

## **Understanding the Input Test**

### *The “Understanding the Product Safety Tests” Series*

*Input Testing* involves measuring the maximum input current and in some cases the input power to a product. The test itself does not have pass/fail criteria. However, the data recorded has direct application to the product’s compliance with other pass/fail criteria in the product safety standards.

#### **The Purpose of the Test:**

- To verify that the product’s input electrical rating provided on the product’s main rating plate is accurate.

**Test Method:** The input test involves loading the product to its maximum load condition and measuring the input current. When the input power, input VA, and/or Power Factor are included on the rating plate, these values must also be measured.

#### **Test Locations:**

- The objective is to measure the input current, and when applicable the input power, at the product’s mains power connection (at the mains plug; at the mains terminal block).

#### **Test Configurations:**

- 1) **Calibrated Meter:** There are a few different ways to measure the input current. Options include a current clamp, an ammeter, or a shunt with a voltmeter. It is important to use a meter that has a suitable range and resolution for the anticipated current level. A current clamp is often not suitable for low current levels. Fewer options exist when there is a need to also measure the input power (Watts), VA, and/or Power Factor (PF) – these require both the voltage and current to be measured simultaneously. A wattmeter is the instrument to use for measuring input current and Watts/VA/PF.
- 2) **Maximum Load Condition:** It is very important to measure the input current when it’s at its highest level. This occurs when the product is at its maximum rated load condition.
  - a) All product options and accessories included.
  - b) All expansion slots fully loaded.
  - c) All output connectors loaded to maximum rated.
  - d) Any other product variations and configurations should be included that can increase the current draw such as a higher speed processor.
- 3) **Voltage Range Ratings:** For products that have an input voltage “range” rating (i.e. 100 - 240VAC), input measurements should be taken at both ends of the voltage range to verify the corresponding current range rating on the rating plate.
- 4) **Dual Voltage Ratings:** For products that have multiple voltage ratings (i.e. 120/240VAC), input measurements should be taken at each rated voltage to verify the corresponding current ratings on the rating plate.

#### **The Test Objectives:** The Input Test objectives are:

- A) **All Products:** Insure that the input electrical ratings are accurate. The input current rating is important to insuring that the product is connected to the properly rated “branch circuit”. The correct branch circuit rating translates to using the proper circuit breaker rating that is intended to trip during fault current conditions helping to prevent a product fire.
- B) **Cord Connected Products:** Insure that the plug rating/configuration is consistent with the product’s input current rating.



Don't Guess on Your Current Rating: For product manufacturers, make sure your current rating marked on your rating plate is consistent with the maximum measured input current.

1) Marking Guidelines:

- a) The product safety standards require that the input current measured not exceed the marked current rating by more than 10%.
- b) The standard will allow you to mark a current rating above your actual current draw – there is no limit. Be very careful when determining your input current rating. It does not help to rate your product more than the highest current draw, and it can actually have unintended negative consequences related to the maximum rated current connected to an electrical circuit.

2) Cord Connected Products:

- a) Are required to have plugs rated at least 125% of their marked current rating.
- b) The plug rating directly relates to the designated plug blade configuration.
- c) It is important to know that for 120VAC products in the United States, you cannot rate your product more than 12 Amps and use a 15 Amp plug (parallel blade). This is especially important for household products = some homes only have 15 Amp receptacles.
- d) A 12 Amp rating means that your product cannot draw more than 13.2 Amps (110% of rated). If your product draws more than 13.2 Amps @ 120 VAC, you will have to use the next higher rated plug configuration (120VAC @ 20 Amps for which the product can be rated up to 16 Amps and can draw up to 17.6 Amps).

Conclusion: As you can see, we don't simply perform the tests because they are in the standard. Each test in the standard has a set of objectives that relate to the 6 Hazards of Product Safety. The Input Test is performed as part of the mains connection and overcurrent protection review – areas especially critical for maintaining Fire Hazard protection. This hazard is magnified in big buildings where a fire could jeopardize the safety of a large number of people. It is therefore an extremely important test – another test that directly saves lives.

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