

Introduction

Control transformers change the high Line Voltage to a lower voltage that is used to control HVAC, Refrigeration, and other equipment. The Line Voltage is called the Primary Voltage and the Control Voltage is called the Secondary Voltage. All transformers are used only with Alternating Voltage and Current, abbreviated as VAC. Transformers do not convert Alternating Voltage to Direct Voltage, abbreviated as DCV or simply DC.

Control Voltage and Class 2 Specifications

The HVAC/R industry standard control voltage is 24 VAC. This voltage was chosen because it is high enough to power most motor start contactors, fan relays, and other related equipment but not high enough to cause harm to individuals.

For safety, control transformers should be UL or CSA recognized as Class 2 transformers. This safety rating guarantees the following safety specifications:

- A) The maximum control voltage is 30 VAC. If a voltage is 30 VAC or less it will not harm an individual.
- B) The maximum control current will not exceed 8 Amps after 60 seconds. This specification prevents fires from short circuits.
- C) The maximum power the transformer can deliver is 100 Volt-Amperes, abbreviated as VA. This specification also prevents fires.

Because of these strict Class 2 specifications the control voltage wiring can be run outside of electrical conduit and stapled to the wall with complete safety and within code.

Mechanical Considerations

Control transformers that have plastic covers or endbells over the transformer windings must be protected within a metal enclosure. This type of transformer is commonly referred to as Foot Mount transformers.

Transformers that are enclosed in metal covers or endbells do not need to be protected within a metal enclosure but the line voltage side of the transformer should have a chase nipple or some mechanical method to fix the transformer so the line voltage leads go directly into an electrical conduit enclosure.

Transformers should never be carried by their leads as that could damage the lead wires or the connections to the transformer winding.

Calculating the transformer VA Power Requirement

Transformer power is rated by the VA (Volt-Amperes) capability. To determine the required transformer VA, multiply the transformer output control voltage by the required Amperes.

$$\text{VA} = \text{Volts} \times \text{Amperes}$$

To determine the maximum output current of a transformer, divide the transformer VA rating by the transformer output voltage.

$$\text{Amperes} = \text{VA} / \text{Volts}$$

Using a Circuit Breaker Control Transformer to find Defective Components

If a technician finds the control transformer in defective equipment does not have a 24 VAC output, most of the time something caused the transformer to fail and simply replacing the transformer will not solve the problem.

HVAC/R transformers are designed to open in order to prevent overheating and starting a fire. The cause of the problem must be found before replacing the transformer.

Temporarily wire in a Circuit Breaker Class 2 transformer. If the Circuit Breaker trips then you know there is a short or overload somewhere in the controls such as a shorted coil in a fan relay or contactor.

One by one, remove a wire from each control item such as fan relays, compressor contactors, etc. and reset the Circuit Breaker after each control item is disconnected from the circuit. If the Circuit Breaker still trips after a control item is disconnected, that item is not the problem and can be connected back into the circuit and another control item disconnected.

You will have located the problem item when the Circuit Breaker no longer trips. Simply reconnect the problem item to make sure the defective control trips the Circuit Breaker.

Replace the defective control, install a less expensive Non-Circuit Breaker transformer, and test the system. You have saved yourself time and money by avoiding replacing a transformer and having it immediately fail.

Summary

- Always install a Class 2 transformer when replacement is necessary.
- Make certain the transformer VA rating is large enough to power all the controls in the equipment.
- Always use a metal endbell transformer if it is mounted outside of the equipment.
- Use a Circuit Breaker protected transformer while troubleshooting to prevent additional transformer failures.