



ESG Service Information

File In/With: N/A

SI0046

New 01-03

Equipment Affected: Chillers Using 3-Phase Motors

Megger Testing 3-Phase Motors

General

This letter will provide the technician with guidance in determining if the insulation within a motor is breaking down and requires that the motor be removed for repairs. The goal is to eliminate removal and repair of motors that are not defective.

Required Tools and Materials

Use a Megger with applied test voltage suitable for the motor in question as follows:

- ▶ Low Voltage Motors (208-600 VAC) use only a 500 Volt megger.
- ▶ Medium Voltage Motors (2300-6600 VAC) use a 1000 Volt megger.
- ▶ High Voltage Motors (7kV - 13kV) use a 2500 Volt megger.

Background

Most open-frame chiller motors exhibit readings well above 20 megohms when new, and in a dry environment. However, it is not unusual to get a reading of one megohm, or less, on an open motor that has not run for a while. ***Most often a low reading is due to the presence of moisture in the motor windings, and does not necessarily mean the motor is bad.***

Procedure

The test voltage should be applied with the motor leads disconnected from the motor-starter, but with the three phases of the motor shorted together so that one lead of the test instrument is connected to all motor windings at the same time. The other test lead is then grounded to the motor frame. Refer to Figure 1.

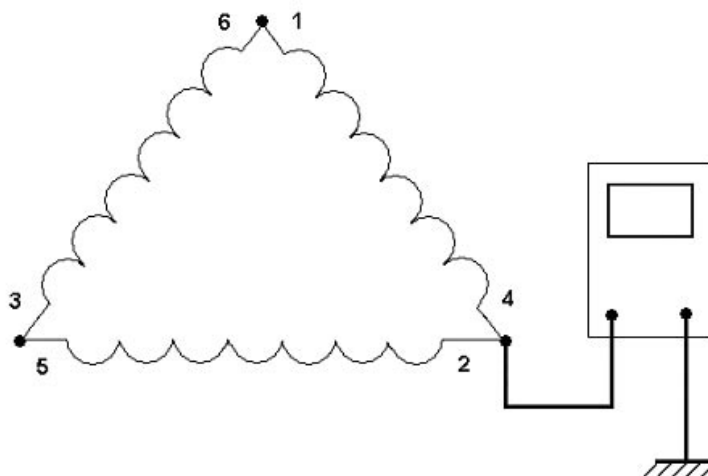


FIGURE 1 - MEGGER CONNECTIONS (STANDARD TEST)

Test results are based on a 40° C ambient. The minimum test result should be the motor's rated voltage in kilovolts, plus 1.

For example:

A 460 volt motor should have a minimum test result of $0.46 \text{ (kV)} + 1.0 = 1.46 \text{ Meg}$.

A 4160 volt motor should be $4.16 \text{ (kV)} + 1 = 5.16 \text{ Meg}$.

These values may seem low compared to factory test results, or manufacturer specifications for a specific motor. These values have been selected by the Institute of Electrical and Electronic Engineers (IEEE) as a universal go/no-go threshold that can be applied regardless of motor manufacturer or age of the motor, without resulting in the testing process causing a failure of the insulation.

Remember - any test result that is below the recommended value does not necessarily condemn the motor. In many cases a low result will be caused by accumulation of moisture in the motor windings.

If the standard megger test, having all three phases tied together results in a low reading, separate the three phases, and re-check each individual phase to ground. As a rule-of-thumb, if the three individual readings are very similar, these low readings are most likely not due to a bad motor. We suggest the motor be heated overnight, or for at least 12 hours, using heat-lamps, strip heat, or another source of heat to drive off residual moisture. The motor should then be re-tested while the windings are still warm. If the motor then tests good, the problem was build up of moisture and corrective measures such as permanent motor space heaters should be suggested. If there is a notable improvement, but not yet acceptable reading, it may be necessary to heat the motor for a longer time. If the motor never reaches an acceptable value, it is suggested the motor be sent to a repair shop where it can be baked and re-varnished in a vacuum impregnation tank.

It is also necessary to check windings for a phase-to-phase short in a similar manner. Separate the motor leads, and connect the megger from the Lead #1 to Lead #2. Likewise, check from Lead #2 to Lead #3, and from Lead #3 to Lead #1. These test results should meet the same minimum value as expected for phase to ground measurements. Keep in mind it is normal to read conduction from Lead #1 to Lead #4, from Lead #2 to Lead #5, and from Lead #3 to Lead #6. Refer to Figure 2.

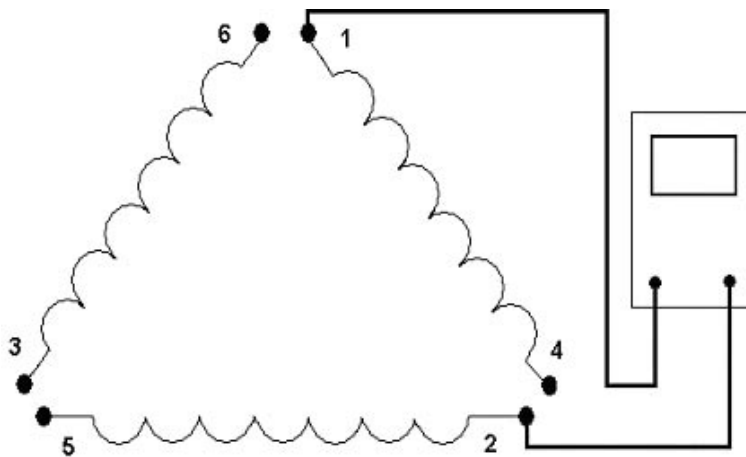


FIGURE 2 - MEGGER CONNECTIONS (FOR INDIVIDUAL WINDINGS)