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Blue M

Batch-type Convection Ovens

w/ STAT-350, PRO-350, or PRO-550 Controller

Installation, Operation, and Maintenance Manual

TPS
Thermal Product Solutions
A Unit of SPX Corporation

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1.1 Instruction Notes

This manual contains **Notes, CAUTIONS, and WARNINGS** which must be followed to reduce the risk of improper maintenance, equipment damage, or personal injury. Read and follow all instruction notes. A description of these terms is as follows:

Note: *Contains any additional information important to a step or procedure.*

⚠ **CAUTION**: Contains information on hazards or practices which could lead to moderate personal injury or equipment damage.

⚠ **WARNING:** Contains information on hazards or practices which could lead to severe personal injury or death!

The ⚠ symbol (lightning bolt within safety alert triangle) precedes an electric shock warning statement.

1.2 Product Description

The Blue M batch ovens are industrial convection ovens available in single or double-door models. Common uses for the ovens are: epoxy curing, annealing plastics, preheating, PC board drying, post mold curing, and a variety of other uses.

The ovens come in various sizes ranging from 9 cubic feet (225 liter) to 96 cubic feet (2720 liter).

Temperature ranges for the ovens are as follows:

- Standard units: to 316°C (600°F)
- Extended range models: to 399°C (750°F)

Basic oven construction consists of heavy gauge cold-rolled steel outer chamber panels. Interior panels are constructed of type 304 stainless steel. Four inches of Fiberglass insulation is used between interior and exterior oven walls.

Heavy-gauge, high temperature, nickel chromium wire elements provide heating. Horizontal air flow is provided by direct drive blower that is self-lubricated.

Temperature control is accomplished through single-set-point or profiling temperature controllers. A separate controller with its own thermocouple provides overtemperature protection.

All models are available with a variety of options such as: light towers, chart recorders, redundant overtemperature protection controllers, and timers. See the sales order for the options included on your unit.

1.3 Operating Parameters

Equipment damage, personal injury, or death may result if this equipment is operated or maintained by untrained personnel. Operators and service personnel must be familiar with the location and function of all controls and the inherent dangers of the equipment before operating or maintaining it. Blue M shall not be liable for any damages, including incidental and/or consequential damages, regardless of the legal theory asserted, including negligence and/or strict liability. Observe the following operating parameters to reduce the risk of equipment damage and personal injury:

⚠ WARNING

- Read and understand this instruction manual and supplied drawings before operating or maintaining the equipment.
- Before using any of the materials or components specified in this manual, be aware of the handling, storage, and disposal precautions recommended by the manufacturer or supplier of the component. Failure to comply with the supplier's or manufacturer's recommendations may result in personal injury or component damage. See the suppler or manufacturer's manual(s) for more information.
- Do not remove or bypass any safety items or electrical circuits.
- Do not modify or change any component on this unit. Replacement parts must be original equipment manufacturer (OEM) specified replacement equipment. Modification or use of equipment other than its intended use may cause severe bodily injury and/or component damage and is therefore strictly prohibited.
- Obey all "DANGER" , "WARNING", and "CAUTION" signs/labels mounted on the equipment. Do not remove any of these signs/labels.
- Never operate the equipment with any guards or shields missing. If it is necessary for guards and shields to be removed for service, replace them before operating the equipment.

This equipment is designed to operate safely when the following environmental conditions are met:

1) Indoor use only.
2) Within a temperature range of 5°C to 40°C.
3) Maximum (non-condensing) relative humidity 90% at 40°C.
4) Supply voltage fluctuations do not exceed +/-10% of nominal voltage.

1.4 Cautions and Warnings

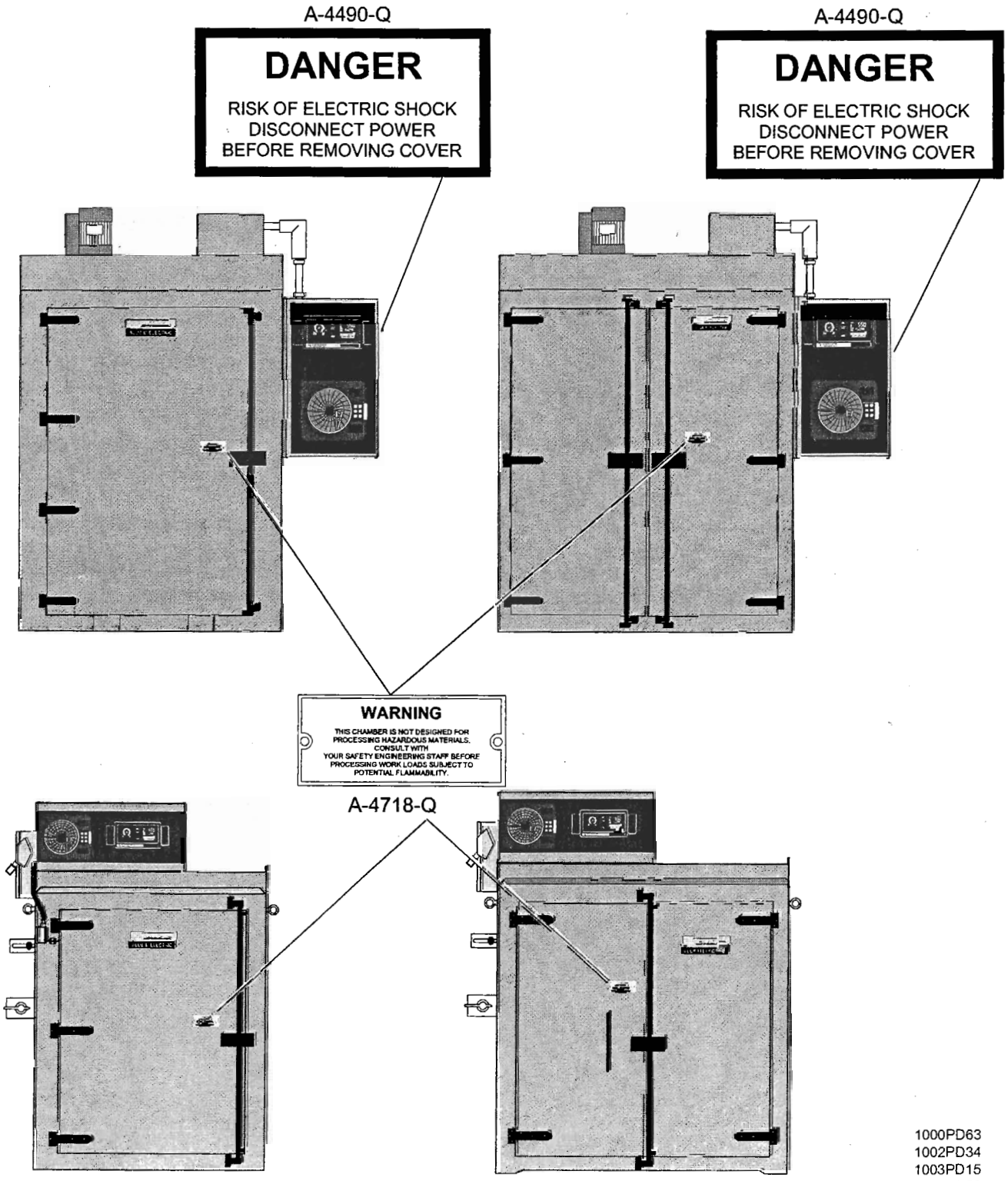
The following list of cautions and warnings will be found throughout this manual. Observe the cautions and warnings to reduce the risk of equipment damage and personal injury.

⚠ WARNING

- Do not install unit in corrosive environment. Corrosive environment may lead to poor performance and deterioration of unit.
- Explosion hazard. Do not place the unit near combustible materials or hazardous fumes or vapors.
- Pinch point hazard. To ensure proper operation of unit and for safety, make sure that unit is level when installed. Door(s) may swing shut on personnel if unit is tilted.
- Electric shock hazard. Connect unit to proper line voltage. Connection to improper voltage may lead to equipment damage and serious personal injury.
- Electric shock hazard. Disconnect power before entering control panel.
- Explosion hazard. Do not process explosive or hazardous materials in this unit. Equipment damage and severe personal injury can result from processing combustible or hazardous materials.
- Equipment damage hazard. Blower motor must have correct rotation. Severe damage will occur if unit is run with incorrect blower rotation.
- Do not overload the floor of the oven or load the oven unevenly.
- Do not arbitrarily change controller configuration settings. Autotuning should be done with a "dummy" load to prevent product work load damage. See controller instructions for detailed configuration and operation information.
- Severe burn hazard. Do not touch hot surfaces of oven.
- Electric shock hazard. Multiple power sources may be connected to the equipment. Shutting off power at the control panel does not necessarily mean that all power supplies are disconnected from the equipment, nor to any power panels or transformers. Before performing maintenance on any electrical equipment, verify that power is disconnected and locked out. Maintenance personnel must be aware of procedures for disconnecting power.
- Electric shock and severe burn hazard. Never perform troubleshooting while the unit is in operation.

1.5 Caution/Warning Labels

Replace any missing or hard-to-read caution/warning labels.



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1.6 Specifications

General Specifications

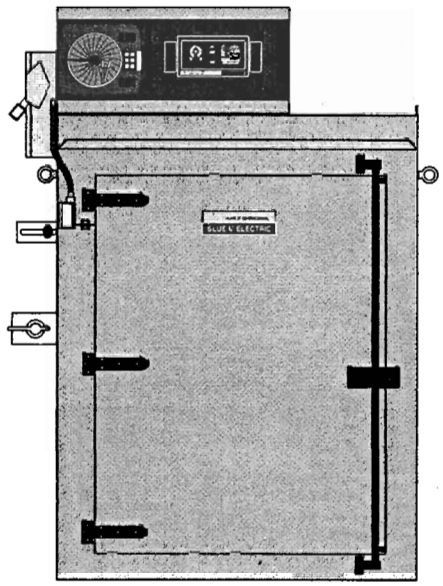
Temperature range: 15°C above ambient to 316°C (650°F)

Uniformity: ±1% of setpoint

Control accuracy: ±0.5°C

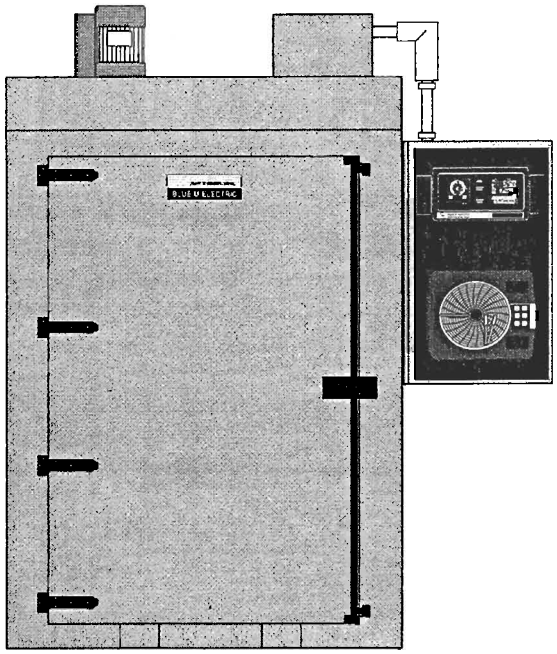
Resolution: ±0.1°C

- Empty chamber performance at rated voltage -



Condensed Specifications — Top Mounted

Model	106 (top mounted)	166 (top mounted)		246 (top mounted)		326 (top mounted)		366 (top mounted)	
Interior Volume ft³ (l)	9.0 (255)	16.0 (453)		24.0 (680)		32.0 (906)		36.0 (1020)	
Interior Dimensions WxDxH in. (mm)	19 x 20 x 39 (483 x 508 x 991)	24 x 24 x 48 (607 x 607 x 1219)		36 x 24 x 48 (914 x 607 x 1219)		48 x 24 x 48 (1219 x 607 x 1219)		36 x 36 x 48 (914 x 914 x 1219)	
Exterior Dimensions WxDxH in. (mm)	ENGINEERED	51 x 39 x 85 (1295 x 991 x 2159)		63 x 39 x 85 (1600 x 991 x 2159)		75 x 39 x 85 (1905 x 991 x 2159)		63 x 51 x 85 (1600 x 1295 x 2159)	
Machine Footprint ft² m²	TO	13.8 (1.28)		17.1 (1.59)		20.3 (1.88)		22.3 (2.07)	
Electrical Service	ORDER	Standard	High power	Standard	High power	Standard	High power	Standard	High power
208 VAC 3Ph 50/60 Hz Line Current (per ph)	CONTACT	9.0kW 29	13.5kW 42	11.0kW 33	16.0kW 48	14.0kW 42	20.0kW 61	14.0kW 42	20.0kW 61
240 VAC 3Ph 50/60 Hz Line Current (per ph)	BLUE M	12.0kW 33	18.0kW 47	14.0kW 38	21.0kW 54	18.0kW 47	27.0kW 70	18.0kW 47	27.0kW 70
480 VAC 3Ph 50/60 Hz Line Current (per ph)	ELECTRIC	12.0kW 17	18.0kW 24	14.0kW 19	21.0kW 28	18.0kW 24	27.0kW 35	18.0kW 24	27.0kW 35



General Specifications

Temperature range: 15°C above ambient to 316°C (650°F)

Uniformity: ±1% of setpoint

Control accuracy: ±0.5°C

Resolution: ±0.1°C

- Empty chamber performance at rated voltage -

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Glen

Condensed Specifications — Side Mounted

Model	606 (side mounted)		756 (side mounted)	806 (side mounted)		966 (side mounted)	
Interior Volume ft³ (l)	60.0 cu.ft.		75.0 (2125)	80.0 (2266)		96.0 (2720)	
Interior Dimensions WxDxH in. (mm)	36 x 48 x 60 (914 x 1219 x 1524)		36 x 60 x 60 (914 x 1524 x 1524)	48 x 48 x 60 (1219 x 1219 x 1524)		48 x 48 x 72 (1219 x 1219 x 1829)	
Exterior Dimensions WxDxH in. (mm)	80 x 63 x 93 (2032 x 1600 x 2362)		ENGINEERED	92 x 63 x 93 (2339 x 1600 x 2362)		92 x 63 x 104 (2339 x 1600 x 2642)	
Machine Footprint ft² m²	35.0 (3.25)		TO	40.2 (3.7)		40.2 (3.7)	
Electrical Service	Standard	High power	ORDER	Standard	High power	Standard	High power
208 VAC 3Ph 50/60 Hz Line Current (per ph)	18.0kW 59	26.0kW 84	CONTACT	21.0kW 67	30.0kW 93	24.0kW 76	NA
240 VAC 3Ph 50/60 Hz Line Current (per ph)	24.0kW 47	34.5kW 96	BLUE M	28.0kW 76	40.0kW 106	32.0kW 87	NA
480 VAC 3Ph 50/60 Hz Line Current (per ph)	24.0kW 34	36.0kW 48	ELECTRIC	28.0kW 38	40.0kW 53	32.0kW 43	48.0kW 62

1.7 Installation

These Installation Instructions contain general information on initial inspection and installation of unit. Read and understand these instructions before attempting to operate or service this equipment.

A. Uncrating

Carefully uncrate unit and all accessories. Visually inspect for any signs of damage from improper handling. Report all claims for damage to carrier immediately. Blue M will assist you with your claim, if requested. Do not return goods to Blue M without written authorization.

Do not discard the shipping container. A request for an inspection of the shipping container and equipment should be made to the carrier when a claim is submitted for shipping damage.

B. Location

This unit will maintain temperatures within its range to close tolerances for extended periods without adjustment. Producing results compatible with this unit's capabilities requires reasonable care in choice of location. Line voltage variations should be kept to a minimum for best control accuracy. Do not locate unit in areas of wide ambient temperature variation such as near vents or outdoor entrances. Unit should be placed at least 30 centimeters from walls, although more may be required for ease of maintenance. Do not install unit in circumstances that would inhibit venting.

Corrosive environments may lead to shortened life or deterioration of unit and performance.

⚠ WARNING: Explosion hazard. Do not place the unit near combustible materials or hazardous fumes or vapors.

⚠ CAUTION: Do not install unit in corrosive environment. Corrosive environment may lead to poor performance and deterioration of unit.

⚠ CAUTION: Pinch point hazard. To ensure proper operation of unit and for safety, make sure that unit is level when installed. Door(s) may swing shut on personnel if unit is tilted.

C. Power Connection

⚠ WARNING: Electric shock hazard. Connect unit to proper line voltage. Connection to improper voltage may lead to equipment damage and serious personal injury.

Chamber must be grounded. For personal safety and to ensure trouble-free operation, this unit must be properly grounded before it is used.

Consult the National Electric Code and local codes to ensure safety and compliance with appropriate codes. Utilize proper grounding techniques to reduce RFI (radio frequency interference) and EMI (electro-magnetic interference) for electronic gear. Do not connect unit to already overloaded power lines—lower voltage to unit will decrease power to heating elements.

⚠ WARNING: Electric shock hazard. Disconnect power before entering control panel.

D. Blower Rotation

Unit must be checked for proper blower rotation. Incorrect blower rotation results in a substantial reduction of airflow. Rotation is correct when a rapid movement of air can be felt from the right side of chamber interior.

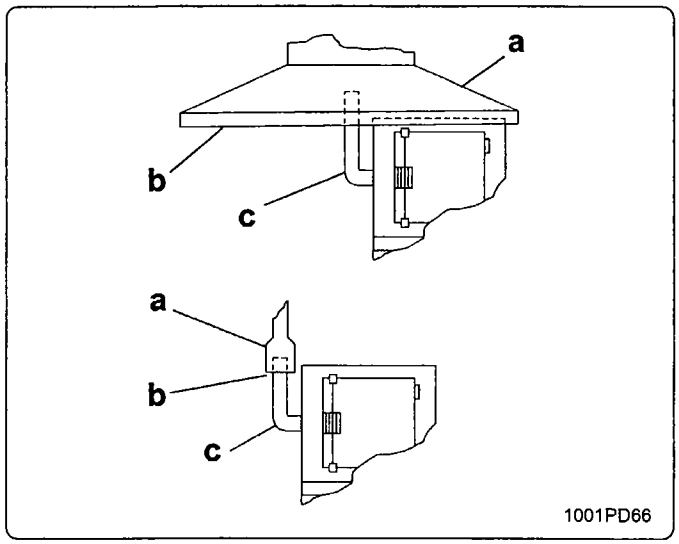
On three phase units, reversing any two of the incoming power lines will reverse blower rotation. Check airflow both ways to determine which produces greatest airflow.

Note: *The heating elements on three phase units will not energize if blower rotation is incorrect. As a safety feature, the unit has an air flow switch installed in the blower plenum of the oven. The pressure switch is used to sense the pressure differential created by the blower. If airflow is not great enough, caused by incorrect blower rotation, elements will not energize.*

E. Exhaust Modifications

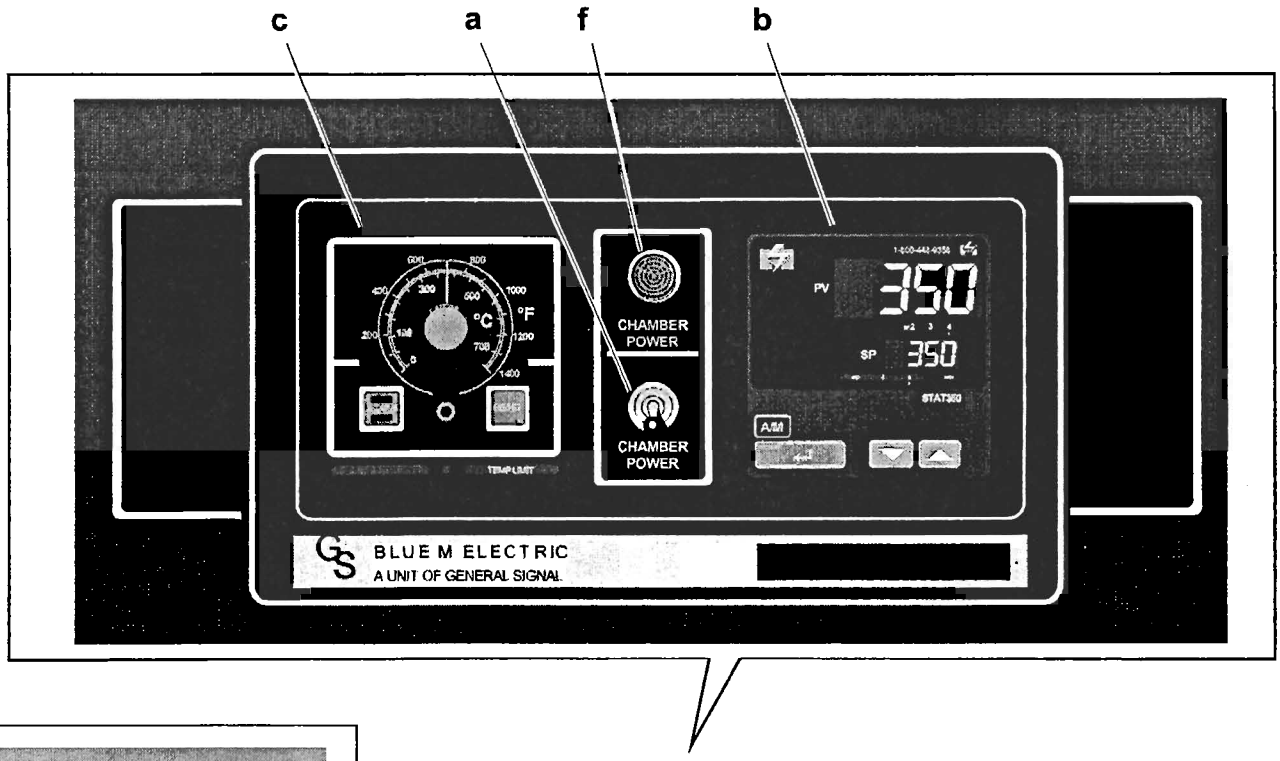
Note: *Never use an exhaust stack directly between unit and the exhaust. A draft diverter, vacuum breaker, exhaust hood, or similar device as shown in illustration must be connected between unit and exhaust. This is to prevent "chimney effect" which would suck heat out of chamber resulting in slow run-up time or poor temperature uniformity.*

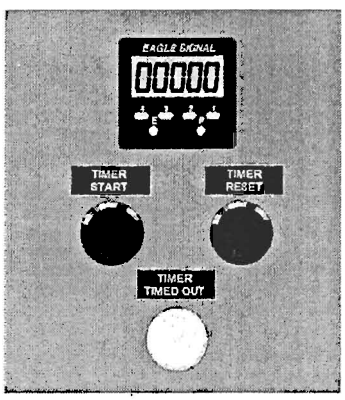
In the illustration, **(a)** refers to point of negative pressure where a vacuum draws exhaust. Point **(b)** is atmospheric pressure and no vacuum exists which would suck out exhaust from the exhaust outlet. Point **(c)** is the actual exhaust stack itself with direction of exhaust rising up to hood.



1.8 Control Layout

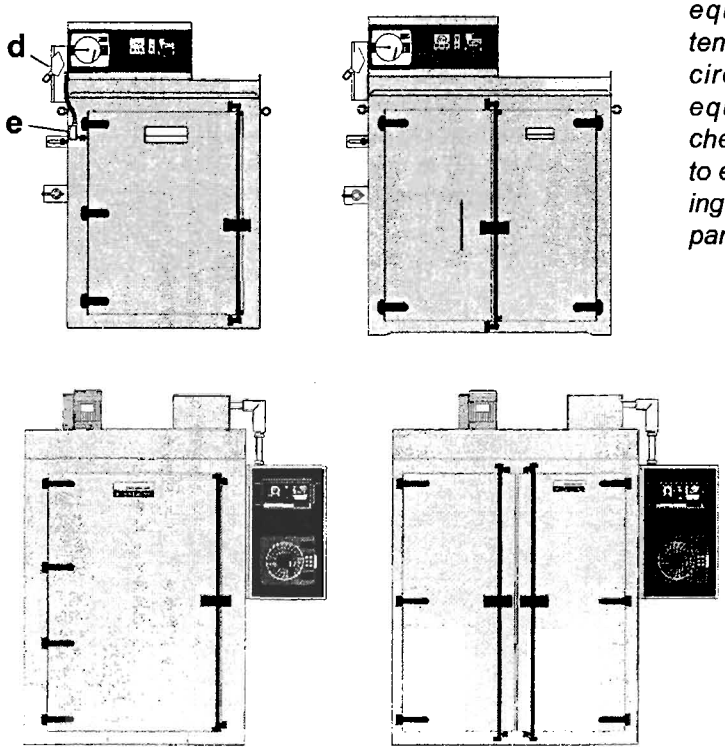
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Typical Optional Timer Layout

Typical Operation
The controller (STAT-350) establishes the temperature setpoint. Once at setpoint, press TIMER START pushbutton, the oven holds the setpoint for the duration of the time set by the timer. The TIMER TIMED OUT pilot light illuminates at the end of the timed cycle. Press the TIMER RESET pushbutton to reset the system for the next cycle.
Note: *Timer operation procedures may vary, check sales order and quote for specific operation.*



Note: *As a unit equipped with over temperature protection circuitry (OTP), this equipment must be checked once a month to ensure it is performing according to design parameters.*

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1.9 Operating Controls & Features

Toggle Switch — Main (a)

This toggle switch turns power on and off to the control circuit.

Temperature Controller — Main (b)

Your oven will utilize one of the following microprocessor based, PID-type controllers: STAT-350, PRO-350, or PRO-550. The STAT-350 functions as a single-setpoint controller. The PRO-350 is a programmable controller that can store 2 programs up to 10 segments each or a single 20 segment program.The PRO-550 is a programmable controller that can store up to 30 separate programs, 99 segments each, or one program of 300 segments.

Each controller controls power to the heating elements' solid state heat relays. A thermocouple is electrically connected to the controller to detect temperature data and automatically react as required. Each controller must be configured to your specific unit and its options before being used. **The controller is configured at the factory.** For more information on the configuration and operation of the controller refer to the appropriate controller user's guide included in your instruction package.

The PRO-550 utilizes a series of timers to enable "events". These events activate contactors, solenoids, or relays depending on the unit and how the controller is configured. which in turn control heating elements, water flow, inert gas flow, etc.. Refer to the wiring diagram event table for the specific events of your controller.

The PRO-550 controller may also be configured and programmed through LL-100 parameter setting software. This Windows-based software is included with your instruction package. Refer to the controller user's guide and the Yokogawa LL-100 instruction manual.

Temperature Controller — OTP (Over-temperature Protection) (c)

The OTP control is a fully independent system with its own thermocouple and FM approved controller. At over-temperature, the OTP controller will remove power to the oven. Turning the knob on front of the controller to the desired value sets the OTP setpoint. Usually, the OTP will be set 10°C above the main temperature controller setpoint. *Once tripped, it is necessary to press the reset square on the OTP controller to return power to the heating system.* The red light on the control indicates over-temperature. A green light indicates that unit is operating and not in an alarm condition. For additional information, refer to the Temp Limit instruction manual included in your instruction package.

Fused Disconnect (d)

Switch serves as the main power supply shut off and power connection point. Fuses protect entire unit from excess current and shorts. Switch is located on rear of some units (DC-606, 806, 966).

⚠WARNING: Electric shock and fire hazard. Replace blown fuses with same amperage rating as original.

OTP Alarm Buzzer

The alarm buzzer sounds when the unit has shut down from an over-temperature condition.

Pressure Switch

Pressure switch cuts power to the heating elements in event that airflow is insufficient due to blower motor failure, fan failure, or incorrect wiring of blower motor.

Door Switch (e) (optional)

Switch cuts power to heating elements in event that door is opened during operation.

Pilot Light — Chamber Power (red) (f)

This pilot light illuminates when chamber power switch is in the on position indicating power to control circuit.

The following two switches are located inside the control panel.

Limit Switch — Panel Interlock

This safety switch disconnects power from most exposed terminals within the control compartment whenever the panel is removed for service. However, you should remove all power by disconnecting the main line breaker before attempting any service or maintenance.

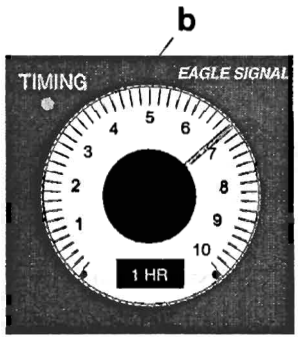
Keyed Switch — Interlock Override (if equipped)

This key lock switch is located on the side of the slide tray and is accessed when the control panel is slid out. This switch allows power to slide tray for troubleshooting when slide tray is out of unit. Switch is activated with key. Switch must be off and key removed before slide tray can be pushed back into unit.

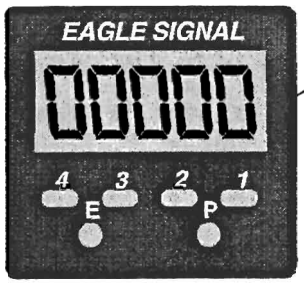
1.10 Optional Instruments



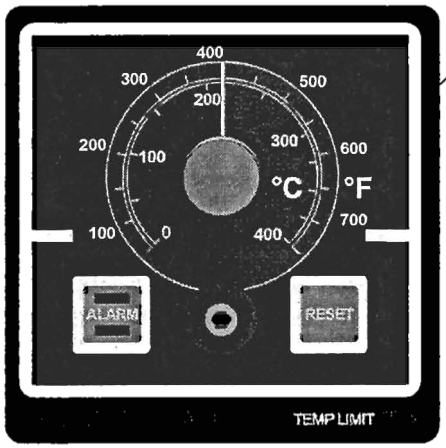
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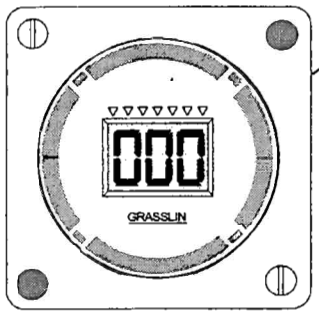
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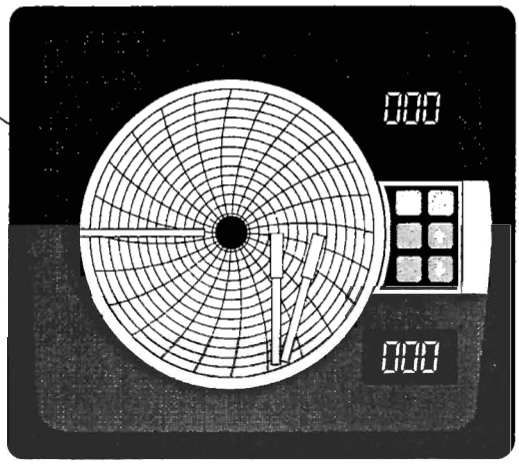
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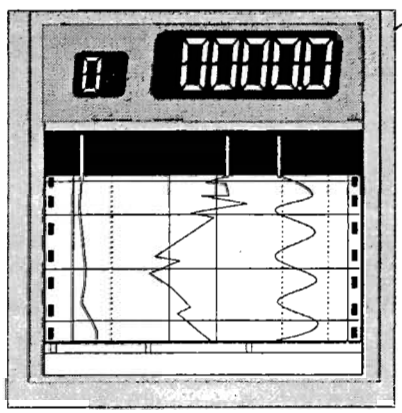
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Illustrations not to scale—for reference only.

1.11 Optional Instrument Functions

Items in *italics* are as shown on wiring diagram.

Light Tower (a)

The light tower includes alarm buzzer, red, amber, and green lights. Green light is lit during normal operations of program—no alarm conditions. The alarm buzzer sounds and amber light flashes signifying end of program cycle. The red light will illuminate signifying system alarm during program process. System alarms include: door open, OTP trip, either of the two air flow switches tripped, and/or overload of either blower motor.

Analog Timer (b)*

The analog timer is used for simple timed thermal processes. The controller (STAT-350) establishes the temperature setpoint. Once the oven is loaded and at setpoint, the operator presses the "Timer" button, and the oven holds the setpoint for the duration of the time set by the timer. When the timer expires an alarm sounds and the oven shuts off. Pressing the "Timer" button silences the alarm. The timer is adjustable up to 10 hours. See manufacturer's instruction for further information.

Digital Process Timer (c)*

The digital timer enables the oven to be used for simple timed thermal process which require precise settings or long cycle settings. The controller (STAT-350) establishes the temperature setpoint. Once at setpoint, the operator presses start, a timing light will illuminate and the oven holds the setpoint for the duration of the time set by the timer. The timer is adjustable up to 9,999 hours. A reset button is provided to reset the system for the next cycle. See manufacturer's instruction for further information.

Redundant OTP (d)

The OTP control is a fully independent system with its own thermocouple. At over-temperature, the OTP will remove power to the heating elements' solid state heat relays, but the chamber and forced exhaust blowers will remain on. The OTP setpoint is set by turning the knob on the front of the control to the desired value. Usually, the OTP will be set 10°C above the Main Temperature Controller. *Once tripped, it is necessary to press the reset square on the OTP control to return power to the heating systems.* The red light on the control indicates over-temperature. A green light indicates that unit is operating and not in an alarm condition. For additional information, refer to manufacturer's manual included in your instruction package.

Digital 7-day/24-hour Timer (e)*

This timer enables the oven to shut off at night and turn on and ramp back to temperature before the work day starts. The timer can be programmed to have different hours of operation for any day of the week. The controller (STAT-350) sets the temperature setpoint. The timer is then programmed with up to 10 on/off cycles which can be assigned to any combination of days. See manufacturer's instruction for more information.

MRC-5000 or BM 7000 Recorder (f)

Single- or dual-pen circular chart recorder measures, displays, and records temperature. See manufacturer's instruction for detailed information.

SR-1000 Recorder (g)

Single-pen strip chart recorder measures, displays, and records temperature. See manufacturer's instruction for more information.

*** Modes of Operation for Timers (on factory installed units)**

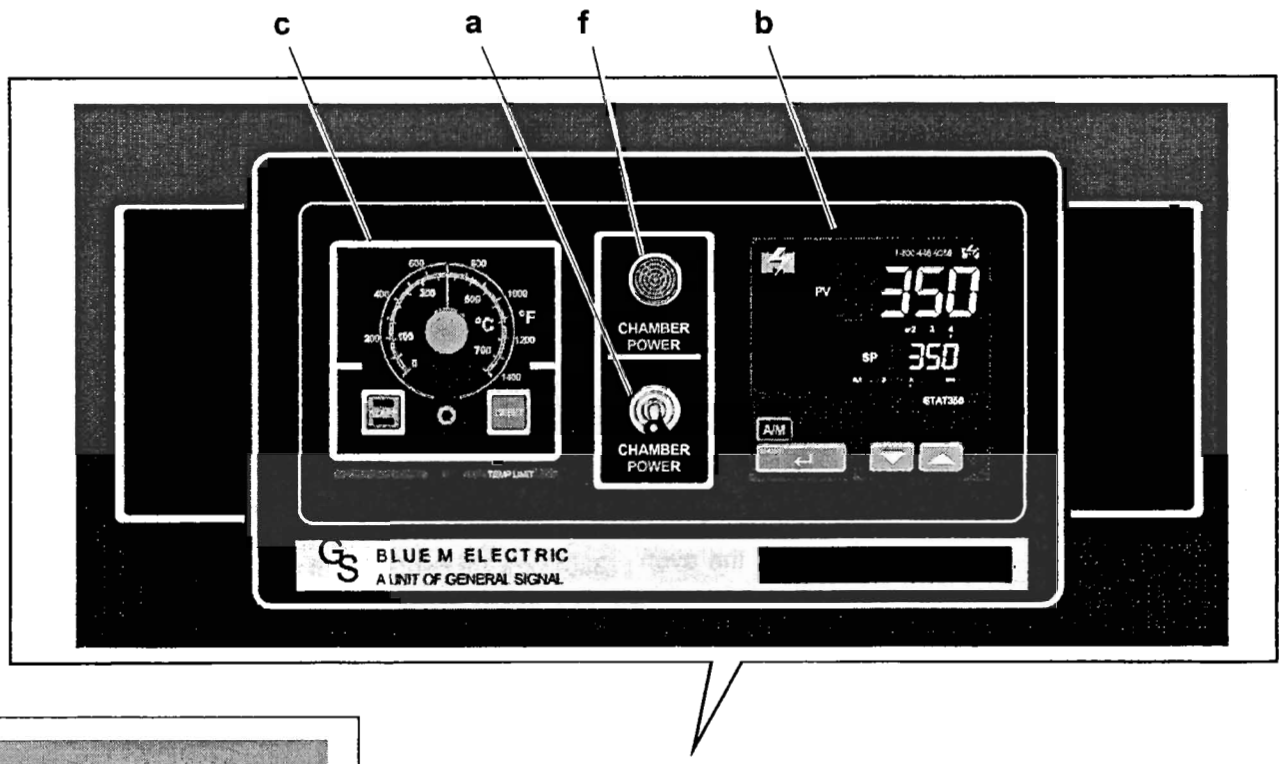
Standard Mode: When timer expires power is shut off to heating elements and blower, an alarm sounds and must be silenced through timer reset button.

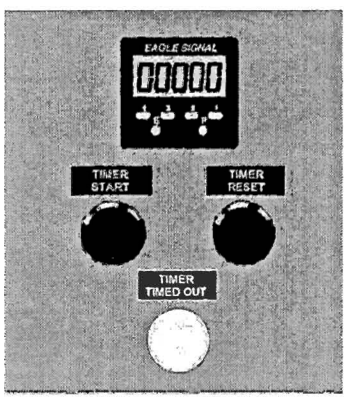
Option B: When timer expires blowers remain on, heat is shut off, alarm sounds. Press the timer reset button to silence alarm.
To configure: Remove wire from 5C terminal 5 and connect to terminal 29 on terminal block.

Option C: When timer expires oven stays at temperature, blowers remain on, and alarm sounds. Silence alarm by pressing timer reset button. Note this mode of operation is not available on 7-day/24-hour timers.
To configure: Place jumper from terminal 29 to terminal 4 on terminal block.

Control Layout

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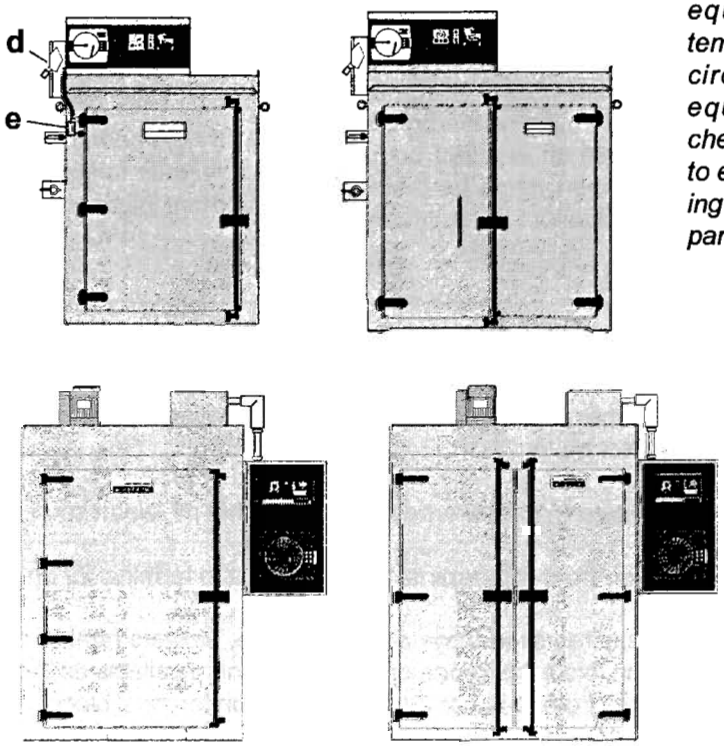


Typical Optional Timer Layout

Typical Operation

The controller (STAT-350) establishes the temperature setpoint. Once at setpoint, press TIMER START pushbutton, the oven holds the setpoint for the duration of the time set by the timer. The TIMER TIMED OUT pilot light illuminates at the end of the timed cycle. Press the TIMER RESET pushbutton to reset the system for the next cycle.

Note: *Timer operation procedures may vary, check sales order and quote for specific operation.*



Note: *As a unit equipped with over temperature protection circuitry (OTP), this equipment must be checked once a month to ensure it is performing according to design parameters.*

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