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HVAC Motor Doctor®
a distribution HVAC newsletter

What to Do When the Wire Diagram is Missing?

Anyone whose job involves servicing electric motors has encountered the problem of a missing nameplate. Other articles in this series have covered ways of determining the specifications of a motor lacking the nameplate, but what if you are trying to figure out how to wire that motor?

For some kinds of motors, principally motors with terminal-based connections, basic wiring is self evident. The terminal board itself usually has markings that indicate where line one and line two are to be connected. But what if you need to reverse that motor, use a different (but available) voltage setting, or have a motor that has nothing more than a bunch of color-coded or numbered leads coming out of it?

The colors or numbers themselves are often a clue, but they alone may not provide sufficient information. There is always the trial and error method, but I don't recommend that because of the potential for destructive results. Instead, equip yourself with an ohmeter (don't settle for just a continuity tester) and learn to perform a few simple tests with it.

The first thing you'll need to discover is whether you're dealing with a three-phase motor. You may already know this from the application, but another giveaway is that the lead wires of most three-phase motors are single colors, not multiple colors, and usually identified with numbers. If, on the other hand, the motor diameter is less than seven inches and has a terminal board, it is most likely a single-phase motor.

For wiring a single-phase motor, the most important objective is to distinguish the starting circuit from the main winding. These two circuits are isolated from one another electrically if the lead wires are separated and not in contact with each other. Initially, the ohmeter can be used to determine which wire belongs to which circuit as well as checking continuity between leads. You should be able to isolate into two groups any leads which have continuity with one another. The starting circuit is likely to isolate to two leads, the running circuit may have two or more leads that show continuity. If the running circuit has more than two leads, you will need to determine how those leads are to be used for voltage or speed changes.

You'll need to use the ohmeter as an ohmeter and not as a continuity checker for the next step in the procedure. You'll want to use the lowest ohm scale your meter offers, as the typical winding resistance in motors such as these is less than 100 ohms. If the motor is a permanent split-capacitor motor, you're going to be looking for common and speed taps of the winding. Using the ohmmeter, find the pair of wires that has the highest resistance as measured in ohms. This will give you your common and lowest speed tap. Using each of these two leads in turn, find the pair that gives you the the second-highest resistance. This should provide you the common and second-lowest speed tap and should also allow you to isolate which of the two leads from the first test is the common.

In addition, note that the common lead in this type of motor is usually white or purple. If there are additional leads in the run widing group, continue to use the ohmmeter to test the now-identified common and additional leads. Descending resistance will give you ascending speeds.

All is not lost if you don't have a diagram for a particular motor, at least not if you understand how to use and ohmmeter. As with any problem-solving exercise, the more tools you have at your disposal, the more effective you become in the field.