Service and Troubleshooting

A/GPDM3 13.4 SEER2 "M" SERIES - Single Package Dual Fuel Gas-Electric Heating & Cooling Units

Pride and workmanship go into every product to provide our customers with quality products. It is possible, however, that during its lifetime a product may require service. Products should be serviced only by a qualified service technician who is familiar with the safety procedures required in the repair and who is equipped with the proper tools, parts, testing instruments and the appropriate service manual. **REVIEW ALL SERVICE INFORMATION IN THE APPROPRIATE SERVICE MANUAL BEFORE BEGINNING REPAIRS.**

WARNING

ONLY PERSONNEL THAT HAVE BEEN TRAINED TO INSTALL, ADJUST, SERVICE, MAINTENANCE OR REPAIR (HEREINAFTER, "SERVICE") THE EQUIPMENT SPECIFIED IN THIS MANUAL SHOULD SERVICE THE EQUIPMENT. THE MANUFACTURER WILL NOT BE RESPONSIBLE FOR ANY INJURY OR PROPERTY DAMAGE ARISING FROM IMPROPER SERVICE OR SERVICE PROCEDURES. IF YOU SERVICE THIS UNIT, YOU ASSUME RESPONSIBILITY FOR ANY INJURY OR PROPERTY DAMAGE WHICH MAY RESULT. IN ADDITION, IN JURISDICTIONS THAT REQUIRE ONE OR MORE LICENSES TO SERVICE THE EQUIPMENT SPECIFIED IN THIS MANUAL, ONLY LICENSED PERSONNEL SHOULD SERVICE THE EQUIPMENT. IMPROPER INSTALLATION, ADJUSTMENT, SERVICING, MAINTENANCE OR REPAIR OF THE EQUIPMENT SPECIFIED IN THIS MANUAL, OR ATTEMPTING TO INSTALL, ADJUST, SERVICE OR REPAIR THE EQUIPMENT SPECIFIED IN THIS MANUAL WITHOUT PROPER TRAINING MAY RESULT IN PRODUCT DAMAGE, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

WARNING

DO NOT BYPASS SAFETY DEVICES

TABLE OF CONTENTS

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September 2022

IMPORTANT INFORMATION

IMPORTANT NOTICES FOR CONSUMERS AND SERVICERS

RECOGNIZE SAFETY SYMBOLS, WORDS AND LABELS

WARNING

TO PREVENT THE RISK OF PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH, DO NOT STORE COMBUSTIBLE MATERIALS OR USE GASOLINE OR OTHER FLAMMABLE LIQUIDS OR VAPORS IN THE VICINITY OF THIS APPLIANCE.

WARNING

HIGH VOLTAGE
DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING THIS UNIT. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

WARNING

THIS UNIT SHOULD NOT BE CONNECTED TO, OR USID IN CONJUNCTION WITH, ANY DEVICES THAT ARE NOT DESIGN CERTIFIED FOR USE WITH THIS UNIT OR HAVE NOT BEEN TESTED AND APPROVED BY THE MANUFACTURER. SERIOUS PROPERTY DAMAGE OR PERSONAL INJURY, REDUCED UNIT PERFORMANCE AND/OR HAZARDOUS CONDITOINS MAY RESULT FROM THE USE OF DEVICES THAT HAVE NOT BEEN APPROVED OR CERTIFIED BY THE MANUFACTURER.

IMPORTANT INFORMATION

SAFE REFRIGERANT HANDLING

While these items will not cover every concievable situation, they should serve as a usefull guide.

WARNING

Refrigerants are heavier than air. They can "push out" the oxygen in your lungs or in any enclosed space. To avoid possible difficulty in breathing or death:

- Never purge refrigerant into an enclosed room or space. By law, all refrigerant must be reclaimed.
- If an indoor leak is suspected, thoroughly ventilate the area before beginning work.
- Liquid refrigerant can be very cold. To avoid possible frostbite or blindness, avoid contact with refrigerant and wear gloves and goggles. If liquid refrigerant does contact your skin or eyes, seek medical help immediately.
- Always follow EPA regulations. Never burn refrigerant, as posionous gas will be produced.

WARNING

To avoid possible injury, explosion or death, practice safe handling of refrigerants.

WARNING

The compressor POE oil for R-410A units is extremely susceptible to moisture absorption and could cause compressor failure. Do not leave system open to atmosphere any longer than necessary for installation.

WARNING

To avoid possible explosion:

- Never apply flame or steam to a refrigerant cylinder. If you must heat a cylinder for faster charging, partially immerse it in warm water.
- Never fill a cylinder more than 80% full of liquid refrigerant.
- Never add anything other than R-22 to an R-22 cylinder or R-410A to an R-410A cylinder. The service equipment used must be listed or certified for the type of refrigerant used.
- Store cylinders in a cool, dry place. Never use a cylinder as a platform or a roller.

WARNING

To avoid possible explosion, use only returnable (not disposable) service cylinders when removing refrigerant from a system.

- Ensure the cylinder is free of damage which could lead to a leak or explosion.
- Ensure the hydrostatic test date does not exceed 5 years.
- Ensure the pressure rating meets or exceeds 400 lbs.

When in doubt, do not use cylinder.

IMPORTANT INFORMATION

WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow the safety warnings exactly could result in serious injury, death or property damage.

Never test for gas leaks with an open flame.
Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

AVERTISSEMENT

RISQUE D'INCENDIE OU D'EXPLOSION

Si les consignes de sécurité ne sont pas suivies à la lettre, cela peut entraîner la mort, de graves blessures ou des dommages matériels.

Ne jamais vérifier la présence de fuites de gaz au moyen d'une flamme nue. Vérifier tous les raccords en utilisant une solution savonneuse commerciale conçue spécialement pour la détection de fuites. Un incendie ou une explosion risque de se produire, ce qui peut entraîner la mort, des blessures ou des dommages matériels.

WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow instructions could result in severe personal injury or death due to carbon-monoxide poisoning, if combustion products infiltrate into the building. Check that all openings in the outside wall around the vent (and air intake) pipe(s) are sealed to prevent infiltration of combustion products into the building. Check that furnace vent (and air intake) terminal(s) are not obstructed in any way during all seasons.

AVERTISSEMENT

RISQUE D'INCENDIE OU D'EXPLOSION

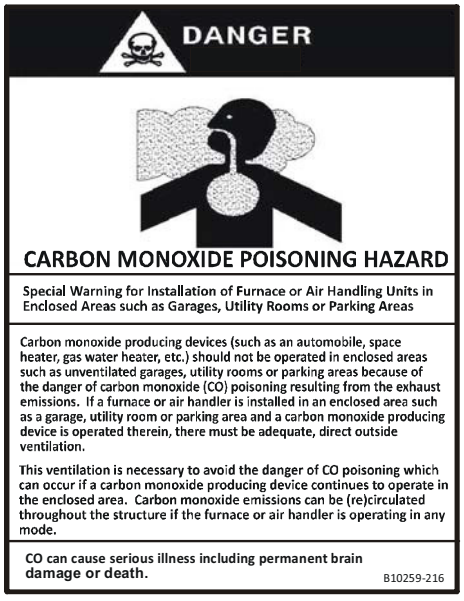
Si les consignes de sécurité ne sont pas suivies à la lettre,cela peut entraîner la mort, de graves blessures ou des dommages matériels.

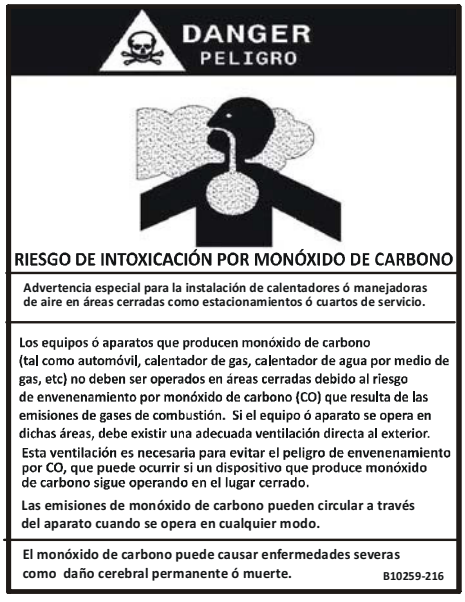
— Ne pas entreposer ni utiliser d'essence ni autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.
— QUE FAIRE SI UNE ODEUR DE GAZ EST DÉTECTÉE
• Ne mettre en marche aucun appareil.
• Ne toucher aucun interrupteur électrique; ne pas utiliser de téléphone dans le bâtiment.
• Quitter le bâtiment immédiatement.
• Appeler immédiatement le fournisseur de gaz en utilisant le téléphone d'un voisin. Suivre les instructions du fournisseur de gaz.
• Si le fournisseur de gaz n'est pas accessible, appeler le service d'incendie.
— L'installation et l'entretien doivent être effectués par un installateur ou une entreprise d'entretien qualifié, ou le fournisseur de gaz.

AVERTISSEMENT

RISQUE D'INTOXICATION AU MONOXYDE DE CARBONE

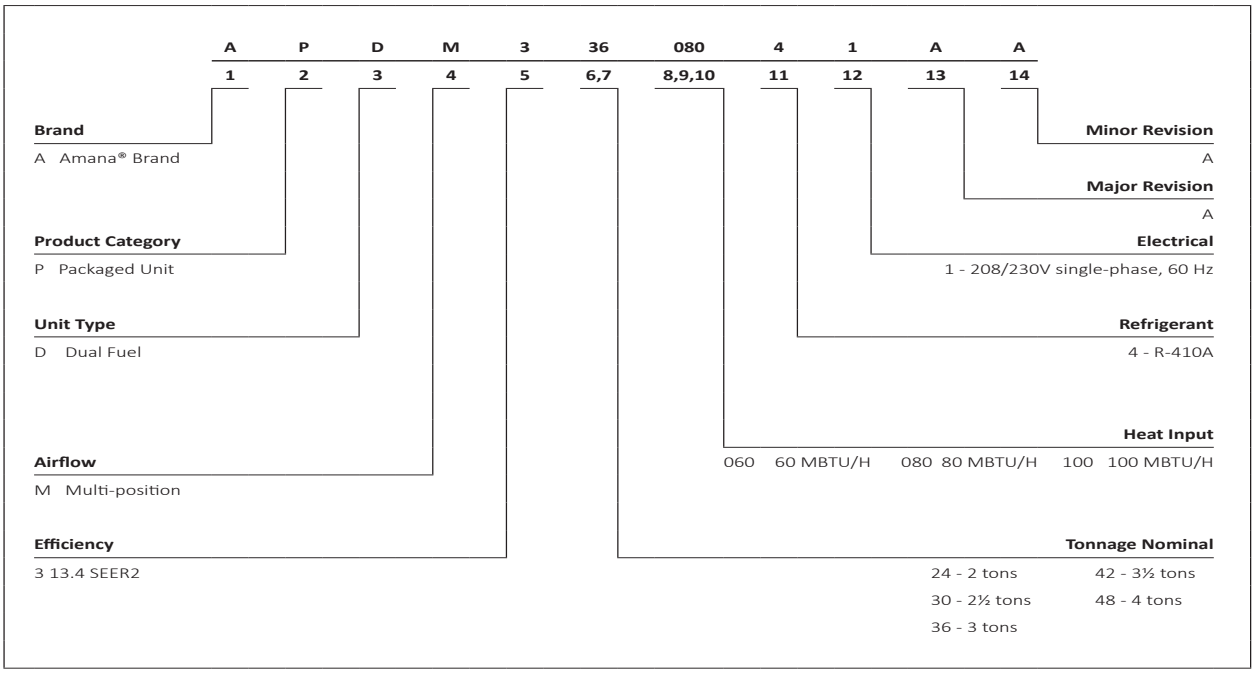
Si ces directives ne sont pas suivies, cela peut entraîner des blessures graves ou une intoxication au monoxyde de carbone pouvant causer la mort, si des produits de combustion s'infiltrent dans le bâtiment. Vérifier que toutes les ouvertures pratiquées dans le mur extérieur autour du ou des tuyaux d'évent (et de la prise d'air) sont scellées de manière à empêcher l'infiltration de produits de combustion dans le bâtiment. Veiller à ce que la ou les sorties de l'évent de l'appareil de chauffage (et la prise d'air) ne soient, en aucune façon, obstruées, quelle que soit la saison.

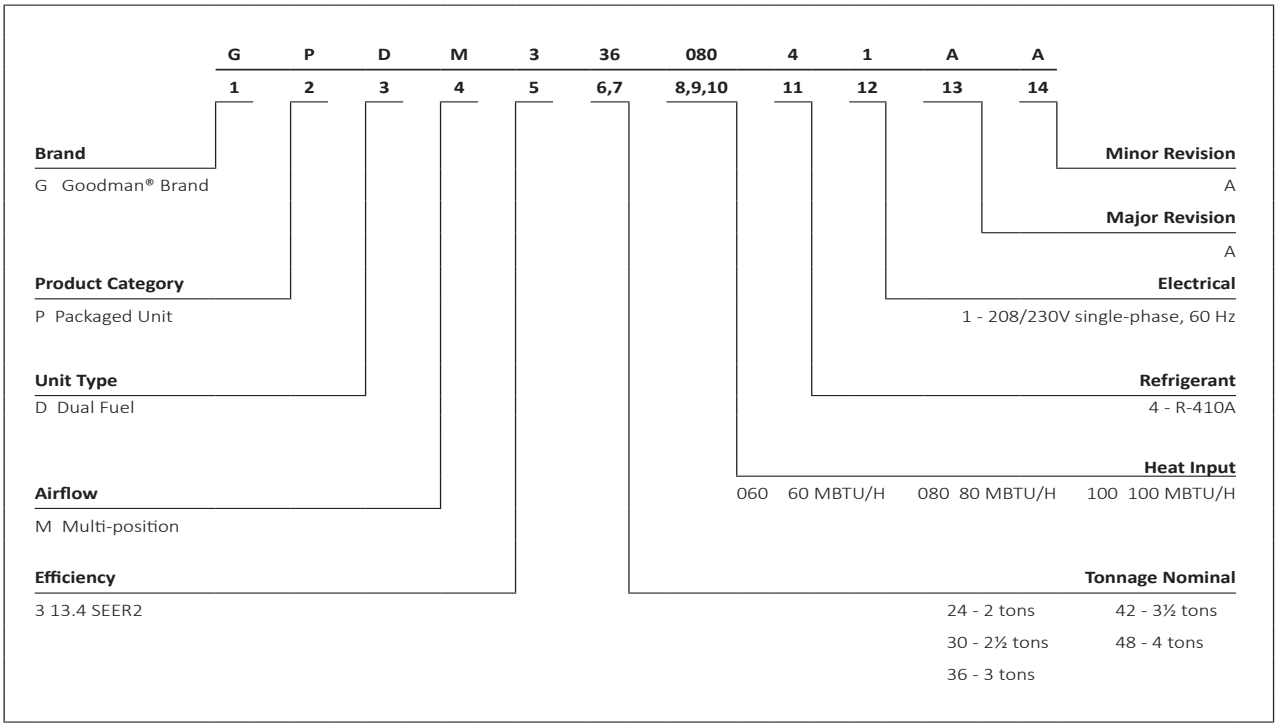




PRODUCT IDENTIFICATION NOMENCLATURE

The model number is used for positive identification of component parts used in manufacturing. Please use this number when requesting service or parts information.





These units have R410A refrigerant.

PRODUCT IDENTIFICATION

Single Phase Dual Fuel Package Units	
Model #	**Description**
APD14[24-48]*M41AA**	**Amana® Brand Package Dual Fuel Units, 14 SEER with R410A. Initial release of 81% AFUE models.**
GPD14[24-48]*M41AA**	**Goodman® Brand Package Dual Fuel Units, 14SEER with R410A. Initial release of 81% AFUE models.**
A/GPD1436080M41AB	**Amana® Brand/Goodman® Brand Package Dual Fuel units, 14 SEER with R410A. Compressor Change.**

Single Phase Package Gas Units	
Model #	**Description**
A/GPDM3[24-48]*M41A***	**Amana® Brand/Goodman® Brand Package Dual Fuel Units, 13.4 SEER(2) R410A. Multi-Position gas/electric units. Initial release of models meeting DOE 2023 Regulatory Requirements.**

These units have R410A refrigerant.

SYSTEM OPERATION

Cooling

The refrigerant used in the system is R-410A. It is a clear, colorless, non-toxic and non-irritating liquid. R-410A is a 50:50 blend of R-32 and R-125. The boiling point at atmospheric pressure is -62.9°F.

A few of the important principles that make the refrigeration cycle possible are: heat always flows from a warmer to a cooler body. Under lower pressure, a refrigerant will absorb heat and vaporize at a low temperature. The vapors may be drawn off and condensed at a higher pressure and temperature to be used again.

The indoor evaporator coil functions to cool and dehumidify the air conditioned spaces through the evaporative process taking place within the coil tubes.

NOTE: The pressures and temperatures shown in the refrigerant cycle illustrations on the following pages are for demonstration purposes only. Actual temperatures and pressures are to be obtained from the "Expanded Performance Chart".

Liquid refrigerant at condensing pressure and temperatures, (270 psig and 122°F), leaves the outdoor condensing coil through the drier and is metered into the indoor coil through the metering device. As the cool, low pressure, saturated refrigerant enters the tubes of the indoor coil, a portion of the liquid immediately vaporizes. It continues to soak up heat and vaporizes as it proceeds through the coil, cooling the indoor coil down to about 48°F.

Heat is continually being transferred to the cool fins and tubes of the indoor evaporator coil by the warm system air. This warming process causes the refrigerant to boil. The heat removed from the air is carried off by the vapor.

As the vapor passes through the last tubes of the coil, it becomes superheated. That is, it absorbs more heat than is necessary to vaporize it. This is assurance that only dry gas will reach the compressor. Liquid reaching the compressor can weaken or break compressor valves.

The compressor increases the pressure of the gas, thus adding more heat, and discharges hot, high pressure super-heated gas into the outdoor condenser coil.

In the condenser coil, the hot refrigerant gas, being warmer than the outdoor air, first loses its superheat by heat transferred from the gas through the tubes and fins of the coil. The refrigerant now becomes saturated, part liquid, part vapor and then continues to give up heat until it condenses to a liquid alone. Once the vapor is fully liquefied, it continues to give up heat which subcools the liquid, and it is ready to repeat the cycle.

Heat Pump Models

Any time the room thermostat is switched to cool, the O terminal is energized. This energizes the 24 volt coil on the reversing valve and switches it to the cooling position.

When the contacts of the room thermostat close, this closes the circuit from R to Y and R to G in the unit.

This energizes the compressor contactor and will energize the EEM indoor blower motor after a 6-second delay.

When the thermostat is satisfied, it opens its contacts breaking the low voltage circuit causing the compressor contactor to open and indoor fan to stop after the programmed 60 second off delay on the EEM motor.

If the room thermostat fan selector switch should be set to the “on” position then the indoor blower would run continuous rather than cycling with the compressor.

Heating/ Gas & L.P.

The heating cycle is accomplished by using a unique tubular design heat exchanger which provides efficient gas heating on either natural gas or propane gas fuels. The heat exchangers compact tubular construction provides excellent heat transfer for maximum operating efficiency.

Inshot type gas burners with integral cross lighters are used eliminating the need for adjustable air shutters. The same burner is designed for use on either natural or propane gas fuels.

The induced draft blower draws fuel and combustion air into the burners and heat exchanger for proper combustion. A pressure switch is used in conjunction with the I. D. blower to detect a blocked flue condition.

Blower operation is controlled by the ignition control module. The module allows for field adjustment of the blower delay at the end of the heating cycle. The range of adjustment is for 90, 120, 150 or 180 seconds. The factory delay setting is 30 seconds delay on 150 seconds delay off.

Direct Spark Ignition (DSI) Systems

A/GPDM3 units are equipped with a direct spark ignition system. Ignition is provided by 22,000 volt electronic spark. A flame sensor then monitors for the presence of flame and closes the gas valve if flame is lost.

HEATING CYCLE

Gas Heating

On a call for first stage heat, the contacts of the room thermostat close. This energizes terminals R to Y and R to G, the low voltage circuit to the contactor is completed starting the compressor and outdoor fan motor. This also energizes the EEM motor after approximately 6-seconds.

SYSTEM OPERATION

When the thermostat is satisfied, breaking the circuit between R to Y and R to G, the compressor and outdoor fan motor will stop. The indoor blower will stop after a programmed 60 second off delay.

NOTE: Should the second stage heating contacts in the room thermostat close, a W1 signal will be sent to the ignition control and the Y signal would be removed. A normal gas heating sequence would then follow.

Ignition Control Sequence Of Operation

A. Heating Operation: Low stage heat

1. Thermostat type is set to two-stage.
2. Thermostat “W1” input initiates low stage heating.
3. Induced draft blower is energized at high speed for the pre-purge period. Pre-purge timer begins after control recognizes pressure switch has closed.
4. Trial-for-ignition period begins after pre-purge period expires. Low and high stage gas valves are energized along with the igniter for trial-for-ignition period. Igniter is de-energized when flame is detected.
5. Flame is achieved and detected during trial-for-ignition period. Flame stabilization period begins when flame is detected.
6. De-energize high stage gas valve and switch induced draft blower to low speed within five seconds of flame detection.
7. Air circulating blower is energized at low heat speed after heat ON delay time expires. Heat ON delay timer begins when flame is detected.
8. Control monitors thermostat, flame, limit, and pressure switch inputs during low stage heating.
9. Thermostat “W1” input is removed.
10. Low stage gas valve is de-energized.
11. Induced draft blower remains energized at low speed for post purge period.
12. Air circulating blower remains energized at low heat speed for heat OFF delay. Heat OFF delay begins when “W1” input is removed.
13. Control returns to Standby and awaits next thermostat request.

B. Heating Operation: High stage heat

1. Thermostat type is set to two-stage.
2. Thermostat “W1” and “W2” inputs initiate high stage heating.
3. Induced draft blower is energized at high speed for the pre-purge period. Pre-purge timer begins after control recognizes pressure switch has closed.
4. Trial-for-ignition period begins after pre-purge period expires. Low and high stage gas valves are energized along with the igniter for trial-for-ignition period. Igniter is de-energized when flame is detected.
5. Flame is achieved and detected during trial-for-ignition period. Flame stabilization period begins when flame is detected.
6. Gas valve and induced draft blower remain at high stage and high speed.
7. Air circulating blower is energized at high heat speed after heat ON delay time expires. Heat ON delay timer begins when flame is detected.
8. Control monitors thermostat, flame, limit, and pressure switch inputs during high stage heating.
9. Thermostat “W1” and “W2” inputs are removed.
10. High and low stage gas valves are de-energized.
11. Induced draft blower switches from high speed to low speed and remains energized for post purge period.
12. Air circulating blower remains energized at high heat speed for High Stage Heat OFF Delay period then switches to low heat speed for the remainder of the selected heat OFF delay. Heat OFF delay begins when “W1” and “W2” inputs are removed.
13. Control returns to Standby and awaits next thermostat request.

A. Cooling Operation: Low stage cool

1. Thermostat type is set to two-stage.
2. Thermostat “Y1” or thermostat “Y1” and “G” input initiates low stage cooling.
3. IDT/ODT/Pressure/Loss of Charge Switch circuits are checked for closed condition. Cooling operation can proceed only if these circuits are closed.
4. Low stage compressor output is energized.
5. Condenser fan motor is energized at low speed.
6. Air circulating blower is energized at low cool speed after cool ON delay expires. Cool ON delay timer begins when thermostat inputs are detected.
7. Control monitors thermostat, gas valve, flame, and IDT/ODT/Pressure/Loss of Charge Switches during low stage cooling.
8. Thermostat “Y1” or “Y1” and “G” inputs are removed.
9. Low stage compressor output is de-energized. Low speed condenser fan motor is de-energized.
10. Air circulating blower remains energized at low cool speed for the cool OFF delay. Cool OFF delay timer begins when thermostat input is removed.
11. Control returns to Standby and awaits next thermostat request.

B. Cooling Operation: High stage cool

Thermostat type is set to two-stage.

Thermostat “Y1” and “Y2” or “Y1”, “Y2” and “G” inputs initiate high stage cooling.

IDT/ODT/Pressure/Loss of Charge Switch circuits are checked for closed condition. Cooling operation can proceed only if these circuits are closed.

SYSTEM OPERATION

1. Low and high stage compressor outputs are energized.
2. Condenser fan motor is energized at high speed.
3. Air circulating blower is energized at high cool speed after cool ON delay expires. Cool ON delay timer begins when thermostat inputs are detected.

Control monitors thermostat, gas valve, flame, and IDT/ ODT/Pressure/Loss of Charge Switches during high stage cooling operation.

Thermostat “Y1” and “Y2” or “Y1”, “Y2” and “G” inputs are removed.

Low and high stage compressor outputs are de-energized.

High speed condenser fan motor is de-energized.

4. Air circulating blower switches to low cool speed for the cool OFF delay. Cool OFF delay timer begins when thermostat input is removed.

Control returns to Standby and awaits next thermostat request.

A. Continuous Fan Operation

1. Thermostat “G” input initiates Continuous Fan operation.
2. Air circulation blower shall be immediately energized at the continuous fan speed. For purposes of this specification, the continuous fan speed shall be the low heat speed.
3. Thermostat “G” input is removed.
4. Air circulation blower is immediately de-energized.
5. Control returns to Standby and awaits next thermostat request.

Heat Pump Operation

Heat Pump Mode Operation Sequence of Operation

1. The thermostat sends a 24VAC signal on Y to the unit requesting heating.
2. Contactor energizes starting compressor and outdoor fan
3. Request sent to indoor blower motor for heating speed. Blower starts after 6 second blower on delay
4. The unit is now operating the heat pump in the heating mode
5. Once the thermostat satisfies, the Y terminal opens ending the call for heating.
6. Compressor & Outdoor Fan deenergize
7. Indoor blower motor shuts off after the 60 second programmed fan off delay.

Heat Pump to Gas Heat Sequence of Operation
NOTE: If the heat pump cannot satisfy the load, the sequence of operation changes and the unit will switch from the heat pump to gas heating.

1. The thermostat sends a 24VAC signal on Y to the unit requesting heating.
2. Contactor is energized starting the compressor and outdoor fan.
3. Request sent to indoor blower motor for heating speed. Blower starts after 6 second blower on delay.
4. The unit is now operating the heat pump in the heating mode.
5. If the thermostat cannot be satisfied, or the outdoor thermostat changes to gas heating operations, W1 is energized, and Y is de-energized.
6. The compressor and outdoor fan are turned off.
7. Gas heating cycle begins.

Heating Cycle (Natural Gas/LP)

1. The Dual Fuel unit will operate in gas heat mode when the thermostat calls for a W-1 or W-2 signal. If outdoor thermostat is installed, the unit will operate in gas heat when ambient is below set point or the unit receives call for low or high stage gas heat.
2. Induced draft blower energizes for 15-second pre-purge.
3. A 7-second trial for ignition begins by energizing the low and high stages of the gas valve along with the spark igniter.

NOTE: The igniter produces a very intense electrical spark that ignites the gas.

4. Main burners light and control detects presence of flame.
5. If the call is for low stage heat, the induced draft blower switches from high to low speed and the gas valve from high to low stage within 5 seconds after the main burners light. If call is for high stage heat, induced draft blower remains at high speed and high stage gas valve remains open.

NOTE: If a W2 is not used, the control will step to low stage after the main burners light and remain at low stage for 5 or 10 minutes, depending on jumper position. If the jumper is set to none, you will never get a call for high stage heat. If the call for HEAT remains after the transition delay time expires, the control will transition from low stage to high stage.

6. The 30-second HEAT FAN ON delay time begins after the main burners light.
7. The unit delivers heat to the conditioned space until the thermostat is satisfied.
8. Gas valve(s) de-energizes. The induced draft blower continues operation for a 30-second post-purge.

NOTE: Induced draft blower remains at low speed (or switches from high to low if operating at high stage heat) for the 30-second post purge.

9. Ignition control begins timing the HEAT FAN OFF delay. There is an adjustable HEAT FAN OFF delay of approximately 90/120/150/180 seconds (factory set at 150). If the unit is operating at high stage when the call for heat is removed, the blower will operate for 30 seconds at high heat speed then switch to low heat speed for the remainder of the selected HEAT FAN OFF delay.

SYSTEM OPERATION

Cooling

1. Thermostat calls for cooling.
2. When the thermostat call is for cooling, the compressor and outdoor fan are energized .
3. The indoor blower will energize approximately 6 seconds later.
4. The unit delivers cooling to the conditioned space until the thermostat is satisfied.
5. The compressor and outdoor fan will be de-energized when the thermostat opens.
6. The indoor blower continues to run at low cool speed for approximately 60 seconds after the thermostat is satisfied. This allows additional cooling from the indoor coil to be transferred to the conditioned space. Then, the indoor blower is de-energized.

NOTE: A 180-second anti-short cycle is integral to the control and prevents recycling of the compressor

Defrost Cycle

NOTE: The defrost board is equipped with a jumper for SmartShift™ defrost technology operation. This operation turns the compressor off for 30 seconds at defrost initiation and termination. The unit is factory shipped for SmartShift™ defrost technology operation. To operate unit at rated efficiencies, move the jumper on the defrost board from "DLY" to "NORM".

During operation, the power to the circuit board is controlled by a temperature sensor, which is clamped to a feeder tube entering the outdoor coil. Defrost timing periods of 30, 60 and 90 minutes may be selected by setting the circuit board jumper to 30, 60 and 90 respectively.

Accumulation of time for the timing period selected starts when the sensor closes (approximately 30°F), and when the wall thermostat calls for heat. At the end of the timing period, the unit's defrost cycle will be initiated provided the sensor remains closed.

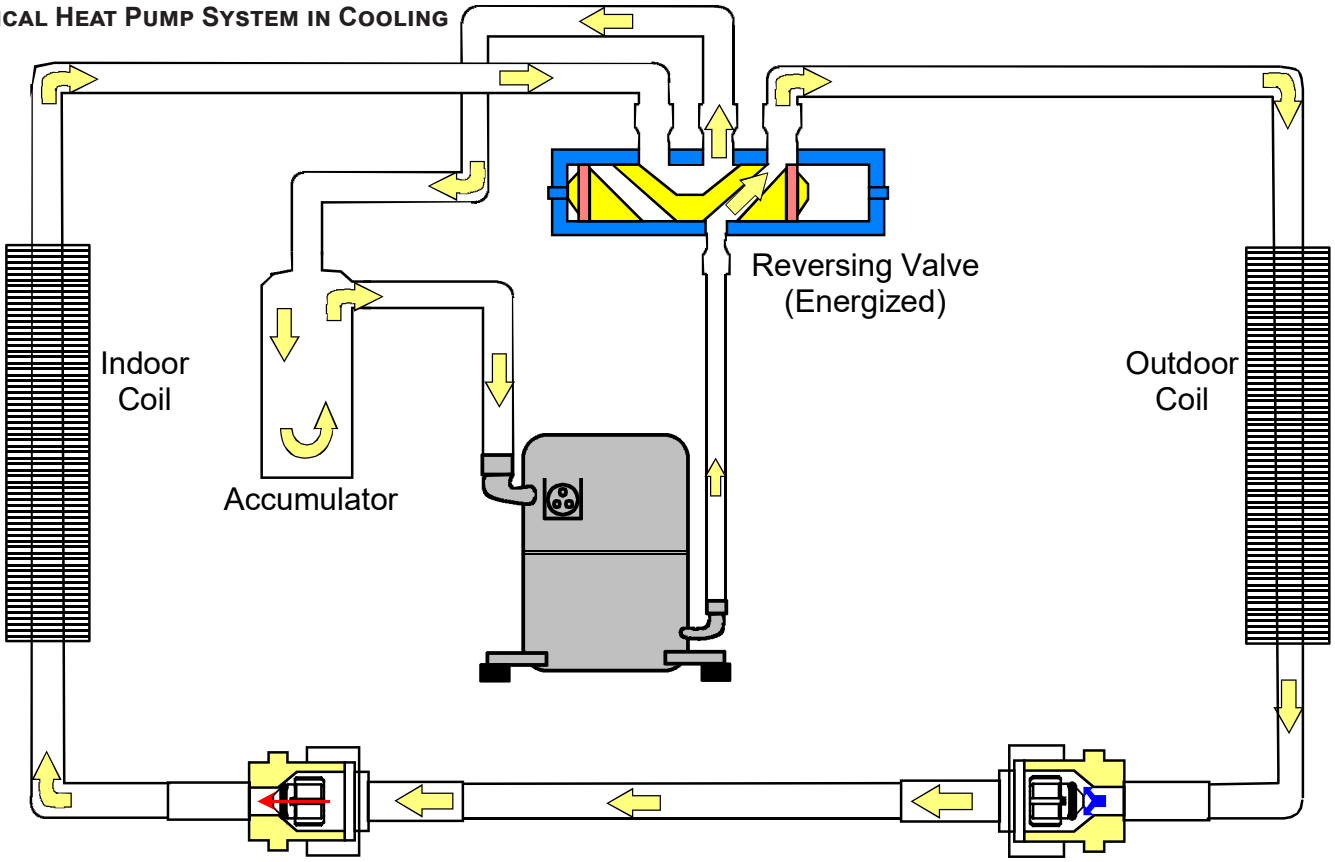
Upon a call for defrost, the blower will continue to run and the defrost board will send a W1 signal to the ignition control. At the same time, the compressor will stop for 30 seconds, if the SmartShift™ defrost technology delay feature is selected on the defrost board. At this time, the reversing valve shifts from heat to cool position and condenser fans shut off. The inducer motor will immediatly energize for a 15 second prepurge.

A 7-second trial for ignition begins by energizing the low and high stages of the gas valve along with this spark ignition. Main burners light and control detects presence of flame. The compressor (after its 30/OFF second delay) restarts in cooling mode to defrost the condensor coil.

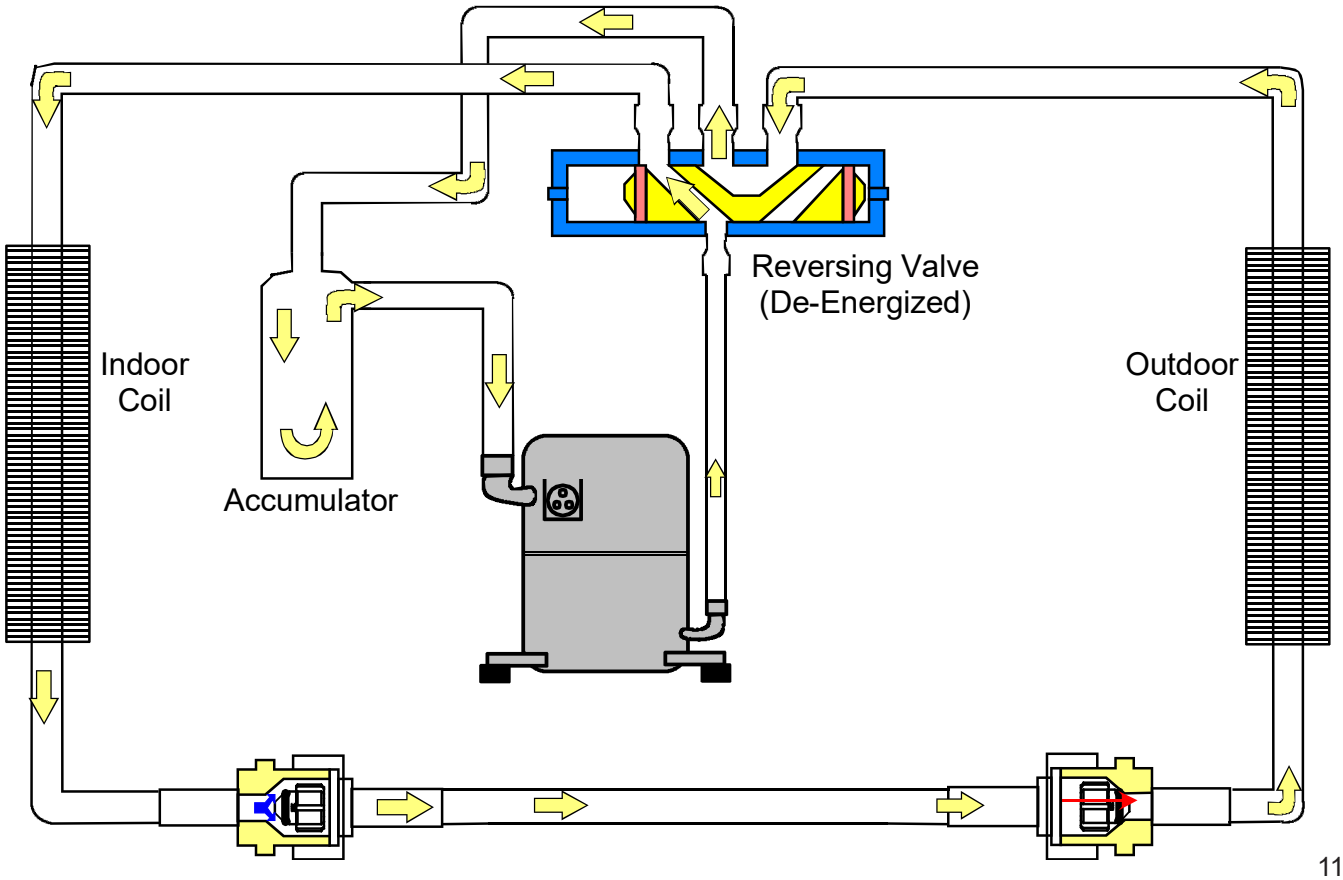
When the sensor opens (approximately 60°F), the defrost cycle is terminated and the timing period is reset. If the defrost cycle is not terminated due to the sensor temperature, a twelve minute override interrupts the unit's defrost period. At this time the W1 signal is removed from the ignition control board, the compressor will stop for a 30 second SmartShift™ defrost technology delay (if selected) and the reversing valve slides back to its normal heat position.

SYSTEM OPERATION

Typical Heat Pump System in Cooling



Typical Heat Pump System in Heating



SYSTEM OPERATION

PCBAG127 Control Board

Description

The ignition control is designed for use in gas heating/ electric cooling package equipment (rooftop applications) and operates with a two stage heat and two stage cooling system. It is a direct spark ignition system that uses a 22,000 volt spark to ignite the burners. A flame sensor is used to monitor the flame.

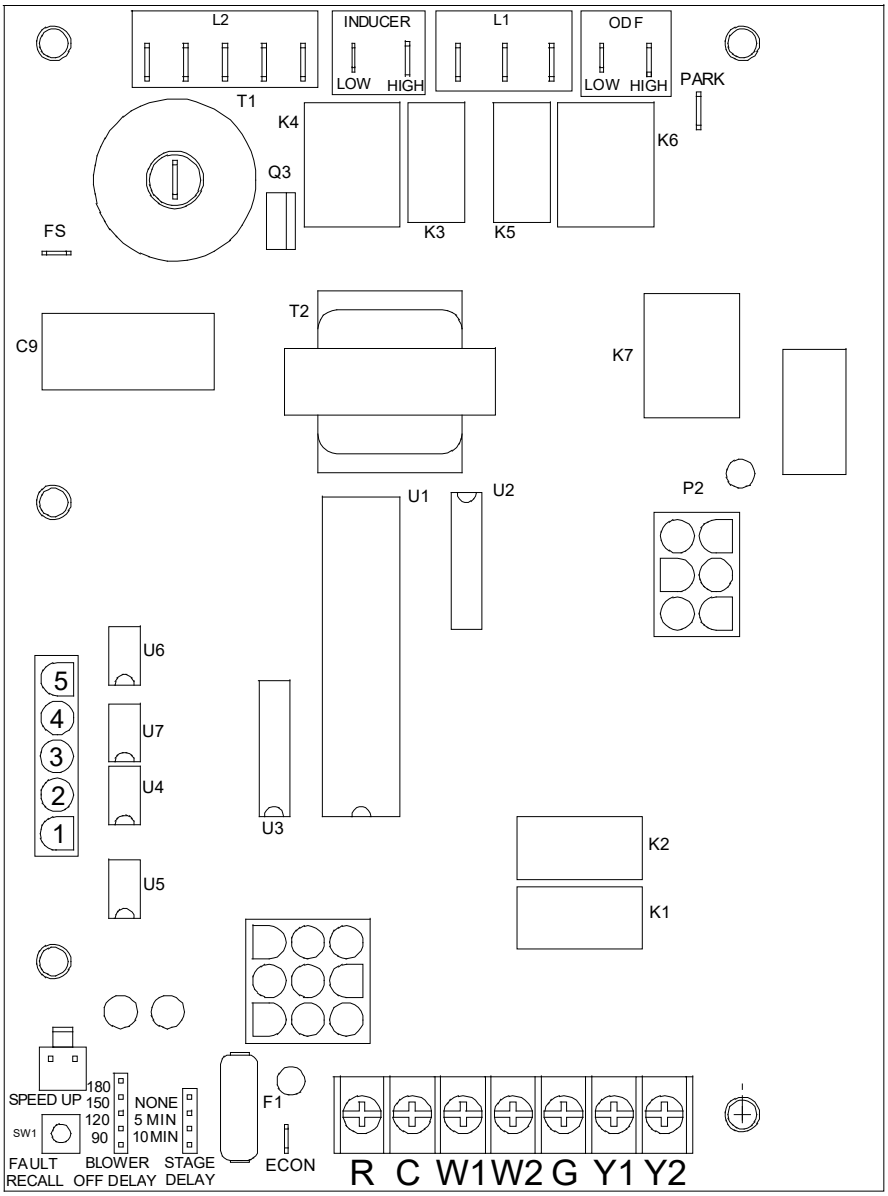
The board has the option of using a single or two stage thermostat. The board also controls the indoor blower and has an adjustable heat fan off delay.

There is also a fault recall button for recalling the last 5 fault codes. To recall the fault codes, depress the fault recall button for at least 2 seconds but not more than 4 seconds. To clear the fault code memory, depress the fault recall button for at least 5 seconds.

The following tables list the functions for the connectors and terminals, the timings, and the fault codes for the PCBAG127 control board.

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.



Pin	Voltage	Function
1	24VAC	Indoor/Outdoor Thermostat (IDT/ODT) Output
2	24VAC	High Stage Compressor Output
3	24VAC	Pressure Switch/Loss of Charge Switch Input
4	24VAC	Indoor/Outdoor Thermostat (IDT/ODT) Input
5	24VAC	Pressure Switch/Loss of Charge Switch Output
6	24VAC	Low Stage Compressor Output

Table 1: Circuit Definitions and Voltage Ratings for the 6-Circuit Connector Circuits

Pin	Voltage	Function
1	24VAC	Limit Switch Output
2	24VAC	24VAC Input to Control
3	24VAC	Limit Switch Input
4	24VAC	Unused
5	24VAC	24VAC Common
6	24VAC	Pressure Switch Output
7	24VAC	Main Valve High Output
8	24VAC	Pressure Switch Input
9	Unused	Main Valve Low Output

Table 2: Circuit Definitions and Voltage Ratings for the 9-Circuit Connector Circuits

Terminal	Label
Line Voltage L1	L1
Transformer Line L1	L1
Air Circulating Blower Line 1	L1
Induced Draft Blower Low Speed	DI Low or "Inducer Low"
Induced Draft Blower High Speed	DI High or "Inducer High"
Condenser Fan Motor Low Speed	ODF Low
Condenser Fan Motor High Speed	ODF High
Line Voltage L2	L2
Transformer Line L2	L2
Air Circulating Blower Line 2	L2
Induced Draft Blower Line 2	L2
Condenser Fan Motor Line 2	L2
Direct Spark Igniter	T1
Flame Detection	FS

Table 3: High Voltage Terminals

SYSTEM OPERATION

Period	Timing
Pre-Purge	15 Seconds
Inter-Purge	30 Seconds
Post Purge	30 Seconds
Trial-for-Ignition (TFI)	7 Seconds
Flame Stabilization Period	10 Seconds
Flame Failure Response Time	2 Seconds within Flame Stabilization Period
	2 Seconds or Per ANSI Z21.20 Outside of Flame Stabilization Period
Low to High Stage Delay	Selectable 5 minutes or 10 minutes (Default = 10 minutes)
Heat ON Delay	30 Seconds
Heat OFF Delay	Selectable 90, 120, 150, or 180 Seconds (Default = 150 Seconds)
High Stage Heat OFF Delay	30 Seconds
Cool ON Delay	6 Seconds
Cool OFF Delay	45 Seconds
Continuous Fan ON Delay	0 Seconds
Continuous Fan OFF Delay	0 Seconds
Ignition Attempts	3
Recycles	Infinite
Automatic Restart	60 Minutes
Pressure Switch Lockout Delay	5 Minutes
Factory Test Mode Active Time	2 Minutes Maximum

Table 4: Control Timings

Color	Function	LED Flashes/Status
Red	Normal	On
	Intrnal/Gas Valve Fault	Off
	Lockout	1
	Pressure Switch Stuck Open	2
	Pressure Switch Stuck Closed	3
	Open High Temperature Limit	4
	Flame Detected with Gas Valve De-Energized	5
	Compressor Short Cycle Delay Active	6
	Limit Opened 5 Times in Same Call For Heat	7
	Indoor Thermostat/Outdoor Thermostat is Open	8
	Pressure Switch/Loss of Charge Switch is Open	9
Amber	Normal Flame	On
	No Flame Present	Off
	Low Flame Current	1
	Flame Detected with Gas Valve De-energized	2

Table 5: LED Status Codes and Corresponding System Condition

SCHEDULED MAINTENANCE

Package gas units require regularly scheduled maintenance to preserve high performance standards, prolong the service life of the equipment, and lessen the chances of costly failure.

In many instances the owner may be able to perform some of the maintenance; however, the advantage of a service contract, which places all maintenance in the hands of a trained serviceman, should be pointed out to the owner.

WARNING

HIGH VOLTAGE
DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING THIS UNIT. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

Once A Month

1. Inspect the return filters of the evaporator unit and clean or change if necessary.

NOTE: Depending on operation conditions, it may be necessary to clean or replace the filters more often. If permanent type filters are used, they should be washed with warm water and dried.

2. When operating on the cooling cycle, inspect the condensate line piping from the evaporator coil. Make sure the piping is clear for proper condensate flow.

Once A Year

Qualified Service Personnel Only

1. Clean the indoor and outdoor coils.
2. Clean the cabinet inside and out .
3. Motors are permanently lubricated and do not require oiling. TO AVOID PREMATURE MOTOR FAILURE, DO NOT OIL.
4. Manually rotate the outdoor fan and indoor blower to be sure they run freely.
5. Inspect the control panel wiring, compressor connections, and all other component wiring to be sure all connections are tight. Inspect wire insulation to be certain that it is good.
6. Check the contacts of the compressor contactor. If they are burned or pitted, replace the contactor.
7. Using a halide or electronic leak detector, check all piping and etc. for refrigerant leaks.
8. Check the combustion chamber (Heat Exchanger) for soot, scale, etc. Inspect all burners for lint and proper positioning.
9. Start the system, using the proper instrumentation check gas inlet and manifold pressures, burner flame and microamp signal. Adjust if necessary.
10. Start the system and run a Heating Performance Test. If the results of the test are not satisfactory, see the “Service Problem Analysis” Guide for the possible cause.

Test Equipment

Proper test equipment for accurate diagnosis is as essential as regular hand tools.

The following is a must for every service technician and service shop:

1. Thermocouple type temperature meter - measure dry bulb temperature.
2. Sling psychrometer- measure relative humidity and wet bulb temperature.
3. Volt-Ohm Meter - testing continuity, capacitors, motor windings and voltage.
4. Accurate Leak Detector - testing for refrigerant leaks.
5. High Vacuum Pump - evacuation.
6. Electric Vacuum Gauge, Manifold Gauges and high vacuum hoses - to measure and obtain proper vacuum.
7. Accurate Charging Cylinder or Electronic Scale - measure proper refrigerant charge.
8. Inclined Manometer - measure static pressure and pressure drop across coils.

Other recording type instruments can be essential in solving abnormal problems, however, in many instances they may be rented from local sources.

Proper equipment promotes faster, more efficient service, and accurate repairs with less call backs.

Heating Performance Test

Before attempting to diagnose an operating fault code, run a Heating Performance Test to determine if the heating system is performing within 5% of the BTU input found on the rating plate of the unit being tested. To conduct a heating performance test, the BTU input to the unit must be calculated (see Clocking a Gas Meter). Before clocking a gas meter, contact your local utility to provide the caloric value (BTU content) of the natural gas in the area.

It is also important to confirm the airflow (CFM) is within the temperature rise range (see Airflow Data in spec sheet) and external static pressure range (approximately 0.5” water column). How-to instructions can be found in the service manual under Checking External Static Pressure and Checking Temperature Rise.

Clocking a Gas Meter

1. Turn off all gas appliances in the home.
2. Turn on the furnace. Ensure the furnace is operating at a 100% firing rate on 2 stage and modulating furnace product.

SCHEDULED MAINTENANCE

3. Once heating cycle is at a steady state (typically 15 minutes of operation), use a stopwatch to time how long it takes the smallest unit of measure dial on the gas meter to make a full revolution. In Table 1, one cubic foot is selected. The smallest unit of measure will vary depending on the gas meter.

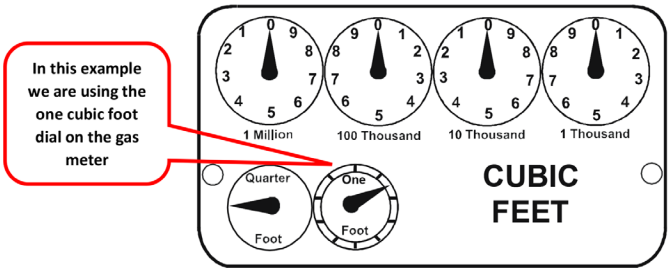


TABLE 1

4. Using Table 2 below, find the number of seconds it took for the dial to make a full revolution. To the right of that number of seconds and below the Size of Test Dial (selected in step 3 and shown in Table 1) will be the Cubic Feet per Hour (CFH).
5. Use this formula to verify the Cubic Feet per Hour (CFH) input determined in step 4 is correct:
   (3600 x Gas Meter Dial Size) / Time (seconds) = Cubic Feet per Hour (CFH)

3600 is used as there are 60 seconds in a minute and 60 minutes in an hour. 60x60=3600

6. Check with your local utility for actual BTU content (caloric value) of natural gas in the area (the average is 1025 BTU's).
7. Use this formula to calculate the BTU/HR input (See BTU/HR Calculation Example):
   Cubic Feet per Hour (CFH) x BTU content of your natural gas = BTU/HR input
8. Should the figure you calculated not fall within five (5) percent of the nameplate rating of the unit, adjust the gas valve pressure regulator or resize orifices. To adjust the pressure regulator on the gas valve, turn downward (clockwise) to increase pressure and input, and upward (counterclockwise) to decrease pressure and input. A properly operating unit must have the BTU per hour input and CFM of air, within the limits shown to prevent short cycling of the equipment. As the external static pressure goes up, the temperature rise will also increase. Consult the proper tables for temperature rise limitation.

BTU/HR CALCULATION EXAMPLE:
The unit being tested takes 40 seconds for the 1 cubic foot dial to make one complete revolution. Using the chart, this translates to 90 cubic feet per hour. Based upon the assumption that one cubic foot of natural gas has 1,025 BTU's (Check with your local utility for actual BTU content), the calculated input is 92,250 BTU's per hour.
Furnace Nameplate Input in this example: 90,000 BTU/HR
Calculated Gas Input in this example: 92,250 BTU/HR
This example is within the 5% tolerance input and does not need adjustment.

Locate 40 seconds for one revolution in the chart below

Then locate the 1 cu ft dial column and select the corresponding CFH from the 40 seconds for one revolution row

GAS RATE -- CUBIC FEET PER HOUR

Seconds for One Revolution	Size of Test Dial					Seconds for One Revolution	Size of Test Dial				
	1/4 cu/ft	1/2 cu/ft	1 cu/ft	2 cu/ft	5 cu/ft		1/4 cu/ft	1/2 cu/ft	1 cu/ft	2 cu/ft	5 cu/ft
10	90	180	360	720	1800	36	25	50	100	200	500
11	82	164	327	655	1636	37	--	--	97	195	486
12	75	150	300	600	1500	38	23	47	95	189	474
13	69	138	277	555	1385	39	--	--	92	185	462
14	64	129	257	514	1286	40	22	45	90	180	450
15	60	120	240	480	1200	41	--	--	--	176	439
16	56	113	225	450	1125	42	21	43	86	172	429
17	53	106	212	424	1059	43	--	--	--	167	419
18	50	100	200	400	1000	44	--	41	82	164	409
19	47	95	189	379	947	45	20	40	80	160	400
20	45	90	180	360	900	46	--	--	78	157	391
21	43	86	171	343	857	47	19	38	76	153	383
22	41	82	164	327	818	48	--	--	75	150	375
23	39	78	157	313	783	49	--	--	--	147	367
24	37	75	150	300	750	50	18	36	72	144	360
25	36	72	144	288	720	51	--	--	--	141	355
26	34	69	138	277	692	52	--	--	69	138	346
27	33	67	133	265	667	53	17	34	--	136	340
28	32	64	129	257	643	54	--	--	67	133	333
29	31	62	124	248	621	55	--	--	--	131	327
30	30	60	120	240	600	56	16	32	64	129	321
31	--	--	116	232	581	57	--	--	--	126	316
32	28	56	113	225	563	58	--	31	62	124	310
33	--	--	109	218	545	59	--	--	--	122	305
34	26	53	106	212	529	60	15	30	60	120	300
35	--	--	103	206	514						

TABLE 2

SERVICING

Checking Voltage

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

1. Remove doors, control panel cover, etc. from unit being tested.

With power ON:

WARNING

Line voltage now present

2. Using a voltmeter, measure the voltage across terminals L1 and L2 of the contactor.
3. No reading - indicates open wiring, open fuse(s) no power or etc. from unit to fused disconnect service. Repair as needed.
4. If incoming voltage is within the range listed in the chart below, energize the unit.
5. Using a voltmeter, measure the voltage with the unit starting and operating to determine if voltage is within the range listed in the chart below.
6. If the voltage falls below the minimum voltage, check the line wire size. Long runs of undersized wire can cause low voltage. If the wire size is adequate, notify the local power company regarding either low or high voltage.

Unit Voltage		
Rated Voltage	**Min. Supply Voltage**	**Max. Supply Voltage**
208/230V	197	253

Checking Wiring

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

1. Check wiring visually for signs of overheating, damaged insulation and loose connections.
2. Use an ohmmeter to check continuity of any suspected open wires.
3. If any wires must be replaced, replace with comparable gauge and insulation thickness.

Branch Circuit Ampacity	15	20	25	30	35	40	45	50
SUPPLY WIRE LENGTH - FEET								
200	6	4	4	4	3	3	2	2
150	8	6	6	4	4	4	3	3
100	10	8	8	6	6	6	4	4
50	14	12	10	10	8	8	6	6

Wiring Table

Checking Thermostat and Wiring

Thermostat Wiring: The maximum wire length for 18 AWG thermostat wire is 100 feet.

A/GPDM3 Terminal	24-48 Thermostat
Red	R (24V)
Green	G (fan)
Orange	O (Rev. Value)
White	W1 (Heat, 2nd)
Brown	W2 (Heat, 3rd)
Yellow	Y (Cool)
Blue	C (24V Common)

WARNING

Line voltage now present

With power ON, thermostat calling for cooling

1. Use a voltmeter to check for 24 volts at thermostat wires C and Y in the condensing unit control panel.
2. No voltage indicates trouble in the thermostat, wiring or external transformer source.
3. Check the continuity of the thermostat and wiring. Repair or replace as necessary.

Indoor Blower Motor

With power ON:

WARNING

Line voltage now present

1. Set fan selector switch at thermostat to “ON” position.
2. With voltmeter, check for 24 volts at wires C and G.
3. No voltage indicates the trouble is in the thermostat or wiring.
4. Check the continuity of the thermostat and wiring. Repair or replace as necessary.

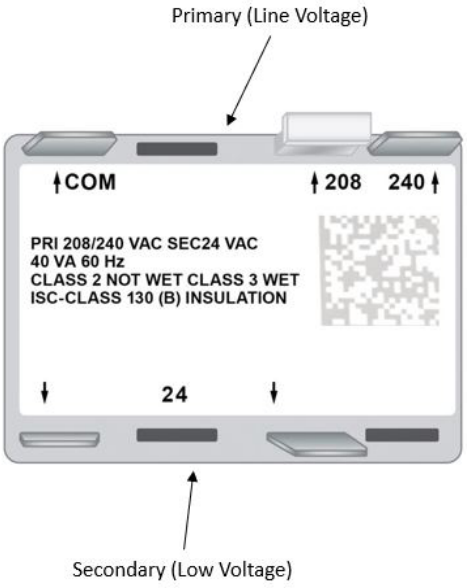
SERVICING

Checking Transformer and Control Circuit

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

A step-down transformer (208/240 volt primary to 24 volt secondary) is provided with each package unit. This allows ample capacity for use with resistance heaters.



WARNING

Disconnect ALL power before servicing.

1. Remove control panel cover, or etc., to gain access to transformer.

With power ON:

WARNING

Line voltage now present

2. Using a voltmeter, check voltage across secondary voltage side of transformer (R to C).
3. No voltage indicates faulty transformer, bad wiring, or bad splices.
4. Check transformer primary voltage at incoming line voltage connections and/or splices.
5. If line voltage available at primary voltage side of transformer and wiring and splices good, transformer is inoperative. Replace.

Checking Contactor and/or Relays

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

The compressor contactor and other relay holding coils are wired into the low or line voltage circuits. When the control circuit is energized the coil pulls in the normally open contacts or opens the normally closed contacts. When the coil is de-energized, springs return the contacts to their normal position.

NOTE: Most single phase contactors break only one side of the line (L1), leaving 115 volts to ground present at most internal components.

1. Remove the leads from the holding coil.
2. Using an ohmmeter, test across the coil terminals.

If the coil does not test continuous, replace the relay or contactor.

Checking Contactor Contacts
Single Phase

WARNING

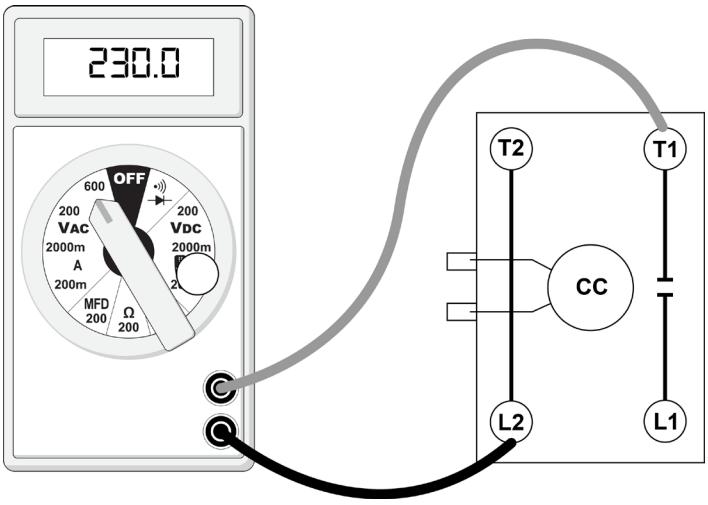
High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

1. Disconnect the wire leads from the terminal (T) side of the contactor.
2. With power ON, energize the contactor.

WARNING

Line voltage now present

SERVICING



TESTING COMPRESSOR CONTACTOR (SINGLE PHASE)

3. Using a voltmeter, test across terminals.
   A. L1 - L2 - No voltage. Check breaker or fuses on main power supply.
   B. T1 to T2 - Meter should read the same as L1 to L2 in step A. If voltage readings are not the same as step A, replace contactor.

If a no voltage reading is obtained - replace the contactor.

CHECKING FAN RELAY CONTACTS

The fan relays are incorporated into the control board.

CHECKING HIGH PRESSURE CONTROL

WARNING

HIGH VOLTAGE!
DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

The high pressure control senses the pressure in the liquid line. If abnormally high condensing pressures develop, the contacts of the control open, breaking the control circuit before the compressor motor overloads. This control is automatically reset.

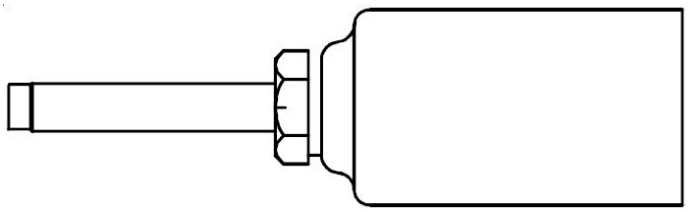
1. Using an ohmmeter, check across terminals of high pressure control, with wire removed. If not continuous, the contacts are open.
2. Attach a gauge to the dill valve port on the base valve.

With power ON:

WARNING

LINE VOLTAGE NOW PRESENT

3. Start the system and place a piece of cardboard in front of the condenser coil, raising the condensing pressure.
4. Check pressure at which the high pressure control cuts-out.



If it cuts-out at 660 PSIG ± 10 PSIG, it is operating normally (See causes for high head pressure in Service Problem Analysis Guide). If it cuts out below this pressure range, replace the control. The control should reset at 420 PSIG ± 25 PSIG.

CHECKING LOW PRESSURE CONTROL

The low pressure control senses the pressure in the suction line and will open its contacts on a drop in pressure. The low pressure control will automatically reset itself with a rise in pressure.

The low pressure control is designed to cut-out (open) at approximately 22 PSIG. It will automatically cut-in (close) at approximately 50 PSIG.

Test for continuity using a VOM and if not as above, replace the control.

CHECKING INTERNAL OVERLOAD

The Internal Overload prevents the compressor windings from overheating. Reacts to both current and temperature Cuts out **302°F**. Cuts in between **146** and **176°F**

1. Using an ohmmeter, test continuity between terminals, If either winding test continuous, Internal overload open.
2. Allow time for the compressor to cool, and overload to close and retest.

CHECKING CAPACITOR

CAPACITOR, RUN

A run capacitor is wired across the auxiliary and main windings of a single phase permanent split capacitor motor. The capacitors primary function is to reduce the line current while greatly improving the torque characteristics of a motor. This is accomplished by using the 90° phase relationship between the capacitor current and voltage in conjunction with the motor windings so that the motor will give two phase operation when connected to a single phase circuit. The capacitor also reduces the line current to the motor by improving the power factor.

SERVICING

Capacitor, Start
Scroll Compressor Models

Hard start components are not required on Scroll compressor equipped units due to a non-replaceable check valve located in the discharge line of the compressor. However hard start kits are available and may improve low voltage starting characteristics.

This check valve closes off high side pressure to the compressor after shut down allowing equalization through the scroll flanks. Equalization requires only about one or two seconds during which time the compressor may turn backwards.

Your unit comes with a 180-second anti-short cycle to prevent the compressor from starting and running backwards.

Models Equipped With A Hard Start Device

A start capacitor is wired in parallel with the run capacitor to increase the starting torque. The start capacitor is of the electrolytic type, rather than metallized polypropylene as used in the run capacitor.

A switching device must be wired in series with the capacitor to remove it from the electrical circuit after the compressor starts to run. Not removing the start capacitor will overheat the capacitor and burn out the compressor windings.

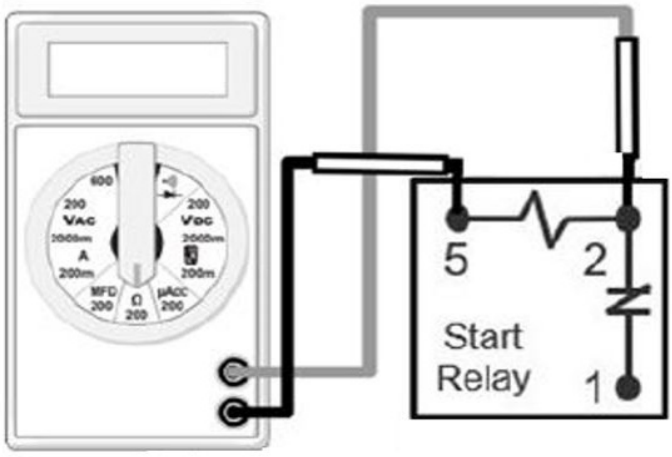
These capacitors have a 15,000 ohm, 2 watt resistor wired across its terminals. The object of the resistor is to discharge the capacitor under certain operating conditions, rather than having it discharge across the closing of the contacts within the switching device such as the Start Relay, and to reduce the chance of shock to the servicer. See the Servicing Section for specific information concerning capacitors.

Relay, Start

A potential or voltage type relay is used to take the start capacitor out of the circuit once the motor comes up to speed. This type of relay is position sensitive. The normally closed contacts are wired in series with the start capacitor and the relay holding coil is wired parallel with the start winding. As the motor starts and comes up to speed, the increase in voltage across the start winding will energize the start relay holding coil and open the contacts to the start capacitor.

Testing Start Relay Kits
Testing Coil Relay

1. Disconnect power to unit
2. Disconnect all wiring
3. Measure the resistance of the coil between terminals 2 & 5
4. If the coil reads open or shorted, replace the relay



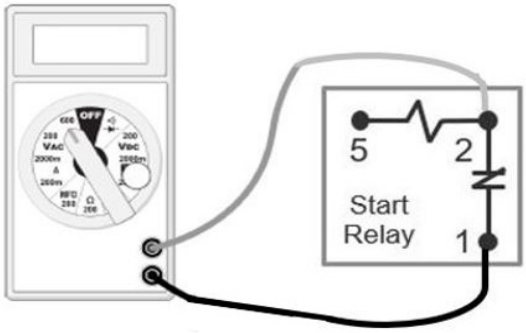
Testing Start Relay Coil Resistance

Testing Contacts Resistance

1. Disconnect power to unit
2. Disconnect all wiring to the start relay
3. Measure the resistance of the contacts between terminals 1 & 2
4. If the contacts read open, replace the relay

Testing Contacts Voltage

1. With power on, provide a call for cool to energize the compressor
2. With the compressor running, use a voltmeter to measure the voltage between terminals 1 & 2
3. voltage reading of zero indicates that the relay's contacts are stuck, replace the relay



Testing Start Relay Contacts

Two quick ways to test a capacitor are a resistance and a capacitance check.

Capacitance Check (MFD)

WARNING

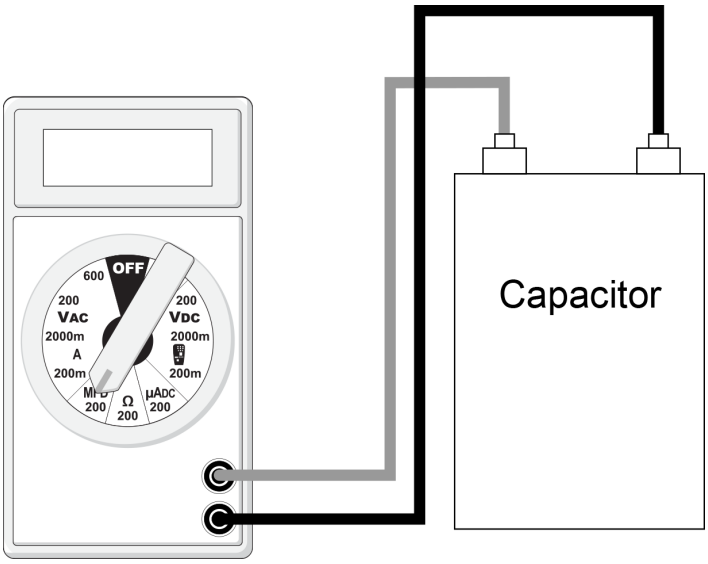
Discharge capacitor through a 20 to 30 OHM resistor before handling.

1. Turn Power off to Unit
2. Discharge capacitor through a 20Ω - 30Ω resistor
3. Remove wires from capacitor
4. Use multi-meter check micro-farads (MFD) of the capacitor.
5. Place leads from C – HERM

SERVICING

6. Place leads from C – FAN
7. Compare to capacitor rating label.

If the reading is within the tolerance listed on rating label the capacitor is good.
If the reading is lower, the capacitor is bad and must be replaced.



Testing Capacitance

WARNING

Discharge capacitor through a 20 to 30 OHM resistor before handling.

Checking Fan And Blower Motor Windings (Psc Motors)

The auto reset fan motor overload is designed to protect the motor against high temperature and high amperage conditions by breaking the common circuit within the motor, similar to the compressor internal overload. However, heat generated within the motor is faster to dissipate than the compressor, allow at least 45 minutes for the overload to reset, then retest.

WARNING

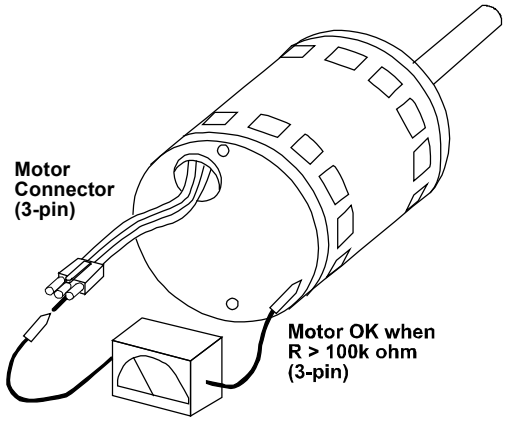
High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

1. Remove the motor leads from its respective connection points and capacitor (if applicable).
2. Check the continuity between each of the motor leads.
3. Touch one probe of the ohmmeter to the motor frame (ground) and the other probe in turn to each lead.

If the windings do not test continuous or a reading is obtained from lead to ground, replace the motor.

Checking EEM Motors

The EEM motor is a one piece, fully encapsulated, 3 phase brushless DC (single phase AC input) motor with ball bearing construction. The EEM motor features an integral control module.



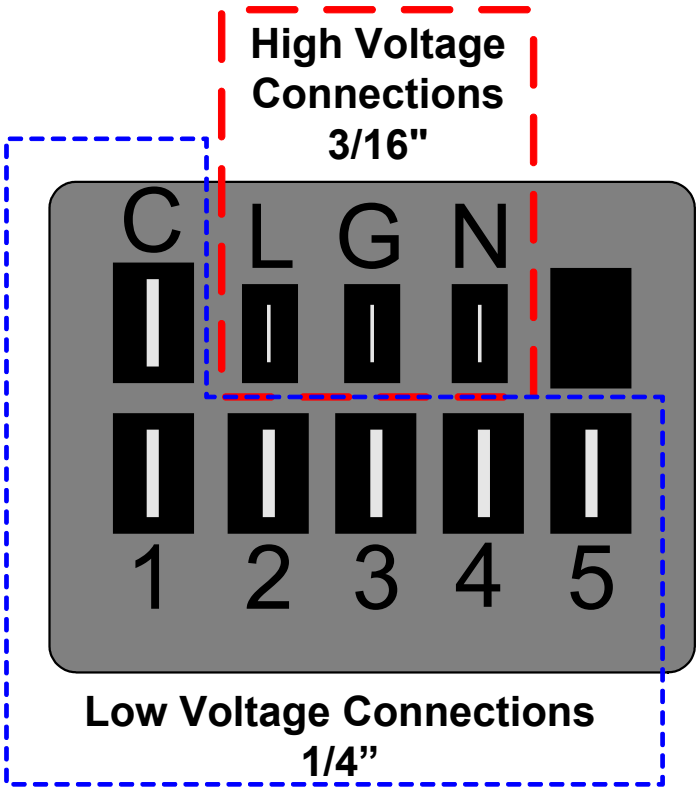
Winding Test

Note: The GE TECMate will not currently operate the EEM motor.

1. Using a voltmeter, check for 230 volts to the motor connections L and N. If 230 volts is present, proceed to step 2. If 230 volts is not present, check the line voltage circuit to the motor.
2. Using a voltmeter, check for 24 volts from terminal C to either terminal 1, 2, 3, 4, or 5, depending on which tap is being used, at the motor. If voltage present, proceed to step 3. If no voltage, check 24 volt circuit to motor.
3. If voltage was present in steps 1 and 2, the motor has failed and will need to be replaced.

NOTE: When replacing motor, ensure the belly band is between the vents on the motor and the wiring has the proper drip loop to prevent condensate from entering the motor.

SERVICING



EEM Motor Connections

Checking Compressor

WARNING

Hermetic compressor electrical terminal venting can be dangerous. When insulating material which supports a hermetic compressor or electrical terminal suddenly disintegrates due to physical abuse or as a result of an electrical short between the terminal and the compressor housing, the terminal may be expelled, venting the vapor and liquid contents of the compressor housing and system.

If the compressor terminal PROTECTIVE COVER and gasket (if required) are not properly in place and secured, there is a remote possibility if a terminal vents, that the vaporous and liquid discharge can be ignited, spouting flames several feet, causing potentially severe or fatal injury to anyone in its path.

This discharge can be ignited external to the compressor if the terminal cover is not properly in place and if the discharge impinges on a sufficient heat source.

Ignition of the discharge can also occur at the venting terminal or inside the compressor, if there is sufficient contaminant air present in the system and an electrical arc occurs as the terminal vents.

Ignition cannot occur at the venting terminal without the presence of contaminant air, and cannot occur externally from the venting terminal without the presence of an external ignition source.

Therefore, proper evacuation of a hermetic system is essential at the time of manufacture and during servicing.

To reduce the possibility of external ignition, all open flame, electrical power, and other heat sources should be extinguished or turned off prior to servicing a system.

Resistance Test

Each compressor is equipped with an internal overload.

The line break internal overload senses both motor amperage and winding temperature. High motor temperature or amperage heats the disc causing it to open, breaking the common circuit within the compressor on single phase units.

Heat generated within the compressor shell, usually due to recycling of the motor, high amperage or insufficient gas to cool the motor, is slow to dissipate. Allow at least three to four hours for it to cool and reset, then retest.

Fuse, circuit breaker, ground fault protective device, etc. has not tripped -

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

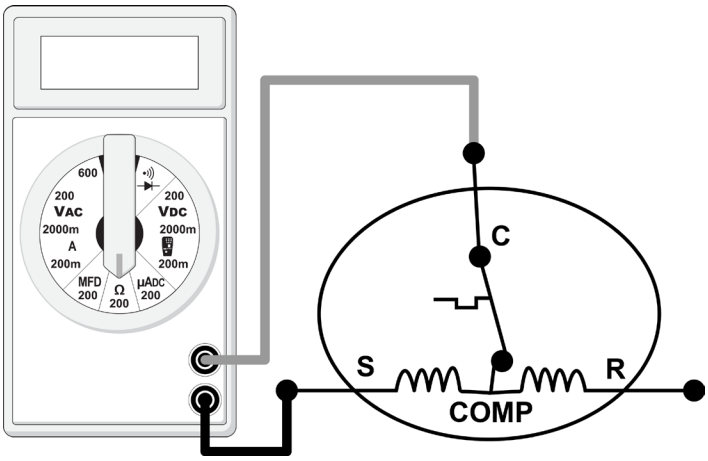
1. Remove the leads from the compressor terminals.

WARNING

See warnings before removing compressor terminal cover.

2. Using an ohmmeter, test continuity between terminals S-R, C-R, and C-S.

SERVICING



TESTING COMPRESSOR WINDINGS

If either winding does not test continuous, replace the compressor.

NOTE: If an open compressor is indicated, allow ample time for the internal overload to reset before replacing compressor.

GROUND TEST

If fuse, circuit breaker, ground fault protective device, etc. has tripped, this is a strong indication that an electrical problem exists and must be found and corrected. The circuit protective device rating must be checked and its maximum rating should coincide with that marked on the equipment nameplate.

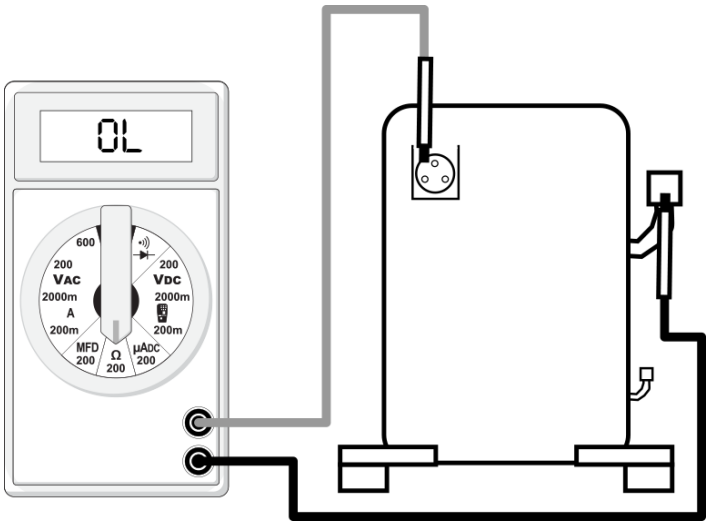
With the terminal protective cover in place, it is acceptable to replace the fuse or reset the circuit breaker **ONE TIME ONLY** to see if it was just a nuisance opening. If it opens again, **DO NOT** continue to reset.

Disconnect all power to unit, making sure that all power legs are open.

1. Carefully remove the compressor terminal protective cover and inspect for loose leads or insulation breaks in the lead wires.
2. Disconnect the three leads going to the compressor terminals at the compressor or nearest point to the compressor.
3. Check for a ground separately between each of the three terminals and ground (such as an unpainted tube on the compressor). If there is any reading of continuity to ground on the meter, the compressor should be considered defective.
4. If ground is indicated, replace the compressor.

WARNING

DAMAGE CAN OCCUR TO THE GLASS EMBEDDED TERMINALS IF THE LEADS ARE NOT PROPERLY REMOVED. THIS CAN RESULT IN TERMINAL AND HOT OIL DISCHARGING.



COMPRESSOR GROUND TEST

OPERATION TEST

If the voltage, capacitor, overload and motor winding test fail to show the cause for failure:

WARNING

HIGH VOLTAGE!
DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

1. Remove unit wiring from disconnect switch and wire a test cord to the disconnect switch.

NOTE: The wire size of the test cord must equal the line wire size and the fuse must be of the proper size and type.

2. With the protective terminal cover in place, use the three leads to the compressor terminals that were disconnected at the nearest point to the compressor and connect the common, start and run clips to the respective leads.
3. Connect good capacitors of the right MFD and voltage rating into the circuit as shown.
4. With power ON, close the switch.

WARNING

LINE VOLTAGE NOW PRESENT

SERVICING

A. If the compressor starts and continues to run, the cause for failure is somewhere else in the system.
B. If the compressor fails to start - replace.

Locked Rotor Test

If fuse, circuit breaker, ground fault protective device, etc. has tripped, this is a strong indication that an electrical problem exists and must be found and corrected. The circuit protective device rating must be checked and its maximum rating should coincide with that marked on the equipment nameplate.

Before checking for locked rotor, the compressor terminals should be checked for open windings (see Resistance Test) and the run capacitor and start capacitor (if used) should be checked thoroughly (see Checking Capacitor).

With power ON:

WARNING

Line voltage now present

1. Check the serial data plate for the compressor locked rotor amps (LRA) rating.
2. Using an ampmeter, measure the amperage reading for the run and common wires to the compressor. Since the compressor motor overload will likely trip soon after drawing locked rotor amps, this measurement should be taken as soon as the compressor starts.
3. If the amperage reading roughly equals the compressor LRA rating and all other checks have been completed, locked rotor amps has been verified.

Testing crankcase heater (Optional Item)

The crankcase heater must be energized a minimum of four (4) hours before the condensing unit is operated.

Crankcase heaters are used to prevent migration or accumulation of refrigerant in the compressor crankcase during the off cycles and prevents liquid slugging or oil pumping on start up.

A crankcase heater will not prevent compressor damage due to a floodback or over charge condition.

WARNING

Disconnect ALL power before servicing.

1. Disconnect the heater lead in wires.
2. Using an ohmmeter, check heater continuity - should test continuous. If not, replace.

Checking Reversing Valve And Solenoid

Reversing valve used in heat pumps could potentially leak internally. Discharge gases can leak into the suction inside the valve. Compound gages will give the same symptoms as bad compressor valves or broken scroll flanks. The temperature between true suction and the suction line after the valve should not be greater than 4 degrees. Note: The center tube is always the suction line and should be cold.

Troubleshooting the Reversing Valve for Electrical Failure

1. Place unit into the cooling mode. Test for 24 volts at the solenoid. If there is no voltage present at coil, check the control voltage.
2. If voltage is present, loosen the nut on the top of the coil. Remove the coil, there should be slight resistance.
3. If the slight resistance is felt, remove the coil. As you remove the coil listen carefully, an audible click should be detected. The clicking is due to the movement of the pilot valve plunger. The absence of a clicking sound indicates the plunger is stuck.

Troubleshooting Mechanical Failures on a Reversing Valve by Pressure

1. Troubleshooting the reversing valve can be done by pressure and touch.
2. Raise the head pressure. In the cooling mode block the fan exhaust. Once head pressure has been raised, cycle between cooling and heating and see if the piston can be freed.

Troubleshooting Mechanical Failures on a Reversing Valve byTemperature

1. When operating properly the valve contains refrigerant gases at certain temperatures.
2. The discharge line should be the same temperature after the valves discharge line.
3. The true suction should be the same as the suction line after the valve. If there is a 4-degree difference, valve is leaking

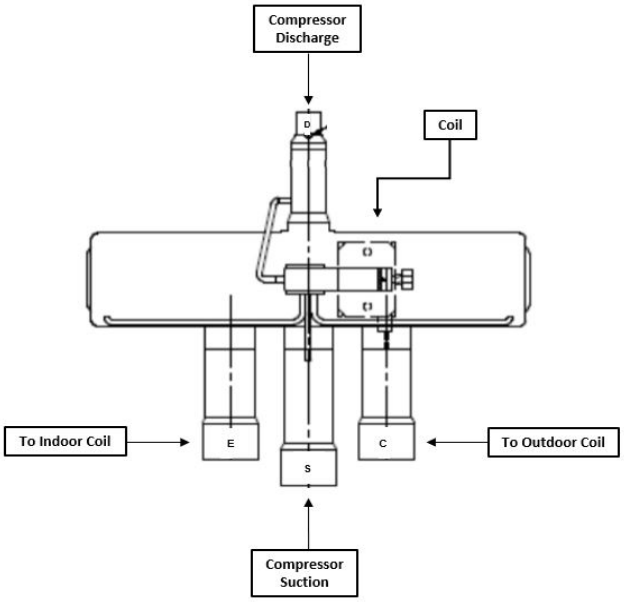
When stuck in the mid-position, part of the discharge gas from the compressor is directed back to the suction side, resulting in excessively high suction pressure. An increase in the suction line temperature through the reversing valve can also be measured. Check operation of the valve by starting the system and switching the operation from COOLING to HEATING cycle.

If the valve fails to change its position, test the voltage (24V) at the valve coil terminals, while the system is on the COOLING cycle.

If voltage is registered at the coil, tap the valve body lightly while switching the system from HEATING to COOLING, etc. If this fails to cause the valve to switch positions,

SERVICING

remove the coil connector cap and test the continuity of the reversing valve solenoid coil. If the coil does not test continuous - replace it. If the coil test continuous and 24 volts is present at the coil terminals, the valve is inoperative - replace it.



Testing Defrost Control

NOTE: PCBDM133 defrost controls have a three (3) minute compressor off cycle delay.

NOTE: The PCBDM133 defrost controls are shipped from the factory with the compressor delay option selected. This will de-energize the compressor contactor for 30 seconds on defrost initiation and defrost termination. If the jumper is set to Normal, the compressor will continue to run during defrost initiation and defrost termination. The control will also ignore the low pressure switch connected to R-PS1 and PS2 for 5 minutes upon defrost initiation and 5 minutes after defrost termination.

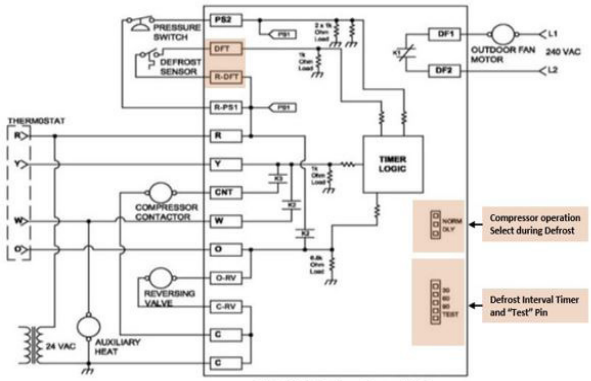
To check the defrost control for proper sequencing, proceed as follows: With power ON; unit not running:

1. Jumper defrost thermostat by placing a jumper wire across the terminals “DFT” and “R”/” R-DFT” at defrost control board.
2. Remove jumper from timer pins and jump across test pins on defrost control board. **Note:** Do not use screwdriver or field supplied jumper to test the control.
3. Set thermostat to call for heating. System should go into defrost within 21 seconds.
4. Immediately remove jumper from test pins.
5. Using VOM check for voltage across terminals “C & O”. Meter should read 24 volts.
6. Using VOM check for voltage across fan terminals DF1 and DF2 on the board. You should read line voltage (208-230 VAC) indicating the relay is open in the defrost mode
7. Using VOM check for voltage across “W”/”W2” & “C” terminals on the board. You should read 24 volts.
8. If not as above, replace control board.
9. Set thermostat to off position and disconnect power. Remove jumper from defrost thermostat and replace timer jumper to the desired defrost time.

NOTE: Remove jumper across defrost thermostat before returning system to service.

Testing Defrost Thermostat

1. Install a thermocouple type temperature test lead on the tube adjacent to the defrost control. Insulate the lead point of contact.
2. Check the temperature at which the control closes its contacts by lowering the temperature of the control. It should close at approximately 30°F.
3. Check the temperature at which the control opens its contacts by raising the temperature of the control. It should open at approximately 60°F.
4. If not as above, replace control.



PCBDM133 Defrost Control PCB

Refrigeration Repair Practice

DANGER

Always remove the refrigerant charge in a proper manner before applying heat to the system.

When repairing the refrigeration system:

WARNING

Disconnect ALL power before servicing.

1. Never open a system that is under vacuum. Air and moisture will be drawn in.
2. Plug or cap all openings.
3. Remove all burrs and clean the brazing surfaces of the tubing with sand cloth or paper. Brazing

materials do not flow well on oxidized or oily surfaces.
4. Clean the inside of all new tubing to remove oils and pipe chips.
5. When brazing, sweep the tubing with dry nitrogen to prevent the formation of oxides on the inside surfaces.
6. Complete any repair by replacing the liquid line drier in the system, evacuate and charge.

Brazing Materials

Copper to Copper Joints - Sil-Fos used without flux (alloy of 15% silver, 80% copper, and 5% phosphorous). Recommended heat 1400°F.

Copper to Steel Joints - Silver Solder used without a flux (alloy of 30% silver, 38% copper, 32% zinc). Recommended heat - 1200°F.

Standing Pressure Test (Recommended before System Evacuation)

WARNING

To avoid the risk of fire or explosion, never use oxygen, high pressure air or flammable gases for leak testing of a refrigeration system.

WARNING

To avoid possible explosion, the line from the nitrogen cylinder must include a pressure regulator and a pressure relief valve. The pressure relief valve must be set to open at no more than 450 psig.

Using dry nitrogen, pressurize the system to 450 PSIG. Allow the pressure to stabilize and hold for 15 minutes (minimum). If the pressure does not drop below 450 PSIG the system is considered leak free. Proceed to system evacuation using the Deep Vacuum Method. If after 15 minutes the pressure drops below 450 PSIG follow the procedure outlined below to identify system leaks. Repeat the Standing Pressure Test.

Leak Testing (Nitrogen or Nitrogen-Traced)

WARNING

To avoid the risk of fire or explosion, never use oxygen, high pressure air or flammable gases for leak testing of a refrigeration system.

WARNING

To avoid possible explosion, the line from the nitrogen cylinder must include a pressure regulator and a pressure relief valve. The pressure relief valve must be set to open at no more than 450 psig.

Leak test the system using dry nitrogen and soapy water to identify leaks. If you prefer to use an electronic leak detector, charge the system to 10 PSIG with the appropriate system refrigerant (see Serial Data Plate for refrigerant identification). Do not use an alternative refrigerant. Using dry nitrogen finish charging the system to 450 PSIG. Apply the leak detector to all suspect areas. When leaks are discovered, repair the leaks, and repeat the pressure test. If leaks have been eliminated proceed to system evacuation.

System Evacuation

Condensing unit liquid and suction valves are closed to contain the charge within the unit. The unit is shipped with the valve stems closed and caps installed. Do not open valves until the system is evacuated.

WARNING

REFRIGERANT UNDER PRESSURE!
Failure to follow proper procedures may cause property damage, personal injury or death.

NOTE: Scroll compressors should never be used to evacuate or pump down a heat pump or air conditioning system.

CAUTION

Prolonged operation at suction pressures less than 20 psig for more than 5 seconds will result in overheating of the scrolls and permanent damage to the scroll tips, drive bearings and internal seal.

Deep Vacuum Method (Recommended)

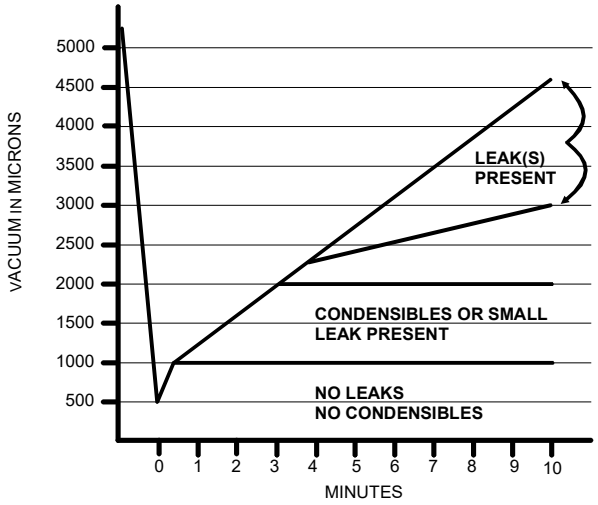
The Deep Vacuum Method requires a vacuum pump rated for 500 microns or less. This method is an effective and efficient way of assuring the system is free of non-condensable air and moisture. As an alternative, the Triple Evacuation Method is detailed in the Service Manual for this product model.

It is recommended to remove the Schrader Cores from the service valves using a core-removal tool to expedite the evacuation procedure.

1. Connect the vacuum pump, micron gauge, and vacuum rated hoses to both service valves. Evacuation must use both service valves to eliminate system mechanical seals.

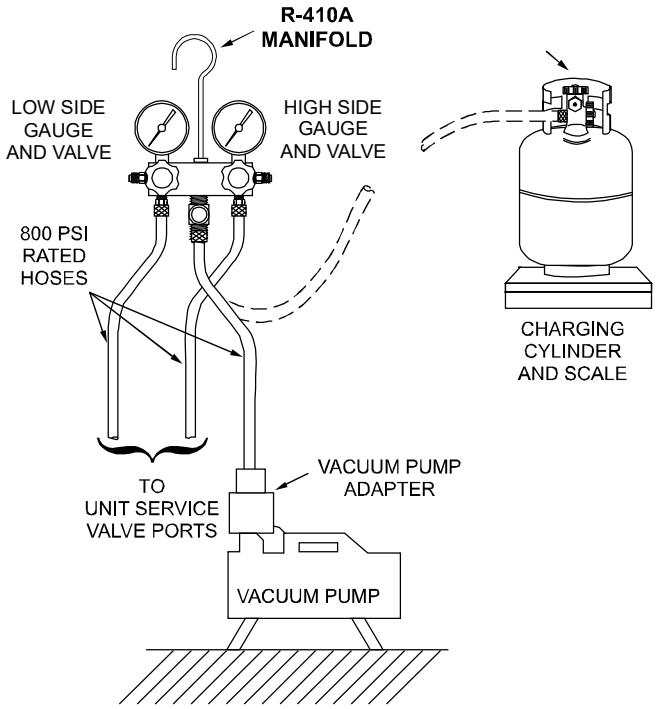
SERVICING

2. Evacuate the system to less than 500 microns.
3. Isolate the pump from the system and hold vacuum for 10 minutes (minimum). Typically, pressure will rise slowly during this period. If the pressure rises to less than 1000 microns and remains steady, the system is considered leak-free; proceed to system charging and startup.
4. If pressure rises above 1000 microns but holds steady below 2000 microns, non-condensable air or moisture may remain or a small leak is present. Return to step 2: If the same result is achieved check for leaks and repair. Repeat the evacuation procedure.
5. If pressure rises above 2000 microns, a leak is present. Check for leaks and repair. Repeat the evacuation procedure.



Triple Evacuation Method (Alternate)

1. Evacuate the system to 4000 microns and hold for 15 minutes. Break the vacuum with dry nitrogen, bring the system pressure to 2-3 PSIG, and hold for 20 minutes. Release the nitrogen,
2. Evacuate to 1500 microns and hold for 20 minutes. Break the vacuum with dry nitrogen again, bring the system pressure back to 2-3 PSIG, and hold for 20 minutes.
3. Evacuate the system to 500 microns and hold for 60 minutes.
4. If the pressure rises to 1000 microns or less and remains steady the system is considered leak free; proceed to start-up.



Evacuation

Charging

WARNING

REFRIGERANT UNDER PRESSURE!

- **Do not overcharge system with refrigerant.**
- **Do not operate unit in a vacuum or at negative pressure.**

Failure to follow proper procedures may cause property damage, personal injury or death.

CAUTION

Only use refrigerant certified to AHRI standards. Used refrigerant may cause compressor damage. Goodman is not responsible for damage or the need for repairs resulting from the use of unapproved refrigerant types or used or recycled refrigerant. Most portable machinces cannot clean used refrigerant to meet AHRI standards.

CAUTION

Operating the compressor with the suction valve closed will cause serious compressor damage.

Charge the system with the exact amount of refrigerant.

See unit nameplate for the correct refrigerant charge amount.

An inaccurately charged system will cause future problems.

1. Using a charging scale, weigh in the refrigerant charge amount listed on unit nameplate. Allow liquid refrigerant only to enter the high side.

SERVICING

2. After the system will take all it will take, close the valve on the high side of the charging manifold.
3. Start the system and charge the balance of the refrigerant through the low side.

Refrigerant Charge Check

Units with Fixed Orifice Devices

After completing airflow measurements and adjustments the unit's refrigerant charge must be checked. All package units with fixed orifice devices are charged using the super heat method at the compressor suction line.

After superheat is verified, it is recommended to check unit sub-cooling at the condenser coil liquid line out.

Superheat

Before checking the superheat or replacing the valve, perform all the procedures outlined under Air Flow, Refrigerant Charge, Expansion Valve - Overfeeding, Underfeeding. These are the most common causes for evaporator malfunction.

Checking Superheat

Refrigerant gas is considered superheated when its temperature is higher than the saturation temperature corresponding to its pressure. The degree of superheat equals the degrees of temperature increase above the saturation temperature at existing pressure.
Procedure:

CAUTION

To prevent personal injury, carefully connect and disconnect manifold gauge hoses. Escaping liquid refrigerant can cause burns. Do not vent refrigerant to atmosphere. Recover during system repair or final unit disposal.

1. Run system at least 15 -20 minutes to allow pressure to stabilize.
2. Install a low side pressure gauge on the suction line access fitting.
3. Temporarily install thermometer on suction (large) line near compressor with adequate contact and insulate for best possible reading.
4. Record the gauge pressure corresponding temperature and the temperature of the suction line.
5. Refer to the superheat table for proper system superheat. Add charge to lower superheat recover charge to raise superheat.

Ambient Condenser Inlet Temp (°F Drybulb)	Return Air Temp. (°F Drybulb)				
	65	70	75	80	85
100	-	-	-	10	10
95	-	-	10	10	10
90	-	-	12	15	18
85	-	10	13	17	20
80	-	10	15	21	26
75	10	13	17	25	29
70	10	17	20	28	32
65	13	19	26	32	35
60	17	25	30	33	37

EXAMPLE:
A. Suction Pressure = 143
B. Corresponding Temp. °F. = 50
C. Thermometer on Suction Line = 61°F.

To obtain the degrees temperature of superheat, subtract 50.0 from 61.0°F.
The difference is 11° Superheat. The 11° Superheat would fall in the ± range of allowable superheat.

Superheat Formula = Suct. Line Temp. - Sat. Suct. Temp.

Checking Subcooling

Refrigerant liquid is considered subcooled when its temperature is lower than the saturation temperature corresponding to its pressure. The degree of subcooling equals the degrees of temperature decrease below the saturation temperature at the existing pressure.
Procedure:

1. Attach an accurate thermometer or preferably a thermocouple type temperature tester to the liquid line close to the pressure switch.
2. Install a high side pressure gauge on the liquid access fitting.
3. Record the gauge pressure and the temperature of the line.
4. The difference between the thermometer reading and pressure to temperature conversion is the amount of subcooling.

Subcooling Formula = Sat. Liquid Temp. - Liquid Line Temp.

EXAMPLE:
A. Liquid Line Pressure = 417
B. Corresponding Temp. °F. = 120°
C. Thermometer on Liquid line = 109°F.

To obtain the amount of subcooling subtract 109°F from 120°F.
The difference is 11° subcooling. See the specification sheet or technical information manual for the design subcooling range for your unit.
See R410A Pressure vs. Temperature Chart

SERVICING

NOTE: R410A should be drawn out of the storage container or drum in liquid form due to its fractionation properties, but should be "Flashed" to its gas state before entering the system. There are commercially available restriction devices that fit into the system charging hose set to accomplish this. DO NOT charge liquid R410A into the compressor.

4. With the system still running, close the valve on the charging cylinder. At this time, you may still have some liquid refrigerant in the charging cylinder hose and will definitely have liquid in the liquid hose. Slowly open the high side manifold valve and transfer the liquid refrigerant from the liquid line hose and charging cylinder hose into the suction service valve port. CAREFUL: Watch so that liquid refrigerant does not enter the compressor.

Due to their design, Scroll compressors are inherently more tolerant of liquid refrigerant.

NOTE: Even though the compressor section of a Scroll compressor is more tolerant of liquid refrigerant, continued floodback or flooded start conditions may wash oil from the bearing surfaces causing premature bearing failure.

Checking Compressor Efficiency

The reason for compressor inefficiency is broken or damaged suction and/or discharge valves, or scroll flanks on Scroll compressors, reducing the ability of the compressor to pump refrigerant vapor.

The condition of the valves or scroll flanks is checked in the following manner:

1. Attach gauges to the high and low side of the system.
2. Start the system and run a Cooling Performance Test.

If the test shows:

A. Below normal high side pressure.
B. Above normal low side pressure.
C. Low temperature difference across coil.
D. Low amp draw at compressor.

-and the charge is correct. The compressor is faulty - replace the compressor.

SERVICING

Pressure vs. Temperature Chart

R-410A

PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F
12	-37.7	114.0	37.8	216.0	74.3	318.0	100.2	420.0	120.7	522.0	137.6
14	-34.7	116.0	38.7	218.0	74.9	320.0	100.7	422.0	121.0	524.0	137.9
16	-32.0	118.0	39.5	220.0	75.5	322.0	101.1	424.0	121.4	526.0	138.3
18	-29.4	120.0	40.5	222.0	76.1	324.0	101.6	426.0	121.7	528.0	138.6
20	-36.9	122.0	41.3	224.0	76.7	326.0	102.0	428.0	122.1	530.0	138.9
22	-24.5	124.0	42.2	226.0	77.2	328.0	102.4	430.0	122.5	532.0	139.2
24	-22.2	126.0	43.0	228.0	77.8	330.0	102.9	432.0	122.8	534.0	139.5
26	-20.0	128.0	43.8	230.0	78.4	332.0	103.3	434.0	123.2	536.0	139.8
28	-17.9	130.0	44.7	232.0	78.9	334.0	103.7	436.0	123.5	538.0	140.1
30	-15.8	132.0	45.5	234.0	79.5	336.0	104.2	438.0	123.9	540.0	140.4
32	-13.8	134.0	46.3	236.0	80.0	338.0	104.6	440.0	124.2	544.0	141.0
34	-11.9	136.0	47.1	238.0	80.6	340.0	105.1	442.0	124.6	548.0	141.6
36	-10.1	138.0	47.9	240.0	81.1	342.0	105.4	444.0	124.9	552.0	142.1
38	-8.3	140.0	48.7	242.0	81.6	344.0	105.8	446.0	125.3	556.0	142.7
40	-6.5	142.0	49.5	244.0	82.2	346.0	106.3	448.0	125.6	560.0	143.3
42	-4.5	144.0	50.3	246.0	82.7	348.0	106.6	450.0	126.0	564.0	143.9
44	-3.2	146.0	51.1	248.0	83.3	350.0	107.1	452.0	126.3	568.0	144.5
46	-1.6	148.0	51.8	250.0	83.8	352.0	107.5	454.0	126.6	572.0	145.0
48	0.0	150.0	52.5	252.0	84.3	354.0	107.9	456.0	127.0	576.0	145.6
50	1.5	152.0	53.3	254.0	84.8	356.0	108.3	458.0	127.3	580.0	146.2
52	3.0	154.0	54.0	256.0	85.4	358.0	108.8	460.0	127.7	584.0	146.7
54	4.5	156.0	54.8	258.0	85.9	360.0	109.2	462.0	128.0	588.0	147.3
56	5.9	158.0	55.5	260.0	86.4	362.0	109.6	464.0	128.3	592.0	147.9
58	7.3	160.0	56.2	262.0	86.9	364.0	110.0	466.0	128.7	596.0	148.4
60	8.6	162.0	57.0	264.0	87.4	366.0	110.4	468.0	129.0	600.0	149.0
62	10.0	164.0	57.7	266.0	87.9	368.0	110.8	470.0	129.3	604.0	149.5
64	11.3	166.0	58.4	268.0	88.4	370.0	111.2	472.0	129.7	608.0	150.1
66	12.6	168.0	59.0	270.0	88.9	372.0	111.6	474.0	130.0	612.0	150.6
68	13.8	170.0	59.8	272.0	89.4	374.0	112.0	476.0	130.3	616.0	151.2
70	15.1	172.0	60.5	274.0	89.9	376.0	112.4	478.0	130.7	620.0	151.7
72	16.3	174.0	61.1	276.0	90.4	378.0	112.6	480.0	131.0	624.0	152.3
74	17.5	176.0	61.8	278.0	90.9	380.0	113.1	482.0	131.3	628.0	152.8
76	18.7	178.0	62.5	280.0	91.4	382.0	113.5	484.0	131.6	632.0	153.4
78	19.8	180.0	63.1	282.0	91.9	384.0	113.9	486.0	132.0	636.0	153.9
80	21.0	182.0	63.8	284.0	92.4	386.0	114.3	488.0	132.3	640.0	154.5
82	22.1	184.0	64.5	286.0	92.8	388.0	114.7	490.0	132.6	644.0	155.0
84	23.2	186.0	65.1	288.0	93.3	390.0	115.0	492.0	132.9	648.0	155.5
86	24.3	188.0	65.8	290.0	93.8	392.0	115.5	494.0	133.3	652.0	156.1
88	25.4	190.0	66.4	292.0	94.3	394.0	115.8	496.0	133.6	656.0	156.6
90	26.4	192.0	67.0	294.0	94.8	396.0	116.2	498.0	133.9	660.0	157.1
92	27.4	194.0	67.7	296.0	95.2	398.0	116.6	500.0	134.0	664.0	157.7
94	28.5	196.0	68.3	298.0	95.7	400.0	117.0	502.0	134.5	668.0	158.2
96	29.5	198.0	68.9	300.0	96.2	402.0	117.3	504.0	134.8	672.0	158.7
98	30.5	200.0	69.5	302.0	96.6	404.0	117.7	506.0	135.2	676.0	159.2
100	31.2	202.0	70.1	304.0	97.1	406.0	118.1	508.0	135.5	680.0	159.8
102	32.2	204.0	70.7	306.0	97.5	408.0	118.5	510.0	135.8	684.0	160.3
104	33.2	206.0	71.4	308.0	98.0	410.0	118.8	512.0	136.1	688.0	160.8
106	34.1	208.0	72.0	310.0	98.4	412.0	119.2	514.0	136.4	692.0	161.3
108	35.1	210.0	72.6	312.0	98.9	414.0	119.6	516.0	136.7	696.0	161.8
110	35.5	212.0	73.2	314.0	99.3	416.0	119.9	518.0	137.0		
112	36.9	214.0	73.8	316.0	99.7	418.0	120.3	520.0	137.3		

*Based on ALLIED SIGNAL Data

REQUIRED LIQUID LINE TEMPERATURE						
LIQUID PRESSURE AT SERVICE VALVE (PSIG)	REQUIRED SUBCOOLING TEMPERATURE (°F)					
	8	10	12	14	16	18
189	58	56	54	52	50	48
195	60	58	56	54	52	50
202	62	60	58	56	54	52
208	64	62	60	58	56	54
215	66	64	62	60	58	56
222	68	66	64	62	60	58
229	70	68	66	64	62	60
236	72	70	68	66	64	62
243	74	72	70	68	66	64
251	76	74	72	70	68	66
259	78	76	74	72	70	68
266	80	78	76	74	72	70
274	82	80	78	76	74	72
283	84	82	80	78	76	74
291	86	84	82	80	78	76
299	88	86	84	82	80	78
308	90	88	86	84	82	80
317	92	90	88	86	84	82
326	94	92	90	88	86	84
335	96	94	92	90	88	86
345	98	96	94	92	90	88
354	100	98	96	94	92	90
364	102	100	98	96	94	92
374	104	102	100	98	96	94
384	106	104	102	100	98	96
395	108	106	104	102	100	98
406	110	108	106	104	102	100
416	112	110	108	106	104	102
427	114	112	110	108	106	104
439	116	114	112	110	108	106
450	118	116	114	112	110	108
462	120	118	116	114	112	110
474	122	120	118	116	114	112
486	124	122	120	118	116	114
499	126	124	122	120	118	116
511	128	126	124	122	120	118

SERVICING

Fixed Orifice Restriction Devices

The fixed orifice restriction device (flowrator) used in conjunction with the indoor coil is a predetermined bore (I.D.).

It is designed to control the rate of liquid refrigerant flow into an evaporator coil.

The amount of refrigerant that flows through the fixed orifice restriction device is regulated by the pressure difference between the high and low sides of the system.

In the cooling cycle when the outdoor air temperature rises, the high side condensing pressure rises. At the same time, the cooling load on the indoor coil increases, causing the low side pressure to rise, but at a slower rate.

Since the high side pressure rises faster when the temperature increases, more refrigerant flows to the evaporator, increasing the cooling capacity of the system.

When the outdoor temperature falls, the reverse takes place. The condensing pressure falls, and the cooling loads on the indoor coil decreases, causing less refrigerant flow.

If a restriction should become evident, proceed as follows:

1. Recover refrigerant charge.
2. Remove the orifice assembly and clean or replace.
3. Replace liquid line drier, evacuate and recharge.

Checking Equalization Time

During the “OFF” cycle, the high side pressure bleeds to the low side through the fixed orifice restriction device. Check equalization time as follows:

1. Attach a gauge manifold to the suction and liquid line dill valves
2. Start the system and allow the pressures to stabilize.
3. Stop the system and check the time it takes for the high and low pressure gauge readings to equalize.

If it takes more than seven (7) minutes to equalize, the restriction device is inoperative. Replace, install a liquid line drier, evacuate and recharge.

Checking Restricted Liquid Line

When the system is operating, the liquid line is warm to the touch. If the liquid line is restricted, a definite temperature drop will be noticed at the point of restriction. In severe cases, frost will form at the restriction and extend down the line in the direction of the flow.
Discharge and suction pressures will be low, giving the appearance of an undercharged unit. However, the unit will have normal to high subcooling.

If a restriction is located, replace the restricted part, replace drier, evacuate and recharge.

Refrigerant Overcharge

An overcharge of refrigerant is normally indicated by an excessively high head pressure.

An evaporator coil, using an expansion valve metering device, will basically modulate and control a flooded evaporator and prevent liquid refrigerant return to the compressor.

An evaporator coil, using a fixed orifice restrictor device (flowrator) metering device, could allow liquid refrigerant to return to the compressor under extreme overcharge conditions.

Also with a fixed orifice restrictor device (flowrator) metering device, extreme cases of insufficient indoor air can cause icing of the indoor coil and liquid refrigerant return to the compressor, but the head pressure would be lower.

There are other causes for high head pressure. If other causes check out normal, an overcharge or a system containing non-condensables would be indicated.

If this system is observed:

1. Start the system.
2. Remove and capture small quantities of refrigerant as from the suction line access fitting until the head pressure is reduced to normal.
3. Observe the system while running a cooling performance test. If a shortage of refrigerant is indicated, then the system contains non-condensables.

Non-Condensables

If non-condensables are suspected, shut down the system and allow the pressures to equalize. Wait at least 15 minutes. Compare the pressure to the temperature of the coldest coil since this is where most of the refrigerant will be. If the pressure indicates a higher temperature than that of the coil temperature, non-condensables are present.

Non-condensables are removed from the system by first removing the refrigerant charge, replacing and/or installing liquid line drier, evacuating and recharging.

SERVICING

Air Conditioning Diagnostic Chart					
Issue	Discharge Pressure	Suction Pressure	(Orifice) Superheat	(TXV) Subcooling	Temperature Split
Liquid Line Restriction	↓	↓	↑	↑	↓
System Undercharge	↓	↓	↑	↓	↓
System Overcharge	↑	↑	↓	↑	↓
Non Condensible	↑	↑	↑	↑	↓
Low Indoor Airflow	↓	↓	↓	↑	↑
Inefficient Compressor	↓	↑	↑	↓	↓

Heat Pump Diagnostic Chart					
Issue	Discharge Pressure	Suction Pressure	(Orifice) Superheat	(TXV) Subcooling	Temperature Split
Liquid Line Restriction	↑	↓	↑	↑	↓
System Undercharge	↓	↓	↑	↓	↓
Leaking Reversing Valve	↓	↑	Normal	↓	↓
Low Indoor Airflow	↑	↑	Normal	Normal	↑
Inefficient Compressor	↓	↑	Normal	↓	↓

NOTE: Superheat and Subcooling is determined by the system metering device.

Compressor Burnout

When a compressor burns out, high temperature develops causing the refrigerant, oil and motor insulation to decompose forming acids and sludge.

If a compressor is suspected of being burned-out, attach a refrigerant hose to the liquid line dill valve and properly remove and dispose of the refrigerant.

NOTICE

Violation of EPA regulations may result in fines or other penalties.

Now determine if a burn out has actually occurred. Confirm by analyzing an oil sample using a Sporlan Acid Test Kit, AK-3 or its equivalent.

Remove the compressor and obtain an oil sample from the suction stub. If the oil is not acidic, either a burnout has not occurred or the burnout is so mild that a complete clean-up is not necessary.

If acid level is unacceptable, the system must be cleaned by using the clean-up drier method.

CAUTION

Do not allow the sludge or oil to contact the skin. Severe burns may result.

NOTE: The Flushing Method using R-11 refrigerant is no longer approved by Amana® Brand Heating-Cooling.

Suction Line Drier Clean-Up Method

The POE oils used with R410A refrigerant is an excellent solvent. In the case of a burnout, the POE oils will remove any burnout residue left in the system. If not captured by the refrigerant filter, they will collect in the compressor or other system components, causing a failure of the replacement compressor and/or spread contaminants throughout the system, damaging additional components.

Install a suction line filter drier. This drier should be installed as close to the compressor suction fitting as possible. The filter must be accessible and be rechecked for a pressure drop after the system has operated for a time. It may be necessary to use new tubing and form as required.

NOTE: At least twelve (12) inches of the suction line immediately out of the compressor stub must be discarded due to burned residue and contaminates.

1. Remove compressor discharge line strainer.
2. Remove the liquid line drier and expansion valve.
3. Purge all remaining components with dry nitrogen or carbon dioxide until clean.
4. Install new components including liquid line drier.
5. Braze all joints, leak test, evacuate, and recharge system.
6. Start up the unit and record the pressure drop across the drier.
7. Continue to run the system for a minimum of twelve (12) hours and recheck the pressure drop across the drier. Pressure drop should not exceed 6 PSIG.
8. Continue to run the system for several days, repeatedly checking pressure drop across the suction line drier. If the pressure drop never exceeds the 6 PSIG, the drier has trapped the contaminants. Remove the suction line drier from the system.
9. If the pressure drop becomes greater, then it must be replaced and steps 5 through 9 repeated until it does not exceed 6 PSIG.

NOTICE: Regardless, the cause for burnout must be determined and corrected before the new compressor is started.

Reversing Valve Replacement

Remove the refrigerant charge from the system.

When brazing a reversing valve into the system, it is of extreme importance that the temperature of the valve does not exceed 250°F. at any time.

Wrap the reversing valve with a large rag saturated with water. “Re-wet” the rag and thoroughly cool the valve after each brazing operation of the four joints involved. The wet rag around the reversing valve will eliminate conduction of

heat to the valve body when brazing the line connection.

The use of a wet rag sometimes can be a nuisance. There are commercial grades of heat absorbing paste that may be substituted.

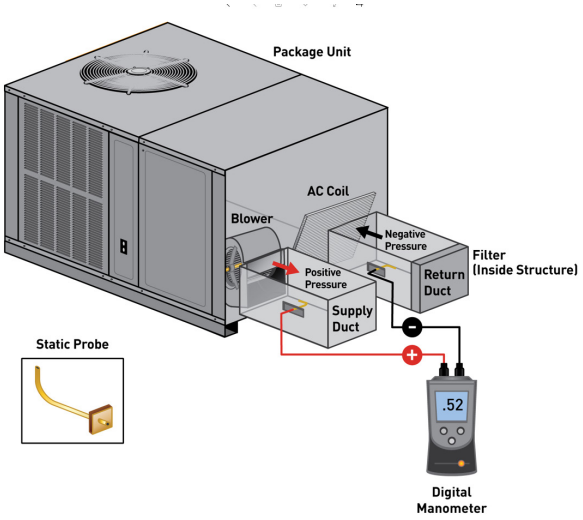
After the valve has been installed, leak test, evacuate and recharge.

Checking External Static Pressure

The minimum and maximum allowable duct static pressure is found in the Technical Information Manual.

Too great of an external static pressure will result in insufficient air that can cause icing of the coil, whereas too much air can cause poor humidity control, and condensate to be pulled off the evaporator coil causing condensate leakage. Too much air can cause motor overloading and in many cases this constitutes a poorly designed system. To determine proper air movement, proceed as follows:

1. Using a digital manometer measure the static pressure of the return duct at the inlet of the unit, (Negative Pressure).



Total External Static

2. Measure the static pressure of the supply duct, (Positive Pressure).
3. Add the two readings together.

NOTE: Both readings may be taken simultaneously and read directly on the manometer if so desired.

4. Consult proper table for quantity of air.

If the external static pressure exceeds the minimum or maximum allowable statics, check for closed dampers, dirty filters, undersized or poorly laid out ductwork.

Adjusting Airflow

The A/GPDM3 models are equipped with EEM motors. EEM motors are constant torque motors with very low power consumption. This motor is energized by 24VAC. Adjust the CFM for the unit by changing the 24VAC leads to the speed terminal block on the motor.

NOTE: Heating airflow must be adjusted to provide the temperature rise shown on rating plate. A higher speed tap may not provide more airflow. Blower speeds are programmed to deliver adequate airflow at rated external static pressure (ESP).

Multi-speed ECM is controlled by three 24V low voltage leads:

T1, T2, and T4.
T1 - Low speed Heating
T2 - High speed Heating
T3 - Low Speed Cooling (optional)
T4 - Medium speed Cooling
T5 - High Speed Cooling (optional)

NOTE: To adjust the blower to high speed, move T4 to T5 in cooling operation

GAS HEATING			COOLING		
Lead Color	Speed Tap	Definition	Lead Color	Speed Tap	Definition
White	T1	Low Speed Heat		T3	Cool/HP Optional Low Speed
Brown	T2	High Speed Heat	Yellow	T4	Cool/HP Speed
				T5	High Static

Checking Temperature Rise

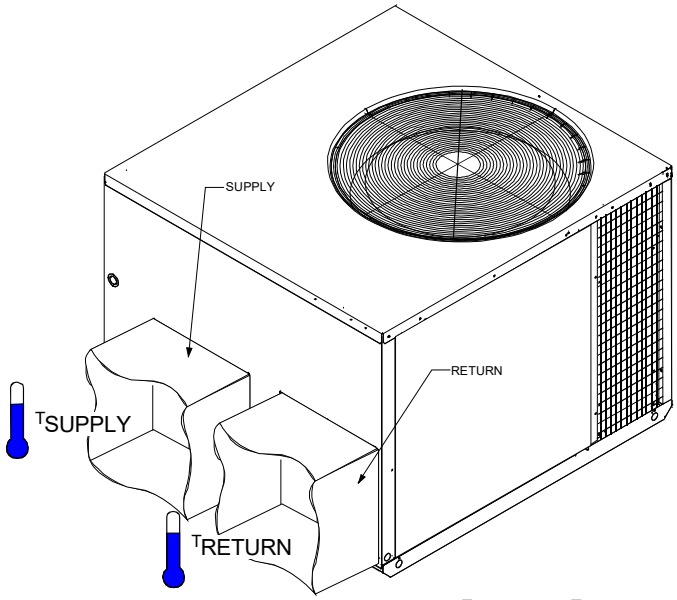
Temperature rise is related to the BTUH output of the unit and the amount of air (CFM) circulated over the indoor coil.

All units are designed for a given range of temperature increase. This is the temperature of the air leaving the unit minus the temperature of the air entering the unit.

The more air (CFM) being delivered through a given unit the less the rise will be; so the less air (CFM) being delivered, the greater the rise. The temperature rise should be adjusted in accordance to a given unit specifications and its external static pressure.

1. Check BTUH input to unit do not exceed input rating stamped on rating plate.
2. Take entering and leaving air temperatures.
3. Select the proper speed tap or dip switch setting for direct drive units.
4. Take motor amperage draw to determine that the motor is not overloaded during adjustments.

SERVICING

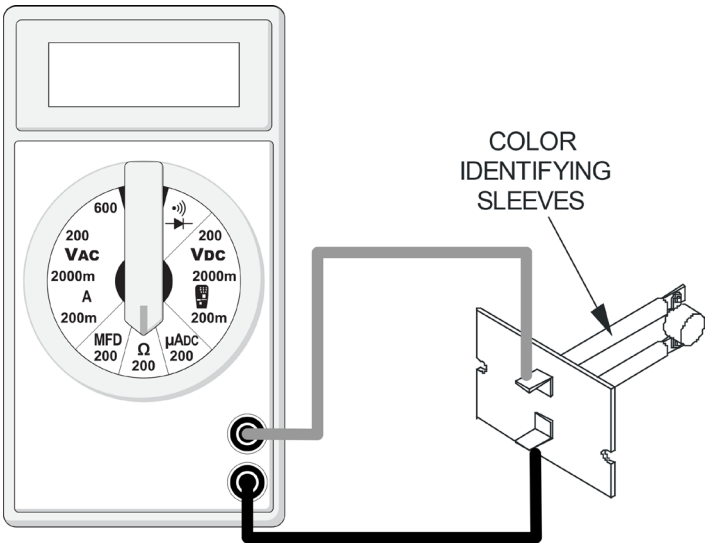


RISE = TSUPPLY -TRETURN

Checking Temperature Rise

Testing Primary Limit Control

APD/GPD units use a snap-disk type primary limit device. Sometimes referred to as “stat on a stick”. The limit setting is fixed and must not be readjusted in the field.



Testing Primary Limit Control

Refer to the specification section to determine the proper limit cutout temperature for the model being serviced.

In all instances the limit control is wired in series with the ignition control.

If the temperature within the furnace should exceed this setting, the control will open, de-energizing the ignition control which in turn will open the electrical circuit to the gas valve.

The control will automatically reset when the temperature within the combustion chamber is sufficiently lowered.

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

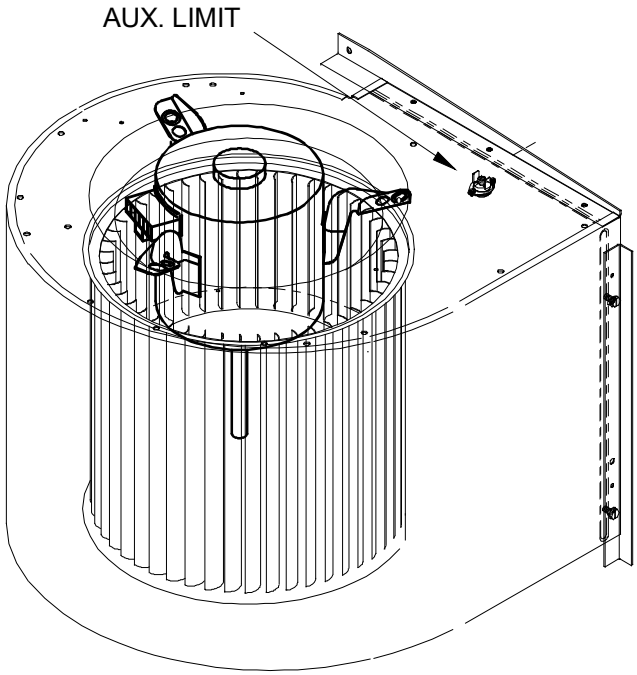
1. Remove electrical power to unit. Some units may have more than one source of power.
2. Remove the wires from the limit control terminals.
3. Using an ohmmeter, test for continuity across the two terminals.
4. If limit test open allow unit to cool and retest.
5. If still open, replace the control.

Testing Auxiliary Limit

The auxiliary limit control is a preset nonadjustable control mounted in the blower compartment area.

It is connected in series with the rollout switch wiring to the gas valve. If its temperature should be exceeded, it will open, interrupting the voltage to the gas valve causing it to open.

An additional limit (primary limit) control is required for safety control of high temperature within the furnace or ductwork.

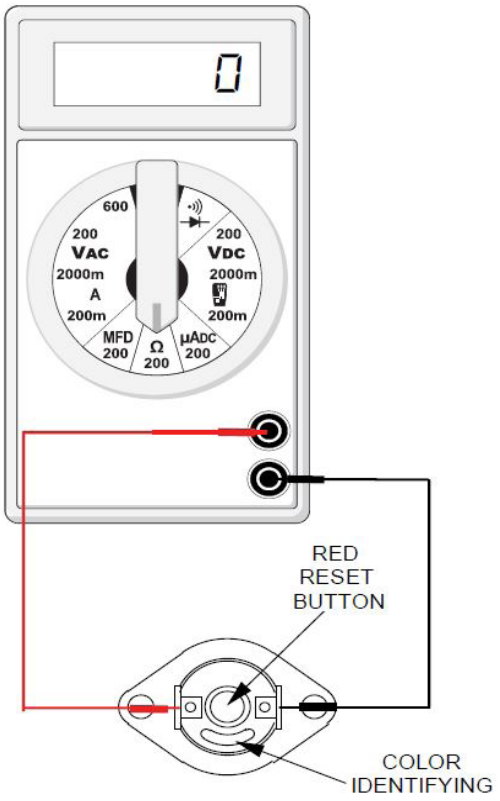


SERVICING

WARNING

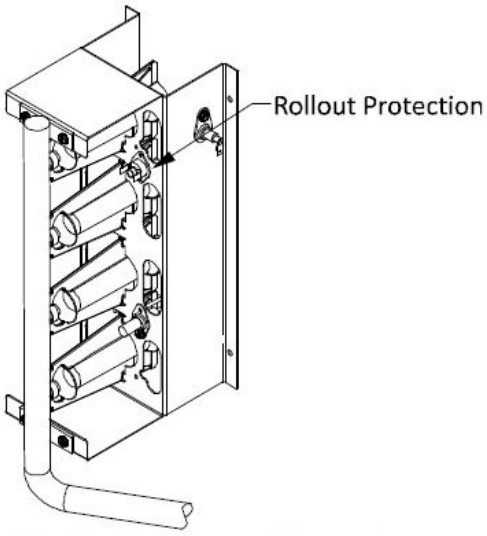
High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

1. Remove the wires from the auxiliary limit control terminals.
2. Using an ohmmeter, test for continuity across the two terminals. No reading indicates the control is open. Push the red reset button, test again - if still open, replace the control.



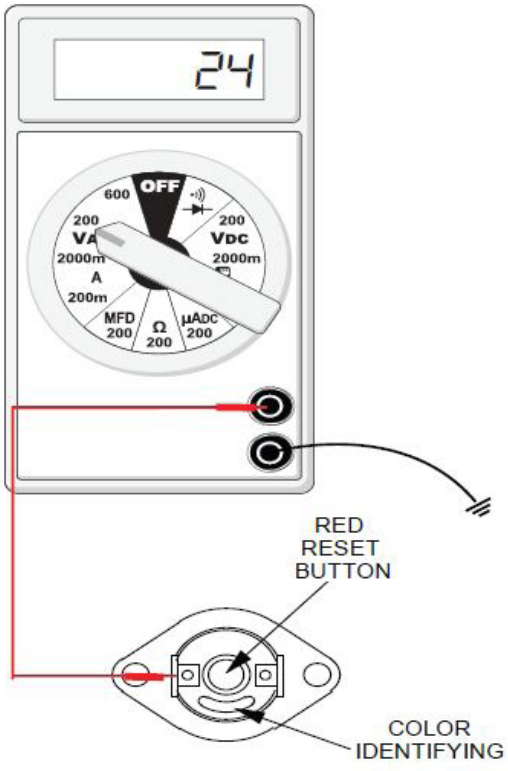
Testing Auxiliary Limit Control

Checking Flame Rollout Switch
A/GPDM3 units are equipped with a temperature-activated manual reset control. This control is mounted to the manifold assembly and is wired in series with the auxiliary limit and gas valve. The control is designed to open should a flame roll out occur. An over firing condition or flame impingement on the heat shield can also cause the control to open.



Rollout Protection on Burner Bracket

If the rollout control has opened, the circuit between the ignition control and gas valve will be interrupted and the ignition control module will go into lockout. The servicer should reset the ignition control by opening and closing the thermostat circuit. The servicer should look for the ignitor sparking which indicates there is power to the ignition control. The servicer should measure the voltage between each side of the rollout control and ground while the ignition control is try to power the gas valve.



Checking Flame Rollout Switch

Limit Switch Operation (Applies to Primary, Auxiliary, and Roll Out Limits) DSI systems.
If a limit switch opens, the indoor blower is energized on heat speed and the induced draft blower is energized. The

SERVICING

LED on the control flashes “4” to indicate an open limit switch. The blower and inducer remain on while the limit switch is open. The gas valve is de-energized. Power to the thermostat “R” is removed while the limit switch is open.

When the limit switch re-closes, the induced draft motor runs through its post purge and the indoor blower goes through the heat off delay.

If a call for heat exists when the limit switch re-closes, the control goes through a pre-purge period and then makes an ignition attempt. The indoor blower remains on (for the delay off time) during the re-ignition attempt.

1. If no voltage is measured on either side of control it indicates ignition control or wiring to control problem.
2. If voltage is measured on one side of the control and not the other, it indicates the control is open.
3. If voltage is measured on both sides of the control the wiring to gas valve or valve is at fault.

Servicing procedure with furnace not firing.

1. Confirm that the outer door was in place and all screws tightened. (No leaks under the door.)
2. Check to see if any damage was done to the furnace especially the wiring.
3. Confirm that heat exchanger is not obstructed by feeling for discharge air from the flue hood when the combustion blower is running but the unit is not firing.

If the above steps do not suggest the reason the control has tripped the furnace should be fired.

1. Remove the heating compartment door.
2. Turn of the power or open the thermostat circuit.
3. Reset the rollout control.
4. Turn power on and put the unit into a call for heating.

CAUTION

Flame rollout could occur. Keep face and hands a safe distance from burner area.

5. Look under the heat shield as the unit is running. Flames should be drawn into firing tubes.
   A. If only one burners flame is not drawn into the tube, that tube is restricted.
   B. If, without the air circulation blower running, all flames are not drawn into the tubes either the collector box, combustion blower, or flue outlet is obstructed. If the combustion blower or flue outlet is obstructed, the pressure switch should have opened preventing the unit from firing, also inspect the unit pressure switch and wiring.
   C. If the burner flame is not drawn into the tube only when the air circulation blower is running, then a cracked heat exchanger tube is present.

Testing Inducer Motor

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

1. Disconnect the motor wire leads from its connection point at integrated ignition control module.
2. Using and ohmmeter, test for continuity between each of the motor leads.
3. Touch one probe of the ohmmeter to the motor frame (ground) and the other probe in turn to each lead.

If the windings do not test continuous or a reading is obtained to ground, replace the motor.

4. After completing check and/or replacement of induced draft blower motor.
5. Turn on electrical power and verify proper unit operation.

Testing Gas Valve

Direct Spark Ignition (DSI) Systems

A combination redundant operator type gas valve which provides all manual and automatic control functions required for gas fired heating equipment is used on single stage models.

A two-stage combination redundant operator type gas valve which provides all manual and automatic control functions required for gas fired heating equipment is used on two stage models.

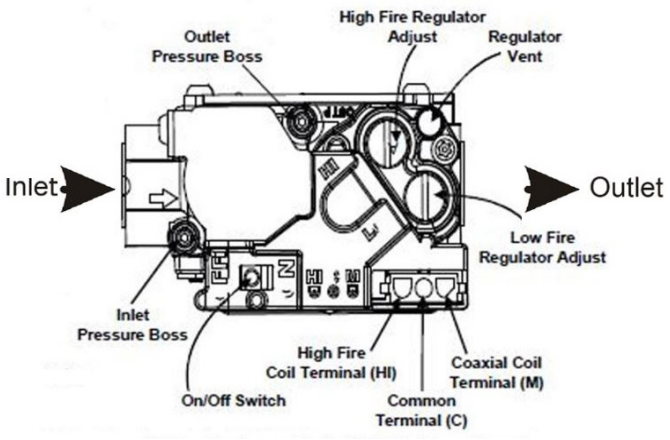
The valve provides control of main burner gas flow, pressure regulation, and 100 percent safety shut-off.

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

1. Ensure gas valve and main gas supply are on.
2. Using a voltmeter, check for 24 volts as noted below for 1- and 2- stage gas valves.
3. If 24 volts are present and no gas flows through the valve, replace valve.

SERVICING

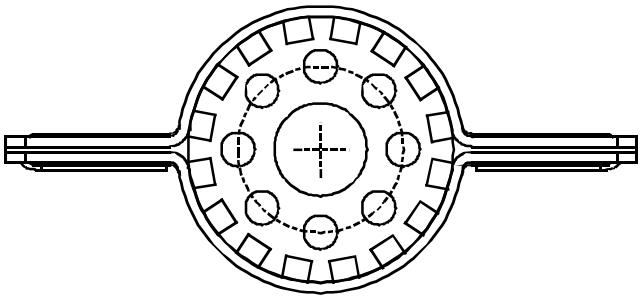


White Rodgers Model 36G54 (Two Stage)

Checking Main Burners

The main burners are used to provide complete combustion of various fuels in a limited space, and transfer this heat of the burning process to the heat exchanger.

Proper ignition, combustion, and extinction are primarily due to burner design, orifice sizing, gas pressure, primary and secondary air, vent and proper seating of burners.



Beckett Burner

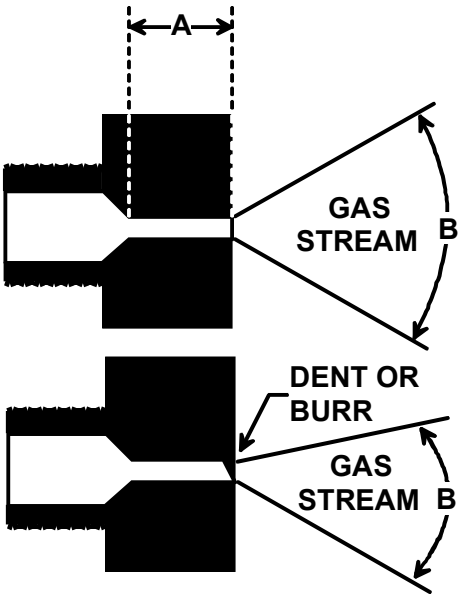
WARNING

Disconnect Gas and electrical power supply.

In checking main burners, look for signs of rust, oversized and undersized carry-over ports restricted with foreign material, etc.

Checking Orifices

A predetermined fixed gas orifice is used in all of these furnaces. That is an orifice which has a fixed bore and position.



The length of Dimension “A” determines the angle of Gas Stream Defraction, “B”.

A dent or burr will cause severe deflection of gas stream.

No resizing should be attempted until all factors are taken into consideration such as inlet manifold gas pressure, alignment, and positioning, specific gravity and BTU content of the gas being consumed.

The only time resizing is required is when a reduction in firing rate is required for an increase in altitude.

Orifices should be treated with care in order to prevent damage. They should be removed and installed with a box-end wrench in order to prevent distortion. In no instance should an orifice be peened over and redrilled. This will change the angle or deflection of the vacuum effect or entraining of primary air, which will make it difficult to adjust the flame properly. This same problem can occur if an orifice spud of a different length is substituted.

WARNING

Disconnect Gas and electrical power supply.

1. Check orifice visually for distortion and/or burrs.
2. Check orifice size with orifice sizing drills.
3. If resizing is required, a new orifice of the same physical size and angle with proper drill size opening should be installed.

Checking Gas Pressure

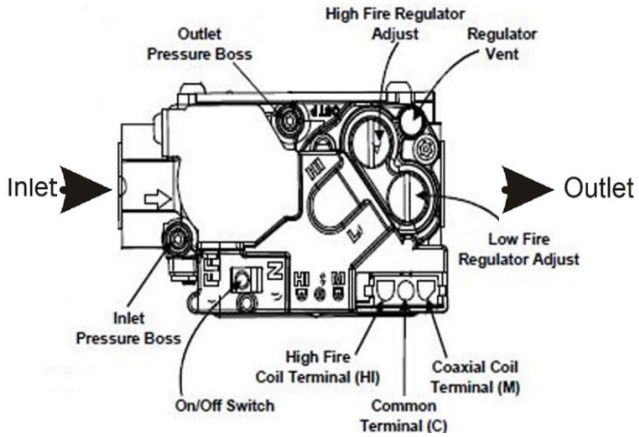
Gas inlet and manifold pressures should be checked and adjusted in accordance to the type of fuel being consumed.

WARNING

Disconnect Gas and electrical power supply.

SERVICING

1. Connect a digital manometer to the inlet pressure fitting of the gas valve.
2. Remove the pressure tap fitting at the manifold if provided or check at the gas valve outlet fitting and connect another manometer or gauge.

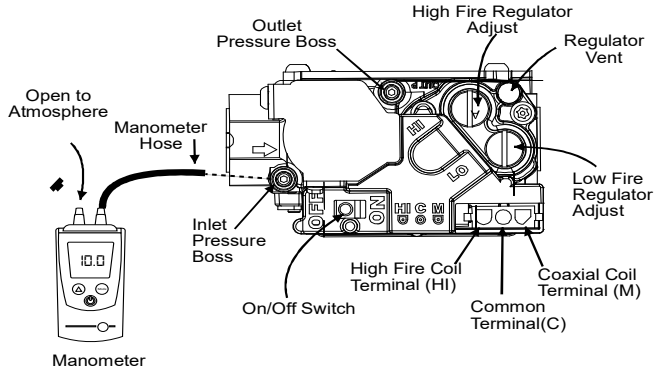


White Rodgers Model 36G54 (Two-Stage)

Measuring Inlet and Manifold Gas Pressure

Gas Inlet Pressure Check

Gas inlet pressure must be checked and adjusted in accordance to the type of fuel being consumed.



White-Rodgers Model 36G54 connected to Manometer

With Power And Gas Off:

1. Back inlet pressure test screw (inlet pressure boss) out one turn (counterclockwise, not more than one turn). Alternately, inlet gas pressure may be measured by removing the cap from the dripleg and installing a predrilled cap with a hose barb fitting. **NOTE:** Use adapter kit #0151K00000S to measure gas pressure on White-Rodgers 36G54 gas valves.
2. Connect a water manometer or adequate gauge to the inlet pressure tap of the gas valve (or hose barb fitting on predrilled cap).

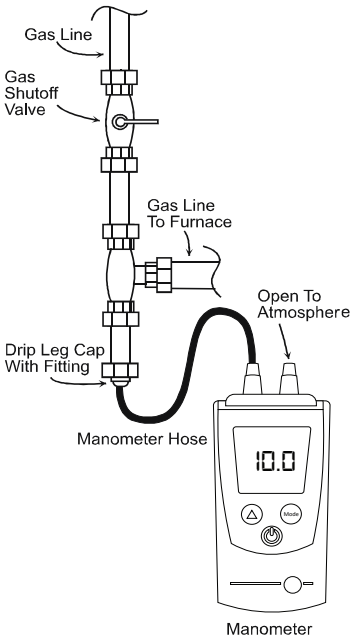
With Power And Gas On:

3. Put unit into heating cycle and turn on all other gas consuming appliances.

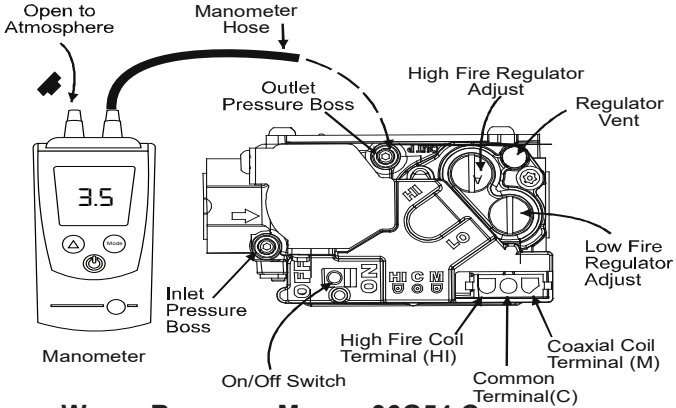
INLET GAS PRESSURE	
Natural	Min 5.0” W.C., Max 10.0” W.C.
Propane	Min 11.0” W.C., Max 13.0” W.C.

NOTE: Inlet Gas Pressure Be Within the Minimum and Maximum Value Shown in the Inlet Gas Pressure chart.

If operating pressures differ from above, make necessary pressure regulator adjustments, check piping size, etc., and/or consult with local utility.



Measuring Inlet Gas Pressure - Alternate Method



White-Rodgers Model 36G54 Connected to Manometer

1. Turn OFF gas to furnace at the manual gas shutoff valve external to the furnace.
2. Turn off all electrical power to the system.
3. Back outlet pressure test screw (outlet pressure boss) out one turn (counterclockwise, not more than one turn).
4. Attach a hose and manometer to the outlet pressure boss of the valve.
5. Turn ON the gas supply.
6. Turn on power and energize main (M) solenoid. Do not energize the HI solenoid.
7. Measure gas manifold pressure with burners firing.

SERVICING

Adjust manifold pressure using the Manifold Gas Pressure table shown below.

Manifold Gas Pressure			
Gas		Range	Nominal
Natural	Low Stage	1.7 -2.3” W.C.	2.0” W.C.
	High Stage	3.2 - 3.8” W.C.	3.5” W.C.
Propane	Low Stage	5.7 - 6.3” W.C.	6.0” W.C.
	High Stage	9.7 - 10.3” W.C.	10.0” W.C.

8. Remove regulator cover screw from the low (LO) outlet pressure regulator adjust tower and turn screw clockwise to increase pressure, or counterclockwise to decrease pressure.
9. Energize main (M) solenoid as well as the HI terminal
10. Remove regulator cover screw from the HI outlet pressure regulator adjust tower and turn screw clockwise to increase pressure, or counterclockwise to decrease pressure.
11. Turn off all electrical power and gas supply to the system.
12. Remove manometer hose from outlet pressure boss.
13. Turn outlet pressure test screw in to seal pressure port (clockwise, 7 in-lb minimum).
14. Turn on electrical power and gas supply to the system.
15. Turn on system power and energize valve.
16. Using a leak detection solution or soap suds, check for leaks at pressure boss screw. Bubbles forming indicate a leak. SHUT OFF GAS AND FIX ALL LEAKS IMMEDIATELY.

NOTE: Use adapter kit #0151K00000S to measure gas pressure on White-Rodgers 36G54 gas valves.

WARNING

LINE VOLTAGE NOW PRESENT

CHECKING FOR DELAYED IGNITION

Delayed ignition is a delay in lighting a combustible mixture of gas and air which has accumulated in the combustion chamber.

When the mixture does ignite, it may explode and/or rollout causing burning in the burner venturi.

If delayed ignition should occur, the following should be checked:

1. Improper gas pressure - adjust to proper pressure.
2. Improper burner positioning - burners should be in locating slots, level front to rear and left to right.
3. Carry over (lighter tube or cross lighter) obstructed - clean.
4. Main burner orifice(s) deformed, or out of alignment to burner - replace.

CHECKING FOR FLASHBACK

Flashback will also cause burning in the burner venturi, but is caused by the burning speed being greater than the gas-air flow velocity coming from a burner port.
Flashback may occur at the moment of ignition, after a burner heats up or when the burner turns off. The latter is known as extinction pop.

Since the end results of flashback and delayed ignition can be the same (burning in the burner venturi) a definite attempt should be made to determine which has occurred.

If flashback should occur, check for the following:

1. Improper gas pressure - adjust to proper pressure.
2. Check burner for proper alignment and/or replace burner.
3. Improper orifice size - check orifice for obstruction.

CHECKING PRESSURE CONTROL

A pressure control device is used to measure negative pressure at the induced draft blower motor inlet to detect a partial or blocked flue.

PRESSURE SWITCH OPERATION (DSI DIRECT SPARK SYSTEM)

The pressure switch is ignored unless there is a call for heat. When the control receives a call for heat, the control checks to see that the pressure switch is open. If the control sees that the pressure switch is closed before the induced draft blower is energized, the LED will flash a code of “2” (to indicate the pressure switch is stuck closed) and the inducer will remain off until the pressure switch opens.

If the pressure switch opens before the ignition period, the induced draft blower will remain on and the control will stay in pre-purge until the pressure switch is closed for an entire 15 second pre-purge period. The LED will flash a code of “3” to indicate open pressure switch.

If the pressure switch opens after the gas valve has been energized, the control will de-energize the gas valve and run the indoor blower through the heat off delay. The inducer stays on until the pressure switch re-closes. Then the control makes another ignition attempt.

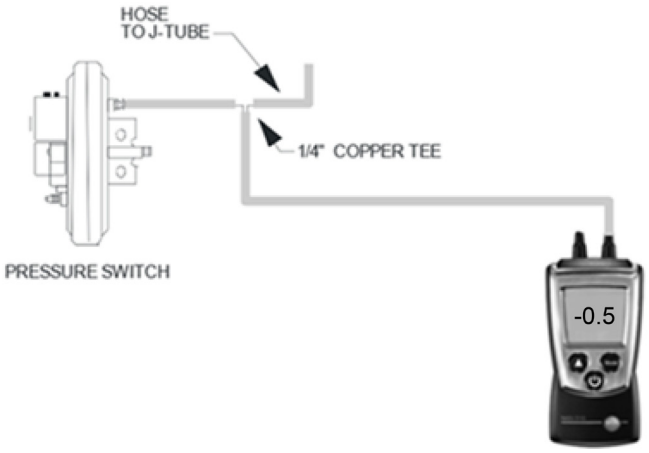
WARNING

HIGH VOLTAGE!
DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

1. Remove wires from the electrical terminals.
2. Using a VOM check from Common to NO (Normally Open) - should read open.
   If switch reads as noted proceed to Step 3, otherwise replace control.

SERVICING

3. Remove the pressure control hose from the control and interconnect with a digital manometer as shown:



Reconnect wires to the Common and NO terminals.

With Power ON:

WARNING

LINE VOLTAGE NOW PRESENT

4. Energize furnace for heating cycle. The induced draft blower motor will begin to run. The manometer should read approximately -1.2" ± 0.3" W.C with no combustion.
5. Remove and check the two electrical wires and using the VOM check from Common to NO (Normally Open), it should read closed (with I.D. motor running). If not as above, replace pressure control.
6. Reconnect all wires to the control and place in heating cycle.
7. As the unit fires on high stage, the manometer negative pressure will drop to -1.0" ± 0.3" W.C.
8. If not as listed, replace control.

NOTE: The pressure switch must be mounted with the diaphragm in a vertical position.

HIGH ALTITUDE APPLICATION
HIGH ALTITUDE DERATE - U.S. INSTALLATIONS ONLY

IMPORTANT NOTE: The gas/electric units naturally derate with altitude. Do not attempt to increase the firing rate by changing orifices or increasing the manifold pressure. This can cause poor combustion and equipment failure. At all altitudes, the manifold pressure must be within 0.3 inches W.C. of that listed on the nameplate for the fuel used. At all altitudes and with either fuel, the air temperature rise must be within the range listed on the unit nameplate. Refer to the Installation Manual provided with the LP kit for conversion from natural gas to propane gas and for altitude adjustments.

When this package unit is installed at high altitude, the appropriate High Altitude orifice kit must be installed. As altitude increases, there is a natural reduction in the density of both the gas fuel and combustion air. This kit will provide the proper design certified input rate within the specified altitude range. High altitude kits are not approved for use in Canada. For installations above 2,000 feet, use kit HA-03. The HA-03 kit is used for both Natural and LP gas at high altitudes.

NOTE: Up to 2,000 feet, no changes are required; above 2,000 feet, refer to the gas/electric package unit specification sheets for required kit(s).

Use LPM-08 (2 stage heat models) propane conversion kit for propane conversions at altitudes below 2000 feet. Natural gas installations below 2000 feet do not require a kit.

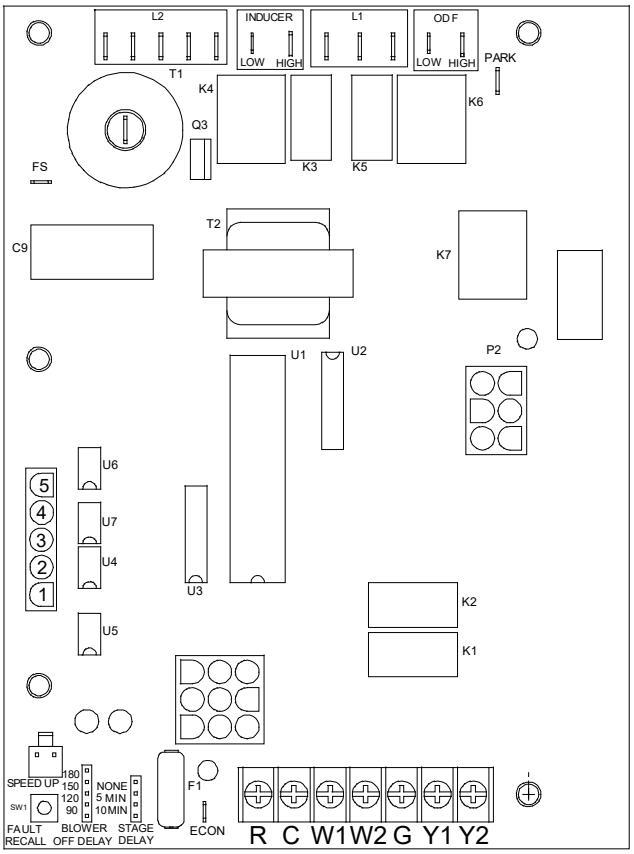
For propane conversions above 2000 feet, high altitude kit HA-03 is required in addtion to the propane conversion kit.

TESTING IGNITION CONTROL MODULE
NOTE: Failure to earth ground the unit, or a high resistance connection in the ground may cause the control to lockout due to failure to flame sense.

WARNING

TO AVOID PERSONAL INJURY OR DEATH DUE TO ELECTRIC SHOCK, WIRING TO THE UNIT MUST BE PROPERLY GROUNDED. DISCONNECT POWER BEFORE INSTALLING OR SERVICING.

SERVICING



PCBAG127 DSI Control Board

Testing Direct Spark Ignition (DSI) Systems PCBAG127 Board

Heating Mode

Indoor thermostat calling for heat (15 second prepurge time and 7 second trial for ignition).

1. Check for 230 volts from L1 terminal of control module to L2. No voltage - check wire connections, continuity, etc.
2. Check for 24 volts at “R” to “C” thermostat terminals.
   A. No voltage - check 3 amp automotive type fuse on control board. A blown fuse could indicate a short in the 24 volt circuit (thermostat or limit circuit).
   B. Voltage Present - check limit and rollout. If limit and rollout are closed, then check for 24 VAC at the gas valve terminals.
   C. No 24 VAC at gas valve - check 9 pin connector and wires from ignition control to gas valve. If wires and connections at 9 pin connector check good, replace ignition control.
   D. Voltage present at gas valve - replace gas valve.

Testing High Stage Heat Operation with Low Stage Heat Operating:

1. Board set for 2 stage thermostat:
   A. Check for 24 Volts at thermostat terminals W2 and C on the control board.
   B. No voltage - check thermostat and thermostat wiring.
   C. Voltage present - check for 24 volts at gas valve terminals C and HI.
   D. No voltage present at valve - check 9 pin connector and wires from ignition control to gas valve. If wires and connections at 9 pin connector check good, replace ignition control.
   E. Voltage present at gas valve - replace gas valve.

2. Board set for 1 stage thermostat:
   A. Wait the selected delay time (either 5 or 10 minutes, depending on jumper setting).
   B. Check for 24 volts at gas valve terminals C and HI.
   C. No voltage present - check 9 pin connector and wires from ignition control to gas valve. If wires and connections at 9 pin connector check good, replace ignition control.
   D. Voltage present at gas valve terminals C and HI - replace valve.

Cooling Mode

Indoor thermostat calling for cool.

1. Check for 230 volts from L1 terminal of control module to L2. No voltage - check wire connections, continuity, etc.
2. Check for 24 volts at R and C thermostat terminals on ignition control.
   A. No voltage - check 3 amp automotive type fuse on control board. A blown fuse could indicate a short in the 24 volt circuit.
   B. Voltage present - proceed to step 3.
3. Check for 24 volts at thermostat terminals C and Y1.
   A. No voltage - check thermostat wiring and thermostat.
   B. Voltage present - check pressure switch circuit. If pressure switch circuit checks closed, proceed to step 4.
4. Check for 24 volts at contactor coil.
   A. No voltage - check 6 pin connector and wires from contactor coil to 6 pin connector on control board. If wires and connector check good, replace control.
   B. Voltage present - replace contactor.

Testing High Stage Cooling Operation with Low Stage Cooling Operating:

1. Board set for 2 stage thermostat:
   A. Check for 24 volts at thermostat terminals C and Y2 on control board.
   B. No voltage - check thermostat and thermostat wiring.
   C. Voltage present - check pressure switch circuit. If pressure switch circuit checks closed, proceed to next step.
   D. Check for 24 volts to compressor unloader solenoid. If no voltage present, check 6

pin connector and wires from compressor unloader solenoid to 6 pin connector on board. If connector and wires check good, replace control.

2. Board set for 1 stage thermostat:
   A. Wait the selected delay time (either 5 or 10 minutes, depending on jumper setting)
   B. Check for 24 volts at compressor unloader solenoid.
   C. No voltage - check 6 pin connector and wires from compressor unloader solenoid to 6 pin connector on board. If connector and wires check good, replace control.

LED Flashes/Status	System Condition
Off	Internal Control Fault, Micro Controller Detected Hardware Failure, or Gas Valve Detected Energized When it Should be De-energized
1	Lockout Due to Excessive Retries
2	Pressure Switch Stuck Open
3	Pressure Switch Stuck Closed
4	Open High Temperature Limit
5	Flame Present Outside the Flame Detect Mode
6	Compressor Short Cycle Delay Active
7	Limit Opened Five Times within the Same Call for Heat
8	Indoor Thermostat/Outdoor Thermostat is Open
9	Pressure Switch/Loss of Charge Switch is Open
Steady ON	Normal

Red LED Fault Codes

LED Flashes/Status	Flame Condition
2	Flame Present Outside the Flame Detect Mode
1	Low Flame Signal Current
Steady ON	Normal Flame
OFF	No Flame Present

Amber LED Flame Status Codes

NOTE: The flash rate is 0.25 seconds on, 0.25 seconds off, with a 2-second pause between codes.

Checking Flame Sensor

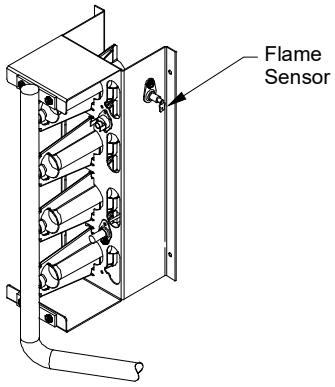
A flame sensing device is used in conjunction with the ignition control module to prove combustion. If a microamp signal is not present the control will de-energize the gas valve and “retry” for ignition or lockout.

DSI Direct Spark Ignition Systems

WARNING

High Voltage!
Disconnect all power before servicing or installing. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death.

1. Disconnect the flame sensor wire from terminal FS of the ignition control module.



Flame Sensor

2. Connect a microamp meter in series with this wire and terminal FS.
3. Be sure the negative side of the meter is to the wire and the positive of the meter is to terminal FS.
4. Turn on Power.

WARNING

Line voltage now present

5. With Power ON, Place the unit into a heating cycle.
6. As soon as flame is established a microamp reading should be evident once proof of flame (microamp reading) is established, the hot surface ignitor will be de-energized.
7. The nominal microamp reading is 4 microamps.
8. If the microamp current is less than 0.5 microamp the control will lockout and flash a code of 1 flash after attempting to reestablish flame sense.
9. If the microamp reading is less than the minimum specified, check for high resistance wiring connections, the distance (3/16”) between the sensor and burner, flame sensor connections, dirty flame sensor or poor grounding.
10. If no reading, check for continuity on all components and if good - replace ignition control module.

NOTE: Contaminated fuel or combustion air can create a nearly invisible coating on the flame sensor. This coating works as an insulator causing a loss in the flame sense signal. If this situation occurs the flame sensor must be cleaned with steel wool. Do not use sand paper, the silicone in sand paper will further contaminate the sensor.

A/GPDM32406041A* - Rise Range: 25° - 55°												
E.S.P	T1 1ST Stage Heating Speed			T2 2nd Stage Heating Speed			T3 Cooling Speed		T4 Cooling Speed		T5 Cooling Speed	
	CFM	WATTS	RISE	CFM	WATTS	RISE	CFM	WATTS	CFM	WATTS	CFM	WATTS
0.1	671	66	50	1069	192	42	859	94	1054	164	1174	220
0.2	614	72	55	1020	200	44	810	102	1007	172	1134	227
0.3	563	79	X	976	206	46	761	109	966	179	1093	233
0.4	499	86	X	936	215	48	713	117	926	186	1050	240
0.5	436	94	X	887	219	51	664	125	884	194	1007	249
0.6	362	99	X	841	226	53	615	133	837	201	963	256
0.7	313	105	X	793	232	X	---	---	788	208	919	262
0.8	251	110	X	745	239	X	---	---	737	216	867	270

A/GPDM33008041A* - Rise Range: 35° - 65°												
E.S.P	T1 1ST Stage Heating Speed			T2 2nd Stage Heating Speed			T3 Cooling Speed		T4 Cooling Speed		T5 Cooling Speed	
	CFM	WATTS	RISE	CFM	WATTS	RISE	CFM	WATTS	CFM	WATTS	CFM	WATTS
0.1	997	147	45	1276	284	47	1059	137	1253	238	1359	317
0.2	965	155	47	1238	284	48	1008	144	1207	245	1326	319
0.3	922	165	49	1206	289	50	956	151	1163	253	1285	331
0.4	886	173	51	1164	302	52	908	158	1118	260	1249	333
0.5	835	182	54	1131	314	53	857	166	1071	268	1211	345
0.6	781	188	58	1086	319	55	784	175	1023	275	1168	348
0.7	731	200	62	1038	319	58	732	180	973	283	1126	360
0.8	677	202	X	984	322	61	673	188	923	290	1082	362

A/GPDM33608041* - Rise Range: High Fire 35° - 65° Low Fire 25° - 55°												
E.S.P	T1 1ST Stage Heating Speed			T2 2nd Stage Heating Speed			T3 Cooling Speed		T4 Cooling Speed		T5 Cooling Speed	
	CFM	WATTS	RISE	CFM	WATTS	RISE	CFM	WATTS	CFM	WATTS	CFM	WATTS
0.1	997	147	45	1276	284	47	1317	230	1390	325	1481	404
0.2	965	155	47	1238	284	48	1269	237	1347	330	1447	410
0.3	922	165	49	1206	289	50	1221	245	1305	339	1410	419
0.4	886	173	51	1164	302	52	1174	253	1263	344	1378	428
0.5	835	182	54	1131	314	53	1126	260	1223	354	1340	439
0.6	781	188	58	1086	319	55	1078	268	1182	358	1304	443
0.7	731	200	62	1038	319	58	1030	276	1138	368	1272	448
0.8	677	202	X	984	322	61	982	283	1091	372	1229	454

X = Outside of Temperature Rise Range - Not Recommended.

A/GPDM34210041A* - Rise Range: 35° - 65°												
E.S.P	T1 1ST Stage Heating Speed			T2 2nd Stage Heating Speed			T3 Cooling Speed		T4 Cooling Speed		T5 Cooling Speed	
	CFM	WATTS	RISE	CFM	WATTS	RISE	CFM	WATTS	CFM	WATTS	CFM	WATTS
0.1	1098	167	51	1423	324	53	1354	260	1535	416	1677	540
0.2	1038	178	54	1375	335	55	1296	267	1489	426	1633	551
0.3	991	184	57	1322	347	57	1237	275	1440	434	1579	555
0.4	932	192	60	1275	347	59	1178	283	1392	440	1537	563
0.5	871	204	65	1224	357	61	1120	291	1342	448	1485	565
0.6	811	213	X	1172	364	64	1061	299	1296	454	1440	577
0.7	753	210	X	1130	379	X	1002	306	1245	463	1390	582
0.8	704	221	X	1075	384	X	944	314	1193	468	1341	578

A/GPDM34810041A* - Rise Range: 35° - 65°												
E.S.P	T1 1ST Stage Heating Speed			T2 2nd Stage Heating Speed			T3 Cooling Speed		T4 Cooling Speed		T5 Cooling Speed	
	CFM	WATTS	RISE	CFM	WATTS	RISE	CFM	WATTS	CFM	WATTS	CFM	WATTS
0.1	1098	167	51	1423	324	53	1164	180	1542	420	1677	540
0.2	1038	178	54	1375	335	55	1100	188	1491	429	1633	551
0.3	991	184	57	1322	347	57	1037	196	1440	435	1579	555
0.4	932	192	60	1275	347	59	974	204	1390	338	1537	563
0.5	871	204	65	1224	357	61	910	212	1341	341	1485	565
0.6	811	213	X	1172	364	64	847	220	1295	343	1440	577
0.7	753	210	X	1130	379	X	784	227	1246	349	1390	582
0.8	704	221	X	1075	384	X	720	235	1195	352	1341	578

X = Outside of Temperature Rise Range - Not Recommended.

TROUBLESHOOTING

DIAGNOSTIC LED - RED	STATUS	CHECK
ON	NORMAL OPERATION	-
OFF	NO POWER OR INTERNAL CONTROL FAULT	CHECK INPUT POWER CHECK FUSE(S) REPLACE CONTROL
1 FLASH	IGNITION FAILURE	GAS FLOW GAS PRESSURE GAS VALVE FLAME SENSOR
2 FLASHES	PRESSURE SWITCH OPEN	CHECK PRESSURE SWITCH CHECK TUBING CHECK VENT MOTOR
3 FLASHES	PRESSURE SWITCH CLOSED WITHOUT INDUCER ON	CHECK PRESSURE SWITCH CHECK WIRING FOR SHORTS
4 FLASHES	OPEN LIMIT SWITCH	CHECK MAIN LIMIT SWITCH CHECK AUXILIARY LIMIT SW. CHECK ROLLOUT LIMIT SW.
5 FLASHES	FALSE FLAME DETECTED	CHECK GAS VALVE CHECK FOR SHORTS IN FLAME SENSOR WIRING
6 FLASHES	COMPR. SHORT CYCLE DELAY	3 MIN COMP. SHORT CYCLE DELAY
7 FLASHES	LIMIT OPEN 5 TIMES IN SAME CALL FOR HEAT	CHECK MAIN LIMIT SWITCH CHECK AUXILIARY LIMIT SW.
8 FLASHES	IDT/ODT OPEN	CHECK JUMPER BETWEEN 1 AND 4 ON 6-CIRCUIT CONNECTOR CHECK OPTIONAL REFRIGERANT SWITCHES
9 FLASHES	PSW/LOC OPEN	CHECK REFRIGERANT SWITCHES FOR LOSS OF CHARGE OR HIGH HEAD PRESSURE

DIAGNOSTIC LED - AMBER	STATUS	CHECK
OFF	NO FLAME PRESENT	-
ON	NORMAL FLAME PRESENT	-
1 FLASH	LOW FLAME SIGNAL	GAS FLOW GAS PRESSURE GAS VALVE FLAME SENSOR
2 FLASHES	FALSE FLAME DETECTED	CHECK GAS VALVE CHECK FOR SHORTS IN FLAME SENSOR WIRING

NOTE:

Fault Recall

The ignition control stores the last 5 faults in memory with the most recent fault indicated first. To retrieve the faults, depress the fault recall button for 2 seconds while in the stand-by mode. To clear the fault memory, depress fault button for 5 seconds but not more than 10 seconds.

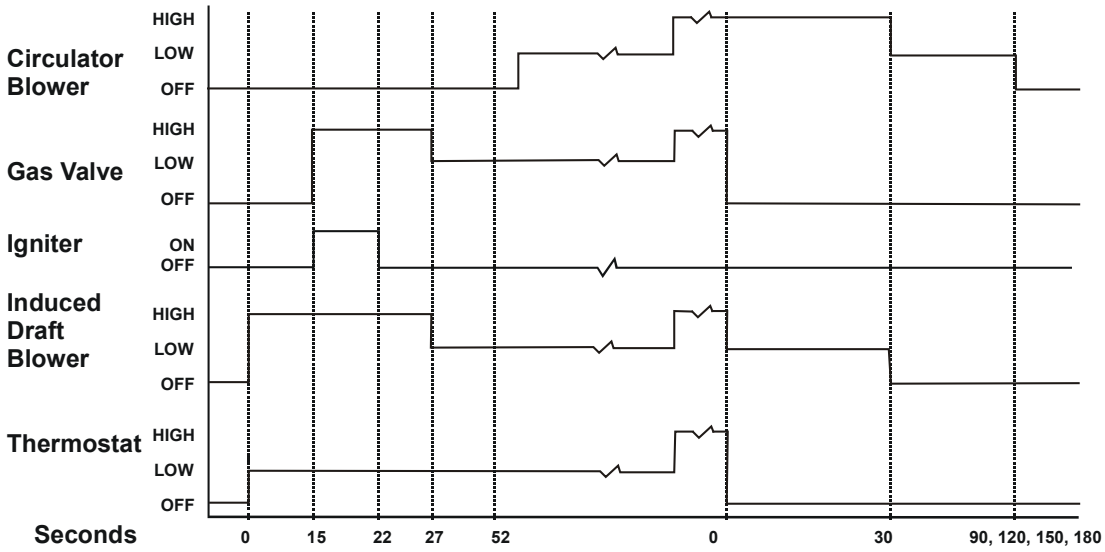
TROUBLESHOOTING

IGNITION CONTROL DIAGNOSTIC INDICATOR CHART

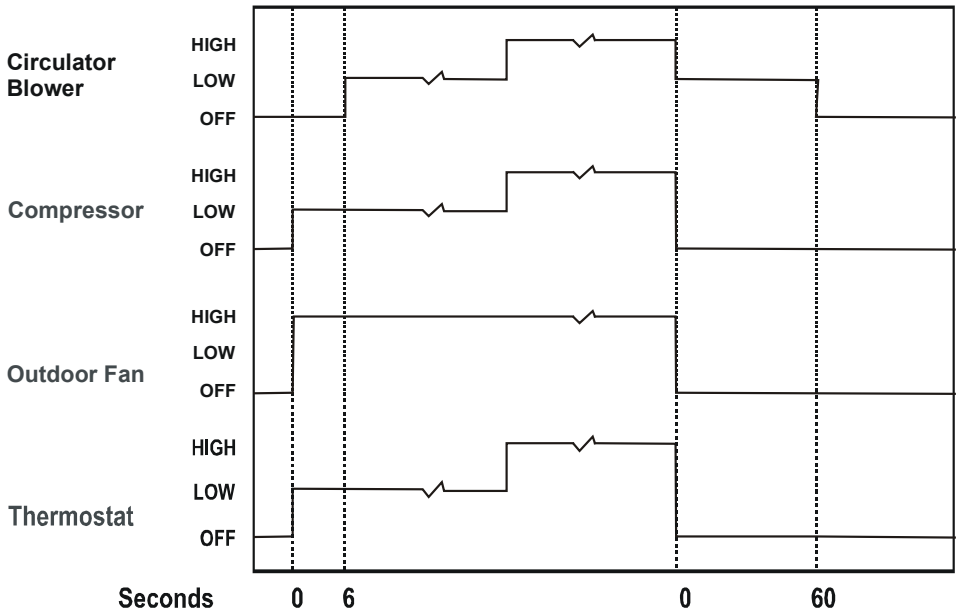
Red Light Signal	Refer to Abnormal Heating or Cooling Operation Sections of this Manual
Off	Internal Control Failure
1 Flash	External Lockout
2 Flashes	Pressure Switch Stuck Open
3 Flashes	Pressure Switch Stuck Closed
4 Flashes	Thermal Protection Device Open
5 Flashes	Flame Detected with Gas Valve Closed
6 Flashes	Short Cycle Compressor Delay (Cooling Only)
7 Flashes	Limit Opened Five (5) Times Within The Same Call For Heat
8 Flashes	Indoor/Outdoor Thermostat Open (Cooling Only; Devices Not present On All Models)
9 Flashes	High Pressure/Loss of Charge Switch Open (Cooling Only; Devices Not Present On All Models)

Amber Light Signal	Refer to Abnormal Heating or Cooling Operation Sections of this Manual
Off	No Flame Present
On	Normal Flame
1 Flash	Low Flame Current
2 Flashes	Flame Detected with Gas Valve De-energized.

HEATING TIMING CHART

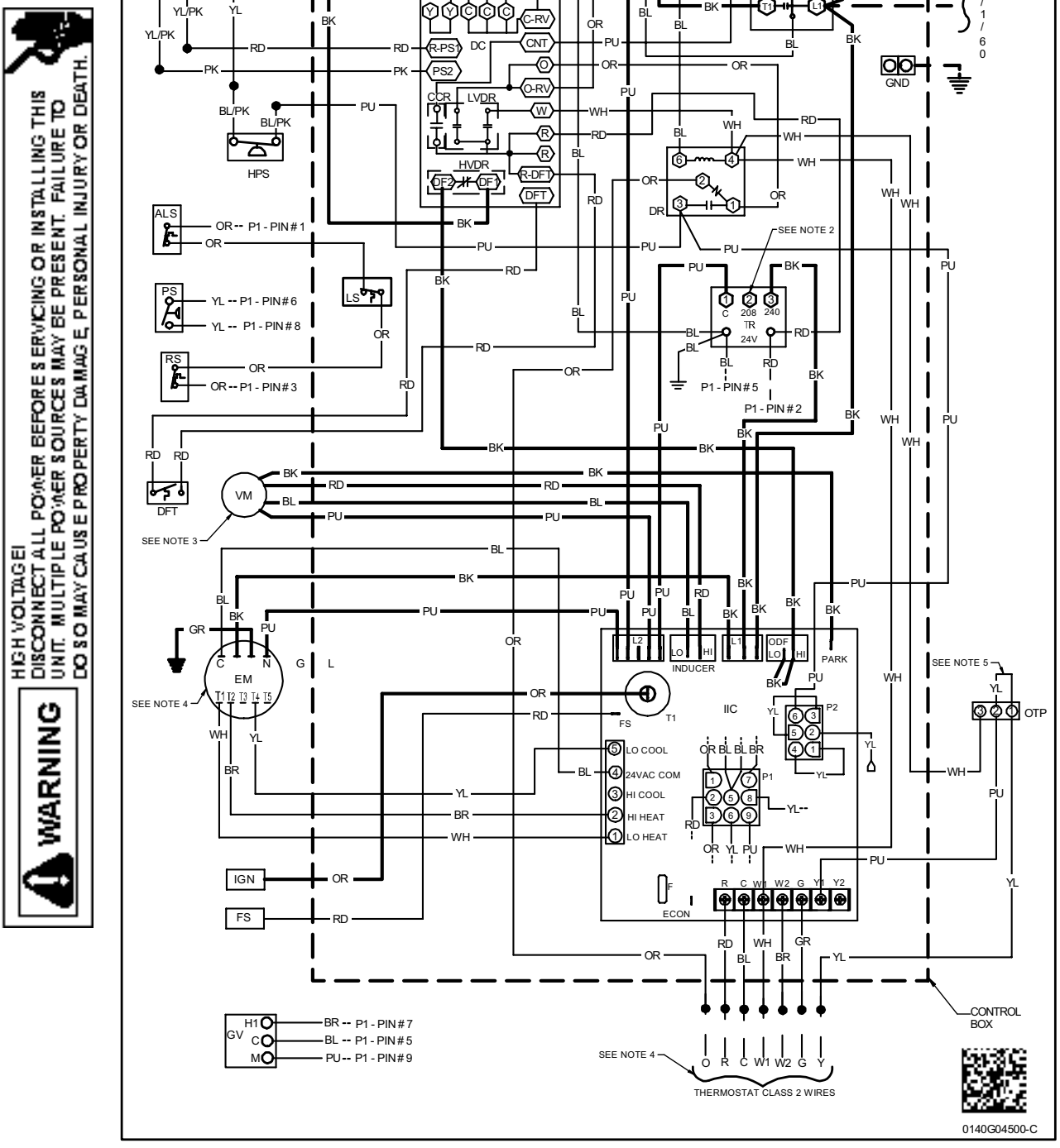


COOLING/HEAT PUMP TIMING CHART



WIRING DIAGRAMS

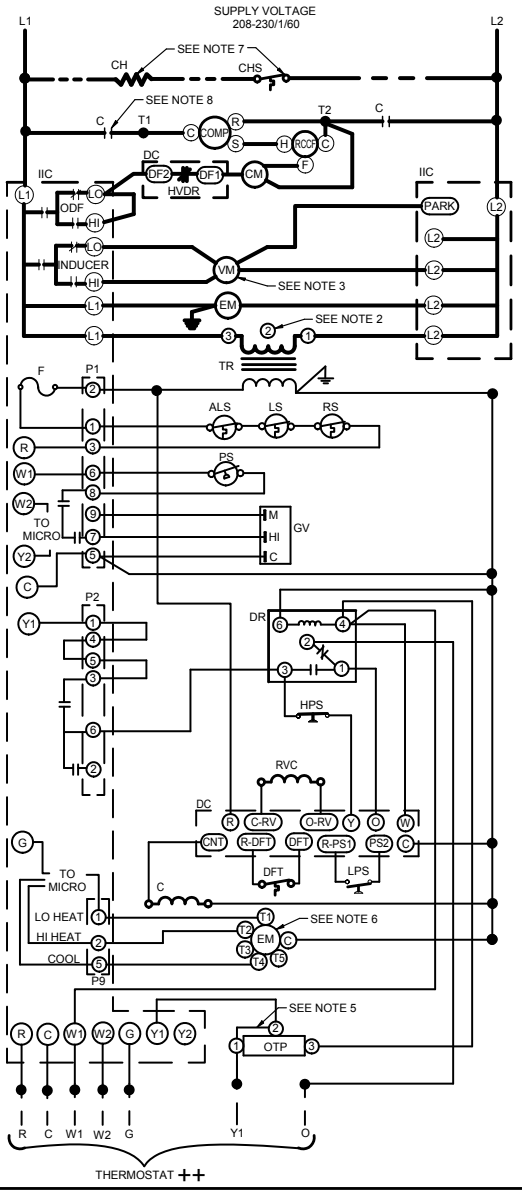
(A/GPDM3[24-48]*41A*)**



Wiring is subject to change. Always refer to the wiring diagram on the unit for the most up-to-date wiring.

WIRING DIAGRAMS

(A/GPDM3[24-48]*41A*)**



COMPONENT LEGEND

ALS	AUXILLARY LIMIT SWITCH
C	CONTACTOR
CH	CRANKCASE HEATER
CHS	CRANKCASE HEATER SWITCH
CM	CONDENSER MOTOR
COMP	COMPRESSOR
DC	DEFROST CONTROL BOARD
DFT	DEFROST THERMOSTAT
DR	DEFROST RELAY
EM	EVAPORATOR MOTOR
F	FUSE
FS	FLAME SENSOR
GND	EQUIPMENT GROUND
GV	GAS VALVE
HPS	HIGH PRESSURE SWITCH
IIC	INTEGRATED IGNITION CONTROL
IGN	IGNITOR
LPS	LOW PRESSURE SWITCH
LS	LIMIT SWITCH
OTP	OUTDOOR THERMOSTAT PLUG
P1	9 PIN CONNECTOR PLUG
P2	6 PIN CONNECTOR PLUG
PS	PRESSURE SWITCH
RCCF	RUN CAPACITOR COMPRESSOR / FAN
RS	ROLLOUT SWITCH
RVC	REVERSING VALVE COIL
TR	TRANSFORMER
VM	VENT MOTOR

FACTORY WIRING
- LINE VOLTAGE
- LOW VOLTAGE
- OPTIONAL HIGH VOLTAGE

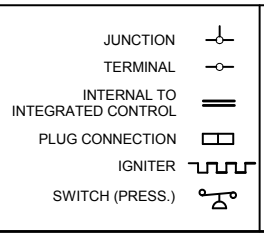
FIELD WIRING
- HIGH VOLTAGE
- LOW VOLTAGE

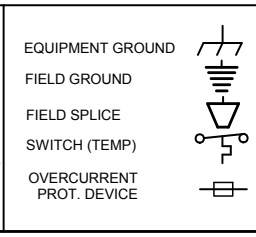
WIRE CODE

BK	BLACK
BL	BLUE
BR	BROWN
GR	GREEN
OR	ORANGE
PK	PINK
PU	PURPLE
RD	RED
WH	WHITE
YL	YELLOW

NOTES

1. REPLACEMENT WIRE MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (AT LEAST 105°C). USE COPPER CONDUCTOR ONLY.
2. FOR 208V TRANSFORMER OPERATION MOVE BLACK WIRE FROM TERMINAL 3 TO TERMINAL 2 ON TRANSFORMER.
3. FOR 208V VENT MOTOR OPERATION, REMOVE BLUE LEAD FROM INDUCER LOW TERMINAL. MOVE BLACK LEAD FROM PARK TERMINAL TO INDUCER LOW TERMINAL, AND PLACE BLUE LEAD ON PARK.
4. USE COPPER CONDUCTORS ONLY.
   ++ USE NEC CLASS 2 WIRE.
5. FOR OUTDOOR THERMOSTAT, REMOVE PLUG FROM HARNESS AND CONNECT PLUG FROM OUTDOOR THERMOSTAT TO HARNESS.
6. TO CHANGE AIRFLOW MOVE YELLOW WIRE (COOLING / HEAT PUMP), WHITE WIRE (LOW STAGE GAS), OR BROWN WIRE (HIGH-STAGE GAS) TO SPEED TAP T1, T2, T3, T4, OR T5 AT EVAPORATOR MOTOR. REFER TO UNIT AIRFLOW TABLES FOR TO DETERMINE THE APPROPRIATE SPEED TAP FOR APPLICATION. UNITS SHIPPED WITH YELLOW, WHITE, AND BROWN ON T4, T1, AND T2 RESPECTIVELY.
7. CRANKCASE HEATER AND CRANKCASE HEATER SWITCH FACTORY EQUIPPED WHEN REQUIRED.
8. DOUBLE POLE CONTACTOR SHOWN. SINGLE POLE CONTACTOR COULD BE FACTORY EQUIPPED AS AN ALTERNATE CONFIGURATION.





DIAGNOSTIC LED - RED	STATUS	CHECK
ON	NORMAL OPERATION	-
OFF	NO POWER OR INTERNAL CONTROL FAULT	CHECK INPUT POWER CHECK FUSE(S) REPLACE CONTROL
1 FLASH	IGNITION FAILURE	GAS FLOW GAS PRESSURE GAS VALVE FLAME SENSOR
2 FLASHES	PRESSURE SWITCH OPEN	CHECK PRESSURE SWITCH CHECK TUBING CHECK VENT MOTOR
3 FLASHES	PRESSURE SWITCH CLOSED WITHOUT INDUCER ON	CHECK PRESSURE SWITCH CHECK WIRING FOR SHORTS
4 FLASHES	OPEN LIMIT SWITCH	CHECK MAIN LIMIT SWITCH CHECK AUXILIARY LIMIT SW. CHECK ROLLOUT LIMIT SW.
5 FLASHES	FALSE FLAME DETECTED	CHECK GAS VALVE CHECK FOR SHORTS IN FLAME SENSOR WIRING
6 FLASHES	COMPR. SHORT CYCLE DELAY	3 MIN COMP. SHORT CYCLE DELAY

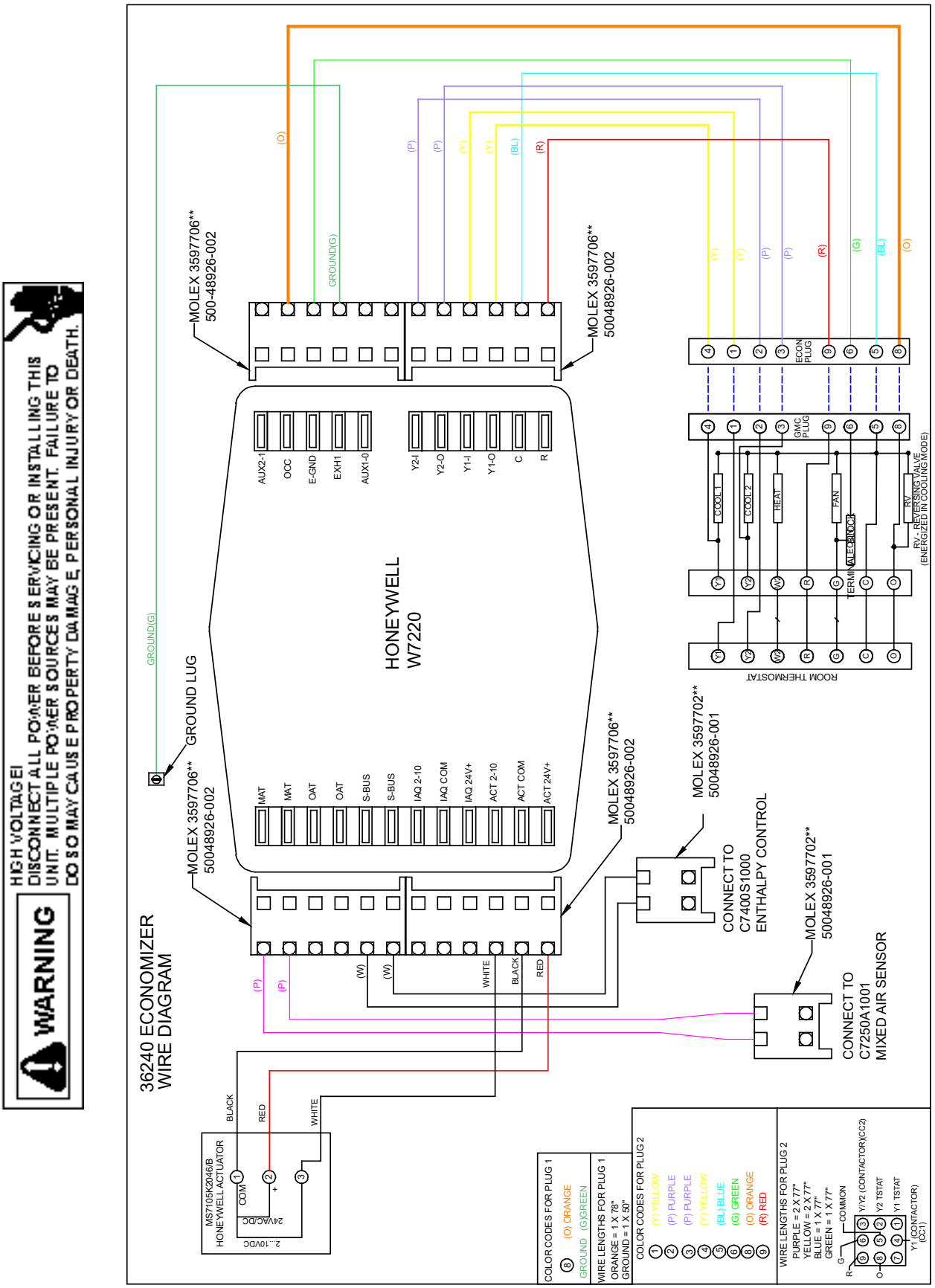
DIAGNOSTIC LED - RED	STATUS	CHECK
7 FLASHES	LIMIT OPEN 5 TIMES IN SAME CALL FOR HEAT	CHECK MAIN LIMIT SWITCH CHECK AUXILIARY LIMIT SW.
8 FLASHES	IDT/ODT OPEN	CHECK JUMPER BETWEEN 1 AND 4 ON 6-CIRCUIT CONNECTOR CHECK OPTIONAL REFRIGERANT SWITCHES
9 FLASHES	PSW/LOC OPEN	CHECK REFRIGERANT SWITCHES FOR LOSS OF CHARGE OR HIGH HEAD PRESSURE

DIAGNOSTIC LED - AMBER	STATUS	CHECK
OFF	NO FLAME PRESENT	-
ON	NORMAL FLAME PRESENT	-
1 FLASH	LOW FLAME SIGNAL	GAS FLOW GAS PRESSURE GAS VALVE FLAME SENSOR
2 FLASHES	FALSE FLAME DETECTED	CHECK GAS VALVE CHECK FOR SHORTS IN FLAME SENSOR WIRING

0140G04501-B

Wiring is subject to change. Always refer to the wiring diagram on the unit for the most up-to-date wiring.

WIRING DIAGRAMS



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CUSTOMER FEEDBACK

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