LENNOX

GS16E

Contents

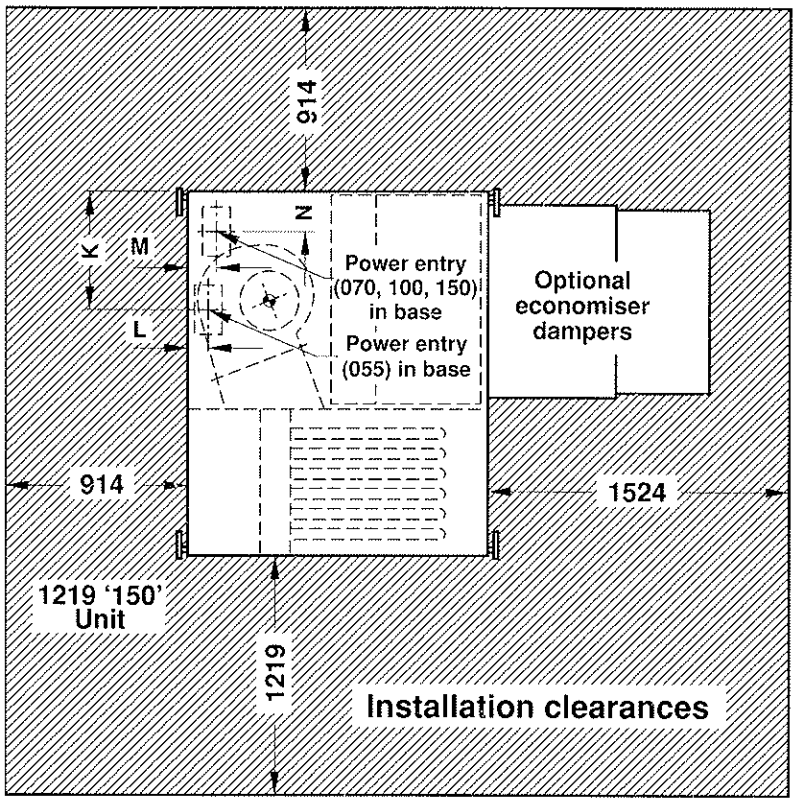
installation, operating and servicing

instructions

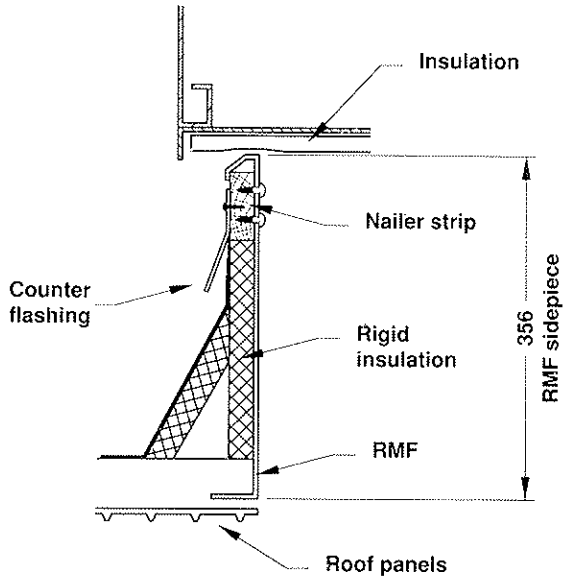
NOTE: To comply with current regulations Gas Fired Warm Air Heaters must be installed and serviced by CORGI registered personnel.

PART No. P - 8 - 67392

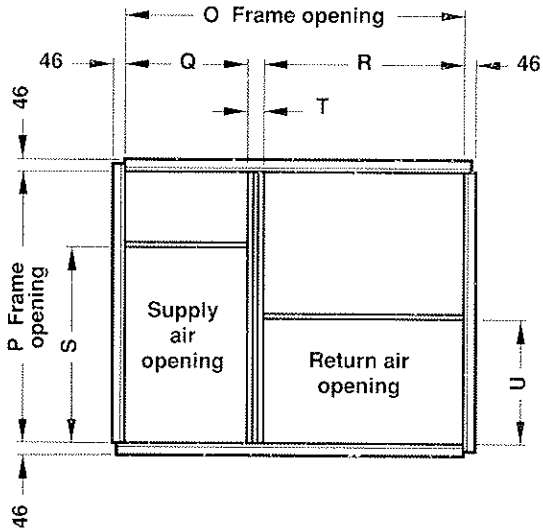
DIMENSIONS (mm)

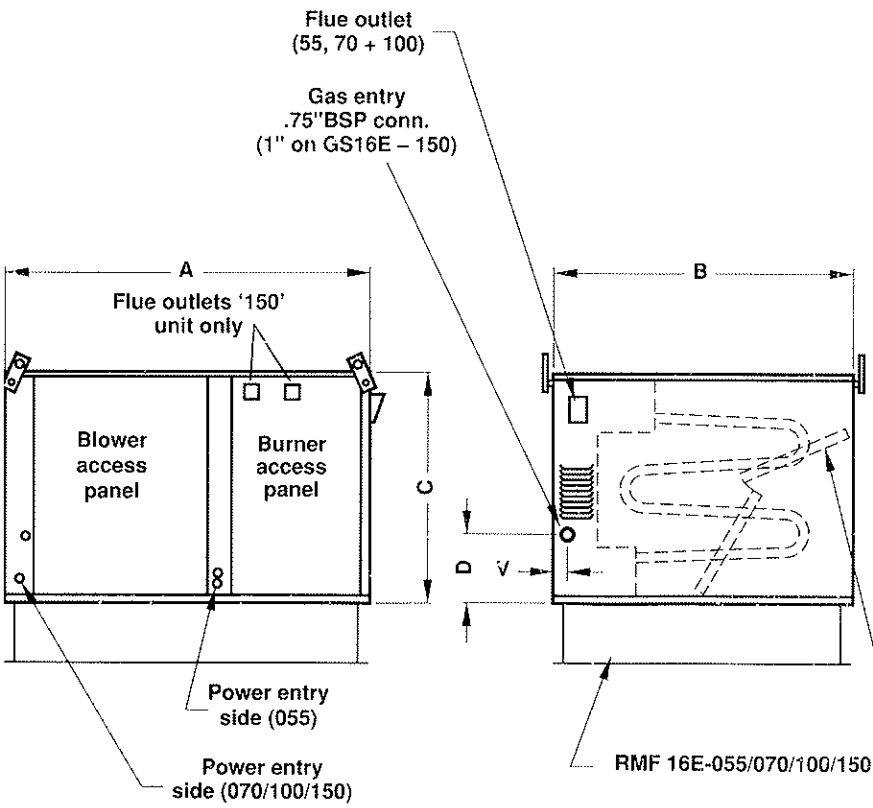


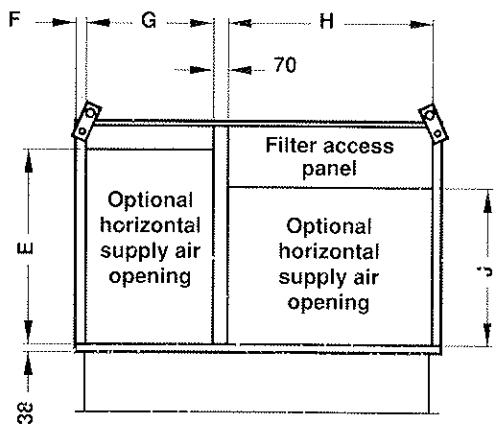
Recommended flashing for roof mounting frame



Plan view of roof mounting frames







Model number	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V
GS16E-055	1498	1220	989	248	816	41	494	838	625	725	148			1358	1092	456	800	800	102	456	73
GS16E-070	1850	1524	1168	356	994	51	641	1041	803			148	209	1722	1394	641	1003	1003	78	641	73
GS16E-100	2190	1730	1260	440	1054	51	654	1273	832			187	185	1927	1530	660	1156	1156	111	660	100
GS16E-150	2784	2160	1260	440	1054	51	920	1645	832			187	185	2540	1962	914	1168	1168	458	914	100

Fig. 1

1.0 Shipping and packing list

Package contains
1. Assembled unit
1. Vent cap package shipped in vestibule area.

2.0 Shipping damage

Check unit for shipping damage. The receiving party should contact the last carrier immediately if shipping damage is found.

3.0 General

These instructions are intended as a general guide and do not supersede local codes in any way. Authorities having jurisdiction should be consulted before installation.

See Fig. 1 for parts arrangement, service clearances, and unit dimensions.

4.0 Installation requirements

The GS16E unit is designed and manufactured for outdoor installations only with clearances to combustible materials listed on unit nameplate and in Fig. 1.

GS16E units may be installed with horizontal discharge on wood flooring or on combustible roof covering material. GS16E units with horizontal or bottom discharge may be installed on non-combustible flooring without a roof mounting frame.

GS16E units may be installed on wood flooring, or combustible roofing material with bottom discharge when installed on a RMF16E roof mounting frame.

Adequate clearance should be provided around air openings into the vestibule area. Provisions should be made for proper operation and for combustion and ventilation air supply. GS16E unit vent system must be installed as received and no alterations or adjustments should be made.

The unit must be adjusted within the temperature rise range listed on the unit nameplate. When installed, the unit must be electrically wired and earthed in accordance with local codes or, in the absence of local codes, with the current National Codes. Authorities having jurisdiction should be consulted before installation.

Note The efficiency rating of this air heater is a product of the thermal efficiency rating determined under continuous operating conditions independent of any installed system.

5.0 Unit support

Roof mounting with Lennox RMF16E - downflow discharge application

The RMF16E roof mounting frame must be installed, flashed and sealed in accordance with the instructions provided with the frame. The frame should be square and level to 5 mm per linear metre in any direction.

Duct must be attached to the roof mounting frame and not to the GS16E unit. Supply and return plenums must be installed before setting the unit.

Roof mounting with installer's frame - downflow applications

Many types of roof frames can be used to mount the GS16E unit, depending upon different roof structures. Items to keep in mind when using the building frame or supports are:

- The GS16E base is fully enclosed and insulated, so an enclosed frame is not required.
- The frames or supports must be constructed with non-combustible materials and should be square and level to 5 mm per linear metre in any direction.
- Frame or supports must be high enough to prevent any form of moisture from entering unit. Recommended frame height is 356 mm.
- Duct must be attached to the roof mounting frame and not to the GS16E unit. Supply and return plenums must be installed before setting the unit.
- Units require support along all four sides of unit base. Supports must be constructed of steel or suitably treated wood materials.

Note When installing a GS16E unit on a combustible surface for downflow discharge application, the Lennox RMF16E roof mounting frame is required.

Horizontal discharge applications
Specified installation clearances must be maintained when mounting GS16E units. Refer to Fig 1. Top of the support slab should be at least 100 mm above the finished ground level and located so no run-off water from higher ground can collect around the unit.

Horizontal discharge kit LB.55756BA for model 55, LB.55756BC for model 70, LB.55756BD for model 100, or LB.55756BE for model 150 is required when units are installed in horizontal discharge applications.

Units require support along all four sides of unit base. Supports must be constructed of steel or suitable treated wood materials.

6.0 **Duct connection**
When the Lennox RMF16E mounting frame is used, the duct must be attached to the roof mounting frame and not secured to the unit. Refer to RMF16E installation instructions.

If a Lennox RMF16E is not used secure duct work to GS16E flanges with screws. Unit supply and return air opening dimensions are shown in Fig. 1.

All exterior ducts, joints, openings in roof or building walls must be insulated and weather-proofed with flashing and sealing compounds in accordance with applicable codes. Any duct passing through an unconditioned space must be insulated.

Caution Do not drill or punch holes in base of unit. Leaking in roof may occur if unit is punctured.

7.0 **Rigging of unit for lifting**
Rig unit for lifting by attaching four suitable wires or chains to factory installed brackets.

Unit Weights
GS16E - 55 - 1M 234 kg
GS16E - 70 - 1M 324 kg
GS16E - 100 - 1M 465 kg
GS16E - 150 - 1M 650 kg

Note For model 150 units two vent caps are furnished and are installed on the face of the unit see Fig 1.

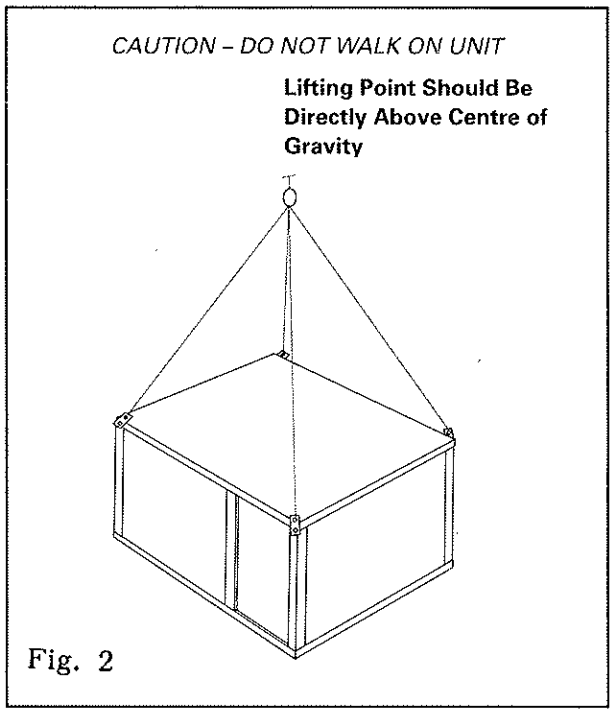


Fig. 2

1. Detach shipping frame assembly and discard before rigging.
2. Connect rigging to provied brackets.
3. All panels must be in place for rigging.

8.0 **Installing vent cap**
Install vent cap/s (shipped in vestibule area) using the three screws provided. See Fig. 3.

Caution Do not start or operate unit unless vent cap is in place.

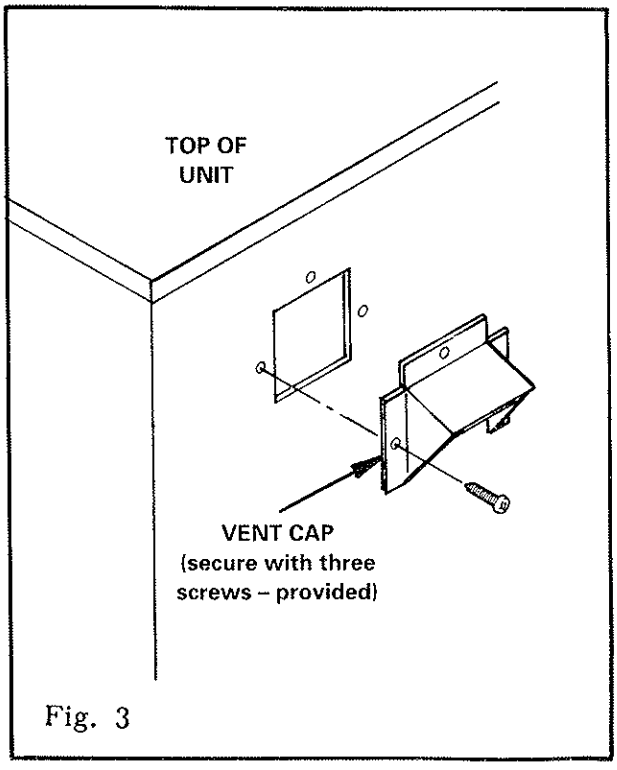


Fig. 3

9.0 Connecting gas piping

Before connecting gas piping, check with gas region or authorities having jurisdiction for local code requirements. When installing gas supply piping, the length of run from the gas meter must be considered in determining pipe size for 1.25 mbar (0.5 in wg) maximum pressure drop. Do not use a supply pipe smaller than unit gas connection.

For natural gas units, operating pressure at the unit gas connection must be a minimum of 13.75 mbar (5.5 in wg) and a maximum of 38.75 mbar (13.5 in wg).

For LP gas units, operating pressure at the unit gas connection must be a minimum of 27.5 mbar (11 in wg) and a maximum of 33.75 mbar (13.5 in wg).

When making piping connections a drip leg should be installed on vertical pipe runs to serve as a trap for sediment or condensate. A RC 1/8 plugged tap in field piping accessible for test gauge connection must be provided upstream of gas supply connection to the unit. Install a ground joint union between the gas control manifold and the main manual shut-off valve. See Fig. 4.

Compounds used on thread joints of gas piping should be resistant to the action of liquefied petroleum gases.

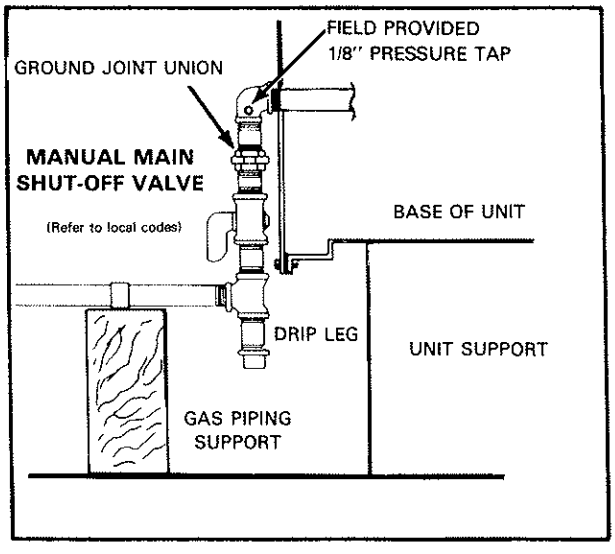


Fig. 4

10.0 Pressure testing gas piping

When pressure testing gas lines, the gas valve must be disconnected and isolated. Gas valves can be damaged if subjected to more than 35 mbar (0.5 lb/in^2 - 14 in wg). See Fig 5.

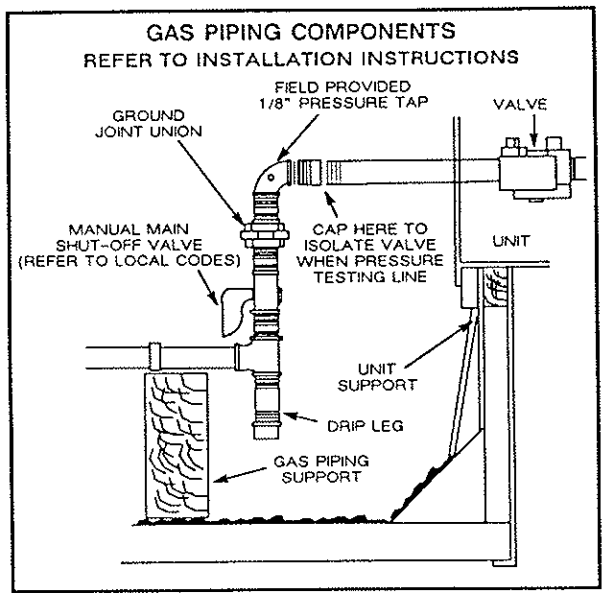


Fig. 5

If the test pressure is equal to or less than 35 mbar (0.5 lb/in^2) (14 in wg) use the main manual shut-off valve before pressure testing to isolate the furnace from the gas supply system.

Note Codes require that manual main shut-off valve and union (supplied by installer) be installed in gas line external to unit. Union must be of the ground joint type.

After all connections have been made, check all piping connections for gas soundness. Use a soap solution or other preferred means. Do not use matches candles or other sources of ignition to check for gas soundness.

Note In case emergency shut down is required, turn off the main manual shut-off valve and disconnect main power to unit. These devices should be properly labelled by the installer.

11.0 Electrical connections - power supply

Do not apply power or close isolator switch until installation is complete refer to start-up directions. Refer closely to unit wiring diagram.

Refer to unit nameplate for minimum circuit amperage.

All units are factory wired for 380/420V 3-phase, 50 Hz supply. See Fig.8 (Wiring Diagrams).

The unit is provided with power entry knockouts through the fan section mullion or through the bottom entry openings. (See Fig.1). Remove necessary electrical knockouts in unit. It may be necessary to punch larger holes for power wiring (refer to current I.E.E. requirements). Install an adequate isolator switch external to the unit in accordance with all applicable codes. The installing electrician must ensure his workmanship is weatherproof.

12.0 Electrical connections - control wiring

Thermostat location

Room thermostat mounts vertically on a standard 50 mm x 100 mm handy box or on any non-conductive flat surface on an internal wall. Locate the thermostat approximately 1524 mm (5 ft) above the floor in an area with good air circulation at average temperature. Avoid locating the room thermostat when it might be affected by;

- Drafts or dead spots behind doors and in corners
- Hot or cold air from ducts
- Radiant heat from sun or appliances
- Concealed pipes and chimneys

Control wiring

Route thermostat cable or wires from sub-base through knockout provided in unit. See wiring diagram on unit. For thermostat wire runs up to 18 m (60 ft), use 100 mm^2 (18 gauge) wire. For 18 m (60 ft) to 27 m (90 ft) runs, use 1.50 mm^2 (16 gauge) wire.

Install thermostat assembly in accordance with instructions provided with thermostat.

Important Terminal connections at the wall plate or sub-base must be made securely. Loose control wire connections may allow unit to operate but not with proper response to room demand.

13.0 Commissioning and Start-up operation adjustments

Preliminary checks

Make sure that unit is installed in accordance with the installation instructions and applicable codes and standards. Inspect all electrical wiring, both field and factory installed, for loose connections. Tighten as required.

Apply power to unit

Check voltage at isolator switch. Voltage must be within range listed on nameplate. If not, consult power authority and have voltage condition corrected before starting unit.

Refer to unit diagram located on inside of unit control box cover for unit wiring.

Adjust fan belt. See section fan belt adjustment.

Heating start-up

Caution This unit is equipped with a direct spark ignition system. Do not attempt to light manually.

To place unit in operation

1. Set thermostat on **OFF** position, close manual knob on gas valve and wait five minutes.

2. Open manual knob on gas valve/s, replace burner access door, and turn on unit electrical supply.

3. Set the fan switch to **AUTO** or **ON** and move the system selector switch to **HEAT.** Adjust the thermostat to a setting above room temperature.

The induced draft fan will start. The burners will light within 40 seconds. If unit does not light first time (gas line not fully purged) it will attempt up to two more ignitions before locking out. If lockout occurs, repeat steps 1, 2, & 3.

Fan operation and adjustments

Fan operation
Fan operation is manually set at the thermostat sub-base fan switch. With fan switch in **ON** position, fans will operate continuously. With fan switch in **AUTO** position, the fan will cycle with demand. Fans and the entire unit, will be off when the system switch is in the **OFF** position.

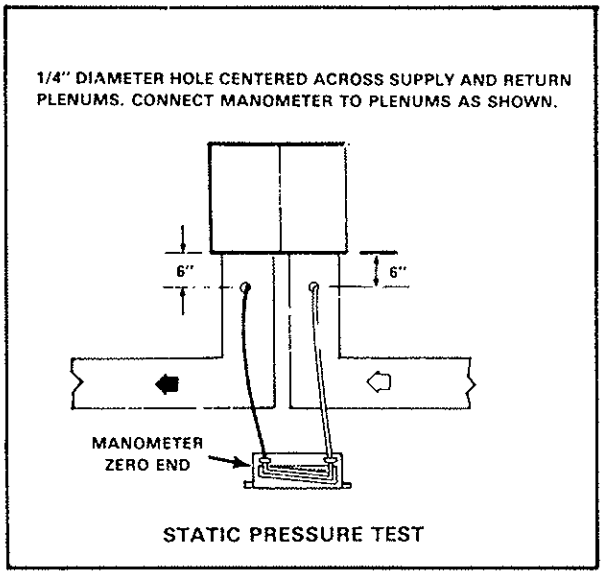


Fig. 6

Determining unit air volume
If optional cooling is included the following procedures must be made with a dry cooling coil and the fan run without a cooling demand.

Air filters must be in place when measurements are taken. Measure the static pressure external to unit (from supply to return). Measure the indoor fan wheel rpm and refer to unit nameplate to determine the fan motor horse power. See Fig. 6.

Referring to the following fan performance tables (m^3/s or cfm) use the static pressure and rpm readings to determine unit air volume.

The volume can be adjusted at the motor pulley (see Fan belt adjustment).

Fan belt adjustment
Maximum life and wear can be obtained from belts only if proper pulley alignment and belt tension are maintained.

Tension new belt/s after a 24-48 hour period of operation. This will allow belts to stretch and seat grooves. To increase belt tension, loosen the two locking bolts and pull mounting plate. Tighten motor mounting plate in vertical position.

Adjusting unit air volume
The air volume can be changed as follows.

Remove the fan belt. Loosen the set screws on motor pulley and remove key as shown in Fig. 7. Turn pulley clockwise to increase air flow and counter-clockwise to decrease air flow. One half turn changes fan speed approximately 20 rpm.

Replace the key and tighten the set screw. Replace and tighten the fan belt.

Heating operation and adjustment

Heating sequence of operation
When the thermostat calls for heat, the induced draught fan starts immediately. The combustion air pressure switch checks for proper fan operation before allowing power to the gas controller. This switch is factory set and no adjustment is necessary.

a. After a pre-purge of 30 to 40 seconds, the spark igniter is energised and the low fire solenoid valve opens in the gas valve.

b. The left burner is lit by the spark igniter and the flames cross light to the right burner where the flame sensor is located.

In the event that the flame is not detected after the first trial for ignition, the controller will repeat steps a) and b) up to two more times (depending upon controller model) before locking out.

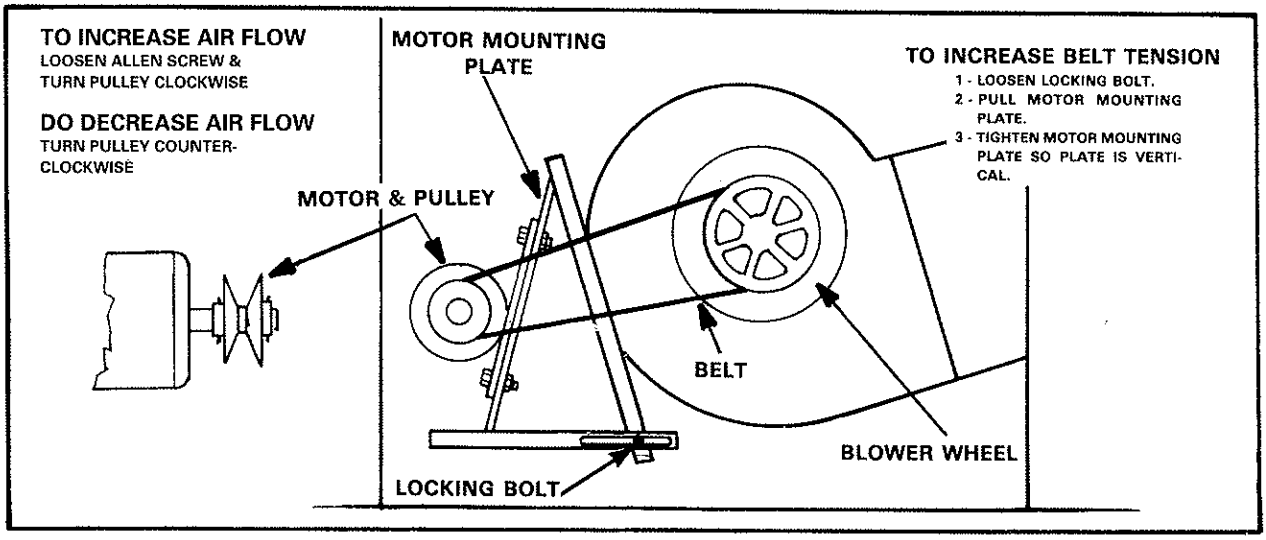


Fig 7. Model 150 has twin pulleys

If the thermostat calls for high heat, a bimetal actuator in the gas valve will be energised, after a time delay, and will progressively raise manifold pressure until full heat input is achieved.

Fan control
Fan control is not adjustable. With the fan switch in **AUTO** position, the fans will cycle with demand. The fan will come on 30 to 40 seconds after the burner lights and will cycle off 100 to 120 seconds after heat demand is satisfied.

Limit controls
Limit controls are factory set and are not adjustable. Limits are located in the division panel between the fan compartment and the heat section.

Heating adjustment
Main burners are fabricated with shutters fully open. **Caution** Do not over tighten mounting screw. Over tightening will distort the burner flame.

Burner flames may be observed through the inspection port in the access panel. Always operate the unit with the access panel in place.

The gap on the flame sensing electrode should be between 2.38 and 3.90 mm (3/32 in and 5/32 in). Remove right burner by removing screw and sliding the burner off the orifice. The carry over slot on burner is 3.175 mm (1/8 in) and it must be maintained. Clean the carry over slot using a strip of 16 gauge steel. Check gap with 1/8 in twist drill. Replace burner using mounting screw.

Maximum input adjustment of natural gas units
The maximum input may be reduced by up to 20% on units operating on natural gas only using the following procedure.

Check the manifold pressure at the gas valve pressure tap. To reduce maximum input, turn regulator adjusting screw counter-clockwise. See unit rating plate for recommended pressure setting.

Note Low fire operating pressure is fixed and not adjustable.

14.0 Servicing

Caution Turn off gas and electrical power to the unit before performing any maintenance or service operations on the unit. Remember to follow lighting instructions attached to the unit when putting unit back into operation after service or maintenance.

FAN PERFORMANCE

GS16E-55-1M

Air volume		Static pressure (Pa)																					
		50		75		100		125		150		175		200		225		250		275		325		375	
m³/s	cfm	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW
1.13	2400	625	0.42	645	0.43	665	0.45	685	0.47	705	0.49	725	0.51	745	0.53	785	0.60	825	0.66	865	0.74	935	0.92	1070	1.07
1.23	2600	640	0.48	660	0.50	680	0.52	700	0.55	720	0.57	740	0.59	775	0.62	815	0.69	850	0.76	890	0.83	960	0.99	1090	1.16
1.32	2800	675	0.53	695	0.55	715	0.57	735	0.60	755	0.62	775	0.65	810	0.72	850	0.79	885	0.86	920	0.94	990	1.11	1120	1.28
1.42	3000	685	0.58	705	0.61	725	0.63	745	0.66	765	0.69	805	0.75	845	0.82	880	0.88	915	0.99	950	1.07	1015	1.23	1135	1.41
1.51	3200	705	0.63	725	0.66	745	0.70	765	0.73	795	0.80	835	0.87	875	0.95	910	0.98	945	1.13	985	1.21	1040	1.39	1155	1.56
1.60	3400	745	0.73	765	0.77	785	0.81	805	0.86	845	0.92	880	1.01	915	1.06	950	1.15	980	1.28	1015	1.36	1075	1.54	1175	1.73
1.70	3600	785	0.82	805	0.91	825	0.95	845	1.01	885	1.07	915	1.14	950	1.22	980	1.31	1015	1.44	1045	1.52	1100	1.69	—	—
1.79	3800	825	0.96	845	1.02	865	1.07	885	1.13	920	1.21	955	1.28	990	1.36	1020	1.54	1045	1.59	1075	1.69	—	—	—	—

GS16E-70-1M

Air volume		Static pressure (Pa)																					
		50		75		100		125		150		175		200		225		250		275		325		375	
m³/s	cfm	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW
1.13	2400	575	0.71	590	0.74	615	0.77	635	0.81	655	0.84	675	0.88	695	0.95	730	1.04	760	1.13	790	1.23	850	1.44	905	1.65
1.23	2600	580	0.75	600	0.78	620	0.82	640	0.85	660	0.89	680	0.97	715	1.07	750	1.13	780	1.26	810	1.37	870	1.58	915	1.79
1.32	2800	610	0.77	630	0.81	650	0.85	670	0.89	690	0.99	710	1.09	740	1.17	770	1.27	805	1.39	835	1.49	890	1.72	940	1.94
1.42	3000	620	0.87	640	0.92	660	0.96	680	1.02	700	1.11	730	1.20	765	1.30	795	1.41	820	1.54	850	1.64	910	1.87	955	2.08
1.51	3200	630	0.98	650	1.04	670	1.09	690	1.14	720	1.24	755	1.35	785	1.45	815	1.59	845	1.76	880	1.88	925	2.02	975	2.24
1.60	3400	645	1.08	665	1.15	685	1.20	705	1.27	755	1.38	785	1.49	815	1.60	845	1.71	870	1.87	900	1.99	950	2.18	1000	2.43
1.70	3600	685	1.23	705	1.30	725	1.37	745	1.44	780	1.54	805	1.66	835	1.77	865	1.86	890	2.04	920	2.17	970	2.37	—	—
1.79	3800	715	1.36	735	1.44	755	1.51	775	1.59	805	1.71	835	1.82	865	1.91	890	2.04	920	2.24	945	2.36	—	—	—	—
1.89	4000	745	1.52	765	1.61	785	1.69	805	1.78	835	1.90	865	2.03	890	2.13	920	2.21	945	2.47	—	—	—	—	—	—

GS16E-100-1M

Air volume		Static pressure (Pa)																					
		50		75		100		125		150		175		200		225		250		275		325		375	
m³/s	cfm	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW
2.45	5200	515	1.15	530	1.22	550	1.28	570	1.34	590	1.43	610	1.52	640	1.61	670	1.77	695	1.92	715	2.07	765	2.30	795	2.61
2.55	5400	525	1.25	540	1.32	560	1.39	580	1.46	610	1.57	630	1.69	665	1.80	685	1.93	705	2.06	730	2.19	775	2.38	820	2.65
2.64	5600	545	1.30	560	1.38	580	1.44	600	1.52	620	1.64	650	1.75	675	1.86	705	1.99	725	2.12	750	2.24	790	2.47	835	2.72
2.74	5800	555	1.42	570	1.50	590	1.57	610	1.66	640	1.78	665	1.91	695	2.03	715	2.15	735	2.26	760	2.37	805	2.64	845	2.79
2.83	6000	570	1.51	585	1.60	605	1.68	625	1.77	655	1.89	685	2.02	705	2.15	725	2.28	750	2.42	770	2.56	815	2.75	855	2.96
2.93	6200	595	1.63	610	1.72	630	1.81	650	1.90	680	2.05	705	2.20	725	2.35	750	2.45	770	2.55	790	2.65	830	2.91	870	3.11
3.02	6400	615	1.75	630	1.86	650	1.95	670	2.05	695	2.21	720	2.37	740	2.54	760	2.62	780	2.71	800	2.79	845	3.06	880	3.24
3.11	6600	640	1.99	655	2.10	675	2.21	695	2.33	715	2.45	735	2.57	760	2.69	780	2.79	800	2.89	815	2.99	860	3.17	900	3.39
3.20	6800	655	2.02	670	2.14	690	2.24	710	2.36	735	2.52	755	2.68	775	2.84	795	2.95	810	3.06	830	3.17	870	3.36	910	3.59
3.30	7000	670	2.25	685	2.38	705	2.50	725	2.63	745	2.73	765	2.83	785	2.92	805	3.06	825	3.19	845	3.33	885	3.62	915	3.80
3.40	7200	695	2.41	710	2.55	730	2.67	750	2.81	770	2.90	785	2.98	805	3.07	820	3.22	840	3.36	860	3.51	900	3.69	935	4.03
3.49	7400	710	2.44	725	2.59	745	2.71	765	2.86	780	2.98	800	3.10	820	3.22	835	3.33	850	3.44	870	3.54	910	3.87	945	4.19
3.58	7600	725	2.60	740	2.75	760	2.88	780	3.04	795	3.15	815	3.25	830	3.36	845	3.48	865	3.61	885	3.73	920	4.05	—	—

GS16E-150-1M

Air volume		Static pressure (Pa)																					
		50		75		100		125		150		175		200		225		250		325		375	
m³/s	cfm	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW	rpm	kW
3.30	7000	410	1.25	425	1.32	445	1.38	465	1.46	490	1.54	510	1.69	530	1.84	550	1.99	575	2.11	630	2.49	660	2.76
3.40	7200	420	1.35	435	1.43	455	1.50	475	1.58	500	1.67	520	1.83	540	1.97	560	2.12	585	2.23	640	2.65	670	2.93
3.49	7400	435	1.44	450	1.53	470	1.60	490	1.68	515	1.79	535	1.95	555	2.08	575	2.22	595	2.34	650	2.78	680	3.07
3.58	7600	450	1.55	465	1.64	485	1.72	505	1.81	525	1.93	545	2.08	565	2.21	585	2.34	605	2.46	660	2.93	690	3.24
3.68	7800	465	1.64	480	1.73	500	1.82	520	1.91	540	2.05	560	2.20	580	2.32	600	2.44	615	2.55	670	3.05	700	3.37
3.77	8000	475	1.72	490	1.82	510	1.91	530	2.01	550	2.16	570	2.31	590	2.42	610	2.54	625	2.65	680	3.17	710	3.50
3.87	8200	490	1.90	505	2.02	525	2.12	545	2.23	565	2.37	585	2.53	605	2.66	625	2.78	640	2.92	695	3.43	725	3.79
3.96	8400	500	2.02	515	2.13	535	2.24	555	2.36	575	2.49	595	2.66	615	2.79	635	2.92	650	3.08	700	3.55	735	3.94
4.06	8600	520	2.15	535	2.27	555	2.38	575	2.51	595	2.64	615	2.81	630	2.95	650	3.09	670	3.27	715	3.71	745	4.12
4.15	8800	530	2.26	545	2.38	565	2.50	585	2.64	605	2.76	625	2.94	640	3.08	660	3.22	680	3.43	720	3.83	755	4.26
4.25	9000	540	2.31	555	2.45	575	2.57	595	2.70	615	2.81	635	3.00	650	3.14	670	3.29	690	3.51	730	3.87	765	4.31
4.34	9200	555	2.40	570	2.54	590	2.67	610	2.81	630	2.97	650	3.17	665	3.33	685	3.47	705	3.68	745	4.11	780	4.51
4.43	9400	570	2.51	585	2.66	605	2.79	625	2.94	640	3.16	660	3.37	680	3.54	695	3.69	715	3.89	755	4.38	790	4.76

DUTIES IN ABOVE SHADED AREAS REFER TO STANDARD MOTOR AND DRIVE KIT.
FOR APPLICATIONS WITHIN SHADED AREAS PLEASE REFER TO LENNOX APPLICATIONS DEPARTMENT, BASINGSTOKE.

Lubrication

Note Always lubricate motors according to manufacturers lubrication instructions on each motor. If no instructions are provided, use the following as a guide.

Supply air fan in motor bearings Bearings are prelubricated. No further lubrication is required for 10 years of normal operation. Thereafter, clean and repack bearings with a suitable bearing grease every two years.

Fan shaft bearings Bearings are prelubricated and sealed. No further lubrication is necessary.

Induced draft fan motor bearings
Bearings are prelubricated and sealed. No further lubrication is necessary.

Filters
GS16E units are equipped with pleated 50 mm (2 in) throw-away type filters. Permanent 25 mm (1 in) foam filters are acceptable replacements. Filters should be checked and replaced when necessary. If permanent foam filters are used as a replacement, they should be checked and cleaned periodically with warm water and a mild detergent.

Burners
Periodically examine burner flames for proper appearance during the heating season. Use inspection port in the front of the burner compartment access panel. Before each heating season examine the burners for any deposits or blockage which may have occurred.

Cleaning
Clean burners as follows, turn off both electrical power and gas supply to unit. Remove access panel to burner compartment. Remove burner mounting screws and lift burners from orifice.

Clean as necessary and replace burners and secure with mounting screws. Make sure that burner heads line up correctly. Spark gaps on igniter and flame sensing electrode must be properly set. Refer to Heating Adjustment section. Replace access panel.

Caution Do not over tighten burner mounting screws. Over tightening will distort burner flame.

Restore electrical power and gas supply. Follow lighting instructions attached to unit and use inspection port in access panel to check flame.

Induced draught fan
A combustion air fan motor centrifugal switch checks the induced draught fan operation before allowing power to the gas controller. The gas controller will not operate if the fan is obstructed.

Under normal operating conditions, the induced draught fan wheel should be checked and cleaned prior to the heating season. However, it should be examined periodically during the heating season to establish an ideal cleaning schedule. With the power supply disconnected, the condition of the fan wheel can be determined by looking through the vent opening.

Cleaning induced draught fan and vent cap
Shut off power supply and gas to unit. Remove four screws retaining vent cap and induced draught fan side panel. Clean vent cap as necessary.

Remove three screws holding fan housing to flue box cover plate and four wires attached to motor. Take care not to lose or damage vent screen.

Clean fan wheel with a small brush and wipe off any dust from housing. Clean accumulated dust from front of flue box cover.

Replace induced draught fan motor by reversing this procedure. It is recommended that the combustion air fan gasket be replaced during reassembly.

Clean louvre in combustion air supply (right side of vestibule panel) using a small brush. See Fig. 1.

Flue passageway and flue box
Remove induced draught fan assembly as described in previous section. Remove flue collector cover and flue collector baffle. Clean with a wire brush as required. Pull tube baffles from heat exchanger and clean tubes with a wire brush.

Reinsert tube baffles by gently bending them to lock tab against tube outlets. Reassemble the unit. The flue collector cover gasket and combustion air fan gasket should also be replaced during reassembly.

Supply air fan wheel
Inspect supply air fan wheel annually, for accumulated dirt or dust. Turn off power before attempting to remove access panel or to clean fan wheel.

Note The following information applies to a basic unit at the time of printing this manual. Lennox GS16E series units are frequently ordered with specific requirements or modifications which alter the basic wiring in which case the individual wiring diagram supplied with the unit should be consulted. Person servicing GS16E units should consult "Parts descriptions" for information on components, their function and operation.

15.0 GS16E 55, 70 & 100 model sequence of operation for electro mechanical thermostat - no optional controls.

Fig. 7 shows the step-by-step sequence required to control and supply power to fans, gas valves, and other components in the system. The numbered steps below refer to the numbers on Fig.8.

Sequence of operation
1. Line voltage power provided from the fused isolator is used to energise the control transformer M10 and all system contactors.
2. Transformer M10 powers all unit controls, thermostat and most of the units optional controls.
3. Heating demand stages are generated through the room thermostat (and sent to the units optional controls if used).
4. From the thermostat heating stages are controlled as follows:

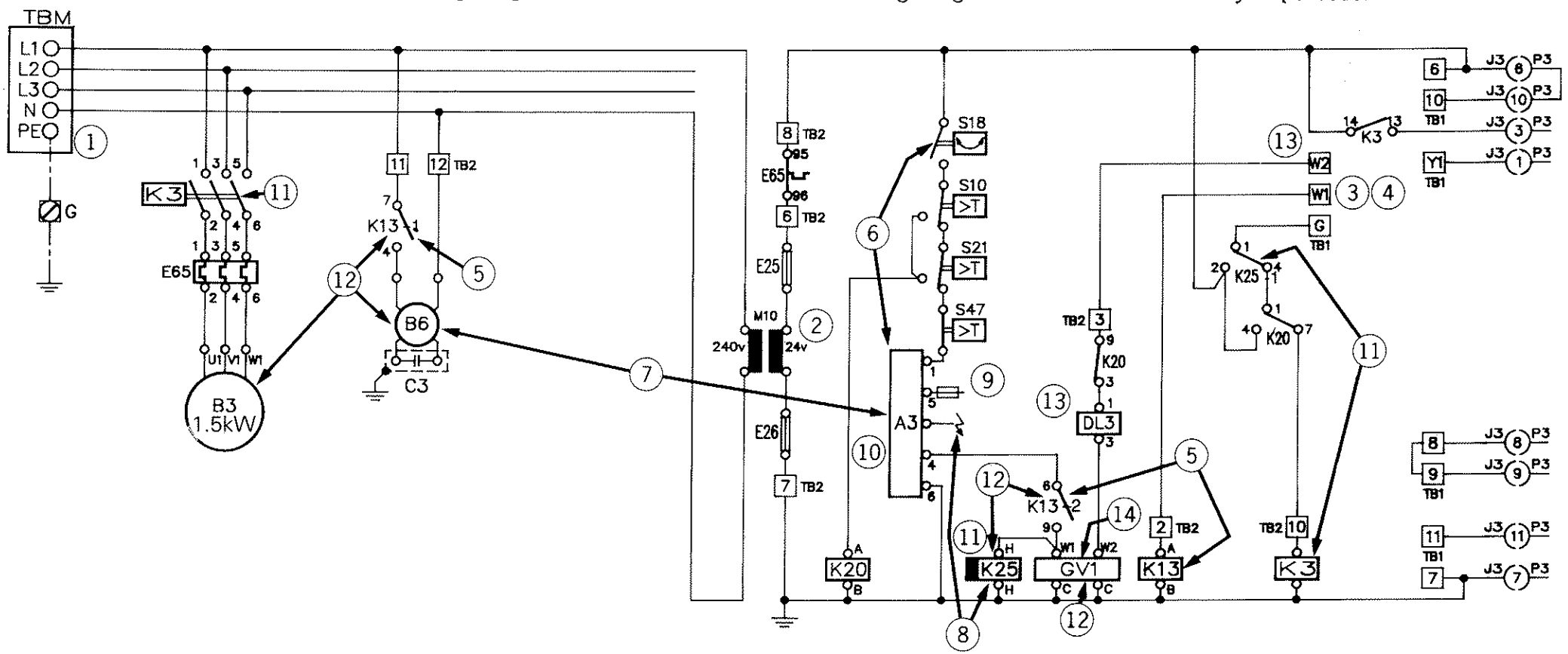
Stage 1
5. Initial heat demand W1 activates induced draught fan relay K13. Contacts K13-1 close and energise induced draught fan B6. Contacts K13-2 close to allow gas valve GV1 to be energised.
6. A centrifugal switch S18 inside the induced draught fan proves the induced draught fan is operating and closes to allow power to ignition control A3.
7. Ignition control A3 waits 30 to 40 seconds to allow induced draught fan B6 to draw exhaust gas from burners and to introduce fresh air.
8. After the 30 to 40 seconds delay, ignition controls activates 1st stage (low fire) position of gas valve GV1, supply air fan delay relay (K25) and spark electrode A3.
9. The left burner is lit by a spark electrode and the flame cross lights to the right burner where the flame sensor is located.
10. If a flame is not detected after first trial for ignition, the controller A3 repeats steps 7 through 9 up to three times before locking out.
11. Supply air fan delay/relay K25 closes 30 to 40 sec after burners light. Contacts K25-1 switch closed to allow power to supply air fan B3 by way of contactor K3.
12. When heating demand is satisfied, contacts K13-1 and K13-2 open to shut off gas valve GV1 and combustion air fan B6. Fan delay/relay K25 cycles off 100 to 120 sec. after heat demand is satisfied to de-energise Fan B3.

Note Thermostat terminal G does not energise contractor K3 contacts K25-1 are used to energise K3.

Stage 2
13. If thermostat calls for high heat W2, time delay DL3 is activated.
14. If high heat demand is still called for after 180 sec, DL3 closed to activate 2nd stage (high fire) position of GV1. Second stage of gas valve is actuated slowly.

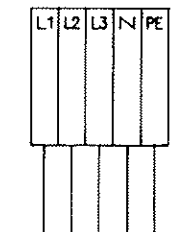
Typical schematic wiring diagram for GS16E series unit. Wiring diagram with actual unit may supercede.

Fig. 7



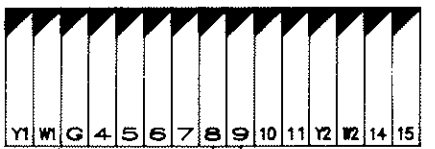
A3	Control – primary burner
B3	Motor – supply air fan 1.5kW
B6	Motor – combustion air fan assembly
C3	Capacitor – combustion air fan motor
DL3	Delay – gas stage 2 (180 S)
E25/E26	Fuses – transformer M10 (5A)
E65	Overload – supply air motor (2.7-7A)
GV1	Valve – gas
K3	Contactor – supply air fan motor
K13	Relay – combustion air fan
K20	Relay – limit S.A. fan
K25	Relay – fan delay (heat)
M10	Transformer – control (75 VA) 240/24V
S10	Switch – limit primary gas
S18	Switch – combustion air fan proving
S21	Switch – limit secondary gas
S47	Switch – limit flame fallout
TB1	Terminal block – low voltage control
TBM	Terminal block – mains 5 pole

TBM
5 pole mains terminal block



415 V, 3-phase, 50 Hz
electrical supply
from fused isolator
full load – 4 A per phase

TB1
Low voltage terminal block



Economiser (if fitted)
1st stage heating
supply air fan
24 volt a.c. output
24 volt a.c. common
24 volt thermostat feed
night setback (optional)
2nd stage heating

16.0 **GS16E repair parts listing**
When ordering parts, include the complete model number listed. eg. GS16E-70-1M.

Heat Section

Heat exchanger
Combustion air fan motor (B6)
Combustion air fan wheel
Burner assembly
Combustion air fan housing
Burner manifold assembly
Main burner orifices
Ignition electrode assembly
Ignition lead
Sensor lead
Gas valve (GV.1) *
Gas valve (GV.2) *
Flue baffle
Limit control
Auxiliary limit control

* Model 150 has two gas valves. GV1 and GV2.

Fan Parts

Indoor fan motor B3
Fan wheel

Electrical Control

Transformer (control) M10
Fan contactor (K3)
Limit fan relay (K20-1, -2)
Primary control (A3)
Fan delay (K25, K25-1)
Capacitor CAB (C3)
Delay relay gas (DL3)
Relay CAB (K13, K13-1)
Transformer fuses M10 (5A) E25/E26
Overload/supply air motor E65
Switch/limit primary gas S10.

17. Parts descriptions

1. Control Transformer M10 located inside the control box is used to step down line voltage to 24 VAC to provide power to all the units controls and thermostat. An integral fuse is used to protect the lead side of the secondary from abnormal amperage.

2. Fuse is rated at 3.2A 300V and can be accessed from outside the transformer.

3. Combustion air fan relay K13. A double pole double throw relay located inside the control box is used to energise the combustion air fan. The relay is energised any time there is a heating demand.

4. Supply air fan motor contactor is a 3 pole double break contactor located in the control box is used to energise the supply air fan motor. On heating demand the contactor is energised after a time delay.

5. Supply air fan. A single belt driven fan provides air supply through the unit. An adjustable sheave is used on the fan motor so that the m^3/s (cfm) rating can be adjusted. (see Fig. 7 and fan performance tables). Model 55 uses a 47.3 in 'A' section belt. Model 70 uses a 54.3 in 'A' section belt.

6. Combustion chamber/heat exchanger (Fig.9). The GS16E uses aluminised steel inshot burners with matching tubular aluminised steel heat exchangers and a two stage redundant gas valve. A burner venturi mixes gas and air for proper combustion.

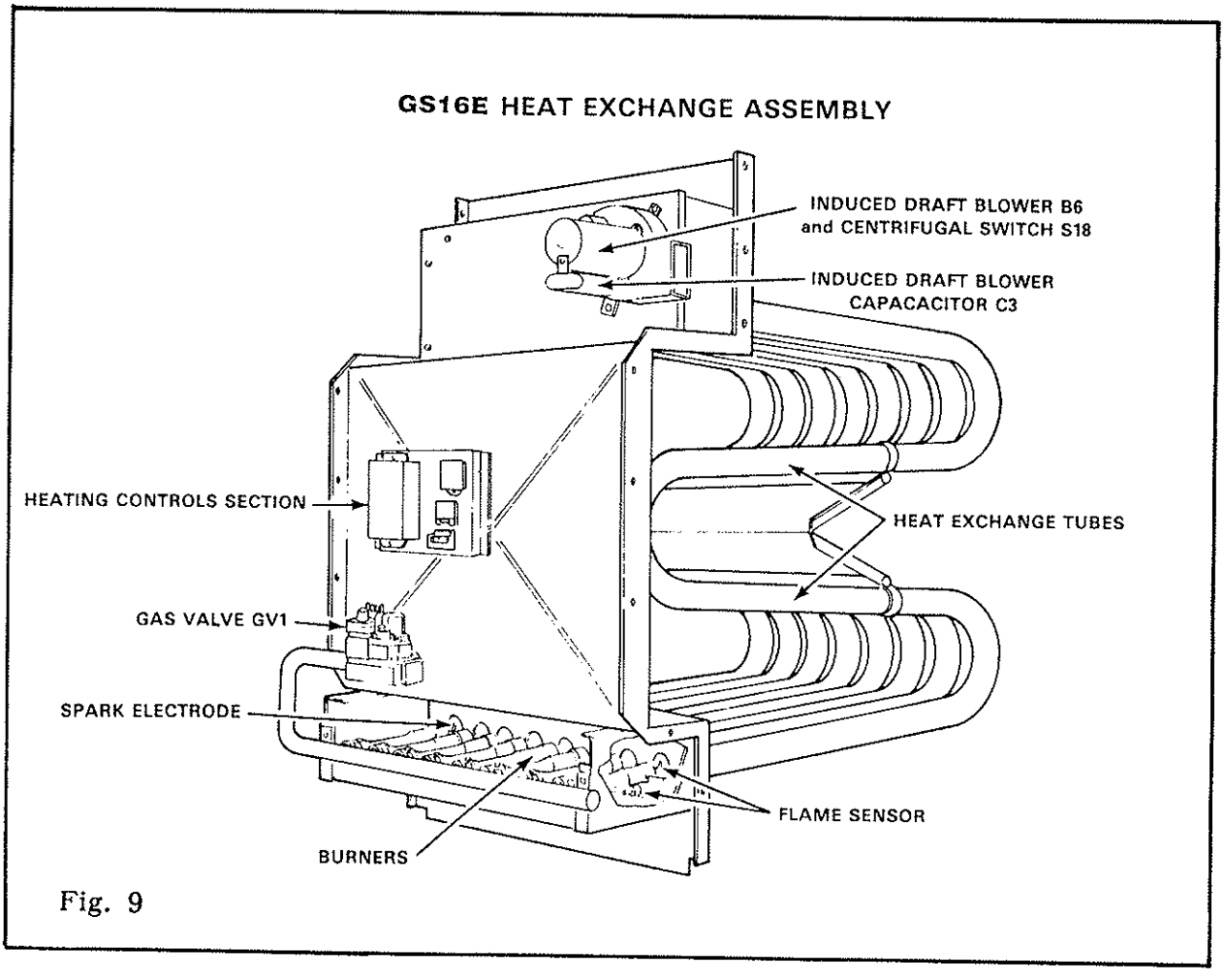


Fig. 9

Burners are controlled by the spark electrode, flame sensing electrode, gas valve GV1 and combustion air fan B6. The spark electrode, flame sensing electrode and gas valve GV1 are directly controlled by ignition control A3. Ignition control A3 and combustion air fan B6 are controlled by heating demand from the thermostat or control system.

Burners are factory set and do not require adjustment. Air shutters should always be fully open. A peep hole with cover is furnished in the cabinet access panel for flame viewing. Always operate the unit with the access panel in place. Burners can be removed individually for service.

Combustion takes place at each tube entrance. As hot exhaust gases are drawn through each tube by the induced draught fan, exhaust gases are drawn out the top and a fresh air/gas mixture is drawn in at the bottom. The supply air fan controlled by the ignition control or the control system forces air across the tubes to extract heat. The shape of the tubes and a deflector ensure maximum heat exchange.

The gas valve accomplishes staging by allowing more or less gas to the burners as called for by the heating demand.

Heating controls section (Figure 9)
The heating controls are located on the vest panel in the heating compartment. The heating controls section contains the ignition control, relays and other controls necessary for operation of the heating unit. See Parts Arrangement.

Ignition (burner) control (A3)
On a heating demand, the ignition control is energised after proving combustion air fan operation and after allowing 30 to 40 seconds for the combustion air fan to vent exhaust gases from the burners. Once energised, the ignition control activates the 1st stage (low fire) position of the gas valve, the fan/delay relay and the spark electrode. The ignition control is not adjustable.

DANGER SHOCK HAZARD. SPARK RELATED COMPONENTS CONTAIN HIGH VOLTAGE. DISCONNECT POWER BEFORE SERVICING. THE IGNITION CONTROL IS NOT FIELD REPAIRABLE. UNSAFE OPERATION MAY RESULT.

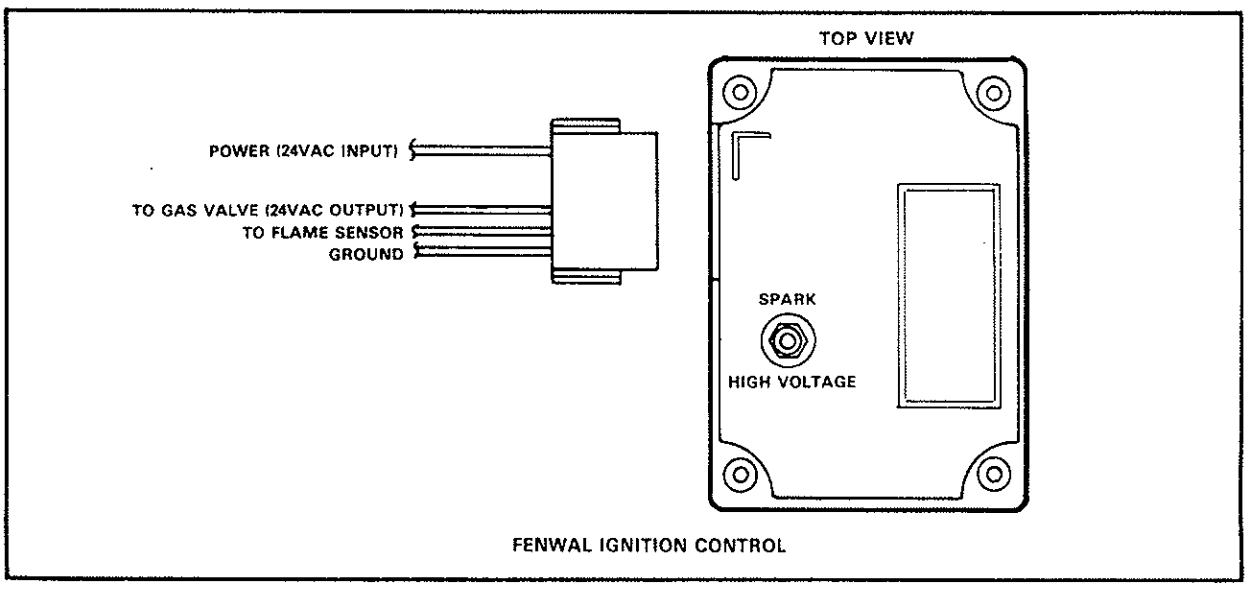


Fig. 10

A "Fenwall" electronic direct spark ignition with flame rectification sensing is used on all GS16E units.

The "Fenwall" control is illustrated in figure 10. The 4 wire harness, plugged directly into the jack at the lower corner of the control, is used to connect the control to the unit. Each of the four jack terminals are identified by number and function. The spark electrode wire connects to the spark plug type connecter as shown.

The ignition control provides three main functions: control of the gas valve, ignition and flame sensing. The ignition attempt sequence of the control provides three for ignition, before "locking out". The unit will usually ignite on the first attempt. See Figure 11 for a normal ignition sequence with nominal timings for simplicity.

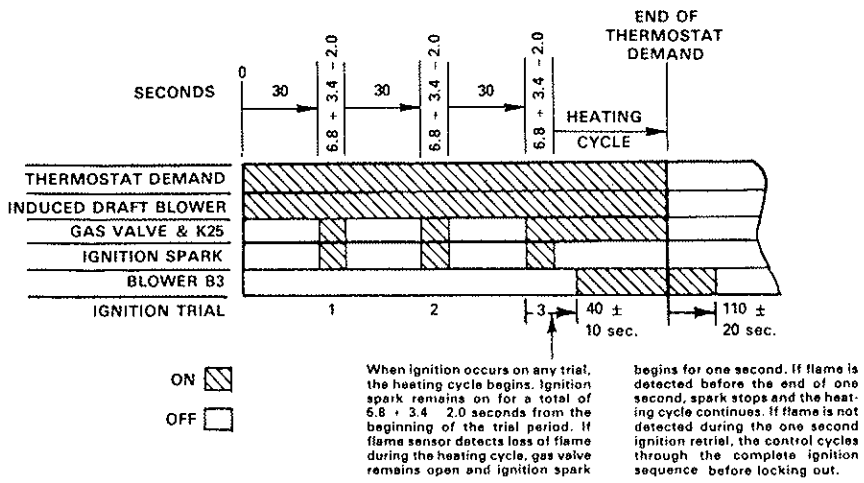
Proper gas/air mixture is required for ignition on the first attempt. If there is any deviation, within tolerance of the unit, a second or third trial may be necessary for ignition. The control will "lock out" the heating system if ignition is not obtained with three trials. Reset after "lock out" requires only breaking and re-making the thermostat demand. See Figure 12 for the ignition attempt sequence with retrials (nominal times given for simplicity).

Loss of combustion during a heating cycle is sensed through an absence of flame signal. If this happens, the control will immediately restart the ignition sequence and then lockout if ignition is not regained within three trials.

Blower limit relay (K20)
A double pole double throw relay located on the vest panel heating controls section is used to energise the fan motor. If either the primary or secondary limit trip, K20 will energise and activate the fan motor for safety cool-down.

Gas time delay (DL3) stage 2 heat
A second stage heat, gas delay is located on the vest panel heating controls section. Upon increased heat demand, the second stage operator of valve is delayed from opening for 180 sec. to prevent frequent cycling of 2nd stage heat. The time delay contacts are normally open.

Fan delay/relay (K25)
A heat type combination fan delay/relay located on the vest panel heating controls section is used to coordinate fan operation with burner operation. The fan cycles on 30 to 40 sec. after the burners light and cycles off 100 to 120 sec. after heat demand is satisfied. The relay is single pole double throw.



FENWAL
IGNITION CONTROL TIMING

Fig. 11

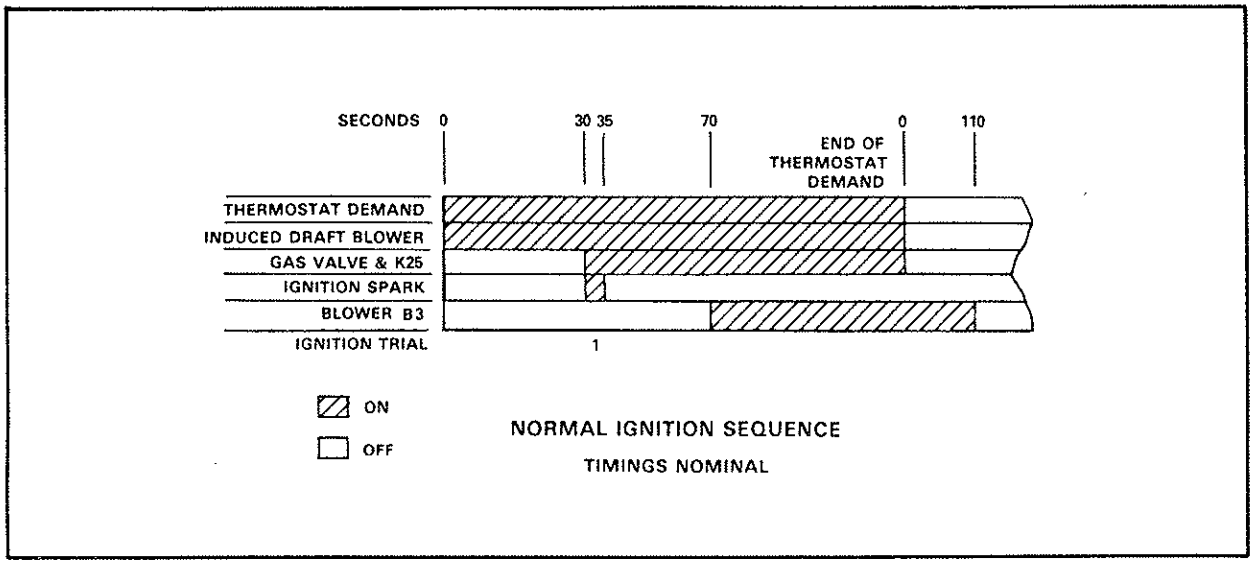


FIGURE 11

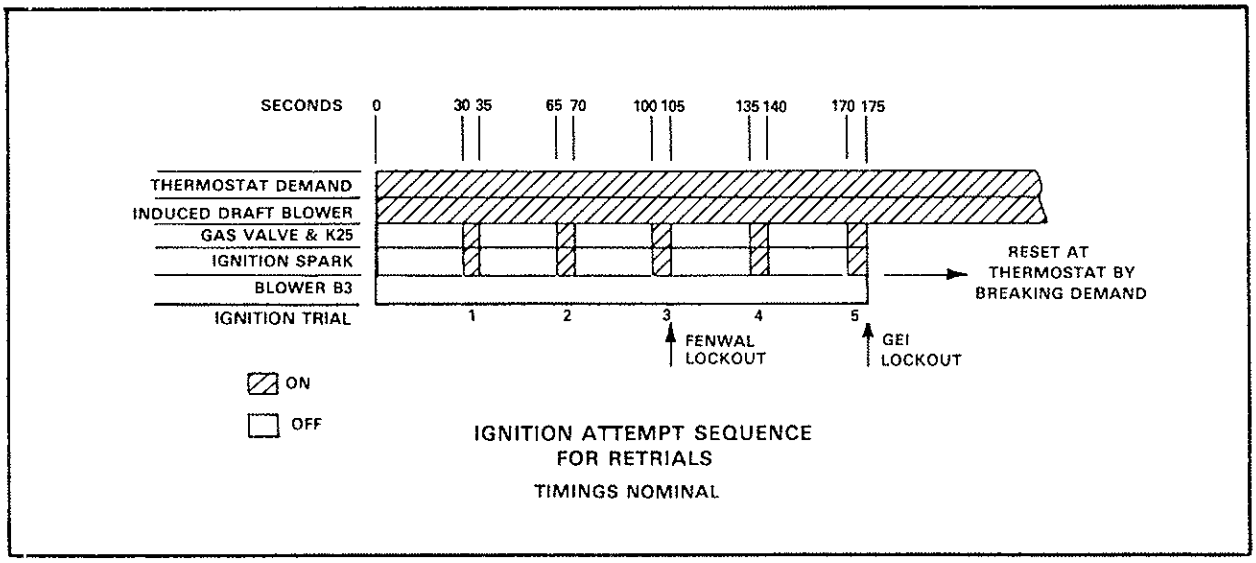


FIGURE 12

Gas valve (GV1) (Figures 14 & 15)
GS16Es may have gas valves manufactured by either 'Honeywell' or 'White-Rodgers'. The gas valve is two-stage and internally redundant. Initial heat demand (W1) from the ignition control (A3) opens both operators of the gas valve. Both operators respond to stage 1 demand quickly. Increased heat demand (W2) from the thermostat or control system activates only the second operator. The second operator responds to stage 2 demand slowly after time delay DL3 closes (3 min) and only after stage 1 has been fully activated. From the time stage 2 demand reaches DL3, it takes at least 4 minutes to fully activate stage 2. The stage 2 operator must complete cycle off (2-4 min) before stage 1 can cycle off.

1. The gas valve located in the heating compartment is 24 VAC two stage and internally redundant to assure safety shut-off. A manual shut-off knob is provided on the valve.

2. Gas valves on all models have top mounted controls and terminals.

3. Units with a 'White-Rodgers' valve (Figure 14) use terminals labelled 'W-1', 'W-2', 'C-1', 'C-2' and 'D-1'.

4. Units with a 'Honeywell' valve (Figure 15) use terminals labelled 'W1', 'W2' and 'C'.

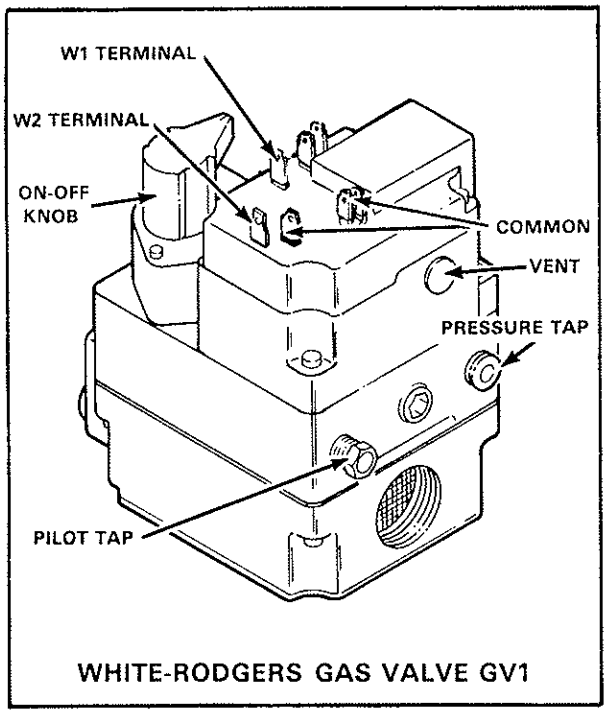
5. All valves use the following open/close timings:
a. Stage 1 open/close - less than 3 sec. (both operators)
b. Stage 2 open - 30-60 sec. (stage 2 operator only)
c. Stage 2 close - 60-90 sec. (stage 2 operator only)

6. All gas valves are factory regulated as per table below.

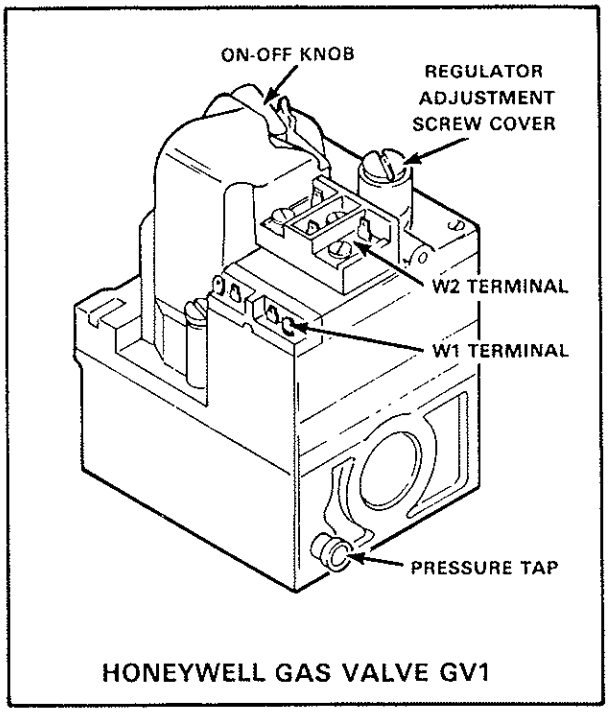
GAS VALVE REGULATION

FUEL	MAXIMUM INLET PRESSURE in. W.C.	HIGH FIRE PRESSURE in. W.C.	LOW FIRE PRESSURE in. W.C.
NATURAL	13.0	3.7 ± 0.2	1.6 ± 0.1
L.P.	13.0	10.5 ± 0.5	5.5 ± 0.3

Secondary (upper) limit switch (S10)
Located in the upper portion of the fan compartment, the primary limit de-energises the ignition control circuit when excessive temperature is reached. It also energises relay K20 to maintain fan operation until the limit resets. The limit is a single pole double throw auto-reset switch.



WHITE-RODGERS GAS VALVE GV1



HONEYWELL GAS VALVE GV1

Fig. 14

On a temperature rise terminals 1-3 open to de-energise the ignition circuit and terminals 1-2 close to energise the fan. The limit is factory preset to "trip" at 65.5°C 3°C (150°F 6°F) on a temperature rise and reset at 43°C 4°C (110°F 7°F) on a temperature fall. This is a safety shut-down function of the unit.

Primary (lower) limit switch (S21)
Located in the lower portion of the fan compartment, the secondary limit de-energises the ignition control circuit when excessive temperature is reached. It also energises relay K20 to maintain fan operation until the limit resets. The limit is a single pole double throw auto-reset switch. On a temperature rise terminals 1-3 open to de-energise the ignition circuit and terminals 1-2 close to energise the fan. The limit is factory preset to "trip" at 82°C 3°C (180°F 6°F) on a temperature rise and reset at 60°C 4°C (140°F 7°F) on a temperature fall. This is a safety shut-down function of the unit.

Induced draft fan (B6)
A run capacitor (C3) is required on all motors. The induced draft fan provides fresh air to the burners while clearing the burners of exhaust gases. A centrifugal switch is included which "makes" between 1800 and 2500 RPM and "breaks" 50 to 450 RPM below "make". On power-up, the switch in the fan closes to allow power through a safety circuit. The centrifugal switch (S18), on "make", "proves" induced draft fan operation and allows power to the ignition control.

Induced draft fan capacitor (C3)
An external run capacitor located on the combustion air motor assembly is used to improve efficiency of the combustion air fan.

Sequence of operation GS16E-150-1M

1. Line voltage power from the fused isolator when closed energises the control transformer M10 and all systems contactors.

2. Transformer M10 powers all unit controls, the thermostat and most of the units operational controls.

3. Heating demand stages are generated through the room thermostat and to the units optional controls if used.

4. From the thermostat, heating stages are controlled as follows:

Stage 1 Heat

5. Heating demand energises W1 in the thermostat. W1 energises combustion air fan relay K13. Normally open contacts K13 close.

6. When K13 in the line voltage circuit closes 240V power is routed to the combustion air fan B6. When K13 in the control section circuit closes a circuit is completed from the ignition control A3 to the gas valve GV1 (K13 acts only as a set of redundant safety contacts) Relay K56 is also energised and closes.

7. As combustion air fan B6 nears full speed combustion air prove switch S18 closes (S18 is a centrifugal switch located inside the combustion air fan motor).

8. When S18 closes 24 VAC power is directed through the high temperature limits S10 and S21 and the rollout switches S47 and S69 to energise ignition control A3.

9. Ignition control waits 30 to 40 seconds to enable combustion air fan B6 to purge the heat exchanger. Combustion air fan B6 operates throughout the heating cycle.

10. After the ignition control delay A3 activates gas valve GV1 through contacts K13 (see step 5), heating fan relay K56 and the spark electrode K56 closes contacts K56 to energise heating fan delay relay K25. When flame is sensed by flame sensor (minimum 5 microamps) the spark electrode stops.

If flame is not sensed after first trial for ignition, controller A3 repeats steps 6 through 10 up to two more times before locking out delay relay K25 waits 60 seconds. If the control locks out, it can be reset by breaking and remaking thermostat demand.

11. After 60 seconds delay, relay K25 normally open contacts close. 24 VAC power is ducted through the normally closed K20 supply air fan limit contacts to energise the supply air fan motor K3. K3 line voltage contacts close to energise supply air fan K3.

Stages 2, 3* and 4* heating demand

12. 2nd stage heating demand is through W2 in the thermostat which energises delay DL17 to give 180 seconds wait before activating 2nd stage gas valve operation on GV1. Supply air leaving temperature is increased (gas delay relay DL3 is also energised (180 seconds) after which relay K102 is energised to close contacts K102 ready for a possible 3rd stage heating demand.

Note Option four stage heating available on GS16E-150 models.

13. Optional 3rd stage heating demand is through W3 in the thermostat and contacts K102 (previously closed) to energise combustion air fan relay K19 and close the line voltage contacts K19 provided power to the combustion air fan B15.

14. Primary burner control No.2 waits 30 to 40 seconds and then energises 1st stage heating on gas valve GV2 through previously closed contacts K19. Relay K57 is also energised and closes the normally open contacts K57 to ensure fan delay relay K25 is energised thus also ensuring main supply air fan operation.

15. Optional 4th stage heating demand is through W4 in the thermostat to gas relay delay stage 4 DL21. After 180 seconds 2nd stage on gas valve GV2 is energised through previously closed contacts K19.

Note
Switching off sequences would pass down through 4, 3, 2, 1 as temperature in zone to be heated is satisfied.