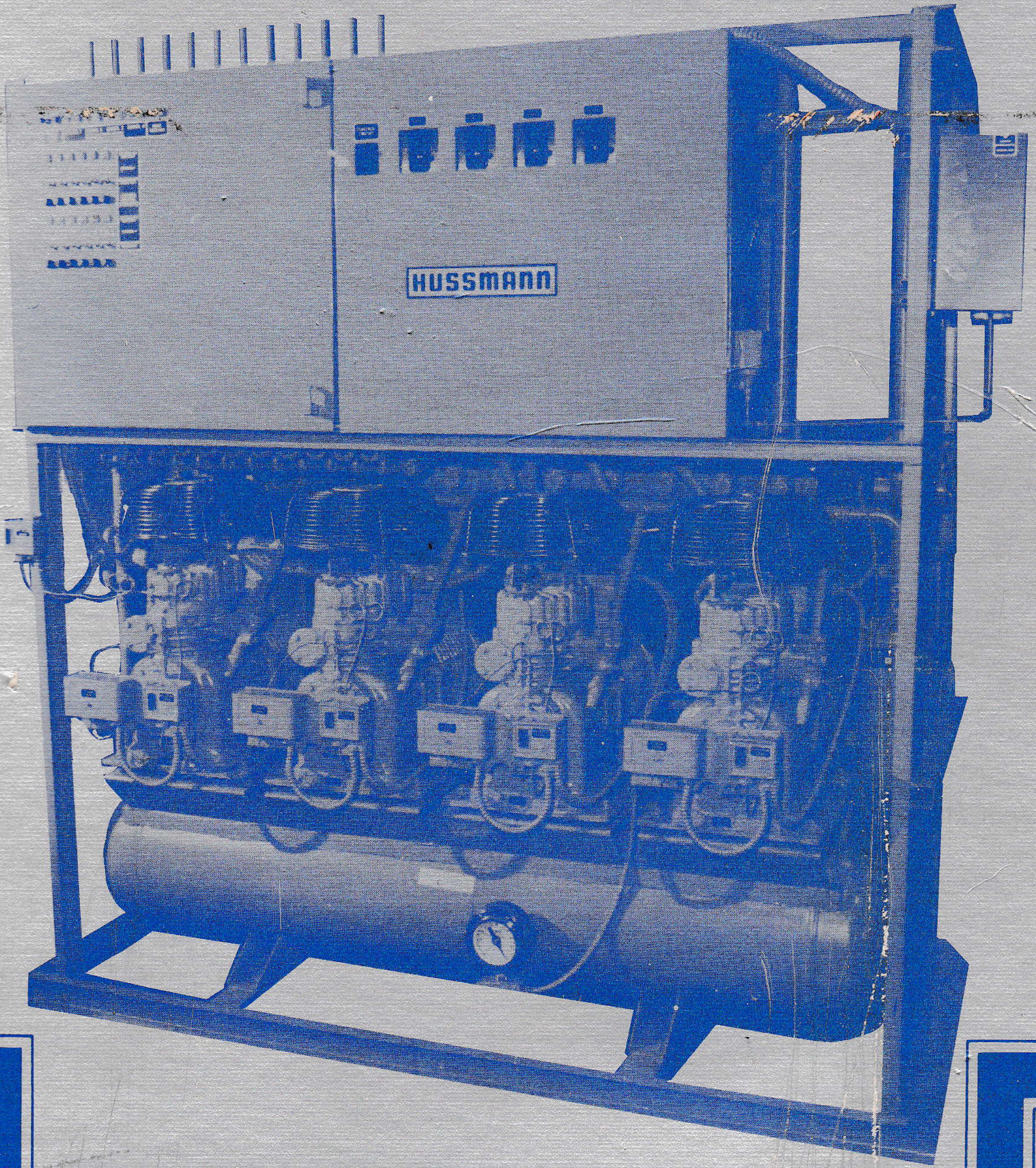
Plus IV

CENTRAL REFRIGERATION SYSTEM



INSTALLATION AND SERVICE MANUAL

HUSSMANN®
FOOD STORE SYSTEMS

HUSSMANN®
An IC Industries Company

Hussmann Corporation
12999 St. Charles Rock Road
Bridgeton, MO 63044
(314) 291 2000

CONGRATULATIONS!

With your purchase of Hussmann's Plus IV, you are receiving equipment designed to provide the finest refrigeration and temperature control for modern supermarket display equipment and coolers.

Since the introduction of Hussmann Central Refrigeration Systems, hundreds of installations have confirmed our belief that, as with all fine equipment, good installation and proper adjustment is the key to customer satisfaction.

The information presented in this manual includes many details resulting from our experience over several years. Its use will guide the contractor to a successful installation. Time taken to read and understand this information will pay off in reducing lost time and duplication of work.

Should there be questions concerning this information, do not hesitate to write me. Your inquiry will be welcomed.

Kenneth S. Franklin
Director of Field Service, U.S.A.

KSF:jl

HUSSMANN®
REFRIGERATION INC

LIMITED WARRANTY

HUSSMANN PLUS IV

This Warranty is made to the original purchaser user and is

NOT TRANSFERABLE

WARRANTIES

1. Hussmann Refrigeration, Inc., warrants the new Hussmann equipment and all parts thereof, to be free from defects in material and workmanship at the time of purchase:
2. Hussmann's obligation under this warranty shall be limited to repairing or exchanging any part or parts, without charge F.O.B. factory or nearest authorized parts depot, which may prove defective within one year from date of original installation and which is proven to the satisfaction of Hussmann to be thus defective.
3. This warranty applies to the **PLUS IV** Compressor rack(s) and header-defrost assembly(s) only.
4. The warranties to repair or replace above recited, are the only warranties, express, implied, or statutory, made by Hussmann with respect to the equipment above listed, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS, and it neither assumes, nor authorizes any person to assume for it, any other obligation or liability in connection with the sale of said equipment or any part thereof.

EXCLUSIONS

1. THIS WARRANTY SHALL NOT APPLY TO LOSS OF FOOD DUE TO FAILURE FOR ANY REASON.
2. Hussmann SHALL NOT BE LIABLE:
   a. for any repairs or replacements made by buyer without the written consent of Hussmann, or when the equipment is installed or operated in a manner contrary to the printed instructions covering installation and service which accompanied such equipment.
   b. for any damages, delays, or losses, direct or consequential, caused by defects, nor for damages caused by short or reduced supply of materials, fire, flood, strikes, acts of God, or circumstances beyond its control.
   c. when the failure or defect of any part or parts is incident to ordinary wear, accident, abuse or misuse; or when the serial number of the equipment has been removed, defaced, altered, or tampered with.
   d. when this equipment is operated on low or improper voltages, or is put to a use other than normally recommended by Hussmann.
   e. toward payment of any removal or installation charges of warranted parts.
   f. when this equipment is moved to a different address other than the original installation.

HUSSMANN REFRIGERATION, INC.
Bridgeton, Missouri 63044 — U.S.A.

TP80-P

HUSSMANN®

Plus IV

INSTALLATION AND SERVICE MANUAL

HUSSMANN®
FOOD STORE SYSTEMS
12999 ST. CHARLES ROCK RD., BRIDGETON, MISSOURI 63044, (314) 291-2000

Second printing: Revision "A", MARCH, 1981

PRINTED IN USA

PRICE: $15.00

GENERAL TABLE OF CONTENTS

Plus IV Refrigeration Process ---------------------------------- I

General Refrigeration Piping ----------------------------------- II

Store Legend -- III

Compressor Unit Installation ----------------------------------- IV

Remote Header Defrost Assembly ------------------------------ V

Condenser Installation -- VI

Remote Satellite Installation ------------------------------------ VII

Defrost Control Program Timer --------------------------------- VIII

Accessories --- IX

CDA Valve --- X

System Start Up and Check-out --------------------------------- XI

Control Settings --- XII

Index

PLUS IV REFRIGERATION PROCESS

Section I | Page

Introduction -- I-1
Refrigeration Cycle -- I-1
Temperature Control -- I-2
Oil Distribution --- I-3
KOOLGAS Defrost -- I-4
Heat Reclaim --- I-5
Winter Condensing Pressure Control ------------------------------- I-5
Piping and Flow Diagram -- I-7

REFRIGERATION PROCESS

PLUS IV REFRIGERATION PROCESS

INTRODUCTION

The Plus IV compressor unit operates with either 4 or 5 compressors in parallel. With the 4 compressor unit, A Satellite can be mounted on the compressor rack. The Satellite can operate at either a lower suction pressure than the main compressor unit (low end Satellite) or at a high suction pressure (high end Satellite).

Figure I-1 at the end of this chapter is a piping and flow diagram intended to assist the installer and service personnel in understanding the various sequences of events during the operation of Plus IV. It can also be used to determine valve and control locations to assist service personnel during start up or in isolating serviceable components.

Normally, all supermarket refrigeration is handled by two Plus IV units and their Satellites: a medium temperature unit which operates refrigerators that maintain product temperature above freezing and a low temperature unit which operates refrigerators that maintain product temperature below freezing.

The following overview examines the operation and various components in Plus IV by breaking the system down into six subsystems:

1. Refrigeration cycle
2. Temperature control
3. KOOLGAS® defrost
4. Heat reclaim
5. Oil distribution
6. Winter condensing pressure control

REFRIGERATION CYCLE

The refrigeration cycle for Plus IV is basically the same as with single compressor units operating a single refrigerator. The following explanation traces the refrigeration circuit, illustrated in Figure I-1, as the refrigerant changes from liquid, to suction gas, to hot discharge gas, and back into liquid again.

<u>Liquid</u> - During refrigeration, liquid refrigerant leaves the receiver, passes through the filter-drier and the main liquid line solenoid. It enters the liquid manifold where it is available to feed individual systems. From the liquid manifold, the liquid passes through the liquid line solenoid to the

Refrigeration Cycle-Liquid (cont'd.)

refrigerator group assigned to that branch. Most refrigerator groups will have several evaporators, but for simplicity, the schematic shows only one. The liquid passes through an optional heat exchanger and then through the thermostatic expansion valve into the evaporator where the liquid boils.

Suction - The evaporated refrigerant then leaves the evaporators and returns to the suction manifold, passing through the temperature control valves (see "Temperature Control"), suction filters, and into the compressors.

Discharge - In the compressors, the cool refrigerant vapor is compressed into a hot discharge gas and sent to the condenser (or heat reclaim coil) where heat is extracted and the refrigerant converted into liquid. It then returns to the receiver where it is ready to begin the cycle again

TEMPERATURE CONTROL

Since there is only one compressor unit operating many refrigerator systems, each refrigerator system has its own means of controlling temperature. Briefly, they are as follows:

Refrigeration Thermostat - A close on rise thermostat controls refrigerator temperature by making or breaking the electrical circuit to the branch liquid line solenoid valve (or motor contactor on Satellites). Best control is obtained when the solenoid valve is located at the refrigerator because there is no long run of liquid piping to empty out after the valve closes, as would be the case if the solenoid valves at the liquid manifold were used.

Evaporator Pressure Regulator (EPR) - This valve maintains a steady evaporator temperature by holding the evaporation pressure at the valve setting. To perform satisfactorily, the setting must be at least 4 psi higher than the suction pressure downstream of the valve. This makes it unsuitable for temperature control of the coldest systems connected to the unit because the compressor unit will have to operate at lower pressure than would otherwise be necessary.

An EPR alone is generally inadequate for temperature control because it maintains a constant evaporator temperature regardless of load changes. Thus, an EPR set to maintain a refrigerator's temperature during the day, when the refrigerator is working hardest, may tend to overcool the refrigerator in the evening, when store temperature, humidity, and customer activity are lower. For this reason a refrigeration thermostat operating a liquid line solenoid must be used in conjunction with an EPR for every application except preparation areas. EPR valves should not be applied to systems operated by Satellites because the small benefit that may be achieved in controlling temperature is more than offset by the penalty in inefficiency and the possibility of compressor damage as a result of short cycling and higher compression ratios.

Thermostatic Evaporator Pressure Regulator (TEPR) - The TEPR also regulates evaporator pressure; unlike the EPR, it does not maintain a fixed pressure, but instead, varies it according to need. If the air temperature is too warm in the refrigerator, the valve's sensing element located in the case causes the valve to open, increasing the refrigeration effect. This, in turn, makes the evaporator colder until the refrigerator reaches the appropriate temperature. The CDA and Loadmaster are examples of TEPR valves.

There are two advantages to TEPR's:

1. Refrigerator temperature is controlled more accurately by a TEPR than an EPR with thermostat. (The TEPR would not be used, however, on service meat and deli cases because the fluctuating evaporator temperature may dry out the product.)

2. Since a pressure differential is not required to operate the TEPR, it can be used on the coldest evaporators connected to the compressor unit without losing efficiency.

OIL DISTRIBUTION

All compressors on each Plus IV share a common oil supply. To maintain safe levels in all operating and idle compressors, Plus IV utilizes a separator, reservoir, regulators, and oil vent line.

Oil Separator - Located downstream of the discharge header, the oil separator removes oil from the refrigerant and delivers it to the oil reservoir. Oil that the separator misses travels through the refrigeration circuit and collects in the compressor unit's suction header, which also serves as a suction accumulator. The drop legs to individual compressors extend into the header a few inches, forming stand pipes that protect the compressors from liquid floodback; the accumulated oil returns through weep holes in the bottom of the stand pipe of compressor No. 1.

Oil Reservoir - The oil reservoir supplies oil to the regulators. A connection to the suction header through a differential check valve keeps the reservoir pressure 5 to 20 psi higher than crankcase suction pressure - enough to insure a positive feed to the compressors, but not enough to prevent the float from stopping feed when the proper oil level is reached.

Oil Regulators - Oil regulators, also called "oil floats," are standard on Plus IV compressor units. See "Compressor Installation Service Tips" for more details; there is one regulator for each compressor.

Oil Vent Line - Also called "overflow" line. The paralleled compressors are interconnected by an oil vent line. This line prevents an idle compressor from filling with oil during extended shutdown periods. Operation is as follows:

> Oil collecting in the suction drop leg of an idle compressor can slowly increase the crankcase oil level. If this level rises as high as the dip tube of the oil vent line (about 1/2 sightglass), the slightly higher pressure in the idle compressor will cause the additional oil to be aspirated into the operating compressors.

KOOLGAS® DEFROST

The basic difference between Hussmann's KOOLGAS defrost and other forms of gas defrost is that cooler, saturated vapor from the receiver is used to accomplish defrost instead of hot discharge gas. Since most defrosting occurs as a result of the latent heat given off as the refrigerant changes to the liquid state, defrost time is not appreciably longer for a KOOLGAS defrost than for a hot gas defrost, but stress on tubing is appreciably lessened. The following is an explanation of the roles played by various KOOLGAS controls and valves: the main liquid line solenoid, either the 3-way defrost reversing valve or suction stop control valves, various bypass check valves, and the main liquid differential check valve.

Main Liquid Line Solenoid - When KOOLGAS defrost initiates, the defrost timer de-energizes the main liquid line solenoid, stopping flow to the liquid manifold. Since evaporators other than the ones being defrosted are still using liquid, the pressure in the liquid manifold quickly lowers.

3-way Valve - (Loadmaster or no temperature control) When a 3-way valve is used, the defrost timer energizes and shifts the 3-way valve, stopping flow to the suction manifold and opening the circuit to the top of the receiver by way of the KOOLGAS manifold. As the pressure lowers in the liquid manifold, refrigerant vapor from the receiver travels through the evaporators against the normal direction of flow.

Suction Stop Temperature Control Valve - When a CDA or EPR valve is used, the defrost timer energizes the valve to stop flow to the suction manifold. The timer simultaneously opens the KOOLGAS solenoid to permit flow to the evaporator. As the pressure lowers in the liquid manifold, the refrigerant vapor from the receiver travels through the evaporator against the normal direction of flow. For more information about CDA valve operation refer to the chapter "CDA Valve."

Bypass Check Valve - The refrigerant vapor turns to liquid in the evaporator as it gives off its latent heat to melt the frost on the evaporator. The liquid then flows out of the evaporator to the liquid manifold, bypassing the expansion valve and branch liquid line solenoid valve by way of two bypass check valves.

Differential Check Valve - Once in the liquid manifold, the refrigerant continues to feed the other refrigerators. If the quantity generated during defrost is insufficient to feed the other systems, pressure in the liquid manifold drops below the rating of the differential check valve, causing it to open and permit liquid flow from the receiver.

HEAT RECLAIM

Heat reclaim is a simple system for returning to the store, heat that has been removed from the refrigerators. Following is a brief description of its operation.

Heat Reclaim On - When the sales area needs heat, the 3-way/4-way heat reclaim valve shifts to route discharge gas to the heat reclaim coil before it goes to the condenser.

Heat Reclaim Off - When the sales area is warm enough, the valve de-energizes, routing the discharge gas directly to the condenser. The fourth port is connected to the suction header: any refrigerant remaining in the heat reclaim coil is bled into the suction header. A solenoid valve installed in the piping to the suction header will close during power failure to prevent liquid from migrating into the suction header.

Heat Reclaim Lockout (not depicted in Figure I-1) - This pressure control, mounted on the compressor rack, locks out heat reclaim when condensing pressure drops below a safe minimum. For the factory setting, see "Summary of Control Settings."

WINTER CONDENSING PRESSURE CONTROL

During cold weather, the condenser of a Plus IV will work too well. Unchecked, its capacity can increase to the point where liquid line pressures are too low to operate the thermostatic expansion valves, and the refrigerators will warm up.

To prevent this, several forms of condensing pressure control can be used on Plus IV to maintain a minimum condensing pressure:

1. Water regulating valve

2. Fan-cycling controls

3. Condensing pressure control valves

Water Regulating Valve - Used with water cooled condensers, the water regulating valve slows the flow of water through the condenser when condensing pressure goes below the valve setting. This slows the condensing process and keeps pressure at the valve setting.

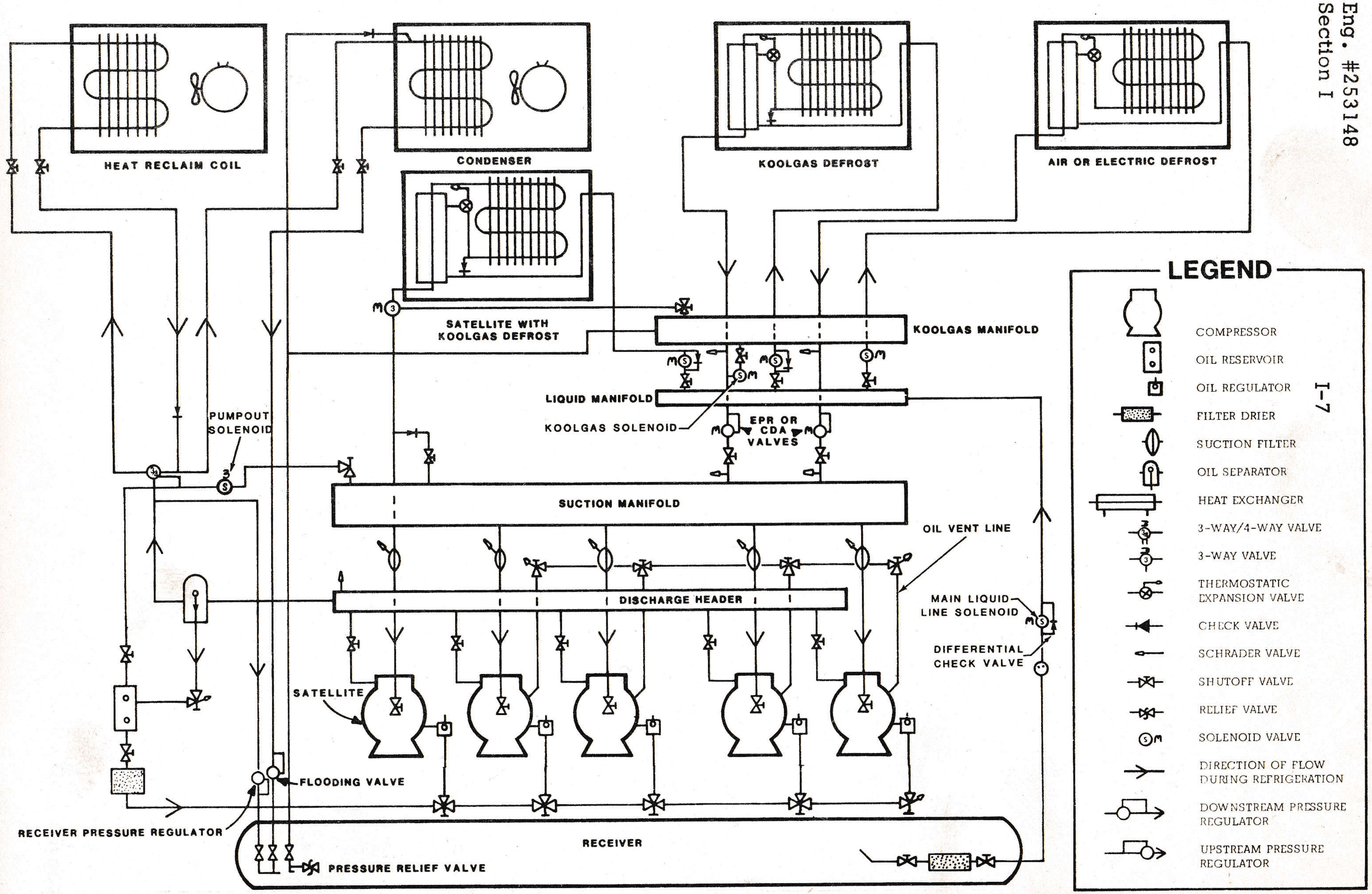
Fan Cycling Controls - Used on remote air cooled condensers, fan cycling controls turn fans off in sequence to maintain a minimum condensing pressure. Three methods of control are used: (1) thermostatic, (2) thermostatic with pressure override, and (3) Control-B (pressure controls and gravity dampers). See the chapter "Condenser" for more details.

Condensing Pressure Control Valves - When either of the thermostatic fan cycling controls are used, condensing pressure control valves are required on Plus IV. The system uses two valves to provide high enough pressure to feed the evaporators: a flooding valve (Flo-Con A7) and a receiver pressure regulating valve (Flo-Con A9).

1. The Flooding Valve - The flooding valve is installed just upstream of the receiver in the liquid return line of the condenser. If upstream (condensing) pressure goes below the valve setting, the valve restricts the refrigerant flow, causing liquid refrigerant to accumulate in the condenser. This, in effect, shrinks the condensing area available for the discharge gas and pressure increases until the valve setting is attained.

2. Receiver Pressure Regulating Valve - The flooding valve raises condensing pressure, which in turn increases discharge pressure. The receiver pressure regulating valve communicates this pressure to the receiver, which in turn raises the pressure at the inlet of the expansion valves so the refrigerators perform properly. The receiver pressure regulator should be set 10 to 12 pounds lower than the flooding valve to insure an adequate pressure differential to operate the flooding valve.

Piping & Flow Diagram
Figure I-1



GENERAL REFRIGERATION PIPING

Section II	Page

Introduction -- II-1
Brazing -- II-1
Service Valves -- II-1
Elbows -- II-1
Piping Support -- II-1
Piping for KOOLGAS Defrost ------------------------------ II-4

II REFRIGERATION PIPING

GENERAL REFRIGERATION PIPING

INTRODUCTION

A complete discussion of refrigeration piping would of course be a book by itself. Therefore, it is not the intention of this section to cover the subject entirely, but rather to highlight or point out some areas where difficulties have occurred in the past.

BRAZING

Use only clean, dehydrated, sealed refrigeration grade copper tubing. All joints should be made with silver alloy brazing material, such as Sil-Fos or equivalent, commonly used for copper to copper; and 35% silver solder for dissimilar metals. Dry nitrogen should be allowed to flow through the tubing during brazing to prevent the formation of copper oxide.

CAUTION: PRESSURE REGULATOR MUST ALWAYS BE USED WITH NITROGEN.

SERVICE VALVES

Field installed service valves are recommended at several locations for ease of maintenance and reduction of service costs. These valves must be UL approved for 410 psig minimum working pressure. Service valves for discharge lines should have lead seats.

ELBOWS

Long radius elbows are recommended because of their low pressure drop and because they are less susceptible to breakage.

PIPING SUPPORT

All piping must be properly supported to eliminate excessive line vibration. Vibration is transmitted to refrigeration piping by movement of the compressor to which it is connected, and by pressure pulsations as the refrigerant passes through the tubing. Insufficient and improper supporting of refrigerant piping can cause excessive line vibration which can result in:

- Excessive noise
- Noise transmission to other parts of the building
- Vibration transmission to floors, walls, and ceilings
- Vibration transmission back to the compressor and attached components
- Line breakage
- Decreased life of all attached components

To eliminate the preceding conditions the following guidelines must be considered.

1. Normally, any straight run of tubing must be supported in at least two locations near each end of the run. Long runs require additional supports.

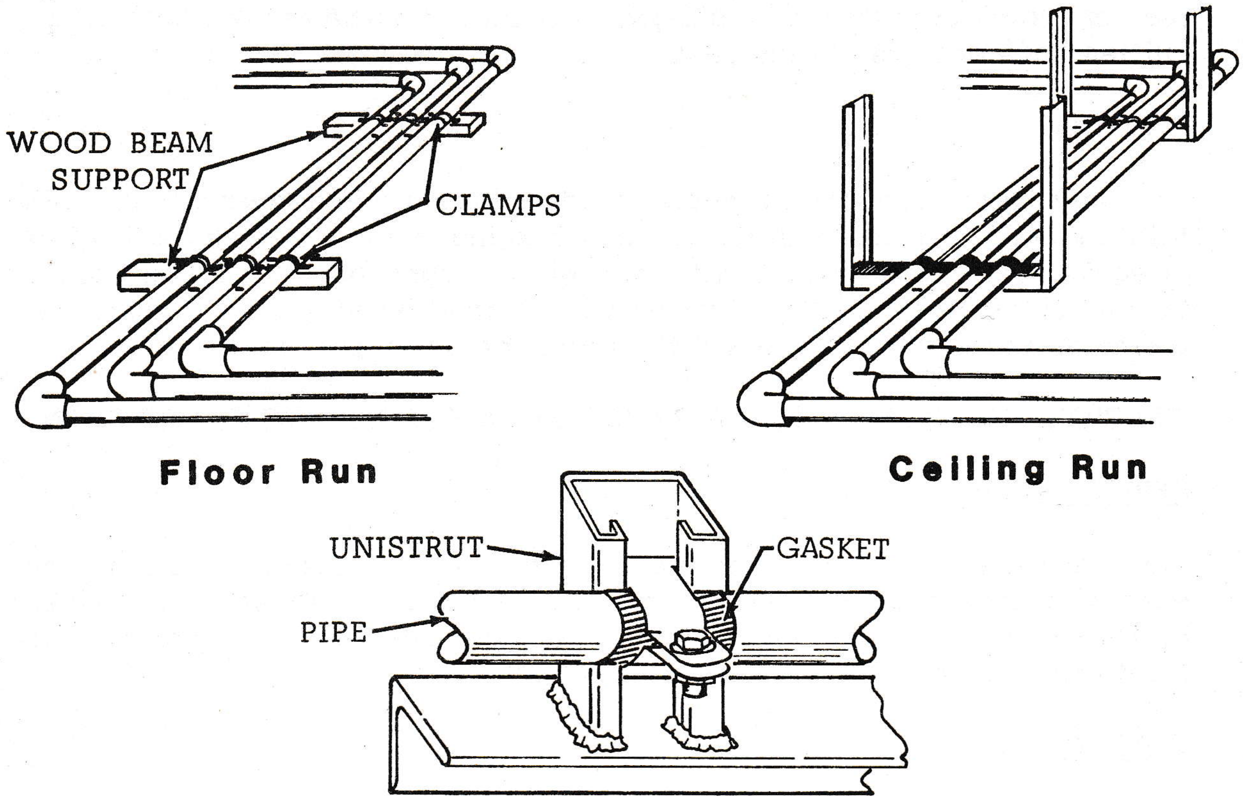


Figure II-1
Support Construction

2. When changing directions in a run of tubing no corner should be left unsupported.

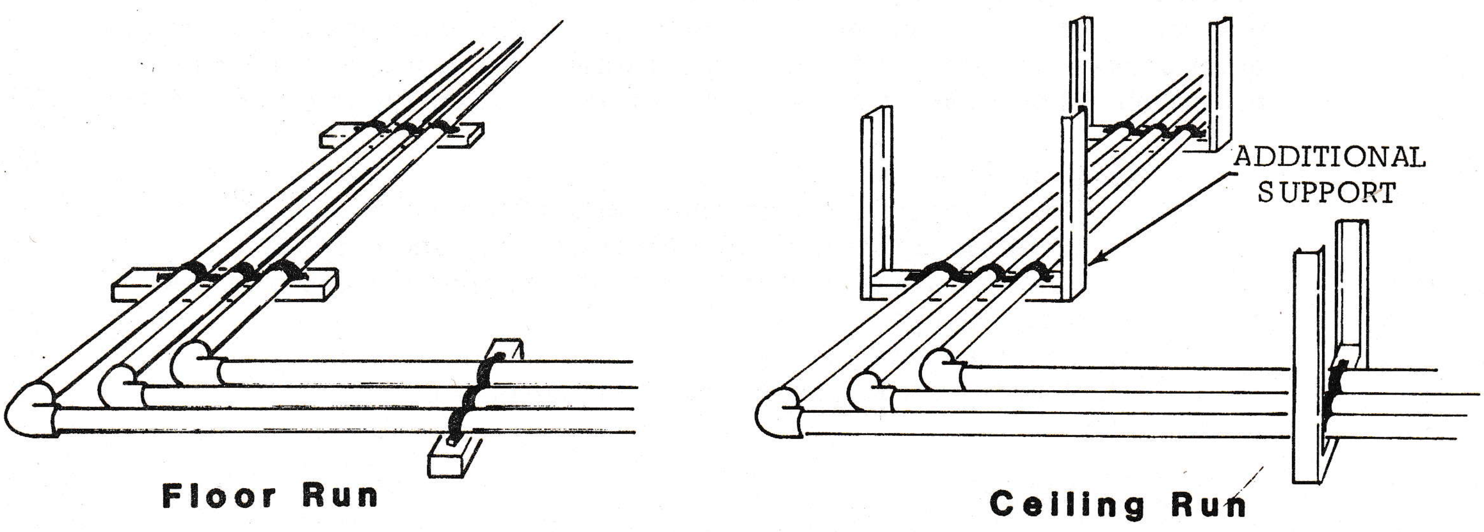


Figure II-2
Corner Support

3. Piping attached to a vibrating object (such as a compressor or compressor base) must be supported in such a manner that it will not restrict the movement of the vibrating object. Rigid mounting will fatigue the copper tubing.

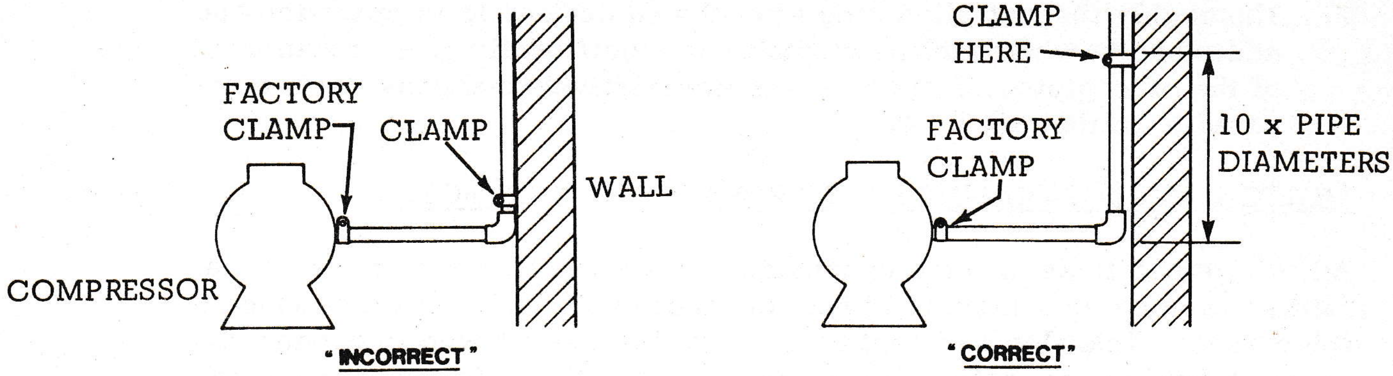


Figure II-3
Vibration Support

4. A P-trap must be constructed at the bottom of all suction risers to insure a proper return of oil to the compressor.

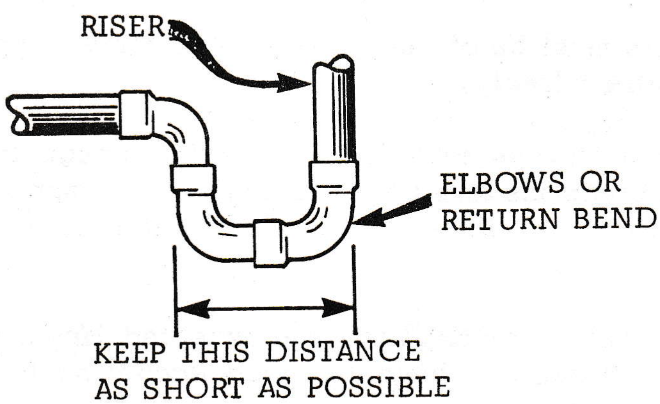


Figure II-4
Riser Construction

5. When a reduced riser is necessary, reduce the pipe on the high side of the riser only. A reduction on the low side backs up a large quantity of oil on the horizontal pipe run, not in the trap.

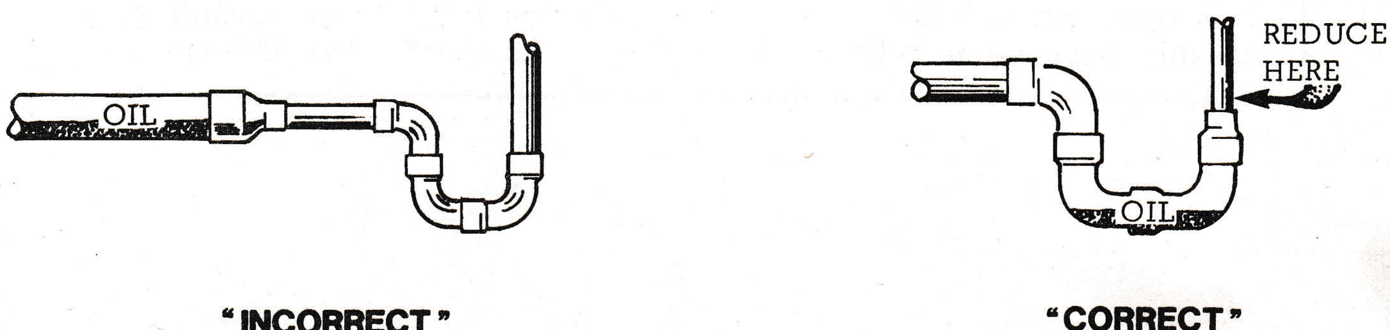


Figure II-5
Reduced Riser

6. Do not use short radius elbows. Short radius elbows can have points of excessive stress concentration and are subject to breakage at these points.

7. Thoroughly inspect all piping after the equipment is in operation and add supports wherever line vibration is significantly greater than most of the other piping. Extra supports are relatively inexpensive as compared to refrigerant loss.

LIQUID AND SUCTION LINE PIPING FOR KOOLGAS® DEFROST

All refrigerant lines undergo expansion and contraction during the normal refrigeration cycle. Liquid and suction lines for KOOLGAS systems undergo the greatest expansion and contraction and must be allowed to expand and contract freely during refrigeration and defrost cycles. To reduce maintenance the following guidelines must be considered.

1. The liquid and suction lines must not be clamped or soldered together in the tubing run for support. Since both lines will expand and contract independently, a break will occur at the joined areas.

2. Tubing hangers must be of the type that will allow copper lines to expand and contract freely.

3. Most refrigeration runs normally provide for enough linear expansion by the many directions taken to get piping from compressor to evaporator to condenser. If there is a long straight run, an offset must be constructed.

   To size an offset correctly, find the expected linear expansion from Table II-1. Offsets can be determined according to tube size from Table II-2.

Table II-1
Thermal Linear Expansion of Copper Tubing

Application	Expansion Inches/100' Copper
Low Temperature R-502 Medium Temperature R-22	1.69 Based on 150°F Temp. Change 1.12 Based on 100°F Temp. Change

Table II-2
Copper Expansion Loops and Offsets
Length (L) in Inches

Tube OD (in.)	Linear Expansion - Inches/100' Copper						
	1/2"	1"	1-1/2"	2"	2-1/2"	3"	4"
7/8	10	15	19	22	25	27	30
1-1/8	11	16	20	24	27	29	33
1-3/8	11	17	21	26	29	32	36
1-5/8	12	18	23	28	31	35	39
2-1/8	14	20	25	31	34	38	44
2-5/8	16	22	27	32	37	42	47
3-1/8	18	24	30	34	39	45	53
4-1/8	20	28	34	39	44	48	58

The drawing in Figure II-6 shows the construction of a simple offset. An offset using two 90° elbows should have a minimum offset of not less than three times the length (L) determined from Table II-2.

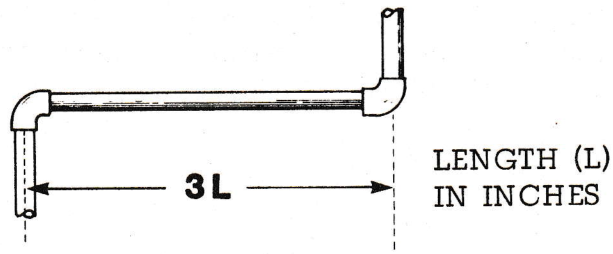


Figure II-6
Offset Construction

4. Expansion loops, like offsets, are constructed to absorb a definite amount of movement. The expansion loop should be located one half the estimated travel of the pipe run. In this manner, the bend is subject to only one half the stress when the line is at the highest temperature.

   Figure II-7 shows the method of constructing an expansion loop. Length (L) is determined by applying the expected linear expansion from Table II-2.

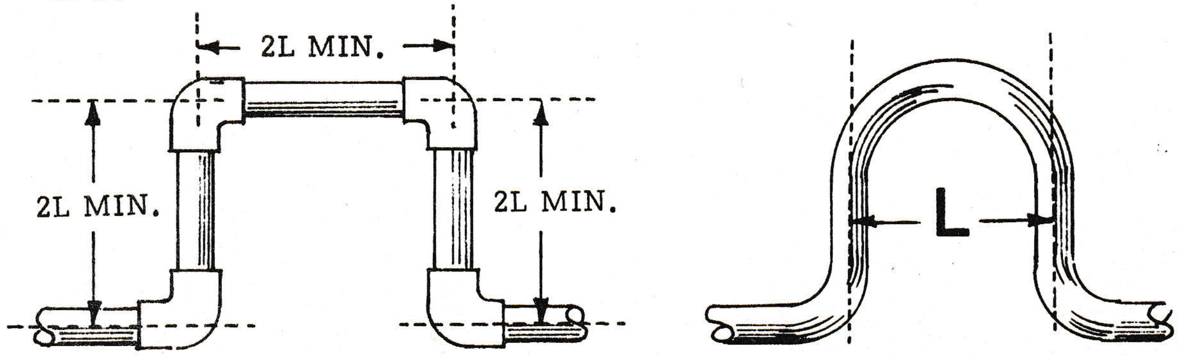


Figure II-7
Expansion Loop Construction

5. Where refrigerant lines are run beneath the floor or in a sand-filled trench the contractor must use heavy thickness insulation (Armaflex or equal) around the pipe where it comes through the concrete floor.

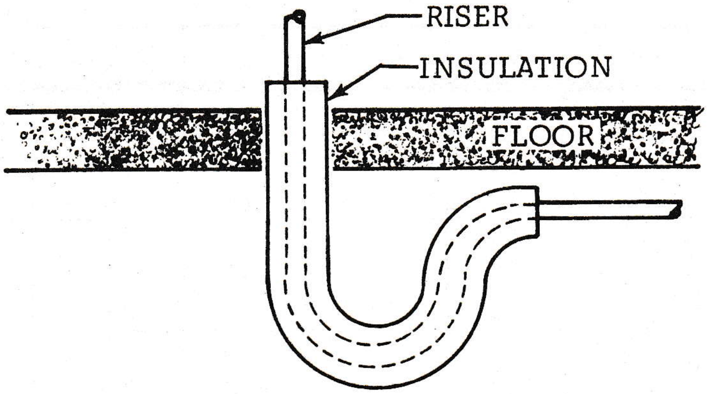


Figure II-8
Tube Through Floor

6. A line sizing guide for all lines and units is supplied in the Plus IV Planning Data. Sizing of all refrigerant lines is the responsibility of the installing contractor.

STORE LEGEND

Section III — Page

Introduction to the Store Legend ---------------------------- III-1
Store Legend -- III-2

III

STORE LEGEND

STORE LEGEND

INTRODUCTION TO THE STORE LEGEND

The Plus IV equipment is keyed to the Store Legend made specifically for each store. It shows what models have been applied to your store, and serves as a master plan for connecting the refrigerated fixtures to the Plus IV, and for interconnecting the Plus IV components.

Figure III-1 is a typical Plus IV Store Legend showing how the various components are identified and interrelated to the total store package. (Note: Legend shown is for a low temperature system only. Some legends may show medium temperature only or both low and medium temperature.)

Eng. #253148

Section III

HUSSMANN ® REFRIGE[...]

STORE DESIGN CONDITIONS

INSIDE DESIGN TEMP. 75°F/55% R.H.

OUTSIDE DESIGN TEMP. 105 °F ______ % R.H.

CONDENSING UNIT TYPE REMOTE AIR COOLED

VOLTS 208 HERTZ 60 PHASE 3

☐ SYSTEM IV LEGEND

☐ SYSTEM II LEGEND

☒ PLUS IV

☐

UNIT LTR	SYSTEM No	REFRIGERATOR • SIZE	MODEL	USE	DISCH AIR TEMP	REQUIRED CAPACITY BTU/HR. EACH SYSTEM	TOTAL	EVAP TEMP	CONDENSING UNIT & COMPRESSOR MODEL UNIT/COMP.	CAPACITY	DEFROST SYSTEMS BASIC MOD. KIT	BRANCH KITS OFF/TIME ELEC	KOOL GAS	ELECTRIC MTG. KITS	CON-TROLS	NUMBER PER DAY TERM	CASE ELECTRICAL AMPS VOLTAGE FANS/ANTI-SWEAT HTRS.	LIGHTS	ELEC DEFROST	TEPR'S CDA SIZE FACTORY INSTALLED	FIELD INSTALLED
	1	10DR	RHC	I.C	-12	20750		-30					55DZ							20	
	2	24' + 6' END	GWI	F.F.	-10	16200		-20					54DZ							10	
	3	36' + 6' END	GWI	F.F.	-10	23400		-20					55DZ							20	
	4	5DR	RHF	F.F.	-5	8000							54DZ							10	
	5	32'	GG	F.MT	-10	9600							55DZ							20	
	6	12×28	OUTDOOR FREEZER	F.F.	-10	21200							55DZ							20	
	7	8×8	FREEZER	F.F.	-5	6600		-19					54DZ							10	
	8	8×8	FREEZER	F.F.	-5	6600		-19					54DZ							10	
	9	2DR	RHF	F.F.	-5	3200		-20					54DZ							10	
A							115550		(4) 9RS-0760-30 S40 JRLK	115 118000											
S1	10	24'	FHMG	MEAT	23		31680	9	HRN602VSK	9° 120° 34300			29DZ							—	
	11	28'	FMG	"	22		11760	9°	SATELLITE	9° 120° 15800			29DZ							—	
	12	24'	JVMZH	DELI	32	30000		15					57DZ							20	
	13	16×32	COOLER	MT.	28	23400		18					56DZ							10	
	14	16' / 16'	FMTS / FMTS	FISH / MEAT	36	2240 / 2240		25					← 01DZ							—	EPR 11 / EPR 11

SYSTEM CAPACITY: Btu/Hr used for line sizing.

DEFROST BRANCH KIT: See kit descriptions in attached material.

UNIT LETTERS: Assigned to each compressor unit.

COMPRESSOR UNIT MODEL NUMBER

REMOTE SATELLITE MODEL NUMBER

REFRIGERATION SYSTEM: System branches bear these numbers at each stub.

CONDENSING UNITS

UNIT LTR	NO OF COMP'RS	SUCTION TEMP.	SUCTION BTU HR	REJECTION BTU/HR.	DESIGN COND. TEMP.	REFRIG.	NOMINAL H.P. EA COMP	UNIT KW	MINIMUM AMPACITY
A	4	-30	118000	207000	115	502	7½	27.43	
S1	1	9	34300	48000	120	22	5	5.45	
S2/B	5	9 / 15	15800 / 27200	22000 / 374000	120	22	3 / 10	2.79 / 36.64	
S3	1	30	47300	61000	120	22	5	5.8	

REMOTE CONDENSER(S)

MAKE & MODEL	UNIT LTR	TD	REJECTION BTU/HR	CIRCUITS	DRIVE DD/BD	RATED H.P. EA MOTOR	VOLTS/ PHASE	NAM[E] FL[A]
HACD44K 33DW 78DX	A	10	207000	ALL	DD	1	208/3	4[...]
HACD76K 35DW 80DX	S,/S2 / B/S3	15	505000	ALL	DD	1	208/3	4[...]

ATOR CO

PLUS IV ACCESSORIES ONLY

- ___ HEADER MODEL No. H224A
- X SINGLE TIER
- ___ DOUBLE TIER
- ___ ALARM SYSTEM
- ___ SINGLE PHASE PROTECTOR
- ___ REMOTE ALARM CONTROL

67DZ CDA BASIC KIT
(5) 66DZ MTG. BOARD KIT

F. O. No. ______ Sheet 1 of 3
CUSTOMER ______
STORE NAME ______
STORE ADDRESS ______
CITY & STATE ______

REMOTE HEADER DEFROST ASSEMBLY: (When applicable)

ACCESSORIES

TEMPERATURE CONTROLS: EPR, Loadmaster, or CDA Valves.

UNIT COOLERS					LINE SIZING											REMARKS
EVAPORATOR		EXP. VALVES		UNIT COOLER HEAT EXCH.	TO SYSTEMS				TO CONDENSER				TO HEAT RECLAIM			OR CONVENTIONAL CONTROL PANEL & ACCESSORIES
MODEL	QTY.		MODEL		APPROX.(5) EQUIV. FT.	LIQUID	SUCTION	RISERS	MAX. EQUIV. FT.	HOT GAS	LIQUID	EQUAL'R LINE	APPROX. EQUIV. FT.	SUPPLY	RETURN	
RS77316 RS77315	1	RS77317	25DY			S40JRLK:										
HS3104KG	1	GRE010ZA	25DY			71DZ GAS DEFROST KIT										
HS3104KG	1	GRE010ZP	25DY			(4) 25DD CURRENT SENSING RELAY										
						78EB HEAT RECLAIM										
						01EB SINGLE PHASE PROTECTION										
						11EB BASIC ALARM KIT										
						(4) 91EB AUXILIARY CONTACT KIT										
						RS 77438 DELETE HIGH SUCTION CONTROL										
						13EB TRANSFORMER FAILURE ALARM										
						54EC LIQUID LOSS ALARM										
						63 EC REMOTE ALARM										
KGG GA1300KG	2	GVE010C	25DY													
						S41HBVSHK										76 DM + T'STAT 76 DM + T'STAT

LA. A.)	TOTAL NAME PLATE FLA	LENGTH	WIDTH	HEIGHT	NET WEIGHT
	13.2	193	39	52 3/8	1440
	26.4	193	78	55	2460

NOTES:

(1) For further information refer to the applicable section of the installation information data attached.

(2) An electric defrost type coil must be used. The defrost timer is not included in the control panel; the proper timer should be purchased separately and installed on the job.

(3) Required capacity is an estimate only, in lieu of more accurate information from the local engineer.

(4) This information supplied by the local engineer.

(5) Listed length is the approximate equivalent foot to the first evaporator considering no more than 5 long radius elbows per run. No suction filters, hand-valves of other field installed sources or refrigerant pressure drop have been considered. When no piping plans or routing have been supplied for the refrigerant lines, sizing is based on 200 equivalent feet.

(6) Amperage values listed are for 208/1/60 except where 3 is shown indicating 208/3/60. In these instances the highest 3 phase leg is shown. Consult your engineering manual for additional information.

(7) Values shown are for total fans and antisweat heaters and cycleable fans and antisweat heaters. Consult your engineering manual for additional information.

(8) The light values shown are for standard lights and do not include optional lights or lights for superstructures. Consult your engineering manual for additional information.

(9) Cooler door switches are recommended.

(10) BTU valves are for cases with unlighted shelves.

"This legend has been prepared at no charge as an added service. Although the information is based on our best technical knowledge and experience, it should be used only as a general recommendation or guide. Since there are many local variables which are unknown to, and uncontrollable by Hussmann Refrigeration, Inc. the final application engineering decisions and responsibilities must rest with the local engineer and are not assumed by us."

REMARKS EQUIPMENT TO BE INSTALLED IN TRAILER

REV.	DATE	BY	REV.	DATE	BY

LEGEND NO. J3480-1024

PREPARED BY S.A

DATE 7-2-80

FORM 1146

COMPRESSOR UNIT INSTALLATION

Section IV | Page

Section IV	Page
Description of Models	IV- 1
Handling	IV- 3
Locating and Leveling	IV- 4
Installation of Liquid Level Indicator	IV- 4
Piping Installation	IV- 5
Suction Lines	IV- 6
Liquid Lines	IV- 6
KOOLGAS	IV- 7
Electrical	IV- 9
Field Wiring	IV- 9
Compressor Unit Control Panel	IV-10
Wiring Diagrams	IV-11
Thermostat Wiring	IV-16
Service Tips	IV-17
Replacing a Compressor	IV-17
Servicing Ultima Compressor Controller	IV-18
Oil Level Regulator Adjustment	IV-19
Flooding and Receiver Pressure Regulators	IV-20
Single Phase Protectors	IV-21

IV
COMPRESSOR UNIT

COMPRESSOR UNIT INSTALLATION

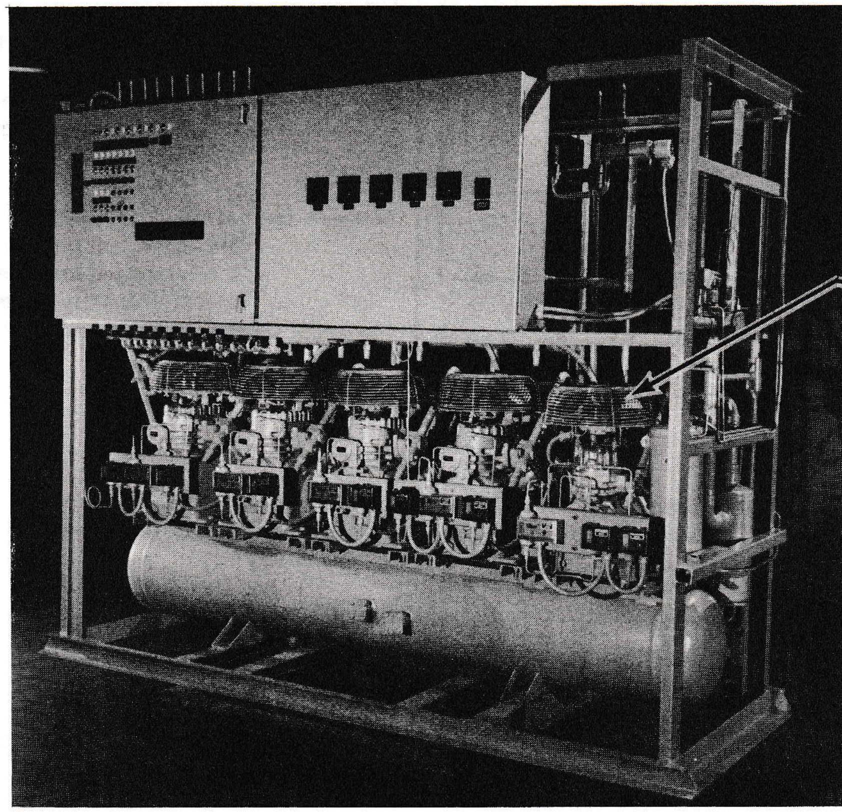


Figure IV-1
Plus IV Compressor Unit

DESCRIPTION OF MODELS

The compressor unit is available with either 4 or 5 identical semi-hermetic compressors piped in parallel. Units with four parallel compressors are available with a Satellite compressor factory installed on the compressor rack.

The compressor unit has its own piping, receiver, control circuit, temperature and defrost controls, and an optional alarm system to signal a malfunction. The temperature and defrost controls are also available installed on a remote header defrost assembly.

The following is a description of model numbers:

S 4 1 E D V S H K

- System (Hussmann designation for paralleled compressors) — S
- Number of compressors in parallel — 4
- Number of Satellites (mounted on the unit) — 1
- Compressor model code (parallel compressors) — E
- Compressor model code (Satellite) — D
- Refrigerant — V
  - F - R12
  - V - R22
  - R - R502
- Evaporator Temperature Range (parallel compressors) — S
  - L - Low temperature
  - S - Medium temperature
  - H - High or medium temperature
- Evaporator Temperature Range (Satellite) — H
  - L - Low temperature
  - S - Medium temperature
  - H - High or medium temperature
- Electrical type — K
  - K - 208/3/60
  - M - 460/3/60

Since Plus IV has a somewhat more complex nomenclature than other Hussmann compressor units, the following will help clarify key code letters.

S 4 1 E D V S H K

- E, V, S — Letters needed for finding the <u>paralleled</u> compressors model.
- D, V, H — Letters needed for finding the <u>Satellite</u> compressor model.

Compressor Model Code	Refrigerant and Temperature Range	Compressor Model No.	Nominal hp
B	VH, RH	ERF-0310	3
C	VS, RS	3RA-0310	3
D	FS, RL VH, RH	LAL-0310 NRA-0500	3 5
E	VS, RS FS, RL	NRM-0500 MRA-0500	5 5
F	FS, RL VH, RH	MRB-0500 MRH-0760	5 7-1/2
G	FS, RL VS, RS	9RJ-0500 9RA-0760	5 7-1/2
H	VH, RH	9RC-1010	10
J	FS, RL VH, RH	9RS-0760 9RS-1500	7-1/2 15

Table IV-1
Compressor Code Description

The model applied to your store is given in the heading of the store legend. Dimensions and weights of the compressor racks are in the planning data supplied with the unit.

Strapped to the compressor rack is an accessory packing box including:

1. Liquid level gauge for the receiver or the optional 2-stage refrigerant loss alarm/indicator.
2. Liquid drier cores
3. Suction filter replacements (extra set)
4. Vibration isolation pads (8)
5. Loose shipped items for accessories

HANDLING

Each compressor rack has four, 2 inch holes in the frame for rigging and lifting. Figure IV-2 illustrates the recommended method of setting up the rigging. It is important to use the spreader bar to prevent the rigging from damaging the copper tubing. Before locating in the machine room remove the shipping skid.

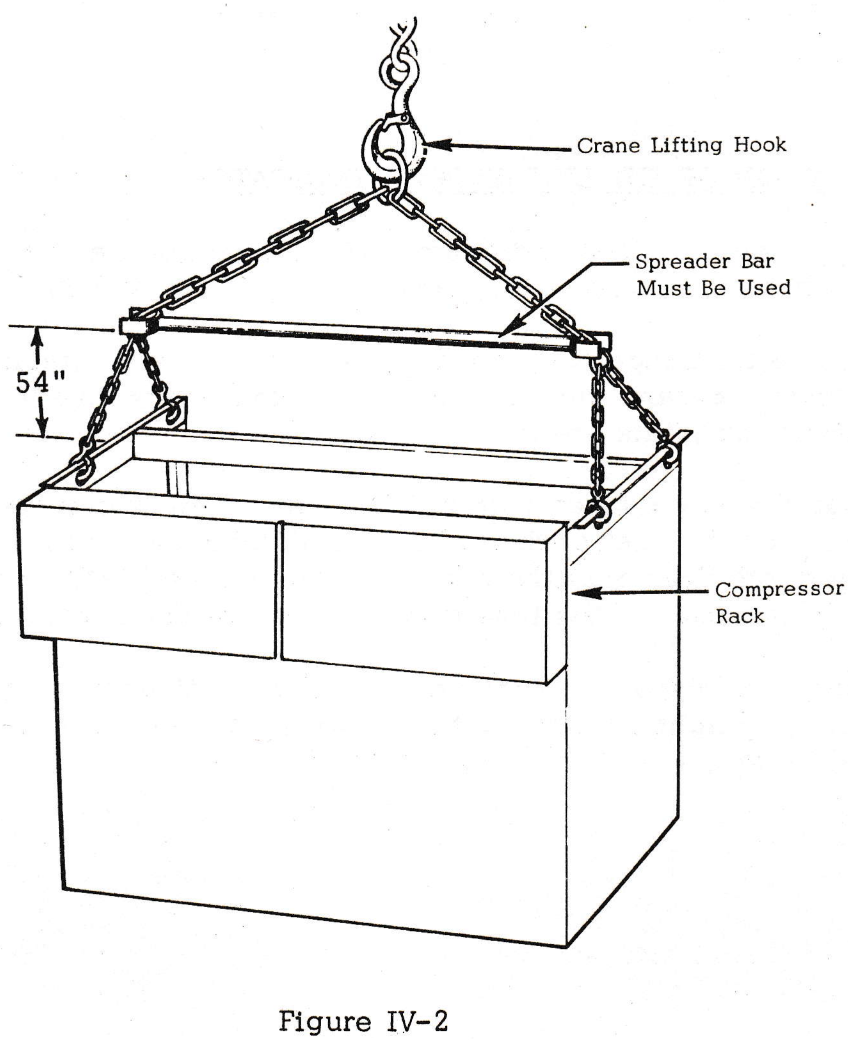


Figure IV-2
Lifting the Compressor

LOCATING & LEVELING

Each compressor unit must be located in the compressor room so that it is accessible from all sides. A minimum of 36 inches clearance is recommended to provide easy access to equipment.

Vibration isolation pads are supplied with each rack. The entire weight of the rack must rest on these pads. The pads should be located as shown in Figure IV-3. Cross-level the compressor unit so all compressors are level with each other.

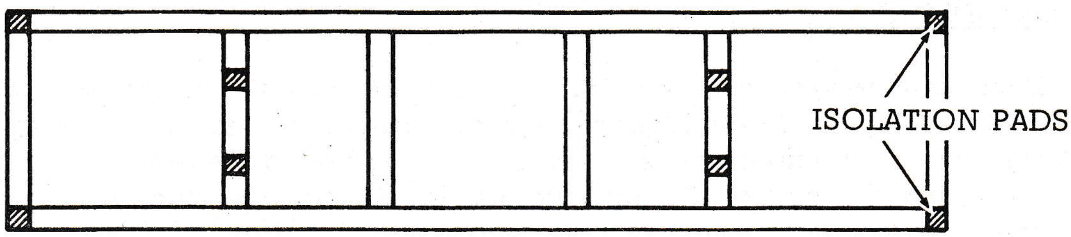


Figure IV-3
Isolation Pad Location

INSTALLATION OF THE LIQUID LEVEL INDICATOR

If Plus IV gets an alarm/indicator, skip this section and turn to "Accessories" chapter. Follow these steps to install the standard indicator.

1. Remove the flange plate on the front of the receiver (facing the control panel). Discard the original gasket and check to see that the new gasket and joints are free from flaws.

2. Coat the new gasket with a light film of oil and install it over the flange on the back of the indicator. Holding the dial face straight up, insert the float into the receiver. See Figure IV-4. Swing the head down to complete the insertion, taking care not to bend the float arm.

3. Check for freedom of float movement by rotating the gauge from side to side. A slight jar should be felt when the float swings to the upper and lower stops.

4. Rotate the device right side up - the square lug securing the dial to its flange should be on the bottom. Install the screws finger tight and tighten in a diagonal pattern.

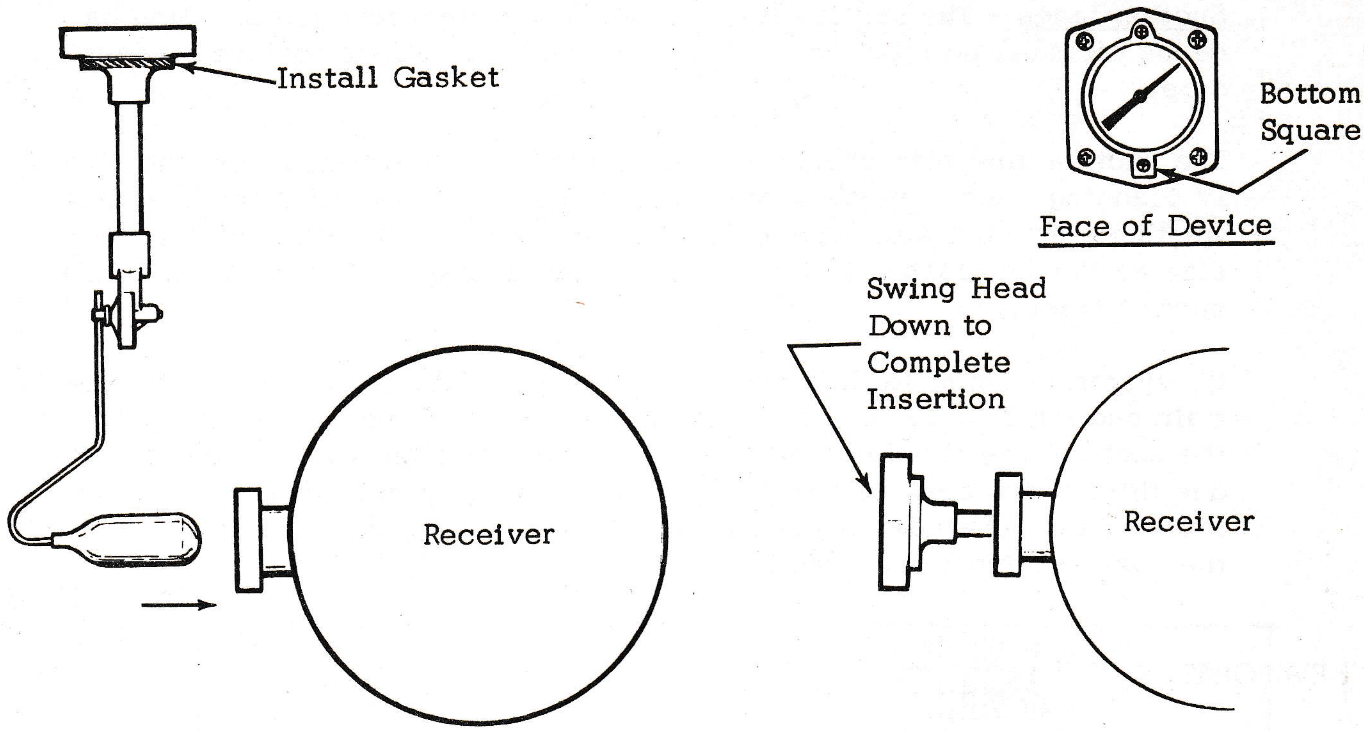


Figure IV-4
Installation of the Liquid Level Indicator

PIPING INSTALLATION

Refer to the chapter "General Refrigeration Piping" before proceeding. For condenser, remote Satellite, or heat reclaim piping see the corresponding chapters.

Plus IV is available with or without a remote header defrost assembly. If a header defrost assembly is provided, interconnect the header defrost assembly to the compressor unit according to the chapter "Remote Header Defrost Assembly." Refrigerator suction and liquid lines should be connected to the header defrost assembly in the same manner as they would if the branch stubs were located on the compressor unit.

When no header defrost assembly is provided, the branch stubs are located on the compressor unit. See Figure IV-1. Usually there will be one liquid branch and one suction branch numbered for each system specified on the store legend.

One liquid and one suction line must be run from each refrigerator system to the liquid and suction branch stubs bearing the same number. In some instances the store legend may show two separate refrigeration loads connected to one system number or branch. If this occurs, the liquid and suction lines from each circuit must be run individually back to the compressor rack and connected to the appropriate branch stub.

WARNING: VENT THE RECEIVER SAFETY RELIEF VALVE TO THE OUTSIDE. REFRIGERANT RELEASED DUE TO EXCESSIVE RECEIVER PRESSURE CAN OBSCURE VISION AND CAUSE ASPHYXIATION.

Suction Lines - The suction line is the most critical refrigeration line because oil must be returned to the compressor without excessive pressure drop.

The suction line size should already have been determined from the Plus IV Planning Data. These sizing tables must also be used to determine whether vertical risers should be reduced in size. A P-trap of the same size as the horizontal suction line must be installed at the bottom of all suction risers.

On systems with multiple evaporators, maintain the size selected for the main suction line through at least one third of the cases. At this point, the suction line should be reduced to the next smaller size for the second one third of the case line up. The suction line may be further reduced one size for the remainder of the cases, but may not be reduced smaller than the case suction line. (See Figure IV-5)

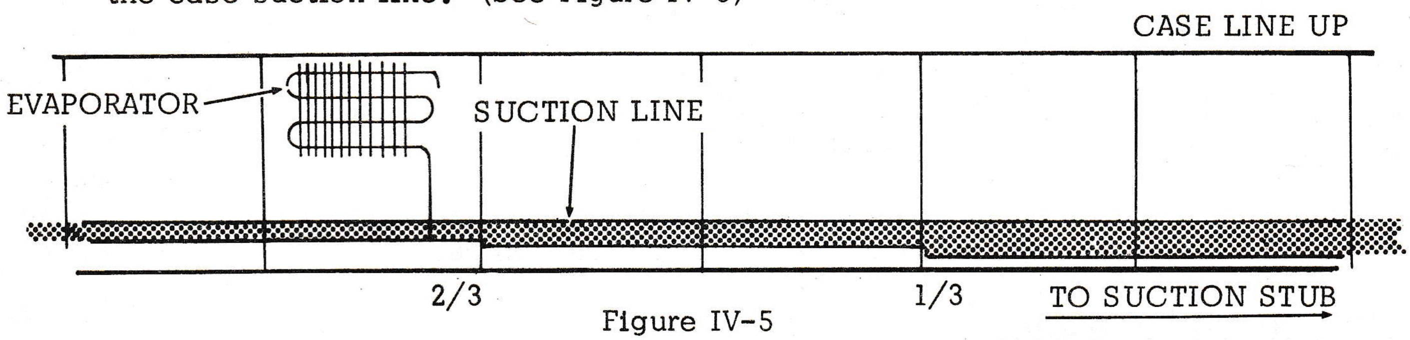


Figure IV-5
Suction Line Reduction

Liquid Lines - Liquid lines are sized in the Plus IV Planning Data selection tables to prevent flashing. Flashing in the liquid lines would create additional pressure drop and poor expansion valve operation.

On multiple case systems, liquid line take-off's to the individual evaporator should be from the bottom half of the branch liquid line. This will further insure a full liquid column to the evaporator. (See Figure IV-6)

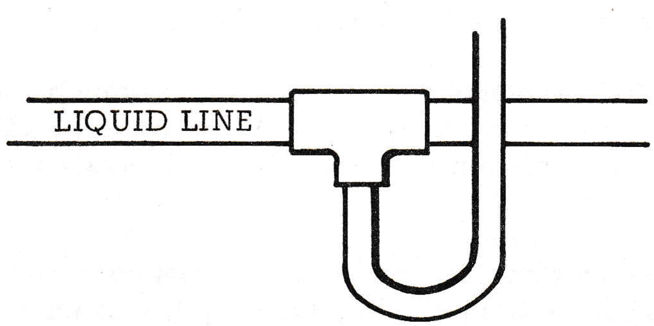


Figure IV-6
Liquid Line Take-off

Maintain the liquid line size selected for the main liquid run through at least one half of the evaporators. At this point, the line may be reduced to the next size smaller for the balance of the run, but should not be reduced smaller than a case liquid line. (See Figure IV-7)

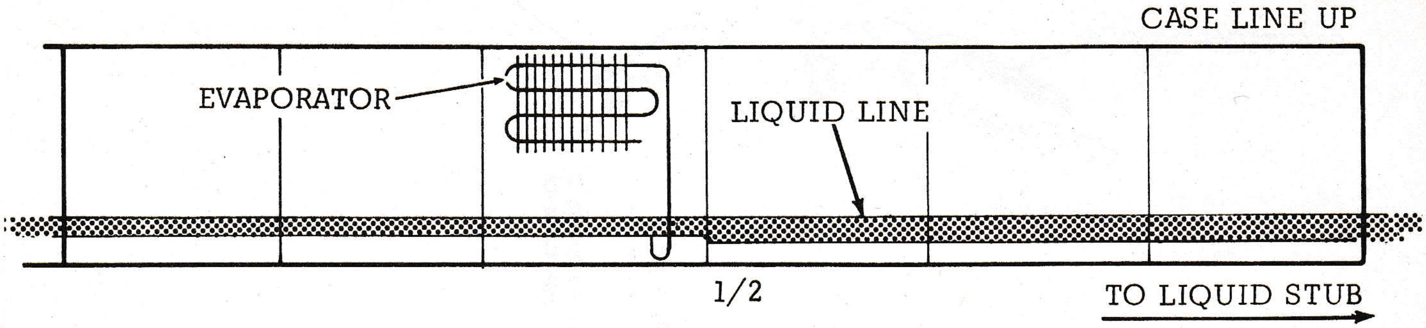


Figure IV-7
Liquid Line Reduction

KOOLGAS Systems - Liquid and suction lines for systems with KOOLGAS defrost should not run through other display cases. If there is no other practical alternative, these lines should be insulated separately for the portion of the run through other display cases. For general KOOLGAS piping procedures see the chapter "General Refrigeration Piping."

1. Liquid Lines - For evaporators using KOOLGAS defrost, the portion of the liquid line between take-offs to the evaporators must be sized 2 sizes larger than the portion of the liquid line between the refrigerator and the compressor unit. The take-offs to the evaporators need not be increased.

Provisions for expansion must be planned in making the individual fixture take-offs. A loop of tubing with a minimum diameter of 3 inches will usually be sufficient. (See Figure IV-8)

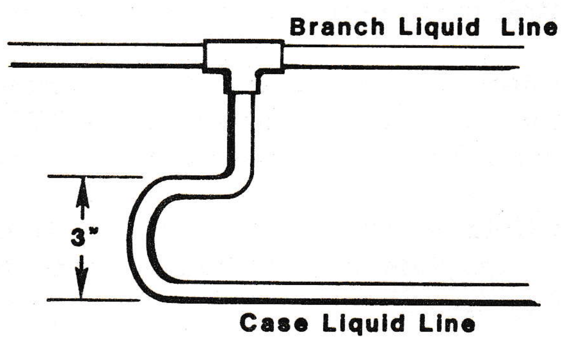


Figure IV-8
Liquid Line Expansion Loop

2. Suction Lines - Due to the size limitations of 3-way valves some of the larger KOOLGAS systems will require parallel connection to 2 suction branch stubs at the suction header. Figure IV-9 is a typical method for making this type of connection.

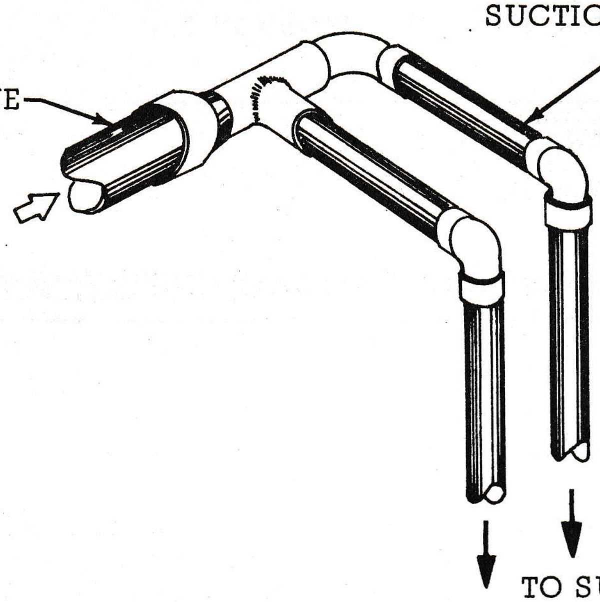


Figure IV-9
Connections for Parallel Suction Branch Stubs

Special Piping for Open Preparation Rooms - The following application may not be covered in specific refrigerator instructions.

An open preparation room is not completely enclosed. Air from the general store area is allowed to infiltrate into the preparation room. This type of area generally cannot be controlled accurately since the preparation room is, in effect, trying to air condition the whole store. This may jeopardize refrigeration performance since the preparation room evaporators are connected to the same central unit the refrigerators are connected to.

To protect the refrigerators, open preparation room evaporators must be provided with a crankcase pressure regulating valve (CPR) in the suction line to prevent these rooms from demanding excessive system capacity.

The CPR valve must be field installed in the main suction line(s) from the open preparation room. The side marked "OUT" connects to the suction stub on the compressor unit.

See "Start Up" section for valve adjustment.

ELECTRICAL

Plus IV is available wired for 208-230/3/60 or 460/3/60 compressors. In either case the control circuit is 208-230/1/60. Refer to the serial plate located on the control panel to determine wire size and overcurrent protection. All wiring must be in compliance with governing electrical codes.

Field Wiring - The control panel is wired as completely as possible at the factory. For 208-230/3/60 volt units, connect only the main power. For 460/3/60 volt units, connect the main power and a 208-230/1/60 volt control circuit. Satellites mounted on the compressor rack are prewired for control and power. Remote Satellites or a remote header defrost assembly will require additional connections. Refer to their individual chapters for electrical interconnection.

Compressor Controls - Each control panel is wired with independent compressor control circuits so any compressor can be electrically isolated without causing other compressors to be shutdown.

Each compressor has a time delay to prevent all compressors from coming on the line at one time following a power interruption. Time delays range from 24 to 40 seconds at 4 second intervals.

Figure IV-10 is a picture of a control panel.

The compressor rack wiring diagram is shown in Figure IV-11. This basic diagram will show the control and power circuit for all compressor types. Where variations occur, the area has been shaded and coded. These coded areas are described in the lower left hand corner of the diagram.

Defrost Controls - There are 8 types of defrost circuits and they are shown in Figure IV-11. These circuits may be repeated in multiple and intermixed in any one store. If Plus IV is used in conjunction with a remote header defrost assembly, the defrost controls will be located in the defrost control panel. For electrical requirements of a remote header defrost assembly see the corresponding chapter.

In the wiring diagram, terminal points in a circuit are often identified by a letter with a dash suffix (for example T_). The actual terminals in the control panel will have the system number in place of the dash.

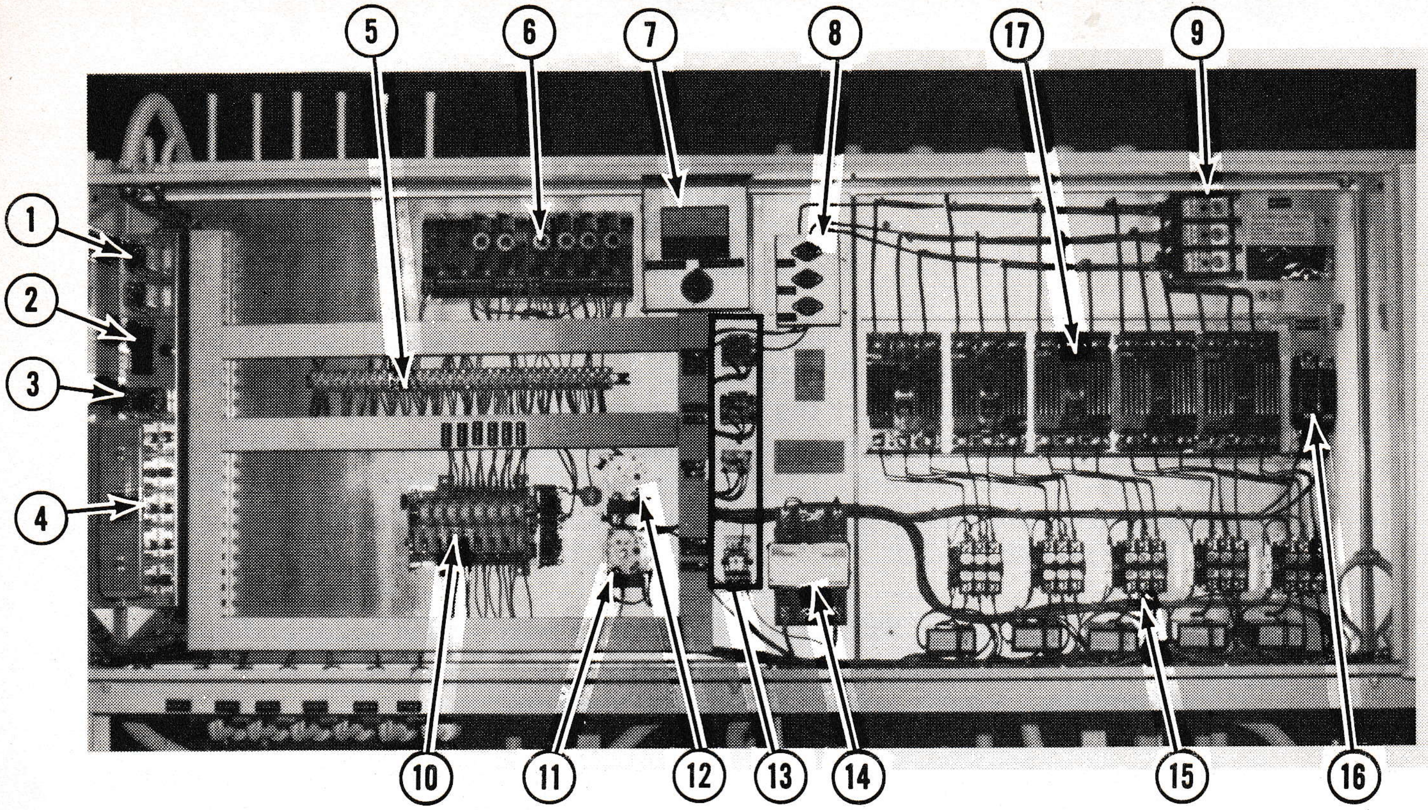


Figure IV-10
Compressor Unit Control Panel

The individual components of each Plus IV control panel may be identified in the photo above by the number designations.

1. Single phase protection circuitry
2. Alarm time delay and fuse
3. Bell and alarm relays
4. Compressor time delay relays and control circuit sub-fusing
5. Terminal block
6. CDA panel boards (if applicable)
7. DC voltmeter (CDA only)
8. Single phase protection fuses
9. Power terminal block
10. Defrost program timer
11. 1/2 hour time delay for alarm on compressor #1
12. 1/2 hour time delay for high suction and refrigerant loss alarm
13. Bell, KOOLGAS, and refrigerant loss alarm relays
14. 24 volt transformer (CDA only)
15. Compressor motor contactors
16. Control circuit breaker
17. Compressor motor circuit breakers

Switches and fuses for individual system branches, alarm, and heat reclaim are mounted on the exterior door of the control panel.

THERMOSTAT WIRING

For CDA temperature control see "CDA Valve" chapter (Sensor Wiring).

Refrigeration Thermostat - (Preferred) When thermostats are used to control refrigerator temperature they should operate a liquid line solenoid field installed at the refrigerator rather than the branch liquid line solenoid on the compressor unit.

Wire the thermostat in series with the liquid line solenoid. Any 120 volt uninterrupted power supply may be used.

Refrigeration Thermostat - (Alternate) If it is desired to have the refrigeration thermostat operate the branch liquid line solenoid on the compressor unit, wire it to the control panel in the following manner.

Determine the system number from the store legend. The system will be the suffix of the appropriate "T" and "B" terminals.

Remove the jumper from the T_ and B_ terminals.
Connect one thermostat wire to the T_ terminal.
Connect the other thermostat wire to the B_ terminal.

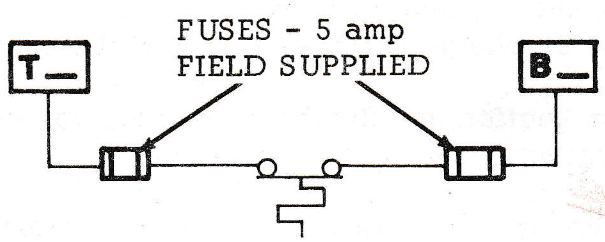


Figure IV-12
Wiring Refrigeration Thermostat

Defrost Termination Thermostat - For each system using defrost termination thermostats, run a two-wire control circuit from all termination thermostats (in series, one per case) to the R_ and F_ terminals in the control panel with a suffix corresponding to the system number.

All thermostat control wires should be sized for pilot duty operation with a maximum power requirement of 125 va to 208-230 volts. Two field supplied fuses are recommended as shown in Figure IV-13.

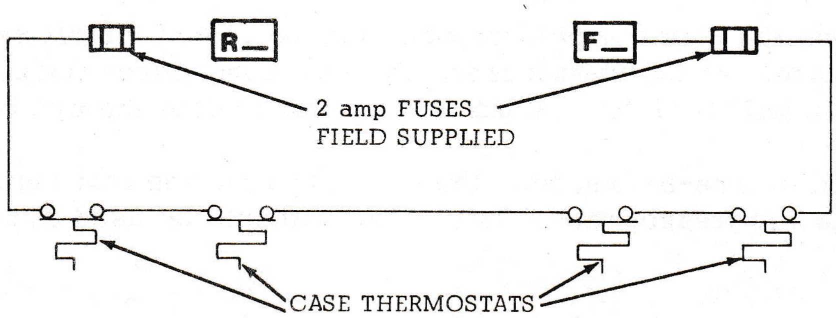


Figure IV-13
Wiring Defrost Termination Thermostats

SERVICE TIPS

REPLACING A COMPRESSOR

Maintain a close watch on the operating compressors if No. 1 compressor is the one being serviced.

Disconnect Electrical -

1. Turn off power and control circuit of the compressor to be removed.

2. Disconnect the compressor wires from the load side of its motor contactor.

3. Disconnect the pilot circuit wires for the compressor. A harness connector is provided for each compressor.

4. Disconnect the conduit from the bottom of the control panel and carefully pull the wires out of the control panel.

Isolating the Compressor -

5. Back-seat the suction and discharge service valves and install a gauge set across the discharge service valve and the suction filter.

6. Front-seat the suction and discharge service valves and close the oil line shutoff valves.

7. Bleed the discharge pressure into the suction filter.

8. Drain oil from the crankcase.

9. Disconnect the discharge and suction service valves, the oil regulator, and the oil vent line from the compressor block.

10. Remove the bolts and studs holding the pressure control's mounting bracket and support the controls off to one side where they will not be damaged during compressor removal.

Removing the Compressor -

11. Remove the four compressor mounting bolts and install an eye bolt in the top rear of the compressor. On some compressor models, the cooling fan will have to be removed to accommodate the eye bolt.

12. Install a come-a-long from the eye bolt up to the rear support channel on the compressor rack. Safety hooks should be used at each connection.

13. If the compressor is below the liquid header, tape a piece of wood to the liquid header to protect it from the cable.

SERVICE TIPS

REPLACING A COMPRESSOR

Maintain a close watch on the operating compressors if No. 1 compressor is the one being serviced.

Disconnect Electrical -

1. Turn off power and control circuit of the compressor to be removed.
2. Disconnect the compressor wires from the load side of its motor contactor.
3. Disconnect the pilot circuit wires for the compressor. A harness connector is provided for each compressor.
4. Disconnect the conduit from the bottom of the control panel and carefully pull the wires out of the control panel.

Isolating the Compressor -

5. Back-seat the suction and discharge service valves and install a gauge set across the discharge service valve and the suction filter.
6. Front-seat the suction and discharge service valves and close the oil line shutoff valves.
7. Bleed the discharge pressure into the suction filter.
8. Drain oil from the crankcase.
9. Disconnect the discharge and suction service valves, the oil regulator, and the oil vent line from the compressor block.
10. Remove the bolts and studs holding the pressure control's mounting bracket and support the controls off to one side where they will not be damaged during compressor removal.

Removing the Compressor -

11. Remove the four compressor mounting bolts and install an eye bolt in the top rear of the compressor. On some compressor models, the cooling fan will have to be removed to accommodate the eye bolt.
12. Install a come-a-long from the eye bolt up to the rear support channel on the compressor rack. Safety hooks should be used at each connection.
13. If the compressor is below the liquid header, tape a piece of wood to the liquid header to protect it from the cable.

Service Tips (cont'd.)

14. Use several 3 to 3 1/2 foot long 2x4's as a ramp in front of the compressor unit, and using the come-a-long, lower the compressor to the floor. Make sure all service valves and control lines are free. Do not use the fan guard as a lift.

15. On the floor, the fan assembly and junction box can be removed as a single unit and reinstalled on the new compressor. Do not reuse the solid state compressor protector. Transfer the oil float to the new compressor.

Installation -

16. To install the compressor use the come-a-long to slide the compressor up the ramp. After the compressor is slightly above the mounting plate, the boards can be used as a lever to lift and slide the compressor into position.

17. Replace the spacer nuts and bolt the compressor into place. Do not tighten compressor bolts at this time.

18. Install new valve gaskets and connect service valves, the oil regulator and the oil vent lines to the compressors.

19. Tighten compressor mounting bolts to 124 ft./lbs.

20. Reinstall pressure controls.

21. Reinstall wiring.

22. Evacuate and leak test the compressor before opening valves and starting the compressor.

SERVICING ULTIMA COMPRESSOR CONTROLLER

If the Ultima compressor controller is suspected of malfunctioning, check the operation of the sequencer by following the precedure in "Start Up." If the sequencer is satisfactory, the problem may be a clogged strainer or oil logged in the capillary tubing.

To clear the capillary tubing, disconnect it from the pressure reservoir and cap the fitting to the reservoir. Attach a refrigerant tank to the capillary tubing and feed refrigerant into the tubing for a few seconds until the obstruction is cleared. Reattach the capillary tubing to the pressure reservoir and restart the unit. Be sure no traps exist in the 3/8 inch tubing running to the suction header.

SPORLAN OL-1 OIL LEVEL REGULATOR

The Sporlan OL-1 oil level control is preset to maintain an oil level at the centerline of the sightglass. Each turn of the adjustment will change the level by .05 inches. Compressors must be pumped down to 1 psig before adjustments can be made. Remove the brass cap from the top connection and adjust as follows:

1. Insert a 7/32" hex wrench into the top connection and engage the locking disk. To free the adjustment mechanism turn counter-clockwise until resistance is felt.

2. To find the present setting insert a 3/16" hex wrench through the locking disk and into the adjustment mechanism. While turning the wrench counter-clockwise, keep track of the number of turns until slight resistance is felt. The adjustment mechanism is now at the top stop. Do not lower the adjustment more than 7 turns from this point or the O-ring will not seal properly. Return the adjustment mechanism to its original position.

3. To lower the oil level, turn clockwise to the desired level. Do not adjust past the 7 turns from the top stop. To raise the oil level, turn counter-clockwise to the desired level.

4. Jam the locking disk by re-inserting the 7/32" hex wrench and turning clockwise.

5. Replace the brass sealing cap and turn on oil supply. Restart compressor.

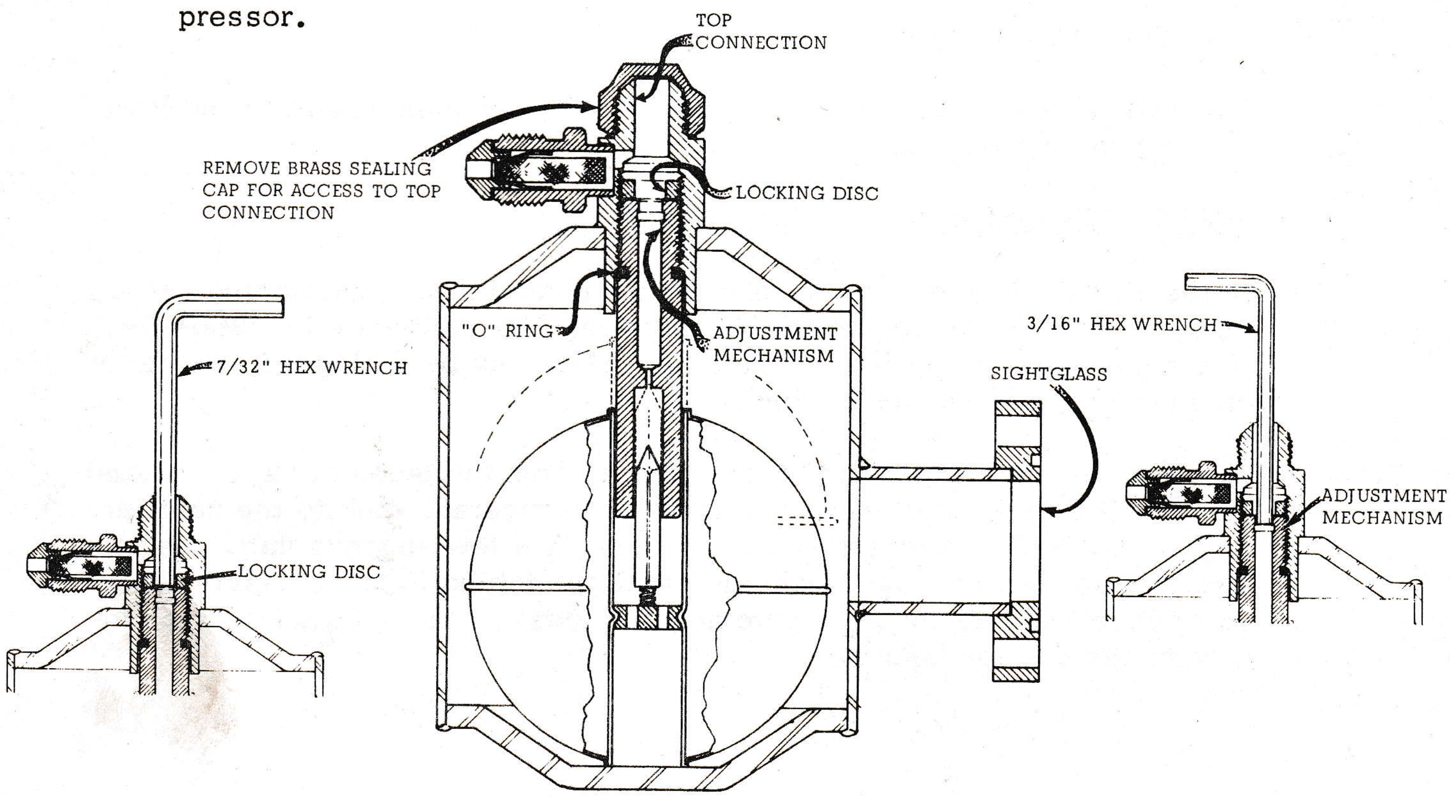
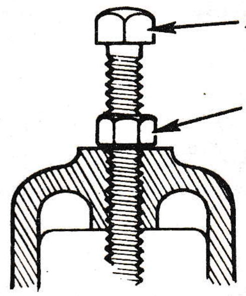


Figure IV-15
Oil Level Regulator

FLOODING AND RECEIVER PRESSURE REGULATOR VALVES

A Flo-Con A7 is used to control the condenser discharge pressure and an A9 is used to control receiver pressure. If replacing the diaphram spring, adjustment stem, or spring plate, Range D parts are required.



Adjustment - Before adjustments can be made the system must be charged and operate near the normal design conditions.

To lower condenser or receiver pressure, loosen the seat nut and turn the adjusting nut counter-clockwise. To raise condenser or receiver pressure, turn the adjusting nut clockwise. Retighten the seat nut. Settings are listed in the chapter, "Control Settings."

One complete turn of the adjusting stem will increase (or decrease) the condenser or receiver pressure approximately 20 psi on A7-0 valves, 75 psi on valves A7-1 and A7-2, and 25 psi on A9 valves.

Diagnostic Chart

Valve	Problem	Cause
A7	Failure to open	1. Adjusting screw may be set at too high a setting. 2. Excessive dirt on power disc 3. Excessive dirt on valve seat 4. Diaphram dirty or misaligned
	Failure to close	1. Adjusting screw may be set at too low of a setting 2. Excessive dirt on pilot seat 3. Regulator may have been installed backwards
A9	Failure to open	1. Adjusting screw may be set at too high a setting 2. Piston plug may be jammed due to excessive dirt
	Failure to close	1. Adjusting screw may be set at too low a setting. 2. Piston plug may be jammed due to excessive dirt 3. Pilot plug may be dirty or corroded 4. Diaphram may be cracked or eroded

SINGLE PHASE PROTECTORS

The single phase protector consists of two relays wired across the three phase power wiring supplying the motor-compressors. When energized, the relays close the pilot circuits. Should the incoming power single phase or drop below 132 volts, one or both relays will open the control circuit. Upon resumption of three phase power, the single phase protector will again close the circuits.

When power voltages above 240 volts are used, resistors are added in two legs of the three phase supply to the two relays. These are wire wound, ceramic coated resistors. Any resistor of 5 watts or more, ±5%, is acceptable for replacement.

Resistor value for the United States is 27,000 ohms. Values for this and other locations are shown in Table IV-2.

The resistors are located on the back side of the relay sockets. Access is gained by shutting off power at the field supplied disconnect switch, and at the 208 volt pilot disconnect switch, then removing the bolts holding the relay board to the control panel. The relay board can then be rotated forward, exposing the rear of the sockets.

No resistors are required for 208/240/3/60 power supply.

NOTE: On the single phase protector, terminal 4 on the K9 relay, and 5 on the K10 relay have been disconnected from the circuit and are used for wiring terminals only.

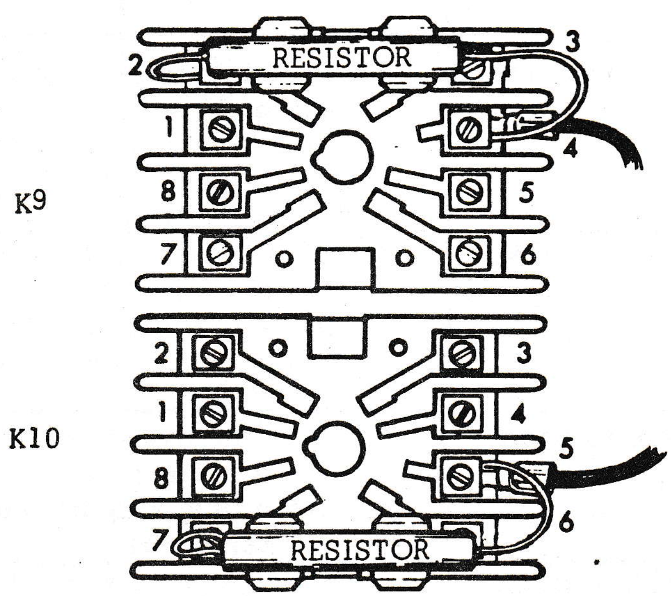


Figure IV-16
Location of Resistors

Location	Volts	Hertz	Ohms
U.S.A.	480	60	27,000
Europe-Africa	380	50	22,000
Australia	415	50	25,000
Canada	550-600	60	33,000

Table IV-2
Resistor Values in Various Locations

Relays - Two especially calibrated, 230 volt relays are used in each single phase protector. Because of the calibration, replacement relays should be ordered from Hussmann, and not procured locally.

One of two brands of relays may be used:

Relay Part #MK5642 (MKH2) Line Electric

Relay Part #22Q1620 Eagle Signal

V

REMOTE HEADER

REMOTE HEADER DEFROST ASSEMBLY

Section V

Section V	Page
Description of Model Numbers	V-1
Handling	V-2
Locating	V-2
Leveling	V-2
Piping	V-2
Electrical	V-2
Wiring Diagrams	V-3,4

HEADER DEFROST ASSEMBLY

DESCRIPTION OF MODEL NUMBERS

Twelve models of header defrost assemblies are available and each model can serve either one or two compressor units. The store legend indicates which models have been applied to your store.

A typical header defrost model number signifies the following:

H-2-32 A

- H — Horizontal branches
- 2 — Number of Plus IV's served (1 or 2)
- 32 — Total available branches
- A — Revised design

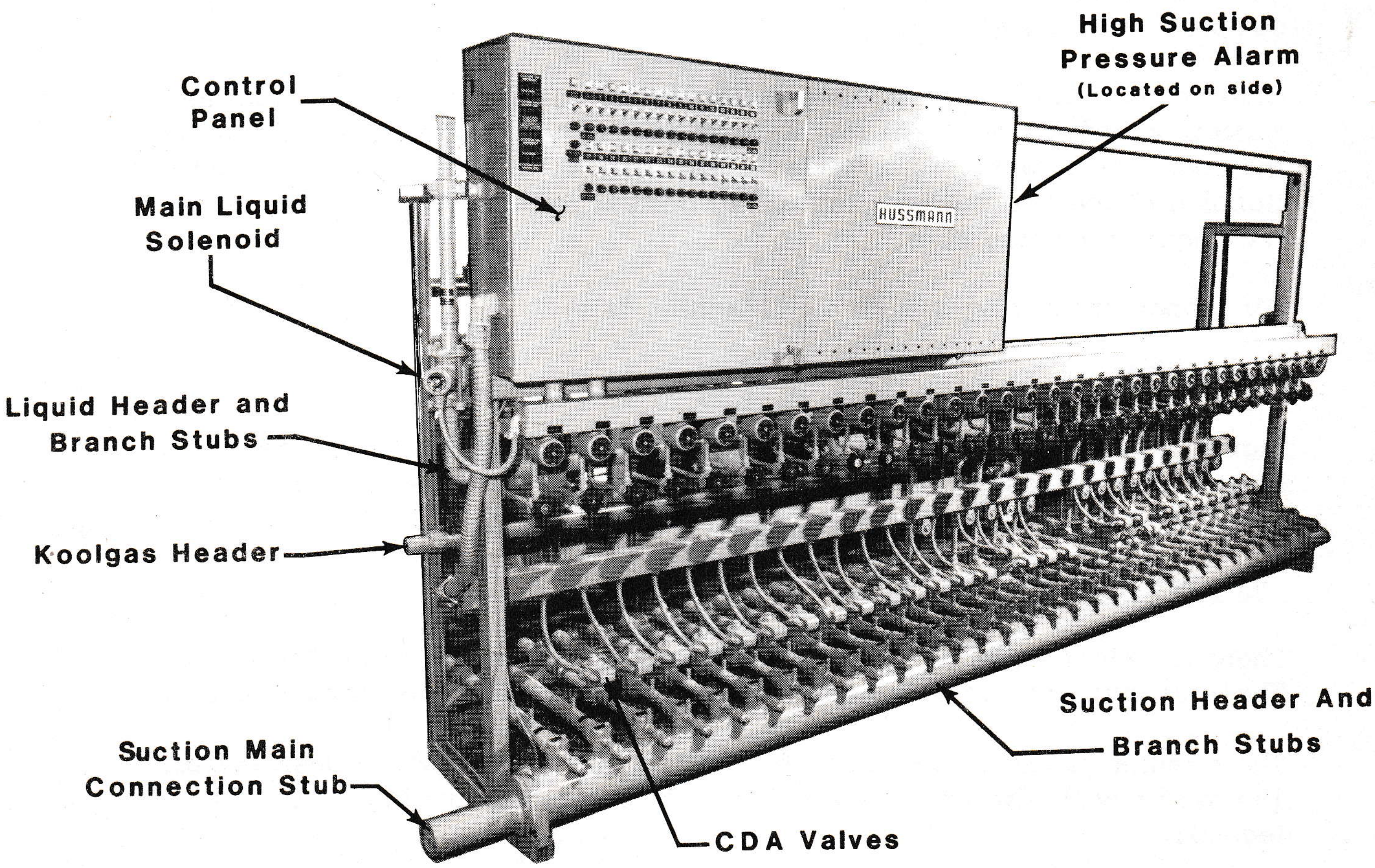


FIGURE V-1
REMOTE HEADER DEFROST ASSEMBLY

HANDLING

It is recommended that rigging and unloading of the header defrost assembly be done before removing the crating.

LOCATION

Locate the header defrost assembly as close as possible to the compressor rack to minimize pressure drop. The interconnecting piping should not exceed 50 equivalent feet.

LEVELING

The header defrost assembly must be leveled on the suction header to prevent oil trapping.

PIPING

When the header defrost assembly is used in conjunction with Plus IV, piping from individual refrigerators will be connected to stubs located on the header defrost assembly instead of on the compressor rack. Construction requirements will, however, be the same, and are discussed in the compressor installation chapter.

Interconnection between the two units require connection of the liquid and suction manifolds on the header defrost assembly to the matching stubs on the compressor rack. For units equipped with KOOLGAS defrost, an additional line must be run from the header defrost assembly to the compressor rack equalizing line stub.

For proper line sizing see Plus IV Planning Data.

ELECTRICAL

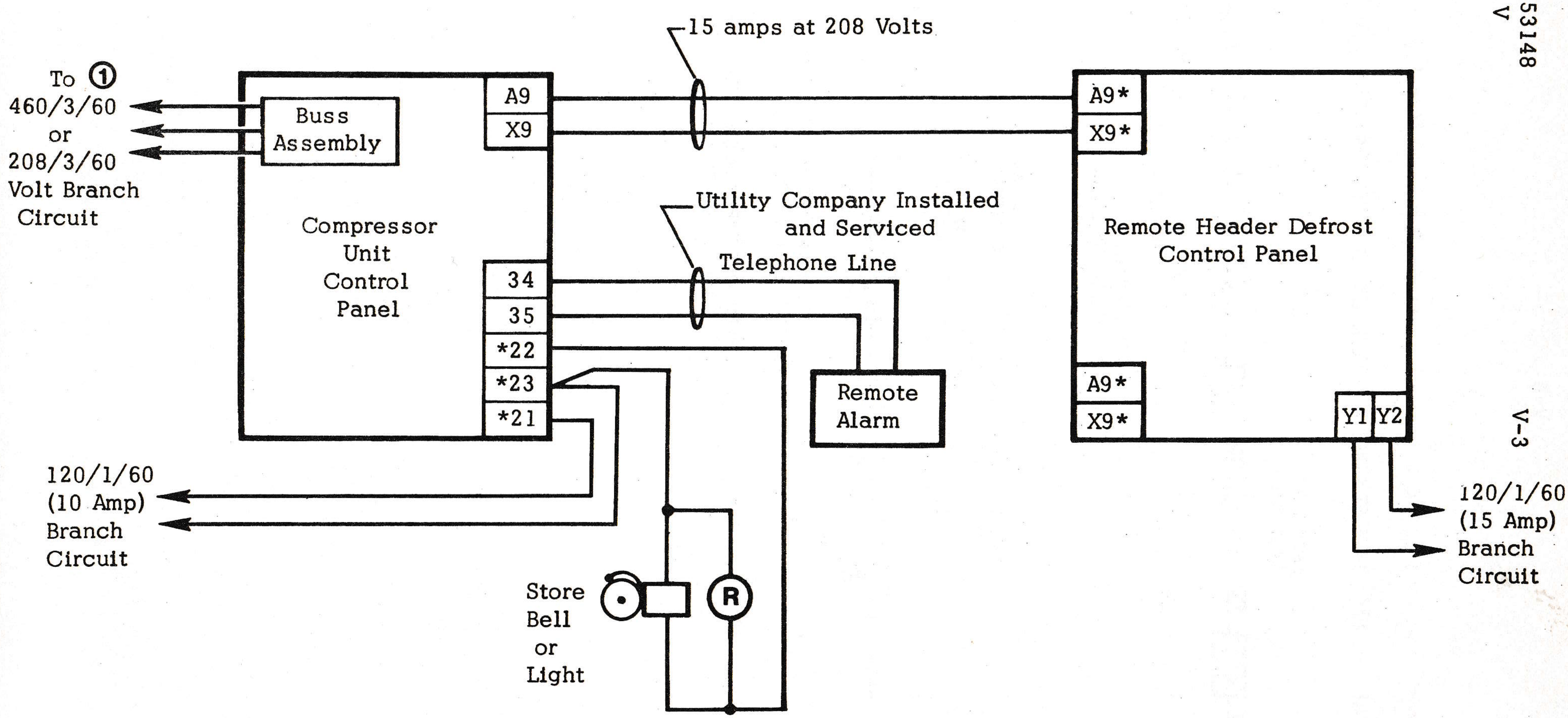
Figure V-2 indicates the necessary field wiring required to connect the header defrost assembly to the compressor rack electrically. Figure V-3 is a wiring diagram for the defrost control panel.

DEFROST CONTROL PANEL

There are eight types of defrost circuits and they are shown in Figure V-3. These circuits may be repeated in multiple and intermixed in any one store.

The terminal points in a circuit are identified by a letter with a dash suffix. The suffix will always be the system number corresponding to the store legend.

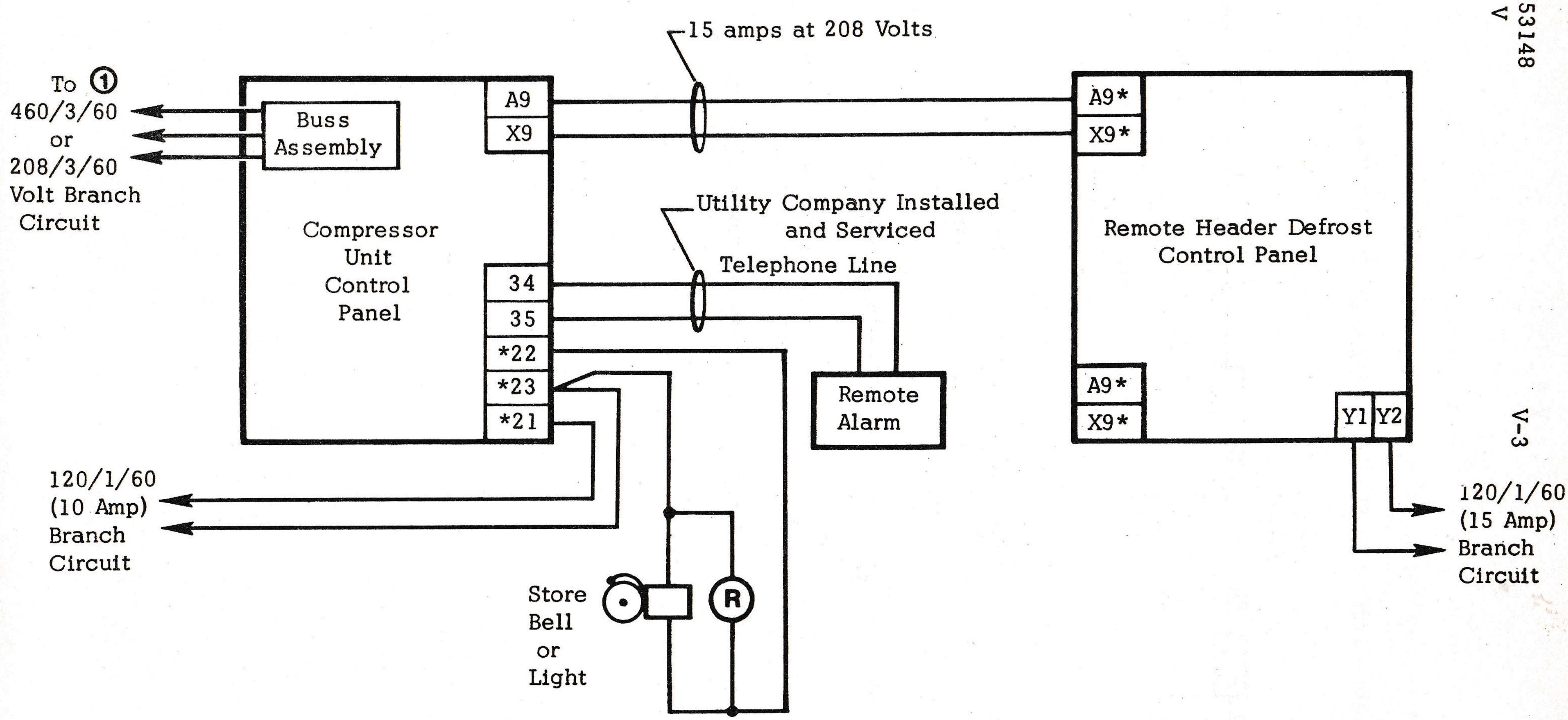
S<u>5</u> =
Store legend defrost System #5
D<u>5</u> =



① If 460 volt power is required, a 208/1/60 volt control circuit must also be run to terminals VCC*.

* Indicates unit letter on store legend.

Figure V-2
Field Wiring for Plus IV and Remote Header Defrost Assembly



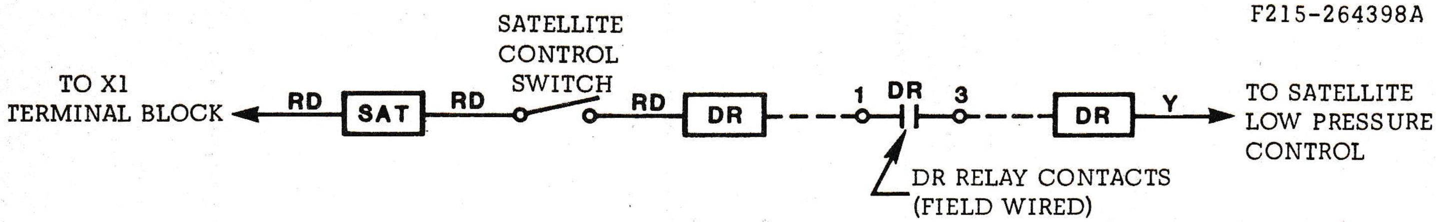
① If 460 volt power is required, a 208/1/60 volt control circuit must also be run to terminals VCC*.

* Indicates unit letter on store legend.

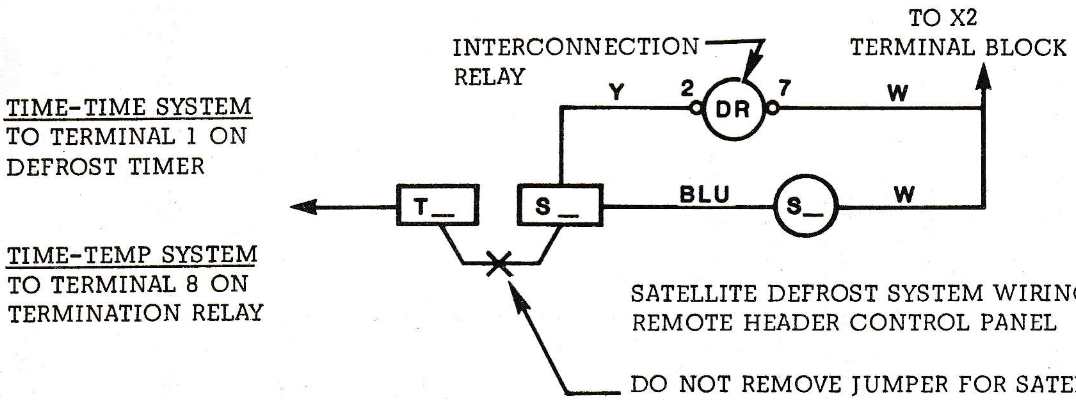
Figure V-2
Field Wiring for Plus IV and Remote Header Defrost Assembly

WIRING DIAGRAM - REMOTE DEFROST HEADER USED WITH S41 PLUS IV SATELLITE

F215-264398A



SATELLITE CONTROL CIRCUIT WIRING IN PLUS IV CONTROL PANEL



SATELLITE DEFROST SYSTEM WIRING IN REMOTE HEADER CONTROL PANEL

DO NOT REMOVE JUMPER FOR SATELLITE SYSTEM - USE THERMOSTAT TERMINALS PROVIDED IN SATELLITE PANEL.

Figure V-3

HEADER DE

LEGEND

W	INDICATOR "ON" LIGHT (WHITE)	DC_	DEFROST CONTACTOR COIL
S_	SYSTEM LIQUID SOLENOID VALVE	TM	TIMER MOTOR
3W	THREE WAY REVERSING VALVE	KS	KOOLGAS SOLENOID VALVE
TR	DEFROST TERMINATION RELAY	ES	EPR SOLENOID
	CONTACTS NORMALLY OPEN		CONTACTS NORMALLY CLOSED
	SWITCH (SPST)		TERMINAL BLOCK
	THERMOSTAT		FUSE
	JUMPER		FACTORY WIRING -CONTROL-
	FIELD WIRING -CONTROL-		FACTORY WIRING -POWER-
	FIELD WIRING -POWER-	V	DC VOLTMETER
		CDA	CDA VALVE (ELECTRONIC EPR VALVE)
		TA	TRANSFORMER ALARM RELAY
			VARISTOR
		( )	CDA THERMOSTAT LETTER

WIRE COLOR CODE			
BLACK	B	RED	RD
BLUE	BLU	YELLOW	Y
ORANGE	OR	BROWN	BR
WHITE	W	PURPLE	P

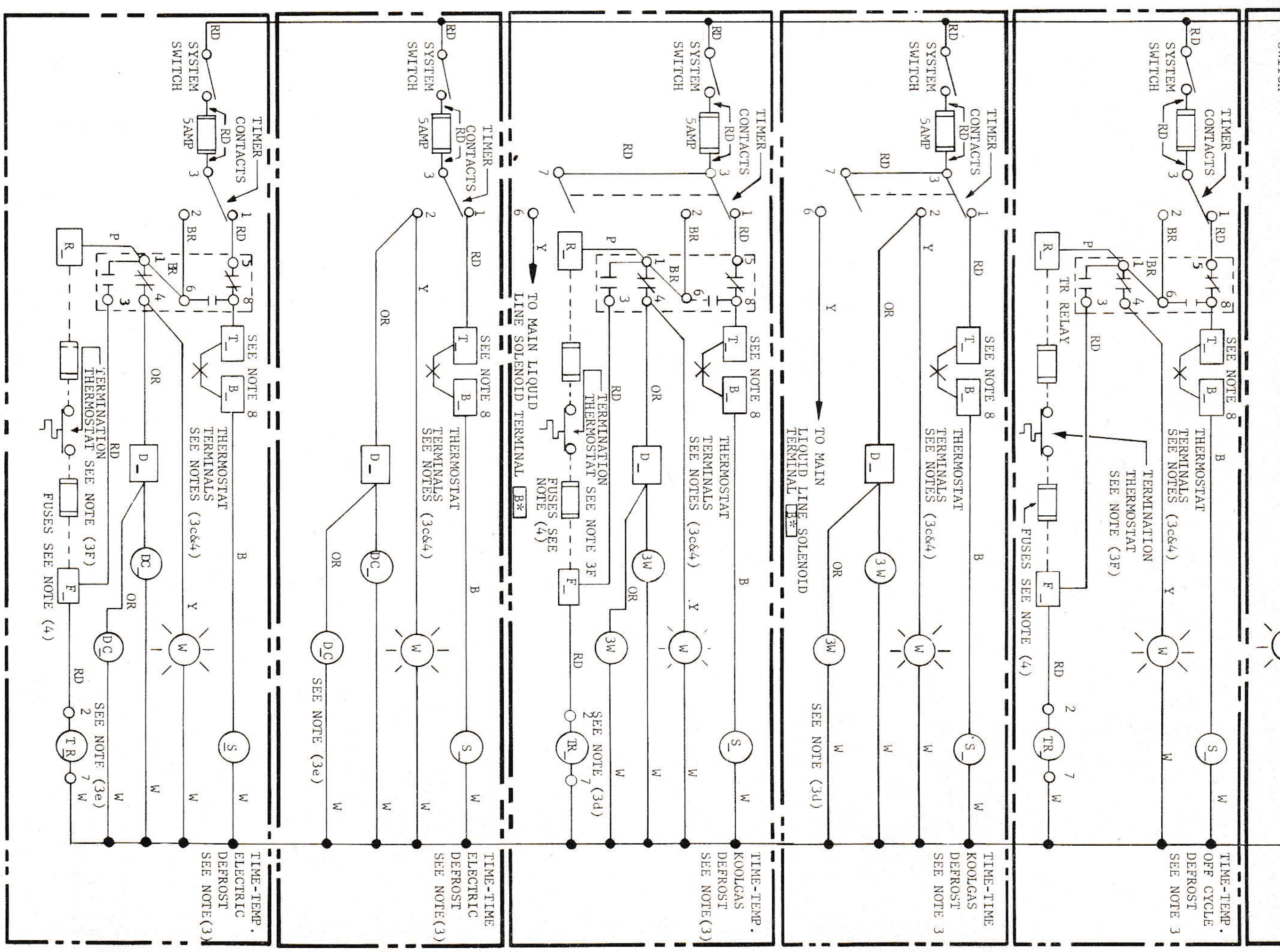
NOTES:

1. CONNECT TO CONTROL CIRCUIT TERMINAL
UNIT LETTER.

2. DEFROST POWER WIRING SHOWS ONE DEFRO
DEFROST CIRCUIT BREAKERS ARE FACTORY WI
IF A SINGLE DEFROST SYSTEM IS REQUIRED,
CIRCUIT BREAKER.

3. DEFROST CONTROL WIRING:
   A. SHOWN ARE TYPICAL DEFROST SYSTEM WI
   BE MULTIPLES OF ONE TYPE OR COMBINATI
   OF 32 SYSTEMS.
   B. THE DASH (-) DESIGNATION IN VARIOUS S
   TUAL DEFROST SYSTEM NUMBER DETERMIN
   C. REFRIGERATION THERMOSTATS WHEN REQ
   RUN FIELD WIRING TO THE [B_] & [T_] TER
   DEFROST SYSTEM. MINIMUM THERMOST
   ONLY.
   D. TWO 3-WAY REVERSING VALVES MAY BE REQ
   ESSARY REFRIGERATION CAPACITY FOR SC
   BE WIRED IN PARALLEL AS SHOWN.
   E. TWO DEFROST CONTACTORS MAY BE REQU
   ESSARY AMPERAGE FOR SOME DEFROST APP
   THE CONTACTOR COILS WILL BE WIRED I
   F. DEFROST TERMINATION THERMOSTAT, MI
   DUTY ONLY.
   G. "*" DESIGNATIONS IN VARIOUS TERMINALS
   FROM THE STORE LEGEND. EXAMPLE [X9
   LETTER A.
   H. "#" DESIGNATIONS IN VARIOUS TERMINAL
   DETERMINED BY THE SYSTEM STORE
   [D5] INDICATE SYSTEM NO. 5.

4. THERMOSTAT FUSING - THERMOSTAT LINES
QUIRED BY N. E. C. OR LOCAL CODES BY FIE
PLACED IN UNIT CONTROL PANEL. FUSE RA
PERES.



ROST ASSEMBLY WIRING DIAGRAM

Figure V-4

CC* FOR CORRESPONDING

SYSTEM LOAD. MULTIPLE
D TO A COMMON BUS BAR.
VIRE TO THE LINE SIDE OF

NG DIAGRAMS. THERE MAY
NS OF TYPES UP TO A TOTAL

MBOLS INDICATES THE AC-
FROM THE STORE LEGEND.
RED; REMOVE JUMPER AND
NALS OF THE APPROPRIATE
RATING 125va PILOT DUTY

IRED TO PROVIDE THE NEC-
E APPLICATIONS AND WILL

RED TO PROVIDE THE NEC-
CATIONS. AT THESE TIMES
PARALLEL.
MUM RATING 125va PILOT

NDICATE THE UNIT LETTER
AND [A9A] INDICATE UNIT

INDICATE SYSTEM NUMBER
GEND. EXAMPLE [B5] AND

UST BE PROTECTED AS RE-
INSTALLED FUSES TO BE
NG NOT TO EXCEED 5 AM-

5. DEFROST TIMERS - WIRING OF THE TIMERS IS SUCH THAT:
   A. CIRCLED NUMBERS IN THE TIMER TERMINAL IDENTIFICATION BLOCKS ARE ONLY FOR DIAGRAM REFERENCES.
   B. REFRIGERATION CYCLE ---- CONTACTS 3 TO 1 ARE CLOSED DURING REFRIGERATION.
   C. DEFROST CYCLE ---- DELTROL TIMER -- 3 TO 2 AND 3 TO 6 ARE CLOSED DURING DEFROST.
   D. DEFROST CYCLE ---- PARAGON TIMER -- 3 TO 2 AND 7 TO 6 ARE CLOSED DURING DEFROST.
   E. TIMERS ARE WIRED FROM LEFT TO RIGHT TO THE SYSTEM NUMBER SEQUENCE.
   F. PARAGON TIMERS --- 3 IS JUMPERED TO 7 FOR KOOLGAS® APPLICATIONS ONLY.
6. FOR COOLER COIL DEFROST WIRING SEE SEPARATE WIRING DIAGRAM.
7. LOCATION AND NUMBER OF DEFROST COMPONENTS WILL VARY DEPENDING UPON THE TYPE OF DEFROST SYSTEMS INSTALLED. SYSTEM SWITCHES AND INDICATOR LIGHTS ARE PROVIDED.

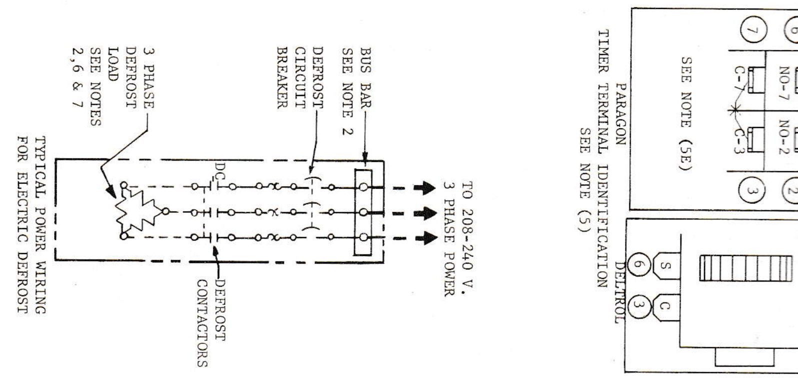
8. TERMINA
TION FO

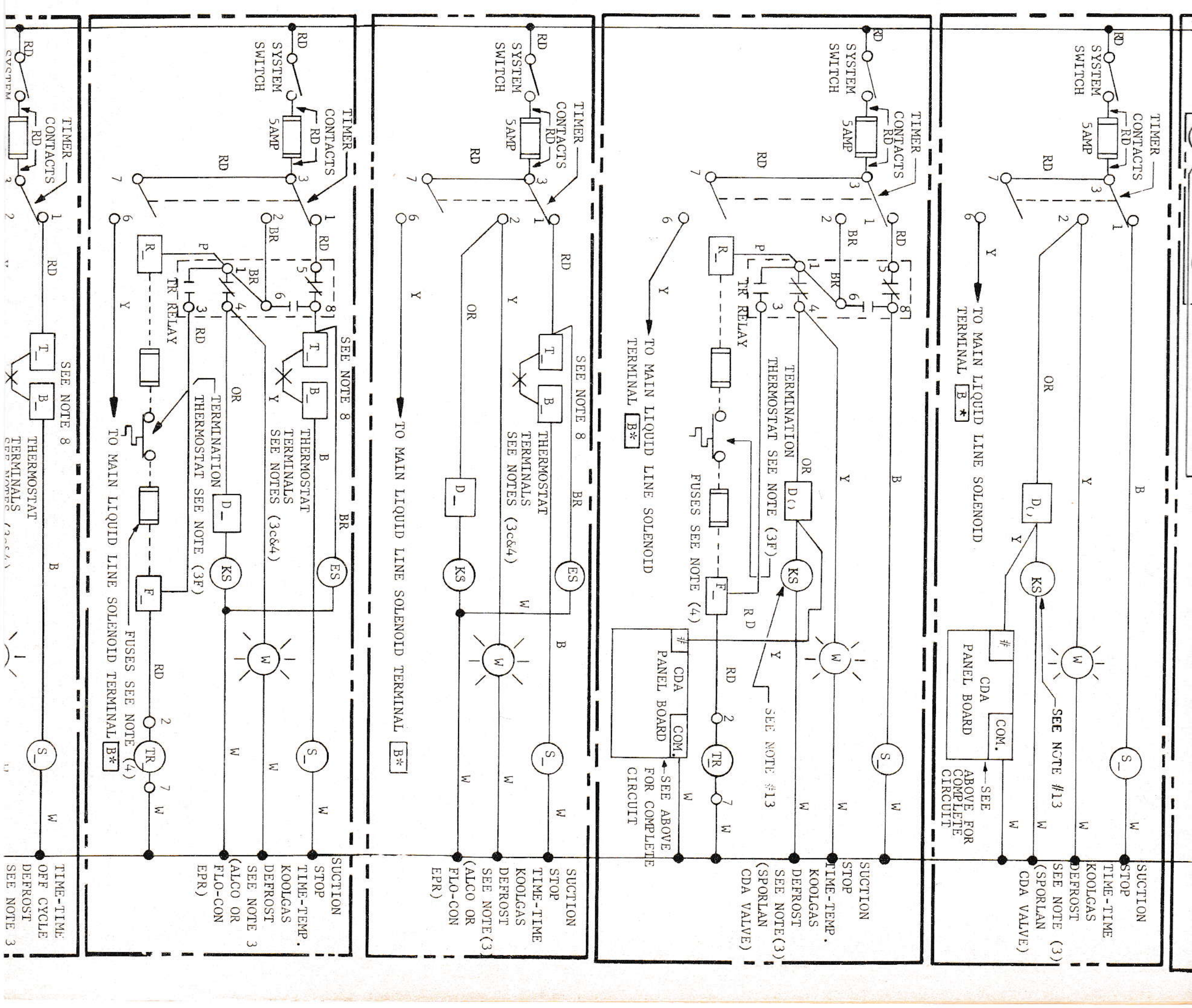
9. X2 TERMI
MUST BE
PANEL M

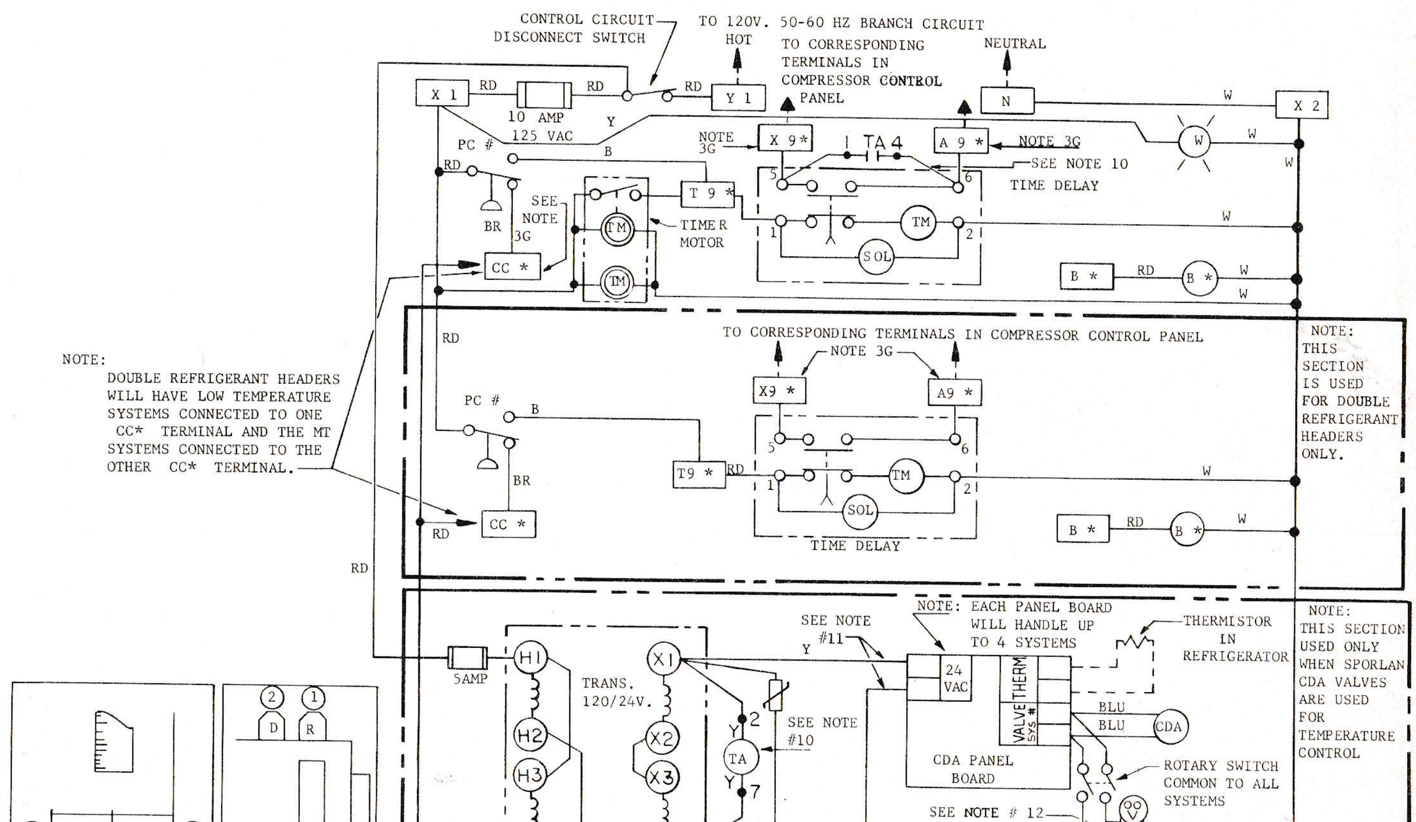
10. TA CONT

11. MOUNTI
ARE REQU

12. RESISTOR







" WILL BE CHANGED TO "S_" TO DESIGNATE THE CONNEC-
TELLITE UNIT. MAXIMUM LOAD 2.5 AMPS AT 208/230 VOLTS.

BLOCKS - ALL X2 TERMINAL BLOCKS IN THE CONTROL PANEL
PERED TOGETHER. X1 TERMINAL BLOCKS IN THE CONTROL
BE JUMPERED TOGETHER. (DO NOT JUMPER X2 TO X1)

USED ONLY WHEN CDA VALVES ARE FURNISHED.

OARDS CAN BE JUMPERED TOGETHER UP TO 5. DUAL WIRES
) FOR MORE THAN 5 MOUNTING BOARDS.

UIRED ON MODUTEC VOLTMETER ONLY.

CONDENSER INSTALLATION

Section VI	Page
General Description	VI- 1
Remote Air Cooled Condensers	VI- 1
Handling	VI- 1
Locating	VI- 1
Leveling	VI- 3
Piping Condensers	VI- 3
Shutoff Valves	VI- 3
Connecting to One Manifold	VI- 4
Connecting to Two Manifolds	VI- 4
Electrical and Preliminary Check-out	VI- 6
Water Cooled Condensers	VI-12
Locating	VI-12
Leveling	VI-12
Lagging	VI-12
Refrigerant Piping	VI-12
Evaporative Water Coolers and Condensers	VI-13

VI

CONDENSER

CONDENSER INSTALLATION

GENERAL DESCRIPTION

Plus IV is available for use with three types of condensers; remote air cooled, water cooled, and evaporative water cooled. Refer to specific manufacturers' instructions for the installation of these components. See the store legend for manufacturer and model number.

Remote Air Cooled Condensers - When air cooled condensers are used there will generally be two individual condensers. In some applications only one condenser is applied with circuits for both the low and medium temperature systems.

Water Cooled Condensers - When water cooled condensers are used they will be shell and tube construction. The water cooled condensers are not factory installed.

Evaporative Water Coolers or Condensers - Evaporative water cooled condensers are shipped directly to the job site by the manufacturer.

REMOTE AIR COOLED CONDENSERS

HANDLING

Lifting channels are provided at each corner of the condenser. Condensers with three or more fans will have additional intermediate lifting channels. Use only these locations for attaching cables during leg assembly and lifting the condensers.

Rig cables to the lifting channels and position the condenser so the legs can be bolted to the frame. If the condenser was shipped on its side, the intermediate erection plates for that side should also be installed at this time. See Figure VI-1 for the proper rigging technique.

LOCATING

Locate the condenser with at least three feet of clear space on all sides to provide adequate air circulation and room for servicing. Mount the condenser on beams supported by building columns or load-bearing walls.

The mounting surface for the condenser should be at least 88 inches higher than the machine room floor when the compressor unit is equipped with condensing pressure control valves. This height requirement is reduced to 54 inches for installations not using condensing pressure control valves, such as when Control B is applied to the condenser.

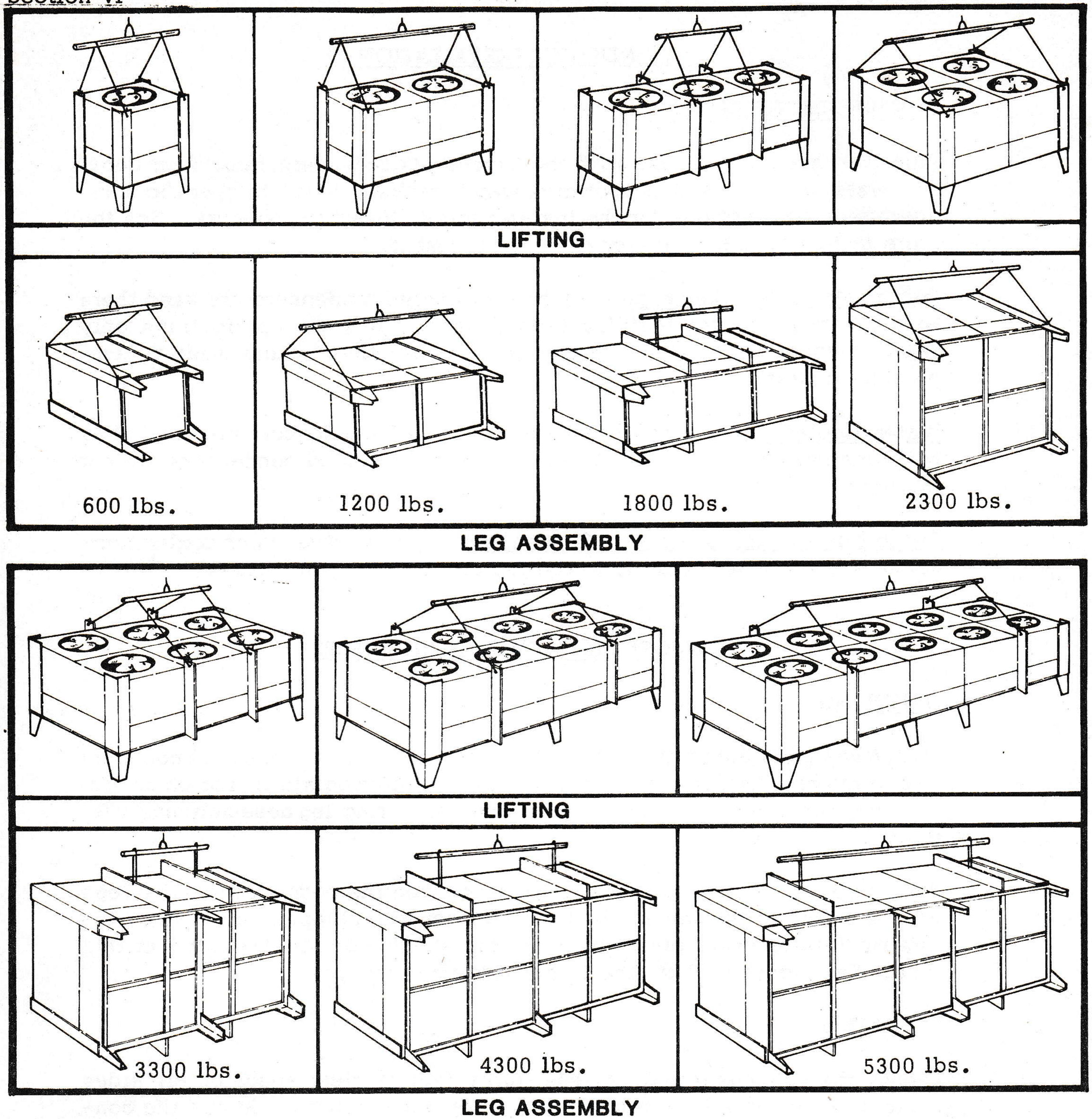


Figure VI-1
Rigging for Leg Assembly and Lifting

Unmounted legs and lifting channels are furnished with necessary bolts, nuts, and washers for mounting to the unit. Mount each leg and plate with the bolts provided.

Under no circumstances should the condenser coil manifolds, control panel, or return bends be used for lifting or moving the unit.

LEVELING

Cross-level the coil section carefully, then bolt the condenser legs to the support beams.

PIPING CONDENSER

For multi-circuit condensers, consult the store legend and refer to the metal identification tag on the manifold end of the condenser to determine which compressor unit to connect to each set of condenser circuits.

Route and support all piping in a manner that relieves stress caused by vibration, thermal expansion, and gradual base or building movement. Construct a pitch box to weatherproof the opening where piping is routed through the roof.

Important Safety Instructions - Hot discharge piping can burn service personnel and presents a potentially dangerous grounding source to anyone servicing electrical components. The installer must provide a safe environment for service personnel by following these three steps (see Figures VI-2 and 3):

1. Route all discharge lines away from the control panel. Route the liquid return lines so they do not protrude more than a few inches in front of the condenser before dropping to the rooftop.

2. Insulate all discharge piping near the control panel to protect service personnel from burns and electrical shock. Use an exterior-grade, heat-resistant insulation.

3. Construct a wooden platform to provide a dry area for service personnel to stand on when servicing electrical components.

Shutoff Valves - Provide a shutoff valve downstream of the oil separator to permit isolation of the component during servicing.

Connecting to One Manifold - When a compressor unit is served by one set of condenser circuits, an equalizing line is not required. Route the discharge line directly to its respective condenser inlet stub and install a purge valve at the highest point in the line. Route the liquid return line in a manner providing free trapless drainage from the condenser to the connection at the compressor unit. See Figure VI-2.

Connecting to Two Manifolds - When a compressor unit is served by two sets of condenser circuits, an expansion loop must be constructed between the manifolds and an equalizing line must be provided. See Figure VI-3.

1. Discharge line: Connect the two inlet stubs to the discharge line by forming an expansion loop extending at least 12 inches away from the manifolds. Do not route the discharge line directly in front of the control panel.

2. Liquid return line: Route each liquid return line downward at least 12 inches between the outlet stubs before teeing into the main liquid return line. After the tee, route the main liquid return line in a manner

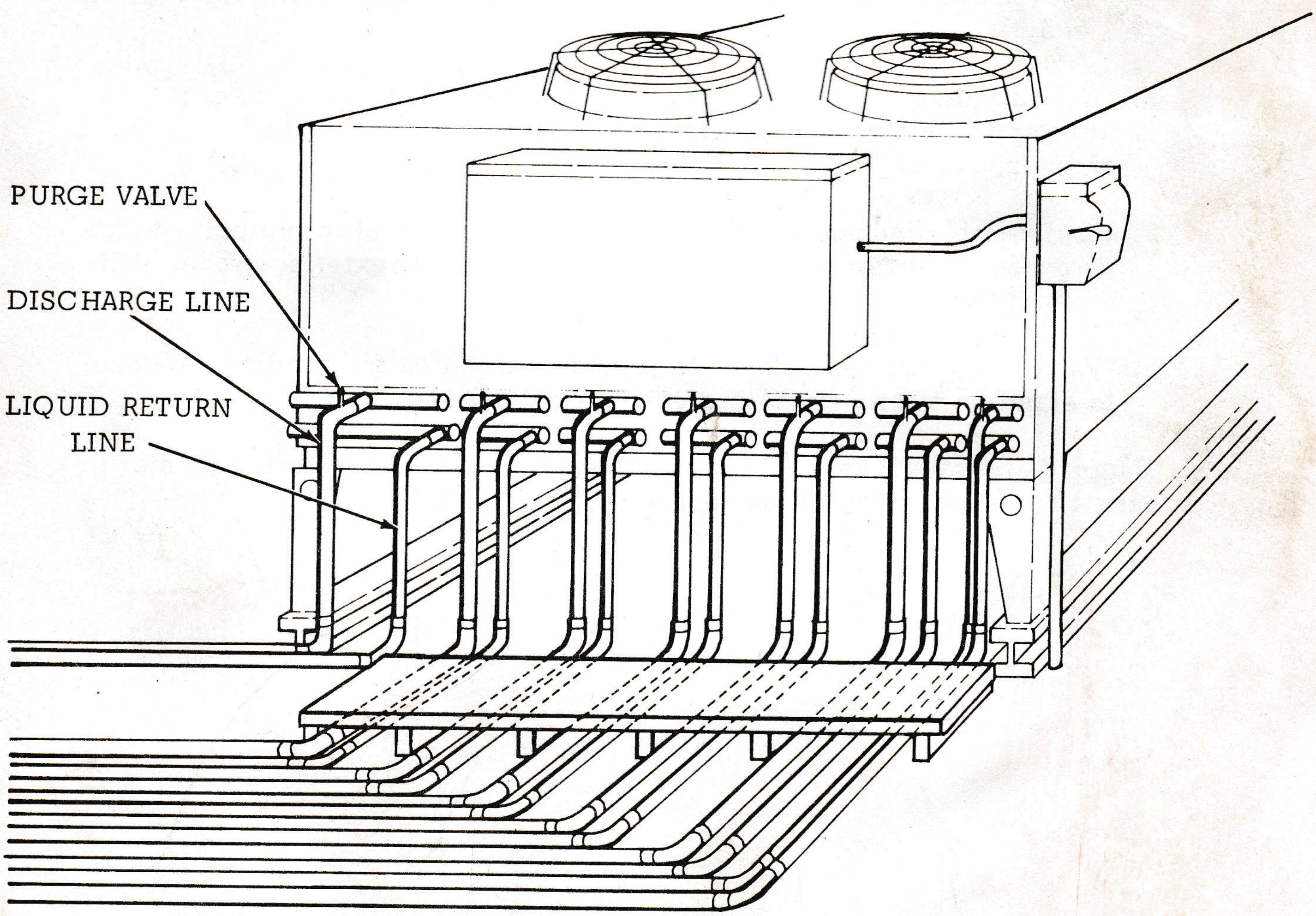


Figure VI-2
Connecting to One Manifold

providing free trapless drainage from the rooftop to the connection at the compressor unit.

3. Equalizing line: To insure positive drainage of both circuits, an equalizing line must be run from the compressor unit receiver to the point where the discharge line tees into the condenser. Install a check valve in this line as depicted in the illustration. Be sure the equalizing line is pitched to provide free trapless drainage away from the check valve in both directions. Install a purge valve and shutoff valve downstream of the check valve.

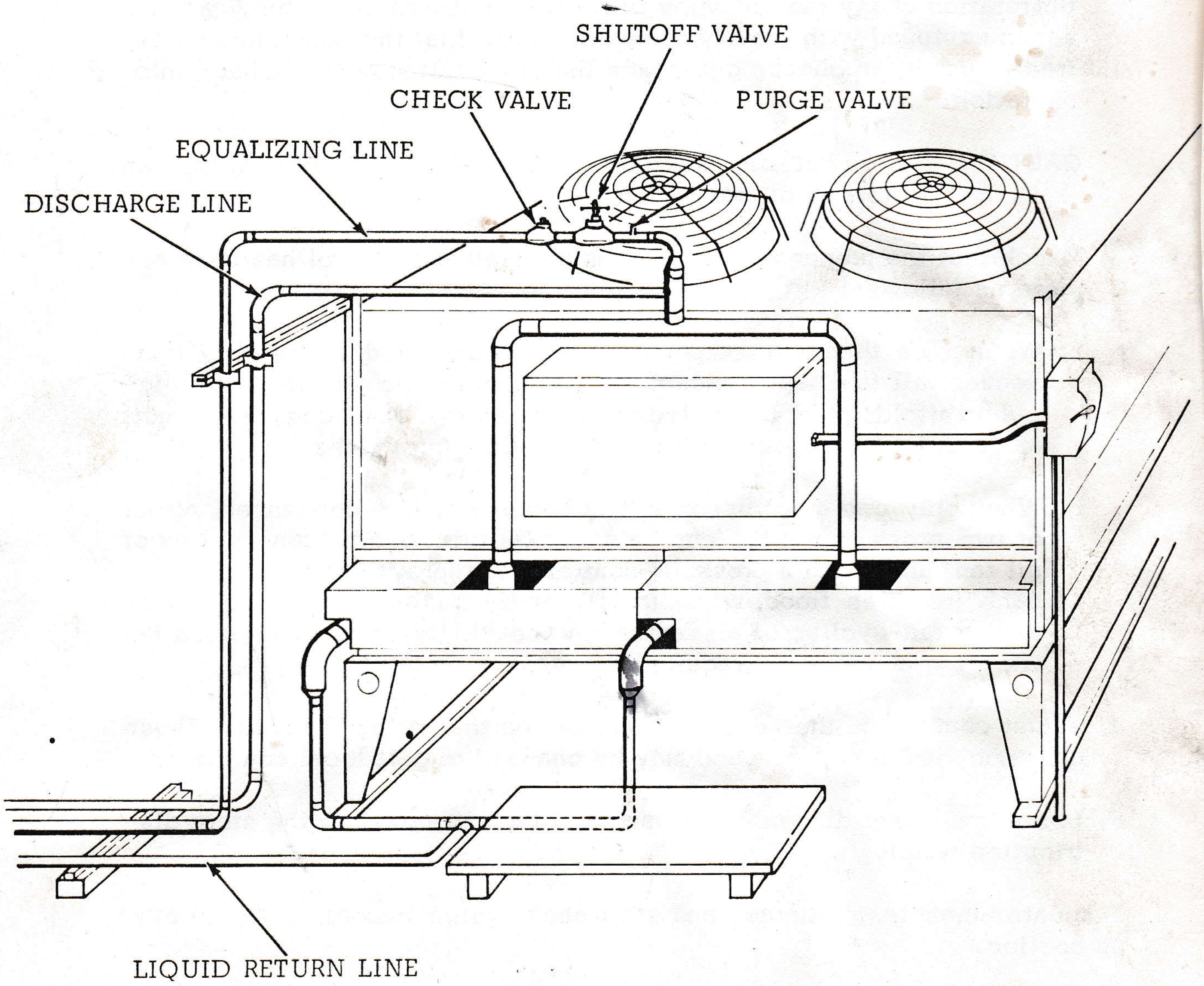


Figure VI-3
Connecting to Two Manifolds

ELECTRICAL AND PRELIMINARY CHECK-OUT

The following electrical diagrams (Figure VI-4 through 6) show the internal wiring. Consult motor serial plate for wire sizes.

After wiring is complete check condenser operation in the following manner prior to compressor start up.

1. Be sure the disconnect at the condenser is open, then turn on power to the condenser at the store distribution panel. By-pass the fan cycling controls so all fans are in the electrical circuits.

2. Close the condenser disconnect and check the fans for proper operation; the fans should discharge air from the top of the condenser. Reverse the rotation of any fans blowing in the wrong direction. If the condenser is equipped with gravity dampers, check that they open and close freely. After fan checks out, place the fan-cycling controls back into operation.

   CAUTION: Before entering any fan section make sure power to the fan motors is disconnected.

3. Check that the proper winter condensing pressure control has been applied as follows:

   a. When more than one compressor unit is connected to the same condenser, all fan banks except the one nearest the discharge and liquid manifolds must be cycled by thermostats. Each compressor unit must also be equipped with condenser flooding valves.

   b. When only one compressor unit is connected to a condenser, either of two types of control can be used: (1) thermostatic fan-cycling of all fan banks with a pressure-control override of the first cycling fan bank (requires flooding controls), or (2) Control B: pressure-controlled fan-cycling of all fan banks and gravity dampers for each fan (flooding controls not required).

4. Adjust controls to the settings specified on the wiring diagram. These are approximate settings and may be changed to suit local conditions.

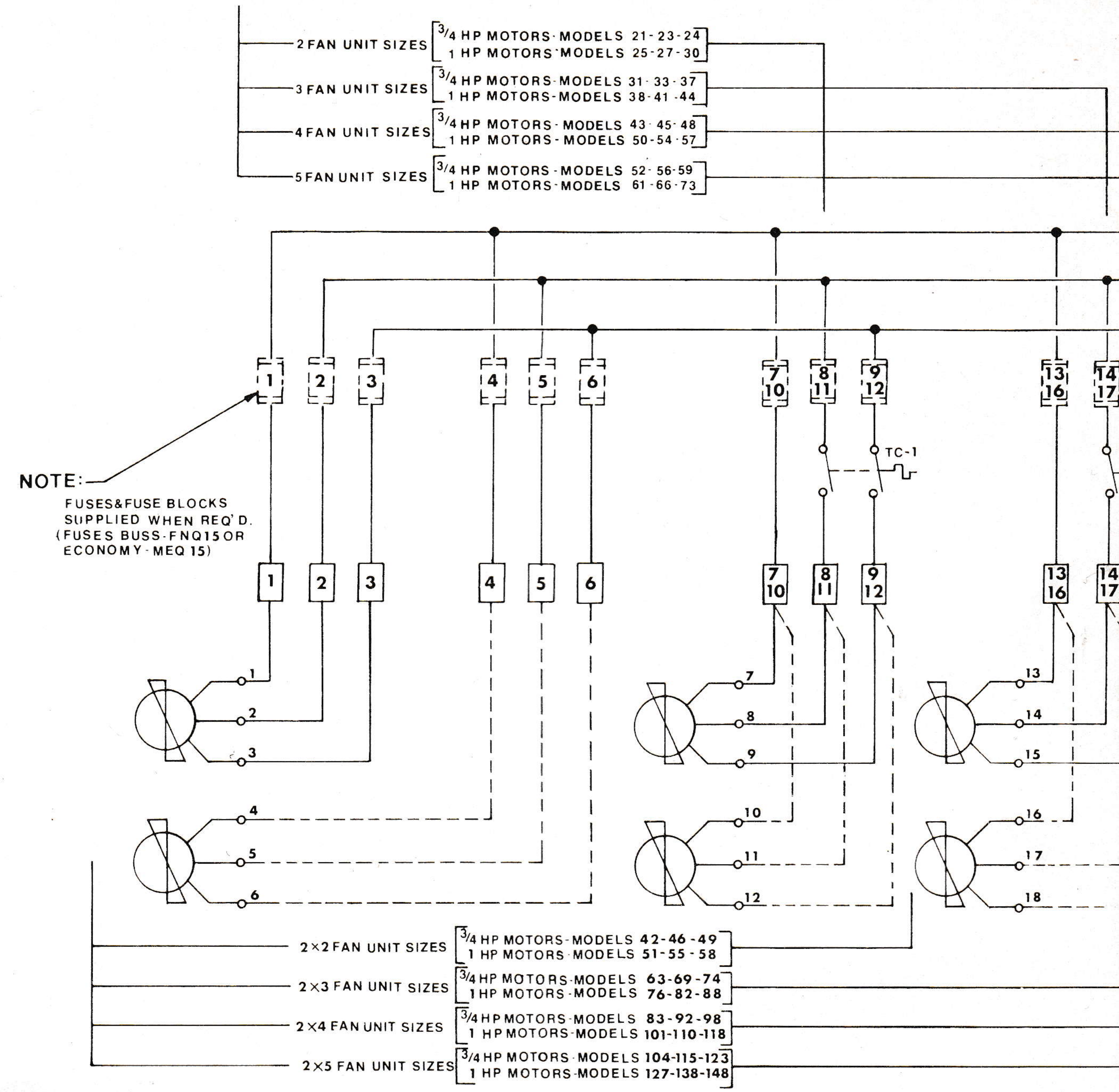
5. Leave condenser disconnect closed and turn off power at the store distribution panel.

Evacuate, leak test, charge, and start each system according to the start up section.

THERMOSTATIC F

AMBIENT TEMPERATURE CONTROL OF

THE ONE NEAREST THE HEADER FOR 2, 3, 4, or



REPLACEMENT PARTS

THERMOSTAT CONTROL
PENN #A72-AA3 OR
RANCO #020-7013

MOTOR (INHERENTLY PROTECTED)
200, 230, 460/60/3 .825 RPM
1HP K. CORP. P.N. 11503
3/4HP K. CORP. P.N. 11504
30 DIA. FAN BLADES
25° PITCH 3/4HP K CORP P.N. 11248
29° PITCH 1HP K CORP P.N. 11247

TERMINAL BLOCK
BUCHANAN HEAVY DUTY #212

TERMINAL BLOCK
BUCHANAN MEDIUM DUTY #514

FUSE HOLDER
BUCHANAN #362

CONTROL SETTINGS				
NUMBER OF THERMOSTATS	CUT IN SETTINGS FOR THERMOSTATS-°F			
	TC-1	TC-2	TC-3	TC-4
1	75°	—	—	—
2	68°	75°	—	—
3	60°	70°	75°	—
4	55°	65°	71°	75°

SET CUT OUT 5°F BELOW CUT IN

	INDIVIDUAL MOTOR FLA		
HP	208/3/60	230/3/60	460/3/60
3/4	3.5	3.2	1.6
1	4.4	4.0	2.0

TOTAL FLA = NO OF MOTORS x APPLICABLE MOTOR FLA

ꓥN CONTROL

ALL BANKS OF FANS EXCEPT

SINGLE FAN BANK HACD CONDENSER

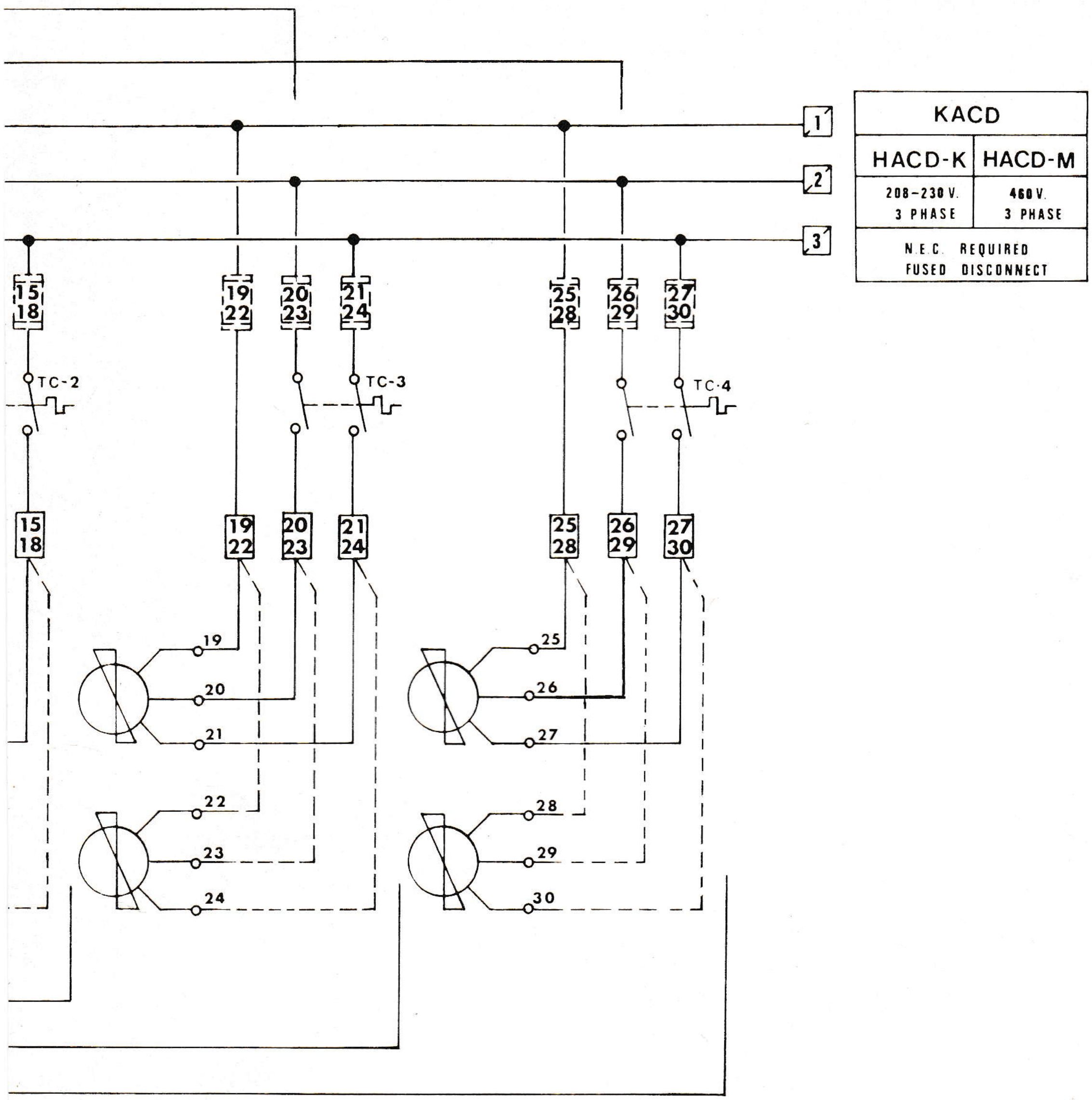


Figure VI-4

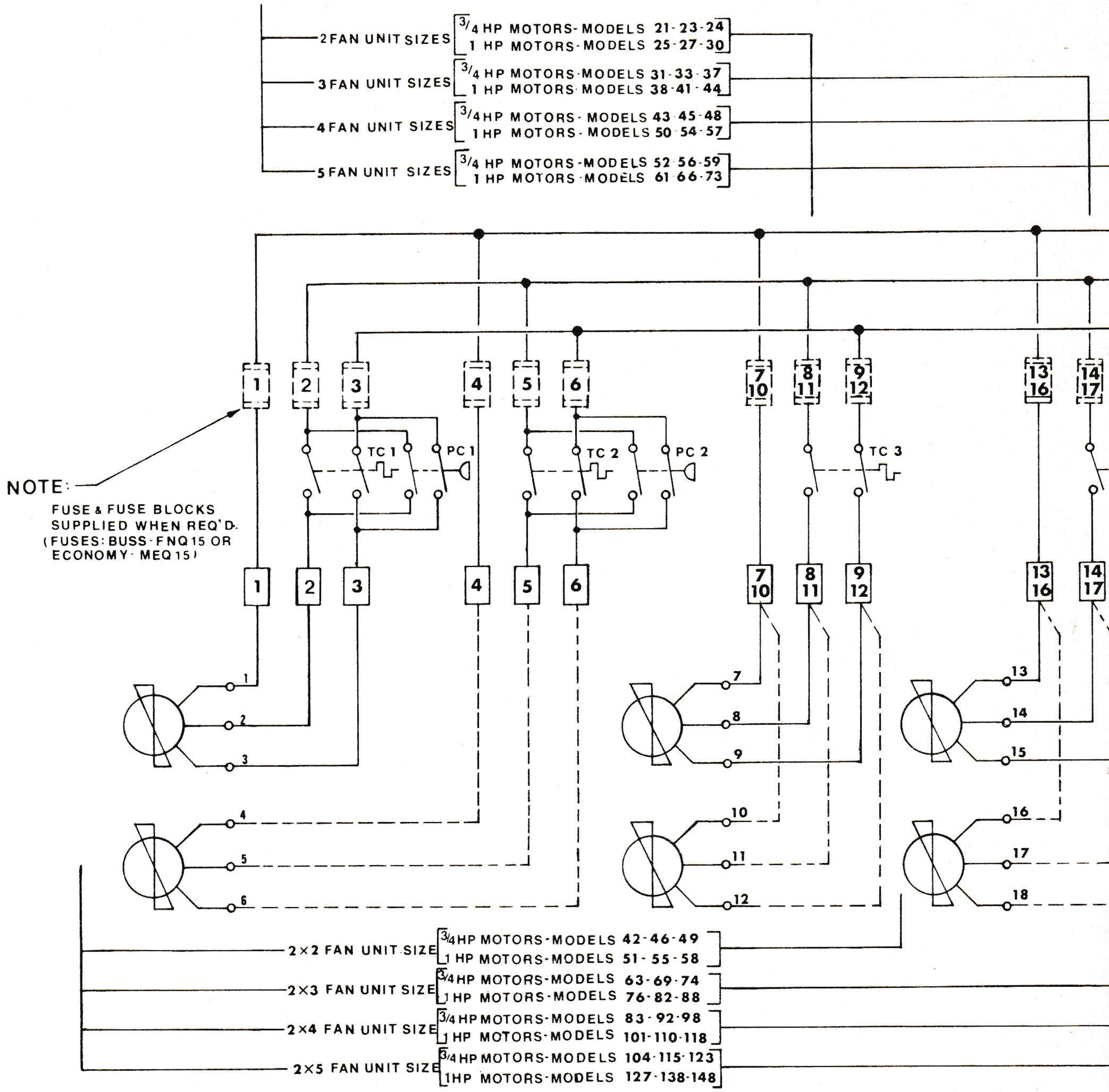
P315-145900-E

P315-145904-E

THERMOSTATIC FA

AMBIENT TEMPERATURE CONTROL OF AL

THE ONE NEAREST THE HEADER FOR 2x2, 2x3, 2x4, or 2x



REPLACEMENT PARTS

- THERMOSTAT CONTROL
  PENN #A72-AA3 OR
  RANCO #020-7013
- PRESSURE CONTROL
  PENN #P72-AA-35 OR
  RANCO #020-7006
- MOTOR (INHERENTLY PROTECTED)
  200,230,460/60/3 825 RPM
  1HP. K CORP. P.N.11503
  3/4 HP. K CORP. P.N. 11504
  30 DIA. FAN BLADES
  25° PITCH-3/4 HP. K.CORP. P.N.11248
  29° PITCH-1HP. K.CORP. P.N.11247
- FUSE HOLDER
  BUCHANAN #362
- TERMINAL BLOCK
  BUCHANAN HEAVY DUTY #212
- TERMINAL BLOCK
  BUCHANAN MEDIUM DUTY #514

CONTROL SETTINGS

NUMBER OF THERMOSTATS	CUT IN SETTING FOR THERMOSTAT- °F						PC-1 & PC-2 SETTINGS-PSIG		
	TC-1	TC-2	TC-3	TC-4	TC-5	TC-6	REFRIG.	CUT IN	CUT OUT
3	80°	75°	55°	—	—	—	R-12	158	117
4	80°	75°	65°	50°	—	—	R-22	260	196
5	80°	75°	70°	60°	50°	—	R-502	283	216
6	80°	75°	70°	65°	55°	50°			

SET CUT OUT 5°F BELOW CUT IN

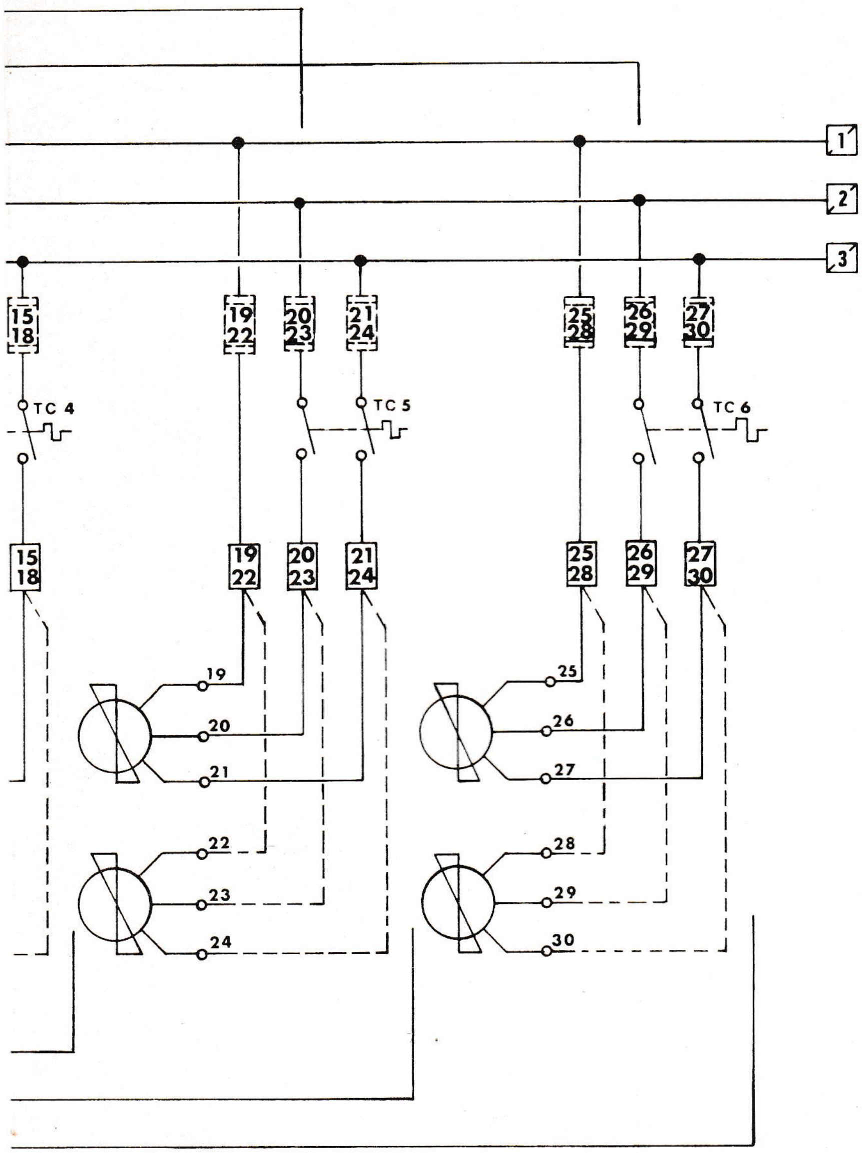
	INDIVIDUAL MOTOR FLA		
HP	208/3/60	230/3/60	460/3/60
3/4	3.5	3.2	1.6
1	4.4	4.0	2.0

TOTAL FLA: NO. OF MOTOR × APPLICABLE MOTOR FLA

N CONTROL

, BANKS OF FANS EXCEPT

5 DOUBLE FAN BANK HACD CONDENSER



KACD	
HACD-K	HACD-M
208-230V. 3 PHASE	460V. 3 PHASE
N.E.C. REQUIRES FUSED DISCONNECT	

Figure VI-5

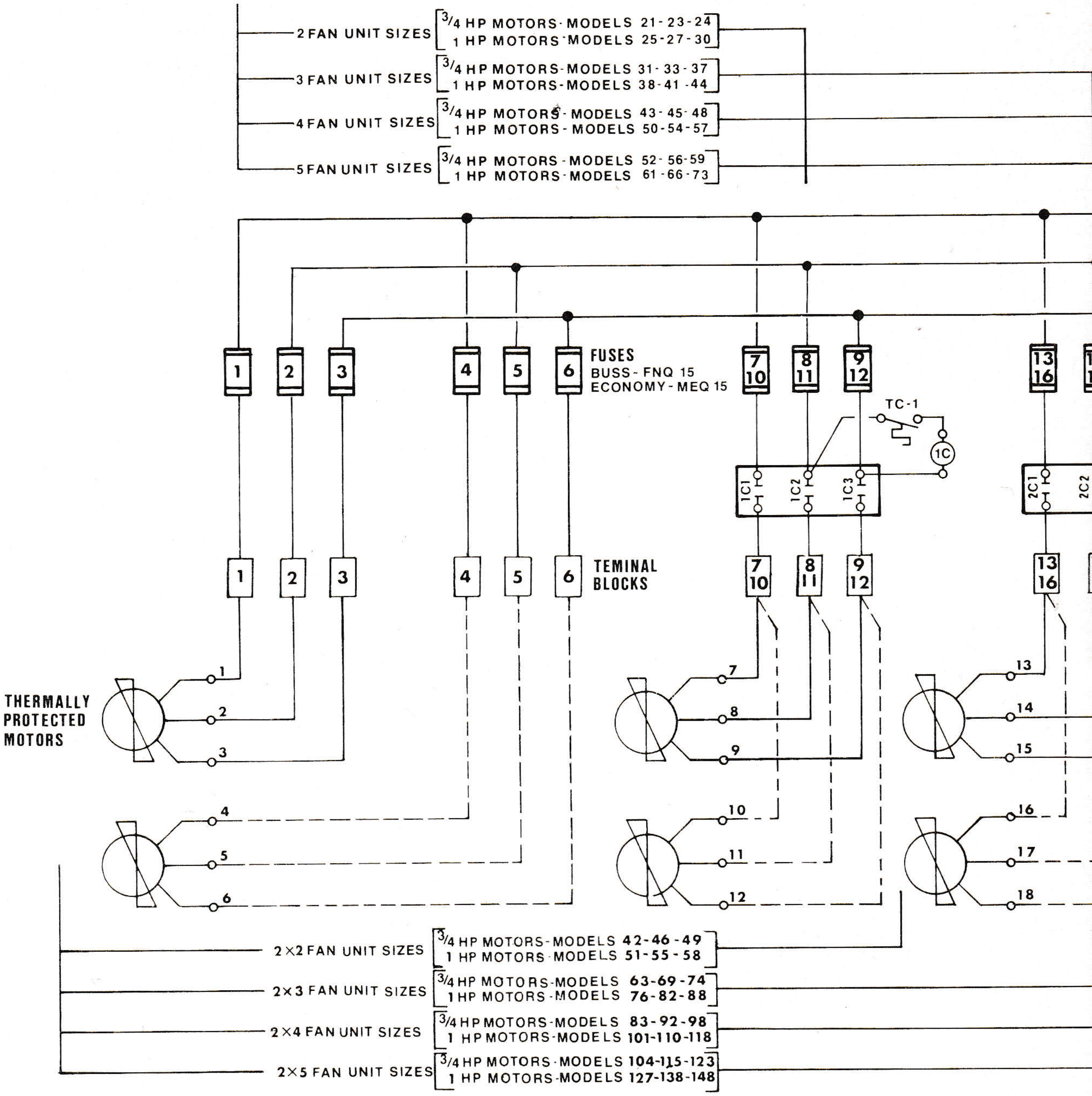
P315-145901-E

P315-145905-E

THERMOSTATIC FAN

AMBIENT TEMPERATURE CONTROL OF ALL BAN

OVERRIDE OF THE FIRST CYCLING FAN BANK FOR 2, 3, 4,



REPLACEMENT PARTS

THERMOSTAT CONTROL
PENN # A19-ABC-24

MOTOR (INHERENTLY PROTECTED)
200, 230.460/60/3 825 RPM
1HP K. CORP. P.N. 11503
3/4HP K. CORP. P.N. 11504
30 DIA. FAN BLADES
25° PITCH 3/4HP K. CORP. P.N. 11248
29° PITCH 1 HP K CORP. P.N. 11247

TERMINAL BLOCK
BUCHANAN HEAVY DUTY #212

TERMINAL BLOCK
BUCHANAN MEDIUM DUTY #514

FUSE HOLDER
BUCHANAN # 362

CONTROL SETTINGS

NUMBER OF THERMOSTATS	CUT IN SETTINGS FOR THERMOSTATS-°F			
	TC-1	TC-2	TC-3	TC-4
1	75°	—	—	—
2	68°	75°	—	—
3	60°	70°	75°	—
4	55°	65°	71°	75°

SET CUT OUT 5°F BELOW CUT IN

	INDIVIDUAL MOTOR FLA		
HP	208/3/60	230/3/60	460/3/60
3/4	3.5	3.2	1.6
1	4.4	4.0	2.0

TOTAL FLA: NO. OF MOTORS x APPLICABLE MOTOR FLA

ONTROL

OF FANS WITH PRESSURE

: 5 SINGLE FAN BANK HACD CONDENSER

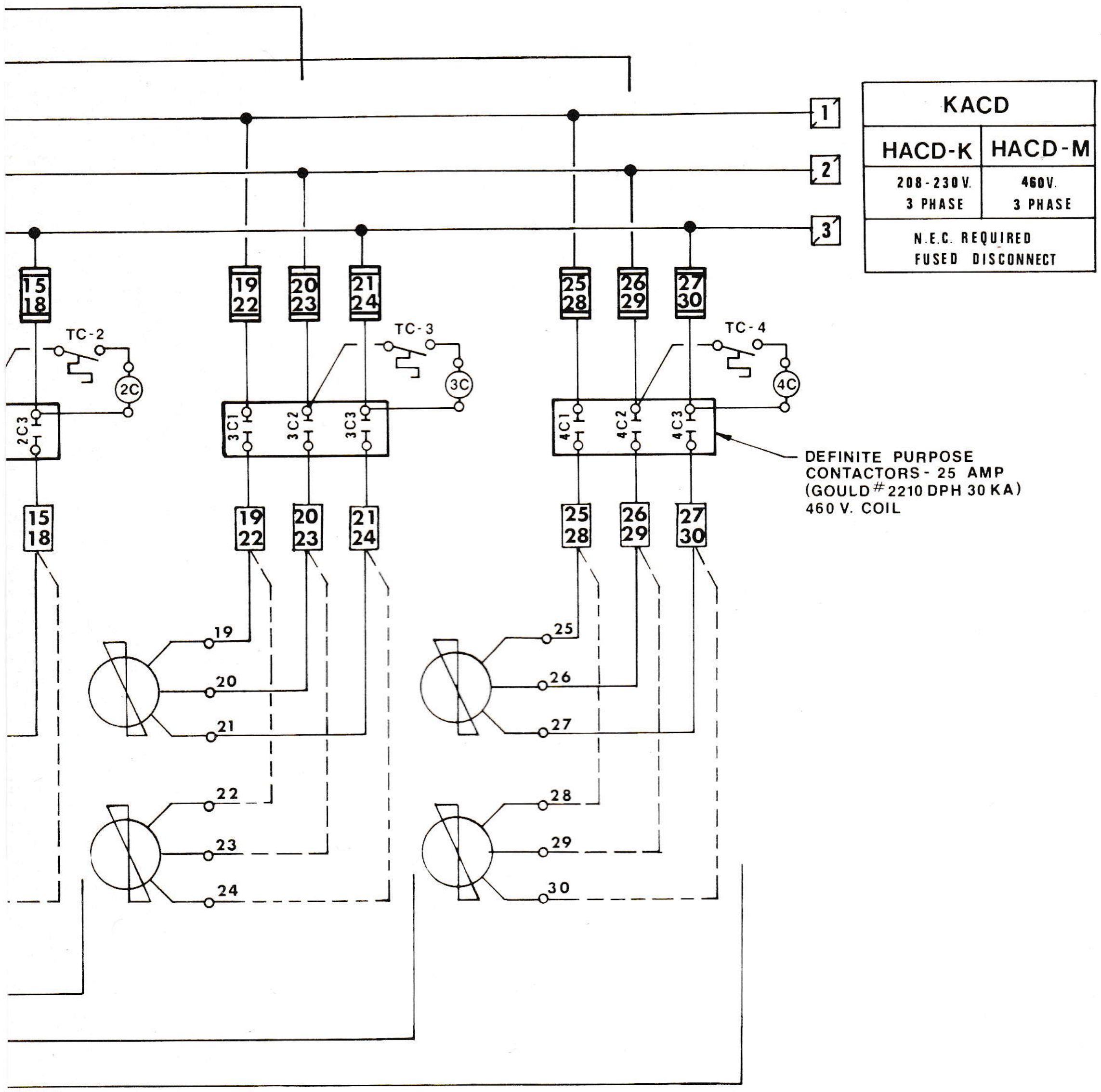


Figure VI-6

P315-260387-B

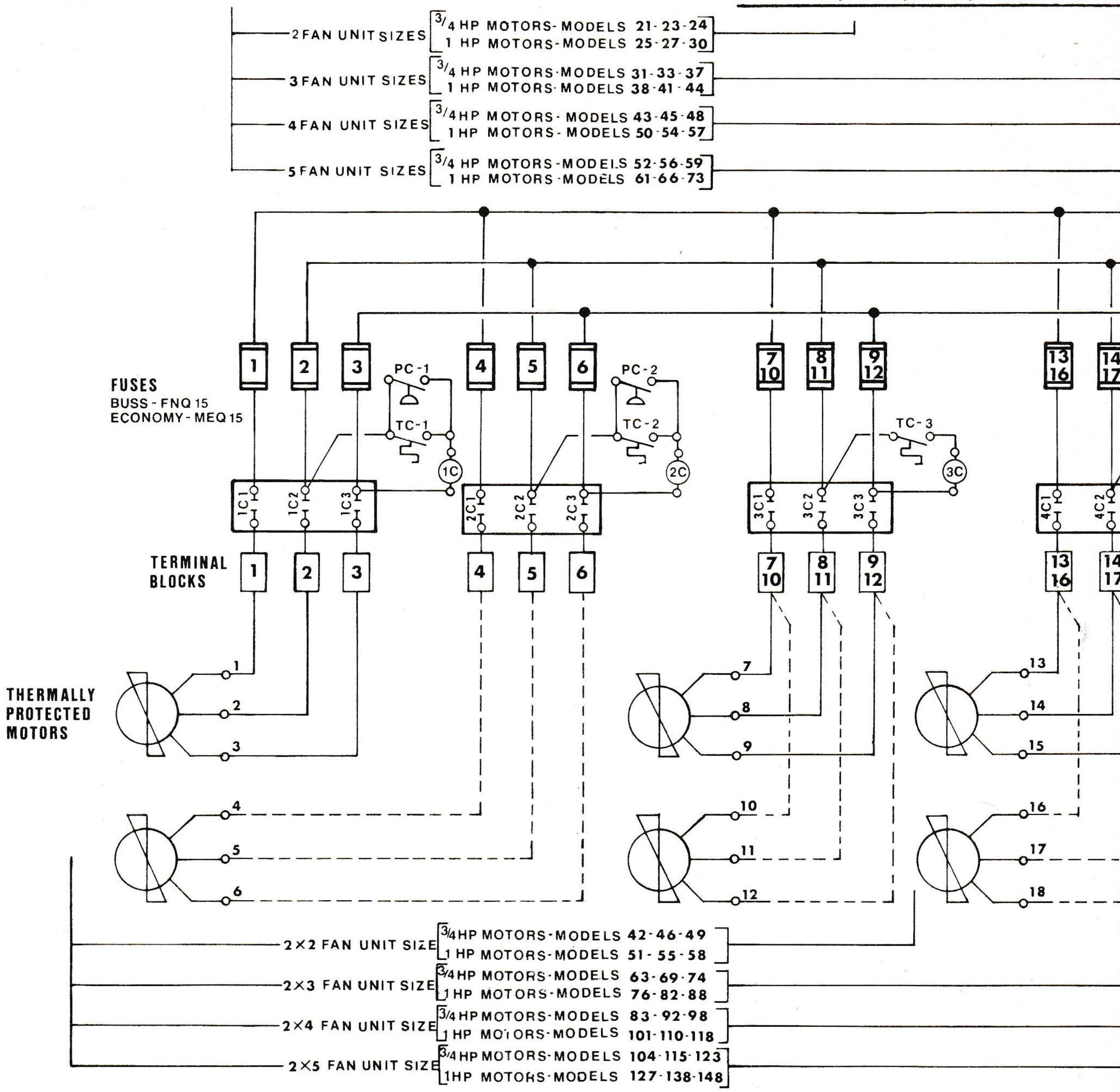
P315-260393-B

THERMOSTATI

AMBIENT TEMPERATURE CONTROL C

OVERRIDE OF THE FIR

FOR 2x2, 2x3, 2x4, or 2x5 DOU



REPLACEMENT PARTS

- THERMOSTAT CONTROL PENN #A19-ABC-24
- PRESSURE CONTROL PENN #P70-AA-118
- MOTOR (INHERENTLY PROTECTED) 200,230,460/60/3 825 RPM
  1 HP. K. CORP. P.N. 11503
  3/4 HP. K CORP. P.N. 11504
  30 DIA. FAN BLADES
  25° PITCH - 3/4 HP. K.CORP. P.N.11248
  29° PITCH - 1 H.P. K.CORP. P.N.11247
- FUSE HOLDER BUCHANAN #362
- TERMINAL BLOCK BUCHANAN HEAVY DUTY #212
- TERMINAL BLOCK BUCHANAN MEDIUM DUTY #514

CONTROL SETTINGS									
NUMBER OF THERMOSTATS	CUT IN SETTING FOR THERMOSTAT - °F						PC-1 & PC-2 SETTINGS-PSIG		
	TC-1	TC-2	TC-3	TC-4	TC-5	TC-6	REFRIG.	CUT IN	CUT OUT
3	80°	75°	55°	—	—	—	R-12	158	117
4	80°	75°	65°	50°	—	—	R-22	260	196
5	80°	75°	70°	60°	50°	—	R-502	283	216
6	80°	75°	70°	65°	55°	50°			

SET CUT OUT 5°F BELOW CUT IN

HP	INDIVIDUAL MOTOR FLA		
	208/3/60	230/3/60	460/3/60
3/4	3.5	3.2	1.6
1	4.4	4.0	2.0

TOTAL FLA = NO. OF MOTOR × APPLICABLE MOTOR FLA

C FAN CONTROL

' ALL BANKS OF FANS WITH PRESSURE

'T CYCLING FAN BANK

3LE FAN BANK HACD CONDENSER

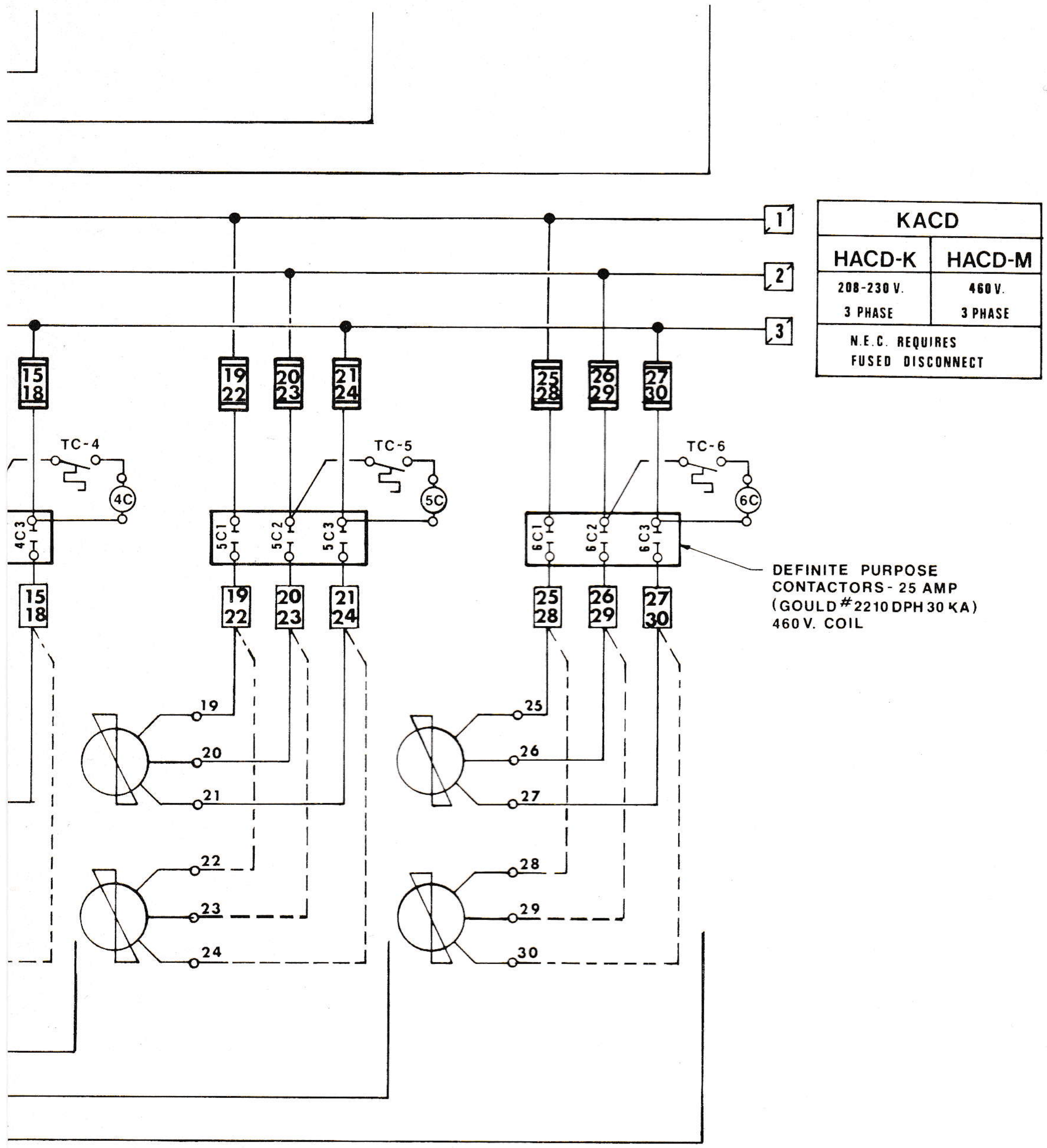


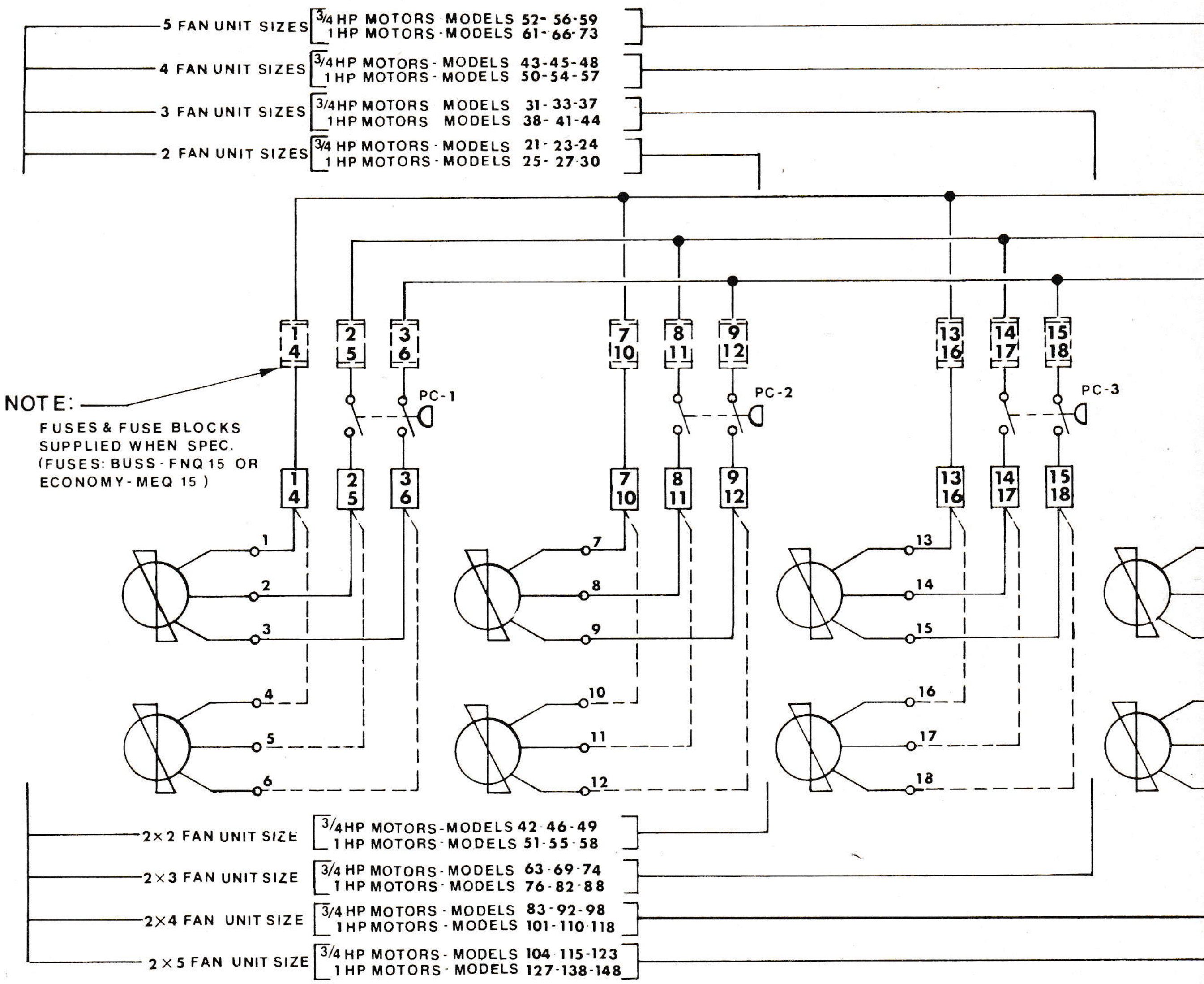
Figure VI-7

P315-260388-B

P315-260394-B

CONTROL "B"

PRESSURE CONTROL AND GRAVITY DAMPERS FC



REPLACEMENT PARTS

PRESSURE CONTROL
PENN # P72-AA-35 OR
RANCO #020-7006

MOTOR (INHERENTLY PROTECTED)
200,230,460/60/3 825 RPM
1 HP. K.CORP. P.N.11503
3/4 HP K.CORP. P.N.11504
30 DIA. FAN BLADES
25° PITCH 3/4 HP K.CORP. P.N.11248
29° PITCH 1 HP. K.CORP. P.N.11247

TERMINAL BLOCK
BUCHANAN HEAVY DUTY #212

TERMINAL BLOCK
BUCHANAN MEDIUM DUTY #514

FUSE HOLDER
BUCHANAN #362

NUMBER OF FANS		CONTROL SETTINGS					
			PRESSURE SWITCH CUT-IN SETTINGS psig				
SINGLE BANK	DOUBLE BANK	REFRIG.	PC-1	PC-2	PC-3	PC-4	PC-5
1	NA	R-12	143	—	—	—	—
		R-22	215	—	—	—	—
		R-502	236	—	—	—	—
2	2×2	R-12	143	152	—	—	—
		R-22	215	247	—	—	—
		R-502	236	270	—	—	—
3	2×3	R-12	143	147	152	—	—
		R-22	215	231	247	—	—
		R-502	236	253	270	—	—
4	2×4	R-12	143	146	149	152	—
		R-22	215	225	236	247	—
		R-502	236	247	259	270	—
5	2×5	R-12	143	145	148	150	152
		R-22	215	223	231	239	247
		R-502	236	244	253	261	270

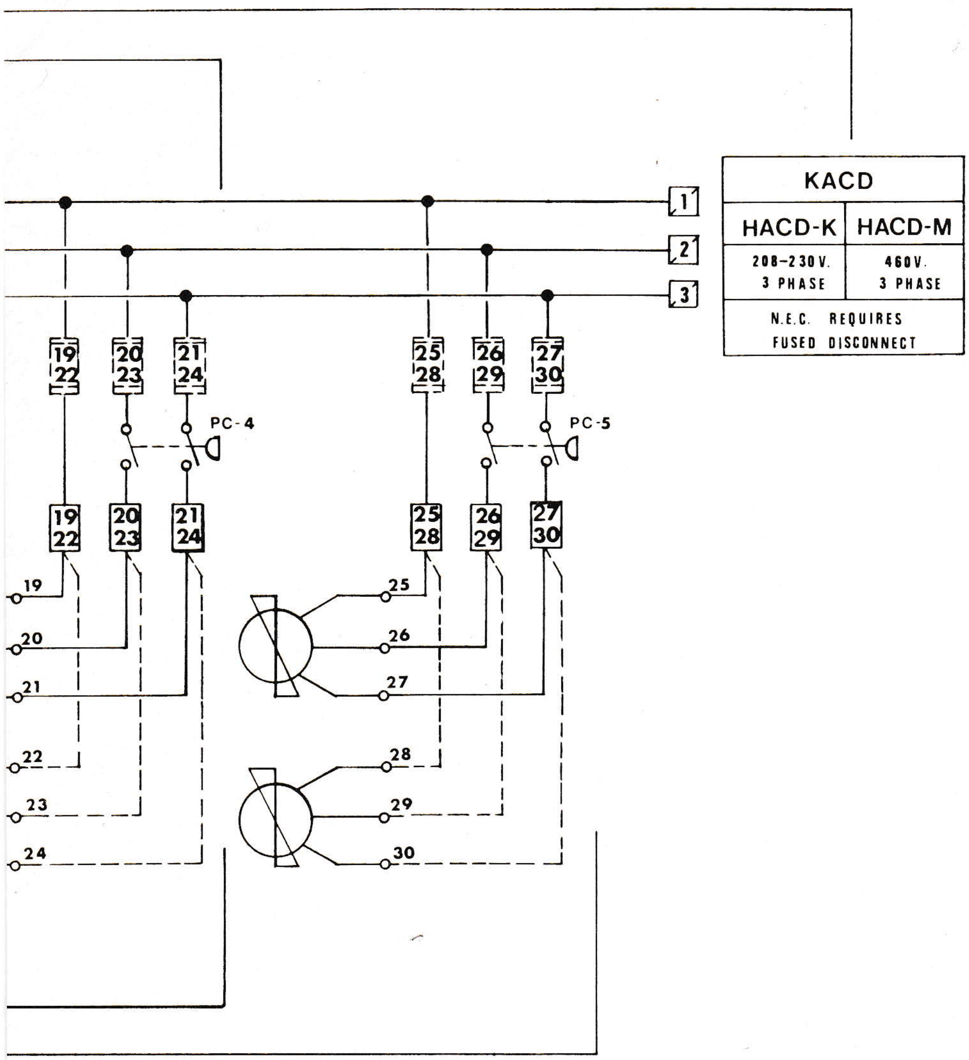
SET CUT-OUT 35 psig BELOW CUT-IN

	I
HP	2
3/4	
1	

TOTAL FL

NOTE: S
D
4,

ALL FANS



IVIDUAL MOTOR FLA		
/3/60	230/3/60	460/3/60
.5	3.2	1.6
.4	4.0	2.0

NO OF MOTORS x APPLICABLE MOTOR FLA

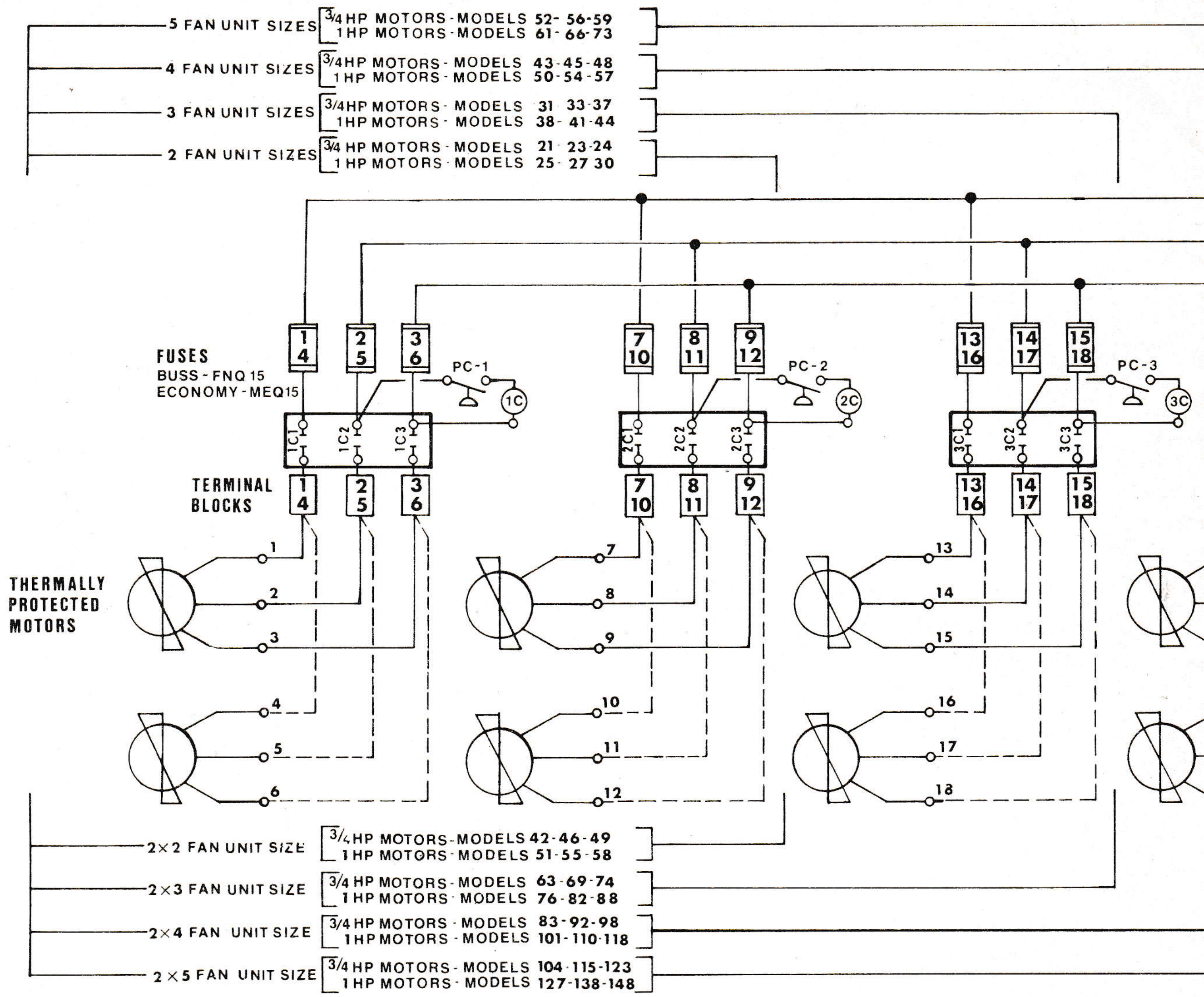
ID LINES REPRESENT WIRING FOR 2,3,4&5 FAN UNITS.
HED LINES REPRESENT ADDITIONAL WIRING FOR
3&10 FAN UNITS.

Figure VI-8

P415-149881-C

CONTROL "B"

PRESSURE CONTROL AND GRAVITY DAMPERS FOR A



REPLACEMENT PARTS

PRESSURE CONTROL
PENN # P70-AA-118

MOTOR (INHERENTLY PROTECTED)
200,230,460/60/3 825 RPM
1 HP. K.CORP. P.N. 11503
3/4 HP. K.CORP. P.N. 11504
30 DIA. FAN BLADES
25° PITCH 3/4 HP K.CORP. P.N. 11248
29° PITCH 1 HP. K.CORP. P.N. 11247

TERMINAL BLOCK
BUCHANAN HEAVY DUTY #212

TERMINAL BLOCK
BUCHANAN MEDIUM DUTY #514

FUSE HOLDER
BUCHANAN #362

NUMBER OF FANS		CONTROL SETTINGS					
			PRESSURE SWITCH CUT-IN SETTINGS psig				
SINGLE BANK	DOUBLE BANK	REFRIG.	PC-1	PC-2	PC-3	PC-4	PC-5
1	NA	R-12	143	—	—	—	—
		R-22	215	—	—	—	—
		R-502	236	—	—	—	—
2	2×2	R-12	143	152	—	—	—
		R-22	215	247	—	—	—
		R-502	236	270	—	—	—
3	2×3	R-12	143	147	152	—	—
		R-22	215	231	247	—	—
		R-502	236	253	270	—	—
4	2×4	R-12	143	146	149	152	—
		R-22	215	225	236	247	—
		R-502	236	247	259	270	—
5	2×5	R-12	143	145	148	150	152
		R-22	215	223	231	239	247
		R-502	236	244	253	261	270

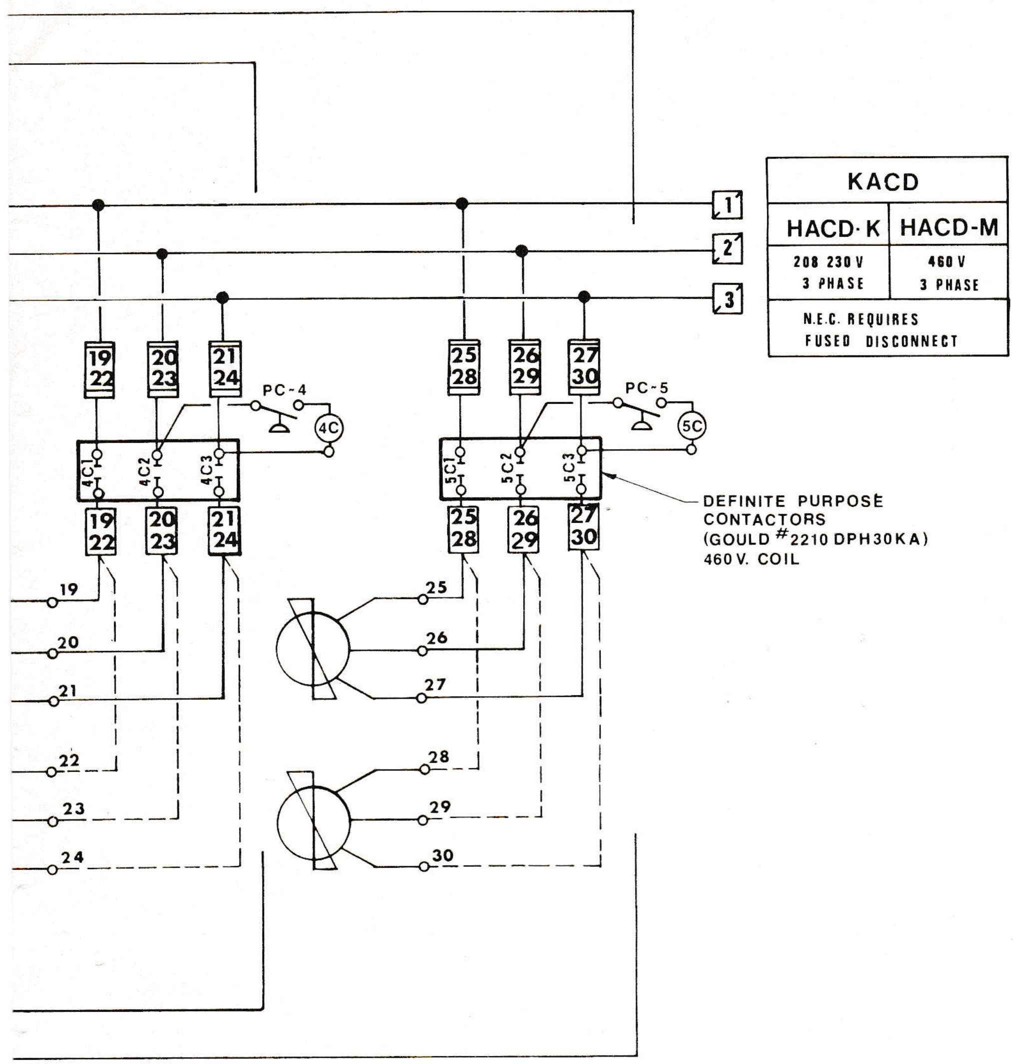
SET CUT-OUT 35 psig BELOW CUT-IN

HP
3/4
1

TOTAL

NOTE:

.L FANS



INDIVIDUAL MOTOR FLA		
208/3/60	230/3/60	460/3/60
3.5	3.2	1.6
4.4	4.0	2.0

.A- NO. OF MOTORS x APPLICABLE MOTOR FLA

;OLID LINES REPRESENT WIRING FOR 2,3,4&5 FAN UNITS.
)ASHED LINES REPRESENT ADDITIONAL WIRING FOR
,6,8&10 FAN UNITS.

Figure VI- 9

P315-260395-B

WATER COOLED CONDENSERS

LOCATION

The shell and tube condensers are normally located near the machine room. Each condenser must be elevated to insure proper drainage. The condenser condensate outlet must be elevated to a minimum of one foot above the liquid inlet valve to the receiver tank. The condenser comes with saddles to facilitate frame mounting.

LEVELING

The water cooled condensers require lengthwise leveling.

LAGGING

Mounting and lagging will be the responsibility of the installing contractor.

REFRIGERANT PIPING

Figure VI-7 shows a typical refrigeration piping for a water cooled condenser. Refer to manufacturer's installation instructions for proper line sizing and water piping requirements.

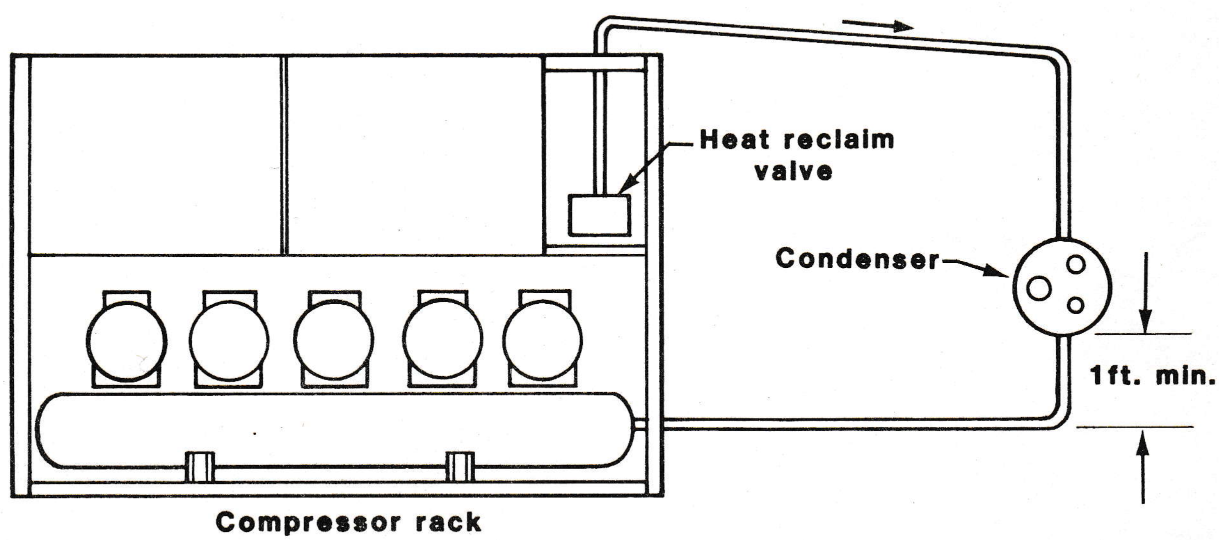


Figure VI-7
Elevation and Refrigerant Piping
for Water Cooled Condensers

Discharge and condensate lines must be free of any traps. Discharge lines must be pitched toward the condenser. Condensate lines must be pitched toward the receiver.

EVAPORATIVE WATER COOLERS AND CONDENSERS

The use of evaporative condensers is specified on the store legend when applied. They are shipped directly to the job site by the manufacturer.

Refer to specific manufacturer's instructions for the installation of these components. See legend for manufacturer and model number.

REMOTE SATELLITE INSTALLATION

Section VII	Page
General Description	VII-1
Location	VII-2
Satellite Interconnecting Piping	VII-2
Suction Line	VII-2
Discharge Line	VII-2
Oil Supply Line	VII-3
Electrical	VII-3
Wiring Diagram	VII-4
Service Tips	VII-7
Suction Filter Replacement Chart	VII-7

VII REMOTE SATELLITE

REMOTE SATELLITE INSTALLATION

GENERAL DESCRIPTION

The following refers only to Satellite units not located on the compressor rack. For Satellites mounted on the unit see "Compressor Installation" section.

The remote Satellite is a separate compressor unit that uses the same source of refrigerant as the main compressor unit. Satellites are available for both medium and low temperature applications.

Within a given temperature range Satellites can be classified as either low end or high end Satellites.

Low End Satellite - By using a Satellite to handle the lowest temperature refrigerators, Plus IV operates at a higher, more efficient suction pressure. Should the Satellite fail, the main compressor unit operates the evaporators connected to the Satellite.

High End Satellite - A high end Satellite operates the warmest refrigerators connected to the compressor system. A Satellite applied in this manner provides more efficient operation of the warmest refrigerators and reduces the required capacity of the main compressor unit. Also, when a high end Satellite is used instead of a separate HR unit, the need for a separate condenser circuit is eliminated, permitting Condenser Control - B to be applied to the condenser.

Table VII-1
Compressor Models

Low Temperature		Medium Temperature		
HRN, HRT* Model	Copeland Compressor	HRN, HRT* Model		Copeland Compressor
R502		R22	R502	
535RL	MRS-0500	202VS	205RS	ERC-0200
545RL	MRB-0500	302VS	305RS	ERF-0310
600RL	9RJ-0760	402VS	405RS	3RA-0310
765RL	9RB-0760	502VS	505RS	NRA-0500
770RL	9RS-0760	602VS	605RS	NRM-0500
1030RL	4RA-1000	702VS	705RS	MRH-0760
1402RL	4RL-1500	802VS	805RS	9RA-0760
1502RL	6RA-2000	1002VS	1005RS	9RC-1010
2102RL	6RL-2500	1502VS	1505RS	9RS-1500
			2005RS	4RA-2000
			2505RS	4RH-2500

*HRT Satellites have 208-230 volt pilot circuits and should be interconnected with the compressor unit control panel. HRN Satellites have 120 volt circuits for interconnection with the header defrost assembly control panel.

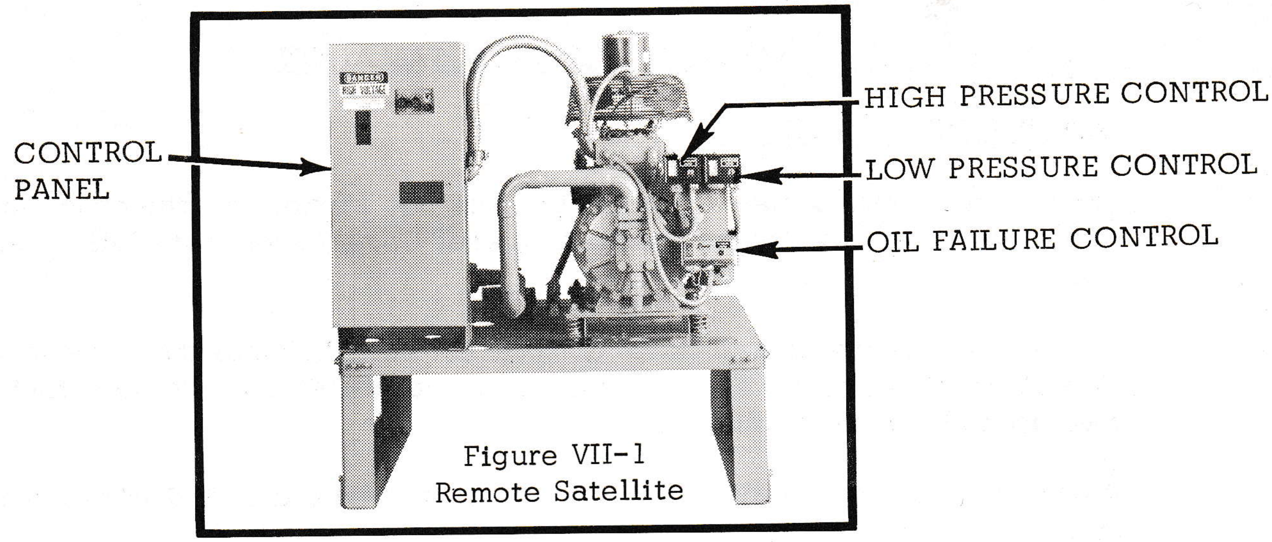


Figure VII-1
Remote Satellite

LOCATION

Locate the Satellite as close as possible to the compressor unit (or header defrost assembly if so equipped). The suction line from the Satellite to its branch on the suction manifold must not exceed 50 equivalent feet.

To insure sufficient oil being fed to the Satellite, high end Satellites must be located on the same plane as the main compressor unit. Low end Satellites, however, may be located up to 10 feet above the compressor unit.

NOTE: Satellite units are shipped with the compressor pulled down on shipping blocks. Turn the mounting spring nuts one full turn counterclockwise. The blocks can then be removed and the spring adjustment is correct. Do this before piping the unit.

SATELLITE INTERCONNECTING PIPING

Suction Line - For low end units run piping from the suction filter on the Satellite unit to the stub marked "Satellite Suction" on the suction manifold. For high end units run piping from the suction filter on the Satellite unit directly to the evaporator.

Discharge Line - Run piping from the discharge stub on the Satellite unit to the stub marked "Satellite Discharge" on the discharge header of the main compressor unit. If there is more than one Satellite, construct a tee at this connection. Do not bullhead the tee in the discharge line. See Figure VII-2.

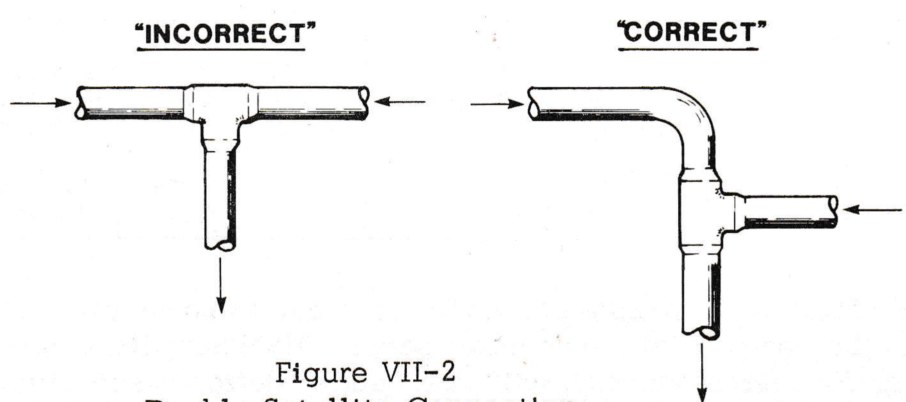


Figure VII-2
Double Satellite Connection

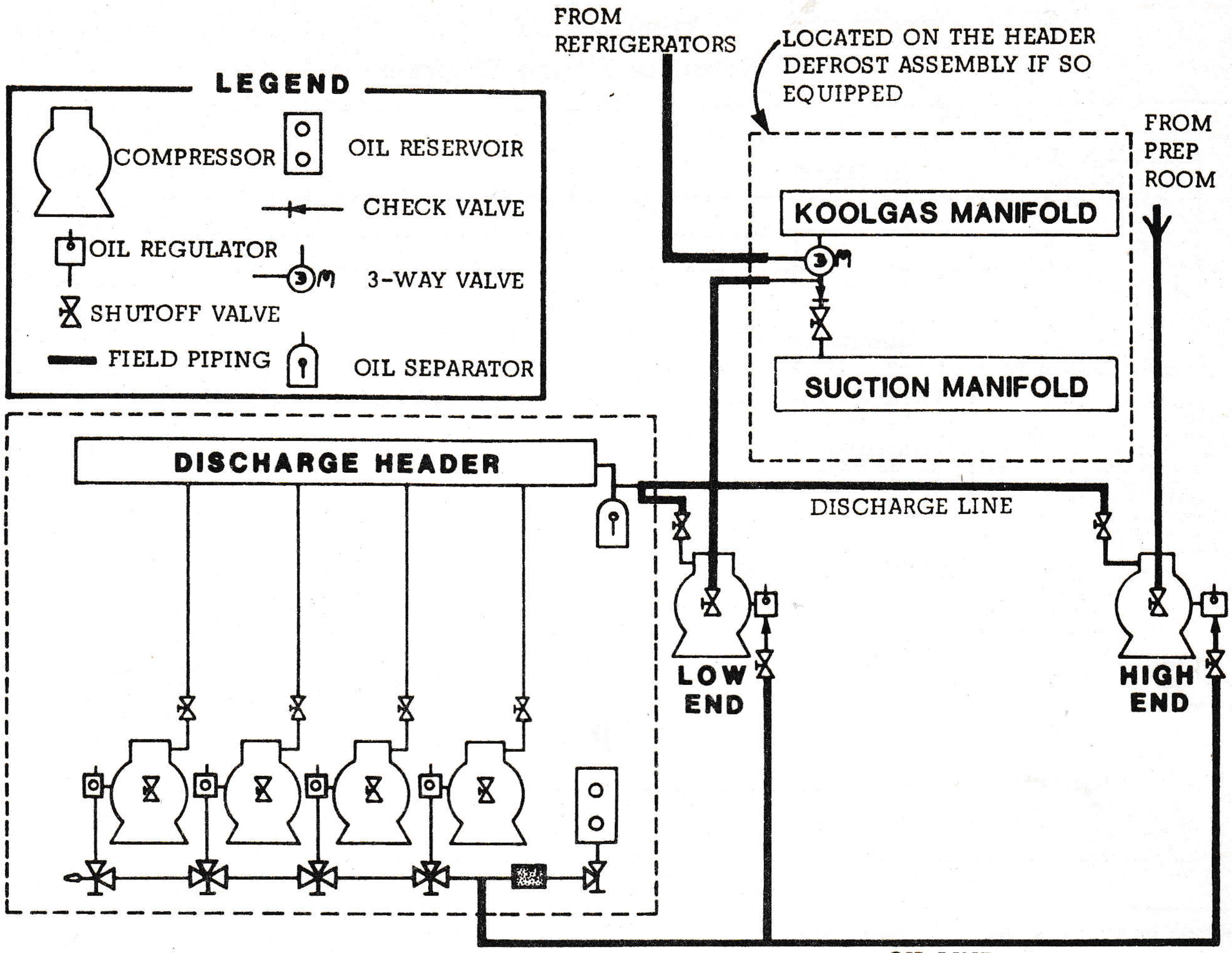


Figure VII-3
Satellite Refrigeration

<u>Oil Supply Line</u> - Run a 3/8" OD line from the oil level regulator on the Satellite unit to the oil supply line connection on the main compressor unit. Provide a vibration loop between the oil regulator inlet and the point where the oil line clamps to the base. Use two clamps to secure the line to the base.

If the oil line is to be run across a walkway, it should be protected with a cover plate securely fastened to the floor. Both sides of the cover plate should taper to the floor to prevent tripping. For low end Satellites, this line can be run up to 10 feet above its connection on the main compressor unit. The oil line for high end Satellites must not be raised above its connection stub.

<u>ELECTRICAL</u>

Figure VII-4 (HRT), Figure VII-5 (HRT with alarm), and Figure VII-6 (HRN) indicate the field connections required for the Satellite compressor and control circuits.

The 208-230/3/60 or 460/3/60 branch circuit powering the compressor <u>cannot</u> be run from the Plus IV control panel.

The control circuit, however, must be interconnected with the Plus IV (or defrost) control panel as noted in the pertinent wiring diagram.

Figure VII-4
HRT Satellite Wiring Diagram

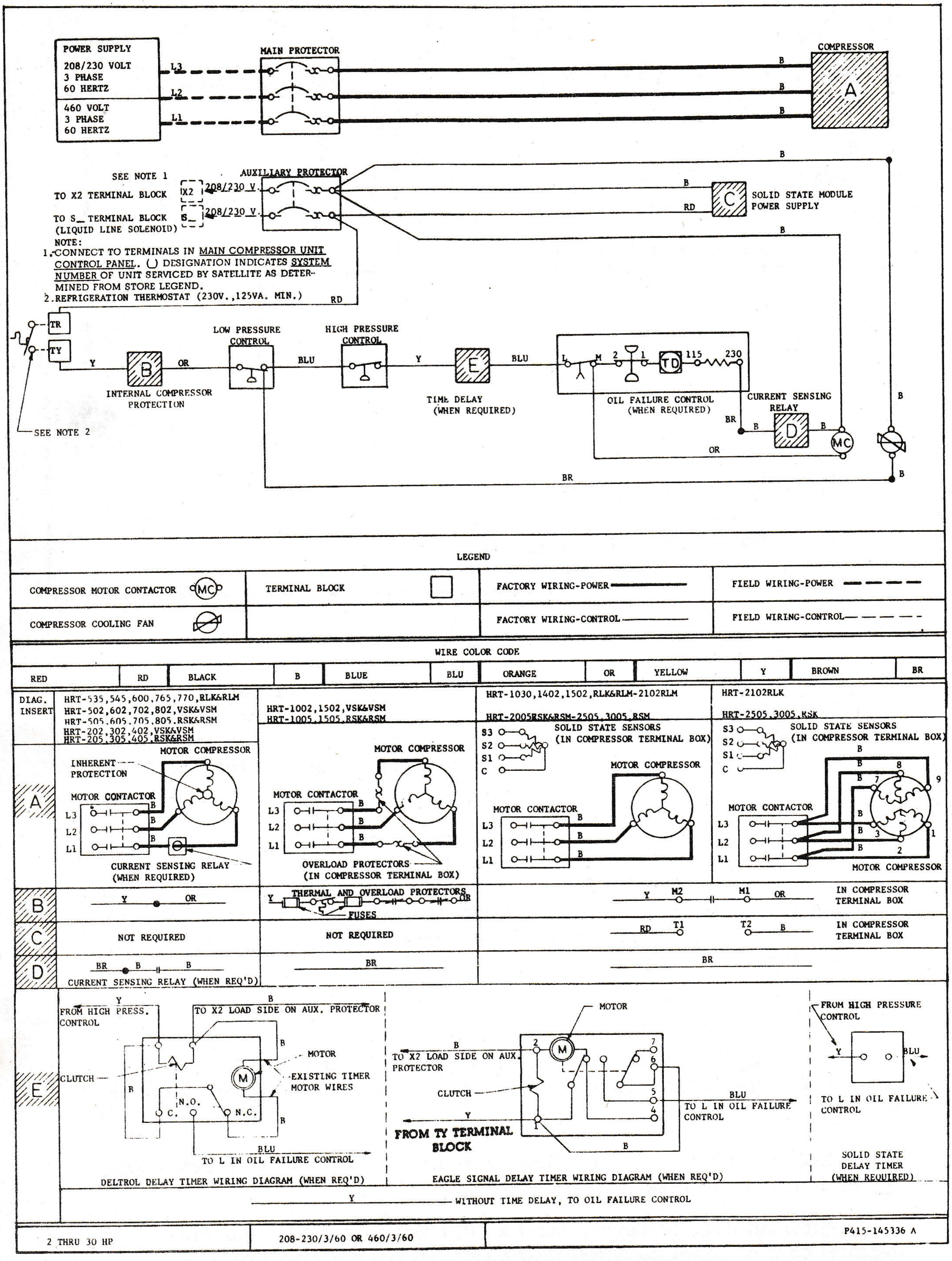
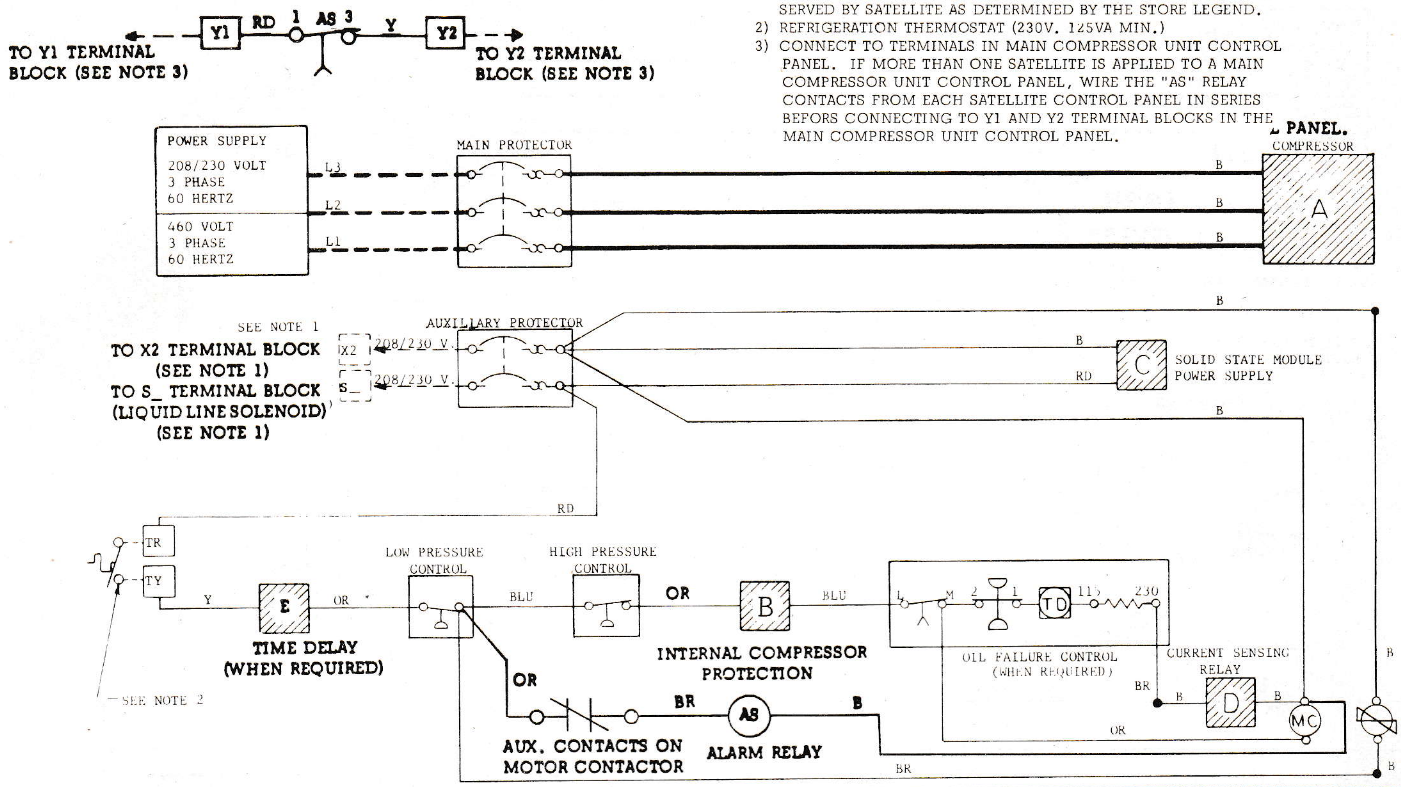


Figure VII-5
HRT With Alarm

NOTES:

1) CONNECT TO TERMINALS IN MAIN COMPRESSOR UNIT CONTROL PANEL. (-) DESIGNATION INDICATES SYSTEM NUMBER OF UNIT SERVED BY SATELLITE AS DETERMINED BY THE STORE LEGEND.
2) REFRIGERATION THERMOSTAT (230V. 125VA MIN.)
3) CONNECT TO TERMINALS IN MAIN COMPRESSOR UNIT CONTROL PANEL. IF MORE THAN ONE SATELLITE IS APPLIED TO A MAIN COMPRESSOR UNIT CONTROL PANEL, WIRE THE "AS" RELAY CONTACTS FROM EACH SATELLITE CONTROL PANEL IN SERIES BEFORS CONNECTING TO Y1 AND Y2 TERMINAL BLOCKS IN THE MAIN COMPRESSOR UNIT CONTROL PANEL.

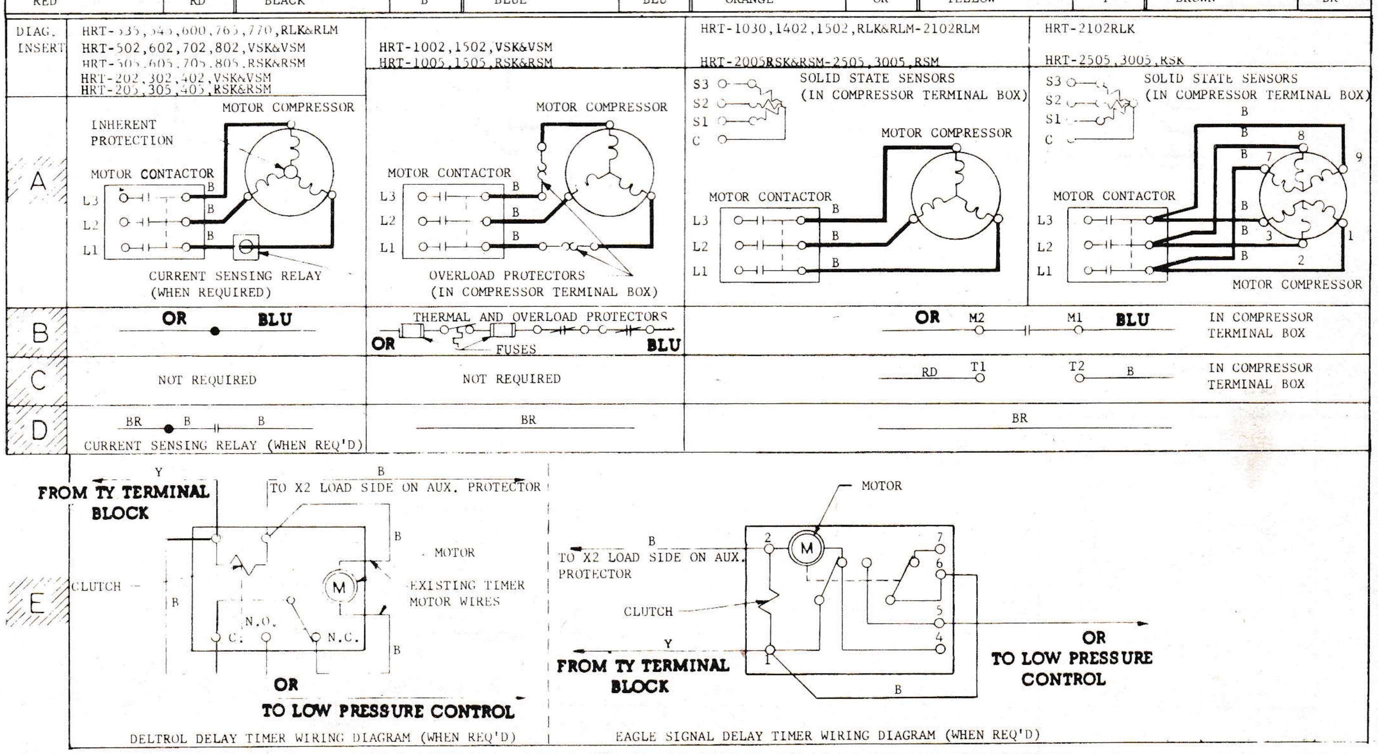


LEGEND

COMPRESSOR MOTOR CONTACTOR (MC)	TERMINAL BLOCK □	FACTORY WIRING-POWER ———	FIELD WIRING-POWER — — —
COMPRESSOR COOLING FAN		FACTORY WIRING-CONTROL ———	FIELD WIRING-CONTROL — — —

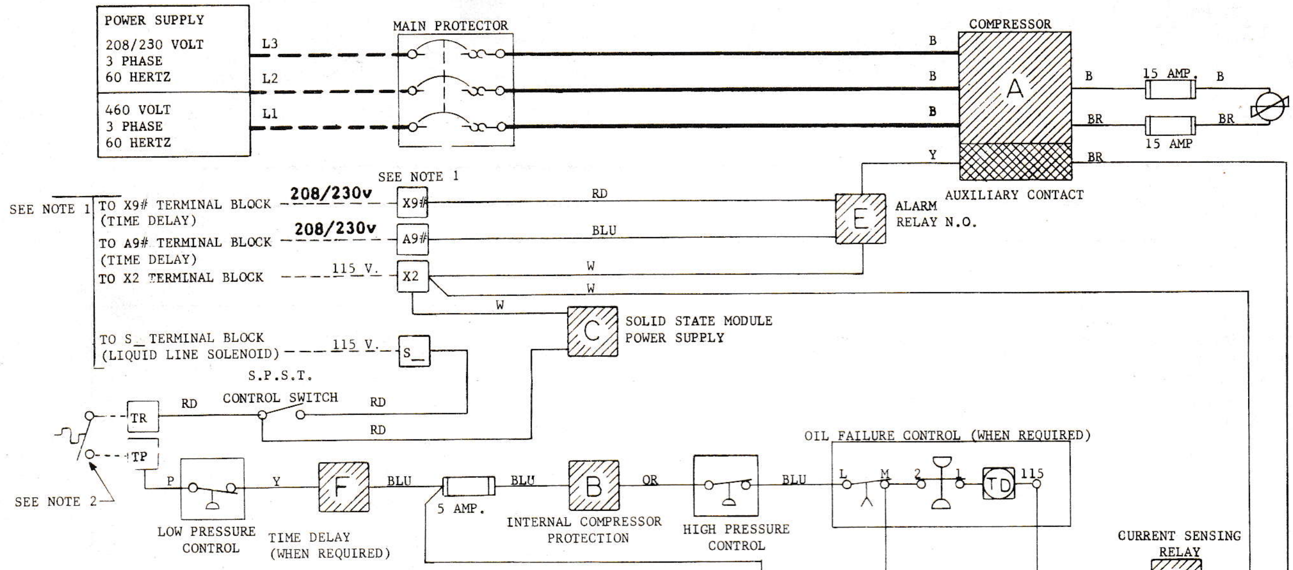
WIRE COLOR CODE

RED	RD	BLACK	B	BLUE	BLU	ORANGE	OR	YELLOW	Y	BROWN	BR



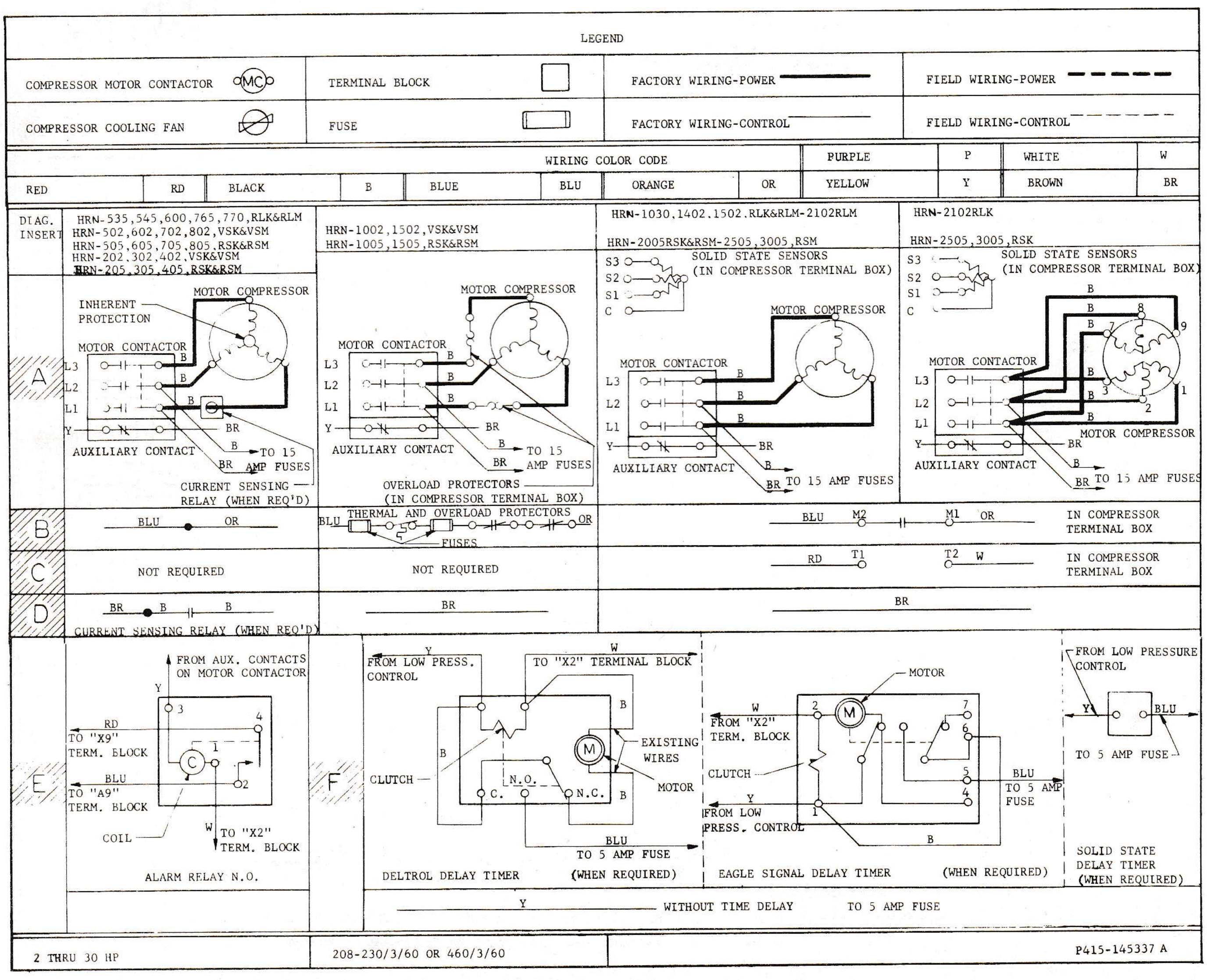
Y ——— WITHOUT TIME DELAY, **TO LOW PRESSURE CONTROL**

Figure VII-6
HRN Satellite Wiring Diagram - Copeland



NOTES:

1. CONNECT TO CORRESPONDING TERMINALS IN THE SYSTEM IV DEFROST CONTROL PANEL. (#) DESIGNATION INDICATES LETTER OF UNIT SERVED BY SATELLITE AS DETERMINED FROM STORE LEGEND. ( ) DESIGNATION INDICATES SYSTEM NUMBER OF UNIT SERVED BY SATELLITE AS DETERMINED FROM STORE LEGEND.
2. REFRIGERATION THERMOSTAT (230V, 125VA MIN.)



SERVICE TIPS

Table VII-2
Suction Filter Replacement Chart for Satellites

COPELAND COMPRESSORS					
HRT or HRN Model		Suction Filter Replacement	HRT or HRN Model		Suction Filter Replacement
R12	R502		R22	R502	
300FS		Superior F 25			
500FS	535RL	Henry 848-CF or Sporlan RFE-48-BD	202VS	205RS	Superior F 25
520FS	545RL		302VS	305RS	
550FS	600RL		402VS	405RS	
750FS	765RL		502VS	505RS	
760FS	770RL		602VS	605RS	
1000FS	1030RL		702VS	705RS	Henry 848-CF or Sporlan RFE- 48-BD
			802VS	805RS	
	1402RL		1002VS	1005RS	
	1502RL		1502VS	1505RS	
	2102RL				
				2005RS	
				2505RS	

DEFROST CONTROL PROGRAM TIMER

Section VIII — Page

General Description -- VIII-1
Components of Precision Brand ------------------------------ VIII-1
Program Timers -- VIII-1
Cycle Timers -- VIII-1
Time Index Dial --------------------------------------- VIII-1
Instructions for Setting ---------------------------------- VIII-3
Defrost Control Program Timer Alarm Switch ----------------- VIII-5
General Description of Paragon Brand ----------------------- VIII-6
Setting the Timer ------------------------------------- VIII-7
Replacing Program Modules ---------------------------- VIII-8
Replacing the Motor Module --------------------------- VIII-9

VIII DEFROST TIMER

DEFROST CONTROL PROGRAM TIMER (PRECISION AND PARAGON BRANDS)

GENERAL DESCRIPTION

The time clock used with Plus IV controls the entire defrost operation. Defrost systems lasting 120 minutes or less are controlled by this clock. Circuits that require more than 120 minutes are controlled by supplemental time clocks.

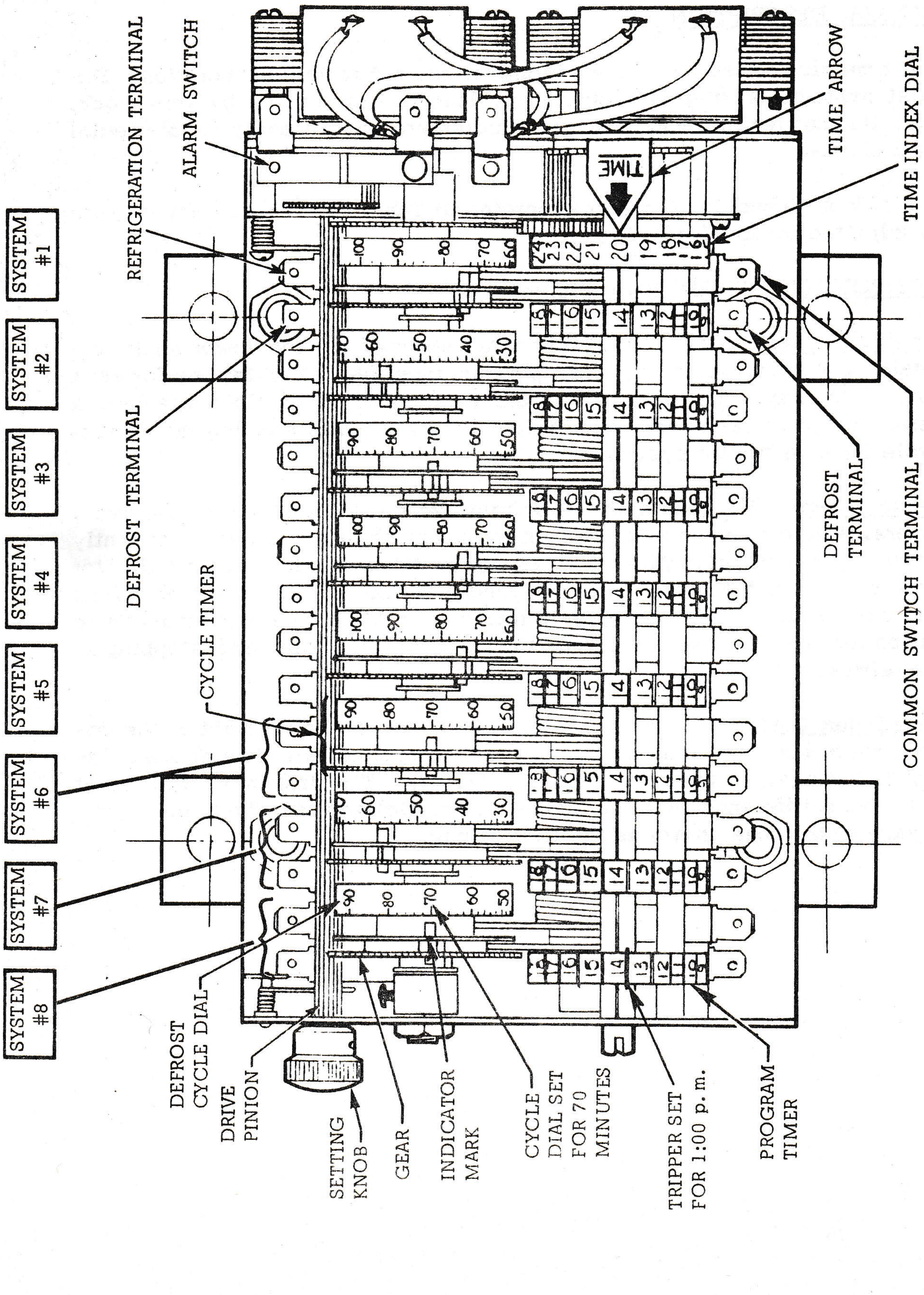
The defrost schedule is preset according to Table XII-12, but may have to be adjusted for local conditions.

COMPONENTS OF PRECISION BRAND

Program Timers - The program timers are mounted on the lower shaft and rotate once every 24 hours. Each program timer has 24 slots, one for each hour of the day. A tripper is inserted into one of these slots whenever a defrost cycle is called for. The tripper throws a switch starting the defrost cycle for a particular system.

Cycle Timers - The length of the defrost cycle is determined by the cycle timers. Cycle timers are located on the upper shaft and are independently driven by a long drive pinion. Each cycle timer consists of an indicator mark and a dial that determines the length of the defrost, adjustable from 2 to 120 minutes. The cycle dials rotate only when a defrost schedule is called for, making one revolution for each defrost cycle, and stopping in the refrigeration position.

Time Index Dial - The time index dial is located at the far right of the defrost control program timer and is set for the approximate time of day. The dial is set against the pointer marked "TIME." The time index dial is set at a 6 hour difference from the program timer dials so that the trippers will engage at the time shown as the time of day.



Defrost Control Program Timer
Figure VIII-1

INSTRUCTIONS FOR SETTING THE DEFROST CONTROL PROGRAM TIMER

To Set the Program Timer - Install the trippers as follows:

1. Determine the time or times of day each system is to go into defrost.

2. Turn the setting knob, causing the program timer shaft to turn. As the desired slots in the program timer become accessible, install trippers in these slots. Continue until the desired program is set up.

   The slot for each tripper is located immediately above the number on the program timer.

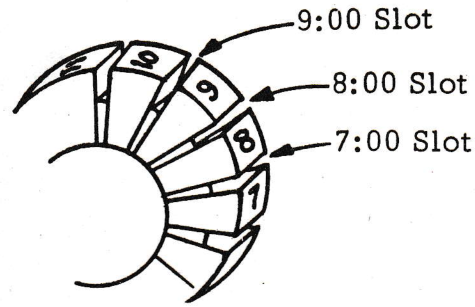


Figure VIII-2
Program Timer Dial

To install a tripper, push straight in until it is felt to snap over its holding detent. A properly installed tripper has its shoulders extending 1/32 inch outside the program timer dial. When the tripper is installed, make sure it is extending straight out from the dial. A badly cocked tripper could cause jamming of the mechanism.

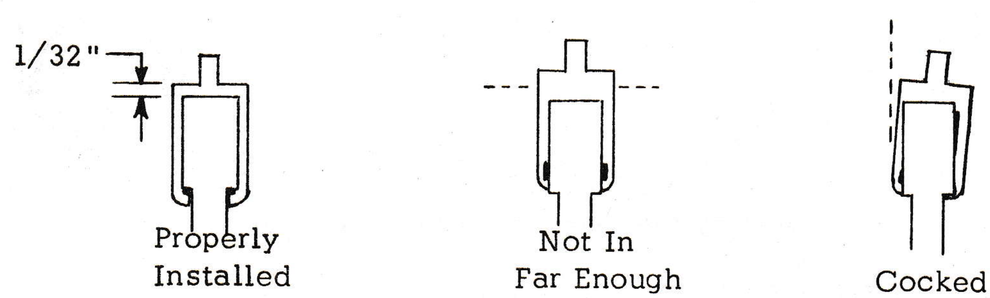


Figure VIII-3
Tripper Installation

Precision Brand (cont'd.)

To Set the Cycle Timers - Adjust as follows:

1. Turn the setting knob clockwise until the indicator mark is facing forward and the cycle dial stops turning.

   WARNING: FAILURE TO HAVE THE INDICATOR MARKS VISIBLE BEFORE ADJUSTMENT MAY CAUSE DAMAGE TO THE CLOCK.

2. Insert the tool in the cycle dial as shown in Figure VIII-4.

   Hold the cycle timer from rotating by grasping the cycle timer gear. Then using the tool, turn the cycle dial until the desired time is opposite the indicator mark.

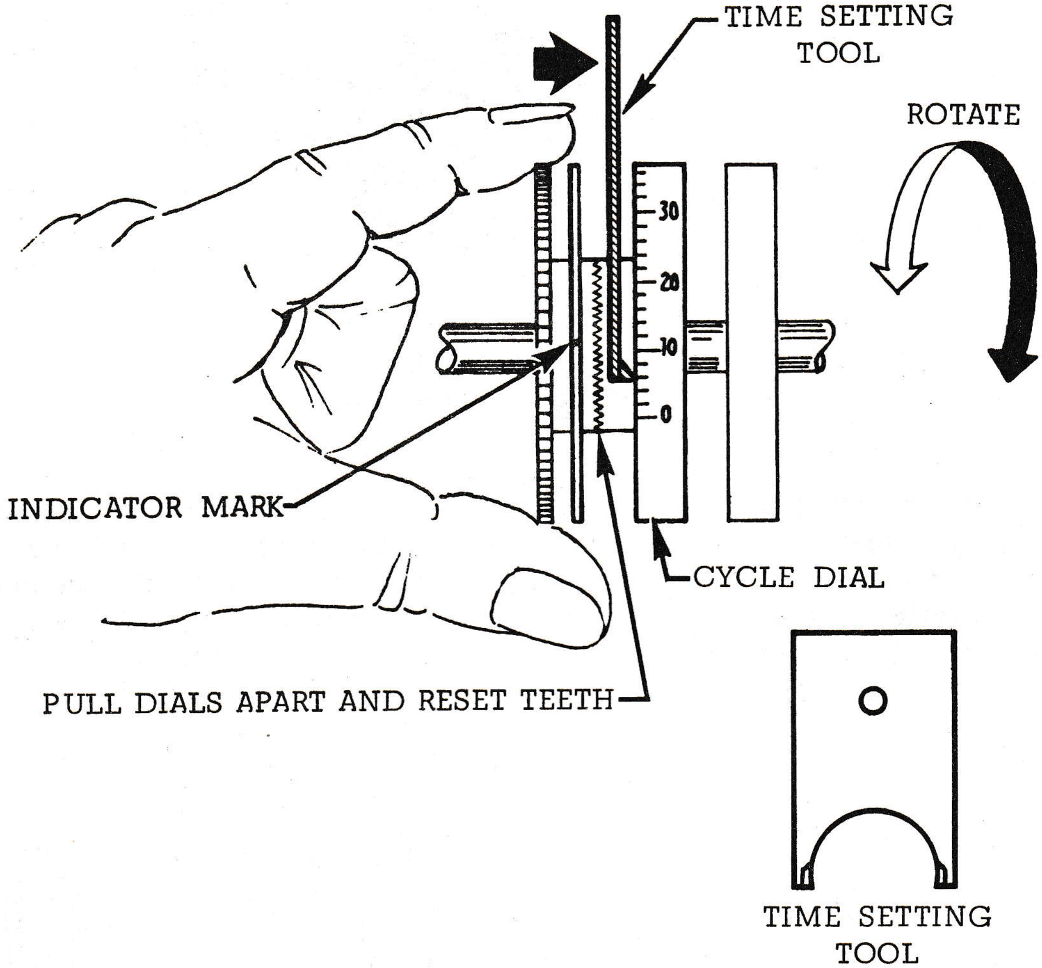


Figure VIII-4
Setting the Defrost Cycle Timer

To Set the Time Index Dial - Adjust as follows:

1. Turn the setting knob until the correct time of day is indicated by the arrow and the number on the time index dial. See Figure VIII-5.

Precision Brand (cont'd.)

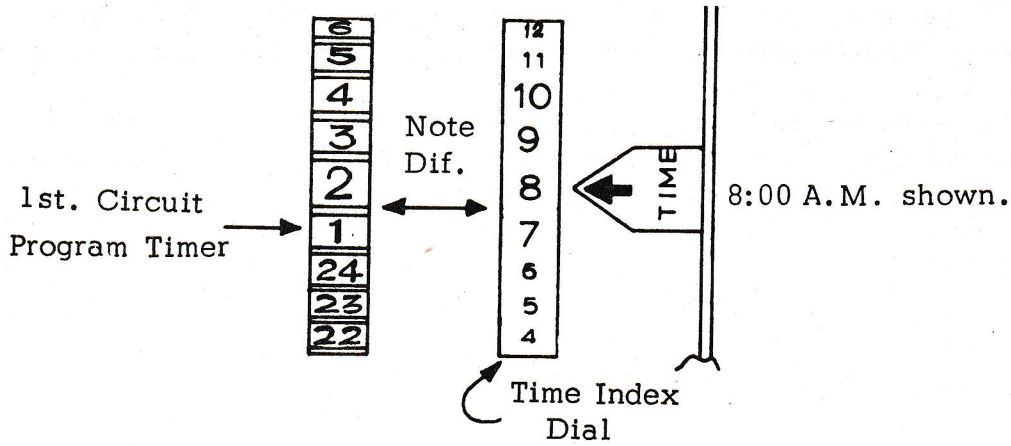


Figure VIII-5
Setting the Time Index Dial

DEFROST CONTROL PROGRAM TIMER ALARM SWITCH

The program timer is provided with two motors and an alarm switch which is normally open. Both motors operate continuously. If one motor fails, the other motor will continue to drive the timer. The alarm switch will close, however, giving warning that the timer requires service.

To reset the alarm switch:

1. Push gear B toward the motor before attempting to reset the lever or part A will be broken.

2. Use a non-metallic object to depress the plastic cam arm until it snaps into position and separates the alarm switch contact points.

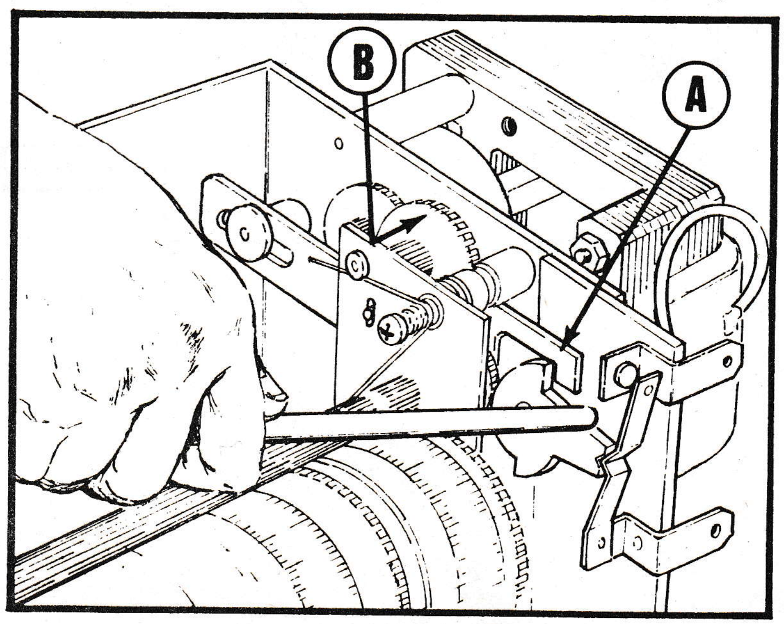


Figure VIII-6
Resetting Alarm Switch

GENERAL DESCRIPTION OF PARAGON BRAND

The Paragon timer is composed of three basic components; a frame, a drive motor module, and as many program modules as there are defrost systems.

There are two basic types of program modules: those which initiate defrosts on the even hours of the day and those which initiate defrosts on the odd hours. These modules are staggered in the frame so every other one is identical. Motor and program modules are removable.

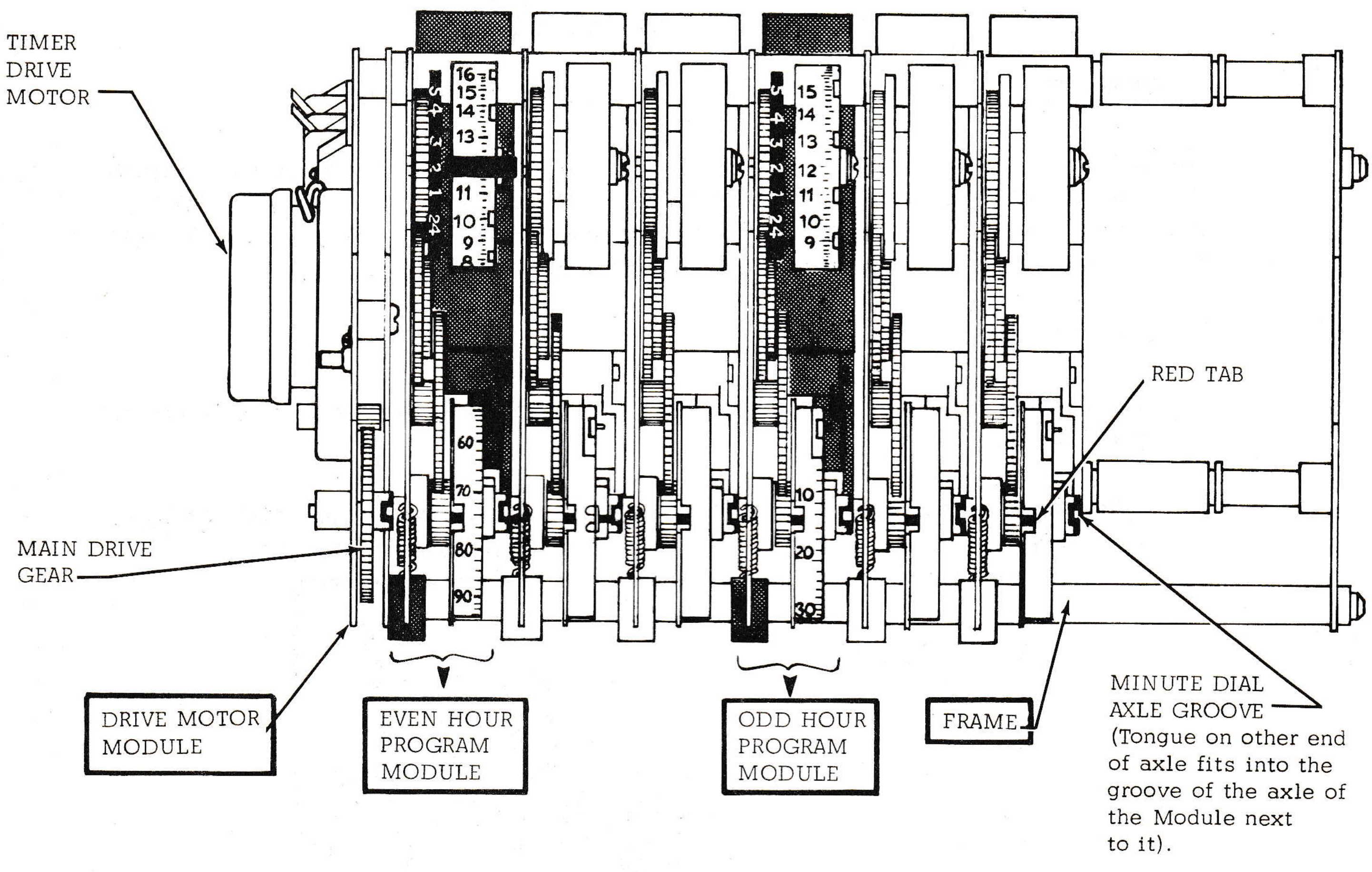


Figure VIII-7
Paragon Program Timer

Paragon Brand (cont'd.)

SETTING THE TIMER

To Set the Time for Defrost - Insert the black tripper into the slot in the 24 hour dial at the time of day defrost is desired. (Hours p.m. are represented by numbers 13 through 24.)

To Set Length of Defrost (or Fail-Safe Setting with Temperature Termination) - Rotate the copper termination lever of the minute dial to the desired number of minutes. Be careful not to bend this lever any further than is necessary to disengage it from the dial teeth. Do not move the red tab.

To Set the Time of Day - Rotate the main drive gear with an upward push of the thumb until the correct hour on the time of day dials aligns with the pointed alignment mark on the modules.

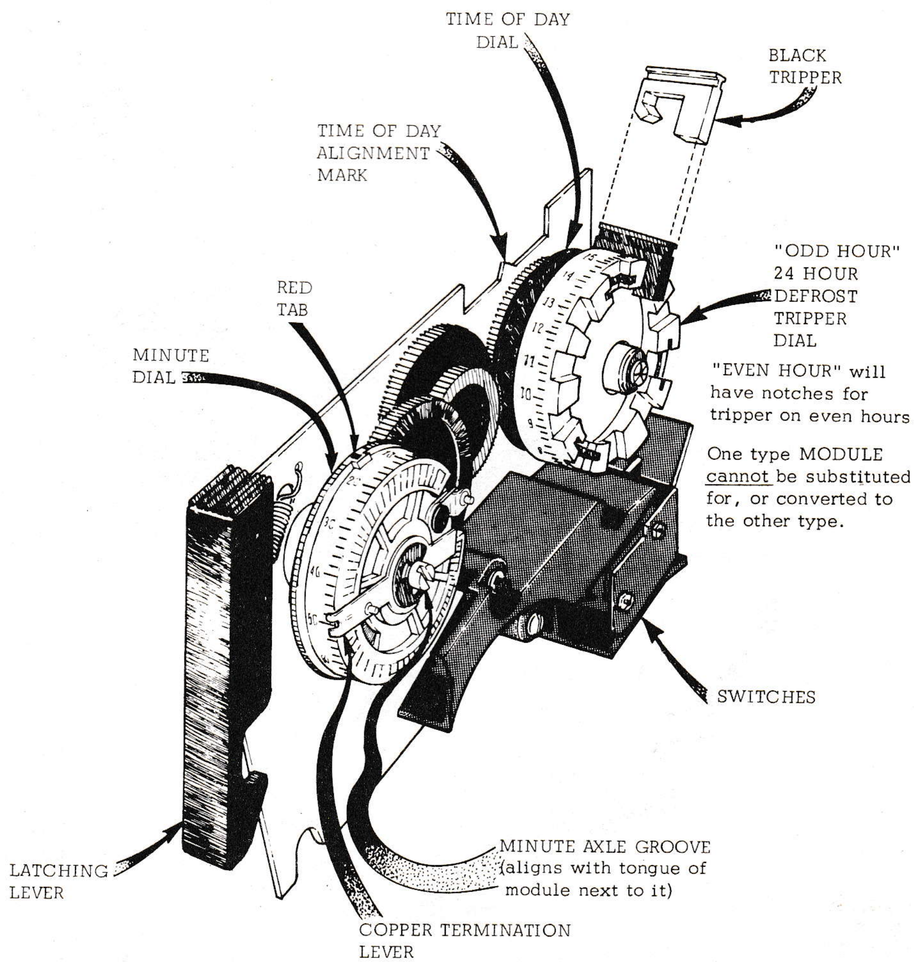


Figure VIII-8
Paragon Timer Program Module

Paragon Brand (cont'd.)

REPLACING PROGRAM MODULES

Removing a Program Module - Turn the control circuit off. Mark wires for identification and disconnect the wires from the switches at the top rear portion of the module. Adjust the timer until the red tabs on the minute dials are in their front most position, then pull the rear portion of the plastic latching lever down to release the module.

Installing a Program Module - Align the 24 hour dials to the same hour and place all red tabs in their front most positions (including the one on the module to be installed. Slip the module into the slotted rod and fit the tongue or groove of the minute dial axle into the mating parts of the adjacent modules. Double check to be sure all red tabs and 24 hour dial numbers line up, and replace the wires to the switches. Reset the time of day and turn on the control circuit.

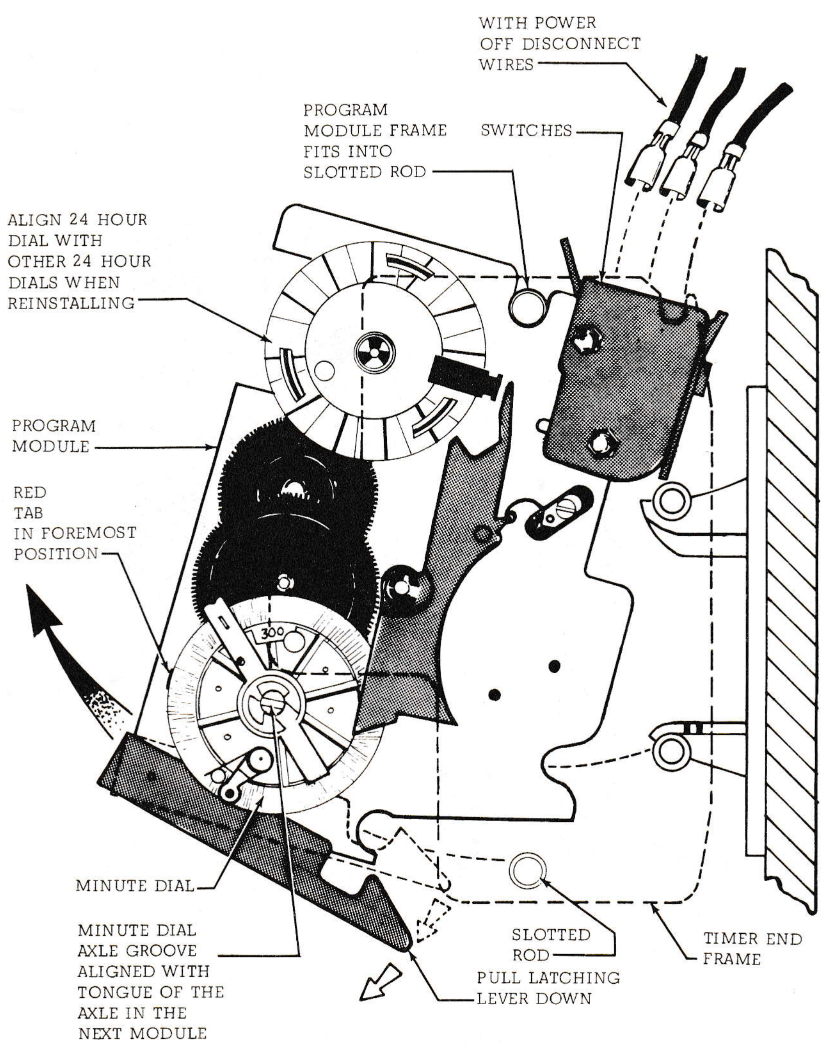


Figure VIII-9
Program Module Removal/Installation

Paragon Brand (cont'd.)

REPLACING THE MOTOR MODULE

1. Turn the control circuit off and disconnect wiring to motor.

2. Rotate the main drive gear until the axle tongues and grooves are vertical.

3. Loosen the hex head bolt on the side of the motor module.

4. Slide the module upward until the three locator studs clear the key slots.

5. Reverse the above for installation of the new motor module.

NOTE: Be sure to check motor voltage requirement before installing.

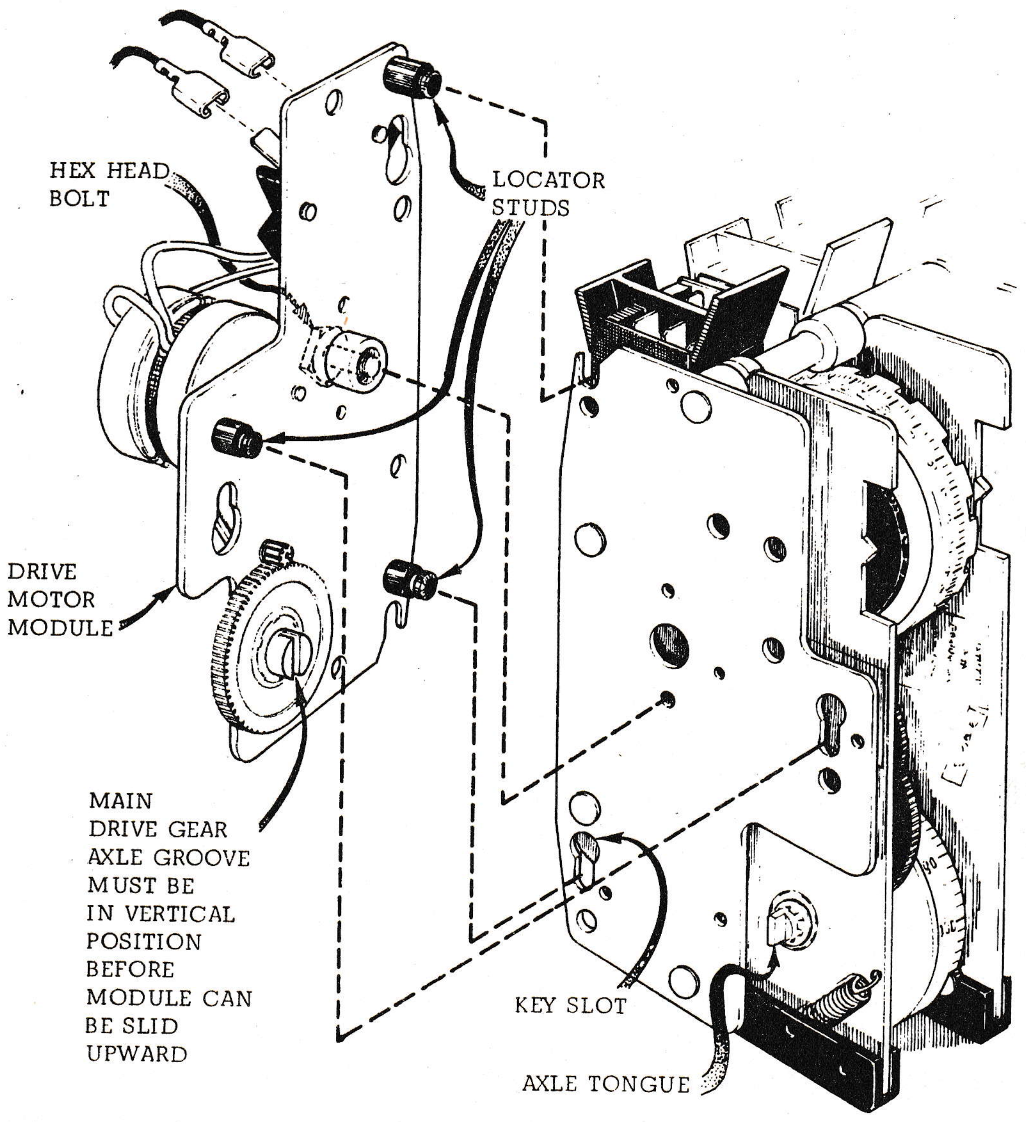


Figure VIII-10
Drive Motor Module Removal

IX ACCESSORIES

ACCESSORIES

Section IX	Page
Installation of the In-store Alarm	IX- 1
Installation of the Remote Alarm	IX- 2
Other Types of Alarm Devices	IX- 3
2-Stage Refrigerant Loss Alarm/Indicator	IX- 4
Alarm Kit Without Heat Reclaim	IX- 5
Alarm Kit With Heat Reclaim	IX- 5
Electrical	IX- 5
Installation of Heat Reclaim	IX- 6
Location of the Heat Reclaim Coil	IX- 6
Heat Reclaim Piping	IX- 6
Heat Reclaim Wiring	IX- 7
Thermostat Specifications	IX- 8
Heat Reclaim Lockout Pressure Control	IX- 8
Service Tips	IX- 9
Servicing Heat Reclaim Valve	IX- 9
Main Valve Body Check	IX- 9
Pilot Assembly Check	IX-10
To Disassemble the Main Valve	IX-10
To Assemble the Main Valve	IX-11
Replacement of Valve	IX-11
Alarm Signal Diagnostic Chart	IX-12

ACCESSORIES

INSTALLATION OF THE IN-STORE ALARM

To install the in-store alarm the following field installed wiring must be run. See Figure IX-1.

1. One alarm bell for alarm system must be field wired at the location desired by the customer. Each bell is 120 volts and connects to terminals "*22" and "*23" in its respective compressor control circuit.

2. An optional in-store light for each alarm system may be installed. The light cannot exceed 300 watts. The light is connected in parallel to the same terminals as the bell, "*22" and "*23."

Should the installer not wish more than one bell or light when interconnecting several Plus IV units, field wire the units according to Figure IX-2. In the event of an alarm, the alarm light mounted on the individual unit control panel will direct the serviceman to the unit on alarm. Since the alarm bell and light are on the same circuit, both will be shutoff by the alarm silencing switch. For the complete wiring diagram see Figure IV-13.

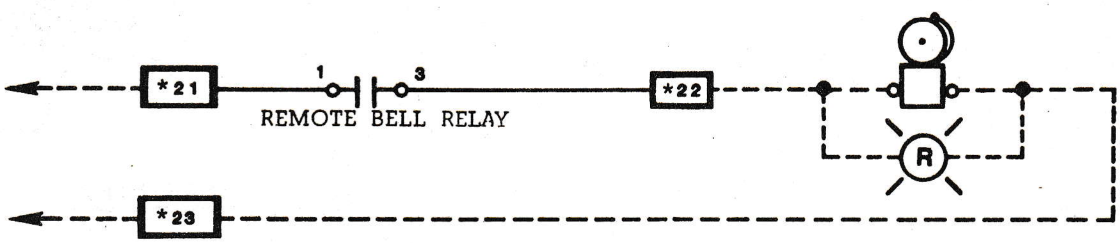
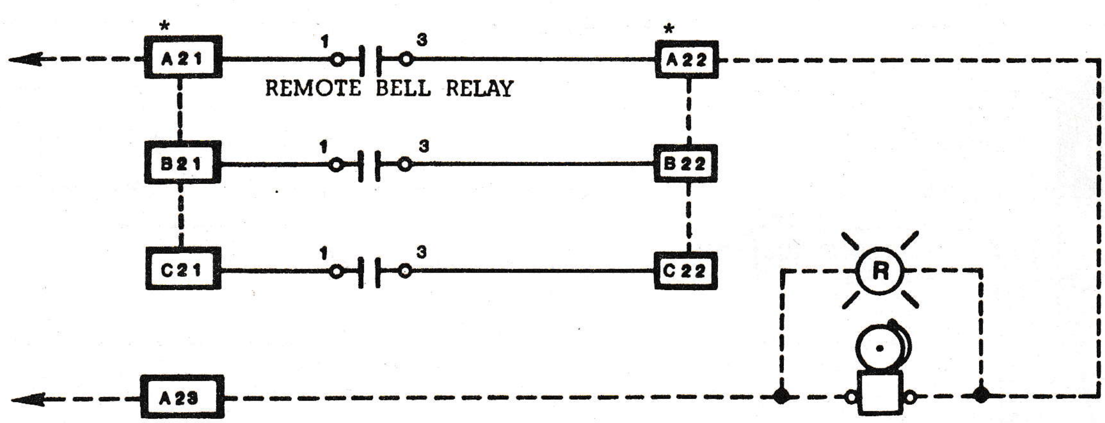


Figure IX-1
Field Wiring Remote Bell or Light



---------- Indicates Field Wiring
* Indicates the Plus IV unit letter on the store legend

Figure IX-2
Alarm Isolation Circuit for Multiple Plus IV Units

INSTALLATION OF HUSSMANN'S REMOTE ALARM

The remote alarm device is offered to signal the loss of 230 volt power and also signal operational problems during periods when the store is closed.

Typical field wiring for Hussmann's Remote Alarm is shown in Figure IX-4.

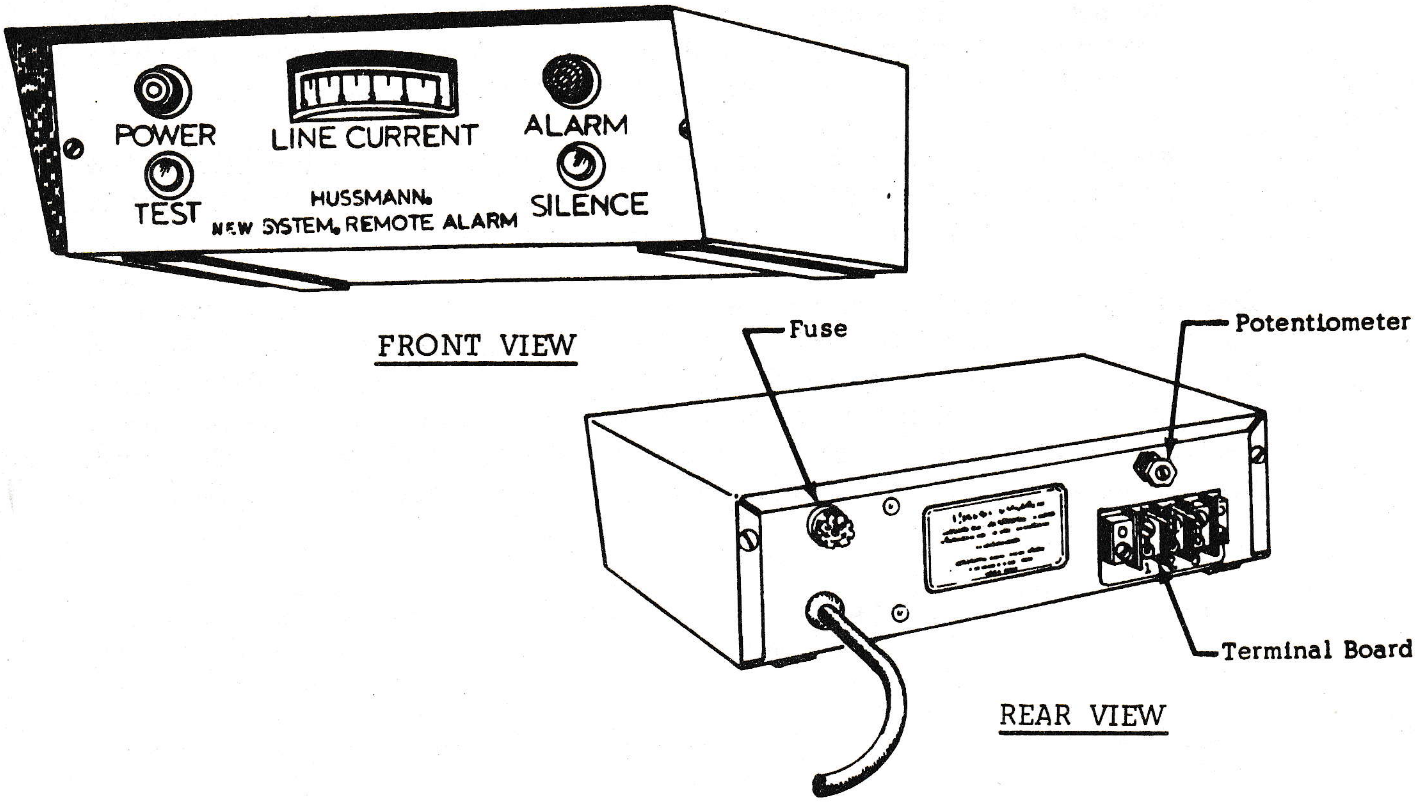


Figure IX-3
Hussmann's Remote Alarm

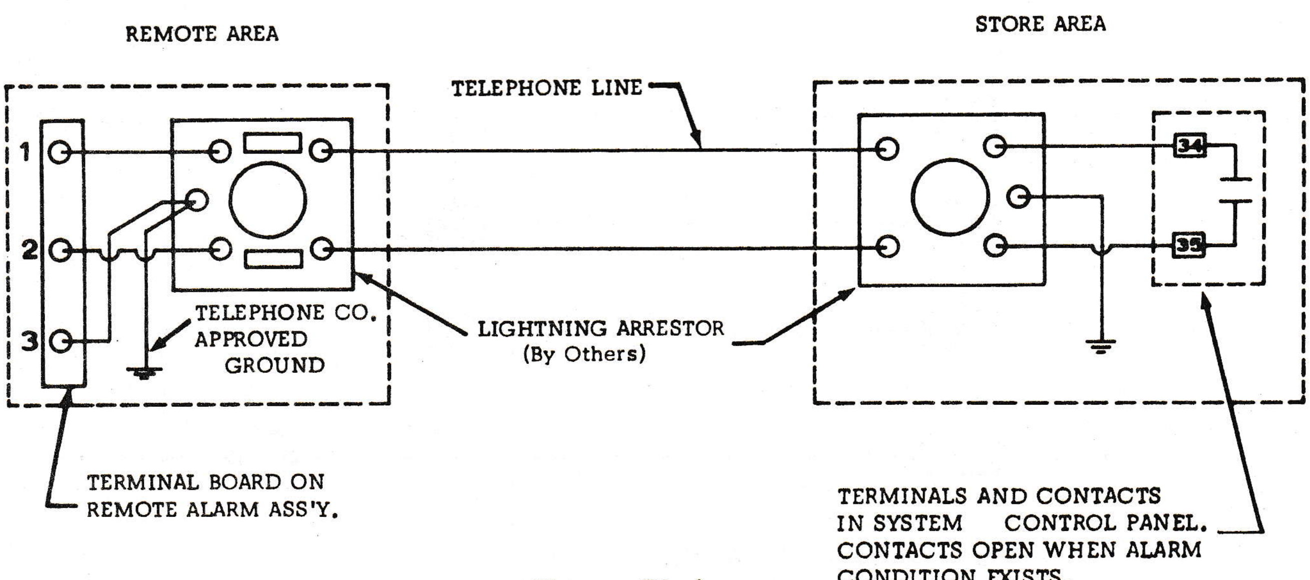


Figure IX-4
Field Wiring for Hussmann's Remote Alarm

OTHER TYPES OF ALARM DEVICES

The in-store alarm is wired to activate other types of alarm equipment. The alarm contains circuitry to activate two types of alarm receivers.

1. Terminals "34" and "36" will close a pair of contacts when an alarm condition is sensed.

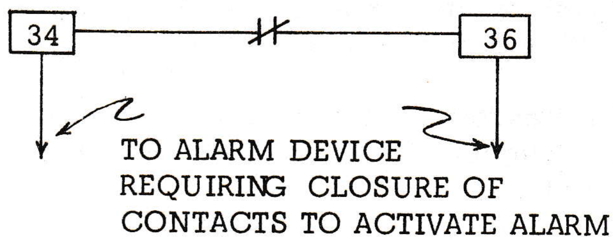
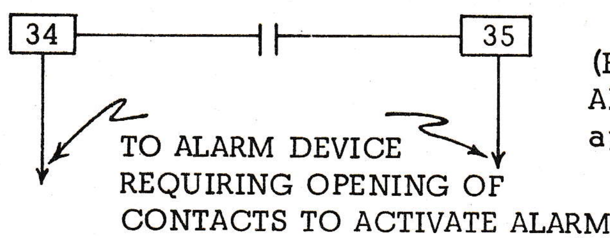


Figure IX-5

2. Terminals "34" and "35" will open a pair of contacts when an alarm condition is sensed.



(Hussmann Remote Alarm uses this application)

Figure IX-6

The local telephone company or private service company can be consulted as to types of equipment that will be compatible to Hussmann's in-store alarm.

NOTE: When using other types of alarm receivers, the Hussmann remote alarm cannot be used.

INSTALLATION OF THE 2-STAGE REFRIGERANT LOSS ALARM/INDICATOR (OPTIONAL)

1. Remove the flange plate on the front of the receiver (viewed from the control panel side of the compressor unit). Discard the original gasket and check to see that the new gasket and joints are free of flaws.

2. Remove the dial housing assembly by removing the 2 slot-head screws located on the dial cover. Coat the new gasket with a light film of oil and install over the flange on the back of the housing. Insert the float into the receiver making sure the gauge face is right side up. The word "Top" is stamped into the housing.

3. Check for freedom of float movement by rotating the gauge from side to side. A slight jar should be felt when the float swings to the upper and lower stops.

4. Install the 4 interior hex bolts finger tight and tighten in a diagonal pattern to 5-8 ft./lb. CAUTION: Overtightening may warp or crack the back of the indicator housing.

5. Install the dial housing right side up. Leak check carefully.

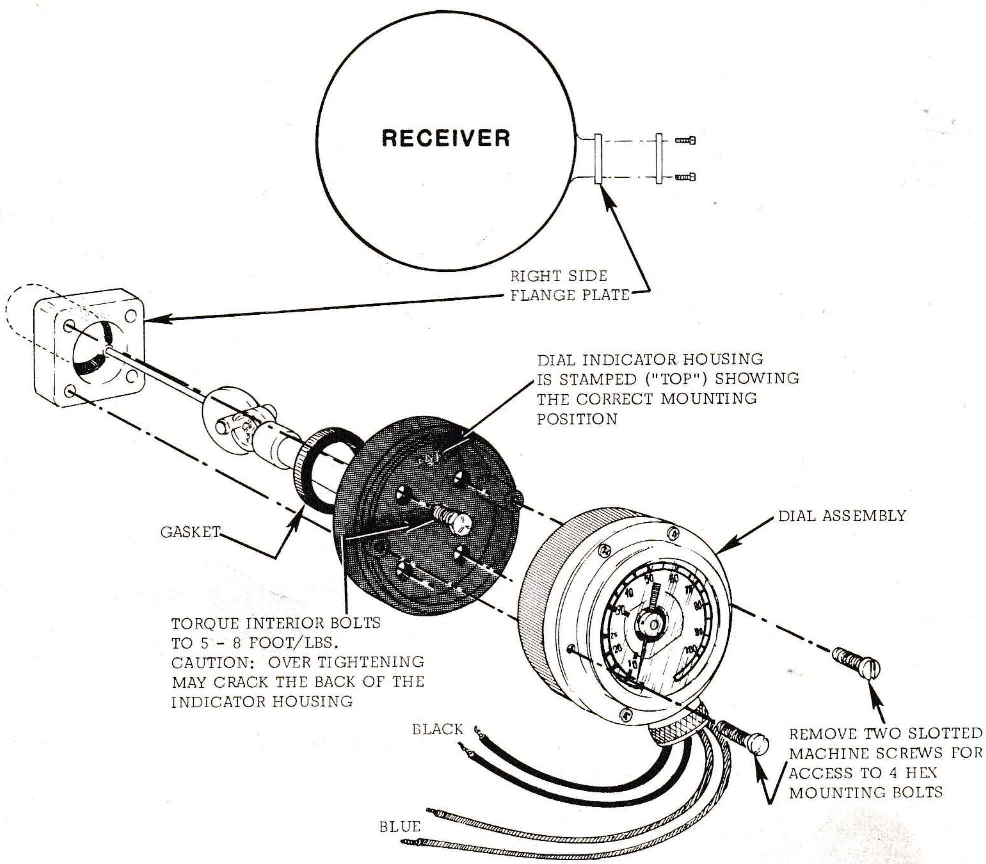


Figure IX-7
Installation of the 2-Stage Refrigerant Loss Alarm/Indicator

<u>Alarm Kit Without Heat Reclaim</u> - On a Plus IV <u>without</u> heat reclaim only one stage of the alarm is used. If the liquid level remains below 10% of receiver capacity for half an hour, the alarm trips.

<u>Alarm With Heat Reclaim</u> - On a Plus IV <u>with</u> heat reclaim both stages are used. With heat reclaim on, the alarm trips if receiver level remains below 10% for half an hour. With heat reclaim off, the alarm trips if receiver level remains below 30% for half an hour.

<u>Electrical</u> - If the compressor unit has heat reclaim, connect the color coded wires from the wiring harness as per Figure IX-8. If the unit has <u>no</u> heat reclaim, only the black (B) wires are connected, as per wiring diagram Figure IX-9 (without heat reclaim). Tape the blue (BLU) wires that are not used.

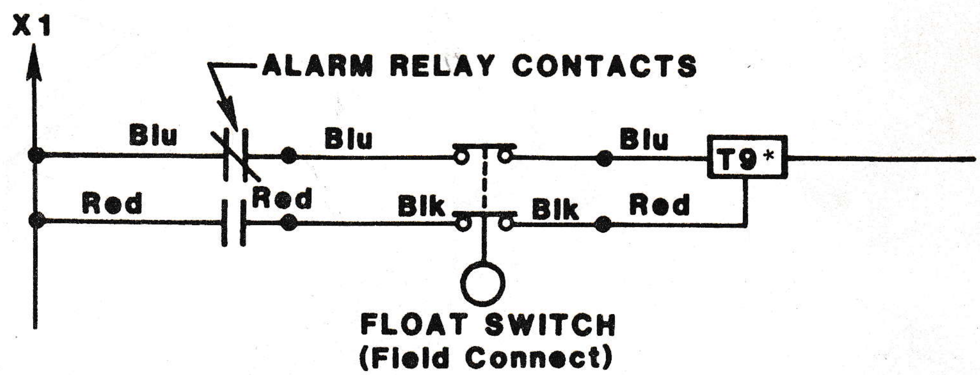
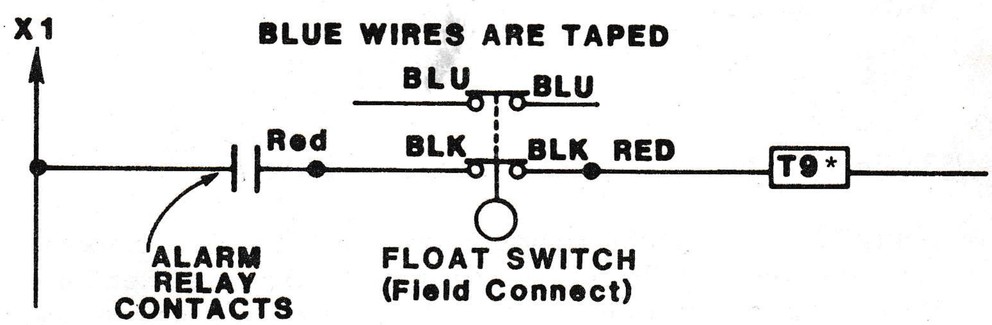


Figure IX-8
Wiring Diagram for Units <u>With</u> Heat Reclaim



* Denotes Unit Letter
For A Complete Diagram See Figure IV-13.

Figure IX-9
Wiring Diagram for Units <u>Without</u> Heat Reclaim

INSTALLATION OF HEAT RECLAIM

If your heat reclaim is part of an HCD package do not use this section. Refer to the HCD Installation Instruction.

Location of the Heat Reclaim Coil - Install the heat reclaim coil in the duct system downstream of any air conditioning and upstream of any booster heat. See Figure IX-10. Allow sufficient space between the coil and booster heat so radiant heat will not affect performance. The heat reclaim coil should be placed 3 to 20 feet higher than the compressor unit's liquid receiver. Neither the supply nor the return line should exceed 150 equivalent feet. Provide gradual transitions in the duct work to insure full air coverage across the face of the heat reclaim coil.

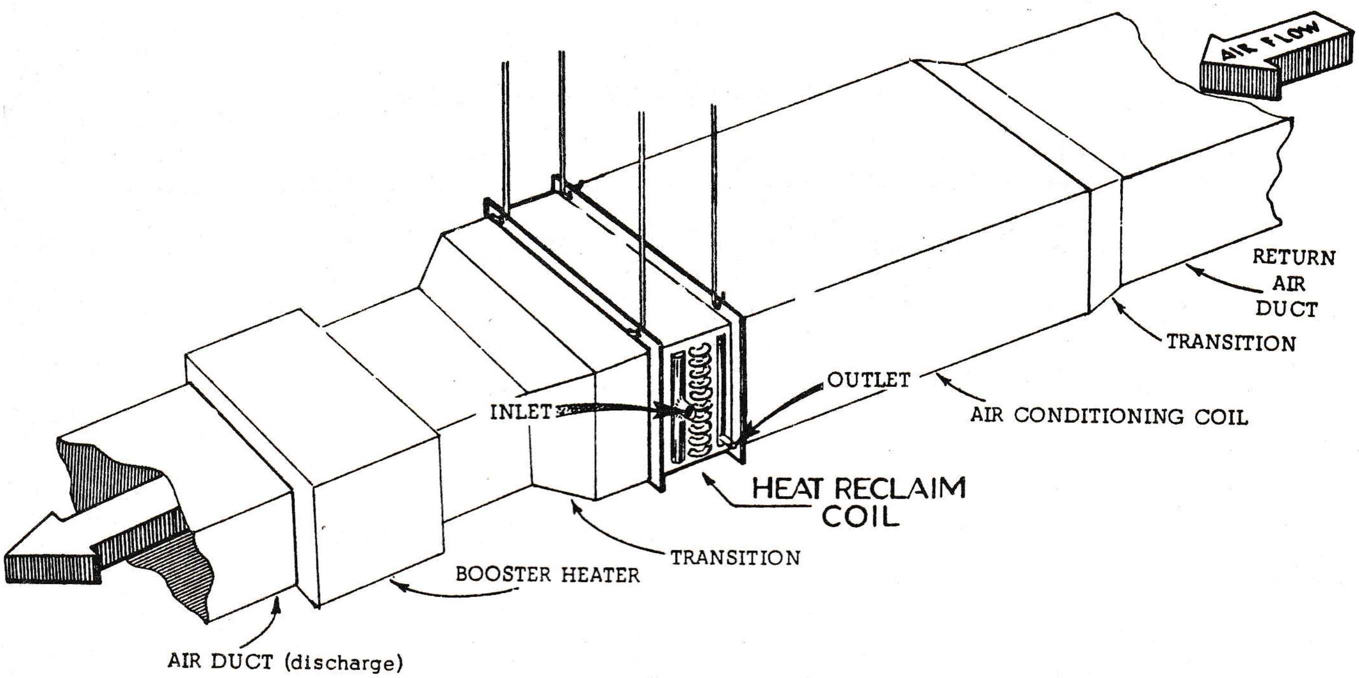


Figure IX-10
Coil Location

Heat Reclaim Piping - Pipe heat reclaim as follows:

1. Supply Line - Connect a supply line from the stub marked "Inlet Heat Coil" on the Plus IV compressor unit to the inlet header on the heat reclaim coil. The inlet stub leads from a reversing valve located at the oil separator end of the compressor unit. See Figure IX-11. A hand valve located in the supply line is recommended.

2. Return Line - Connect a return line from the stub marked "Heat Coil Return" on Plus IV to the liquid header (bottom connection) on the heat reclaim coil. See Figure IX-11. A hand valve located in the return line is recommended.

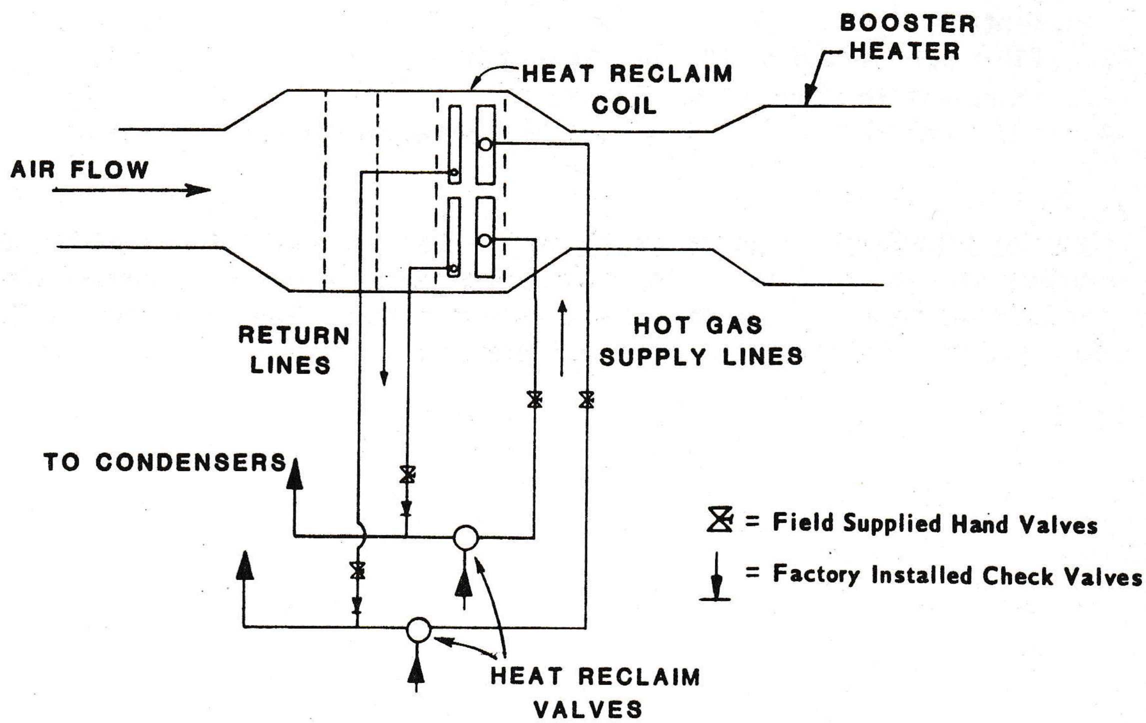


Figure IX-11
Heat Reclaim Piping Diagram

Refrigerant line sizing guide is located in the Plus IV Planning Data.

Heat Reclaim Wiring - The heat reclaim control is equipped with a manual control switch and operation pilot light for each stage. The operation pilot light is ON when the system is operating on heat reclaim. The manual switch and pilot light are located at the compressor control panel.

Connect the store heating thermostat to the compressor control panel with a two wire, 125va pilot duty circuit.

The heating thermostat is a two pole device for connection of two stages of heat reclaim. If additional booster heat is desired, an additional (field supplied) thermostat is recommended.

For complete wiring diagram see Figure IV-13.

Thermostat Specifications -

1. Penn brand T25A, two sets of SPST contacts, line voltage (or equivalent)
2. Pilot duty rating of 125 va, 24 to 277 vac
3. Temperature range of 40°F to 90°F
4. Differential 0.7°F each stage, 3°F between stages

Heat Reclaim Lockout Pressure Control - Factory set and installed, this control will shutoff heat reclaim when heat reclaim would otherwise cause condensing pressure to drop below a safe minimum. See "Summary of Control Settings" for the factory set adjustment.

SERVICING HEAT RECLAIM VALVE

Main Valve Body Check - Service the main valve body as follows:

1. Close the shutoff valve for the pilot pumpout line. The valve is on the end of the suction manifold.

2. Disconnect the lines from the main valve body running to the pilot assembly. Use flare plugs to prevent gas from escaping.

3. Connect a gauge set to the 1/4 inch SAE connections on the main valve body. See Figure IX-12. Hand valves "A" and "B" should be closed.

4. Connect the center hose of the gauge set to any suction connection, such as a suction filter.

5. Open the hand valve "A" on the gauge set. The heat reclaim valve will shift to that end. The gauge at "A" will read suction pressure. Gauge "B" will read discharge pressure.

6. Close hand valve "A" and open "B." The gauge at "B" will now read suction pressure while "A" will read discharge pressure.

7. Repeat 6 or 7 times. The heat reclaim valve should shift correctly each time. If no shift occurs, the main body should be disassembled, carefully cleaned, and reassembled.

   CAUTION: UNIT MUST BE SHUT DOWN FOR DISASSEMBLY.

8. After cleaning the main valve, reassemble and test again. If no shift occurs the entire valve should be replaced. If the valve shift is correct, remove the gauge connections and cap the 1/4 inch SAE connections on the valve body. Disconnect the gauge from the suction connection and proceed to test the pilot.

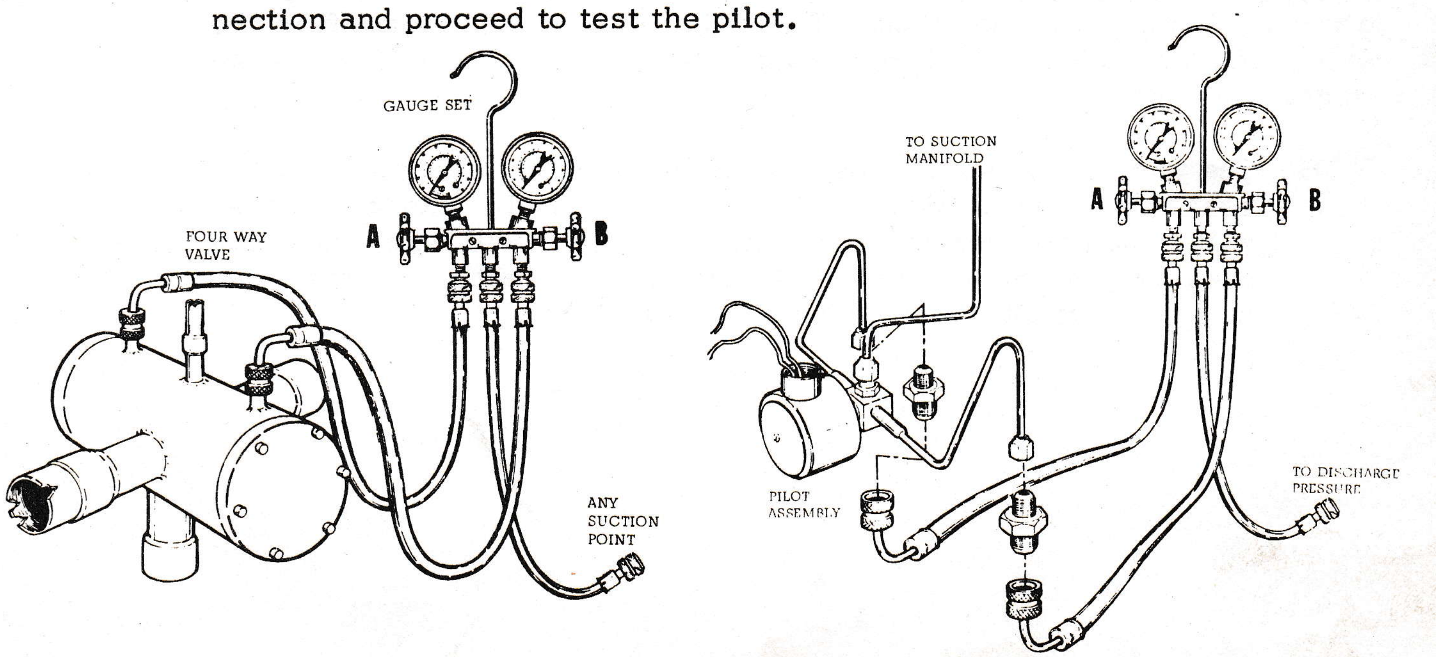


Figure IX-12
Main and Pilot Valve Check

SERVICING HEAT RECLAIM VALVE

Main Valve Body Check - Service the main valve body as follows:

1. Close the shutoff valve for the pilot pumpout line. The valve is on the end of the suction manifold.

2. Disconnect the lines from the main valve body running to the pilot assembly. Use flare plugs to prevent gas from escaping.

3. Connect a gauge set to the 1/4 inch SAE connections on the main valve body. See Figure IX-12. Hand valves "A" and "B" should be closed.

4. Connect the center hose of the gauge set to any suction connection, such as a suction filter.

5. Open the hand valve "A" on the gauge set. The heat reclaim valve will shift to that end. The gauge at "A" will read suction pressure. Gauge "B" will read discharge pressure.

6. Close hand valve "A" and open "B." The gauge at "B" will now read suction pressure while "A" will read discharge pressure.

7. Repeat 6 or 7 times. The heat reclaim valve should shift correctly each time. If no shift occurs, the main body should be disassembled, carefully cleaned, and reassembled.

   CAUTION: UNIT MUST BE SHUT DOWN FOR DISASSEMBLY.

8. After cleaning the main valve, reassemble and test again. If no shift occurs the entire valve should be replaced. If the valve shift is correct, remove the gauge connections and cap the 1/4 inch SAE connections on the valve body. Disconnect the gauge from the suction connection and proceed to test the pilot.

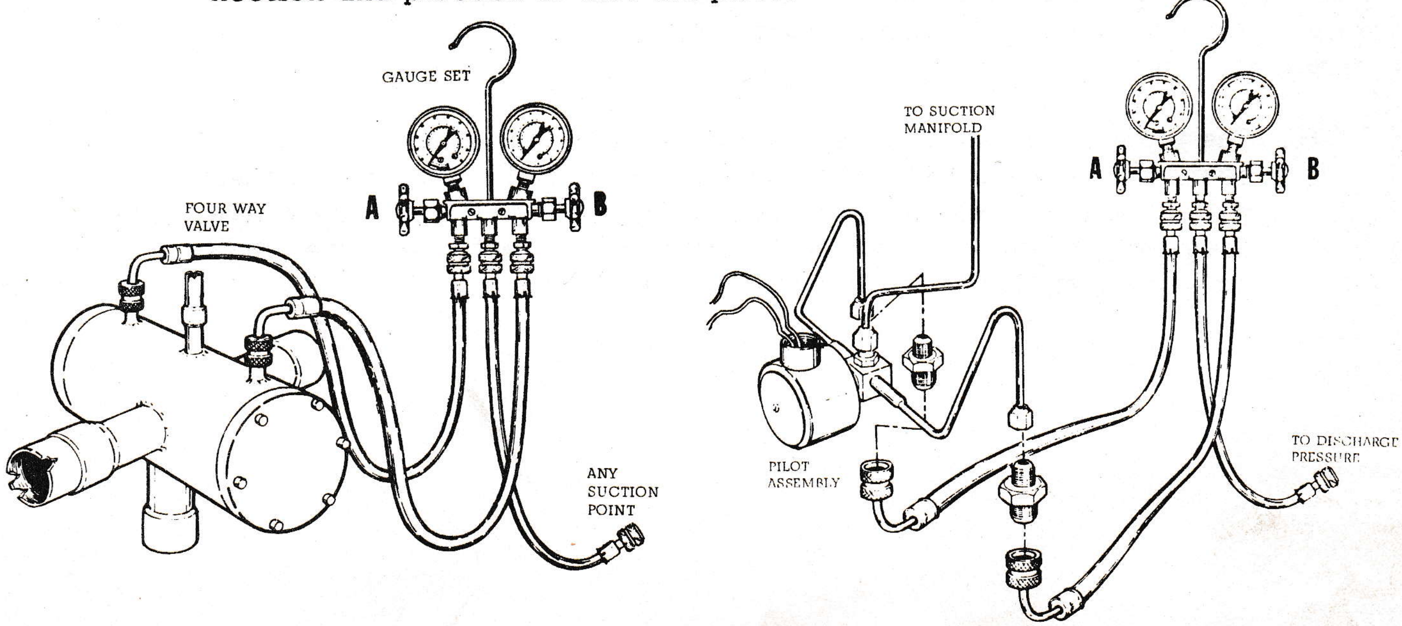


Figure IX-12
Main and Pilot Valve Check

<u>Pilot Assembly Check</u> - Service the pilot assembly as follows:

1. Place the store thermostat in a heat demand position and turn heat reclaim toggle switch "off" (at control panel).
2. Referring to the pilot assembly in Figure IX-12, connect the gauges to the 1/4 inch flare nuts of the pilot assembly tubing.
3. Open the shutoff valve on the suction manifold connecting the pilot pumpout line to the pilot assembly.
4. Connect the center hose of the gauge set to a discharge pressure connection. Gauge valves "A" and "B" to be closed.
5. The first check is made with the pilot solenoid de-energized.
6. Crack gauge valves "A" and "B" to allow a pressure reading on both gauges. One gauge should read discharge pressure, one gauge should read lower than discharge pressure (since the pressure is flowing through the pilot assembly into the suction manifold).
7. Energize the pilot solenoid by turning the heat reclaim toggle switch to "on." The two gauge pressure readings should reverse, indicating the pilot solenoid functions correctly.
8. If both gauges read low or high at the same time, the pilot assembly is either dirty or bad. (Two highs usually means the pilot assembly must be replaced.)
9. To clean the pilot, do the following:
   a. With gauges connected to the pilot assembly as in Figure IX-12, shutoff the pressure source to the center gauge hose and open the hose to the atmosphere.
   b. Open both gauges hand valves ("A" and "B").
   c. Energize and de-energize the pilot solenoid several times. This will blow any dirt backwards out of the pilot valve with suction pressure.
   d. Recheck for proper operation.

<u>To Disassemble Main Valve</u> - Loosen all screws in both end caps. Tap the end caps lightly to unseat them. This will release any vapor left in the valve. Then remove all the screws, both end caps, and carefully slide out interchange spool.

NOTE: The interchange spool must be handled with extreme care. It has been fitted to a very close tolerance and even small nicks or scratches will impair its smooth operation. This spool will enter the valve body only when it is correctly aligned. Do not use force when attempting to fit the spool into the valve body.

To Assemble the Main Valve - Replace the spool carefully. There is a large index pin on the cap and an alignment hole in the piston; and a small pin on the same cap and matching hole on the valve body. This prevents misassembly of the valve.

Oil the O-ring grooves in the ends of the valve. Insert new O-rings. Replace the end cap with the large index pin first, making sure the pin is entered into the spool locating hole. This aligns the spool within the body in the correct radial location. Replace the other end cap and tighten all screws.

The O-rings for the 3-way/4-way heat reclaim valve on Plus IV are No. 234 Buna N Rings measuring 3" I.D., 3 1/4" O.D., and have a 1/8 inch cross section.

NOTE: The interchange spool is honed to the valve in which it is assembled. Do not install the spool from one valve body into a different body. Even though the spool fits, unsatisfactory operation will result.

Replacement of Valve - Should a 3-way/4-way heat reclaim valve require replacement, the following will provide a guidance.

The all metal construction of this valve makes disassembly unnecessary while brazing, although over-heating of the connections will make brazing more difficult. Point the flame toward the copper tubing more than on the steel valve connections. DO NOT WRAP WET RAGS AROUND THE VALVE BODY WHEN BRAZING.

It is important that the tubing be formed accurately so that excessive strain is not exerted on the connections and valve body.

As used on Plus IV, no additional mountings other than the tubing to the connections are required.

Connection identification is stamped on the valve body adjacent to each connection. Plus IV connections are:

D = Discharge Inlet
C = Outlet to Condenser
HC = Outlet to Heat Coil
S = Pump Out Line

Table IX-1
Plus IV Alarm Signal Diagnostic Chart

Alarm Device	Compressor Number	Alarm Indication	Cause of Alarm
AD1 AD2 AD3 AD4 AD5	1 2 3 4 5 or Satellite	1. High pressure control	1. Check for following items: a. Condenser fan belt loose or off b. Condenser fan motor inoperative c. Condenser fan cycling controls d. Condenser surface obstructed e. Faulty condensing pressure control valve f. Excessive non-condensables in system g. Defective high pressure control
		2. Oil differential switch open	2. See Note 1.
		3. Compressor inherent overload or solid state module tripped	3. Excessive motor current
AD1	1	1. All compressors off	1. Check for following: a. Loss of refrigerant charge b. Suction filter plugged c. Liquid drier plugged d. Excessive number of systems on defrost
AD9		1. Timer motor	1. Program timer motor failure
		2. Hi suction pressure alarm control	2. If timer motor OK then check following: a. Compressor time delay failure b. Low pressure control failure c. Excessive load conditions causing high suction pressure
		3. Low liquid level alarm	3. Receiver level has been low for over 1/2 hour a. Check system for leaks b. Check for undercharge

NOTE 1. Oil differential switch can be tripped directly by low oil pump pressure or indirectly by a variety of electrical failures.

a. Check oil levels
b. Reset oil control, if compressor starts then check following items:
   (1) Oil pump pressure for defective pump. Pressure should be approximately 30-50 psi above suction pressure (Copeland).
   (2) Possible liquid refrigerant flood back causing oil pump to cavitate.
c. The following items can cause the oil switch to trip:
   (1) Compressor contactor coil failure.
   (2) Compressor circuit breaker tripped.
   (3) Compressor electric motor failure.
   (4) Compressor mechanically defective (broken crankshaft, etc.).

d. On models with oil equalizing lines, an obstruction in the suction line (for example a clogged suction filter) to one or more compressors can cause oil to be forced from compressor with higher crankcase pressure resulting in oil failure.

NOTE 2. The remote alarm can sense and give warning of the following additional failures:

a. Complete power failure.
b. Failure of 120 volt control circuit.
c. Tripping of single phase protector.

CDA VALVE

Section X | Page

Description of Components ---------------------------------- X- 1
Installation of Sensor Wiring ------------------------------- X- 8
CDA Valve Setting Procedure ------------------------------ X- 8
Control Settings --- X-10
Service Tips --- X-11
    Disassembly of Valve ---------------------------------- X-12
    Diagnostic Chart --------------------------------------- X-13
    Temperature Sensor Location -------------------------- X-15
    Components Parts List --------------------------------- X-17

X CDA VALVE

DESCRIPTION OF CDA COMPONENTS

The Sporlan CDA valves are designed for precise and energy efficient control of the temperature in refrigerators. Proper temperature is maintained by regulating refrigerant flow.

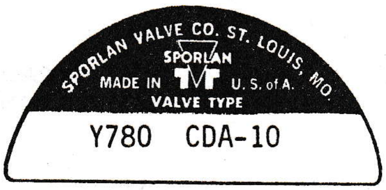
The use of the CDA temperature control replaces evaporator pressure regulators, Loadmaster valves, and conventional thermostats.

The CDA valve system of temperature control is composed of the CDA valve and the electronic components that operate it. The purpose of this section is to acquaint you with the components and their operation.

THE VALVE

CDA valves are factory installed in the suction branches on the compressor unit or on the header defrost assembly. The valves modulate by the change in the magnetic pull of the dc-operated solenoid. There are two sizes: the CDA-10 and the CDA-20, nominal 1 ton and 3 ton ratings respectively.

CDA-10. The CDA-10 is directly operated by the magnetic pull on the valve plunger. The solenoid coil is serviceable, but internal parts are not. Figure X-1 shows a cross section of the CDA-10. A cut-away view of the valve is depicted in Figure X-10.



CDA-10 Valve Label

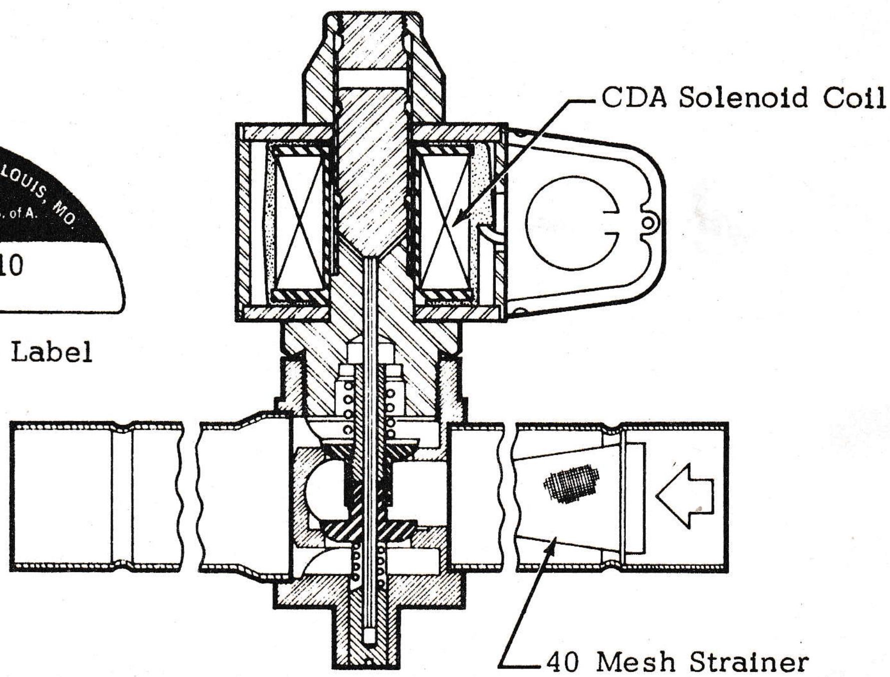
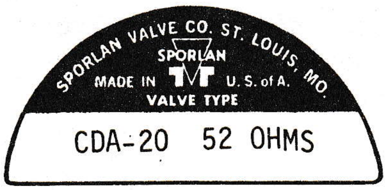


Figure X-1
CDA-10 with Label

CDA-20. The CDA-20 is pilot operated, requiring discharge pressure to close the valve. The valve is serviceable without removal from the suction line. The valve consists of a solenoid (same as the CDA-10), pilot assembly, piston, piston return spring, and valve body. Figure X-2 shows a cross section of the CDA-20. An exploded view is depicted in Figure X-10.



CDA-20 Valve Label

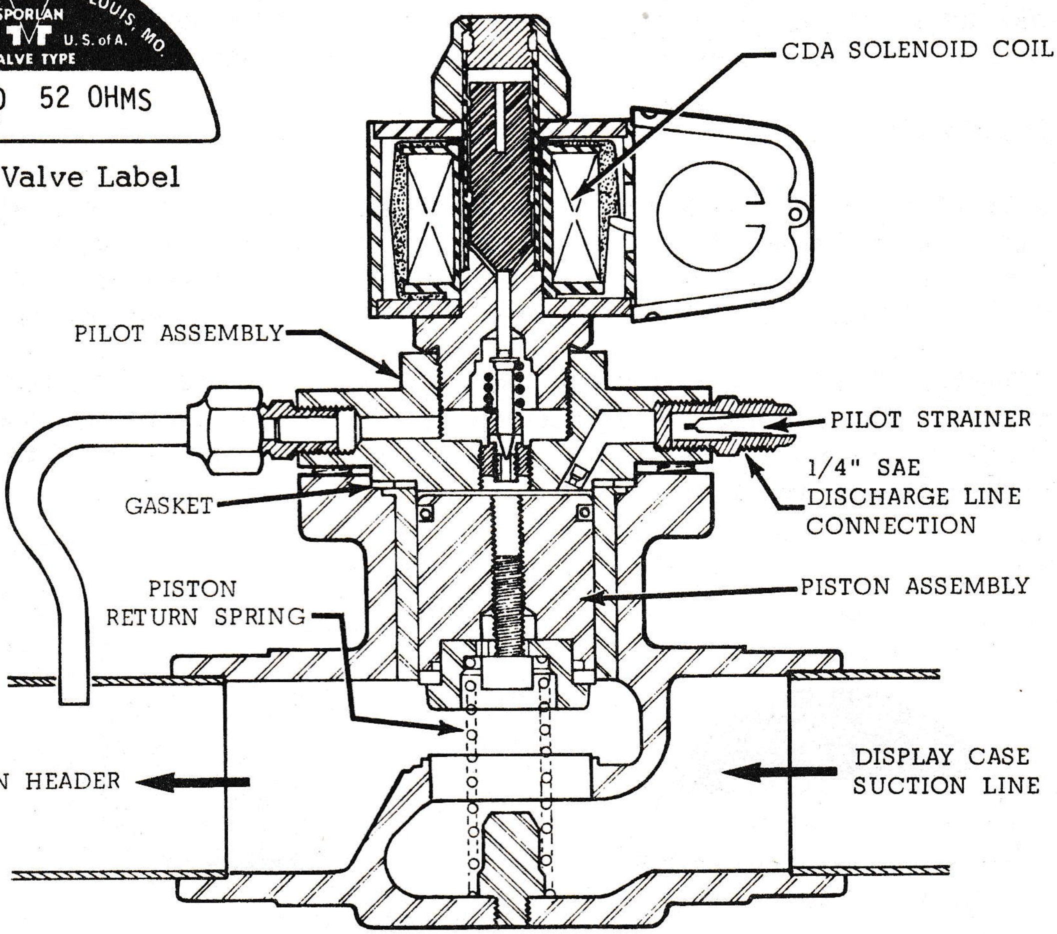


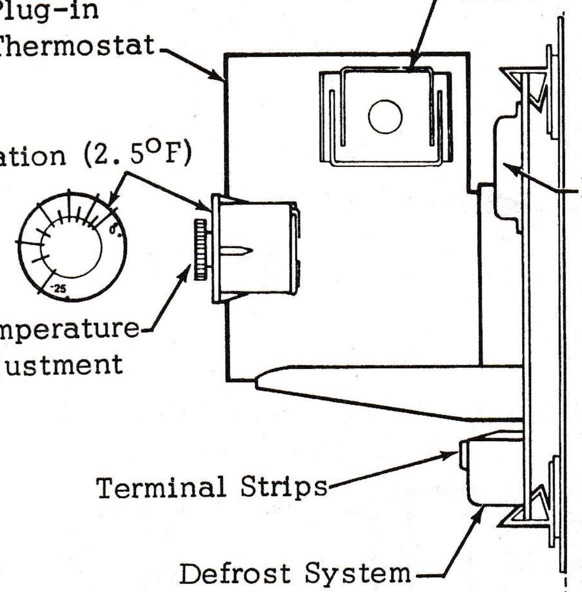
Figure X-2
CDA-20 with Label

The main port of the CDA-20 is modulated by bleeding a controlled amount of discharge pressure to the chamber above the valve piston. The discharge pressure enters the piston chamber through an orifice and then drains through the modulating pilot valve to the suction line downstream of the valve; thus, as the pilot valve opens, the pressure decreases in the piston chamber and the piston return spring pushes the piston upward, opening the valve.

CDA CONTROL COMPONENTS

The components which control the CDA valve consist of a plug-in thermostat, a panelboard, a refrigerator air temperature sensor, and a 24 volt ac output transformer.

Plug-in thermostat. The plug-in thermostat is the brain of the CDA system. It has a temperature adjustment dial, operational amplifier, full-wave rectifier, and wheatstone bridge circuit for modulating the electrical output to the CDA valve solenoid. Plug-in thermostats can be easily checked for proper operation (see Service Tips). Thermostat ranges are shown on the temperature adjustment dial (see Figure X-3).



TEMPERATURE RANGES

Valve Type \ Temperature Range	-25°/0°F	10°/40°F	40°/60°F
CDA-10	TA10P	TB10P	TC10P
CDA-20	TA20P	TB20P	TC20P

Figure X-3
Plug-in Thermostat

Operation of the plug-in thermostat is as follows (see Figure X-4):

1. The 24 volt ac power supply from the transformer is rectified to a variable dc voltage (0-34 volt dc).

2. When the temperature sensor's resistance is increased by a drop in temperature, a voltage difference occurs across the bridge circuit.

3. Voltage difference across the bridge is measured and amplified 50 times by the operational amplifier.

4. The operational amplifier transmits the amplified signal to the base of the transistor.

5. The current flow through the power transistor increases to a value equal to 100 times the base current. This current flows through the CDA solenoid coil to reposition the CDA valve and thereby regulate air temperature.

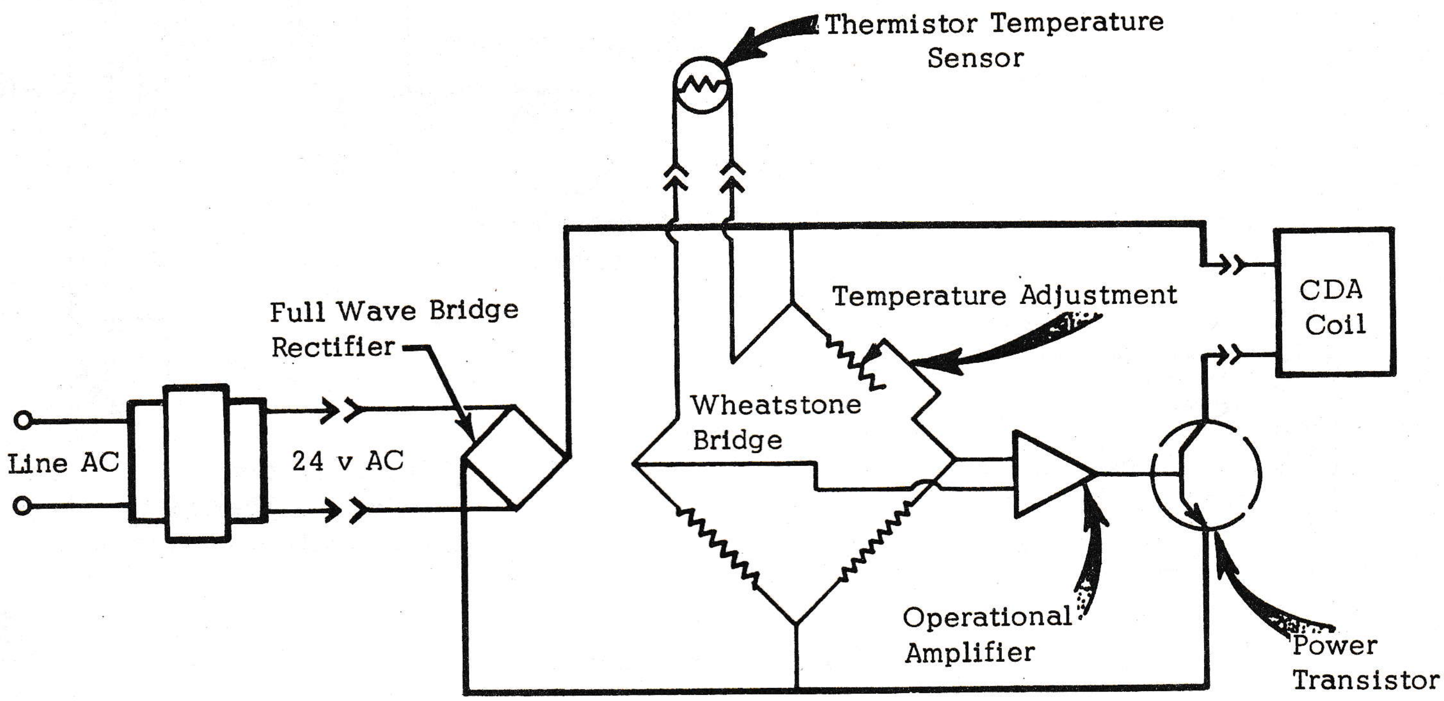


Figure X-4
CDA Plug-in Thermostat Diagram

Panelboard. The thermostat plugs into the panelboard; each section of the panelboard has slots to accept four thermostats. The panelboard has four wiring connections for each thermostat: two wires to the CDA valve solenoid, and two wires to the temperature sensor in the refrigerator. There are also terminals for wiring the defrost clock and for the 24 volt power supply from the transformer. The panelboard is equipped with a solid state reply that will cause the CDA valve to close when the defrost clock applies 208-240 volts to the CDA panelboard connections. Figure X-5 shows the panelboard wiring.

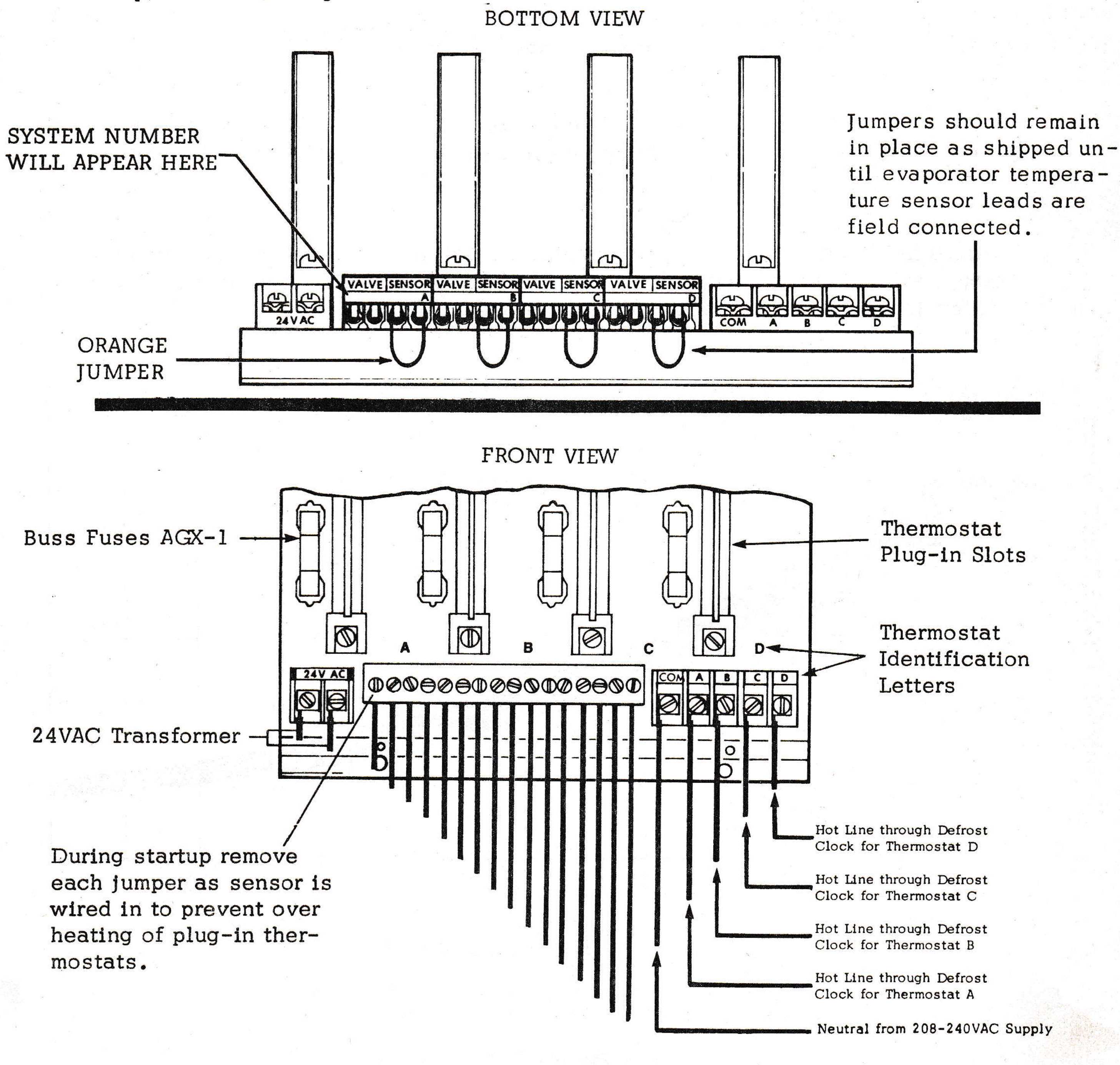


Figure X-5
Wiring Terminals on the CDA Panelboard

<u>Temperature sensor.</u> The temperature sensor consists of a thermistor with protective shield and a neoprene covered lead wire. Nominal resistance at 77°F is 1000 ohms. The sensor is factory installed in Hussmann display cases. Sensors for walk-in refrigerators are shipped inside the compressor unit control panel. One sensor is required for each walk-in refrigerator or preparation room. Install it in the discharge air stream of one unit cooler. One sensor is factory installed in the master refrigerator of each case line-up.

Figure X-6
Temperature Sensor

Figure X-7 shows the change in resistance of the temperature sensor as compared to changes in temperature. The sensor consists of a carbon disc which increases resistance with a decrease in temperature.

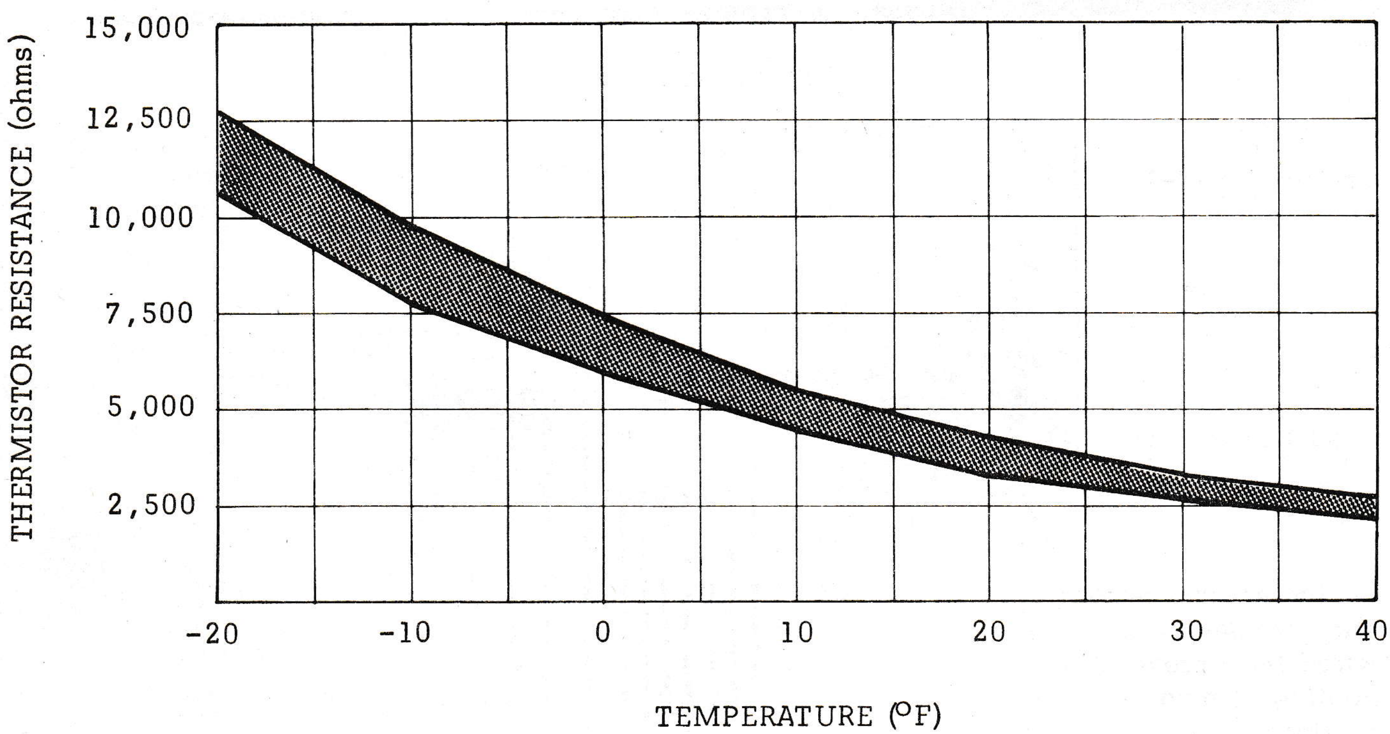
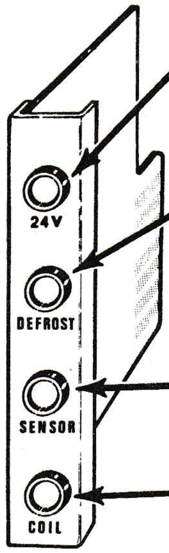


Figure X-7
Resistance of Temperature Sensor

<u>Diagnostic board</u>. The diagnostic board plugs into the panelboard slot and is used to check operation during start up and service. There are four lights which check: (1) 24 volt ac supply; (2) defrost clock wiring and operation; (3) CDA solenoid wiring for open or short; (4) temperature sensor wiring for open or short. Figure X-8 shows a front view of the diagnostic board. See diagnostic chart (Table X-2) for possible causes and remedies for malfunctions.



Lights when the 24 volt ac circuit is complete from the transformer to the plug-in slot.

For the KOOLGAS® system only. Lights when the timer is in the defrost mode. It will fail to light if the timer output is less than 80 volts.

Lights when the circuit through the temperature sensor is complete.

Lights when the circuit through the CDA solenoid is complete.

Figure X-8
Diagnostic Board

INSTALLATION AND SETTING PROCEDURE

INSTALLATION OF SENSOR WIRING

The only field wiring required for the CDA system is connecting the temperature sensor to the panelboard. Temperature sensors are already mounted in display refrigerators but wires must be run from the sensor to the panelboard. Use 14 gauge wire with 600 volt insulation. Route the sensor wiring in conduit to prevent damage. Each system (case or case line-up) has been assigned a number on the store legend. Corresponding system numbers are located on the panelboard terminal strip (see Figure X-5).

Temperature sensors for unit coolers and preparation areas are shipped in the compressor unit control panel and must be field installed. Locate the temperature sensor in the discharge air according to Figure X-9.

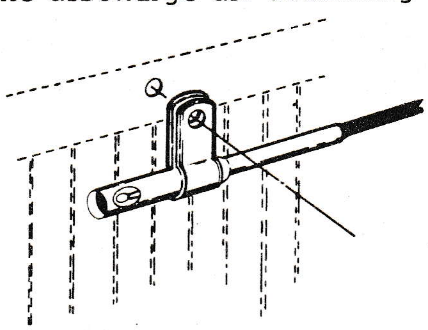


Figure X-9
Locate Temperature Sensor
In Discharge Air of Unit Cooler

CDA VALVE SETTING PROCEDURE

1. Insert the diagnostic board to make sure all systems are operational and no systems are on defrost. Then remove diagnostic board and install thermostat.

2. Set the CDA thermostat to the required temperature. See Table X-1 for recommended control temperatures in Hussmann refrigerators.

3. Start the compressor unit and allow the fixtures to pull down.

   Note: This procedure assumes the refrigerators are too warm at the time of start up.

4. Place a thermometer in the air stream of the control fixture. For unit coolers, place the thermometer in the return air.

   Note: Further reference of control fixture and slave fixture will be as follows:

   Control Fixture - That refrigerated fixture which contains the CDA temperature sensor.

   Slave Fixture - The other refrigerated fixtures that are on the same suction line controlled by the CDA valve but do not contain the temperature sensor.

Setting Procedure (Cont'd.)

5. Allow a minimum of one hour operation at this setting. If the air temperature is more than 3°F off of the desired setting, then adjust the CDA thermostat to bring it within this tolerance. Check those systems with the highest operating temperature first.

6. With the control fixtures adjusted to the correct temperature tolerance, the thermostatic expansion valve must be adjusted. To properly adjust the expansion valve, the CDA valve must not be allowed to control at this time. Mark the adjusted position of the CDA thermostat. See Figure X-3. Turn the thermostat adjustment to the coldest temperature (counter-clockwise). This will make the CDA valve open up and stay open until TEV adjustments are completed. Adjust all expansion valves that are controlled by the CDA valve at this time with the following procedure:

   a. Expansion valve must be adjusted to fully feed the evaporator. Before attempting to adjust valve, make sure the evaporators are either clear or only lightly covered with frost, and that the fixtures are within 10° of their expected operating temperature. Adjust the valve as follows.

   b. Attach two sensing probes (either thermocouple or thermistor) to the evaporator: one under the clamp holding the expansion valve bulb, and the other securely taped to one of the return bends two-thirds through the evaporator circuit.

   c. Some "hunting" of the expansion valve is normal. The valve should be adjusted so that during the hunting the greatest difference between the two probes is 3° to 5°F. With this adjustment, during a portion of the hunting, the temperature difference between the probes will be less than 3° (at times as low as 0°). Make adjustment of no more than one-half turn of the valve stem at a time and wait for at least fifteen minutes before rechecking the probe temperature and making further adjustments.

   Upon completion of setting the TEV's, reset the CDA thermostat to the reference setting. This should return the fixtures to the correct temperature tolerance.

7. Check the air temperature in the control fixture and make necessary adjustment on the CDA thermostat to bring it to the desired temperature. When making final adjustments, a minimum of thirty minutes must be allowed for system to balance to the new setting before checking results. This step should be repeated as many times as necessary to get correct control temperature.

8. Check the air temperature in all the fixtures and compare to the control fixture. A tolerance of 3°F is an acceptable deviation from the control fixture. If one or more slave fixtures are out of this tolerance, then the cause must be found and corrected.

Table X-1
Recommended Control Temperature
Settings for Refrigerators

Refrigerator Model	Set CDA to Control at the Following Temperatures **
FMG, FMRG, FM, FMR FHM, FHMG, FHMS	24°F Discharge Air - Meat 27°F Discharge Air - Deli
FHD, FHDG	26°F Discharge Air - Meat 29°F Discharge Air - Deli
JVM, JVMH, RVM	32°F Discharge Air - Dairy 30°F Discharge Air - Deli
BHDB, AFF, AFR, RHM	28°F Discharge Air
P, PH	37°F Discharge Air - Bulk Produce 33°F Discharge Air - Package Produce
FML, FMLG, JJA, GWI(T), G/F, GC ,GG	-10°F Discharge Air - Frozen Food -20°F Discharge Air - Ice Cream
G6, G5	- 3°F Discharge Air - Non Code - 8°F Discharge Air - Zero Code *
FML, FMLG	-10°F Discharge Air
RHF, RHC, R6F, R6C	- 5°F Discharge Air - Frozen Food -12°F Discharge Air - Ice Cream
Meat Coolers	28°F Discharge Air
Dairy Coolers	36°F Return Air
Produce Coolers	41°F Return Air
Frozen Food Coolers	- 5°F Return Air
Ice Cream Coolers	-15°F Return Air
Preparation Areas	55°F Return Air

* Where codes require 0°F return air temperature.

** The settings shown above are approximate and may change due to revisions in refrigerator instructions. The specific refrigerator installation instruction should be referred to for current data.

SERVICE TIPS

PLUG-IN THERMOSTAT

A dc voltmeter and 24 position switch is provided to test the plug-in thermostat. Turn the switch to the system number to be tested. Systems are numbered according to the store legend. Operation can be confirmed by placing a jumper across the sensor terminals to open the valve. The dc voltmeter should show almost no voltage when the sensor terminals are shorted and more than 20 volts when one sensor lead is disconnected.

If either test indicates a wrong voltage, replace the plug-in thermostat with another of the proper temperature range. If the problem is still apparent, check the wiring to the sensor and CDA solenoid according to the following procedure.

SOLENOID COIL

To check the coil, measure its resistance. The reading should be approximately 52 ohms at 70°F.

TEMPERATURE SENSOR

To check the temperature sensor, measure its resistance. The reading should be approximately 1000 ohms at 77°F. See Figure X-7 for resistance at other temperatures. See Figure X-11 for temperature sensor location in refrigerator fixtures.

VALVE REPLACEMENT

The following steps should be followed when installing the CDA valve:

1. Wrap the valve in wet cloth.

2. Solder or braze the body into the suction line. Heat should be applied away from the valve body. Low melting point, high strength solders such as 'Staybright' 95% tin and 5% silver is recommended to keep the valve body at as low in temperature as possible.

3. Reconnect the solenoid coil wires to the panelboard.

4. Test the system by plugging in the diagnostic board.

5. Adjust the CDA valve (see Settings Procedure).

DISASSEMBLY OF CDA VALVES

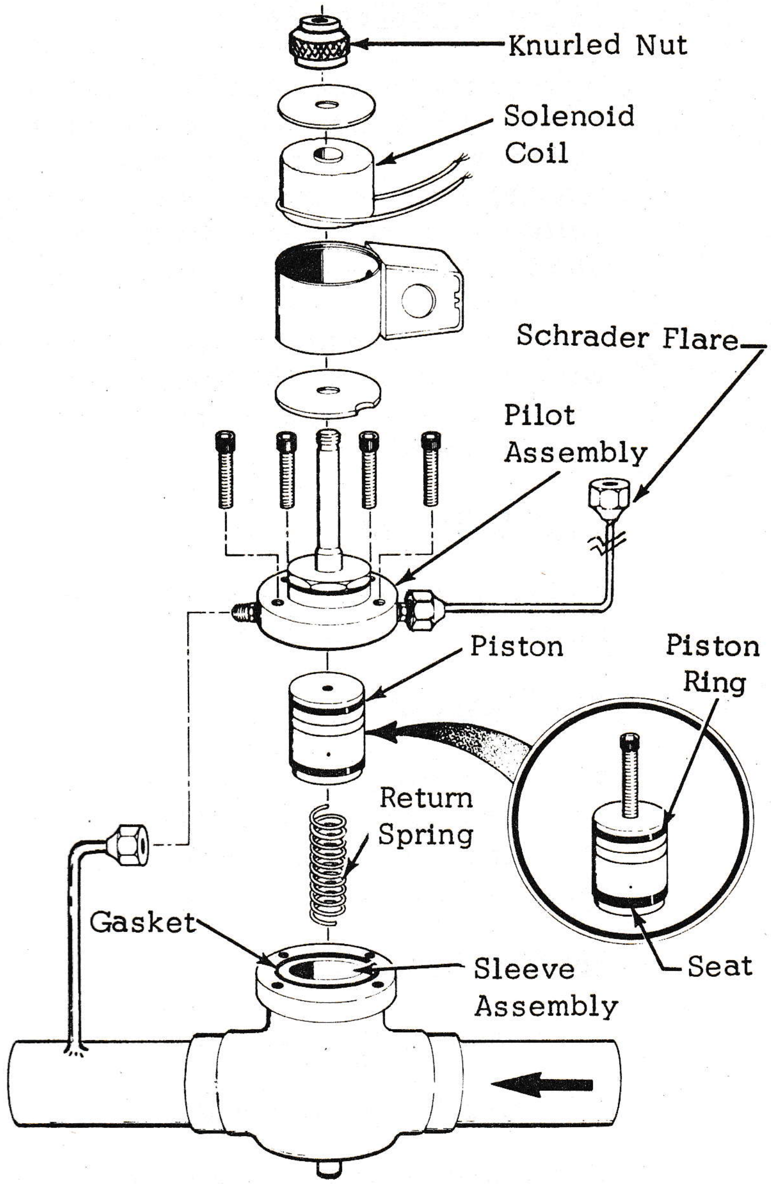
The solenoid on both the CDA-10 and CDA-20 can be serviced by removing the knurled nut holding the coil assembly in place.

To disassemble the CDA-20 valve:

1. Pump down the system to be serviced to 1 psig.
2. Disconnect the discharge pilot line from the Schrader valve on the KOOLGAS manifold. Take care not to damage the flare because it is an adapter fitted with a valve core depressor.
3. Disconnect the suction pilot from the pilot assembly and remove the four bolts holding the pilot assembly with a 1/4 inch Allen wrench. Lift off the pilot assembly.
4. Remove the piston assembly by screwing one of the cap screws (previously removed in 3) into the threaded hole in the center of the piston and use the cap screw as a handle to pull the piston out. Take precautions not to damage the piston ring.
5. Inspect the flange gasket and replace if worn or delaminated. Inspect the Nylatron piston seat for damage. Replace if necessary.
6. Reassemble by reversing the procedure. The pilot assembly has a locating pin to prevent misassembly.

The internal parts of the CDA-10 are not serviceable.

CDA-20 Exploded View



CDA-10 Cutaway View

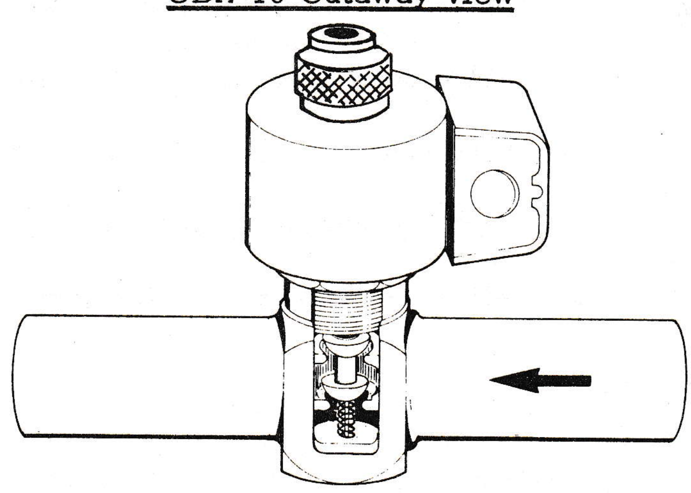


Figure X-10
CDA-10 and 20

INTRODUCTION TO DIAGNOSTIC CHART

Poor refrigeration performance can be the result of causes other than the CDA valve. To eliminate guesswork, carefully observe the problem and screen out other possible causes before concluding the CDA valve is malfunctioning. For example:

Be sure all refrigerators controlled by the valve are performing poorly. If only some are, the CDA valve is probably not at fault; the fault is probably within the refrigerators.

If all refrigerators are performing poorly, install pressure gauges at the nearest taps on each side of the CDA valve.

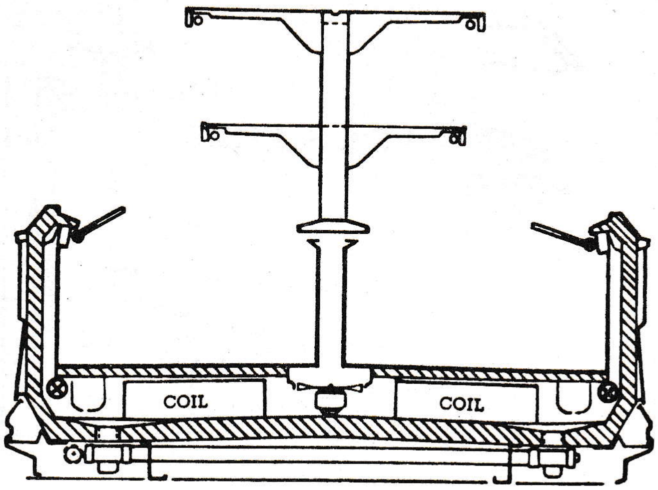
Note the present setting of the thermostat and turn the dial to the coldest possible setting. The pressure difference across the valve should be 2 psi or less which indicates the valve is wide open.

Next, turn the thermostat to the highest setting. The pressure difference should be significantly higher.

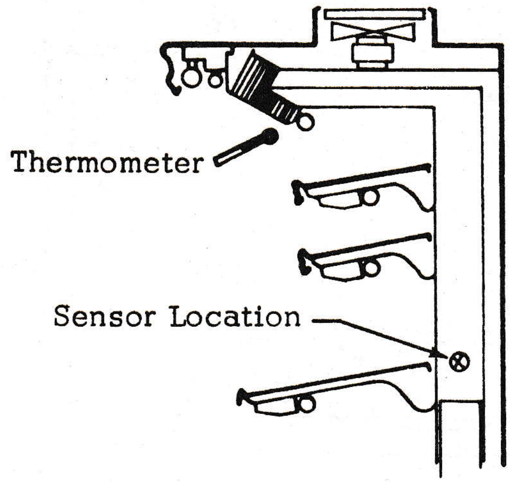
If both gauge readings are correct, the problem is not with the CDA valve or its control.

Table X-2
Diagnostic Chart

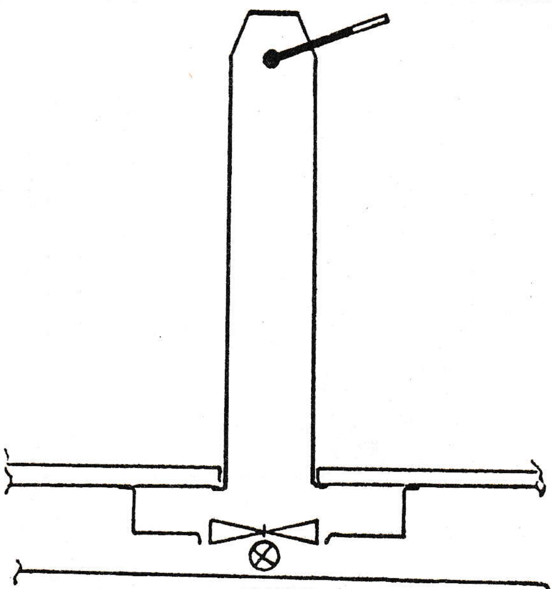
Malfunction	Diagnostic Board Indicator Lights	Possible Cause	Action
Valve Stays Closed	1. Defrost (lit)	1. Defrost in "on" mode	1. Readjust or repair defrost timer
	2. Sensor (unlit)	2a. Open circuit in temperature sensor wiring	2a. Locate and correct
		b. Temperature sensor damaged	b. Replace sensor
	3. Beyond scope of diagnostic board	3. Plug-in thermostat circuit defective or wrong range	3. Replace circuit
Valve Stays Open	1. 24V (unlit)	1. No 24vac to panel board	1. Verify 24vac supply
	2. Sensor (unlit)	2a. Short circuit in temperature sensor wire	2a. Locate and correct
		b. Temperature sensor damaged	b. Replace sensor
		c. Low temp case - frost on temperature sensor in flue	c. Relocate sensor away from evaporator
	3. Coil (unlit)	3a. Open circuit in coil wiring	3a. Locate and correct
		b. Coil has open winding	b. Replace coil
	4. Defrost (unlit)	4. No voltage or low voltage defrost signal	4. Readjust or repair defrost timer
	5. Beyond scope of diagnostic board	5a. Discharge to suction pressure difference below 45 psi (CDA-20 only)	5a. Raise discharge pressure
		b. Plug-in thermostat circuit defective or wrong range	b. Replace circuit
		c. Blocked orifice or restricted strainer	c. Repair or replace valve
		d. Valve held open by solder or dirt	d. Repair or replace valve
		e. Panel board damaged	e. Replace panel board
		f. Panel board relay defective	f. Replace panel board
Valve Does Not Control Temp.	1. Sensor (unlit)	1a. Temperature sensor damaged	1a. Replace sensor
		b. Open or short circuit in temperature sensor	b. Locate and correct
	2. Beyond scope of diagnostic board	2a. Plug-in thermostat circuit defective	2a. Replace circuit
		b. Valve damaged	b. Repair or replace valve



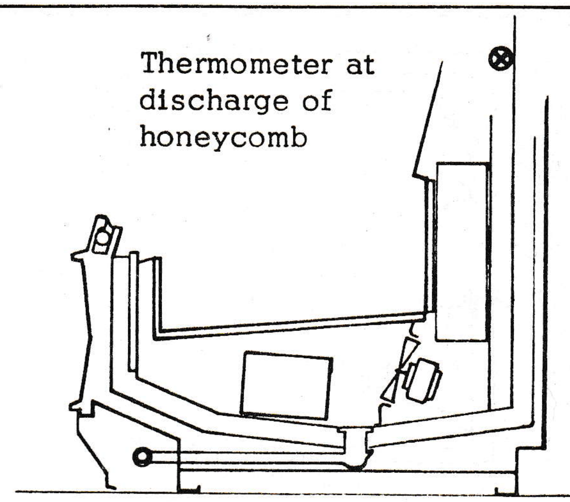
GWI - GWIT



FHM - FHMG - FHMS



BTF



R6 - G6 - G5
(FROZEN FOOD ONLY)

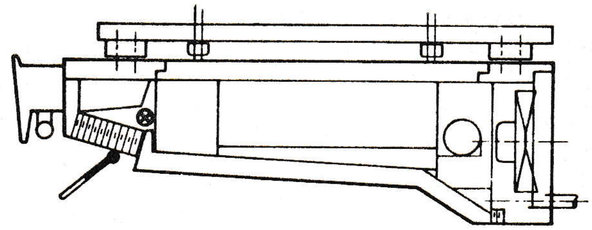
NOTE: Locate the thermometer in the return air and the sensor in the discharge air of unit coolers.

Figure X - 11

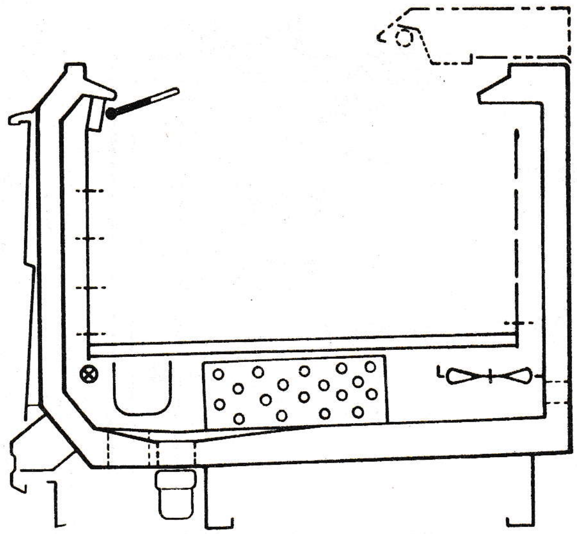
Thermometer and Temperature Sensor Location

Thermometer

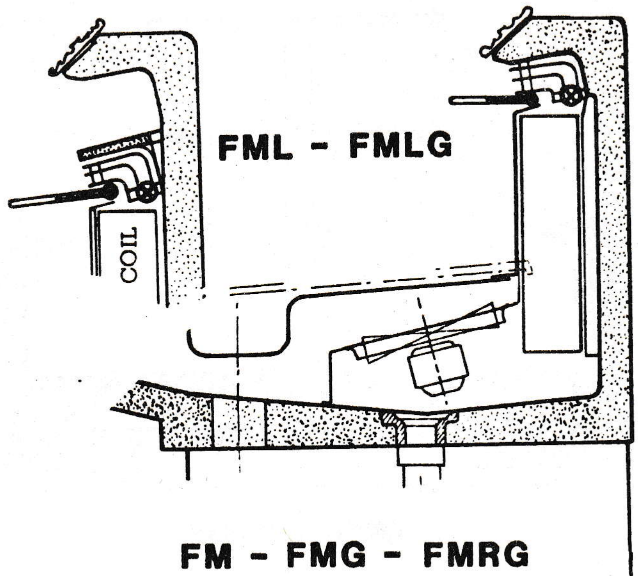
Sensor



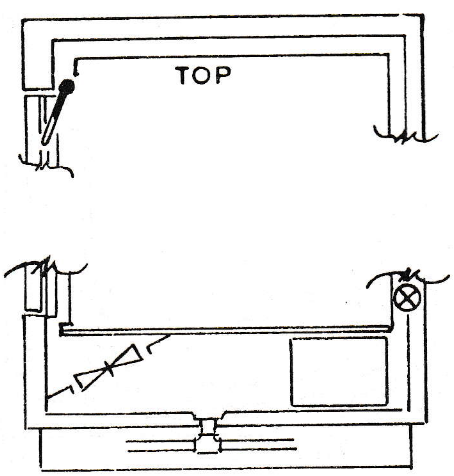
JVMR - JVMRS



GC(I)-GF(I)- GG(C)

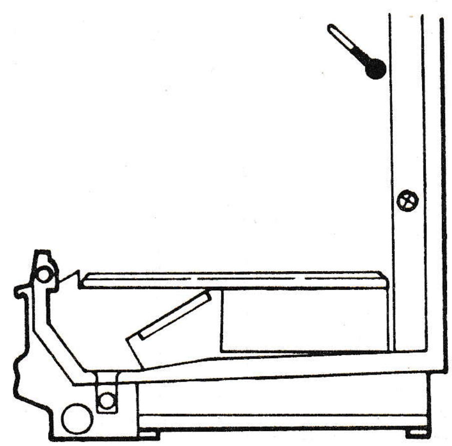


FM - FMG - FMRG

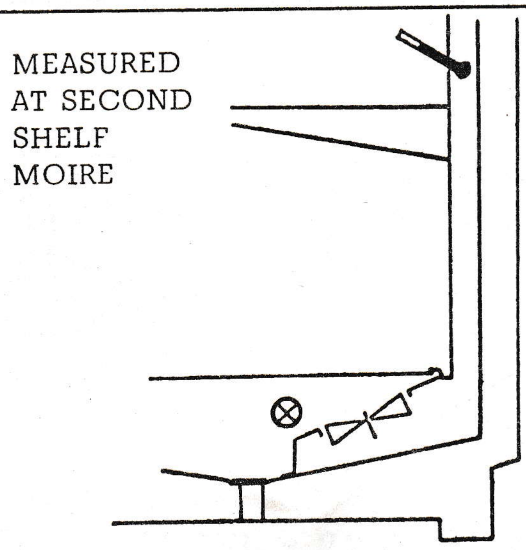


REACH - IN

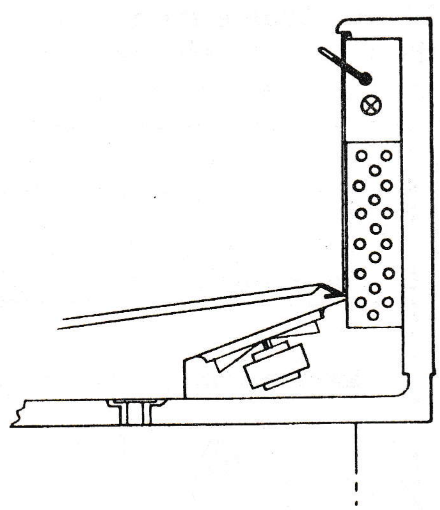
RHF - RHC - RHM



RVM - JVM - JVMH



BHDB



P

CDA COMPONENTS PARTS LIST

Components	Sporlan Part Number	Hussmann Part Number
CDA-10 valve	Y780-CDA-10	P009 0251900
Coil	MKC-CDA 52 OHM	
CDA-20 valve (includes the following)	CDA-20	P009 0251901
Pilot Assembly	A 2492	
Piston	A 2454	
Gasket	938	
Spring	2295	
Sleeve	2250	
Coil	MKC-CDA 52 OHM	P011 0252755
Temperature Sensor (10 ft. lead)	2232-1	P211 0252213
Panelboard (for four plug-in thermostats)	2238 (120 v) 2238-1 (208 v)	P011 0143950
Diagnostic Board	2241	P011 0252852
Relay (24 volt)	-------	P011 0147560
Voltmeter Assembly	-------	FA010 0143951
Transformer	9T58B2881 (GE brand)	P011 0149614
Varistor	V33ZA5 (GE brand)	P011 0149616
Thermostats (see Page X-3 for temperature range and application)		
	TA10P	P011 0143892
	TA20P	P011 0143893
	TB10P	P011 0143894
	TB20P	P011 0143895
	TC10P	P011 0143896
	TC20P	P011 0143929

SYSTEM START UP AND CHECK-OUT

Section XI

Section XI	Page
Preparation	XI-1
Leak Testing	XI-1
Preliminary Oil Charging	XI-2
Evacuation	XI-2
Condenser Check-out	See Condenser Section
Preliminary Checking of Control Settings	XI-4
Charging and Initial Start Up	XI-5
Oil Charging Requirements	XI-6
Balancing Store Refrigerators	XI-6
Setting Open Preparation Room Controls	XI-7
Final Checks	XI-8

SYSTEM START UP AND CHECK-OUT

Section XI | Page

Preparation -- XI-1
Leak Testing --- XI-1
Preliminary Oil Charging -------------------------------------- XI-2
Evacuation --- XI-2
Condenser Check-out -------------------------------- See Condenser Section
Preliminary Checking of Control Settings -------------------- XI-4
Charging and Initial Start Up --------------------------------- XI-5
Oil Charging Requirements ----------------------------------- XI-6
Balancing Store Refrigerators ------------------------------- XI-6
Setting Open Preparation Room Controls --------------------- XI-7
Final Checks -- XI-8

XI

START UP

SYSTEM START UP AND CHECK-OUT

PREPARATION

To simplify the following procedures and future servicing, turn to the chapter "Control Settings" and write down all recommended control settings where they will be visible during setting and servicing.

Prior to each of the following procedures (leak testing, evacuation, charging, and start up) be sure the refrigeration system has been prepared according to the following steps. These steps prepare the system for unrestricted refrigerant flow by opening all shutoff, solenoid, and regulating valves.

1. Turn off main and control circuit power at the store distribution panel.
2. Turn off compressor control circuits at the compressor control panel and the Remote Satellite (if so equipped).
3. Open all EPR, TEPR, CDA, and shutoff valves. See Figure I-1 in the chapter "Refrigeration Process" for valve locations.
4. Disconnect and tape the end of the red wire from the time clock motor in the control panel so the clock will not rotate when control circuit power is applied.

   NOTE: The defrost control panel will be located on the header defrost assembly if so equipped. Terminal numbers and jumpering procedures will remain the same.
5. Install a jumper from terminal X1 to CC#. Install a jumper from Z1 to X1.
6. Turn on control circuit power at the store distribution panel.
7. Turn on the control circuit.
8. Turn on system shutdown switches at the control panel.
9. Adjust the timer so all systems are in the refrigeration mode. All the defrost indicator lights should be out.

LEAK TESTING

The success of the following procedures (evacuation, charging, and start up) as well as the successful operation of the system, depends on a totally leak free system. Take your time and do a thorough job when leak testing.

Pressurize the system with a refrigerant-nitrogen mixture and check with an electronic leak detector. The refrigerant will be removed in the evacuation process so it makes no difference which type is used. You may check the system in parts or as a whole; the size of the system will dictate the best approach. This procedure will test the whole system, one compressor group at a time.

Caution: Do not start any compressors during this procedure, as serious compressor damage could result.

1. Construct a charging apparatus to introduce refrigerant and dry nitrogen.

   WARNING: WHEN USING HIGH PRESSURE NITROGEN, ALWAYS USE A PRESSURE REGULATOR AND PRESSURE RELIEF VALVE. FOLLOW ALL SAFETY RULES. BE CAREFUL!

2. Connect the pressurizing line to the receiver liquid line valve gauge port.

3. Slowly charge approximately 25 pounds of refrigerant into the system; then using the dry nitrogen tank, pressurize the system to 150 psig.

   Note: If higher than 150 psig is to be used for pressure testing, close the shutoff valve on the Ultima compressor controller prior to pressurization to avoid damage to the bellows.

   Oil level regulators must also be isolated to prevent damage to the floats. Turn off the oil supply line from the reservoir and the oil vent line shutoff valves to the individual compressors.

   If units are equipped with Satellites (mounted or Remote), turn off the suction, discharge, and oil supply service valves.

4. Using an electronic leak detector, carefully check the entire system for leaks. Take special care to inspect all connections. If leaks are found, isolate that system with hand valves, release the pressure, and repair them immediately. Do not attempt to repair leaks while the system is under pressure. Allow the system to stand for 12 hours with the pressure on; if no pressure change is observed, the system is tight.

5. When each system is proven leak free, release the pressure and remove the charging apparatus. Turn the control circuit off and open all valves.

PRELIMINARY OIL CHARGING

The compressor crankcase oil level should be between 1/8 and 1/2 of each oil level regulator sightglass. In the oil reservoir, maintain a level between the two sightglasses.

EVACUATION

Complete evacuation is extremely important in guaranteeing good performance. An improper evacuation will cause service problems, lost time, and poor system performance. Hussmann recommends a triple evacuation process; we feel this is the most practical method for field evacuation.

Use a large displacement vacuum pump (8 CFM) capable of at least 500 microns absolute. Connection lines should be copper tubing at least 3/8 O.D. Do not start any compressors during these evacuation procedures, as serious damage could result.

1. The system should be prepared for unrestricted evacuation according to the steps at the beginning of this chapter. The defrost control circuit should be on.

2. Install a compound gauge on the low pressure side of the system to be evacuated.

3. Connect the vacuum pump so evacuation will occur from the Plus IV high pressure side and both Plus IV and Satellite low pressure sides. This can be done by installing a tee on the discharge valve of compressor No. 5 (or 4 if an S40 model) and connecting one copper line from the tee to the vacuum pump and the other line from the tee to the suction service valve of the same compressor. Install an electronic vacuum gauge on the system outside the machine room as far as possible from the vacuum pump.

4. Back-seat the main liquid line shutoff valve on the receiver. Connect a refrigerant tank, with gauge and dehydrator to the valve. (A 16 cubic inch drier should be used on a 145 pound cylinder.) Because the refrigerant charge will be removed, it makes no difference which refrigerant is used.

5. Evacuate the system to 1500 microns, purge the refrigerant charging line, and break the vacuum with a refrigerant charge to 2 psig.

6. Again evacuate the system to 1500 microns and break the vacuum with a refrigerant charge to 2 psig.

7. Install the liquid drier cores in the drier shell.

8. Now evacuate the system to 500 microns and allow the system to stand for a minimum of 12 hours for a final leak-test. If no pressure change is observed at the end of this time, the system is ready for charging.

9. After the system has been proven leak tight, break the vacuum with the proper refrigerant for that system and remove the vacuum gauge and pump.

10. Turn off the control circuit.

CONDENSER CHECKOUT

If the preliminary checkout of the condensers was not done after the condensers were installed, turn to the chapter "Condenser Installation" and do so at this time.

PRELIMINARY CHECK OF CONTROL SETTINGS

1. Close the Ultima compressor controller shutoff valve and remove the wooden shipping block which is taped to the sequencer.

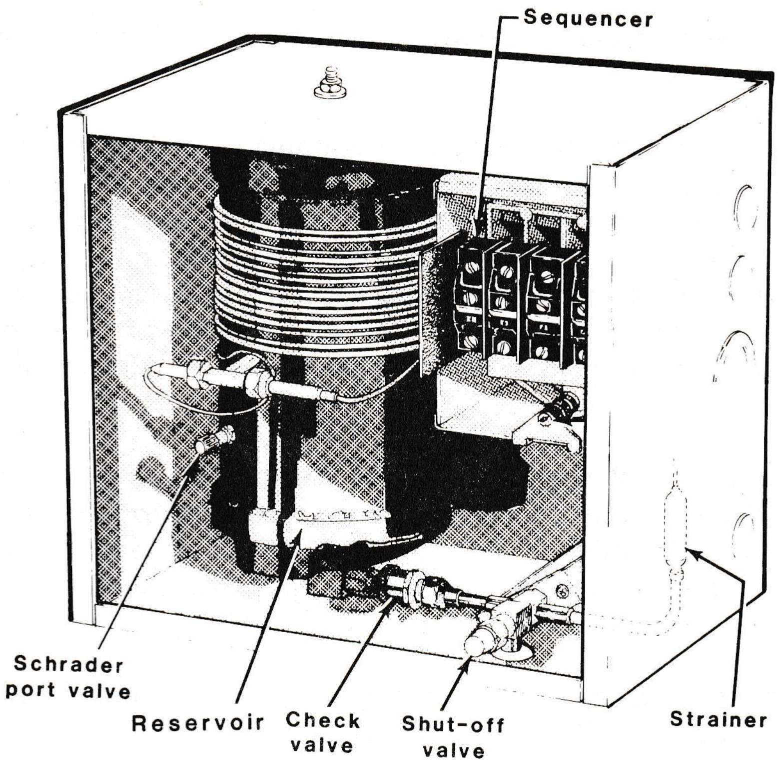


Figure XI-1
Ultima Compressor Controller

2. Connect a voltmeter or neon test light to the red and yellow terminals of the sequencer. (Sequencer switch No. 3 controls compressor number 3, 4 controls compressor number 4, etc.)

3. Open the compressor circuit breakers and turn on the compressor control circuit.

4. Charge the proper refrigerant into the pressure reservoir through the Schrader port and observe the opening and closing of the switches.

The appropriate cut-out pressure for compressor No. 5 (or 4 on a S4 model) is given in the chapter "Control Settings." The cut-out pressures for the remaining compressors are fixed at 2 psig lower for each succeeding compressor. The cut-out pressure for each compressor is fixed at 5 psig above the cut-out pressure for the same compressor. Open the shutoff valve after checking the settings.

5. Set the high suction alarm controls located in front of the compressors according to the table in "Summary of Control Settings."

6. Press the reset button on the high pressure safety control and the oil failure control on each compressor.

CHARGING AND INITIAL START UP

At this stage, all power at the store distribution panel should be off, and the condenser disconnect on the roof should be closed. Charge and start the system as follows:

1. Check that the compressor and defrost control circuit switches are off. Turn on all main power and 230 volt power at the store distribution panel.

2. Connect the proper refrigerant tank with a charging line equipped with a shutoff valve to the main liquid line valve at the receiver. Purge the charging line before tightening the connections.

CAUTION: LIQUID CHARGING MUST BE DONE ON THE HIGH PRESSURE SIDE ONLY. LIQUID CHARGING ON THE LOW PRESSURE SIDE CAN CAUSE SERIOUS COMPRESSOR DAMAGE. NEVER TRAP LIQUID BETWEEN CLOSED VALVES.

3. Front-seat the liquid line valve. Slowly open the valve on the refrigerant tank and charge liquid into the system. Continue charging until you hear the refrigerant flow slow down.

4. To accelerate charging, close the compressor circuit breakers, turn on the control circuit and compressor No. 1 and No. 2 switches. The compressors will start one at a time in about 30 seconds. During the charging operation, the suction pressure should remain below 20 psig for low temperature units and 45 psig for medium temperature units. If necessary, start compressors No. 3 and 4 to maintain suction pressure below these limits.

CAUTION: Because this is the initial start up of the compressors, be particularly watchful for peculiar pressure readings or compressor operation. Turn off the compressors at the first sign of trouble. Keep a close watch on compressor oil levels throughout the charging operation.

5. Charge the system to approximately 30% of the receiver level as indicated on the liquid level indicator.

6. When the 30% refrigerant level is obtained, close the valve at the refrigerant tank and back-seat the liquid line valve at the receiver. This allows refrigerant to flow through the entire system and should cause the refrigerant level to drop to approximately the 15% level.

7. If the refrigerant level drops below the 15% level, repeat the charging procedure until a 15% level is reached with the liquid line valve back-seated. Leave the refrigerant tank connected after the charging is complete because during the first hours of running, additional refrigerant is often required. Approximately 20 - 100 pounds of refrigerant should be added to compensate for heat reclaim coil requirements.

OIL CHARGING REQUIREMENTS

After the equipment has been started and initial refrigerant charging is completed, all compressors should be turned off and oil levels must be checked. All compressors should have been running prior to shutdown. With all compressors off, all oil level sightglasses should be about 1/2 or less. The oil level in the oil reservoir should be maintained between the two sightglasses. If adjustment of the oil regulators is necessary, see Service Tips in the chapter "Compressor Installation."

BALANCING STORE REFRIGERATORS

Balancing of the refrigerators to Plus IV is mandatory to obtain proper compressor operation and to insure the maximum temperature performance and efficiency of Hussmann refrigerators.

If Plus IV is equipped with either CDA valves or Loadmasters, a thorough understanding of their operation is required. For CDA setting procedures, see the chapter "CDA Valve." For an understanding of Loadmaster valves, see Loadmaster Installation Instruction #146180.

The following guidelines apply to total store balancing for refrigerators using Loadmaster valves:

1. Thermometers must be placed in the control fixture of each system no later than 2 hours after the compressors have been started. The locations for these thermometers are shown in the Loadmaster installation instructions or in the CDA valve chapter. The use of thermometer kits installed in cases cannot be used because they are not located in the proper location required for adjustment of the refrigerators.

2. Adjustment of Loadmasters to a rough temperature should be started no later than 2 hours after start up. The highest temperature refrigerator first. This preliminary adjustment can be off as much as 5^{O}F if desired.

3. After all the preliminary temperature adjustments have been made on the Loadmasters, the refrigeration system should be allowed to operate in this mode from 12 to 24 hours before further adjustments are made. This allows sufficient time for compressors to balance to near operating suction pressure and allows the heat load of the hot cases and coolers to be removed.

4. Final adjustments must be made with one system at a time until all systems are completed. Before adjusting a system, thermometers are required in all refrigerators of that particular system. For each system, open the Loadmaster by turning the adjustment screw full clockwise, adjust TEV's, then re-adjust the Loadmasters to the exact temperature required.

5. After all branches have been adjusted the refrigerators should operate at peak efficiency and maintain proper temperature control. Balancing should be rechecked after 2 weeks.

SETTING OPEN PREPARATION ROOM CONTROLS

1. Install a low pressure gauge (0-60 psi) on each pressure tap.

2. Manually turn the temperature control valve to the maximum cold setting and observe gauge "A" and "B" reading.

3. Turn off one or more compressors to raise suction pressure.

4. When suction pressure (gauge "A") reaches 30 psi, the CPR valve should start throttling. This will make gauge "B" increase rapidly. Adjust the valve as required to obtain this operating condition.

5. Set the temperature control valve to maintain approximately 45^{O}F coil discharge temperature. This may require deviation to satisfy local requirements.

It is possible to create frost on the coils and it is recommended that at least one defrost per day be initiated on this branch. This would also apply to closed preparation rooms. The recommended defrost length is a minimum of 60 minutes.

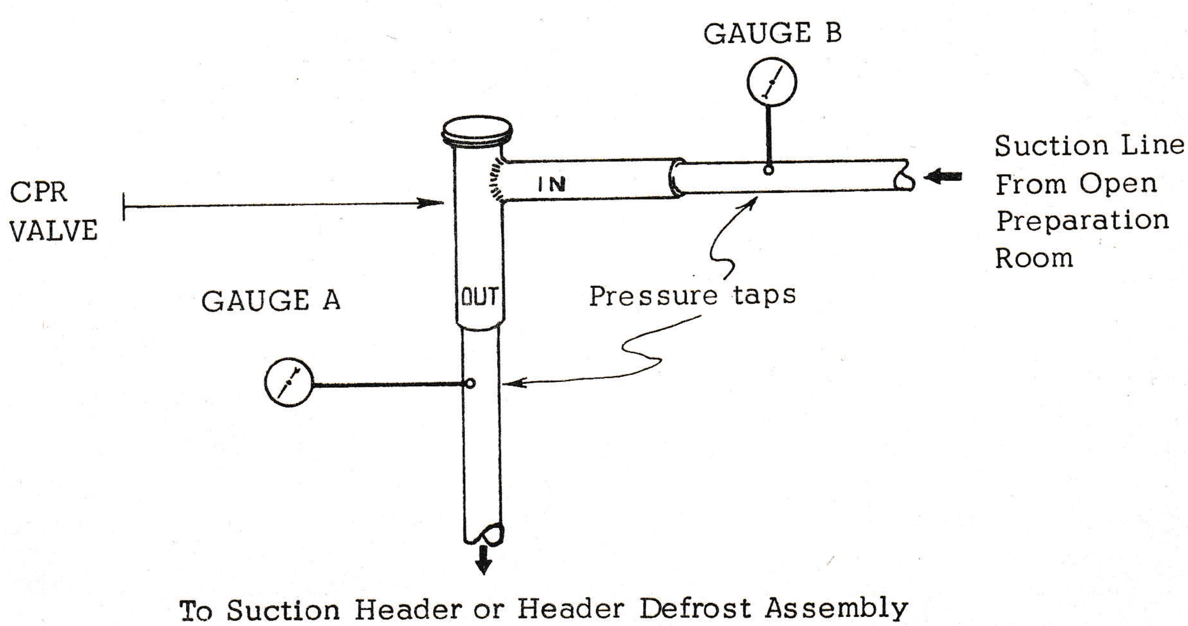


Figure XI-2
CPR Valve Adjustment

FINAL CHECKS

1. Check oil level.

2. Check refrigerant level.

3. Remove the jumper wires from the control panel.

4. Set the time clock to match the proper time. Reconnect the red wire to the time clock.

5. Remove all gauges from the system. Install all service caps. Check that caps are tight.

6. When refrigerators are completely stocked, check the operation of the system again.

7. After approximately 2 weeks of operation, the liquid drier cores and suction filters should be replaced.

8. Recheck the entire system after 90 days. Check for leaks at valves, liquid alarm and flare connections.

CONTROL SETTINGS

Section XII | Page

Section XII	Page
Fan Cycling Control Settings	XII-1
Compressor Cycling Pressure Control Settings	XII-1
Satellite Low Pressure Control	XII-2
High Suction Alarm Control	XII-2
High Pressure Safety Control	XII-3
Compressor Oil Failure Control	XII-3
Receiver Capacity	XII-3
Heat Reclaim Lockout Pressure Settings	XII-3
Additional Refrigerant Charge for Winter Condensing Pressure Controls	XII-4
Winter Condensing Pressure Control Settings	XII-5
EPR Pressure Settings	XII-5
Defrost Timer Settings	XII-6

XII CONTROL SETTINGS

CONTROL SETTINGS

Table XII-1
Condenser Fan Cycling Control Settings

THERMOSTATIC FAN CONTROL

CONTROL SETTINGS				
NUMBER OF THERMOSTATS	CUT-IN SETTINGS FOR THERMOSTATS - °F			
	TC-1	TC-2	TC-3	TC-4
1	75°	—	—	—
2	68°	75°	—	—
3	60°	70°	75°	—
4	55°	65°	71°	75°

SET CUT-OUT 5°F BELOW CUT-IN

THERMOSTATIC FAN CONTROL WITH PRESSURE OVERRIDE

CONTROL SETTINGS								
NUMBER OF THERMOSTATS	CUT-IN SETTINGS FOR THERMOSTATS - °F					PC-1 SETTINGS psig.		
	TC-1	TC-2	TC-3	TC-4	TC-5	REFRIG.	CUT-IN	CUT-OUT
2	80°	75°	—	—	—	R-12	158	117
3	80°	75°	55°	—	—	R 22	260	196
4	80°	75°	65°	50°	—	R-502	283	216
5	80°	75°	70°	60°	50°			

SET CUT-OUT 5°F BELOW CUT-IN

PRESSURE CONTROL B WITH GRAVITY DAMPERS

NUMBER OF FANS		CONTROL SETTINGS					
		REFRIG.	PRESSURE SWITCH CUT-IN SETTINGS psig				
SINGLE BANK	DOUBLE BANK		PC-1	PC-2	PC-3	PC-4	PC-5
1	NA	R-12	143	—	—	—	—
		R-22	215	—	—	—	—
		R-502	236	—	—	—	—
2	2×2	R-12	143	152	—	—	—
		R-22	215	247	—	—	—
		R-502	236	270	—	—	—
3	2×3	R-12	143	147	152	—	—
		R-22	215	231	247	—	—
		R-502	236	253	270	—	—
4	2×4	R-12	143	146	149	152	—
		R-22	215	225	236	247	—
		R-502	236	247	259	270	—
5	2×5	R-12	143	145	148	150	152
		R-22	215	233	231	239	247
		R-502	236	244	253	261	270

SET CUT-OUT 35 psig BELOW CUT-IN

COMPRESSOR CYCLING PRESSURE CONTROL SETTINGS

Ultima compressor controller has been set to provide the lowest evaporator temperature connected to the Plus IV unit. In addition, a factory set and sealed low limit stop is provided to prevent destructively high compression ratios.

DO NOT TAMPER WITH THE SETTING OF THIS STOP WITHOUT WRITTEN AUTHORIZATION FROM HUSSMANN'S SERVICE OR ENGINEERING DEPARTMENT, BRIDGETON, MISSOURI.

The following table contains the proper evaporator temperatures and corresponding pressure settings.

Table XII-2
Ultima Pressure Control Settings

Evaporator Temperature (°F)	Compressor No. 4 Cut-out (psig) R502	Evaporator Temperature (°F)	Compressor No. 4 Cut-out (psig) R502	R22	R12	Evaporator Temperature (°F)	Compressor No. 4 Cut-out (psig) R502	R22	R12
-35	5.0	-21	12.3			6	34	27	8.9
-34	5.3	-20	13.0			7	35	28	9.6
-33	5.7	-19	13.75			8	36	29	10.2
-32	6.1	-18	14.4			9	37	30	10.8
-31	6.6	-17	15.2			10	38	31	11.5
-30	7.0	-16	16.0			11	39	32	12.2
-29	7.5	-15	17.0			12	40	33	12.8
-28	8.0	0	28	21	5	13	41	34	13.5
-27	8.5	1	29	22	5.6	14	42	35	14.2
-26	9.1	2	30	23	6.3	15	43	36	14.8
-25	9.65	3	31	24	6.9	18	47	39	16.7
-24	10.3	4	32	25	7.6	21	50	42	18.5
-23	10.95	5	33	26	8.2	25	55	47	21.3
-22	11.6								

NOTE: Cut-out will be Compressor No. 5 on S50 models, No. 4 on models S40 and S41.

SATELLITE LOW PRESSURE CONTROL

The temperature of refrigerators connected to the Satellite must be controlled by a thermostat controlling the motor contactor. Adjust the Satellite compressor low pressure control according to Table XII-3.

Table XII-3
Satellite Low Pressure Control

	Refrigerant	Cut-out	Cut-in
Medium Temperature	R12	5	15
	R22	20	30
	R502	25	35
Low Temperature	R502	1	10

These settings apply to low end and high end Satellites.

Table XII-4
High Suction Alarm Controls

Saturated Suction Temperature (°F)		Alarm Set Point (psig) ①
Low Temperature R-502	- 35	25
	- 30	30
	- 25 to - 23	35
	- 22 to - 20	40
Medium Temperature R-502	+ 6 to + 12	55
	+ 15 to + 21	60
Medium Temperature R-22	+ 6 to + 12	47
	+ 15 to + 21	57
Medium Temperature R-12	+ 6 to + 12	25
	+ 15 to + 21	31

① Set the alarm differential 10 psi below the alarm set point.

Table XII-5
High Pressure Safety Controls
(Manual Reset)

Refrigerant	Control Settings
R12	230
R502, R22	355

Table XII-6
Compressor Oil Failure Control

Compressor	Oil Pressure Differential Switch		Time Delay (Seconds)
	Cut-in	Cut-out	
Copeland	7 - 11	12 - 18	120
Carlyle	4 - 6	9 - 12	60

Oil failure control is a manual reset safety device.

Table XII-7
Receiver Capacity

Model	Receiver Size (inches)	R502* (lbs.)	R22* (lbs.)	R12* (lbs.)
S540	14 x 72	307	306	339
S541,S550	14 x 90	387	386	428

*Based on 80% receiver capacity at 110°F liquid refrigerant.

Table XII-8
Heat Reclaim Lockout Pressure Settings

Refrigerant	SETTINGS (psig)	
	Cut-In	Cut-Out
R502	165	145
R22	150	130
R12	100	80

ADDITIONAL REFRIGERANT CHARGE REQUIRED FOR COMPRESSOR UNITS WITH WINTER CONDENSING PRESSURE CONTROL VALVES

The following table lists the pounds of refrigerant required to flood each condenser circuit 50%. This is the refrigerant charge required in addition to the normal summer operating charge and heat reclaim coil requirements. Multiply it by the number of circuits used by each compressor unit to determine the charge.

If the temperature is above 60°F, add the specified amounts of refrigerant when the system stablilizes after start up. If it is below 60°F but above the coldest expected temperature, some condenser flooding will already be occurring and the additional charge required will be correspondingly lower. Also, if the coldest expected temperature is above 20°F, the flooding charge required will be less than 50%. Use your judgment in estimating the required charge based on the value indicated in the table.

Table XII-9

APPROXIMATE FLOODING CHARGES FOR HACD CONDENSERS

HACD Model	Total Available Circuits	Pounds of Refrigerant (90°F)			
		R12		R22 and R502	
		Per Circuit	Total	Per Circuit	Total
10, 11, 13	18	1.1	20	1.0	19
12, 15	24	1.1	27	1.0	25
14	24	1.7	41	1.6	39
21, 23, 25	18	2.3	41	2.2	39
24, 30	24	2.3	55	2.2	51
27	24	3.4	82	3.2	78
31, 33, 38	18	3.4	62	3.2	58
37, 44	24	3.4	82	3.2	78
41	24	5.6	124	4.7	116
42, 46, 51	36	2.3	85	2.2	80
49	48	2.3	113	2.2	107
55	48	3.5	170	3.3	160
58	48	1.8	85	1.7	80
63, 69, 76	36	3.5	126	3.2	119
74, 88	48	3.5	168	3.2	159
82	48	5.3	253	5.0	238
83, 92, 101	42	4.0	168	3.7	158
98, 118	56	4.0	224	3.7	211
110	56	6.0	336	5.6	317
104	42	5.0	209	4.6	197
123, 148	56	5.0	279	4.6	263
138	56	7.5	419	7.0	395

WINTER CONDENSING PRESSURE CONTROL

With two or more compressors running adjust the controls as follows:

Table XII-10
Winter Condensing Pressure Control Settings

Application	Flooding ① ② Value (Liquid)	Receiver ② Pressure Control (Gas)
R502	190 psig	180 psig
R22	175 psig	165 psig
R12	120 psig	110 psig

① Increase this pressure by 1 psig for every two feet in height that the condenser is above the 6 foot minimum.

② It may be desirable at times to go below these recommended pressure settings in the interest of power savings, but discretion should be used so as not to affect refrigeration performance. Absolute minimum receiver pressure is 140 psig for R502, 125 psig for R22, and 80 psig for R12. Even these settings may result in marginal performance.

Table XII-11
EPR Pressure Settings

Evaporator Temperature (°F) ①	EPR Pressure Settings ②
-25°	10 (R502)
-22°	12 (R502)
-20°	13 (R502)
-15°	17 (R502)
+6°	35 (R502) 27 (R22) 10 (R12)
+9°	38 (R502) 30 (R22) 12 (12)
+12°	41 (R502) 33 (R22) 14 (R12)
+15°	44 (R502) 36 (R22) 16 (R12)
+18°	48 (R502) 39 (R22) 18 (R12)
+21°	52 (R502) 42 (R22) 20 (R12)
+25°	57 (R502) 47 (R22) 23 (R12)
+30°	64 (R502) 53 (R22) 26 (R12)

① Pressure settings are based on a nominal 2 psi pressure drop assumed to be in the suction line when the control is mounted in the machine room.

② When EPR's are applied, temperature must also be controlled by a thermostat (sensing fan discharge air) which operates a branch liquid line solenoid valve installed at the case. Consult individual case installation instructions for the thermostat setting. For KOOLGAS® systems, a bypass check valve must be installed around the solenoid valve.

RECOMMENDED APPROXIMATE DEFROST TIMER SETTINGS

Defrost is accomplished by means of the time clocks supplied in the control panel. These time clocks provide time-initiated, time or temperature terminated defrost action. Each system defrost can be tailored to suit the application. Space defrost periods on any load to allow for recovery time. Arrange defrost periods so only one KOOLGAS defrost system is energized at any one time for either the low or medium temperature compressors. Off time defrost loads should be arranged to allow no more than 33% of unit capacity on defrost at one time.

The settings in Table XII-12 are approximate and may change due to revisions in refrigerator instructions. The specific refrigerator instructions should be referred to for current data. The most recent date of publication will take precedence.

Table XII-12 gives approximate defrost timer settings for most installations. Adjust timing and frequency in accordance with voltage conditions and store conditions. Where liquid lines are long, increase off-time defrost to compensate for "pump down" time, as some refrigeration effect continues until the liquid line clears of liquid.

Table XII-12
Defrost Timer Settings

APPLICATION	REFRIGERATED FIXTURE	DEFROST LENGTH-MINUTES NON-ELEC.	ELEC.	KOOLGAS	NO. OF DEFROST PER 24 HRS.
MEAT	MMS	46	46	16-20	2
	VGL	120		10	1
	FMG, FMRG	70	46	14	2
	FMTS, DTSMV	96		10	1
	FHMSG	46	46	12-16	4
	FHDG	60	46	12-16	3
	DTSV, DRSV	60		10	1
DELI	FMTSD	96		10	1
	FHDG	60	46	14	3
	FHMSG	46	46	14	4
	VBL, VGL	120		10	1
	DRSV, DTSV, DFTV	60		10	1
	FMGC, FMRGC	70	46	14	2
	JVM, JVMH, JVMA	46	46	14	3
	BHDB	110	46	12-16	2
	RVM, RVMH, RVMA	60	46	12	1
DAIRY	AFF-AFR	60		16-18	4
	JVM, JVMH, JVMA, JVMRS	46		14	3
	BHDB	110	46	12-16	2
	RVM, RVMH, RVMA	60		12	1
PRODUCE	P, PH	46		10-14	4
MISC.	RAM, RHM (Reach-In)	60		12	1
ICE CREAM	BJC, BJI-C, BTF-C, JJA-C		46	24	1
	GCI, GGC		60	24	1
	GWIC, GWIT		60	24	1
	G6C-G5C		36	20-24	4
	R6C		60	22	1
	RAC, RHC (Reach-In)		60	14	1
FROZEN FOOD	G6F-G5F		32	20-24	2
	GWI, GWIT		60	24	1
	GFI, GG		60	24	1
	BFI, BJI, BTF, JJA		46	20	1
	FMLG, FML		46	14	2
	R6F		60	22	1
	RAF, RHF (Reach-In)		60	14	1
LOW TEMP. COOLERS	Frozen Food - 5°F		24	16	2
	Ice Cream -15°F		24	16	2
MED. TEMP. COOLERS	Meat	90	24	16	2
	Deli	90	24	24	2
	Dairy & Bev.	60		16	2
	Produce Cooler	60			2
	Gravity Coils	240		16	1
	Prep. Areas	120			1

(1) For defrost applications that utilize temperature termination use the defrost lengths indicated as fail-safe setting. Refer to fixture instructions for temperature termination settings.

INDEX

INDEX

Accessories
- Alarms (see Alarms)
- Heat Reclaim IX-6
- 2-Stage Liquid Level IX-4

Alarms
- Bell IX-1
- Defrost Timer VIII-5
- Diagnostic Chart IX-12
- High Suction XII-2
- In-store IX-1
- Light IX-1
- Other Types IX-3
- Remote IX-2
- 2-Stage Liquid Level IX-4

Balancing Store Fixtures XI-6

Branch Stubs IV-8

Brazing II-1

CDA Valve (see Valve)

Charging (Refrigerant)
- Capacity XII-3
- Procedure XI-5

Check Valve (see Valve)

Compressors
- Description I-1, IV-1
- Installation IV-3
- Electrical IV-9
- Leveling IV-4
- Locating IV-4
- Piping (see Piping)
- Replacing IV-17
- Wiring Diagrams IV-11

Condensers
- Description VI-1
- Fan Cycling Control Settings XII-1
- Remote Air Cooled VI-1
  - Checkout VI-6
  - Electrical VI-6
  - Flooding Charge XII-4

Remote Air Cooled (cont'd.)
  - Piping VI-3
  - Winter Condensing Pressure Control Setting XII-5
  - Wiring Diagram VI-11
- Water Cooled VI-12
- Water Cooled Evaporative VI-13

Contactors IV-10

Control Panels
- Compressor IV-9, 10
- Defrost IV-9
- Wiring Diagrams IV-11, V-4

Control Settings (see Chapter XII)

Defrost Control Program Timer
- Precision Brand
  - Cycle Dial VIII-4
  - Description VIII-1
  - Program Timer VIII-3
  - Time Index Dial VIII-4
  - Tripper Alarm VIII-5
- Paragon Brand
  - Description VIII-6
  - Setting VIII-7
  - Replacement VIII-8

Defrost Schedule XII-7

Discharge Line VI-3

Discharge Pressure Control XII-2

Elbows (see Piping)

EPR Valve (see Valve)

Equalizing Line I-7, VI-5

Evacuation XI-2

Expansion Loop II-5

Fan Cycling Control I-5, XII-1

Filters
Location I-7
Satellite VII-7

Flooding Valves (see Valve)

Hand Valve (see Valve - Shutoff)

Header Defrost Assembly (Remote)
Description V-1
Electrical V-2
Installation V-2
Piping V-2
Wiring Diagrams V-3, 4, 5

Heat Reclaim
Description I-5
Installation IX-6
Lockout Setting XII-3
Thermostat Specifications IX-8

High Pressure Control Settings XII-2

High Suction Alarm Control
Settings XII-2

Interconnecting Piping
(Remote Header Defrost) V-2

Isolation Pads IV-4

KOOLGAS Defrost
Description I-4, II-4
Liquid Line IV-7
Suction Line IV-7

Leak Testing XI-1

Legend (Store) III-1

Liquid Level Indicator IV-4

Liquid Line
General I-1
For KOOLGAS (see KOOLGAS)
Sizing IV-6
To Refrigerators IV-6
To Remote Header Defrost V-2
Return VI-4

Loadmaster Valve (see Valve)

Low Pressure Control
(Satellite) XII-2

Nitrogen II-1

Offset Piping II-4

Oil
Charging Procedure XI-2
Description I-3
Failure Control Settings XII-3
Location of Components I-7
Regulators IV-19
Remote Satellite VII-3
Requirements XI-6
Vent Line I-4

Piping
Brazing II-1
Compressor IV-5
Diagram I-7
Description II-1
Elbows II-1, 4
Expansion Loops II-5
Offsets II-4
P-trap II-3
Risers II-3
Sizing (see Planning Data)
Special Applications IV-8
Support II-1

Preparation Room (Open)
Control Settings XI-7
Piping IV-8

Pressure Regulator (see Valve)

Program Timer (see Defrost Control
Program Timer)

P-trap II-3

Purge Valve (see Valve)

Receiver Capacity XII-3

Relays
Location IV-10
Single Phase Relay Replacement IV-22

Reversing Valve (see Valve)

Risers II-3

Safety Relief Valve (see Valve)

Satellite
Mounted I-1, IV-1
Remote
Description VII-1
Electrical VII-3
Location VII-2
Low Pressure Control XII-2
Piping VII-2
Suction Filter Replacement VII-7
Wiring Diagrams VII-4

Schrader Valve (see Valve)

Service Valve (see Valve - Shutoff)

Shutoff Valve (see Valve)

Single Phase Protector IV-10, 21

Solder II-1

Solenoid Valve (see Valve)

Start Up XI-1

Suction Filter (see Filter)

Suction Line
General I-2
For KOOLGAS (see KOOLGAS)
Sizing IV-6
To Refrigerators IV-6
To Remote Header Defrost Assembly V-2

Suction Stop I-4

Thermostat
Defrost Termination IV-16
Heat Reclaim IX-8
Refrigeration I-2, IV-16

Thermostatic Evaporator Pressure
Regulator I-3

Time Delay IV-9

Time Index Dial (see Defrost Control
Program Timer)

Ultima
Control Settings XII-1
Servicing IV-18
Start Up XI-4

Valve
CDA
Description X-1
Diagnostic Chart X-13
Parts List X-17
Sensor Location X-15
Sensor Wiring X-8
Service X-11
Setting X-8
Check I-4, 7, VI-5
CPR IV-8
EPR
Description I-2
Setting XII-5
Flooding (Winter Condensing
Pressure Control)
Description I-6
Servicing IV-20
Heat Reclaim (3-way/4-way) I-5, IX-7
Servicing IX-9
Loadmaster XI-6
Purge VI-4, 5
Receiver Pressure Regulator
Description I-6
Servicing IV-20
Relief (Pressure) IV-6
Schrader I-7
Shutoff (Hand or Service) I-7, II-1,
VI-3, 5, VII-3, IX-7
Solenoid I-1, 4, 7
3-way I-4, 7
Water Regulating I-5

Winter Condensing Pressure Control I-5

BUSINESS REPLY

This manual is designed to assist qualified refrigeration installers and service personnel in achieving a trouble free refrigeration system.

Every attempt has been made to make information readily available and understandable. The great variety and complexity of components make it impossible to thoroughly treat each one of them, but we do wish to include all specific information needed in the field.

We need your comments.

Any suggestions that would help to improve this manual will be seriously considered. Please include specific references as well as page or figure numbers.

Use the following checklist as a guide to your comments.

1. Is important information hard to find or non-existent?
2. Are the illustrations satisfactory?
3. Are service tips clear and helpful? Do you have tips that might help others?

Detach and mail - no postage necessary

Comments: ____________________

____

____

____

____

____

____

Company Name: ____________________

Name, Job Title: ____________________

Address: ____________________

____________________ Zip ________

Reply requested:

Yes: ___

No: ___

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

First Class Postal Permit No. 258 Bridgeton, Mo 63044

HUSSMANN®

An IC Industries Company

Attn: TECHNICAL PUBLICATIONS DEPT.
12999 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI 63044