



Installation, Operations & Maintenance Manual

Garmat USA
Models 99270,
99273, and 99275

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FOR YOUR SAFETY

If You Smell Gas:

1. Open Window
2. Don't Touch Electrical Switches
3. Extinguish Any open Flame.
4. Immediatly Call Your Gas Supplier

FOR YOUR SAFETY

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions throughly before installing or servicing this equipment.

NOT FOR RESIDENTIAL USE.

**Garmat® USA, Models 99270, 99273,
& 99275 Direct Gas-Fired Industrial
Heater**

HEATER DESCRIPTION

The Garmat® USA, Inc. heater is a direct gas-fired fresh-air appliance. It is designed for indoor installation, outdoor installation with the proper sheltering from weather, with fresh outdoor air delivered to the combustion zone. The heater is designed for use with natural gas or LPG (check the heaters' rating plate). The direct gas-fired burner will modulate to maintain the selected air discharge temperature. This appliance is most suited for use with spray paint booths and associated equipment. It does, however, fill the need for non-recirculating building air make up.

INSTALLATION CODES

This equipment is designed and manufactured to provide years of safe and efficient operation. In order to retain these features, The installer (s) need to achieve certain installation and operation requirements. These requirements will be defined throughout this manual and should be specifically noted.

The type of fuel used with this equipment and it's proper firing rate are shown on the appliance rating plate. Electrical characteristics are shown on the rating plate as well. If the need for a change in fuel type occurs, the manufacturer must be consulted.

WARNING: THIS UNIT IS NOT FOR INSTALLATION ON COMBUSTIBLE MATERIALS. THIS UNIT IS TO BE INSTALLED ON CONCRETE OR OTHER NON COMBUSTABLE SURFACES.

WARNING: CLEARANCE AROUND THE UNIT TO COMBUSTIBLES SHOULD BE NO LESS THAN 4" (FOUR INCHES).

This equipment shall be installed in accordance with the standards of the National Fire Protection Association and the National Fuel Gas Code (NFPA 54).

Local authorities having jurisdiction must be consulted first to verify local codes and installation procedures. In the absences of such codes and installation procedures, the unit shall be installed in accordance with the National Fuel Gas Code ANSI Z223.1 - Latest addition.

HEATER INSTALLATION:

**CONFIGURATION AIR BOX
INSTALLATION**

The Garmat® USA air make up units are equipped with a configuration air box ("C" box). This "C" box needs to be attached to the top of the make up unit utilizing 3/4" number 8 self drilling screws. The screws should be sent through the framing of both the unit and the "C" box to ensure it's security.

burner size. Model 99270 have 0.84 MBTU burner. Model 99273 has a 1.0 MBTU burner and model 99275 has a 1.5 MBTU burner. The gas pipe connection size for the model 99270 will be 1” and for the models 99273 and 99275 will be 1 1/4”. A drip leg or trap at the inlet of the gas manifold is provided.

WARNING: PIPING MUST BE ADDED IN ORDER TO INSURE GAS TRAIN VENT IS PIPED TO THE OUTSIDE OF BUILDING. FAILURE TO DO SO WILL CAUSE GAS TO VENT INTO THE BUILDING AROUND THE MANIFOLD.

WARNING: ALL COMPONENTS OF THE GAS SUPPLY SYSTEM MUST BE LEAK TESTED PRIOR TO PLACING EQUIPMENT INTO OPERATION.

ELECTRICAL:

WARNING: SPARK TESTING OR SHORTING OF THE CONTROL WIRES BY ANY MEANS WILL DAMAGE THE CONTROL PANEL AND VOID THE WARRANTY.

All electrical wiring and connections, including electrical grounding, should be made in accordance with the National Electric Code ANSI/NFPA 70 current addition.

Although the Garmat® USA, Inc. air make up units are for use in most commercial heating applications, the main application of the unit is for use with a paint spray booth. The use of two 120 volt 20 ampere circuits for lighting will need to be supplied to the unit when

used in conjunction with a paint spray booth.

The motor requirements are as follows: for 3 PH, 10 HP units, 208 volt AC requires 30.8 Full Load Amperage “FLA”, 230 volt AC requires 28 FLA and 460 volt requires 14 FLA. For single phase, 10 HP motors 230 volt AC requires 50 FLA. The single phase motors are not available and a roto-phase inverter or buck booster is required and not provided by Garmat USA®.

For Three Phase 15 HP units, 208 volt AC requires 46.2 FLA., 230 volt AC requires 42 FLA., 460 volt AC requires 21 FLA. The single phase motors are not available.

For control voltage a transformer is provided to convert the motor voltage to the proper control voltage/s.

NOTE: ALL MOTOR AMPERAGE FIGURES ARE BASED ON NEC. LOCAL REQUIREMENTS MAY VARY.

WARNING: ELECTRICAL AND IGNITION SYSTEMS MUST BE PROTECTED FROM DRIPPING WATER. IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE, OR MAINTENANCE CAN CAUSE PROPERTY DAMAGE, INJURY OR DEATH. READ THE INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS THOROUGHLY BEFORE INSTALLING OR SERVICING THIS EQUIPMENT.

SAFETY SYSTEM

Manual High Limit (All models)

If any situation occurs creating a temperature reaching 200° F at the air discharge, power to the gas train circuitry will be terminated. At this point none of the operating components of the gas train will function. To reactivate the gas train the reset button on the limit switch must be depressed. The main application of this heater is for use with a paint spray booth and a additional high limit thermostat is provided for use in the spray mode to shut down the gas train if the discharge air temperature reaches 165 deg. F. This high limit is automatically resetting.

Air Flow Sensor (All models)

Air flow sensors are connected directly to the flame guard device. When a loss or lack of air flow, or too much air flow across the burner is sensed, the flame guard device will terminate power to the pilot solenoid and the connection of the temperature controller to the gas train modulator. The through-put air around the burner will need to be reestablished, or reduced for the burner to fire.

Flame Guard Device (All models)

The flame guard is a device that will check the burner for pilot during initiation and for pilot and main flame during full operation. The flame guard device uses a flame rod installed in the burner which will thermally induce a 15 - 18 volt DC signal in the flame guard device. During initiation there is a 10 second trial period. At the end of this time if there is no flame in the pilot area, the flame guard will lock out the burner system. The flame guard will need to be

manually reset to start initiation. It does not re-attempt initiation automatically.

The flame guard is a “one try” system that will require manual reset each time the device locks out. When a flame depletes or disappears in the burner during full operation, the flame guard will have a 10 second delay and will lock out the burner system. The flame guard will need to be manually reset at this point.

Temperature Control System (Models 99270)

The system uses an analog temperature controller with analog input and a 100% symmetrically modulating gas valve. The thermister connected to the temperature control will be placed in the air output of the make up air unit. The temperature controller internally limits the discharge temperature to 170° F when shipped. The manual high limit will act as a back up to this.

Temperature Control System (Models 99273 and 99275)

This system uses a digital temperature controller, a 100% modulator and a symmetrically modulating gas valve. The thermocouple connected to the temperature control will be placed in the air output of the make up air unit. The temperature controller internally limits the discharge temperature to 190° F when shipped. The manual high limit will act as a back up to this.

FREEZE THERMOSTAT (All Models)

In areas where the ambient temperature can fall below –20 deg. F, it is recommended that a low temperature limit control (freeze thermostat) be installed (not provided by Garmat USA®. The low temperature control shall be installed in series with the high limit switch in the gas train safety circuit.

High Gas Pressure Switch (Models 99273 and 99275)

This component is on the gas manifold and will disconnect electrical power to the gas train circuit before reaching the flame guard device. In the event that more than 21” WC of gas pressure enters the gas manifold at this point, the switch will disconnect the power and will need to be manually reset.

Low Gas Pressure Switch (Models 99273 and 99275)

This component is on the gas manifold and will disconnect electrical power to the gas train circuit before reaching the flame guard device. In the event that less than 3” WC of gas pressure enters the gas manifold or pressure drops below this point, the switch will disconnect the power and will automatically reset when pressure is restored.

Proof Of Closure Switch (Models 99273 and 99275)

This switch is mounted directly under one of the blocking valves on the gas train and is linked to the valve actuator and proves that the valve is closed before allowing electrical power to continue through the gas train circuit.

Cabin Pressure Control System

(Model 99270)

A manual ¼ adjust lever is provided at the exhaust pressure damper. A slack tube manometer is provided for monitoring the cabin pressure.

(Models 99273 and 99275)

The remote control panel contains a photohelic gauge. This gauge is displayed on the face of the remote panel and controls the air pressure within the cabin. This gauge is adjustable using the two orange needles visible on the face of the gauge. The gauge operates a modulating motor attached to exhaust pressure damper. Opening the cabin will cause loss of cabin air pressure.

PROGRAMMABLE LOGIC CONTROLLER (PLC) (All Models)

The electrical panel contains a programmable logic controller (PLC). The PLC controls all of the automatic functions of the control sequence including flash-off time duration, bake time duration and cool down time duration. Bake time duration is set at the remote panel on the 99270 deluxe, 99273, 99275 models. On the model 99270 the bake timer is internal in the PLC. Flash-off time duration and cool down time duration are internal functions of the PLC and are set at the factory. The factory setting of the flash-off time duration is three minutes and for the cool down time duration is ten minutes. These time durations can be reset by your authorized local authorized distributor.

OUTDOOR VENTILATION AIR (All Models)

Outdoor air must be ducted to the air make up unit inlet when unit is installed inside of a building. This ducting shall be no smaller than 30” square or the equivalent in crosssectional surface area in diameter of round ducting. Bends or transitions are not recommended and length should be kept to less than 5 meters or 16.5 feet. If bends or transitions are required, turning vanes are recommended.

LINE PRESSURE TEST (All Models)

The make up unit and its inlet manual gas valve must be disconnected from gas supply piping during any pressure testing above 21” WC. The air make up unit must be isolated from the gas supply system by closing the manual gas valve up stream of the regulator on the inlet of the gas manifold.

PROPER SEQUENCE OF OPERATION

The Garmat® USA Inc. air make up unit can be ordered with several different usage options. To simplify the sequence of operations, all four available options will be covered.

There are four modes of operation:
Power On, Run or Spray, Recycle or Bake and Shut Down.

Power On (Models 99273 & 99275)

The three phase voltage supplies power to the control transformer. The 120, and 24 volt is connected through the control transformer. When the power switch and spray switch are actuated, power is given to the motors. If either exhaust fan motor starter or the supply motor starter trips out on overload the respective motor and make up unit operations will cease until respective motor starter is reset. Both control voltages are protected with breakers in the main electrical panel.

A 120 volt jumper is provided in the main control panel which can be connected through a NC contact on a micro switch used for a fire suppression system.

When The NC contact is opened, the 120 volt control supply is removed from the circuit and the entire unit shuts down. The EM (Emergency stop) switch on the remote control panel does the same. Rotating the EM switch reconnects the 120 volt supply, unless the fire system has not been reset.

The green light will illuminate when the EM switch is rotated clockwise. The 120 volt control power is connected through the EM switch in the remote control panel. If either motor starter trips out on overload, a red light will illuminate for the respective motor and make up unit operations will cease until respective motor starter is reset. Both control voltages are protected with breakers in the main control panel.

Run or Spray (Models 99270 and 99270-E)

With the OFF switch on the spray cycle can be started by pushing the SPRAY switch. The air make up will run in the

spray mode until it is switched to either the OFF switch or the BAKE switch is pushed. The SPRAY mode provides 120 volt to the PLC, which in turn supplies 120 volt to starter SM2 and the temperature controller in the remote control panel. SM2 is present for controlling an exhaust motor. As soon as SM2 is energized, 120 v power is supplied to SM1 through the PLC after a timed delay. SM1 is provided for controlling the motor contained within the air make up unit and a timed delay will still be present to delay start up. SM1 allows 120 volt power to be supplied to the green light for the supply motor and the burner thru the PLC. Both are located on the remote control panel.

When the burner switch is set to the winter position, 120 volt power is provided to the PLC, which supplies 120 volt power to the gas train power circuit. When the burner switch is in the summer position the gas train power circuit will not be energized in the SPRAY mode.

Bake (Models 99270)

With the OFF switch on and the SPRAY switch on Placing the BAKE switch in BAKE provides 120 volt power through the PLC internal bake timer. For the 99270 deluxe model the bake timer is located on the face of the remote panel.

The BAKE switch supplies 120 volt power to the PLC in the main control panel, which begins the delay cycle. The purge timer should be set for a minimum of 3 minutes. At the completion of the delay cycle, 120 volt power is supplied to the change over damper solenoid. In turn, the change over damper is opened pneumatically releasing the damper air

valve. When the damper valve is released, the change over damper solenoid is energized, the compressed air solenoid is de-energized. The lighting circuit is also removed from 120 volt supply. This drops out the lighting and compressed air source for spray. The PLC supplies 120 volt power to the gas train power circuit.

In bake the PLC places the temperature controller in the second set point or 2SP. This is the bake mode setting. At the end of the programmed bake time, whether 1 or 999 minutes, the PLC initiates the shut down mode.

Shut Down

The bake timer initiates the timed shut down mode. The supply to the change over solenoid is also reestablished. The change over damper closes. The lights come back on and the temperature controller returns to the first set position, SP. If burner switch is in the summer position, the PLC will shut off the gas train circuit.

At the end of the timed cool down cycle (1 to 10 minutes), all functions of the unit will shut down completely, with the exception of the lights. The PLC interrupts the 120 volt power to the exhaust fan, the intake fan and the burner circuit. The lights in the booth will remain “on” until switched off. The PLC will hold the unit in the “off” status until the power is interrupted to the system by pushing the OFF switch to “off” and back “on”.

Bake (Models 99273 and 99275)

Placing the OFF-SPRAY-BAKE switch in BAKE provides 120 volt power through the PLC to the bake timer located on the remote control panel and power to the change over damper solenoid. The timer will begin the timing sequence. The bake timer should be set in the “C” mode on the left of the timer face and the “M” mode on the right. “M” is for minutes.

The bake delay timer supplies 120 volt power to the PLC in the main control panel, which begins the delay cycle. The bake delay timer should be set for a minimum of 5 minutes. At the completion of the delay cycle, 120 volt power is supplied to the change over damper solenoid. In turn, the change over damper is opened pneumatically releasing the damper air valve. When the damper valve is released, the compressed air solenoid is de-energized and the lighting circuit is removed from 120 v supply. This drops out the lighting and compressed air source. The PLC supplies 120 volt power to the gas train power circuit.

The PLC places the temperature controller in the second set point or 2SP. This is the bake mode setting.

At the end of the programmed bake time, whether 1 or 999 minutes, the PLC initiates the shut down mode.

Shut Down

The bake timer initiates the timed shut down mode. The supply to the change over solenoid is also interrupted. The change over damper closes. The lights come back on and the temperature controller returns to the first set position, SP. When the burner switch is in the

summer position, the PLC shuts off the gas train circuit.

At the end of the timed cool down cycle (1 to 10 minutes), all functions of the unit will shut down completely. The PLC interrupts the 120 volt for all components, including the exhaust fan, intake fan, and burner circuit and holds the unit in an “off” status until the OFF/SPRAY/BAKE switch is set to the OFF position. The shut down mode can be interrupted at any time by switching the unit to Spray.

GAS TRAIN POWER CIRCUIT (Models 99270)

With the OFF switch on and the SPRAY switch in the SPRAY position and the burner is in the WINTER position, or if the BAKE switch is in the BAKE position the PLC provides 120 volt power through the Manual High Limit. This allows 120 volt power to be provided to the Flame Guard Device. The Flame Guard Device starts a 7 second delay before ignition. When this time delay is finished, both the ignition transformer and the pilot solenoid are energized. If the flame rod in the burner provides proof of flame to the Flame Guard Device, the ignition transformer is shut down and the normally open vent valve is closed and the main gas valves open. After the main gas valves have opened, the PLC closes the circuit between the temperature control and the gas manifold modulating valve.

If the Flame Guard Device does not receive proof of flame in the burner within 10 seconds, the pilot solenoid and the ignition transformer will be de-energized. The Flame Guard Device will shut down the gas train.

The burner green light is denergized on the remote control panel. The Flame Guard Device will need to be manually reset to start the process over.

GAS TRAIN POWER CIRCUIT (Models 99273 and 99275)

When the OFF-SPRAY-BAKE switch is in the SPRAY position and the burner is in the WINTER position, or if the OFF-SPRAY –BAKE switch is in the BAKE position the PLC provides 120 volt power to the Low Gas Pressure Switch. The 120 volt power continues to the High Gas Pressure Switch and proceeds to the Proof of Closure Switch, continuing to the Manual High Limit. All of these components must allow the 120 volt power to be provided to the Flame Guard Device. When the 120 volt power reaches the Flame Guard Device it passes through directly to the High Air flow Sensor and the Low Air Flow Sensor. The Air Flow Sensors prove air flow and the Flame Guard Device starts a 7 second delay before ignition. When this time delay is finished, both the ignition transformer and the pilot solenoid are energized. If the flame rod in the burner provides proof of flame to the Flame Guard Device, the ignition transformer is shut down and the normally open vent valve is closed and the main gas valves are opened. After the valves are open, the PLC closes the circuit between the temperature control and the gas manifold modulating valve.

If the Flame Guard Device does not receive proof of flame in the burner within 10 seconds, the pilot solenoid and the ignition transformer will be de-energized. The Flame Guard Device will send a signal to the PLC. The PLC

switches the 120 volt power from the burner green light to the burner red light on the remote control panel. This also de-energizes the gas train power circuit. The Flame Guard Device will need to be manually reset to start the process over.

COMPRESSED AIR FOR SPRAY APPLICATION WITHIN BOOTH (All Models)

A solenoid is provided to control the compressed air source in a paint spray booth. It is located in the main control panel. 120 v power is provided to the solenoid through the PLC to the exhaust pressure switch, door air switch and return air switch. The make up unit must be in the Spray mode for compressed air to be provided to the spray booth.

CHECK, TEST, START UP PROCEDURES (All Models)

CAUTION: HIGH VOLTAGE PRESENT IN PANEL

Before Start Up

1. Inspect roof caps, inlet, and outlet of the air make up unit for any debris that can block airflow.
2. With multimeter, test motor voltages to assure that they agree with the tag on the unit. In addition, test the lighting voltage. Make sure that the breakers at the building panel and/or the fuse in the disconnect match the amperage ratings on the makeup units' information tag.
3. Inspect the burner to assure that the assembly is tight and in the proper place. Inspect the flame rod, ignitor and pilot

gas tube for tightness and good connection. Make sure that the air flow sensor tube is tight and well connected.

4. Perform gas pressure test at test port on inlet manual gas valve and assure that the maximum pressure listed on the unit information tag is not exceeded. In addition, check that there is enough gas pressure and capacity for burner size.

5. Check all gas lines and gas manifold for leaks.

6. Double check all electrical connections to the unit.

Start Up

1. Bump start the motors and check for proper rotation. Correct rotation if necessary.

2. Connect amp probe to motor circuits and turn unit on. Document amperages for each power leg and date. Assure that motors are within their motor plate amperage ratings. Leave documentation in the control panel and send copy with warranty information to manufacturer.

3. Install gas pressure gauges on the on manual gas valves of the gas train. After unit is up and running, turn burner on. While waiting for gas train safety to complete it's cycle, turn burner manifold manual gas valve off. When ignition sequence has completed and pilot flame is present, use the pilot orifice on the gas manifold to adjust the pilot flame to approximately four (4) inches in height, or the size of a fist. If a freeze thermostat is install for extremely cold climates, (below -20 deg. F.) the burner will not start if the temperature across the burner is below -20 deg. F.

4. Adjust high fire setting by viewing gas meter at the test port on the burner manifold manual gas valve.

Set the temperature controller on the remote control panel to the manual setting and set output to 100 %. Open the burner manifold manual gas valve long enough to acquire reading and close the valve. The pressure should be 4.2" WC minimum and should not exceed 5.2" WC maximum. Adjust regulator if necessary and test again. Set temperature controller back to 0.0 % output and open output manual gas valve.

5. Adjust the burner ribbon with the temperature control in the manual setting and set to 0.0 % output. Viewing the burner, adjust the zero increase potentiometer in the top of the gas manifold modulating motor. Adjust the zero increase until a small flame is ribboning across the bottom of the burner trough. When adjustment is correct, set temperature control back to the auto setting. Increase and decrease the temperature setting on the temperature control to check for proper operation.

6. Set the bake timer to 5 minutes. On 99270 model push the SPRAY and the BAKE switches. On the 99273 and 99275 units set the OFF/SPRAY/BAKE switch to the BAKE position. Wait for change over to occur. After 3 minutes the dampers should change over to recycle. When the bake timer times out, the cool down cycle will begin. The entire unit should shut down after the cool down cycle is complete.

7. Test air through- put and change sheaves if necessary.

the air flow direction indication on the filter frame when reinstalling.

MAINTENANCE INSTRUCTIONS (All Units)

1. Motor bearings should be lubricated at 4 month intervals.
2. Drive belts should be adjusted at least two times during the first two hours of operation. Adjust for 1/2 inch deflection with medium pressure at middle of belt span. Belts should be replaced annually.
3. Blower wheel should be periodically inspected for build up of dust or dirt and cleaned if necessary.
4. Annually check the burner and components. The flame rod should be changed annually.
5. The air flow sensing switch and tubing should be checked periodically for obstructions or debris.
6. The metallic inlet air filters should be cleaned in 4 month intervals. Observe

TROUBLE SHOOTING CHART

SYMPTOM	POSSIBLE CAUSE	ACTION RECOMMENDED
NOTHING WORKS (GREEN POWER LIGHT IS NOT ON)	EM switch is off. Incoming 1 PH voltage is off. The 120 volt control breaker in main panel is tripped.	Turn EM switch on. Check for incoming 3 phase voltage. Reset breaker in main control panel.
NOTHING WORKS (RED POWER LIGHT IS NOT ON)	Overload relay is tripped. loss of phase. Low 3 phase voltage.	Reset overload relay. Check for 3PH. Measure 3PH voltage.
EVERYTHING WORKS EXCEPT BOOTH LIGHTS	Lighting breaker(s) tripped. Change over damper stuck open Control air is off.	Reset lighting breaker(s). Check change over damper. Ensure control air is set at 40-60 PSI.
TEMPERATURE DOES NOT RISE (BURNER GREEN LIGHT IS ON)	Outside air temperature is greater than set point. High limit is tripped. Low gas Pressure. High gas pressure. Proof of closure switch is open.	Increase set point on Temperature control. Reset high limit. Check low and High gas switches. Check Proof of Closure switch. If problem persists call an authorized Garmat® service technician.
TEMPERATURE DOES NOT RISE (BURNER RED LIGHT IS ON.	Pilot has failed during ignition cycle. Pilot manual gas valve Turned off.	Push red reset button on red box marked Fireye. Turn manual pilot valve on. If lockout continues , call Garmat® authorized service Technician.
TEMPERATURE TOO HIGH DURING SPRAY MODE.	Controller set in second set point. Outside temperature above 70 ° Fahrenheit.	Check temperature controller display. Set burner Switch to summer setting.