Control & Instrumentation

To help in selecting the most suitable equipment for your application, the operating characteristics of our ovens and furnaces are shown on their product bulletins. This bulletin more completely defines and explains these operating characteristics and their use as a guideline for equipment selection.

- CONTROL ACCURACY –

Temperature controllers have many different accuracy ratings for features such as set point, display, repeatability and calibration. For the purpose of our product bulletins, we have defined control accuracy as the ability of the temperature controller to maintain a constant temperature, by altering heat input, at the point in the equipment where the temperature is being sensed. For this reason, we have chosen the manufacturer's published accuracy rating of the temperature controller that would most affect the stability of temperature at this sensing point.

Product bulletins for equipment using non-electronic temperature controllers such as bi-metallic or fluid filled thermostats, list the control accuracy in degrees. In these cases, the control accuracy gives an indication of the maximum amount of cyclic variation which could be seen at the sensing point.

For electronic temperature controllers, the control accuracy on the product bulletins is shown as a percent of the span and is a comparison of the temperature at the sensing point to a calibration source. The span of the temperature controllers is typically 900°F, 1600°F or 2400°F, depending on the maximum operating temperature of the equipment. In most instances, the temperature fluctuation due to the electronic temperature controller is dwarfed by other system characteristics affecting temperature uniformity such as loading, exhaust rate and available heat input.

Equipment with heat input most closely sized to requirements will show the least fluctuation at the sensing point. Very large heat input (most often encountered in gas or steam heated equipment), can result in a large addition of heat input to the system before the temperature controller can react. This effect is minimized in gas and steam heated equipment by modulating the heat input rather than turning it on and off. Electric ovens with large heat input can minimize this effect by the installation of an SCR power controller.

Temperature controller accuracy is based on tests performed by the temperature controller manufacturer with published results. This is only one of the many specifications published by the temperature controller manufacturer. Complete temperature controller specifications are available upon request.

- TEMPERATURE UNIFORMITY –

Temperature uniformity is listed in degrees. This is a measurement of the distribution of heat within the oven work space. This data is the result of actual tests run in a stabilized empty oven with a minimum of nine thermocouples—eight thermocouples located at the corners of the work space and one in the center of the work space. The corner thermocouples are placed 2" to 12" from the work space edges (based on the size of the equipment) to be representative of the useable work space. Temperature uniformity will normally improve as the operating temperature is lowered.

Other factors may affect temperature uniformity adversely.

Blocking the air flow within the work space will adversely affect the distribution of heated air and, therefore, the temperature uniformity. Care must be taken to pick equipment with a recirculated air flow pattern suited to the product loading.

Temperature uniformity tests have been run with minimal exhaust from the equipment. Heat input that is required to offset a large exhaust rate can be compensated for by increasing heat input.

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However, a large exhaust rate can have a detrimental effect on temperature uniformity. Hot air exhausted must be replaced with cooler fresh air. The fresh air is heated by being recirculated through the heat source. The larger the exhaust rate, the less the fresh air is mixed before being exhausted. This will result in nonuniform temperatures in the recirculated air flow.

If tight temperature uniformity is required with a large exhaust rate, it may be necessary to increase the size of the recirculating blower in the equipment. Those applications which will require large exhaust rates should be discussed with our sales engineers. In furnaces, where the heat transfer is by radiant heat, high temperature fans can be added to the equipment or the heating elements zoned within the work space to improve temperature uniformity. These applications should be discussed with a factory sales engineer.

- RISE TIME–

The time required to heat oven air to set point (rise time) is a measure of available heat input and an indication of how fast an oven may heat up. The rise time information is based on actual tests measuring the time required for temperature at the sensing point to rise from room temperature to set point.

The rise time tests were run with an empty oven and a minimum exhaust rate. Lower than design voltage on electric equipment or insufficient gas pressure on gas equipment will reduce heat input and increase rise time. Increased exhaust or heavy loads will also increase the time required to rise to set temperature.

Initially, it is necessary to heat up internal steel and insulation that surrounds the work space. Once the equipment reaches the set temperature, additional time is required to stabilize temperatures within the oven. During this stabilization period, the insulation is heated and the temperature profile through the insulated wall will reach a steady state. As this happens, the output of the heat source will reduce from maximum to the much smaller amount required to offset the loss through the insulated walls and exhaust.

While both a high exhaust rate and a large load will increase the time to reach set point and stabilize, only the exhaust rate will increase power consumption after stabilization. Once the load is stabilized, the power consumption will be the same as for an unloaded oven.

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-SPECIFICATIONS-

Instruments have been selected to provide a full range of features at an economical price. Consideration has also been given to selecting instruments that are easy to understand and use. We can provide full installation and configuration of any other instrument. Also, alternate control arrangements such as remote or freestanding control panels are available. Please contact our sales engineers in your area.

STANDARD DIGITAL TEMPERATURE CONTROLLER - WATLOW PM4

- **Digital Display**, two LED, alphanumeric, 4 digit displays; 0.875" high for temperature display and 0.500" high for set point display
- **Accuracy**, ±0.1% of span plus 1 degree display error

STANDARD EXCESS TEMPERATURE INTERLOCK - WATLOW PM6

- **Digital Display**, two LED, alphanumeric, 4 digit displays; 0.425" high for temperature display and 0.275" high for set point display
- **Accuracy**, ±0.1% of span plus 1 degree display error

PROGRAMMABLE TEMPERATURE CONTROLLER - WATLOW F4T

- **Program Parameters**, 40 profiles of up to 50 steps each, a real-time clock with battery backup to allow starting profile at any time of day
- **Digital Display**, 4.3” color touch screen
- **Accuracy**, ±0.1% of span plus 1 degree display error
- **Connectivity**, Relay output for alarm or other notification, two (2) USB ports, Ethernet compatable
- **Also Available**
- Up to four (4) control channels of temperature, relative humidity or vacuum
- Monitor up to16 sensors
- Math and logic functions
- Digital inputs and outputs
- Data logging
- Graphic Trending

RECORDING THERMOMETER - HONEYWELL DR4300

- **Record**, 10" diameter circular chart 24 hour chart rotation (others available)
- **Digital Display**, 0.56" high, LED, alphanumeric, 4 digit display; LED status display
- **Accuracy**, ±0.25%of span plus 1 degree display error

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SCR POWER CONTROLLER

Silicon controlled rectifier power controllers are completely solid state industrial controllers that insure precise proportioning of electric power to the heating elements. Oven temperature is maintained smoothly and evenly over the entire temperature range of the unit. SCR power controllers minimize maintenance, as there are no moving parts or electrical contacts to wear out. Heating element fatigue is reduced since the elements do not cool between releases of electric power. Zero voltage firing, including the first one half cycle of voltage, minimizes radio frequency and electromagnetic interference. Transient voltage suppressor networks are included, and the units are provided with protective fusing.