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## 15 rules for control wiring for low-temperature systems

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THE DAYS OF wiring two-wiring thermostats to T-T terminal on a burner, zone valves or relay as the finishing touches of a building a hydronic heating system are slowly coming to an end.

Outdoor reset controls becoming the standard of the industry. As hydronic floor heating and constant circulation are synonymous, outdoor are also catching on with other types of radiator from panel radiator to copper fine tube.

The heating or mechanical contractor traditionally, if he doesn't wire the controls himself, subs it out to an electrical contractor. Most of us, however, including the electrical contractor, are not familiar with more complex control wiring unless we specialize in commercial control systems.

Most of the outdoor reset controls we are dealing with are not terribly complicated from a wiring aspect. As long as you know the basic rules, you can eliminate a lot of confusion in the field, panic phone calls to the supplier and the common troubleshooting technique of changing new-for-new components.

Here are some basic rules to follow:

### **Rule No.1:**

Do not assume that your wiring sub, who has done all your boiler work over the years, can also wire reset controls. These controls may be new to him and the new methods of wiring do not apply.

### **Rule No.2:**

If you do your own low voltage wiring, designate a person within the company to become the control expert. Have that person become familiar with standard wiring proce-

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dures and send this controls person to seminars and training sessions offered by controls manufactures so your company has a reliable person for installation of controls and troubleshooting.

### **Rule No.3:**

Learn basic control terminology and usage such as voltages, amperage, resistance, single pole/double throw, dry contacts and thermistors. some excellent literature is available from companies such as Honeywell, White Rogers and Barber Coleman.

### **Rule No.4:**

Don't be intimidated by looking at those little boxes controlling your new-age hydronic system. Learn everything about it. This is becoming increasingly important, not only for initial installation but also for future troubleshooting. You won't be able to rely on your wiring sub to do the troubleshooting for you because he won't know how the entire system is supposed to operate. You must be able to put the system to its pace to determine the problem. You must become self-reliant.

### **Rule No.5:**

Location of the outdoor sensor is critical. It must always be placed on the north side of the building where it is not exposed to direct sunlight at anytime. Do not mount the sensor next to outside exhausts, ducts or dryer vents. You don't want to get a no-heat call every time the customers do their laundry and the reset controls thinks it's in Florida.

### **Rule No.6:**

When roughing in the wiring before the walls are closed in, always use 4-lead thermostat wire for every room, outdoor, wind thermostat and solar sensor location (whatever is applicable). Even if you are only going to need two wires, it's handy to have spares when you need them.

### **Rule No. 7:**

Never install any sensor wires within line-voltage conduits. Do not attach

them with nylon fasteners to the outside of the conduit and do not bundle them together with other low-voltage wire. Keep them independent and at least a foot apart from other wires if running parallel. Crossing low- or line-voltage wires perpendicularly is OK. Not following this rule can cause your control to react erratically, because the sensor resistance reading can be and will be affected by it.

**Rule No.8:**

If you are dealing with an area prone to voltage spikes or electrical storms, always use power surge protection equipment to protect the control.

**Rule No.9:**

Follow the control's wire schematic methodically without crossing wires or mixing up terminals. Remember, if one little wire out of 20 is attached to the wrong terminal, nothing will work.

**Rule No.10:**

Always tag all the wires at the control master during rough wiring. Once the drywall is in place and you come back to complete the wiring, there will be a bundle of 10 to 15 wires. If you label them, you can get right to work. If not, you have hours of backtracking ahead of you because you will not know which wire goes where.

**Rule No.11:**

Never splice wires anywhere, but if it's absolutely necessary, keep the color coding the same. If you switch the color coding, you will certainly drive someone (perhaps yourself) crazy when time comes for the final wiring of the control.

**Rule No.12:**

When making the final control and sensor terminal connections, make sure that the wire is tight by tugging it gently by the terminal.

**Rule No.13:**

After all the sensors are in place, check them at the control base plate by taking resistance readings, which must conform with the temperature at the sensor and the

manufacturer's corresponding resistance chart.

If your ohmmeter reads infinity, you know you have a broken wire or disconnected sensor. If your meter reads zero resistance, you know that the wire is shorted out, most likely by a defective thermostat wire with leads touching internally. Remember those extra wires I mentioned in Rule No.6? This is when you need them.

**Rule No.14:**

When wiring the control output to the burner, pumps and mixing valves, make sure the control contact ratings are compatible with the controlling device, i.e. always make sure that the control output contacts are dry (no voltage) before going to any T-T terminals on relays or burners. If you don't, you will quickly smell the odor of a burned-out circuit board. Suppliers know how these burnouts happen. After the second try, the control is no longer to blame. It's a very expensive dart board approach no one can afford.

**Rule No.15:**

After all the base plate wiring checks out, take some output tests by jumpering the control terminals at the base to confirm proper operation. Once confirmed you are ready for ignition. Engage the reset control "brain" carefully into the wiring base plate and tighten the mounting screws.

Assuming all the checks have been made properly, you'll hear the whole boiler room come alive! We have lift off! It is a wonderful feeling of accomplishment and of a job well done. I must admit that even after 20 years, it's still music to my ears.

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