Problem: AC circuit breaker trips immediately when you try to close it.
By William K. Bennett

Conditions

- AC input voltage has been verified as the correct value; if three phase, all three phases are good.
- Ohmeter measurement of the rectifier components (SCRs and/or Diodes) shows that no component is shorted.
- *With the battery connected,* the dc circuit breaker can be closed, and holds.

Analysis

The facts that the dc breaker holds, and the SCRs and Diodes test good, indicate that the secondary circuit, consisting of the rectifier bridge, polarity diode(s), filter capacitors, etc. are OK. Whatever fault exists is in the ac circuitry *before* the rectifier bridge. This includes the main isolation transformer, wiring from the transformer to the rectifier bridge, wiring from the circuit breaker to the transformer, MOV surge suppressors, and the ac circuit breaker itself.

- A transformer failure is a rare occurrence. This is especially true for a new installation; the probability of failure increases slightly with time, but you can expect the transformer to last for decades under the normal conditions of charger use.
- A circuit breaker failure is even less common. You should, however, verify that the magnetic trip setting on the breaker is set to its maximum (this applies only to breakers with trip ratings of 125A and higher).
- Wiring faults can occur due to defective insulation, movement of conductive parts during shipment, or improper routing of conductors near sharp edges of sheet metal. In the last case, a fault would be from one ac input line to ground, and the circuit breaker would trip only if the charger is fed from a bonded wye source, not an ungrounded delta source.
- MOV surge suppressor failures usually result in the MOV vaporizing, assuming there is enough energy in the source. The short circuit then disappears.

Isolating the failure zone

Disconnect the battery and the ac supply at the feeder breaker. Remember that when the feeder breaker is on, ac voltage is present at the terminals of the ac circuit breaker on the charger. When the battery is connected, dc voltage is present on the terminals of the dc breaker (if you have fuses, and no dc breaker, the voltage is on the fuse terminals).

Before you begin any troubleshooting procedures, thoroughly check the ac wiring on both the transformer primary and secondary sides, to verify that there is no obvious physical defect.

Once you have determined that the dc breaker holds, you need to isolate the transformer and the secondary wiring from the ac supply to determine the area where the fault exists. First, identify the main secondary wires. The secondary terminals on the transformer are usually marked X1 and X2 (single phase) or X1, X2, X3 (three phase). Some single phase transformers are marked

X1 and X5. The main secondary wires run from these terminals to the rectifier bridge, and should be easy to trace.

At the main transformer, remove any insulation from the secondary terminal connections. Disconnect the wires from the transformer terminals (mark them if necessary to be sure you get them reconnected correctly). Wrap electrical tape around the transformer terminals. Now try to close the ac breaker. If it holds, the fault is in the wiring from the transformer to the rectifier bridge, or in the bridge itself.*

If the ac breaker doesn't hold, the fault is in the transformer or the wiring between the ac breaker and the transformer primary terminals. Now repeat the above step for the two or three transformer primary terminals. These are usually marked H1 and H5 (single phase) or H1, H2, H3 (three phase). Insulate the ends of the wires after disconnecting them from the transformer. Try to close the ac breaker. If it holds, the fault is in the transformer. If not, it's in the wiring.

Once you have isolated (and repaired) the fault, reconnect the wiring to the transformer terminals, being sure to make the connections the same as the original. Cover the connections with electrical tape or other suitable insulation. Use high-temperature tape if you have it. If you have heat-shrink sleeving, or silicone-impregnated glass sleeving, use that instead of tape.

*There is an extremely rare SCR failure, in which the SCR loses reverse blocking ability but maintains forward blocking ability. You probably don't have that.