

## Exterior Finish

The standard outside finish for liquid insulated transformers is satisfactory for widely diverse atmospheric conditions. However if the paint is damaged, the tank exterior metal is susceptible to rusting. All exposed metal surfaces must be thoroughly cleaned and prepared for the application of touch-up paint since the proper preparation of surfaces to be finished is an important factor in securing a satisfactory and lasting finish and maximizing the tank wall and radiator cooling effectiveness. Touch-up paint may be ordered from Schneider Electric. See "Section 9—Replacement Parts" on page 38.

Regardless of how good the paint may be, it will fail as a protector if applied over a wet, dirty, rusty, or greasy surface. Rust and scale will absorb and hold moisture. Therefore, to obtain a durable finish, it is absolutely essential that no moisture be sealed in by the application of paint. For large areas, to obtain a clean, dry surface with sufficient roughness for good adhesion of the priming coat, shot- or sand-blast the exposed surfaces of the transformer tank.

## Locating Pressure Leaks Above the Liquid Level

Each transformer is pressure tested at the factory to ensure a pressure-tight seal, preventing moisture contamination of the liquid coolant. Review "Receiving" on page 8 for initial inspection and methods of verifying the pressure seal. If the seal is broken due to mishandling or other adverse conditions, locate and repair the leak point as follows:

Apply dry air or nitrogen with a dew point of -50 °C (-58 °F) through the Schraeder valve in the tank wall. Do not apply through the pressure-vacuum bleeder valve. Apply a solution of soap and glycerin to all seams and joints above the liquid level. As the pressure rises to 5 psi, any bubbling of the soap solution will pinpoint the location of a pressure leak. Patch the leak by tightening devices at the point of the leak, applying epoxy patches, or welding.

## Liquid Leaks

### DANGER

#### HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

De-energize the transformer before performing any maintenance procedures.

**Failure to follow this instruction will result in death or serious injury.**

Liquid coolant leaks are rare, but if detected, repair them at once to avoid the liquid level dropping below energized parts, creating a possibility of flashover or transformer overheating. To repair a weld leak in a tank seam or around one of the fittings, follow steps 1–9:

1. De-energize the transformer following the safety precautions listed on page 7 and your facility's lock-out/tag-out procedures. Check the liquid level in relation to the area to be welded. It should be 4 in. (102 mm) or more above the area to be welded. Should the area to be welded be above the liquid or if the liquid has been removed from the tank, blanket the transformer with dry nitrogen.
2. If the liquid has not been removed, pull a vacuum of several psi above the liquid to stop the liquid leak. This may be done with a vacuum pump or by sealing all fittings on the tank and draining sufficient liquid to obtain the necessary vacuum.

*NOTE: Vacuum is not always required, especially when a sweating leak is to be repaired and the tank wall is relatively thick.*

3. Peen the weld leak closed, if possible, with the ball end of a ball-peen hammer or with a blunt or round-nosed chisel.
4. Grind or scrape the paint from the area to be welded and prepare a suitable point for attaching the ground lead to the arc welding machine.
5. Select a 1/8 in. diameter all-purpose coated electrode. Either ac or dc welding current may be used. When dc current is used, straight polarity (the electrode is negative) is preferred. Adjust the welding machine to supply the desired welding current. Depending on the welding operator's

ability and the individual task at hand, set the welding current between 115 and 125 A.

6. Apply a string bead sealing weld over the weld defect in a single, quick pass. This weld may be deposited horizontally or vertically depending upon circumstances. If the weld is deposited vertically, make it downward to drive any liquid seepage ahead of the weld. Remove the slag from the deposited weld before depositing each successive weld pass.

Liquid interferes with the welding operation and the quality of the deposited metal. Wipe off any liquid with a dry cloth. Deposit all welds in a sequence as described above to prevent any liquid seepage from interfering with the welding operation other than the final sealing at the lowest point of the weld leak.

7. Clean the repaired area and check with a suitable leak detector to be sure the leak has been stopped.
8. After testing for leaks, reclean the area and apply touch-up paint.
9. If required, refill the transformer to its proper operating level (see “Draining and Filling the Tank” on page 35).

### Small Pin-Hole Leaks

#### **⚠ DANGER**

##### **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

De-energize the transformer before performing any maintenance procedures.

**Failure to follow this instruction will result in death or serious injury.**

Small pin-hole leaks in the exterior metal, weld seam, etc., resulting in slow dripping, can be repaired with a durable epoxy patch kit. First de-energize the transformer following the safety precautions listed on page 7 and your facility’s lock-out/tag-out procedures, then apply a temporary liquid stick before the epoxy. In most cases this eliminates the need for a vacuum pump to stop the liquid leak while the epoxy is curing. Larger leaks may require the use of a vacuum pump. Detailed instructions are included with the epoxy repair kit.

Welding of small leaks can also be accomplished in the field on de-energized transformers, however avoid penetrating the metal and creating a more serious leak. **Welding on radiator metal is not recommended due to the thinner gauge material. See “Liquid Leaks” on page 33.**

### Bushing Leaks

Some bushing leaks at the bushing connector may be corrected by tightening the metal terminator part of the bushing. Leaks between the bushing and the tank wall may be corrected by tightening the bushing clamp bolts.

*NOTE: Do not exceed 40–60 lb-in. (5–7 N•m) torque on the bushing clamp bolts or terminals to avoid cracking the bushing material.*

### Maintenance of Internal Features

The transformer normally does not require internal maintenance throughout its life except for periodic sampling of the liquid coolant. The unit is shipped from the factory with the tank sealed. If inspection or repair of the internal tank parts is necessary, be careful to reseal the openings properly on completion of the work.

### Sampling the Liquid

The dielectric strength of liquid is affected by the most minute traces of certain impurities, particularly water. To avoid contamination, use great care in obtaining and handling the samples. When sampling the liquid, use a clean, dry, dark glass bottle or jar with a cork stopper. Do not use a rubber stopper or a sealing lid with a rubber gasket since the sulfur in natural rubber can easily contaminate the liquid. Clean the bottle by washing it with non-leaded gasoline followed by strong soap, and rinsing it with distilled water before drying. Be careful to procure a sample that fairly represents the liquid at the bottom of the tank by drawing off a sufficient amount of liquid

before taking the sample. This ensures that the sample is not liquid that was stored in the sampling pipe.

Open the drain valve or plug and release a small amount of the liquid coolant to flush out the valve and plug opening. The valve and drain pipe should be small enough to be emptied conveniently and large enough to give an even flow of liquid and avoid clogging by sediment. Take a quart sample, leaving space in the jar for expansion. Seal the jar and send it to the nearest testing facility for testing in accordance with ANSI standards. Testing must include as a minimum dielectric strength, power factor, and moisture content.

It is essential that the sample of insulating liquid represent the actual condition of the liquid in the transformer. Take every precaution to keep the sample and container free from foreign impurities or moisture. If the transformer is installed outdoors, be careful to prevent contamination of the sample by rain, snow, etc.

#### Receiving, Storing, and Handling the Liquid

If liquid is received in drums, as soon as they are unloaded, examine the bungs for damage or leaks. Store the drums in a closed room. Do not store the liquid outdoors since it is hazardous to the liquid. Store the drums with the bung down so the bung is under positive pressure. Do not open a drum until the liquid is needed. Tightly reseal any partially emptied containers and store them the same as new drums.

Like liquid purchased in drums, do not expose one- and five-gallon cans of liquid to the weather. Keep the seal intact until the liquid is needed. It is not necessary to perform dielectric tests on liquid in sealed cans. If a can is not completely emptied, use the provided screw cap to prevent contamination by moisture and dirt. The liquid in a partially used can must be tested before using it.

#### Draining and Filling the Tank

De-energize the transformer following the safety message on page 7 and your facility's lock-out/tag-out procedures.

### DANGER

#### FLAMMABLE LIQUID. RISK OF FIRE OR EXPLOSION

- Purge the gas space with nitrogen before adding/filling the transformer with liquid.
- Ground the transformer, transformer bushings, and all liquid-handling equipment.

**Failure to follow this instruction will result in death or serious injury and damage to equipment.**

Transformer liquid should be considered and handled as a flammable liquid. Under certain conditions, the closed transformer tank may contain combustible gases, and filling procedures may generate static electricity. Purge the gas space with nitrogen and ground all equipment following the safety message above.

When adding liquid to the transformer, take the precautions necessary to prevent PCB contamination. When draining or filling the tank, be careful to avoid contamination of the stored liquid. Use chemically cleaned and dry barrels or storage containers. Before opening the storage containers, allow them to reach the ambient temperature to avoid condensation. Use hoses and fittings that are liquid-resistant to avoid sulfur contamination. Remove the fill plug to equalize the tank pressure while draining. Drain the tank from the drain valve and plug location into the storage containers. When filled, properly seal the storage containers.

Before filling the tank, tightly seal all fittings. Fill the tank through the upper fill plug. Use of a filter press is recommended when filling to ensure the liquid is free from moisture, air, or solid contamination. After filling the tank, test the liquid quality and tank seal.

*NOTE: Never fill or add liquid to the transformer through the drain valve.*

**⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

Do not re-energize the transformer before draining or adding liquid.

**Failure to follow this instruction will result in death or serious injury and damage to equipment.**

Reconditioning the liquid consists of removing water, carbon gases, and sludge. Four types of equipment are generally used: centrifuge, blotter filter press, and a combination of fullers earth and vacuum dehydration process.

In general, when large quantities of liquid have been contaminated, it is preferable to replace the liquid rather than attempt to reclaim it. When small quantities of liquid have been contaminated, the reclamation process depends on the kind and degree of contamination. Contact your local Schneider Electric field sales representative for recommendations and instructions.

Opening the Transformer Tank

Transformers are shipped sealed and in most cases need not be opened. If it should become necessary to open the tank to gain internal access, follow steps 1–7:

**⚠ DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

De-energize the transformer before opening the transformer.

**Failure to follow this instruction will result in death or serious injury and damage to equipment.**

1. De-energize the transformer following the safety message above and on page 7, and your facility's lock-out/tag-out procedures.

**⚠ DANGER**

**HAZARDOUS PRESSURE. RISK OF FLYING OBJECTS.**

Release the internal pressure before removing accessories or hand-hole inspection covers.

**Failure to follow this instruction will result in death or serious injury and damage to equipment.**

2. Release the internal pressure by operating the pressure relief valve, or by slowly removing the filling plug a thread at a time until the pressure starts to relieve itself.
3. Do not open the transformer in an area that is unprotected from the weather if there is a possibility of precipitation, or in an area where the air contains dirt or other particles. When the transformer is opened, protect the opening from foreign matter. Do not permit anyone on the tank cover until they have emptied all pockets of loose objects, and removed watches, rings, etc.

4. Clean off the cover of the transformer to prevent the entrance of any dirt or foreign material when the cover is opened.
5. Remove the tamper-proof cover over the hand hole cover by removing the nuts holding it in place. These nuts are located inside the high- and low-voltage compartments. Slide the tamper-proof cover back and lift it off.
6. Remove the hand hole cover by removing the nuts holding it in place and lifting it off.

## **⚠ DANGER**

### **HAZARD OF SUFFOCATION**

Purge the gas space with dry air before entering the transformer tank.

**Failure to follow this instruction will result in death or serious injury.**

7. Purge the gas space with dry air. Never enter the transformer tank until an analysis of the air in the tank shows at least 19.5% oxygen.
8. To ventilate the inside of the tank while it is open, use dry air with a dew point of -50 °C (-58 °F) or lower. If dry air is not available, outside air may be used to ventilate the transformer as long as the outside relative humidity is less than 60% and the temperature of the transformer is at least 10 °C higher than the dew point of the outside air.
9. Tie off all tools outside the cover opening before using them inside the tank. Air hoses may be placed inside the transformer tank if they are clean and are made of material resistant to the liquid in the transformer.
10. If it is necessary to lower the liquid level, see “Draining and Filling the Tank” on page 35.

The maximum time that the transformer can be open is 12 hours. If this time must be exceeded, contact your local Schneider Electric field sales representative for instructions.

### Entering the Transformer Tank

If it is necessary to enter the tank, first make sure an analysis of the air in the tank shows at least 19.5% oxygen. Use clean drop cloths under the working area to prevent objects from falling into the core and coil assembly. Wear clean cloth covers over shoes and never stand on any electrical insulation. Whenever anyone is inside the tank, station a second person at the opening in the cover of the tank to ensure the safety of the person inside. Follow all OSHA “confined space” entry rules and regulations.

### Closing the Transformer Tank

After completing work inside the transformer tank, follow steps 1–3:

1. Clean the contact surfaces of the hand hole gasket and cover. If the gasket has been damaged in any way, replace the gasket.
2. Replace the transformer hand-hole cover and tighten the nuts evenly around the cover. Refill the transformer with any liquid that was removed. See “Draining and Filling the Tank” on page 35.
3. Perform the tests described in “Scheduled Maintenance” on page 30.
4. Pressure test the transformer for leaks as described in “Locating Pressure Leaks Above the Liquid Level” on page 33.
5. Replace the tamper-proof cover over the hand hole cover.

### Repairs

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

Report all problems during the warranty period to your Schneider Electric field sales representative. All warranty repairs must be made by Schneider Electric or an approved service facility.