installation operation and service instructions

GCS16–261 Through –650 Series Units

ROOFTOP UNITS
502,810M
5/95
Supersedes 5/94

RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE

⚠ WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

WHAT TO DO IF YOU SMELL GAS:

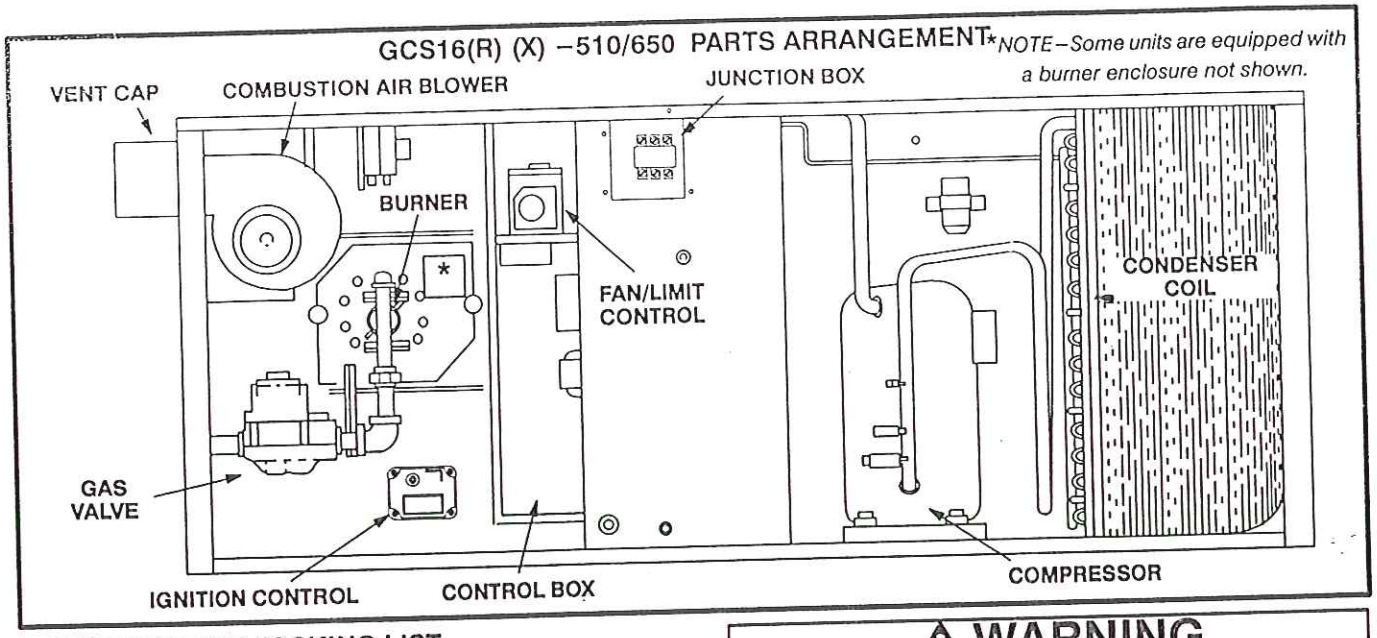
- **Do not try to light any appliance.**
- **Extinguish any open flames.**
- **Do not touch any electrical switch; do not use any phone in your building.**
- **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

Technical Literature
Litho U.S.A

LENNOX Industries Inc.
Dallas, Texas

GCS16(R) (X) –510/650 PARTS ARRANGEMENT*

NOTE – Some units are equipped with a burner enclosure not shown.



I–SHIPPING AND PACKING LIST

Package 1 of 1 contains:

1 – Assembled unit

1 – Vent cap assembly (shipped in blower compartment)

1 – Access panel cover (shipped in blower compartment)

1 – Filter (included in GCS16(X)–261, 311, 410, 510, and 650 units only)

II–SHIPPING DAMAGE

Check unit for shipping damage. Receiving party should contact last carrier immediately if shipping damage is found.

III–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.

IV–REQUIREMENTS

NOTE – These units must not be used as a "construction heater" at any time during any phase of construction. Very low return air temperatures, harmful vapors, and misplacement of the filters will damage the unit and its efficiency.

United States:

The GCS16 unit is American Gas Association (A.G.A.) certified for outdoor installations only at the clearances to combustible materials listed on unit nameplate and figures 1 and 2.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a qualified installer, service agency or the gas supplier.

⚠ WARNING

Product contains fiberglass wool.

Disturbing the insulation in this product during installation, maintenance, or repair will expose you to fiberglass wool. Breathing this may cause lung cancer. (Fiberglass wool is known to the State of California to cause cancer.)

Fiberglass wool may also cause respiratory, skin, and eye irritation.

To reduce exposure to this substance or for further information, consult material safety data sheets available from address shown below, or contact your supervisor.

Lennox Industries Inc.
P.O. Box 799900
Dallas, TX 75379–9900

GCS16 unit may be installed on wood flooring or on class A, class B, or class C roof covering material with horizontal discharge. GCS16 unit may be installed on noncombustible flooring only with bottom discharge.

GCS16 unit may be installed on wood flooring, class A, class B, or class C roofing material with bottom discharge when installed on a roof mounting frame RMF16.

When installed, the unit must be electrically wired and grounded in accordance with local codes or, in the absence of local codes, with the current National Electric Code, ANSI/NFPA No. 70, if an external power source is utilized.

The current National fuel Gas Code (ANSI–Z233.1) is available from:

American National Standard Institute Inc.
1430 Broadway
New York, NY 10018

The current National Electric Code (ANSI/NFPA No. 70) is available from:

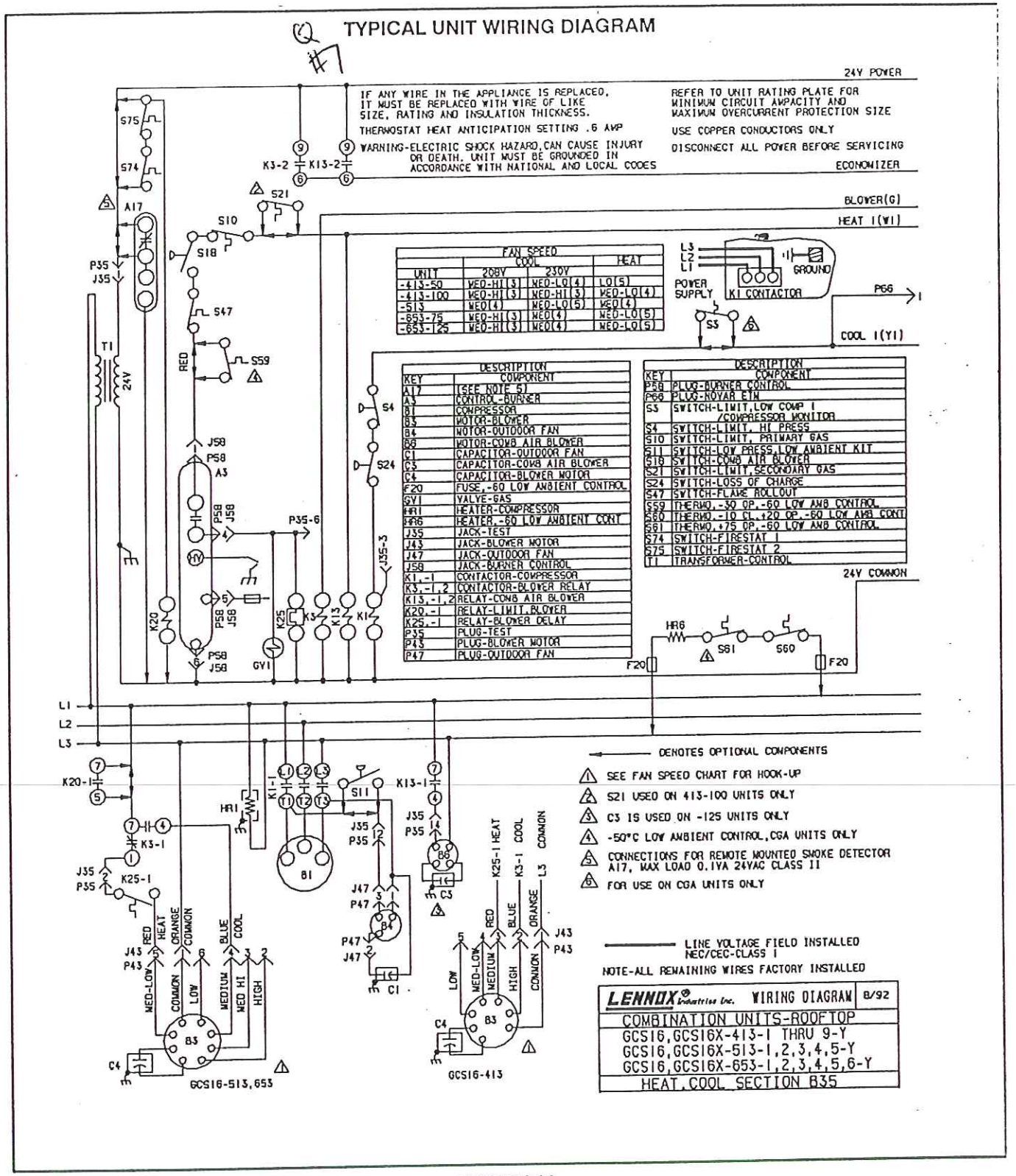

TYPICAL UNIT WIRING DIAGRAM
24V POWER
IF ANY WIRE IN THE APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING AND INSULATION THICKNESS.
THERMOSTAT HEAT ANTICIPATION SETTING .6 AMP
WARNING-ELECTRIC SHOCK HAZARD, CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES
REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE
USE COPPER CONDUCTORS ONLY
DISCONNECT ALL POWER BEFORE SERVICING
ECONOMIZER
BLOWER(G)
HEAT 1(W1)
COOL 1(Y1)
24V COMMON
FAN SPEED
UNIT | COOL 208V | COOL 230V | HEAT
-413-50 | MED-HI(3) | MED-LO(4) | LO(5)
-413-100 | MED-HI(3) | MED-HI(3) | MED-LO(4)
-513 | MED(4) | MED-LO(5) | MED(4)
-653-75 | MED-HI(3) | MED(4) | MED-LO(5)
-653-125 | MED-HI(3) | MED(4) | MED-LO(5)
KEY | DESCRIPTION COMPONENT
A17 | (SEE NOTE 5)
A3 | CONTROL-BURNER
B1 | COMPRESSOR
B3 | MOTOR-BLOWER
B4 | MOTOR-OUTDOOR FAN
B8 | MOTOR-COMB AIR BLOWER
C1 | CAPACITOR-OUTDOOR FAN
C3 | CAPACITOR-COMB AIR BLOWER
C4 | CAPACITOR-BLOWER MOTOR
F20 | FUSE,-60 LOW AMBIENT CONTROL
GY1 | YALYE-GAS
HR1 | HEATER-COMPRESSOR
HR6 | HEATER,-60 LOW AMBIENT CONT
J35 | JACK-TEST
J43 | JACK-BLOWER MOTOR
J47 | JACK-OUTDOOR FAN
J58 | JACK-BURNER CONTROL
K1,-1 | CONTACTOR-COMPRESSOR
K3,-1,2 | CONTACTOR-BLOWER RELAY
K13,-1,2 | RELAY-COMB AIR BLOWER
K20,-1 | RELAY-LIMIT,BLOWER
K25,-1 | RELAY-BLOWER DELAY
P35 | PLUG-TEST
P43 | PLUG-BLOWER MOTOR
P47 | PLUG-OUTDOOR FAN
KEY | DESCRIPTION COMPONENT
P58 | PLUG-BURNER CONTROL
P66 | PLUG-NOVAR ETN
S3 | SWITCH-LIMIT,LOW COMP 1 /COMPRESSOR MONITOR
S4 | SWITCH-LIMIT, HI PRESS
S10 | SWITCH-LIMIT, PRIMARY GAS
S11 | SWITCH-LOW PRESS,LOW AMBIENT KIT
S18 | SWITCH-COMB AIR BLOWER
S21 | SWITCH-LIMIT,SECONDARY GAS
S24 | SWITCH-LOSS OF CHARGE
S47 | SWITCH-FLAME ROLLOUT
S59 | THERMO.-30 OP.-60 LOW AMB CONTROL
S60 | THERMO.-10 CL.+20 OP.-60 LOW AMB CONT
S61 | THERMO.+75 OP.-60 LOW AMB CONTROL
S74 | SWITCH-FIRESTAT 1
S75 | SWITCH-FIRESTAT 2
T1 | TRANSFORMER-CONTROL
DENOTES OPTIONAL COMPONENTS
1 SEE FAN SPEED CHART FOR HOOK-UP
2 S21 USED ON 413-100 UNITS ONLY
3 C3 IS USED ON -125 UNITS ONLY
4 -50°C LOW AMBIENT CONTROL,CGA UNITS ONLY
5 CONNECTIONS FOR REMOTE MOUNTED SMOKE DETECTOR A17, MAX LOAD 0.1VA 24VAC CLASS II
6 FOR USE ON CGA UNITS ONLY
LINE VOLTAGE FIELD INSTALLED NEC/CEC-CLASS 1
NOTE-ALL REMAINING WIRES FACTORY INSTALLED
LENNOX Industries Inc. WIRING DIAGRAM 8/92
COMBINATION UNITS-ROOFTOP
GCS16,GCS16X-413-1 THRU 9-Y
GCS16,GCS16X-513-1,2,3,4,5-Y
GCS16,GCS16X-653-1,2,3,4,5,6-Y
HEAT,COOL SECTION 835
GCS16-513,653
GCS16-413

FIGURE 19

Q#10

In the U.S.A., unit may be fired at full input up to 2000 feet above sea level. If unit is installed at an altitude higher than 2000 feet, unit must be derated 4% for each 1000 feet above sea level.

TABLE 3
UNIT OUTPUT NATURAL GAS

UNIT	INPUT (Btuh)	OUTPUT (Btuh)
GCS16(R, H)–50	50,000	40,000
GCS16(R, H)–75	75,000	60,000
GCS16(R)–100	100,000	80,000
GCS16(R)X–100	92,000	73,000
GCS16(R)–125	125,000	100,000
GCS16(R)X–125	115,000	92,000

Q #11

TABLE 4
UNIT OUTPUT PROPANE/LP GAS

UNIT	INPUT (Btuh)	OUTPUT (Btuh)
GCS16(R, H)–50	50,000	40,000
GCS16(R)–75	67,500	54,000
GCS16H–75	67,500	52,650
GCS16(R)–100	90,000	72,000
GCS16(R)–125	112,500	90,000

C–Gas Pressure

1– Check gas line pressure with unit firing at maximum rate. A minimum pressure of 4.5" (114 mm) w.c. for natural and a minimum pressure of 11" (279 mm) w.c. for propane/LP gas should be maintained. On multiple unit installations, each unit should be checked separately with all units firing.

2– After line pressure has been checked and adjusted, check manifold pressure. Refer to figure 22 for proper location to measure manifold pressure and location of adjustment screw. Correct manifold pressures are shown in table 5.

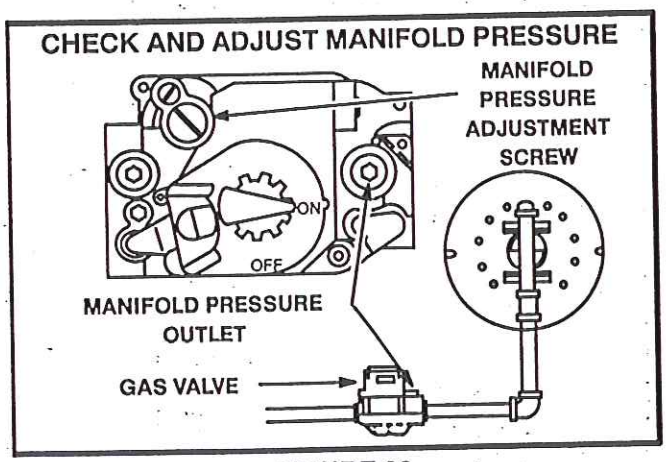


FIGURE 22

TABLE 5
UNIT MANIFOLD PRESSURES

UNIT	NATURAL GAS MANIFOLD PRESSURE	(LP) GAS MANIFOLD PRESSURE
GCS16(R, H)–50	3.5"	10.5"
GCS16(R, H)–75	3.5"	10.5"
GCS16(R)–100	3.5"	9.5"
GCS16(R)–125	2.7"	10.0"

D–Proper Gas Flow

To check for proper gas flow to combustion chamber, determine Btuh input from the unit rating plate. Divide this input rating by the Btuh per cubic foot of available gas. Result is the number of cubic feet per hour required. Determine the flow of gas through gas meter for two minutes and multiply by 30 to get the hourly flow of gas to burner.

E–Combustion Air

The combustion air is factory set for normal operation. No adjustment is necessary.

F–Burner Adjustment

1– Burner is factory set and does not require adjustment. Always operate the unit with access panel in place. The flame should be blue with clear yellow streaking.

2– The spark gap on the ignition electrode must be 1/8" ± 1/32". The electrode assembly can be removed from unit by removing two screws securing the electrode assembly and sliding it out of unit. The gap can be checked using properly sized twist drills or feeler gauges. Refer to figure 23.

Q #9

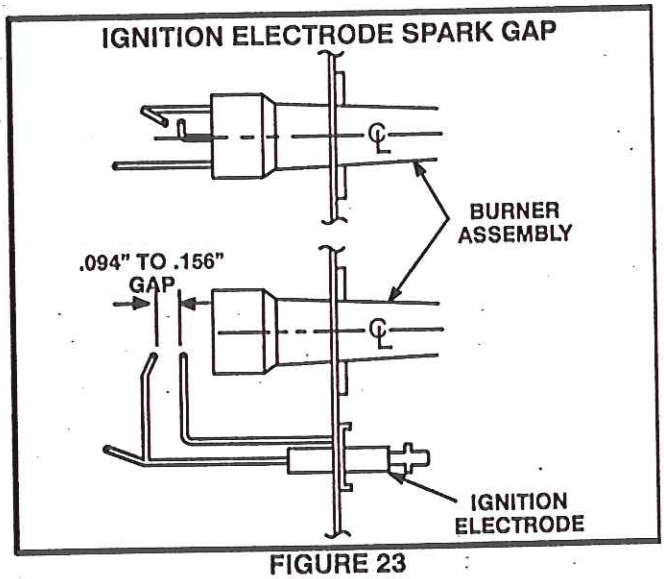


FIGURE 23

G–Combustion Air Pressure Switch

This pressure switch checks for proper combustion air blower operation before allowing an ignition trial. The switch is factory set – no field adjustments are needed.

H–Fan and Limit Control Settings

Fan Control

Fan control is factory set at 90° F. This control can be field adjusted. In some cases, an unusual duct design can cause the indoor blower to cycle on after the heat demand is satisfied. If this situation occurs, the Fan Off setting on the fan/limit control should be set below 90° F. See figure 24.

Limit Control

Limit control is factory set and does not require field adjustment.

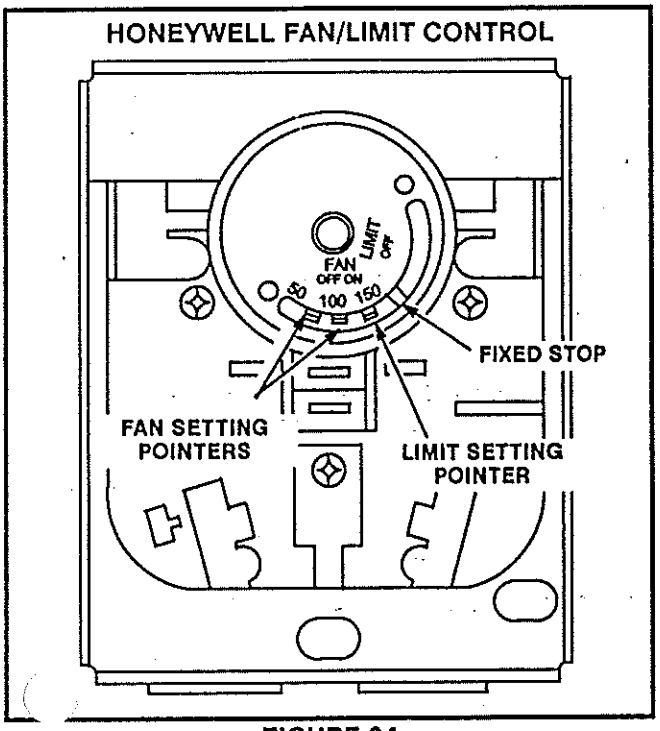


FIGURE 24

L-Heating Shutdown

1- Place thermostat system switch in "Off" position.

2- Close manual main gas valve (if used).

3- Turn unit disconnect switch to "Off" position and main gas valve to "Off" position.

M-Emergency Burner Shutdown

In case of emergency shutdown, shut off main manual gas valve and disconnect main power to unit. These devices should be properly labeled by installer.

IV-BLOWER OPERATION AND ADJUSTMENTS

A-Blower Operation

1- Blower operation is manually set at the thermostat subbase fan switch. When fan switch is in "On" position, blower operates continuously.

2- When fan switch is in "Auto" position, blower will cycle with demand. Blowers and entire unit will be off when system switch is in "Off" position.

B-Blower Speed Adjustment

Blower speed selection is accomplished by changing the taps at the harness connector at the blower motor. See figure 25.

The following blower performance tables show specific air volumes at various blower speeds.

NOTE-CFM readings are taken external to unit with a dry evaporator coil and without accessories.

J-Ignition Control

When the thermostat calls for heat, the ignition control module initiates a 30 second purge of the burner and heat exchanger. The electric spark ignites for five to ten seconds while the gas valve opens. If ignition is not achieved, the control closes the gas valve. This process is repeated two times and on the third ignition trial the ignition control locks out the gas valve. To re-establish trail for ignition after lock, move the thermostat switch to "Off" and return the thermostat switch to "Heat" position.

K-Temperature Rise

Adjust the blower speed for proper air temperature rise (listed on unit rating plate). To measure this temperature rise, place thermometers in the supply and return air plenums. Turn up thermostat as high as possible to start the unit. After plenum thermometers have reached their highest and most steady readings, subtract reading of thermometers. The difference should be in the range listed on unit rating plate. If this temperature is high, wire the blower to a higher speed; if resulting temperature is too low, wire the blower to a slower speed. Repeat this procedure until desired temperature rise is obtained.

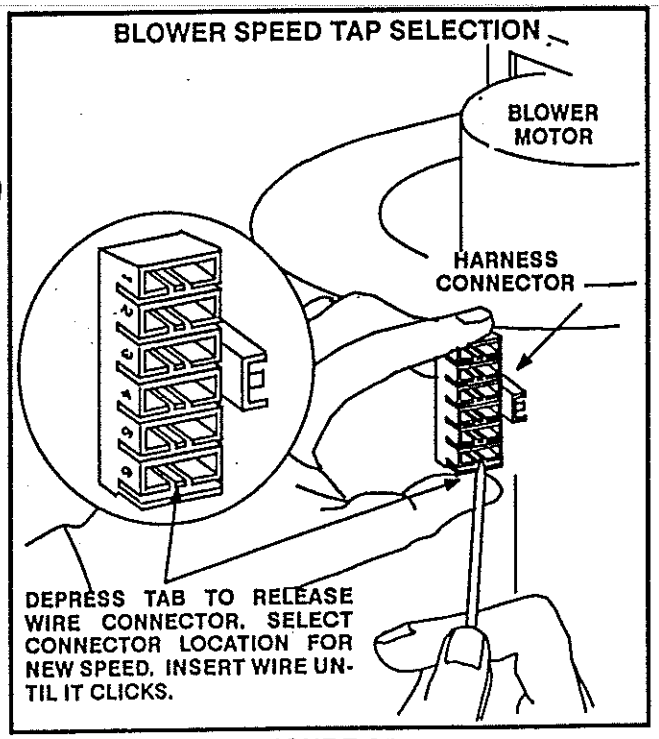


FIGURE 25

LENNOX®

PRODUCT LITERATURE

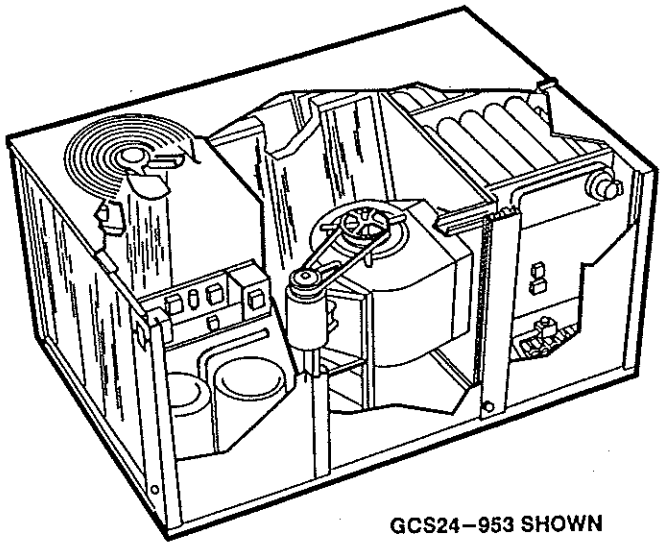
INSTALLATION INSTRUCTIONS

GCS24–953, 1353, AND 1603

ROOFTOP UNITS
503,053M
11/94
Supersedes 6/94

Technical Literature

Litho U.S.A.



GCS24–953 SHOWN

TABLE OF CONTENTS

RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE

DESIGN CERTIFIED AMERICAN GAS ASSOCIATION

⚠ WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

CANADIAN GAS ASSOCIATION APPROVED

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

WHAT TO DO IF YOU SMELL GAS:

- **Do not try to light any appliance.**
- **Extinguish any open flame.**
- **Do not touch any electrical switch; do not use any phone in your building.**
- **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

UNIT	WEIGHT*	
	LBS.	KG.
,24– 953	875	397
GCS24–1353	1255	569
GCS24–1603	1315	600

*Weight without accessories

Note – Lifting frame is not required if four hoisting cables are at least 15 feet long each.

Lifting Point Should Be Directly Above Center Of Gravity.

CAUTION: DO NOT WALK ON UNIT.

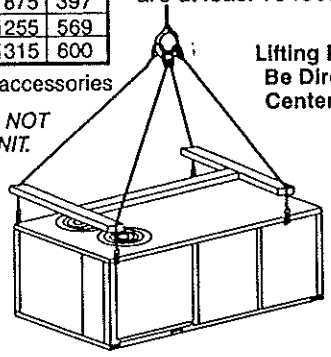


FIGURE 2

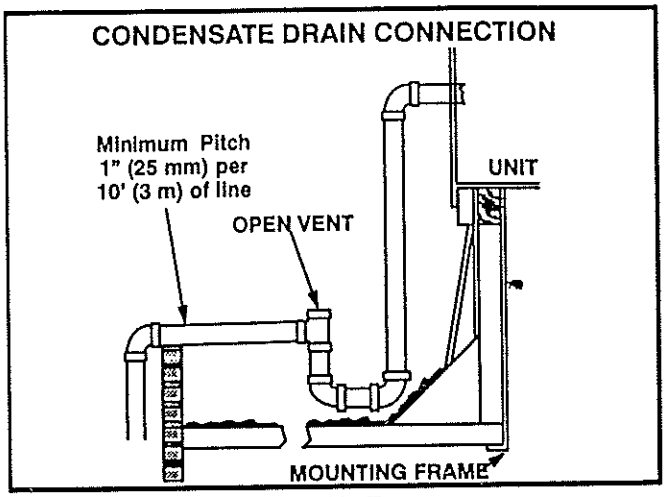


FIGURE 4

INSTALL VENT CAP

Install vent cap (shipped in vestibule area) using three screws provided. See figure 3.

Q #12

⚠WARNING

Danger of explosion. Can cause injury or product or property damage. For proper unit operation, vent cap assembly must be installed without any modification.

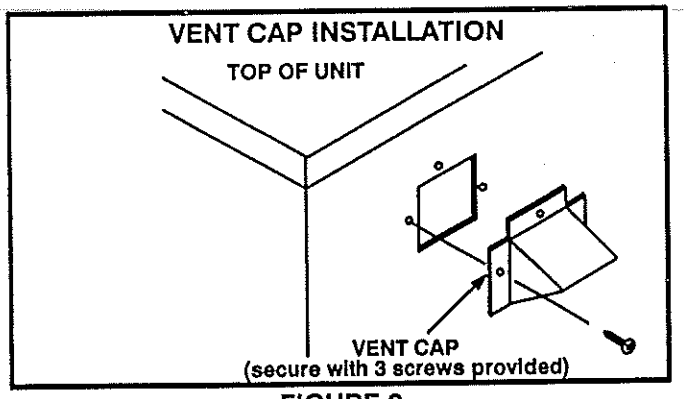


FIGURE 3

CONDENSATE DRAINS

Make drain connection to the 3/4" N.P.T. drain nipple provided on unit. A trap must be installed between drain connection and an open vent for proper condensate removal. See figure 4. It is sometimes acceptable to drain condensate onto the roof or grade; however, a tee should be fitted to the trap to direct condensate downward. The condensate line must be vented. Check local codes concerning condensate disposal. Refer to pages 1 and 2 for condensate drain location.

CONNECT GAS PIPING

Before connecting piping, check with gas company or authorities having jurisdiction for local code requirements. When installing gas supply piping, length of run from gas meter must be considered in determining pipe size for 0.5" w.c. maximum pressure drop. Do not use supply pipe smaller than unit gas connection. For natural gas units, operating pressure at the unit gas connection must be a minimum of 5.5" w.c. and a maximum of 10.5" w.c. For LP/propane gas units, operating pressure at the unit gas connection must be a minimum of 11" w.c. and a maximum of 13.5" w.c.

Q#13

When making piping connections a drip leg should be installed on vertical pipe runs to serve as a trap for sediment or condensate. A 1/8" N.P.T. 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 figure 5.

Compounds used on threaded joints of gas piping shall be resistant to the action of liquified petroleum gases.

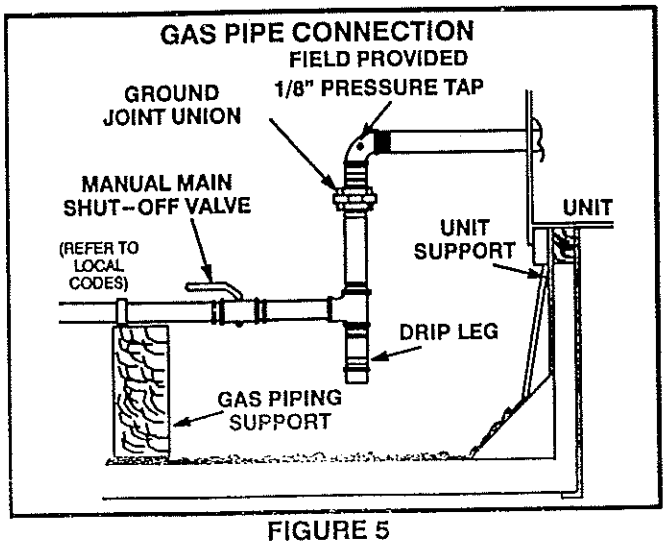


FIGURE 5

ELECTRICAL CONNECTIONS

POWER SUPPLY

Do not apply power or close disconnect switch until installation is complete. Refer to start–up directions. Refer closely to unit wiring diagram. See figures 13, 14, or 15.

Refer to unit nameplate for minimum circuit ampacity and maximum fuse size.

1 – 230/460/575 volt units are factory wired. For 208V supply, disconnect the orange wire (230V) at control power transformer(s). Reconnect the red wire (208V). Tape the exposed end of the 230V orange wire.

Units Without Electrical Convenience Package

1 – The unit is provided with power entry knockouts through the base and the end mullion (see pages 1 and 2). GCS24–953 and –1353 units require kit LB–55757CA when utilizing bottom power entry.

2 – Remove necessary electrical knockouts in unit.

3 – Make power wiring connections in control box when using side power entry. Make power wiring connections in bottom power entry box when using bottom power entry.

Units With Electrical Convenience Package

1 – Remove necessary electrical knockouts in unit.

2 – Make power wiring connections in bottom power entry box.

3 – Connect separate 120v wiring to GFCI outlet pigtails in bottom power entry box.

CONTROL WIRING

A–Thermostat Location

Room thermostat mounts vertically on a standard 2" X 4" handy box or on any non–conductive flat surface. Locate thermostat approximately 5 feet (1524 mm) above the floor in an area with good air circulation at average temperature. Avoid locating the room thermostat where 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

B–Control Wiring

1 – Route thermostat cable or wires from subbase through knockout provided in unit. See figure 11 for electro–mechanical thermostat wiring and wiring diagram on unit. For thermostat wire runs up to 60 feet, use 18 gauge wire. For 60 to 90 feet runs, use 16 gauge wire.

2 – Install thermostat assembly in accordance with instructions provided with thermostat.

IMPORTANT – Terminal connections at the wall plate or subbase must be made securely. Loose control wire connections may allow unit to operate but not with proper response to room demand.

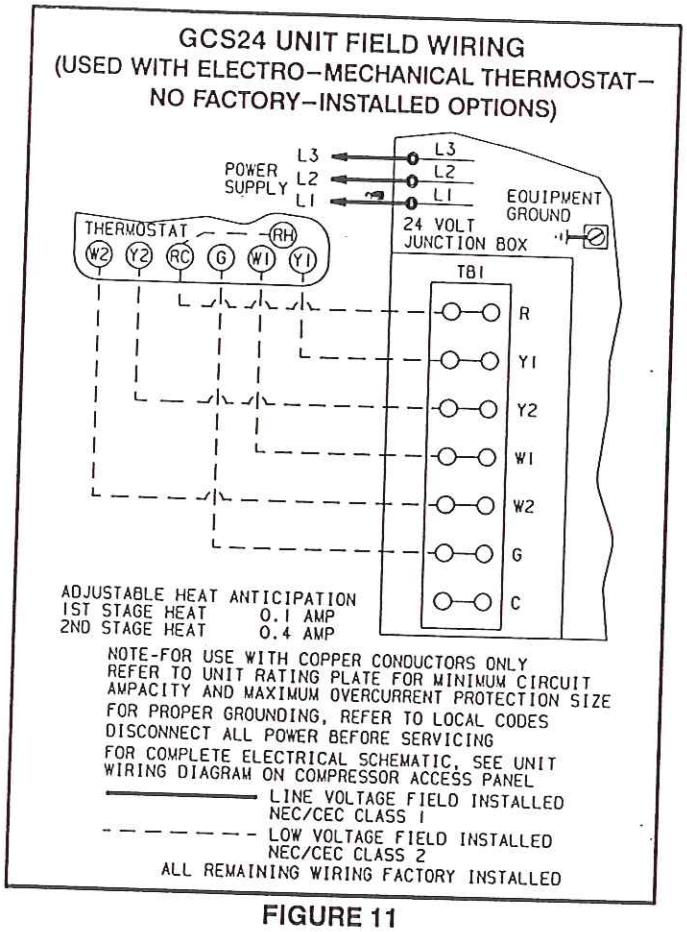


FIGURE 11

C–Commercial Controls Platform

Units without an optional factory–installed control system may use a variety of different temperature control systems. The GCS24 unit has a pre–wired jack–plug platform allowing a variety of control systems to "plug–in" to unit jack–plugs. Control systems which have the mating commercial controls platform jack–plug contain a control system wiring diagram "C" section. This diagram section is used with unit and accessory diagram sections for total system operation. Affix diagrams to unit in alpha–numeric order as shown in figure 12. Refer closely to installation instructions provided with each temperature control system for proper unit operation.

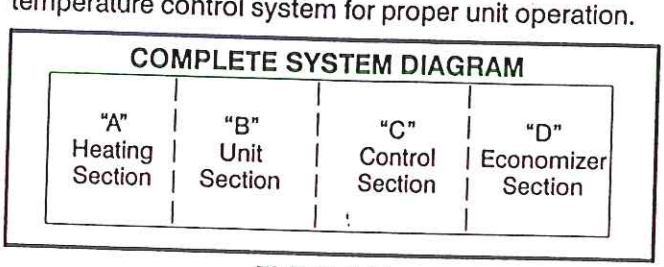


FIGURE 12

TABLE 3
GCS24-1603 BLOWER PERFORMANCE

Air Volume cfm (L/s)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge (Pa)																					
	.20 (50)		.40 (75)		.50 (125)		.70 (175)		.80 (200)		.90 (225)		1.00 (250)		1.10 (275)		1.30 (325)		1.50 (	
	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	
4200 (1980)	----	----	750	1.67 (1.25)	780	1.77 (1.32)	840	2.05 (1.53)	870	2.17 (1.62)	900	2.31 (1.72)	930	2.45 (1.83)	955	2.60 (2.07)	1010	2.90 (2.28)	1045	(
4400 (2075)	710	1.59 (1.19)	770	1.83 (1.41)	805	1.99 (1.48	860	2.24 (1.67)	890	2.39 (1.78)	915	2.51 (1.87)	945	2.67 (1.99)	970	2.83 (2.11)	1025	3.12 (2.33)	1060	(
4600 (2170)	735	1.78 (1.33)	795	2.13 (1.59)	825	2.17 (1.62)	880	2.45 (1.83)	910	2.60 (1.94)	935	2.75 (2.05)	960	2.89 (2.16)	990	3.06 (2.39)	1040	3.38 (2.66)	1075	(
4800 (2265)	760	2.00 (1.49)	820	2.27 (1.69)	850	2.43 (1.81)	905	2.70 (2.01)	930	2.85 (2.13)	955	3.01 (2.25)	980	3.26 (2.43)	1010	3.33 (2.48)	1055	3.63 (2.71)	1090	(
5000 (2360)	790	2.26 (1.69)	845	2.53 (1.89)	875	2.68 (2.00)	925	2.96 (2.21)	950	3.11 (2.32)	975	3.27 (2.44)	1000	3.41 (2.54)	1025	3.58 (2.67)	1075	3.94 (2.94)	1110	(
5200 (2455)	815	2.50 (1.87)	870	2.80 (2.09)	900	2.95 (2.20)	950	3.25 (2.42)	975	3.42 (2.55)	1000	3.56 (2.66)	1025	3.75 (2.80)	1045	3.88 (2.89)	1095	4.23 (3.16)	1125	(
5400 (2550)	840	2.79 (2.08)	895	3.07 (2.29)	920	3.24 (2.42)	970	3.55 (2.65)	995	3.70 (2.76)	1020	3.87 (2.89)	1045	4.09 (3.05)	1070	4.22 (3.15)	1110	4.53 (3.38)	1145	(
5600 (2645)	865	3.08 (2.30)	920	3.39 (2.53)	950	3.58 (2.67)	995	3.88 (2.89)	1020	4.05 (3.02)	1045	4.22 (3.15)	1065	4.37 (3.26)	1090	4.57 (3.41)	1130	4.89 (3.65)	1165	(
5800 (2735)	895	3.38 (2.52)	945	3.73 (2.78)	980	3.90 (2.91)	1020	4.25 (3.17)	1045	4.42 (3.30)	1065	4.57 (3.41)	1090	4.76 (3.55)	1110	4.93 (3.68)	1150	5.25 (3.92)	1185	(

NOTE — All data is measured external to the unit with dry coil and with the air filters in place.
NOTE — Data in shaded area requires field furnished motor and drive. NOTE — In Canada, maximum usable motor output is 3 hp (2.24 kW).

HEATING OPERATION AND ADJUSTMENTS

A–Heating Sequence of Operation

1– When the thermostat calls for heat, the combustion air blower starts immediately.
2– The induced draft air switch checks for proper blower operation before allowing power to the gas controller. This switch is factory set and no adjustment is necessary.
3– After a pre–purge of 30 to 40 seconds, the spark ignition is energized, and the low fire solenoid valves open in the gas valve.
4– The left burner is lit by the spark electrode and the flames cross light to the right burner where the flame sensor is located.
5– In the event that the flame is not detected after the first trial for ignition, the controller will repeat steps 3 and 4 up to four more times (depending upon controller model) before locking out.
6– If the thermostat calls for high heat, a bimetal actuator in the gas valve will be energized, after a time delay, and will progressively raise manifold pressure until full heat input is achieved.

B–Fan Control

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

C–Limit Controls

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

D–Heating Adjustment

1– Main burners are factory set and do not require adjustment. Air shutters should always be fully open.
2– Burner flames may be observed through the inspection port in the access panel. Always operate the unit with the access panel in place.
3– The gap on the flame sensing electrode should be between 3/32" and 5/32" (0.094 – 0.156 mm) Remove right burner by lifting out the retaining clip and sliding the burner off the orifice. The gap may be checked with appropriately sized twist drills or feeler gauges. Replace burner and retaining clip after checking gap.
4– Spark gap on ignition electrode must be between 3/32" and 7/64" (0.094 –0.109mm). Remove left burner and check spark gap using the same procedure as outlined in step 3 above. Replace burner and retaining clip after checking gap.