Safety Testing of Electrical Equipment...

There are three types of tests that are commonly run on electrical equipment to insure its safety. These are ground wire continuity, insulation and operational type tests.

Ground wire continuity test

Most metal cased electrical products are furnished with a three wire power cord. The continuity test is performed to verify the quality of the ground wire in this power cord. No current would pass through this wire during the normal operation of the product. Its function is to provide a means of holding the frame of the product at ground potential in the event an electrical fault should occur between the product's electrical wiring and the frame. Without the ground wire, such a fault might allow the frame of the product to rise to full line voltage, creating a hazard to the user.

Most US and Canadian (UL and CSA) standards require only that the continuity be verified using any indicating device. Most standards from Europe (TUV, BSI and VDE) require test currents of 10 to 30 amperes at 6 volts, with a maximum allowable resistance of 0.1 ohms. Note that most of our continuity testers are designed to meet the UL and CSA requirements with options that test to the European requirements.

Insulation tests

These tests are designed to verify the integrity of the product's insulation. There are three basic types Dielectric Strength (Hi-Pot), Line Voltage Leakage Current and Insulation Resistance (IR). Each has its own application and advantages.

Dielectric strength

Dielectric Strength (often called Hi-Pot or high potential) is commonly specified for production testing of electrical products. It is conducted by applying a high voltage between mutually insulated portions and ground. Normally the high voltage is applied to the current carrying wires holding the product's case (or exposed metal parts) at ground potential.

It is not intended to cause insulation breakdown or that it be used to detect corona. Rather it serves to determine whether insulating materials and spacings are adequate. When a product is faulty the application of test voltage will result in either a disruptive discharge or high fault currents. The results are a qualitative PASS or FAIL in lieu of measured values.

Some special care should be taken in the application and removal of the test voltage. If a simple switch or relay is used to control the voltage it will turn on the voltage at random points on the sine wave. This can cause unwanted high voltage spikes and breakdowns and can be a problem in products that contain inductive components such as large motors or transformers. The problem can be avoided by increasing and decreasing the voltage slowly. If the testing is being done on a production line the use of an automatic voltage ramp should be considered. Selecting a tester that uses a zero turn on switch can be a low cost and effective answer as well.

For products with large capacitors in the input., such as RFI filter, consider using a DC tester. Special precautions are required as in some cases DC testers can leave a charge on the product tested. A higher test voltage is normally specified when DC is used to make up for the loss of the stress reversals that occur in AC testing.

Line voltage leakage current

Line voltage leakage tests are conducted by operating the product at its normal operating voltage, but with the ground wire open. A special milliampmeter is then connected between any exposed metal parts of the product and ground. The special meter has an input impedance to simulate the impedance of an average person. This test has the advantage of measuring the actual amount of shock that a person would feel if he used the product. The line voltage leakage test is widely used in applications calling for frequent retesting, such as tool cribs or by equipment rental companies, as it does not degrade the product's insulation.

Insulation resistance

Insulation resistance is a measurement of the insulation itself. This test is widely used to test the condition of wiring in a building or large motor. It is also often specified by BSI. It is very similar to the line voltage leakage test in that it is measurement of the insulation. It is not as useful for product safety testing as it is harder to relate to the amount of shock someone might receive. It is an ideal test for studying, measuring and recording the long-term stability of an insulating material. Tests are normally conducted at 100 or 500 volts DC. The results are measured in terms of megohms of resistance.

Operational tests

These are the operational tests that verify the product will perform without overheating, drawing excessive current or creating a hazard. Measuring a product's current draw or wattage will often satisfy this need. A number of the testers in this catalog meet this need. Special measurements such as speed or temperature can also be made.

Selecting the right test

The dielectric strength test is normally selected when testing new or repaired electrical products. The leakage current test is usually the best choice for repeated tests on electrical products, or when you wish to study the results of various conditions on the safety of a product. The dielectric test could be compared to testing a home garden hose by applying a water pressure of 300 psi with the end capped off. If there was a water leak you would know it right away. If there was none, you could be confident that

with the end capped off. If there was a water leak you would know it right away. If there was none, you could be confident that the hose would operate for a long time at normal water pressure. While this would be a good test to verify its quality, if you tried testing it every day, you would shorten the life of the hose. The same is true of the dielectric test. It's a good test to make following the manufacture or repair of a product, but if you try it every day in a tool crib or rental equipment center, you will shorten the product's useful life. For these applications, the line voltage leakage test is best.