Tecumseh

AH HEAT PUMP AND AIR CONDITIONING COMPRESSORS

19,500 btu/hr. — 31,000 btu/hr.

The AH line is the newest series offered by Tecumseh and is designed to cover the range from 19,500 BTU/hr to 31,000 BTU/hr. Compressors are internally spring mounted with external grommets for quiet operation. This line offers considerable savings in cost and weight over comparable Tecumseh twins and is ideal for large window coolers, small residential air conditioners, or heat pumps.

All motors are PSC and the compressor will be equipped with an internal line break overload which cannot be by-passed. The end turns of the motor are cooled by suction gas and the system will normally not require a low pressure control. Several variations are available in tubes and mounting to provide complete flexibility. Rotolock valves are offered and all models may include a mechanical anti-slug device. The dual voltage models are designed to operate over a range of plus 10% of 230 volts and minus 5% of 208 volts. Both the dual voltage and single voltage lines may be applied to 50 cycle current with a nominal voltage range of 240/220.

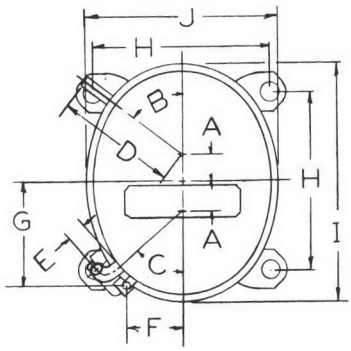
Customers looking for an efficient, economical compressor will find the AH series perfect for their applications.

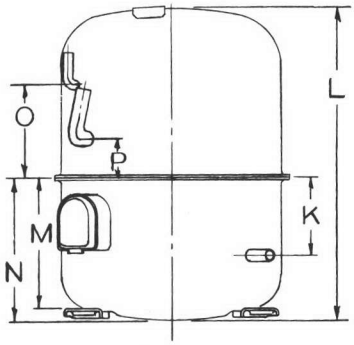
Model	Bore	Stroke	Disp.	BTU/Hr.	Refgr.	Motor Type	Suct. Line	Disc. Line	Oil Chg.	• Net Weight
AH20L12	1 3/8	3/4	2.220	19500	22	PSC	1/2 ID	5/16 ID	45 oz.	66
AH22M12	1 7/16	3/4	2.430	22000	22	PSC	1/2 ID	5/16 ID	45 oz.	66
AH24P12	1 1/2	3/4	2.650	24000	22	PSC	1/2 ID	5/16 ID	45 oz.	67*
AH28Q13	1 17/32	13/16	2.990	27500	22	PSC	1/2 ID	5/16 ID	45 oz.	68*
AH31S13	1 19/32	13/16	3.240	31000	22	PSC	1/2 ID	5/16 ID	45 oz.	70*

All models available as either ÷ dual voltage — 230/208 volts (nominal)
or ÷ single voltage — 230 volts (nominal)

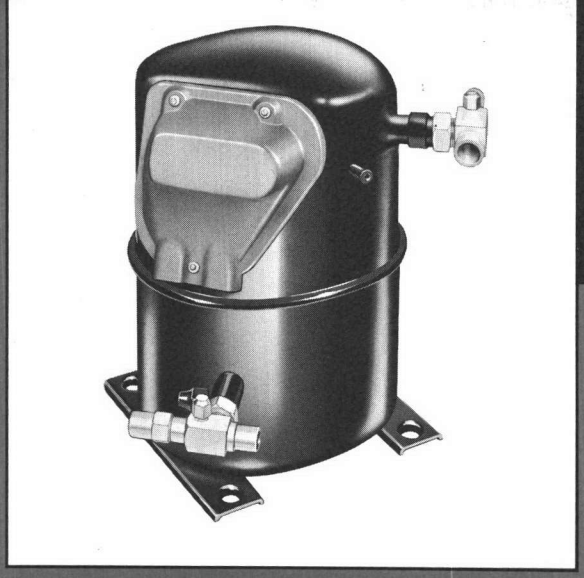
• Approximate
* For dual voltage models with Anti-Slug add 1 1/2 lbs.

DIMENSIONS





Model	AH20, AH22, AH24, AH28 — No Anti Slug	AH24, AH28 — With Anti Slug; AH31
A	1 1/8	1 1/8
B	53°	53°
C	49°	49°
D	5 3/32	5 3/32
E	7/8	7/8
F	2 7/16	2 7/16
G	4 3/8	4 3/8
H	7 1/2	7 1/2
I	10	10
J	8 3/16	8 13/16
K	3 3/8	3 3/8
L	13 3/16	14 1/8
M	5 1/2	5 1/2
N	6	6
O	3 7/8	3 7/8



Tecumseh

CL HEAT PUMP AND AIR CONDITIONING COMPRESSORS

31,000 btu/hr. — 62,500 btu/hr.

The CL line for residential air conditioning and heat pump applications covers the range from 31,000 BTU/hr to 62,500 BTU/hr. All are internally mounted, in line twins with two pole motors for minimum physical dimensions. The line is designed for R-22 and includes all of the major advancements in compressor design.

All models include the exclusive Tecumseh mechanical anti-slug device described on page 10 for protection against liquid or oil slugs. With the exception of the special, heavy-duty window cooler model CL26, all include an internal thermostat built into the motor windings. The thermostat in conjunction with a supplementary overload provide fully automatic inherent protection. These components control the contactor through a pilot circuit and the system normally will not require a low pressure control.

All models have dual voltage motors with nominal values of 230/208 volts for single and 240/208 volts for three phase, except the CL51 which has nominal 230 volt single phase. Further, all models also have three phase motors with nominal voltages of 480/440 and 550 volts.

The CL26 and CL31 models are also available using motors (less internal thermostat) with a voltage rating of 230 single phase. These are used on units which do not employ a pilot duty control circuit, such as window units.

This line of motors provides the widest operating electrical range available today. The dual voltage models are designed to operate over a range of 197 to 253 volts. The single voltage models over the standard ±10% range. Both lines may be applied to 50 cycle current also.

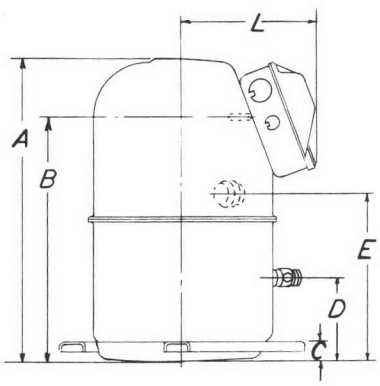
Other features include Rotolock valves, Fiberglas covers, and Mylar motor insulation. The CL line offers maximum performance on the "tough" applications at a highly competitive price.

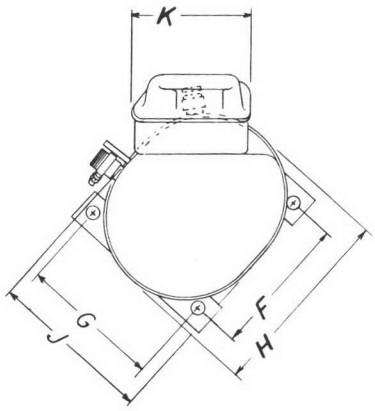
Motor H.P.	Model	Bore	Stroke	Disp.	BTU/Hr.	Refgr.	Motor Type	Suct. Line	Disc. Line	Oil Chg.	• Net Weight
2½	CL26X12	1¾	¾	3.61	31000	22	PSC	¾ ID	⅜ ID	45 oz.	95
3	CL31Y14	1 25/32	⅞	4.36	38000	22	PSC	¾ ID	⅜ ID	45 oz.	103
3½	CL36ZC14	1 29/32	⅞	4.99	44000	22	PSC	¾ ID	⅜ ID	45 oz.	105
4	CL41ZA17	1 27/32	1 1/16	5.68	51000	22	PSC	¾ ID	⅜ ID	45 oz.	106
5	CL51ZH17	2 1/16	1 1/16	7.08	62500	22	PSC	⅞ ID	½ ID	45 oz.	108

• Approximate

Model	CL26 CL31	CL36 CL41	CL51
A	15 13/32	16 9/32	17 5/32
B	12 11/32	13 7/32	14 3/32
C	1 7/32	1 7/32	1 7/32
D	4 21/32	4 21/32	4 21/32
E	9 23/32	10 19/32	9 5/32
F	7½	7½	7½
G	7½	7½	7½
H	10½	10½	10½
J	8 15/16	8 15/16	8 15/16
K	6 19/64	6 19/64	6 19/64
L	7 1/16	7 1/16	7 1/16

DIMENSIONS





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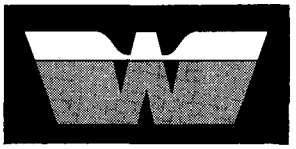
INSTALLATION AND OPERATION

INSTRUCTIONS FOR

HERMETIC COMPRESSOR AND CONDENSING UNITS

MODEL VH



WORTHINGTON AIR CONDITIONING COMPANY

Ampere Station, East Orange, New Jersey

1100-E84B

FOREWORD

Worthington products are the result of more than a century of progressive study and development. Advanced design, proper selection of materials, and precision construction reflect this wide experience. Worthington products will give trouble-free efficient operation with minimum maintenance and repair.

This instruction book will familiarize management and operating personnel with pertinent details and proper procedures for the installation, operation, and maintenance of Model VH Hermetic Compressor and Condensing Units.

STUDY THIS INSTRUCTION BOOK

The descriptions and instructions included in this book cover the standard design of the equipment and any common deviations when possible. This book does not cover all design details and variations nor does it provide for every possible contingency which may be encountered. When information cannot be found in this book, contact the nearest Worthington District Office.

WARRANTY

WORTHINGTON warrants this product so far as the same is of its own manufacture, against defects in material and workmanship, under normal use and service, for a period of one (1) year from date of shipment, WORTHINGTON'S obligation under this warranty being limited, however, to furnishing or repairing, without charge, f.o.b. its Works, a similar part to replace any part of its own products which within one year from date of shipment is proven to have been defective at the time it was shipped, provided WORTHINGTON has been given immediate written notice upon the discovery of such defect. WORTHINGTON shall have the option of requiring the return of the defective material, transportation prepaid, to establish the claim. WORTHINGTON shall in no event be held liable for damages or delay caused by defective material, and no allowance will be made for repairs or alterations unless made with its written consent or approval. WORTHINGTON shall not be held responsible for work done, apparatus furnished or repairs made by others. There are no warranties, express or implied, except the above and such other express warranties, if any, as may be definitely set forth herein.

WORTHINGTON shall not be liable for any special, indirect, or consequential damages, or for any damages arising from the use of products specified herein.

Equipment manufactured or supplied by others, but furnished by WORTHINGTON hereunder, carries the same warranty that the manufacturer or supplier thereof furnished to WORTHINGTON.

"Do not operate this equipment in excess of its rated capacity, nor otherwise than in accordance with the instructions contained in this Manual. This equipment (or a prototype) has been shop tested and found satisfactory for the conditions for which it was sold, but its operation in excess of these conditions will subject it to stresses and strains which it was not designed to withstand.

Failure to heed this warning may result in an accident causing personal injury."

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SECTION I
INSTALLATION

A. GENERAL DESCRIPTION

1. Introduction—This manual covers the installation, operation and preventive maintenance of the Worthington Compressor and Condensing Units, Model No. 2VH and 3VH (including the 3VH Duplex Units). Many of the features and characteristics of these different models are the same; therefore, the installation and operating instructions which apply have been combined in one manual. Where separate instructions are necessary, they are so noted; otherwise, it may be assumed that the instructions apply equally to all.

Worthington believes it has achieved in the V-Line compressors a product of superior design and manufacture. However, to maintain superior performance of these units, the following are absolutely necessary:

(1) Proper Application.
(2) Proper Installation.
(3) Correct Operation.
(4) Faithful Periodic Preventive Maintenance.

To aid you in carrying out the above, Worthington has written this Manual. Following these instructions is your assurance that the equipment will perform as expected, and only then will the Worthington warranty apply.

2. Description of VH Units

a. Compressor Unit (Fig. 1)—This V-Line Compressor (Fig. 2) mounted on a suitable base. The arrangement of safety switches, gauges, starters and overload protection is described below. Compressor units range in capacity from 7.5 to 80 tons, employing four to eight cylinders and two different piston displacements. In addition to the safety valve, set at 300 psig, which is mounted on the compressor motor housing to prevent excessive low-side pressure, there is an internal relief valve located behind the discharge shut-off valve to safeguard against dangerous high-side pressure. A thermal protector switch mounted on one of the cylinder heads stops the compressor operation whenever the discharge gas temperature is too high.

b. Condensing Unit (Fig 3)—Series CDS-300 and Series CDS-400 condensers are employed on the V-Line condensing units. The basic difference in them lies in the method of fastening the tubes in place. The series CDS-300 has its tubes brazed to the tube sheet, while the Series CDS-400 has replaceable rolled-in tubes. The condenser heads may be interchanged end-for-end to accommodate the piping layout.

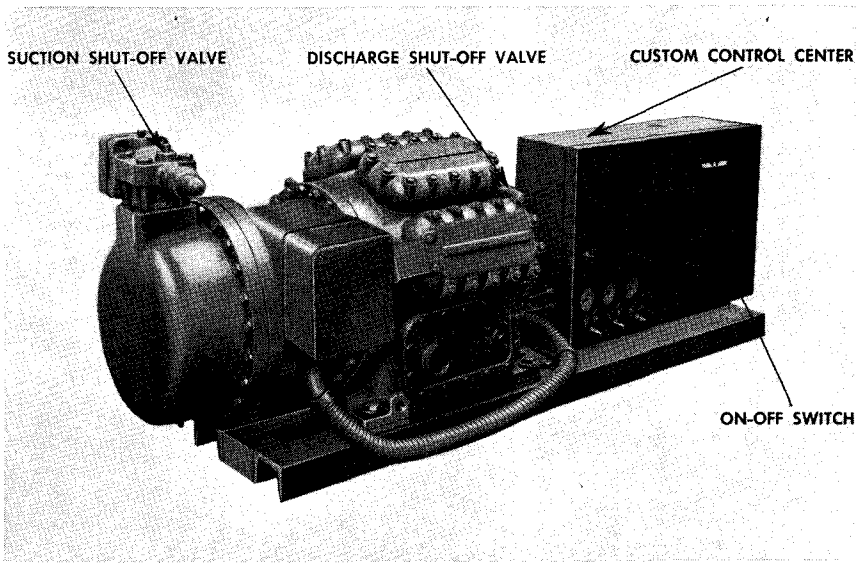

Fig. 1—VH Compressor Unit C-5286

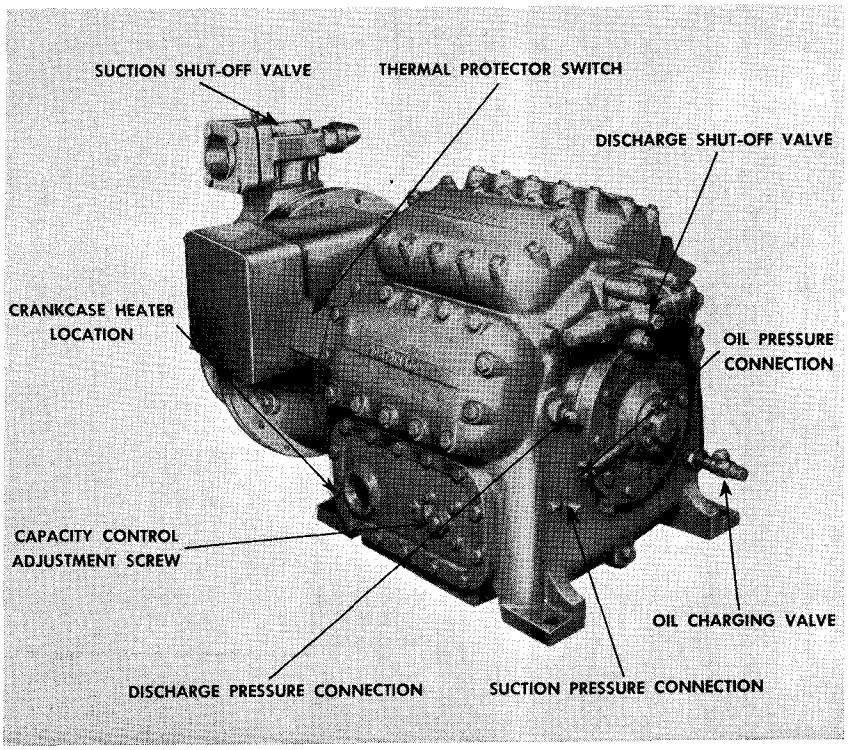

Fig. 2—V-Line Compressor C-5266

c. Duplex Unit (Fig 4)—Where higher capacity than obtainable with standard units is desired, two 3VH type compressors are installed on a single base with factory installed oil level equalizing provisions. Capacities from 80 to 160 tons can thus be obtained.

d. Control Center—The VH units with control center are equipped with a custom designed control box and may be completely factory-wired on

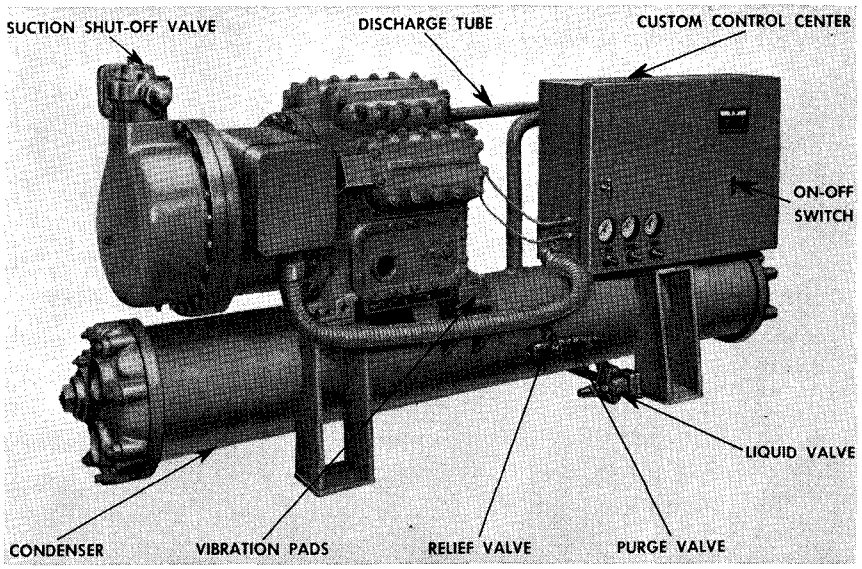

Fig. 3—VH Condensing Unit C-5285

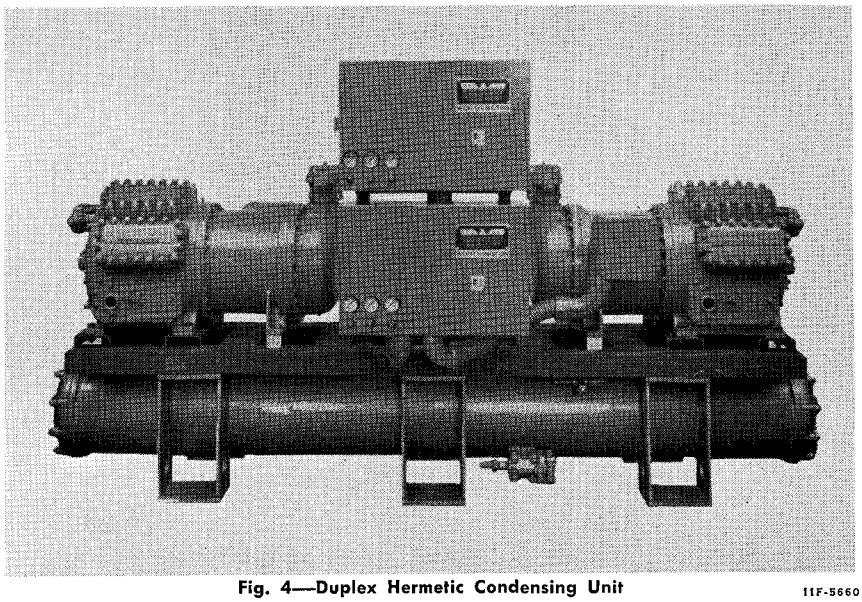

Fig. 4—Duplex Hermetic Condensing Unit 11F-5660

order. Included in the "control center" are:

(1) Control circuit "on-off" switch

(2) Motor starter(s) with auxiliary contact

(3) (a) Motor overload protectors (2VH units)
(b) Guardistor* relay circuit (3VH units)

(4) Hi-Lo pressure switch (Manual reset for both high and low cut-outs)

(5) Low-oil pressure switch (Manual reset)

(6) Gauges with shut-off valves to indicate discharge, suction and oil pressures.

(7) Crankcase heater control.

*Registered Trade Mark, Westinghouse Elect. Corp.

e. Starter(s) in NEMA Enclosure —The 2VH units—with starter, less factory wiring—are shown on the dimension sheets Fig. 6. The auxiliary electrical equipment, mounted directly on the compressor, includes the hi-lo pressure switch and the low-oil pressure switch. An oil pressure gauge with shut-off valve is also furnished on the compressor. The starter box kit, complete with overload protectors and interlockers in a standard NEMA enclosure, is packaged separately for wall mounting at the installation site. A bracket used to mount the starter on top of the condenser is an optional feature for the condensing unit. Unlike the VH units—with control center, these models **always** require complete electrical wiring when they are being installed.

f. Model Designation Code — The Model designation code (found on the unit's nameplate) consists of three groups of letters and/or numerals.

(1) The first group identifies the compressor in the following sequence:

(a) Numeral indicating nominal piston size

(b) Letter V indicating compressor series

(c) Letter H indicating hermetic type

(d) Letter code for motor horsepower

(e) Numeral indicating number of cylinders

(2) The second group identifies the electrical characteristics of the unit in the following sequence:

(a) Numeral indicating type of current
2=208/220V 3-phase 60 cycle
4=440 V 3-phase 60 cycle
5=550 V 3-phase 60 cycle

(b) Letter indicating type of starter
A=across-the-line
P=part winding

(c) Numeral indicating control circuit Voltage
1=110 V single-phase 60 cycle
2=220 V single-phase 60 cycle

(d) Letter indicates type of control circuit provided
W=with control center, factory wired
S=with control center, not factory wired
N=with conventional starter, not factory wired

(3) The third group pertains to condenser units. For example:
301=condenser CDS-301
302=condenser CDS-302
There are many condenser sizes available which will not be listed here.

(4) Duplex units are indicated by the repetition of the first group with both compressor designations separated by a dash.

(5) The following examples may aid in understanding the nameplate nomenclature:

(a) 3VHN5-2P2W — 303 describes a unit with a 3VH5 compressor having a size "N" hermetic motor wound for 208/220 Volts operation; the starter is a part winding type; the control circuit operates at 220 Volts; a

control center is provided and the unit is factory wired; a model CDS-303 condenser is used.

(b) 3VHN4—3VH06—2P2W—423 describes a duplex unit with a 3VHN4 and 3VH06 compressor wound for 208/220 Volt starter part winding type, control circuit 220V, control center provided, unit factory wired, Model CDS-423 condenser used.

B. INSTALLATION

1. General—A self-explanatory Installation Check list, as shown on page 34 is supplied with this Manual. It should be completed STEP-by-STEP by the person or persons supervising the various phases of the installation. It forms part of the warranty of this unit and a copy should be returned to Worthington with the warranty card.

2. Receiving and Handling — The unit should be uncrated as closely—and carefully—as possible to its installed location. Report any damage to the product or discrepancies between it and the shipping papers to the shipper and to the nearest Worthington representative for appropriate action. Never suspend the unit by any of its components, but support it under the compressor base or under the condenser to move it into position. Do not remove the skid from under the condenser until the unit is being lifted upon the foundation.

3. Location Requirements

a. Space—The V-Line unit should be located in a dry and well lighted room. Enough space must be allowed around the unit to inspect and service it. In general, a 24 inch clearance all around for the 2VH and a 30 inch clearance on all sides for the 3VH is satisfactory. For condensing units allowance should be made for tube cleaning or in the case of CDS-400 series, for tube replacement.

b. Ventilation—Refrigeration compressors, auxiliary pumps and fan motors reject heat to the surrounding air. Forced ventilation should be considered when this equipment is located in fairly small quarters with no natural ventilation. Since every installation situation is different, no definite set of rules can be stated regarding the amount of space required for good heat dissipation. Many localities consider the proper removal of heat so important that they have adopted ordinances requiring the use of exhaust fans in compressor rooms. Check local building codes in this respect.

c. Drainage—A floor drain should be located near the V-Line condensing unit. The piping should also be laid out to permit draining of the condenser and water piping for seasonal shut-down or for repairs. Never locate the unit so that sweating or leaking pipes will drip on it. The electrical equipment; especially, should be protected from dirt or water.

d. Important Note—Local and National codes have sections covering the location and installation of refrigeration equipment, "American Standards Association Mechanical Code No. ASAB9" and Worthington's "System Design and Installation Manual", Section 300, are recommended guides.

4. Vibration Isolation—The VH compressor crankshaft and rotor are dynamically balanced. Vibration pads assembled beneath the compressor feet also serve to limit the transmission of vibration to the building. For systems where no noticeable vibration can be tolerated, additional vibration isolators beneath the unit may be required if the floor is not sufficiently rigid. Minor irregularities in the mounting and in the foundation, which contribute to a noise problem, can be corrected through the proper use of vibration isolators. Location and specification for the VH vibration eliminators can be found in Fig. 13 and 14.

In addition, it is advisable to reinforce floors of light or medium construction directly under the unit base. Be certain that these reinforcements do not contact the floor at any other point since they might transmit vibrations that could cause a noise problem. Some conditions make a concrete foundation desirable. The weight of the concrete foundation (usually 1½ times the unit weight is important in reducing vibrations.)

Comp.	A	B	C	D	E	F	G	Weight Comp.	Base	Cab.*	Total
2VH4	22 15/16	1 9/16	10 5/8	2 1/8	1 3/8	10 13/16	67 1/2	910	80	175	1165
2VH5 2VH6	24	2 11/16	11 1/4	2 1/8	1 3/8	11 7/16	68 1/8	950	80	175	1205
2VH7 2VH8	24 5/16	2 15/16	11 7/8	2 5/8	1 5/8	12 1/16	68 3/4	980	80	175	1235

*Max. weight includes all wiring.

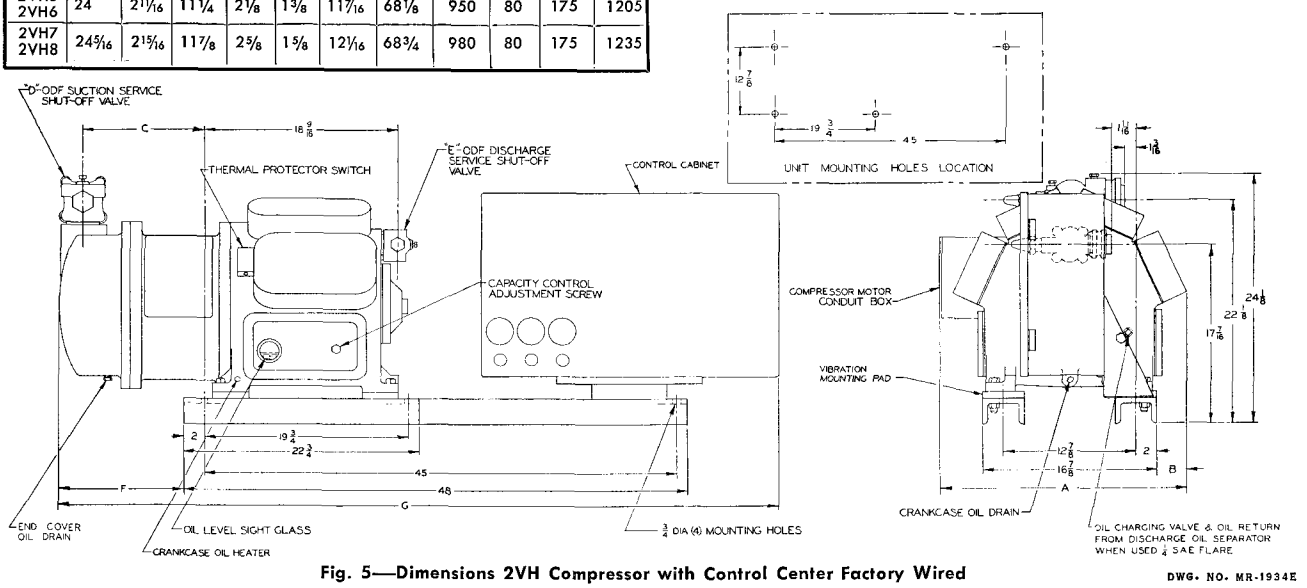

Fig. 5—Dimensions 2VH Compressor with Control Center Factory Wired

DWG. NO. MR-1934E

Comp.	A	B	C	D	E	F	G	Weight - Lb. Comp.	Weight - Lb. Starter
2VH4	23 9/16	3	16 1/8	2 1/8	1 3/8	15 1/4	37 5/16	910	50 Max.
2VH5 2VH6	24	3 3/8	16 3/4	2 1/8	1 3/8	15 7/8	37 15/16	950	
2VH7 2VH8	24 5/16	3 11/16	17 3/8	2 5/8	1 5/8	16 1/2	38 9/16	980	

*Items shipped loose

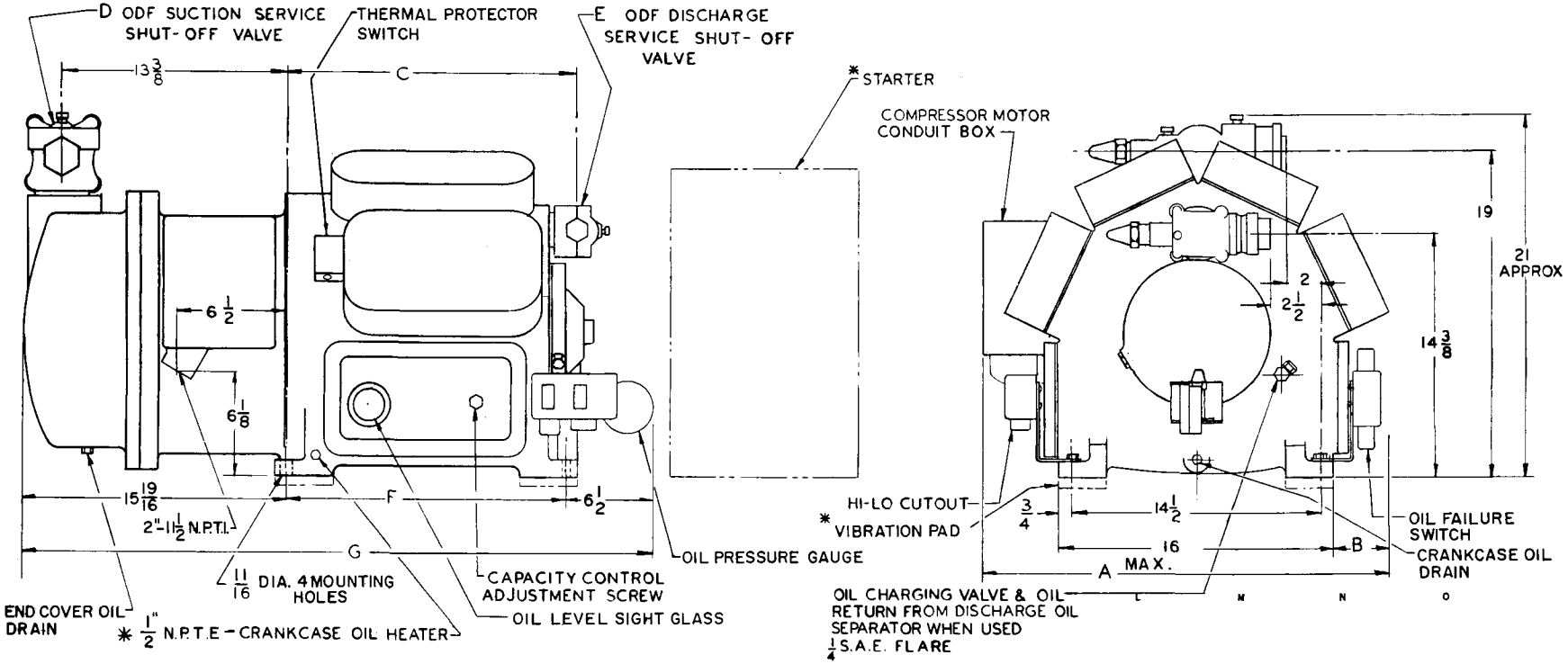

Fig. 6—Dimensions 2VH Compressor with Starter Non-Wired

MX-1889B

Comp.	Condensers CDS-300 Series	Condensers CDS-400 Series	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	Weight Lb. Cond.	Comp.	Starter	Total
2VH4	301	401	65 1/4	34 3/4	12 7/8	32 13/16	2 1/8	9 7/16	7/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	23 9/16	1 1/2	13 3/4	68 5/16	385	910	50 Max.	1345
	302	402	65 1/4	34 3/4	12 7/8	32 13/16	2 1/8	9 7/16	7/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	23 9/16	1 1/2	13 3/4	68 5/16	425			1385
	303	403	65 1/4	34 3/4	12 7/8	32 13/16	2 1/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	23 9/16	1 1/2	13 3/4	68 5/16	450			1410
	304	404	77 1/4	34 3/4	18 7/8	32 13/16	2 1/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	23 9/16	1 1/2	13 3/4	74 5/16	510			1470
2VH5 & 2VH6	302	402	65 1/4	34 3/4	12 7/8	32 13/16	2 1/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	23 31/32	1 7/8	14 3/8	68 15/16	425	950		1425
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	304	404	77 1/4	34 3/4	18 7/8	32 13/16	2 1/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	23 31/32	1 7/8	14 3/8	74 15/16	510			1510
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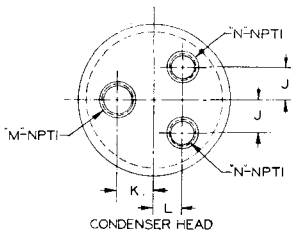
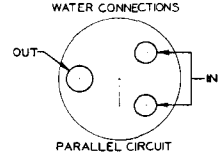
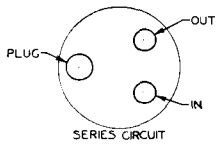
2VH7 & 2VH8	303	403	65 1/4	34 3/4	12 7/8	32 13/16	2 5/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	24 9/32	2 3/16	15	69 9/16	450	980		1480
	304	404	77 1/4	34 3/4	18 7/8	32 13/16	2 5/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	24 9/32	2 3/16	15	75 9/16	510			1540
	305	405	77 1/4	34 3/4	18 7/8	32 13/16	2 5/8	9 1/4	1 3/8	7 3/4	2 5/8	2 3/8	1 3/8	2 1/2	1 1/2	24 9/32	2 3/16	15	75 9/16	535			1565
	306	406	79	36 9/16	19 3/4	34 5/8	2 5/8	9 1/4	1 3/8	8 11/16	3 5/8	4 3/8	3 5/8	2 1/2	2	24 9/32	2 3/16	15	76 7/16	670			1700







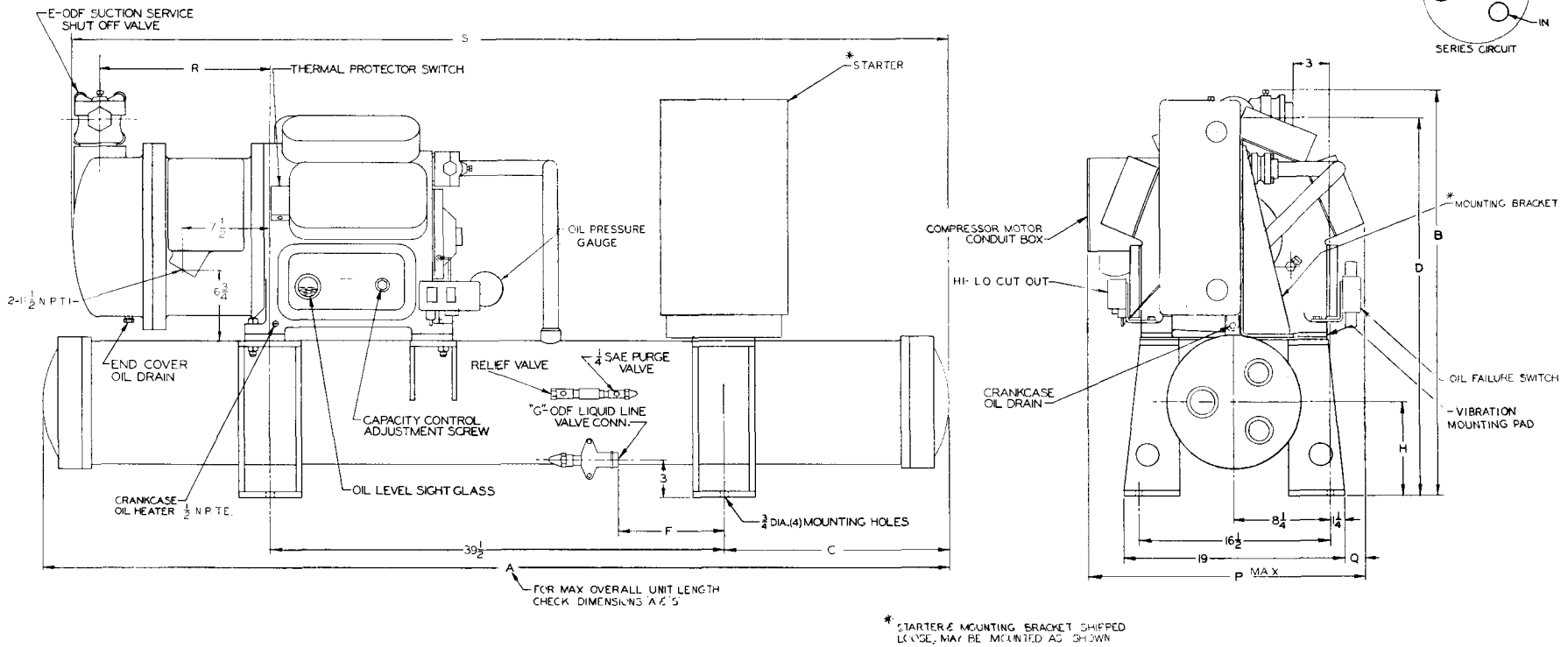
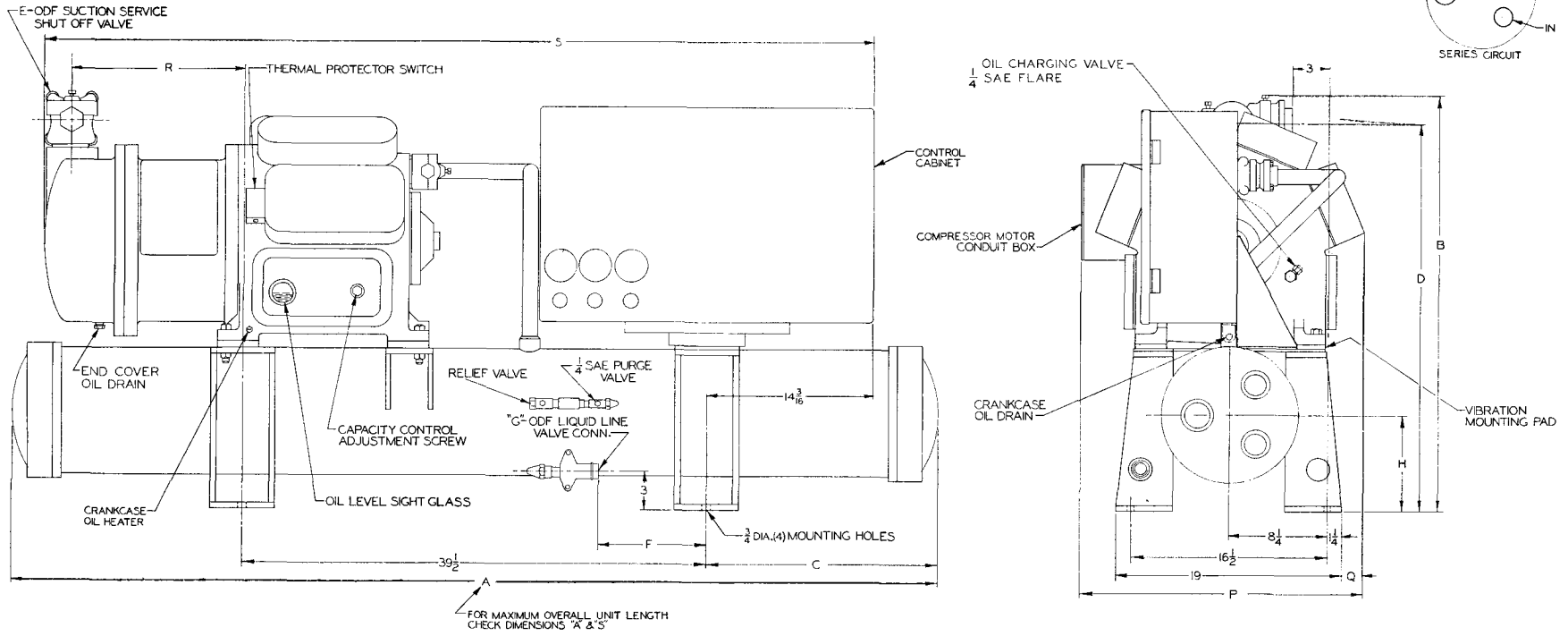


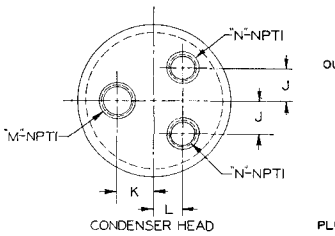
Fig. 7—Dimensions 2VH Condenser with Starter Non-Wired

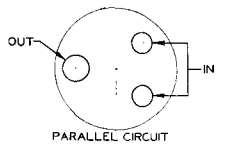
DWG. NO. MR-2104A

COMP.	CONDENSERS CDS-300 SERIES	CDS-400 SERIES	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	WEIGHT CONDT.	COMP.	CAB.*	TOTAL
2VH4	301	401	65 1/4	34 3/4	12 7/8	32 15/16	2 1/8	9 7/16	7/8	7 3/4	4 3/8	2 3/4	3/8	2	1 1/2	22 3/4	1/2	13 3/4	69 5/8	385	910	175	1470
	302	402	65 1/4	34 3/4	12 7/8	32 15/16	2 1/8	9 7/16	7/8	7 3/4	4 3/8	2 3/4	3/8	2	1 1/2	22 3/4	1/2	13 3/4	69 5/8	425	910	175	1510
	303	403	65 1/4	34 3/4	12 7/8	32 15/16	2 1/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	22 3/4	1/2	13 3/4	69 5/8	450	910	175	1535
	304	404	77 1/4	34 3/4	18 7/8	32 15/16	2 1/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	23 3/4	1/2	13 3/4	69 5/8	510	910	175	1595
2VH5 2VH6	302	402	65 1/4	34 3/4	12 7/8	32 15/16	2 1/8	9 7/16	7/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	24	1	14 3/8	70 1/4	425	950	175	1550
	303	403	65 1/4	34 3/4	12 7/8	32 15/16	2 1/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	24	1	14 3/8	70 1/4	450	950	175	1575
	304	404	77 1/4	34 3/4	18 7/8	32 15/16	2 1/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	24	1	14 3/8	70 1/4	510	950	175	1635
	305	405	77 1/4	34 3/4	18 7/8	32 15/16	2 1/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	1 3/8	2 1/2	1 1/2	24	1	14 3/8	70 1/4	535	950	175	1660
2VH7 2VH8	303	403	65 1/4	34 3/4	12 7/8	32 15/16	2 5/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	24 1/4	1 7/8	15	70 7/8	450	980	175	1605
	304	404	77 1/4	34 3/4	18 7/8	32 15/16	2 5/8	9 1/4	1 1/8	7 3/4	4 3/8	2 3/8	3/8	2	1 1/2	24 1/4	1 7/8	15	70 7/8	510	980	175	1665
	305	405	77 1/4	34 3/4	18 7/8	32 15/16	2 5/8	9 1/4	1 3/8	7 3/4	2 5/8	2 3/8	1 3/8	2 1/2	1 1/2	24 1/4	1 7/8	15	70 7/8	535	980	175	1690
	306	406	79	36 9/16	19 3/4	34 5/8	2 5/8	9 1/4	1 3/8	8 11/16	3 5/8	4 3/8	3 3/8	2 1/2	2	24 1/4	1 7/8	15	70 7/8	670	980	175	1825

† NOMINAL OPERATING WEIGHT
* MAX. WEIGHT INCLUDES ALL WIRING







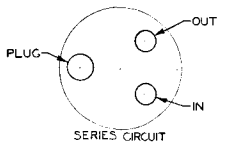


Fig. 8—Dimensions 2VH Condensing Unit

MR-2125D

COMPR.	A	B	C	D	E	F	G	H	J	WEIGHT COMPR.	BASE	CAB.	TOTAL
3VH4	27 3/8	30 1/2	2 1/8	5/8	1 5/8	1 5/8	2 5/8	5/8	38 5/8	1355	220	175	1750
3VH5			3 5/8	2 1/4	2	2 1/8	3 1/8	1"	39	1500			1895
3VH6										1530			1925
3VH7	27 5/8	31		2 1/4	2 3/8		3 5/8	1 3/8	39 1/2	1720			2115
3VH8										1775			2170

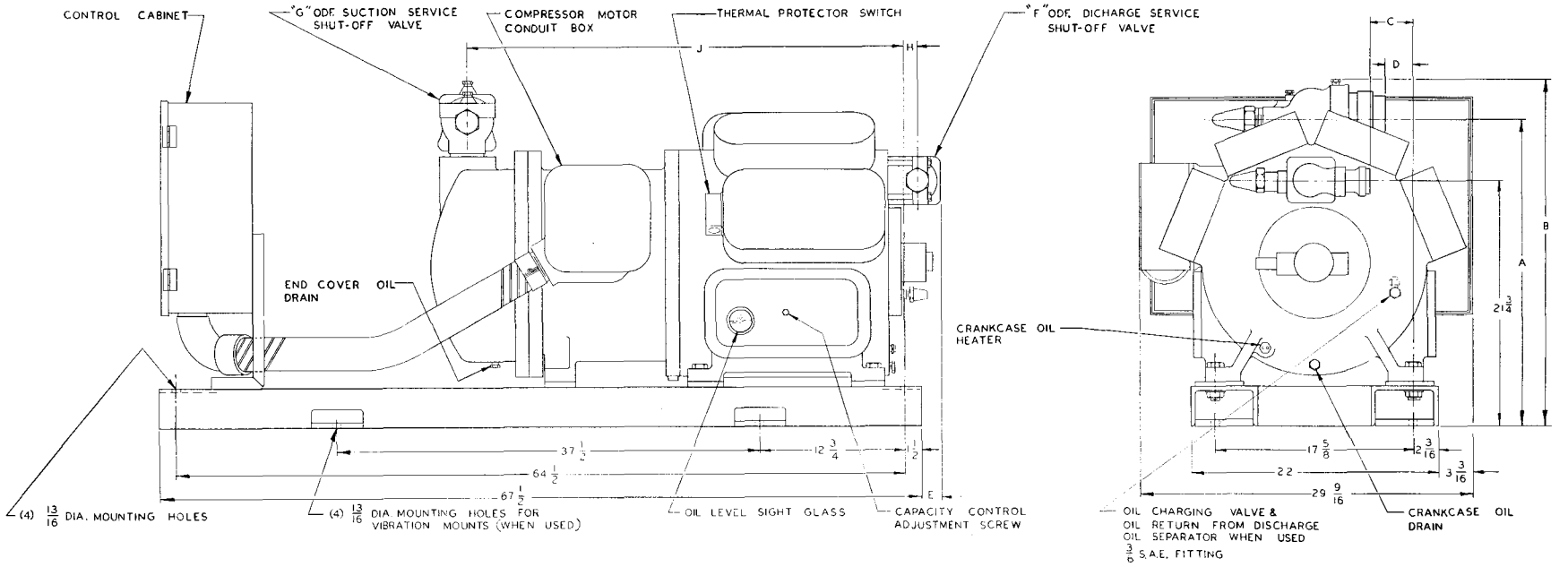


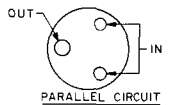
Fig. 9—Dimensions 3VH Compressor Unit

MR-1997A

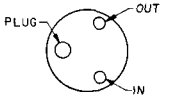
COMPR.	CONDENSERS CDS-300 SERIES	CONDENSERS CDS-400 SERIES	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T
3VH4	311	411	77 1/4	43 7/8	19 7/8	20 1/4	3 1/4	40 3/4	7 7/8	1/2	25 7/8	2 7/8	2 5/8	1 3/8	2 3/8	1 1/2	2 1/2	1 3/8	7 3/8
	312	412	79	46 5/8	20 3/4		4 1/4	43 1/2	9 3/4				3 5/8	3 3/8	4 3/8	2		1 5/8	8 3/4
	313	413				18 1/4	4 3/8	45	10 1/2				4 1/4	3	4	2 1/2	3		9 7/8
3VH5 / 3VH6	312	412	79	46 3/8	20 3/4	20 1/4	4 1/4	43 1/2	9 3/4	2 1/8	26 1/4	3 1/8	3 3/8	3 3/8	4 3/8	2	2 1/2	1 3/8	8 3/4
	313	413																	
	314	414	79 1/4	48 1/8	20 7/8	18 1/4	4 3/8	45 3/4	10 1/2				4 1/4	3	4	2 1/2	3	1 5/8	9 7/8
	315	415	91 1/4		26 7/8	17 3/4	4 1/2											2 1/8	
3VH7 / 3VH8	313	413	79	47 1/8	20 3/4	18 1/4	4 3/8	43 3/4	9 3/4	2 1/8	26 3/4	3 5/8	3 5/8	3 5/8	4 3/8	2	2 1/2	1 3/8	8 3/4
	314	414	79 1/4	48 5/8	20 7/8			45 1/4	10 1/2				4 1/4	3	4	2 1/2	3		9 7/8
	315	415	91 1/4		26 7/8	17 3/4	4 1/2											2 1/8	
	316	416	92	50 5/8	27 1/4			47 1/4	11 1/2					2 1/4	4 1/2	3	4		10 1/8

WEIGHT			
CAB.	COND.	COMPR.	BASE
175	555	1355	220
	690		
	750		
	1040		
	690	1500	
	750		
	1040		
	1195	1530	
	750	1720	
	1040		
	1195		
	1425	1775	

WATER CONNECTIONS



PARALLEL CIRCUIT



SERIES CIRCUIT

NOTE:
FOR TOTAL CONDENSING UNIT OPERATING WEIGHTS ADD CABINET WEIGHT, COND. WEIGHT, COMPR. WEIGHT, AND BASE WEIGHT.

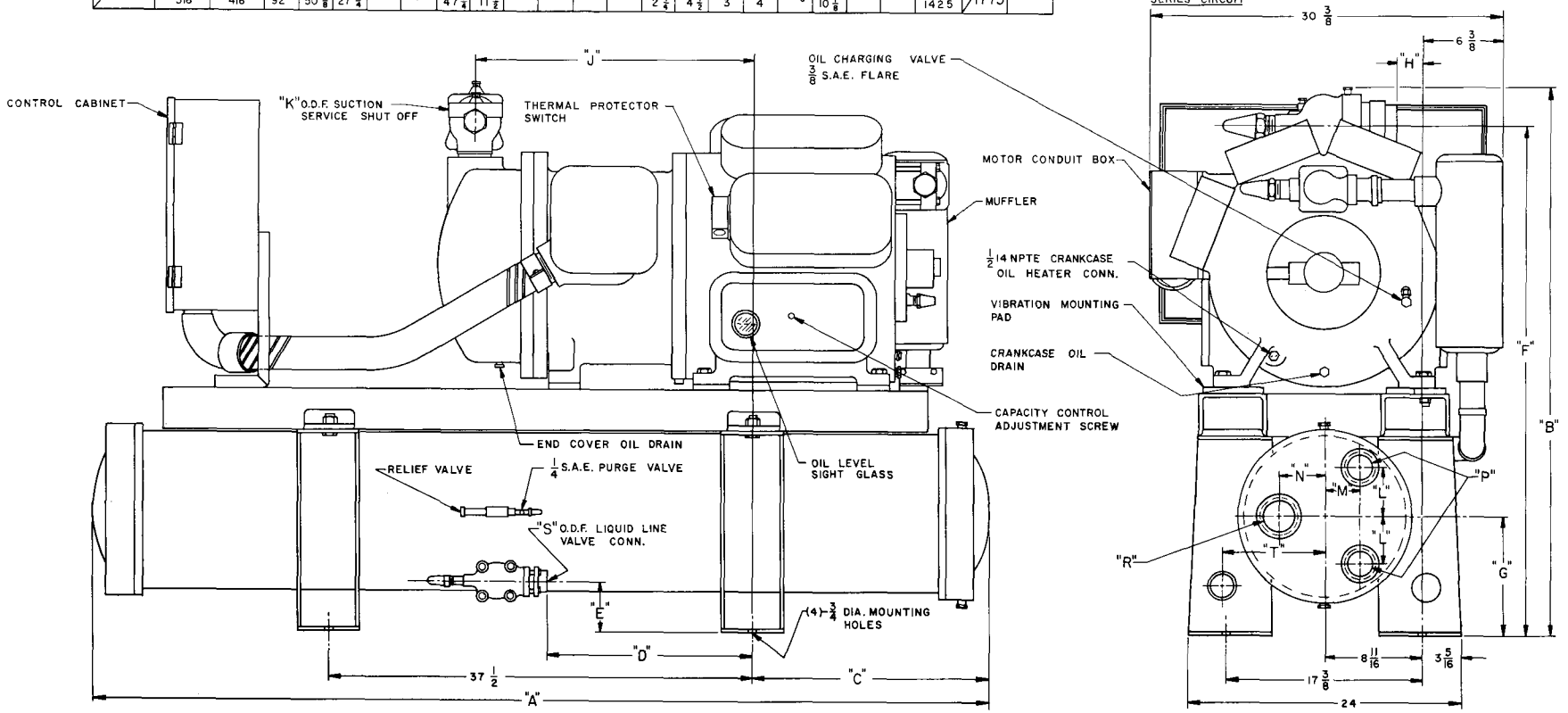
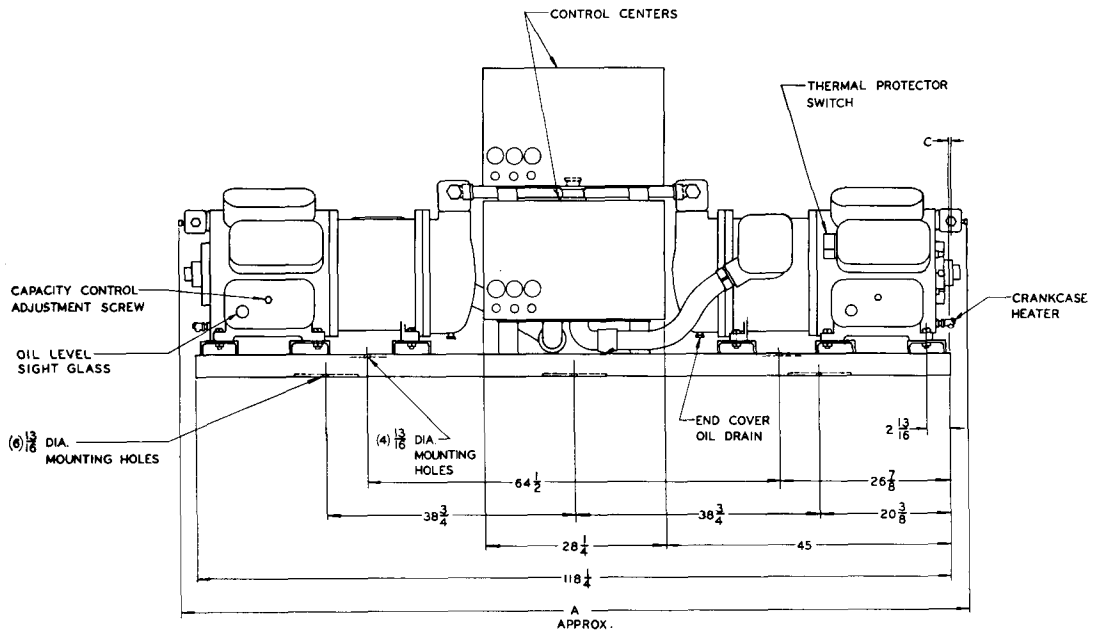


Fig. 10—Dimensions 3VH Condenser Unit

MR-2134A

UNIT	DIM. A	DIM. B	WEIGHT IN LBS.
3VH5– 3VH4 3VH6 – 3VH4	124 9/16	32 3/8	3710
3VH6 – 3VH5 3VH6 – 3VH6	124 15/16	32 3/8	3885
3VH6 – 3VH7 3VH8 – 3VH6	125 3/8	32 1/2	4130
3VH8 – 3VH7 3VH8 – 3VH8	125 3/4	32 5/8	4370

NO. OF CYL.	DIM. C
4	7/16
5 & 6	13/16
7 & 8	1 1/4



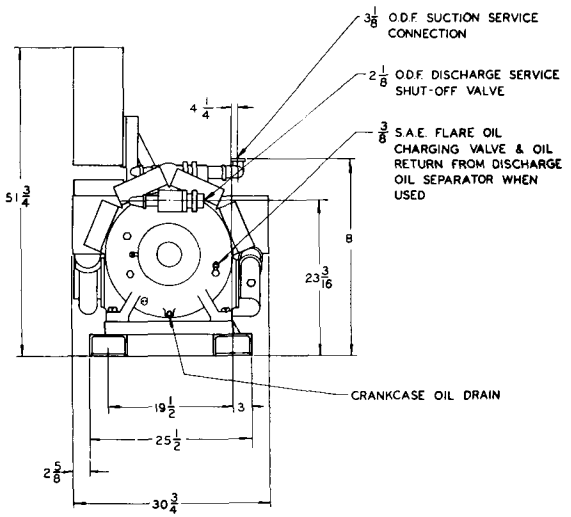
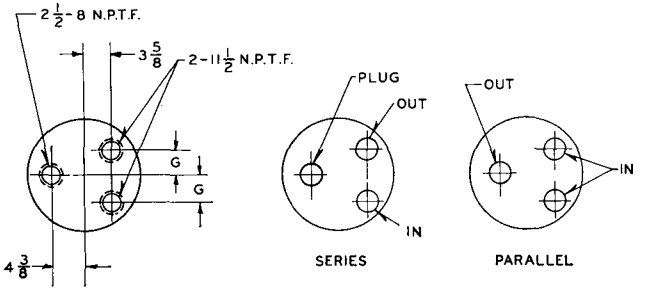


Fig. 11—Dimensions 3VH Duplex Compressor Unit

MR 2195

UNIT	CONDENSER	A	B	C	D	E	F	G	H	WEIGHT IN LBS.
3VH5 - 3VH4	CDS - 420	127	24 3/4		68 1/8	48 3/4	4 3/8 / 0	3 5/8 / 3	9 7/8	5075
	CDS - 421									5160
3VH6 - 3VH4	CDS - 422	127 1/4	24 7/8		69 3/8	50	2 5/16	3 5/16	10 1/2	5545
	CDS - 423	128	25 1/4		71 3/8	52	1 3/8	4 1/4	11 1/2	5910
	CDS - 424	140	31 1/4		71 3/8	52	1 3/8	4 1/4	11 1/2	6060
3VH6 - 3VH5	CDS - 420	127	24 3/4		68 1/8	48 3/4	4 3/8 / 0	3 5/8 / 3	9 7/8	5250
	CDS - 421									5335
3VH6 - 3VH6	CDS - 422	127 1/4	24 7/8		69 3/8	50	2 5/16	3 5/16	10 1/2	5720
	CDS - 423	128	25 1/4		71 3/8	52	1 3/8	4 1/4	11 1/2	6085
	CDS - 424	140	31 1/4		71 3/8	52	1 3/8	4 1/4	11 1/2	6235
3VH6 - 3VH7	CDS - 420	127	24 3/4		68 1/8	48 7/8	4 3/8 / 0	3 5/8 / 3	9 7/8	5495
	CDS - 421									5580
3VH8 - 3VH6	CDS - 422	127 1/4	24 7/8		69 3/8	50 1/8	2 5/16	3 5/16	10 1/2	5965
	CDS - 423	128	25 1/4		71 3/8	52 1/8	1 3/8	4 1/4	11 1/2	6330
	CDS - 424	140	31 1/4		71 3/8	52 1/8	1 3/8	4 1/4	11 1/2	6480
3VH8 - 3VH7	CDS - 420	127	24 3/4		68 1/8	49	4 3/8 / 0	3 5/8 / 3	9 7/8	5735
	CDS - 421									5820
3VH8 - 3VH8	CDS - 422	127 1/2	24 7/8		69 3/8	50 1/4	2 5/16	3 5/16	10 1/2	6205
	CDS - 423	128	25 1/4		71 3/8	52 1/4	1 3/8	4 1/4	11 1/2	6570
	CDS - 424	140	31 1/4		71 3/8	52 1/4	1 3/8	4 1/4	11 1/2	6720

NOMINAL OPERATING WEIGHTS



WATER CONNECTIONS FOR CDS - 420 ONLY

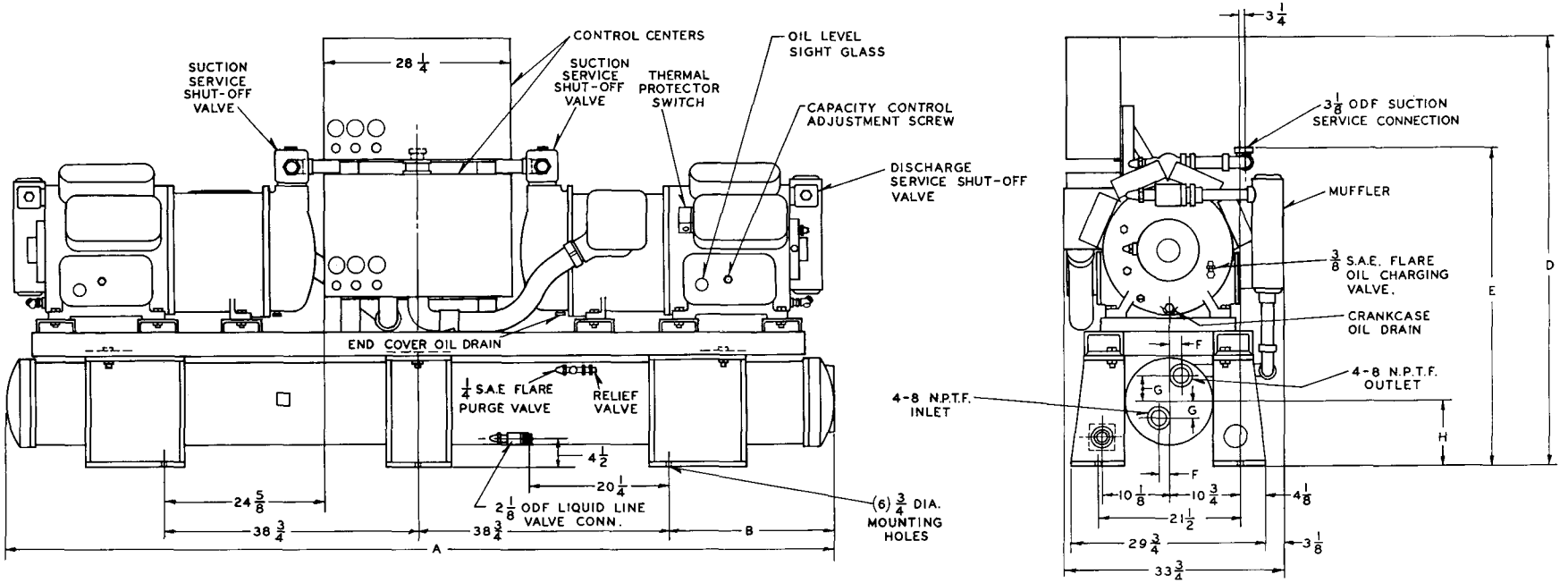


Fig. 12—Dimensions 3VH Duplex Condenser Unit

MR-2195

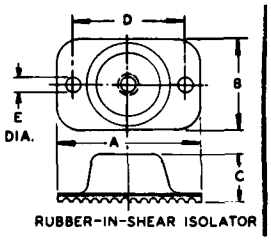
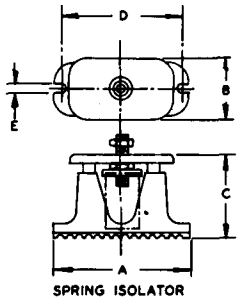
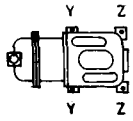
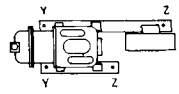
TYPE ISOLATION	UNIT	WORTHINGTON PART NUMBER	NO. REQ.	LOCATION	VENDOR	DIMENSIONS				
						A	B	C	D	E
 RUBBER-IN-SHEAR ISOLATOR	2VH Compressor (Fig. 2A)	552217	2	Z	Mason Ind. or Vibration Mtg.	5-1/2	3-5/16	1-5/8	4-1/8	9/16
		552218	2	Y		5-3/8	3-1/4	2-7/8	4-1/8	9/16
	2VH Condenser (Fig. 3A)	551703	2	Y	Mason Ind. or Vibration Mtg.	5-1/4	3-5/16	1-5/8	4-1/8	9/16
		552212	2	Z		5-3/8	3-1/4	1-3/4	4-1/8	9/16
	3VH Compressor (Fig. 2B)	551703	2	Y	Mason Ind. or Vibration Mtg.	5-1/4	3-5/16	1-5/8	4-1/8	9/16
		552212	2	Z		5-3/8	3-1/4	1-3/4	4-1/8	9/16
	3VH4 Condenser (Fig. 3B)	551703	2	Y	Mason Ind. or Vibration Mtg.	5-1/4	3-5/16	1-5/8	4-1/8	9/16
		551489	2	Z		5-3/8	3-1/4	1-3/4	4-1/8	9/16
	3VH5,6,7,8 Condenser (Fig. 3B)	552214	2	Y	Mason Ind.	7-3/8	5-1/8	1-5/8	6-1/8	9/16
					Vibration Mtg.	6-1/4	4	1-3/4	5	9/16
		551489	2	Z	Mason Ind.	5-1/4	3-5/16	1-5/8	4-1/8	9/16
					Vibration Mtg.	5-3/8	3-1/4	1-3/4	4-1/8	9/16
	3VH Duplex Condenser (Fig. 3C)	552214	6	X	Mason Ind.	7-3/8	5-1/8	1-5/8	6-1/8	9/16
					Vibration Mtg.	6-1/4	4	1-3/4	5	9/16
	3VH Duplex Compressor (Fig. 2C)	551703	6	X	Mason Ind.	5-1/4	3-5/16	1-5/8	4-1/8	9/16
					Vibration Mtg.	5-3/8	3-1/4	1-3/4	4-1/8	9/16
 SPRING ISOLATOR	2VH Compressor Bare (Fig. 1)	552241	2	Y	Mason Ind. or Vibration Mtg.	7-1/4	2-3/8	5	6-3/8	5/16
		551488	2	Z		7-1/2	2-3/4	5-5/8	6-1/2	5/8
	3VH Compressor Bare (Fig. 1)	552738	2	Y	Mason Ind. or Vibration Mtg.	7-1/4	2-3/8	5	6-3/8	5/16
		551488	2	Z		7-1/2	2-3/4	5-5/8	6-1/2	5/8
	2VH Compressor (Fig. 2A)	551488	2	Z	Mason Ind. or Vibration Mtg.	7-1/4	2-3/8	5	6-3/8	5/16
		552241	2	Y		7-1/2	2-3/4	5-5/8	6-1/2	5/8
	2VH Condenser (Fig. 3A)	551488	2	Z	Mason Ind. or Vibration Mtg.	7-1/4	2-3/8	5	6-3/8	5/16
		551702	2	Y		7-1/2	2-3/4	5-5/8	6-1/2	5/8
	3VH4 Compressor (Fig. 2B)	552742	2	Z	Mason Ind. or Vibration Mtg.	7-1/4	2-3/8	5	6-3/8	5/16
		551701	2	Y		7-1/2	2-3/4	5-5/8	6-1/2	5/8
	3VH5,6 Compressor (Fig. 2B)	552742	2	Z	Mason Ind. or Vibration Mtg.	7-1/4	2-3/8	5	6-3/8	5/16
		552744	2	Y		7-1/2	2-3/4	5-5/8	6-1/2	5/8
	3VH7,8 Compressor (Fig. 2B)	552742	2	Z	Mason Ind. or Vibration Mtg.	7-1/4	2-3/8	5	6-3/8	5/16
		552745	2	Y		7-1/2	2-3/4	5-5/8	6-1/2	5/8
	3VH4 Condenser (Fig. 3B)	552241	2	Z	Mason Ind. or Vibration Mtg.	7-1/4	2-3/8	5	6-3/8	5/16
		552739	2	Y		7-1/2	2-3/4	5-5/8	6-1/2	5/8
	3VH5,6 Condenser (Fig. 3B)	552241	2	Z	Mason Ind. or Vibration Mtg.	7-1/4	2-3/8	5	6-3/8	5/16
		552740	2	Y		7-1/2	2-3/4	5-5/8	6-1/2	5/8
	3VH7,8 Condenser (Fig. 3B)	551701	2	Z	Mason Ind.	7-1/4	2-3/8	5	6-3/8	5/16
					Vibration Mtg.	7-1/2	2-3/4	5-5/8	6-1/2	5/8
		552741	2	Y	Mason Ind.	8-7/8	3-3/8	4-13/16	7-7/8	7/16
					Vibration Mtg.	10-1/4	2-3/4	5-3/8	9-1/4	5/8
	3VH Duplex Compressor (Fig. 2C)	551701	6	X	Mason Ind.	7-1/4	2-3/8	5	6-3/8	5/16
					Vibration Mtg.	7-1/2	2-3/4	5-5/8	6-1/2	5/8
	3VH Duplex Condenser (Fig. 3C)	552740	6	X	Mason Ind.	7-1/4	2-3/8	5	6-3/8	5/16
					Vibration Mtg.	7-1/2	2-3/4	5-5/8	6-1/2	5/8

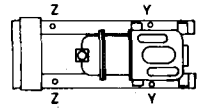
Fig. 13—VH Vibration Eliminators MY-2353



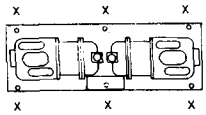
VH COMPRESSOR UNIT WITH STARTER NON WIRED FIG. 1



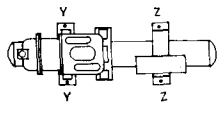
2VH COMPRESSOR UNIT WITH CONTROL CENTER FIG. 2-A



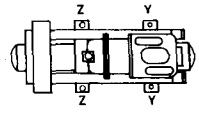
3VH COMPRESSOR UNIT WITH CONTROL CENTER FIG. 2-B



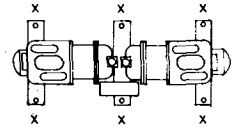
3VH DUPLEX COMPRESSOR UNIT FIG. 2-C



2VH CONDENSING UNIT FIG. 3-A



3VH CONDENSING UNIT FIG. 3-B



3VH DUPLEX CONDENSING UNIT FIG. 3-C

Fig. 14—VH Vibration Eliminators MY-2353

Concrete weighs 150 pounds per cubic foot. The weight of the VH units is shown on the dimension sheets. Helpful information on foundation design can be found in the Worthington "Design and Installation Manual", Section 300.

C. WIRING

1. CODES AND ORDINANCES—All wiring must be done with strict compliance with all codes and ordinances.

2. Mechanical Installation—Since the crankcase heater is shipped loose, it has to be installed in the well to the left of nameplate in the mounting foot of the 2VH compressors, and between the mounting foot and the oil drain plug on the discharge end of the 3VH compressors. Before installing the crankcase heater, be sure to check that it is stamped with the same voltage rating as the control circuit.

3. General Wiring Instructions and Precautions—Proper grounding and circuit continuity are to be checked after completion of any field wiring and before attempting to energize the unit. If a megger is used to check insulation resistance to ground, then a minimum reading of 10 meghoms is the limit.

NOTE: Do not take megger readings with the crankcase below atmospheric pressure.

Since V-Line compressors can run in either direction, no precautions in this respect need to be taken at start-up. However, it is considered good practice to maintain the original direction of rotation throughout the life of the unit. Thus, on servicing, leads should be tagged.

The voltage measured at the compressor motor terminals must be as shown in the operating limits (Table 5). The unbalance between the phases must not exceed 2%. Whenever there is an unbalance, the power lines with the higher amperage should be connected through the motor overloads of the 2VH units.

The power lines to the motor starter must be fused with the fusetrons selected from the electrical data sheets, Table 1, 2, or 3.

4. To Wire Systems for VH Unit—with Control Center—The VH units —with control center may be manufactured with factory wiring installed between all of the electrical components. In this case, the controls, safety switches, and crankcase oil heater are connected to the terminal block in the control center. Additional controls and equipment can be tied into the control circuit at this terminal block. The wiring diagrams Fig. 15 for the 2VH, Fig. 16 for the 3VH Fig. 17 for 3VH Duplex show the unit wiring that is installed at the Factory. Factory-wiring between the control and the compressor is optional. By referring to the schematic diagrams of the 2VH, 3VH and 3VH Duplex units the installer can determine the relation and function of each component with the control circuit. When the method of control is determined, the system should be wired per applicable wiring diagram.

The interlocks and operating controls of the system components are connected to the control center board as indicated. **Be sure to remove the jumper at the terminal location when a set of control wires is to be added.** The control circuit in the VH control center operates on 220 volts single-phase, 60 cycles only. If the installation site does not have such a source available, a transformer will be required. The following transformer size should be used:

2VH—500 VA
3VH—750 VA
3VH Duplex—1500 VA

5. To Wire Systems for 2VH Units—With Starters No Factory Wiring—The high-low pressure safety switch, the low-oil pressure switch, the compressor thermal protection switch and an oil pressure gauge with shut-off valve are mounted directly on the compressor. The starter and the motor overloads in a standard general purpose NEMA enclosure, and the crankcase oil heater are furnished loose, 220 volts is the standard control circuit voltage for these units. However, when specified, control circuit components and a crankcase oil heater siutable for 110 volts can be furnished by Worthington.

The control and power circuits must be wired per Fig. 15, with other wiring drawings as a reference in developing the proper wiring layout.

6. Overload Protection

a. Model 2VH Series—For the Model 2VH overload, relays are provided—check the electrical data sheet Table 2 to be sure that the proper size has been provided in the control center or NEMA enclosure.

b. Model 3VH Series—Overload protection in the 3VH Series is provided by "Guardistor"* motor relays. The three PTC Thermistors in the winding of a motor have a maximum current rating of 70 MA. They increase sharply many times in resistance when the limiting temperature of the motor's insulation is approached. To protect the motor from overheating these positive thermistors are connected in series with the holding coil of the control relay. The relay contacts open when the motor starts to overheat, they close when the winding cools to a safe operating temperature and the circuit has been energized by closing the manual reset switch.

*Registered trademark-Westinghouse Elec. Corp.

7. Secondary Circuits

a. General—This section is mainly applicable to field-wired installation circuits.

b. Crankcase Heater Circuit—Since during shut-down the compressor cools off, liquid refrigerant would accumulate in the crankcase unless precaution is taken to prevent it. This is done by means of the crankcase heater which is energized when the control circuit is opened by any of the operating switches or protective devices and is non-operative when the control circuit switch is closed. Therefore, the following is important:

1. **A single-pole, single-throw "on-off" switch is an absolute requirement and must not be omitted in the control circuit of VH units with starter.**

2. **Always use the "on-off" switch to manually stop operation, except when the system is pumped down for prolonged shut-down or for repairs when the compressor is opened up.**

(3) Because of the need to activate the crankcase heater at least 1 hour prior to starting the unit, careful thought should be given to installations where it is the practice to shut off all main power when personnel are not present,

TABLE 1—2VH ELECTRICAL DATA SHEET

Unit Model No.	Compressor Motor Electrical Characteristics			(1) Type Start.	(6) Full Load Amps		(5) Locked Rotor Amps.	(4) Fusetron Sizes		Conductor Sizes (AWG No.) of Motor Power (3) Supply, depending on length. Use Type RHW				2VH Units with Control Center				2VH Units with NEMA Enclosure			
										Up to 100 ft.		100 ft. to 200 ft.	200 ft. to 300 ft.	(4) Overl'd Relays CR 2824-43-		Overload Trip Amps.		(4) Overl'd Relays CR 2824-43-		Overload Trip Amps.	
	Ph.	Cyc.	Volts (2)		R-12	R-22		R-12	R-22	R-12	R-22			R-12	R-22	R-12	R-22	R-12	R-22	R-12	R-22
2VHD4-2A	3	60	208/220	A.L.	43	60	186/196	60	80	4	4	2	0	B19	B36	52.2	73	B19	B37	52	75
2VHD4-4A	3	60	440	A.L.	22	30	98	35	40	10	8	8	6	B12	B15	27	37.2	B13	B16	28	38
2VHD4-5A	3	60	550	A.L.	16	24	78	20	35	10	10	10	8	A9	B13	20.4	29.8	A9	B13	19.1	28
2VHD4-2P	3	60	208/220	P.W.	43	60	186/196	60	80	4	4	2	0	B12	B15	27	37.2	—	—	—	—
2VHG5-2A	3	60	208/220	A.L.	58	80	274/290	80	110	3	3	0	00	B85	B39	62.5	99	B85	B40	64	101
2VHG5-4A	3	60	440	A.L.	29	40	145	40	50	8	6	6	4	B14	B17	33.3	45	B15	B18	34.8	45.2
2VHG5-5A	3	60	550	A.L.	22	30	116	35	40	10	8	8	6	B12	B15	27	37.2	B12	B16	25.7	38
2VHG5-2P	3	60	208/220	P.W.	58	80	274/290	80	110	3	3	0	00	B15	B18	37.2	47.5	—	—	—	—
2VHG5-4P	3	60	440	P.W.	29	40	145	40	50	8	6	6	4	A7	All	18.1	24.5	—	—	—	—
2VHG6-2A	3	60	208/220	A.L.	66	86	274/290	90	110	3	2	0	00	B37	B39	82	99	B37	B40	75	101
2VHG6-4A	3	60	440	A.L.	33	43	145	40	60	8	6	6	4	B15	B19	37.2	52.2	B16	B19	38	52
2VHG6-5A	3	60	550	A.L.	24	34	116	35	45	10	8	8	6	B13	B16	29.8	42.6	B14	B17	31	42.2
2VHG6-2P	3	60	208/220	P.W.	66	86	274/290	90	110	3	2	0	00	B15	B19	37.2	52.2	—	—	—	—
2VHG6-4P	3	60	440	P.W.	33	43	145	40	60	8	6	6	4	A8	B12	18.5	27	—	—	—	—
2VHJ7-4A	3	60	440	A.L.	39	54	176	50	70	6	4	4	4	B18	B35	47.5	62.5	B18	B35	46.5	64.0
2VHJ7-5A	3	60	550	A.L.	27	42	146	35	60	8	6	6	6	B14	B19	33.3	52.2	B15	B19	34.8	52
2VHJ7-2P	3	60	208/220	P.W.	78	108	333/352	110	150	2	0	00	000	B68	B35	47.5	62.5	—	—	—	—
2VHJ7-4P	3	60	440	P.W.	39	54	176	50	70	6	4	4	4	All	B14	24.5	33.3	—	—	—	—
2VHJ8-4A	3	60	440	A.L.	42	58	176	60	80	6	4	4	4	B19	B36	52.2	73	B19	B36	52	70.8
2VHJ8-5A	3	60	550	A.L.	34	45	146	45	70	8	6	6	6	B16	B20	42.6	58	B17	B20	42.2	58
2VHJ8-2P	3	60	208/220	P.W.	84	116	333/352	110	150	2	0	00	000	B69	B36	52.2	73	—	—	—	—
2VHJ8-4P	3	60	440	P.W.	42	58	176	60	80	6	4	4	4	All	B14	24.5	33.3	—	—	—	—

(1) A.L. = Across-line start — P.W. = Part winding start.

(2) Voltage tolerance on 220, 440, and 550 volt networks, up to 125 F. condensing temperature (R-22) is plus or minus 10%. Above 125 F. tolerance is plus 10% or minus 5%. Voltage limits for 208 volt network is 198 volts min., 242 volts max.

(3) For field wired models the length of run from starter to compressor motor must not be over 20 feet, and wire size must be per "up to 100 ft." column. Use table for size of feeder conductors to starters.

(4) The control circuit must be a separate circuit wired thru a fused (15 amps) disconnect. Standard for all models is 220 volts, single-phase, 60 cycles, 110 volts is available on the type N unit (separate NEMA starters). All control panels are wired 220 volt only and a transformer is furnished if control circuit is 110V. This transformer will be 500VA for 2VH units.

(5) In rush current Part winding start — Approx. 65% LRA.

(6) Value stated for full load amps is calculated at 10% voltage reduction from nominal. In the case of 208/220 volt motors the value is stated at 198V.

TABLE 2—3VH ELECTRICAL DATA SHEET

Unit Model No.	Compressor Motor Electrical Characteristics			(1) Type Start	Amps (5) Full Load		Amps (4) Locked Rotor	Fustron Sizes		AWG Wire Size Type RH Lg. of Run in Ft.		
	Ph.	Cyc.	Volts (2)		R-12	R-22		R-12	R-22	100'	200'	300'
3VHN4-4A	3	60	440	A.L.	46	59	246	60	80	4	4	2
3VHN4-5A	3	60	550	A.L.	37	47	197	50	60	6	6	4
3VHN4-2P	3	60	208/220	P.W.	92	119	465/492	125	150	0	00	000
3VHN4-4P	3	60	440	P.W.	46	59	246	60	80	4	4	2
3VHN5-4A	3	60	440	A.L.	59	59	246	80	80	4	4	2
3VHN5-5A	3	60	550	A.L.	47	47	197	60	60	6	6	4
3VHN5-2P	3	60	208/220	P.W.	119	119	465/492	150	150	0	00	000
3VHN5-4P	3	60	440	P.W.	59	59	246	80	80	4	4	2
3VHO5-4A	3	60	440	A.L.		75	303		100	3	3	2
3VHO5-5A	3	60	550	A.L.		60	242		80	4	4	4
3VHO5-2P	3	60	208/220	P.W.		150	573/606		200	000	000	0000
3VHO5-4P	3	60	440	P.W.		75	303		100	3	3	2
3VHO6-4A	3	60	440	A.L.	69	75	303	90	100	3	3	2
3VHO6-5A	3	60	550	A.L.	55	60	242	70	80	4	4	4
3VHO6-2P	3	60	208/220	P.W.	138	150	573/606	175	200	000	000	0000
3VHO6-4P	3	60	440	P.W.	69	75	303	90	100	3	3	2
3VHP6-4A	3	60	440	A.L.		89	338		110	2	2	2
3VHP6-5A	3	60	550	A.L.		71	270		90	3	3	3
3VHP6-2P	3	60	208/220	P.W.		178	639/676		225	0000	0000	250M
3VHP6-4P	3	60	440	P.W.		89	338		110	2	2	2
3VHP7-4A	3	60	440	A.L.	80	89	338	110	110	2	2	2
3VHP7-5A	3	60	550	A.L.	64	71	270	80	90	3	3	3
3VHP7-2P	3	60	208/220	P.W.	160	178	639/676	225	225	0000	0000	250M
3VHP7-4P	3	60	440	P.W.	80	89	338	110	110	2	2	2
3VHR7-4A	3	60	440	A.L.		103	402		125	1	1	1
3VHR7-5A	3	60	550	A.L.		83	322		110	2	2	2
3VHR7-2P	3	60	208/220	P.W.		207	760/804		250	300M	300M	300M
3VHR7-4P	3	60	440	P.W.		103	402		125	1	1	1
3VHR8-4A	3	60	440	A.L.	90	103	402	125	125	1	1	1
3VHR8-5A	3	60	550	A.L.	72	83	322	100	110	2	2	2
3VHR8-2P	3	60	208/220	P.W.	180	207	760/804	225	250	300M	300M	300M
3VHR8-4P	3	60	440	P.W.	90	103	402	125	125	1	1	1
3VHT8-4A	3	60	440	A.L.		119	515		150	0	0	0
3VHT8-5A	3	60	550	A.L.		95	412		125	1	1	1
3VHT8-2P	3	60	208/220	P.W.		237	972/1030		300	350M	350M	350M
3VHT8-4P	3	60	440	P.W.		119	515		150	0	0	0

(1) A.L. = Across-line start — P.W. = Part winding start.

(2) Voltage tolerance is plus or minus 10% on 220, 440, or 550-volt networks. Voltage limit on 208-volt networks is 198 volts min., 242 volts max.

(3) The control circuit must be a separate circuit wired thru a fused (15 amps) disconnect. Standard for all models is 220 volts, single-phase, 60 cycles. For 110 volt control a 750VA step-up transformer 110 to 220V is furnished.

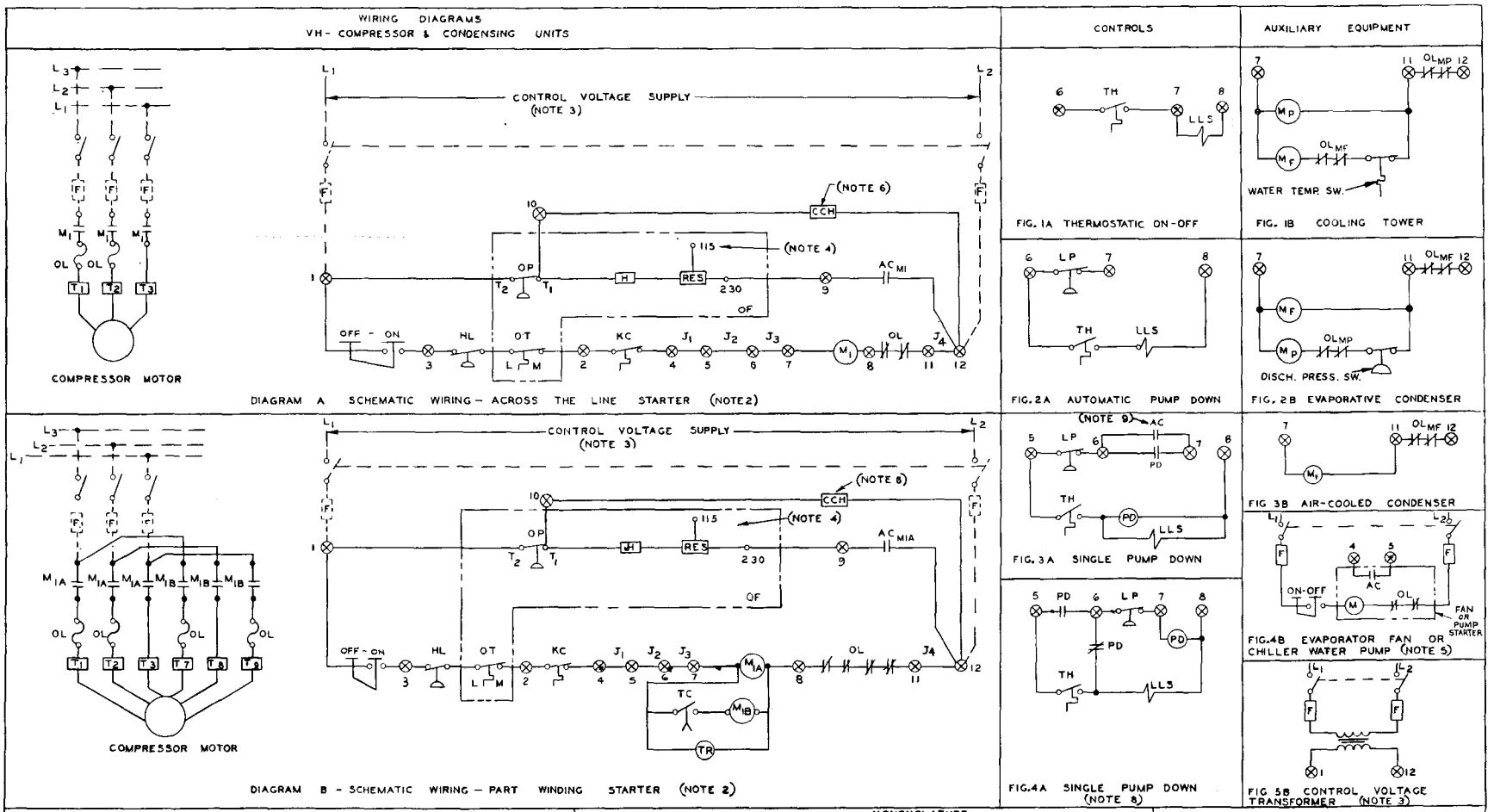
(4) Inrush current Part winding start—Approx. 65% LRA.

(5) Value stated for full load amps is reduction from nominal. In the case of 208/220 volt motors the value is stated at 198V.

TABLE 3—3VH DUPLEX ELECTRICAL DATA SHEET

UNIT MODEL No. (See Note 6)	COMPRESSOR MOTOR ELECTRICAL CHARACTERISTICS			TYPE START (See Note 1)	CONTROL VOLTAGE (See Note 3)	FULL LOAD AMPS (See Note 5)				LOCKED ROTOR AMPS (See Note 4)		FUSETRON SIZES				AWG WIRE SIZES TYPE RH Length of Run In Ft.					
						R-12		R-22				R-12		R-22		100'		200'		300'	
Comp. No. 1 Comp. No. 2	Ph.	Cy.	Volts (See Note 2)			Comp. No. 1	Comp. No. 2	Comp. No. 1	Comp. No. 2	Comp. No. 1	Comp. No. 2	Comp. No. 1	Comp. No. 2	Comp. No. 1	Comp. No. 2	Comp. No. 1	Comp. No. 2	Comp. No. 1	Comp. No. 2	Comp. No. 1	Comp. No. 2
3VHO6-3VHN4-4A2*	3	60	440	AL	208/220	69	46	75	59	303	246	90	60	100	80	3	4	3	4	2	2
3VHO6-3VHN4-5A2*	3	60	550	AL	208/220	55	37	60	47	242	197	70	50	80	60	4	6	4	6	4	4
3VHO6-3VHN4-2P2*	3	60	208/220	PW	208/220	138	92	150	119	573/606	465/492	175	125	200	150	000	0	000	00	0000	000
3VHO6-3VHN4-4P2*	3	60	440	PW	208/220	69	46	75	59	303	246	90	60	100	80	3	4	3	4	2	2
3VHP6-3VHN4-4A2*	3	60	440	AL	208/220			89	59	338	246			110	80	2	4	2	4	2	2
3VHP6-3VHN4-5A2*	3	60	550	AL	208/220			71	47	220	197			90	60	3	6	3	6	3	4
3VHP6-3VHN4-2P2*	3	60	208/220	PW	208/220			178	119	639/676	465/492			225	150	0000	0	0000	00	250M	000
3VHP6-3VHN4-4P2*	3	60	440	PW	208/220			89	59	338	246			110	80	2	4	2	4	2	2
3VHO6-3VHN5-4A2*	3	60	440	AL	208/220	69	59	75	59	303	246	90	80	100	80	3	4	3	4	2	2
3VHO6-3VHN5-5A2*	3	60	550	AL	208/220	55	47	60	47	242	197	70	60	80	60	4	6	4	6	4	4
3VHO6-3VHN5-2P2*	3	60	208/220	PW	208/220	138	119	150	119	573/606	465/492	175	150	200	150	000	0	000	00	0000	000
3VHO6-3VHN5-4P2*	3	60	440	PW	208/220	69	59	75	59	303	246	90	80	100	80	3	4	3	4	2	2
3VHP6-3VHO5-4A2*	3	60	440	AL	208/220			89	75	338	303			110	100	2	3	2	3	2	2
3VHP6-3VHO5-5A2*	3	60	550	AL	208/220			71	60	270	242			90	80	3	4	3	4	3	4
3VHP6-3VHO5-2P2*	3	60	208/220	PW	208/220			178	150	639/676	573/606			225	200	0000	000	0000	000	250M	0000
3VHP6-3VHO5-4P2*	3	60	440	PW	208/220			89	75	338	303			110	100	2	3	2	3	2	2
3VHO6-3VHO6-4A2*	3	60	440	AL	208/220	69	69	75	75	303	303	90	90	100	100	3	3	3	3	2	2
3VHO6-3VHO6-5A2*	3	60	550	AL	208/220	55	55	60	60	242	242	70	70	80	80	4	4	4	4	4	4
3VHO6-3VHO6-2P2*	3	60	208/220	PW	208/220	138	138	150	150	573/606	573/606	175	175	200	200	000	000	000	000	0000	0000
3VHO6-3VHO6-4P2*	3	60	440	PW	208/220	69	69	75	75	303	303	90	90	100	100	3	3	3	3	2	2
3VHP6-3VHP6-4A2*	3	60	440	AL	208/220			89	89	338	338			110	110	2	2	2	2	2	2
3VHP6-3VHP6-5A2*	3	60	550	AL	208/220			71	71	270	270			90	90	3	3	3	3	3	3
3VHP6-3VHP6-2P2*	3	60	208/220	PW	208/220			178	178	639/676	639/676			225	225	0000	0000	0000	0000	250M	250M
3VHP6-3VHP6-4P2*	3	60	440	PW	208/220			89	89	338	338			110	110	2	2	2	2	2	2
3VHO6-3VHP7-4A2*	3	60	440	AL	208/220	69	80	75	89	303	338	90	110	100	110	3	2	3	2	2	2
3VHO6-3VHP7-5A2*	3	60	550	AL	208/220	55	64	60	71	242	270	70	80	80	90	4	3	4	3	4	3
3VHO6-3VHP7-2P2*	3	60	208/220	PW	208/220	138	160	150	178	573/606	639/676	175	225	200	225	000	0000	000	0000	0000	250M
3VHO6-3VHP7-4P2*	3	60	440	PW	208/220	69	80	75	89	303	338	90	110	100	110	3	2	3	2	2	2
3VHP6-3VHR7-4A2*	3	60	440	AL	208/220			89	103	338	402			110	125	2	1	2	1	2	1
3VHP6-3VHR7-5A2*	3	60	550	AL	208/220			71	83	270	322			90	110	3	2	3	2	3	2
3VHP6-3VHR7-2P2*	3	60	208/220	PW	208/220			178	207	639/676	760/804			225	250	0000	300M	0000	300M	250M	300M
3VHP6-3VHR7-4P2*	3	60	440	PW	208/220			89	103	338	402			110	125	2	1	2	1	2	1
3VHR8-3VHO6-4A2*	3	60	440	AL	208/220	90	69	103	75	402	303	125	90	125	100	1	3	1	3	1	2
3VHR8-3VHO6-5A2*	3	60	550	AL	208/220	72	55	83	60	322	242	100	70	110	80	2	4	2	4	2	4
3VHR8-3VHO6-2P2*	3	60	208/220	PW	208/220	180	138	207	150	760/804	573/606	225	175	250	200	300M	000	300M	000	300M	0000
3VHR8-3VHO6-4P2*	3	60	440	PW	208/220	90	69	103	75	402	303	125	90	125	100	1	3	1	3	1	2
3VHT8-3VHP6-4A2*	3	60	440	AL	208/220			119	89	515	338			150	110	0	2	0	2	0	2
3VHT8-3VHP6-5A2*	3	60	550	AL	208/220			95	71	412	270			125	90	1	3	1	3	1	3
3VHT8-3VHP6-2P2*	3	60	208/220	PW	208/220			237	178	972/1030	639/676			300	225	350M	0000	350M	0000	350M	250M
3VHT8-3VHP6-4P2*	3	60	440	PW	208/220			119	89	515	338			150	110	0	2	0	2	0	2
3VHR8-3VHP7-4A2*	3	60	440	AL	208/220	90	80	103	89	402	338	125	110	125	110	1	2	1	2	1	2
3VHR8-3VHP7-5A2*	3	60	550	AL	208/220	72	64	83	71	322	270	100	80	110	90	2	3	2	3	2	3
3VHR8-3VHP7-2P2*	3	60	208/220	PW	208/220	180	160	207	178	760/804	639/676	225	225	250	225	300M	0000	300M	0000	300M	250M
3VHR8-3VHP7-4P2*	3	60	440	PW	208/220	90	80	103	89	402	338	125	110	125	110	1	2	1	2	1	2
3VHT8-3VHR7-4A2*	3	60	440	AL	208/220			119	103	515	402			150	125	0	1	0	1	0	1
3VHT8-3VHR7-5A2*	3	60	550	AL	208/220			95	83	412	322			125	110	1	2	1	2	1	2
3VHT8-3VHR7-2P2*	3	60	208/220	PW	208/220			237	207	972/1030	760/804			300	250	350M	300M	350M	300M	350M	300M
3VHT8-3VHR7-4P2*	3	60	440	PW	208/220			119	103	515	402			150	125	0	1	0	1	0	1
3VHR8-3VHR8-4A2*	3	60	440	AL	208/220	90	90	103	103	402	402	125	125	125	125	1	1	1	1	1	1
3VHR8-3VHR8-5A2*	3	60	550	AL	208/220	72	72	83	83	322	322	100	100	110	110	2	2	2	2	2	2
3VHR8-3VHR8-2P2*	3	60	208/220	PW	208/220	180	180	207	207	760/804	760/804	225	225	250	250	300M	300M	300M	300M	300M	300M
3VHR8-3VHR8-4P2*	3	60	440	PW	208/220	90	90	103	103	402	402	125	125	125	125	1	1	1	1	1	1
3VHT8-3VHT8-4A2*	3	60	440	AL	208/220			119	119	515	515			150	150	0	0	0	0	0	0
3VHT8-3VHT8-5A2*	3	60	550	AL	208/220			95	95	412	412			125	125	1	1	1	1	1	1
3VHT8-3VHT8-2P2*	3	60	208/220	PW	208/220			237	237	972/1030	972/1030			300	300	350M	350M	350M	350M	350M	350M
3VHT8-3VHT8-4P2*	3	60	440	PW	208/220			119	119	515	515			150	150	0	0	0	0	0	0

NOTE:
1. AL = Across-the-line start — PW = Part winding start.
2. Voltage tolerance is plus or minus 10% on 220, 440 or 550-volt networks. Voltage limit on 208-volt networks is 198 volts min., 242 volts max.
3. The control circuit must be a separate circuit wired through a fused (15 amps) disconnect. Standard for all models is 208/220 volts, single-phase, 60 cycles. For 110 volt control a 1500 V.A. transformer 110 to 220V is furnished.
4. Inrush current part winding start — approx. 65% LRA.
5. Value stated for full load amps is calculated at 10% voltage reduction from nominal. In the case of 208/220 volt motors the value is stated at 198V.
6. Insert "W" in space marked "*" for 3VH Duplex units **factory wired.**
   Insert "S" in space marked "*" for 3VH Duplex units **non-wired.**



NOTES:

1. VH UNITS MUST BE WIRED PER THIS DIAGRAM. SELECT ONE OF THE "CONTROL" CIRCUIT SHOWN (FIGS. 1A-4A). REMOVE "JUMPERS" NOT NEEDED
2. VH UNITS WITH "CONTROL CENTER" WHEN FACTORY WIRED ARE WIRED PER DIAGRAM "A" OR "B."
3. CONTROL VOLTAGE-208/220V. STANDARD. 115V. MAY BE USED IF SPECIFIE, WHEN 115V SUPPLIED FOR VH UNITS WITH "CONTROL CENTER" A STEP-UP TRANSFORMER MUST BE USED - SEE FIG. 5B.
4. FOR VH UNITS WITH "STARTER-NON WIRED" WHEN CONTROL VOLTAGE IS 115V WIRE TO "115" TERMINAL OF O.F.
5. EVAPORATOR FAN OR CHILLER WATER PUMP MUST BE INTERLOCKED IN CIRCUIT AS SHOWN (SEE FIG. 4B.)
6. CRANKCASE HEATER SHOULD ALWAYS BE ENERGIZED DURING "OFF" CYCLE EXCEPT DURING SEASONAL SHUT DOWN.
7. WHEN CITY WATER OR WELL WATER IS SUPPLIED FOR CONDENSER A WATER PRESSURE SWITCH OR FLOW SWITCH SHOULD BE INTERLOCKED IN CIRCUIT BETWEEN TERMINALS 11 & 12.
8. PUMP DOWN RELAY USED MUST BE "MAKE BEFORE BREAK - OVERLAPPING" TYPE.
9. IN FIG. 3A AC IS A SEPARATE AUXILIARY CONTACT THAT MUST BE ADDED TO COMPRESSOR MOTOR STARTER M_1 OR M_{1A}.

NOMENCLATURE

	AC	AUXILIARY STARTER CONTACT
*	OFF-ON	START-STOP SWITCH
△ *	HL	HI-LO PRESSURE CUT-OUT (MAN. RESET)
△ *	OF	OIL PRESSURE FAILURE SWITCH (MAN RESET) OP- OIL PRESSURE CONTACT N.C. H - HEATER OT - THERMAL CONTACT
△ *	KC	COMP. THERMAL PROTECTOR SWITCH (MAN. RESET)
△ *	M_1	COMPRESSOR MOTOR STARTER
*	TC	TIMED CLOSING SWITCH
*	TR	TIMED CLOSING RELAY (WHEN USED)
△ *	OL	OVERLOAD- (MAN. RESET)
	TH	CONTROL THERMOSTAT
	LLS	LIQUID LINE SOLENOID (S)
	LP	LOWPRESSURE CUT-OUT-PUMP DOWN (AUTO CUT-IN)
	PD	PUMP DOWN RELAY - NON - RECYCLING
*	⊗	TERMINAL BOARD CONNECTOR
*	J	JUMPER
	M_F	FAN MOTOR STARTER
	M_P	PUMP MOTOR STARTER

* SUPPLIED ON "VH UNITS WITH CONTROL-CENTER FACTORY WIRED"

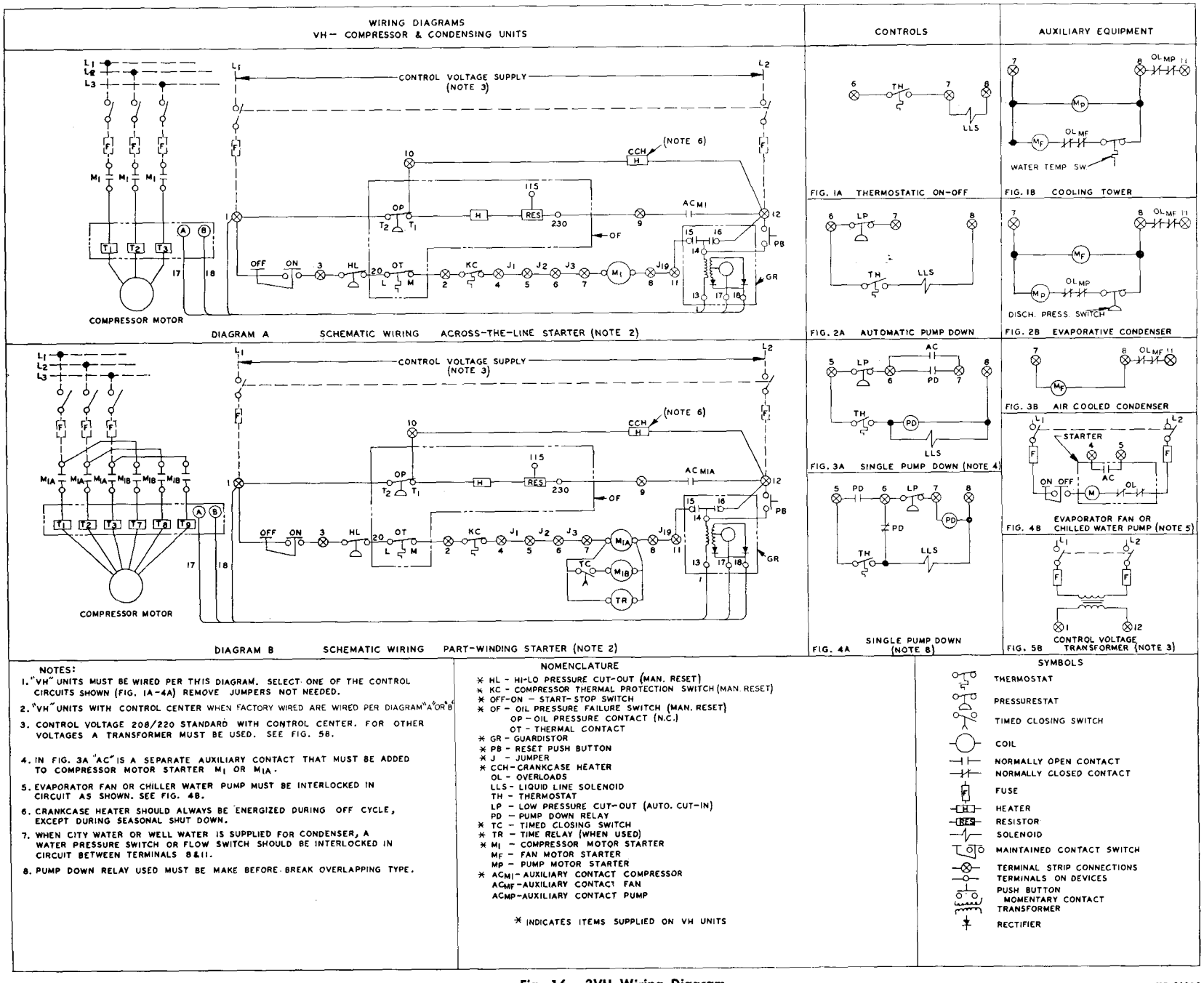
△ SUPPLIED ON "VH UNITS WITH STARTER NON-WIRED"

SYMBOLS

- THERMOSTAT
- PRESSURESTAT
- TIMED CLOSING SWITCH
- COIL
- NORMALLY OPEN CONTACT
- NORMALLY CLOSED CONTACT
- F FUSE
- RES RESISTOR
- H HEATER
- SOLENOID
- MAINTAIN CONTACT SWITCH

Fig. 15—2VH Wiring Diagram

MR-1989C



NOTES:

1. "VH" UNITS MUST BE WIRED PER THIS DIAGRAM. SELECT ONE OF THE CONTROL CIRCUITS SHOWN (FIG. 1A–4A) REMOVE JUMPERS NOT NEEDED.
2. "VH" UNITS WITH CONTROL CENTER WHEN FACTORY WIRED ARE WIRED PER DIAGRAM "A" OR "B"
3. CONTROL VOLTAGE 208/220 STANDARD WITH CONTROL CENTER. FOR OTHER VOLTAGES A TRANSFORMER MUST BE USED. SEE FIG. 5B.
4. IN FIG. 3A "AC" IS A SEPARATE AUXILIARY CONTACT THAT MUST BE ADDED TO COMPRESSOR MOTOR STARTER M_1 OR M_{1A}.
5. EVAPORATOR FAN OR CHILLER WATER PUMP MUST BE INTERLOCKED IN CIRCUIT AS SHOWN. SEE FIG. 4B.
6. CRANKCASE HEATER SHOULD ALWAYS BE ENERGIZED DURING OFF CYCLE, EXCEPT DURING SEASONAL SHUT DOWN.
7. WHEN CITY WATER OR WELL WATER IS SUPPLIED FOR CONDENSER, A WATER PRESSURE SWITCH OR FLOW SWITCH SHOULD BE INTERLOCKED IN CIRCUIT BETWEEN TERMINALS 8&11.
8. PUMP DOWN RELAY USED MUST BE MAKE BEFORE BREAK OVERLAPPING TYPE.

NOMENCLATURE

- * HL – HI-LO PRESSURE CUT-OUT (MAN. RESET)
- * KC – COMPRESSOR THERMAL PROTECTION SWITCH (MAN. RESET)
- * OFF-ON – START-STOP SWITCH
- * OF – OIL PRESSURE FAILURE SWITCH (MAN. RESET)
  - OP – OIL PRESSURE CONTACT (N.C.)
  - OT – THERMAL CONTACT
- * GR – GUARDISTOR
- * PB – RESET PUSH BUTTON
- * J – JUMPER
- * CCH – CRANKCASE HEATER
- OL – OVERLOADS
- LLS – LIQUID LINE SOLENOID
- TH – THERMOSTAT
- LP – LOW PRESSURE CUT-OUT (AUTO. CUT-IN)
- PD – PUMP DOWN RELAY
- * TC – TIMED CLOSING SWITCH
- * TR – TIME RELAY (WHEN USED)
- * M_1 – COMPRESSOR MOTOR STARTER
- M_F – FAN MOTOR STARTER
- MP – PUMP MOTOR STARTER
- * AC_{M1} – AUXILIARY CONTACT COMPRESSOR
- AC_{MF} – AUXILIARY CONTACT FAN
- AC_{MP} – AUXILIARY CONTACT PUMP

* INDICATES ITEMS SUPPLIED ON VH UNITS

SYMBOLS

- THERMOSTAT
- PRESSURESTAT
- TIMED CLOSING SWITCH
- COIL
- NORMALLY OPEN CONTACT
- NORMALLY CLOSED CONTACT
- FUSE
- HEATER
- RESISTOR
- SOLENOID
- MAINTAINED CONTACT SWITCH
- TERMINAL STRIP CONNECTIONS
- TERMINALS ON DEVICES
- PUSH BUTTON MOMENTARY CONTACT
- TRANSFORMER
- RECTIFIER

Fig. 16—3VH Wiring Diagram

MR-2128C

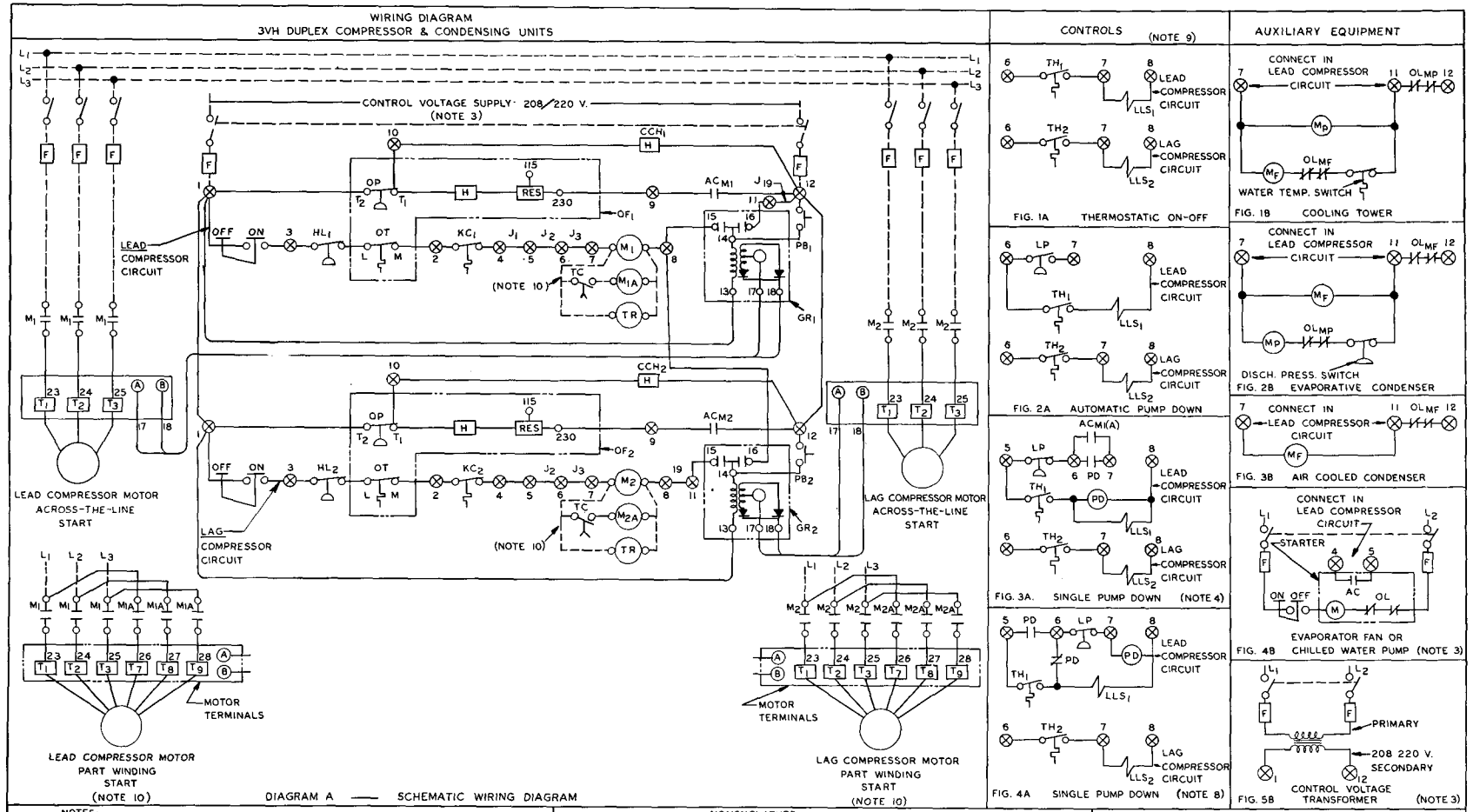


Fig. 17—3VH Duplex Wiring Diagram

NOTES:

1. "VH" UNITS MUST BE WIRED PER THIS DIAGRAM. SELECT ONE OF THE CONTROL CIRCUITS SHOWN (FIG. 1A-4A) REMOVE JUMPERS NOT NEEDED.
2. "VH" UNITS WITH CONTROL CENTER WHEN FACTORY WIRED ARE WIRED PER DIAGRAM "A."
3. CONTROL VOLTAGE 208/220 STANDARD WITH CONTROL CENTER. FOR OTHER VOLTAGES A TRANSFORMER MUST BE USED. SEE FIG. 5B.
4. IN FIG. 3A "$AC_{MI(A)}$" IS A SEPARATE AUXILIARY CONTACT THAT MUST BE ADDED TO LEAD COMPRESSOR MOTOR STARTER M_1 OR M_{1A}.
5. EVAPORATOR FAN OR CHILLER WATER PUMP MUST BE INTERLOCKED IN LEAD COMPRESSOR CIRCUIT AS SHOWN. SEE FIG. 4B.
6. CRANKCASE HEATER SHOULD ALWAYS BE ENERGIZED DURING OFF CYCLE, EXCEPT DURING SEASONAL SHUT DOWN.
7. WHEN CITY WATER OR WELL WATER IS SUPPLIED FOR CONDENSER, A WATER PRESSURE SWITCH OR FLOW SWITCH SHOULD BE INTERLOCKED IN LEAD COMPRESSOR CIRCUIT BETWEEN TERMINALS 8&11
8. PUMP DOWN RELAY USED MUST BE MAKE BEFORE BREAK OVERLAPPING TYPE IN FIG. 4A
9. "CONTROL" DIAGRAMS INDICATE TWO CONTROL THERMOSTATS (TH_1 AND TH_2). THIS MAY BE EITHER A SINGLE TWO-STEP THERMOSTAT OR TWO SEPARATE THEMOSTATS. IN EITHER CASE "TH_1" SHOULD ALWAYS CLOSE FIRST ON TEMP. RISE AND OPEN LAST ON A FALL OF TEMP.
10. WHEN PART WINDING STARTERS SPECIFIED, UNITS WILL BE WIRED AS SHOWN.

NOMENCLATURE

- * HL — HI-LO PRESSURE CUT-OUT (MAN. RESET)
- * KC — COMPRESSOR THERMAL PROTECTION SWITCH (MAN. RESET)
- * OFF-ON-START-STOP SWITCH
- * OF — OIL PRESSURE FAILURE SWITCH (MAN. RESET)
  - OP — OIL PRESSURE CONTACT (N.C.)
  - OT — THERMAL CONTACT
- * GR — GUARDISTOR
- * PB — RESET PUSH BUTTON (GUARDISTOR)
- * J — JUMPER
- * CCH — CRANKCASE HEATER
  - OL — OVERLOADS
  - LLS — LIQUID LINE SOLENOID
  - TH — THERMOSTAT
  - LP — LOW PRESSURE CUT-OUT (AUTO. CUT-IN)
  - PD — PUMP DOWN RELAY
- * TC — TIMED CLOSING SWITCH
- * TR — TIMED RELAY (WHEN USED)
- * M_1, M_{1A}, M_2, M_{2A} — COMPRESSOR MOTOR STARTER
  - MF — FAN MOTOR STARTER
  - MP — PUMP MOTOR STARTER
- * AC_{M1-M2} — AUXILIARY CONTACT COMPRESSOR
  - AC_{MF} — AUXILIARY CONTACT FAN
  - AC_{MP} — AUXILIARY CONTACT PUMP

* INDICATES ITEMS SUPPLIED ON VH UNITS

SYMBOLS

- THERMOSTAT
- PRESSURESTAT
- TIMED CLOSING SWITCH
- COIL
- NORMALLY OPEN CONTACT
- NORMALLY CLOSED CONTACT
- FUSE
- RESISTOR
- HEATER
- SOLENOID
- MAINTAINED CONTACT SWITCH
- TERMINAL STRIP CONNECTIONS
- TERMINALS ON DEVICES
- PUSH BUTTON (MOMENTARY CONTACT)
- TRANSFORMER
- RECTIFIER

MR-2181B

such as at night or week-ends. If the power to the compressor is also effected, it may be necessary to lead the control circuit directly from a main distribution board. This will energize the crankcase heater while the compressor power is shut off.

The crankcase heater is wired as shown in applicable wiring diagram.

8. Pump-Down—As an additional safeguard against liquid accumulation in the crankcase during the compressor off-cycles, the single pump-down (non-recycling) control circuit, as shown in the system wiring diagrams, should be used. A low-pressure switch (with automatic reset) plus an auxiliary non-recycling relay must be provided by the contractor for this arrangement.

If automatic pump-down is slected, set the cut-in point of the pump-down control as high as possible to provide the longest cycling interval. When single pump-down or automatic pump-down is used, it is advisable to make the low pressure setting on the units dual pressure safety switch about 5 psi below the pump-down control cut out point so as to lock out the compressor in the event of a loss of refrigerant.

D. PIPING

1. Codes and Regulations—The piping must be in accordance with local codes and regulations and by following the best refrigeration practices. Section 700 of the Worthington "System Design and Installation Manual" contains many helpful suggestions on the piping of a refrigeration system.

2. Soldering—While the practices listed below are probably familiar, they are given as reference to insure joints being of the high quality necessary for a satisfactory system.

a. Fluxes containing acids should never be used to make R-12 or R-22 refrigerating pipe joints. Ingredients in these fluxes can seriously damage the compressor and its motor even when there is only the smallest amount (a few parts per million) carried along in the refrigerant.

b. When applying flux to a joint, brush it on the outside only of the tubing end on the male end of the fitting; never dip the end into the flux container. Fluxes, used for silver soldering become hard and brittle when they are heated. This "glass like" substance inside the piping would eventually reach the compressor to cause excessive wear of the running gear.

c. Use an oxy-acetylene torch to heat the joint for brazing.

d. Most codes require the use of silver solder. Some codes allow 95-5 solder (95% tin - 5% antimony) because of its good mechanical strength.

e. Pass an inert gas, such as dry nitrogen, through the tubing to prevent the formation of oxides by the high brazing temperatures.

f. Do not apply the solder to the joint until it is heated high enough to melt the solder on contact.

g. It is good practice to clean the excess flux from the outside of a joint after it is made in order to permit immediate visual inspection of the joint and to give accurate results when the system is tested for leaks.

3. Oil Return—Since a compressor will become "oil starved" unless the oil returns to it at the same rate as leaving it, attention must be paid to this fact in system design. The following contains abstracts from Worthington's "Design and Installation Manual". For further information write Worthington Corp., AC Engineering Dept., Ampere Station, East Orange, New Jersey.

a. Refrigerant gas coming in contact with lubricating oil on the cylinder walls of the compressor will pick up some of this oil and carry it into the system. To protect the compressor from running short of oil the piping system must be designed to carry the oil through the condenser, expansion valve, and evaporator back to the compressor. The lines must be properly sized and pitched to have the necessary velocity to carry the oil back.

b. Hot gas or discharge lines to water-cooled or evaporative condensers require careful attention. Unless the oil can drain to the condenser or receiver by gravity, the gas velocity must be high enough to force the oil to flow there. When the system is operating with a minimum load, the gas velocity should not be less than 800 feet per minute for horizontal lines, or less than 1500 feet per minute for vertical runs when the flow is upward more than a few feet above the compressor. It is good practice to loop the hot gas line downward before rising as this loop will collect the oil so that it can be entrained by the rapidly moving gas and be carried upward to the condenser.

c. The maximum pressure drop in a discharge line between the compressor and condenser should not exceed 4 psi. If a vertical discharge line is sized to provide a minimum velocity of 1500 feet per minute at minimum load, it is often found that a full load there will be an excessive pressure loss in the discharge line. This problem is found particularly on systems which use capacity control by cylinder unloading. To help overcome this condition a double pipe riser system can be used. This system has one small line and one line slightly larger in place of one large discharge line. The smaller of the two risers is sized for a minimum gas velocity of 1500 feet per minute at minimum load. The larger riser should be sized so that at maximum load conditions the gas velocity through both risers will not be less than 1500 feet per minute. When the system is operating at partial loads, the oil will collect in the loop at the bottom of the risers sealing off the larger line. All of the gas will then travel at high velocity upward through the small riser. When the system is operating at maximum capacity, the seal will be broken at the bottom of the loop and the gas will travel upward through both risers at the desired velocity.

4. Filter-Drier—A good filter **must** be installed in the liquid line between the solenoid valve and the condenser in order to keep the system dry and to remove contaminants and foreign matter from the refrigerant. A moisture indicator shipped loose with all VH units must also be installed between the drier and the expansion valve. Change the drier cartridges whenever moisture or foreign matter is evident.

NOTE: The refrigerant flow should not be by-passed except to permit replacement of the cartridges. Table 4 lists filter-driers that are recommended for systems using VH compressors. A by-pass arrangement that

TABLE 4—RECOMMENDED FILTER-DRIERS

	Nominal Comp. Capacity—Tons	20	30	40	50	60	70	80	100	120	140	160
Sporlan Valve Co.	Drier Shell No.	C-487	C-967	C-969	C-1449	C-14411	C-19211	C-19213	C-19213	C-30013	C-40017	C-40017
	Connection ODF (inches)	7/8	7/8	1 1/8	1 1/8	1 3/8	1 3/8	1 5/8	1 5/8	1 5/8	2 1/8	2 1/8
	Core No.	RC-4864	RC-4864	RC-4864	RC-4864	RC-4864	RC-4864	RC-4864	RC-4864	RC-10098	RC-10098	RC-10098
	No. of cores required	1	2	2	3	3	4	4	4	3	4	4
	Overall length (inches)	9 3/8	14 15/16	15	20 9/16	20 11/16	26 1/4	26 5/16	26 5/16	27 13/16	34 9/16	34 9/16
The McIntyre Co.	Drier Shell No.	41-14S	41-18S	2M41-18S	2M41-22S	2M41-22S	2M41-26S	3M41-34S	3M41-34S			
	Connection ODS (inches)	7/8	1 3/8	1 3/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8			
	Core No.	HC-4	HC-4	HC-4	HC-4	HC-4	HC-4	HC-4	HC-4			
	No. of cores required	1	1	1	2	2	2	3	3			
	Overall length (inches)	13 5/8	13 15/16	13 15/16	13 15/16	13 15/16	13 15/16	13 15/16	13 15/16			
Henry Valve Co.	Drier Shell No.	7850-7/8	7810-7/8	7910-1 1/8	7910-1 3/8	7920-1 3/8	7510-1 3/8	7515-1 5/8	7515-1 5/8	7520-2 1/8	7520-2 1/8	7525-2 1/8
	Connection ODS (inches)	7/8	7/8	1 1/8	1 3/8	1 3/8	1 3/8	1 5/8	1 5/8	2 1/8	2 1/8	2 1/8
	Core No.	873-C	873-C	876-C	876-C	876-C	875-CMS	875-CMS	875-CMS	875-CMS	875-CMS	875-CMS
	No. of cores required	1	2	1	1	2	2	3	3	4	4	5
	Overall length (inches)	14 1/8	23 3/8	16 7/8	16 7/8	27 3/8	16 7/8	22	22	27 1/2	27 1/2	32 1/2
Mueller Brass Co.	Drier Shell No.	A-16180	A-16187	A-16188	A-16190	A-16190	A-16195	A-16195	A-16195	A-16195	A-16197	A-16199
	Connection ODF (inches)	7/8	7/8	1 1/8	1 1/8	1 1/8	1 5/8	1 5/8	1 5/8	1 5/8	1 5/8	2 1/8
	Core No.	A-16289	A-16289	A-16289	A-16289 A-16299	A-16289 A-16299	A-16288	A-16288	A-16288	A-16288	A-16287	A-16287 A-16288
	No. of cores required	1 can	2 cans	2 cans	1 can ea.	1 can ea.	1 can	1 can	1 can	2 cans	2 cans	1 can ea.
	Overall length (inches)	11 13/32	17 15/32	17 15/32	20 1/2	20 1/2	27 1/2	27 1/2	27 1/2	33 25/32	33 25/32	40 3/64

allows core replacement without shutting down the system is also shown.

WARNING: Always relieve the pressure in the drier section of the liquid line before isolating it to replace elements, since the pressures developed by closing hand valves and trapping liquid refrigerant in the drier are dangerous. If experienced personnel are apt to close valves without pumping the section down, the installation of a pressure relief valve in the drier section is recommended.

In systems having a filter-drier as shown in Fig. 18 the cartridges may be changed with a minimum loss of refrigerant while the system is operating by:

1. Close valve (A) on the up-stream side of the drier while the compressor is running.

2. As soon as the compressor is stopped by the pump-down control, close valve (B).

3. Open by-pass valve (C). The compressor will start again when the suction pressure reaches the cut-in point of the pump-down control.

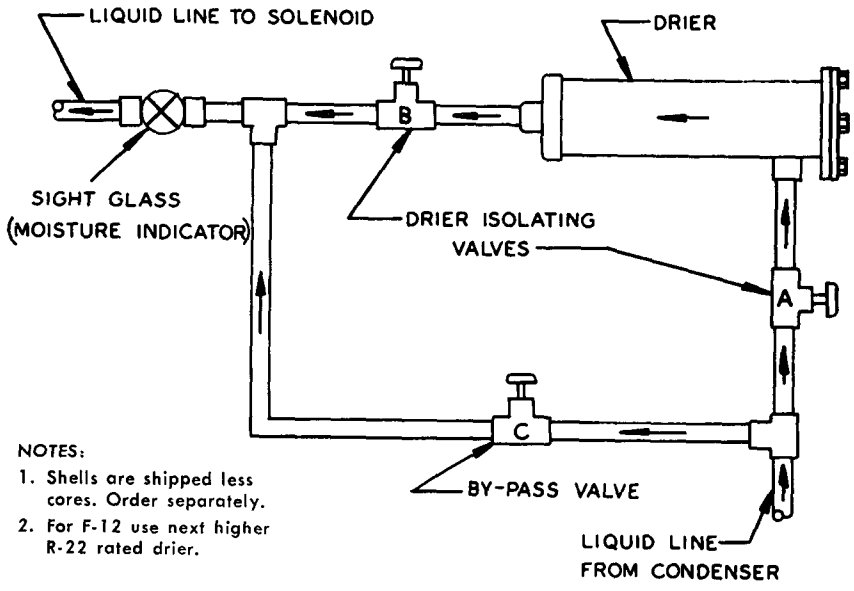


Fig. 18—Arrangement of Filter Drier

4. Remove the cartridges from the drier body and install the replacement cartridges. The use of a new flange gasket is strongly recommended.

5. Before tightening the flange bolts, crack open valve (A) to allow refrigerant to purge the air from the drier body.

6. Back seat valves (A) and (B) and close valve (C).

7. Leak-test the joint between the flange and the drier body.

5. Muffler—VH compressors, having been specifically designed for quiet operation are not factory-equipped with mufflers and in the vast majority of cases they are not needed. It is possible, however, that gas pulsations might cause significant noise in some installation. This is easily taken care of with a muffler, which is to be chosen from the Worthington price and data book. 3VH compressors and condensing units have a muffler furnished as standard equipment. The muffler is factory installed in the discharge line of the condensing unit; it is shipped loose with compressor units. A vertical field installation is preferred, as shown in Fig. 10, with the discharge gas entering at the side and leaving at the bottom.

6. Condenser Piping—The liquid line valve (King Valve) may be reversed to accommodate the system's piping layout. Before opening the valve to purge the factory holding charge out of the condenser, be sure the compressor discharge shut-off valve is closed. The condensers will later have to be re-dehydrated with the rest of the system.

Some means of controlling condensing pressure is necessary for proper operation at varying load condition. One method is a pressure actuated water regulating valve in the water inlet to the condenser. This valve is actuated by the discharge pressure of the condensing unit to control the flow of water, which maintains a desired operating head pressure, and also to shut off the water when the unit is stopped. For the cooling tower applications, a three-way valve is recommended to maintain a nearly constant head pressure.

The condenser is designed to accommodate either a parallel or series circuit hook-up. For the parallel circuit hook-up, the two smaller openings are manifolded together to become the condenser inlet.

7. Suction Line Strainer—Contaminants will get into the system during installation in spite of efforts to keep it clean. Therefore, a strainer should be installed in the suction line to prevent dirt and foreign matter, that might be present in the low side of the system at start-up, from reaching the compressor. Serious damage to the compressor, especially in the form of a motor burn-out, can often be avoided through the proper use of a suction line strainer.

E. PRESSURE TESTING

1. General—Each unit is given a holding charge of dry nitrogen at the factory. If the compressor connection valves and the condenser outlet valves are closed during the installation and if a minimum 20 psig holding pressure still registers on the gauges, it may not be necessary to pressure test the unit with the rest of the system. The unit must be tested, however, if the minimum pressure is not indicated on the gauges or if the local codes require that it be checked again with the rest of the system.

2. Tools and Equipment—The following is required for leak testing:

a. Pressurized cylinder of dry nitrogen equipped with pressure regulating valve.

b. Connecting lines and fittings.

c. Soap solution to make firm bubbles.

d. Brush for applying soap solution.

e. Hammer with steel face.

f. Cylinder of refrigerant.

g. Halide torch or electronic leak detector.

3. Maximum Pressure—The ASA code calls for test pressures as follows:

	High Side	Low Side
Refrigerant-12	....235 psig	150 psig
Refrigerant-22	....300 psig	150 psig

To provide an even greater margin of safety, each compressor has been tested to 230 psig, low side, and 400 psi, high side, at the factory. It is urged that these pressures not be exceeded since injury and damage could result.

4. Leak-Test Procedure—To check the system for leaks the following instructions are recommended:

a. Connect a cylinder of dry nitrogen to the systems charging valve through a pressure regulating valve. This valve is **necessary** because of the excessive pressure (2000 psig) in the full tank or nitrogen.

b. Open all the valves between the components to be tested. Note that solenoid valves are usually provided with jack screws to permit opening them without energizing the coils.

c. Admit the dry nitrogen to the system until the test pressure for the low side is reached. If local codes require a greater pressure on the high side, close the liquid line solenoid valve and resume charging until the desired pressure registers on the charging gauge. Remove the nitrogen tank as a safety measure against a shut-off valve leak.

d. Leak-test all joints with a soap solution that is clean and has the proper consistency to give good bubbles. Apply the solution carefully to each joint with a small brush. Tapping the joint lightly while it is being tested will break a "flux joint" and show a leak that could give trouble after the unit is started up. Wipe off the soap solution after inspection. Establish a definite order so that no joint will be neglected. Mark all leaks for repair after the inspection is completed. **Be sure to remove all the pressure** before heating a joint to be repaired.

e. Once the soap shows the system to be tight, the nitrogen pressure may be reduced to 50 psig and a cylinder of refrigerant connected to the charging valve. Allow the refrigerant to flow into the system until a pressure of 70 psig is reached. Then replace the nitrogen cylinder and boost the pressure to 150 psig. Close the charging valve and remove the nitrogen cylinder before proceeding to test for leaks with a halide torch or an electronic leak detector. All leaks should be marked for repairs as noted previously. Leak-testing must be repeated on repaired joints until there is complete assurance that the system is right.

f. It should be noted that one of the chief causes of leaks in a soldered joint is the presence of dirt. "Puddling" solder over a leak is poor practice and a waste of time. It is far better to disassemble the joint, clean it and resweat it.

g. If time permits, the test pressure should be left on the system over night. In a leak-tight system and with little change in the ambient temperature, there will be no noticeable difference between the initial and final gauge readings.

F. DEHYDRATION

1. General—Moisture is probably

the greatest source of trouble that can occur in a system. Corrosion, expansion valve freeze-up, oil sludge and copper plating can all be caused by moisture. The most practical method of dehydrating a system is by evacuation, which should be done every time a system has been opened to the atmosphere.

2. Equipment—The following are needed for this operation.

a. A vacuum pump capable of reducing the pressure to at least 0.2 in. of mercury. **Do not use the compressor as a vacuum pump. Doing so constitutes misuse and results in serious damage.**

b. A manometer or absolute pressure gage to be used for determining the degree of vacuum.

3. Preparation—First, permit the leak test charge to escape to the atmosphere. Care should be taken in handling the manometer. Keep connections tight. No loads, such as the weight of connecting lines, should be placed on it. The atmospheric ambient temperature must be 60F or higher.

4. Operation—Check to see that all valves in that part of the system to be evacuated are open (or that connections have been made to evacuate from both sides of closed valves); then start the pump. Keep the valve to the manometer closed, except when taking a reading. This will help complete the process sooner and help to prevent the mercury from entering system. When opening the valve to take a reading, keep it open for at least three minutes before taking the reading, which then will be accurate. Close the valve immediately after taking the reading. Pump down until a pressure of 0.2 in. of mercury is reached.

Then at the point(s) farthest from the vacuum pump connection **gradually** introduce dry nitrogen into the system, breaking the vacuum. The need for doing this gradually is stressed because a sudden change in pressure can damage the pump. Crack open the line to the pump where it connects to the compressor, and permit dry nitrogen to purge the system. This purging with nitrogen should eliminate the last traces of moisture.

Turn off the nitrogen, disconnect the drum, and again evacuate to 0.2 in. of mercury. Let the unit remain idle for one hour; then recheck the manometer. It should not have increased to more than 0.230 in. of mercury. If it has increased to more than 0.230, the system should again be evacuated to 0.2 and rechecked after an hour. If two more trials still show an excessive rise, the system should again be checked for leaks and repaired where necessary. Re-evacuate the system, and if the vacuum holds satisfactorily, the system will be ready for charging with refrigerant. Remove the pump and manometer.

G. CHARGING

1. Procedure—The following instructions pertain to charging of the system with refrigerant:

a. The system must have been evacuated per Section 1F. First, weigh the cylinder of refrigerant. Then shut off the liquid line valve. Connect the cylinder to the charging valve, purging the air from the line. Then open the charging valve. Invert the refrigerant cylinder and allow liquid to flow directly into the system.

b. Check the refrigerant from time to time by closing the charging valve, opening the liquid line shut-off valve and starting up the compressor.

Caution: Do not start the compressor without reading the start-up instructions in Section II. Observe the liquid line sight glass after conditions have leveled off. The system is charged when bubbles no longer appear in the glass under full load. **When this point has been reached, do not add more refrigerant. Doing so, would result in greater consumption of cooling water, waste of power, and possibility of flooding the compressor with refrigerant.** Weigh refrigerant cylinder after charging so that a record may be kept of the amount of refrigerant used.

SECTION II

OPERATING

A. START-UP INSTRUCTIONS

1. Before starting, after shut-down

a. Make certain crank case heater is turned on and operating properly **at least one hour before starting.**

b. See that all **refrigerant valves** are **open.**

c. Recheck safety control wiring.

d. See that all cooling water line valves are open and the water is under sufficient pressure.

e. Start all auxiliary equipment such as fans, cooling tower pumps, etc., and see that they are operating properly.

f. Check oil level in crank case sight glass and add or remove as necessary.

g. Start the compressor by using "on-off" switch.

2. Before starting, after installation (or overhaul)

a. Perform all the steps in Section 1 above except starting of compressor.

b. Do not take anything for granted. Check the following:

(1) See that the 2VH units have overload relays exactly as specified in the electrical data table.

(2) A Worthington recommended filter-drier has been installed. (Reminder test after an overhaul—the cartridge(s) should be replaced).

(3) The system has been dehydrated and a moisture indicator has been installed.

c. **NEGLECT OF ABOVE VOIDS THE WARRANTY.**

d. Start compressor using "on-off" switch.

3. After Starting

a. Note the difference between the oil pressure and suction gauges. This net oil pressure should be between 30 psig and 60 psig. A too low pressure prevents the compressor from loading up. On the other hand, a higher than normal pressure prevents un-

loading. However, an initial high oil pressure might come from a cold start and this will settle out as regular operating conditions are reached. If the oil pressure is not between 30-60 psig see the trouble diagnosis chart, Appendix IV.

b. Check the safety switches as follows:

(1) **High pressure control**—Shut off water to condenser or stop fans if air-cooled unit. The pressure will rise and the compressor will stop when the discharge pressure reaches the control cut-out setting. If it does **not** stop, immediately stop the compressor with the "on-off" switch. Then lower the control setting and restart. If it does not stop, the switch is probably defective or there is an obstruction in the line. After making necessary corrective action recheck the control.

Note: After the safety switch operates, it must be re-set before the compressor will start again.

(2) **Low-pressure safety switch**—Slowly close the compressor suction shut-off valve to stop the compressor, at approximately the set pressure. If it does not stop, open the shut-off valve and stop the compressor with the "on-off" switch. The control should then be examined for a defect or an obstruction in the line. Make necessary corrective measures and recheck control. Reset the switch before starting the compressor again.

(3) **Low-Oil Pressure Switch**—Remove the switch housing cover. Short terminals T_1 and T_2 with an **insulated** jumper and wait for compressor to stop. It should run about 90 seconds or possibly a little longer since the cover will be off. If the compressor continues to run, the switch is defective. Stop operation and replace the control. If the compressor is stopped by the switch, observe the spring for snap action shortly after the compressor stops. This will mean that the switch's pressure contacts have closed as they should. Remove the jumper. If the switch has operated normally, the reset button will have to be pressed to start the compressor. Replace the cover after completing the test.

Caution: After the switch has been checked, do not by-pass it or operate the compressor by manually operating the contacts. Serious damage may result. One reason for the necessity of this switch is the liquid refrigerant in the crank case can cause excessive foaming and loss of pressure, especially at start-up or when the compressor is being pumped down for repairs.

c. Check the following:

(1) **Oil Level**—A careful check must be maintained on the oil level. When charging the system with the liquid line valve closed, the level should be checked constantly because oil mixed with refrigerant will not circulate with it, but will be trapped in the condenser.

(2) **Gauges**—Constant pounding due to pressure pulsations will shorten the life of the gauges. Therefore, after the system has been stabilized, the gauge valves should be closed until it is desired to take a reading. They should then be cracked slightly, left open just long enough to take a true reading and then closed. This will lengthen the gauge life considerably.

(3) **"Guardistors"***—If the "Guardistor" relay drops out or will not pick up, test as follows:

1) Inspect relay to make sure that contact motion is mechanically free and that contacts are in good condition.

(2) Check the following electrical characteristics using a volt-ohm-ammeter:

B. COMPRESSOR LUBRICATION

1. Lubricating oil for V-Line compressors must meet the following specifications:

Viscosity: 280-300 SSU @ 100F
Gravity: 20.4 - 22.4 API
Flash Point: (ASTM open cut) 350-360F
Fire Point: 400 - 420F
Color: (ASTM) 2 Maximum
Pour Point Test: (ASTM) - 25F Maximum
Dielectric Strength: 25 Kilovolts Minimum
Slight Oxidation: 10-20
Floc Test for Wax: —50F Maximum

2. Each compressor receives its proper change of oil at the factory. The amounts for each are shown in the following table:

OIL CHARGE
V-Line Compressors

Model	Charge
2VH4	26 pints
2VH5	27 pints
2VH6	27 pints
2VH7	28 pints
2VH8	28 pints
3VH4	45 pints
3VH5	45 pints
3VH6	47 pints
3VH7	49 pints
3VH8	49 pints

3. Sufficient oil in the compressor when its level can be seen through the crank case sight glass. If the level drops below that point, the oil has been trapped somewhere in the system and must be replaced. Follow the procedure outlined in the section on routine service operation.

Check	Should Be	Method
(a) Transformer primary input	220V AC $\mp$ 10% —15%	Check terminals No. 13 and No. 14 Control circuit power "on" and "reset" depressed.
(b) Thermistor Input	7 to 10V DC	As Above
(c) Thermistor resistance	80 to 180 Ohms	As Above
(d) Relay circuit resistance	About 1050 Ohms in each direction of current flow	As Above
(e) Rectifier resistance	600 to 720 Ohms forward; 50,000+ Ohms reverse	As Above
(f) Relay Coil resistance	320 Ohms	As Above

*Registered trademark—Westinghouse Elec. Corp.

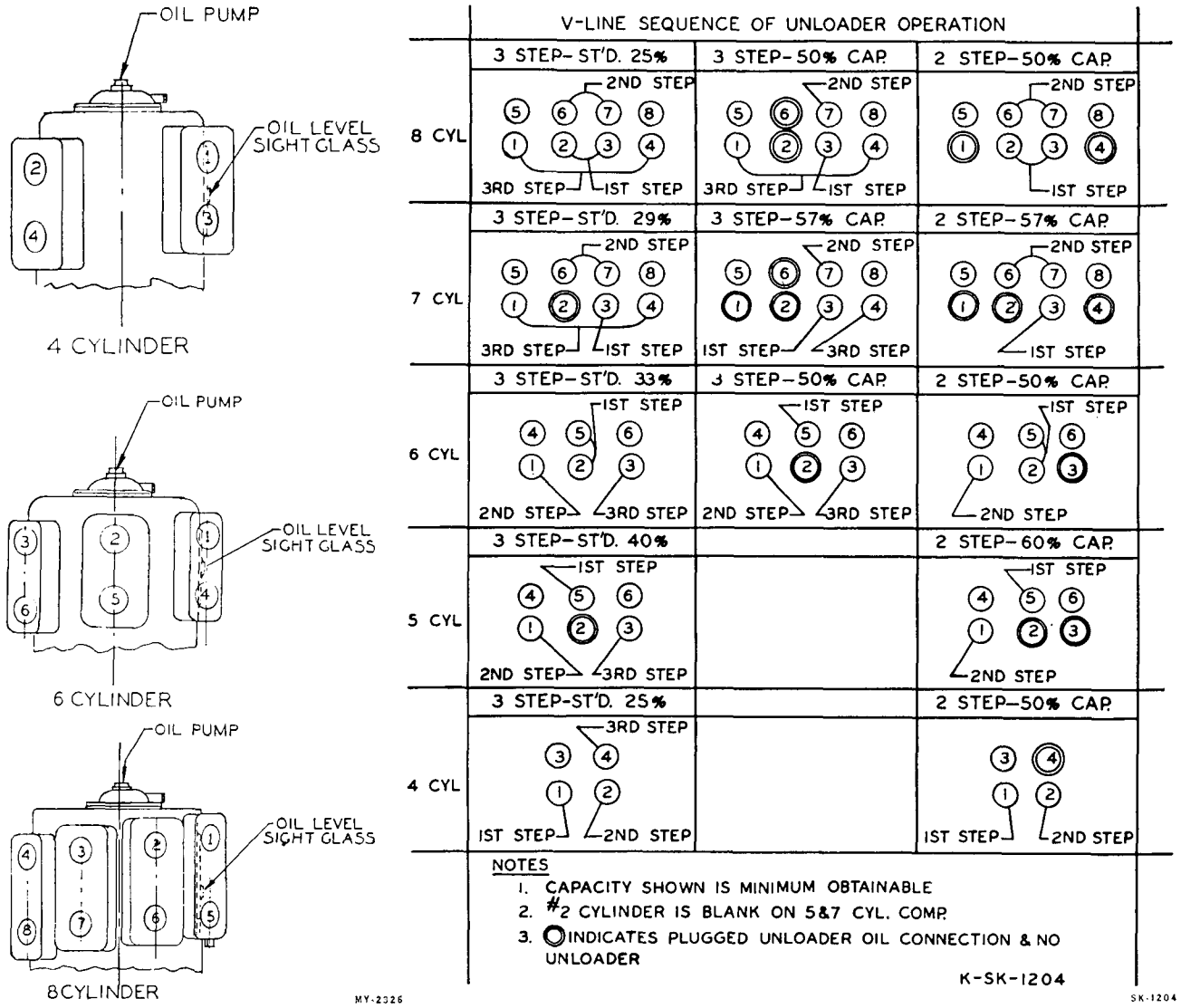


Fig. 19—Compressor Cylinder Positions

C. UNLOADING MECHANISM

1. General—While usually referred to as the "unloading" mechanism, this component actually performs both loading and unloading functions, activating or deactivating cylinders as required when the demands of the system increase or decrease. It consists of the capacity control, which operates as a sensing device to monitor compressor output, and the cylinder "unloaders", which vary the compressor's output. Both are shown in Fig. 20, to which reference should be made while reading the following explanations.

2. The Unloader—The cylinder will deliver its normal output when the suction valve ring is in its regular place, bearing on the cylinder liner valve seat. Unloading is accomplished when the valve ring is lifted.

In detail, loading is accomplished when—Oil is fed to the unloader from the capacity control through tubes (9, 10 or 11) and the connector (1). Pressure will then increase in the unloader chamber (4), causing the outer sleeve (3) to move downward. The inner sleeve (5), held by the retainer ring (7), stays in place. The return springs (2) are compressed by the outer sleeve. This permits the springs on the lifting pins (8) to push down the lifting ring (6) which as it bears on the outer sleeve, follows its motion. This permits the suction valve ring to seat itself on the cylinder liner.

Unloading is accomplished when—A drop in the cooling load causes oil in the unloader chamber (4) to return to the capacity control. The reduction in unloader chamber pressure permits the return springs (2) to raise the outer sleeve (3). This pushes the lifting ring (6) against the lifting pins (8), raising the suction valve ring. The suction ports, therefore, are kept open during the upstroke of the piston, and the refrigerant gas is returned to the suction manifold.

The action of the outer sleeve must be as smooth as possible. At the same time, an effective seal must be maintained to prevent the leakage of oil from the unloader chamber. Both of these requirements are effectively met through the use of Teflon®, in the form of O-rings.

3. The Capacity Control—As the compressor's suction pressure varies with changes in the cooling load, the capacity control correspondingly

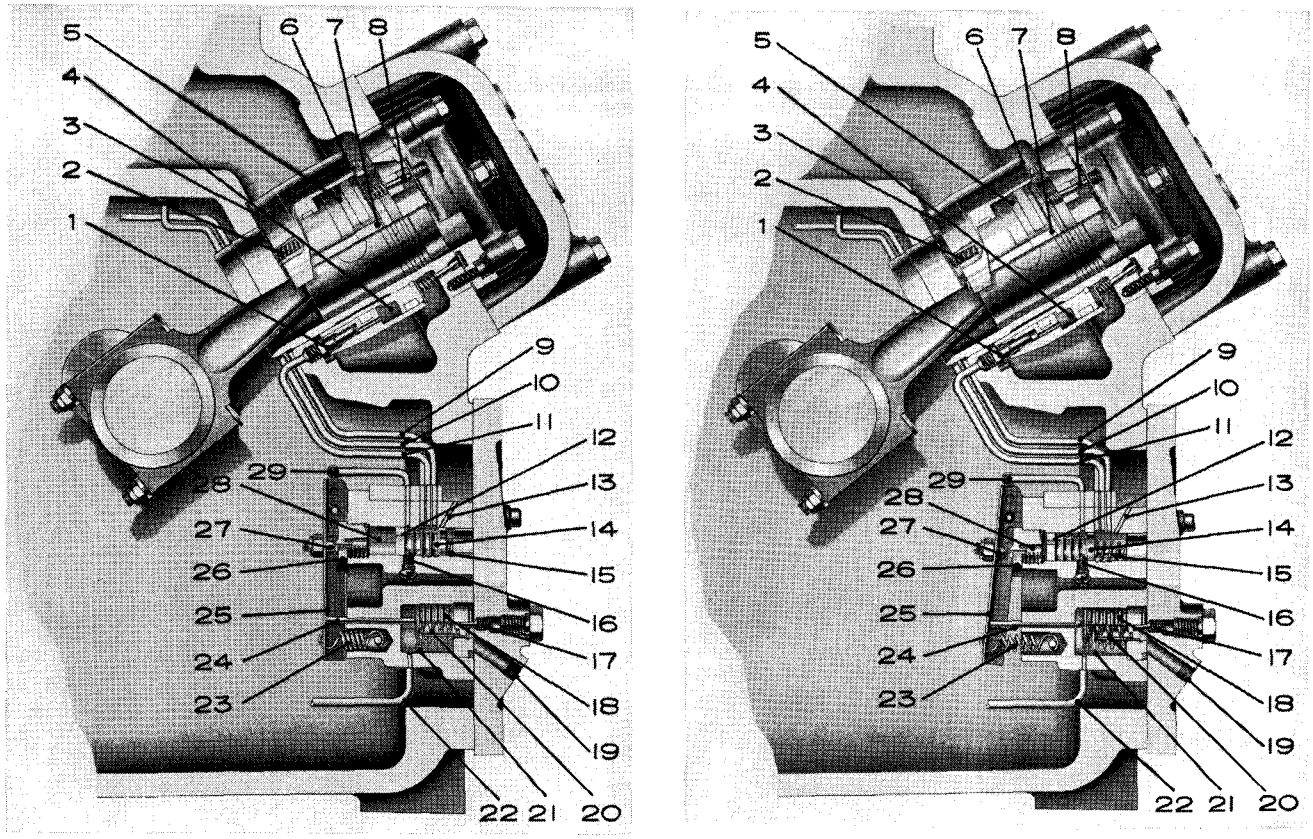


Fig. 20—Unloading Mechanism

feeds more or less oil to the unloader chambers. This affects compressor output through the action described in Section 2 above, permitting the output to match the cooling load changes.

Mechanics of Operation—The capacity control works as it does because of the motion of the bellows (18). The bellows is at rest when compressor suction pressure, atmospheric pressure, the bellows compression spring (20), and the tension spring (23) counterbalance each other. With changes in any of these forces, the bellows (18) expands and contracts. This moves the push rod in and out, changing the position of the metering lever (25). As the metering lever pivots, the distance between the end of the metering screw (27) and the mouth of the orifice (26) changes. This regulates the amount of oil leaving the chamber (28).

Oil flows through a tube (29) and a V-notch (12) in the floating piston (14) into the chamber (28) at a uniform rate. Therefore, the factor controlling chamber pressure is the change in outward flow of oil through the metering orifice.

The pressure differential between that acting on one face of the spring-loaded piston (15) (14) and that acting on the opposite face causes the piston to move. This differential must be sufficiently high to overcome the spring and, in addition, is in graduated steps due to the action of the spring-loaded detents (16) in the annular grooves of the piston, permitting oil to flow to the unloaders through tubes (9, 10, and 11), with all being fed simultaneously when the piston (14) is farthest from the orifice (26). When the differential drops as the chamber pressure decreases, the piston moves toward the orifice, cutting off oil flow to each of the unloaders in turn.

Suction Pressure—Because of the relative stability of the other forces acting on the bellows (18), the suction pressure can be considered for practical purposes to be the only force actuating the capacity control. How it does this is explained below.

Decrease of Suction Pressure—The suction manifold is connected to the bellows chamber (21) through a tube (22). A decrease in suction pressure lessens the load on the bellows (18). The bellows extends, forcing the push rod (24) against the metering lever (25), moving it outward. This moves the metering screw (27) away from the orifice (26), permitting oil to flow from the chamber (28). This lowers chamber pressure so that the piston moves toward the orifice and cuts off the flow of oil to the unloaders, as explained above. The reduction in pressure causes the suction valve rings to be raised, and unloading takes place.

Increase of Suction Pressure—When cooling loads increase, with a corresponding increase in suction pressure, the bellows chamber (21) pressure increases, compressing the bellows (18). The tension spring (23) then pulls in the metering lever (25), to which the metering screw (27) is attached. This covers the orifice (26) and reduces the flow of oil from the chamber (28), causing the chamber pressure to rise. The piston (14) then moves away from the orifice and permits control oil under pressure to flow to the unloaders, causing the suction valve rings to seat against the cylinder liners and the compressor output to increase.

Starting Torque—Oil pressure does not build up until the crankshaft is

turning over at rated speed. Since cylinder loading is dependent upon oil pressure, this means that the starting torque of V-line compressors will always be low.

D. CAPACITY CONTROL ADJUSTMENT

1. General—Controls calibrated for use with R-22 refrigerant are adjustable for balancing suction pressures between 0 and 85 psi. Those designed for use in R-12 systems, in systems meant for low temperatures, or for other special applications have a different range.

Since instructions for capacity control accessories will have been furnished as required, the following applies to standard units only.

2. Mechanics of Adjustment—Adjustment is made by rotating a screw which is located on the same handhole cover as the oil level sight glass. It is protected by a plug with an 11/16-in. hex head, which first must be removed. When the adjusting screw is turned in, the controlled suction pressure rises.

3. Procedure—The design suction pressure for the particular unit installed and the other conditions under which it is to operate will have been given the installing technician. During the compressor test at the factory, an adjustment has been made so that the first step of unloading will occur at 68 psig for R-22 refrigerant or 38 psig for R-12 refrigerant. This adjustment is for air conditioning operation, so if the compressor is to be used for that service, only a small screw adjustment should be necessary. Adjustment steps are as follows:

If the system is operating ABOVE the design suction pressure—Close the compressor suction shut-off valve until the suction pressure drops to the design figure.

Slowly turn the adjusting screw in until a step of unloading occurs. A step of unloading is accompanied by a change in compressor tone and a decrease in motor power consumption. Since the change in tone might be missed, a surer indication can be obtained by placing an ammeter in the motor power line and watching for the needle to swing sharply to the left when unloading occurs.

The compressor suction shut-off valve should then be again fully opened. After the system stabilizes, the unloading operation will start immediately when the suction pressure drops below the setting.

If the system is operating BELOW the design suction pressure—Turn the adjusting screw in as far as possible, so that the compressor will be operating at minimum capacity. As the screw is turned in, the pressure should increase until it exceeds the design suction pressure. If it is still below the design value, increase the evaporator load if possible, maintaining the proper condensing temperature. If this fails to increase suction pressure above the design figure, a fault exists which must be discovered and corrected. Check the Trouble Diagnosis Chart under "Low Suction Pressure" for causes and their correction. If the pressure does exceed the design suction pressure, however, the suction shut-off valve should then be closed until the suction pressure is about 10 psi for R-22 refrigerant (or 6.5 psi for R-12 refrigerant) below the design suction pressure. Now back off the adjusting screw until a step of loading occurs. This is accompanied by a change in compressor tone, an increase in motor power consumption, and a decrease in suction pressure. A positive way of determining this point is to install an ammeter in the motor power line and watch for the needle to swing sharply to the right when loading occurs. The compressor suction shut-off valve should again be fully opened, and the system permitted to stabilize. If the above procedure does not result in exact capacity control operation, very little additional screw adjustment will be needed. Turn the screw in to increase suction pressure, and back it off to reduce the pressure.

IMPORTANT—A short time lag usually occurs between a change in the screw adjustment and the resulting loading or unloading. The screw should therefore be turned very slowly, with a wait after each slight turn, or a step might be missed completely. For the 6-, 7-, and 8-cylinder compressors, two unloaders act together. Since there is usually a lag in current change because the two do not normally act at exactly the same time, completion of the loading or unloading step could be misjudged.

E. TRANSFERRING THE SYSTEM TO OPERATING PERSONNEL

1. Before turning over the system to the operating personnel, the installer should check it out completely after its operation has fully stabilized. Minor adjustments may be required at that time. Refrigerant charge and compressor crankcase oil level should be noted carefully. Check the moisture indicator and replace the drier cartridges, if necessary.

DO NOT RUN THE UNIT WITH MOISTURE PRESENT. DOING SO VOIDS THE WARRANTY. This interval may also be used by the installer to instruct the operating personnel in the proper care of the system, as well as its operation. The function of each component should be clearly explained. The preventive maintenance program and routine service operations should be gone over in detail. This indoctrination will result in fewer service calls and much more dependable operation, so that the customer will be satisfied with the equipment as he should be.

F. OPERATING LIMITS

1. General—Operation within the limits listed below will insure reliability and long life. Although the R-22 ratings are based on a suction gas superheat of 15F, the compressor will operate satisfactorily within the limits up to a superheat of 25F and an ambient (atmospheric) temperature of 90F. The R-12 ratings are based on 65F suction gas temperature. Under certain conditions, these limits may be exceeded, but to keep the warranty active and to obtain the most efficient operation, consult the Air Conditioning Division Service or Sales Department, Worthington Corporation, Ampere Station, East Orange, New Jersey. See Table 5 for operating limits.

TABLE 5—VH OPERATING LIMITS

Comp. Model No.	Design Working Pressure	Allowable Voltage Variation at Compressor Terminals Running & Starting		Maximum Operating Pressure		Maximum Disch. Pressure Cut-Out Setting		Minimum Evap. Temps at Specific Cond. Temps		Maximum Superheat (R-12 & R-22) (See Note 1)	Minimum Superheat (R-12 & R-22) (See Note 1)	Maximum Discharge Temp. (R-12 & R-22) (See Note 2)	Low Oil Pressure Cut-Out Setting (R-12 & R-22)	Maximum Oil Temp. (R-12 & R-22) (See Note 3)
		R-12	R-22	R-12	R-22	R-12	R-22	R-12	R-22					
2VH8 2VH7 2VH6 2VH5 2VH4 3VH8 3VH7 3VH6 3VH5 3VH4	High Side 400 Psig Low Side 230 Psig	±10% of Voltage Specified on Compressor Nameplate (See Note 4)	±10% of Voltage Specified on Compressor Nameplate Except Conditions at 130 C.T. With Evap. Temp. Below 40F Where the Limits are +10% and −5% (See Note 4)	235 Psig or 150F	300 Psig or 130F	Water Cooled 210 Psig Air Cooled 250 Psig	Air Cooled 310 Psig Water Cooled 270 Psig	30F @ 150F and @ 140F or 20F @ 130F and @ 120F or 10F @ 110F and @ 100F or of @ 90F and @ 80F	30F @ 150F or 20F @ 120F and @ 110F and @ 100F or 10F @ 90F and @ 80F	65F Return Gas for R-12 and 25F Superheat for R-22	10F	275F	25 Psi Cut Out 35 Psi Cut In	195F

NOTES: 1. Measured at suction shut-off valve.
2. Measured in discharge line within 12 inches of discharge shut-off valve.
3. Measured below oil level sight glass.
4. On 208/220 volt motors, apply voltage tolerance to 220 volts only.
5. Phase unbalance not to exceed 2%.

SECTION III

INSPECTION AND PREVENTIVE MAINTENANCE

A. GENERAL

While Worthington's designers and engineers have tried to incorporate into the VH compressors all possible features to reduce periodic inspection and maintenance, nevertheless such surveillance is necessary at specified intervals. To neglect to do this, invites trouble. Worthington not only urges that faithful periodic inspection be made but that the results of these inspections and notation of maintenance be recorded in a suitable notebook. Such a notebook serves not only to record the work done but may also be used to permit convenient scheduling of shutdowns for corrective action thus avoiding possible untimely failures.

B. INSPECTION AND PREVENTIVE MAINTENANCE CHART

Worthington's engineers have prepared an Inspection and Preventive Maintenance Chart which can be found on page 38 of this manual. These recommendations are based on cumulative experience of many men and many installations over many years. They represent the minimum operation required to keep the units in proper running condition. Space is also provided in this check-off list for routine maintenance required by manufacturers of other components in the system.

C. ROUTINE SERVICE OPERATIONS

1. Compressor Pump-Down—Whenever it is necessary to open the compressor, it should first be pumped-down and shut off from the rest of the system. To pump down the compressor,

a. Use a screw driver to hold the spring loaded arm up in low pressure switches to keep the switches closed. This prevents the compressor from stopping before it is cleared of refrigerant.

b. While the compressor is running, slowly close the suction shut-off valve.

c. When the suction pressure drops to about 2 psig, stop the compressor.

CAUTION: Never pump the compressor below 2 psig. Negative pressure pulls moisture and dirt into the crankcase when it is opened. Negative pressure can also critically lower the motor's insulation resistance; thereby causing a motor burn-out.

The low-oil pressure switch may stop the compressor before reaching the 2 psig figure because excessive oil foaming causes the oil pump to lose suction. If this occurs, a wait of a few minutes will then be necessary so that the switch's thermal element can cool enough to permit the manual resetting.

d. After reaching 2 psig suction pressure and stopping the compressor, a few minutes wait will be needed to permit the refrigerant to leave the oil in the crankcase. This will be accompanied by a rise in suction pressure.

e. More refrigerant can then be pumped to the condenser by again reducing suction pressure to 2 psig.

f. This is to be repeated until the suction pressure stops rising after shut-off following the reaching of 2 psig. If after the first such shut-off, the suction pressure rises rapidly, the discharge service is leaky and no further attempt should be made to pump out more refrigerant. When such evidence of leaky discharge service appears, close the discharge shut-off valve as quickly as possible.

g. If normal results are obtained and the 2 psig pressure is held, close the discharge shut-off valve.

2. Removing Refrigerant

a. Connect an empty or partly empty refrigerant cylinder to the liquid line charging valve. The cylinder should be specifically designed for the refrigerant.

b. Purge the air from the connection line before tightening the connection.

c. Keep the cylinder cold by immersing it in water and cracked ice. This will insure flow to it from the system.

d. Start the compressor and crack open the liquid line charging valve. If the removal is made to draw off excess refrigerant, close the liquid line charging valve as soon as the head pressure is normal.

e. **CAUTION: Do not overcharge the cylinder: the excessive pressure would be dangerous.** Weigh the cylinder after closing the valve and disconnecting it to see that its weight does not exceed the original gross weight marked on it.

3. Adding Oil To The Compressor—The correct amount of oil is in the compressor crankcase when its level appears anywhere in the sight glass. Even though the correct amount may have been initially put in the crankcase, it is possible that some of it, carried along in the refrigerant through the system, may be trapped in components or in the piping. When this process stops and the lost oil is replaced, the oil level in the crankcase will be maintained. To add oil:

a. Pump-down the compressor, as described in Section III C above. This reduction in crankcase pressure will reduce the load on the oil charging pump. Disconnect the oil separator if used.

b. Connect the pump to the compressor oil charging valve. The location of the valve is shown in the unit dimension sheets. Do not tighten the connection.

c. Start the pump, and when oil has purged the air from the line between the pump and the oil charging valve, tighten the connection and open the valve.

d. When the oil level reaches a point ½ to ¾ of the height of the sight glass, stop the pump.

e. Close the oil charging valve tightly, remove the charging line, and replace the gasket and cap on the charging valve.

f. If an oil separator is used, reconnect it to the oil charging valve and open the valves at each end of the oil return line. Purge the air from the line before tightening the connection at the oil charging valve and opening the valve.

g. Open the compressor shut-off valves.

h. Start the compressor, observing the crankcase oil level until satisfied that it is being maintained.

4. Removing Oil From The Crankcase—When the oil level is maintained above the top of the sight glass, the excess must be removed. This is done as follows:

a. Pump-down the compressor, as described in Section III C above.

b. Crack open the oil drain plug, permitting the oil to flow into a suitable container. Since escaping refrigerant can cause foaming which can make the container overflow, the need for caution during this operation is stressed.

c. When the oil level is visible in the sight glass, reseat the oil drain plug.

d. Open the compressor shut-off valves, start the compressor, and observe the crankcase oil level until satisfied that the proper height is being maintained.

5. Purging Non-Condensibles From The System—If present in sufficient quantity, non-condensible gases, such as air, cause excessive discharge pressure, which results in lower capacity and higher power consumption. If these symptoms are present, the amount of non-condensibles can be checked by doing the following:

a. Shut down the system long enough for the temperature of all components to level off. This usually can be done overnight.

b. Obtain the condenser pressure, and note the amount by which it exceeds the refrigerant saturation pressure at the temperature of the system. The saturation pressure can be obtained from the chart published for the refrigerant used.

c. If the condenser pressure exceeds the saturation pressure by 10 psi or more, the non-condensibles are excessive and must be removed, e.g., if R-22 refrigerant were being used, and the system temperature 85 F, a condenser pressure of 175 psi would indicate excessive non-condensibles. This is determined by referring to the table for R-22, which shows a saturation pressure of 157.2 and 85 F. The difference of 17.8 psi, being higher than 10 psi, indicates that corrective purging is required.

If Excessive Non-Condensibles Are Present

a. Pump-down the system as described for a prolonged shut-down in paragraph 6 below.

b. Immediately after stopping the compressor, close the compressor discharge shut-off valve.

c. Run the water through the condenser in order to condense as much of the refrigerant vapor as possible. (It may be necessary to block open the water regulating valve). For systems having an evaporative condenser, the refrigerant inlet shut-off valve should be closed as soon as the compressor is stopped. **Do not** shut off the spray water and the condenser fan.

d. Crack open the purge valve for an instant, then shut it again.

e. Allow the system to stand as is for a few minutes before reopening and closing the purge valve. Repeated purging and condensing operation should adequately clear the system of non-condensibles.

f. After purging, restore normal system operation. Check for improvement in discharge pressure conditions. Check refrigerant charge and compressor oil level.

6. Preparing for a Prolonged Shut-Down—Often, refrigerating systems, such as air conditioning systems, may not be needed for months. In such cases, they should be pumped-down and the refrigerant stored in the condenser or liquid receiver. This eliminates unnecessary stresses in lines and equipment and reduces the chance of refrigerant being lost. The following steps should be taken:

a. Stop the refrigerant flow at the condenser or liquid receiver by closing the liquid line valve.

b. Manually open the liquid line solenoid valve.

c. If an evaporator back-pressure valve is used and has a by-pass around it, by the by-pass should be opened. If there is no by-pass, set the regulator so that evaporator pressure can be reduced to 0 psi.

d. Install jumpers across the contacts of all low-pressure switches.

e. With the above settings, and with all equipment running, operate the

system. This will pump refrigerant from the liquid line, evaporator, and suction line into the condenser or receiver.

f. When the suction drops to 2 psig, stop the unit. For the same reason given in para. 1 above, do not go below 2 psig.

g. While the compressor is stopped, refrigerant in the oil and in any low points in the evaporator circuit will cause the suction pressure to rise. When this occurs, the system should again be pumped-down to 2 psig suction pressure and the process repeated until the suction pressure holds at 2 psig. This slight pressure should be maintained during the shut-down period so that if a leak develops, the possibility of air being drawn into the system is minimized.

h. The condenser or liquid receiver and associated piping used to store the refrigerant should be checked carefully for leaks.

i. If there is a possibility of freezing, the condenser water supply should be shut off and the condenser drained. Advantage could be taken of this condition to give the condensing equipment its annual inspection and preventive maintenance.

j. Return the liquid line solenoid valve to normal and remove the screw driver from the spring loaded arm.

k. Open the system's master switch, lock or seal it in that position, and attach a tag warning against unauthorized operation of the system.

7. Starting-up After a Prolonged Shut-Down—All annual inspection and preventive maintenance procedures can be performed during a prolonged shut-down.

This will insure ready start-up and efficient operation when the system is put back into service. After a prolonged shut-down, the steps given below are to be followed for starting up the system.

a. Open all drains, and inspect all water lines and air-cooled or evaporative condensers, if used.

b. Manually turn over the shafts of auxiliary equipment for freedom of rotation.

c. Turn on the condensing water supply.

d. Open the compressor discharge shut-off valve, and be sure that the suction shut-off valve is back-seated.

e. Assure yourself that the liquid line solenoid valve will close when not energized.

f. Close the system's master switch.

g. Open the liquid line valve and charge the system with refrigerant.

h. Leak-test the entire system. See para. 4 above.

i. Start all auxiliary equipment.

j. Start the compressor, as described in Section II under A.

D. TROUBLE SHOOTING

1. Operating personnel should become as familiar with the equipment as possible. This will permit ready diagnosis of any troubles which develop and the immediate correction of minor faults, avoiding unnecessary shut-downs. Considerable time can be saved by correct diagnosis, either for minor repairs or the distinguishing of conditions calling for expert services. For this reason, a Trouble Diagnosis Chart is given in this Manual. At times, the obvious is overlooked. Therefore, a check list follows, in which operating personnel will usually find nothing new, but which if used can often save a great deal of time and trouble:

1. Is the system undercharged with refrigerant? Is it overcharged?

2. Is there a load on the system other than that for which the system was designed?

3. Is the evaporator functioning correctly? Are temperatures being maintained? What is the condition of the coils?

4. Is the supply line voltage sufficient?

5. Is enough water being fed to the condenser? Are the temperatures satisfactory? Is all auxiliary equipment (pumps and fans) operating as it should?

6. Is the expansion valve functioning correctly?

7. Are the safety controls defective? Are they set properly, or are they set too close to operating valves?

2. If the above list has been gone over and a fault still persists, consult Trouble Diagnosis Chart located in Appendix I.

APPENDIX I

TROUBLE DIAGNOSIS CHART

COMPLAINT	POSSIBLE CAUSES	CORRECTIVE STEPS
1. Compressor will not run	a) Main switch open	a) Close switch
	b) Fuses blown	b) Check electrical circuits and motor winding for shorts or grounds. Investigate for possible overloading. Replace fuse after failure cause is corrected.
	c) Thermal overloads, tripped or open	c) See complaint 12
	d) Defective starter	d) Repair or replace
	e) System shut down by safety devices	e) Determine type and cause of shut down and correct it before resetting the safety switch
	f) Thermostat set too high	f) Check evaporator temperature. Lower thermostat setting if there is no danger of freeze up.
	g) Liquid line solenoid will not open	g) Repair or replace
	h) Electrical trouble in the motor	h) Check motor for opens, short circuit, and burnout
	i) Loose wiring	i) Check all the wire junctions. Tighten the terminal screws
2. Compressor noisy and/or vibrating	a) Flooding of refrigerant into crankcase	a) Check rating and setting of the expansion valve
	b) Improper clearances	b) Running gear worn. Overhaul compressor and replace defective parts
	c) Improper support of piping	c) Relocate, add or remove hangers
	d) Gas pulsations	d) Install a muffler in the discharge line
	e) Improper isolation	e) Check height of isolators. Refer to Vibration Mounting Information Fig. 13 and 14 to be sure proper isolators are being used
	f) Motor rotor is loose	f) Check key fit and tightness of rotor locking bolt
3. High discharge pressure High discharge pressure (cont.)	a) Condenser water flow insufficient and/or temperature too high	a) Readjust water regulating valve. Investigate ways of improving water supply
	b) Fouled, condenser tubes (water-cooled condenser.) Clogged spray nozzles (Evaporative Condenser) Dirty tube and fin surfaces (air-cooled condenser)	b) Clean
	c) Non-condensibles in system	c) Purge the non-condensibles
	d) System overcharged with refrigerant	d) Remove excess
	e) Discharge shut-off valve partially closed	e) Open valve
	f) Condenser undersize	f) Check condenser rating table vs. application
4. Low discharge pressure	a) Faulty condensing temperature regulation	a) Check condenser control operation
	b) Suction shut-off valve partially closed	b) Open valve
	c) System low on refrigerant	c) Check for leaks; repair and add charge
	d) Worn piston rings; worn discharge valve service	d) Overhaul compressor
	e) Low suction pressure	e) See complaint 6
	f) Compressor operating unloaded	f) See complaint 8
	g) Condenser too large	g) Check rating tables vs. application
5. High suction pressure	a) Excessive load	a) Reduce load or add equipment
	b) Expansion valve overfeeding	b) Check remote bulb. Regulate super heat. Check expansion valve rating vs. applications
	c) Compressor operating unloaded	c) See complaint 8

TROUBLE DIAGNOSIS CHART—(Continued)

COMPLAINT	POSSIBLE CAUSES	CORRECTIVE STEPS
	d) Worn piston rings; worn or broken suction valve ring	d) Overhaul compressor
	e) Compressor undersize, evaporator too large	e) Check ratings
6. Low suction pressure	a) Lack of refrigerant	a) Check for leaks and repair; add charge
	b) Evaporator dirty or iced up	b) Clean or defrost
	c) Clogged liquid line filter-drier	c) Replace cartridge(s)
	d) Clogged suction line or compressor suction gas strainers	d) Clean strainers
	e) Expansion valve malfunctioning	e) Check and reset for proper superheat. Repair or replace if necessary.
	f) Condensing temperature too low	f) Check means for regulating condensing temperature
	g) Compressor will not unload	g) See complaint 7
	h) Evap. fan or chiller pump off	h) Check. Add interlock
7. Compressor will not unload	a) Excessive oil pressure (above 65 psi)	a) Clean oil pump relief valve
	b) Clogged sensing device metering orifice	b) Unplug orifice
	c) Defective sensing device	c) Replace
	d) Stuck unloader mechanism. Unloader lifting pins worn	d) Replace cylinder liner-unloader assembly
	e) Auxiliary unloading control mechanism inoperative	e) Repair or replace mechanism.
8. Compressor will not load up	a) Insufficient oil pressure	a) See complaint 10
	b) Ruptured sensing device bellows	b) Replace bellows
	c) Defective sensing device	c) Replace
	d) Defective unloader assembly	d) Replace cylinder liner-unloader assembly
	e) Auxiliary unloading control mechanism inoperative	e) Repair or replace mechanism
9. Compressor loading-unloading intervals too short	a) Oversize expansion valve causing excessive fluctuation of suction pressure	a) Check expansion valve tables
	b) Erratic control oil pressure	b) Check compressor oil level. Check for foaming. Check oil pump relief valve
10. Low or no oil pressure	a) Oil pump reversing gear stuck in wrong direction	a) Reverse direction of rotation compressor
	b) Defective oil pump relief valves	b) Repair or replace
	c) Broken oil pump tang	c) Replace pump assembly
	d) Oil pressure gauge defective	d) Repair or replace. Keep gauge valve closed except to take readings
	e) Low-oil pressure safety switch defective	e) Repair or replace
	f) Clogged suction oil strainer	f) Clean
	g) Broken control oil tube to sensing device or unloader	g) Repair tubing
	h) Excessive liquid in crankcase	h) Energize crankcase heater. Reset expansion valve for higher superheat. Check liquid line solenoid valve operation

TROUBLE DIAGNOSIS CHART—(Continued)

COMPLAINT	POSSIBLE CAUSES	CORRECTIVE STEPS
	i) Worn oil pump	i) Replace
	j) Worn bearings	j) Overhaul compressor
	k) Worn unloader assembly	k) Replace cylinder-liner-unloader assembly
	l) Low oil level	l) See complaint 11. Add oil
	m) Loose fitting on oil suction strainer tube	m) Check and tighten
	n) Pump housing gasket assembled wrong	n) Check assembly. All the holes in the face of the housing must be gasketed
11. Compressor loses oil	a) Clogged return oil strainer in suction end cover	a) Replace
	b) Lack of refrigerant	b) Check for leaks and repair; add charge
	c) Excessive compression ring blow by	c) Overhaul compressor
	d) Velocity in risers too low	d) Check riser sizes
	e) Oil trapped in line or evaporator	e) Check pitch in line. Check refrigerant velocities
	f) Leaky unloader assembly	f) Replace unloader-cylinder liner assembly
12. Motor overload	a) Defective relay assembly	a) Repair or replace
	b) Low voltage during high load conditions	b) Check for low supply voltage, excessive line drop
	c) One line fuse open, causing single-phase running or start-up	c) Replace fuse
	d) Locked compressor	d) Overhaul compressor
	e) Defective or grounded motor or power wiring	e) Repair or replace
	f) Loose power wiring	f) Check all connections and tighten
	g) Overload wrong size	g) Refer to 2VH Electrical Data Table and use overload specified
	h) High condensing temperature	h) See complaint 3
	i) Power line fault causing single-phase running or unbalanced voltage*	i) Check supply voltage. Notify Power Co. Restart system only after the fault has been corrected
	j) High ambient temperature around the overall relay	j) Provide cooling. Blow air over switch enclosure to remove heat
	k) Failure of second starter to pull up on part-winding-start systems	k) Repair or replace starter or time delay mechanism
13. Compressor thermal protector switch opens	a) Open relief valve	a) Replace
	b) Broken discharge valve	b) Replace valve service. Check compressor for additional damage
	c) Operating beyond design limits	c) Check the table of limits. Provide facilities to bring the conditions to allowable values.
	d) Discharge valve partially shut	d) Open valve
	e) Blown valve plate gasket	e) Replace gasket

*On wye-delta power system, if a primary leg of the transformer opens, serious voltage unbalance will occur on the secondary. When this failure occurs such that high current flows in the unprotected leg of the three phases, hermetic motor burn-out will occur. On across-the-line start motors, an additional overload could be installed in this line. On part-winding start motors, there is at least one overload in each phase so that the seriousness of the condition is reduced. No remote overload protection can be provided, however, to protect fully under both single-phasing and unbalanced voltage conditions.

APPENDIX II
INSTALLATION CHECK LIST

Job Name ..... Job No. .....

COMPRESSOR NAMEPLATE DATA

Model No. ..... Part No. ..... Serial No. ..... Refrigerant .....
Volts: ..... F.L.A. Water: ..... F.L.A. Air: ..... L.R.A.: ..... Phase: .....
Volts: ..... F.L.A. Water: ..... F.L.A. Air: ..... L.R.A.: ..... CYC. AC .....
Unit Model No. ..... Unit Serial No. ..... Date .....

Installation Phase	Check Points	Yes	No	Checked by:
1. Receiving the Unit	a) Unit undamaged on arrival. b) Shipping papers agree with material received.			
2. Vibration Isolators	a) Vibration isolators used. b) Isolators adjusted for equal height.			
3. Wiring	a) Wiring complies with all applicable codes b) Pump down control installed c) Motor circuit has proper size fusetrons d) System wired per Diagram No. ..... e) All lead connections tight			
4. Piping	a) Piping complies with all applicable codes b) Oil Separator used c) Proper size filter-drier in liquid line d) Moisture Indicator in liquid line e) Muffler installed f) Condensing temperature regulating means used. g) Suction line strainer installed			
5. Leak Testing	a) System tight per soap bubble test b) System tight per refrigerant test c) System tight per static pressure test			
6. Dehydration & Evacuation	a) Final system vacuum reading ..... b) Vacuum reading on complete system (including unit before charging			
7. Charging the System	Amount of refrigerant (R.....) used: ..... Lb.			
8. Starting Up	a) **Before starting:** 1. Water and refrigerant valves opened 2. Control wiring O.K. 3. Auxiliary equipment (fans, pumps, etc.) started 4. Pressure safety switches set 5. Compressor oil level O.K. 6. Crankcase oil heater operating satisfactorily b) **After starting: (System stabilized)** 1. Hi-Lo safety switch O.K.....High Side Low Side 2. Low-oil pressure switch O.K. 3. Compressor oil level remains satisfactory 4. For Part-Winding Start, Time delay is 1 to 1.5 Sec.			
10. Capacity Control Adjustment	a) Capacity Control adjusted to system designed suction pressure b) Capacity Control Operation checked and current values recorded below			
11. Operating Personnel Instructions	Proper instructions given to operating personnel on complete system			

OPERATING DATA

A. Pressure Gauge Readings (a) Suction_____psig (b) Oil_____psig (c) Discharge_____psig
B. Net Oil Pressure [(b)—(a)] ..... _____ psi
C. Discharge Temperature * ..... _____ F.
D. Superheat of Entering Gas * ..... _____ F.
E. Oil Temperature * ..... _____ F.
F. High-Pressure Switch Cut-out Setting ..... _____ psig
G. Low-Pressure Switch Cut-out Setting ..... _____ psig
H. Low-Oil Pressure Switch Cut-out Setting ..... _____ psig
I. Voltage* _____v._____v._____v.
Current Reading
a) Full Capacity .....Amps
b) 1st Step of Unloading .....Amps
c) 2nd Step of Unloading .....Amps
d) Minimum Capacity .....Amps

*Measured per Table of Limits (30 and 31).

Reviewed by: ..... Date:.....
Installation Foreman

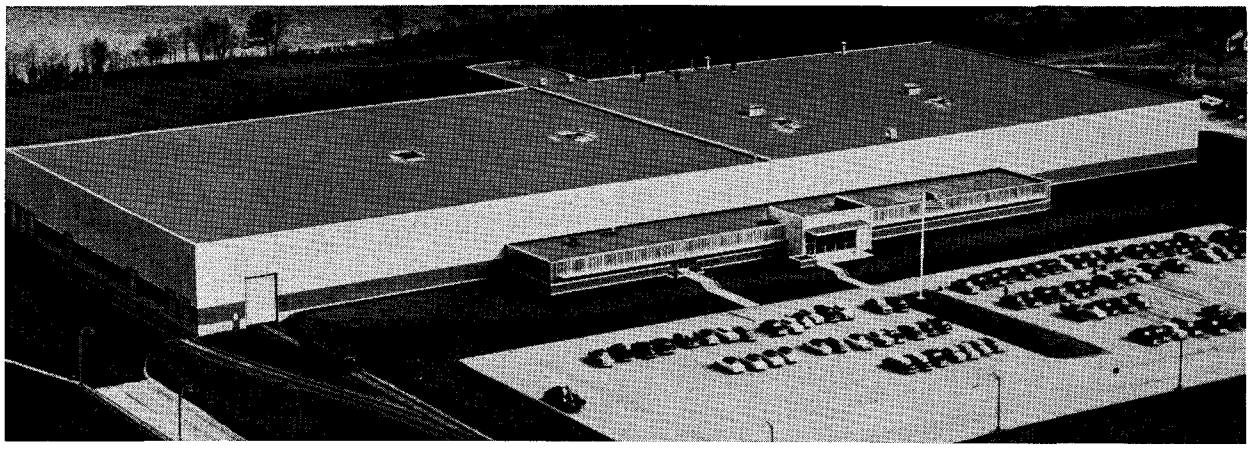
Approved by: ..... Date:.....
Installation Engineer

APPENDIX III

INSPECTION AND PREVENTIVE MAINTENANCE CHART

Inspection or Operation No.	Description	Suggested Schedule			
		Weekly	Monthly	Semi-Annually	Annually
1	Read and record refrigerant gauge pressures	X			
2	Read and record oil gauge pressure and calculate net oil pressure	X			
3	Read and record motor power supply voltage	X			
4	Read and record motor power supply current	X			
5	Check compressor oil level	X			
6	Check refrigerant charge through liquid line sight glass	X			
7	Check suction gas temperature for proper superheat		X		
8	Check operation of all safety controls		X		
9	Check all starter and control electrical contacts		X		
10	Check refrigerant moisture indicator		X		
11	Check compressor crankcase oil condition			X	
12	Check compressor running gear for wear				X
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

NOTES



Worthington air conditioning products are built in this modern air conditioning plant in Decatur, Alabama and also at East Orange, N. J.

11F-5614

PRODUCTS

PACKAGE AIR CONDITIONERS
(Air or Water Cooled)

FLEXI-COOL BLOWER COIL
AIR CONDITIONERS

AIR-COOLED CONDENSING UNITS

CENTRAL STATION AIR HANDLING UNITS

REMOTE PACKAGE AIR CONDITIONERS

EVAPORATIVE CONDENSERS

AIR-COOLED CONDENSERS

FAN-COIL ROOM AIR CONDITIONERS

TWIN-DUCT AIR BLENDERS

FANS

INDUCTION CIRCULATORS

REFRIGERATION COMPRESSORS

HERMETIC/COUPLED COMPRESSOR UNITS

HERMETIC/COUPLED CONDENSING UNITS

HERMETIC/COUPLED FLUID CHILLER PACKAGES

VERTICAL/HORIZONTAL AMMONIA
COMPRESSORS

CONDENSERS AND BRINE COOLERS

CENTRIFUGAL REFRIGERATION SYSTEMS

TRANSPORTATION REFRIGERATION

COMMERCIAL HEAT PUMP PACKAGES
AIR TO AIR
AIR TO WATER

SALES OFFICES

CENTRAL ZONE
Buffalo 2, New York
Cincinnati 2, Ohio
Cleveland 14, Ohio
Columbus, Ohio
Detroit 27, Michigan
Louisville 4, Kentucky
Pittsburgh 19, Pennsylvania

CENTRAL EAST ZONE
Bala-Cynwyd, Pennsylvania
Baltimore 2, Maryland
Harrisburg, Pennsylvania
Richmond 26, Virginia
Washington 6, D.C.

CENTRAL WEST ZONE
Albuquerque, New Mexico
Kansas City 8, Missouri
Oklahoma City 7, Oklahoma
Omaha, Nebraska
St. Louis 3, Missouri
Tulsa, Oklahoma
Wichita, Kansas

DALLAS ZONE
Dallas, Texas
Lubbock, Texas

HOUSTON ZONE
Houston 24, Texas
San Antonio, Texas

MIDWEST ZONE
Chicago 46, Illinois
Indianapolis 2, Indiana
Milwaukee 1, Wisconsin
Minneapolis 4, Minnesota

NEW ENGLAND ZONE
Boston 15, Massachusetts
Hartford, Connecticut

NEW ORLEANS ZONE
Baton Rouge 6, Louisiana
Jackson 6, Mississippi
Mobile, Alabama
New Orleans 50, Louisiana

NEW YORK ZONE
East Orange, New Jersey
New York 16, New York

SOUTHEAST ZONE
Atlanta 9, Georgia
Birmingham 13, Alabama
Charlotte 2, North Carolina
Knoxville 2, Tennessee
Memphis 11, Tennessee
Miami, Florida
Tampa, Florida

WESTERN ZONE
Alhambra, California
Phoenix, Arizona
Portland 14, Oregon
Sacramento 14, California
San Francisco 7, California

WORTHINGTON CORPORATION

PRODUCTS THAT WORK FOR YOUR PROFIT

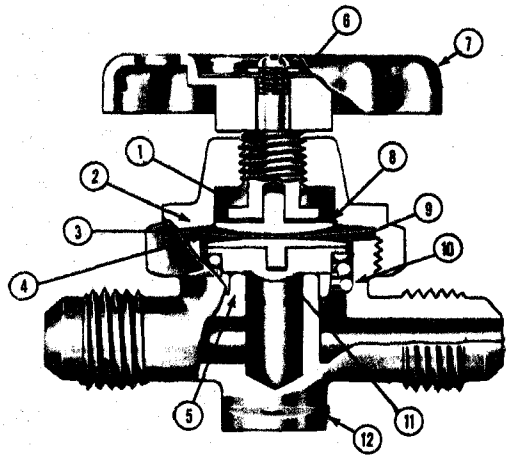
AIR CONDITIONING COMPANY, AMPERE STATION • EAST ORANGE, NEW JERSEY

1100-E84B 643* TC
Supersedes 1100-E84A

Printed in U.S.A.

HENRY diaphragm packless, shut-off valves

"GOLDEN BANTAM"® TYPES



MAXIMUM WORKING PRESSURE 500 P.S.I.

MAXIMUM TEMPERATURE RATING 275°F.

Henry diaphragm packless valves are recommended for refrigeration service, charging boards, gauge shut-off valves, hot gas line and vacuum applications. They are also widely used for the control of various industrial fluids which are hazardous and expensive.

*For other applications, consult factory.

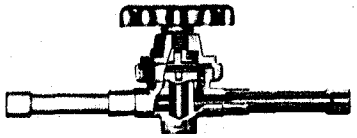
Available in a complete range of sizes and types.

CHECK THESE HENRY PERFORMANCE FEATURES IN THESE LIGHTER - SMALLER VALVES

1. **POSITIVE BACKSEATING**—with valve in wide open position.
2. **FORGED BRASS BONNET**—machined to provide support for diaphragms when valve is wide open.
3. **HERMETIC SEAL**—between bonnet, diaphragms and body. Leak proof construction.
4. **LARGE DIAMETER DIAPHRAGMS**—of dissimilar metals permit greater lift, aids flow and longer life. Phosphor bronze for greater wear; stainless steel to eliminate corrosion.
5. **RAISED SEAT**—reduces possibility of foreign matter accumulating on valve seat.
6. **INDIVIDUAL NAME PLATES**—for easy valve identification.
7. **ROUND HAND WHEEL**—for easy grip hand operation.
8. **NON-ROTATING FLOATING BEARING PLATE**—in upper stem eliminates torsional wear and strain on diaphragms.
9. **BRASS STEM CAP**—minimizes wear and strain on diaphragm and seat disc.
10. **STAINLESS STEEL SPRING**—corrosion resistant for long life.
11. **HEAT STABILIZED NYLON SEAT DISC**—for easy positive shut-off.
12. **FORGED BRASS BODY with integral mounting bracket**—provides durability, maximum rigidity, strength and simplifies installation.
13. **FULL CAPACITY PORTS**—insure unrestricted and maximum flow.
14. **INLET AND OUTLET PORTS ARE IN LINE**—neat and easy to install.
15. **INDIVIDUALLY PACKAGED AND LABELED**—for protection, ease of handling and identification.

Type 515
"Golden Bantam"
GLOBE SHUT-OFF VALVE
Flare connections.

Type 516
"Golden Bantam"
GLOBE SHUT-OFF VALVE
Solder connections.
No need to dismantle valve for brazing.



Type 517 "Golden Bantam"
GLOBE SHUT-OFF VALVE
Extended copper ends, solder connections.
Quick and easy to install.

"GOLDEN BANTAM"® GLOBE VALVES

Golden Bantam valves are small, compact and light in weight. Simple in design and low in cost. The one piece heat stabilized nylon seat disc provides for ease in operation and tight shut-off.

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES			LIST PRICE
		FULL OPEN HEIGHT	FACE TO FACE ON RUN	MOUNTING HOLE CENTERS	
MALE FLARE					
5151	¼" Flare	2½	2⅝	2	$10.80
5153	⅜" Flare	2½	2⅞	2	10.80
5154	½" Flare	2¾	3⅛	2	13.60
5155	⅝" Flare	3⅛	4⅛	2	14.70
O.D. SOLDER					
5161	¼" O.D.S.	2½	3¼	2	11.20
5163	⅜" O.D.S.	2½	3½	2	11.20
5164	½" O.D.S.	2¾	3⅞	2	13.90
5165	⅝" O.D.S.	3⅛	4⅜	2	14.80
5166	¼" O.D.S.	5	4⅜	2¼	36.10
5167	⅞" O.D.S.	5⅛	4 19/32	2½	38.80
5168	1⅛" O.D.S.	6½	5 19/32	3¼	65.00
EXTENDED COPPER ENDS					
5171	¼" O.D.S.	2½	6⅛	2	13.40
5173	⅜" O.D.S.	2½	6¼	2	13.40
5174	½" O.D.S.	2¾	7⅜	2	15.90
5175	⅝" O.D.S.	3⅛	8⅛	2	17.70

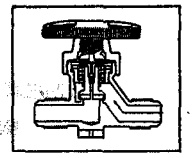
HENRY diaphragm packless valves *(Cont'd.)*

"STANDARD" GLOBE AND ANGLE BALANCED-ACTION DIAPHRAGM PACKLESS VALVES ARE NON-DIRECTIONAL

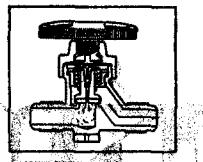
HENRY "STANDARD" VALVES FEATURE A COMPLETE RANGE OF SIZES AND TYPES.

They provide the design and material features of the "Golden Bantam" shut-off valves, in addition they offer:

1. BALANCED-ACTION
2. NON-DIRECTIONAL FLOW
3. BACKSEATING LOWER STEM
4. DIAPHRAGMS ARE CHANGEABLE UNDER LINE PRESSURE
5. MAXIMUM TEMPERATURE RATING 275°F.
6. MAXIMUM WORKING PRESSURE 500 P.S.I.

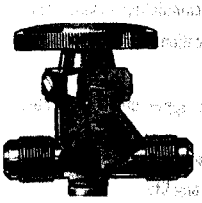


BALANCED-ACTION VALVE IN CLOSED POSITION—High pressure above the seat, low pressure below the seat. High pressure regions are shown yellow. Pressure in spring cage below diaphragms is the same as that in main passage of valve body above the seat. This is due to seepage between the lower stem and the guide. Downward pressure of the bearing plate on the diaphragm seals the upper port of the balancing channel.

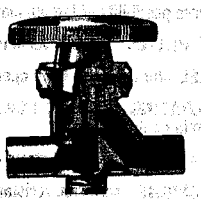


OPENING THE BALANCED-ACTION VALVE—As hand wheel is turned to open valve, the diaphragms, because of pressure beneath them and their own snap action, rise and expose the upper port of the balancing channel. The high pressure shown in gray, unseats ball check and is instantly released through the open channel to the low pressure region below the valve seat, thus achieving "balanced-action" by equalizing pressure.

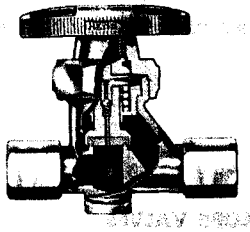
BALANCED-ACTION VALVE IN FULL OPEN POSITION—Equalization or balancing of pressures above and below the seat, as shown in gray, guarantees that this valve can never "stick shut" but will always open positively, up to 350 pounds differential in pressures. When there is high pressure below the seat and low pressure above, the balanced valve opens easier than other types.



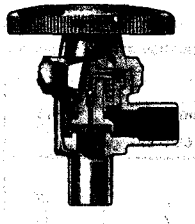
Type 625 Standard
GLOBE SHUT-OFF VALVE
Flare connections.



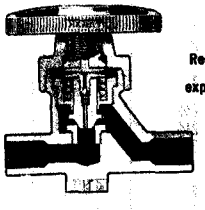
Type 626 Standard
GLOBE SHUT-OFF VALVE
Solder connections.



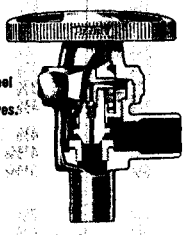
Type 626-P Standard GLOBE SHUT-OFF VALVE
Female pipe thread connections.



Types 647 and 642 Standard
ANGLE SHUT-OFF VALVE
Solder connections.



Red hand wheel identifies expansion valves.



Type 629 Standard
GLOBE EXPANSION VALVE
Solder connections.

Type 649 Standard
ANGLE EXPANSION VALVE
Solder connections.

"STANDARD" GLOBE VALVES

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES: FULL OPEN HEIGHT	FACE TO FACE ON RUN	MOUNTING HOLE CENTERS	LIST PRICE
MALE FLARE					
6251	¼" Flare	3⅜	2⅝	1⅝	$16.60
6253	⅜" Flare	3⅜	2⅝	1⅝	16.60
6254	½" Flare	3⁹⁄₁₆	3⅛	1¾	18.80
6255	⅝" Flare	3¾	3⅛	2	20.80
O.D. SOLDER					
6261	¼" O.D.S.	3⅜	2⅝	1⅝	16.60
6263	⅜" O.D.S.	3⅜	2⅝	1⅝	16.60
6264	½" O.D.S.	3⁹⁄₁₆	3⅛	1¾	18.80
6265	⅝" O.D.S.	3¾	3½	2	20.80
6266	¾" O.D.S.	5	4⅜	2½	39.30
6267	⅞" O.D.S.	5⅜	4¹³⁄₁₆	2½	46.90
6268	1⅛" O.D.S.	6½	6	3¼	72.20
FEMALE PIPE THREAD					
6263-P	¼" F.P.T.	3⅜	4⅛	1⅝	22.10
6264-P	⅜" F.P.T.	3½	4½	1¾	24.40
6265-P	½" F.P.T.	3¾	5½	2	30.60

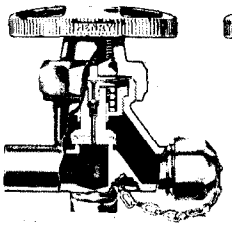
"STANDARD" ANGLE VALVES

O.D. SOLDER		FULL OPEN HEIGHT	CENTER TO BOTTOM	CENTER TO SIDE FACE	LIST PRICE
6471	¼" O.D.S.	3⁷⁄₁₆	1⅛	1⁹⁄₁₆	$16.60
6473	⅜" O.D.S.	3⁷⁄₁₆	1⅛	1⁹⁄₁₆	16.60
6474	½" O.D.S.	3½	1¹³⁄₁₆	1½	18.80
6475	⅝" O.D.S.	3¹³⁄₁₆	1⅝	1½	20.80
6476	¾" O.D.S.	4⅞	1⁷⁄₁₆	1⅞	39.30
6477	⅞" O.D.S.	5⅜	1¹³⁄₁₆	2⅛	46.90
6478	1⅛" O.D.S.	6½	2¼	2½	72.20
6421	1⅜" O.D.S.	9¼	3	3⁹⁄₁₆	361.00
6422	1⅝" O.D.S.	9¼	3	3⁹⁄₁₆	361.00

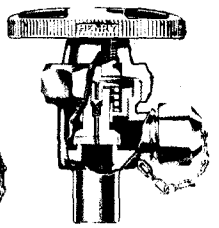
HAND EXPANSION VALVES—"STANDARD" TYPE

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES: ORIFICE DIAMETER	FULL OPEN HEIGHT	FACE TO FACE ON RUN	MOUNTING HOLE CENTERS	LIST PRICE
6291	¼" O.D.S.	7⁄32	3⅜	2⅝	1⅝	$21.70
6293	⅜" O.D.S.	7⁄32	3⅜	2⅝	1⅝	21.70
6294	½" O.D.S.	7⁄32	3⅜	2⅝	1⅝	24.50
6295	⅝" O.D.S.	9⁄32	3⁹⁄₁₆	3⅛	1¾	26.60
6296	¾" O.D.S.	11⁄32	3¾	3⅛	2	51.50
6297	⅞" O.D.S.	⅜	5	4⅜	2½	75.80
6298	1⅛" O.D.S.	7⁄16	5⅜	4⅞	2½	99.20
				CENTER TO BOTTOM	CENTER TO SIDE FACE	
6494	½" O.D.S.	7⁄32	3⅜	1⅝	1⁹⁄₁₆	26.30

HENRY diaphragm packless shut-off valves *(Cont'd.)*



Type 623
Standard Globe
One end—solder
Other end—flare connection.



Type 643
Standard Angle
Bottom—solder connection.
Side—flare connection.

CHARGING AND PURGING VALVES—"STANDARD" TYPE

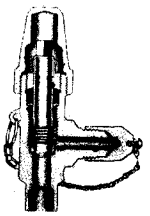
REMOVABLE SEAL CAP. Flare connection has cap chained to valve body. Removable seal cap features mechanically retained copper gasket. 500 P.S.I. WORKING PRESSURE.

CATALOG NUMBERS	SIZE CONNECTIONS		DIMENSIONS—INCHES			LIST PRICE
			FULL OPEN HEIGHT	FACE TO FACE ON RUN	MOUNT. HOLE CENTERS	
6231	¼" O.D.S. x ¼" Flare		3⅜	2⅝	1⅝	$21.70
6232	⅜" O.D.S. x ⅜" Flare		3⅜	2⅝	1⅝	21.70
6233	½" O.D.S. x ½" Flare		3⁹⁄₁₆	3¼	1¾	24.50
6234	⅝" O.D.S. x ⅝" Flare		3¾	3¹¹⁄₁₆	2	26.50
	BOTTOM	SIDE		CENTER TO BOTTOM	CENTER TO SIDE FACE	
6431	¼" O.D.S.	¼" Flare	3⅜	1⅛	1⁵⁄₁₆	23.50
6432	⅜" O.D.S.	⅜" Flare	3⅜	1⅛	1⁵⁄₁₆	23.50
6433	½" O.D.S.	½" Flare	3⁹⁄₁₆	1¾	1⅝	26.40
6434	⅝" O.D.S.	⅝" Flare	3¾	1⅜	1¾	28.50

HENRY BALANCED-ACTION DIAPHRAGM PACKLESS VALVES ARE NON-DIRECTIONAL FOR FLOW

HENRY packed, shut-off valves
angle charging and purging—offset and globe types

Suitable for refrigerants and other industrial fluids non-corrosive to brass and steel.



Type 927
Angle Charging
& Purge Valve
Bottom—solder connection.
Side—flare connection.

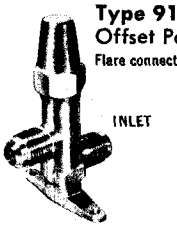
Flare connection has removable seal cap chained to valve body. Seal cap features mechanically retained copper gasket.

CHARGING AND PURGING ANGLE VALVES—Seal Cap Type

Forged brass body—non-back-seating

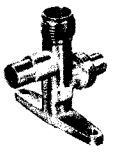
FURNISHED DISASSEMBLED TO AVOID EXCESSIVE HEATING OF INTERNAL PARTS DURING BRAZING. 500 P.S.I. WORKING PRESSURE. Maximum Temperature Rating 300°F.

CATALOG NUMBERS	SIZE CONNECTIONS			CENTER TO BOTTOM INCHES	OVER-ALL HEIGHT INCHES	LIST PRICE
	BOTTOM		SIDE			
	EXTERNAL	INTERNAL				
9270	⅜" O.D.M.	¼" O.D.S.	¼" Flare	1⅛	3⁵⁄₁₆	$8.90
9271	½" O.D.M.	⅜" O.D.S.	¼" Flare	1⅛	3⁵⁄₁₆	8.90
9272	½" O.D.M.	⅜" O.D.S.	⅜" Flare	1⅛	3⁵⁄₁₆	8.90
9273	⅝" O.D.M.	½" O.D.S.	¼" Flare	1⅛	3⁵⁄₁₆	8.90
9274	⅝" O.D.M.	½" O.D.S.	⅜" Flare	1⅛	3⁵⁄₁₆	8.90



Type 915
Offset Port Valve
Flare connections.

INLET



Type 916
Offset Port Valve
Solder connections.

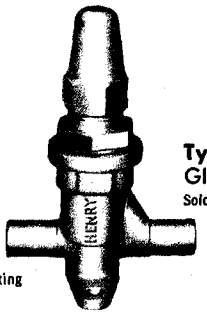
O.D.S. VALVES FURNISHED DISASSEMBLED TO AVOID EXCESSIVE HEATING OF INTERNAL PARTS DURING BRAZING.

OFFSET PORT SHUT-OFF VALVES—Seal Cap Type

Forged brass body, integral mounting bracket—non-back-seating

RECOMMENDED FOR HOT GAS SERVICE OR OTHER HIGH TEMPERATURE APPLICATIONS.
Integral Mounting Bracket Bolt Centers 2¼".
500 P.S.I. WORKING PRESSURE. Maximum Temperature Rating 300°F.

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES				LIST PRICE
		OUTLET CENTER TO BOTTOM	INLET CENTER TO BOTTOM	OVER-ALL HEIGHT	OVER-ALL WIDTH	
9151	¼" Flare	1½	1⁵⁄₁₆	3⅝	2¹³⁄₁₆	$10.90
9153	⅜" Flare	1⁷⁄₁₆	1⁵⁄₁₆	3⅝	2¼	10.90
9154	½" Flare	1⁹⁄₁₆	1⁵⁄₁₆	4¼	2⅝	12.60
9161	¼" O.D.S.	1½	1⁵⁄₁₆	3⅝	2½	10.00
9163	⅜" O.D.S.	1½	1⁵⁄₁₆	3⅝	2½	10.00
9164	½" O.D.S.	1⁹⁄₁₆	1⁵⁄₁₆	4¼	2½	11.70
9165	⅝" O.D.S.	1⁹⁄₁₆	1⁵⁄₁₆	4¼	2½	11.70



Type 926
Globe Valve
Solder connections.

Integral Mounting Bracket.

GLOBE SHUT-OFF VALVES—Seal Cap Type

Forged brass body, integral mounting bracket—back seating

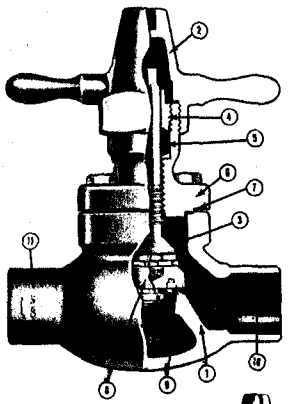
RECOMMENDED FOR HOT GAS SERVICE OR OTHER HIGH TEMPERATURE APPLICATIONS.
500 P.S.I. WORKING PRESSURE. Maximum Temperature Rating 300°F.

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES				LIST PRICE
		CENTER TO BOTTOM	CENTER TO TOP OF CAP	OVER-ALL HEIGHT	OVER-ALL LENGTH	
9261	¼" O.D.S.	⁹⁄₁₆	3½	4¹⁄₁₆	2⅝	$12.60
9263	⅜" O.D.S.	⁹⁄₁₆	3½	4¹⁄₁₆	2⅝	12.60
9264	½" O.D.S.	⅝	3⅝	4¼	3⅛	14.10
9265	⅝" O.D.S.	¾	3¹¹⁄₁₆	4⁷⁄₁₆	3½	17.10
9267	⅞" O.D.S.	¾	5¹⁄₁₆	5¹³⁄₁₆	4¹³⁄₁₆	35.20
9268	1⅛" O.D.S.	1⁵⁄₁₆	5½	6⁷⁄₁₆	5¹³⁄₁₆	63.20

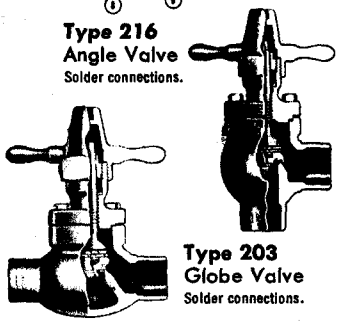
For mounting hole center dimension see STANDARD GLOBE valves page 208.

HENRY wing cap, packed, shut-off valves—(back-seating)

U.S. Patent Number 2,470,700



Type 216
Angle Valve
Solder connections.



Type 203
Globe Valve
Solder connections.

THE MOST COMPLETE RANGE OF SIZES AND TYPES IN THE INDUSTRY

⅛" THROUGH 4⅛"—BRONZE ALLOY BODY—FULL CAPACITY DESIGN—MAXIMUM STRENGTH

CHECK THESE FEATURES:

1. **HEAVY WALL BRONZE CONSTRUCTION** provides additional strength and greater flow.
2. **FORGED BRASS WING CAP SEAL** with stem operating socket wrench in top of cap.
3. **PLATED STEEL STEM, BACK-SEATING,** can be repacked under pressure.
4. **SPECIALLY DESIGNED GLAND** for tight seal and longer packing life.
5. **PACKING**—Special molded rings.
6. **FORGED BRASS BOLTED BONNET**—for maximum safety.
7. **BODY-BONNET SEAL**—Fully retained gasket.
8. **PATENTED, NON-ROTATING SELF-ALIGNING SWIVEL DISC.** Easy positive sealing. Minimum seat wear. Chatterproof.
9. **HEAT STABILIZED NYLON SEAT DISC** insures easy, quick positive shut-off and long life.
10. **HIGH CAPACITY FLOW THROUGHOUT.** Full size ports and large flow chambers. Insure minimum pressure drop.
11. **VALVE SIZE IDENTIFICATION**—embossed on Bronze body.
12. ***INDIVIDUALLY PACKAGED AND LABELED*** for protection, ease of handling and identification.

WING CAP, PACKED VALVES—O.D.S. CONNECTIONS

Maximum Temperature Rating 275°F. 450 P.S.I. Working Pressure.

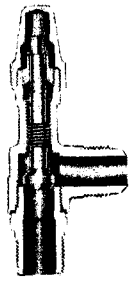
CATALOG NUMBERS		SIZE CONNECTIONS	DIMENSIONS—INCHES						LIST PRICE
			CENTER TO BOTTOM		OVER-ALL HEIGHT		OVER-ALL LENGTH CENTER TO SIDE		
GLOBE	ANGLE		GLOBE	ANGLE	GLOBE	ANGLE	GLOBE	ANGLE	
2030-A	2160-A	⅛" O.D.S.	1	1 1/16	5⅝	6⅜	4¼	2	$50.60
2030-B	2160-B	1⅛" O.D.S.	1⅛	2	6⅛	6⅞	4⅜	2 5/16	68.60
2031	2161	1⅜" O.D.S.	1 5/16	2 5/16	7⅞	8⅝	6	2 11/16	92.10
2032	2162	1⅝" O.D.S.	1½	2½	8⅜	9	6½	2⅞	112.90
2033	2163	2⅛" O.D.S.	2	3¼	10 7/16	11¼	8½	3⅝	169.70
2034	2164	2⅝" O.D.S.	2¼	3 13/16	11⅝	12 7/16	11	4¼	252.80
2035	2165	3⅛" O.D.S.	2⅝	4 5/16	13¼	14½	12	4⅝	334.10
2036	—	3⅝" O.D.S.	3	—	14⅞	—	14	—	454.90
2037	—	4⅛" O.D.S.	3⅝	—	15¾	—	15	—	527.20

For Wing Cap, Packed Shut-off Valves, Ductile Iron or Semi-Steel, Flanged or Screw End Connections, consult Factory or Wing Cap Valve Bulletin C-1525.

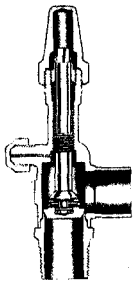
HENRY packed angle (receiver) valves

Maximum Temperature Rating 300°F. 500 P.S.I. Maximum Working Pressure.

Type 776-B
Angle Valve
Non-Back-Seating



Type 779-B
Angle Valve
Back-Seating



Type 780
Angle Valve
Back-Seating

FORGED BRASS

CATALOG NUMBERS	SIZE CONNECTIONS		DIMENSIONS—INCHES			LIST PRICE
	BOTTOM	SIDE	CENTER TO BOTTOM	CENTER TO SIDE	OVER-ALL HEIGHT	
NON-BACK-SEATING						
7761-B	¼" M.P.T.	¼" Flare	⅞	1 5/16	3	$6.60
7771-B	¼" M.P.T.	¼" F.P.T.	1	1¼	3¼	7.50
7763-B	¼" M.P.T.	⅜" Flare	1	1¼	3¼	7.50
7764-B	⅜" M.P.T.	¼" Flare	1 1/16	1 1/16	3 5/16	7.50
7766-B	⅜" M.P.T.	⅜" Flare	1 1/16	1¼	3 5/16	7.50
7767-B	⅜" M.P.T.	½" Flare	1¼	1¼	3 13/16	8.70
7768-AB	½" M.P.T.	⅜" Flare	1⅜	1¼	3 13/16	13.80
7768-B	½" M.P.T.	⅜" Flare	1⅜	1⅝	4 9/16	15.70
7768-BS	½" M.P.T.	⅝" O.D.S.	1⅜	1¼	3 13/16	13.60
BACK-SEATING						
7792-B	½" M.P.T.	½" Flare	1⅞	1 5/16	4⅛	12.60
7792-BS	½" M.P.T.	½" O.D.S.	1⅞	1⅜	4⅛	14.50
7793-B	½" M.P.T.	⅜" Flare	1⅞	1½	4¾	14.50
7793-BS	½" M.P.T.	⅝" O.D.S.	1⅞	1½	4¾	16.30
7796-BS	¾" M.P.T.	⅞" O.D.S.	2⅛	1¾	5⅞	25.30

FORGED STEEL—NICKEL PLATED

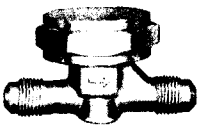
Furnished with ¼" flare capped charging and testing connection above back seat.

CATALOG NUMBERS	SIZE CONNECTIONS		DIMENSIONS—INCHES			LIST PRICE
	BOTTOM	SIDE	CENTER TO BOTTOM	CENTER TO SIDE	OVER-ALL HEIGHT	
BACK-SEATING						
7801	¾" M.P.T.	⅞" O.D.S.	2	1 5/16	5¼	$23.50
7803	1" M.P.T.	1⅛" O.D.S.	2¼	1¾	7 5/16	31.60

HENRY check valves

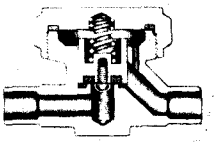
Quiet Operation—Positive Closing Action—Full Flow

Type 115A
Check Valve
Flare connections.



Listed by Underwriters' Laboratories, Inc., Re-Examination Service.

Type 116A
Check Valve
Solder connections.



CHECK VALVES—FORGED BRASS BODY—Accessible Internal Parts

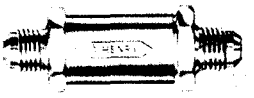
Soft synthetic seat, with fully guided brass piston and stainless steel spring. Will operate in any position. Internal parts can be easily removed to prevent damage when soldering valve into line. (U.L. Listed.)

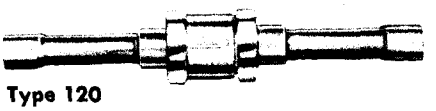
500 P.S.I. Working Pressure. Maximum Temperature Rating 200°F.

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES				LIST PRICE
		CENTER TO BOTTOM	CENTER TO TOP	OVER-ALL HEIGHT	OVER-ALL LENGTH	
115A-¼	¼" Flare	9/16	1 5/16	1⅞	2⅞	$12.60
115A-⅜	⅜" Flare	9/16	1 5/16	1⅞	3 1/16	12.60
115A-½	½" Flare	⅝	1⅞	2¼	3½	14.10
115A-⅝	⅝" Flare	¾	1⅞	2⅝	3⅞	16.10
116A-¼	¼" O.D.S.	9/16	1¼	1⅞	2 7/16	12.60
116A-⅜	⅜" O.D.S.	9/16	1¼	1⅞	2¼	12.60
116A-½	½" O.D.S.	⅝	1⅞	2¼	3⅛	13.20
116A-⅝	⅝" O.D.S.	¾	1⅞	2⅝	3½	14.10
116A-⅞	⅞" O.D.S.	¾	2 11/16	3 7/16	4 13/16	28.10

O.D.S. type remove piston before brazing. Machined O.D.S. and O.D.M.

Type 119
Check Valve
Flare connections.





Type 120
Check Valve
Solder connections.

CHECK VALVES—BRASS BODY—STRAIGHT-THRU—Full Flow

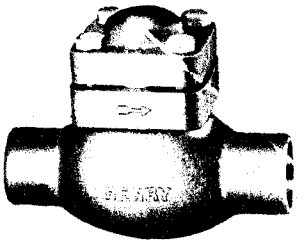
500 P.S.I. Working Pressure. Maximum Temperature Rating 200°F.

Compact sturdy and noiseless in operation, with minimum pressure drop. Features of design, which provide positive seating action:

1. Soft Seat Ring. 2. Complete Piston guidance. Operates in any position. 3. Beryllium copper spring.

CATALOG NUMBERS	SIZE CONNECTIONS	OVER-ALL LENGTH INCHES	LIST PRICE
119-¼	¼" Flare	2 3/16	$7.00
119-⅜	⅜" Flare	2½	7.00
119-½	½" Flare	3	8.90
119-⅝	⅝" Flare	3 3/16	9.60
EXTENDED COPPER ENDS			
120-¼	¼" O.D.S.	5 3/16	9.20
120-⅜	⅜" O.D.S.	5 3/16	9.20
120-½	½" O.D.S.	5 13/16	11.20
120-⅝	⅝" O.D.S.	6¼	12.40

Type 205
Check Valve
Solder connections.



CHECK VALVES—BRONZE ALLOY BODY—Forged Brass Bonnets*

Synthetic Seat—Quiet Operation—Positive Closing Action
450 P.S.I. Working Pressure. Maximum Temperature Rating 300°F.

Floating piston with mechanically retained Teflon seat disc assure quiet operation and positive closing action. Suitable for highside or lowside installation and hot gas applications. Must be installed in horizontal position. Valve size identification embossed on valve body.

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES				LIST PRICE
		CENTER TO BOTTOM	CENTER TO TOP	OVER-ALL HEIGHT	OVER-ALL LENGTH	
205-⅞	⅞" O.D.S.	1	2 3/16	3 3/16	4¼	$59.60
205-1⅛	1⅛" O.D.S.	1⅛	2¾	3⅞	4⅞	67.80
205-1⅜	1⅜" O.D.S.	1 5/16	3	4 5/16	6	92.20
205-1⅝	1⅝" O.D.S.	1½	4	5½	6½	124.60
205-2⅛	2⅛" O.D.S.	2	4 5/16	6 5/16	8½	191.40
205-2⅝	2⅝" O.D.S.	2¼	5 5/16	7 5/16	11	270.80
205-3⅛	3⅛" O.D.S.	2⅝	5⅞	8½	12	361.10

*Cast Bronze Bonnet on 3⅛ size.

HENRY liquid level gauges

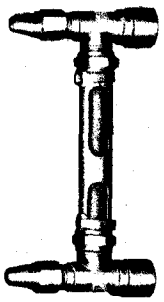
LIQUID LEVEL GAUGES

Types 502 and 602 liquid level gauge sets are recommended for use on accumulators, liquid receivers, oil reservoirs, or similar vessels where it is important to keep an accurate liquid level check. In case of glass-breakage, liquid cannot escape because safety ball checks seal off gauge glass. High-pressure glass tubing protected by metal guard. Conforms to safety code requirements.

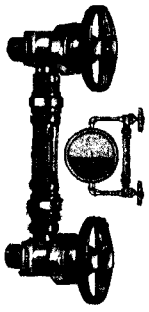
Recommended maximum working pressures for glass lengths:

1" to 20" ..... 400 PSI
21" to 30" ..... 340 PSI
31" to 40" ..... 290 PSI

For mounting centers greater than 40" it is recommended that multiple gauge sets be used.
Maximum temperature rating 150°F.



Type 502 Gauge Set
Seal cap type
Female pipe thread connections.
For all refrigerants, including Ammonia. (R-717)



Type 602 Gauge Set
Back seating valves
Male pipe thread connections.
For common refrigerants like R-12, R-22, etc.

ORDERING INFORMATION:
Gauge sets with standard 15" mounting centers will be furnished unless special glass lengths are required. For special lengths orders must specify exact glass lengths required or mounting centers of Gauge Set. Specify whether dimension is exact Glass or Guard Length or mounting centers of Gauge Set.

PACKED TYPE—CAPPED—FORGED STEEL GAUGE SET—
Cadmium Plated—complete with glass and slotted steel guard

CATALOG NUMBER	SIZE CONNECTIONS	DIMENSIONS—INCHES			LIST PRICE
		SIZE GLASS	MOUNTING CENTERS		
			STANDARD	MINIMUM	
5024 (set)	½" F.P.T.	½ x 13⅜	15	6⅛	$36.10

SINGLE GAUGE VALVES—Non-Back-Seating

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES		LIST PRICE
		FULL OPEN HEIGHT	VERT. C/L TO FACE OF PIPE TH'RD.	
5021 (Lower) 5022 (Upper)	½" F.P.T. ½" F.P.T.	4 4	1½ 1½	$14.50 14.50

GAUGE CLASS AND GUARDS: Glass Length is always 1⅛" less than mounting centers. Guard Length is always 2¾" less than mounting centers. Minimum mounting centers 6¼".

PACKLESS TYPE, WITH HAND WHEELS—FORGED BRASS GAUGE SET—complete with glass and slotted steel guard

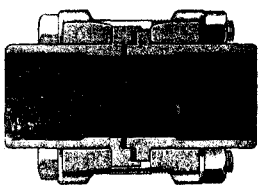
CATALOG NUMBER	SIZE CONNECTIONS	DIMENSIONS—INCHES			LIST PRICE
		SIZE GLASS	MOUNTING CENTERS		
			STANDARD	MINIMUM	
6024 (Set)	½" M.P.T.	½ x 12⅛	15	7⅝	$61.40

SINGLE GAUGE VALVES—Back-Seating

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES		LIST PRICE
		FULL OPEN HEIGHT	VERT. C/L TO FACE OF PIPE TH'RD.	
6021 (Lower) 6022 (Upper)	½" M.P.T. ½" M.P.T.	3⅜ 3⅜	1⅜ 1⅜	$27.10 27.10

GAUGE GLASS AND GUARDS: Glass Length is always 2⅛" less than mounting centers. Guard Length is always 4¼" less than mounting centers. Minimum mounting centers 7⅝".

HENRY flanged unions forged steel flanges



FOUR BOLT CONSTRUCTION

Type P30 Flange Union
For Joining Two Copper Lines

Type P30 Flange Unions consist of two brass tailpiece adapters for O.D. copper tubing, two forged steel flanges, four plated steel bolts, silicon bronze nuts and asbestos fibre gasket. Flanges and bolts have rust resistant finish.

FLANGED UNIONS FOR COPPER TUBING
Maximum Working Pressure 400 P.S.I. Maximum Temp. Rating 300°F.

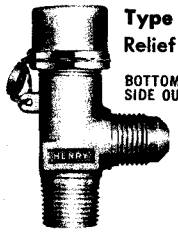
CATALOG NUMBERS	SIZE CONNECTIONS	OVER-ALL LENGTH INCHES	LIST PRICE
P30-G	⅞" O.D.S.	2⅜	$15.30
P30-J	1⅛" O.D.S.	2⅝	15.30
P30-L	1⅜" O.D.S.	4¼	29.80
P30-N	1⅝" O.D.S.	4¹⁵⁄₁₆	34.30
P30-Q	2⅛" O.D.S.	3⅞	52.30
P30-T	2⅝" O.D.S.	3¹⁵⁄₁₆	59.60
P30-V	3⅛" O.D.S.	5¹⁵⁄₁₆	108.10

HENRY automatic pressure relief valves

UV ASME NB National Board Certified

Type 522
Relief Valve

No outlet line connection.
For small systems.



Type 52
Relief Valve

BOTTOM INLET—
SIDE OUTLET

Type 523
Relief Valve

Type 524
Relief Valve

Henry Relief valves in the types and sizes shown on this page are constructed in accordance with the requirements of the ASME. These valves are also approved by many local refrigeration and air conditioning codes in the U.S.A. and Canada for relief of excess pressure. In addition, these valves are stamped with A.S.M.E. UV symbol and NB to indicate National Board certification as to capacities.

DESIGN FEATURES:

1. Positive Pressure Relief.
2. Consistent operation at marked pressure setting.
3. Excellent reseating characteristics.
4. A special process reduces valve seat "stickage" to the absolute minimum.
5. Valve stem properly guided for minimum friction.
6. Suitable for Refrigerants 12, 22, 500 and 502.
7. Factory sealed.

Prices apply to valves with standard settings. Standard settings are:
235 P.S.I. 300 P.S.I. 350 P.S.I. 400 P.S.I. 450 P.S.I.

RELIEF VALVES—ATMOSPHERIC TYPE—BRASS BODY

CATALOG NUMBERS	SIZE CONNECTION INLET	OVER-ALL LENGTH INCHES	LIST PRICE
5220	⅛" M.P.T.	2¼	$8.70
5221	¼" M.P.T.	2⅜	8.70
5223	⅜" M.P.T.	2⅜	9.80

IMPORTANT: Orders must specify pressure setting. Range 50 to 450 p.s.i.

RELIEF VALVES—ANGLE BODY—FORGED BRASS

CATALOG NUMBERS	SIZE CONNECTIONS		DIMENSIONS—INCHES			LIST PRICE
	INLET	OUTLET	CENTER TO BOTTOM	CENTER TO SIDE	OVER-ALL HEIGHT	
526-A	¼" M.P.T.	⅜" Flare	1 1/16	1¼	2¾	$17.20
526	⅜" M.P.T.	⅜" Flare	1 1/16	1¼	2¾	17.20
526-B	⅜" M.P.T.	½" Flare	1 1/16	1¼	2¾	18.10
526-C	⅜" Flare	½" Flare	1 1/16	1¼	2¾	18.10
527	½" M.P.T.	⅝" Flare	1⅜	1⅝	3 5/16	20.60
529-S	⅝" O.D.S.	⅝" O.D.S.	3 11/16	3 11/16	5⅞	31.20

IMPORTANT: Orders must specify pressure setting. Range 50 to 450 p.s.i.

RELIEF VALVES—STRAIGHT-THRU BRASS BODY

CATALOG NUMBERS	SIZE CONNECTIONS		OVER-ALL LENGTH INCHES	LIST PRICE
	INLET	OUTLET		
MALE PIPE THREAD BY MALE FLARE				
5230	¼" M.P.T.	⅜" Flare	3⅛	$17.20
5231	⅜" M.P.T.	⅜" Flare	3⅛	17.20
5231-A	⅜" M.P.T.	½" Flare	3¼	18.10
5232	½" M.P.T.	⅝" Flare	3 15/16	20.80
FEMALE PIPE THREAD BY FEMALE PIPE THREAD				
5233	½" F.P.T.	½" F.P.T.	4 7/16	33.50
5234	¾" F.P.T.	¾" F.P.T.	4 7/16	37.00
5234-C	1" F.P.T.	1" F.P.T.	6⅛	50.60
MALE PIPE THREAD BY FEMALE PIPE THREAD				
5240-½	½" M.P.T.	¾" F.P.T.	3 11/16	25.80
5242-¾	¾" M.P.T.	¾" F.P.T.	3 11/16	32.10
5244-1	1" M.P.T.	1" F.P.T.	4 1/16	35.30
5246-1¼	1¼" M.P.T.	1¼" F.P.T.	5½	72.20

IMPORTANT: Orders must specify pressure setting. Range 150 to 450 p.s.i.

RELIEF VALVE CAPACITY RATINGS
A.S.M.E. Certified
pounds of air per minute

CATALOG NUMBERS	STANDARD PRESSURE SETTINGS—P.S.I.G.				
	235	300	350	400	450
5220	5.8	7.3	8.4	9.6	10.7
5221	5.8	7.3	8.4	9.6	10.7
5223	5.8	7.3	8.4	9.6	10.7
526-A	7.0	8.8	10.2	11.6	13.0
526	7.0	8.8	10.2	11.6	13.0
526-B	7.0	8.8	10.2	11.6	13.0
526-C	7.0	8.8	10.2	11.6	13.0
5230	7.6	9.6	11.2	12.7	14.3
5231	7.6	9.6	11.2	12.7	14.3
5231-A	13.2	16.7	19.3	22.0	24.6
5232	19.2	24.2	28.1	32.0	35.8
527	19.5	24.6	28.5	32.4	36.3
529-S	19.5	24.6	28.5	32.4	36.3
5240-½	28.4	35.9	41.6	47.3	53.0
5242-¾	28.4	35.9	41.6	47.3	53.0
5233	29.8	37.6	43.6	49.6	55.6
5234	29.8	37.6	43.6	49.6	55.6
5234-C	43.2	54.5	63.2	71.8	80.5
5244-1	50.6	63.8	74.0	84.2	94.4
5246-1¼	88.6	111.8	129.7	147.5	165.4

CAPACITY IN C.F.M.—To convert pounds of air per minute to standard cubic feet per minute multiply by 13.3.

SELECTION OF RELIEF VALVES. Most states and municipalities which have refrigeration safety codes conform to the "American Standard Safety Code for Mechanical Refrigeration (ASA B9.1-1964)." This code provides for a relief valve setting not to exceed the design working pressure of the vessel on which the relief valve is installed. The discharge capacity required is based on the size of the vessel and the refrigerant used. The discharge capacity of relief valves varies with the pressure setting. The capacities of Henry Relief Valves at various pressure settings are shown on Data Sheet No. AE1303, copies of which are available upon request.

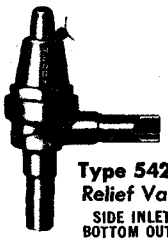
Whenever conditions permit, it is advisable to have the relief valve pressure setting (which must not exceed the design working pressure of the vessel) at least 25 percent higher than the normal maximum operating pressure for the refrigerant used.

HENRY diaphragm, angle relief valves

U.S. Patent Numbers 2,448,429 and 2,772,019

These diaphragm valves provide positive opening and reseating. Unlike conventional relief valves which function with a fixed pressure differential between inlet and outlet, the opening pressure of these valves does not increase with increasing outlet pressure. This design *feature permits the use of a rupture disc* assembly on the outlet side without increasing the initial leak pressure. This feature also makes these valves particularly suitable, and in compliance with code requirements, for high side to low side discharge.

Type 541
Relief Valve
SIDE INLET—
BOTTOM OUTLET



Type 542
Relief Valve
SIDE INLET—
BOTTOM OUTLET

Brass Tube O.D. Extensions are supplied in both ports to prevent heat of installation from damaging internal parts. Do not dismantle for brazing.

RELIEF VALVES—DIAPHRAGM TYPE, FORGED BRASS BODY

CATALOG NUMBERS	SIZE CONNECTIONS		DIMENSIONS—INCHES			LIST PRICE
			CENTER TO FACE		OVER-ALL HEIGHT	
	INLET	OUTLET	SIDE	BOTTOM		
5412	½" F.P.T.	½" F.P.T.	1¾	1⅞	5⅝	$54.10
5422	⅝" O.D.S.	⅝" O.D.S.	3 15/16	3⅝	7½	63.20
5423	⅞" O.D.M.	⅞" O.D.M.	5¼	4 15/16	8 13/16	66.80

IMPORTANT: Orders must specify pressure setting. Range 75 to 300 P.S.I.

Type 545
Relief Valve
SIDE INLET—
BOTTOM OUTLET

Complete with rupture disc cartridge. For high side to atmosphere discharge. Pressure setting range 150 to 350 P.S.I.

RELIEF VALVE—Combination Diaphragm and Rupture Disc, Forged Brass Body

DOUBLE PROTECTION—FOR MAXIMUM SAFETY. An exclusive Henry design with built-in replaceable rupture disc cartridge in outlet port. Provides additional protection against loss of refrigerant.

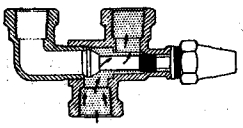
CATALOG NUMBERS	SIZE CONNECTIONS		DIMENSIONS—INCHES			LIST PRICE
			CENTER TO FACE		OVER-ALL HEIGHT	
	INLET	OUTLET	SIDE	BOTTOM		
5454	½" M.P.T.	⅝" Flare	2	2¾	6 9/16	$101.00
5551	A replacement disc cartridge for catalog No. 5454 Relief Valve.					18.10

IMPORTANT: Orders must specify valve pressure setting; refrigerant; also rupture disc bursting pressure and operating temperature. RUPTURE PRESSURES—150 to 350 P.S.I. Unless otherwise specified the bursting pressure for the rupture disc will be furnished at the same pressure setting as the relief valve and set at 72° F our standard setting temperature.

Prices apply to valves with standard settings. Standard settings are: 235 P.S.I. 300 P.S.I. 350 P.S.I.

HENRY three-way dual shut-off valves

For Dual Relief Valves and Drier By-Pass Installations or Applications requiring simultaneous opening of one line and closing of another.



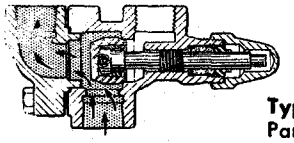
Type 92
Parallel Mounting
FORGED BRASS VALVE
Right Outlet Port Open
Left Outlet Port Closed

INLET

Recommended for use with Relief Valve Types 52, 523, 524.

Type 802-A
Parallel Mounting
DUCTILE IRON VALVE

INLET



INLET

Type 8023
Parallel Mounting
SEMI-STEEL VALVE
Left Outlet Port
Open
Right Outlet Port
Closed

Three-Way Dual Shut-off Valve inlets are shown at the bottom of the illustrations. Tight shut-off can be obtained at *either extreme of stem position*, closing off either the left or right outlet port. When the valve stem is in an intermediate position, the flow is through both *outlet ports*.

A dual relief valve installation consists of one three-way shut-off valve and two relief valves so arranged that both relief valves cannot be shut off from the protected pressure vessel at the same time. This permits safe removal of either relief valve for repair or replacement, while the vessel is protected and under pressure. EACH relief valve must have sufficient capacity to provide the necessary discharge flow when used alone.

The design of this Three-Way Valve provides full discharge area through the valve regardless of stem position, assuring maximum protection. Furthermore, this design provides for convenient parallel mounting of the two relief valves and fulfills the requirement set forth in the ASA B9.1 1964 Code Section 12.1.1.

"No stop valve shall be located between any automatic pressure relief device or fusible plug and the part or *parts of the system protected* thereby, except when the parallel relief devices mentioned in 13.2 are so arranged that only one can be rendered inoperative at a time for test or repair purposes."

Two three-way valves, installed with drier bypass line, permit installation or removal of service drier without air, dirt, or moisture entering line.

PARALLEL MOUNTING—CAPPED TYPE, BOTTOM INLET

450 P.S.I. Working Pressure. Maximum Temperature Rating 300°F.

CATALOG NUMBERS	SIZE CONNECTIONS	BODY MATERIAL	DIMENSIONS—INCHES				LIST PRICE
			INLET CENTER TO		INLET FACE TO OUTLET FACES	OUTLET PORT CENTERS	
			ELBOW CENTER	CAP END			
925	½" F.P.T.	Forged Brass	2 1/16	3¼	2½	2¾	$22.80
8021A	½" F.P.T.	Ductile Iron	1⅞	4⅝	2⅜	3	39.80
8022A	¾" F.P.T.	Ductile Iron	2 1/16	5⅛	3⅜	3⅜	43.40
8022A-B	1" F.P.T.	Ductile Iron	2⅜	6½	3½	4 5/16	63.20
8023	1¼" F.P.T.	Semi-Steel	2⅜	7	4⅜	4⅜	83.00

HENRY "DRI-VUE"® moisture-liquid indicators

Answer vital questions—Is Moisture Present? Low on Gas? or All is well.

"DRI-VUE" INDICATION

This Moisture-Liquid Indicator installed in the liquid line of a refrigeration or air conditioning system will provide a positive moisture and liquid indication of the condition of the refrigerant in the system.

As a liquid indicator it shows the absence or presence of liquid refrigerant. Beyond this the "DRI-VUE" moisture-liquid indicator, by spelling and color change, reveals the moisture content of the refrigerant which is also very significant. The knowing of moisture's entry or presence in the system followed by proper corrective measures can minimize or eliminate costly damage and repairs brought about by the build-up of acids and sludge created by the circulation of wet refrigerant under the heat of compression.

MOISTURE INDICATION

Water solubility in the halogenated hydrocarbons at various temperatures reveals a wide difference between refrigerants. For instance, the ability of Refrigerant 22 to hold several times the amount of water absorbed by Refrigerant 12 shows that moisture detection is more critical in the latter refrigerant. For this reason, a moisture element calibrated to indicate a safe moisture level in Refrigerant 12 can also be used satisfactorily with other refrigerants that have a lower water solubility.

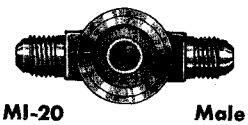
Because of the difference in the moisture solubility limits of different refrigerants the color change will not occur at the same moisture level in all refrigerants. Since temperature changes affect the solubility, the color change will also vary with the refrigerant temperature. The tables show the color change for refrigerants at various moisture levels and liquid line refrigerant temperatures.

LIQUID INDICATION

The liquid refrigerant is readily visible through the center opening of the moisture element where the presence of bubbles indicates a shortage of refrigerant, restriction in the line or lack of sub-cooling.

"DRI-VUE" FEATURES

MI-20 Single and MI-21-S Double Port Types



Type MI-20 **Male flare**

1. Spells "WET" or "DRY"—Avoids Color Confusion.
2. Positive Color Contrast—Completely reversible.
3. Extra large sensitized moisture element for easy viewing.
4. Moisture element protected by filter screen and pad.
5. Clear polished optical glass—triple sealed.
6. Forged Brass Body—Large wrench flats.
7. Threaded Protective Cap keeps glass clean.
8. Suitable for liquid line applications—R-12, R-22, R-500 and R-502.
9. Complete range of sizes and types.
10. Disassembly unnecessary in O.D. Solder types.
11. Female flare types have mechanically retained copper gasket.
12. Moisture element can be replaced—order Kit MI-2.
13. Individually packaged and labeled.
14. 500 P.S.I. working pressure—U.L. Listed.

Danger "Wet"

When the refrigerant contains excess moisture, enough to damage the system, the indicator element is pink and the word "WET" is clearly visible in contrasting blue letters.

Caution "Wet"—"Dry"

As moisture is removed from the refrigerant, the indicator element changes to light violet and as the word "WET" fades in contrast, the word "DRY" in pink letters begins to appear.

Safe "Dry"

When the moisture in the refrigerant has been reduced to a safe level the indicator element becomes blue and the word "DRY" stands out in contrasting pink letters.

Bubbles—

If present in polished optical glass porthole indicate refrigerant shortage or line restriction. No bubbles in the port says, "All is well."

"DRI-VUE" MOISTURE-COLOR TABLES

REFRIGERANT 12

MOISTURE CONTENT—PARTS PER MILLION (P.P.M.)			
TEMPERATURE	INDICATOR COLOR		
	BLUE	LIGHT VIOLET	PINK
75°F.	Below 5	5–15	Above 15
100°F.	Below 10	10–30	Above 30
125°F.	Below 15	15–45	Above 45

REFRIGERANT 502

MOISTURE CONTENT—PARTS PER MILLION (P.P.M.)			
TEMPERATURE	INDICATOR COLOR		
	BLUE	LIGHT VIOLET	PINK
75°F.	Below 15	15–60	Above 60
100°F.	Below 25	25–90	Above 90
125°F.	Below 30	30–120	Above 120

REFRIGERANTS 22 & 500

MOISTURE CONTENT—PARTS PER MILLION (P.P.M.)			
TEMPERATURE	INDICATOR COLOR		
	BLUE	LIGHT VIOLET	PINK
75°F.	Below 30	30–120	Above 120
100°F.	Below 45	45–180	Above 180
125°F.	Below 60	60–240	Above 240

A moisture level of 15 PPM for Refrigerant 12; 30 PPM for Refrigerant 502 and 60 PPM for Refrigerants 22 and 500 indicated in the blue color range of the tables are generally considered dry and safe for most installations.

LISTED BY UNDERWRITERS' LABORATORIES, INC.
RE-EXAMINATION SERVICE

Continued on next page

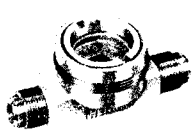
HENRY "DRI-VUE"® moisture-liquid indicators (Cont'd.)

U.S. Patent Number 3,088,811

For Refrigerants 12, 22, 500 & 502

MI-20 Single and MI-21-S Double Port Types

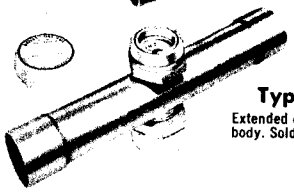
Spells "WET" or "DRY"—Avoids Color Confusion.



Type MI-20
Male flare connections.

Type MI-20-F
Male flare by female flare connections.

Type MI-20-S
Extended copper ends solder connections.

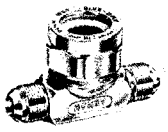


Type MI-21-S*
Extended ends, copper tube body. Solder connections.

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES OVER-ALL HEIGHT	DIMENSIONS—INCHES OVER-ALL LENGTH	LIST PRICE
POLISHED GLASS—MALE FLARE				
MI-20-¼	¼" M. Flare	1⅜	2 5/16	$12.20
MI-20-⅜	⅜" M. Flare	1⅜	3 1/16	12.20
MI-20-½	½" M. Flare	1⅜	3 7/16	13.40
MI-20-⅝	⅝" M. Flare	1 9/16	3 13/16	14.00
MALE FLARE BY FEMALE FLARE				
MI-20-¼F	¼" M.Fl. x F.Fl.	1⅜	2¾	12.50
MI-20-⅜F	⅜" M.Fl. x F.Fl.	1⅜	3 1/16	12.80
MI-20-½F	½" M.Fl. x F.Fl.	1 9/16	3 5/16	14.50
MI-20-⅝F	⅝" M.Fl. x F.Fl.	1 9/16	3 9/16	15.70
O.D. SOLDER—EXTENDED COPPER ENDS				
MI-20-¼S	¼" O.D.S.	1⅜	5¼	13.90
MI-20-⅜S	⅜" O.D.S.	1⅜	5¼	13.90
MI-20-½S	½" O.D.S.	1⅜	6⅛	14.10
MI-20-⅝S	⅝" O.D.S.	1⅜	6⅛	14.80
MI-20-⅞S	⅞" O.D.S.	1 9/16	7	18.80
DOUBLE PORT*—EXTENDED COPPER BODY				
MI-21-⅞S	⅞" O.D.S.	3⅛	7	27.20
MI-21-1⅛S	1⅛" O.D.S.	3⅛	7¼	27.20
MI-21-1⅜S	1⅜" O.D.S.	3⅜	8⅞	30.70
MI-21-1⅝S	1⅝" O.D.S.	3⅝	9	34.30
MI-21-2⅛S	2⅛" O.D.S.	4⅛	9	39.70

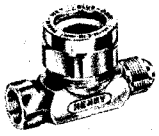
*Only one port has sensitized moisture element.

MI-30-S Single and MI-31-S Double Port Types—Self-Contained Cap Type



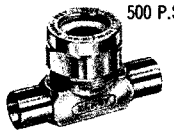
Type MI-30
Single Port
Flare connections.

U.S. Patent Number 3,142,287

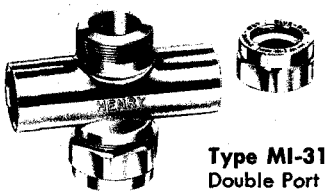


Type MI-30-F
Single Port
Male flare by female flare connections.

500 P.S.I. working pressure



Type MI-30-S
Single Port
Solder connections.



Type MI-31-S*
Double Port
Solder connections.

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES OVER-ALL HEIGHT	DIMENSIONS—INCHES OVER-ALL LENGTH	LIST PRICE
POLISHED GLASS—MALE FLARE				
MI-30-¼	¼" M. Flare	1⅝	2⅝	$9.90
MI-30-⅜	⅜" M. Flare	1⅝	2¾	9.90
MI-30-½	½" M. Flare	1 13/16	3⅛	11.30
MI-30-⅝	⅝" M. Flare	2	3 13/16	12.70
MALE FLARE BY FEMALE FLARE				
MI-30-¼F	¼" M.Fl. x F.Fl.	1⅝	2¼	9.90
MI-30-⅜F	⅜" M.Fl. x F.Fl.	1 13/16	2 13/16	10.70
MI-30-½F	½" M.Fl. x F.Fl.	1 13/16	3⅛	11.30
MI-30-⅝F	⅝" M.Fl. x F.Fl.	2	3 5/16	13.20
O.D. SOLDER				
MI-30-¼S	¼" O.D.S.	1⅝	2¼	9.80
MI-30-⅜S	⅜" O.D.S.	1⅝	2⅜	9.80
MI-30-½S	½" O.D.S.	1⅝	2⅝	9.80
MI-30-⅝S	⅝" O.D.S.	1 13/16	2 15/16	11.00
MI-30-⅞S	⅞" O.D.S.	2	3¼	12.70
MI-30-1⅛S	1⅛" O.D.S.	2 5/16	3 5/16	16.20
DOUBLE PORT*—CLOSE COUPLED—O.D. SOLDER				
MI-31-⅜S	⅜" O.D.S.	2 9/16	2⅛	17.40
MI-31-½S	½" O.D.S.	2 9/16	2¼	17.40
MI-31-⅝S	⅝" O.D.S.	2 11/16	2½	18.10
MI-31-⅞S	⅞" O.D.S.	2 15/16	3	19.90
MI-31-1⅛S	1⅛" O.D.S.	3 3/16	3 3/16	21.70
MI-31-1⅜S	1⅜" O.D.S.	3 7/16	3 7/16	25.30
MI-31-1⅝S	1⅝" O.D.S.	3 13/16	3 11/16	28.90
MI-31-2⅛S	2⅛" O.D.S.	4 9/16	4½	34.30

*Only one port has sensitized moisture element.

For general construction details other than self-contained Type Moisture Element, consult Type MI-20, Page 215.

MI-30 and MI-31 FEATURES

Compact, factory-assembled removable cap. Contains polished optical glass, triple-sealed in one easy-to-handle moisture indicating unit.

LIST PRICE
$7.20

SELF-CONTAINED MI-3 CAP ASSEMBLY

One used on MI-30 or MI-31. For second port on MI-31, use LI-3 Cap Assembly which is interchangeable.

To install, simply unscrew the removable cap assembly. Mount the short indicator body on the line and solder. Replace cap by threading clockwise until hand tight. Wrench tighten ⅓ to ½ turn beyond handtight position. This provides the proper sealing torque (approximately 25 ft. lbs.).

See Moisture-Color tables page 215.

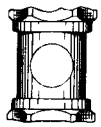
LISTED BY UNDERWRITERS' LABORATORIES, INC.

HENRY liquid indicators

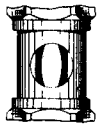
PROVIDE A CONVENIENT CHECK ON REFRIGERANT IN SYSTEM WHEN INSTALLED IN LIQUID LINES. GAS BUBBLES PASSING UNDERNEATH GLASS INDICATE SHORTAGE OF REFRIGERANT. MAXIMUM WORKING PRESSURE 500 P.S.I. INDIVIDUALLY PACKAGED IN CARTONS.

Type LI-12-F
Male flare by female flare.

Full
If indicator is full of liquid, opening on opposite side of glass has its true circular shape.



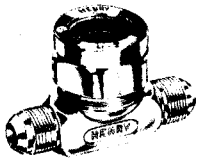
Empty
If indicator is empty, opening appears oval.



TUBULAR GLASS TYPE—BRASS BODY

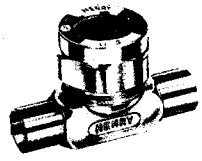
Brass construction. "O" ring seal at each end prevents leaks. Pyrex glass tube with heavy guard. Wide wrench flats. Negligible pressure drop. Available packaged individually or in lots of ten. 500 P.S.I. Working Pressure

CATALOG NUMBERS	SIZE CONNECTIONS	OVER-ALL LENGTH INCHES	LIST PRICE
MALE FLARE BY MALE FLARE			
LI-12-¼	¼" M. Flare	2⅞	$5.30
LI-12-⅜	⅜" M. Flare	3	5.30
LI-12-½	½" M. Flare	3¼	6.20
MALE FLARE BY FEMALE FLARE			
LI-12-¼F	¼" M.Fl. x ¼" F.Fl.	2¾	5.30
LI-12-⅜F	⅜" M.Fl. x ⅜" F.Fl.	2⅞	5.30
LI-12-½F	½" M.Fl. x ½" F.Fl.	3⅜₁₆	6.80



Type LI-30
Single Port
Male flare connections

Type LI-30-F
Single Port
Male flare by female flare connections.



Type LI-30-S
Single Port
Solder connections.

To install, simply unscrew the removable cap assembly. Solder indicator body in line. Replace cap assembly.

CAP TYPE—FORGED BRASS BODY

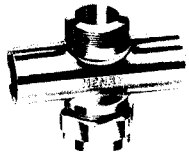
Featuring self-contained removable cap assembly with triple sealed glass. Convertible into moisture-liquid indicator by interchangeability of cap assemblies. 500 P.S.I. Working Pressure (U.L. Listed.)

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES		LIST PRICE
		OVER-ALL HEIGHT	OVER-ALL LENGTH	
SINGLE PORT—POLISHED GLASS—MALE FLARE				
LI-30-¼	¼" M. Flare	1⁹⁄₁₆	2⅝	$8.20
LI-30-⅜	⅜" M. Flare	1⁹⁄₁₆	2¾	8.20
LI-30-½	½" M. Flare	1¾	3⅛	9.40
LI-30-⅝	⅝" M. Flare	1¹⁵⁄₁₆	3¹³⁄₁₆	10.80
MALE FLARE BY FEMALE FLARE				
LI-30-¼F	¼" M.Fl. x ¼" F.Fl.	1⁹⁄₁₆	2¼	8.20
LI-30-⅜F	⅜" M.Fl. x ⅜" F.Fl.	1¾	2¹³⁄₁₆	8.90
LI-30-½F	½" M.Fl. x ½" F.Fl.	1¾	3⅛	9.40
LI-30-⅝F	⅝" M.Fl. x ⅝" F.Fl.	1¹⁵⁄₁₆	3⅝	11.40
O.D. SOLDER CONNECTIONS				
LI-30-¼S	¼" O.D.S.	1⁹⁄₁₆	2¼	8.00
LI-30-⅜S	⅜" O.D.S.	1⁹⁄₁₆	2⅜	8.00
LI-30-½S	½" O.D.S.	1⁹⁄₁₆	2⅝	8.00
LI-30-⅝S	⅝" O.D.S.	1¾	2¹³⁄₁₆	9.20
LI-30-⅞S	⅞" O.D.S.	1¹⁵⁄₁₆	3¾	10.80
LI-30-1⅛S	1⅛" O.D.S.	2¼	3⁵⁄₁₆	14.50

LI-3 LIQUID INDICATOR CAP ASSEMBLY. One used on LI-30, two on LI-31. These liquid indicators can be converted to MI-30 and MI-31 Moisture Indicators by substituting an MI-3 Moisture Indicator Cap Assembly.

U.S. Patent Number 3,142,287

Type LI-31-S
Double Port
Solder connections.



To install, simply unscrew both the removable cap assemblies. Solder indicator body in line. Replace both cap assemblies.

DOUBLE PORT—FORGED BRASS—O.D. SOLDER CONNECTIONS

Featuring compact factory-assembled self-contained removable cap assembly with triple sealed glass. Convertible into moisture-liquid indicator by interchangeability of cap assemblies. 500 P.S.I. Working Pressure (U.L. Listed.)

CATALOG NUMBERS	SIZE CONNECTIONS	DIMENSIONS—INCHES		LIST PRICE
		OVER-ALL HEIGHT	OVER-ALL LENGTH	
DOUBLE PORT—POLISHED GLASS				
LI-31-⅜S	⅜" O.D.S.	2½	2⅛	$14.60
LI-31-½S	½" O.D.S.	2½	2¼	14.60
LI-31-⅝S	⅝" O.D.S.	2⅝	2½	15.30
LI-31-⅞S	⅞" O.D.S.	2⅞	3	17.20
LI-31-1⅛S	1⅛" O.D.S.	3⅛	3⅝	19.00
LI-31-1⅜S	1⅜" O.D.S.	3⅜	3⁷⁄₁₆	22.50
LI-31-1⅝S	1⅝" O.D.S.	3⅞	3¹⁄₁₆	26.20
LI-31-2⅛S	2⅛" O.D.S.	4½	4½	32.50

LI-3 LIQUID INDICATOR CAP ASSEMBLY. One used on LI-30, two on LI-31. These liquid indicators can be converted to MI-30 and MI-31 Moisture Indicators by substituting an MI-3 Moisture Indicator Cap Assembly.

List – $5.40

Listed by Underwriters' Laboratories, Inc., Re-Examination Service.

HENRY "DRI-COR"® sealed type refrigerant filter-drier

U.S. Patent Number 2,873,856

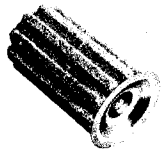
the High Flow . . . High Drying Capacity . . . Acid Removing . . . Filter-Drier
With Properly Proportioned Drying and Filtering through Two Stages—High Capacity Blend of Granular Desiccant and JET-FLO Molded Core—Molecular Sieves and Activated Alumina

V800 DRI-COR Filter-Drier JET-FLO Molded Core Features

A molded core made by the ceramic bonding of a blend of highly efficient desiccant particles at elevated temperatures. The DRI-COR has uniform porosity throughout supporting rapid adsorption of moisture and acid. The consistent core porosity permits maximum flow and depth filtration at minimum pressure drop.

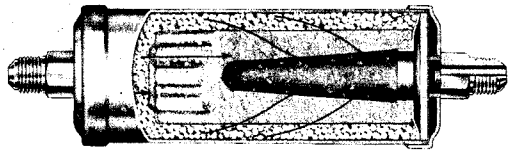
The fluted perimeter desiccant filter block has increased surface area to receive liquid refrigerant faster and provide more surface for micronic filter-drying in depth.

The DRI-COR assures clean, dry, acid-free safe refrigerant.



Molded Core and Positioning Ring

CAPACITY RANGE:
Refrigerant 12
¼ to 25 Tons



Refrigerant 22
¾ to 30 Tons

V800 DRI-COR ADSORBS ACID—Refrigerants react with water to form hydrochloric acid and hydrofluoric acid. Henry DRI-COR filter-driers not only remove moisture that may cause formation of these acids, but also remove the acids if they are already present in the system. This protects the system from damage and costly repairs.

DRI-COR FILTER-DRIER FEATURES

1. **ADVANCED JET-FLO MOLDED CORE DESIGN.**
   a. Micronic Filtration in Depth
   b. High Drying Capacity
   c. Efficient Acid Removal
   d. Low Pressure Drop
   e. Uniform Core Porosity
   f. Core flow access surface increased up to 50%
2. **TWO STAGE DRYING—PROGRESSIVE FILTRATION.**
   a. High Capacity blend of Granular Desiccant
   b. Ceramic Fired Molded Desiccant Filter Core
3. **GRANULAR DESICCANT** — Thoroughly reactivated and blended to produce high capacity drying even at relatively high temperatures.
4. **DRYING AND FILTERING ARE PROPERLY PROPORTIONED for maximum efficiency.**
5. **FILTER CORE IS CUSHIONED** in a bed of granular desiccant to prevent possibility of damage in careless handling.
6. **TRANSVERSE FLOW—LOW PRESSURE DROP**—No by-passing of refrigerant.
7. **HIGH WORKING PRESSURE** approved for 500 P.S.I. or bursting pressure of 2500 P.S.I.
8. **BRASS FLARE OR SOLDER END CONNECTIONS.** Machined O.D.S. and O.D.M. through ⅝".
9. **DURABLE MOLDED PLASTIC SEAL CAPS** furnished to protect flare faces and seal filter-drier.
10. **LISTED BY UNDERWRITERS' LABORATORIES, INC. RE-EXAMINATION SERVICE**

FILTER-DRIER SELECTION—V800—DRI-COR®

CATALOG NUMBERS		SIZE CONN.	†CORE FILTER AREA SQ. IN.	DIMENSIONS—INCHES			WEIGHT POUNDS	RECOMMENDED TONNAGE BASED ON BOTH DRYING AND FLOW CAPACITY*		CAPACITY RATINGS ACCORDING TO A.R.I. STANDARD 710-58							LIST PRICE
				SHELL DIA.	OVER-ALL LENGTH					DROPS OF WATER				FLOW CAPACITY @ 2 P.S.I. IN TONS			
										R-12 (15 P.P.M.)		R-22 (60 P.P.M.)					
FLARE	O.D. SOLDER				FLARE	O.D.S.		REFRIGERANTS		LIQUID LINE TEMP. °F.							
								R-12	R-22	75°	125°	75°	125°	R-12	R-22	R-502	
V803-¼	V803-¼S	¼"	6.1	1¾	4¾₁₆	3⅝	½	¾	¾	41	33	30	21	2.3	3.0	1.9	$5.70
V805-¼	V805-¼S	¼"	6.1	2	4⅝	4¹⁄₁₆	⅝	1	1	81	65	59	41	2.5	3.3	2.1	7.30
V805-⅜	—	⅜"			5¹⁄₁₆	—	¾	1	1					3.8	5.0	3.1	7.50
V808-¼	—	¼"	12.1	2	5⅝	—	1	1	1	147	112	105	76	2.5	3.3	2.1	8.50
V808-⅜	V808-⅜S	⅜"			6¹⁄₁₆	5¼	1⅛	2	2					3.8	5.0	3.1	8.70
V816-¼	—	¼"	26	2½	6⁵⁄₁₆	—	1¾	2	2	242	187	177	128	2.7	3.5	2.2	11.20
V816-⅜	—	⅜"			6¾	—	1⅞	3	3					4.7	6.2	3.9	11.42
V816-½	V816-½S	½"			7	6	2	4	4					8.5	11.2	7.0	12.20
V816-⅝	V816-⅝S	⅝"			7¼	6¼	2⅛	5	5					10.6	13.8	8.7	12.90
V830-⅜	—	⅜"	40	2½	9¾	—	2¾	4	5	428	388	351	251	4.9	6.5	4.0	20.60
V830-½	—	½"			10	—	2⅞	7½	7½					11.2	14.6	9.2	21.50
V830-⅝	V830-⅝S	⅝"			10¼	9¼	3	10	10					13.3	17.5	10.9	22.00
—	V830-⅞S	⅞"			—	9⅝	3⅛	10	15					15.1	19.8	12.4	23.00
V841-⅜	—	⅜"	50.2	3	9¹¹⁄₁₆	—	4	5	7½	507	419	380	266	5.7	7.5	4.7	28.00
V841-½	—	½"			9¹⁵⁄₁₆	—	4¼	10	10					16.0	21.0	13.1	28.90
V841-⅝	V841-⅝S	⅝"			10⅜	9⅜	4⅜	10	15					17.4	22.8	14.3	29.50
—	V841-⅞S	⅞"			—	9¹⁵⁄₁₆	4½	15	20					19.2	25.2	15.7	30.30
—	V875-⅞S	⅞"	93	3½	—	15⁷⁄₁₆	8	25	30	1157	809	738	494	25.0	32.2	20.5	56.90

†Actual Filter Area of a Henry DRI-COR Filter-Drier is much greater than the core filter-area, since the granules of the surrounding desiccant bed provide additional filter area resulting in progressive filtration.

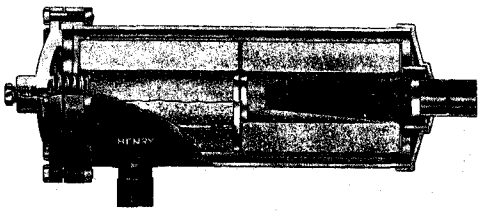
*Recommended Tonnage Rating based on both Drying and Flow Capacity is shown in table. For Refrigerants 500 and 502 use data shown for Refrigerant 12.

V800 Filter-Driers with O.D.S. Connections in sizes other than those listed can be furnished in production quantities. Prices on application.

For Suction Line applications see data page 224.

HENRY replaceable core refrigerant filter-driers and filters
—flanged, angle type, V8000 shells—offer maximum flexibility

"DRI-COR"® For Fast—Effective—Efficient—Moisture, Acid and Foreign Matter Removal
High Drying Capacity—Low Pressure Drop—Micronic Filtration—Interchangeable Cores
Available in a complete range of connection sizes and capacities for single and multiple molded core types.



V8000 REPLACEABLE CORE FILTER-DRIERS

SHELL TYPES AND SIZES		COPPER CONNECTIONS
V80	4¾" O.D. Steel Shell	⅝" Thru 2⅛" O.D.S.
V81	4¾" O.D. Steel Shell	1⅛" Thru 2⅛" O.D.S.
V83	6" O.D. Steel Shell	1⅝" Thru 2⅝" O.D.S.
V84	6" O.D. Steel Shell	2⅛" Thru 2⅝" O.D.S.

CAPACITY RANGE	HIGH WORKING PRESSURE
Refrigerant 12; 10 to 135 tons	approved for 500 P.S.I. or bursting pressure of 2500 P.S.I.
Refrigerant 22; 15 to 165 tons	

"DRI-COR" FEATURES

1. **High Drying Capacity:** molded desiccant Cores with Activated Alumina and Molecular Sieves.
2. **High Flow Capacity:** is same for standard DRI-COR and Hi-Capacity DRI-COR replaceable cores.
3. **Low Pressure Drop:** flow rate increases proportionally with the addition of cores to the drier shell.
4. **Acid Removal:** for both Hydrochloric and Hydrofluric acids which are harmful to metal surfaces.
5. **Replaceable Cores:** thoroughly activated and hermetically packaged in sealed metal containers. A new cover plate and cone screen gasket are packed with each core for convenience.
6. **Drier Shell:** of Corrosion resistant steel, steel flange ring and spring with wrought copper fittings. Ductile iron cover plate with steel nuts and bolts. Nuts held by shell, cannot turn.
7. **Flange Cover Plates:** except those with MI-3 Moisture Indicator Cap are tapped ¼" F.P.T. and plugged for field installation of a Schrader Valve pressure tap or other type of connection.
8. **Pressure Rating:** Shells have a safe working pressure of 500 P.S.I. and 2500 P.S.I. bursting pressure.
9. **Packaging:** Drier Shells are individually packaged in corrugated cartons. They include the required number of core spacer plates and springs.

LISTED BY UNDERWRITERS' LABORATORIES, INC. RE-EXAMINATION SERVICE

Ordering Information:
Drier Shell Catalog number does not include the replaceable cores which must be ordered separately.

Drier By-Pass:
These high flow capacity filter-driers may be installed in the liquid line without a by-pass. However, a valve by-pass is recommended on field erected systems to facilitate future core replacement.

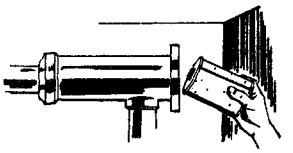
FEATURES EASY TO INSTALL OR REPLACE—

Individual Molded Cores, Short Compact Units that are inserted into shell with a Minimum of Time, Space and Exposure. Installation of multiple cores can be a prolonged and costly operation. The Henry DRI-COR spring-assembled core reduces the operation to seconds.

On new systems or old, to remove cores and clean shell, follow these simple instructions.

1. Close service valves and pump down. Open drier shell.
2. Remove fully activated DRI-COR from hermetically sealed container.
3. Slip DRI-COR between triple spring-tensioned spacer plates as shown.
4. Muzzle load as many compact replaceable cores as required. A spring-tensioned press fit provides full flow channel without refrigerant by-pass.

Less installation and service space is required with Henry Replaceable Core Filter-Driers, due to the short, compact, spring assembled, individual core design.



Shown with Spacers and Springs

"DRI-COR" Replaceable Filter-Drier Cores

with Activated Alumina and Molecular Sieves as the desiccant provide micronic filtration. Two types available—STANDARD or HI-CAPACITY Cores that are interchangeable with same flow capacity. Hi-Capacity cores have extra drying capacity. Cores are interchangeable (also with those in competitive rod type assemblies).

"FIL-COR" Replaceable Filter Cores

provides micronic filtration when drying is not required. These FIL-COR's are interchangeable with the above DRI-COR's. Core spacer plates and springs are furnished with the V8000 shells.

For Type V8000 Replaceable Core FIL-COR Filters, see pages 223 and 224.

FILTER-DRIER SELECTION

In selecting a drier, both its water capacity rating and flow capacity rating must be considered. In addition to the drops of water rating in Table 3, the water capacity of the Driers are shown in pounds of refrigerant charge based on the following assumed conditions.

(1) Reducing the moisture content of Refrigerant 12 from 550 PPM to 15 PPM or removal of 5 drops of water per lb. of Refrigerant 12.

(2) Reducing the moisture content of Refrigerant 22 from 990 PPM to 60 PPM or removal of 9 drops of water per lb. of Refrigerant 22.

If the total refrigerant charge in the system is known, this water capacity rating in pounds of refrigerant may be used to determine the drier size and number of cores required to provide sufficient drying capacity under these assumed conditions at liquid line temperature of 75°F. or 125°F. If the amount of charge is not known, it may be assumed to be 8 lbs. of Refrigerant 12 per ton and 6 lbs. of Refrigerant 22 per ton.

In addition to adequate drying capacity the corresponding flow capacity of the drier should be equal to, or greater than, the system tonnage. Both drying capacity and flow capacity increase in proportion to the number of cores employed.

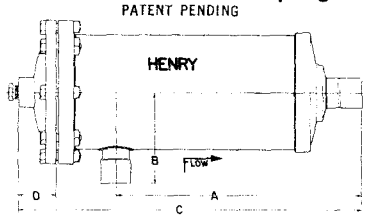
Continued on next page

HENRY type V8000 replaceable core—refrigerant driers

with compact, individual Filter-Drier Cores

Spring Assembled—Speeds Up Installation—Reduces Humidity Pick Up

PATENT PENDING



Dimension "D" is the minimum space required to remove the filter-drier core from the shell.

DESCRIPTION KEY FOR HENRY REFRIGERANT DRIERS & FILTER DRIERS

TABLE 1. REPLACEABLE FILTER-DRIER and FILTER CORES

CORE CATALOG NUMBERS	CONSTRUCTION	DRIER SHELL DIA. IN.	VOLUME CUBIC INCHES	A.R.I. CAPACITY RATINGS DROPS OF WATER				LIST PRICE
				R-12 (15 PPM)		R-22 (60 PPM)		
				LIQUID LINE TEMP. ° F.				
				75°	125°	75°	125°	
848-C	STANDARD "DRI-COR"	4¾	48	475	225	206	154	$13.00
848-CM	"DRI-COR" HI-CAP. DRYING	4¾	48	686	566	400	350	18.40
810-CM		6	100	1430	1180	835	730	35.20
848-F	"FIL-COR"	4¾	64 sq. in.	Filter	use when drying			8.50
810-F	FILTER-CORE	6	98 sq. in.	Area	is not required			13.60
FULLY ACTIVATED MOLDED CORES NOT INCLUDED IN DRIER SHELLS—ORDER SEPARATELY								

Cores are available packed 12 to a carton. Type 810-CM available packed 4 to a carton.

TABLE 2. SPECIFICATIONS—RECOMMENDED CAPACITY—500 P.S.I. working pressure—U.L. Listed

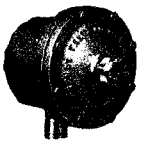
SHELL CATALOG NUMBERS	O.D.S. CONN. INCHES	DRI-COR® RECOMMENDED CAPACITY TONS*		CORES		CORE DATA		SHELL DIMENSIONS—INCHES				SHELL CATALOG NUMBERS	DRI-COR® FLOW CAPACITY @ 2 P.S.I. IN TONS		SHELL LIST PRICE
		R-12	R-22	QTY.	CAT. NO.	VOLUME CU. IN.	SURFACE AREA SQ. IN.	A	B	C	D		R-12**	R-22	
V8048-⅝ V8048-⅞ V8048-1⅛ V8048-1⅜ V8048-1⅝	⅝" ⅞" 1⅛" 1⅜" 1⅝"	10 15 	15 20 	1	848-C	48	64	5 13/16 6⅛ 6 3/16 6 5/16 6 7/16	3½ 3¾ 3 13/16 3 15/16 3 15/16	10 10 3/16 10¼ 10⅜ 10½	5⅝	V8048-⅝ V8048-⅞ V8048-1⅛ V8048-1⅜ V8048-1⅝	18 38 58 78 97	23 49 75 101 125	$84.90 84.90 86.70 88.50 90.30
V8096-⅞ V8096-1⅛ V8096-1⅜ V8096-1⅝ V8096-2⅛	⅞" 1⅛" 1⅜" 1⅝" 2⅛"	20 30 	30 40 	2	848-C	96	128	11 1/16 11¾ 11⅞ 11 5/16 12 1/16	3¾ 3 13/16 3 15/16 3 15/16 4 1/16	15¾ 15 13/16 15 15/16 16 16⅛	5⅝	V8096-⅞ V8096-1⅛ V8096-1⅜ V8096-1⅝ V8096-2⅛	40 60 80 101 140	52 77 103 130 180	97.50 99.40 101.00 102.90 108.30
V8144-1⅛ V8144-1⅜ V8144-1⅝ V8144-2⅛	1⅛" 1⅜" 1⅝" 2⅛"	40 50 	50 60 	3	848-C	144	192	17 5/16 17 7/16 17½ 17⅝	3 13/16 3 15/16 3 15/16 4 1/16	21⅜ 21½ 21 9/16 21 11/16	5⅝	V8144-1⅛ V8144-1⅜ V8144-1⅝ V8144-2⅛	62 84 105 144	80 108 135 186	122.80 124.60 126.40 131.80
V8192-1⅜ V8192-1⅝ V8192-2⅛	1⅜" 1⅝" 2⅛"	60 75	75 90	4	848-C	192	256	23 23 1/16 23 3/16	3 15/16 3 15/16 4 1/16	27 1/16 27⅛ 27¼	5⅝	V8192-1⅜ V8192-1⅝ V8192-2⅛	86 109 149	111 141 192	140.80 142.70 147.90
V8300-1⅝ V8300-2⅛ V8300-2⅝	1⅝" 2⅛" 2⅝"	100	125	3	810-CM	300	294	23⅞ 24 1/16 24⅝	5⅛ 5 5/16 5⅞	28 9/16 28¾ 29 5/16	6⅝	V8300-1⅝ V8300-2⅛ V8300-2⅝	111 153 195	143 197 252	288.90 297.80 307.00
V8400-2⅛ V8400-2⅝	2⅛" 2⅝"	135	165	4	810-CM	400	392	30½ 31 1/16	5 5/16 5⅞	35 3/16 35¾	6⅝	V8400-2⅛ V8400-2⅝	157 195	202 252	343.00 352.10

*Recommended Tonnage Rating based on both Drying and Flow Capacity is shown in table. For Refrigerants 500 and 502 use data shown for Refrigerant 12.

**FOR FLOW CAPACITY OF REFRIGERANT 502 USE 90% OF REFRIGERANT 12 FLOW CAPACITIES.

TABLE 3. DRYING CAPACITY IN ACCORDANCE WITH ARI-STANDARD 710—58

SHELL CATALOG NUMBERS	CORE TYPE	REFRIGERANT 12 DRYING CAPACITY Drops of Water 15 PPM		REFRIGERANT 22 DRYING CAPACITY Drops of Water 60 PPM	
LIQUID LINE TEMPERATURE °F.		75°	125°	75°	125°
V8048	STANDARD "DRI-COR"	475	225	206	154
V8048	HI-CAP. "DRI-COR"	686	566	400	350
V8096	STANDARD "DRI-COR"	950	450	412	307
V8096	HI-CAP. "DRI-COR"	1373	1133	800	701
V8144	STANDARD "DRI-COR"	1425	675	618	461
V8144	HI-CAP. "DRI-COR"	2059	1699	1200	1051
V8192	STANDARD "DRI-COR"	1900	900	824	614
V8192	HI-CAP. "DRI-COR"	2746	2266	1600	1402
V8300	HI-CAP. "DRI-COR"	4290	3540	2505	2190
V8400	HI-CAP. "DRI-COR"	5720	4720	3340	2920



DRI-VUE® MI-3 CAP ASSEMBLY is available on the shell flange cover plate as optional accessory.

The moisture indicator cap used on MI-30 or MI-31 can be included for additional charge.

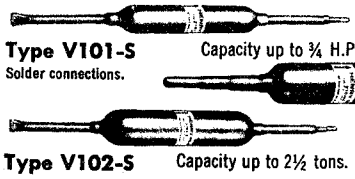
Compact, factory-assembled removable cap contains indicating color element and polished optical glass, triple-sealed, in one easy-to-handle unit.

Gives you accurate diagnosis of moisture condition in your system by element color variation. See the Moisture-Color table page 215.

ADD LETTER "M" TO SHELL CATALOG NUMBER. EXAMPLE: V8048-⅞M.

HENRY sealed type refrigerant driers

Available in a complete range of shell sizes, connections and capacities for Moisture and Acid Removal in Refrigeration and Air Conditioning Applications



Type V101-S Capacity up to ¾ H.P.
Solder connections.

Type V101U-S
Solder connections.
Capacity up to 1 H.P.

Type V102-S Capacity up to 2½ tons.
Solder connections.

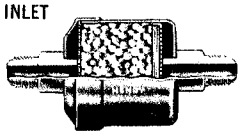
V100-S DRIERS, CAPILLARY TUBE TYPE—100% High Capacity Molecular Sieves, Copper Tube Body, Sealed Extended Copper Ends

Spun heavy duty copper shell with hermetically sealed copper tube connections silver brazed into place. Tubes fit O.D. or I.D. lines and can be cut-off, swedged, soldered, flared or bent to accommodate a variety of service applications including capillary tubing at outlet. Driers thoroughly reactivated.

Maximum Working Pressure 350 P.S.I.

O.D.M. connections can be joined to the same size tubing by use of a coupling.

CATALOG NUMBERS	SIZE SOLDER CONNECTIONS		SPECIFICATIONS				RECOMMENDED TONNAGE BASED ON BOTH DRYING AND FLOW CAPACITY*		CAPACITY RATINGS				DRYING CAPACITY POUNDS OF REFRIGERANT				LIST PRICE
			DIMENSIONS—INCHES			WEIGHT POUNDS			DROPS OF WATER				REFRIGERANTS				
	INLET	OUTLET	CUBIC VOLUME	SHELL DIAMETER	OVER-ALL LENGTH		REFRIGERANTS		R-12 (15 PPM)		R-22 (60 PPM)		R-12		R-22		
							R-12	R-22	LIQUID LINE TEMP. °F.				LIQUID LINE TEMP. °F.				
									75°	125°	75°	125°	75°	125°	75°	125°	
V101-S	¼ ODM by ⅜ ODF	.065 Cap. Tube	1	¾	9⅛	¼	¾	½	36	36	31	23	7.2	7.2	3.5	2.6	$4.70
V101U-S	¼ ODM by ⅝ ODM by ⅜ ODM		1½	1	9	⅜	1	¾	57	57	52	38	11.4	11.4	5.8	4.2	5.70
V102-S	⅝ ODM by ¼ ODF	.125 Cap. Tube	2	1¼	11⅝	½	2½	2	96	96	92	80	19.2	19.2	10.2	8.9	8.30



Type V200M Drier
Flare connections.

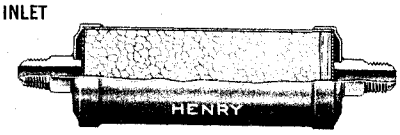
V200M DRIERS, STEEL SHELL, 100% High Capacity Molecular Sieves

Progressive Filtration through Perforated Inlet Disc, Packed Desiccant Bed, Filter Pad and Fine Mesh Outlet Screen. Design features are the same as V400 except for Desiccant and inclusion of brass flare nuts. Driers thoroughly reactivated.

Maximum Working Pressure 500 P.S.I. Bursting Pressure of 2500 P.S.I.

Listed by Underwriters' Laboratories, Inc., Re-Examination Service.

CATALOG NUMBERS	SIZE CONNECTIONS	SPECIFICATIONS				RECOMMENDED TONNAGE BASED ON BOTH DRYING AND FLOW CAPACITY*		CAPACITY RATINGS							LIST PRICE
		DIMENSIONS—INCHES			WEIGHT POUNDS			DROPS OF WATER				FLOW CAPACITY @ 2 P.S.I. IN TONS			
		CUBIC VOLUME	SHELL DIAMETER	OVER-ALL LENGTH		REFRIGERANTS		R-12 (15 PPM)		R-22 (60 PPM)					
						R-12	R-22	LIQUID LINE TEMP. °F.				R-12	R-22	R-502	
								75°	125°	75°	125°				
V201M-¼	¼" M. Flare	1	1¼	3¼	¼	1	½	41	41	37	27	1.8	2.4	1.5	$5.80
V202M-¼	¼" M. Flare	2	1½	3½	½	1½	1	70	70	63	46	1.9	2.5	1.6	6.20



Type V400 Drier
Flare connections.

V400 DRIERS, STEEL SHELL—with PA 400 Silica Gel

Davison's PA-400 Silica Gel, having greatly increased moisture adsorption capacity, is a non-corrosive, inert material that removes moisture by physical adsorption and will not dissolve in the refrigerant or react with oil in any way. Driers thoroughly reactivated.

DURABLE MOLDED PLASTIC SEAL CAPS protect flare faces and seal drier. Corrosion Resistant Finish, with Brass Fittings and Brass Flare Nuts. **END CAPS** brazed to shell. **LARGE WRENCH FLATS** facilitate installation.

Maximum Working Pressure 500 P.S.I Bursting Pressure of 2500 P.S.I.

Listed by Underwriters' Laboratories, Inc., Re-Examination Service.

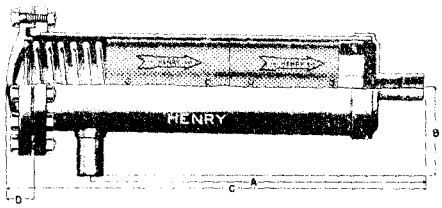
CATALOG NUMBERS	SIZE CONNECTIONS	SPECIFICATIONS				RECOMMENDED TONNAGE BASED ON BOTH DRYING AND FLOW CAPACITY*		A.R.I. STANDARD 710-58 CAPACITY RATINGS							LIST PRICE
		DIMENSIONS—INCHES			WEIGHT POUNDS			DROPS OF WATER				FLOW CAPACITY @ 2 P.S.I. IN TONS			
		CUBIC VOLUME	SHELL DIAMETER	OVER-ALL LENGTH		REFRIGERANTS		REFRIG. 12		REFRIG. 22					
						R-12	R-22*	LIQUID LINE TEMP. °F.				R-12	R-22	R-502	
								75°	125°	75°	125°				
V403-¼	¼" M. Flare	3	1¾	4¼	½	⅓	¼	58	21	17	7	1.9	2.4	1.6	$6.90
V405-¼	¼" M. Flare	5	2	4⅝	⅝	½	⅓	87	35	28	12	1.9	2.4	1.6	7.20
V409-¼ V409-⅜	¼" M. Flare ⅜" M. Flare	9	2	5⅝ 6	⅞ 1	1 1	1 1	175	62	50	22	2.1 3.0	2.7 3.9	1.7 2.5	7.50 8.10
V412-¼ V412-⅜	¼" M. Flare ⅜" M. Flare	12	2	6⅝ 7	1⅛ 1¼	2 2	1½ 1½	233	83	67	29	2.0 2.9	2.6 3.7	1.6 2.4	7.60 8.30
V418-¼ V418-⅜ V418-½	¼" M. Flare ⅜" M. Flare ½" M. Flare	18	2	8⅞ 9¼ 9½	1½ 1⅝ 1¾	1½ 2 3	2 2 2	349	124	101	43	1.7 2.6 3.6	2.2 3.4 4.6	1.4 2.1 3.0	8.60 9.20 10.60
V430-⅜ V430-½ V430-⅝	⅜" M. Flare ½" M. Flare ⅝" M. Flare	30	2	13½ 13¾ 14	2⅛ 2¼ 2⅜	2 2 3	2 2 2	582	207	168	72	2.3 2.6 3.0	3.0 3.4 3.7	1.9 2.1 2.5	10.60 12.00 12.80

*Recommended Tonnage Rating based on both Drying and Flow Capacity is shown in table. For Refrigerants 500 and 502 use data shown for Refrigerant 12.

HENRY cartridge refrigerant driers—flanged, angle type

Available in shell sizes, connection sizes and capacities for single and multiple cartridges with a choice of cartridges in drier or "DRI-COR"® filter-drier types

U.S. Patent No. 2,873,856 and 3,064,819



SHELL TYPES AND SIZES

77	2"	O.D. Brass Shell
78	3"	O.D. Brass Shell
79	4¼"	O.D. Brass Shell
75	5"	O.D. Brass Shell

BRASS CONNECTIONS

⅜" Thru ⅝" O.D.S.
⅝" Thru 1⅜" O.D.S.
1⅜" Thru 2⅛" O.D.S.
1⅝" Thru 2⅛" O.D.S.

BRASS SHELL, END CAP AND FITTINGS. DUCTILE IRON OR STEEL FLANGED COVER PLATE STEEL RING AND SPRING. STEEL OR SILICON BRONZE NUTS AND BOLTS.

CAPACITY RANGE

Refrigerant 12; 2 to 100 tons
Refrigerant 22; 2 to 135 tons

350 P.S.I. WORKING PRESSURE. LISTED BY UNDERWRITERS' LABORATORIES, INC. RE-EXAMINATION SERVICE.

FEATURES: CARTRIDGES are completely self-contained, self-positioning and self-sealing for quick and easy installation or replacement. A minimum of time and space are required for cartridge installation in either single or multiple cartridge type Henry driers. They effectively remove moisture, acids, sludge and foreign matter. Cartridges have a perforated metal casing for uniform refrigerant distribution. Transverse flow for low pressure drop.

THOROUGHLY REACTIVATED cartridges are individually packaged in hermetically sealed, moisture proof, key operated metal containers. These hermetic cartridge containers are individually labeled and packed in corrugated cartons for adequate protection against damage in handling before actual use.

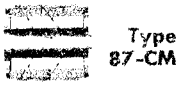
A drier flange gasket is packed with each cartridge for replacement convenience.

TABLE 1. FILTER-DRIER and DRIER CARTRIDGES ®

CARTRIDGE CATALOG NUMBERS	CONSTRUCTION	DRIER DIA. INCHES	VOLUME CUBIC INCHES	A.R.I. CAPACITY RATINGS DROPS OF WATER R-12 (15 PPM) LIQUID LINE TEMP. °F. 75°	125°	R-22 (60 PPM) LIQUID LINE TEMP. °F. 75°	125°	LIST PRICE
872-C	"DRI-COR" FILTER-DRIER CARTRIDGES	2	10	170	121	117	83	$12.90
873-C		3	45	643	458	441	314	23.90
876-C		4¼	109	1560	1110	1069	760	37.90
875-CM		5	50	1192	1139	1038	733	47.80
72-C	DRIER (PA400 SILICA GEL) CARTRIDGES	2	10	194	69	56	24	10.50
73-C		3	45	873	310	252	108	18.00
76-C		4¼	109	2115	752	610	262	26.20

CARTRIDGES NOT INCLUDED IN DRIER SHELLS—ORDER SEPARATELY. CARTRIDGES AND REPLACEABLE CORES ARE NOT INTERCHANGEABLE.

Type 87-C



Type 87-CM

Type 7-C

"DRI-COR" FILTER-DRIER CARTRIDGES

Contain a molded desiccant filter core and a blend of high capacity granular desiccants. Activated Alumina and Molecular Sieves to provide efficient moisture and acid removal together with high capacity filtrating for complete system clean-up.

DRIER CARTRIDGES

Are filled with PA400 Silica Gel for efficient moisture and acid removal and contains a glass wool filter and a dutch weave screen at the outlet.

TABLE 2. SPECIFICATIONS—DRYING AND FLOW CAPACITY IN ACCORDANCE WITH ARI-STANDARD 710-58

Based on using Filter-Drier or Drier Cartridges. *Recommended Tonnage Rating based on both Drying and Flow Capacity is shown in table. For Refrigerants 500 and 502 we suggest the use of data shown for Refrigerant 12.

DRIER SHELL CATALOG NUMBERS	O.D.S. CONN. INCHES	RECOMMENDED TONNAGE BASED ON BOTH DRYING AND FLOW CAPACITY* REFRIGERANTS R-12	R-22	CARTRIDGES FILTER-DRIER OR DRIER QTY.	CAT. NO.	PROGRESSIVE FILTER AREA SURFACE SQ. IN.	CORE SQ. IN.	A.R.I. CAPACITY RATINGS DROPS OF WATER R-12 (15 PPM) LIQUID LINE TEMP. °F. 75°	125°	R-22 (60 PPM) LIQUID LINE TEMP. °F. 75°	125°	SHELL DIMENSIONS—INCHES A	B	C	D**	SHELL LIST PRICE
7712-⅜	¾"	2	2	1	872-C	25	10	170	121	117	83	6¾	2⅛	8¹⅛₆	5⅛	$27.90
7712-⅝	⅝"	3	3		72-C		—	194	69	56	24	6¹³⁄₁₆	2¼	8¾		27.90
7724-½	½"	4	4	2	872-C	50	20	340	242	234	166	11¹³⁄₁₆	2¼	13¾	5⅛	31.10
7724-⅝	⅝"	5	6		72-C		—	384	138	112	48					31.10
7850-⅝	⅝"	10	15	1	873-C	71	34	643	458	441	314	11⅜₆	2⅞	13⅞	9⅛	84.90
7850-⅞	⅞"											11⅞₆		14⅛		84.90
7850-1⅛	1⅛"	20	20		73-C		—	873	310	252	108	11¹¹⁄₁₆	3	14⅜		84.90
7810-⅞	⅞"	25	30	2	873-C	142	68	1286	916	882	628	20¾	2⅞	23⅜	9⅛	97.50
7810-1⅛	1⅛"											21	3	23⅝		97.50
7810-1⅜	1⅜"	30	35		73-C		—	1746	620	504	216	20⁹⁄₁₆	3⅛	23⅜		97.50
7910-1⅜	1¾"	40	50	1	876-C	122	60	1560	1110	1069	760	13¼	4	16⅞	10⅝	131.80
7910-1⅝	1⅝"				76-C		—	2115	752	610	262	13⅜		17		131.80
7920-1⅝	1⅝"	40	50	2	876-C	244	120	3120	2220	2138	1520	23⅞	4	27½	10⅝	157.10
7920-2⅛	2⅛"	50	60		76-C		—	4230	1504	1220	524	24⅞		28½		175.10
7515-1⅝	1⅝"	75	100	3	875-CM	180	135	3576	3417	3114	2199	18⁹⁄₁₆	4⅜	22	5⅛	249.20
7520-2⅛	2⅛"	100	135	4	875-CM	240	180	4768	4556	4152	2932	24¹⁄₁₆		27½		279.90

**Dimension "D" is the minimum space required to remove the cartridge from the drier shell.

HENRY refrigrant filters for liquid or suction line service—sealed and replaceable core types

Micronic Filtration in Depth—Low Pressure Drop. Super Fine Filtering to Provide Maximum System Clean Up Protection Both Before and After Motor Compressor Burn-Outs. Reduced foreign matter in circulation, prolongs system life. Keeps oil and refrigerant clean and sludge free.—No by-passing of refrigerant.

Type 852 Filter

Brass Solder connections.

Molded filter core provides micronic filtration. Is securely located which prevents by-passing of refrigerant.

High Flow Capacity with maximum surface. Particle Retention Size—10 Microns.

Type 853 Filter with Schrader Valve pressure tap. Copper Solder connections.

Molded filter core provides micronic filtration. Convex shaped flow diverter and spacer cap with heat shield protects filter element during brazing operation and permits use of silver solder joints.

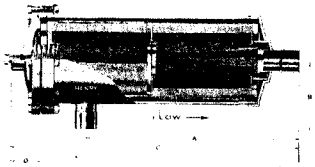
Shells feature capped ¼" Schrader Valve pressure tap to determine operating pressure drop across filter.

Molded filter core is securely located. No by-passing of refrigerant.

High Flow Capacity with maximum surface. Particle Retention Size—10 Microns.

Type V8000 Filter

Interchangeable replaceable Molded filter cores provide micronic filtration. Particle retention size—10 Microns. Corrosion resistant steel shell. Two diameters: 4¾" and 6" Copper Line Connections.



Flange cover plates are tapped ¼" F.P.T. and plugged for field installation of a pressure tap such as a Schrader Valve or other type of connection.

FIL-COR CATALOG NUMBER	FOR SHELL DIA.	CORE LENGTH	CORE WT. LBS.
848-F	4¾"	5½"	½
810-F	6"	6⅞"	¾

FIL-COR

Shown with Spacers and Springs

Ordering Information: The catalog number of the shell does not include the cores which must be ordered separately. All HENRY FIL-CORS are fully reactivated and hermetically sealed in containers, individually packaged and labeled. Core Spacer Plates and Springs are included with V8000 shells. Shells **are individually packaged in corrugated cartons and labeled.**

LISTED BY UNDERWRITERS' LABORATORIES, INC. RE-EXAMINATION SERVICE.

"FIL-COR" FILTERS, STRAIGHT-THRU—SEALED TYPE—Brass Shell—Lacquered Satin Finish

Maximum Temperature Rating 250°F.—350 P.S.I. Maximum Working Pressure

CATALOG NUMBERS	SIZE & TYPE CONNECTION	DIMENSION—INCHES			LIST PRICE
		SIZE SHELL DIA.	FILTER AREA SQ. IN.	OVER-ALL LENGTH	
852A-⅝	⅝" O.D.S.	2	27	8⅜	$19.20
852A-⅞	⅞" O.D.S.			8¹³⁄₁₆	19.90
852A-1⅛	1⅛" O.D.S.			8¹³⁄₁₆	20.80
852-1⅜	1⅜" O.D.S.	3	37	9⅛	36.10
852-1⅝	1⅝" O.D.S.			9¼	36.10
852-2⅛	2⅛" O.D.S.	4¼	61	11	66.80

"FIL-COR" FILTERS, STRAIGHT-THRU—SEALED TYPE—Steel Shell Corrosion Resistant Finish, With Brass Flare or Copper Solder Connections—500 P.S.I. Max. Working Pressure—Max. Temperature Rating 250°F.

CATALOG NUMBERS	SIZE & TYPE CONNECTION	DIMENSION—INCHES			LIST PRICE
		SIZE SHELL DIA.	FILTER AREA SQ. IN.	OVER-ALL LENGTH	
853A-⅝FL	⅝" Flare	2	27	9¹³⁄₁₆	$19.90
853A-⅝	⅝" O.D.S.	2	27	8⅜	19.90
853A-⅞	⅞" O.D.S.			8¾	20.80
853A-1⅛	1⅛" O.D.S.			8⅞	21.70
853-⅞	⅞" O.D.S.	3	37	8¾	29.80
853-1⅛	1⅛" O.D.S.			8¹³⁄₁₆	30.60
853-1⅜	1⅜" O.D.S.			9¹³⁄₁₆	31.60
853-1⅝	1⅝" O.D.S.			9¹³⁄₁₆	32.60
853-2⅛	2⅛" O.D.S.	4¼	61	11¹³⁄₁₆	52.40
853-2⅝	2⅝" O.D.S.	4¾	100	14½	90.30

"FIL-COR" REPLACEABLE CORE TYPE FILTERS—Flanged, Steel Shell—Angle, Copper Solder Connections—500 P.S.I. Max. Working Pressure—Maximum Temperature Rating 250°F.—Patent Pending.

SHELL CATALOG NUMBERS	SIZE O.D.S. CONN.	FIL-COR		FILTER AREA SQ. IN.	DIMENSIONS—INCHES				LIST PRICE
		QTY.	CAT. NO.		A	B	C	D	
V8048-⅝	⅝"	1	848-F	64	5¹³⁄₁₆	3½	10	5⅝	$84.90
V8048-⅞	⅞"				6⅛	3¾	10³⁄₁₆		84.90
V8048-1⅛	1⅛"				6⅜	3¹³⁄₁₆	10¼		86.70
V8048-1⅜	1⅜"				6⅝	3¹³⁄₁₆	10⅜		88.50
V8048-1⅝	1⅝"				6⅞	3¹⁵⁄₁₆	10½		90.30
V8096-⅞	⅞"	2	848-F	128	11¹¹⁄₁₆	3¾	15¾	5⅝	97.50
V8096-1⅛	1⅛"				11¾	3¹³⁄₁₆	15¹³⁄₁₆		99.40
V8096-1⅜	1⅜"				11⅞	3¹⁵⁄₁₆	15¹⁵⁄₁₆		101.00
V8096-1⅝	1⅝"				11¹³⁄₁₆	3¹⁵⁄₁₆	16		102.90
V8096-2⅛	2⅛"				12⅛	4¹⁄₁₆	16⅛		108.30
V8144-1⅛	1⅛"	3	848-F	192	17⅝	3¹³⁄₁₆	21⅜	5⅝	122.80
V8144-1⅜	1⅜"				17⁷⁄₁₆	3¹⁵⁄₁₆	21½		124.60
V8144-1⅝	1⅝"				17½	3¹⁵⁄₁₆	21⁹⁄₁₆		126.40
V8144-2⅛	2⅛"				17⅝	4¹⁄₁₆	21¹¹⁄₁₆		131.80
V8192-1⅜	1⅜"	4	848-F	256	23	3¹⁵⁄₁₆	27¹⁄₁₆	5⅝	140.80
V8192-1⅝	1⅝"				23¹⁄₁₆	3¹⁵⁄₁₆	27⅛		142.70
V8192-2⅛	2⅛"				23⁹⁄₁₆	4¹⁄₁₆	27¼		147.90
V8300-1⅝	1⅝"	3	810-F	294	23⅞	5⅛	28⁹⁄₁₆	6⅝	288.90
V8300-2⅛	2⅛"				24¹⁄₁₆	5⁵⁄₁₆	28¾		297.80
V8300-2⅝	2⅝"				24⅝	5⅞	29⁵⁄₁₆		207.00
V8400-2⅛	2⅛"	4	810-F	392	30½	5⁵⁄₁₆	35³⁄₁₆	6⅝	343.00
V8400-2⅝	2⅝"				31¹⁄₁₆	5⅞	35¾		352.10

"FIL-COR" filter-cores and "DRI-COR" filter-drior cores are interchangeable with those in competitive rod type assemblies. "DRI-COR's" may be used when drying is required. See pages 216 & 217.

HENRY refrigerant suction line filters *(Cont'd.)*

TABLE 1. FLOW CAPACITIES—STRAIGHT-THRU SEALED TYPE 852 OR 853 "FIL-COR" FILTERS

CAPACITIES IN TONS—REFRIGERANT 22						
CATALOG NUMBERS	PRESSURE DROP P.S.I.	SUCTION EVAPORATING TEMPERATURE				
		—40°F	—20°F	0°F	20°F	40°F
853A-⅝FL 852A-⅝ 853A-⅝	0.5	.5	.6	.8	1.0	1.2
	1.0	.7	.9	1.1	1.4	1.7
	2.0	1.0	1.3	1.6	2.0	2.4
	5.0	1.6	2.0	2.5	3.3	3.9
852A-⅞ 853A-⅞	0.5	1.2	1.5	1.9	2.3	2.8
	1.0	1.7	2.2	2.7	3.1	3.9
	2.0	2.5	3.1	3.8	4.6	5.5
	5.0	3.9	4.9	6.0	7.3	8.8
852A-1⅛ 853A-1⅛	0.5	1.4	1.9	2.3	2.9	3.4
	1.0	2.0	2.6	3.3	4.0	4.9
	2.0	2.9	3.7	4.7	5.7	7.0
	5.0	4.6	5.8	7.5	9.0	11.0
853-⅞	0.5	1.5	2.0	2.5	3.0	3.6
	1.0	2.2	2.8	3.5	4.3	5.1
	2.0	3.0	3.9	4.9	6.1	7.3
	5.0	4.8	6.2	7.8	9.5	11.5
853-1⅛	0.5	2.3	2.9	3.6	4.4	5.4
	1.0	3.3	4.1	5.2	6.2	7.6
	2.0	4.6	5.8	7.2	8.8	10.6
	5.0	7.4	9.1	11.4	14.0	17.0
852-1⅜ 853-1⅜	0.5	2.9	3.7	4.6	5.7	6.9
	1.0	4.1	5.3	6.5	8.0	9.7
	2.0	5.8	7.4	9.2	11.4	13.9
	5.0	9.2	11.6	14.5	18.0	22.0
852-1⅝ 853-1⅝	0.5	3.3	4.2	5.2	6.3	7.8
	1.0	4.6	5.8	7.2	8.9	11.0
	2.0	6.5	8.2	10.0	12.5	15.5
	5.0	10.3	13.0	16.0	19.9	24.6
852-2⅛ 853-2⅛	0.5	4.2	5.4	6.4	8.0	9.9
	1.0	5.9	7.4	9.2	11.4	14.0
	2.0	8.4	10.5	13.0	16.1	20.0
	5.0	13.3	16.5	20.5	25.5	33.0
853-2⅝	0.5	6.6	8.4	10.4	13.0	15.5
	1.0	9.3	11.8	14.5	17.7	21.5
	2.0	13.0	16.6	20.5	25.0	31.0
	5.0	20.5	26.5	32.3	39.3	48.0

TABLE 2. FLOW CAPACITIES—REPLACEABLE CORE TYPE V8000 "FIL-COR" FILTERS OR "DRI-COR" FILTER-DRIERS

CAPACITIES IN TONS—REFRIGERANT 22						
V8000 SHELL CONNECTION SIZES	PRESSURE DROP P.S.I.	SUCTION EVAPORATING TEMPERATURE				
		—40°F	—20°F	0°F	20°F	40°F
-⅝	0.5	.6	.8	1.0	1.3	1.5
	1.0	.9	1.1	1.4	1.8	2.1
	2.0	1.3	1.6	2.0	2.5	3.0
	5.0	2.0	2.5	3.3	4.0	4.7
-⅞	0.5	1.4	1.8	2.2	2.6	3.3
	1.0	2.0	2.5	3.1	3.7	4.7
	2.0	2.7	3.5	4.4	5.2	6.5
	5.0	4.3	5.5	7.0	8.2	10.3
-1⅛	0.5	2.1	2.7	3.4	4.2	5.1
	1.0	3.0	3.8	4.8	5.9	7.2
	2.0	4.2	5.4	6.8	7.1	10.2
	5.0	6.7	8.3	10.8	13.1	16.1
-1⅜	0.5	2.9	3.8	4.7	5.8	7.1
	1.0	4.1	5.3	6.7	8.3	10.0
	2.0	5.8	7.6	9.5	11.7	14.3
	5.0	9.0	12.0	14.9	18.8	22.5
-1⅝	0.5	3.7	4.8	6.1	7.6	9.1
	1.0	5.2	6.9	8.6	10.7	12.9
	2.0	7.4	9.7	12.1	15.2	18.3
	5.0	11.6	15.3	19.3	23.9	28.7
-2⅛	0.5	5.2	6.7	8.3	11.0	12.3
	1.0	7.4	9.5	11.7	15.7	17.4
	2.0	10.5	13.4	16.5	22.0	24.5
	5.0	16.5	21.0	26.2	35.0	39.0
-2⅝	0.5	8.1	10.4	12.9	17.2	19.5
	1.0	11.4	14.8	18.3	24.4	27.7
	2.0	16.3	21.2	26.0	34.5	39.5
	5.0	26.0	33.4	41.0	55.0	62.5

FOR REFRIGERANT 12
Multiply the tonnage capacities shown by 0.7

FOR REFRIGERANTS 500 & 502
Multiply the tonnage capacities shown by 0.8

HENRY "DRI-COR"® sealed type refrigerant filter-driers

U.S. Patent No. 2,873,856

suction line service

TABLE 3. FLOW CAPACITIES—STRAIGHT-THRU—SEALED TYPE V800

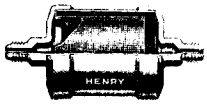
SUCTION SERVICE FILTER-DRIER—SELECTION								CAPACITIES IN TONS—REFRIGERANT 22					
CATALOG NUMBERS		SIZE CONN.	*CORE FILTER AREA SQ. IN.	DIMENSIONS—INCHES			WT. LBS.	PRESSURE DROP P.S.I.	SUCTION EVAPORATING TEMPERATURE				
				SHELL DIA.	OVER-ALL LENGTH								
FLARE	O.D. SOLDER				FLARE	O.D.S.			—40°F	—20°F	0°F	20°F	40°F
V830-⅝	V830-⅝S	⅝"	40	2½	10¼	9¼	3	0.5	.4	.5	.6	.8	.9
								1.0	.6	.7	.9	1.1	1.3
								2.0	.8	1.0	1.3	1.5	1.9
								5.0	1.3	1.6	2.0	2.4	2.9
—	V830-⅞S	⅞"	40	2½	—	9⅝	3	0.5	.6	.7	.9	1.1	1.3
								1.0	.8	1.0	1.3	1.6	1.9
								2.0	1.1	1.5	1.8	2.2	2.7
								5.0	1.8	2.3	2.9	3.5	4.2
V841-⅝	V841-⅝S	⅝"	50.2	3	10⅜	9⅜	4¼	0.5	.4	.5	.6	.8	.9
								1.0	.6	.7	.9	1.1	1.3
								2.0	.8	1.0	1.3	1.5	1.9
								5.0	1.3	1.6	2.0	2.4	2.9
—	V841-⅞S	⅞"	50.2	3	—	9 15/16	4¼	0.5	.6	.7	.9	1.1	1.3
								1.0	.8	1.0	1.3	1.6	1.9
								2.0	1.1	1.5	1.8	2.2	2.7
								5.0	1.8	2.3	2.9	3.5	4.2
—	V875-⅞S	⅞"	5	3½	—	15 7/16	8	0.5	.6	.7	.9	1.1	1.3
								1.0	.8	1.0	1.3	1.6	1.9
								2.0	1.1	1.5	1.8	2.2	2.7
								5.0	1.8	2.3	2.9	3.5	4.2

*Actual Filter Area of a Henry DRI-COR Filter-Drier is much greater than the core filter-area, since the granules of the surrounding desiccant bed provide additional filter area resulting in progressive filtration. NOTE: For Refrigerant 12, Refrigerant 500 and Refrigerant 502, use data above table.

For Type V800 construction details, see Page 218.

HENRY strainers remove foreign matter from liquid or gas lines

FEATURES OF CONSTRUCTION: All joints brazed—exceptionally large screen area to insure maximum capacity and long service before cleaning. Screens securely anchored to provide a tight seal preventing by-passing of refrigerant. Larger screen cylinders reinforced with 10 mesh brass screen.



Types 891B and 892B Strainers

Male flare or Solder connections.

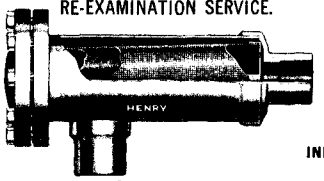
Polished Brass 2" diameter shells and brass end connections. Monel screen. 350 p.s.i. working pressure.

Type 891B-S Strainer

Solder connections.

See Screen Data Table

ALL TYPES SHOWN LISTED BY UNDERWRITERS' LABORATORIES, INC. RE-EXAMINATION SERVICE.

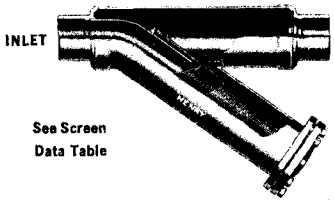


See Screen Data Table

INLET

Type 866 Strainer Solder connections

Monel replaceable screen cartridge—Reinforced (except 10 sq. in.) with 10 mesh brass screen. Brass shell, forged brass end caps with integral end connections. Screen cartridges are securely located by means of spring tension, preventing by-passing of refrigerant. 350 p.s.i. maximum working pressure.



See Screen Data Table

Type 895 Strainer Solder connections.

Monel replaceable screen cartridge—Reinforced (except 10 sq. in.) with 10 mesh brass screen. Steel shell (corrosion resistant finish). Straight-line connections. Forged brass end caps with integral end connections. Screen cartridges are securely located by means of spring tension, preventing by-passing of refrigerant. 350 p.s.i. maximum working pressure.

HENRY STRAINER SCREEN DATA		
SCREEN MESH	PARTICLE RETENTION SIZE	OPEN AREA
100	.006 inches	30.3%
80	.007 inches	31.4%
60	.009 inches	30.5%
50	.011 inches	30.3%

Type 896-PT Strainer

Female pipe thread connections.

Forged brass with integral end connections. Monel replaceable screen. Gasketed, screw clean-out plug. 1 3/64" Diameter mounting hole, all types.

See Screen Data Table

Type 896-S Strainer

Solder connections.

STRAINERS, STRAIGHT-THRU TYPE—Non-Cleanable—Brass Shell

CATALOG NUMBERS	SIZE CONNECTIONS	SCREEN DATA		OVER-ALL LENGTH INCHES	LIST PRICE
		MESH SIZE	AREA SQ. IN.		
891B-1/4	1/4" Flare	100	11	4 11/16	$10.20
891B-3/8	3/8" Flare	100	11	5 1/16	10.80
892B-3/8	3/8" Flare	100	21	7	12.40
891B-3/8S	3/8" O.D.S.	100	11	4 1/2	11.70
891B-1/2S	1/2" O.D.S.	100	11	4 5/8	12.60
891B-5/8S	5/8" O.D.S.	100	11	4 5/8	13.60
891B-7/8S	7/8" O.D.S.	100	11	4 7/8	14.50
891B-1 1/8S	1 1/8" O.D.S.	100	11	4 7/8	15.30

STRAINERS, ANGLE TYPE—Flanged Cleanout—Solder Connections

CATALOG NUMBERS	SIZE O.D.S. CONN.	SCREEN DATA			DIMENSIONS—INCHES			LIST PRICE
		MESH SIZE	AREA SQ. IN.	LGTH. IN.*	FACE OF INLET TO CENTER OF OUTLET	CENTER TO OUTLET FACE	OVER-ALL LENGTH	
866A-3/8	3/8"	80	10	2 3/4	2 3/8	2 1/8	4 3/8	$26.20
866A-1/2	1/2"	80	10	2 3/4	2 7/16	2 1/4	4 7/16	26.20
866A-5/8	5/8"	80	10	2 3/4	2 7/16	2 1/4	4 7/16	26.20
866A-7/8	7/8"	80	10	2 3/4	2 9/16	2 3/8	4 9/16	29.00
866-3/8	3/8"	80	23	5 1/2	4 7/8	2 1/8	7 3/16	29.80
866-1/2	1/2"	80	23	5 1/2	4 13/16	2 1/4	7 1/4	29.80
866-5/8	5/8"	80	23	5 1/2	4 13/16	2 1/4	7 1/4	29.80
866-3/4	3/4"	80	23	5 1/2	4 7/8	2 3/8	7 3/16	32.50
866-7/8	7/8"	80	23	5 1/2	5 1/16	2 3/8	7 3/8	32.50
866-1 1/8	1 1/8"	80	23	5 1/2	5 1/16	2 1/2	7 3/8	36.10
866-1 3/8	1 3/8"	60	36	5 1/2	6 3/8	3 3/16	9 3/8	60.50
866-1 5/8	1 5/8"	60	36	5 1/2	6 3/8	3 3/16	9 3/8	60.50
866-2 1/8	2 1/8"	60	64	9 3/8	8 5/8	3 1/2	11 15/16	88.50

*Dimension is the minimum space required to remove the cartridge from the shell.

STRAINERS, "Y" TYPE—Flanged Cleanout—Solder Connections

CATALOG NUMBERS	SIZE CONNECTIONS	SCREEN DATA		OVER-ALL LENGTH INCHES	LIST PRICE
		MESH SIZE	AREA SQ. IN.		
895A-5/8	5/8" O.D.S.	80	10	6 1/4	$45.90
895A-7/8	7/8" O.D.S.	80	10	6 1/2	49.70
895-5/8	5/8" O.D.S.	80	23	7 3/8	50.60
895-3/4	3/4" O.D.S.	80	23	7 3/4	54.10
895-7/8	7/8" O.D.S.	80	23	8 1/8	54.10
895-1 1/8	1 1/8" O.D.S.	80	23	8 1/8	56.90
895-1 3/8	1 3/8" O.D.S.	60	36	10 1/8	70.40
895-1 5/8	1 5/8" O.D.S.	60	36	10 1/8	70.40
895-2 1/8	2 1/8" O.D.S.	60	64	12 3/16	103.00
895-2 5/8	2 5/8" O.D.S.	60	86	13 5/16	153.50

STRAINERS, "Y" TYPE—FORGED BRASS—Cleanable

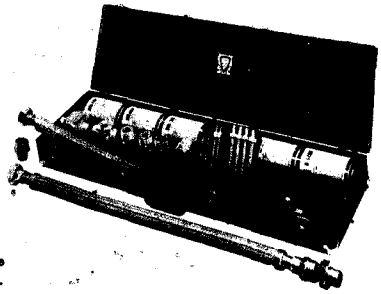
Recommended for air, light oil, gas, water, brine, steam and refrigerants (excluding Ammonia). Service pressure 250 p.s.i. at 350° F. or 500 p.s.i. cold working pressure.

CATALOG NUMBERS	SIZE CONNECTIONS	SCREEN DATA		OVER-ALL LENGTH INCHES	LIST PRICE
		MESH SIZE	AREA SQ. IN.		
896-1/4PT	1/4" F.P.T.	80	2	2 3/16	$6.70
896-3/8PT	3/8" F.P.T.	80	2	2 3/16	6.70
896A-3/8PT	3/8" F.P.T.	80	3	2 1/4	10.00
896A-1/2PT	1/2" F.P.T.	80	3	2 1/4	10.90
896B-3/4PT	3/4" F.P.T.	80	7	3 1/16	20.80
896C-1PT	1" F.P.T.	60	11	3 1/16	29.00
896A-3/8S	3/8" O.D.S.	80	3	3 3/16	13.60
896A-1/2S	1/2" O.D.S.	80	3	3 3/8	13.60
896A-5/8S	5/8" O.D.S.	80	3	3 1/2	13.60
896B-7/8S	7/8" O.D.S.	80	7	4 1/16	26.20
896C-1 1/8S	1 1/8" O.D.S.	60	11	4 13/16	34.40

HENRY "UNI-COR" System Cleaner

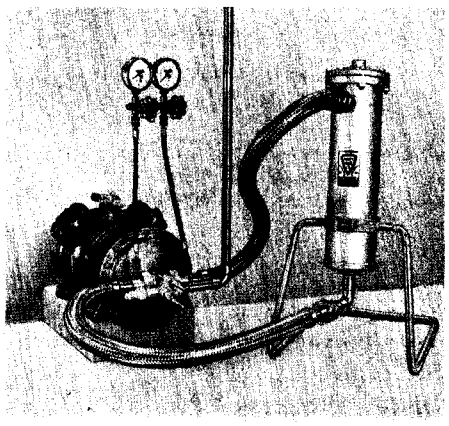
The UNIVERSAL Replaceable CORE Suction Line Filter-Drier Method For Compressor **Protection Before** and System **Clean-up After** a Refrigerant Motor Compressor Burnout. Its use **before** start-up provides essential protection for longer system service life. The major causes of hermetic motor compressor burnouts are moisture and other foreign contaminants. These must be completely removed so that high temperatures and pressure, in the presence of moisture, won't create hydrofluoric and hydrochloric acids.

UC 8000 "UNI-COR" KIT COMPLETE Includes Case, Diverter Blocks, Coupling Kits, Hose Assemblies, Bolts, Nuts and Gaskets.



(Does not include Filter-Drier Shell, Cores or Stand which must be ordered separately. See Page 15).

CATALOG NUMBER	UC 8000 KIT CONTENTS DESCRIPTION	QTY.	LIST PRICE
UC8005	Carrying Case	1	$66.30
UC8110	Oval Diverter Block Kit	1	17.80
UC8120	Oval Diverter Block Kit	1	33.70
UC8130	Square Diverter Block Kit	1	33.70
UC8210	Diverter Coupling Kits	1	28.60
UC8220	Diverter Coupling Kits	1	28.60
UC8230	Diverter Coupling Kits	1	13.80
UC8310	Hose Assembly F.X.F.	1	105.10
UC8320	Hose Assembly F.X.M.	1	105.10
PP106-1	90° Elbow 1⅜" O.D.S.	1	3.10
UC8000	Kit Complete	1	435.80
UC8007	Tubular Steel Stand	1	22.40



"UNI-COR" Uses DRI-COR® and FIL-COR® Replaceable Cores in V8000 Type Shell mounted in Tubular Steel Metal Stand for 4¾" O.D. Shell.

WHAT DOES IT DO? HOW DOES IT WORK?

The Henry "UNI-COR" is a simple inexpensive device when compared to the cost of a precision manufactured compressor. Its basic function is to divert the flow of refrigerant gas from the suction line immediately ahead of the motor compressor to and through a filter-drier; then back to the system and motor compressor. Three parts accomplish this:

(1) A diverter block or fitting for diverting the flow of the refrigerant suction gas. (2) Flexible hoses carrying the refrigerant gas to and from the Filter-Drier. (3) A Henry Type V8000 Replaceable Core—flanged access, angle, filter-drier shell with proper cores to filter and dry the refrigerant gas.

Caution: Since excessive pressure drop in the filter-drier will reduce system efficiency and can damage the replacement motor compressor requiring refrigerant vapor for cooling it is extremely important to know when to change cores. Maximum recommended pressure drops are shown in Table No. 1.

The Henry flexible hoses come factory equipped with union nut connectors for ease of installation, as well as with a convenient Schrader pressure tap built into each hose assembly. Pressure drop across the filter-drier can be easily determined by use of proper gauges and a Henry Charging and Testing Manifold connected directly to the pressure taps.

TABLE NO. 1. MAXIMUM RECOMMENDED PRESSURE DROP DURING CLEAN-UP—psi

REFRIGERANT	AIR CONDITIONING	COMMERCIAL	LOW TEMP.
12 and 500	8	6	2
22 and 502	14	9	3

HOW TO SELECT PROPER FILTER-DRIER SHELL

See data below for "UNI-COR" System Cleaner. Information in Table No. 2 is based on pressure drop through the V8000 Type Replaceable Core Shell (with clean DRI-COR's) equal to approximately 10% of the maximum pressure drop recommended in Table No. 1.

TABLE NO. 2.

SHELL NOs. WITH DRI-COR'S	REFRIGERANTS 12 AND 500 TONS EVAPORATOR TEMP. 40° F.	0° F.	—40° F.	DISPLACEMENT—CFH EVAPORATOR TEMP. 40° F.	0° F.	—40° F.	REFRIGERANTS 22 AND 502 TONS EVAPORATOR TEMP. 40° F.	0° F.	—40° F.	DISPLACEMENT—CFH EVAPORATOR TEMP. 40° F.	0° F.	—40° F.
V8048-1⅜	5	3	1¼	1000	1300	1500	10	5	2	1300	1400	1500
V8096-1⅜	5	3	1¼	1000	1300	1500	10	5	3	1300	1400	2200
V8144-1⅜	5	3	1¼	1000	1300	1500	10	7½	3	1300	2100	2200
V8192-1⅜	5	3	1¼	1000	1300	1500	10	7½	3	1300	2100	2200

CFH—Cubic Feet Per Hour
Shells Furnished without cores.
For Drying & Filtering use 848-C DRI-COR.
For Filtering only use 848-F FIL-COR.

Any one of the four V8000 Type Replaceable Core Shells shown above (1⅜" O.D. Solder Connection Sizes) may be coupled **directly** to the "UNI-COR" System Cleaner hose assemblies. V8000 Shells with connections other than 1⅜ require reducing bushings and nipples not furnished with the UC-8000 kit. See Pages 220 or 223 for other V8000 shell connection sizes.

PENN

R&E LTD.

PENN WATER REGULATING VALVES

SERIES 246 AND 247 PRESSURE ACTUATED WATER REGULATING VALVES

Penn pressure actuated water regulating valves are modulating type valves. They are designed for various applications and are suitable for either open or hermetic refrigeration units.

Series 246 direct acting valves OPEN on pressure increase. They are designed primarily for regulation of water cooled refrigeration condensers.

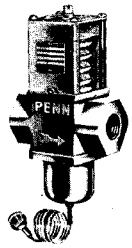
Series 247 reverse acting valves CLOSE on pressure increase. May be used for by-pass service. A range of 40 to 100 psig is available for heat pump application.

Sizes ⅜" through 1½" are provided in all-range construction for *R-12, R-22, R-500 or R-502* service. Sizes 2" and 2½" are available for either R-12 or R-22 service. Valves are also available for ammonia service. Valves supplied for Navy and Maritime applications have naval bronze bodies equipped with monel interior metal parts.

Maximum permissible water supply pressure is 150 psig.

TO ORDER: Specify (1) Type Number only (2) Companion flange kit if required.

Type No.	Pipe Size	Inlet and Outlet	Service	Opening Point Adjustment Range—psig	Head Pressure Connector *	List
COMMERCIAL TYPE — NON-CORROSIVE REFRIGERANTS						
246P03AR	⅜" NPT	Threaded	All-Range	70 to 260	Style 13	33.08
246P04AR	½" NPT	Threaded	All-Range	70 to 260	Style 13	38.16
246P06AR	¾" NPT	Threaded	All-Range	70 to 260	Style 13	47.06
246P08AR	1" NPT	Threaded	All-Range	70 to 260	Style 13	94.94
246P10AR	1¼" NPT	Threaded	All-Range	70 to 260	Style 13	101.56
246P12FAR	1½"	4 Hole ASME Flange	All-Range	70 to 260	Style 13	159.10
246P16F	2"	4 Hole ASME Flange	R-12, R-500	70 to 170	Style 5	211.82
246P1622F	2"	4 Hole ASME Flange	R-22, R-502	160 to 260	Style 5	211.82
246P20F	2½"	4 Hole ASME Flange	R-12, R-500	70 to 170	Style 5	322.96
246P2022F	2½"	4 Hole ASME Flange	R-22, R-502	160 to 260	Style 5	322.96
COMMERCIAL TYPE — AMMONIA						
246P03NH	⅜" NPT	Threaded	Ammonia	100 to 200	Style 15	79.54
246P04NH	½" NPT	Threaded	Ammonia	100 to 200	Style 15	87.06
246P06NH	¾" NPT	Threaded	Ammonia	100 to 200	Style 15	150.38
246P08NH	1" NPT	Threaded	Ammonia	100 to 200	Style 15	159.16
246P10NH	1¼" NPT	Threaded	Ammonia	100 to 200	Style 15	188.76
246P12FNH	1½"	4 Hole ASME Flange	Ammonia	100 to 200	Style 15	241.48
246P16FNH	2"	4 Hole ASME Flange	Ammonia	100 to 200	Style 15	352.64



SERIES 246
Threaded Type
Style 13 Connection

SERIES 246
Threaded Type (For Ammonia)
Style 15 Connection

SERIES 3246 THREE-WAY WATER REGULATING VALVE FOR NON-CORROSIVE REFRIGERANTS

Series 3246 are designed specifically for condensing units cooled either by atmospheric or forced draft cooling towers. They are used on single or multiple condenser hook-ups to the tower to provide the most economical and efficient use of the tower. Water supply pressure to 150 lbs.

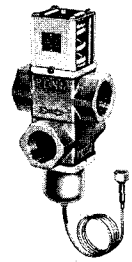
Refrig.	Factory Settings	
	Opening Press. Port 1 to Port 2	Closing Press. Port 1 to Port 3
R-12	95 psig	130 psig
R-22	165 psig	215 psig

TO ORDER: Specify Type Number only.

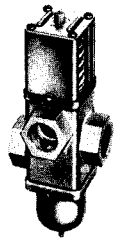
Type No.	Pipe Size	Inlet and Outlet	Service	Range Opening Point of Normally Closed Side	Head Pressure Connector *	List
3246P04	½" NPT	Threaded	R-12	85 to 110	Style 13	72.80
3246P0422	½" NPT	Threaded	R-22	145 to 190	Style 13	72.80
3246P06	¾" NPT	Threaded	R-12	85 to 110	Style 13	93.24
3246P0622	¾" NPT	Threaded	R-22	145 to 190	Style 13	93.24
3246P08	1" NPT	Threaded	R-12	85 to 110	Style 13	165.54
3246P0822	1" NPT	Threaded	R-22	145 to 190	Style 13	165.54
3246P10	1¼" NPT	Threaded	R-12	85 to 110	Style 13	177.56
3246P1022	1¼" NPT	Threaded	R-22	145 to 190	Style 13	177.56
3246P12	1½" NPT	Threaded	R-12	85 to 110	Style 5	242.10
3246P1222	1½" NPT	Threaded	R-22	145 to 190	Style 5	242.10

Maximum permissible bellows pressure for R-12 is 230 psig and for R-22 is 320 psig.

★ **Non-Stock Item. Must be Built to Order.**



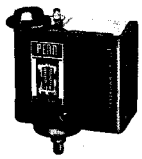
SERIES 3246
Sizes ½"
through 1¼"



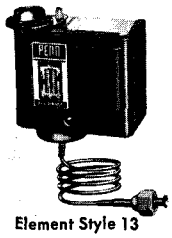
SERIES 3246
Size 1½"

PENN PRESSURE CONTROLS

SINGLE POLE LOW PRESSURE



Element Style 5



Element Style 13

Element Style 15

"ALL RANGE" FOR R-12, R-22, R-500, R-502

Catalog Number	Switch Action	Range * (psig)	Differential (psi)	Pressure Connector	Limited Knob Adjustment	Electrical Rating 120 V. A.C. (See page R-4)	List
P70AB-1	SPST Close High Open Low	20" Vac. to 100	Min. 6 to Max. 70	¼" Male Flared Conn. Style 5	Cutout	20.0 A. Table 1	27.24
P70AB-2	SPST Close High Open Low	20" Vac. to 100	Min. 6 to Max. 70	36" Capillary with ¼" Flare Nut, Style 13	Cutout	20.0 A. Table 1	28.78
P70CA-1	SPST Open High Close Low	20" Vac. to 100	Min. 6 to Max. 70	36" Capillary with ¼" Flare Nut, Style 13	None	20.0 A. Table 1	30.58

CAUTION:
These controls are "not for water service." Use Penn Series 470P, 154, 160, 161 or 162 for water service applications.
Adjusting knob supplied on differential (cutout setting) to limit adjustments to 5 psi above or below normal setting.

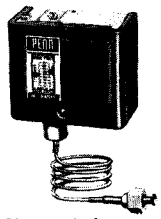
FOR AMMONIA

P70AA-5	SPST Close High Open Low	20" Vac. to 100	Min. 6 to Max. 70	¼" Female NPT Style 15	None	20.0 A. Table 1	59.16
P70CA-4	SPST Open High Close Low	20" Vac. to 100	Min. 6 to Max. 70	¼" Female NPT Style 15	None	20.0 A. Table 1	61.76

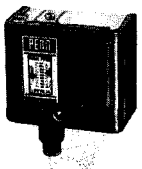
CAUTION:
These controls are "not for water service." Use Penn Series 470P, 154, 160, 161 or 162 for water service applications.

SINGLE POLE HIGH PRESSURE

Element Style 5



Element Style 13



Element Style 15

Catalog Number	Switch Action	Range * (psig)	Differential (psi)	Pressure Connector	Limited Knob Adjustment	Electrical Rating 120 V. A.C. (See page R-4)	List

CONDENSER FAN

P70AA-2	SPST Close High Open Low	0 to 150	Min. 12 to Max. 40	36" Capillary with ¼" Flare Nut, Style 13	None	20.0 A. Table 1	28.12

"ALL RANGE" FOR R-12, R-22, R-500, R-502

P70AA-3	SPST Close High Open Low	100 to 300	Min. 25 to Max. 75	36" Capillary with ¼" Flare Nut, Style 13	None	20.0 A. Table 1	28.12
P70AA-6	SPST Close High Open Low	50 to 450	Min. 50 to Max. 150	36" Capillary with ¼" Flare Nut, Style 13	None	20.0 A. Table 1	28.12
P70CA-2	SPST Open High Close Low	50 to 450	Min. 50 to Max. 150	¼" Male Flared Conn. Style 5	None	20.0 A. Table 1	29.00
P70CA-3	SPST Open High Close Low	50 to 450	Min. 50 to Max. 150	36" Capillary with ¼" Flare Nut, Style 13	None	20.0 A. Table 1	30.58
P70DA-1	SPST Open High Close Low	50 to 450	Lockout (Requires Manual Reset)	36" Capillary with ¼" Flare Nut, Style 13	None	20.0 A. Table 1	33.00

Maximum overrun pressure for Code P70AA-2 is 325 psig, P70AA-3 is 425 psig and P70AA-6 is 475 psig.

FOR AMMONIA

P70AA-4	SPST Close High Open Low	50 to 240	Min. 20 to Max. 100	¼" Female NPT Conn., Style 15	None	20.0 A. Table 1	59.16
P70CA-5	SPST Open High Close Low	50 to 450	Min. 50 to Max. 150	¼" Female NPT Conn., Style 15	None	20.0 A. Table 1	61.76
P70DA-2	SPST Open High Close Low	50 to 450	Lockout (Requires Manual Reset)	¼" Female NPT Conn., Style 15	None	20.0 A. Table 1	64.34

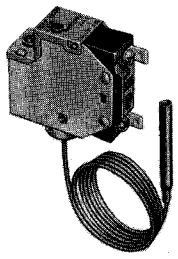
* Metric Scales: May be supplied in — 1 to 7; 4 to 32 or 7.5 to 30 Kg/cm² ranges.

TO ORDER: Specify Catalog Number only.

Refer to Pages R-2, R-3 for Cross Reference Chart of old Catalog Code Numbers with the new Catalog Numbers.

SERIES 210 AIR CONDITIONING LIMIT (Field Replacement)

Single Pole, Single Throw Contacts



Element Style 34

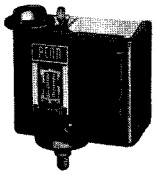
FOR R-12 OR R-22

Code No.	Type No.	Range of Cutout	Differential (factory set)	Pressure Connector	Contact Action		Approx. lbs. Shipping Wt.
					Opens	Closes	
10P1	210AP50	10 to 75 psig	25 psig	Style 34 36" capillary ¼" Sweat Section	40 psig	65 psig	.8
10P5	210AP60	220 to 425 psig	70 psig	Style 34 36" capillary ¼" Sweat Section	400 psig	330 psig	.8
10P7	210AP60AN	220 to 425 psig	Lockout (Requires Manual Reset)	Style 34 36" capillary ¼" Sweat Section	400 psig	Locks out (manual reset)	.8

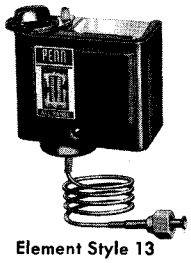
All models are shipped with Arkles connectors, thirty-six inches of capillary with flare extension and without flare nuts. No brackets are furnished but screws are provided for mounting. Screwdriver adjustment is provided.

SERIES 270 LOW PRESSURE

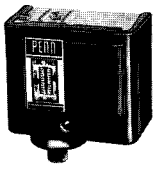
Single Pole, Single Throw Contacts
Mounting Bracket Regularly Supplied



Element Style 5



Element Style 13



Element Style 15

"ALL RANGE" FOR R-12, R-22, R-500, R-502

Code No.	Type No.	Electrical Rating	Range*	Differential	Pressure Connector	Limited Knob Adjustment	Contact Action	Approx. lbs. Shipping Wt.
4P4A	270AP10AC	Table 1, Page R-7	20" Vac. to 100 lbs.	Min. 6 lbs. to Max. 70 lbs.	¼" Male Flared Conn. Style 5	Cutout	Close High Open Low	2.3
4P5A	270AP10AC	Table 1, Page R-7	20" Vac. to 100 lbs.	Min. 6 lbs. to Max. 70 lbs.	36" Capillary with ¼" Flare Nut, Style 13	Cutout	Close High Open Low	2.4
4P6A	270AP20	Table 1, Page R-7	20" Vac. to 100 lbs.	Min. 6 lbs. to Max. 70 lbs.	36" Capillary with ¼" Flare Nut, Style 13	None	Open High Close Low	2.3

Adjusting Knob Supplied on Differential (Cutout Setting) to Limit Adjustments to 3½ lbs. above or below Normal Setting

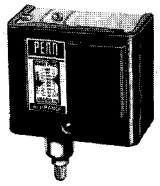
FOR AMMONIA

4P15A	270AP10NA	Table 1, Page R-7	20" Vac. to 100 lbs.	Min. 6 lbs. to Max. 70 lbs.	¼" Female N.P.T. Style 15	None	Close High Open Low	2.4
4P17A	270AP20NA	Table 1, Page R-7	20" Vac. to 100 lbs.	Min. 6 lbs. to Max. 70 lbs.	¼" Female N.P.T. Style 15	None	Open High Close Low	2.4

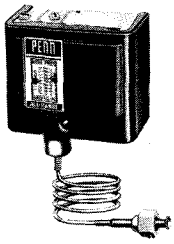
*Metric Scales: May be supplied in −1 to 7; 4 to 32 or 7.5 to 30 Kg/cm² ranges.

Controls listed on this page should be ordered by Code Number only.

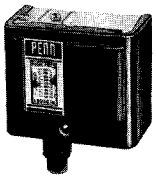
SERIES 270 HIGH PRESSURE



Element Style 5



Element Style 13



Element Style 15

"ALL RANGE" FOR R-12, R-22, R-500, R-502

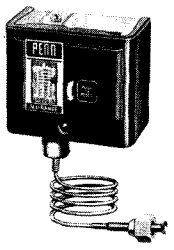
Code No.	Type No.	Electrical Rating	Range*	Differential	Pressure Connector	Limited Knob Adjustment	Contact Action	Approx. lbs. Shipping Wt.
4P9B	270AP10	Table 1, Page R-7	100 lbs. to 300 lbs.	Min. 25 lbs. to Max. 75 lbs.	36" Capillary with ¼" Flare Nut, Style 13	None	Close High Open Low	2.3
4P10A	270AP20	Table 1 Page R-7	50 lbs. to 450 lbs.	Min. 50 lbs. to Max. 150 lbs.	¼" Male Flared Conn. Style 5	None	Open High Close Low	2.3
4P11A	270AP20	Table 1, Page R-7	50 lbs. to 450 lbs.	Min. 50 lbs. to Max. 150 lbs.	36" Capillary with ¼" Flare Nut, Style 13	None	Open High Close Low	2.4
4P14A	270AP20AN	Table 1, Page R-7	50 lbs. to 450 lbs.	Lockout (Requires Manual Reset)	36" Capillary with ¼" Flare Nut, Style 13	None	Open High Close Low	2.4

FOR AMMONIA

4P16A	270AP20NA	Table 1, Page R-7	50 lbs. to 450 lbs.	Min. 50 lbs. to Max. 150 lbs	¼" Female N.P.T. Conn., Style 15	None	Open High Close Low	2.4
4P18A	270AP20NB	Table 1, Page R-7	50 lbs. to 450 lbs.	Lockout (Requires Manual Reset)	¼" Female N.P.T. Conn., Style 15	None	Open High Close Low	2.4
4P19	270AP10NA	Table 1, Page R-7	50 lbs. to 240 lbs.	Min. 20 lbs. to Max. 100 lbs.	¼" Female N.P.T. Conn., Style 15	None	Close High Open Low	2.4

SERIES 270 HIGH PRESSURE CUTOUT WITH ALARM CIRCUIT

{ Main Contacts Open High Simultaneously the Secondary Contacts Close High



Element Style 13

"ALL RANGE" FOR R-12, R-22, R-500, R-502

Code No.	Type No.	Range*	Differential	Pressure Connector	Contact Action	Approx. lbs. Shipping Wt.
2P11A	270MP20AN	Min. 50 lbs. to Max. 450 lbs.	Lockout (Requires Manual Reset after Cutout)	36" Copper Capillary Tube with ¼" Flare Nut, Style 13	L1-M1 Close High L2-M2 Open High	2.5

The Type 270MP20AN incorporates a four-wire block with one set of contacts opening on rising pressure to shut down the compressor. Simultaneously, the other set of contacts closes to sound an alarm or light a signal light. This control locks out under high pressure conditions and must be manually reset before restarting.

ELECTRICAL RATING

Motor Rating Amps. A.C.	L2-M2		L1-M1	
	115 V.	230 V.	115 V.	230 V.
Full Load	13.0	6.5	4.6	2.3
Locked Rotor	78.0	39.0	27.6	13.8
Non-inductive	13.0	6.5	11.0	5.5
Pilot Duty	125 VA.-115/230 V. A.C. 57.5 VA.-115/230 V. D.C.		125 VA.-115/230 V. A.C. 40 VA.-115/230 V. D.C.	

*Metric Scales: May be supplied in —1 to 7; 4 to 32 or 7.5 to 30 Kg/cm² ranges.

Controls listed on this page should be ordered by Code Number only.

ALCO SOLENOID VALVES

Installation

INSTALLATION INSTRUCTIONS

Alco Solenoid Valves, with the exception of the Type DS2228, are designed to operate in a vertical position and therefore must be installed in a horizontal line. Alco Solenoid Valves can be installed in rooms which are held at normal air temperatures as well as on frosted pipes in cold rooms. For applications in extremely high ambient temperatures, special high temperature Solenoid Coils must be used.

An adequate strainer should be installed ahead of each Solenoid Valve to keep litharge, thread sealing compound, solder, and other foreign matter out of the valve. On some installations, particularly on large multiple and flooded systems, where pump down is difficult or impossible, it is advisable to install full opening, hand-operated globe valves ahead of and beyond each Solenoid Valve and strainer assembly. This will facilitate cleaning of the strainer and servicing of the control valve without pumping down the system. When closing these hand valves, liquid refrigerant should not be trapped to fill the space between the valves. With an increase in temperature, the liquid would expand and create pressures which could cause serious damage. During normal operation, the hand valves should always be fully opened.

When installing a Solenoid Valve, be sure the arrow on the valve body points in the direction of refrigerant flow. When threading a pipe into a valve do not apply pressure either by hand or by wrench against the coil housing or enclosing tube. Instead, apply a wrench on flats provided on valve body for this purpose. *Do not apply excessive wrench torque.*

SOLDER WARNING

When installing valves with solder connections, the coil and housing assembly must be removed before soldering line connections. Replace all parts (including coil sleeves) in proper order. Check tightness of the gasket joints after soldering.

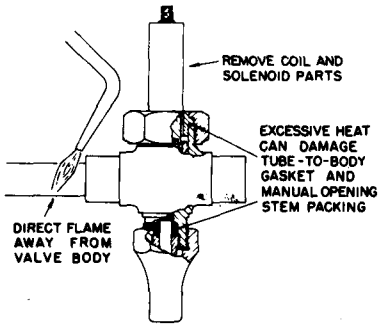


Figure 22

ELECTRICAL WIRING INSTRUCTIONS

When connecting a Solenoid Valve to the electrical system, make sure that the voltage marked on the nameplate and the coil is the same as the system voltage.

Never wire a Solenoid Valve directly on the load side of a motor so that the valve would be energized at the same time the motor is drawing its starting current. This double-load condition could produce sufficiently high voltage drop to cause failure of the valve to open. If the Solenoid Valve must be wired on the load side of a motor starter, a time delay relay must be used to delay the energizing of the Solenoid Valve coil until the voltage has been restored to its full value.

In circuits employing low voltage currents (up to and including 24 volts), the use of solder to join the connecting wires is preferred to the usual method of joining the wires by twisting them together.

A surge suppressor is furnished with all valves to be used on direct current of 50 volts and over and should be wired across the coil leads as shown in Fig. 23. This surge suppressor prevents damage to the coil by the high voltage discharge which is created when the electrical circuit is broken.

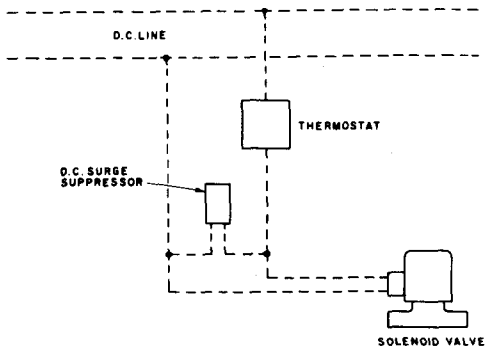


Figure 23—Wiring Diagram for DC Surge Suppressor

At the point where the electrical wiring passes from a warm room through the wall of a refrigerated room, the use of a sealed electrical fitting is recommended to prevent breathing, condensation, and accumulation of water in the conduit line inside of the cold room. Electrical conduit lines containing water or ice are potential sources of trouble. A breather pipe should be installed in the wall to allow free opening and closing of the service door without creating a pressure through the conduit line.

Figures 24 and 25 illustrate wiring diagrams for multiple systems where individual room temperatures are controlled by thermostats in conjunction with Solenoid Valves. When all refrigeration loads are satisfied and all the Solenoid Valves are closed, the thermostats will automatically shut off the compressor motor. In such a system, three-wire controls must be used. This can be accomplished by the use of either double-pole, single-throw thermostats or three-wire, single-throw thermostats. If a single-pole, single-throw thermostat is used, it must be combined with a double-pole, single-throw relay.

The coil circuit of each Solenoid Valve should be protected by adequate fuses. Table 10, Page 4 lists current ratings for the various type valves.

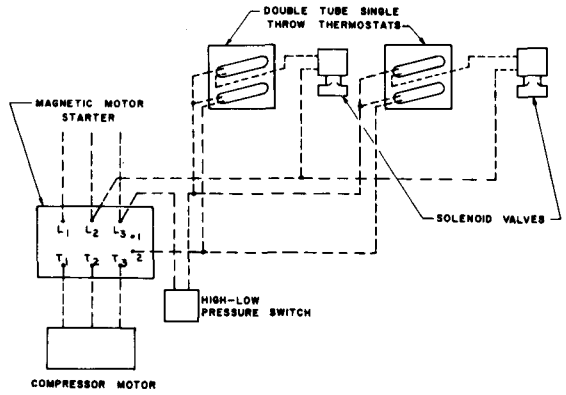


Figure 24—Wiring Diagram for Individual Unit Temperature Control in a Multiple System, using Solenoid Valves and Double Pole Thermostats

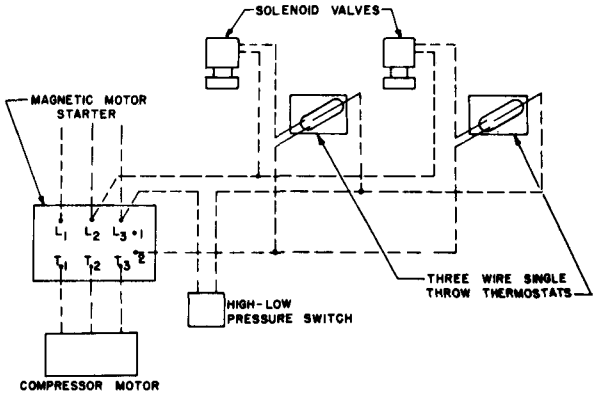


Figure 25—Wiring Diagram for Individual Unit Temperature Control in a Multiple System, using Solenoid Valves and Three-Wire Thermostats

A Strainer of adequate capacity is urgently recommended for installation directly ahead of each Solenoid Valve, regardless of any master strainer that may exist elsewhere in the system. The recommended strainer is shown in the physical data tables for each valve type.

SERVICE INSTRUCTIONS

General Service Hints

Should a Solenoid Valve fail to function properly, the following service hints indicate some of the probable causes of failure as well as suggestions for correcting them.

A. Solenoid Valve fails to open

1. *Solenoid Valve assembled incorrectly.* Check the location of the coil sleeves, coil plate, spacer (S1 Series and S608-1 valves only), and the coil support spring ("M" and "R" Series valves only). Each part must be positioned correctly if the valve is to function properly.
2. *System operating pressures too high.* Check the actual pressure differential across the valve against the nameplate MOPD rating. If the actual pressure differential exceeds the nameplate rating, a valve with a higher MOPD rating must be used.
3. *Valve body or internal parts warped due to excessive brazing temperatures or excessive torque.* Replace damaged valve or component parts as required.
4. *Dirt or sludge causing the valve to stick.* Dismantle the valve and completely clean the interior and component parts. Install an Alco Dri-Kleaner of proper capacity to prevent foreign material from reaching the valve.
5. *Low voltage.* The voltage applied to the Solenoid coil must be at least 85% of the rated nameplate voltage. If the voltage is found to be lower, the cause of the voltage drop must be determined and corrected. Common causes of voltage drops are undersized supply lines, other loads connected in series with the Solenoid coil, loose connections, and faulty control switches.
6. *Coil burnout.* Excessive voltage is the most common cause of Solenoid coil burnout. Solenoid coils cannot be subjected to a voltage greater than 10% above the rated nameplate voltage. Prolonged exposure to excessive ambient temperature can also cause coil burnout. If the valve cannot be relocated to a space at a more reasonable temperature, the use of a special high temperature coil is advisable.

B. Solenoid Valve fails to close

1. *Valve body or internal parts warped due to excessive brazing temperatures or excessive torque.* Replace damaged valve or component parts as required.
2. *Dirt or sludge causing the valve to stick.* Dismantle the valve and completely clean the interior and component parts. Install an Alco Dri-Kleaner of proper capacity to prevent foreign material from reaching the valve.
3. *Electrical circuit closed because of faulty switch or relay contacts.* Repair or replace the faulty control.
4. *Congealed oil causing valve to stick.* Refrigerant oil should be of the proper type for the temperature range of the system. This is particularly true of low-temperature applications. Clean interior of valve thoroughly. Change to oil of proper viscosity at system operating temperature.

C. Solenoid Valve noise

A partially open Solenoid Valve is apt to develop a mechanical chatter which may be amplified to an objectionable level by the system piping. This type of noise can be caused by low voltage, excessive pressure differential, or foreign material, causing the valve to "hang" in a partially open position. The noise can usually be eliminated by removing the cause of the sticking.

A Solenoid Valve with a loose or mis-assembled coil and housing can exhibit an electrical hum. This type of noise is corrected by either tightening the coil housing nut securely, or by reassembling the valve parts in their proper order.

SERVICE INSTRUCTIONS

Hermetically Sealed Construction

3-Way Valves: Types S608-1 and DS2355

The mechanical portion of hermetically sealed valves cannot be field serviced. If mechanical failure of the valve is suspected, it should be replaced with a similar valve and the inoperative one returned to the factory for inspection and replacement.

The coil assembly can be replaced in the field in the following manner:

Type S608-1: Break the connection to the inlet at the top of the valve. Remove the locknut from the inlet connection and lift off the nameplates, coil housing, coil sleeves, coil, and coil plate. When reassembling with a new coil, the coil sleeves must be replaced in their proper locations. See Table 12.

Type DS2355: Remove the housing nut. Lift off the nameplates, coil housing, coil sleeves, coil, and coil plate. When reassembling with a new coil, the coil sleeves must be replaced in their proper location. See Table 12.

2-Way Valves: S101 and S1 Series and Type DS2228

The coil assembly on these valves can be replaced in the field in the following manner:

Remove the coil housing nut. Then lift off the nameplates, coil housing, coil sleeves, coil, and coil plate. When reassembling with a new coil, the two coil sleeves must be replaced in their proper positions. See Table 12.

"Come-apart" Construction

S1M Series and S3 Series

The above valve types can be readily opened for inspection and cleaning without removing the valve from the line. This is accomplished by disassembling the valve in the following manner:

Remove the coil housing nut. Lift off the nameplates, coil housing, coil sleeves, coil, and coil plate. Loosen and remove the union nut, enclosing tube assembly, and the body gasket. The stainless steel plunger and stem assembly (S1M series), or the plunger and stem assembly and piston (S3 series) are then available for inspection and cleaning. Use extremely fine emery or crocus cloth to remove any scale or rust deposit. The valve interior and the removable parts must be thoroughly cleaned before reassembling. When reassembling with a new coil, the coil sleeves must be replaced in their proper locations. See Table 12. When reassembling the valve, replace the body gasket with a new one. Be sure that all parts are assembled in their proper sequence and all nuts carefully tightened.

If external leakage is observed at the tube-to-body gasket joint, further tightening of the union nut may stop it. However, if the union nut proves to be tight, replace the body gasket and carefully tighten the union nut. Excessive tightening of the union nut will deform the body bore, resulting in mechanical damage and binding of the piston. This will prevent opening and closing of the valve.

M and R Series

The M and R Solenoid Valves can be readily opened for inspection and cleaning without removing the valve from the line. This is accomplished by disassembling the valve in the following manner:

M Series: Remove the coil housing nut. Lift off the nameplates, coil housing, coil sleeves, coil, coil support spring, and coil plate. Loosen and remove the two cap screws, enclosing tube assembly, and body gasket on M3 type valves. On M6 type valves, loosen and remove the union nut, enclosing tube assembly, and body gasket. The stainless steel plunger and stem assembly and piston are then available for inspection and cleaning.

R Series: Remove the coil housing nut; then lift off the nameplates, coil housing, coil, coil plate, and coil support spring. Loosen and remove the four cap screws, bonnet, enclosing tube assembly, and body gasket on Types R2 and R6. On types R1 and R3 valves, loosen and remove the two cap screws, enclosing tube assembly, and the body gasket. The stainless steel plunger and stem assembly and piston are then available for inspection and cleaning.

When reassembling the valve, replace all gaskets with new ones. Be sure that all parts are assembled in their proper sequence and all screws and nuts carefully tightened. The coil sleeves on the M Series valves must be replaced in their proper locations. See Table 12.

If external leakage is observed at the gasketed joints, further tightening of the cap screws or union nut may stop it. However, if the gasket joint proves to be tight, replace the gasket and carefully tighten the cap screws or union nut. Uneven tightening of the cap screws or excessive tightening of the union nut may deform the body bore, resulting in mechanical damage and binding of the piston. This will prevent opening and closing of the Solenoid Valve.

Table 12

VALVE TYPE	ELECTRICAL SERVICE	COIL SLEEVE LENGTH	
		UPPER COIL SLEEVE	LOWER COIL SLEEVE
S608-1	AC	11/32"	1/2"
	DC		
DS2355	AC	11/32"	11/32"
DS2228	AC	11/32"	11/32"
S1, S101 & S1M Series	AC	1/2"	11/32"
	DC	1/2"	1/2"
S3 Series	AC	1/2"	1/2"
	DC		
M Series	AC	7/8"	1/2"
	DC		
R Series	AC	Not Required	
	DC		
905 Series	AC	1/2"	11/32"
	DC	1/2"	1/2"

Table 10
ELECTRICAL DATA* FOR ALCO SOLENOID VALVES

ELECTRICAL SERVICE		2-WAY VALVES											3-WAY VALVES						
		VALVE SERIES											VALVE SERIES						
		"S"					"M"			"R"			S608-1			DS2355			
		AMPERES		WATTS			AMPERES		Watts	AMPERES		Watts	AMPERES		Watts	AMPERES		Watts
Volts	Cycles	Inrush	Holding	S1	S3	DS2228	Inrush	Holding		Inrush	Holding		Inrush	Holding		Inrush	Holding	
24	60	4.2	1.2	12	11	—	7.5	1.4	17	14.0	2.6	25	4.2	1.2	9	—	—	—
115	25	.8	.18	12	11	—	1.5	.30	17	3.0	.4	25	.8	.18	9	—	—	—
115	50	.9	.3	12	11	12	1.7	.35	17	3.9	.55	25	.9	.3	9	.43	.22	12
115	60	.9	.3	12	11	12	1.7	.35	17	3.9	.55	25	.9	.3	9	.43	.22	12
115	76	1.0	.4	12	11	—	2.0	.4	17	4.0	.6	25	1.0	.4	9	—	—	—
208	25	.4	.095	12	11	—	.7	.18	17	1.5	.2	25	.4	.095	9	—	—	—
208	50	.5	.15	12	11	12	.9	.18	17	2.0	.3	25	.5	.15	9	.21	.13	12
208	60	.5	.15	12	11	12	.9	.18	17	2.0	.3	25	.5	.15	9	.21	.13	12
230	25	.4	.095	12	11	—	.7	.14	17	1.5	.2	25	.4	.095	9	—	—	—
230	50	.5	.15	12	11	12	.9	.18	17	1.9	.28	25	.5	.15	9	.20	.12	12
230	60	.5	.15	12	11	12	.9	.18	17	1.9	.28	25	.5	.15	9	.20	.12	12
208/230	50	—	—	—	—	12	—	—	—	—	—	—	—	—	—	.20	.12	12
208/230	60	—	—	—	—	12	—	—	—	—	—	—	—	—	—	.20	.12	—
460	25	.2	.05	12	11	—	.35	.07	17	.75	.1	25	.2	.05	9			
460	50	.3	.08	12	11	—	.5	.1	17	1.0	.15	25	.3	.08	9			
460	60	.3	.08	12	11	—	.5	.1	17	1.0	.15	25	.3	.08	9			
6	DC**	3.9	3.9	24	24	—	4.5	4.5	27	5.0	5.0	30	3.9	3.9	24			
12	DC**	1.92	1.92	24	24	—	2.3	2.3	27	2.5	2.5	30	1.92	1.92	24			
24	DC**	.98	.98	24	24	—	1.15	1.15	27	1.25	1.25	30	.98	.98	24			
32	DC**	.76	.76	24	24	—	.9	.9	27	.94	.94	30	.76	.76	24			
64	DC**	.37	.37	24	24	—	.45	.45	27	.47	.47	30	.37	.37	24			
115	DC**	.14	.14	16	16	—	.23	.23	27	.26	.26	30	.14	.14	16			
230	DC**	.08	.08	16	16	—	.11	.11	27	.13	.13	30	.08	.08	16			

*These are nominal values. For other ratings and special valves, consult the Alco Engineering Department.
**These readings are for cold coils. Hot coil values are approximately 75% of these values.

CONSTRUCTION FEATURES AND DESIGN DETAILS

All Alco Solenoid valves incorporate the finest corrosion resistant materials available. Brass, bronze, and stainless steel are used extensively in the construction of these valves. Table 11, lists the main construction materials of the standard Alco Solenoid valves.

Table 11
MATERIALS OF CONSTRUCTION

VALVE TYPE	BODY	SEAT MATERIAL		
		Main Port	Piston	Stem
S608-1	Stainless Steel	Stainless Steel	—	Synthetic
DS2355	Brass	Monel	—	Chrome Alloy Steel
DS2228		Brass	Stainless Steel	Stainless Steel
"S1" Series		Stainless Steel	—	
"S34" Series			Stainless Steel	
S36-1 F.P.T. Conn.	Bronze	Bronze		
S36-1 O.D.F. Conn.				
"S37" Series				
S310-1				
"M6" Series				
"M3" Series				
"RI" Series	Meehanite	Meehanite		
"R3" Series	Bronze	Bronze		
"R6" Series*	Meehanite	Meehanite	Ni-Resist	
"R2" Series*				

*Types R22, R2H, R62, and R6H valves use stainless steel pistons. The balance of the R2 and R6 Series valves use the material shown in Table

series 3246

3-WAY WATER REGULATING VALVES FOR COOLING TOWER SYSTEMS

APPLICATION

Series 3246 3-way pressure actuated water regulating valves are designed specifically for condensing units cooled either by atmospheric or forced draft cooling towers. They may be used on single, or multiple condenser hook-ups to the tower to provide the most economical and efficient use of the tower.

Low refrigerant head pressure, which may be the result of low tower water temperature, causes the cooling ability of the refrigeration system to fall off rapidly. The Series 3246 valve senses the compressor head pressure and allows cooling water to flow to the condenser, to by-pass the condenser, or, to allow water flow to both condenser and by-pass line in order to maintain correct refrigerant head pressures. With the correct valve size (see Selection of Valve Size) and adequate pump capacity, the 3-way valve will maintain refrigerant condensing temperatures between 90° F. and 105° F. with cooling tower water temperatures of 85° F. to 40° F.

The 3-way valve permits water flow to the tower through the by-pass line, even though the condenser doesn't require cooling. This provides an adequate head of water at the tower at all times so the tower can operate efficiently with a minimum of maintenance on nozzles and wetting surfaces.

GENERAL DESCRIPTION

Series 3246 valves are supplied in ½", ¾", 1", 1¼" and 1½" sizes for R-12 or R-22 as specified. Range spring and sliding parts are not immersed in water where they would be subject to sedimentation and corrosion. Only three parts, made of corrosion resistant aluminum bronze, come in contact with the water . . . valve disc holder, valve seat and extension sleeve.

These outstanding features assure you of the best valve possible for your equipment:

1. No close fitting sliding parts in water passes.
2. Range spring does not come in contact with the cooling water.
3. Easy manual flushing, if required.
4. Valves will not chatter.
5. Free movement of all parts insures accurate pressure modulation.

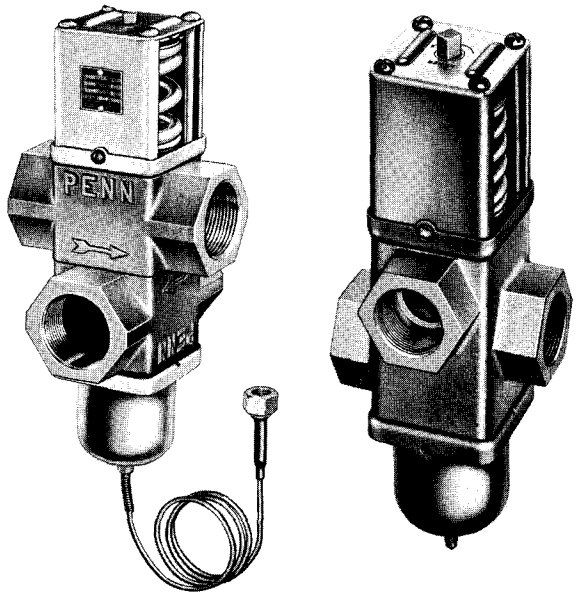


Fig. 1 — (Left) 3-Way Valve sizes ½" through 1¼". (Right) 3-Way Valve size 1½".

6. Adjustment not affected by water pressure variations.
7. Withstands high hydraulic shock without damage.
8. Reduces problems of water distribution on multiple unit applications.

TYPE NUMBER SELECTION

Valve Size N. P. T.	Refrigerant	
	R-12	R-22
½"	3246P04	3246P0422
¾"	3246PO6	3246P0622
1"	3246PO8	3246P0822
1¼"	3246P10	3246P1022
1½"	3246P12	3246P1222

PRESSURE RANGE SPECIFICATIONS

Refrigerant	Pressure Range (Opening Point of Normally Closed Side)	Maximum Permissible Pressure
R-12	85 to 110 psig	320 psig
R-22	145 to 190 psig	320 psig

OPTIONAL CONSTRUCTIONS

Capillary Tubing Length: Standard length 30". Optional 48" capillary furnished at additional cost, when specified.

Pressure Connections: Style 13, 30" copper capillary with ¼" flare nut supplied as standard.

Disc Holder, Valve Seat and Extension Sleeve: Supplied in aluminum bronze.

MISCELLANEOUS SPECIFICATIONS

Identification: Regulators for R-12 have black nameplates. Regulators for R-22 have green nameplates. All nameplates indicate type, model, range, setting and serial.

Valve Body: ½" and ¾" sizes supplied in cast brass. 1" and 1¼" sizes supplied in cast iron with corrosion resisting finish. 1½" size has a one-piece cast iron body with corrosion resisting finish.

Power Element: Brass bellows in brass cup.

Manual Flushing: Valves may be manually flushed by lifting range spring follower with screwdrivers at two sides of lower spring cap. This does not affect valve adjustment.

Adjustment: With standard service valve wrench. Adjustment can be made to raise or lower settings. Both condenser and by-pass settings are changed by an equal amount.

FACTORY SETTINGS

Refrigerant	Opening Pressure Port 1 to Port 2* (To Condenser)	Closing Pressure Port 1 to Port 3* (To by-pass)
R-12	95 psig	130 psig
R-22	165 psig	215 psig

*See Fig. 2 for Port arrangements.

Water Supply Pressure: 150 psig maximum.

Packaging: All valves individually packed.

SHIPPING WEIGHTS

Size	Individually Packed	Overpack of 10 Units per Carton
½"	5 lbs.	52 lbs.
¾"	6½ lbs.	67 lbs.
1"	12 lbs.	122 lbs.
1¼"	16 lbs.	162 lbs.
1½"	25 lbs.	—

ORDERING INFORMATION

Specify:

1. Type and Model Number, if known.
2. If Model Number is not known, specify Type 3246, refrigerant, and size valve required. See "Selection of Valve Size" for instructions on selection.

REPAIRS AND REPLACEMENT

Series 3246 valves may be repaired in the field, or return to the factory for repairs and exchange. Repair parts are shown below:

SELECTION OF VALVE SIZE

Refer to Flow Chart for selection of water valves. Carefully follow the steps as outlined below.

1. Determine the maximum water flow required through the condenser.
   a. Check condenser manufacturer's recommendations for water flow or use recommended condenser water temperature rise in following calculation.

$$\text{gallons/min/ton} = \frac{30}{(\text{water outlet temp.} - \text{water inlet temp.})}$$

   b. The normal flow through a condenser used with a cooling tower is 3 gallons/min/ton.
   c. Total flow (gallons/min) = tons of refrigeration x gallons/min/ton.
2. Draw horizontal line across upper half of Flow Chart through flow required as determined by 1-C above.
3. Determine refrigerant head pressure rise above valve opening point. It is considered good practice in most applications to maintain a condensing temperature between 90° F. and 105° F. This corresponds to a pressure range of 100 to 130 psig on R-12 and 170 to 215 psig on R-22. In general, therefore, the refrigerant head pressure rise above the opening point should be 30 psig with R-12 and 45 psig with R-22. Some manufacturers recommend a slightly higher head pressure range.
4. Note that there are two vertical pressure scales in the lower half of the Flow Chart; one for R-12 and one for R-22. Draw a horizontal line across lower half of Flow Chart through the value determined in 3 above. Be sure to use correct scale.

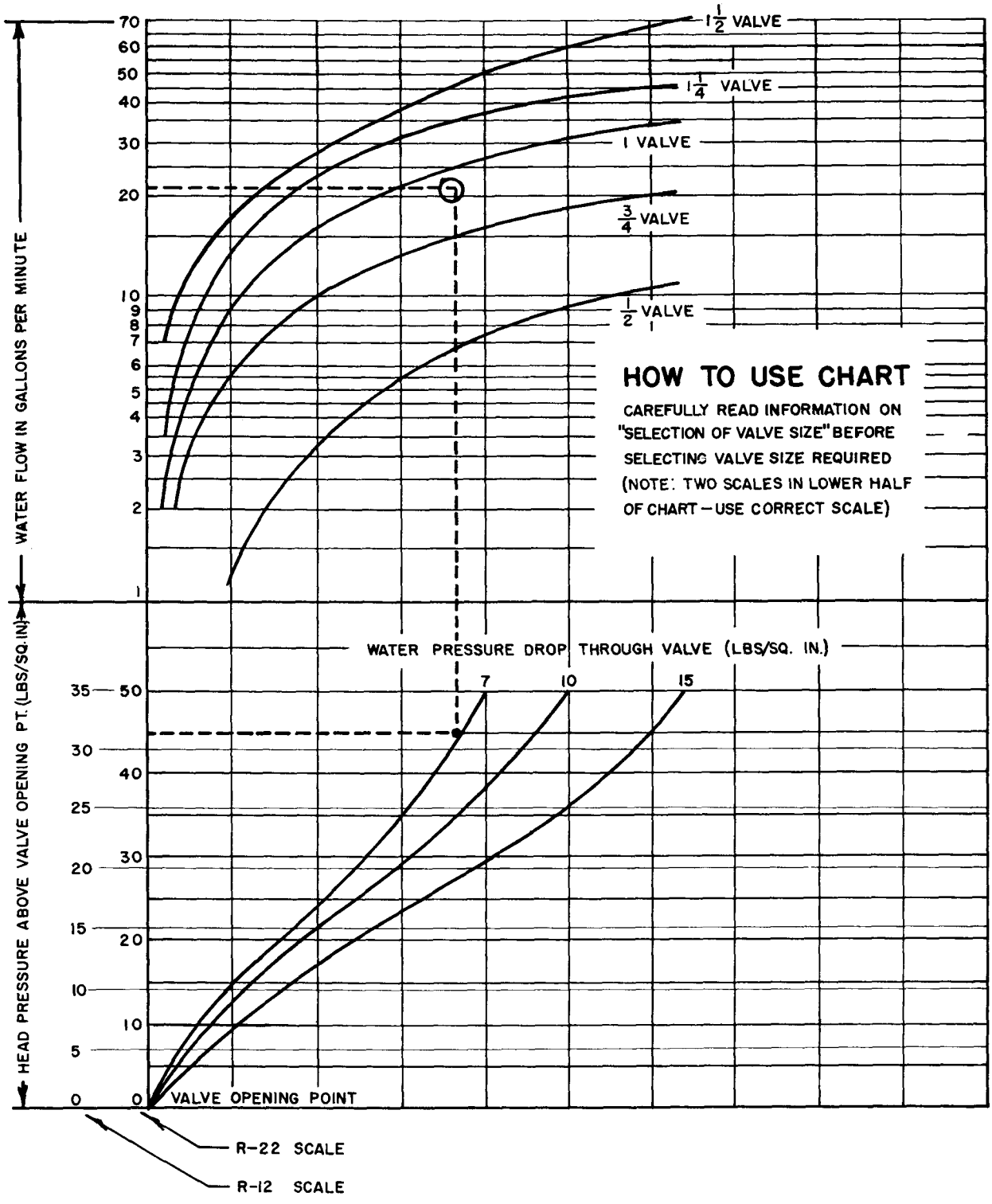
REPAIR PARTS

Type	Bellows	Valve Seat	Valve Disc	Disc Retainer	Extension Sleeve	Diaphragm Kit and Diaphragm (both req'd)
3246P04, 3246P0422	246-824R	246-82	246-92	246-520	246-519	246-731, 246-523
3246P06, 3246P0622	246-825R	246-66	246-65	246-526	246-527	246-732, 246-528
3246P08, 3246P0822	246-925	246-282	246-262	246-536	246-537	246-733, 246-538
3246P10, 3246P1022	246-925	246-7	246-5	246-531	246-530	246-733, 246-529
3246P12	246-671	STT10-1	DSC10-1	—	SPA12-1	Kit 11A-600
3246P1222	246-758	STT10-1	DSC10-1	—	SPA12-1	Kit 11A-600

5. Determine allowable water pressure drop through valve. The pumping head should include the pressure drop through the valve (7 psig = 16 ft., 10 psig = 23 ft., 15 psig = 35 ft.).
6. On the lower half of curve, mark point on horizontal head pressure line where it intersects the allowable water pressure drop curve.
7. From this point draw line vertically upward until it intersects water flow line in upper half of Flow Chart.
8. If intersection falls on a valve size, this is the size.
9. If intersection falls between two curves, the required valve size is the larger of the two.

(See Page 4 for example.)

FLOW CHART
R-12 AND R-22 REFRIGERANTS



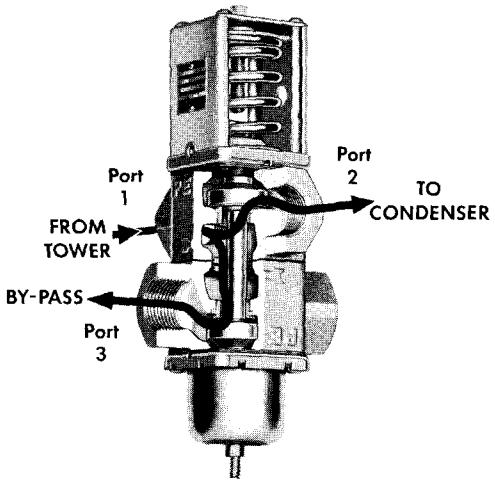


Fig. 2 — Cut-away section of Series 3246 sizes ½" through 1¼" illustrating water flow.

EXAMPLE:

1. The required flow for an R-22 system is found to be 21 gpm. It is desirable to operate at a condensing temperature between 90° F. and 105° F. Head pressure will be between 170 and 215 psig. Allowable water pressure drop is 7 psig.
2. Draw line through 21 gpm — see dotted line, upper half of Flow Chart.
3. Draw line through head pressure rise of 45 psig — see dotted line, lower half of Flow Chart.
4. At intersection of lower horizontal line and pressure drop of 7 psig, draw a vertical line upward from this point to flow line — circle on Flow Chart marks this intersection.
5. This intersection falls between curves for ¾" and 1" valves. A 1" valve is required.

NOTE: If a head pressure rise above the valve opening point is chosen at less than 45 psig for R-22 or less than 30 psig for R-12, the condenser by-pass will be partly open when the desired maximum flow is obtained through the condenser. In these cases, the pump flow required should be taken from the following table:

REQUIRED PUMP FLOW IN GPM

Pressure Drop, psig	Valve Size				
	½"	¾"	1"	1¼"	1½"
7	8	20	27.5	38	53
10	10	23	32.5	46	64
15	12.5	28	39	56	78

INSTALLATION

1. Install 3-way water valve as shown in Fig. 3. Port No. 1 is for connection from the tower, port No. 2 is for connection to condenser inlet, and port No. 3 is the by-pass connection.
2. With tower pump operating and compressors shut down, manually flush each valve by lifting the range spring follower with screwdrivers at two sides of the lower spring cap. This does not affect valve adjustment.
3. When used on a single condenser system, the square head cock in the by-pass should be adjusted with the compressor shut down and the tower pump operating. Adjust cock so that amount of water through by-pass is just sufficient to provide minimum recommended nozzle pressure.
4. On a multiple condenser system, the square head cocks in the by-passes should be adjusted evenly with the compressors shut down and the tower pump operating. The total flow through all the by-passes should be just sufficient to provide the minimum recommended nozzle pressure.
5. The R-22 valves are factory set to start flow to the condenser at 165 psig and be fully open at 215 psig. The R-12 valves are factory set to start flow to the condenser at 95 psig and be fully open at 130 psig. The opening point may be increased or decreased by turning the adjustment screw counterclockwise or clockwise, respectively. Any increase or decrease in the opening point will result in a like increase or decrease in the pressure at which the valve is fully open to the condenser.

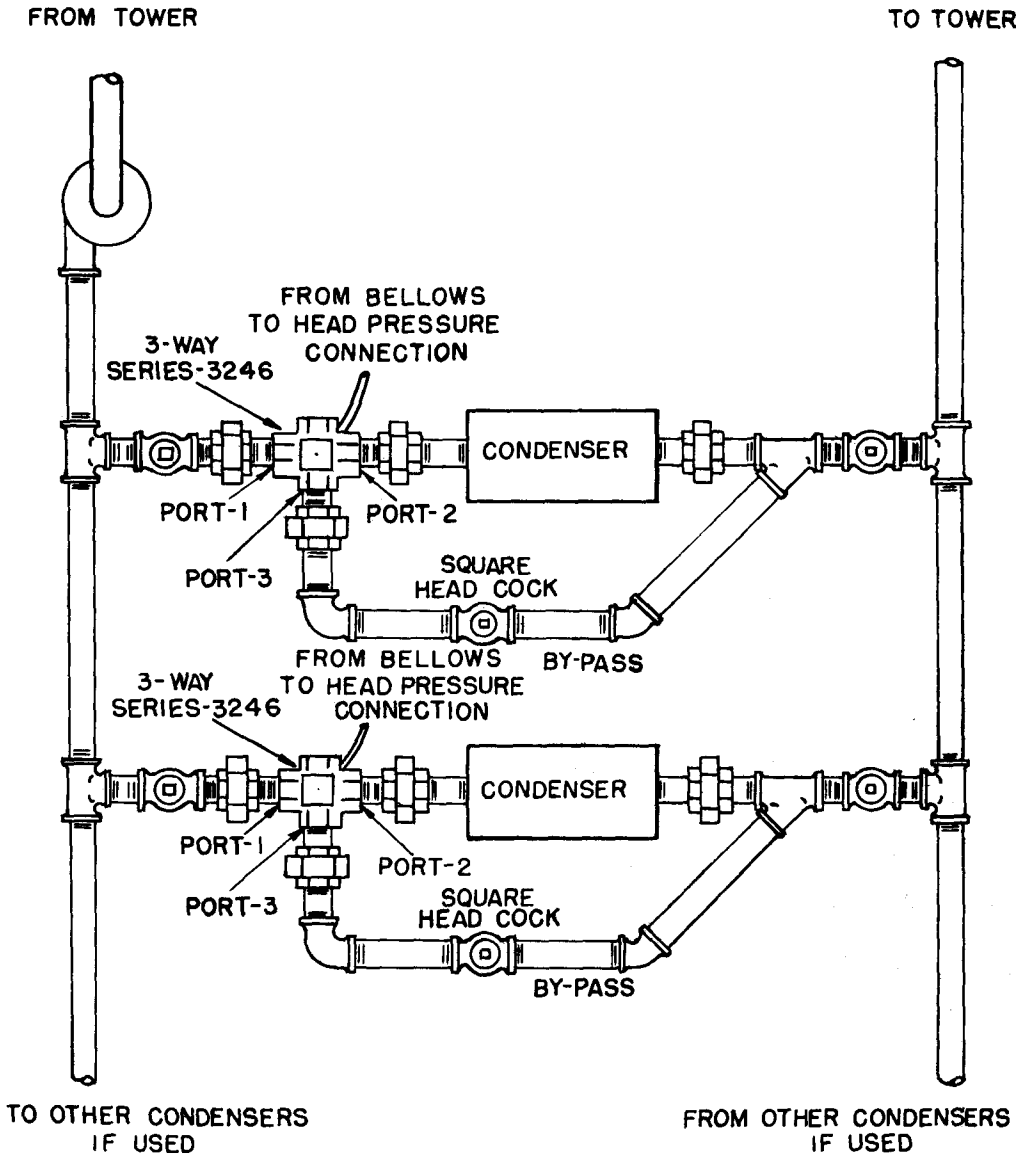
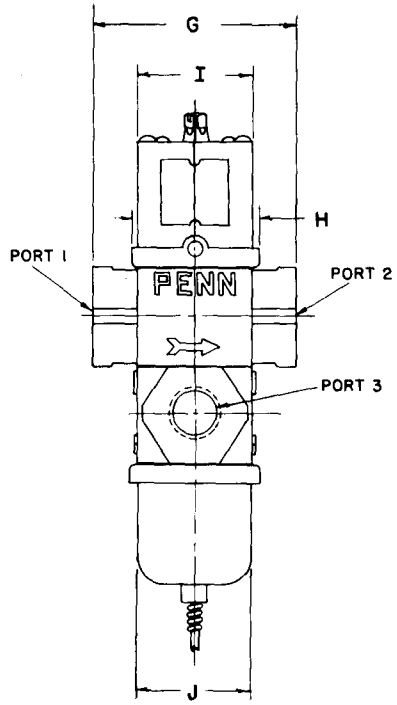
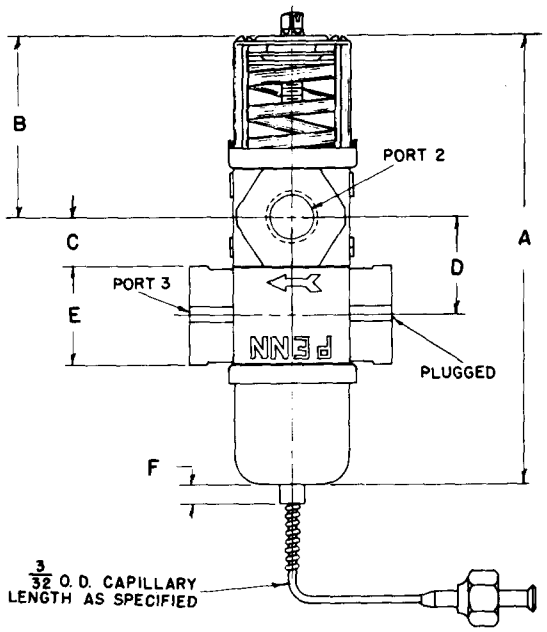


Fig. 3 — Recommended piping arrangement.

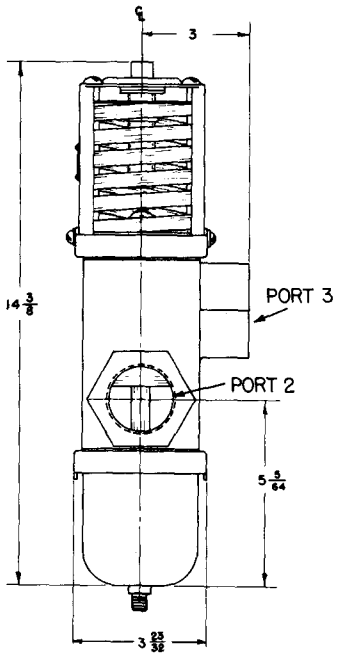
PENN SERIES 3246 3-WAY WATER REGULATING VALVES

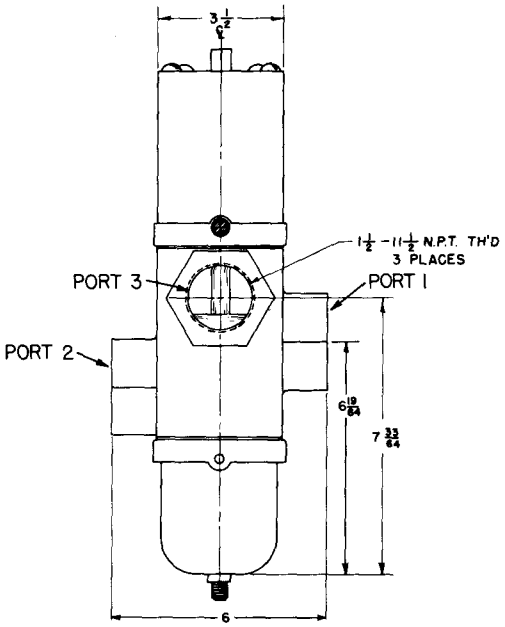




DIMENSIONS IN INCHES SIZES ½"- 1¼"

VALVE SIZE	A	B	C	D	E	F	G	H	I	J
½"	7 5/8"	3½"	¾"	1 17/32"	1½"	9/32"	3⅛"	2"	1 27/32"	1¾"
¾"	8 19/32"	3 15/16"	1 1/32"	1 25/32"	1¾"	9/32"	3 9/16"	2 11/64"	2 1/32"	1 57/64"
1"	11 51/64"	5 57/64"	1 1/32"	2 5/32"	2⅛"	9/32"	4¾"	2 25/32"	2⅝"	2 5/16"
1¼"	12 35/64"	6 5/64"	1 7/32"	2 13/32"	2⅜"	9/32"	4¾"	2 25/32"	2⅝"	2 5/16"





SIZE 1½"

PENN

R&E LTD.

PENN WATER REGULATING VALVES

Revised June 23, 1967

SERIES 246 AND 247 PRESSURE ACTUATED WATER REGULATING VALVES

† Extra 5% Discount allowed on 10 or more assorted controls

Penn pressure actuated water regulating valves are modulating type valves. They are designed for various applications and are suitable for either open or hermetic refrigeration units.

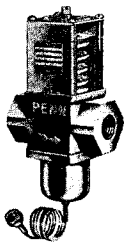
Series 246 direct acting valves OPEN on pressure increase. They are designed primarily for regulation of water cooled refrigeration condensers.

Series 247 reverse acting valves CLOSE on pressure increase. May be used for by-pass service. A range of 40 to 100 psig is available for heat pump application.

Sizes ⅜" through 1½" are provided in all-range construction for *R-12, R-22, R-500 or R-502* service. Sizes 2" and 2½" are available for either R-12 or R-22 service. Valves are also available for ammonia service. Valves supplied for Navy and Maritime applications have naval bronze bodies equipped with monel interior metal parts.

Maximum permissible water supply pressure is 150 psig.

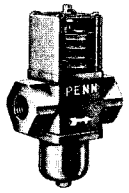
TO ORDER: Specify (1) Type Number only (2) Companion flange kit if required.



SERIES 246
Threaded Type
Style 13 Connection

COMMERCIAL TYPE — NON-CORROSIVE REFRIGERANTS

Type No.	Pipe Size	Inlet and Outlet	Service	Opening Point Adjustment Range — psig	Head Pressure Connector *	List†
246P03AR	⅜" NPT	Threaded	All-Range	70 to 260	Style 13	33.02
246P04AR	½" NPT	Threaded	All-Range	70 to 260	Style 13	38.10
246P06AR	¾" NPT	Threaded	All-Range	70 to 260	Style 13	46.96
246P08AR	1" NPT	Threaded	All-Range	70 to 260	Style 13	94.76
246P10AR	1¼" NPT	Threaded	All-Range	70 to 260	Style 13	101.36
246P12FAR	1½"	4 Hole ASME Flange	All-Range	70 to 260	Style 13	158.78
246P16F	2"	4 Hole ASME Flange	R-12, R-500	70 to 170	Style 5	211.40
246P1622F	2"	4 Hole ASME Flange	R-22, R-502	160 to 260	Style 5	211.40
246P20F	2½"	4 Hole ASME Flange	R-12, R-500	70 to 170	Style 5	322.32
246P2022F	2½"	4 Hole ASME Flange	R-22, R-502	160 to 260	Style 5	322.32



SERIES 246
Threaded Type (For Ammonia)
Style 15 Connection

COMMERCIAL TYPE — AMMONIA

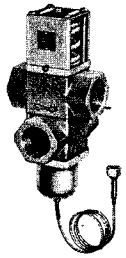
★	246P03NH	⅜" NPT	Threaded	Ammonia	100 to 200	Style 15	72.80
	246P04NH	½" NPT	Threaded	Ammonia	100 to 200	Style 15	79.40
	246P06NH	¾" NPT	Threaded	Ammonia	100 to 200	Style 15	86.90
	246P08NH	1" NPT	Threaded	Ammonia	100 to 200	Style 15	150.08
	246P10NH	1¼" NPT	Threaded	Ammonia	100 to 200	Style 15	158.86
	246P12FNH	1½"	4 Hole ASME Flange	Ammonia	100 to 200	Style 15	188.40
	246P16FNH	2"	4 Hole ASME Flange	Ammonia	100 to 200	Style 15	241.00
	246P20FNH	2½"	4 Hole ASME Flange	Ammonia	100 to 200	Style 15	351.94

SERIES 3246 THREE-WAY WATER REGULATING VALVE FOR NON-CORROSIVE REFRIGERANTS

Series 3246 are designed specifically for condensing units cooled either by atmospheric or forced draft cooling towers. They are used on single or multiple condenser hook-ups to the tower to provide the most economical and efficient use of the tower. Water supply pressure to 150 lbs.

Refrig.	Factory Settings	
	Opening Press. Port 1 to Port 2	Closing Press. Port 1 to Port 3
R-12	95 psig	130 psig
R-22	165 psig	215 psig

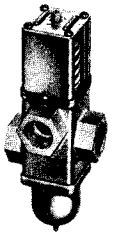
TO ORDER: Specify Type Number only.



SERIES 3246
Sizes ½" through 1¼"

Type No.	Pipe Size	Inlet and Outlet	Service	Range Opening Point of Normally Closed Side	Head Pressure Connector *	List†
3246P04	½" NPT	Threaded	R-12	85 to 110	Style 13	73.00
3246P0422	½" NPT	Threaded	R-22	145 to 190	Style 13	73.00
3246P06	¾" NPT	Threaded	R-12	85 to 110	Style 13	93.06
3246P0622	¾" NPT	Threaded	R-22	145 to 190	Style 13	93.06
3246P08	1" NPT	Threaded	R-12	85 to 110	Style 13	165.28
3246P0822	1" NPT	Threaded	R-22	145 to 190	Style 13	165.28
3246P10	1¼" NPT	Threaded	R-12	85 to 110	Style 13	177.20
3246P1022	1¼" NPT	Threaded	R-22	145 to 190	Style 13	177.20
3246P12	1½" NPT	Threaded	R-12	85 to 110	Style 5	241.64
3246P1222	1½" NPT	Threaded	R-22	145 to 190	Style 5	241.64

Maximum permissible bellows pressure for R-12 is 230 psig and for R-22 is 320 psig.



SERIES 3246
Size 1½"

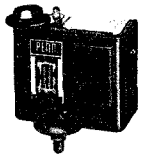
★ **Non-Stock Item. Must be Built to Order.**

Revised
June 23,
1967

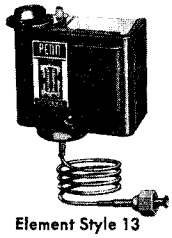
PENN PRESSURE CONTROLS

† Extra 5% Discount allowed on 10 or more assorted controls

SINGLE POLE LOW PRESSURE



Element Style 5



Element Style 13

Element Style 15

"ALL RANGE" FOR R-12, R-22, R-500, R-502

Catalog Number	Switch Action	Range * (psig)	Differential (psi)	Pressure Connector	Limited Knob Adjustment	Electrical Rating 120 V. A.C. (See page R-4)	List †
P70AB-1	SPST Close High Open Low	20" Vac. to 100	Min. 6 to Max. 70	1/4" Male Flared Conn. Style 5	Cutout	20.0 A. Table 1	27.18
P70AB-2	SPST Close High Open Low	20" Vac. to 100	Min. 6 to Max. 70	36" Capillary with 1/4" Flare Nut, Style 13	Cutout	20.0 A. Table 1	28.72
P70CA-1	SPST Open High Close Low	20" Vac. to 100	Min. 6 to Max. 70	36" Capillary with 1/4" Flare Nut, Style 13	None	20.0 A. Table 1	30.52

CAUTION:
These controls are "not for water service." Use Penn Series 470P, 154, 160, 161 or 162 for water service applications.

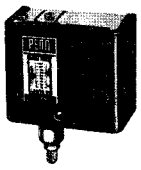
Adjusting knob supplied on differential (cutout setting) to limit adjustments to 5 psi above or below normal setting.

FOR AMMONIA

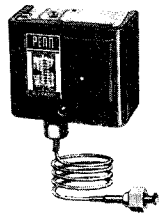
P70AA-5	SPST Close High Open Low	20" Vac. to 100	Min. 6 to Max. 70	1/4" Female NPT Style 15	None	20.0 A. Table 1	59.06
P70CA-4	SPST Open High Close Low	20" Vac. to 100	Min. 6 to Max. 70	1/4" Female NPT Style 15	None	20.0 A. Table 1	61.64

CAUTION:
These controls are "not for water service." Use Penn Series 470P, 154, 160, 161 or 162 for water service applications.

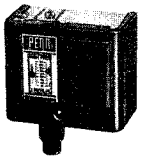
SINGLE POLE HIGH PRESSURE



Element Style 5



Element Style 13



Element Style 15

Catalog Number	Switch Action	Range * (psig)	Differential (psi)	Pressure Connector	Limited Knob Adjustment	Electrical Rating 120 V. A.C. (See page R-4)	List †

CONDENSER FAN

P70AA-2	SPST Close High Open Low	0 to 150	Min. 12 to Max. 40	36" Capillary with 1/4" Flare Nut, Style 13	None	20.0 A. Table 1	28.04

"ALL RANGE" FOR R-12, R-22, R-500, R-502

P70AA-3	SPST Close High Open Low	100 to 300	Min. 25 to Max. 75	36" Capillary with 1/4" Flare Nut, Style 13	None	20.0 A. Table 1	28.04
P70AA-6	SPST Close High Open Low	50 to 450	Min. 50 to Max. 150	36" Capillary with 1/4" Flare Nut, Style 13	None	20.0 A. Table 1	28.04
P70CA-2	SPST Open High Close Low	50 to 450	Min. 50 to Max. 150	1/4" Male Flared Conn. Style 5	None	20.0 A. Table 1	28.96
P70CA-3	SPST Open High Close Low	50 to 450	Min. 50 to Max. 150	36" Capillary with 1/4" Flare Nut, Style 13	None	20.0 A. Table 1	30.52
P70DA-1	SPST Open High Close Low	50 to 450	Lockout (Requires Manual Reset)	36" Capillary with 1/4" Flare Nut, Style 13	None	20.0 A. Table 1	32.96

Maximum overrun pressure for Code P70AA-2 is 325 psig, P70AA-3 is 425 psig and P70AA-6 is 475 psig.

FOR AMMONIA

P70AA-4	SPST Close High Open Low	50 to 240	Min. 20 to Max. 100	1/4" Female NPT Conn., Style 15	None	20.0 A. Table 1	59.06
P70CA-5	SPST Open High Close Low	50 to 450	Min. 50 to Max. 150	1/4" Female NPT Conn., Style 15	None	20.0 A. Table 1	61.64
P70DA-2	SPST Open High Close Low	50 to 450	Lockout (Requires Manual Reset)	1/4" Female NPT Conn., Style 15	None	20.0 A. Table 1	64.20

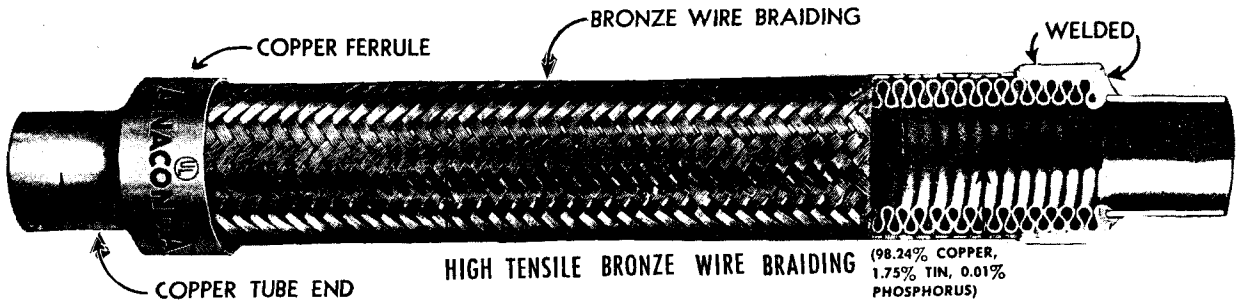
* Metric Scales: May be supplied in — 1 to 7; 4 to 32 or 7.5 to 30 Kg/cm² ranges.

TO ORDER: Specify Catalog Number only.

Refer to Pages 285 & 286 for Cross Reference Chart of old Catalog Code Numbers with the new Catalog Numbers.

R&E THERMAL LTD.

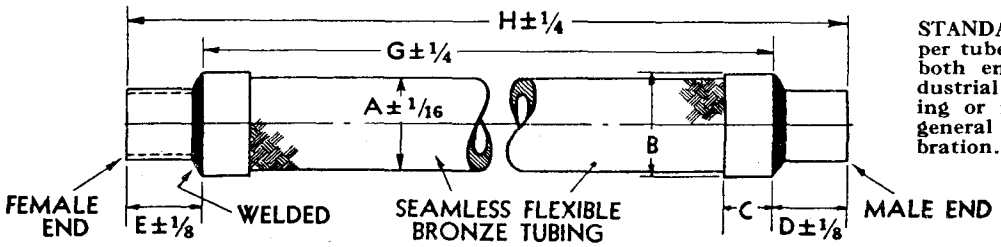
SPECIFY AMERICAN VIBRATION ELIMINATORS



An ANACONDA product

AMERICAN VIBRATION ELIMINATORS are designed especially for industrial and domestic air conditioning or refrigeration units or any general piping where vibration is encountered.

STANDARD SIZES



STANDARD SIZES: Standard copper tube "slip-fittings" welded on both ends. Suitable for any industrial or domestic air conditioning or refrigeration unit or any general piping encountering vibration.

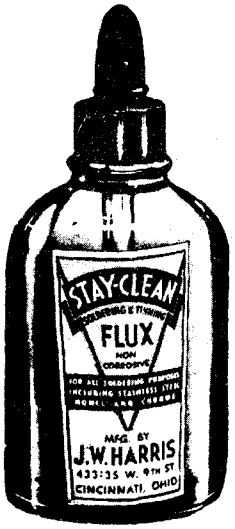
SPECIAL LENGTHS MADE TO ORDER. PRICES ON APPLICATION.

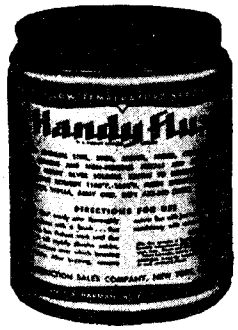
ASSEMBLY NUMBERS		To go over Water Tube Size	H	OD Sizes	List Prices
FLEXONICS	ANACONDA				
F-1	3618FX	1/8	7	1/4"	$7.90
F-3	1414FX	1/8	7 1/2	1/4"	7.90
F-5	5614FX	1/4	8 1/4	3/8"	8.20
F-7	3838FX	3/8	9	1/2"	8.90
F-9	1212FX	1/2	9 3/4	5/8"	10.76
F-11	1258FX	5/8	10	3/4"	10.76
F-13	3458FX	5/8	11 1/4	3/4"	14.66
F-15	3434FX	3/4	11 1/2	7/8"	14.66
F-17	1010FX	1	13	1 1/8"	18.50
F-19	5454FX	1 1/4	14 3/4	1 3/8"	25.70
F-21	6464F	1 1/2	17	1 5/8"	36.20
F-23	2020F	2	20	2 1/8"	57.40
F-25	5252F	2 1/2	24	2 5/8"	95.26
F-27	3030FH	3	27	3 1/8"	124.86
F-29	7272F	3 1/2	31 3/8	3 5/8"	238.88
F-31	4040F	4	32 1/8	4 1/8"	289.80
	5050F	5	39 1/2	5 1/8"	Prices
	6060F	6	47	6 1/8"	on
	8080F	8	62 1/2	8 1/8"	Application

R&E THERMAL LTD.

Revised May 15, 1967

FLUXES & SOLDERS





STAY-CLEAN FLUX

Meets All The Requirements For A *CLEAN* Soldering Job

STAY-CLEAN SOLDERING FLUX LIQUID

		List Price
2-oz.	Dropper Bottle	$ 1.44
3½-oz.	Glass Bench Bottle	$ 1.94
4-oz.	Re Fillable Plastic Container	$ 2.48
8-oz.	Glass Bottle	$ 2.38
16-oz.	Plastic Safety Container	$ 3.70
32-oz.	Glass Bottle	$ 6.18
1-Gal.	Jug	$20.12

	List Prices
1-oz.	$ 1.68
½-lb.	$ 2.82
1-lb.	$ 5.00
5-lb.	$20.40

for a BETTER Soldering Job!

Use *Universal* **STAY-CLEAN** *on*

- ★ Stainless Steel
- ★ Monel
- ★ Chrome
- ★ Copper
- ★ Brass
- ★ Cast Iron

And all other metals except Aluminum and die cast alloys

★ ★ ★

STAY-CLEAN Soldering Flux is available in a 2 oz. dropper bottle, and in ½ pint, 1 pint, 1 quart, and 1 gallon bottles.

HANDY FLUX

This flux is entirely fluid at 1100° Fahrenheit and permits taking full advantage of the low melting temperatures of the Handy & Harman silver brazing alloys. In addition to the low melting point this flux remains fluid and active over a wide range, thus assuring sound joints with a variety of alloys and under many conditions. It is recommended for brazing stainless steel, nickel, monel, copper, brass and other non-ferrous and ferrous alloys, when using Sil-Fos or Easy-Flo. Upon completion of a joint, excess flux is readily removed with hot water, thus saving clean-up time.

Packed

No. 50 solder flux

Norwesco

	List
2 oz. Tin	$ .82
1 Pound Tin	3.38

SOFT SOLDER

No. 50 50% Tin 50% Lead

Size	Wt. Each
3/32"	1 lb. spool
1/8"	1 lb. spool
1/8"	5 lb. spool

No. 95 95% Tin 5% Antimony

Size	Wt. Each
3/32"	1 lb. spool
1/8"	1 lb. spool

STAY-BRITE

Silver Bearing – SOLDER

Size	List Prices 1/8"	1/16"
1# - 4#	$17.90	$18.20
5# - 9#	17.14	17.40
10# - over	16.40	16.64

		Per Pound	Per Spool
50/50	1# Spools	$5.36	$ 5.36
	5# "	5.26	26.30
95/5	1# "	8.06	8.06
	5# "	8.60	43.00

LIST PRICES — SILVER ALLOYS
PHOS COPPER ROD — ON APPLICATION
EASY FLO #45 ALLOYS LIST PRICES PER OUNCE

SIZE	1 - 9	10 - 24	25 - 99	100 & OVER
1/8"	$3.16	$2.94	$2.78	$2.64
3/32"	3.12	2.90	2.70	2.60
1/16"	3.06	2.86	2.68	2.56

SILFOS SQUARE WIRE #5 LIST PRICES PER POUND

SIZE	1 - 9	10 - 24	25 - 99	100 & OVER
1/8"	$11.84	$11.06	$10.60	$ 9.80
3/32"	12.28	11.50	10.92	10.08
5/64"	12.60	11.80	11.10	10.24
1/16"	12.80	11.98	11.22	10.36

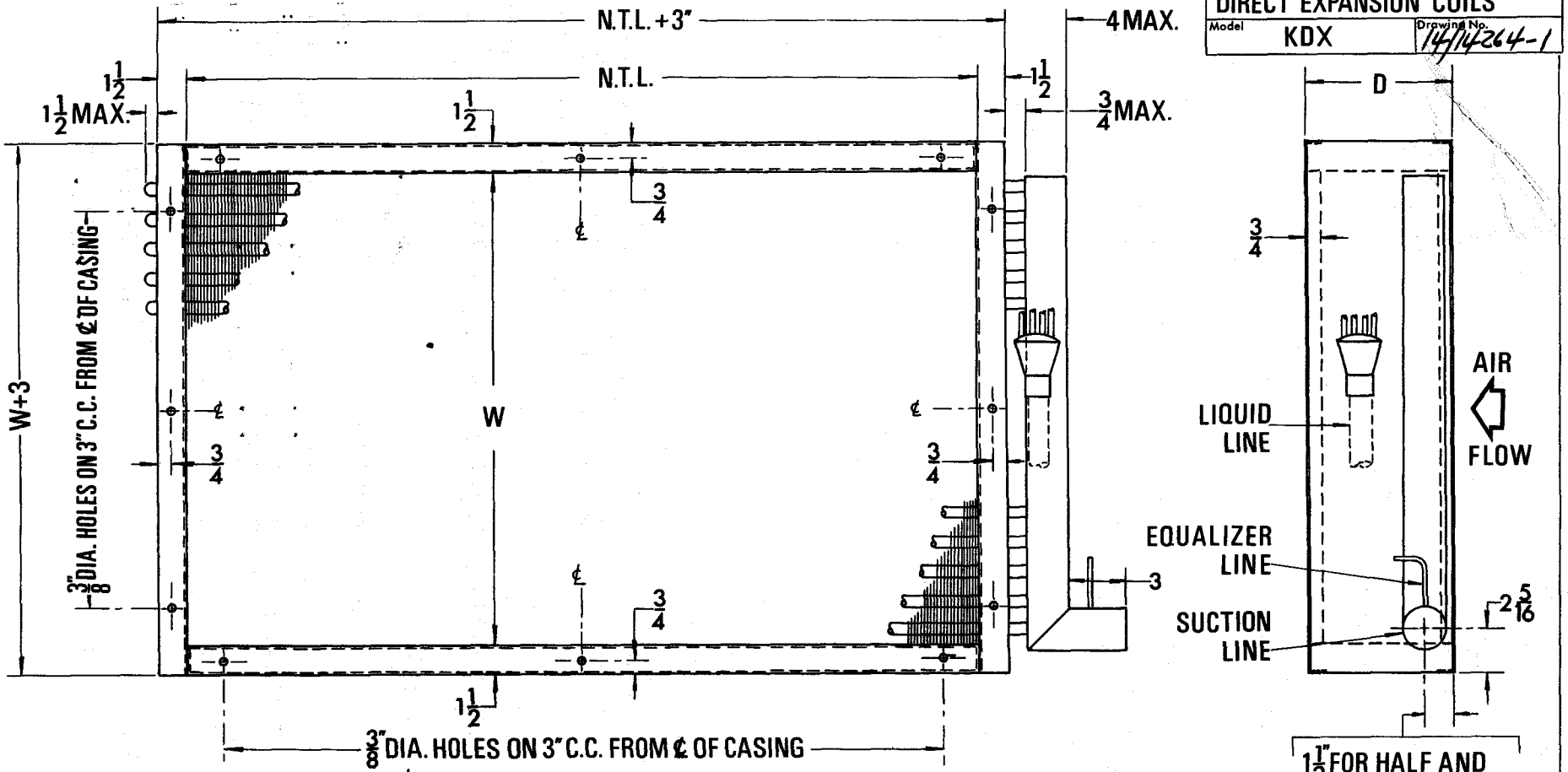
ITEM	PART No.	DWG.	REQ.	DESCRIPTION

QUAN.	TONS	REFRIGERANT TYPE	REFRIGERANT TEMP.	R.H. or L.H.	ROWS DEEP	FINS INCH	FACE HT.	FACE LTH.	FIN MAT.	TUBE MAT.	SPECIAL FEATURES	CUSTOMER	ORDER NO.
1	27.7	R22	40	LH	8	8	39	36	Al	Cu	c/w special drain pan as per dwg CP1-5	GULF EQUIPMENT LTD.	1433-3

KeepRite PRODUCTS BRANTFORD LIMITED CANADA

DIRECT EXPANSION COILS

Model KDX Drawing No. 14/14264-1



ROWS DEEP	2	3	4	5	6	8	10	12
DIM. 'D'	5	6	7½	9	10½	13½	16½	19½

NOTE: R.H. COIL SHOWN···ON L.H. COIL
SUCTION HEADER IS ON OPPOSITE SIDE

1½" FOR HALF AND SINGLE SERPENTINE
2¼" FOR DOUBLE SERPENTINE

(1)	Area:	9.75 sq. ft.
(2)	Capacity:	232,000 BTUs per hour
(3)	CFM air eff:	4,250
(4)	Entering air:	80°F D.B. 76°F W.B.
(5)	Leaving air:	58°F D.B. 54°F W.B.
(6)	Face velocity:	436 FPM
(7)	Air P.D.:	0.62" WG

ITEM	PART No.	DWG. No.	REQ.	DESCRIPTION

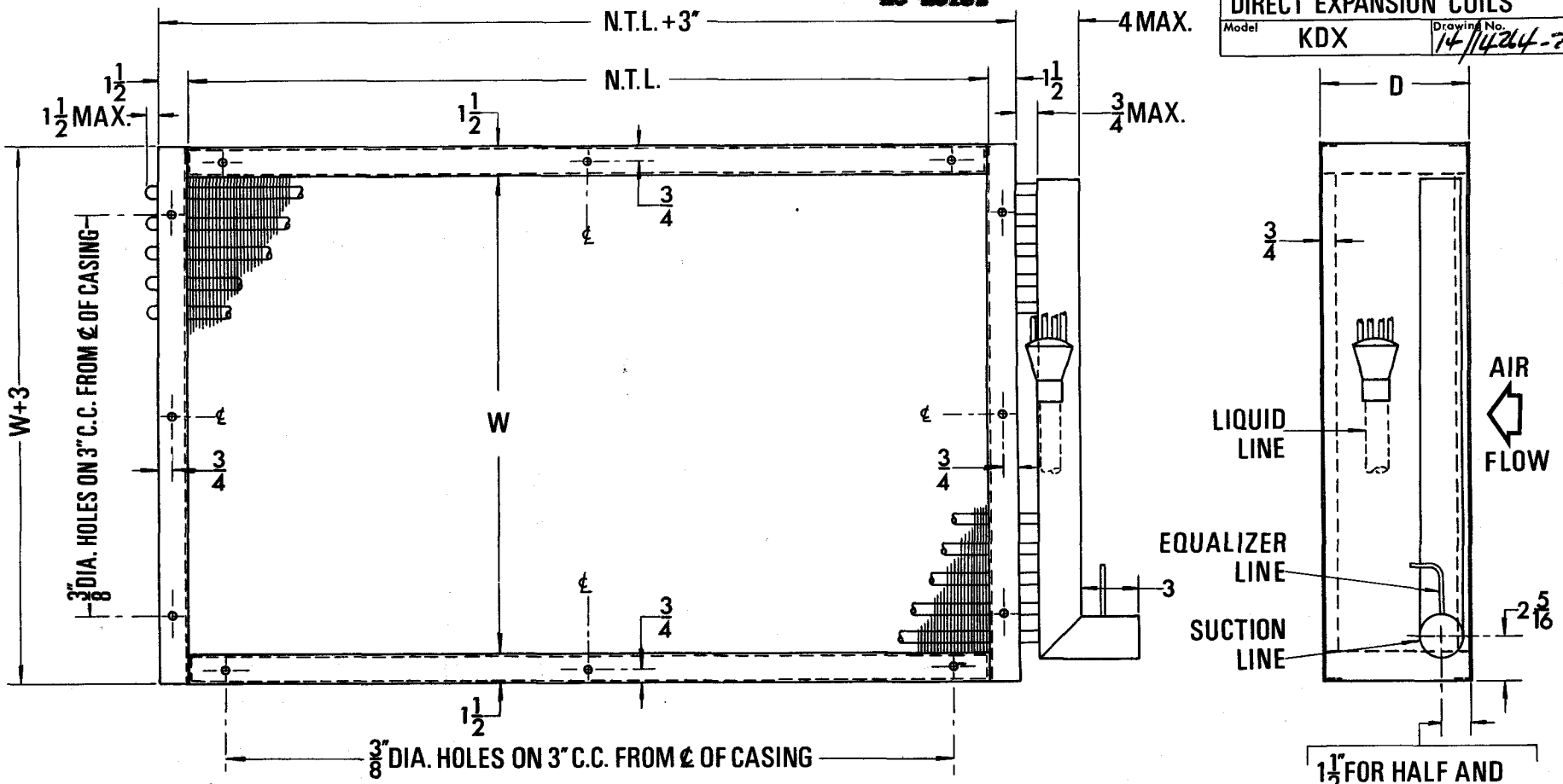
QUAN.	TONS	REFRIGERANT TYPE	REFRIGERANT TEMP.	R.H. or L.H.	ROWS DEEP	FINS INCH	FACE HT.	FACE LTH.	FIN MAT.	TUBE MAT.	SPECIAL FEATURES	CUSTOMER	ORDER NO.
2	2	R22	40	each RH	3	8	15	19½	Cu	Cu	Copper frames all tinned	GELT EQUIPMENT LTD	1433-4

N.B.: 1" flange all round no holes

KeepRite PRODUCTS BRANTFORD LIMITED CANADA

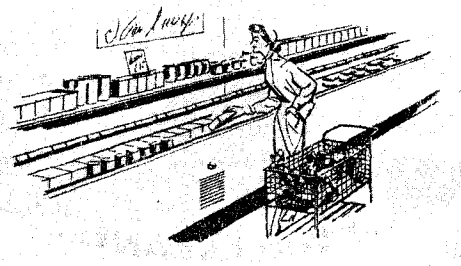
DIRECT EXPANSION COILS

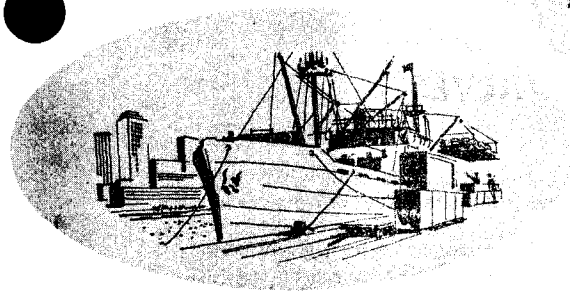
Model KDX Drawing No. 14/1424-7

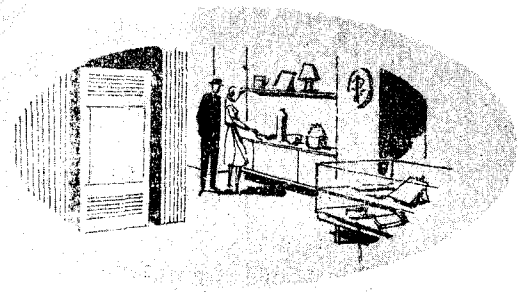


ROWS DEEP	2	3	4	5	6	8	10	12
DIM. 'D'	5	6	7½	9	10½	13½	16½	19½

NOTE: R.H. COIL SHOWN···ON L.H. COIL
SUCTION HEADER IS ON OPPOSITE SIDE



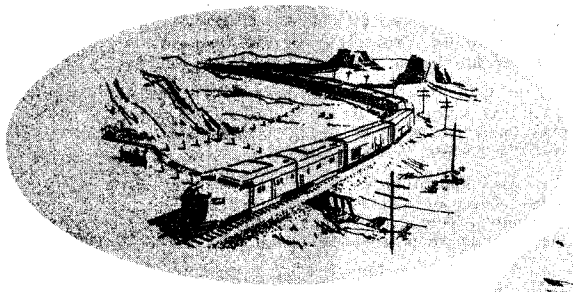


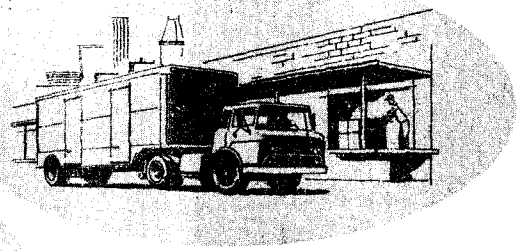


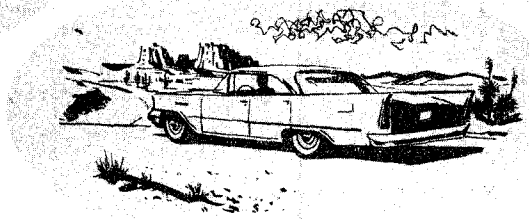
DETROIT

Refrigeration and Air Conditioning

Components







DETROIT PRODUCTS
CATALOGUE PAGES 164-171

AMERICAN-Standard CONTROLS DIVISION

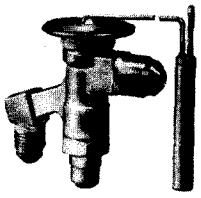
DETROIT® 900 EXPANSION VALVES

Compact in size but with the capacity to do a big job! That's the description of the Detroit 900 expansion valve. It is ideally suited for general replacement installations where space is at a premium. Inlet and outlet connections are in the same position as bulkier valves, allowing easy replacement without repiping.

There are only three moving parts! The valve is easily disassembled for inspection and cleaning without removal from the refrigerant line.

Standard valves are drilled so that a reducing flare nut can be used in either the inlet or outlet. Full ID size drilled valves are available on special order. Also available with ¼" FPT outlet. ¼" SAE inlet also available when specified.

900 THERMOSTATIC EXPANSION VALVE ADJUSTABLE



900

The 900 series valve unit number contains capacity ratings, refrigerant designation and power element charge within its structure. For example: 910-C; the nine represents the series, the one provides the one ton capacity rating, and the letter "C" designates the element charge.

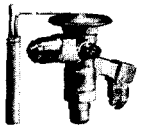
Tons Cap.		P.E.	SAE Connection		Unit No.		List
R-12	R-22	Charge	Inlet	Outlet	R-12	R-22	
.5	.8	C	1/4	1/2 x 3/8	905C	908C	28.80
		Z			905Z	908Z	28.80
1.0	1.6	C	3/8 x 1/4	1/2 x 3/8	910C	916C	29.40
		Z			910C	916Z	29.40
1.5	2.4	C	3/8	1/2	915C	924C	29.40
		Z			915Z	924Z	29.40
2.0	3.2	C	3/8	1/2	920C	932C	33.60
		Z			920Z	932Z	33.60
3.0	4.8	C	3/8	5/8 x 1/2	930C	948C	33.60
		Z			930Z	948Z	33.60

900 THERMOSTATIC EXPANSION VALVE R-502

Tons Cap.	SAE Connection		Unit. No.	List
R-502	Inlet	Outlet	R-502*	
.6	1/4	1/2 x 3/8	907C/Z	28.90
1.2	3/8 x 1/4	1/2 x 3/8	912C/Z	29.40
1.8	3/8	1/2	918C/Z	29.40
2.4	3/8	1/2	923C/Z	33.60
3.6	3/8	5/8 x 1/2	936C/Z	33.60

*C/Z is Universal High or Low Charge

900-E THERMOSTATIC EXPANSION VALVE EXTERNALLY EQUALIZED – ADJUSTABLE



900-E

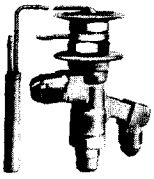
Available in "C" and "Z" charges. Also "G" charged for use with distributors on multiple pass installations. Equalizer connection ¼" SAE.

Tons Cap.		P.E.	SAE Connection		Unit No.		List
R-12	R-22	Charge	Inlet	Outlet	R-12	R-22	
1.0	1.6	C	3/8 x 1/4	1/2 x 3/8	910CE	916CE	35.70
		Z			910ZE	916ZE	35.70
1.5	2.4	C	3/8	1/2	915CE	924CE	35.70
		Z			915ZE	924ZE	35.70
2.0	3.2	C	3/8	1/2	920CE	932CE	35.70
		Z			920ZE	932ZE	35.70
3.0	4.8	C	3/8	5/8 x 1/2	930CE	948CE	39.90
		Z			930ZE	948ZE	39.90

900-E For R-500 and R-502

Tons Cap.		SAE Connection		Unit No.		List
R-500	R-502	Inlet	Outlet	R-500	R-502	
1.1	1.2	3/8 x 1/4	1/2 x 3/8	911E	912C/ZE	35.70
1.7	1.8	3/8	1/2	917E	918C/ZE	35.70
2.2	2.4	3/8	1/2	922E	923C/ZE	35.70
3.3	3.6	3/8	5/8 x 1/2	933E	936C/ZE	39.80

900-PL THERMOSTATIC EXPANSION VALVE WITH PRESSURE LIMITING



900-PL

Only one charged element. Uses a DETROIT patented mechanical means – a simple, rugged and accurate spring – thus eliminating the necessity of a second charged element.

When the spring is held at a pre-determined length "L" and force "A" by means of a collapsible mechanical system such as the "tied-in collars" shown at the left, the force "B" must automatically become greater than force "A" in order to compress the spring and shorten its length.

When the **suction pressure** in the system is greater, the push rod collapses, the two diaphragms move toward each other, and the valve closes tightly **regardless of the temperature of the liquid charged power element.**

When the **suction pressure is less,** the push rod remains at its predetermined length and the valve operates as a standard thermostatic expansion valve.

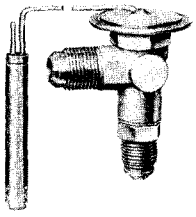
The push rod collapses only at suction pressures above the selected "Maximum Operating Pressure" thereby preventing motor overload during pulldown or abnormal operation.

Shipping Weight: 2 lbs.

Nom. Cap. Tons		MOP	Equalizer	SAE Conn.		Unit Numbers		List
R-12	R-22			Inlet	Outlet	R-12	R-22	
.5	.8	10	Internal	3/8	1/2	905PL10		
		25		x	x	905PL30	908PL30	31.20
		45		1/4	3/8	905PL45	908PL45	31.20
1	1.6	10		3/8	1/2	910PL10	910PL10	
		25		x	x	910PL30	910PL30	31.20
		45		1/4	3/8	910PL45	910PL45	31.20
1.5	2.4	10		3/8	1/2	915PL10		
		25				915PL30	924PL30	31.20
		45				915PL45	924PL45	31.20
2	3.2	10		3/8	1/2	920PL10		
		25				920PL30	932PL30	35.70
		45				920PL45	932PL45	35.70
1	1.6	10	External	3/8	1/2	910PLE10		
		25		x	x	910PLE30	916PLE30	39.00
		45		1/4	3/8	910PLE45	916PLE45	39.00
1.5	2.4	10		3/8	1/2	915PLE10		
		25				915PLE30	924PLE30	39.00
		45				915PLE45	924PLE45	39.00
2	3.2	10		3/8	1/2	920PLE10		
		25				920PLE30	932PLE30	44.20
		45				920PLE45	932PLE45	44.20

DETROIT® EXPANSION VALVES

717 AND 719 THERMOSTATIC EXPANSION VALVES INTERNALLY ADJUSTABLE



717

Ideal for general field replacements, this is a factory set valve. The No. 717 superheat setting is easily adjusted in the field before installation with an Allen wrench through the inlet connection. This allows superheat settings other than standard. The adjusting screw is not sealed or soldered. Also available with external equalizer connection.

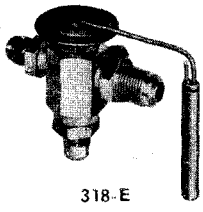
The No. 719 is a "G" charged reverse flow valve. It has the same internal adjustment feature of the No. 717.

Capillary tube 60".

Shipping Weight: 1 lb.

Valve No.	Nom. Cap Tons R-12	Power Element Charge	SAE Connection		Unit Number	List
			Inlet	Outlet		
717	.5	L C Z	1/4	1/2	717252 717198 717253	26.20 26.20 26.20
717	1.0	L C	3/8	1/2	717236 717237	26.20 26.20
719 719	.5 1.0	45 MOP 45 MOP	1/4 3/8	1/2	719100 719101	26.20 26.20

318-E THERMOSTATIC EXPANSION VALVE EXTERNALLY EQUALIZED – ADJUSTABLE



318-E

Designed for application on "A" coils or similar evaporators in domestic air conditioning systems, the 318 is a very compact valve with a large capacity. Internal parts are the same as used in the Model 900 valve. The external equalizer connection is 1/4" SAE.

The 318 valve is available with O.D. connections and R-500 or R-502 on request.

NOM. CAP. TONS		MOP		SAE CONNECT'N		UNIT NUMBER	
R-12	R-22	R-12	R-22	Inlet	Outlet	R-12	R-22
1.3	2	60	105	3/8	1/2	318100	318106
2	3			3/8	1/2	318102	318108
3.3	5			3/8	1/2	318103	318109
3.3	5			1/2	5/8	318104	318110
4	6			1/2	5/8	318105	318111

Prices On Application

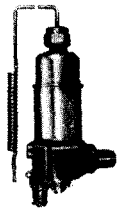
REPLACEMENT THERMOSTATIC POWER ELEMENTS FOR 318, 717, 719 AND 900 VALVES

Capillary Tube Length 60"

For Valve Model	Charge	Unit Number		List
		R-12	R-22	
717 or 718	L C Z	717296 717297 717298	717299 717300 717301	14.70 14.70 14.70
719		719106		14.70

673 THERMOSTATIC EXPANSION VALVE BELLOWS TYPE – ADJUSTABLE

"THE STANDARD OF THE INDUSTRY"



673

Double bellows construction allows adjustment through a broad range of superheat settings, which remain constant under varying conditions. Widely used as original equipment and for replacement in the commercial refrigeration field. Gas charged for motor protection and quick response. Capillary tube: 60".

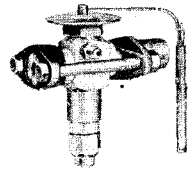
Shipping Weight: 3 lbs.

See Technical Data Sheet 12-70

Tons Capacity		Max. Oper. Pressure		SAE Connection		Unit Number		List
R-12	R-22	R-12	R-22	Inlet	Outlet	R-12	R-22	
1	2	15	25	3/8	1/2	6731968	6732673	33.60
		30	–	3/8		6732684	–	33.60
		55	–			6731428	–	33.60
2	4	15	25	3/8	1/2	6732137	6732137	33.60
		30	–			6732668	–	33.60
		55	–			6731412	–	33.60
3.6	–	55	–	3/8	1/2	6731429	–	34.60

NOTE: Special charges are available on order.

716 THERMOSTATIC EXPANSION VALVE ADJUSTABLE



716

The 716 Valve has the same internal construction as the 714. It has straight through flange connections. These valves are available for refrigerants 12, 22 and 500, in two through ten ton (R-12) sizes with any combination of O.D. inlet and outlet connections. The connections listed below are standard, but other sizes can be provided on special order. Capillary tube: 60".

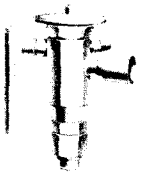
Shipping Weight: 4 lbs.

Nom. Cap. Tons		Power Element Charge	O.D.S. Connections		Unit Numbers		List
R-12	R-22		Inlet	Outlet	R-12	R-22	
2	3	G C Z	1/2	5/8	71600 71613 71617	71621 71626 71631	53.40 53.40 53.40
3	5	G C Z	5/8	7/8	71610 71614 71618	71622 71627 71632	53.40 53.40 53.40
6	10	G C Z	5/8	7/8	71611 71615 71619	71623 71628 71633	53.40 53.40 53.40
8	14	G C Z	5/8	7/8	71645 – 71646	71624 71629 71634	53.40 53.40 53.40
10	17	G C	7/8	1-1/8	71612 71616 71620	71625 71630 71635	82.80 82.80 82.80

ISSUED MAY 18, 1967.
DESTROY PREVIOUS COPY

DETROIT® EXPANSION VALVES

714 THERMOSTATIC EXPANSION VALVE ADJUSTABLE



714

The 714 and 716 Thermostatic Expansion Valves with their simple construction and interchangeable parts provide a compact streamlined valve. Interchangeable power elements are available in Detroit custom charges: "C" for commercial, "Z" for low temperature, and "G" for air conditioning. The level action feeler bulb provides close superheat control and maximum valve operating efficiency.

Shipping Weight: 3 lbs.

Nom. Cap. Tons		Power Element Charge	O.D.S. Connections		Unit Numbers		List
R-12	R-22		Inlet	Outlet	R-12	R-22	
2	3	C	3/8	5/8	714127	714108	40.90
		Z			714133	714117	40.90
		G			714123	714101	40.90
3	5	C	1/2	7/8	714129	714111	42.50
		Z			714135	714119	42.50
		G			714124	714103	42.50
6	10	C	5/8	7/8	714130	714425	45.10
		Z			714136	714426	45.10
		G			714125	714405	45.10
8	14	C	For R-12 5/8 x 7/8		714432	714427	45.10
		Z			714433	714428	45.10
		G			714434	714407	45.10
10	17	C	For R-22 7/8 x 1-3/8		714435	714429	71.90
		Z			714436	714430	71.90
		G			714437	714431	71.90

714 THERMOSTATIC EXPANSION VALVE FOR R-500

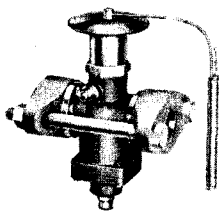
Nom. Cap. Tons.	Power Element Charge	O.D.S. Connections		Unit Numbers	List
		Inlet	Outlet		
2.5	G	3/8	5/8	714381	40.90
3.5		1/2	7/8	714382	40.90
5.5	G	1/2	7/8	714384	42.50
5.5		5/8	7/8	714386	42.50
7.2	G	5/8	7/8	714231	45.10
9.5		5/8	7/8	714388	45.10
9.5		5/8	1-3/8	714389	45.10
12.0	G	5/8	7/8	714391	71.80
12.00		5/8	1-3/8	714392	71.80
12.0		7/8	1-3/8	714390	71.80

714, 716 and 720 THERMOSTATIC POWER ELEMENTS

The removable power element is interchangeable. Use Bonney Wrench #1244. Package includes bulb clamp.

Tons Capacity			Power Element Charge	Repl. P.E. Number			List
R-12	R-22	R-500		R-12	R-22	R-500	
2-3	3-5	2.5-3.5	G	714187	714190	714199	14.90
			C	714185	714188	–	14.90
			Z	714186	714189	–	14.90
			L	–	–	714201	14.90
6-10	10-17	5.5-12	G	714193	714196	714210	23.30
			C	714191	714194	–	23.30
			Z	714192	714195	–	23.30
			L	–	–	–	23.30
			720 VALVE				
15-25 35-55	26-42 59-93	–	G	720295 720265	720335 720325	– –	

720 THERMOSTATIC EXPANSION VALVE ADJUSTABLE



720

The DETROIT 720 is a large capacity adjustable, externally equalized, thermostatic expansion valve well suited for general replacement use. Its compact design provides a *far greater capacity range* within the same valve body than previously obtainable in conventional valves.

Unique design provides complete internal pressure balance resulting in immediate superheat response. Varying head pressure has no effect on superheat control. This is an important feature on modern air conditioning systems with their built-in capacity variations.

Valve metering piston flow apertures of different capacities make possible wide tonnage range with one body size.

The valve is equipped with a removable power element, and may be dis-assembled for service. For complete information and capacity tables ask for Technical Data Sheet 12-71.

720 CAPACITIES – GAS CHARGED

Tons Capacity		Unit Numbers		List
R-12	R-22	R-12	R-22	
15	26	720150	720260	126.50
20	34	720200	720340	126.50
25	42	720250	720420	126.50
35	59	720350	720590	169.30
45	76	720450	720760	169.30
55	93	720550	720930	169.30

Max. Operating Pressure: R-12, 60 lbs.
R-22, 100 lbs.

Regularly supplied set for 10°superheat.

All 720 Valves have:
- 60" capillary tube
- 3/8 dia. x 4" stainless steel bulb
- 1/4" SAE equalizer connection

Also available for R-500 and R-502.

Flange and tail pipe assemblies are included in the 720 prices, but must be ordered separately, as listed below.

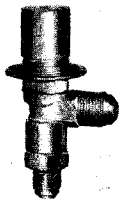
FLANGE AND TAIL PIPE ASSEMBLIES

Package Number	Connections		List
	Inlet	Outlet	
720-1	7/8 O.D.F or 1-1/8 O.D.M.	7/8 O.D.F. or 1-1/8 O.D.M.	25.70
720-2	7/8 O.D.F.	1-1/8 O.D.F.	25.70
720-3	7/8 O.D.F.	1-3/8 O.D.F.	25.70
720-4	7/8 O.D.F.	1-5/8 O.D.F.	25.70
720-5	1-1/8 O.D.F.	1-1/8 O.D.F.	25.70
720-6	1-1/8 O.D.F.	1-3/8 O.D.F.	25.70
720-7	1-1/8 O.D.F.	1-5/8 O.D.F.	25.70
720-8	1-3/8 O.D.F.	1-3/8 O.D.F.	25.70
720-9	1-3/8 O.D.F.	1-5/8 O.D.F.	25.70

NOTE: Model 786,787 and 788 Valves are obsolete.
Replace 786 and 787 with 716. Replace 788 with 720.

DETROIT® AEV, CRV, ERV VALVES—THERMOSTAT

722 AUTOMATIC EXPANSION VALVE DIAPHRAGM TYPE – ADJUSTABLE



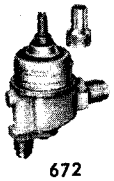
722

The small, shielded-arc welded, single diaphragm construction makes possible this rugged and compact valve. It is ideal for domestic, small commercial, window units, and other applications with constant load requirements. It is also available with bleed type seat on special order. The bleed provides equalization of pressures for off cycle unloading of low starting torque hermetic motors. Several standard bleed rates are available. Reverse flow and/or sweat connections available on special order. Tons capacity: R-12—.5 to 1; R-22—.8 to 2.

Shipping Weight: 1 lb.

Adjustable Range	Tons Cap. .5	Tons Cap. .8	SAE Connections Inlet	SAE Connections Outlet	Unit No.	List
0-65	.5	.8	1/4"	1/4" FPT	72238	14.40
			1/4"	1/2"	72236	14.40
	1.0	1.6	1/4"	1/2"	72220	14.08
			1/4"	3/8"	72222	14.08
			1/4"	1/4" FPT	72234	14.08
			3/8"	1/2"	72200	14.08
10-100	1.0	1.6	1/4"	1/2"	72221	14.08
			1/4"	3/8"	72223	14.08
			3/8"	3/8"	72225	14.08
			3/8"	1/2"	72213	14.08

672 AUTOMATIC EXPANSION VALVE BELLOWS TYPE – ADJUSTABLE



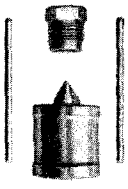
672

The bellows construction of this valve makes it extremely sensitive to pressure changes and consistent in operation. Widely used on domestic and commercial applications where close control of evaporator pressure is required. Inlet connection: 3/8 SAE.

Shipping Weight: 2 lbs.

Adjustable Range	Tons Cap. R-12	Tons Cap. R-22	Orifice	Outlet Connection	Unit Number	List
25" to 25#	1	2	5/64"	1/4" FPT	67200	22.00
	1	2		1/2" SAE	672451	22.00
	2	3.5	5/32"	1/4" FPT	672400	22.00
	2	3.5		1/2" SAE	672456	22.00
5# to 50#	1	2	5/64"	1/4" FPT	672539	22.00
	2	2	5/32"		672197	22.00
5# to 100#	1	2	5/64"		672989	22.00
	2	3.6	5/32"		6721009	22.00

714 AND 716 SERVICE KITS

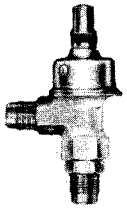


Parts are interchangeable in the 714 and 716 Valves in the field and service kits are available as listed below.

The Service Kit consists of the piston and needle assembly, seat and push rods. All push rods are the same length and no gauge is necessary to assemble new parts in the valve body.

For Valve	Tons Cap. R-12	Tons Cap. R-22	Orifice	Kit Number	List
714 and 716	2	3	5/32"	714266	4.74
	3	5	7/32"	714267	6.80
	6	10	1/4"	714268	8.40
	–	8	7/32"	714269	8.40
	8	14	1/4" disc	714270	10.50
	10	17	9/32" disc	714271	12.60

667 CRANKCASE REGULATING VALVE ADJUSTABLE



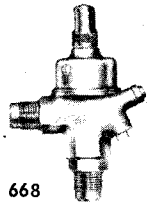
667

The 667 Valve will hold back the pressure from the crankcase regardless of the pressure in the evaporator. In this manner motor protection is accomplished, as the pressure will not exceed the point at which the motor would be overloaded, provided the valve is set to maintain a low crankcase pressure.

Shipping Weight: 2 lbs.

Adjustable Range	Capacity R-12		Connections R-22	Connections Outlet	Unit Number	List
5# to 50#	1	1.5	5/8" SAE	5/8" SAE	66700	33.20

668 EVAPORATOR REGULATING VALVE ADJUSTABLE



668

The 668 will accurately maintain evaporator pressure in accordance with its setting, and thereby accomplish individual evaporator control in single or multiple systems. Furnished with a 1/8" female pipe gauge connection.

Shipping Weight: 2 lbs.

Adjustable Range	Capacity R-12	Capacity R-22	Connections Inlet	Connections Outlet	Unit Number	List
5# to 50#	.5	.75	1/2" SAE	1/2" SAE	66800	28.80

HELPFUL ORDERING INFORMATION

DIRECT REPLACEMENT CHART

The "900" will replace the following valves without repiping

900 VALVE	DETROIT 777	DETROIT 718	ALCO 402	SPORLAN G	A–P 207
905-C	777128	71861	402-2F	GF-½C	207-C
905-Z	777129	71864	402-2F	GF-½Z	207-C
910-C	777137	71862	402-4F	GF-1C	207-C
910-Z	777136	71865	402-4F	GF-1Z	207-C
915-C	–	–	TK-100F	GF-1½C	207-C
915-Z	–	–	TK-100F	GF-1½Z	207-C
920-C	777206	71863	TK-200F	CF-2C	–
920-Z	777155	71866	TK-200F	CF-2Z	–

Application	Temperature Range (Refrigerant Suction)	Type of Charge
Air Conditioning, Commercial and Low Temperature where no maximum pressure is required.	Conventional Liquid Charged Element. Use on all suction temperature ranges.	L
Air Conditioning	+50° F. to +30° F.	G
Commercial Refrigeration	+35° F. to 0° F.	C
Low Temp. Refrigeration	0° F. to −40° F.	Z

Standard "G" Charge MOP is 55# for Refrigerant-12 and 100# for Refrigerant-22.

DETROIT® EXPANSION VALVE CAPACITIES

672 AUTOMATIC EXPANSION VALVE CAPACITIES

Capacity based on 2 to 3 lbs. change in suction pressure* Inlet Liquid 100° F. saturation temperature and vapor free

Suction Temperature Valve Outlet Degrees Fahr.	Orifice	Capacity in Tons Refrigeration	
		R-12	R-22
+5°	1/32	.35	.53
	5/64	1.2	1.8
	5/32	2.1	3.2
	7/32	3.6	5.4

*Change in suction pressure is defined as the decrease in suction pressure necessary to open valve.

722 AUTOMATIC EXPANSION VALVE CAPACITIES

Capacity based on 2 to 3 lbs. change in suction pressure* Inlet Liquid 100° saturation temperature and vapor free

Suction Temperature Valve Outlet Degrees Fahr.	Capacity in Tons Refrigeration	
	R-12	R-22
−10°	.85	.75
+ 5°	.50	.45

*Change in suction pressure is defined as the decrease in suction pressure necessary to open valve.

714 and 716 EXPANSION VALVE CAPACITIES Based on 100% liquid at valve inlet

NOTE: With the broad use of these valves in air cooled installations, with resulting high condensing temperatures, the pressure-drop-across-valve rating method has been used in the table below.

For R-500 capacities, add 20% to values shown for R-12.
For R-502 capacities, add 10% to values shown for R-12.

Valve and Nominal Capacity	Suction Temp.	REFRIGERANT-12 Pressure Drop Across Valve					REFRIGERANT – 22 Pressure Drop Across Valve					
		40	60	80	100	120	100	125	150	175	200	225
	+40	1.70	2.00	2.20	2.30	2.40	3.44	3.64	4.04	4.04	3.94	4.04
714	+20	1.30	1.56	1.60	1.70	1.80	2.72	2.92	3.22	3.12	3.22	3.22
and	+ 5	1.10	1.22	1.32	1.52	1.52	2.26	2.36	2.56	2.56	2.56	2.56
716	−10	.96	.96	1.06	1.16	1.16	1.72	1.92	2.02	2.02	2.02	2.02
2 Ton 12	−20	.68	.78	.88	.88	.98	1.54	1.64	1.74	1.64	1.74	1.74
3 Ton 22	−40	.42	.52	.62	.62	.62	1.08	1.08	1.18	1.18	1.18	1.18
	+40	2.60	3.00	3.30	3.50	3.70	5.25	5.65	6.15	6.25	6.15	6.15
714	+20	2.00	2.40	2.60	2.70	2.80	4.22	4.52	4.92	4.82	4.92	4.92
and	+ 5	1.65	1.85	2.05	2.25	2.25	3.46	3.66	3.96	3.86	3.96	3.96
716	−10	1.30	1.50	1.60	1.70	1.70	2.72	2.92	3.12	3.12	3.12	3.12
3 Ton 12	−20	.73	1.23	1.33	1.43	1.43	2.34	2.54	2.74	2.54	2.64	2.64
5 Ton 22	−40	.68	.88	.88	.88	1.10	1.68	1.68	1.88	1.78	1.78	1.78
	+40	5.20	6.00	6.60	7.00	7.20	10.50	11.00	12.10	12.20	12.10	12.10
714	+20	4.10	4.70	5.20	5.40	5.60	8.35	8.95	9.25	9.05	9.25	9.35
and	+ 5	3.30	3.80	4.10	4.50	4.50	6.87	7.37	7.97	7.77	7.87	7.87
716	−10	2.60	3.00	3.20	3.40	3.50	5.40	5.90	6.30	6.10	6.20	6.20
6 Ton 12	−20	2.18	2.48	2.68	2.88	2.88	5.00	5.40	5.70	5.50	5.60	5.70
10 Ton 22	−40	1.38	1.68	1.78	1.88	1.88	3.44	3.64	3.84	3.74	3.74	3.84
	+40	6.90	8.00	8 70	9.30	9.60	14.00	14.90	16.40	16.50	16.30	16.40
714	+20	5.35	6.25	6.75	7.15	7.35	11.20	11.90	13.00	12.80	13.00	13.10
and	+ 5	4.40	5.00	5.40	5.90	5.90	9.25	9.85	10.65	10.35	10.45	10.55
716	−10	3.46	3.96	4.26	4.46	4.66	7.27	7.87	8.37	8.17	8.27	8.27
8 Ton 12	−20	2.94	3.34	3.54	3.74	3.84	6.15	6.75	7.25	7.00	7.00	7.00
14 Ton 22	−40	1.88	2.28	2.38	2.48	2.58	4.40	4.60	5.00	4.80	4.80	4.90
	+40	8.60	10.00	10.90	11.60	12.00	17.40	18.60	20.50	20.60	20.30	20.50
714	+20	6.70	7.80	8.40	8.90	9.20	14.00	14.90	16.20	16.00	16.20	16.40
and	+ 5	5.50	6.30	6.80	7.40	7.40	11.50	12.10	13.20	13.00	13.10	13.20
716	−10	4.40	4.90	5.30	5.60	5.80	9.00	9.70	10.40	10.20	10.30	10.30
10 Ton 12	−20	3.60	4.10	4.40	4.70	4.80	7.70	8.40	9.00	8.60	8.80	8.80
17 Ton 22	−40	2.30	2.80	3.00	3.10	3.20	5.50	5.80	6.20	6.00	6.00	6.10

GENERAL CATALOG
Number 1965

Ranco®

AUTOMATIC CONTROLS

HOUSEHOLD and

COMMERCIAL REFRIGERATION

and AIR CONDITIONING

Ranco® INCORPORATED

601 West Fifth Ave., Columbus, Ohio 43201

IN CANADA: Ranco Controls, Canada, Ltd., Toronto 18, Canada

INDEX OF CONTROLS

R A N C O

INDEX OF CONTROLS (continued)

*SIGNAL CIRCUIT CONTROL

Ranco Order Department will automatically substitute an ADAPTABLE listed replacement, A11, A30, A33 or A42 on purchase orders for a *cataloged control if stock of it at Ranco has been depleted.*

Notice of an ADAPTABLE substitution is by a small printed label attached to the invoice, which reads, "*Substitution for controls ordered may be returned for full credit, if unacceptable. Any return must be within 30 days from shipping date and reference made to this shipping order*".

Substitution of any control(s) in the *A30 10-Pack package*, illustrated on page 18, will **not** be made.

Return of any A30 10-Pack controls will not be accepted by the factory as a result of broken packages from substituting controls *outside the factory.*

It is our hope that this Catalog serve you, our Ranco Wholesalers and Servicemen, by aiding in selecting suitable replacement controls so service interruption is at a minimum for your customers.

RANCO

CHANGES IN BULLETIN

controls dropped from bulletin

Codes	Application	Usable Replacement
K0T-69	Ice Cream Cabinet	None
B-218	Crosley, Household	None
KWS-412	General Use, Household	A30-183
KR-459	Norge, Household	None
A10-509	Coldspot, Household	A30-180
A10-594	Admiral, Household	A30-182
A10-595	Admiral, Household	A30-180
A10-596	Admiral, Household	A30-301
A10-597	Admiral, Household	A30-180
A10-598	Admiral, Household	A30-180
A10-606	Crosley, Household	A30-180
A10-607	Crosley, Household	A30-180
A10-608	Frigidaire, Household	A30-182
A10-609	Frigidaire, Household	A30-182
A10-610	International Harvester	A30-182
A10-632	Frigidaire, Household	A30-182
A10-636	Norge, Household	A30-183
A10-644	Firestone, Household	A30-180
A10-645	Firestone, Household	A30-180
A10-646	Firestone, Household	A30-180
A10-647	Firestone, Household	A30-180
A10-648	Firestone, Household	A30-180
A10-649	Firestone, Food Server	A30-301
A10-684	Gibson, Household	None
A10-685	Gibson, Household	None
A10-714	Marvel, Household Trailer	None
A10-715	Franklin, Household	A30-182
A10-720	Philco, Household	None
A10-721	Philco, Household	None
A10-722	Stewart-Warner, Household	A30-260
A10-737	Sanitary, Household	A30-182
A10-738	Frigidaire, Household	A30-182
KWS-857	General Electric, H'ld.	A30-180
KWS-858	General Electric, H'ld.	A30-180
KWS-859	General Electric, H'ld.	A30-180
KWS-978	Blue Flash, Bev. Cooler	A30-260
RJ-1066	Norge, Household	A30-180
RJ-1067	Norge, Household	A30-180
RJ-1068	Norge, Household	A30-180
RJ-1088	Mills Vending Machine	None
E11-1205	Crosley, Household	None
E11-1252	Crosley, Household	None
E11-1507	Crosley, Household	None
E11-1508	Gibson, Household	None
E11-1509	Admiral, Household	None
A10-1519	York, Ice Cube Maker	A30-262
A10-1520	Heinz, Beverage Cooler	A30-262
A10-1521	York, Freezer	A30-260
A10-1523	Copeland, Water Cooler	A30-261
A10-1523	Temprite, Water Cooler	A30-261
A10-1524	York, Auto. Ice Maker	A30-260
A10-1535	Liquid Carbonic, Fountain	A30-262
E11-1552	Crosley, Household	None
A10-1587	Fedders, Air Conditioner	A30-452
E11-1627	Admiral, Household	None
E13-2505	Kelvinator, Household	None
A10-2573	Franklin, Freezer	A30-301
A10-2582	Firestone, Household	A30-180
A10-2584	Firestone, Household	A30-180
A10-2614	Steinhorst, Freezer	A30-377
KWS-3067	Blue Flash, Bev. Cooler	None
RJ-3164	Philco, Household	A30-182
RJ-3165	Stewart-Warner, H'ld.	None
RJ-3166	Stewart-Warner, H'ld.	A30-182
KWS-3170	Kelvinator, Household	None
KWS-3171	Kelvinator, Bev. Cooler	None
KOD-3173	Kelvinator, Beverage and Water Cooler	None
KJB-3175	Coldspot, Household	None
KJB-3176	Coldspot, Household	None
KJB-3177	Coldspot, Household	None
KJB-3178	Coldspot, Household	None
RJ-3200	Norge, Household	A30-180
RJS-3218	Larco, Water Cooler	A30-261
RJS-3222	Sunroc, Water Cooler	None
RJS-3223	Kalva Venders, Bottle Vending Machine	A30-261
RJS-3224	Kelvinator, Ice Cream	A30-260
RJS-3226	Ben Hur, Freezer	A30-305
RJB-3237	Coldspot, Household	None
RJB-3238	Coldspot, Household	None
KJ-3244	Leonard, Household	None
RJ-3245	Kelvinator, Household	None
RJ-3248	Kelvinator, Household	None
KJB-3270	Kelvinator, Household	None
KWS-3289	Halsey Taylor, Water Cooler	None
B-4500	Zero, Milk Cooler	A10-3622
A10-4500	Frigikar, Auto Air Cond.	
A18-4500	A.R.A. Auto Air Cond.	
A10-4501	Auto Air Conditioner	
A18-4501	Auto Air Conditioner	
A10-4502	Auto Air Conditioner	
A18-4502	Auto Air Conditioner	A10-6010 (48" cap. tube) or A10-6011 (24" cap. tube)
A10-4503	Auto Air Conditioner	
A18-4503	Auto Air Conditioner	
A10-4504	Auto Air Conditioner	
A18-4504	Auto Air Conditioner	
A10-4505	Clardy, Auto Air Cond.	
A18-4505	Auto Air Conditioner	
A10-4506	Auto Air Conditioner	
A18-4506	Auto Air Conditioner	
A10-4507	Auto Air Conditioner	
A18-4507	Auto Air Conditioner	
A10-4508	Auto Air Conditioner	
A18-4508	Mark IV, Auto Air Cond.	
A10-4509	Auto Air Conditioner	
A18-4509	Frigikar, Auto Air Cond.	
A10-4510	A.R.A. Auto Air Cond.	
A10-4511	Auto Air Conditioner	
A10-4512	Auto Air Conditioner	
A10-4513	Artic Kar, Auto Air Cond.	
A10-4514	Auto Air Conditioner	
022-6000	(Series) All Codes	022-7000
022-7704	Dual Pressure	022-7706

parts dropped

Code	Description
LDS-709	Light Socket and door switch
10072	Overload heater coil, 3.9 Amp.
10193	Terminal prongs
10194	Overload cover
10565	Dial plate
10744	Dial plate
10749	Dial plate
10777	Screw, ¼" long
10792	Dial plate
13679	Mounting screw, 8-32 x ½"
14572	Nut for screw, cat. 13679
15613	Overload heater coil, 1.4 Amp.
16010	Nut
17007	Mounting bracket
17461	Dial knob
32086-3	Power Element
33155-3	Terminal cover
44863-2	Dial plate
49680-1	Dial plate

controls and parts added to bulletin

Codes	Application
V30-103	Reversing Valve
016-142	SPDT, High Pressure
V26-150	Reversing Valve
F17-158	Air Cond. General Replacement
F17-159	Air Cond. General Replacement
016-165	SPDT, 30°F to 105°F
016-166	SPDT, High Pressure
F17-521	Air Cond. General Replacement
F17-522	Air Cond. General Replacement
V25-751	Reversing Valve
F11-1016	Safety Control, Cold Vend.
F11-1019	Safety Control, Cold Vend.
E21-1201	Ice Bank Control
E20-1202	Bin Level Control
F11-1305	Cold Vend safety, Auto. Reset
F11-1306	Cold Vend Safety, Auto. Reset
E15-1501	De-ice Control
J13-1501	Dehumidification Control
E21-2401	Ice Bank Control
E20-2402	Bin Level Control
E15-2501	De-ice Control
J13-2501	Humidification Control
J12-2502	Humidification Control
011-3099	SPST, Low Pressure
J12-3501	Humidification Control
J13-3501	Dehumidification Control
P30-3501	Diff. Oil Pressure Control
P30-3601	Diff. Oil Pressure Control
P30-3701	Diff. Oil Pressure Control
P30-3801	Diff. Oil Pressure Control
012-4100	Dual Pressure
012-4101	Dual Pressure
012-4650	Dual Pressure, Man. Reset
A10-6010	Automotive Air Conditioner
A10-6011	Automotive Air Conditioner
022-7725	Dual Pressure, Auto. Reset
022-7825	Dual Pressure, Man. Reset
17085	"0" Toggle Spring
20850-1	H80 Relay cover
57841-1	3" shaft with flat
58074-1	Terminal adapters
58679-1	Parts package for H80 relays
58699-1	Dial shaft assembly
58649-1	Transverse mounting bracket for ADAPTABLES
320491-1	Power element
320662-1	Power element

control codes changed

From	To	From	To
A15-116	A30-1668	A15-3001	A30-3014
A15-156	A30-1667	022-6713	022-7713

RANCO

QUICK REFERENCE CHART—COMMERCIAL CONTROLS

SINGLE PRESSURE

RANCO CODE NO.	Pressure Type, Switch Action	Control Operation
CLOSE on RISE		
020-7002		
020-7004	Low, DPST	
020-7006	High, DPST	
010-1401		Automatic Reset
010-1402		
010-1842		
010-1483		
010-1831	Low, SPST	
010-1894		
010-2054	High, SPST	
OPEN on RISE		
021-7406	High, DPST	
011-1754		
011-3094		Automatic Reset
011-1799		
011-3099	Low, SPST	
011-1711		
011-1713	High, SPST	
OPEN or CLOSE on RISE		
016-107		
016-120	Low, SPDT	Automatic Reset
016-108		
016-142		
016-166	High, SPDT	
LOCK OPEN on DROP		
016-250	High, SPDT	
010-1867		Manual Reset
010-1925	Low, SPST	
010-1895	High, SPST	
LOCK OPEN on RISE		
021-7480	High, DPST	
011-1712		Manual Reset
011-1714	High, SPST	
016-200	High, SPDT	

DUAL PRESSURE & TEMPERATURE

RANCO CODE NO.		Switch Action & Operation
AUTOMATIC RESET		
012-1505	Dual Pressure	
012-1506	Dual Pressure	
012-1514	Dual Temperature	
012-1534	Dual Temperature	SPST
012-1535	Dual Temperature	
012-1536	Dual Temperature	
012-1549	Dual Pressure	
012-1550	Dual Pressure	
012-4008	Dual Temperature	
012-4100	Dual Pressure	
012-1537	Dual Temperature	
012-1554	Dual Pressure	
012-1609	Dual Pressure	SPST, with Safety Limit Stop
012-1637	Dual Pressure	
012-4101	Dual Pressure	
022-7702	Dual Pressure	
022-7707	Dual Temperature	DPST
022-7709	Dual Temperature	
022-7713	Dual Temperature	
022-7706	Dual Pressure	
022-7725	Dual Pressure	DPST, with Safety Limit Stop
MANUAL RESET		
012-1546	Dual Pressure	
012-1551	Dual Pressure	SPST, reset on High Pressure Side
012-4650	Dual Pressure	
012-1605	Dual Pressure	SPST, reset on High Pressure Side with Safety Limit Stop
012-1530	Dual Pressure	
012-1594	Dual Pressure	SPST, reset on Low & High Pressure Sides with Safety Limit Stop
012-1595	Dual Pressure	
012-1617	Dual Pressure	
022-7802	Dual Pressure	
022-7804	Dual Pressure	DPST, reset on High Pressure Side
022-7806	Dual Pressure	
022-7825	Dual Pressure	

ELECTRICAL RATINGS

LISTED by Underwriters' Laboratories and Canadian Standards Association—unless otherwise noted

Type of Controls	Switch Action	VOLTAGES	Maximum Motor AMPERE Rating FULL LOAD	LOCKED ROTOR	(Non-inductive)	Horsepower Approximate	Remarks
		115 ac	20	120		3	
		240 ac	17	102			Herm. Units Only
		240 ac	20	102			
		115 dc	4.6	46.0			With
010, 011, 012, 018, 019	SPST	240 dc	2.3	23.0			Magnet
		115 ac	7.4	44.4			
015	SPDT	230 ac	3.7	22.2			
		120 ac	12	72			
		240 ac	9.8	58.8			
		240 ac	—	—	25 AMPERES		
016, 021-100 (SPST action)	SPDT	240 ac	20	80			Herm. Units Only
		120 ac	24.0	144.0	24 AMPERES	2	
		208/240 ac	24.0	144.0	24 AMPERES	3	
		120 dc	4.6	46.0	3.0 AMPERES		
7000 Series (1 Phase)	DPST	240 dc	2.3	23.0	0.5 AMPERES		
		208 ac	**16.0	**96.0		5	**Hermetic
020		240 ac	**15.0	**90.0		5	Units Only
021		480 ac	**7.5	**45.0		5	See Note on
022 (2 & 3 Phase)	DPST	600 ac	**6.0	**36.0		5	Page 8.
		115 ac			1500 WATTS		
025 (UL Only)	SPDT	230 ac			750 WATTS		

PILOT DUTY

010, 011, 012, 018, 019	720 Volt-ampere at 120/240 Volts, ac. 125 Volt-ampere at 240/600 Volts, ac. 57.5 Volt-ampere at 120/240 Volts, dc. with magnet
020, 021, 022	125 Volt-ampere at 120/600 Volts, ac. 57.5 Volt-ampere at 120/600 Volts, dc.

RANCO

CONDENSED CONTROL INFORMATION

SINGLE LOW PRESSURE CONTROLS

Ranco Code No.	Features
12" vac. to 50 psi Range, 1/4" SAE Male Elbow Fitting	
016-120	SPDT, Open/Close on Rise, Automatic Reset.
010-1401	SPST, Close on Rise, Automatic Reset.
011-1754	SPST, Open on Rise, Automatic Reset.
010-1867	SPST, Lockout on Drop, Manual Reset.
36" Cap. Tube with 1/4" SAE Flare Nut	
010-1402	SPST, Close on Rise, Automatic Reset.
011-3094	SPST, Open on Rise, Automatic Reset.
020-7002	DPST, Close on Rise, Automatic Reset, Special Shaft without a Knob.
48" Cap. Tube with 1/4" SAE Flare Nut	
010-1842	SPST, Close on Rise, Automatic Reset.
0 to 100 psi Range, 1/4" SAE Male Elbow Fitting	
016-107	SPDT, Open/Close on Rise, Automatic Reset.
011-1799	SPST, Open on Rise, Automatic Reset.
010-1831	SPST, Close on Rise, Automatic Reset.
36" Cap. Tube with 1/4" SAE Flare Nut	
010-1483	SPST, Close on Rise, Automatic Reset.
011-3099	SPST, Open on Rise, Automatic Reset.
020-7004	DPST, Close on Rise, Automatic Reset, Special Shaft without a Knob.
0 to 90 psi Range, 1/4" SAE Male Elbow Fitting	
010-1925	SPST, Lockout on Drop, Manual Reset.

SINGLE HIGH PRESSURE CONTROLS

150 to 450 psi Range, 1/4" SAE Male Elbow Fitting

for Cooling Towers

011-1713	SPST, Open on Rise, Automatic Reset.
010-1894	SPST, Close on Rise, Automatic Reset.

for Other Applications

011-1714	SPST, Lockout on Rise, Manual Reset.
010-1895	SPST, Lockout on Drop, Manual Reset.

36" Cap. Tube with 1/4" SAE Flare Nut

for Cooling Towers

010-2054	SPST, Close on Rise, Automatic Reset.
011-1711	SPST, Open on Rise, Automatic Reset.

for Other Applications

011-1712	SPST, Lockout on Rise, Manual Reset.
020-7006	DPST, Close on Rise, Automatic Reset, Special Shaft without a Knob.
021-7406	DPST, Open on Rise, Automatic Reset, Special Shaft without a Knob.
021-7480	DPST, Lockout on Rise, Manual Reset, Special Shaft without a Knob.

150 to 450 psi Range, 36" Cap. Tube with 1/4" SAE Fitting

for Cooling Towers & Air Cooled Condensers

016-108	SPDT, Open/Close on Rise, Automatic Reset.

for Other Applications

016-200	SPDT, Lockout on Rise to #1 & #2 terminals (#2 & #3 Close for an Alarm Circuit), Manual Reset.
016-250	SPDT, Lockout on Drop to #2 & #3 terminals (#1 & #2 Close for an Alarm Circuit), Manual Reset.

100 to 360 psi Range, 36" Cap. Tube with 1/4" SAE Flare Nut

016-142	SPDT, Open or Close on Rise, Auto. Reset.

50 to 150 psi Range, 36" Cap. Tube with 1/4" SAE Flare Nut

016-166	SPDT, Open or Close on Rise, Auto. Reset.

DUAL PRESSURE CONTROLS

12" vac. to 50 psi L.P. & 100 to 250 psi H.P. Ranges
1/4" SAE Male Elbow Fitting

012-1505	SPST, Automatic Reset.
012-1546	SPST, Manual Reset on High Pressure.

36" Cap. Tube with 1/4" SAE Flare Nut

012-1506	SPST, Automatic Reset.
012-1595	SPST, Manual Reset on High & Low Pressures, with Limit Stop.
022-7802	DPST, Manual Reset on High Pressure, Special Shaft without a Knob.

48" Cap. Tube with 1/4" SAE Flare Nut

012-1554	SPST, Automatic Reset, with Limit Stop.

DUAL PRESSURE CONTROLS (continued)

Ranco Code No.	Features
0 to 100 psi L.P. & 150 to 450 psi H.P. Ranges	
1/4" SAE Male Elbow Fitting	
012-1550	SPST, Automatic Reset.
36" Cap. Tube with 1/4" SAE Flare Nut	
012-1549	SPST, Automatic Reset.
012-1551	SPST, Manual Reset on High Pressure.
012-1637	SPST, Automatic Reset, with Limit Stop.
48" Cap. Tube with 1/4" SAE Flare Nut	
012-4100	SPST, Automatic Reset.
012-4101	SPST, Automatic Reset, with Limit Stop.
012-4650	SPST, Manual Reset on High Pressure.
022-7725	DPST, Automatic Reset, with Limit Stop.
022-7825	DPST, Manual Reset on High Pressure.
5 to 95 psi L.P. & 100 to 360 psi H.P. Ranges	
36" Cap. Tube with 1/4" SAE Flare Nut	
012-1609	SPST, Automatic Reset, with Limit Stop.
022-7804	DPST, Manual Reset on High Pressure, Special Shaft without a Knob.
36" Cap. Tube with 3" x 1/4" Sweat Fitting	
012-1530	SPST, Manual Reset on High & Low Pressures, with Limit Stop.
012-1605	SPST, Manual Reset on High Pressure, with Limit Stop.
0 to 100 psi L.P. & 150 to 450 psi H.P. Ranges	
36" cap. Tube with 1/4" SAE Flare Nut	
012-1594	SPST, Manual Reset on High & Low Pressures, with Limit Stop.
012-1637	SPST, Automatic Reset, with Limit Stop.
022-7806	DPST, Manual Reset on High Pressure, Special Shaft without a Knob.
022-7706	DPST, Automatic Reset, with Limit Stop, Special Shaft without a Knob.
5 to 95 psi L.P. & 250 to 450 psi H.P. Ranges	
36" Cap. Tube with 3" x 1/4" Sweat Fitting	
012-1617	SPST, Manual Reset on High & Low Pressures, with Limit Stop.

DUAL TEMPERATURE CONTROLS

100 to 360 psi H.P. Range, 1/4" SAE Male Elbow Fitting
76" Cap. Tube, 3/8" dia. Bulb

012-1534	SPST, −15° to 40°F Temp. Range, Automatic Reset.
012-1535	SPST, 0° to 55°F Temp. Range, Automatic Reset.
012-1536	SPST, 25° to 75°F Temp. Range, Automatic Reset.

84" Cap. Tube, 3/8" x 9 1/2" Bulb, Cross Ambient

012-1514	SPST, 30° to 50°F Temp. Range.

100 to 250 psi H.P. Range
36" Cap. Tube with 1/4" SAE Flare Nut
76" Cap. Tube, 3/8" dia. Bulb

012-4008	SPST, 30° to 50°F Temp. Range, for Ice Cube Maker.
022-7707	DPST, −35° to 15°F Temp. Range, Automatic Reset, Special Shaft without a Knob.
022-7709	DPST, 0° to 55°F Temp. Range, Automatic Reset, Special Shaft without a Knob.

150 to 450 psi H.P. Range
84" Cap. Tube, 3/8" x 9 1/2" Bulb, Cross Ambient

022-7713	DPST, 50° to 105°F Temp. Range, Automatic Reset, with a Dial Knob.

100 to 300 psi H.P. Range
36" Cap. Tube, 3" x 1/4" Sweat Fitting
76" Cap. Tube, 3/8" dia. Bulb

012-1537	SPST, 25° to 75°F Temp. Range, with Limit Stop, for Ice Cube Maker.

TWO-TEMPERATURE CONTROLS

019-1559	10° to 60°F (cut-out) 20° to 60°F (cut-in)	SPST, Defrosts unit each running cycle, for Walk-in Coolers & Display Cases.
015-4351	40° to 85°F (cut-in)	SPDT, Bin Control on Ice Maker.

RANCO

CONDENSED CONTROL INFORMATION

SINGLE TEMPERATURE CONTROLS

Air Conditioning — *50° to 105°F Group Ranges*

Cooling

016-102 SPDT, 3° to 25°F Diff., 84" Cap. Tube, 3/8" x 9½" Bulb, Cross Ambient.
016-105 SPDT, 3° to 25°F Diff., 76" Tube, 3/8" Bulb.
016-112 SPDT, 3° to 25°F Diff., 48" Tube, No Bulb.
A13-109 SPST, 3°F Differential, No OFF.
A13-110 SPST, 3°F Differential, With OFF.
A30-1668 SPST, 4½°F Diff., 25" Cap. Tube, 3/8" x 4½" Bulb, Cross Ambient.
A30-1564 SPST, 5°F Diff., No OFF.
A30-1596 SPST, 5°F Diff., With OFF.
020-7013 DPST, 3.5° to 25°F Diff., 84" Tube, 3/8" x 9½" Bulb, Cross Ambient, No dial knob.
016-165 SPDT, 2.5°F Fixed Diff., 1½" x 1¼" Air Coil Bulb.

Heating & Cooling (Use with Manual Selector Switch)

A14-109 SPDT, 4°F Max. Diff., 1" x 1" Air Coil Bulb.
C12-5010 SPDT, 3°F Max. Diff., 26" Tube, 3/8" x 9½ Bulb, Liquid Filled.
A10-6010 Automotive Air Conditioner, 28° to 52°F, 48" st. tube.
A10-6011 Automotive Air Conditioner, 28° to 52°F, 24" st. tube.

Heating & Cooling-Automatic Changeover on Heat Pumps

C17-100 Two electrically separate SPDT switches, 26" Tube, 3/8" x 9" Bulb, Liquid Filled.
D52-100 SPDT De-Icer, 18" Tube & 27" Tube with Cross Amb. Bulb.
D52-101 SPDT De-Icer, 36" Tube & 39" Tube with Cross Amb. Bulb.
V26-100 4-Way Reversing Valve, 2½ ton max. capacity.
V26-150 4-Way Reversing Valve, 2½ ton max. capacity.
V30-101 4-Way Reversing Valve, 5 ton max. capacity.
V30-103 4-Way Reversing Valve, 5 ton max. capacity.
V25-500 4-Way Reversing Valve, 8½ ton max. capacity.
V25-750 4-Way Reversing Valve, 8½ ton max. capacity.
V25-751 4-Way Reversing Valve, 8½ ton max. capacity.

Air Temperature Applications — *−35° to 85°F Group Ranges*

010-1415 SPST, 3° to 25°F Diff., 84" Tube, 3/4" Air Coil Bulb.
010-1418 SPST, 3° to 25°F Diff., 1¼" x 1½" Air Coil Bulb.
010-1802 SPST, 3° to 25°F Diff., 1¼" x 1½" Air Coil Bulb.
010-1903 SPST, 3° to 25°F Diff., 84" Tube, 3/4" Air Coil Bulb.
020-7016 DPST, 3.5° to 25°F Diff., 1¼" x 1½" Air Coil Bulb, No Dial Knob.

Beverage Coolers — *−10° to 55°F Group Ranges*

016-104 SPDT, 2.5° to 23°F Diff., 76" Tube, 3/8" Bulb.
016-111 SPDT, 2.5° to 23°F Diff., 76" Tube, No Bulb.
010-1409 SPST, 3° to 25°F Diff., 76" Tube, 3/8" Bulb.
010-1490 SPST, 3°F Fixed Diff., 76" Tube, 3/8" Bulb.
020-7009 DPST, 3.5° to 25°F Diff., 76" Tube, 3/8" Bulb, No Dial Knob.
A10-1502 SPST, 8° to 13.5°F Diff., 48" Tube, No Bulb.
RJS-3163 SPST, 6° to 18°F Diff., 76" Tube, No Bulb.

Beer Coolers

010-1823 SPST, 2°F Fixed Diff., 25" Tube, 3/8" Bulb.

Display Cases (Unfrozen) — *25° to 90°F Group Ranges*

010-1840 SPST, 5° to 27.5°F Diff., 76" Tube, 3/8" Bulb.
010-1491 SPST, 3°F Fixed Diff., 76" Tube, 3/8" Bulb.

Food Vending Cabinets (Health Code Safety Controls)

Cold Vending ..... *45° & 50°F Termination*

F11-1000 SPDT, Automatically stops Coin Mechanism, manual reset, 30 minute timer.
F11-1016 SPDT, Automatically stops Coin Mechanism, manual reset, no bulb on cap. tube.
F11-1019 Same as F11-1000, EXCEPT 45° termination and 60 minute timer.
F11-1306 Same as F11-1000, EXCEPT 45° termination and AUTOMATIC RESET.
F11-1305 Same as F11-1306, EXCEPT 60 minute timer.

Hot Vending ..... *150°F Termination*

F11-1200 SPDT, Automatically stops Coin Mechanism, manual reset, 30 minute timer.

Frozen Food Cases — *−35° to 45°F Group Ranges*

016-103 SPDT, 3° to 20°F Diff., 76" Tube, 3/8" Bulb.
010-1408 SPST, 3° to 25°F Diff., 76" Tube, 3/8" Bulb.
010-1416 SPST, 3° to 25°F Diff., 76" Tube, No Bulb.
010-1419 SPST, 3° to 25°F Diff., 76" Tube, No Bulb.
010-1433 SPST, 3° to 25°F Diff., 76" Tube, 3/8" Bulb.
010-1469 SPST, 3° to 25°F Diff., 76" Tube, 3/8" Bulb, Signal contacts MAKE on temp. rise.
010-1470 SPST, 3° to 25°F Diff., 76" Tube, No Bulb, Signal contacts MAKE on temp. rise.

SINGLE TEMPERATURE CONTROLS

Frozen Food Cases (continued)

020-7007 DPST, 3.5° to 25°F Diff., 76" Tube, 3/8" Bulb, No Dial Knob.
A10-2502 SPST, 8° to 14°F Diff., 48" Tube, No Bulb.
A30-2538 SPST, 8° to 14°F Diff., 48" Tube, No Bulb, Signal contacts MAKE on temp. rise.
RJS-3110 SPST, 9° to 17°F Diff., 76" Tube, No Bulb.
RJS-3199 SPST, 9° to 17°F Diff., 76" Tube, 3/8" Bulb.

Household Refrigerators — *−13° to 65°F Group Ranges*

General Replacement Controls

A10-518 SPST, Closes on Rise, 10.5° to 15°F Diff., 25" Tube, No Bulb, Non-adjustable Mounting Bracket.
A10-519 SPST, Closes on Rise, 12° to 16°F Diff., 25" Tube, No Bulb, Non-adjustable Mounting Bracket.
RJS-830 SPST, Closes on Rise, 8° to 25°F Diff., 25" Tube, 3/8" Bulb, Adjustable Mounting Bracket.
A10-918 SPST, Closes on Rise, 10.5° to 15°F Diff., 72" Tube, No Bulb, Non-adjustable Mounting Bracket.
A10-919 SPST, Closes on Rise, 12° to 16°F Diff., 72" Tube, No Bulb, Non-adjustable Mounting Bracket.
RJS-1080 SPST, Closes on Rise, 9° to 29°F Diff., 48" Tube, No Bulb, Adjustable Mounting Bracket.
RJS-3216 SPST, Closes on Rise, 8° to 22°F Diff., 38" Tube, 7/16" Twisted Bulb, Adjustable Mounting Bracket, Insulator for Light Socket.

Ice Cream Cabinets — *−15° to 40°F Group Ranges*

Hardening & Holding Types

A10-1503 SPST, 7.5° to 12.5°F Diff., 48" Tube, No Bulb, Non-adjustable Mounting Bracket.

Soft Ice Cream Dispenser

025-100 SPDT, Pilot Duty rating, 1½°F Fixed Diff., 48" Tube, No Bulb, 3 7/16" long dial shaft.

Ice Maker (Defrosting) — *32°F (No Range)*

Solenoid Operated Hot Gas Defrost

021-100 SPST, Opens on rise, No Adjustments, 72" Tube, Special Bulb.

Milk Cooler Applications — *0° to 55°F Group Ranges*

010-1414 SPST, 4° to 10°F Diff., 84" Tube, 3/8" x 9½" Bulb, Cross Ambient.
010-1477 SPST, 4° to 10°F Diff., 84" Tube, 3/8" x 9½" Bulb, Cross Ambient.
010-1829 SPST, 4° to 10°F Diff., 84" Tube, 3/8" x 9½" Bulb, Cross Ambient, with Manual Start Lever.
020-7012 DPST, 3.5° to 25°F Diff., 84" Tube, 3/8" x 9½" Bulb, Cross Ambient, no Dial Knob.

Ice Bank Type Cooler

018-100 SPST, Closes on rise, No Adjustments, 72" Tube, Special Bulb, Operates only at **32°F** to maintain established thickness of ice around evaporator coils.

Storage Alarm Systems — *0° to 105°F Group Ranges*

011-1756 SPST, Opens on Rise, 3° to 25°F Diff., 76" Tube, No Bulb.
011-1758 SPST, Opens on Rise, 3° to 25°F Diff., 48" Tube, No Bulb.
011-3019 SPST, Opens on Rise, 3° to 25°F Diff., 76" Tube, No Bulb.
021-7409 DPST, Opens on Rise, 5° to 26°F Diff., 76" Tube, No Bulb, without a Dial Knob.

Water Coolers — *14° to 75°F Group Ranges*

016-110 SPDT, 2°F Fixed Diff., 76" Tube, 3/8" Bulb.
010-1410 SPST, 3° to 25°F Diff., 76" Tube, 3/8" Bulb.
A10-1501 SPST, 8° to 13°F Diff., 48" Tube, No Bulb.
RJS-3111 SPST, 7.5° to 26.5°F Diff., 48" Tube, 3/8" Bulb.

Wide Cycle Defrost Control — *0° to 50°F Range*

010-1473 SPST, 7° to 55°F Diff., 76" Tube, 3/8" Bulb.

DIFFERENTIAL OIL PRESSURE CONTROLS

36" cap. tube, 1/4" SAE Flare Nut
CUT-OUT Range 5 to 60 PSI

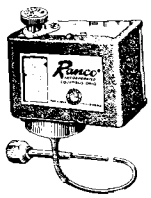
P30-3501 SPST, 45 sec. time delay switch.
P30-3601 SPST, 60 sec. time delay switch.
P30-3701 SPST, 90 sec. time delay switch.
P30-3801 SPST, 120 sec. time delay switch.

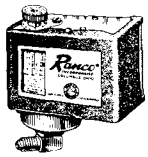
Time Delay Switches

S30-1001 45 sec. delay.
S30-1101 60 sec. delay.
S30-1201 90 sec. delay.
S30-1301 120 sec. delay.

RANCO

SINGLE LOW PRESSURE CONTROLS





Control Code	Switch Type And Action	Range (adjustable)		Differential Low and High Extremes	Factory Setting Cut-out	Factory Setting Cut-in	Power Element Catalog No. & Fitting
AUTOMATIC RESET			Lowest Cut-out	**contacts CLOSE ON RISE of pressure**			
010-1401	SPST CLOSE ON RISE	12" Vac. to 50 PSI	20" Vac.	5 to 35 PSI	15 PSI	25 PSI	Cat. No. 32094-1 ¼" SAE male, angle
010-1402							Cat. No. 32107-1 36" cap. tube ¼" SAE Flare Nut
010-1842							Cat. No. 32107-5 48" cap. tube ¼" SAE Flare Nut
010-1483		0 to 100 PSI		10 to 40 PSI	50 PSI	60 PSI	Cat. No. 32107-21 36" cap. tube ¼" SAE Flare Nut
010-1831							Cat. No. 32094-3 ¼" SAE male, angle
MANUAL RESET				**manually reset 8 PSI ABOVE cutout setting**			
010-1867	SPST LOCK OPEN ON DROP	12" Vac. to 40 PSI	— —	8 PSI FIXED	15 PSI	23 PSI	Cat. No. 32094-1 ¼" SAE male, angle
MANUAL RESET				**manually reset 10 PSI ABOVE cut-out setting**			
010-1925	SPST LOCK OPEN ON DROP	0 to 90 PSI	— —	10 PSI FIXED	50 PSI	60 PSI	Cat. No. 32094-3 ¼" SAE male, angle
AUTOMATIC RESET			Lowest Cut-in	**contacts OPEN ON RISE of pressure**			
011-1754	SPST OPEN ON RISE	12" Vac. to 50 PSI	20" Vac.	5 to 35 PSI	25 PSI	15 PSI	Cat. No. 32094-1 ¼" SAE male, angle
011-3094							Cat. No. 32107-1 36" cap. tube ¼" SAE Flare Nut
011-1799		0 to 100 PSI		10 to 40 PSI	30 PSI	20 PSI	Cat. No. 32094-3 ¼" SAE male, angle
011-3099							Cat. No. 32107-21 36" cap. tube ¼" SAE Flare Nut
AUTOMATIC RESET			Lowest Operating	**contacts OPEN OR CLOSE on RISE of pressure**			
016-120	SPDT OPEN OR CLOSE ON RISE	12" Vac. to 50 PSI	20" Vac.	5 to 35 PSI	10 PSI	15 PSI	Cat. No. 32094-1 ¼" SAE male, angle
016-107		0 to 100 PSI		10 to 40 PSI	50 PSI	60 PSI	Cat. No. 32094-3 ¼" SAE male, angle
AUTOMATIC RESET			Lowest Cut-out	**contacts CLOSE ON RISE of pressure**			
020-7002	DPST CLOSE ON RISE	12" Vac. to 50 PSI	20" Vac.	5 to 35 PSI	15 PSI	25 PSI	Cat. No. 32107-1 36" cap. tube ¼" SAE Flare Nut
020-7004		0 to 100 PSI		10 to 40 PSI	50 PSI	60 PSI	Cat. No. 32107-21 36" cap. tube ¼" SAE Flare Nut

Electrical Ratings

Volts	Amps Full Load	Amps Locked Rotor
AC		
115	20	120
240	17	102
*DC		
115	4.6	46.0
240	2.3	23.0
HERMETIC UNITS ONLY		
240	20	102
PILOT DUTY		
120/240 AC		720 V.A.
240/600 AC		125 V.A.
120/240 DC		57.5 V.A.

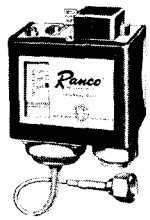
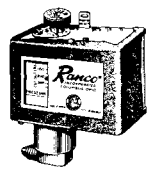
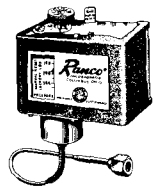
*With Magnet installed Order Magnet (cat. 16993) separately.

Volts	Amps Full Load	Amps Locked Rotor
AC		
120	12	72
240	9.8	58.8
240	25A.	Non-Ind.
HERMETIC UNITS ONLY		
240	20	80

Volts	Amps. Full Load	Amps. Locked Rotor
SINGLE PHASE		
AC		
120	24	144
208/240	24	144
DC		
120	4.6	46.0
240	2.3	23.0
†2 & 3 PHASE		
AC		
208	16	96
240	15	90
480	7.5	45
600	6	36
PILOT DUTY		
120/600 V.AC		125 V.A.
120/600 V.DC		57.5 V.A.

†**Full Load and Locked Rotor ratings** are only suitable for hermetic compressors. When 020, 021 or 022 are used as a 2 circuit switch, the combined load must not exceed 5885 V.A. and must have a common return. 2 circuit load applications are limited to **(a)** 2 non-inductive loads, **(b)** 1 motor and 1 pilot duty load and **(c)** 1 motor load and 1 non-inductive load.

SINGLE HIGH PRESSURE CONTROLS

Control Code	Switch Type And Action	Range (adjustable)		Differential Low and High Extremes	Factory Setting Cut-out	Factory Setting Cut-in	Power Element Catalog No. & Fitting
AUTOMATIC RESET			Lowest Cut-Out	contacts CLOSE ON RISE of pressure			
010-1894	SPST CLOSE ON RISE	150 to 450 PSI	0 PSI	35 to 150 PSI	250 PSI	290 PSI	Cat. No. 320662-1 ¼" SAE male, angle
010-2054							Cat. No. 320491-1 36" cap. tube ¼" SAE Flare Nut
MANUAL RESET				manually reset 45 PSI ABOVE CUT-OUT setting			
010-1895	SPST LOCK OPEN ON DROP	(Lock out range) 110 to 410 PSI	——	45 PSI FIXED	250 PSI	295 PSI	Cat. No. 320662-1 ¼" SAE male, angle
AUTOMATIC RESET			Lowest Cut-in	contacts OPEN ON RISE of pressure			
011-1711	SPST OPEN ON RISE	150 to 450 PSI	0 PSI	35 to 150 PSI	290 PSI	250 PSI	Cat. No. 320491-1 36" cap. tube ¼" SAE Flare Nut
011-1713							Cat. No. 320662-1 ¼" SAE male, angle
MANUAL RESET				manually reset 45 PSI BELOW CUT-OUT setting			
011-1712	SPST LOCK OPEN ON RISE	150 to 450 PSI	——	45 PSI FIXED	290 PSI	245 PSI	Cat. No. 320491-1 36" cap. tube ¼" SAE Flare Nut
011-1714							Cat. No. 320662-1 ¼" SAE male, angle
AUTOMATIC RESET			Lowest Operating	contacts OPEN OR CLOSE ON RISE of pressure			
016-108	SPDT OPEN OR CLOSE ON RISE	150 to 450 PSI	0 PSI	35 to 150 PSI	290 PSI	250 PSI	Cat. No. 320491-1 36" cap. tube ¼" SAE Flare Nut
016-142		100 to 360 PSI	83 PSI	17 PSI FIXED	233 PSI	250 PSI	Cat. No. 32116-1 36" cap. tube ¼" SAE Flare Nut
016-166		50 to 150 PSI	10 PSI	10 to 40 PSI	90 PSI	115 PSI	
MANUAL RESET				manually reset 40 PSI ABOVE OR BELOW CUT-OUT setting			
* 016-200	SPDT OPEN OR CLOSE ON RISE	(Lock out range) 150 to 450 PSI	——	40 PSI FIXED	290 PSI	250 PSI	Cat. No. 320491-1 36" cap. tube ¼" SAE Flare Nut
** 016-250		110 to 410 PSI		40 PSI FIXED	250 PSI	290 PSI	
AUTOMATIC RESET			Lowest Cut-Out	contacts CLOSE ON RISE of pressure			
020-7006	DPST CLOSE ON RISE	150 to 450 PSI	0 PSI	35 to 150 PSI	250 PSI	290 PSI	Cat. No. 320491-1 36" cap. tube ¼" SAE Flare Nut
AUTOMATIC RESET			Lowest Cut-in	contacts OPEN ON RISE of pressure			
021-7406	DPST OPEN ON RISE	150 to 450 PSI	0 PSI	35 to 150 PSI	290 PSI	250 PSI	Cat. No. 320491-1 36" cap. tube ¼" SAE Flare Nut
MANUAL RESET				manually reset 45 PSI BELOW CUT-OUT setting			
021-7480	DPST OPEN ON RISE	150 to 450 PSI	——	45 PSI FIXED	290 PSI	245 PSI	Cat. No. 320491-1 36" cap. tube ¼" SAE Flare Nut

Electrical Ratings

Volts	Amps. Full Load	Amps. Locked Rotor
AC		
115	20	120
240	17	102
*DC		
115	4.6	46.0
240	2.3	23.0
HERMETIC UNITS ONLY		
240	20	102
PILOT DUTY		
120/240 AC	720 V.A.	
240/600 AC	125 V.A.	
120/240 DC	57.5 V.A.	

*With Magnet installed

Order Magnet (cat. 16993) separately.

Volts	Amps. Full Load	Amps. Locked Rotor
AC		
120	12	72
240	9.8	58.8
240	25A.	Non-Ind.
HERMETIC UNITS ONLY		
240	20	80

* Lock out on rise of pressure
** Lock out on drop of pressure

†**Full Load and Locked Rotor ratings** are only suitable for hermetic compressors. When 020, 021 or 022 are used as a 2 circuit switch, the combined load must not exceed 5885 V.A. and must have a common return. 2 circuit load applications are limited to (**a**) 2 non-inductive loads, (**b**) 1 motor and 1 pilot duty load and (**c**) 1 motor load and 1 non-inductive load.

Volts	Amps. Full Load	Amps. Locked Rotor
SINGLE PHASE		
AC		
120	24	144
208/240	24	144
DC		
120	4.6	46.0
240	2.3	23.0
†2 & 3 PHASE		
AC		
208	16	96
240	15	90
480	7.5	45
600	6	36
PILOT DUTY		
120/600 AC	125 V.A.	
120/600 DC	57.5 V.A.	

DUAL PRESSURE CONTROLS

Dual unit Ranco "012" controls are a combination of two single type control mechanisms within one case connected mechanically to operate one switch with one set of contacts.

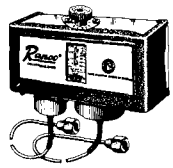
The switch is single pole, single throw with a snap acting toggle operated by either side of control mechanisms.

The High Pressure Cut-Out construction opens the circuit on rise of high pressure. The circuit recloses when the high pressure drops by the amount of the fixed, constant differential.

The Low Pressure or Temperature side, independent in operation to the High Pressure side, cycles the same single pole, single throw switch to close the circuit on increase and open the circuit on decrease of either low pressure or temperature.

single pole, single throw switch

LOW PRESSURE CLOSES ON RISE
HIGH PRESSURE OPENS ON RISE



BOLD-FACE TYPE—HIGH PRESSURE SIDE
LIGHT-FACE TYPE—LOW PRESSURE SIDE

Control Code	Low Press. Side-Cut-in Range / High Press. Side-Cut-out Range	Lowest Cut-out	Differential L.P. Side-adjustable / H.P. Side-fixed	Factory Setting Cut-out	Factory Setting Cut-in	Safety Limit Stop	Power Element Catalog No. & Fitting
AUTOMATIC RESET	**Low Press. Side CLOSE ON RISE**		**High Press. Side OPEN ON RISE**				
012-1505	12" Vac. to 50 PSI	20"Vac.	5 to 35 PSI	15 PSI	25 PSI	— —	Low Press. Side Cat. 32094-1 High Press. Side Cat. 32117-1 ¼" male angle, both sides
	100 to 250 PSI	— —	**40 PSI FIXED**	**190 PSI**	**150 PSI**	— —	
012-1550	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	— —	Low Press. Side Cat. 32094-3 High Press. Side Cat. 32117-1 ¼" male angle, both sides
	150 to 450 PSI	— —	**65 PSI FIXED**	**290 PSI**	**225 PSI**	— —	
012-1506	12" Vac. to 50 PSI	20"Vac.	5 to 35 PSI	15 PSI	25 PSI	— —	Low Press. Side Cat. 32107-1 High Press. Side Cat. 32116-1 36" cap. tube, ¼" Flare Nut both sides
	100 to 250 PSI	— —	**40 PSI FIXED**	**190 PSI**	**150 PSI**	— —	
012-1549	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	— —	Low Press. Side Cat. 32107-21 High Press. Side Cat. 32116-1 36" cap. tube, ¼" Flare Nut both sides
	150 to 450 PSI	— —	**65 PSI FIXED**	**290 PSI**	**225 PSI**	— —	
012-4100	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	— —	Low Press. Side Cat. 32107-19 High Press. Side Cat. 32116-2 48" cap. tube, ¼" Flare Nut both sides
	150 to 450 PSI	— —	**65 PSI FIXED**	**290 PSI**	**225 PSI**	— —	
012-1554	12" Vac. to 50 PSI	20"Vac.	5 to 35 PSI	15 PSI	25 PSI	— —	Low Press. Side Cat. 32107-5 High Press. Side Cat. 32116-2 48" cap. tube, ¼" Flare Nut both sides
	100 to 247 PSI	— —	**50 PSI FIXED**	**247 PSI**	**197 PSI**	**247 PSI**	
012-1609	5 to 95 PSI	10"Vac.	10 to 40 PSI	40 PSI	50 PSI	— —	Low Press. Side Cat. 32107-1 High Press. Side Cat. 32116-1 36" cap. tube, ¼" Flare Nut both sides
	100 to 360 PSI	— —	**50 PSI FIXED**	**360 PSI**	**310 PSI**	**360 PSI**	
012-1637	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	— —	Low Press. Side Cat. 32107-21 High Press. Side Cat. 32116-1 36" cap. tube, ¼" Flare Nut both sides
	150 to 450 PSI	— —	**60 PSI FIXED**	**400 PSI**	**340 PSI**	**450 PSI**	
012-4101	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	— —	Low Press. Side Cat. 32107-19 High Press. Side Cat. 32116-2 48" cap. tube, ¼" Flare Nut both sides
	150 to 450 PSI	— —	**60 PSI FIXED**	**400 PSI**	**340 PSI**	**450 PSI**	
MANUAL RESET	**on HIGH PRESSURE SIDE**						
012-1546	12" Vac. to 50 PSI	20"Vac.	5 to 35 PSI	15 PSI	25 PSI	— —	Low Press. Side—Cat. 32094-1 High Press. Side—Cat. 32117-1 ¼" SAE male angle, both sides
	100 to 250 PSI	— —	**40 PSI FIXED**	**190 PSI**	**150 PSI**	— —	**Man. reset 40 PSI Below Cut-out**
012-1551	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	— —	Low Press. Side—Cat. 32107-21 High Press. Side—Cat. 32116-1 36" cap. tube, ¼" Flare Nut both sides
	150 to 450 PSI	— —	**65 PSI FIXED**	**290 PSI**	**225 PSI**	— —	**Man. reset 65 PSI Below Cut-out**
012-4650	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	— —	Low Press. Side—Cat. 32107-19 High Press. Side—Cat. 32116-2 48" cap. tube, ¼" Flare Nut both sides
	150 to 450 PSI	— —	**65 PSI FIXED**	**290 PSI**	**225 PSI**	— —	**Man. reset 65 PSI Below Cut-out**
012-1605	5 to 95 PSI	10"Vac.	10 to 40 PSI	40 PSI	50 PSI	— —	Low Press. Side—32107-6 High Press. Side—32241-1 36" cap. tube, ¼" x 3" sweat fittings
	100 to 360 PSI	— —	**50 PSI FIXED**	**360 PSI**	**310 PSI**	**360 PSI**	**Man. reset 50 PSI Below-Cut out**

Electrical Ratings

Volts	Amps. Full Load	Amps. Locked Rotor
AC		
115	20	120
240	17	102
*DC		
115	4.6	46.0
240	2.3	23.0
HERMETIC UNITS ONLY		
240	20	80
PILOT DUTY		
120/240 VAC		720 V.A.
240/600 VAC		125 V.A.
120/240 VDC		57.5 V.A.

*With Magnet installed Order Magnet (cat. 16993) separately.

All type "012" controls have the same electrical rating

RANCO

Dual Pressure Controls continued next page

DUAL PRESSURE CONTROLS
(continued)

BOLD-FACE TYPE—HIGH PRESSURE SIDE
LIGHT-FACE TYPE—LOW PRESSURE SIDE

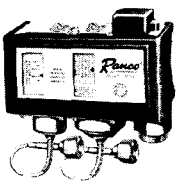
Control Code	Low Press. Side-Cut-in Range / High Press. Side-Cut-out Range	Lowest Cut-out	Differential	Factory Setting Cut-out	Factory Setting Cut-in	Safety Limit Stop	Power Element Catalog No. & Fitting	Electrical Ratings (See Preceding Page)
MANUAL RESET — manually reset on BOTH SIDES								
012-1530	5 to 95 PSI	10"Vac.	10 PSI FIXED	40 PSI	50 PSI	——	MANUAL RESET	LOW SIDE 10 PSI ABOVE CUT-OUT
	100 to 360 PSI	——	**50 PSI FIXED**	**360 PSI**	**310 PSI**	**360 PSI**		**HIGH SIDE 50 PSI BELOW CUT-OUT**
							Low Press. Side—Cat. 32107-6 High Press. Side—Cat. 32241-1 36" cap. tube, ¼" x 3" sweat fitting both sides	
012-1617	5 to 95 PSI	10"Vac.	10 PSI FIXED	40 PSI	50 PSI	——	MANUAL RESET	LOW SIDE 10 PSI ABOVE CUT-OUT
	250 to 425 PSI	——	**55 PSI FIXED**	**425 PSI**	**370 PSI**	**425 PSI**		**HIGH SIDE 55 PSI BELOW CUT-OUT**
							Low Press. Side—Cat. 32107-6 High Press. Side—Cat. 32241-1 36" cap. tube, ¼" x 3" sweat fitting both sides	
012-1594	0 to 100 PSI	20"Vac.	10 PSI FIXED	40 PSI	50 PSI	——	MANUAL RESET	LOW SIDE 10 PSI ABOVE CUT-OUT
	150 to 450 PSI	——	**65 PSI FIXED**	**350 PSI**	**285 PSI**	**450 PSI**		**HIGH SIDE 65 PSI BELOW CUT-OUT**
							Low Press. Side—Cat. 32107-21 High Press. Side—Cat. 32116-1 36" cap. tube, ¼" Flare Nut both sides	
012-1595	12" Vac. to 50 PSI	20"Vac.	8 PSI FIXED	15 PSI	23 PSI	——	MANUAL RESET	LOW SIDE 8 PSI ABOVE CUT-OUT
	100 to 220 PSI	——	**50 PSI FIXED**	**190 PSI**	**140 PSI**	**220 PSI**		**HIGH SIDE 50 PSI BELOW CUT-OUT**
							Low Press. Side—Cat. 32107-1 High Press. Side—Cat. 32116-1 36" cap. tube, ¼" Flare Nut both sides	

The "022" series dual unit controls are a combination of two single controls within one case connected mechanically to operate one double pole, single throw set of contacts to switch two circuits simultaneously, switch two lines of a three phase circuit, or a double break for a single phase circuit.

The double pole, single throw snap acting switch is operated by either side of the control.

The HIGH PRESSURE mechanism cuts-out the circuit (opens switch) on rise of high pressure. The circuit is reclosed when the high pressure drops by the amount of the fixed, constant differential.

The LOW PRESSURE or TEMPERATURE side, independent in operation to the High Pressure Side, cycles the same double pole, single throw switch to CLOSE the circuit on Increase and OPEN the circuit on Decrease of pressure or temperature.



double pole, single throw switch

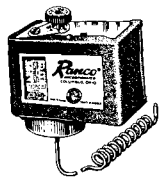
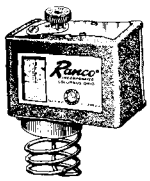
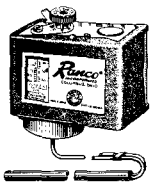
LOW PRESSURE CLOSES ON RISE
HIGH PRESSURE OPENS ON RISE

Control Code	Low Press. Side-Cut-in Range / High Press. Side-Cut-out Range	Lowest Cut-out	Differential	Factory Setting Cut-out	Factory Setting Cut-in	Safety Limit Stop	Power Element Catalog No. & Fitting
AUTOMATIC RESET							
022-7702	12" Vac. to 50 PSI	20"Vac.	5 to 35 PSI	15 PSI	25 PSI	——	Low Press. Side Cat. 32107-1 High Press. Side Cat. 32116-1 36" cap. tube, ¼" Flare Nut both sides
	100 to 250 PSI	——	**40 PSI FIXED**	**190 PSI**	**150 PSI**	——	
022-7706	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	——	Low Press. Side Cat. 32107-21 High Press. Side Cat. 32116-1 36" cap. tube, ¼" Flare Nut both sides
	150 to 450 PSI	——	**60 PSI FIXED**	**400 PSI**	**340 PSI**	**450 PSI**	
022-7725	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	——	Low Press. Side Cat. 32107-19 High Press. Side Cat. 32116-2 48" cap. tube, ¼" Flare Nut both sides
	150 to 450 PSI	——	**60 PSI FIXED**	**400 PSI**	**340 PSI**	**450 PSI**	
MANUAL RESET on HIGH PRESSURE SIDE							
022-7802	12" Vac. to 50 PSI	20"Vac.	5 to 35 PSI	15 PSI	25 PSI	——	Low Press. Side—Cat. 32107-1 High Press. Side—Cat. 32116-1 36" cap. tube, ¼" Flare Nut Both sides
	100 to 250 PSI	——	**40 PSI FIXED**	**190 PSI**	**150 PSI**	——	**Man. reset 40 PSI Below Cut-out**
022-7804	5 to 95 PSI	10"Vac.	10 to 40 PSI	50 PSI	60 PSI	——	Low Press. Side—Cat. 32107-1 High Press. Side—Cat. 32116-1 36" cap. tube, ¼" Flare Nut Both sides
	100 to 360 PSI	——	**50 PSI FIXED**	**290 PSI**	**240 PSI**	——	**Man. reset 50 PSI Below Cut-out**
022-7806	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	——	Low Press. Side—Cat. 32107-21 High Press. Side—Cat. 32116-1 36" cap. tube, ¼" Flare Nut Both sides
	150 to 450 PSI	——	**60 PSI FIXED**	**400 PSI**	**340 PSI**	——	**Man. reset 60 PSI Below Cut-out**
022-7825	0 to 100 PSI	20"Vac.	10 to 40 PSI	50 PSI	60 PSI	——	Low Press. Side—Cat. 32107-19 High Press. Side—Cat. 32116-2 48" cap. tube, ¼" Flare Nut Both sides
	150 to 450 PSI	——	**60 PSI FIXED**	**400 PSI**	**340 PSI**	——	**Man. reset 60 PSI Below Cut-out**

Volts	Amps Full Load	Amps Locked Rotor
SINGLE PHASE AC		
120	24	144
240	24	144
2 & 3 PHASE		
208	16	96
240	15	90
480	7.5	45
600	6	36
PILOT DUTY		
120/600 V. AC		125 V.A.
120/600 V. DC		57.5 V.A.

All type 022 controls have the same electrical ratings.

TEMPERATURE CONTROLS


Control Code	Switch Type And Action	Range (adjustable)		Differential Low & High Extremes	Factory Setting		Power Element Catalog No. & Fitting
					Cut-out	Cut-in	
GENERAL APPLICATION			Lowest Cut-out				
010-1408	SPST CLOSE ON RISE	−15°F. to 40°F.	−20°F.	LOW END 5°F. to 25°F. HIGH END 3°F. to 20°F.	−5°F.	0°F.	Cat. No. 32086-5 76" cap. tube, ⅜" x 1½" bulb
010-1409		0°F. to 55°F.	−10°F.		10°F.	15°F.	Cat. No. 32086-4 76" cap. tube, ⅜" x 1½" bulb
010-1410		25°F. to 75°F.	15°F.		40°F.	44°F.	Cat. No. 32086-6 76" cap. tube, ⅜" x 1½" bulb
010-1416		0°F. to 45°F.	−10°F.		30°F.	34°F.	Cat. No. 32081-1 76" cap. tube, no bulb
010-1419		−35°F. to 15°F.	−40°F.		−4°F.	0°F.	Cat. No. 32081-47 76" cap. tube, no bulb
010-1433		−35°F. to 15°F.	−40°F.		−4°F.	0°F.	Cat. No. 32086-43 76" cap. tube, ⅜" x 1½" bulb
***010-1840**		30°F. to 90°F.	19°F.	5°F. to 27.5°F.	50°F.	60°F.	Cat. No. 32086-13 76" cap. tube, ⅜" x 1½" bulb
* Supplied with Magnet							
AIR TEMPERATURE							
010-1415	SPST CLOSE ON RISE	0°F. to 45°F.	−10°F.	LOW END 5°F. to 25°F. HIGH END 3°F. to 20°F.	36°F.	40°F.	Cat. No. 32115-2 84" cap. tube, ¾" x 6" air coil
010-1418		0°F. to 45°F.	−10°F.		36°F.	40°F.	Cat. No. 32115-1 1 7/32" x 1¼" air coil
010-1802		25°F. to 75°F.	15°F.		52°F.	56°F.	Cat. No. 32115-7 1 7/32" x 1¼" air coil
010-1903		40°F. to 85°F.	20°F.		65°F.	70°F.	Cat. No. 32115-14 84" cap. tube, ¾" x 6" coil
FIXED DIFFERENTIAL							
010-1490	SPST CLOSE ON RISE	0°F. to 55°F.	− 3°F.	3°F. FIXED	35°F.	38°F.	Cat. No. 32086-4 76" cap. tube, ⅜" x 1½" bulb
010-1491		25°F. to 75°F.	22°F.		40°F.	43°F.	Cat. No. 32086-6 76" cap. tube, ⅜" x 1½" bulb
MILK COOLERS							
010-1414	SPST CLOSE ON RISE	30°F. to 50°F.	20°F.	4°F. to 10°F.	40°F.	44°F.	Cat. No. 32076-1 84" cap. tube, ⅜" x 9½" cross amb. bulb
010-1477		25°F. to 45°F.	15°F.		26°F.	31°F.	
***010-1829**		30°F. to 50°F.	20°F.		40°F.	44°F.	
*With Manual Start Lever							
SIGNAL CIRCUIT				**Signal contacts CLOSE 10°F. ABOVE Cut-in setting**			
010-1469	SPST CLOSE ON RISE	−15°F. to 40°F.	−20°F.	LOW END 5°F. to 25°F. HIGH END 3°F. to 20°F.	−5°F.	0°F.	Cat. No. 32086-5 76" cap. tube, ⅜" x 1½" bulb
010-1470		−35°F. to 15°F.	−40°F.		−4°F.	0°F.	Cat. No. 32081-47 76" cap. tube, no bulb
SOFT ICE CREAM DISPENSERS (3 7/16" Dial Shaft)							
010-1823	SPST CLOSE ON RISE	0°F. to 55°F.	− 2°F.	2°F. FIXED	38.5°F.	40.5°F.	Cat. No. 32086-1 25" cap. tube, ⅜" x 1½" bulb
WIDE CYCLE DEFROST							
010-1473	SPST CLOSE ON RISE	0°F. to 50°F.	−15°F.	7°F. to 55°F.	15°F.	40°F.	Cat. No. 32086-5 76" cap. tube, ⅜" x 1½" bulb
GENERAL APPLICATIONS			Lowest Cut-in				
011-1758	SPST OPEN ON RISE	50°F. to 105°F.	40°F.	LOW END 5°F. to 25°F. HIGH END 3°F. to 20°F.	90°F.	85°F.	Cat. No. 32081-55 48" cap. tube, no bulb
011-1756		25°F. to 75°F.	15°F.		65°F.	60°F.	Cat. 32081-11 76" cap. tube, no bulb
010-3019		0°F. to 55°F.	−10°F.		20°F.	15°F.	Cat. No. 32081-1 76" cap. tube, no bulb

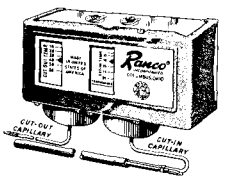
Electrical Ratings

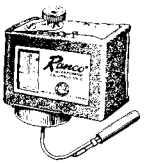
Volts	Amps. Full Load	Amps. Locked Rotor
AC		
115	20	120
240	17	102
*DC		
115	4.6	46.0
240	2.3	23.0
HERMETIC UNITS ONLY		
240	20	102
PILOT DUTY		
120/240 V. AC		720 V.A.
240/600 V. AC		125 V.A.
120/240 V. DC		57.5 V.A.

*With Magnet Installed Order Magnet (cat. 16993) separately.

RANCO

TEMPERATURE CONTROLS
(continued)





Control Code	Switch Type And Action	Range (adjustable)	Lowest Operating	Differential Low & High Extremes	Factory Setting Cut-out	Factory Setting Cut-in	Power Element Catalog No. & Fitting
GENERAL APPLICATION							
016-103	SPDT OPEN OR CLOSE ON RISE	−30°F. to 20°F.	−39°F.	LOW END 4°F. to 25°F. HIGH END 3°F. to 15°F.	−13°F.	−10°F.	Cat. No. 32086-43 76″ cap. tube, ⅜″ x 1½″ bulb
016-104		0°F. to 55°F.	− 5°F.		27°F.	30°F.	Cat. No. 32086-4 76″ cap. tube, ⅜″ x 1½″ bulb
016-105		50°F. to 105°F.	40°F.		66°F.	70°F.	Cat. No. 32086-46 76″ cap. tube, ⅜″ x 1½″ bulb
016-111		0°F. to 55°F.	− 5°F.		15°F.	20°F.	Cat. No. 32081-1 76″ cap. tube, no bulb
016-112		50°F. to 105°F.	40°F.		85°F.	90°F.	Cat. No. 32081-55 48″ cap. tube, no bulb
AIR TEMPERATURE							
016-102	SPDT OPEN OR CLOSE ON RISE	50°F. to 105°F.	40°F.		60.5°F.	65°F.	Cat. No. 32076-13, 84″ cap. tube, ⅜″ x 9½″ cross amb. bulb
016-110		22.5°F. to 47.5°F.	21°F.	1.5°F. FIXED	35.5°F.	37°F.	Cat. No. 32086-4 76″ cap. tube, ⅜″ x 1½″ bulb
016-165		30°F. to 105°F.	27.5°F.	2.5°F. FIXED	72.5°F.	75°F.	Cat. No. 321011-1 $1\frac{7}{32}$″ x 1¼″ air coil

TYPES 016, 021-100

Volts	Amps. Full Load	Amps. Locked Rotor
AC		
120	12	72
240	9.8	58.8
240	25A.	Non-Ind.
HERMETIC UNITS ONLY		
240	20	80

Control Code	Switch Type And Action	Range (adjustable)	Lowest Cut-out	Differential Low & High Extremes	Factory Setting Cut-out	Factory Setting Cut-in	Power Element Catalog No. & Fitting
GENERAL APPLICATION							
020-7007	DPST CLOSE ON RISE	−35°F. to 15°F.	−40°F.	LOW END 6°F. to 25°F. HIGH END 3.5°F. to 14°F.	−4°F.	6°F.	Cat. No. 32086-43 76″ cap. tube, ⅜″ x 1½″ bulb
020-7009		0°F. to 55°F.	−10°F.		10°F.	18°F.	Cat. No. 32086-4 76″ cap. tube, ⅜″ x 1½″ bulb
020-7012		0°F. to 55°F.	−10°F.		40°F.	44°F.	Cat. No. 32076-3, 84″ cap. tube, ⅜″ x 9½″ cross amb. bulb
AIR TEMPERATURE							
020-7013	DPST CLOSE ON RISE	50°F. to 105°F.	40°F.	LOW END 6°F. to 25°F. HIGH END 3.5°F. to 14°F.	65°F.	70°F.	Cat. No. 32076-13, 84″ cap. tube, ⅜″ x 9½″ cross amb. bulb
020-7016		−35°F. to 15°F.	−40°F.		−4°F.	6°F.	Cat. No. 32115-17 $1\frac{7}{32}$″ x 1¼″ air coil
GENERAL APPLICATION			Lowest Cut-in				
021-7409	DPST OPEN ON RISE	0°F. to 55°F.	−10°F.	5°F. to 26°F.	20°F.	12°F.	Cat. No. 32081-1 76″ cap. tube, no bulb

TYPES 020, 021

SINGLE PHASE		
AC		
120	24	144
208/240	24	144
DC		
120	4.6	46.0
240	2.3	23.0
†2 & 3 PHASE		
AC		
208	16	96
240	15	90
480	7.5	45
600	6	36
PILOT DUTY		
120/600 V. AC 125 VA		
120/600 V. DC 57.5 VA		

†see Note Page 8

Control Code	Switch Type And Action	Range (adjustable)	Lowest Cut-out	Differential Low & High Extremes	Factory Setting Cut-out	Factory Setting Cut-in	Power Element Catalog No. & Fitting
SOFT ICE CREAM DISPENSER (3 7/16″ Dial Shaft)							
025-100	SPDT OPEN OR CLOSE ON RISE	−15°F. to 40°F.	−17°F.	1.5°F. FIXED	23.5°F.	25°F.	Cat. No. 32081-56 48″ cap. tube, no bulb
ICE BANK CONTROLS							
018-100	SPST CLOSE ON RISE	No Range Adjustment	——	No Differential Adjustment	UNDER 32°F.	OVER 32°F.	Cat. No. 52266-1 72″ cap. tube, Special bulb
021-100	SPST OPEN ON RISE		——		OVER 32°F.	UNDER 32°F.	

TYPE 025
PILOT DUTY ONLY
345 V.A. @ 230 V. AC

TYPES 018, 019

Volts	Amps Full Load	Amps Locked Rotor
AC		
115	20	120
240	17	102
*DC		
115	4.6	46
240	2.3	23
HERMETIC UNITS ONLY		
240	20	80
PILOT DUTY		
120/240 V. AC		720 V.A.
240/600 V. AC		125 V.A.
120/240 V. DC		57.5 V.A.

*With Magnet Installed Order Magnet (cat. 16993) separately.

TWO-TEMPERATURE CONTROLS

Control Code	Range	Differential	Factory Setting Cut-out	Factory Setting Cut-in	Power Element Catalog No. & Fitting
015-4351	CUT-OUT SIDE— 38°F. FIXED	—————	38°F.	———	Cat. No. 32081-7 48″ cap. tube, no bulb
	CUT-IN SIDE— 40°F. to 85°F. adjustable	—————	———	55°F.	Cat. No. 32076-5, 48″ cap. tube, ⅜″ x 9½″ cross amb. bulb
019-1559	CUT-OUT SIDE— 10°F. to 60°F. adjustable	—————	38°F.	———	Cat. No. 32081-1 76″ cap. tube, no bulb
	CUT-IN SIDE— 20°F. to 60°F. adjustable	6°F. FIXED	———	36°F.	Cat. No. 32081-6 96″ cap. tube, no bulb

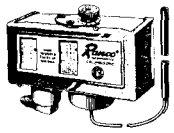
TYPE 015 ONLY

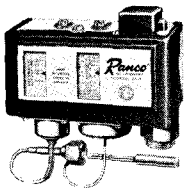
AC	Full Load	Locked Rotor
115	7.4	44.4
230	3.7	22.2

RANCO

DUAL TEMPERATURE CONTROLS

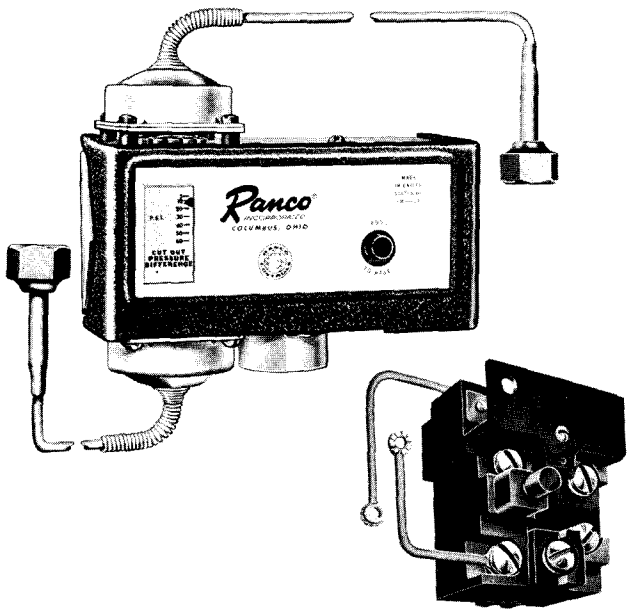
Type 012
single pole, single throw switch
electrical ratings same as shown on page 10





Type 022
double pole, single throw switch
electrical ratings same as shown on page 11

Control Code	Temperature Side Adjustable Differential				High Pressure Side Fixed Differential					
	Cut-in Range	Factory Setting		Power Element	Cut-out Range	Factory Setting		Fixed Diff.	Safety Limit Stop	Power Element
		Cut-out	Cut-in			Cut-out	Cut-in			
012-1514	30°F. to 50°F.	40°F.	44°F.	Cat. No. 32076-1 84" cap. tube, 3/8" x 9½" cross amb. bulb	100 to 360 PSI	190 PSI	140 PSI	50 PSI	—	Cat. No. 32117-1 ¼" SAE male, angle
012-1534	−15°F. to 40°F.	−5°F.	0°F.	Cat. No. 32086-5 76" cap. tube, 3/8" x 1½" bulb	100 to 300 PSI	270 PSI	205 PSI	65 PSI	300 PSI	Cat. No. 32241-1 36" cap. tube 3" sweat fitting
012-1535	0°F. to 55°F.	10°F.	15°F.	Cat. No. 32086-4 76" cap. tube, 3/8" x 1½" bulb	100 to 250 PSI	220 PSI	175 PSI	45 PSI	—	Cat. No. 32116-1 36" cap. tube ¼" SAE Flare Nut
012-1536	25°F. to 75°F.	40°F.	44°F.	Cat. No. 32086-6 76" cap. tube 3/8" x 1½" bulb	150 to 450 PSI	290 PSI	225 PSI	65 PSI	—	Cat. No. 32116-1 36" cap. tube ¼" SAE Flare Nut
012-1537	25°F. to 75°F.	38°F.	42°F.							
012-4008	30°F. to 50°F.	33.5°F.	40.5°F.		100 to 250 PSI	190 PSI	150 PSI	40 PSI	—	Cat. No. 32116-1, 36" cap. tube, ¼" SAE Flare Nut
022-7713	50°F. to 105°F.	65°F.	70°F.	Cat. No. 32076-13 ,84" cap. tube, 3/8" x 9½" bulb						
022-7707	−35°F. to 15°F.	−4°F.	6°F.	Cat. No. 32086-43, 76" cap. tube, 3/8" x 1½" bulb						
022-7709	0°F. to 55°F.	10°F.	18°F.	Cat. No. 32086-4, 76" cap. tube, 3/8" x 1½" bulb						



S30 TIME DELAY RELAY

SPECIFICATIONS

Ranco Code No.	C.O.P.D. Range	C.I.P.D. Minus C.O.P.D.	Time Delay (Seconds)	Delay Switch Code	Cap. Tube Length
P30-3801	5-60 PSI	FIXED 7 PSI MAX.	120 Sec.	S30-1301	36" Cap. tube, ¼" Flare Nut, Both sides.
P30-3701	"	"	90 Sec.	S30-1201	
P30-3601	"	"	60 Sec.	S30-1101	
P30-3501	"	"	45 Sec.	S30-1001	

ELECTRICAL RATING
PILOT DUTY—720 VA @ 120 to 240 VAC

TYPE P30
DIFFERENTIAL OIL PRESSURE CONTROL

The Type P30 Differential Oil Pressure Control provides protection for pressure-lubricated type refrigeration compressors, against the loss of lubricating oil pressure, which could cause severe bearing damage, resulting in a compressor breakdown.

The function of the Differential Oil Pressure Control is to measure the amount by which the oil pressure to the bearings exceeds the crankcase pressure.

Should the oil pressure drop below the control "cut-out" setting, the compressor will stop after completion of the time delay period.

SAFELIGHT CONNECTION.
ALARM CIRCUIT CONNECTION.
MANUAL RESET.
REPLACEABLE TIME DELAY SWITCH.
FIELD ADJUSTABLE PRESSURE DIFFERENCE.

EXPLANATION OF TERMS

OIL PUMP PRESSURE (O.P.P.)
Pressure supplied by the oil pump.

CRANKCASE PRESSURE (C.P.)
Pressure of the low side of the compressor.

CUT-OUT PRESSURE DIFFERENTIAL (C.O.P.D.)
Pressure difference between O.P.P. and C.P. at which the time delay relay is energized to shut down the system.

CUT-IN PRESSURE DIFFERENTIAL (C.I.P.D.)
Pressure difference between O.P.P. and C.P. required to de-energize the time delay relay.

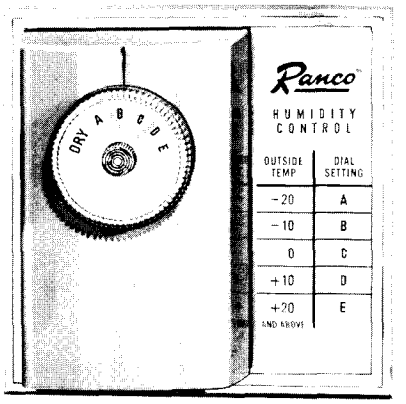
WALL-MOUNTED HUMIDITY CONTROLS

Type J13 Humidity Controls are designed to control operation of a unitary or central humidification or dehumidification system. They are ideal for automatic control of kitchen and bathroom fans when used for dehumidification in tightly sealed homes.

Dehumidification models have direct-reading dials marked in percentage R.H. The switch will close on rise of Relative Humidity to the percentage indicated on the dial.

The humidification model has its dial lettered A through E and a scale plate to show where the dial should be set for various outdoor temperatures. The switch will open on rise of Relative Humidity.

Type J13 Humidity Controls are suitable for line voltage or low voltage circuit. Easy to follow instructions provide for quick installation.



SPECIFICATIONS

Control	Description	Scale-Range In (%) R.H.	Operating Differential Average
J13-1501	Wall Mounted Dehumidification	15-75	5% R.H.
J13-2501	Wall Mounted Humidification	15-35	5% R.H.
J13-3501	Wall Mounted Dehumidification with Fan Switch	15-75	5% R.H.

ELECTRICAL RATINGS

Listed by Underwriters' Laboratories

Voltage, A.C.	Maximum Motor Ampere Rating		Pilot Duty Volt-Amperes
	Full Load	Locked Rotor	
120 240	7.5 3.3	45 20	240
120 240	6.5 3.3	39 20	240
120	3.0	18	240

DUCT-MOUNTED HUMIDITY CONTROLS

The J12 is a humidity sensitive control designed to be mounted in the return-air duct of a central heating forced air furnace to control the addition of moisture to the circulated air. The control is dial adjustable from "Dry"(off) through a nominal operating range of 15% to 75% Relative Humidity and to constant "On".

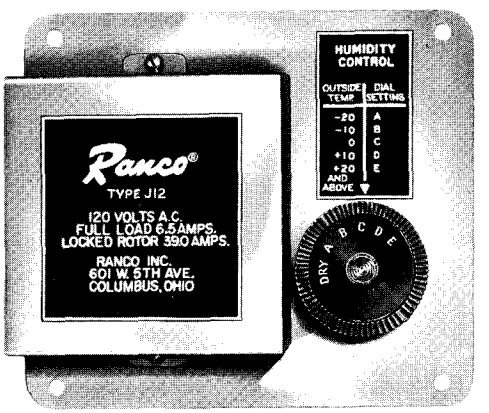
The dial is marked with letters A, B, C, D & E through the significant range of settings that should be used in humidification.

At "Dry" the switch is blocked open.

At "A" the switch opens on rise of R.H. at approximately 15%.

At "E" the switch opens on rise of R.H. at approximately 35%.

Turning the dial counter-clockwise beyond "E" gives a constant increase in R.H. to approximately 75%.



SPECIFICATIONS

Control	Description	Scale-Range In (%) R.H.	Operating Differential Average
J12-2502	Duct Mounted Permanent Wiring Humidification	15-35	5% R.H.
J12-3501	Duct Mounted Plug-in Humidification	15-35	5% R.H.

ELECTRICAL RATINGS

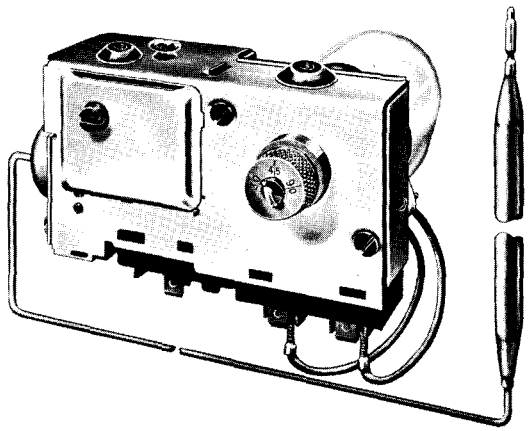
Listed by Underwriters' Laboratories

Voltage, A.C.	Maximum Motor Ampere Rating		Pilot Duty Volt-Amperes
	Full Load	Locked Rotor	
120	6.5	39	240

The J12-3501 electrical capacity is the same as J12-2502 but it is not U/L listed. Underwriters' Laboratories will approve only permanent installation of this type equipment.

TYPE E15 DE-ICE CONTROL

TEMPERATURE TERMINATION
COMBINED TIME AND TEMPERATURE INITIATION



FEATURES

A. FREQUENCY SELECTION OF DE-ICE CYCLE.

B. TERMINATION TEMP. FIELD ADJUSTMENT

C. INTERLOCK REQUIRING INITIATION TEMPERATURE (OR COLDER) AT THE INSTANT OF TIME INITIATION.

D. INTERLOCK PERMITTING ONLY ONE DE-ICE INITIATION PER TIME PERIOD, AFTER TRIAL INITIATION PERIOD.

E. TIME-SAFE TERMINATION

F. ONE CONTROL PACKAGE, ENCOMPASSING ALL FUNCTIONS OF DE-ICE CONTROL

G. ASSURED RELIABILITY AND EASE OF APPLICATION

The E15 De-ice Control is designed to control the removal of ice, or frost from the outdoor coil of central system and window unit heat pump installations.

De-icing is initiated at a pre-selected time interval, provided the outdoor coil is below a preset initiation temperature. The de-icing cycle is terminated as soon as the outdoor coil rises to a preset temperature, or after a preset length of time.

If the outdoor coil cannot reach the desired preset temperature due to weather conditions, or a malfunction, a "time-safe" termination will occur after 10 minutes. This termination of the de-ice cycle will restore the heat pump to the normal heat cycle.

FREQUENCY SELECTOR—

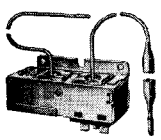
The frequency of initiation of the de-ice cycle is controlled by setting the knurled frequency selector knob to one of the three time positions—30 minutes, 45 minutes, or 90 minutes.

Features	Ranco Code Series	For One Revolution of Shaft			Initiation Temperature	Termination Temperature		Timer Motor Voltage
		Time	Initiations	Termination		Cold Cam	Warm Cam	
Adjustable Frequency	E15-2501	90 MIN.	1, 2, OR 3	10 MIN.	26°F. or below	55°F.	70°F.	240 V.
Adjustable Frequency	E15-1501	90 MIN.	1, 2, OR 3	10 MIN.	26°F. or below	55°F.	70°F.	120 V.

DE-ICE CONTROLS

The SPDT de-ice control switch detects the increase in temperature "spread" over a CLEAR COIL temperature condition, and operates solely from ice accumulation on the outside coil of a HEAT PUMP system.

D52-100



2⅛" Mounting hole centers.
Cat. 57380-1 Clamp package supplied.
3 terminals are quick-connect type.
2 Power Elements: **One in AIR STREAM:** 18" cap. tube, no bulb.

One to OUTSIDE COIL:
27" cap. tube, $\frac{5}{16}$" x 3⅜" long solid bulb, (cross-ambient).

Factory Setting** Ambient (minus)	Coil Cut-Out (equals)	Spread*	(Coil Cut-in) TERMINATION
40°F	25°F	15°F	Approx. 63°F
**10°F	0°F	10°F	45°F

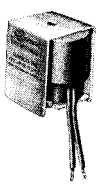
***NOTE: Spread is: Ambient minus Coil Cut-out.**

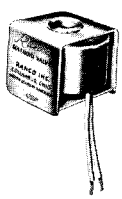
D52-101

Specifications are the same as D52-100 EXCEPT:
2 Power Elements: **One in AIR STREAM:** 36" cap. tube, no bulb.

One to OUTSIDE COIL:
39" cap. tube, $\frac{5}{16}$" x 3⅜" long solid bulb, (cross-ambient).

SOLENOID COILS





USED ON ALL V25, V26, V30 REVERSING VALVES

Code No.	Voltage	Cycles	Watts
L27-100	115 AC	60	9.5
L27-101	230 AC	60	9.5
L27-102	24 AC	60	9.5
L27-103	208 AC	60	9.5
L27-1003	*12 DC		10.6

All L27 codes have 48" leads.

*NOTE: To operate the 12 volt DC coil on AC current, use 34-volt 60-cycle, 15-volt ampere transformer.

FOR HOT GAS DEFROST

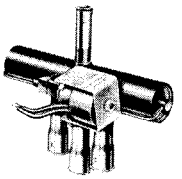
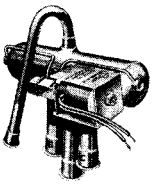
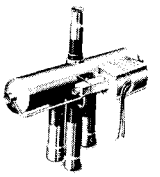
Code No.	Voltage	Cycles	Series Used On
L16-115	115 AC	60	V16-300 V16-100
L16-506	115 AC	60	V16-500 V16-600
L16-510 (with cover)	115 AC	60	V16-500 V16-600
L16-507	230 AC	60	V16-500 V16-600

L16-115 has 36" leads
L16-506, L16-510 & L16-507 have 48" leads

Coils are designed to operate valves at advertised pressures, at 10% over and 15% under the rated coil voltage at an 80°F. ambient temperature, with 30 ft./minute air movement over them.

HEAT PUMP CONTROLS

REVERSING VALVES

Types V26, V30, and V25 Reversing Valves are slide-type, 4-way valves which operate under full pressure of a Heat Pump system.

They are hermetically constructed, and operation is controlled by an L27 type Solenoid Coil on a single Pilot Valve, which is an integral part of the Main Valve.

These solenoid-operated Reversing Valves are suitable for Heat Pump, Central Air-Conditioning, and Window-Type Air Conditioners, using Refrigerants 12, 22, and 502.

Other controls, such as a temperature-cycling control and a de-icer control, are required in addition to the Reversing Valve for automatic operation of the Heat Pump for cooling and heating.

THE FOLLOWING RATINGS APPLY TO ALL VALVES

Maximum Operating Pressure Differential	375 psig
*Minimum Operating Pressure	15 psig
Maximum System Pressure	500 psig
Minimum Bursting Pressure	2600 psig
Solenoid Coil	Type L27

* The pressure differential across the valve may momentarily drop below the minimum 15 psig value during reversal. However, if the system can produce a pressure differential of 15 psig (or higher) across the valve, then reversal will be satisfactory.

Control Code	Maximum Capacity (Tons)		Users' Tube Sizes (O.D.)		Valve Body Dimensions	
	R12	R22	Suction	Discharge	Length	Diameter
V26-100	1.75	2.5	½"	⅜"	4 15/16"	1"
V26-150			⅝"	⅜"		
V30-101	3.5	5.0	¾"	½"	7 27/32"	1⅜"
V30-103			⅞"	½"		
V25-500	6.0	8.5	⅞"	½"	8 11/16"	1¾"
V25-750			⅞"	¾"		
V25-751			1⅛"	⅞"		

FOR HEAT PUMP OR AIR CONDITIONING TEMPERATURE CYCLING

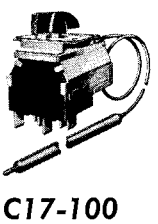
two stage control

For AUTOMATIC Changeover to Heating and Cooling

Causes automatic changeover from heating to cooling, and the reverse, on Heat Pumps equipped with a reversing valve or a resistance heater.

For Multiple Compressors.
For Space Heating with Staged Heaters.
3½° Differential
30°F Dial Range

Two SPDT switches on the control are electrically separated.



C17-100

1 5/16" mounting hole centers.
Cat. 53684-1 dial plate, no "OFF" position.
Cat. 15515 dial knob with a set screw.
Six adapter terminals, Cat. 54241-2, supplied.
26" cap. tube, ⅜" x 8¼" long bulb is liquid filled.

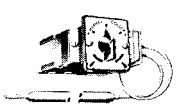
FACTORY SETTING:	CUT-OUT	CUT-IN
Cold Position		
On Cooling	**67.5°F**	**71°F**
On Heating	**67.5°F**	**64°F**
Warm Position		
On Cooling	101°F	
On Heating	97.5°F	

single pole, double throw control

For Heating and/or Cooling
For Heat Pump Application
3°F Differential

Use manual Selector Switch to CHANGEOVER from heating to cooling, and the reverse.

COOLING ONLY, use terminals #1 & #2, which CLOSE on temperature rise.



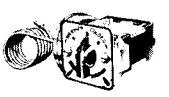
C12-5010

1 5/16" & 1 7/32" sets of mounting hole centers.
Cat. 53684-1 dial plate, no "OFF" position.
Cat. 15515 dial knob with set screw.
Cat. 54212-1 terminal cover.
3 screw type terminals are tapped 8-32.
26" cap. tube, ⅜" x 9" long bulb is liquid filled.

FACTORY SETTING:	CUT-OUT	CUT-IN
Cold	**60°F**	**3°F Diff.**
Warm	98°F	

Constant Run is at extreme clockwise dial position.

Specifications are the same as C12-5010 EXCEPT:
4°F Differential
For COOLING ONLY, use terminals #2 & #3.



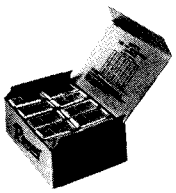
A14-109

1 7/32" mounting hole centers.
3 screw type terminals are tapped 6-32.
No "constant run" position.
1" dia. x 1" long air coil bulb, **Vapor Fill**

FACTORY SETTING:	CUT-OUT	CUT-IN
Cold	**67°F**	**4°F Diff.**
Warm	83°F	

RANCO

ADAPTABLE CONTROLS



A30 10-PACK KIT

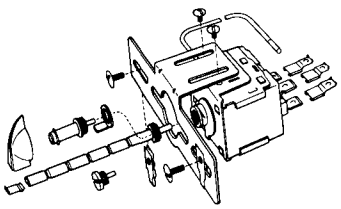
An Assortment of 7 different A30 ADAPTABLES total 10 controls packaged in one compact carton.

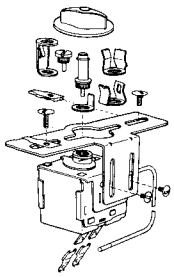
A CHART underneath the carton lid gives the CODE NUMBER and LOCATION of each A30 control inside the 10-PACK for reorder reference.

Cat. No. 58359-1

10-PACK CONTENTS:

2 of A30-180
2 of A30-182
1 of A30-185
1 of A30-262
2 of A30-301
1 of A30-383
1 of A30-450





Control Code	Range	Differential Low & High Extremes	Factory Setting				Power Element	*Parts Package	Electrical Rating
			Cut-out		Cut-in				
			Cold	Normal		Warm			
GENERAL APPLICATION			**Single Pole Double Throw Switch**			**Off Position on Cam**			
A11-391	12°F. to 60°F.	8°F. to 12°F.	12°F.	30°F.	38°F.	56°F.	66″ cap. tube no bulb	A	
A11-392	10°F. to 68°F.	21°F. to 27°F.	10°F.	27°F.	52°F.	66°F.	48″ cap. tube no bulb	A	
A11-393	12°F. to 60°F.	13°F. to 17°F.	12°F.	29°F.	44°F.	58°F.	72″ cap. tube no bulb	A	
A11-394	59°F. to 83°F.	7°F. FIXED	59°F.	——	——	83°F.	18″ cap. tube no bulb	A	

Volts	Amps. Full Load	Amps. Locked Rotor
AC 240	8.3	39
3 wire 120/240	20	78
NON-INDUCTIVE 25 Amps.		

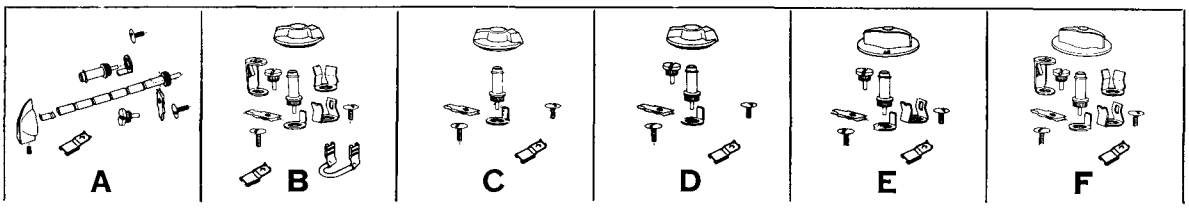
SETTINGS FOR ABOVE CONTROLS REFER TO TERMINALS #2 & #3

			Single Pole Single Throw Switch			Off Position on Cam		
HOUSEHOLD CABINETS			Cold	Normal		Defrost		
A30-180	—4.5°F. to 45°F.	9°F. to 13°F.	—4.5°F.	9°F.	20°F.	43°F.	42″ cap. tube no bulb	B
A30-181	—4.5°F. to 45°F.	9°F. to 13°F.	—4.5°F.	9°F.	20°F.	43°F.	78″ cap. tube no bulb	C
A30-182	—4°F. to 48°F.	14°F. to 20°F.	—4°F.	3°F.	20°F.	45°F.	42″ cap. tube no bulb	B
A30-183	—4°F. to 48°F.	14°F. to 20°F.	—4°F.	3°F.	20°F.	45°F.	78″ cap. tube no bulb	D
A30-184	—7°F. to 45°F.	22°F. to 25°F.	—7°F.	5°F.	30°F.	45°F.	42″ cap. tube no bulb	D
A30-185	—25°F. to 45°F.	18.5°F. to 22°F.	—25°F.	3.5°F.	25.5°F.	45°F.	42″ cap. tube no bulb	C
WATER AND BEVERAGE COOLERS			**Off Position on Cam**					
A30-260	—1°F. to 38°F.	6°F. FIXED	—1°F.	16°F.	22°F.	38°F.	78″ cap. tube no bulb	E
A30-261	30°F. to 68°F.	6°F. FIXED	30°F.	41.5°F.	47.5°F.	68°F.	78″ cap. tube no bulb	E
A30-262	0°F. to 59°F.	9°F. to 15°F.	0°F.	24°F.	36°F.	56°F.	78″ cap. tube no bulb	E
A30-263	3°F. to 57°F.	18°F. to 26°F.	3°F.	17°F.	39°F.	53°F.	78″ cap. tube no bulb	E
LOW TEMPERATURE CABINETS			**No Off Position**					
A30-304	—24°F. to 25°F.	13°F. to 19°F.	—24°F.	—7°F.	9°F.	22°F.	78″ cap. tube no bulb	F
FREEZER AND ICE CREAM CABINETS			**No Off Position**					
A30-301	—23°F. to 25°F.	7°F. to 11°F.	—23°F.	—5°F.	4°F.	23°F.	78″ cap. tube no bulb	H
A30-305	—24°F. to 25°F.	13°F. to 19°F.	—24°F.	—7°F.	9°F.	22°F.	108″ cap. tube no bulb	H
A30-307	—23°F. to 26°F.	23°F. to 29°F.	—23°F.	—12°F.	14°F.	23°F.	78″ cap. tube no bulb	H

Volts	Amps, Full Load	Amps, Locked Rotor
AC 240 V. or less	20	80

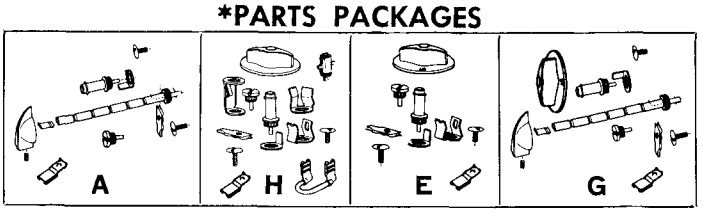
FUSE THE LINE when using A30 to replace a control having OVERLOAD PROTECTION

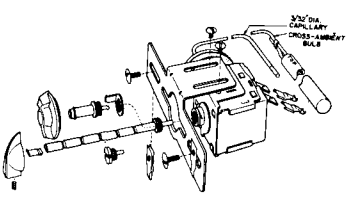
*PARTS PACKAGES

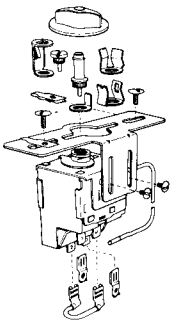


ADAPTABLE AND GENERAL REPLACEMENT

*PARTS PACKAGES





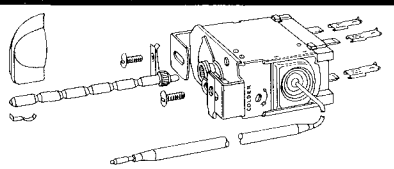


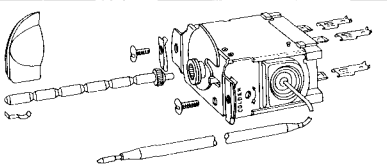
Control Code	Range	Differential Low & High Extremes	Factory Setting Cut-out Cold	Factory Setting Cut-in Normal	Factory Setting Cut-in Warm	Power Element	*Parts Package	Signal Circuit Contacts
FREEZER CABINETS		**With Signal Circuit**						
A30-377	−23°F. to 23°F.	9°F. FIXED	−23°F.	−5°F.	4°F. 23°F.	78″ cap. tube no bulb	H	Break 12°F. above cut-in
A30-378	−23°F. to 23°F.	9°F. FIXED	−23°F.	−5°F.	4°F. 23°F.	78″ cap. tube no bulb	H	Make 12°F. above cut-in
A30-380	−23°F. to 23°F.	9°F. FIXED	−23°F.	−5°F.	4°F. 23°F.	108″ cap. tube no bulb	H	Make 12°F. above cut-in
A30-383	−24°F. to 22°F.	16°F. FIXED	−24°F.	−7°F.	9°F. 22°F.	78″ cap. tube no bulb	H	Break 12°F. above cut-in
A30-384	−24°F. to 22°F.	16°F. FIXED	−24°F.	−7°F.	9°F. 22°F.	78″ cap. tube no bulb	H	Make 12°F. above cut-in
A30-389	−23°F. to 23°F.	26°F. FIXED	−23°F.	−12°F.	14°F. 23°F.	78″ cap. tube no bulb	H	Break 12°F. above cut-in
AIR CONDITIONING		**No Off Position**						
A30-450	58°F. to 91°F.	5°F. FIXED	58°F.	——	—— 91°F.	18″ cap. tube 1″ air coil	A	
A30-451	58°F. to 91°F.	5°F. FIXED	58°F.	——	—— 91°F.	48″ cap. tube no bulb	A	
A30-452	58°F. to 91°F.	5°F. FIXED	58°F.	——	—— 91°F.	39″ cap. tube, ⅜″ x 4″ cross ambient bulb	A	
A33-453	65°F. to 85°F.	3°F. FIXED	65°F.	——	—— 85°F.	48″ cap. tube no bulb	G	
A33-454	65°F. to 85°F.	3°F. FIXED	65°F.	——	—— 85°F.	54″ cap. tube, ⅜″ x 9½″ cross ambient bulb	G	
A33-455	65°F. to 85°F.	3°F. FIXED	65°F.	——	—— 85°F.	76″ cap. tube, ⅜″ x 9½″ cross ambient bulb	G	
BEVERAGE COOLERS		**No Off Position**						
A33-264	25°F. to 44°F.	3°F. FIXED	25°F.	33°F.	36°F. 44°F.	76″ cap. tube no bulb	G	

			Cut-out Cold	Cut-out Normal	Cut-out Warm	Constant Cut-in		
CONSTANT CUT-IN		**DEFROSTS Refrigerator each cycle**					**Off Position on Cam**	
A42-187	−20°F. to 36°F.	NO DIFFERENTIAL ADJUSTMENT	−20°F.	−10°F.	0°F.	36°F.	48″ cap. tube no bulb	E
A42-188	5°F. to 38°F.		5°F.	13.5°F.	22°F.	38°F.	66″ cap. tube no bulb	E
A42-189	−7°F. to 36°F.		−7°F.	3°F.	13°F.	37°F.	84″ cap. tube no bulb	E

Electrical Ratings

Volts	Amps Full Load	Amps Locked Rotor
AC 240	8	42





F17-158 and F17-522

Slotted mounting bracket with 1⅛″ to 2¾₁₆″ centers.

F17-159 and F17-521

2¹³⁄₁₆″ mounting hole centers.

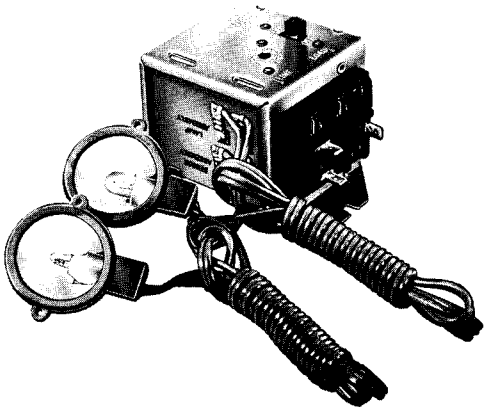
			Cut-out Cold	Cut-in Cold	Cut-in Warm			
AIR CONDITIONING REPLACEMENT						**Off Position on Cam**		
F17-158	63°F. to 92°F.	4°F. FIXED	63°F.	67°F.	92°F.	———	36″ cap. tube, ¼″ x 6″ cross ambient bulb	Terminals 1 & 3
F17-159	63°F. to 92°F.	4°F. FIXED	63°F.	67°F.	92°F.	———	45″ cap. tube, ¼″ x 6″ cross ambient bulb	Terminals 2 & 3
F17-521	63°F. to 87°F.	4°F. FIXED	63°F.	67°F.	87°F.	———	27″ cap. tube, ¼″ x 6″ cross ambient bulb	Constant Run
F17-522	66°F. to 90°F.	5°F. FIXED	66°F.	71°F.	90°F.	———	18″ cap. tube no bulb	Constant Run

Electrical Ratings

Volts	Amps Full Load	Amps Locked Rotor
Terminals 1 & 3		
115/230AC	16	78
Terminals 2 & 3 (with fan switch)		
115AC	10	60
230AC	5	30

RANCO

E20
PHOTO-ELECTRONIC BIN LEVEL CONTROL



	VOLTS	AMPS. FULL LOAD	AMPS. LOCKED ROTOR
E20-1202	120V. AC	20	84
E20-2402	240V. AC	20	84

FUNCTION

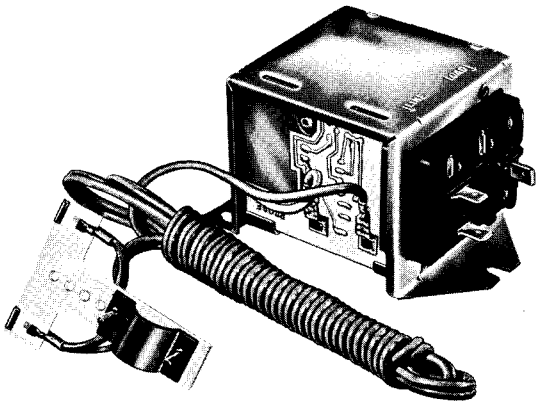
The E20 Bin Level control is designed to control the manufacturing cycle of automatic ice-making machines, so as to maintain the desired level of ice in the storage bin. The proper ice level is maintained by a photo-electronic (electric eye) system. A parallel beam of light is projected across the storage bin and focused on a light activated switch, which controls the compressor.

As the ice level builds up and depletes, it makes and breaks the light beam, thereby controlling the compressor on-off. The E20-1202 is for 120 V. AC operation, and the E20-2402 is used on 240 V. AC installations.

Lamp & L.A.S. assembly lead lengths

E20-1202.....48" leads both sides
E20-2402.....48" leads both sides

E21
ELECTRONIC ICE BANK CONTROL



	VOLTS	AMPS. FULL LOAD	AMPS. LOCKED ROTOR
E21-1201	120V. AC	20	84
E21-2401	240V. AC	20	84

FUNCTION

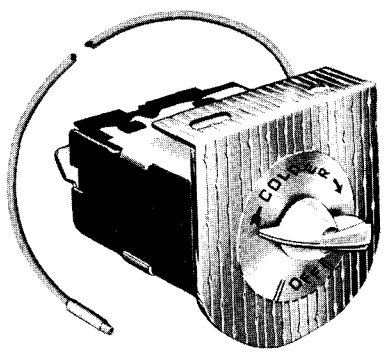
The E21 Ice Bank control is designed to control the refrigeration cycle so as to maintain a desired thickness of ice build-up around the evaporator coil on ice bank machines such as milk coolers or vending equipment. The desired volume of ice is maintained by sensing the difference in electrical conductivity of ice as compared to water (across a submerged probe).

A solid state amplifier, which greatly amplifies the change in electrical conductivity across the probe assembly actuates a switch which turns the compressor on and off thereby controlling the refrigeration cycle.

Probe assembly lead length

E21-1201.....72"
E21-2401.....72"

AUTOMOTIVE AIR CONDITIONING CONTROL (HANG-ON TYPE)



FUNCTION

The Type A10-6010 and A10-6011 Auto Air Conditioning controls will replace clutch-cycling controls on most hang-on type or under-dash mounted air conditioners.

These controls are designed for mounting under the dash or externally on the air conditioner housing.

Two different capillary lengths are available to compensate for placement of the hang-on control.
A10-6010 has a 48" long cap. tube.
A10-6011 has a 24" long cap. tube.

Control Code	Range	Diff.	Factory Setting: Cold Cut-Out	Factory Setting: Cold Cut-In	Factory Setting: Warm Cut-In	Factory Setting: Cap. Tube Length
A10-6010	28°F. to 52°F.	5½°F. Fixed	28°F.	34°F.	52°F.	48", no bulb
A10-6011						24", no bulb

AIR CONDITIONING AND HEALTH CODE SAFETY

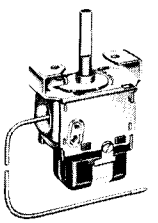
For Window Conditioners Manufactured by O. A. Sutton
Under BRAND Names: Emerson, General Electric, Hotpoint, Kelvinator, Westinghouse, Vornado and others

1952 through 1958

Replaces: A18-107, 1168222.
Applies to: 14583, A10-1637, 16558, A10-1717 by shortening dial shaft to match original control.
Applies to: 13310, A10-1579, 14169, A10-1631, 14618, A10-1636 by shortening shaft and add screw driver slot to match original control.

A30-1500

$1\frac{7}{32}$" *mounting hole centers.*
$1\frac{25}{64}$" extended dial shaft with 7/8" long flat.
18" cap. tube, no bulb.



FACTORY SETTING:	CUT-OUT	CUT-IN
Cold	**66°F**	**71°F**
Warm	90°F	

1955 through 1958

Replaces: 17666, A15-112, A15-156
Applies to: 18810, A10-1757 by shortening shaft to $\frac{823}{64}$" long.
Applies to: 22487, A10-1829 by shortening shaft to $\frac{827}{32}$" long.

A30-1667

$1\frac{7}{32}$" mounting hole centers.
$1\frac{25}{64}$" extended dial shaft with 7/8" long flat.
18" cap. tube, no bulb.

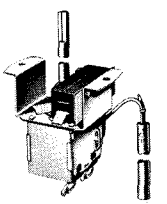
FACTORY SETTING: Constant Run position is beyond "cold" on the dial.	CUT-OUT	CUT-IN
Cold	**67°F**	**72°F**
Warm	90°F	

1956, 57, 58

Replaces: 22778, A10-3009.
Applies to: 20755, A10-3003 by shortening shaft to 7 1/8" long.

A30-3013

$2\frac{3}{16}$" mounting hole centers.
7 3/8" extended dial shaft with 3/4" long flat.
Auxiliary switch on mounting bracket for FAN operation.
38" cap. tube, 3/8" x 4" long bulb (cross ambient).



FACTORY SETTING:	CUT-OUT	CUT-IN
Cold	63°F	
Normal	**68°F**	**74°F**
Warm	91°F	

1956, 57, 58

Replaces: 19532, A15-3001
Applies to: 19389, A10-3001, 17147 (excludes auxiliary FAN switch).

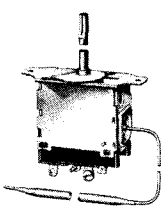
A30-3014

$2\frac{3}{16}$" mounting hole centers.
7 1/8" extended dial shaft with 1/2" long flat.
18" cap. tube, no bulb.

FACTORY SETTING:	CUT-OUT	CUT-IN
Cold	55°F	
Normal	**70°F**	**76°F**
Warm	88°F	

1957, 1958

Replaces: 25055, F17-123.
Applies to: 22909, F17-105 by shortening shaft to $6\frac{5}{32}$" long.

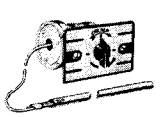


$2\frac{13}{16}$" mounting hole centers pierced.
$6\frac{13}{32}$" extended dial shaft with 3/4" long slotted flat.
Terminals #1 & #3 (screw type) for compressor.
Terminals #2 (ark-les) and #3 (screw) for integral auxiliary switch for fan.
One DUMMY screw type terminal.
38" cap. tube, 1/4" x 6" long bulb (cross-ambient).

FACTORY SETTING:	CUT-OUT	CUT-IN
Cold	**60°F**	**65°F**
Warm	90°F	

F17-152

4 1/2°F Differential



$2\frac{3}{16}$" mounting hole centers.
Cat. 52578-1 dial plate, no "OFF" position.
Cat. 15515 dial knob with set screw.
25" cap. tube, 3/8" x 4" long bulb (cross-ambient).

FACTORY SETTING:	CUT-OUT	CUT-IN
Cold (not continuous run)	**67°F**	**72°F**
Warm	87°F	

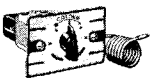
(A30-452 is an adaptable replacement.)

A30-1668

For Cooling Units

single pole, single throw switch

5°F Differential



$2\frac{3}{16}$" mounting hole centers.
Cat. 52578-1 dial plate, no "OFF" position.
Cat. 15515 *dial knob with set screw.*
1" dia. x 1" long air coil bulb.

FACTORY SETTING	CUT-OUT	CUT-IN
Cold	**60°F**	**65°F**
Warm	80°F	

A30-1564

Specifications are the same as A30-1564 EXCEPT:
3°F Differential

FACTORY SETTING:	CUT-OUT	CUT-IN
Cold	**67°F**	**70°F**
Warm	83.5°F	

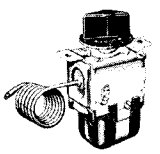
(A33-453 is an adaptable replacement.)

A13-109

5°F Differential

A30-1596

$2\frac{3}{16}$" mounting hole centers.
Cat. 50839-1 dial knob with "OFF" position.
1" dia. x 1" long air coil bulb.



FACTORY SETTING:	CUT-OUT	CUT-IN
Cold	62°F	
No. 4 (Normal)	**66.5°F**	**71.5°F**
Warm	80°F	

Specifications are the same as A30-1596 EXCEPT:
3°F Differential

FACTORY SETTING:	CUT-OUT	CUT-IN
Cold	**67°F**	**70°F**
Warm	82°F	

(A33-453 is an adaptable replacement.)

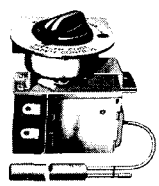
A13-110

health code safety controls

For COLD food or beverage VENDING MACHINES

Control prevents vending operation (EXCEPT for 34 minutes after product loading) by stopping coin mechanism when the refrigerated storage space RISES ABOVE 50°F.

SPDT switch contacts, normally OPEN to terminals #2 & #3, are CLOSED by manually turning the timer knob to a stop, actuating the timer. Contacts remain CLOSED after expiration of the 34 minute time period as long as the bulb temperature is 50°F or colder.



$2\frac{3}{8}$" mounting hole centers.
34 minute operation of mechanical timer.
Cat. 56892-1 dial knob.
3 terminals tapped.
48" cap. tube, 3/8" x 4" bulb, fail-safe, (cross-ambient).

FACTORY SETTING: **50°F TERMINATION of Vending.**

F11-1000

Specifications are the same as F11-1000 EXCEPT:
48" cap. tube, no bulb.

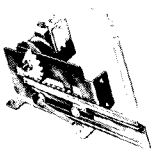
F11-1016

Specifications are the same as F11-1000 EXCEPT:
60 minute operation of timer.
45° termination of vending.

F11-1019

Specifications are the same as F11-1000 EXCEPT:
Automatic reset of timer.
90" cap. tube, 3/8" x 4" cross amb. bulb
45° termination of vending.
2 sets of mounting holes
5 1/2" mounting centers
1 1/2" mounting centers.
No dial knob.
SPST with quick-connect terminals

F11-1306



Specifications are the same as F11-1306 EXCEPT:
60 minute operation of timer.

F11-1305

For HOT food or beverage VENDING MACHINES

Control prevents vending operation (EXCEPT for 34 minutes after product loading) by stopping coin mechanism when the heated storage space DROPS below 150°F.

SPDT switch contacts, normally OPEN to terminals #2 & #3, are CLOSED by manually turning the timer knob to a stop, actuating the timer. Contacts remain CLOSED after expiration of the 34 minute time period as long as the bulb temperature is 150°F or warmer.

Specifications are the same as F11-1000 EXCEPT:
FACTORY SETTING: **150°F TERMINATION of Vending.**

F11-1200

RANCO