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KYSOR // WARREN
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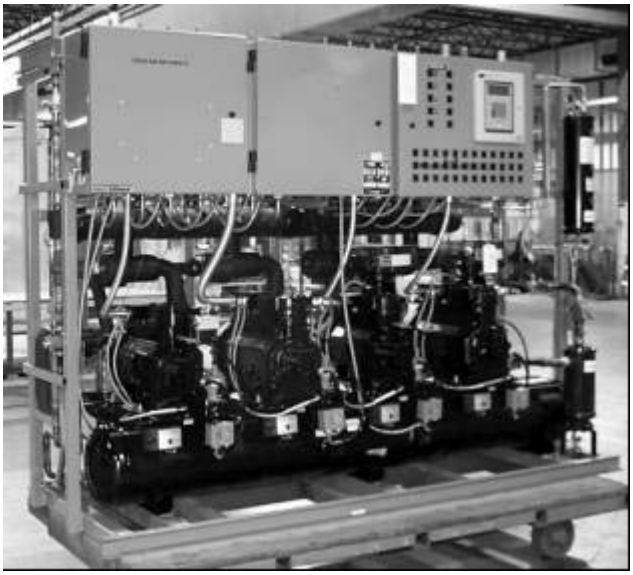
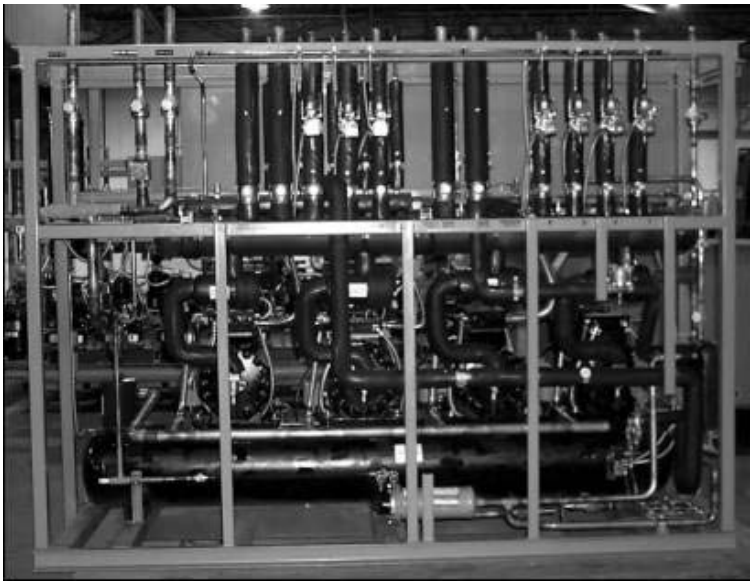
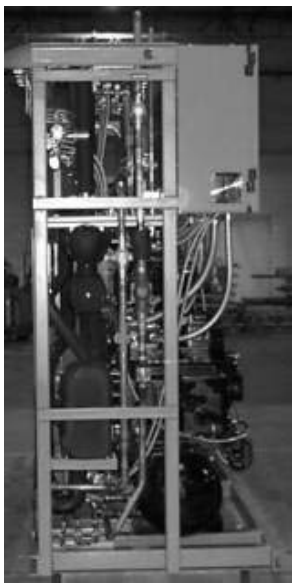


Installation & Operation Manual

Parallel Compressor Units





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Introduction

The operational advantages of using Kysor//Warren parallel refrigeration systems are well known and accepted in the industry for past performances. The simplicity and compactness of the Kysor//Warren design makes the addition of hot gas defrost and/or heat reclaim a simple and economical feature. The most important point in planning an installation of the Kysor//Warren parallel system is the proper selection of the optimum system components for the particular application.

The selection and design of the system is based on the needs of the individual customer. This information must be passed on to the application engineer and must be complete and accurate. Due to the individuality of each customer and his needs, it is therefore impossible to categorize the parallel system. The customer must make his needs known to the regional manager, and he must be sure this information is passed on to the application engineer, who will design the system. A quote request form is available from our website to aid in transmitting system requirements.

Component parts have been selected for their dependability and availability to keep service problems to a minimum. Simplicity of design has also made the Kysor//Warren parallel system one of the easiest to service and install.

Explanations of system components, wiring and piping diagrams, control settings, and operational guides will be found in the following pages. By calling the Regional Manager in your area, the Technical Service Supervisor in your area, or contacting the Kysor//Warren Technical Service Department in Columbus, GA, you may obtain any additional information.

Receipt and Inspection of Unit

Inspect the parallel system and any accessories shipped with them for damages or shortages before and during unloading. If there is any damage, the carrier should be notified immediately and an inspection requested. The delivery receipt must be annotated

that the equipment was received damaged. If damage is of a concealed nature, you must contact the carrier immediately or no later than three (3) days following delivery.

It is the responsibility of the consignee to file all claims for damage with the transportation company.

The system is shipped with a holding charge of dry nitrogen. Check to see that pressure is still in the unit upon receipt. Report lack of pressure immediately to service department.

Accessory items, such as drier cores, mounting pad, etc. are packaged in a separate carton. Be sure that you receive all items.

Lifting instructions

The parallel system is a heavy piece of machinery and careful considerations for lifting should be made before the unit is lifted by any means. Each product family has specific locations where they can be lifted. Failure to lift the unit properly could cause damage to the unit or bodily harm to people in the area of the lift. Lifting cables and other lifting equipment should be prevented from contacting any of the unit piping or electrical components.

Unit designation

A letter (A, B, C, etc) identifies the units, refrigeration circuits and all field-piping connections (including condenser and heat reclaim) are labeled. Unless otherwise requested by the customer all refrigeration circuits are numbered sequentially from one to the highest number and from left to right facing the electrical panel.

Model Nomenclature

Example:

TD320-075-DS-3-NHE-A
Uneven
Discus
3 comp in suction group 1
2 comp in suction group 2
0 comp in rest of suction groups
75 total horsepower
R22
Split temperature
208/60/3
Narrow rack horizontal receiver
141 to 160 inches long
Unit “A”

Key:

1st is the type.

E – even compressors
T – uneven compressors

2nd is compressor code.
B – Bitzer screw
C – Carlyle recip
D – Copeland discus recip
R – Bitzer recip
S – Carlyle screw
Z – Copeland scroll

3rd is the number of compressors in 1st suction group.
4th is the number of compressors in 2nd suction group.
5th is the number of compressors in remaining suction groups.
6th is a dash.
7th, 8th 9th and are total compressor horsepower (with leading zero for less than 100).
10th is a dash.
11th is the refrigerant code.
D – R22
R – R502
S – R404A
P – R507
J – R134a

12th is application code.
L – low temp (single or two stage)
D – low temp (auxiliary cooled)
C – medium temp
H – high temp
S – split temp

13th is a dash.
14th is electrical code.
3 – 208/60/3
4 – 460/60/3
5 – 575/60/3
6 – other

15th is a dash.
16th and 17th or 16th, 17th, and 18th or 16th, 17th, 18th and 19th – rack style
CSSB, D, T – compact scroll system
DSS – distributed scroll system
DV – double stacked vertical receivers
FH – front access horizontal receiver
FV – front access vertical receiver
FX – front access no receiver
FXSL – front access no receiver separator on left
FXSR – front access no receiver separator on right
NH – narrow horizontal receiver (this unit family is obsolete)
NH2 – narrow horizontal receiver 2nd generation
NV – narrow vertical receiver

NX – narrow no receiver (this unit family is obsolete)
NX2 – narrow no receiver 2nd generation
OH – outdoor high profile horizontal receiver (this unit family is obsolete)
OHD – outdoor horizontal receiver double wide
OHN – outdoor horizontal receiver narrow
OHS – outdoor horizontal receiver single wide
OHW – outdoor horizontal receiver wide
OL – outdoor low profile horizontal receiver (this unit family is obsolete)
ONH – outdoor narrow horizontal receiver
ONX – outdoor narrow no receiver
OVL – outdoor narrow vertical left
OVR – outdoor narrow vertical right
RHN – remote header no receiver
RHVL – remote header vertical receiver left
RHVR – remote header vertical receiver right
SP – special
SV – stacked vertical receiver
WH – wide horizontal receiver (this unit family is obsolete)

Third from the last – rack length code.

A – under 80
B – 81 to 100
C – 101 to 120
D – 121 to 140
E – 141 to 160
F – 161 to 180
G – 181 to 200
H – 201 and up

Next to last is a dash.

Last – unit letter designation.

A, B, C, D, E, F, G, H, I, J, K or L

Location of equipment

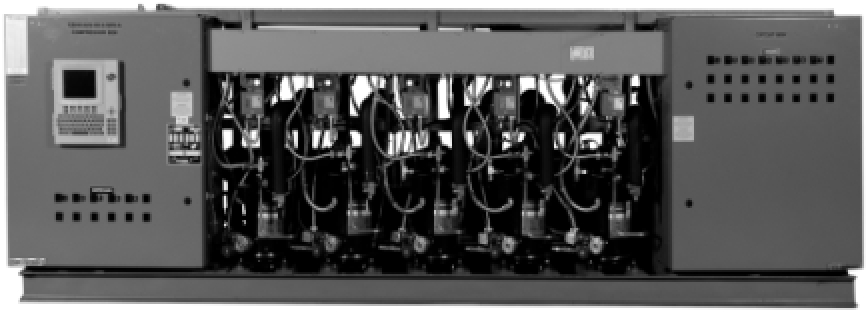
The parallel systems must be located so they are level and easily serviced. For clearance dimensions see “Unit Dimension” tables.

Unit Dimensions

Rack Style CSSB, D and T

Model	Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
							R22	R404A
CSSB	125	4 S or 3 L	10	8	6	70	267	232
CSSB	140	5 S or 4 L	12	8	6	70	267	232
CSSB	155	6 S or 4 L and 1 S	14	10	8	98	378	328
CSSD	125	4 S or 3 L	11	8	6	70	267	232
CSSD	140	5 S or 4 L	13	8	6	70	267	232
CSSD	155	6 S or 4 L and 1 S	15	10	8	98	378	328
CSST	125	4 S or 3 L	10	8	6	70	267	232
CSST	140	5 S or 4 L	12	8	6	70	267	232
CSST	155	6 S or 4 L and 1 S	14	10	8	98	378	328

CSS table notes:



1) CSSB has circuits going out the rear at the Bottom of the unit.
2) CSSD has circuits going Down through the bottom of the unit.
3) CSST has circuits going out the rear at the Top of the unit.
4) For every suction group over 1 the maximum circuit quantity must be reduced by 1.
5) S (small) scroll compressors are 6 hp and smaller.
6) L (large) scroll compressors are 7-1/2 hp and larger.
7) Unit height is 42” for all units.
8) Unit depth is 44-7/16” for all units without controller and 45-15/16” with controller. Depth does not include length of tubes protruding out the rear of the “B” and “T” units.
9) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
10) Standard refrigeration circuits are on minimum of 5-inch centers.
11) Recommended minimum clearances
    a) Front: 36”
    b) Right Side: 18”
    c) Left Side: 18”
    d) Rear: 18”

Rack Style DSS

Width	Max Comp	Max Circuits	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
44	6 S or 4 L	2	6	NA	NA	NA	NA

DSS table notes:

1) All units have a frame depth of 30.5” and a maximum of depth of 30.5”.
2) All units have a frame height of 80” and a maximum of height of 80”.
3) S (small) scroll compressors are 6 hp and smaller.
4) L (large) scroll compressors are 7-1/2 hp and larger.
5) Unit has two compressor decks.
   a) 3 small compressors will fit on a deck.
   b) 2 large compressors will fit on a deck.
   c) 1 small and 1 large compressor will fit on a deck.
6) Suction groups:
   a) Standard with 1 suction group.
   b) Optional with 2 suction groups that must be split with each suction group corresponding to each compressor deck.
7) Receivers are required, but must be located remote from the DSS unit. Product Families RA (receiver assembly) or CA (condenser assembly) are available. Contact Application Engineering for selection and specifications.
8) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 32”
   c) Left Side: 32”
   d) Rear: 18”

Rack Style DV

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver (2) 16 x	Receiver Pump Down 80% @ 90°F Each	
						R22	R404A
178	3 over 3	Loop System	12	10	66	396	345
203	4 over 4	Loop System	12	10	66	396	345
228	5 over 5	Loop System	14	12	66	396	345
253	6 over 6	Loop System	14	12	66	396	345
278	7 over 7	Loop System	14	12	66	396	345
303	8 over 8	Loop System	16	14	66	396	345
178	3 over 3	Loop System	12	10	66	396	345
203	4 over 4	Loop System	12	10	66	396	345

DV table notes:

1) All units have a frame depth of 48” and a maximum of depth of 48”.
2) All units have a frame height of 75” and a maximum of height of 78”.
3) Unit has two compressor decks.
   a) All compressors for rack 1 must be located on lower deck.
   b) All compressors for rack 2 must be located on upper deck.

4) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 18”

Rack Style FH

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Control Box Width	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
							R22	R404A
122	3	8	10	8	32	70	267	232
132	3	8	10	8	42	70	267	232
144	4	12	12	10	32	98	378	328
154	4	12	12	10	42	98	378	328
166	5	16	12	10	32	122	473	410
176	5	16	12	10	42	122	473	410
188	6	20	12	10	32	148	576	500
198	6	20	12	10	42	148	576	500
210	7	24	14	12	32	176	687	596
220	7	24	14	12	42	176	687	596

FH table notes:

1) All units have a frame depth of 34” and a maximum of depth of 43”.
2) All units have a frame height of 79” and a maximum of height of 80”.
3) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 0”

Rack Style FV

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Control Box Width	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
							R22	R404A
100	2	4	10	8	32	16 x 66	396	345
122	3	8	10	8	32	16 x 66	396	345
132	3	8	10	8	42	16 x 66	396	345
144	4	12	12	10	32	16 x 66	396	345
154	4	12	12	10	42	16 x 66	396	345
166	5	16	12	10	32	16 x 66	396	345
176	5	16	12	10	42	16 x 66	396	345
188	6	20	12	10	32	16 x 66	396	345
198	6	20	12	10	42	16 x 66	396	345
210	7	24	14	12	32	16 x 66	396	345
220	7	24	14	12	42	16 x 66	396	345

FV table notes:

1) All units have a frame depth of 38” and a maximum of depth of 38”.
2) All units have a frame height of 75” and a maximum of height of 78”.
3) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 0”

Rack Style FX

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
100	2	4	10	8	NA	NA	NA
122	3	8	10	8	NA	NA	NA
132	3	8	10	8	NA	NA	NA
144	4	12	12	10	NA	NA	NA
154	4	12	12	10	NA	NA	NA
166	5	16	12	10	NA	NA	NA
176	5	16	12	10	NA	NA	NA
188	6	20	12	10	NA	NA	NA
198	6	20	12	10	NA	NA	NA
210	7	24	14	12	NA	NA	NA
220	7	24	14	12	NA	NA	NA

FX table notes:

1) All units have a frame depth of 34” and a maximum of depth of 43”.
2) All units have a frame height of 79” and a maximum of height of 80”.
3) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”

c) Left Side: 18”
d) Rear: 0”

Rack Style FXSL, R

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
151	5	10	14	NA	NA	NA	NA
191	6	10	18	NA	NA	NA	NA

FXSL, R table notes:

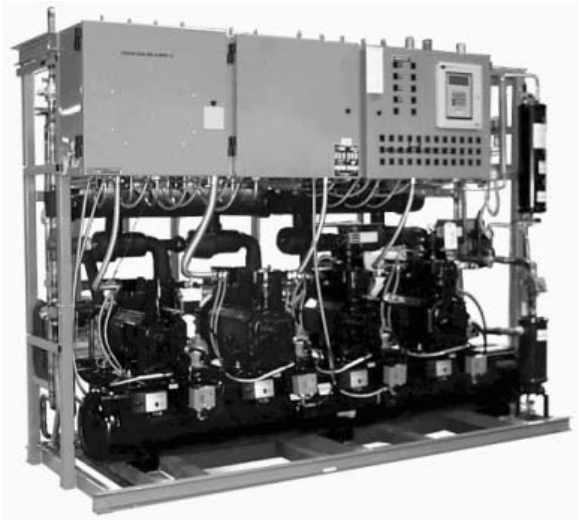
1) All units have a frame depth of 37” and a maximum of depth of 37”.
2) All units have a frame height of 77” and a maximum of height of 77”.
3) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 0”

Rack Style NH

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
						R22	R404A
79	3	10	10	6	70	267	232
95	3	13	10	6	70	267	232
107	4	13	10	8	98	378	328
123	5	17	10	8	98	378	328
153	6	22	12	10	122	473	410
168	6	24	12	10	122	473	410
180	7	27	12	10	148	576	500
205	8	32	14	12	176	687	596
225	9	36	14	12	196	767	669

NH table notes:

1) All units have a frame depth of 37” and a maximum of depth of 43”.
2) All units have a frame height of 77” and a maximum of height of 80”.
3) The front to back depth on the vast majority of Narrow Racks can be held to the frame depth. The rack depth may have to be increased for a variety of reasons. The most common reasons are as follow:



a) Copeland 6D compressors and
b) Carlyle compressors and
c) Combinations of large oil separators, discharge pressure regulators and heat reclaim valves and
d) Any suction accumulator and
e) Custom options not normally a part of the Kysor//Warren Narrow Rack.

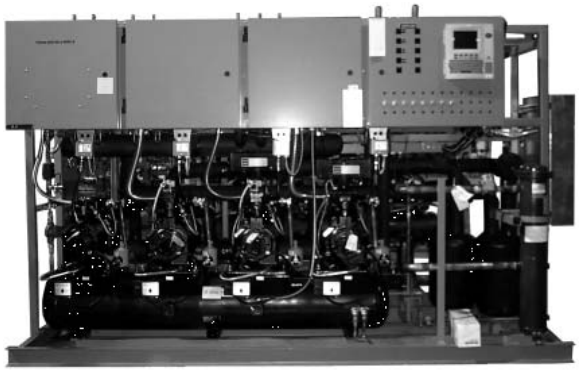
4) The maximum overall height includes all refrigerant field connections stubs.
5) The maximum number of compressors shown assumes only Copeland 2D and/or 3D compressors are utilized. Use of Copeland 4D, 6D or any Carlyle compressor may reduce this number on most rack sizes.
6) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
7) Standard refrigeration circuits are on minimum of 5-inch centers.
8) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 18”

Rack Style NH2

Width	Max Comp 2D & 3D	Max Comp 4D	Max Comp 6D, 06D & 06E	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
								R22	R404A
095	3	3	3	10	10	6	72	275	240
115	3	3	3	10	10	8	72	275	240
120	4	4	4	15	10	8	97	375	327
125	4	3	3	10	10	8	82	315	275
140	4	4	4	15	12	10	97	375	327
145	5	5	5	20	12	10	122	474	413
165	5	5	5	20	12	10	122	474	413
170	7	6	6	25	12	10	147	573	500
190	7	6	6	25	14	12	147	573	500
195	8	7	7	30	14	12	172	672	586
215	8	7	7	30	14	12	172	672	586
220	9	8	8	35	14	12	197	771	673
240	9	8	8	35	16	14	197	771	673
265	9	8	8	35	16	14	197	771	673

NH2 table notes:

1) All units have a frame depth of 40-3/16” without a hot gas return header and 45-3/16” with a hot gas return header.
2) All units have a frame height of 76-7/16” and a maximum of height of 80”.
3) The front to back depth on the vast majority of NH2 Racks can be held



to the frame depth. The rack depth may have to be increased for a variety of reasons. The most common reasons are as follow:

a) Carlyle compressors and
b) Custom options not normally a part of the Kysor//Warren NH2 Rack.

4) The maximum overall height includes all refrigerant field connections stubs.
5) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
6) Standard refrigeration circuits are on minimum of 5-inch centers.
7) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 18”

Rack Style NV

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
100	2	4	10	8	16 x 66	396	345
122	3	8	10	8	16 x 66	396	345
144	4	12	12	10	16 x 66	396	345
166	5	16	12	10	16 x 66	396	345
188	6	20	12	10	16 x 66	396	345
210	7	24	14	12	16 x 66	396	345
232	8	28	18	14	18 x 60		

NV table notes:

1) All units have a frame depth of 38” and a maximum of depth of 38”.
2) All units have a frame height of 75” and a maximum of height of 78”.
3) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 18”

Rack Style NX

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
79	3	10	10	6	NA	NA	NA
95	3	13	10	6	NA	NA	NA
107	4	13	10	8	NA	NA	NA
123	5	17	10	8	NA	NA	NA
153	6	22	12	10	NA	NA	NA
168	6	24	12	10	NA	NA	NA
180	7	27	12	10	NA	NA	NA
205	8	32	14	12	NA	NA	NA
225	9	36	14	12	NA	NA	NA

NX table notes:

4) All units have a frame depth of 37” and a maximum of depth of 43”.
5) All units have a frame height of 77” and a maximum of height of 80”.
6) The front to back depth on the vast majority of Narrow Racks can be held to the frame depth. The rack depth may have to be increased for a variety of reasons. The most common reasons are as follow:
   a) Copeland 6D compressors and
   b) Carlyle compressors and
   c) Combinations of large oil separators, discharge pressure regulators and heat reclaim valves and
   d) Any suction accumulator and
   e) Custom options not normally a part of the Kysor//Warren Narrow Rack.
7) The maximum overall height includes all refrigerant field connections stubs.
8) The maximum number of compressors shown assumes only Copeland 2D and/or 3D compressors are utilized. Use of Copeland 4D, 6D or any Carlyle compressor may reduce this number on most rack sizes.
9) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
10) Standard refrigeration circuits are on minimum of 5-inch centers.
11) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 18”

Rack Style NX2

Width	Max Comp 2D & 3D	Max Comp 4D	Max Comp 6D, 06D & 06E	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
								R22	R404A
095	3	3	3	10	10	6	NA	NA	NA
115	3	3	3	10	10	8	NA	NA	NA
120	4	4	4	15	10	8	NA	NA	NA
125	4	3	3	10	10	8	NA	NA	NA
140	4	4	4	15	12	10	NA	NA	NA
145	5	5	5	20	12	10	NA	NA	NA
165	5	5	5	20	12	10	NA	NA	NA
170	7	6	6	25	12	10	NA	NA	NA
190	7	6	6	25	14	12	NA	NA	NA
195	8	7	7	30	14	12	NA	NA	NA
215	8	7	7	30	14	12	NA	NA	NA
220	9	8	8	35	14	12	NA	NA	NA
240	9	8	8	35	16	14	NA	NA	NA
265	9	8	8	35	16	14	NA	NA	NA

NX2 table notes:

1) All units have a frame depth of 40-3/16” without a hot gas return header and 45-3/16” with a hot gas return header.
2) All units have a frame height of 76-7/16” and a maximum of height of 80”.
3) The front to back depth on the vast majority of NX2 Racks can be held to the frame depth. The rack depth may have to be increased for a variety of reasons. The most common reasons are as follow:
   a) Carlyle compressors and
   b) Custom options not normally a part of the Kysor//Warren NX2 Rack.
4) The maximum overall height includes all refrigerant field connections stubs.
5) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
6) Standard refrigeration circuits are on minimum of 5-inch centers.
7) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 18”

Rack Style OH

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
						R22	R404A
133	4	12	NA	NA	90	346	301
177	4	16	NA	NA	90	346	301

OH table notes:

1) All units have a frame depth of 45-1/2” and a maximum of depth of 49-1/4”.
2) All units have a frame height of 56-1/2” and a maximum of height of 96-1/2”.

3) The maximum number of compressors shown assumes only Copeland 2D and/or 3D compressors are utilized. Use of Copeland 4D, 6D or any Carlyle compressor may reduce this number on most rack sizes.
4) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
5) Standard refrigeration circuits are on minimum of 5-inch centers.
6) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 36”
   c) Left Side: 36”
   d) Rear: 36”

Rack Style OHD

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Condenser Size	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
							R22	R404A
288	4	10	NA	NA	2 x 2	72	267	232
312	5	15	NA	NA	2 x 2	72	267	232
343	4	10	NA	NA	2 x 3	72	267	232
367	5	15	NA	NA	2 x 3	72	267	232
391	6	20	NA	NA	2 x 3	72	267	232
398	4	10	NA	NA	2 x 4	72	267	232
422	5	15	NA	NA	2 x 4	72	267	232
446	6	20	NA	NA	2 x 4	72	267	232
453	4	10	NA	NA	2 x 5	122	474	413
477	5	15	NA	NA	2 x 5	122	474	413
501	6	20	NA	NA	2 x 5	122	474	413
525	7	25	NA	NA	2 x 5	122	474	413
508	4	10	NA	NA	2 x 6	172	672	586
532	5	15	NA	NA	2 x 6	172	672	586
556	6	20	NA	NA	2 x 6	172	672	586
580	7	25	NA	NA	2 x 6	172	672	586
604	8	30	NA	NA	2 x 6	172	672	586

OHD table notes:

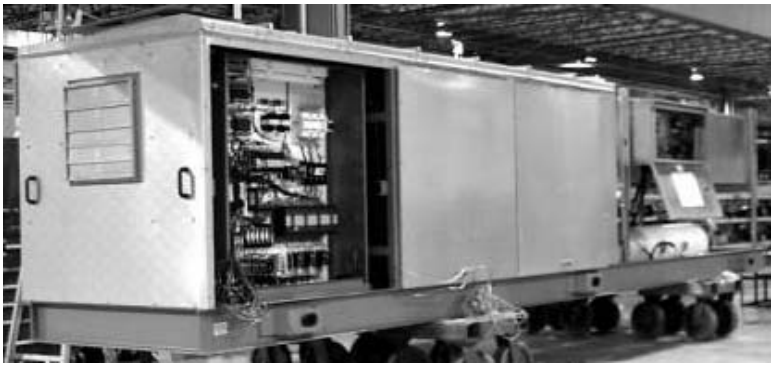
1) All units have a frame depth of 88” and a maximum of depth of 88”.
2) All units have a frame height of 58” and a maximum of height of 60”.
3) Recommended minimum clearances
   a) Front: 48”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 48”

Rack Style OHS

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Condenser Size	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
							R22	R404A
288	4	10	NA	NA	1 x 2	72	267	232
312	5	15	NA	NA	1 x 2	72	267	232
343	4	10	NA	NA	1 x 3	72	267	232
367	5	15	NA	NA	1 x 3	72	267	232
398	4	10	NA	NA	1 x 4	72	267	232
422	5	15	NA	NA	1 x 4	72	267	232

OHS table notes:

1) All units have a frame depth of 50" and a maximum of depth of 50".
2) All units have a frame height of 58" and a maximum of height of 60".
3) Recommended minimum clearances
   a) Front: 48"
   b) Right Side: 18"
   c) Left Side: 18"
   d) Rear: 48"



Rack Style OHW w/Condenser on Top or Remote

Width	Max Comp	Max Circuit	Max Condenser	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
							R22	R404A
121	3	13	2x2	NA	NA	72	275	240
145	4	18	2x2	NA	NA	97	375	327
169	5	22	2x3	NA	NA	122	474	413
193	6	27	2x3	NA	NA	147	573	500
217	7	31	2x3	NA	NA	172	672	586
241	8	36	2x4	NA	NA	197	771	673
265	9	40	2x4	NA	NA	197	771	673
289	10	45	2x5	NA	NA	197	771	673
313	11	49	2x5	NA	NA	197	771	673
337	12	54	2x6	NA	NA	197	771	673

Rack Style OHW w/Condenser In-Line

Width	Max Comp	Max Circuit	Condenser	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
							R22	R404A
261	3	13	2x2	NA	NA	72	275	240
285	4	18	2x2	NA	NA	97	375	327
364	5	22	2x3	NA	NA	122	474	413
388	6	27	2x3	NA	NA	147	573	500
412	7	31	2x3	NA	NA	172	672	586
491	8	36	2x4	NA	NA	197	771	673
515	9	40	2x4	NA	NA	197	771	673
594	10	45	2x5	NA	NA	197	771	673
618	11	49	2x5	NA	NA	197	771	673
642	12	54	2x6	NA	NA	197	771	673

OHW table notes:

1) All units have a frame depth of 86” and a maximum of depth of 89”.
2) All units have a frame height of 53” and a maximum of height of 53”.
3) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
4) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 36”
   d) Rear: 36”

Rack Style OL

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
						R22	R404A
181	3	8	NA	NA	90	346	301
205	4	8	NA	NA	90	346	301
229	4	12	NA	NA	90	346	301
260	4	16	NA	NA	90	346	301

OL table notes:

1) All units have a frame depth of 74-1/8” and a maximum of depth of 74-1/8”.
2) All units have a frame height of 49” and a maximum of height of 54”.

3) The maximum number of compressors shown assumes only Copeland 2D and/or 3D compressors are utilized. Use of Copeland 4D, 6D or any Carlyle compressor may reduce this number on most rack sizes.
4) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
5) Standard refrigeration circuits are on minimum of 5-inch centers.
6) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 54” (Compressor Side)
   c) Left Side: 36”
   d) Rear: 36”

Rack Style ONH

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 12-3/4 x	Receiver Pump Down 80% @ 90°F	
						R22	R404A
96	3	8	NA	NA	70	267	232
112	3	13	NA	NA	70	267	232
124	4	13	NA	NA	98	378	328
140	5	17	NA	NA	104	402	351
170	6	22	NA	NA	122	473	410
185	6	24	NA	NA	122	473	410
197	7	27	NA	NA	148	576	500
212	8	32	NA	NA	176	687	596
242	9	36	NA	NA	196	767	669

ONH table notes:

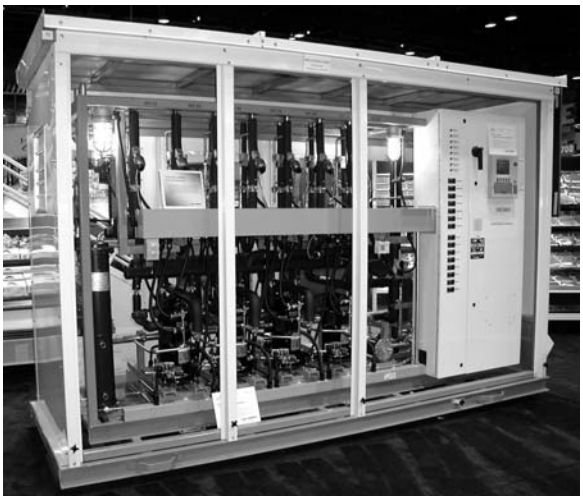
1) All units have a frame depth of 52-1/4” and a maximum of depth of 52-1/4”.
2) All units have a frame height of 90” and a maximum of height of 90”.
3) The maximum number of compressors shown assumes only Copeland 2D and/or 3D compressors are utilized. Use of Copeland 4D, 6D or any Carlyle compressor may reduce this number on most rack sizes.
4) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
5) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 36”
   d) Rear: 36”

Rack Style OVL, R

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
117	2	4	NA	NA	16 x 66	396	345
139	3	8	NA	NA	16 x 66	396	345
161	4	12	NA	NA	16 x 66	396	345
183	5	16	NA	NA	16 x 66	396	345
205	6	20	NA	NA	16 x 66	396	345
227	7	24	NA	NA	16 x 66	396	345

OVL, R table notes:

1) All units have a frame depth of 52-1/4" and a maximum of depth of 52-1/4".
2) All units have a frame height of 90" and a maximum of height of 90".
3) Recommended minimum clearances
   a) Front: 36"
   b) Right Side: 18"
   c) Left Side: 18"
   d) Rear: 18"



Rack Style ONX

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
117	2	4	NA	NA	NA	NA	NA
139	3	8	NA	NA	NA	NA	NA
161	4	12	NA	NA	NA	NA	NA
183	5	16	NA	NA	NA	NA	NA
205	6	20	NA	NA	NA	NA	NA
227	7	24	NA	NA	NA	NA	NA

ONX table notes:

1) All units have a frame depth of 52-1/4" and a maximum of depth of 52-1/4".
2) All units have a frame height of 90" and a maximum of height of 90".
3) Recommended minimum clearances
   a) Front: 36"
   b) Right Side: 18"
   c) Left Side: 18"
   d) Rear: 18"

Rack Style RHN

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
60	NA	9	NA	NA	NA	NA	NA
65	NA	10	NA	NA	NA	NA	NA
70	NA	11	NA	NA	NA	NA	NA
75	NA	12	NA	NA	NA	NA	NA
80	NA	13	NA	NA	NA	NA	NA
85	NA	14	NA	NA	NA	NA	NA
90	NA	15	NA	NA	NA	NA	NA
95	NA	16	NA	NA	NA	NA	NA
100	NA	17	NA	NA	NA	NA	NA
105	NA	18	NA	NA	NA	NA	NA
110	NA	19	NA	NA	NA	NA	NA

RHN table notes:

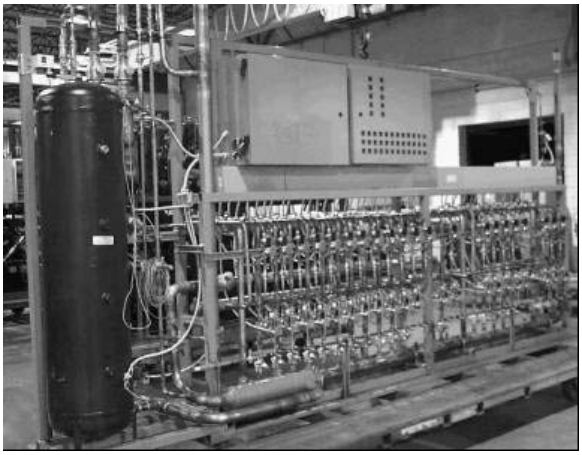
1) All units have a frame depth of 22" and a maximum of depth of 32".
2) All units have a frame height of 67-5/16" and a maximum of height of 67-5/16".
3) Recommended minimum clearances
   a) Front: 36"
   b) Right Side: 18"
   c) Left Side: 18"
   d) Rear: 18"

Rack Style RHVL, R

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
119	NA	8	NA	NA	16 x 66	396	345
182	NA	19	NA	NA	16 x 66	396	345

RHVL, R table notes:

1) All units have a frame depth of 20" and a maximum of depth of 20".
2) All units have a frame height of 85" and a maximum of height of 85".
3) Recommended minimum clearances
   a) Front: 36"
   b) Right Side: 18"
   c) Left Side: 18"
   d) Rear: 0"



Rack Style SV

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver Size	Receiver Pump Down 80% @ 90°F	
						R22	R404A
122	6	2	6	NA	12-3/4 x 70	267	232

SV table notes:

1) All units have a frame depth of 30-1/2" and a maximum of depth of 30-1/2".
2) All units have a frame height of 80" and a maximum of height of 80".
3) Recommended minimum clearances
   a) Front: 36"
   b) Right Side: 18"
   c) Left Side: 18"
   d) Rear: 18"

Rack Style WH

Width	Max Comp	Max Circuit	No. Of Isolation Pads	No. Of Spring Isolators	Standard Receiver 16 x	Receiver Pump Down 80% @ 90°F	
						R22	R404A
79	3	8	10	6	70	421	367
95	4	10	10	6	70	421	367
111	4	12	10	6	70	421	367
127	5	14	10	8	70	421	367
143	5	16	12	8	70	421	367
159	6	18	12	10	66	421	367

WH table notes:

1) All units have a frame depth of 54" and a maximum of depth of 54".
2) All units have a frame height of 70" and a maximum of height of 74".
3) The front to back depth on the vast majority of WH can be held to the frame depth. The rack depth may have to be increased for a variety of reasons. The most common reasons are as follow:
   a) Copeland 6D compressors and
   b) Carlyle compressors and
   c) Combinations of large oil separators, discharge pressure regulators and heat reclaim valves and
   d) Any suction accumulator and
   e) Custom options not normally a part of the Kysor//Warren Narrow Rack.
4) The maximum overall height includes all refrigerant field connections stubs.
5) The maximum number of compressors shown assumes only Copeland 2D and/or 3D compressors are utilized. Use of Copeland 4D, 6D or any Carlyle compressor may reduce this number on most rack sizes.
6) The maximum number of circuits shown assumes a single suction group. Subtract 1 for each additional suction group (or satellite).
7) Standard refrigeration circuits are on minimum of 5-inch centers.

8) Recommended minimum clearances
   a) Front: 36”
   b) Right Side: 18”
   c) Left Side: 18”
   d) Rear: 18”

Ventilation requirements

Compressors without head cooling fans dissipate about 10% of the input watts as heat through the compressor body. Compressors with head cooling fans dissipate about 20% of the input watts. The ventilation equipment for the machine room should provide airflow of approximately 40 to 100 cfm per compressor horsepower depending on the ambient temperatures. Cooler climates do not require as much ventilation as warmer climates. The air intake should be positioned so that air passes over the units.

Leak Check, Evacuation and Start-up

Warning:

Effective 7/1/92 it is illegal to knowingly vent or discharge any CFC or HCFC refrigerant to the atmosphere. All CFC and HCFC refrigerant must be reclaimed or recycled.

1) To check the systems for leaks, leave all valves closed on suction, liquid and hot gas manifolds (the system is shipped with a holding charge of dry nitrogen). Build up the pressure to a maximum of 150 psig using dry nitrogen. Each circuit can be leak checked in this way, one at a time.
2) After each circuit has been checked, open all valves to allow the pressure into the unit assembly. Check to be sure that the pressure is throughout the assembly. Check all connections and accessories for leaks.
3) After the system is leak checked, evacuate the system to 1500 microns for the first evacuation, install drier cores (suction filter cores are factory installed) between first and second evacuation, then evacuate to 500 microns. After each evacuation, the system should be pressurized to 2 psig with dry nitrogen before starting the next evacuation. A triple evacuation is recommended.
4) With the system in a vacuum, liquid charge the system by putting refrigerant into the liquid outlet of the receiver with the inlet valve closed and the liquid line shut off closed. Add as much refrigerant to the receiver as possible (the amount depends on the size of the receiver). Now you are ready to start the system.
5) Set all low-pressure controls as recommended elsewhere in this manual. Recheck all hand valves and shut off valves to be sure they are open (receiver inlet and liquid line valves were closed in step 4).
6) Add refrigerant oil to the oil reservoir until oil is shown in upper glass (see procedure under AC&R oil control system in this manual).
7) Remove all time trippers, remove program from all defrost modules, or put all circuits on refrigeration only (no defrosts should occur during start up of equipment).

8) Check and be sure the condenser fan motors are running and rotating the correct direction and will not cycle. All case fans and cooler fans must be running or operational if controlled by temperature.
9) With all compressor and control breakers and toggle switches off, apply power to the unit. If unit is using a phase monitor (or other power monitoring device) the running light must come on before going any further. Check with a voltmeter to see if correct voltage is connected to unit.
10) Turn on the circuit breaker for the control circuit. If the unit is equipped with an electronic pressure control, you can adjust the cut in and cutout at this time. See parallel system unit control/alarm panel, and initial recommended pressure settings in this manual or review the program installed in the controller at the time of manufacture.
11) Check the actual suction header pressure with an accurate gauge and see if the electronic pressure control is displaying the same pressure (the pressure must be below 65 psig before this can be done). Calibrate as necessary. Refer to the correct electronic pressure control manual from the control manufacturer (the manual for the controller is included in the instructions envelope).
12) All rocker switches (both compressor and circuit) on control panel must be off. Turn on circuit breakers to all compressors.
13) Close control panel doors before actually starting compressors.
14) You will find it necessary to open the manual stems on the EPR valves during start up to lower the case temperatures and keep the compressors running. The bypass shut off valve in the piping between the high stage and low stage suction header must be open before starting any compressors on two stage systems.
15) With a low side gauge and high side gauge installed, turn on the rocker switch to the smallest compressor in the highest suction pressure group. Allow the compressor to pull the suction down to the operating pressure of the system. As the pressure lowers, turn on one circuit rocker switch at a time starting with the highest suction group. Try to maintain no more than 20 psig above the electronic pressure control cut in pressure. Once the suction pressure stays high, turn on the rocker switch for compressor #2. Continue turning on circuits and compressors as necessary until all are on. Repeat for next lower suction pressure group. If this is low stage of two-stage unit, turn on circuit controlling liquid injection desuperheating valve before starting this compressor group.
16) Now that the system is operating, it is time to set the pressure regulating valves (see parallel systems recommended control settings in this manual). Once they are set, recheck again as these settings are important.
17) Set and check expansion valve superheat on each case and cooler (EPR valve must be open prior to adjusting superheat on expansion valves). The TXV superheat cannot be properly set if the EPR is in control.
18) Set each EPR valve (manual stem closed) as needed (see initial control settings in this manual). Suction header pressure must be lower than the EPR setting before valve can be set correctly.
19) Check each fixture temperature and adjust EPR valves as necessary to maintain proper temperature. Check expansion valve superheat and adjust as necessary.

20) Readjust electronic pressure control as needed to maintain necessary suction header pressure.
21) Set condenser fan controls as recommended to maintain head pressure and liquid level in receiver. Recommended settings are in the condenser manufacturer's installation manual.
22) Check refrigerant level in receiver and add as necessary. Minimum level is 20% in the coldest weather for area.
23) Add defrost pins or tripper to time clock or remove overrides on electronic pressure controller and set defrost fail-safe. Check the defrost timer and temperature at which cases terminate.
24) Set the time delay on satellite compressor(s) to 3 minutes (on units with optional adjustable time delay). This delay allows the satellite compressor to wait after defrost of the circuit for the main higher suction compressors to lower the circuit pressure to not overload the satellite compressor motor. It also allows for faster pull-down of fixture temperature after defrost has terminated.
25) If the unit is equipped with an alarm status panel, check to see that the operating switch is in manual or auto mode depending on desired operation (see alarm status instructions in this manual).
26) Check oil reservoir after two (2) days of operation and add oil as necessary.
27) Do not add more than a total of 2 gallons of oil to each system. If more than this is needed, recheck piping etc., as oil is not returning to the unit properly (see oil control system in this manual).
28) After all adjustments have been made, check all valves for proper stem position and replace valve caps.
29) Recheck all capillary tubes on all pressure controls to be sure that they are properly secured and free of vibration.

Regular Inspection

In order to ensure that the system is running at peak efficiency regular inspection and record keeping is highly recommended. Due to the myriad of options available it is impossible to list here everything that must be routinely checked. The following should be used as a guide as to what types of inspections are needed.

Initial Start-up Maintenance

Liquid Filter Drier Core

1) After 24 hours of initial run replace cores.
2) After next 48 hours on run replace cores.

Suction Filter Core

1) Replace core after 24 hours of initial run time.
2) After next 48 hours of run time inspect core
   a) If clean the core can be removed from system.
   b) If dirty replace with new core and repeat.

General Maintenance Schedule

(Service/Maintenance should be performed only by a qualified / certified refrigeration service technician.)

Weekly

1) Check refrigerant charge using the liquid line sight glass.
2) Check compressor oil level.
3) Check compressor crankcase heater operation.
4) Check main power and control voltage.
5) Check appearance of area around the unit.
6) Check system pressures.

Monthly

1) Check the refrigerant system for leaks.
2) Check suction filters and liquid line filter driers.
3) Check all flanged connection bolts, fittings and line clamps for tightness.
4) Inspect condenser fan blades and motor mounts for cracks, loose set screws or mounting bolts.
5) Tighten all electrical connections.
6) Check operation and condition of contacts on compressor / fan motor contactors.
7) Check appearance of control panel interior.
8) Check appearance of exterior conduit / junction boxes.
9) Check appearance of insulation.
10) Check operation of auxiliary equipment.
11) On systems with Temprite oil separators check pressure drop across oil filter inside separator (see section on Temprite oils separators in this manual).

Quarterly

1) With unit in stable operation, record all operating conditions:
   a) Suction / discharge / liquid refrigerant pressure(s) and temperature(s)
2) System superheat, liquid sub-cooling, ambient temperature
3) Compressor amperage
4) Test all operating and safety controls.

Annually

1) Obtain oil sample for analysis; change oil if required.
2) Clean condenser coil.
3) Straighten condenser fins as required.
4) Change liquid line filter drier and suction filter cores.

Note:

The above information is provided only as a general guideline to aid servicing personnel and equipment owners in maintaining equipment. Due to variables in the actual

equipment application, operating conditions, and environment recommended service intervals might vary.

Piping

All refrigeration circuit piping leaving the unit is equipped with shut off valves. Shut off valves for condenser and heat reclaim lines can be added at the customer's request. The system is sealed and leak tested before leaving the factory. It is shipped with a dry nitrogen holding charge. See general system piping arrangement below.

Recommended Piping for Kysor//Warren Cases

1) Properly sized refrigeration lines are essential to good refrigeration performance. Suction lines are more critical that liquid or discharge lines. Oversized suction lines may prevent proper oil return to the compressor. Undersized lines can rob refrigeration capacity and increase operating cost. Consult the technical manual or legend sheet for proper line sizes.
2) Refrigeration lines in cases in line ups can be reduced. However, the lines should be no smaller than the main trunk lines in at least 1/3 of the cases and no smaller than one size above the case lines to the last case. Reductions should not exceed one line size per case. It is preferred to bring the main trunk lines in at the center of the line up. Liquid lines on systems on hot gas defrost must be increased one line size above the main trunk line for the entire line up. Individual feed lines should be at the bottom of the liquid header.
3) Do not run refrigeration lines from one system through cases on another system.
4) Use dry nitrogen in lines during the brazing to prevent scaling and oxidation.
5) Insulate suction lines from the cases to the compressor with 3/4" wall thickness Armaflex insulation or equal on low temperature cases to provide maximum of 65°F superheated gas back to the compressor (we recommend a return gas superheat lower than 65°F for optimum efficiency) and prevent condensation in exposed areas. Insulate suction lines on medium temperature cases with 1/2" thick insulation in exposed areas to prevent condensate dropping.
6) Suction and liquid lines should never be taped or soldered together. Adequate heat exchanger is provided in the case.
7) Refrigeration lines should never be placed in the ground unless they are protected against moisture and electrolysis attack.
8) Always slope suction lines down toward the compressor, 1/2 inch each 10 feet. Do not leave dips in the line that would trap oil.
9) Provide "P" traps at the bottom of suction line risers, 4 feet or longer. Use a double "P" trap for each 20-foot of riser. "P" traps should be the same size as the horizontal line. Consult the technical manual or legend sheet for proper size risers.
10) Use long radius ells and avoid 45° ells.
11) Provide expansion loops in suction lines on systems on hot gas defrost (see expansion loops gas defrost in this manual).
12) Strap and support tubing to prevent excessive line vibration and noise.

13) Brazing of copper-to-copper should be with a minimum of 10% silver solder. Copper to brass or copper to steel should be brazed with a minimum 45% silver solder.
14) Avoid the use of "bull head" tees in suction lines. An example is suction gas enters both ends of the tee and exits the center. This can cause a substantial increase in pressure drop in the suction lines.
15) When connecting more than one suction line to a main trunk line, connect each branch line with an inverted trap.

Expansion Loops – Hot Gas Defrost

Reprinted from Kysor//Warren Technical Bulletin #85 204 3 dated 9/11/90.

On a refrigeration system with gas defrost, the refrigerant lines expand and contract with temperature changes. The suction line will normally have the greatest movement since it has the largest temperature change during defrost.

If this expansion and contraction is not planned for during the installation of refrigeration lines, kinking and breaking of the lines could occur.

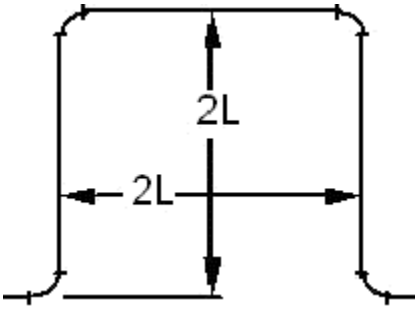
In order to compensate for the expansion of the tubing, it is necessary to estimate the amount of expansion and then provide offsets or loops in the refrigerant piping. Generally, medium temperature lines will expand approximately 1 1/2 inches for each 100 feet and low temperature lines approximately 2 inches for each 100 feet of tubing.

Normally, in a supermarket, the area to be most concerned with is the straight-line distance from the fixture to the main access pit in or near the motor room.

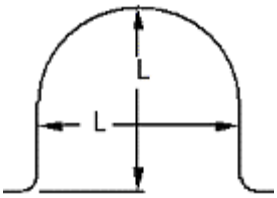
In compensating for expansion and contraction, two items are very important.

1) Liquid and suction lines should not be brazed together and should not touch at any point.
2) Pipe hangers must be located and installed in such a manner as not to restrict the expansion and contraction of the tubing. All tubing clamps should have an insulation material (i.e. Bee Line bushing) to prevent metal-to-metal contact.

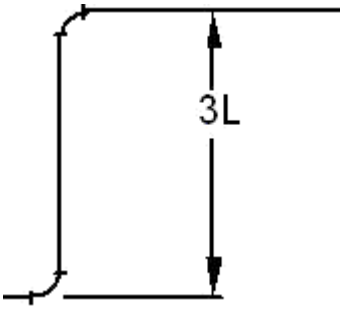
Loop with Fittings



Loop Formed



Loop Offset



Expansion Loop Calculation

Medium Temperature

Line Length 225 Feet

Line Size 1 5/8 Inches

Amount of expansion = 200/100 x 1.5"/100ft = 3"

Based on 3" expansion and 1 5/8" tubing, the legs of the loop would be 2 times L value or 2 x 35 = 70" each.

Low temperature lines would be calculated in a similar manner.

By utilizing proper methods to allow for expansion and contraction of refrigerant lines, the reliability of systems with gas defrost is enhanced greatly.

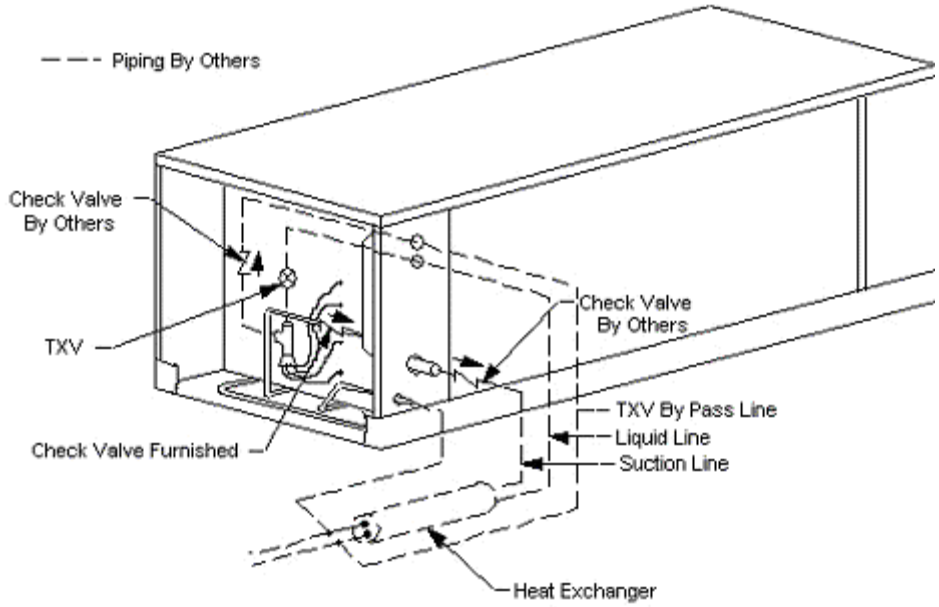
Paul F. Renaud 3/13/85 rev. 9/11/90.

Expansion chart

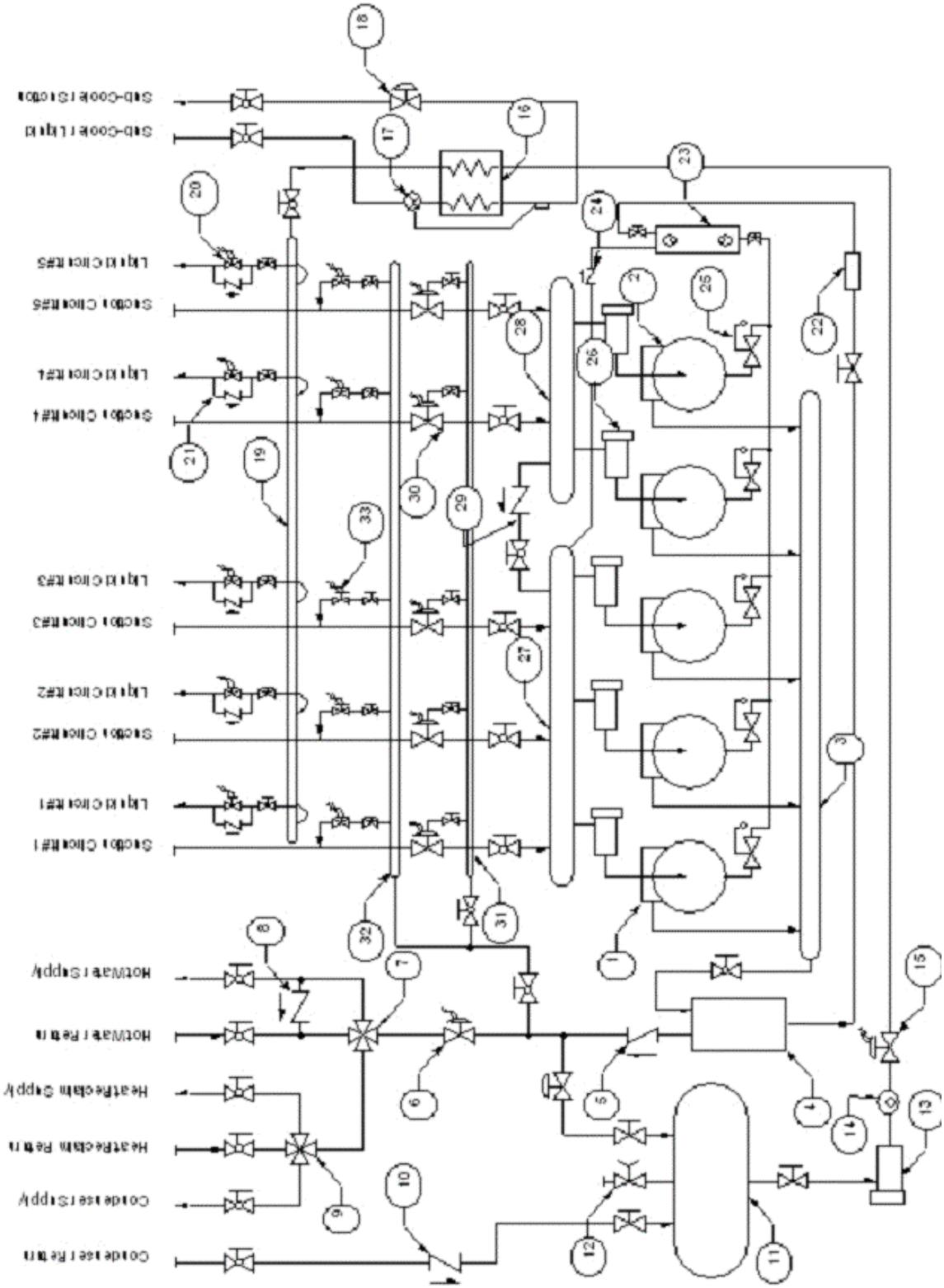
Ref Line	**Length L (inches) Amount of Expansion**								
OD	**1/2**	**1**	**1 1/2**	**2**	**2 1/2**	**3**	**4**	**5**	**6**
7/8	10	15	19	22	25	27	30	34	38
1 1/8	11	16	20	24	27	29	33	38	42
1 3/8	11	17	21	26	29	32	36	42	47
1 5/8	12	18	23	28	31	35	39	46	51
2 1/8	14	20	25	31	34	38	44	51	57
2 5/8	16	22	27	32	37	42	47	56	62

Walk In Hot Gas Defrost Piping

Typical piping for a walk in unit with hot gas defrost.



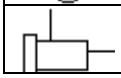
Typical Rack Piping Schematic



Piping Schematic Item

1	Main suction group compressor
2	Satellite suction group compressor
3	Compressor discharge header
4	Oil separator
5	Discharge check valve
6	Electrically wide open pressure regulating valve (Flo Con A82B)
7	4 Way diverting valve used for hot water
8	10 psi by pass check valve
9	4 Way diverting valve used for comfort
10	Liquid drop leg check valve
11	Liquid receiver tank
12	Pressure relief valve
13	Liquid filter drier
14	Moisture indicator/sightglass
15	Pressure differential regulating valve for defrost (Sporlan OLDR)
16	Liquid sub cooler
17	TX valve
18	Evaporator pressure regulator (Sporlan ORIT)
19	Bottom feed liquid header
20	Liquid solenoid valve
21	By pass check valve for return during hot gas defrost
22	Oil line filter
23	Oil reservoir
24	Oil reservoir pressure differential check valve
25	Compressor oil float valve
26	Suction line filter
27	Main suction group suction header
28	Satellite suction group suction header
29	Suction header cross over piping
30	Electrically operated evaporator pressure regulating valve
31	Discharge gas pilot header for EPR valves
32	Hot gas defrost header
33	Hot gas solenoid

Piping Schematic Legend

	Ball Type Shut Off Valve
	Shut Off Valve
	Float Type Regulating Valve
	Check Valve
	Pressure Regulating Valve
	Pressure Regulating Valve Electrically Operated
	Solenoid Valve
	4 Way Diverting Valve
	Pressure Relief Valve
	Thermal Expansion Valve
	Moisture Indicator/Sightglass
	Removable Core Filter

Kysor//Warren Case Wiring Identification

208/1/60

Wire	Description	Terminal
#7	Defrost heaters (electric defrost)	Contactor
#8	Defrost heaters (electric defrost)	Contactor
#7	Defrost relay coil (air defrost)	L
#8	Defrost relay coil (air defrost)	2
#9	Temperature control	T
#10	Temperature control	L
#17	Defrost termination	L*
#18	Defrost termination	8*
#19	Defrost relay circuit {I)(L)V5(H)(V)(F)1}	1

Note:

The terminals designated above are in the parallel system units' control panel.

* L and 8 are only wired for defrost termination when a Paragon Time Clock is used. Wire to appropriate input boards when an electronic defrost control is used.

115/1/60

Wire	Description
#1	Anti sweat heater
#2	Anti sweat heater
#3	Drain heater and fan motor
#4	Drain heater and fan motor
#5	Light circuit
#6	Light circuit
#15	Dual temperature (LM1AG only)
#16	Dual temperature (LM1AG only)

Note:

All above to be wired to proper voltage that remains on at all times.

Kysor//Warren Walk In Wiring Identification

Hot gas and electric defrost only.

208/1/60

Wire	Description	Terminal
L1 4	Evaporator fan motor (208 VAC)	Contactor
L2	Evaporator fan motor (208 VAC)	Contactor
F	Defrost termination control	F
N 1	Defrost termination control	L
X 8	Defrost termination control	8

Note:

The terminals designated above are in the parallel system unit control panel when using gang time clock.

Construction

The basic construction of the parallel system is made up of carefully selected over the counter items that can be readily obtained at refrigeration wholesalers. As previously mentioned, each system is custom designed to meet the needs of each customer. The following is a description of a parallel system containing all of the standard and optional components available.

Electrical

All solenoids, contactors, controls, time clocks, and crankcase heaters are installed and wired at the factory. Electrical connections to the parallel system include three-phase power and single-phase control circuits. These are made in the control panel. The control panel is located in various places depending on the product family.

Parallel system units are available with compressors rated at 208/60/3, 460/60/3 and 575/60/3. For 208 VAC systems a single power feed is required for the unit. For 460 and 575 VAC systems a separate 208/60/1 control circuit supply is required; if electric defrost is used a 208/60/3 supply is normally required, which may be combined with the control circuit supply. An optional transformer may be added to step down the 460 (or 575) VAC for the control circuit on each unit.

All field wiring must be in compliance with the national electrical code and local codes. Minimum unit wiring ampacity and maximum overcurrent protective device rating as calculated per the national electric code are shown on the parallel system nameplate.

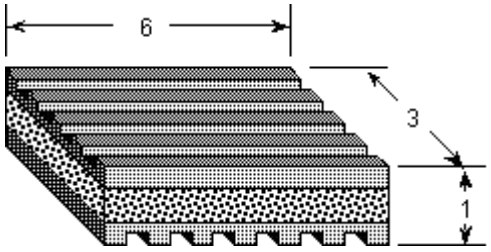
Typical 208 and 460 VAC wiring diagrams with typical circuit wiring for different types of circuits are included in the wiring diagram section of this manual. All types of defrost circuits may be intermixed in the panel depending on the individual store requirements. The wiring diagram sent with each parallel system is the diagram for that particular unit and shows the circuit wiring as set up for that specific application.

Parallel systems units with optional heat reclaim normally require two wires from the store environmental control panel supplying voltage requested by the customer.

Vibration Mounts

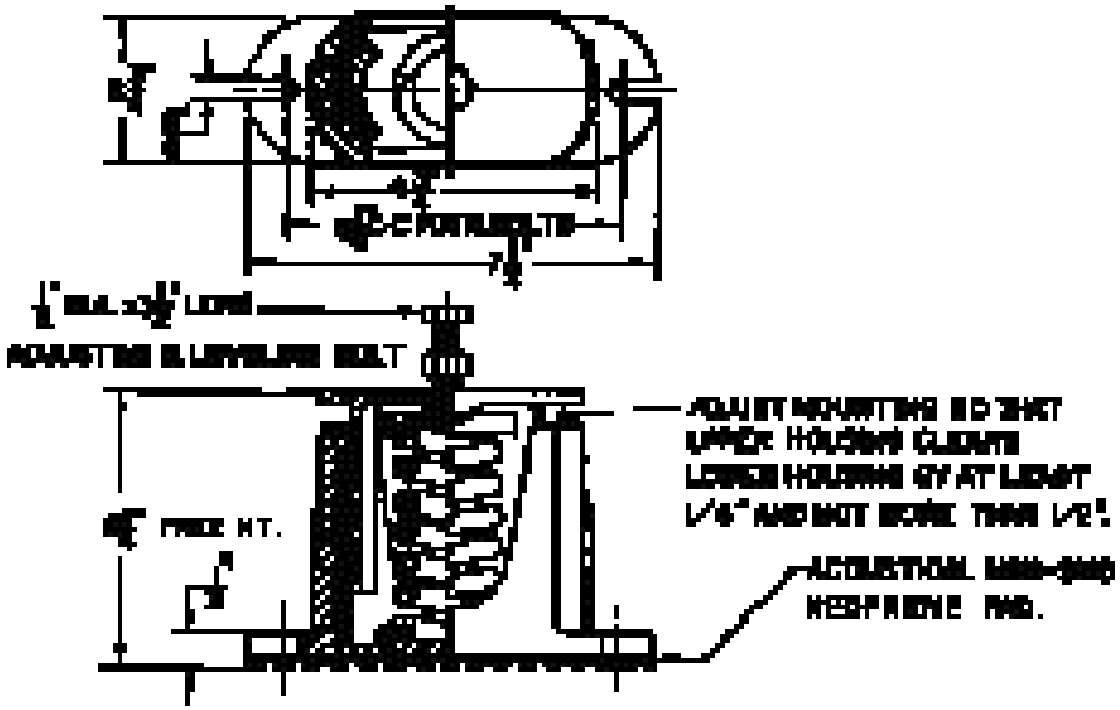
Vibration pads are supplied with each indoor unit as standard. Isolator springs are optionally available. The quantity of vibration pads or isolator springs is shown in the dimension tables. Their recommended placement is shown in the tables and drawings that follow.

Vibration Pad:



Spring Isolator:

Spring Isolator Dimensions:



Compressors

Copeland, Carlyle and Bitzer compressors are available. The compressors are solid mounted to the refrigerant receiver or base frame assembly. All reciprocating compressors incorporate oil floats. Crankcase heaters, if provided, will be installed and wired. Cylinder head cooling fans will be installed as required by the compressor manufacture or customer request on reciprocating compressor systems. Typically, a high-pressure cutout, low-pressure control and oil failure controls are installed and wired for each compressor. The suction filter cores are shipped installed.

Compressors may be selected in Even Horsepower, Uneven Horsepower and Hybrid arrangements.

Many compressors are available with unloading for capacity control. The unloading of a compressor adds many capacity steps to those normally available to an electronic controller. Usually the more steps available the better the load can be matched. The better the load is matched the more efficient the system will run. Digital Scroll compressors can be included with many systems.

Satellite Compressor

A compressor may be added to the parallel system for ice cream or fresh meat cases. This compressor would maintain lower suction pressure than the main suction header and provide several advantages over a remote unit.

Hot gas would be available to the ice cream circuits for defrost and the suction would be connected to the main header providing help on pull down and standby protection should the satellite fail.

Compressor Info

Copeland Discus Electrical Rating

R22 Low Temp Discus

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
2DF3-030	3.0	15.9	102	8.1	52	6.7	41
2DL3-040	4.0	24.1	161	10.2	60	7.7	49
2DA3-060	6.0	25.4	161	10.2	60	9.1	49
2DB3-060	6.0	25.4	161	13.3	80	9.6	63
3DA3A060	6.0	26.8	150	13.7	77	10.5	62
3DB3A075	7.5	29.6	161	16.1	83	11.0	67
3DF3A090	9.0	37.0	215	16.9	106	16.5	84
3DS3A100	10.0	35.1	215	18.6	106	16.8	84
4DA3A101	10.0	35.0	240	21.0	120	17.4	106
4DL3A150	15.0	46.4	278	23.2	139	20.9	113
4DT3A220	22.0	51.4	374	25.7	187	24.2	135
6DL3A270	27.0	67.9	450	34.0	225	32.5	172
6DT3A300	30.0	75.7	470	37.9	235	39.6	200

R22 Medium Temp Discus

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
2DC3-050	5.0	22.3	120	10.4	60	7.7	49
2DD3-050	5.0	22.3	120	10.5	60	7.9	49
2DL3-075	7.5	31.6	169	13.8	85	13.2	67
2DA3-075	7.5	32.0	169	14.1	85	13.3	67
3DA3A075	7.5	31.5	161	20.0	106	16.5	84
3DB3A100	10.0	43.6	215	20.0	106	16.5	84
3DF3A120	12.0	48.2	275	23.6	138	NA	NA
3DS3A150	15.0	59.6	275	29.0	138	23.6	110
4DA3A200	20.0	66.0	308	33.0	154	24.7	135
4DB3A220	22.0	65.6	374	32.8	187	26.5	135
4DH3A250	25.0	82.2	428	41.1	214	34.4	172
4DJ3A300	30.0	94.0	470	47.0	235	39.3	200
6DH3A350	35.0	107.0	565	53.5	283	42.5	230
6DG3A350	35.0	125.0	594	62.5	297	46.0	245
6DJ3A400	40.0	142.0	594	71.0	297	53.5	245

R22 High Temp Discus

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
2DC3-050	5.0	22.3	120	10.4	60	7.7	49
2DD3-050	5.0	22.3	120	10.5	60	7.9	49
2DL3-075	7.5	31.6	169	13.8	85	13.2	67
2DA3-075	7.5	32.0	169	14.1	85	13.3	67
3DA3A075	7.5	31.5	161	20.0	106	16.5	84
3DB3A100	10.0	43.6	215	20.0	106	16.5	84
3DF3A120	12.0	48.2	275	23.6	138	NA	NA
3DS3A150	15.0	59.6	275	29.0	138	23.6	110
4DA3A200	20.0	66.0	308	33.0	154	24.7	135
4DB3A220	22.0	65.6	374	32.8	187	26.5	135
4DH3A250	25.0	82.2	428	41.1	214	34.4	172
4DJ3A300	30.0	94.0	470	47.0	235	39.3	200
6DH3A350	35.0	107.0	565	53.5	283	42.5	230
6DG3A350	35.0	125.0	594	62.5	297	46.0	245
6DJ3A400	40.0	142.0	594	71.0	297	53.5	245

R404A & R507 Low Temp Discus

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
2DF3-030	3.0	16.8	102	8.1	52	6.7	41
2DL3-040	4.0	26.3	161	10.2	60	7.7	49
2DA3-060	6.0	28.8	161	10.2	60	9.1	49
2DB3-060	6.0	28.2	161	13.3	80	9.6	63
3DA3A060	6.0	30.3	150	13.7	77	10.5	62
3DB3A075	7.5	31.5	161	16.1	83	11.0	67
3DF3A090	9.0	39.0	215	16.9	106	16.5	84
3DS3A100	10.0	42.0	215	20.0	106	16.8	84
4DA3A101	10.0	45.2	220	22.6	110	17.4	106
4DL3A150	15.0	52.6	278	26.3	139	20.9	113
4DT3A220	22.0	66.0	374	33.0	187	24.2	135
6DL3A270	27.0	80.8	450	40.4	225	32.5	172
6DT3A300	30.0	95.6	470	47.8	235	39.6	200

R404A & R507 Medium Temp Discus

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
2DC3-050	5.0	22.3	120	10.4	60	7.7	49
2DD3-050	5.0	22.3	120	10.5	60	7.9	49
2DL3-075	7.5	31.6	169	13.8	85	13.2	67
2DA3-075	7.5	32.0	169	14.1	85	13.3	67
3DA3A075	7.5	41.0	215	20.0	106	16.5	84
3DB3A100	10.0	43.6	215	20.0	106	16.5	84
3DF3A120	12.0	48.2	275	23.6	138	NA	NA
3DS3A150	15.0	59.6	275	29.0	138	23.6	110
4DA3A200	20.0	66.0	308	33.0	154	24.7	135
4DH3A250	25.0	82.2	428	41.1	214	34.4	172
4DJSA270	27.0	94.0	470	47.0	235	39.3	200
4DJ3A300	30.0	94.0	470	47.0	235	39.3	200
6DH3A350	35.0	107.0	565	53.5	283	42.5	230
6DG3A350	35.0	125.0	594	62.5	297	46.0	245
6DJ3A400	40.0	142.0	594	71.0	297	53.5	245

R404A & R507 High Temp Discus

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
2DC3-050	5.0	22.3	120	10.4	60	7.7	49
2DD3-050	5.0	22.3	120	10.5	60	7.9	49
2DL3-075	7.5	31.6	169	13.8	85	13.2	67
2DA3-075	7.5	32.0	169	14.1	85	13.3	67
3DA3A075	7.5	41.0	215	20.0	106	16.5	84
3DB3A100	10.0	43.6	215	20.0	106	16.5	84
3DF3A120	12.0	48.2	275	23.6	138	NA	NA
3DS3A150	15.0	59.6	275	29.0	138	23.6	110
4DA3A200	20.0	66.0	308	33.0	154	24.7	135
4DH3A250	25.0	82.2	428	41.1	214	34.4	172
4DJSA270	27.0	94.0	470	47.0	235	39.3	200
4DJ3A300	30.0	94.0	470	47.0	235	39.3	200
6DH3A350	35.0	107.0	565	53.5	283	42.5	230
6DG3A350	35.0	125.0	594	62.5	297	46.0	245
6DJ3A400	40.0	142.0	594	71.0	297	53.5	245

Copeland Scroll Electrical Rating

R22 Low Temp ZF

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
ZF06K4	2.0	7.9	55	3.6	27	NA	NA
ZF08K4	2.5	7.9	63	3.9	31	NA	NA
ZF09K4	3.0	10.0	77	5.0	39	NA	NA
ZF11K4	3.5	12.5	88	6.4	44	NA	NA
ZF13K4	4.0	15.0	99	6.8	49.5	NA	NA
ZF15K4	5.0	16.4	123	8.6	62	NA	NA
ZF18K4	6.0	20.0	156	7.5	70	7.1	55
ZF24K4	7.5	22.9	189	11.4	94	8.9	74
ZF33K4	10.0	30.1	278	16.4	127	11.6	100
ZF40K4	13.0	40.7	350	20.0	158	15.4	125
ZF48K4	15.0	48.2	425	22.1	187	17.9	148

R22 Medium Temp ZS

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
ZS15K4	2.0	7.9	55	3.6	27	NA	NA
ZS19K4	2.5	7.9	63	3.9	31	NA	NA
ZS21K4	3.0	10.0	77	5.0	39	NA	NA
ZS26K4	3.5	12.5	88	6.4	44	NA	NA
ZS30K4	4.0	15.0	99	6.8	49.5	NA	NA
ZS38K4	5.0	16.4	123	8.6	62	NA	NA
ZS45K4	6.0	20.0	156	7.5	70	7.1	55
ZS56K4	7.5	22.9	189	11.4	94	8.9	74
ZS75K4	10.0	30.1	278	16.4	127	11.6	100
ZS92K4	13.0	40.7	350	20.0	158	15.4	125
ZS11M4	15.0	48.2	425	22.1	187	17.9	148

R404A & R507 Low Temp ZF

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
ZF06K4E	2.0	9.3	55	4.3	27	4.3	31
ZF08K4E	2.5	9.7	63	5.0	31	5.0	34
ZF09K4E	3.0	11.1	77	5.7	39	8.2	40
ZF11K4E	3.5	13.6	88	7.1	44	7.9	50
ZF13K4E	4.0	15.0	99	8.2	49.5	7.9	54
ZF15K4E	5.0	21.4	123	9.6	62	11.8	74
ZF18K4E	6.0	23.9	156	9.3	70	16.1	100
ZF24K4E	7.5	30.0	189	15.7	94	20.0	125
ZF33K4E	10.0	43.6	278	21.1	127	22.5	148
ZF40K4E	13.0	52.9	350	25.8	158	4.3	31
ZF48K4E	15.0	60.0	425	28.2	187	5.0	34

R404A & R507 Medium Temp ZS

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
ZS15K4E	2.0	9.3	55	4.3	27	4.3	31
ZS19K4E	2.5	9.7	63	5.0	31	5.0	34
ZS21K4E	3.0	11.1	77	5.7	39	8.2	40
ZS26K4E	3.5	13.6	88	7.1	44	7.9	50
ZS30K4E	4.0	15.0	99	8.2	49.5	7.9	54
ZS38K4E	5.0	21.4	123	9.6	62	11.8	74
ZS45K4E	6.0	23.9	156	9.3	70	16.1	100
ZS56K4E	7.5	30.0	189	15.7	94	20.0	125
ZS75K4E	10.0	43.6	278	21.1	127	4.3	31
ZS92K4E	13.0	52.9	350	25.0	158	5.0	34
ZS11M4E	15.0	60.0	425	28.2	187	22.5	148

R404A & R507 Medium Temp ZB

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
ZB19KCE	2.5	10.0	63	5.0	31	NA	NA
ZB21KCE	3.0	12.1	77	6.1	39	NA	NA
ZB26KCE	3.5	13.9	88	7.1	44	NA	NA
ZB30KCE	4.0	15.7	115	7.5	47.5	NA	NA
ZBD30KCE	4.0	15.7	115	7.5	47.5	NA	NA
ZB38KCE	5.0	22.1	115	9.6	63	NA	NA
ZBD45KCE	6.0	22.5	156	11.5	70	NA	NA
ZB45KCE	6.0	22.5	156	11.5	70	NA	NA
ZB56KCE	7.5	30.0	189	15.7	94	NA	NA
ZB75KCE	10.0	43.6	278	21.1	127	NA	NA
ZB92KCE	13.0	52.9	350	25.0	158	NA	NA
ZB11MCE	15.0	60.0	425	28.2	187	NA	NA

Copeland Screw Electrical Rating

R22 Low Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
SHL2-2000	20.0	81.0	492	41.0	246	NA	NA
SHL2-2500	25.0	84.0	436	42.0	218	NA	NA
SHL2-3000	30.0	104.0	532	52.0	266	NA	NA
SHL1-4000	40.0	136.0	655	65.0	313	NA	NA
SHL1-5000	50.0	165.0	743	79.0	355	NA	NA
SHL1-6000	60.0	186.0	939	89.0	449	NA	NA
SHL1-7000	70.0	215.0	1015	103.0	485	NA	NA
SHL1-7500	75.0	249.0	1224	119.0	585	NA	NA

R22 Medium Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
SHM2-3000	30.0			46.0	218	NA	NA
SHM2-3500	35.0	121.0	532	60.0	266	NA	NA
SHM2-4000	40.0	130.0	622	65.0	311	NA	NA
SHM1-5000	50.0	165.0	743	79.0	355	NA	NA
SHM1-6000	60.0	205.0	939	98.0	449	NA	NA
SHM1-7000	70.0	251.0	1015	120.0	485	NA	NA
SHM1-8000	80.0	263.0	1224	126.0	585	NA	NA
SHM1-9000	90.0	305.0	1435	146.0	686	NA	NA

R404A & R507 Low Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
SHL2-2000	20.0	82.0	495	37.0	227	NA	NA
SHL2-2500	25.0	97.0	536	44.0	241	NA	NA
SHL2-3000	30.0	110.0	607	50.0	250	NA	NA
SHL1-4000	40.0	150.0	724	65.0	313	NA	NA
SHL1-5000	50.0	182.0	832	79.0	355	NA	NA
SHL1-6000	60.0	227.0	1038	98.0	449	NA	NA
SHL1-7000	70.0	286.0	1122	124.0	485	NA	NA
SHL1-7500	75.0	286.0	1122	144.0	585	NA	NA

R404A & R507 Medium Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
SHM2-3000	30.0	102.0	536	46.0	241	NA	NA
SHM2-3500	35.0	124.0	607	56.0	250	NA	NA
SHM2-4000	40.0	144.0	727	65.0	304	NA	NA
SHM1-5000	50.0	182.0	822	79.0	355	NA	NA
SHM1-6000	60.0	227.0	1038	98.0	449	NA	NA
SHM1-7000	70.0	286.0	1122	124.0	485	NA	NA
SHM1-8000	80.0	333.0	1353	144.0	585	NA	NA
SHM1-9000	90.0	375.0	1587	162.0	686	NA	NA

Carlyle Recip. Electrical Rating

R22 Low Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
06DR109	2.0	8.6	53.3	3.9	26.3	2.8	21.3
06DR013	3.0	12.4	71	6.2	35.5	5.0	28.4
06DR316	5.0	19.3	100	9.6	50	7.7	40
06DR718	5.0	19.3	100	9.6	50	7.7	40
06DR820	6.5	31.4	160	15.7	80	12.6	64
06DR725	6.5	31.4	160	15.7	80	12.6	64
06DR228	8.0	39.6	198	19.8	99	15.9	79
06DR337	10.0	44.3	228	22.1	114	17.9	91
06ER450	15.0	59.3	282	33.9	150	23.9	97
06ER465	20.0	74.3	350	35.0	175	27.1	124
06ER475	20.0	74.3	350	35.0	175	27.1	124
06ER399	30.0	116.4	507	52.1	210	41.4	168

R404A & R507 Low Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
06DR109	2.0	8.6	53.3	3.9	26.3	2.8	21.3
06DR013	3.0	12.4	71	6.2	35.5	5.0	28.4
06DR316	5.0	19.3	100	9.6	50	7.7	40
06DR718	5.0	19.3	100	9.6	50	7.7	40
06DR820	6.5	31.4	160	15.7	80	12.6	64
06DR725	6.5	31.4	160	15.7	80	12.6	64
06DR228	8.0	39.6	198	19.8	99	15.9	79
06DR337	10.0	44.3	228	22.1	114	17.9	91
06DR541	15.0	63.6	266	28.6	120	20.0	90
06ER450	15.0	59.3	282	33.9	150	23.9	97
06ER465	20.0	74.3	350	35.0	175	27.1	124
06ER475	20.0	74.3	350	35.0	175	27.1	124
06ER399	30.0	116.4	507	52.1	210	41.4	168

R22 Medium Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
06DM808	3.0	12.4	71	6.2	35.5	5.0	28.4
06DM313	5.0	19.3	100	9.6	50	7.7	40
06DR316	5.0	19.3	100	9.6	50	7.7	40
06DA818	6.5	31.4	160	15.7	80	12.6	64
06DR820	6.5	31.4	160	15.7	80	12.6	64
06DR725	6.5	31.4	160	15.7	80	12.6	64
06DA825	8.0	39.6	198	19.8	99	15.9	79
06DR228	8.0	39.6	198	19.8	99	15.9	79
06DA328	10.0	44.3	228	22.1	114	17.9	91
06DM337	10.0	44.3	228	22.1	114	17.9	91
06DR337	10.0	44.3	228	22.1	114	17.9	91
06DA537	15.0	63.6	266	28.6	120	22.9	96
06EM450	15.0	64.3	246	33.9	150	23.9	97
06ER450	15.0	59.3	282	33.9	150	23.9	97
06EA550	20.0	74.3	350	35.0	175	27.1	124
06EA565	25.0	90.7	420	45.7	210	37.8	164
06EM475	25.0	90.7	420	45.7	210	37.9	164
06EA575	30.0	116.4	507	52.1	210	41.4	188
06EM499	35.0	130.0	590	62.9	283	55.7	236
06EA599	40.0	153.6	636	75.7	295	60.7	236

R22 High Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
06DM808	3.0	12.4	71	6.2	35.5	5.0	28.4
06DM313	5.0	19.3	100	9.6	50	7.7	40
06DA818	6.5	31.4	160	15.7	80	12.6	64
06DA825	8.0	39.6	198	19.8	99	15.9	79
06DA328	10.0	44.3	228	22.1	114	17.9	91
06DA537	15.0	63.6	266	28.6	120	22.9	96
06EM450	15.0	64.3	246	33.9	150	23.9	97
06EA550	20.0	74.3	350	35.0	175	27.1	124
06EA565	25.0	90.7	420	45.7	210	37.8	164
06EM475	25.0	90.7	420	45.7	210	37.9	164
06EA575	30.0	116.4	507	52.1	210	41.4	188
06EM499	35.0	130.0	590	62.9	283	55.7	236
06EA599	40	153.6	636	75.7	295	60.7	236

R404A & R507 Medium Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
06DM808	3.0	12.4	71	6.2	35.5	5.0	28.4
06DM313	5.0	19.3	100	9.6	50	7.7	40
06DR316	5.0	19.3	100	9.6	50	7.7	40
06DR820	6.5	31.4	160	15.7	80	12.6	64
06DR725	6.5	31.4	160	15.7	80	12.6	64
06DR228	8.0	39.6	198	19.8	99	15.9	79
06DM337	10.0	44.3	228	22.1	114	17.9	91
06DR337	10.0	44.3	228	22.1	114	17.9	91
06DR541	15.0	63.6	266	28.6	120	20.0	90
06EM450	15.0	64.3	246	33.9	150	23.9	97
06EA565	25.0	90.7	420	45.7	210	37.8	164
06EM475	25.0	90.7	420	45.7	210	37.9	164
06EM499	35.0	130.0	590	62.9	283	55.7	236

Carlyle Screw Electrical Rating

R22, R404A & R507 Low Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
06TRC033F2EA	15.0	64.0	250.0	32.9	150.0	23.9	97.0
06TRD039F2EA	20.0	74.3	350.0	35.0	173.0	27.1	124.0
06TRD044F2EA	20.0	74.3	350.0	35.0	173.0	27.1	124.0
06TRE048F2EA	25.0	90.7	420.0	45.7	215.0	37.9	164.0
06TRE054F2EA	25.0	90.7	420.0	45.7	215.0	37.9	164.0
06TRF065F2EA	30.0	110.0	611.0	54.3	274.0	43.6	219.0
06TRG078F2EA	35.0	129.3	721.0	63.6	323.0	51.4	258.0
06TRH088F2EA	40.0	145.0	825.0	72.1	370.0	57.9	296.0

R22, R404A & R507 Medium Temp

Base Model	HP	208		460		575	
		RLA	LRA	RLA	LRA	RLA	LRA
06TAD033F2EA	20.0	74.3	350.0	35.0	173.0	27.1	124.0
06TAE039F2EA	25.0	90.7	420.0	45.7	215.0	37.9	164.0
06TAF044F2EA	30.0	116.4	507.0	52.1	210.0	41.4	168.0
06TAF048F2EA	30.0	116.4	507.0	52.1	210.0	41.4	168.0
06TAG054F2EA	35.0	130.0	590.0	62.9	283.0	55.7	236.0
06TAG065F2EA	35.0	129.3	721.0	63.6	323.0	51.4	258.0
06TAH078F2EA	40.0	145.0	825.0	72.1	370.0	57.9	296.0
06TAK088F2EA	50.0	164.3	979.0	81.4	439.0	66.0	323.0

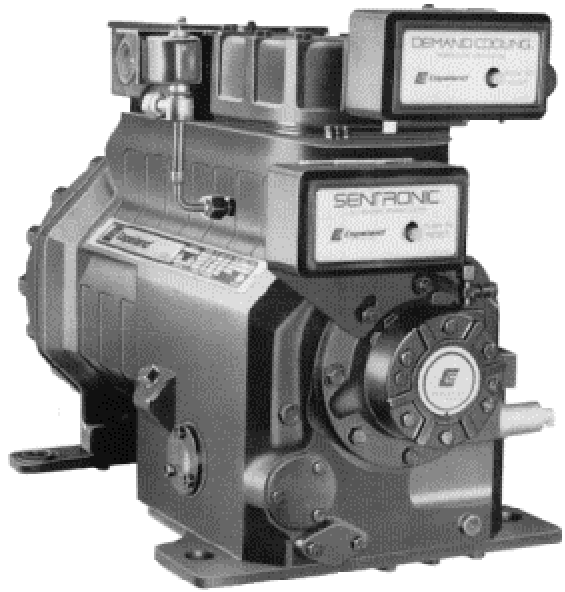
Copeland Demand Cooling™

Demand Cooling™ is a method of cooling a low temperature compressor by injecting refrigerant around the cylinder walls of the compressor. This is done in response to discharge temperature. The following is an excerpt from a Copeland Bulletin on Demand Cooling.

Application Engineering Bulletin

AE 1287 R1 December 1, 1990

COPELAND DEMAND COOLING



Introduction

HCFC-22, when used in a properly designed and controlled refrigeration system, is a realistic low temperature refrigerant alternative to CFC-502, which must be phased out due to its high ozone depletion potential. However, experience has shown that HCFC-22 can present problems as a low temperature refrigerant because under some conditions the internal compressor discharge temperature exceeds the safe temperature limit for long term stability of refrigeration oil.

The Copeland Demand Cooling System (see Figure 1) uses modern electronics to provide a reliable cost effective solution to this problem. It is required for all single stage HCFC-22 applications with saturated suction temperatures below -10°F.

Demand Cooling is compatible with single (conventional) units as well as parallel racks.

The Demand Cooling module uses the signal of a discharge head temperature sensor to monitor discharge gas temperature. If a critical temperature is reached, the module energizes a long life injection valve which meters a controlled amount of saturated refrigerant into the compressor suction cavity to cool the suction gas. This process controls the discharge temperature to a safe level. If, for some reason, the discharge temperature rises above a preset maximum level. the Demand Cooling module will turn the compressor off (requiring a manual reset) and actuate its alarm contact. To minimize the amount of refrigerant which must be injected, the suction gas cooling process is performed after the gas has passed around and through the motor.

Injection valve orifices have been carefully chosen for each body style to be large enough to provide the necessary cooling when required but not so large that dangerous amounts of liquid are injected, or that excessive system pressure fluctuation occurs during injection valve cycling. Normally, pressure fluctuations are no greater than 1 to 2 psi. It is important to use the correct valve for each compressor body style.

Performance data for Demand Cooling compressors includes the effects of injection when it is required. The approximate conditions where injection occurs are shown in Figure 2. At the conditions where Demand Cooling is operating, the performance values are time averages of the instantaneous values, since small fluctuations in suction and discharge conditions occur as the Demand Cooling injection valve cycles.

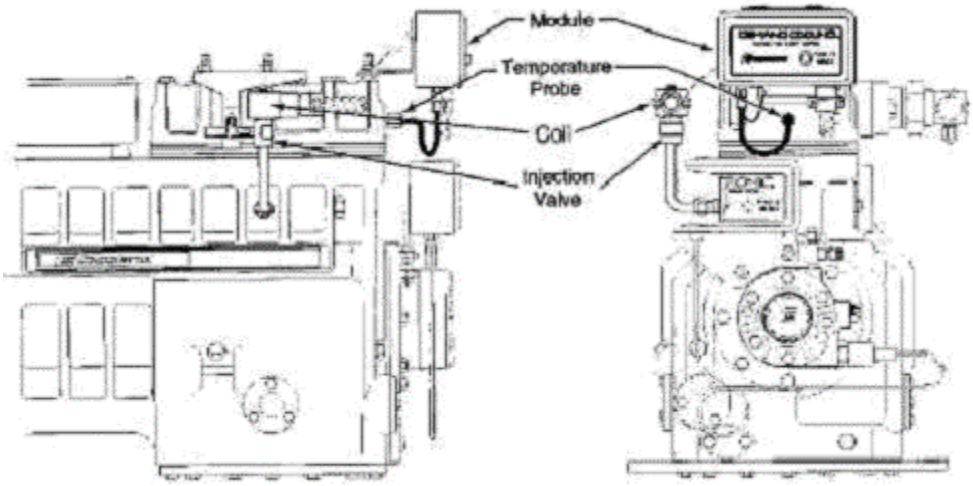
While the refrigerant injection concept has been widely recognized for some time, its application has not been widely used since the early 1960's because of the widespread availability of CFC-502, reduction of capacity and efficiency, and poor reliability of injection systems.

The Copeland Demand Cooling system addresses the capacity and efficiency issues by limiting injection to those times when it is required to control discharge temperatures to safe levels. For most applications this will only be during periods of high condensing temperatures, high return gas temperatures, or abnormally low suction pressure. The Demand Cooling system has been designed to meet the same high reliability standards as Discus compressors.

In most cases, with floating head systems where condensing temperatures are low during most of the year. Demand Cooling will operate primarily as a compressor protection control much as the oil failure control protects the compressor during periods of low oil pressure. Demand Cooling will be called to operate only during those periods when condensing temperature and return gas temperatures are high or in periods where a system failure (such as an iced evaporator, an expansion valve which does not con-trol superheat, blocked condenser, or a failed con-denser fan) raises condensing temperatures or return gas temperatures to abnormally high levels or lowers suction pressure to abnormally low levels.

Figure 1

Demand Cooling™ System



Operating Range

Demand Cooling is designed to protect the compressor from high discharge temperatures over the evaporating and condensing temperature ranges shown in Figure 2 at a maximum return gas temperature of 65°F.

Figure 2

Demand Cooling™ Injection

Demand Cooling System Design

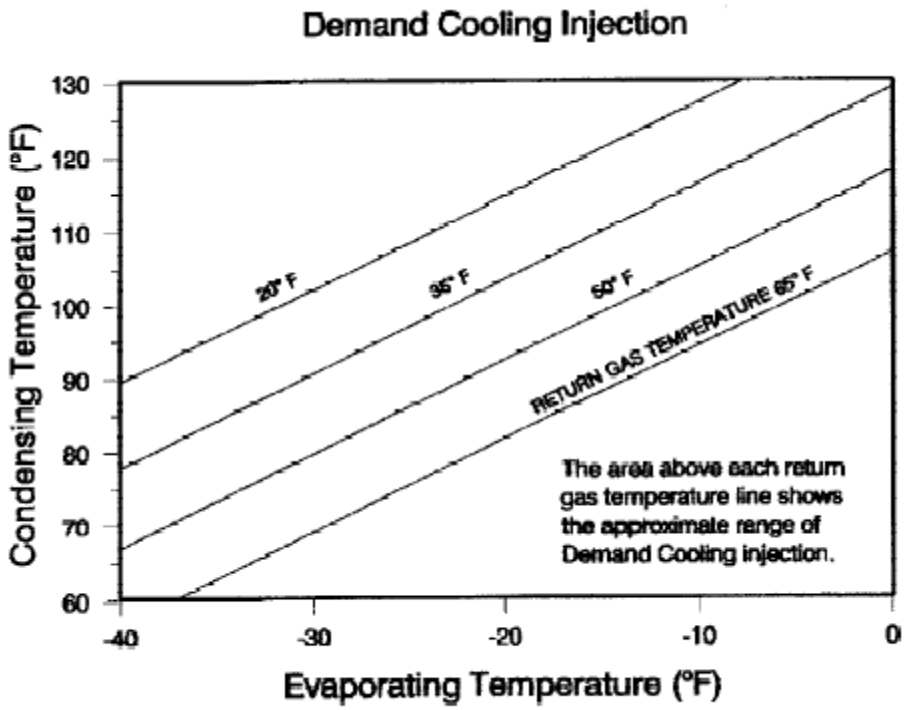


Figure 2

When Demand Cooling operates, it "diverts" refrigeration capacity in the form of injected saturated refrigerant from the evaporator to the compressor (See Figure 3 for a typical single system schematic). The effect of this diversion on evaporator capacity is minimal because the diverted capacity is used to cool the gas entering the compressor. As the gas is cooled, it naturally becomes more dense, increasing the mass flow through the compressor, which partly compensates for the capacity diverted from the evaporator.

If there is substantial heat gain along the suction line, injection may result in a substantial loss in evaporator capacity during Demand Cooling operation. In order to minimize this loss, good practice indicates Demand Cooling operation be kept to a mini-mum through proper system design and installation practices. There are three areas which can be addressed to minimize the impact of Demand Cooling operation on performance.

1) Compressor Return Gas Temperature: Suction lines should be well insulated to reduce suction line heat gain. Return gas superheat should be as low as possible consistent with safe compressor operation.

2) Condensing Temperatures: It is important when using HCFC-22 as a low temperature refrigerant that condensing temperatures be minimized to reduce compression ratios and compressor discharge temperature.

3) Suction pressure: Evaporator design and system control settings should provide the maxi-mum suction pressure consistent with the application in order to have as low a compression ratio as possible.

Demand Cooling Compressor

No new compressor models have been introduced for Demand Cooling. Instead, existing low temperature. Discus CFC-502 compressors have been modified and rerated for use with HCFC-22 and Demand Cooling. The modifications are the addition of an injection port on the compressor body and a temperature sensor port in the head of the compressor. The locations of these ports are critical and were determined through an extensive development program.

The HCFC-22 rating data includes the effects of Demand Cooling injection when operating conditions require it.

Figure 3

Demand Cooling™ System Diagram

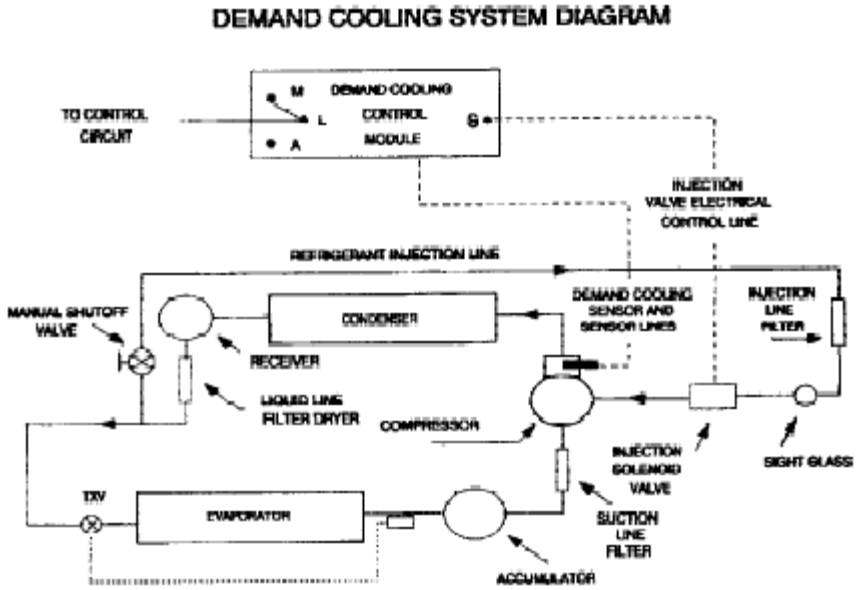


Figure 3

Condenser Sizing

Condensers should be sized using conventional methods. Demand Cooling has virtually no effect on system heat of rejection.

Demand Cooling System Components

The Demand Cooling System (see Figure 1) consists of: The Demand Cooling Temperature Sensor (TS), The Demand Cooling Module (CM), and the Injection Valve (lV).

The TS uses a precision Negative Temperature Coefficient (NTC) Thermistor (thermistor resistance drops on temperature rise) to provide temperature signals to the CM.

The IV meters refrigerant flow from the liquid line to the compressor. The IV solenoid receives on-off signals from the CM. When compressor cooling is required, the solenoid is energized and opens the IV orifice to deliver saturated refrigerant to the compressor for cooling. The valve orifice is carefully sized to meet the requirements of each body style of Discus compressors.

The CM has three functional groups:

A. The Input signal and calculator circuits compare the temperature sensor input signal to an internal set-point and decide whether to energize the IV solenoid or, in the case of a problem. The CM alarm relay.

B. The output signal to the IV is controlled by an electronic switch connected to the IV solenoid so that, when required, refrigerant vapor can be metered to the compressor to prevent compressor overheating. One side of the electronic switch is connected internally to "L1" and the other side to output terminal "S" (see Figure 4)

C. The alarm signal for local or remote control. The alarm relay is energized, after a one minute delay, by a continuous, low or high TS temperature signal. An alarm signal can indicate the following:

1. Compressor discharge temperature has risen above the level designed to be controlled by Demand Cooling.

2. A shorted sensor.

3. An open sensor.

In order to avoid nuisance trips, a one minute time delay is provided before alarm after a continuous high or low resistance reading or over temperature condition.

The alarm relay uses a single pole double throw contact. The contact terminals are "L", "M", and "A".

"L"	Common (to "A" and "M")
"L M"	Normally closed (compressor run, open on alarm)
"L A"	Normally Open (alarm signal, close on alarm)

The Normally Closed (NC) contact of the alarm relay ("L" to "M") should be wired in the compressor contactor control circuit so that opening this contact removes the compressor from the line and removes power to the CM. See Figure 4A, B, C, & D.

Figures 4A & B also shows a current sensing relay (which must be used with compressors employing internal overcurrent protection) and Sentronic oil pressure switch. The control circuit is purposely arranged so that an internal overload protector trip removes power to both the Sentronic and the Demand Cooling module. This precaution prevents the oil pressure switch from timing out and the Demand Cooling solenoid from injecting when the compressor is not operating.

The alarm relay requires a manual reset in order to call attention to a system problem.

Demand Cooling Wiring Schematic

Figure 4A

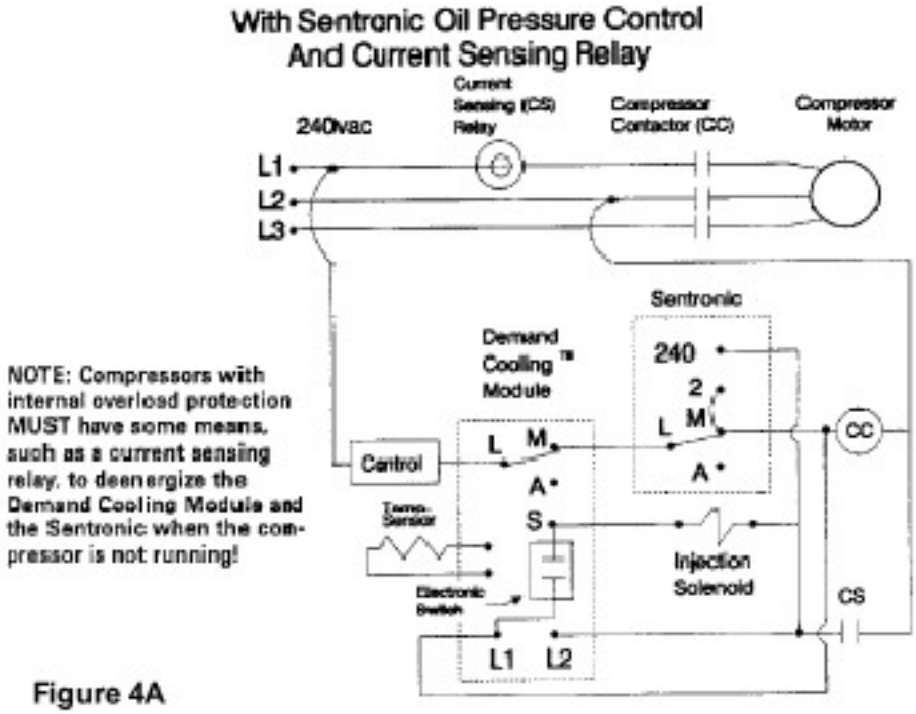


Figure 4A

Figure 4B

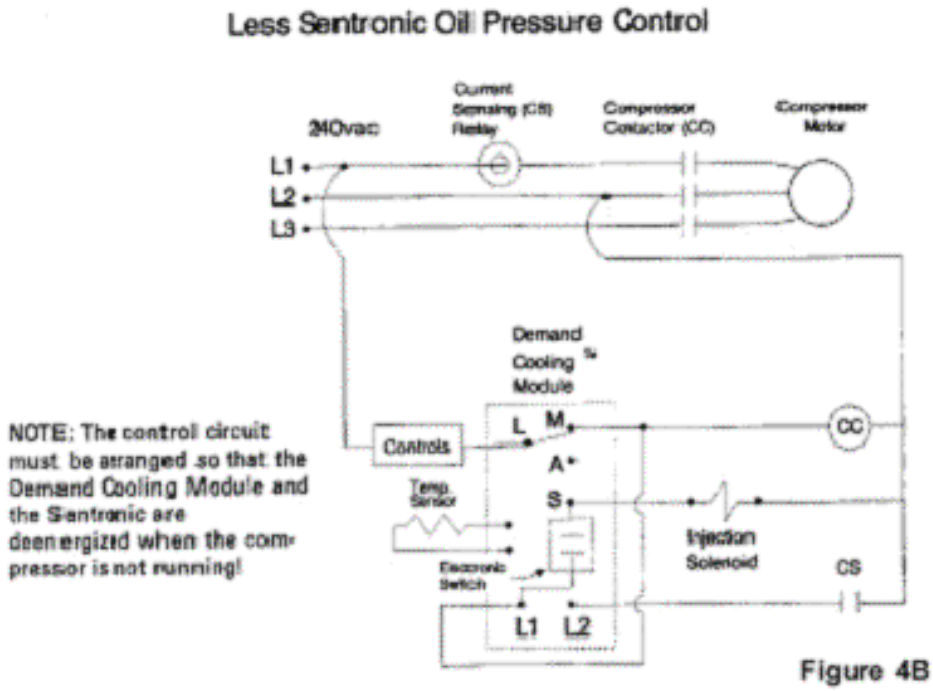


Figure 4B

Figure 4C

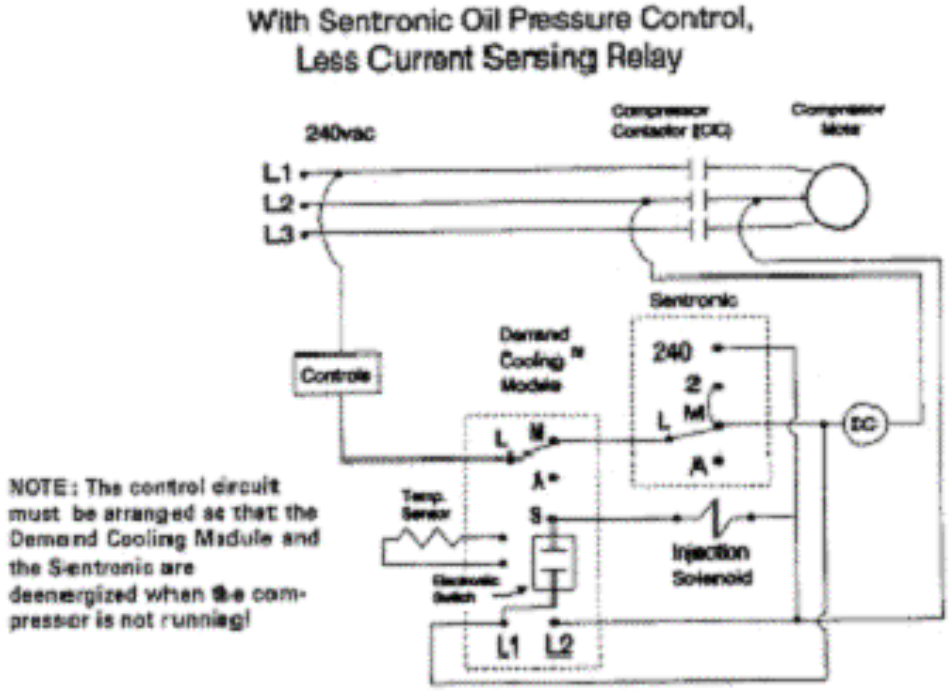


Figure 4C

Figure 4D

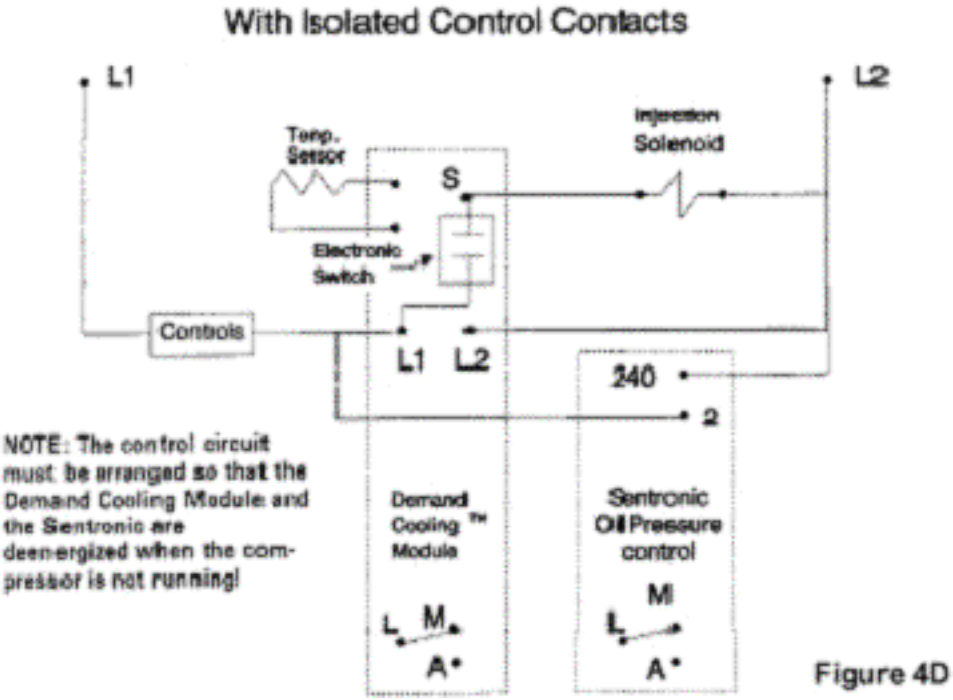


Figure 4D

System Information

1. Demand Cooling is designed to work on all Copeland Discus compressors equipped with injection ports. A different kit is required for each compressor body style and control volt-age. See Table 2 for a listing of Demand Cooling Kit part numbers.

2. The system must be clean. A dirty system may have foreign material that can lodge in the solenoid orifice. Always install a liquid line filter dryer in the injection valve inlet line capable of removing particles as small as 25 microns. Do not use any filters containing materials that con leave the filter and possibly clog the IV orifice.

3. The liquid refrigerant supply line must be a minimum of 3/8" and routed so it will not interfere with compressor maintenance. Liquid refrigerant must have sufficient sub-cooling at the injection valve to prevent flashing upstream of the valve.

4. The liquid refrigerant supply line to the IV must be supported so that it does not place stress on the IV and IV tubing or permit excess vibration. Failure to make this provision may result in damage to the IV and its tubing and/or refrigerant loss.

5. A head fan must be used to help lower compressor discharge temperatures.

6. Return gas temperatures must NOT exceed 65°F. System designers are advised to review their defrost schemes to avoid floodback to the compressor which may occur at defrost termination with HCFC-22. HCFC-22 has a significantly higher heat of vaporization than does CFC-502, and, if the same design parameters used with CFC-502 are used with HCFC-22 floodback could occur.

Capacity Modulation

Demand Cooling is not approved as yet for compressors with capacity modulation.

Performance Adjustment Factors

Since compressor discharge temperature depends strongly on the return gas temperature. the amount injection and its effect on evaporator capacity and mass flow will vary somewhat with return gas temperature. The approximate effects of return gas temperature on evaporator capacity and mass flow are tabulated in Table 3A and B. These factors should be applied to the 65°F return gas capacity and mass flow values in the published performance data sheets.

Demand Cooling Specifications

Demand Cooling is designed to operate and protect the compressor within the evaporating and condensing envelope identified in Figure 2. Operating setpoints and control actions are listed in Table 1.

Optional Demand Cooling Module Mounting Brackets	
2D and 3D Models	998 0700 09
4D and 6D Models	998 0700 10

Temperature Sensors	
3 ft. Shielded Cable (standard)	085 0109 00
10 ft. Shielded Cable (optional)	085 0109 01

See also:

Demand Cooling Installation Instruction Guides

Copeland Publication Nos.

90 130 for 2D/3D Compressors

90 131 for 4D Compressors

90 133 for 6D Compressors

Table 1

Demand Cooling Operating Setpoints And Control Actions		
Internal Head Temperature	CM Operation	Approximate Sensor Resistance
Rising through 292°F	Demand Cooling Solenoid On	2100 Ohms
Falling through 282°F	Demand Cooling Solenoid Off	2400 Ohms
Rising through 310°F	Alarm Contact Energized	1700 Ohms
At Room Temp. (77°F)	Demand Cooling Solenoid Off	90,000 Ohms

Table 2

Demand Cooling Kit Part Numbers					
		2D	3D	4D	6D
50 Hz	120V	998 1000 12	998 1001 13	998 1001 14	998 1001 16
	240V	998 1000 22	998 1001 23	998 1001 24	998 1001 26
60 Hz	120V	998 1000 12	998 1000 13	998 1000 14	998 1000 16
	240 V	998 1000 22	998 1000 23	998 1000 24	998 1000 26

Table 3A

Demand Cooling Evaporator Capacity Adjustment Factors										
Return Gas Temperature	Condensing Temperature	Saturated Suction Temperature (°F)								
(°F)	(°F)	40	35	30	25	20	15	10	5	0
50	70	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005
	80	.976	.994	1.002	1.003	1.003	1.003	1.004	1.004	1.004
	90	1.000	.997	.995	.992	1.002	1.002	1.003	1.003	1.003
	100	1.004	1.001	.998	.995	.993	.990	1.001	1.002	1.002
	110	1.007	1.004	1.002	.999	.996	.993	.990	.998	1.000
	120	1.010	1.008	1.005	1.002	.999	.997	.994	.991	.988
	130	1.013	1.011	1.008	1.005	1.002	1.000	.997	.994	.991
35	70	1.007	1.007	1.008	1.008	1.009	1.009	1.010	1.010	1.011
	80	1.005	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.009
	90	1.000	.996	1.004	1.004	1.004	1.005	1.006	1.006	1.007
	100	1.006	1.001	.997	.993	1.002	1.002	1.003	1.003	1.004
	110	1.010	1.006	1.002	.998	.994	.989	1.000	1.000	1.001
	120	1.016	1.011	1.007	1.003	.990	.995	.991	.986	1.000
	130	1.020	1.016	1.012	1.007	1.003	.999	.994	.990	.985
20	70	1.012	1.012	1.013	1.014	1.015	1.016	1.017	1.018	1.019
	80	1.009	1.009	1.009	1.010	1.011	1.013	1.014	1.014	1.015
	90	1.006	1.006	1.006	1.070	1.008	1.009	1.010	1.010	1.011
	100	.990	.985	1.003	1.003	1.003	1.004	1.005	1.006	1.007
	110	1.003	.998	.993	.988	.999	1.000	1.001	1.002	1.003
	120	1.016	1.011	1.005	1.000	.995	.990	1.000	.998	.995
	130	1.027	1.022	1.017	1.012	1.006	1.001	.996	.990	.991

Table 3B

Demand Cooling Evaporator Mass Flow Adjustment Factors										
Return Gas Temperature	Condensing Temperature	Saturated Suction Temperature (°F)								
(°F)	(°F)	40	35	30	25	20	15	10	5	0
50	70	1.020	1.017	1.015	1.012	1.009	1.006	1.004	1.001	1.000
	80	1.025	1.022	1.020	1.017	1.014	1.012	1.009	1.006	1.004
	90	1.030	1.027	1.025	1.022	1.019	1.017	1.014	1.011	1.009
	100	1.035	1.032	1.030	1.027	1.024	1.022	1.019	1.016	1.014
	110	1.040	1.037	1.035	1.032	1.029	1.027	1.024	1.021	1.019
	120	1.045	1.042	1.040	1.037	1.034	1.032	1.029	1.026	1.024
	130	1.050	1.047	1.045	1.042	1.039	1.037	1.034	1.031	1.029
35	70	1.025	1.023	1.019	1.015	1.010	1.006	1.002	1.000	1.000
	80	1.042	1.038	1.034	1.030	1.025	1.021	1.016	1.011	1.006
	90	1.061	1.057	1.053	1.049	1.045	1.041	1.037	1.033	1.029
	100	1.070	1.066	1.062	1.058	1.054	1.050	1.046	1.042	1.038
	110	1.078	1.074	1.070	1.066	1.062	1.058	1.054	1.050	1.046
	120	1.087	1.083	1.079	1.075	1.071	1.067	1.063	1.059	1.055
	130	1.096	1.092	1.088	1.084	1.079	1.075	1.071	1.069	1.062
20	70	1.031	1.026	1.021	1.016	1.011	1.006	1.001	1.000	1.000
	80	1.050	1.045	1.040	1.035	1.030	1.025	1.020	1.015	1.010
	90	1.069	1.064	1.059	1.054	1.049	1.044	1.039	1.034	1.029
	100	1.088	1.083	1.078	1.073	1.068	1.063	1.058	1.053	1.048
	110	1.107	1.102	1.097	1.092	1.087	1.082	1.077	1.072	1.067
	120	1.126	1.121	1.116	1.111	1.106	1.101	1.096	1.091	1.086
	130	1.145	1.140	1.135	1.130	1.125	1.120	1.115	1.110	1.105

Copeland Sentronic+™

Sentronic+™ is an electronic oil pressure control. The following is an excerpt from a Copeland Bulletin on Sentronic.

Copeland
Subsidiary, Emerson Electric Co.

Application Engineering Bulletin

AE-1314 Issued February 2001

Sentronic+™

Electronic Oil Pressure Control

Introduction and Features

The Sentronic +™ electronic oil pressure safety control uses a pressure sensor and an electronic module to precisely measure oil pump differential pressure. Common sources of leaks (bellows, capillary tubes, and pressure connections) are eliminated when using the Sentronic+™.

Another advantage of Sentronic +™ is a precise electronic clock for the two-minute time-out circuit. Traditional mechanical controls use resistance heaters to measure the time-out in the event of low oil pressure. On 208V systems, low ambient temperatures or brown-out type conditions cause the heater output to be reduced, thus increasing the time-out period from two minutes to three minutes or more when low oil pressure conditions exist. The electronic clock will always provide a two-minute time-out.

The Copeland Sentronic +™ module features a light emitting diode (LED) to provide a visual indication of the oil pressure condition. To aid in trouble-shooting, the cover label has a summary of the LED fault indications.

Sentronic +™ no longer requires the use of shielded cables because of an electronic noise suppression feature.

All Copelametic compressors that have an external oil pump (see Copeland AE Bulletin 4-1166) require a Copeland approved oil pressure safety control. Failure to use an approved oil pressure safety control will be considered misuse of the compressor and may void the warranty if the compressor should fail due to lack of lubrication.

An oil pressure safety control must meet many requirements for Copeland approval. These requirements include maintaining the pressure setting and time delay calibration within close limits over the widest variation in expected operating conditions. Safety controls must pass a life test with a minimum of 200,000cycles. Controls must be non-adjustable and must have a manual reset with a 120 second nominal time delay at rated voltage, have a cut-out pressure setting of 7 to 9PSID (Pounds per Square Inch Differential), and a cut-in pressure of 12-14 PSID. In this case, PSID is the difference between the crankcase pressure and oil pump outlet pressure.

The module control base can accept either threaded or push-in electrical conduit connections.

Basic Control Operation

The oil pressure sensor is mounted directly into the oil pump of the compressor. The Sentronic +™ sensor measures the oil pump differential pressure and has an internal contact that opens due to low oil pressure, causing the Sentronic + electronic control module to begin the timing clock.

Should the oil pressure fall below 7 to 9 PSID for a period of two minutes, the Sentronic +™ module will open the normally closed control circuit, which shuts the compressor off.

The Sentronic +™ will also shut the compressor down if the oil pressure fluctuates between acceptable and low oil pressure (indicated by an alternating red and green LED) and records a history of low oil pressure for 60% or more of a running cycle. In addition, Sentronic + has a memory that will retain the oil pressure levels for up to one minute during a power loss.

A trip of the oil pressure safety switch is a warning that the system has been without proper lubrication for too long. Repeated trips of the oil pressure safety control are a clear indication that something in the system requires immediate remedial action. On a well-designed system, there should be no trips of the oil pressure safety control, and repeated trips should never be accepted as a normal part of system operation.

In addition to the normally closed (N.C.) contact used for compressor shutdown, the Sentronic + has a normally open (N.O.) contact which can be used in an alarm circuit (See Figure 5).

The Single Pole Double Throw (S.P.D.T.) contact of Sentronic+ can be electrically isolated from the control circuit power supply and used to control a different voltage (See Figure 3).

Installation

All Copeland compressors with external oil pumps shipped after September 1986 have a plug fitting in the oil pump for mounting the sensor. The external oil pump is designed to accept either the Sentronic + sensor or a capillary tube for the traditional mechanical oil pressure control.

Removing the cover on the module is accomplished by gently lifting two locking tabs on the lower corners of the cover and pulling the lower edge of the cover away from the base. Refer to figure 1.

Installation of the cover is accomplished by hooking the top of the cover down on the three tabs on the top of the module base and swinging the cover back into position until the cover release tabs latch into place. Refer to figure 2.

Installing the Sensor

1. Remove the plug fitting from the oil pump housing (new installations). Discard the copper washer from under the head of the plug fitting.

2. Install the new O-ring into the groove around the sensor. Note: If applicable, replace the aged O-ring with the new one supplied in the kit. Use refrigeration oil to pre-lubricate the O-ring before installation. Use care not to cut the O-ring.

3. Use the new copper washer. Do not reuse the copper washer removed with the plug fitting.

4. Screw the sensor into the pump body. Torque the sensor to 60-65 Ft.-Lb.

Figure 1

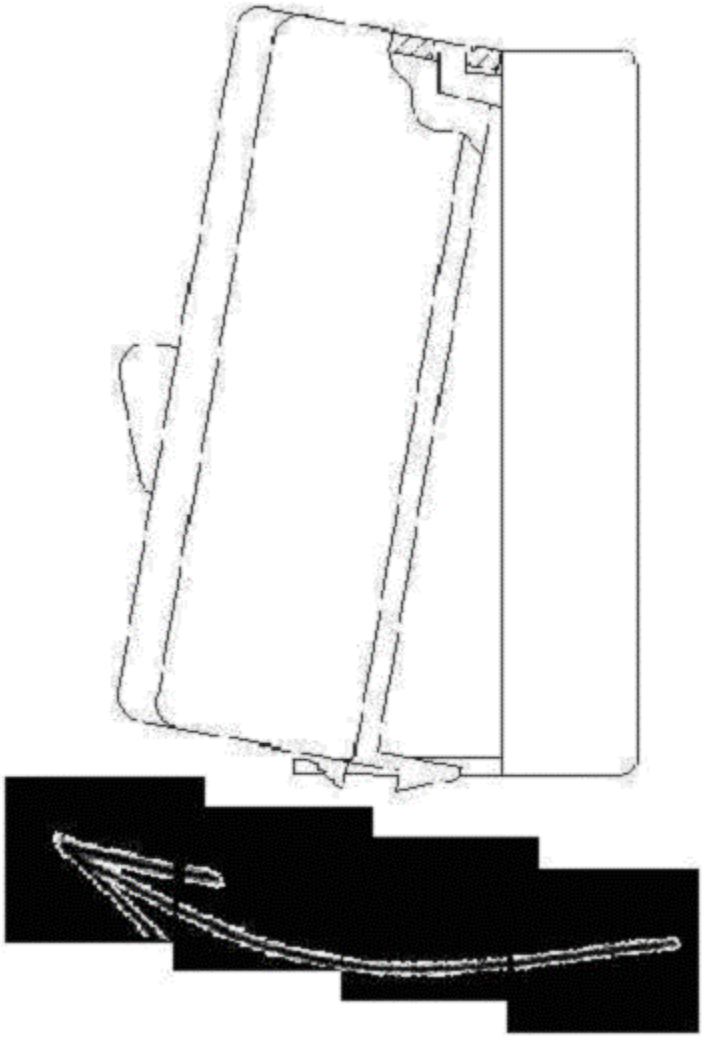
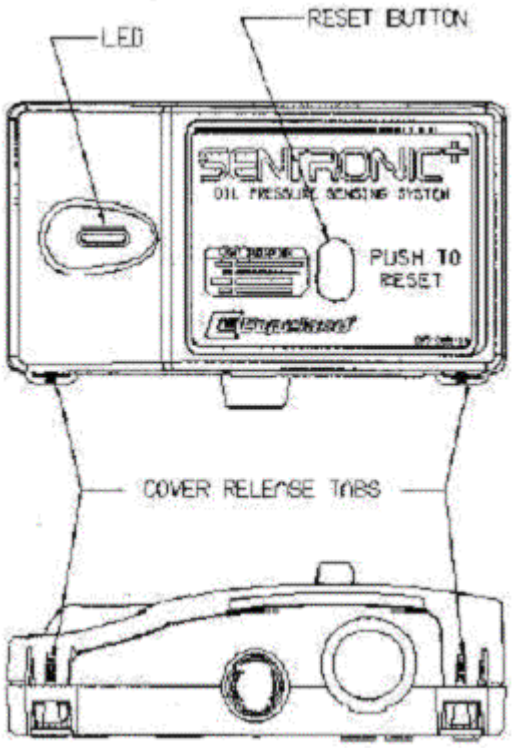


Figure 2



Installing the Module

1. When using the bracket above the oil pump, use the supplied 10-32 pan head slotted screws with washers. Alternatively, four holes have been incorporated in the module base to provide the option of remote mounting. Refer to figure 7. The maximum screw length is .265" plus bracket thickness. Longer screws could damage the circuit board.

2. Plug the cable from the module into the end of the sensor. Care should be taken to route the cable away from current carrying conductors.

Excessive hi-potting can cause damage to the Sentronic+™ module. If hi-potting is required, we recommend it be limited to a single time.

Static electricity discharges from electrostatic paint-ing can damage the Sentronic +™ module. We recommend that the module not be mounted until such painting is completed.

The module location and conduit lengths should be chosen to avoid bending of the conduit beyond its normal range of flexibility.

Remote Mounting

The Sentronic +™ module sends a low voltage signal to determine whether the sensor circuit is opened or closed. When the Sentronic +™ module is mounted on the compressor, the sensor will normally experience no disturbances from nearby electrical sources. While the Sentronic +™ is not particularly susceptible to Electromagnetic Field (EMF) interference, it is wise to keep the cable away from other current carrying conductors.

Grounding

The Sentronic +™ plus has been designed with a plastic case, and does not require a ground connection. A ground screw is provided on the terminal strip for those installations utilizing a ground wire in the conduit.

Sentronic+™ Specifications

Cut-Out	7-9 PSID
Cut-In	12-14PSID
Time Delay	120 seconds + 15 seconds
Sensor Torque	60-65 Ft.-Lb.
Max Control	375 VA; 120V
Max Control	500 VA; 240V
Max Inrush	1600 VA; 120 V
Max Inrush	3000 VA; 240 V

Installing external timer

Caution: An electronic timer may be placed in series with the compressor contactor to force a delay before each start and prevent possible short cycling. The timer must be located so it also prevents the Sentronic + from energizing during the timing period. SOME INEXPENSIVE TIMERS MAY "LEAK" ENOUGH POWER WHILE "TIMING-OUT," TO ENERGIZE THE SENTRONIC + EVEN THOUGH THERE MAY NOT BE ENOUGH "LEAKAGE" TO CLOSE THE COMPRES-SOR CONTACTOR. THIS CAN CAUSE A PREMATURE SENTRONIC+ TRIP.

If there is doubt, the circuit should be checked before placing it in operation.

Standard Control Circuits

Both Figures 4A (Sentronic+™) and 4B (previous Sentronic) show typical wiring connections and the similarity of Sentronic + and Sentronic oil pressure switches used on three-phase motor compressors.

When the operating and limit controls are closed, the system is calling for the compressor to run. The electrical circuit for the Sentronic + module consists of a 240 V (120V) connection to the appropriate terminal and the jumper between 2 and "M" and the normally closed (N.C.) contact between "M" and "L". The compressor contactor circuit is completed by the normally closed contact between "M" and "L". If the module trips the circuit due to low oil pressure, the N.C. contact between "M" and "L" opens thereby opening the circuit of the compressor contactor and the module.

Once the Sentronic+™ module has tripped, it must be manually reset to restore operation.

Control with Alarm

The alarm circuit as seen in Figure 5 will be activated when the Sentronic + trips on low oil pressure. The normally open (N.O.) contactor between "L" and "A" will be closed when the module trips thereby activating the alarm circuitry.

The Current Sensing Relay Used With Compressor Inherent Motor Protectors:

A compressor may exhibit nuisance trips if it has an inherent protector and experiences motor overheating. The use of a current-sensing relay allows the compressor to cycle on the internal inherent protector without affecting the operation of the Sentronic+™. After an overload trip of a compressor with an inherent protector, the control circuit will still be closed and the Sentronic energized although the compressor motor is not operating. The two-minute timing circuit will activate due to a lack of oil pressure, and after the 120-second time delay; the oil pressure safety switch will trip. Even though the compressor motor cools sufficiently for the internal inherent protector to automatically reset, the compressor cannot start until the oil pressure safety control is manually reset.

This is normally not a problem since the compressor, if properly applied, will seldom if ever trip on the internal inherent protector. If it should happen to do so, the fact that a protector trip has occurred indicates that the system operation should be reviewed. However, on frozen food or other critical applications where a product loss may occur, if a compressor shutdown should occur during the night or a weekend when the equipment is unattended, it may be desirable to prevent a possible nuisance trip by means of a current sensing relay.

The current sensing Relay is mounted on the load side of the contactor, senses by induction the full operating current of one phase of the motor, closes on a rise above 14 amps, and opens if the load current falls below 4 amps.

Figure 6 uses a current relay (C.S.). When the current relay is not energized by motor current, its Normally Open (N.O.) contact opens the circuit that powers the Sentronic to avoid a nuisance trip. NOTE: On some 550 volt motor-compressors, it may be necessary to loop the current carrying wire so that it passes through the current sensing relay twice in order to increase the metered amperage to close the relay contacts.

Using a Separate Control Voltage with the Sentronic+ (Figure 3):

To supply the Sentronic +™ with two separate voltages (compressor contactor coil and module), remove the jumper between terminals "2" and "M." In this diagram, the separate control voltage is supplied by "LL1" and "LL2." The separate voltage powers the compressor contactor (CC) by means of a remote relay. When the remote relay is energized, requesting the compressor to run, its contact (RR), closes to deliver "LL1" voltage to the operating and limit contacts. If the contacts in the operating and limit circuit are closed, "LL1" voltage energizes the compressor contactor coil (CC). When the compressor contactor closes, it provides the power, through a control circuit transformer (XFMR), to energize the Sentronic +™. If the Sentronic + trips, its contact ("L" to "M") in the "LL1-LL2" control circuit opens to de-energize the compressor contactor and stop the compressor. The Sentronic+™ contact ("L" to "A") closes to energize an Alarm Relay (AR).

Note that any A.C. voltage up to and including 240 volts may be used. For line voltages greater than 240 V, a step-down transformer (circuit transformer XFMR in Figure 3) must be used.

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Note that any A.C. voltage up to and including 240 volts may be used. For line voltages greater than 240 V, a step-down transformer (circuit transformer XFMR in Figure 3) must be used.

LED Interpretation

To aid in troubleshooting an oil pressure problem, the Sentronic+™ has an LED as a visual aid. This section explains the information provided by the LED.

LED Green

Compressor has sufficient oil pressure.

LED Red

Compressor is experiencing insufficient oil pressure.

Red/Green LED Alternating

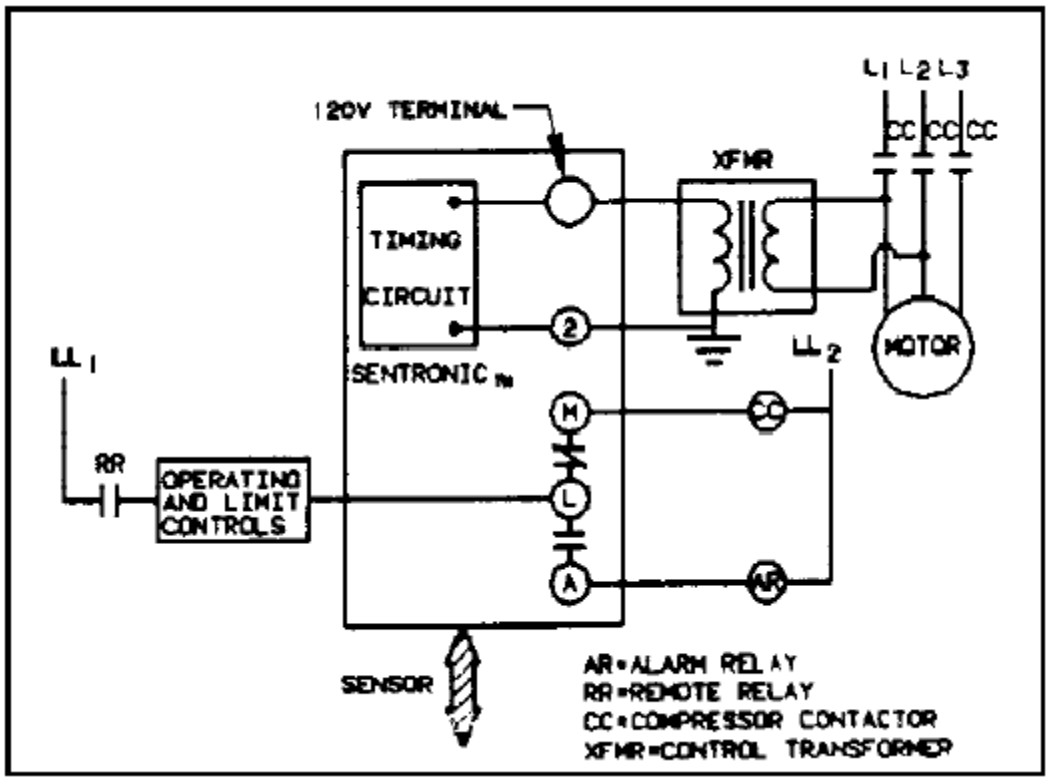
Compressor is experiencing erratic oil pressure indicating a possible system problem.

No Light

Control Circuit is not energized L or M for light circuit.

The Current Sentronic+™

Figure 3



Start-Up Procedure

This page describes an electrical check for the Copeland Sentronic oil pressure module and sensor installed in an air-conditioning or refrigeration system.

This test must only be performed by qualified service personnel (see next page for further information and a bench test procedure for the Sentronic module).

Important! Before energizing this system, make sure the Sentronic is wired correctly. Refer to the wiring diagrams in the Sentronic brochure. Failure to do so may result in a damaged control unit.

This test is to be performed with the Sentronic oil pressure module and sensor connected to the system, and the system energized at the start of the test.

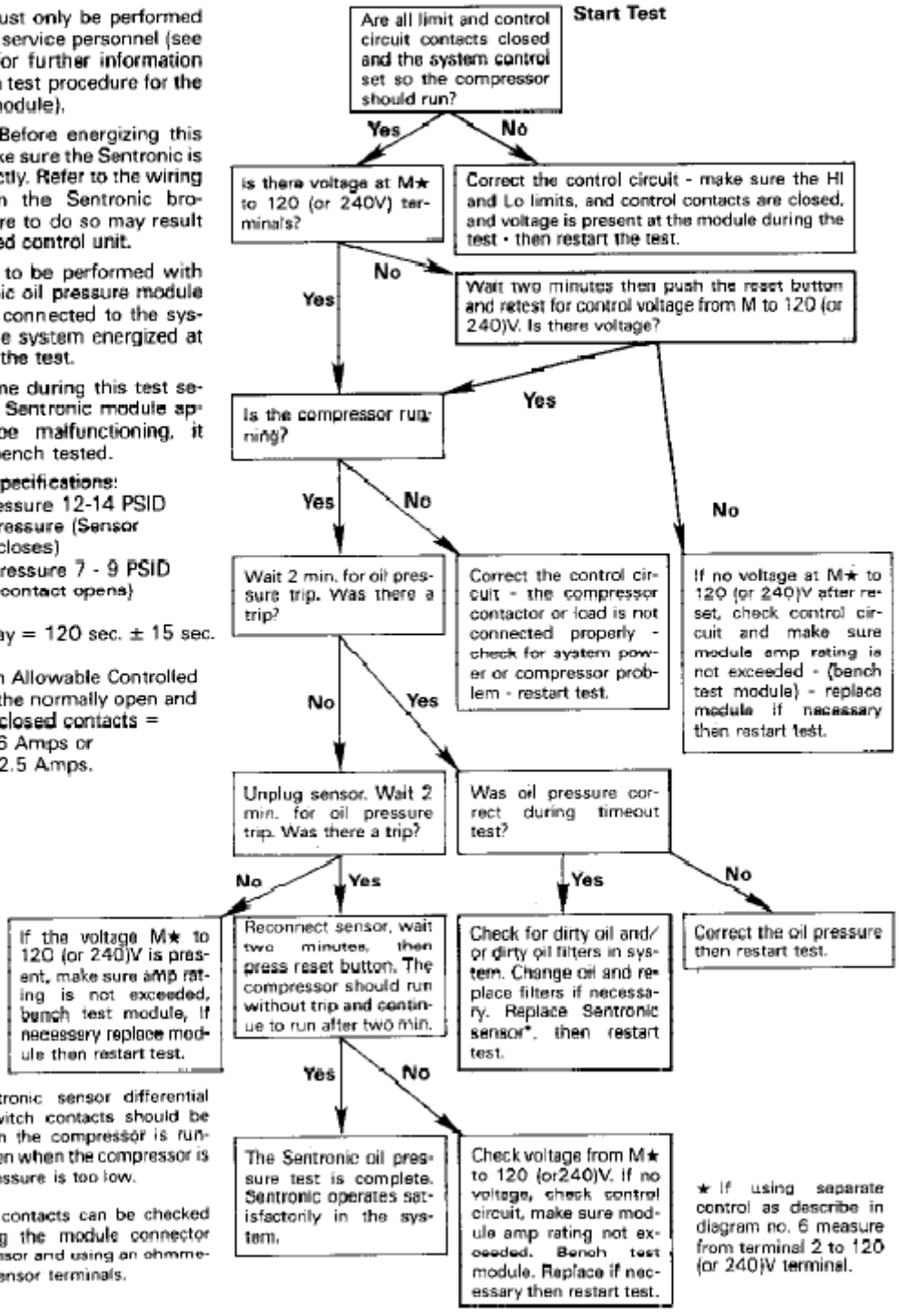
If at any time during this test sequence the Sentronic module appears to be malfunctioning, it should be bench tested.

Sentronic Specifications:

Cut-in pressure 12-14 PSID
Cut-in pressure (Sensor contact closes)
Cut-out pressure 7 - 9 PSID
(Sensor contact opens)

Time Delay = 120 sec. ± 15 sec.

Maximum Allowable Controlled Load for the normally open and normally closed contacts =
120V, 6 Amps or
240V, 2.5 Amps.



* The Sentronic sensor differential pressure switch contacts should be closed when the compressor is running and open when the compressor is off or oil pressure is too low.

The switch contacts can be checked by removing the module connector from the sensor and using an ohmmeter on the sensor terminals.

★ If using separate control as describe in diagram no. 6 measure from terminal 2 to 120 (or 240)V terminal.

Troubleshooting

Approximate oil pressure can be measured in the field. Oil pumps are furnished with a Schrader valve mounted on the oil pump discharge port. To measure oil pressure, subtract crankcase pressure from discharge oil pressure.

Checking the Installed Sentronic+ Module

Shut off the compressor. Unplug the sensor. Read the control voltage between the 240V (or 115V) terminal and the L (or 2 if separate control is used) terminal to verify power to the module.

Start the compressor with the sensor unplugged. Recheck to make sure the module voltage is still present. After 120 seconds ± 15 seconds, the L-M contact should open and shut off the compressor. With the module off due to low oil pressure, wait two minutes and press the reset button. Lack of power after a reset may be due to an external time delay circuit.

Checking the Sensor

Unplug the sensor and, start the compressor. The Sentronic+™ module LED should be red. Simultaneously measure the oil pump differential pressure. Monitor the two terminals at the back of the sensor with an ohmmeter or continuity measuring set. If the differential pressure is below the range of 7 to 9 PSID, the sensor circuit should be open (no continuity, infinite resistance). If the pressure is above 12 to 14 PSID, the sensor circuit should be closed.

Measure the differential pressure by subtracting the crankcase pressure from the oil pump outlet pressure.

Figure 4A

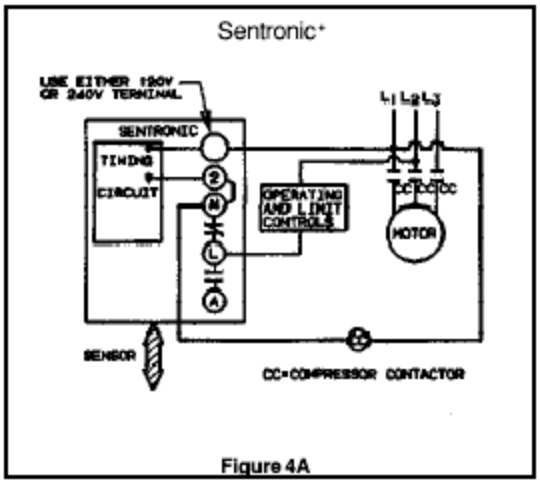


Figure 4A

Figure 4B

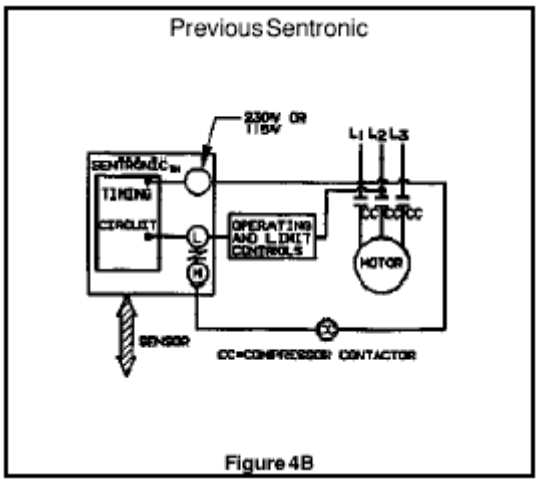


Figure 4B

Figure 5

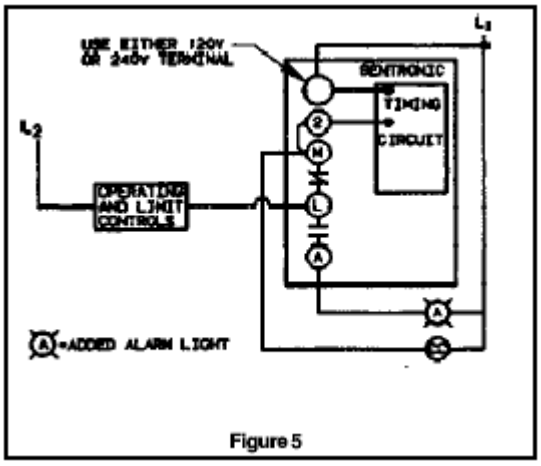


Figure 5

Figure 6

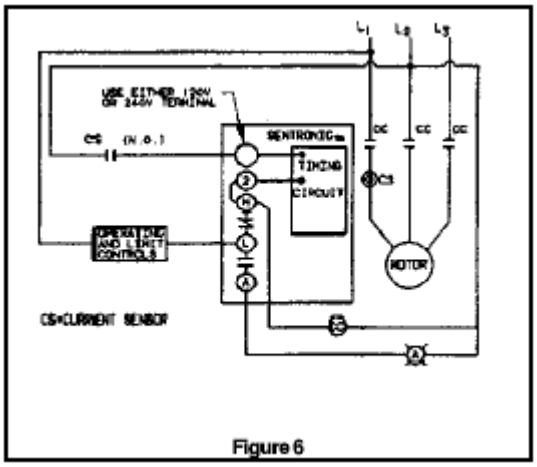


Figure 6

Interchangeability with Previous Sentronic Controls

The electronic two minute timing circuit operates whenever voltage is applied to a Sentronic+™, and it has not tripped. The timing will be interrupted when oil pressure rises above 12-14 PSID and closes the Sentronic sensor. Should oil pressure not build up sufficiently within 120- seconds, the electronic delay will time out, open its L-M contact, break the control circuit, and de-energize the compressor contactor to stop compressor operation.

While the compressor is running, if the compressor net oil pressure falls below the cut-out setting of the sensor while operating, and does not re-establish sufficient pressure within an acceptable time, the time delay circuit will open the L-M contacts, stopping compressor operation. Once the oil pressure switch has tripped, it must be manually reset to restore the system to operation.

IMPORTANT: If a power interruption occurs after an oil pressure safety trip, wait two minutes before resetting after power is restored.

Electrical bench checkout procedure

This instruction sheet describes how the Sentronic+™ may be easily bench-checked using only a voltmeter and a 120VAC electrical extension cord.

CAUTION!

Damage to the Sentronic+™ module may result if the "M" terminal of the Sentronic+ is connected to ground or directly to a voltage line!

This test is conducted with 120VAC. A shock will result if the Sentronic+ terminals are touched when the Sentronic module is energized.

Use care whenever working with any voltage! Make sure your electrical outlet is grounded, the electrical extension cord used has a ground wire, and the ground wire is connected to the grounding screw of the Sentronic+™.

1. Apply 120VAC power to the Sentronic+ module terminals marked "120" and "L". The Sentronic should have a jumper in place between terminals "M" and "2".

2. Wait two minutes, then push the Sentronic+ reset button to reset the module and start the timing circuit.

3. With a voltmeter, measure line voltage (120VAC) between the "M" terminal and the "120" terminal. It should be the same as the electrical outlet voltage –about 120VAC.

4. Since there is no connection made to the pressure sensor, the module sees this as a no-oil pressure condition. After two minutes (plus or minus 15 seconds - dependent on 50 or 60 cycle frequency) the Sentronic internal timer will "time-out". The module will trip; the circuit between "L" and "M" will open, and it will no longer pass current to the load.

5. With the voltmeter connected to terminals "M" and "120", the voltage should now read zero volts because the circuit between "L" and "M" has been opened through the action of the electronic circuit.

6. Reset the Sentronic+™, then remove voltage from terminals "120" and "L". With a small piece of wire, jumper the female sensor connections at the end of the black sensor cord

attached to the module. Reapply power to terminals “120” and “L” and wait two minutes. The module should not “time-out” after two minutes because jumpering the sensor connections makes the timing circuit “see” good oil pressure. The jumper imitates the action of a small pressure switch located in the sensor. This switch opens on low oil pressure and closes on good oil pressure.

7. Measure between the “120” terminal and the “M” terminal with the voltmeter. The meter should read full line voltage showing that the circuit has not opened.

8. To check if the module will operate on 208/240 volts as well as on 120 volts, change the scale of the voltmeter (if necessary), to read up to 250VAC. Without removing power, measure the voltage between the “M” terminal and the “240” terminal. You should read nearly twice the voltage as that read between the “M” terminal and the 120“ terminal. This is because Sentronic+ has a small control trans-former connected so that it can accept either 120V or 208/240V. Its self-transforming action actually enables it to step up its own voltage. By making this voltage check, the transformer is being checked.

9. If the module successfully passes the above test sequence it is fully functional. If the module fails any of the above steps, it is faulty and should be replaced.

Interchangeability of Sentronic+™ and Sentronic™ modules and sensors

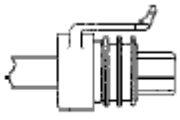
The Sentronic+™ oil pressure control uses both a new module and a new sensor. The sensors and module can be made compatible with older generation compo-nents if the following steps are taken:

To use a Sentronic+™ module with an older Sentronic™ sensor, the older Sentronic sensor cable must be wired to the new Sentronic+ module.

To use an older Sentronic module with a Sentronic+™ sensor, the Sentronic+™ cable must be wired to the Sentronic module.

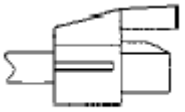
There is an older generation Sentronic module which is fully compatible with the Sentronic+ sensor. It is supplied with the new (Sentronic+) cable which is gray for identification purposes, see illustration below.

New Sentronic



New Sentronic+

Old Sentronic



Old Sentronic

Connecting the Sentronic+™ module to an older Sentronic sensor

Removing the cable from the old Sentronic module:

- Disconnect power to the old module
- Disconnect the cable from the sensor
- Remove the cover from the old module
- Remove the two cable quick connections from the circuit board
- Using pliers, squeeze the strain relief slots and pull to remove the cable from the module
- Remove the old module from the compressor

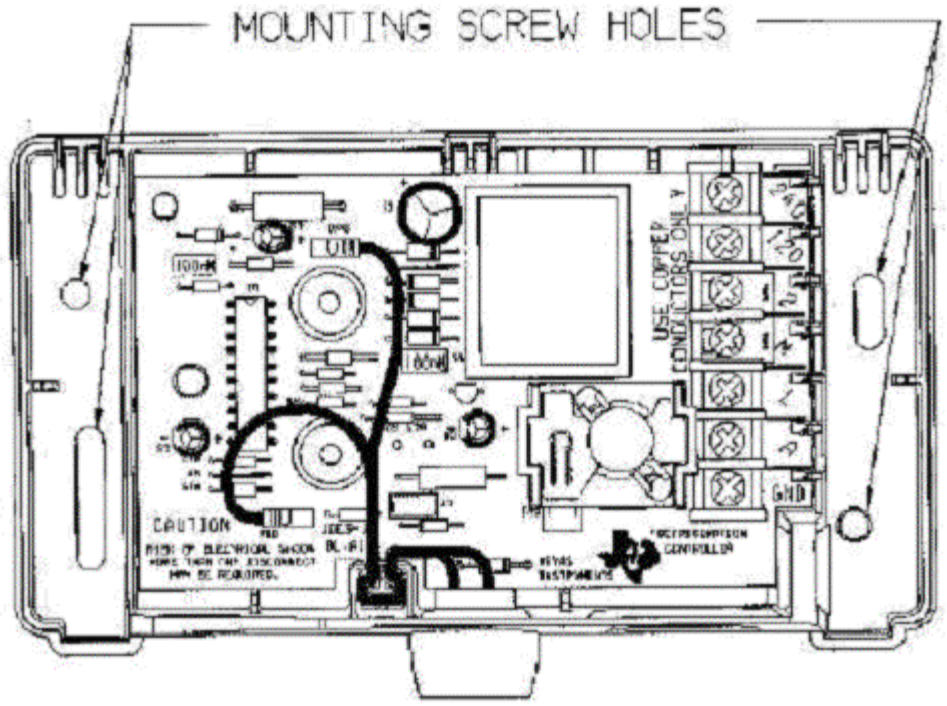
Removing the cable from the new Sentronic+ module:

- Remove the cover from the Sentronic+™ module
- Pull the 2 cable quick connects from the circuit board (these are labeled "Org" and "Red")
- Remove the wires from the strain relief (note the routing of the wires for future reference) and lift the wires out
- Remove the wire cable from the module by twisting the conduit counterclockwise and gently pulling

Connecting the old cable to the Sentronic+ module:

- Trim approximately 2" of cable sheathing from the module end of the old cable, taking care not to nick the wire insulation
- Feed the wires into the module through the hole in the bottom of the case
- Leaving enough lead length to reach the quick connects, push the wires into the strain relief.
- Connect the 2 quick-connects to the "ORG" and "RED" spades. (Note: the connections may be inter-changed; there is no polarity on these wires). Refer to figure 7.
- Install the module to the compressor and make wiring and sensor connections per the general instructions.

Figure 7



Connecting the older Sentronic module to Sentronic+™ sensor

Removing the cable from the new Sentronic+™ module:

- Disconnect power to the module
- Disconnect the cable from the sensor
- Remove the cover from the Sentronic+™ module
- Pull the 2 cable quick connects from the circuit board (these are labeled “Org” and “Red”)
- Remove the wires from the strain relief by lifting the wires out
- Remove the wire cable from the module by twisting the conduit counterclockwise and gently pulling

Removing the cable from the old Sentronic module:

- Remove the cover from the old module
- Remove the two cable quick connections from the circuit board
- Using pliers, squeeze the strain relief slots and pull to remove the cable from the module
- Retain the strain relief from the cable for use on the Sentronic+™ cable

Connecting the new cable to the old Sentronic module:

- Position the strain relief on the new cable at the termination of the conduit
- Feed the wires into the module through the hole in the bottom of the case
- Push the strain relief into position to lock it
- Connect the two quick connects to the circuit board. There is no polarity on the leads.
- Install the module on the compressor and make wiring and sensor connections per the general instructions

Sentronic+™ Terminal Strip

- The Sentronic+™ module terminal strip is designed to accept a bare wire end instead of a spade terminal
- If a Sentronic+ module is being retrofitted to a system with spade connections, the spade may be clipped off and ¼" of the wire end stripped. Or, one leg of the spade may be clipped off for insertion into the terminal strip

Copeland Scroll Compressors

The following is an excerpt from a Copeland Bulletin on application guidelines for scroll compressors.

Application Engineering Bulletin

AE-1299-R4

Revised March 2000

APPLICATION GUIDELINES

FOR "GLACIER ™"K4 &KA REFRIGERATION SCROLL COMPRESSORS "GLACIER ™"K4 &KA REFRIGERATION SCROLL COMPRESSORS 2 -6 HORSEPOWER

Introduction

The Glacier™ K4 Scroll represents the second generation of compliant Scroll technology for the refrigeration industry. Four major changes have been incorporated as compared to the previous K3 offering:

• Revised Scroll Form - Specifically designed to achieve the higher compression ratios typically found in refrigeration applications

• Addition of Dynamic Discharge Valve – Provides improved energy efficiency when operating at high compression ratio conditions

• Modified Injection System - Enables the Scroll to accept either liquid or vapor injection depending on system design

• DU Drive Bearing - This Teflon impregnated bronze bearing provides improved reliability These changes result in a compressor that is suitable for the most demanding refrigeration applications with efficiencies comparable to the industry standard Discus® compressor.

Nomenclature

The Glacier™ Scroll model numbers include the nominal capacity at standard 60Hz ARI rating conditions. Please refer to product literature for model number details.

Operating Envelope

Glacier™ K4/KA models can be used with a variety of refrigerants depending on the model selected and the lubricant used:

Table 1

MODEL	REFRIGERANT	LUBRICANT
ZS, ZB, ZF	R-22	MO
ZF	R-404A, R-507, R-134A, R-22	POE
ZS	R-404A, R-507, R-134A	POE

See Application Engineering Bulletin 17-1248 for a complete list of all Copeland approved lubricants.

The ZF and ZS model families are intended for refrigeration type duty. The approved operating envelopes for these models are depicted in Figures 1B through 1G. The ZB**KA models are intended for use with R-22 at higher evaporator temperatures. Figure 1A represents this operating envelope.

It must be noted that the ZF model when operated at low evaporator temperatures requires some form of injection to prevent overheating. Either liquid or vapor injection is sufficient for moderate condensing temperatures (indicated by vapor or liquid portion in Figure 1D). At elevated condensing temperatures (indicated by liquid region in Figure 1D), liquid injection is required as vapor injection does not provide sufficient cooling.

Liquid Injection

The low temperature Scroll compressor is provided with an injection port suitable for connection to a source of liquid refrigerant. Internally, this port is connected to an inner pocket of the scroll mechanism. Since this pocket is separated from the suction inlet, no loss of capacity or mass flow results from injecting at this point.

Refrigerant injected in this manner must include the system components listed on next page. Failure to provide these components can result in liquid refrigerant completely filling the Scroll during an "off" cycle. When power is reapplied in this condition, the hydraulic effect produced can result in pressures high enough to cause permanent damage to the compressor. Due to this, it is a condition of warranty that these components, properly installed, be provided whenever liquid or vapor injection is used.

• Capillary Tube - Liquid must be fed through an appropriate capillary tube as defined in Table 2.

• Solenoid Valve - A solenoid valve with a minimum .109 inch orifice must be provided in the injection circuit that opens whenever the compressor is operative or cooling is required during pumpdown. The solenoid must be closed when the compressor is cycled off.

• Current Sensing Relay - To prevent the solenoid from remaining open during a "motor protector trip" a current sensing relay must be provided that senses whenever the compressor is "off" and closes the solenoid to stop injection.

The following components are not required, but they are recommended for liquid injection.

• Sight Glass - A sight glass just before the capillary tube inlet is recommended to allow visual inspection for the presence of liquid refrigerant.

• Filter/Drier - A filter/drier installed in the injection circuit is recommended to avoid the possibility of capillary tube blockage due to contaminants.

Capillary Tubes For Liquid or Vapor Injection

Table 2

Model	Cap Tube		Copeland Kit Number
	I.D (Inches)	Length (Inches)	
R-22			
ZF06K4	0.042	70	998-1583-00
ZF08K4	0.042	70	998-1583-00
ZF09K4	0.042	30	998-1583-03
ZF11K4	0.042	30	998-1583-03
ZF13K4	0.042	10	998-1583-05
ZF15K4	0.042	5	998-1583-06
ZF18K4	0.050	5	998-1586-00
R-404A/R-507/R-134A			
ZF06K4E	0.042	70	998-1583-00
ZF08K4E	0.042	70	998-1583-00
ZF09K4E	0.042	70	998-1583-00
ZF11K4E	0.042	50	998-1583-01
ZF13K4E	0.042	40	998-1583-02
ZF15K4E	0.042	30	998-1583-03
ZF18K4E	0.042	20	998-1583-04

Figure 2 is a representation of a typical system with these components.

The advantage of this type of injection system is that it tends to be self regulating i.e., as the pressure differential across the capillary tube increases, the amount of liquid fed to the compressor also increases. Since more cooling is needed at high compression ratio conditions, this "automatic" increase in liquid feed is exactly what is needed.

For the liquid injection system to be effective, a minimum of 5°F sub-cooled liquid at the capillary inlet is required.

Vapor Injection

Substantial system efficiency improvement can be achieved by sub-cooling the liquid fed to the evaporator expansion valve. The K4 Scroll is uniquely suited for this "economizer cycle" due to the intermediate pressure available at the injection port. Figure 3 is a representation of this type of system.

It is beyond the scope of this bulletin to provide detailed instructions as to the proper application of vapor injection systems. For information on this subject consult your Application Engineer.

DISCHARGE TEMPERATURE CONTROL VALVE

Introduction

The purpose of the DTC valve is to eliminate the need for a capillary tube on the 2 through 6 horsepower "ZF" Glacier scroll model family.

The DTC valve is approved for all refrigerants in this product range.

Valve Specifications

Opening Setpoint: 193°F ±5°F

Liquid Line Connection: 3/8" (9.5mm)

Installation of Valve (see Figure 4)

The valve bulb must be installed in the top cap thermal well to adequately control scroll temperatures. The valve should be tightened on the injection fitting to a torque of 216-245 in. lbs. (24.4 - 27.7 Nm). A 90° orientation on the valve is recommended, however it will function properly in any orientation. The capillary tube connecting the valve to the bulb should be positioned such that it does not contact the compressor during operation. Do not bend the capillary tube within 1" (25.4mm) of the valve.

The DTC Valve comes with an insulating cap. If this additional height from the cap is an issue, the valve cap could be replaced with high temperature insulation. This should be applied to insulate and protect the valves remote bulb assembly. This will reduce the total height requirement by 0.5" (12.7mm).

Suggested Application Techniques

For the most efficient thermal sensing, spread a thin film of thermal grease around the DTC Valve bulb before installing into the top cap well. This is not required, however, for proper functioning of the valve.

At your discretion, field serviceability can be improved by installing a shut-off valve in the liquid line just before the DTC Valve.

The valve requires a solid column of liquid. A liquid line sightglass could be applied to visually insure liquid flow.

Compressor Or Valve Service

Replacing a ZF compressor using capillary tube, liquid injection solenoid, and current sensing relay:

The ZF compressor and DTC Valve eliminates the need for the solenoid and current sensing relay. These devices may be left on if desired, but they are not required.

Replacing a ZF compressor using the DTC Valve: We recommend replacing both the DTC Valve and the compressor at the same time. If you wish to use the existing DTC Valve, the valve filter (pn 013-0119-00) should be cleaned and/or replaced.

Replacing a capillary tube on a ZF compressor: The DTC Valve is not backward compatible on compressors with no thermal well in the top cap. Replacement capillary tubes will be available through our PrimeSourceSM network.

Replacing a DTC Valve on a ZF compressors:

Before replacing the DTC Valve, clean and/or change the filter to verify there is an unobstructed column of liquid to the valve.

Accumulators

Due to the Scroll's inherent ability to handle liquid refrigerant in flooded start and defrost cycle operation conditions, accumulators may not be required. An accumulator is required on single compressor systems with charges over 10 lbs. On systems with defrost schemes or transient operations that allow prolonged, uncontrolled liquid return to the compressor, an accumulator is required unless a suction header of sufficient volume to prevent liquid migration to the compressor is used.

Excessive liquid flood back or repeated flooded starts will dilute the oil in any compressor causing inadequate lubrication and bearing wear. Proper system design will minimize liquid floodback thereby ensuring maximum compressor life.

Crankcase Heaters

- Single Phase

No crankcase heaters are required on single phase Scroll compressors.

- Three Phase - Outdoor Only

Crankcase heaters are required on three phase compressors when the system charge exceeds 10 lbs. See Table 3A.

Crankcase Heaters

Table 3A

Model				
ZF 06,08,09,11,13,15,18,ZS/B 21,26, 30,38,45				
Part Number	Volts	Watts	Lead Length (in)	Grounding Wire Length (in)
018-0057-00	240	70	21.7	28.5
018-0057-01	480	70	21.7	28.5
018-0057-02	575	70	21.7	28.5
018-0057-03	240	70	31.5	28.5
018-0057-04	240	70	48.2	47.5
018-0057-05	480	70	48.2	47.5
018-0057-06	575	70	48.2	47.5
018-0057-07	120	70	48.2	47.5

The listed crankcase heaters are intended for use only where there is limited access. The heaters are not equipped for use with electrical conduit. Where applicable electrical safety codes require heater lead protection, a crankcase terminal box should be used. Recommended crankcase heater terminal box and cover kit numbers are listed in Table 3B. If there are any questions concerning their application, contact the Copeland Application Engineering Dept.

Conduit Ready Heater Terminal Box Kits

Table 3B

Models	Part Number
ZF06, 08, 09, 11,ZS/B21, 26	998-7026-00
ZF13, 15, 18,ZS/B30, 38, 45	998-7024-00

Discharge Line Thermostat

A discharge line thermostat is required in the compressor control circuit. The thermostats have a cut out setting that will insure discharge line temperatures below the 260°F maximum limit. It should be installed approximately 7 inches from the discharge tube outlet. If a service valve is installed at the discharge tube, the thermostat should be located 5 inches from the valve braze. For proper functioning, it is recommended the thermostat should be insulated to protect it from a direct air stream.

Kits have been set up to include the TOD thermostat, retainer, and installation instructions. These thermostats must be used with 1/2" O.D. discharge lines to ensure proper thermal transfer and temperature control. They work with either 120 or 240 volt circuits, and are available with or without an alarm circuit capability. See Table 4 for a list of discharge line thermostat kit numbers.

Discharge Line Thermostat Kits

Table 4

Kit Number	Conduit Connector	Alarm Contact Lead
998-7022-02	Yes	No
998-0540-00	No	No
998-0541-00	No	Yes

Pressure Controls

Both high and low pressure controls are required and the following set points are the minimum and maximum limits. See Table 5 for setpoints.

Table 5

Application	Control Type	R-404A/R-507	R-22
High Temp.(ZB)	LowHigh		38 PSIG Min.381 PSIG Max.
Medium Temp.(ZF)	LowHigh	17.1 PSIG Min.445 PSIG Max	10 PSIG Min.381PSIG Max.
Medium Temp.(ZS)	LowHigh	8 PSIG Min.445 PSIG Max.	24 PSIG Min.381 PSIG Max.
Low Temp.(ZF)	LowHigh	0 PSIG Min.400 PSIG Max.	2 in. Hg Min.335 PSIG Max.

IPR Valve

Refrigeration Scroll compressors (up to 6 HP size) have internal pressure relief valves which open at a discharge to suction differential pressure of 375 to 450 psi. This action will trip the motor protector and remove the motor from the line.

Motor Protection

Conventional inherent internal line break motor protection is provided.

Oil Type

Polyol ester lubricant must be provided if the Glacier™ Scroll is to be used with HFC refrigerants. Copeland Ultra 22 CC™, Mobil EAL Arctic 22 CC, ICI EMKARATE RL 32CF, or Thermal Zone 22 CC are the only polyol esters approved by Copeland at this time.

ZB**KA and ZF**K4 model Scrolls, intended for use with R-22, are supplied with mineral oil. The proper oil is Sontex 200LT or Witco LP-200.

See Table 6 for the proper field oil recharge values.

The oil level of Scroll compressors should be adjusted to the mid-point of the sight glass.

Oil Charges

Table 6

Model Family	Initial	Recharge
ZF06K/ZS15K/ZB15KA	44	40
ZF08K/ZS19K/ZB19KA	50	46
ZF09K/ZS21K/ZB21KA	49	45
ZF11K/ZS26K/ZB26KA	49	45
ZF13K/ZS30K/ZB30KA	64	60
ZF15K/ZS38K/ZB38KA	64	60
ZF18K/ZS45K/ZB45KA	64	60

Oil Management

Glacier™ Scrolls may be used on multiple compressor parallel rack applications. This requires the use of an oil management system to maintain proper oil level in each compressor crankcase. The sight glass connections supplied can accommodate the mounting of the oil control devices.

Unlike Semi-Hermetic compressors, Scrolls do not have an oil pump with accompanying oil pressure controls. Therefore, an external oil level control is required.

The Flow Controls Trax-Oil S1 control, P/N 085-0157-00, combines the functions of oil level control and timed compressor shut-off should the level not come back to normal within a set period of time. This device has been found to provide excellent performance in field tests on Scroll compressors and is recommended for parallel system applications.

Immediately after system start-up the oil reservoir level will fluctuate until equilibrium is reached. It is advisable to monitor the oil level during this time to assure sufficient oil is available. This will prevent unnecessary trips of the oil control system.

Discharge Mufflers

Flow through Scroll compressors is continuous with relatively low pulsations. External mufflers applied to piston compressors may not be required on the Glacier™ Scroll. Due to system variability individual tests should be conducted by the system manufacturer to verify acceptable levels of sound and vibration.

Compressor Tubing and Mounting

Compressor mounting must be selected based on application. Consideration must be given to sound reduction and tubing reliability. Some tubing geometry or "shock loops" may be required to reduce vibration transferred from the compressor to external tubing.

Mounting for Rack Systems

Specially designed rubber grommets are available for Glacier™ Scroll 2-6 H.P. scroll rack applications. These grommets are formulated from a high durometer material specifically designed for refrigeration applications. The high durometer limits the compressors motion thereby minimizing potential problems of excessive tubing stress. Sufficient isolation is provided to prevent vibration from being transmitted to the mounting structure. This mounting arrangement is recommended for multiple compressor rack installations. See Figure 5A for a detail of this mounting system.

Note: The use of standard soft grommets is not recommended for most Glacier™ Rack installations. These "softer" mounts allow for excessive movement that will result in tube breakage unless the entire system is properly designed.

Condensing Units

For 2-6 H.P. Glacier™ Condensing unit applications soft mounts are recommended. See Figure 5B.

Tubing Considerations

Proper tube design must be taken into consideration when designing the tubing connecting the Scroll to the remaining system. The tubing should provide enough "flexibility" to allow normal starting and stopping of the compressor without exerting excessive stress on the tube joints. In addition, it is desirable to design tubing with a natural frequency away from the normal running frequency of the compressor. Failure to do this can result in tube resonance and unacceptable tubing life. Figures 6A and 6B are examples of acceptable tubing configurations.

Caution: These examples are intended only as guidelines to depict the need for flexibility in tube designs. In order to properly determine if a design is appropriate for a given application, samples should be tested and evaluated for stress under various conditions of use including voltage, frequency, and load fluctuations, and shipping vibration. The guidelines above may be helpful; however, testing should be performed for each system designed.

Starting Characteristics

Single phase Scrolls are designed with PSC type motors and therefore will start without the need of start assist devices in most applications. However, if low voltage conditions exist at start-up, protector trips can result. Therefore start assist devices (start capacitors & relays) are available to maximize starting characteristics under abnormal conditions.

Fusite

Fusite pin orientation for single phase and three phase Glacier™ compressors are shown in Figure 7 and inside the terminal box.

Shell Temperature

System component failure may cause the top shell and discharge line to briefly reach temperatures above 300°F. Wiring or other materials which could be damaged by these temperatures should not come in contact with the shell.

Connection Fittings

Scroll compressors are provided either with stub connections or Rotalock adapters depending on the bill of material selected (consult your District Sales Manager or Application Engineer for details).

As of April 1, 1998 stub tube models have copper plated steel suction, discharge, and injection fittings for a more rugged, leak resistant connection. Prior to April 1, 1998 discharge connections were 100% copper.

Brazing procedures for copper plated steel fittings are inherently different than brazing pure copper fittings. See section on Field Service (see Figure 9) for suggestions on how to properly make these connections.

Three Phase Scroll Compressors - Directional Dependence

Scroll compressors are directional dependent; i.e. they will compress in one rotational direction only. On single phase compressors this is not an issue since they will always start and run in the proper direction (except as described in the section Brief Power Interruptions). Three phase Scrolls however, will rotate in either direction depending on the power phasing. Since there is a 50/50 chance of connected power being "backwards", contractors should be warned of this. Appropriate instructions or notices should be provided by the OEM.

Verification of proper rotation can be made by observing that suction pressure drops and discharge pressure rises when the compressor is energized. Additionally, if operated in

reverse the compressor is noisier and its current draw is substantially reduced compared to tabulated values.

Although operation of the Scroll in the reverse direction for brief periods of time is not harmful, continued operation could result in a failure.

All three phase compressors are wired identically internally. Once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the same Fusite terminals will maintain proper rotation.

Brief Power Interruptions

Brief power interruptions (less than 1/2 second) may result in powered reverse rotation of single phase Glacier™ Scroll compressors. High pressure discharge gas expands backwards through the scrolls at power interruption, causing the scroll to orbit in the reverse direction. If power is re-applied while this reversal is occurring, the compressor may continue to run noisily in the reverse direction for several minutes until the compressor's internal protector trips. This has no negative impact on durability. When the protector resets the compressor will start and run normally.

Copeland strongly encourages use of a timer which can sense brief power interruptions and lock the compressor out of operation for two minutes. A typical timer is shown in Figure 8.

No time delay is required on three phase models to prevent reverse rotation due to power interruptions.

Deep Vacuum Operation

WARNING: Do not run a Glacier™ compressor in a deep vacuum. Failure to heed this advice can result in arcing of the Fusite pins and permanent damage to the compressor.

A low pressure control is required for protection against deep vacuum operation. See section on Pressure Controls for the proper set points.

Scroll compressors (as with any refrigerant compressor) should never be used to evacuate a refrigeration or air conditioning system. See Application Engineering Bulletin AE 24-1105 for proper system evacuation procedures.

Assembly Line System Charging Procedure

Rapid charging only on the suction side of a Scroll system can occasionally result in a temporary no-start condition for the compressor. If the flanks of the scroll happen to be in a sealed position, rapid pressurization of the low side without opposing high side pressure can cause the scrolls to seal axially. Until the pressures eventually equalize, the scrolls can be held tightly together, preventing rotation.

The best way to avoid this situation is to charge on both the high and low sides simultaneously at a rate which does not result in axial loading of the scrolls. The maximum charging rate can be determined through simple tests.

Should a Scroll fail to start and this "sealing" condition is suspected, reverse the three phase leads and momentarily (1-2 seconds) power the compressor in the reverse direction. This should free the scroll flanks and allow for normal operation.

Unbrazing System Components

If the refrigerant charge is removed from a Scroll unit by bleeding the high side only, it is sometimes possible for the scrolls to seal, preventing pressure equalization through the compressor. This may leave the low side shell and suction line tubing pressurized. If a brazing torch is then applied to the low side, the pressurized refrigerant and oil mixture could ignite as it escapes and contacts the brazing flame. It is important to check both the high and low sides with manifold gauges before unbrazing, or in the case of assembly line repair, remove refrigerant from both the high and low sides. Instructions should be provided in appropriate product literature and assembly (line repair) areas.

HiPot Testing

Compliant Scroll compressors are configured with the motor in the bottom of the shell. Unlike most other hermetic compressors, the Scroll motor can be immersed in refrigerant when liquid is present in the shell. In this respect, the Scroll is more like semi hermetic compressors which have horizontal motors partially submerged in oil and refrigerant. HiPot tests with liquid refrigerant in the shell can show higher levels of current leakage due to higher electrical conductivity of liquid refrigerant vs. refrigerant vapor and oil. This phenomenon can occur with any compressor when the motor is immersed in refrigerant and does not present any safety issue. To lower the current leakage reading operate the system for a brief period of time, redistributing the refrigerant to a more normal configuration, and test again.

Compliant Scroll Functional Check

Glacier™ Scroll compressors do not have internal suction valves. It is not necessary to perform functional compressor tests to check how low the compressor will pull suction pressure. This type of test may damage a Scroll compressor. The following diagnostic procedure should be used to evaluate whether a Compliant Scroll compressor is functioning properly.

1. Verify proper unit voltage.

2. Normal motor winding continuity and short to ground checks will determine if the inherent overload motor protector has opened or if an internal short to ground has developed. If the protector has opened, the compressor must cool sufficiently to reset.

3. With service gauges connected to suction and discharge pressure fittings, turn on the compressor. If suction pressure falls below normal levels the system is either low on charge or there is a flow blockage.

4. Single Phase Compressors

If the suction pressure does not drop and the discharge pressure does not rise to normal levels the compressor is faulty.

5. Three Phase Compressors

If the suction pressure does not drop and the discharge pressure does not rise, reverse any two of the compressor power leads and reapply power to make sure the compressor was not wired to run in the reverse direction.

The compressor current draw must be compared to published compressor performance curves at the compressor operating conditions (pressures and voltages). Significant deviations (±15%) from published values may indicate a faulty compressor.

New Installation

- The copper-coated steel suction, discharge, and injection tubes on Scroll compressors can be brazed in approximately the same manner as any copper tube.
- Recommended brazing material - Any Silfos material is recommended, preferably with a minimum of 5% silver. However, 0% silver is acceptable.
- Use of a dry nitrogen purge to eliminate possibility of carbon buildup on internal tube surfaces is recommended.
- Be sure process tube fitting I.D. and process tube O.D. are clean prior to assembly.
- Apply heat in Area 1. As tube approaches brazing temperature, move torch flame to Area 2.
- Heat Area 2 until braze temperature is attained, moving torch up and down and rotating around tube as necessary to heat tube evenly. Add braze material to the joint while moving torch around circumference.
- After braze material flows around joint, move torch to heat Area 3. This will draw the braze material down in to the joint. The time spent heating Area 3 should be minimal.
- As with any brazed joint, overheating may be detrimental to the final result.

Field Service

To disconnect:

- Reclaim refrigerant from both the high and low side of the system. Cut tubing near compressor.

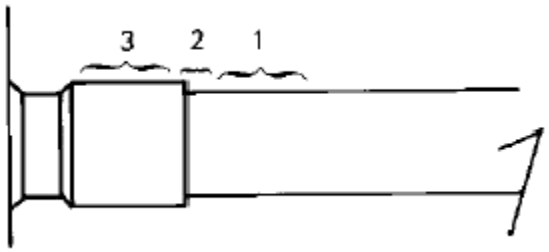
To reconnect:

- Recommended brazing materials; Silfos with minimum 5% silver or silver braze material with flux.
- Reinsert tube fitting.
- Heat tube uniformly in Area 1, moving slowly to Area 2. When joint reaches brazing temperature, apply brazing material.
- Heat joint uniformly around the circumference to flow braze material completely around the joint.
- Slowly move torch in Area 3 to draw braze material into the joint.

Do not overheat joint.

Scroll Tube Brazing

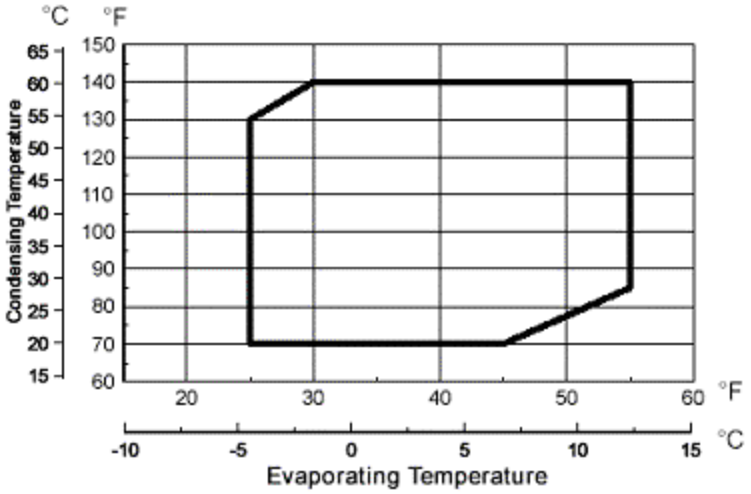
Figure 9



ZB**KA Envelope (R-22)

Conditions: 65°F Return Gas; 0°F Sub-cooling, 95°F Ambient

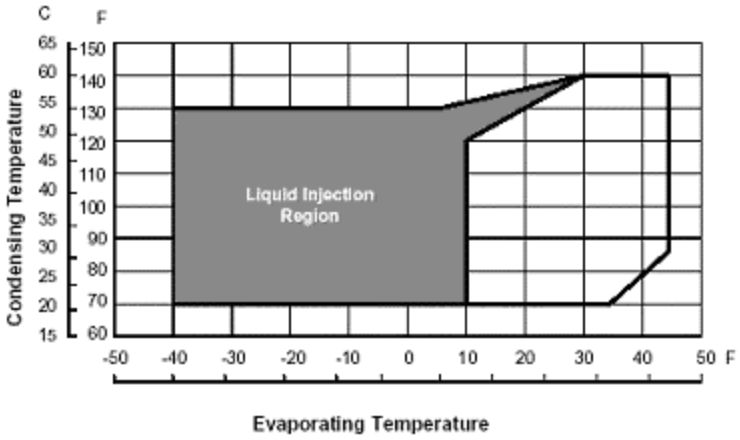
Figure 1A



ZF**K4 Envelope (R-22)

Conditions: 65°F Return Gas; 0°F Sub-cooling, 95°F Ambient

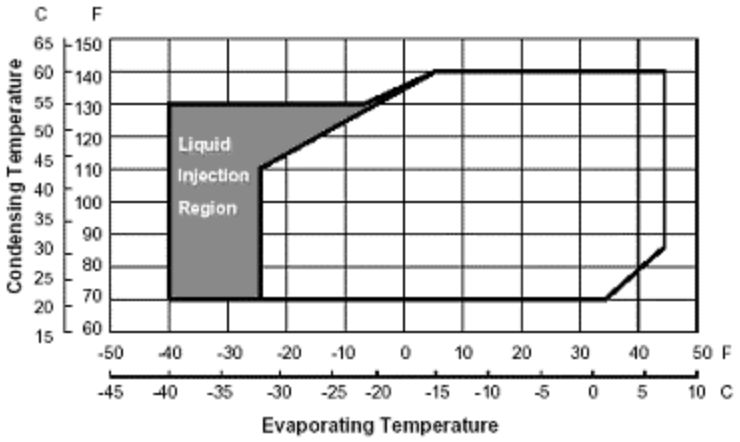
Figure 1B



ZF**K4E Envelope (R-134A)

Conditions: 65°F Return Gas; 0°F Sub-cooling, 95°F Ambient

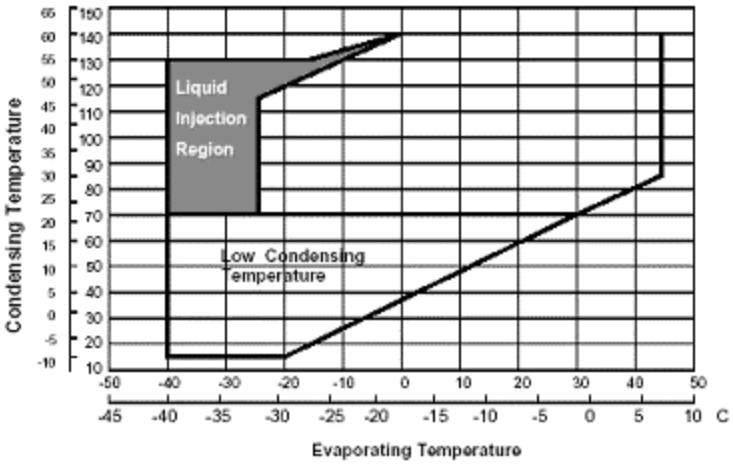
Figure 1C



ZF**K4E Envelope (R-404A/R-507)

Conditions: 65°F Return Gas; 0°F Sub-cooling, 95°F Ambient

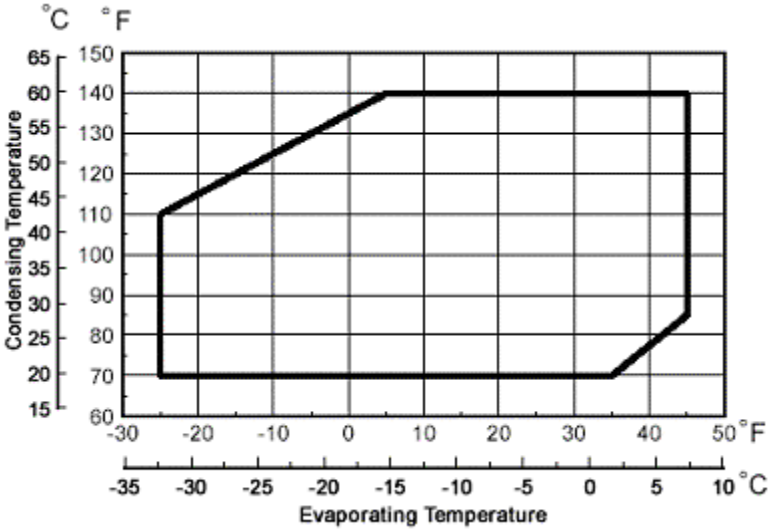
Figure 1D



ZS**K4E Envelope (R-134A)

Conditions: 65°F Return Gas; 0°F Sub-cooling, 95°F Ambient

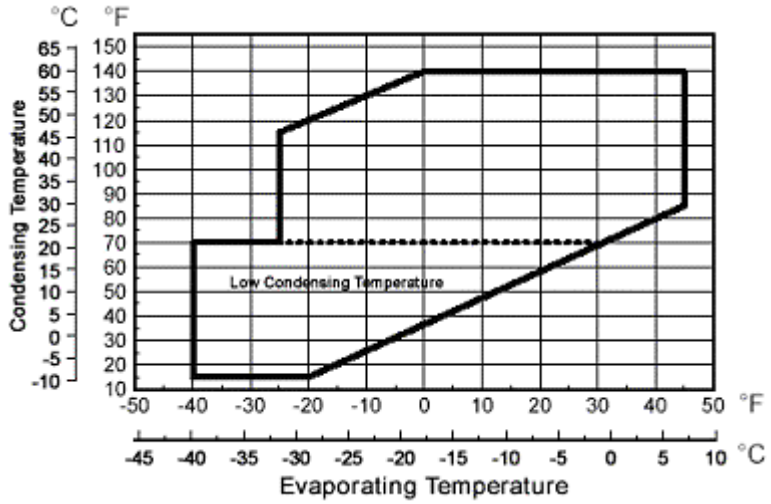
Figure 1E



ZS**K4E Envelope (R-404A/R-507)

Conditions: 65°F Return Gas; 0°F Sub-cooling, 95°F Ambient

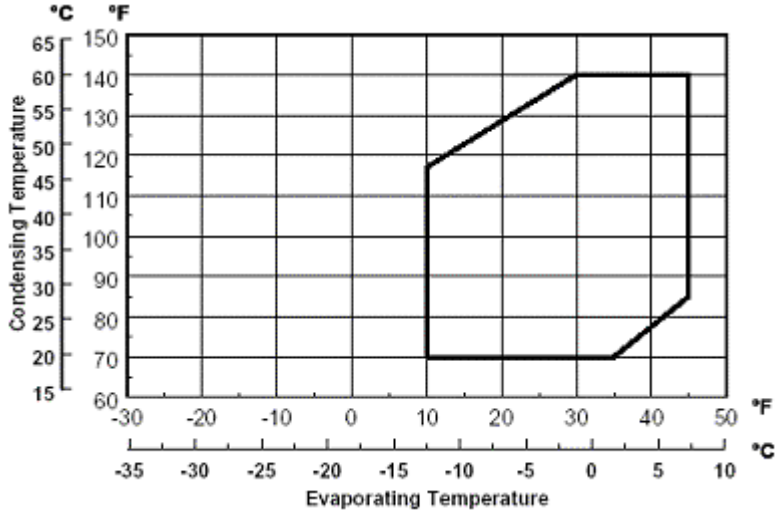
Figure 1F



ZS**K4/K4E Envelope (R-22)

Conditions: 65°F Return Gas; 0°F Sub-cooling, 95°F Ambient

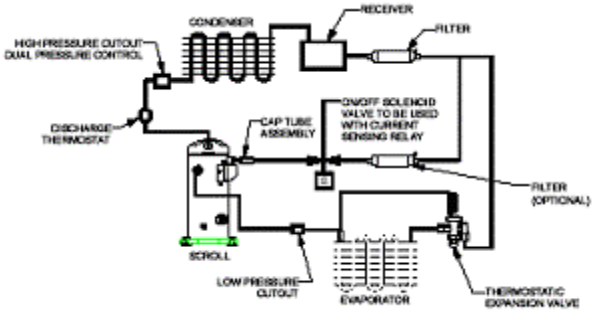
Figure 1G



GLACIER™ K4

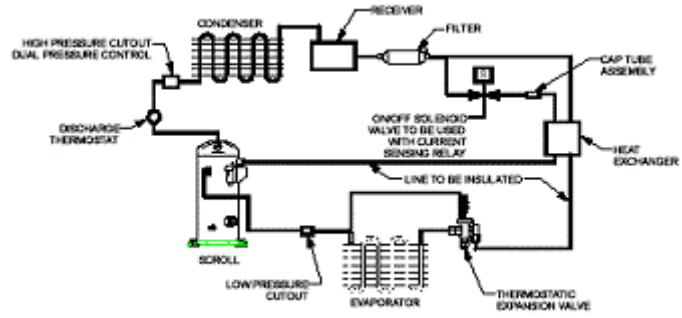
Liquid Injection*

Figure 2



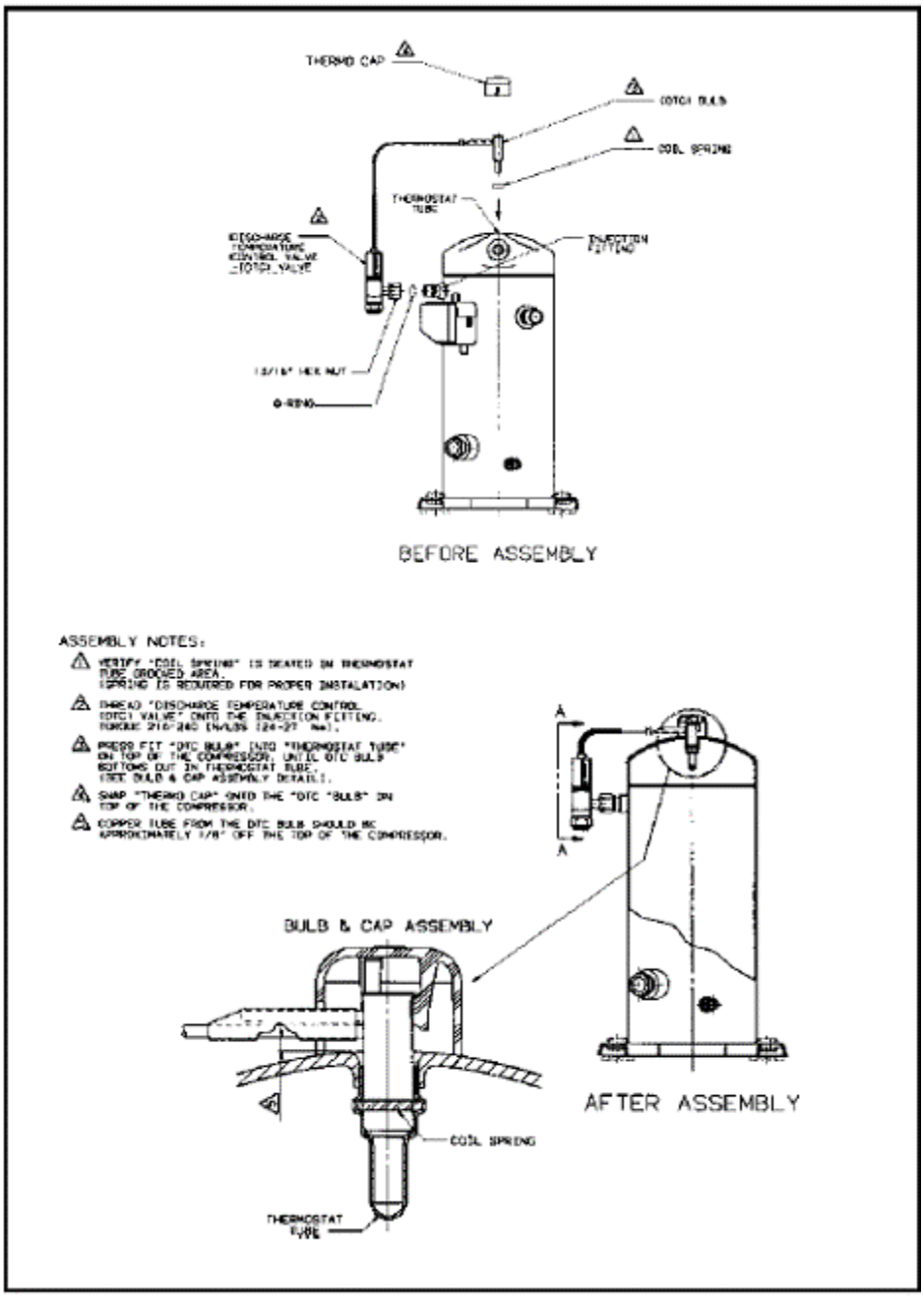
Vapor Injection*

Figure 3



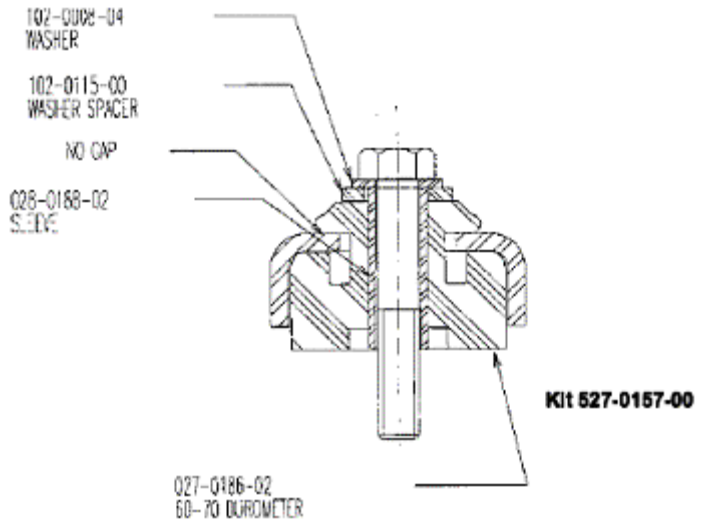
* See catalog 1.401 for part information.

Figure 4


THERMO CAP
COIL SPRING
THERMOSTAT TUBE
BEFORE ASSEMBLY
ASSEMBLY NOTES:
BULB & CAP ASSEMBLY
COIL SPRING
THERMOSTAT TUBE
AFTER ASSEMBLY

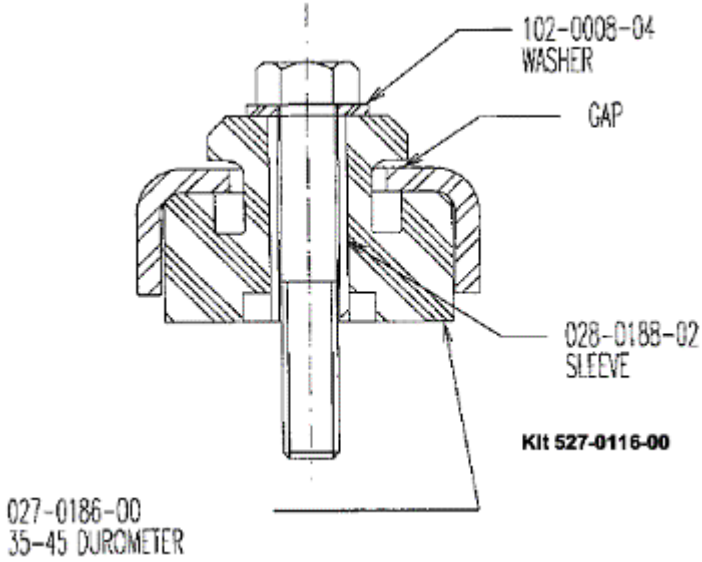
2-6 HP Glacier™ Rack Mounting

Figure 5A



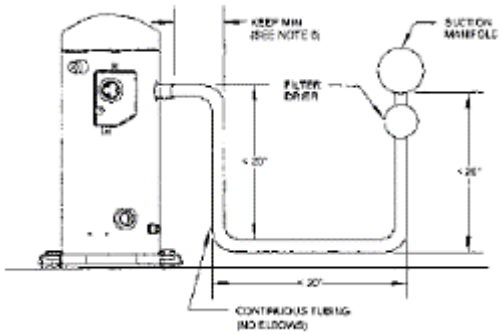
2-6 HP Glacier™ Condensing Unit Mounting

Figure 5B



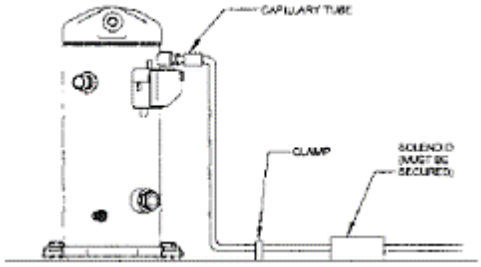
Typical Suction Tubing

Figure 6A



Typical Injection Tubing

Figure 6B



NOTES:

(1) The above tubing configurations are guidelines to minimize tube stress.

(2) Follow similar guidelines for discharge tubing and oil return tubing as needed.

(3) If a run of over 20" is required, intermediate clamps may be necessary.

(4) Do not hang weights on tubing (e.g. filter drier on suction tubing) except after clamps or close to the header.

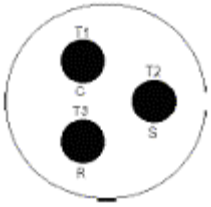
(5) Tube runs of less than 8" are not recommended.

(6) This dimension should be made as short as possible (e.g. 2" or less) but still insuring a proper braze joint.

(7) The above tubing recommendations are based on "no elbow joints". The use of continuous tubing is preferred.

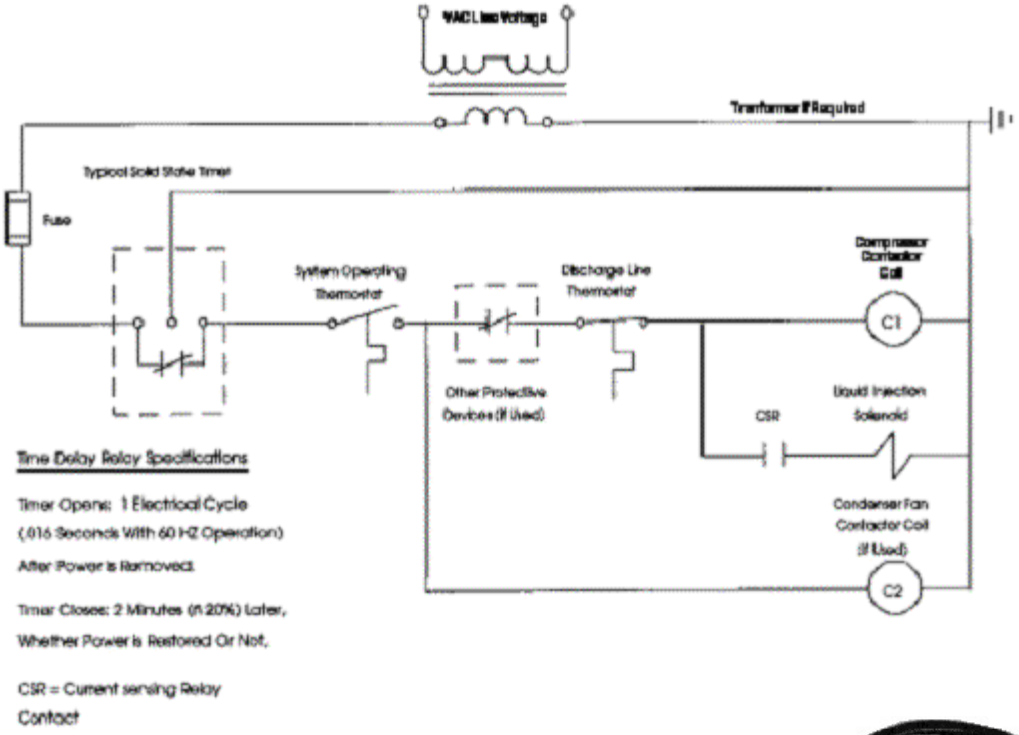
Motor Terminal (Fusite) Connections for Single Phase and Three Phase Scrolls

Figure 7



Scroll Wiring Schematic

Figure 8



Hi Pressure Control

Each compressor is equipped as standard with a non-adjustable high-pressure cutout. This cutout eliminates the use of a high-pressure line and mechanical controls thereby minimizing the chance for refrigerant leaks.

A variety of high-pressure controls or dual-pressure controls are also available. These controls will be equipped with a flexible hose, minimizing the risk of

leak. Flow Controls, Johnson Controls or Danfoss makes these controls.

Low Pressure Control

Each compressor is equipped as standard with an adjustable low-pressure control. This control is equipped with a flexible hose, minimizing the risk of a leak. Flow Controls, Johnson Controls or Danfoss makes this control.

Liquid Filter/Drier Shell

A replaceable core liquid filter/drier is supplied as standard on all units. An Schrader type access valve is installed in the flange plate. The liquid drier cores are shipped loose for field installation. Flow Controls or Sporlan makes the shell.

Flow Controls

Model	Line OD	No. of Cores	Core Size
STAS-967T	7/8	2	48
STAS-969T	1 1/8	2	48
STAS-1449T	1-1/8	3	48
STAS-14411T	1 3/8	3	48
STAS-19211T	1 3/8	4	48
STAS-19213T	1-5/8	4	48
STAS-19217T	2-1/8	4	48
ADKS-30017T	2-1/8	3	100
ADKS-40017T	2-1/8	4	100

Sporlan

Model	Line OD	No. of Cores	Core Size
C-967-G	7/8	2	48
C 969 G	1 1/8	2	48
C-1449-G	1-1/8	3	48
C 14411 G	1 3/8	3	48
C 19211 G	1 3/8	4	48
C-19213-G	1-5/8	4	48
C-19217-G	2-1/8	4	48
C-30017-G	2-1/8	3	100
C-40017-G	2-1/8	4	100

Sub-cooler

Sub-cooling is optional on all parallel racks. It is highly recommended on all 2-stage equipment (including compound cooling) and recommended on all low temperature systems. When sub-cooling is employed on a rack, the heat exchanger will be a Flat Plate

or Alfa Laval brazed plate heat exchanger. The brazed plate heat exchanger is substantially smaller and lower cost than other technologies that could be used as a sub-cooler.

Sub-cooler piping is shown in the typical piping diagram elsewhere in this manual.

The EPR valve should normally be set to maintain desired liquid temperature. This is normally 50°F but may be as low as 40°F for some systems. Check with Application Engineering for specifics of the rack you are working on.

There will be a lockout system installed on each sub-cooler. This normally consists of a rack controller temperature sensor (it might also be a thermostat on less sophisticated control schemes) positioned on the drop leg (condenser return) of the rack. The closing of a liquid line solenoid in front of the sub-cooler expansion valve when the drop leg temperature gets below the set point shuts off the sub-cooler.

Flat Plate Sub-cooler

The following is an excerpt from a FlatPlate Bulletin on SC Series.

FlatPlate's SC Series is the most advanced, compact Sub-cooler in the industry. Designed specifically for refrigeration systems the SC Series is widely used in Supermarkets, Food Processing, Industrial Refrigeration, Two Stage systems and Economizers; anywhere sub-cooled refrigerant liquid is used to enhance system efficiency and capacity.

Simple And Compact

The SC Series Brazed Plate Heat Exchanger consists of stainless steel plates with a high efficient heat transfer surface. The plates are copper brazed together at high temperature, allowing the heat exchanger to be compact, leak tight and rugged. The SC Series can be up to 50% to 80% smaller than other types of heat exchangers. This allows for easy packaging and simplified installation.

The SC Series is highly versatile and can be configured for both standard and custom designs from 1 to 120 tons of sub-cooling. Based on years of field experience, the SC Series differs significantly from other types of heat exchangers.

Built-In Dx Distribution

Low load stability and capacity control are very important with Sub-coolers, which must provide a stable liquid refrigerant temperature to the overall system. FlatPlate accomplishes this with a Built-in Direct Expansion (DX) distribution device inside the Sub-cooler. This feature allows the Sub-cooler to perform properly at all full load and part load conditions and ensures no expansion valve hunting.

Totally Sealed Construction

The SC Series has an integral top sealing plate and completely sealed construction so there are no places for frost or moisture to collect. This important feature provides product reliability and protection from external freeze damage and potential loss of refrigerant charge.

The Right Connections

FlatPlate SC Sub-coolers have large EasySweat fittings. These properly sized sweat fittings make installation simple and minimize pressure drop. Optional socket weld fittings and custom fitting sizes are also available.

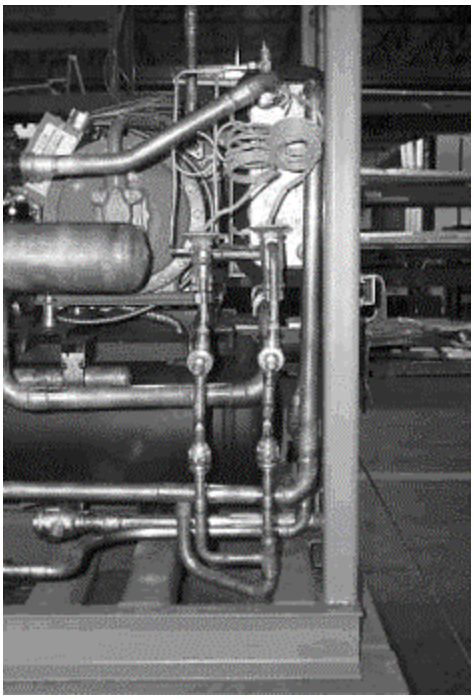
Proven Performance

FlatPlate designs have been tested for performance over a wide range of operating conditions. All applications can be computer selected for optimum performance. Plus, all FlatPlate units are Helium leak tested for assured quality.

The SC Series is by far the best Sub-cooler in the industry. The proof is in every field installation.

For application assistance please call us at the factory.

Sub-cooler on Rack



Sub-cooler Electronic Expansion Valve

The following is an excerpt from Sporlan SD-243-5-404.

Step Motor Expansion Valves

Operation

The SER, SEI and SEH series valves are step motor operated electric expansion valves. Step motors are designed to provide discrete segments of angular motion, or rotation, in response to an electronically generated signal. The advantages of step motors in valve applications are high resolution, repeatability and reliability with low hysteresis. Feedback loops are not required, simplifying controller design and circuitry.

The step motor used in the SER, SEI and SEH valves is a 12-volt DC, two-phase, bi-polar, permanent magnet rotor type. Each step creates a 3.6° rotation of the rotor. This rotation is increased in torque and reduced in speed by a 12.25:1 gear train. Final rotation is converted to linear motion by the use of a lead screw and threaded drive coupling. Forward motion of the motor extends the drive coupling and pin, which moves the valve to the closed position. Backward rotation of the motor retracts the drive coupling and pin modulating the valve in the opening direction. Full forward or backward travel, while the valve is assembled, is limited by the valve seat in the closed position or an upper stop in the open direction. A slight clicking sound may be heard at either of these two positions and does no harm to the valve or drive mechanism.

The valve will operate only when connected to a properly designed controller. The controller must supply the necessary square wave step signal at 12 volts DC and 200 PPS for the valve to control properly. Various Sporlan and third party controllers are available for use with the valve. Questions of suitability of a specific controller should be directed to Sporlan Valve Company, Attn.: Product Manager — Mechatronics Products. Control algorithms for the valve include a initialization sequence that will first over-drive the valve in the closing direction. This is to assure that the valve is completely shut and to establish the "zero" open position. The controller then keeps track of valve's position for normal operation. During this initialization phase, a light clicking sound may be heard, which will serve as proof of the valves operation and closure.

The valves have synthetic seating for tight shutoff and uniquely characterized pin and port combinations for exceptional control of refrigerant flow. The seats require no service and are not replaceable. The motor may be easily replaced without removing the valve body from the system.

Installation

The SE series valves are electronically controlled Step Motor Expansion Valves, and are installed before the distributor and evaporator just as one would install a Thermostatic Expansion Valve. The valves are directional, and the inlet is clearly marked. Location should

be planned to provide serviceability and to allow controller installation within the maximum cable length of forty feet. The valve may be installed in the refrigerated space and may be mounted in any position except with the motor housing below the liquid line. Cable routing should avoid any sharp edges or other sources of potential physical damage such as defrost heaters and fan blades. For neatness and protection, the cable may be fastened to the suction or liquid lines with nylon wire ties.

The flare version is supplied with brass fittings and should be installed using properly made flare connections. A drop of refrigerant oil should be used to prevent galling of the threads when tightening. Inlet strainers that are removable for cleaning are supplied as part of the flare connection.

The sweat version has copper connections and any solder or brazing alloy may be used to install the valve. There is no need to disassemble the valve for installation, however, the torch flame should be directed away from the motor housing and cable. Care must be taken to assure that the cable is not damaged either directly from the flame, or indirectly from contact with hot piping. The valve is shipped in the open position to prevent heat being conducted into the motor, but it is strongly suggested that the valve body be wrapped with a wet cloth during the soldering operation. Inlet strainers are supplied optionally with ODF style valves, and if used, should be oriented in the proper direction as shown on the strainer package. The valve should be completely installed and reassembled before connecting to the controller and applying power. The wiring is color-coded and the controller manufacturer should be consulted for the proper attachment to the controller.

Field Servicing Instructions SEI & SHE Only

The following steps are necessary for the proper disassembly, inspection, cleaning and reassembly of the SEI/SEH valve models (whether in or out of the refrigerant piping).

1. Before disassembling the valve, be sure the refrigerant pressure in the system has been reduced to a safe level (0 psig).

2. Disconnect the line voltage to the valve controller.

3. Refer to the exploded view of the SEI/SEH (figure 1) for the remaining instructions. Using the appropriate wrenches or a vice to properly support the valve body, remove the motor assembly from the valve body by loosening the lock nut. To prevent permanent damage to the motor, DO NOT attempt to disassemble the motor housing.

CAUTION: Regardless of whether the valve is in the system or in a vise, care must be taken to prevent distorting the valve parts when tightening.

4. The motor assembly may be removed for inspection and cleaning.

5. If the motor fails to operate properly, check the resistance of each motor phase. Resistance between the black and white leads or between the red and green leads should be approximately 75 ohms. Differences of more than 10% between phases indicate a defective motor. Resistance between black and red, or any lead and housing should be infinite, any resistance reading will indicate a shorted winding and the motor will need to be replaced.

6. If you have access to a SMA test instrument, operation of the valve may be proven. Connect the motor leads to the proper color-coded connector on the SMA. Set the rate to 200 PPS and toggle in the "OPEN" direction. The white polyester driver/piston should

retract into the driver guide. After approximately 30 seconds, the driver should be fully retracted and a light clicking or "ratcheting" sound may be heard, this is normal to the valves and proves operation of the motor. If the SMA is toggled in the "CLOSE" position, after approximately 30 seconds the white polyester driver/piston should disengage the lead screw, and can be removed. Inspect the driver/piston for damage. To replace the driver, toggle the SMA to the "OPEN" position and carefully engage the driver to the lead screw.

CAUTION: Whenever the motor is powered while not in place on the valve, the driver must be fully retracted into the guide before the valve is reassembled. Failure to do this will permanently damage the valve.

7. If the motor responds to step 6 above, the valve body itself should be checked for obstruction. Check for contaminants in the port or strainer, if used.

8. If the valve body and strainer are clear and the motor operates as in step 6 above, the valve is considered operational and the problem lies in the controller or power supply. The manufacturer of these components should be contacted for further assistance.

Motor Adaptor Assembly Replacement SEI 25 & SEH Only

If the motor is found to be defective in the above, the entire motor assembly must be replaced.

1. Remove all power from the valve and controller.

2. Cut the existing valve cable at a convenient point at the driest or most protected location.

3. Splice the new cable to the old cable using the waterproof butt splices. COLOR CODING ON THE INDIVIDUAL WIRES MUST BE MATCHED; FAILURE TO DO SO WILL RENDER THE VALVE INOPERATIVE AND MAY DAMAGE EITHER THE VALVE OR CONTROLLER.

4. Waterproof the splice with shrink tube or electrical tape suitable for use in cold and damp environments. Care should be taken to prevent the splice from lying in the case pan or other wet location.

Valve Replacement

The entire valve may be replaced if desired. The old valve may be unsoldered or cut out of the piping. If cut out, use a tubing or pipe cutter and not a saw. When installing the new valve any convenient brazing alloy and method may be used. The valve need not be disassembled, but the body and motor assembly should be wrapped with a wet cloth to prevent damage.

Extra care should be taken to prevent damage to the motor cable, either directly from the torch, or indirectly from contact with a hot surface.

Waterproof butt splices are not supplied with complete valves but must be used to prevent corrosion on the motor leads. Refer to the instruction for MOTOR REPLACEMENT above. If the valve is disassembled for installation, refer to REASSEMBLY instructions, below.

Reassembly

1. Use the SMA in the "OPEN" mode or valve controller to retract the white polyester driver/piston fully into the driver guide. Remove power from the valve or controller.

2. Lightly oil the threads and knife-edge on the new motor adaptor. Carefully seat the adaptor on the valve body or engage and tighten the lock nut. One eighth turn more than hand tight is sufficient to achieve a leak proof seal.

3. Pressurize the system and check for leaks.

4. Reapply power to the controller. Each controller manufacturer has a slightly different initialization scheme and the proper procedure must be followed. Since, during service, valve position as calculated by the controller will be lost, the controller should be initialized at least twice. In some instances, cycling power to the controller will accomplish this. However, the controller literature or the manufacturer should be consulted.

SMA-12 VDC Bipolar Step Motor Actuator

1. Connect any Sporlan step motor valve to the SMA-12 by matching wire color to terminal color. Any 12 VDC bipolar step motor may be tested with the SMA-12. Phase one leads should be connected to the black and white terminals, Phase two leads should be connected to the red and green terminals.

2. Select a step rate with the selector knob.

3. Push the open/close toggle switch in the "CLOSE" direction to extend the driver or close the valve.

4. Push the open/close toggle in either direction at the 1 step rate will alternate the phases energized.

5. Observe the terminal indicator lights. At rates other than 1, indicator lights will flash quickly. Pushing the open/close toggle in either direction at the 1 step rate will alternate the phases energized.

The following sequence of indicator lights will light.

Opening	Closing
Black & Red	Red & White
Red & White	Red & Black
White & Green	Black & Green
Green & Black	Green & White

6. Check that the power indicator light is lit; if not, replace the batteries.

7. If the terminal indicator lights do not light, one or both motor phases are open and the motor must be replaced.

8. If the motor can be powered smoothly in both directions, the motor assembly is functional and the controller must be tested or replaced.

Specifications

Power input – Two 9 volt Alkaline batteries

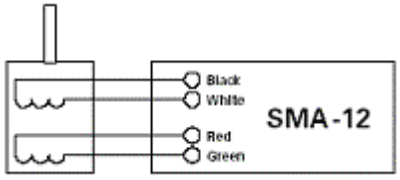
Power output – 10 Watts intermittent

Step rate – Selectable - 1, 50, 100, 200 steps per second

Drive type – Bipolar

Connector – Binding post with banana plug socket

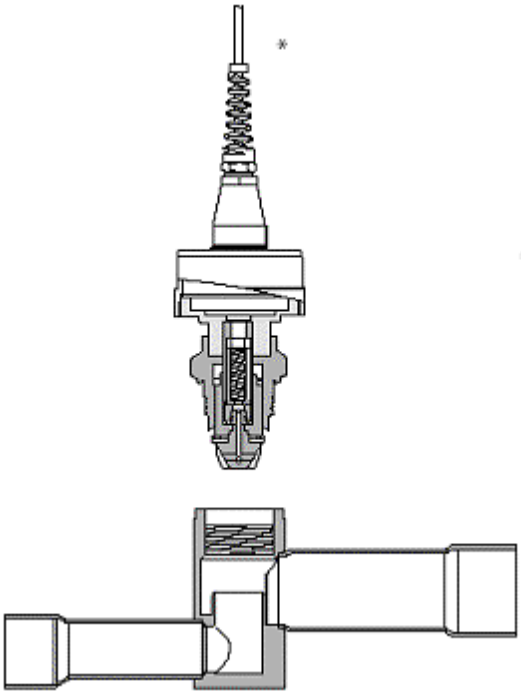
12 Volt DC Bipolar Step Motor



An accessory pigtail item number 958112 is available at extra charge to allow the SMA-12 to be directly connected to all Sporlan Packard Weather-PackÔ equipped valves.

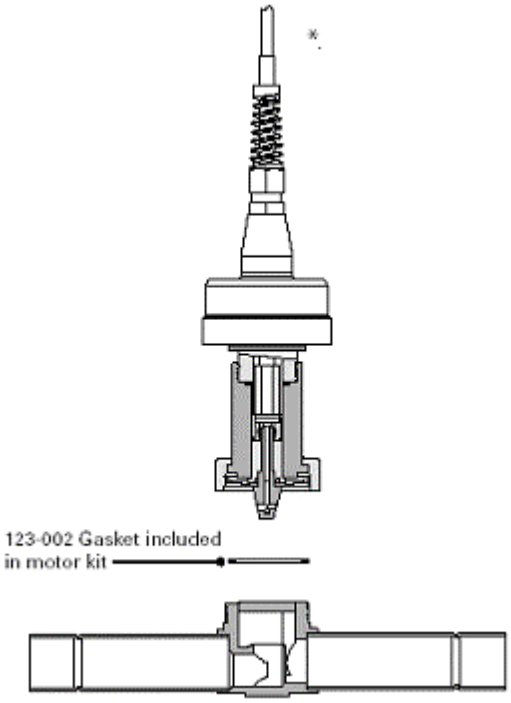
Valve Model	Motor and Adaptor Assembly
SER	Not Available
SEI-.5 to 11	Not Available
SEI-30	KS-SEI-30
SEI-50	KS-SEI-50
SHE-100 & 175	KS-SHE 100/175

SHE Valve Assembly



* Motor kits supplied with 24" lead wire with butt splice connectors.

SEI Valve Assembly



Sightglass/Moisture Indicator

A sightglass moisture indicator is installed as standard on all units. The sightglass is installed immediately after the filter/drier, unless a liquid sub-cooler is employed, then the sightglass is located down stream of the sub-cooler. This location makes the moisture indication more accurate.

Sporlan Model	Line OD
SA-17S	7/8
SA 19S	1 1/8
SA 211	1 3/8
SA 213	1 5/8
SA-217	2-1/8

SA-217

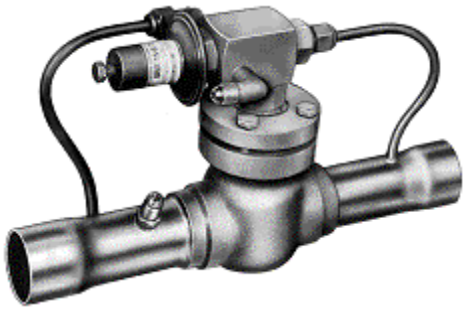
EPR Valves

Mechanical EPR Valve

An evaporator pressure regulator is required on a suction circuit when the temperature difference of the evaporator coil and the compressor group is 5°F or greater. If the temperature is the same, an EPR valve may still be ordered. EPR valves from Sporlan, Parker and Danfoss may be customer specified.

Usually a 0/75 psig pressure range valve is used. A 0/100 psig pressure range valve is required for some combinations of refrigerant and application temperatures.

Sporlan ORIT-15



Sporlan Model	Line OD
SORIT 12	1 1/8
SORIT 15	1 3/8
SORIT 20	1 5/8

Sporlan SORIT

The following excerpt is taken from Sporlan Bulletin 90 21 1; Installation & Service Instructions for SORIT 12, SORIT 15 and SORIT 20.

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS, MO 63143
FAX: 314-647-1714 PHONE: 314-647-2775

SORIT

To insure optimum performance, evaporator pressure regulating valves must be selected and applied correctly. This is covered thoroughly in Bulletin 90 20 1. However, proper installation procedures are equally as important. All of the information in the Application Section should be reviewed before installing SORIT valves.

Valve Location

The SORIT 12, 15, and 20 must be installed upstream of any other suction line controls or accessories. They may be installed in the horizontal or vertical position... whichever best suits the application and permits easy adjustment and accessibility. However, consideration should be given to locating these valves so they don't act as an oil trap, or so solder cannot run into the internal parts during brazing in the suction line. Reverse flow is not recommended. Therefore a high side to low side hot gas defrost line must be connected upstream of the SORIT 12, 15, and 20.

Installation And Brazing Procedures

It is not necessary to disassemble the valve when soldering to the connecting lines. Any of the commonly used types of solder (such as 50 50, 95 5, Easy Flo, Phos Copper, or equivalents) are satisfactory. It is important—regardless of the solder used—to direct the flame away from the valve body and avoid excessive heat on the diaphragm of the pilot valve. As an extra precaution, a damp cloth may be wrapped around the diaphragm during the soldering operation.

Important

The pilot valve high-pressure source is the primary valve port closing force, so this connection must be made for proper performance. There are several precautions to observe when making this connection.

1 Generally the high-pressure connection is made either to the discharge line or the top of the receiver. If hot discharge gas is used for defrost, the SORIT pilot supply line must originate from the same location as that of the hot gas defrost line. However, equipment manufacturers sometime select other locations that are compatible with their specific design requirements. Precautions should always be taken so this line does not serve as an oil trap. The pilot supply line should be kept as short as possible to minimize condensing. Alternate feeding of gas and liquid to the pilot supply may cause the valve to operate erratically.

2 It is also recommended that a hand valve or solenoid valve (Sporlan A3) be installed in this line so the pilot can be isolated should servicing become necessary. The hand valve or solenoid valve is mandatory if it is necessary to pump out an evaporator for service or for a pumped down system. Closing the hand valve or solenoid valve will cause the main piston to shift to the full open position for rapid evacuation of the evaporator. The positive closure of the pilot supply line is also necessary on pump down systems to eliminate the high side to low side equalization path. The SORIT 12, 15, and 20 are normally open and therefore by closing off the pilot supply pressure (closing pressure), the SORIT main piston will shift to the full open position.

3 To insure proper performance, the high pressure source supplied to the inlet of the pilot valve must be at least 50 psi above the outlet suction pressure of the SORIT evaporator pressure regulator.

Test Pressures And Dehydration Temperatures

For better leak detection, an inert dry gas such as nitrogen or CO2 may be added to an idle system to supplement the refrigerant pressure.

Caution:

Inert gases must be added to the system carefully through a pressure regulator. Unregulated gas pressure can seriously damage the system and endanger human life. Never use oxygen or explosive gases.

Excessive pressure can shorten the life of the pilot regulator valve diaphragm. The maximum low side test pressure that can safely be applied is 450 psig. This maximum pressure is well above the minimum field leak test pressures for low side listed in the ANSI/ASHRAE Standard 15 197X.

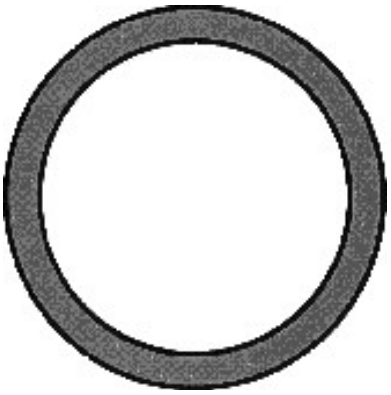
The maximum dehydration temperature to which the valve body can be subjected without danger is 250°F.

Valve Setting And Adjustment

The standard factory setting for the 0/75 psig range is 30 psig. The main function of an SORIT valve is to keep the evaporator pressure above some given point at minimum load conditions. Therefore, even though the valves are selected on the basis of pressure drop at full load conditions, they should be adjusted to maintain the minimum allowable evaporator pressure under the actual minimum load conditions.

When adjusting both evaporator pressure regulating valves and thermostatic expansion valves, the following procedure is recommended.

Figure 1



With the expansion valve at the Sporlan factory setting, or at a manufacturer's predetermined set point, and under the actual minimum load condition, the evaporator pressure-regulating valve should be adjusted to the desired setting. Finally, if necessary, the thermostatic expansion valve or valves can be adjusted to the desired superheat setting while under the normal operating load condition.

When an evaporator pressure regulating valve has been operating for a period of time at a given setting and an increase in the setting is required, as much as 30 minutes may be required for the new balance to take place after an adjustment is made. If the valve is being adjusted to a lower setting an immediate response to an adjustment should be observed.

To adjust the SORIT valves, turn the adjustment screw with a 3/8" hex wrench. A clockwise rotation increases the valve setting, while a counterclockwise rotation decreases the setting. To obtain the desired setting, a pressure gauge should be utilized on the inlet side of the valve so the effects of any adjustments can be observed.

When SORITs are installed in parallel, each should be adjusted the same amount to obtain optimum performance. If one valve has been adjusted more than the other, both valves should be adjusted all the way in before resetting them an equal amount.

Service Instructions

The SORIT 12, 15, and 20 can be easily disassembled for inspection and cleaning, or for replacement of the pilot assembly. The pilot assembly is available with (Kit number K Y100S) or without (Kit number K Y1010) the solenoid stop valve. The solenoid stop valve is not available separately and should not be removed from the pilot regulator, nor should a standard solenoid valve be added to the pilot assembly to achieve the stop feature. The pilot port is critically sized with an orifice in the outlet of the pilot assembly. The pilot kits contain: I pilot assembly; 2 gaskets (tetraseal for SORIT 12 and 15; composition gasket for SORIT 20), and I1copper flare gasket for the SORIT 20.

Caution

The pilot assembly should be isolated from the high-pressure power source before removal, and the main valve body should be isolated from inlet and outlet pressures. The SORIT 12, 15, and 20 are normally open and therefore by closing off the pilot supply pressure (closing pressure), the SORIT main piston will shift to the full open position.

Sorit Service Tips

Malfunction	Cause	Remedy
Failure to open	1 Dirt or foreign material holding pilot port open.	1 Disassemble and clean pilot port.
	2 Pilot solenoid valve coil failure	2 Replace solenoid valve coil. Use the MKC 1 coil with the proper voltage.
Does not regulate or regulates sluggishly	1 The high pressure source supplied to the inlet of the pilot valve must be at least 50 psi above the outlet suction pressure of the SORIT.	1 Re locate pilot valve power source.
	2 If the pilot supply line is of considerable distance, condensing may occur.	2 Insulate pilot supply line or if supply line originates from the top of the receiver move it to the top of the discharge line.
Failure to close for defrost	1 High pressure supply line pinched shut or plugged	1 Replace or clean high-pressure supply line.
	2 T seal or gasket between adapter and valve body does not seal. If this should occur pressure can bleed out of the chamber faster than can be supplied by the pilot valve.	2 Replace T seal or gasket. These should be replaced any time the pilot assembly is removed from the valve body.
	3 Dirt or foreign material either lodged between piston and sleeve causing hang up or excessive scoring in the sleeve or the piston allowing the high pressure to bleed out of the chamber above the piston.	3 Clean or if necessary replace the piston and the sleeve.
	4 Inlet strainer to pilot plugged with foreign material.	4 Clean or replace strainer.
	5 Refrigerant flow through pilot is restricted by oil in the pilot supply line either due to a trapped supply line or too much oil in the system.	5 Check the pilot supply line to be sure that it is open and that it does not serve as an oil trap.
	6 Pilot supply pressure originates from a lower pressure source than is used for defrost.	6 If the pilot pressure source originates from the top of the receiver and the valve is not closing for defrost move the pilot supply pressure source to the discharge line.

Pilot Replacement Instructions

1 Disconnect the three connections of the pilot valve. They are:

- inlet (high pressure source)
- outlet
- and external equalizer

2 With the locknut or body flange still intact, place a wrench on the bottom fitting of the pilot valve. Turn counterclockwise and remove the pilot assembly from the adapter.

3 Install the new pilot assembly. (At this point the flange is still securely bolted to the valve body.) Again place a wrench on the bottom connection of the pilot valve. Turn clockwise until the pilot assembly is firmly in place. Do not attempt to align the three pilot valve connections at this time.

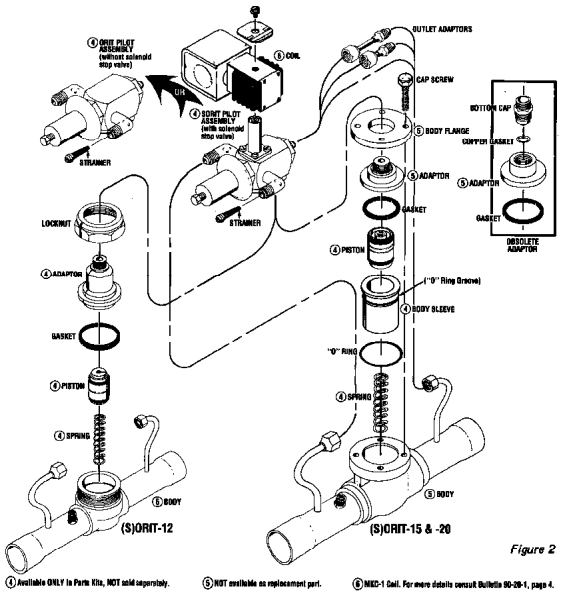


Figure 2

4 Remove the locknut or cap screws and replace the gasket under the adapter. Two gaskets are supplied with each pilot assembly kit. The correct gasket for the SORIT 12 and 15 is the tetraseal. The SORIT 20 uses the composition gasket. See figure 1 for actual dimensions of the tetraseal and the gasket.

5 Reassemble the valve. Allen head cap screws must be replaced with the hex head screws included with the pilot assembly kit. Before completely tightening the locknut or cap screws, rotate the pilot valve to properly align the inlet, outlet, and external equalizer connections. Join these connections and tighten the locknut of the SORIT 12 to 30 ft. lbs. A torque value for the cap screws on the SORIT 15 and 20 is not recommended but uniformity of compression from the four cap screws is important. Screw the flange down evenly and firmly. The pilot replacement is now complete.

Piston Replacement SORIT 12

1 Remove the pilot assembly from the adapter as described in Steps 1 and 2 of the pilot replacement instructions.

2 Remove the locknut and replace the adapter, tetraseal, piston assembly, and bottom spring. Reassemble the valve and tighten the locknut to 30 ft. lbs.

3 Reinstall the pilot assembly. Place a wrench on the bottom connection of the pilot valve and turn clockwise until the pilot assembly is firmly in place. Do not attempt to align the three pilot valve connections at this time.

4 Loosen the locknut and rotate the pilot valve to properly align the inlet, outlet, and external equalizer connections. Join these connections and tighten the locknut to 30-ft.-lbs.

SORIT 15 and 20

1 Disconnect the three connections of the pilot valve and remove the four cap screws. The complete pilot assembly, adapter, and body flange can now be lifted off the main valve body.

2 Replace the piston assembly, body sleeve, and bottom spring.

3 Install a new gasket and reassemble the valve. Before completely tightening the cap screws, rotate the pilot valve to properly align the inlet, outlet, and external equalizer connections. Join these connections and tighten the cap screws. A torque value for the cap screws is not recommended but uniformity of compression from the four cap screws is important. Screw the flange down evenly and firmly.

Replacement Parts And Parts Kits

		Valve Type And Size					
		ORIT			SORIT		
Part No.	Description	12	15	20	12	15	20
		Quantity Required					
Replacement Parts Sold Separately							
2626	Cap Screw			4			4
2627	Cap Screw		4			4	
2539	Gasket			1			1
2645	Gasket	1	1		1	1	
13681 1	Locknut	1			1		
621 28	O Ring		1			1	
621 31	O Ring			1			1
2445	Strainer	1	1	1	1	1	1
2491 1	Outlet Adapter (1 1/2")			(2)			
2491	Outlet Adapter (2 1/2")			(2)			
1517	Bottom Cap			(2)			
JP 543 2	Copper Flare Gasket			(2)			
(1) Replacement Pilot Valve Parts Kits							
K Y1005	All Kits Include: Pilot Assembly,				1	1	1
K Y1010	Strainer, Gasket(s), and Cap Screws	1	1	1			
Replacement Internal Parts Kits							
(3) KS ORI 12	All Kits Include: Gasket(s), Piston, and Spring. The	1			1		
KS ORI/CDA 15	KS ORI 12 also Includes the Adapter. The KS ORI/CDA 15		1			1	
KS ORI/CDA 20	KS ORI/CDA 20, also Includes a Body Sleeve and O ring			1			1

(1) The pilot valve is available with or without the solenoid stop valve. The solenoid stop valve is not available separately and should not be removed from the pilot regulator.

(2) This part may be necessary to adapt a new pilot to some obsolete valves.

(3) Replacement (S)ORIT 12 internal parts are only compatible with the Y1005 and Y1010 pilot valves. When using these parts with obsolete pilot valves, the pilot valve must also be replaced.

Electronic EPR Valve

Electronic EPR valves are available from Flow Controls (ESR Valve) and Sporlan (CDS Valve).

The following is an excerpt from Flow Controls.

ESR Electronic Stepper Regulator

Selecting an electric stepper valve for a refrigeration application, whether it is an ESV (Electric Stepper Expansion Valve) or an ESR (Electric Stepper Regulator), is much the same as selecting a standard valve. The laws of thermodynamics are not changed by the electric motor in the valve or the electronics controlling the valve. One still needs to know the system refrigerant, evaporator load, liquid temperature, desired capacity and pressure drop across the valve regardless if the valve is a conventional valve or a stepper valve.

While stepper valves are a relatively new technology for the refrigeration industry they have actually been around a number of years in various other industries. There is nothing complicated or mysterious about the valves. The stepper motor that drives the valve is like any other electric motor and should be thought of as such. It works, acts, and behaves like an electric motor, only it operates with a square wave instead of a sine wave like a standard AC motor. The average service technician is very familiar working with AC and DC electric motors so a stepper motor should not present any real difficulties once he is familiar with the correct service techniques.

As far as the refrigeration system is concerned there is no difference between a stepper valve and a conventional valve. The stepper expansion valve works the same way as a thermo expansion valve, controlling the evaporator superheat by regulating the amount of refrigerant in the evaporator coil. A stepper regulator works the same way as a conventional regulator does by opening and closing to control the evaporator pressure which in turn controls the evaporator temperature.

Stepper Motor Types

There are two types of motors used on these valves - unipolar and bipolar. The names refer to the direction of the current flow through the motor windings.

A simple unipolar motor with a simple drive circuit is shown in Figure 1. As the transistors are turned on in pairs the current will flow from the positive terminal of the power supply through the motor winding, through the transistor to ground. As can be seen from the diagram the current can only flow through the motor windings in one direction. Since the current only flows in one direction, this means that the magnetic field, caused by the current flow, creates only one magnetic pole, hence the name unipolar.

A bipolar motor with a simple control bridge circuit is shown in Figure 2. By turning two transistors on at a time in each bridge circuit the direction of the current in each winding can be reversed depending on which transistors are turned on. Since the current can be reversed in each winding this means that each winding can create two magnetic fields, hence the name bipolar.

Figure 1. A unipolar motor/driver circuit diagram.

Figure 2. A bipolar motor/driver circuit diagram.

Stepper Valve Selection

When you select an electric stepper valve, there are two parameters you must take into account that arenít a concern when youíre choosing a conventional valve. One of the two parameters is the type of motor the stepper valve has in it, either bipolar r unipolar. These

are the two main types used in refrigeration valves at this time. The other parameter is the motor voltage. If either of these two parameters do not match the valve controller then the valve will not perform correctly.

The easiest way to identify which type of stepper valve is in the system is to count the number of terminals on the valve. A unipolar stepper motor valve will have five terminals and a bipolar stepper valve will have only four leads. At this time, the Flow Controls ESV is the only valve that is using a unipolar motor. Both Flow Controls and Sporlan ës electric stepper suction regulators use bipolar motors, but the current rating is very different between the two.

It is very important to know the type of motor the valve has and that the appropriate controller setting is selected.. For a stepper to work correctly in the system, the electronic controller must be setup for the type of valve motor it will control. A unipolar valve will run with a bipolar driver circuit and a bipolar valve will run with a unipolar driver circuit but in both cases the valve will run backwards to what the controller tells it to.

The voltage of the stepper valve and the controller must also match for the system to operate correctly. The correct voltage to the stepper motor valve is just as critical as it is for any electric motor. Too high or too low a voltage will cause problems with valve operation. The stepper valve will operate with the incorrect voltage under certain circumstances for short periods of time, but at some point it will fail completely.

If a 24 VDC stepper valve is operated with an electronic controller set for 12 VDC there will be a large reduction in valve performance. The torque of the motor is greatly reduced at lower voltages. With a loss of torque, the valve will fail to operate at high pressures. The valve may not be able to move when necessary or if it does move it may skip steps due to the loss of torque. Either of these conditions will cause the controller to lose track of where the valve is, which will cause over all system problems.

If a 12 VDC stepper happens to be installed with a 24 VDC controller, several problems could arise. The current draw of the valve motor will be increased by about four times because of the difference in motor resistance. This increase in motor current can cause the components on the controller board to fail if they are not rated for this large of current. If the board components do not fail the life of the motor windings will be shortened due to the excessive current.

Competitive Replacement

Replacing one manufacturer's stepper valve with another manufacturerís is not as simple as replacing conventional valves but it need not be a complicated affair either. The service mechanic should be aware that in most cases the existing case controller could be used for both a Sporlan valve and a Flow Controls valve. When converting from one manufacturer's valve to another there may be required changes that need to be made to the case controller. A hand held terminal may have to be used to change the valve parameters in the case controller software as well.

When replacing a Sporlan stepper regulator with a Flow Controls stepper (or vice versa) the same wiring harness can be used since both valves are bipolar. The wire colors are the same except the Flow Controls Blue wire is the same as the Sporlan Green wire. The other leads in the wiring harness can be connected color for color without any change in valve

performance. The changes to the case controller will still have to be made for the valve to operate properly.

There is one exception to the above procedure and that is if a Flow Controls stepper suction regulator replaces a Sporlan stepper suction regulator with a CPC controller. Due to the difference in current draw between the two valves the existing controller has to be changed out. Before doing this procedure, contact CPC and Flow Controls for the correct parts and procedure for doing this.

Replacing the Sporlan stepper expansion valve with a Flow Controls stepper expansion requires the wiring harness to be changed out. This is because the Flow Controls stepper expansion valve is a unipolar valve that requires a wiring harness that has five wires, while the Sporlan expansion valve is bipolar requiring only four wires. Once the wiring harness is changed out changes still have to be made to the controller to accept the new valve.

Troubleshooting

One problem that service technicians have with stepper valves is determining when they have a bad valve or a bad controller. The following are techniques that the serviceman can use to troubleshoot stepper valves with a Digital Multi Meter (DMM). These techniques were developed in Flow Controls Controls' lab and in field tests using Flow Controls stepper valves.

To determine the valve motor type and voltage, you can use the number of leads and the resistance of the windings. Remember by counting the leads you can determine the type of motor. If the motor is a bipolar motor it will have four leads while a unipolar motor will have at least five leads. The voltage of the motor can be determined by measuring the resistance of the motor windings and then refer to the manufacturer's motor specs. A rule of thumb is a higher voltage motor will have much higher resistance.

If the valve motor type is correct and is matched to the controller then the following steps can be used to determine if the problem is with the valve or with the controller. Before starting the check out procedure, it is recommended that the DMM is set to the AC voltage setting even though the voltage rating for the stepper valve is DC. The DC setting will work with a unipolar valve but it will read zero when testing a bipolar valve so the recommendation is to use the AC setting on the meter to avoid any confusion.

The motor type must be known before using the following techniques. The voltage measurements for a unipolar motor are taken different than with a bipolar motor. The determination of motor type, as discussed above, is as simple as just counting the motor leads or terminals. A unipolar motor has at least five leads while a bipolar motor has four leads.

The following steps are used if the valve in question has a unipolar motor in it.

1. When measuring between the colored leads White and Black or Red and Blue a nominal voltage (rated motor voltage) should be read on the DMM.

2. Any measurements taken between the common lead (Yellow) and any other lead will give a voltage reading of ½ nominal voltage.

3. Any other lead combinations will not give a meaningful voltage reading.

4. If the DC setting is used with the DMM, the above readings will be the same, but the positive lead of the meter must be connected to the Yellow lead. On a stepper motor this lead is the positive voltage lead when the motor is running.

When troubleshooting a bipolar valve the following steps should be followed.

1. When measuring between the White and Black leads or the Blue (Green) and Red leads, the nominal motor voltage should be read with the DMM.

2. Other lead combinations will give half of the nominal voltage.

With the above voltage readings the serviceman should be able to determine is there is a controller failure or a valve failure. If the voltage to the motor is with the manufacturer's recommendation, then the valve can be assumed to be bad. If the motor voltage is outside of the manufacturer's recommendation, there is either a controller problem or a power supply problem.

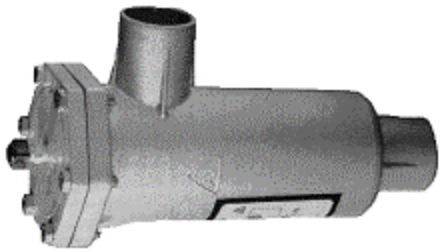
Attention to detail and following the few simple steps enumerated here will ensure the satisfactory installation and, if necessary, replacement of these state-of-the-art valves.

Suction Filter Shell

A suction filter is supplied as standard for each compressor. A Flow Controls or Superior brass shell will be provided. Both the Flow Controls and Superior shell accepts the same filter core. Also available is a Sporlan steel shell.

Flow Controls

Superior



Sporlan Suction Filter

The following excerpt is from Sporlan Bulletin 80 10 dated May 1993.

Replaceable Suction Filter

The flanged shell holds replaceable pleated filter elements, suitable for installation in the suction line of refrigeration systems. In this way any contaminants left in the system at start up can be removed before they circulate back to the compressor and cause damage.

Another tool for system clean up, offering the following BENEFITS:

- Replaceable pleated filter elements
- Can be used with desiccant cores for cleanup after burnout, if certain precautions are followed.
- Highly effective filtration at low cost
- Low pressure drop due to large filtering area
- Bi directional can be installed with flow in either direction, for easy installation on compact units.
- Various fitting sizes available from 1 1/8" to 3 1/8" line size. Suitable for sil fos brazing.
- Access valve supplied for pressure drop measurements or charging

How It Is Used

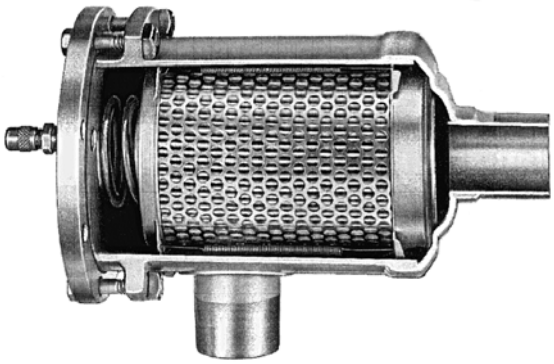
Sporlan Replaceable Suction Filters are installed in the suction line of refrigeration or air conditioning systems to remove the contaminants that may be in the system at start up. In this way the filter will protect the compressor from copper chips, copper oxide, core sand, and other solid contaminants, and thus extend the life of the system. These units are used most often on supermarket installations. A liquid line Catch AII Filter Drier is still required for removing moisture, acid, and wax. The design of the Replaceable Suction Filter, with its large fittings, permits using a small size shell on a system with large line sizes, resulting in considerable economy. The angle construction, suitable for flow in either direction, muzzle loading of elements, and access valve all aid in making a simple installation. Sporlan reliable flow capacity ratings permit selection of the proper size with assurance that the resulting pressure drop will be within the required limitations.

Construction

The RSF shell is similar to that used for the Sporlan Catch All Filter Driers. However, the outlet seal of the Replaceable Suction Filter is made using a large diameter gasket, thus permitting a large flow area. This construction permits the Replaceable Suction Filters to be

used on systems of large tonnage with large line sizes and still maintain a very low pressure drop.

For temporary use in clean up after a burnout, desiccant cores can be used by adding a special 100 mesh outlet screen, as described on page 8.



In the muzzle loading design used, the filter elements are assembled with a spacer plate at either end, held in position by three springs. This assembly is then inserted into the shell as a unit. These assemblies are inserted one at a time. Therefore, the "pull space" required in order to change the elements is the same for the two element shell, as for the one element shell.

A pull bar on the spacer plate at the flange end permits easy removal of the elements. The flange design and end plate gasket are the same as those used on the replaceable core Catch AII Filter Driers. The dimensional details are given in the table of specifications on page 6. Shells with fittings of 2 5/8" and larger have a concave shell end which is slightly different than shown on the drawing.

The Replaceable Suction Filters are listed by Underwriters' Laboratories, Inc. for a working pressure of 500 psi on the smaller sizes and 400 psi on the 2 5/8" and 3 1/8" line sizes. UL Guide Card SMGT and File No. SA1756. They are also certified by the Canadian Standards Association in File LR 19953.

Corrosion Resistance

The shells of the Replaceable Suction Filters are constructed of steel with copper fittings. The steel shell is protected from corrosion by an epoxy powder paint system. The resulting finish will withstand over 700 hours in a salt spray test. This construction has given excellent service in suction line applications over a period of many years.

Filter Elements

All Sporlan Replaceable Suction filters use the Type RPE 48 BD pleated element. The RPE48 BD is a direct replacement for the RFE 48 BD felt element. The pleated element filter offers 7 times the surface area of the previous felt element. This results in greater dirt capacity at a minimum pressure drop. The RPE 48 BD has perforated metal tubes around the inside and the outside diameters, allowing the suction filter to tolerate flow in either direction. The "BD" indicates that the elements are Bi-directional. The RPE 48 BD should never be subject to reverse flow.

The RPE 48 BD pleated element can also be used with CatchAll replaceable core type filter driers, (C485 through C 19217G), when these filter driers are used in the suction line. This situation may occur when cleaning up a system after a hermetic motor burnout. Desiccant cores are first used to collect acid, moisture, and sludge from the burnout. The pleated elements (RPE 48 BD) are then installed and left in the system to obtain the lowest possible

pressure drop. The RPE 48BD can also be used in 4 3/4" replaceable filter shells supplied by other manufacturers. A large RPE 100 is also available for the larger replaceable core filter drier shells (C 30013 G through C 40033 G) when they are used in the suction line. For more detailed information, see Bulletin 40 10.

NOTE: The pleated Suction Filter elements are not suitable for use on ammonia systems.

Selection

The table above gives nominal HORSEPOWER ratings for the various size Replaceable Suction Filters. When using units of HORSEPOWER these approximate ratings can be used for any evaporator temperature. However for most accurate selection, the suction flow capacity in TONS at the proper evaporator condition should be used. These selections are for permanent application on new systems. See page 8 for Recommendations for temporary application to clean up a system after burnout.

The table gives the flow capacity in tons for various refrigerants at various evaporator temperature conditions involved. These flow capacity ratings in TONS apply for units with the RPE 48 BD element in place and flowing in either flow direction.

The first two digits of the type number indicate the fact that the "48" size element is used, or that in the "96" series, two of these elements are used. The last one or two digits in the type number indicate the connection size in 1/8's of an inch.

Application & Installation

Either the side fitting or the end fitting of the Replaceable Suction Filters can be used as the inlet connection. All Replaceable Suction Filters are supplied without filter elements. For special considerations, see the system clean up section...

During installation the shell should be supported properly so that it does not hang on the suction line. The use of Sporlan A 685 mounting brackets is recommended. During installation the RPE 48 BD element is assembled between the spacer plates and the springs are attached. A replacement gasket for the end plate of the shell is supplied with each RPE 48 BD along with detailed instructions. The fittings on the Replaceable Suction Filters are attached to the shell with high melting brazing material. Therefore, the unit may be brazed into the line using Sta Brite, silver solder, sil fos, or other brazing materials.

An access valve and cap are supplied for use in the 1/4" NPT hole in the end plate of the Replaceable Suction Filter. When the side fitting is used as the inlet, then a pressure gauge can be attached to the access valve as shown in Figure 1. This permits measuring the pressure drop from the upstream side of the filter element to the gauge connection on the suction service valve. Excessive pressure drop caused by plugged filter elements will be easily noticeable, and the elements can be changed as required. The access valve can also be used for charging.

System Clean Up

If a hermetic motor burnout occurs on a system that has a Replaceable Suction Filter already installed—then use cores in the RSF unit for clean up, following the maximum size recommendation in the table above. Proper clean up of most hermetic motor burnout will generally require a greater amount of desiccant than is available in the RSF unit. Therefore,

the core should be changed at least once. The pressure drop across the RSF should be checked during the first few hours of operation to determine if the cores need changing. After clean up, replace the cores with pleated elements.

If no RSF was originally installed on the unit select a Suction Line Filter Drier or Replaceable core Catch AII Filter Drier for installation in the suction line wherever possible. These Catch Alls have the large amount of desiccant that is needed to provide adequate clean up on a system that has had a hermetic motor burnout. If the Replaceable Core Catch AII is too large to physically fit into the space available on the unit involved, then select a Replaceable Suction Filter from the table above. Change the cores at least once, and after clean up remove the 100 mesh screen and install a pleated element. Bulletin 40 109 gives additional selection information.

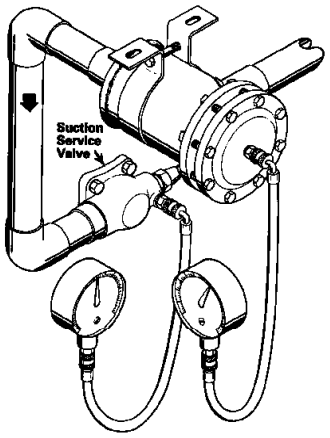


Figure 1

Measuring Pressure Drop

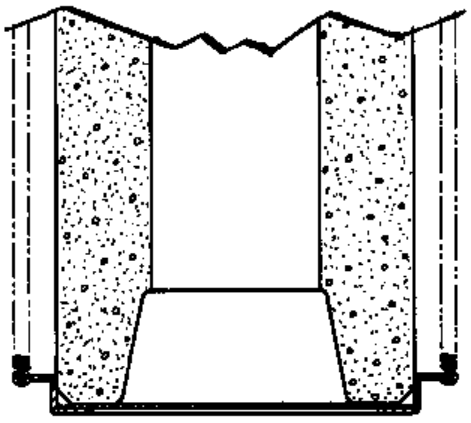
In using the replaceable suction filters with cores, (i.e. Types RC 4864, RCW 48, and RC 4864 HH) the unit must be piped with the side fitting as the inlet. The core is installed in place of the pleated element and a special 100 mesh screen (Part No. 6171 5) is installed. This screen is necessary as a safety filter. The screen is not shipped with the Replaceable Suction Filter, since these units are normally used with pleated elements instead of cores. The screen is available through Sporlan wholesalers as an accessory.

Install The Screen

As shown in Figure 2, the screen is installed between the outlet core spacer plate and the core. This assembly is then inserted as the first core into the Replaceable Suction Filter with the screen end in first. In this way the screen is at the outlet end of the Replaceable Suction Filter and serves as a final filter. Instructions for installing the screen are printed on the package, and on a label attached to the Replacement Suction Filter shell.

Figure 2

Screen 61871-5



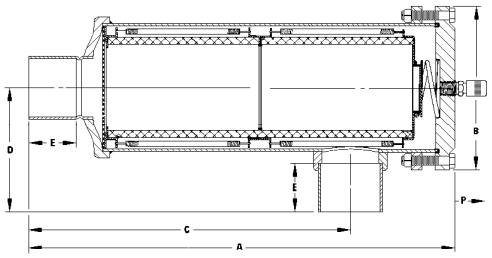
The screen and the core significantly increase the pressure drop through the unit. Therefore, after the clean up is complete, the core should be replaced with pleated elements AND THE SCREEN SHOULD BE REMOVED. Because of the increased pressure drop, the screen should not be used when pleated elements are installed.

Since hermetic motors rely on refrigerant vapor for cooling, the pressure drop in the suction line must be limited to a reasonable value. The maximum recommended values are shown in the table below.

Selection should be based on the full compressor capacity. This will provide some margin of safety, since the unit will frequently operate with one step of unloading when a core is used.

Maximum Recommended Pressure Drop—Psi For Suction Line Filters Or Filter Driers				
System	Permanent Installation		Temporary Installation	
	R 22 & R 502	R 12 & R 134a	R 22 & R 502	R 12 & R 134a
Air Conditioning	3	2	8	6
Commercial	2	1 1/2	4	3
Low Temperature	1	1/2	2	

- For information on Catch AII Filter Driers, Suction Line Filter Driers, and recommendations for Clean up after burnout, request Bulletin 40 10.



Head pressure control

Kysor//Warren offers the following head pressure control arrangements:

An inlet pressure regulator in the discharge line with a wide-open solenoid that acts in response to hot gas defrost occurrences. This system operates as a floating head system when not in defrost and a minimum head system when in defrost. This system may optionally have:

1) a receiver pressure regulator
2) a condenser fan cycling package
3) a condenser splitting package
4) a drop leg pressure regulator.

An inlet pressure differential regulator in the discharge line with a solenoid that acts in response to hot gas defrost occurrence. This system operates as a float head system. This system may optionally have:

1) a receiver pressure regulator
2) a condenser fan cycling package
3) a condenser splitting package
4) a drop leg pressure regulator.

An inlet pressure regulator in the discharge line that allows the system to operate as a fixed head pressure system. This system may optionally have:

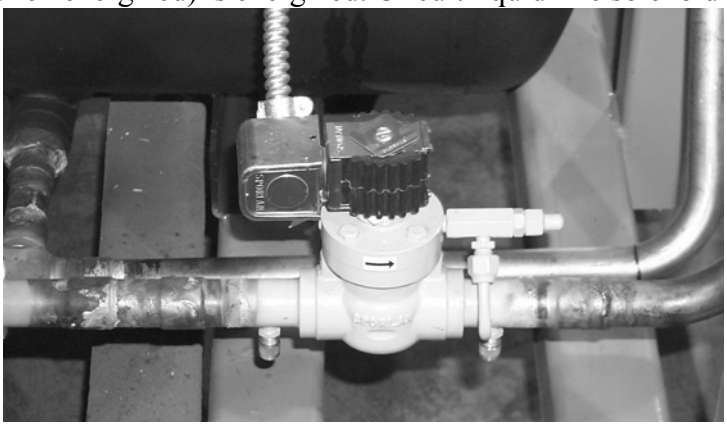
1) a receiver pressure regulator
2) a condenser fan cycling package
3) a condenser splitting package

Hot Gas Defrost

Due to the compactness of the parallel system and the availability of hot gas at the unit, hot gas defrost can be readily incorporated into the total custom design. The hot gas header at the rear of the unit is installed between the liquid and suction headers on top liquid feed systems. It is between the liquid header and control panel on bottom feed systems. Manual shut off and solenoid valves are factory installed and wired.

The hot gas line is piped into the suction line up stream of the EPR or solenoid valve. Cases are equipped accordingly when ordered.

When defrost is initiated by the time clock the master liquid line solenoid or OLDR (a normally open valve that closes when energized) is energized. Circuit liquid line solenoid (if used) and suction stop are de energized. The hot gas enters the suction line and travels to the evaporator (reverse cycle). As the hot gas condenses in the evaporator, it travels around the expansion valve through a check valve and back through the liquid line header. This returning liquid in turn feeds the circuits still calling for refrigeration.



Should the returning liquid not be adequate for the demand, the pressure in the liquid header will start to drop. When a difference of twenty (20) pounds between the liquid header and main liquid line pressure occurs, a twenty (20) pound differential check valve (either piped in parallel with the main liquid line solenoid or as an integral part of a Sporlan OLDR will open and supply the required liquid.

OLDR

A typical piping schematic for gas defrost can be found in this manual.

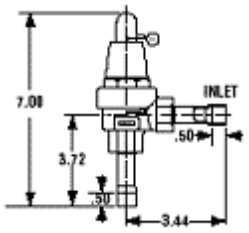
Sporlan Hot Gas Solenoid Valve

Unless otherwise instructed at order entry a hot gas solenoid valve manufactured by Sporlan Valve Company will be used on all hot gas circuits. This valve is supplied with a manual operation stem and a 208 240VAC coil.

MB19S2

Henry Bypass Valve

The following is an excerpt from a Henry Bulletin on Henry Bypass Valve.



Features:

1) Brass construction

2) 5⁄8" O.D.S. extended brass connections

3) Positive pressure relief

4) Consistent operation

5) Excellent reseating characteristics

6) Suitable for refrigerants 12, 22, 500, 502, 123, 134A, and other industrial fluids non-corrosive to brass, steel and Teflon

7) Factory set and sealed

Notes:

The Henry By-Pass Valve was designed to handle momentary instances of over pressure (not a fire). It by-passes excess pressure to the low side of the system thus preventing the catastrophic relief valve from discharging refrigerant into the atmosphere. If the over pressure increases then the catastrophic relief valve will be activated.

The By-Pass Valve is an indirectly spring loaded diaphragm type of valve. System pressure acts on the diaphragm causing the piston to lift from the valve seat. The valve has relatively low flow rates. It's primary function is to by-pass only enough gas so as to reduce the effects of the high pressure spiked. High flow rates would adversely affect system performance.

Continued by-passing of refrigerant for extended periods of time can lead to loss of system capacity, excessively high temperatures at the compressor and possible compressor failure. We recommend a sensor be put in the discharge line from the valve to monitor if the valve was relieving from the high side to the low side.

Orders must specify pressure setting. Range 150 to 450 PSI

Standard settings are:

250 PSI (For 300 PSI, Relief Valve)

290 PSI (For 350 PSI, Relief Valve)

330 PSI (For 400 PSI, Relief Valve)

350 PSI (For 425 PSI, Relief Valve)

375 PSI (For 450 PSI, Relief Valve)

At what pressure should these devices be set? A typical installation with a pressure vessel having a maximum working pressure of 400 PSI might be:

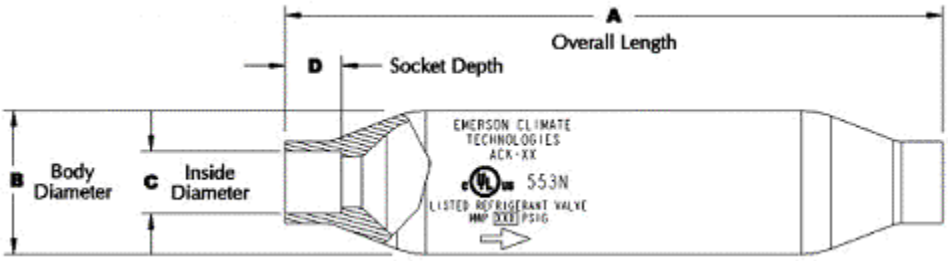
Relief Valve: Set the design working pressure 400 PSI of the vessel or 25% higher than the maximum working pressure of the system

High/Low Side Valve: Set at approximately 330 PSI 80-85% of the relief valve setting

Sealed Check Valve

If an optional liquid line solenoid is installed on a hot gas defrost circuit then a sealed check valve is installed as a bypass with the solenoid. Flow Controls, Watsco or Parker may manufacture the check valve.

Flow Controls ACK Check Valve:



PCN	Description	Connection Size	A (in.)	B (in.)	C (in.)	D (in.)
054985	ACK-4	1/4 ODF	4	7/8	.254 ± .002	0.19
054986	ACK-6	3/8 ODF	4	7/8	.379 ± .002	0.40
054987	ACK-8	1/2 ODF	5	1-1/8	.504 ± .002	0.31
054988	ACK-10	5/8 ODF	5	1-1/8	.629 ± .002	0.50
054989	ACK-12	3/4 ODF	7	1-5/8	.754 ± .002	0.63
054990	ACK-14	7/8 ODF	7	1-5/8	.879 ± .003	0.75
054991	ACK-18	1-1/8 ODF	8-3/8	2-1/8	1.130 ± .003	0.94
054992	ACK-22	1-3/8 ODF	9-3/8	2-5/8	1.380 ± .003	1.04
054993	ACK-26	1-5/8 ODF	10-1/2	3-1/8	1.630 ± .003	1.07
054994	ACK-34	2-1/8 ODF	12	3-5/8	2.130 ± .003	1.34
054995	ACK-42	2-5/8 ODF	13	4-1/8	2.630 ± .003	1.50

Floating Head with Hot Gas Defrost

A typical piping arrangement for a refrigeration system incorporating heat reclaim, remote condenser, gas defrost and ambient liquid sub-cooling may be found in the drawing section of this manual.

The intent of this arrangement is to obtain maximum liquid sub cooling in low ambient temperatures.

Components and recommended settings:

1) A8_B inlet pressure regulator with solenoid wide open feature this valve is located in the main discharge line and is used to create a minimum head for hot gas defrost. When no hot gas defrost is required the solenoid will send the valve to a wide open state. At that time the valve will let the head pressure float. The pressure difference required for defrost is normally obtained by using an OLDR valve.

2) A8_BL differential pressure regulator this valve is located in the main discharge line and is used to create the 20 to 25 psig differential required for gas defrost. The valve is adjusted during the defrost mode to maintain a 20 to 25 psig differential between the discharge and liquid header pressures.

3) A8 pressure regulator heat reclaim return the A8 at this location is optional and is used to maintain a minimum head pressure when the system is in the heat reclaim mode. This valve is normally set to maintain 105 to 110°F condensing temperature in the heat reclaim coil.

4) A8 pressure regulator condenser return the A8 at this location is used to establish a minimum head pressure for floating head operation. Normally on R502, this valve would be set at 140 to 150 psig; on R22 set at 140 psig.

5) A9 pressure regulator receiver pressure the A9 valve is used to maintain a constant pressure on the receiver to insure adequate sub cooling to prevent flashing and insure a constant liquid feed. This valve should be set at the same pressure as the A8 in the condenser return line.

6) Note: An alternative arrangement for an uncontrolled floating head would remove the A8 in the condenser return line and change the A9 to an Y894 1 pressure differential valve. The Y894 1 senses receiver pressure and liquid drop leg pressure. This insures a solid column of liquid under all pressure conditions. Some units are provided with an A9 and Y894 1 in parallel.

7) Condenser fan controls condenser fans can be controlled on the basis of pressure or temperature; however, the most effective method is a combination of the two. To accomplish this, all fans except the last fan or bank of fans should be controlled by pressure. The fans controlled by pressure should operate in the 180 to 200-psig range. The last fan or bank of fans should be controlled by liquid drop leg temperature. These fans should be set to maintain 55°F.

Sporlan OLDR Valve

The following excerpt is from Sporlan Bulletin F90 60 2 dated August 1989. References to LDR, XTM and XTO have been edited out, as they do not apply.

Subject: Liquid Line Differential Regulating Valve OLDR

In many supermarket applications refrigerant gas from the discharge line or from the top of the receiver is used for defrost by diverting a portion of the flow to the suction line and back through the evaporator being defrosted. The gas condenses in the evaporator and flows in reverse around the TEV and liquid line solenoid valve through check valves. This liquid refrigerant then flows to the liquid header where it is distributed to evaporators not in defrost. In order for this reverse flow to occur, the pressure of the defrost header must be greater than the pressure of the liquid header.

Several methods are used to obtain this differential. A common liquid line method is to install a differential valve in parallel with a solenoid valve between the receiver and liquid header. The solenoid valve is closed during defrost allowing the differential valve to control. The liquid line differential pressure regulating valve combines the features of a separate differential valve and solenoid valve. The advantages of this type of valve are a reduction in piping costs and the added ability to adjust the differential.

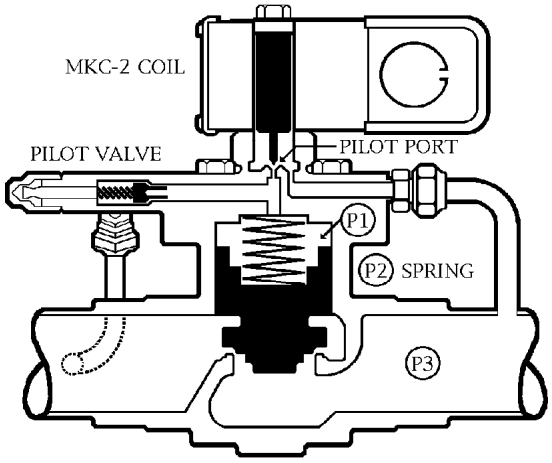
Differential Valve Design

This valve has a solenoid bypass feature so that the valve can either remain fully open or operate to maintain a differential. We supply two versions of this valve:

The OLDR uses an MKC 2 coil and fails in the open position. (Figure 3)

A pilot differential valve controls the valve by varying the pressure on top of the main piston. These valves are available in two port sizes. Inlet pressure enters the pilot assembly through a passageway in the valve body on the smaller size and through an external tube connected to the inlet fitting on the larger size. The outlet of the pilot differential valve is connected to the outlet fitting with an external tube on both valves.

Figure 1. OLDR 20, Coil Energized, Differential Operation.

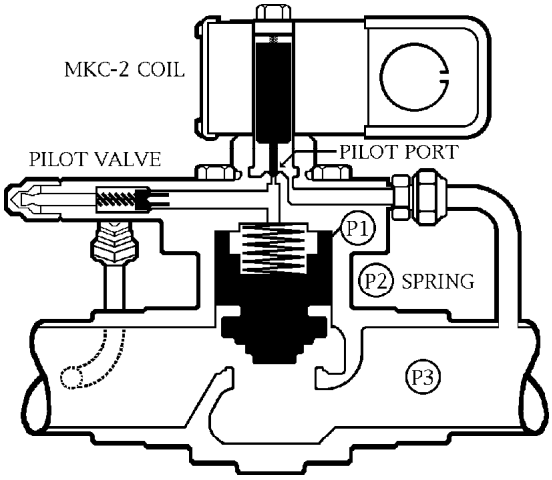


Differential Operation (OLDR Coil Energized)

The valve is in the differential mode when the solenoid coil is energized on the OLDR valve and de energized on the LDR valve. The plunger lifts off of the pilot port, allowing inlet pressure to enter the chamber on top of the main piston and bleed out through the pilot differential valve. (see figure 1).

When the differential pressure across the valve is below the setting of the pilot valve, the pilot valve modulates closed. This allows pressure to build on top of the main piston. As this pressure (P1) approaches the inlet pressure (P3), the force combined with the force from the spring (P2) pushes the piston down, modulating the valve closed.

Figure 2. OLDR 20, Coil De Energized, Full Open Operation.



As the differential pressure rises above the pilot valve setting, the pilot valve modulates open. This bleeds refrigerant from the chamber on top of the piston at a faster rate than it is entering, so the pressure decreases. As this pressure (P1) plus the pressure from the spring (P2) falls below the inlet pressure (P3), the inlet pressure pushes the piston up, modulating the valve open. The valve will open only as far as necessary to maintain the pilot valve setting. The pilot valve will then modulate the piston from partially open to partially closed to maintain its setting.

Full Open Operation (OLDR Coil De Energized)

The valve is in the full open position when the coil is de energized on the OLDR valve and energized on the LDR valve. The plunger moves down to close the pilot port which stops all flow to the chamber above the piston. The refrigerant remaining above the piston then bleeds to the valve outlet through an orifice (bleed hole) in the pilot differential valve piston. The pressure in the chamber (Pl) decreases so the inlet pressure (P3) moves the piston up and the valve opens (see figure 2).

Note:

OLDR 15 size valves do not have the tube from inlet fitting to pilot assembly. Inlet pressure enters the pilot assembly through a passageway in the valve body (see figure 3).

Setting Procedure

The OLDR is set by turning the adjusting stem located under the cap on the pilot differential valve. Turning the stem clockwise increases the setting, counterclockwise decreases the setting. Adjustments must be made with the valve in its differential mode and no refrigerated cases in defrost, so that the head pressure is normal. Artificially low head pressure at the initiation of defrost can prevent a differential from occurring thereby making it impossible to set the valve. Therefore, always set the OLDR when, no cases are in defrost.

Once the valve is set it will control to maintain this differential setting during defrost. However, there are several system conditions that can cause the differential to change beyond the valve's control:

1 When a defrost is initiated the head pressure may fall. It can take several minutes for the differential to be created while the head pressure returns to normal.

2 If there is a very low requirement for refrigeration, and therefore a low demand for liquid refrigerant, the differential may never build up enough to reach the valve setting.

3 As a gas defrost cycle progresses, condensing occurs in the evaporators in defrost at a slower rate. Therefore, there is more gas present in the evaporators, which results in a

higher natural pressure drop. It is possible for this natural pressure drop to be higher than the differential valve's setting.

Important

To verify valve operation if no differential is occurring between the liquid header and the receiver during defrost, first take all cases out of defrost. Then put the valve in its differential mode and check its setting. If the valve is maintaining its set point with normal head pressures and no cases in defrost, then the valve is operating correctly and some other system condition such as outlined above may be causing the problem.

"O" – Normally Open
"LDR" – Liquid Differential Regulator
"–" – Dash
"15" – Valve Size
"–" – Dash
"5/50" – Adjustment Range psi
"–" – Dash
"1 3/8 ODF" – Connection Size
"–" – Dash
"120/50 60" – Electrical Specifications

Designation/Ordering Instructions

Sample valves are available to OEM's for testing. Select from the capacity table above. When ordering be sure to give complete valve designation including voltage and cycles.

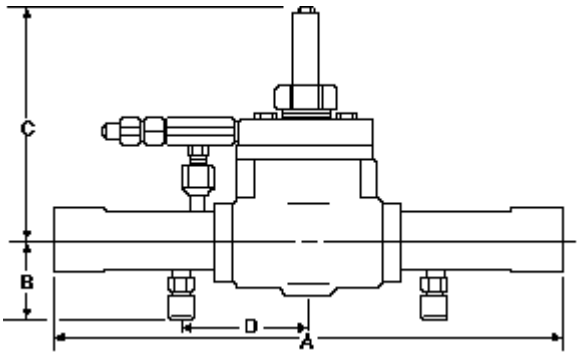
These valves are designed for supermarket applications. Please review any other potential applications with the St. Louis Office.

These valves are available to wholesalers for field replacements. The following replacement parts kits are also available.

Internal Parts Kits include: Stem and plunger assembly OLDR, Enclosing tube gasket, Piston assembly, Bottom spring and Tetraseal gasket.

Part No.	Description
KS OLDR 15	Internal Parts Kit
KS OLDR 20	Internal Parts Kit

Figure 3 OLDR 15:



Valve Type	Port Size In.	Diff. Setpoint Range	Connections Inches Inlet x Outlet	A	B	C	D	Coil
OLDR 15	1	5/50 psi	1 1/8 ODF x 1 1/8 ODF	10.06	1.66	5.00	2.68	MKC 2
OLDR 20	1 5/16		1 5/8 ODF x 1 5/8 ODF	11.06	1.66	5.54	3.35	MKC 2

		Tons of Refrigeration														
	Port	12					22					502				
Valve	Size	Pressure Drop Across Valve psi														
Type	Inches	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
OLDR 15	1	25.3	36.0	44.2	51.0	57.0	33.2	46.9	57.6	66.5	74.3	21.4	30.3	37.2	42.9	47.9
OLDR 20	1 5/16	56.3	79.7	97.6	113	126	73.4	104	127	147	164	47.6	67.0	82.1	95.1	106

FLO CON A8_ Valve

The following excerpt is from Parker Bulletin 25 94D dated August 2004.

COMPACT WIDE-RANGE PRESSURE REGULATORS

Type A8A, A81, A82

Ports 9mm (3/8") to 66mm (2 5/8") Nom.

FEATURES

- Dual spring for wide range pressure set-points
- Pilot operated for close control at desired set-point
- Excellent regulation at light loads
- Interchangeable capacity cartridges
- Inlet, outlet or differential regulator functions
- Low pressure drop
- Few moving parts
- Long-life stainless steel diaphragms (no bellows to fail)
- Variations available for pilot electric shut-off and pilot electric wide-opening pressure control
- Manual opening feature
- All service from the top
- Sweat-in-place without disassembly
- Furnished with access fitting

- UL listed (except 50 Hertz versions)

SPECIFICATIONS

- Design pressure (PS): 31.0 bar (450 psig)
- Range: 250mm hg to 27.6 bar (10" hg to 400 psig)

DESCRIPTION

These ductile iron-bodied regulators, with brazed copper couplings, will modulate the flow of refrigerant vapor or liquid to maintain a constant pressure at a control point regardless of fluctuations in load or ambient conditions, or alternate diversions for flow. Models are available in combinations of connection sizes, port sizes, functions and features as designated by the model code, for application in a wide variety of control functions on industrial, commercial and air conditioning systems. (3) control functions are available: Inlet, Outlet and Differential pressure control. (2) control features can be added by incorporating pilot solenoids; either Electric Shut-off (S) or Electric Bypass (also called Wide-Opening) (B).

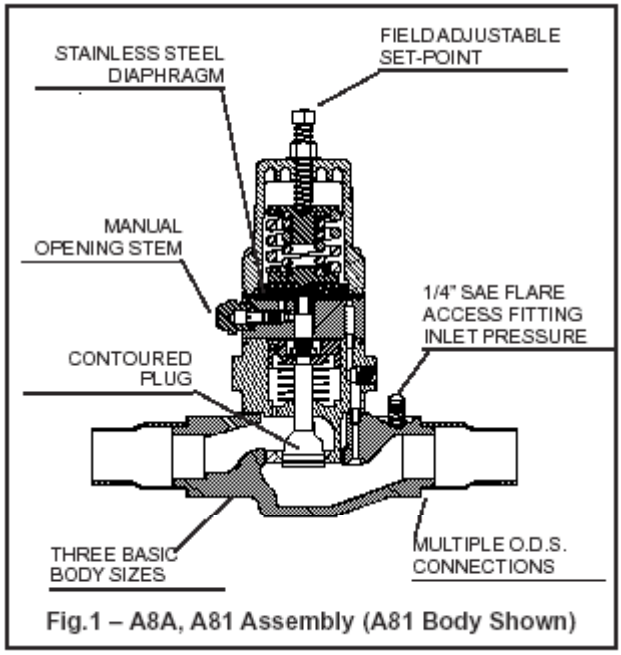


Fig.1 – A8A, A81 Assembly (A81 Body Shown)

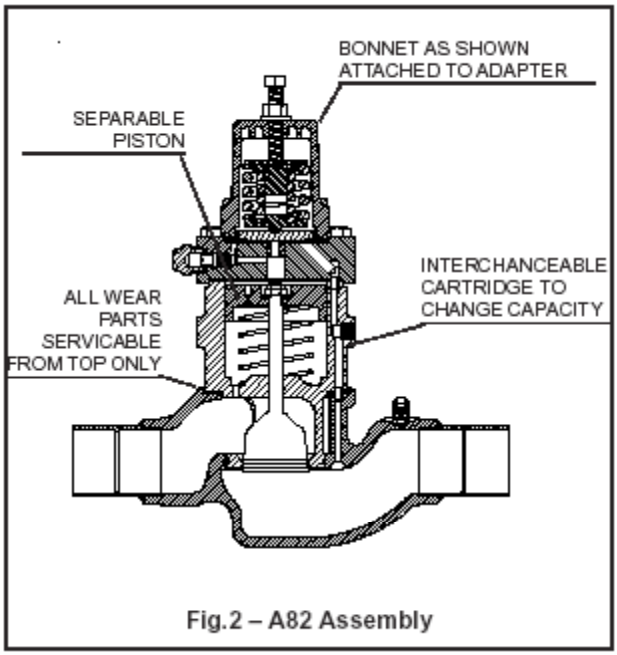


Fig.2 – A82 Assembly

The valves are an integrated assembly of (4) modules: 1) A body, which contains no moving parts, but is ordered to suit a particular connection size; 2) A capacity cartridge, which contains both piston and modulating plug, and defines the Port Size; 3) A pilot adapter, which defines the valve function and onto which the Pilot Solenoids providing either the "S" or "B" feature are added as required; 4) The bonnet, containing the Range Spring and adjustment screw, which mechanisms are set for the value of pressure which the valve is to maintain.

This unique modular design allows the regulator to be soldered into the line without disassembly, yet provides full access for disassembly, cleaning and servicing from the top only. Interchangeable capacity cartridges

facilitate flow revisions should an undersized or oversized condition be created, while pilot adaptors can be changed out to add features or even change functions. Thus, retrofitting for additional evaporator capacity, heat reclaim, or holdback for hot gas defrost is simple and requires no pipe line revisions under most circumstances.

All A8 series regulators for inlet and outlet functions feature the wide range pressure setting, 250mm Hg to 27.6 bar (10" VA. to 400 psig). Regulators for differential function have a range of 0 to 8.3 bar (0 to 120 psi).

PURPOSE

These valves will modulate to maintain a pressure as set for in the field, in spite of fluctuations in load, changes in ambient, changes in available refrigerant flow paths, and other operating variances. Appropriately sized, these valves will modulate the flow of liquid or vapor, high side or low side in a wide variety of system arrangements used in industrial, commercial and air conditioning installations. A particular inlet regulator can be applied to control evaporator, condensate, discharge or defrost relief pressure; a particular outlet regulator can be applied to control crankcase, receiver or hot gas bypass; or a differential regulator can be applied to maintain oil receiver pressure, or discharge differential, or liquid line differential pressure. Each port size will have a specific maximum capacity at full opening corresponding to the available or sensible pressure difference under which it will operate, for each of these applications. The prefix A8 defines a body or assembly style, in this case a direct-connected, O.D.S. stubbed, modular assembly, pressure regulator. The basic designations are A8A, A81, and A82, which, with no other suffix, define by default Inlet Pressure Regulators in the (3) available body sizes. To complete the purchasing specification for an inlet regulator with no additional features, the Port Size and Connection Size must yet be determined. For an Inlet Pressure Regulator, as the valve's inlet pressure increases even marginally above the set-point the valve tends to open, increasing flow and reducing inlet pressure. As operating conditions change and the inlet pressure tends to drop, the valve's port closes and the inlet pressure will tend to rise. In this fashion the valve continually adjusts its available flow area in response to flow conditions to maintain a practically constant inlet pressure.

The solenoid features can be designated for these inlet pressure regulators by adding the appropriate suffix, thus A8-S for Inlet Regulator with Electric Shut-off and A8-B for Inlet Regulator with Electric Wide Opening.

The suffix "O" defines a regulator whose function is to modulate flow to maintain a constant Outlet or Downstream pressure. This valve function requires that an external field installed connection be made between the pilot equalizing connection and the downstream pipe, thus the "O" designation is always accompanied by an "E" for externally equalized (A8-OE). The function now is to open and permit higher flows when outlet pressure tends to drop, and to close and reduce flow when outlet pressure tends to rise. In this fashion the valve is continuously adjusting its opening to maintain downstream pressure practically constant.

The outlet pressure regulators are available with the "S" feature, thus the designation A8-OES defines an Outlet Pressure Regulator with Electric Shut-Off, which will maintain constant downstream pressure when the coil is energized, and close tightly when the coil is de-energized.

The suffix “L” is added to designate a Differential Pressure Regulator. This valve function senses both Upstream and Downstream pressure and modulates to maintain the difference, practically constant. Thus the regulator responds to a rise in that pressure difference by opening the port, and responds to a drop in that difference by closing the port. An A8-L is a Differential Pressure Regulator.

The Differential Pressure Regulators can all be ordered with the Wide Opening Feature, by adding the suffix “B” to the valve designation. Thus, an A8-BL is a Differential Pressure Regulator when the solenoid coil is not energized, and will open wide, providing the system flow can maintain a minimum pressure difference of 1.5 psig, once the solenoid coil is energized.

The valve designation then describes the Body Size, Function, and Control Features of the Regulator. A complete specification for a regulator also includes: The Port Size: Selected according to the state and density of the refrigerant along with the sensible or available pressure difference under which the valve will operate; The Connection Size: Normally designated by the system designer, but often selected by the installer to match the line size as found in the field. Note that the particular combination of the above (2) sizes will normally indicate the appropriate body size, though there are some overlaps.

The Pressure Control Function: Inlet, by default; Outlet (OE) or Differential (L), according to just what pressure, or pressure difference, the designer or installer expects the valve to regulate.

The Control Features: Shut-off, “S” or Bypass “B”, as selected by the designer or the installer.

AND, ONLY FOR THOSE VALVES REQUIRING THE “S” OR “B” FEATURE: The Control Circuit Voltage: As required by the installation, consists of Voltage and, for A.C. circuits, Frequency.

All A8 regulators will permit reverse flow if the outlet pressure exceeds the inlet pressure by more than 0.14 bar (2 psi).

INSTALLATION

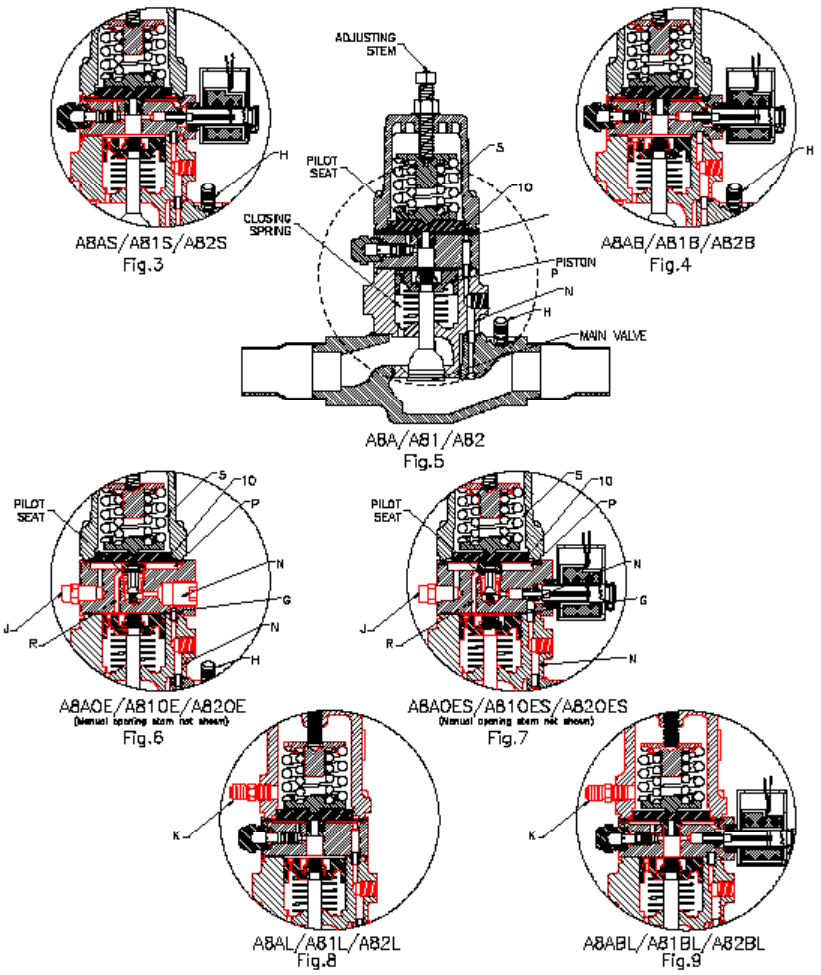
On the Types A8A, A81 and A82 Series Regulators, the proper direction of flow is designated by an arrow cast into the side of the valve body, pointing from inlet to outlet.

The regulator can be mounted in a horizontal or vertical pipe line with direction of flow as described above. As with all pressure regulators, these compact regulators can control flow in this normal direction only. If a change in system operating conditions causes the outlet pressure to rise sufficiently above the

inlet pressure, the Main Valve Assembly may be blown down from its seat and reverse flow can occur. This is often accompanied by a clicking noise. Protect the inside of the regulator from moisture, dirt, chips and solder beads during installation. These compact regulators may be soldered into the line without disassembly if reasonable precautions are taken. The flame from the soldering torch should be directed away from the valve body to avoid excessive heat build-up which could possibly damage some of the internal parts. As an additonal precaution, a wet cloth should be wrapped around the regulator body to dissipate some of the heat during the soldering operation.

PRINCIPLES OF OPERATION

(Referring to Valves as shown in Fig. 3-9)



In all cases, a throttling point serves to increase or reduce the rate of delivery of the pilot stream from the upstream side of the valve to the space on top of the piston, from which it is bled to the downstream via both a tiny hole through the piston and the clearance between piston and bore. An increased pilot stream flow increases the pressure on top of the piston which pushes the modulating plug down. Conversely, a decreased pilot stream flow reduces the pressure on top of the piston and permits the closing spring to push the modulating plug up, reducing the flow area available at the port. The pilot portion of the valve is devoted to administering this pilot stream flow, thus effectively controlling the main valve opening. The valve function (inlet, outlet, differential) is determined by the pressure condition to which the pilot aspect of the valve responds.

FOR AN INLET PRESSURE REGULATOR:

The inlet pressure is applied via Passage N to the underside of the #10 Diaphragm at Chamber P. Considering a valve that is initially closed, as the inlet pressure rises, the Diaphragm exerts a force upward against the #5 Range Spring. When that force developed by the inlet pressure is high enough, it will equal the spring force at that point of adjustment and the diaphragm will rise off its seat and permit flow from the upstream to Chamber G, thus raising the pressure on top of the piston, causing the Modulating Plug H to move down, and opening the port. Should the system conditions cause the upstream pressure to decrease, the Diaphragm will return to a position closer to the Pilot Seat, reducing the pilot stream flow, and allowing the pressure in Chamber G to bleed away somewhat, which permits the closing spring to move the modulating plug up, thus closing the port.

FOR AN OUTLET PRESSURE REGULATOR:

The external, field installed connection is run from the Fitting J to the appropriate space where the pressure is to be controlled. If this is the pressure at the outlet of the valve, then downstream pressure is communicated to the space beneath the Diaphragm #10. As outlet pressure drops, the Range Spring overcomes the force developed by the Diaphragm #10, pushing it down and opening the passage in the Pilot Seat. Thus, the pilot stream flow from the inlet side of the valve via Passage N increases, raising the pressure in Chamber G and pushing the piston and modulating plug down, causing the port to open. As downstream pressure increases, the force developed by the Diaphragm #10 increases, overcoming the range spring force, and the Pilot Passage closes, reducing pilot stream flow and the pressure at Chamber G, permitting the closing spring to move the Modulating Plug up, and reducing the available flow area.

FOR A DIFFERENTIAL PRESSURE REGULATOR:

The inlet pressure is applied to the underside of the Diaphragm #10 and the outlet pressure is field connected to the Fitting K on the Special bonnet, such that pressure is applied to the top of the Diaphragm #10. The force applied against the range spring by the diaphragm is now due to the difference between the inlet pressure and the outlet pressure. As the inlet pressure rises to exceed the outlet pressure by more than the compressive force of the spring, the diaphragm will tend to lift and the pilot stream increase, applying more pressure to the top of the piston and increasing the port area available to flow. As conditions change and the Outlet Pressure rises to reduce the difference between inlet and outlet, the Diaphragm 10 will be pushed down toward its seat by the Range Spring, which will decrease the pilot stream flow, reduce the pressure in Chamber G and permit the closing spring to raise the modulating plug, thus reducing the available flow area.

ITEM	DESCRIPTION	QTY	FOR A8A KIT NO.	FOR A81 KIT NO.	FOR A82 KIT NO.
17	Cartridge Assembly	1	Only with kit	Only with kit	Only with kit
14, 17, 17A, 18	Cartridge Assembly (Red 5/8")	1 ea	202712	202712	—
14, 17, 17A, 18	Cartridge Assembly (Full 5/8")	1 ea	202711	202711	—
14, 17, 17A, 18	Cartridge Assembly (7/8")	1 ea	202710	202710	—
14, 17, 17A, 18	Cartridge Assembly (1-1/8")	1 ea	—	202709	—
14, 17, 17A, 18	Cartridge Assembly (1-3/8")	1 ea	—	202708	—
17B	Capacity Cartridge Housing, A82	1	—	—	Only with kit
14, 17A, 17B, 18, 26, 30	Complete Capacity Cartridge, 1-5/8 P.	1 ea	—	—	203811
14, 17A, 17B, 18, 26, 30	Complete Capacity Cartridge, 2-1/8 P.	1 ea	—	—	203812
14, 17A, 17B, 18, 26, 30	Complete Capacity Cartridge, 2-5/8 P.	1 ea	—	—	203813

ITEM	DESCRIPTION	QTY	FOR A8A, A81 KIT NUMBER	FOR A82 KIT NUMBER
1	Adjusting Stem (All except "L")	1	301888	301888
1A	Adjusting Stem ("L" Types only)	1	Only with kit	Only with kit
1A, 25, 26	Adjusting Stem Kit ("L" Types only)	1 ea	201698	201698
2	Adjusting Stem Seal Nut	1	301836	301836
3	Bonnet (All except "L")	I	Only with kit	Only with kit
3, 11, 8	Bonnet Kit (All except "L")	1 ea	200910	200910
3A	Bonnet ("L" Types only)	1	Only with kit	Only with kit
3A, 11, 12, 32, 33, 33A	Bonnet Kit ("L" Types only)	1 ea	202714	202714
4	Upper Spring Rest	1	Only with kit	Only with kit
5	Range Spring (Outer)	1	Only with kit	Only with kit
5A	Range Spring (Inner)	1	Only with kit	Only with kit
7	Lower Spring Rest	1	Only with kit	Only with kit
8	"O"Ring Diaphragm Follower (All except "L")	1	Only with kit	Only with kit
4, 5, 5A, 7, 8, 11	Spring Kit (All except "L")	1 ea	202205	202205
4, 5, 7, 11	Spring Kit ("L" Types only)	1 ea	202702	202702
6, 6A	Bolt Package (All except "OE and L') A82	4 ea	—	203820
6, 6A	Bolt Package ("OE" Types only) A82	4 ea	—	203821
6, 6A	Bolt Package ("L" Types only) A82	4 ea	—	203822
6	Bolt Package (All except "OE" and "L") A8A, A81	4	202717	—
6	Bolt Package ("OE" Types only) A8A, A81	4	202716	—
6	Bolt Package ("L" Types only) A8A, A81	4	20271 8	—
8, 11, 12, 14, 17A,	Gasket/O-Ring Kit, All Types except "L"	8	202701	203818
18, 19, 37				
11, 12, 14, 17A, 18, 19,	GaskeVO-Ring Kit "L" Type	10	203714	203819
32, 33, 33A, 37				
9	Diaphragm Follower	1	Only with kit	Only with kit
8, 9, 11	Diaphragm Follower Kit	1 ea	200911	200911
	(Do not use O-Ring on "L" versions)			
10	Diaphragm	1	Only with kit	Only with kit
10, 11, 12	Diaphragm Kit	1 ea	200873	200873
13	AdapterAssembly	1	Only with kit	Only with kit
20	Seal Cap	1	Only with kit	Only with kit
11, 12, 13, 14, 19, 20	Adapter Assembly A8A, A81 Only	1 ea	202721	—
11, 12, 13, 14, 19, 20, 36, 37	Adapter Assembly A8AS, A81S Only	1 ea	202722	—
11, 12, 13, 14, 19, 20, 36, 37	Adapter Assembly ASAS, A81B Only	1 ea	202723	—
11, 12, 13, 14, 19, 20, 35	Adapter Assembly A8AOE, A81OE Only	1 ea	202720	—
11, 12, 13, 14, 19, 20, 35, 36, 37	Adapter Assembly A8AOES, A81OES Only	1 ea	202719	—
11, 12, 13, 14, 19, 20	Adapter Assembly A82 Only	1 ea	—	203803
11, 12, 13, 14, 19, 20, 36, 37	Adapter Assembly A82S Only	1 ea	—	203805
11, 12, 13, 14, 19, 20, 36, 37	Adapter Assembly A82B Only	1 ea	—	203804
11, 12, 13, 14, 19, 20, 35	Adapter Assembly A82OE Only	1 ea	—	203806
11, 12, 13, 14, 19, 20, 35, 36, 37	Adapter Assembly A82OES Only	1 ea	—	203807
15	Pin, Locating	2	N/A Separately	N/A Separately

16	Body Assembly	1	N/A Separately	N/A Separately
21, 22	Access Fitting and Cap	1 ea	N/A Separately	N/A Separately
23	Self-Lock Nut	1	—	Only with kit
24	Washer	1	—	Only with kit
25	O-Ring	1	—	Only with kit
26	Above 3 Items			—
14, 17A, 18, 26	Service Kit, Piston/Plug	1 ea	—	203823
27	Piston	1	—	Only with kit
28	Closing Spring	1	—	Only with kit
14, 17A, 18, 26, 27, 28	Piston Kit	1 ea	—	203824
29	Modulating Plug	1	—	Only with kit
30	Items: 27, 28, 29	-	—	Only with kit
31	Seal Cap (Only "L")	1	Only with kit	Only with kit
31, 32	Seal Cap Kit (Only "L")	1 ea	202713	202713
	(Discard gasket from kit)			
33	Retaining Ring, "L" Bonnet	1	Part of 201698	Part of 201698
33A	O/Ring, Adjusting Stem	1	Part of 210698	Part of 210698
34	1/4" SAE Flare Half-Union	1	Part of 202714	Part of 202714
35A	Seat, Pilot ("OE"Only)	1	Only with kit	Only with kit
35B	O-Ring, Pilot Seat ("OE" Only)	1	Only with kit	Only with kit
35C	Spring, Pilot Seat ("OE" Only)	1	Only with kit	Only with kit
10, 11, 12, 35A-C	Seat Kit, Pilot ("OE" Only)	1 ea	202715	202715
36	Solenoid Operator Assembly	1	Only with kit	Only with kit
36, 37, 38	Solenoid Operator Repair Kit	1 ea	202700	202700
39	Coil	1	Only with kit	Only with kit
40	Sleeve, Coil Insert	2	Only with kit	Only with kit
41	Clip, Coil Cover	1	Only with kit	Only with kit
39, 40, 41	Coil and Housing Kit 120V/60; 110V/50	1	202940	202940
39, 40, 41	Coil and Housing Kit 240V/60; 220V/50	1	202941	202941
39, 40, 41	Coil and Housing Kit 208V/60	1	202942	202942
39, 40, 41	Coil and Housing Kit 480V/60; 440V/50	1	202943	202943
39, 40, 41	Coil and Housing Kit 24V/60	1	202944	202944
39, 40, 41	Coil and Housing Kit 240V/50	1	202945	202945

THE SOLENOID FEATURES:

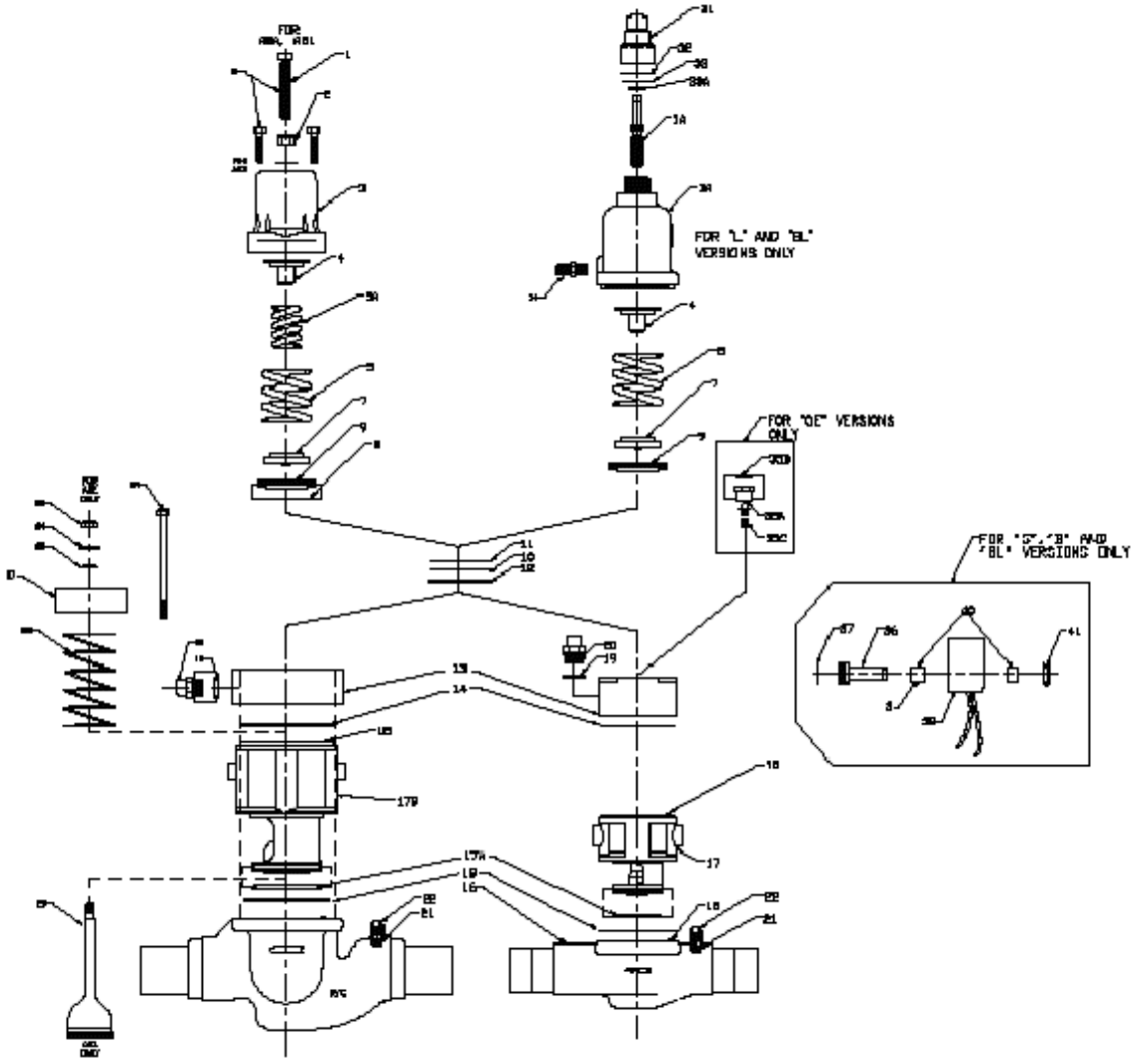
"S" for Shut-off, "B" for Bypass. To effect either of the features, a Solenoid is employed to modify the Pilot Stream at the Pilot Adapter. The Actuator is Normally Closed for both features, and can accept a variety of different coil voltages.

A valve with the "S" feature will act to regulate in its normal fashion, according to its function and as set-for, when its solenoid coil is energized, and shut tightly when the solenoid coil is de-energized. The pilot solenoid is arranged such that, when closed, it will intercept the pilot stream before it reaches the throttling device, thus ensuring that the pressure on top of the Piston is the same as Downstream pressure and permitting the closing spring to close the main valve. When the Solenoid is energized, it permits the full upstream pressure to be delivered to the throttling device.

A valve with the "B" feature will act to regulate in its normal fashion, according to its function and as set for, when its solenoid coil is de-energized, and will open wide when its coil is energized, providing the available flow can maintain a 1.5 psi minimum pressure difference.

Now the pilot solenoid is arranged such that, when energized it bypasses the throttling device in the pilot circuit and delivers full upstream pressure to Chamber G on top of the piston, causing piston and modulating plug to move all the way down and the main valve to open wide. When de-energized the pilot stream is managed by the normal throttling device, and the regulator will maintain its set-for pressure in its normal fashion. This feature is available for the Inlet and Differential regulator functions.

Figure 10



ADJUSTMENT

Adjustment of a regulator's set point requires that the pressure being controlled be monitored by an accurate pressure gauge. Before making any adjustments, the SEAL NUT #2 must be loosened. In all cases where the regulator is administering a pressure condition and a solenoid feature is not overriding that function, and the flow is in the normal direction, turning the ADJUSTING SCREW #1 in (i.e. clockwise) will raise the set point, and turning

it out (i.e. counterclockwise) will lower the set point. Depending on system responses, the gauge may reflect some delay before a change in set point actually results in a change in the pressure being maintained. This can also sometimes be observed following the energization or de-energization of the Solenoid Features.

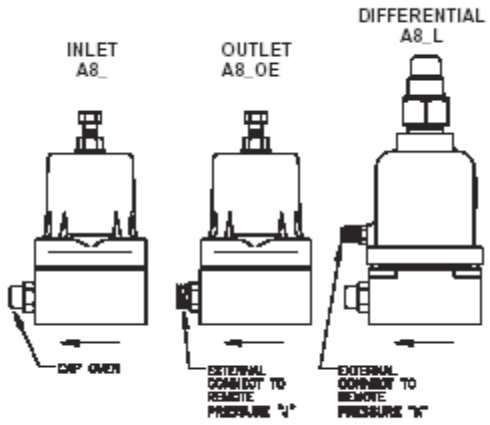


Fig. 11
External Differences in Pilot Section;
for Various Functions

For any Inlet Pressure Regulator, the Pressure Gauge can be connected to the Access Fitting H on the Inlet side of the regulator Cartridge Assembly #17. For an Outlet Pressure Regulator, if no system gauge is available to monitor the controlled pressure, an access fitting for the gauge will have to be incorporated into the External Equalizer. For a Differential Pressure Regulator, both upstream and remote pressure must be known before a sensible adjustment can be made. The inbuilt Access Fitting H reads only upstream pressure; the Bonnet Pressure must be measured by a second gauge.

For Inlet and Outlet Pressure Regulators: Between 0 and 6.2 Bar (90 psig), one complete turn of the Adjusting Screw will change the set point 1.4 Bar (20 psi). Between 6.2 Bar (90 psig) and 400 psig, one complete turn of the Adjusting Screw will change the set point 4.8 Bar (70 psi). For Differential Pressure Regulators, one complete turn of the Adjusting Screw will change the set point 1.4 Bar (20 psi) up to the maximum 8.4 Bar (120 psi) differential.

CAUTION: Regulators with B features can only be adjusted with the pilot solenoid de-energized. Regulators with the S feature can only be adjusted with the solenoid energized.

Always re-tighten the Seal Nut once adjustment is completed.

CONTROL CONFIGURATIONS TYPICAL APPLICATIONS	BODY SIZE & FUNCTION	PORT SIZES	CONNECTION SIZES	FEATURES (PILOT CIRCUIT) NOTE (1)
INLET PRESSURE (INTEGRATED) Evaporator Pressure Regulator Defrost Relief Regulator Head Pressure Control Heat Reclaim	A8A	3/8", 5/8", 7/8"	5/8", 7/8", 1-1/8"	Shut-Off "S" A8AS, A81S, A82S Wide Opening "B" A8AB, A81B, A82B
	A81	(3/8", 5/8")7/8", 1-1/8", 1-3/8"	1-1/8", 1-3/8", 1-5/8", 2-1/8"	
	A82	1-5/8", 2-1/8", 2-5/8"	1-5/8", 2-1/8", 2-5/8"	
OUTLET PRESSURE (EXTERNAL EQUALIZED)Crankcase Pressure RegulatorReceiver Pressure ControlHeat Reclaim	A8AOE	3/8", 5/8", 7/8"	5/8", 7/8", 1-1/8"	Shut-Off "S" A8AOES A81OES A82OES
	A81OE	(3/8", 5/8)" 7/8", 1-1/8", 1-3/8"	1-1/8", 1-3/8", 1-5/8", 2-1/8"	
	A82OE	1-5/8", 2-1/8"	1-5/8", 2-1/8", 2-5/8"	
DIFFERENTIAL PRESSURE (EXTERNAL EQUALIZED) Liquid Main Pressure ControlHeat ReclaimOil ReturnLiquid Overfeed Control	A8AL	3/8", 5/8", 7/8"	5/8", 7/8", 1-1/8"	Wide-Open "B" A8ABL A81BL A82BL
	A81L	(3/8", 5/8")7/8", 1-1/8", 1-3/8"	1-1/8", 1-3/8", 1-5/8", 2-1/8"	
	A82L	1-5/8", 2-1/8", 2-5/8"	1-5/8", 2-1/8", 2-5/8"	

DISASSEMBLY (See also Bulletin RSBCV)

All A8 series regulators can be disassembled and all serviceable and moving parts replaced without disturbing the piping, but of course, disassembly will cause exposure of some section of piping to atmosphere, which should be addressed before disassembly by evacuation and reclaim of the refrigerant.

For the A8A and A81 series Inlet and Outlet Pressure Regulators, the Seal Nut should be loosened and the Adjustment Screw backed out until no futher spring compression is felt. For the OE and L function valves, all external equalizers should now be carefully disconnected, taking care that any trapped refrigerant is allowed to escape slowly. For any Differential (L) Function regulator, remove the seal cap carefully to ensure all trapped refrigerant is safely vented; then back out the Adjusting Screw.

For the A82 series, if it is known that access to the Range Spring(s) #5 and Diaphragm #10 is not required, the sub-assembly from the Adapter up can remain intact and the regulator set point can thus be preserved, avoiding the need for gross adjustments when the valve is put back in service. If access to the pilot parts on an A82 is required, then the compression must be taken off the Range Spring as described above, and the Bonnet Bolts #6 removed. if a Solenoid Feature is incorporated, the Solenoid Coil #39 should now be removed by removing the Coil Cover Retaining Clamp. Never energize a Solenoid Coil that is not mounted and secured on its Solenoid Actuator #36.

If the subject valve is of the A8A or A81 series, then the 4-bolts retaining the Valve Assembly can now be removed. The bonnet can be easily lifted off, and will usually leave the Diaphragm #10 resting on top of the O-Ring #12. If the valve is of the A82 series, the bolts retaining the (3) lower sub-assemblies can now be removed. The wear aspects of the Adapter

Assembly #13 are the Diaphragm #10 and the Pilot Seat, which is pressed into the top of the Adapter #13, and which may cause replacement of that Adapter. Remove the diaphragms and inspect carefully for cracks, or scarring around the pilot seat area. This is most easily done by looking down a piece of large tubing, through the diaphragm, at a safety lamp or similar light source. Inspect the Pilot Seat area of Inlet or Differential regulators for erosion or other damage; it should be dead smooth to maintain a good metal-to-metal seat.

Removal of the Adapter Assembly #13 and the Cartridge Assembly #17 may require a sharp tap on their sides to unseat the parts from their sealed position, for which a rubber or rawhide hammer is recommended so as to avoid damage to the sealing surfaces. Removal of the Adapter #13 will expose the top of the piston. The top of piston space should be inspected now, and the piston pressed down by hand and permitted to return to ensure it is free. The return stroke is damped and is fairly slow, though there should be no dragging or hesitation. In the case of the A8A and A81, the Cartridge Assembly #17 is a sealed sub-assembly which must be replaced intact, but it is of very rugged construction so, with the exception of change to valve port size with changes in flow requirements, it should not require servicing beyond basic cleaning. With the Capacity Cartridge removed from the body, depress the piston and inspect the Seating Surfaces at the Modulating Plug for deleterious material, extraordinary wear, misalignment, etc.

Before re-assembly, all parts must be cleaned with a suitable solvent, permitted to dry, and lubricated with a light film of refrigerant oil, simply wiped on with the fingers, All gaskets and O-Rings should be renewed, and insertion and sealing will be facilitated if a similar film of oil is applied to them as well.

Re-assembly is exactly the reverse of disassembly, with the precaution that the reliefs cut into each module of the valve assembly and the corresponding gaskets be aligned with the appropriate Locating Pin #15. Ensure that all access fittings and external equalizing lines are sealed when re-installing the corresponding parts. Adjust all torques to the values indicated by Table 1.

Tighten all bolts equally to draw the assembly together evenly, to ensure properly sealing of all joints. Replace all Seal Caps as applicable. When re-adjusting following servicing, prevent excessive pressures by starting with the adjustment stems at low spring compression until the system approaches the desired operating pressures, then re-set as per "ADJUSTMENT", above.

ELECTRICAL

The Refrigerating Specialties Division molded water resistant Class "H" solenoid coil is designed for long lite and powerful opening force. The standard coil housing meets NEMA 3R and 4 requirements. This sealed construction can withstand direct contact with moisture and ice. By definition, Class "H" coil construction will permit coil temperatures, as measured by resistance method, as high as 185°C. (366°F.) Final coil temperatures are a function of both fluid and ambient temperatures. The higher fluid temperatures require lower ambient temperatures so the maximum coil temperature is not exceeded. Conversely, low fluid temperatures permit higher ambient temperatures.

A solenoid coil should never be energized except when mounted on its corresponding solenoid tube.

The molded Class "H" coil is available from stock with most standard voltages. However, coils are available for other voltages and frequencies, as well as for direct current. Coils are also available as transformer type with a 6 volt secondary winding for use with the Refrigerating Specialties Division Pilot Light Assembly Model PLT-2. See Bulletin No. 60-20.

The solenoid coil must be connected to electrical lines with volts and Hertz same as stamped on coil. The supply circuits must be properly sized to give adequate voltage at the coil leads even when other electrical equipment is operating. The coil is designed to operate with line voltage from 85% to 110% of rated coil voltage. Operating with a line voltage above or below these limits may result in coil burn-out. Also, operating with line voltage below the limit will definitely result in lowering the valve's maximum opening pressure differential. Power consumption during normal operation will be 10.2 wafts or less. On transformer coils the 6 volt leads are always black.

SAFE OPERATION (See Bulletin RSBCV)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent product bulletins and the current Bulletin RSB-FC prior to installation or servicing work.

WARRANTY

All products are warranted against defects in workmanship and materials for a period of one year from date of shipment from originating factory. This warranty is in force only when products are properly installed, field assembled, maintained and operated in use and service as specifically stated in catalogs or bulletins for normal refrigeration applications, unless otherwise approved in writing. Defective products or parts thereof, returned to the factory with transportation charges prepaid and found to be defective by factory inspection, will be replaced or repaired at the company's option, free of charge, F.O.B. factory. Warranty does not cover products which have been altered or repaired in the field, damaged in transit, accidents, misuse or abuse. Products disabled by dirt or other foreign substances will not be considered defective.

The express warranty above constitutes the only warranty of the company's products and is in lieu of all other warranties expressed or implied, written or oral, including any warranty of merchantability or warranty of fitness for a particular purpose, and in no event is the company responsible for any consequential damages of any nature, whatsoever. No employee, agent, dealer or other person is authorized to give any warranties on behalf of the company, nor to assume, for the company, any other liability in connection with any of its products.

TABLE 1 - TORQUES FOR RE-ASSEMBLY

(Presumes use of New Gaskets, O-Rings)

Location, Use	Description (SAE)	Required Torque	
		mkg.	Ft-Lbs.
Cartridges: A8A, A81	1/4"-20	1.1	8
Bonnet: A82			
Cartridges: A82	5/16"-18	1.7	12
Piston/Plug: A82		1.1	8
Jam Nut Solenoid Operator (all)		0.9	6

TABLE 2 - SERVICE POINTERS

Symptom	Probable Cause	Correction
Failure to open, close or regulate	Piston jammed due to excessive dirt	Flush clearance space between piston and cartridge bore with refrigeration oil solvent
	Valve manually open	Close manual bypass stem by turning clockwise
	Adjusting stem improperly Position:a. Turned in too far Does not open (inlet regulator)b. Not turned in far enough Does not close (inlet regulator) Does not open (Outlet regulator)	Position adjusting stem properly
	Passage “N” clogged	Clean passage “N”
	Pilot seat dirty or eroded	Clean and smooth pilot seat If diaphragm is removed, replace with new gasket and O-Ring
	Regulator installed backwards	Re-install regulator. in proper position
System control cannot be maintained–unstable valve operation	Improper Regulator selection:a. Actual load is much lower than regulator capacityb. Actual pressure drop across valve higher than originally intendedc. Combinations of a and b	Replace cartridge with one of suitable size

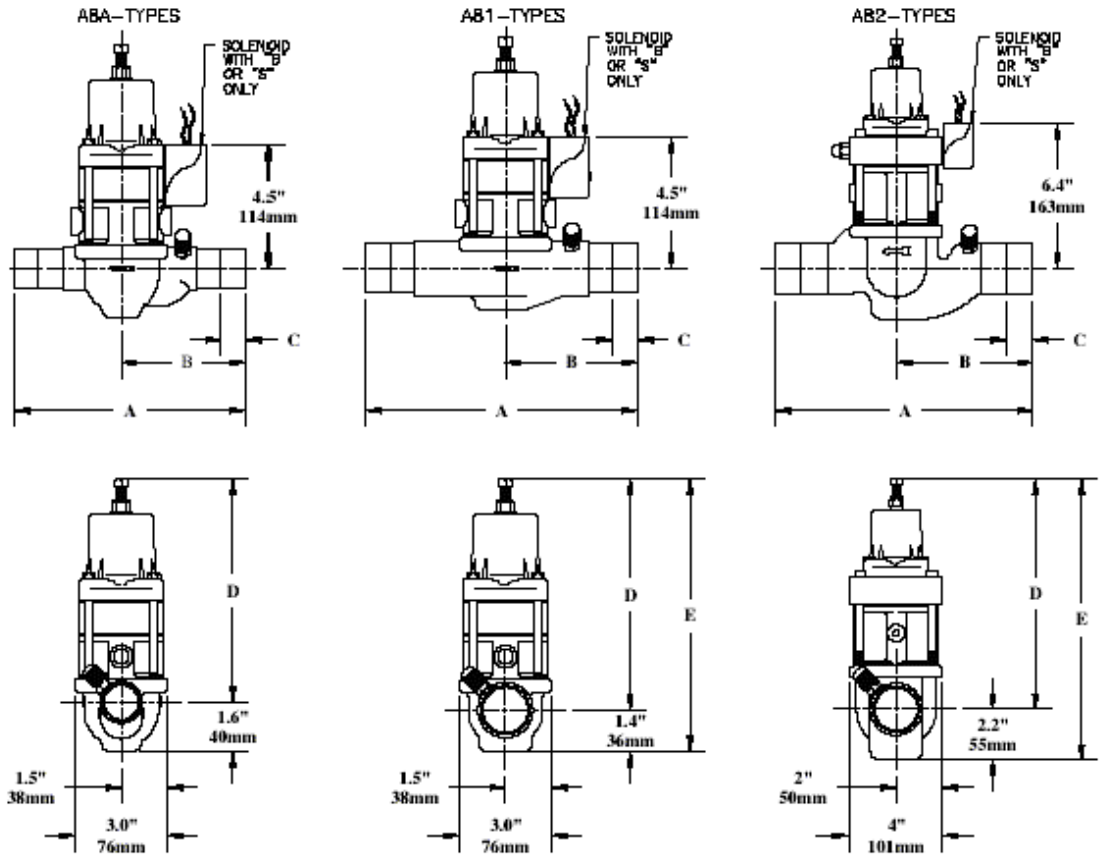


TABLE OF DIMENSIONS

Type	A8A (AllTypes)	A81 (All Types)	A82								
Connection Size	5/8"	7/8"	1-1/8"	1-1/8"	1-3/8"	1-5/8"	2-1/8"	1-5/8"	2-1/8"	2-5/8"	
	15 mm	22 mm	28 mm	28 mm	35 mm	42 mm	54 mm	42 mm	54 mm	67 mm	
A	Inch	7.2	7.5	8.0	8.9	9.4	9.9	11.1	11	12	13.5
	mm	183	190	203	226	239	251	282	279	305	343
B	Inch	3.9	4.0	4.3	4.5	4.7	5.0	5.6	5.9	6.4	7.1
	mm	99	102	109	114	119	127	142	149	162	181
C	Inch	0.6	0.8	1.0	1.0	1.0	1.1	1.2	1.1	1.4	1.7
	mm	15	20	25	25	25	28	30	28	36	44

Functions		A8A	-S, -B	-L	-BL	-OE, -OES	A81	-S, -B	-L	-BL	-OE, -OES	A82	-S, _B	-L	-BL	-OE
D	Inch	8.0	8.0	8.6	8.6	8.4	8.0	8.0	8.6	8.6	8.4	10.2	10.1	10.4	10.4	10.5
	mm	203	203	218	218	213	201	201	218	218	213	260	260	264	264	267
E	Inch	9	9.4	10.0	10.0	9.8	9.4	9.4	10.0	10.0	9.8	12.2	12.2	12.4	12.4	12.5
	mm	239	239	254	254	249	239	239	254	254	249	310	310	315	315	318

FLO CON A9 Valve

A typical piping arrangement for a refrigeration system incorporating heat reclaim, remote condenser, gas defrost and ambient liquid sub-cooling may be found in the drawing section of this manual.

The A9 valve is normally used as a receiver pressure regulator on Kysor//Warren parallel compressor systems.

The following excerpts are from Parker Bulletin 25 95E dated March 2002.

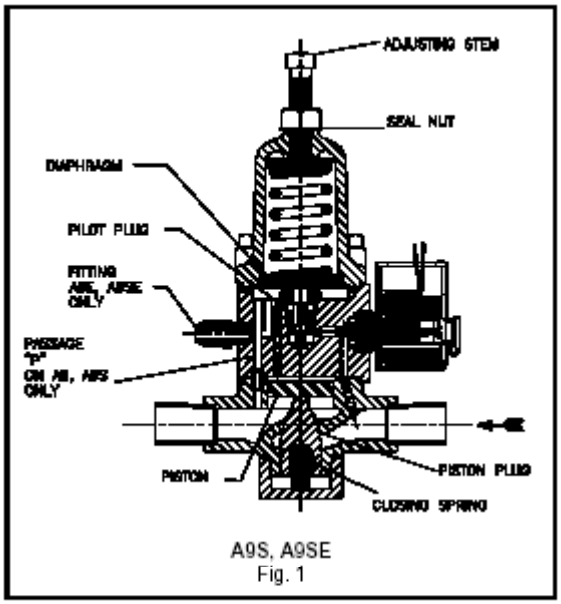
HOT GAS BYPASS REGULATOR

Types A9, A9E, A9S and A9SE

Port 9mm (3/8") to 28mm (1-1/8")

FEATURES

- Controls outlet pressure at sensing point
- Pilot operated for close regulation
- Few sizes cover entire capacity range
- External or internal equalizer
- Available with integral electric shut-off
- Tight seating - simple adjustment
- Sweat end design solders into line without disassembly
- Cleanable in line - Nominal capacities 1.3 to 24 tons
- CSA certified (A9S and A9SE types only)
- UL listed



A9S, A9SE
Fig. 1

SPECIFICATIONS

- 27.5 bar (400 psig) maximum rated pressure (MRP)
- Adjustment range: Range A = 250mm hg to 8.2 bar (10" hg to 120 psig); Range B = 5.5 to 15.1 bar (80 to 220 psig)

- Minimum pressure drop to open valve completely: 0.67 bar (10 psi)
- Maximum pressure change from valve closed to completely open: 0.34 bar (5 psi)
- Temperature range: -45°C to 93°C (-50°F to 200°F)

DESCRIPTION

These ductile iron bodied regulators with brazed copper couplings are used to modulate the flow of refrigerant gas to maintain a nearly constant outlet pressure at the sensing point. The regulators are pilot operated. The unique design allows the regulators to be soldered into the line without disassembly, yet allows disassembly of the valve for cleaning and maintenance without removing the regulator from line.

WHEN YOU ORDER

Please give valve size and type, and pressure range. If internally equalized is required specify the Type A9, otherwise externally equalized A9E will be supplied as standard. Standard outlet pressure Range A, 10" hg vacuum to 120 psig will be furnished unless otherwise specified. Range B, 80 to 220 psig is available at no extra charge. Pilot electric shut-off is available: specify A9S or A9SE and coil voltage and cycles.

PURPOSE

The A9 Hot Gas Bypass Regulators modulate the flow of refrigerant gas to maintain a nearly constant pressure at the sensing point at the outlet or at a remote point (A9E) of the regulator. The regulator allows loading of the system to eliminate short cycling of the compressors, provide required humidity control, and proper oil return.

OTHER USES

- Booster suction control to prevent deep vacuum
- Air cooled condenser control
- Hot gas defrost control
- Liquid pressure control

INTERNALLY EQUALIZED

This regulator is normally furnished as A9E externally equalized. The pressure being controlled is that pressure at the external equalizer connection. In many applications where it is acceptable to control the pressure at the outlet of the regulator, an internally equalized regulator should be used. In this instance, the A9 should be ordered.

NOTE: A9E or A9SE can not be converted to A9 or A9S without replacing the #22 adapter.

ELECTRIC SHUT-OFF

For pump-down control the regulator must be electrically shut off. Specify A9S or A9SE "with pilot electric shut-off" and specify voltage and frequency. Alternately, a separate full size solenoid valve can be used upstream of the regulator for shut-off.

Repair Kits for A9, A9S, A91E and A9SE Regulators (Refer to Figure2)						
Item No.	Description	Qty	Port Size			
			3/8	5/8	7/8	1-1/8
1, 2, 3,15	Spring Kit Range A	1	202200			
1, 2, 3,15	Spring Kit Range B	1	202201			
3,15	Follower Kit, Diaphragm	1	200896			
4, 5, 6, 8,14,15	Seat Kit Pilot, Range A	1	200859			
9,11,15,16	Gasket Kit	1	202420			
10, 9	Piston Kit	1	200897			
12, 11	Plug Kit	1	200895	200894	200892	200893
14(2),15,16	Diaphragm Kit Range A	1	200860			
14(3),15,16	Diaphragm Kit Range B	1	200862			
19,15	Bonnet Kit	1	200907			
22, 9,16	Adapter Kit A9E	1	200889			
22, 9,16	Adapter Kit A9	1	200890			
22, 9,16	AdapterKitA9SE	1	202401			
22, 9,16	Adapter Kit A9S	1	202402			
24	Bolt Pkg (A9, A9E)	4	202254			
24	Bolt Pkg (A9S, A9SE)	4	202255			
26, 11	Cover Kit	1	200891			
27	Repair Kit, Solenoid	1	202700			
39, 40, 41	Coil and Housing Kit 120/60,110/50	1	202940			
	Coil and Housing Kit 240/60, 220/50	1	202941			
	Coil and Housing Kit 480/60, 440/50	1	202943			
	Coil and Housing Kit 24/60	1	202944			
	Coil and Housing Kit 240/50	1	202945			
	Coil and Housing Kit 208/60	1	202942			
	Coil and Housing Kit 120/6/60	1	202946			
	Coil and Housing Kit 208/6/60	1	202947			
	Coil and Housing Kit 240/6/60	1	202948			
	Coil Assembly Q/D 240/60, 220/50	1	203730			
	Coil Assembly Q/D 240/50	1	203734			

BOLT TORQUE TABLE		
Item	Port Size	Torque
1-1/4" bonnet bolt	All	72 in lb

INSTALLATION

The regulator can be mounted in a horizontal or vertical line with the flow in the direction of the arrow on the valve body. The adjusting stem should not be located below the centerline of the valve. The valve should be installed in a manner that avoids trapping condensed refrigerant in the valve. Protect the inside of the regulator from moisture, dirt and chips during installation. These regulators may be soldered into the line without disassembly. A wet cloth should be wrapped around the valve and the soldering flame should be directed away from the valve body.

PRINCIPLES OF OPERATION

Referring to figure 3, control pressure is transmitted through #7 Fitting to space A under #14 Diaphragm. When this pressure is lower than the setting of the #2 Spring, this spring force pushed against the #5 Pilot plug moving it off the #4 Pilot Seat and the inlet pressure is transmitted from area X through passage N, pilotseat, and passage D to the chamber on top of #10 Piston. The difference in this pressure and the pressure in space M causes the

Piston to move the #12 Piston Plug off the seat allowing flow from inlet space X to outlet space B, increasing the controlled pressure.

As the control pressure increases, the #14 Diaphragm moves against the force of #2 Spring, allowing the #5 Pilot Plug to start to close and reduce the flow to the top of #10 Piston. The pressure on top of the piston bleeds to the space M and the force of #13 Spring causes the #12 Piston Plug to move towards closed position, thus reducing the flow through the valve and maintaining the control pressure.

In case of the internally equalized A9 the control pressure is sensed at the valve outlet and transmitted through passage P.

When a solenoid shut-off feature is used, the passage N is open only when the solenoid is energized.

During operation, the Main Valve will assume an intermediate or throttling position with respect to the regulator setting. A properly sized A9E Hot Gas Bypass Regulator will control to within 1/2 to 5 pounds of the pressure setting depending on the system operating characteristics and the sizing of the regulator.

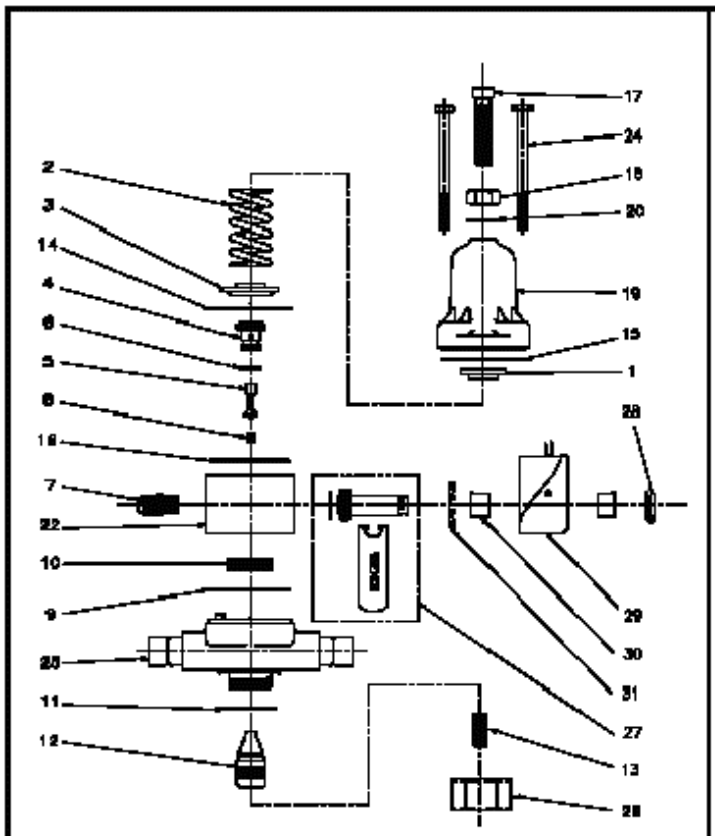


Fig. 2

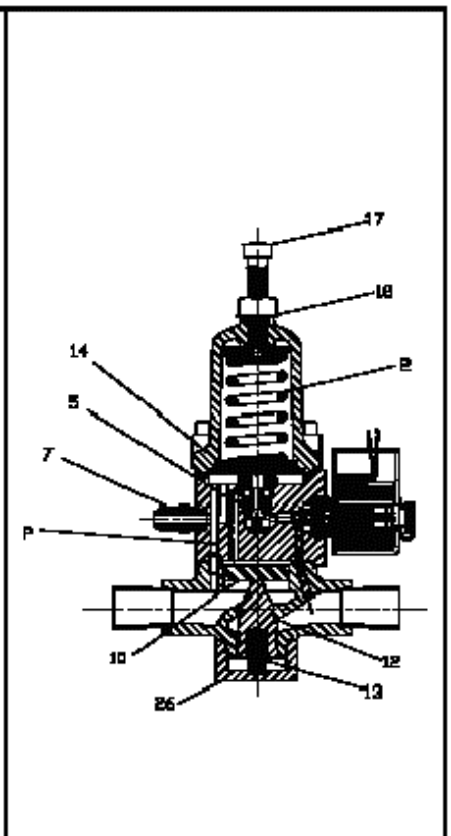


Fig. 3

ADJUSTMENT

Install an accurate pressure gauge at the control (sensing) point at the outlet side of the valve.

To adjust the valve, loosen #18 Seal Nut and turn the #17 Adjusting Stem clockwise to raise the pressure or counterclockwise to lower the pressure. For Range A one turn equals approximately 1.1 bar (16 psi), for Range B one turn equals approximately 1.7 bar (25 psi). The regulator should be set under actual operating conditions. For hot gas bypass this condition occurs under minimal system load conditions.

The regulator should be adjusted to maintain minimum desired suction pressure. Hot gas flow through the valve can be detected by listening to the gas flow through the regulator or by feeling the outlet pipe for warmth. When it is not possible to simulate minimum load conditions, an approximate setting may be obtained by adjusting the valve until gas flow begins, observing the gauge reading, and then turning the adjusting stem counterclockwise for the required number of turns to obtain the desired minimum pressure. This setting should be checked and readjusted as needed under actual conditions.

SERVICE POINTERS

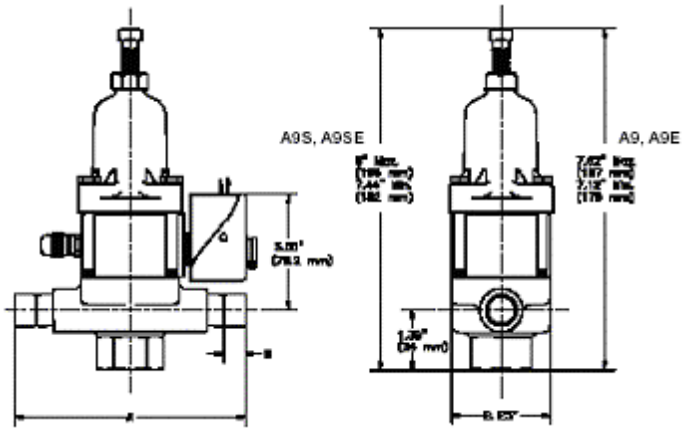
1. Failure to regulate: (a) #10 Piston may be jammed due to excessive dirt. This is the most likely cause of any regulator difficulties even when the regulator is preceded by a filter. Remove #24 Bolts. Remove #22 Adaptor. Push down on #10 Piston against the returning #13 Plug Spring Force. If jammed or sticky, remove #26 Bottom Cap and push up # 12 Piston Plug from the bottom with the blunt end of a wood pencil or similar tool #10 Piston should now pop free from #25 Body. Remove #12 Piston Plug by pushing from top to eject from the bottom. Clean all removed parts thoroughly. If jamming has occurred, remove all burrs from #10 Piston, #12 Piston Plug and Cylinder Wall with fine crocus cloth. Reassemble the regulator with a light coating of refrigeration oil on all parts. (b) #5 Pilot Plug may be dirty or eroded (inspect and replace if necessary). Remove #5 Pilot Plug by removing #4 Pilot Seat with a 5,18" socket. (c) # 14 Diaphragm may be broken or eroded (inspect and replace if necessary). (d) #14 Diaphragm may not be receiving downstream pressure. In the case of and A9E external equalized regulator, the pipe leading to a downstream source may be blocked by dirt or a closed valve. In the case of an A9 internally equalized regulator, passage P may be blocked by dirt.
2. Failure to open: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This is the most likely cause of not opening; to correct, see 1 (a) above. (b) # 17 adjusting stem may be turned out so far that a lower downstream pressure may be required to open the regulator than can be created by the system. (Turn in the #17 adjusting stem.) (c) #2 Diaphragm Range Spring may be the improper range for the pressure setting desired. This most likely to occur when range B regulator is supplied. To correct, change #2 Spring. (d) In case of regulator with electric shut-off the solenoid may not be energized or coil may be burned out. Check electrical circuit to make sure the solenoid is energized and drawing current. Replace #29 Coil if necessary.
3. Failure to close: (a) #10 Piston or #12 Piston Plug maybe jammed due to excessive dirt. This the most likely cause of not closing, to correct, see 1 (a). (b) # 17 adjusting stem may be turned in so far that a higher pressure is opening the regulator than is desired in the system. (Turn out # 17 adjusting stem until the regulator closes at the desired pressure.) (c) #2 Diaphragm Range Spring may be the improper range for the pressure desired. (Change #2 Diaphragm Spring.) (d) #5 Pilot Plug may be dirty

or eroded (inspect and replace if necessary); see 1 (b). (e) #14 Diaphragm may be broken or eroded (inspect and replace if necessary); see 1 (c), (f) In case of regulator with solenoid shut-off the regulator should close when the solenoid coil is de-energized. Check electrical circuit to make sure no power is applied to the solenoid coil. Remove solenoid tube and check seat for damage. Replace internal parts using #27 Solenoid Repair Kit if necessary.

4. Hunting: Under light load conditions, a system may hunt. Unless the hunting is adversely affecting temperatures or bothering the performance of the equipment, the hunting itself should be ignored. If very serious, the matter should be looked into further.

The Hot Gas Bypass Regulators is sometimes blamed if the system seems to hunt. The A9E regulator was especially designed with a characterized plug to give controlled flow over its entire hot gas flow range. For this reason, we suggest that the other elements and control valves in the system be critically examined if there appears to be intolerable hunting.

The following action is recommended: (a) If bypass with liquid injection is used, refer to BYG Bulletin for correct TXV size. (b) Examine TXV's; are they operating below 50% of capacity? If so, use one of the methods recommended by TXV manufacturers for this type operation. (c) Increase superheat of TXV liquid injection valve by adjusting, or installing new charge. (d) Wrap bulb to dampen action of TXV liquid injection valve. (e) Check location of entrance of external equalizer connection to suction line in relation to TXV liquid injection bulb location. (f) If hot gas side inlet type of distributor is used, determine whether it is properly selected. (g) If "T" is used between main TXV and distributor for hot gas input, limit bypass tonnage to one-third of capacity of distributor. (h) Check with TXV manufacturer for proper TXV charge. (i) Determine if the A9E used for the job is oversized for the actual maximum load conditions, if so, use a smaller capacity plug. Piston plugs #12 are interchangeable on all sizes of A9 type regulators.



	DIM A	DIM B		
	inches	mm	inches	mm
3/8	5.25	133	0.5	13
5/8	5.25	133	0.5	13
7/8	6.19	157	0.75	19
1-1/8	6.87	175	0.94	24

ELECTRICAL

The Refrigerating Specialties Division molded water resistant Class "H" solenoid coil is designed for long life and powerful opening force. The standard coil housing meets NEMA 3R and 4 requirements. This sealed construction can withstand direct contact with moisture and ice. By definition, Class "H" coil construction will permit coil temperatures, as measured by resistance method, as high as 185°C (386°F). Final coil temperatures are a function of both fluid and ambient temperatures.

A solenoid coil should never be energized except when mounted on its corresponding solenoid tube.

The molded Class "H" coil is available from stock with most standard voltages. However, coils are available for other voltages and frequencies, as well as for direct current. Coils are also available as transformer type with a 6 volt secondary winding for use with the Refrigerating Specialties Division Pilot Light Assembly Model PLT-2. See Bulletin No. 60-20.

The solenoid coil must be connected to electrical lines with volts and Hertz same as marked on coil. The supply circuits must be properly sized to give adequate voltage at the coil leads even when other electrical equipment is operating. The coil is designed to operate with line voltage from 85% to 110% of rated coil voltage. Operating with a line voltage above or below these limits may result in coil burnout. Also, operating with line voltage below the limit will definitely result in lowering the valves maximum opening pressure differential. Power consumption during normal operation will be 11 watts or less. On transformer coils the 6 volt leads are always black.

SAFE OPERATION (See Bulletin RSBCV)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent product bulletins and the current Bulletin RSB prior to installation or servicing work.

WARRANTY

All Refrigerating Specialties Products are warranted against defect in workmanship and materials for a period of one year from date of shipment from the factory. This warranty is in force only when products are properly installed, maintained and operated in use and service as specifically stated in Refrigerating Specialties Catalogs or Bulletins for normal refrigeration applications, unless otherwise approved in writing by Refrigerating Specialties Division. Defective products, or parts thereof, returned to the factory with transportation charges prepaid and found to be defective by factory inspection will be replaced or repaired at Refrigerating Specialties' option, free of charge, F.O.B. factory. Warranty does not cover products which have been altered or repaired in the field; damaged in transit, or have suffered accidents, misuse, or abuse. Products disabled by dirt, or other foreign substances will not be considered defective.

THE EXPRESS WARRANTY SET FORTH ABOVE CONSTITUTES THE ONLY WARRANTY APPLICABLE TO REFRIGERATING SPECIALTIES PRODUCTS, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Refrigerating Specialties, nor to assume, for Refrigerating Specialties, any other liability in connection with any of its products.

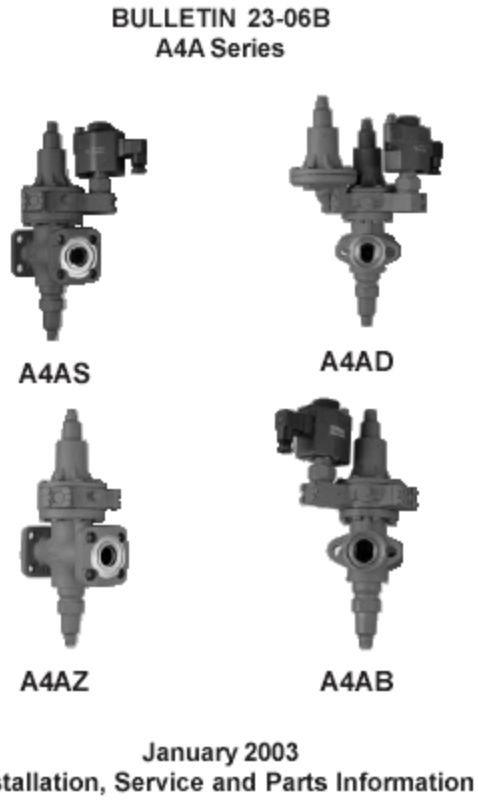
FLO CON A4AB, A4YB

The A4 valve is normally used as a discharge pressure regulator on Kysor//Warren parallel compressor systems. The A4YB is a slight modification of the A4AB. The only difference is that the 'YB' uses the S6B integral solenoid pilot instead of the S6A solenoid pilot. This allows the use of the valve in a vertical line installation. The 'AB', with the S6A pilot valve, must be installed in a horizontal line. Otherwise, the valves are identical in design, service, parts, etc.

The following excerpts are from Parker Bulletin 23 06B dated January 2003.

ADAPTOMODE® INLET PRESSURE REGULATORS

Types: A4AS, A4AB, A4AD, A4AZ PORT SIZE 20 - 100 mm (3/4" - 4") FOR AMMONIA, R-12, R-22, R-502 OTHER REFRIGERANTS AND OIL



FEATURES

- Pilot operated characterized Modulating Plug for precise control
- Suitable for all common refrigerants and oil
- 27.6 bar (400 psig) maximum rated pressure (MRP)
- Flanges for threaded or welded steel pipe and copper tube (copper not for ammonia)
- Unique Modular construction
- Interchangeable parts
- Easy to service
- Close coupled strainers, optional
- Many control variations are possible with the use of a few Modules and kits.
- Stainless Steel Diaphragm
- Chrome Plated Pilot Seat
- Manual Opening Stem

Description:

These compact, heavy duty, pilot operated, iron alloy (ASTM A126 Class B high strength semi-steel) Inlet Pressure Regulators are suitable for Ammonia, R-12, R-22, R-502 and other common refrigerants and fluids approved for use in refrigeration systems.

All A4 Regulators are pilot operated using upstream pressure for the opening force and require a minimum 0.14 bar (2 psi) pressure drop to fully open.

These valves are generally ordered with close coupled upstream strainer to prevent entrance of foreign material into the valve and the rest of the system. (See current Bul. 00-10 for strainer information.)

Purpose

Modulates flow of refrigerant gas or liquid to maintain a constant upstream (or inlet) pressure as set-for, despite load fluctuations.

The fluid temperature range for the A4 Series of Regulators is -45°C to 105°C (-50°F to 220°F).

Principles of Operation (See Fig. 1)

The inlet pressure enters the space under the diaphragm through passage N. When the force created by the pressure exceeds the force of the range spring, the diaphragm is lifted off the pilot seat allowing pressure to enter on top of the power piston. This causes the power piston to move downward forcing the modulating plug to open and modulate to maintain constant inlet pressure. An increase in inlet pressure lifts the diaphragm further, allowing more pressure on top of the power piston and opening the valve wider. A decrease in inlet pressure causes the diaphragm to move closer to the pilot seat reducing the pressure on the top of the power piston and causing the closing spring to reduce the valve opening. The pressure on top of the power piston is controlled by the flow through the pilot seat and the bleed off through the bleed hole in the power piston and through the clearance between the piston and cylinder. A minimum of 0.14 bar (2 psi) pressure drop across the valve is required to open it fully.

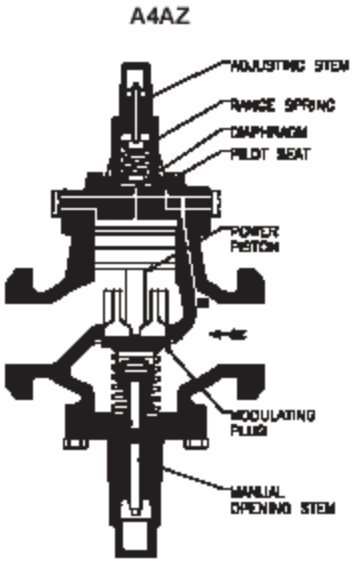


Fig. 1

The A4A Inlet Pressure Regulator therefore opens on a rise in the inlet pressure above its set point and closes on a drop in inlet pressure below its set point. The inlet pressure set point is not appreciably affected by variations in the outlet pressure.

Manual Opening Stem

All Type A4A Regulators are provided with a manual opening stem. To open the regulator manually, back the stem out (turn counter-clockwise) until it stops. To put the regulator into automatic operation, turn the stem in (clockwise) until only the flats on the stem protrude from the packing nut.

Adjustment

Install an accurate pressure gauge in the gauge port. Back the adjusting stem all the way out to stop. This will reduce the set point to its lowest level and cause the valve to open wide. Start the system, and when suction pressure is about the desired pressure, turn the adjusting stem in until the pressure gauge shows a slight rise in the inlet pressure. At this point the adjusting stem may be turned in (clockwise) to raise the pressure further, or backed out

(counterclockwise) to lower it; but the final adjustment should be made after the system has been operating for a period of time.

INLET PRESSURE SETTING RANGES

	Set Point Range	Approx. Pressure Change per Turn of Adjusting Screw	Factory Set Point unless otherwise specified)
A:	0 to 10.3 bar (0 to 150 psig)	1.7 bar (25 psi)	2.8 bar (40 psi)
V:	500mm hg to 8.3 bar (20 in hg to 120 psig)	1.7 bar (25 psi)	1.0 bar (15 psi)
D:	5.2 to 19.3 bar (75 to 280 psig)	3.7 bar (53 psi)	9.7 bar (140 psi)

Type A4AZ (See Figs 1 and 2)

Description

The A4AZ Inlet Pressure Regulator is the basic building block from which most Series A4 variations are made. This regulator incorporates the specially designed Modudapter® to accommodate the Adaptomode® bolt on modules, providing unique modular construction and many control valve variations with the use of a few modules and kits. See page 3 for an explanation of "Basic Adaptomode Functions", describing modules, module placement and schematic pilot circuit flow diagrams for all variations covered within this bulletin.

The A4AZ regulator is a complete factory assembled and bench tested valve and, in itself, may be used as a basic inlet pressure regulator. In addition, this valve can easily be modified in the field to perform the function of the A4AS, A4AB or A4AD valve variations.

Type A4AS (See Fig. 3)

Description

The Type A4AS is an inlet pressure regulator with a pilot electric shut off. The integrally mounted solenoid must be energized for the valve to function as a regulator. When de-energized the regulator is closed regardless of inlet pressure.

Purpose

The Type A4AS should be used whenever it is required to stop all flow (in the normal fluid flow direction) through the regulator. This could include use in defrost applications as well as part of a temperature control system.

Principles of Operation

The operation of the A4AS is the same as that described on page 1, except the inlet pressure from passage N must pass through the S6A Pilot Solenoid Valve before it can reach the diaphragm. Thus the S6A Pilot Solenoid must be energized before the A4AS can begin to regulate regardless of inlet pressure.

Adjustment

With the solenoid pilot electrically energized, proceed as described above.

Type A4AB (See Fig. 4)

Description

The Type A4AB is an Inlet Pressure Regulator with a Pilot Electric Wide-opening, or Bypass, variation. When the integrally mounted solenoid is energized the main valve is wide open, thereby bypassing the regulator function i.e. not regulating. However, in the wide open mode the regulator will still require the 0.14 bar (2 psi) minimum pressure drop. When the solenoid is de-energized the valve functions as an Inlet Pressure Regulator.

Purpose

The Type A4AB frequently is used with the wide-open function where maximum refrigeration capacity from an evaporator is required. During the defrost of the evaporator, the regulator pilot solenoid is deenergized thus functioning as a defrost relief regulator or for high pressure limit protection. When used in a discharge pressure line, it can when de-energized, hold back enough pressure for some heat reclaim or defrosting function and then, when energized, allow the discharge pressure to drop to a lower level. Frequently this regulator is used in the wide open mode for evaporator pump out prior to hot gas defrost.

Principles of Operation

The operation of the A4AB is the same as that described on page 1 when operating as a regulator (Pilot Solenoid de-energized). When the solenoid is energized the upstream pressure from passage N bypasses the underside of the diaphragm and is fed directly to the top of the piston where, provided a 0.14 bar (2 psi) pressure difference exists across the main valve, the Modulating Plug will be held wide open.

Adjustment

With the solenoid pilot electrically de-energized, proceed as described above.

Type A4AD (See Fig. 5)

Description

The Type A4AD is a Dual Inlet Pressure Regulator capable of regulating at two different pressure set-points. When the integrally mounted S6A Pilot Solenoid Valve is energized the regulator is controlling at the lower of two set-points, which must be adjusted on the pressure pilot over the center of the main valve. When the solenoid is de-energized the regulator is controlling at the higher set-point, which must be adjusted on the bolt-on (outboard) pressure pilot.

Purpose

The Type A4AD uses are similar to those for the A4AB except, instead of operating in a wide-open position when the pilot solenoid is energized, the regulator Is controlling at some preset level. Typical uses include capacity control of an evaporator at two different pressure levels to regulate temperature, and evaporator pressure control combined with defrost pressure relief.

Principles of Operation

The operation of the A4AD is similar to that described on page 1. When the Pilot Solenoid is energized, upstream pressure from passage N is made available to both diaphragms. Since the path of least resistance will be through the Pressure Pilot with the lower set-point (lower range spring force) that pilot will control. When the Pilot Solenoid Is de-energized, upstream pressure from passage N can flow only to the high pressure pilot, which will then control the regulator.

Adjustment

Electrically de-energize the solenoid pilot and adjust the modular (bolt-on) pressure pilot for the desired high pressure setting following the adjusting procedure as described above. Energize the solenoid pilot and adjust the integral pressure pilot for the desired low pressure setting following the adjusting procedure described above.

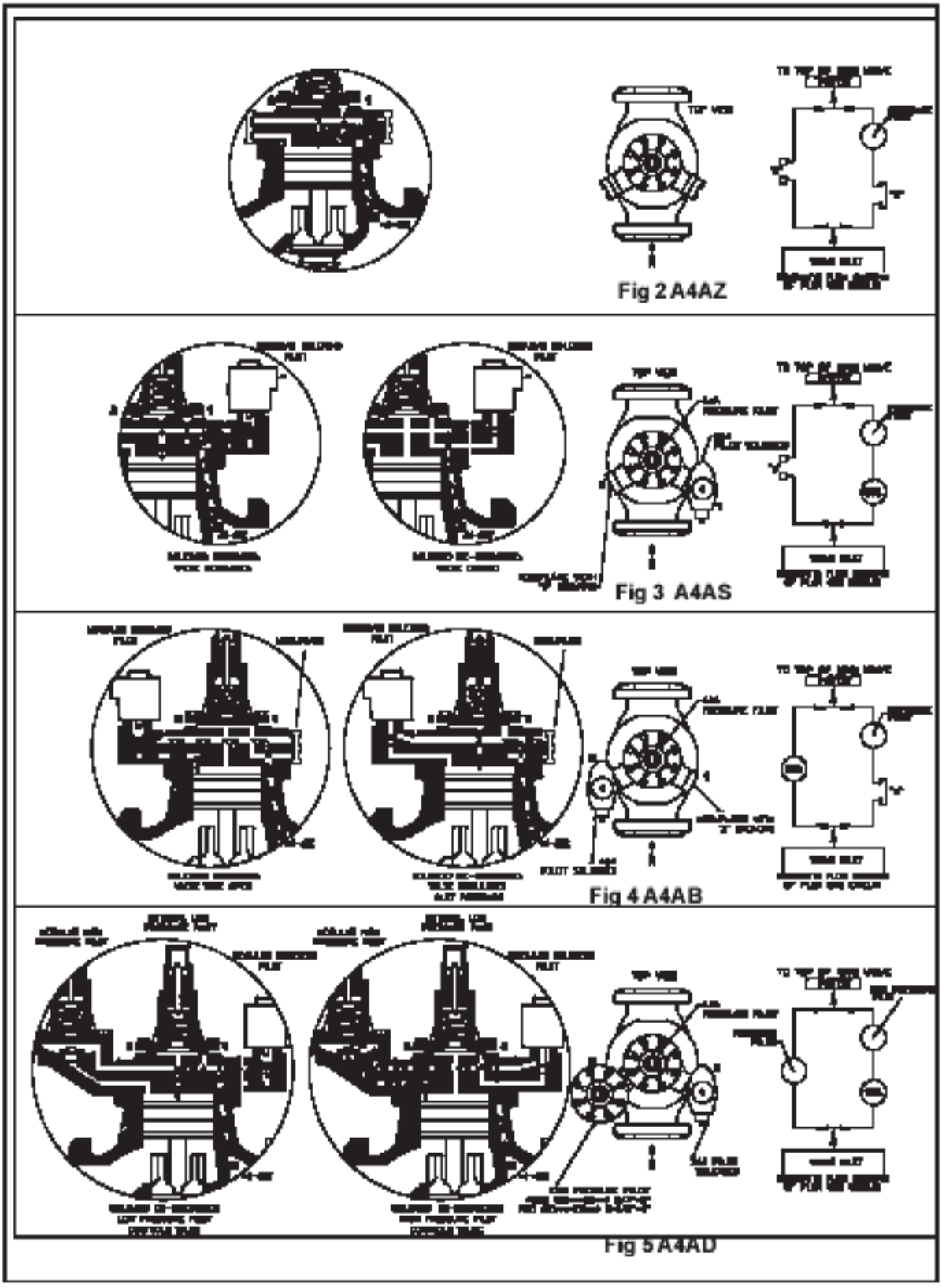


Fig 2 A4AZ

Fig 3 A4AS

Fig 4 A4AB

Fig 5 A4AD

Installation

All regulators are packed for maximum protection. Unpack carefully. Check the carton to make sure all flanges and other items are unpacked. Save the enclosed instructions for the installer and eventual user.

Do not remove the protective coverings from the inlet and outlet of the regulator until the regulator is ready to be installed. Protect the inside of the regulator from moisture, dirt and chips before and during installation. When welded or brazed flange connections are used, all slag, scale and loose particles should be removed from the flange interior before the regulator is installed between the flanges. It is advisable to install a close-coupled companion strainer (RSF) at the inlet of the regulator to help protect it from any foreign material in the system.

The A4A series of regulators will give optimum performance if mounted in a horizontal line in a vertical position with the manual opening stem on bottom. Where other positions are desired, the factory should be consulted; please give application and piping details. The regulator must be installed with the arrow on the valve body pointing in the direction of the fluid flow for the regulator to function properly. Backward flow through the regulator is uncontrolled and will vary with the valve model and the reverse pressure drop encountered. The regulator is not a check valve.

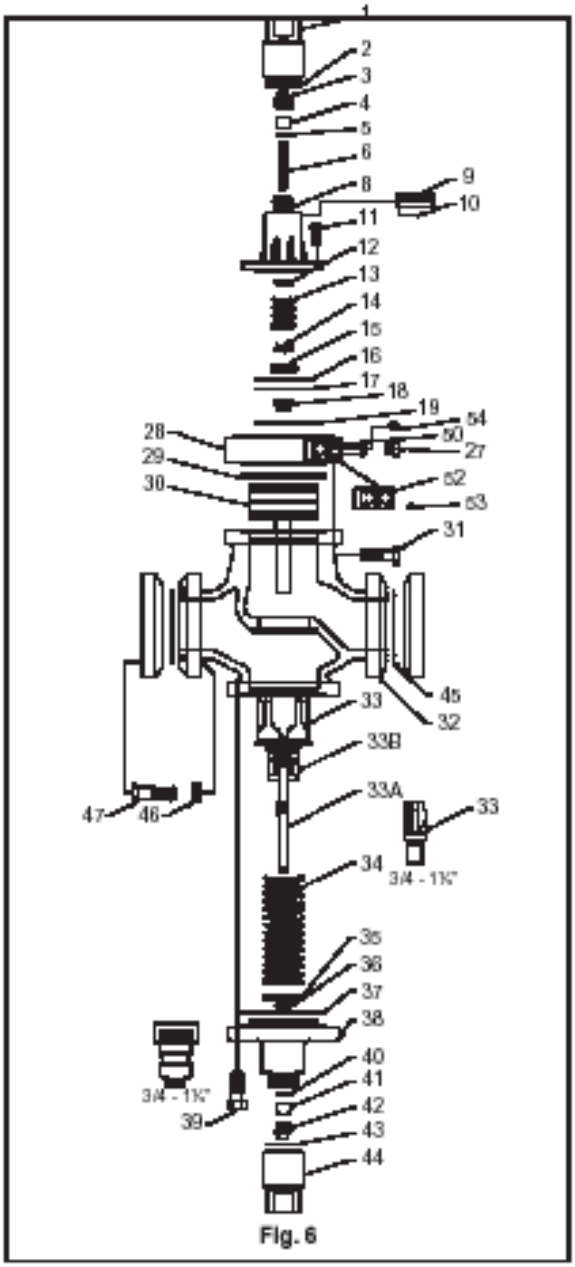


Fig. 6

Tighten the flange bolts and nuts evenly to provide proper seating of the flange gasket and to avoid damage to gaskets or flanges. (See Flange Bolt Torque Table, page 16) Avoid using the regulator flange bolts to stretch or align pipe. Even the heavy duty semisteel body of an A4A can be distorted, causing the precision parts to bind.

The regulator should be installed in a location where it is easily accessible for adjustment and maintenance. The location should be such that the regulator can not be easily damaged by material handling equipment. When it is necessary to insulate the regulator (and companion strainer), the insulation should be installed to provide access to the regulator (and companion strainer) for adjustment and maintenance. Do not insulate the solenoid coil and

coil housing. Proper indicating gauges should be installed to be easily visible to the operating engineer for system checking and adjusting purposes.

Disassembly and Assembly

Refer to the exploded views, Figs. 6 and 7, in this section.

Before disassembling any A4A type regulator, read the information in this bulletin and Bulletin RSB, Safety Procedures for Refrigerating Specialties Division Refrigeration Control Valves.

Before a regulator is removed from the line or disassembled in the line, make sure that all refrigerant has been removed from the regulator, including the bonnet where applicable, and the close coupled strainer. The regulator must be isolated from the rest of the system in a safe manner. When pumping down to remove the refrigerant, the manual opening stem 33A must be turned out (counter clockwise) to make sure the valve is open.

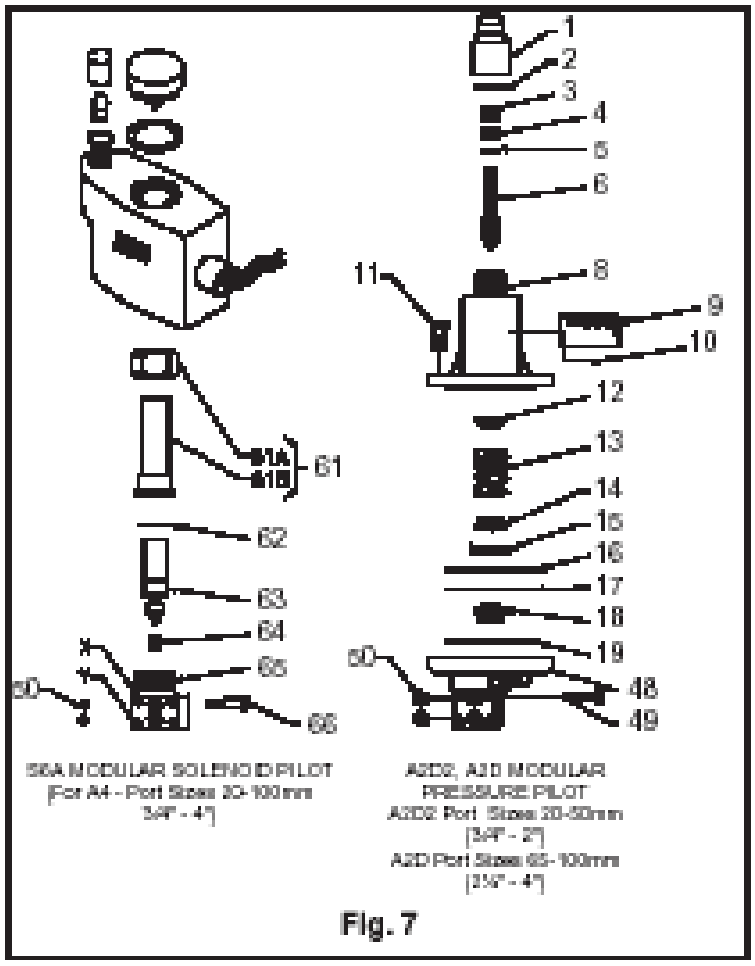


Fig. 7

All A4A Regulators General Procedure

The construction of the regulator and the method of disassembly are relatively simple, but some procedures must be followed to avoid damage. The following describes the procedure for the basic A4A; special instructions for other types are included in other appropriate sections.

Disassembly

Take care when removing Seal Caps 1 and 44 in case some refrigerant may be trapped inside. Back the Adjusting Stem 6 all the way out to remove any pressure from Range Spring 13 otherwise damage to Diaphragm 17 or Pilot Seat 18 may occur. Remove Bonnet 8 by carefully removing Cap Screws 11. Take care not to damage Diaphragm Follower 15. Remove Adapter 28 by removing Cap Screws 31. Turn the Manual Opening Stem 33A all the way in until the flats on the stem barely protrude from the stuffing box nut. Push Piston 30 down against the spring force. The piston should move freely down and be returned by

the spring force. If the piston is jammed or sticky, remove Bottom Cap Assembly which includes Items 33 through 42 by removing Cap Screws 39 or unscrewing Bottom Cap, 20mm through 32mm (3/4" through 1-1/4"). Using a hard wood dowel rod inserted through the bottom of the valve, tap the piston upward and out. Thoroughly clean all parts. If jamming has taken place and the piston and bore are scored, remove all burrs by polishing the piston, bore and throttling plug with fine crocus cloth. Inspect the seating area of the Throttling Plug 33 for damage or erosion. If damaged it should be replaced. It would be advisable to replace the entire bottom cap assembly. Inspect all gaskets and "O" rings for damage and replace where necessary.

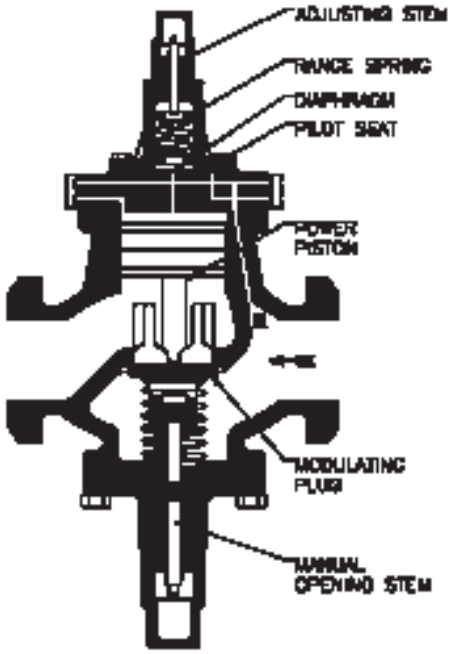


Fig. 8 (A4AZ)

Assembly

When reassembling the valve, all internal parts should be clean, dry and lightly oiled with refrigerant oil, except "O" rings. Apply silicone grease to the "O" rings. Care must be taken especially when the parts are cold since moisture can condense on parts and cause rapid rusting. When replacing gaskets, they should be oiled very lightly with refrigerant oil before assembly. Install bottom cap assembly first and tighten in place. Carefully replace the piston; never try to force it in place. Align the Adapter Gasket 29 carefully with the proper holes in the adapter and valve body and fasten adapter in place. Before assembling the bonnet be sure the Adjusting Stem 6 is turned all the way out and that the Bonnet 8 and Diaphragm Follower 15 are properly aligned, otherwise damage to the diaphragm and pilot seat may occur. Place Gasket 19 in the adapter and align Gasket 16 and Diaphragm 17 to the center of the bonnet. The raised center of the diaphragm must be towards the bonnet. For range "D" use two diaphragms. Tighten Cap Screws 11 evenly. The ideal tightening torque is 1.5 Kg-m (11 ft. lbs.). Valve is now ready to be adjusted for normal operation.

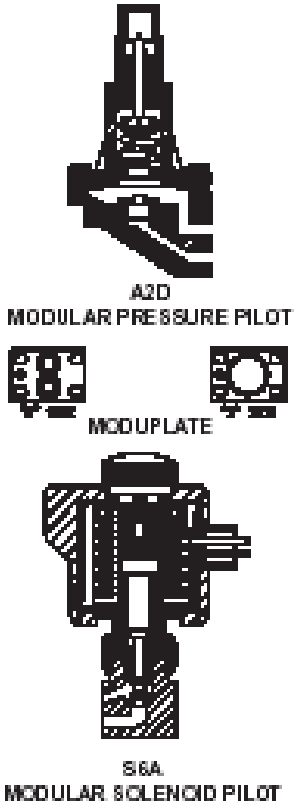


Fig. 9

If close coupled strainer is used, it may be cleaned before putting the valve back in operation. The regulator must be tested for leaks with refrigerant gas or other appropriate gas before the system is put into operation.

Basic Modules Disassembly and Assembly

Refer to exploded views (Figs. 10 and 11) and also page 3 for explanation of "Basic Adaptomode Functions" to assist in clarification of module placement, as discussed in this section. Before disassembling and assembling any modules, refer to page 4 of this bulletin and to Bulletin RSB, Safety Procedure for Refrigerating Specialties Division Refrigeration Control Valves.

Modudapter

The Modudapter 28 will accommodate the Modular Pilots and Moduplates illustrated on page 3. When assembling make sure the Modudapter gauge port is directly lined up with the inlet of the regulator. Passage N must communicate upstream pressure through the hole in Adapter Gasket 29 as well as into Modudapter 28 and thence to the pilot modules. It is imperative that proper alignment of these items be made to assure regulator function.Before disassembly, make sure all refrigerant has been removed from the regulator and strainer, if used. Protect the surfaces of Pads 1 and 2 of the Modudapter at all times since these surfaces determine the sealing tightness of the "O" Rings.

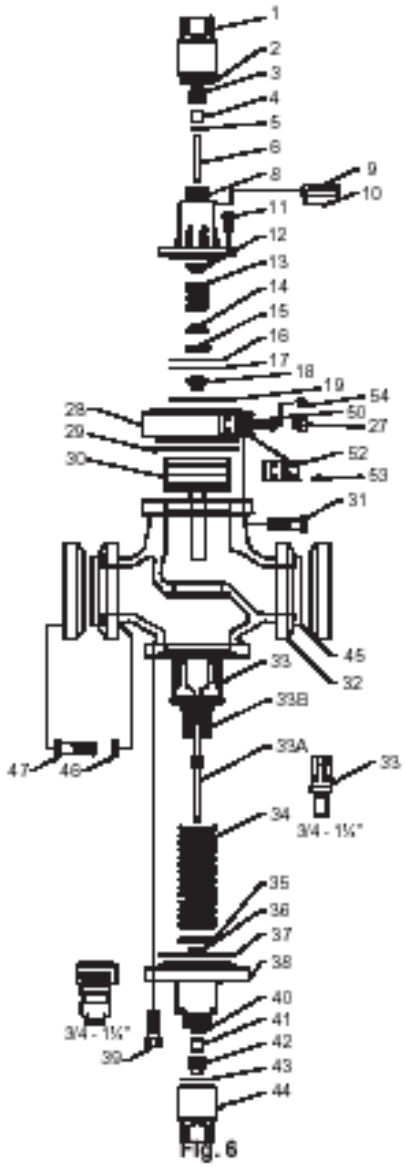


Fig. 6

A2D, A2D2 Modular Pressure Pilots (Figs. 11 and 12)

These pressure pilots are used where a dual pressure regulator is desired and is mounted on Pad 2. Follow the disassembly and assembly procedure for the A4A pilot (pages 4 and 5). When mounting the pilot, place the "O" Rings 50 into the proper grooves and tighten the Cap Screws 49 evenly. The ideal tightening torque is 1.1 Kg-m (8 ft. lbs).

S6A Modular Solenoid Pilot (Figs. 10 and 12)

This solenoid pilot may be mounted on either Pad 1 or 2 depending on the function desired (see pages 2 and 3). Before working on any solenoid pilot, make sure the coil is de-energized and will remain so during the servicing period.

Disassembly (Fig. 10)

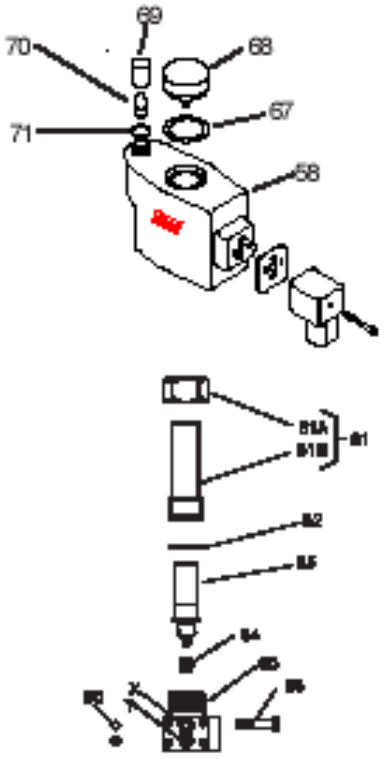
Remove Coil Housing Screw 55 and pull entire Coil and Housing Assembly, 56 through 60, upward and off of Bonnet-Tube Assembly 61. Carefully remove Bonnet-Tube Assembly. Lift out Plunger-Needle Assembly 63, avoid damaging the needle. Remove Seat Assembly 64 by using a 7/16" (11 mm) socket wrench. Inspect all parts, clean or replace as needed.

Assembly (Fig. 10)

Reinstall the Seat Assembly and tighten (no gasket needed). Carefully insert the Plunger Needle Assembly. Replace the Gasket 62 and reinstall Bonnet-Tube Assembly. Replace entire Coil and Housing Assembly and tighten Coil Housing Screw. Make sure the solenoid coil is of the proper voltage and frequency. When mounting the solenoid pilot, place the "O" Rings 50 into the proper grooves and tighten the Cap Screws 66, evenly. The ideal tightening torque is 1.1 kg-m (8 ft. lbs.).

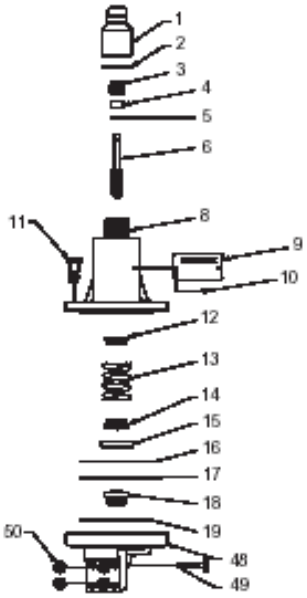
Moduplate (Figs. 6 and 12)

These Moduplates 52 are used to direct the flow or stop the flow through the flow paths of the Modudapter. Protect the "O" Ring surfaces at all times. When mounting the Moduplate, place "O" Rings 50 (or "O" Ring 54) into the proper grooves (lubricate with silicone grease) and tighten the Cap Screws 53 evenly to avoid distortion and assure proper sealing. The ideal tightening torque is 1.1 Kg-m (8 ft. lbs.).



S6A MODULAR SOLENOID PILOT
For A4 Port Sizes 20 - 100mm (¾" - 4")
Fig. 10

Maintenance and Service General Procedure:



A2D2, A2D MODULAR
PRESSURE PILOT
A2D2 Port Sizes 20-50mm (3/4" - 2")
A2D Port Sizes 65-100mm (2½" - 4")

Before disassembly of regulator, make certain that all refrigerant has been removed (pumped out) from the regulator and its companion strainer where one is used. Read Safety Bulletin RSB.

Dirt In the system Is the greatest single cause of regulator malfunction. All screens or filters must be cleaned or replaced when they become dirty. At start up it is especially important that these Items are cleaned or changed frequently. When the RSF close-coupled companion strainers are used, maintain according to instructions in Bulletin 00-10. Moisture in halocarbon systems in particular can cause corrosion or form ice, causing the piston to freeze in position. Filter-driers should be used and maintained for halocarbon systems.

Before deciding to disassemble a regulator for servicing, the following investigations should be made:

Check the manual opening stem; it should be turned in for automatic operation.

Check the regulator setting to make sure it is properly adjusted. Turn adjusting screw slowly to see if regulator responds. Check regulator pressure range; if wrong, range spring must be replaced.

Check other system components for proper operation. Make sure that the regulator receives the proper electrical signal where modular pilot solenoids are used. Make sure they are same as the power supply.

Check hand valves in the system to make sure they are open or closed as required and the system is receiving liquid or gas as the case may be.

Solenoid Coils and Coil Housing

The solenoid coils and coil housing, identified and described on page 8 for the Type S6A Solenoid Pilot, are an improved design which provide a higher MOPD and a cooler coil resulting in longer life. The new coil and its heavily plated, rust resisting housing are interchangeable with the obsolete coil and cast iron housing as follows: The new coil, which has its Part Number stamped on the side, can be used in both the old and new coil housing; the old coil which has its 30-0030-XX Series Part Number stamped on one end, can be used in the old, cast iron housing only. There is no bottom marking on the new coil; either end may be positioned up. The color coding of lead wires for various voltage and frequencies has not been changed. The fuses used with the old coils are suitable for the new coils; the new coil power consumption is 33 Watts instead of 37.

The S6A pilot solenoid valve is also available with a coil using a quick electrical connector or plug, permitting easy wiring connection with an exposed rubber covered cable instead of a rigid or flexible conduit and enclosed wiring. This type of coil cannot be used with the old,

cast Iron housing.

The new coils and new housing described above for the S6A valve are also used with Solenoid Valve Types S4, S5, S6N, S7, S8 and S9.

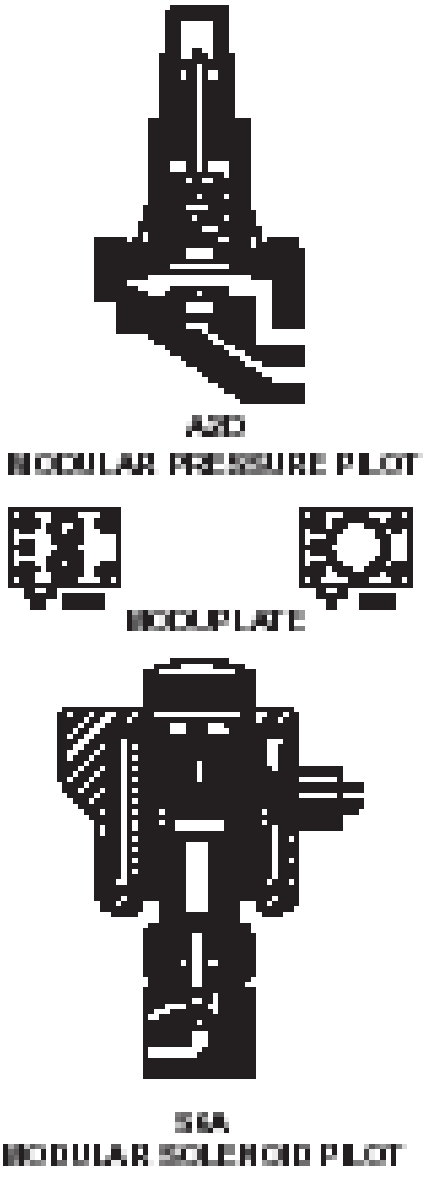


Fig. 12

Electrical

The Refrigerating Specialties Division molded water resistant Class “B” solenoid coil is designed for long life and powerful opening force. The standard coil housing meets NEMA 3R and 4 requirements. This sealed construction can withstand direct contact with moisture and ice. The coil housing far exceeds the requirements of NEMA Standard ICS, 1-110.57 salt spray test for rust resistance.

By definition, Class "B" coil construction will permit coil temperatures, as measured by resistance method, as high as 130°C (266°F). Final coil temperatures are a function of both fluid and ambient temperatures. The higher fluid temperatures require lower ambient temperatures so the maximum coil temperature is not exceeded. Conversely, low fluid temperatures permit higher ambient temperatures.

The molded Class "B" coil is available from stock with most standard voltages. However, coils are available for other voltages and frequencies, as well as for direct current. Coils are also available as transformer type with a 6 volt secondary winding for use with the Refrigerating Specialties Division Pilot Light Assembly (see current copy of Bulletin 60-10, "Pilot Light Assembly and Solenoid Transformer Coil").

The solenoid coil must be connected to electrical lines with volts and Hertz same as stamped on coil. The supply circuits must be properly sized to give adequate voltage at the coil leads even when other electrical equipment is operating. The coil is designed to operate with line voltage from 85% to 110% of rated coil voltage. Operating with a line voltage above or below these limits may result in coil burnout. Also, operating with line voltage below the limit will definitely result in lowering the valve opening pressure differential. Power consumption during normal operation will be 33 watts or less.

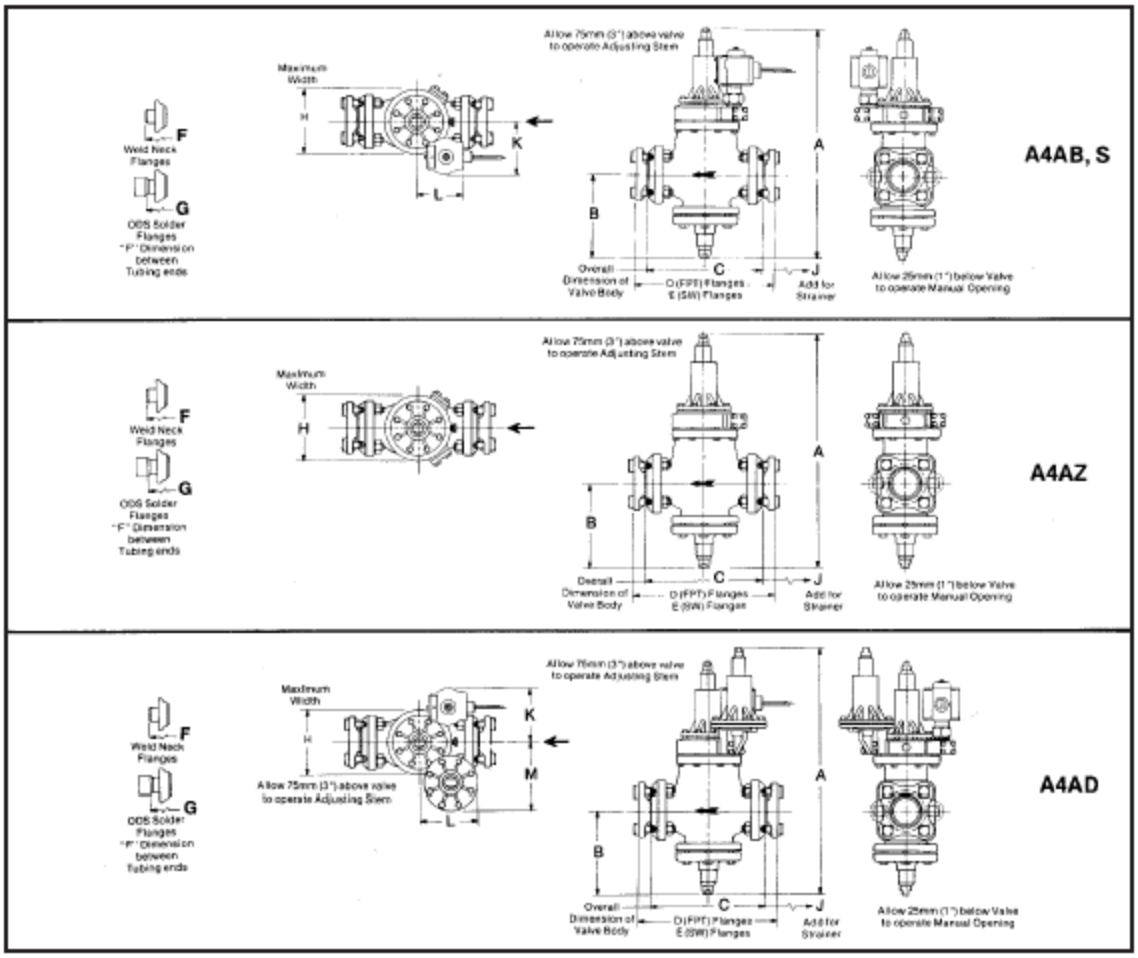
Inrush and running current is listed below:

Standard Coil Volts/Hertz	Inrush Current (Amps)	Running Current (Amps)	Fuse Size (Amps)
120/60 (Blue leads)	1.1860	0.46	1
208/60 (Blue & Red leads)	0.63	0.26	1
240/60 (Red leads)	0.60	0.23	1
440/60 (Yellow & Red leads)	0.39	0.13	1
115/50 (Yellow & Blue leads)	1.22	0.21	1
230/50 (Yellow leads)	0.65	0.26	1
Other	Contact Factory		

On transformer coil the 6 volt leads are always black.

SERVICE POINTERS (Check General Procedure)

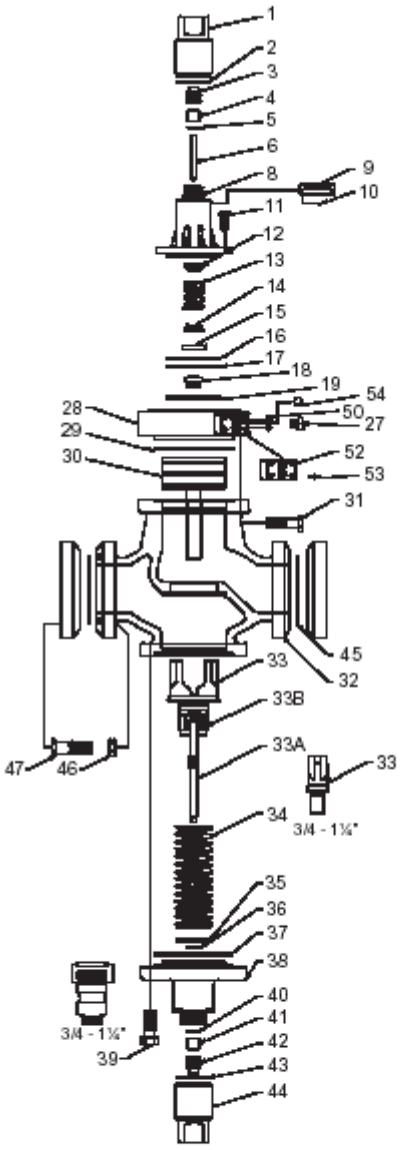
SYMPTOM	PROBABLE REASON	CORRECTION
Regulator does not shut off flow.	Diaphragm or seat dirty, damaged or frozen.	Clean or replace. Clean strainer.
	Diaphragm follower stuck or damged.	Clean or replace. Install follower carefully.
	Piston jammed with excess dirt.	Remove and polish piston and bore with crocus cloth. Clean valve and strainer.
	Throttling plug leaking due to excess dirt or damage.	Clean or replace. If used on liquid, check for erosion due to excessive flash gas. Reduce flash gas by subcooling or by reducing pressure drop across valve by providing restriction at valve outlet.
	Diaphragm ruptured or badly deformed.	Replace. If Range "D" make sure has 2 diaphragms.
	A4AB Modular Solenoid Pilot seat leaking.	Check seat and needle. Replace as needed,
	A4AS Modular Solenoid Pilot seat leaking.	Check seat and needle. Replace as needed.
	Diaphragm and seat eroded due to flash gas.	Replace. Reduce flash gas by subcooling or by reducing pressure drop across regulator by providing restriction at valve outlet.
	Modular Solenoid Pilot not closing.	Check power at leads, make sure coil is de-energized.
Regulator does not open	A4A (inlet) Pressure Regulator Diaphragm ruptured or badly deformed.	Replace. It Range D make sure has 2 diaphragms.
	Diaphragm follower stuck, damaged or frozen.	Clean or replace. Install follower carefully.
	A4AS/A4AB Modular Solenoid Pilot not opening.	Pressure drop across valve too high; over 21 bar (300 psig). Lower pressure drop. Improper power supply. Correct. Replace solenoid coil.
	Piston worn, too much clearance.	Replace piston. Check for reason. If used on liquid, check for flash gas.
Regulator Operation erratic.	Diaphragm or seat dirty or damaged.	Clean or replace. Clean strainer.
	Diaphragm follower has dirt on the outside diameter or outside diameter is damaged.	Clean or replace.
	Other system components, line controllers, thermostats, etc., erratic.	Adjust, repair or replace.
	Regulator too far oversized.	Check load. Replace with smaller regulator or investigate use of reduced capacity plug.
Pressure drop across regulator too high.	Inlet or outlet restricted.	Check for restriction. Clean strainer.
	Regulator too small.	Open manually to be sure valve is full open. Replace with proper size regulator.
	Large amount of flash gas in liquid line.	Reduce flash gas by subcooling. Reduce line restriction by increasing line size, particularly at the regulator outlet. Replace with larger regulator.
	High pressure drop causes high rate of expansion of gas at regulator outlet.	Increase pipe size at the outlet of the regulator.
	Regulator does not open all the way.	Check piston for wear. Replace, it needed.



Dimensions

TABLE OF DIMENSIONS FOR INLET PRESSURE REGULATORS Types A4AS, A4AB, A4AD and A4AZ																Types A4AS, A4AB & A4AZ 100mm (4")			Type A4AD only 100mm (4")		
Type	20mm & 25mm (3/4 & 1")			32mm (1-1/4")			40mm & 50mm (1-5/8 & 2")			65mm (2-1/2")			75mm (3")								
DIMENSION		mm	inch		mm	inch		mm	inch		mm	inch		mm	inch		mm	inch		mm	inch
A		429	16.9		447	17.6		500	19.7		513	20.2		632	24.9		685	27.0		685	27.0
B		148	5.8		162	6.3		177	6.9		181	7.1		273	10.7		292	11.5		292	11.5
C		164	6.2		203	8.0		251	9.9		251	9.9		311	12.2		339	14.1		339	14.1
(D) (FPT) for PIPE SIZES SHOWN	1/2"	216	8.5	1-1/4"	256	10.1	1-1/2"	307	12.1	2-1/2"	331	13.0	3"	389	15.3	4"	450	17.7	4"	450	17.7
	3/4"	216	8.5																		
	1"	216	8.5	1-1/2"	256	10.1	2"	307	12.1												
	1-1/4"	216	8.5																		
(E) (SW) FOR PIPE SIZES SHOWN	1/2"	216	8.5	1-1/4"	256	10.1	1-1/2"	307	12.1	2-1/2"	331	13.0	3"	389	15.3	4"	450	17.7	4"	450	17.7
	3/4"	216	8.5																		
	1"	216	8.5	1-1/2"	256	10.1	2"	307	12.1												
	1-1/4"	216	8.5																		
(F) (WN) FOR PIPE SIZES SHOWN	—	—	—	1-1/4"	300	11.8	1-1/2"	364	14.3	2-1/2"	401	15.6	3"	478	18.8	4"	571	22.5	4"	571	22.5
	3/4"	254	10.0																		
	1"	261	10.3	1-1/2"	304	12.0	2"	371	14.6												
	1-1/4"	261	10.3																		
(G) (ODS) FOR TUBE SIZES SHOWN	7/8"	239	9.4	1-3/8"	269	10.6	1-5/8"	358	14.1	2-5/8"	348	13.7	3-1/8"	414	16.3	4-1/8"	503	19.8	4-1/8"	503	19.8
	1-1/8"	239	9.4	1-5/8"	279	11.0	2-1/8"	338	13.3												
	1-3/8"	231	9.1	2-1/8"	305	12.0	2-5/8"	358	14.1	3-1/8"	389	15.3	3-5/8"	432	17.0						
	1-5/8"	239	9.4																		
H		117	4.6		117	4.6		140	5.5		159	6.2		178	7.0		222	8.8		222	8.8
J		98	3.9		178	7.0		251	9.9		314	12.4		314	12.4		363	14.3		363	14.3
K		112	4.4		112	4.4		117	4.6		124	4.9		142	5.6		158	6.2		157	6.2
L		122	4.8		122	4.8		135	5.3		133	5.2		122	4.8		152	6.0		140	5.5
M		138	5.4		138	5.4		140	5.5		150	5.9		170	6.6					190	7.7

Repair Kits for A4AS, A4AB, A4AD and A4AZ



Item No.	Description		20mm (3/4") Kit No.	Qty	25mm (1") Kit No.	Qty
1	Seal Cap		Only Avail. with Kit	1	Only Avail. with Kit	1
2	Seal Cap Gasket		Only Avail. with Kit	1	Only Avail. with Kit	1
1-2	Cap Kit, Seal		202110	1	202110	1
3	Nut, Packing		Only Avail. with Kit	1	Only Avail. with Kit	1
4	Packing, Stem		Only Avail. with Kit	1	Only Avail. with Kit	1
5	Washer, Flat		Only Avail. with Kit	1	Only Avail. with Kit	1
3-5	Packing Kit, Stem		202100	1	202100	1
6	Stem, Adjusting		Only Avail. with Kit	1	Only Avail. with Kit	1
4-6	Stem Kit, Adjusting		202120	1	202120	1
12	Plate, Spring, Upper		Only Avail. with Kit	1	Only Avail. with Kit	1
13	Spring, Comp.		Only Avail. with Kit	1	Only Avail. with Kit	1
14	Plate, Spring, Lower		Only Avail. with Kit	1	Only Avail. with Kit	1
15	Follower, Diaphragm		Only Avail. with Kit	1	Only Avail. with Kit	1
3-5,6,	Spring/	Rge. A/V	202006	1	202006	1
12-15	Stem Kit	Rge. D	202007	1	202007	1
8	Bonnet		Only Avail. with Kit	1	Only Avail. with Kit	1
11	Screw, Hx Hd.		Only Avail. with Kit	8	Only Avail. with Kit	8
16	Bonnet Gasket		Only Avail. with Kit	1	Only Avail. with Kit	1
1-6,8,	Spring Kit	Rge. A/V	202008	1	202008	1
11-16	with Bonnet	Rge. D	202009	1	202009	1
12-14,	Spring Kit,	Rge. A/V	202481	1	202481	1
16	less Bonnet	Rge. D	202482	1	202482	1
17	Diaphragm		Only Avail. with Kit	1	Only Avail. with Kit	1
19	Gasket		Only Avail. with Kit	1	Only Avail. with Kit	1
16,17,19	Diaphragm Kit	Rge. A/V	200770	1	200770	1
17	Diaphragms	Rge. D	Only Avail. with Kit	2	Only Avail. with Kit	2
16,17,19	Diaphragm Kit	Rge. D	200771	1	200771	1
16-19	VC Vacuum Cartridge		Only Avail. with Kit	1	Only Avail. with Kit	1
16-19	Pilot Seat/	Rge. A	202000	1	202000	1
	Diaphragm Kit	Rge. V	202004	1	202004	1
	(Not A4AO)	Rge. D	202002	1	202002	1
27	Plug Plug, 1/4" NPT		202552	5	202552	5
28	Adapter		Only Avail. with Kit	1	Only Avail. with Kit	1
29	Gasket		Only Avail. with Kit	1	Only Avail. with Kit	1
19,27,28, 29,31	Adapter Kit		200691	1	200691	1
30	Piston/Stem Assembly		Only Avail. with Kit	1	Only Avail. with Kit	1
29,30	Piston Kit		200760	1	200760	1
32	Valve Body		Not Available		Not Available	
34	Spring, Comp.		Only Avail. with Kit	1	Only Avail. with Kit	1
35	Washer, Flat		Only Avail. with Kit	1	Only Avail. with Kit	1
36	Wiper, Dirt		Only Avail. with Kit	1	Only Avail. with Kit	1
37	"O" Ring		Only Avail. with Kit	1	Only Avail. with Kit	1
34-37	Spring Kit,	(A4A)	202300	1	202300	1
	Closing	(A4AK)	202298	1	202298	1
33	Plug/Stem Assembly		Only Avail. with Kit	1	Only Avail. with Kit	1
40	Washer, Flat		Only Avail. with Kit	1	Only Avail. with Kit	1
41	Packing, Stem		Only Avail. with Kit	1	Only Avail. with Kit	1
42	Nut, Packing		Only Avail. with Kit	1	Only Avail. with Kit	1
33,34-37,	Full Cap. Plug		202021	1	202022	1
40-42	Kit, Modul.					
33,34-37,	50% Cap. Plug		202029	1	()	
40-42	Kit, Modul.					
33,34-37,	35% Cap. Plug		Not Available		Not Available	
40-42	Kit, Modul.					
33,34-37,	17% Cap. Plug		202030	1	()	
40-42	Kit, Modul.					

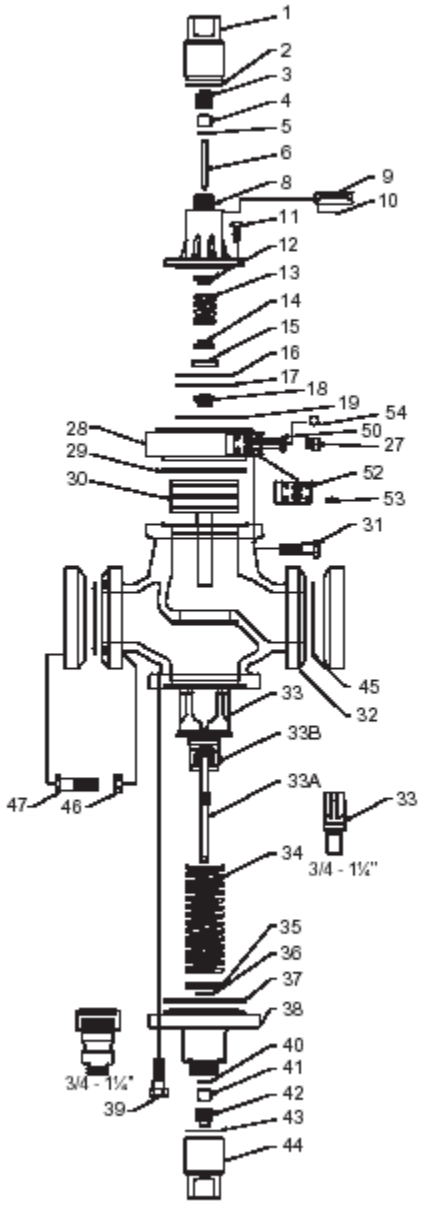
* All Plug Kits and Bottom Assembly Kits for 3/4" Port Size Valves can be used in the 1" Port Size Valves for reducing capacity.

Repair Kits for A4AS, A4AB, A4AD and A4AZ

	32mm (1-1/4)		40mm (1-5/8")		50mm (2")		65mm (2-1/2")		75mm (3")		100mm (4")	
Item No.	Kit No.	Qty	Kit No.	Qty	Kit No.	Qty	Kit No.	Qty	Kit No.	Qty	Kit No.	Qty
1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
2	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
1-2	202110	1	202110	1	202110	1	202110	1	202110	1	202110	1
3	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	only Avail with Kit	1
4	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
5	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
3-5	202100	1	202100	1	202100	1	202100	1	202100	1	202100	1
6	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
4-6	202120	1	202120	1	202120	1	202120	1	202120	1	202120	1
12	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
13	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
14	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
15	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
3-5,6, 12-15	202006	1	202006	1	202006	1	202006	1	202006	1	202006	1
	202007	1	202007	1	202007	1	202007	1	202007	1	202007	1
8	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
11	Only Avail. with Kit	8	Only Avail. with Kit	8	Only Avail. with Kit	8	Only Avail. with Kit	8	Only Avail. with Kit	8	Only Avail. with Kit	8
16	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
1-6,8, 11-16	202008	1	202008	1	202008	1	202008	1	202008	1	202008	1
	202009	1	202009	1	202009	1	202009	1	202009	1	202009	1
12-14, 16	202481	1	202481	1	202481	1	202481	1	202481	1	202481	1
	202482	1	202482	1	202482	1	202482	1	202482	1	202482	1
17	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
19	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
16,17,19	200770	1	200770	1	200770	1	200770	1	200770	1	200770	1
17	Only Avail. with Kit	2	Only Avail. with Kit	2	Only Avail. with Kit	2	Only Avail. with Kit	2	Only Avail. with Kit	2	Only Avail. with Kit	2
16,17,19	200771	1	200771	1	200771	1	200771	1	200771	1	200771	1
16-19	Only Avail. with Kit	1	Only Avail. with Kit	1	202004	1	202004	1	202004	1	202004	1
16-19	202000	1	202000	1	202000	1	202001	1	202001	1	202001	1
	202004	1	202004	1	202004	1	202004	1	202004	1	202004	1
	202002	1	202002	1	202002	1	202003	1	202003	1	202003	1
27	202552	5	202552	5	202552	5	202552	5	202552	5	202552	5
28	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
29	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
19,27,28, 29,31	200683	1	200695	1	200595	1	200597	1	200699	1	200606	1
30	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
29,30	200767	1	200389	1	200389	1	200391	1	200393	1	200227	1
32	Not Available		Not Available		Not Available		Not Available		Not Available		Not Available	
34	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
35	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
36	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
37	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
34-37	202301	1	202302	1	202302	1	202303	1	202304	1	202305	1
	202299	1	202302	1	202302	1	202303	1	202304	1	202305	1
33	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
40	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
41	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
42	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
33,34-37, 40-42	202023	1	202024	1	202025	1	202026	1	202027	1	202028	1
33,34-37, 40-42	Not Available		Not Available		Not Available		Not Available		Not Available		Not Available	
33,34-37, 40-42	202031	1	202032	1	(**)		202033	1	202034	1	202035	1
33,34-37, 40-42	Not Available		Not Available		Not Available		Not Available		Not Available		Not Available	
	Not Available		Not Available		Not Available		Not Available		Not Available		Not Available	

**All Plug Kits and Bottom Assembly Kits for 1-5/8" Port Size Valves can be used in the 2" Port Size Valves for reducing capacity.

Repair Kits for A4AS, A4AB, A4AD and A4AZ



			20mm (3/4")		25mm (1")	
Item No.	Description		Kit No.	Qty	Kit No.	Qty
37	"O" Ring		Only Avail. with Kit	1	Only Avail. with Kit	1
38	Cover, Bottom		Only Avail. with Kit	1	Only Avail. with Kit	1
40	Washer, Flat		Only Avail. with Kit	1	Only Avail. with Kit	1
41	Packing, Stem		Only Avail. with Kit	1	Only Avail. with Kit	1
37,38,40,41	Cover Kit		200761	1	200761	1
42	Nut, Packing		Only Avail. with Kit	1	Only Avail. with Kit	1
40-42	Packing Kit, Stem		202100	1	202100	1
43	Gasket		Only Avail. with Kit	1	Only Avail. with Kit	1
44	Seal Cap		Only Avail. with Kit	1	Only Avail. with Kit	1
43,44	Seal Cap, Kit		202110	1	202110	1
33-38,	Full Cap, Bottom	A4A	202010	1	202011	1
40-44	Assembly Kit	A4AK	202018	1	202019	1
33-38,	50% Cap, Bottom	A4A	202347	1	(*)	1
40-44	Assembly Kit	A4AK	202348	1	(*)	1
33-38,	17% Cap, Bottom	A4A	202346	1	(*)	1
40-44	Assembly Kit	A4AK	Not Available		Not Available	
3-6, 12-19,	Full Cap, Repair	Rge. A	202041	1	202044	1
29, 30, 33-37,	Kit, Reg. (All	Rge. V	202040	1	202043	1
40-42	except A4AK)	Rge. D	202042	1	202045	1
3-6, 12-19,	50% Cap, Repair	Rge. A	202352	1	(*)	1
29-30, 33-37,	Kit, Reg. (All	Rge. V	202354	1	(*)	1
40-42	except A4AK)	Rge. D	202353	1	(*)	1
3-6, 12-19,	17% Cap, Repair	Rge. A	202349	1	(*)	1
29-30, 33-37,	Kit, Reg. (All	Rge. V	202351	1	(*)	1
40-42	except A4AK)	Rge. D	202350	1	(*)	1
112	Cover, Top		Only Avail. with Kit	1	Only Avail. with Kit	1
29,112	A4AR Cover Kit		200680	1	200680	1
2,16(2),19(2),	Gasket Kits (Includes complete set of gaskets plus "O" Rings if applicable)					
25, 26, 29, 37,	Gasket Kit A4/S4		202112		202112	
43,45(3)						
	Indv'l Gaskets, "O" Rings & Valve Pk'g sold & pkgd in qtys only as indicated.					
29	Gasket Pkg, Adapter		202406	5	202406	5
37	"O" Ring/Gasket Pkg, Bottom Cap		202384	3	202384	3
43	Gasket Pkg, Seal Cap (Bottom)		202408	12	202408	12
2	Gasket Pkg, Seal Cap (Top)		202408	12	202408	12
45	Gasket Pkg, Flange		202079	12	202079	12
4	Packing Pkg, Stem (Top)		202478	25	202478	25
41	Packing Pkg, Stem (Bottom)		202478	25	202478	25
	Bolt Package Kits					
11	Bolt Package, A4A Bonnet		202246	8	202246	8
31	Bolt Package, Adapter		202248	8	202249	8
39	Bolt Package, Bottom Cap		Not Required		Not Required	
	Flange Bolt Package Includes bolts and nuts; no gaskets					
46	Nut		5/8"-11	2	5/8"-11	2
47	Bolt		5/8"-11x3"	2	5/8"-11x3"	2
46,47	Bolt Kit, Flange		201585	1	201585	1
50,52-54	Moduplate Kit "MP"		200518		200518	
52	Moduplate		Only Avail. with Kit	1	Only Avail. with Kit	1
54	O-Ring, "B"		Only Avail. with Kit	1	Only Avail. with Kit	1
50	O-Ring, "S", "D"		Only Avail. with Kit	2	Only Avail. with Kit	2

	Flange Kit	FK-25				FK-25			
	Specify Flange, Style, Connection, Size	FPT, SW, WN		ODS		FPT, SW, WN		ODS	
	Kit includes 2 Flanges only	Std	Also Avail.	Std	Also Avail.	Std	Also Avail.	Std	Also Avail.
	Connections Available Sizes in Inches	3/4	1, 1-1/4	7/8	1-1/8, 1-3/8	1	3/4 1-1/4	1-1/8	1-3/8 1-5/8

* All Plug Kits and Bottom Assembly Kits for 3/4" Port Size Valves can be used in the 1" Port Size Valves for reducing capacity.

Repair Kits for A4AS, A4AB, A4AD and A4AZ

	32mm (1-1/4")		40mm (1-5/8")		50mm (2")		65mm (2-1/2")		75mm (3")		100mm (4")	
Item No.	Kit No.	Qty	Kit No.	Qty	Kit No.	Qty	Kit No.	Qty	Kit No.	Qty	Kit No.	Qty
37	Only Avail. with Kit	1										
38	Only Avail. with Kit	1										
40	Only Avail. with Kit	1										
41	Only Avail. with Kit	1										
37,38,40,41	200761	1	Not Available		Not Available		Not Available		Not Available		Not Available	
42	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
40-42	202100	1	202100	1	202100	1	202100	1	202101	1	202101	1
43	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
44	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
43,44	202110	1	202110	1	202110	1	202110	1	202111	1	202111	1
33-38,	202012	1	202013	1	202014	1	202015	1	202016	1	202017	1
40-44	202020	1	202013	1	202014	1	202015	1	202016	1	202017	1
33-38, 40-44	Not Available		Not Available		Not Available		Not Available		Not Available		Not Available	
33-38, 40-44	Not Available		Not Available		Not Available		Not Available		Not Available		Not Available	
3-6, 12-19,	202047	1	202060	1	202063	1	202066	1	202059	1	202062	1
29, 30, 33-37,	202046	1	202049	1	202052	1	202055	1	202058	1	202061	1
40-42	202048	1	202061	1	202064	1	202067	1	202060	1	202063	1
3-6, 12-19, 29-30, 33-37, 40-42	NOTE: 50% Capacity Repair Kit is not available for port sizes 1-1/4" to 4". Capacity reduction can be obtained through use of field installing "Reduced Capacity Plug Kits". See description and contents of these kits elsewhere this section.											
3-6, 12-19, 29-30, 33-37, 40-42	NOTE: 17% Capacity Repair Kit is not available for port sizes 1-1/4" to 4". Capacity reduction can be obtained through use of field installing "Reduced Capacity Plug Kits". See description and contents of these kits elsewhere this section.											
1,12	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
29,112	200669	1	200673	1	200673	1	200690	1	200676	1	200677	1
7,16(2),19(2)	Gasket Kits (includes complete set of gaskets plus "O" Rings if applicable)											
25,26,29,37 43,45(3)	202113		202114		202114		202115		202116		202117	
Individual Gaskets, "10" Rings and Valve Packing sold and packaged in quantities only as Indicated.												
29	202407	5	202397	3	202397	3	202396	3	202399	3	202400	3
37	202384	3	202374	6	202374	6	202374	6	202382	3	202383	3
43	202408	12	202408	12	202408	12	202408	12	202404	5	202404	5
2	202408	12	202408	12	202408	12	202408	12	202408	12	202408	12
45	202080	12	202081	12	202081	12	202082	12	202083	12	202084	12
4	202478	25	202478	25	202478	25	202478	25	202478	25	202478	25
41	202478	25	202478	25	202478	25	202478	25	202479	5	202479	5
Bolt Package Kits												
11	202246	8	202246	8	202246	8	202246	8	202246	8	202246	8
31	202248	8	202249	8	202249	8	202249	8	202250	6	202250	6
39	Not Required		202251	6	202251	6	202251	6	202252	6	202252	6
Flange Bolt Package Includes bolts and nuts; no gaskets												
46	5/8"-11	4	5/8"-11	4	5/8"-11	4	3/4"-10	4	3/4"-10	4	7/8"-9	4
47	5/8"-11x2-3/4"	4	5/8"-11x3-1/4"	4	5/8"-11x3-1/4"	4	3/4"-10x3-3/4"	4	3/4"-10x3-3/4"	4	7/8"-9x4-1/2"	4
46,47	201595	1	201604	1	201604	1	201611	1	201611	1	201620	1
50,52-54	200518		200518		200518		200518		200518		200518	
52	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
54	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1	Only Avail. with Kit	1
50	Only Avail. with Kit	2	Only Avail. with Kit	2	Only Avail. with Kit	2	Only Avail. with Kit	2	Only Avail. with Kit	2	Only Avail. with Kit	2

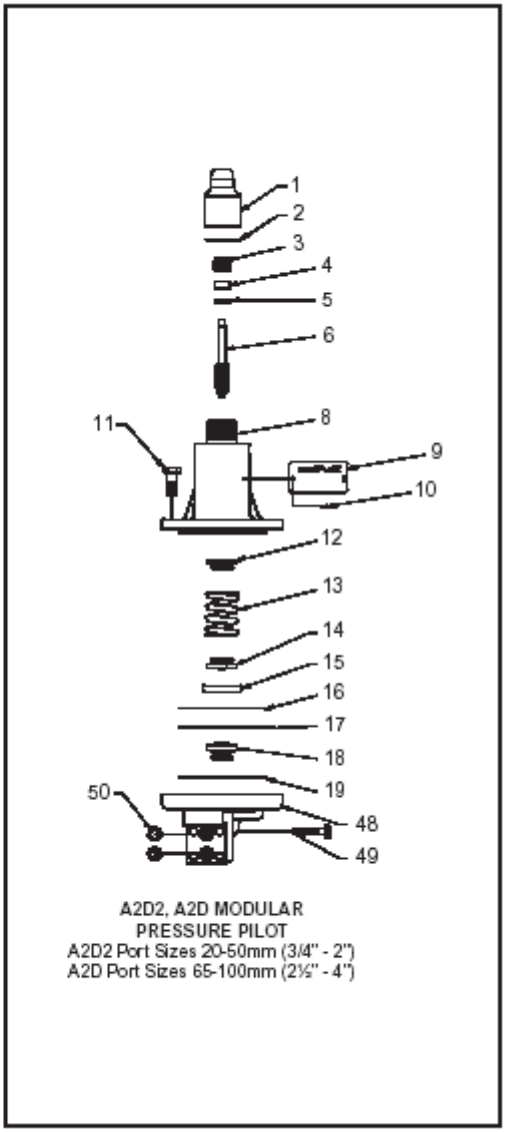
	FK-32				FK-40				FK-50				FK-65				FK-75				FK-100			
	FPT, SW WN		ODS		FPT, SW WN		ODS		FPT, SW WN		ODS		FPT, SW WN		ODS		FPT, SW WN		ODS		FPT, SW WN		ODS	
	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.	Std.	Also Avail.
	1-1/4	1-1/2	1-3/8	1-5/8, 2-1/8	1-1/2	2	1-5/8	2-1/8, 2-5/8	2	1-1/2	2-1/8	2-5/8	2-1/2		2-5/8	3-1/8	3		3-1/8	3-5/8	4		4-1/8	

Repair Parts Kits for A2D2 and A2D Modular Pressure Pilots

Item	Description		Qty.	Kit Number
1-2	Seal Cap Kit		1	202110
3-5	Packing Kit/Stem		1	202100
3-6, 12-15	Spring/Stem Kit	Rge. A/V	1	202006
		Rge. D	1	202007
1-6,8 11-16	Bonnet/Spring Kit	Rge. A/V	1	202008
		Rge. D	1	202009
12-14, 16	Spring Kit, Bonnet	Rge. A/V	1	202481
		Rge. D	1	202482
16,17 19	Diaphragm Kit	Rge. A/V	1	200770
		Rge. D	1	200771u
u Rge. D Diaphragm Kit has two (2) Diaphragms				
16-19	Seat Kit, Pilot	Rge. A	1	202001
		Rge. V	1	202004
		Rge. D	1	202003
48	Body			Not available separately
49-50	Bolt/"O" Ring Kit	Bolts	4	201572
		"O"Ring	2	onlyAvail.w/Kit

Note: Pressure Pilot A2D2 used on main valve sizes 3/4" to 2" port.
Pressure Pilot A2D used on main valve sizes 2-1/2" to 4" port.

Repair Kits indicated for the A2D2 and A2D are common parts used on the integral pressure pilot mounted on the A4A Series Regulator.



A2D2, A2D MODULAR
PRESSURE PILOT
A2D2 Port Sizes 20-50mm (3/4" - 2")
A2D Port Sizes 65-100mm (2½" - 4")

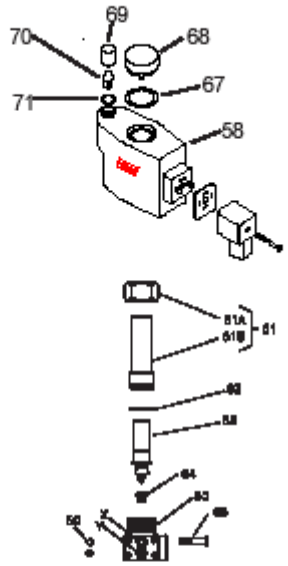
Spare or Additional A2D2 and A2D Repair Kit Packages

Note: The following items are included in the above Kits in the exact numbers as required for field repair. If additional "O" Rings, Gaskets or Stem Packing are desired for spares or future use, order from the following listing:

Item	Description	Qty.	Kit Package Number
2	Gasket Pkg./Seal Cap	12	202408
50	"O"Ring Pkg/Moduplate	12	202424
4	Stem Packing, Pkg.	25	202478

Repair Parts Kits for S6A Modular Pressure Pilot Solenoid

Item	Description	Qty.	Kit Number
55	Screw	1	Only Available with Kit
58	Coil Assembly	1	Consult Factory
67	O-Ring	1	Only Available with Kit
68	Knob	1	Only Available with Kit
67, 68	Knob Kit	1	205047
69	Lens	1	Only Available with Kit
70	Bulb Kit	6	205282
71	O-Ring	1	Only Available with Kit
69, 71	Lens Kit	6	205279
61B	Tube Assembly, Solenoid	1	Only Available with Kit
61A	Nut, Solenoid Tube	1	Only Available with Kit
62	Gasket	1	Only Available with Kit
61A, 61B 62	Tube Kit, Solenoid	1	201036
50	"O" Ring	2	Only Available with Kit Also available in package. See below.
66	Bolts	4	Only Available with Kit
50,66	Bolt/"O" Ring Kit	1	201574
62	Gasket	1	Only Available with Kit
63	Plunger/Needle Assembly	1	Only Available with Kit
62,63	Plunger Kit, Needle	1	201019
62	Gasket	1	Only Available with Kit
63	Plunger/Needle Assembly	1	Only Available with Kit
62, 63	Plunger Kit, Needle (D.C only)	1	201021
62	Gasket	1	Only Available with Kit
63	Plunger/Needle Assembly	1	Only Available with Kit
64	Seat Assembly	1	Only Available with Kit
62,63,64	Plunger Seat Kit	1	201630
50	"O" Ring Pkg., Moduplate	12	202424
65	Body S6A	1	Not Available Separately



S6A MODULAR SOLENOID PILOT
For A4 Port Sizes 20 - 100mm (¾" - 4")

FLANGES

VALVE SIZE		Ã FPT FLANGES		WELDING FLANGES								Ã FLANGES				
		Nom. Pipe Size	Flange Pkg. No.	Nominal Pipe Size		Sock Weld Socket I.D.		Weld Neck O.D.		Flange Package Number(2/Pkg)		Tubing O.D.		Fitting I.D.		Flge Pkg. No. (2/Pkg)
					Ã					Socket	Weld		Ã			
mm	Inches	Inches	(2/Pkg)	Inches	NW No.	Inches	mm	Inches	mm	Weld	Neck	Inches	mm	Inches	mm	
20	3/4	3/4	200016	3/4	20	1.070	27.81	1.050	26.67	200020	200023	1-1/8	28.57	1.130	28.70	200027
and	and	1	200017	1	25	1.365	34.67	1.315	33.40	200021	200024	1-3/8	34.92	1.380	33.05	200028
25	1	1-1/4	200018	1-1/4	32	1.705	43.31	1.660	42.16	200022	200025	1-5/8	41.27	1.631	41.43	200029
		1-1/4	200030	1-1/4	32	1.705	43.31	1.660	42.16	200032	200034	1-3/8	34.92	1.380	35.05	200036
32	1-1/4	1-1/2	200031	1-1/2	40	1.930	49.02	1.900	48.26	200033	200035	1-5/8	41.27	1.631	41.43	200037
												2-1/8	53.97	2.131	54.13	200038
40	1-5/8	1-1/2	200039	1-1/2	40	1.930	49.02	1.900	48.26	200041	200043	1-5/8	41.27	1.631	41.43	200045
and	and	2	200040	2	50	2.445	62.10	2.375	60.33	200042	200044	2-1/8	53.97	2.131	54.13	200046
50	2											2-5/8	66.67	2.631	66.83	200047
65	2-1/2	2-1/2	200048	2-1/2	65	2.945	—	2.875	73.03	200049	200050	2-5/8	66.67	2.631	66.83	200051
												3-1/8	79.37	3.131	79.53	200052
75	3	3	200053	3	80	3.575	90.81	3.500	88.90	200054	200055	3-1/8	79.37	3.131	79.53	200056
												3-5/8	92.07	3.631	92.23	200057
100	4	4	200062	4	100	4.575	116.20	4.500	114.30	200063	200064	4-1/8	104.77	4.132	104.95	200065

Ã FPT: Internal NPT (USA Standard Taper Pipe Thread).
Á NW: Metric equivalent nominal size for steel tubing.
Â Metric copper tubing used for refrigeration.
Ã ODS connections to fit copper tubing of given outside diameter. (Not for use with ammonia)

Definitions:
ODS - Outside Diameter Sweat
I.D. - Inside Diameter
O.D. - Outside Diameter
N.A. - Not Available

Flange Bolt Torque Requirements

Bolt Diameter	Valve Port Size	Torque
11mm (7/16")	13mm (1/2 ")	3.9 mkg (28 ft lb)
16mm (5/8")	20-50mm (3/4 "- 2")	11.8 mkg (85 ft lb)
19mm (3/4")	65-75mm (2-1/2 "- 3")	14.5 mkg (105 ft lb)
22mm (7/8")	100mm (4")	22.1 mkg (150 ft lb)

Safe Operation

(See also Bulletin RSBCV)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the Refrigerating Specialties Division valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent Refrigerating Specialties Division product Bulletins, and Safety Bulletin RSB prior to installation or servicing work.

Where cold refrigerant liquid lines are used, it is necessary that certain precautions be taken to avoid damage which could result from liquid expansion. Temperature increase in a piping section full of solid liquid will cause high pressure due to the expanding liquid which can possibly rupture a gasket, pipe or valve. All hand valves isolating such sections should be marked, warning against accidental closing, and must not be closed until the liquid is removed. Check valves must never be installed upstream of solenoid valves, or regulators with electric shutoff, nor should hand valves upstream of solenoid valves or downstream of check valves be closed until the liquid has been removed. It is advisable to properly install relief devices in any section where liquid expansion could take place.

Avoid all piping or control arrangements which might produce thermal or pressure shock.

For the protection of people and products, all refrigerant must be removed from the section to be worked on before a valve, strainer, or other device is opened or removed.

Flanges with ODS connections are not suitable for ammonia service.

Warranty

All Refrigerating Specialties Products are warranted against defect in workmanship and materials for a period of one year from date of shipment from factory. This warranty is in force only when products are properly installed, field assembled, maintained and operated in use and service as specifically stated in Refrigerating Specialties Catalogs or Bulletins for normal refrigeration applications, unless otherwise approved in writing by Refrigerating Specialties Division. Defective products, or parts thereof, returned to the factory with transportation charges prepaid and found to be defective by factory inspection will be replaced or repaired at Refrigerating Specialties' option, free of charge, F.O.B. factory. Warranty does not cover products which have been altered or repaired in the field; damaged in transit, or have suffered accidents, misuse, or abuse. Products disabled by dirt, or other foreign substances will not be considered defective.

THE EXPRESS WARRANTY SET FORTH ABOVE CONSTITUTES THE ONLY WARRANTY APPLICABLE TO REFRIGERATING SPECIALTIES PRODUCTS, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OR MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Refrigerating Specialties, nor to assume, for Refrigerating Specialties, any other liability in connection with any of its products.

Sporlan DDR 20 Valve

This valve is a differential pressure regulator that can be used on floating head systems with hot gas defrost. The following is an excerpt from the Sporlan Valve Company bulletin F90 60 3.

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS, MO 63143
FAX: 314-647-1714 PHONE: 314-647-2775

SPORLAN VALVE COMPANY

Bulletin F90 60 3 August 1990

Subject: DDR 20 Discharge Differential Regulating Valves

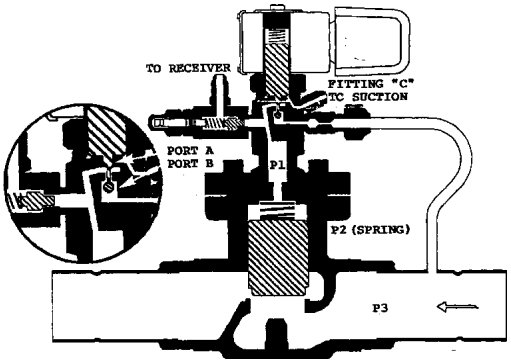
The DDR 20 is an adjustable pilot operated differential pressure regulating valve designed to control a differential pressure between the discharge line and the receiver on Supermarket refrigeration systems which utilize hot gas defrost. When defrost is initiated, hot gas flows back through the evaporators being defrosted. This defrost gas condenses in the evaporators and flows in reverse around the TEV and liquid line solenoid valve through check valves. This liquid refrigerant then flows to the liquid header where it is used by the evaporators that are not in defrost. In order for this reverse flow of hot gas to occur, the pressure of the discharge gas (defrost header) must be greater than the pressure of the receiver (liquid header). This pressure differential is created by the DDR 20 valve which is located in the discharge line before the condenser.

Valve Operation

The DDR 20 valve is designed to create a differential pressure between its inlet pressure and the receiver pressure. The pilot part of the valve senses receiver pressure through a field installed pilot line from the pilot differential valve to the receiver. Pressure from the valve's inlet enters the pilot through a tube from the inlet connection. This inlet pressure bleeds through a fixed restrictor to the top of the main valve piston. Pressure on top of the main piston is bled off through the pilot differential valve. The pilot differential valve reacts to the difference in pressure between the valve's inlet pressure and the receiver pressure. As this differential pressure increases and decreases it causes the pilot differential valve to open and close which in turn increases and decreases the pressure on top of the main piston. As this pressure on top of the main piston increases and decreases it causes the main piston to modulate closed and open.

A solenoid bypass feature is incorporated in the valve so that the valve can be made to go full open when there is no need for a differential to be created. Energizing this solenoid coil will open the valve fully. De-energizing this solenoid coil will allow the valve to modulate to maintain a differential.

Figure 1



Differential Operation

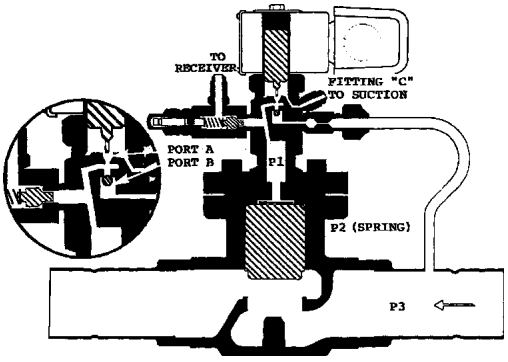
Coil De energized (See Figure 1) When the solenoid is de energized the kick off spring forces the pin and plunger down, closing Port A and opening Port B. Discharge gas enters the chamber on top of the piston through Port B and is bled out through the pilot differential valve.

When the differential pressure between the discharge line and the receiver is below the setting of the pilot valve, the pilot valve modulates closed. This allows pressure to build on top of the main piston. As this pressure (P1) approaches the inlet pressure (P3) the force combined with the force from the spring (P2) pushes the piston down, modulating the valve closed.

As the differential pressure rises above the pilot valve setting, the pilot valve modulates open. This bleeds refrigerant from the chamber on top of the piston at a faster rate than it is entering so the pressure decreases. As this pressure (P1) plus the pressure from the spring (P2) falls below the inlet pressure (P3), the inlet pressure pushes the piston up, modulating the valve open. The valve will open only as far as necessary to maintain the pilot valve

setting. The pilot valve will then modulate the piston from partially open to partially closed to maintain its setting.

Figure 2



Full Open Operation

Coil Energized (See Figure 2) When the solenoid is energized, the pin and plunger are pulled up, opening Port A. The discharge gas entering the valve then forces the small ball up to close Port B.

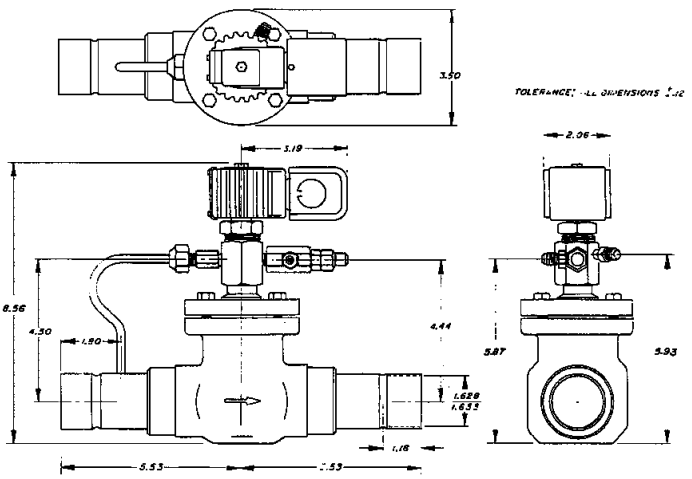
Discharge gas can no longer enter the chamber on top of the main piston. The pilot differential valve closes and refrigerant from the top of the piston bleeds to the suction line through Port A and Fitting C. This decreases pressure in the chamber (P1) so the inlet pressure (P3) moves the piston up and the valve opens.

Valve Location And Installation These valves can be installed in horizontal or vertical lines, whichever best suits the application and permits easy accessibility of the valves. However, consideration should be given to locating these valves so they don't act as oil traps or so that solder cannot run into the internal parts during brazing. Care should also be taken to install the valves with the flow in the proper direction.

Any of the commonly used brazing alloys for high side usage are satisfactory. However, when soldering or brazing, it is very important that the internal parts be protected by wrapping the valve with a WET cloth to keep the body temperature below 250°F. Also, when using high temperature solders, the torch tip should be large enough to avoid prolonged heating of the copper connections. And, always direct the flame away from the valve body.

Important

The two field installed pilot lines, one to the receiver and one to the suction line, must be connected in order for the valve to operate properly. The pilot line to suction is not a constant high to low side bleed. It only bleeds the small amount of refrigerant from the top of the valve's main piston to



open the valve when the solenoid coil is energized. Once the valve is open and at all other times there is no high to low side bleed. The bleed through the pilot differential valve, that occurs when the valve is modulating, is to the receiver.

Setting Procedures

The DDR 20 is set by turning the adjusting stem located under the cap on the pilot differential valve. Turning the stem clockwise increases the setting, counterclockwise decreases the setting. Adjustments must be made with the valve de energized and no cases in defrost. Once the valve is set it will control to maintain this differential setting during defrost. However, when a defrost is initiated the head pressure may fall. It can take several minutes for the differential to be created while the discharge pressure increases above the liquid header pressure.

Specifications

Valve Type	Port Size	Adjustment Range	Connections (ODF)	
	(In.)	(Psig)	Inlet	Outlet
DDR 20	1 5/16	5/50	1 5/8	1 5/8

DDR 20 Capacities Tons Of Refrigeration			
Pressure Drop Across Valve (Psig)	Refrigerant		
	12	22	502
0.5	7.1	10.2	8.4
1	10.1	14.4	11.8
2	14.3	20.4	16.7
3	17.5	24.9	20.5
4	20.2	28.8	23.7
5	25.6	32.2	26.5

Capacities are based on 40°F evaporator temperature, 100°F condenser temperature, 25°F superheated return gas, discharge gas temperature 50°F above isentropic compression. For capacities at other evaporator temperatures use multipliers in table below:

Evaporator Temperature Correction Factors

	Multiplier				
	Evaporator Temperature °F				
	40°	30°	20°	10°	0°
R 12	1.0	.97	.95	.93	.91
R 22	1.0	.98	.96	.94	.92
R 502	1.0	.98	.95	.92	.90

	Multiplier				
	Evaporator Temperature °F				
	0°	10°	20°	30°	40°
R 12	.91	.88	.86	.83	.81
R 22	.92	.90	.87	.85	.83
R 502	.90	.87	.84	.82	.79

Sporlan Y894 Valve

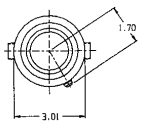
The following is an excerpt from Sporlan Valve Company.

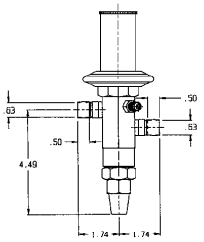
SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS, MO 63143
FAX: 314-647-1714 PHONE: 314-647-2775

November 9, 1989

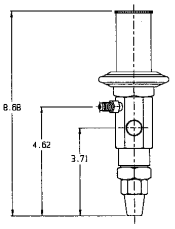
Y894 Receiver Pressurization Valve

Description





The Y894 is a differential pressure regulating valve used on surge receiver type systems. It is installed in a line from the discharge of the system to the receiver. Two equalizer lines are installed to allow the valve to sense the pressures it will control. One line runs from the valve to the receiver to sense receiver pressure. The other line runs from the valve to a point above the sightglass on the liquid drop line from the condenser. This point needs to be 6 feet above the receiver. This will require field installation in most circumstances.



During summer conditions the Y894 valve will bypass discharge gas into the receiver as required to raise its pressure above the pressure in the liquid line from the condenser. This causes liquid to back up in the liquid line to the level of the sightglass. This insures that liquid is being supplied to the system.

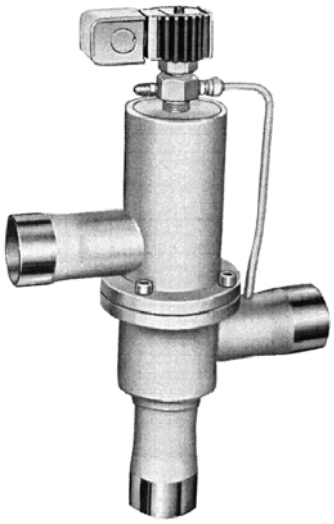
Valve Adjustment

To adjust the Y894 valve the system must be in a summer condition, or a simulated summer condition, with the outlet pressure regulating valve that pressurizes the receiver during winter operation closed. The Y894 valve can then be adjusted from the adjustment stem underneath the valve's bottom cap. Turn this adjustment stem to raise the level of the liquid in the liquid line from the condenser to the level of the sightglass. A clockwise adjustment will reduce the receiver pressure and lower the liquid level. A counter clockwise adjustment will increase the receiver pressure and raise the liquid level.

Heat Reclaim

The basic concept of refrigeration is to transfer heat from one place to another. Heat is removed from the display case or walk-in and its contents and transferred to the outside or ambient air. By incorporating a multi-circuited heat reclaim coil in to the air handling system of the store, this heat can be diverted to heat the store.

The heat reclamation coil is installed in the store duct system and is integrated with the heating and air conditioning system. The coil should be downstream of the ac coil and upstream of any booster heaters. The air should enter the refrigerant outlet side of the coil, and the liquid outlet of the coil should be lower than the gas inlet.



Sporlan HR Valve:

Simply speaking, a diverting valve is installed in the discharge line of the compressor and is piped to the normal condenser and the heat reclaim coil. This valve is equipped with an electric solenoid that is activated by the environmental control panel.

The diverting valve is optional and can be factory installed. Piping and wiring from the controls and the heat reclaim coil is field installed. A check valve, required for series piping of Sporlan HR Valve is normally field furnished and installed, but can be supplied as an option for field or factory installation. Standard valve coil voltage is 208/1/60. Other voltages can be furnished on request. Unless otherwise instructed a Product Engineering heat reclaim valve will be used.

When using a hot water reclaim tank, it is quite normal for the rack to have a much greater flow capacity than the tank can handle with a reasonable pressure drop. A differential check valve is optionally available that can be field or factory installed in parallel with the water tank. This valve is set for a ten (10) psi differential. This valve will bypass sufficient gas to keep the total pressure drop across the tank to the 10 lb. limit.

Product Engineering HR Valve

See the Product Engineering Bulletin that follows for instructions on Installing a P.E. Valve, Function Testing and Servicing, Checking the Solenoid Coil, Checking the Pilot Assembly, Checking the Main Body, Disassembling the valve, and Reassembling the valve. The following excerpt is taken from Product Engineering Bulletin SR02.

PRODUCT
ENGINEERING
CORPORATION

P O BOX 15369
ASHEVILLE NC 28813

1140 SWEETEN CREEK RD
ASHEVILLE NC 28803

704 274 1286
FAX 704 274 0027

BULLETIN SR02

Product Engineering Corporation

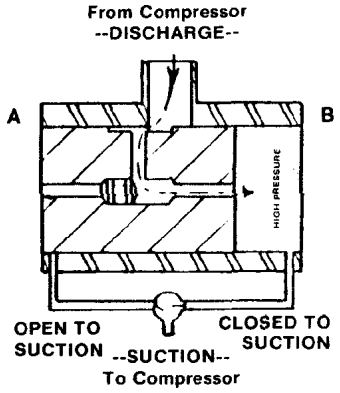
Installation & Service Instructions

Sizes 02 12

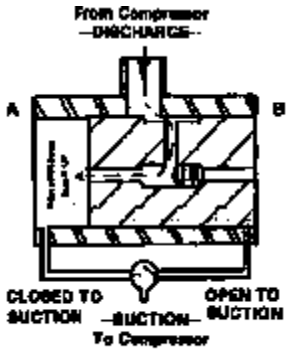
This Valve Is Intended For Use With R12, R22, R500, And R502, At A Maximum Fluid Temperature Of 149° C For Other Refrigerants, Please Consult The Manufacturer.

Operation

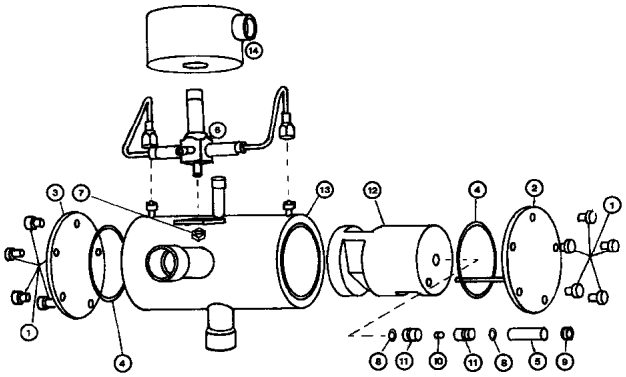
With the valve in the de engerized position (Figure 1) high pressure gas is being directed to end B of the valve through the slave pilot inside the spool. If the solenoid pilot is then energized end 'B' of the valve will become open to the suction side of the system through the solenoid pilot valve allowing the high pressure gas to escape. The drop in pressure will pull the slave pilot piston toward end B thereby routing the high pressure gas to end 'A' of the valve and push the spool toward the lower pressure at end 'B (Figure 2)



(FIGURE 1)



(FIGURE 2)



NO	Description	QTY.	02	03	06	07	090	12
* + 1	Cap Screws	()	(10) 40 02	(10) 40 03	(10) 40 06	(10) 40 07	(12) 40 09	(12) 40 12
2	Pin Cap	1	60 02	60 03	60 06	60 07	60 09	60 12
3	End Cap	1	61 02	61 03	61 06	61 07	61 09	61 12
* + 4	"O" Ring	2	50 02	50 03	50 06	50 07	50 09	50 12
+ 5	Slave Spacer	1	02 1 9	03 1 9	06 1 9	07 1 9	09 1 9	12 1 9
# 6	Pilot Assembly	1	P200 2 (Valve Number)					
+ 7	Pilot Nut	1	P200 2 3	Same For All Valves				
+ 8	Slave "O" Ring	2	P200 50					
+ 9	Locking Screw	1	P200 1 4					
+ 10	Slave Pilot Piston	1	P200 1 5					
+ 11	Slave Pilot Seat	2	P200 1 6					
12	Spool	1	Not Available					
13	Body	1	Not Available					
14	Coil	1	Ap100 1 16 (Consult Coil Catalog For Voltage And Lead Length Req'd)					

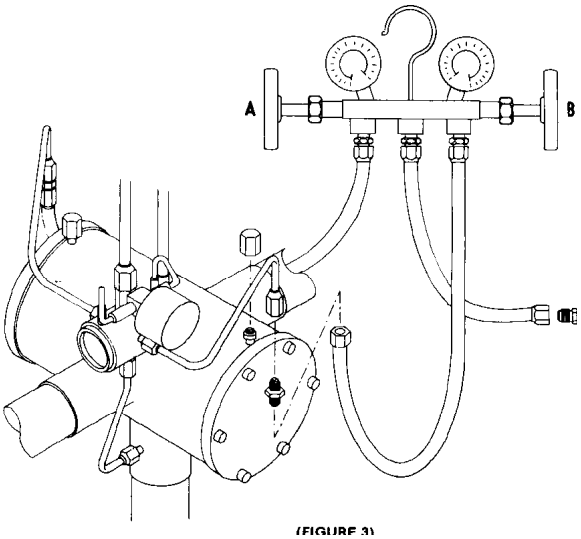
This item constitutes the Pilot Assembly.

+ These items included in the Slave Pilot Kit.

Installing A P.E. Valve

Do not disassemble the valve before, during, or after installing. Disassembly is not necessary while brazing, but overheating the connections will make the brazing more difficult. A thick consistency flux is required to ensure that no flux enters the valve. Use silver solder only, when brazing steel stub valves. DO NOT USE WET RAGS FOR COOLING: Steam will be drawn into the valve and cause rusting. It is suggested that one play the brazing torch more on the system tubing than on the valve connections

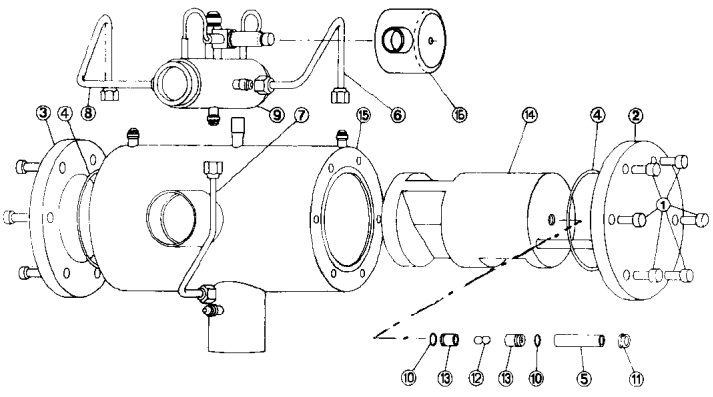
It is important that the tubing be formed accurately so that strain will not be exerted on the stubs and the valve body DO NOT MOUNT OR SUPPORT THE VALVE BY CONNECTIONS AROUND THE BODY OR THE STUBS, but around the system tubing only; otherwise the valve could bind.



(FIGURE 3)

Function Testing And Servicing

A Check the valve for binding. Because the body and spool are a precision fit, any undue tension applied to the valve or stubs can keep the spool from shifting In installation, do not support the valve connections around the body or the stubs. Avoid long runs of straight pipe leading into the valve, which in expanding or contracting could compress the valve To release any tension on the valve, anneal the lines 12" to 18" away from the valve body by heating the lines with a torch until they are red hot.



B Check the connections on the main valve body and the

pilot assembly, and tighten or solder any leaks.

C Check both end caps for leaking and tighten if necessary; if leak persists, replace the neoprene 'O' rings. Unit must be shut down, or valve isolated from pressure Loosen all end cap screws 1/8" to 1/4", and tap end cap slightly with something soft (a piece of nylon or soft clean wood) to release any vapor still in the valve (CAUTION: If the removing of the spool is not done in this way, the vapor in the valve could cause the spool to shoot out the opened end, resulting in possible injury to service personnel and damage to the spool) When there is no vapor in the valve, remove end caps and replace the 'o' rings.

D Check The Solenoid Coil. The only way to check the solenoid coil is to take it off the armature, turn it on and test the magnetic pull with a metal rod. CAUTION: Leaving the coil 'ON' for more than one minute when it is removed from the armature will burn it out.

E Check The Pilot Assembly

Required Equipment:

(1) Serviceman's gage set with hoses

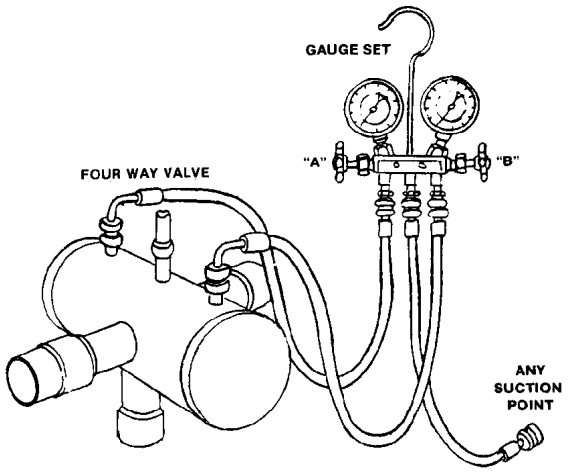
(2) 1/4 X 1/4 SAE Unions

(2) 1/4 SAE Flare Cap

(1) 1/4 SAE Plug

1 With the unit shut down, attach the gage set hoses to the pilot lines as shown in Fig. 3 Use the Flare Caps on main valve body to pilot connections, and plug the gage set middle hose.

2 With hand valves fully open and the valve de energized, gage A should read discharge pressure, and gage B should read suction pressure



(FIGURE 4)

3 When the coil is energized. gage B should read discharge pressure and gage A should read suction pressure

4 Repeat steps 3 and 4 several times. If the pilot valve is faulty, it cannot be cleaned or repaired, and should be replaced with the appropriate P.E. Pilot Assembly.

F Check The Main Valve. To check the main valve for malfunction; DO NOT REMOVE FROM SYSTEM. Heat reclaim valves can be completely checked for operation in the system.

Required Equipment:

(1) Serviceman's gage set with hoses

(2) 1/4 SAE Plugs

(1) 1/4 SAE Flare Cap

1 Close the hand shut off valve for the pump out line.

2 Close the shut off valve for the pilot valve to suction connection

3 Disconnect the lines from the pilot assembly to the main valve body, plug the pilot lines, and cap the SAE 1/4 flare connection on the side of the Discharge stub.

4 Connect the gage set to the 1/4 SAE connections of the main valve body. (Fig. 4) Hand valves A and B should be closed.

5 Connect the center hose of the gage set to any suction connections, such as a compressor suction service valve.

6 Open hand valve A of the gage set. The spool will shift to the end of the valve where A is connected. The A gage will display suction pressure; B will show discharge pressure.

7 Close gage A and open gage B. The spool should shift to the end where hose B is connected. Now gage B will indicate suction pressure; and gage A will show discharge pressure.

8 Repeat steps 6 & 7 several times. If no shift occurs the main valve or the slave pilot has contamination, and may be disassembled and cleaned, following carefully the instructions given.

G To Disassemble The Valve. The unit must be completely shut down. Be extremely careful with the inner parts, which are not interchangeable. Each spool is a hone fit with its own body.

To disassemble the valve, loosen all the end cap screws between 1/8" and 1/4", and tap the end cap slightly. If there is any vapors till remaining in the valve, this will release it (Caution: If there moving of the end caps is not done in this way, any vapor still in the valve will cause the spool to shoot out the opened end, resulting in possible injury to service personnel and damage to the spool.) When there is no more vapor in the valve, remove the caps and carefully slide the spool out. If the spool is too tight to remove by hand, DO NOT HAMMER IT. A piece of nylon or soft, clean wood can be used When the spool is out, clean the spool and body with a lint free towel.

It is not recommended that the slave pilot be removed because it is factory seated, but if something is protruding from either end hole, remove the slave pilot, clean it and carefully replace it in the exact order it came apart.

H TO Reassemble The Valve. Use the drawing on the white sticker (on the non pin end cap) to check which end of the valve that cap goes on. The spool will accordingly be oriented with the pin hole toward the other end. The shallow lengthwise groove in the spool which connects two of the crosswise slots must face into the discharge stub. Once you have determined the general orientation of the spool, oil it and align it so that it will enter the valve body. Again, DO NOT USE A HAMMER to force it in. Do not attempt to loosen the spool by sanding it, as this will make it leak internally. Oil the o'ring grooves in the ends of the body. Replace index pin cap first, making sure the pin is locating properly in the spool. The screw holes are drilled so that the end cap will only match in the correct radial position. Replace other cap and tighten screws. When replacing end caps, be sure to use new screws and 'O' rings as furnished in P.E. Inspection Kits. Repeat function test of valve; if it will not function, replace it.

Ball Shut-Off Valve

Kysor//Warren uses as standard ball valves manufactured by Mueller Valve Company. The valves are used as isolation valves throughout the unit. When valves are sent loose in field-installed kits, these valves will be sent.

Mueller Actuated Ball Valve

The following excerpt is taken from a Mueller product catalog.

Advanced Isolation Control Free Flowing Efficiency.

Mueller's CYCLEMASTER® Series actuated ball valves feature exclusive MCMTM seal technology which provides virtually no leak rates, even after hundreds of thousands of cycles. Precision dual bearings and blowout-proof stems are engineered for extended life cycles that far exceeds industry standards.

CYCLEMASTER® valves feature a full-flow ball port design to match line size I.D., minimizing pressure drop and increasing flow capacity. The gradual operating characteristics of the ball valve eliminates the abrupt cycling, line hammer, and efficiency loss associated with solenoid-operated shut-off valves.

The motorized actuator provides either local or remote operation, and may be controlled by a thermostat, pressure, switch, or microprocessor. Models are available in multiple voltages and with an optional fail-safe positioning feature.

Another product solution from the company who's been leading valve technology for over 80 years.

Talk to your local Mueller representative, or call 1-800-251-8983 for more information.

Look for these Mueller advantages:

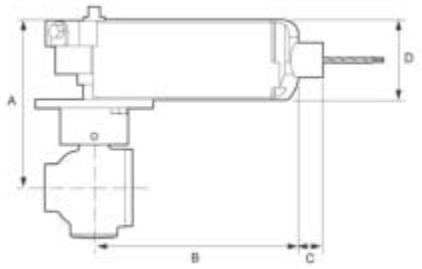
- Full port construction to match line size I.D.
- Minimizes pressure drop.
- Quarter turn operation, with ball position indicated by arrow.
- Full shutoff capability.
- Dual pin stops.
- Gradual open/close stops line hammer.

- Chromium plated ball.
- Nylon anti-friction ring.
- Exclusive MCMTM leak-free seals.
- Compatible with all new refrigerants and oils.
- Remote operating capability.
- Removable actuator for quick change replacement.
- Manual override and valve positioning.
- Electronic overload protection.
- Models available with auxiliary switch.
- All valves are 100% tested and UL/cUL listed.

Specifications

Actuator	Series I	Series II	Series III
Size	1/2-7/8	1/8 - 1 5/8	2 1/8 - 3 1/8
Torque (in.-lb.)	44	132	310
Power Supply (VAC/DC)	24		
Power Consumption (W)	2.3	2.3	6
Running Time (sec.)	90	125	150
Ambient Temp (°F)	-22 to 130		

Ball Valve	
Refrigerants	All Flourinated Types
MWP	700 psig
Working Temp Range	-40° F to 300° F



CYCLEMASTER® Actuated Ball Valves										
	Straight					3-Way				
	Part No.	A	B	C	D	Part No.	A	B	C	D
1/2	AW17861	4.05	3.71	NA	2.69	AY17861	4.05	3.71	NA	2.69
5/8	AW17862	4.05	3.71	NA	2.69	AY17862	4.05	3.71	NA	2.69
3/4	AW17863	4.36	3.71	NA	2.69	AY17863	4.36	3.71	NA	2.69
7/8	AW17864	4.36	3.71	NA	2.69	AY17864	4.36	3.71	NA	2.69
1 1/8	AW17865	4.89	5.75	.65	3.18	AY17865	4.89	5.75	.65	3.18
1 3/8	AW17866	5.12	5.75	.65	3.18	A 17810	5.70	5.75	.65	3.18
1 5/8	AW17867	5.84	5.75	.65	3.18	A 17811	6.19	5.75	.65	3.18
2 1/8	AW17868	6.50	8.25	.67	3.93	A 17812	6.50	8.25	.67	3.93
2 5/8	AW17871	6.50	8.25	.67	3.93	A 17813	6.50	8.25	.67	3.93
3 1/8	AW17872	6.50	8.25	.67	3.93	A 17814	6.50	8.25	.67	3.93

Straight		Nominal Liquid Capacity				Suction Vapor Capacity			
Size	Cv	R12	R134a	R404a	R410a	R12	R134a	R404a	R410a
1/2	6.20	20.126	18.249	12.619	19.617	1.997	1.469	1.565	2.363
5/8	11.20	36.358	32.966	22.796	35.437	3.608	2.654	2.827	4.268
3/4	18.95	61.516	55.777	38.569	59.957	6.104	4.491	4.783	7.221
7/8	29.30	95.114	86.240	59.635	92.704	9.438	6.943	7.395	11.165
1 1/8	56.55	183.573	166.447	115.098	178.923	18.216	13.401	14.272	21.549
3/8	84.58	274.564	248.949	172.148	267.609	27.244	20.043	21.347	32.23
1 5/8	225.04	730.527	662.373	458.030	712.021	72.489	53.327	56.797	85.753
2 1/8	291.59	946.562	858.254	593.480	922.583	93.926	69.097	73.593	111.112
2 5/8	184.85	600.061	544.080	376.230	584.861	59.543	43.803	46.653	70.438
3 1/8	127.99	415.482	376.720	260.501	404.957	41.228	30.329	32.303	48.771

Straight		Nominal Hot Gas Capacity			
Size	Cv	R12	R134a	R404a	R410a
1/2	6.20	3.723	2.971	2.855	4.343
5/8	11.20	6.725	5.367	5.157	7.845
3/4	18.95	11.379	9.080	8.726	13.273
7/8	29.30	17.594	14.040	13.491	20.522
1 1/8	56.55	33.957	27.097	26.039	39.609
3/8	84.58	50.789	40.528	38.945	59.242
1 5/8	225.04	135.132	107.831	103.621	157.623
2 1/8	291.59	175.094	139.720	134.264	204.236
2 5/8	184.85	110.999	88.574	85.115	129.473
3 1/8	127.99	76.855	61.328	58.934	89.647

3-Way		Nominal Liquid Capacity				Suction Vapor Capacity			
Size	Cv	R12	R134a	R 404a	R410a	R12	R134a	R404a	R410a
1/2	3.94	12.790	11.597	8.019	12.466	1.269	0.934	0.994	1.501
5/8	4.63	15.030	13.628	9.424	14.649	1.491	1.097	1.169	1.764
3/4	11.90	38.630	35.026	24.220	37.651	3.833	2.820	3.003	4.535
7/8	10.89	35.351	32.053	22.165	34.456	3.508	2.581	2.748	4.150
1 1/8	19.33	62.749	56.895	39.343	61.160	6.226	4.581	4.879	7.366
1 3/8	31.06	100.827	91.421	63.217	98.273	10.005	7.360	7.839	11.836
1 5/8	44.69	145.073	131.539	90.959	141.398	14.395	10.590	11.279	17.029
2 1/8	76.32	247.751	224.637	155.336	241.474	24.584	18.085	19.262	29.082
2 5/8	69.85	226.748	205.594	142.167	221.004	22.500	16.552	17.629	26.617
3 1/8	58.19	188.897	171.274	118.436	184.112	18.744	13.789	14.686	22.174

3-Way		Nominal Hot Gas Capacity			
Size	Cv	R12	R134a	R404a	R 410a
1/2	3.94	2.366	1.888	1.814	2.760
5/8	4.63	2.780	2.219	2.132	3.243
3/4	11.90	7.146	5.702	5.479	8.335
7/8	10.89	6.539	5.218	5.014	7.628
1 1/8	19.33	11.607	9.262	8.901	13.539
1 3/8	31.06	18.651	14.883	14.302	21.755
1 5/8	44.69	26.835	21.414	20.578	31.302
2 1/8	76.32	45.829	36.570	35.142	53.456
2 5/8	69.85	41.944	33.470	32.163	48.925
3 1/8	58.19	34.942	27.883	26.794	40.758

Conditions:

Tonnage calculations are based on the following conditions:

Evaporator temperature = 10°F

Vapor temperature exiting evaporator = 10°F superheated

Liquid temperature entering evaporator = 100°F

Hot gas temperature = 140°F

Pressure drop across valve = 1psi

Prefixed for Actuator Options:

AWS = Straight Actuated Ball Valve with Auxiliary Switch

AYS = 3-Way Actuated Ball Valve with Auxiliary Switch

AS = 3-Way Actuated Ball Valve with Auxiliary Switch

BS = Actuator Kit with Auxiliary Switch

Actuator Kits		
Size	Straight	3-Way
1/2	B 34437	B 34437
5/8	B 34437	B 34437
3/4	B 34438	B 34438
7/8	B 34438	B 34438
1 1/8	B 34439	B 34439
1 3/8		B 34440
1 5/8	B 34440	B 34441
2 1/8	B 34441	B 34442
2 5/8	B 34441	B 34442
3 1/8	B 34441	B 34442

Condensers

All condensers should be located at an elevation higher than the parallel system to assure liquid drainage from the condensers to the receiver. If the condenser has dual drop legs to a single unit, an elevation difference of a least six (6) feet is required. The dual drop legs should be dropped the six (6) feet before being joined together. This is to prevent the possibility of some of the condenser tubes being logged with liquid.

The remote air-cooled condensers must be located to receive free airflow through the coil. Exhaust heat from any source must not be allowed to interfere with condenser operations. Vertical airflow condensers must be cross-leveled (see condenser bulletin for recommended settings).

Oil Control System

The oil control system provides a method of regulating the oil level in each individual crankcase. It does not require that the compressors be the same make or model. The oil control system uses two or three basic components.

- Oil Separator
- Oil Reservoir (low pressure systems only)
- Oil Level Regulator

Oil Level Regulators

Each compressor has an oil level regulator attached to control the oil level in each individual compressor. The regulators are supplied oil by the common oil reservoir, which in turn is supplied by the oil separator.

The oil level regulator controls the oil level in each individual crankcase with a float-operated valve. It holds back excess oil until the oil level in the compressor crankcase drops, lowering the float and opening the valve. Oil from the oil reservoir will then be admitted into the crankcase, raising the float. When the correct level is reached, the valve will close stopping the flow of oil to that particular crankcase.

As standard, all oil level regulators are adjustable. The regulator is UL listed at 450 psig working pressure and with a 2250 psig burst strength. All oil regulators are suitable up to a maximum differential pressure of 90 psig. Sporlan models are standard.

Temprite Oil Separator

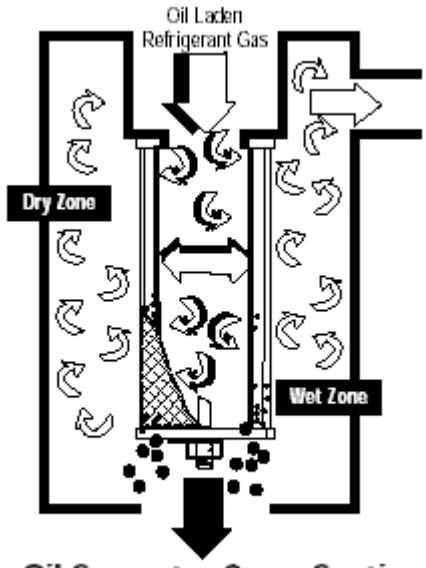
The following excerpt is taken with permission from the Temprite Product Catalog.

Temprite

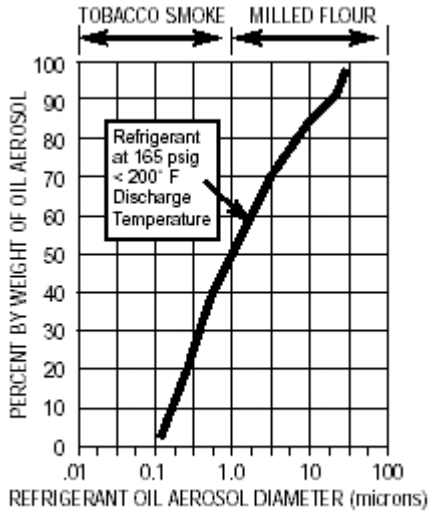
The most respected name in oil management systems

We, at Temprite, have one goal in mind when we conceptualize our products; to design and manufacture the most efficient refrigeration components available, worldwide. We realize that with refrigeration design, the sum of the components equals the overall efficiency of the system. When you call out Temprite products, you can feel confident that you're specifying an engineered product designed to enhance the performance of the total system.

Why Coalescent Oil Separators?



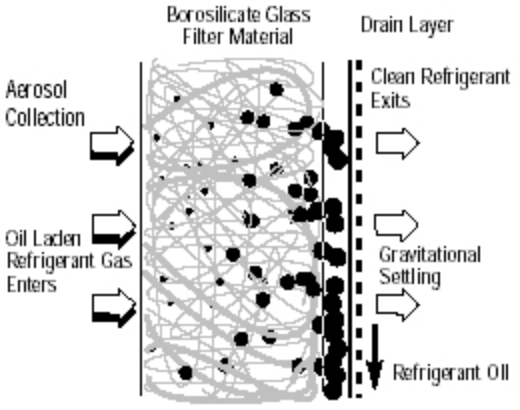
Oil Separator Cross Section



Typical Aerosol Distribution

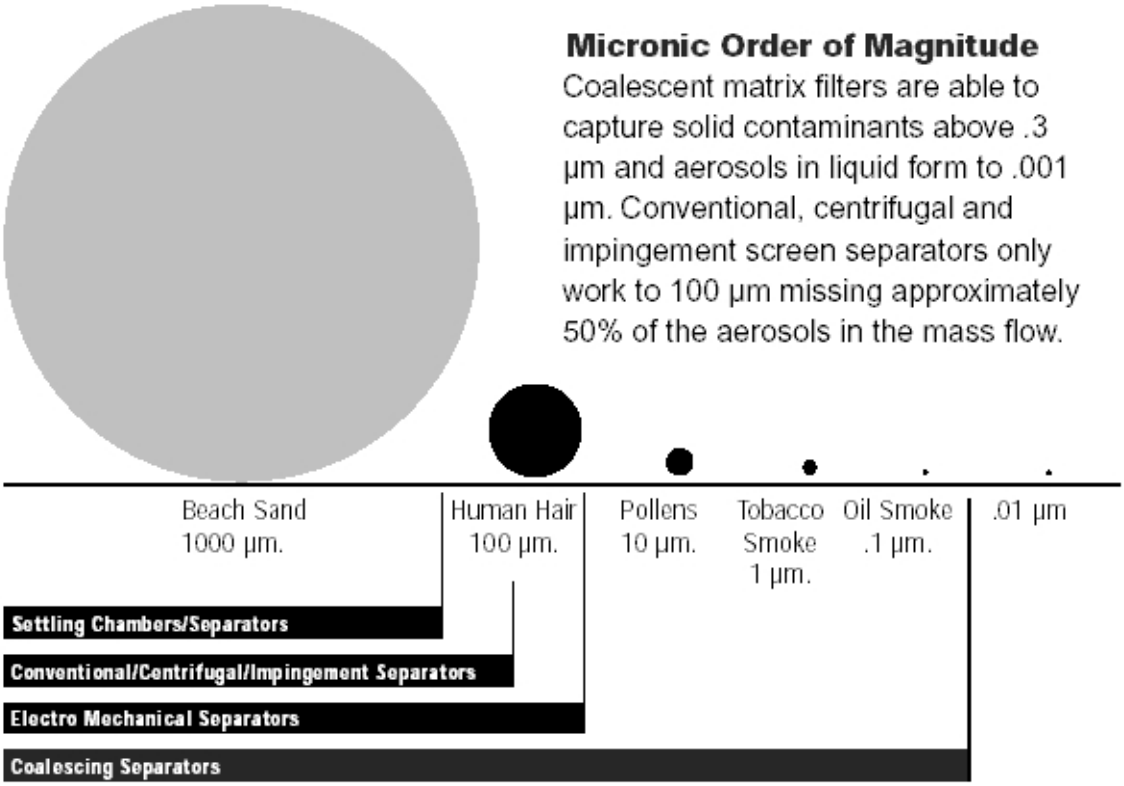
Atomized oil present in the discharge gas enters the interior of the filter flowing from the inside of the filter to the outside. Droplet sized oil over 100 microns (100 μm) are generally separated here by expansion of gases.

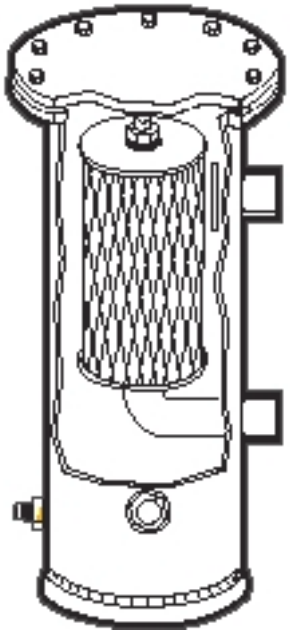
This graph illustrates micron particle sizes from .01 to 100. Refrigerant oils in aerosol form typically range from less than 0.1 to 40 microns in size. The majority of aerosols in the discharge gas are in the 0.4 to 10 micron range with greater than 50% of the aerosols less than 1 μm in size.



Filter Cross Section

As aerosol sized gas enters the borosilicate glass matrix it vibrates from side to side colliding with other molecules and agglomerating. Large oil droplets are moved to the outside of the filter and enter the gravitational drain layer.





The Temprite 900 and 920 Series is unquestionably the standard in modern oil separation by virtue of their exceptional performance range. Unlike centrifugal or impingement screen separators, which have virtually the same performance characteristics, the 900 and 920 Series separators are not dependent upon velocity for efficiency. So, when the load drops off, the separator keeps working at 99% efficiency. The reason the 900 and 920 Series oil separators work so well is because they employ a borosilicate coalescent filter-separator to do the work impingement screens formerly did. These exceptionally pure, extremely fine glass fiber matrices force the oil molecules to collide into one another, agglomerating until they fall to the bottom of the separator. Because this filter is finer than a filter/drier, it will pick up any and all solid contaminants and dirt circulating in the system to 0.3 microns. Remember, the filter is also doing the separating. Normally, on short self-contained applications the amount of solid contaminants is small, but on large parallel rack/pack/multiplexed systems, system cleanliness can be a problem. This is why Temprite developed the 920 Series accessible coalescent oil separators. In the first 24 to 48 hours of operation, the filter-separator cleans the system of all solid contaminants larger than 0.3 microns. The filter-separator is then changed and a new filter-separator does the job of separating and balancing out the system. The Temprite 900 Series is designed for OEM applications where cleanliness specifications may be audited.

However, if the filter-separator becomes over-loaded with solid contaminants and dirt, it will not function at it's optimum performance level. This is why we have introduced the Temprite Pressure Differential Indicator. It tells you when the filter separator is becoming dirt logged. Just check the pressure differential across the filter and you'll know whether or not the filter needs changing. The PDI may also be wired to an alarm to warn you electronically. In the event of a compressor burn-out, the carbon and solid contaminants will be localized at the separator. You may also install a Temprite 920 Series on a system that has had a burn out to facilitate clean up. Just put in a Temprite Clean-Up Filter to purge the system of unwanted contaminants. If used in conjunction with a standard filter-separator, you can return the oil to near virgin state.

The 900 and 920 Series also enhance the performance of other components by eliminating solid contaminants and oil from the system. Thermostatic Expansion Valves work better because they're dirt free-oil free. Desiccant in filter dryers are more effective when they're not logged with oil thus enhancing the entire system's performance.

Finally, the Temprite 920 Series Oil Separators have been proven, in independent third-party tests, to be more efficient than any other oil separator commercially available. This efficiency means better heat transfer through the coils translating into significant kW savings for the end user. For a copy of the Emerson Climate Technologies report to see how much money your chain could save, contact Temprite at temprite@temprite.com or 630-293-5910.

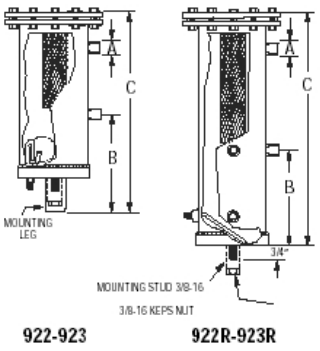
Dimensions

Model 922, 922R, 923 & 923R

Model 922, 923
Oil Separator – Accessible Coalescent
Model 922R, 923R
Oil Separator/Reservoir – Accessible Coalescent

Model	Maximum Working Pressure	Oil Connector Size	Dia.	Dimension "A"	Dimension "B"	Dimension "C"	Oil Charge Amount	
922	450 PSIG	1/4" SAE	4"	5/8" ODS	9 3/8"	17 1/4"	15 oz	445 ml
923	450 PSIG	1/4" SAE	4"	7/8" ODS	9 3/8"	17 1/4"	15 oz	445 ml
922R	450 PSIG	1/4" SAE	4"	5/8" ODS	11 5/8"	19 1/2"	77 oz	2.27 lit.
923R	450 PSIG	1/4" SAE	4"	7/8" ODS	11 5/8"	19 1/2"	77 oz	2.27 lit.

Replacement Filter Kit	Standard	Clean-Up
Product No.	62034000	62024000



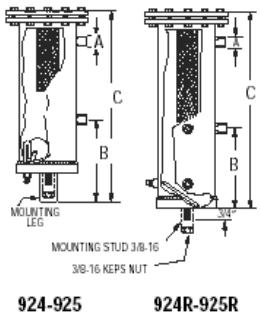
922-923 922R-923R

Model 924, 924R, 925 & 925R

Model 924, 925
Oil Separator – Accessible Coalescent
Model 924R, 925R
Oil Separator/Reservoir – Accessible Coalescent

Model	Maximum Working Pressure	Oil Connector Size	Diameter	"A" Dimension	"B" Dimension	"C" Dimension	Oil Charge Amount	
924	450 PSIG	1/4" SAE	4"	1 1/8" ODS	9 3/8"	20 5/8"	16 oz	475 ml
925	450 PSIG	1/4" SAE	4"	1 3/8" ODS	9 3/8"	20 5/8"	16 oz	475 ml
924R	450 PSIG	1/4" SAE	4"	1 1/8" ODS	16 3/8"	27 5/8"	109 oz	3.22 lit.
925R	450 PSIG	1/4" SAE	4"	1 3/8" ODS	16 3/8"	27 5/8"	109 oz	3.22 lit.

Replacement Filter Kit	Standard	Clean-Up
Product No.	62037000	62047000

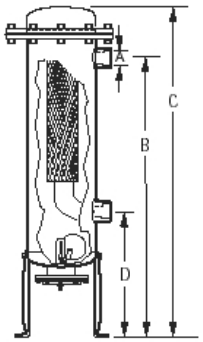


Model 926 & 927

Model 926, 927
Oil Separator – Accessible Coalescent

Model	Maximum Working Pressure	Oil Connector Size	Diameter	"A" Dimension	"B" Dimension	"C" Dimension	"D" Dimension	Oil Charge Amount	
926	450 PSIG	3/8" SAE	6"	1 5/8" ODS	29"	35"	12"	34 oz	1 Lit
927	450 PSIG	3/8" SAE	6"	2 1/8" ODS	29"	35"	12"	34 oz	1 Lit

Replacement Filter Kit	Standard	Clean-Up
Product No.	62028000	62030000

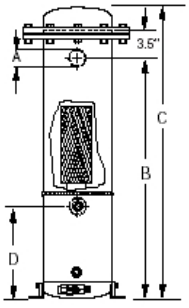


Model 926R & 927R

Model 926R, 927R
Oil Separator/Reservoir – Accessible Coalescent

Model	Maximum Working Pressure	Oil Connector Size	Diameter	"A" Dimension	"B" Dimension	"C" Dimension	"D" Dimension	Oil Charge Amount	
926R	450 PSIG	3/8" SAE	6"	1 5/8" ODS	33 7/8"	39 3/8"	16 5/8"	1.8 Gal	6.7 Lit
927R	450 PSIG	3/8" SAE	6"	2 1/8" ODS	33 7/8"	39 3/8"	16 5/8"	1.8 Gal	6.7 Lit

Replacement Filter Kit	Standard	Clean-Up
Product No.	62028000	62030000

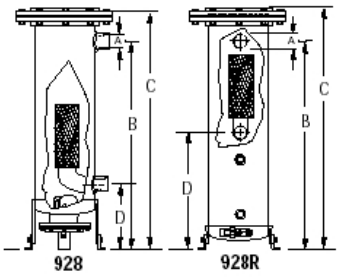


Model 928 & 928R

Model 928
Oil Separator – Accessible Coalescent
Model 928R
Oil Separator/Reservoir – Accessible Coalescent

Model	Maximum Working Pressure	Oil Connector Size	Dia.	Dimensions "A"	"B"	"C"	"D"	Oil Charge Amount	
928	450 PSIG	3/8″ SAE	8 5/8″	2 5/8″ ODS	33 5/8″	40 1/4″	12″	34 oz.	1.00 Lit
928R	450 PSIG	3/8″ SAE	8 5/8″	2 5/8″ ODS	32 3/8″	39″	11 1/2″	2.0 Gal	7.55 Lit

Replacement Filter Kit	Standard	Clean-Up
Product No.	62051000	62092802

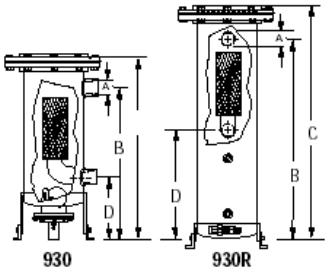


Model 930 & 930R

Model 930
Oil Separator – Accessible Coalescent
Model 930R
Oil Separator/Reservoir – Accessible Coalescent

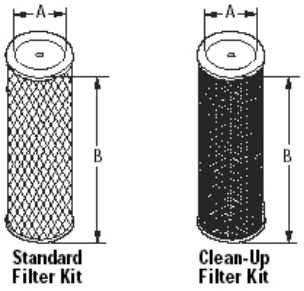
Model	Maximum Working Pressure	Oil Connector Size	Dia.	Dimensions "A"	"B"	"C"	"D"	Oil Charge Amount	
930	450 PSIG	3/8″ SAE	12 3/4″	3 1/8″ ODS	35 3/4″	43 3/8″	13 3/4″	85 oz.	2.50 Lit
930R	450 PSIG	3/8″ SAE	12 3/4″	3 1/8″ ODS	37 1/8″	44 3/4″	15 1/8″	5.7 Gal	21.25 Lit

Replacement Filter Kit	Standard	Clean-Up
Product No.	62085000	62086000



Filter Kits

Standard Filter Kit Product No.	Clean-Up Filter Kit Product No.	Model	"A" Nominal	"B" Nominal
62034000	62024000	922-923, 922R-923R	1″	5″
62037000	62047000	924-925, 924R-925R	2″	9″
62028000	62030000	926-927, 926R-927R	3 1/2″	14″
62051000	62092802	928, 928R	5 1/8″	16″
62085000	62086000	930, 930R	8 1/2″	16″



Clean-Up Filter Instructions

Cleaning up after a compressor burn-out is easy with Temprite's Clean-Up Filter. The "Clean-Up" filter is designed for more "dirt loading" than our Hi-Efficiency 920 Series

filters. It removes dirt and contaminants to 3 microns. Just install a Clean-Up filter in a Temprite 920 Series Oil Separator along with the Model 224 Pressure Differential Indicator (PDI). When the PDI stays below 13.5 PSIG/0.9 Bar – your system is clean. Then switch-out the "Clean-Up" filter with Hi-Efficiency 920 Series filter and you'll have oil separation to 98.5%, saving you money and the rack's owner Kw

Remember the following: • When using a Pressure Differential Indicator (PDI), check and change filters at 13.5 PSIG/0.9 Bar. Pressure drop beyond this point may rupture the filter. • The Clean-Up filter will remove dirt and contaminants to 3 microns. In contrast, the standard Temprite Hi-Efficiency filter will pick up solid contaminants to 0.3 microns…ten times smaller. Monitor both the Clean-Up Filter and the Hi-Efficiency Filter to be sure they don't exceed 13.5 PSIG/0.9 Bar. • Oil separation with the Clean-Up Filter varies based on media viscosity, flow velocity, particulate size, etc. When the PDI stays below 13.5 PSIG/0.9 Bar, change to a Hi-Efficiency filter.

Pressure Drop vs. Particulate Loading

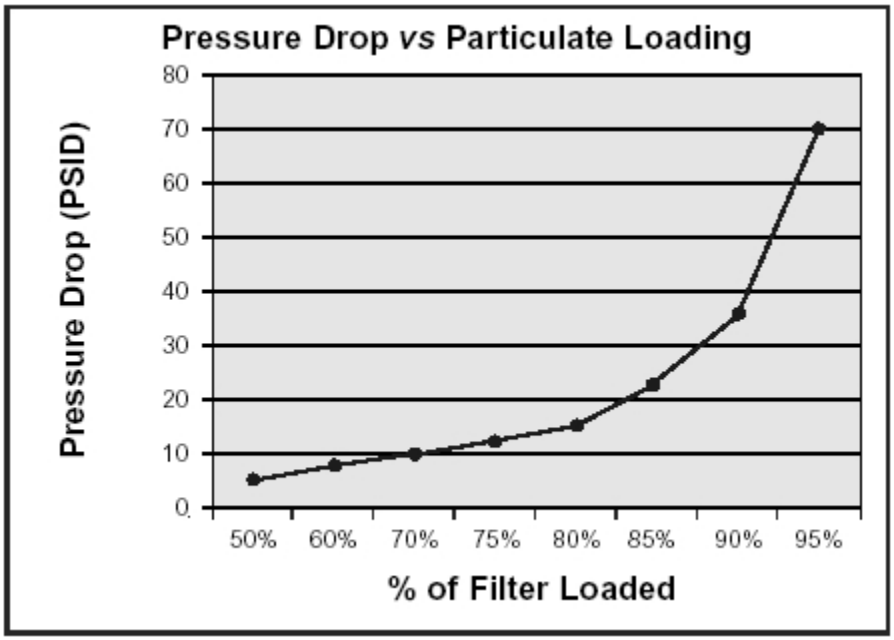
Pressure Drop	Approximate % of Filter Loaded	Action
<5 psid – 0.34 bar	50%	
<7 psid – 0.48 bar	60%	
<10 psid – 069 bar	70%	
<12 psid – 0.83 bar	75%	Change Filter
<15 psid – 1.03 bar	80%	Change Filter
<20 to 25 psid – 1.4 to 1.7 bar	85%	Change Filter
<30 to 40 psid – 2.1 to 2.8 bar	90%	Filter O-ring could dislodge
<60 to 80 psid – 4.1 to 5.5 bar	95%	Filter could rupture

The above figures are for design conditions given in the Temprite catalog with normal oil loading. System design conditions such as pipe sizing, other discharge line components, piping layout, under-sized oil separators, higher density oils, high oil levels or liquid loading, may cause a higher than normal pressure drop.

The above figures area for Medium Temp R-22 systems with 150-300 SSU or 32-48 cST viscosity mineral oil. Higher density oils such as 450 SSU or 68 cST will have a slightly higher pressure drop. For other conditions see below:

For High Temp:	multiply by 1.36
For Low Temp:	multiply by 0.49
For R-404A (HP-62) with 22-32 cST viscosity POE oil:	multiply by 0.86
For R-507 (AZ-50) with 22-32 cST viscosity POE oil:	multiply by 0.875

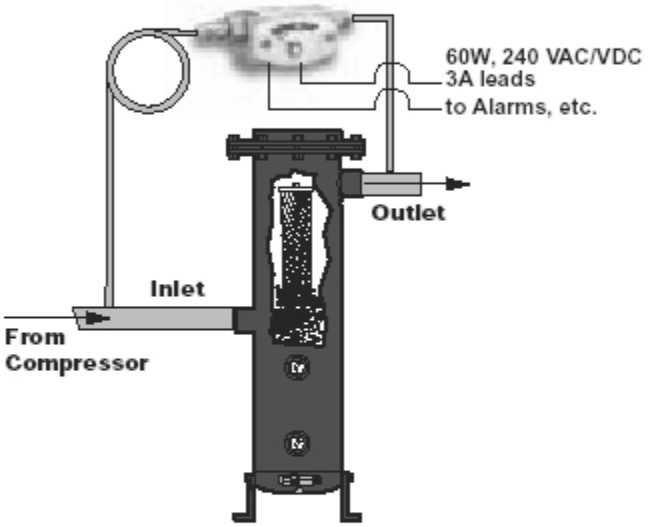
Pressure drop can compound itself at exponential rates. This is why it is important to keep the 920 Series internal filter clean and free from debris and solid contaminants.



Additional Temprite Products

Pressure Differential Indicator

The Model 224 Pressure Differential Indicator (PDI) tells you the Δp at the filter. It's important to know when your filter is dirty and needs to be changed.



Limited Warranty/Disclaimer

A: Limited Warranty on the Temprite Product. If within the time specified below, the Temprite Product shall prove to be defective in material or workmanship upon examination Temprite, Temprite shall supply an identical or substantially similar replacement Temprite Product or part, or at Temprite's option, Temprite will repair such Temprite Product. This warranty does not cover any labor costs incurred by purchaser for repair of equipment into which the Temprite Product has been integrated.

Where Temprite elects to replace a defective Temprite Product or to repair the Temprite Product at its own factory, purchaser shall ship the Temprite Product to Temprite c.i.f.

Temprite's warehouse. Temprite shall reimburse purchaser for cost, insurance and freight charges if the Product proves to be defective.

The Warranty set forth above shall be in effect with respect to the Temprite Product for one year following the date of delivery of the Temprite Product at purchaser's site. Purchaser must notify Temprite of a warranty claim within this period. Any repair of replacement of a Temprite Product provided hereunder shall be warranted against defects in material or workmanship for the unexpired portion of the Temprite Product's warranty.

B. DISCLAIMER. THIS WARRANTY SHALL BE APPLICABLE ONLY WITH RESPECT TO A TEMPRITE PRODUCT WHICH IS THE PROPERTY OF THE PURCHASER OR ORIGINAL USER AND WHICH HAS BEEN PROPERLY USED, OPERATED AND MAINTAINED IN ACCORDANCE WITH THE INSTRUCTIONS PROVIDED WITH THE TEMPRITE PRODUCT (OR EQUIPMENT INTO WHICH IT HAS BEEN INTEGRATED) AND FOR THE PURPOSE FOR WHICH THIS WARRANTY SHALL NOT BE APPLICABLE IF THE TEMPRITE PRODUCT (OR EQUIPMENT) OR ANY PART THEREOF HAS BEEN REPAIRED OR REPLACE BY PURCASER OR THE ORIGINAL USER CONTRARY TO TEMPRITE'S OR PURCHASER'S WRITTEN INSTRUCTIONS OR HAS BEEN SUBJECTED TO ANY ACCIDENT, CASUALTY, MISAPPLICATION, ALTERATION, ABUSE OR MISUSE. NO OTHER WARRANTY, EITHER EXPRESS OR IMPLIED (INCLUDING WITHOUT PARTICULAR LIMITATION) WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, HAS BEEN OR WILL BE MADE WITH RESPECT TO THE TEMPRITE PRODUCTS, AND ACCESSORIES OR THEIR INSTALLATION, USE, OPERATION, REPLACEMENT, OR REPAIR.

THIS WARRANTY DOES NOT COVER DAMAGE DUE TO FAILURE OF EQUIPMENT INTO WHICH THE TEMPRITE PRODUCT HAS BEEN INTEGRATED.

TEMPRITE SHALL NOT BE LIABLE BY VIRTURE OF THIS WARRANTY, OR OTHERWISE, FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGE RESULTING FROM THE USE OR OPERATION OF THE TEMPRITE PRODUCT, WHETHER OR NOT TEMPRITE WAS APPRISE OF THE POSSIBILITY OF SUCH DAMAGES.

IRRESPECTIVE OF ANY STATUTE, PURCHASER RECOGNIZES THAT THE EXPRESS WARRANTY SET FORTH ABOVE IS THE EXCLUSIVE REMEDY TO WHICH IT IS ENTITLED AND WAIVES ALL OTHER REMEDIES, STATUTORY OR OTHERWISE. REPAIR OR REPLACEMENT SHALL BE THE PURCHASER'S SOLE REMEDY UNDER THIS WARRANTY.

THIS WARRANTY SHALL BE CONSTRUED AND INTERPRETED IN ACCORDANCE WITH THE LAWS OF THE STATE OF ILLINOIS, USA, WITHOUT REGARD TO ITS CONFLICTS OF LAW PROVISIONS.

THIS WARRANTY SHALL EXTEND ONLY TO THE PURCHASER AS ORIGINAL EQUIPMENT MANUFACTURER AND TO THE FIRST USER OF THE PRODUCTS.

TEMPRITE WARRANTIES THE PRESSSURE VESSEL SHELL ONLY, FOR A PERIOD OF FIVE YEARS FROM THE DATE OF MANUFACTURE. THIS WARRANTY IS SPECIFIC TO THE PRESSURE VESSEL ITSELF AND EXCLUDES

ALL PARTS AND MOVING PARTS SUCH AS FILTERS, O-RINGS, BOLTS, NUTS, WASHERS, GAUAGES, INTERNAL MECHANISMS, FLOAT BALL ASSEMBLIES, AND NOZZLES/CONNECTORS.

The Temprite Company

West Chicago, Illinois

Oil Reservoir

A reserve of oil is necessary for the operation of some low-pressure oil control systems. The oil reservoir is the holding vessel for this standby oil. It has two or more sight ports on the shell to observe the oil level inside the vessel. Oil is fed into the oil reservoir by the oil separator. Pressure in the reservoir is maintained above the suction pressure by a differential check valve on top of the reservoir. Depending upon the application and components chosen, the pressure differential check valve may be either 5 or 20 psig.

The valve on the top of the oil reservoir automatically receives oil from the oil separator (open position). To add oil to the oil reservoir manually, close the valve and fill the oil reservoir through the 1/4" flare connection on the side of the valve. Open valve after filling.

The valve on the bottom of the oil reservoir is the distribution valve to the oil level regulators (open position). To remove oil from the oil reservoir, close the valve and use the 1/4" flare connection on the side of the valve to drain the oil out. Open valve after draining.

On system start up of a new parallel system, oil should be added to the reservoir until oil is visible in the upper sight glass port, not above it. It is commonly accepted that in a new refrigeration system, some will be absorbed by the refrigerant as the system operates. After two hours of operation, the oil reservoir should again be filled to the upper sight glass and again after two days. The oil level in the reservoir must be observed on each service call. Oil should not be added again until the oil level falls below the lower sight glass port.

Do not add more than a total of 2 gallons of oil to each system. If more than this is needed, recheck piping etc., as oil is not returning to the unit properly (see oil control system in this manual).

Power Entrance Block

A power distribution block is located on the far left hand side of the control box. It is for field connection to a protected power source. The block is directly below the power entrance location.

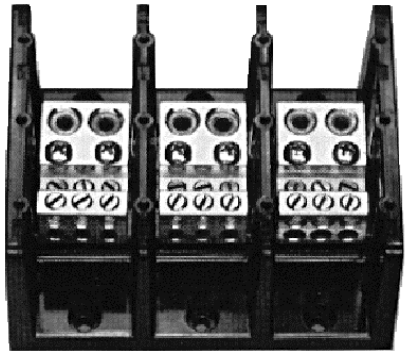
On systems requiring conductors of 400MCM or smaller a single conductor per pole block is used.

On systems that would require single conductors greater than 400MCM a parallel conductor block will be used.

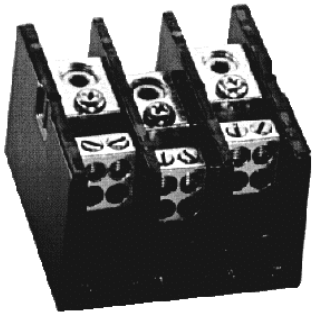
A parallel conductor block is optionally available on any system.

An optional cover is also available.

Parallel Conductor per Pole



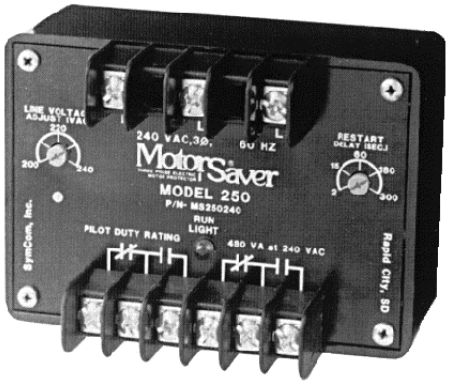
Single Conductor per Pole



Phase Monitor

A phase monitor is highly recommended for any parallel compressor system. The default phase monitor is from MotorSaver.

SymCom MotorSaver



Circuit Breakers

GE circuit breakers are used as standard through out the unit. Heinemann calibrated circuit breakers are required on some Carlyle compressors. Circuit breakers from SQ D are also available.

GE Spectra

Definite Purpose Contactor

Furnas definite purpose contactors are used as standard throughout the unit.

Siemens (Furnas)

Compressor Control

For compressor control Siemens (Furnas), GE and SQ D definite purpose contactors are available. NEMA rated from Furnas, GE, Square D and Allen Bradley are available. EIC rated contactors from Furnas, GE, SQ D, and Allen Bradley are available.

Electric Defrost, Etc.

For electric defrost, evaporator fans and other miscellaneous applications Furnas, GE and SQ D are available.

Recommended Control Settings

Discharge Pressure Regulator

Discharge Pressure Regulator	
Refrigerant	PSIG
R22	150
R134a	90
R404A	180
R507	180

Set with gage on the compressor discharge service valve.

Receiver Pressure Regulator

Receiver Pressure Regulator	
Refrigerant	PSIG
R22	140
R134a	80
R404A	170
R507	170

Set with gage on receiver outlet valve.

High-pressure compressor controls (when non standard cutout is used):

Single stage and high stage of two stage systems:	
Refrigerant	Cut out Psig
R22	350
R134a	200
R404A	375
R507	375

Low stage of two stage systems:

Refrigerant	Cut out Psig
R22	100 125

Low-pressure compressor controls:

The following settings apply to multiple compressor systems with electronic suction pressure control. The system design suction temperature and the recommended control settings are indicated on the refrigeration legend. As a general rule, the control should be set to cut in 2 psig above the design suction pressure and cut out 2 psig below the design pressure.

It is also recommended that the rack controller be set up to float the suction based on target case temperature. Typical target cases would be ice cream reach in units, dairy milk cases and fresh meat cases. Do not use walk in units as target fixtures.

Single compressor satellites should be controlled by fixture temperature.

Note:

1) Kysor//Warren does not recommend cycling mechanical EPR or suction stop solenoids of individual rack circuits to control fixture temperature. In some instances, this method can cause rapid shifting from low to high load conditions which result in compressor short cycling and inadequate heat for gas defrost.
2) The fixture sensors should be used to monitor temperatures for alarm purposes and for control of suction pressure in the float mode of operation.
3) Defrost and EPR settings.
4) Adjustable time delay controls for satellite compressors a minimum setting of 3 minutes.
5) Condenser fan operation can be controlled by several different methods. The preferred method is to use a rack controller that incorporates condenser control. For condenser fans controlled electronically, fans can be cycled based on pressure, drop leg temperature or a combination of temperature and pressure.

Condenser Fans

Refrigerant	Cut in	Cut out
R22	175	160
R134a	110	100
R404A	210	195
R507	210	195

Note:

1) Do not set the fans to cut out at a point lower than the setting of the hold back valve in the condenser drop leg. If this occurs, the condenser fans will not cycle.
2) If the control system uses condenser drop leg temperature, use a setting of 55°F.
3) If condenser fans are controlled by temperature from the condenser package, all fans are cycled based on the temperature of the air leaving the condenser at the header end. Set the fan thermostat in accordance with the condenser bulletin.

Temperature - Pressure Chart

Saturation Pressure (psig) At Various Temperatures:

°F	R22	R134a	R404A	R507
-35	2.6	12.3	7.4	7.8
-30	4.9	9.7	10.2	10.7
-25	7.5	6.8	13.3	13.8
-20	10.2	3.6	16.7	17.3
-15	13.3	0	20.3	21.0
-10	16.5	2.0	24.3	25.1
-5	20.0	4.3	28.9	30.4
0	24.0	6.5	33.5	35.2
+5	28.2	9.3	38.4	40.5
+10	32.8	12.0	43.9	45.0
+15	37.8	15.1	49.8	51.0
+20	43.1	18.4	56.1	57.4
+25	48.8	22.1	62.9	64.3
+30	54.9	26.1	70.2	71.7
+35	61.5	30.4	78.0	79.6
+40	68.5	35.0	85.1	89.8
+45	76.0	40.0	92.6	98.8
+50	84.0	45.4	99.2	108.6
+55	92.6	51.2	115.0	118.9
+60	101.6	57.4	125.0	129.7
+65	111.2	64.0	136.5	141.3
+70	121.5	71.1	148.5	150.8
+75	132.2	78.6	161.0	166.6
+80	143.7	86.7	174.5	177.1
+90	168.4	104.3	203.5	206.4
+100	195.9	124.1	235.7	239.0
+105	210.8	134.9	252.5	261.8
+110	226.3	146.4	271.4	275.1
+115	242.7	158.4	290.0	300.7
+120	259.9	171.1	310.7	315.1
+125	277.9	184.5	332.0	340.3
+130	297.0	198.7	354.0	359.2
+135	316.6	213.5	378.0	392.6
+140	337.3	229.2	402.0	4187
+145	358.9	245.6	418.0	446.2

R22 Low Temperature

Kysor//Warren currently recognizes five types of R22 systems for low temperature applications.

1) Two-stage stand-alone. This approach is a compound two-stage system that uses a desuperheating expansion valve driven by the high stage compressors to cool the discharge gas from the low stage compressors. This low temperature system does not affect the medium temperature systems. A detailed piping schematic for the stand-alone system is included in the drawings section of this manual.
2) Two-stage mixed. This approach is a compound two-stage system that uses the return gas from the medium temperature fixtures to de-superheat the discharge gas from the low stage compressors. The low stage discharge gas mixes with the return gas of the medium temperature fixtures. A desuperheating expansion valve may further cool the gas. The de-superheated gas then enters the high stage compressors, which provide the cooling for the medium temperature fixtures.
3) Single stage demand cooling. This approach is a single stage system utilizing Copeland discus compressors with the demand-cooling feature. This method incorporates a precise metering device, solenoid and control unit on each compressor to inject refrigerant into the suction passages to keep the discharge temperatures below the critical 300°F point. The temperature probe, in the cylinder head, senses discharge temperature and activates only as necessary. With suction return gas temperatures in the +20 to +30°F range, compressor cooling would be satisfied. The demand cooling would then act only as a safety. See Copeland Demand Cooling section in this manual.
4) Two stage internally compounded.
5) Single stage with suction injection. Employ a Sporlan Y 1037 injection valve. Temperature setting will vary with the exact system requirements, but usually 230°F.

Terminology and settings

1) Booster compressors are the low temperature compressors in a two-stage system.
2) High stage compressors are the high or medium temperature compressors in a two-stage system. In a stand-alone system, the high stage would operate in the +30 to +40°F range. On mixed systems, the high stage would operate at a temperature equivalent to the coldest fixture on the medium temperature portion of the unit.
3) An air-cooled desuperheater is a small air-cooled condenser that is used to reduce the temperature of the discharge gas, from the booster compressors, before it reaches the desuperheating expansion valve. The fan(s) on this device is controlled by the rack controller and should be set to 100°F. The temperature is measured at the rack on the refrigerant line from the desuperheater before the CDA bypass.
4) Electronic bypass valve is a CDA valve piped in parallel with the air-cooled desuperheater and bypasses discharge gas around the desuperheater to insure that the refrigerant does not condense. The CDA valve senses the refrigerant temperature from the air cooled desuperheater at a point on the rack below the

bypass and before the desuperheating expansion valve and is set at 65°F. A special electronic board is required to set this temperature.

5) A desuperheating expansion valve is a Sporlan Y 1037 that injects liquid into the suction line of a high stage compressor. This completes the cooling of the low stage discharge gas. A liquid solenoid valve in front of the Y 1037 is wired in parallel with the compressor contactor. The temperature of the discharge gas should not exceed the temperature rating of the Sporlan Y 1037 by more than a few degrees. The sensing bulb for the Y 1037 is located on the compressor discharge line. Each compressor will have its own injector valve. The normal temperature rating of this valve is 230°F.
6) Sub-cooler is a heat exchanger that cools the liquid refrigerant going to the circuits to 50°F. This process increases the system efficiency dramatically and helps balance the load on the high stage compressors. The rack controller, EPR or a combination can control the liquid temperature. The sub-cooler should be set to turn off when the liquid returning from the condenser is less than 50°F.
7) Start up bypass valve is a ball valve and check valve arrangement that connects the high and low stage suction headers to prevent a pressure build up in the low stage suction. The ball valve must be open at all times, so that the check valve can relieve pressure as necessary. This arrangement also allows the high stage compressors to pull through the low stage at start up and on a restart after a power outage.

Kysor//Warren Status Alarm Panel

The Kysor//Warren Status Alarm Panel when used in combination with relatively low level electronic controllers (SSPC, LPPC, etc) provides a means of controlling multiple compressors on a parallel compressor rack and also provides indication of the mode of operation and transmission of alarm conditions.

Individual switches, which indicate the presence of supply voltage to the compressors and compressor operation, control compressors; additionally, individual refrigeration circuits are controlled by switches which also indicate the presence of supply voltage to the circuit and whether a circuit is in refrigeration or defrost.

An electronic pressure controller with separate cut in and cut out settings controls operating conditions of the compressors. The controller will bring compressors on and off line in accordance with refrigeration demand to maintain suction pressure in a range determined by the settings on the pressure controller.

An electronic alarm panel within the unit continuously monitors critical conditions of the system; these are oil failure, high discharge pressure, high suction pressure, phase loss, and refrigerant level. Internal time delays of 15 minutes for high suction and 60 minutes for liquid level prevent nuisance alarms. Oil failure is indicated by a contact closure of an oil pressure relay in response to the oil pressure control at each compressor.

A high suction or high discharge pressure condition is signaled by a contact closure of a pressure switch in the discharge or suction header.

Phase loss indication is signaled by contact closure from the pilot circuit of a three-phase power monitor.

A sensor mounted in the receiver senses refrigerant liquid level. An LED bar graph on the panel indicates percent liquid level within the receiver. The low refrigerant level alarm is energized at 15% liquid level and heat reclaim is locked out at 10%. Once locked out the liquid level must reach 20% before heat reclaim can again be energized.

The presence of any alarm condition will control the alarm relay, which provides transmission of an alarm signal. A man/auto/off switch on the panel will automatically reset the alarm relay when all alarm conditions cease when in auto mode. In the manual mode the alarm reset switch must be depressed to remove the transmission of an alarm condition. In the off mode no alarm signal will be transmitted in the event of an alarm condition; however, the LED circuitry for each alarm condition will remain active.

There is an alarm hookup-wiring diagram in the drawings section of this manual.

Kysor//Warren Status Alarm Panel Specifications

Input specifications

Input voltage	208 VAC single phase
Oil alarm	Dry contacts from of an oil pressure relay
Phase alarm	Dry contact from phase monitor relay
Discharge alarm	Dry contact from pressure switch
Suction alarm	Dry contact from pressure switch
Refrigerant level	"Liquicator" 3 wire sensor

Output specification

Alarm relay	DPDT 10 amp @ 240vac
Heat reclaim	SPDT 10 amp @ 240vac

Recommended Alarm Pressure Settings

Adjust these initial pressure settings as necessary.

R22

R22	High Suction	High Discharge
35	12	300
30	14	300
25	16	300
20	19	300
15	22	300
+10	39	300
+15	44	300
+20	49	300
+30	61	300
+40	75	300

R404A

R404A	High Suction	High Discharge
35	10	325
30	13	325
25	16	325
20	20	325
15	25	325
+10	50	325
+15	56	325
+20	63	325
+30	70	325

R507

R507	High Suction	High Discharge
35	19	325
30	22	325
25	25	325
20	28	325
15	31	325
+10	55	325
+15	59	325
+20	65	325
+30	79	325

R134a

R134a	High Suction	High Discharge
+10	16	200
+15	19	200
+20	22	200
+30	30	200
+40	39	200

Control Settings

Due to the wide variety of evaporator temperatures, display case options and defrost schedules it has become impossible to create a meaningful list of universal initial settings. Please refer to the display case manufactures' data for control settings appropriate for the exact equipment and application you have.

Conductor Color Code

Refrigeration Circuits

Color	Physical Circuit
Red	1, 9, 17
Blue	2, 10, 18
Orange	3, 11, 19
Yellow	4, 12, 20
Brown	5, 13, 21
Purple	6, 14, 22
Tan	7, 15, 23
Gray	8, 16, 24

The control circuit conductors of the parallel unit are numbered and color-coded. The color code corresponds to the physical location of the circuit, not the customer circuit number. The physical circuits are from left to right when facing the front of the rack.

Power Wires

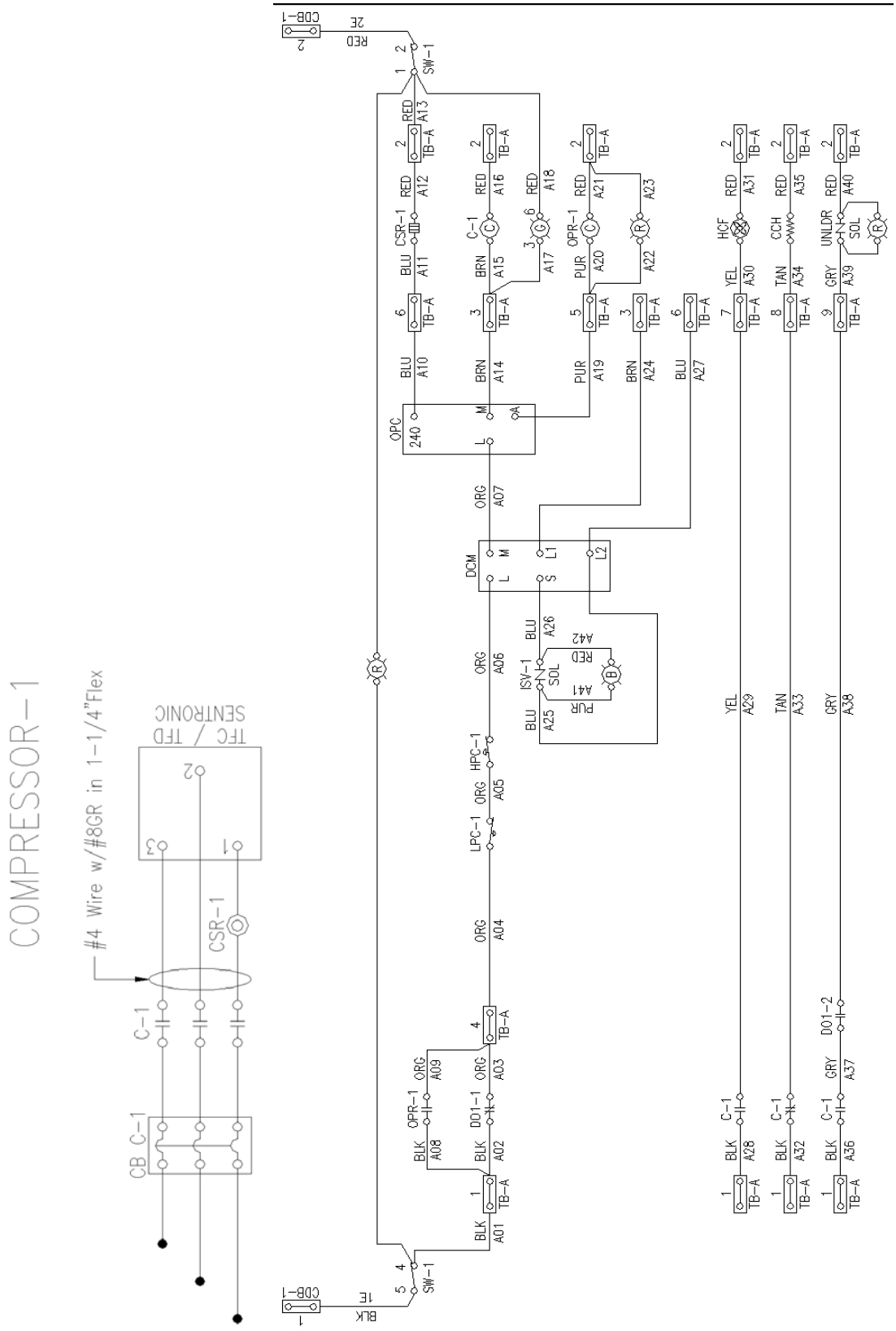
The power conductors are color coded as follows:

Leg	208	460	575
L1	Black	Brown	Brown & Purple
L2	Red	Orange	Orange & Purple
L3	Blue	Yellow	Yellow & Purple

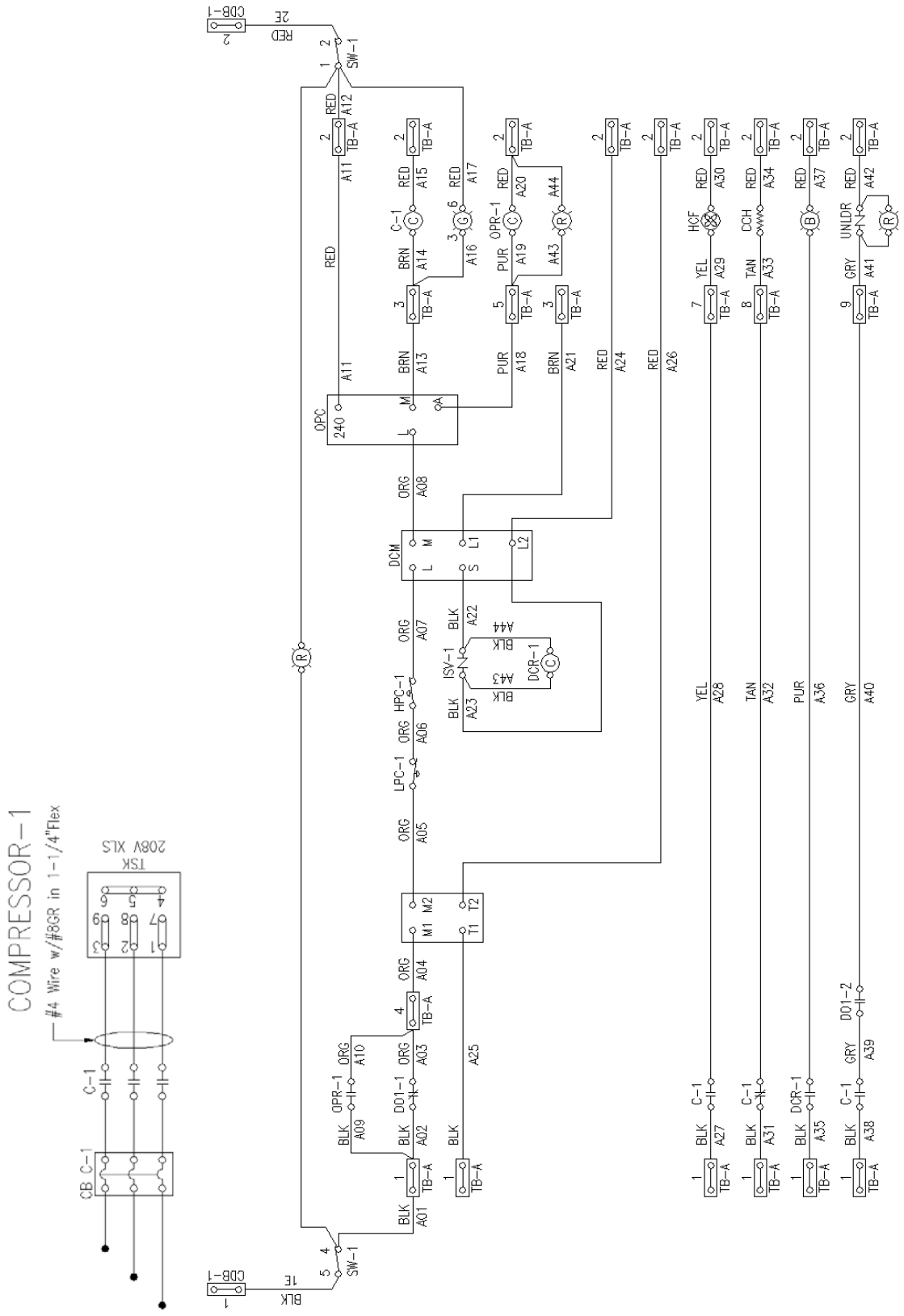
Typical Wiring

Typical compressor and refrigeration circuit wiring follow. Please refer to the job specific wiring diagrams supplied with your unit.

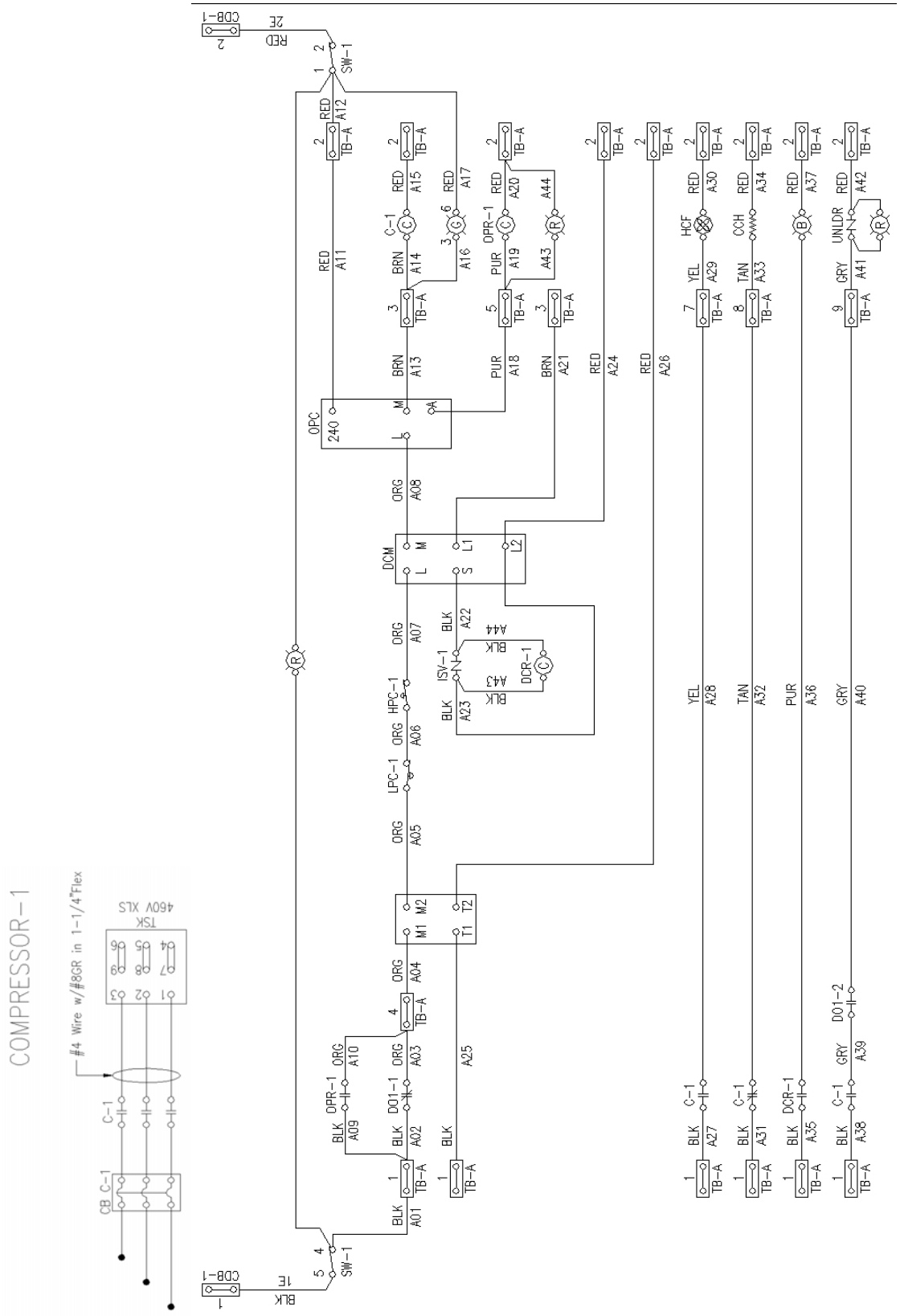
Compressor 208 TFC & 460V TFD



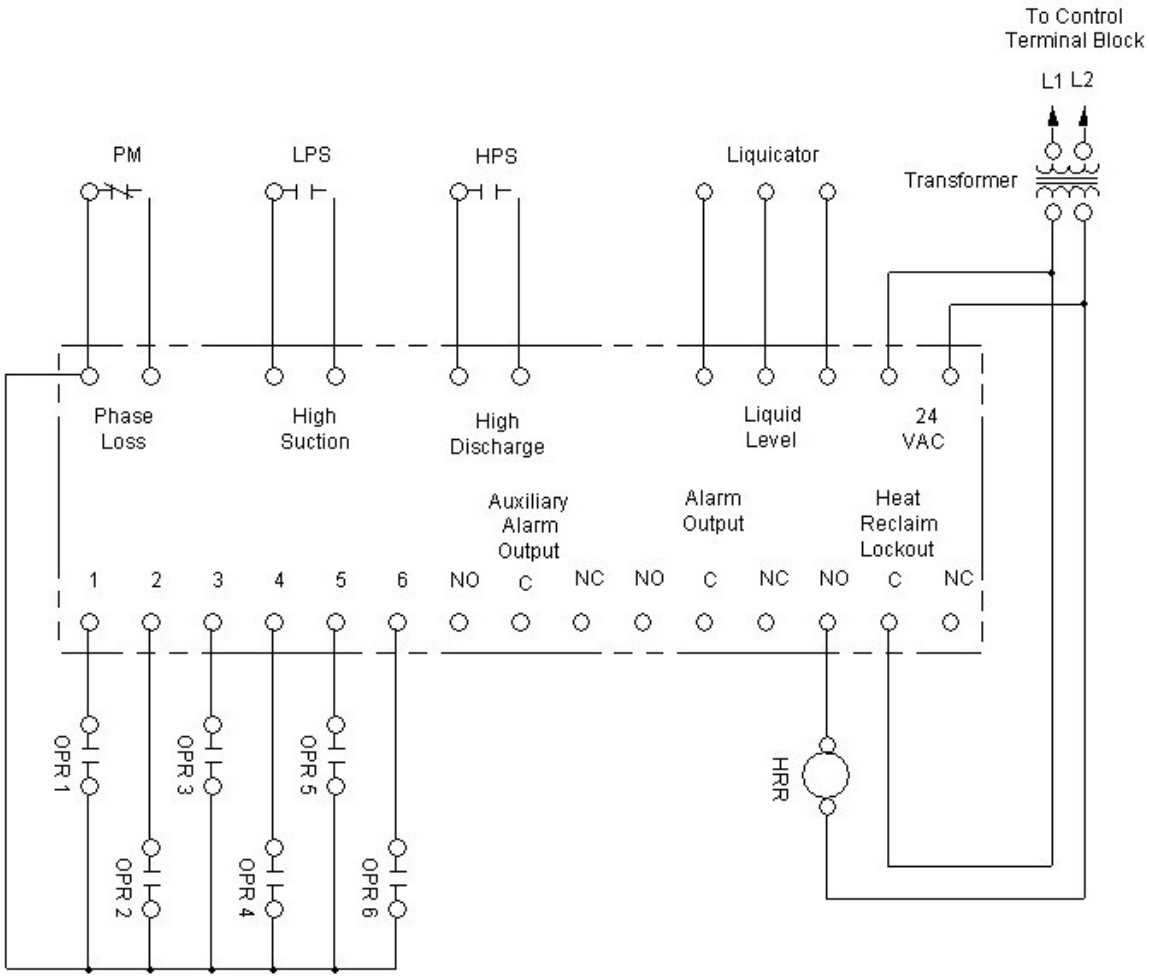
Compressor 208V TSK



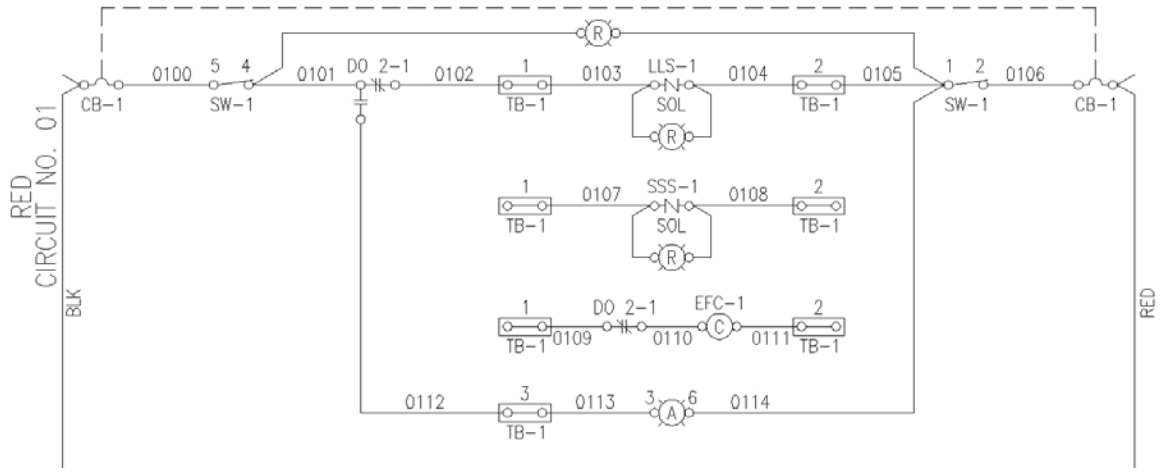
Compressor 460V TSK



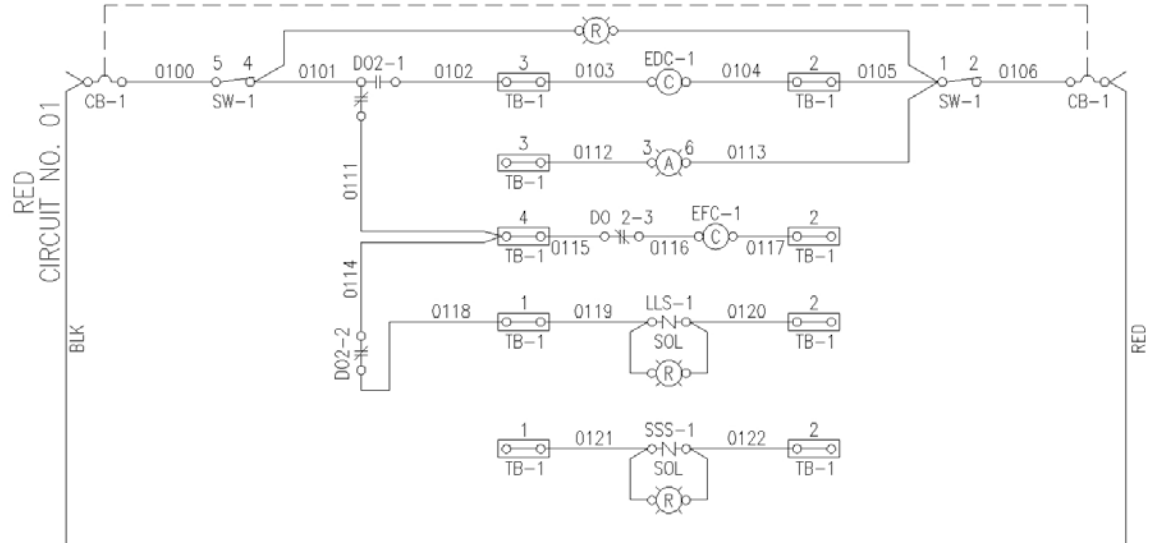
Kysor//Warren Status Alarm Panel



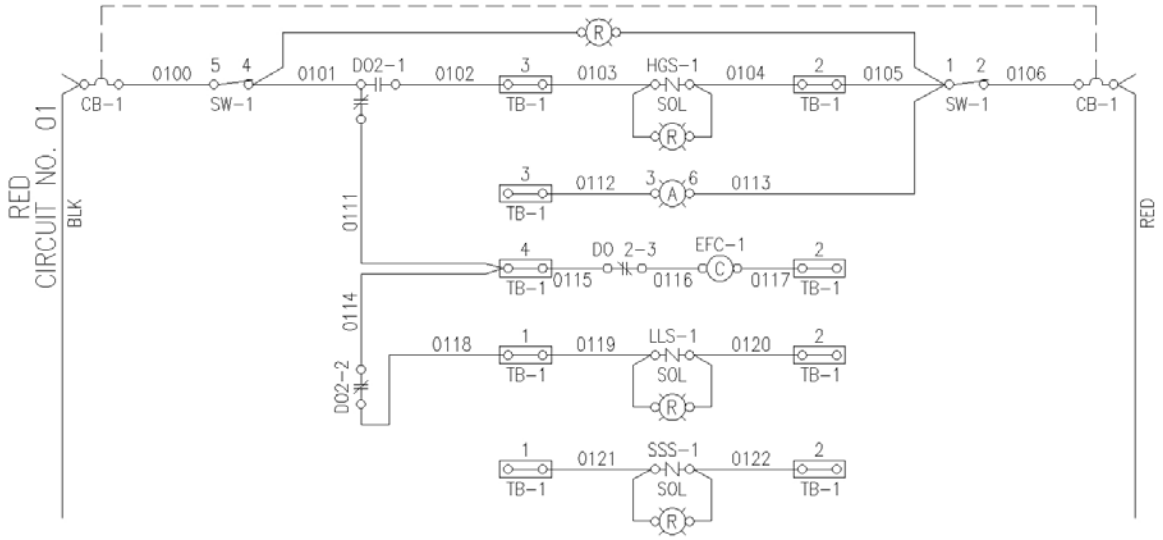
Off Cycle Defrost Circuit



Electric Defrost Circuit



Hot Gas Defrost Circuit



Wiring Diagram Legend

ELECTRICAL WIRING DIAGRAM LEGEND

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TERMINAL BLOCK

TB–A = COMPRESSOR TERMINAL BLOCK
TB–1 = CIRCUIT TERMINAL BLOCK
TB–X = MISCELLANEOUS TERMINAL BLOCK
TB–M = MAIN TERMINAL BLOCK
CDB–1 = CONTROL DISTRIBUTION BLOCK

SOLENOID

LLS = LIQUID LINE SOLENOID
HGS = HOT GAS SOLENOID
SSS = SUCTION STOP SOLENOID
HRV–W = HEAT RECLAIM VALVE – WATER
HRV–C = HEAT RECLAIM VALVE – COMFORT
UNLDR = UNLOADER SOLENOID
ORS = OIL RETURN SOLENOID
ECO = ECONOMIZER SOLENOID
ISV = INJECTOR SOLENOID
IS = INTERSTAGE SOLENOID
SCV = SPLIT CONDENSER VALVE
VI = VARIABLE INLET SOLENOID
MCS = MOTOR COOLING SOLENOID
CPV = CONDENSER PUMP DOWN VALVE
CSV = CONDENSER SWITCHING VALVE
MLS = MASTER LIQUID SOLENOID
PDV = PRESSURE DIFFERENTIAL VALVE
POS = PUMP OUT SOLENOID
RBV = RAPID BALANCE VALVE
SOL = TERMINATION SOLENOID
DRV = DISCHARGE REGULATING VALVE
RBS = RECEIVER BYPASS SOLENOID
CRB = CONDENSER REGULATING BYPASS
CPS = CONDENSER PUMP SOLENOID
RAS = REVERSE AIR SOLENOID
LPS = LIQUID PUMP SOLENOID

CONTACTOR, RELAYS, MOTOR STARTERS

C–# = COMPRESSOR CONTACTOR
R–# = RELAY NO.
OPR = OIL PRESSURE RELAY
ALR = ALARM RELAY
EFC = EVAPORATOR FAN CONTACTOR
EDC = ELECTRIC DEFROST CONTACTOR
OLS = OIL LEVEL SWITCH
OFSD = OIL FILTER SHUTDOWN
SDR = SHUT DOWN RELAY
OLR = OIL LEVEL RELAY
TDR = TIME DELAY RELAY
DR = DEFORST RELAY
DTR = DUAL TEMP RELAY
U# = UNLOADER RELAY
PLR = PHASE LOSS RELAY
HRR = HEAT RECLAIM RELAY
BC = BYPASS CONTACTOR
IC – INVERTER CONTACTOR
M = MOTOR
PLM = PHASE LOSS MONITOR
CSR = CURRENT SENSING RELAY
SSR = SENSING SWITCHING RELAY
PMR = PHASE MONITOR RELAY
LLR = LIQUID LEVEL RELAY
PRR = PRESSURE RELIEF RELAY

FAN, HEATERS

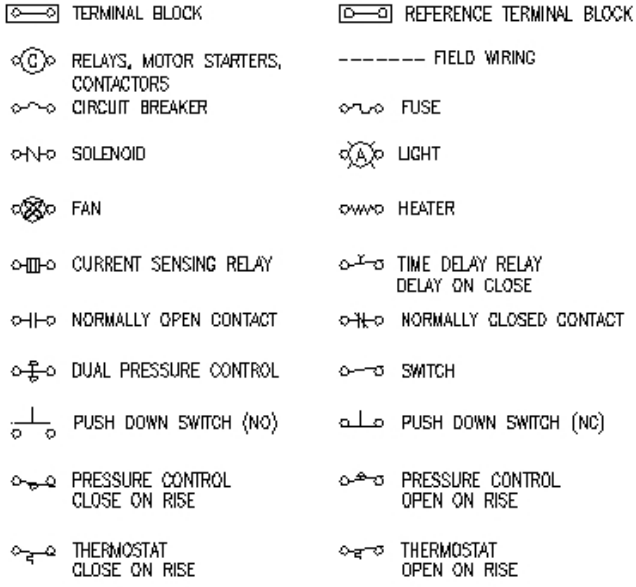
BCF = CONTROL BOX COOLING FAN
HCF = HEAD COOLING FAN
CCH = CRANK CASE HEATER
OSH = OIL SEPARATOR HEATER

CONTROLS

LPC = LOW PRESSURE CONTROL
HPC = HIGH PRESSURE CONTROL
DPC = DUAL PRESSURE CONTROL
ECP = ENVIRONMENTAL CONTROL PANEL
OPC = OIL PRESSURE CONTROL
DCM = DEMAND COOLING MODULE
HPS = HIGH PRESSURE SWITCH
RRS = REVERSE ROTATION SWITCH
EMS = EMERGENCY SHUTDOWN SWITCH
RLS = RECEIVER LEVEL SWITCH
CDO = CONDENSER DIGITAL OUTPUT BOARD (NOVAR)
CO = COMPRESSOR BOARD OUTPUT (NOVAR)
RO = RACK OUTPUT BOARD (NOVAR)

MISCELLANEOUS

A,G,R, = LIGHT
CB = CIRCUIT BREAKER
CBC = CIRCUIT BREAKER, COMPRESSOR
CBH = CIRCUIT BREAKER, HEATER
CBF = CIRCUIT BREAKER, EVAPORATOR FAN
CKT = CIRCUIT
DEF = DEFROST
DI = DIGITAL INPUT ELECTRONIC CONTROLLER
DO = DIGITAL OUTPUT ELECTRONIC CONTROLLER
GR = GROUND LUG
HM# = HOUR METER
REF = REFRIGERATION
Y = CYCLE METER
CT = CURRENT TRANSFORMER



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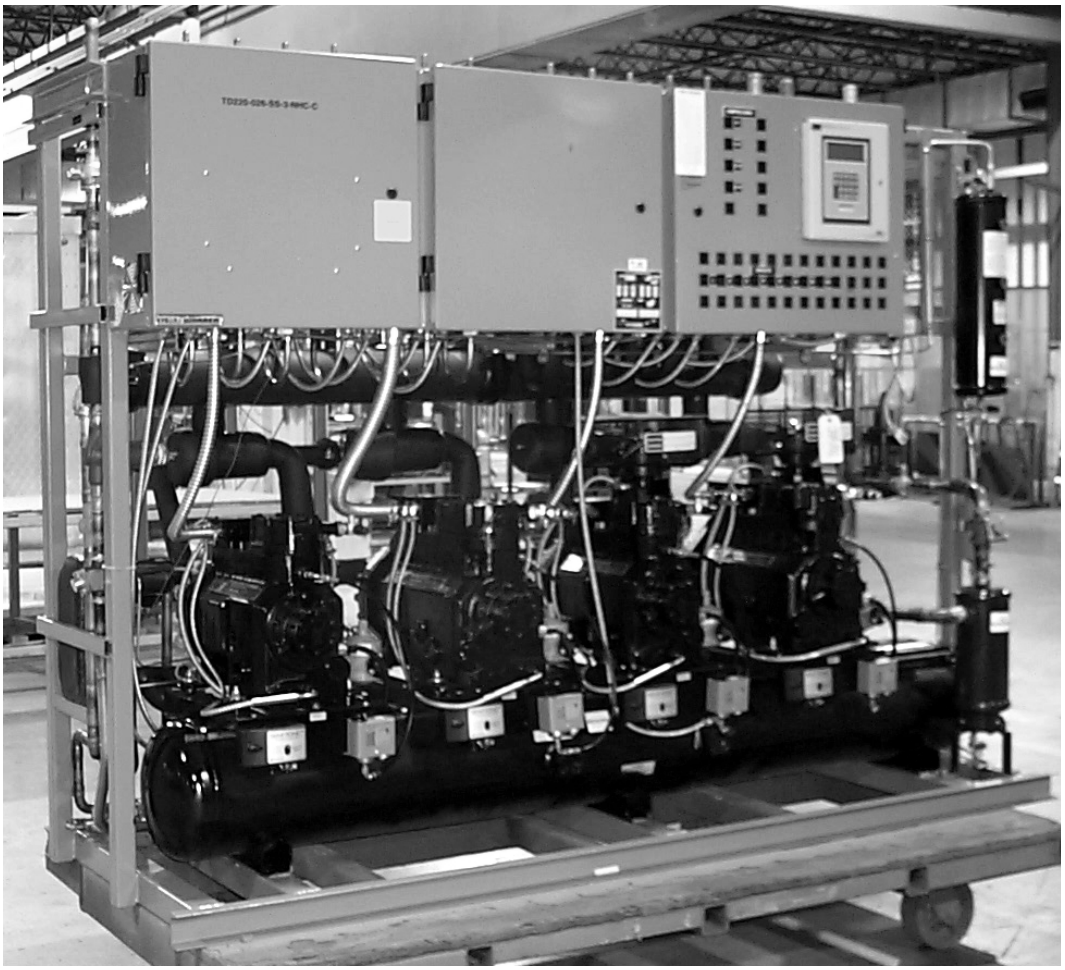

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