INSTALLATION INSTRUCTIONS

WALL MOUNTED PACKAGE AIR CONDITIONERS WITH HOT GAS BYPASS SYSTEM DESIGN

MODELS

24WA6
36WA6
49WA
60WA

MANUAL 2100-182 REV. A
SUPERSEDES REV.
FILE VOL. III, TAB 16

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FIGURES AND TABLES

WALL MOUNT PACKAGE AIR CONDITIONERS

WIRING--MAIN POWER

Refer to the rating plate for wire sizing information and maximum fuse or HACR type circuit breaker size. Each outdoor unit is marked with a Minimum Circuit Ampacity. The Minimum Circuit Ampacity for Hot Gas Bypass models is calculated for the concurrent operation of the air conditioner and electric heaters. Many Hot Gas Bypass installations require continuous operation of the compressor with the room air temperature being maintained by cycling the electric heat strips on and off. This leads to the higher than normal Minimum Circuit Ampacity of the Hot Gas Bypass units.

Since the field wiring must be sized to carry the concurrent current of both compressor and electric heaters, the field wiring must be sized to carry the Minimum Circuit Ampacity Current. See instruction sheet for further details.

These instructions MUST BE adhered to. Refer to the National Electrical Code for complete current carrying capacity data on the various insulation grades of wiring material.

The electrical data lists fuse and wire sizes (60°C copper) for all models, including the most commonly used heater sizes. Also shown are the number of field power circuits required for the various models with heaters. .

The unit rating plate lists a "Maximum Time Delay Relay Fuse" or "HACR Type" circuit breaker that is to be used with the equipment. The correct size must be used for proper circuit protection and also to assure that there will be no nuisance tripping due to the momentary high starting current of the compressor motor.

TABLE 1
HOT GAS BYPASS ELECTRICAL SPECIFICATIONS

Model	Rated Volts and Phase	(1) Maximum Unit Amps @ 240/208	Number Field Power Circuit	Internal Fuses	(1) Maximum External Fuse Or Circuit Breaker	Minimum Circuit Ampacity	(2) Field Power Wire Size	(2) Ground Wire Size
24WA6-A05H	230/208/1	32.3/30.6	1	---	45	43	6	10
24WA6-A08H		44.8/41.3	1	---	60	58	4	10
36WA6-A10H		62.3/60.4	1	45/60	90	82	3	
36WA6-B09H	230/208/3	38.4/36.4	1	---	50	49	6	10
36WA6-C12H	460/3	23.9	1	---	30	30	10	10
49WA-A10H	230/208/1	68.9/65	1	50/60	90	87	2	8
49WA-B09H	230/208/3	42.5/39.5	1	---	60	52	6	10
49WA-B18H		64.1/58.3	1	35/60	80	79	3	8
49WA-C15H	460/3	28.8	1	---	40	36	8	10
60WA-A10H	230/208/1	71.9/69	1	60/60	110	96	1	8
60WA-B09H	230/208/3	44/43	1	---	60	56	4	10
60WA-B18H		65.3/61.8	1	45/60	90	83	3	8
60WA-C00H	460/3	11.8	1	---	20	15	14	14
60WA-C09H		22.6	1	---	30	28	10	10
60WA-C15H		29.8	1	---	40	37	8	10

(1) Maximum size of the time delay fuse or HACR type circuit breaker for protection of field wiring conductors. (Sizes 70 amp or greater are not HACR type).

(2) Based on 60°C copper wire.

TABLE 2

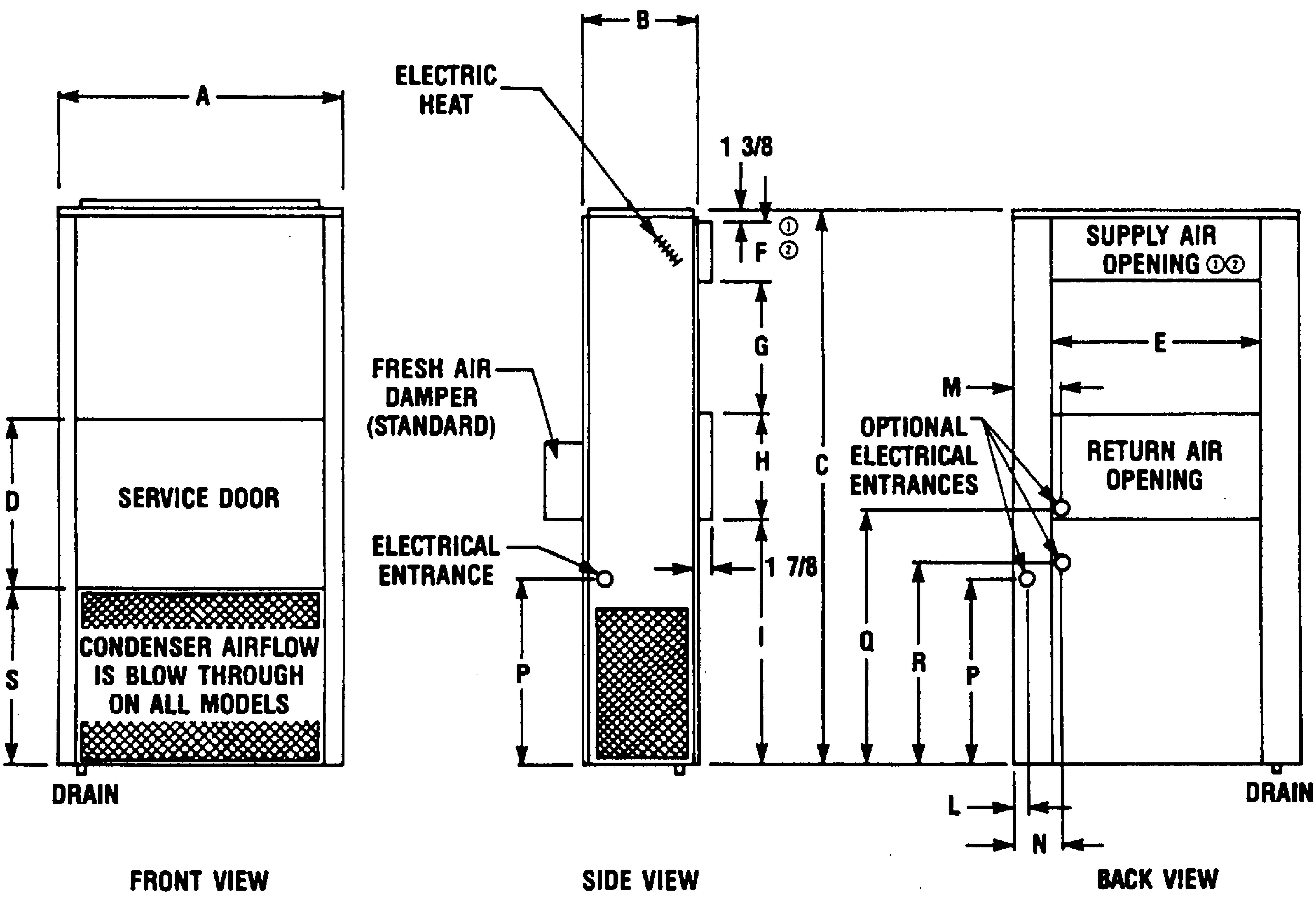
DIMENSIONS OF BASIC UNIT FOR ARCHITECTURAL AND INSTALLATION REQUIREMENTS (Nominal)

Model	A	B	C	D	(1) (2) E	(1) (2) F	G	H	I	L	M	N	P	Q	R	S	Fresh Air Intake Standard
24WA	32-3/8	14-5/8	69-3/8	23-1/2	19-7/8	7-7/8	20-1/2	11-7/8	27-1/2	4	6-1/4	NA	22-3/8	28-5/8	NA	21-1/8	0-10%
36WA	38	16-1/2	74	24-3/4	27-7/8	7-7/8	18	13-7/8	32-7/8	2-3/8	5-3/4	6-1/4	24-7/8	34-1/2	27	23-3/8	0-25%
49WA, 60WA	42	23	84	21-1/2	29-7/8	9-7/8	30	15-7/8	26-7/8	NA	8	NA		32-5/8	NA	31-3/4	0-25%
Dimensions and filter sizes are in inches.																	

(1) The supply duct requires a one inch clearance on all four sides from combustible materials. This is required for the first three feet of supply duct. Refer to the installation manual for more detailed information.

(2) On model 24WA6 with electric heat, supply duct is approved for zero inch clearance to combustible materials.

FIGURE 1



IMPORTANT

The equipment covered in this manual is to be installed by trained, experienced service and installation technicians. Any heat pump is more critical of proper operating, charge and an adequate duct system than a straight air conditioning unit. All duct work supply and return, must be properly sized for the design air flow requirement of the equipment. ACCA is an excellent guide to proper sizing. All duct work or portions thereof not in the conditioned space should be properly insulated in order to both conserve energy and prevent condensation or moisture damage.

SHIPPING DAMAGE

Upon receipt of equipment, the carton should be checked for external signs of shipping damage. If damage is found, the receiving party must contact the last carrier immediately, preferably in writing, requesting inspection by the carrier's agent.

GENERAL

The refrigerant system is completely assembled and charged. All internal wiring is complete.

The unit is designed for use with or without duct work. Flanges are provided for attaching the supply and return ducts.

These instructions explain the recommended method to install the air cooled self-contained unit and the electrical wiring connections to the unit.

These instructions and any instructions packaged with any separate equipment required to make up the entire air conditioning system should be carefully read before beginning the installation. Note particularly "Starting Procedure" and any tags and/or labels attached to the equipment.

While these instructions are intended as a general recommended guide, they do not supersede any national and/or local codes in any way. Authorities having jurisdiction should be consulted before the installation is made.

INSTALLATION

Size of unit for a proposed installation should be based on heat loss calculation made according to methods of Air Conditioning Contractors of America (ACCA). The air duct should be installed in accordance with the Standards of the National Fire Protection Association for the Installation of Air Conditioning and Ventilating systems of Other Than Residence Type, NFPA No. 90A, and Residence Type Warm Air Heating and Air Conditioning Systems, NFPA No. 90B. Where local regulations are at a variance with instructions, installer should adhere to local codes.

DUCT WORK

Design the duct work according to methods given by the Air Conditioning Contractors of America. When duct runs through unheated spaces, it should be insulated with a minimum of one inch of insulation. Use insulation with a vapor barrier on the outside of the insulation. Flexible joints should be used to connect the duct work to the equipment in order to keep the noise transmission to a minimum.

A one-inch clearance to combustible material for the first three feet of duct attached to the outlet air frame is required see page 5 for further details.

FILTER

A one inch throwaway filter is supplied with each unit. The filter slides into position making it easy to service. This filter can be serviced from the outside by removing the service door.

FRESH AIR INTAKE

All units are built with a fresh air inlet hole punched in the service panel. The fresh air damper assembly is shipped with each unit, and must be attached at the installation site. See Figure 4 for typical installation procedure.

The fresh air damper assembly is standard equipment with the unit because of the variety of state or local codes requiring fresh air capability.

All capacity, efficiency and cost of operation information as required for Department of Energy "Energyguide" Fact Sheets is based upon the fresh air blank-off plate in place and is recommended for maximum energy efficiency.

The blank-off plate is available upon request from the factory and is installed in place of the fresh air damper shipped with each unit.

WALL MOUNTING

1. Two holes, for the supply and return air openings must be cut through the wall as shown in Figure 5.

2. On wood-frame walls, the wall construction must be strong and rigid enough to carry the weight of the unit without transmitting any unit vibration. WARNING: Fire hazard can result if one inch clearance to combustible material for supply air duct is not maintained. See Figure 5.

3. Concrete block walls must be thoroughly inspected to insure that they are capable of carrying the weight of the installing unit.

4. Ducts through the walls must be insulated and all joints taped or sealed to prevent air or moisture entering the wall cavity.

5. Some installations may not require any return air duct. It is recommended that on this type of installation that a filter grille be located in the wall. Filters must be of sufficient size to allow a maximum velocity of 400 FPM.

NOTE: If no return air duct is used, applicable installation codes may limit this cabinet to installation only in a single story structure.

WIRING--MAIN POWER

Refer to the unit rating plate for wire sizing information and maximum fuse or "HACR Type" circuit breaker size. Each outdoor unit is marked with a "Minimum Circuit Ampacity". This means that the field wiring used must be sized to carry that amount of current. Depending on the installed KW of electric heat, there may be two field power circuits required. If this is the case, the unit serial plate will so indicate. Some models are suitable only for connection with copper wire, while others can be wired with either copper or aluminum wire. Each unit and/or wiring diagram will be marked "Use Copper Conductors Only" or "Use Copper or Aluminum Conductors." These instructions MUST BE adhered to. Refer to the National Electrical Code for complete current carrying capacity data on the various insulation grades of wiring material.

The electrical data lists fuse and wire sizes (60 degree C copper) for all models, including the most commonly used heater sizes. Also shown are the number of field power circuits required for the various models with heaters.

The unit rating plate lists a "Maximum Time Delay Relay Fuse" or "HACR Type" circuit breaker that is to be used with the equipment. The correct size must be used for proper circuit protection and also to assure that there will be no nuisance tripping due to the momentary high starting current of the compressor motor.

Field conduit connections must be to the control box and not terminate at the cabinet.

FAN BLADE SETTING DIMENSIONS

Shown in the drawing below are the correct fan blade setting dimensions for proper air delivery across the outdoor coil.

Any service work requiring removal or adjustment in the fan and/or motor area will require that the dimensions below be checked and the blade adjusted in or out on the motor shaft accordingly.

FIGURE 2

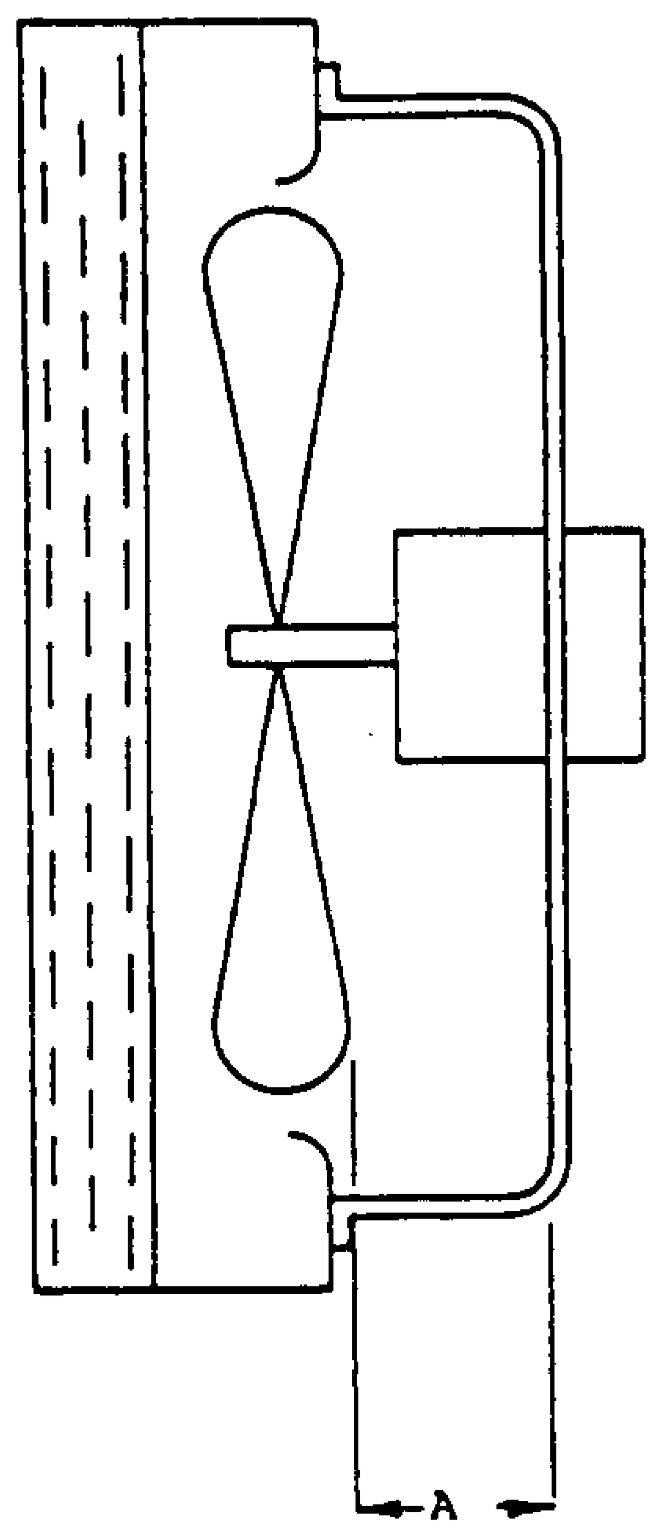


TABLE 3

Model	Dimension A
24WA6	1/2
36WA6	3/4
49WA	2
60WA	2

TABLE 4
INDOOR BLOWER PERFORMANCE
*CFM--Dry Coil

E.S.P. In H20	24WA6 **	36WA6		49WA		60WA	
		Low	High	Low	High	Low	High
.00	1000	970	1435	1450	1940	1460	2000
.10	935	925	1350	1395	1865	1415	1890
.20	870	900	1260	1340	1780	1375	1840
.30	800	---	1150	----	1690	----	1765
.40	715	---	1050	----	1610	----	1670
.50	630		940	----	1510	----	1560

* Filter included. See specifications for unit CFM rating.
**Single speed.

PRESSURE SERVICE PORTS

High and low pressure service ports are installed on all units so that the system operating pressures can be observed.

TABLE 5

Model	Rated CFM*	Rated ESP*	Recommended Airflow Range
24WA6	825	.15	725 - 900
36WA6	1140	.15	930 - 1300
49WA	1725	.30	1425 - 1900
60WA	1700	.20	1425 - 1900

*Rated CFM and ESP on high speed tap.

IMPORTANT INSTALLER NOTE

For improved start-up performance, wash the indoor coil with a dishwater detergent.

CRANKCASE HEATERS

All units are provided with some form of compressor crankcase heat. Some single phase units utilize the compressor motor start winding in series with a portion of the run capacitor to generate heat within the compressor shell to prevent liquid refrigerant migration.

Some three phase units utilize a wraparound type of crankcase heater that warms the compressor oil from the outside.

Some single and three phase models have an insertion well-type heater located in the lower section of the compressor housing. This is a self-regulating type heater that draws only enough power to maintain the compressor at a safe temperature.

Some form of crankcase heat is essential to prevent liquid refrigerant from migrating to the compressor, causing oil pump out on compressor start-up and possible valve failure due to compressing a liquid.

Refer to unit wiring diagram to find exact type of crankcase heater used.

The decal in Figure 3 is affixed to all outdoor units detailing start-up procedure. This is very important. Please read carefully.

FIGURE 3

IMPORTANT

THESE PROCEDURES MUST BE FOLLOWED AT INITIAL START-UP AND AT ANY TIME POWER HAS BEEN REMOVED FOR 12 HOURS OR LONGER.

TO PREVENT COMPRESSOR DAMAGE WHICH MAY RESULT FROM THE PRESENCE OF LIQUID REFRIGERANT IN THE COMPRESSOR CRANKCASE

1. MAKE CERTAIN THE ROOM THERMOSTAT IS IN THE "OFF" POSITION. (THE COMPRESSOR IS NOT TO OPERATE).
2. APPLY POWER BY CLOSING THE SYSTEM DISCONNECT SWITCH THIS ENERGIZES THE COMPRESSOR HEATER WHICH EVAPORATES THE LIQUID REFRIGERANT IN THE CRANKCASE.
3. ALLOW 4 HOURS OR 60 MINUTES PER POUND OF REFRIGERANT IN THE SYSTEM AS NOTED ON THE UNIT RATING PLATE. WHICHEVER IS GREATER.
4. AFTER PROPERLY ELAPSED TIME THE THERMOSTAT MAY BE SET TO OPERTHE COMPRESSOR.
5. EXCEPT AS REQUIRED FOR SAFETY WHILE SERVICING — <u>DO NOT OPEN SYSTEM DISCONNECT SWITCH.</u>

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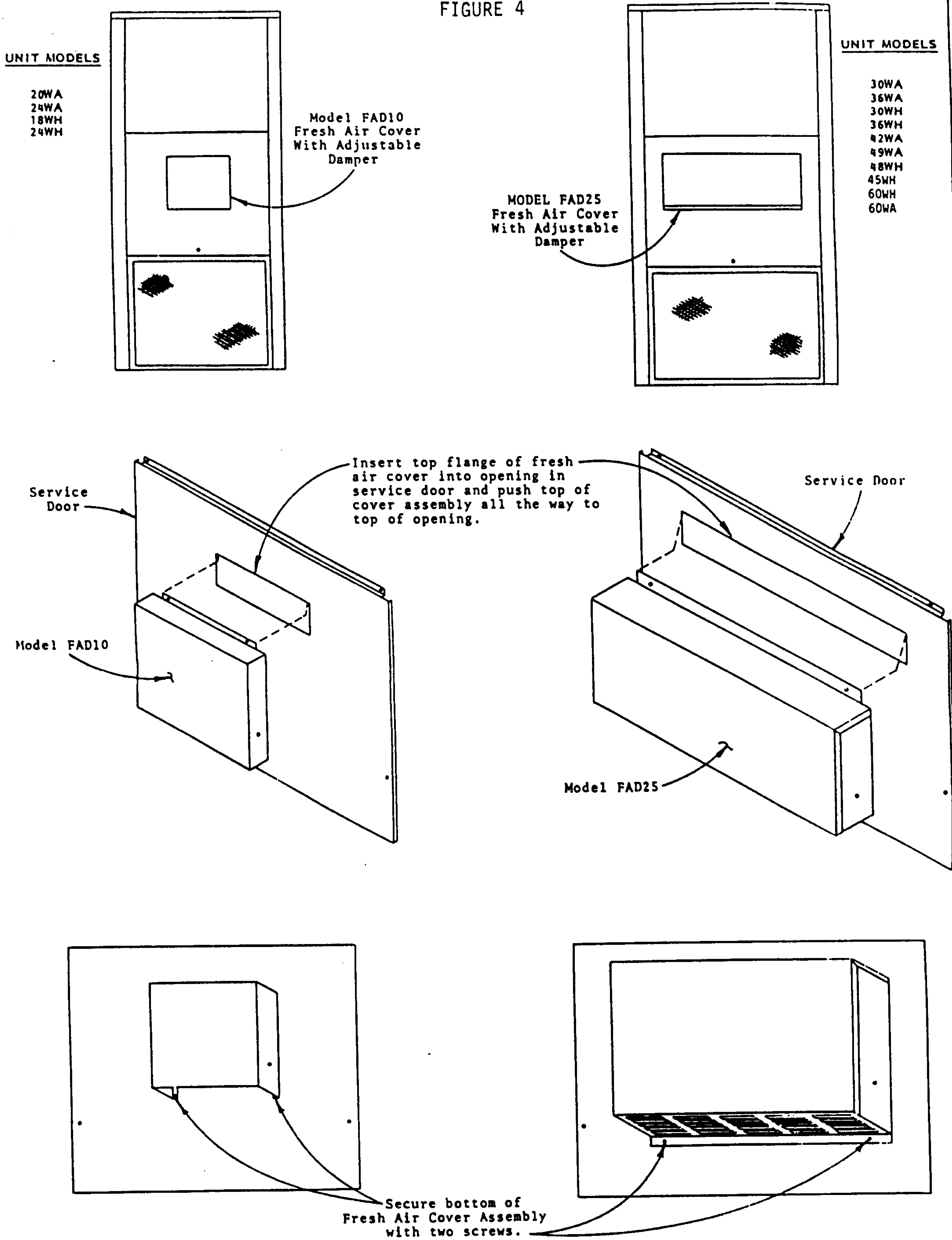
FIGURE 4


UNIT MODELS
20WA
24WA
18WH
24WH
Model FAD10
Fresh Air Cover
With Adjustable
Damper
UNIT MODELS
30WA
36WA
30WH
36WH
42WA
49WA
48WH
45WH
60WH
60WA
MODEL FAD25
Fresh Air Cover
With Adjustable
Damper
Service
Door
Insert top flange of fresh
air cover into opening in
service door and push top of
cover assembly all the way to
top of opening.
Service Door
Model FAD10
Model FAD25
Secure bottom of
Fresh Air Cover Assembly
with two screws.

RIGHT SIDE VIEW FIGURE 5 WALL VIEW

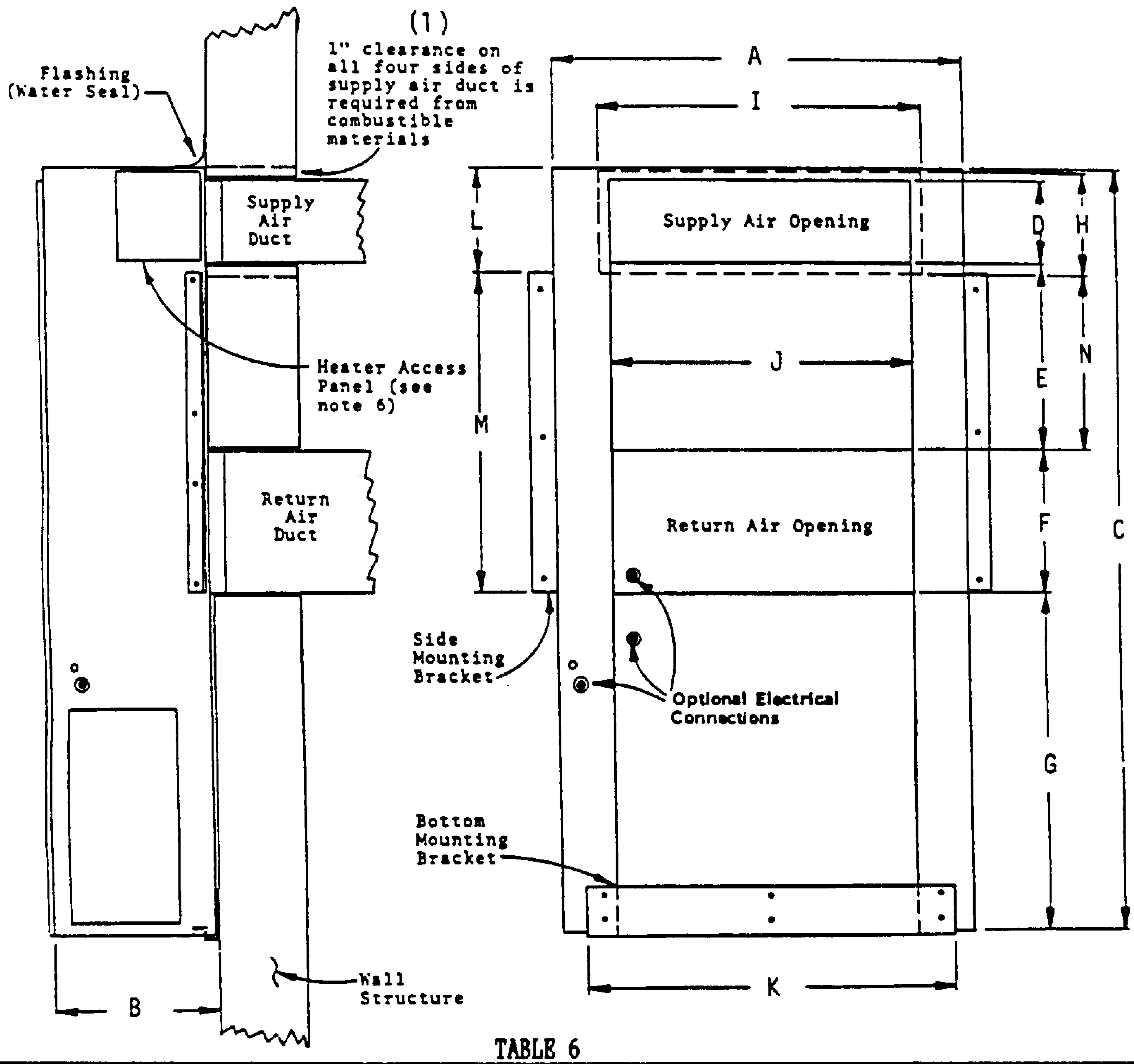


TABLE 6

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
24WA	32-1/4	13-1/2	69-3/8	8	20-1/2	12	27-1/2	(1)	(1)	20	24	10	31	(1)
36WA	38-1/4	15-1/4	74	8	18	14	32-7/8	10	30	28	34	10	31	17
49WA, 60WA	42	22	84	10	30	16	26-3/4	12	32	30	34	10	42	29

MOUNTING INSTRUCTIONS

1. These units are secured by wall mounting brackets which secure the unit to the outside wall surface at both sides and at the bottom.
2. The unit itself is suitable for "0" inch clearance, but the supply air duct flange and the first three feet of (1) supply air duct require 1 inch clearance to combustible material. If combustible wall, use H x I dimensions for sizing, if non-combustible, use D x J dimensions.

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WARNING: (1) Failure to provide the one inch clearance for the first three feet between the supply duct and a combustible surface can result in fire.

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3. After the wall opening positions have been selected, lay out the position for the bottom and side brackets. Fasten the brackets securely to the wall (type of fasteners will depend on wall construction).
4. Be sure to observe the 10" dimension when attaching the side brackets. This will assure that no screws are driven into the unit sides damaging any internal parts. One-half inch sheet metal screws are recommended.
5. For additional mounting rigidity, the return air and supply air (depending upon wall construction) frames or collars can be drilled and screwed or welded to the structural wall itself. Be sure to observe required clearance if combustible wall.
6. Maintain 30 inches minimum clearance on right side of unit to allow access to heat strip and control panel.

(1) Model 24WA6 is approved for "0" inch clearance on both unit and duct surfaces to combustible material.

HOT GAS BYPASS SYSTEM DESIGN

The Hot Gas Bypass System Design consists of two important modifications to the standard, proven air conditioning unit: system capacity control and head pressure control. Each of these sets of controls perform a specific function but both are necessary and dependent upon one another in the overall operation of the system.

The system is designed for outdoor operating temperature range of -10 degrees F to 115 degrees F. Both the head pressure control and the system capacity control are accomplished in the refrigerant cycle design and are independent of the electrical circuit. Therefore, it can be applied to all voltage, phase, KW and other variations of basic system design package air conditioners.

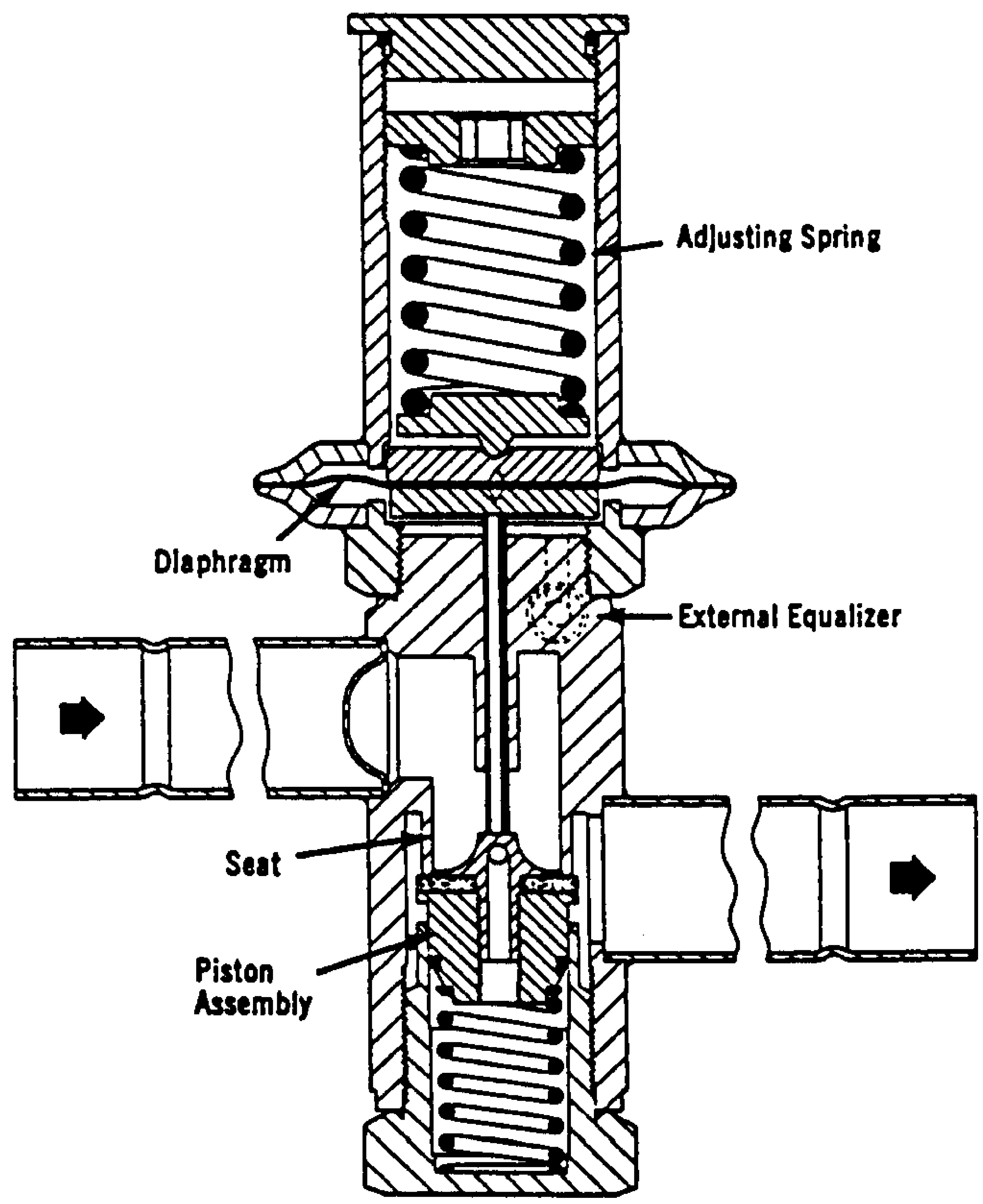
SYSTEM CAPACITY CONTROL

The hot gas bypass valve monitors the outlet pressure of the evaporator and the return air temperature to the unit and will begin to modulate open as the load on the unit decreases to the point where the evaporator temperature is at the setpoint of the bypass valve. The bypass valves are factory adjusted to a setting of 70 psig (41 degree F evaporator temperature). This means that the compressor can be operated continuously and the minimum evaporator temperature will be maintained at 41 degrees F regardless of indoor or outdoor load conditions. Should a lower minimum evaporator temperature be desired, it can be reduced to 36 degrees F by turning the adjusting screw in the end of the remote adjusting bulb in a ccw direction. A 46 degree F evaporator temperature can be achieved by turning the adjusting screw to its full cw position.

The hot gas bypass valve (also called Discharge Bypass Valve, or DBV) responds to changes in downstream pressure (suction pressure) from the evaporator.

When the evaporating pressure is above the valve setting, the valve remains closed. As the suction pressure drops below the valve setting, the valve responds and begins to open. As with all modulating type valves, the amount of opening is proportional to the change in the variable being controlled--in this case the suction pressure. As the suction pressure continues to drop, the valve continues to open farther until the limit of the valve stroke is reached. See Figure 6.

FIGURE 6



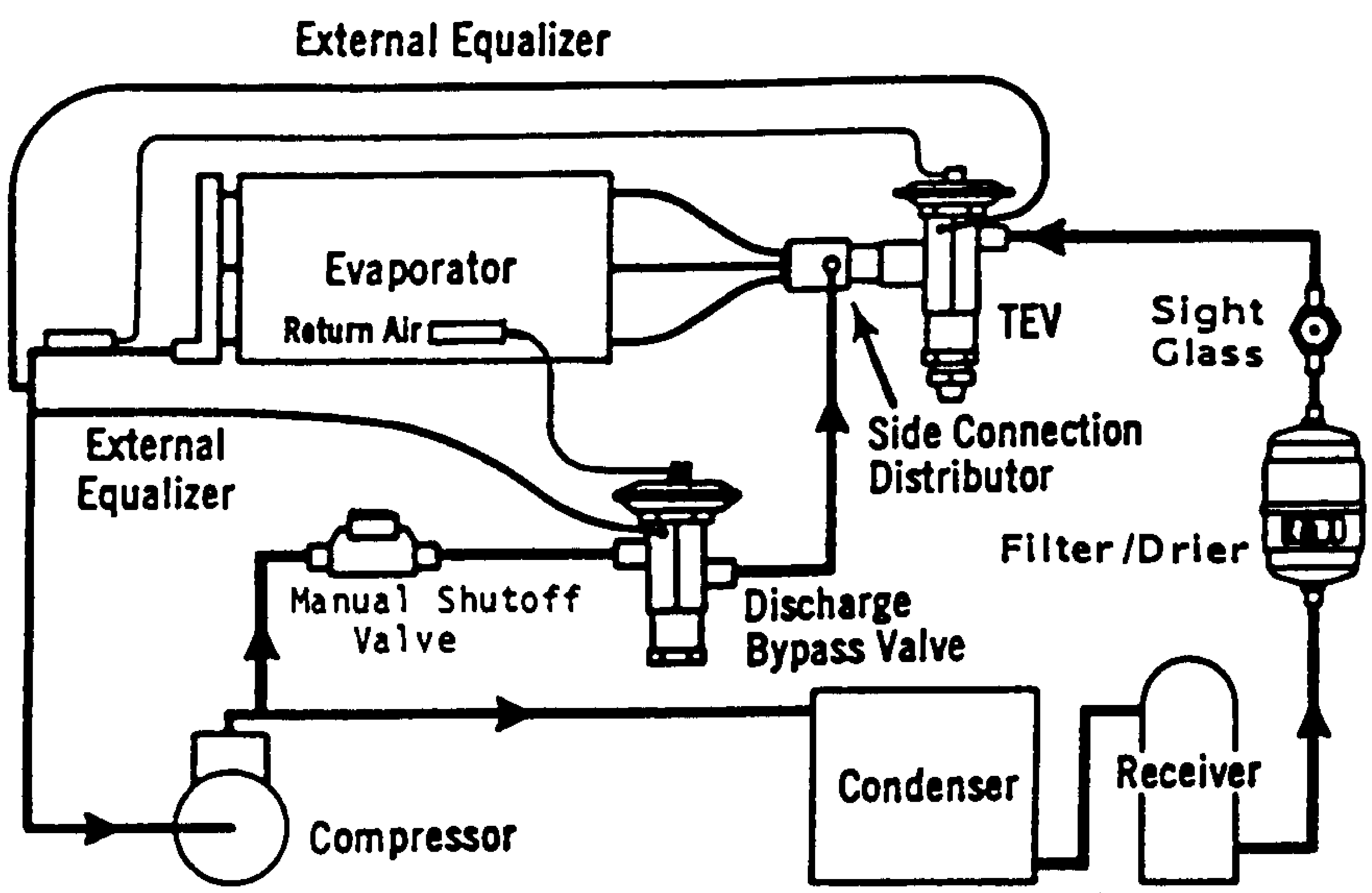
NOTE: Figure 6 depicts a basic "adjustable spring type" DBV. All Bard units employ an "adjustable remote bulb type" where the adjusting spring shown on top of valve in Figure 6 is in a 7/8" x 4.5" bulb and located in the evaporator air stream. The adjustment screw is on the open end (end opposite capillary tubing).

Bypass To Evaporator Inlet With Distributor

This method of application, illustrated in Figure 7, provides distinct advantages.

The primary advantage of this method is that the system thermostatic expansion valve will respond to the increased superheat of the vapor leaving the evaporator and will provide the liquid required for desuperheating. Also the evaporator serves as an excellent mixing chamber for the bypassed hot gas and the liquid-vapor mixture from the expansion valve. This ensures a dry vapor reaching the compressor suction. Oil return from the evaporator is also improved since the velocity in the evaporator is kept high by the hot gas.

FIGURE 7



Externally Equalized Bypass Valves

Since the primary function of the DBV is to maintain suction pressure, the compressor suction pressure is the control pressure and must be exerted on the underside of the valve diaphragm. When the DBV is applied as shown in Figure 7 where there is an appreciable pressure drop between the valve outlet and the compressor suction, the externally equalized valve must be used. This is true because when the valve opens, a sudden rise in pressure occurs at the valve outlet.

A thermal expansion valve with external equalizer and a special refrigerant distributor to allow hot gas injection at the inlet of the evaporator by feeding the side connection distributor is utilized. The expansion valve also has a rapid pressure balancing feature to allow system pressure equalization during any periods the compressor may be turned off.

HEAD PRESSURE CONTROL

Design of air conditioning system utilizing air cooled condensing units involves two main problems which must be solved if the system is to operate reliably and economically....high ambient and low ambient operation. If the condensing unit is properly sized, it will operate satisfactorily during extremely high ambient temperatures. However, since most units will be required to operate at ambient temperatures below their design dry bulb temperature during most of the year, the solution to low ambient operation is more complex.

Without good head pressure control during low ambient operation, the system can experience both running cycle and off-cycle problem. Two running cycle problems are of prime concern:

1. Since the pressure differential across the thermostatic expansion valve port affects the rate of refrigerant flow, low head pressure generally causes insufficient refrigerant to be fed to the evaporator.

2. Any system using hot gas for compressor capacity control must have a normal head pressure to operate properly. In either case failure to have sufficient head pressure will result in low suction pressure and/or iced evaporator coils.

The primary off-cycle problem is the possible inability to get the system on-the-line if the refrigerant has migrated to the condenser. Insufficient flow through the TEV will cause a low suction pressure which results in compressor cycling.

When low ambient conditions are encountered during operation on air cooled systems with the resultant drop in condensing pressure, Head Pressure Control's purpose is to hold back enough of the condensed liquid refrigerant so that some of the condenser surface is rendered inactive. This reduction of active condensing surface results in a rise in condensing pressure and sufficient liquid line pressure for normal system operation.

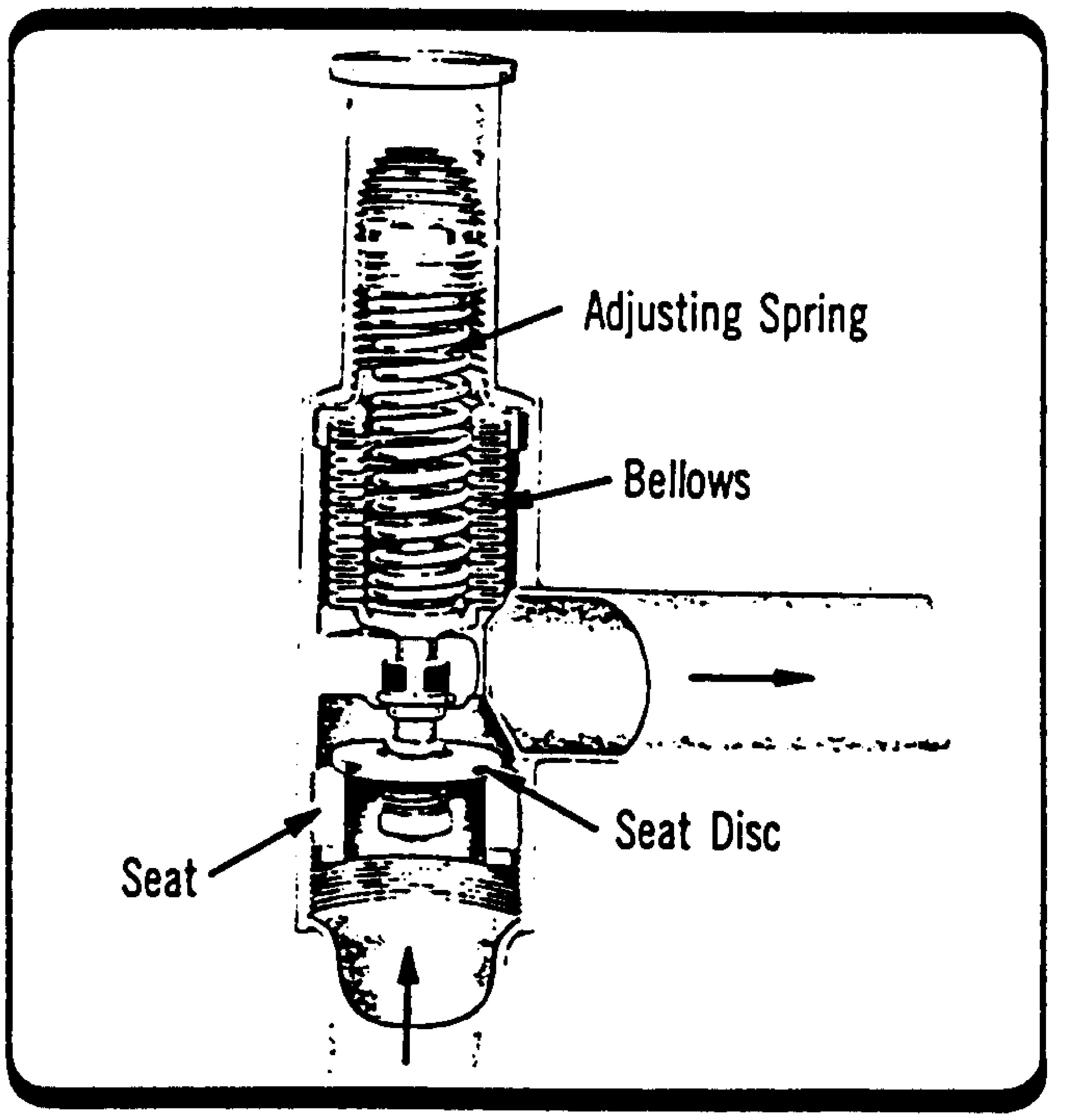
A head pressure control valve and a pressure differential valve are used in conjunction with a receiver to allow for proper head pressure control. Any system using hot gas for capacity control must have a normal head pressure to operate properly.

The operation of the valve types....ORI and ORD....is discussed below. When the operation of each valve is understood, it is easier to apply them to systems that require head pressure control.

ORI Valve Operation

The ORI head pressure control valve is an inlet pressure regulating valve and responds to changes in condensing pressure only. The valve designation stands for Opens on Rise of Inlet pressure. As shown in Figure 8, the outlet pressure is exerted on the underside of the bellows and on top of the seat disc. Since the effective area of the bellows is equal to the area of the port, the outlet pressure cancels out the inlet pressure acting on the bottom of the seat disc opposes the adjusting spring force. These two forces are the operating forces of the ORI.

FIGURE 8



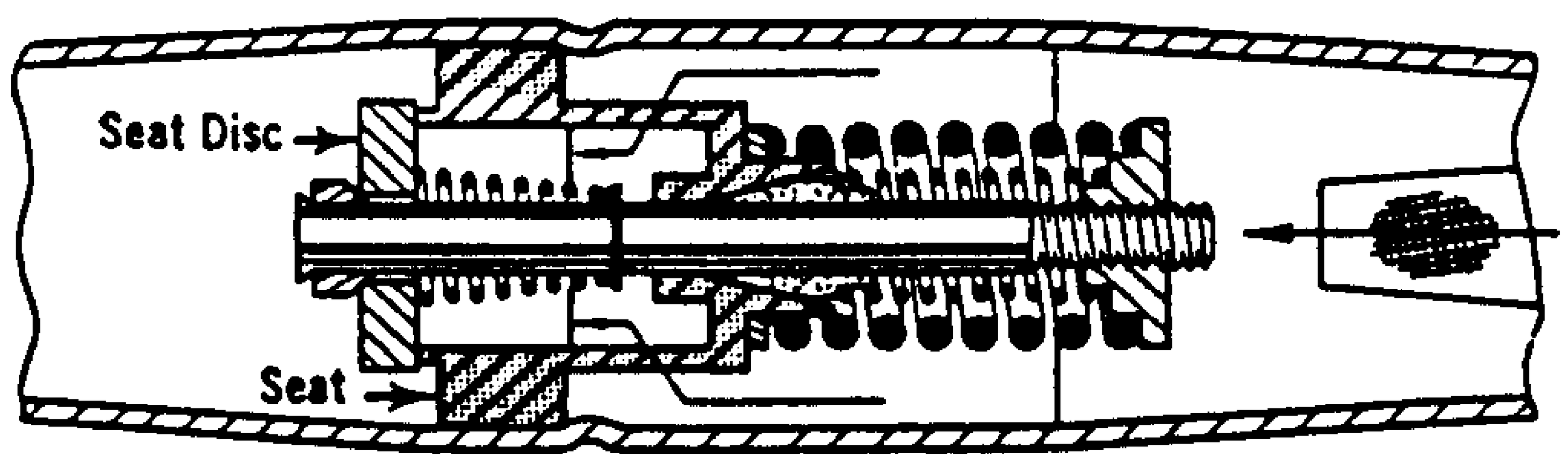
When the outdoor ambient temperature changes, the ORI opens or closes in response to the change in condensing pressure. An increase in inlet pressure above the valve setting tends to open the valve. And if the ambient temperature drops, the condenser capacity is increased and the condensing pressure drops off. This causes the ORI to start to close or assume a throttling position.

The head pressure control valve will begin to throttle when the condensing pressure falls below the setting of the valve. This restricts the flow of liquid from the condenser, causing the refrigerant to back up into the condenser and raising the head pressure. The valve is factory set to maintain a nominal 225 psig minimum head pressure. Head pressures of higher than 225 psig will occur during any conditions of indoor or outdoor loading that would dictate so.

ORD Valve Operation

The ORD valve is a pressure differential valve that responds to changes in the pressure difference across the valve, Figure 9. The valve designation stands for Opens on Rise of Differential pressure. Therefore, the ORD is dependent on some other control valve or action for its operation. And in this respect, it is used with the ORI for head pressure control.

FIGURE 9



As the ORI valve starts to throttle, the flow of liquid refrigerant from the condenser, a pressure differential is created across the ORD. When the differential reaches 25 psi, the ORD starts to open and bypasses hot gas to the liquid line. As the differential increases, the ORD opens further until its full stroke is reached at a differential of 30 psi. The hot gas flowing through the pressure differential valve heats up the cold liquid being passed by the head pressure control valve, and the liquid refrigerant reaching the receiver is warm and with sufficient pressure to assure proper expansion valve operation.

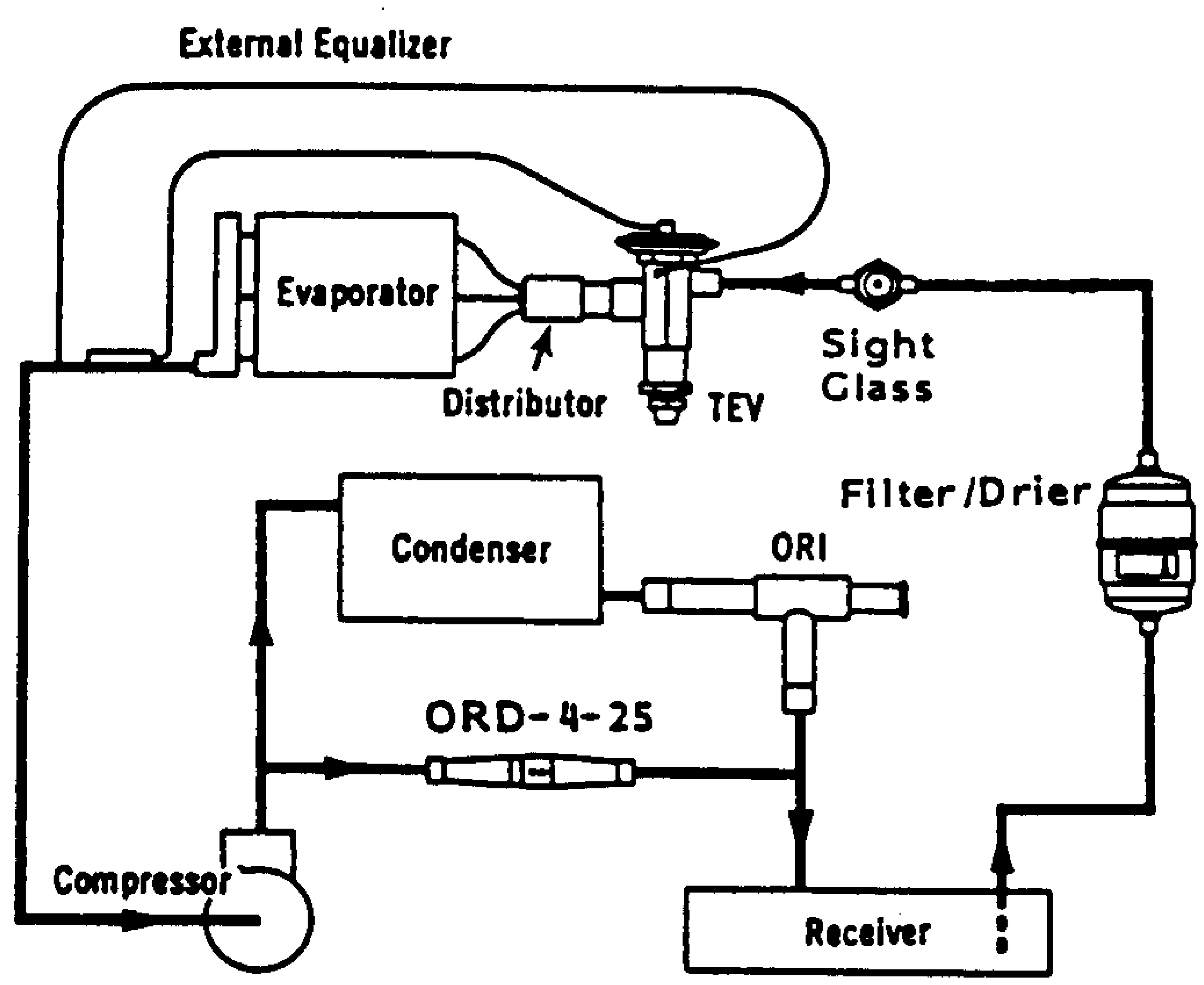
Adjustable ORI/ORD System Operation

The adjustable ORI head pressure control valve and the non-adjustable ORD pressure differential valve comprise an improved system of head pressure control.

The operation of the ORI/ORD system is such that a constant receiver pressure is maintained for normal system operation.

As shown in Figure 10, the ORI is located in the liquid line between the condenser and the receiver. And the ORD is located in a hot gas line bypassing the condenser. During periods of low ambient temperature, the condensing pressure falls until it approaches the setting of the ORI valve. The ORI then throttles, restricting the flow of liquid from the condenser. This causes refrigerant to back up in the condenser thus reducing the active condenser surface. This raises the condensing pressure. Since it is really receiver pressure that needs to be maintained, the bypass line with the ORD is required.

FIGURE 10



The ORD opens after the ORI has offered enough restriction to cause the differential between condensing pressure and receiver pressure to exceed 25 psi. The hot gas flowing through the ORD serves to heat up the cold liquid being passed by the ORI. Thus the liquid reaches the receiver warm and with sufficient pressure to assure proper expansion valve operation. As long as sufficient refrigerant charge is in the system, the two valves modulate the flow automatically to maintain proper receiver pressure regardless of outside ambient.

Refrigerant Charge

When "refrigerant side" head pressure control is utilized on a system, two additional considerations must be completely analyzed. First of all, there must be the correct amount of refrigerant to flood the condenser at the lowest expected ambient and still have enough charge in the system for proper operation. A shortage of refrigerant will cause hot gas to enter the liquid line and the expansion valve, and refrigeration will cease. Too much charge doesn't cause any operating difficulties during the low ambient season; however, this will cause high head pressures during the summer season when head pressure control is not required.

Secondly, the receiver must have sufficient capacity to hold all of the liquid refrigerant in the system, since it will be returned to the receiver when high ambient conditions prevail. If the receiver is too small, liquid refrigerant will be held back in the condenser during the high ambient conditions and excessively high discharge pressure will be experienced.

The receiver has been sized to hold the necessary amount of refrigerant required during light load conditions so the head pressure control system can function properly, and also to accommodate the surplus charge that occurs under periods of normal loading at the warmer outdoor temperatures. Any erratic operating during light load conditions either inside or outside could be attributed to an undercharge of refrigerant even though the unit may operate normally at higher temperatures. Because of the complexity of the system design and operation, the only way to assure correct system charge and operating characteristics over the entire design operating range of the unit is to completely recharge the system with the total amount of R-22 shown on the unit serial plate after proper lead test and evacuation procedures have been followed.

TROUBLESHOOTING GUIDE

Troubleshooting the refrigerant system can be quite complicated because of the number of refrigerant valves in the system. There are two devices installed in the system to aid in this process:

1. A liquid line sight glass is located directly above the filter-drier. If a solid column of refrigerant is not present during normal operation, an undercharge or defective pressure differential valve should be suspected.

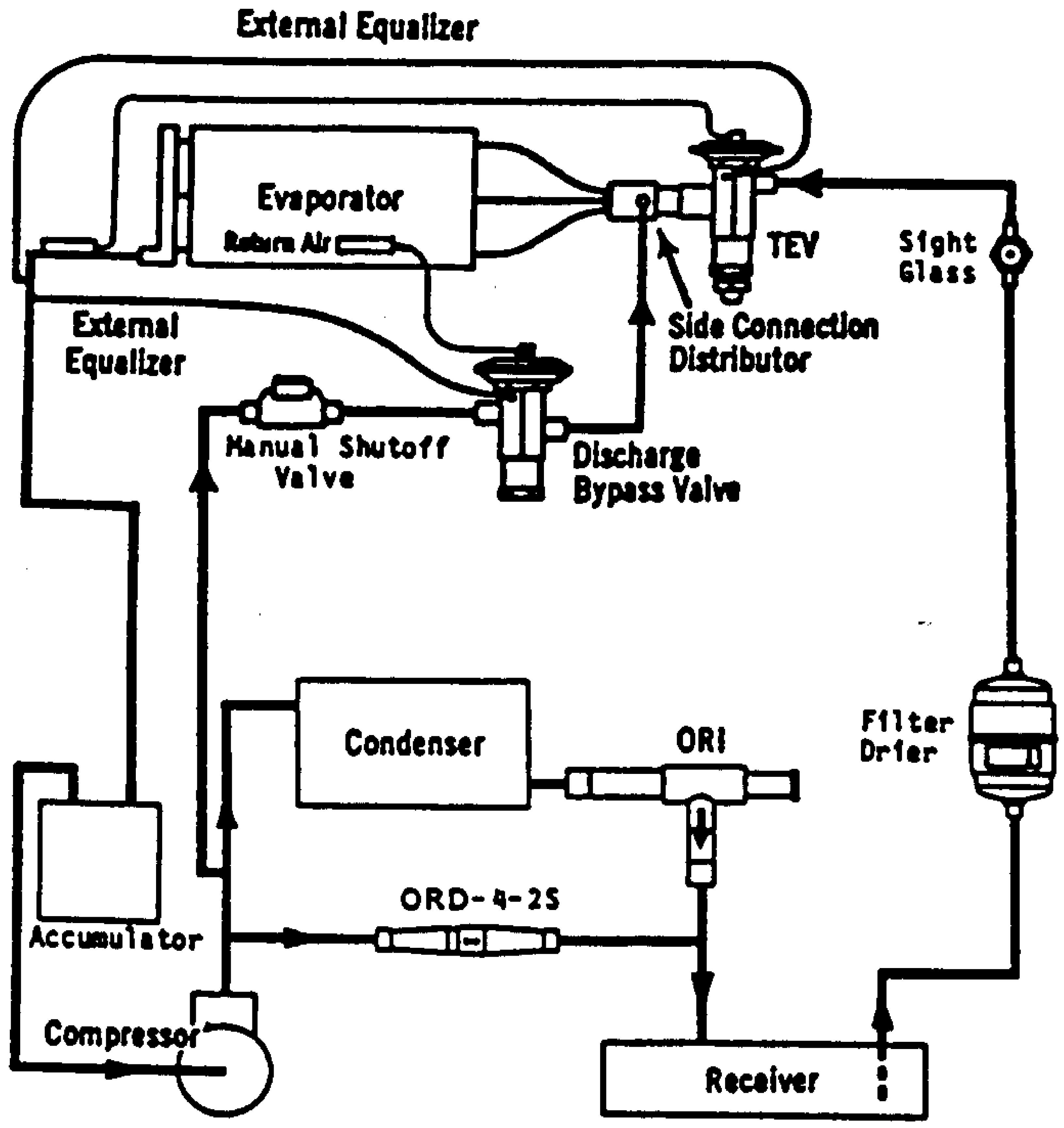
2. A manual shutoff valve is installed in the feed line from the discharge line to the hot gas bypass valve. This valve is normally open but can be closed down by service personnel to help in evaluating system operation should it be necessary.

Please refer to Figure 13, Refrigerant System Troubleshooting Guide, for complete details.

REFRIGERANT PIPING AND FLOW DIAGRAM

Earlier in this manual Figure 7 reviewed the components used in System Capacity Control and Figure 10 those used for Head Pressure Control. Please refer to Figure 11 for complete piping diagram including System Capacity and Head Pressure Control.

FIGURE 11



TYPICAL CONTROL CIRCUIT WIRING

The air conditioning portion of the system is designed for continuous run type of operation for those types of installations that require cooling operation without cycling of the compressor during critical periods (see earlier discussion titled "System Capacity Control").

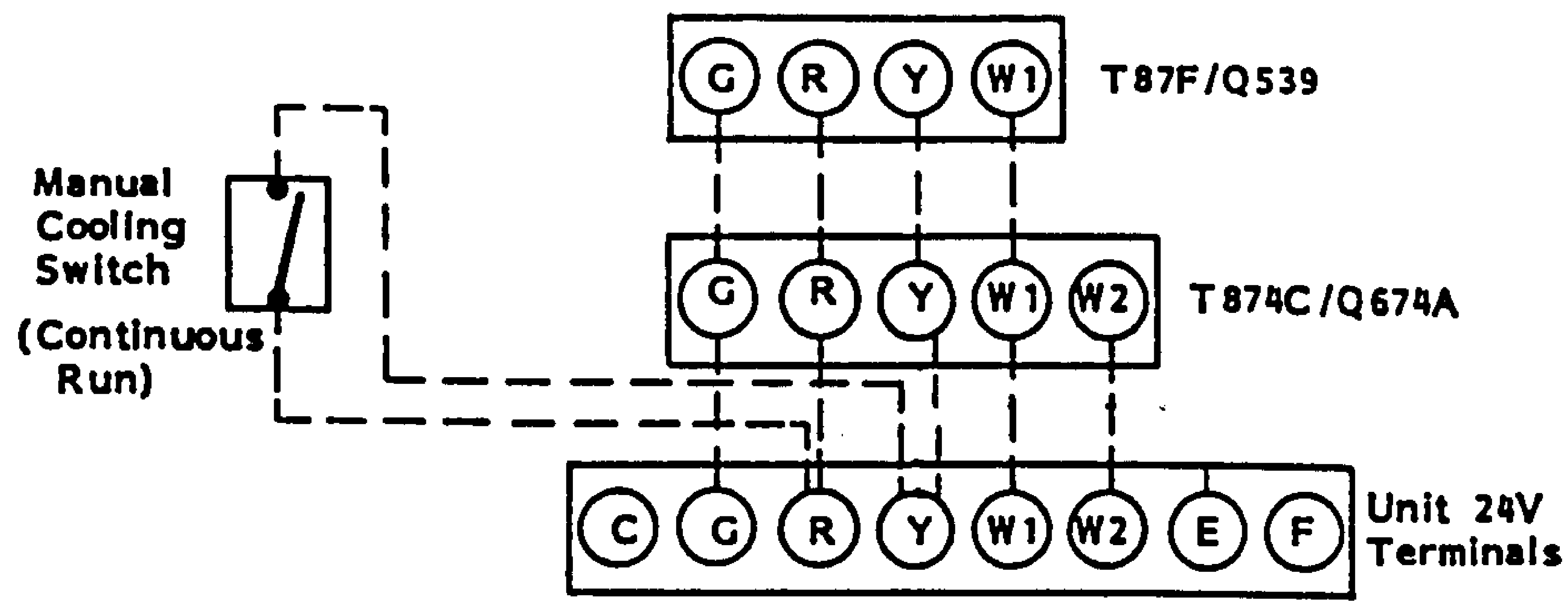
Many systems may also employ electric heaters for certain conditions that may necessitate heating rather than cooling operation.

The control of the space temperature is dependent upon several variables such as basic size of the air conditioner; structure design, internal heat generation from people, lights and equipment; and external weather conditions.

A generally recommended control circuit would consist of conventional heat/cool wall thermostat with an additional SPST toggle switch used to provide a manual cooling switch (continuous run type of operation). This would allow the flexibility of having the wall thermostat cycle the compressor during non-critical periods, and when the manual cooling switch is thrown (closed) the compressor would run all of the time. A secondary feature of this type of set-up is that the manual cooling switch can be activated, and at the same time the wall thermostat can be set for heating and the thermostat adjusted to the desired temperature. This would allow the electrical heater to cycle on demand to help regulate the space temperature. This type of operation may prove helpful if the basic air conditioner is way oversized or there are temporary conditions when a major portion of the heat producing equipment within the building is shut down for some reason.

Shown below is a typical 24V connection.

FIGURE 12

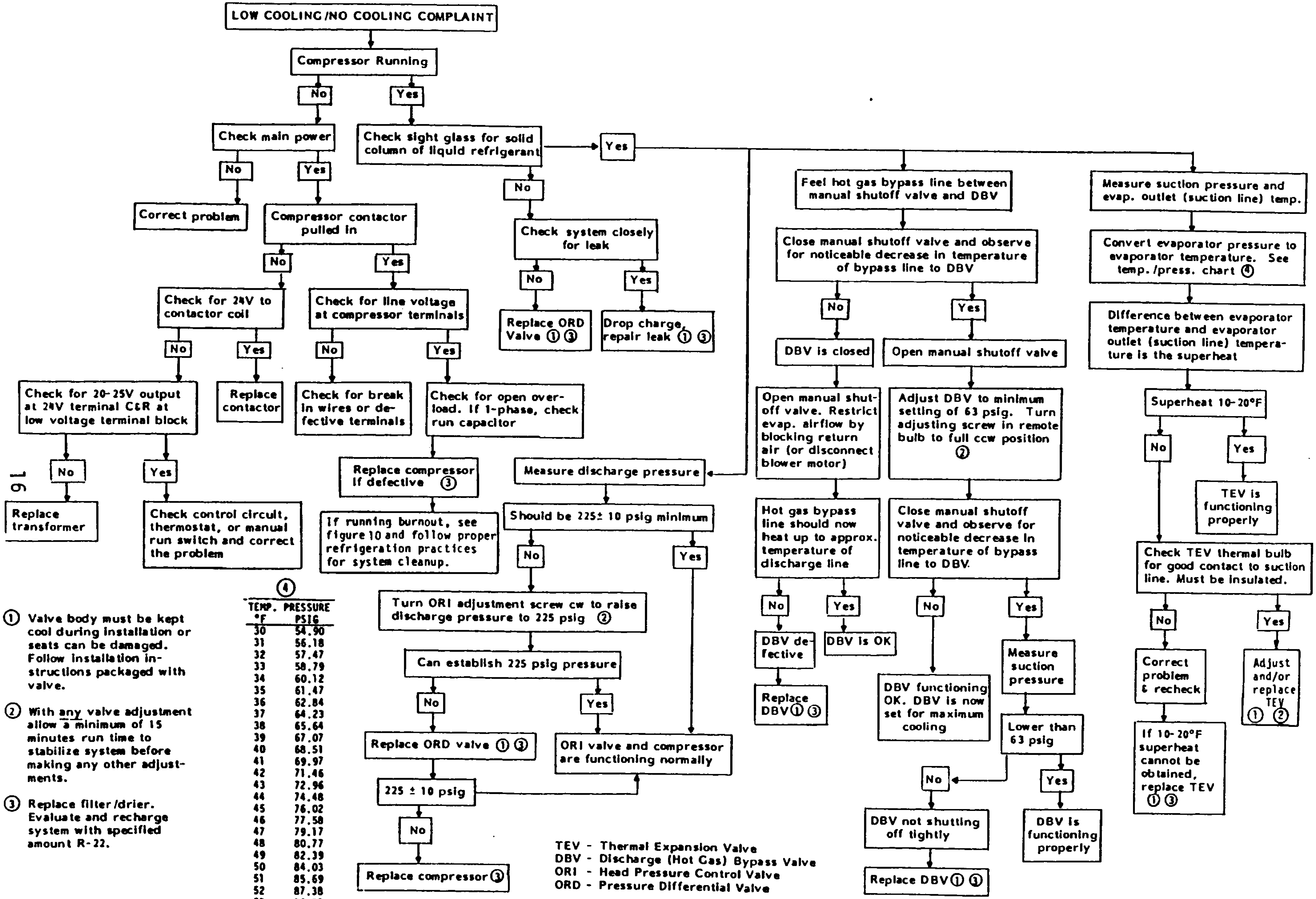


WIRING--MAIN POWER

Refer to the rating plate for wire sizing information and maximum fuse or HACR type circuit breaker size. Each outdoor unit is marked with a Minimum Circuit Ampacity. The Minimum Circuit Ampacity for Hot Gas Bypass models is calculated for the concurrent operation of the air conditioner and electric heaters. Many Hot Gas Bypass installations require continuous operation of the compressor with the room air temperature being maintained by cycling the electric heat strips on and off. This leads to the higher than normal Minimum Circuit Ampacity of the Hot Gas Bypass units.

Since the field wiring must be sized to carry the concurrent current of both compressor and electric heaters, the field wiring must be sized to carry the Minimum Circuit Ampacity Current. See instruction sheet for further details.

FIGURE 13



④

TEMP. °F	PRESSURE PSIG
30	54.90
31	56.18
32	57.47
33	58.79
34	60.12
35	61.47
36	62.84
37	64.23
38	65.64
39	67.07
40	68.51
41	69.97
42	71.46
43	72.96
44	74.48
45	76.02
46	77.58
47	79.17
48	80.77
49	82.39
50	84.03
51	85.69
52	87.38
53	89.08
54	90.81

① Valve body must be kept cool during installation or seats can be damaged. Follow installation instructions packaged with valve.

② With any valve adjustment allow a minimum of 15 minutes run time to stabilize system before making any other adjustments.

③ Replace filter/drier. Evaluate and recharge system with specified amount R-22.

TEV - Thermal Expansion Valve
DBV - Discharge (Hot Gas) Bypass Valve
ORI - Head Pressure Control Valve
ORD - Pressure Differential Valve

FIGURE 14

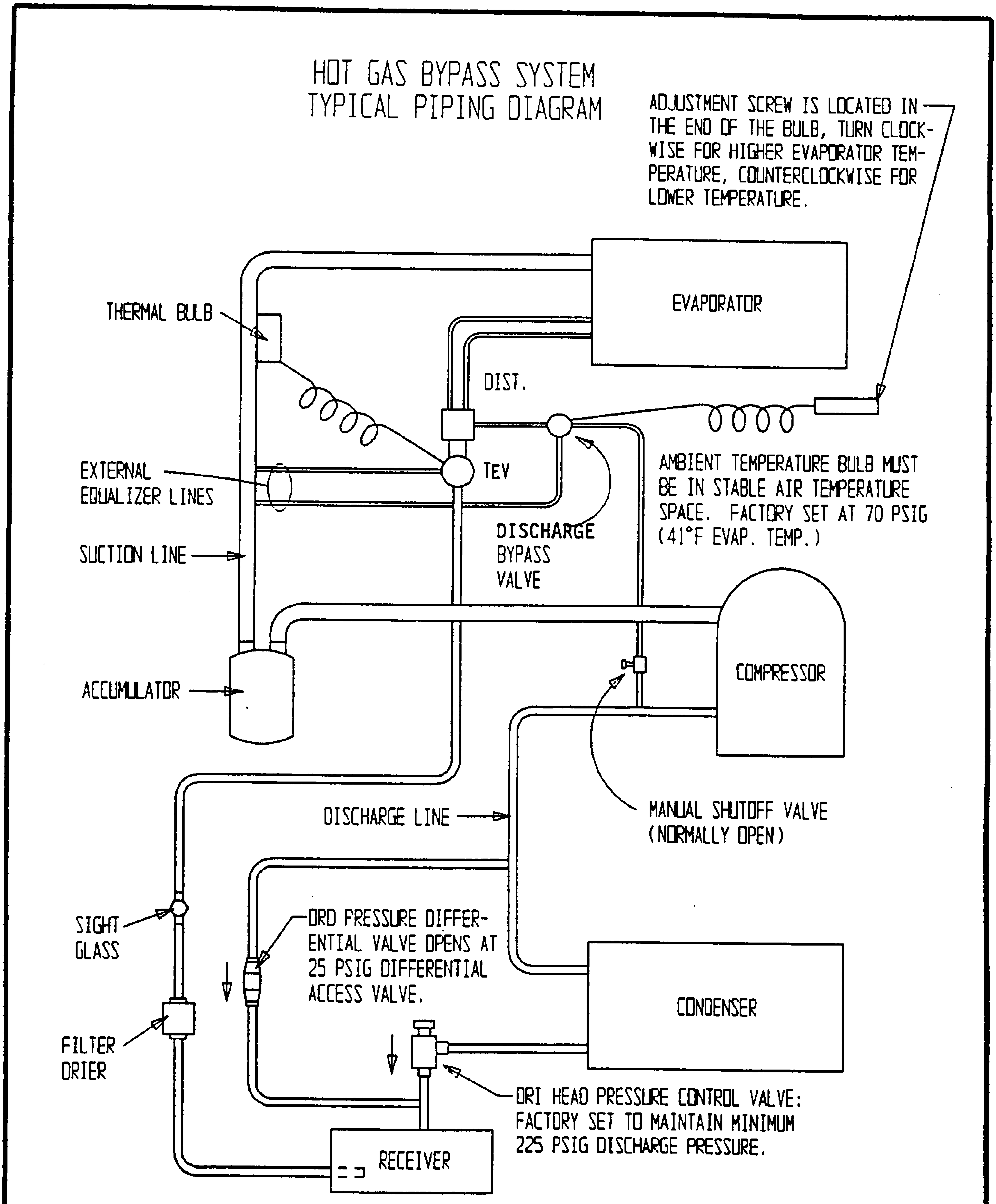
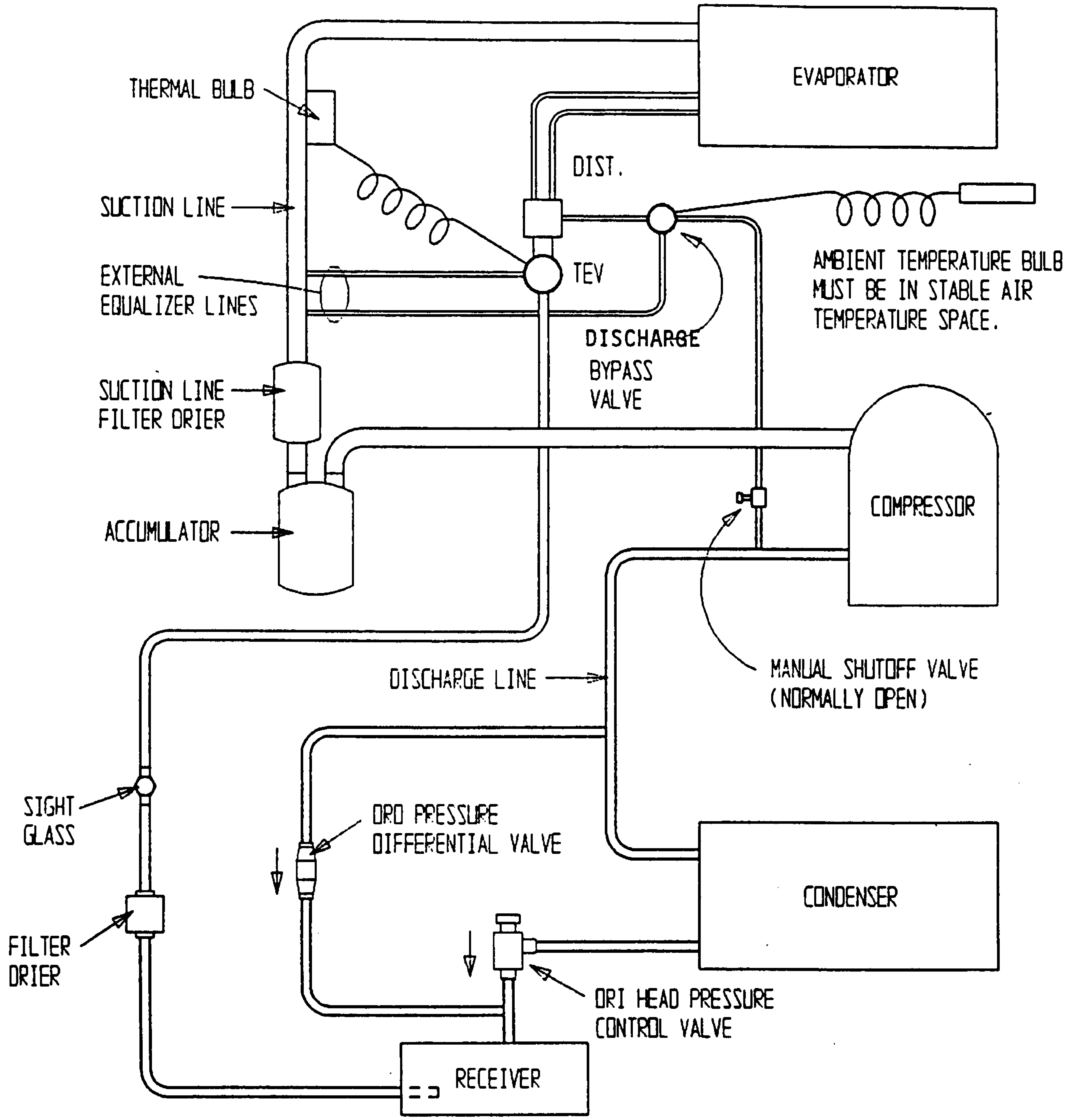
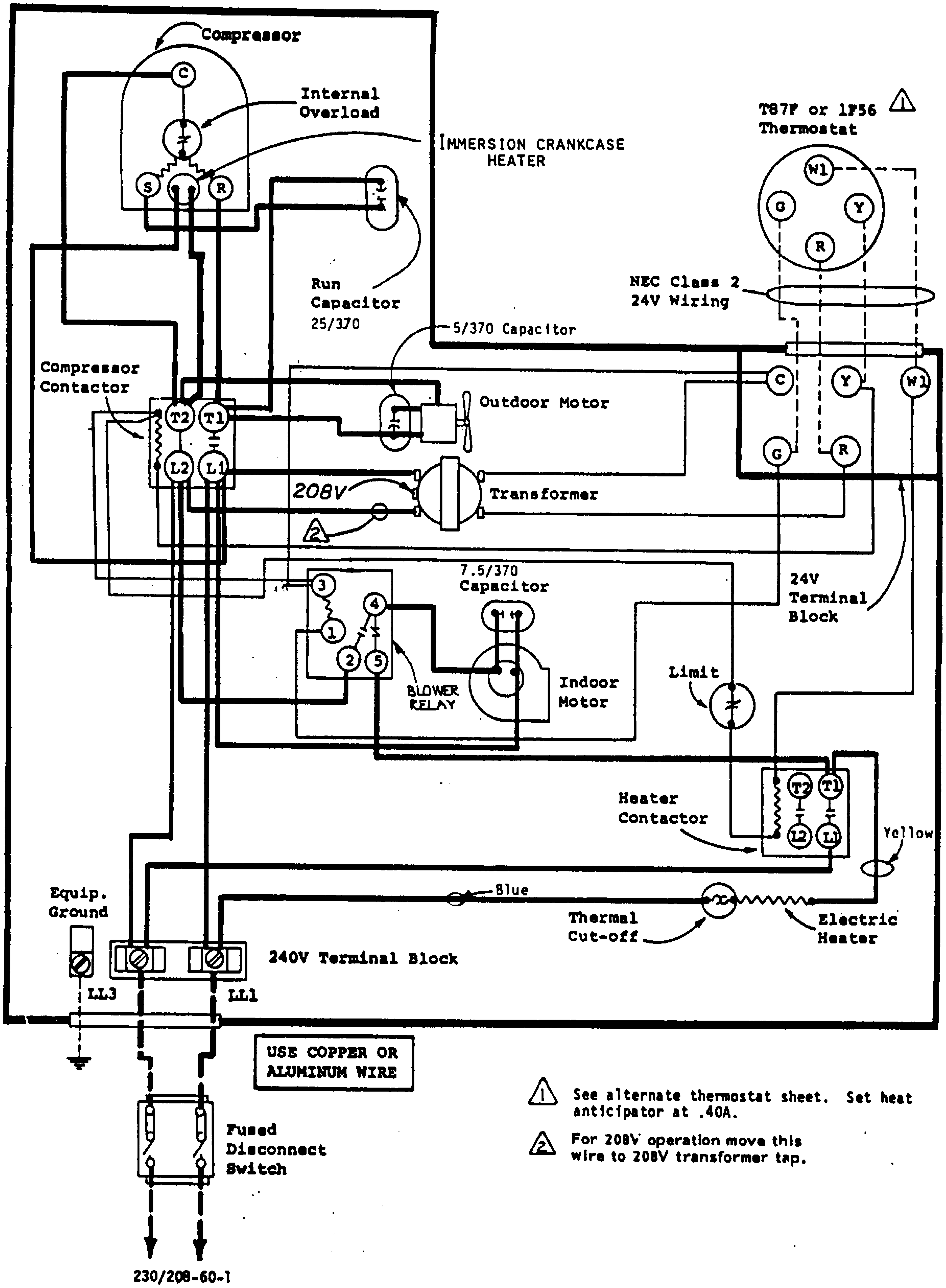

HOT GAS BYPASS SYSTEM
TYPICAL PIPING DIAGRAM
ADJUSTMENT SCREW IS LOCATED IN THE END OF THE BULB, TURN CLOCKWISE FOR HIGHER EVAPORATOR TEMPERATURE, COUNTERCLOCKWISE FOR LOWER TEMPERATURE.
EVAPORATOR
THERMAL BULB
DIST.
TEV
EXTERNAL EQUALIZER LINES
AMBIENT TEMPERATURE BULB MUST BE IN STABLE AIR TEMPERATURE SPACE. FACTORY SET AT 70 PSIG (41°F EVAP. TEMP.)
DISCHARGE BYPASS VALVE
SUCTION LINE
COMPRESSOR
ACCUMULATOR
DISCHARGE LINE
MANUAL SHUTOFF VALVE (NORMALLY OPEN)
SIGHT GLASS
ORD PRESSURE DIFFERENTIAL VALVE OPENS AT 25 PSIG DIFFERENTIAL ACCESS VALVE.
CONDENSER
FILTER DRIER
ORI HEAD PRESSURE CONTROL VALVE: FACTORY SET TO MAINTAIN MINIMUM 225 PSIG DISCHARGE PRESSURE.
RECEIVER

FIGURE 15

HOT GAS BYPASS SYSTEM
COMPRESSOR BURNOUT CLEANUP PROCEEDURE



IF A RUNNING BURNOUT OCCURS, REPLACE THE LIQUID LINE FILTER DRIER AND ACCUMULATOR, AND INSTALL A SUCTION LINE FILTER DRIER. CLEAN OR REPLACE THE HOT GAS BYPASS VALVE, TEV, ORD DIFFERENTIAL VALVE, ORI CONTROL VALVE, DISCHARGE, LIQUID, AND HOT TUBING. THE ORI AND ORD VALVES HAVE MESH SCREENS THAT MUST BE CLEANED

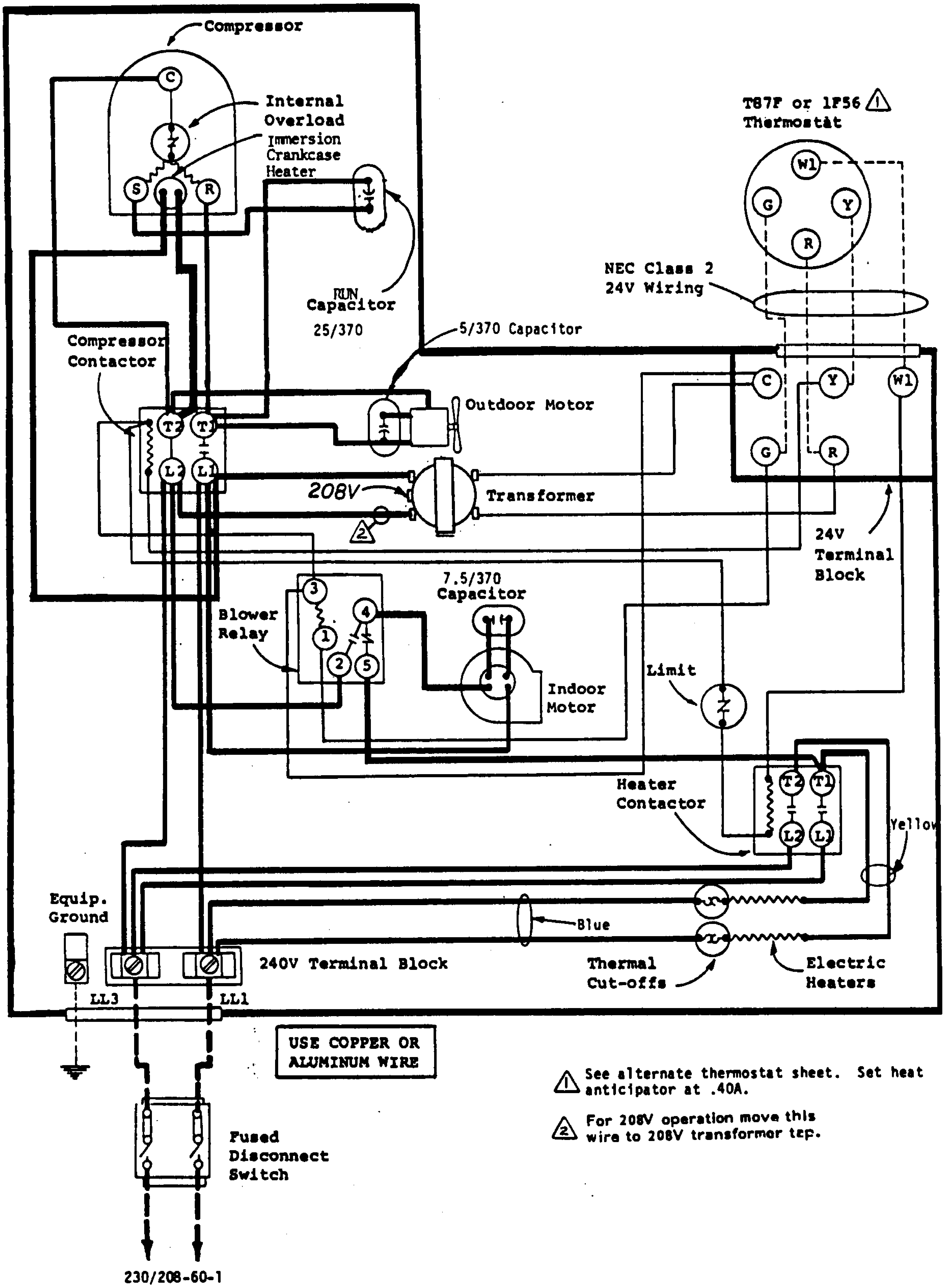


⚠1 See alternate thermostat sheet. Set heat anticipator at .40A.

⚠2 For 208V operation move this wire to 208V transformer tap.

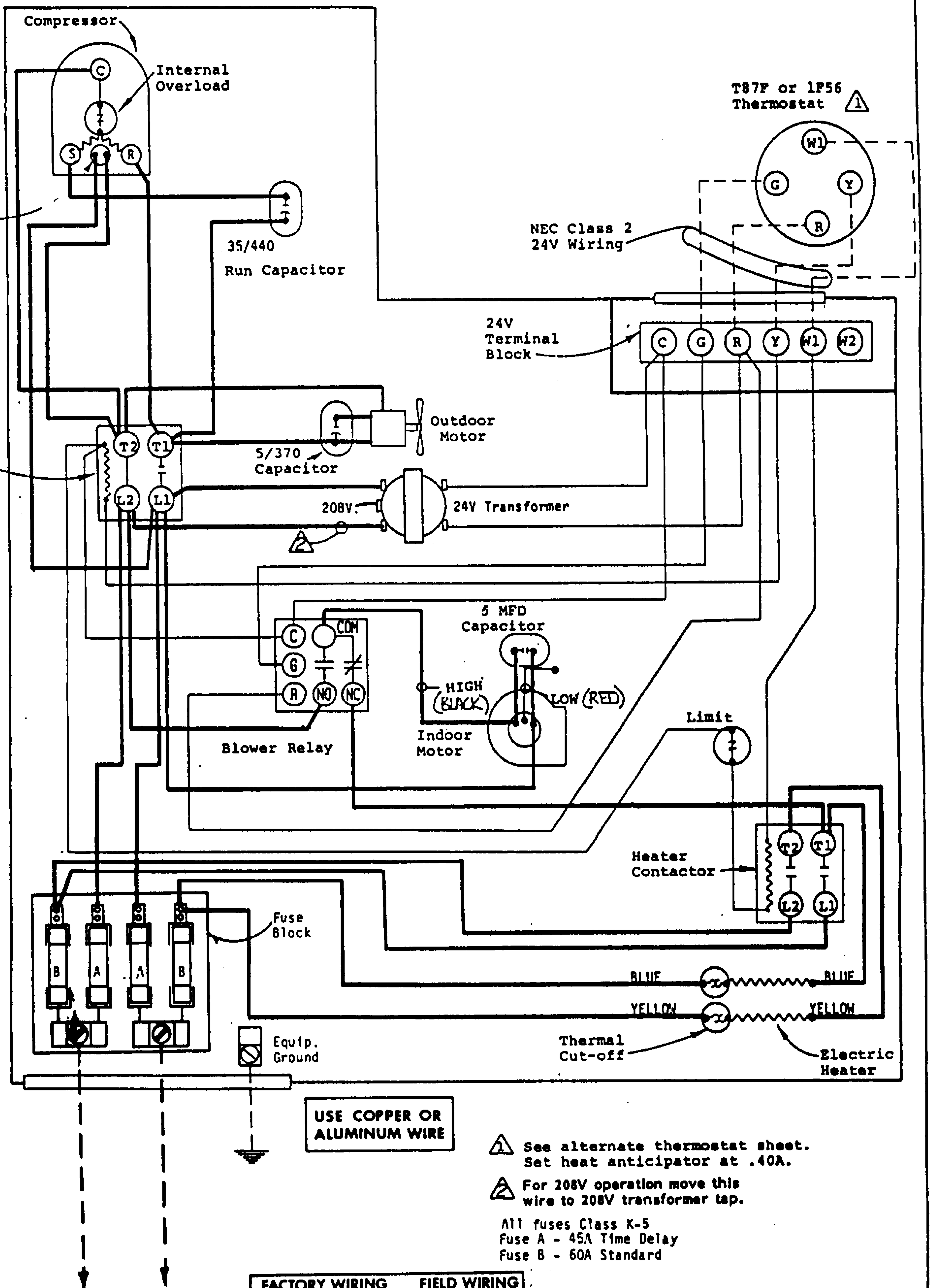
	FACTORY WIRING	FIELD WIRING
Low Voltage	———	– – – –
High Voltage	━━━	━ ━ ━ ━

4007-120K



1. See alternate thermostat sheet. Set heat anticipator at .40A.
2. For 208V operation move this wire to 208V transformer tap.

4007-130 K



⚠1 See alternate thermostat sheet. Set heat anticipator at .40A.

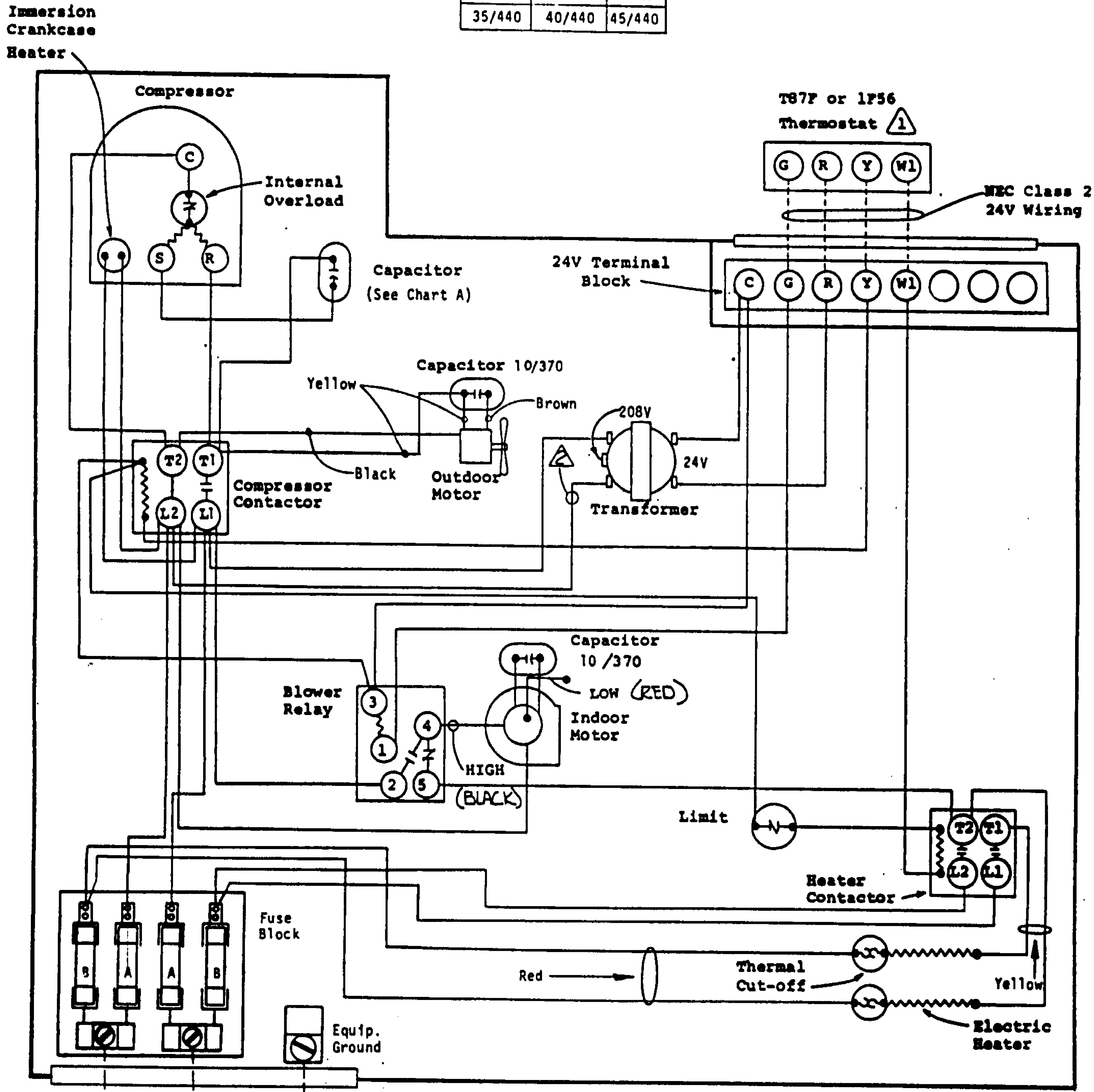
⚠2 For 208V operation move this wire to 208V transformer tap.

All fuses Class K-5
Fuse A - 45A Time Delay
Fuse B - 60A Standard

FACTORY WIRING	FIELD WIRING
Low Voltage ———	— — — —
High Voltage ━━━	━ ━ ━ ━

4009-132

CHART A		
42WA	49WA	60WA
35/440	40/440	45/440



230/208-60-1

USE COPPER OR ALUMINUM WIRE

1 Set heat anticipator at .40A.

2 For 208V operation move this wire to 208V transformer tap.

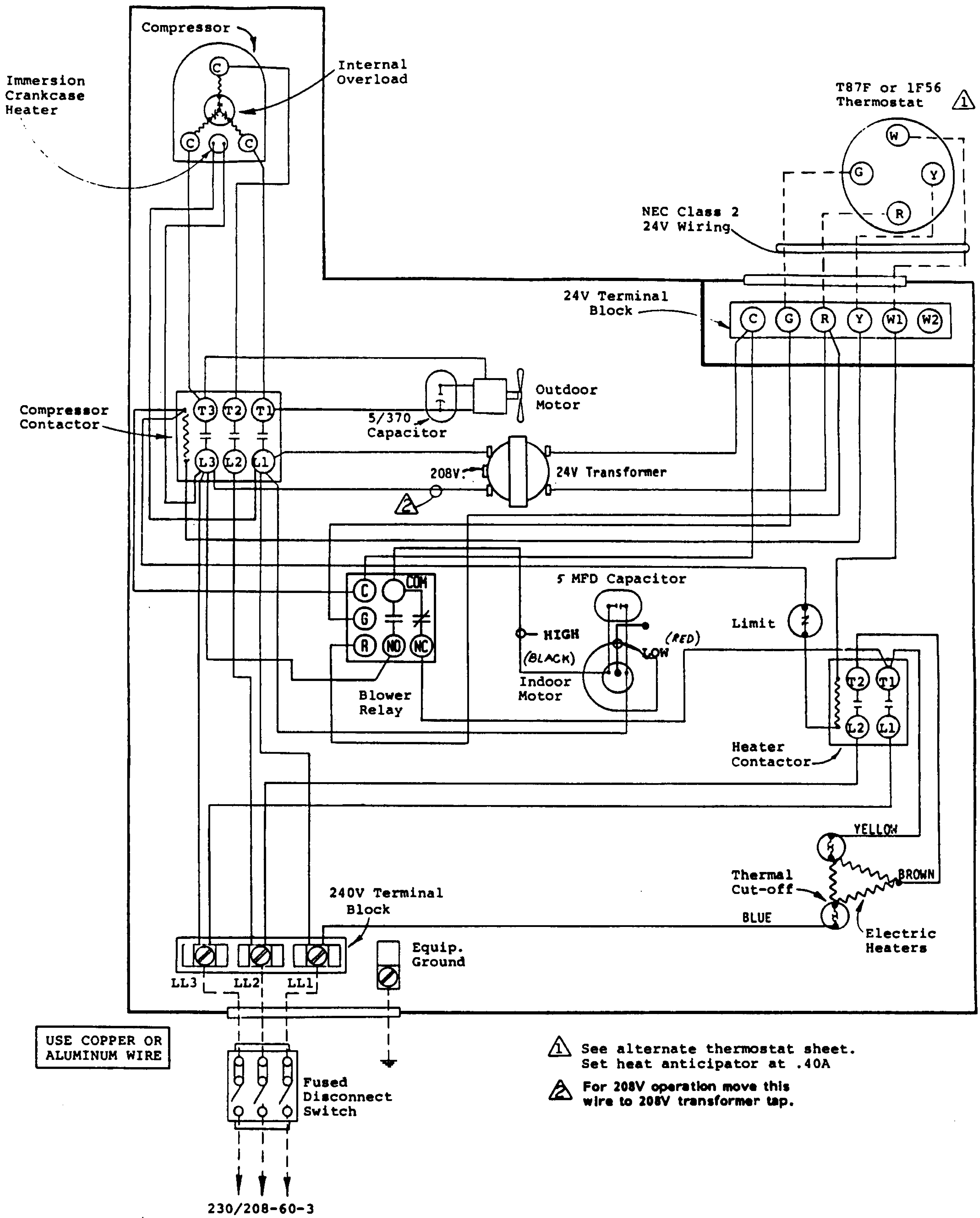
Model	Fuse A	Fuse B
60WA	60A TD	60A STD
49WA	50A TD	60A STD

All fuses Class K-5

Factory Wiring ______

Field Wiring - - - - -

4010-133



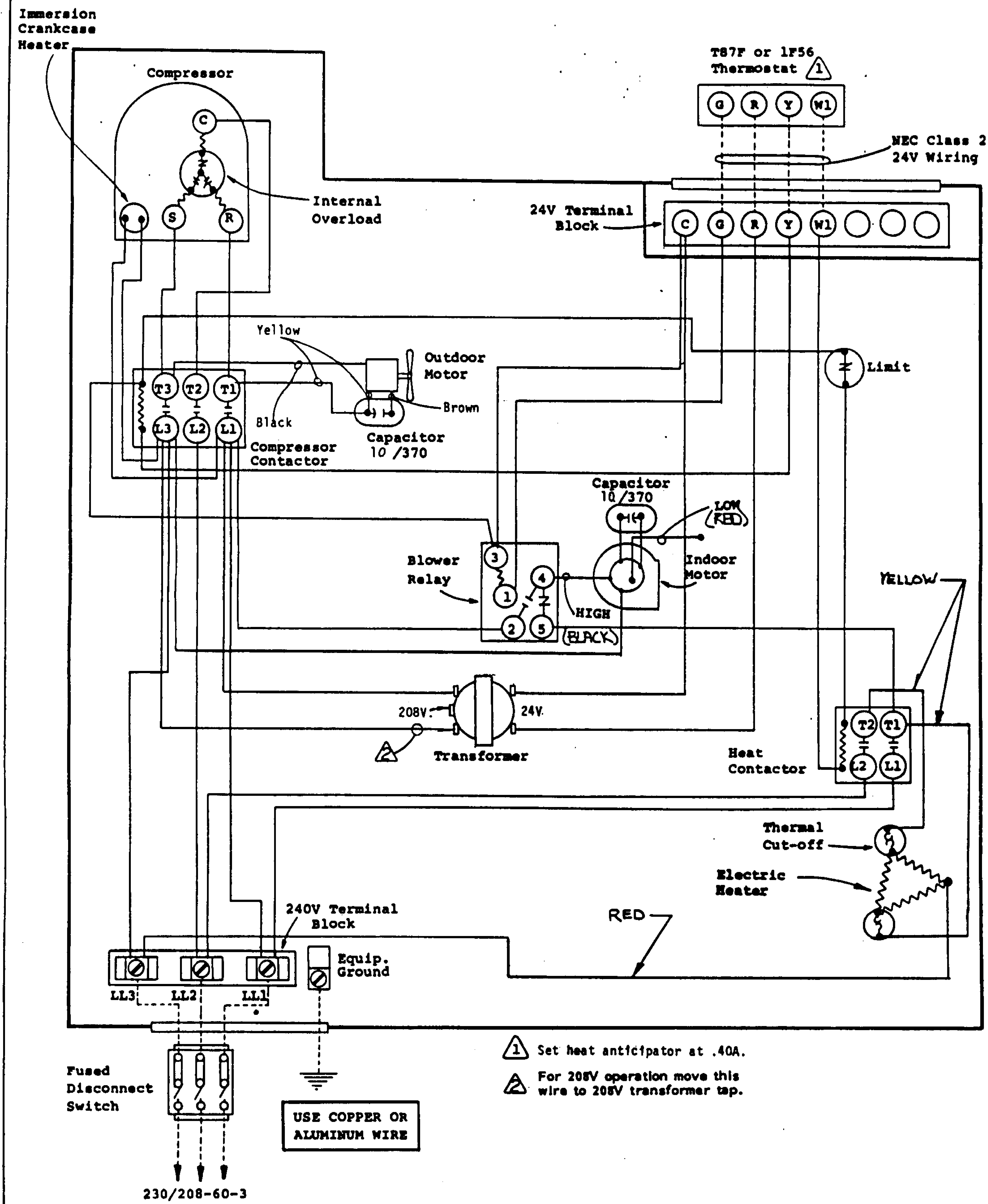
⚠1 See alternate thermostat sheet. Set heat anticipator at .40A

⚠2 For 208V operation move this wire to 208V transformer tap.

Factory Wiring ______

Field Wiring - - - - -

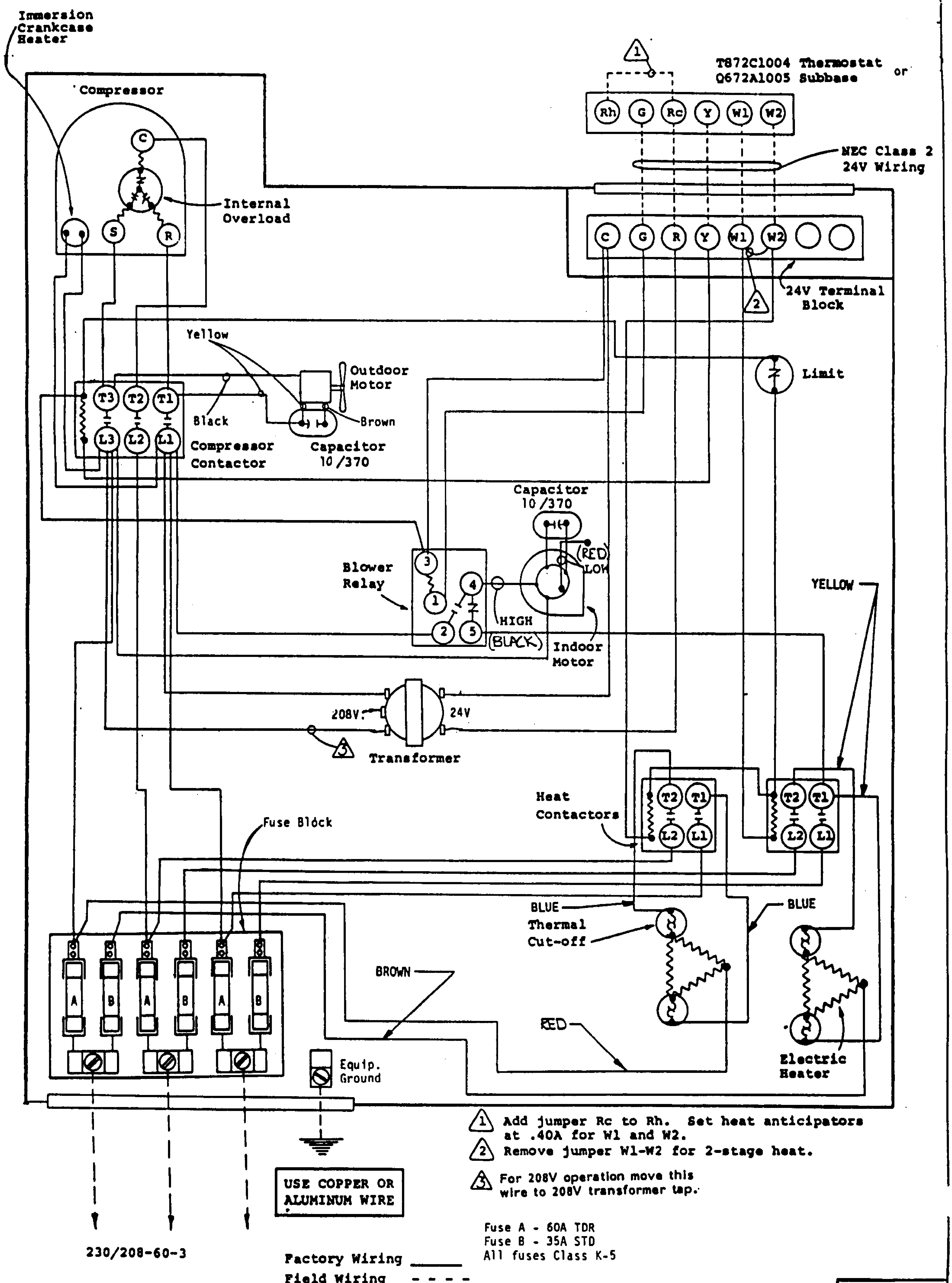
4009-220 N



Factory Wiring ______

Field Wiring - - - - -

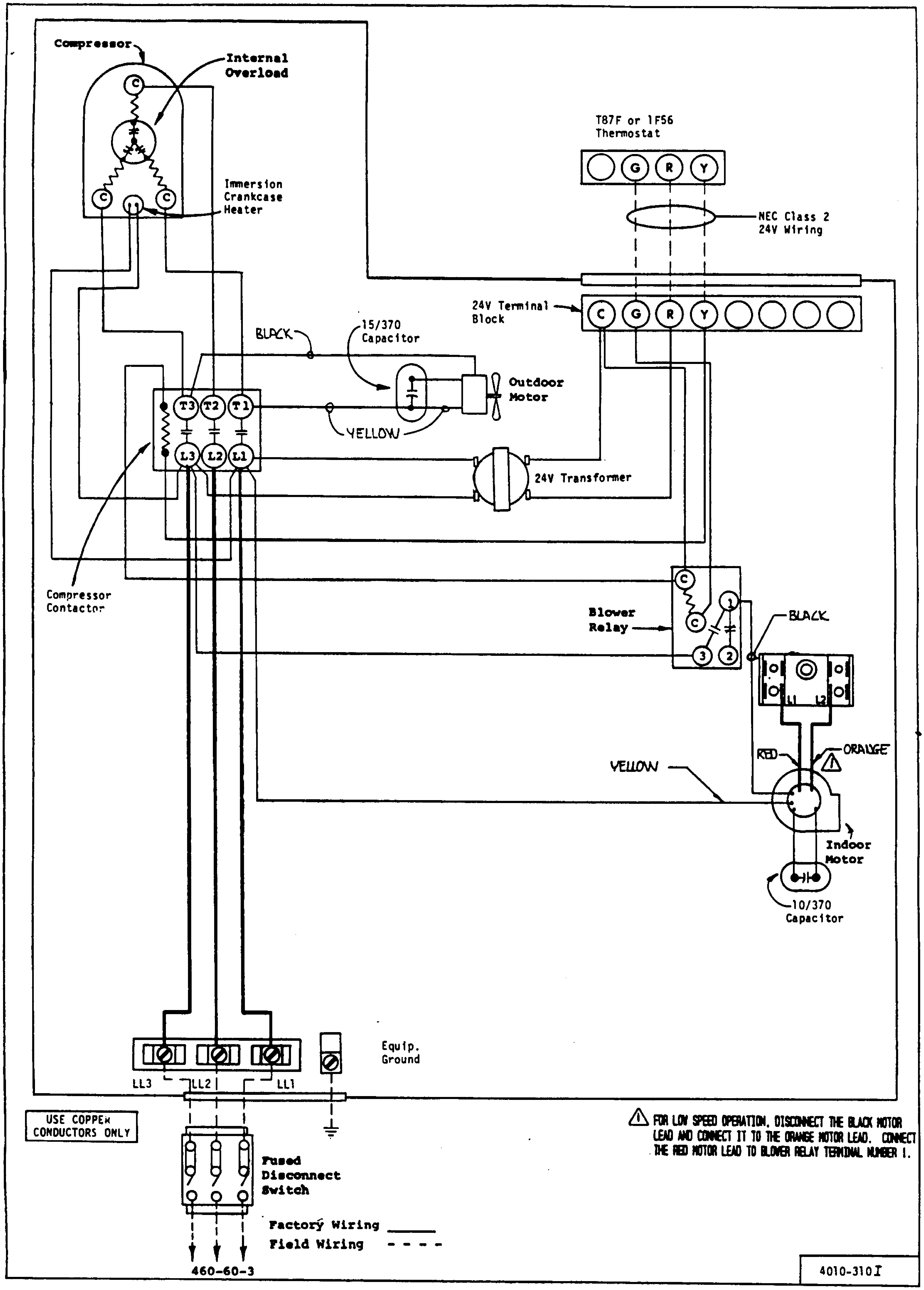
4010-220 Q



1. Add jumper Rc to Rh. Set heat anticipators at .40A for W1 and W2.
2. Remove jumper W1-W2 for 2-stage heat.
3. For 208V operation move this wire to 208V transformer tap.

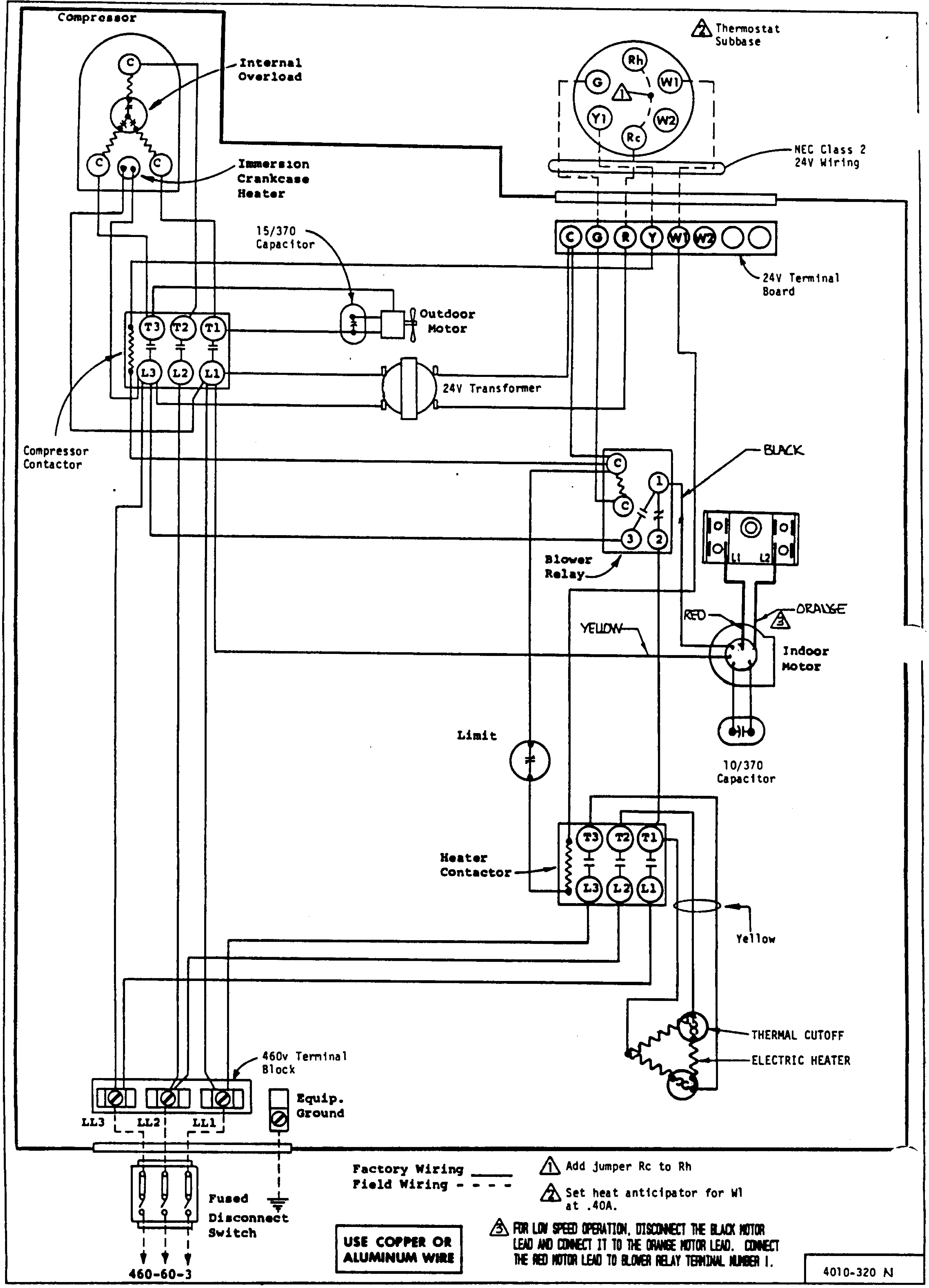
Fuse A - 60A TDR
Fuse B - 35A STD
All fuses Class K-5

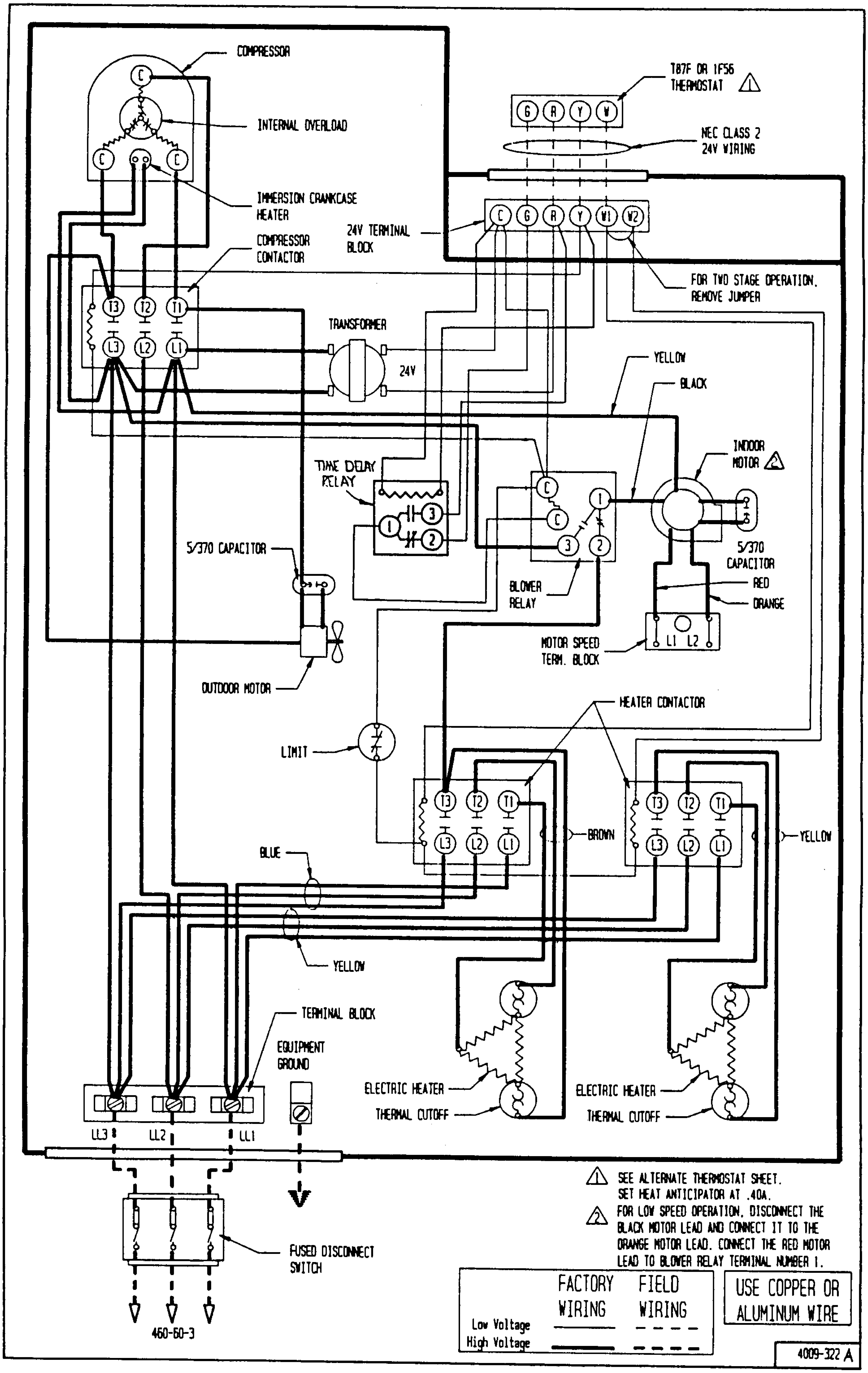
4010-242



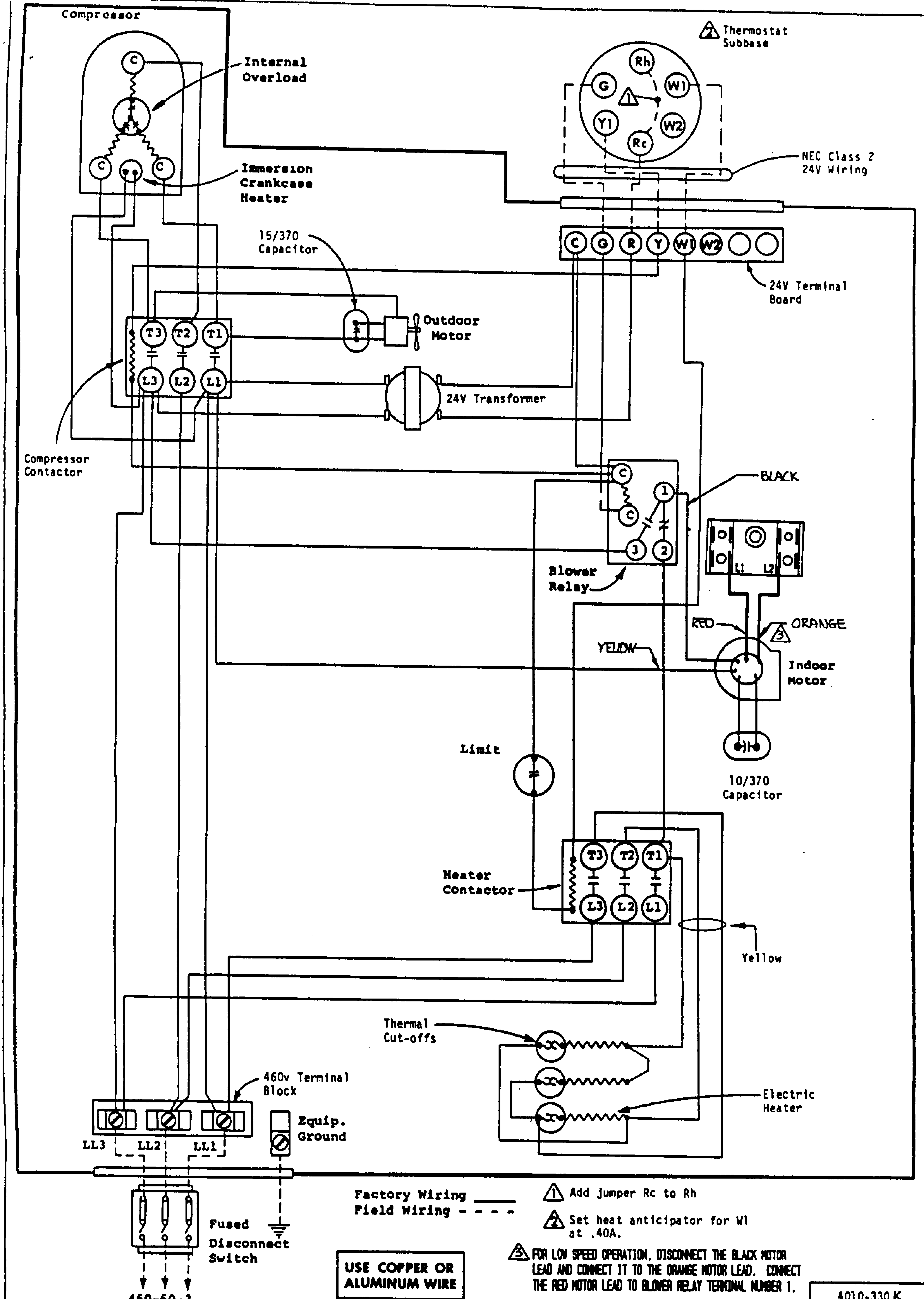
⚠ FOR LOW SPEED OPERATION, DISCONNECT THE BLACK MOTOR LEAD AND CONNECT IT TO THE ORANGE MOTOR LEAD. CONNECT THE RED MOTOR LEAD TO BLOWER RELAY TERMINAL NUMBER 1.

4010-310 I


Compressor
Internal Overload
Immersion Crankcase Heater
C
C
C
2 Thermostat Subbase
Rh
G
W1
1
Y1
W2
Rc
NEC Class 2 24V Wiring
15/370 Capacitor
C G R Y W1 W2
24V Terminal Board
T3 T2 T1
L3 L2 L1
Outdoor Motor
24V Transformer
Compressor Contactor
BLACK
Blower Relay
L1 L2
RED
ORANGE
3
YELLOW
Indoor Motor
Limit
10/370 Capacitor
Heater Contactor
Yellow
THERMAL CUTOFF
ELECTRIC HEATER
460v Terminal Block
LL3 LL2 LL1
Equip. Ground
Fused Disconnect Switch
460-60-3
Factory Wiring
Field Wiring
1 Add jumper Rc to Rh
2 Set heat anticipator for W1 at .40A.
USE COPPER OR ALUMINUM WIRE
3 FOR LOW SPEED OPERATION, DISCONNECT THE BLACK MOTOR LEAD AND CONNECT IT TO THE ORANGE MOTOR LEAD. CONNECT THE RED MOTOR LEAD TO BLOWER RELAY TERMINAL NUMBER 1.
4010-320 N



COMPRESSOR
INTERNAL OVERLOAD
IMMERSION CRANKCASE HEATER
COMPRESSOR CONTACTOR
T87F OR 1F56 THERMOSTAT
NEC CLASS 2 24V WIRING
24V TERMINAL BLOCK
FOR TWO STAGE OPERATION, REMOVE JUMPER
TRANSFORMER
24V
YELLOW
BLACK
INDOOR MOTOR
TIME DELAY RELAY
5/370 CAPACITOR
BLOWER RELAY
5/370 CAPACITOR
RED
ORANGE
MOTOR SPEED TERM. BLOCK
OUTDOOR MOTOR
HEATER CONTACTOR
LIMIT
BROWN
YELLOW
BLUE
YELLOW
TERMINAL BLOCK
EQUIPMENT GROUND
ELECTRIC HEATER
THERMAL CUTOFF
ELECTRIC HEATER
THERMAL CUTOFF
LL3
LL2
LL1
FUSED DISCONNECT SWITCH
460-60-3
SEE ALTERNATE THERMOSTAT SHEET. SET HEAT ANTICIPATOR AT .40A.
FOR LOW SPEED OPERATION, DISCONNECT THE BLACK MOTOR LEAD AND CONNECT IT TO THE ORANGE MOTOR LEAD. CONNECT THE RED MOTOR LEAD TO BLOWER RELAY TERMINAL NUMBER 1.
FACTORY WIRING
FIELD WIRING
Low Voltage
High Voltage
USE COPPER OR ALUMINUM WIRE
4009-322 A



Factory Wiring ____
Field Wiring - - - -

⚠1 Add jumper Rc to Rh

⚠2 Set heat anticipator for W1 at .40A.

⚠3 FOR LOW SPEED OPERATION, DISCONNECT THE BLACK MOTOR LEAD AND CONNECT IT TO THE ORANGE MOTOR LEAD. CONNECT THE RED MOTOR LEAD TO BLOWER RELAY TERMINAL NUMBER 1.

USE COPPER OR ALUMINUM WIRE

4010-330 K