# 090: Transformers

### *Discussion leader duties for this session:*

Walk through the job site and note how transformers are grounded. Note any transformers that are connected to a driven rod. If the rod isn't bonded back to the main grounding system, initiate the process of fixing this deficiency.

### *What this Safety Talk covers:*

Safe installation, connection, and testing of transformers.

### *Discussion notes :*

## *Pre-installation inspection*

Inspect the transformer to verify there are no obvious signs of damage, such as bent mounting hardware. On dry-types, look for such things as damaged insulation on the windings, damaged windings, and bent frames. On liquid-filled, look for anything that might compromise the integrity of the transformer vessel.

Check the weight of the transformer and verify that any lifts, hoists, or other rigging devices you might use can safely support this weight.

Verify the integrity of lifting lugs, eyes, or other items you might use to support the transformer during the lift.

Verify the transformer meets the specifications and will work with the power supply and mounting location intended for it.

Verify that the mounting clearances meet NEC clearance requirements. For example, mounting a transformer under a circuit panel violates the clearance requirement for the circuit panel. Such an arrangement puts a person's shins directly in the path of the vent of a dry-type transformer. If a fault were to occur while that person were closing a breaker, that person would suffer a serious but preventable injury.

Verify you're using the correct mounting hardware and methods. If you're unsure the mounting will support the transformer, ask your foreman.

## *Installation and wiring*

Place the transformer in its intended location and mount in a temporary fashion—for example, with hardware loosely assembled—to allow you to safely check "as installed" clearances. If this isn't safe or practical, improvise—for example, use a couple of boards cut to the length and the width of the unit. The purpose of this step is to eliminate the extra work involved in mounting, de-mounting, and re-mounting the transformer to meet clearances. Follow the axiom, "Measure twice, cut once." Verify clearances again, after final mounting. Secure all fasteners.

Follow NEC wiring methods and manufacturer's instructions.

Modifying the transformer violates its UL listing. Some "power quality experts" are instructing their clients to undo the grounding strap inside the transformer. While this does nothing to improve power quality, it does create a shock hazard by allowing the transformer case to float with respect to ground. Don't do it.

Connecting a transformer to a driven rod that isn't bonded to the Grounding Electrode Conductor (GEC) doesn't provide a proper ground. Electricity is always trying to get back to the source, not to the earth. Per Kirchoff's Law, it will follow all paths before it in inverse proportion to the resistances of those paths. If earth is your bonding jumper back to the source, the ground path is well beyond billions of ohms. Such a situation greatly increases the likelihood of power quality problems, equipment damage, and lethal shocks.

Bond the XO of the transformer to the GEC as required by the NEC and as directed in the construction documents. Make this termination to bright metal—remove paint and varnish as required.

Do not route the GEC in metallic raceway unless non-metallic raceway is prohibited. If you route it in metallic raceway, bond the raceway to the GEC with a jumper wire at each end.

### *Review and Discussion*

What should you look for during the initial inspection? Why?

Why is it important to know the weight of the transformer?

Should you assume that all factory-supplied lifting hardware is secure?

What should you verify before mounting the transformer in place and then again after it is in place?

What should you do before testing conductor insulation?

If you determine the transformer has been damaged, what should you do?

Is it OK to remove the bonding jumper or grounding strap that connects to the transformer case?

What are some things to remember about bonding and grounding transformers?

What should you do before energizing a transformer for the first time?

Why is it important to have all of the covers in place before energizing a transformer for the first time?

### *Testing*

It is a "best practice" to perform insulation resistance tests on all conductors before terminating them. It's also a "best practice" to run these tests on the transformer windings, primary and secondary to ground. Before doing these tests, ensure the transformer is not connected to a monitoring system or a load. If it is connected to a monitoring system, ask the manufacturer how to proceed with testing.

Other tests may also apply. If a transformer fails any of the tests you are performing on it, notify your foreman. Don't just wire it up and turn in the test results.

### *Energizing*

Conduct a final inspection of the transformer before energizing.

Remove all construction debris and verify there are no tools or other items in the transformer or related equipment.

Secure all covers and replace any missing hardware prior to energizing.

Ensure the covers are in place when energizing a transformer for the first time. Should the transformer contain an internal fault, the covers will contain the explosion. Once you've established that the transformer can safely handle supply power, you can de-energize and remove the covers as required to verify voltages or conduct other tests.

### *Participant's Signature and Date*