

Insulation resistance tests at low voltage

Insulation tests are conducted for two reasons: to discern existing weakness or faults or to give some indication of expected service reliability. Insulation resistance tests should also be conducted when the unit is subjected to excessive moisture or dirt.

Insulation resistance tests are based on determining the current through the insulation and across the surface when a DC voltage is applied. The leakage current is dependent upon the voltage and time of application, the area and thickness of the insulation, and the temperature and humidity conditions during the test.

The insulation resistance test is used to determine the insulation condition prior to application of more extensive testing measures. Refer to the following electrical measurement procedures for testing detail.

Refer to IEEE Standard. 432-1992 when more extensive insulation tests are required.

Note: *New generators should measure about 100 megohms of insulation resistance when meggered. Generators that read 50 megohms or less should be dried out according to the dry out procedures here. Generators with insulation resistance readings of 10 megohms or less must be cleaned and then dried out.*

Winding Temp (°C)	Conversion factor
10	0.23
20	0.37
30	0.6
40	1
50	1.7
60	2.7
70	4.5
80	7.5
90	14
100	23
110	38
120	61

Table 4: Temperature conversion factor for resistance readings

Warning: *Never apply the megger to the rotating rectifier, the voltage regulator, or generator accessories (e.g., temperature detectors, space heaters).*

Caution: *The insulation resistance tests are usually made on all or parts of an armature or field circuit to ground. They primarily indicate the degree of contamination of the insulating surfaces or solid insulation by moisture and other conducting influences and will not usually reveal complete or uncontaminated ruptures.*

Note: *The insulation resistance value increases with decreasing winding temperatures. All readings should be corrected to a reference winding temperature of 40° C. Use Table 4 for converting megger readings to other temperatures (e.g., 100 megohms at 50° C is converted to 170 megohms: 1.7×100 at 40° C).*

Exciter field (stator) and PMG armature (stator)

1. Disconnect the exciter leads from the terminals in the terminal box or the voltage regulator.
2. Connect exciter leads to one clamp of 500-volt megger, and connect the other clamp to the generator frame.
3. Apply 500 V from the megger, and measure the resistance reading after 1 minute. The reading must be a minimum of 50 megohm. If it is not, refer to the cleaning or dry out procedures.
4. Ground the exciter field leads to the generator frame for several minutes after the megger has been disconnected. This will allow the voltage build up to be properly discharged.

Exciter armature

1. Disconnect the exciter armature leads from the rotating rectifiers.
2. Connect the leads of the exciter armature to one clamp of a 500-volt megger, and connect the other clamp to a suitable connection on the shaft.
3. Apply 500 V from the megger, and measure the resistance reading after 1 minute. The reading must be a minimum of 50 megohm. If it is not, refer to the cleaning or dry out procedures.
4. Ground the exciter leads to the shaft after disconnecting the megger. This will allow the voltage build up to be properly discharged.

Main rotor

1. Disconnect the generator field leads from the positive and negative terminals of the rotating rectifier assembly.
2. Connect the positive and negative leads to one clamp of the 500-volt megger, and connect the other clamp to the shaft.
3. Apply 500 V from the megger, and measure the resistance reading after 1 minute. The reading must be a minimum of 50 megohm. If it is not, refer to the cleaning or dry out procedures.
4. Ground the field leads to the shaft after disconnecting the megger. This will allow the voltage build up to be properly discharged.

Main stator

1. Disconnect power connections and all control apparatus from the generator terminals.
2. Measure insulation resistance of each phase separately with the two other phases shorted to the frame.
3. Use a 500-volt megger connected between the lead(s) of the phase to be measured and generator frame. The minimum 1-minute insulation resistance must not be less than 50 megohm.
4. Ground the leads to the frame after the 1-minute megger test. This will allow the voltage build up to be properly discharged.

Dry out procedures

If the insulation resistance readings are below the recommended minimum values specified previously, use one of the dry out procedures described below. Select the procedure based on the size and location of the unit, available equipment, and experience of personnel. Before drying, remove the voltage regulator, and cover all inlet and discharge openings. Provide an opening at the top of the machine, preferably at the fan end, for moisture to evaporate.

Drying with external heat: Place heat lamps, space heaters (in addition to the ones already supplied) or a steam pipe near the windings. Monitor winding temperatures. Raise winding temperature gradually at a rate of 50° F (28° C) per hour up to 200° F (93° C). Measure insulation resistance at 1-hour intervals. Typically the insulation resistance will slowly drop while the temperature is coming up, and then gradually increase and level out.

Caution: *Do not apply heat too rapidly. It could damage the windings.*

Drying with AC current in the armature: Short circuit the generator terminals. Provide DC excitation to the brushless exciter field winding. Insert a current transformer and an ammeter to read full load current. Run the generator at rated speed. Apply excitation to the exciter field until rated current is developed. Monitor winding temperatures until they stabilize. Continue running until insulation resistance values level off. Monitor winding temperatures. Raise winding temperature gradually at a rate of 50° F (28° C) per hour up to 200° F (93° C). Measure insulation resistance at 1-hour intervals. Typically, the insulation resistance will slowly drop while the temperature is coming up and then gradually increase and level out.