GLOBAL FINISHING SOLUTIONS

GUL and BT Air Heaters

Owner's Manual

Document Number: 239-097 rev 2
Publication date 12/22/2021

Read and keep this manual for future reference. All personnel operating the equipment described in this manual should review and understand all instructions before use.

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Introduction

About Global Finishing Solutions LLC

Leading the Industry in Paint Booth and Finishing System Technology

With decades of experience, Global Finishing Solutions is the leading manufacturer of paint booths and finishing systems for many industries, including automotive refinish, aerospace and defense, industrial manufacturing, woodworking, and large equipment. By combining high-quality components, strong relationships with paint manufacturers, and our experienced distribution network, GFS provides the best equipment and support to set your business up for success.

Contacting Global Finishing Solutions

General information

- Toll-free: 800-848-8738
- Fax: 715-597-2193
- Email: info@globalfinishing.com
- Online: www.globalfinishing.com

Technical support

- Toll-free: 800-848-8738
- Fax: 715-597-8818
- Email: techservices@globalfinishing.com

Parts and filters

- Toll-free: 800-848-8738
- Fax: 888-338-4584
- Email: parts@globalfinishing.com

Target audience

This document is intended for use by trained, experienced installers and maintenance technicians. If you have questions about the installation procedure described in this manual, contact GFS as described above.

Conventions used in this manual

This section describes how information is presented, organized, and referenced within this manual.

Safety notices

This manual uses the following standards to identify conditions related to safety hazards and equipment damage.

Table 1. Safety notices

Symbol	Description
DANGER	Indicates an imminent hazard that will result in death.
WARNING	Indicates a hazard that can result in serious personal injury or death.
CAUTION	Indicates a hazard that can result in personal injury.
NOTICE	Indicates a situation that can result in equipment or property damage, but poses no risk of personal injury.

Information notices

In addition to the safety notices described above, this manual uses a boldface keyword to identify certain other types of information.

Table 2. Information notices

Keyword	Description
NOTE	Denotes general information that provides additional context or guidance.
Important	Denotes information to which you should pay special attention.
Reference	Directs you to related content in a separate document.
Prerequisites	Specifies other tasks that must be completed or conditions that must exist before you perform the current task.
Scope	Describes limitations to the current task or conditions under which the task applies or does not apply to the procedure.

General safety

Follow all safety guidelines when assembling, operating, or servicing this product.

WARNING
There are inherent hazards associated with the operation and service of this equipment. For your personal safety, observe all safety information. Failure to observe these safety practices can result in personal injury or death.

WARNING
Operation and maintenance of this product must be performed properly by qualified personnel who observe the warnings in all documentation and notes provided with and on the product.

WARNING
Follow all general standards for installation and safety for work on installations. Follow all good practices for the proper use of lifting tackle and equipment. The use of protective equipment such as safety goggles and protective footwear must be considered.

WARNING
All persons who will operate, service, inspect, or otherwise handle this product must read and understand the safe operating practices, safety precautions, and warning messages in this documentation.

WARNING
The roofs of GFS equipment are not designed or intended to be walked upon or to support weight of any kind. As designed and manufactured, equipment roofs do not meet the minimum requirements of a safe walking and/or working surface under OSHA 1910.22. Under no circumstances should the roof be used by maintenance personnel or others for walking, standing, or storage of any kind. When necessary, roof access should be secured through the use of a properly supported platform that satisfies the minimum load requirements specified by ASCE 7 (Minimum Design Loads and Associated Criteria for Buildings and Other Structures) and ASCE 37 (Design Loads on Structures during Construction). Additionally, personnel should always utilize appropriate fall safety protocols when using an elevated platform. Use of the roof in a contrary manner may result in injury and/or death.

WARNING
Comply with OSHA guidelines and with all applicable local electrical, safety, and fire codes and standards.

WARNING
All field wiring provided must comply with local codes or, in the absence of local codes, the National Electrical Code (NFPA 70).

WARNING
Electrical installation should be completed by a qualified electrician. Installation must meet all applicable national, state, and local electrical codes.

WARNING
Ensure that all electrical components are grounded to a central ground.

WARNING
Disconnect and lock out the main electrical service before installing, adjusting, or servicing the product.

WARNING
Lockout the main gas shutoff valve before maintenance or inspection of the air heater.

WARNING
Guards and covers that prevent contact with electrically energized or moving parts are required and must not be removed or left open during operation.

WARNING
Local fire and building codes require fire protection. Check with local inspector authorities for requirements.

CAUTION
Read and save these instructions before attempting to install, operate, or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage. Retain these instructions for future reference.

CAUTION
This manual contains statements that relate to worker safety. Read this manual thoroughly and comply as directed. Operate this equipment in accordance with the guidelines set forth in this manual. It is impossible to list all potential hazards of this equipment. Instruct all personnel involved with this equipment in the safe conduct and operation of the system. GFS recommends that only qualified personnel operate and maintain this equipment.

CAUTION
Safety signs, panels, and labels that are normally affixed to the product must be replaced immediately if illegible or missing.

CAUTION
New or replacement parts that are installed during repair or maintenance must include all safety signs, panels, and labels as specified by the manufacturer. These must be affixed to the new or replacement parts as specified by the manufacturer.

CAUTION
Where applicable, use earplugs or take other safety measures for hearing protection.

NOTICE
product must be installed and serviced only by a trained, qualified service technician. Incorrect installation may void the warranty.

NOTICE
If you have questions about the warranty, please contact your distributor prior to contacting GFS.

Air heater safety

WARNING
All equipment must be operated and maintained in accordance with local, state, and federal (OSHA) requirements governing occupational safety, fire protection, and air heater operations. Operators must read and understand GFS and included independent equipment and/or component manufacturer's instructions prior to use. **Disclaimer:** GFS is not responsible for any injury, illness, or property damage that results from not abiding by local, state, or federal (OSHA) requirements that govern occupational safety, fire protection, and air heater operations. GFS is also not responsible for any injury, illness, or property damage that is the result of not adhering to GFS and/or independent equipment/component operating, service, maintenance, and/or installation requirement's or directives.

WARNING
Refer to the air heater nameplate to determine the minimum and maximum gas supply pressure for the air heater. The inlet gas pressure must not exceed the pressure indicated on the nameplate.

WARNING
Install the air heater in compliance with locally enforced codes and standards.

WARNING
Install the manual emergency shut-off valve in an appropriate location to allow access to the valve to shut off the fuel process heater in the case of a fire or explosion at the heater.

WARNING
Gas piping must be installed to conform with local building codes, or in the absence of local codes, the latest edition of the National Fuel Gas Code, ANSI Z223.1 (NFPA 54). In Canada, gas piping must be installed in accordance with CAN/CGA-B149.1 for natural gas units and CAN/CGA-B149.2 for propane units.

WARNING
A fire suppression system is required by the International Fire Code and NFPA 33. A fire suppression system is not supplied with this equipment.

WARNING
On air heaters that recirculate room air, outside ventilation air must be provided in accordance with the information shown on the air heater nameplate.

WARNING
Fuel bleeds and vents must be vented outdoors.

WARNING
Treat used filters and any other paint-contaminated items as flammable products and dispose of them safely.

WARNING
Improper disposal of used filters may cause spontaneous combustion. You must consult local authorities for proper storage and disposal requirements. Guidelines include:

- Immediately remove all contaminated filters.
- Discard filters to a safe, detached location, place them in a noncombustible container with tight-fitting lid, or place them in a water-filled metal container to prevent a possible fire hazard.
- Disposal varies depending on the type of paint that is being captured. Consult local authorities for storage and disposal requirements.

WARNING
If you smell gas:

1. Open windows.
2. **Do not** touch electrical switches.
3. Extinguish any open flames.
4. Immediately call your gas service provider.

CAUTION
Become familiar with all controls before operating or servicing this air heater.

NOTICE
The GUL/BT air heater is intended to be used with GFS auto refinish paint booths and prep stations. The air heater must be interlocked with a powered exhaust system to prevent over pressurization when the heat system is operating at its rated capacity.

NOTICE
GFS recommends storing crates indoors pending installation. If you must store crates outside, protect crates and their contents from moisture to prevent damage to equipment.

NOTICE
Install the control panel per NFPA 70 and local codes and standards.

NOTICE
Failure to anchor the air heater structure to the floor properly may result in structural damage.

Air heater description

Designed for indoor installation, direct-fired GUL2000 and BT1200 air heaters draw fresh outside air over a gas-fired burner. The air heaters are designed to elevate the temperature inside the booth to provide a comfortable atmosphere for applying paint, followed by a higher temperature cure cycle.

Air heater installation

Air heater location requirements

WARNING
The top, back, and front surfaces of this heater may not be installed less than 6 inches from combustible materials.

NOTE
The following clearances are required to perform air heater operation and maintenance procedures:

- Clear space of 3 feet is required for access to the control panel.
- Clear space of 2 feet is required on the side of the heater to access the filters.
- Clear space of 1-1/2 feet is required at the rear of the GUL air heater for access to the exhaust motor.
- Clear space around the exhaust stack large enough to access the BT air heater fan and clean out door for inspection and maintenance.

Air heater ventilation requirements

NOTE
BT/GUL air heaters are intended to be used with GFS automotive refinish paint booths and CTOF booths. The air heater must be interlocked with a powered exhaust system to prevent over pressurization when the heat system is operating at its rated capacity.

- Recirculation of room air may be hazardous in the presence of:
  - Flammable solids, liquids, and gases
  - Explosive materials (e.g. grain dust, coal dust, gunpowder, etc.)
  - Substances that may be toxic when exposed to heater (e.g. refrigerants, aerosols, etc.)
- Recirculation is not recommended in uninsulated buildings where the outside temperatures fall below 32° F (0° C).
- Excessive recirculation or insufficient ventilation air, which results in inadequate dilution of the combustion products generated by the heater, may create hazardous concentrations of carbon dioxide, carbon monoxide, nitrogen dioxide, and other combustion products in the heated space.
- If gas fork trucks or other fossil fuel powered equipment are utilized in the conditioned area, additional ventilation requirements for the facility must be addressed separately.
- The heater inlet shall be located in accordance with the applicable building code provisions for ventilation air.
- Field constructed intake accessories should be properly designed to minimize the entry of snow and rain.
- All ventilation air to the heater shall be ducted directly from the outdoors.

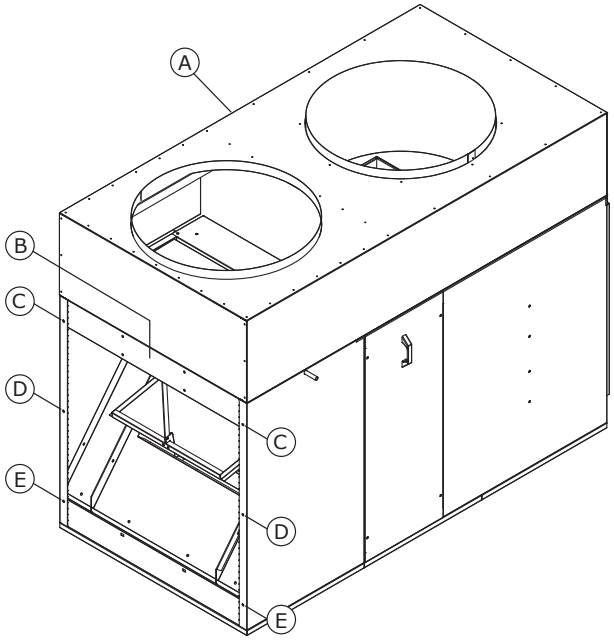
If applicable: Install the GUL air heater

Scope: This task applies only if the booth uses a GUL air heater. If this booth uses a BT air heater, perform “*If applicable:* Install the BT air heater” (page 12).

Prerequisites: The air heater footprint must already be marked on the floor.

Reference:

- Refer to the Air Heater page of the Design Drawings and to the diagram below while completing this task.
- Refer to the booth installation manual for additional context and procedures.



A: *Filter section of GUL air heater*
B: *Channel brace*
C: *Channel-brace bolts (upper bolts for connecting filter section to blower section)*
D: *Center bolts for connecting filter section to blower section*
E: *Lower bolts for connecting filter section to blower section*

1. Remove the channel brace from the filter section (the larger of the two base sections) and set it aside.
2. Prepare the blower section (the smaller of the two base sections):
   a. Remove the two access doors from the blower section and set them aside.
   b. Remove the filters from the blower section and set them aside.

      NOTE
      Place the filters in a location where they are protected from dirt and moisture.
3. Orient the filter section and blower section so that the open ends face each other; then slide the filter section and blower section together.
4. Slide the channel brace back into position between the filter section and the blower section; then reinstall the two bolts that secure the channel brace.

NOTE
The bolts connect the filter section and the blower section to each other, with the channel brace in between.

5. Install four additional bolts (two center, two lower) to connect the filter section to the blower section.
6. Replace the filters in the blower section.

NOTE
These filters may be removed during the startup and commissioning process to check motor rotation and damper function.

7. Reinstall the access doors on the blower section.
8. Place the assembled base in its designated position (denoted by the air heater footprint marked on the floor).

NOTE
Be sure to orient the assembled base appropriately for the intended booth layout.

9. Ensure that the assembled base is level front-to-back and side-to-side.
10. Build the discharge hood as directed on the Discharge Hood Assembly page of the Design Drawings.
11. Place the assembled discharge hood on top of the air heater's burner section and bolt it into position.
12. Place the burner section (with discharge hood assembly installed) on top of the base and bolt it into position.

If applicable: Install the BT air heater

Prerequisites: The air heater footprint must already be marked on the floor.

Reference:

- Refer to the Air Heater page of the Design Drawings while completing this task.
- Refer to the booth installation manual for additional context and procedures.

1. Place the air heater's base section in its designated position (denoted by the air heater footprint marked on the floor).

NOTE
Be sure to orient the base appropriately for the intended booth layout.

2. Ensure that the base section is level front-to-back and side-to-side.
3. Build the discharge hood as directed on the Discharge Hood Assembly page of the Design Drawings.
4. Place the assembled discharge hood on top of the air heater's burner section and bolt it into position.
5. Place the burner section (with discharge hood assembly installed) on top of the base and bolt it into position.

Install gas piping

WARNING
Gas piping must be installed to conform with local building codes, or in the absence of local codes, the latest edition of the National Fuel Gas Code, ANSI Z223.1 (NFPA 54). In Canada, gas piping must be installed in accordance with CAN/CGA-B149.1 for natural gas units and CAN/CGA-B149.2 for propane units.

WARNING
Refer to the air heater nameplate to determine the minimum and maximum gas supply pressure for the air heater. The inlet gas pressure must not exceed the pressure indicated on the nameplate.

WARNING
Before servicing, lockout/tagout the air heater, including the main electrical service and the main gas supply.

WARNING
Fuel bleeds and vents must be vented outdoors.

1. Match the incoming pipe near the heater to the connection on the outside of the air heater. BT/GUL air heaters with 1.2 MBTU burners have a 1-inch diameter gas train; 1.5 MBTU burners have a 1-1/4-inch gas train.

   NOTE
   Avoid multiple taps in the gas supply so the unit has a steady supply of gas at all times.

2. Install a ground joint union with brass seat and a manual shut-off valve external to the air heater casing.

   NOTE
   Install the union adjacent to the unit for emergency shut-off and easy servicing of controls.

3. Provide a sediment trap before the air heater gas train.
4. Blow out the gas line to remove debris before making connections.
5. Before starting the air heater, purge the lines to remove air.
6. All field gas piping must be pressure/leak tested prior to operating the unit. See “Test for valve leaks” (page 31).
7. Install the manual shut-off in an easily-accessible location in case of a fire or explosion at the heater.

Install electrical wiring

WARNING
Electrical installation should be completed by a qualified electrician. Installation must meet all applicable national, state, and local electrical codes.

WARNING
Before servicing, lockout/tagout the air heater, including the main electrical service and the main gas supply.

WARNING
An electric disconnect switch with adequate ampacity must be installed in accordance with the National Electrical Code NFPA 70. Refer to the marking on the heater for voltage and ampacity.

NOTICE
Ensure that the power source is compatible with the requirements of your equipment. The heater nameplate identifies the proper phase and voltage of the motor.

Reference: Refer to instructions in the Electrical Drawings.

1. Before connecting the heater to the building power source, verify that the power line wiring is de-energized.
2. Secure the power cables to prevent contact with sharp objects.

   NOTE
   Do not kink power cables and never allow the cable to come in contact with oil, grease, hot surfaces, or chemicals.
3. Check the fan wheel for free rotation.
4. Make sure that the interior of the heater is free of loose debris or shipping materials.
5. If necessary, the original wire supplied with the heater may be replaced with type TW wire or equivalent.

Air heater operation

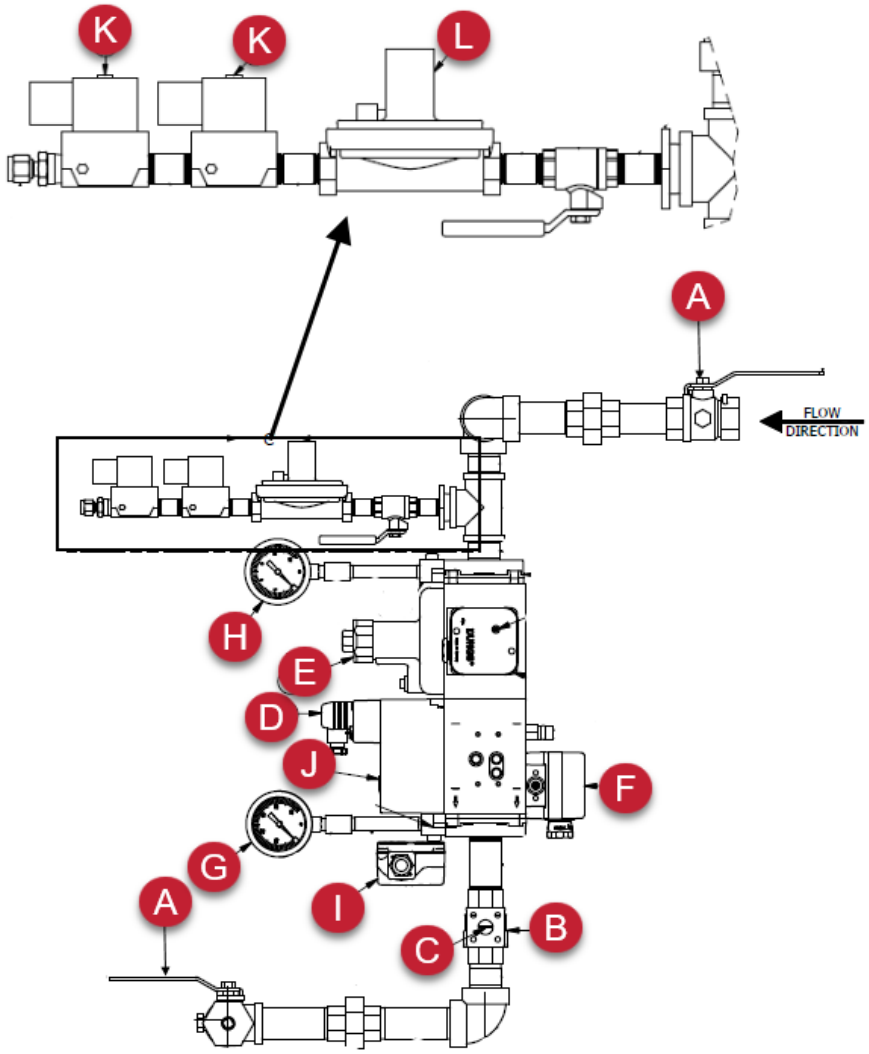
WARNING
Do not operate the air heater unless all of the filters are in place and the access doors are closed.

WARNING
Do not enter the booth during or immediately after the cure cycle. GFS air heaters are supplied with a variable length cool down cycle. The cool down cycle will purge contaminants from the space and cool the vehicle to avoid burn hazards.

The operator interface terminal houses the touchscreen and/or pushbutton controls the operator uses to control the booth. Starting the booth, painting, curing, stopping, and shutting down the booth are described in the control panel operator manual for your booth model.

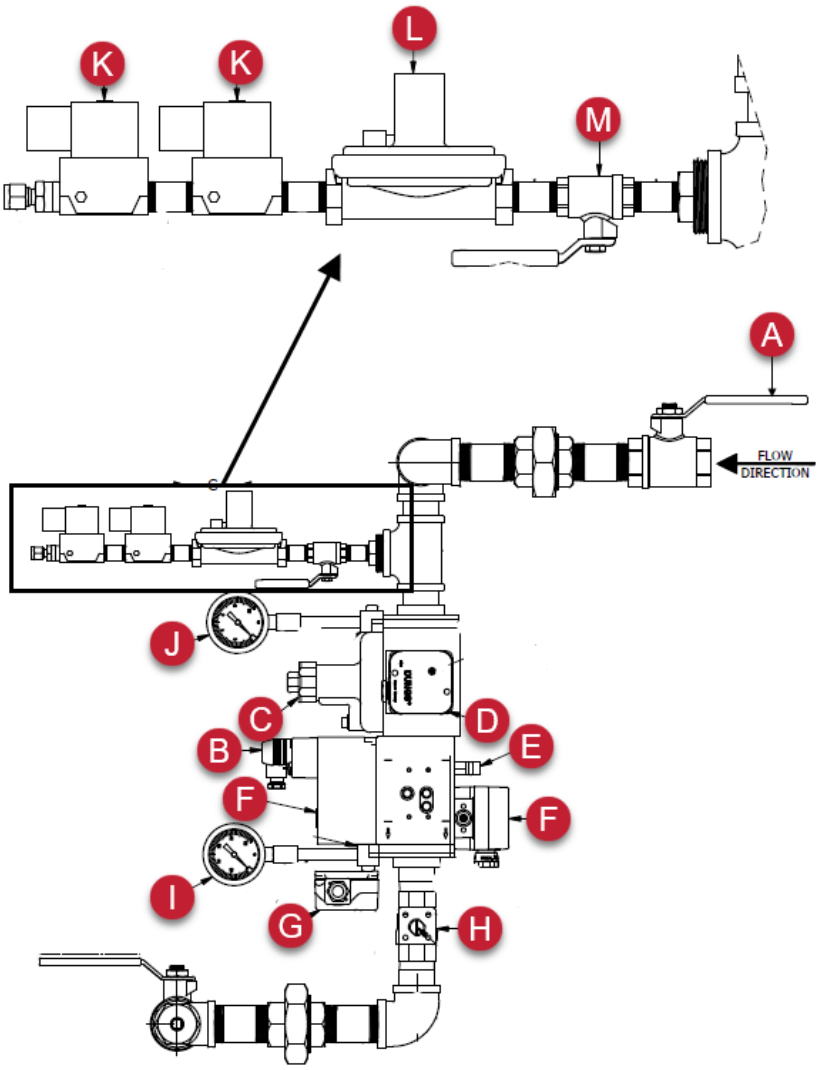
Air heater gas trains

Refer to the illustrations below for gas train components for BT/GUL air heaters.



A: *1-inch NPT ball valve*
B: *Actuated ball valve*
C: *Ball valve shaft*
D: *Din connector with cable*
E: *Main gas pressure regulator*
F: *Dual modulator valve*
G: *Pressure gauge*
H: *Pressure gauge*
I: *High-gas pressure switch manual reset*
J: *Dual modulator valve*
K: *120 V NC pilot gas valve*
L: *Maxitrol spring*

Figure 1. GUL 2000/BT 1200 1.2 MBTU standard burner gas train



A: *1-1/4-inch NPT ball valve*
B: *Din connector with cable*
C: *Main gas pressure regulator*
D: *Pressure switch auto reset*
E: *Visual position indicator*
F: *Dual modulator valve*
G: *High-gas pressure switch manual reset*
H: *1-1/4-inch actuated ball valve*
I: *Pressure gauge*
J: *Pressure gauge*
K: *120 V NC pilot gas valve*
L: *Maxitrol spring*
M: *Ball valve*

Figure 2. GUL 2000/BT 1200 1.5 MBTU standard burner gas train

Natural gas to propane conversion

All standard BT/GUL air heaters come with a gas pressure regulator installed. This regulator valve ships with a blue spring to be used for all air heaters burning natural gas.

NOTE
For information on adjusting the gas pressure regulator valve, see “Adjust the gas pressure” (page 20).

Air heaters burning propane must use an orange spring. This spring will be shipped loose with the air heater and must be installed in the regulator prior to operation. See Table 3 for regulator and spring specifications.

Table 3. BT/GUL burner spring and regulator specifications

Nominal Burner Firing Rate	Gas Train Diameter	Regulator Part Number	Standard Spring (Natural Gas)	Optional Spring (Propane)	Optional Spring Part Number
1.2 MBTU	1 inch	Dungs FRI 712/6	**Blue spring** 4 inch w.c. to 12 inch w.c.	**Orange spring** 2.8 inch w.c. to 8 inch w.c. of gas pressure	1029075
1.5 MBTU	1-1/4 inch				

The conversion to propane affects the minimum inlet pressure, manifold pressure, and temperature rise of the air heater. See Table 4 for air heater specifications.

Table 4. BT1200/GUL2000 air heater specifications for standard burner

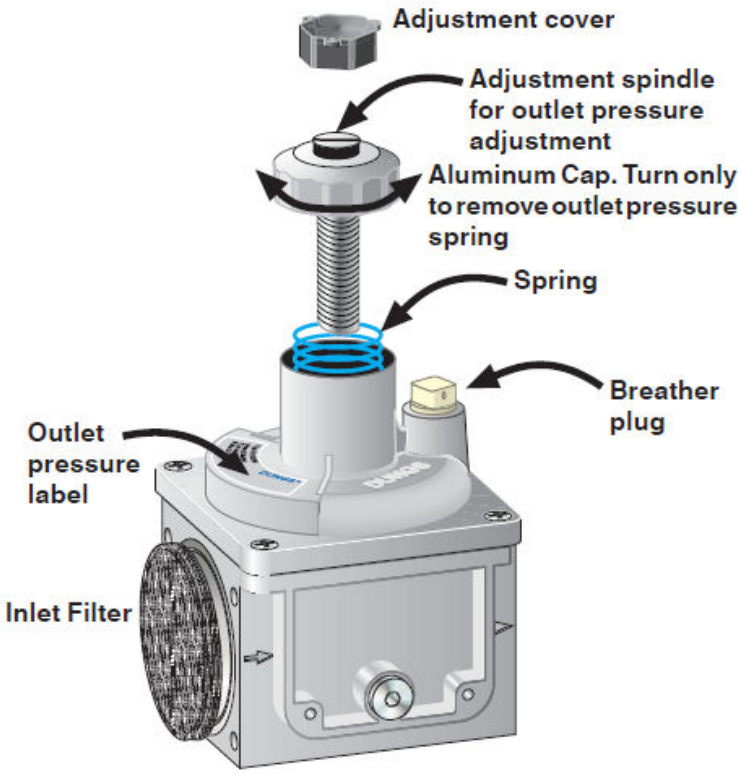
Maximum Airflow Rate	Gas Train Diameter	Fuel	Maximum Firing Rate	Minimum Inlet Pressure[1]	Manifold Pressure[1]	Temp Rise at Maximum Airflow Rate
12,541 CFM	1 inch	Natural Gas	1,440,000 BTU/hr	11.3 inch w.c.	7.8 inch w.c.	102 °F
		Propane	1,125,000 BTU/hr	5 inch w.c.	2 inch w.c.	80 °F
15,205 CFM	1-1/4 inch	Natural Gas	1,512,605 BTU/hr	13 inch w.c.	8.8 inch w.c.	91 °F
		Propane	1,323,529 BTU/hr	5 inch w.c.	2.5 inch w.c.	80 °F

[1]At maximum firing rate

If applicable: Replace the outlet pressure spring

Scope: Complete this procedure to convert the air heater to burn propane fuel instead of natural gas, if required by the site.

WARNING
Do not position your head above or near the aluminum cap when removing the regulator spring. The spring tension can be high enough to eject the cap with a great amount of force.



1. Remove the black adjustment cover.
2. Release the spring tension by turning the adjustment spindle completely counterclockwise with a screwdriver.
3. Remove the aluminum cap.
4. Remove the existing spring and insert the new orange spring.
5. Reinstall the adjustment spindle and adjust the desired outlet pressure. Follow the instructions in “Adjust the gas pressure” (page 20).
6. Reinstall the adjustment cover, and apply the provided outlet pressure label with the new outlet pressure range onto the nameplate.

Adjust the gas pressure

WARNING
During startup, a pressure gauge must be used to read the setpoint of the regulator outlet pressure. After the safety shutoff valves are closed, the outlet pressure must not exceed the setpoint by more than 30 percent.

WARNING
While adjusting the outlet pressure of the regulator, confirm that adjusting the outlet pressure does not create a hazard to the burner.

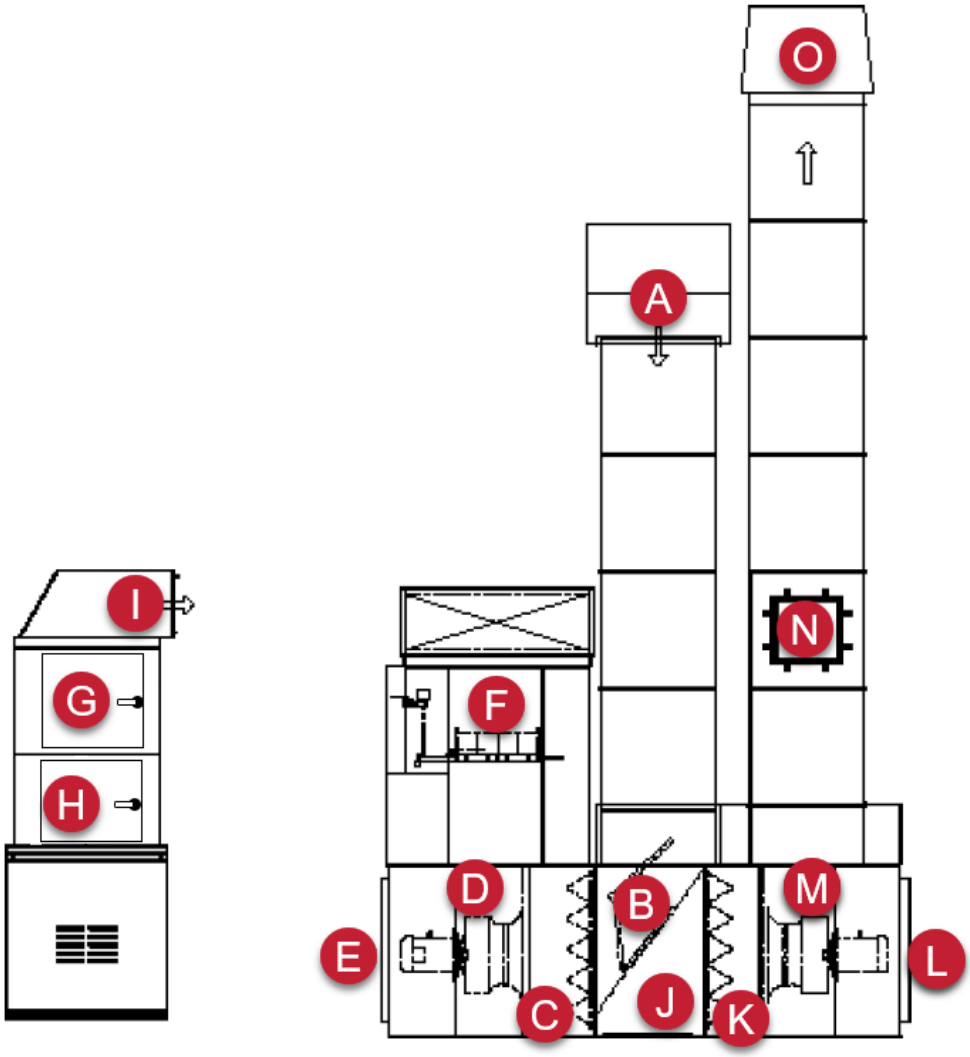
1. Remove the black adjustment cover.
2. To increase the outlet pressure setpoint, turn the adjustment spindle clockwise with a screwdriver.
3. To decrease the outlet pressure setpoint, turn the adjustment spindle counterclockwise with a screwdriver.
4. Always use an accurate pressure gauge connected downstream from the regulator to measure the actual outlet pressure.
5. Reinstall the black adjustment cover.
6. After adjusting the setpoint for normal operation, verify that the gas pressure regulator operates as intended.

Maintenance schedule

The frequency of the following maintenance checks depend upon the material being sprayed (amount and kind). The booth operators and maintenance technicians should perform these checks at regular intervals to reduce fire hazards, maintain booth efficiency, prevent freshly painted objects from becoming blemished, and hinder booth corrosion and wear. Adjust the frequency of the checks according to local guidelines and actual usage.

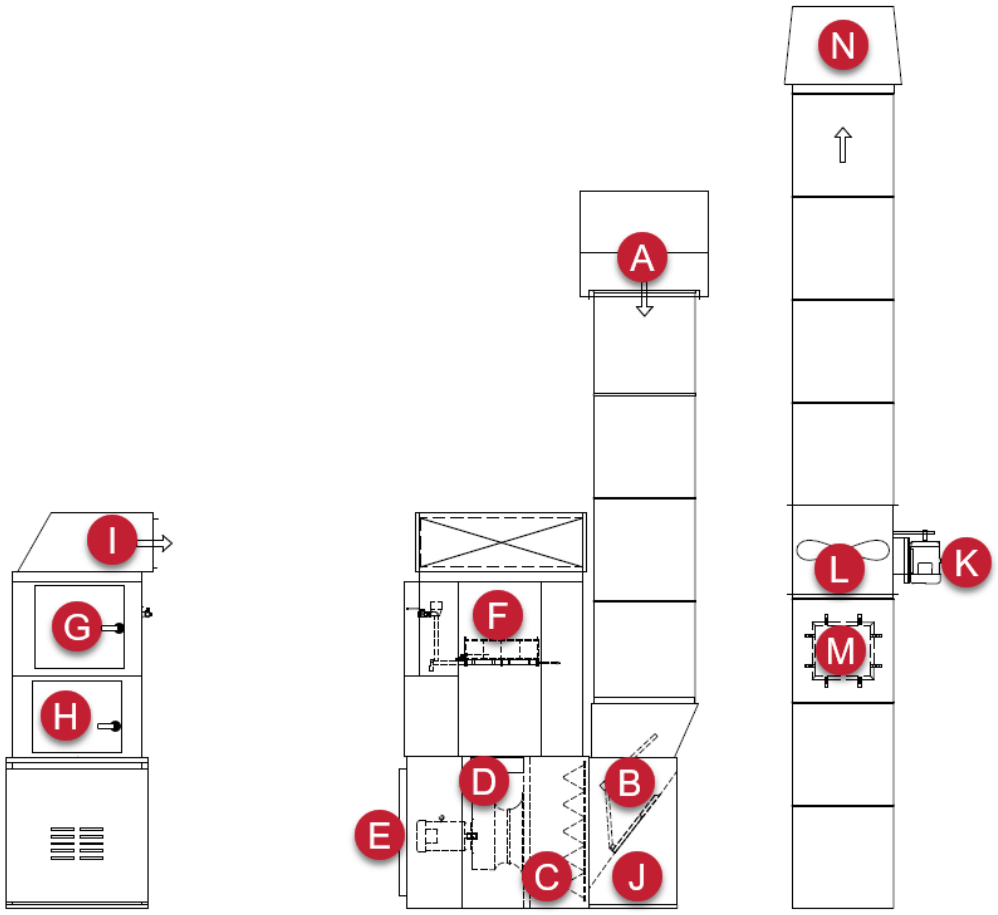
Complete the applicable air heater maintenance procedures at the intervals shown below. For full service procedures, refer to the air heater maintenance procedures later in this manual.

Items to Be Inspected and/or Cleaned	Daily	Monthly	Yearly
Check air heater filters and replace if needed.	X		
Inspect and clean the air heater, including the fan inlet and intake areas, fan, wheels, and other moving parts.		X	
If applicable: Adjust belt tension		X	
Inspect and clean the air heater.			X
Ensure that the cycle damper(s) can rotate freely.			X
Perform valve leak test check on external sealing.			X
Check the gas pressure switch(es).			X



A: *Fresh air inlet*
B: *Cycle damper*
C: *Intake filter access door*
D: *Intake blower assembly*
E: *Intake motor access door*
F: *Burner*
G: *Gas train and combustion air filter access door*
H: *Control panel access door*
I: *Air heater discharge*
J: *Recirculating opening*
K: *Exhaust filter access door*
L: *Exhaust motor access door*
M: *Exhaust blower assembly*
N: *Exhaust inspection door*
O: *Exhaust air discharge*

Figure 3. Recirculating GUL Air Heater



A: *Fresh air inlet*
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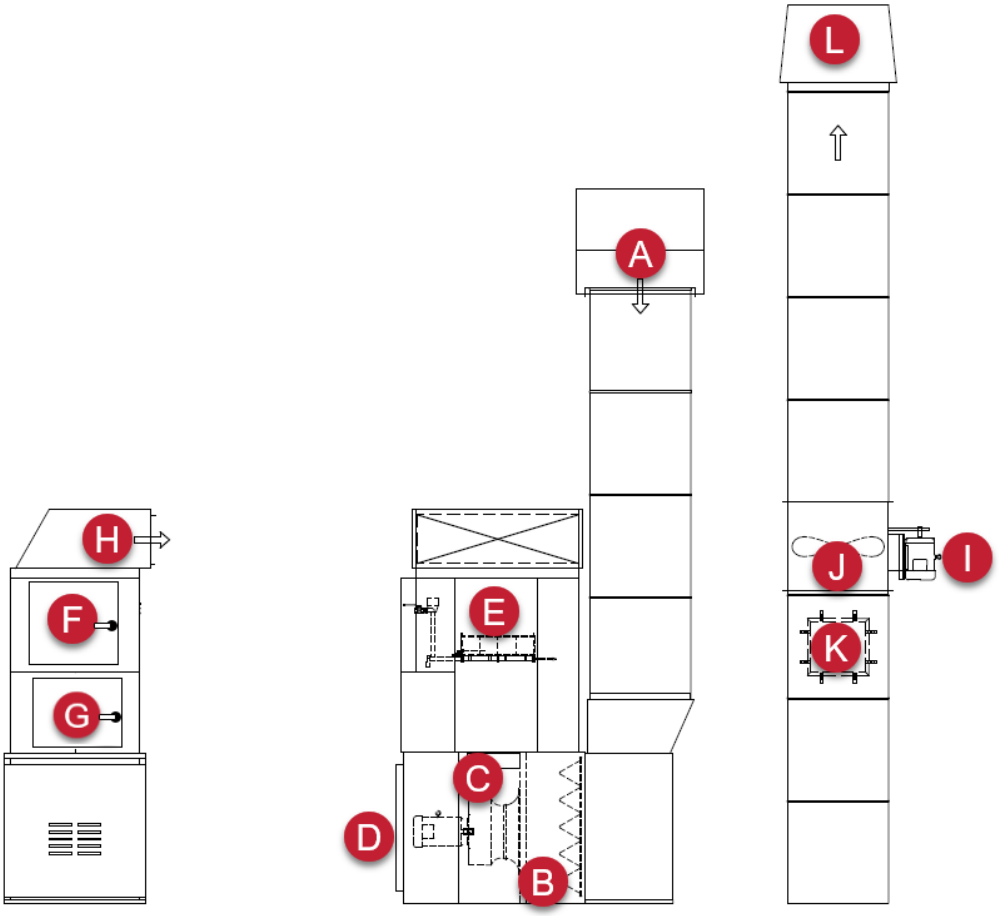
D: *Intake blower assembly*
E: *Intake motor access door*
F: *Burner*
G: *Gas train and combustion air filter access door*
H: *Control panel access door*
I: *Air heater discharge*
J: *Recirculating opening*
K: *Exhaust motor*
L: *Exhaust fan assembly*
M: *Exhaust inspection door*
N: *Exhaust air discharge*

Figure 4. Recirculating BT Air Heater



A: *Fresh air inlet*
B: *Intake filter access door*
C: *Intake blower assembly*
D: *Intake motor access door*
E: *Burner*
F: *Gas train and combustion air filter access door*
G: *Control panel access door*
H: *Air heater discharge*
I: *Exhaust motor*
J: *Exhaust fan assembly*
K: *Exhaust inspection door*
L: *Exhaust air discharge*

Figure 5. Forced Dry BT Air Heater

Daily maintenance

This section contains tasks that should be performed every day.

NOTE
Refer to the “Air heater filter replacement log” (page 38) to track the exhaust filter replacement dates.

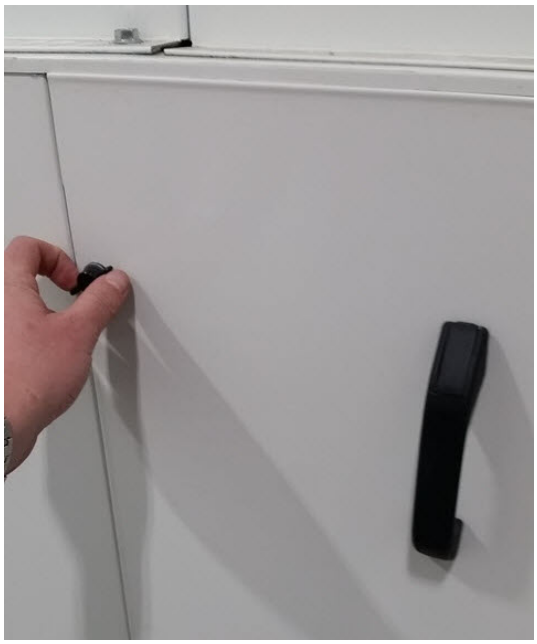
Replace air heater filters

WARNING
Before servicing, lockout/tagout the air heater, including the main electrical service and the main gas supply.

Perform these steps to replace the air heater filters:

1. On the air heater, locate the panel that houses the filter.

2. Remove the four wing-head thumb screws.



3. Lift the panel using the handle to remove and gain access to the filters.
4. Using both hands, pull the used filter by its frame along the track and out of the unit.

   Remove the remaining filters in the same manner as the first filter.

   WARNING
   Treat used filters and any other paint-contaminated items as flammable products and dispose of them safely.

   NOTE
   Pay attention to the orientation of the filter inside the unit.
5. Making sure the filter is oriented the same way, slide the new GFS pocket filters along the track into the air heater.
6. Reattach the panel and secure it with the four wing-head thumb screws.

Monthly maintenance

This section contains tasks that should be performed on a monthly basis. Increase or decrease frequency as needed for specific operating conditions and use of air heater.

Inspect and clean the air heater

CAUTION
Use care when touching the exterior of an operating motor or a motor that has just been shut down. Motors usually run hot and may be hot enough to be painful or cause injury.

WARNING
Before servicing, lockout/tagout the air heater, including the main electrical service and the main gas supply.

1. Check that the fan inlet and intake areas (approaches to the ventilator) are free from obstructions and clean.
2. Check the fan, wheel, other moving parts, and the inlet, especially if the blower is installed in a corrosive or dirty environment.

   Oil, dust, or overspray may occasionally accumulate on the fan, causing an imbalance. For smooth and safe operation, inspect and clean the wheel and other moving parts as needed.
3. *If applicable,* check air heater V-belt alignment.

   NOTE
   For instructions, see “*If applicable:* Check V-belt drive alignment” (page 36)
4. After performing the above maintenance checks, ensure that all fasteners are tight.
5. When the booth has been returned to a safe operating state, remove the locks and restore power.

If applicable: Adjust belt tension

Scope: This procedure only applies to the tube axial fan belt drives in BT air heaters.

Belt tension is very important to the proper operation of a fan and to the service life of a V-belt drive. The belts on a new fan are properly adjusted; however, all V-belts stretch in the first few hours of operation. It is necessary to readjust the belt tension after eight hours of running. After approximately 100 hours of running, the belts should be adjusted again. Thereafter, tracking the number of hours the air heater is in use and periodic inspection are recommended so belts may be adjusted or replaced when necessary.

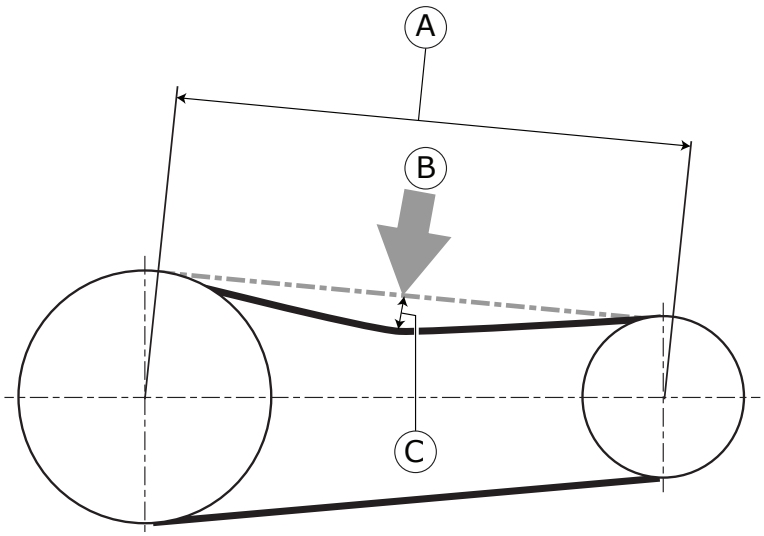
WARNING
Operating drives without guards in place can result in severe injury or death. If you remove any guards, make sure you replace them before removing locks and restoring power.

WARNING
Before servicing, lockout/tagout the main electrical service to the device.

CAUTION
Do not tighten belts by changing the setting of the motor pulley as this changes the fan speed and may damage the motor.

NOTICE
Over-tightening results in too much tension, causing excessive belt wear and noise. Under-tightening results in too little tension, causing slippage at start-up and uneven wear.

1. Measure the belt span as illustrated below.



A: *Span length*
B: *Force*
C: *Deflection*

2. Calculate the required deflection by multiplying the belt span by 1/64.

   For example, if the belt span is 32 inches, the belt deflection equals 1/2 inch (32 inches x 1/64 = 1/2 inch).

3. Apply the force from the following table evenly across the width of the belt at the center of the belt span and measure the deflection.

   NOTE
   A strip of keystock or similar material may be used to distribute the force evenly across the belt width.

   Table 5. Belt deflection force

Belt type	New belt force (measured in pounds)	Used belt force (measured in pounds)
B	6.7-9.4	4.5-6.3

4. With the force still applied, measure the actual belt deflection. Adjust the belt tension if the measured belt deflection is greater than the calculated deflection.
5. When the air heater has been returned to a safe for operation state, remove locks and restore power.

Replace combustion blower filters

Scope: This procedure applies only to air heaters with Low NOx burners.

WARNING
Before servicing, lockout/tagout the air heater, including the main electrical service and the main gas supply.

1. Loosen the 8 mm bolts securing the filter frame to the side of the combustion blower box and lift the filter frame grate out of place.
2. Remove the used filter pad.
3. Making sure the replacement filter is oriented the same way, insert the new combustion blower filter (GFS part number 1010333).
4. Close the filter frame grate and tighten the bolts.

Yearly maintenance

This section contains tasks that should be performed on a yearly basis. Increase or decrease frequency as needed for specific operating conditions and use of air heater.

NOTE
Once each year, perform these tasks in addition to the monthly maintenance tasks.

Inspect and clean the air heater

Once each year, perform these tasks in addition to the monthly air heater maintenance tasks.

WARNING
Before servicing, lockout/tagout the air heater, including the main electrical service and the main gas supply.

CAUTION
Use care when touching the exterior of an operating motor or a motor that has just been shut down. Motors usually run hot and may be hot enough to be painful or cause injury.

1. *If applicable:* Inspect the air heater fan belt for wear; replace any torn or worn belts.

   NOTE
   For instructions, see “Replace fan belts” (page 37).

2. Inspect the bolts and screws for tightness. Tighten them as necessary.
3. Inspect the motor for cleanliness. Remove dirt and grease from the wheel and housing to prevent imbalance and damage.
   a. Clean exterior surfaces only.
   b. Use a rag to remove dust and grease from the motor housing to ensure proper motor cooling.
   c. Remove dirt and grease from the wheel and housing to prevent imbalance and damage.
4. Use soapy water or a gas detector to check for bubbles caused by a gas leak. Seal any leaks, if present.
5. Clean both sides of the stainless-steel burner plates with a stiff wire brush to remove any soot or other crud.

   NOTE
   All of the burner plate holes must be clear so air can pass through them unrestricted.

6. Inspect the burner plates for cracking. Some cracking between one or two holes is normal. If the cracking is more extensive, replace the affected plates.
7. Use the wire brush to remove rust and foreign material from the burner orifice area.
8. Clean the burner gas and air ports and remove debris; then use compressed air or a vacuum to remove any debris from the manifold.

NOTE
If needed, use a piece of wire or drill bit to clean the ports:

- **Gas port:** Drill size 1/8-inch (0.125 inch)
- **Air port:** Drill size 42 (0.093 inch)

9. Inspect the spark rod.
   - The tip should be clean and free of dirt and carbon. If not clean, replace the spark rod.
   - The porcelain must be intact. If the porcelain is cracked, replace the spark rod with spark plug (GFS part number 1013671).

     NOTE
     This part includes the spark rod, flame sensor, and pilot line entry to the burner.
10. Pull the flame rod.
    - The metal rod should be clean and free of dirt and carbon. If needed, either replace the flame rod, or clean the rod with steel wool and wipe with a clean paper towel. Avoid touching the flame rod while cleaning.
    - The porcelain must be intact. If the porcelain is cracked, replace the flame rod.

If applicable: Inspect the cycle damper

1. Remove the filter access door.
2. Remove the air heater intake filters.
3. Inspect the cycle dampers, pivots, and linkage for damage. Replace components if necessary.
4. Ensure the cycle damper is free to rotate to the fully closed position.
5. Replace the air heater intake filters.
6. Replace the filter access door.

Test for valve leaks

Scope: This procedure applies only to air heaters with standard burners.

This leak test checks the external sealing and valve seat sealing capabilities of the DMV automatic safety shutoff valve. Only qualified personnel should perform this test.

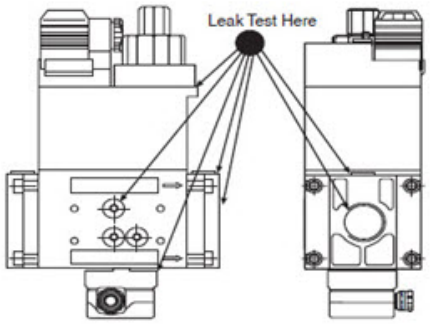
The test requires the following:

- Test nipples installed in the downstream pressure tap port of each automatic safety shutoff valve
- Transparent glass of water filled at least 1 inch from the bottom
- Leak test tube: aluminum or copper 1/4-inch rigid tube with a 45 degree cut at the end
- All-purpose liquid leak detector solution

Perform these steps to test for valve leaks.

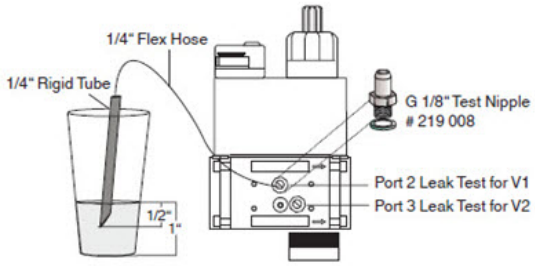
1. With the upstream ball valve open, the downstream ball valve closed, and both valves are energized, apply an all-purpose liquid leak detector solution to the areas indicated in the illustration below.

- Any accessories mounted to the safety valve
- All gas piping and gas components downstream the equipment isolation valve
- Inlet and outlet gas piping of the automatic safety shutoff valve.



The presence of bubbles indicates a leak, which needs to be fixed before proceeding. Replace the valve, reassemble, and retest for bubbles.

2. Remove all power to the burner system, and verify that both automatic safety shutoff valves are closed.
3. Close the upstream and downstream manual ball valve.
4. Using a screwdriver, slowly open the V1 test nipple (port 2) by turning it counter clockwise to depressurize the volume between the two valves; then connect the 1/4-inch flexible hose to the test nipple.



5. Slowly open the upstream manual ball valve; then allow time for potential leakage to charge the test chamber before measuring the valve seat leakage.
6. Immerse the 1/4-inch tube vertically 1/2-inch (12.7 mm) below the water surface. If bubbles emerge from the 1/4-inch tube and after the leakage rate has stabilized, count the number of bubbles appearing during a 10 second period. (See table below for allowable leakage rates.)

Type	Allowable Valve Seat Leakage up to 7 PSI inlet	Air	# of Bubbles in 10 s Natural Gas	LP
DMV D(LE) 701/622	239 cc/hr	5	6	4
DMV-D(LE) 702/622	464 cc/hr	9	11	7
DMV-D(LE) 703/622	464 cc/hr	9	11	7

IMPORTANT

If leakage values are exceeded, replace valve immediately.

7. Repeat the same procedure for valve V2 (port 3). (Energize terminal 2 on the DIN connector to open valve 1.)
8. Verify that the downstream manual ball valve is closed and both automatic safety shutoff valves are de-energized.
9. Remove the flexible hose, and close all test nipples.
10. With the upstream manual ball valve open, energize both automatic safety shutoff valves.
11. Use soapy water to check all test nipples to ensure that there are no leaks.
12. If no leakage is detected, de-energize all automatic safety shutoff valves, and open the downstream manual ball valve.

Check the gas pressure switches

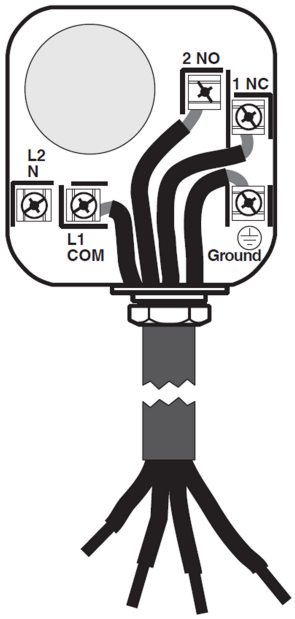
Check the low-pressure and high-pressure switches once a year for proper operation.

Low-pressure gas switch

Perform these tasks to check the resistance of the low-pressure switch both in normal operation and in a fault state.

NOTE
A resistance of more than 1.0 ohm indicates that the switch contacts are starting to either corrode or carbonize.

1. Connect a meter capable of reading +/- 0.1 ohms to the NO and COM contacts.



2. Measure the resistance. If the resistance is more than 1.0 ohm, remove the switch from service.
3. Connect the meter to the NC and COM contacts.
4. Cause a low-pressure fault condition using one of methods below:

NOTICE
Do not simulate fault conditions while the burner is firing.

- Turn the pressure switch set point counter-clockwise until the switch trips.
- De-pressurize the volume of gas the low-pressure gas switch is sensing.
  - For FRI/6 regulators, open the side tap on the opposite side of the FRI/6 regulator.
  - For DMV and MBC safety shutoff valves, open the port 1 pressure tap.

5. When the fault occurs, measure the resistance. If the resistance is more than 1.0 ohm, remove switch from service.
6. Allow the burner to go through a startup sequence, and then verify that the burner faults and is not allowed to light.
7. When testing is complete, close all pressure test points used.
8. Open the upstream ball valve SLOWLY to allow gas pressure to gradually re-enter the system.

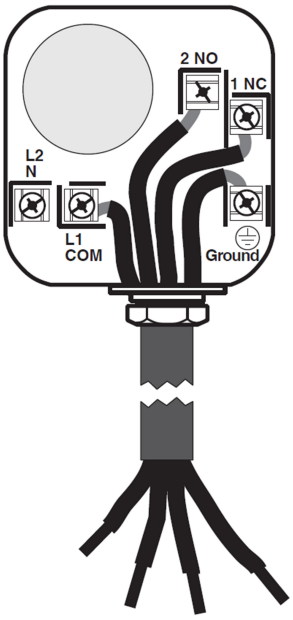
NOTICE
Opening the upstream ball valve too fast can permanently damage the pressure switch.

High-pressure gas switch

Perform these tasks to check the resistance of the high-pressure switch both in normal operation and in a fault state.

NOTE
A resistance of more than 1.0 ohm indicates that the switch contacts are starting to either corrode or carbonize.

1. Connect a meter capable of reading +/- 0.1 ohms to the NC and COM contacts.



2. Measure the resistance. If the resistance is more than 1.0 ohm, remove the switch from service.

3. Connect the meter to the NO and COM contacts.
4. Cause a high-pressure fault condition using one of methods below:

   NOTICE
   Do not simulate fault conditions while the burner is firing.

   - Turn the pressure switch set point clockwise until the switch trips.
   - Pressurize the volume of gas the high-pressure gas switch is sensing by closing the downstream ball valve and open the port 3 tap.
5. When the fault occurs, measure the resistance. If the resistance is more than 1.0 ohm, remove the switch from service.
6. Allow the burner to go through a startup sequence, and then verify that the burner faults and is not allowed to light.
7. When testing is complete, close all test taps (ports), and then open downstream ball valve.

Reset the air heater flame safety control

If the flame safety control alarm light is on (locked out), manually reset the unit.

1. Reset the flame safety guard.
2. Reset warning on screen.

Reset the gas pressure switch

Units are equipped with a manual reset high gas pressure switch. The burner will not operate if a switch is tripped. To reset a switch, follow the reset instructions provided on the top of the switch.

Reset the high temperature limit switch

Typically, two high temperature limit switches protect the system in the event a failure causing high temperature in the air heater blower cabinet or high blower discharge temperature. One device automatically resets when temperature falls under the device's setpoint. The second device requires manual reset after a high temperature fault. The booth uses one of the following types of manual reset, high temperature limit switches:

- **Honeywell:** Press the red button toward the bottom (on the face) of the limit device
- **Future Design:** Press the reset button.

NOTE
Either type can be reset with or without power applied to the booth.

NOTE
You may not feel any change in the device as you reset it.

General service procedures

This section contains procedures that can be performed as needed to correct problems or as directed by the preventive maintenance schedules in “Daily maintenance” (page 25), “Monthly maintenance” (page 27), and “Yearly maintenance” (page 30).

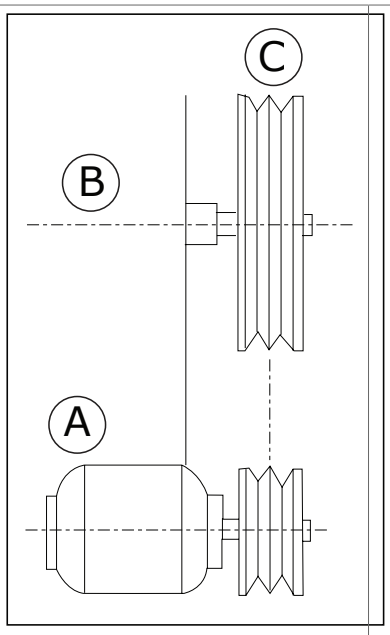
If applicable: Check V-belt drive alignment

Scope: This procedure only applies to the tube axial fan belt drives in BT air heaters.

Proper alignment and balance of the V-belt is important; check the following items to ensure smooth fan operation.

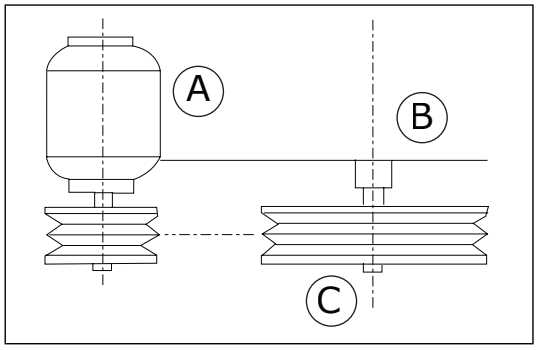
1. Check that the fan and motor sheaves are in axial alignment; adjust sheaves as required.

   NOTE
   Shafts are parallel in both the vertical and horizontal planes.



A: *Motor*
B: *Fan*
C: *Drive*

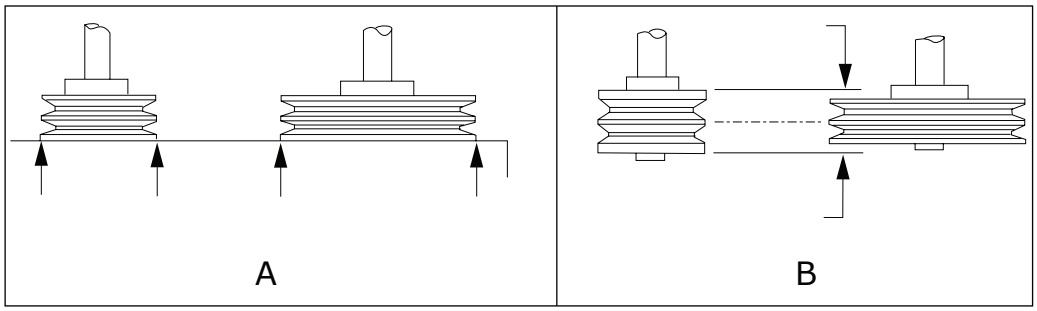
Side view (vertical alignment)



A: *Motor*
B: *Fan*
C: *Drive*

Top view (horizontal alignment)

2. Check that the fan motor sheaves are in radial alignment; adjust sheaves as required:
   - When sheaves are of equal width, align the sheaves with a straight-edge (inset A).
   - When sheaves are of unequal width, align the center of the sheaves (inset B).



A: *Equal-width sheaves: Align to straight-edge touching sheaves at arrows*
B: *Unequal-width sheaves: Align to center of sheaves*

3. Verify that sheaves have no noticeable eccentricity.
4. If adjustments were made, check belts for proper tension.

   NOTE
   Belts that are either too loose or too tight cause vibration and excessive wear. (see "*If applicable:* Adjust belt tension" (page 28), as applicable).

5. After all adjustments have been completed, check the complete assembly for smoothness of operation.

Replace fan belts

WARNING
Before servicing, lockout/tagout the fan, including the main electrical service.

1. Loosen the motor hold-down bolts and move the motor toward the fan. (This is done by turning a jackscrew which is a part of the motor base on models having larger motors.) The belt may be slipped off the motor sheave and then easily removed from the sheave on the blade shaft.
2. Check the numbers on the belt and make the replacement with a belt having the same length and section.

3. Adjust the motor outward to tighten the belt (see "*If applicable:* Adjust belt tension" (page 28)) and tighten the motor hold-down bolts. Be sure that the motor is not cocked at an angle and that the end face of the motor sheave is parallel to the end face of the driven sheave.
4. Adjust the belt tension (see "*If applicable:* Adjust belt tension" (page 28)).
5. After performing the above maintenance, check that all fasteners are tight.
6. When the air heater has been returned to a safe for operation state, remove locks and restore power.

Air heater filter replacement log

Air heater and combustion blower filters should be replaced every 160 to 180 hours of operation.

NOTE
Visually inspect the filters daily and change them immediately if they become saturated sooner than the recommended replacement interval.

Hours of Operation	Date	Comments
Spec/Actual		
160/		
320/		
480/		
640/		
800/		
960/		
1,120/		
1,280/		
1,440/		
1,600/		
1,760/		
1,920/		
2,080/		
2,240/		
2,400/		
2,560/		
2,720/		
2,880/		
3,040/		