ETL LISTED

REZNOR

PACKAGED ELECTRIC COOLING/GAS HEATING 100% OUTSIDE MAKEUP AIR

(Specifications subject to change without notice.)

Installation/Operation/Maintenance /Service Form RGM-414 NEW

Applies to: Reznor® Models PCCH and PCCR

Table of Contents

For more specific information relating to Duct Furnace Heating Component, refer to Installation/Operation/Maintenance Manual RGM-401

FOR YOUR SAFETY

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

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

If you smell gas:
1. **Open windows.**
2. **Don't touch electrical switches.**
3. **Extinguish any open flame.**
4. **Immediately call your gas supplier.**

KEEP THIS BOOKLET FOR MAINTENANCE AND SERVICE REFERENCE.

⚠ WARNING

This unit contains chlorodifluoromethane (HCFC-22), a substance that harms public health and environment by destroying ozone in the upper atmosphere.
Do not vent HCFC-22 to the atmosphere. The U.S. Clean Air Act requires the recovery of any residual refrigerant.

1. General Description

Each Model Series packaged makeup air unit is designed to cool and heat 100 percent outside air year round. Outdoor air can be hot and humid, so the airflow must be reduced to less than half the cfm per ton of a conventional air conditioner. This reduced airflow ensures proper moisture removal. At higher wet bulb temperatures more than twice the amount of condensate is produced, and the lower airflow prevents condensate carry over. At lower ambient temperatures, the supply air is heated and the temperature is maintained by modulating the indirect fired gas heat as needed.

These units may be roof mounted on a factory supplied roof curb, slab mounted, or installed on post and rails. Air is drawn into the outside air intake located on the end of the unit and through metal mesh filters before entering the evaporator coil and heat exchanger.

Every unit is charged with refrigerant and run tested in both cooling and heating modes before shipment.

Standard Sizes

Model Sizes	*Nominal CFM*	*Nominal Cooling (MBH)*	*Heating Input Max (MBH) Single/Dual*
071	*1,200*	*70.6*	*125*
101	1,500	101.1	175
141	2,000	135.3	225 / 450
181	2,500	180.8	300 / 600
201	3,000	201.7	350 / 700
271	4,000	271.2	400 / 800
361	5,000	339.0	400 / 800
412	6,000	370.0	400 / 800

2. Model Designation

This packaged unit is shipped fully assembled and factory tested. It is generally installed on a steel roof mounting curb assembly which has been shipped to the job site for installation on the roof structure prior to the arrival of the unit, or on an appropriate ground level concrete pad.

The model number shown on the unit identification plate identifies the unit by Application, Cooling Capacity (Nominal MBH) and Gas heating by Input (MBH). See chart to right.

3. Unpacking

When received, the unit should be checked for damage that might have occurred in transit. If damage is found, it should be noted on the carrier's Freight Bill. Request for inspection by carrier's agent should be made in writing at once.

4. Design Certification

All units are certified by Electrical Testing Laboratories (E.T.L.), under ANSI/UL 1995. The furnace designs are certified by American Gas Association (A.G.A.) under ANSI Z83.9 (latest edition) for use with natural gas only.

5. Codes and Ordinances

These units must be installed in accordance with the standard of the National Fire Protection Association or the National Fuel Gas Code ANSI Z83.9 (latest edition). The National Fuel Gas Code is available from the American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209. NFPA Publications are available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269. Local authorities having jurisdiction should be consulted before installations are made to verify local codes and installation procedures.

All field wiring to the unit must be done in accordance with these instructions, the National Electric Code (ANSI/NFPA 70-1981) and all local codes and ordinances.

Clearances from the heater and vent to construction or material in storage must conform with the National Fuel Gas Code ANSI Z83.9 (latest edition), pertaining to gas-burning devices, and such material must not attain a temperature over 160°F by continued operation of the heater.

Model Designation Chart

Code	Application
PCCR	100% Outside Air Rooftop Model
PCCH	100% Outside Air Horizontal Discharge

PCCR 141 225

Cooling

Code	Nom. MBH
071	70.6
101	101.1
141	135.3
181	180.8
201	201.7
271	271.2
361	339.0

Heating

Code	High Input BTUH	Output Capacity BTUH	Models Used With
100	100,000	80,000	071 - 101
125	125000	100000	071 - 271
150	150000	120000	101 - 361
175	175000	140000	101 - 361
200	200000	160000	141 - 361
225	225000	180000	141 - 361
250	250000	200000	181 - 361
300	300000	240000	181 - 361
350	350000	280000	271 - 361
400	400000	320000	361

Installation should be done by a qualified agency in accordance with the instructions in this manual and in compliance with all codes and requirements of authorities having jurisdiction.

6. Cooling Section

Compressor

High efficiency scroll and serviceable-hermetic discus compressors have been selected for their refrigeration reliability in these units. Compressor mountings are designed to minimize vibration and piping stress. Serviceable-hermetic models use special waffle pad isolator and washers. All compressors have hot gas bypass capacity reduction: serviceable-hermetic compressors also have cylinder unloading.

Compressor Protection

All compressors have crankcase heaters and the motors are equipped with internal overload protection. The serviceable-hermetic compressors are also equipped with isolation valves and oil pressure failure protection.

Coil

The condenser and evaporator coils are aluminum plate-finned, formed on multiple rows of seamless copper tubing arranged in a staggered-tube configuration. The tubes are mechanically expanded, firmly bonding the tube to the shoulder of each fin.

Refrigerant Circuit

Included in the refrigerant circuit is an accumulator, filter-drier, high-pressure safety control (manual reset), low-pressure safety control/loss of charge protector (auto reset), gauge port connections for high and low pressure readings, sight-glass moisture indicator, and thermostatic expansion valve. The expansion valve has adjustable superheat and distributors to meter the refrigerant evenly to the evaporator refrigerant circuits.

Condenser Air Fan and Motor

The condenser air fan is of the propeller type, electronically balanced, and direct-driven by a 1075 rpm Permanent Split Capacitor fan motor. The inherent protected motor has sealed ball bearings that do not require lubrication. The outdoor air is discharged through a vinyl-coated fan guard. This directs all sounds upward, eliminating the effects of wind direction and minimizing condenser airflow sound projection.

Blower and Motor

A forward curved, statically and dynamically balanced DIDW centrifugal blower is used for the indoor air. The blower wheel and housing are corrosion protected. The blower wheel is mounted on a solid steel shaft supported by sealed ball bearings. The shaft is driven by adjustable belt-driven sheaves, connected to a 1725 rpm motor with sealed ball bearings. The sealed bearings on both the blower shaft and motor do not require lubrication. Motors through 3 horsepower are internally protected (auto reset) and motors 5 horsepower and larger are externally protected (manual reset).

7. Gas Furnace Section

This unit is equipped with an indirect gas-fired furnace which is 80 percent thermal efficient. All units are equipped for natural gas and include an integral power-vent system which provides metered combustion air, dilutes flue products, and eliminates the need for a vent cap. Combustion air intake and flue outlet locations are on same side of the unit. Each unit has all the required limit and safety controls, including a venter pressure switch which verifies power vent operation prior to allowing operation of 24-volt gas valve.

8. Connections

The installation of packaged units consists of making final connections between the unit and building services such as electrical power supply, natural gas, supply and return duct connections, and drain connections.

The internal systems of the unit are completely factory installed and tested prior to shipment and no additional field labor is required.

9. Clearances

Adequate clearance around the unit must be kept for safety, accessibility, service, and maintenance. 48 inches clearance is required on the rear (furnace and electrical) end of the unit. This clearance must be maintained for compressor removal and in the case of a furnace unit, for removal of the furnace and to insure proper flue gas flow. All combustible materials must be kept out of the area. A 48 inch clearance is also required on the front (outside air) end of the unit for blower removal and for adequate outside air accessibility. The clearance of 96 inches on the filter access side of the unit is required for blower shaft removal and 36 inches is required on the condenser side for an adequate supply of condenser air.

Required Clearances

Provide minimum clearance as shown for safety, clearance from combustibles, and for service.

10. Setting the Unit

CAUTION: Units may look identical but have significant internal differences. Check specific unit location carefully (referring to plans if necessary) prior to setting unit.

Top	36”
Control Side	48”
All Other Sides	36”
Note: A clearance of 100” is suggested on the side opposite the condenser should it become necessary to remove the fan shaft.	

Curb Installation

Proper installation requires that the roof mounting curb be firmly and permanently attached to the roof structure. Check for adequate fastening method prior to setting rooftop unit on curb.

Protrusions

Inspect curb to insure that none of the utility services (electric, gas, drain lines) routed through the curb protrude above the curb. Duct connections will normally be made after unit is set on curb. If duct is prefabricated and installed within the curb prior to setting unit, insure that duct work does not protrude above curb.

DO NOT ATTEMPT TO SET UNIT ON CURB IF PROTRUSIONS EXIST.

Unit Installation

Lower unit carefully onto roof mounting curb or mounting rails or ground level slab. While rigging unit, center of gravity will cause condenser end to be lower than supply/return air end. Bring condenser end of unit into alignment with curb. With condenser end of unit resting on curb member and using curb as fulcrum, lower front end of unit until entire unit is seated on curb.

Rigging Removal

Remove spreader bars, lifting cables and other rigging equipment.

CAUTION: Do not allow crane hooks and spreader bars to rest on roof of unit.

11. Electrical

Wiring Connections

Power wiring should be connected to the main power terminal block located within the unit main control section. Power wiring connections on units with factory disconnects should be made at the line side of the disconnect switch.

Low voltage wiring connections are made to the remote mounted controller or time clock.

Do Not Tamper with Factory Wiring

Contact your local representative or the factory if assistance is required. The internal power and control wiring of these units is factory installed and each unit is thoroughly tested prior to shipment.

Independent Power Source

It is recommended that an independent 115 volt power source be brought to the vicinity of the rooftop unit for portable lights and tools used by the service mechanic.

When providing or replacing fuses in a fusible disconnect switch, use dual element time delay fuses and size 1.25 times the maximum total input amps as stated on the unit rating plate.

Main Power Wiring

The units are factory wired for the voltage shown on the nameplate.

Main power wiring should be sized for the minimum wire ampacity shown on the nameplate.

An external weather-tight disconnect switch properly sized for the unit total load is required for each unit. Disconnect must be installed in accordance with Local and/or National Electric Codes.

Power wiring may enter the Rooftop Unit through the side on all models, or through the unit base and roof curbs on models with the Power Through Curb option. Install conduit connectors at the entrance locations. External connectors must be weatherproof.

Grounding

All units must be properly grounded. The ground lug is provided for this purpose. DO NOT use the ground lug for connecting a neutral conductor. The unit must be electrically grounded in accordance with local codes, or in the absence of local codes, with the NEC ANSI/NFPA 70 1981.

Low Voltage Control Wiring

Remote Control

The MC20 controller may be shipped loose to accommodate remote mounting. Cable connections are facilitated by use of standard barrier terminal strip and spade terminal connections for easy installations.

Follow the installation and wiring instructions supplied with the MC20 controller. Low voltage wiring may be NEC Class II when permitted by local codes.

DDC Controls

If a multifunction direct digital controller is factory installed or remote mounted it would provide a complete operating and monitoring system. (Refer to the DDC Controls Specification Sheet)

12. Gas Piping

For Your Safety

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

⚠ WARNING

Gas-fired appliances are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, in atmospheres containing chlorinated or halogenated hydrocarbons, or in applications with airborne silicone substances. Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury, or death. Read the installation, operation, and maintenance instructions thoroughly before installing or servicing this equipment.

CAPACITY OF PIPING
Cubic Feet per Hour Based on 0.3" W.C. Pressure Drop
Specific gravity for Natural Gas – 0.6 (1000 BTU/Cubic Foot)

Length of PIPE	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
20'	92	190	350	730	1,100	2,100
30'	73	12	285	590	890	1,650
40'	63	130	245	500	760	1,450
50'	56	115	215	440	670	1,270
60'	50	105	195	400	610	1,105
70'	46	96	180	370	560	1,050
80’	43	90	170	350	530	990
90'	40	84	160	20	490	930
100'	38	79	150	305	460	870
125'	34	72	130	275	410	780
150'	31	64	120	250	380	710
175'	28	59	110	225	350	650
200'	26	55	100	210	320	610

Gas Piping

Sizing Gas Supply Lines

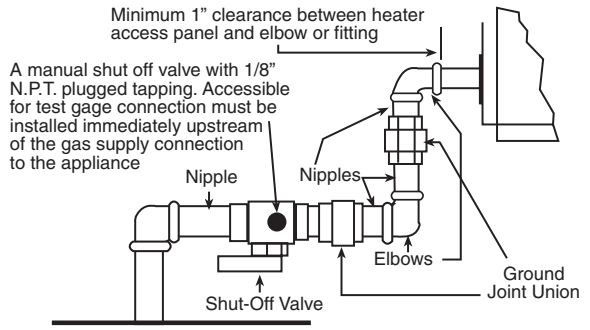
All piping must be in accordance with requirements outlined in the National Fuel Gas Code ANSI/Z223.1a (latest edition), published by the American Gas Association. Gas supply piping installation should conform with good practice and with local codes.

Pipe joint compounds (pipe dope) must be resistant to the action of liquefied petroleum gas or any other chemical constituents of the gas being supplied.

Install a ground joint union and manual shut-off valve upstream of the unit control system, as shown in the above illustration. The 1/8" plugged tapping in the shut-off valve provides connection for supply line pressure test gauge. The National Fuel Gas Code requires the installation of a trap with a minimum 3" drip leg. Local codes may require a minimum drip leg longer than 3" (typically 6").

NOTE: When sizing supply lines, consider possibilities of future expansion and increased heating requirements.

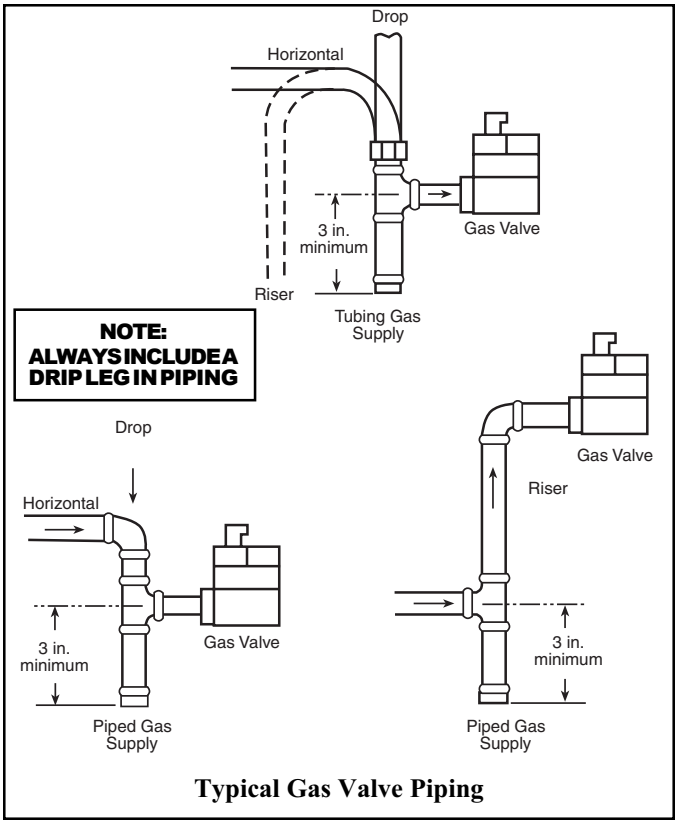
See National Fuel Gas Code for additional information on supply pipe sizing.



Gas Connection – All Models

⚠ WARNING

All components of a gas supply system must be leak tested prior to placing equipment in service. NEVER TEST FOR LEAKS WITH AN OPEN FLAME. Failure to comply could result in personal injury, property damage or death.



Typical Gas Valve Piping

After all connections are made, disconnect the pilot supply at the control valve and bleed the system of air. Reconnect the pilot line and leak-test all connections by brushing on a soap solution.

Install the gas supply piping so that when the union is disconnected, the supply pipe will not interfere with the removal of the burner rack. The burner rack slides out of the control side of the furnace.

This appliance is equipped for a maximum gas supply pressure of 1/2 pound, 8 ounces, or 14 inches water column. Supply pressure higher than 1/2 pound requires installation of an additional service regulator external to the unit.

Pressure Testing Supply Piping

Test Pressures Above 1/2 PSI: Disconnect the heater and manual valve from the gas supply line which is to be tested. Cap or plug the supply line.

Test Pressures Below 1/2 PSI: Before testing, close the manual valve on the heater.

13. Venting

Flue Gas and Combustion Air Openings

These screened openings are located on the side of the furnace just above the control access panel. The positions of these openings discourages recirculation of combustion products and provides for furnace operation in all normal weather conditions. See the illustration below.

Chlorines — All Models

The presence of chlorine vapors in the combustion air of gas-fired heating equipment presents a potential corrosion hazard. Chlorine will, when exposed to flame, precipitate from the compound, usually refrigerant or degreaser vapors, and go into solution with any condensation that is present in the heat exchanger or associated parts. The result is hydrochloric acid which readily attacks all metals including 300 grade stainless steel.

Care should be taken to separate these vapors from the combustion process. This may be done by wise location of the furnace with regard to exhausters or prevailing wind direction. Remember, chlorine is heavier than air. This fact should be kept in mind when determining installation locations of heating equipment and building exhaust systems.

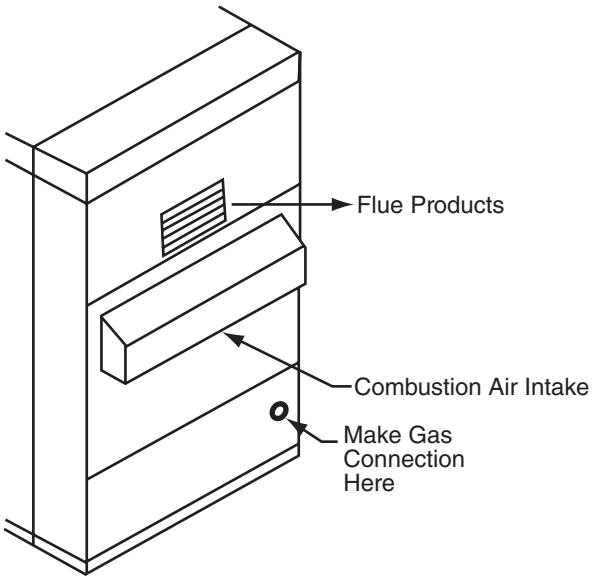
Venting Requirements

Locate power-vented furnaces so that flue discharge is not directed at fresh air inlets.

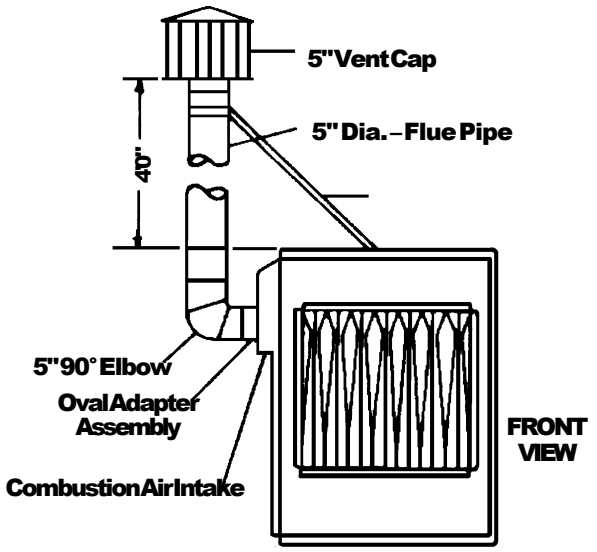
These power vented furnaces are certified with four feet of vertical pipe attached as shown in the following illustration. The distance is measured from the top of the unit to the bottom of the vent cap. The option package includes the 5 inch vent cap, the adapter assembly, and the seal plate. The vent pipe and supports are field supplied.

Optional vertical vent piping provides compliance with local codes that require either 10 foot horizontal or 4 foot vertical clearance between the flue outlet and fresh air intake of the heating system and/or the building.

Flue Gas and Combustion Air Openings



Installation of the Vent Cap (included in the option package) and the field-supplied Piping and Supports



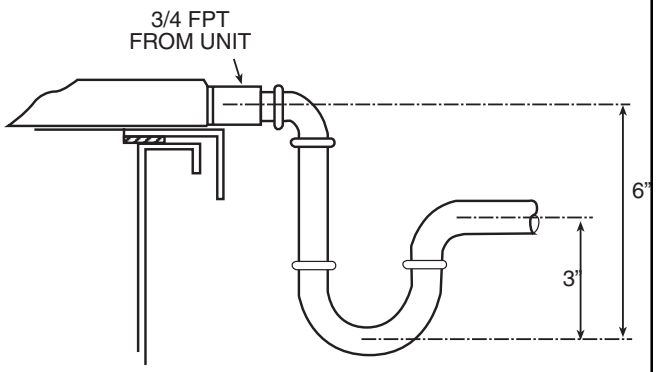
The straight pipe connecting the furnace to the 90° elbow must be at least 12" in length.

Vertical Vent

14. Condensate Piping

A condensate trap must be provided by customer. Drainage of condensate directly onto the roof is acceptable if permitted by local codes. It is recommended that a small drip pad of either stone, mortar, wood or metal be provided to prevent any possible damage to the roof. If condensate is to be piped into the building drainage system, the drain line must penetrate the roof external to the unit. Refer to local codes for additional requirements.

The Trap must be primed before operating unit.



Drain Trap

⚠ WARNING

This furnace is not A.G.A certified or C.G.A. approved for use in drying or process applications. If the unit is to be used in a drying or process application, contact the factory for application guidelines and manufacturer's authorization. Without factory authorization, the warranty is void, and the manufacturer disclaims any responsibility for the furnace and/or the application.

15. Sequence of Operation

General System Sequence of Operation (refer to unit wiring diagrams)

1. When electric power is applied to the unit, the 24 volt transformer is energized.

   Time delay begins (set at five minutes from the factory, field adjustable from 6 seconds to 8 minutes). Upon completion of the delay period the coil of the slave relay is energized, closing its N.O. contacts. This makes a circuit through the normally closed high pressure cutout, compressor motor protection module if applicable, and through the oil failure cutout to the low pressure control. The N.O. contacts of the slave relay close making a line voltage circuit to the N.O. contacts of the cooling pilot relay. At the same time, the crankcase heaters are energized.

2. On a call for system operation the field installed system switch is closed, and a control circuit is made.

3. The coil energizes the blower pilot relay which closes its N.O. contacts, energizing the coil of the evaporator blower motor contactor which in turn closes its line voltage contacts and energizes the evaporator blower motor also making a line voltage power supply to the gas furnace.

4. As the evaporator blower motor contactor closes, it causes a 24 volt control circuit to terminal "R" of the compressor lockout thermostat "CLT" and gas furnace.

5. If the outdoor ambient temperature is above the set point of 65° F, the coil of the cooling pilot relay causes its N.O. contacts to close, making a line voltage circuit across the coil of the liquid line solenoid valve.

   As the refrigerant pressure increases and closes the low pressure control, a line voltage circuit is made to the time delay. Upon completion of the delay period the coil(s) of the compressor contactor(s) are energized, causing the contactor to close and energize the compressor.

   A line voltage circuit is also made to the unloading pressure control. If it is closed, a circuit is made to the coils of the unloader solenoid and the hot gas bypass solenoid valve.

   When the compressor contactor closes, it also closes the compressor contactor auxiliary making a circuit to the coil of the condenser fan contactor and through low ambient fan controls to the coils of condenser fan contactors.

   If the outdoor ambient temperature is below the set point of 65° F, the N.C. contacts of the compressor contactor auxiliary energizes the coil of the interlock relay causing its N.O. contacts to close in the gas furnace control circuit. NOTE: The compressor contactor auxiliary "CC2A" can only be closed if the compressor contactor is open, therefore the interlock relay prevents the simultaneous operation of the compressor and gas furnace.

   On a call for heat, a control circuit is made to energize the coil of the heat relay. The main blower proving switch will close when airflow is present.

   The furnace section is made from the control terminal across the N.C. contacts of the combustion pressure switch, energizing pilot ignition time delay relay heater. After delay of approximately 30-50 seconds the time delay relay's switch closes energizing the furnace venter motor. As the venter operates, it causes the combustion pressure switch to open. The ignition control energizes a high voltage electric spark, and the pilot valve solenoid in the combination gas valve.

   The flame sensor proves the presence of the pilot flame generating a DC current of 0.2 microamp (or greater) to the ignition control. The ignition control's internal switch action then de-energizes the spark transformer and makes a circuit to the high fire solenoid of the combination gas valve.

   When there is a call for gas furnace operation the discharge air temperature causes a change in the resistance of a discharge air sensor thermistor. The Maxitrol solid state control center measures the sensor's change in resistance and sends a varying DC current to the Modulator-Regulator valve to adjust the gas input as required.

Mechanical Cooling

The compressor starts when the outside air temperature is above the adjustable setpoint. In the cooling mode the leaving air temperature will be maintained by hot gas bypass and/or unloading the compressor. This is accomplished through suction-pressure sensing, thus tracking the outside air temperature variations.

Gas Heat

In the heating mode the leaving air temperature will be maintained by a modulating gas regulator in response to the leaving air temperature set point.

When the leaving air temperature drops below the leaving air sensor set point, the venter motor is energized after 15-seconds (approximate) time delay. Venter flow causes switching from N.C. to N.O. contacts, energizing the pilot gas valve and spark gap to produce a pilot flame on each operating cycle. The sensing probe proves the presence of the pilot flame and energizes the safety switch portion of the control. The switch action de-energizes the spark gap and energizes the main valve. The main gas ignites and the unit fires at full rate. If the flame is extinguished during main burner operation, the safety switch closes the main valve and recycles the spark gap.

Electronic Proven Pilot Spark Ignition Control

When there is a call for heat, the electric spark and pilot valve are automatically energized to produce a pilot flame on each operating cycle. The flame sensor proves the presence of the pilot flame; internal switch action de-energizes the spark transformer and energizes the main burner electric valve. The main gas ignites and the heating cycle is in normal operation. When the call for heat is satisfied, the main burner valve and the pilot valve are de-energized.

15. Sequences of operation

Series 21/31 Maxitrol Regulator

This unit may be equipped with electronic modulation that will provide firing rate of 100% down to 50%, depending on the heat requirements as established by the thermistor sensor. The thermistor is a resistor that changes its resistance depending upon the surrounding temperature. This change in resistance is monitored by the solid state control center which, in addition to opening and closing the main valve, will furnish varying DC current to the modulating valve to adjust the gas input as required. The modulating valve is basically a regulator with electrical means of raising and lowering the discharge pressure. When no DC current is fed to this device, it becomes a gas pressure regulator, supplying 3.5"w.c. pressure to the main operating valve and the burners.

Condenser Fan Motor and Control

A variable speed fan motor and control is standard with all reheat options because units operating in low ambient temperature require a control system to maintain stable head pressure. Head pressure control is accomplished with one or two variable speed condenser fan drives. A pressure sensing control modulates the condenser fan speed as required to maintain head pressure between 190 psig and 250 psig.

Sizes 071, 101 and 141 — are equipped with one variable speed motor and control.

Sizes 181, 201 and 271 — are equipped with one single phase variable speed motor and one 3 phase motor (dual fan units).

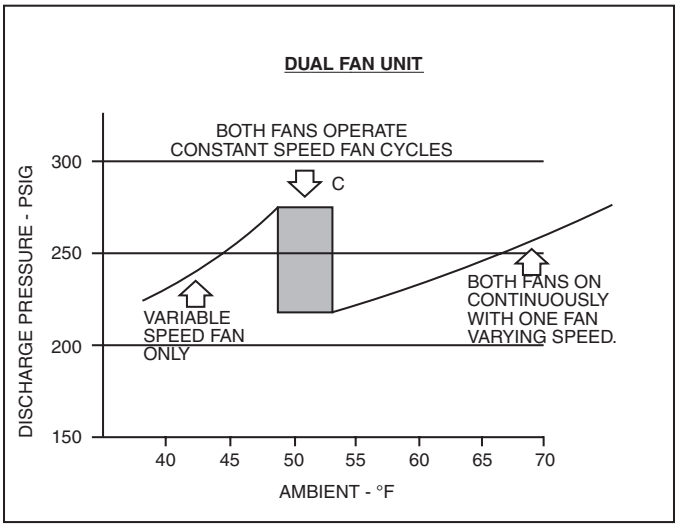
The size 361 is equipped with one variable speed motor and three 3 phase motors (four fan unit).

This pressure sensing system consists of a variable speed motor driven fan and a constant speed motor driven fan. Both are controlled from refrigerant pressure rather than ambient temperature, reflecting actual operating conditions in the machine.

At low ambient, the variable speed fan operates, increasing in speed until maximum RPM is achieved at or around 45°F ambient. An adjustable pressure switch operates the constant speed three-phase fan set to energize the motor at 275 psig and de-energize at 220 psig. In the ambient temperature span of approximately 50°F to 53°F, the variable speed fan will ramp between maximum and minimum speed while the constant speed fan cycles. The start-stop cycle varies from 45 seconds to 22 minutes during this period.

At 53°F, both fans are operating, the variable speed at minimum RPM and the constant speed at full RPM. As the ambient continues to rise, the variable speed motor increases to full speed and remains there.

If the application calls for a closer setting between maximum and minimum pressure settings on the constant speed fan, for example 275 psig on, 240 psig off, the effect will be to lengthen the temperature span during which the cycling takes place, for example 50°F to 57°F.



Optional Hot Gas Reheat

Factory installed hot gas reheat circuit includes inlet regulator valve, check valves, hot gas solenoid operated control valve, variable speed condenser head pressure control, one stage sensor, and one row heat reclaim coil. The coil is equal to the evaporator face area and installed in the reheat position. The sensor is factory mounted. Hot gas reheat may not be operated below 60°F ambient temperature.

Optional Reheat plus

To lower relative humidity (RH) in the supply air stream, a one row subcooling coil, generally equal to the evaporator face area may be specified. The refrigerant liquid passes through the tube side, adding up to 40°F of subcooling. For every two degrees of subcooling, the compressor capacity is increased one percent. This is also reflected as an increase in efficiency. The resulting heat is passed into the air stream as reheat, usually 8°F to 10° F at 200 cfm/ton, thus the lower discharge air relative humidity.

Optional Motorized Outside Air Damper

The damper motor and damper are factory mounted in unit and interlocked with blower motor.

Optional Clogged Filter Indicator

Dirty or clogged filters are red flagged by an indicator when the preset pressure differential across the filters is reached. The indicator is factory installed and manual-reset. It includes contacts for remote annunciation.

16. Check, Test, Start-Up, Service and Maintenance

⚠ WARNING

This unit contains chlorodifluoromethane (HCFC-22), a substance that harms public health and environment by destroying ozone in the upper atmosphere.
Do not vent HCFC-22 to the atmosphere. The U.S. Clean Air Act requires the recovery of any residual refrigerant.

16A. GENERAL

This manual has been prepared as a guide for the Check–Test–Start and maintenance of the 100% Outside Makeup Air packaged unit.

Air balancing of duct system is not considered part of Check–Test–Start of the packaged unit. It is however, an important phase of the start-up of any air conditioning system and should be performed upon completion of the Check–Test–Start procedure.

This packaged unit is designed to cool and heat 100% outside air year round. Since outdoor air can be hot and humid, the airflow must be reduced to less than half the cfm per ton of a conventional air conditioner (see the Blower Performance chart on page 14.) This reduced airflow assures proper moisture removal and prevents condensate carry over of the increased volume of condensation that will be produced from the higher wet bulb temperatures. At lower ambient temperatures, the supply air is heated and the temperature is maintained by modulating the indirect fired gas heat as needed.

CONTRACTOR RESPONSIBILITY

The installing contractor must be certain that:

- All supply and return air duct work is in place and corresponds with installation specifications.
- All system switches, time clocks and disconnect switches are mounted and wired in accordance with installation specifications.
- The central control panel (optional equipment) is installed and wired in accordance with installation instructions.
- The condensation trap(s) have been properly installed.

All electric power and all gas line connections must be functional and capable of operating.

TOOLS REQUIRED TO PERFORM CHECK–TEST–START or Troubleshoot The Unit

The manufacturer of this unit recommends that the service technician have available and be proficient with the following tools. This recommendation is for the minimum service tools and does not preclude additional tools and equipment:

1. Refrigeration Gauge & Manifold
2. Multimeter with the following scales:
   AC volts to 750
   DC volts to 50
   Resistance to 200K ohm
   Micro amperage
3. Clamp-On Ampmeter
4. Temperature measuring devices:
   For measuring air wet bulb and dry bulb temperatures
   For measuring surface dry bulb temperature
   For measuring flue temperature.
5. Non-contact Tachometer
6. Manometer for verifying gas pressure 0-20" W.C.
7. Air Measuring Device
8. Refrigerant leak detector (D-Tec or equal)
9. General Refrigeration Mechanics Tools

16B. INSPECTION

Check of Roof Mounting Curb Installation

The proper installation of the unit on the roof mounting curb

should be checked. Any deficiencies observed should be noted in a separate report and forwarded to the manufacturer. The unit and curb assembly must be installed level.

Check for Minimum Clearances

A minimum of 48 in. clearance must be provided on the main control box side of the unit. A minimum of 36 in. clearance is required on all other sides. A clearance of 100 in. is desirable on the side opposite the condenser for removal of the fan shaft.

The outside air intake must be remote from all building exhausts. The condenser air intake must be remote from all exhausts to assure full condenser capacity.

Check and Report Damage

Damaged or missing parts, if any, should be itemized in a separate report stating what action has been initiated by the contractor to correct them. The absence of this information will be the basis for assuming that the unit was complete and in good condition on date of Check—Test—Start.

Check for Obstructions, Fan Clearance, Wiring

During the performance of the Check—Test—Start procedure you will have occasion to work in the various sections of the unit. During the performance of the individual checks, it is important that you remove extraneous construction and shipping materials that may be found.

All fans should be rotated manually to check for proper clearances and make certain that they rotate freely. Bolts and screws that may have jarred loose during shipment to the job site should be checked for tightness. All electrical connections should be retightened.

16. Check, Test, Start-Up, Service and Maintenance (cont'd)

PRE-START-UP PRECAUTIONS

It is important to your safety that the unit has been properly grounded during installation. Check ground lug connection in main control box for tightness prior to closing circuit breaker or disconnect switch.

Verify that supply voltage on line side of disconnect agrees with voltage on unit identification plate and is within the Utilization Voltage Range as indicated in the following table:

Voltage	Minimum	Maximum
208	187	228
230	207	253
460	414	506

System Voltage —That nominal voltage value assigned to a circuit or system for the purpose of designating its voltage class.

Nameplate Voltage —That voltage value assigned to a piece of equipment for the purpose of designating its voltage class and for the purpose of defining the minimum and maximum voltage at which the equipment will operate.

16. Check, Test, Start-Up, Service and Maintenance (cont'd)

Preliminary Check

Make sure that hold down bolts on compressor(s) are secure and have not vibrated loose during shipment. Check that upper and lower vibration pads have been installed.

Visually check all piping and clamps.

With disconnect switch in the "off" position, remove the electrical box cover from the compressor(s) and check the power connections for tightness. In the event any connections have vibrated loose in shipment, extreme care must be taken to see that they are properly replaced.

The entire refrigeration system has been factory charged and tested, making it unnecessary to field charge. Factory charges are shown in the following table on the unit nameplate.

CAUTION: Prior to the start-up of the refrigeration system, the compressor crankcase heaters must have been in operation for at least eight (8) hours. All subsequent start-ups must be preceded by the same eight (8) hour heater operation if the main power to the unit has been interrupted.

Remove seal caps from all compressor and liquid line service valves and place all valves in a back-seated position. Install service manifold hoses, and rotate valve stems one turn clockwise off backseat position. Gauges should read saturation pressure corresponding to ambient temperature.

Refrigeration Performance Check

This information should only be used as a guide, due to the diversity of applications and various conditions that might be represented in the field. A properly charged system will have varied suction and discharge pressures depending on whether the unit is equipped with unloading, hot gas reheat, or hot gas bypass. The head pressure will be controlled by the variable speed head pressure control system. The suction pressures will vary up and down reacting to outdoor temperature and will depend on whether the unit is operating in the hot gas bypass mode or the unloaded mode. The head pressure will vary from 220 psig to 250 psig at average (85° to 95°F DB) outdoor temperatures.

The temperature difference between the return air (outside temperature DB) and the supply air should be approximately 30 to 40 degrees at average entering (WB) conditions. If not, air volume (cfm) must be corrected. The subcooling should be at or about 15 degrees at 75° F and as low as 5° at 105° F. The superheat should be approximately 18° to 20° F at the exit of the condenser.

Check oil level in compressor crankcase. Level should be at center of sight glass.

Refrigerant System Charge - Lbs. - R-22

Model Sizes	Pounds
071	8.5
101	8.5
141	20.0
181	20.0
201	26.0
271	33.0
361	40.0

16C. CONTROL SYSTEM

Control Voltage Check

With disconnect switch in the open (off) position; disconnect field installed control wires from the "R", "G", and "E" terminals of the control circuit terminal board TS1. This will allow you to control the unit operation from the unit.

Close disconnect switch to energize TR1 and TR2 Control Transformers.

Check primary (208V or 230V) and secondary (24V) of Control Transformers.

16D. EVAPORATOR BLOWER FAN

Set Fan RPM

All evaporator motor sheaves are set at midpoint when tested and shipped from the factory. Actual rpm must be set and verified with a tachometer. Refer to the following Blower Performance Chart for basic unit fan rpm.

With disconnect switch open, place a jumper wire across Terminals R and G at TS1 Terminal Block. Close disconnect switch; evaporator fan motor will operate so rpm can be checked.

Drive Belt Tension and Alignment

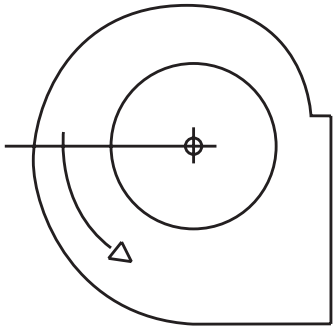
Fan belt alignment and tension should be checked. Tension on drive belt should be 3/4" depression per foot of belt span between pulleys. (See the illustration. on page 11).

Fan Rotation Check

Check that fan rotates clockwise when viewed from the drive side of unit and in accordance with rotation arrow shown on blower housing. If it does not, reverse two incoming power cables at TB Terminal Block.

Do not attempt to change load side wiring. Internal wiring assures all motors will rotate in correct direction once evaporator fan motor rotation check has been made.

BLOWER ROTATION



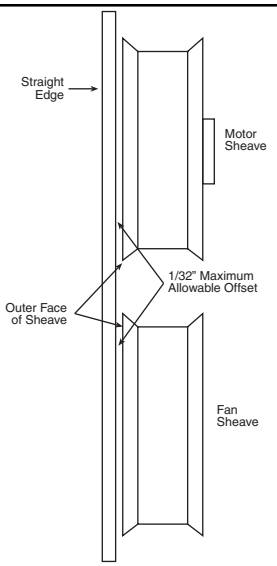
16. Check, Test, Start-Up, Service and Maintenance (cont'd)

Electrical Data

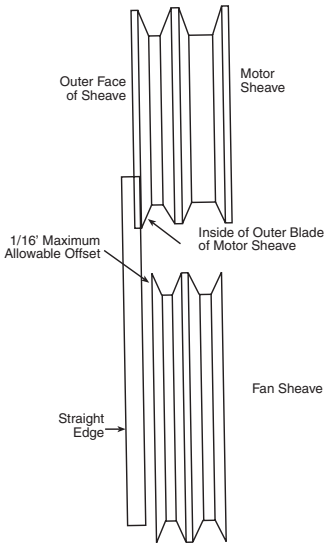
Model Sizes	Furnace	Power	Compressor		Evaporator Blower Motor		Condenser Fan Motor(s)				Comb Blower Motor	Unit RLA	MCA*	Max. Fuse Size*
			RLA	LRA	HP	FLA	No.	HP	FLA	FLA				
PCC-071	100-125	208/230-3-60	15.4	123.0	1/2	2.0	1	1/2	3.5	—	0.8	20.9	25.0	35
PCC-071		460-3-60	7.7	62.0	1/2	1.0	1	1/2	1.8	—	0.32	10.5	13.0	20
PCC-071		208/230-3-60	15.4	123.0	3/4	2.8	1	1/2	3.5	—	0.8	21.7	26.0	40
PCC-071		460-3-60	7.7	62.0	3/4	1.4	1	1/2	1.8	—	0.32	10.9	13.0	20
PCC-071		208/230-3-60	15.4	123.0	1	3.6	1	1/2	3.5	—	0.8	22.5	27.0	40
PCC-071		460-3-60	7.7	62.0	1	1.8	1	1/2	1.8	—	0.32	11.3	14.0	20
PCC-101	100-175	208/230-3-60	26.2	189.0	1/2	2.0	1	1	6.2	—	0.8	34.4	41.0	60
PCC-101		460-3-60	14.3	94.0	1/2	1.0	1	1	3.1	—	0.32	18.4	22.0	35
PCC-101		208/230-3-60	26.2	189.0	3/4	2.8	1	1	6.2	—	0.8	35.2	42.0	60
PCC-101		460-3-60	14.3	94.0	3/4	1.4	1	1	3.1	—	0.32	18.8	23.0	35
PCC-101		208/230-3-60	26.2	189.0	1	3.6	1	1	6.2	—	0.8	36.0	43.0	60
PCC-101		460-3-60	14.3	94.0	1	1.8	1	1	3.1	—	0.32	19.2	23.0	35
PCC-141	150-500	208/230-3-60	38.5	255.0	1	3.6	1	1	6.2	—	0.8	48.3	58.0	90
PCC-141		460-3-60	18.8	127.0	1	1.8	1	1	6.2	—	0.32	26.8	32.0	50
PCC-141		208/230-3-60	38.5	255.0	1 1/2	4.6	1	1	6.2	—	0.8	49.3	59.0	90
PCC-141		460-3-60	18.8	127.0	1 1/2	2.3	1	1	6.2	—	0.32	27.3	33.0	50
PCC-141		208/230-3-60	38.5	255.0	2	7.0	1	1	6.2	—	0.8	51.7	62.0	90
PCC-141		460-3-60	18.8	127.0	2	3.5	1	1	6.2	—	0.32	28.5	34.0	50
PCC-181	150-600	208/230-3-60	47.1	318.0	1	3.6	2	1	6.2	3.4ea	0.8	60.3	72.0	110
PCC-181		460-3-60	22.8	158.0	1	1.8	2	1	6.2	1.7ea	0.32	32.5	39.0	60
PCC-181		208/230-3-60	47.1	318.0	2	7.0	2	1	6.2	3.4ea	0.8	63.7	76.0	110
PCC-181		460-3-60	22.8	158.0	2	3.5	2	1	6.2	1.7ea	0.32	34.2	40.0	60
PCC-181		208/230-3-60	47.1	318.0	3	8.8	2	1	6.2	3.4ea	0.8	65.5	78.0	110
PCC-181		460-3-60	22.8	158.0	3	4.4	2	1	6.2	1.7ea	0.32	35.1	41.0	50
PCC-201	150-700	208/230-3-60	48.2	275.0	1	3.6	2	1	6.2	3.4ea	0.8	61.4	74.0	110
PCC-201		460-3-60	23.6	138.0	1	1.8	2	1	6.2	1.7ea	0.32	33.3	40.0	60
PCC-201		208/230-3-60	48.2	275.0	2	7.0	2	1	6.2	3.4ea	0.8	64.8	77.0	125
PCC-201		460-3-60	23.6	138.0	2	3.5	2	1	6.2	1.7ea	0.32	35.0	41.0	60
PCC-201		208/230-3-60	48.2	275.0	3	8.8	2	1	6.2	3.4ea	0.8	66.6	79.0	125
PCC-201		460-3-60	23.6	138.0	3	4.4	2	1	6.2	1.7ea	0.32	35.9	42.0	60
PCC-271	150-800	208/230-3-60	86.0	428.0	2	7.0	2	1	6.2	3.4ea	0.8	102.6	124.0	200
PCC-271		460-3-60	43.0	214.0	2	3.5	2	1	6.2	1.7ea	0.32	54.4	66.0	100
PCC-271		208/230-3-60	86.0	428.0	3	8.8	2	1	6.2	3.4ea	0.8	104.4	126.0	200
PCC-271		460-3-60	43.0	214.0	3	4.4	2	1	6.2	1.7ea	0.32	55.3	66.0	100
PCC-271		208/230-3-60	86.0	428.0	5	14.0	2	1	6.2	3.4ea	0.8	109.6	132.0	200
PCC-271		460-3-60	43.0	241.0	5	7.0	2	1	6.2	1.7ea	0.32	57.9	69.0	110
PCC-361	150-800	208/230-3-60	118.0	470.0	3	8.8	4	1	6.2	3.4ea	0.8	143.2	173.0	250
PCC-361		460-3-60	59.0	235.0	3	4.4	4	1	6.2	1.7ea	0.32	74.7	90.0	125
PCC-361		208/230-3-60	118.0	470.0	5	14.0	4	1	6.2	3.4ea	0.8	148.4	178.0	250
PCC-361		460-3-60	59.0	235.0	5	7.0	4	1	6.2	1.7ea	0.32	77.3	93.0	150
PCC-361		208/230-3-60	118.0	470.0	7 1/2	24.0	4	1	6.2	3.4ea	0.8	158.4	188.0	300
PCC-361		460-3-60	59.0	235.0	7 1/2	10.0	4	1	6.2	1.7ea	0.32	80.3	96.0	150

* MCA - Minimum Circuit Ampacity Max. Fuse Size - Maximum Time Delay Fuse or HACR Circuit Breaker

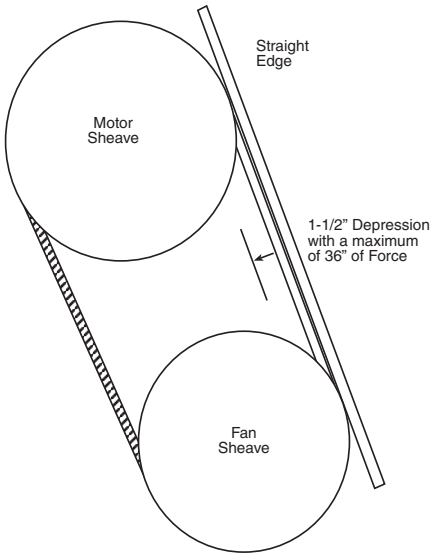
16. Check, Test, Start-Up, Service and Maintenance (cont'd)



Motor/Fan Sheave of Equal Width



Motor sheave Width Greater Than Fan Sheave Width



Blower Performance

Model Blower	FURN SIZE	CFM	External Static Pressure – Inches H_2O													
			0.4		0.6		0.8		1.0		1.2		1.4		1.6	
			R.P.M.	B.H.P.	R.P.M.	B.H.P.	R.P.M.	B.H.P.	R.P.M.	B.H.P.	R.P.M.	B.H.P.	R.P.M.	B.H.P.	R.P.M.	B.H.P.
071 (1) 10 x 10	100-125	1000	870	0.2	1000	0.3	1100	0.4	1200	0.4	1270	0.5	1360	0.6	1450	0.7
		1100	1090	0.3	1190	0.4	1280	0.5	1350	0.6	1420	0.7	1500	0.8	1600	0.8
		1200	1200	0.5	1250	0.6	1350	0.7	1410	0.7	1500	0.8	1580	0.9	1630	1.0
101 (1) 10 x 10	100-125	1100	800	0.2	960	0.3	1050	0.4	1150	0.6	1230	0.6	1310	0.6	1400	0.7
		1300	980	0.3	1090	0.4	1150	0.5	1250	0.6	1320	0.7	1400	0.8	1500	0.9
		1500	1050	0.5	1150	0.6	1220	0.7	1310	0.8	1390	0.8	1470	0.9	1550	1.0
101 (1) 12 x 12	150-175	1100	610	0.2	710	0.3	820	0.4	910	0.6	1000	0.6	1090	0.6	1140	0.6
		1300	800	0.4	900	0.4	1000	0.5	1080	0.6	1100	0.7	1200	0.8	1230	0.8
		1500	910	0.5	1000	0.6	1080	0.7	1150	0.8	1200	0.8	1280	0.9	1320	1.0
141 (1) 12 x 12	150-225	1400	700	0.3	910	0.4	1050	0.6	1200	0.8	1300	1.0	1410	1.1	1500	1.4
		1700	900	0.5	1020	0.7	1190	0.8	1300	1.1	1400	1.3	1500	1.5	1600	1.7
		2000	1080	0.8	1200	1.1	1320	1.3	1430	1.6	1550	1.7	1650	2.0	—	—
181 (1) 12 x 12	150-225	1800	790	0.4	850	0.5	910	0.6	1000	0.7	1080	0.8	1130	0.9	1200	1.0
		2200	970	0.7	1010	0.8	1100	1.0	1150	1.1	1210	1.2	1290	1.3	1350	1.4
		2500	1200	1.5	1300	1.6	1300	1.7	1350	1.8	1400	1.9	1450	2.0	1500	2.2
181 (2) 10 x 10	250-300	2000	1200	0.8	1290	0.9	1350	1.0	1450	1.2	1510	1.4	1600	1.5	1650	1.7
		2500	1250	1.2	1320	1.3	1410	1.4	1500	1.6	1590	1.8	1650	2.0	1700	2.2
		3000	1300	1.5	1390	1.6	1490	1.7	1550	2.0	1600	2.2	1690	2.5	1750	2.7
201 (1) 12 x 12	150-225	1800	750	0.4	850	0.5	930	0.6	1000	0.7	1040	0.8	1120	0.9	1200	1.0
		2400	910	0.8	1000	0.9	1050	1.0	1100	1.1	1150	1.2	1220	1.3	1300	1.4
		3000	1200	2.0	1250	2.1	1300	2.3	1350	2.5	1400	2.6	1450	2.8	1490	2.9
201 (2) 10 x 10	250-300	2200	1100	0.7	1200	0.8	1300	1.2	1400	1.3	1450	1.4	1510	1.6	1600	1.8
		2600	1200	1.2	1280	1.3	1380	1.4	1450	1.5	1500	1.7	1600	2.0	1670	2.4
		3000	1300	1.6	1400	1.7	1480	1.8	1550	2.0	1600	2.1	1690	2.4	1750	2.7
271 (1) 12 x 12	150-225	2400	950	0.8	1000	0.9	1070	1.0	1150	1.2	1200	1.3	1250	1.4	1310	1.5
		3300	1200	1.8	1250	2.0	1300	2.1	1350	2.3	1400	2.5	1450	2.6	1500	2.7
		4000	1400	3.1	1440	3.4	1500	3.6	1550	3.8	1580	4.0	1610	4.1	1650	4.3
271 (2) 10 x 10	250-300	3000	1300	1.5	1400	1.6	1470	1.8	1530	2.0	1600	2.3	1640	2.6	1710	2.8
		3500	1450	2.0	1510	2.2	1600	2.6	1650	2.7	1700	2.8	1780	3.2	1850	3.5
		4000	1540	2.6	1600	2.8	1670	3.0	1730	3.2	1790	3.5	1850	3.7	1900	4.0
271 (2) 12 x 12	350	3000	1150	1.5	1200	1.6	1270	1.8	1320	2.0	1400	2.4	1450	2.5	1500	2.8
		3500	1210	2.0	1300	2.2	1350	2.4	1400	2.6	1450	2.9	1500	3.0	1550	3.2
		4000	1310	2.8	1400	2.9	1450	3.0	1500	3.5	1550	3.8	1600	4.0	1620	4.2
361 (1) 12 x 12	150-225	3500	1210	2.0	1280	2.4	1310	2.5	1380	2.7	1410	2.8	1450	2.9	1500	3.0
		4000	1500	3.8	1540	4.0	1590	4.1	1620	4.2	1650	4.5	1700	5.0	—	—
		5000	1680	5.0	1700	5.2	1750	5.4	1800	6.0	—	—	—	—	—	—
361 (2) 10 x 10	250-300	3500	1350	1.8	1410	2.0	1500	2.2	1570	2.5	1610	2.6	1700	2.8	1750	3.1
		4000	1500	2.5	1530	2.8	1600	2.9	1650	3.2	1710	3.5	1780	3.6	1850	3.9
		5000	1680	4.0	1720	4.5	1790	4.9	1840	5.0	1900	5.1	1950	5.3	2000	5.5
361 (2) 12 x 12	350-400	3500	1300	2.4	1390	2.5	1410	2.7	1490	3.0	1540	3.2	1590	3.5	1640	3.8
		4000	1350	2.6	1410	2.9	1440	3.2	1510	3.5	1560	3.8	1600	4.0	1660	4.2
		5000	1400	3.8	1450	4.0	1500	4.5	1550	4.6	1600	5.0	1610	5.1	1700	5.6

16. Check, Test, Start-Up, Service and Maintenance (cont'd)

16E. GAS FIRED FURNACE

GAS SUPPLY PRESSURE & REGULATOR ADJUSTMENTS

A soapy water solution should be used to check for gas leaks. Since the unit is subject to considerable jarring during shipment, it is extremely important that all gas connections and joints be tested for tightness.

The natural gas supply pressures should be adjusted to 7.0" W.C. Pressure taps are provided on both the upstream and downstream sides of the valves.

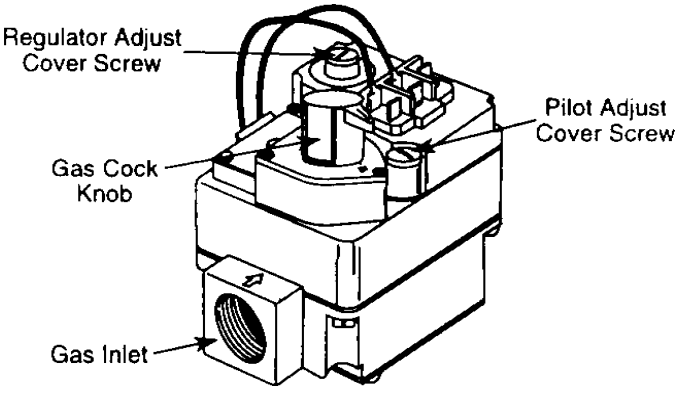
The normal manifold pressure for full input is 3.5" W.C. on Natural gas. Minimum gas supply pressure is 5.5" W.C. for Natural gas in order to maintain rating. Do not attempt adjustment of the built in pressure regulator unless the supply pressure is at least 7" W.C. for Natural Gas.

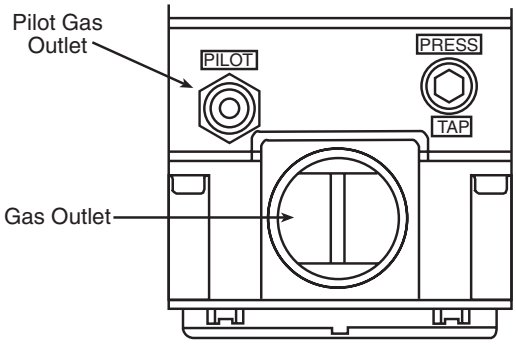
The stamping on the side of the valve contains the factory set value of the pressure regulator. Although adjustment should not be necessary, the regulator can be field adjusted to outlet pressures normally ranging from 2.5 to 5 inches W.C (natural gas). Do not force the adjusting screw beyond the limits that it can easily be adjusted.

If adjustment is necessary:

1. The first step in checking out the gas fired furnace is to test the gas supply piping to the unit for tightness and purge the system of air using methods outlined in the National Fuel Gas Code (ANSI Z83.9 latest edition).
2. Verify that the disconnect switch is in the "OFF" position.
3. Turn the gas cock knob to the "ON" position.
4. Attach a manometer to the outlet pressure tap of the gas valve.
5. Turn on power to the system and energize the valve.
6. Remove regulator adjust cover screw (see illustrations).
7. To DECREASE outlet pressure, turn the adjusting screw (located beneath the cover screw) counterclockwise (↶). To INCREASE outlet pressure, turn the adjusting screw clockwise (↷). Adjust the regulator until pressure shown on the manometer matches the pressure specified on the furnace rating plate.
8. Replace the cover screw. Cycle the valve two or three times to verify regulator setting.
9. After completing adjustments of the gas valve pressure regulator, turn off power to the system at disconnect switch.

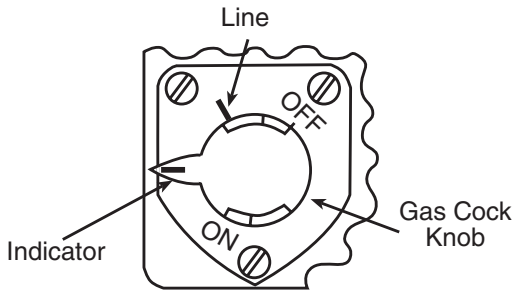
SINGLE STAGE GAS VALVE DRAWING USED WITH MAXITROL SYSTEMS





WARNING

Turn or depress gas cock knob only by hand. Do not use tools on knob, hit or damage knob. Damaged knob may result in a gas leak causing a fire and/or explosion, and can cause severe personal injury, death, or substantial property damage.



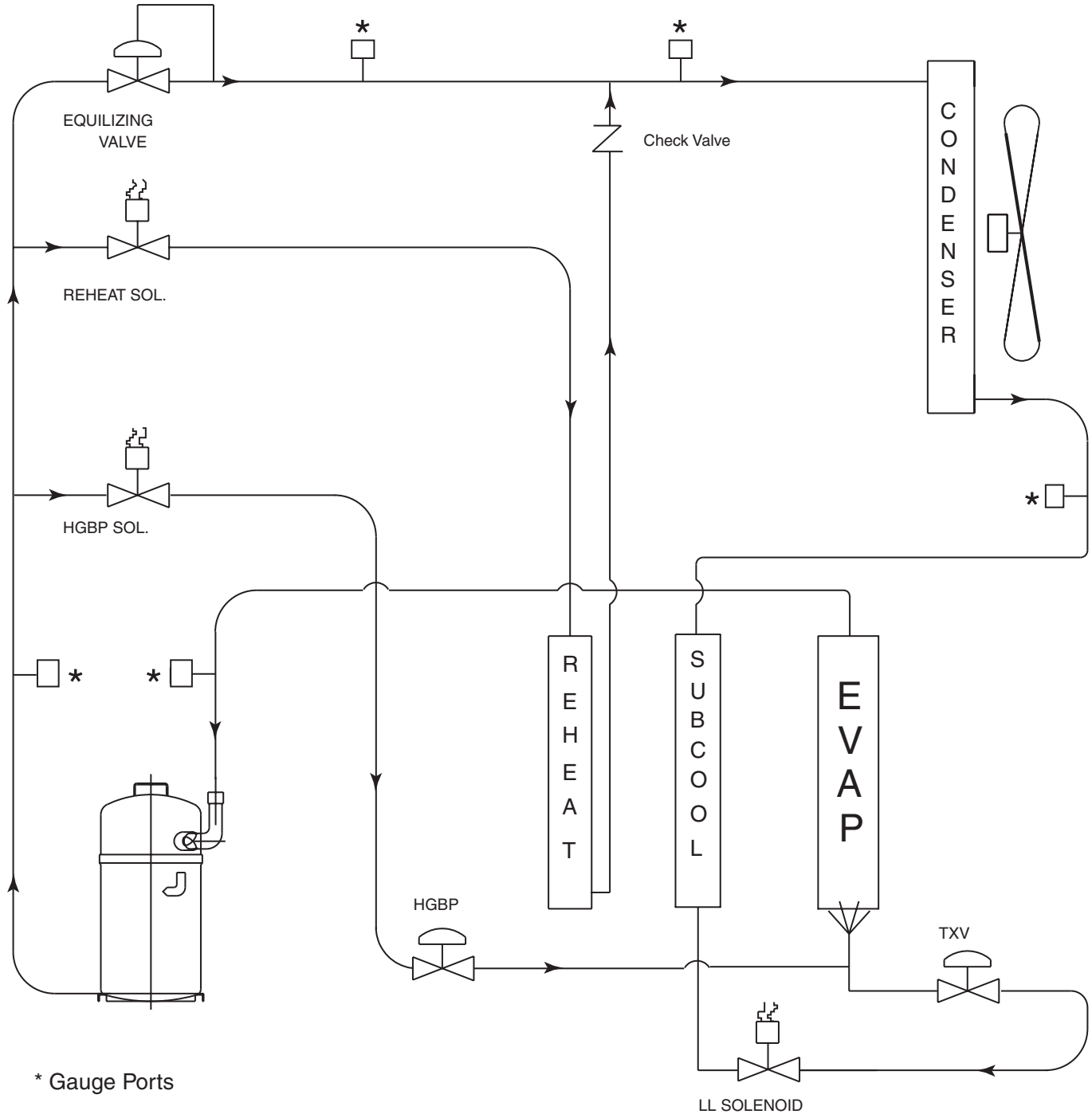
The gas cock knob is a two-position, detent-off type.

TO TURN VALVE OFF: Rotate knob clockwise (↷) to the "Off" line on the collar around the knob. Depress knob and continue rotation to "OFF" position.

TO TURN VALVE ON: Rotate knob counterclockwise (↶) to the line on the collar around the knob. Allow knob to "pop up", and continue rotation to "ON" position.

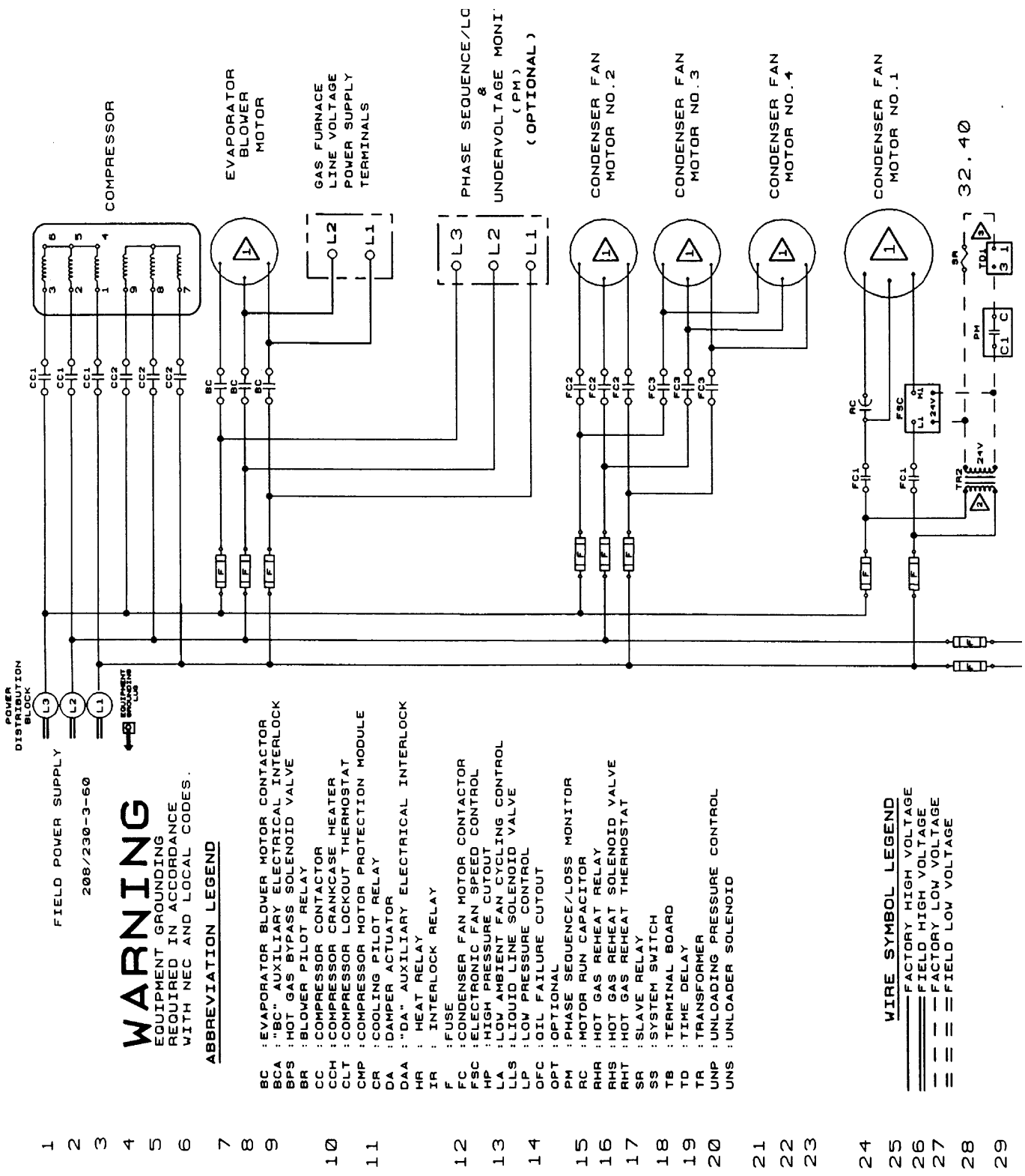
16. Check, Test, Start-Up, Service and Maintenance (cont'd)

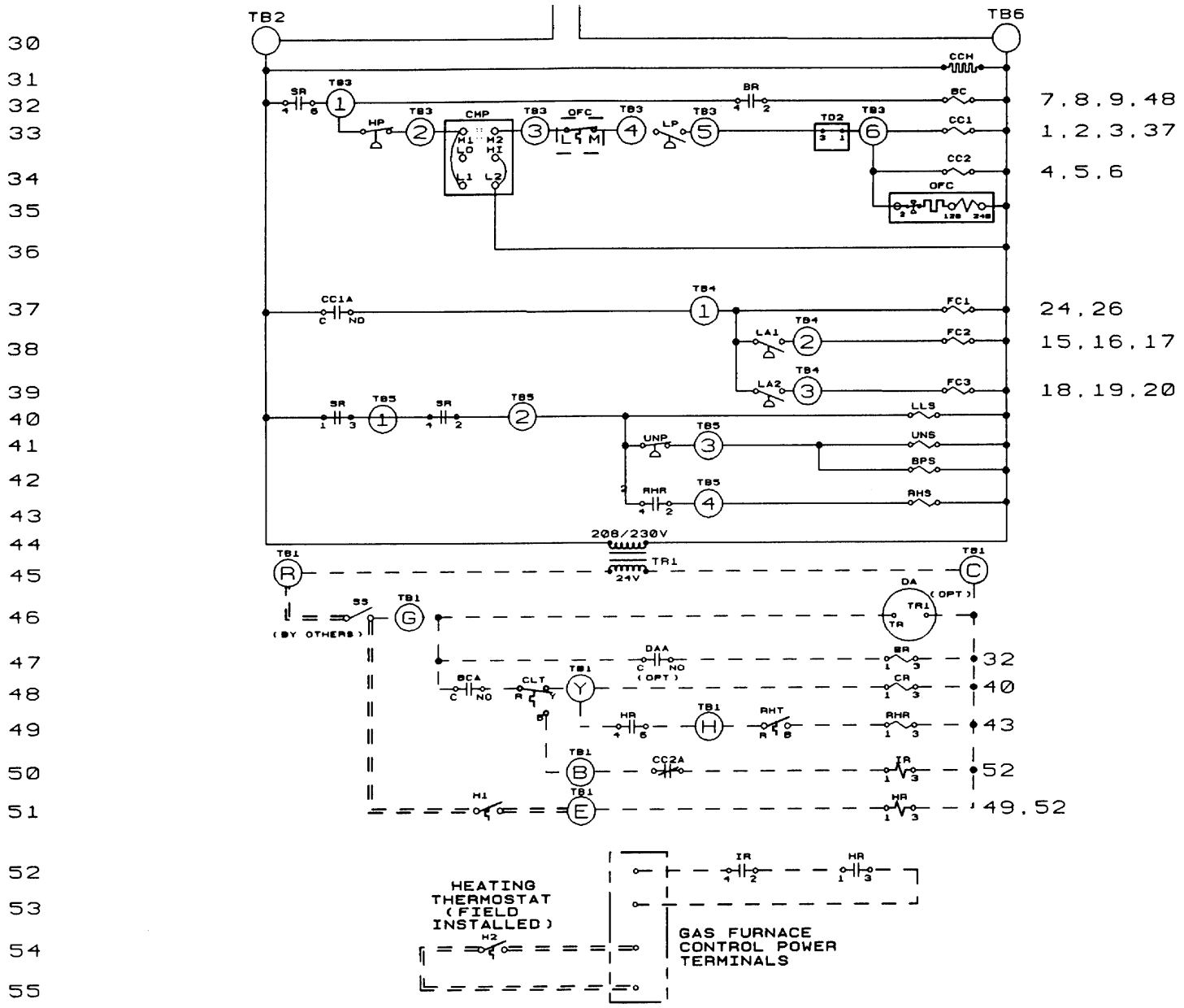
REFRIGERATION PIPING DIAGRAM



16. Check, Test, Start-Up, Service and Maintenance (cont'd)

TYPICAL WIRING DIAGRAM





NOTES:

1. TYPICAL MOTOR WITH AUTO-RESET INHERENT PROTECTION SHOWN. SEE CONNECTION DIAGRAM ON MOTOR FOR ACTUAL WIRING DETAIL.
2. CONDENSER FAN MOTOR NO.1 AND TRANSFORMER NO.2 PRIMARY MUST BE ON THE SAME PHASE IN ORDER FOR THE P66 FAN SPEED CONTROL TO FUNCTION PROPERLY.
3. UPON APPLICATION OF POWER TO TD1. FIVE MINUTE TIME DELAY BEGINS. UPON COMPLETION OF DELAY PERIOD, RELAY "SR" IS OPERATED.
4. UPON APPLICATION OF POWER TO TD2.CC1 AND CC2 ARE OPERATED AFTER A ONE SECOND DELAY, WHEN POWER IS REMOVED, A LOCKOUT CONDITION AND FIVE MINUTE TIME DELAY IS INITIATED. DURING THIS LOCKOUT/TIME DELAY PERIOD, CC1 AND CC2 CANNOT BE OPERATED.

361
208/230-3-60
B962-309-2
09/23/96
SHEET 2 OF 2

16. Check, Test, Start-Up, Service and Maintenance (cont'd)

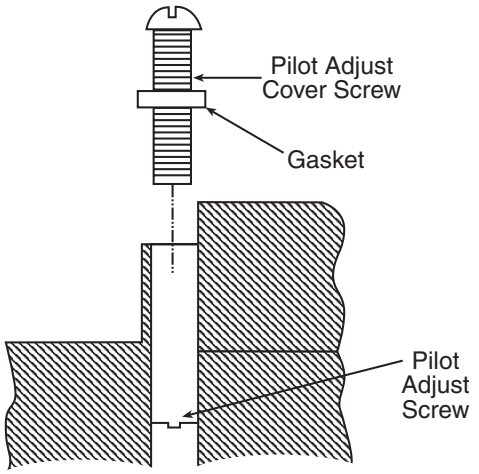
Pilot Flame Adjustment

While checking and adjusting the gas pressure, observe the intermittent pilot flame. This control is factory preset and will not normally require additional adjustment of pilot flame.

If the pilot flame is low and does not engulf the sensor, the system will not energize the main valve.

If pilot gas pressure is too high, gas will sputter past the ignition electrode and may not ignite. High pilot gas pressure may cause the flame to lift off of the burner and cause "low" heat at the flame sensor.

To adjust the pilot flame, remove the pilot adjust cover screw and gasket (see illustrations below) to expose adjusting screw. Turn adjusting screw clockwise (↷) to reduce flame, or counterclockwise (↶) to increase flame. Replace gasket and pilot adjust cover screw.



Pilot gas adjustment

Firing Sequence.

On call for heat by the thermostat, the venter motor is energized after a 15 second (approximately) time delay. Venter flow switch switches from N.C. to N.O. contacts energizing the pilot gas valve and spark gap to produce a pilot flame on each operating cycle. The sensing probe proves the presence of the pilot and energizes the safety switch portion of the control. The switch action de-energizes the spark gap and energizes the main valve. The main gas ignites and the unit fires at 50% to 100% rate based on control set point.

If the flame is extinguished during main burner operation, the safety switch closes the main valve and recycles the spark gap.

Limit Control

The furnace is equipped with a nonadjustable high limit switch which shuts off the gas in the event of motor failure, lack of air due to dirty filters, restrictions at the inlet or outlet of the unit, or any other condition causing overheating of the heat exchanger.

Combustion Air Proving Switch

The combustion air proving switch, which ensures that proper combustion air flow is available is a pressure switch. The switch is a single pole, double-throw switch, which senses pressure caused by the flow of combustion air from the venter. To prevent the switch from responding to sudden temporary pressure fluctuations and to provide a pre-purge, a small diameter orifice is installed in the outlet fitting of the pressure switch.

The electrical circuit of this furnace is designed to check for proper switch position before each complete heat cycle. Only after checking the state of the pressure switch, and proving that combustion air is present, will the gas ignition sequence begin.

Input Rating

Input rate must be checked because gas appliances must be derated 4% per 1000 Ft. of elevation for all altitudes more than 2000 Ft. above sea level and because variance in heating value and specific gravity require change in manifold pressure.

The input must be adjusted at the installation site. All installations should be made as outlined in the latest edition of National Fuel Gas Code ANSI Z83.9, section entitled "Procedure to be Followed to Place an Appliance In Operation."

1. It is the responsibility of the contractor to adjust the gas input to the unit. The input rate can be calculated by using the formula:

$$\text{Input BTU/HR} = \frac{3600 \times HV}{T}$$

⚠ WARNING

Safe operation requires proper venting flow. Never bypass the combustion air proving switch or attempt to operate the unit without the venter running and proper flow in the vent system. Hazardous condition could result.

HV = Heating valve of fuel = BTU/ft^3 of gas.

T = Time in seconds per ft^3 of gas flow as read from gas meter.

2. Adjust input rate by varying the adjustment of the gas pressure regulator. All adjustments must be made with furnace operating at high fire. Clockwise rotation of the pressure regulator dial increases pressure and gas flow rate. Turn dial counterclockwise to decrease pressure and gas flow rate.

3. If the manifold pressure after adjustment of input rating does not fall within the range of 3 in. to 4 in. w.c., contact your local Gas Supplier Service Representative or the Factory Service Supervisor.

   Observe furnace operation for several cycles. Firing can be observed through the viewglass in the burner box access panel.

16F. Field Adjustable Controls

Setting of various adjustable controls will depend on the desired conditions of service. Conditioning of outside air is accomplished by reduced airflow, 200 cfm per ton or less, to provide higher temperature reduction. This reduced air volume will prevent condensate carryover from the evaporator coil as it operates at a higher latent capacity. Be sure air volume is within the range specified in the Blower Performance Chart. Higher volume air flow will result in higher leaving air temperatures and will prevent proper reheat operation or cause short cycling of the gas furnace.

Refrigeration Circuit Controls

Optional Motorized Outside Air Dampers

The motorized outside air damper motor used on this unit is a two position device designed to open the outside air dampers when the 24 volt system switch is closed. When the system switch opens, the motor spring returns the dampers to the closed position.

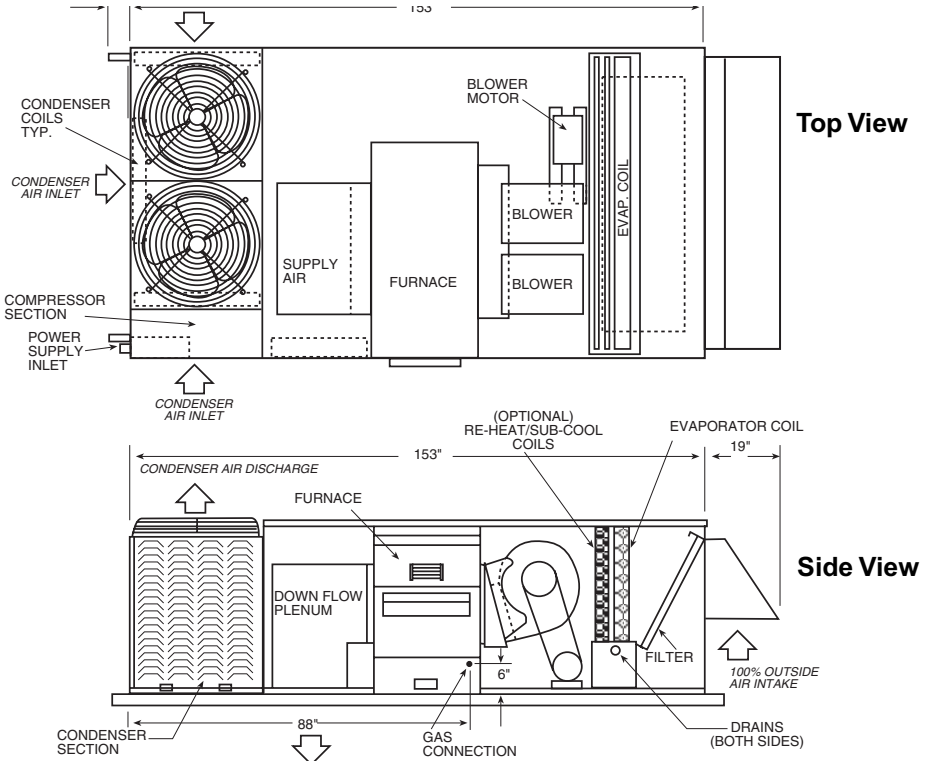
Operate the motor through its complete open-close stroke. If necessary, release one of the linkage connections to prevent damage. Check for proper operation, making sure that the linkage does not bind and that the motor travels smoothly throughout its fully open and closed position.

Make necessary minor adjustments until desired operation is obtained, and tighten all nuts and setscrews.

This damper motor has an internal auxiliary switch that is used as an evaporator blower motor interlock which prevents operation of the

16. Check, Test, Start-Up, Service and Maintenance (cont'd)

COMPONENT LOCATION GUIDE



evaporator motor until the outside air dampers are fully open. The auxiliary switch can be adjusted to operate at any point between 5° and 65° of motor stroke.

Check and adjust the auxiliary switch as follows:

1. Close the 24 volt system switch, operate the damper motor toward open and note the position of the crank arm when the evaporator blower motor starts. NOTE: Contact closure can be verified by a continuity check of the auxiliary switch circuit.
2. To obtain auxiliary switch closure at the point desired, set auxiliary switch adjustment knob for desired position of crank arm where evaporator blower motor is energized.

Adjustable Ambient Thermostat (Compressor Lockout Thermostat)

A remote field supplied and installed system switch, such as a time clock or exhaust fan interlock, is required to start/stop the air handler blower motor and energize the controls. The compressor adjustable ambient lockout thermostat controls the cooling operation at a setting between 65 and 70 degrees F. Operation of the compressor is thus limited to outside air temperatures above the set point.

To adjust the high or low cutout stop:

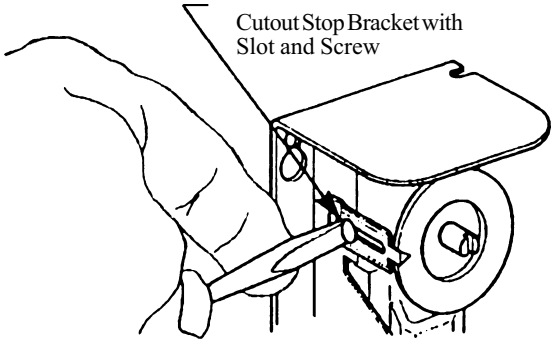
1. Set dial to temperature at which stop is desired.
2. Remove the cover of the control.
3. Loosen the cutout stop screw, slide the screw to the front of the temperature control against the plastic step behind the dial and tighten the screw (see drawing.) Sometimes an exact stop setting is not possible and stop must be set to the closest step corresponding to dial setting required.
4. Replace cover.

Typically, blower operation is continuous. The leaving air temperature will be maintained by compressor capacity control, accomplished through suction-pressure sensing, thus tracking the outside air temperature variations. The use of discharge air or space sensing devices (duct or room thermostats) to control the compressor will produce unpredictable results and is not recommended

Hot Gas Bypass

The purpose of the hot gas bypass refrigerant circuit is to maintain evaporator temperature above freezing (32° F), thus saving the compressor from failure and controlling capacity. Compressor capacity modulation by means of hot gas bypass is used where normal compressor cycling or the use of cylinder unloading alone may not be sufficient. This bypass valve is standard on all of these units. It must be field adjusted. The bypass valve opens at the recommended setting and can bypass up to 50% to the evaporator. Due to the reduced power consumption at lower suction pressures the hot gas bypass valve should be adjusted to bypass at the minimum suction pressure within the compressors operating limits. Be sure the hot gas setting is lower than the unloading pressure control when both are used. If the pressure setting of the cylinder unloading is increased, the hot gas bypass setting must also be increased.

In order to make field adjustments to this regulator, it may require simulating a light load condition. Connect a pressure gauge to the suction line and block the entering air to the evaporator. Suction pressure will drop and the valve should begin to open at approximately 62 psig. It has a range



All models have a screw type cutout stop. The stop screw must be loosened and moved to the stop setting desired. Tighten screw after setting is made.

16. Check, Test, Start-Up, Service and Maintenance (cont'd)

of 6 psig and will be fully open at 56 psig. The hot gas bypass valve will get warm to the touch when the valve begins to open. To adjust, remove the cap and turn the adjusting stem clockwise to increase the pressure and counterclockwise to decrease the pressure. Allow 5 minutes between adjustment to allow the system to stabilize.

Check to be sure that suction pressure does not fall below 56 psig. Adjustments should be made in small increments, allowing the system to stabilize after each turn. Vary the evaporator load to test at various conditions to ensure the suction pressure does not drop below the set point. Replace the seal cap on the adjusting stem.

Optional Hot Gas Reheat

Check the reheat control valve. This valve is factory set at a differential of 8 to 10 psig. This should be adequate for most applications. However, if additional reheat capacity is required, increase the differential pressure to a higher value. To do this:

1. Attach discharge pressure gauges to the Schraeder connections upstream and downstream of the valve.
2. Remove the cap from the top of the valve and turn the stem clockwise to increase the pressure differential and counterclockwise to decrease the differential.
3. Verify the operation of the reheat system by turning the reheat thermostat to a temperature 5 to 10 degrees above the leaving air temperature. The reheat solenoid will be energized and will cycle as the temperature changes. Set the reheat thermostat at the desired leaving air temperature.
4. Adjust the refrigerant charge by clearing the sight glass. This would be the maximum charge required for this system.
5. The final adjustment of the refrigerant charge should be by subcooling. The recommended subcooling at the condensing unit should be 15 degrees at 75 degrees F. and as low as 5 degrees at 105 degrees F. Verify proper operation of the thermostatic expansion valve by checking the superheat. The superheat should be 18-20 degrees at the suction line in the condensing section.
6. Check the airflow by checking the external static pressure. Verify the airflow is within the ratings. Check blower motor amperage. Make adjustments as needed to ensure airflow is correct and to specifications.

Adjustment of the reheat system should also include a calibration check of the head pressure control for the other fan motor(s). For more information on the reheat control valve, see *"Supplemental Instructions for Hot Gas Reheat*."

Cylinder Unloader Pressure Switch

Cylinder Unloading is used on all of these units with serviceable hermetic compressors. The unloader pressure switch must be field adjusted on these units. It should be set to open (unload) at 64 psig and close at 78 psig. This will maintain a refrigerant temperature in the evaporator of approximately 40 degrees F. This is a general recommended setting and may have to be adjusted in up or down a few psig for optimum operation. A 14 psig differential should be maintained. If the compressor runs unloaded for long periods of time, it is an indication that the control is set too high, or that some other part of the system needs adjustment. Check airflow, expansion valve superheat, refrigerant charge or low ambient conditions.

Variable Speed Condenser Head Pressure Control

The system consists of a variable speed motor driven fan and a constant speed motor driven fan(s). Both are controlled from refrigerant pressure rather than ambient temperature. At low ambient temperature, the variable speed fan operates, increasing in speed as head pressure rises, until maximum rpm is achieved (at or around 45°F). An adjustable pressure switch operates the constant speed three-phase fan motor(s) set to energize the motor at 275 psig and de-energize at 220 psig. In the ambient temperature span of approximately 50° to 53°F, the variable speed fan will ramp between maximum and minimum speed while the constant speed fan cycles. The start—stop cycle varies from 45 seconds to 22 minutes during this period. At 53°F, both fans are operating, the variable speed at minimum rpm and the constant speed at full rpm. As the ambient temperature continues to rise, the variable speed motor increases to full speed and remains there.

Constant Speed 3ø Motors(s)

If the application calls for a closer setting between maximum and minimum pressure settings on the constant speed fan (for example 275 psig on, 240 psig off) the effect will be to lengthen the temperature span during which the cycling takes place (for example 50°F to 57°F.)

The low ambient head pressure control should be factory set to cut in at 250 psig and cutout at 180 psig. Check calibration of this control and if trim adjustment is required maintain as wide a differential as possible.

The recommended settings are to cutin at 280 psig and cutout at 230 psig. It is factory set to maintain a minimum head pressure of 205 psig.

Variable Speed Single Phase Motor(s)

The Electronic Fan Speed Control is used with a single phase permanent split capacitor motor which has been rated and approved for speed control. By directly sensing pressure, this device electronically varies the speed of a fan motor. CAUTION: If replacement is necessary, use only single phase motors approved by the unit manufacturer.

The throttling range of the Electronic Fan Speed Control is internally fixed and cannot be adjusted. However, the operating range can be increased or decreased within the control's pressure range. The operating range can be adjusted as follows:

1. Locate the adjustment screw on the control's pressure transducer. The screw can be accessed through the opening in the upper left-hand corner of the control's base
2. Turn the adjustment screw clockwise to increase or counterclockwise to decrease the operating range. 1 turn = approximately ±35 psig. CAUTION: Any adjustments should be limited to two full turns in either direction. Over-adjustments may prohibit modulation of the motor and cause high head pressures.

Field repairs must not be made on this control. For a replacement control contact the Original Equipment Manufacturer. CAUTION: If replacement is necessary the 24 volt control circuit and the motor must be on the same electrical phase.

16. Check, Test, Start-Up, Service and Maintenance (cont'd)

GAS FURNACE CONTROLS

After gas supply pressure and regulator adjustments have been made as outlined above, the Selectra amplifier and Maxitrol modulating regulator valve can be checked for proper operation and the amplifier set to the appropriate leaving air temperature setting. It is helpful to have an AC and DC voltmeter and an ohmmeter capable of reading to 15,000 ohms. It is necessary to temporarily replace the discharge air sensor with a 4500 ohm, 2 watt test resistor.

Connect a DC voltmeter to the Maxitrol modulating regulator valve terminals. Rotate the temperature selection knob (in the amplifier) to maximum setting. The DC volts should read zero. The voltage should gradually increase to at least 20 volts when the temperature selector is slowly rotated to its minimum position (generally over a 3° to 4° range).

After the electronic modulation function is tested, a voltage reading must be taken across the automatic gas valve. This voltage reading will be approximately 24 V AC with the temperature selection knob at maximum setting, zero volts AC with the selector at minimum setting. The relay switching action should occur when the modulating voltage is between 15 and 19 V DC.

If these voltage readings are observed as noted, the amplifier and temperature selector are operating properly. After testing, remove the resistor and reconnect the discharge air sensor.

With the modulator-regulator valve and discharge air sensor rewired as instructed:

1. Set the selector at least 10° higher than incoming air and allow discharge air temperature to stabilize. Discharge air temperature should agree with temperature selector setting.
2. Increase temperature setting by 5° to 10°. Furnace manifold pressure should immediately go to high fire. Manifold pressure will decrease as the discharge air temperature approaches the setting and will stabilize at the temperature setting.
3. Decrease temperature to the original setting. Burner should immediately turn off. Then, as the discharge air temperature decreases, the burner should ignite at low fire.

If the preceding readings are not obtained:

4. Recheck wiring to ensure system is consistent with appropriate wiring diagram.
5. Check power source for 24 volts.
6. Some automatic gas valves require as much as 20 seconds to open. In this case, check for 24 V AC output at automatic gas valve terminals.

CHECK, TEST AND START FORM

GENERAL INFORMATION

DATE _____

Customer Name _____ Dealer Name _____
Address _____ Address _____
City _____ City _____
ST, Zip _____ ST, Zip _____
Phone # _____ Phone # _____

PRODUCT INFORMATION

Unit Model # _____ Unit Serial # _____

A/H Non-Cond. Space _____ Ductwork-Estimate Total Equivalent Feet _____

Liquid Line Solenoid Installed _____ Hot Gas Bypass Installed _____

Cylinder Unloading _____ Type of Head Pressure Control Used _____

Hot Gas Reheat _____ Phase Monitor Protection _____ Type of Thermostat _____

Electric Heat Installed _____ Liquid Injection _____ Other Optional _____

START UP INFORMATION

Supply Voltage L1-L2 L2-L3 _____ L1-L3 _____

(Return) Entering Air Temperature _____ DB _____ WB _____ Design Duct ESP _____

(Supply) Leaving Air Temperature _____ DB _____ WB _____ Design CFM _____

Outdoor Air (Inlet) Temperature _____ DB _____ WB _____

Outdoor Fan Discharge Air Temperature _____ DB _____

Suction Pressure _____ PSIG Suction Line Temp _____ Degrees Superheat _____ Degrees

Note: To Calculate Superheat, Convert Suction Pressure to Saturation Temperature, Then Subtract the Suction Line Temperature From the Saturation Temperature of the Evaporator.

Discharge Pressure _____ PSIG Liquid Line Head Pressure _____ PSIG

Liquid Line Temperature _____ Degrees Subcooling _____ Degrees

Note: To Calculate Subcooling Convert Head Pressure to Saturation Temperature, Then Subtract the Liquid Line Temperature From the Condensing Temperature (Saturation).

Oil Level _____ Crankcase Heater Operating _____ Sight Glass Clear _____

Noise Level _____ Condition of Unit _____

Compressor(s)

#1 FLA _____ Voltage T1-T2 _____ T2-T3 _____ T1-T3 _____ Amperage 1PH _____ 2PH _____ 3PH _____

#2 FLA _____ Voltage T1-T2 _____ T2-T3 _____ T1-T3 _____ Amperage 1PH _____ 2PH _____ 3PH _____

Condenser Fan(s) HP _____ FLA _____ Blower Motor HP _____ FLA _____

#1 Voltage _____ Amperage _____ #3 Voltage _____ Amperage _____

#2 Voltage _____ Amperage _____ #4 Voltage _____ Amperage _____

SETTINGS	CUT-IN	CUT-OUT	CUT-IN	CUT-OUT
High Pressure Switch				
Low Pressure Switch				
Pumpdown Low Pressure				
Low Ambient Fan #1				
Low Ambient Fan #2				
Low Ambient Fan #3				
Low Ambient Fan #4				
Oil Failure Control				
Hot Gas Bypass				
Cylinder Unloader Switch				

16G. Trouble Shooting Guides
General Refrigeration Circuit

SYMPTOM	POSSIBLE CAUSE	REMEDY
A. Compressor will not start	1. Power off, loose electrical connections or fuse open. 2. Compressor contactor not closing. 3. Internal compressor thermal overload open. 4. Compressor defective. 5. High or low pressure switch open or defective. 6. Oil pressure control open or defective.	1. Check disconnect switch, fuses and wiring. Replace parts or repair as necessary. 2. Check voltage to contactor coil, transformer, slave relay, system. Replace parts as necessary. 3. If compressor is hot, allow 2 hours to cool. See thermal overload below. 4. Check compressor for electrical failure. Compressor may be seized, check for L.R.A. 5. Check calibration of high or low pressure switch, re-calibrate or replace. 6. Check oil failure control. See oil failure control below.
B. Compressor starts but cuts out on low pressure switch.	1. Low refrigerant charge 2. Airflow restricted. 3. Restriction in liquid line. 4. Defective low pressure switch.	1. Check sightglass and check pressures. 2. Check for dirty evaporator coil, dirty filters, dampers closed, iced evaporator, improper belt, check motor amps, duct design. 3. Check head pressure, check and adjust TXV if not functioning properly, check pressure drop across filter drier. 4. Check calibration of switch.
C. Compressor starts but cuts out on high pressure switch.	1. Refrigerant overcharge. 2. Condenser fan control has incorrect setting. 3. Fan motor defective. 4. Condenser coil inlet obstructed or dirty. 5. Air or non-condensables in system. 6. Defective high pressure switch. 7. Restriction in discharge or liquid line.	1. Check pressures, charge by sub cooling. 2. Check calibration of low ambient control. 3. Check fan motor. 4. Check coil and inlet clearances and for possible air recirculation. 5. Check high side equalized pressure reading with equivalent outdoor temperature. 6. Check calibration of switch. 7. Check discharge and liquid line pressures, check TXV.
D. Compressor cuts out on thermal overload.	1. Low voltage. 2. Sustained high discharge pressure. 3. High suction and discharge pressures. 4. Defective compressor overload. 5. Defective run capacitor. 6. Improper refrigerant charge. 7. Bearings or pistons too tight. 8. Allow time for compressor to cool.	1. Check voltage. 2. Check running amperage and conditions described under "high discharge pressure." 3. Check TXV setting, check for air in system. 4. Allow compressor to cool for two hours if compressor is hot. Recheck for open circuit. 5. Check run capacitor for compressor and fan motor. 6. Check subcooling. 7. Check for low oil level. 8. Check dome temperature of the compressor.
E. Compressor cuts out on oil failure control (semi-herm.)	1. Low oil level. 2. Defective oil pump. 3. Defective control. 4. Liquid refrigerant is entering crankcase.	1. Check crankcase sightglass - add oil to bring level to midway in sightglass. 2. Check oil pump. 3. Check oil failure control for calibration. 4. Compressor will be wet. Check crankcase heater or cause for liquid feedback.
F. Noisy compressor.	1. Scroll compressors are rotation sensitive. 2. Refrigerant overcharge. 3. Excessive or insufficient oil in compressor crankcase. 4. Liquid floodback. 5. Tubing rattle. 6. Compressor defective.	1. Reverse wiring at disconnect switch, recheck for correct evaporator blower rotation. 2. Check pressures and subcooling. 3. Check oil level in hermetic compressors. Check total equivalent feet of piping. Add oil as recommended. 4. Check TXV setting. Check for refrigerant overcharge. 5. Dampen tubing vibration by taping or clamping. Bend tubing away from contact where possible. 6. Check internal parts (semi-herm.)

General Refrigeration Circuit (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
G. Noisy unit operation.	1. Blower rotational noise. 2. Air noise. 3. Chattering contactor. 4. Tubing rattle.	1. Check blower, motor and drive for faulty adjustment or noisy bearings, loose parts, blower out of balance. 2. Check ductwork. Air velocity too high. 3. Check for adequate control voltage, check for shorts or breaks, check thermostat, check contact points. 4. Dampen by taping or clamping, bend tubing away from contact when possible.
H. High suction pressure.	1. Excessive load on evaporator coil. 2. Broken compressor valves. Scroll compressors do not have valves. 3. Compressor is unloaded. 4. Leaking check valve. 5. Expansion valve not secured to suction line or TXV defective.	1. Check for high entering wet bulb temperature. Check for excessive airflow. 2. Remove head (semi-herm.) inspect valves reeds. Scroll compressors should not be pumped down below 5 psig. re-calibrate unloader pressure switch. 3. Check head pressure, check and adjust TXV if not functioning properly, check pressure drop across filter drier. 4. Check temperature across check valve. 5. Check the TXV, ensure bulb is insulated.
I. High discharge pressure.	1. TXV setting. 2. Air inlet to condenser dirty or obstructed. 3. Condenser fan motor defective. 4. Condenser fan control has incorrect setting.	1. Check TXV setting and calibrate superheat. 2. Check for proper clearances and possible air recirculating. 3. Check condenser fan motor and run capacitor. 4. Check calibration of low ambient head pressure control.
J. Suction pressure too low.	1. Refrigerant undercharge. 2. Blower running backward. 3. Loose blower, pulley or belts. 4. Defective or improperly adjusted expansion valve. 5. Dirty filter. 6. Too little air flow or low entering air temperature. 7. Restriction in suction or liquid line.	1. Check pressures and subcooling. 2. Interchange any two wires from 3 phase disconnect. 3. Check drive pulley alignment, belt tension. 4. Check superheat and adjust TXV. 5. Check filter and evaporator coil. 6 Check airflow and entering air wet bulb conditions. 7. Check refrigerant circuit for restriction
K. Head pressure too low.	1. Insufficient refrigerant charge. 2. Defective or improperly adjusted expansion valve. 3. Low suction pressure. 4. Condenser fan control setting. 5. Defective compressor.	1. Check subcooling, check for leak. 2. Check superheating and adjust TXV. 3. See “suction pressure too low” above. 4. Check calibration of low ambient control. 5. See “high suction pressure” above.
L. Compressor short cycles.	1. Thermostat location or malfunction. 2. Improper refrigerant charge. 3. Defective high or low pressure control. 4. Liquid floodback. 5. Defective expansion valve. 6. Poor air distribution. 7. High discharge pressure. 8. Leaking discharge valves in compressor.	1. Check thermostat, check heat anticipator setting. 2. Check subcooling, verify superheat. 3. Check high or low pressure switch. 4. Possible tight bearings, see above. 5. Check TXV and superheat. 6. Check ductwork for recirculating. 7. See “high discharge pressure” above. 8. See “high suction pressure” above.
M. Running cycle too long or unit operates continuously.	1. Refrigeration undercharged. 2. Dirty filter or evaporator coil. 3. Dirty or clogged condenser coil. 4. Air or other non-condensables in system. 5. Defective compressor. 6. Restriction in suction and liquid line. 7. Control contacts stuck.	1. Check subcooling. 2. Check filter, coil and airflow. 3. Check coil and airflow. 4. Check equalized high side pressure with equivalent outdoor temperature. 5. See “high suction pressure” above. 6. Check for restrictions in refrigerant circuit. 7. Check thermostat, shorts in wiring, slave relay compressor contactor

General Refrigeration Circuit (continued)

SYMPTOM	POSSIBLE CAUSE	REMEDY
N. Supply air temperature too high.	1. Refrigerant undercharge or leak in system. 2. Evaporator plugged with dirt or ice. 3. Improperly adjusted or defective expansion valve. 4. Defective compressor. 5. High discharge pressure. 6. Airflow is too high.	1. Check subcooling and check for leaks. 2. Check evaporator, airflow and filter. 3. Check superheat and adjust TXV, check bulb. 4. Check compressor for proper operation. 5. See “high discharge pressure” above. 6. Check external static pressure.
O. Supply air temperature too low.	1. Airflow is too low. 2. Return air temperature too low.	1. Check evaporator coil, filter, check for closed dampers, grills, drive for loose parts, belts, misalignment, check external static pressure. 2. Check entering air wet bulb conditions.
P. Liquid line too hot.	1. Refrigerant undercharge. 2. High discharge pressure.	1. Adjust the charge by subcooling. 2. See “high discharge pressure” above.
Q. Liquid line frosted or wet.	1. Restriction in liquid line.	1. Restriction upstream of point of frosting.
R. Suction line frosting.	1. Insufficient evaporator air flow. 2. Restriction in suction or liquid line. 3. Malfunctioning or defective expansion valve.	1. Check airflow, check drive for loose parts, belts, closed dampers. 2. Restriction upstream of point of frosting. 3. Check bulb of TXV.
S. Blower motor not running.	1. Improper wiring. 2. Defective motor. 3. Defective thermostat or control circuit. 4. Motor off on overload protector.	1. Check wiring diagrams. 2. Check motor and controller. 3. Check control circuit. 4. Allow motor to cool, check amperage.

Variable Speed Condenser Head Pressure Control

SYMPTOM	POSSIBLE CAUSE	REMEDY
A. No fan operation.	1. Input pressure is below operating range. 2. No 24 volt control voltage 3. No input pressure to control. 4. Bad fan motor. 5. Pressure transducer problem.	1. No problem, normal operation. 2. Check for 24 V AC at control. 3. Check alignment of Capillary fitting. Schrader valve depressor must depress Schrader valve enough to allow pressure into capillary. 4. Disconnect power. Place a jumper from L_1 to M_1 and connect power. If fan does not start, motor is bad and should be replaced. 5. Disconnect 6 pin connector from right side of control. Place a jumper wire between third pin from the top and bottom pin on the control (not the cable). If fan goes to full speed, check for input pressure. If it has been determined there is adequate pressure, the transducer is bad and the control must be replaced.
B. Fan stops when pressure reaches the high end of the operating range.	1. Control is not wired correctly.	1. See wiring diagrams.
C. No fan modulation (On-Off Operation)	1. Control is not wired correctly.	1. See wiring diagrams.
D. Fan starts at full speed.	1. Control is not wired correctly.	1. See wiring diagrams.
E. Erratic fan operation.	1. Control is not wired correctly. 2. Dirty or blocked condenser coil.	1. Check to see if control voltage (24 V AC) is on same phase as motor. 2. Clean condenser coil.
F. Fan motor is cycling on thermal overload.	1. Dirty or blocked condenser coil. 2. Wrong motor for fan speed control application.	1. Clean condenser coil. 2. Replace with motor approved for fan speed control application.

Hot Gas Bypass Regulator

SYMPTOM	POSSIBLE CAUSE	REMEDY
A. Erratic pressure control.	1. Defective regulator. 2. Dirt causing regulator to bind. 3. Power source to hot gas solenoid or operation of the solenoid is intermittent.	1. Replace defective part. 2. Disassemble regulator and clean internal parts. Install ALCO strainer. 3. Determine if problem is caused by supply voltage, solenoid, or excessive MOPD. Make changes necessary to correct problem.
B. Regulator leakage.	1. Dirt in regulator causing seat to remain open. 2. Worn or eroded seating surface on regulator.	1. Clean the regulator. Install ALCO strainer. 2. Replace defective part.
C. Regulator hunting (chattering) wild fluctuations in controlled pressures.	1. Regulator is oversized. 2. Regulator and EPR have control interaction. 3. Regulator and liquid injection Thermo Valve have control interaction. 4. Regulator and cylinder unloaders have control interaction.	1. Contact OEM manufacturer for correctly sized regulator. 2. Move the external equalizer line downstream from the EPR. 3. Increase superheat setting. Dampen bulb response by repositioning. 4. Differential should be increased between the controls by lowering the regulator's set point.
D. Regulator will not provide pressure control.	1. Regulator seat is restricted. 2. Pressure adjusting stem is set at a point so high that suction pressure never reaches the set point. 3. External equalizer line upstream of the EPR. 4. Strainer clogged at the regulator inlet. 5. MOPD exceeded across the solenoid or loss of source voltage. 6. Solenoid coil burn out. 7. Wrong type distributor for hot gas bypass to the evaporator.	1. Locate and remove stoppage. Install ALCO strainer. 2. Readjust the regulator. 3. Move external equalizer line downstream from the EPR. 4. Locate and remove stoppage. 5. Replace solenoid or trouble—shoot the electrical problem. 6. Replace coil. 7. Install proper Venturi - Flo type distributor for low pressure drop.
E. Regulator fails to close.	1. Dirt under seat of the regulator. 2. Diaphragm failure (leakage around the adjusting stem) 3. Pressure adjusting stem is set at a point so high that suction never reaches the set point. 4. Blocked external equalizer passage. 5. Worn or eroded regulator seat.	1. Locate and remove stoppage. Install ALCO strainer or EK drier filter. 2. Replace defective parts. 3. Readjust the regulator. 4. Locate and remove stoppage. Install ALCO strainer. 5. Replace defective part.

General Gas Furnace

SYMPTOM	POSSIBLE CAUSE	REMEDY
A. Venter motor will not start.	1. Manual valve not open. 2. No 24 volt power to venter relay. 3. Venter relay defective 4. Defective motor or capacitor.	1. Turn on power. Check supply fuses or circuit breaker. 2. Turn up thermostat, check control transformer output. Check for loose or improper wire connections. 3. Replace. 4. Replace defective part.
B. Pilot will not light.	1. Manual valve not open. 2. Air in gas line. 3. Dirt in pilot orifice. 4. Gas pressure too high or too low. 5. Kinked pilot tubing. 6. Pilot valve does not open. 7. No spark. a) Loose wire connections. b) Transformer failure. c) Incorrect spark gap. d) Spark cable shorted to ground. e) Spark electrode shorted to ground. f) Drafts affecting pilot. g) Ignition control not grounded. h) Faulty ignition controller. 8. Optional lockout device interrupting control circuit by above causes. 9. Faulty combustion air proving switch.	1. Open manual valve. 2. Bleed gas line. 3. Remove and clean with compressed air or solvent (do not ream). 4. Adjust supply pressure 5. Replace tubing. 6. If 24 volt available at valve, replace valve. 7. a) Be certain all wires connections are solid. b) Be certain 24 volts are available. c) Maintain spark gap at 7/64". d) Replace worn or grounded spark cable. e) Replace pilot if ceramic spark electrode is cracked or grounded. f) Make sure all panels are in place and tightly secured to prevent drafts at pilot. g) Make certain ignition control is grounded to furnace chassis. h) If 24 volt is available to ignition controller and all other causes have been eliminated, replace ignition control. 8) Reset lockout by interrupting control power. 9) Replace combustion air proving switch.
C. Pilot lights, main valve will not open.	1. Manual valve not open. 2. Main valve not opening. a) Defective valve. b) Loose wire connections. 3. Ignition control does not power main valve. a) Loose wire connections. b) Flame sensor grounded. (Pilot lights - spark continues.) c) Gas pressure incorrect. d) Cracked ceramic at sensor. e) Faulty ignition controller. f) Poor microamp signal.	1. Open manual valve. 2. a) If 24 volt is measured at valve connections and valve remains closed, replace valve. b) Check and tighten all wiring connections. 3. a) Check and tighten all wiring connections. b) Be certain flame sensor lead is not grounded or insulation or ceramic is not cracked. Replace as required. c) Set supply pressure at 5" w.c. to 8" w.c. for natural gas. d) Replace sensor. e) If all checks indicate no other cause, replace ignition controller. DO NOT attempt to repair the ignition controller. This device has no field replaceable parts. f) Adjust pilot regulator.
D. No heat (furnace operating).	1. Dirty filters in blower system. 2. Incorrect manifold pressure. 3. Cycling on limit control. 4. Improper discharge air sensor location. 5. Belt slipping on blower.	1. Clean or replace filters. 2. Check manifold pressure. 3. Check air flow through heat exchanger. 4. See Maxitrol instructions. 5. Adjust belt tension.
E. Cold air on start-up or during operation.	1. Fan control improperly wired. 2. Defective fan control. 3. Incorrect manifold pressure. 4. Blower set for too low temperature.	1. Connect per wiring diagram. 2. Replace fan control. 3. Check manifold line pressure. 4. Slow down blower or increase static pressure.

Ignition Control

SYMPTOM	POSSIBLE CAUSE	REMEDY
A. No spark and system does not operate.	1. No call for heat. 2. Ignition control not grounded. 3. 24 volt not present between term. 6 and GR 4. 24 volt not present between term. 2 and GR. 5. 24 volt not present between term. 1 and GR. 6. High voltage not present between spark gap and ground. 7. High voltage cable brittle, burnt or cracked. 8. Spark electrode ceramic cracked. 9. Spark gap more or less than 7/64" and is not located in pilot gas stream.	1. Close the heating circuit. 2. Correct by making connections. 3. Check the circuit providing 24V AC to terminal 6 and GR. 4. Check the circuit providing 24V AC to terminal 2 and GR. 5. Replace the ignition control. 6. Check that high voltage cable is securely connected to spark transformer. 7. Replace the cable. 8. Replace burner pilot assembly 9. Re-gap the spark gap and reposition it in the pilot gas stream. If gap and position are OK and problem continues, Replace ignition control.
B. Igniter sparks but pilot will not light.	1. Pilot valve wiring loose at terminal. 2. Inlet gas pressure too high or too low. 3. No gas at pilot. 4. Spark gap more or less than 7/64" and is not located in pilot gas stream.	1. Tighten wiring connection. 2. Readjust gas pressure. 3. Make sure pilot line is not kinked or obstructed. Check for clean pilot orifice. If OK replace pilot valve. 4. Re-gap or replace pilot. If OK check for drafts and shield pilot as necessary.
C. Pilot lights but main valve will not open.	1. Spark stays on for more than 30 seconds after pilot has proven. 2. 24V AC not present between terminal 3 and ground. a) Inlet gas pressure not per specifications. b) Main valve wiring not securely attached to terminal 3 and ground. 3. Sensor cable not securely attached to terminal 4 and flame sensor. a) Sensor Ceramic cracked. b) Sensor cable is grounded out. c) Sensor or sensor connector shorted out to metal surface. d) Sensor cable conductor is open or cable insulation has failed. e) DC microamp current is 0.2 microamps or greater with pilot only operation. If so, check for Proper gas pressure, clean pilot assembly, tight mechanical and electrical connections. If no improvement is noted, it may be necessary to change the flame sensor length or the orifice size. If these components are changed, it is necessary to perform the proper turn down tests to provide a satisfactory pilot application. It may also be necessary to replace the ignition control.	1. Make sure sensor cable and high voltage cable are separated from each other and not wrapped around any pipe or accessories. 2. Replace ignition control. a) Readjust gas pressures. b) Securely attach wiring. If problem continues, replace gas valve. 3. Correct wiring connections. a) Replace sensor. b) Replace the cable. c) Correct the grounding. d) Replace the cable. e) Disconnect main valve lead from term. 3. Disconnect sensor cable from term. 4, connect DC microampmeter between terminal of sensor cable and term. 4. Observe correct polarity. If 0.2 or more microamps is not measured with pilot in operation, replace the ignition control.

Maxitrol-Regulator

SYMPTOM	POSSIBLE CAUSE	FIELD TEST	REMEDY
A. Automatic control valve will not close despite full range of modulating voltage at terminals 1 and 2.	1. Faulty automatic control valve. 2. Installation wiring error. 3. Amplifier is faulty.	1. Remove wire from valve, if valve doesn't close —valve is faulty. 2. Remove wire from amplifier terminal 10 and 11. If valve remains open check for miswiring. 3. If AC voltage will not drop to zero at terminals 8 and 11 when DC voltage at terminals 1 and 2 is above 20 V DC, amplifier is faulty. If space temperature is less than 60° or greater than 85° F, see Gas Furnace Controls, page 18.	1. Replace automatic control valve. 2. Correct wiring. 3. Replace amplifier.
B. Automatic control valve will not open despite full range of modulating voltage at terminals 1 and 2.	1. Faulty automatic control valve. 2. Open wire to automatic valve. 3. Amplifier is faulty.	1. Read voltage across valve terminals. If 24 V AC, valve is faulty. 2. Read voltage across terminals 8 and 11 on amplifier. If 24V AC, check for open circuit to automatic valve. If space temperature is less than 60° or greater than 85°F. 3. If AC voltage reading remains zero when DC voltage at terminals 1 and 2 is below 14V DC, amplifier is faulty. If space temperature is less than 60° or greater than 85°F.	1. Replace automatic control valve. 2. Correct wiring. 3. Replace amplifier.
C. No gas flow.	1. Faulty power supply. 2. MR valve installed backward.	1. Read voltage at amplifier terminals 8 and 14 (24 V AC). 2. Arrow on MR valve should point in direction of gas flow.	1. Power supply must be 24V AC. 2. Install properly.
D. Continuous high fire.	1. Room Override Thermostat, if used, calls for heat. 2. Open circuit in sensing and setting circuit.	1. Remove T115 wires from amplifier terminals 3 and 14. 2. Disconnect and measure across wires connected to amplifier be terminals 3 and 4 (A1010). Should read between 8,000 and 12,000 ohms.	1. If proper operation is obtained, check thermostat wiring for shorts. Rotate thermostat dial above and below room temperature to prove thermostat function. 2. If above 12,000 ohms check circuit for open or loose wires.
E. Continuous high fire but automatic valve cycles.	1. Open circuit in wiring to MR valve. 2. Plunger jammed or installed upside down. 3. Faulty MR valve.	1. Check wiring for defects. 2. Plunger should be smooth and clean and operate freely in solenoid sleeve. 3. Measure voltage across MR valve.	1. Replace wiring if necessary. 2. Clean or replace plunger. 3. If modulating voltages are obtained, but no gas modulation, MR valve is faulty. Replace if necessary.
F. Furnace won't activate due to constant high modulating voltage (above 17 V DC)	1. Short circuit in sensing and setting circuit.	1. Disconnect and measure across wires connected to amplifier terminals 3 and 4 (A1010 models). Should read between 8,000 and 12,000 ohms.	1. If below 8,000 ohms check circuit for shorts or miswiring.

Maxitrol-Regulator (continued)

SYMPTOM	POSSIBLE CAUSE	FIELD TEST	REMEDY
G. Continuous low or medium fire, but automatic valve cycles correctly.	1. Heat load requires low fire only.	1. Increase temperature setting 10 degrees.	1. If heater goes to high fire, system is working correctly.
	2. Plunger and/or maximum spring missing.	2. Check for parts.	2. Install correct parts.
	3. Jammed plunger.	3. Examine. Plunger should be clean, smooth, and operate freely in solenoid sleeve.	3. Clean, or replace plunger if necessary.
	4. Other valves faults.	4. Remove wire from MR valve.	4. If MR valve remains on low fire, valve may be faulty. Check item 19 below, then replace valve if necessary.
	5. Inadequate supply pressure.	5. Remove max. adjustment spring from MR valve, push down on plunger. Insufficient manifold pressure with furnace operating indicates supply is too low.	5. Check for obstruction in gas pipe ahead of controls. Increase gas pressure if possible.
H. Incorrect discharge air temperature.	1. Calibration.	1. Check seal on calibration potentiometer.	1. Recalibrate per "Temperature Calibration" procedure.
I. Erratic or severely pulsating flame.	1. Dirty or sticking plunger.	1. Examine. Plunger should be clean, smooth, and operate freely in solenoid sleeve.	1. Clean or replace plunger if necessary.
	2. Loose or broken wiring.	2. Inspect wiring.	2. Correct wiring.
	3. Erratic DC voltage.	3. Observe DC voltage across amplifier terminals 1 and 2.	3. If erratic or pulsating DC voltage is observed and wiring shows no defects, replace amplifier. If erratic or pulsating voltage continues, contact the mfg.

* Control circuits external to the Maxitrol-Regulator and Amplifier can cause burner malfunction. Always check gas valve to be certain it is turned on, and check limit controls for normal operation.

Printed in the U.S.A.