



THREE PHASE PADMOUNT MANUAL

INTRODUCTION

This instruction manual provides general information for the installation, operation, and maintenance of Maddox three phase, pad mounted transformers. These units are designed for outdoor installation on flat, level pads or foundations. All high voltage and low voltage cables are installed through an opening in the pad beneath the cable termination compartment. The compartment is designed for padlocking and has barriers to resist tampering and vandalism.

These transformers are to be applied and used per the "usual service conditions" described in ANSI C57.12.00 (General Requirements for Liquid-Immersed Distribution, Power and Regulation Transformers).

RECEIVING AND INSPECTION

Maddox pad mounted transformers are shipped filled with insulating transformer oil. Immediately upon receipt, and before being put into service, transformers should be carefully inspected for any external damage or loose parts caused by shipping and handling. Damage presumed to have occurred during shipment should be noted, and your Maddox sales representative contacted. Each unit has been carefully assembled and inspected at the factory. Extreme care has been taken in the processing and sealing of the transformer to ensure that it is clean and dry, and of adequate dielectric strength. Therefore, it is not recommended that the transformer seals be broken. If it is decided, however, that the transformer be opened, adequate precautions should be taken as outlined in the next section of the instructions.

HANDLING AND INSTALLATION

Transformers should only be lifted using all four lifting provisions installed on the transformer. The transformer must never be moved or lifted by any means other than the lifting provisions provided for that purpose. Do not use the holes in the four lifting hooks as they are only used for tie down purposes and are not suitable for lifting. Care must be taken to avoid excessive horizontal force during lifting. Use a separate sling attached to each of the four lifting provisions of sufficient length to satisfy the cable pull angle and of sufficient strength to safely handle the weight. Cable pull angles should not exceed 30° from vertical or a spreader bar should be used to hold the lifting cables in a vertical position. It is not recommended to lift the transformer with a forklift truck since weight and balance can be problematic and damage could be easily inflicted to radiator panels and cooling fins. Do not use jacks or tackles under cooling panels, if supplied. Jacks should only be placed under the jack pads provided on the tank. The unit may be skidded in both directions. With the sill and doors in place, the unit may be rolled in both directions using rolling bars. The cable compartment sill may be unbolted and removed. The cable compartment may be removed by lifting the side door out of the hinges where it is attached to the tank front plate. The cable compartment hood can be tilted back for improved access to the tank front plate. For best results and assurance of proper electrical insulation to ground, the transformer should always be installed and maintained on a flat, level surface while energized. The transformer to pad interface should not have gaps, which could defeat the tamper-resistance of the transformer.

Ensure that all hardware removed during installation is securely replaced in order to eliminate any openings into the cabinet or any other potentially energized area of the transformer. Check to make sure that any protective barriers are securely in place, the cabinet is completely closed and locking provisions are installed before leaving the transformer site unattended. Maddox takes no responsibility for damages due to completing all installation work in a good workmanship manner and within industry standards.

TANK COVER REMOVAL

Do not open the transformer tank unless absolutely necessary. Clean the area around the entrance cover before opening the transformer and exposing the internal materials to the atmosphere. Keep moisture and foreign debris out of the tank.

The transformer must be de-energized, grounded, and disconnected before opening. The transformer may have a bolted on tank cover which can be removed to gain access to the internals. To remove the tank cover, begin by opening the terminal compartment to expose the front cover nuts. Remove these nuts to allow removal of the cover tamper guard. Finally, remove the nuts holding the tank cover in place, remove the cabinet flip-top, and lift the tank cover vertically to prevent damage to the cover, gasket or fasteners.

In the event the hand hole or transformer cover is removed, care should be taken to re-seal the transformer so that moisture is permanently excluded from the interior. To verify the transformer is properly sealed, conduct a pressure test using dry air or nitrogen. The pressure test can be made by removing the pressure relief valve and applying pressure through the threaded fitting. Pressurize the transformer for 5 psig and hold for 30 minutes. A drop in pressure during this time would indicate the transformer is not properly sealed and the tank and fittings should be checked and the leak repaired. Finally, the pressure relief valve should be installed using Teflon tape or paste on the threads and carefully tightened.

OIL

Transformers are thoroughly dried at the factory and filled with Maddox inhibited mineral oil having a minimum dielectric strength of 30 kV at 60 Hz when tested per ASTM D-877. Maddox inhibited mineral oil contains less than 1 ppm of PCBs at time of manufacture. The transformer should never be energized unless it is filled with oil. If it should be found necessary to add to or replace the oil in the transformer, use clean, dry oil only, having a minimum dielectric strength of 30 kV and less than 1 ppm PCB's. Before opening the transformer, sufficient time should be allowed for the transformer to come to temperature equilibrium with the air in the room to eliminate the possibility of moisture condensation from the air.

To check oil level or to add oil, first bring the interior of the transformer to atmospheric pressure by venting the automatic pressure relief valve furnished on all Maddox transformers. Then, remove the oil level plug located on the tank front plate which is located at the 25°C oil level. If it is necessary to add oil, it may be added through the oil level plug.

A natural rubber hose should not be used in the transfer of oil.

To lower the insulating oil for maintenance or inspection:

1. Start with a clean dry container to store the transformer oil.
2. Use clean pumps and hoses that will not contaminate the oil. **Do not use natural rubber hoses.**
3. Attach the pump intake line to the drain valve on the transformer.
4. Place the output line on the bottom of the storage container. Do not permit the oil to splash into the container as this may introduce air and moisture into the oil.
5. **Do not lower the oil below the top of the core clamp.** Exposing the coil and insulation to the atmosphere will allow air bubbles to become trapped in the insulation and could lead to insulation failure.

To replace the oil in the transformer:

1. Pump from the bottom of the storage container. **Do not allow the intake line to suck air.**
2. To prevent aeration at the outfeed, direct the oil stream parallel to and along the upper surface of the core clamp.
3. Pump slowly and fill the tank to the 25°C line.

4. Allow several hours between refilling and energization of the transformer to be sure that any gas bubbles created during the process have dissipated.

To sample the transformer oil:

1. Samples should be taken only after the oil has settled which can be several days for large transformers or in cold climates.
2. Oil samples should be taken from the sampling valve at the bottom of the tank.
3. Start with a clean dry bottle to store the transformer oil.
4. Sample the oil only when the transformer is warmer than the surrounding air to avoid condensation of moisture on the oil.
5. Draw out sufficient oil to fill the bottle three or four times. Discard this oil according to proper environmental requirements. Retain the oil from the final draw in the bottle as the test sample.

CONNECTIONS

Refer to the transformer nameplate for the kVA rating and the permissible connections. No connections other than those shown on the nameplate should be made; and none of the connections should be changed while voltage is applied to the transformer.

For low voltage connections, the loads between the line terminals and neutral should be as nearly equal as possible. More than one-half the rated kVA should not be applied between any one line terminal and neutral.

Provisions are made for grounding the tank by means of tapped pads and ground connectors, if ordered.

GROUND-WYE TRANSFORMERS

Grounded-wye pad transformers normally have one end of the high voltage winding brought out through insulated bushings and the other end of the winding connected internally to the tank. A substantial and thoroughly reliable ground connection should be made between the tank and low resistance ground through a conductor of adequate cross section. One or more external grounding pads are provided on the tank front plate of the unit. It is imperative that both the tank (and the low voltage neutral if it is grounded-wye) be solidly and permanently grounded to the common neutral of the system before the transformer is energized. If this is not done, a high voltage may be impressed between the low voltage circuit and ground constituting a hazard to life and property. The safest procedure is to first make the ground connections, then the low voltage lines, and finally the high voltage connections. When the transformer is removed from service, all high voltage connections including those to protective devices should be opened first.

PRIMARY TERMINATIONS

Dead front transformer connections: Primary terminations are made with shielded separable insulated cable elbow connectors, used with externally clamped bushing wells. Loadbreak or non-loadbreak bushing inserts should be used with the wells, unless integrated bushings are furnished.

Bushings are provided with tabs to accept a bail, used as a positive hold down for elbows. The bail prevents accidental removal of elbow connectors under energized conditions.

When removing cables from the bushings, they may be easily transferred to an adjacent parking stand. The parking stands will accept open plug type accessories available for loop feed, grounding or insulating the terminators during troubleshooting, sectionalizing or

maintenance. On transformers equipped with bushing wells, the bushing inserts may be changed or replaced at the installation site. Changing inserts does not affect the transformer seal.

SECONDARY TERMINATIONS

Low voltage bushings are externally clamped insulators with either threaded studs or spade terminations. With grounded-wye secondaries, the neutral terminal consists of an insulated bushing with a ground strap connecting the bushing to ground. To avoid damaging the bushing when blade type spades are added, replaced or interchanged, first install the jam nut on the stud, hand tight. Second, install the spade and back the jam nut against the spade with a wrench, thus locking the nut and spade together on the stud.

OVERLOAD AND OVER VOLTAGE PROTECTION

Transformer protection against overloads and over voltages may be obtained by having the unit supplied with suitable devices from the factory.

A. Bayonet Fuses

Maddox transformers may be equipped with a bayonet type expulsion fuse. The externally operable bayonet fuse assembly provides load break capacity by simple hot stick withdrawal. Transformers incorporating this device must not be applied to primary distribution systems where the available fault current will exceed the maximum current interrupting capability of the bayonet fuse. Where the available fault current does exceed the maximum current interrupting capability of the fuse, current limiting fuses should be used.

Fuse Removal Procedure:

1. Vent transformer by opening the pressure relief device with hot stick. Next, standing to one side of the transformer, attach hot stick to fuse holder eye and twist hot stick to unlock fuse holder.
2. Turn fuse holder 90° in tube to break the seal between the seal gasket and the outer tube assembly. **NOTE: If tank pressure is not released, fuse holder may be forced out of transformer.** Maintain control of fuse holder at all times.
3. Draw the fuse holder out quickly 4 to 6 inches to interrupt the load. Wait a few moments for the oil to drain into the tank.
4. Remove fuse holder from outer tube assembly and wipe off fuse cartridge holder and fuse cartridge.
5. Use a wrench to remove the fuse cartridge from the cartridge holder.
6. Remove end plug from fuse cartridge using two wrenches. Use screwdriver or other tool to straighten the tulip tip end of fuse element and push fuse element out of fuse cartridge. **NOTE: Replace fuse cartridge if damaged.**
7. Insert replacement fuse element into cartridge from either end. Tulip tip may have to be closed slightly to allow insertion into cartridge.
8. Install the cartridge and fuse to the holder with the formed end ferrule towards the holder. Secure the holder while using a wrench on the flat of the cartridge ferrule and torque to 50-70 in-lbs.
9. Spread tulip tips of fuse before installing end plug. Tighten end plug to expand the tulip tips using a wrench on end plug while holding fuse cartridge with wrench on flat of ferrule next to end plug and torque to 50-70 in-lbs.
10. Remove end plug and inspect the tulip tips to see that they are uniformly expanded to insure even contact. Replace the end plug and torque to 50-70 in-lbs.

11. Check oil level at oil fill plug, and add oil, if necessary.

12. Attach end of fuse holder assembly to hot stick and insert holder assembly firmly into the outer tube assembly. Twist the locking handle so that the latch engages the outer tube shoulder. **NOTE: Visually inspect inner fuse holder assembly to ensure it is installed properly.**

WARNING: The bayonet fuse is not recommended for fault closing. Serious personal injury may result if attempted. Internal fault conditions can cause the transformer to rupture. Always energize transformer from remote location to be safe. This device was designed and intended for under oil application only. Refer to Step 11. for correct oil level.

Do not re-energize a suspected failed transformer. When replacing a blown fuse, the feed circuit should be opened and closed from a remote location. After fuse replacement, the bayonet should be replaced using the procedure described above and re-energized from a remote location. If equipment is re-fused while energized, the fuse could close in on the system's maximum fault current. Any equipment that has a suspected failure should not be closed in with this fuse. The bayonet fuse is designed to be operated in accordance with normal safe operating procedures. These instructions are not intended to supersede or replace existing safety and operating procedures. The bayonet fuse should be installed and serviced only by personnel familiar with good safety practices and the handling of high voltage electrical equipment.

B. Internal Expulsion Fuses

Some Maddox transformers may be equipped with internal expulsion fuses that cannot be replaced. The fuse is in series with the HV winding, and in case of internal failure of the transformer or overload, the protective link disconnects the transformer from the line without affecting line fuses or breakers.

Internal expulsion fuses should not be used on primary distribution systems where the available fault current exceeds the maximum current interrupting capability of the fuse element. Where the available fault current does exceed the maximum current interrupting capability of the fuse, current limiting fuses should be used.

C. Internal Current Limiting Fuse

Maddox transformers are also available with internal current limiting fuses that will limit the energy let through into the fault.

D. Dry-Well Current Limiting Fuse

The transformer may be supplied with a dry, current limiting fuse holder and full range current limiting fuse. Fuse holder types may be non-loadbreak or loadbreak. Consult the labels on the transformer front plate near the fuse holders for instructions on removal of the fuse. The transformer must be de-energized before attempting removal of a non-loadbreak dry well fuse holder.

E. Lightning Arresters

Some transformers are supplied with internal under-oil lightning arresters. These arresters are permanently connected into the transformer circuit. A disconnect switch may be supplied with the transformer to allow the lightning arresters to be removed from the circuit for testing purposes. This switch is not rated for load break application. Follow the instructions on the label supplied next to the switch for proper operation.

Elbow type lightning arresters may be applied to Maddox transformers by the end-user.

F. Secondary Breakers

Some Maddox transformers are protected against secondary overloads and short circuits by an internally mounted circuit breaker. The function

of the breaker is to open the low voltage circuit and protect the transformer from faults or severe overloads.

The breaker operating mechanism is designed to be operated by a lineman's hot stick. Transformers are shipped with the circuit breaker in the closed position.

To open the breaker manually, move the handle fully counterclockwise so that the pointer moves from the "C" (closed) to "O" (open), at which point the circuit is open. Verify that the circuit breaker is latched in the "open" position. To ensure the discharge of the static charge, which is sometimes present in the low voltage winding due to capacitance, it is recommended that the low voltage be grounded after opening the circuit breaker until after the high voltage is disconnected.

To close the breaker, rotate the handle fully counterclockwise to "R" (reset), which engages the latch mechanism, and then clockwise to "C" (closed). If a fault exists or an excessive load exists at the time the breaker is closed, the breaker will reopen even though the handle is held in the "C" (closed) position.

Some circuit breakers are equipped with an emergency overload device that can be used to restore service following a circuit breaker operation due to overload. The emergency overload lever is located immediately above the breaker operating handle. With the emergency lever in the normal position, the breaker will trip at its normal setting as calibrated at the factory. Moving the lever in a clockwise direction increases the setting so a higher temperature is required to trip the breaker. The emergency setting may be adjusted to an intermediate or extreme value. This emergency setting provides extra load capacity and still permits manual breaker operation, and also retains short circuit protection of the transformer. It is important that the emergency setting be used only when, and as long as, absolutely necessary because its use will result in a reduction of transformer life.

A meter seal is provided on the emergency lever to prevent tampering. It is recommended that a new seal be installed on the lever when it is returned to the normal position after emergency operation.

The breaker is a thermal and short circuit protective device for the transformer. It is not recommended that the breaker be used for routine disconnect operations.

G. Internal Fault Detector

Some transformers are supplied with an Internal Fault Detector (IFD). The IFD is a mechanical sensor that activates when sudden pressure from internal arcing occurs inside the transformer releasing a visible non-resettable orange indicator alerting crews that the transformers is faulted. The IFD also incorporates a standard pressure relief valve.

The orange shipping lock on the IFD should be removed after the transformer is installed and before it is placed in service. The shipping lock should be re-installed if the transformer must be relocated to prevent accidental operation of the IFD.

SWITCHING DEVICES

Dual Voltage and Taps:

Maddox transformers rated for more than one primary voltage are equipped with a dual voltage switch and/or tap changer. These switches are externally operated, but should never be operated while the transformer is energized. When switching from one voltage to another, make sure the switch is in the proper position before re-energizing the transformer. After turning the switch, tighten the locking device to minimize the possibility of unintentional movement. Units equipped with dual voltage and tap changer switches should be operated with extreme caution. **Taps should only be changed when dual voltage switch is set in the series (higher) voltage position, otherwise serious damage to the transformer could result.**

Internal Loadbreak Switches:

Internal loadbreak switches may be supplied with the transformer. These switches are designed to interrupt rated current only and they are not designed to interrupt fault currents. Consult the labels on the transformer front plate near the switch for instructions on operating the switch.

GASKETS

Gaskets on new Maddox padmounts are all made of Buna-N Nitrile rubber and may be reused if not damaged. Gaskets on some Maddox reconditioned padmounts are made of other materials, and may not be reused.

STORAGE

Transformers should be stored filled with oil and in a clean dry place. If possible they should be stored where there will be no extreme temperature changes. Before the transformer is put in service, it should be checked in the same manner as when received.

MAINTENANCE

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

1. High voltage bushings
2. Low voltage bushings
3. Arresters (if provided)
4. Enclosure integrity (hinges, locking provisions, corrosion, etc.)
5. Evidence of oil leakage
6. Ground connections
7. Accessories
8. Safety labels
9. Transformer tilt

Where tanks show evidence of rusting or deterioration of the finish, they may be cleaned and then retouched with paint. It is necessary to remove all loose paint and rust by wire brushing, scraping, or sanding. Clean the surface using a good solvent. Apply an acrylic lacquer, alkyd enamel, two part urethane, or a silicone alkyd primer, allow to dry, and then apply a color matched, compatible top coat and allow to dry. If metal is rusted to the point of being weak such that the enclosure integrity can be compromised, repair or replace the part rather than painting it.

REPLACEMENT PARTS

Replacement parts are available from Maddox. When ordering parts, give a complete description of the part. Also, give the kVA, voltage, and serial number of the transformer, all of which may be found on the nameplate.

ADDITIONAL INFORMATION

Complete information on the details of construction, installation, operation, and maintenance of your transformer can be obtained from your Maddox sales representative.

