

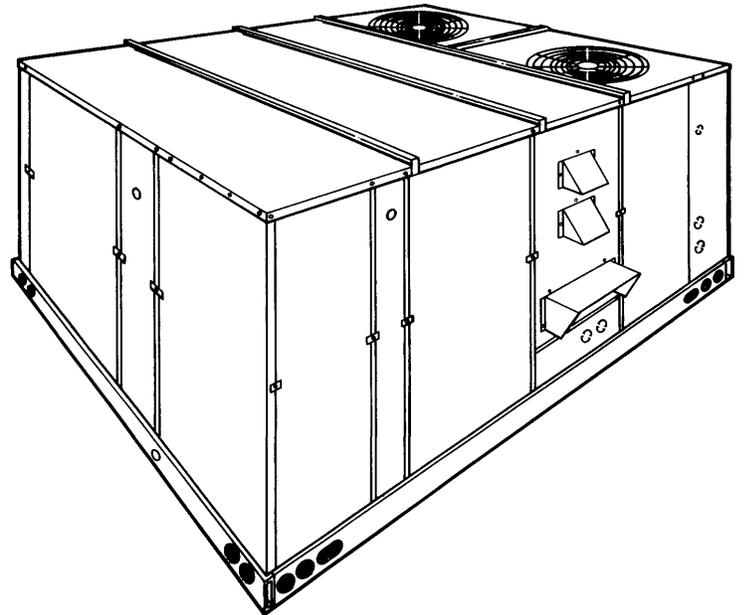
# INSTALLATION MANUAL - 50Hz

## SUNLINE™ 2000 GAS/ELECTRIC SINGLE PACKAGE AIR CONDITIONERS

MODELS: DM180, 240 & 300  
(Export)

### CONTENTS

GENERAL .....	4
SAFETY CONSIDERATIONS .....	4
INSPECTION .....	4
REFERENCE .....	4
RENEWAL PARTS .....	5
APPROVALS .....	5
PRODUCT NOMENCLATURE .....	6
INSTALLATION .....	7
OPERATION .....	36
START-UP (COOLING) .....	42
START-UP (GAS HEAT) .....	43
TROUBLESHOOTING .....	45



See the following page for a complete Table of Contents.

### NOTES, CAUTIONS AND WARNINGS

The installer should pay particular attention to the words: *NOTE*, *CAUTION*, and *WARNING*. *Notes* are intended to clarify or make the installation easier. *Cautions* are given to prevent equipment damage. *Warnings* are given to alert installer that personal injury and/or equipment damage may result if installation procedure is not handled properly.

**CAUTION: READ ALL SAFETY GUIDES BEFORE YOU BEGIN TO INSTALL YOUR UNIT.**

SAVE THIS MANUAL



ISO 9001  
Certified Quality  
Management System

## TABLE OF CONTENTS

<b>GENERAL</b> .....	4	ECONOMIZER (SINGLE OR DUAL ENTHALPY) WITH	
<b>SAFETY CONSIDERATIONS</b> .....	4	POWER EXHAUST - .....	37
<b>INSPECTION</b> .....	4	MOTORIZED OUTDOOR AIR DAMPERS - .....	37
<b>REFERENCE</b> .....	4	COOLING OPERATION ERRORS .....	37
<b>RENEWAL PARTS</b> .....	5	HIGH-PRESSURE LIMIT SWITCH .....	37
<b>APPROVALS</b> .....	5	LOW-PRESSURE LIMIT SWITCH .....	37
<b>PRODUCT NOMENCLATURE</b> .....	6	FREEZESTAT .....	37
<b>INSTALLATION</b> .....	7	LOW AMBIENT COOLING .....	38
INSTALLATION SAFETY INFORMATION: .....	7	SAFETY CONTROLS .....	38
LIMITATIONS .....	7	COMPRESSOR PROTECTION .....	38
LOCATION .....	8	FLASH CODES .....	38
RIGGING AND HANDLING .....	9	RESET .....	38
CLEARANCES .....	9	ELECTRIC HEATING SEQUENCE OF OPERATIONS ...	38
DUCTWORK .....	10	HEATING OPERATION ERRORS .....	39
FIXED OUTDOOR AIR INTAKE DAMPER .....	10	TEMPERATURE LIMIT .....	39
CONDENSATE DRAIN .....	11	SAFETY CONTROLS .....	39
COMPRESSORS .....	11	FLASH CODES .....	39
FILTERS .....	11	RESET .....	39
SERVICE ACCESS .....	11	HEAT ANTICIPATOR SETPOINTS .....	39
THERMOSTAT .....	13	GAS HEATING SEQUENCE OF OPERATIONS .....	39
POWER AND CONTROL WIRING .....	13	GAS HEATING OPERATION ERRORS .....	40
OPTIONAL ELECTRIC HEAT .....	13	TEMPERATURE LIMIT .....	40
OPTIONAL GAS HEAT .....	14	GAS VALVE .....	41
GAS PIPING .....	14	SAFETY CONTROLS .....	41
GAS CONNECTION .....	14	FLASH CODES .....	42
L.P. UNITS, TANKS AND PIPING .....	15	RESETS .....	42
VENT AND COMBUSTION AIR HOODS .....	16	HEAT ANTICIPATOR SETPOINTS .....	42
OPTIONAL ECONOMIZER/MOTORIZED DAMPER RAIN		<b>START-UP (COOLING)</b> .....	<b>42</b>
HOOD .....	16	PRESTART CHECK LIST .....	42
OPTIONAL POWER EXHAUST/BAROMETRIC RELIEF		OPERATING INSTRUCTIONS .....	42
DAMPER RAIN HOOD .....	17	POST START CHECK LIST .....	42
OPTIONAL ECONOMIZER AND POWER EXHAUST		SHUT DOWN .....	43
DAMPER SET POINT ADJUSTMENTS AND		<b>START-UP (GAS HEAT)</b> .....	<b>43</b>
INFORMATION .....	17	PRE-START CHECK LIST .....	43
MINIMUM POSITION ADJUSTMENT .....	17	OPERATING INSTRUCTIONS .....	43
ENTHALPY SET POINT ADJUSTMENT .....	17	TO LIGHT PILOT AND MAIN BURNERS: .....	43
POWER EXHAUST DAMPER SETPOINT .....	17	TO SHUT DOWN: .....	43
INDOOR AIR QUALITY AQ .....	17	POST-START CHECK LIST (GAS) .....	43
OPTIONAL BAS-READY ECONOMIZER POWER EX-		MANIFOLD GAS PRESSURE ADJUSTMENT .....	44
HAUST DAMPER SET POINT ADJUSTMENT .....	17	PILOT CHECKOUT .....	44
CFM, STATIC PRESSURE, AND POWER -		BURNER INSTRUCTIONS .....	44
ALTITUDE AND TEMPERATURE CORRECTIONS .....	26	BURNER AIR SHUTTER ADJUSTMENT .....	44
PHASING .....	34	CHECKING GAS INPUT .....	44
CHECKING AIR SUPPLY CFM .....	34	NATURAL GAS .....	44
<b>OPERATION</b> .....	<b>36</b>	ADJUSTMENT OF TEMPERATURE RISE .....	45
SEQUENCE OF OPERATIONS OVERVIEW .....	36	BELT DRIVE BLOWER .....	45
COOLING SEQUENCE OF OPERATION .....	36	<b>TROUBLESHOOTING</b> .....	<b>45</b>
CONTINUOUS BLOWER .....	36	COOLING TROUBLESHOOTING GUIDE .....	45
INTERMITTENT BLOWER .....	36	GAS HEAT TROUBLESHOOTING GUIDE .....	50
NO OUTDOOR AIR OPTIONS .....	36	UNIT FLASH CODES .....	52
ECONOMIZER WITH SINGLE ENTHALPY SENSOR - ..	36	UNIT CONTROL BOARD OPTION SETUP .....	54
ECONOMIZER WITH DUAL ENTHALPY SENSORS - ..	37	OPTION BYTE SETUP .....	54
		HEAT DELAY SETUP .....	54

**LIST OF FIGURES**

<u>Fig. #</u>	<u>Pg. #</u>
1	9
2	9
3	11
4	11
5	12
6	15
7	15
8	16
9	18
10	18
11	19
12	19
13	23
14	24
15	25
16	27
17	34
18	35
19	40
20	42
21	43
22	44
23	44
24	53

**LIST OF TABLES**

<u>Tbl. #</u>	<u>Pg. #</u>
1	8
2	13
3	13
4	14
5	14
6	19
7	20
8	21
9	22
10	23
11	26
12	28
13	29
14	30
15	31
16	32
17	33
18	33
19	33
20	39
21	39
22	41
23	42
24	45
25	53
26	54

## GENERAL

YORK Model DM units are either single package air conditions equipped with optional factory installed electric heaters, or single package gas-fired central heating furnaces with cooling unit. Both are designed for outdoor installation on a rooftop or slab.

The units are completely assembled on rigid, permanently attached base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require electric power, gas connection, duct connections, installation of combustion air inlet hood, flue gas outlet hoods and fixed outdoor air intake damper (units without economizer or motorized damper option only) at the point of installation.

The supplemental electric heaters have nickel-chrome elements and utilize single point power connection.

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition with proven pilot. All gas heaters are shipped from the factory equipped for natural gas use, but can be field converted to L.P./ Propane with Kit Model # 1NP0418. See Gas Heat Application Data Table.

## SAFETY CONSIDERATIONS

Due to system pressure, moving parts and electrical components, installation and servicing of air conditioning equipment can be hazardous. Only qualified, trained, service personnel should install, repair, maintain or service this equipment.

Observe all precautions in the literature, on labels and tags accompanying the equipment whenever working on air conditioning equipment. Be sure to follow all other safety precautions that apply.

Wear safety glasses and work gloves, and follow all safety codes. Use a quenching cloth and have a fire extinguisher available for all brazing operations.

### WARNING

#### FIRE OR EXPLOSION HAZARD

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

- 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.
  - Leave the building immediately.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  - If you cannot reach the gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

## INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing.

## REFERENCE

Additional information on the design, installation, operation and service of this equipment is available in the following reference forms:

- Technical Guide - 262257
- General Installation - 175240

## RENEWAL PARTS

Contact your local York® Parts Distribution Center for authorized replacement parts.

## APPROVALS

Design certified by CSA as follows:

- For use as a cooling unit only with or without optional electric heat.
- For use as a forced air furnace with cooling unit
- For outdoor installation only.
- For installation on combustible material.
- For use with natural gas or propane gas.

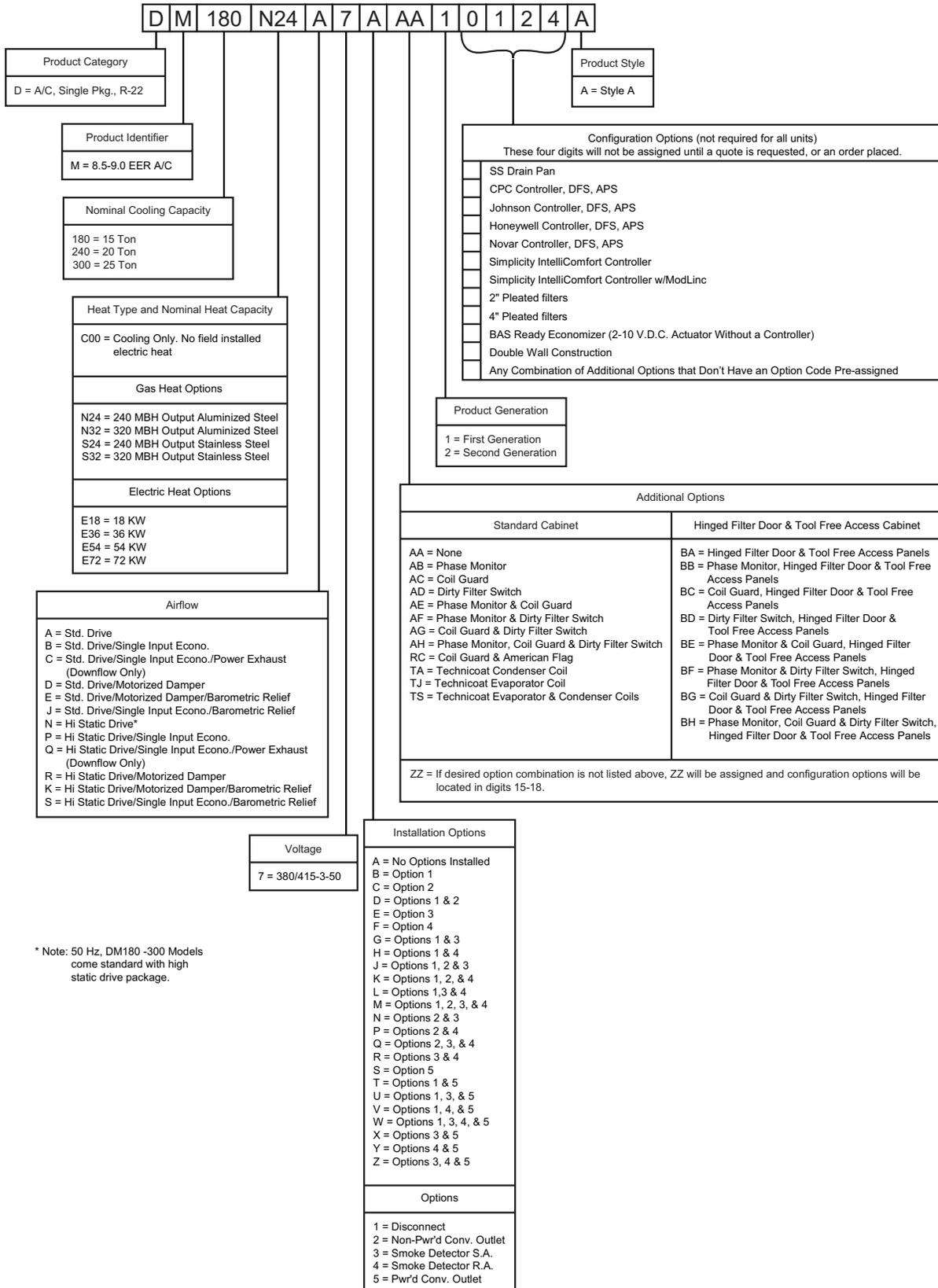
 <b>CAUTION</b>
THIS PRODUCT MUST BE INSTALLED IN STRICT COMPLIANCE WITH THE ENCLOSED INSTALLATION INSTRUCTIONS AND ANY APPLICABLE LOCAL, STATE, AND NATIONAL CODES INCLUDING, BUT NOT LIMITED TO, BUILDING, ELECTRICAL, AND MECHANICAL CODES.

 <b>WARNING</b>
IMPROPER INSTALLATION MAY CREATE A CONDITION WHERE THE OPERATION OF THE PRODUCT COULD CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

The installer should pay particular attention to the words: NOTE, CAUTION and WARNING. Notes are intended to clarify or make the installation easier. Cautions are given to prevent equipment damage. Warnings are given to alert installer that personal injury and/or equipment damage may result if installation procedure is not handled properly.

# PRODUCT NOMENCLATURE

## 15-25 Ton Sunline & Magnum™ & MagnaDRY™ Model Number Nomenclature



\* Note: 50 Hz, DM180 -300 Models come standard with high static drive package.

## INSTALLATION

### INSTALLATION SAFETY INFORMATION:

Read these instructions before continuing this appliance installation. This is an outdoor combination heating and cooling unit. The installer must assure that these instructions are made available to the consumer and with instructions to retain them for future reference.

1. Refer to the unit rating plate for the approved type of gas for this unit.
2. Install this unit only in a location and position as specified on Page 10 of these instructions.
3. Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when checking all connections, as specified on Pages 8, 16, 17 and 40 of these instructions.
4. Always install unit to operate within the furnace's intended temperature-rise range with the duct system and within the allowable external static pressure range, as specified on the unit name/rating plate, specified on Page 42 of these instructions.
5. This equipment is not to be used for temporary heating of buildings or structures under construction.

### **▲WARNING**

#### FIRE OR EXPLOSION HAZARD

FAILURE TO FOLLOW THE SAFETY WARNING EXACTLY COULD RESULT IN SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

NEVER TEST FOR GAS LEAKS WITH AN OPEN FLAME. USE A COMMERCIALY AVAILABLE SOAP SOLUTION MADE SPECIFICALLY FOR THE DETECTION OF LEAKS TO CHECK ALL CONNECTIONS. A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

## LIMITATIONS

These units must be installed in accordance with the following national and local safety codes:

### In U.S.A.:

- National Electrical Code ANSI/NFPA No. 70.
- National Fuel Gas Code Z223.1.
- Gas-Fired Central Furnace Standard ANSI Z21.47a.
- Local gas utility requirements.

### In Canada:

- Current Canadian Electrical Code C22.1.
- Current Gas Installation Codes CSA-B149.1.
- Local plumbing and waste water codes.
- Other applicable local codes.

Refer to the Unit Application Data table and to the Gas Heat Application Data table.

After installation, the unit must be adjusted to obtain a temperature rise within the range specified on the unit rating plate.

If components are to be added to a unit to meet local codes, they are to be installed at the dealer's and/or the customer's expense.

Size of unit for proposed installation should be based on heat loss/heat gain calculation made according to the methods of the Air Conditioning Contractors of America (ACCA).

This equipment is not to be used for temporary heating of buildings or structures under construction.

### International:

- Local Government/Agency Regulations

**TABLE 1: UNIT APPLICATION DATA**

UNIT MODEL NUMBER		DM180	DM240	DM300
Voltage Variation, Min. / Max. <sup>1</sup>	380/415-3-50	342/456		
Supply Air CFM, Min. / Max.		4,500 / 7,200	6,000 / 9,400	7,500 / 12,500
Wet Bulb Temperature (°F) of Air on Evaporator Coil, Min. / Max.		57 / 72		
Dry Bulb Temperature (°F) of Air on Condenser Coil, Min. / Max.		0 / 125		

<sup>1</sup>. Utilization range "A" in accordance with ARI Standard 110.

## LOCATION

Use the following guidelines to select a suitable location for these units.

- Unit is designed for outdoor installation only.
- Condenser coils must have an unlimited supply of air.
- Where a choice of location is possible, position the unit on either north or east side of building.
- For ground level installation, use a level concrete slab with a minimum thickness of 4 inches. The length and width should be at least 6 inches greater than the unit base rails. Do not tie slab to the building foundation.
- Roof structures must be able to support the weight of the unit and its options and/or accessories. Unit must be installed on a solid level roof curb or appropriate angle iron frame.
- Maintain level tolerance to 1/2 inch maximum across the entire length or width of the unit.

### **WARNING**

Excessive exposure of this furnace to contaminated combustion air may result in equipment damage or personal injury. Typical contaminants include: permanent wave solutions, chlorinated waxes and cleaners, chlorine based swimming pool chemicals, water softening chemicals, carbon tetrachloride, Halogen type refrigerants, cleaning solvents (e.g. perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, antistatic fabric softeners for clothes dryers, masonry acid washing materials.

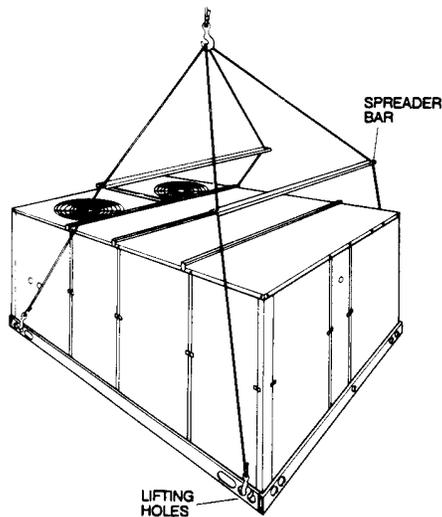
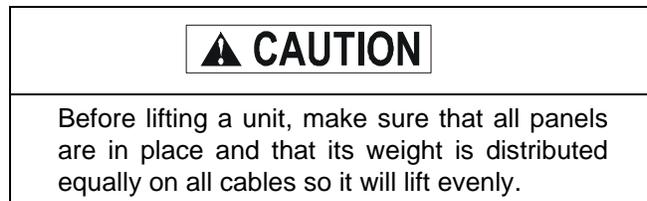
If a unit is to be installed on a roof curb or special frame other than a YORK roof curb, gasketing must be applied to all surfaces that come in contact with the unit

## RIGGING AND HANDLING

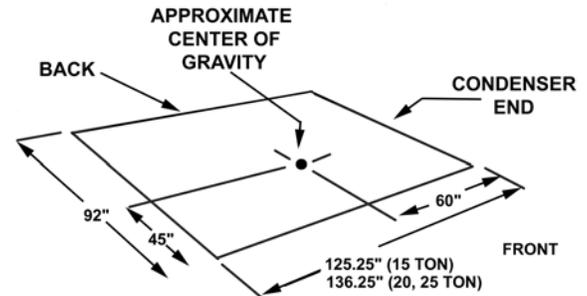
Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the round lifting holes provided in the base rails. Spreaders, whose length exceeds the largest dimension across the unit, **MUST BE USED**. Refer to Figure 1.

Units may also be moved or lifted with a forklift, from the **side only**, providing that an accessory skid is used. LENGTH OF FORKS MUST BE A MINIMUM OF 90".

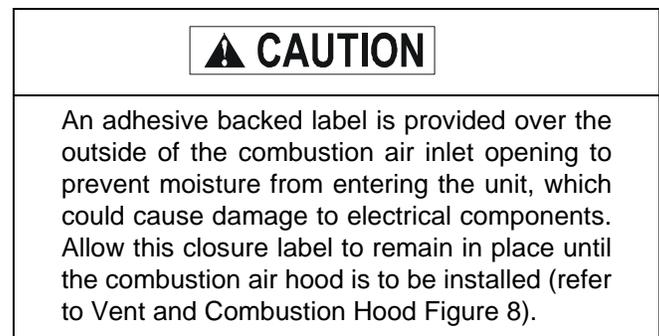
Refer to the Physical Data Table 7 for unit weights and to the Figures 2 or 12 for approximate center of gravity.



**FIGURE 1 - TYPICAL RIGGING**



**FIGURE 2 - CENTER OF GRAVITY**



## CLEARANCES

All units require certain clearances for proper operation and service. Installer must make provisions for adequate combustion and ventilation air in accordance with Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 (in U.S.A.) or Sections 7.2, 7.3 or 7.4 of Gas Installation Codes CSA-B149.1 (in Canada) and/or applicable provisions of the local building codes. Refer to Dimensions and Clearances Figure 13 for the clearances required for combustible construction, servicing, and proper unit operation.

**▲ WARNING**

Do not permit overhanging structures or shrubs to obstruct outdoor air discharge outlet, combustion air inlet or vent outlets.

**DUCTWORK**

Ductwork should be designed and sized according to the methods in Manual Q of the Air Conditioning Contractors of America (ACCA).

A closed return duct system shall be used. This shall not preclude use of economizers or outdoor fresh air intake. The supply and return air duct connections at the unit should be made with flexible joints to minimize noise.

The supply and return air duct systems should be designed for the CFM and static requirements of the job. They should NOT be sized to match the dimensions of the duct connections on the unit.

**▲ CAUTION**

When fastening ductwork to side duct flanges on unit, insert screws through duct flanges only. DO NOT insert screws through casing. Outdoor ductwork must be insulated and waterproofed.

Refer to Dimensions and Clearances Figure 13 for information concerning side and bottom supply and return air duct openings.

**NOTE:** It is recommended that, in Canada, the outlet duct be provided with a removable access panel. It is recommended that this opening be accessible when the unit is installed in service, and of a size such that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The cover should be attached in a manner adequate to prevent leakage.

**FIXED OUTDOOR AIR INTAKE DAMPER**

This damper is shipped inside the return air compartment. It is completely assembled and ready for installation. A damper baffle inside of the hood is adjustable to provide variable amounts of outdoor air intake on units that are not provided with an economizer or a motorized damper option. Refer to the Fixed Outdoor Damper Figure 3.

Gasketing and mounting screws are provided in a parts bag attached to the hood assembly. Apply gasketing to the three flange surfaces on the hood prior to installing the hood. Extend gasketing 1/4 inch beyond the top and bottom of the two side flanges to insure adequate sealing.

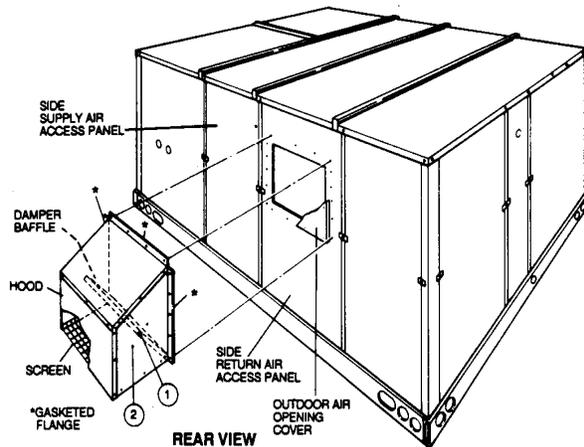
Adjusting the damper to the desired air flow may be done before mounting the hood into position or after installation by removing the front hood panel or the screen on the bottom of the hood. Damper baffle in position 1 will allow approximately 10% outdoor air flow, position 2 approximately 15% and, to allow approximately 25%, remove the damper baffle.

On units with bottom return air application install the damper assembly over the opening in the side return air access panel. Remove and discard the opening cover and the covering over the hood mounting holes (used for shipping) before installing. Secure with the screws provided.

On units with side return air applications, install the damper assembly on the return air ductwork as close to the unit as possible. Cut an opening 16 inches high by 18 inches wide in the ductwork to accommodate the damper. Using the holes in the hood flanges as a template, drill 9/64 inch dia. (#26 drill) holes into the ductwork and secure with the screws provided.

**▲ CAUTION**

If outdoor air intake will not be required on units with bottom return air applications, the damper assembly should still be mounted on the side return air access panel, per the instructions above, to insure moisture is not drawn into the unit during operation. The covering over the mounting holes only need be removed. Do not remove the opening cover.

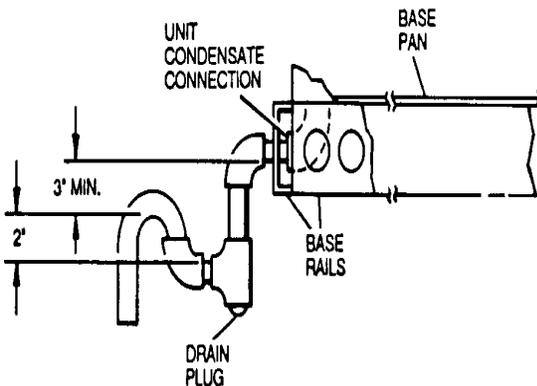


**FIGURE 3 - FIXED OUTDOOR AIR DAMPER**

### CONDENSATE DRAIN

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install a condensate drain line from the one-inch NPT female connection on the unit to an open drain.

**NOTE:** The condensate drain operates in a negative pressure in the cabinet. The condensate drain line **MUST** be trapped to provide proper drainage. See Figure 4.



**FIGURE 4 - RECOMMENDED DRAIN PIPING**

### COMPRESSORS

Units are shipped with compressor mountings factory-adjusted and ready for operation.

#### **CAUTION**

Do not loosen compressor mounting bolts.

### FILTERS

Two-inch or four-inch filters can be supplied with each unit. Filters must always be installed ahead of the evaporator coil and must be kept clean or replaced with same size and type. Dirty filters will reduce the capacity of the unit and will result in frosted coils or safety shut-down. Minimum filter area and required sizes are shown in Physical Data Table 7.

### SERVICE ACCESS

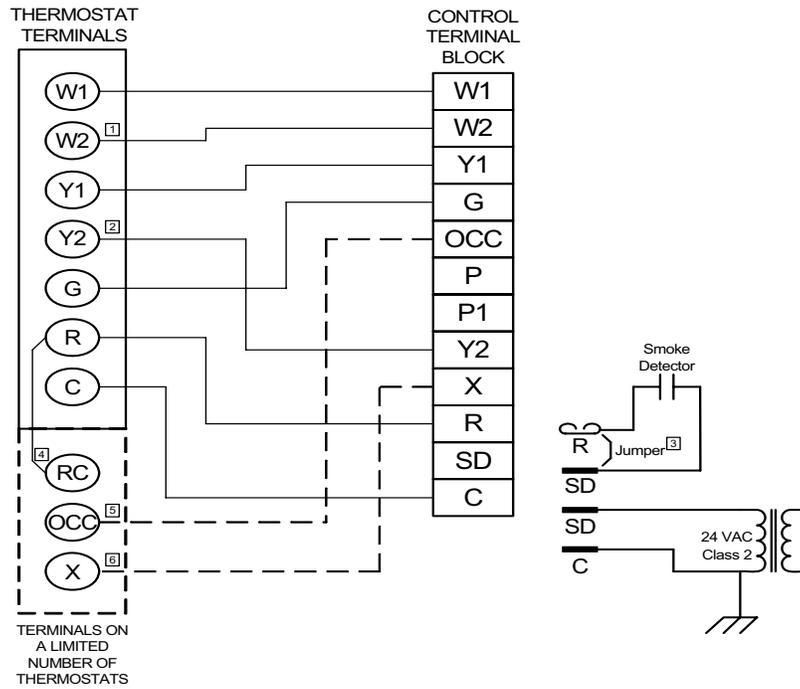
The following removable panels provide access to all serviceable components:

- Compressor compartment
- Electric Heat compartment
- Gas Heat compartment (Two panels)
- Side Supply & Return Air compartments (Two panels)
- Blower compartment (Three panels)
- Main control box
- Filter compartment
- Outdoor Air compartment (Two panels)

Refer to the Dimensions and Clearances Figure 13 for location of these access panels.

#### **CAUTION**

Make sure that all screws and panel latches are replaced and properly positioned on the unit to maintain an airtight seal.



- ❑ Second stage heating not required on single stage heating units.
- ❑ Second stage cooling not required on single stage cooling units.
- ❑ Jumper is required if there is no Smoke Detector circuit.
- ❑ Jumper is required for any combination of R, RC, or RH.
- ❑ OCC is an output from the thermostat to indicate the Occupied condition.
- ❑ X is an input to the thermostat to display Error Status conditions.

**FIGURE 5 - FIELD WIRING - DM ELECTRIC/ELECTRIC AND GAS/ ELECTRIC UNITS**

## THERMOSTAT

The room thermostat should be located on an inside wall approximately 56 inches above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow manufacturer's instructions enclosed with thermostat for general installation procedure. A minimum of seven color-coded insulated wires (#18 AWG) should be used to connect thermostat to unit.

## POWER AND CONTROL WIRING

Field wiring to the unit must conform to provisions of the National Electrical Code, ANSI / NFPA No. 70 (in U.S.A.), current Canadian Electrical Code C22.1 (in Canada) and/or local ordinances. The unit must be electrically grounded in accordance with NEC and CEC (as specified above) and/or local codes. Voltage tolerances, which must be maintained at the compressor terminals, during starting and running conditions, are indicated on the unit Rating Plate and the Unit Application Data table.

The internal wiring harness furnished with this unit is an integral part of a CSA design certified unit. Field alteration to comply with electrical codes should not be required.

A fused disconnect switch should be field provided for the unit. The switch must be separate from all other circuits. Wire entry at knockout openings require conduit fittings to comply with NEC (in U.S.A.), CEC (in Canada) and/or local codes. Refer to the Dimensions and Clearances Figure 13 for installation location. If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram and the same minimum gauge as the replaced wire.

Electrical line must be sized properly to carry the load. Use copper conductors only. Each unit must be wired

with a separate branch circuit fed directly from the meter panel and properly fused.

### CAUTION

When connecting electrical power and control wiring to the unit, waterproof type connectors **MUST BE USED** so that water or moisture cannot be drawn into the unit during normal operation. The above waterproofing conditions will also apply when installing a field-supplied disconnect switch.

Refer to the Typical Field Wiring Figure 5 and to the appropriate unit wiring diagram for control circuit and power wiring information.

**TABLE 2: CONTROL WIRE SIZES**

Wire Size	Maximum Length <sup>1</sup>
18 AWG	150 Feet

<sup>1</sup>. From the unit to the thermostat and back to the unit.

## OPTIONAL ELECTRIC HEAT

The factory-installed heaters are wired for single point power supply. Power supply need only be brought into the single point terminal block and thermostat wiring to the low voltage terminal strip located in the upper portion of the unit control box.

These CSA approved heaters are located within the central compartment of the unit with the heater elements extending into the supply air chamber. Refer to Figure 13 for access panel location.

Fuses are supplied, where required, by the factory. Some KW sizes require fuses and others do not. Refer to Table 3 for minimum CFM limitations and to Tables 8 and 9 for electrical data.

**TABLE 3: ELECTRIC HEAT APPLICATION DATA**

NOMINAL HEATER SIZE (KW)	VOLTAGE 3-PHASE, 50 HZ	MINIMUM CFM UNIT SIZE		
		15 TON	20 TON	25 TON
18	380/415	4500	6000	7500
36	380/415	4500	6000	7500
54	380/415	5000	6000	7500
72	380/415	5000	6000	7500

## OPTIONAL GAS HEAT

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition with proven pilot.

All gas heaters are shipped from the factory equipped for natural gas use, but can be field converted to L.P./Propane with Kit Model # 1NP0418. See Gas Heat Application Data Table.

**TABLE 4: GAS HEAT APPLICATION DATA**

0 To 2,000 Feet Above Sea Level		2,000 To 4,500 Feet Above Sea Level		Output Capacity (Mbh)		Available on Models	Gas Rate (Ft./Hr.)	Temp. Rise °F At Full Input	
				0 To 2,000 Feet Above Sea Level	2,000 To 4,500 Feet Above Sea Level			Min.	Max.
Max.	Min.	Max.	Min.	Max.	Max.			Min.	Max.
300	150	270	135	240	213	15, 20 & 25 Ton	279	20	50
350	175	320	160	280	241	25 Ton	326	30	60

## GAS PIPING

Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of run. "National Fuel Gas Code" Z223.1 (in U.S.A.) or the current Gas Installation Codes CSA-B149.1 (in Canada) should be followed in all cases unless superseded by local codes or gas utility requirements. Refer to the Pipe Sizing Table 5.

The heating value of the gas may differ with locality. The value should be checked with the local gas utility.

**NOTE:** There may be a local gas utility requirement specifying a minimum diameter for gas piping. All units require a one-inch pipe connection at the entrance fitting.

**TABLE 5: PIPE SIZING**

Length in Feet	Nominal Iron Pipe Size	
	1 in.	1-1/4 in.
10	520	1,050
20	350	730
30	285	590
40	245	500
50	215	440
60	195	400
70	180	370
80	170	350
90	160	320
100	150	305

Maximum capacity of pipe in cubic feet of gas per hour. (Based upon a pressure drop of 0.3 inch water column and 0.6 specific gravity gas).

## GAS CONNECTION

The gas supply line can be routed through the knockouts located on the front of the unit or through the opening provided in the unit's base. Refer to the Dimensions and Clearances Figure 13 to locate these access openings. Typical supply piping arrangements are shown in the figures on page 15. All shaded items are field-supplied.

If gas supply line is routed through the unit's base ensure that the burner assembly can be removed for maintenance without disturbing the supply line. The supply piping and fittings must lie below the bottom gas manifold to avoid interference with the burner assembly.

Two grommets are shipped in the blower compartment (in parts bag taped to the blower housing) of every unit with gas heat and should be used in the knockouts when the gas piping penetrates the front of the unit.

After the gas supply piping has been installed, the bottom opening in the unit should be sealed to prevent water from leaking into the building.

### **Gas piping recommendations:**

1. A drip leg and a ground joint union must be installed in the gas piping.
2. When required by local codes, a manual shut-off valve may have to be installed outside of the unit.
3. Use wrought iron or steel pipe for all gas lines. Pipe compound should be applied sparingly to male threads only.

**▲WARNING**

Natural gas may contain some propane. Propane, being an excellent solvent, will quickly dissolve white lead or most standard commercial compounds. Therefore, a special pipe compound must be applied when wrought iron or steel pipe is used. Shellac base compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clyde's or John Crane may be used.

- All piping should be cleaned of dirt and scale by hammering on the outside of the pipe and blowing out the loose dirt and scale. Before initial start-up, be sure that all of the gas lines external to the unit have been purged of air.
- The gas supply should be a separate line and installed in accordance with all safety codes as prescribed under "Limitations". After the gas connections have been completed, open the main shut-off valve admitting normal gas pressure to the mains. Check all joints for leaks with soap solution or other material suitable for the purpose. **NEVER USE A FLAME.**

**▲WARNING****FIRE OR EXPLOSION HAZARD**

FAILURE TO FOLLOW THE SAFETY WARNING EXACTLY COULD RESULT IN SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

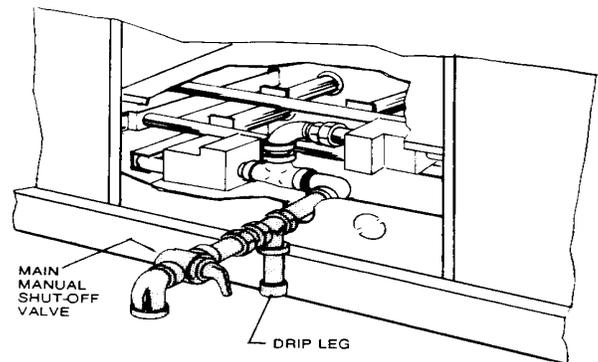
NEVER TEST FOR GAS LEAKS WITH AN OPEN FLAME. USE A COMMERCIALY AVAILABLE SOAP SOLUTION MADE SPECIFICALLY FOR THE DETECTION OF LEAKS TO CHECK ALL CONNECTIONS. A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

- The furnace and its individual manual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.48kPa).

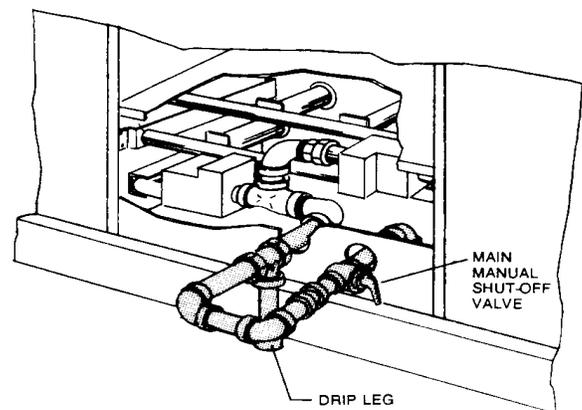
The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas

supply piping system at test pressures equal to or less than 1/2 psig (3.48kPa).

- A 1/8 inch NPT plugged tap, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the furnace.



**FIGURE 6 - EXTERNAL SUPPLY CONNECTION  
EXTERNAL SHUT-OFF**



**FIGURE 7 - BOTTOM SUPPLY CONNECTION  
EXTERNAL SHUT-OFF**

**L.P. UNITS, TANKS AND PIPING**

All gas heat units are shipped from the factory equipped for natural gas use only. The unit may be converted in the field for use with L.P./propane gas with accessory kit model number 1NP0418.

All L.P./propane gas equipment must conform to the safety standards of the National Fire Protection Association.

For satisfactory operation, L.P./propane gas pressure must be 10.0 I.W.C. at the unit manifold under full load. Maintaining proper gas pressure depends on three main factors:

1. The vaporization rate depends on (a) the temperature of the liquid and (b) the "wetted surface" area of the container or containers.
2. The proper pressure regulation. (Two-stage regulation is recommended from the standpoint of both cost and efficiency.)
3. The pressure drop in the lines between regulators and between the second stage regulator and the appliance. Pipe size required will depend on the length of the pipe run and the total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and L.P./propane gas suppliers.

L.P./propane gas is an excellent solvent and special pipe compound must be used when assembling piping for this gas as it will quickly dissolve white lead or most standard commercial compounds. Shellac base compounds such as Rectorseal #5 are satisfactory for this type of gas.

Check all connections for leaks when piping is completed, using a soap solution. **NEVER USE A FLAME.**

### **▲WARNING**

#### **FIRE OR EXPLOSION HAZARD**

FAILURE TO FOLLOW THE SAFETY WARNING EXACTLY COULD RESULT IN SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

NEVER TEST FOR GAS LEAKS WITH AN OPEN FLAME. USE A COMMERCIALY AVAILABLE SOAP SOLUTION MADE SPECIFICALLY FOR THE DETECTION OF LEAKS TO CHECK ALL CONNECTIONS. A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

#### **VENT AND COMBUSTION AIR HOODS**

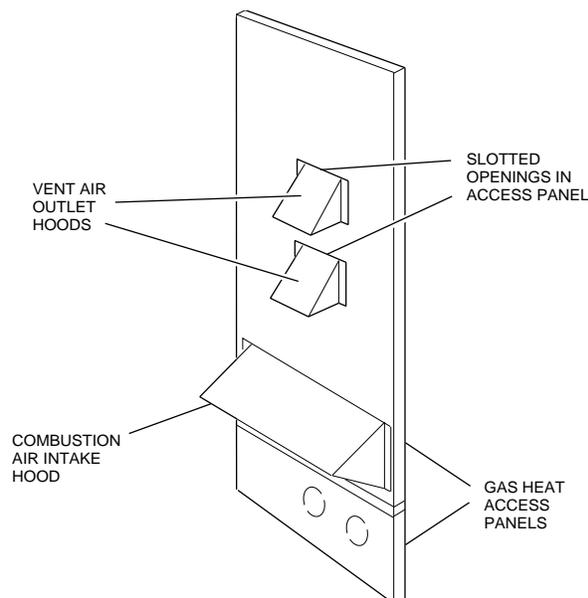
Two vent hoods and a combustion air hood (with screens) are shipped attached to the blower housing in

the blower compartment. These hoods must be installed to assure proper unit function. All hoods must be fastened to the outside of the gas heat access panel with the screws provided in the bag also attached to the blower housing.

The screen for the combustion air intake hood is secured to the inside of the access panel opening with four fasteners and the screws used for mounting the hood to the panel. The top flange of this hood slips in under the top of the access panel opening when installing. Refer to Vent and Combustion Air Hood Figure 8.

Each vent hood is installed by inserting the top flange of the hood into the slotted opening in the access panel and securing in place.

The products of combustion are discharged horizontally through these two screened, hooded vent openings on the upper gas heat access panel.



**FIGURE 8 - VENT AND COMBUSTION AIR HOOD**

#### **OPTIONAL ECONOMIZER/MOTORIZED DAMPER RAIN HOOD**

The instruction for the optional economizer/motorized damper rain hood can be found in the kit. Use these instructions when field assembling an economizer rain hood onto a unit. The outdoor and return air dampers, the damper actuator, the damper linkage, the outdoor and return air divider baffles, and all the control sensors are factory mounted as part of the "Factory installed" economizer option.

### OPTIONAL POWER EXHAUST/BAROMETRIC RELIEF DAMPER RAIN HOOD

The instructions for the power exhaust/barometric relief damper rain hood can be found in the kit. The exhaust fan, all supporting brackets, angles, and the wiring are factory installed as part of the power exhaust option.

### OPTIONAL ECONOMIZER AND POWER EXHAUST DAMPER SET POINT ADJUSTMENTS AND INFORMATION

Remove the economizer access panel from the unit. Loosen but do not remove the two panel latches. Locate the economizer control module, where the following adjustments will be made.

#### CAUTION

EXTREME CARE MUST BE EXERCISED IN TURNING ALL SETPOINT, MAXIMUM, AND MINIMUM DAMPER POSITIONING ADJUSTMENT SCREWS TO PREVENT TWISTING THEM OFF.

Check that the damper blades move smoothly without binding; carefully turn the Minimum Position Adjusting screw (found on the damper control module) fully clockwise and then set the thermostat indoor fan switch to the on position and then off, or energize and de-energize terminals "R" to "G".

### MINIMUM POSITION ADJUSTMENT

With thermostat set to indoor fan on position, or terminals "R" to "G" energized, turn the Minimum Position Adjusting screw (located on the damper control module) counterclockwise until the desired minimum damper position has been attained.

### ENTHALPY SET POINT ADJUSTMENT

The enthalpy set point may now be set by selecting the desired setpoint shown in the Enthalpy Setpoint Adjustment Figure 9. Adjust as follows:

- For a single enthalpy operation carefully turn the set point adjusting screw (found on the damper control module) to the "A", "B", "C" or "D" setting corresponding to the lettered curve of the Enthalpy Setpoint Adjustment Figure 9.
- For a dual enthalpy operation, carefully turn the set point adjusting screw fully clockwise past the "D" setting.

### POWER EXHAUST DAMPER SETPOINT

With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer damper position (Percent Open). The Exhaust Air Adjustment Screw should be set at the Percent Open of the economizer damper at which the power exhaust is needed. It can be set from 0 to 100% damper open.

- For a dual enthalpy operation, carefully turn the set point adjusting screw fully clockwise past the "D" setting.

### INDOOR AIR QUALITY AQ

Indoor Air quality (indoor sensor input): Terminal AQ accepts a +2 to +10 Vdc signal with respect to the (AQ1) terminal. When the signal is below its setpoint, the actuator is allowed to modulate normally in accordance with the enthalpy and mixed air sensor inputs. When the AQ signal exceeds its setpoint setting and there is no call for free cooling, the actuator is proportionately modulated from the 2 to 10 Vdc signal, with 2 Vdc corresponding to full closed and 10 Vdc corresponding to full open. When there is no call for free cooling, the damper position is limited by the IAQ Max damper position setting. When the signal exceeds its setpoint (Demand Control Ventilation Setpoint) setting and there is a call for free cooling, the actuator modulates from the minimum position to the full open position based on the highest call from either the mixed air sensor input or the AQ voltage input.

- Optional CO<sub>2</sub> Space Sensor Kit Part # 2AQ04700324
- Optional CO<sub>2</sub> Unit Sensor Kit Part # 2AQ04700424

Replace the economizer access panel.

### OPTIONAL BAS-READY ECONOMIZER POWER EXHAUST DAMPER SET POINT ADJUSTMENT

Remove the economizer access panel from the unit. Loosen, but do not remove the two panel latches. Locate the economizer actuator, where the following adjustment can be made.

With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer's outdoor damper position. The actuator's auxiliary switch adjustment screw should be set at the damper position at which the power exhaust is needed. The adjustment screw can be set between 25 to 85 degrees open.

Replace the economizer access panel.

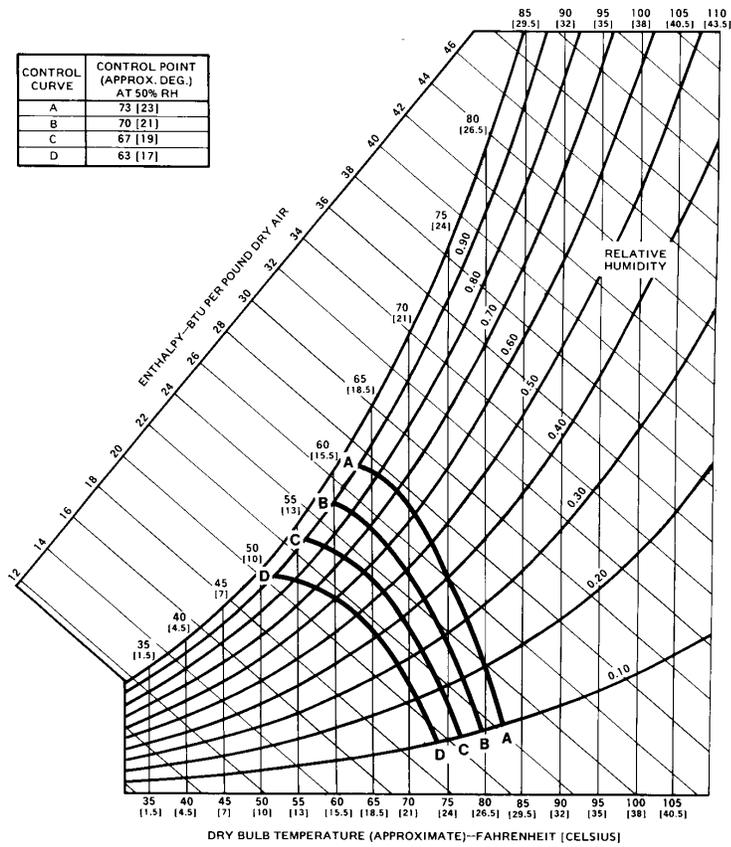


FIGURE 9 - ENTHALPY SETPOINT ADJUSTMENT

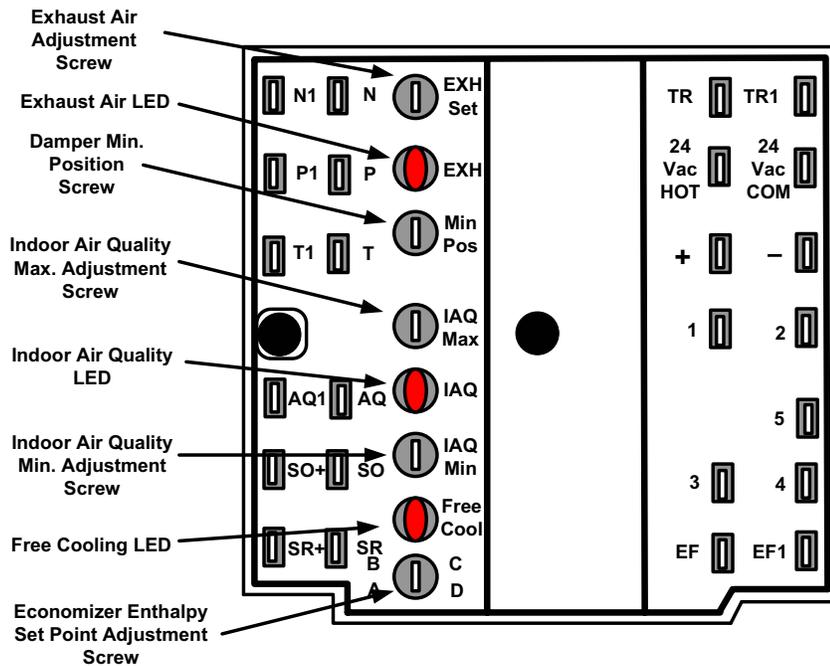


FIGURE 10 - HONEYWELL ECONOMIZER CONTROL W7212

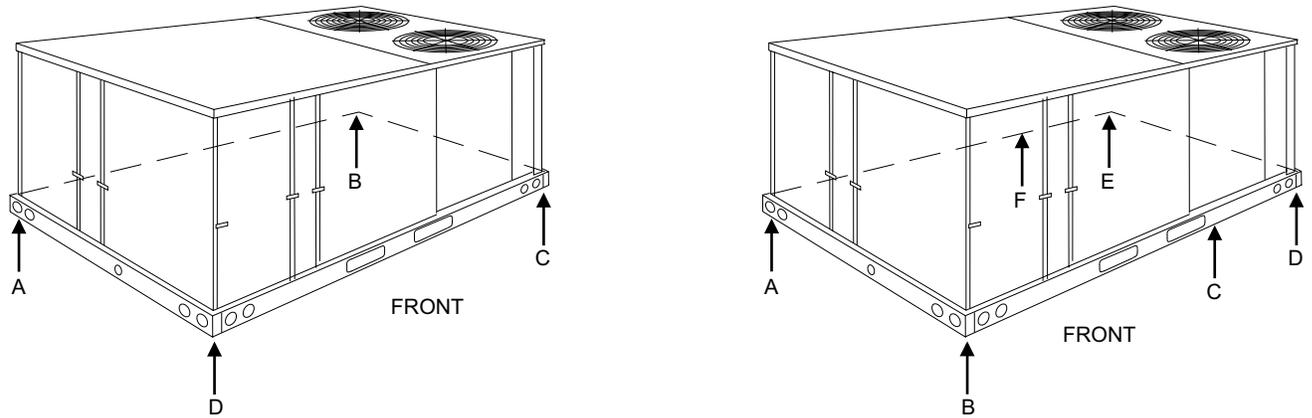


FIGURE 11 - FOUR AND SIX POINT LOADS

TABLE 6: FOUR AND SIX POINT LOADS

Unit Size	Total Shipping Weight	4 Point Loads (lbs)			
		A	B	C	D
180 Gas	2300	539	563	612	586
240 Gas	2500	538	563	715	684
300 Gas	3130	615	671	962	882
180 Elec	2100	492	514	558	536
240 Elec	2300	295	517	658	630
300 Elec	2890	487	619	646	508

Unit Size	Total Shipping Weight	6 Point Loads (lbs)					
		A	B	C	D	E	F
180 Gas	2300	351	367	392	416	399	375
240 Gas	2500	334	350	426	502	481	407
300 Gas	3130	418	438	533	628	603	510
180 Elec	2100	320	335	358	380	364	343
240 Elec	2300	307	322	392	462	442	375
300 Elec	2890	415	471	528	551	492	433

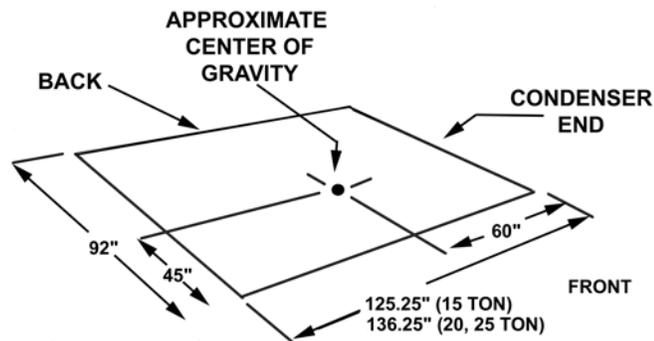


FIGURE 12 - CENTER OF GRAVITY

TABLE 7: PHYSICAL DATA

MODELS		DM180	DM240	DM300		
EVAPORATOR BLOWER	CENTRIFUGAL BLOWER (Dia. x Wd.)		15x15	18x15	18x15	
	FAN MOTOR HP		5.0	7.5	10	
EVAPORATOR COIL	ROWS DEEP		3	3	4	
	FINS PER INCH		13.5			
	FACE AREA (Sq. Ft.)		15.5	20.5	25	
CONDENSER FAN (Two Per Unit)	PROPELLER DIA. (In.) (Each)		30			
	FAN MOTOR HP (Each)		1			
	NOM. CFM TOTAL (Each)		6,000	8,000	7,200	
CONDENSER COIL	ROWS DEEP		2	2	3	
	FINS PER INCH		13	20	15	
	FACE AREA (Sq. Ft.)		36	43.3	43.3	
COMPRESSOR (Qty. Per Unit)	5 TON HERMETIC (RECIP.)		1	~	~	
	10 TON TANDEM (RECIP.)		1*	~	~	
	10 TON SCROLL		~	2	~	
	12.5 TON		~	~	2	
FILTERS	QUANTITY PER UNIT (12" X 24" X 2" or 4")		~	~	12	
	QUANTITY PER UNIT (16" X 20" X 2" or 4")		~	4	~	
	QUANTITY PER UNIT (16" X 25" X 2" or 4")		~	4	~	
	QUANTITY PER UNIT (18" X 24" X 2" or 4")		5	~	~	
	TOTAL FACE AREA (Sq. Ft.)		15	20	24	
CHARGE	REFRIGERANT 22 (Lb./Oz.)	SYSTEM No.1	16	19/0	25/8	
		SYSTEM No. 2	7/8	16/4	24/8	
OPERATING WEIGHTS (LBS.)	BASIC UNIT	COOLING ONLY		1900	2100	2709
		GAS / ELECTRIC	N24	2100	2300	2909
			N32	2140	2340	2971
	OPTIONS	ECONOMIZER		160		
		ECONOMIZER WITH POWER EXHAUST		245		
		MOTORIZED DAMPER		150		
		ELECTRIC HEATER	18 KW	25		
			36 KW	30		
			54 KW	35		
	72 KW		40			
	ACCESSORIES	ROOF CURB		175	185	185
		BAROMETRIC DAMPER		45		
		ECONOMIZER / MOTORIZED DAMPER RAIN HOOD		55		
		ECONOMIZER / POWER EXHAUST RAIN HOOD		90		
		WOOD SKID		200	220	220

\* NOTE: This compressor will be energized first.

TABLE 8: DM ELECTRICAL DATA -WITHOUT POWERED CONVENIENCE OUTLET

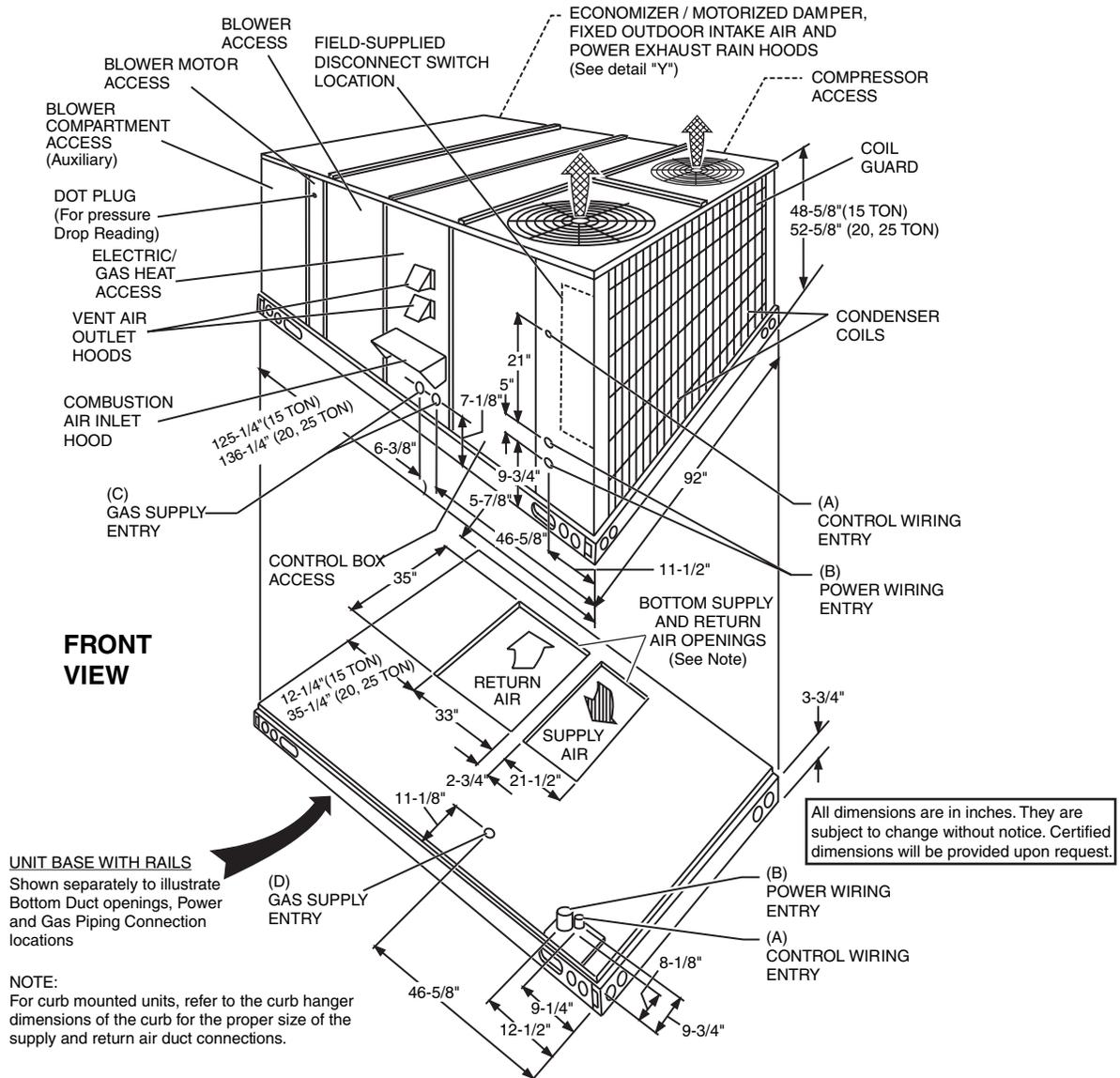
MODEL TONNAGE	VOLTAGE	COMPRESSORS		OD FAN MOTORS FLA EACH	ID BLOWER MOTOR FLA	CONV OUTLET AMPS	HEATER OPTION				MIN. CIRCUIT AMPACITY (AMPS)	MAX. FUSE/ BRKR <sup>1</sup> SIZE (AMPS)
		RLA EACH	LRA EACH				MODEL	KW	STAGES	AMPS		
15	380	9.6	62	2.1	8.3	0.0	None	0.0	-	-	46.0	50
							E18	11.3	1	17.1	46.0	50
							E36	22.6	2	34.3	53.3	60
							E54	33.8	2	51.4	74.6	80
							E72	45.1	2	68.6	96.0	100
	415	9.6	62	2.1	8.3	0.0	None	0.0	-	-	46.0	50
							E18	13.5	1	18.7	46.0	50
							E36	26.9	2	37.4	57.2	60
							E54	40.4	2	56.2	80.6	90
							E72	53.8	2	74.9	85.2	100
20	380	20.7	130	2.1	11.7	0.0	None	0.0	-	-	62.5	80
							E18	11.3	1	17.1	62.5	80
							E36	22.6	2	34.3	62.5	80
							E54	33.8	2	51.4	80.6	90
							E72	45.1	2	68.6	100.3	110
	415	20.7	130	2.1	11.5	0.0	None	0.0	-	-	62.5	80
							E18	13.5	1	18.7	62.5	80
							E36	26.9	2	37.4	62.3	80
							E54	40.4	2	56.2	84.6	90
							E72	53.8	2	74.9	89.2	100
25	380	22.9	145	2.1	19	0.0	None	0.0	-	-	74.7	90
							E18	11.3	1	17.1	76.0	90
							E36	22.6	2	34.3	76.0	90
							E54	33.8	2	51.4	87.9	90
							E72	45.1	2	68.6	109.4	110
	415	22.9	145	2.1	19	0.0	None	0.0	-	-	74.7	90
							E18	13.5	1	18.7	76.0	90
							E36	26.9	2	37.4	76.0	90
							E54	40.4	2	56.2	94.0	100
							E72	53.8	2	74.9	98.6	110

Note 1: HACR Type per NEC.

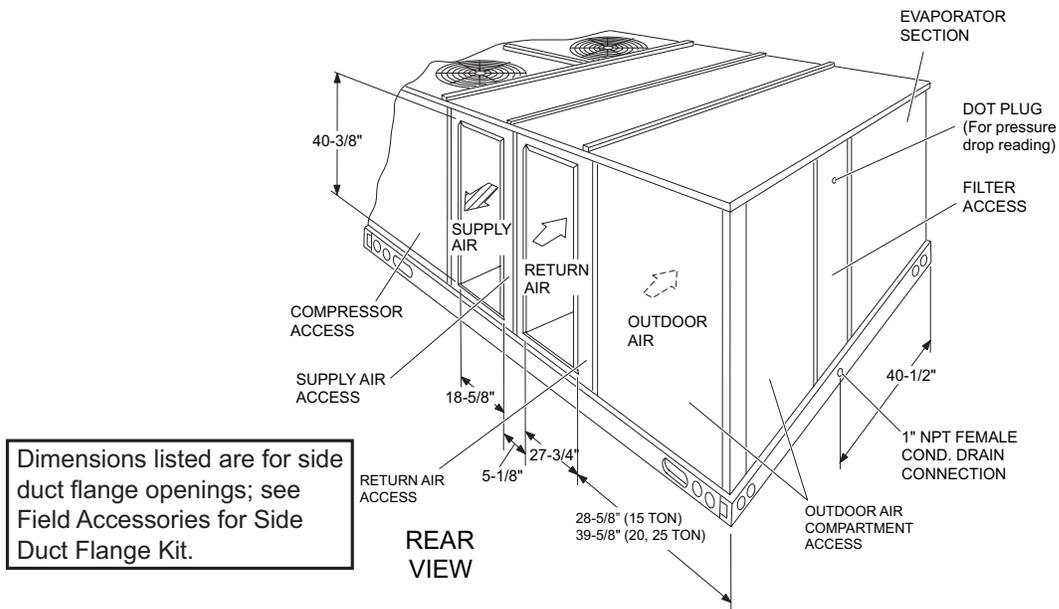
TABLE 9: DM ELECTRICAL DATA -WITH POWERED CONVENIENCE OUTLET

MODEL TONNAGE	VOLTAGE	COMPRESSORS		OD FAN MOTORS FLA EACH	ID BLOWER MOTOR FLA	CONV OUTLET AMPS	HEATER OPTION				MIN. CIRCUIT AMPACITY (AMPS)	MAX. FUSE/ BRKR <sup>1</sup> SIZE (AMPS)
		RLA EACH	LRA EACH				MODEL	KW	STAGES	AMPS		
15	380	9.6	62	2.1	8.3	6.3	None	0.0	-	-	52.3	50
							E18	11.3	1	17.1	52.3	60
							E36	22.6	2	34.3	61.2	70
							E54	33.8	2	51.4	82.4	90
							E72	45.1	2	68.6	103.9	110
	415	9.6	62	2.1	8.3	6.3	None	0.0	-	-	52.3	50
							E18	13.5	1	18.7	52.3	60
							E36	26.9	2	37.4	65.0	70
							E54	40.4	2	56.2	88.5	90
							E72	53.8	2	74.9	93.1	100
20	380	20.7	130	2.1	11.7	6.3	None	0.0	-	-	68.8	80
							E18	11.3	1	17.1	68.8	80
							E36	22.6	2	34.3	68.8	80
							E54	33.8	2	51.4	86.7	90
							E72	45.1	2	68.6	108.2	110
	415	20.7	130	2.1	11.5	6.3	None	0.0	-	-	68.8	80
							E18	13.5	1	18.7	68.8	80
							E36	26.9	2	37.4	69.0	80
							E54	40.4	2	56.2	92.5	100
							E72	53.8	2	74.9	97.1	100
25	380	22.9	145	2.1	19	6.3	None	0.0	-	-	82.3	100
							E18	11.3	1	17.1	82.3	100
							E36	22.6	2	34.3	82.3	100
							E54	33.8	2	51.4	95.8	100
							E72	45.1	2	68.6	117.3	125
	415	22.9	145	2.1	19	6.3	None	0.0	-	-	82.3	100
							E18	13.5	1	18.7	82.3	100
							E36	26.9	2	37.4	82.3	100
							E54	40.4	2	56.2	101.9	110
							E72	53.8	2	74.9	106.5	110

Note 1: HACR Type per NEC.



**FIGURE 13 - FRONT VIEW DIMENSIONS (15, 20 & 25 TON)**



**FIGURE 14 - REAR VIEW DIMENSIONS**

**NOTE:** Units are shipped with the bottom duct openings covered. An accessory flange kit is available for connecting side ducts.

**For bottom duct applications:**

1. Remove the side panels from the supply and return air compartments to gain access to the bottom supply and return air duct covers.
2. Remove and discard the bottom duct covers. Duct openings are closed with sheet metal covers except when the unit includes a power exhaust option. The covering consists of a heavy black paper composition.
3. Replace the side supply and return air compartment panels.

**For side duct applications:**

1. Replace the side panels on the supply and return air compartments with the side duct flange accessory kit panels.
2. Connect ductwork to the flanges on those panels.

**CLEARANCES**

LOCATION	CLEARANCE
Front	914 / 36"
Rear	610 / 24" (Less Economizer) 1245 / 49" (With Economizer)
Left Side (Filter Access)	610 / 24" (Less Economizer) 1372 / 54" (With Economizer) <sup>3</sup>
Right Side (Cond. Coil)	914 / 36"
Below Unit <sup>1</sup>	0 / 0"
Above Unit <sup>2</sup>	1829 / 72" With 914 / 36" Maximum Horizontal Overhang (For Condenser Air Discharge)

- Units may be installed on combustible floors made from wood or class A, B, or C roof covering material.
- Units must be installed outdoors. Overhanging structures or shrubs should not obstruct condenser air discharge outlet.
- If economizer is factory installed, the unassembled rain hood must be removed from its side along position in front of evaporator coil, or in the outdoor air compartment, prior to final installation.

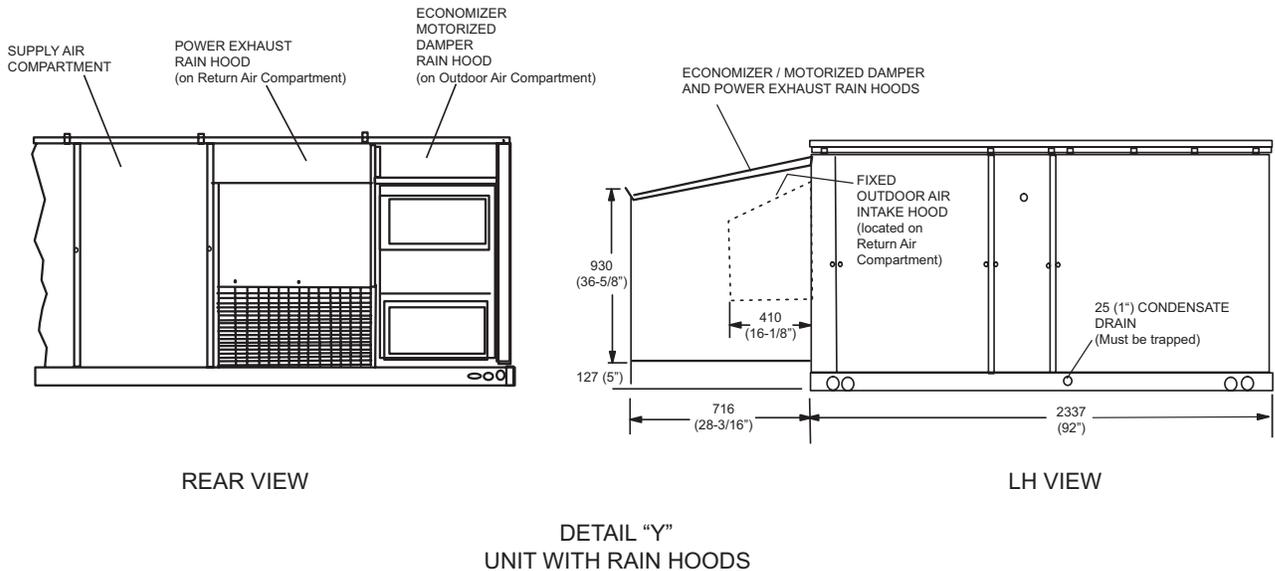
**NOTE:** ELEC / ELEC Models: Units and ductwork are approved for zero clearance to combustible material when equipped with electric heaters.

GAS / ELEC Models: A 25mm/1" clearance must be provided between any combustible material and the supply air ductwork for a distance of .9 meter/3 feet from the unit.

The products of combustion must not be allowed to accumulate within a confined space and recirculate.

Locate unit so that the vent air outlet hood is at least:

- 9 meters/3 feet above any force air inlet located within 3.0 meters/10 horizontal feet (excluding those integral to the unit).
- 1.2 meters/4 feet below, four horizontal feet from, or one foot above any door or gravity air inlet into the building.
- 1.2 meters/4 feet from electric and gas meters, regulators and relief equipment.



**FIGURE 15 - UNIT CLEARANCES AND RAIN HOOD DIMENSIONS (15, 20 & 25 TON)**

## CFM, STATIC PRESSURE, AND POWER - ALTITUDE AND TEMPERATURE CORRECTIONS

The information below should be used to assist in application of product when being applied at altitudes at or exceeding 1000 feet above sea level.

The air flow rates listed in the standard blower performance tables are based on standard air at sea level. As the altitude or temperature increases, the density of air decreases. In

order to use the indoor blower tables for high altitude applications, certain corrections are necessary.

A centrifugal fan is a "constant volume" device. This means that, if the rpm remains constant, the CFM delivered is the same regardless of the density of the air. However, since the air at high altitude is less dense, less static pressure will be generated and less power will be required than a similar application at sea level. Air density correction factors are shown in Table 10 and Figure 16.

**TABLE 10: ALTITUDE CORRECTION FACTORS**

AIR TEMP °C	ALTITUDE (METER)										
	0	305	610	914	1219	1524	1829	2134	2438	2743	3048
4.4	1.060	1.022	0.986	0.950	0.916	0.882	0.849	0.818	0.788	0.758	0.729
10	1.039	1.002	0.966	0.931	0.898	0.864	0.832	0.802	0.772	0.743	0.715
15.5	1.019	0.982	0.948	0.913	0.880	0.848	0.816	0.787	0.757	0.729	0.701
21	1.000	0.964	0.930	0.896	0.864	0.832	0.801	0.772	0.743	0.715	0.688
26.6	0.982	0.947	0.913	0.880	0.848	0.817	0.787	0.758	0.730	0.702	0.676
32	0.964	0.929	0.897	0.864	0.833	0.802	0.772	0.744	0.716	0.689	0.663
38	0.946	0.912	0.880	0.848	0.817	0.787	0.758	0.730	0.703	0.676	0.651

AIR TEMP °F	ALTITUDE (FEET)										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
40	1.060	1.022	0.986	0.950	0.916	0.882	0.849	0.818	0.788	0.758	0.729
50	1.039	1.002	0.966	0.931	0.898	0.864	0.832	0.802	0.772	0.743	0.715
60	1.019	0.982	0.948	0.913	0.880	0.848	0.816	0.787	0.757	0.729	0.701
70	1.000	0.964	0.930	0.896	0.864	0.832	0.801	0.772	0.743	0.715	0.688
80	0.982	0.947	0.913	0.880	0.848	0.817	0.787	0.758	0.730	0.702	0.676
90	0.964	0.929	0.897	0.864	0.833	0.802	0.772	0.744	0.716	0.689	0.663
100	0.946	0.912	0.880	0.848	0.817	0.787	0.758	0.730	0.703	0.676	0.651

The examples below will assist in determining the airflow performance of the product at altitude.

**Example 1:** What are the corrected CFM, static pressure, and BHP at an elevation of 5,000 ft. if the blower performance data is 6,000 CFM, 1.5 IWC and 4.0 BHP?

**Solution:** At an elevation of 5,000 ft the indoor blower will still deliver 6,000 CFM if the rpm is unchanged. However, Table 10 must be used to determine the static pressure and BHP. Since no temperature data is given, we will assume an air temperature of 70°F. Table 10 shows the correction factor to be 0.832.

$$\text{Corrected static pressure} = 1.5 \times 0.832 = 1.248 \text{ IWC}$$

$$\text{Corrected BHP} = 4.0 \times 0.832 = 3.328$$

**Example 2:** A system, located at 5,000 feet of elevation, is to deliver 6,000 CFM at a static pressure of 1.5". Use the unit

blower tables to select the blower speed and the BHP requirement.

**Solution:** As in the example above, no temperature information is given so 70°F is assumed.

The 1.5" static pressure given is at an elevation of 5,000 ft. The first step is to convert this static pressure to equivalent sea level conditions.

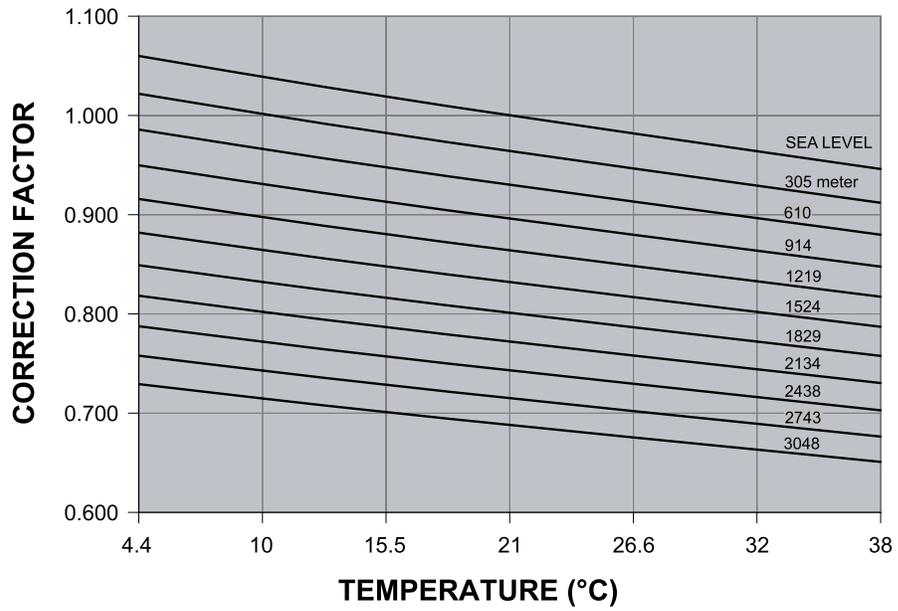
$$\text{Sea level static pressure} = 1.5 / .832 = 1.80"$$

Enter the blower table at 6000 sCFM and static pressure of 1.8". The rpm listed will be the same rpm needed at 5,000 ft.

Suppose that the corresponding BHP listed in the table is 3.2. This value must be corrected for elevation.

$$\text{BHP at 5,000 ft} = 3.2 \times .832 = 2.66$$

### Altitude/Temperature Conversion Factor



### Altitude/Temperature Conversion Factor

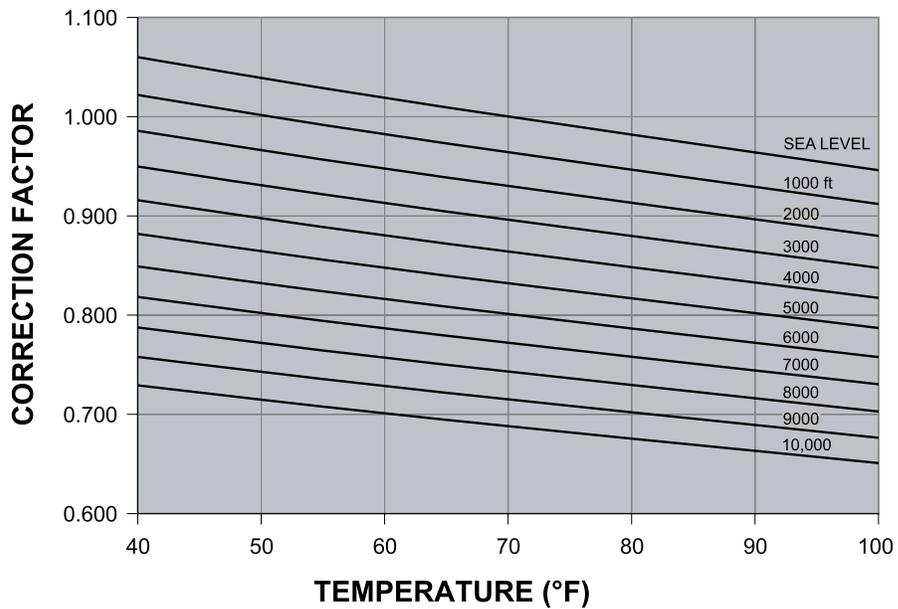


FIGURE 16 - ALTITUDE/TEMPERATURE CONVERSION FACTOR

**TABLE 11: SUPPLY AIR BLOWER PERFORMANCE (15 TON) - COOLING ONLY  
180 MBH - BOTTOM DUCT CONNECTIONS**

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	AIRFLOW														
		2.10 m <sup>3</sup> /s			2.45 m <sup>3</sup> /s			2.80 m <sup>3</sup> /s			3.10 m <sup>3</sup> /s			3.40 m <sup>3</sup> /s		
		ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)
<b>HIGH STATIC DRIVE (m<sup>3</sup>/s)</b>																
1030	6.0	357	2.4	2.8	316	2.8	3.4	253	3.3	3.9	183	3.7	4.5	97	4.2	5.0
1070	5.0	405	2.5	3.0	362	3.0	3.6	298	3.5	4.2	226	3.9	4.7	-	-	-
1115	4.0	461	2.7	3.2	416	3.2	3.8	351	3.7	4.4	278	4.2	5.0	-	-	-
1155	3.0	514	2.9	3.4	468	3.4	4.0	401	3.9	4.7	-	-	-	-	-	-
1200	2.0	577	3.1	3.7	529	3.6	4.3	461	4.1	5.0	-	-	-	-	-	-
1240	1.0	636	3.3	3.9	587	3.8	4.5	-	-	-	-	-	-	-	-	-

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	AIRFLOW														
		4450 CFM			5190 CFM			5930 CFM			6565 CFM			7200 CFM		
		ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)
<b>HIGH STATIC DRIVE (CFM)</b>																
1030	6.0	1.4	3.2	2.8	1.3	3.8	3.4	1.0	4.4	3.9	0.7	5.0	4.5	0.4	5.6	5.0
1070	5.0	1.6	3.4	3.0	1.5	4.0	3.6	1.2	4.7	4.2	0.9	5.3	4.7	-	-	-
1115	4.0	1.9	3.6	3.2	1.7	4.3	3.8	1.4	5.0	4.4	1.1	5.6	5.0	-	-	-
1155	3.0	2.1	3.9	3.4	1.9	4.5	4.0	1.6	5.2	4.7	-	-	-	-	-	-
1200	2.0	2.3	4.1	3.7	2.1	4.8	4.3	1.8	5.5	5.0	-	-	-	-	-	-
1240	1.0	2.6	4.4	3.9	2.4	5.1	4.5	-	-	-	-	-	-	-	-	-

NOTES: 1. Blower performance includes fixed outdoor air, 2" T/A filters, a dry evaporator coil and no electric heat.

2. Refer to Table 16 for additional static resistances.

ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.

\* Do **NOT** close the pulley below 1 turn open.

\*\* Factory setting.

**TABLE 12: SUPPLY AIR BLOWER PERFORMANCE (20 TON) - COOLING ONLY  
240 MBH - BOTTOM DUCT CONNECTIONS**

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	AIRFLOW														
		2.80 m <sup>3</sup> /s			3.30 m <sup>3</sup> /s			3.80 m <sup>3</sup> /s			4.10 m <sup>3</sup> /s			4.40 m <sup>3</sup> /s		
		ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)
<b>HIGH STATIC DRIVE (m<sup>3</sup>/s)</b>																
895	6.0	312	3.5	4.0	268	3.7	4.3	198	4.2	4.8	143	4.6	5.2	79	5.1	5.8
930	5.0	362	3.7	4.3	318	4.0	4.5	248	4.5	5.1	193	4.9	5.6	129	5.4	6.2
970	4.0	421	4.0	4.5	377	4.2	4.9	306	4.8	5.5	252	5.2	6.0	187	5.8	6.6
1005	3.0	473	4.2	4.8	429	4.5	5.1	359	5.1	5.8	304	5.6	6.4	240	6.1	7.0
1045	2.0	535	4.4	5.0	491	4.8	5.5	420	5.4	6.2	365	5.9	6.8	-	-	-
1080	1.0	590	4.6	5.3	546	5.0	5.8	475	5.7	6.5	420	6.2	7.1	-	-	-

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	AIRFLOW														
		5930 CFM			6990 CFM			8050 CFM			8685 CFM			9320 CFM		
		ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)
<b>HIGH STATIC DRIVE (CFM)</b>																
895	6.0	1.3	4.7	4.0	1.1	5.0	4.3	0.8	5.6	4.8	0.6	6.1	5.2	0.3	6.8	5.8
930	5.0	1.5	5.0	4.3	1.3	5.3	4.5	1.0	6.0	5.1	0.8	6.6	5.6	0.5	7.2	6.2
970	4.0	1.7	5.3	4.5	1.5	5.7	4.9	1.2	6.4	5.5	1.0	7.0	6.0	0.8	7.8	6.6
1005	3.0	1.9	5.6	4.8	1.7	6.0	5.1	1.4	6.8	5.8	1.2	7.4	6.4	1.0	8.2	7.0
1045	2.0	2.1	5.9	5.0	2.0	6.4	5.5	1.7	7.3	6.2	1.5	7.9	6.8	-	-	-
1080	1.0	2.4	6.2	5.3	2.2	6.8	5.8	1.9	7.7	6.5	1.7	8.4	7.1	-	-	-

NOTES: 1. Blower performance includes fixed outdoor air, 2" T/A filters, a dry evaporator coil and no electric heat.

2. Refer to Table 16 for additional static resistances.

ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.

\* Do **NOT** close the pulley below 1 turn open.

\*\* Factory setting.

**TABLE 13: SUPPLY AIR BLOWER PERFORMANCE (15 TON) - GAS HEAT  
180 MBH - BOTTOM DUCT CONNECTIONS**

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	AIRFLOW														
		2.10 m <sup>3</sup> /s			2.45 m <sup>3</sup> /s			2.80 m <sup>3</sup> /s			3.10 m <sup>3</sup> /s			3.40 m <sup>3</sup> /s		
		ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)	ESP (Pa)	Output (kW)	Input (kW)
<b>HIGH STATIC DRIVE (m<sup>3</sup>/s)</b>																
1030	6.0	378	2.3	2.7	321	2.7	3.2	258	3.2	3.8	199	3.6	4.4	134	4.2	5.0
1070	5.0	417	2.4	2.9	361	2.9	3.4	299	3.4	4.1	240	3.9	4.7	-	-	-
1115	4.0	461	2.6	3.1	407	3.1	3.7	345	3.7	4.4	286	4.2	5.0	-	-	-
1155	3.0	502	2.8	3.3	448	3.3	4.0	387	3.9	4.7	-	-	-	-	-	-
1200	2.0	548	3.0	3.6	495	3.6	4.3	435	4.2	5.0	-	-	-	-	-	-
1240	1.0	590	3.2	3.8	538	3.8	4.6	-	-	-	-	-	-	-	-	-

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	AIRFLOW														
		4450 CFM			5190 CFM			5930 CFM			6565 CFM			7200 CFM		
		ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)	ESP (iwg)	Output (bhp)	Input (kW)
<b>HIGH STATIC DRIVE (CFM)</b>																
1030	6.0	1.5	3.1	2.7	1.3	3.6	3.2	1.0	4.3	3.8	0.8	4.9	4.4	0.5	5.6	5.0
1070	5.0	1.7	3.3	2.9	1.4	3.8	3.4	1.2	4.5	4.1	1.0	5.2	4.7	-	-	-
1115	4.0	1.9	3.5	3.1	1.6	4.1	3.7	1.4	4.9	4.4	1.2	5.6	5.0	-	-	-
1155	3.0	2.0	3.7	3.3	1.8	4.4	4.0	1.6	5.2	4.7	-	-	-	-	-	-
1200	2.0	2.2	4.0	3.6	2.0	4.8	4.3	1.7	5.6	5.0	-	-	-	-	-	-
1240	1.0	2.4	4.3	3.8	2.2	5.1	4.6	-	-	-	-	-	-	-	-	-

NOTES: 1. Blower performance includes a gas-fired heat exchanger, fixed outdoor air, two-inch T/A filters and a dry evaporator coil.

2. Refer to the additional Static Resistances table.

ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.

\* Do **NOT** close the pulley below 1 turn open.

\*\* Factory setting.

**TABLE 14: SUPPLY AIR BLOWER PERFORMANCE (20 TON) - GAS HEAT  
240 MBH - BOTTOM DUCT CONNECTIONS**

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	AIRFLOW														
		2.80 m <sup>3</sup> /s			3.30 m <sup>3</sup> /s			3.80 m <sup>3</sup> /s			4.10 m <sup>3</sup> /s			4.40 m <sup>3</sup> /s		
		ESP (Pa)	Output (kW)	Input (kW)												
<b>HIGH STATIC DRIVE (m<sup>3</sup>/s)</b>																
895	6.0	361	2.8	3.2	249	3.5	4.0	114	4.3	4.9	22	4.7	5.4	-	-	-
925	5.0	400	2.9	3.4	290	3.7	4.2	157	4.5	5.1	66	5.0	5.7	-	-	-
955	4.0	439	3.1	3.6	332	3.9	4.4	201	4.7	5.4	112	5.2	6.0	15	5.8	6.6
990	3.0	486	3.3	3.8	381	4.1	4.7	254	5.0	5.7	166	5.5	6.3	70	6.1	7.0
1020	2.0	527	3.5	4.0	425	4.3	5.0	299	5.2	6.0	213	5.8	6.7	119	6.4	7.3
1050	1.0	569	3.7	4.2	469	4.6	5.2	346	5.5	6.3	261	6.1	7.0	-	-	-
1080	0.0	612	3.9	4.4	514	4.8	5.5	393	5.8	6.6	310	6.4	7.3	-	-	-

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	AIRFLOW														
		5930 CFM			6990 CFM			8050 CFM			8685 CFM			9320 CFM		
		ESP (iwg)	Output (bhp)	Input (kW)												
<b>HIGH STATIC DRIVE (CFM)</b>																
895	6.0	1.5	3.7	3.2	1.0	4.7	4.0	0.5	5.7	4.9	0.1	6.3	5.4	-	-	-
925	5.0	1.6	3.9	3.4	1.2	4.9	4.2	0.6	6.0	5.1	0.3	6.7	5.7	-	-	-
955	4.0	1.8	4.2	3.6	1.3	5.2	4.4	0.8	6.3	5.4	0.4	7.0	6.0	0.1	7.8	6.6
990	3.0	2.0	4.4	3.8	1.5	5.5	4.7	1.0	6.7	5.7	0.7	7.4	6.3	0.3	8.2	7.0
1020	2.0	2.1	4.7	4.0	1.7	5.8	5.0	1.2	7.0	6.0	0.9	7.8	6.7	0.5	8.6	7.3
1050	1.0	2.3	4.9	4.2	1.9	6.1	5.2	1.4	7.4	6.3	1.0	8.2	7.0	-	-	-
1080	0.0	2.5	5.2	4.4	2.1	6.4	5.5	1.6	7.7	6.6	1.2	8.5	7.3			

NOTES: 1. Blower performance includes a gas-fired heat exchanger, fixed outdoor air, two-inch T/A filters and a dry evaporator coil.

2. Refer to the additional Static Resistances table.

ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.

\* Do **NOT** close the pulley below 1 turn open.

\*\* Factory setting.

**TABLE 15: SUPPLY AIR BLOWER PERFORMANCE (25 TON) - COOLING APPLICATIONS  
300 MBH - BOTTOM DUCT CONNECTIONS**

<b>DM300 UNIT - DOWNFLOW DUCT CONNECTIONS (CFM)</b>										
BLOWER SPEED (rpm)	PULLEY TURNS OPEN	7500 CFM			8750 CFM			10000 CFM		
		ESP (iwg)	OUTPUT (bhp)	INPUT (kW)	ESP (iwg)	OUTPUT (bhp)	INPUT (kW)	ESP (iwg)	OUTPUT (bhp)	INPUT (kW)
945	6.0	1.2	5.6	4.6	0.8	7.0	5.7	0.3	8.4	6.9
975	5.0	1.4	5.9	4.9	1.0	7.3	6.0	0.5	8.8	7.2
1005	4.0	1.6	6.2	5.1	1.2	7.7	6.3	0.7	9.2	7.6
1040	3.0	1.8	6.6	5.4	1.4	8.1	6.7	0.9	9.7	8.0
1070	2.0	2.0	6.9	5.7	1.6	8.5	7.0	1.1	10.2	8.3
1100	1.0	2.1	7.3	6.0	1.8	8.9	7.3	1.3	10.6	8.7
1130	0.0	2.3	7.6	6.2	2.0	9.3	7.6	1.5	11.0	9.0

<b>DM300 UNIT - DOWNFLOW DUCT CONNECTIONS (m<sup>3</sup>/s)</b>										
BLOWER SPEED (rpm)	PULLEY TURNS OPEN	3.53 m <sup>3</sup> /Sec.			4.13 m <sup>3</sup> /Sec.			4.72 m <sup>3</sup> /Sec.		
		ESP (Pa)	OUTPUT (bhp)	INPUT (kW)	ESP (Pa)	OUTPUT (bhp)	INPUT (kW)	ESP (Pa)	OUTPUT (bhp)	INPUT (kW)
945	6.0	303	5.6	4.6	198	7.0	5.7	71	8.4	6.9
975	5.0	347	5.9	4.9	244	7.3	6.0	120	8.8	7.2
1005	4.0	391	6.2	5.1	291	7.7	6.3	169	9.2	7.6
1040	3.0	443	6.6	5.4	347	8.1	6.7	228	9.7	8.0
1070	2.0	489	6.9	5.7	396	8.5	7.0	280	10.2	8.3
1100	1.0	536	7.3	6.0	445	8.9	7.3	332	10.6	8.7
1130	0.0	583	7.6	6.2	495	9.3	7.6	385	11.0	9.0

<b>DM300 UNIT - DOWNFLOW DUCT CONNECTIONS - GAS HEAT MODELS (CFM)</b>										
BLOWER SPEED (rpm)	PULLEY TURNS OPEN	7500 CFM			8750 CFM			10000 CFM		
		ESP (iwg)	OUTPUT (bhp)	INPUT (kW)	ESP (iwg)	OUTPUT (bhp)	INPUT (kW)	ESP (iwg)	OUTPUT (bhp)	INPUT (kW)
945	6.0	1.0	5.6	4.6	0.3	7.0	5.7	-	-	-
975	5.0	1.2	5.9	4.9	0.5	7.3	6.0	-	-	-
1005	4.0	1.4	6.2	5.1	0.7	7.7	6.3	-	-	-
1040	3.0	1.6	6.6	5.4	0.9	8.1	6.7	0.2	9.7	8.0
1070	2.0	1.8	6.9	5.7	1.1	8.5	7.0	0.4	10.2	8.3
1100	1.0	2.0	7.3	6.0	1.3	8.9	7.3	0.6	10.6	8.7
1130	0.0	2.2	7.6	6.2	1.5	9.3	7.6	0.8	11.0	9.0

<b>DM300 UNIT - DOWNFLOW DUCT CONNECTIONS - GAS HEAT MODELS (m<sup>3</sup>/s)</b>										
BLOWER SPEED (rpm)	PULLEY TURNS OPEN	3.53 m <sup>3</sup> /sec.			4.13 m <sup>3</sup> /sec.			4.72 m <sup>3</sup> /sec.		
		ESP (Pa)	OUTPUT (bhp)	INPUT (kW)	ESP (Pa)	OUTPUT (bhp)	INPUT (kW)	ESP (Pa)	OUTPUT (bhp)	INPUT (kW)
945	6.0	258	5.6	4.6	87	7.0	5.7	-	-	-
975	5.0	301	5.9	4.9	133	7.3	6.0	-	-	-
1005	4.0	345	6.2	5.1	180	7.7	6.3	-	-	-
1040	3.0	398	6.6	5.4	236	8.1	6.7	43	9.7	8.0
1070	2.0	444	6.9	5.7	285	8.5	7.0	94	10.2	8.3
1100	1.0	490	7.3	6.0	334	8.9	7.3	146	10.6	8.7
1130	0.0	537	7.6	6.2	384	9.3	7.6	199	11.0	9.0

NOTES: 1. Blower performance includes a gas-fired heat exchanger, fixed outdoor air, two-inch T/A filters and a dry evaporator coil.

2. Refer to the additional Static Resistances table.

ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.

\* Do **NOT** close the pulley below 1 turn open.

\*\* Factory setting.

**TABLE 16: STATIC RESISTANCES<sup>1</sup>**

DESCRIPTION		RESISTANCE, Pa/IWG									
		m <sup>3</sup> /s/CFM									
		MODEL 180			MODEL 240			MODEL 300			
		2.1/4500	2.8/6000	3.4/7200	2.8/6000	3.8/8000	4.4/9400	3.78/8000	4.25/9000	4.72/10000	
WET COIL		24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	25/0.1	25/0.1	25/0.1	
GAS HEAT		24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	25/0.1	25/0.1	25/0.1	
ELECTRIC HEAT OPTIONS		18 KW	24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	25/0.1	25/0.1	25/0.1	
		36 KW	24.8/0.1	50.0/0.2	74.4/0.3	24.8/0.1	50.0/0.2	74.4/0.3	25/0.1	50/0.2	75/0.3
		54 KW	50.0/0.2	74.4/0.3	99.2/0.4	50.0/0.2	74.4/0.3	99.2/0.4	50/0.2	75/0.3	100/0.4
		72 KW	50.0/0.2	99.2/0.4	149.0/0.6	50.0/0.2	99.2/0.4	149.0/0.6	50/0.2	100/0.4	150/0.6
ECONOMIZER OPTION		24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	24.8/0.1	25/0.1	25/0.1	25/0.1	
HORIZONTAL DUCT CONNECTIONS		50.0/0.2	74.4/0.3	124.0/0.5	50.0/0.2	74.4/0.3	124.0/0.5	50/0.2	75/0.3	125/0.5	

- <sup>1</sup> Deduct these resistance values from the available external static pressures shown in the respective Blower Performance Table except for Horizontal Duct Connections.  
 Add these values due to less airflow resistance.

**TABLE 17: POWER EXHAUST PERFORMANCE**

MOTOR SPEED	STATIC RESISTANCE OF RETURN DUCTWORK, IWG									
	0.2		0.3		0.4		0.5		0.6	
	CFM	KW	CFM	KW	CFM	KW	CFM	KW	CFM	KW
HIGH*	5250	0.83	4500	0.85	4200	0.88	3750	0.93	3000	0.99
MEDIUM	4900	0.77	3900	0.79	3500	0.82	2900	0.85	-	-
LOW	4400	0.72	3700	0.74	3000	0.78	-	-	-	-

- \* Factory Setting  
 Power Exhaust motor is a 3/4 HP, PSC type with sleeve bearings, a 48 frame and inherent protection.

**TABLE 18: BLOWER MOTOR AND DRIVE DATA**

MODEL SIZE	DRIVE <sup>1</sup>	BLOWER RANGE (RPM)	MOTOR <sup>2</sup>			ADJUSTABLE MOTOR PULLEY <sup>3</sup>			FIXED BLOWER PULLEY			BELT (NOTCHED)		
			kW/HP	FRAME	EFF. (%)	DESIG-NATION	PITCH DIA. (mm/IN.)	BORE (mm/IN.)	DESIG-NATION	PITCH DIA. (mm/IN.)	BORE (mm/IN.)	DESIG-NATION	PITCH LENGTH (mm/IN.)	QTY.
180	High Static	1030/1240	3.7/5.0	184 T	83	1VP62	109-135 4.3-5.3	29/1-1/8	BK75	175/6.9	25/1	BX68	1773/69.8	1
240	High Static	895-1080	5.6/7.5	213 T	87	1VP75	140-165 5.5-6.5	35/1-3/8	BK100	239/9.4	30/1-3/16 <sup>4</sup>	BX81	2103/82.8	1
300	High Static	950/1130	7.5/10	254 T	89	1LVP58 B70A	157-188 (6.2-7.4)	A2 Bushing	1B5V94	241 (9.5)	B Bushing	5VX840	2134/84	1

- All 50 Hz DM180-300 models come standard with factory filtered High Static Drive.
- All motors have a nominal speed of 1450 RPM, a 1.15 service factor and a solid base. They can operate to the limit of their service factor because they are located in the moving air, upstream of any heating device.
- Do **NOT** close this pulley below 1 turn open.
- Requires bushing (included in kit).

## PHASING

YORK MODEL DM, units are properly phased at the factory. Check for proper compressor rotation. If the blower or compressors rotate in the wrong direction at start-up, the electrical connection to the unit is mis-phased. Change the incoming line connection phasing to obtain proper rotation. (Scroll compressors operate in only one direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or producing a high noise level, the scroll is misphased).

### **CAUTION**

Scroll compressors require proper rotation to operate correctly. Units are properly phased at the factory. Do not change the internal wiring to make the blower, condenser fans, or compressor rotate correctly.

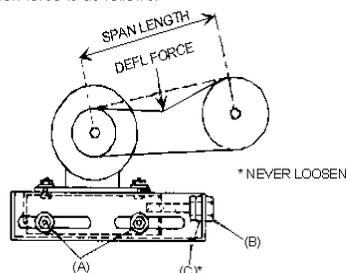
## CHECKING AIR SUPPLY CFM

The RPM of the supply air blower will depend on the required CFM, the unit accessories or options and the static resistances of both the supply and the return air duct systems. With this information, the RPM for the supply air blower and the motor pulley adjustment (turns open) can be determined from the Blower Performance Data Tables.

### **CAUTION**

Procedure for adjusting belt tension:

1. Loosen four nuts (top and bottom) (A).
2. Adjust by turning (B).
3. Never loosen nuts (C).
4. Use a belt tension checker to apply a perpendicular force to one belt at the midpoint of the span as shown. The deflection force should be applied until a specific deflection distance of 4mm (5/32") is obtained. To determine the deflection distance from normal position, use a straight edge from sheave to sheave as a reference line. The recommended deflection force is as follows:



Tension new belts at the max. deflection force recommended for the belt section. Check the belt tension at least two times during the first 24 hours of operation. Any re-tensioning should fall between the min. and max. deflection force values.

5. After adjusting, re-tighten nuts (A).

## FIGURE 17 - BELT ADJUSTMENT

Note the following:

1. The supply air CFM must be within the limitations shown in the Unit Application Data Table 1.
2. Pulleys can be adjusted in half turn increments.
3. The tension on the belt should be adjusted as shown in the Belt Adjustment Figure 17.

Start the supply air blower motor. Adjust the resistances in both the supply and the return air duct systems to balance the air distribution throughout the conditioned space. The job specifications may require that this balancing be done by someone other than the equipment installer.

To check the supply air CFM after the initial balancing has been completed:

1. Remove the two 5/16" dot plugs from the blower motor and the filter access panels shown in the Dimensions and Clearances Figure 13.
2. Insert at least 8" of 1/4 inch tubing into each of these holes for sufficient penetration into the air flow on both sides of the indoor coil.

**NOTE:** The tubes must be inserted and held in a position perpendicular to the air flow so that velocity pressure will not affect the static pressure readings.

3. Using an inclined manometer, determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil may vary greatly,

measuring the pressure drop across a wet coil under field conditions would be inaccurate. To assure a dry coil, the compressors should be deactivated while the test is being run.

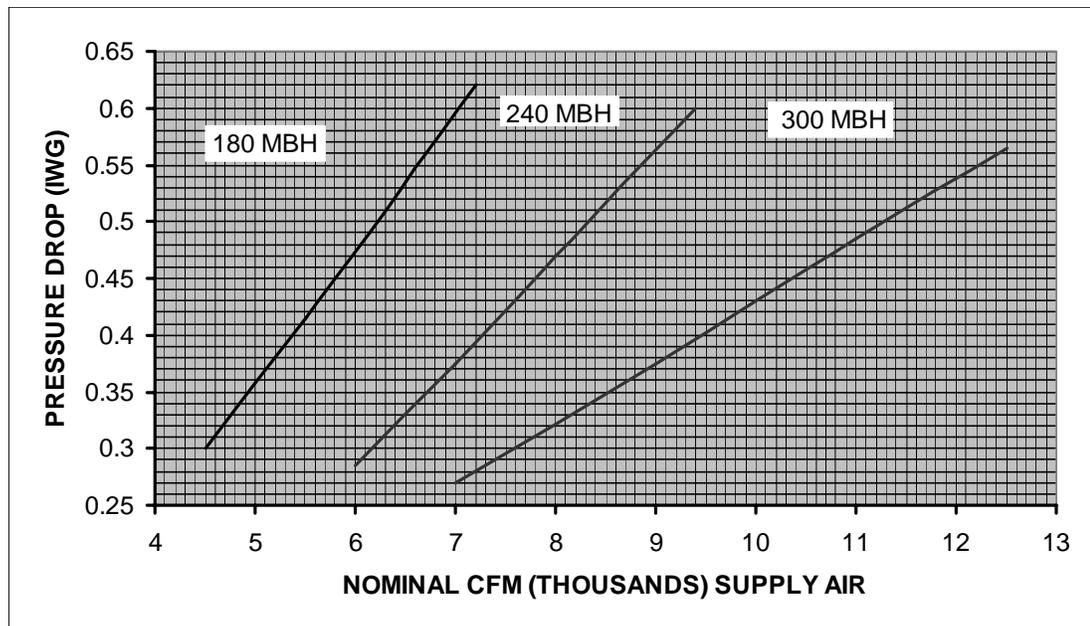
4. Knowing the pressure drop across a dry coil, the actual CFM through the unit can be determined from the curve in Pressure Drop vs. Supply Air CFM Figure 18.

### WARNING

Failure to properly adjust the total system air quantity can result in extensive blower damage.

After readings have been obtained, remove the tubes and reinstall the two 5/16" dot plugs that were removed in Step 1.

**NOTE:** DE-ENERGIZE THE COMPRESSORS BEFORE TAKING ANY TEST MEASUREMENTS TO ASSURE A DRY INDOOR COIL.



**FIGURE 18 - PRESSURE DROP ACROSS A DRY INDOOR COIL VS SUPPLY AIR CFM FOR ALL UNIT TONNAGES**

## OPERATION

### SEQUENCE OF OPERATIONS OVERVIEW

For these units, the thermostat makes a circuit between "R" and "Y1" for the first stage of cooling.

The call is passed to the unit control board (UCB), which then determines whether the requested operation is available and, if so, which components to energize.

For gas heating, the UCB monitors the "W1" call but does not handle the operation of the gas furnace. An ignition control board controls the gas heater operation.

For electric heat units, the UCB passes the call to the electric heater.

In both cases, when the "W1" call is sensed, the indoor air blower is energized following a specified heating delay.

If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

### COOLING SEQUENCE OF OPERATION

#### CONTINUOUS BLOWER

By setting the room thermostat fan switch to "ON," the supply air blower will operate continuously.

#### INTERMITTENT BLOWER

With the room thermostat fan switch set to "AUTO" and the system switch set to either the "AUTO" or "HEAT" settings, the blower is energized whenever a cooling or heating operation is requested. The blower is energized after any specified delay associated with the operation.

When energized, the indoor blower has a minimum run time of 30 seconds. Additionally, the indoor blower has a delay of 10 seconds between operations.

#### NO OUTDOOR AIR OPTIONS

When the thermostat calls for the first stage of cooling, the low-voltage control circuit from "R" to "Y1" and "G" is completed. For first stage cooling, compressor #1,

condenser fan motor #1, and condenser fan motor #2 for 15 and 20T only (if the ambient temperature is above 60°F), are energized. After completing the specified fan on delay for cooling, the UCB will energize the blower motor.

When the thermostat calls for the second stage of cooling, the low-voltage control circuit from "R" to "Y2" is completed. Compressor #2, and condenser fan motor #2, 25T only (if the ambient temperature is above 60°F), is energized, provided it has not been locked-out.

If there is an initial call for both stages of cooling, the UCB will delay energizing compressor #2 by 30 seconds in order to avoid a power in rush.

Once the thermostat has been satisfied, it will de-energize Y1 and Y2. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling.

To be available, a compressor must not be locked-out due to a high or low-pressure switch or freestat trip and the anti-short cycle delay (ASCD) must have elapsed.

#### ECONOMIZER WITH SINGLE ENTHALPY SENSOR -

When the room thermostat calls for "first-stage" cooling, the low voltage control circuit from "R" to "G" and "Y1" is completed. The UCB energizes the blower motor (if the fan switch on the room thermostat is set in the "AUTO" position) and drives the economizer dampers from fully closed to their minimum position. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller (previously determined), "Y1" energizes the economizer. The dampers will modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the setpoint, "Y1" energizes compressor #1, condenser fan motor #1, and condenser fan motor #2, 15 and 20T only (if the ambient temperature is above 60°F).

When the thermostat calls for "second-stage" cooling, the low voltage control circuit from "R" to "Y2" is completed. The UCB energizes the first available compressor. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller (i.e. first stage

has energized the economizer), "Y2" will energize compressor #1. If the outdoor air is above the setpoint, "Y2" will energize compressor #2.

Once the thermostat has been satisfied, it will de-energize Y1 and Y2. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continuous fan operation the economizer damper goes to the min. position.

#### **ECONOMIZER WITH DUAL ENTHALPY SENSORS -**

The operation with the dual enthalpy sensors is identical to the single sensor except that a second enthalpy sensor is mounted in the return air. This return air sensor allows the economizer to choose between outdoor air and return air, whichever has the lowest enthalpy value, to provide maximum operating efficiency.

#### **ECONOMIZER (SINGLE OR DUAL ENTHALPY) WITH POWER EXHAUST -**

This system operates as specified above with one addition. The power exhaust motor is energized 45 seconds after the actuator position exceeds the exhaust fan setpoint on the economizer control. When the power exhaust is operating, the second stage of mechanical cooling will not operate. As always, the "R" to "G" connection provides minimum position but does not provide power exhaust operation.

#### **MOTORIZED OUTDOOR AIR DAMPERS -**

This system operation is the same as the units with no outdoor air options with one exception. When the "R" to "G" circuit is complete, the motorized damper drives open to a position set by the thumbwheel on the damper motor. When the "R" to "G" circuit is opened, the damper spring returns fully closed.

#### **COOLING OPERATION ERRORS**

Each cooling system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum run times for compressors.

#### **HIGH-PRESSURE LIMIT SWITCH**

During cooling operation, if a high-pressure limit switch opens, the UCB will de-energize the associated compressor, initiate the ASCD (Anti-short cycle delay), and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (see Table 24). If the other compressor is inactive, the condenser fans will be de-energized.

#### **LOW-PRESSURE LIMIT SWITCH**

The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB will monitor the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30-second monitoring phase, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

Once the low-pressure switch has been proven (closed during the 30-second monitor period described above), the UCB will monitor the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a low-pressure switch open three times within one hour of operation, the UCB will lock-out the associated compressor and flash a code (Table 24). If the other compressor is inactive, the condenser fans will be de-energized.

#### **FREEZESTAT**

During cooling operation, if a freezestat opens, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a freeze-stat open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (Table 24). If the other compressor is inactive, the condenser fans will be de-energized.

### LOW AMBIENT COOLING

To determine when to operate in low ambient mode, the UCB has a pair of terminals connected to a temperature-activated switch set at 30°F. When the low ambient switch is closed and the thermostat is calling for cooling, the UCB will operate in the low ambient mode.

Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes off. The indoor blower is operated throughout the cycle. The 5-minute off period is necessary to defrost the indoor coil.

Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The defrost cycle will begin immediately following the elapse of the minimum run time.

When operating in low ambient mode, the UCB will not lockout the compressors due to a freeze-stat trip. However, a freeze-stat trip will de-energize the associated compressor. If the call for cooling is still present at the end of the ASCD and the freeze-stat has closed, the unit will resume operation.

### SAFETY CONTROLS

The unit control board monitors the following inputs for each cooling system:

1. A suction line freeze-stat to protect against low evaporator temperatures due to a low airflow or a low return air temperature, (opens at  $26 \pm 5$  °F and resets at  $38 \pm 5$  °F).
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at  $380 \pm 10$  psig and resets at  $300 \pm 10$  psig).
3. A low-pressure switch to protect against loss of refrigerant charge, (opens at  $22 \pm 5$  psig and resets at  $45 \pm 5$  psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system will be affected by any safety/preventive action.

The other refrigerant system will continue in operation unless it is affected by the fault as well.

The unit control board monitors the temperature limit switch of electric heat units and the temperature limit switch and the gas valve of gas furnace units.

### COMPRESSOR PROTECTION

The compressors also have inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the protector will open to shut down the compressor. The UCB incorporates features to minimize compressor wear and damage. An anti-short cycle delay (ASCD) is utilized to prevent operation of a compressor too soon after its previous run. Additionally, a minimum run time is imposed any time a compressor is energized.

The ASCD is initiated on unit start-up and on any compressor reset or lock-out.

### FLASH CODES

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 24.

### RESET

Remove the call for cooling, by raising thermostat setting higher than the conditioned space temperature. This resets any pressure or freeze-stat flash codes.

### ELECTRIC HEATING SEQUENCE OF OPERATIONS

The following sequence describes the operation of the electric heat section.

Single-stage heating (applies only to 18 KW heater, all other heaters MUST use a two-stage thermostat):

- a. Upon a call for heat by the thermostat, the heater contactor (6M) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.
- b. The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

Two-stage heating (applies to all heaters except 18 KW):

- a. Upon a call for first-stage heat by the thermostat, the heater contactor (6M) (6M & 7M on 72 KW, 240V) will be energized. After completing the specified fan

on delay for heating, the UCB will energize the blower motor.

If the second stage of heat is required, heater contactor (7M) will be energized. Note that on the 54 KW, 240V heater, heater contactors (7M & 8M) will be energized and on the 72 KW, 240V heater, heater contactors (8M & 9M) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

- b. The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

**NOTE:** All 50 Hz heaters are provided with manual reset backup protection limits. These will de-energize the heaters should the primary limit fail to open or the contactors fail to open in a failure mode.

## HEATING OPERATION ERRORS

### TEMPERATURE LIMIT

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized.

This limit is monitored regardless of unit operation status, i.e. the limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and a flash code is initiated (See Table 24).

### SAFETY CONTROLS

The unit control board monitors the temperature limit switch of electric heat units.

The control circuit includes the following safety controls:

1. Temperature Limit Switch (TLS 1, 2).

This control is located inside the heater compartment and is set to open at the temperature indicated in the Limit Control Setting Table 19. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

2. Temperature Limit Switch (TLS 3, 4, 5 and 6).

This control is located inside the heater compartment and is set to open at the temperature indi-

cated in the Limit Control Setting Table 19. It is a manual reset limit. These limit switches will de-energize the heaters should the primary limit fail to open or the contactors fail to open in a failure mode.

**TABLE 19: LIMIT CONTROL SETTING**

UNIT (Tons)	VOLTAGE	HEATER kW	TEMPERATURE LIMIT SWITCH 1, 2 OPENS, °F	TEMPERATURE LIMIT SWITCH 3, 4, 5, 6 OPENS, °F
15, 20, 25	415	18	120	170
		36	120	170
		54	120	170
		72	120	170

### FLASH CODES

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 24.

### RESET

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes.

### HEAT ANTICIPATOR SETPOINTS

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter "ON" cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 20 for the required heat anticipator setting.

**TABLE 20: ELECTRIC HEAT ANTICIPATOR SETPOINTS**

HEATER kW	VOLTAGE	SETTING, AMPS	
		TH1	TH2
18	380/415-3-50	0.29	-
36		0.29	0.29
54		0.29	0.29
72		0.29	0.29

### GAS HEATING SEQUENCE OF OPERATIONS

The following sequence describes the operation of the gas heat section.

When the thermostat calls for the first stage of heating, the low-voltage control circuit from "R" to "W1" and "G" is completed, thru the UCB. The heat relay "RW1" is energized. The "RW1-2" contacts close energizing the draft motor control. The draft motor control contacts close and start the draft motor. As the speed of the draft motor reaches approximately 2500 RPM, the centrifugal switch contact, located on the end of the draft motor shaft, closes to power the first stage ignition module "IC1", thru the "RW1-1" contacts.

Ignition module "IC1" will immediately start the first stage igniter sparking and will open the redundant valve located inside the first stage main gas valve "GV1" to allow a flow of gas to only the first stage carry-over tube. Only after the pilot flame has been ignited and the presence of pilot flame detected at the "IC1" by a signal sent back through the flame sensor is sparking terminated and the first stage main gas valve opened.

Gas flows into each of the main burners and is ignited from the carryover tube flame.

After completing the specified fan on delay for heating, the UCB will energize the blower motor.

If "IC1" fails to detect a pilot flame, it will continue to try for a maximum of 85 seconds to ignite the pilot tube. If the pilot flame is not detected, then "IC1" will lock out first stage furnace operation for five minutes or until 24V power is removed from the module either at the unit or by resetting the room thermostat.

When the thermostat calls for the second stage of heating, the low-voltage control circuit from "R" to "W2" is completed, thru the UCB. Heat relay "RW2" is energized. The "RW2-1" contact is closed energizing the second stage ignition module "IC2". "IC2" will immediately start the second stage igniter sparking and will open the redundant valve located inside the second stage main gas valve "GV2" to allow a flow of gas to the second stage carryover tube. Only after the pilot flame has been ignited and the presence of pilot flame detected at "IC2" by a signal sent back through the flame sensor is sparking terminated and the main gas valve opened.

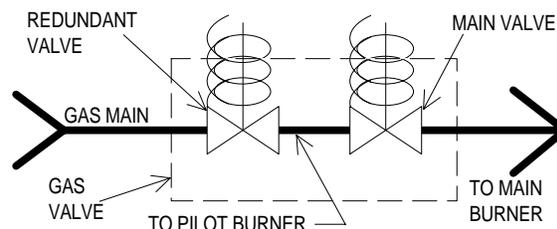
Gas flows into each of the second stage main burners and is ignited from the carryover tube flame.

If "IC2" fails to detect a pilot flame, it will continue to try for a maximum of 85 seconds to ignite the pilot tube. If the pilot flame is not detected, then "IC2" will lock out first stage furnace operation for five minutes or until

24V power is removed from the module either at the unit or by resetting the room thermostat.

**NOTE:** That the second stage furnace can operate even if first stage has locked out.

When the thermostat satisfies de-energizing the "RW2" and "RW1", thus opening all gas valves. The blower motor will continue to run after the furnace is shut down until the specified fan off delay for heating has been satisfied. The UCB will de-energize the blower motor.



**FIGURE 19 - GAS VALVE PIPING**

When the thermostat calls for the first stage of heating, the low-voltage control circuit from "R" to "W1" is completed. A call for heat passes through the UCB to the ignition control board (ICB). The UCB monitors the "W1" call and acts upon any call for heat. Once voltage has been sensed at "W1", the UCB will initiate the fan on delay for heating, energizing the indoor blower after the specified delay has elapsed.

When the thermostat has been satisfied, heating calls are ceased. The GV is immediately de-energized. The blower is de-energized after the fan off delay for heating has elapsed. The draft motor performs a 25-second post purge.

## **GAS HEATING OPERATION ERRORS**

### **TEMPERATURE LIMIT**

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized. When the UCB again senses 24 volts from the temperature limit, the draft motor will perform a 25-second post-purge and the indoor blower will be de-energized following the elapse of the fan off delay for heating.

This limit is monitored regardless of unit operation status, i.e. the limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and a flash code is initiated (See Table 24).

### GAS VALVE

The UCB continuously monitors the GV. Any time the UCB senses voltage at the GV without a call for heat for a continuous five-minute period, the UCB will lock-on the indoor blower and a flash code is initiated (Table 24). When voltage is no longer sensed at the GV, the UCB will de-energize the indoor blower following the elapse of the fan off delay for heating.

If voltage has been sensed at the GV for at least 15 seconds during the fan on delay for heating and GV voltage or "W1" is lost, the indoor blower is forced on for the length of the fan off delay for heating.

### SAFETY CONTROLS

The unit control board monitors the temperature limit switch and the gas valve of gas furnace units.

The control circuit includes the following safety controls:

#### 1. Limit Control (LS).

This control is located inside the heat exchanger compartment and is set to open at the temperature indicated in the Limit Control Setting Table 21. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the ignition control and closing the main gas valves and energizing the blower.

#### 2. Centrifugal Switch (CS).

If the draft motor should fail, the centrifugal switch attached to the shaft of the motor prevents the ignition controls and gas valves from being energized.

#### 3. Redundant Gas Valve.

There are two separate gas valves in the furnace. Each valve contains a main and a redundant valve.

The redundant valves are located upstream of the main gas valves. Should either or both of the main gas valves fail in the open position the redundant valves serve as back-ups and shut off the flow of gas.

#### 4. Flame Sensor Rod / 100% Ignition Control Lock-Out.

The flame rods and controls are located per Proper Flame Adjustment Figure 22. If an ignition control fails to detect a signal from the flame sensor indicating the pilot flame is properly ignited, then the main gas valve will not open. It will continue to try and ignite the pilot for a maximum of 85 seconds, then if the pilot flame is not detected, the ignition control will lock out furnace operation until 24V power is removed from the module either at the unit or by resetting the room thermostat.

#### 5. Rollout Switch.

This switch is located above the main burners in the control compartment, which in the event of a sustained main burner rollout shuts off and locks out both ignition controls closing both gas valves. The ignition controls lock out furnace operation until 24V power is removed from the controls either at the unit or by resetting the room thermostat.

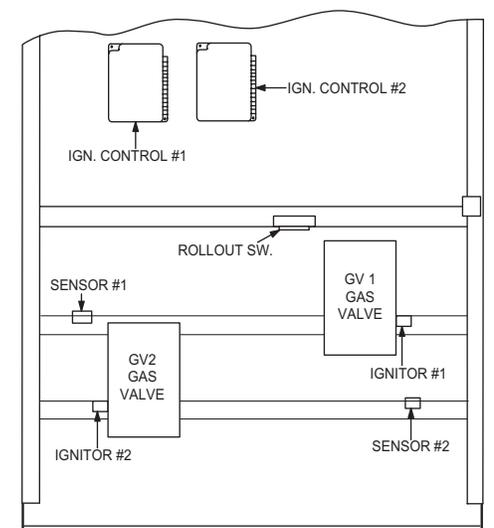
**NOTE:** The auto reset rollout switch must reset before allowing furnace operation.

#### 6. Auxiliary limit switch (AUX) -

This control is located inside the heat exchanger compartment and is set to open at 190°F. It is a manual reset switch. If AUX trips, then the primary limit has not functioned correctly. Replace the primary limit.

**TABLE 21: LIMIT CONTROL SETTING**

Units (Tons)	Capacity, MBH		Limit Control Opens, °F
	Input	Output	
15, 20 & 25	300	240	195
15, 20 & 25	350	280	195



**BURNER COMPARTMENT**

**FIGURE 20 - GAS VALVE AND CONTROLS**

### FLASH CODES

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 24.

### RESETS

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes.

### HEAT ANTICIPATOR SETPOINTS

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter "ON" cycles and may result in the lowering of the temperature within the conditioned space.

**TABLE 22: GAS HEAT ANTICIPATOR SETPOINTS**

Gas Valve	Anticipator Setpoint	
	1st Stage	2nd Stage
Honeywell VR8440	0.30 amp	0.11 amp
White-Rodgers 36C68		

## START-UP (COOLING)

### PRESTART CHECK LIST

After installation has been completed:

1. Check the electrical supply voltage being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Set the room thermostat to the off position.
3. Turn unit electrical power on.
4. Set the room thermostat fan switch to on.
5. Check indoor blower rotation.
  - If blower rotation is in the wrong direction. Refer to Phasing Section in general information section.
  - Check blower drive belt tension.
6. Check the unit supply air (CFM). See "CHECKING SUPPLY AIR CFM" on page 34.
7. Measure evaporator fan motor's amp draw.
8. Set the room thermostat fan switch to off.
9. Turn unit electrical power off.

### OPERATING INSTRUCTIONS

1. Turn unit electrical power on.
2. Set the room thermostat setting to lower than the room temperature.
3. First stage compressors will energize after the built-in time delay (five minutes).
4. The second stage of the thermostat will energize second stage compressor if needed.

### POST START CHECK LIST

1. Verify proper system pressures for both circuits.
2. Measure the temperature drop across the evaporator coil.

3. Measure the system Amperage draw across all legs of 3 phase power wires.
4. Measure the condenser fan amp draw.

### SHUT DOWN

1. Set the thermostat to highest temperature setting.
2. Turn off the electrical power to the unit.

### START-UP (GAS HEAT)

#### PRE-START CHECK LIST

Complete the following checks before starting the unit.

1. Check the type of gas being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Make sure that the vent and combustion air hoods have been properly installed.

#### OPERATING INSTRUCTIONS

### CAUTION

This furnace is equipped with an intermittent pilot and automatic re-ignition system. DO NOT attempt to manually light the pilot.

#### TO LIGHT PILOT AND MAIN BURNERS:

1. Turn "off" electric power to unit.
2. Turn room thermostat to lowest setting.
3. Turn gas valve knob or switch to "on" position.
4. Turn "on" electric power to unit.
5. Set room thermostat to desired temperature. (If thermostat "set" temperature is above room temperature, pilot burner ignition will occur and, after an interval to prove pilot flame, main burners will ignite).

#### TO SHUT DOWN:

1. Turn "off" electric power to unit.
2. Depress knob of gas valve while turning to "off" position or turn gas valve switch to "off" position.

### POST-START CHECK LIST (GAS)

After the entire control circuit has been energized and the heating section is operating, make the following checks:

1. Check for gas leaks in the unit piping as well as the supply piping.

### WARNING

#### FIRE OR EXPLOSION HAZARD

FAILURE TO FOLLOW THE SAFETY WARNING EXACTLY COULD RESULT IN SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

NEVER TEST FOR GAS LEAKS WITH AN OPEN FLAME. USE A COMMERCIALY AVAILABLE SOAP SOLUTION MADE SPECIFICALLY FOR THE DETECTION OF LEAKS TO CHECK ALL CONNECTIONS. A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

2. Check for correct manifold gas pressures. See "Checking Gas Input" page 44.
3. Check the supply gas pressure. It must be within the limits shown on rating nameplate. Supply pressure should be checked with all gas appliances in the building at full fire. At no time should the standby gas line pressure exceed 13", nor the operating pressure drop below 5.0" for natural gas units. If gas pressure is outside these limits, contact the local gas utility for corrective action.

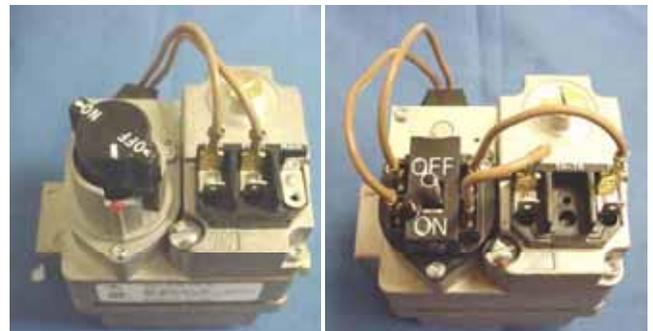


FIGURE 21 - TYPICAL GAS VALVES

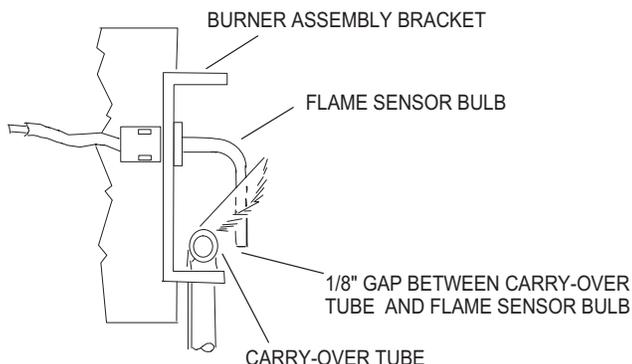
## MANIFOLD GAS PRESSURE ADJUSTMENT

Small adjustments to the high-fire gas flow may be made by turning the pressure regulator adjusting screw on the automatic gas valve.

Adjust as follows:

1. Remove the cap on the regulator. It's located next to the push-on electrical terminals.
2. To decrease the gas pressure, turn the adjusting screw counterclockwise.
3. To increase the gas pressure, turn the adjusting screw clockwise.

**NOTE:** The correct manifold pressure for these furnaces is 3.65 IWG  $\pm$ 0.3.



**FIGURE 22 - PROPER FLAME ADJUSTMENT**

### PILOT CHECKOUT

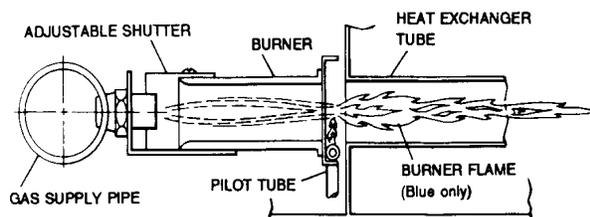
The pilot flame should envelope the end of the flame sensor. To adjust pilot flame, (1) remove pilot adjustment cover screw, (2) increase or decrease the clearance for air to the desired level, (3) be sure to replace cover screw after adjustment to prevent possible gas leakage.

Put the system into operation and observe through complete cycle to be sure all controls function properly.

### BURNER INSTRUCTIONS

To check or change burners, pilot or orifices, CLOSE MAIN MANUAL SHUT-OFF VALVE AND SHUT OFF ALL ELECTRIC POWER TO THE UNIT.

1. Remove the screws holding either end of the manifold to the burner supports.
2. Open the union fitting in the gas supply line just upstream of the unit gas valve and downstream from the main manual shut-off valve.
3. Remove the gas piping closure panel.
4. Disconnect wiring to the gas valves and spark igniters. Remove the manifold-burner gas valve assembly by lifting up and pulling back.



**FIGURE 23 - TYPICAL FLAME APPEARANCE**

Burners are now accessible for service.

Reverse the above procedure to replace the assemblies. Make sure that burners are level and seat at the rear of the heat exchanger.

### BURNER AIR SHUTTER ADJUSTMENT

Adjust burner shutters so no yellow flame is observed in the heat exchanger tubes.

### CHECKING GAS INPUT

#### NATURAL GAS

1. Turn off all other gas appliances connected to the gas meter.
2. With the furnace turned on, measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter usually has a 1/2 or a 1 cubic foot test dial.
3. Using the number of seconds for each revolution and the size of the test dial increment, find the cubic feet of gas consumed per hour from the Gas Rate - Cubic Feet Per Hour Table 23.

If the actual input is not within 5% of the furnace rating (with allowance being made for the permissible range

of the regulator setting), replace the orifice spuds with spuds of the proper size.

**NOTE:** To find the Btu input, multiply the number of cubic feet of gas consumed per hour by the Btu content of the gas in your particular locality (contact your gas company for this information - it varies widely from city to city.)

**TABLE 23: GAS RATE - CUBIC FEET PER HOUR**

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
4	450	900
6	300	600
8	228	450
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129

Example: By actual measurement, it takes 13 seconds for the hand on the 1-cubic foot dial to make a revolution with just a 300,000 Btuh furnace running. Read across to the column in the table above, headed "1 Cubic Foot", where you will see that 278 cubic feet of gas per hour are consumed by the furnace at that rate. Multiply 278 x 1050 (the Btu rating of the gas obtained from the local gas company). The result is 292,425 Btuh, which is close to the 300,000 Btuh rating of the furnace.

### ADJUSTMENT OF TEMPERATURE RISE

The temperature rise (or temperature difference between the return air and the heated air from the furnace) must lie within the range shown on the rating plate and the data in the Gas Heat Application Table 4.

$$CFM = \frac{\text{Btuh Input} \times 0.8}{108 \times \text{°F Temp. Rise}}$$

After the temperature rise has been determined, the cfm can be calculated as follows:

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts (about six feet from the furnace) where they will not be affected by radiant heat. Increase the blower cfm to decrease the temperature rise; decrease the blower cfm to increase the rise. Refer to the Blower Motor and Drive Data Table 18.

### BELT DRIVE BLOWER

All units have belt drive single-speed blower motors. The variable pitch pulley on the blower motor can be adjusted to obtain the desired supply air CFM.

### TROUBLESHOOTING

#### COOLING TROUBLESHOOTING GUIDE

#### WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

When not necessary, shut off all electric power to the unit prior to any of the following maintenance procedures so as to prevent personal injury.

#### CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation, which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

On calls for cooling, if the compressors are operating but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in the "AUTO" position).

1. Turn the thermostat fan switch to the ON position. If the supply air blower motor does not energize, go to Step 3.
2. If the blower motor runs with the fan switch in the ON position but will not run after the first compressor has energized when the fan switch is in the AUTO position, check the room thermostat for contact between R and G in the AUTO position during calls for cooling.

3. If the supply air blower motor does not energize when the fan switch is set to ON, check that line voltage is being supplied to the contacts of the M3, contactor, and that the contactor is pulled in. Check for loose wiring between the contactor and the supply air blower motor.
  4. If M3 is pulled in and voltage is supplied to M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on internal protection. Cancel any thermostat calls and set the fan switch to AUTO. Wait for the internal overload to reset. Test again when cool.
  5. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts are present at M3 but M3 is not pulled in, replace the contactor.
  6. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.
  7. If 24 volts is not present at M3, check that 24 volts is present at the UCB supply air blower motor terminal, "FAN". If 24 volts is present at the FAN, check for loose wiring between the UCB and M3.
  8. If 24 volts is not present at the "FAN" terminal, check for 24 volts from the room thermostat. If 24 volts are not present from the room thermostat, check for the following:
    - a. proper operation of the room thermostat (contact between R and G with the fan switch in the ON position and in the AUTO position during operation calls), b. proper wiring between the room thermostat and the UCB, and c. loose wiring from the room thermostat to the UCB.
  9. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.
  10. If the thermostat and UCB are properly wired, replace the UCB.
- On calls for cooling, the supply air blower motor is operating but compressor #1 is not (the room thermostat fan switch is in the "AUTO" position).
1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling and the compressors will not immediately operate. If both stages of cooling are requested simultaneously and the economizer provides free cooling, following a short delay compressor #1 will be energized unless it is locked out. If compressor #1 is locked out, compressor #2 is energized. Compressor #2 is always energized in place of compressor #1 when compressor #1 is requested but locked out.
  2. If no economizer is installed or the economizer is not opening to provide free cooling and compressor #1 does not energize on a call for cooling, check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.
  3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.
  4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts are present and M1 is not pulled in, replace the contactor.
  5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.
  6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.
  7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts is not present from the room thermostat, check for the following:
    - a. 24 volts at the thermostat Y1 terminal
    - b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2
    - c. Loose wiring from the room thermostat to the UCB.
  8. If 24 volts is present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.

9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing an alarm code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, cancel any call for cooling. This will reset any compressor lock outs.

**NOTE:** While the above step will reset any lockouts, compressor #1 may be held off for the ASCD. See the next step.

10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 "OUT" terminal of the UCB. If 24 volts is present, trace the wiring from Y1 "OUT" for incorrect wiring. If 24 volts is not present at the Y1 "OUT" terminal, the UCB must be replaced.
12. *For units without economizers:* If 24 volts is present at the Y1 OUT terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 "ECON" terminal.
13. *For units with economizers:* If 24 volts is present at the Y1 "OUT" terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer dMate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from the Mate-N-Lock plug to the Y1 "ECON" terminal. If nothing is found, the economizer control may have faulted and is failing to return the 24-volt "call" to the Y1 "ECON" terminal even though the economizer is not providing free cooling. To test, discon-

nect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB's Mate-N-Lock plug. If compressor #1 energizes, there is a fault in the economizer wiring or economizer control.

14. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.

For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.

15. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C1 terminal wire and jumper it to the Y1 terminal. DO NOT jump the Y1 to C1 terminals. If the compressor engages, the UCB has faulted.
16. If none of the above correct the error, replace the UCB.

On calls for the second stage of cooling, the supply air blower motor and compressor #1 are operating but compressor #2 is not (the room thermostat fan switch is in the "AUTO" position).

1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling. If the second stage of cooling is requested, following a short delay, compressor #1 will be energized unless it is locked out. Typically, compressor #2 is energized only during free cooling if the call for the second stage of cooling persists for 20 minutes.
2. Compressor #2 will not energize simultaneously with compressor #1 if a call for both stages of cooling is received. The UCB delays compressor #2 by 30 seconds to prevent a power surge. If after the delay compressor #2 does not energize on a second stage call for cooling, check for line voltage at the compressor contactor, M2, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.

3. If M2 is pulled in and voltage is supplied at M2, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.
  4. If M2 is not pulled in, check for 24 volts at the M2 coil. If 24 volts is present and M2 is not pulled in, replace the contactor.
  5. Failing the above, if voltage is supplied at M2, M2 is pulled in, and the compressor still does not operate, replace the compressor.
  6. If 24 volts is not present at M2, check for 24 volts at the UCB terminal, C2. If 24 volts are present, check for loose wiring between C2 and the compressor contactor.
  7. If 24 volts is not present at the C2 terminal, check for 24 volts from the room thermostat at the UCB Y2 terminal. If 24 volts is not present from the room thermostat, check for the following:
    - a. 24 volts at the thermostat Y2 terminal
    - b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2
    - c. Loose wiring from the room thermostat to the UCB.
  8. If 24 volts is present at the UCB Y2 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS2, LPS2, and FS2 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS2 has opened, there will be 24 volts of potential between the LPS2 terminals.
  9. If 24 volts is present at the UCB Y2 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing a code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, remove any call for cooling at the thermostat or by disconnecting the thermostat wiring at the Y2 UCB terminal. This will reset any compressor lock outs.
- NOTE:** While the above step will reset any lock outs, compressor #1 will be held off for the ASCD, and compressor #2 may be held off for a portion of the ASCD. See the next step.
10. If 24 volts is present at the UCB Y2 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
  11. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.
 

For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.
  12. If none of the above corrected the error, test the integrity of the UGB. Disconnect the C2 terminal wire and jumper it to the Y2 terminal. DO NOT jump the Y2 to C2 terminals. If the compressor engages, the UCB has faulted.
  13. If none of the above correct the error, replace the UCB.
 

On a call for cooling, the supply air blower motor and compressor #2 are operating but compressor #1 is not (the room thermostat fan switch is in the "AUTO" position).

    1. Compressor #2 is energized in place of compressor #1 when compressor #1 is unavailable for cooling calls. Check the UCB for alarms indicating that compressor #1 is locked out. Press and release the ALARMS button if the LED is not flashing an alarm.
    2. Check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.
    3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.

4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts is present and M1 is not pulled in, replace the contactor.
  5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.
  6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.
  7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts are not present at the UCB Y1 terminal, the UCB may have faulted. Check for 24 volts at the Y1 ECON terminal. If 24 volts is not present at Y1 "ECON", the UCB has faulted. The UCB should de-energize all compressors on a loss of call for the first stage of cooling, i.e. a loss if 24 volts at the Y1 terminal.
  8. If 24 volts are present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.
  9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing a code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, remove any call for cooling. This will reset any compressor lock outs.
- NOTE:** While the above step will reset any lock outs, compressor #2 will be held off for the ASCD, and compressor #1 may be held off for a portion of the ASCD. See the next step.
10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.
  11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 "OUT" terminal of the UCB. If 24 volts is present, trace the wiring from Y1 "OUT" for incorrect wiring. If 24 volts is not present at the Y1 "OUT" terminal, the UCB must be replaced.
  12. *For units without economizers:* If 24 volts is present at the Y1 "OUT" terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 "ECON" terminal.  
  
*For units with economizers:* If 24 volts is present at the Y1 "OUT" terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer Mate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from the Mate-N-Lock plug to the Y1 "ECON" terminal. The economizer control may have faulted and is not returning the 24 volts to the Y1 "ECON" terminal even though the economizer is not providing free cooling. To test the economizer control, disconnect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB's Mate-N-Lock plug.
  13. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. They can be checked by local distributors.  
  
For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.  
  
For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.
  14. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C1 terminal wire and jumper it to the Y1 terminal. DO NOT jump the Y1 to C1 terminals. If the compressor engages, the UCB has faulted.

15. If none of the above correct the error, replace the UCB.

## GAS HEAT TROUBLESHOOTING GUIDE

### WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

When not necessary, shut off all electric power to the unit prior to any of the following maintenance procedures so as to prevent personal injury.

### CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation, which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

**NOTE:** To find the Btu input, multiply the number of cubic feet of gas consumed per hour by the Btu content of the gas in your particular locality (contact your gas company for this information - it varies widely from city to city.).

### WARNING

The furnace may shut down on a high temperature condition during the procedure. If this occurs, the UCB energize the supply air blower motor until the high temperature limit has reset. Caution should be used at all times as the supply air blower may energize regardless of the room thermostat fan switch position.

On calls for heating, the draft motor operates and the furnace lights but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in "AUTO" position).

1. Place the thermostat fan switch in the "ON" position. If the supply air blower motor energizes, go to Step 10.
2. If the supply air blower motor does not energize when the fan switch is set to "ON," check that line voltage is being supplied to the contacts of the M3 contactor, and that the contactor is pulled in. Check for loose wiring between the contactor and the supply air blower motor.
3. If M3 is pulled in and voltage is supplied at M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on inherent protection. Cancel any thermostat calls and set the fan switch to "AUTO", wait for the internal overload to reset. Test again when cool.
4. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts is present at M3 but M3 is not pulled in, replace the contactor.
5. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.
6. If 24 volts is not present at M3, check that 24 volts is present at the supply air blower motor terminal on the UCB. If 24 volts is present at the UCB terminal, check for loose wiring between the UCB and M3.
7. If 24 volts is not present at the UCB supply air blower motor terminal, check for 24 volts from the room thermostat. If 24 volts is not present from the room thermostat, check for the following:
  - a. Proper operation of the room thermostat (contact between R and G with the fan switch in the "ON" position and in the "AUTO" position during operation calls).
  - b. Proper wiring between the room thermostat and the UCB.
  - c. Loose wiring from the room thermostat to the UCB.
8. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.
9. If the thermostat and UCB are properly wired, replace the UCB.

10. If the blower motor runs with the fan switch in the "ON" position but does not run shortly after the furnace has ignited when the fan switch is in the "AUTO" position, check the room thermostat for contact between R and G during "W1" calls.

On calls for heating, the supply air blower operates but the draft motor does not (the room thermostat fan switch is in the "AUTO" position).

1. The draft motor has inherent protection. If the motor shell is hot to the touch, wait for the internal overload to reset.
2. If the motor shell is cold with the room thermostat calling for heat, check for line voltage at the motor's Mate-N-Lok connector attached to the evaporator partition. If line voltage is present, replace the draft motor.
3. If line voltage is not present, check for line voltage at the heat relay (RW1) contacts in the main control box and check to see if the (RW1) is pulled in.
4. If the (RW1) relay is pulled in, check for a loose line voltage connection.
5. If the (RW1) relay is not pulled in, check for 24 volts at the (RW1) coil. If 24 volts is present, replace the (RW1) relay. If 24 volts is not present, check for a loose 24 volt connection back to the relay board and check the connections from the room thermostat to the relay board. If all connections are correct, replace the relay board.

The draft motor runs but the furnace does not light and the sparker does not spark.

1. The ignition control (IC1, IC2) may be locked out due to either a flame roll out or 100% shut off. These safety features are described above. If lock-out has occurred, 24V must be removed from the ignition controls. This is done at the unit or by resetting the room thermostat. After resetting 24V, check for proper furnace operation. If lock-out continues to occur, locate the source of the problem and correct.
2. Check all 24 volt connections from the relay board to and in the gas heat section. Check low voltage connections to the (ETD) located in the control box.
3. If the furnace is hot, it may be out on an over-temperature condition, wait for limit reset.

4. If the furnace is cold, check for 24 volts at wire 241 attached to the electrical time delay (ETD) located in the main control box. If 24 volts is not found, replace the ETD.
5. 24 volts is found at wire 241, remove the wires attached to the (TDR) and with a VOM, check for continuity across contacts 1 and 2. If none is found, the (TDR) is open and must be replaced. If there is continuity, re-attach the wires. With the draft motor running, check for 24 volts at terminal 4 of (RW1-2) and (RW2-1). If 24 volts is not present, the centrifugal switch (CS) has not closed or has gone bad. Check the line voltage to the unit - if it is correct, replace the draft motor. If line voltage is low, call the power company.
6. Check for 24V at terminal 2 of (RW1-2 and RW2-1). If 24V is not present, check for 24V at (RW1 and RW2) relay coils. If these relays are pulled in, then check for a loose connection at terminal 2 and terminal 4 of each relay. If no problem is found, then replace (RW1 and/or RW2) as required.
7. If 24 volts is present at the ignitor controls, check all control wiring at the ignitor controls and the high tension wire to the ignitors. Check that the ground wires from the ignitor controls, the gas valves and pilot burners are all intact and making good electrical connection. Check to make sure that the ceramic insulator on the pilot ignitors or sensors is not broken or cracked, if all are intact, replace the ignition control IC1 or IC2.

The draft motor runs and the ignitor sparks at the pilot burner but the pilot does not ignite and a gas odor is not detected at the draft motor outlet.

1. Check to make sure gas is being supplied to the unit. Make sure that the gas pressure to the unit is within the proper limits as described in the "POST START CHECK LIST" page 43 and that the pilot adjust screw is allowing some flow of gas as described in "PILOT CHECKOUT" page 44.
2. Check all wiring between the ignitor control and the gas valve. Check to make sure the ground connections are intact.
3. If the wiring is intact, check for 24 volts across terminals "PV" and "COMMON" on the ignitor control. If 24 volts is not present, replace the ignitor control.

- If 24 volts is present, remove the pilot burner and remove the pilot orifice from the pilot burner. The orifice is removed in the direction opposite the flow of gas. Inspect the orifice for obstruction. If it is clear, replace the main gas valve.

The ignitor sparks at the pilot burner but the pilot does not ignite and a gas odor is detected at the draft motor outlet.

- Adjust the pilot adjust screw on the gas valve as described in "PILOT CHECKOUT" page 44.
- Check the supply pressure as described in "POST START CHECK LIST" page 43. Make adjustments as necessary.
- Check the pilot orifice for obstruction as described in paragraph above. Clean as needed but the problem should not be the gas valve.

The pilot burner ignites but the ignitor continues to spark and the main burners do not ignite.

- Make the same checks and adjustment as described in "PILOT CHECKOUT" page 44.
- Check the supply pressure as described in "POST START CHECK LIST" page 43. Make adjustments as necessary.
- Make sure that the pilot burner is not bent or damaged.
- Make sure that the ground connections at the pilot burner, gas valve and ignitor control are intact. Check the high tension wire for good electrical connection. If all are intact, replace the ignitor module.

The pilot burner lights and the spark stops but the main burners do not light.

- Check electrical connections between the ignitor control and the gas valve. If intact, check for 24 volts across terminals "MV" and "COMMON" terminals. If no voltage detected, replace ignitor control. If voltage is present, replace gas valve.

Furnace lights with roll-out or one burner has delayed ignition.

- Make sure that the pilot burner is aligned properly with the carryover as described in "PILOT CHECKOUT" page 44.
- Make sure that the carryovers on adjoining burners are screwed fast and are level with respect to one another.

Main burners light but exhibit erratic flame characteristics.

- Adjust air shutters as described in "BURNER AIR SHUTTER ADJUSTMENT" page 44.
- Check the main burner orifices for obstruction and alignment. Removal procedure is described in BURNER INSTRUCTIONS page 44. Clean or replace burner orifices and burners as needed.

## UNIT FLASH CODES

Various flash codes are utilized by the unit control board (UCB) to aid in troubleshooting. Flash codes are distinguished by the short on and off cycle used (approximately 200ms on and 200ms off). To show normal operation, the control board flashes a 1 second on, 1 second off "heartbeat" during normal operation. This is to verify that the UCB is functioning correctly. Do not confuse this with an error flash code. To prevent confusion, a 1-flash, flash code is not used.

Alarm condition codes are flashed on the UCB lower left Red LED, See Figure 24. While the alarm code is being flashed, it will also be shown by the other LEDs: lit continuously while the alarm is being flashed. The total of the continuously lit LEDs equates to the number of flashes, and is shown in the table. Pressing and releasing the LAST ERROR button on the UCB can check the alarm history. The UCB will cycle through the last five (5) alarms, most recent to oldest, separating each alarm flash code by approximately 2 seconds. In all cases, a flashing Green LED will be used to indicate non-alarm condition.

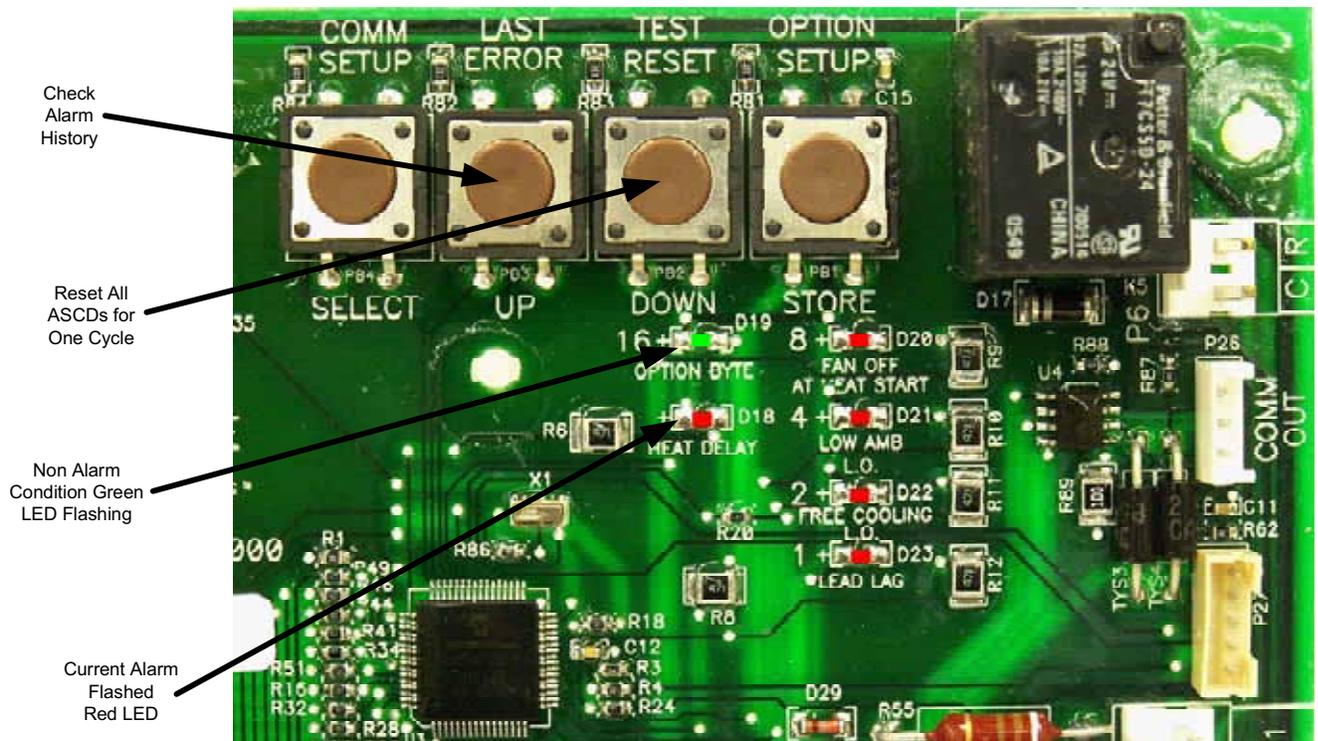
In some cases, it may be necessary to "zero" the ASCD for the compressors in order to perform troubleshooting. To reset all ASCDs for one cycle, press and release the UCB TEST/ RESET button once.

Flash codes that do and do not represent alarms are listed in Table 24.

**TABLE 24: UNIT CONTROL BOARD FLASH CODES**

FLASH CODE	DESCRIPTION	GREEN LED 16	RED LED 8	RED LED 4	RED LED 2	RED LED 1
On Steady	This is a Control Failure	-	-	-	-	-
1 Flash	Not Applicable	-	-	-	-	-
2 Flashes	Control waiting ASCD <sup>1</sup>	Flashing	Off	Off	On	Off
3 Flashes	HPS1 Compressor Lockout	Off	Off	Off	On	On
4 Flashes	HPS2 Compressor Lockout	Off	Off	On	Off	Off
5 Flashes	LPS1 Compressor Lockout	Off	Off	On	Off	On
6 Flashes	LPS2 Compressor Lockout	Off	Off	On	On	Off
7 Flashes	FS1 Compressor Lockout	Off	Off	On	On	On
8 Flashes	FS2 Compressor Lockout	Off	On	Off	Off	Off
9 Flashes	Ignition Control Locked Out / Ignition Control Failure	Off	On	Off	Off	On
10 Flashes	Compressors Locked Out on Low Outdoor Air Temperature <sup>1</sup>	Flashing	On	Off	On	Off
11 Flashes	Compressors locked out because the Economizer is using free Cooling <sup>1</sup>	Flashing	On	Off	On	On
12 Flashes	Unit Locked Out due to Fan Overload Switch Failure	Off	On	On	Off	Off
13 Flashes	Compressor Held Off due to Low Voltage <sup>1</sup>	Flashing	On	On	Off	On
14 Flashes	EEPROM Storage Failure	Off	On	On	On	Off
OFF	No Power or Control Failure	Off	Off	Off	Off	Off

<sup>1</sup>. Non-alarm condition.



**FIGURE 24 - UNIT CONTROL BOARD**

## UNIT CONTROL BOARD OPTION SETUP

### OPTION BYTE SETUP

- Enter the Option Setup mode by pushing the OPTION SETUP / STORE button, and holding it for at least 2 seconds.
- The green status LED (Option Byte) will be turned on and the red status LED (Heat Delay) is turned off.
- The 8, 4, 2 and 1 LEDs will then show the status of the 4 labeled options ((8) Fan Off at Heat Start, (4) Low Ambient Lockout, (2) Free Cooling Lockout, and (1) Lead / Lag).
- Press the UP or Down button to change the LED status to correspond to the desired Option Setup.
- To save the current displayed value, push the OPTION SETUP / STORE button and hold it for at least 2 seconds. When the value is saved, the green LED will flash a few times and then normal display will resume.

**NOTE:** While in either Setup mode, if no buttons are pushed for 60 seconds, the display will revert to its normal display, exiting the Option Setup mode. **When saving, the control board only saves the parameters for the currently displayed mode (Option Byte or Heat Delay).**

### HEAT DELAY SETUP

- Enter the Option Setup mode by pushing the OPTION SETUP / STORE button, and holding it for at least 2 seconds.
- The green status LED (Option Byte) will be turned on and the red status LED (Heat Delay) is turned off.
- Press the COMM SETUP / SELECT button to toggle into the Heat Delay Setup, the green LED will turn off and the red LED for Heat Delay will turn on.

- The 8, 4, 2 and 1 LEDs will then show the status of the Heat Delay, (See Table 25). Press the UP or Down button to change the LED status to correspond to the desired Heat Delay Value.
- To save the current displayed value, push the OPTION SETUP / STORE button and hold it for at least 2 seconds. When the value is saved, the red LED will flash a few times and then normal display will resume.

**NOTE:** While in either Setup mode, if no buttons are pushed for 60 seconds, the display will revert to its normal display, exiting the Option Setup mode. **When saving, the control board only saves the parameters for the currently displayed mode (Option Byte or Heat Delay).**

**TABLE 25: HEAT DELAY**

Heat Fan On Delay	Heat Fan Off Delay	Red LED 8	Red LED 4	Red LED 2	Red LED 1
60	180	On	On	On	On
60	90	On	On	On	Off
60	60	On	On	Off	On
60	30	On	On	Off	Off
45	180	On	Off	On	On
45	90	On	Off	On	Off
45	60	On	Off	Off	On
45	30	On	Off	Off	Off
30	180	Off	On	On	On
30	90	Off	On	On	Off
30	60	Off	On	Off	On
30	30	Off	On	Off	Off
0	60	Off	Off	On	On
0	30	Off	Off	On	Off
0	10	Off	Off	Off	On
Non-std	Non-std	Off	Off	Off	Off



