damaged, the old bushing must be removed and replaced with a new one according to instructions below.

Removal of Bushings. For both removing and replacing inert-arc welded bushings, the following instructions should be carefully followed step by step to insure that no damage is done to the bushings and mounting surface and that a pressure tight welded joint is accomplished.

1. Remove outer adapter by unscrewing from the stud.

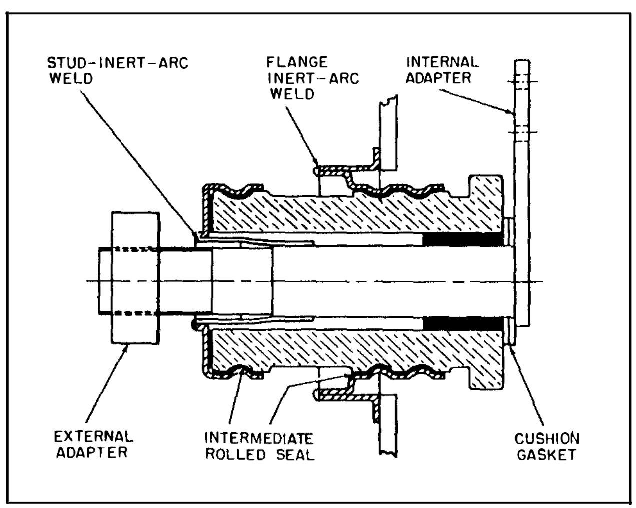

Fig. 2. Rolled Flange Bushing

2. The design shown in Figures 1 and 2 is of the type where the porcelain only is removed and the bushing stud is used with the new porcelain. It is, therefore, not necessary to have access to the inside of the tank for disconnecting the stud.

3. The inert-arc welds are about 1/16" thick and can be broken by filing or cutting. One method recommended is to use a high speed rotary file to cut through the weld (c). Care should be taken not to remove an excessive amount of the flange and cone as there must be sufficient material left for welding in the replacement bushing. If after removing 3/32" to 1/8" of weld, the bushing does not appear to be free, a strong tug will usually dislodge it as the welding process tends to contract the two copper pieces together and have them appear solid.

4. After the weld is broken, remove porcelain from stud.

Replacement of Bushings. Since the intermediate bushing seals used on the solder sealed and rolled flange seals are essentially low temperature seals, it is important to handle these types of bushings with extreme care.

If the operator is not familiar with the inert-arc welding process, it is recommended that he practice on similar pieces of copper before attempting to install a bushing.

The following procedure is recommended as the safest and best means of installing these bushings:

1. Before sliding porcelain over bushing stud, dress bushing flange lip and end of copper cone on stud so as to be smooth and level. The mating surfaces to be welded must be clean.

2. Check to see that the cushion gasket is in place on stud. Slide porcelain over stud.

3. Push the porcelain against the cushion gasket and pull up snug.

4. Before welding, copper parts to be welded together should be a snug fit. If necessary to insure this, peen parts together with small hammer.

5. Wrap wet asbestos packing or cord around the porcelain to protect intermediate seals from excessive heat.

6. First, weld bushing to tank flange by inert-arc method using helium gas. (d) No filler rod or flux is necessary. Fuse parts together moving as quickly as possible along the weld. Deep weld penetration is not necessary or desirable. The less time consumed in making the weld will afford better protection to the intermediate seal.

7. After welding bushing to tank flange, make stud to bushing weld. It will usually be found easier to make two or three small spot welds, while holding the stud snug against the cushion washer, to hold the bushing and stud together. Then the weld can be completed.

8. After all welded joints have been allowed to cool, test the joints for tightness by applying 7 p.s.i. pressure to the transformer tank.

9. If there is a leak in the welded joint, it will usually be better to seal it by soldering according to the instruction given previously.

10. After testing, put on external adapter.

NOTES

(a) Oxy-acetylene equipment consists of a torch, hose, Oxygen Regulator, Acetylene Regulator, and cylinders of O_2 (oxygen) and C_2H_2 (acetylene). These can be obtained from any reputable supply house such as National Cylinder and Gas Company, Airco, or Linde Air Products Company.

(b) A commercial 60-40 solder is recommended having 60% tin and 40% lead and melting at approximately 358°F.

(c) A high speed rotary file, size 3/16 x 1/2, shape C with radius end, is recommended. Such files can be obtained from any tool supply firm.

(d) Inert-arc equipment from National Cylinder and Gas Company, Airco or Linde Air Products Company. 300 ampere D.C. Welder.

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FRED II MAIN INDEX
CSC PRODUCTS AND SERVICES

GENERAL INFORMATION

FRED II MAIN INDEX
CSC PRODUCTS AND SERVICES

GENERAL INFORMATION

Description	FRED No.	Page
Molded Case Breaker Indexes		
• Curve index by breaker type to curve number and FRED number	201	11
• Curve index by curve number to breaker type and FRED number	202	11
• Curve index obsolete breaker type to FRED number	204	3
• Outline index obsolete breaker type to FRED number	205	3
• Outline index present breaker type to FRED number	206	3
• Technical information index molded case breaker	249	2
EDP Switches		
• FDPW Outlines 30A thru 1200A	207	16
• FDPW Styles & Connectors 30-1200A(SA12045)	208	6
• FDPW Rating Chart	209	1
Control Indexes		
• Application note index Advantage	400	1
• Outline index enclosed control	450	1
• Ampguard renewal and replacement parts (Asheville, N.C. not CSC)	8855	24
Power Breaker and Fuse Indexes		
• Curve index for DS and DSL 500, 600, 700, 800	328602	1
• Curve index for DS and DSL breaker amptector	328600	1
• Curve index for Digitrip MV trip unit	337401	1
• Curve index for obsolete power breakers	500	1
• Curve index for power fuse BA, DBA	366230	1
• Curve index for power fuse RBA, RDB	367330	1
• Descriptive bulletin for switchgear indicating lamps (EZC and rectangular minalite)	34350	3
• Curve index for SPB 510/610/810	29863	1
• Curve index for DS 510/610/810	32870	1
Retrofit		
• Contacts for catalog 26-000	300	2
• Selection procedure for Digitrip Retrofit Kits	321	16
• Catalog 26-000 update sheet (Page 101-DB Kits)	326101	1
• Catalog 26-000 update sheet (Page 103-DS Kits)	326103	3
• Catalog 26-000 update sheet (Page 105-SPB Kits)	326105	1
• Catalog 26-000 update sheet (Page 107-GE Kits)	326107	3
• Catalog 26-000 update sheet (Page 109-ITE Kits)	326109	2

• Catalog 26-000 update sheet (Page 111-AC Kits)	326111	2
Fred Main II Index		
CSC Products and Services		
General Information		

<u>Retrofit</u> (continued)

• Catalog 26-000 update sheet (Other Kits)	326113	3
• Catalog 26-000 update sheet (All Kits)	326	15
• Digitrip retrofit kit product guide	9375487	3

<u>Circuit Protective Devices</u>

• Index for Cutler-Hammer safety switches	20041	2
• Index for Cutler-Hammer meter centers	200201	1
• Outline index for general duty safety switches	11999	1
• Outline index for heavy duty safety switches (Old Westinghouse type)	12000	2

BREAKER TECHNICAL INFORMATION

FRED 249
Page 2

DESCRIPTION

DESCRIPTION	FRED#	PAGES
SERIES RATINGS (SALES AID SA11564)	292	19
SERIES RATINGS (WITH SERIES C L FRAME UPSTREAM)	293	5
ALTITUDE DERATING	294	3
GROUNDED B-PHASE APPLICATION	296	3
HMCP MAG RANGE TOLERANCES (WEST. CURVES. U.L. STD, NEMA AB4)	297	1
HIGH EFFICIENCY MOTORS CAUSING BREAKER AND HMCP TRIPS	271	3
PANELBOARD AND MCCB REPLACEMENT CHART	298	3
FACTORY AUTHORIZED REPAIR FOR MOLDED CASE BREAKERS	299	2
"DC" MOLDED CASE BREAKERS	257	8
"HID" HIGH INTENSITY DISCHARGE BREAKRS	258	1
"SWD"SWITCHING DUTY BREAKERS	259	1
"HACR" HEATING, AIR COND. AND REFRIDGERATING BREAKERS	253	5
"SLASH" RATINGS FOR BREAKERS (EXAMPLE 277/480VAC)	272	2