

Temperature Uniformity – Hot or Cold Spots

WARNING: VOLTAGE AND AMPERAGE CHECKS, OR ELECTRICAL CHANGES SHOULD BE PERFORMED BY A QUALIFIED ELECTRICIAN OR MAINTENANCE TECHNICIAN. WORK PERFORMED BY UNQUALIFIED PERSONNEL MAY RESULT IN EQUIPMENT DAMAGE, PERSONAL INJURY OR POSSIBLE DEATH.

The following information is typical guideline items to check whenever temperature uniformity problems occur.

Common Temperature Uniformity Variables

- Volume and weight of products being processed.
- Process temperature(s), Ramp time(s).
- Product orientation (part racking or placement). Do not block supply air ductwork.
- Fresh-air and exhaust damper position (work chamber pressure and exhaust volume).
- Recirculation blower fan efficiency.
- General condition of equipment:
 - Doors.
 - Door seals.
 - Louvers
 - Recirculation blower fan.
- Wall losses.
- Non-linearity of gas valves and some SCR firing electric systems.

Equipment utilizing a modulating temperature control configuration are typically capable of achieving +/- 2.0% temperature uniformity at a given operating temperature

(Example: +/-10°F @ 500°F). This assumes the equipment is in good working order.

Equipment utilizing a On-Off temperature control configuration are typically capable of achieving similar temperature uniformity at a given point in the on-off cycle. An on-off control system introduces a temperature oscillation (saw-tooth effect) that is inherent. The uniformity spread will oscillate, following the temperature oscillation, with overall temperature uniformity dependent upon the amount of control oscillation. On-off control systems can typically oscillate from 5°F to 30°F.

Temperature Uniformity Check List

- Are the Recirculation fan(s) rotating in the proper direction? *Check the rotation arrow near fan drive assembly.*
- What are the cold motor amps of the Recirculation fan(s) motor? Check the motor amps with oven at ambient! (*with equipment at room temperature*). Low motor amps (*below 75% of nameplate*) could indicate incorrect fan rotation, an obstruction (*dirt or debris*) in the fan wheel or in the return or supply air duct-work or that the fan is operating below rated RPM, or the louvers are not adjusted properly.
- What is the condition of the door seals? The seals should be in good condition, they should be pliable with no rips or tears, and should mate with the door skin properly.
- What is the work chamber air pressure with all fans operating? On equipment operating up to 650°F, the chamber pressure should be neutral or slightly positive with respect to the room or work space the equipment is located. (slightly positive is preferred) On high temperature units (operating above

650°F) running pressurized can cause warping problems, it is generally recommended that you operate as close to a neutral condition as possible. The chamber pressure can be varied by making adjustments to either the fresh air or, the exhaust dampers.

An extreme negative condition would be with the exhaust damper full open and the fresh air damper full closed.

An extreme pressure or positive condition would be with the exhaust damper full closed and the fresh air damper full open.

- What is the condition of the return and supply air duct-work? Are the louvers loose, or damaged? Is the supply air being evenly distributed across all of the supply air duct/s louver openings?
- Is the supply air being evenly distributed across all of the supply air duct(s) louver openings?

Most ovens have adjustable louver openings, but some models only have fixed louver openings. If equipped with adjustable louvers, compare the ratio of supply louvers cross-sectional area of louver openings to that of the return louvers opening area. Generally a good rule of thumb is that the return louvers cross-section area should be approximately 1.5 times greater than the supply louver's area.

- Is the temperature controller sensor properly located?

Place a secondary thermocouple alongside the controller sensor to verify the accuracy of the controller and the sensor. The temperature controller may need calibration.

- Are you using certified thermocouple(s) for your test?
- When were the thermocouples last certified?

Repeated use of the test thermocouples will degrade their accuracy over time.

- Are you're survey or test thermocouples located within the estimated work zone, and is the oven allow to stabilize a minimum of thirty (30) minutes after each setpoint change.

Typically uniformity checks or survey are performed by using a test thermocouple grid. The test thermocouple grid will typically be setup within an established work zone or load car. The maximum recommended work zone area to survey would be the area inside of 12" down from top and 12" up from the floor and 6" from any interior surfaces (ducts, doors, walls, Etc.).

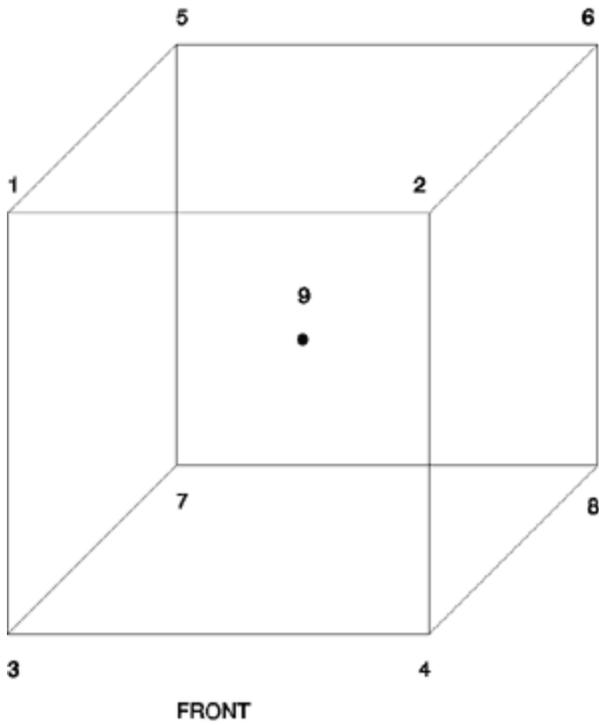
Exception #1: Reach-in series ovens a minimum of 6" away from ceiling and floor and 3" away from all interior surfaces.

Exception #2: Bench top series ovens a minimum of 3" away from all interior surfaces

The number of thermocouples used in a survey is typically based on the customer's QA specification. Our standard thermocouple survey would utilize a nine (9) point layout with an additional thermocouple tied alongside to the temperature controller sensor

(See Figure #1). The addition of additional survey thermocouples would be based on the work chamber size.

Standard 9-Point Thermocouple Layout



We hope you will find this information useful. THANK YOU for contacting us and allowing us to be a service to you. Please contact us at 1-800-473-7373 if you have any questions.

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