Part # 456857

Installation, Operation and Maintenance Instructions

for MAKE-UP AIR UNITS

with Direct Fired Gas Heater Option

(for natural or LP gas)

ETL Listed

WARNING:

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.

When suspending this unit the following ANSI standards must be followed: the standard for aircraft hangars, ANSI/NFPA 409-1985; the standard for parking structures, ANSI/NFPA 88A-1985; and the standard for repair garages, ANSI/NFPA 88B-1985.

For Your Safety

If you smell gas:

1. **Open windows**
2. **Don't touch electrical switches**
3. **Extinguish any open flame**
4. **Immediately 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.

This manual is the property of the owner, and is required for future maintenance.
Please leave it with the owner when you complete the job.

GREENHECK
P.O. BOX 410 SCHOFIELD, WISCONSIN 54476-0410
PH. 715-359-6171
www.greenheck.com

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Unit Installation
This unit should be installed according to the Greenheck IOM:
 # 456856 for model TSU
 # 457615 for model KSU
 # 457831 for model VSU

Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. Any units of parts which prove to be defective during the warranty period will be repaired or replaced at our option.

The motor is warranted by the motor manufacturer for a period of one year. Should the motor prove defective during this period, it should be returned to an authorized motor service station.

Greenheck will not be responsible for any installation or removal costs.

Due to continuing research, Greenheck reserves the right to change specifications without notice.

Gas Piping Instructions

Warnings

Leak Testing Components

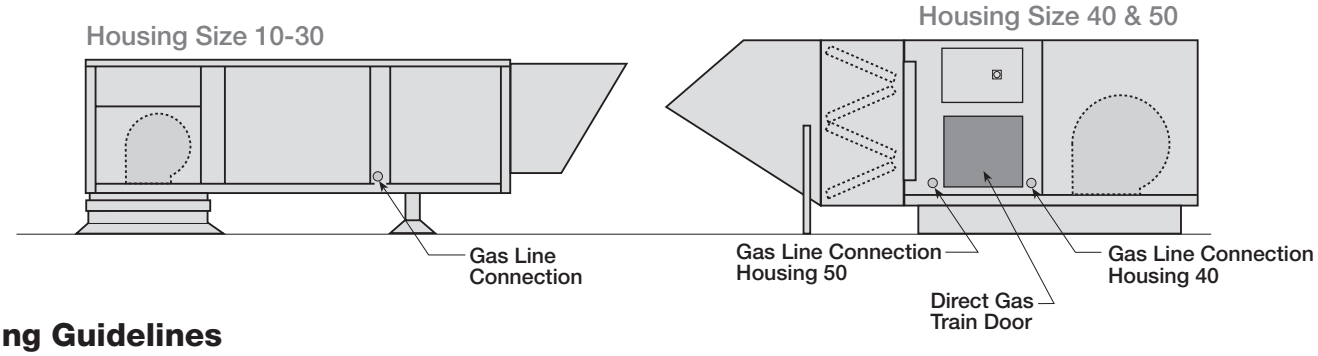
All components of this or any other gas fired heating unit must be leak tested prior to placing the unit into operation. A soap and water solution should be used to perform this test. NEVER test for gas leaks with an open flame. See page 10 for safety shut off valve leak testing.

High Pressure Testing

The heater and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.5 KPa).

The heater must be isolated from the gas supply system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.5 KPa).

Location of Gas Connection



Piping Guidelines

All gas piping must be installed in accordance with the National Fuel Gas Code ANSI/Z223.1 - latest edition and any local codes that may apply. In Canada, the equipment shall be installed in accordance with the Installation Code for Gas Burning Appliances and Equipment, CGA B149, and Provincial Regulations for the class; which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.

The nameplate on the direct gas section door describes all the requirements about the gas being supplied to the unit. For typical operation size 10 through size 30 units need a minimum of 6 in. to a maximum of 14 in. wg for natural gas and 2 to 6 in. wg pressure for LP gas. Sizes 40 and 50 need a min. of 1/2 PSI to a max. of 5 PSI.

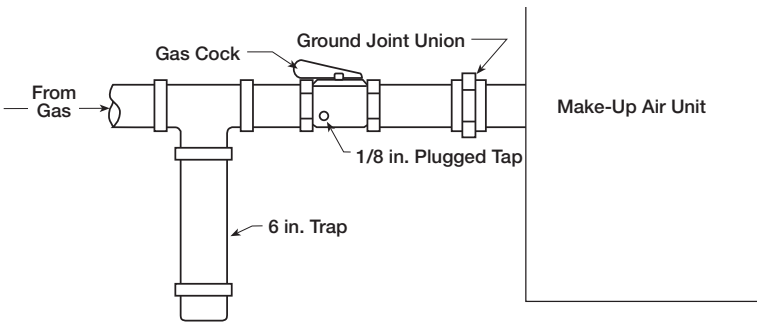
When the supply pressure exceeds the maximum pressure an ***additional*** regulator (furnished by others) is needed to step down the pressure. The regulators in the unit are used to adjust the maximum output temperature of the unit. Piping should be of adequate size to provide a sufficient supply of gas to meet the maximum demand with minimal pressure loss between the meter and the unit.

A manual shut off valve (gas cock) and a 1/8 in. plugged tapping and a 6 in. drip leg must be installed prior to the gas train and must be accessible for connection to test gauge.Connections are to be made by a qualified installer and are not furnished by Greenheck.

Standard Inlet Gas Pipe Size					
Max. BTUs	<400,000	400,000 1,375,000	1,375,000 2,475,000	2,475,000 4,400,000	4,400,000 5,500,000
Pipe Size	3/4 in.	1in.	1 1/2 in.	2 in.	2 1/2 in.

Finally, check for leaks in the supply lines to the unit. The factory piping has been checked for leaks, but should be rechecked due to shipping and installation. See leak test warnings above.

All piping should be clean and free of any foreign matter. Foreign material entering the gas train can cause problems with the valves, regulators, and the burner.



SYSTEM STARTUP

For proper unit function and safety, follow everything in this startup procedure in the order presented. This to be done after the electrical (see base unit IOM GFC #456856) and gas connections are complete.

Special Tools Required

- Voltage meter
- Incline manometer or equivalent
- Tachometer
- Thermometer
- Amperage meter

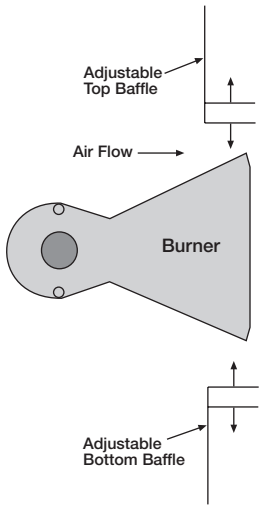
See IOM GFC #456856 (TSU) or GFC #457831 (VSU) before completing these steps.

1. Check Gas Pressure

Check the gas pressure with the unit's nameplate pressure requirements.

2. Burner Air Pressure Differential

Proper air velocity over the burner is critical on a direct fired gas unit. If the air velocity is not within specifications, the unit will not operate efficiently, can produce excess carbon monoxide (CO) or other gases, and may have sporadic shutdowns. Proper air velocity is determined by measuring the static pressure drop across the burner.



To measure the static pressure drop, the fan should be running and be discharging 70° air. Using an incline manometer or equivalent, insert one sensor into the entering air access opening (plugged test port) and the other on the downstream side, through the view port (see page 12 for locations). The proper static pressure reading should be from .625 in. to .675 in.

If this reading is higher or lower and the air quantity (cfm) delivered to the building is acceptable, then the burner baffles will need to be adjusted (see diagram).

Open the burner access door. Using a wrench loosen the 4 screws to adjust the baffles. To increase the static pressure loss, decrease the opening size and to decrease the loss, increase the opening size. The top and bottom baffles should be of equal distance from the burner. Tighten the baffle fasteners, replace the door, turn unit on, and recheck the loss. This process may need to be repeated until the proper pressure reading is attained. This adjustment will change the air quantity delivered by the unit and therefore should be rechecked (see start up in Base Unit IOM).

3. Pilot Pressure

The pilot pressure is preset at the factory and should not require adjustment. Pilot pressure will vary by unit size.

4. Set Maximum Discharge Temperature

Do not set the burner based on gas pressure. The burner's maximum fire rate needs to be set or the unit will over fire at startup causing unit shutdowns. To do this, the inlet air and outlet air temperatures of the unit need to be measured with the burner on high fire.

a. Determine Required Temperature Rise

Based on the geographical area, determine the winter design temperature. Subtract the winter design temperature from the desired output temperature to get the required temperature rise.
Desired output temperature - winter design temperature = temperature rise.
(Example: for Schofield, WI 70° - (-15°) = 85°F)

b. Set unit to Run at high fire.

1. On Maxitrol Series 14 systems remove and isolate the wire attached to terminal #4 of the A1014 amplifier.
2. On Maxitrol Series 44 systems remove and isolate the wire attached to terminal #3 of the A1044 amplifier.

SYSTEM STARTUP (cont.)

c. Adjust High Fire

Monitor the temperature difference between the inlet air and blower discharge temperature. Adjust the main regulator by turning the adjustment screw inside the main regulator until the required temperature rise is equal to the actual temperature rise. On units over 1,000,000 BTU's, the regulator is built into the modulating valve.

d. Replace Wire

Reattach wire to proper terminal.

NOTE: This test procedure can be done in the summer, however, there will be hot air being blown into the building and the high limit may trip out, requiring manual resetting.

5. Low Fire

For safe operation, the burner should have a flame across the entire burner at all times. This is factory set but should be field inspected.
To check this, adjust the discharge temperature air to its lowest setting and view the flame. This should be done when the outside air temperature is above the lowest discharge temperature setting. At all times there should be a small flame present across the entire length of the burner.
If adjustment is required, refer to the Maxitrol manual provided with the unit.

6. Set Unit's Discharge Temperature

Maxitrol Series 14 Systems

Set the temperature selector to the desired discharge temperature. (Maximum of 75º F on Canadian Units.)

Maxitrol Series 44 Systems

For Maxitrol Series 44 units the selectrastat T244 adjusts the discharge temperature according to the building requirements. The discharge setting temperatures on the A1044E amplifier should be set. Greenheck recommends the minimum be set to 50º F and the maximum be set at 100º F.

7. Flame Signal Check

To ensure trouble free operation, the flame rod signal to the flame safeguard should be checked. Readings should be recorded in the following flame conditions: Pilot only, low fire, mid fire and high fire. The readings should be steady and be at or above the recommended minimum reading shown below. If problems do exist with this, see the Trouble Shooting section of this manual for more information.

To measure the flame signal:

For RM7895 Flame Safeguards

A standard DC volt meter can be used and connected at the flame amplifier test jacks + and - (com) on the outside of the flame safeguard. The keyboard display module Honeywell #S7800A1001 (not provided) can also be used to measure the flame signal. The signal will be in DC volts and should be above or at 1.25v and stable for all flame conditions.

8. Optional High/Low Gas Pressure Switch

These switches denergize the heater if the gas pressures are above or below the limits. Both switches are manual resetting.
Typical settings are:

Low pressure at 2 inches wg
High pressure at 8 inches wg for natural gas and 4 inches wg for L.P. gas.

Sequence of Operation

This is included to help in determining if the unit is functioning properly upon initial startup.

Control Center

1. Turn the fan switch to the “on” position or the Summer/off/Winter switch to the "Winter" position.
2. (Optional) Damper actuator is energized.
3. Supply starter is energized. Supply fan runs*.
4. Turn the heater switch “on”, if using separate switches.

Heater

5. Open all manual gas valves.
6. High temperature limit switch contact is closed (normally closed).
7. Optional high/low gas pressure switch contacts are closed (high pressure is normally closed, low pressure is normally open).
8. Optional inlet air sensor contact is closed.
9. Airflow sensing switch contact is closed (normally open).
10. Flame safeguard starts cycle.

    A. 10 second initiation period

    B. 10 second purge

    C. Spark generator will be energized for 10 seconds and the pilot solenoid valve will be energized

    D. Pilot flame signal will be sensed

    E. With proof of pilot after 10 seconds, the main solenoid valves will open. The optional vent valve will close at this time

    F. Flame will be continually checked by safeguard

11. Maxitrol system will adjust to maintain the required discharge temperature.

NOTES:

*1. If exhaust starter is included, it must operate first before the supply starter.

2. If an off delay timer (1-120 minutes) is included, the unit will continue to operate after the switch is turned to the off position.

3. If freeze protection is included, a timer (1 to 5 minutes) and a discharge temperature sensor is included. The unit must heat up to above the discharge temperature before the timer runs out or the unit will shut off.

Trouble Shooting

The following is a cause and correction list for common problems with these units. Also included in the unit owners packet are the Maxitrol Systems owner's manual plus the Flame Safeguard owner's manual. The sequence of operation should be used to help determine where the problems could be when trouble shooting the unit.

Heater

Symptom	Possible Cause	Corrective Action
Blower runs but heater will not operate	Gas is not on	Turn gas on
	Heater is not getting power	Check switch and wiring
	Gas piping is not purged of air	Purge line
	Inlet clogged	Clear inlet of unit
	Filter(s) clogged	Clean or replace filters
	Ductwork clogged	Check ductwork for obstructions
	Registers in building closed	Open registers
	Airflow pickups clogged or tubing crimped	Unclog pickups Straighten or replace tubing
	Blower rotating in the wrong direction	Reverse blower rotation
	Inlet damper closed or not fully open	Open damper
	Bad airflow sensing switch	Replace Note: Do not replace or adjust airflow switch without determining burner air pressure differential, Step 2 in the system startup.
	Flame safeguard is not getting power	A. Check heater main voltage B. Check high limit switch (requires manual reset) C. Check High/Low Gas Switch D. Check inlet air sensor setting (if supplied) E. Check wiring F. Check summer/winter switch in gas section
	Flame safeguard is getting power but will not operate	A. Reset manual switch on cover of flame safeguard B. Check airflow and switch C. Check purge card
	Inlet clogged with ice or snow	Check for building or unit exhaust near intake Moist air can clog filter with snow and frost
	Unit not grounded or improperly grounded	The flame safeguard will not operate if unit is not grounded
Blower Runs, heater tries to light - no visible pilot	Air in pilot line	Cycle unit to purge air
	Spark rod and flame rod wires crossed	Check wires to be sure they are correct
	Bad connections to spark generator and to spark plug	Check all wire connections from flame safeguard
	Spark plug gap not set	Adjust spark plug gap to .062"
	Cracked porcelain	Replace spark plug
	Dirty or corroded spark plug	Clean and remove any matter from the spark plug or porcelain or replace with AC or equivalent

Heater

Symptom	Possible Cause	Corrective Action
Blower runs, heater tries to light with visible spark, and possibly pilot but shuts down prior to main fire.	Cracked flame rod	Porcelain can be cracked. Replace flame rod.
	No gas to pilot	A. Check gas pressure B. Check pilot solenoid valve for restrictions C. Check pilot regulator for restrictions D. Check for bend in aluminum pilot line, repair or replace
	Check for ground	A. Unit should be well grounded B. Flame safeguard has a grounding screw in it, check to see if it is grounded. Pilot will not work if unit is not grounded.
	Dirty flame rod	Clean flame rod with emery cloth and wipe porcelain clean.
	Flame rod is grounded out	Check that flame rod is not touching burner or that foreign debris is not grounding out unit. Clean or adjust.
Blower runs, high limit trips out	High limit switch not set correctly	High limit should be set to 130°F.
	Modulation device is not modulating	Check modulation system and see owners manuals for repair.
Blower runs, flame safeguard goes out on safety after operating or unit cycles on and off	High gas pressure not set properly	See startup instructions for setting high fire
	Pilot regulator not set properly	Pilot is too large causing flame to go past flame rod. Turn down gas pressure
	Airflow too low or marginal for unit. Unit heats, lowering airflow causing switch to open	A. Adjust unit's CFMs to increase SP loss across burner B. Adjust baffles across burner to increase SP
	Microamps not steady with pilot on	A. Check wiring for spark rod and flame rod B. Check for cracks in porcelain on flame rod. If present, replace C. Soot buildup on flame rod If present clean rod
Blower runs, unit heats, Output air not warm enough.	Output temperature not set properly	See startup section for proper setting
	Main regulator not set properly	See setup section for setting high fire on main regulator
	Clogged vent orifice on regulator	Clean or replace vent
	Supply pipe too small	Recheck pipe size going to unit and repipe with larger pipe if necessary
	Discharge bulb not sensing discharge air	Check placement, should be in blower discharge
	Maxitrol System not functioning properly	Refer to Maxitrol manuals, make adjustments as manuals suggest
	Supply pressure too low	Contact utility company

MAINTENANCE

Greenheck recommends these procedures to insure trouble free operation of this unit. It is especially important to maintain gas heater units for clean and efficient operation. Most unit failures can be attributed to poor setup or poor maintenance.

A record of maintenance performed on this unit should be kept. This information will provide essential information if problems are encountered. A section at the back of this manual is provided for recording the unit's maintenance history.

CAUTION: When performing any maintenance on this unit be sure that the power is disconnected and cannot be accidentally turned on. The control center disconnect can be locked in the off position.

Yearly

The **burner system** should be inspected for accumulation of scale on both the upstream and downstream sides of the mixing plates. Any scaling or foreign material should be removed with a wire brush. Check visually that no holes in the mixing plates are blocked. If any burner ports are plugged (even partially) clear them with a piece of wire or a #47 drill bit.

WARNING: Do not enlarge burner ports or performance may be drastically affected.

If any mixing plates are loose or missing fasteners, tighten/replace as necessary. Always use zinc plated or stainless fasteners.

After inspection and cleaning, put system back into operation and if possible view from downstream side while cycling burner through full firing range. This will give a visual check for blocked burner ports.

Observe flame pattern and if necessary, take steps to correct velocity and/or air distribution problems.

Flame rods can last many years, but because of the high heat and expansion and contraction on the porcelain, flame rods can fail. Nuisance shutdowns of the burner can be caused by cracks in the flame rod porcelain. Some cracks may be too small to be seen with the naked eye, but will still cause shutdowns. Inspection, cleaning, and occasional replacement of the flame rods and spark rods may be necessary to insure optimum unit performance.

Beginning of the heating season

1. Turn the main gas valve to the “on” position.
2. The summer/off/winter switch should be switched to the winter position (in the heater box if provided).
3. The unit should be allowed to operate. Inspect the flame through the burner view port to make sure it is operating normally. Turn off the main gas to make sure the flame safeguard locks on safety.

End of the heating season

1. Turn the summer/off/winter switch to the summer position (in the heater box if provided).
2. Turn the main gas valve to the off position for the summer.

Canadian Requirements

1) All air handled by the unit shall be brought directly from outdoor. This unit is solely for replacing exhausted air with heated outside air.
2) The total air discharge capacity of the unit shall not exceed the total discharge capacity of the exhaust system by more than 10%. If the unit discharges directly into a booth, then the capacity should not exceed the exhaust capacity of the booth.
3) The unit intake should be located to prevent snow, rain, flammable gases, toxic gases, and other deleterious materials from entering the unit.
4) The supply fan shall be electrically interlocked with the associated exhaust fan so the that it will only run when when the exhaust fan is running. An exhaust flow proving device shall also be used, except on multiple exhaust systems where a measuring device electrically interlocked with the appliances may perform both functions.
5) Automatically operated inlet or discharge air dampers shall be electrically interlocked to ensure maximum design opening before either starting or running circuits may be energized.
6) No source of flammable vapor gases or dust shall be within 20 feet horizontally of any unit unless that source is separated from the unit by an enclosure of fire and vapor resistive materials.
7) The unit shall be installed so that the temperature of any adjacent combustible materials shall not exceed 90° F above an ambient temperature of 77° F or as permitted by table 1, Appendix A of CAN 3.7.
8) Bleed and vent lines shall be installed in accordance with applicable requirement of section 2.18 of CAN 3.7.
9) In the event that the make up air heater failure creates a hazard to other fuel burning equipment in the building, the unit shall be interlocked to open balancing inlet air dampers.
10) The content of toxic vapors and gases in the tempered air at the point of discharge into the building shall be such that no irritating effects are evident during normal operation, and the installation shall not be considered acceptable if the discharged toxic products are know to exceed the limits set out in table II, Appendix A of CAN 3.7.
11) The temperature of the discharge air shall be controlled so that it does not exceed 75° F, at the outlet of the appliance, excluding connected ductwork.

Safety Shut Off Valve Leak Test Procedure

1) Turn the unit off and attach a pressure gauge to the downstream side of the first SSOV.
2) Turn the unit on and allow the burner to go to main flame.
3) With the unit running close the hand-valve located just upstream of the burner.
4) Turn the unit off and read the pressure between the SSOV's.
5) Remove the test port on the upstream side of the second SSOV, and allow the pressure to go to zero.
6) Replace the plug and wait 10 minutes to see of there is a change in the pressure between the SSOV's.
7) If the pressure between the valves increase, the valve needs to be replaced.
8) To test the second valve, move the pressure gauge from the downstream side of the first SSOV to the downstream side of the second SSOV. Replace the plug in the first SSOV.
9) Turn the unit on, allow the burner to go to main flame, then shut the unit down.
10) Open the hand-valve upstream from the burner and allow the pressure to drop to zero.
11) Close the hand valve and wait 10 minutes to see if there is a change in pressure.
12) If the pressure increases, the second SSOV needs to be replaced.
13) Remove the pressure gauge and replace the plug. On units with a vent line remove the plug from the vent line.
14) Open the hand-valve.
15) The unit is now ready for operation.

System Start-Up Documentation

Job Information

Job Name: _____
Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Fax: _____
Contact Person: _____

Service Organization: _____
Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Fax: _____
Work Done By: _____

Name Plate Information

Min. BTH: _____ Max. BTH: _____
Type of Gas: ❑ Natural ❑ L.P.
Minimum _____ in. wg Maximum _____
Normal Manifold Pressure _____ in. wg @ Max. Output
Minimum Gas Pressure _____ in. wg for Max. Output
_____ SCFM against an E.S.P. of _____ in. wg

Model: _____
Volts: _____ Hertz: _____ Phase: _____
Amps: _____ Mark: _____
Supply Hp: _____ Exhaust hp: _____
Serial Number: _____

Field Start-Up Documentation

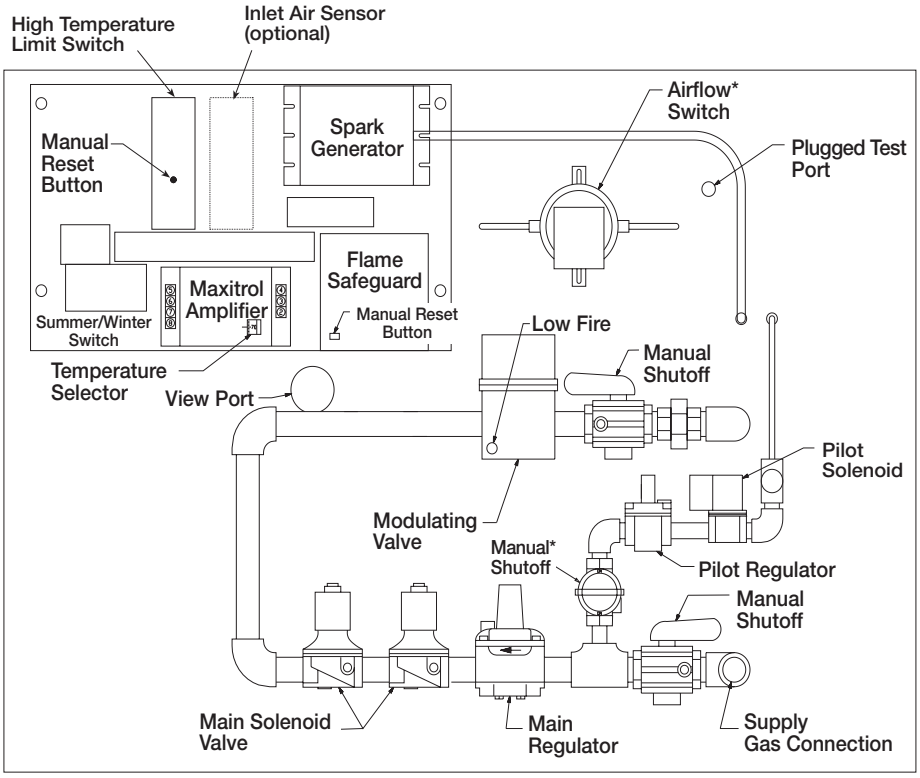
Actual Voltage: _____ Hertz: _____ Phase: _____
Actual Amperage: _____
Gas Pressure: Inlet _____ ❑ in. wg ❑ PSI
Burner _____ in. wg
Blower Rotation ❑ Correct
Air Volume Design _____cfm
Actual _____ cfm
Burner Baffle Opening: Length _____ in.
Width _____ in.
Burner Air Pressure Differential _____ in. wg

Motor Voltage: _____
Motor Amperage: _____
Discharge Temperature Setting _____°F
Fan RPM: _____
Flame Signal
Pilot On _____ Vdc
Low Fire _____ Vdc
Mid Fire _____ Vdc
High Fire _____ Vdc

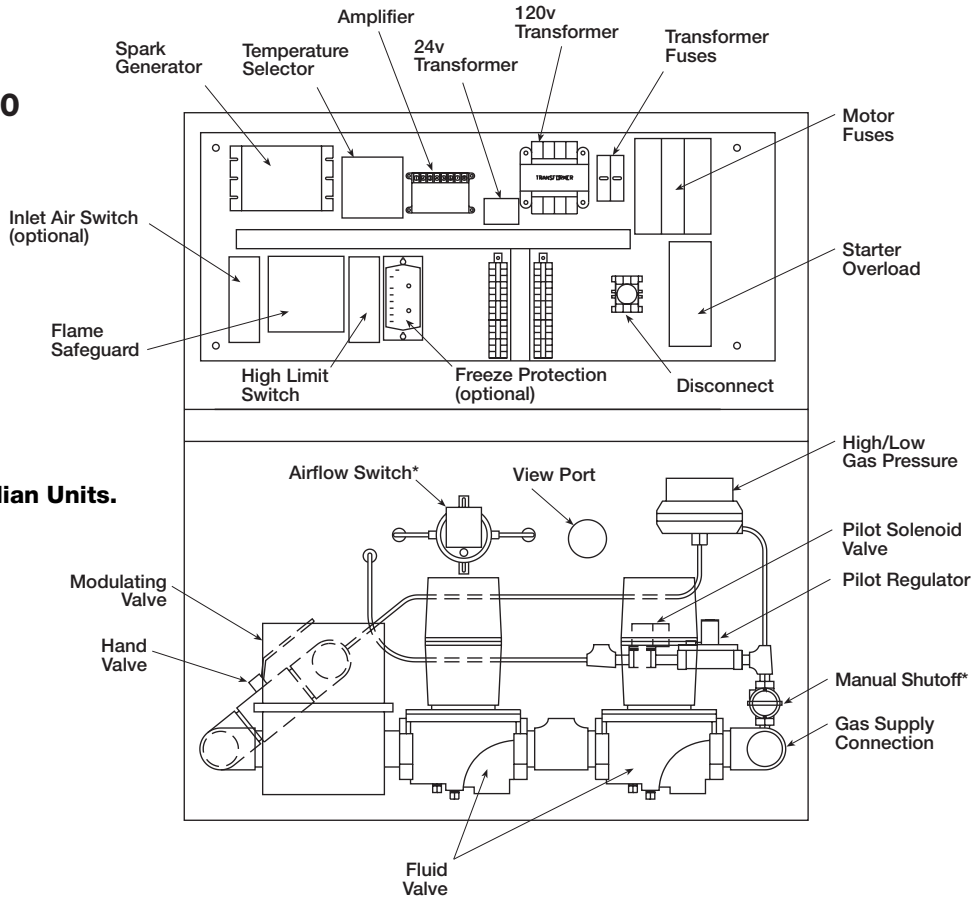
Maintenance

Date	Time	Notes: (Person calling, problem, contact person, etc.)

Typical Gas Control Compartment Layout for Housing Sizes 10, 20 & 30



Typical Gas Control Compartment Layout for TSU Housing Sizes 40 & 50



Note: * Two are provided on Canadian Units.