Service and Troubleshooting

Goodman® Brand GMEC80/GCEC80 & Amana® Brand AMEC80/ACEC80
Two Stage Furnace with multi-speed ECM Motor

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 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 servise the equipment. Improper installation, adjustment, servicing 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.

PROP 65 WARNING
FOR CALIFORNIA CONSUMERS

WARNING

Cancer and Reproductive Harm -
www.P65Warnings.ca.gov

0140M00517-A

TABLE OF CONTENTS

RS6621005r1
June 2020

IMPORTANT INFORMATION

IMPORTANT NOTICES FOR CONSUMERS AND SERVICERS

RECOGNIZE SAFETY SYMBOLS, WORDS AND LABELS

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

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

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

Improper servicing could result in dangerous operation, serious injury, death or property damage.

- **Before servicing, disconnect all electrical power to furnace.**
- **When servicing controls, label all wires prior to disconnecting.**
  Reconnect wires correctly.
- **Verify proper operation after servicing.**

WARNING

FIRE, EXPLOSION OR CARBON MONOXIDE POISONING HAZARD

Failure to replace with proper control could result in fire, explosion or carbon monoxide poisoning.

This appliance uses NEGATIVE PRESSURE REGULATED gas control.

Replace ONLY with the same model number or as specified by the manufacturer.

AVERTISSEMENT

RISQUE D'ÉLECTROCUTION, 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, un fonctionnement dangereux ou des dommages matériels.

Un entretien inadéquat peut entraîner la mort, de graves blessures, un fonctionnement dangereux ou des dommages matériels.

- **Avante de faire l'entretien de l'appareil de chauffage, le débrancher de l'alimentation électrique.**
- **Avant l'entretien des commandes, étiqueter tous les fils avant de les déconnecter. Rebrancher correctement les fils.**
- **Vérifier que l'appareil fonctionne correctement après l'entretien.**

AVERTISSEMENT

RISQUE D'INCENDIE, D'EXPLOSION OU D'INTOXICATION AU MONOXYDE DE CARBONE

Le remplacement de ce dispositif par une commande no conforme risque de provoquer un incendie, un explosion ou une intoxication au monoxyde de carbone.

Cet appareil utilise une commande de gaz À RÉGULATION DE PRESSION NÉGATIVE.

La remplacer UNIQUEMENT par un dispositif portant le même numéro de modèle ou conforme aux spécifications du fabricant.

OUTSIDE THE U.S., **call 1-713-861-2500**.
(Not a technical assistance line for dealers.) Your telephone company will bill you for the call.

IMPORTANT INFORMATION

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.

B. BEFORE OPERATING smell around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

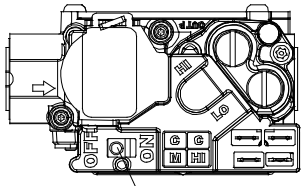
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any telephone in your building.
- Immediately call your supplier from a neighbor's phone. Follow the gas suppliers instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to move the gas control switch or knob. Never use tools. If the gas control switch or knob will not operate, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an automatic ignition system which automatically lights the burners. Do not try to light the burners by hand.
5. Remove control access panel.
6. Move the gas control switch or knob to "OFF".



GAS CONTROL SWITCH SHOWN IN "ON" POSITION

7. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
8. Move the gas control switch or knob to "ON".
9. Replace control access panel.
10. Turn on all electric power to the appliance.
11. Set the thermostat to the desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to its lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove control access panel.
4. Move the gas control switch or knob to "OFF". Do not force.
5. Replace control access panel.

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to the user's information manual provided with this furnace. For assistance or additional information consult a qualified installer, service agency or the gas supplier.

This furnace must be installed in accordance with the manufacturers instructions and local codes. In the absence of local codes, follow the National Fuel Gas Code, ANSI Z223.1.

For indoor installation.

PGB & PGJ
For outdoor installation only.

WARNING: If not installed, operated and maintained in accordance with the manufacturer's instructions, this product could expose you to substances in fuel combustion which can cause death or serious Illness.

This product contains Fiberglass insulation.

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

0140F00001P

IMPORTANT INFORMATION

CONSIGNES DÉ SECURITÉ - LIRE AVANT D'ALLUMER L'APPAREIL

AVERTISSEMENT: Le non-respect des instructions qui suivent peut entraîner un risque d'incendie ou d'explosion causant des dommages, des blessures ou la mort.

A. Cet appareil comporte pas de veilleuse. Il est muni d'un mécanisme qui allume automatiquement le brûleur. N'allumez paz le brûleur manuellement.

B. Sentir tout autour de l'appariel AVANT D'ALLUMER afin de déceler toute fuite de gaz. Assurez-vous de sentir tout près du plancher car certains gaz sont plus lourds que l'air et se déposeront sur le plancher.

SI VOUS SENTEZ UNE ODEUR DE GAZ:

- Ne tentez d'allumer aucun appariel.
- Ne touchez pas aux interrupteurs électriques; n'utiliser aucun téléphone dans l'édifice où vous vous trouvez.
- Appelez immédiatement votre fournisseur de gaz en utilisant le téléphone d'un voisin et suivez les instructions du fournisseur.
- Appelez les pompiers si vous ne parvenez pas à rejoindre votre fournisseur de gaz.

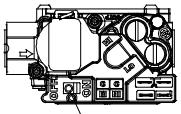
C. N'utiliser que votre main pour pousser ou tourner le commande du gaz. N'utilisez jamais d'outils. Si vous ne parvenez pas à pousser ou à tourner la commande, ne tentez pas de la réparer; appelez un réparateur qualifié. Forcer la commande ou essayer de la réparer peut entraîner un risque d'incendie ou d'explosion.

D. N'utilisez pas cet appareil si l'une de ses parties a été dans l'eau. Si cela se produit, demandez immédiatement à un réparateur qualifié d'inspecter l'appareil et de remplacer toute pièce du systeme de contrôle et toute commande de gaz ayant été dans l'eau.

0140F00002P

INSTRUCTIONS DE SERVICE

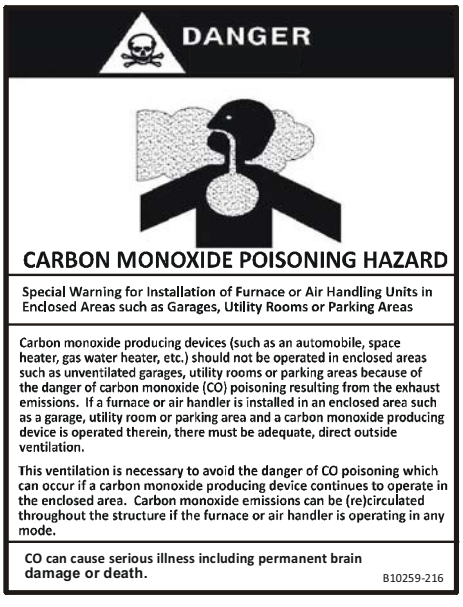
1. UN INSTANT! Lisez d'abord les consignes de sécurité ci-dessus.
2. Réglez le thermostat à son point le plus bas.
3. Coupez l'alimentation électrique de l'appareil.
4. Cet appareil est muni d'un mécanisme qui allume automatiquement le brûleur. Ne tentez pas d'allumer le brûleur manuellement.
5. Retirez le panneau d'accès de la commande.
6. Mettez la commande de gaz à la position ARRÊT ("OFF").
7. Attendez cinq (5) minutes afin de permettre à tout gaz présent d'être évacué. Si vous sentez une odeur de gaz à ce moment, ARRETÊZ! et suivez les consignes de sécurité données au paragraphe B ci-dessus. Si vous ne sentez pas de gaz, passez à l'étape suivante.
8. Mettez la commande de gaz à la position MARCHE ("ON").
9. Remettez la panneau d'accès de la commande en place.
10. Rétablissez l'alimenation électrique de l'appareil.
11. Réglez le thermostat à le température désirée.
12. Si l'appareil ne fonctionne pas, suivez les instructions intituleés "Arrêt du gaz" et appelez un réparateur qualifie ou votre fournisseur de gaz.



Commande de gaz en position "MARCHE"

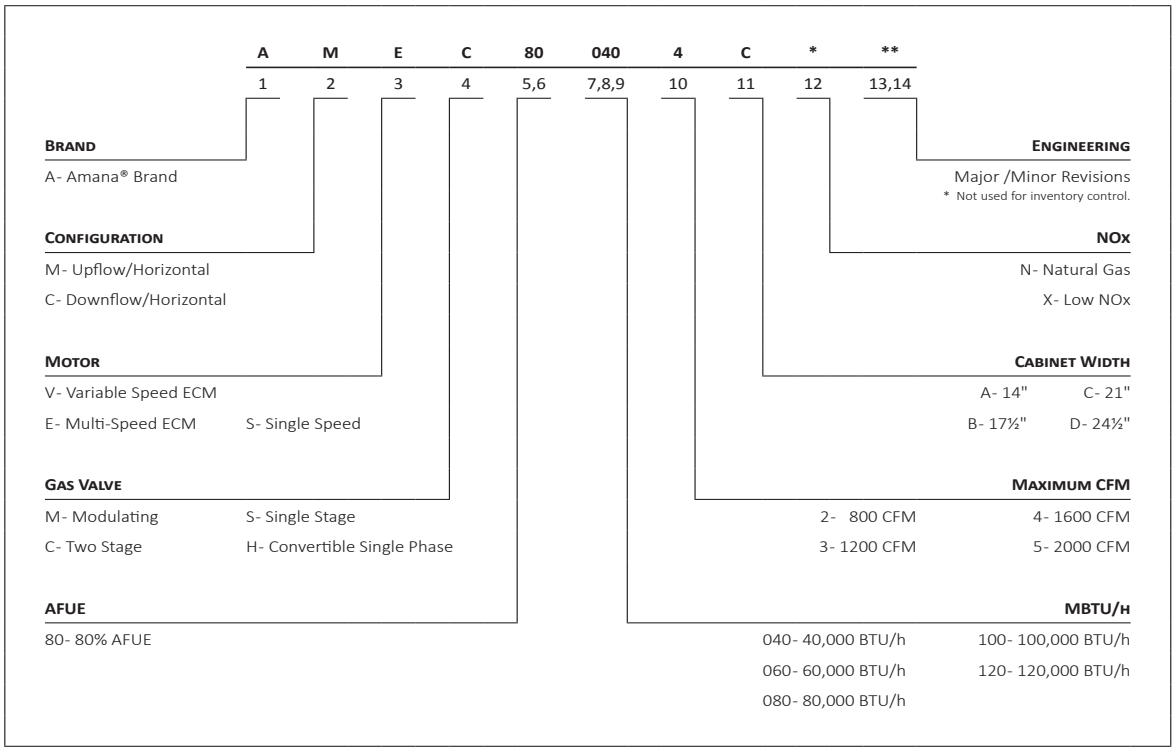
ARRÊT DU GAZ

1. Réglez le thermostat à son point le plus bas.
2. Coupez l'alimentation électrique de l'appareil si vous devez effectuer un entretien.
3. Retirez le panneau d'accès de la commande.
4. Mettez la commande de gaz à la position ARRÊT ("OFF").
5. Remettez le panneau d'accès de la commande en place.



PRODUCT IDENTIFICATION NOMENCLATURE

The model and manufacturing number are used for positive identification of component parts used in manufacturing. Please use these numbers when requesting service or parts information.



SYSTEM OPERATION

⚠ WARNING

IF THE INFORMATION IN THESE INSTRUCTIONS IS NOT FOLLOWED EXACTLY, A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

– DO NOT STORE OR USE GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN THE VICINITY OF THIS OR ANY OTHER APPLIANCE.

– **WHAT TO DO IF YOU SMELL GAS**:

- DO NOT TRY TO LIGHT ANY APPLIANCE.
- DO NOT TOUCH ANY ELECTRICAL SWITCH; DO NOT USE ANY PHONE IN YOUR BUILDING.
- IMMEDIATELY CALL YOUR GAS SUPPLIER FROM A NEIGHBOR'S PHONE. FOLLOW THE GAS SUPPLIER'S INSTRUCTIONS.
- IF YOU CANNOT REACH YOUR GAS SUPPLIER, CALL THE FIRE DEPARTMENT.

– INSTALLATION AND SERVICE MUST BE PERFORMED BY A QUALIFIED INSTALLER, SERVICE AGENCY OR THE GAS SUPPLIER.

ELECTRICAL CONNECTIONS

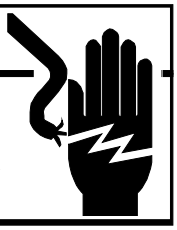
⚠ WARNING

TO AVOID THE RISK OF ELECTRICAL SHOCK, WIRING TO THE UNIT MUST BE PROPERLY POLARIZED AND GROUNDED.

⚠ 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.



⚠ CAUTION

LABEL ALL WIRES PRIOR TO DISCONNECTION WHEN SERVICING CONTROLS. WIRING ERRORS CAN COUSE IMPROPER AND DANGEROUS OPERATION. VERIFY PROPER OPERATION AFTER SERVICING.

WIRING HARNESS

The wiring harness is an integral part of this furnace. Field alteration to comply with electrical codes should not be required. Wires are color coded for identification purposes. Refer to the wiring diagram for wire routings. If any of the original wire as supplied with the furnace must be replaced, it must be replaced with wiring material having a temperature rating of at least 105° C. Any replacement wiring must be copper conductor.

115 VOLT LINE CONNECTIONS

Before proceeding with electrical connections, ensure that the supply voltage, frequency, and phase correspond to that specified on the unit rating plate. Power supply to the furnace must be N.E.C. Class 1, and must comply with all applicable codes. The furnace must be electrically grounded in accordance with local codes or, in their absence, with the latest edition of The National Electric Code, ANSI NFPA 70 and/or The Canadian Electric Code CSA C22.1.

An electrical disconnect must be provided at the furnace location.

NOTE: Line polarity must be observed when making field connections.

Connect hot, neutral, and ground wires as shown in the wiring diagram located on the unit's blower door. Line polarity must be observed when making field connections. Line voltage connections can be made through either the right or left side panel.

The furnace is shipped configured for a right side (left side for counterflow) electrical connection with the junction box located inside the burner compartment. To make electrical connections through the opposite side of the furnace, the junction box must be relocated to the other side of the burner compartment prior to making electrical connections.

⚠ CAUTION

EDGES OF SHEET METAL HOLES MAY BE SHARP. USE GLOVES AS PRECAUTION WHEN REMOVING HOLE PLUGS.

N**OTE:** Wire routing must not interfere with circulator blower operation, filter removal, or routine maintenance.

⚠ WARNING

TO AVOID THE RISK OF ELECTRICAL SHOCK, INJURY, OR DEATH, THE FURNACE MUST BE ELECTRICALLY GROUNDED IN ACCORDANCE WITH LOCAL CODES OR, IN THEIR ABSENCE, WITH THE LATEST EDITION OF THE NATIONAL ELECTRIC CODE.

115 VOLT LINE CONNECTION OF ACCESSORIES (ELECTRONIC AIR CLEANER)

⚠ WARNING

HIGH VOLTAGE

DISCONNECT ALL POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

ACCESSORY LOAD SPECIFICATIONS	
Electronic Air Cleaner	1.0 Amp maximum at 120 VAC
Humidifier	1.0 Amp maximum at 24 VAC

Turn OFF power to the furnace before installing any accessories. Follow the humidifier or air cleaner manufacturers' instructions for locating, mounting, grounding, and controlling these accessories.

If it is necessary for the installer to supply additional line voltage wiring to the inside of the furnace, the wiring must conform to all local codes, and have a minimum temperature rating of 105°C. All line voltage wire splices must be made inside the furnace junction box.

SYSTEM OPERATION

The integrated control module electronic air cleaner terminals (EAC) are energized with 115 volts whenever the circulator blower is energized.

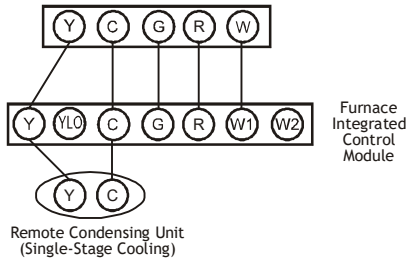
24 VOLT THERMOSTAT WIRING

NOTE: Low voltage connections can be made through either the right or left side panel. Wire routing must not interfere with circulator blower operation, filter removal, or routine maintenance.

A 40 V.A. transformer and an integrated electronic control are built into the furnace to allow use with most cooling equipment. Consult the wiring diagram located in this manual, the installation manual, or on the blower door for further details of 115 Volt and 24 Volt wiring.

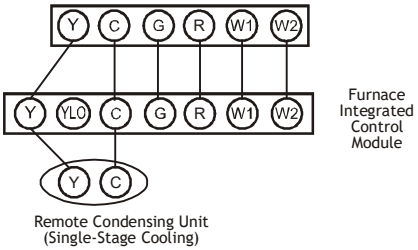
THERMOSTAT WIRING

The *MEC80 furnace has W1 & W2 terminals for connection of a two stage heating thermostat. If desired, a thermostat with only one stage of heat may be used. As shipped, the furnace S1-1 switch is OFF; S1-2 switch is ON. This is the correct position to use a single stage heating thermostat with auto timing transition to high fire.

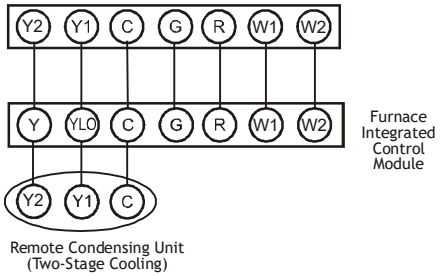


Thermostat - Single -Stage Heating with Single-Stage Cooling

NOTE: **To apply a single-stage Heating Thermostat, the thermostat selector switch on the Integrated Control Module *must* be set on single-stage.**



Thermostat - Two-Stage Heating with Single-Stage Cooling



Thermostat - Two-Stage Heating with Two-Stage Cooling

Thermostat Wiring Diagrams

Single-Stage Heating Thermostat Application

A single-stage thermostat with only one heating stage may be used to control this furnace. The application of a single-stage thermostat offers a *timed* transition from low to high fire. The furnace will run on low stage for a fixed period of time before stepping up to high stage to satisfy the thermostat's call for heat. The delay period prior to stepping up can be set at either a fixed 10 or 20 minute time delay or a load based variable time between 1 and 12 minutes (AUTO mode). If the AUTO mode is selected, the control averages the cycle times of the previous three cycles and uses the average to determine the time to transition from low stage to high stage.

Staging and Blower Off Delay Dip Switches PCBBF139

Purpose	Switch Group	Function	Dip Switch			
			1	2	3	4
Thermostat setup	S3	2 Stage Stat	OFF	OFF		
		1 Stg Stat 10 min delay	ON	OFF		
		1 Stg Stat 20 min delay	ON	ON		
		Auto	Off*	ON*		
Heating Fan Off Delay	S3	90			OFF	OFF
		120			OFF	ON
		150			ON*	OFF*
		180			ON	ON

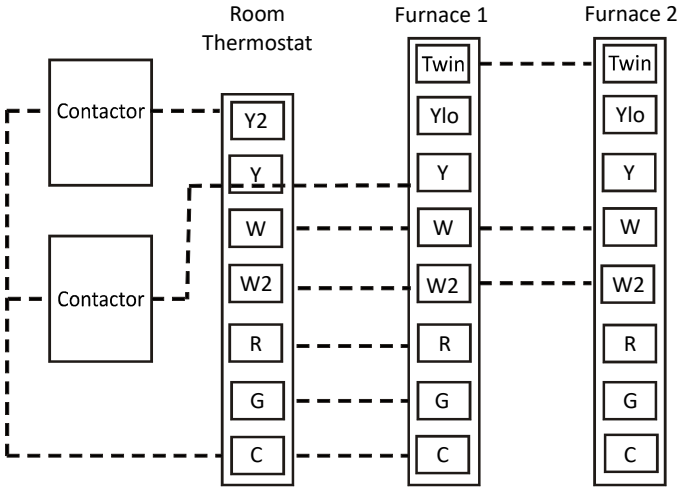
*Factory Setting

Twinning

Using the "TWIN" terminals and proper wiring enables two *MEC80 furnaces of the same model and size to be twinned. Twinning allows simultaneous operation of two furnaces and forces the indoor blower motors of each furnace to operate synchronously into a common duct system. Using the twinning function will require only field installed wiring with no external kits or parts.

- · The staging DIP switches and speed tap DIP switches must be set the same on both furnaces.

NOTE: Each furnace must be connected to its own 115 VAC power supply. The L1 connection toeach furnace must be in phase (connected to circuit breakers on the same 115 VAC service panel phase leg). To verify that the furnaces are in phase, check from L1 to L1 on each furnace with a voltmeter. If the furnaces are in phase, the voltage between both furnaces will be **ZERO**.



SYSTEM OPERATION

CIRCULATOR BLOWER SPEED ADJUSTMENT

⚠ WARNING

HIGH VOLTAGE
DISCONNECT ALL POWER BEFOR CHANGING SPEED TAPS.
MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

This furnace is equipped with a multi-speed ECM motor. Two wiring harnesses connect the motor to the integrated control board and furnace power supply. The line voltage (115 VAC) power supply to the motor is constant and not switched by the control board. Motor operation is also dependent on a 24 VDC signal on one of the four speed taps on the motor. The airflow tables for heating and cooling speeds show the relationship between airflow (CFM) and external static pressure for each size furnace.

⚠ WARNING

TO AVOID PERSONAL INJURY OR DEATH DUE TO ELECTRICAL SHOCK, TURN OFF POWER TO THE FURNACE BEFORE CHANGING SPEED TAPS.

Circulator Blower Speed

1. Motor speed Tap wiring must remain in factory position on the control board and motor.
2. There are 4 speed Tap wires to the motor T1, T2, T3, T4.
3. There are 5 speeds available, depending on DIP switch settings and found in air flow table for each size furnace.
4. Heating input (W1/ W2) always has priority over all other thermostat input.
5. Cooling input (YLo/ Y) has priority over continuous fan input.
6. Continuous fan input (G) has lowest priority.

****The blower speed wiring connections must remain in factory position***.

1. Refer to the air flow table for your specific model furnace.
2. If a cooling or heat pump condensing unit is being used in conjunction with this furnace, the three DIP switches in S2 are used to select the proper cooling speeds to match the outdoor unit size. Typical CFM requirements are 400 CFM / Ton.
3. Turn OFF power to the furnace.
4. Select the cooling blower speeds that match the installation requirements from the airflow table in this manual or the Installation Manual, If factory cooling speeds do not match the installation requirements, the dip switch settings must be changed from factory position
5. Turn ON power to furnace.
6. Verify proper temperature rise in heat modes and CFM in cooling modes

CIRCULATING AIR AND FILTERS

DUCTWORK - AIR FLOW

Duct systems and register sizes must be properly designed for the C.F.M. and external static pressure rating of the furnace. Ductwork should be designed in accordance with the recommended methods of “Air Conditioning Contractors of America” manual D.

A duct system should be installed in accordance with Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating and Ventilating Systems, Pamphlets No. 90A and 90B.

A return air filter is not supplied with the furnace. The installer must supply a means of filtering all of the return air. Filter(s) shall comply with UL900 or CAN/ULC-S111 Standards. If the furnace is installed without filters, and is not covered by the warranty.

Upflow furnaces with air delivery of less than 1800 CFM:

Use one side return or one bottom return ductwork connection.

Upflow furnaces with air delivery of 1800 CFM or higher:

Use two side returns or one side return and one bottom return connection.

Counterflow Furnaces must have a return air duct connection attached to the end of the furnace (top of the furnace when installed vertically) whether the furnace is installed vertically of horizontally. Filters must be installed externally to the furnace cabinet, in the return air plenum or centrally located.

Guide dimples locate the side and bottom return cutout locations. Use a straight edge to scribe lines connecting the dimples. Cut out the opening on these lines. An undersized opening will cause reduced airflow. For bottom return connection, remove the bottom of the cabinet before setting the furnace on the raised platform or return air duct.

A closed return duct system must be used, with the return duct connected to the furnace. ***NOTE:*** *Ductwork must never be attached to the back of the furnace.* Supply and return connections to the furnace may be made with flexible joints to reduce noise transmission, if desired. If a central return is used, a connecting duct must be installed between the unit and the utility room wall so the blower will not interfere with combustion air or draft. The room, closet, or alcove must not be used as a return air chamber.

When the furnace is used in connection with a cooling unit, the furnace should be installed in parallel with or on the upstream side of the cooling unit to avoid condensation in the heating element. With a parallel flow arrangement, the dampers or other means used to control the flow of air must be adequate to prevent chilled air from entering the furnace and, if manually operated, must be equipped with means to prevent operation of either unit unless the damper is in the full heat or cool position.

When the furnace is heating, the temperature of the return air entering the furnace must be between **55°F** and **100°F**

SYSTEM OPERATION

⚠ WARNING

TO AVOID PERSONAL INJURY OR DEATH DUE TO ELECTRICAL SHOCK, TURN OFF POWER TO THE FURNACE BEFORE CHANGING SPEED TAPS.

Circulator Blower Speed Facts

1. Motor speed Tap wiring must remain in factory position on the control board and motor.
2. There are 4 speed Tap wires to the motor T1, T2, T3, T4.
3. There are 5 speeds available, depending on DIP switch settings and found in air flow table for each size furnace.
4. Heating input (W1/ W2) always has priority over all other thermostat input.
5. Cooling input (YLo/ Y) has priority over continuous fan input.
6. Continuous fan input (G) has lowest priority.

****The blower speed wiring connections must remain in factory position***.

1. Refer to the air flow table for your specific model furnace.
2. If a cooling or heat pump condensing unit is being used in conjunction with this furnace, the three DIP switches in S2 are used to select the proper cooling speeds to match the outdoor unit size. Typical CFM requirements are 400 CFM / Ton.

1. Turn OFF power to the furnace.
2. Select the cooling blower speeds that match the installation requirements from the airflow table in this manual or the Installation Manual, If factory cooling speeds do not match the installation requirements, the dip switch settings must be changed from factory position
3. Turn ON power to furnace.
4. Verify proper temperature rise in heat modes and CFM in cooling modes

CIRCULATING AIR AND FILTERS

DUCTWORK - AIR FLOW

Duct systems and register sizes must be properly designed for the C.F.M. and external static pressure rating of the furnace. Ductwork should be designed in accordance with the recommended methods of “Air Conditioning Contractors of America” manual D.

A duct system should be installed in accordance with Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating and Ventilating Systems, Pamphlets No. 90A and 90B.

A return air filter is not supplied with the furnace. The installer must supply a means of filtering all of the return air. Filter(s) shall comply with UL900 or CAN/ULC-S111 Standards. If the furnace is installed without filters, and is not covered by the warranty.

Upflow furnaces with air delivery of less than 1800 CFM:

Use one side return or one bottom return ductwork connection.

Upflow furnaces with air delivery of 1800 CFM or higher:

Use two side returns or one side return and one bottom return connection.

Guide dimples locate the side and bottom return cutout locations. Use a straight edge to scribe lines connecting the dimples. Cut out the opening on these lines. An undersized opening will cause reduced airflow. For bottom return connection, remove the bottom of the cabinet before setting the furnace on the raised platform or return air duct.

A closed return duct system must be used, with the return duct connected to the furnace. ***NOTE:*** *Ductwork must never be attached to the back of the furnace.* Supply and return connections to the furnace may be made with flexible joints to reduce noise transmission, if desired. If a central return is used, a connecting duct must be installed between the unit and the utility room wall so the blower will not interfere with combustion air or draft. The room, closet, or alcove must not be used as a return air chamber.

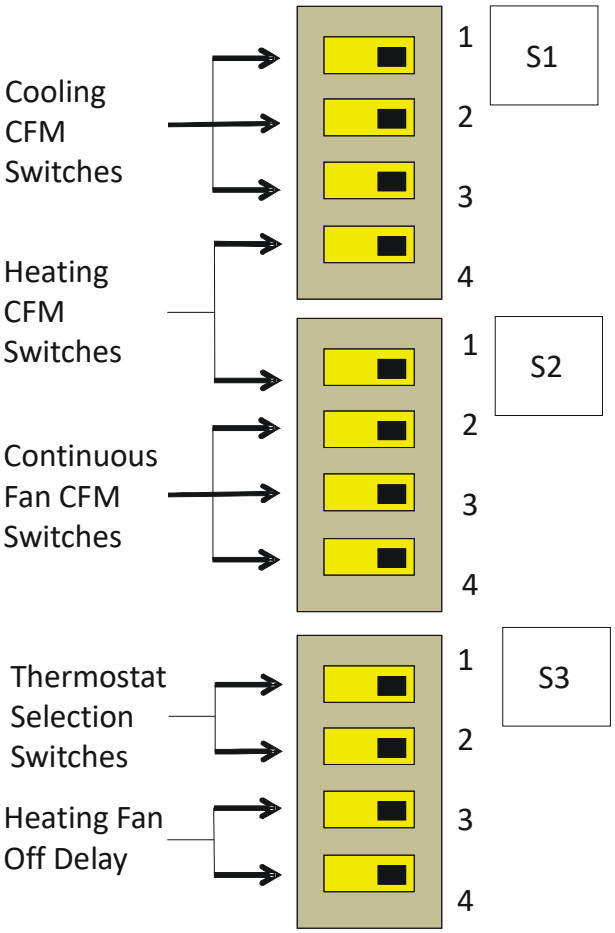
When the furnace is used in connection with a cooling unit, the furnace should be installed in parallel with or on the upstream side of the cooling unit to avoid condensation in the heating element. With a parallel flow arrangement, the dampers or other means used to control the flow of air must be adequate to prevent chilled air from entering the furnace and, if manually operated, must be equipped with means to prevent operation of either unit unless the damper is in the full heat or cool position.

When the furnace is heating, the temperature of the return air entering the furnace must be between **55°F** and **100°F**.

SYSTEM OPERATION

DIP Switch Settings

PCBBF139 CONTROL BOARD DIP SWITCHES



Purpose	Switch Group	Function	Dip Switch			
			1	2	3	4
Thermostat Setup	S3	2 Stage Stat	OFF	OFF		
		1 Stg Stat 10 min delay	ON	OFF		
		1 Stg Stat 20 min delay	ON	ON		
		Auto	OFF*	ON*		
Heating Fan Off Delay	S3	90			OFF	OFF
		120			OFF	ON
		150			ON*	OFF*
		180			ON	ON

* FACTORY SETTING

SYSTEM OPERATION

⚠ WARNING

TO AVOID PERSONAL INJURY OR DEATH DUE TO ELECTRICAL SHOCK, TURN OFF POWER TO THE FURNACE BEFORE CHANGING SPEED TAPS.

SEQUENCE OF OPERATION

POWER UP:

- When power is supplied, the control will energize the Red LED, microcomputer runs its self-check routine.
- The control will check the status of the gas valve circuitry.
- Line polarity is checked.
- The control then enters standby waiting for a call for heat or cool.
- The Furnace status LED will display a slow green flash signaling standby mode

HEAT MODE:

Call For 1st Stage Heat

- On a call for first stage heat, the thermostat contacts close signaling the control module.
- The microcomputer runs its self-check routine.
- The Amber LED will display a slow flash signaling normal heat operation.
- The control module checks the high limit (and/or auxiliary limit) switch(es) for normally closed contacts.
- The control checks the low pressure switch for a shorted condition.
- The gas valve relay status is checked for proper operation. Once the low pressure switch is detected open, the inducer blower is energized at high speed and the humidifier is enabled.
- The low pressure switch is checked for closure.
- Once the low pressure switch is closed, the pre-purge period begins. The inducer will be energized at high speed for the pre-purge period.
- Following the completion of pre-purge, the inducer switches to low speed and the igniter warm up period begins.
- After completion of the igniter warm up period:
  - Trial for ignition begins.
  - The first stage of the gas valve is energized.
- The igniter is de-energized when flame is sensed or at the conclusion of the ignition activation period (IAP), whichever comes first.
- When flame is sensed, the delay to heat on period begins timing.
- Retry counter is zeroed, if after 10 seconds the flame is sensed:
  - Control enters normal operating loop where all inputs are continuously checked.
- After the delay to heat on period, the circulator fan is energized at the low heat speed.
- The air cleaner will be energized with the circulator.
- If the call for heat is lost while the control is in the trial for ignition period without flame being detected, the control will turn off the gas valve and igniter. The control then enters the post-purge routine. The post-purge time will be increased to 60 seconds. After completing the post-purge, the control resumes normal operation.

CALL FOR 2ND STAGE AFTER FIRST STAGE:

- The inducer motor is enabled at high speed.
- The pressure switches are checked for closure. Closure of the second stage pressure switch will energize the high fire stage of the gas valve.
- The high speed circulator output is energized.
- **NOTE:** A call for 2nd stage without a call for 1st stage will be ignored, and a three amber flash code will be displayed on the LED. This error code will only be stored in memory once during a single power cycle.

2ND STAGE SATISFIED, FIRST STAGE STILL CALLED:

- When the second stage of the thermostat is satisfied, the inducer blower is reduced to low speed which de-energizes the second stage of the gas valve.
- After the high heat off delay expires, the circulator is reduced to low heat speed.

SIMULTANEOUS CALL FOR LOW AND HIGH HEAT

A call for both stages of heat will establish low fire before going to high fire

Operation Using a Single Stage Heating Thermostat

Using a single stage thermostat, the options for high fire delay are: 10 minutes; 20 minutes; or auto

- The automatic second stage logic is a method of energizing the second stage valve based on the recent average of the heating duty cycle. During a typical heating day there will be at least one call for heat within a 3 hour period, and usually much more often. During this mode the low to high stage delay is determined by using the average calculated duty cycle from the table below. Once the specified delay time has expired the second stage valve will be energized
- On the heating cycle following a period of 3 hours (or greater) in which there is no call for heat, the second stage valve will energize based on the average calculated duty cycle prior to the three hour no call for heat. If the average calculated duty cycle is less than 50%, then the low to high stage delay will be determined from the table below. In this case, an assumption is made that the outside temperature is fairly mild and the long time between calls for heat was due to a low thermal loss in the building. Going quickly to second stage heat is not required in this instance.

SYSTEM OPERATION

- If the average calculated duty cycle is 50% or greater, then the heating cycle will be treated as if high stage is needed and the transition from low to high stage delay will happen quickly. In this case an assumption is made that the outside temperature is cold and that the thermostat is likely coming out of setback. Since assumptions are being made during this heating cycle the duty cycle for this heat cycle will not be used in the average calculated duty cycle formula for future heating cycles.
- The duty cycle is calculated every cycle and used during the next cycle. The equation for the duty cycle is calculated as follows: Duty Cycle = (Time the appropriate stage is ON) / (Time of the complete cycle).
- The average calculated duty cycle is determined by averaging the previous average calculated duty cycle with the duty cycle from the previous cycle. This places a large emphasis on the previous cycle but allows a large variation in any one duty cycle to be averaged out after just a few complete heating cycles.
- If there is no load activity for 24 hours or more then set the Duty Cycle = 100%
- The initial default average calculated duty cycle = 50%

Duty Cycle %	Valve Output	Demand
0-38	1st Stage, 12 minute 2nd Stage	Light
38-50	1st Stage, 10 minute 2nd Stage	Light to Average
50-62	1st Stage, 7 minute 2nd Stage	Average
62-75	1st Stage, 5 minute 2nd Stage	Average to Heavy
75-88	1st Stage, 3 minute 2nd Stage	Heavy
88-100	1st Stage, 1 minute 2nd Stage	Heavy

Blower Off Delay Dip Switches PCBBF139

Purpose	Switch Group	Function	Dip Switch			
			1	2	3	4
Heating Fan Off Delay	S3	90			OFF	OFF
		120			OFF	ON
		150			ON*	OFF*
		180			ON	ON

*Factory Setting

Heat Mode Blower Off Delay Timing

COOLING MODE:

LOW STAGE COOLING MODE SEQUENCE:

- On a call for lo cool, the Ylo and G thermostat contacts close signaling the control module.
- The LED will display a “GREEN”1 flash
- The compressor and condenser fan are energized. The compressor is connected to the Ylo terminal of the control module.
- The circulator fan is energized at lo cool speed after a cool on delay. The electronic air cleaner will also be energized.
- After the thermostat is satisfied, the compressor is de-energized
- Following the 60 second Cool Mode Fan Off Delay period, the cool circulator and air cleaner relay are de-energized.
- When the call for “Ylo”and “G”are presented simultaneously, the control will honor the Cool On delay and keep the circulator de-energized. After the Cool On delay, the circulator fan and air cleaner relays are energized. The circulator fan is energized at the cool speed. If a call for “G”is present prior to a call for “Ylo”, the circulator will remain at the FAN circulator speed during the Cool On delay.

SINGLE COOLING STAGE THERMOSTAT OR 2ND STAGE COOLING MODE SEQUENCE.

- On a call for cool, the Y and G thermostat contacts close signaling the control module.
- The LED will display a “GREEN”2 flash
- The compressor and condenser fan are energized. The compressor is connected to the Y terminal of the control module.
- The circulator fan is energized at cool speed after a cool on delay. The electronic air cleaner will also be energized.
- After the thermostat is satisfied, the compressor is de-energized and the Cool Mode FanOff Delay period begins.
- Following the 60 second Cool Mode Fan Off Delay period, the cool circulator and air cleaner relay are de-energized

MANUAL FAN ON:

- On a call for Fan, the G thermostat contacts close signaling the control module.
- The LED will display a solid “GREEN”
- When a call for G is received, the control will energize the circulator in low heat speed after the fan on delay time expires. The electronic air cleaner will also be energized at this time.
- When the thermostat fan switch is moved to the ON position, the circulator blower is energized at low heat speed and the electronic air cleaner is also energized
- When the thermostat fan switch is moved back to the AUTO position, the circulator fan and air cleaner relay are de-energized and the control awaits a thermostat call for heat or cool.
- Exception: During the Cool “On”delay, the control will not respond to the fan input. If the fan was called prior to the call for cool, the circulator will remain energized during the Cool “On”delay.
- If the fan is called prior to a call for heat, the circulator will remain energized during the entire call for heat sequence.

SCHEDULED MAINTENANCE

Upflow / Horizontal Models	Minimum Recommended Filter Size^
MEC800403A	1-16 x 25 Side or 14 x24 Bottom Return
MEC800603A	1-16 x 25 Side or 14 x24 Bottom Return
MEC800603B	1-16 x 25 Side or 14 x24 Bottom Return
MEC800803B	1-16 x 25 Side or Bottom Return
MEC800804B	1-16 x 25 Side or Bottom Return
MEC800804C	1-16 x 25 Side or Bottom Return
MEC800805C†	1-16 x 25 Side or Bottom Return
MEC800805D†	1-16 x 25 Side or Bottom Return
MEC801004C	1-16 x 25 Side or Bottom Return
MEC801005C	2 - 16 x 25 Side or 1 - 20 x 25 Bottom Return
MEC801205D	2 - 16 x 25 Side or 1 - 20 x 25 Bottom Return
Downflow / Horizontal Models	**Minimum Recommended Filter Size^**
CEC800403A	2 -10 x 20 or 14 x 25 Top Return
CEC800603A	2 -10 x 20 or 14 x 25 Top Return
CEC800603B	2 - 10 x 20 or 1 - 14 x 25 Top Return
CEC800804B	2 - 10 x 20 or 1 - 14 x 25 Top Return
CEC800805C	2 - 14 x 20 or 1 - 16 x 25 Top Return
CEC801005C	2 - 14 x 20 or 1 - 20 x 25 Top Return

^ Larger filters may be used, filters may also be centrally located.

† = Use 2 - 16x 25 filters and two side returns or 20 x 25 filter on bottom return if furnace is connected to a cooling unit over 4 tons nominal capacity.

FLAME SENSOR (QUALIFIED SERVICER ONLY)

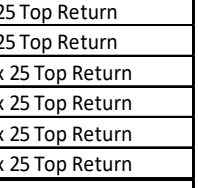
Under some conditions, the fuel or air supply can create a nearly invisible coating on the flame sensor. This coating acts as an insulator, causing a drop in the flame sensing signal. If this occurs, a qualified servicer must carefully clean the flame sensor with steel wool. After cleaning, the flame sensor output should be as listed on the specification sheet.

BURNERS

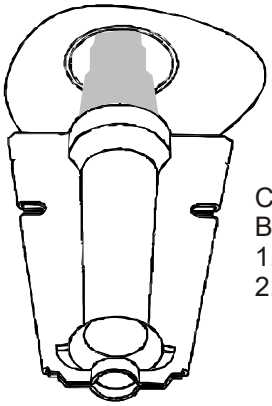
⚠ WARNING

HIGH VOLTAGE

ELECTRICAL COMPONENTS ARE CONTAINED IN BOTH COMPARTMENTS. TO AVOID ELECTRICAL SHOCK, INJURY OR DEATH, DO NOT REMOVE ANY INTERNAL COMPARTMENT COVERS OR ATTEMPT ANY ADJUSTMENT. CONTACT A QUALIFIED SERVICE AGENT AT ONCE IF AN ABNORMAL FLAME APPEARANCE SHOULD DEVELOP.



Periodically during the heating season make a visual check of the burner flames. Turn the furnace on at the thermostat. Wait a few minutes since any dislodged dust will alter the normal flame appearance. Flames should be stable, quiet, soft and blue with slightly orange tips. They should not be yellow. They should extend directly outward from the burner ports without curling downward, floating or lifting off the ports.



Check the
Burner Flames for:
1. Stable, soft and blue.
2. Not curling, floating or lifting off.

Burner Flame

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. Dial type thermometers or thermocouple meter (optional) - to measure dry bulb temperature.
2. Amprobe - to measure amperage and voltage.
3. Volt-Ohm Meter - testing continuity, capacitors, and motor windings.
4. Inclined Manometer - to measure static pressure, pressure drop across coils, filters, and draft.
5. Water Manometer (12”) - to test gas inlet and manifold pressure.

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 resulting in fewer 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.

SCHEDULED MAINTENANCE

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.
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.

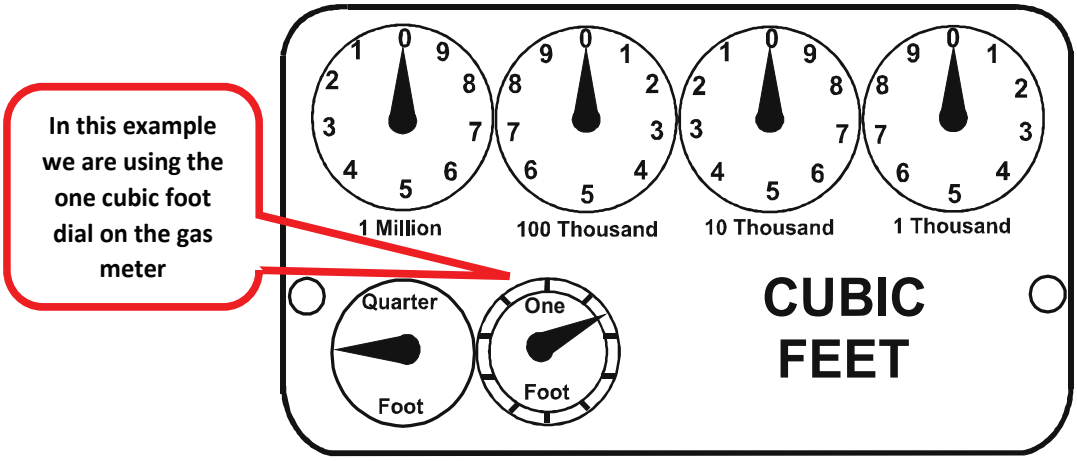


TABLE 1

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).

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

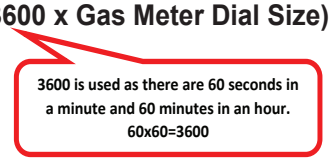
Seconds for One Revolution	Size of Test Dial 1/4 cu/ft	1/2 cu/ft	1 cu/ft	2 cu/ft	5 cu/ft	Seconds for One Revolution	Size of Test Dial 1/4 cu/ft	1/2 cu/ft	1 cu/ft	2 cu/ft	5 cu/ft
10	90	180	360	720	1800	36	25	50	100	200	500
11	82	164	327	655	1636	37	--	--	97	195	486
12	75	150	300	600	1500	38	23	47	95	189	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

SCHEDULED MAINTENANCE

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)



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

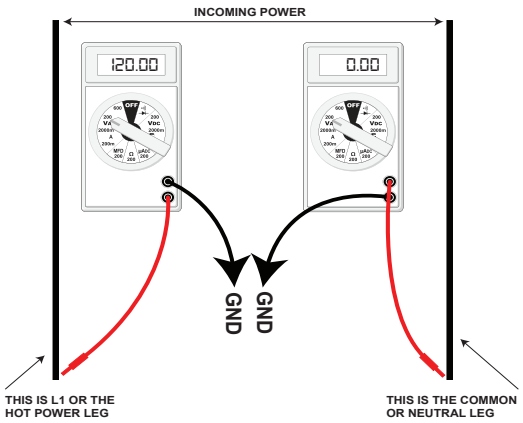
This example is within the 5% tolerance input and does not need adjustment.

SERVICING

As more and more electronic's are introduced to the Heating Trade, Polarization of incoming power and phasing of primary to secondary voltage on transformers becomes more important.

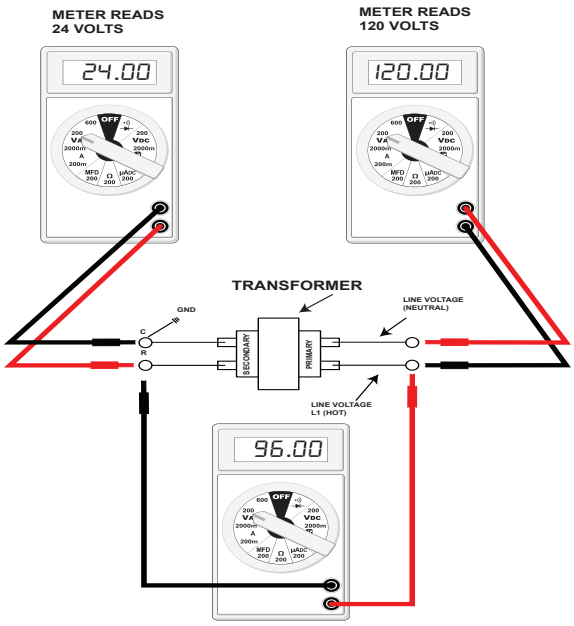
Polarization has been apparent in the Appliance industry since the introduction of the three prong plug, however, the Heating Industry does not use a plug for incoming power, but is hard wired.

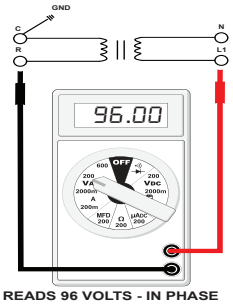
Some of the electronic boards being used today, with flame rectification, will not function properly and/or at all without polarization of incoming power. Some also require phasing between the primary and secondary sides of step-down transformers.



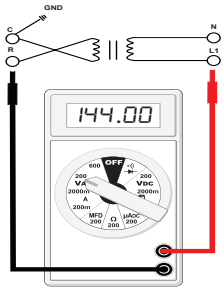
These then should be wired to the furnace accordingly.

CHECKING FOR PHASING - PRIMARY TO SECONDARY OF UNMARKED TRANSFORMERS*





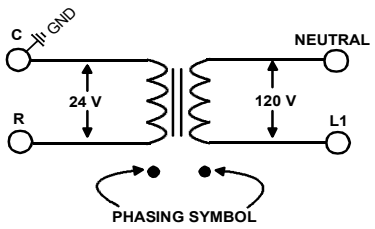
READS 96 VOLTS - IN PHASE



READS 144 VOLTS - OUT OF PHASE

If meter reads approximately 96 volts - the primary to secondary are in phase - if reads approximately 144 volts out of phase - reverse low voltage wires.

***NOTE:** For flame rectification the common side of the secondary voltage (24 V) is cabinet grounded. If you were to bench test a transformer the primary neutral and secondary common must be connected together for testing purposes.



Some transformers will display phasing symbols as shown in the illustration to the left to assist in determining proper transformer phasing.

Checking for polarization and phasing should become a habit in servicing. Let's start now.

NOTE: PCBBF139 ignition control has a diagnostic flash code for reversed polarity.

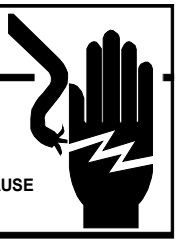
SERVICING

CHECKING VOLTAGE

⚠ WARNING

HIGH VOLTAGE

DISCONNECT ALL POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



1. Remove cover from the Junction Box and gain access to incoming power lines.

With Power ON:

⚠ WARNING

LINE VOLTAGE NOW PRESENT

2. Using a voltmeter, measure the voltage across the hot and neutral connections.

NOTE: To energize the furnace, the Door Interlock Switch must be engaged at this point.

3. No reading - indicates open wiring, open fuse, no power, or faulty Door Interlock Switch from unit to fused disconnect service. Repair as needed.
4. With ample voltage at line voltage connectors, energize the furnace blower motor by jumpering terminals R to G on the integrated ignition control.
5. With the blower motor in operation, the voltage should be 115 volts ± 10 percent.
6. If the reading falls below the minimum voltage, check the line wire size. Long runs of undersized wire can cause low voltage. If wire size is adequate, notify the local power company of the condition.
7. After completing check and/or repair, replace Junction Box cover and reinstall the service panel doors.
8. Turn on electrical power and verify proper unit operation.

CHECKING WIRING

⚠ WARNING

DISCONNECT ALL POWER BEFORE SERVICING.

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 AWM, 105°C. 2/64 thick insulation of the same gauge or its equivalent.

CHECKING THERMOSTAT, WIRING

⚠ WARNING

DISCONNECT ALL POWER BEFORE SERVICING.

1. Remove the blower compartment door to gain access to the thermostat low voltage wires located at the furnace integrated control module terminals.
2. Remove the thermostat low voltage wires at the furnace control panel terminal board.
3. Jumper terminals R to W (or W1 and W2 for two-stage models) on the integrated ignition control.

With Power On (and Door Interlock Switch closed):

⚠ WARNING

LINE VOLTAGE NOW PRESENT

4. Induced Draft Motor must run and pull in pressure switch.
5. If the hot surface ignitor heats and at the end of the ignitor warm-up period the gas valve opens and the burners ignite, the trouble is in the thermostat or wiring.
6. With power off, check the continuity of the thermostat and wiring. Repair or replace as necessary.

If checking the furnace in the air conditioning mode, proceed as follows.

7. With power off, Jumper terminals R to Y
8. Turn on the power.
9. If the furnace blower motor starts and the condensing unit runs, then the trouble is in the thermostat or wiring. Repair or replace as necessary.
10. After completing check and/or repair of wiring and check and/or replacement of thermostat, reinstall blower compartment door.
11. Turn on electrical power and verify proper unit operation.

CHECKING HEATING ANTICIPATOR

The heating anticipator on older thermostats is a wire wound adjustable heater which is energized during the “ON” cycle to help prevent overheating of the conditioned space.

The anticipator is a part of the thermostat and if it should fail for any reason, the thermostat must be replaced. Modern thermostats do not have this type of heat anticipator. Many have a selector switch to adjust the number of cycles per hour.

SERVICING

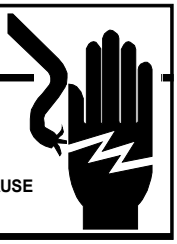
CHECKING TRANSFORMER AND CONTROL CIRCUIT

A step-down transformer 120 volt primary to 24 volt secondary, 40 VA (Heating and Cooling Models) supplies ample capacity of power for either operation.

⚠ WARNING

HIGH VOLTAGE

DISCONNECT ALL POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



1. Remove blower compartment door to gain access to the thermostat low voltage wires located at the furnace integrated control module.
2. Remove the thermostat low voltage wires at the furnace integrated control module terminals.

With Power On (and Door Interlock Switch closed):

⚠ WARNING

LINE VOLTAGE NOW PRESENT

3. Use a voltmeter, check voltage across terminals R and C. Must read 24 VAC.
4. No voltage indicates faulty transformer, open fuse, bad wiring, bad splice, or open door interlock switch.
5. Check transformer primary voltage at incoming line voltage connections, fuse, splices, and blower door interlock switch.
6. If line voltage is available to the primary side of transformer and not at secondary side, the transformer is inoperative. Replace.
7. After completing check and/or replacement of transformer and check and/or repair of control circuit, reinstall blower compartment door.
8. Turn on electrical power and verify proper unit operation.

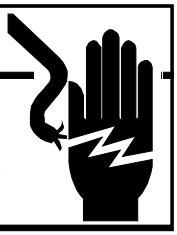
⚠ WARNING

LINE VOLTAGE NOW PRESENT

⚠ 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.



CHECKING AIR CIRCULATOR BLOWER MOTOR (MULTI-SPEED ECM MOTOR)

⚠ WARNING

DISCONNECT ALL POWER BEFORE SERVICING.

1. Remove blower compartment door to gain access to the circulator blower motor and integrated ignition control.
2. Check for any obstruction that would keep the fan wheel / fan motor from turning.
3. Check wiring, the motor has two wiring harnesses, a main harness and a control harness. The main pin harness has:

   White neutral wire connected to the Neutral terminal on the control board.

   Black wire connected to the CIRC H terminal on the control board.

   Red wire connected to the COM terminal, which is a female spade connection next to the T1 – T4 wires on the control board.

   Green ground wire connected to cabinet ground

   The control harness has:

   Blue wire connected to T1 on the control board.

   Red wire connected to T2 on the control board.

   Orange wire connected to T3 on the control board.

   Black wire connected to T4 on the control board.

   The multi-speed ECM motor requires a line voltage power supply (black connected to CIRC H and white connected to neutral on the control board) as well as a signal on one of the speed taps (T1-T4).

   The speed tap voltage is 3-15 D.C. and can vary depending on S2 DIP switch selection. The voltage reading from any one of the speed taps is referenced between the female COM terminal next to the speed taps on the control board.

CHECKING DUCT STATIC

The maximum and minimum allowable external static pressures are found in the specification section. These tables also show the amount of air being delivered at a given static by a given motor speed or pulley adjustment.

The furnace motor cannot deliver proper air quantities (CFM) against statics other than those listed.

Too great of an external static pressure will result in insufficient air that can cause excessive temperature rise, resulting in limit tripping, etc. Whereas not enough static may result in motor overloading.

To determine proper air movement, proceed as follows:

1. With clean filters in the furnace, use a draft gauge (inclined manometer) to measure the static pressure of the return duct at the inlet of the furnace. (Negative Pressure)
2. Measure the static pressure of the supply duct. (Positive Pressure)

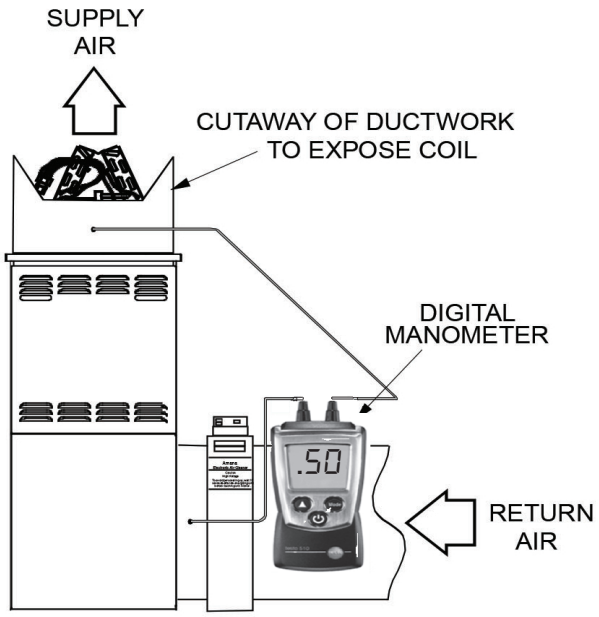
SERVICING

3. Add the two (2) readings together for total external static pressure.

NOTE: Both readings may be taken simultaneously and read directly on the manometer if so desired. If an air conditioner coil or Electronic Air Cleaner is used in conjunction with the furnace, the readings must also include theses components, as shown in the following drawing.

4. Consult proper tables for the quantity of air.

If the total external static pressure exceeds the minimum or maximum allowable statics, check for closed dampers, registers, undersized and/or oversized poorly laid out duct work.

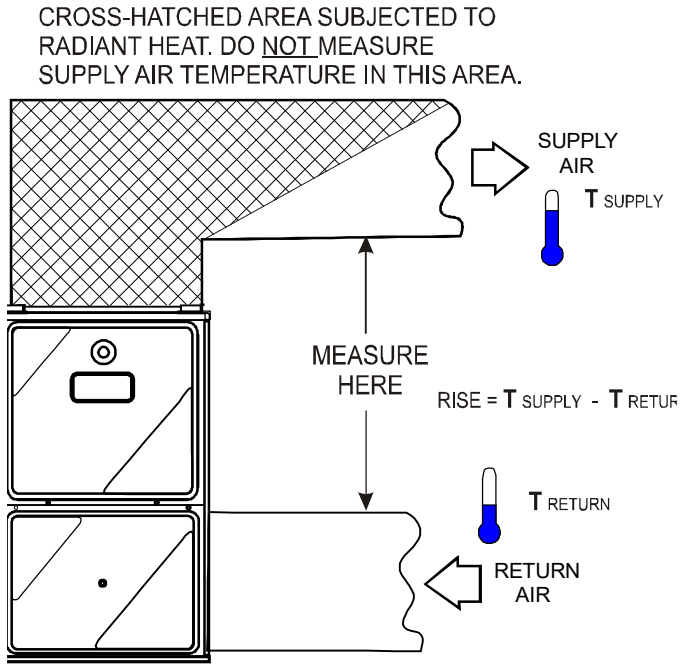


Checking Static Pressure

CHECKING TEMPERATURE RISE

The more air (CFM) being delivered through a given furnace, 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 furnace specifications and its external static pressure. An incorrect temperature rise may result in condensing in or overheating of the heat exchanger. An airflow and temperature rise table is provided in the blower performance specification section. Determine and adjust temperature rise as follows:

1. Operate furnace with burners firing for approximately ten minutes. Check BTU input to furnace - do not exceed input rating stamped on rating plate. Ensure all registers are open and all duct dampers are in their final (fully or partially open) position.
2. Place thermometers in the return and supply ducts as close to the furnace as possible. Thermometers must not be influenced by radiant heat by being able to “see” the heat exchanger.

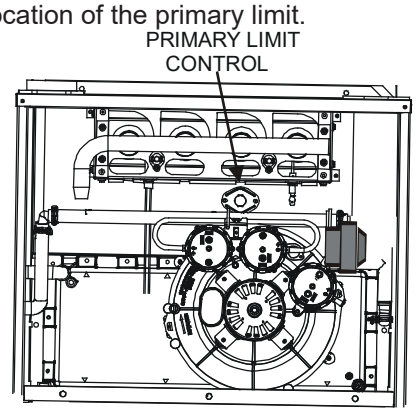


Checking Temperature Rise

3. Subtract the return air temperature from the supply air temperature to determine the air temperature rise. Allow adequate time for thermometer readings to stabilize.
4. Adjust temperature rise by adjusting the circulator blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise. Refer to *Circulator Blower Speed* section in the Product Design section of this manual for speed changing details. Temperature rise is related to the BTUH output of the furnace and the amount of air (CFM) circulated over the heat exchanger. Measure motor current draw to determine that the motor is not overloaded during adjustments.

CHECKING PRIMARY LIMIT CONTROL

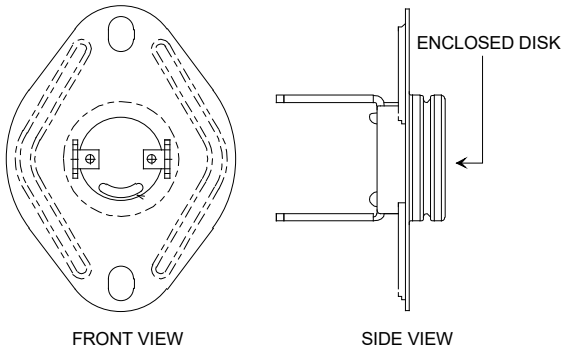
All primary limit controls are nonadjustable, automatic reset, bi-metal type limit control. Refer to the following drawing for the location of the primary limit.



Primary Limit Control Location (90% Upflow Furnace Shown)

SERVICING

The following drawing illustrates the style of limit switches used on the 90% furnaces.



Primary Limit Control Style (90% Furnaces)

⚠ WARNING

HIGH VOLTAGE

DISCONNECT ALL POWER BEFORE SERVICING OR CHANGING ANY ELECTRICAL WIRING. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

1. Remove burner compartment door to gain access to the primary limit.
2. Remove low voltage wires at limit control terminals.
3. With an ohmmeter, test between these two terminals as shown in the following drawing. The ohmmeter should read continuous unless heat exchanger temperature is above limit control setting. If not as above, replace the control.

LIMIT FAULT CODES

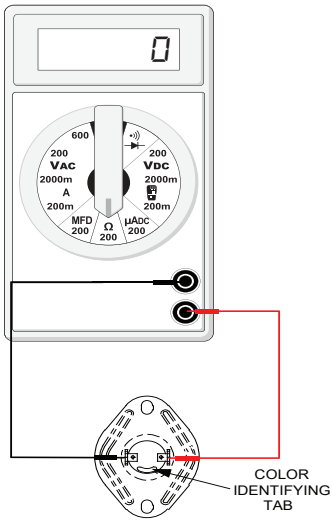
If the control detects the high limit circuit open, the RED LED will flash FOUR times and energize the inducer and indoor blower.

If the limit circuit opens five times within a single call for heat, the furnace will go into lockout for one hour. The RED LED will display a FOUR flash code during this time. The control board can be reset by cycling 115 volt power to the furnace.

If the limit circuit opens and does not close within five minutes, the control assumes the blower has failed the RED LED will flash ELEVEN times.

If the limit circuit opens and does not close within fifteen minutes, the control assumes the manual rollout or fuse has opened and the RED LED will flash FIVE times. The control will enter a one hour lockout and the inducer will run continuously.

In an open limit condition the red LED will flash as described above but the error code will not be stored in memory until the limit resets or until 15 minutes has elapsed. So if the limit resets in less than 5 minutes a four flash code will be stored. If the limit resets in more than 5 but less than 15 minutes, an eleven flash code will be stored. If the limit is still open after 15 minutes, a five flash code will be stored.



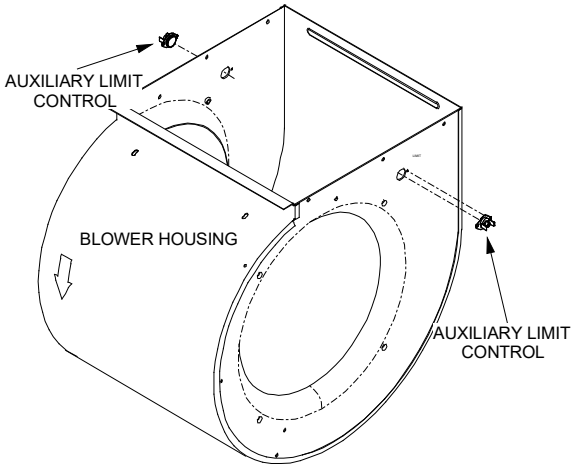
Testing Primary Limit Control

4. After completing check and/or replacement of primary limit control, reinstall burner compartment door.
5. Turn on electrical power and verify proper unit operation.

CHECKING AUXILIARY LIMIT CONTROL

The auxiliary limit control is designed to prevent furnace operation in case of main blower failure in horizontal installations. It may also open if the power supply is interrupted while the furnace is firing.

The auxiliary limit control is suitable for both horizontal right and horizontal left installations. Regardless of airflow direction, it does not need to be relocated. The (2) two auxiliary limits are located on the blower housing (one on each side), as shown in the following illustration.



Auxiliary Limit Control Location

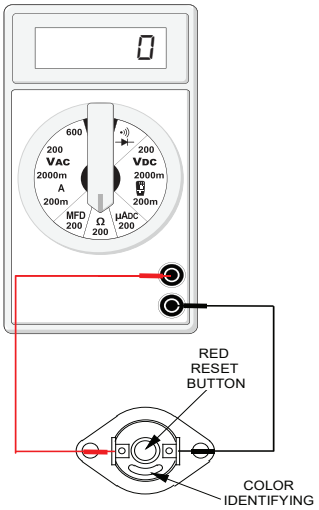
SERVICING

⚠ 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.

1. Remove blower compartment door to gain access to the auxiliary.
2. Remove the wires from the auxiliary limit control terminals.
3. Using an ohmmeter, test for continuity across the two terminals.



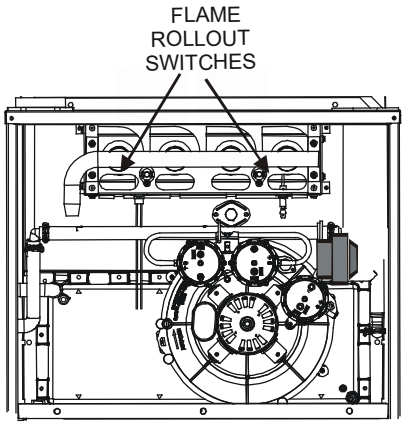
Testing Auxiliary Limit Control

⚠ WARNING

TO AVOID POSSIBLE FIRE, ONLY RESET THE AUXILIARY LIMIT CONTROL ONCE. IF IT SHOULD OPEN A SECOND TIME, A QUALIFIED SERVICER MUST DETERMINE WHY THE AUXILIARY LIMIT OPENED BEFORE RESETTING AGAIN.

CHECKING FLAME ROLLOUT CONTROL

A temperature activated manual reset control is mounted to the manifold assembly as shown in the following illustration.



Flame Rollout Switch Location
(90% Upflow Furnace Shown, Counterflow Similar)

The control is designed to open should a flame roll out occur. An over firing condition or flame impingement on the heat shield may also cause the control to open. If the rollout control opens, the air circulation blower will run continuously.

⚠ WARNING

LINE VOLTAGE NOW PRESENT

1. Remove the burner compartment door to gain access to the rollout switch(es) mounted to burner bracket.
2. Reset the manual roll out switch
3. Remove wires from roll out switch
4. Using an ohmmeter, check for continuity across the switch.
5. If the switch will not close after manually resetting, it must be replaced.
6. Measure the voltage between each side of the rollout control and ground during the ignition attempt. If a roll out switch has tripped, it is important to find out why. Possible causes could be flame impingement, orifice plate out of position, burners with excessive cross-over slot dimension, over-firing, improper orifices, improper gas pressure, air leaking from around the heat exchanger into the burner compartment, air leaking through the heat exchanger itself.
7. After check and/or replacement of rollout switch, reinstall burner compartment door and verify proper unit operation.

INDUCED DRAFT BLOWER MOTOR

⚠ 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.

1. Remove burner compartment door to gain access to the induced draft blower motor.
2. Disconnect the motor wire leads from its connection

point at the induced draft motor.

3. Using a ohmmeter, test for continuity between each of the motor leads.
4. 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.
5. If the windings have a continuity reading, reconnect wires. Turn power on to the furnace and turn the thermostat on in the heating mode. Check voltage for 115V at the induced draft motor terminals during the trial for ignition. If you have 115V and the motor does not run, replace the induced draft motor.
6. After completing check and/or replacement of induced draft motor, reinstall burner compartment door.
7. Turn on electrical power and verify proper unit operation.

CHECKING GAS VALVE (Redundant)

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

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

⚠ WARNING

DISCONNECT ALL POWER BEFORE SERVICING

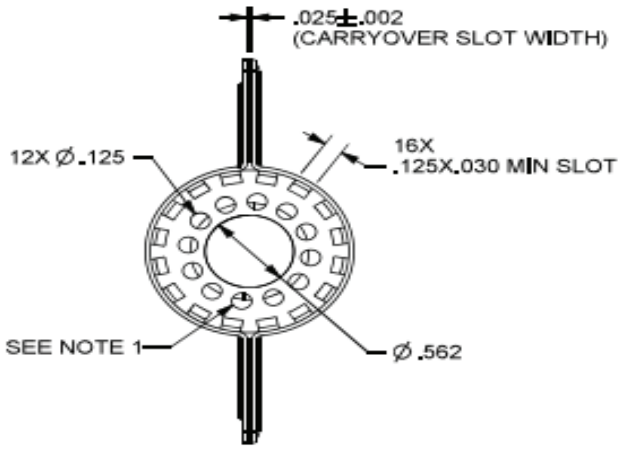
Two stage gas valves always require 24 volts between common and low fire (main coil) to open. Also, the furnace front cover pressure switch is wired in series with the low (main) solenoid of the gas valve. In the event of a non functioning gas valve, always check the front cover pressure switch.

CHECKING MAIN BURNERS

Burners have been redesigned for 34.5” chassis furnaces. Overall length and width dimensions remain the same as 40” model burners. The burners used 34.5” models have burner head insert with larger diameter center hole and a larger number of surrounding holes.

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.



34.5” Burner

⚠ WARNING

DISCONNECT ALL 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, burner cross-over slots should not be altered in size.

CHECKING ORIFICES

*MEC80/*CEC80 model furnaces have factory installed #45 natural gas orifices.

The only time resizing is required is when a reduction in firing rate is required for an increase in altitude or a furnace is being converted for use with LP gas.

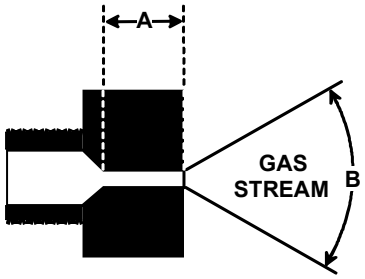
Orifices should be treated with care in order to prevent damage. They should be removed and installed with a box-end wrench in order to prevent distortion. In no instance should an orifice be peened over and redrilled. This will change the angle or deflection of the vacuum effect or entraining of primary 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

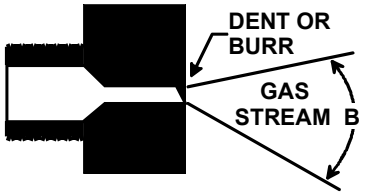
DISCONNECT ALL GAS AND ELECTRICAL POWER SUPPLY.

1. Check orifice visually for distortion and/or burrs.
2. Check orifice size with orifice sizing drills.

SERVICING



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



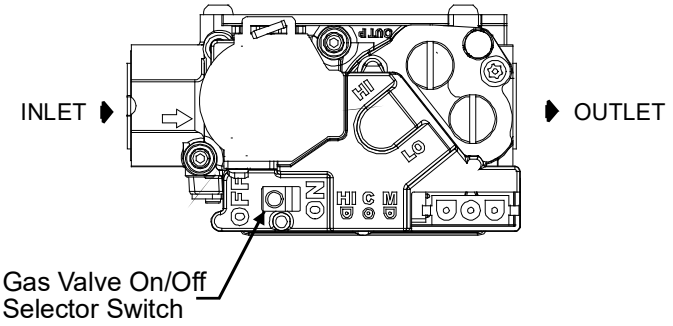
A dent or burr will cause a severe deflection of the gas stream.

CHECKING GAS PRESSURE

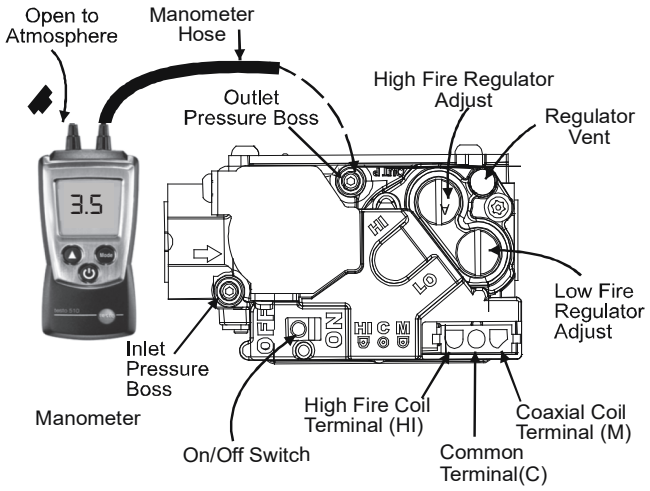
Gas Supply Pressure Measurement

Gas Pressure Test

The line pressure supplied to the gas valve must be within the range specified below. The supply pressure can be measured at the gas valve inlet pressure tap or at a hose fitting installed in the gas piping drip leg. The supply pressure must be measured with the burners operating. To measure the gas supply pressure, use the following procedure.



White-Rodgers Model 36J54 (Two-Stage)



White-Rodgers Model 36J54 Connected to Manometer

1. Turn OFF gas to furnace at the manual gas shutoff valve external to the furnace.
2. Connect a calibrated water manometer (or appropriate gas pressure gauge) at either the gas valve inlet pressure tap or the gas piping drip leg. See White-Rodgers 36J54 gas valve figure for location of inlet pressure tap.

INLET GAS SUPPLY PRESSURE		
Natural Gas	Minimum: 4.5" w.c.	Maximum: 10.0" w.c.
Propane Gas	Minimum: 11.0" w.c.	Maximum: 13.0" w.c.

NOTE: If measuring gas pressure at the drip leg, a field-supplied hose barb fitting must be installed prior to making the hose connection. If using the inlet pressure tap on the White-Rodgers 36J54 gas valve, then use the 36G/J Valve Pressure Check Kit, Part No. 0151K00000S.

3. Turn ON the gas supply and operate the furnace and all other gas consuming appliances on the same gas supply line.
4. Measure furnace gas supply pressure with burners firing. Supply pressure must be within the range specified in the *Inlet Gas Supply Pressure* table.

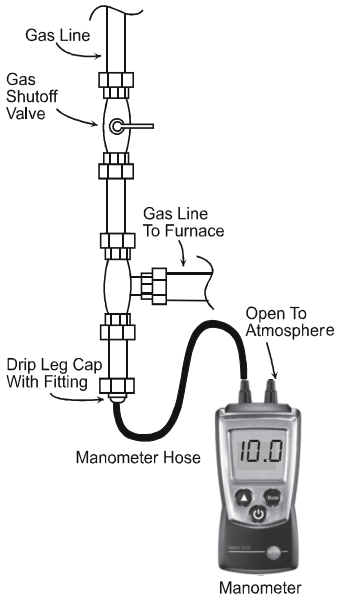
If supply pressure differs from table, make the necessary adjustments to pressure regulator, gas piping size, etc., and/or consult with local gas utility.

5. Turn OFF gas to furnace at the manual shutoff valve and disconnect manometer. Reinstall plug before turning on gas to furnace.
6. Turn OFF any unnecessary gas appliances stated in step 3.

Gas Manifold Pressure Measurement and Adjustment

Only small variations in gas pressure should be made by adjusting the gas valve pressure regulator. The manifold pressure must be measured with the burners operating. To measure and adjust the manifold pressure, use the following procedure.

SERVICING



Measuring Inlet Gas Pressure (Alt. Method)

CAUTION

TO PREVENT UNRELIABLE OPERATION OR EQUIPMENT DAMAGE, THE INLET GAS SUPPLY PRESSURE MUST BE AS SPECIFIED ON THE UNIT RATING PLATE WITH ALL OTHER HOUSEHOLD GAS FIRED APPLIANCES OPERATING.

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. Outlet pressure tap connections:

   White-Rodgers 36J54 valve: Back outlet pressure test screw (inlet/outlet pressure tap) out one turn (counterclockwise, not more than one turn).
4. Attach a hose and manometer to the outlet pressure tap (White-Rodgers valve).
5. Turn ON the gas supply.
6. Turn on power and close thermostat “R” and “W1” contacts to provide a call for low stage heat.
7. Measure the gas manifold pressure with burners firing. Adjust manifold pressure using the *Manifold Gas Pressure* table shown below.
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. Replace regulator cover screw.
9. Close thermostat “R”, “W1” and “W2” contacts to provide a call for high stage heat.
10. Remove regulator cover screw from the high (HI) outlet pressure regulator adjust tower and turn screw clockwise to increase pressure or counterclockwise to decrease pressure. Replace regulator cover screw.
11. Turn off all electrical power and gas supply to the system.
12. Remove the manometer hose from the hose barb fitting or outlet pressure tap.
13. Replace outlet pressure tap:

    White-Rodgers 36J54 valve: 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. Close thermostat contacts “R” and “W1/W2” to energize the valve.

Manifold Gas Pressure			
Gas		Range	Nominal
Natural	Low Stage	1.6 - 2.2" w.c.	1.9" 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.

Using a leak detection solution or soap suds, check for leaks at screw (White-Rodgers valve). Bubbles forming indicate a leak. SHUT OFF GAS AND REPAIR ALL LEAKS IMMEDIATELY!

NOTE: For gas to gas conversion, consult your dealer for appropriate conversion.

CAUTION

TO PREVENT UNRELIABLE OPERATION OR EQUIPMENT DAMAGE, THE INLET GAS SUPPLY PRESSURE MUST BE AS SPECIFIED ON THE UNIT RATING PLATE WITH ALL OTHER HOUSEHOLD GAS FIRED APPLIANCES OPERATING.

1. 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. Replace regulator cover screw.
   a. Close thermostat “R” and “W” contacts to provide a call for heat.
   b. Remove regulator cover screw from the high (HI) outlet pressure regulator adjust tower and turn screw clockwise to increase pressure or counterclockwise to decrease pressure. Replace regulator cover screw.
   c. Turn off all electrical power and gas supply to the system.
   d. Remove the manometer hose from the outlet pressure boss.
   e. Remove the 1/8” NPT hose barb fitting from the outlet pressure tap. Replace the outlet pressure boss plug and seal with a high quality thread sealer.

WARNING

HIGH VOLTAGE

DISCONNECT ALL ELECTRICAL POWER AND SHUT OFF GAS SUPPLY BEFORE SERVICING OR INSTALLING.

SERVICING

2. Turn on gas to furnace and check for leaks. If leaks are found, repair and then reinstall burner compartment door.
3. Turn on electrical power and verify proper unit operation. Make sure furnace operates at the proper manifold pressure at both high and low stage outputs.

Manifold Gas Pressure			
Gas	**Rate**	**Range**	**Nominal**
Natural Gas	High Stage	3.2 to 3.8" w.c.	3.5" w.c.
	Low Stage	1.6 to 2.2" w.c.	1.9" w.c.

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

HIGH VOLTAGE
DISCONNECT ALL ELECTRICAL POWER AND SHUT OFF GAS SUPPLY BEFORE SERVICING OR INSTALLING.

Manifold Gas Pressure			
Gas	**Rate**	**Range**	**Nominal**
Propane Gas	High Stage	9.7 to 10.3" w.c.	10.0" w.c.
	Low Stage	5.7 to 6.3" w.c.	6.0" w.c.

CHECKING HOT SURFACE IGNITOR

120V Silicon Nitride Ignitor - *M/CEC80 use a 120V silicon nitride ignitor for ignition. The normal operating temperature is approximately 2156°F - 2678°F. At room temperature the igniter ohm reading should be from 37-68 ohms.

7. Place unit in heating cycle, measure current draw of ignitor during preheat cycle.

   The steady state current at 120V is 0.37 to 0.68 amps.
8. After checking and/or replacing of hot surface ignitor, reinstall burner compartment door and verify proper unit operation.

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.

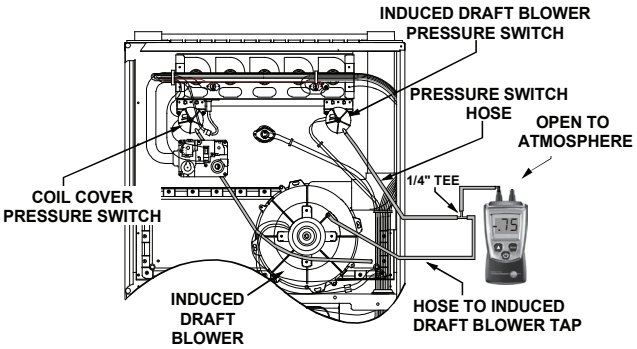
CHECKING PRESSURE SWITCH

The pressure control is a safety device to prevent the combustion cycle from occurring with inadequate venting caused by a restricted or blocked vent pipe.

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.

1. Remove burner compartment door to gain access to pressure switch(es).
2. Remove wires from the pressure switch(es) electrical terminals.
3. Remove the pressure control hose from the control and interconnect with an inclined manometer as shown in the following figures.
4. With an ohm meter connected across the pressure switch terminals; with the inducer running the switch should close and the ohm meter should show a complete circuit across the pressure switch. If the switch is not closed, compare the negative pressure to the closing point specified for the particular switch. Either the switch is defective or the inducer / venting system is inadequate.



Blower Pressure Switch
Negative Pressure Measurement

HIGH ALTITUDE APPLICATION (USA)

The furnace as shipped requires no change to run between 0 - 7500 feet. Do not attempt to increase the firing rate by changing orifices or increasing the manifold pressure below 7500 feet. feet. This can cause poor combustion and equipment failure. High altitude installations above 7500 feet. feet may require both a pressure switch and an orifice change. These changes are necessary to compensate for the natural reduction in the density of both the gasfuel and the combustion air at higher altitude.

SERVICING

For installations above 7500 feet. feet, please refer to your distributor for required kit(s). Contact the distributor for a tabular listing of appropriate manufacturer's kits for propane gas and/or high altitude installations. The indicated kits must be used to insure safe and proper furnace operation. All conversions must be performed by a qualified installer, or service agency.

In some areas the gas supplier may artificially derate the gas in an effort to compensate for the effects of altitude. If the gas is artificially derated the appropriate orfice size must be determined based on the BTU/ft^3 content of the derated gas and the altitude. Refer to the National Fuel Gas Code, NFPA 54/ANSI Z223.1, and information provided by the gas supplier to determine the proper orifice size.

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.

Furnace design makes this extremely unlikely unless safety controls have been by-passed or tampered with. Never by-pass or alter furnace controls.

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 INTEGRATED IGNITION CONTROL BOARDS

NOTE: Failure to earth ground the furnace, reversing the neutral and hot wire connection to the line (polarity), or a high resistance connection in the neutral line may cause the control to lockout due to failure to sense flame.

⚠ WARNING

TO AVOID THE RISK OF ELECTRICAL SHOCK, WIRING TO THE UNIT MUST BE PROPERLY POLARIZED AND GROUNDED. DISCONNECT POWER BEFORE PERFORMING SERVICE LISTED BELOW.

The ground wire must run from the furnace all the way back to the electrical panel. Proper grounding can be confirmed by disconnecting the electrical power and measuring resistance between the neutral (white) connection and the burner closest to the flame sensor. Resistance should be less than 2 ohms.

The ignition control is a combination electronic and electromechanical device and is not field repairable. Complete unit must be replaced.

⚠ WARNING

LINE VOLTAGE NOW PRESENT

These tests must be completed within a given time frame due to the operation of the ignition control.

The ignition control is capable of diagnosing many furnace failures to help in troubleshooting. The trial for ignition period is 4 seconds.

Goodman® Brand and Amana® Brand Two-Stage

1. Check for 120 volts from Line 1 (Hot) to Line 2 (Neutral) at the ignition control. No voltage, check the door switch connections and wire harness for continuity.
2. Check for 24 volts from W to C terminal on the ignition control. No voltage. Check transformer, room thermostat, and wiring.

   If you have 24 volts coming off the transformer but receive approximately 13 volts on the terminal board between (C) and (R), check for blown fuse.
3. Check 120 volt outputs on the 5 pin harness.

   Pin 1 = HSI Hot

   Pin 2 = Inducer High

   Pin 3 = Inducer Low

   Pin 4 = Inducer N

   Pin 5 = HSI N
4. After the ignitor warmup time, begin checking for 24 volts to the gas valve. Voltage will be present for four seconds only if proof of flame has been established.
5. If proof of flame was established voltage will be provided to the air circulation blower following the heat on delay period.

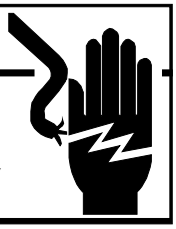
CHECKING FLAME SENSOR

A flame sensing device is used in conjunction with the ignition control module to prove combustion. If proof of flame is not present the control will de-energize the gas valve and "retry" for ignition or lockout.

⚠ 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.

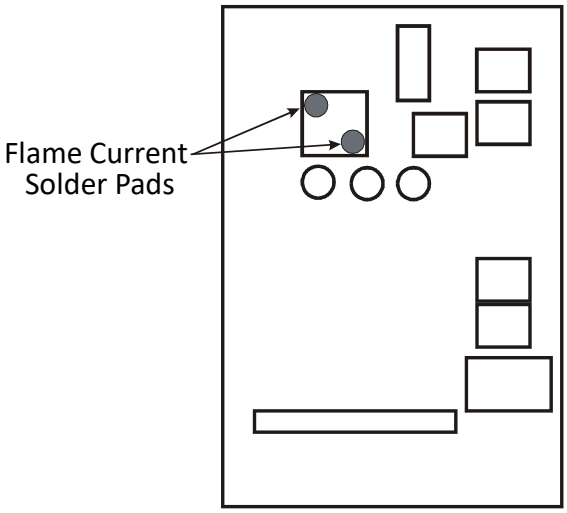


Flame current can be measured in two ways:

1. Putting a D.C. microamp meter in series with the flame rod
2. Putting a D.C. volt meter across the two solder pads in the flame current section of the control board.

   1 D.C. volt = 1 microamp.

SERVICING



⚠ WARNING

LINE VOLTAGE NOW PRESENT

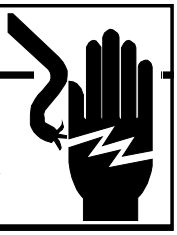
3. As soon as flame is established a micro-amp reading should be evident once proof of flame (micro-amp reading) is established, the hot surface ignitor will be de-energized.
4. The Integrated Ignition controls will have 1 to 4 micro-amps. If the micro-amp reading is less than the minimum specified, check for high resistance wiring connections, sensor to burner gap, dirty flame sensor, or poor grounding.
5. If absolutely 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.

⚠ 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.



⚠ CAUTION

IF YOU MUST HANDLE THE ITNITOR, HANDLE WITH CARE. TOUCHING THE IGNITOR BODY WITH BARE FINGERS, ROUGH HANDLING, OR VIBRATION COULD RESULT IN EARLY IGNITOR FAILURE. ONLY A QUALIFIED SERVICER SHOULD EVER HANDLE THE IGNITOR.

TROUBLESHOOTING

Symptoms	Green LED Code	Amber LED Code	Red LED Code	Fault Description	Check	Cautions
•Furnace fails to operate •Control board LED is off	•None	•None	•None	•Defective disconnect switch •defective door switch • No 115 volt power •No 24 volt power	•Determine cause and restore proper high and low volt power supply	•Confirm electrically safe condition before proceeding with repairs
•Furnace is waiting for a call	•Solid ON	•None	•None	•Furnace is not receiving a call	•None Required	•Confirm electrically safe condition before proceeding with work
•Furnace fan only is running	•Rapid Flash	•None	•None	•Furnace is receiving a call for fan (24 volts on G terminal	•None Required	•Confirm electrically safe condition before proceeding with work
•Normal operation with low stage call for cooling (Ylo & G)	•One repeating flash	•None	•None	•Normal operation with low stage call for cooling (Ylo & G)	•None Required	•Confirm electrically safe condition before proceeding with work
•Normal operation with high or single stage call for cooling (Y & G)	•Two repeating flashes	•None	•None	•Normal operation with high or single stage call for cooling (Y & G)	•None Required	•Confirm electrically safe condition before proceeding with work
•Normal operation with low stage call for heat (W1)	•None	•One repeating flash	•None	•Normal operation with low stage call for heat (W1)	•None Required	•Confirm electrically safe condition before proceeding with work
•Normal operation with high or single stage call for heat	•None	•Two repeating flashes	•None	•Normal operation with high or single stage call for heat	•None Required	•Confirm electrically safe condition before proceeding with work
•Furnace does not operate, three Amber flashes on control board	•None	•Three repeating flashes	•None	•W2 call present without W1	•Faulty thermostat or thermostat wiring or improperly connected thermostat wires	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, four Amber flashes on control board	•None	•Four repeating flashes	•None	•Ylo or Y call present without G	•Faulty thermostat or thermostat wiring or improperly connected thermostat wires	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, rapid Amber flashes on control board	•None	•Rapid	•None	•Low flame sense current	•Dirty / coated flame rod, poor flame, improper gas pressure, poor flame sense wire or connections	•Clean flame rod with steel wool. Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, one Red flash on control board	•None	•None	•One repeating flash	•Flame sensed when no flame should be present	•Gas valve stuck open, improper wiring to gas valve, shorted flame rod or wire	•Confirm electrical and gas safe conditions before proceeding with repairs
•Furnace does not operate, two Red flashes on control board, possible inducer operation	•None	•None	•Two repeating flashes	•Pressure switch stuck closed	•Faulty pressure switch, pressure switch wires shorted, control board inducer relay stuck closed	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, three Red flashes on control board	•None	•None	•Three repeating flashes	•Low fire pressure switch stuck open	•Faulty pressure switch, pressure switch or tubing or wiring / connection, control board inducer relay failed, vent pipe restriction / excessive elbows or length	•Confirm electrically safe condition before proceeding with repairs

TROUBLESHOOTING

Symptoms	Green LED Code	Amber LED Code	Red LED Code	Fault Description	Check	Cautions
•Furnace does not operate, four Red flashes on control board	•None	•None	•Four repeating flashes	•Open limit circuit, main limit, aux limit, or roll out switch	•Temperature rise, duct static, gas pressure, burner alignment, orifice plate position, wiring to all limits	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, five Red flashes on control board	•None	•None	•Five repeating flashes	•Limit & rollout circuit open for 15 minutes. Open control board fuse or rollout switch	•Control board fuse, Temperature rise, duct static, gas pressure, burner alignment, orifice plate position, wiring to all limits	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, six Red flashes on control board	•None	•None	•Six repeating flashes	•Pressure switch cycling lockout, pressure switch has opened 5 times in the same heating cycle	•Excessive venting restriction, leaking pressure switch tubing	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, seven Red flashes on control board	•None	•None	•Seven repeating flashes	•Lockout - excessive retries from flame not being proven during trial for ignition	•Gas pressure, gas valve, front cover pressure switch, flame rod	•Confirm electrical and gas safe conditions before proceeding with repairs
•Furnace does not operate, eight Red flashes on control board	•None	•None	•Eight repeating flashes	• Lockout - excessive recycles from flame proving being lost after being proven	•Gas pressure, gas valve, front cover pressure switch, flame rod	•Confirm electrical and gas safe conditions before proceeding with repairs
•Furnace does not operate, nine Red flashes on control board	•None	•None	•Nine repeating flashes	•Improper grounding or reverse polarity	•115 volt hot & neutral supply to furnace reversed, hot wire (door switch & L1 on control board) must read 115 volts to ground & neutral. Neutral wire should measure 0 volts to ground	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, ten Red flashes on control board	•None	•None	•Ten repeating flashes	•Gas valve current detected with no call for heat	•Verify gas valve is not receiving voltage from an electrical short. If valve wiring is correct replace control board	•Confirm electrical and gas safe conditions before proceeding with repairs
•Furnace does not operate, eleven Red flashes on control board, inducer running	•None	•None	•Eleven repeating flashes	•Open limit switch circuit for more than 5 minutes	•Re-set main power and check indoor blower operation	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, twelve Red flashes on control board	•None	•None	•Twelve repeating flashes	•Control board igniter relay not energizing igniter	•Replace control board	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, control board Red LED on solid	•None	•None	•Solid ON	•Control board internal fault	•Replace control board	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, control board Red LED rapid flash	•None	•None	•Rapid Flash	•Twinning error	•Correct twinning wiring	•Confirm electrically safe condition before proceeding with repairs
•Furnace does not operate, control board Red LED with three double flashes	•None	•None	•Three double flashes	•Second stage pressure switch stuck open	•Verify pressure switch function & tubing, verify inducer operating and pulling enough vacuum to engage switch	•Confirm electrically safe condition before proceeding with repairs

TROUBLESHOOTING

Green LED Flash	Amber LED Flash	Red LED Flash	Error/Condition
		1	Flame sensed when no flame should be present
		2	Pressure Switch Stuck Closed/ Inducer Error
		3	1st-stage Pressure Switch Stuck Open/ Inducer Error
		4	Open limit switch
		5	Open Rollout/Open Fuse Detect
		6	Pressure switch cycle lockout
		7	External lockout (retries)
		8	External lockout (recycles)
		9	Grounding or Reversed polarity
		10	Gas flow with no call for heat
		11	Limit switch open – blower failure
		12	Ignitor Relay Failure
		Solid	Internal, GV Error, Micro, and Frequency Check
		Rapid	Twinning error
		3 double	2nd-stage Pressure Switch Stuck Open/ Inducer Error
	1		Normal Operation with call for first stage heat (W1)
	2		Normal Operation with call for second stage heat (W2)
	3		W2 present with no W1
	4		Y present with no G call, Y1 present with no G call.
	Rapid		Low flame sense current
Solid			Standby
Rapid			Normal Operation with call for fan (G)
1			Normal Operation with call for Low stage cool (Ylo + G)
2			Normal Operation with call for High stage cool/or single stage cooling. (Y + G)

Dianostic Chart

Refer to the *Troubleshooting Chart* in the back of this manual for assistance in determining the source of unit operational problems.

External Lockout

- -A control lockout resulting from an external fault sensed by the control, such as an unsuccessful recycle or retry period, or a limit trip. Once in External Lockout, the control will shut down for a period of one hour before attempting another trial for ignition.

Internal Lockout

- -A failure internal to the control board.

Fault Recall

Retrieving Fault Codes

To retrieve fault codes, push and release the "LAST ERROR" button for more than 1/5 second and less than 5 seconds (the LED will indicate this period by solid GREEN for 1/5 second to 5 seconds). The LED will flash up to five stored fault codes, beginning with the most recent. If there are no fault codes in memory, the LED will flash two green flashes. The control will flash the most recent error first and the oldest error last. If multiple faults exist there will be 2 seconds between codes. Solid LED error codes will not be displayed.

Fault Code Reset

To clear the fault code memory, push and hold the "LAST ERROR" button for more than 5 seconds and less than 10 seconds (the LED will indicate this period by RAPID GREEN FLASH for 5 seconds to 10 seconds). The LED will flash three green flashes when the memory has been cleared.

The ignition control is equipped with a momentary push button switch that can be used to display on the diagnostic LED the last five faults detected by the control. The control must be in Standby Mode (no thermostat inputs) to use the feature.

Depress the push button switch for approximately 2 seconds. Release the switch when the LED is turned off. The diagnostic LED will then display the flash codes associated with the last five detected faults. The order of display is the most recent fault to the least recent fault.

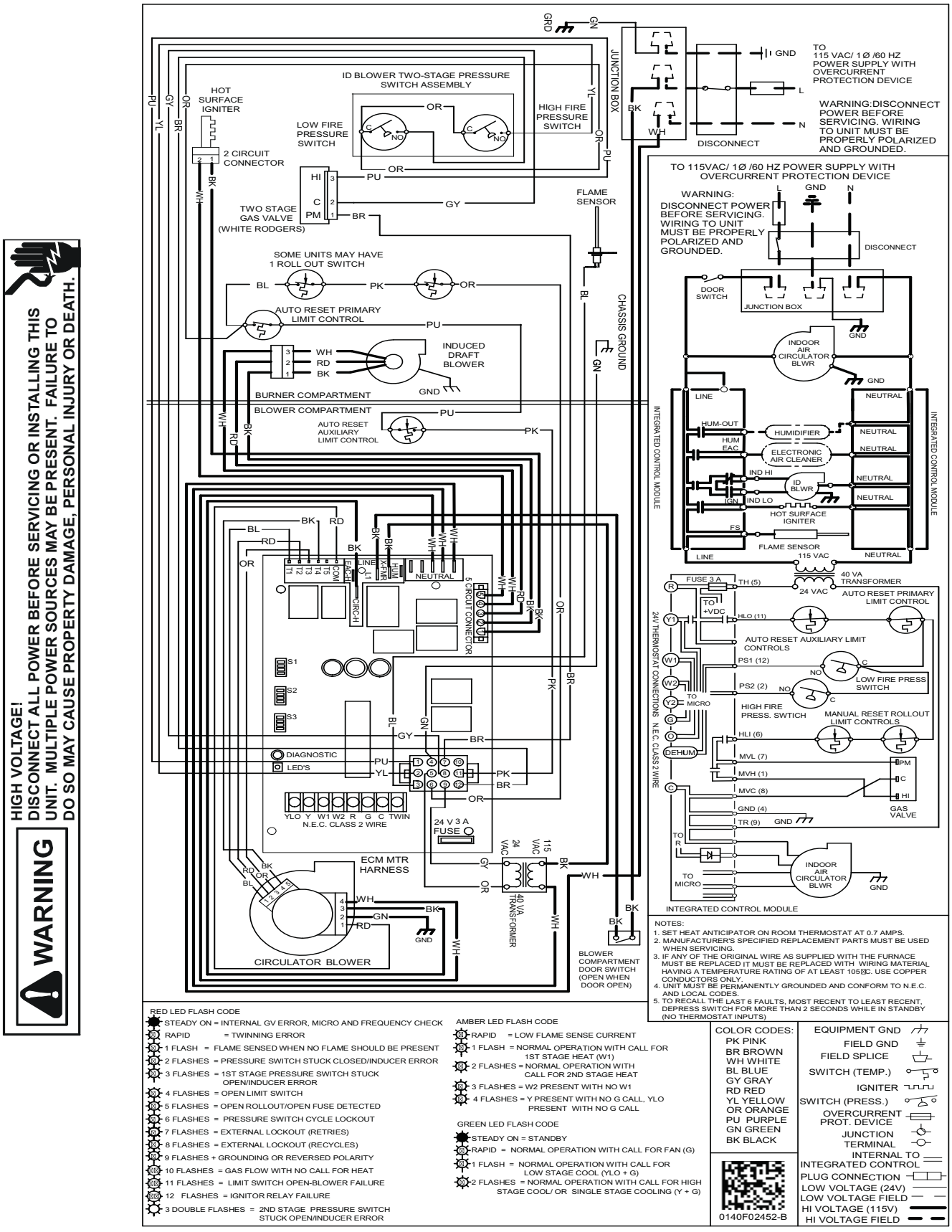
Resetting From Lockout

Furnace lockout results when a furnace is unable to achieve ignition after three attempts during a single call for heat. It is characterized by a non-functioning furnace and a one flash diagnostic LED code. If the furnace is in "lockout", it can be reset in any of the following ways.

1. Automatic reset. The integrated control module will automatically reset itself and attempt to resume normal operations following a one hour lockout period.
2. Manual power interruption. Interrupt 115 volt power to the furnace for 1 - 20 seconds.
3. Manual thermostat cycle. Lower the thermostat so that there is no longer a call for heat then reset to previous setting. Interrupt thermostat signal to the furnace for 1 - 20 seconds.

WIRING DIAGRAMS

*MES80/*CES80
(WITH PCBBF161 CONTROL BOARD)



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

CUSTOMER FEEDBACK
We are very interested in all product comments.
Please fill out the feedback form on one of the following links:
Goodman® Brand Products: (http://www.goodmanmfg.com/about/contact-us).
Amana® Brand Products: (http://www.amana-hac.com/about-us/contact-us).
You can also scan the QR code on the right for the product brand you purchased to be directed to the feedback page.

GOODMAN® BRAND

AMANA® BRAND