DMS4 SERIES MULTIZONE

LENNOX INDUSTRIES INC.

ROOFTOP UNITS
501,292M
3/97

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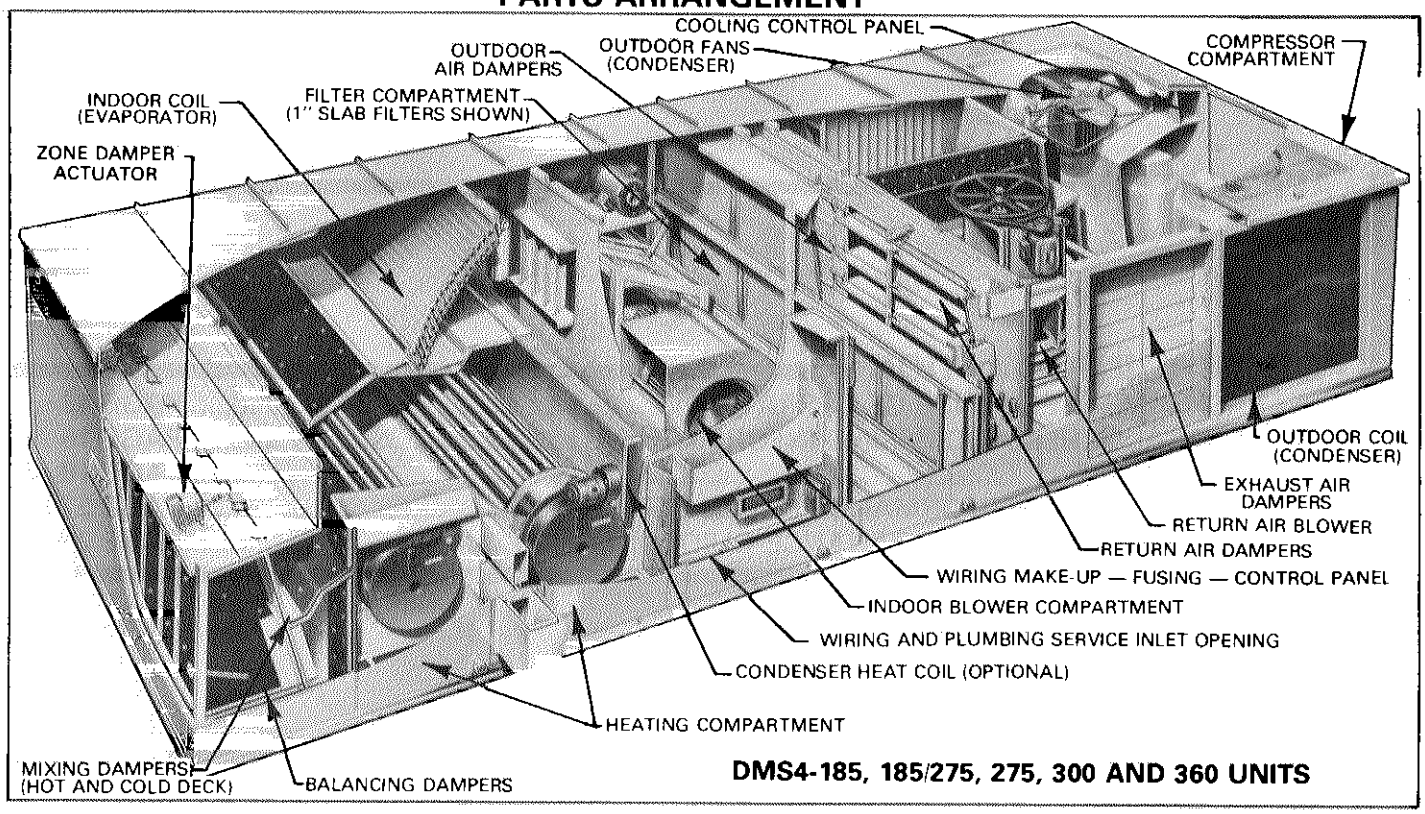
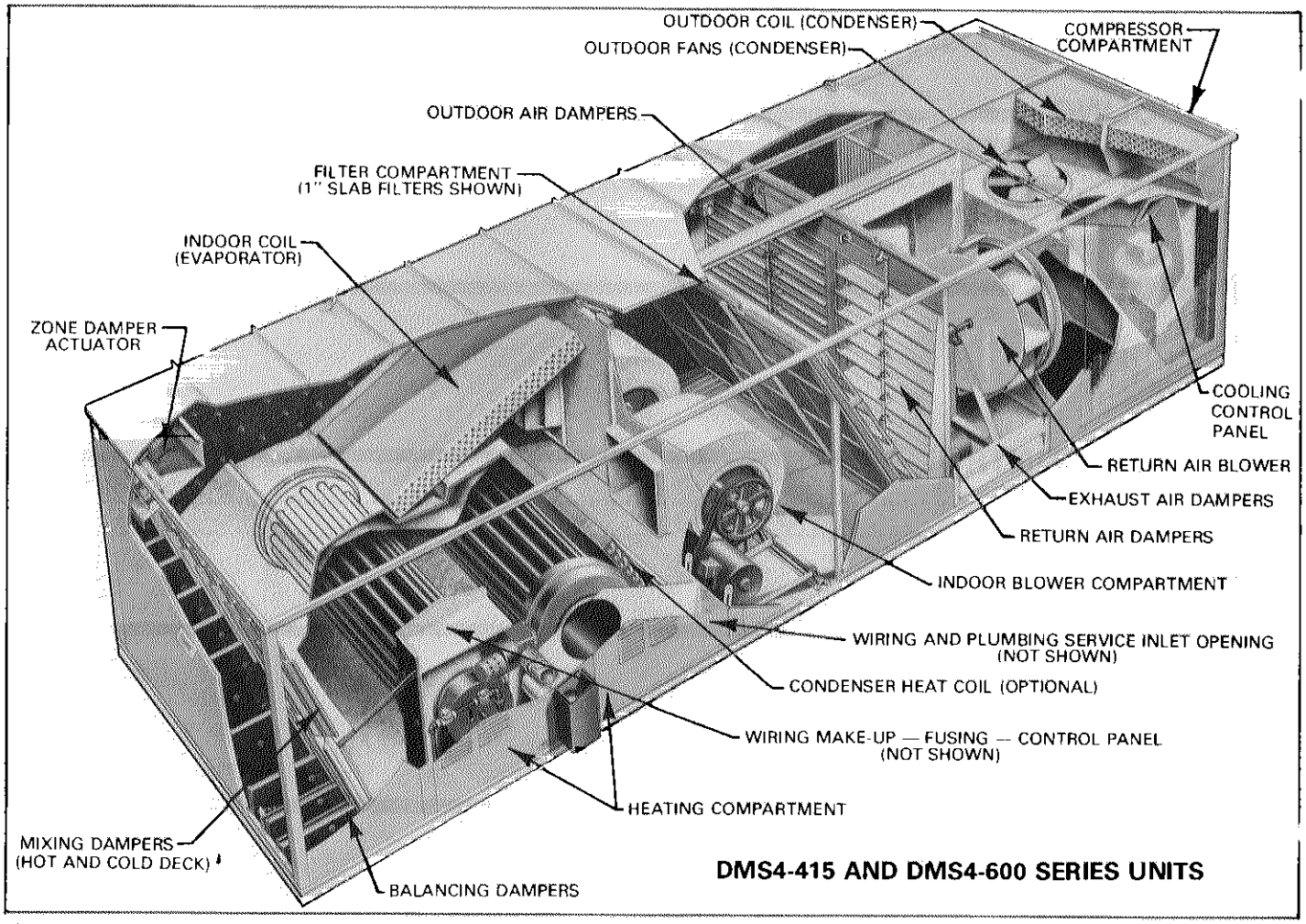


DMS4-185, 185/275, 275, 300 AND 360 UNITS

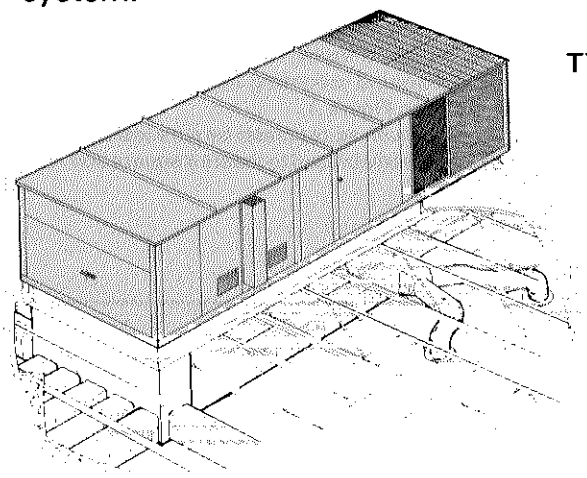


DMS4-415 AND DMS4-600 SERIES UNITS

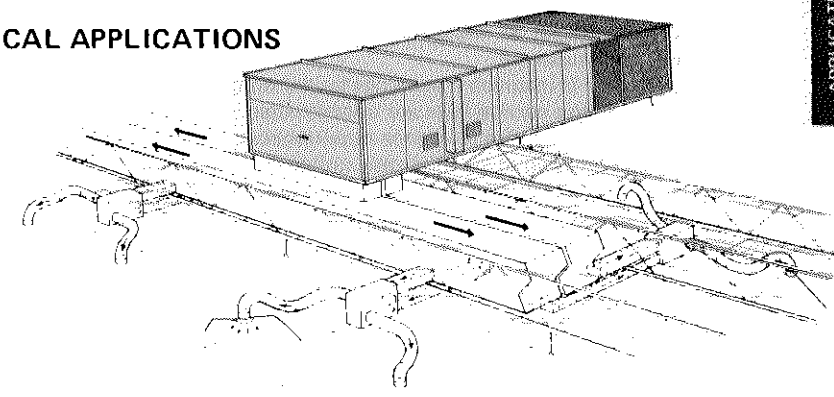
DMS4 APPLICATION SECTION

This section lists fundamental guidelines and requirements when applying a direct multizone system.

TYPICAL APPLICATIONS



Zone distribution system.
Mixing dampers located at unit.



Double duct distribution system with zone damper boxes.
Mixing dampers remote from unit

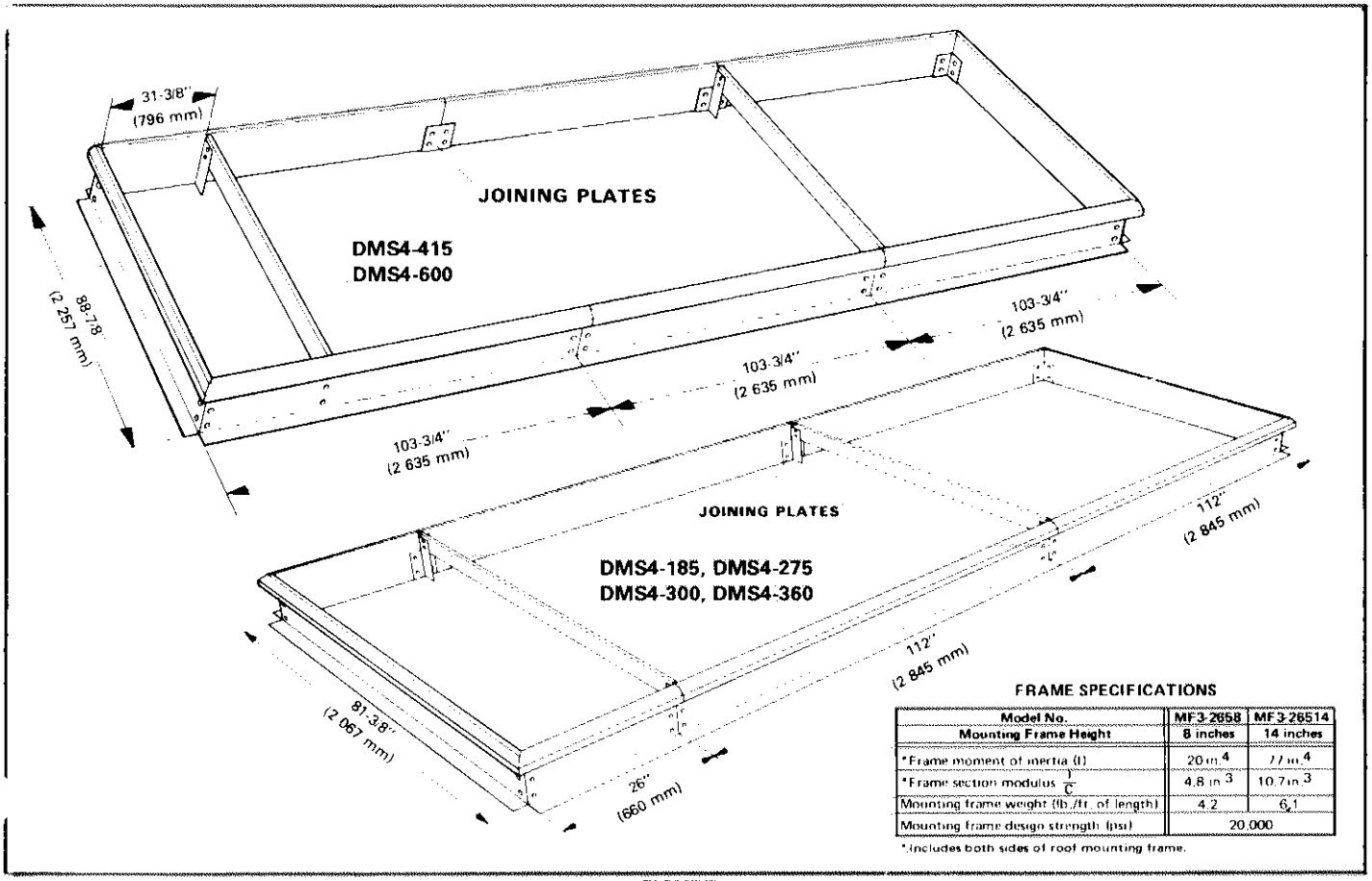
I - ROOF MOUNTING FRAME

Standard roof mounting frame is 14" (356 mm) galvanized steel that fits the perimeter of the multizone unit. Frame is approved by the National Roofing Contractors Association (NRCA). Frame is shipped knocked down, sections are assembled together with bolts and joint plates. Figure 1.

A - Frame Application and Location

Mounting frame can be installed directly on a roof deck having adequate structural strength or on roof supports under deck. When installing frame on support members under deck, the following support specifications apply:

1 - With joint plates bolted, the maximum frame span between supports is 5 feet (1.52 meters).



FRAME SPECIFICATIONS

Model No. / Mounting Frame Height	MF3-2658 8 inches	MF3-26514 14 inches
*Frame moment of inertia (I)	20 in.^{4}	77 in.^{4}
*Frame section modulus $\frac{I}{C}$	4.8 in.^{3}	10.7 in.^{3}
Mounting frame weight (lb./ft. of length)	4.2	6.1
Mounting frame design strength (psi)	20,000	

*Includes both sides of roof mounting frame.

FIGURE 1

2 - With joint plates welded to the frame the maximum frame span is 16 feet (4.88 meters) and maximum cantilever is 9 feet (2.74 meters).
3 - A bolted joint plate cannot be included in a cantilever. If the frame is cantilevered more than 6 feet (1.83 meters) the joint plate and frame closest to the overhang must be welded.
4 - There must be at least 32 linear inches (813 mm) of frame in contact with roof supports.
5 - Care must be taken to insure that openings for the supply plenum, wiring and plumbing service inlet are unobstructed.
6 - Refer to Figure 2 for service clearance requirements.
7 - To assure proper mating of the multizone unit to the roof mounting frame, it is mandatory that the frame be properly squared, all sides straight and shimmed, if necessary and secured to the roof structure.
8 - Maximum slope tolerance of the roof mounting frame (length only) is 1/8" per foot (10.8 mm per meter). The frame must be level side to side.

B - Curbing and Flashing

1 - The outside of the frame should be insulated with a rigid type insulation, preferably 2" (51 mm) thick. Do not use any combustible material for filling around frame.
2 - Counter flash and seal around mounting frame using approved roofing methods. Refer to Figure 3.
3 - If a poured roof is used, (such as concrete) be sure inside of roof mounting frame is adequately braced to insure a square and level frame.

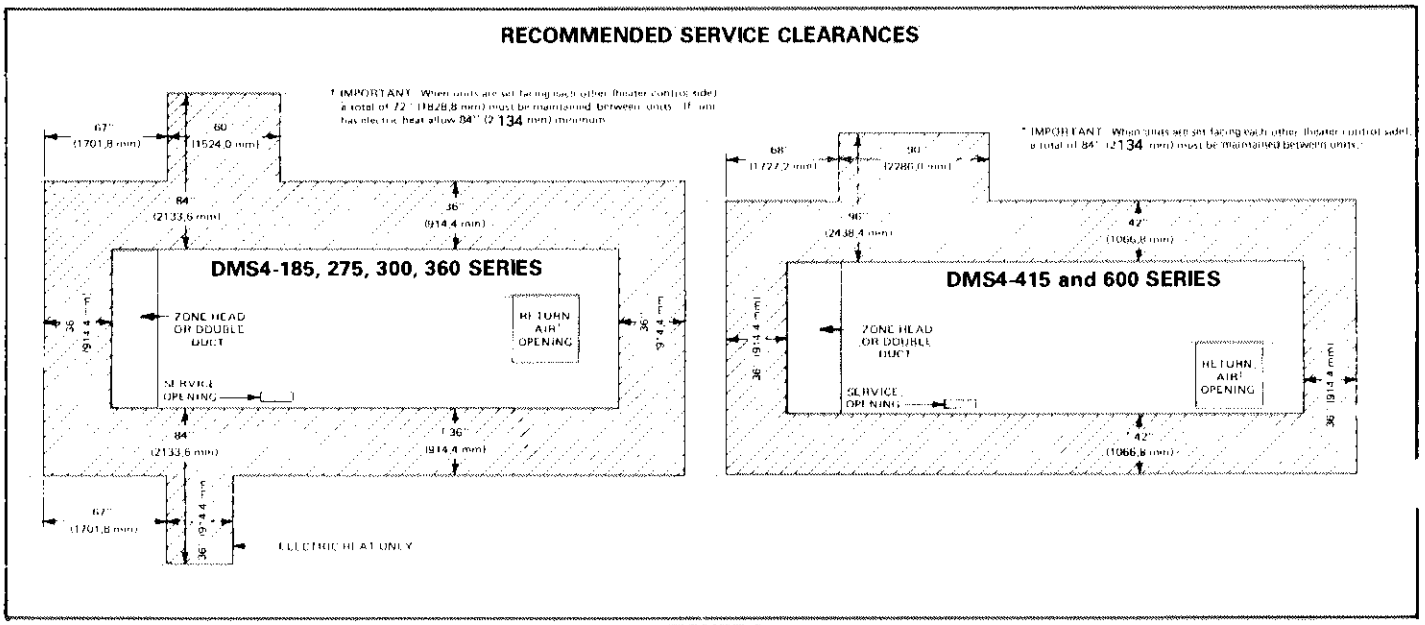


FIGURE 2

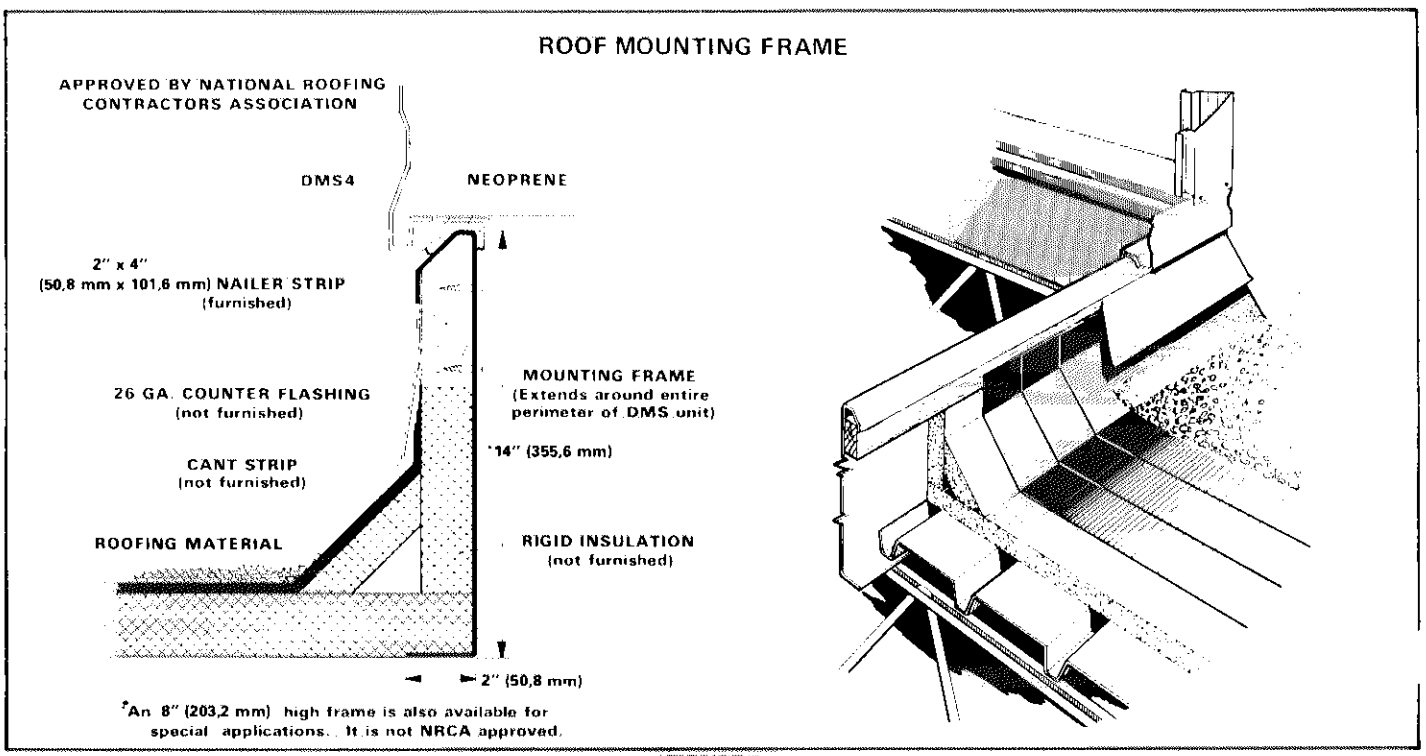


FIGURE 3

HOT DECK LIMIT HEATING CONTROL

HOT DECK LIMIT FUNCTION

A hot deck limit, located in the main control box, is used as a high temperature limit for gas, electric and hot water heat. The hot deck limit (A7) and corresponding thermistor (RT15) monitor the hot deck temperature to change the heating command signal at temperatures above set point. For example if the "Lo" signal from load analyzer is 2 VDC and asks for full heat, but the hot deck temperature is already at the limit set point, A7 will control the command signal to maintain the hot deck temperature at the set point. A7 and RT15 do not initiate the heating demand.

The limit is factory set at 90°F; however, the setting can be field changed to either 110°F or 130°F if desired. Refer to Figure 1 to change setting.

Figure 2 shows the A7 hot deck limit relationship to the Load Analyzer Module within the unit operating flow chart. Electric heat is shown but the A7 effect is similar for gas or hot water heat.

Heating operation flow charts are shown on pages 41 and 47.

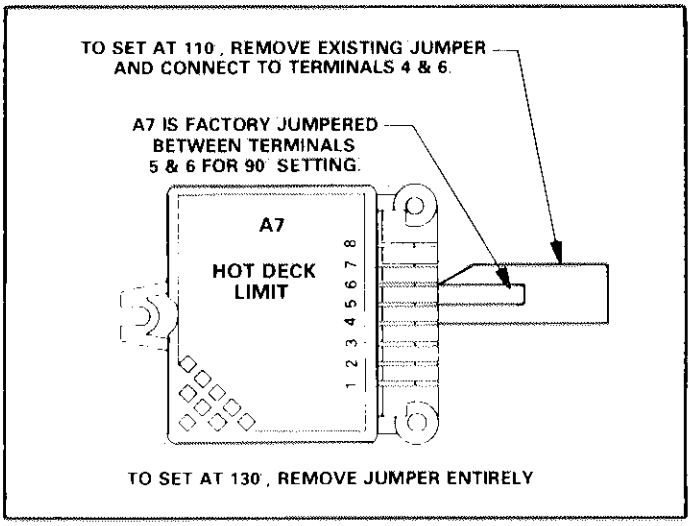


FIGURE 1

TYPICAL ELECTRIC HEAT OPERATION

(ILLUSTRATING A TEN ELEMENT UNIT WITH CONDENSER HEAT AND DISCRIMATOR)

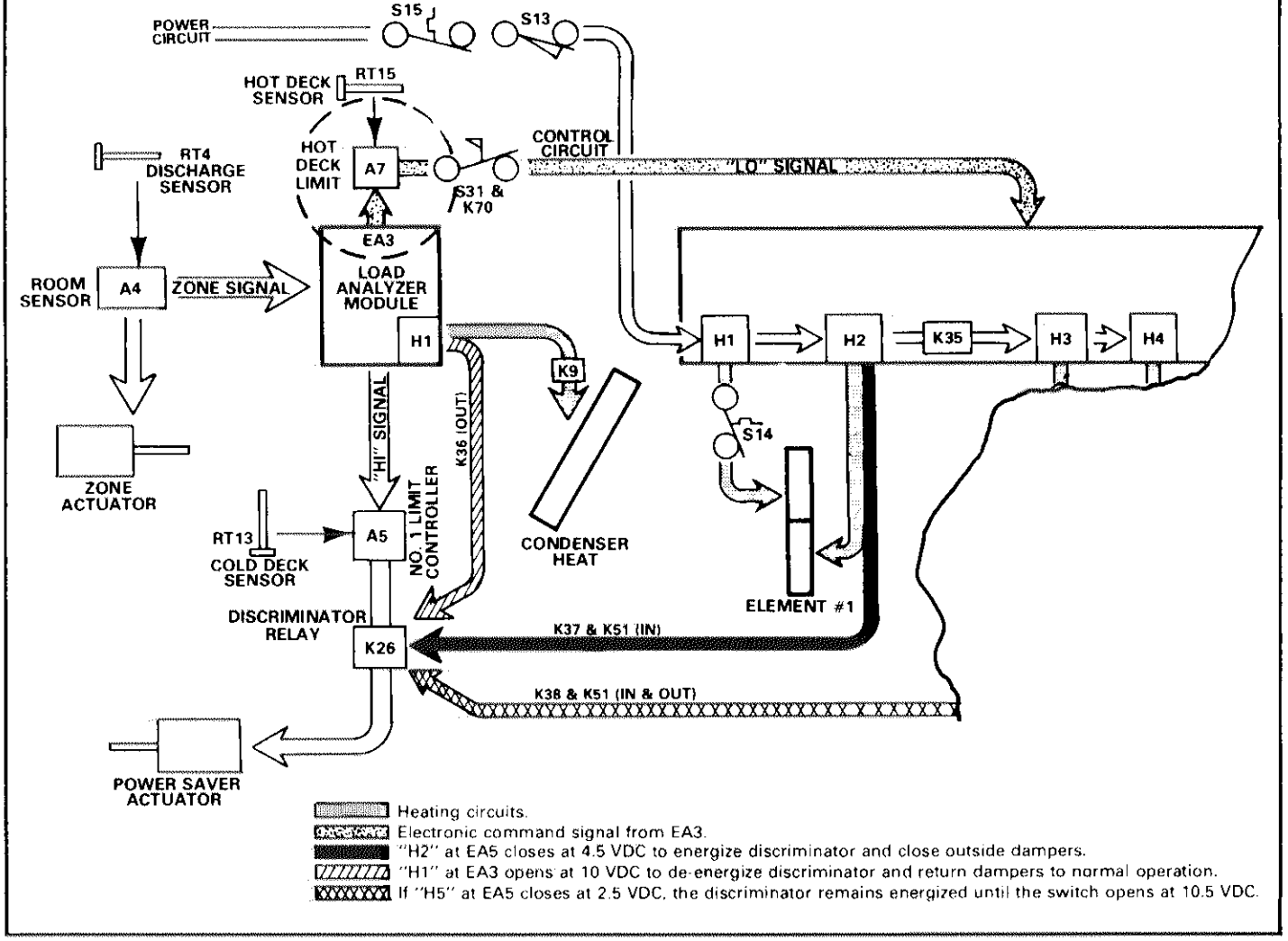


FIGURE 2

II - SUPPLY AIR SYSTEM

Supply air for the conditioned area is supplied from a zone head at the unit which is divided into individual zones or by a dual duct system with remote mixing boxes sized for individual zones. Unit zone head is available with either bottom or horizontal air discharge. Each zone has hot and cold mixing dampers controlled by a room sensor.

A - Plenum Construction

Plenum must be constructed of galvanized steel (26 gauge minimum) with 3 lb. (1.36 kg.) by 1/2" (13 mm) thick fiberglass insulation applied to the inside of zone dividers. If 1-1/2 lb. (.68 kg.) density insulation is used, mechanical fastners must be used to secure insulation to plenum. Refer to the following typical double duct and zone plenum illustrations for both horizontal (Figure 4) and bottom discharge air systems. (Figure 5).

NOTE - Refer to DMS4 plenum installation instructions for detail dimensions of all plenums.

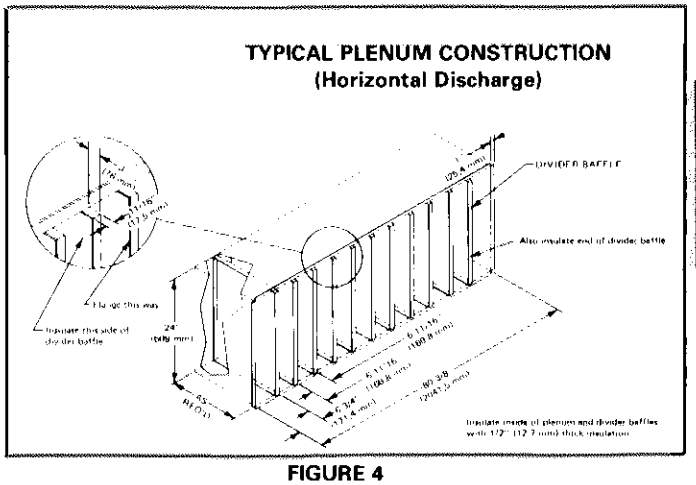
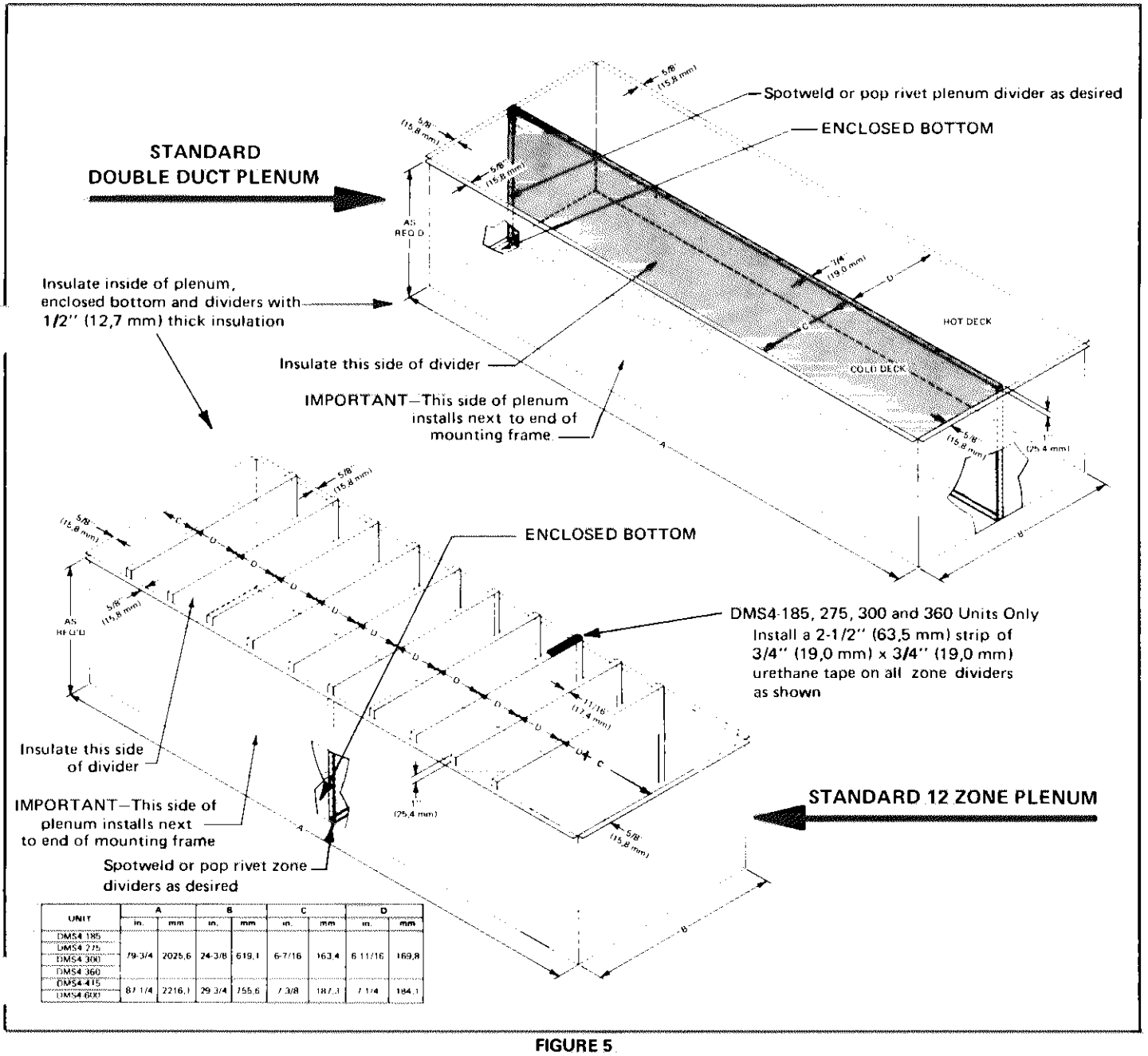


FIGURE 4



UNIT	A		B		C		D	
	in.	mm	in.	mm	in.	mm	in.	mm
DMS4-185	79-3/4	2025,6	24-3/8	619,1	6-7/16	163,4	6 11/16	169,8
DMS4-275								
DMS4-300								
DMS4-360								
DMS4-415	87 1/4	2216,1	29 3/4	755,6	7 3/8	187,3	7 1/4	184,1
DMS4-600								

FIGURE 5

B - Installation (Bottom Discharge Plenum) Figure 6.

1 - Plenum support Z-bars must be provided to install the zone plenum in the roof mounting frame.

NOTE - If an AF6 or AF7 adaptor frame (required with gas fired equipment mounted on a combustible roof deck) the Z-bar supports are not used. Figure 7.

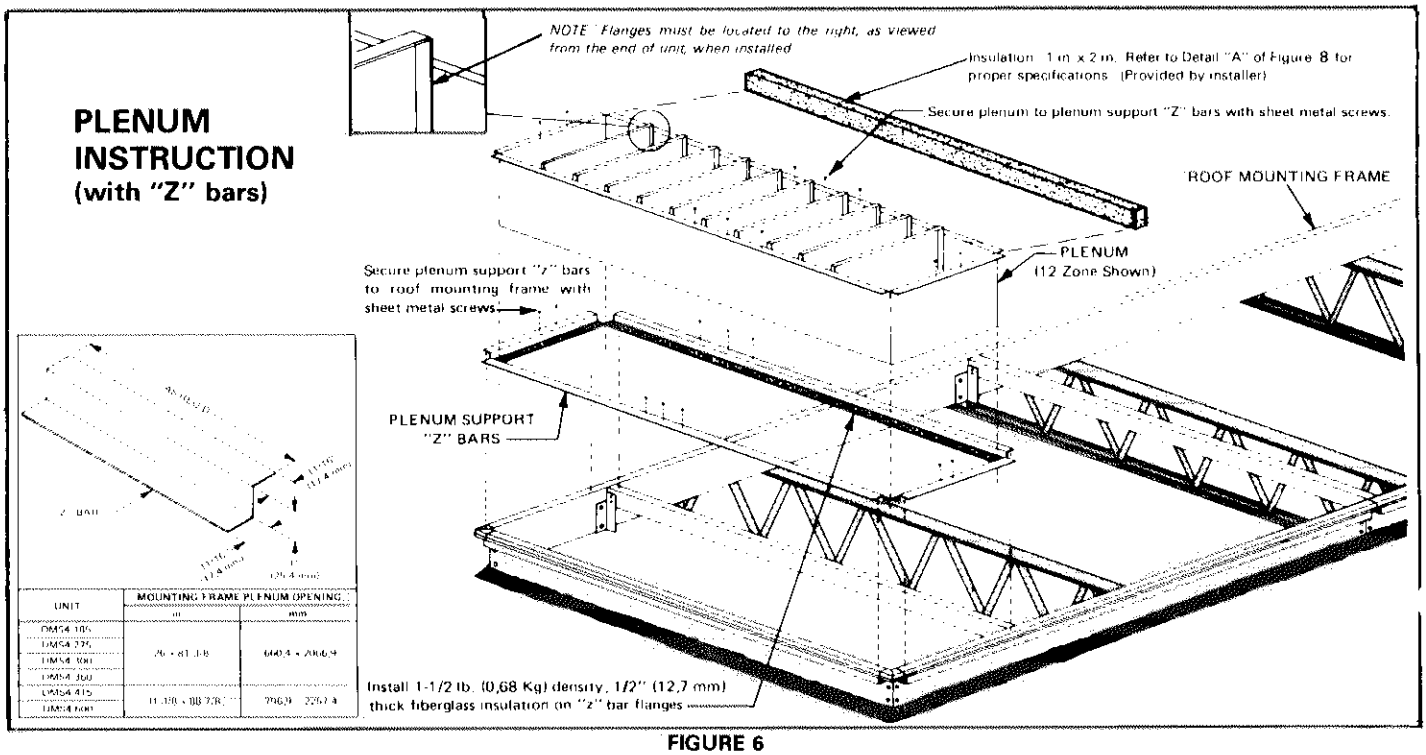
2 - The plenum must be installed with the plenum divider flanges to the right (as viewed from zone head end of the unit) to assure proper mating to zone dividers in unit. Refer to Figure 6.

3 - A field provided insulation seal is required to prevent bypass air from zone to zone and also short cycling back through the return air system. Fiberglass requirements are 1-1/2 lb. (.68 kg.) density by 1" by 2" (25.4 mm by 51 mm) by the length of the zone plenum. Refer to Figure 8.

C - Installation (Horizontal Discharge Plenum) Figure 9.

1 - Requires field fabricated sheet metal divider panel outlet mullion and filter pieces. Refer specifically to Lennox Horizontal Discharge Installation Instructions No. 501,237M for construction detail.

2 - Insulated bottom closure panel is factory installed in Multizone unit when unit is specified on order form for horizontal air discharge.



UNIT	MOUNTING FRAME PLENUM OPENING	
	in	mm
DMS4-105	26 x 81-1/8	660.4 x 2060.4
DMS4-225		
DMS4-300		
DMS4-360		
DMS4-415	11-3/8 x 88-7/8	289.0 x 2257.4
DMS4-600		

FIGURE 6

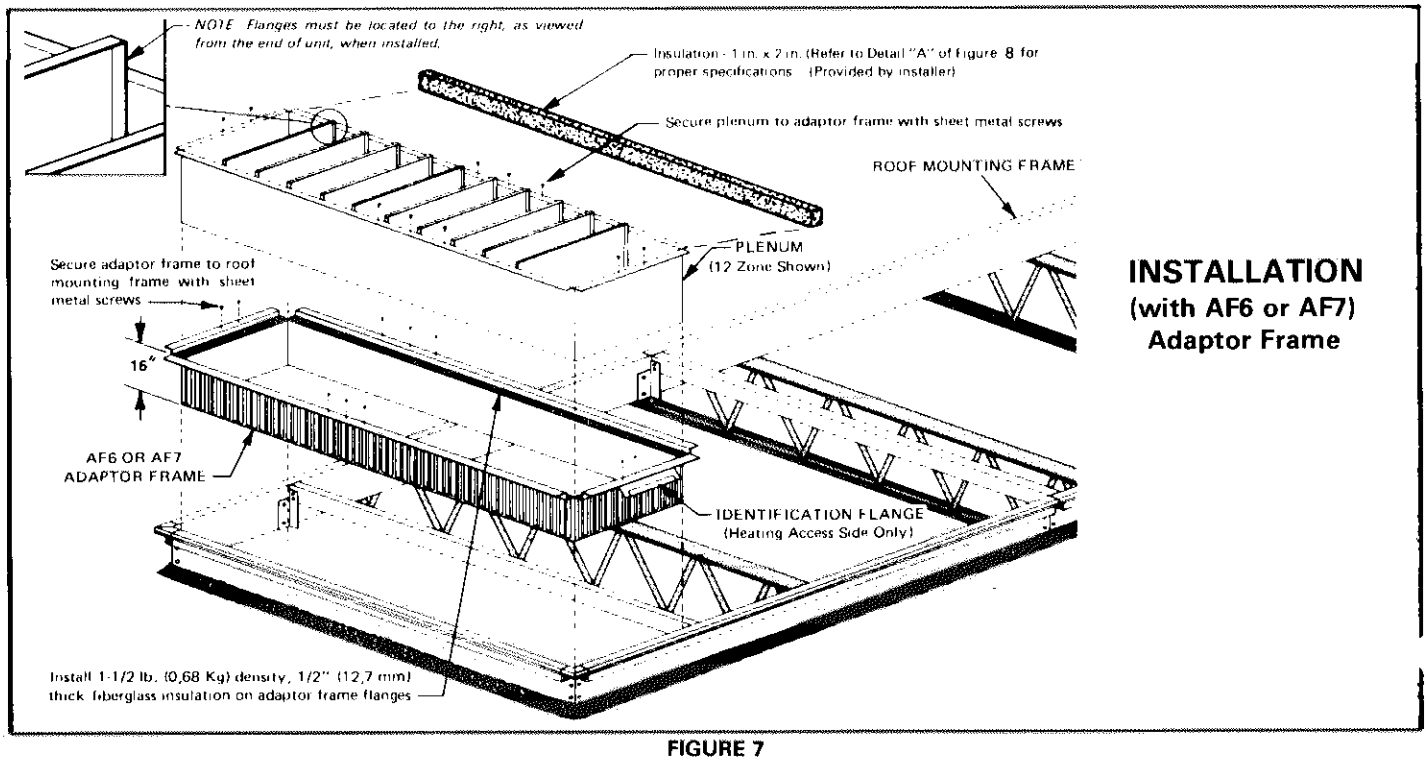
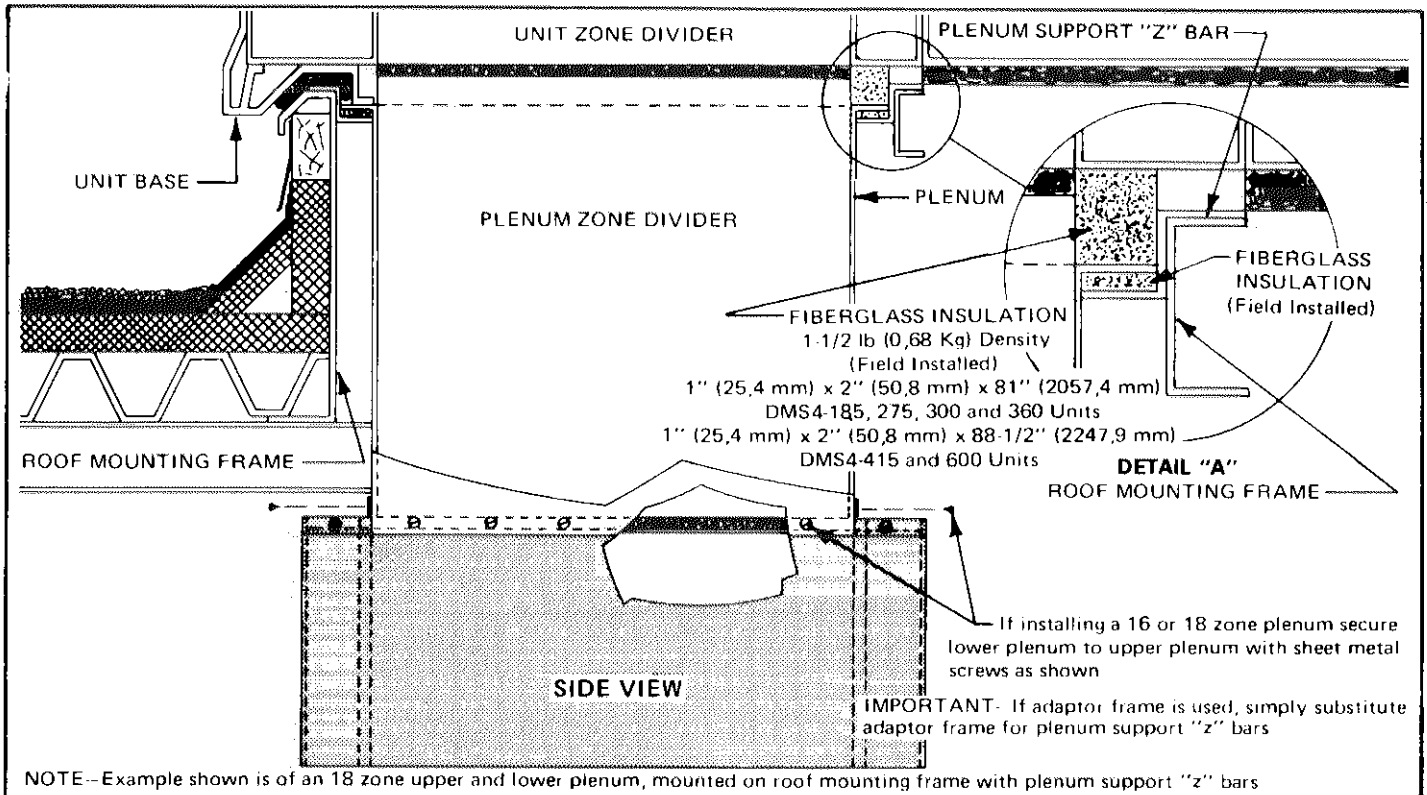
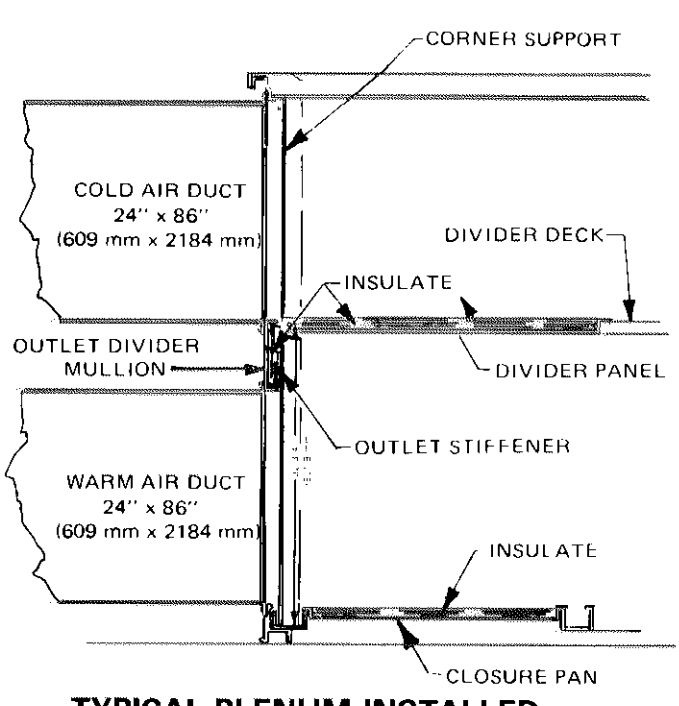


FIGURE 7

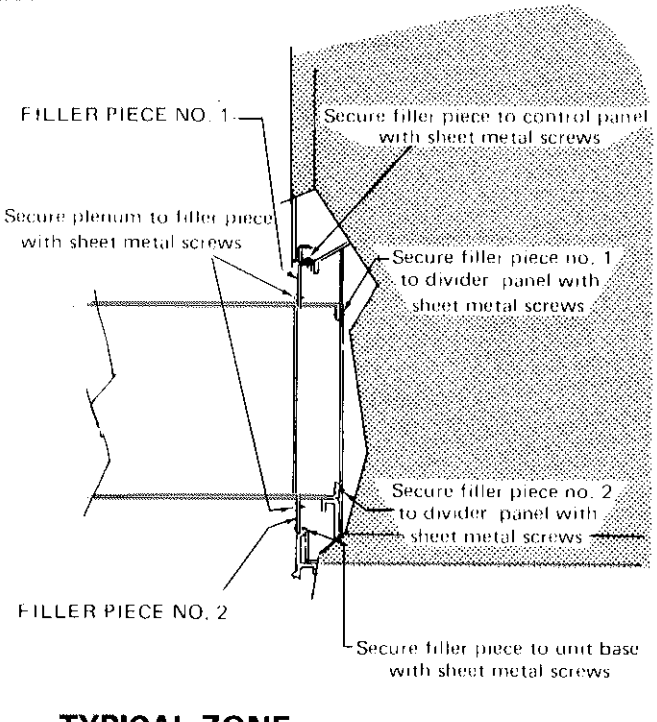


BOTTOM DISCHARGE CROSS SECTION OF PLENUM IN PLACE (shown with "Z" bars)

FIGURE 8



TYPICAL PLENUM INSTALLED ON DOUBLE DUCT
(Horizontal Discharge)



TYPICAL ZONE PLENUM INSTALLATION
(Horizontal Discharge)

FIGURE 9

D - Remote Mixing Boxes

Remote zone mixing boxes are used with dual duct applications; 1 zone damper box is required per conditioned zone.

1 - The zone damper boxes may be installed in a false ceiling area, or any convenient indoor location that lends itself to proper air distribution. On installations with false ceiling areas, suspend damper box with 4 metal straps attached to each corner of the box

2 - The supply air from the hot and cold ducts are transitioned in the zone damper box by a splitter baffle. Refer to Figure 10 for the duct take offs in relationship to the splitter baffle.

3 - Use the following guidelines for running duct work from the zone damper box.

a - When running one duct from the zone box, remove splitter baffle. Refer to Figure 11.

b - When two ducts are run from the damper box, always take off opposite sides of the splitter baffle. Refer to Figure 11.

c - When 3 or more ducts are required, use an extended plenum and run individual ducts from plenum. Refer to Figure 11.

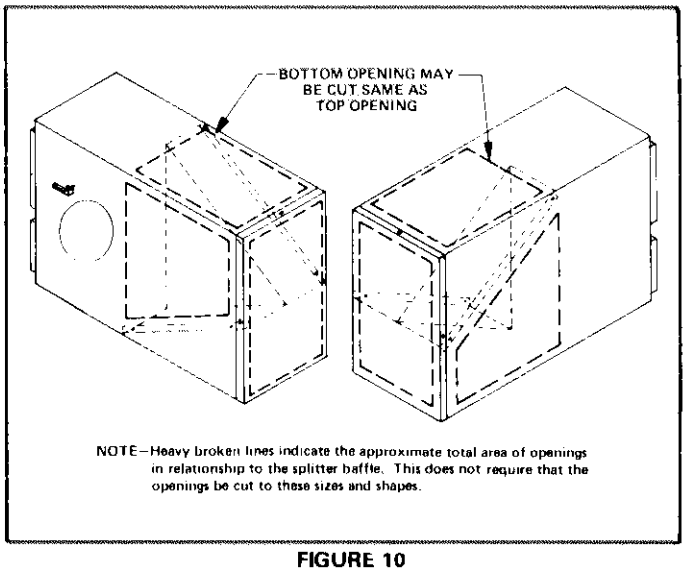


FIGURE 10

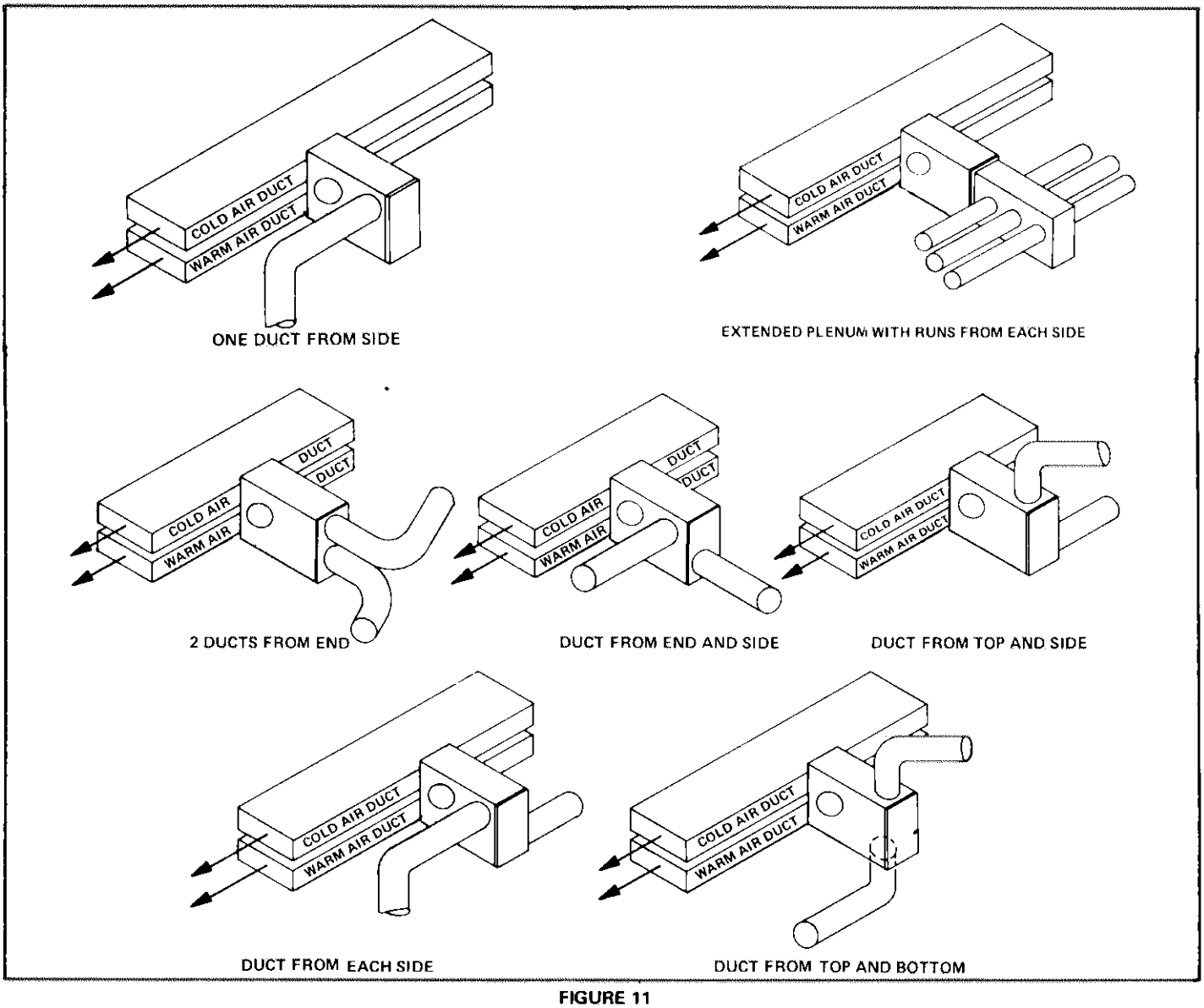


FIGURE 11

III - RETURN AIR SYSTEMS

Return air systems are generally either ducted or an open return air through a sandwich space above a false ceiling.

A - Ducted Return System

The ducted return air system offers the feature of lining the duct with insulation giving the ultimate in acoustical treatment.

B - Open Return System

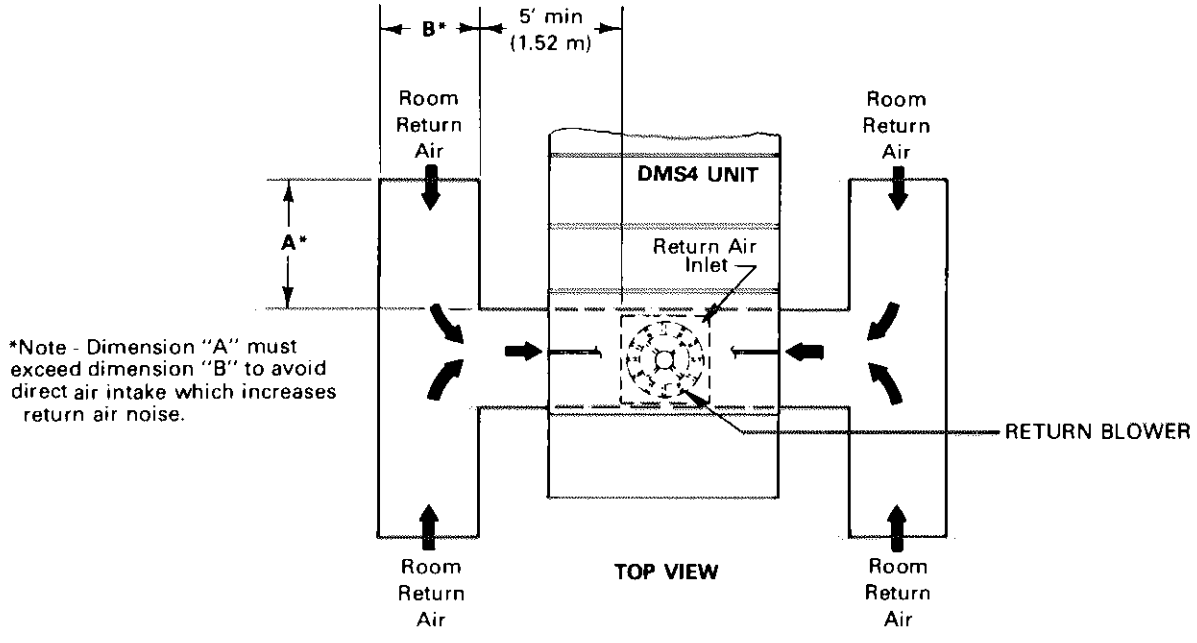
The open plenum system eliminates the cost of return air ducts and is extremely flexible. In a building with relocatable interior walls it is much easier to change the location of a ceiling grille than reroute a ducted return air system.

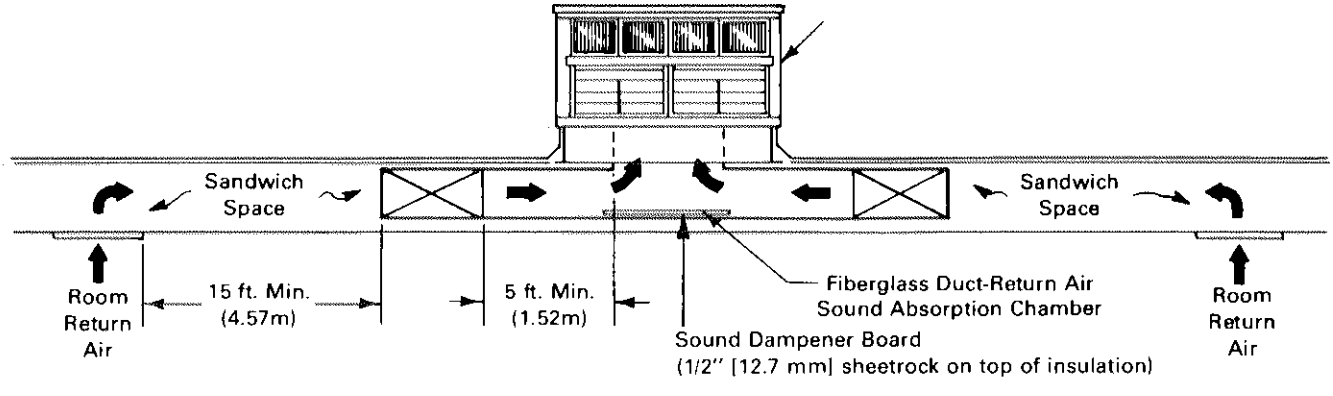
Where any rooftop equipment utilizes the sandwich space for the return air system, a return air chamber such as illustrated in Figure 12, should be connected to the air inlet opening of the rooftop equipment. This reduces air handling sound transmissioning through the thin false ceiling panels. It should be sized not to exceed 1500 FPM (7.6 m/s) return air velocity. It can be a fiberglass duct or fiberglass lined metal duct. It is recommended not to install a ceiling return air grille within 15 feet (4.57 meters) of the duct inlet.

C - Roof Mounting Frame as Plenum Chamber

The RMF3 Roof Mounting Frame may also be treated and used as a return air chamber to the Multizone unit. Depending on the CFM requirements, the 4" (102 mm) cross support members in the frame may need replacing with 3/4" (19 mm) rods. Refer to typical application in Figure 13 .

RETURN AIR ACOUSTICAL TREATMENT





END VIEW

FIGURE 12

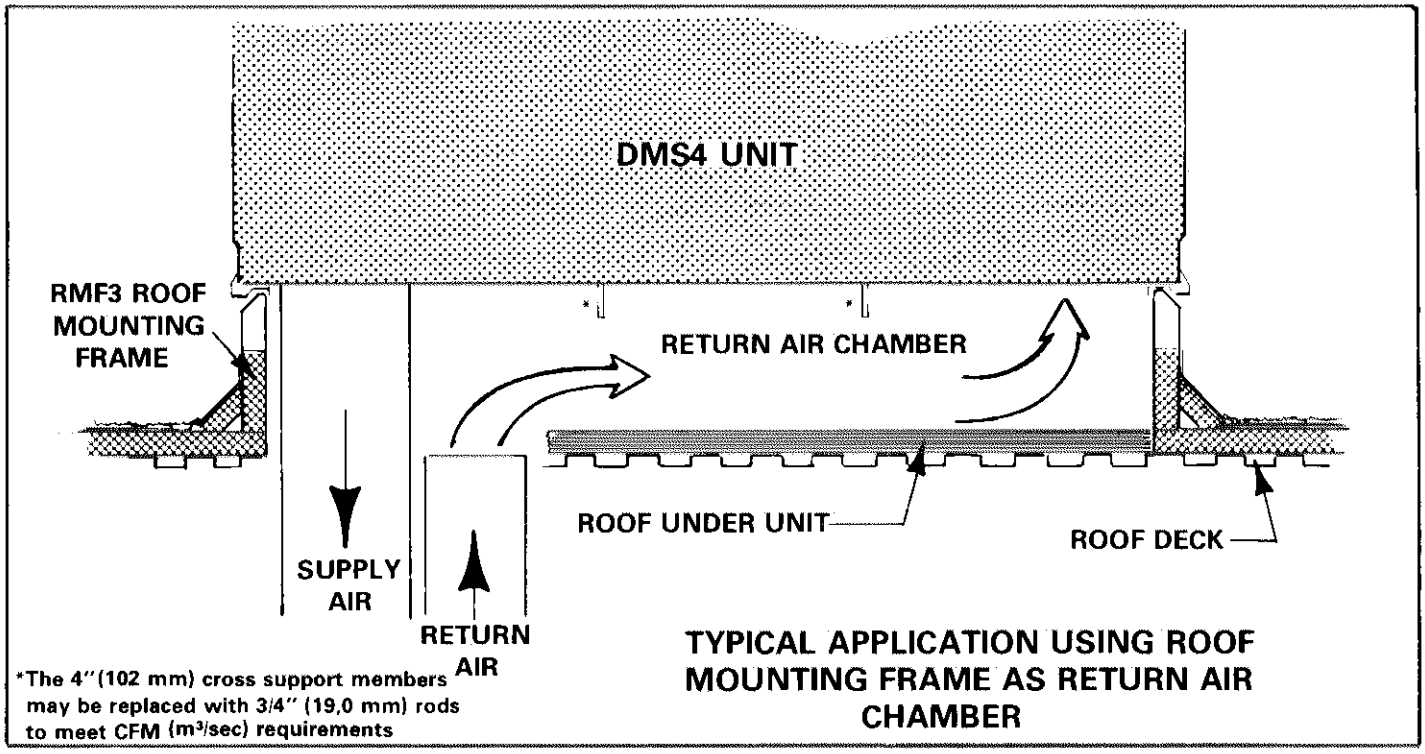


FIGURE 13

IV - ZONE DISTRIBUTION

Lennox multizone equipment is designed and engineered to deliver uniform air volume through the individual dampers in the zone head. However, due to different heating and cooling options available, the air pattern and volume may vary with certain options. Therefore, Lennox recommends the following guidelines to assure proper air volume and control to each of the zones.

1 - Whenever possible, combine the end damper with center dampers and use the combination on larger zones.

2 - For small or critical zones that require air from one or two dampers, use the center dampers to assure adequate zone control.

3 - Units with bottom air discharge have balancing dampers for each individual zone provided in the zone head. The dampers are located in each zone at the air discharge end of the unit at the bottom of the air outlet. These individual zone dampers must be adjusted to assure proper overall system balance. Units with horizontal air discharge and dual duct system do not have balancing dampers. We recommend balance dampers be installed in supply duct work to individual zones.

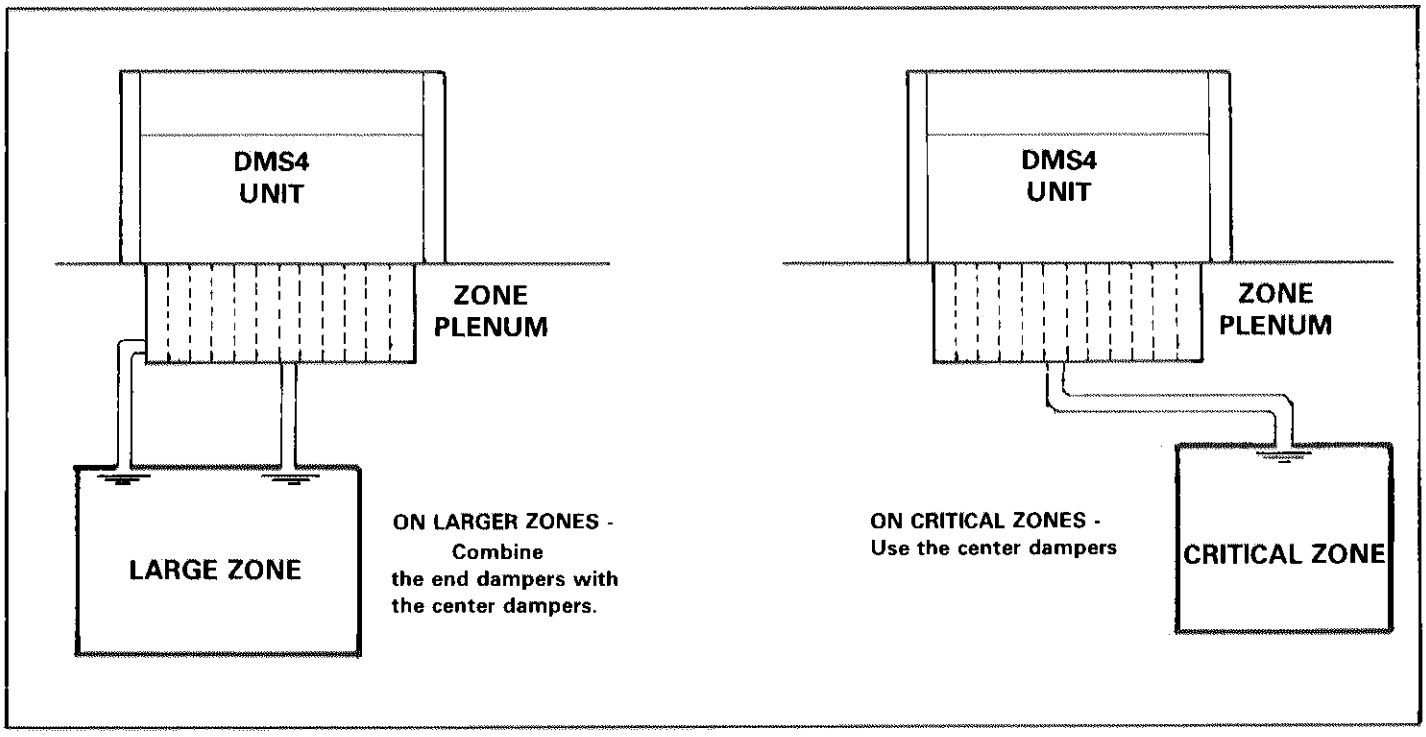
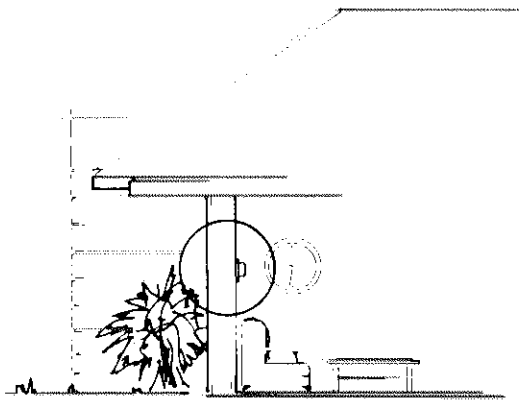


FIGURE 14

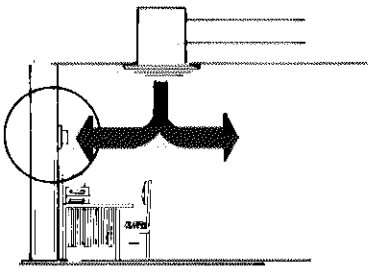
V - PREREQUISITES FOR ZONES

A zone is a separate area within the conditioned area which regulates its temperature by means of a room sensor. Zones must be properly divided to assure proper unit operation and control.

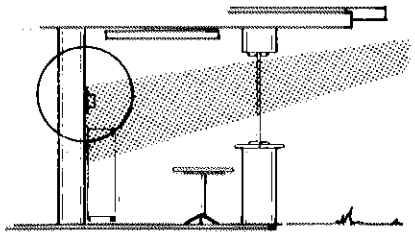
1 - Wall dividers or partitions do not constitute separate zones.
2 - A small zone adjacent to a large zone must keep its door closed or else the overall affect is the same as trying to make separate zones out of a partitioned area.
3 - Do not use 2 multizone units to control one zone.
4 - Locate equipment as near the center of the space as possible to reduce duct size and length and result in a better balanced system.
5 - Return air provisions must be made from each individual zone.
6 - An individual zone which needs an excessive amount of heat compared to the other zones, should use its own single zone unit.
7 - Only one room sensor should be used per zone. If a zone requires more CFM (m^3/sec) than one zone head damper can deliver, it is recommended two or more dampers be slaved (lined) together to satisfy the zone requirements. Adjacent dampers in the zone head can be slaved together with mechanical linkage. Non-adjacent dampers can be electrically slaved together. DO NOT USE MULTIPLE ROOM SENSORS IN THE SAME ZONE. Figure 15.



DO NOT LOCATE ON EXTERIOR WALLS

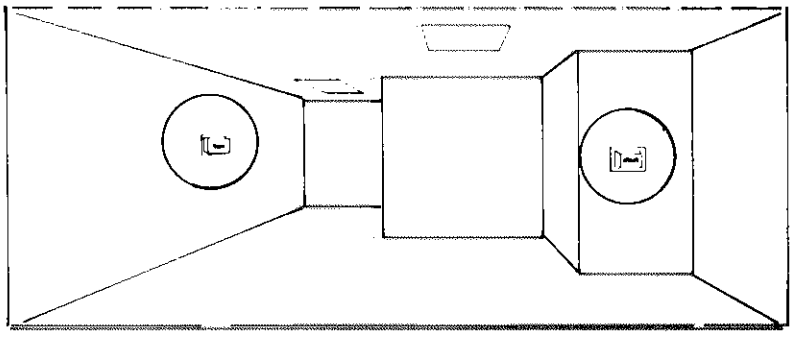


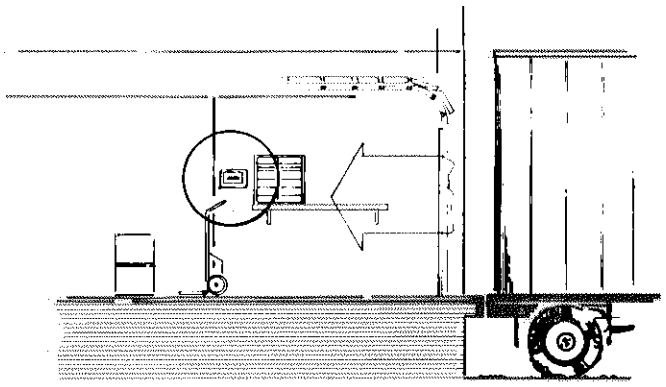
DO NOT EXPOSE TO DISCHARGE AIR



DO NOT EXPOSE TO DIRECT SUNLIGHT

DO NOT INSTALL MORE THAN ONE SENSOR PER ZONE





DO NOT LOCATE IN ENTRANCE OR AREAS AFFECTED BY DRAFTS

FIGURE 15

8 - In multiple unit installations, the following guidelines are recommended for mixing perimeter and core zones:

Maximum Load Diversity

For optimum energy efficiency, install a DMS4 equipped with condenser heat and outside air discriminator in applications with maximum load diversity. See Figure 16. By intermixing perimeter and core zones, the heat rejected into the return air from core zones will be recirculated into the supply air stream. A cooling demand will initiate DX cooling and bring additional heat into the hot deck.

Minimize Load Diversity

Minimize load diversity in installations less condenser heat and outside air discriminator. If possible design system so perimeter zones go to one unit and core zones go to another. Figure 16.

VI - ROOM SENSOR

Two types of room sensors are offered: the standard and a wide no-load band type. On a typical heating/cooling day, the load demand swing from morning heating to midday cooling and back to late day heating. The standard room sensor controls the heating/cooling demand through the day within plus or minus 2 degrees of set point. The wide no-load room sensor gives approximately 6 degree range between the heating and cooling demand. The unit coasts within the no-load band. Temperature control remains plus or minus 2 degrees at either end of the band. Refer to following graph.

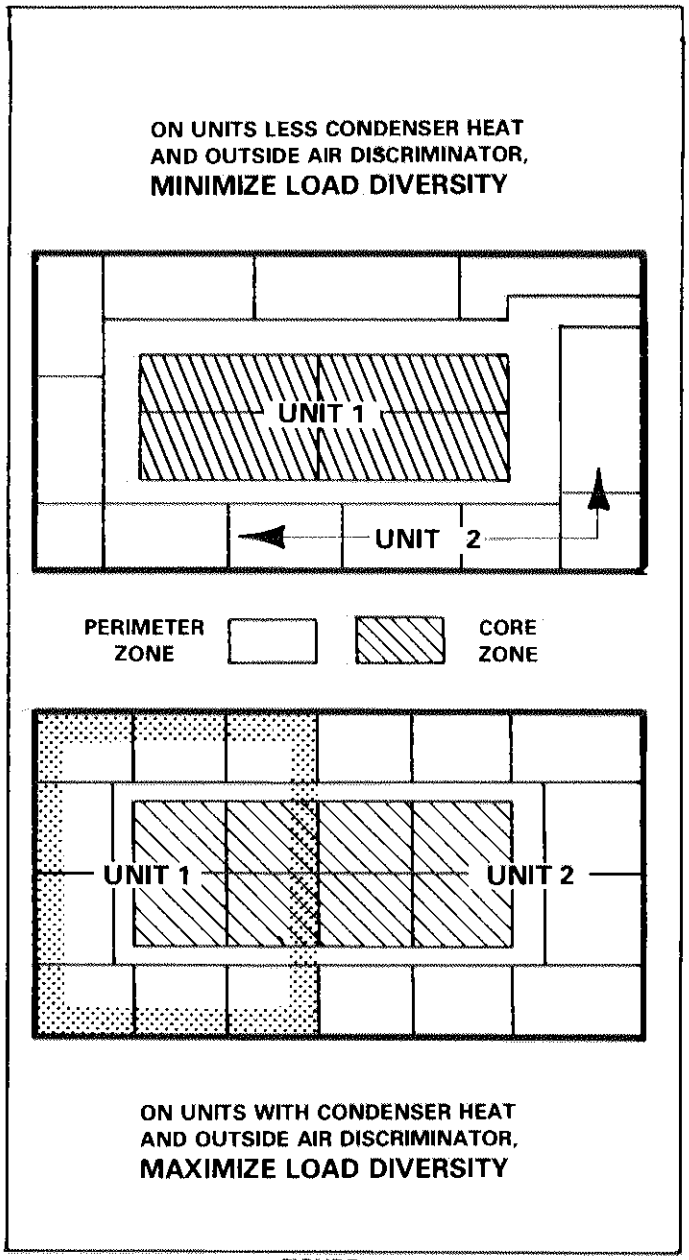
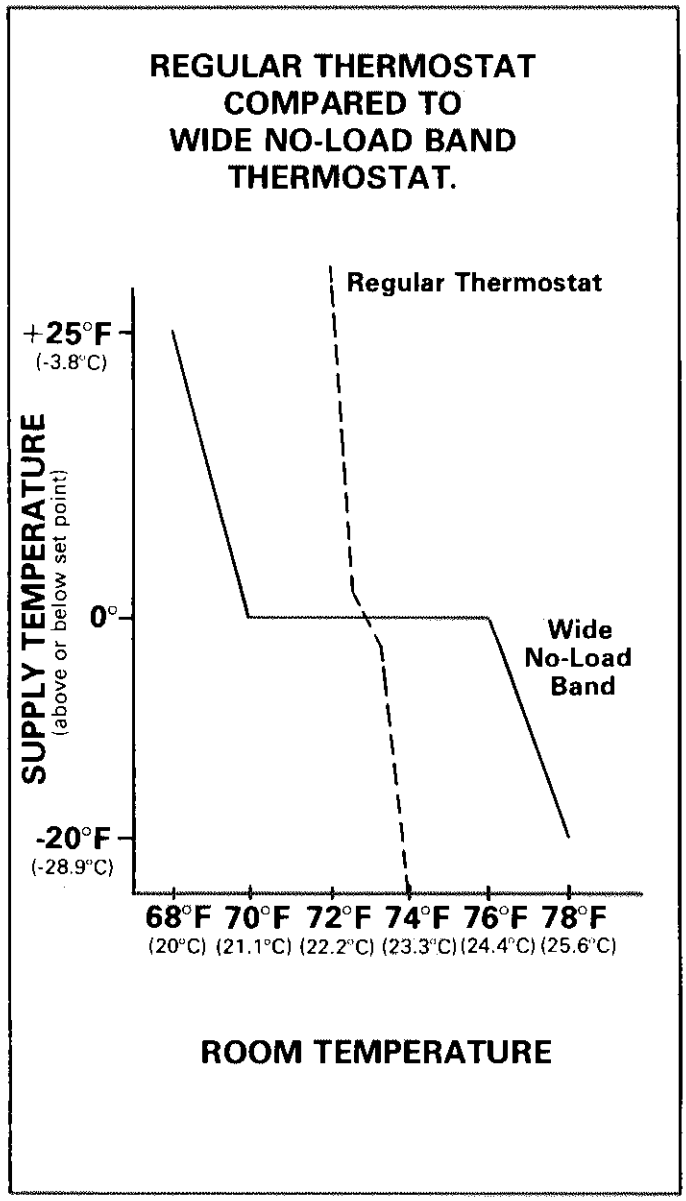


FIGURE 16



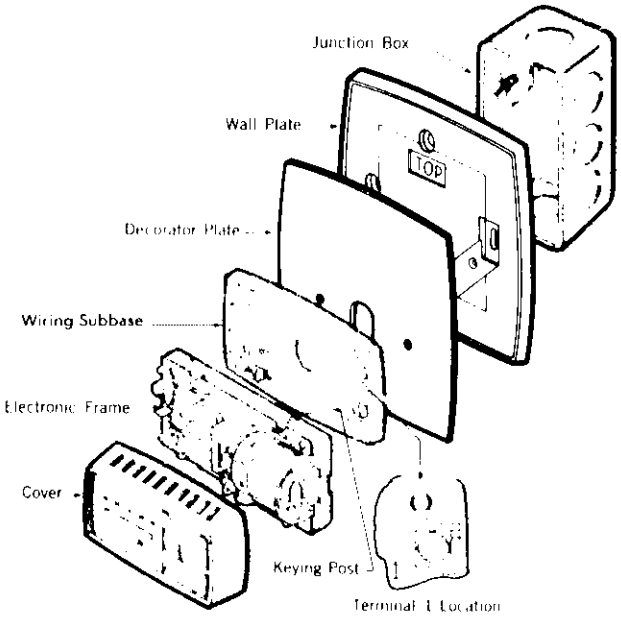
A - Installation

1 - Room sensor mounts on a standard 2" x 4" (51 mm x 102 mm) outlet box. Wall plate, decorator plate, wiring subbase, electrical frame and cover make up the sensor assembly. Figure 17.

2 - Do not locate room sensor on an exterior wall, in an entryway, or in direct sunlight. Figure 15.

3 - Make certain room sensor or sensors are located where they sample air in the occupied space for a particular zone, however, direct impingement by discharged air upon the room sensor should be avoided or minimized. Figure 15.

4 - All room sensors should be maintained at approximately the same set point.



SENSORS (THERMOSTAT)

FIGURE 17

BASIC DMS4 SEQUENCE OF OPERATION

I - BLOWER OPERATION

1 - The indoor blower (B3) runs continuously under normal operation. The nite setback controls (optional) cycle the blower in response to heating demands during night operation. When heat demand is satisfied, the fan control (S6) allows blower to run until the excess heat dissipates from heat exchanger (gas heat only).

2 - The return air blower (B4 - optional) runs whenever the indoor blower is operating.

3 - Fire protection thermostats (S24 & S25) are located in the return air compartment and blower compartment. Thermostats terminate all unit operation at temperatures above setting.

4 - All other systems are dependent upon the blower operation. The sail switch (S31), located in the indoor blower air stream, senses a blower failure and shuts down all systems within the unit.

5 - With the presence of smoke, the smoke detection system (optional) terminates heating and cooling functions and provides 4 options of controlling blower and damper operation. See Figure 18.

Option 1 - "Shutdown"
a - Supply blower stops.
b - Return blower stops.
c - Outside dampers close.
d - Return dampers close.

Option 2 - "Exhaust"
a - Supply blower stops.
b - Return blower continues to run.
c - Outside dampers close.
d - Return dampers close.

Option 3 - "Intake"
a - Supply blower continues to run.
b - Return blower stops.
c - Outside dampers open.
d - Return dampers close.

Option 4 - "Intake and Exhaust"
a - Supply blower continues to run.
b - Return blower continues to run.
c - Outside dampers open.
d - Return dampers close.

Upon power failure or during nite setback conditions, the blowers stop and the return and outside dampers close. A remote smoke detector test station simulates smoke conditions to check performance of smoke detectors.

When the smoke detector(s) are reset, a time delay relay (DL7) in the blower circuit allows time for both dampers to open before supply and return blowers begin operation. A direct acting actuator (B9) drives the outside dampers while a reverse acting actuator (B10) drives the return air dampers.

II - THE LENNOX ELECTRONIC ENERGY SAVING SYSTEM

The DMS4 is equipped with a solid-state control system which cycles the unit to match its output to the load requirements. The solid-state control system has two functions.

1 - To modulate zone dampers to provide conditioned supply air that satisfies the heating or cooling demands in each zone without override.

2 - To maintain hot and cold deck temperatures in the unit that satisfy the requirements of the zone with the largest heating load and the zone with the largest cooling load.

A - Zone Damper Control

Two air temperature sensors are used for each zone — one located in the conditioned space (A4 room sensor) and one mounted in the supply duct (RT4 discharge sensor). An electronic circuit compares the temperatures at room sensor and discharge air sensor to control the position of zone dampers. See Figure 19.

As the room temperature changes from the room sensor setpoint, the zone dampers will move to satisfy the demand. On a change in

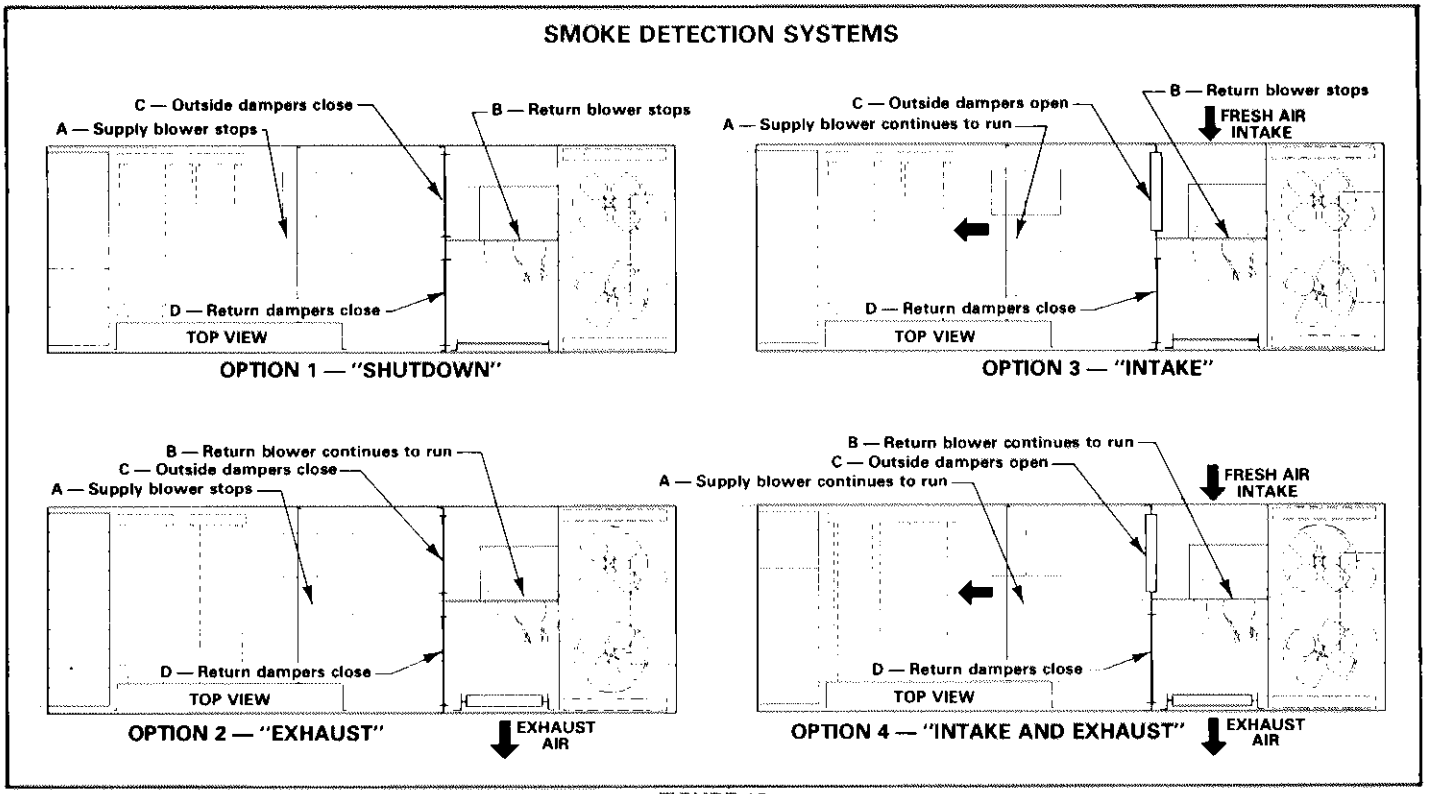


FIGURE 18

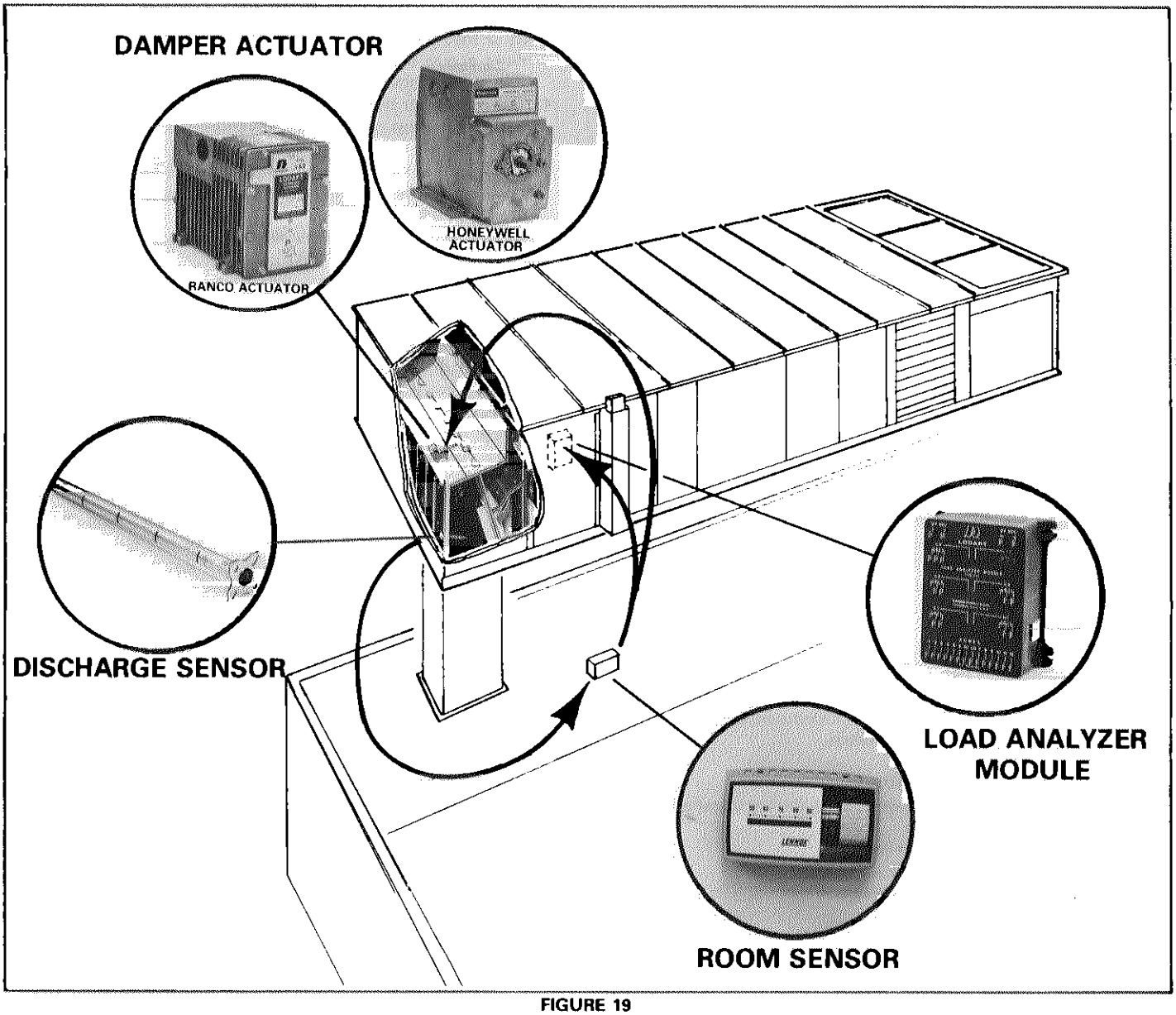


FIGURE 19

discharge air temperature, the zone damper will reposition in anticipation of the effect on room temperature.

In addition to the standard room sensor, an optional "no load band" room sensor allows a wide temperature differential of 6 degrees before cycling the heating or cooling in the DMS4.

If the conditioned zone requires more CFM than a particular damper opening can deliver, two or more dampers must be linked together to provide the needed CFM. Adjacent dampers can be slaved together using mechanical linkge. Non-adjacent dampers can be electrically slaved together. Although several dampers may be linked together, they still constitute one zone and are consequently controlled by one room sensor. Refer to "Electronic Zone Control" on page 83 for additional information on slaving dampers.

Three zone damper actuators are available:

1 - ZC14 and ZC16 Direct Acting - Actuator modulates in response to the variable voltage signal transmitted by the demands of the room sensor and discharge sensor.

2 - ZC14 Reverse Acting - This actuator functions the same as above except that on power failure the shaft will spring return with the dampers closed to the hot deck and open to the cold deck.

3 - ZC15 Pneumatic - This actuator is controlled by a pneumatic space thermostat.

In addition the unit may be applied to a dual duct system with remote mixing boxes using the ZC6 direct acting or ZC7 pneumatic actuators.

B - Hot And Cold Deck Controls

The EA3 load analyzer module cycles the unit in response to the zone with the greatest heating demand and the zone with the greatest cooling demand. Any zone can generate these demands. See Figure 19. If no zone has a demand of sufficient magnitude to actuate either the heating or cooling functions, the system will coast with only the blowers running.

Overriding controls monitor cold deck temperatures to protect unit from problem zones (a zone which transmits a constant heating or cooling demand).

III - CONDENSER HEAT

The condenser heat option is used in conjunction with outside air discriminator and power saver. The condenser heat coil within the hot deck gives off heat from the No. 1 refrigerant circuit whenever compressor 1 is running and there is a heating demand. The function chart in each respective heating section illustrate staging of con-

denser heat. The "Refrigerant Cooling" section on page 59 explains condenser heat operation. The following table lists the available heat per size unit.

CONDENSER HEAT CAPACITY		
Size Unit	**Btuh Available**	**Kcal/hr Available**
DMS4-185 DMS4-185/275	95,000	23 940
DMS4-275	125,000	31 500
DMS4-300 DMS4-360	155,000	39 060
DMS4-415	125,000	31 500
DMS4-600	155,000	39 060

IV - GAS HEAT

Gas heat capacities range from 275,000 through 850,000 Btu input.

1 - On a heating demand, the combustion air blower is energized to provide a prepurge period to clear combustion chamber. A time delay brings on the first stage of gas heat after the prepurge period has elapsed.
2 - An additional heat demand brings on the second stage of gas heat after 5 minute delay.
3 - A power burner, with individual electronic safety controls that monitor flame conditions, is incorporated on each heat exchanger used. Two high limit controls shut down burner(s) at excessive hot deck temperatures.

V - ELECTRIC HEAT

Electric heaters range in size from 45 KW to 150 KW. Each element has 15 KW capacity. A five switch EA5 electric heat sequencer controls stepping of elements to satisfy the heating demand. Lockout relays balance the load between electric elements and compressors to prevent overloading the main switch.

VI - HOT WATER AND STEAM HEAT

The motorized valve controls flow through the hot water and steam coils.

1 - A heating demand will open valve.
  a - The steam coil uses a two way valve.
  b - The hot water coil uses a three way valve to either direct hot water to coil or by-pass coil.
  c - An auxiliary circulator pump (optional) continuously circulates water through coil.
2 - Both coils are equipped with air bleed valves. The hot water coil has a drain valve.
3 - The freeze protection thermostat (S40) monitors the coil manifold temperature and opens the valve at a set point to prevent coil freezing.

VII - POWER SAVER

1 - The power saver consists of outside and return air dampers which are linked together. These dampers open and close in reverse relationship to each other. A cooling demand modulates the outside dampers open. If the fresh air cannot satisfy the demand, mechanical cooling will be engaged.
2 - The power saver actuator has a minimum air adjustment to set for a specific amount of fresh air.
3 - The enthalpy control (S18) senses both temperature and humidity or the heat content of the outdoor air. When the heat content rises above control set point, the outside dampers close to minimum position.
4 - The outside air discriminator (optional) holds the outside dampers at minimum position at a given switch point in the heating mode.
5 - The morning warm up control (S16) holds outside dampers at closed position until the return air temperature has risen above the set point.
6 - On nite setback, the outside air dampers are in the fully closed position.
7 - The sandstorm switch (optional) is a manual switch which closes the outdoor dampers.

VIII - REFRIGERANT COOLING

The operating sequence and cooling functions vary according to the size of the unit.

1 - The Lennox L6 compressor has two speeds which run at 1,800 rpm at low speed and 3,600 rpm at hi speed. Each L6 compressor has a positive interlock between speeds to prevent both speeds from being energized simultaneously. There is a time delay between speeds.
2 - Each compressor has an individual refrigerant circuit. The No. 1 refrigerant circuit is equipped with a hot gas by-pass valve for conditions requiring reduced capacity. As the suction pressure drops below the hot gas valve set point, the valve opens to prevent an evaporator coil freeze-up.
  DMS4-300/360/600 units are also equipped with an additional solenoid valve (L1) which only permits hot gas by-pass when the L6 compressor is on low speed.
3 - Each compressor is protected by a high gas pressure switch (S32), low gas pressure switch (S34), ambient thermostat (S33) and a crankcase heater. In addition 8 and 11 ton compressors use internal cut-out thermostats (S35) and overload relays while the 15 ton compressors use inwinding thermistors with a protection module (A1).
4 - The compressor monitor (S38) locks out compressors whenever the outdoor air falls below set point.
5 - The evaporator low limit (S41) control locks out compressors when cold deck temperature drops below set point.
6 - The following list matches compressor usage to unit size.
  a - DMS4-185 uses two L2, 8 ton compressors
  b - DMS4-185/275 uses two L2, 8 ton compressors but has a larger evaporator for 19 tons of cooling.
  c - DMS4-275 uses two L2, 11 ton compressors.
  d - DMS4-300 uses one L6, 15 ton compressor and one L2, 11 ton compressor.
  e - DMS4-360 uses one L6, 15 ton compressor and one L2, 15 ton compressor.
  f - DMS4-415 uses three L2, 11 ton compressors.
  g - DMS4-600 uses one L6, 15 ton compressor and two L2, 15 ton compressors.

IX - CHILLED WATER

A motorized valve controls flow through coil. The valve is located on the return line from the coil and has three ports — inlet, outlet and by-pass. Each chilled water coil is equipped with an air-bleed and a drain valve.

GENERAL SCHEMATIC WIRING INFORMATION

1 - The DMS4 schematic wiring diagram format incorporates a horizontal power line which separates the line voltage circuit (motors-compressors-electric elements) from the controlling circuit. The motors, compressors and electric elements are located below the power line with the controlling circuit directly above the line.

2 - The graphic symbols for components and code lettering conforms to the "IEEE Standard and American National Standard" of graphic symbols for electrical diagrams. All symbols and code lettering used are approved by the International Electrotechnical Commission (IEC). Refer to Figure 20 for code and symbol identification.

3 - Terminal numbers on jack plugs are located by a ridge on the corner of the plug called the "Key." Refer to Figure 21 for proper numbering sequence.

4 - A component index chart is provided on each diagram which includes -
- Code numbers (Key).
- Description of component.
- Location of component. See Example A in Figure 22.
- Cross reference to other diagram sections. See Example B in Figure 22.

5 - Jack plugs are shown in the schematic circuit by both jack plug number and terminal number. In Example C of Figure 22, JP17-2 indicates jack plug number 17 and terminal number 2.

6 - Optional circuits are shown with arrow connections. Example D — Compressor 1 crankcase heater (HR4) and thermostat (S2) are used only with condenser heat and discriminator.

7 - Solid lines around a control indicate a complete control — Example E. Dashed lines around a control indicates only a part of a control — Example F.

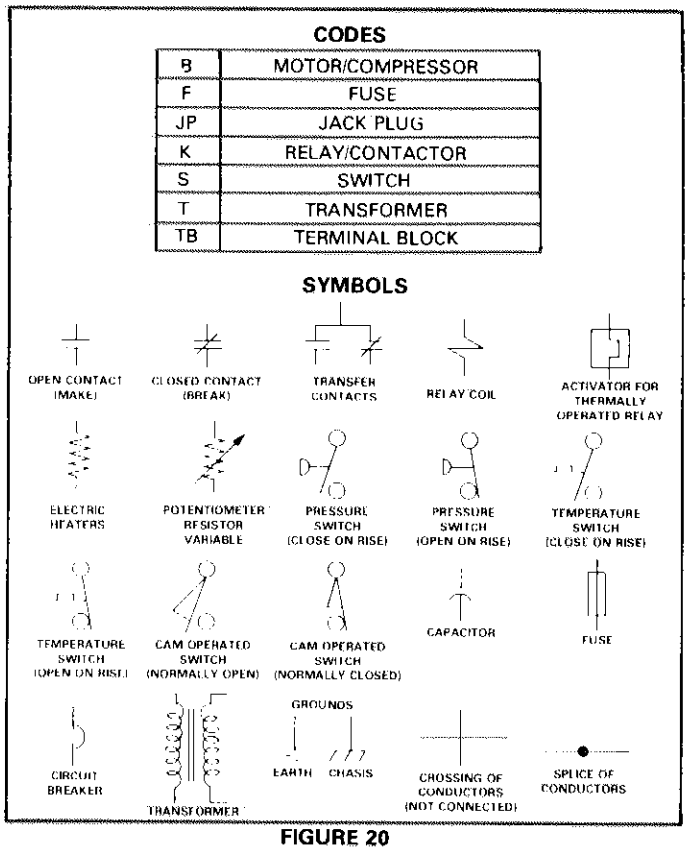


FIGURE 20

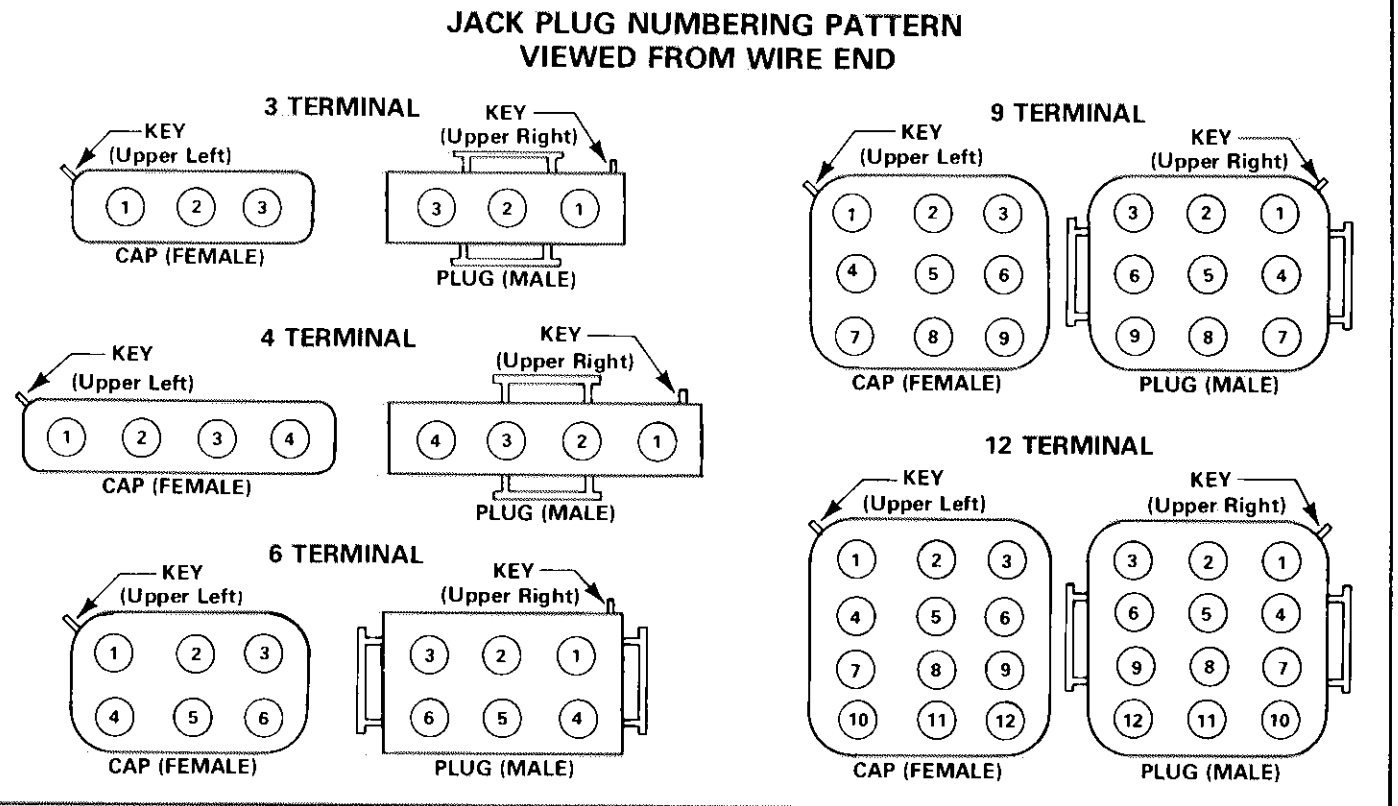


FIGURE 21

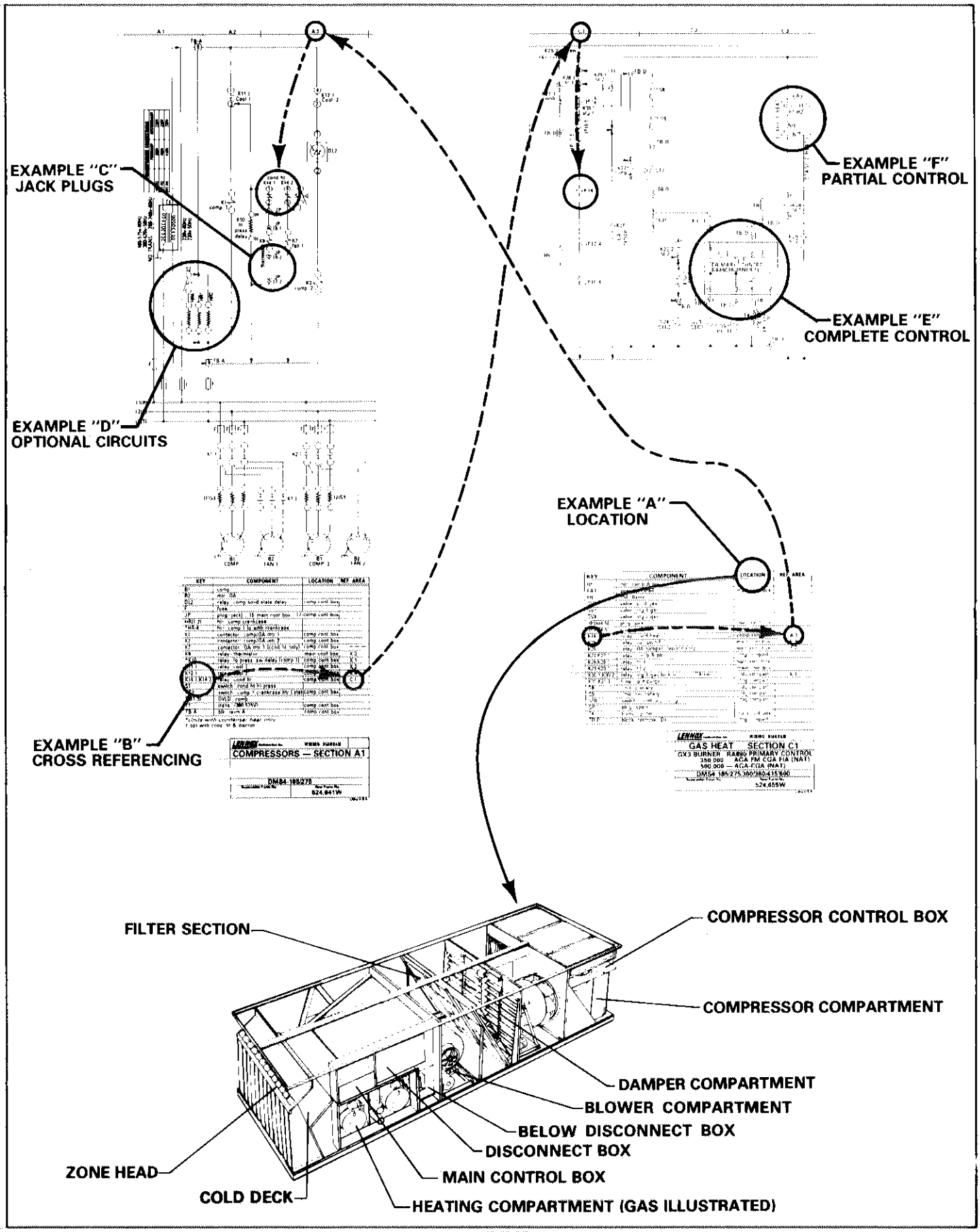

EXAMPLE "C"
JACK PLUGS
EXAMPLE "D"
OPTIONAL CIRCUITS
EXAMPLE "B"
CROSS REFERENCING
COMPRESSORS — SECTION A1
EXAMPLE "F"
PARTIAL CONTROL
EXAMPLE "E"
COMPLETE CONTROL
EXAMPLE "A"
LOCATION
GAS HEAT SECTION C1
FILTER SECTION
COMPRESSOR CONTROL BOX
COMPRESSOR COMPARTMENT
DAMPER COMPARTMENT
BLOWER COMPARTMENT
BELOW DISCONNECT BOX
DISCONNECT BOX
MAIN CONTROL BOX
HEATING COMPARTMENT (GAS ILLUSTRATED)
ZONE HEAD
COLD DECK

FIGURE 22

COMPONENT

I - COMPONENT DESCRIPTION

Table 1 lists the electrical components by their key numbers and then gives a brief description of the component. Table 1 also lists control set points (if applicable) and the reference pages within this manual where additional information can be found.

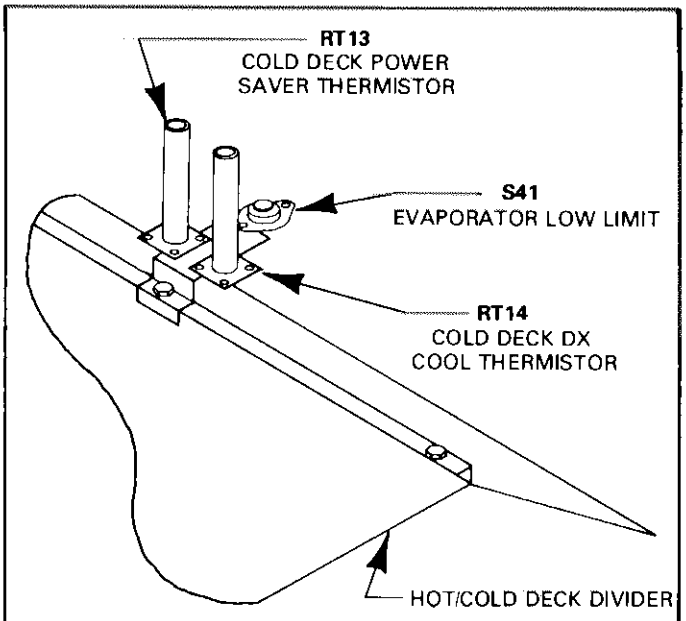
II - FUSE REPLACEMENT

The fuse replacement table on page 26 lists the fuses according to their key number, location within unit and fuse replacement size.

III - COMPONENT IDENTIFICATION

Figures 23 thru 26 illustrate the compressor control boxes, main control boxes, damper section and cold deck sensors. Refer to following sections on the pages given for additional illustrations.

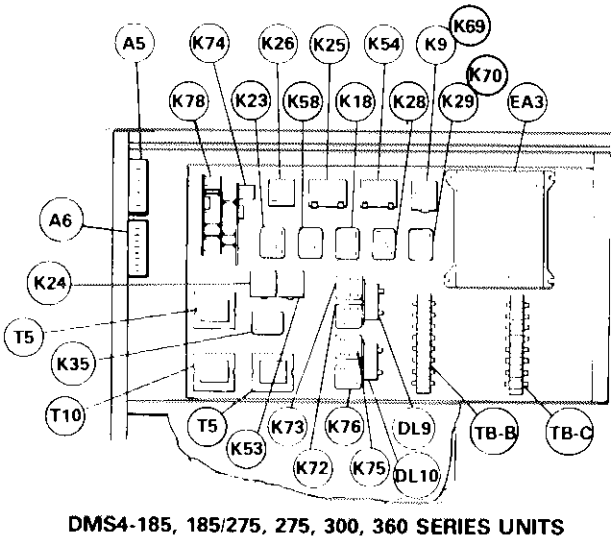
Heating Compartment.....Gas Heat (Figure 37 on page 39)
Heating Compartment.....
.....Electric Heat (Figures 43 & 44 on pages 44 & 45)
Heating Compartment.....
.....Hot Water Heat (Figure 48 on page 49)
Heating Compartment .....Steam Heat (Figure 49 on page 49)
Cooling Compartment...Chilled Water (Figure 75 on page 68)
Compressor Compartment.....
..... DX Cooling (Figures 62, 63, 64 on pages 55 & 56)
Evaporator Section.....DX Cooling (Figure 70 on page 58)
Indoor Air Blower.....Blowers (Figure 79 on page 70)
Return Air Blower.....Blowers (Figure 80 on page 71)
Zone Head.....Zone Control (Figures 99 & 100 on page 83)



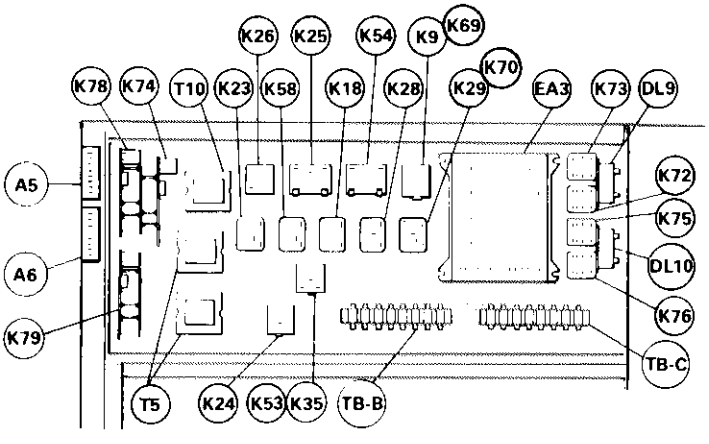
MOUNTING DETAIL OF COLD DECK SENSORS

FIGURE 23

DMS4 MAIN CONTROL BOX



DMS4-185, 185/275, 275, 300, 360 SERIES UNITS



DMS4-415, 600 SERIES UNITS

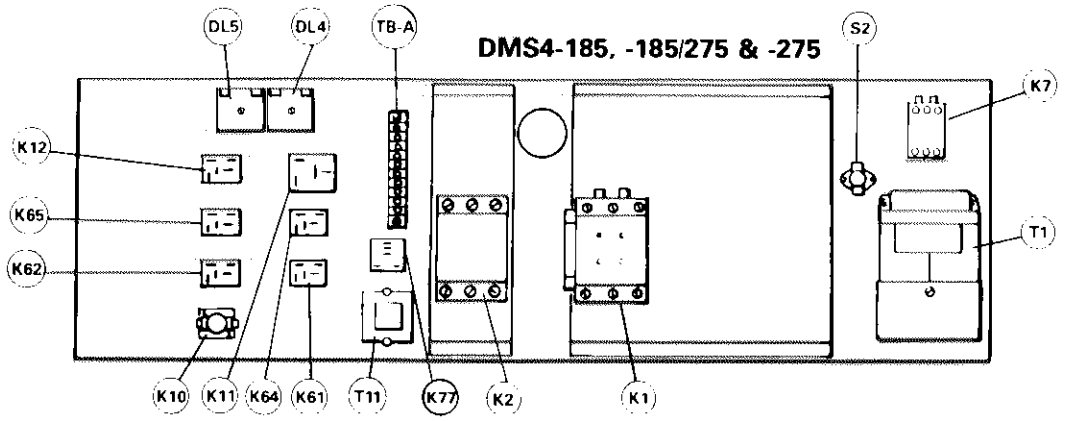
KEY	DESCRIPTION
A5	No. 1 limit controller
A6	No. 2 limit controller
DL9	2nd stage burner solid-state delay
DL10	Power saver solid state delay
EA3	Load analyzer module
K9	Thermistor relay
K18	Indoor blower & R.A. blower relay
K23	Smoke relay
K25	Sail switch relay
K26	Discriminator relay

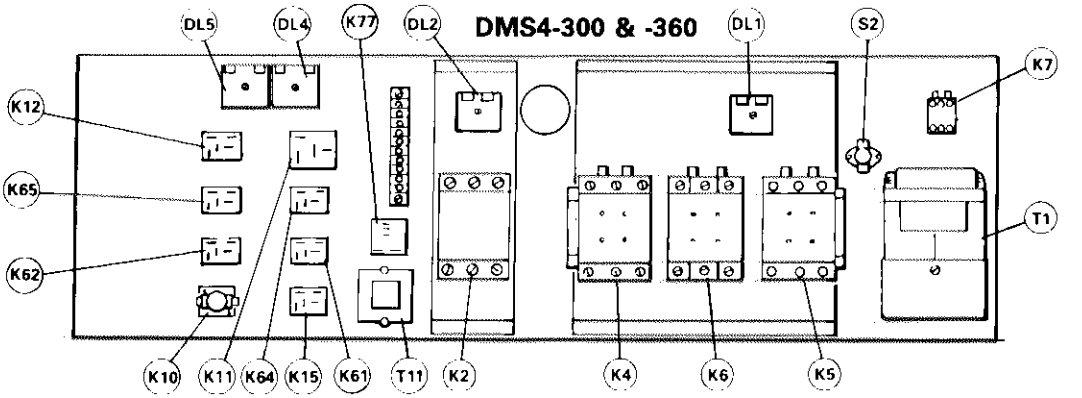
KEY	DESCRIPTION
K28	Heat 1 relay (gas)
K29	Heat 2 relay (gas)
K35	Electric heat lockout relay
K53	Freezestat relay (hot water & steam)
K58	Filter remote lite relay
K69	Chilled water relay
K70	Sequence relay (electric heat)
K72	Lo temperature relay
K73	Upper temperature relay
K74	Stage 1 heat relay

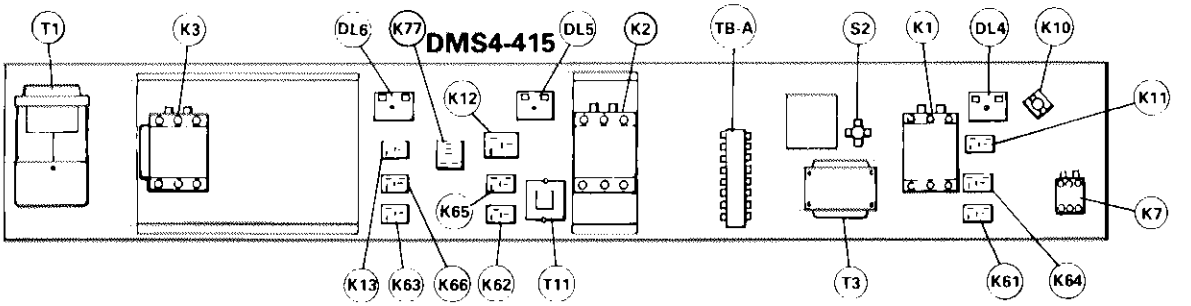
KEY	DESCRIPTION
K75	Power saver relay
K76	Power saver delay relay
K78	Compressor 2 cutout relay
K79	Compressor 3 cutout relay
T5	Valve motor transformer
T10	Control transformer
TB B	Terminal block "B"
TB-C	Terminal block "C"

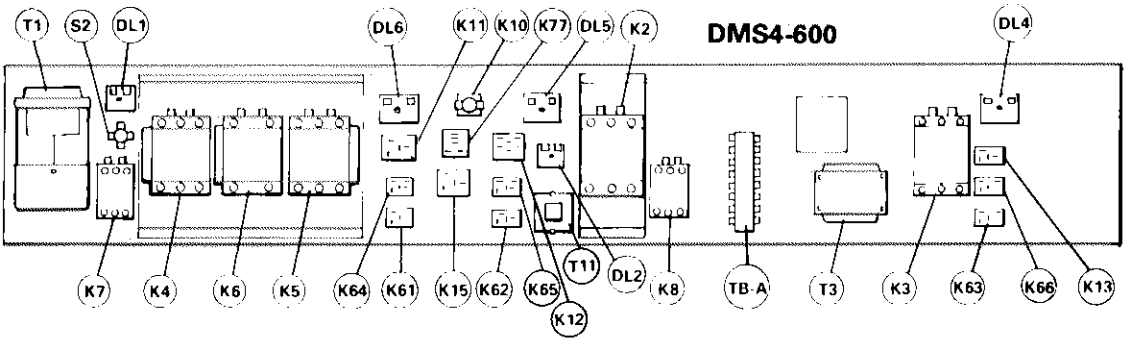
FIGURE 24

DMS4 SERIES COMPRESSOR CONTROL BOX









KEY	DESCRIPTION
DL1	Compressor solid-state delay (L6 comp - lo speed)
DL2	Compressor solid-state delay (L6 comp - hi speed)
DL4	Compressor delay #1
DL5	Compressor delay #2
DL6	Compressor delay #3
K1	Compressor 1 & condenser fan 1 contactor (L2 only)
K2	Compressor 2 & condenser fan 2 contactor
K3	Compressor 3 & condenser fan 3 contactor
K4	Compressor 1 "Hi" speed contactor (L6 only)
K5	Compressor 1 "Lo" speed contactor (L6 only)

KEY	DESCRIPTION
K6	Compressor 1 "Tie" speed contactor (L6 only)
K7	Condenser fan 1 contactor (L6 only)
K8	Condenser fan 2 contactor
K10	Lo pressure switch delay
K11	Cool 1 relay
K12	Cool 2 relay
K13	Cool 3 relay
K15	Compressor 1 "Hi" speed relay (L6 only)
K61	Readout relay 1
K62	Readout relay 2

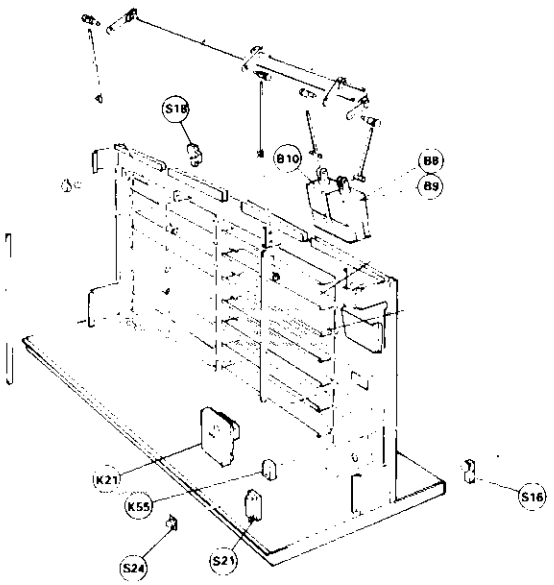
KEY	DESCRIPTION
K63	Readout relay 3
K64	Signal relay 1
K65	Signal relay 2
K66	Signal relay
K77	Set point relay
S2	Crankcase heater thermostat
T1	Power transformer
T3	Smoke detector transformer
TBA	Terminal block "A"

FIGURE 25

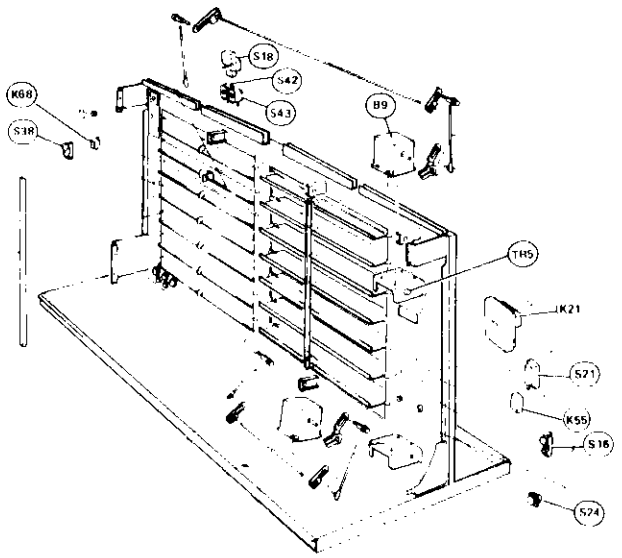
DAMPER SECTION

185 THRU 360 SERIES

RANCO MOTORS WITH SMOKE DETECTOR

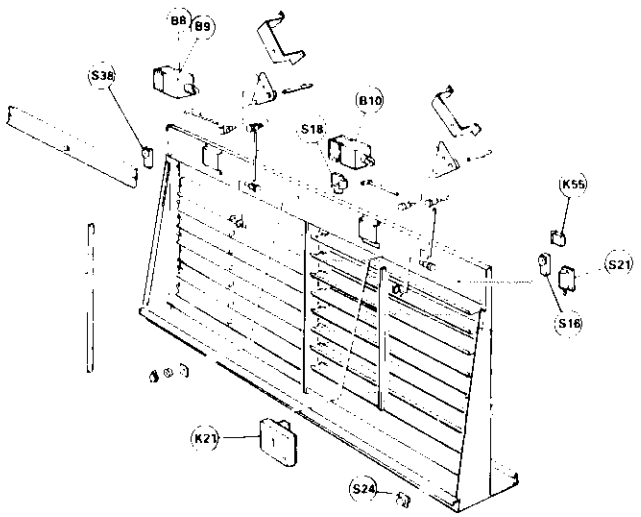


HONEYWELL MOTORS WITH SMOKE DETECTOR

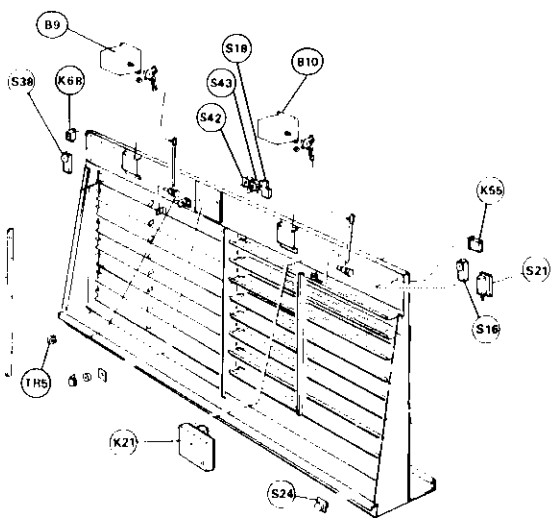


415 AND 600 SERIES

RANCO MOTORS WITH SMOKE DETECTOR



HONEYWELL MOTORS WITH SMOKE DETECTOR



KEY	DESCRIPTION
B8	Power saver actuator (less smoke detection)
B9	Outdoor air actuator (with smoke detection)
B10	Return air actuator (with smoke detection)
K21	Return air smoke detection relay
K55	Warm-up DX cool relay
K68	Compressor control relay
S16	Morning warm-up thermostat

KEY	DESCRIPTION
S18	Enthalpy control
S21	Filter pressure switch (roll filter)
S24	Return air firestat
S38	Compressor monitor
S42	Low temperature limit
S43	Upper temperature limit
TR5	Remote minimum positioner

FIGURE 26

TABLE 1

COMPONENT	DESCRIPTION AND FUNCTION	LOCATION	SETTING	REFERENCE PAGES
A(1-3)	Compressor Protection Modules — Prevents overheating in motor windings on all 15 ton compressors.	Internal to Compressor	—	15, 58
A4	Room Sensor — An air temperature sensor located within the zone that modulates hot & cold deck zone dampers to maintain zone temperature at room sensor set point. Also transmits an electronic signal to EA3 to control heating and cooling functions at unit.	Remote	Adj.	10, 11, 29, 34, 35,13
A5	No. 1 Limit Controller — Modulates outdoor dampers so cold deck temperature does not drop below 50°F.	Main Control Box	—	30, 52, 18
A6	No. 2 Limit Controller — Generates an overriding signal which cuts out compressors 2 or 3 when cold deck temperature drops below setpoint.	Main Control Box	50°F or 55°F	30, 59, 18
B1	Compressors — Initiates DX cool.	Compressor Compartment	—	
B2	Condenser Fans — Draws air across condenser coil to allow refrigerant to condense as it flows through coil.		—	
B3	Indoor Blower Motor — Provides supply air to hot and cold decks.	Blower Compartment	—	13, 70
B4	Return Air Blower Motor (option) — Cycles with B3 blower motor. Overcomes resistance in return air system.		—	13, 71
B5	Combustion Air Blower (gas) — Provides combustion air to burners.	Heating Compartment	—	39
B6	Water Pump (hot water option) — Continuously circulates water through hot water coil.	Heating Compartment	—	15,49
B7	Motorized Water Valve — Initiates hot water or chilled water operation.	Htg. or Cooling Compt.	—	15, 49, 68
B8	Power Saver Actuator — On units less smoke detector, modulates outdoor dampers and return air dampers	Damper Compartment	—	20, 52, 53
B9	Outdoor Air Actuator — On units with smoke detector, modulates outdoor dampers.	Damper Compartment	—	13,20, 52, 53, 54
B10	Return Air Actuator — On units with smoke detector, modulates return air dampers.	Damper Compartment	—	13, 20, 52
B11	Motorized Steam Valve (steam) — Controls steam flow thru steam coil.	Heating Compartment	—	49
B12	Zone Damper Actuator — Modulates zone damper to room sensor demand.	Zone Head	—	14, 30, 83
CMC1	Nite Setback Clocktimer — 7 day clock cycles the unit into day, night and weekend operation.	Remote	Adj.	44, 45
CMC2	Roll Filter Clocktimer — Introduces a fixed amount of new filter media per 24 hours of unit operation.	Filter Compartment	Adj.	89
DL(1-2)	Compressor Solid-State Delay (L6 compressors) — Provide a 2 second time delay between "hi" and "lo" speeds.	Compressor Control Box	2 sec.	19, 59
DL4	Compressor Delay #1 — Provides a 3 minute time delay for compressor 1.	Comp. Cont. Box	3 min.	19, 59, 61
DL5	Compressor Delay #2 — Provides a 10 minute time delay for compressor 2.	Comp. Cont. Box	10 min.	19, 59, 61
DL6	Compressor Delay #3 — Provides a 15 minute time delay for compressor 3.	Comp. Cont. Box	15 min.	19, 59, 61
DL7	Blower Solid-State Delay — Allows OA & RA dampers to open before supply and return blowers operate.	Disconnect Box	3 min.	13, 44, 45
DL8	Burner Solid-State Delay — On gas units with R4795D primary control, delays burner operation for 5 seconds.	Heating Compartment	5 sec.	40
DL9	2nd Stage Burner Solid-State Delay — Delays the start of second stage gas for 5 minutes.	Main Control Box	5 min.	18, 40
DL10	Power Saver Solid-State Delay — Used with power saver relay (K75) & power saver delay relay (K76) to deactivate power saver for 3 minutes after comp. 1 is energized to allow cold deck time to stabilize.	Main Control Box	3 min.	18, 52
EA3	Load Analyzer Module — Monitors the signals from room & discharge sensors then initiates the heating and/or cooling modes as needed.	Main Control Box	—	14, 18, 29, 30 31,35
EA3 Adder	Load Analyzer Adder Module — Provides capacity for an additional 12 zones to the basic EA3.	Zone Head	—	
EA5	Electric Heat Sequencer — Controls stepping of elements to satisfy heating demand.	Heating Compartment	—	15, 44, 45
EA5	Pneumatic Interface Module — Converts the transducer electrical resistance changes into voltage signals which are then sent to the EA3 module.	Below Disconnect Box	—	85, 86
F	Fuses — Circuit protectors.	Throughout Unit	—	
FR	Flame Rod (gas heat) — Monitors flame conditions to primary control.	Heating Compartment	—	39
GV1	Pilot Gas Valve — Provides gas flow for pilot ignition.	Heating Compartment	—	39
GV3	1st Stage Gas Valve — Provides gas flow to either burner no. 1 or 1st stage of burner.	Heating Compartment	—	39

TABLE 1 (cont'd)

COMPONENT	DESCRIPTION AND FUNCTION	LOCATION	SETTING	REFERENCE PAGES
GV4	2nd Stage Gas Valve — Provides gas flow to either burner no. 2 or 2nd stage of burner.	Heating Compartment	—	39
HE(1-10)	Electric Elements — Provide resistance heat.	Heating Compartment	—	44, 45
HR(1-3)	Compressor Crankcase Heaters — Warms the compressor to prevent liquid refrigerant from migrating to compressor during off cycle and "slugging" it on start-up. (continuously energized)	Cooling Compartment	—	
HR4	Compressor 1 Lo Ambient Crankcase Heater (option with condenser heat & discriminator) — Energized by S2 to provide additional heat for compressor 1 when operating at low temperature conditions.	Cooling Compartment	—	
HR(5-6)	Electric Expansion Valves (condenser heat) — A condenser heat demand opens these valves and allows refrigerant to flow into accumulator and through condenser heat coil.	Compressor Compartment	—	58
K1	Compressor 1 & Condenser Fan 1 Contactor (L2 only) — Energizes respective motors.	Comp. Cont. Box	—	19
K2	Compressor 2 & Condenser Fan 2 Contactor — Energizes respective motors.	Comp. Cont. Box	—	19
K3	Compressor 3 & Condenser Fan 3 Contactor — Energizes respective motors.	Comp. Cont. Box	—	19
K4	Compressor 1 "Hi" Speed Contactor (L6 only) — Energizes the high speed circuit of compressor 1.	Comp. Cont. Box	—	19
K5	Compressor 1 "Lo" Speed Contactor (L6 only) — Energizes the low speed circuit of compressor 1.	Comp. Cont. Box	—	19
K6	Compressor 1 "Tie" Speed Contactor (L6 only) — Provides a positive interlock between Hi & Lo speeds to prevent both speeds from being energized simultaneously.	Comp. Cont. Box	—	19
K7	Condenser Fan 1 Contactor — Energizes condenser fan 1 motor.	Comp. Cont. Box	—	19
K8	Condenser Fan 2 Contactor (DMS4-600 only) — Energizes condenser fan 2 motor.	Comp. Cont. Box	—	19
K9	Thermistor Relay — Initiates condenser heat operation.	Main Cont. Box	—	18, 47,59, 46
K10	Lo Pressure Switch Delay — Shunts out low pressure switch (S34) during low ambient start-up.	Comp. Cont. Box	1 min.	19
K11	Cool 1 Relay — Initiates compressor 1 operation.	Comp. Cont. Box	—	19
K12	Cool 2 Relay — Initiates compressor 2 operation.	Comp. Cont. Box	—	19
K13	Cool 3 Relay — Initiates compressor 3 operation.	Comp. Cont. Box	—	19
K15	Comp. 1 "Hi" Speed Rly. (L6 only) — The EA3 "C3" or "C4" contacts energize K15 which in turn energizes K4 to run comp. 1 at high speed.	Comp. Cont. Box	—	19
K16	Indoor Blower Contactor — Energizes indoor blower motor.	Disconnect Box	—	44, 45, 73
K17	Return Air Blower Contactor — Energizes return air blower motor.	Disconnect Box	—	44, 45
K18	Indoor Blower & Return Air Blower Relay — Energizes K16 & K17 contactors to start respective motors.	Main Control Box	—	18
K19	Shutdown Relay (with smoke detection) — Controls blower and damper operation per smoke detection option described on page 12.	Disconnect Box	—	44, 45
K21	Return Air Smoke Detector (with smoke detection) — De-energizes shutdown relay (K19) in response to the smoke detection option used, upon the presence of smoke in the return air.	Damper Compartment	—	36, 20
K22	Filter Section Smoke Detector (with smoke detection) — Shuts down K19, in response to the smoke detection option used, upon the presence of smoke in the supply air stream.	Blower Compartment	—	36, 70
K23	Smoke Relay (smoke detection options 2, 3 & 4) — Nite setback operation energizes K23 which then energizes K19 to end smoke detection operation.	Main Control Box	—	18, 36
K24	Plus Relay (smoke detection options 3 & 4) — Opens outside dampers and closes return dampers with the presence of smoke.	Main Control Box	—	
K25	Sail Switch Relay — Shuts down unit when the indoor blower motor is off.	Main Cont. Box	—	18
K26	Damper Relay (option, with condenser heat only) — Holds the outdoor dampers at minimum position at a given switch point in the heating mode.	Main Control Box	—	18, 41, 47, 52, 46
K27	Combustion Air Blower Relay — Energizes combustion air blower motor (B5).	Heating Compartment	—	
K28	Heat 1 Relay (gas) — Initiates either burner no. 1 (2 burner units) or 1st stage burner (single burner units).	Heating Compartment	—	18, 41
K29	Heat 2 Relay (gas) — Initiates either burner no. 2 (2 burner units) or 2nd stage burner (single burner units.)	Heating Compartment	—	18, 41

TABLE 1 (cont'd)

COMPONENT	DESCRIPTION AND FUNCTION	LOCATION	SETTING	REFERENCE PAGES
K30	Transfer Relay (gas) — Compressor 1 operation energizes K30, which then shifts the unit into condenser heat and 1st stage gas heat. With compressor 1 off, unit returns to 1st and 2nd stage gas heating.	Heating Compartment	——	40, 41
K31	Prepurge Relay (gas) — Provides combustion chamber prepurge before 1st stage of gas comes on.	Heating Compartment	——	
K32	Burner Alarm Relay (gas, 50 Hz only) — The primary control energizes K32 to set off an alarm when the burners are locked out.	Heating Compartment	——	
K33	Element 1 Stage 1 Contactor (elec.) — Operates first half of element 1.	Heating Compartment	——	44, 45
K34	Element 1 Stage 2 Contactor (elec.) — Operates second half of element 1.	Heating Compartment	——	44, 45
K35	Electric Heat Lockout Relay (DX cool only) — Compressor 1 operation energizes K35 to lock out all elements except no. 1.	Main Control Box	——	44, 45, 46, 18, 47
K36-K38	Discriminator H1, H2, H5 Relays (elec.) — These relays bring on discriminator function (damper relay - K26) as "H2" or "H5" contacts close and terminate discriminator function as "H1" or "H5" contacts open.	Heating Compartment	——	44, 45, 46 47
K39-K47	Elements 2-10 Contactors (elec.) — Operates respective elements.	Heating Compartment	——	44, 45
K48	Element 7 Delay Relay (7 element elec. only) — Delays the last element for 40 seconds.	Heating Compartment	40 sec.	44, 45, 46
K49	Element 10 Delay Relay (10 element elec. only) — Provides a 40 second time delay for element no. 10	Heating Compartment	40 sec.	45, 47
K50	Element 7-8-9 Delay Relay (10 element elec. only) — After "H5" close, K50 provides a 25 second delay for elements 7 & 8 and a 40 second delay for element 9.	Heating Compartment	25 & 40 sec.	45, 47
K51	Discriminator Latch Relay (elec.) — Latches in when "H2" switch on EA5 closes. Keeps K26 damper relay energized until "H1" on EA3 opens.	Heating Compartment	——	44, 45, 46, 47
K53	Freezestat Relay (hot water & steam) — K53 must be energized before valve (B6) can modulate. K53 is either energized by upper temperature relay (K73) or freezestat (S40).	Main Control Box	——	18, 49
K54	Night Relay — Cuts out power saver and DX cooling during nite setback.	Main Cont. Box	——	
K55	Warm-up DX Cool Relay — K55 holds outdoor dampers at closed position when it's energized by morning warm-up thermostat (S16).	Damper Compartment	——	20, 52
K56	"B" Relay (roll filter) — Operates filter motor when either S21 or S22 close.	Filter Compartment	——	
K57	"A" Relay (roll filter with timer control) — Operates filter motor when filter media runout switch (S20) and clock timer motor (CMC2) are closed.	Filter Compartment	——	
K58	Filter Remote Lite Relay (roll filter & readout panel) — Lights a bulb at readout panel to indicate the end of media. Is energized by filter media switch (S20).	Remote	——	18, 36
K59	Phone Delay Relay (readout panel) — Lights a bulb at readout panel to indicate a locked out primary control. Also can use additional contacts for phone.	Remote	——	36
K60	Delay Relay (readout panel) — Provides a 60 second delay before lighting a bulb at readout panel to indicate an open set of contacts within the compressor safety circuit.	Remote	1 min.	36
K61-63 K64-K66	K61-K63 Readout Relays & K64-K66 Signal Relays — These relays work in conjunction to indicate an open compressor safety circuit. An open circuit will energize damper relay (K60).	Compressor Control Box	——	19
K68	Compressor Control Relay —K68 isolates compressor control circuit to transformer (T11).	Damper Compt.	——	20
K69	Chilled Water Relay — During nite setback, K69 terminates cooling.	Main Cont. Box	——	18, 68
K70	Sequence Relay (electric heat) — K70 provides electric heat when energized by indoor blower sail switch (S31).	Main Cont. Box	——	18, 46, 47
K71	Burner Relay (R4795D primary control only) — Burner delay (DL8) controls K71, which in turn controls burner operation.	Heating Compartment	——	
K72	Lo Temperature Relay — Lower temp. limit (S42) energizes K72. On units with condenser heat, K72 locks out comp. 1 below set point. In addition K72 permits operation of second stage burner on gas units or the last bank of elements on electric units below set point.	Main Cont. Box	——	18, 31, 40, 41, 47, 61 30, 48, 59
K73	Upper Temperature Relay — S43 energizes K73. K73 locks out hi speed on L6 compressors. In addition K73 locks out all gas, electric, hot water and steam heat.	Main Cont. Box	——	18, 31, 40, 41, 49, 61 30, 59,
K74	Stage 1 Heat Relay — K74 energizes thermistor relay (K9) which brings on condenser heat or provides discriminator function.	Main Cont. Box	——	18, 30, 40, 41

TABLE 1 (cont'd)

COMPONENT	DESCRIPTION AND FUNCTION	LOCATION	SETTING	REFERENCE PAGES
K75 & K76	Power Saver Relay & Power Saver Delay Relay — Used with power saver delay (DL10) to deactivate power saver for 3 minutes after compressor 1 is energized.	Main Control Box	3 min.	52, 18
K77	Set Point Relay — After compressor 2 starts, K77 shifts the cold deck setting from 55°F to 50°F for no. 2 limit controller (A6).	Compressor Control Box	———	19, 30, 59, 61
K78	Compressor 2 Cutout Relay — No. 2 limit controller (A6)generates an overriding signal which closes K78 and allows compressor 2 to run.	Main Cont. Box	———	18, 30, 59, 60, 63
K79	Compressor 3 Cutout Relay — No. 2 limit controller (A6) generates an overriding signal which closes K79 and allows compressor 3 to run.	Main Cont. Box	———	18, 30, 59
L1	Comp. 1 Hot Gas By-pass Solenoid (L6 only) — On two speed compressors, L1 only permits hot gas by-pass operation during low speed.		———	15, 58
PC1-1 PC2-1	Alarm Contacts Burner 1 & Burner 2 (used with readout panel) — The primary control energizes these relays to light a bulb at readout panel when the burners are locked out.	Heating Compartment	———	
RT4	Discharge Sensor — Used with room sensor. Senses discharge air temperature to reposition zone damper in anticipation of the effect on room temperature.	Zone Head	———	13, 14
RT5	Cold Deck Sensor (pneumatic) — Changes the command signal upon a change in cold deck temperature.	Zone Head	———	85
RT6	Hot Deck Sensor (pneumatic) — Changes the command signal upon a change in hot deck temperature.	Zone Head	———	85
RT7 & RT8	Hi & Lo Pressure Transducers (pneumatic) — Convert air pressure changes into electrical resistance changes.	Below Disconnect Box	see instructions	85
RT9 & RT11	Normal Thermistors (condenser heat) — Without a condenser heat demand these thermistors are energized to maintain the normal refrigerant circuit.		———	58
RT10 & RT12	Condenser Heat Thermistors — K9 activates these thermistors which then open HR5 & HR6 to begin condenser heat operation.		———	58
RT13	Cold Deck Power Saver Thermistor — Senses cold deck temperature for no. 1 limit controller (A5).		———	18, 30, 52
RT14	Cold Deck DX Cool Thermistor — Senses cold deck temperature for no. 2 limit controller (A6).		———	18, 30, 59, 63
S1	Compressor 1 Condenser Heat High Pressure Switch — Starts condenser fan 1 when the head pressure exceeds setting to maintain normal operating pressure during condenser heat cycles.	Compressor Compartment	on 285 psi off 145 psi	59
S2	Crankcase Heater Thermostat (option with condenser heat & discriminator) — Energizes HR4 to provide additional heat to compressor 1 at temperature below setting.	Compressor Control Box	Fixed 35°F close, 60°F open	19
S3	Compressor Overload — Protects compressor circuits from overheating.	Comp. Compart.	———	58
S4	Blower Motor Overloads — Protects blower motor circuit from overheating.	Disconnect Box	———	44, 45
S5	Return Air Motor Overloads (7-1/2 hp only) — Protects motor circuit from overheating.	Disconnect Box	———	45
S6	Fan Control (gas only) — During nite setback, S6 allows indoor blower to run to dissipate heat from heat exchanger after a burner on cycle.	Heating Compartment	120°F on, 90° off	13
S7	Remote Test Station (smoke detection) — Simulates smoke conditions to check performance of smoke detectors.	Heating Compartment	———	36, 37
S8	Primary Limit Control — Shuts off burner(s) when hot deck temperatures exceed switch setting.	Heating Compartment	150°F or 170°F	40
S9	Secondary Limit Control — Shuts off burner when hot deck temperatures exceed switch setting.	Heating Compartment	150°F	40
S10	Combustion Air Proving Switch — Makes sure combustion blower (B5) is running before burners can operate.	Heating Compartment	.5 wc	40
S11	Hi Pressure Gas Switch (R4795D primary control) — Opens circuit to burner when gas pressure exceeds setting. (F.I.A. & F.M.)	Heating Compartment	see instructions	40, 42
S12	Lo Pressure Gas Switch (R4795D primary control) — Opens circuit to burner when gas pressure drops below set point. (F.I.A. & F.M.)	Heating Compartment	see instructions	40, 42
S13	Door Interlock Switch (electric) — Assures that element access panel is in place before electric heat can come on.	Heating Compartment	———	44, 45, 46, 47
S14	Safety Limit (electric) — Cuts out respective element at temperatures above setting.	Elements	300°F	44, 45, 46, 47
S15	Hi Limit (electric) — Shuts off electric heat when hot deck temperatures exceed switch setting.	Heating Compartment	180°F	44, 45, 46, 47

TABLE 1 (cont'd)

COMPONENT	DESCRIPTION AND FUNCTION	LOCATION	SETTING	REFERENCE PAGES
S16	Morning Warm-Up Thermostat — Opens at return air temperatures below setting to de-energize DX cool warm-up relay (K55) to hold outdoor dampers at closed position during morning warm-up period.	Damper Compartment	70°F	15, 20, 52
S17	Sandstorm Switch (optional) — This is a manual switch which closes the outdoor dampers.	Remote	manual	15, 38
S18	Enthalapy Control — Senses heat content of outside air and closes outdoor dampers to minimum position when heat content arises above set point.	Damper Compartment	"A" adj.	15, 20, 52, 53 59
S20	Media Runout Switch (roll filter) — Energizes filter remote light relay (K58) when media runs out.	Filter Compartment	———	
S21	Filter Pressure Switch (pressure, roll filter) — Introduces media into airstream whenever pressure differential across filter curtain is reached indicating dirty filter.	Filter Compartment	see instructions	20
S22	Jog Switch (roll filter) — A manual switch which advances filter media.	Filter Compartment	manual	
S23	Metering Switch (timer, roll filter) — Cam energizes S23 after 1 inch of media has passed. S23 stops drive motor until next time interval.	Filter Compartment	———	
S24	Return Air Firestat — Terminates entire unit operation when return air temperature exceeds set point.	Damper Compt.	136°F	13, 29, 72 20
S25	Supply Air Firestat — Terminates entire unit operation when supply air temperature exceeds set point.	Blower Compt.	136°F	13, 72
S27	Nite Thermostat — During nite setback S27 energizes unit heating when temperature drops below set point.	Remote	adj.	34
S28	Manual Timer (readout panel) — Overrides nite setback controls to provide regular heating functions during night building occupancy.	Remote	0-8 hours (manual)	34
S29	System Switch (readout panel) — Shuts down entire unit at readout panel.	Remote	manual	34
S30	Filter Switch — Lights a bulb at readout panel to indicate a dirty filter.	Blower Compt.	———	
S31	Indoor Blower Sail Switch — Energizes sail switch relay (K25) when air flow is detected at indoor blower.	Blower Compt.	———	13, 70, 72 46, 47
S32	Compressor Hi Pressure Switch — Shuts off compressor when refrigerant pressure exceeds set point.	Internal to Compressor	410 psi	15, 58
S33	Compressor Lo Ambient Thermostat — Shuts off compressor when temperature at thermostat drops below set point.	Internal to Compressor	25°F	15, 58
S34	Compressor Lo Pressure Switch — Shuts off compressor when refrigerant pressure drops below set point.	Internal to Compressor	20 psi off, 50 psi on	15, 58
S35	Internal Compressor Thermostat (L2 compressors except 15 tons) — Shuts off compressor when internal temperature rises above set point.	Internal to Compressor	———	15, 58
S36	Condensing Unit Switch (readout panel) — A manual switch which stops all cooling.	Remote	manual	
S38	Compressor Monitor — Locks out compressors whenever the outdoor air temperature falls below set point.	Damper Compartment	40°F to 90°F or 55°F to 85°F	15, 20, 59, 60
S39	System Switch (optional) — A manual switch which shuts down entire unit.	Remote	———	
S40	Freezestat (hot water & steam) — S40 energizes freezestat relay (K53) at temperatures below set point to prevent coil freezing.	Heating Compartment	34°F close, 60°F open	15, 18, 49
S41	Evaporator Low Limit — Locks out compressors when cold deck temperature drops below set point.	Cold Deck	42°F opens, 57°F close	15, 18, 59, 60
S42	Low Temperature Limit — Energizes LO temperature relay (K72) when temperatures drop below set point.	Damper compartment	10°F to 40°F adj.	20, 30, 40, 41, 49, 61
S43	Upper Temperature Limit — S43 opens contacts at temperatures above set point to de-energize upper temperature relay (K73).	Damper Compartment	75°F close	20, 30, 40, 41, 49, 61, 59
SP	Spark Plug (gas) — Ignites pilot.	Heating Compartment	.035 gap	
T1	Transformer (380-575V) — Drops line voltage to 220V for compressor crankcase heaters and compressor control circuit.	Comp. Control Box	———	19
T2	Control Power Transformer — Drops line voltage to 120V for 60 Hz units and 215V for 50 Hz for control circuit voltages.	Main Cont. Box	———	70
T3	Smoke Detector Transformer (50 Hz only) — Drops 215V to 120V for smoke detection options.	Compressor Control Box	———	19
T4	Ignition Transformer (gas) — Increases voltage to spark plug for ignition.	Heating Compartment	———	
T5	Valve Motor Transformer (hot water, steam & chilled water) — Provides 24V power to water valve (B7).	Main Control Box	———	18
T6	Damper Actuator Transformer — Provides 24V power to zone actuators (B6).	Zone Head	———	83
T7	Power Saver Actuator Transformer (less smoke detectors) — Provides 24V power to power saver actuator (B8).	Blower Compartment	———	

TABLE 1 (cont'd)

COMPONENT	DESCRIPTION AND FUNCTION	LOCATION	SETTING	REFERENCE PAGES
T8	Outdoor Air Damper Actuator, Transformer (with smoke detection) — Provides 24V power to outdoor actuator (B8).	Blower Compartment	—	
T9	Return Air Damper Actuator Transformer (with smoke detection) — Provides 24V power to return air actuator (B9).		—	
T10	Control Transformer — Provides 24V power to the control circuit.	Main Cont. Box	—	18
T11	Compressor Control Transformer — Provides 24V power to the isolated compressor control circuit.		—	
TB-A	Terminal Block "A"	Comp. Cont. Box	—	19
TB-B	Terminal Block "B"	Main Cont. Box	—	18
TB-C	Terminal Block "C"	Main Cont. Box	—	18
TB-D	Terminal Block "D"	Heating Compartment	—	
TB-E	Terminal Block "E"	Heating Compartment	—	
TB-F	Terminal Block "F" — readout	Below Disc. Box	—	
TB-P	Terminal Block "P" — positive reference strip	Zone Head	—	
TB-N	Terminal Block "N" — minus reference strip	Zone Head	—	
TB-Z	Terminal Block "Z" — room sensor	Below Disconnect Box	—	

GENERAL

DMS4 ALLOWABLE REPLACEMENT FUSE TABLE (AMPS)

Wiring Diagram Key	Voltage		208V & 230V Units (Use 250V Fuses)						480V & 575V Units (Use 600V Fuses)					
	DMS4 Model		185 185/275	275	300	360	415	600	185 185/215	275	300	360	415	600
F1	Compressor 1		50A	60A	100A	100A	60A	100A	25A	30A	50A	50A	30A	50A
F2	Compressor 2		50A	60A	60A	100A	60A	100A	25A	30A	30A	50A	30A	50A
F3	Compressor 3		----	----	----	----	60A	100A	----	----	----	----	30A	50A
F4	Compressor Control		3-2/10A	3-2/10A	3-2/10A	3-2/10A	3-2/10A	3-2/10A	1-1/8A	1-1/8A	1-1/8A	1-1/8A	1-1/8A	1-1/8A
F5	2 KVA Transformer		20A	20A	20A	20A	20A	20A	10A	10A	10A	10A	10A	10A
F6	Indoor Blo. Mtr.	3 & 5 hp	20A	20A	20A	20A	20A	20A	10A	10A	10A	10A	10A	10A
		7½ & 10 hp	40A	40A	40A	40A	40A	40A	20A	20A	20A	20A	20A	20A
		15 hp	----	----	----	----	60A	60A	----	----	----	----	30A	30A
F7	R.A. Blo. Mtr.	1½ thru 5 hp	20A	20A	20A	20A	20A	20A	10A	10A	10A	10A	10A	10A
		7½ hp	----	----	----	----	40A	40A	----	----	----	----	20A	20A
F8-F17	Electric Heat		60A	60A	60A	60A	60A	60A	30A	30A	30A	30A	30A	30A

START-UP AND PERFORMANCE CHECK LIST

Job Name _____ Job Number _____ Date _____

Job Location _____ City _____ State _____

Installer _____ City _____ State _____

Unit Model No. _____ Serial No. _____ Serviceman _____

GENERAL

TEMPERATURE AT TIME OF INSPECTION

Outdoor air D.B. _____ Return Air _____

Mixed Air _____ Hot Deck _____ Cold Deck _____

ELECTRICAL

Unit Nameplate Voltage _____

Minimum Circuit Ampacity - Disconnect 1 _____ 2 _____ 3 _____

Maximum Fuse Size - Disconnect 1 _____ 2 _____ 3 _____

Wiring connections checked for tightness [ ]

Supply Voltage Unit Off 1 & 2 _____ 1 & 3 _____ 2 & 3 _____

Electronic circuit checked for shorts [ ]

*Transformer Secondary Voltage T10 _____

SUPPLY BLOWER/FILTER

Motor HP _____ Make _____

Shipping Blocks Removed [ ] Filters in place [ ]

Lub & Bearings: Motor [ ] Blowers [ ] Pulleys Tight [ ]

Belt Tension & Alignment [ ] Proper Blower Rotation [ ]

Motor Amps: 1 _____ 2 _____ 3 _____

Smoke Detector Operates [ ]

*Transformer Secondary Voltage T2 _____ T3 _____

Blower RPM _____ CFM _____

Roll Filters Only: Pressure Control Set [ ] Clocktimer Adjusted [ ]

RETURN BLOWER

Motor Hp _____ Make _____

Shipping Blocks Removed [ ]

Lub & Bearings: Motor [ ] Fan [ ] Pulleys Tight [ ]

Belt Tension & Alignment [ ] Proper Fan Rotation [ ]

Motor Amps 1 _____ 2 _____ 3 _____

OUTSIDE-RETURN-EXHAUST DAMPERS

Enthalpy Control Setting _____

Morning Warmup Thermostat Setting _____

Damper Linkage Adjusted & Tight [ ]

Minimum Air Adjusted (Blade opening) _____" Outside Air _____%

*Transformer Secondary Voltage T7 _____ T8 _____ T9 _____

Shipping screws removed from exhaust dampers [ ]

Exhaust dampers open & close freely [ ]

ZONE DAMPERS

*Transformer Secondary Voltage T6 _____

Balancing dampers adjusted [ ]

Damper blades free & not binding [ ]

Zones ducted & wired to correct room sensor [ ]

CHILLED WATER

Water Connections Tight [ ] Water Pump Operating [ ]

Water valve adjusted [ ] Air Bled from system [ ]

*Transformer Secondary Voltage T5 _____

SYSTEM TIME CLOCK

Normal _____ Setback _____ Skip day(s) _____

DX COOLING

Crankcase heater energized 24 hours before installing compressor fuses [ ]

Refrigerant Lines Secure [ ] Service Valves Backseated [ ]

Proper Condenser Fan Rotation Fan 1 [ ] 2 [ ] 3 [ ] 4 [ ]

Hot Gas Bypass Valve Operating [ ]

*Transformer Secondary Voltage T1 _____

Voltage with compressors operating 1&2 _____ 1&3 _____ 2&3 _____

Amps:

Supply	1 _____	2 _____	3 _____
Condenser Fan Motor No. 1	1 _____	2 _____	3 _____
Condenser Fan Motor No. 2	1 _____	2 _____	3 _____
Condenser Fan Motor No. 3	1 _____	2 _____	3 _____
Condenser Fan Motor No. 4	1 _____	2 _____	3 _____
Compressor No. 1	1 _____	2 _____	3 _____
Compressor No. 2	1 _____	2 _____	3 _____
Compressor No. 3	1 _____	2 _____	3 _____

Condenser Air Temperature: In _____ Out _____

Compressor Discharge Pressure 1 _____ 2 _____ 3 _____

Compressor Suction Pressure 1 _____ 2 _____ 3 _____

Refrigerant Charge O.K. 1 [ ] 2 [ ] 3 [ ]

GAS HEAT

Burner Model No. _____ Serial No. _____

*Transformer Secondary Voltage T4 _____ T4 _____

Fuel Type _____ Pipe Size _____

Line Pressure _____ Pilot Reg. _____ Main Reg. _____

Micro Amps Pilot _____ Low Fire _____ High Fire _____

Fan Control Setting _____

Safety Controls Checked [ ] Combustion Blower Free & Clean [ ]

Motor Lubrication [ ] Motor Amps _____

ELECTRIC HEAT

Model No. _____ Serial No _____

Voltage 1 & 2 _____ 1 & 3 _____ 2 & 3 _____

Amps 1 _____ 2 _____ 3 _____

Sequenced Properly [ ]

HOT WATER/STEAM

*Transformer Secondary Voltage T5 _____

Shipping blocks removed from pump [ ]

Lines Tight [ ] Pump Operating [ ]

Valve Adjusted [ ] Air Bled from system [ ]

REMOTE READOUT PANEL

Switches operative: System [ ] Condensing Unit [ ]

Manual Over-ride Timer [ ]

Lights function properly: System [ ] Comb. Lockout [ ]

Cond. Unit Inoperative [ ] Dirty Filter [ ]

*Refer to wiring diagrams legend for location of transformers

DMS4 PREVENTIVE MAINTENANCE GUIDE

The general climatic conditions and specific application will affect service frequency.

1 - For climates with a heavy heat demand, an additional heating check should be made about midway through the heating season. For climates with a heavy cooling demand, an additional cooling check should be made about midway through the cooling season.

2 - Equipment operating under industrial or heavy duty conditions (shopping centers, factories, etc.) will require four or more inspections per year.

3 - Parts should be replaced if they are found defective or show sufficient wear to indicate imminent failure.

4 - Filter service will vary according to the type of filter used. The frequency of filter service will vary with each unit, but must be often enough to protect the equipment and the conditioned space.

SECTION	SERVICE CHECKS	PRE-HEATING SEASON	PRE-COOLING SEASON
Electrical	Tight wire connections	X	X
	Check for proper fusing	X	X
	Contacts of compressor and motor starters	X	X
	Supply voltage - unit off/unit on	X	X
	Supply voltage - compressors on	----	X
Indoor Blower & Return Blower	Shaft or bearing wear / Shaft alignment	X	X
	Bearing locking collars	X	X
	Belt tension and wear	X	X
	Filters	X	X
	Motor amps	X	X
	Smoke detector test	X	X
	Lubricate	X	----
Outdoor & Return Air Dampers	Clean enthalapy control	X	X
	Linkage adjusted and tight	X	X
	Minimum air setting	X	X
	Exhaust damper operation	X	X
System Operation	EA3 Load analyzer module operates properly	X	X
	Perform heating function test with load simulator	X	----
	TR3 Room sensor operation	X	X
	Performance cooling function test with load simulator	----	X
	LA2 Zone actuators operate properly	X	X
	Voltage at actuator transformers	X	X
Gas Heat	Replace burner spark plug	X	----
	Clean combustion air wheels	X	----
	Main line pressure / Regulator pressure	X	----
	Micro-amp reading	X	----
	Safety controls operate	X	----
	Burner motor amps	X	----
Electric Heat	Check for broken elements	X	----
	Tighten all wire connections	X	----
	Safety controls operate	X	----
	Heater amps	X	----
Hot Water or steam	Pumps operate	X	----
	Valve motor operates	X	----
	Leaks in system	X	----
	Water temperature - Steam pressure	X	----
Refrigerant Cooling	Discharge pressure, suction pressure & refrigerant charge	----	X
	Hot gas bypass	----	X
	Super heat setting	----	X
	Pressure switches operate	----	X
	Condenser fans operate	----	X
	Condenser heat operates	----	X
	Compressor timed interlock	----	X
	Clean evaporator coil if required	----	X
	Clean condensate pans and drains	----	X
	Compressor amps	----	X
	Condenser motor amps	----	X
	Crankcase heaters	----	X
Chilled Water Cooling	Valve motor operates	----	X
	Leaks in system	X	X
Optional Controls	Time clock settings	X	X
	Nite setback operation	X	X
	Read-out panel function	X	X

SYSTEM CONTROL

I - COMMAND SIGNAL

The basic operation of the control system is dependent upon a voltage command signal generated by each room sensor and corresponding discharge air sensor. An authority ratio of 20 to 1 exists between the discharge air sensor and the room sensor. This means a 20° temperature change across the discharge air sensor has the same magnitude as a 1° change across the room sensor. The load analyzer module provides the 24 VDC power supply to each room sensor.

These signals range from 2 VDC to 22 VDC. A 4° change across the discharge air sensor or a 0.2° change across the room sensor causes a one volt change.

Figure 27 identifies the room sensor, discharge sensor, subbase and room sensor accessories.

A - Zone Actuators

Each zone actuator receives the command signal from its respective room sensor and then modulates the dampers to satisfy the demand.

The modulating voltage range is from 10.5 VDC to 13.5 VDC. If the voltage is 10.5 volts or lower, the zone actuator positions the damper to full heating. At 12 volts the command signal is at midpoint and the dampers are 50% open to both hot and cold decks. When the voltage rises to 13.5 volts or higher, the zone actuator positions the damper to full cooling.

B - Load Analyzer Module

Command signals from room discharge sensors feed into the load analyzer module. The module monitors the signals and selects the low and high to initiate DMS4 heating and cooling modes. The zone with the lowest voltage command signal controls the heating, while the zone with the highest voltage command signal controls the cooling. Any zone may transmit the high or low signal.

The load analyzer module has internal logic relays which are programmed to close at specific voltages. The "H" contacts control gas and electric heat while the "C" contacts control DX cooling.

The "HI" command signal controls the chilled water valve and power saver damper modulation for cooling. The "LO" command signal controls the hot water and steam valve modulation for heating. Figure 28 identifies all the switches and terminals on the load analyzer module.

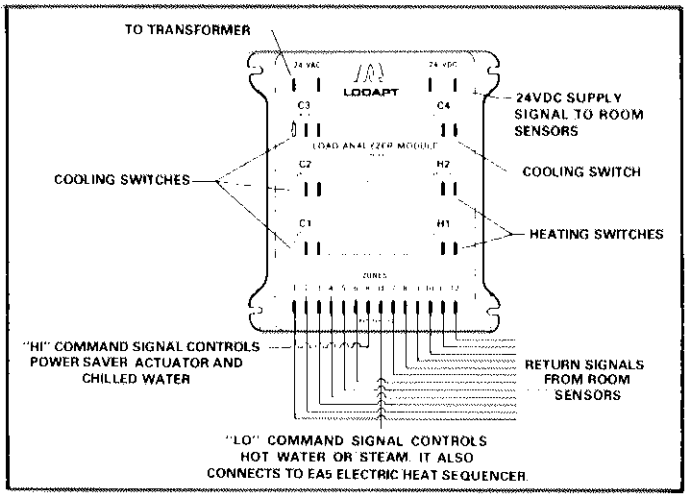


FIGURE 28

C - System Monitoring Controls

After a particular zone transmits its signal and the load analyzer determines a heating and/or cooling demand, an additional set of controls override unit operation. If these controls detect an erroneous operating condition, a combination of switches and electronic relays are programmed to return unit into the desired operation. Table 2 lists these overriding controls and Figure 29 illustrates a typical flow chart for the DMS4 control system. Refer to individual heating and cooling sections for additional information on monitoring controls.

NOTE - The overriding limit controls (A5 and A6) generate limit sig-

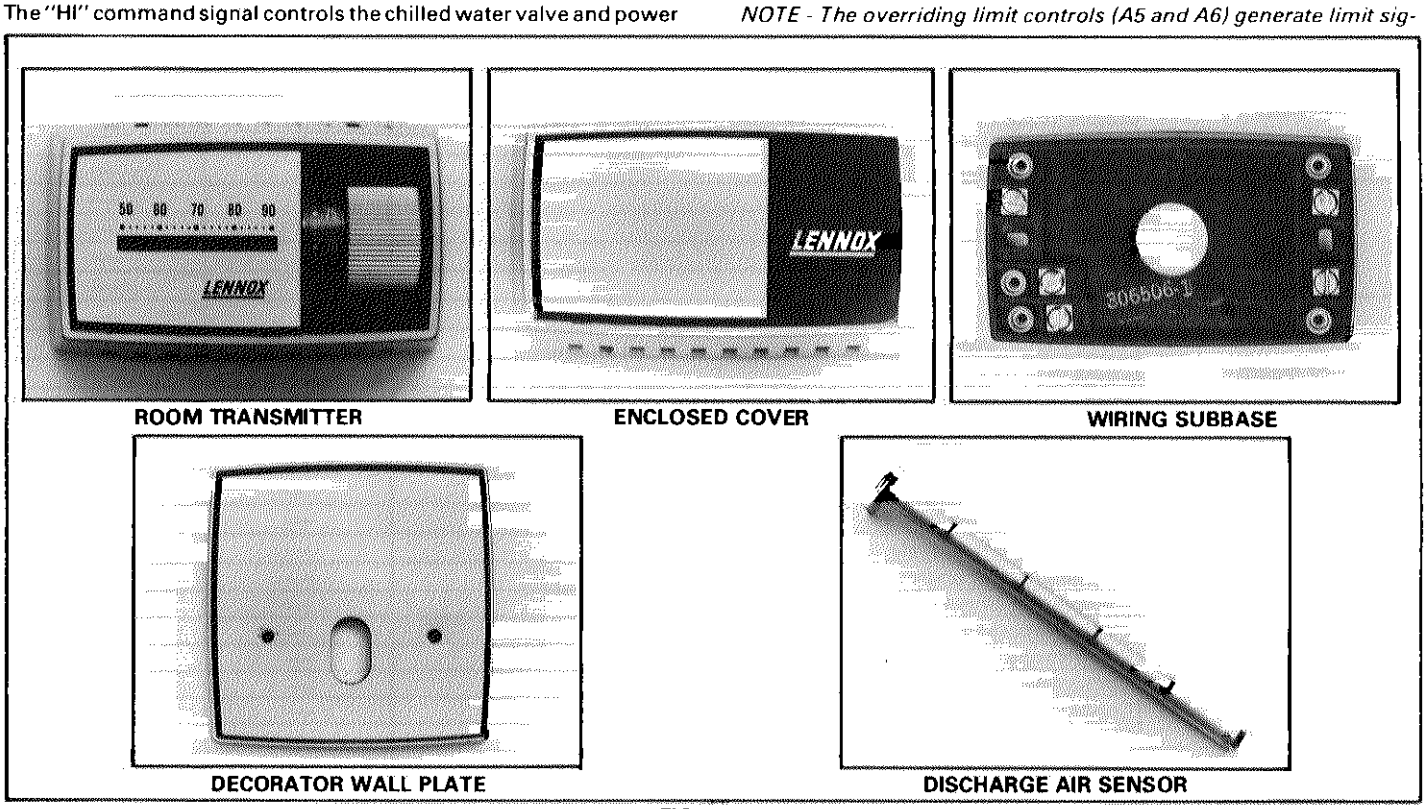


FIGURE 27

nals based on the cold deck temperature. They do not initiate the cooling demand, but must approve the EA3 cooling command signal before the unit goes into normal cooling.

II - LOAD SIMULATOR

A load simulator (P-8-10532) is used to check system operation. The load simulator produces a signal ranging from 2 volts thru 22 volts to simulate a zone demand in the electronic circuits. Refer to the individual heating and cooling sections for the complete heating or cooling checkout.

NOTE - The load simulator may cause a shift of + 1 volt from settings on function charts. Any variation in starting points should be consistent.

Use the following steps to connect load simulator.

1 - Turn off power to DMS4.

2 - Disconnect the (+) wire which runs from terminal strip TB-Z to 24 VDC terminal at EA3 module.

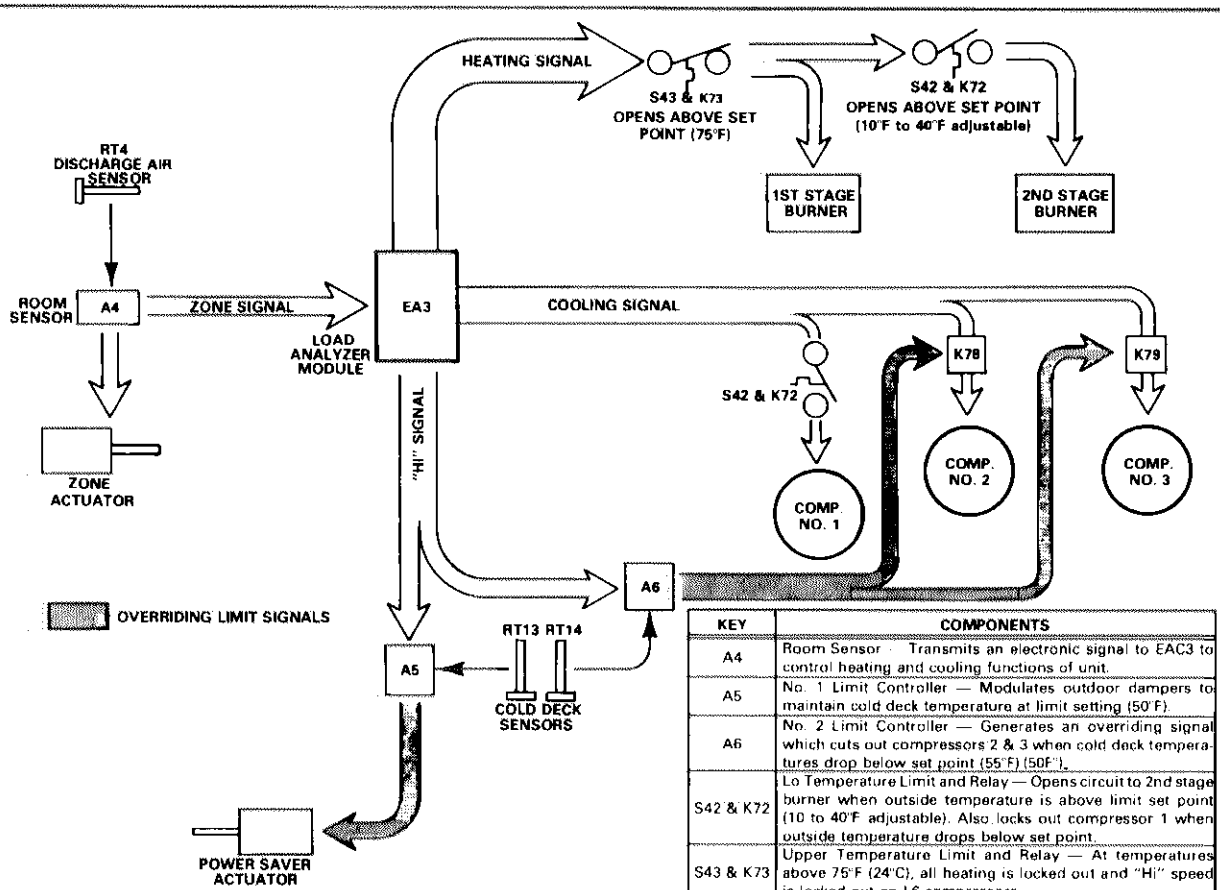
NOTE - The zone actuators will remain open to the hot deck and closed to the cold deck during the checks. On units with condenser heat, the discriminator function will close the outside dampers to minimum position.

3 - Connect load simulator as shown in Figure 30. Null simulator by aligning thumbwheel mark with null indicator.

4 - Turn on power to unit. Check heating or cooling operation according to the appropriate section within this manual.

TABLE 2

SYSTEM MONITORING CONTROLS		
KEY	**DESCRIPTION**	**LOCATION**
A5	No. 1 Limit Controller	main control box
A6	No. 2 Limit Controller	main control box
K72	Lo Temperature Relay	main control box
K73	Upper Temperature Relay	main control box
K74	Stage 1 Heat Relay	main control box
K77	Set Point Relay	compressor control box
K78	Compressor 2 Cutout Relay	main control box
K79	Compressor 3 Cutout Relay	main control box
RT13	Cold Deck Power Saver Thermistor	cold deck
RT14	Cold Deck DX Cool Thermistor	cold deck
S42	Lo Temperature Limit	damper compartment
S43	Upper Temperature Limit	damper compartment

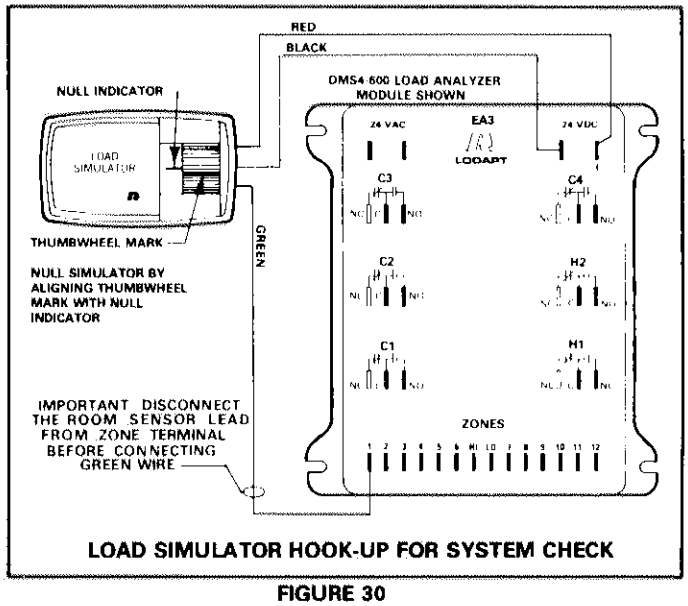


TYPICAL FLOW CHART

(GAS HEAT AND POWER SAVER LESS CONDENSER HEAT AND DISCRIMINATOR)

KEY	COMPONENTS
A4	Room Sensor — Transmits an electronic signal to EAC3 to control heating and cooling functions of unit.
A5	No. 1 Limit Controller — Modulates outdoor dampers to maintain cold deck temperature at limit setting (50°F).
A6	No. 2 Limit Controller — Generates an overriding signal which cuts out compressors 2 & 3 when cold deck temperatures drop below set point (55°F) (50F°).
S42 & K72	Lo Temperature Limit and Relay — Opens circuit to 2nd stage burner when outside temperature is above limit set point (10 to 40°F adjustable). Also locks out compressor 1 when outside temperature drops below set point.
S43 & K73	Upper Temperature Limit and Relay — At temperatures above 75°F (24°C), all heating is locked out and "Hi" speed is locked out on L6 compressors.
K78	Compressor 2 Cutout Relay — A6 generates an overriding signal which closes K78 and allows compressor 2 to run.
K79	Compressor 3 Cutout Relay — A6 generates an overriding signal which closes K79 and allows compressor 3 to run.
RT4	Discharge Air Sensor — Senses discharge air temperature to reposition zone damper in anticipation of the effect on room temperature.
RT13	Cold Deck Power Saver Thermistor — Senses cold deck temperature for A5.
RT14	Cold Deck DX Cool Thermistor — Sense cold deck temperature for A6.

FIGURE 29



LOAD SIMULATOR HOOK-UP FOR SYSTEM CHECK

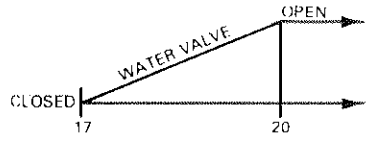
FIGURE 30

III - FUNCTION CHARTS

The correlation between the command signal voltage and the DMS4 sequence of operation is illustrated in chart form. A basic function chart is provided on page 33 on which individually adhesive backed function charts are overlayed to give a complete unit operating sequence. These individual function charts (totaling 10) are packed in an envelope on the cover of this manual. Refer to the decision tree on page 34 to select the charts that apply to your unit. A corresponding function chart is also supplied with each DMS4 unit.

All the function charts are listed below. Refer to each heating and cooling section for a detailed explanation of the corresponding function chart.

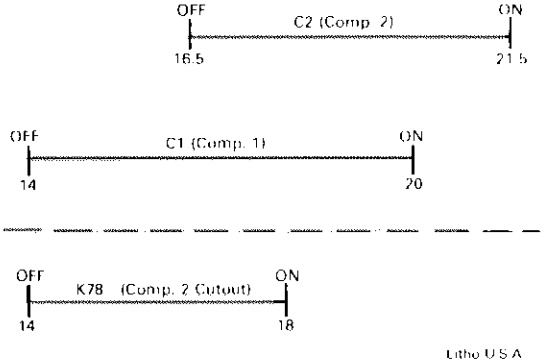
CHART ① CHILLED WATER



Wiring Diagram Section Reference E1

Litho U.S.A. 8 7123D

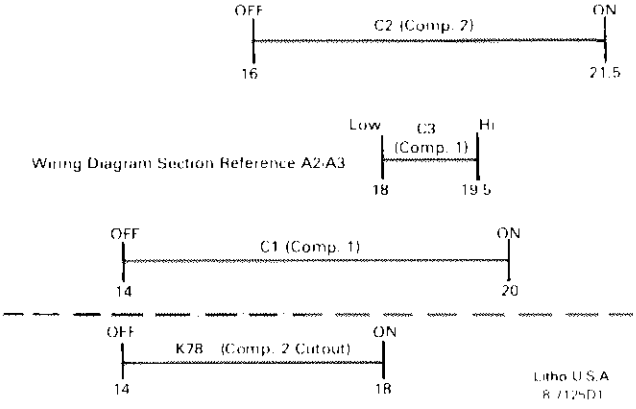
CHART ② DX COOL DMS4-185-185/275-275



Wiring Diagram Section Reference A1

Litho U.S.A. 8 7123D1

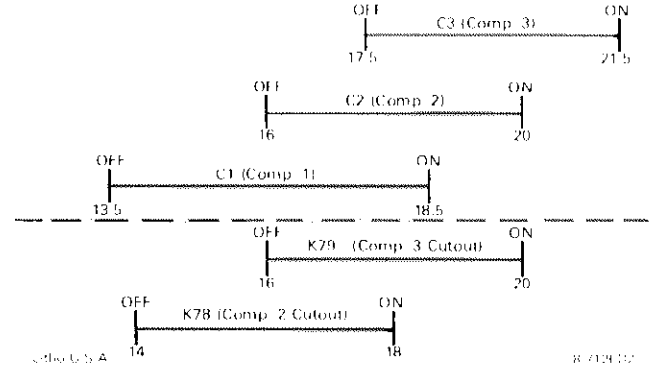
CHART ③ DX COOL DMS4-300-360



Litho U.S.A. 8 7125D1

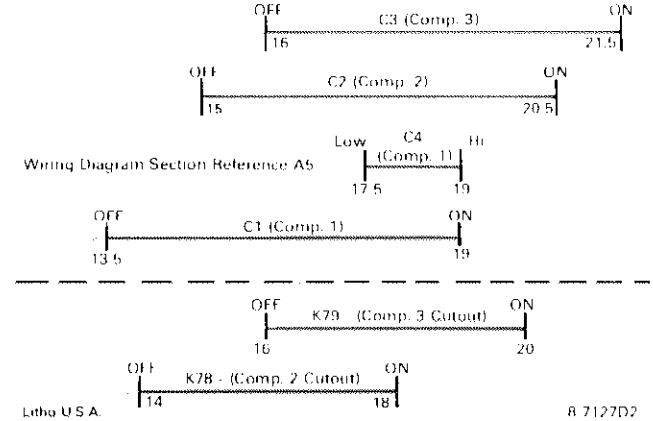
CHART ④ DX COOL DMS4-415

Wiring Diagram Section Reference A4



Litho U.S.A. 8 7126D2

CHART ⑤ DX COOL DMS4-600



Litho U.S.A. 8 7127D2

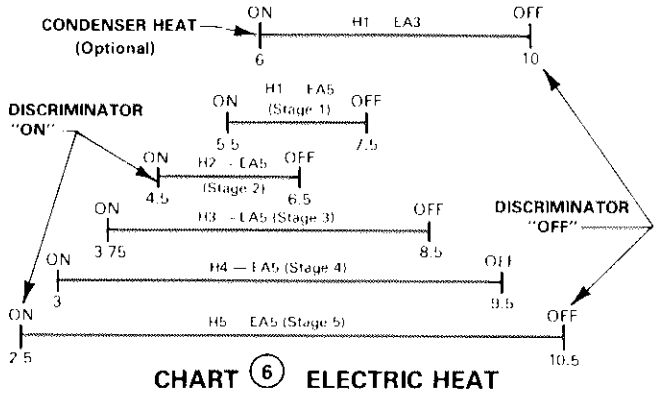


CHART (6) ELECTRIC HEAT

(DISCRIMINATOR AND CONDENSER HEAT OPTIONAL)

Wiring Diagram Section Reference C8/C9/C10

Litho U.S.A

8-7128D

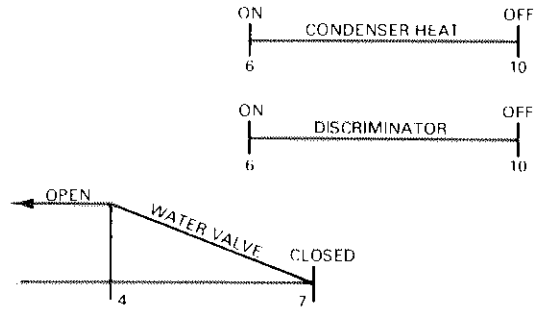


CHART (8) HOT WATER OR STEAM

(DISCRIMINATOR AND CONDENSER HEAT OPTIONAL)

Wiring Diagram Section Reference C11/C12

Litho U.S.A

8-7130D

SYSTEM CONTROL

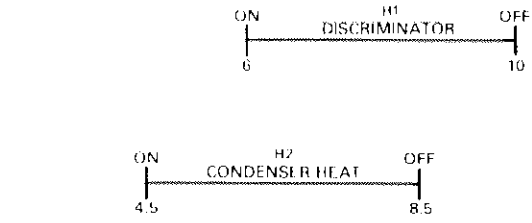


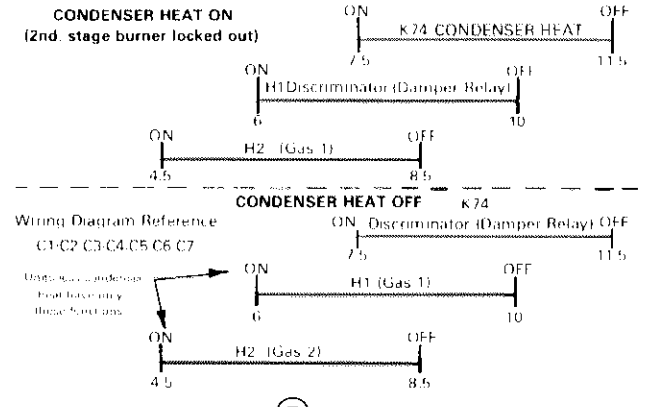
CHART (9) NO HEAT

(DISCRIMINATOR AND CONDENSER HEAT OPTIONAL)

Wiring Diagram Section Reference C13

Litho U.S.A

8-7131D

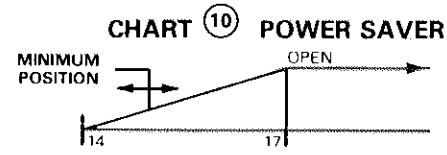


Litho U.S.A

CHART (7) GAS HEAT

(Discriminator and Condenser Heat Optional)

8-7129D

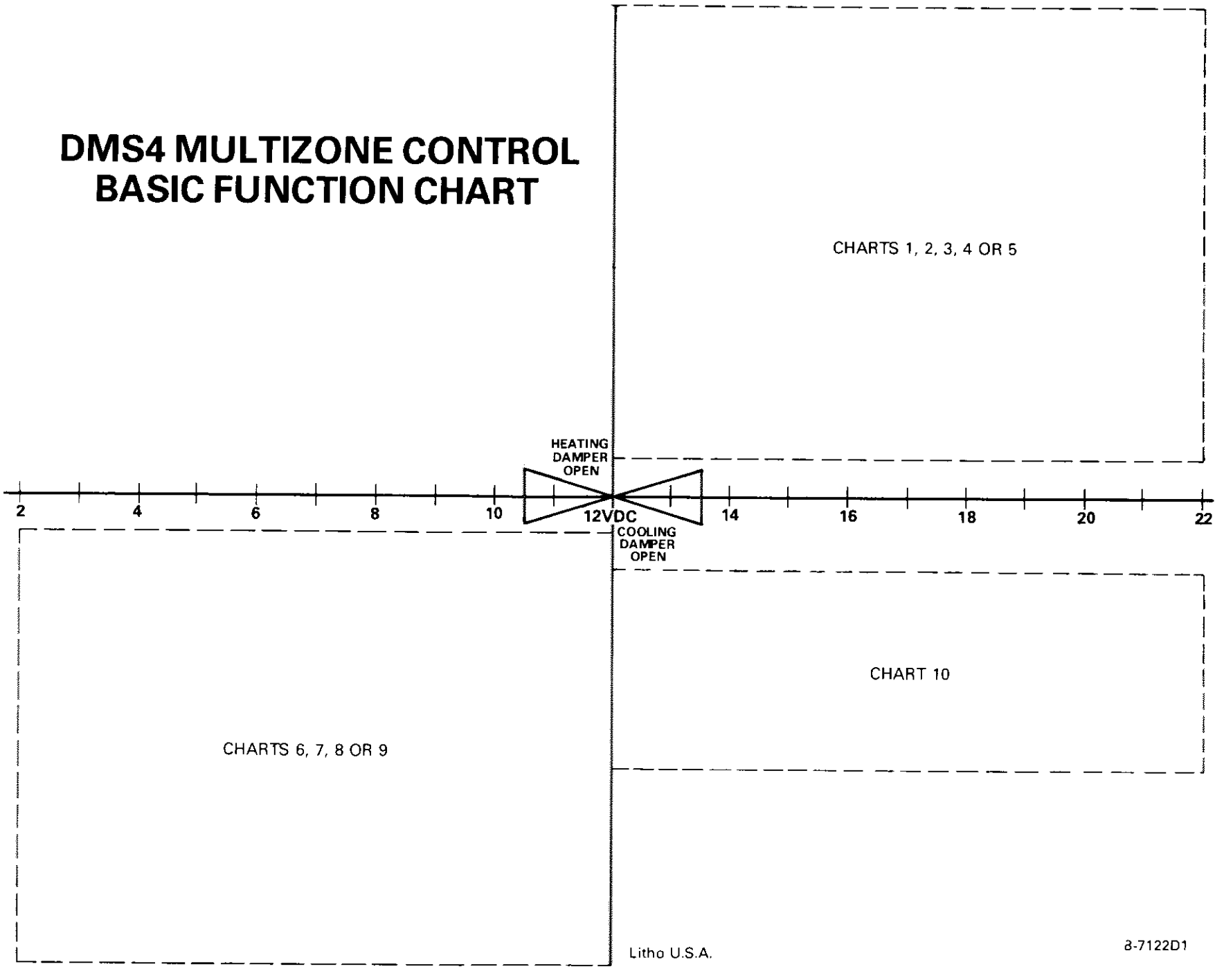


Wiring Diagram Section Reference F1/F2

Litho U.S.A

8-7132D

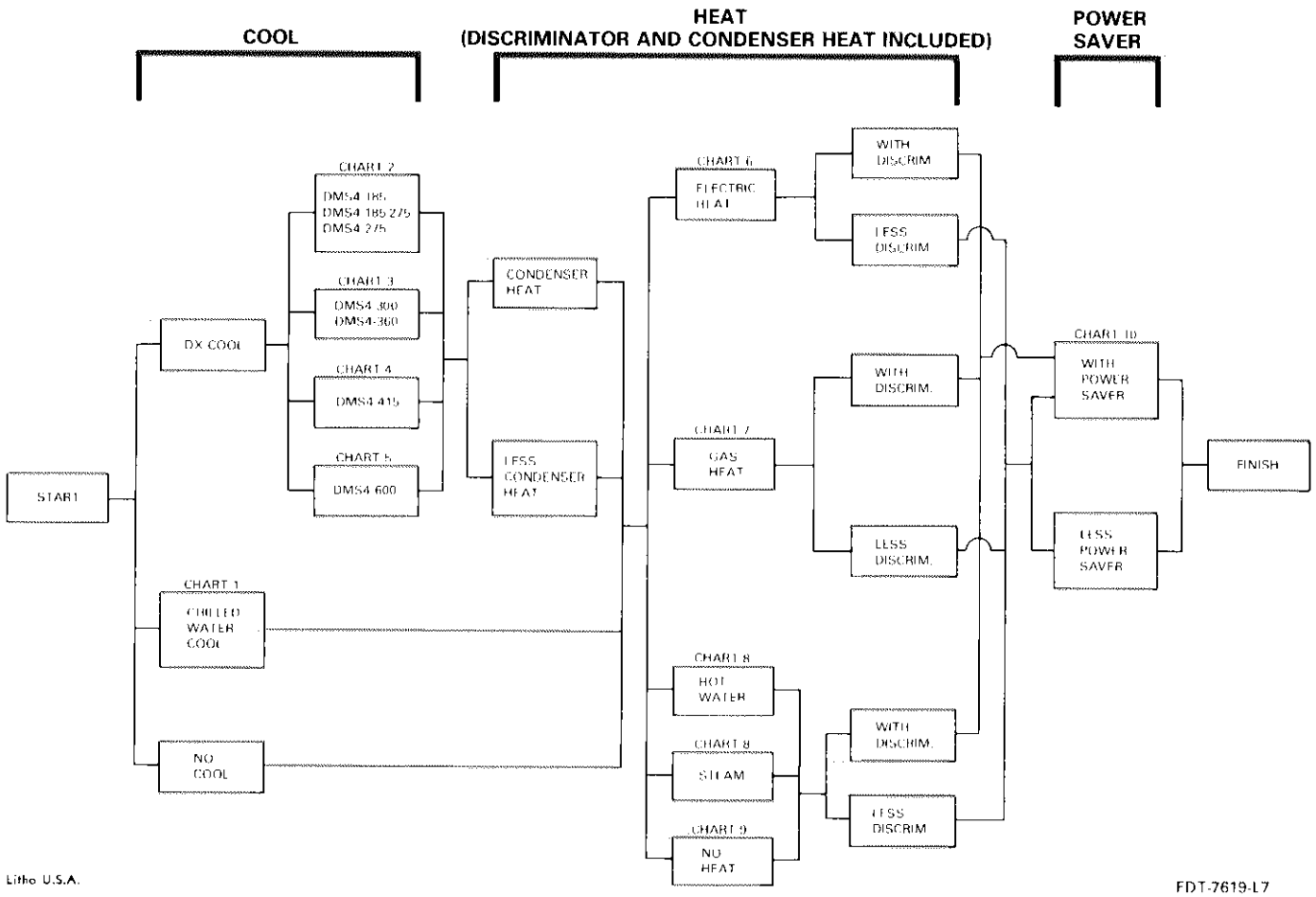
DMS4 MULTIZONE CONTROL BASIC FUNCTION CHART



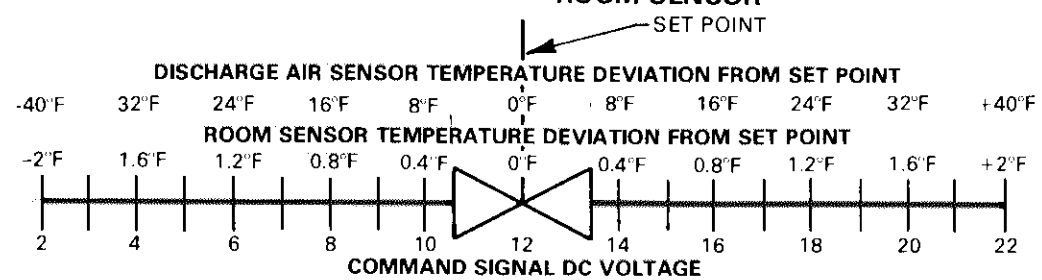
Litho U.S.A.

8-7122D1

DMS4 MULTIZONE — FUNCTION DECISION TREE



ROOM SENSOR



"NO LOAD BAND" ROOM SENSOR

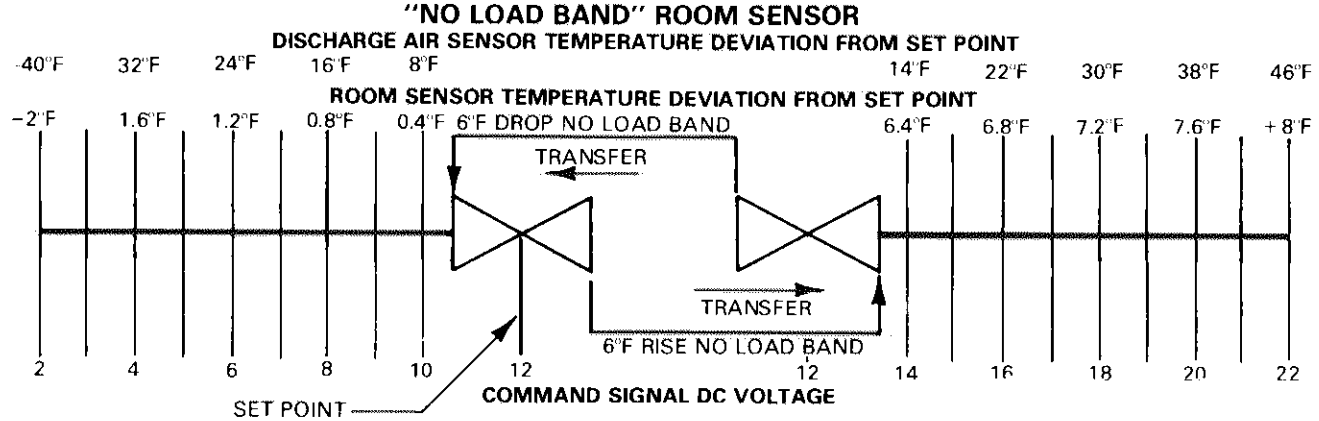


FIGURE 31

IV - ROOM SENSOR CHECKS

A - Voltage Signal

The command signal voltage is the algebraic sum of the room sensor and discharge air sensor (RT4). This sum reflects the temperature deviations from set point. A 4° change across the discharge air sensor or a 0.2° change across the room sensor each cause a one volt change. Figure 31 illustrates the correlation between temperature changes and voltage signal for both standard room sensor and "no load band" room sensor.

B - Performance Check

A DC voltmeter must be used for the following check.

CAUTION - The thermistor will change its resistance in response to changes in temperatures. When making set point adjustments, keep hands and other heat sources away from thermistor.

1 - Remove cover from room sensor. Connect voltmeter to terminals 3 (—) and 4 (+). See Figure 32.

2 - Slowly increase set point 5 degrees above room temperature. The voltage should decrease to approximately 2 VDC before set point is 5 degrees above room temperature.

NOTE - If the "wide no load band" room sensor is used, an additional 6 degrees must be added to these checks.

3 - Slowly decrease set point 5 degrees below room temperature. The voltage should increase to approximately 22 VDC before set point is 5 degrees below temperature.

4 - Refer to "Electronic Circuit Troubleshooting" section on page 36 if command voltage does not respond to set point adjustments.

5 - Table 3 lists the voltage ranges that reflect conditions at room sensor. Refer to Figure 32 for meter connections.

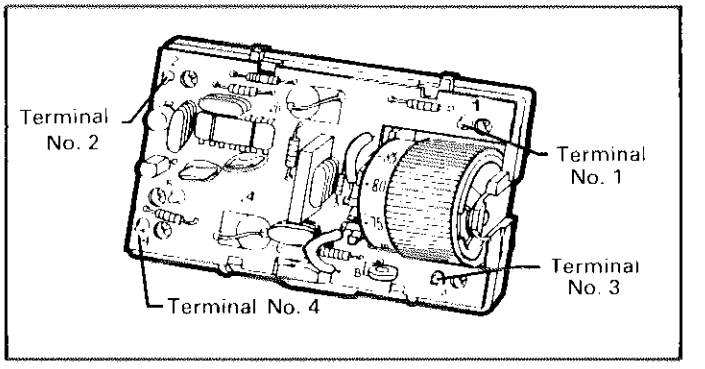


FIGURE 32

TROUBLE SHOOTING CHART

PROBLEM	POSSIBLE CAUSES	ELIMINATION PROCEDURE
No. DC Power at terminals marked 24 VDC	No AC Power.	Check T10 transformer.
	Room Sensor wires 2 and 3 shorted or reversed on one or more zones.	Correct short or reverse leads.
DC Power reads constant low voltage (Approx. 2 to 6 Volts) at terminals marked 24 VDC.	Room Sensor wires 2 and 4 shorted or reversed on one or more zones. Room Sensor wires 3 and 4 shorted or reversed on one or more zones.	Disconnect Room Sensor wire No. 3 from "Z" terminal strip. If meter reads 24 Volts DC, then Room Sensor wires 3 and 4 are shorted. If meter reads a constant low voltage (2 to 6 Volts), then Room Sensor wires 2 and 4 are shorted.
	Zone Actuator or Power Saver Actuator terminals 1 and 6 are shorted or reversed on one or more zones.	Disconnect the No. 1 Actuator wires from terminal strips "Z" and "F" until DC power is restored.
	TR3 Room Sensor damaged.	Replace Room Sensor.
EA3 Output Voltages: Constant zero (0) Volts: Minus (—) DC terminal to HI.	Power Saver Actuator or wiring shorted.	Disconnect command wire from terminal marked HI on EA3 Load Analyzer Module. If meter reads a command signal, then the Power Saver Actuator or wiring is shorted.
Minus (—) DC terminal to LO.	Motorized Valve or wiring shorted.	Disconnect command wire from terminal marked LO on EA3 Control Module. If meter reads a command signal, then the motorized valve or wiring is shorted.
Constant 2 to 6 Volts Minus (—). DC terminal to LO (heating).	Room Sensor wire 2 open on one or more zones.	Connect voltmeter between minus (—) 24 Volt DC terminal to each of the terminals marked ZONES. This will locate the zone(s) reading a constant 2 to 6 Volts. Once the zone(s) has been located, check the field wiring between the terminal strip "Z" and Room Sensor.
Constant 22 Volts Minus (—) DC terminal to HI (cooling).	Room Sensor wire 3 opens on one or more zones.	Connect voltmeter between minus (—) 24 Volt DC terminal to each of the terminals marked ZONES. This will locate the zone(s) reading a constant 22 volts. Once the zone(s) has been located, check the field wiring between the terminal strip "Z" and Room Sensor.
Heating equipment does not operate when command voltage is (+) 2 Volts DC (full heating). Minus (—) DC terminal to LO.	Heating relays H1, H2 or H3 damaged.	Consecutively jumper H1, H2 and H3 heating relays. If all heating functions operate, the appropriate relay is damaged. Replace the EA3 Load Analyzer Module.
Cooling equipment does not operate when command voltage is (+) 22 Volts DC (full cooling). Minus (—) DC terminal to HI.	Cooling relays C1, C2 or C3 damaged.	Consecutively jumper C1, C2, C3 and C4 cooling relays. If all cooling functions operate, the appropriate relay is damaged. Replace the EA3 Load Analyzer Module.
Individual zone temperature running approximately four (4) degrees below set point.	Transmitter wires 1 and 3 shorted. Duct Temperature Sensor shorted.	Correct short.
Individual zone temperature running approximately four (4) degrees above set point.	Room Sensor wire 1 open.	Connect lead.
	Room Sensor wires 1 and 2 shorted.	Correct short.
	Discharge Air Sensor open.	Connect lead.

TABLE 3

Room Sensor	Correct Voltage
DC Power Supply Terminals 2 (+) and 3 (—)	24 VDC
TR1 Discharge Sensor (Adjust set point to room temperature) Terminals 1 (+) and 3 (—)	6 VDC to 18 VDC (Depending on duct temperature)
Command Voltage Terminals 3(—) and 4 (+)	2 VDC to 22 VDC (Varies with difference between set point and room temperature)

V - ELECTRONIC CIRCUIT TROUBLESHOOTING

The Troubleshooting Chart on page 35 will assist the serviceman in locating possible wiring problems. These checks are additions to the heating or cooling checks given in each section. The recommended troubleshooting procedure is one of eliminating symptoms by disconnecting a possible short on a single zone basis until the symptom is eliminated. These checks are made at the EA3 load analyzer module.

NOTE - Make certain all room sensor frames are snug against subbase.

VI - REMOTE CONTROL OPTIONS

A - Smoke Detectors

Photo cell smoke detectors detect smoke within the system and terminate unit heating and cooling upon the presence of smoke. Blowers and dampers are controlled by 1 of 4 options as described in Figure 18 on page 13. Two detectors are used; one next to the return air dampers and another in the blower compartment downstream from air filters. Each detector has a built-in key operated test feature. In addition, two remote test stations may be used (one per detector). Refer to Figure 34 for smoke detector description and test procedure.

The smoke detectors are equipped with terminals for remote alarm and trouble circuit hook-ups.

1 - Trouble relay contacts (terminals 8 & 9) are normally open (closed during unit operation). A typical trouble circuit would incorporate a system light that would be "ON" during normal unit operation and would go "OFF" with the presence of smoke.
2 - Alarm contacts (terminals 6 & 7) are normally closed (open during unit operation). An alarm, telephone or buzzer would be energized with the presence of smoke.

Maintenance

Clean the smoke detector sensing chamber at least once a year and more often when abnormal accumulations are noted on the outer filter. See Figure 34 for cleaning instructions.

CAUTION - Turn off power before servicing or the alarm may be activated (if used). Cleaning should be performed in subdued light for minimum reset time.

1 - Remove cover from detector.
2 - Disconnect wiring harness and light from sensing chamber.
3 - Remove chamber mounting screws and draw assembly straight out from detector.
4 - Remove chamber outer filter and rinse in a solution of warm water and mild detergent. Allow to air dry.
5 - Remove nuts and washers from front of chamber plate and draw cage straight out from plate using caution to avoid any damage to the assembly. Remove chamber plate gasket.
6 - Clean cage inner filter by vacuum or air pressure. This filter is cemented to the cage and must not be removed. If filter is loose contact cement may be used to resecure it.
7 - Clean the optical block and surrounding surfaces with air pressure, vacuum, or with a soft cloth if necessary. Clean all dust and lint from holes and lens in optical block as these could cause a false alarm.
8 - Install gasket on cage and secure cage to chamber plate with the washers and nuts.
9 - Install outer filter on cage and install chamber assembly to detector base with the mounting screws.
10 - Connect wiring harness and light to sensing chamber.

NOTE - If the photocell was exposed to light during cleaning, the alarm (if used) will go on unless the power at unit was turned off.

11 - Install detector cover and turn detector key switch to RESET position. Connect unit power.

NOTE - A reset period of up to one half hour may be required depending on the amount of light the photocell was exposed to during servicing.

12 - After resetting the detector, turn detector key switch to the NORMAL position.
13 - Allow detector to remain powered for one hour after resetting, then test detector using standard test procedure.
14 - Return system to normal operation.

NOTE – If unit is used for temporary heat during construction, smoke detector sensing chambers should be removed as large amounts of fine construction dust may cause a false alarm. A sensing chamber from one detector should not be placed in another detector, since they were each calibrated as a complete unit before leaving the factory.

B - Night Setback Controls

Night setback and override controls are designed for use in conjunction with a clocktimer. When system clocktimer shuts unit down for night operation, the control of unit is automatically switched from the day thermostat to the night thermostat which will maintain a lower room temperature. The optional clocktimer may be ordered factory installed in the compressor compartment of the unit or ordered separately and field installed remote from unit.

Night setback kit with manual 12 hour timer (in readout panel) will return system to normal daytime conditions by setting clock for desired length of time. When time expires and timer is at original position, the system will return to nighttime control.

Night setback kit with manual switch works the same way the manual timer kit works, except the manual switch must be turned off to return system to nighttime control. See Figure 33.

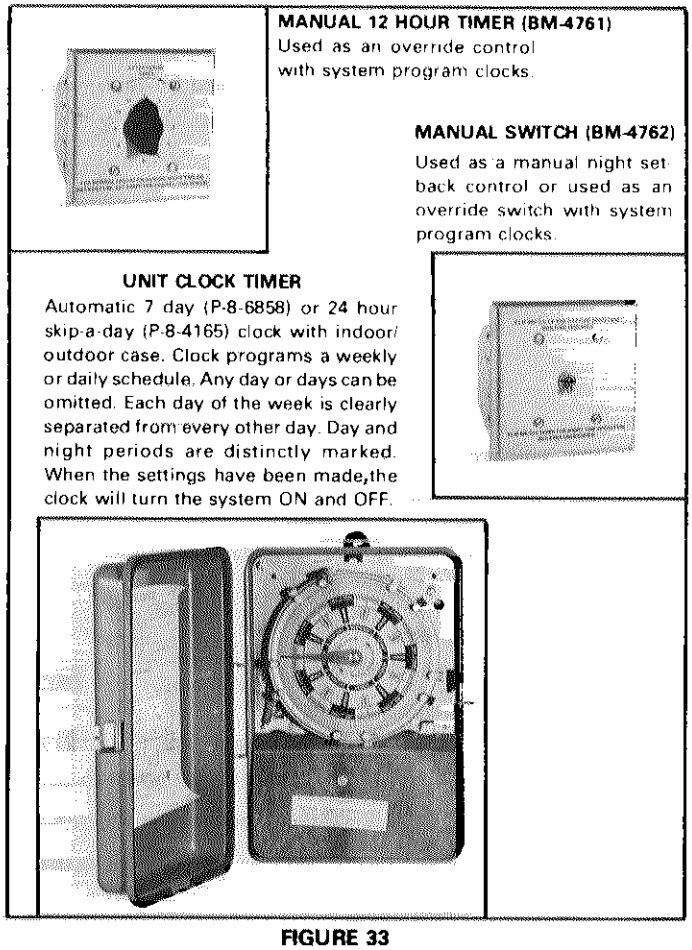
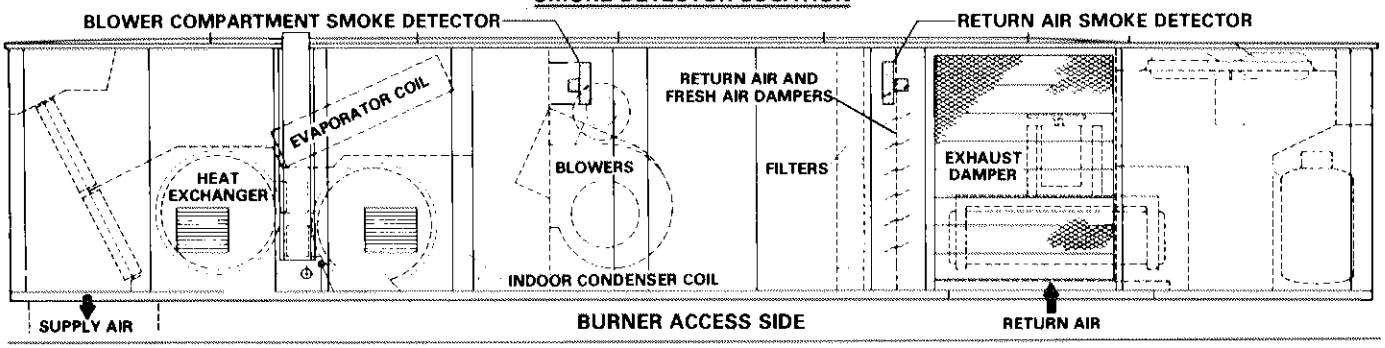
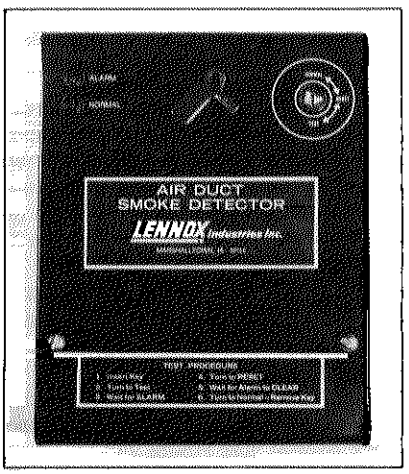


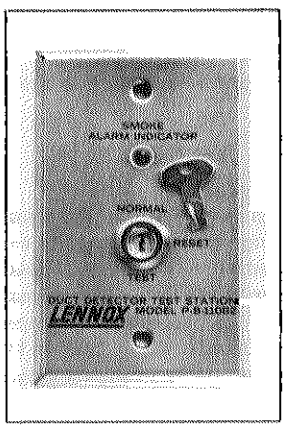
FIGURE 33

SMOKE DETECTOR LOCATION





SMOKE DETECTOR
(2 IN UNIT)



REMOTE TEST STATION
(2 REQUIRED)

TEST PROCEDURE

1 - Insert key and turn to TEST.
2 - Unit heating/cooling functions will terminate and blower/damper operation will respond.
3 - Turn to RESET. Wait for unit blower to start.
4 - Turn to NORMAL (green light on). Remove key.

TEST PROCEDURE

1 - Insert key and turn to TEST.
2 - Wait for indicator lamp (red) to light. Check for units response.
3 - Turn to RESET. Wait for indicator lamp to go off and that unit blower starts.
4 - Turn key to NORMAL. Remove key.

NOTE - All key switches must be left in the "NORMAL" position.

SMOKE DETECTOR ASSEMBLY (MODEL 760)

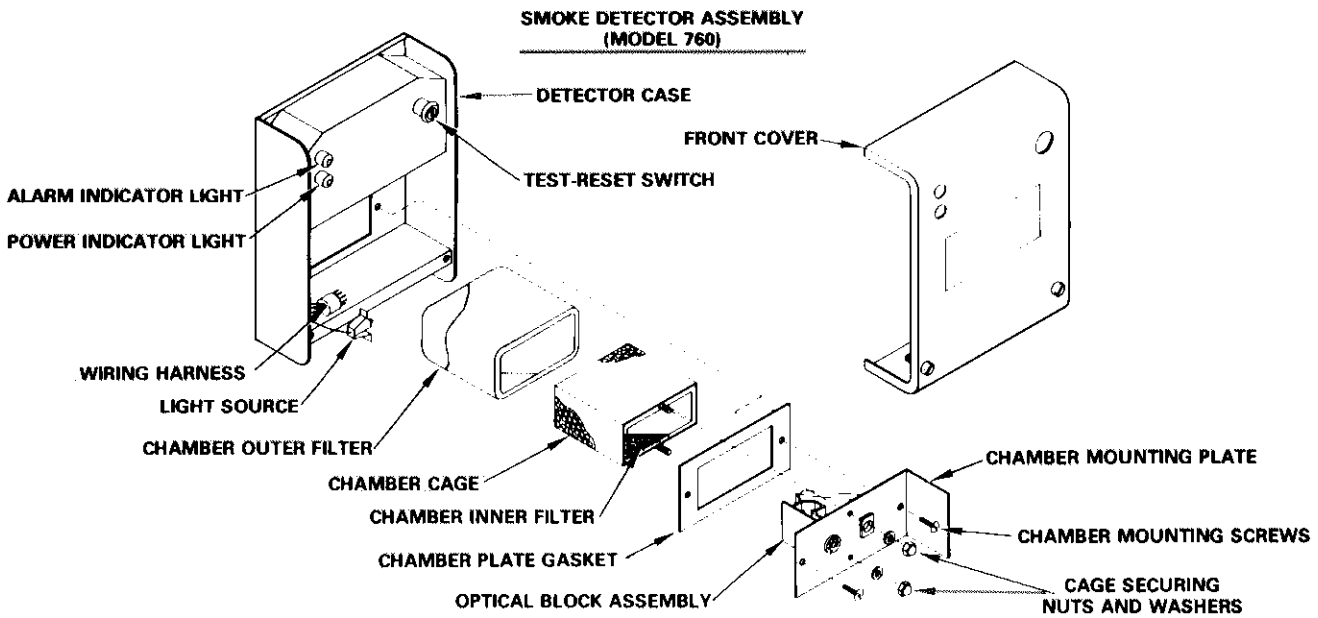


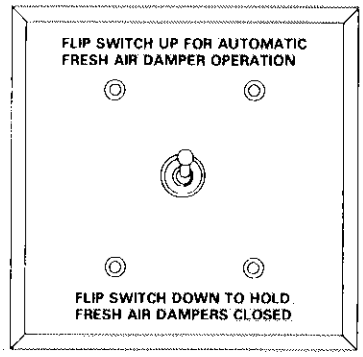
FIGURE 34

C - Sandstorm Switch

The remote sandstorm switch (BM-7262) closes outside air dampers when switch is in "down" position. When switch is in "up" position it allows normal damper operation. Refer to Figure 35.

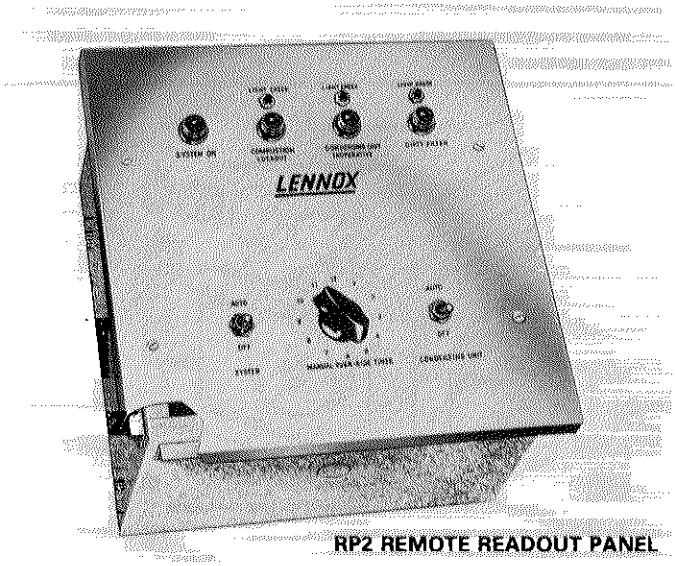
D - Lennox RP2 Remote Readout Panel

Remote readout panel is designed to show at a glance operation of equipment. A green light is provided for system operation and three red lights for combustion lockout, condensing unit malfunction and dirty filter. In addition, the readout panel contains a system switch for shutting down equipment, an after hours timer to be used for after hours occupancy and a switch for shutting off DX cooling. The three red lights on panel are equipped with push button switches for checking the light bulbs. In addition, the combustion lockout energizes phone or service relay as light is energized. Refer to Figure 36 for readout panel identification.



REMOTE SANDSTORM SWITCH (BM-7262)

FIGURE 35



RP2 REMOTE READOUT PANEL

FIGURE 36

GAS HEAT

I - GAS HEAT SECTION

A - Gas Heating Compartment Identification

Refer to Figure 37 for locations of gas components.

B - Manifold Piping

Refer to the piping manifold schematics in Figure 38 for location of the manual shut-off valve(s) and regulators for the natural and propane gas options.

II - GAS HEAT CONTROLS

A - GX3 Burner

Table 4 lists the sizes available with the number of burners and corresponding Btuh values. Figure 39 identifies the GX3 power burner.

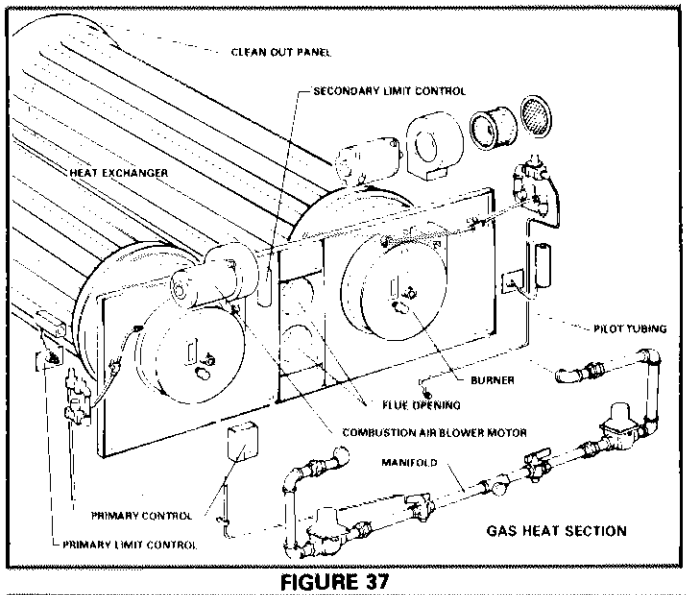


FIGURE 37

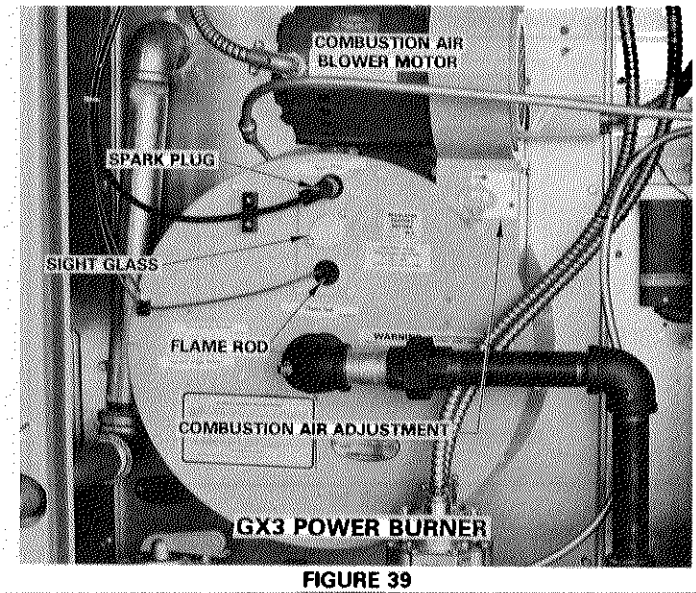
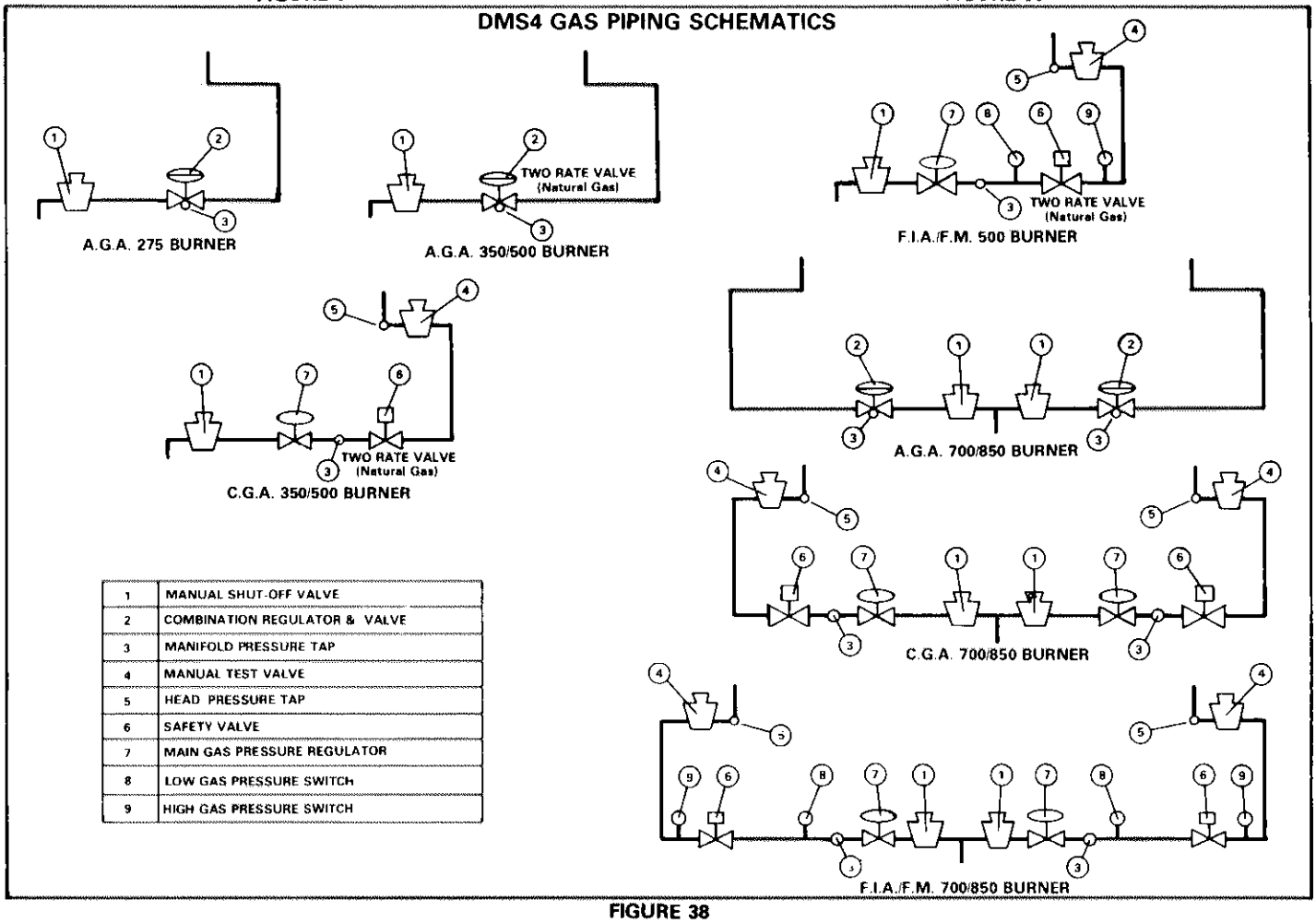


FIGURE 39



1	MANUAL SHUT-OFF VALVE
2	COMBINATION REGULATOR & VALVE
3	MANIFOLD PRESSURE TAP
4	MANUAL TEST VALVE
5	HEAD PRESSURE TAP
6	SAFETY VALVE
7	MAIN GAS PRESSURE REGULATOR
8	LOW GAS PRESSURE SWITCH
9	HIGH GAS PRESSURE SWITCH

FIGURE 38

TABLE 4

Heating Capacity	Gas Type	Number of Burners	Staging	
			1st Stage	2nd Stage
275,000	Natural	1	275,000	---
350,000	Propane	1	350,000	---
350,000	Natural	1	250,000	100,000
500,000	Natural & Propane	1	320,000	180,000
700,000	Natural & Propane	2	350,000	350,000
850,000	Natural & Propane	2	350,000	500,000

B - Primary Controls

Four types of primary controls are available: RA890, R4795D, Fireye and LFA 1.63 (50 Hz only). A high gas pressure switch, a low gas pressure switch, and a time delay circuit in first stage of heat are included with the R4795D option for F.I.A. and F.M. systems. Each burner has its respective primary control. Figure 40 locates the primary control for a DMS4-185/185-275/300/360. On DMS4-415/600 units, the reset buttons are located on the vestibule panel.

Note - RA890 is the only primary control A.G.A. certified.

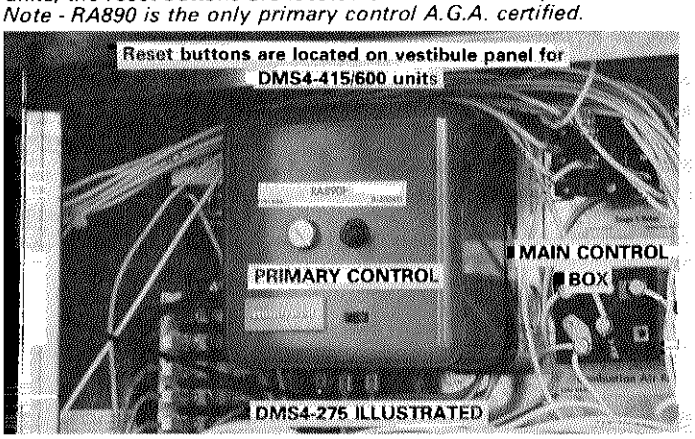


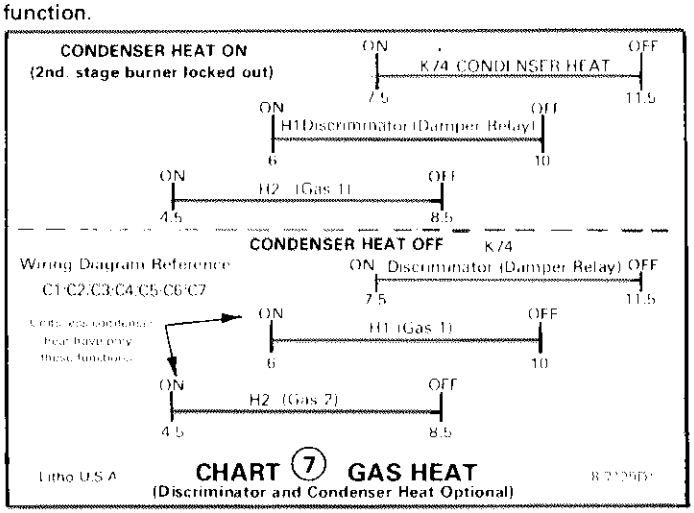
FIGURE 40

C - Units With Condenser Heat

A transfer relay (K30) and stage 1 relay (K74) are used with condenser heat. K74 receives the "LO" signal from the EA3. This relay is programmed to close at a specific voltage to initiate a condenser heat demand. See Function Chart. If K74 is closed, compressor 1 operation energizes K30 which then shifts the unit into condenser heat and first stage gas heat. With compressor 1 off, unit returns to first and second stages of gas heat. Figure 41 illustrates the staging with condenser heat both "on" and "off". For additional information on condenser heat, refer to page 59.

III - SEQUENCE OF OPERATION (Function Chart Voltage)

The following chart illustrates gas heat operation. If the unit is less condenser heat, refer to only the bottom two functions as noted in chart. The ambient limits and safety controls must close for unit to function.



Condenser Heat On

1 - Compressor 1 operation energizes K30 which locks out second stage of gas heat and permits condenser heat. At 7.5 volts K74 closes to activate condenser heat. No. 1 outdoor fan also stops. K74 opens at 11.5 volts to shut off condenser heat.
2 - At 6 volts "H1" switch closes to energize discriminator (damper relay) and drive outdoor dampers to minimum position. "H1" opens at 10 volts.
3 - At 4.5 volts "H2" switch closes to actuate the first stage of gas heat. "H2" opens at 8.5 volts to shut off burner.

Condenser Heat Off

1 - At 7.5 volts K74 closes to energize discriminator (damper relay) and drive outdoor dampers to minimum position. K74 is used only with condenser heat. K74 opens at 11.5 volts.
2 - At 6 volts "H1" switch closes to actuate the first stage of gas burner. "H1" opens at 10 volts.
3 - At 4.5 volts "H2" switch closes to activate the second stage of gas burner. "H2" opens at 8.5 volts.

IV - SAFETY MONITORING CONTROLS

Although the heating command signal calls for heat, the following controls affect unit operation.

1 - *Descriptions of S8 thru S12*

These switches terminate burner operation when temperatures or pressures exceed their set points. Refer to "Component" section on page 24 for a detailed description.

2 - *Low Temperature Limit*

The low temperature limit (S42) and low temperature relay (K72) opens the circuit to the second stage of burner when the outside temperature rises above control set point (adjustable 10° to 40°F). Refer to Figures 24 & 26 on pages 18 & 20 for locations.

3 - *Upper Temperature Limit*

The upper temperature limit (S43) and upper temperature relay (K73) terminate all gas heating when temperatures rise above 75°F (23,9°C). Refer to Figures 24 & 26 on pages 18 & 20 for locations.

4 - *Time Delays*

On gas units with R4795D primary control, DL8 delays entire burner operation for 5 seconds to prevent lockout due to short cycling. DL9 delays the start of second stage gas for 5 minutes. Refer to Figure 24 on page 18.

V - INITIAL GAS START-UP

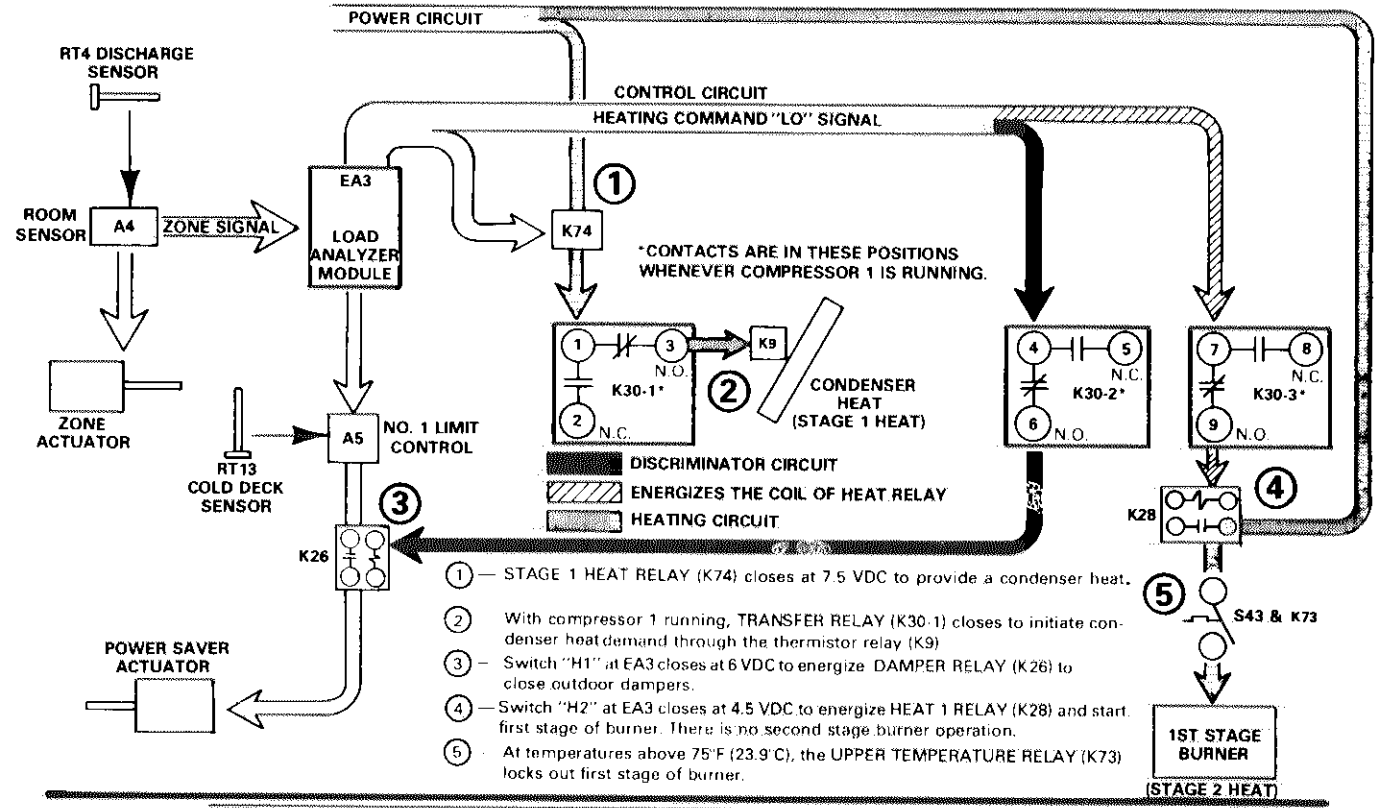
A - Leak Checking

Check all piping connections for gas leaks. Use a soap solution or other preferred means. Do not use matches, candles, flame or other sources of ignition to check for gas leaks.

Refer to the following procedure to check gas valves:

1 - Turn off power to unit so that valve closes and gas pressure is upstream.
2 - Close manual shut-off valve.
3 - Place a "B" valve (field provided) on downstream side of valve.
4 - Connect a hose from "B" valve to a bottle of water.
5 - Close manual test valve (C.G.A. units only).
6 - Open manual shut-off valve.
7 - Open the "B" valve and watch for water bubbles. A maximum of 7 bubbles per minute is allowed, based on 1/4" (6 mm) tubing. If more, replace gas valve.
8 - Repeat leak check for each valve. If necessary add jumpers at terminal strip above burner to open gas valves upstream of valve being checked.

GAS HEAT OPERATION WITH CONDENSER HEAT ON



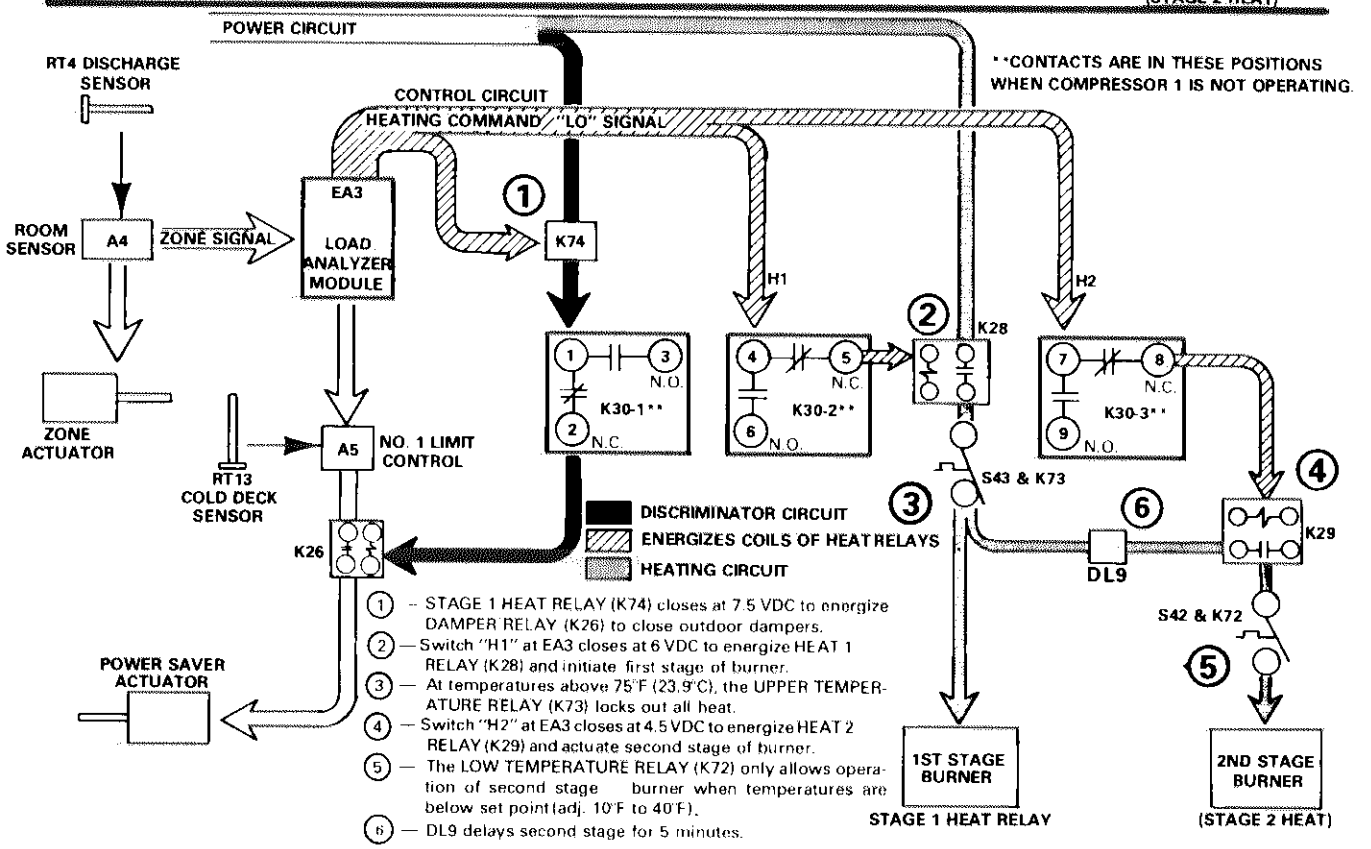
1 — STAGE 1 HEAT RELAY (K74) closes at 7.5 VDC to provide a condenser heat.

2 With compressor 1 running, TRANSFER RELAY (K30-1) closes to initiate condenser heat demand through the thermistor relay (K9)

3 — Switch "H1" at EA3 closes at 6 VDC to energize DAMPER RELAY (K26) to close outdoor dampers.

4 — Switch "H2" at EA3 closes at 4.5 VDC to energize HEAT 1 RELAY (K28) and start first stage of burner. There is no second stage burner operation.

5 At temperatures above 75°F (23.9°C), the UPPER TEMPERATURE RELAY (K73) locks out first stage of burner.



1 — STAGE 1 HEAT RELAY (K74) closes at 7.5 VDC to energize DAMPER RELAY (K26) to close outdoor dampers.

2 — Switch "H1" at EA3 closes at 6 VDC to energize HEAT 1 RELAY (K28) and initiate first stage of burner.

3 — At temperatures above 75°F (23.9°C), the UPPER TEMPERATURE RELAY (K73) locks out all heat.

4 — Switch "H2" at EA3 closes at 4.5 VDC to energize HEAT 2 RELAY (K29) and actuate second stage of burner.

5 — The LOW TEMPERATURE RELAY (K72) only allows operation of second stage burner when temperatures are below set point (adj. 10°F to 40°F).

6 — DL9 delays second stage for 5 minutes.

GAS HEAT OPERATION WITH CONDENSER HEAT OFF

FIGURE 41

TABLE 5
GAS PRESSURE VALUES

BURNER		LINE PRESSURE				+PILOT REGULATOR		MAIN REGULATOR			
Btuh	Kcal/hr.	Natural		Propane		"w.c.	mm w.c.	Natural		Propane	
		"w.c.	mm w.c.	"w.c.	mm w.c.			"w.c.	mm w.c.	"w.c.	mm w.c.
275,000	69 300	6	152	---	---	4	101	3.5	88,9	---	---
350,000	88 200	6	152	11	279	4	101	3.5	88,9	9	228
500,000	126 000	6	152	11	279	4	101	3.5	88,9	9	228
*700,000	176 400	6	152	11	279	4	101	3.5	88,9	9	228
†850,000	214 200	6	152	11	279	4	101	3.5	88,9	9	228

*(2) 350,000 Burners
†(1) 350,000 Burner and (1) 500,000 Burner.
+Natural Gas Only.

9 - Remove all jumpers and "B" valves and restore unit to operating condition.

B - Start-Up

1 - Close main disconnect switch on unit. Indoor blower and return air blower (if used) should start.
2 - Open gas supply line valve(s) to unit. Open burner manual main shut-off valve. Open manual pilot shut-off valve.
3 - Perform the heating check-out as instructed in this section. The primary control may lockout several times until the air is purged from gas line.

VI - GAS PRESSURE

1 - *Line Pressure* - Take the reading on line side of burner shut-off valve. Refer to Table 5 for pressure. Reading should be taken with all units operating at maximum firing rate. If high gas pressure, over 11" w.c. (279 mm w.c.) is supplied to building, a pounds to inches (kilograms to millimeters) regulator must be used to lower the pressure to the required limits.
2 - *Pilot Regulator (natural gas only)* - Refer to Table 5 for setting. Adjust setting with unit firing at maximum rate.
3 - *Main Regulator* - Refer to Figure 38 for location to take reading and Table 5 for setting. Take reading and make adjustments with unit operating at maximum firing range.

VII - PRESSURE SWITCH SETTINGS (F.I.A./F.M. UNITS ONLY)

F.I.A./F.M. approved units are equipped with a high pressure and a low pressure switch. Refer to Figure 38 of this instruction for the location of switches and to Table 6 for their set point.

TABLE 6

GAS	PRESSURE SWITCH SETTINGS			
	High		Low	
	in. w.c.	mm w.c.	in. w.c.	mm w.c.
Natural	7	177	3	76
Propane	12	304	8	203

VIII - MICRO-AMP READINGS

Check with micro-ammeter through jack provided on primary control (1 each burner). Refer to Table 7 for proper micro-amp reading.

TABLE 7
MICRO AMP READINGS

Burner		Pilot	Low Fire		High Fire	
Btu	Kcal/hr		Nat.	Prop.	Nat.	Prop.
275,000	69 300	2-3	----	----	3-5	----
350,000	88 200	2-3	2-4	----	3-5	3-5
500,000	126,000	2-3	3-5	3-5	3-5	3-5
*700,000	176 400	2-3	3-5	3-5	3-5	3-5
†850,000	214 200	2-3	3-5	3-5	3-5	3-5

*(2) 350,000 Burners.
†(1) 350,000 Burner and (1) 500,000 Burner.
NOTE - For pilot readings, close burner manifold shut-off valve to hold burner in pilot position.

IX - MINIMUM BLOWER HORSEPOWER REQUIREMENTS

Table 8lists the minimum horsepower requirements per size burner as required by A.G.A.

TABLE 8
A.G.A. MINIMUM H.P. ON BLOWERS

Gas Input (Btuh)	Minimum Supply Air Blower Motor Required	*Minimum Return Air Blower Motor Required
350,000	5 hp	1-1/2 hp
500,000	5 hp	1-1/2 hp
700,000	7-1/2 hp	3 hp
850,000	10 hp	3 hp

*Return air blower is optional and not required in all applications.

X - HEATING CHECK-OUT USING LOAD SIMULATOR

Connect the load simulator as shown in Figure 30 on page 31. The following procedure will check the heating logic relays at the load analyzer module.

1 - If the unit is equipped with condenser heat and discriminator, install a jumper between the 24 VDC (+) terminal and any zone terminal to provide a cooling demand. See Figure 42.
2 - Connect DC voltmeter negative lead to 24 VDC (—) terminal and positive lead to "LO" terminal to obtain heating command signal.
3 - Connect test lights to the heating logic relays and No. 8 terminal of TB-C terminal strip. For ease in installing test lights, we recommend making a harness as shown in Figure 42.
4 - Refer to function chart. Slowly rotate load simulator while observing voltmeter. As the load simulator lowers the heating command input voltage, the heating logic relays will respond according to the function chart sequence of operation. Observe test lights to verify switching action and then check mechanical operation of unit.
5 - Slowly reverse rotation of load simulator until output voltage reaches 12. The heating logic relays will open according to the chart.
6 - Remove jumpers (if used). Disconnect load simulator, test lights and DC voltmeter from the load analyzer module. Reconnect the negative and positive wires to the correct 24 VDC terminals.

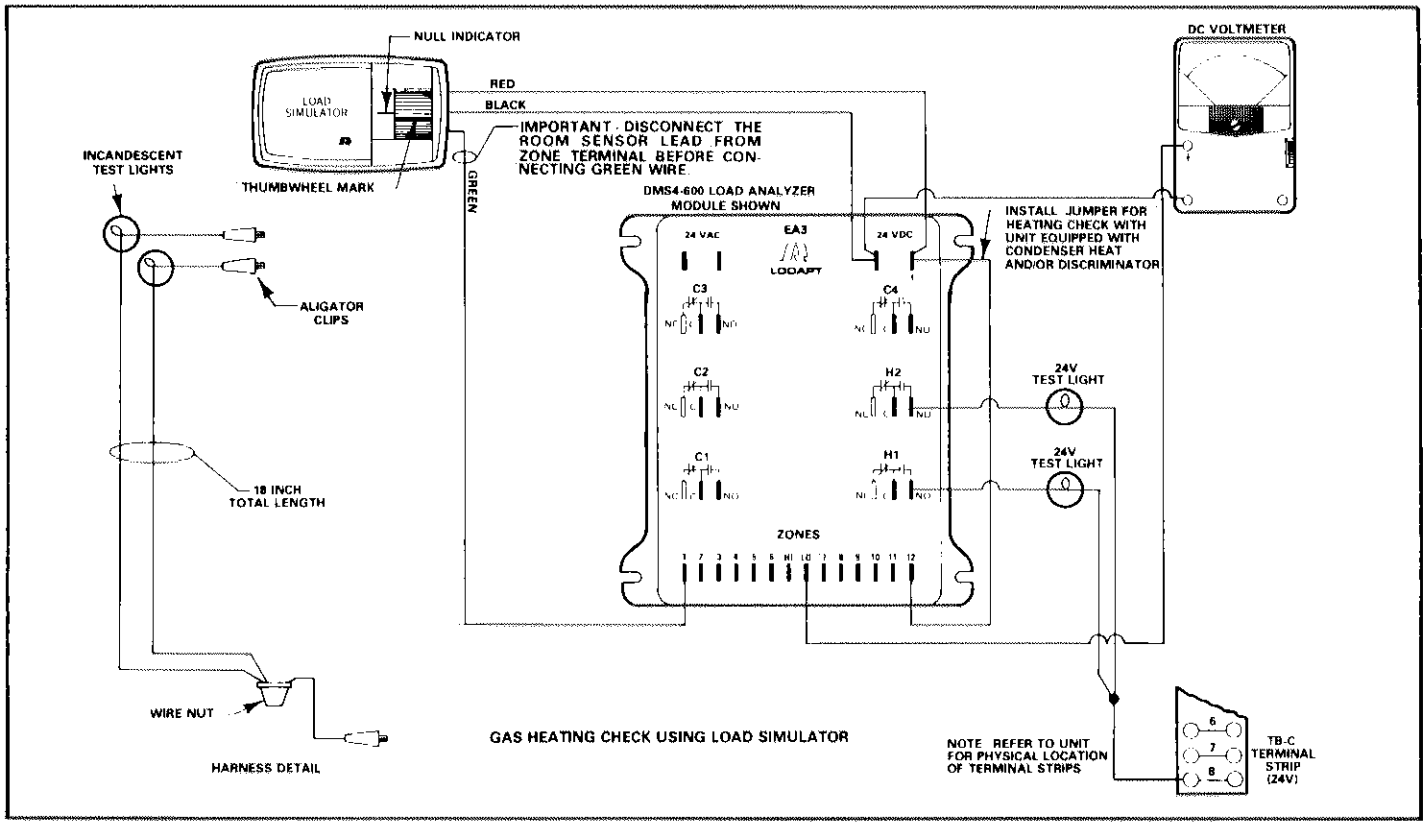

NULL INDICATOR
LOAD SIMULATOR
THUMBWHEEL MARK
RED
BLACK
GREEN
IMPORTANT - DISCONNECT THE ROOM SENSOR LEAD FROM ZONE TERMINAL BEFORE CONNECTING GREEN WIRE.
DC VOLTMETER
INCANDESCENT TEST LIGHTS
ALIGATOR CLIPS
18 INCH TOTAL LENGTH
WIRE NUT
HARNESS DETAIL
DMS4-600 LOAD ANALYZER MODULE SHOWN
24 VAC
EA3
LOADAPT
24 VDC
C3
C4
C2
H2
C1
H1
ZONES
INSTALL JUMPER FOR HEATING CHECK WITH UNIT EQUIPPED WITH CONDENSER HEAT AND/OR DISCRIMINATOR
24V TEST LIGHT
24V TEST LIGHT
NOTE: REFER TO UNIT FOR PHYSICAL LOCATION OF TERMINAL STRIPS
TB-C TERMINAL STRIP (24V)
GAS HEATING CHECK USING LOAD SIMULATOR

FIGURE 42

ELECTRIC HEAT

I - ELECTRIC HEAT SECTION

Figure 43 identifies the electric heat section for DMS4-185/275/300/360 units and Figure 44 identifies the DMS4-415/600.

II - HEATING CAPACITY

Table10lists the number of elements available and gives the corresponding Btuh value based on the voltage.

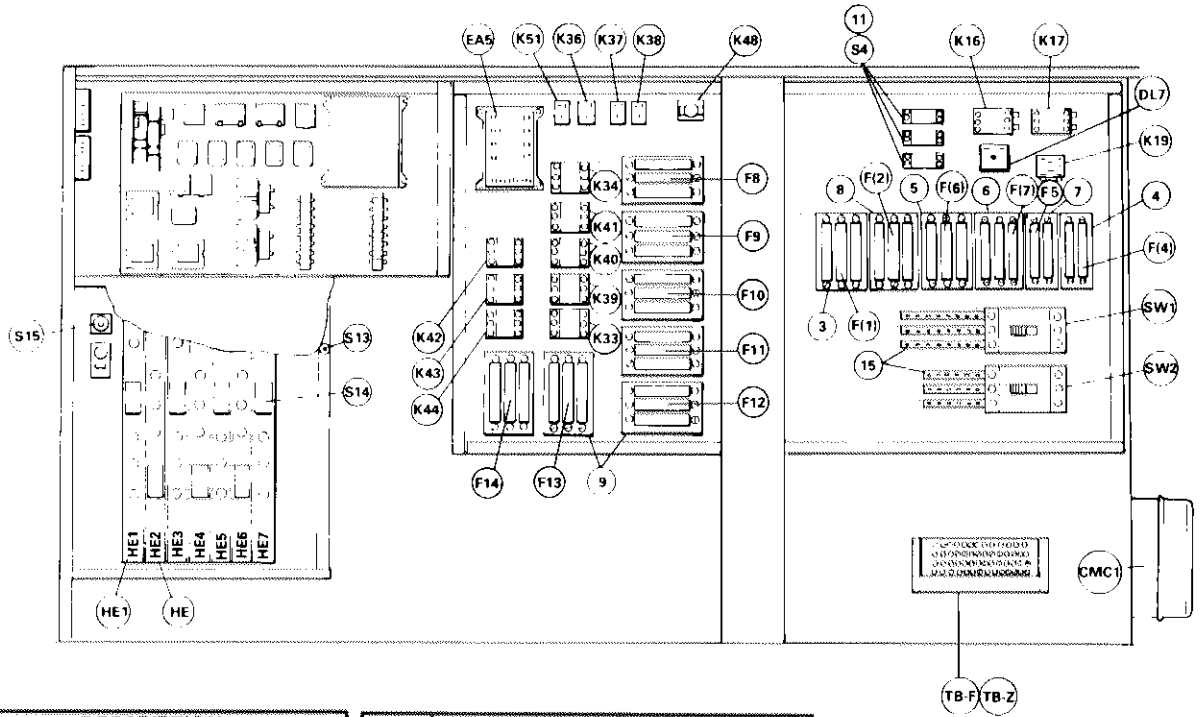
In addition to the EA3 load analyzer module, an EA5 electric heat sequencer is used to step the elements. The EA5 responds to the same heating command signal as the EA3; so consequently, the heating logic relays function the same. Table 9 lists the number of elements controlled by each switch of the EA5.

NOTE - A 7.5 KW load (1/2 of element #1) is connected to sequencer switches H1 and H2.

TABLE 9

TOTAL NUMBER OF ELEMENTS	ELEMENTS PER SEQUENCER SWITCH				
	H1	H2	H3	H4	H5
3	1/2	1/2	1	1	----
4	1/2	1/2	1	2	----
5	1/2	1/2	1	2	1
6	1/2	1/2	1	2	2
7	1/2	1/2	1	2	3
8	1/2	1/2	1	2	4
9	1/2	1/2	1	2	5
10	1/2	1/2	1	3	5

DMS4-185, -275, -300 AND -360 SERIES ELECTRICAL CONTROL BOX



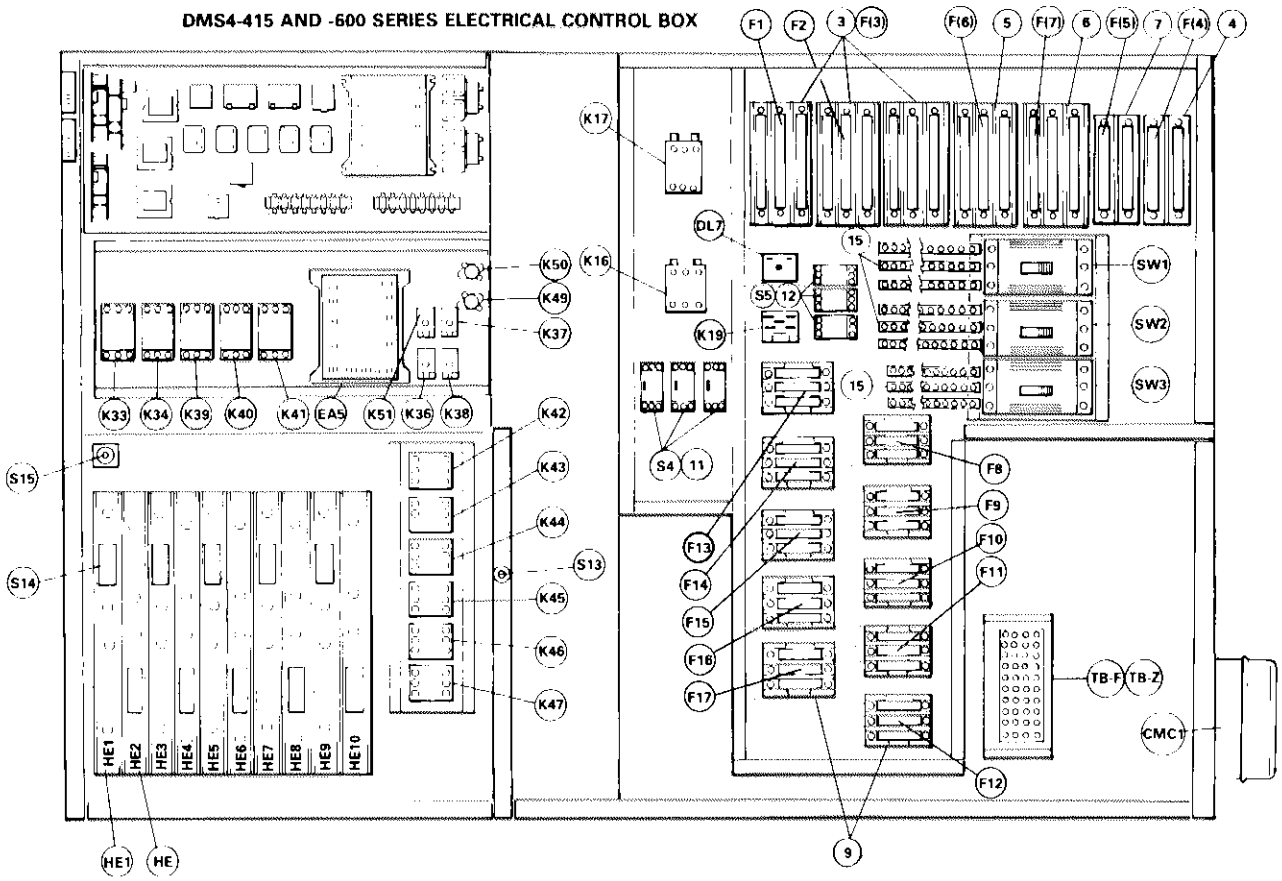
KEY	DESCRIPTION
CMC1	clock timer
DL7	relay - blower dly (smoke detection)
EA5	module - elec. ht. load sequencer
F (1)	fuse - compressor 1
F (2)	fuse - compressor 2
F (4)	fuse - compressor control
F (5)	fuse - transformer
F (6)	fuse - indoor blower
F (7)	fuse - R.A. blower
F (8)	fuse - element #1
F (9)	fuse - element #2
F (10)	fuse - element #3
F (11)	fuse - element #4
F (12)	fuse - element #5
F (13)	fuse - element #6
F (14)	fuse - element #7
HE	element - elec. heat
HE1	element - elec. heat (stage 1 only)

KEY	DESCRIPTION
K16	contactor - main blower
K17	contactor - R.A. blower
K19	relay - shutdown (smoke detector)
K33	contactor - element 1 (stage 1)
K34	contactor - element 1 (stage 2)
K36	relay - discrim. H1
K37	relay - discrim. H2
K38	relay - discrim. H5
K39	contactor - element 2
K40	contactor - element 3
K41	contactor - element 4
K42	contactor - element 5
K43	contactor - element 6
K44	contactor - element 7
K48	relay - element 7 delay
K51	relay - discrim. latch
S4	relay - overload main blower
S13	switch - door interlock

KEY	DESCRIPTION
S14	limit safety
S15	limit - hi
SW1	switch - disconnect
SW2	switch - disconnect
TB-F	block - terminal (F) (readout)
TB-Z	block - terminal (Z) room sensor
3	fuse block - compressor
4	fuse block - compressor control
5	fuse block - main blower
6	fuse block - R.A. blower
7	fuse block - transformer
8	fuse block - compressor
9	fuse block - electric heat
11	heater - overload main blower
15	buss bar

FIGURE 43

DMS4-415 AND -600 SERIES ELECTRICAL CONTROL BOX



KEY	DESCRIPTION
CMC1	clock timer
DL7	relay - blower dly (smoke detection)
EA5	module - elec. ht. load sequencer
F (1)	fuse - compressor 1
F (2)	fuse - compressor 2
F (3)	fuse - compressor 3
F (4)	fuse - compressor control
F (5)	fuse - transformer
F (6)	fuse - indoor blower
F (7)	fuse - R.A. blower
F (8)	fuse - element #1
F (9)	fuse - element #2
F (10)	fuse - element #3
F (11)	fuse - element #4
F (12)	fuse - element #5
F (13)	fuse - element #6
F (14)	fuse - element #7
F (15)	fuse - element #8
F (16)	fuse - element #9
F (17)	fuse - element #10
HE	element - electric heat

KEY	DESCRIPTION
HE1	element - elec. heat (stage 1 only)
K16	contactor - main blower
K17	contactor - R.A. blower
K19	relay - shutdown (smoke detector)
K33	contactor - element 1 (stage 1)
K34	contactor - element 1 (stage 2)
K36	relay - discrim. H1
K37	relay - discrim. H2
K38	relay - discrim. H5
K39	contactor - element 2
K40	contactor - element 3
K41	contactor - element 4
K42	contactor - element 5
K43	contactor - element 6
K44	contactor - element 7
K45	contactor - element 8
K46	contactor - element 9
K47	contactor - element 10
K49	relay - element 10 delay
K50	relay - element 7-8-9 delay
K51	relay - discrim. latch

KEY	DESCRIPTION
S4	relay - overload main blower
S5	relay - overload R.A. blower
S13	switch - door interlock
S14	limit - safety
S15	limit - hi
SW1	switch - disconnect
SW2	switch - disconnect
SW3	switch - disconnect
TB-F	block - terminal (F) (readout)
TB-Z	block - terminal (Z) room sensor
3	fuse block - compressor
4	fuse block - compressor control
5	fuse block - main burner
6	fuse block - R.A. blower
7	fuse block - transformer
9	fuse block - electric heat
11	heater - overload main blower
12	heater - overload R.A. blower
15	buss bar

FIGURE 44

TABLE 10

ELECTRIC HEAT RATINGS					
Elements	**Volts Input**	**208V**	**220/240V**	**440/480V**	**550/600V**
*3	KW Input	33.8	37.7/45.0	37.7/45.0	37.7/45.0
	Btuh Output	115,300	128,000/153,500	128,000/153,500	128,000/153,500
	Kcal/hr. Output	29 055	32 256/38 682	32 256/38 682	32 256/38 682
4	KW Input	45.0	50.5/60.0	50.5/60.0	50.5/60.0
	Btuh Output	153,500	169,800/204,600	169,800/204,600	169,800/204,600
	Kcal/hr. Output	38 682	42 790/51 559	42 790/51 559	42 790/51 559
5	KW Input	56.3	63.0/75.0	63.0/75.0	63.0/75.0
	Btuh Output	191,800	212,300/255,800	212,300/255,800	212,300/255,800
	Kcal/hr. Output	48 334	53 499/64 462	53 499/64 462	53 499/64 462
6	KW Input	67.5	75.6/90.0	75.6/90.0	75.6/90.0
	Btuh Output	230,200	254,700/306,900	254,700/306,900	254,700/306,900
	Kcal/hr. Output	58 010	64 184/77 339	64 184/77 339	64 184/77 339
7	KW Input	78.8	88.4/105.0	88.4/105.0	88.4/105.0
	Btuh Output	268,500	297,000/358,000	297,000/358,000	297,000/358,000
	Kcal/hr. Output	67 662	74 844/90 216	74 844/90 216	74 844/90 216
†8	KW Input	90.0	101.0/120.0	101.0/120.0	101.0/120.0
	Btuh Output	306,900	339,600/409,200	339,600/409,200	339,600/409,200
	Kcal/hr. Output	77 338	85 579/103 118	85 579/103 118	85 579/103 118
†9	KW Input	101.3	113.6/135.0	113.6/135.0	113.6/135.0
	Btuh Output	345,300	382,100/460,400	382,100/460,400	382,100/460,400
	Kcal/hr. Output	87 016	96 289/116 021	96 289/116 021	96 289/116 021
†10	KW Input	112.5	----	126.1/150.0	126.1/150.0
	Btuh Output	383,600	----	424,500/511,500	424,500/511,500
	Kcal/hr. Output	96 667	----	106 974/128 898	106 974/128 898

*DMS4-185/275/300/360 units only.
†DMS4-415/600 units only.

III - FUNCTION CHART

The following chart illustrates electric heat operation. The "H1" switch at the EA3 brings on condenser heat (if used) while the "H" switches on EA5 control element stepping.

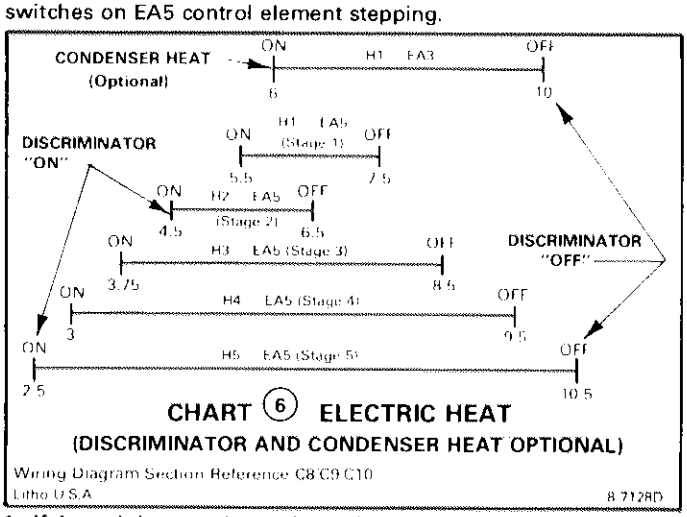


CHART ⑥ ELECTRIC HEAT

(DISCRIMINATOR AND CONDENSER HEAT OPTIONAL)

Wiring Diagram Section Reference C8 C9 C10
Litho U.S.A. 8 712RD

1 - If the unit has condenser heat, the "H1" switch on the EA3 load analyzer module closes at 6 volts to actuate condenser heat (providing that compressor #1 is operating). The switch opens at 10 volts to shut off condenser heat.

2 - At 5.5 volts the "H1" switch on EA5 sequencer closes to bring on the first step of electric heat. The switch opens at 7.5 volts to de-energize the first step.

3 - The remaining four switches at the EA5 sequencer actuate and de-energize their heating elements at the voltages indicated on the function chart.

4 - The discriminator (if used) is activated by the closing of "H2" switch at 4.5 volts or "H5" switch at 2.5 volts to drive outdoor air dampers to minimum position. The discriminator remains activated until the "H1" switch at load analyzer module opens at 10 volts or until the "H5" switch at EA5 opens at 10.5 volts. For detailed information of electric heat with discriminator, refer to "Sequence of Operation" within this section.

IV - SEQUENCE OF OPERATION

In addition to the EA3 and EA5 modules a number of relays and limit controls affect electric heat operation. Figure 45 illustrates a control chart for a ten element unit.

A - Condenser Heat (if used)

On the initial heating demand, condenser heat is utilized first before strip heat. After "H1" closes, K9 switches the thermistors into condenser heat. Compressor 1 must run, however, before the heat can be reclaimed.

B - Discriminator (if used)

After "H2" closes, the discriminator option closes the outdoor dampers to terminate power saver. Cooling requirements are satisfied with mechanical cooling and compressor 1 is energized.

The following sequence details the discriminator functions with electric heat:

1 - As "H2" on EA5 closes, discriminator H2 relay (K37) energizes both damper relay (K26) and discriminator latch relay (K51). The outdoor dampers close.

2 - The K51 latching circuit then transfers K26 control on to discriminator H1 relay (K36). The outdoor dampers remain closed until "H1" contacts on EA3 open.

3 - As "H5" on EA5 closes, discriminator H5 relay (K38) takes control of K26 and keeps outdoor dampers closed until "H5" opens.

C - Limit Controls and Door Interlock

The door interlock switch (S13) assures that element access panel is in place before electric heat can energize. The hi limit control (S15) stops all electric heat when temperatures exceed the fixed setting. Each element is equipped with a safety limit (S14) which must be manually reset. Figure 46 demonstrates how to reset this back-up limit.

D - Electric Heat Lockout

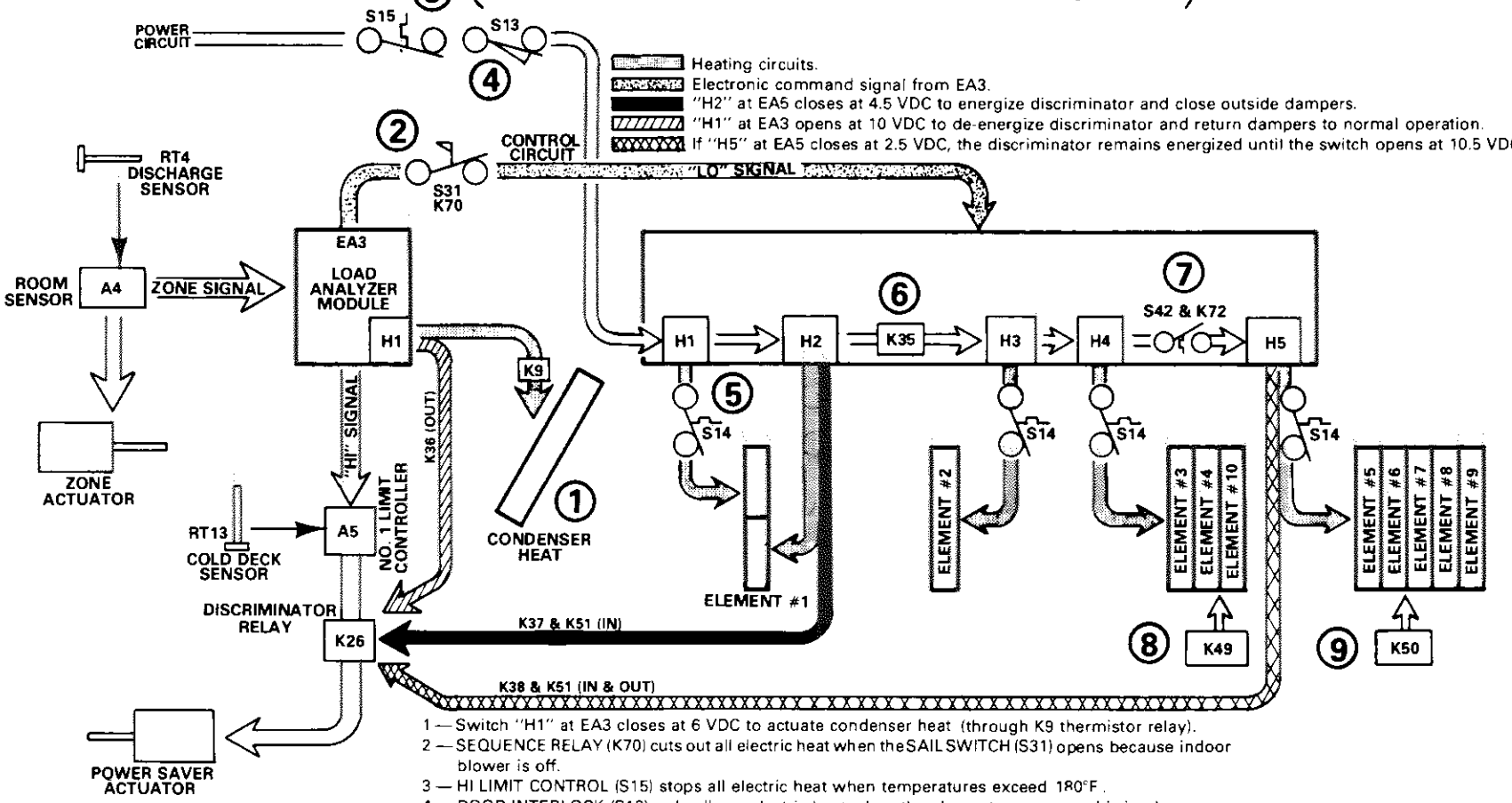
The electric heat lockout relay (K35) de-energizes all the elements except no. 1 whenever compressor no. 1 is running. This relay thus balances the load between electric elements and compressors to prevent overloading the main switch.

E - Sequence Relay

The sequence relay (K70) is energized by the indoor blower sail switch (S31). It terminates electric heat whenever the indoor blower is off. It provides a sequenced start of electric heat.

TYPICAL ELECTRIC HEAT OPERATION

(ILLUSTRATING A TEN ELEMENT UNIT WITH CONDENSER HEAT AND DISCRIMATOR



1 — Switch "H1" at EA3 closes at 6 VDC to actuate condenser heat (through K9 thermistor relay).
2 — SEQUENCE RELAY (K70) cuts out all electric heat when the SAIL SWITCH (S31) opens because indoor blower is off.
3 — HI LIMIT CONTROL (S15) stops all electric heat when temperatures exceed 180°F.
4 — DOOR INTERLOCK (S13) only allows electric heat when the element access panel is in place.
5 — Each element has a SAFETY LIMIT (S14) which opens when temperatures exceed 300°F. This switch must be manually reset.
6 — ELECTRIC HEAT LOCKOUT RELAY (K35) cuts out all but no. 1 element when compressor 1 is running.
7 — LO TEMPERATURE RELAY (K72) locks out the last bank of elements at temperatures above set point.
8 — K49 delays element #10 for 40 seconds.
9 — K50 delays elements #7 & 8 for 25 seconds and #9 for 40 seconds.

FIGURE 45

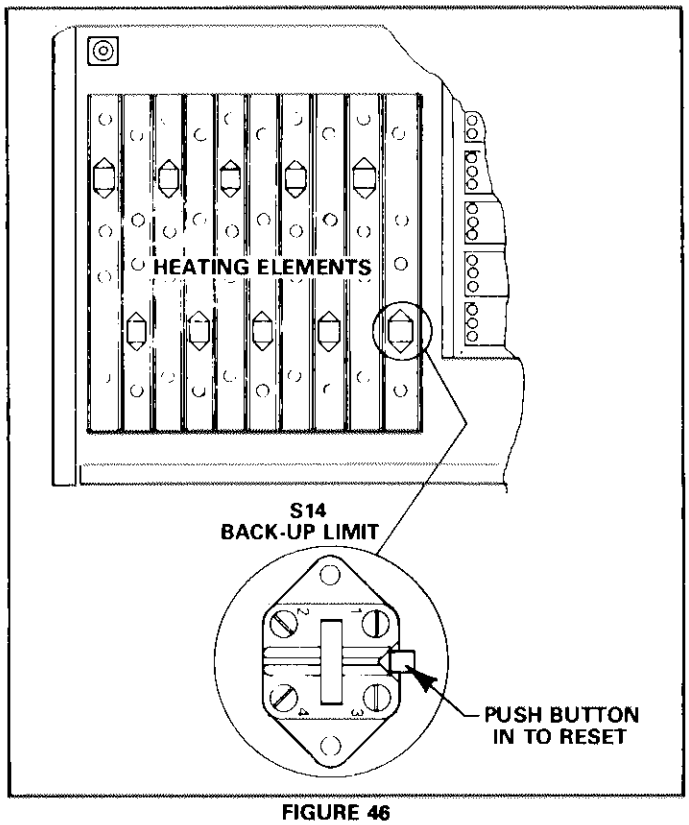


FIGURE 46

F - Low Temperature Limit

The low temperature limit (S42) and low temperature relay (K72) lock out all the elements controlled by "H5" on EA5 when the outside temperature rises above control set point (adjustable 10° to 40°F). Refer to Figures 24 & 26 on pages 18 & 20 for locations.

V - INITIAL ELECTRIC HEAT START-UP

1 - Close main disconnect switch on unit. Indoor blower and return air blower (if used) should start.
2 - Perform the heating check-out as instructed in this section.
3 - Provide a full heating demand to energize all the elements. Using a clamp-on ammeter, check amperage draw of each wiring lead from the heater contactors to the heater elements. All leads should measure approximately the same amperage draw. If so, all heater elements are operating satisfactory. If a wiring lead does not register a reading, it indicates that the element is not operating and should be checked.

VI - HEATING CHECK-OUT USING LOAD SIMULATOR

Connect the load simulator as shown in Figure 30 on page 31. The following procedure will check the heating logic relays at the load analyzer and sequence modules.

1 - If the unit is equipped with condenser heat and/or discriminator, install a jumper between the 24 VDC (+) terminal and any zone terminal to provide a cooling demand. See Figure 47.
2 - Connect DC voltmeter negative lead to 24 VDC (—) terminal and positive lead to "LO" terminal to obtain heating command signal.
3 - Connect test lights to the heating logic relays and No. 6 terminal of TB-D terminal strip. For ease in installing test lights, we recommend making a harness as shown in Figure 47.
4 - Refer to function chart. Slowly rotate load simulator while observing voltmeter. As the load simulator lowers the heating command input voltage, the heating logic relays will respond according to the function chart sequence of operation. Observe test lights to verify switching action and then check mechanical operation of unit.
5 - Slowly reverse rotation of load simulator until output voltage reaches 12. The heating logic relays will open according to the chart.
6 - Remove jumper (if used). Disconnect load simulator, test lights and DC voltmeter from the load analyzer module. Reconnect the negative and positive wires to the correct 24 VDC terminals.

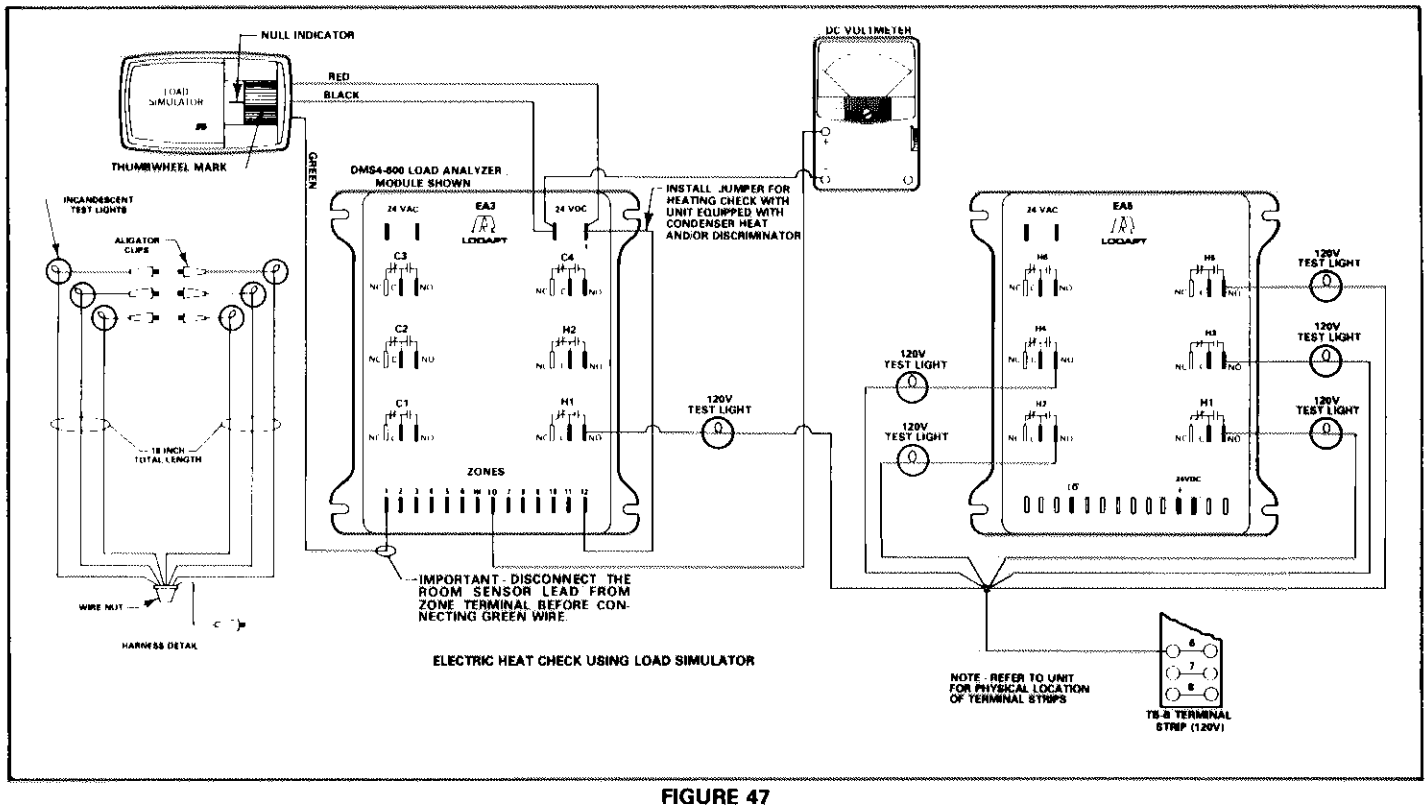


FIGURE 47

HOT WATER AND STEAM HEAT

I - HOT WATER AND STEAM HEAT SECTIONS

Figures 48 and 49 illustrate the DMS4 hot water and steam sections. The motorized valve is secured to a support bracket for shipping. Remove the two bolts as shown.

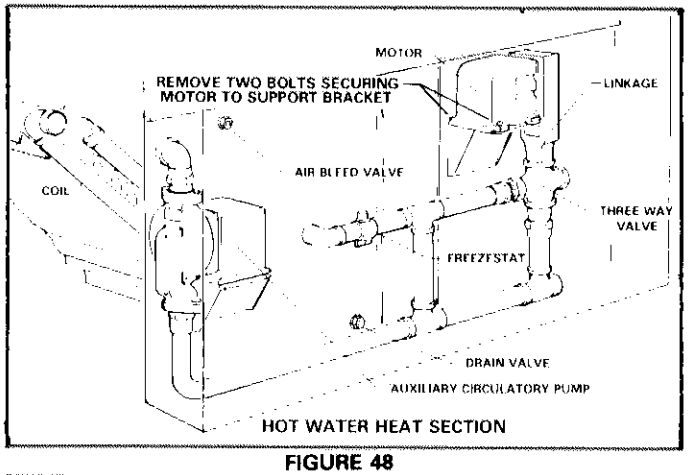


FIGURE 48

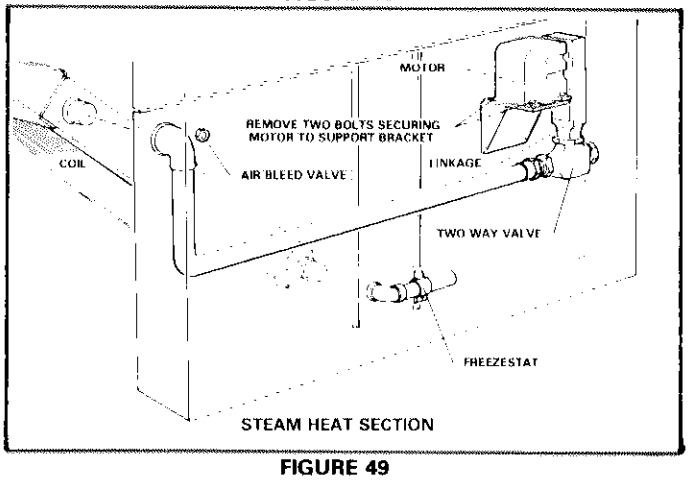
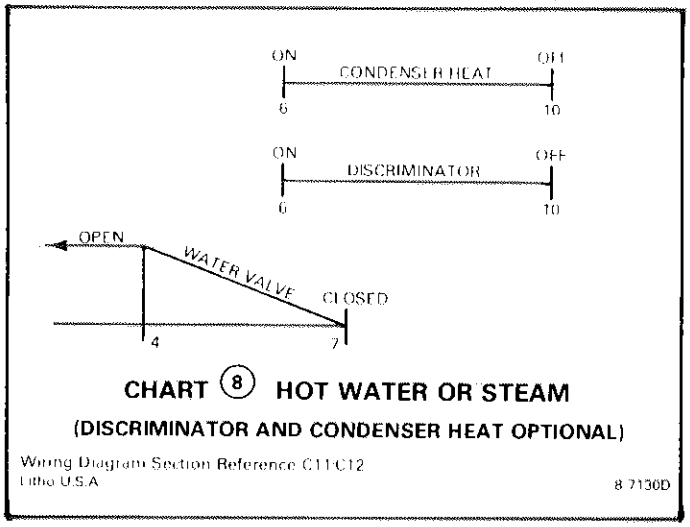


FIGURE 49

II - FUNCTION CHART

The following chart illustrates hot water and steam operation.



1 - Switch "H1" on EA3 controls condenser heat and load discriminator operation. The command signal from the "LO" terminal controls valve modulation.

2 - At 6 volts "H1" closes to energize condenser heat and load discriminator which drives outdoor air dampers to minimum position. The switch opens at 10 volts.

3 - At 7 volts or higher there is no flow through coil.

4 - The valve modulates open upon a voltage decrease and is fully open at 4 volts.

III - SEQUENCE OF OPERATION

In addition to the EA3 module other controls affect unit operation.

A - Freezestat

The freezestat thermostat (S40) energizes the freezestat relay (K53) at coil manifold temperatures below set point and opens the valve and runs optional pump motor to prevent freezing.

B - Upper Temperature Limit

The upper temperature thermostat (S43) energizes the upper temperature relay (K73) and stops hot water and steam operation when outside temperature rises above 75°F.

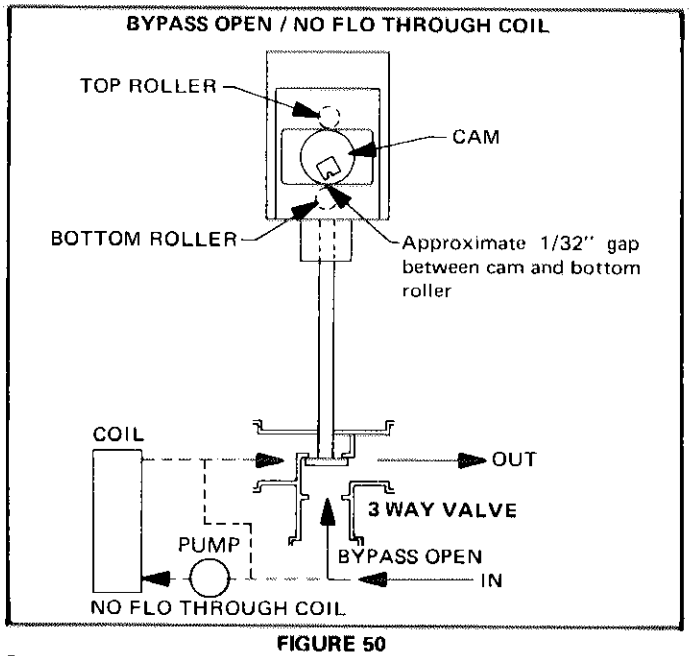


FIGURE 50

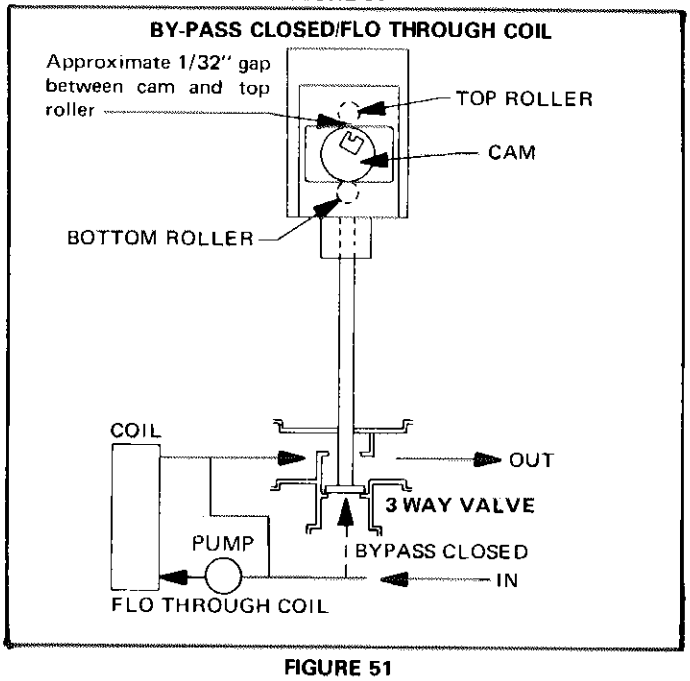


FIGURE 51

IV - CHECKING VALVE

A - Hot Water Coil

1 - Close main disconnect switch on unit.
2 - Remove wire from LO terminal on EA3. Put jumper across C and F terminals on motor. Motor should rotate clockwise lifting valve stem. Refer to Figure 50.
   a - At end of stroke, notch in motor shaft should be down, but at an angle 10° to right of vertical.
   b - The motor should be free to run its complete stroke.
   c - With the valve in this position, the by-pass line is open and flow to the coil is closed.
3 - Remove the jumper installed in step 2. Motor shaft should rotate counterclockwise, lowering valve stem. Refer to Figure 51.
   a - At end of stroke, notch in motor shaft should be up, but at an angle 10° to right of vertical.
   b - With the valve in this position, the by-pass line is closed and water will flow through the coil.
4 - Remove jumper from terminals C and F on motor. Reconnect wire to LO terminal on EA3.

B - Steam Coil

1 - Close main disconnect switch on unit.
2 - Remove wire from LO terminal on EA3. Put jumper across C and F terminals on motor. Motor shaft should rotate counterclockwise, lowering valve stem. Refer to Figure 52.
   a - At end of stroke, notch in motor shaft should be up, but at an angle 10° to right of vertical.
   b - With the valve in this position, the valve is closed and flow to the coil is closed.
3 - Remove the jumper installed in step 2. Motor should rotate clockwise lifting valve stem. Refer to Figure 53.
   a - At end of stroke, notch in motor shaft should be down, but at an angle 10° to right of vertical.
   b - The motor should be free to run its complete stroke.
   c - With the valve in this position, the valve is open and steam will flow to the coil.
4 - Remove jumper from terminals C and F on motor. Reconnect wire to LO terminal on EA3.

V - HEATING CHECK-OUT USING LOAD SIMULATOR

Connect the load simulator as shown in Figure 30 on page 31. The following procedure will check the heating logic relays and the "LO" signal at the load analyzer module.

1 - If the unit is equipped with condenser heat and/or discriminator, install a jumper between the 24 VDC (+) terminal and any zone terminal to provide a cooling demand. See Figure 54.
2 - Connect DC voltmeter negative lead to 24 VDC (—) terminal and positive lead to "LO" terminal to obtain heating command signal. Use a double spade adapter at "LO" terminal.
3 - Connect test lights to the heating logic relays and No. 6 terminal of TB-B terminal strip.
4 - Refer to basic function chart. Slowly rotate load simulator while observing voltmeter. As the load simulator lowers the heating command input voltage, the heating logic relays will respond according to the function charts sequence of operation.
5 - Slowly reverse rotation of load simulator until output voltage reaches 12. "H1" and "H2" will open according to the chart.
6 - Remove jumper (if used). Disconnect load simulator, test lights and DC voltmeter from the load analyzer module. Reconnect the negative and positive wires to the correct 24 VDC terminals.

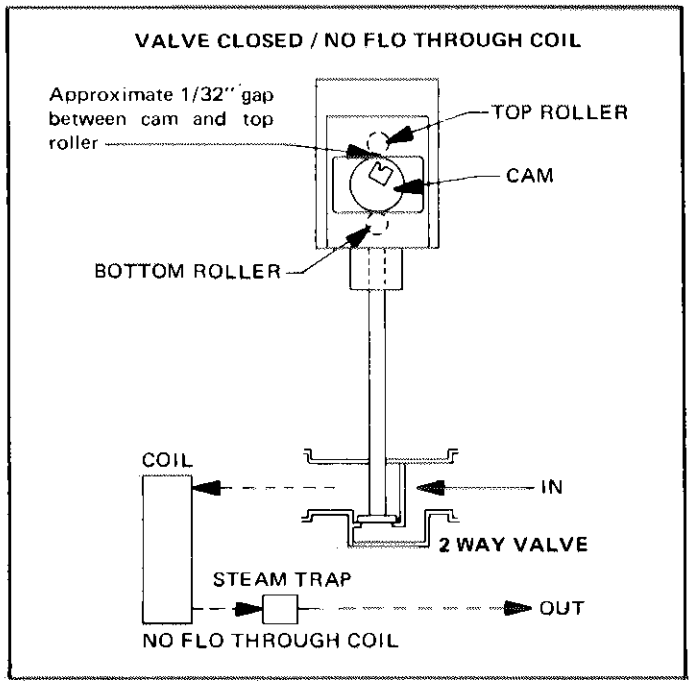


FIGURE 52

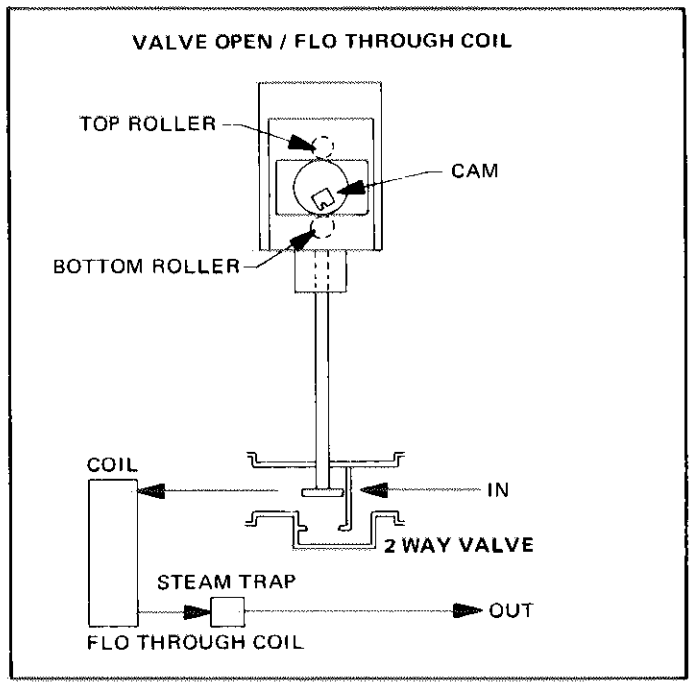


FIGURE 53

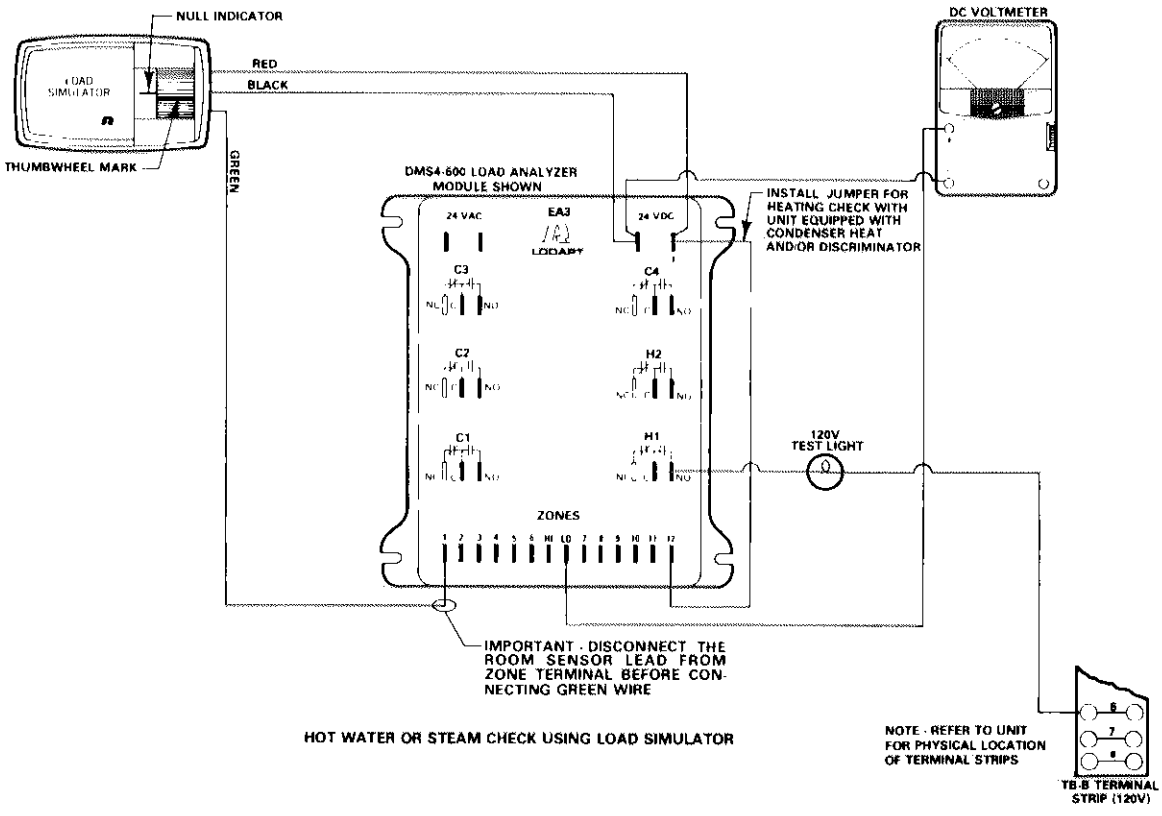

NULL INDICATOR
LOAD SIMULATOR
RED
BLACK
GREEN
THUMBWHEEL MARK
DC VOLTMETER
DMS4-600 LOAD ANALYZER MODULE SHOWN
24 VAC
EA3
LOADAPT
24 VDC
INSTALL JUMPER FOR HEATING CHECK WITH UNIT EQUIPPED WITH CONDENSER HEAT AND/OR DISCRIMINATOR
C3
C4
C2
H2
C1
H1
120V TEST LIGHT
ZONES
IMPORTANT - DISCONNECT THE ROOM SENSOR LEAD FROM ZONE TERMINAL BEFORE CONNECTING GREEN WIRE
HOT WATER OR STEAM CHECK USING LOAD SIMULATOR
NOTE - REFER TO UNIT FOR PHYSICAL LOCATION OF TERMINAL STRIPS
TB-B TERMINAL STRIP (120V)

FIGURE 54

POWER SAVER AND DISCRIMINATOR

I - POWER SAVER SECTION

Figure 55 illustrates power saver operation and identifies dampers. A DMS4-275 with smoke detection is shown.

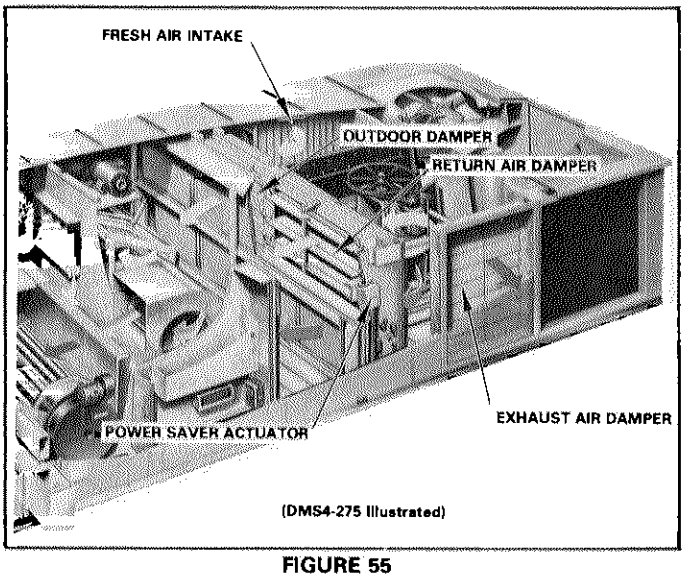


FIGURE 55

II - POWER SAVER OPERATION

A - Power Saver

Units with power saver use outside air for free cooling. During power saver operation, the outdoor air dampers open and the return air dampers close. The return air is exhausted outside. On nite setback the outdoor dampers remain in the fully closed position.

The power saver may be ordered less controls with the dampers linked for manual operation.

B - Power Saver Actuators

Either Ranco or Honeywell power saver actuators are used.

1 - *Units Less Smoke Detector*

One actuator controls outdoor and return air damper operation. These dampers open and close in reverse relationship to each other. Outside air dampers are closed at 14 VDC and open at 17 VDC.

2 - *Units With Smoke Detectors*

Two actuators control outdoor and return air damper modulation. The actuators work in reverse relationship to each other during normal power saver operation.

The outdoor damper actuator is direct acting. Return air dampers are open at 14 VDC and closed at 17 VDC.

With the presence of smoke, the blowers and dampers are controlled by 1 of 4 options as described in Figure 18 on page 13. For additional information on the smoke detectors, refer to page 36.

C - Discriminator

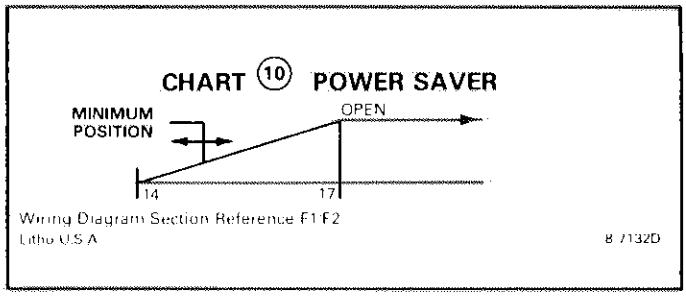
The discriminator option is used with power saver and condenser heat. It drives the outdoor dampers to minimum position when the number 1 compressor requires less energy to use than what is otherwise needed to heat the hot deck. An "H" switch at the load analyzer module activates the damper relay (K26) to initiate discriminator operation. This will occur on a demand of 15 KW for electric heat, first stage heat demand for gas heat and 30% of the heat demand for hot water and steam heat. Without outside air, cooling needs must be satisfied with DX cooling so the unit can take advantage of condenser heat. Refer to Figure 24 on page 18 to identify K26.

D - Overriding Limit

The no. 1 limit controller (A5) and cold deck power saver thermistor (RT13) modulate the outdoor air dampers to maintain a 50°F (10°C) cold deck temperature. For example if the "HI" signal from load analyzer module is 17 VDC and asks for open outdoor dampers but the cold deck temperature is already 50°F, A5 will drop the signal to 14 VDC to maintain minimum position.

A5 and RT13 do not initiate the cooling demand. Figures 23 and 24 on page 18 identify the controls.

III - Function Chart



1 - The command signal from the "HI" terminal controls actuator(s) operation and subsequent damper modulation. The reading is taken at A5 to reflect cold deck effects on the signal.

2 - At 14 VDC the outdoor dampers are closed. Minimum position is approximately 15 VDC.

3 - The outdoor dampers modulate open with a voltage increase and are fully open at 17 VDC.

IV - POWER SAVER CONTROLS

Once the command signal initiates a cooling demand, several controls affect power saver operation.

1 - *Enthalpy Control*

The enthalpy control (S18) senses both temperature and humidity or heat content of the outside air. When the heat content rises above the control set point, the outside dampers close to minimum position. Refer to Figure 26 on page 20 for location.

2 - *Morning Warm-up Control (S16)*

The morning warm-up control holds outside dampers at closed position until the return air temperature has risen above 70°F (21,1°C). Refer to Figure 26 on page 20 for location.

3 - *Power Saver Delay*

The power saver includes a delay circuit (K75, K76 & DL10) which holds the outdoor dampers closed for a period of 3 minutes after compressor 1 starts. This assures a load on compressor 1 and permits the cooling circuit to stabilize before the outdoor dampers are permitted to open. Refer to Figure 24 on page 18 for locations.

V - ADJUSTMENTS

A - Linkage Adjustment Without Smoke Detector

1 - Remove the lead from terminal (10-Ranco, TR-Honeywell) at outdoor actuator to drive outdoor dampers closed and return air dampers open. Adjust each individual damper blade separately. Refer to Figure 56 for DMS4-185, 185/275, 300 & 360 units or Figure 57 for DMS4-415 & 600 units.

2 - Reconnect the lead to terminal (10-Ranco, TR-Honeywell). Connect leads from 24 VDC terminals at EA3 load analyzer to outdoor actuator as dictated in Figure 58. Outdoor dampers will open and return dampers will close. Adjust each individual damper blade separately.

B - Linkage Adjustment With Smoke Detector

1 - Disconnect the lead from terminal (10-Ranco, TR-Honeywell) at outdoor actuator to drive outdoor dampers closed. Adjust each individual damper blade separately.

2 - Disconnect the lead from terminal (10-Ranco, TR-Honeywell) at return air actuator to drive return air dampers closed. Adjust each individual damper blade separately.

3 - Reconnect leads at both actuators.

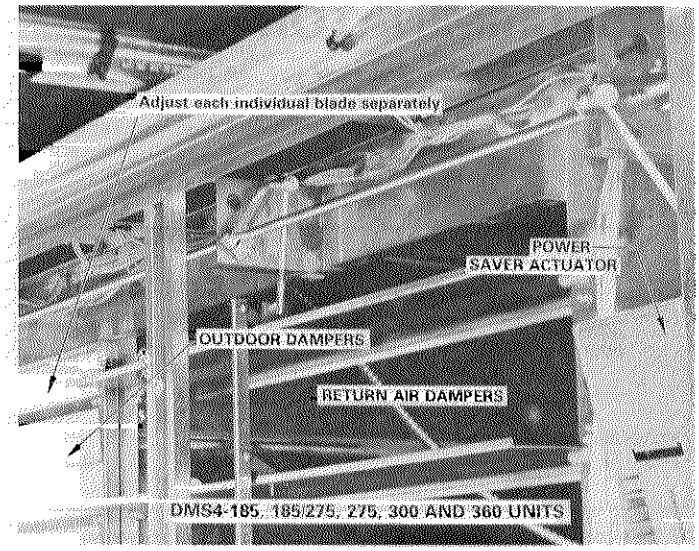


FIGURE 56

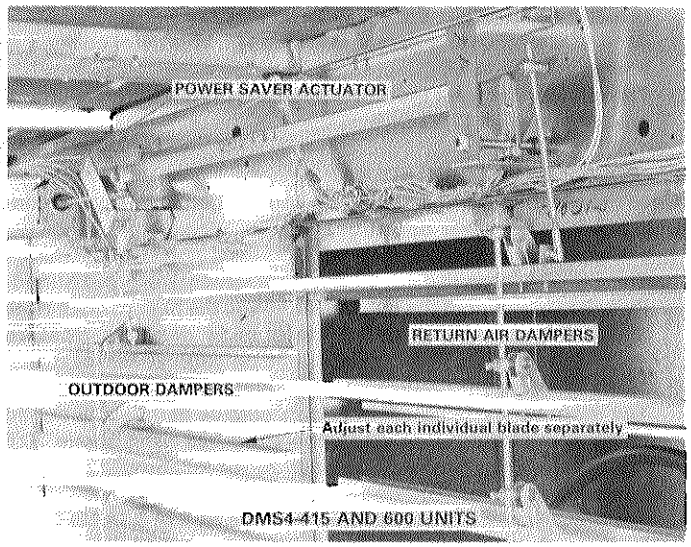


FIGURE 57

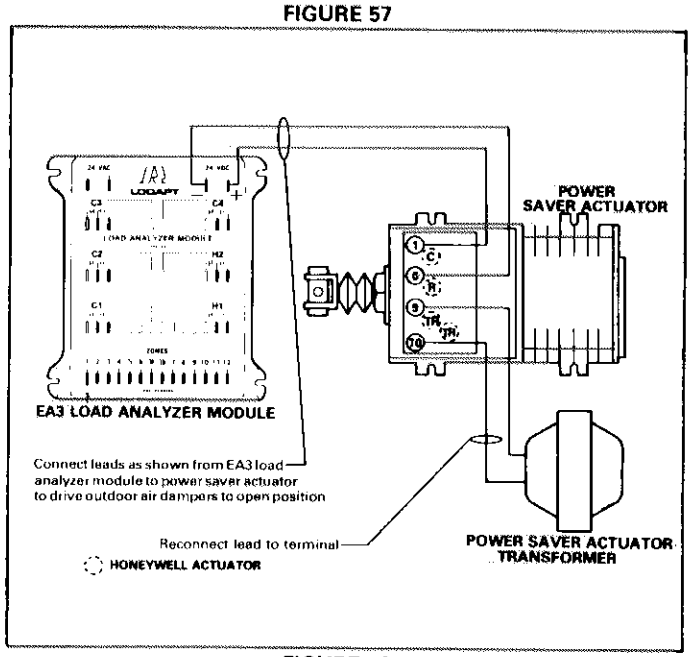
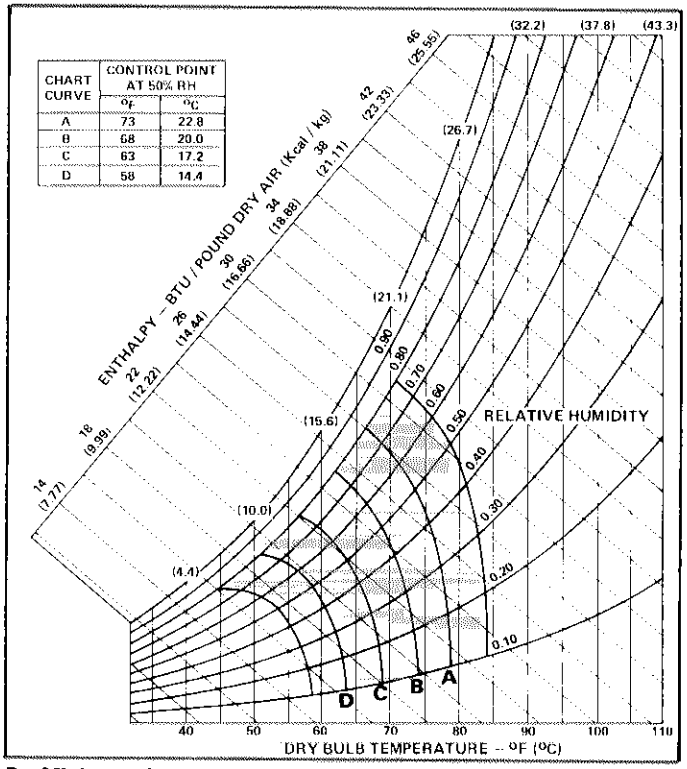


FIGURE 58

C - Enthalpy Control

The recommended set point is "A". If power saver is allowing air which is too warm or too humid to enter system, control may be changed to a lower set point. Refer to Chart A.



D - Minimum Positioner

Adjust minimum positioner with outside dampers at minimum position. Turn setting on enthalpy control to "D". Pull lead of terminal (1 - Ranco, C - Honeywell) and adjust minimum positioner control starting from damper closed position until desired minimum position is obtained. Reconnect lead. Rotate screw clockwise to open dampers or counterclockwise to close dampers. Refer to Figure 59 for Honeywell actuator or Figure 60 for Ranco actuator. See Chart B for percentage of fresh air versus dimensional opening of blade at system static pressure.

IMPORTANT - After adjustment is completed, return enthalpy control to its normal setting.

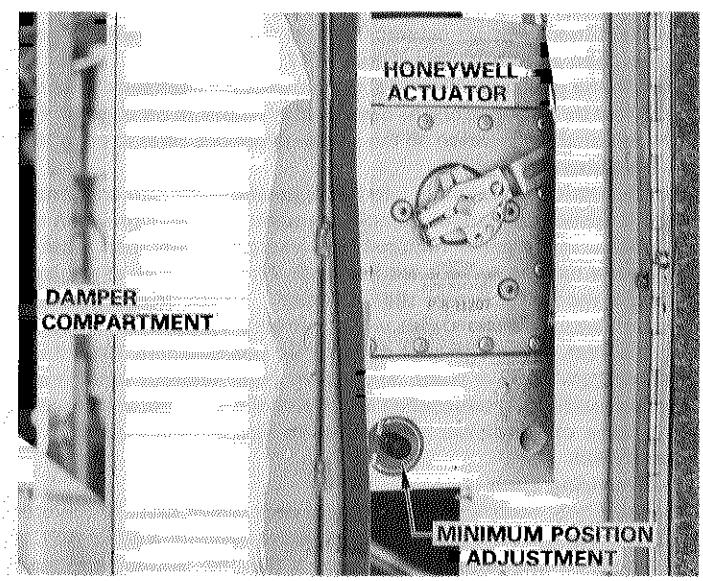


FIGURE 59

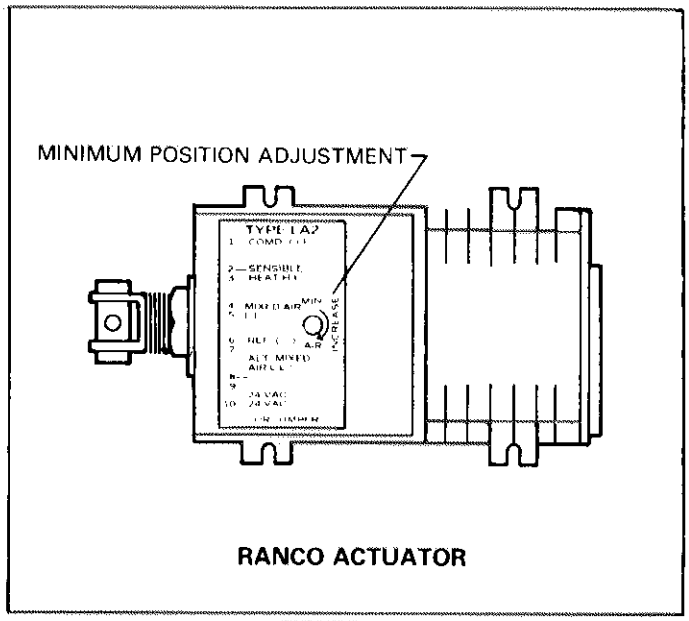
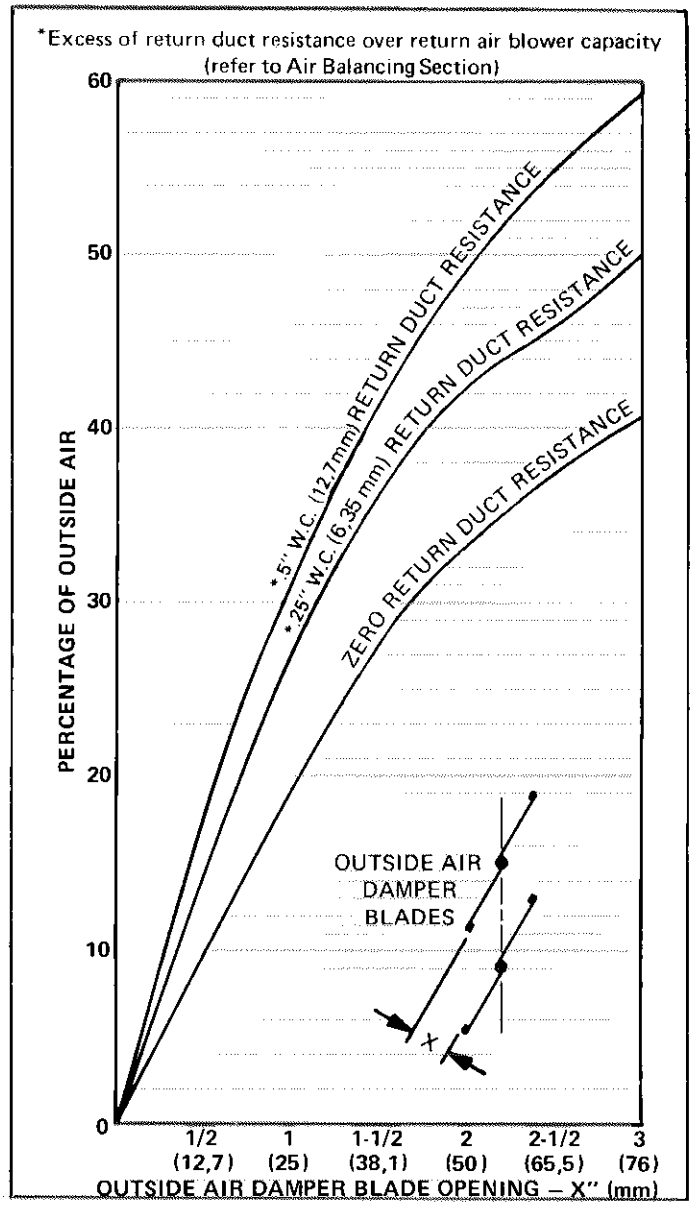


FIGURE 60



VI - POWER SAVER CHECK-OUT USING LOAD SIMULATOR

Connect the load simulator as shown in Figure 30 on page 31. Do not impose a simultaneous heating demand as the following checks are made.

1 - Connect DC voltmeter negative lead to 24 VDC (—) terminal and positive lead to terminal #1 on A5 limit controller to obtain cooling command signal. See Figure 61.
2 - Refer to function chart. As the simulator raises the cooling command input voltage, the power saver actuator(s) will modulate according to the function chart.
3 - Slowly reverse the rotation of load simulator until output voltage recedes to 12 VDC. The power saver actuator(s) will close according to the chart.
4 - Disconnect load simulator and DC voltmeter. Reconnect the (+) wire which runs from terminal strip TB-Z to 24 VDC terminal at EA3 module.

IMPORTANT - Cold deck thermistor (RT13) must be sensing 50°F or above for this check to function. If RT13 is sensing temperatures below 50°F, the limit controller (A5) will hold outdoor dampers at minimum position.

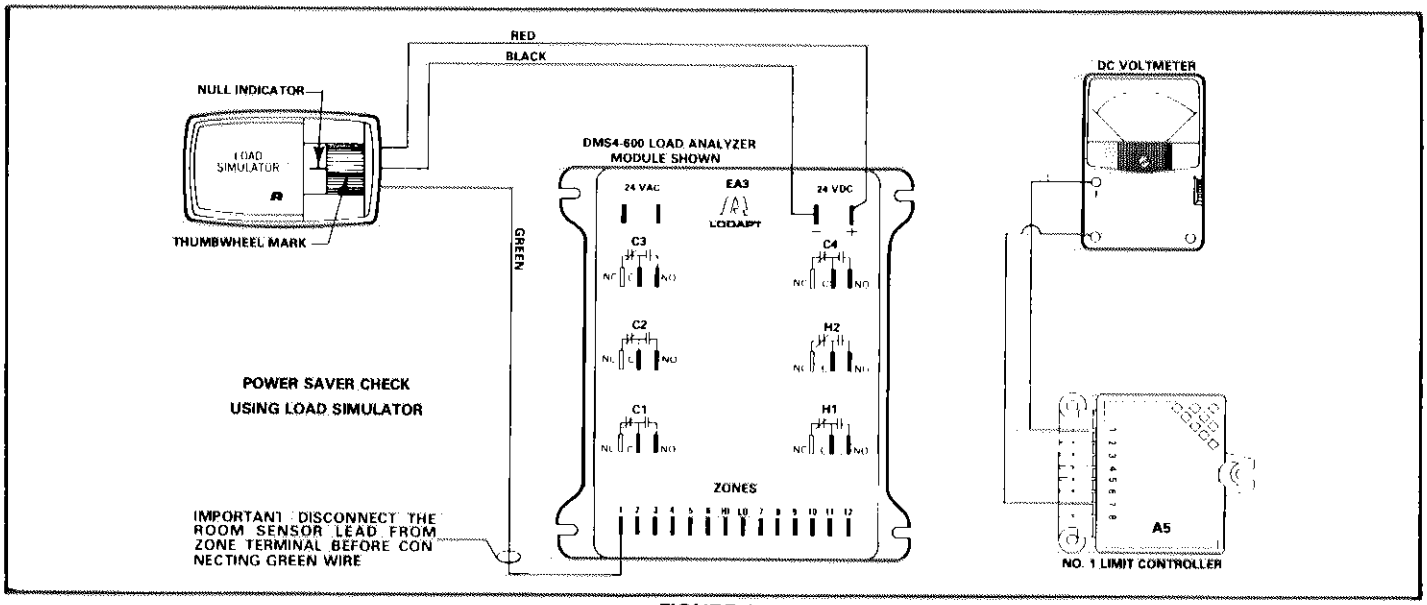


FIGURE 61

REFRIGERANT COOLING

I - REFERIGERANT COOLING SECTION

A - Compressor Compartment Identification

Refer to Figure 62 (185, 185/275, 275, 300 & 360 units), Figure 63 (415 units) and Figure 64 (600 units) for compressor compartment identification.

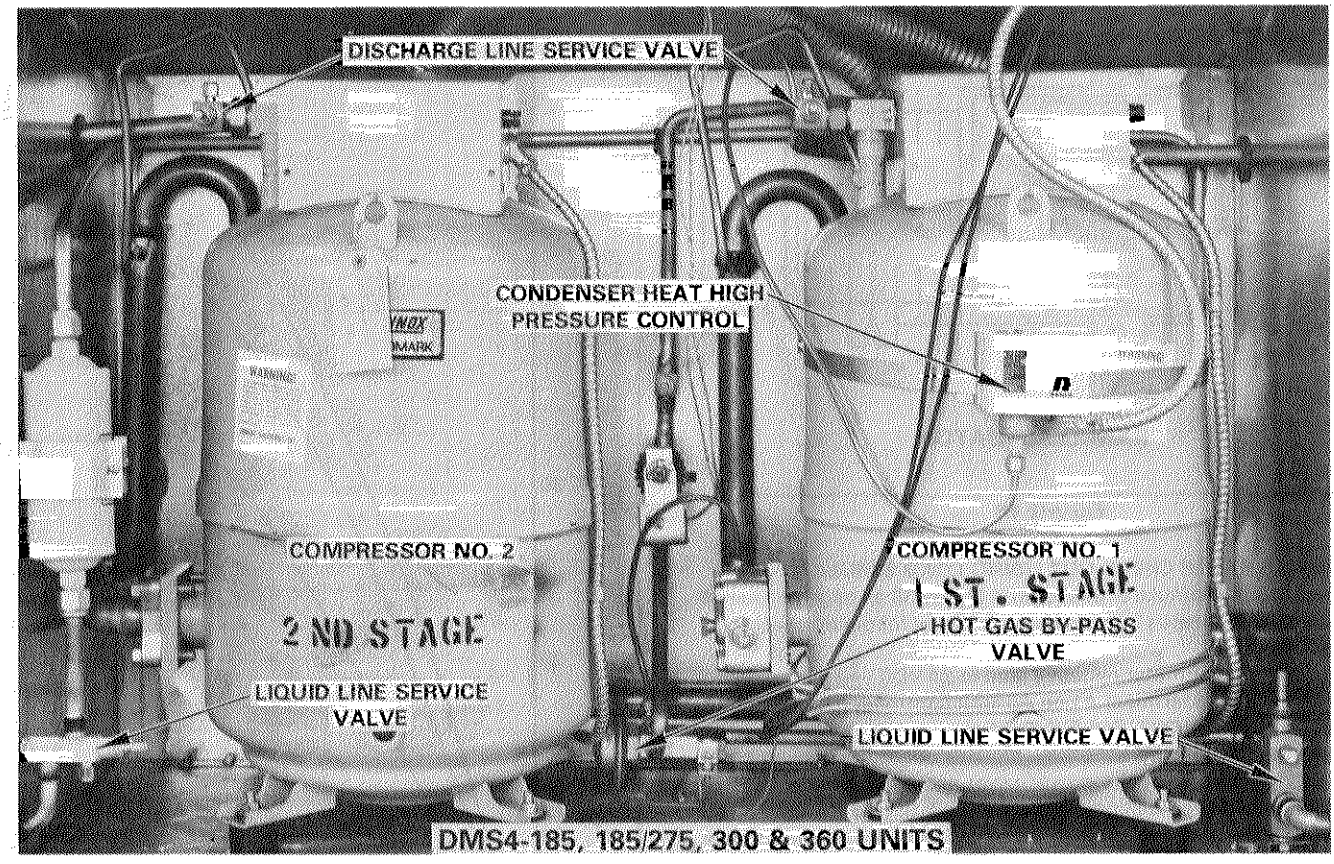


FIGURE 62

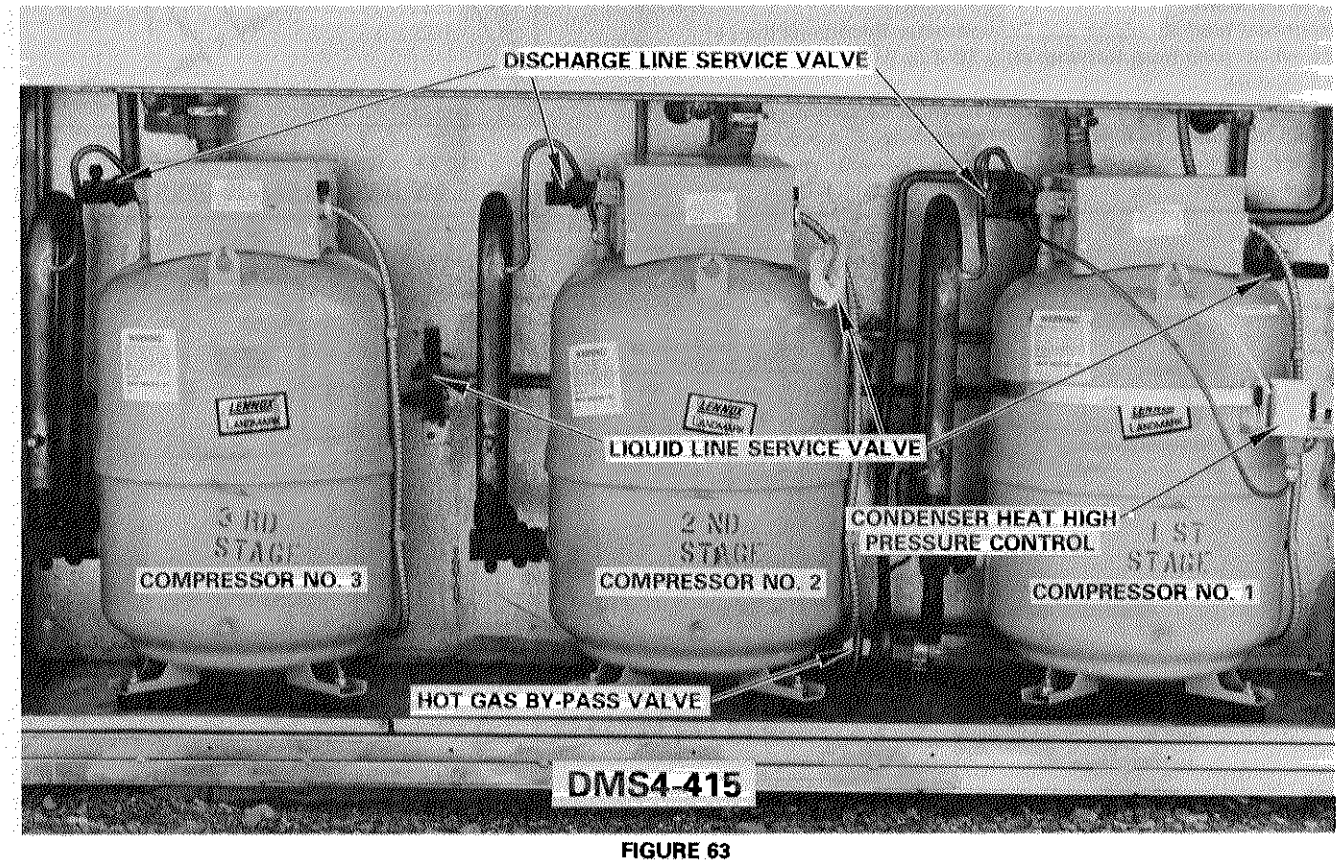


FIGURE 63

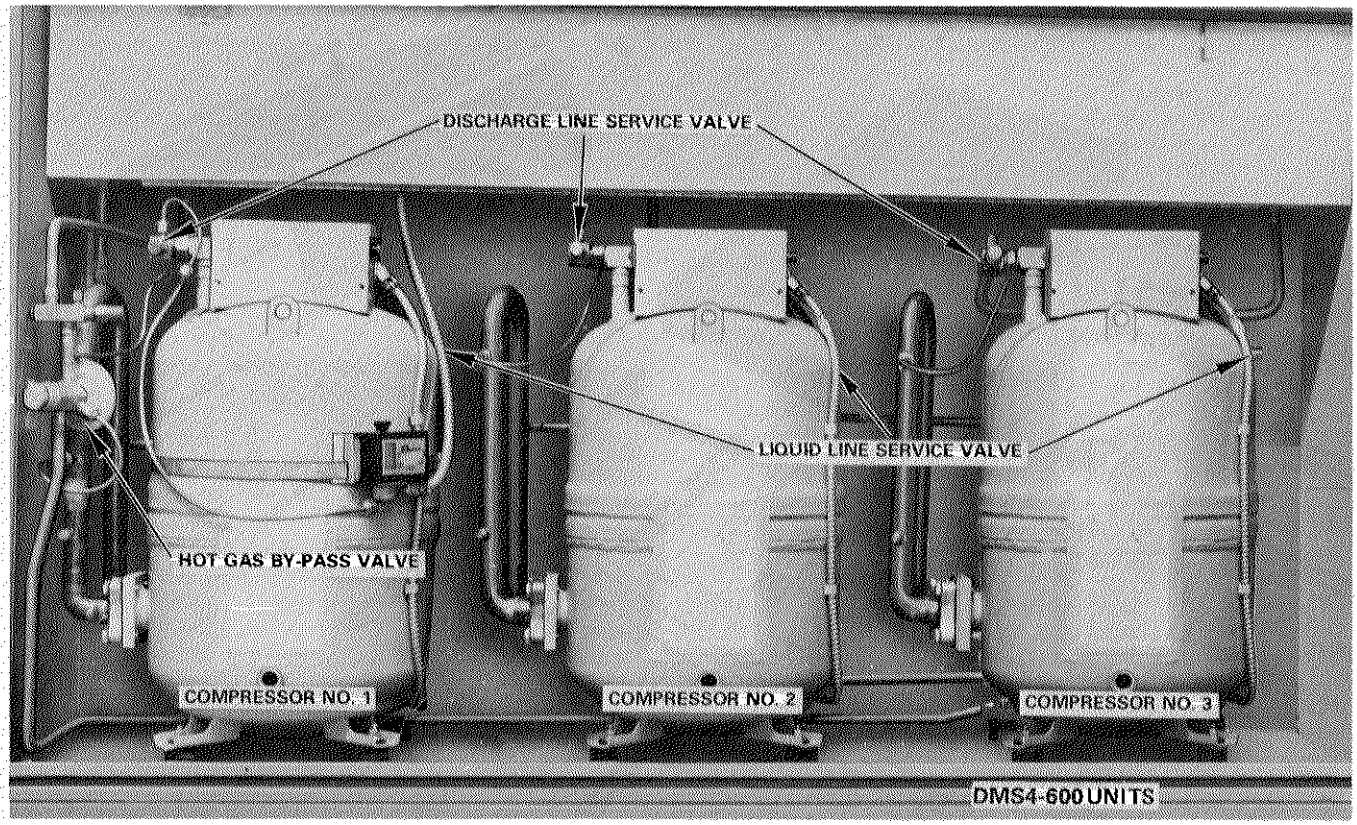


FIGURE 64

B - Refrigerant Circuiting

There is an individual refrigerant circuit for each compressor in the DMS4 unit. These circuits are numbered for identification. Refer to Figure 65 (185, 185/275, 275, 300 & 360 units), Figure 66 (415 units) or Figure 67 (600 units) for refrigerant circuit schematics.

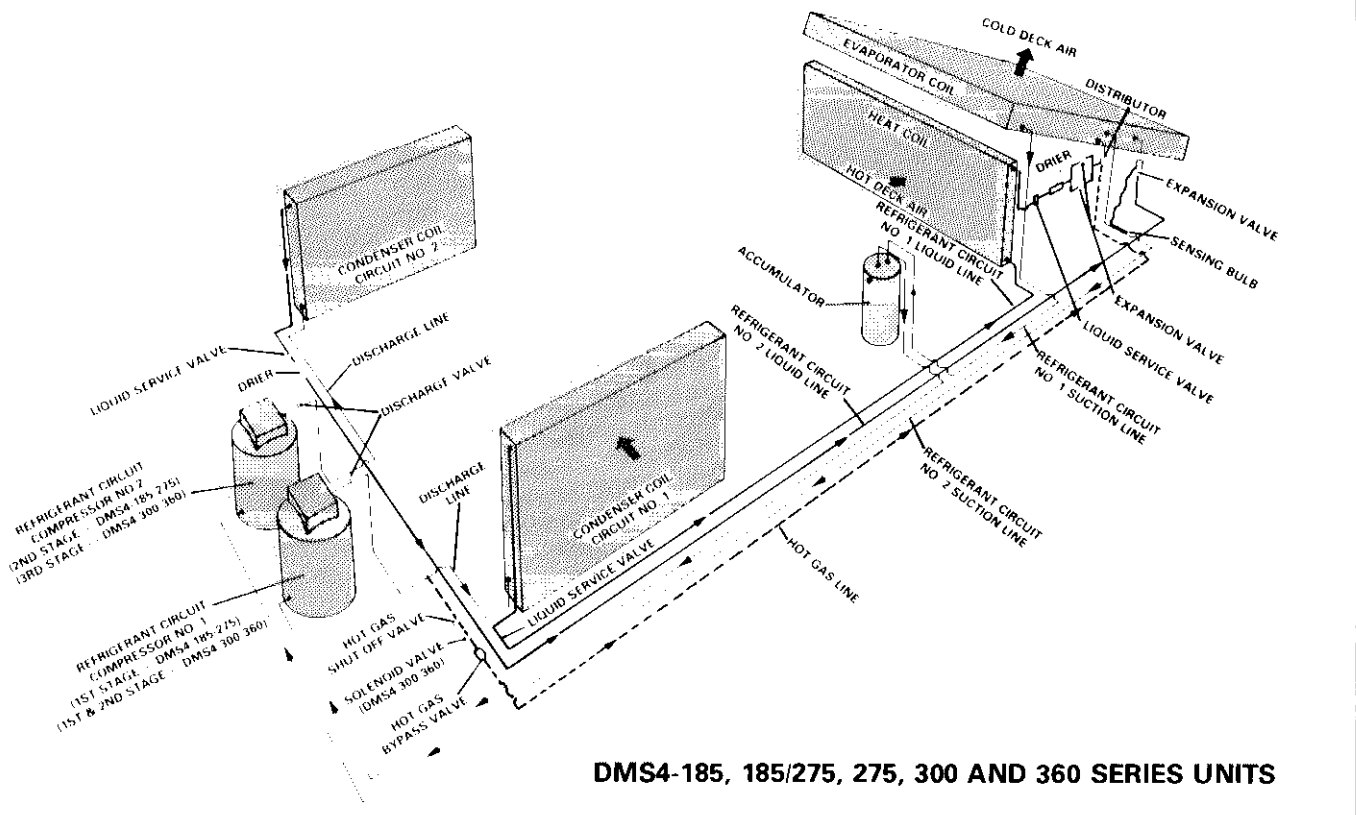


FIGURE 65

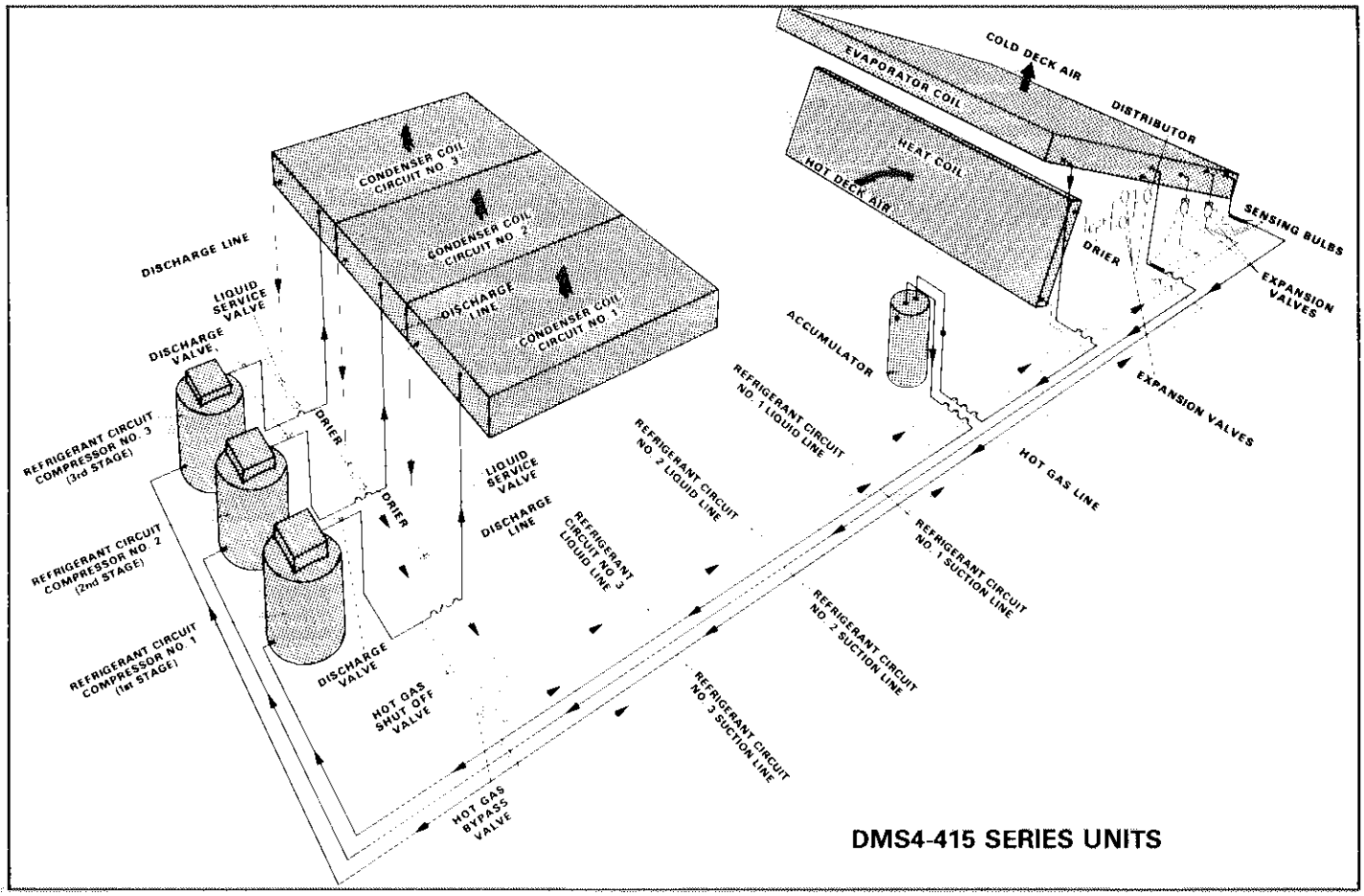


FIGURE 66

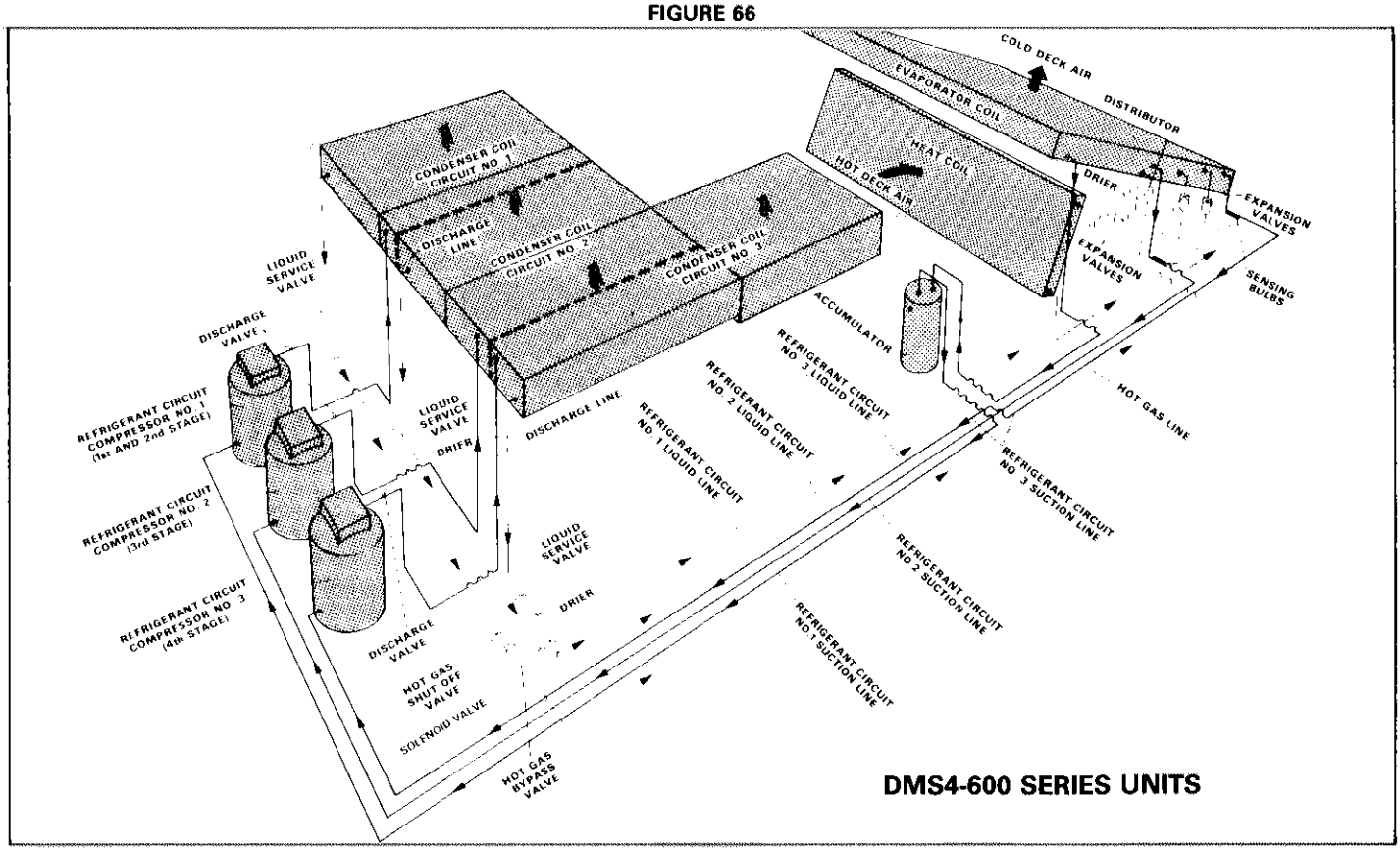


FIGURE 67

II - REFRIGERANT CONTROLS

A - Compressor Protection

Each compressor is protected by a high pressure switch (S32), a low pressure switch (S34) and a low ambient cut-out thermostat (S33). In addition 8 and 11 ton compressors use internal cut-out thermostat (S35) and overload motor protection while the 15 ton compressors use inwinding thermistors with a protection module (A1-3). If the inwinding sensors lock out, allow one hour for protection to reset. Figures 68 and 69 shows the location of these controls and Table 1 lists the various set points.

B - Hot Gas By-Pass

The no. 1 refrigerant circuit includes hot gas by-pass to prevent evaporator coil freeze-up during periods of reduced capacity. The hot gas by-pass valve opens when no. 1 circuit suction pressure drops to 58 psig (4.1 Kg/cm²). The L6 two speed compressor is equipped with an additional solenoid valve which permits hot gas by-pass operation only during low speed.

The hot gas system is also equipped with a manual main shutoff valve that must be closed to check refrigerant charge. Figures 62, 63 and 64 identify the hot gas components.

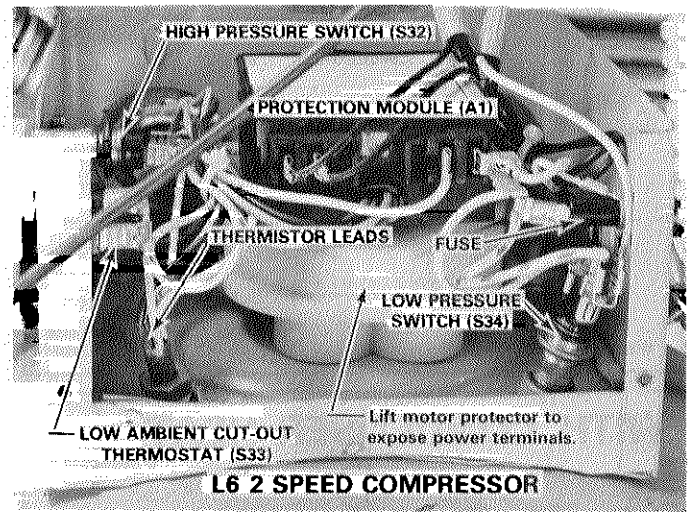


FIGURE 68

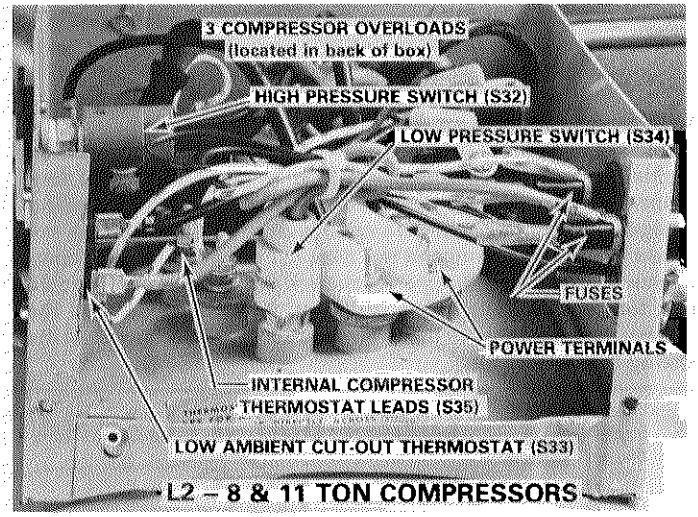
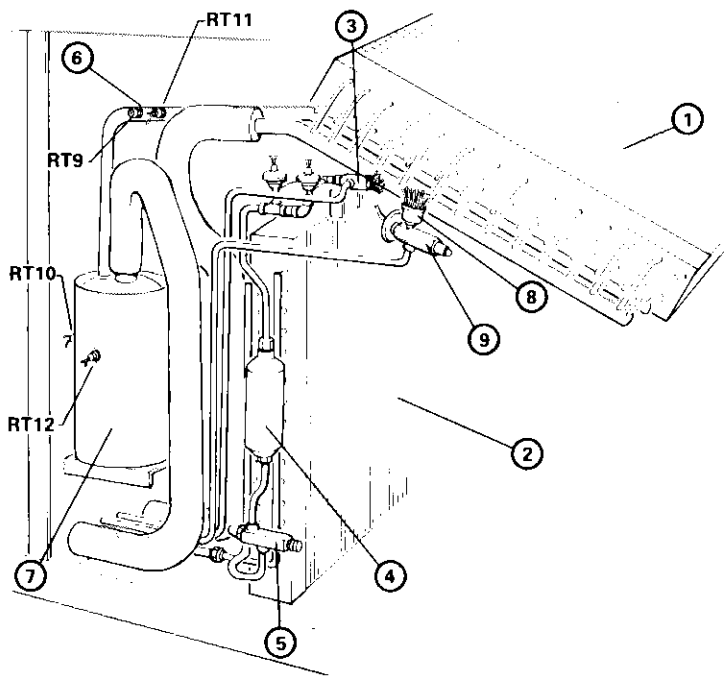
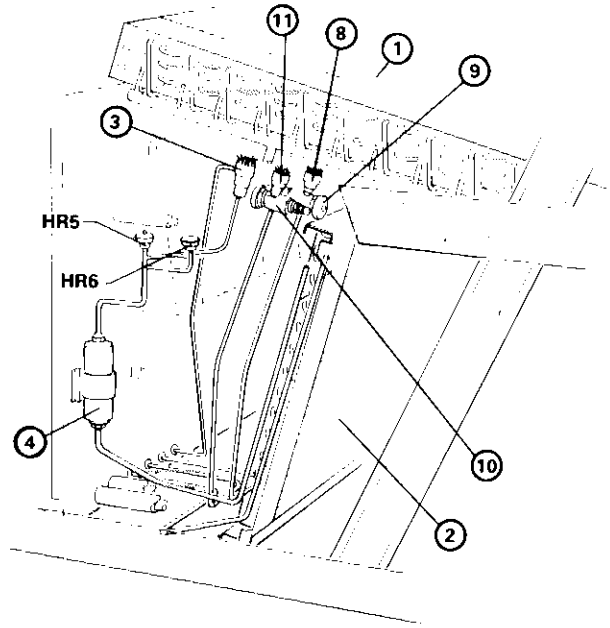


FIGURE 69



DMS4-185, -185/275, -275, -300 & -360 SERIES



DMS4-415 & 600 SERIES

KEY	DESCRIPTION
1	Evaporator Coil
2	Condenser Coil
3	1st Stage Distributor
4	Drier
5	Service Valve
6	Fusable Plug

KEY	DESCRIPTION
7	Tank Accumulator
8	2nd Stage Distributor
9	2nd Stage Expansion Valve
10	3rd Stage Distributor
11	3rd Stage Expansion Valve
HR5	Thermal Expansion Valve

KEY	DESCRIPTION
HR6	Thermal Expansion Valve
RT9	Normal Thermistor
RT10	Condenser Heat Thermistor
RT11	Normal Thermistor
RT12	Condenser Heat Thermistor

DMS4 SERIES EVAPORATOR SECTION

FIGURE 70

C - Condenser Heat

1 - A heat demand initiates the condenser heat cycle if no. 1 compressor is operating. A condenser heat demand energizes the thermistor relay (K9) to switch from the normal thermistors located on evaporator coil suction line to the suction accumulator thermistors.

2 - This thermistor transfer opens the expansion valve and allows refrigerant to flow into the accumulator. At this point a coil located in the hot deck now becomes the condenser and the heat which was previously expelled to the outside is added to the hot deck. Figure 70 identifies the thermistor and expansion valves.

3 - Figures 65, 66 and 67 illustrate the piping for condenser heat.

4 - A pressure switch (S1) automatically starts the condenser fan if the head pressure exceeds switch setting.

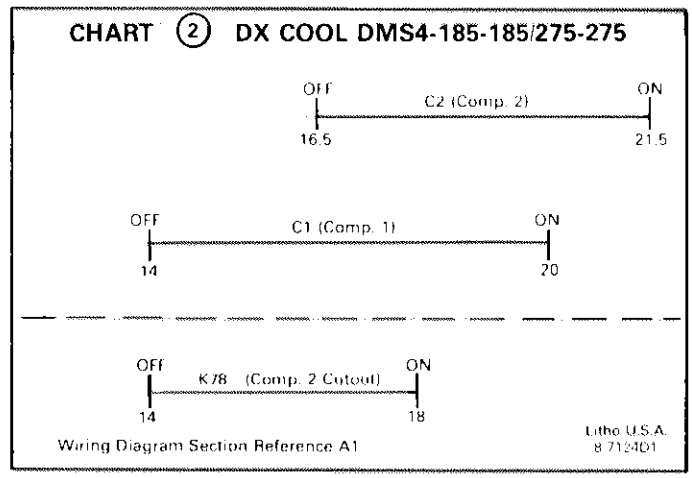
D - Overriding Limit Controls

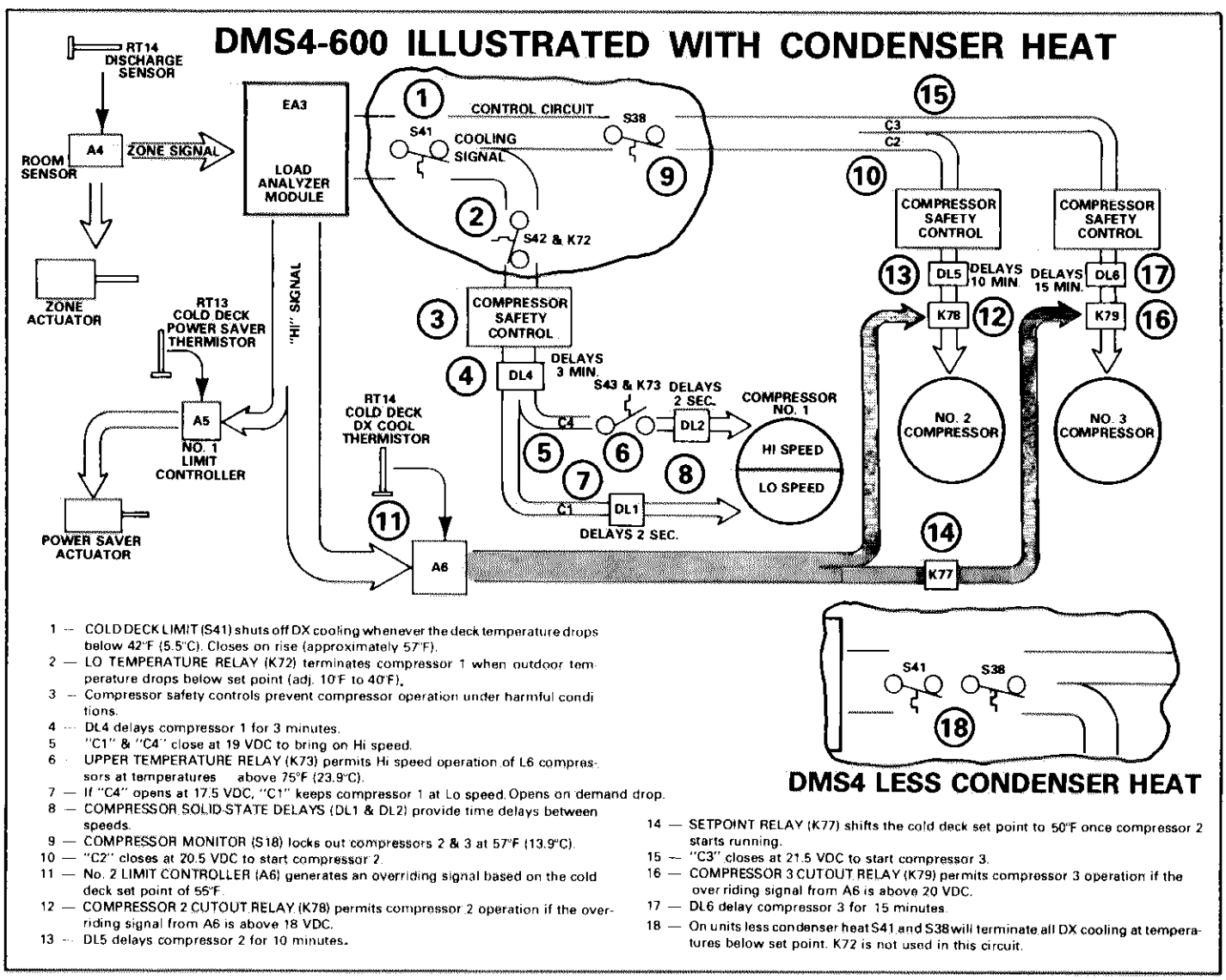
The no. 2 limit control (A6) and RT14 cold deck sensor generate an overriding signal based upon the EA3 "HI" signal and the cold deck temperature. A cold deck temperature fall causes a corresponding voltage decrease through RT14 and A6. This limit signal does not initiate the cooling command but does cut out no. 2 or no. 3 compressor operation with electronic relays (K78 and K79) when the cold deck temperature falls below set point. Figure 71 illustrates the interrelationship between the overriding controls and the rest of the cooling control system.

III - COOLING SEQUENCE (Function Chart Voltage)

The following sections exemplify both the cooling command signal and the overriding limit signal for each size unit. Keep in mind that although the cooling signal may indicate a cooling demand, the ambient limits and safety controls must be closed to begin compressor operation.

A - Chart 2 DX Cool DMS4-185-185/275-275





1 — COLD DECK LIMIT (S41) shuts off DX cooling whenever the deck temperature drops below 42°F (5.5°C). Closes on rise (approximately 57°F).

2 — LO TEMPERATURE RELAY (K72) terminates compressor 1 when outdoor temperature drops below set point (adj. 10°F to 40°F).

3 — Compressor safety controls prevent compressor operation under harmful conditions.

4 — DL4 delays compressor 1 for 3 minutes.

5 — "C1" & "C4" close at 19 VDC to bring on Hi speed.

6 — UPPER TEMPERATURE RELAY (K73) permits Hi speed operation of L6 compressors at temperatures above 75°F (23.9°C).

7 — If "C4" opens at 17.5 VDC, "C1" keeps compressor 1 at Lo speed. Opens on demand drop.

8 — COMPRESSOR SOLID-STATE DELAYS (DL1 & DL2) provide time delays between speeds.

9 — COMPRESSOR MONITOR (S18) locks out compressors 2 & 3 at 57°F (13.9°C).

10 — "C2" closes at 20.5 VDC to start compressor 2.

11 — No. 2 LIMIT CONTROLLER (A6) generates an overriding signal based on the cold deck set point of 55°F.

12 — COMPRESSOR 2 CUTOUT RELAY (K78) permits compressor 2 operation if the overriding signal from A6 is above 18 VDC.

13 — DL5 delays compressor 2 for 10 minutes.

14 — SETPOINT RELAY (K77) shifts the cold deck set point to 50°F once compressor 2 starts running.

15 — "C3" closes at 21.5 VDC to start compressor 3.

16 — COMPRESSOR 3 CUTOUT RELAY (K79) permits compressor 3 operation if the overriding signal from A6 is above 20 VDC.

17 — DL6 delay compressor 3 for 15 minutes.

18 — On units less condenser heat S41 and S38 will terminate all DX cooling at temperatures below set point. K72 is not used in this circuit.

FIGURE 71

Cooling Signal

1 - At 20 volts switch "C1" closes. Compressor #1 starts after a 3 minute time delay. The switch opens at 14 volts to shut off compressor.

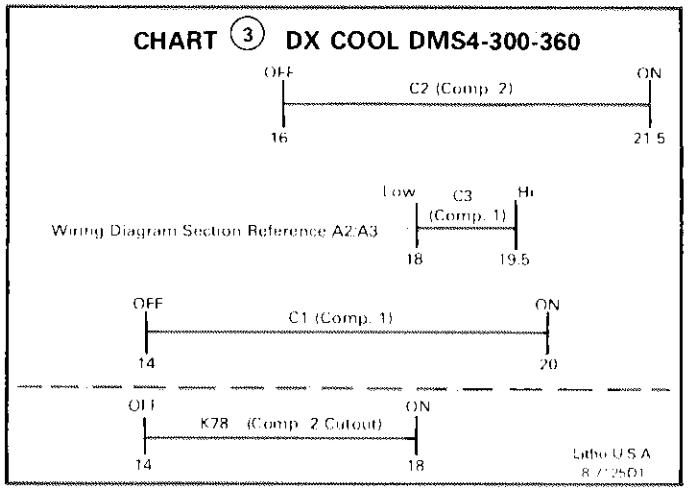
2 - At 21.5 volts switch "C2" closes. Compressor #2 starts 7 minutes after compressor 1 starts. The switch opens at 16.5 volts to shut off compressor. Compressor #2 has a 10 minute delay.

Overriding Limit Signal

1 - When the signal from limit controller (A6) reaches 18 volts, K78 contacts close and compressor #2 is allowed to run.

2 - If this signal falls below 14 volts, K78 contacts open and compressor #2 shuts off.

B - Chart 3 DX Cool DMS4-300-360



Cooling Signal

1 - Two switches control the operation of the two speed compressor. At 20 volts switches "C1" and "C3" are both closed to bring on high speed. "C3" remains closed until a voltage drop to 18 opens switch and transfers compressor #1 to low speed.

2 - Compressor #1 remains at low speed until either the voltage falls to 14 and "C1" opens to stop compressor or until voltage rises to 19.5 and "C3" closes to bring on high speed.

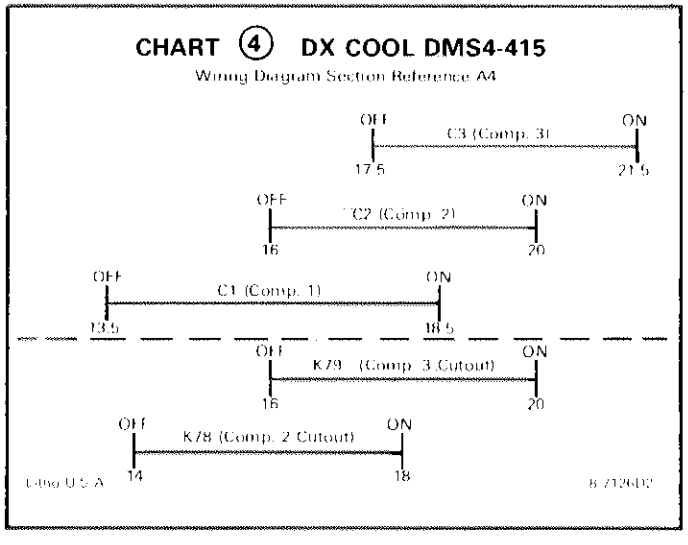
3 - At 21.5 volts switch "C2" closes and compressor #2 operates. The switch opens and shuts off compressor at 16 volts.

Overriding Limit Signal

1 - When the signal from limit controller (A6) reaches 18 volts, K78 contacts close and compressor #2 is allowed to run.

2 - If this signal falls below 14 volts, K78 contacts open and compressor #2 shuts off.

C - Chart 4 DX Cool DMS4-415



Cooling Signal

1 - At 18.5 volts switch "C1" closes and compressor #1 runs. The switch opens at 13.5 volts to shut off compressor.

2 - At 20 volts switch "C2" closes and compressor #2 runs. The switch opens at 16 volts to shut off compressor.

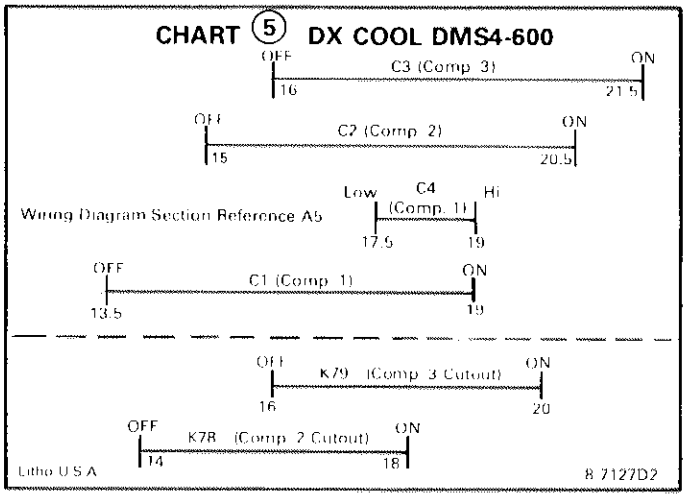
3 - At 21.5 volts switch "C3" closes and compressor #3 runs. The switch opens at 17.5 volts to shut off compressor.

Overriding Limit Signal

1 - When the signal from limit controller (A6) reaches 18 volts, K78 contacts close and compressor #2 is allowed to run. If this signal falls below 14 volts, K78 contacts open and compressor #2 shuts off.

2 - When the signal reaches 20 volts, K79 contacts close and compressor #3 is allowed to run. If the signal falls below 16 volts, K79 contacts open and compressor #3 shuts off. Compressor 3 starts 5 minutes after compressor #2 starts.

D - Chart 5 DX Cool DMS4-600



Cooling Signal

1 - Two switches control the operation of the two speed compressor. At 19 volts both switches "C1" and "C4" close to bring on high speed. "C4" remains closed until a voltage drop to 17.5 opens switch and transfers compressor #1 to low speed.

2 - Compressor #1 remains at low speed until either the voltage falls to 13.5 and "C1" opens to stop compressor or until the voltage rises to 19 and "C3" closes to bring on high speed.

3 - At 20.5 volts "C2" closes and compressor #2 runs. The switch opens at 15 volts to shut off compressor.

4 - At 21.5 volts switch "C3" closes and compressor #3 runs. The switch opens at 16 to shut off compressor.

Overriding Limit Signal

1 - When the signal from limit controller (A6) reaches 18 volts, K78 contacts close and compressor #2 is allowed to run. If this signal falls below 14 volts, K78 contacts open and compressor #2 shuts off.

2 - When the signal reaches 20 volts, K79 contacts close and compressor #3 is allowed to run. If the signal falls below 16 volts, K79 contacts open and compressor #3 shuts off.

IV - AMBIENT CONTROLS

Once the command signal initiates a cooling demand and the overriding limit signal approves, a series of ambient controls affect unit operation.

1 - *Compressor Monitor*

On units with condenser heat, the compressor monitor (S38) locks out no. 2 and no. 3 compressors at 57°F (13.9°C). On units less condenser heat, the compressor monitor locks out all the compressors. See Figure 72 for location.

2 - *Evaporator Low Limit*

The evaporator low limit (S41) terminates all DX cooling

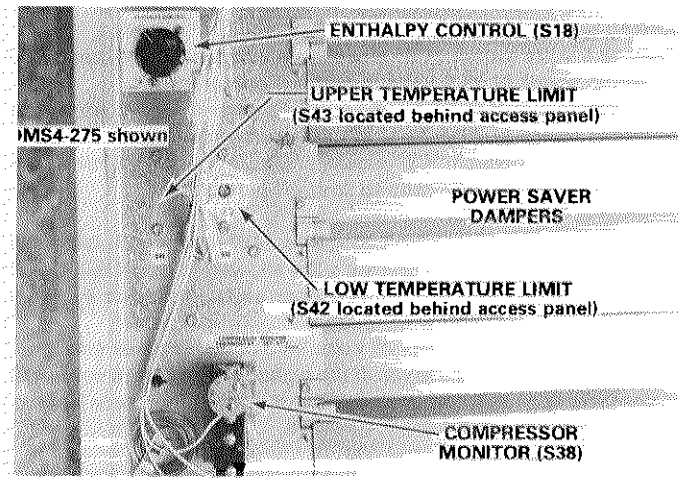


FIGURE 72

whenever the cold deck temperature falls to 42°F (5.5°C). S41 opens at 42°F ± 5°F and closes 15°F above opening point.

3 - *Low Temperature Limit*
On units with condenser heat, the low temperature limit (S42) and low temperature relay (K72) lockout compressor #1 when the outdoor temperature drops below the set point (adjustable 10° to 40°F). Refer to Figures 24 & 26 on pages 18 & 20 for locations.

4 - *Upper Temperature Limit*
On two speed compressors, the upper temperature limit (S43) and upper temperature relay (K73) do not permit high speed operation at temperatures below 75°F (23.9°C). Refer to Figures 24 & 26 on pages 18 & 20 for locations.

5 - *Time Delays*
DL4 delays compressor #1 for 3 minutes, DL5 delays compressor #2 for 10 minutes and DL6 delays compressor #3 for 15 minutes. Refer to Figure 25 on page 19.

6 - *Set Point Relay*
Normally the cold deck set point for the limit controller (A6) is 55°F (12.8°C). Once compressor #2 starts, the set point relay (K77) shifts the setting to 50°F (10°C). This provides a longer run time for compressor #2. Refer to Figure 25 on page 19.

V - INITIAL START-UP

1 - Crankcase heaters **must** be energized 24 hours before starting compressor. After 24 hours install compressor fuses provided in cloth bag on compressor.
2 - Close main disconnect switch on unit. Indoor and return air blowers should start. If the unit has smoke detector, the blowers have a 3 minute delayed start.
3 - Perform the cooling check-out as instructed in this section.

VI - REFRIGERANT CHECK

1 - Refer to Figures 62, 63 and 64 for service valve identification. Attach gauge manifold.
2 - Set each room sensor to its lowest setting to provide a full cooling demand. This opens all the zone dampers to the cold deck insuring that 100% supply air goes through the evaporator coil. L6 compressors (two speed) must run at "HI" speed to check refrigerant charge. Jumper as necessary to provide manual control of compressor.
3 - Before checking or charging no. 1 compressor circuit, disconnect H1 and/or H2 leads at load analyzer to prevent condenser heat from being energized.

NOTE - The no. 1 compressor circuit has a hot gas by-pass valve that must be closed (front seated) before charging the circuit. This prevents refrigerant from by-passing through hot gas circuit thus giving false charging values.

4 - Allow unit to run for a few minutes to stabilize system.
5 - Using a thermometer, find condenser entering air temperature. Read suction and discharge pressures on gauge manifold. Check each circuit separately.
6 - Refer to Table11to select the correct normal operating pressure curve and find suction pressure in left-hand column. Follow across the curve to correct outdoor coil entering air temperature. Mark this point, then read discharge pressure directly below. If the discharge reading is within 3 psig (0.21 Kg/cm²) of gauge manifold system is properly charged.
7 - If there is a loss of charge in a circuit, remove the compressor fuses from that circuit to prevent compressor from cycling on low pressure control. Refer to the Lennox Service Manual for leak checking, evacuating and charging procedures.
8 - Table 12 lists the refrigerant charge per compressor. All condenser and condenser heat coils have 3/8" tubes while the evaporator coils have 1/2" tubes.
9 - After charging is completed, disconnect gauge manifold.

TABLE 12

Unit	Refrigerant Charge Per Compressor											
	With Condenser Heat						Without Condenser Heat					
	Comp. #1		Comp. #2		Comp. #3		Comp. #1		Comp. #2		Comp. #3	
	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg
185	32	14.4	15	6.7	---	---	15	6.7	15	6.7	---	---
185/275	32	14.4	19	---	---	---	19	---	19	---	---	---
275	32	14.4	22	9.9	---	---	22	9.9	22	9.9	---	---
300	37	16.8	23	10.4	---	---	23	10.4	23	10.4	---	---
360	37	16.8	23	10.4	---	---	23	10.4	23	10.4	---	---
415	33	14.9	22	9.9	22	9.9	23	10.4	22	9.9	22	9.9
600	36	16.3	24	10.8	23	10.4	24	10.8	24		23	10.4

VII - COMPRESSOR OIL CHARGE

Table 13 lists the correct charge per compressor and Table 14 lists the oil type. Refer to Lennox Cooling Service Handbook for correct procedure to check and add compressor oil.

TABLE 13

Unit	OIL CHARGE					
	Compressor 1		Compressor 2		Compressor 3	
	oz.	kg	oz.	kg	oz.	kg
185	132	3.73	132	3.73	---	---
275	172	4.86	132	3.73	---	---
300	172	4.86	132	3.73	---	---
360	172	4.86	132	3.73	---	---
415	172	4.86	132	3.73	132	3.73
600	172	4.86	132	3.73	132	3.73

*L6 Compressor used on 300, 360 and 600 units only.

TABLE 11

SIZE UNIT	PRESSURE CURVE NUMBER					
	With Condenser Heat			Without Condenser Heat		
	Comp. #1	Comp. #2	Comp. #3	Comp. #1	Comp. #2	Comp. #3
185 185/275	PC-7428-L9	PC-7429-L9	- - - - -	PC-7429-L9	PC-7429-L9	- - - - -
275	PC-7430-L9	PC-7431-L9	- - - -	PC-7431-L9	PC-7431-L9	- - - - -
300	PC-7432-L9	PC-7433-L9	- - - -	PC-7434-L9	PC-7433-L9	- - - -
360	PC-7432-L9	PC-7434-L9	- - - -	PC-7434-L9	PC-7434-L9	- - - -
415	PC-7430-L9	PC-7431-L9	PC-7431-L9	PC-7431-L9	PC-7431-L9	PC-7431-L9
600	PC-7432-L9	PC-7434-L9	PC-7435-L9	PC-7434-L9	PC-7434-L9	PC-7435-L9

TABLE 14

COMPRESSOR MODEL NUMBER	OIL TYPE
L2-09724 L2-12724	Suniso 4 G
L2A09724 L2A12724	
L2B09724 L2B12724	
L2C09724 L2C12724	
L2-18024 L6-18024	
L2D09724 L2D12724	Zephron 150
L2A18024 L6A18024	

VIII - COOLING CHECK-OUT USING LOAD SIMULATOR

Connect the load simulator as shown in Figure 30 on page 31.

A - Cooling Command Signal

The following procedure will check the cooling logic relays at the load analyzer module. Do not impose a simultaneous heating demand as the following checks are made.

1 - Connect DC voltmeter negative lead to 24 VDC (—) terminal and positive lead to terminal to obtain cooling command signal. Connect test lights to the cooling logic relays and No. 8 terminal of TB-C terminal strip. For ease in installing test lights, we recommend making a harness as shown in Figure 73.

2 - Refer to function chart. Slowly rotate load simulator while observing voltmeter. As the simulator raises the cooling command input voltage, the cooling logic relays will respond according to the function chart's sequence of operation. Observe test lights to verify switching action and check mechanical operation of unit.

3 - Slowly reverse the rotation of load simulator until output voltage recedes to 12 VDC. The cooling logic relays will open according to the chart.

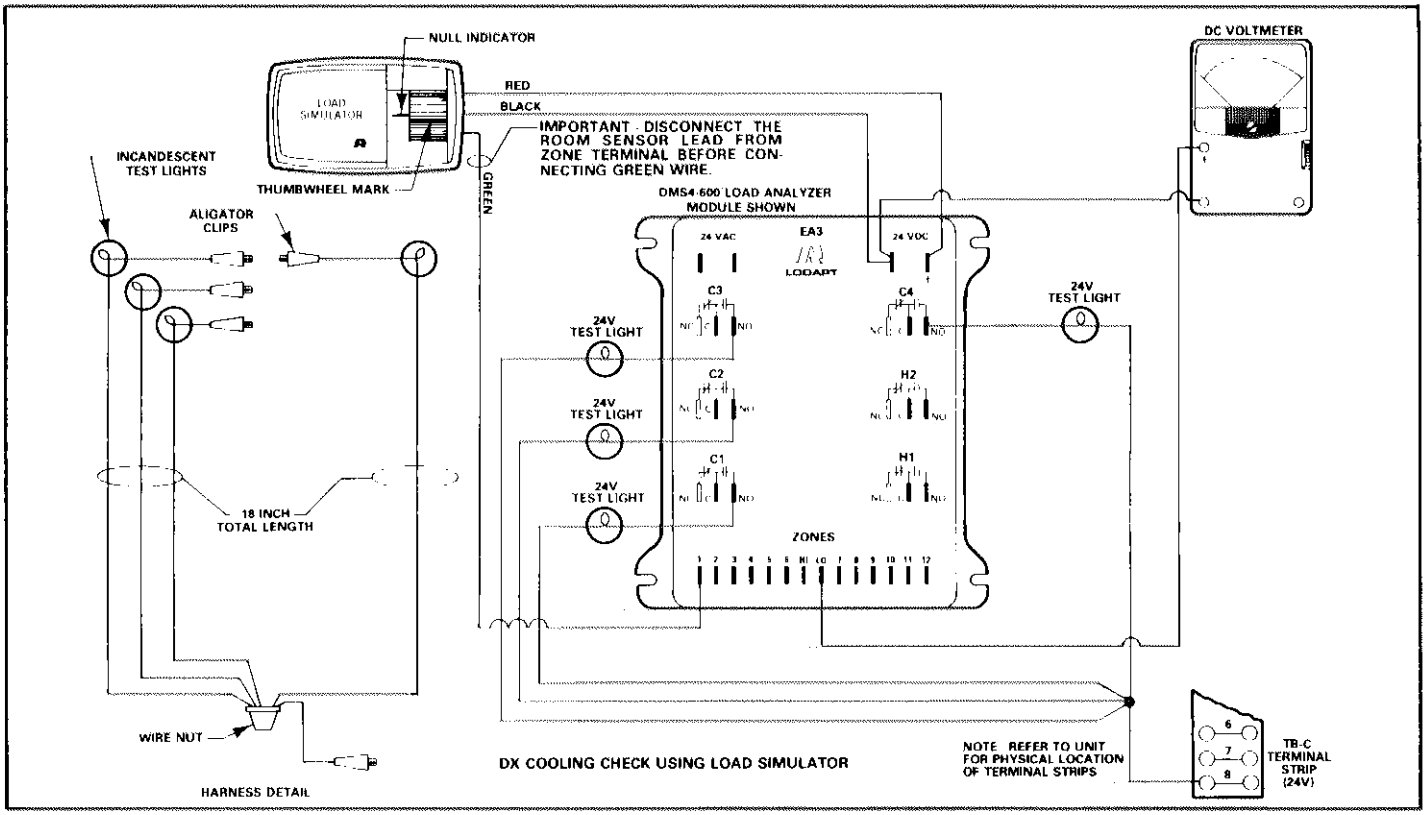


FIGURE 73

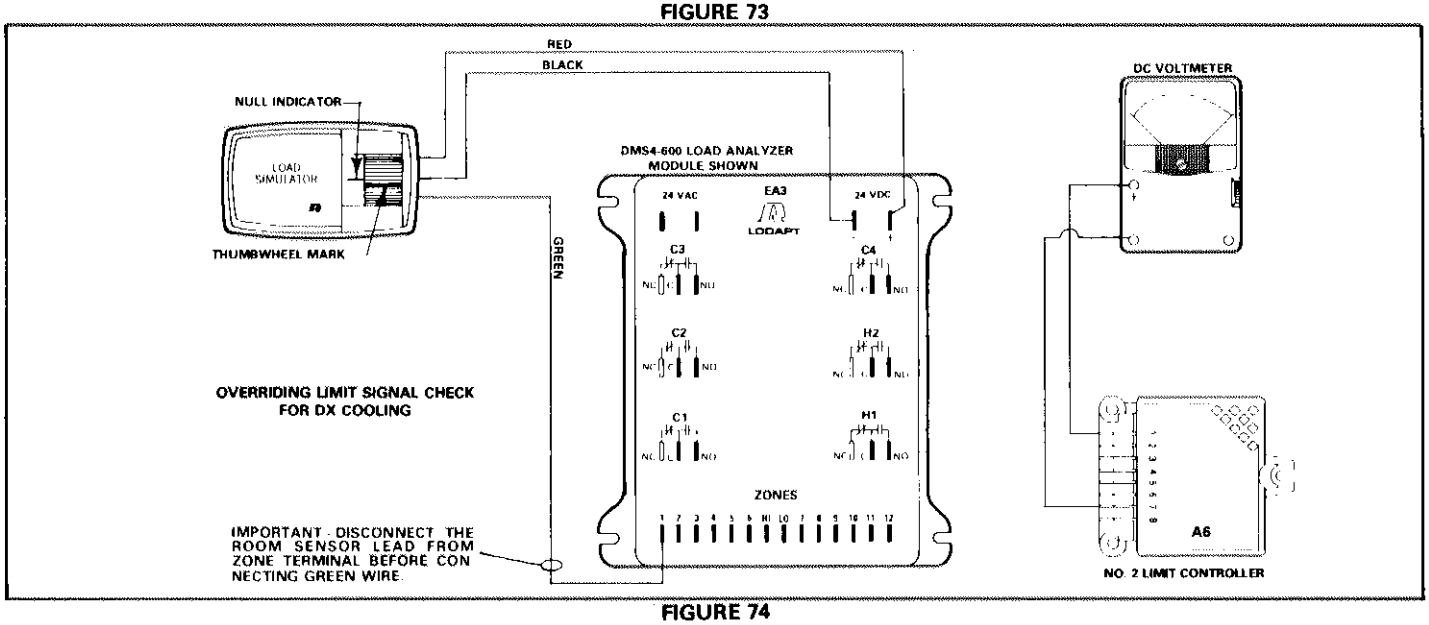


FIGURE 74

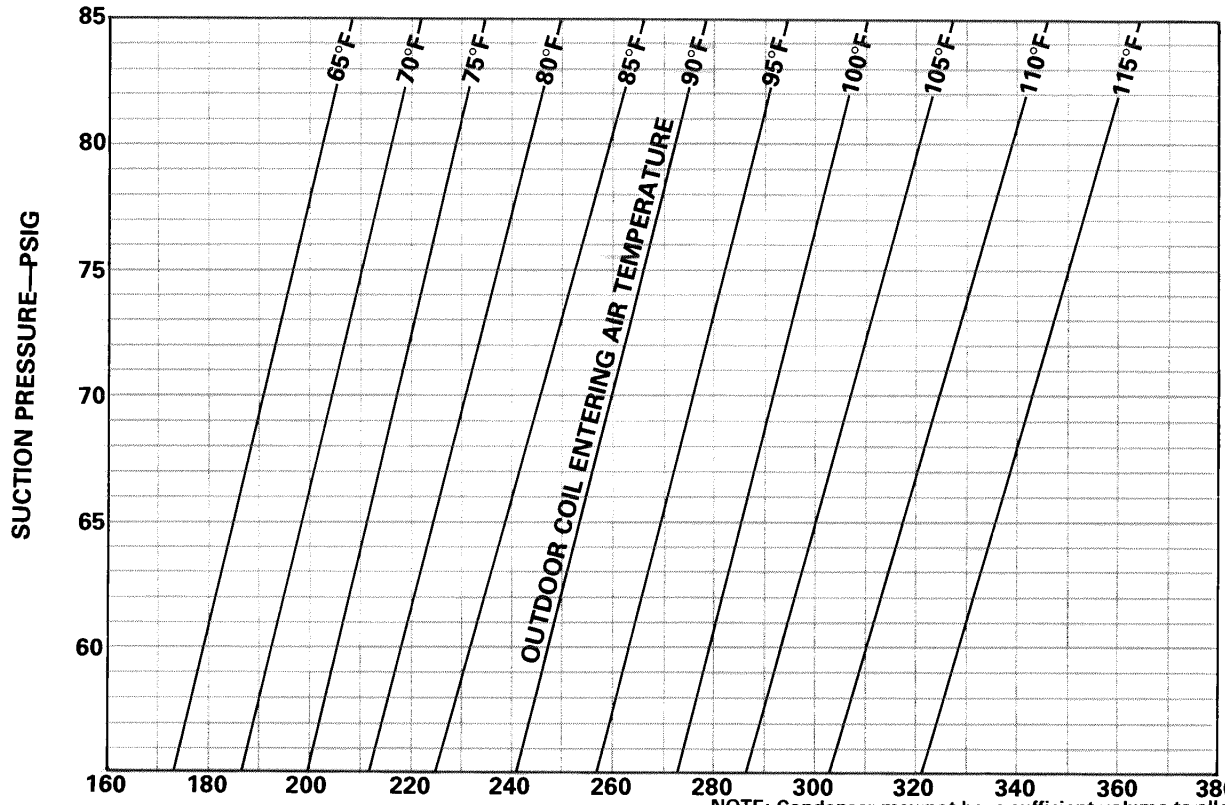
4 - Disconnect load simulator, test lights and DC voltmeter from the load analyzer module.
5 - Reconnect the negative and positive voltage wires to the correct 24 VDC terminals.

B - Overriding Limit Signal

1 - Connect DC voltmeter negative lead to terminal #7 of limit controller (A6) and positive lead to terminal #1 of limit controller (A6). See Figure 74.
2 - Rotate Load Simulator to maximum voltage at the "HI" terminal. Compressor one should start after 3 minute delay. Voltage as measured at terminal #4 on A6 should start to drop when air across the evaporator coil is being cooled.
3 - If the voltage drops to 14 volts or less within the next 7 minutes after compressor one starts, K78 prevents compressor #2 from running. K79 will lockout compressor #3 when voltage drops to 16 volts.
4 - If the voltage does not drop to 14 volts or less within 7 minutes, compressor #2 will start. The voltage should then show a more rapid decrease, dropping compressor #2 at 14 volts. Compressor #2 cannot come back on until its delay time of 10 minutes expires and the voltage demand has risen to 18 volts or more.
5 - Compressor #3 has a dropout point of 16 volts, a delay time of 15 minutes and a pickup point of 20 volts.

IMPORTANT - Cold deck thermistor (RT14) must be sensing 55°F or above for compressor 2 & 3 to operate during this check. At temperatures below 55°F, the limit controller (A6) will lock out compressors 2 & 3.

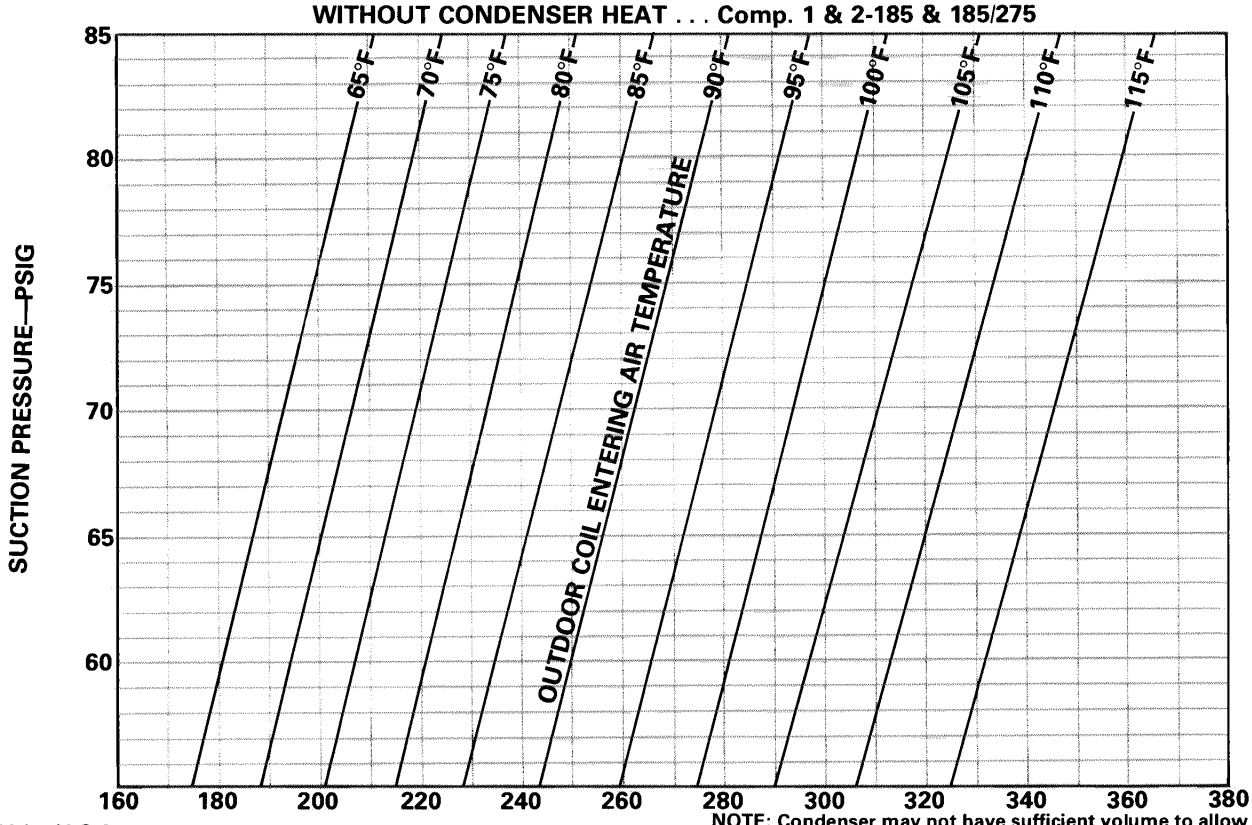
NORMAL OPERATING PRESSURE CURVE FOR DMS4-185 & 185/275 WITH CONDENSER HEAT . . . Comp. 1-185 & 185/275



Litho U.S.A.
PC-7428-L9

NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.

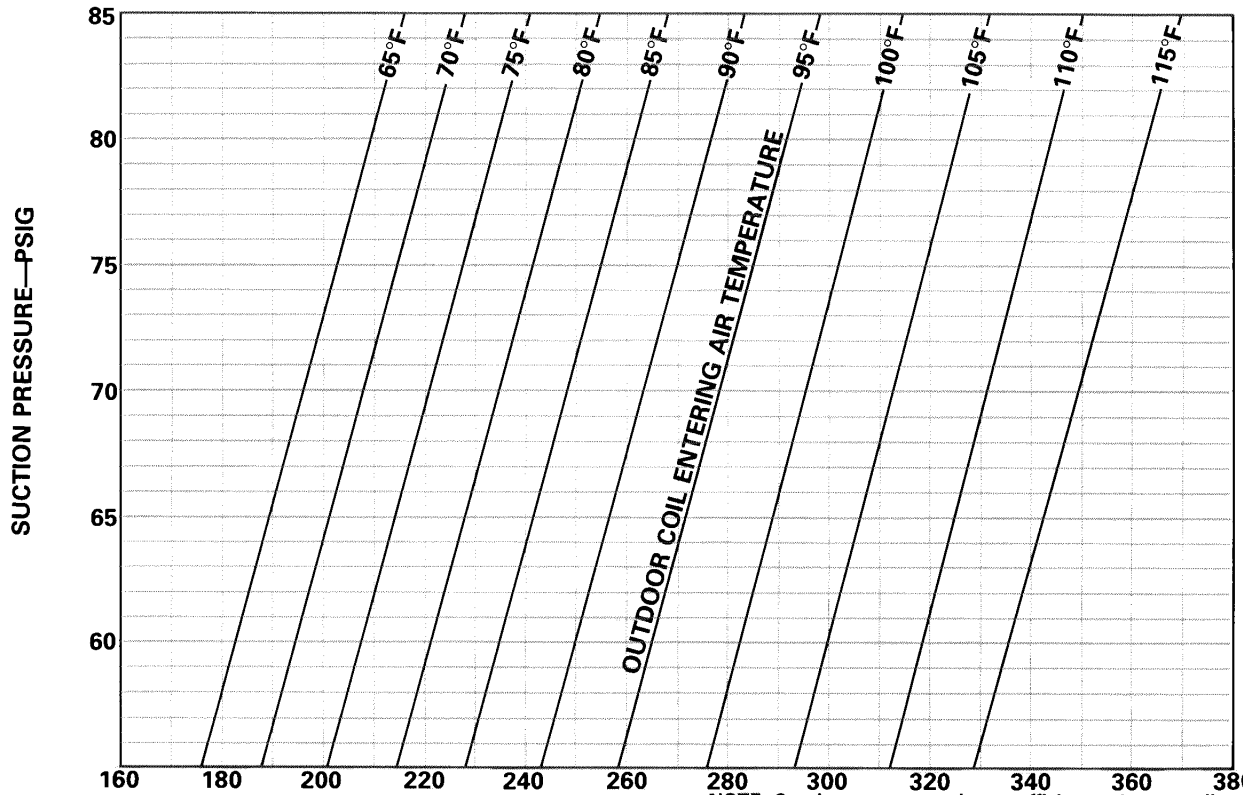
NORMAL OPERATING PRESSURE CURVE FOR DMS4-185 & 185/275 WITH CONDENSER HEAT . . . Comp. 2-185 & 185/275 WITHOUT CONDENSER HEAT . . . Comp. 1 & 2-185 & 185/275



Litho U.S.A.
PC-7429-L9

NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.

NORMAL OPERATING PRESSURE CURVE FOR DMS4-275 & 415 WITH CONDENSER HEAT . . . Comp. 1

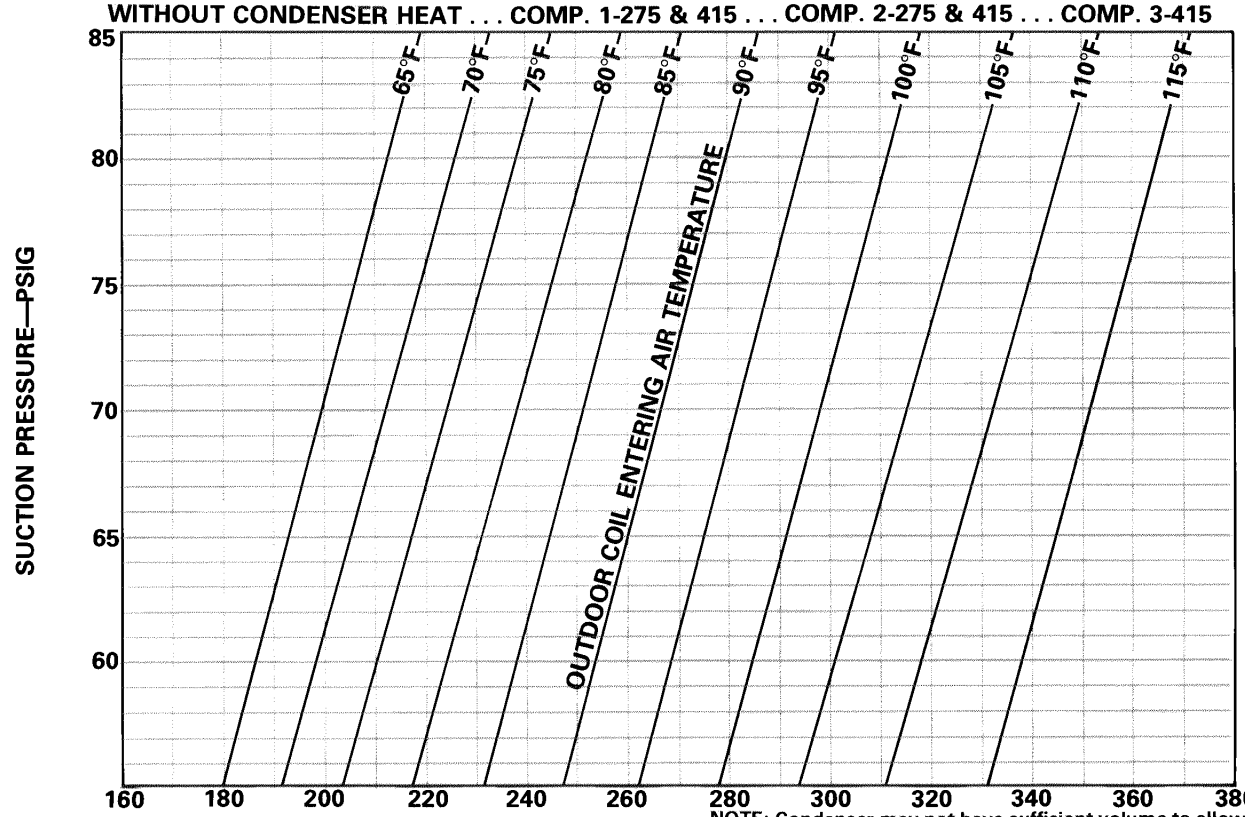


Litho U.S.A.
PC-7430-L9

NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.

COOLING

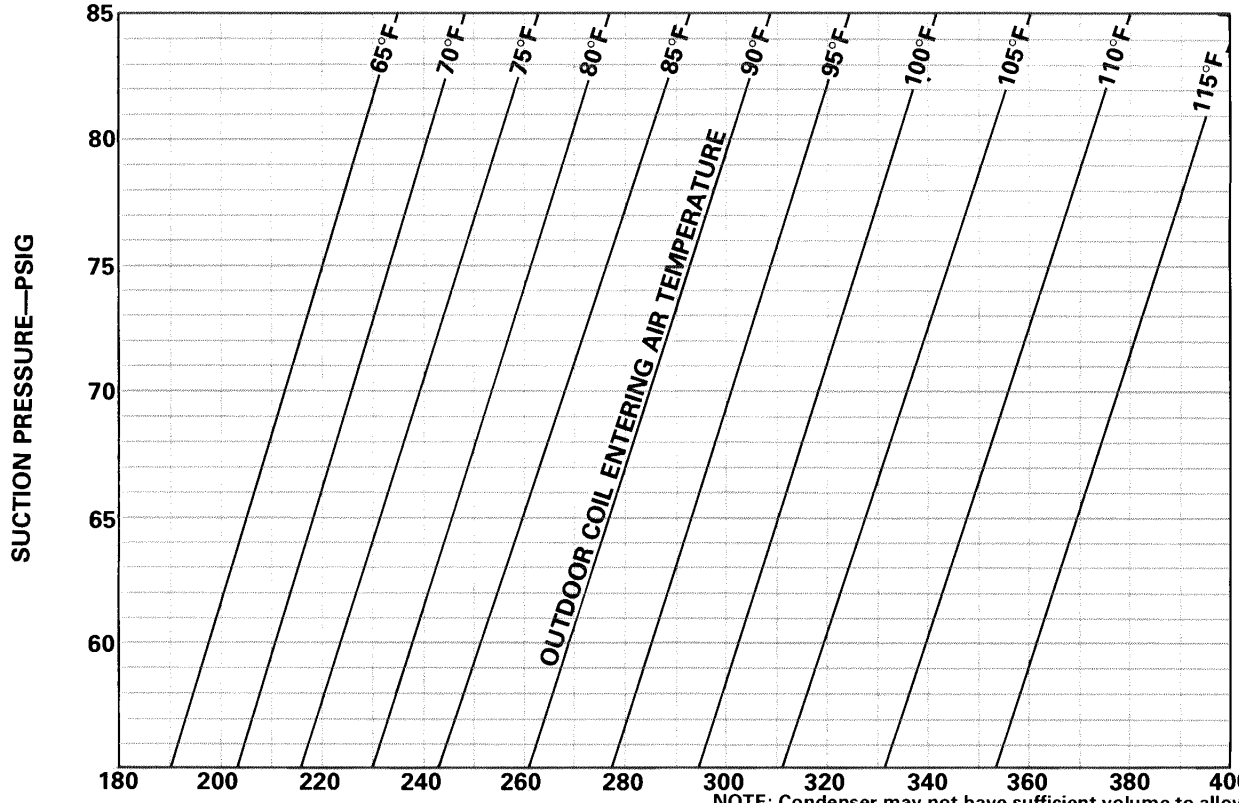
NORMAL OPERATING PRESSURE CURVE FOR DMS4-275 & 415 WITH CONDENSER HEAT . . . Comp. 2-275 & 415 . . . Comp. 3-415 WITHOUT CONDENSER HEAT . . . COMP. 1-275 & 415 . . . COMP. 2-275 & 415 . . . COMP. 3-415



Litho U.S.A.
PC-7431-L9

NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.

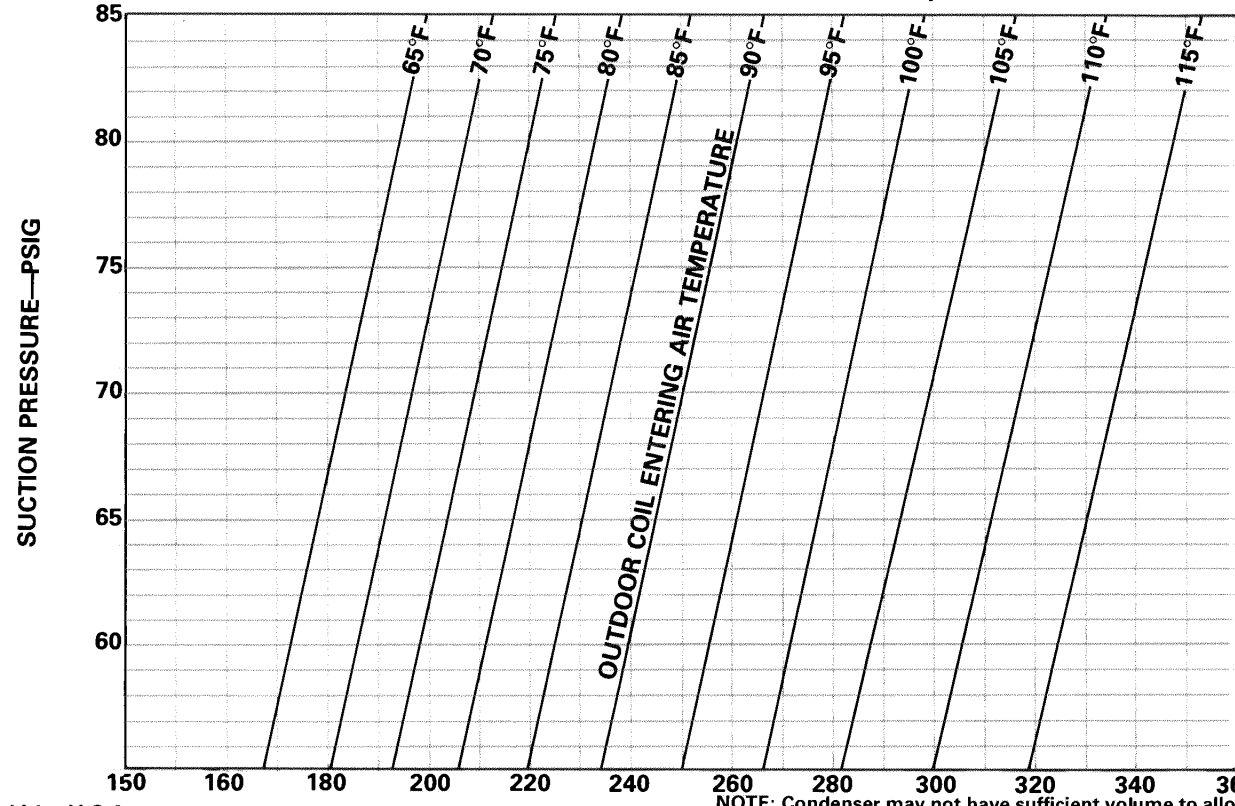
NORMAL OPERATING PRESSURE CURVE FOR DMS4-300, 360 & 600 WITH CONDENSER HEAT . . . Comp. 1-300, 360 & 600



Litho U.S.A.
PC-7432-L9

NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.

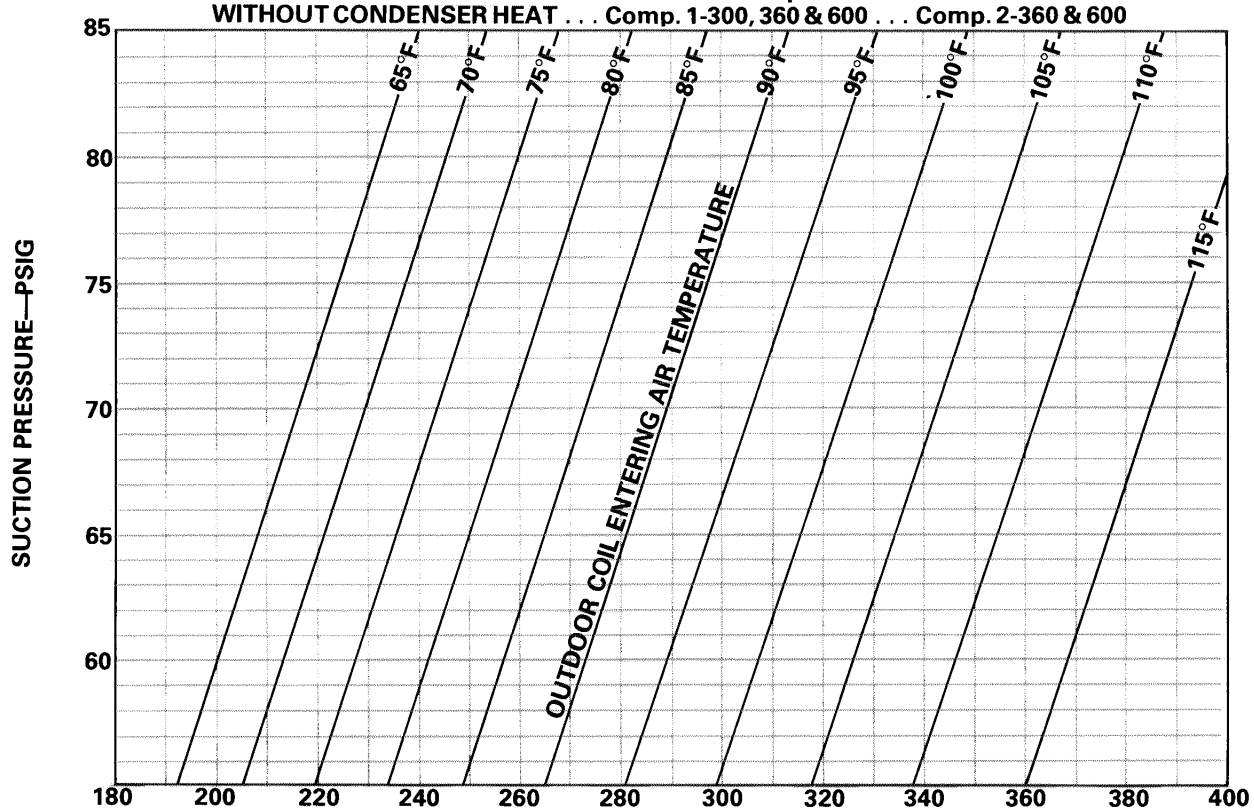
NORMAL OPERATING PRESSURE CURVE FOR DMS4-300 WITH OR WITHOUT CONDENSER HEAT . . . Comp. 2-300



Litho U.S.A.
PC-7433-L9

NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.

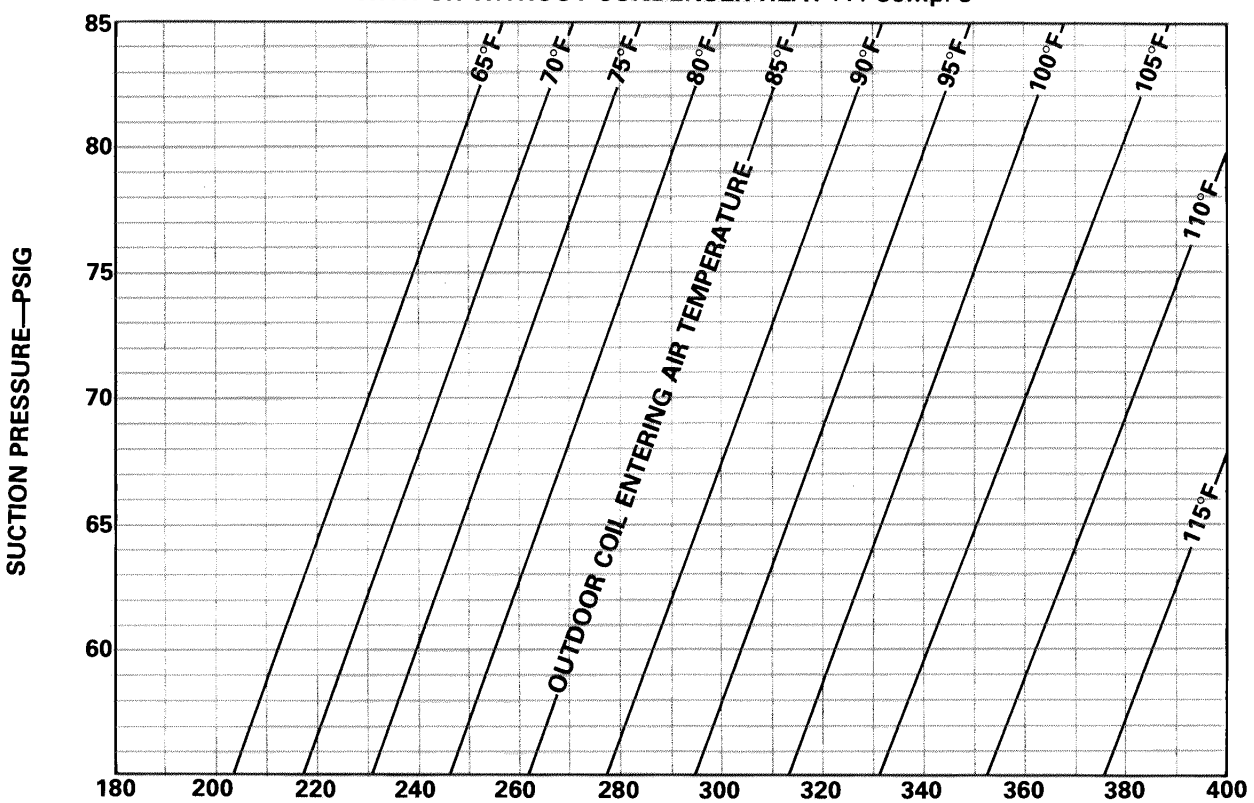
NORMAL OPERATING PRESSURE CURVE FOR DMS4-300, 360 & 600
WITH CONDENSER HEAT . . . Comp. 2-360 & 600
WITHOUT CONDENSER HEAT . . . Comp. 1-300, 360 & 600 . . . Comp. 2-360 & 600



Litho U.S.A.
PC-7434-L9

NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.

NORMAL OPERATING PRESSURE CURVE FOR DMS4-600
WITH OR WITHOUT CONDENSER HEAT . . . Comp. 3



Litho U.S.A.
PC-7435-L9

NOTE: Condenser may not have sufficient volume to allow a complete pump down. Use high and low pressure gauges during pump down cycle. High pressure should not exceed 410 pounds.

CHILLED WATER

I - CHILLED WATER SECTION

Figure 75 identifies chilled water section. The motorized valve is secured to a support bracket for shipping. Remove the two bolts as shown.

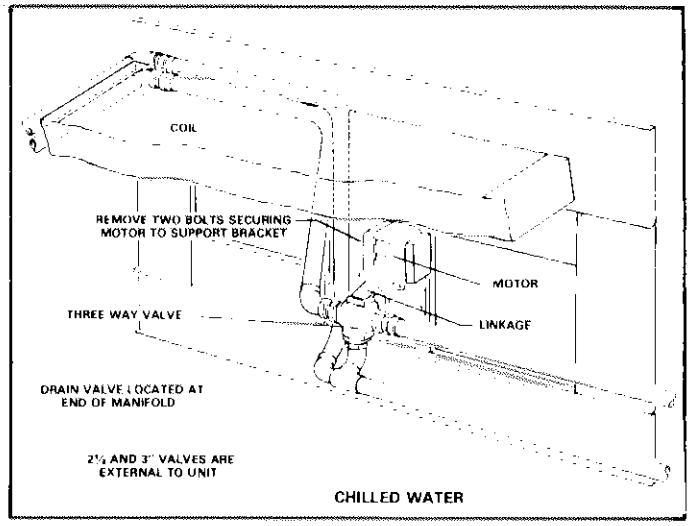
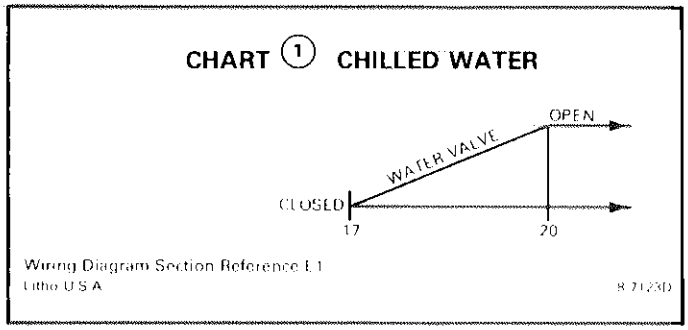


FIGURE 75

II - FUNCTION CHART

The following chart illustrates chilled water operation.



1 - The switches at load analyzer module are not used. The command signal from "HI" terminal controls valve modulation.

2 - At 17 volts or lower there is no water flow through coil.

3 - The valve modulates open upon a voltage increase and is fully open at 20.

III - CHECKING VALVE

1 - Close main disconnect switch on unit.

2 - Remove wire from terminal 2 of chilled water relay (K69). Connect jumper across C and F terminals on motor. Motor should rotate clockwise lifting valve stem. Refer to Figure 76.

- a - At end of stroke, notch in motor shaft should be down but at an angle 10° to right of vertical.
- b - The motor should be free to run its complete stroke.
- c - With the valve in this position, the by-pass line is open and flow to the coil is closed.

3 - Remove jumper across C and F terminals. Motor shaft should rotate counterclockwise, lowering valve steam. Refer to Figure 77.

- a - At end of stroke, notch in motor shaft should be up, but at an angle 10° to right of vertical.
- b - With the valve in this position, the by-pass line is closed and water will flow through the coil.

4 - Reconnect wire to terminal 2 of chilled water relay (K69).

IV - INITIAL CHILLED WATER START-UP

1 - Close main disconnect switch on unit. Indoor blower and return air blower should start.

2 - Refer to section "System Check Using Load Simulator" to check valve modulation in response to a cooling demand.

V - COOLING CHECK-OUT USING LOAD SIMULATOR

Connect the load simulator as shown in Figure 30 on page 31. The following procedure will check the "HI" signal at the load analyzer module.

1 - Connect DC voltmeter negative lead to 24 VDC (—) terminal and positive lead to "HI" terminal to obtain heating command signal. Use a double spade adapter at "HI" terminal. See Figure 78.

2 - Refer to function chart. Slowly rotate load simulator while observing voltmeter. As the load simulator raises the command input voltage, the chilled water valve will modulate in response to the demand.

3 - Disconnect load simulator and DC voltmeter from the load analyzer module. Reconnect the negative and positive wires to the correct 24 VDC terminals.

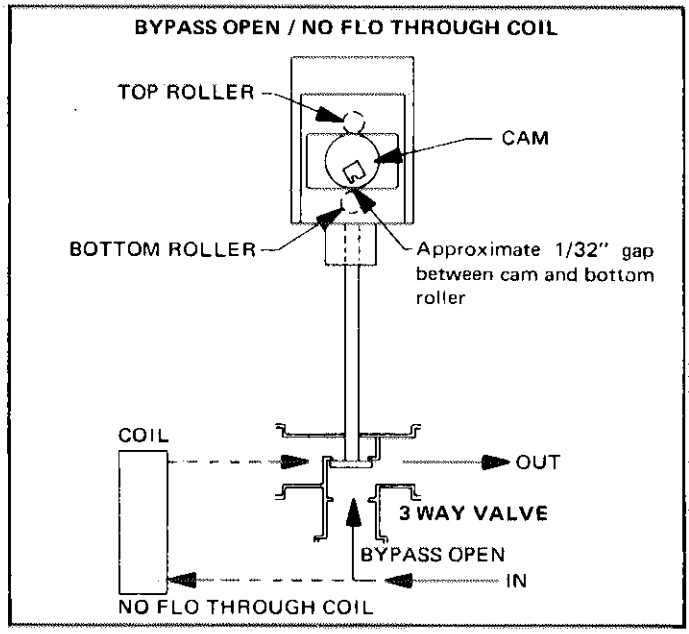


FIGURE 76

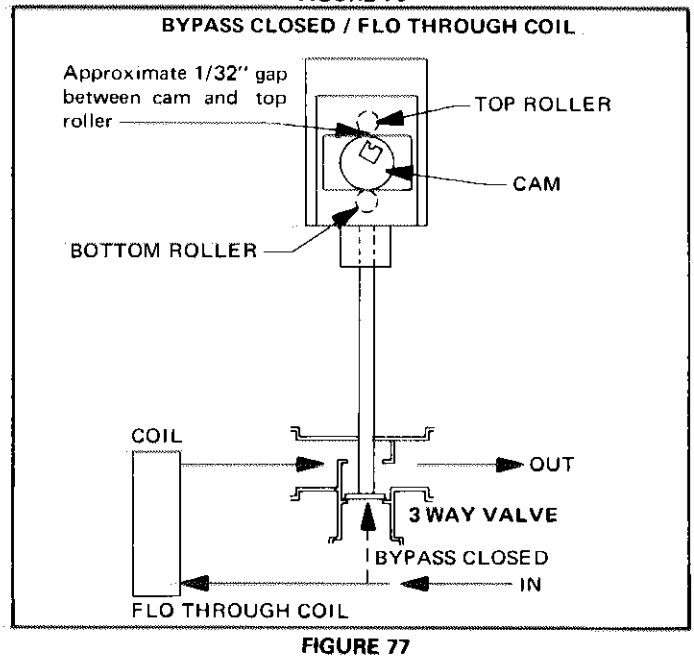


FIGURE 77

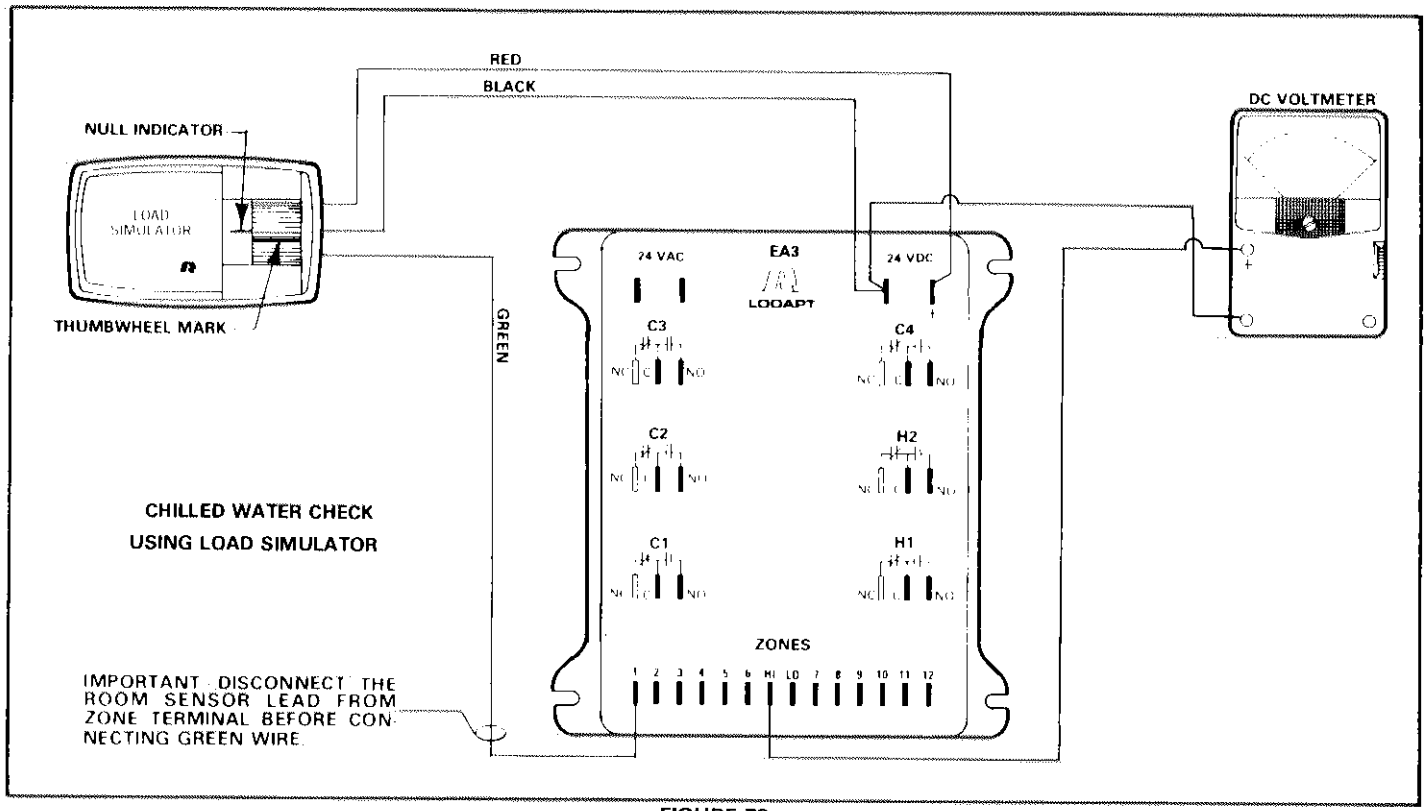

RED
BLACK
NULL INDICATOR
LOAD SIMULATOR
THUMBWHEEL MARK
GREEN
DC VOLTMETER
24 VAC
EA3
LOOAPT
24 VDC
C3
C4
C2
H2
C1
H1
ZONES
1 2 3 4 5 6 HI LO 7 8 9 10 11 12
CHILLED WATER CHECK
USING LOAD SIMULATOR
IMPORTANT DISCONNECT THE ROOM SENSOR LEAD FROM ZONE TERMINAL BEFORE CONNECTING GREEN WIRE.

FIGURE 78

BLOWERS

I - INDOOR BLOWER AND RETURN BLOWER IDENTIFICATION

Figure 79 identifies the indoor blower motor section for DMS4 series units. The return air blower is optional. Figure 80 designates the return air blower components for DMS4 series units.

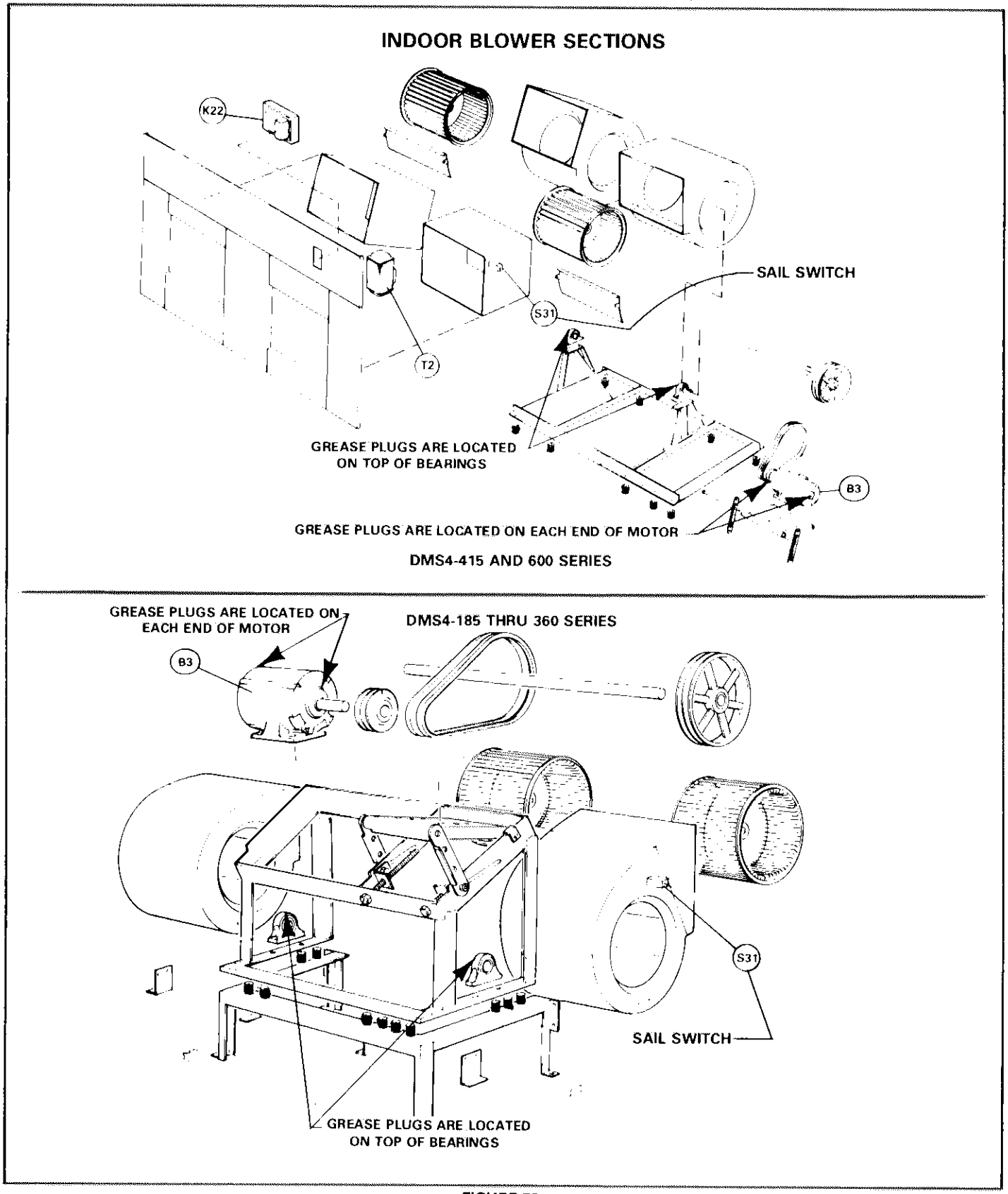
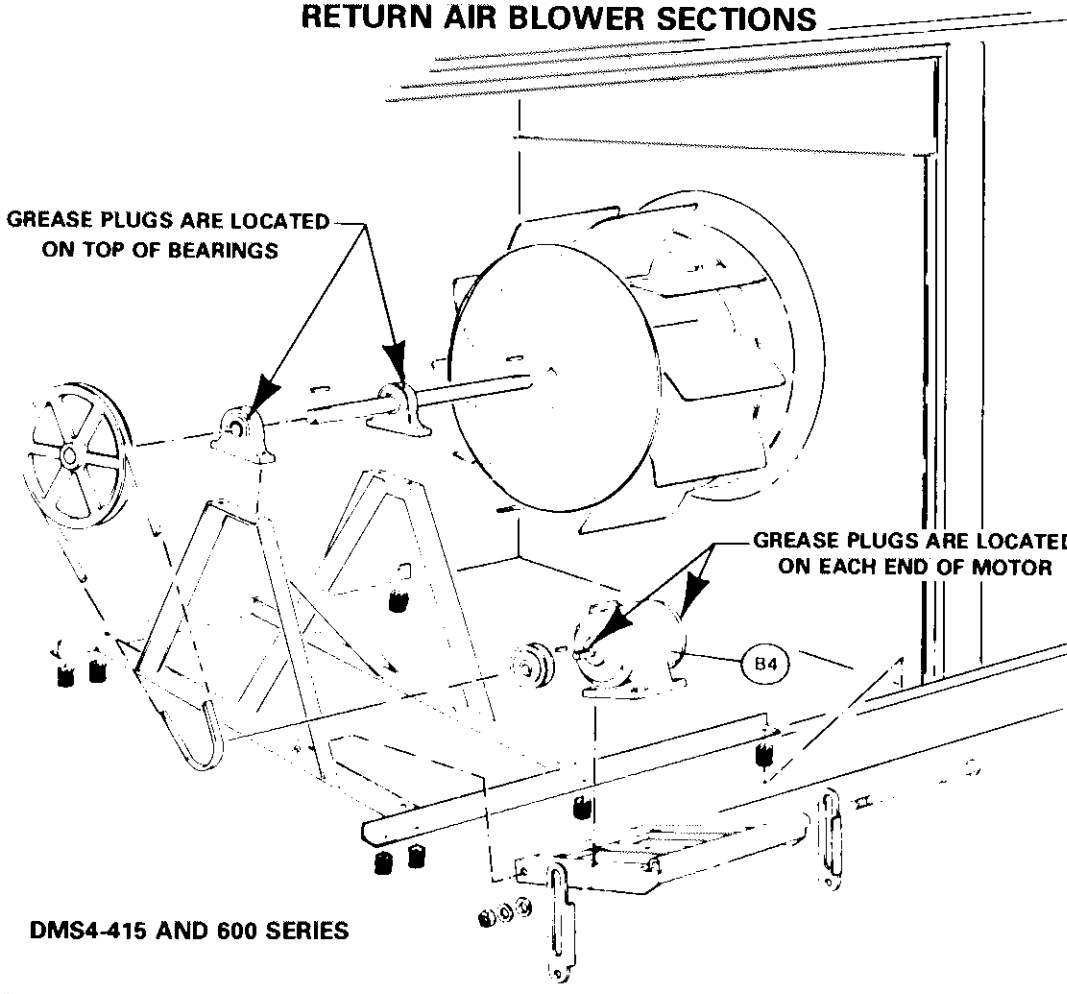
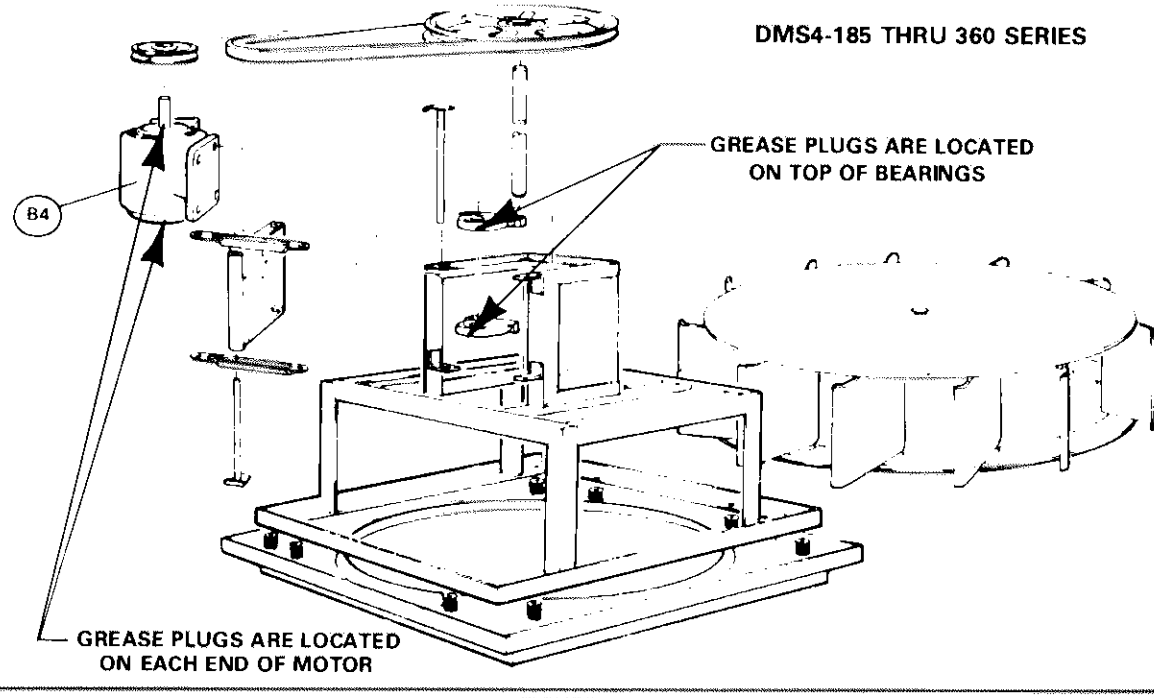


FIGURE 79

RETURN AIR BLOWER SECTIONS



DMS4-415 AND 600 SERIES



DMS4-185 THRU 360 SERIES

FIGURE 80

II - BLOWER CONTROLS

The contactors, fusing and overloads for motors are identified within the disconnect box.

A - Sail Switch

The sail switch senses any indoor blower motor failure and shuts down all systems within unit. See Figure 79.

B - Firestats

Firestats (manual reset) are mounted in the return and supply air streams as shown in Figures 81 and 82. They will shut off unit with temperatures in excess of 136°F (57.8°C).

III - BLOWER DRIVE SELECTION

Refer to Table 15 and Table 16 for maximum usable horsepower and drive selection for both the supply air blower and return air blower.

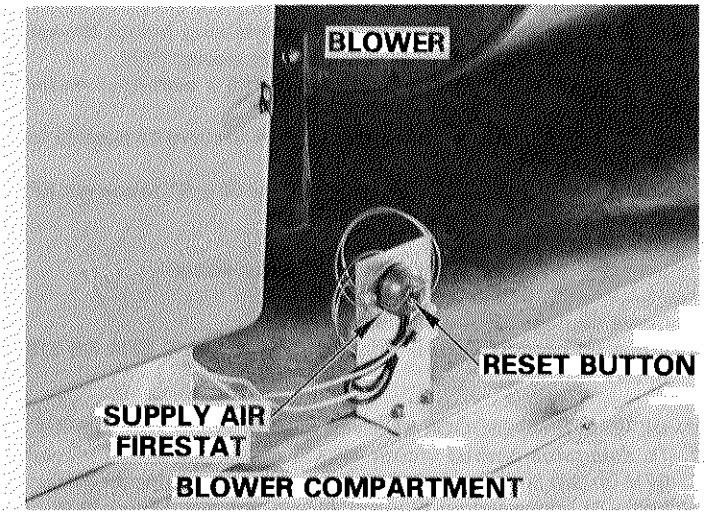


FIGURE 81

IV - CHECKING INDOOR BLOWER CFM (m^3/hr)

Either an amp or watt method can be used to determine indoor blower CFM (m^3/hr).

A - Amp Method

Four factors are needed to determine indoor blower CFM (m^3/hr); (1) measured blower RPM, (2) measured voltage, (3) blower motor amps, (4) motor manufacturer nameplate voltage and HP.

1 - Using blower amperage and voltage measured at unit, refer to corrrect Amps to Horsepower Curve on page 78 or 79 to convert to HP.

2 - Using this HP figure, refer to curve on page 80 or 81 to convert HP and RPM to CFM (m^3/hr).

Example - Readings with a 15 HP, 230 volt rated General Electric Motor.

26 Amps
230 measured voltage
800 measured blower RPM

3 - Curve on page 79 — 26 amps and 230 volts = 9 HP.

4 - Curve on page 81 — 9 HP and 800 RPM = 14,900 CFM (25 318 m^3/hr).

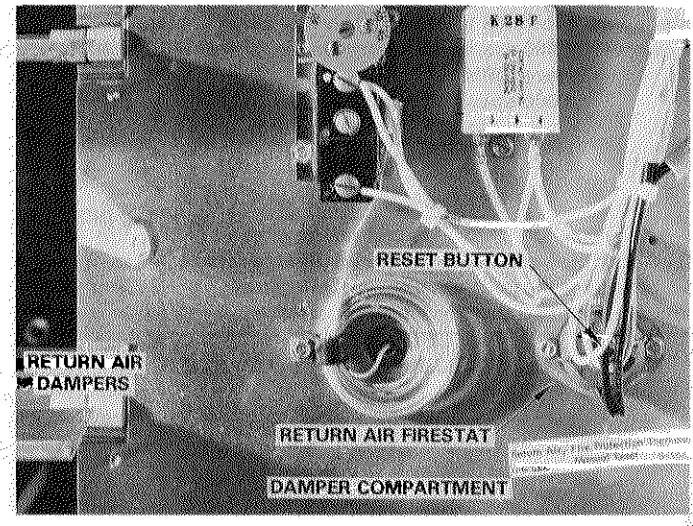


FIGURE 82

TABLE 15

Nominal Motor Hp	**Maximum Usable Hp	SUPPLY AIR BLOWER Rpm Range Of All Available Drive Setups					
		185, 275, 300 and 360 Units		415 and 600 Units			
		@1725 Rpm Motor Speed/60 Hz	@1440 Rpm Motor Speed/50 Hz	@1725 Rpm Motor Speed/60 Hz	@3450 Rpm Motor Speed/60 Hz	@1440 Rpm Motor Speed/50 Hz	@2880 Rpm Motor Speed/50 Hz
3	3.45	595/925	595/760 760/900	----	----	----	----
5	5.75	595/925	595/760 760/900	515/735	----	512/650 595/735	----
7-1/2	8.63	825/915	840/995 890/1070	680/900	----	*680/817 748/915	----
10	11.50	*960-1030- 1095-1160	*990-1060- 1130-1200	*725-780- 835-890	----	*720-775- 830-885	----
15	17.25	----	----	----	*870-910- 950-1010	----	*825-970

*Fixed sheaves.

**On 50 Hertz units, nominal motor H.P. is the maximum usable H.P.

TABLE 16

Nominal Motor Hp	*Maximum Usable Hp	RETURN AIR BLOWER Rpm Range of All Available Drive Setups			
		185, 275, 300 and 360 Units		415 and 600 Units	
		@1725 Rpm Motor Speed/60 Hz	@1440 Rpm Motor Speed/50 Hz	@1725 Rpm Motor Speed/60 Hz	@1440 Rpm Motor Speed/50 Hz
1-1/2	1.72	351/447	314/430	330/430	330/466
3	3.45	460/561	430/546	445/545	466/604
5	5.75	466/561	----	550/665	568/700
7-1/2	8.62	----	----	680/815	660/817

*On 50 Hertz units, nominal motor H.P. is the maximum usable H.P.

B - Watt Method (Preferred Method)

Two measured factors are needed in determining indoor blower CFM (m^3/hr); (1) blower motor watts and (2) blower RPM.

NOTE - Motor watts must be determined with a watt-hour meter (watt meter).

1 - Using blower wattage read at motor, refer to curve on page 82 to convert watts to HP.

2 - Using this HP rating, refer to curve on page 80 or 81 to convert HP and RPM to CFM (m^3/hr).

Example - Readings at unit

7,900 measured blower motor watts

800 measured blower RPM

3 - Curve on page 82 — 7,900 watts = 9 HP.

4 - Curve on page 81 — 9 HP and 800 RPM = 14,900 CFM (25 318 m^3/hr).

V - DETERMINING INDOOR BLOWER SPEED

1 - To determine desired indoor blower speed, the actual blower CFM (m^3/hr) and blower RPM must be found as shown in section "IV" - Checking Indoor Blower CFM (m^3/hr).

These factors plus the specified indoor blower CFM (m^3/hr) can be made into a formula to calculate correct blower speed.

Example - 14,900 measured indoor blower CFM (25 318 m^3/hr) at 800 blower RPM.

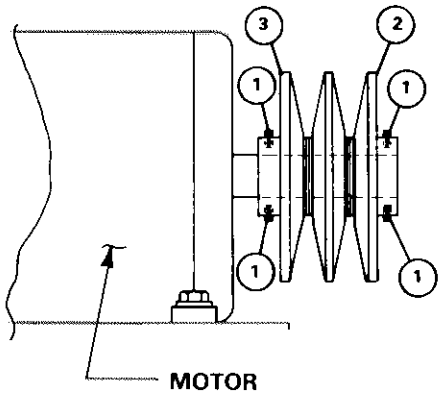
14,000 specified indoor blower CFM (23 788 m^3/hr).

$$\frac{\text{14,000 CFM X 800 RPM}}{\text{14,900 CFM}} = \text{750 RPM}$$

$$\frac{\text{23 788 } m^3/hr \text{ x 800 RPM}}{\text{25 318 } m^3/hr} = \text{750 RPM}$$

2 - Adjust blower drive to the speed (RPM) as instructed in Figure 83 or replace the pulley, whichever is necessary. 10 H.P. and 15 H.P. motors use fixed sheaves which must be replaced to change speed.

PULLEY ADJUSTMENT (BELOW 10 H.P.)



Step 1 - Loosen Allen screws.

Step 2 - Turn outside pulley clockwise to increase speed; turn counterclockwise to decrease speed.

Step 3 - Turn inside pulley counterclockwise to increase speed; turn clockwise to decrease speed.

FIGURE 83

VI - CHECKING INDOOR AND RETURN AIR BLOWER MOTOR AMPERAGE

It is mandatory that the blower motor amperages be checked on every DMS4 unit to be sure the motors are not overloaded.

1 - Open exterior panel exposing the electrical box.

2 - Turn handle to open electrical box. This disconnects power to the unit.

WARNING - Box contains high voltage – use extreme caution.

3 - *415 and 600 Units Only* - Remove indoor and return air blower motor contactor access panel. Refer to Figure 84.

4 - Attach amp meter and then turn "On" disconnect.

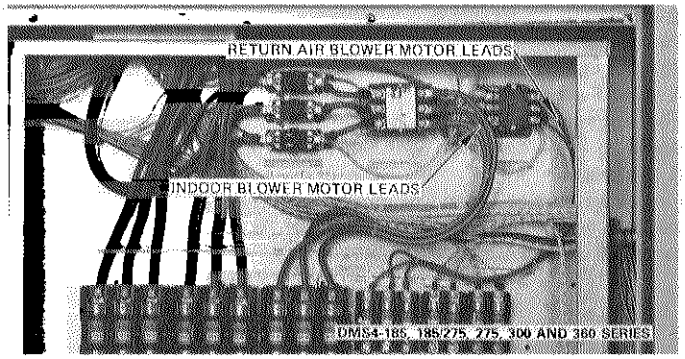


FIGURE 84

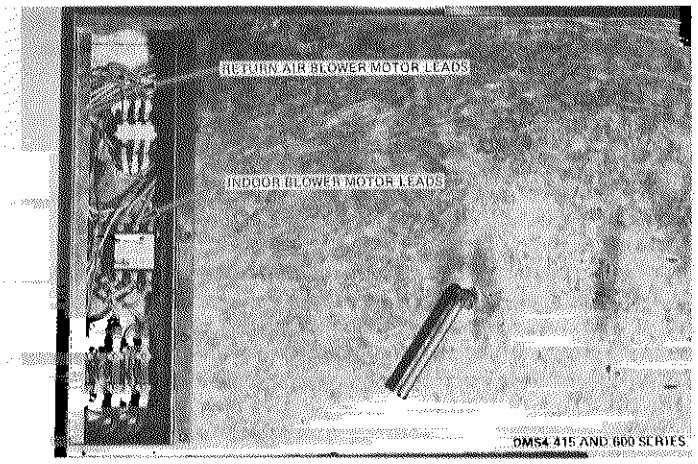


FIGURE 85

5 - Check amperage draw on each of the (3) wiring leads to the motor. See Figure 85 (185, 275, 300, 360 units) or Figure 84 (415, 600 units).

6 - Refer to Table 17 for motor full load amps.

7 - If amperage reading is greater than shown on Table 17, motor is overloaded. Overloaded motors must be replaced with a larger motor that will operate in the specified amperage range.

TABLE 17

BLOWER MOTOR FULL LOAD AMPS (NEC)				
*Blower Motor	208 Volt	230 Volt	460 Volt	575 Volt
Indoor	Amps	Amps	Amps	Amps
3 Hp	10.6	9.6	4.8	3.9
5 Hp	16.7	15.2	7.6	6.1
7-1/2 Hp	24.2	22.0	11.0	9.0
10 Hp	30.8	28.0	14.0	11.0
15 Hp	46.2	42.0	21.0	17.0
Return				
1-1/2 Hp	5.7	5.2	2.6	2.1
3 Hp	10.6	9.6	4.8	3.9
5 Hp	16.7	15.2	7.6	6.1

*See manufacturers nameplate for maximum full load amps.

VII - EXTERNAL STATIC PRESSURE MEASUREMENTS

If desired, external static pressure can be taken as follows:

1 - Assemble a static pressure probe according to Figure 86.

2 - Take external static pressures at locations specified in Figure 87.

VIII - AIR BALANCING

A - Supply And Return Air Blowers

The unit must be adjusted so both supply and return blowers have the same air handling capacities. This is very important in buildings that are exceptionally tight. See Figure 88 for three applications where blowers should be in balance.

On multiple unit installations, operation of other equipment can greatly effect the balancing procedure. During checkout of each unit, shut off other units.

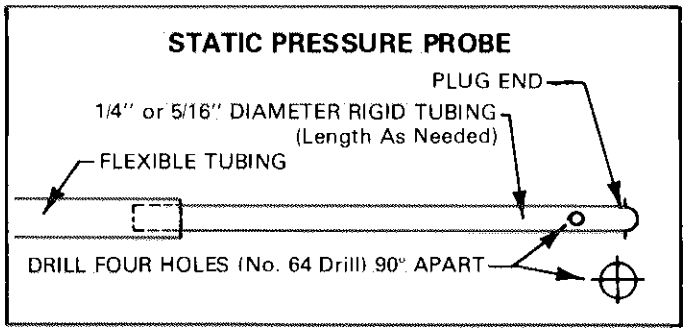


FIGURE 86

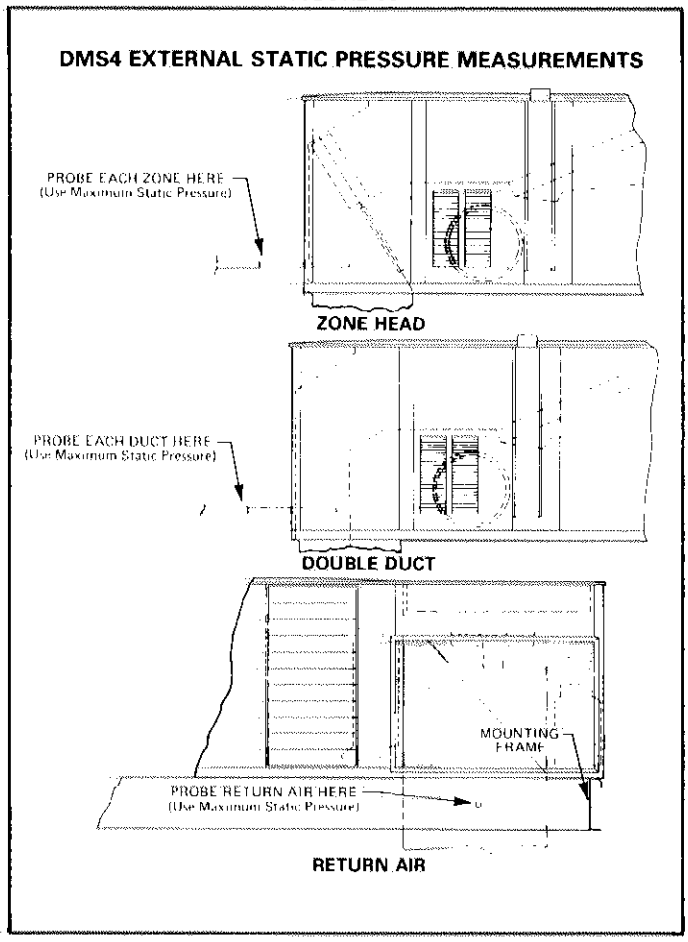


FIGURE 87

NOTE - When balancing unit, adjust zone dampers so that 50% of the air goes through hot deck and 50% goes through cold deck.

1 - Adjust main blowers, using watt meter or ammeter method to get desired operating cfm. This should be set with fresh air/return air dampers in the 50/50 position.

2 - Adjust fresh air/return air dampers to the 100% return air position and measure static pressure at position "A" on unit. See Figure 89. This static pressure must be 0" w.c. to + 0.10" w.c. (0 mm w.c. to 2.54 mm w.c.).

3 - If static pressure is negative at point"A", increase return air blower rpm until proper static pressure is obtained.

NOTE - Increasing or decreasing static pressure at point "A" will change overall pressure of indoor blowers and cfm accordingly. Therefore, some adjustment of indoor blowers rpm may be necessary.

B - Adjusting Damper Volume

Because the supply run lengths and air requirements do vary, balancing dampers are provided at each zone head outlet to permit manual air adjustment. Refer to Figure 90. The installer must furnish

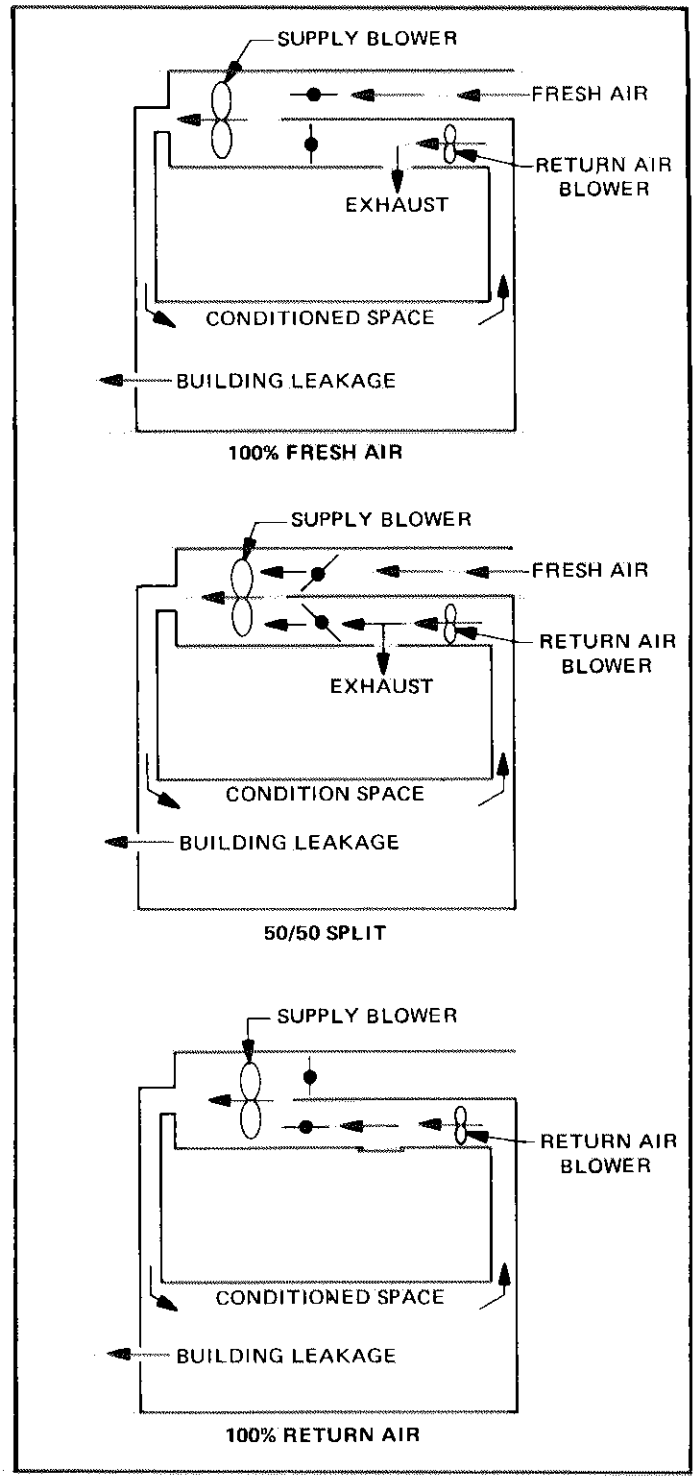


FIGURE 88

and install the balancing dampers for double duct applications. Dampers should be installed between the mixing box and diffuser outlet.

IX - BELT ADJUSTMENT

Maximum life and wear can be obtained from belts only if proper pulley alignment and belt tension are maintained.

Initially, tension new belt(s) at the maximum deflection force recommended; then re-tension belt(s) after a run in period of 24-48 hours. This allows belt(s) to stretch and seat in the grooves.

A - Pointers For Installing Belts

1 - Use a matched set of belts.

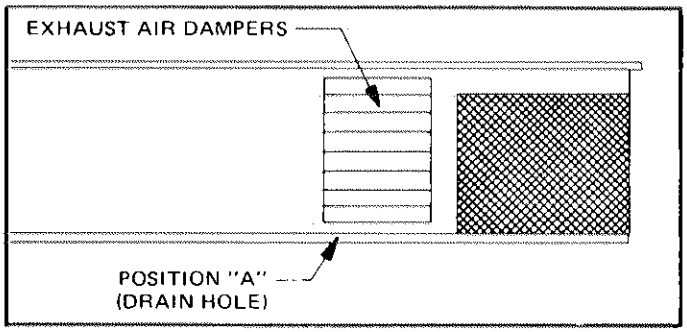


FIGURE 89

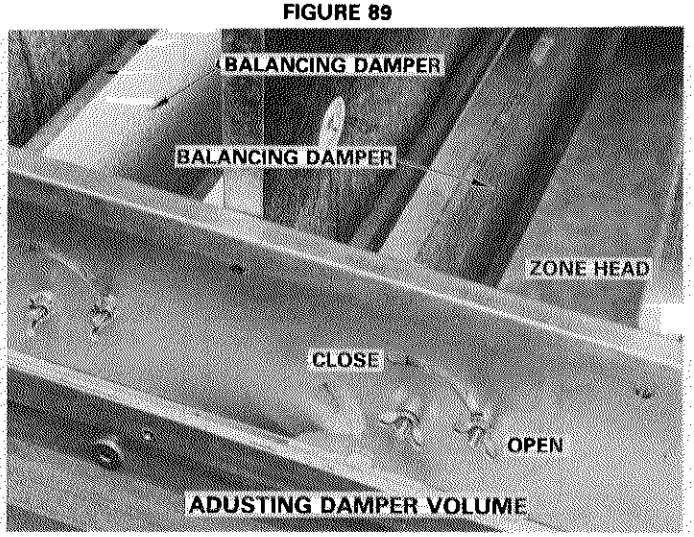


FIGURE 90

2 - Clean oil and grease from the grooves, also remove any rust or burrs from the sheave grooves.

3 - Shorten the center distance of the drive until the belts can be put on the sheaves without forcing.

4 - Make sure that the sheaves are correctly aligned, the shafts are parallel, there is clearance for the drive to run and the bearings have oil.

5 - On two groove adjustable pulley, be sure both are set at same pitch diameter.

B - Tensioning Belts

Ideal tension is the lowest tension at which the belt(s) will not slip under peak load conditions. Over-tensioning shortens belt and bearing life. The following is a recommended procedure for tensioning belts.

1 - Measure the span lenth, X. Refer to Figure 91.

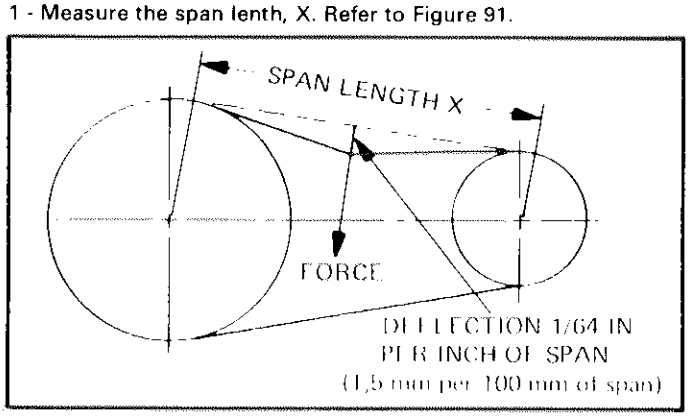


FIGURE 91

2 - At center of span length (X) apply a force perpendicular to span large enough to deflect belt 1/64" for every inch of span length (deflection 1.5 mm per 100 mm of span length).

Example - Deflection force of a 40" span would be 40/64 or 5/8".

Example - Deflection force of a 1000 mm span would be 15 mm.

3 - Compare the applied force with the value given in Table 18. If the force is between the minimum and maximum range shown, the drive tension should be satisfactory. A force below minimum value indicates an undertensioned belt. A force that exceeds maximum value indicates an overtensioned belt. Adjust the belt tension for the indoor blower as shown in Figures 92 and 93. Adjust the belt tension for the return blower as shown in Figures 94 and 95.

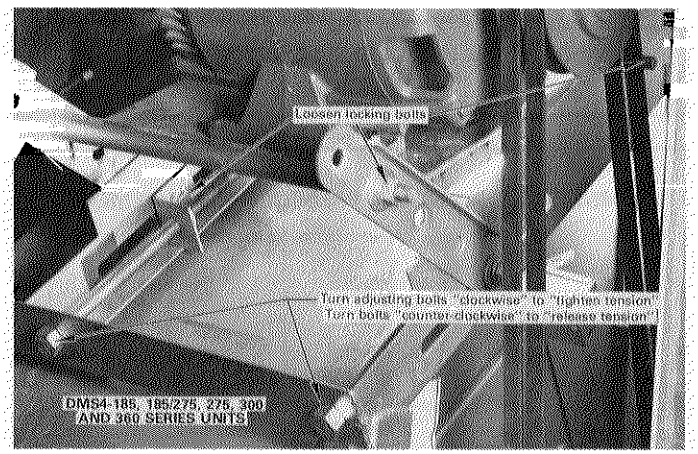


FIGURE 92

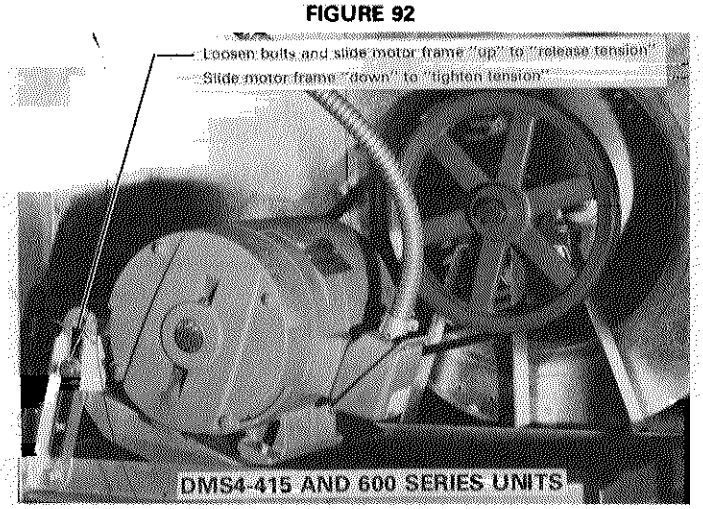


FIGURE 93

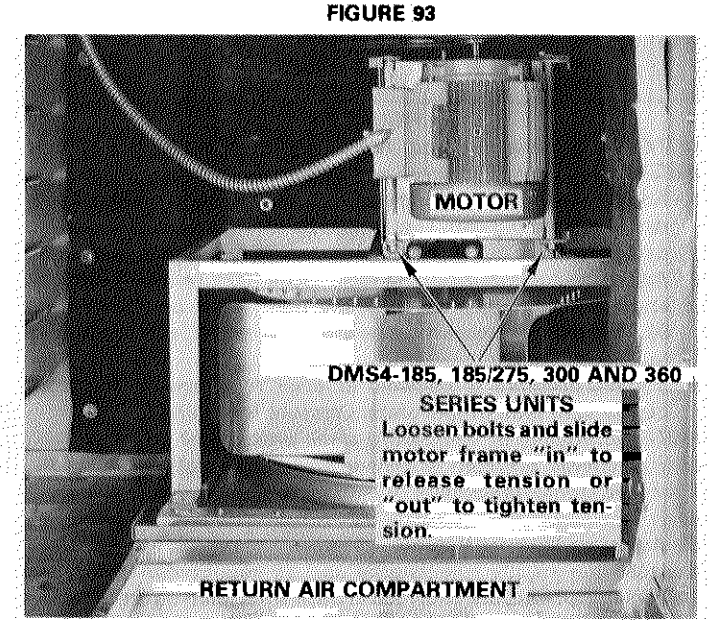


FIGURE 94

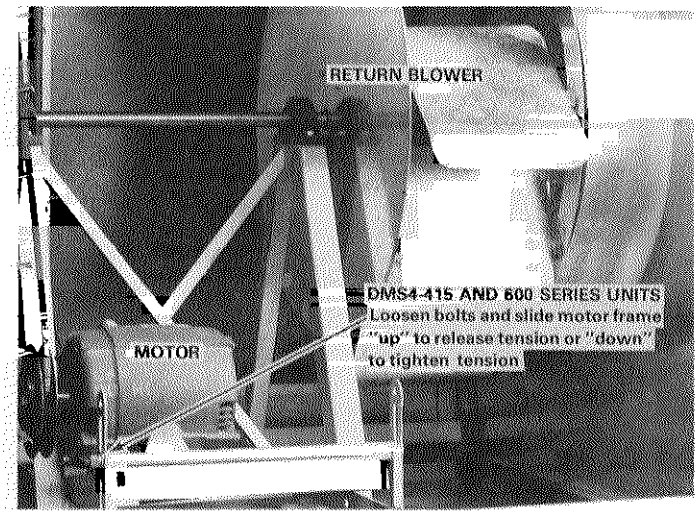


FIGURE 95

TABLE 18

Belt Cross Section (Marked on Belt)	Motor Pulley Pitch Diameter		Deflection Force			
			Minimum		Maximum	
	in.	mm	lbs.	Kg	lbs.	Kg
A	3.0 — 3.6	76,2 — 91,4	2-5/8	1,19	3-1/4	1,47
	3.8 — 4.8	96,5 — 121,9	3	1,36	4	1,81
	5.0 — 7.0	127,0 — 177,8	3-1/4	1,47	5	2,27
B	3.4 — 4.2	86,3 — 106,6	3	1,36	5	2,27
	4.4 — 5.6	111,7 — 142,2	4	1,81	5-7/8	2,66
	5.8 — 8.6	147,7 — 218,4	5-1/4	2,38	7-7/8	3,57

X - LUBRICATION

A - Motor Bearings

NOTE - Always relubricate motors according to manufacturer's lubrication instructions on each motor. If no instructions are provided, use the following as a guide:

1 - *Indoor and Return Air Blower Motor Bearings* - Bearings are prelubricated. For extended bearing life, relubricate at least once every two years with a lithium base grease, such as Westinghouse 53701RW, Chevron BRB2 (Standard Oil) or Andok 260 (Humble Oil). To relubricate, replace top plugs with standard grease fittings. Remove lower outlet plugs and add grease with handgun until new grease appears at bottom outlets. Run motor for a short time before replacing bottom plugs. Refer to Figures 79 and 80.

2 - *Condenser Fan Motors* - Prelubricated and sealed. No further lubrication required.

B - Blower Bearings

Indoor and Return Air Blower Bearings - Bearings are prelubricated. For extended bearing life, relubricate at least once every two years with a lithium base grease, such as Alvania 3 (Shell Oil), Chevron BRB2 (Standard Oil) or Regal AFB2 (Texas Oil). Use hand grease gun for relubrication. Add only enough grease to purge through the bearings so that a bead of grease appears at the seal lip contacts. Refer to Figures 79 and 80.

XI - REPLACING BLOWER BEARINGS

A - Alignment of Blower Bearings

Before installing blower bearings, the self-alignment feature of the bearing must be loose and free. Use the following procedure.

1 - Hold bearing stationary, such as in a vice.

2 - Insert a short length of blower shafting or wooden mallet handle into bearing to serve as a lever. **Do not use a tool that will score or gouge the inside surface of the bearing.**

3 - Move lever side to side and up and down until bearing rotates free and easy in the housing. A small amount of light weight oil between the outer race and the bearing housing may aid in loosening the self-alignment feature.

IMPORTANT - If the self-alignment feature of the bearing can not be freed, do not use the bearing.

B - Assembly of Shaft, Bearings and Wheels

1 - Clean grease and dirt from blower shaft with solvent. **During assembly it is extremely important to keep shaft free of oil at the bearing locations since a bearing/shaft sealant will be used and oil will decrease the effectiveness of the sealant. However, a light coat of oil may be used on other areas of the shaft to aid in sliding shaft through blower wheels.**

2 - Assemble bearings, locking collars and blower wheels on the shaft.

3 - Proceed with securing bearing housings to frame. It is extremely important to properly align bearings to shaft. The bearing housing must be aligned so it will **rest perfectly flat** on the frame mounting arm. Tap lightly on the bearing housing with wooden mallet to obtain this alignment, then use slotted holes to center blower wheels in the housing orifice and secure bearing housings to frame.

IMPORTANT - There must be no misalignment between the bearing housing and frame since tightening down misaligned bearings will cause binding conditions and will result shortly in bearing and/or shaft failure.

4 - Now center the blower wheels side to side in housings and secure with woodruff keys and set screws.

5 - Check bearing and shaft alignment by sliding the shaft back and forth in the bearing. A properly aligned assembly should slide easily; not requiring over 40 lbs. (18 Kg) of force.

C - Bearing and Shaft Sealant

It is recommended that a sealant (loctite #601) be used between the bearing and shaft to take up clearance and aid in securing the inner race to the shaft. Loctite #601 is available from the Lennox Parts Center in 10 cc tubes, part number P-8-11211. An acceptable substitute is Stud, N Bearing Mount, Loctite #22, which is available at most automotive supply houses.

1 - Apply the sealant **sparingly** to the shaft on each side of the bearings. Slide the shaft back and forth until sealant is thoroughly worked into the shaft and bearing contact area.

NOTE - Loctite sealants remain liquid outside the joint. Remove excess. Sealant will partially cure in 10 minutes and fully cure in 1 hour.

2 - Position shaft to center blower wheels side to side in housings.

D - Locking Collars

If "Schwezloc" Sealmaster bearings are used, install locking collars immediately. Torque the set screws on collars by bending hex wrench. If bearings with eccentric locking collars are used, allow approximately 10 minutes for sealant to cure before locking collars in place. Lock as follows:

1 - Mate cam of collar with cam of bearing inner ring.

2 - Press collar lightly against inner ring, then turn collar **in direction of shaft rotation** until engaged. Refer to Figure 96.

3 - With draft pin in collar hole, strike in direction of shaft rotation to lock. See Figure 97.

4 - Tighten set screw in collar.

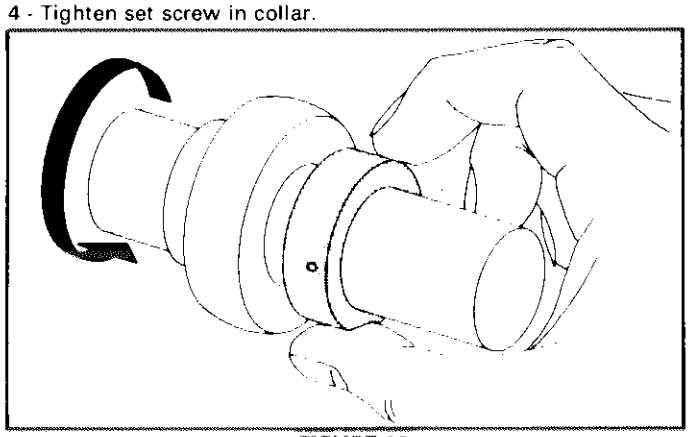


FIGURE 96

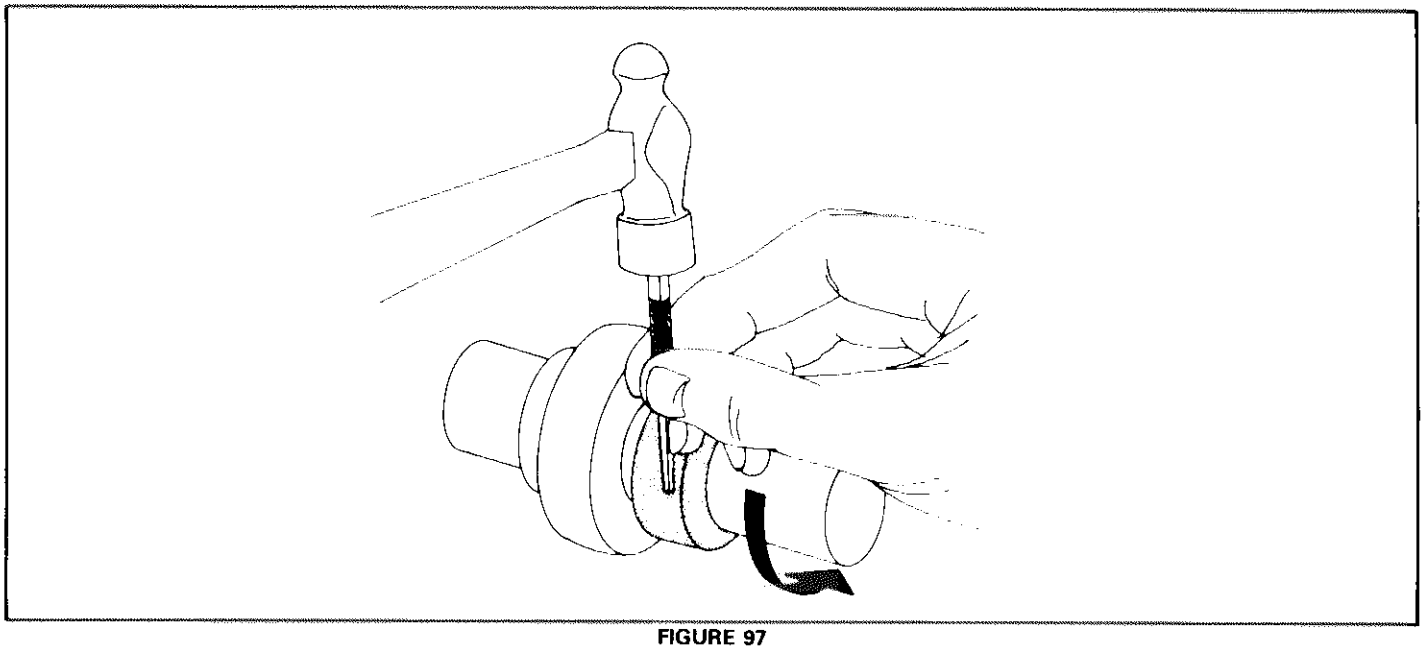
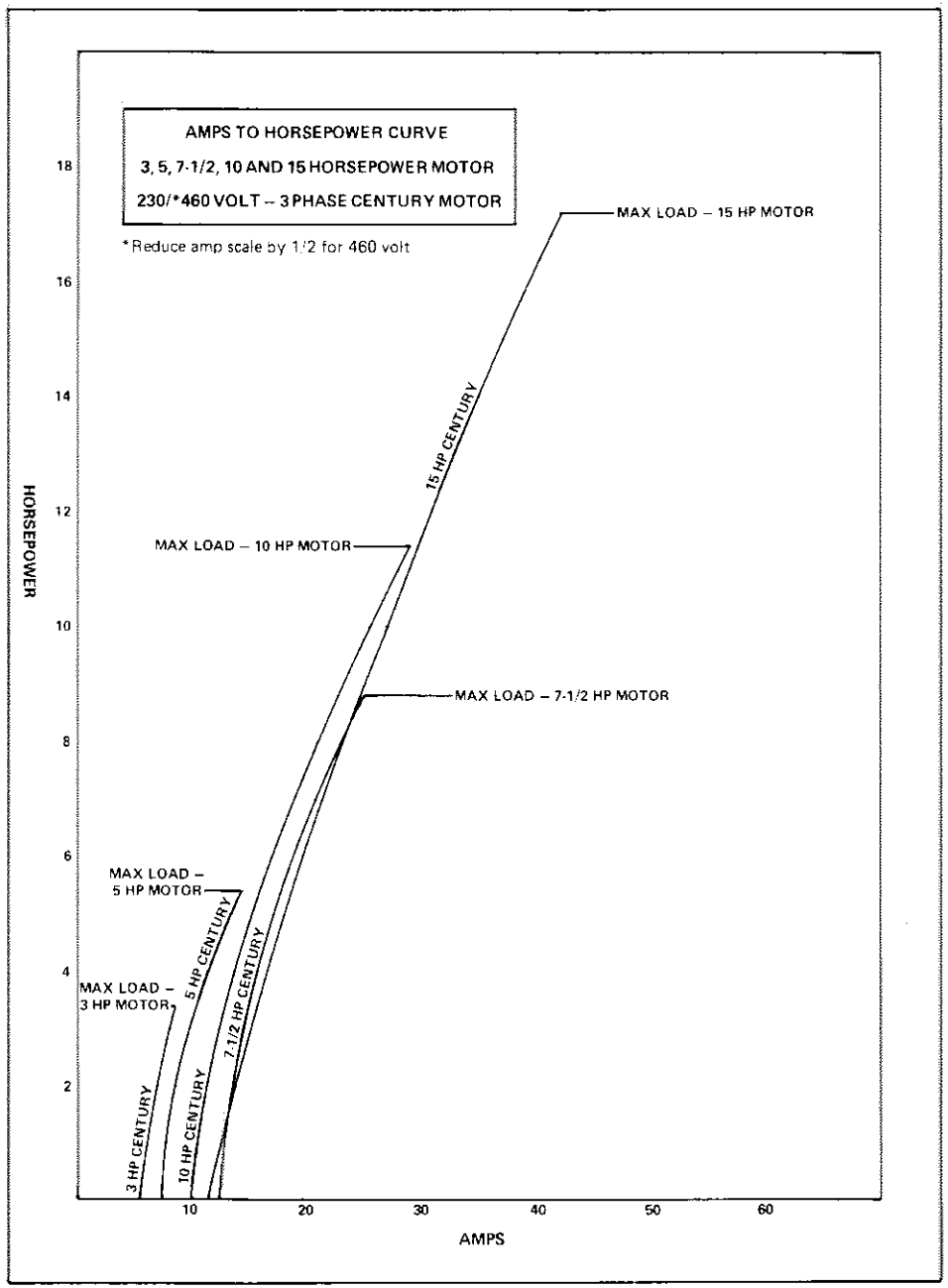
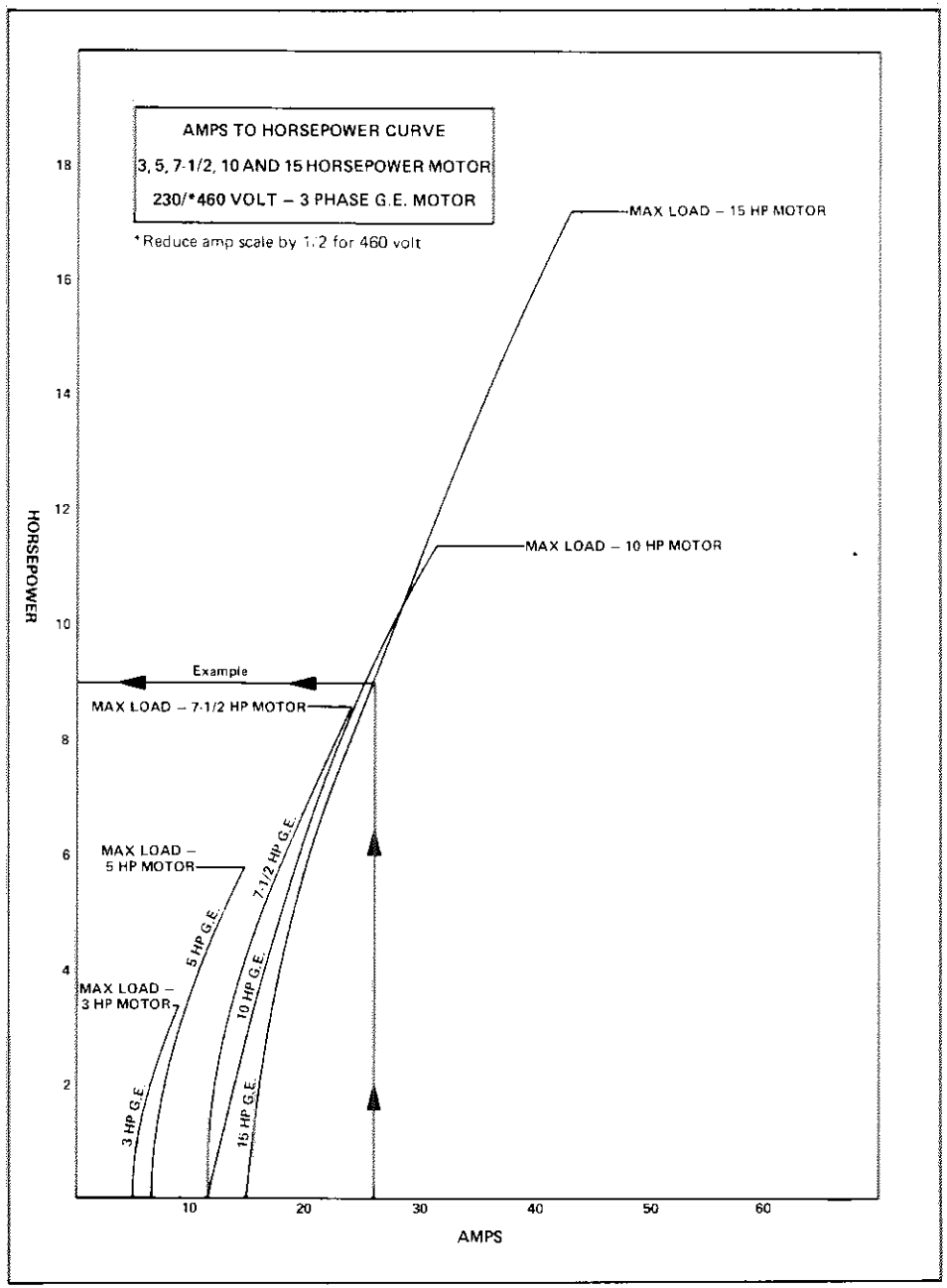
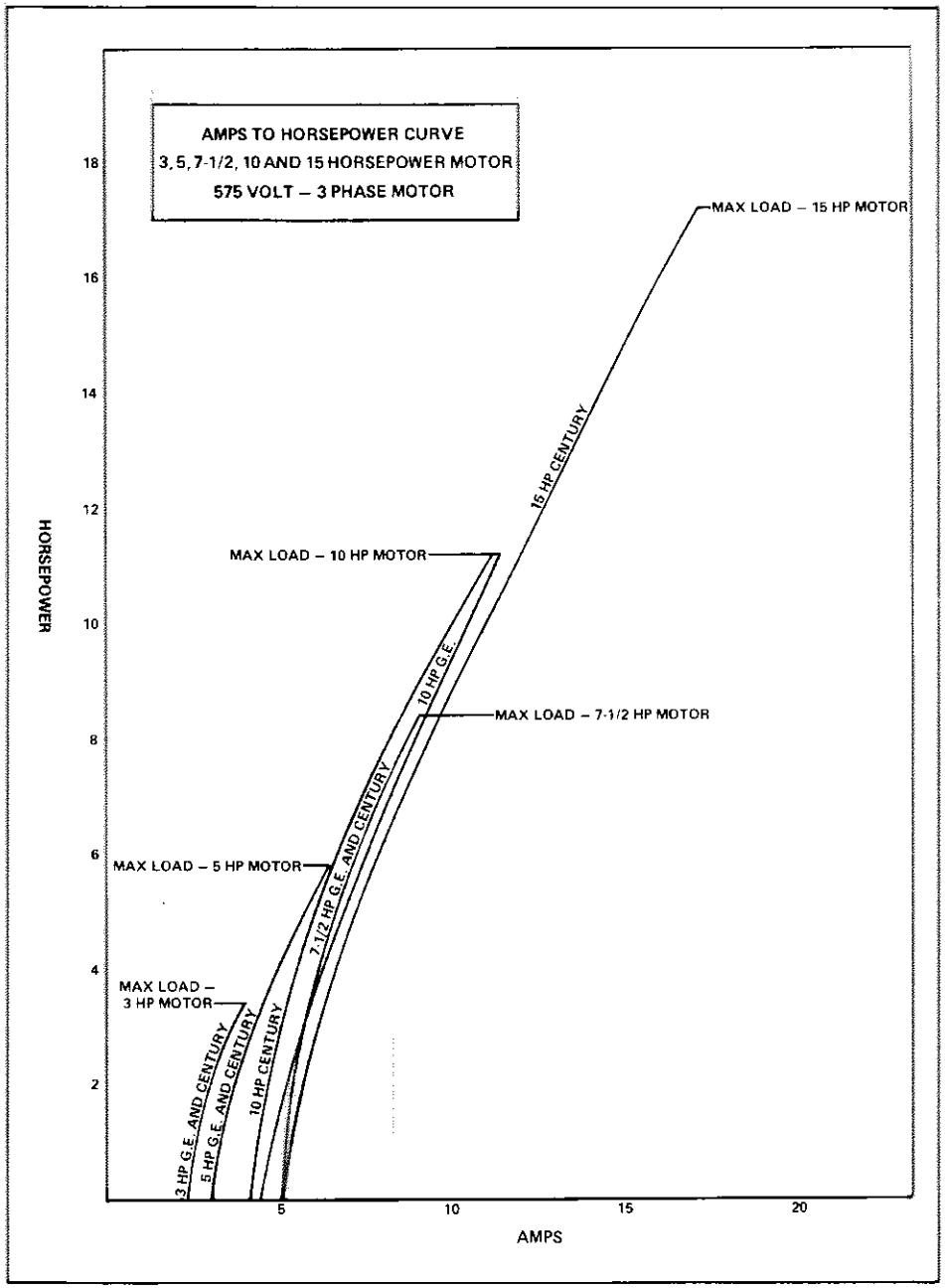
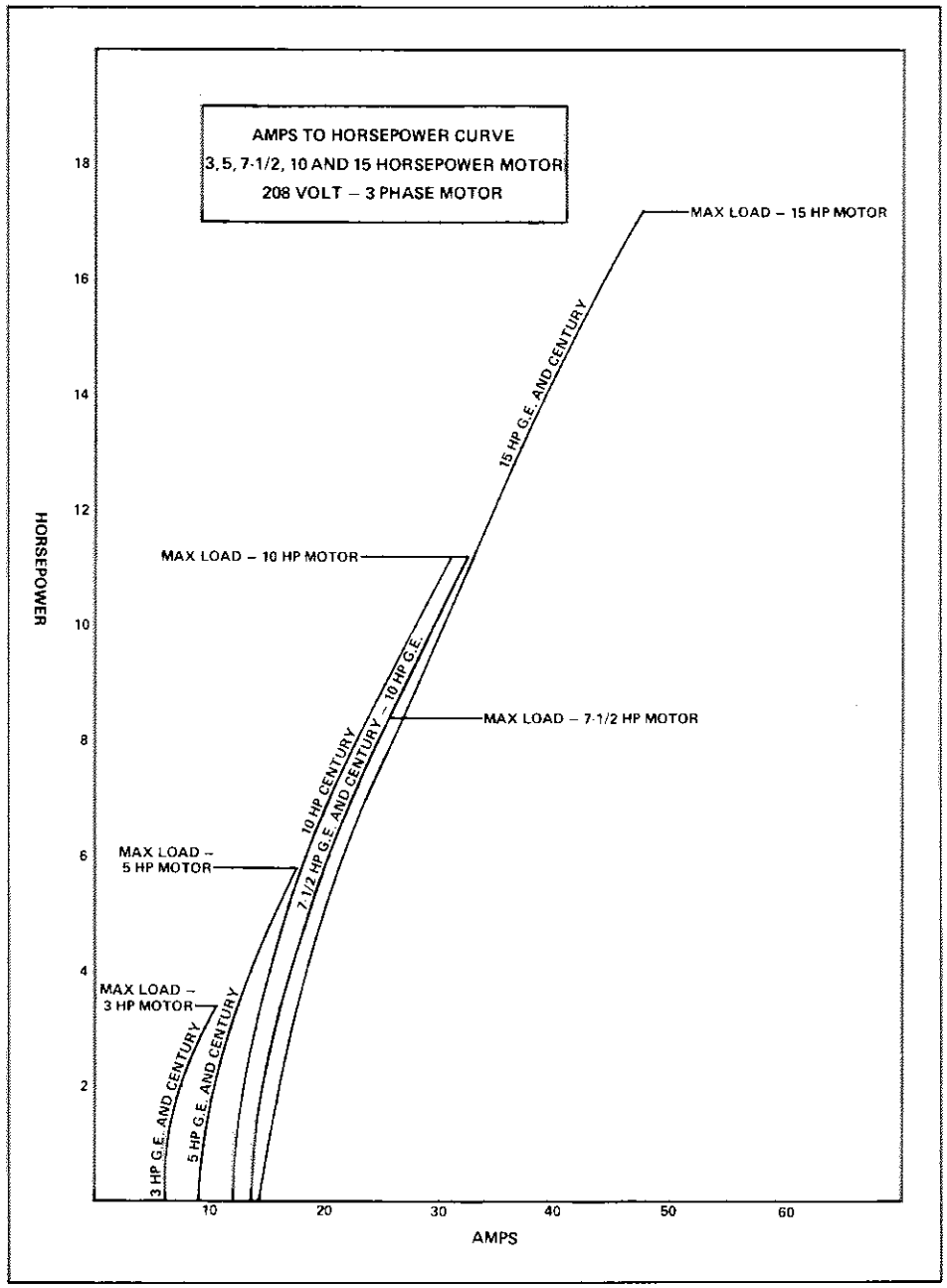


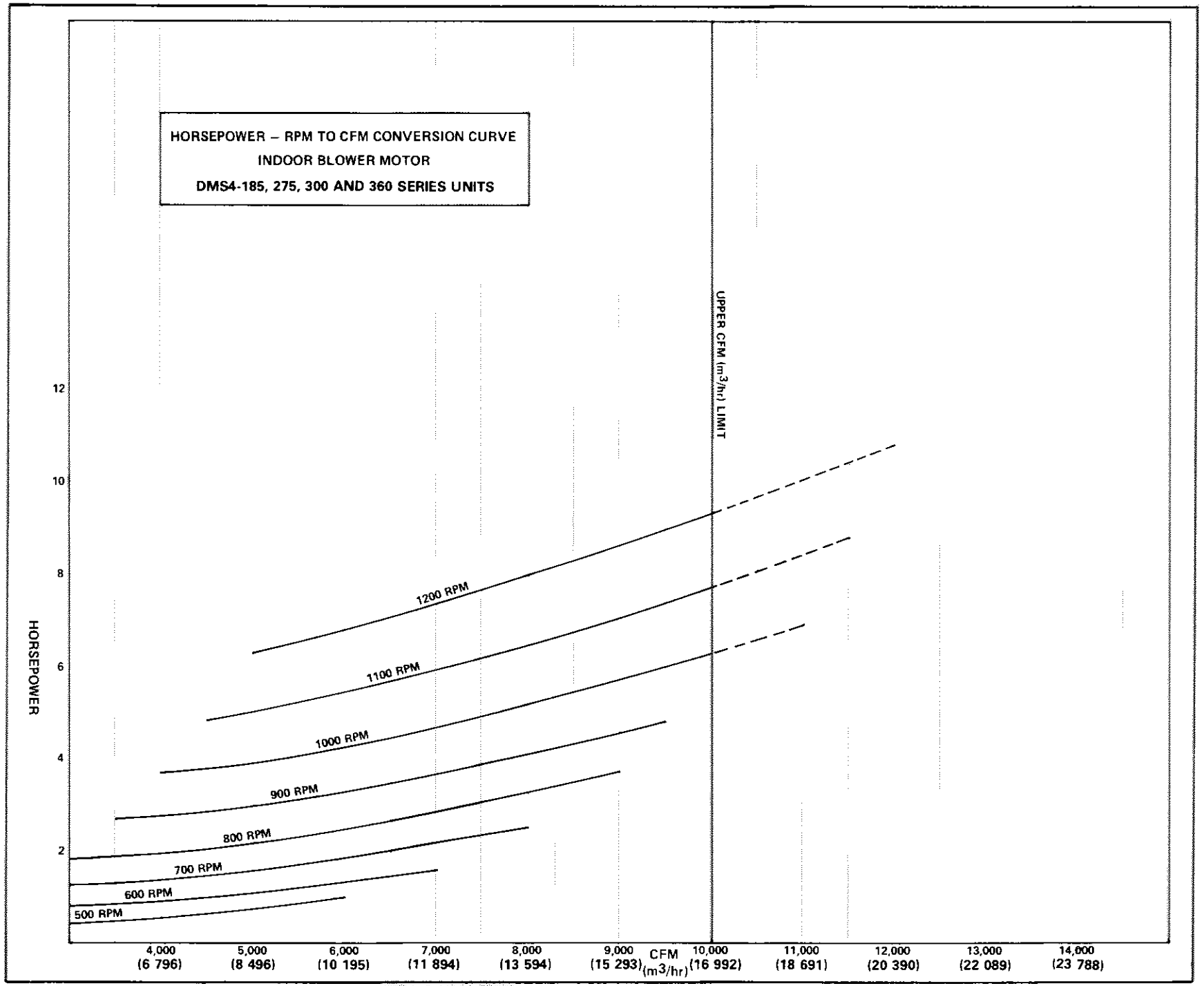
FIGURE 97

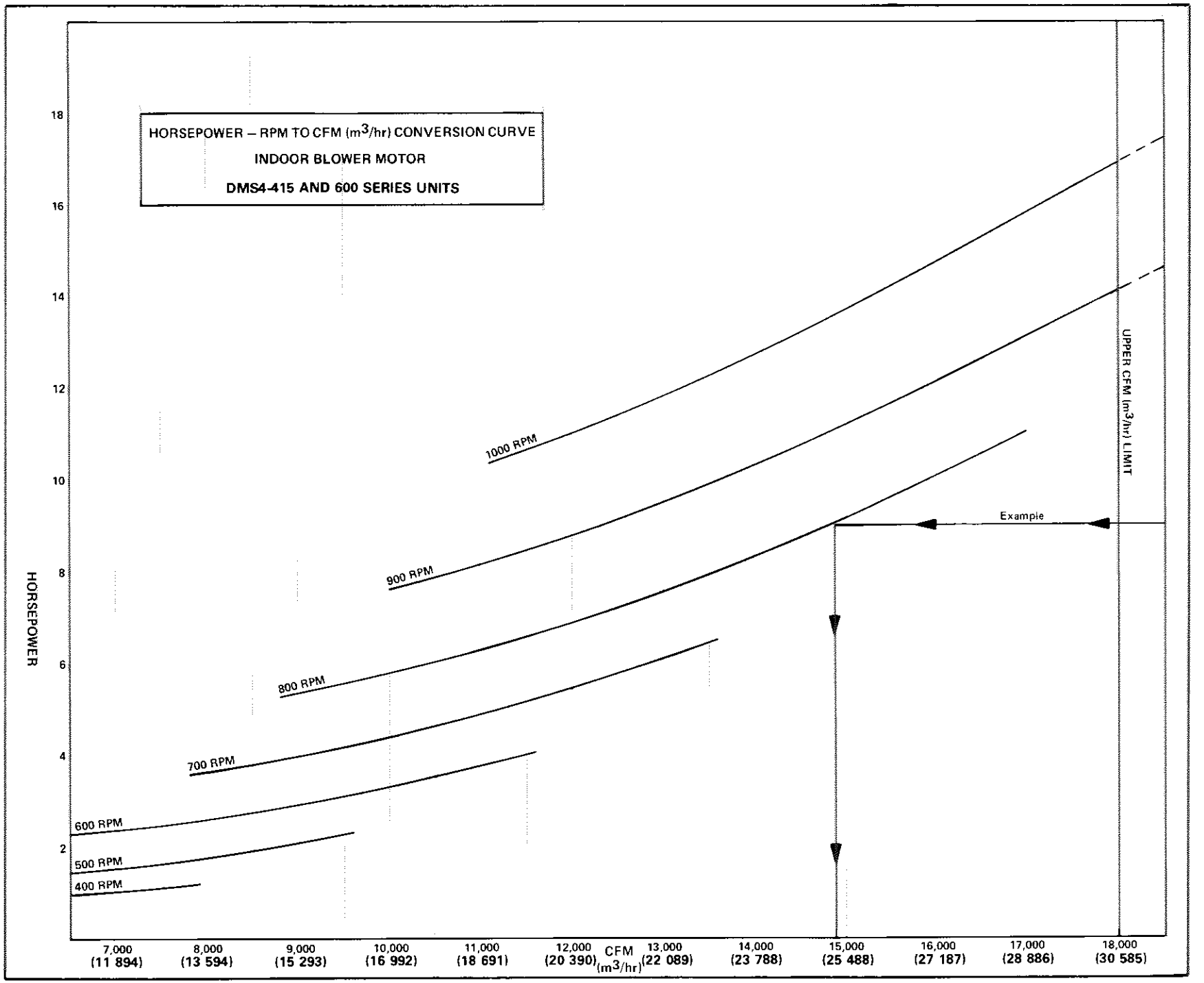

AMPS TO HORSEPOWER CURVE
3, 5, 7-1/2, 10 AND 15 HORSEPOWER MOTOR
230/*460 VOLT – 3 PHASE CENTURY MOTOR
*Reduce amp scale by 1/2 for 460 volt
HORSEPOWER
AMPS
MAX LOAD – 15 HP MOTOR
MAX LOAD – 10 HP MOTOR
MAX LOAD – 7-1/2 HP MOTOR
MAX LOAD – 5 HP MOTOR
MAX LOAD – 3 HP MOTOR
15 HP CENTURY
7-1/2 HP CENTURY
5 HP CENTURY
10 HP CENTURY
3 HP CENTURY

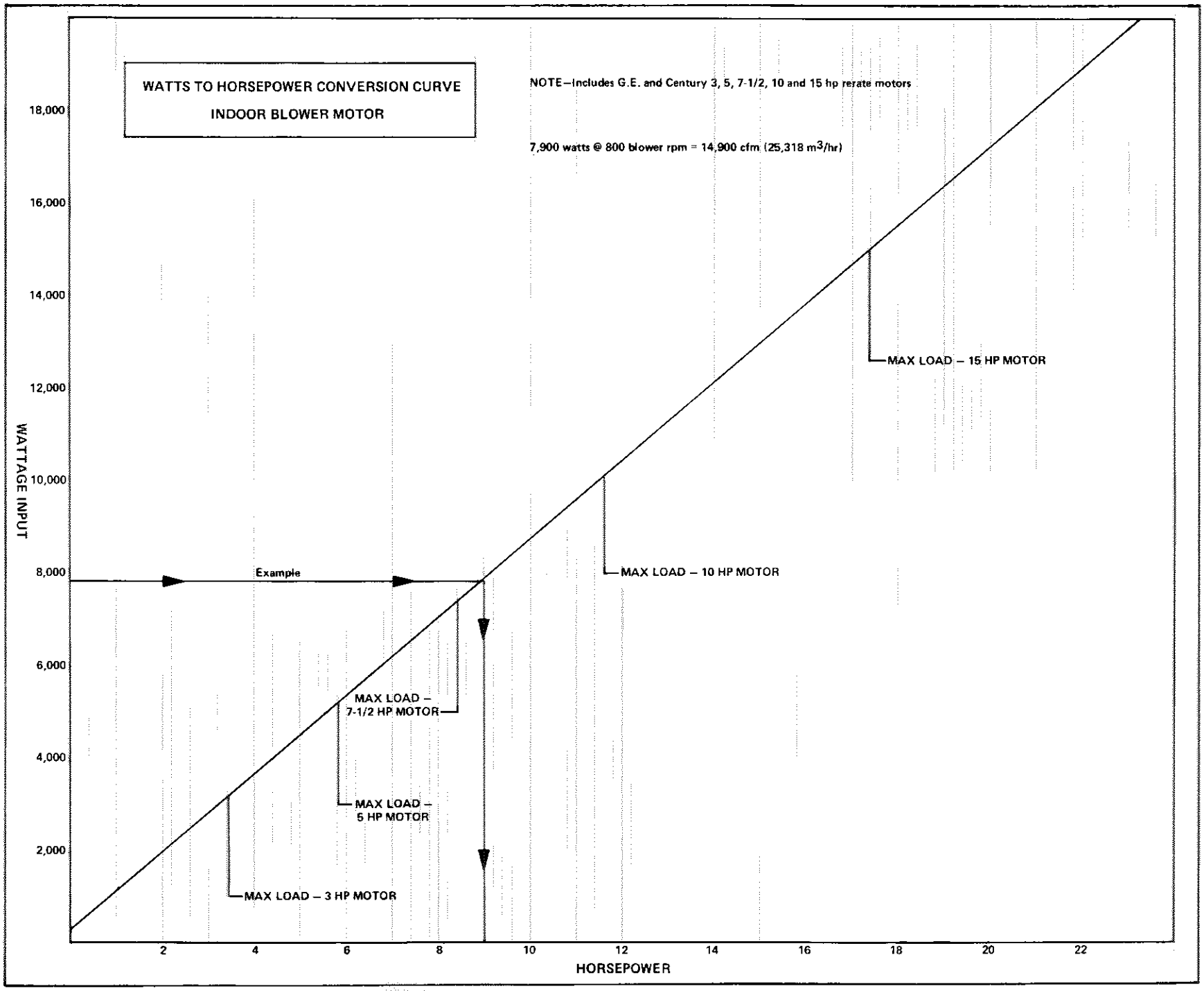

AMPS TO HORSEPOWER CURVE
3, 5, 7-1/2, 10 AND 15 HORSEPOWER MOTOR
230/*460 VOLT – 3 PHASE G.E. MOTOR
*Reduce amp scale by 1/2 for 460 volt
HORSEPOWER
AMPS
MAX LOAD – 15 HP MOTOR
MAX LOAD – 10 HP MOTOR
Example
MAX LOAD – 7-1/2 HP MOTOR
MAX LOAD – 5 HP MOTOR
MAX LOAD – 3 HP MOTOR
7-1/2 HP G.E.
5 HP G.E.
10 HP G.E.
15 HP G.E.
3 HP G.E.


AMPS TO HORSEPOWER CURVE
3, 5, 7-1/2, 10 AND 15 HORSEPOWER MOTOR
575 VOLT – 3 PHASE MOTOR
HORSEPOWER
AMPS
MAX LOAD – 15 HP MOTOR
MAX LOAD – 10 HP MOTOR
MAX LOAD – 7-1/2 HP MOTOR
MAX LOAD – 5 HP MOTOR
MAX LOAD – 3 HP MOTOR
15 HP CENTURY
10 HP G.E.
7-1/2 HP G.E. AND CENTURY
10 HP CENTURY
5 HP G.E. AND CENTURY
3 HP G.E. AND CENTURY


AMPS TO HORSEPOWER CURVE
3, 5, 7-1/2, 10 AND 15 HORSEPOWER MOTOR
208 VOLT – 3 PHASE MOTOR
HORSEPOWER
AMPS
MAX LOAD – 15 HP MOTOR
MAX LOAD – 10 HP MOTOR
MAX LOAD – 7-1/2 HP MOTOR
MAX LOAD – 5 HP MOTOR
MAX LOAD – 3 HP MOTOR
15 HP G.E. AND CENTURY
10 HP CENTURY
10 HP G.E.
7-1/2 HP G.E. AND CENTURY
5 HP G.E. AND CENTURY
3 HP G.E. AND CENTURY


HORSEPOWER – RPM TO CFM CONVERSION CURVE
INDOOR BLOWER MOTOR
DMS4-185, 275, 300 AND 360 SERIES UNITS
HORSEPOWER
12
10
8
6
4
2
1200 RPM
1100 RPM
1000 RPM
900 RPM
800 RPM
700 RPM
600 RPM
500 RPM
UPPER CFM (m3/hr) LIMIT
4,000 (6 796)
5,000 (8 496)
6,000 (10 195)
7,000 (11 894)
8,000 (13 594)
9,000 (15 293)
CFM (m3/hr)
10,000 (16 992)
11,000 (18 691)
12,000 (20 390)
13,000 (22 089)
14,000 (23 788)


HORSEPOWER – RPM TO CFM (m3/hr) CONVERSION CURVE
INDOOR BLOWER MOTOR
DMS4-415 AND 600 SERIES UNITS
HORSEPOWER
18
16
14
12
10
8
6
4
2
1000 RPM
900 RPM
800 RPM
700 RPM
600 RPM
500 RPM
400 RPM
Example
UPPER CFM (m3/hr) LIMIT
7,000 (11 894)
8,000 (13 594)
9,000 (15 293)
10,000 (16 992)
11,000 (18 691)
12,000 (20 390)
CFM (m3/hr)
13,000 (22 089)
14,000 (23 788)
15,000 (25 488)
16,000 (27 187)
17,000 (28 886)
18,000 (30 585)

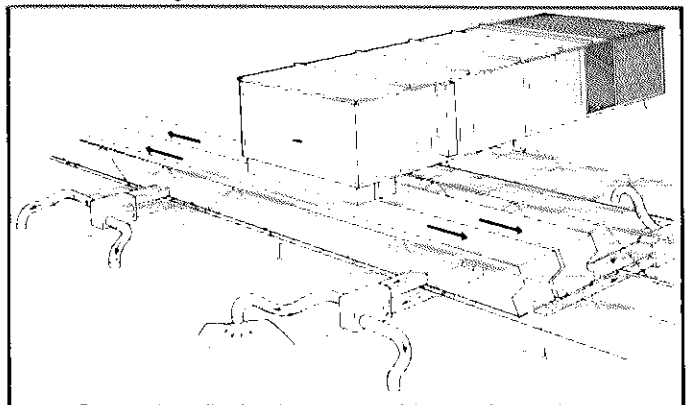

WATTS TO HORSEPOWER CONVERSION CURVE
INDOOR BLOWER MOTOR
NOTE—Includes G.E. and Century 3, 5, 7-1/2, 10 and 15 hp rerate motors
7,900 watts @ 800 blower rpm = 14,900 cfm (25,318 m3/hr)
WATTAGE INPUT
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
Example
MAX LOAD – 15 HP MOTOR
MAX LOAD – 10 HP MOTOR
MAX LOAD – 7-1/2 HP MOTOR
MAX LOAD – 5 HP MOTOR
MAX LOAD – 3 HP MOTOR
2
4
6
8
10
12
14
16
18
20
22
HORSEPOWER

ELECTRONIC ZONE CONTROL

I - GENERAL

A - Dual Duct

ZD6 mixing damper boxes are available for double duct applications. See Figure 98. The discharge sensor and zone damper actuator are located at mixing box. Refer to ZD6 installation instructions.



Double duct distribution system with zone damper boxes. Mixing dampers remote from unit

FIGURE 98

B - Zone Dampers

Hot and cold damper blades are mounted on a common shaft. Blades are always 90 degrees to each other. Vertical adjustment should allow blades to rotate freely without binding on ends or center divides. Figure 99 identifies the zone head components for Ranco and Figure 100 identifies Honeywell components.

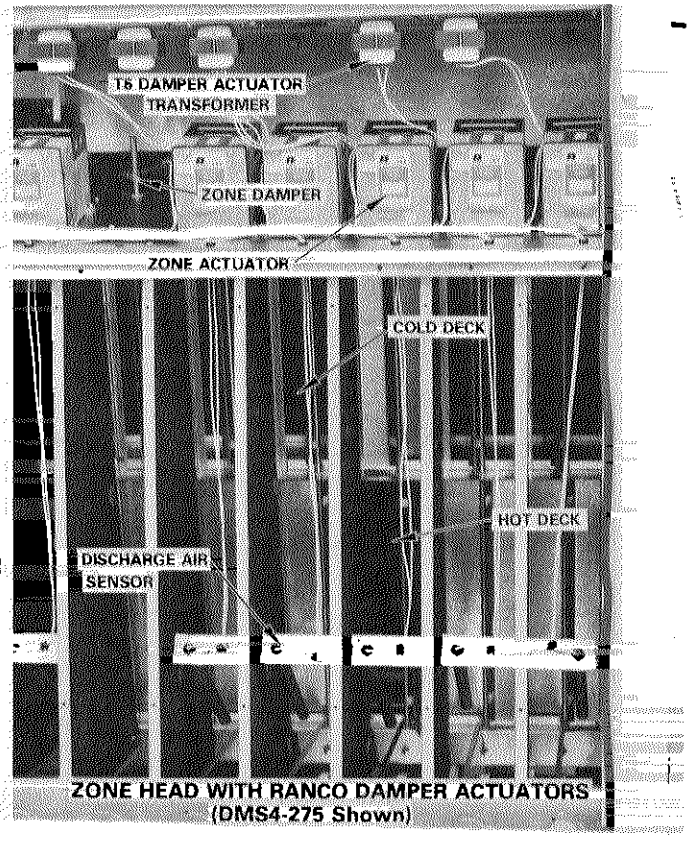


FIGURE 99

II - ZONE DAMPER ACTUATOR

A - Direct Drive Actuators

Direct acting actuators are standard with the DMS4 unit. At 10.5 VDC the zone damper is open to the hot deck and closed to the cold deck.

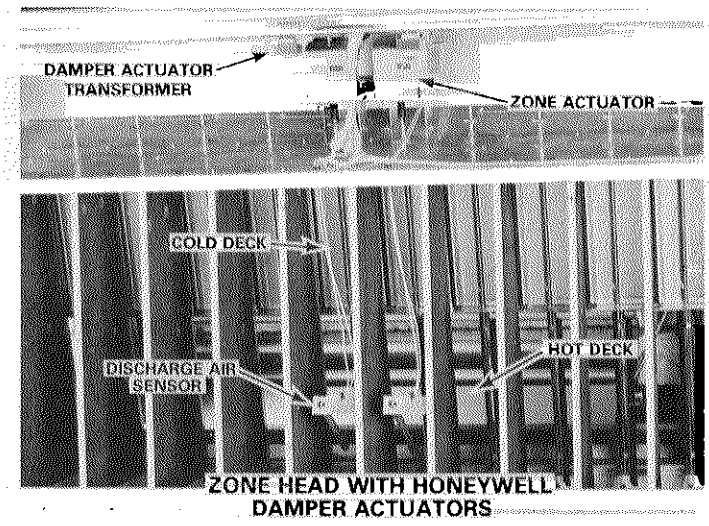


FIGURE 100

At 13.5 VDC the zone damper is closed to the hot deck and open to the cold deck. Figure 101 illustrates the operation of both the Ranco and Honeywell direct acting actuators.

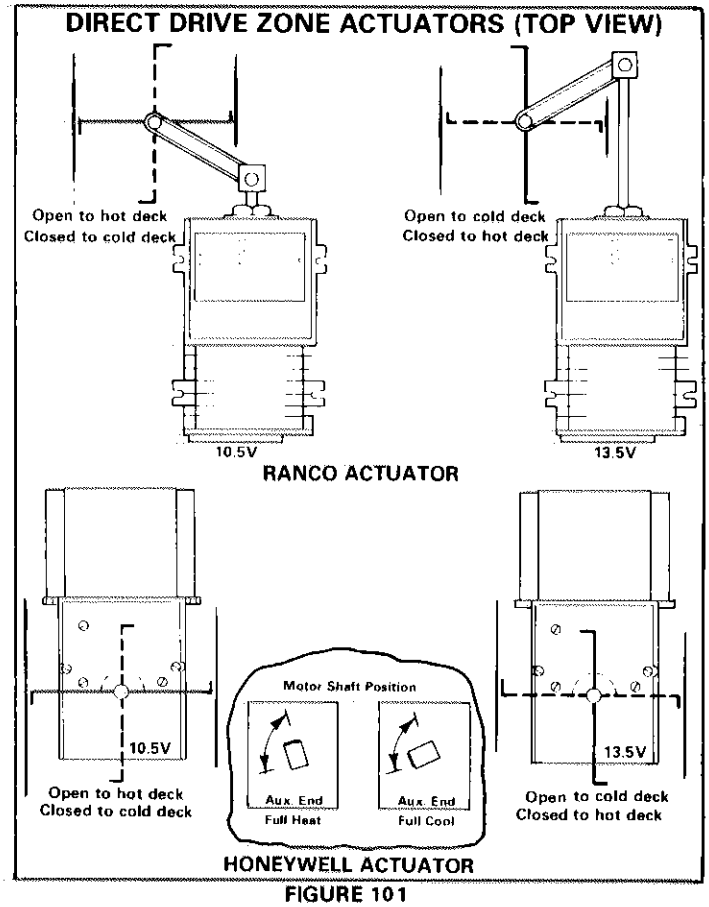


FIGURE 101

B - Reverse Acting Actuators

A reverse acting actuator is also available but must be specifically ordered. This option uses only the Ranco actuator which spring returns closed on a power failure. The shaft is extended at 10.5 VDC and retracted at 13.5 VDC. Figure 102 illustrates the position of zone damper at the different voltages and Figure 103 shows the Ranco reverse acting actuator.

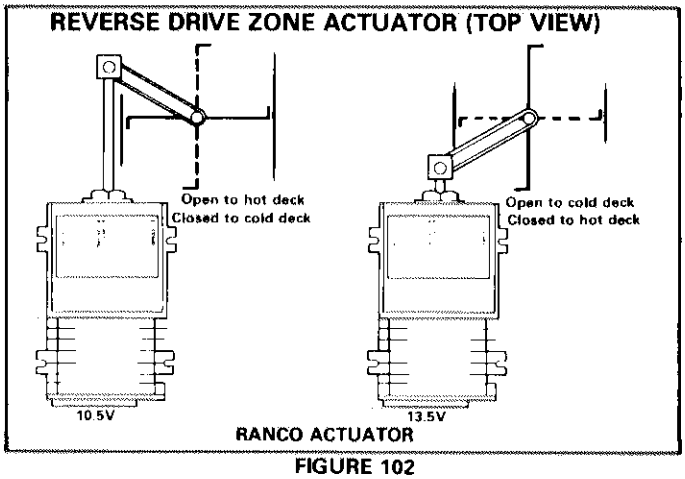


FIGURE 102

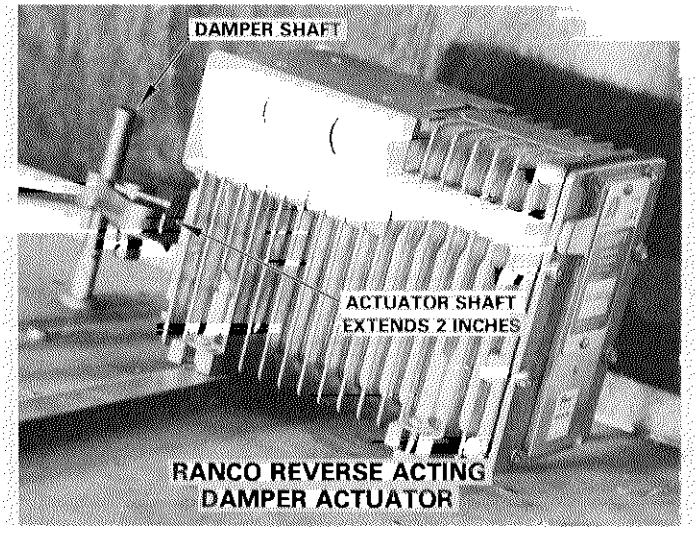


FIGURE 103

C - Mechanically Slaving Dampers

One zone damper actuator can operate a series of damper blades by mechanically connecting zones to motor. Refer to Figure 104.

NOTE- Do not connect more than 4 blades per actuator.

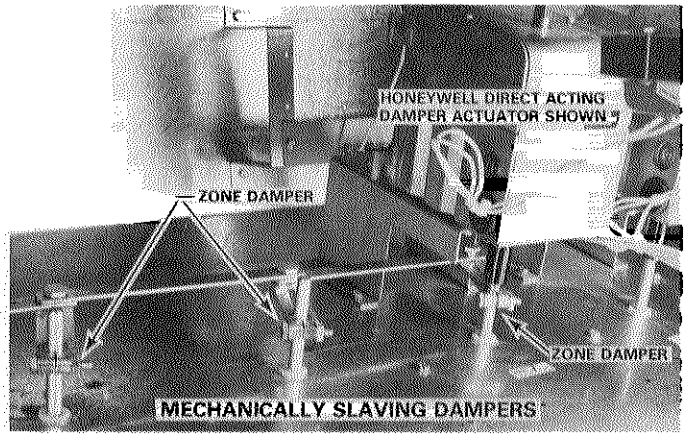


FIGURE 104

D - Electrically Slaving Actuators

1 - Connect terminal (6-Ranco, R-Honeywell) of secondary motor to the same terminal of primary motor.

2 - Connect terminal (1-Ranco, C-Honeywell) of secondary motor to the same terminal of primary motor. Refer to Figure 105.

E - Performance Check

The following test requires a Load Simulator and DC voltmeter to check operation of each zone actuator.

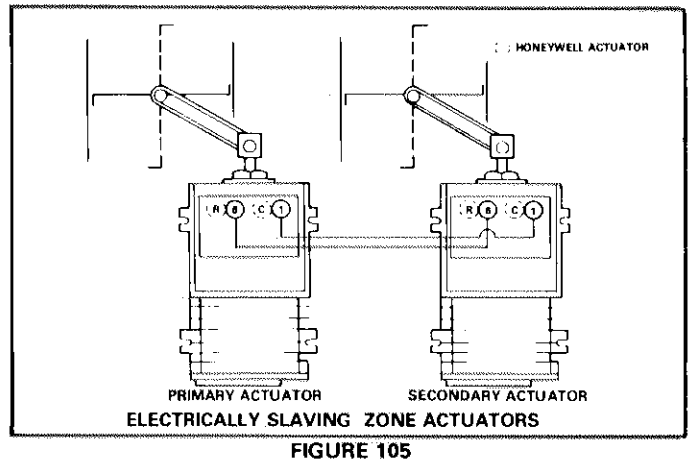


FIGURE 105

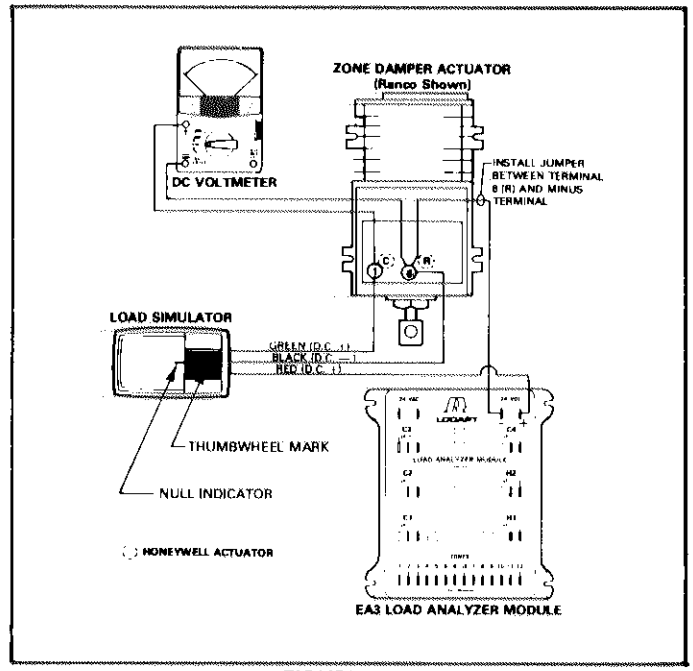


FIGURE 106

1 - Connect Load Simulator to zone actuator as follows:
  a - Turn off power to DMS4.
  b - Set Load Simulator by aligning thumbwheel mark with null indicator. See Figure 106.
  c - Remove wire from terminals (1 & 6 - Ranco, C & R - Honeywell) DO NOT SHORT WIRE.
  d - Connect Load Simulator and DC voltmeter leads as shown in Figure 106.

2 - Turn on power to DMS4

3 - Allow a short warm-up period before proceeding with test. Full extension time of shaft normally takes 2 minutes after warm-up.

4 - Slowly rotate Load Simulator while observing DC voltmeter. Actuators will respond to command signal variations as described in basic function chart. Damper shaft is retracted at 10 volts and extended at 14 volts.

NOTE - Most portable voltmeters are accurate to ±1 volt. Any variation in starting points should be consistent on voltmeter.

5 - Refer to "Electronic Circuit Troubleshooting" section on page 35 if the zone actuator does not respond correctly.

6 - Remove Load Simulator and DC voltmeter and reconnect leads to terminals at zone actuator.

III - PROBLEM ZONES

If the equipment cycles continuously because a problem zone transmits a constant heating or cooling demand, remove that particular zone lead from EA3 load analyzer module.

PNEUMATIC ZONE CONTROL

I - PNEUMATIC IDENTIFICATION

Pneumatic controls furnished by Lennox consist of: thermostats, damper actuators, a high-low pressure selector manifold, a high pressure transducer, a low pressure transducer and an interface module. Air lines (1/4" o.d. polyethylene tubing) are factory installed from the damper actuators to the manifold within the DMS4. Air lines are field connected from manifold to thermostats and air compressor. The installer must make provisions for the pneumatic air supply. Refer to Figure 107 for the locations of pneumatic controls on DMS4-185-185/275-275-300 & 360 units. On DMS4-415/600 units the selector manifold is on the right end of vestibule panel.

II - PNEUMATIC OPERATION

Figure 108 illustrates how the pneumatic controls function together.

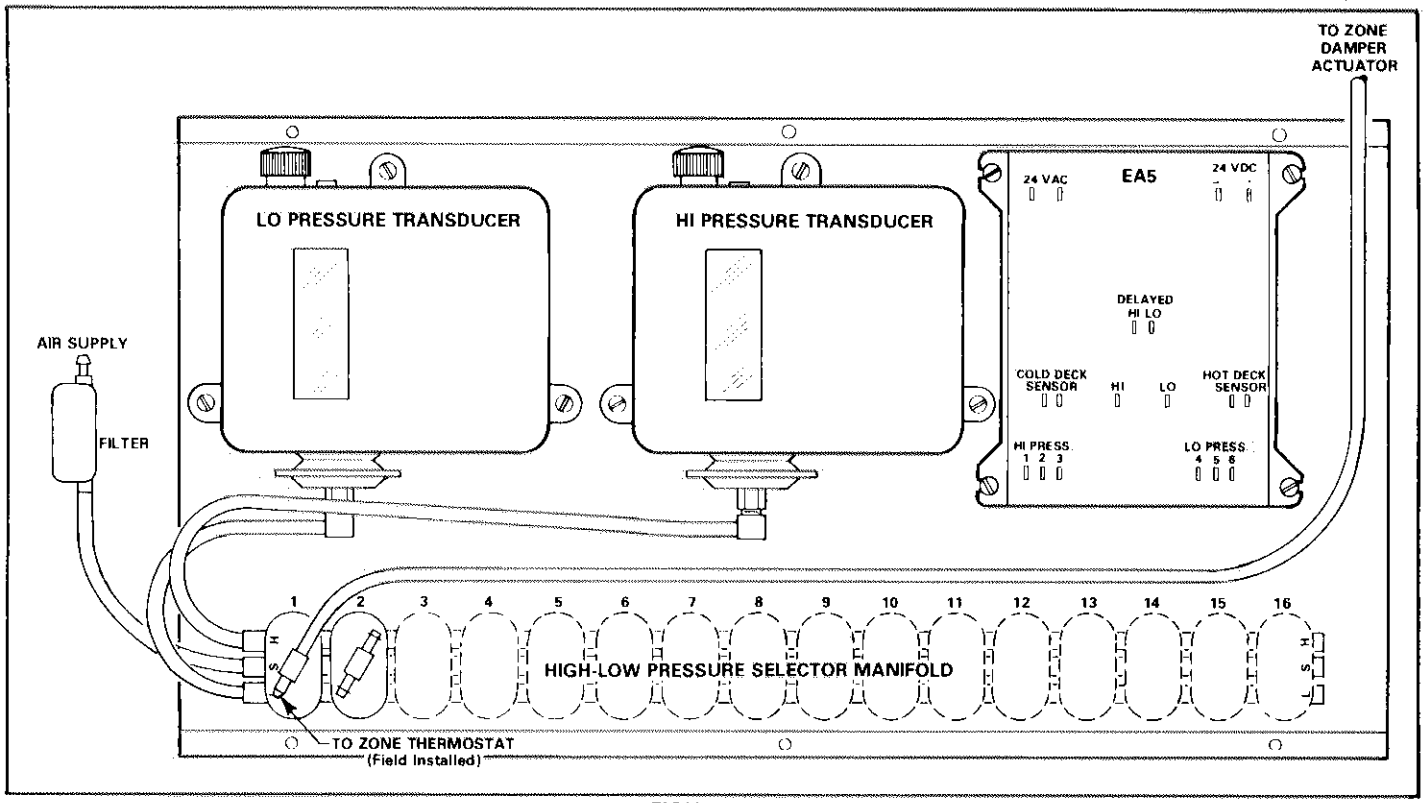


FIGURE 107

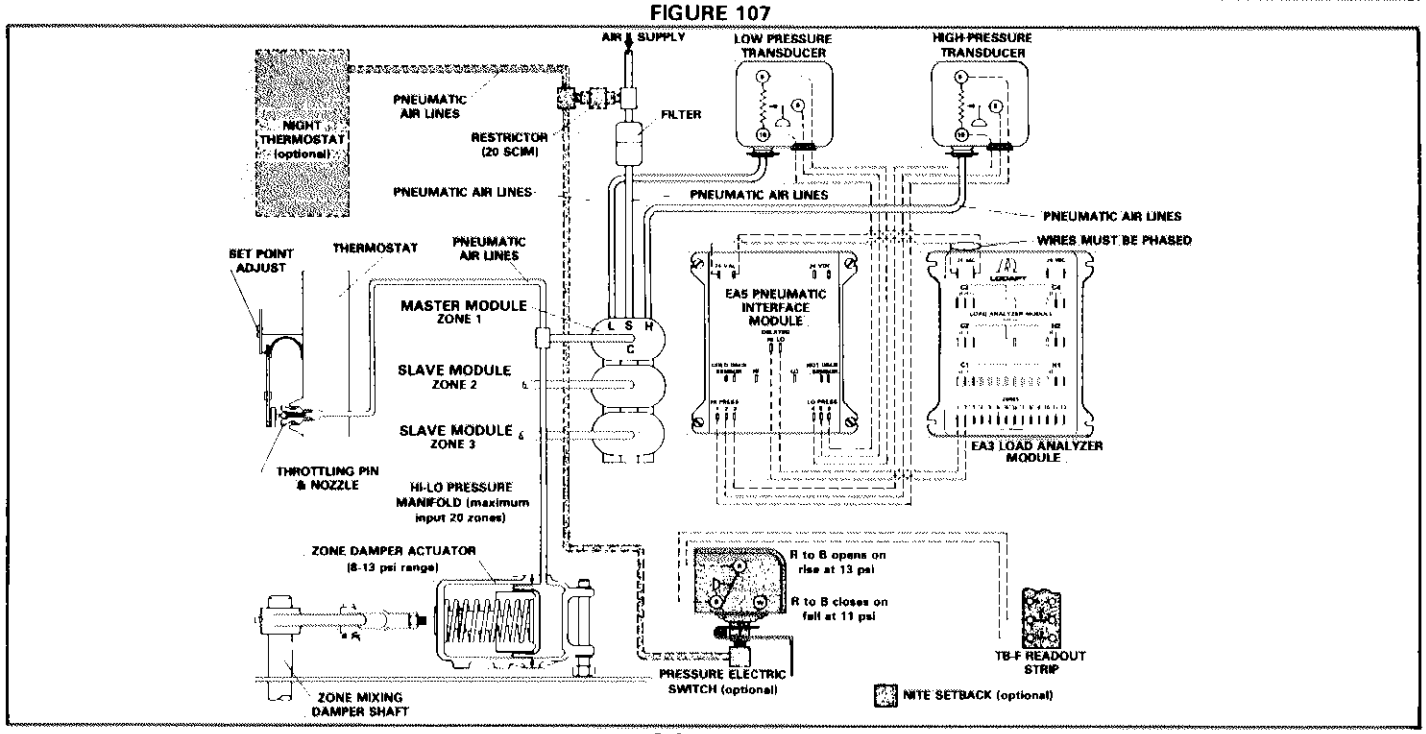


FIGURE 108

A - Zone Actuator

The actuators modulate in response to the zone thermostats. The shaft is extended at 13 psi for cooling and is retracted at 8 psi for heating. The actuator is a piston type pneumatic motor with replaceable synthetic diaphragm, adjustable stroke and non-adjustable spring tension. One actuator can drive a maximum of 4 dampers with mechanical linkage.

On double duct applications the pneumatic actuator is located at the mixing damper box. Refer to ZD7 installation instruction.

B - Zone Thermostat

The thermostat has exposed thermometer and set point indicator. It has a concealed temperature adjustment and mounts vertically. The bi-metal sensing element responds to a temperature change of one-tenth of one degree. An optional thermostat guard (P-8-8594) is available. Refer to the following for thermostat specifications.

Thermostat sensitivity.....1 to 4 psi per °F
Adjustable.....at 1 psi/°F temperature range is 5°F
at 4 psi/°F temperature range is 1.25°F
Factory sensitivity setting...2.5 psi/°F temperature range is 2°F

C - Optional Nite Setback Controls

The pneumatic control system adapts to nite setback controls. The pneumatic nite setback kit (LB-22018) consists of nite thermostat (P-8-8592), thermostat cover (P-8-8800) and factory installed pressure electric switch (P-8-8675). Locate nite thermostat in an average zone and set temperature for desired night operation.

D - High-Low Pressure Selector Manifold (maximum capacity-20 zones)

A manifold selector chooses the highest pressure from the zone that requires the most cooling and the lowest pressure from the zone that requires the most heating. It then transfers these pressures to the appropriate transducer.

The manifold is composed of one master non-relay (zone 1) and a slave non-relay for each additional zone. The non-relays have an internal restrictor (20 SCIM) that provides the supply air to the respective thermostat.

A non-relay module with an internal restrictor is used with a non-relay thermostat or controller.

A relay module is used with relay thermostat or controller or can be used with non-relay thermostat or controller with appropriate restrictor. A combination of modules (non-relay & relay) can be used on the same manifold.

E - High Pressure and Low Pressure Transducers

The high pressure transducer receives the high command pressure from the selector manifold and converts it into an electrical resistance change. The low pressure transducer does the same for the low command pressure. These electrical resistance changes are then transferred to the pneumatic interface module (EA5).

E - Pneumatic Interface Module (EA5)

This module receives the electrical resistance changes and transforms them into DC electronic signals which feed into any two (usually 1 & 2) zone input terminals of the load analyzer module (EA3). Signal from interface is delayed to prevent rapid cycling of heating or cooling. As with the electronic system control, the low signal cycles the heating to maintain hot deck temperatures that satisfy the zone with the largest heating load and the high signal cycles the cooling to maintain cold deck temperatures that satisfy the zone with the largest cooling load.

Hot and cold deck sensors wire into the pneumatic interface module and are used in place of zone discharge sensors. These thermistors change the respective command signal upon a change in deck temperature.

III - TRANSDUCER ADJUSTMENT

The low pressure transducer is factory calibrated for 3 - 8 psig and the high pressure transducer is calibrated for 13 - 20 psig. However, the following procedure is needed to recheck calibration.

A - Low Pressure Transducer Adjustment

1 - Hook OHM meter to terminals 9 and 10 as shown in Figure 109.

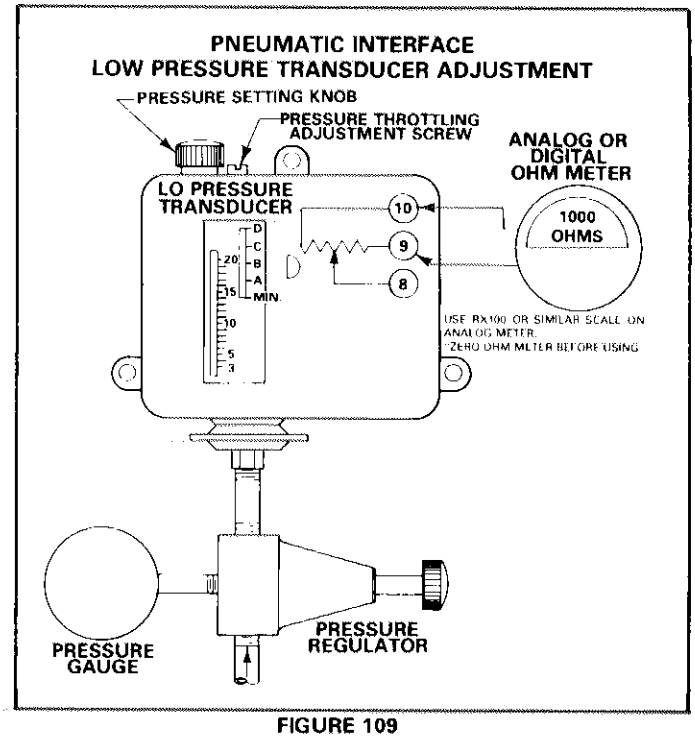


FIGURE 109

Resistance should read 1000 + 10% OHMs. Note value read.

2 - Hook OHM meter to terminals 8 and 10 as shown in Figure 110. Lower air pressure to 3 psi. Adjust pressure setting knob to read zero* OHMs (adjust from reading greater than zero toward zero and stop at zero*). Pressure scale reading should be approximately 4 psi.

**Zero or lowest value that shows no further decrease.*

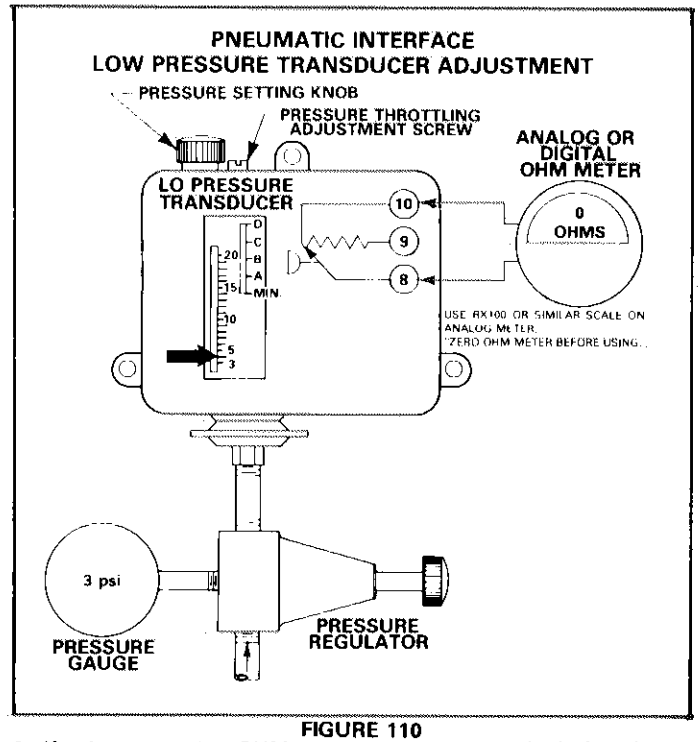


FIGURE 110

3 - If using an analog OHM meter connect to terminals 8 and 9 as shown in Figure 111. If using a digital OHM meter leave wiring connected to terminals 8 and 10 as shown in Figure 112.

4 - Raise air pressure to 10 psi and then lower pressure to 8 psi.

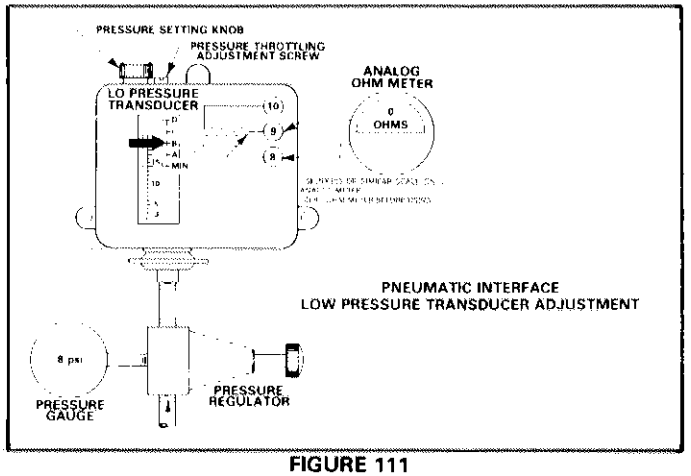


FIGURE 111

5 - Adjust throttling adjustment screw. Start from "C" position and move toward "MIN" until no further resistance increase is noted. Value should be approximately zero OHMs using an analog meter. Setting should be approximately "B". See Figure 111 for analog meters or Figure 112 for digital meters.

6 - Check setting by repeating step no. 2

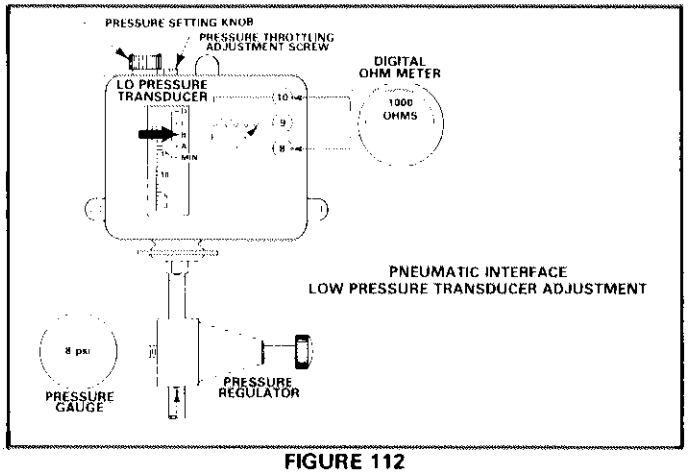


FIGURE 112

B - High Pressure Transducer Adjustment

1 - Hook OHM meter to terminals 9 and 10 as shown in Figure 109. Resistance should read 1000 + 10% OHMs. Note value read.

2 - Hook OHM meter to terminals 8 and 10. Set air pressure to 10 psi and then raise air pressure to 13 psi. Start pressure setting knob at 10 and raise to higher pressure setting until OHM meter reading approaches zero OHMs or to the point where there is no further change toward zero. Setting should be approximately 15. See Figure 113.

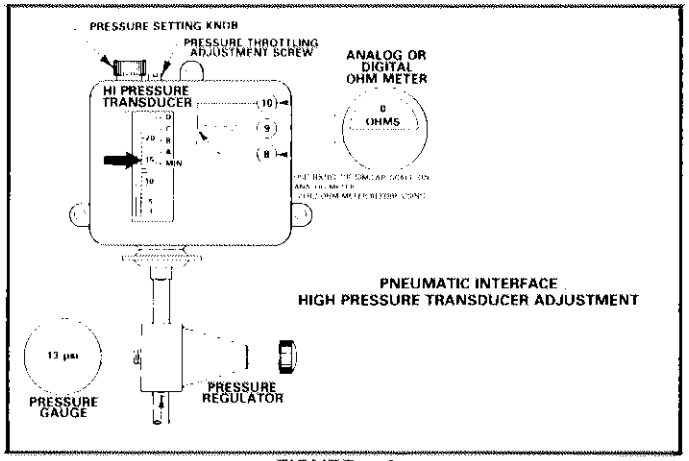


FIGURE 113

3 - Raise air pressure to 20 psi.

4 - If using an analog OHM meter, connect to terminals 8 and 9 as shown in Figure 114 before continuing with following steps.

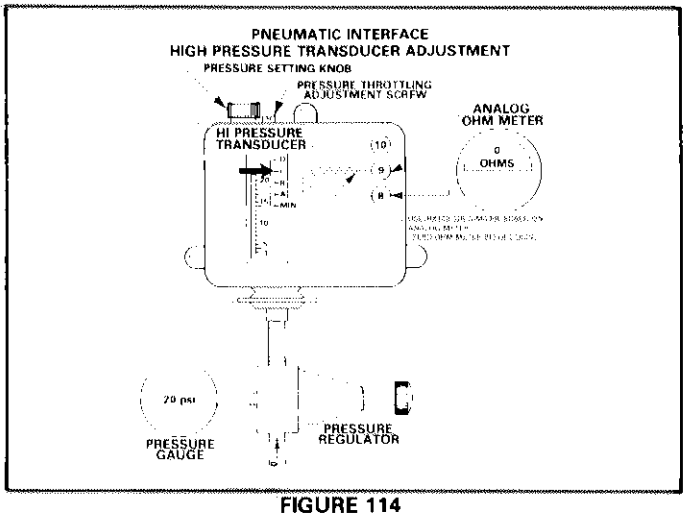


FIGURE 114

5 - Adjust throttling adjustment screw. Start from "D" position and move toward "MIN" until no further resistance decrease is noted. Value should be approximately zero with an analog meter. Setting should be approximately "C". See Figure 114 for analog meter or Figure 115 for digital meters.

6 - Check setting by repeating step no. 2

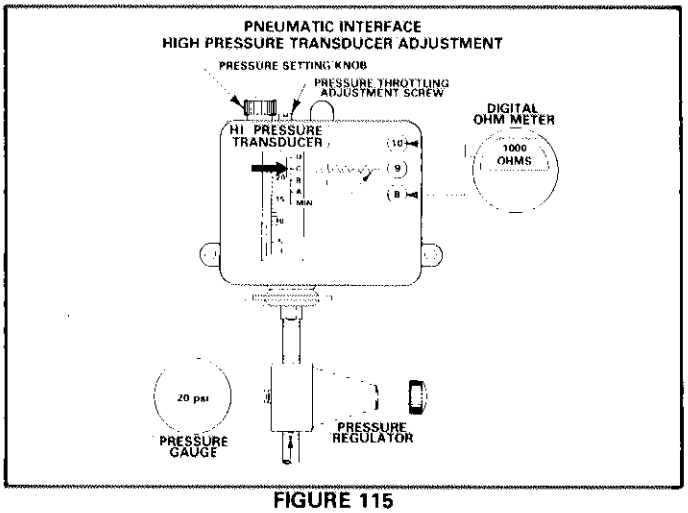


FIGURE 115

IV - PNEUMATIC ADJUSTMENT

The motors are mechanically linked to zone dampers. One pneumatic motor can be used to operate a series of zones by mechanically connecting zones to motor. The damper motors can be pneumatically interlocked and controlled by a single thermostat.

To replace motor or to check linkage for proper adjustment use the following procedure.

1 - Motor is in start position when there is no air pressure applied to motor.

2 - With motor in start position, hold cold air damper fully closed and connect clevis to damper arm.

3 - Connect air pressure, 20-25 psig (1.41-1.17 Kg/cm²), to drive warm air dampers fully closed and cold air dampers fully open. If warm air dampers are not fully closed or if they close before motor finishes its stroke, contact a qualified serviceman. Maximum stroke of motor is 3-1/8" (79 mm).

4 - Repeat this procedure to check each zone thermostat.

5 - If a zone functions according to the thermostat demand, the zone wiring and duct outlets should be correct. If not, refer to "Electronic Circuit Troubleshooting" section on page 35.

FILTERS

Three types of filters are available; polyurethane, bag type filters and automatic roll filters.

I - POLYURETHANE FILTERS

1 - Remove access panel from the damper/filter cabinet to expose banks of filters. Grasp the bracket on chain at bottom of each bank. Simply pull chain and bring out filters. Refer to Figure 116.

2 - To clean the filter, vacuum or wash with mild soap and water. For increased efficiency, coat the filter with water soluble oil, No. P-8-5069, available from your Lennox dealer.

CAUTION - Some detergents have an adverse effect on the filter media, causing it to loose its flexibility or become soft. It is recommended that dish washing liquid be used. When cleaning the filter do not leave it soaking in cleaner; leave filter in cleaner only as long as it takes to clean it. Do not use any enzyme detergents or pre-soakers. After filter is clean, rinse it thoroughly before replacing in unit.

3 - Replace filters in unit noting arrangement and air flow direction. Refer to Figure117(185, 275, 300, 360) or Figure118(415, 600). Slide filters in on track, pulling chain and bracket in place.

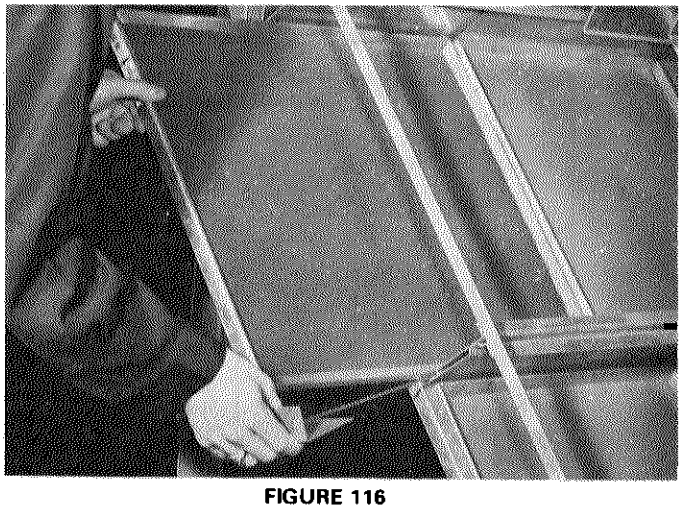
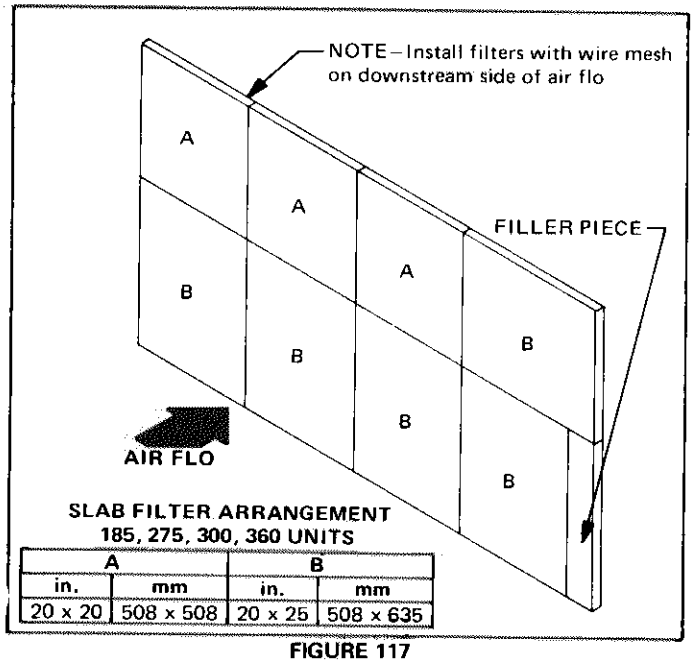


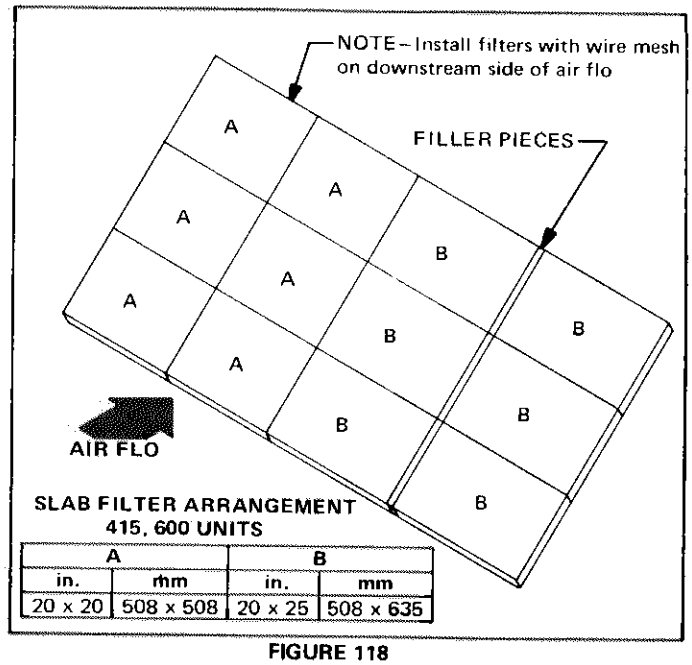
FIGURE 116



SLAB FILTER ARRANGEMENT
185, 275, 300, 360 UNITS

A		B	
in.	mm	in.	mm
20 x 20	508 x 508	20 x 25	508 x 635

FIGURE 117



SLAB FILTER ARRANGEMENT
415, 600 UNITS

A		B	
in.	mm	in.	mm
20 x 20	508 x 508	20 x 25	508 x 635

FIGURE 118

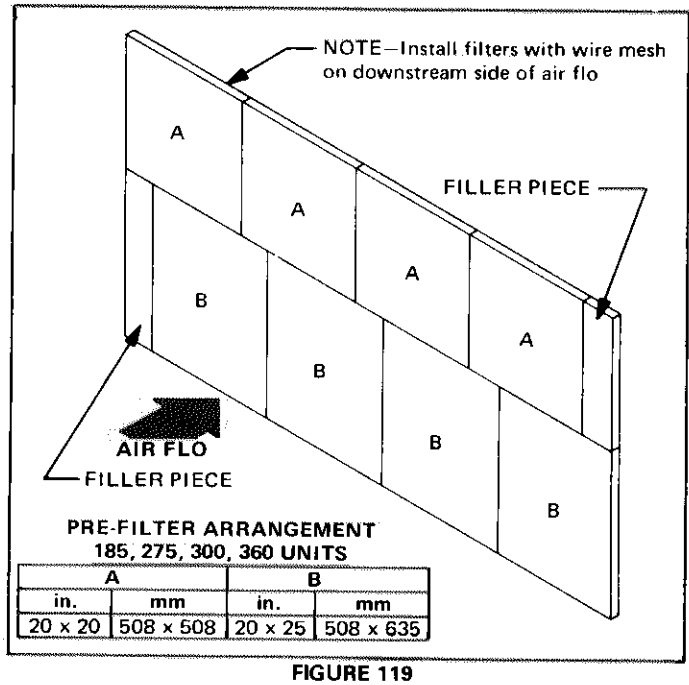
II - BAG ASSEMBLY FILTERS

1 - High efficiency bag assembly filters (non-cleanable) and polyurethane pre-filters (cleanable) are used.

IMPORTANT – The pre-filters must be cleaned regularly to extend the life of the bag filters. Be sure to reinstall pre-filter seal strips after each cleaning. Use the same procedure as for "I – Polyurethane Filters". Refer to pre-filter arrangement, Figure119(185, 275, 300, 360) or Figure120 (415,600).

2 - To change bag assembly filters, pull old filters from unit as shown in Figure121. Remove wire support rack from filter frame and reinstall on replacement filters:

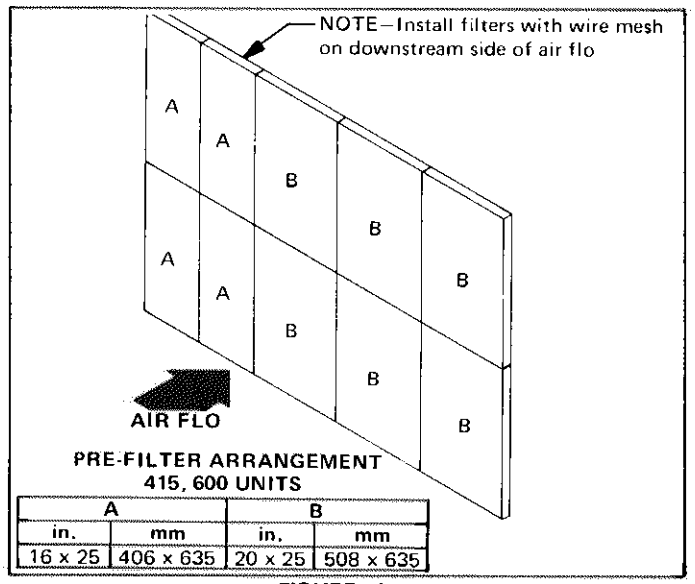
a - Thread rear connecting wire out of loops at the top rear of bag assemblies.



PRE-FILTER ARRANGEMENT
185, 275, 300, 360 UNITS

A		B	
in.	mm	in.	mm
20 x 20	508 x 508	20 x 25	508 x 635

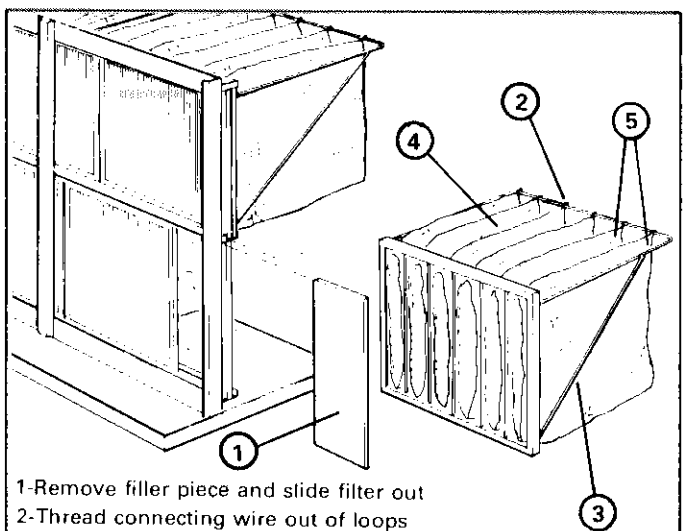
FIGURE 119



PRE-FILTER ARRANGEMENT
415, 600 UNITS

A		B	
in.	mm	in.	mm
16 x 25	406 x 635	20 x 25	508 x 635

FIGURE 120



1-Remove filler piece and slide filter out
2-Thread connecting wire out of loops
3-Remove triangular side pieces
4-Install replacement filter
5-Space bags equally along connecting wire

FIGURE 121

b - Remove triangular side pieces by bowing out vertical wire until free of frame.

c - Reverse procedures (a) and (b) to install on replacement filter frames.

d - Slide the bags along the rear connecting wire until there is an equal amount of space between each bag assembly.

e - Replace filter bag assemblies in unit. See Figure122(185, 275, 300, 360) or Figure123(415, 600) for arrangement.

III - AUTOMATIC ROLL FILTERS

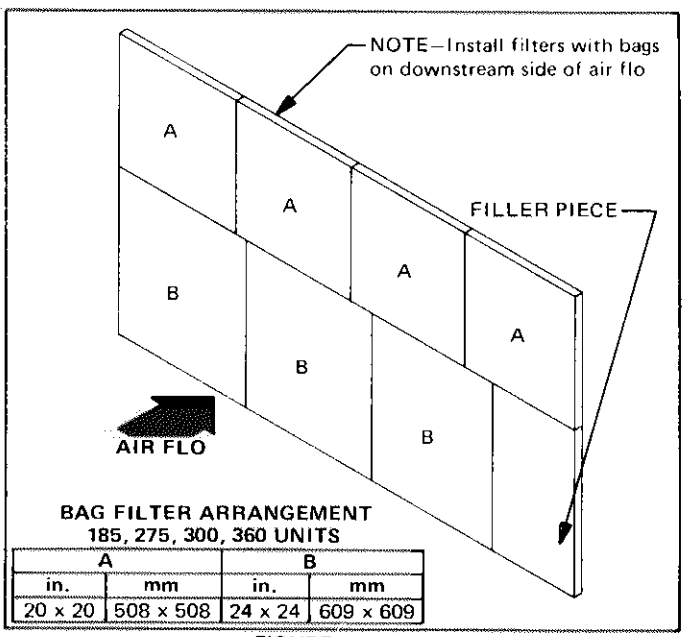
Roll filters have (2) different types of advancement; timer control and pressure control. 2" (50,8 mm) thick glass media is standard with 1/2" (12,7 mm) synthetic media as optional.

A - Timer Control Adjustment

The adjustable timer control system assures that a fixed amount of media per 24 hours of unit operation will be introduced into air stream. (De-energized during nite-setback).

1 - The timer dial is calibrated in inches of media introduced in any 24 hour period of unit operation. Each timer is pre-set at the factory for "Normal" dust load operation.

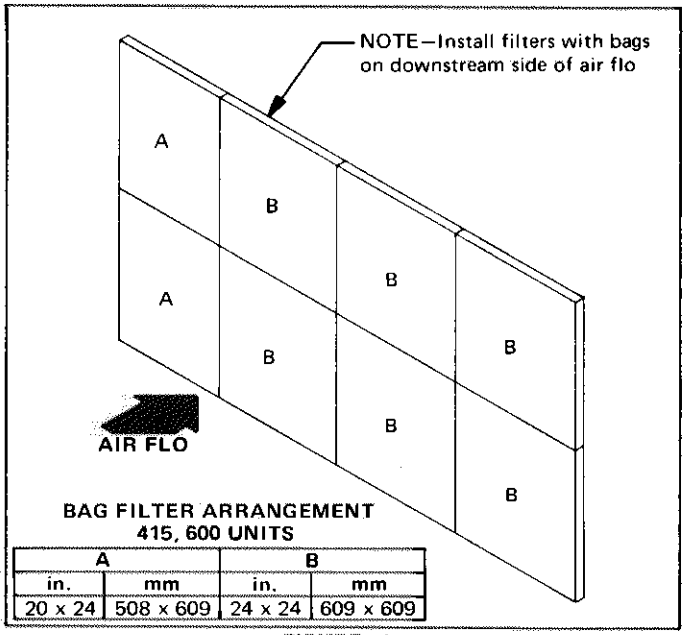
2 - Pressure drop across the filter curtain, which may be determined by use of a draft gauge, should be 0.45" - 0.5" w.c. (11,4 mm - 12,7 mm w.c.).



BAG FILTER ARRANGEMENT
185, 275, 300, 360 UNITS

A		B	
in.	mm	in.	mm
20 x 20	508 x 508	24 x 24	609 x 609

FIGURE 122



BAG FILTER ARRANGEMENT
415, 600 UNITS

A		B	
in.	mm	in.	mm
20 x 24	508 x 609	24 x 24	609 x 609

FIGURE 123

3 - Should dust load to which filters are actually subjected be more or less than "normal," simply reset timer to desired amount of media to be introduced per 24 hours of operation to keep pressure drop across filter curtain between 0.45" - 0.5" w.c. (11,4 mm - 12,7 mm w.c.).

AIR FILTER TIME FACTORY SETTING

Unit	Filter Length		Media indexed per 24 hrs. of unit operation		Timer cycle interval (hours - minutes)	Approximate media "life" at recommended timer setting (hours)
	in.	mm	in.	mm		
185,275 300,360	72	1828	2-1/2	63,5	9 - 36	6816
415,600	90	2286	3-1/4	82,5	7 - 32+	5095

4 - Metering cam assures that 1" (25,4 mm) of clean media is introduced. Timer resets and starts on a new cycle.
5 - Timer motor operates until timer interval is completed, at which time 1" (25,4 mm) of clean media is introduced. Timer resets and starts on a new cycle.
6 - Media movement rotates splined roller on which metering cam is mounted. Cam follower of media metering switch is actuated by rotation of cam which stops drive motor until another time interval has elapsed.

B - Pressure Control Operation and Adjustment

Pressure control introduces media into airstream whenever selected pressure differential across filter curtain is reached.

1 - Pressure differential is determined by air velocity through media and filter loading.
2 - Each pressure differential switch is preset at factory to operate at a system velocity of 500 fpm (2,54 m/s).
3 - To change velocity setting:
a - Select proper control scale from the chart.

PRESSURE CONTROL ADJUSTMENT			
fpm	m/s	in. w.c.	mm w.c.
600	3,04	0.68	17,2
550	2,79	0.59	14,9
500	2,54	0.50	12,7
450	2,28	0.41	10,4
400	2,03	0,34	8,6
350	1,77	0.27	6,8
300	1,52	0.21	5,3

b - Calibration or actuation point of pressure switch is indicated by scale affixed to transparent range spring enclosed. Recalibration to another setting within range of control is accomplished by turning center adjusting screw. Refer to Figure 124.

C - Changing Roll Filters

Refer to Figure 125 for installation arrangement.

1. Open doors on both ends of filter.
2 - Install small trunnion (from top of empty core) on top of core in clean media roll and large trunnion (from bottom of empty core) into bottom of core in media roll.
3 - Insert fresh media roll (with trunnions in place) into filter opposite the drive end of filter. Large trunnions must be on bottom and MEDIA MUST FEED FROM CLEAN ROLL SO THAT EXTERIOR OF CLEAN ROLL BECOMES AIR ENTERING SIDE OF FILTER WHEN MEDIA IS UNROLLED.
4 - Rotate latch handle to closed position to lock roll in place.
5 - At used media end of filter inset large lower trunnion (from used media core) into bottom end of empty media core.
6 - Insert empty core and trunnions into trunnion supports in drive end of filter with gear trunnion engaging the pinion gear.

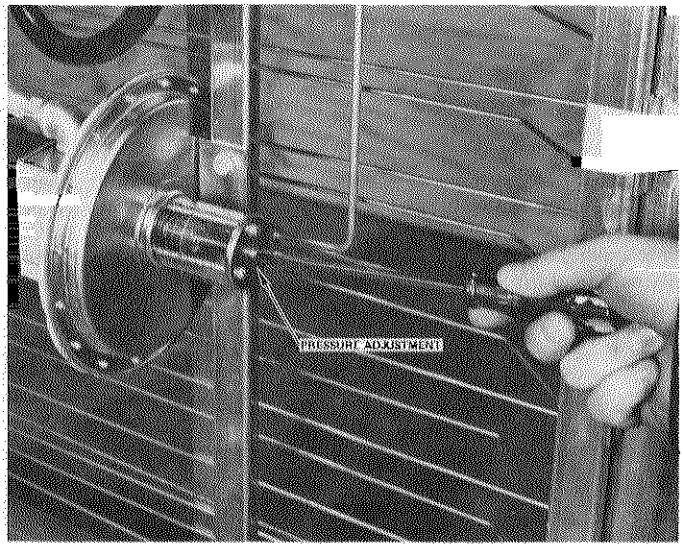
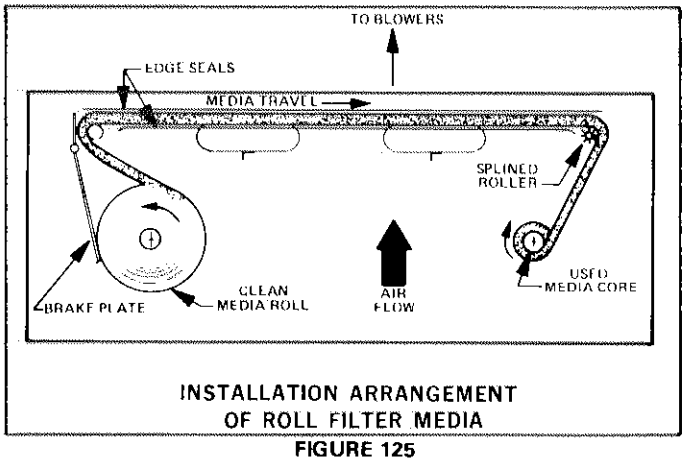


FIGURE 124



INSTALLATION ARRANGEMENT OF ROLL FILTER MEDIA

FIGURE 125

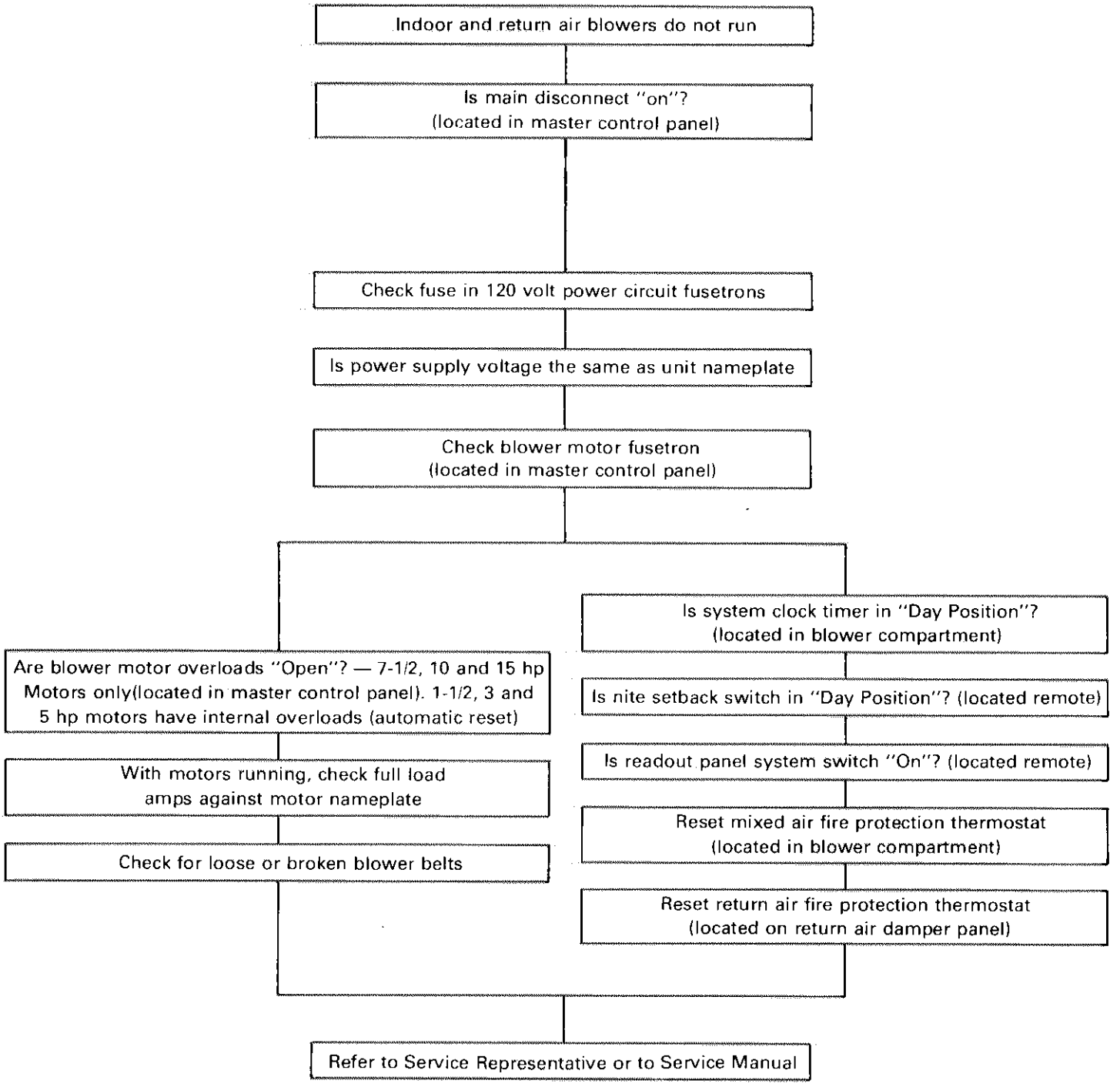
7 - Mesh gear trunnion and drive pinion, and rotate latch handle to closed position.
8 - Feed lead end of media roll between idler roller and filter housing.
9 - Pull media through filter between front and rear grids and between edge seals being careful that media enters both edge seals evenly.
10 - Feed end of media around splined roller and empty core.
11 - Metal core is provided with teeth to engage media. Make one full wrap on core to insure proper engagement.
12 - Recheck above steps to be sure all steps have been followed correctly. Filter is now ready to operate. Figure 125 illustrates roll filter operation.

SERVICE FLOW CHARTS

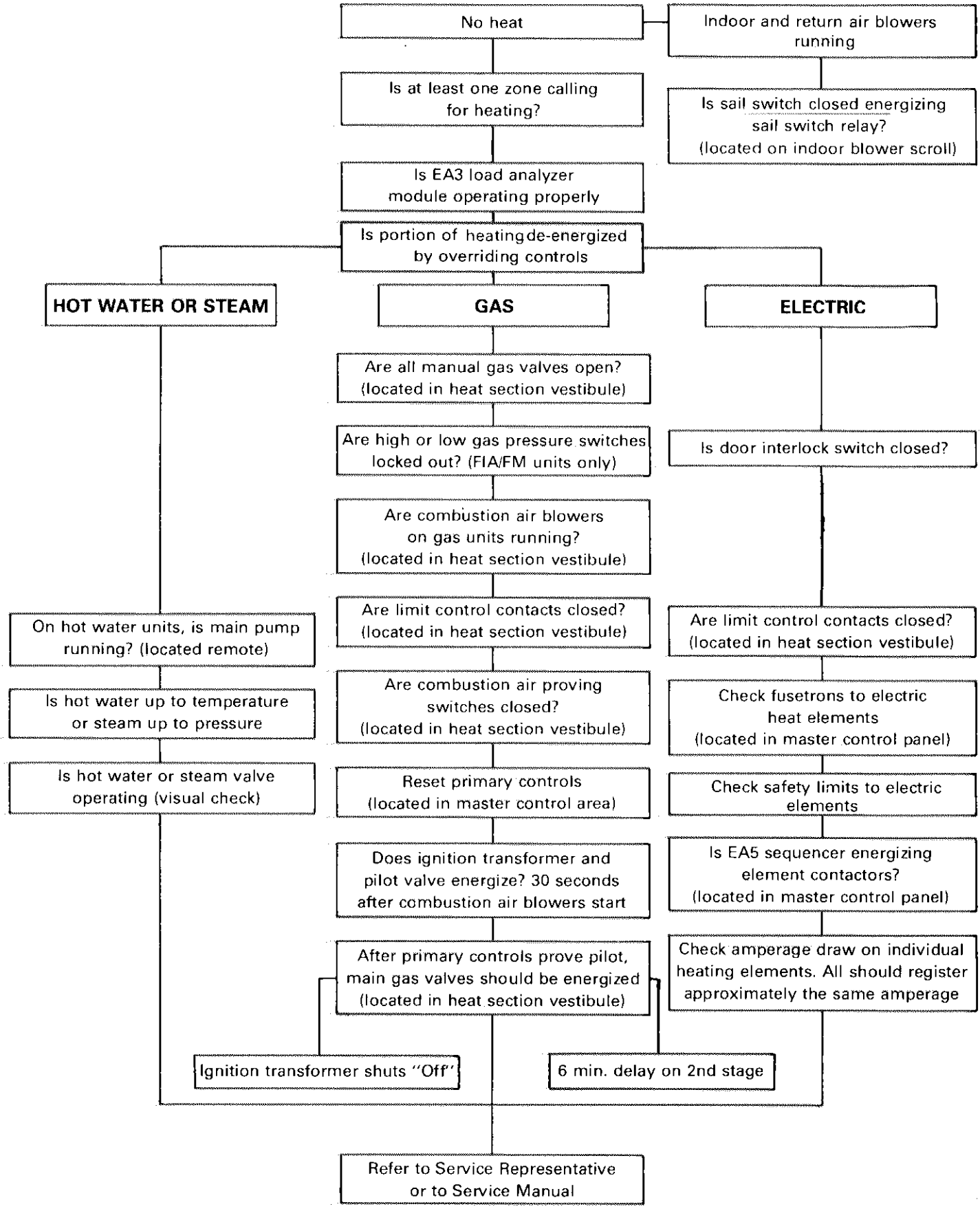
With a piece of equipment as sophisticated as the DMS4 unit, it can often be difficult to locate the source of trouble from a given set of conditions.
The following service flow charts are designed to direct you to the likely source of trouble from certain observed or readily determined conditions.

When going through the following service flow charts, always start with "Supply And Return Air Blower Operation." Once the indoor and return air blowers are running, go to the flow charts for "Hot Deck" or "Cold Deck." The schematic wiring diagrams provided on the unit are to assist you in understanding the various circuits.

SERVICE FLOW CHART FOR INDOOR AND RETURN AIR BLOWERS



SERVICE FLOW CHART FOR HOT DECK OR HEATING SECTIONS



SERVICE FLOW CHART FOR COLD DECK OR COOLING SECTIONS