

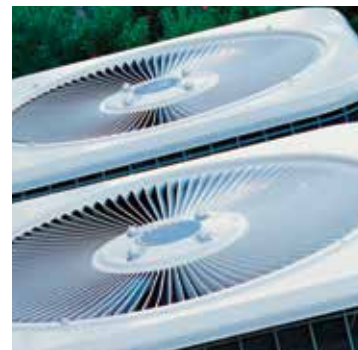


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# Refrigeration Solenoid Valves & 3-Way Heat Reclaim Valves

Catalog D-1, December 2016



ENGINEERING YOUR SUCCESS.

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Catalog D-1, December 2016 supersedes Catalog D-1, May 2010 and all prior publications.

# Introduction

The Parker 'R' Series Refrigeration Valves consist of a family of direct and pilot operated solenoid valves for liquid, suction and hot gas defrost application requirements. The valves are compatible with virtually all of today's commercially available CFC, HCFC and HFC refrigerants and blends. The Parker refrigeration valves meet a broad range of system needs including refrigeration, air conditioning and freezing applications. From small fractional tonnage to large systems.

The portfolio is endowed with numerous benefits including:

- A full-line of normally closed and normally open valves.
- State of the art operator performance for long life, ease of service and tighter system integrity.
- Manual stem functionality.

- High pressure ratings to comply with newer refrigerants.
- Extended sweat connections enable brazing installation without disassembly.
- Complete line of watertight coil designs suitable for all valves are available per special order.
- AC & DC coils are interchangeable on all valve body versions.

The Parker 'R' Series Refrigeration Solenoid Valves are constructed of the highest quality materials available for exceptional quality, long life and reliability. All components have been rigorously qualified based on the international standard ISO9001 / 2000 certification processes providing rigorous standards for design, development, manufacturing and testing. High quality you've come to expect from Parker.

# General Information

## Solenoid Valve Nomenclature

The numbering system allows every user an easy method to identify, select and understand the valve being purchased. The following table describes the numbering system

### Nomenclature for Complete Valve Assemblies:

Valve Assemblies						
Type	Family Configuration		Connection	Port Size	Connection Size	Manual Stem
	Normally Closed	Normally Open				
R Refrigeration	12	–	E – Ext End F – Flare	Port sizes are measured in 1/32nds of an inch	Connection sizes are measured in 1/8ths of an inch	M
	16	–				
	22	–				
	26	27				
	28	29				
	36	37				
	38	39				
	42	43				
	46	47				
	52	53				
	56	57				

# General Information

## Valve Ordering

### For combined Valve and Coil Assemblies:

**Step 1:** Select the Valve catalog number based on the application requirements as specified in the individual catalog section based on the connection type, port size, connection size and rating.

**Step 2:** Add the optional Manual Stem, if required.

**Step 3:** Select the appropriate coil type and wattage per the valve specification chart based on the system pressures.

**Step 4:** Use the Voltage Code to specify the correct voltage.

### Example:

**Step 1 & 2:** To order a 2-way normally closed valve, 1/2 ODF connection, manual bypass option, R22, 5 ton liquid line rating, reference R26 valve catalog page. Select **R26E64M**.

**Step 3 & 4:** To order a junction box coil assembly, 10W, 208-240VAC rat-

ing, reference coil assembly catalog page. Select **R12 thru R36, R52, R56 = PKC-1 208-240/50-60 JAN**

### For Valves Only:

Valve assemblies can be ordered as separate items. Simply select the catalog valve number in steps 1 & 2 above.

### For Coil Assemblies:

Coil Assemblies can be ordered as separate items.

**Example:** To select a junction box coil assembly, 10W, 208-240VAC rating, reference coil assembly catalog page. Specify **PKC-1 208-240/50-60 JAN = R12 thru R36, R52, R56**

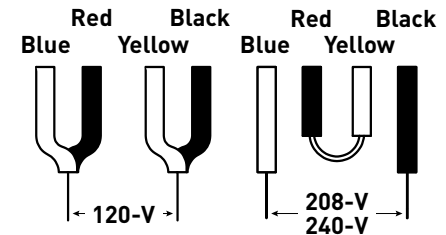
**PKC-2 208-240/50-60 JAN = R38, R42, R46**

## Standard Voltages

Consult Parker for additional voltages that can be satisfied with a new coil of a specific voltage.

Valves with four wire dual voltage coil have a wiring diagram decal (see right)

on the coil housing or bracket. This illustrates which wires to connect for either 120, 208 or 240 volt operation. Wiring and fusing (when used) must comply with prevailing local and national wiring codes and ordinances.



AC Voltage	
24/50-60	
120/50-60	
208-240/50-60	
DC Voltage	
12 VDC	
24 VDC	
Dual Voltage	
120-208-240/50-60	

Electrical Enclosures - R12 thru R57				
Coil Type	Voltage	Enclosure	Insulation Type	Lead Wire Color Code
PKC-1 for R12, R16, R22, R26, R28, R36, R52, R56	24/50-60	J	A	Q (Orange)
	120/50-60	J	A	M (Blue)
OPKC-1 for R27, R29, R37, R53, R57	208-240/50-60	J	A	N (Red)
PKC-2 for R38, R42, R46	12 VDC	J	A	K (Black)
	24 VDC	J	A	K (Black)
OPKC-2 for R39, R43, R47	120-208-240	J	A	U (Red, Black, Yellow, Blue)

Standard enclosure is junction box. Conduit boss is available for some voltages. Contact Parker Hannifin Aftermarket in Broadview, IL for details.

# General Specifications

Refrigerants..R22, R134a, R404A, R407A, R407C, R407F, R410A, R448A, R449A, R450A, R507A, R513A, etc.  
 Maximum Rated Pressure .....700psi  
 Operating Temperature Range  
 Fluid ..... -40°F to 240°F (-40°C to 116°C)  
 Ambient for AC voltages ..... -40°F to 120°F (-40°C to 49°C)  
 Ambient for DC voltages..... -40°F to 120°F (-40°C to 49°C)  
 (Valves not suitable for ammonia service)

Standard Voltages:  
 AC Voltages                      DC Voltages  
 24/50-60                            12 VDC  
 120/50-60                          24 VDC  
 208-240/50-60

Coil Enclosures: Reference Coil Enclosure page 41 and Electrical Specifications pages 42.

## Normally Closed Valve Specifications

Valve Series*	Port Size	Cv	AC Operating Pressure Differential (psi)					DC Operating Pressure Differential (psi)					
			Min	Maximum AC Ratings		Ambient Temp. °F	Fluid Temp. °F	Min	Maximum DC Ratings			Ambient Temp. °F	Fluid Temp. °F
				10w	15w				10w	15w	18w		
R12 E2	.078	0.16	0	450	—	120	240	0	—	400	—	120	240
R16 E3**	.101	0.30	0	300	—	120	240	0	—	175	—	120	240
R22 E5	.150	0.50	1	450	—	120	240	1	—	400	—	120	240
R26 E6	.197	0.90	1	450	—	120	240	1	—	400	—	120	240
R28 E8	1/4	1.20	1	450	—	120	240	1	—	400	—	120	240
R36 E10s1	5/16	2.06	1	450	—	120	240	1	—	400	—	120	240
R38 E14	7/16	3.0	1	—	450	120	240	1	—	—	400	120	240
R42 E19	19/32	4.60	1	—	450	120	240	1	—	—	400	120	240
R46 E25	25/32	7.80	1	—	450	120	240	1	—	—	400	120	240
R52 E35	1	10.9	1	450	—	120	240	1	—	400	—	120	240
R56 E43	1-5/16	24.0	1	450	—	120	240	1	—	400	—	120	240

\* Reference individual catalog pages for specific valve numbers and connection sizes.

\*\* SAE Connections may require minimum order quantity.

## Normally Open Valve Specifications

Valve Series*	Port Size	Cv	AC Operating Pressure Differential (psi)						DC Operating Pressure Differential (psi)						
			Min	Maximum AC Ratings		Ambient Temp. °F	Fluid Temp. °F		Min	Maximum DC Ratings				Ambient Temp. °F	Fluid Temp. °F
				10w	15w		10w	15w		10w	15w	18w	22w		
R27 E6	.197	0.90	1	400	—	120	240	240	1	—	400	—	—	120	240
R29 E8	1/4	1.20	1	400	—	120	240	240	1	—	400	—	—	120	240
R37 E10s1	5/16	2.06	1	400	—	120	240	240	1	—	400	—	—	120	240
R39 E14	7/16	3.00	1	—	400	120	240	240	1	—	—	400	—	120	240
R43 E19	19/32	4.60	1	—	400	120	240	240	1	—	—	400	—	120	240
R47 E25	25/32	7.80	1	—	400	120	240	240	1	—	—	400	—	120	240
R53 E35	1	10.9	1	450	—	120	240	240	1	—	400	—	—	120	240
R57 E43	1-5/16	24.0	1	450	—	120	240	240	1	—	400	—	—	120	240

\* Reference individual catalog pages for specific valve numbers and connection sizes.

# Capacity Tables

## E Series Solenoid Valve Liquid Capacity in IP Units

Type	Port Size Inches	Tons of Refrigeration														
		22					134a					404A				
		Pressure Drop - psi														
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
R12E2	0.075	0.50	0.71	0.88	1.01	1.14	0.47	0.67	0.82	0.95	1.06	0.32	0.46	0.57	0.65	0.73
R16E3	0.101	0.90	1.30	1.61	1.88	2.12	0.84	1.21	1.51	1.75	1.98	0.58	0.84	1.04	1.21	1.36
R22E5	0.150	1.61	2.29	2.81	3.26	3.65	1.50	2.14	2.63	3.04	3.41	1.04	1.48	1.82	2.10	2.36
R26E6/R27E6	3/16	2.88	4.05	4.95	5.70	6.36	2.69	3.78	4.61	5.31	5.93	1.86	2.62	3.20	3.68	4.11
R28E8/R29E8	1/4	3.70	5.23	6.40	7.39	8.27	3.45	4.88	5.97	6.90	7.71	2.39	3.38	4.14	4.78	5.34
R36E10/R37E10	5/16	6.27	8.90	10.93	12.64	14.14	5.85	8.30	10.19	11.79	13.20	4.05	5.74	7.05	8.16	9.13
R38E14/R39E14	7/16	9.13	12.89	15.77	18.20	20.33	8.52	12.03	14.71	16.98	18.97	5.90	8.33	10.19	11.76	13.14
R42E19/R43E19	19/32	13.94	19.77	24.26	28.04	31.38	13.01	18.45	22.63	26.16	29.28	9.00	12.77	15.66	18.10	20.26
R46E25/R47E25	25/32	23.84	33.78	41.41	47.85	53.53	22.24	31.51	38.64	44.65	49.95	15.39	21.81	26.74	30.90	34.57
R52E35/R53E35	1.0	39.00	56.92	71.01	83.08	93.83	36.41	53.15	66.30	77.57	87.61	25.02	36.52	45.56	53.30	60.20
R56E43/R57E43	1-5/16	73.56	104.0	127.4	147.1	164.4	68.63	97.04	118.8	137.2	153.4	47.52	67.19	82.28	95.00	106.2

Type	Port Size Inches	Tons of Refrigeration														
		407A					407C					407F				
		Pressure Drop - psi														
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
R12E2	0.075	0.43	0.62	0.76	0.88	0.98	0.47	0.67	0.83	0.96	1.07	0.43	0.61	0.75	0.87	0.97
R16E3	0.101	0.78	1.13	1.40	1.63	1.83	0.85	1.22	1.52	1.77	1.99	0.77	1.11	1.38	1.61	1.81
R22E5	0.150	1.39	1.98	2.44	2.82	3.16	1.52	2.16	2.65	3.07	3.44	1.38	1.96	2.41	2.79	3.13
R26E6/R27E6	3/16	2.50	3.51	4.29	4.94	5.51	2.72	3.82	4.66	5.37	5.99	2.47	3.48	4.24	4.89	5.45
R28E8/R29E8	1/4	3.20	4.53	5.55	6.41	7.16	3.48	4.93	6.03	6.97	7.79	3.17	4.48	5.49	6.34	7.09
R36E10/R37E10	5/16	5.43	7.71	9.46	10.95	12.25	5.91	8.38	10.29	11.90	13.32	5.37	7.63	9.37	10.83	12.13
R38E14/R39E14	7/16	7.91	11.17	13.67	15.77	17.62	8.61	12.15	14.86	17.15	19.16	7.83	11.06	13.53	15.61	17.44
R42E19/R43E19	19/32	12.08	17.13	21.01	24.29	27.19	13.14	18.63	22.85	26.42	29.56	11.96	16.95	20.80	24.04	26.90
R46E25/R47E25	25/32	20.66	29.27	35.88	41.46	46.39	22.46	31.82	39.02	45.09	50.44	20.44	28.96	35.51	41.04	45.91
R52E35/R53E35	1.0	33.72	49.22	61.40	71.83	81.13	36.66	53.51	66.76	78.10	88.21	33.39	48.73	60.79	71.12	80.32
R56E43/R57E43	1-5/16	63.75	90.13	110.4	127.4	142.5	69.32	98.01	120.0	138.6	154.9	63.1	89.2	109.2	126.1	141.0

Type	Port Size Inches	Tons of Refrigeration														
		448A					449A					450A				
		Pressure Drop - psi														
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
R12E2	0.075	0.44	0.62	0.76	0.88	0.99	0.43	0.61	0.75	0.87	0.98	0.43	0.62	0.76	0.88	0.99
R16E3	0.101	0.78	1.13	1.40	1.63	1.83	0.77	1.12	1.38	1.61	1.82	0.78	1.13	1.40	1.63	1.83
R22E5	0.150	1.40	1.99	2.44	2.83	3.17	1.38	1.97	2.42	2.80	3.14	1.40	1.99	2.44	2.83	3.17
R26E6/R27E6	3/16	2.50	3.52	4.30	4.95	5.52	2.48	3.49	4.26	4.91	5.48	2.50	3.51	4.29	4.94	5.51
R28E8/R29E8	1/4	3.21	4.54	5.56	6.42	7.18	3.18	4.50	5.51	6.36	7.11	3.21	4.53	5.55	6.41	7.17
R36E10/R37E10	5/16	5.44	7.72	9.48	10.96	12.27	5.39	7.65	9.40	10.87	12.17	5.44	7.72	9.48	10.96	12.27
R38E14/R39E14	7/16	7.93	11.19	13.69	15.80	17.66	7.86	11.10	13.58	15.66	17.50	7.92	11.18	13.68	15.78	17.64
R42E19/R43E19	19/32	12.10	17.16	21.05	24.33	27.23	11.99	17.01	20.87	24.12	26.99	12.09	17.15	21.04	24.32	27.21
R46E25/R47E25	25/32	20.69	29.31	35.94	41.53	46.46	20.51	29.06	35.63	41.17	46.06	20.68	29.29	35.92	41.50	46.43
R52E35/R53E35	1.0	33.71	49.21	61.39	71.82	81.11	33.42	48.77	60.85	71.19	80.40	33.81	49.35	61.57	72.03	81.36
R56E43/R57E43	1-5/16	63.9	90.3	110.6	127.7	142.7	63.31	89.51	109.6	126.5	141.5	63.80	90.20	110.5	127.5	142.6

Minimum operating capacity is at one psi pressure drop for pilot operated valves.

# Capacity Tables

## E Series Solenoid Valve Liquid Capacity in IP Units (cont.)

Type	Port Size Inches	Tons of Refrigeration														
		507					513A					410A				
		Pressure Drop - psi														
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
R12E2	0.075	0.31	0.45	0.55	0.63	0.71	0.40	0.56	0.69	0.80	0.90	0.47	0.67	0.82	0.95	1.06
R16E3	0.101	0.56	0.81	1.01	1.17	1.32	0.71	1.03	1.28	1.49	1.67					
R22E5	0.150	1.01	1.43	1.76	2.04	2.28	1.27	1.81	2.23	2.58	2.89	1.50	2.14	2.63	3.04	3.41
R26E6/R27E6	3/16	1.81	2.54	3.10	3.57	3.98	2.28	3.20	3.91	4.51	5.03	2.69	3.79	4.63	5.33	5.95
R28E8/R29E8	1/4	2.31	3.27	4.01	4.63	5.17	2.92	4.13	5.06	5.85	6.54	3.45	4.88	5.98	6.91	7.72
R36E10/R37E10	5/16	3.92	5.57	6.83	7.90	8.85	4.96	7.04	8.64	9.99	11.18	5.85	8.31	10.20	11.80	13.21
R38E14/R39E14	7/16	5.72	8.07	9.88	11.39	12.73	7.22	10.19	12.47	14.39	16.08	8.54	12.05	14.74	17.01	19.01
R42E19/R43E19	19/32	8.72	12.37	15.17	17.54	19.63	11.02	15.63	19.18	22.17	24.81	13.02	18.46	22.65	26.19	29.30
R46E25/R47E25	25/32	14.92	21.13	25.91	29.94	33.50	18.85	26.71	32.74	37.84	42.33	22.27	31.55	38.68	44.70	50.00
R52E35/R53E35	1.0	24.25	35.39	44.15	51.65	58.33	30.82	44.98	56.11	65.65	74.15	36.21	52.85	65.93	77.13	87.12
R56E43/R57E43	1-5/16	46.05	65.10	79.72	92.05	102.9	58.2	82.2	100.7	116.3	130.0	68.74	97.19	119.0	137.4	153.6

Minimum operating capacity is at one psi pressure drop for pilot operated valves.

## Refrigerant Liquid Temperature Correction Factors

Refrigerant Liquid Temperature °F	40	50	60	70	80	90	100	110	120	130	140
R-22	1.33	1.27	1.22	1.17	1.11	1.06	1.00	0.94	0.89	0.83	0.77
R-134a	1.39	1.33	1.26	1.20	1.13	1.07	1.00	0.93	0.87	0.80	0.73
R-404A	1.58	1.49	1.39	1.30	1.20	1.10	1.00	0.90	0.79	0.68	0.57
R-407A	1.42	1.36	1.29	1.22	1.15	1.07	1.00	0.92	0.84	0.76	0.67
R-407C	1.45	1.38	1.30	1.23	1.15	1.08	1.00	0.92	0.84	0.75	0.67
R-407F	1.42	1.35	1.28	1.21	1.14	1.07	1.00	0.93	0.85	0.78	0.70
R-448A	1.46	1.38	1.31	1.23	1.16	1.08	1.00	0.92	0.84	0.75	0.67
R-449A	1.44	1.37	1.30	1.22	1.15	1.08	1.00	0.92	0.84	0.76	0.68
R-410A	1.45	1.38	1.30	1.23	1.15	1.08	1.00	0.92	0.83	0.74	0.64
R-450A	1.41	1.34	1.27	1.21	1.14	1.07	1.00	0.93	0.86	0.79	0.72
R-507A	1.54	1.45	1.36	1.27	1.18	1.09	1.00	0.90	0.80	0.69	0.56
R-513A	1.44	1.37	1.29	1.22	1.15	1.07	1.00	0.93	0.85	0.77	0.69

Liquid Capacity is based on 110°F condensing temperature, 100°F liquid temperature and 40°F evaporating temperature. For each 10°F reduction in evaporating temperature, capacities are reduced by approximately 1-1/2%.

## E Series Solenoid Valve Discharge Gas Capacity in IP Units

Type	Port Size Inches	Tons of Refrigeration																	
		22						134a						404A					
		Pressure Drop - psi																	
		2	5	10	25	50	100	2	5	10	25	50	100	2	5	10	25	50	100
R12E2	0.075	0.15	0.24	0.34	0.51	0.64	Critical	0.12	0.20	0.28	0.40	0.47	Critical	0.13	0.20	0.28	0.43	0.56	0.64
R16E3	0.101	0.25	0.41	0.60	0.83	1.08	1.26	0.21	0.34	0.50	0.66	0.81	Critical	0.22	0.35	0.51	0.71	0.94	1.13
R22E5	0.150	0.48	0.76	1.08	1.97	2.58	3.04	0.40	0.64	0.91	1.58	1.95	Critical	0.41	0.64	0.92	1.69	2.24	2.72
R26E6/R27E6	3/16	0.89	1.40	1.96	3.35	4.27	Critical	0.75	1.17	1.65	2.65	3.12	Critical	0.75	1.18	1.66	2.88	3.74	4.32
R28E8/R29E8	1/4	1.12	1.77	2.50	3.84	5.11	6.33	0.94	1.49	2.10	3.11	3.97	Critical	0.95	1.50	2.12	3.28	4.42	5.59
R36E10/R37E10	5/16	1.87	2.98	4.23	6.60	8.56	9.93	1.57	2.50	3.54	5.26	6.41	Critical	1.60	2.53	3.60	5.67	7.45	8.94
R38E14/R39E14	7/16	2.78	4.39	6.20	10.44	13.89	17.19	2.34	3.69	5.20	8.45	10.78	Critical	2.36	3.72	5.26	8.94	12.01	15.18
R42E19/R43E19	19/32	4.18	6.64	9.41	15.47	20.69	25.91	3.51	5.57	7.90	12.56	16.17	18.35	3.56	5.65	8.01	13.25	17.87	22.80
R46E25/R47E25	25/32	7.17	11.37	16.11	24.71	33.05	41.38	6.02	9.54	13.52	20.06	25.82	29.30	6.11	9.68	13.71	21.16	28.54	36.41
R52E35/R53E35	1.0	10.59	17.46	25.49	43.36	58.51	74.82	8.82	14.53	21.21	35.40	46.28	54.77	9.18	15.12	22.07	37.09	50.40	65.43
R56E43/R57E43	1-5/16	22.30	35.24	49.83	72.04	96.34	120.57	18.72	29.59	41.84	58.50	75.26	85.31	18.96	29.96	42.37	61.71	83.19	106.10

# Capacity Tables

## E Series Solenoid Valve Discharge Gas Capacity in IP Units (cont.)

Type	Port Size Inches	Tons of Refrigeration																	
		407A						407C						407F					
		Pressure Drop - psi																	
		2	5	10	25	50	100	2	5	10	25	50	100	2	5	10	25	50	100
R12E2	0.075	0.14	0.22	0.32	0.48	0.62	Critical	0.15	0.23	0.33	0.50	0.63	Critical	0.14	0.22	0.31	0.47	0.59	Critical
R16E3	0.101	0.24	0.39	0.57	0.79	1.04	1.22	0.25	0.40	0.58	0.81	1.05	1.21	0.23	0.38	0.55	0.77	0.99	1.15
R22E5	0.150	0.46	0.72	1.03	1.88	2.47	2.94	0.47	0.74	1.06	1.93	2.51	2.94	0.44	0.70	1.00	1.82	2.37	2.78
R26E6/R27E6	3/16	0.85	1.32	1.86	3.20	4.11	Critical	0.87	1.36	1.92	3.27	4.15	Critical	0.82	1.29	1.81	3.08	3.92	Critical
R28E8/R29E8	1/4	1.07	1.68	2.38	3.66	4.89	6.10	1.09	1.73	2.45	3.75	4.98	6.14	1.03	1.63	2.31	3.53	4.70	5.81
R36E10/R37E10	5/16	1.79	2.84	4.03	6.30	8.21	9.62	1.83	2.91	4.13	6.43	8.33	9.59	1.73	2.75	3.90	6.07	7.86	9.08
R38E14/R39E14	7/16	2.65	4.18	5.90	9.97	13.30	16.56	2.72	4.29	6.06	10.19	13.54	16.67	2.56	4.05	5.71	9.61	12.78	15.76
R42E19/R43E19	19/32	3.99	6.32	8.97	14.77	19.81	24.93	4.09	6.49	9.20	15.10	20.17	25.15	3.86	6.12	8.68	14.25	19.04	23.77
R46E25/R47E25	25/32	6.84	10.84	15.36	23.59	31.63	39.81	7.01	11.12	15.75	24.12	32.21	40.16	6.62	10.49	14.86	22.75	30.40	37.96
R52E35/R53E35	1.0	10.16	16.75	24.45	41.39	55.97	71.87	10.37	17.09	24.94	42.34	57.05	72.72	9.81	16.18	23.61	39.94	53.85	68.71
R56E43/R57E43	1-5/16	21.25	33.59	47.49	68.80	92.22	116.02	21.80	34.46	48.72	70.33	93.89	117.0	20.55	32.49	45.94	66.35	88.63	110.62

Type	Port Size Inches	Tons of Refrigeration																	
		448A						449A						450A					
		Pressure Drop - psi																	
		2	5	10	25	50	100	2	5	10	25	50	100	2	5	10	25	50	100
R12E2	0.075	0.15	0.23	0.33	0.50	0.64	Critical	0.14	0.23	0.33	0.50	0.63	Critical	0.11	0.18	0.26	0.35	Critical	Critical
R16E3	0.101	0.25	0.40	0.58	0.82	1.07	1.26	0.25	0.40	0.58	0.81	1.06	1.25	0.19	0.31	0.45	0.59	0.70	Critical
R22E5	0.150	0.47	0.74	1.06	1.94	2.54	3.04	0.46	0.74	1.05	1.93	2.53	3.02	0.36	0.58	0.82	1.41	1.68	Critical
R26E6/R27E6	3/16	0.87	1.36	1.91	3.29	4.23	Critical	0.86	1.35	1.90	3.27	4.20	Critical	0.68	1.07	1.50	2.34	Critical	Critical
R28E8/R29E8	1/4	1.09	1.73	2.44	3.76	5.03	6.29	1.09	1.72	2.43	3.74	5.00	6.25	0.85	1.35	1.91	2.78	3.48	Critical
R36E10/R37E10	5/16	1.83	2.91	4.13	6.47	8.45	9.96	1.82	2.90	4.11	6.44	8.40	9.89	1.43	2.27	3.22	4.67	5.51	Critical
R38E14/R39E14	7/16	2.71	4.28	6.05	10.23	13.67	17.08	2.70	4.26	6.02	10.18	13.59	16.97	2.12	3.35	4.73	7.56	9.45	Critical
R42E19/R43E19	19/32	4.08	6.48	9.19	15.15	20.35	25.71	4.07	6.45	9.15	15.08	20.24	25.54	3.19	5.06	7.17	11.25	14.22	Critical
R46E25/R47E25	25/32	7.00	11.10	15.73	24.20	32.49	41.05	6.97	11.05	15.66	24.08	32.32	40.79	5.47	8.67	12.28	17.96	22.71	Critical
R52E35/R53E35	1.0	10.41	17.15	25.04	42.44	57.46	74.01	10.36	17.08	24.93	42.24	57.16	73.56	7.99	13.16	19.21	31.77	40.94	46.61
R56E43/R57E43	1-5/16	21.76	34.39	48.63	70.56	94.72	119.62	21.66	34.24	48.41	70.21	94.21	118.86	17.01	26.89	38.01	52.37	66.18	Critical

Type	Port Size Inches	Tons of Refrigeration																	
		507A						513A						410A					
		Pressure Drop - psi																	
		2	5	10	25	50	100	2	5	10	25	50	100	2	5	10	25	50	100
R12E2	0.075	0.13	0.20	0.28	0.45	0.57	0.65	0.11	0.18	0.26	0.37	0.44	Critical	0.18	0.28	0.40	0.64	0.83	1.03
R16E3	0.101	0.22	0.35	0.51	0.83	0.94	1.14	0.20	0.31	0.45	0.61	0.75	Critical						
R22E5	0.150	0.41	0.64	0.92	1.47	2.25	2.75	0.37	0.58	0.83	1.45	1.81	Critical	0.57	0.91	1.29	2.05	3.26	4.17
R26E6/R27E6	3/16	0.75	1.17	1.65	2.60	3.76	4.38	0.69	1.07	1.51	2.44	2.91	Critical	1.05	1.65	2.32	3.65	5.51	6.83
R28E8/R29E8	1/4	0.95	1.50	2.12	3.35	4.43	5.62	0.86	1.36	1.92	2.86	3.68	Critical	1.33	2.10	2.97	4.70	6.36	8.35
R36E10/R37E10	5/16	1.59	2.53	3.59	5.71	7.48	9.03	1.44	2.29	3.25	4.86	5.97	Critical	2.23	3.54	5.03	7.99	10.87	13.80
R38E14/R39E14	7/16	2.36	3.72	5.25	8.28	12.03	15.27	2.15	3.38	4.77	7.79	10.00	Critical	3.30	5.21	7.35	11.60	17.30	22.68
R42E19/R43E19	19/32	3.56	5.64	8.00	12.69	17.89	22.93	3.22	5.11	7.25	11.58	14.98	17.21	4.97	7.89	11.19	17.76	25.67	33.87
R46E25/R47E25	25/32	6.10	9.66	13.68	21.69	28.57	36.61	5.53	8.76	12.42	18.50	23.92	27.49	8.53	13.52	19.15	30.35	40.99	54.08
R52E35/R53E35	1.0	9.18	15.13	22.08	36.41	50.44	65.71	8.15	13.42	19.60	32.61	42.81	51.16	12.78	21.06	30.74	50.68	72.08	96.17
R56E43/R57E43	1-5/16	18.92	29.90	42.27	66.82	83.30	106.69	17.20	27.17	38.42	53.94	69.72	80.04	26.5	41.8	59.2	93.5	119.5	157.7

Minimum operating capacity is at one psi pressure drop for pilot operated valves.

## Evaporator Temperature Correction Factors

Evaporator Temperature °F	40	30	20	10	0	-10	-20	-30	-40
Multiplier	1.00	0.96	0.93	0.90	0.87	0.84	0.81	0.78	0.75

Capacities based on 110°F condensing temperature, isentropic compression plus 50°F, 40°F evaporating temperature and 65°F suction gas. For capacities at other conditions use the multipliers in tables above.



# Capacity Tables

## E Series Solenoid Valve Suction Capacity in IP Units

Type	Port Size Inches	Tons of Refrigeration														
		22					134a					404A				
		Pressure Drop - psi														
		40	20	0	-20	-40	40	20	0	-20	-40	40	20	0	-20	-40
R12E2	0.075	0.07	0.06	0.04	0.04	0.03	0.05	0.04	0.03	0.02	0.02	0.06	0.05	0.04	0.03	0.02
R16E3	0.101	0.11	0.09	0.07	0.06	0.04	0.09	0.07	0.05	0.04	0.03	0.09	0.07	0.06	0.04	0.03
R22E5	0.150	0.22	0.18	0.14	0.11	0.09	0.17	0.13	0.10	0.08	0.06	0.18	0.15	0.11	0.09	0.06
R26E6/R27E6	3/16	0.42	0.34	0.28	0.22	0.17	0.32	0.26	0.20	0.15	0.11	0.35	0.28	0.22	0.17	0.12
R28E8/R29E8	1/4	0.52	0.43	0.34	0.27	0.21	0.40	0.32	0.24	0.18	0.13	0.43	0.34	0.27	0.21	0.15
R36E10/R37E10	5/16	0.87	0.71	0.57	0.44	0.34	0.67	0.52	0.40	0.30	0.22	0.72	0.57	0.45	0.34	0.25
R38E14/R39E14	7/16	1.30	1.07	0.86	0.67	0.52	1.00	0.79	0.61	0.46	0.34	1.08	0.86	0.67	0.51	0.38
R42E19/R43E19	19/32	1.94	1.58	1.27	1.00	0.76	1.49	1.17	0.90	0.68	0.49	1.61	1.28	1.00	0.76	0.56
R46E25/R47E25	25/32	3.33	2.72	2.18	1.72	1.32	2.56	2.01	1.55	1.16	0.85	2.77	2.20	1.72	1.31	0.97
R52E35/R53E35	1.0	4.61	3.71	2.93	2.26	1.70	3.49	2.70	2.04	1.50	1.07	3.89	3.05	2.34	1.75	1.27
R56E43/R57E43	1-5/16	10.40	8.51	6.83	5.38	4.13	8.01	6.30	4.86	3.65	2.66	8.63	6.88	5.37	4.09	3.03

Type	Port Size Inches	Tons of Refrigeration														
		407A					407C					407F				
		Pressure Drop - psi														
		40	20	0	-20	-40	40	20	0	-20	-40	40	20	0	-20	-40
R12E2	0.075	0.06	0.05	0.04	0.03	0.02	0.06	0.05	0.04	0.03	0.02	0.06	0.05	0.04	0.03	0.02
R16E3	0.101	0.10	0.08	0.06	0.05	0.03	0.11	0.08	0.06	0.05	0.04	0.10	0.08	0.06	0.05	0.03
R22E5	0.150	0.20	0.16	0.12	0.09	0.07	0.21	0.16	0.13	0.10	0.07	0.20	0.15	0.12	0.09	0.07
R26E6/R27E6	3/16	0.38	0.31	0.24	0.18	0.14	0.39	0.31	0.25	0.19	0.14	0.37	0.30	0.23	0.18	0.13
R28E8/R29E8	1/4	0.48	0.38	0.30	0.23	0.17	0.49	0.39	0.30	0.23	0.17	0.46	0.37	0.29	0.22	0.16
R36E10/R37E10	5/16	0.79	0.63	0.49	0.37	0.28	0.81	0.65	0.50	0.38	0.28	0.77	0.61	0.48	0.36	0.27
R38E14/R39E14	7/16	1.19	0.95	0.74	0.57	0.42	1.22	0.97	0.76	0.58	0.43	1.16	0.92	0.72	0.55	0.40
R42E19/R43E19	19/32	1.78	1.41	1.10	0.84	0.62	1.81	1.45	1.13	0.86	0.64	1.72	1.37	1.06	0.81	0.59
R46E25/R47E25	25/32	3.05	2.43	1.90	1.44	1.07	3.12	2.49	1.94	1.48	1.10	2.96	2.35	1.83	1.39	1.03
R52E35/R53E35	1.0	4.23	3.32	2.54	1.90	1.38	4.30	3.37	2.59	1.94	1.40	4.11	3.21	2.45	1.83	1.32
R56E43/R57E43	1-5/16	9.53	7.60	5.93	4.52	3.35	9.73	7.77	6.08	4.64	3.44	9.25	7.36	5.73	4.36	3.22

Type	Port Size Inches	Tons of Refrigeration														
		448A					449A					450A				
		Pressure Drop - psi														
		40	20	0	-20	-40	40	20	0	-20	-40	40	20	0	-20	-40
R12E2	0.075	0.06	0.05	0.04	0.03	0.02	0.06	0.05	0.04	0.03	0.02	0.05	0.04	0.03	0.02	0.01
R16E3	0.101	0.11	0.08	0.06	0.05	0.04	0.11	0.08	0.06	0.05	0.04	0.08	0.06	0.04	0.03	0.02
R22E5	0.150	0.21	0.16	0.13	0.10	0.07	0.20	0.16	0.13	0.10	0.07	0.15	0.12	0.09	0.07	0.05
R26E6/R27E6	3/16	0.39	0.31	0.25	0.19	0.14	0.39	0.31	0.25	0.19	0.14	0.29	0.23	0.18	0.13	0.09
R28E8/R29E8	1/4	0.49	0.39	0.31	0.23	0.17	0.48	0.39	0.30	0.23	0.17	0.36	0.28	0.22	0.16	0.12
R36E10/R37E10	5/16	0.81	0.65	0.51	0.39	0.29	0.80	0.64	0.50	0.38	0.29	0.60	0.47	0.36	0.26	0.19
R38E14/R39E14	7/16	1.22	0.97	0.76	0.59	0.44	1.21	0.97	0.76	0.58	0.44	0.90	0.71	0.54	0.40	0.29
R42E19/R43E19	19/32	1.81	1.45	1.13	0.87	0.64	1.80	1.44	1.13	0.86	0.64	1.34	1.04	0.80	0.59	0.43
R46E25/R47E25	25/32	3.11	2.49	1.95	1.49	1.11	3.09	2.47	1.94	1.48	1.10	2.31	1.80	1.37	1.02	0.73
R52E35/R53E35	1.0	4.31	3.39	2.61	1.96	1.43	4.29	3.38	2.60	1.95	1.42	3.13	2.40	1.80	1.31	0.92
R56E43/R57E43	1-5/16	9.71	7.77	6.10	4.67	3.48	9.66	7.73	6.06	4.64	3.46	7.21	5.63	4.30	3.20	2.30

Minimum operating capacity is at one psi pressure drop for pilot operated valves.

# Capacity Tables

## E Series Solenoid Valve Suction Capacity in IP Units (cont.)

Type	Port Size Inches	Tons of Refrigeration														
		507A					513A					410A				
		Pressure Drop - psi														
		40	20	0	-20	-40	40	20	0	-20	-40	40	20	0	-20	-40
R12E2	0.075	0.06	0.05	0.04	0.03	0.02	0.05	0.04	0.03	0.02	0.02	0.08	0.07	0.05	0.04	0.03
R16E3	0.101	0.09	0.07	0.06	0.04	0.03	0.08	0.06	0.05	0.03	0.03					
R22E5	0.150	0.18	0.14	0.11	0.09	0.06	0.16	0.12	0.09	0.07	0.05	0.26	0.21	0.17	0.14	0.10
R26E6/R27E6	3/16	0.35	0.28	0.22	0.17	0.12	0.30	0.24	0.18	0.14	0.10	0.50	0.41	0.33	0.26	0.20
R28E8/R29E8	1/4	0.43	0.34	0.27	0.20	0.15	0.37	0.29	0.23	0.17	0.12	0.62	0.51	0.41	0.32	0.25
R36E10/R37E10	5/16	0.72	0.57	0.44	0.34	0.25	0.62	0.49	0.37	0.28	0.20	1.03	0.85	0.68	0.54	0.41
R38E14/R39E14	7/16	1.07	0.86	0.67	0.51	0.38	0.93	0.73	0.56	0.42	0.31	1.55	1.27	1.03	0.81	0.62
R42E19/R43E19	19/32	1.60	1.28	0.99	0.76	0.56	1.39	1.09	0.83	0.62	0.45	2.31	1.90	1.52	1.20	0.92
R46E25/R47E25	25/32	2.75	2.19	1.71	1.30	0.97	2.39	1.87	1.43	1.07	0.78	3.97	3.26	2.62	2.06	1.59
R52E35/R53E35	1.0	3.88	3.04	2.33	1.75	1.27	3.27	2.52	1.90	1.40	0.99	5.58	4.50	3.57	2.76	2.08
R56E43/R57E43	1-5/16	8.59	6.85	5.35	4.08	3.03	7.46	5.85	4.49	3.36	2.45	12.40	10.17	8.19	6.46	4.97

Minimum operating capacity is at one psi pressure drop for pilot operated valves.

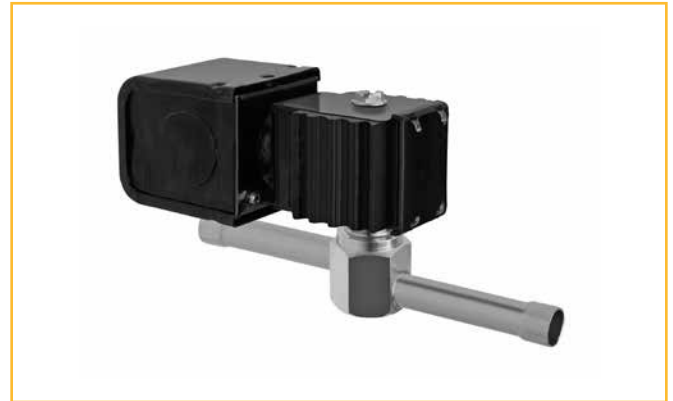
# Series R12 and R16 Direct Acting Valves

## Series R12 & R16 — 2-Way Direct Acting Normally Closed Valves



### Materials of Construction

Body .....	Brass
Seating Material .....	Teflon®
Seals .....	Gasket
Plunger .....	Stainless
Sleeve Tube .....	Stainless
Stop .....	Stainless
Springs .....	Stainless
Shading Ring .....	Copper
Connections .....	Extended Ends - Copper SAE Flare Ends Available



### Specifications

#### R12 & R16 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①												
				Liquid												
				R22 3 psi ↘	R134a 2 psi ↘	R404A 3 psi ↘	R407A 3 psi ↘	R407C 3 psi ↘	R407F 3 psi ↘	R410A 5 psi ↘	R448A 3 psi ↘	R449A 3 psi ↘	R450A 2 psi ↘	R507A 3 psi ↘	R513A 2 psi ↘	
R12E22	1/4" ODF	0.075	0.16	0.88	0.67	0.57	0.76	0.83	0.75	1.06	0.76	0.76	0.62	0.55	0.56	
R12E23	3/8" ODF															
R16E32	1/4" ODF	0.101	0.3	1.61	1.21	1.04	1.40	1.52	1.38	NA	1.40	1.40	1.13	1.01	1.03	
R16E33	3/8" ODF															
R16F32	1/4" SAE															

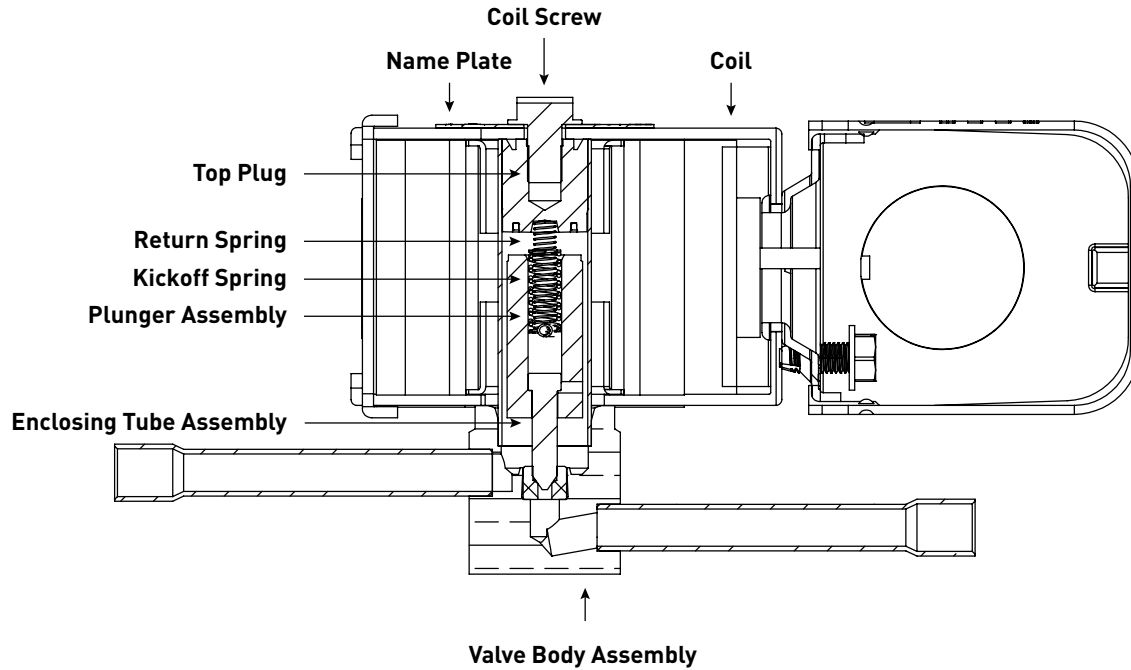
Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①												
				Discharge												
				5 psi ↘												
R12E22	1/4" ODF	0.075	0.16	0.24	0.20	0.20	0.23	0.23	0.22	0.28	0.23	0.23	0.18	0.20	0.18	
R12E23	3/8" ODF															
R16E32	1/4" ODF	0.101	0.3	0.41	0.34	0.35	0.39	0.40	0.38	NA	0.40	0.40	0.31	0.35	0.32	
R16E33	3/8" ODF															
R16F32	1/4" SAE															

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①												
				Suction												
				1 psi ↘ at 40°F												
R12E22	1/4" ODF	0.075	0.16	0.07	0.05	0.06	0.06	0.06	0.06	0.06	0.08	0.06	0.06	0.05	0.06	0.05
R12E23	3/8" ODF															
R16E32	1/4" ODF	0.101	0.3	0.11	0.09	0.09	0.10	0.11	0.10	NA	0.11	0.11	0.08	0.09	0.08	
R16E33	3/8" ODF															
R16F32	1/4" SAE															

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
Coils available separately. Use Coil PKC-1 with R12 & R16 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

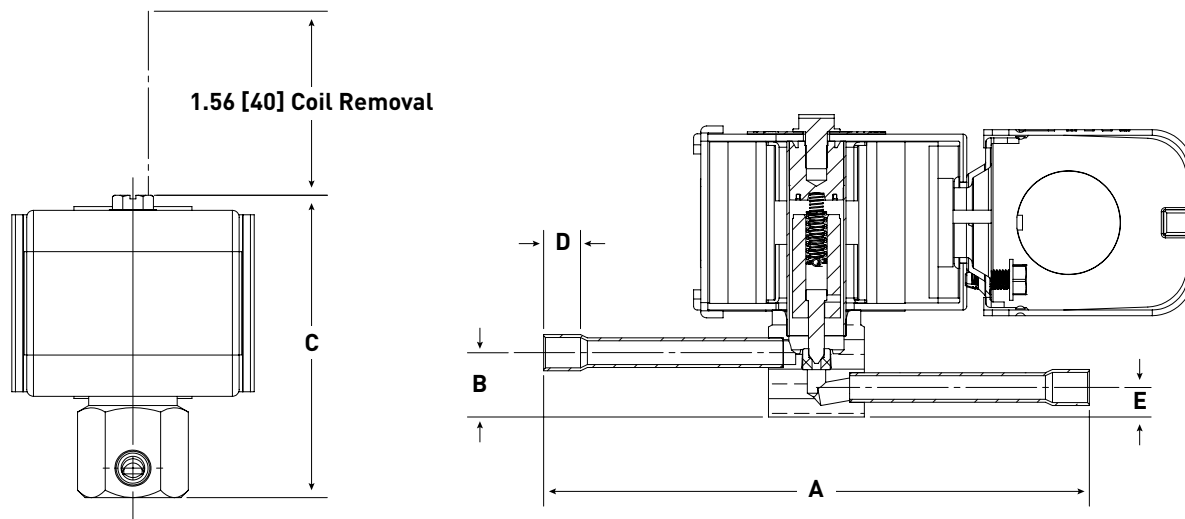
## Call-Outs

### R12 and R16 Direct Acting Valves



## Dimensions - Inches

### R12 and R16 Direct Acting Valves - Normally Closed



Valve Series	Connection (Inches)	Dimensions					Offset
		A	B	C	D	E	
R12E22	1/4" ODF	4.63	0.55	2.56	0.31	0.25	0.30
R12E23	3/8" ODF	4.56	0.49				0.24
R16E32	1/4" ODF	4.63	0.55	2.56	0.31	0.25	0.30
R16E33	3/8" ODF	4.56	0.49				0.24
R16F32	1/4" SAE	2.38	0.22	2.47	n/a	n/a	n/a

# Series R22 Pilot-Operated Valves

## Series R22 — 2-Way Pilot-Operated Normally Closed Valves



### Materials of Construction

Body .....	Brass
Seating Material .....	Teflon®
Seals .....	Gasket
Plunger .....	Stainless
Sleeve Tube .....	Stainless
Stop .....	Stainless
Springs .....	Stainless
Piston .....	Brass
Shading Ring .....	Copper
Connections .....	Extended Ends - Copper



### Specifications

#### R22 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22 3 psi ~	R134a 2 psi ~	R404A 3 psi ~	R407A 3 psi ~	R407C 3 psi ~	R407F 3 psi ~	R410A 5 psi ~	R448A 3 psi ~	R449A 3 psi ~	R450A 2 psi ~	R507A 3 psi ~	R513A 2 psi ~
R22E52	1/4" ODF	0.15	0.5	2.81	2.14	1.82	2.44	2.65	2.41	3.41	2.44	2.42	1.99	1.76	1.81
R22E53	3/8" ODF														

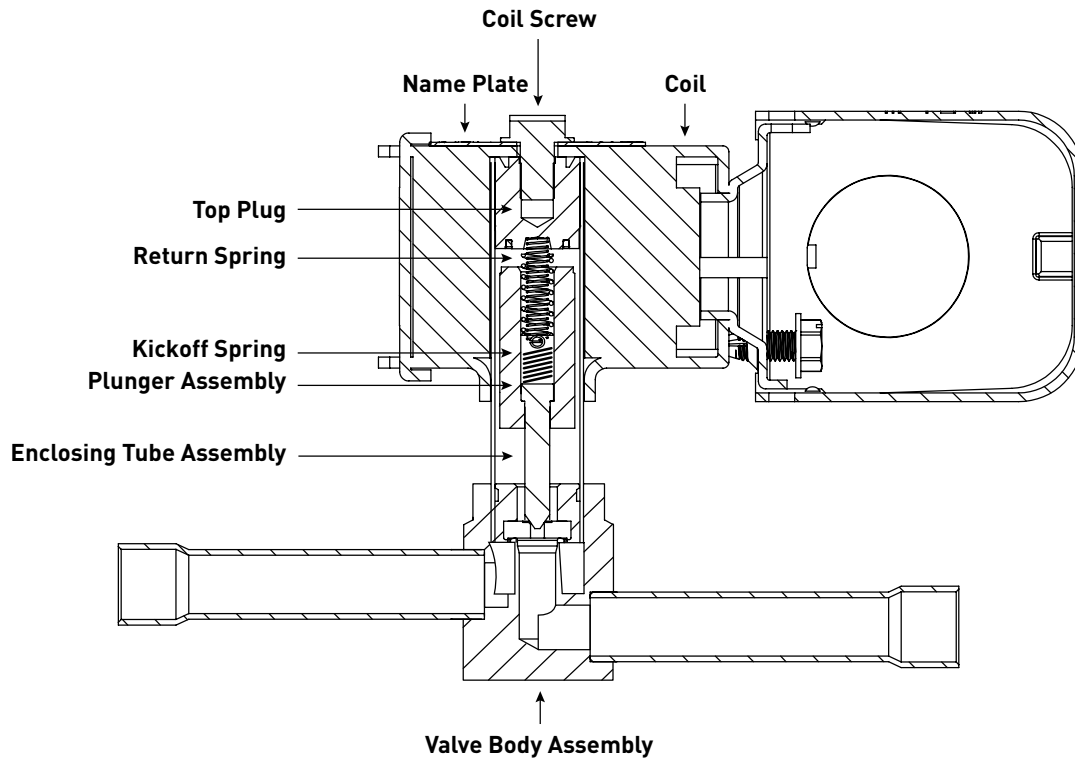
Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				5 psi ~											
R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A				
R22E52	1/4" ODF	0.15	0.5	0.76	0.64	0.65	0.72	0.74	0.70	0.91	0.74	0.74	0.58	0.65	0.59
R22E53	3/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				1 psi ~ at 40°F											
R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A				
R22E52	1/4" ODF	0.15	0.5	0.22	0.17	0.18	0.20	0.21	0.20	0.26	0.21	0.20	0.15	0.18	0.16
R22E53	3/8" ODF														

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil PKC-1 with R22 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

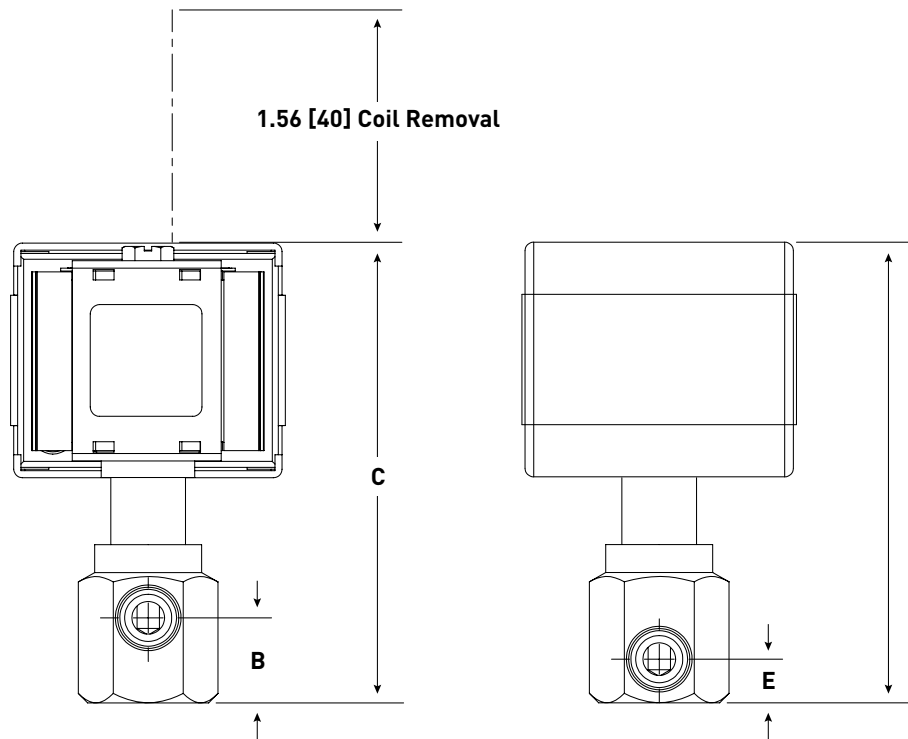
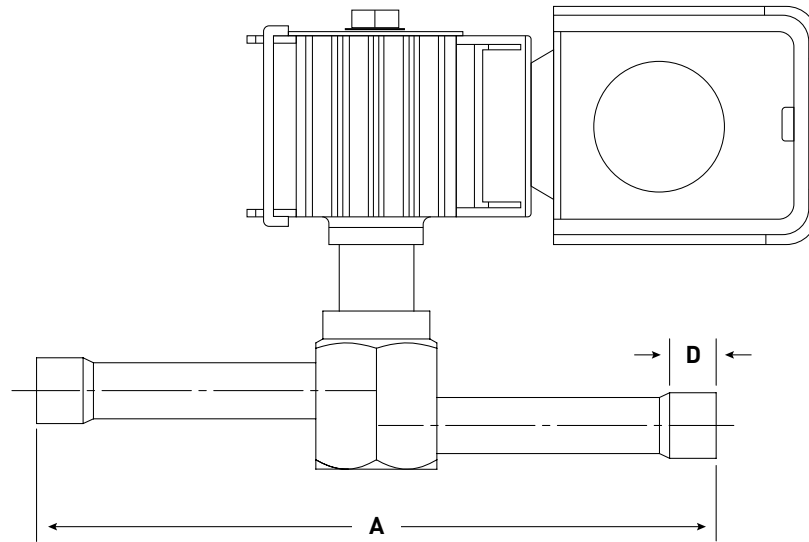
## Call-Outs

### R22 Pilot-Operated Valves



## Dimensions - Inches

### R22 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions					
		A	B	C	D	E	Offset
R22E52	1/4" ODF	4.63	0.53	3.09	0.31	0.29	0.24
R22E53	3/8" ODF	4.56					

# Series R26 & R28 and R27 & R29 Pilot-Operated Valves

Series R26 & R28 — 2-Way Pilot-Operated Normally Closed Valves



Series R27 & R29 — 2-Way Pilot-Operated Normally Open Valves

## Materials of Construction

Body .....	Brass
Seating Material .....	Teflon®
Seals .....	Gasket
Plunger .....	Stainless
Sleeve Tube .....	Stainless
Stop .....	Stainless
Piston .....	Brass
Springs .....	Stainless
Shading Ring .....	Copper
Connections .....	Extended Ends - Copper
Manual Stem .....	Brass



## Specifications

### R26 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22 3 psi ↘	R134a 2 psi ↘	R404A 3 psi ↘	R407A 3 psi ↘	R407C 3 psi ↘	R407F 3 psi ↘	R410A 5 psi ↘	R448A 3 psi ↘	R449A 3 psi ↘	R450A 2 psi ↘	R507A 3 psi ↘	R513A 2 psi ↘
R26E63	3/8" ODF	3/16	0.9	4.95	3.78	3.20	4.29	4.66	4.24	5.95	4.30	4.26	3.51	3.10	3.20

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				5 psi ↘											
R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A				
R26E63	3/8" ODF	3/16	0.9	1.40	1.17	1.18	1.33	1.36	1.29	1.08	1.36	1.35	1.07	1.18	1.08

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				1 psi ↘ at 40°F											
R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A				
R26E63	3/8" ODF	3/16	0.9	0.42	0.32	0.35	0.38	0.39	0.37	0.50	0.39	0.39	0.29	0.35	0.30

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil PKC-1 with R26 & R28 series valves and coil OPKC-1 with R27 & R29 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.



## Specifications

### R27 Series Valve — Normally Open

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R27E63	3/8" ODF	3/16	0.9	3 psi ↘	2 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	5 psi ↘	3 psi ↘	3 psi ↘	2 psi ↘	3 psi ↘	2 psi ↘
				4.95	3.78	3.20	4.29	4.66	4.24	5.95	4.30	4.26	3.51	3.10	3.20

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R27E63	3/8" ODF	3/16	0.9	5 psi ↘											
				1.40	1.17	1.18	1.33	1.36	1.29	1.08	1.36	1.35	1.07	1.18	1.08

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R27E63	3/8" ODF	3/16	0.9	1 psi ↘ at 40°F											
				0.42	0.32	0.35	0.38	0.39	0.37	0.50	0.39	0.39	0.29	0.35	0.30

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil PKC-1 with R26 & R28 series valves and coil OPKC-1 with R27 & R29 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

### R28 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R28E84	1/2" ODF	1/4"	1.2	3 psi ↘	2 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	5 psi ↘	3 psi ↘	3 psi ↘	2 psi ↘	3 psi ↘	2 psi ↘
				6.40	4.88	4.14	5.55	6.03	5.49	7.72	5.56	5.51	4.53	4.01	4.13

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R28E84	1/2" ODF	1/4"	1.2	5 psi ↘											
				1.77	1.49	1.50	1.69	1.73	1.63	2.10	1.73	1.72	1.35	1.50	1.36

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R28E84	1/2" ODF	1/4"	1.2	1 psi ↘ at 40°F											
				0.52	0.40	0.43	0.48	0.49	0.46	0.62	0.49	0.48	0.36	0.43	0.37

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil PKC-1 with R26 & R28 series valves and coil OPKC-1 with R27 & R29 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Specifications

### R29 Series Valve — Normally Open

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R29E84	1/2" ODF	1/4"	1.2	3 psi ↘	2 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	5 psi ↘	3 psi ↘	3 psi ↘	2 psi ↘	3 psi ↘	2 psi ↘
				6.40	4.88	4.14	5.55	6.03	5.49	7.72	5.56	5.51	4.53	4.01	4.13

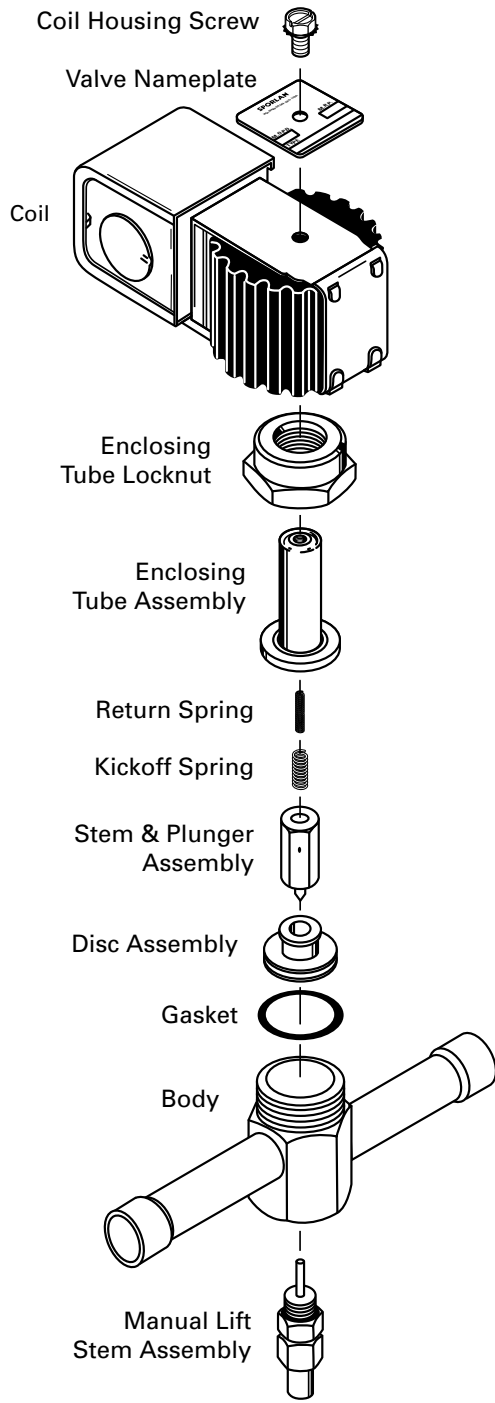
Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R29E84	1/2" ODF	1/4"	1.2	5 psi ↘											
				1.77	1.49	1.50	1.69	1.73	1.63	2.10	1.73	1.72	1.35	1.50	1.36

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R29E84	1/2" ODF	1/4"	1.2	1 psi ↘ at 40°F											
				0.52	0.40	0.43	0.48	0.49	0.46	0.62	0.49	0.48	0.36	0.43	0.37

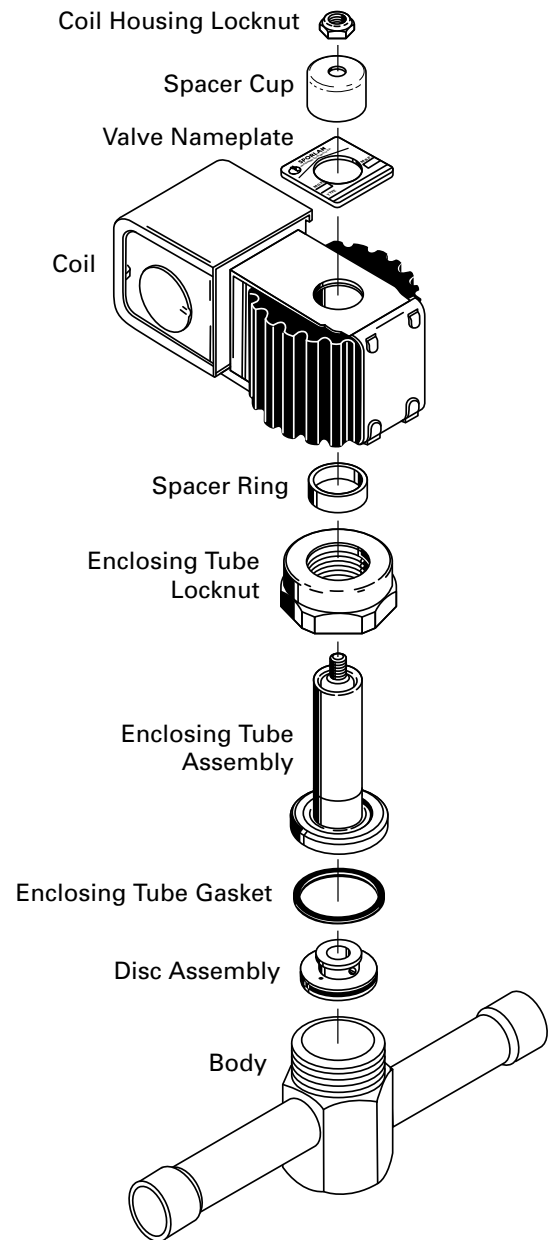
① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil PKC-1 with R26 & R28 series valves and coil OPKC-1 with R27 & R29 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Call-Outs

### R26 & R28 Pilot-Operated Valves

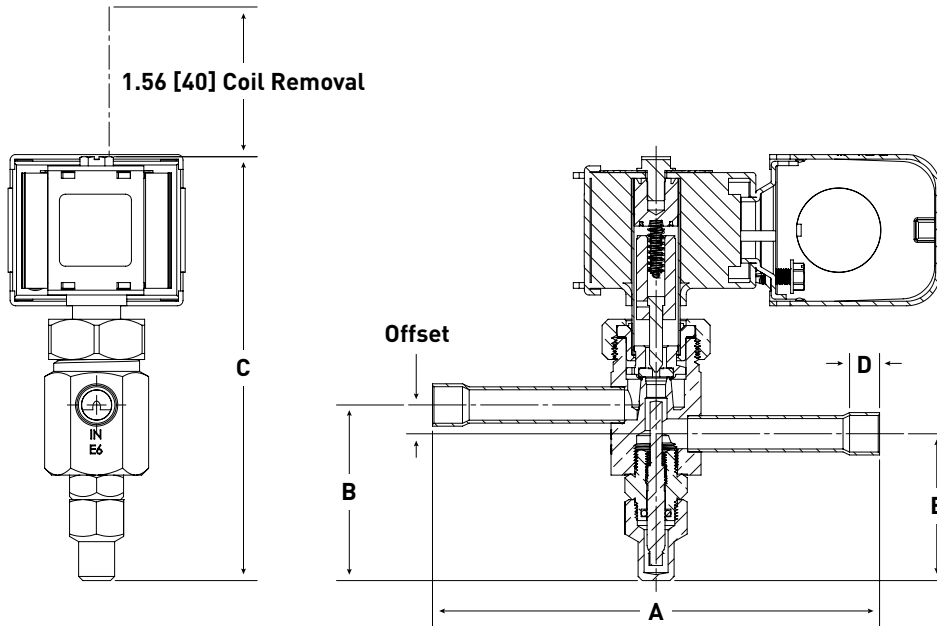


### R27 & R29 Pilot-Operated Valves



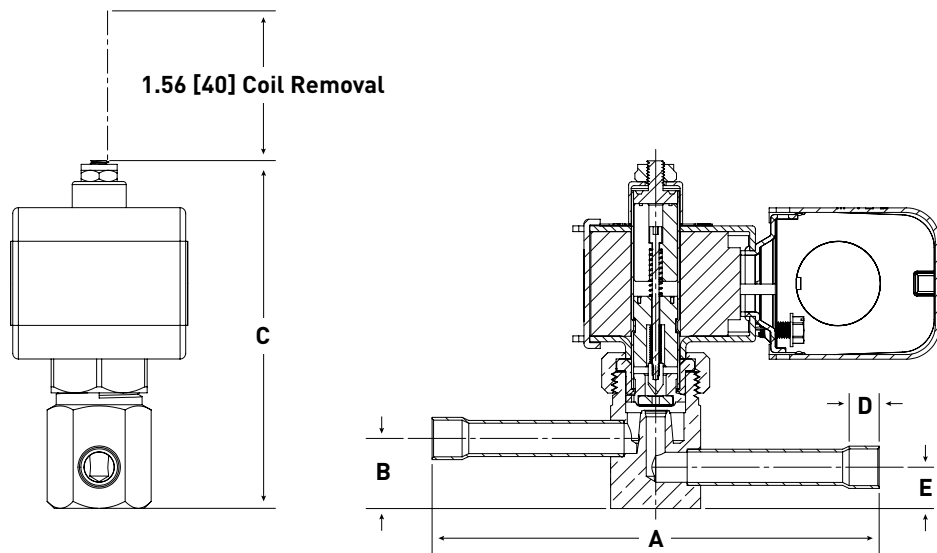
## Dimensions - Inches

### R26 & R28 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions					
		A	B	C	D	E	Offset
R26E63M	3/8" ODF	4.66	1.83	4.42	0.31	1.53	0.30
R28E84M	1/2" ODF	5.04	1.83	4.42	0.38	1.53	0.30

### R27 & R29 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions					
		A	B	C	D	E	Offset
R27E63	3/8" ODF	4.66	0.73	3.62	0.31	0.43	0.30
R29E84	1/2" ODF	5.04	0.73	3.62	0.38	0.43	0.30

# Series R36 and R37 Pilot-Operated Valves

Series R36 — 2-Way Pilot-Operated Normally Closed Valves

Series R37 — 2-Way Pilot-Operated Normally Open Valves



## Materials of Construction

Body .....	Brass
Seating Material .....	Teflon®
Seals .....	Gasket
Plunger .....	Stainless
Sleeve Tube .....	Stainless
Stop .....	Stainless
Piston .....	Brass
Springs .....	Stainless
Shading Ring .....	Copper
Connections .....	Extended Ends - Copper
Manual Stem .....	Brass



## Specifications

### R36 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22 3 psi ↘	R134a 2 psi ↘	R404A 3 psi ↘	R407A 3 psi ↘	R407C 3 psi ↘	R407F 3 psi ↘	R410A 5 psi ↘	R448A 3 psi ↘	R449A 3 psi ↘	R450A 2 psi ↘	R507A 3 psi ↘	R513A 2 psi ↘
R36E104	1/2" ODF	5/16"	2.06	10.93	8.30	7.05	9.46	10.29	9.37	13.21	9.48	9.40	7.72	6.83	7.04
R36E105	5/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				5 psi ↘											
R36E104	1/2" ODF	5/16"	2.06	2.98	2.50	2.54	2.84	2.91	2.75	3.54	2.91	2.90	2.27	2.53	2.30
R36E105	5/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				1 psi ↘ at 40°F											
R36E104	1/2" ODF	5/16"	2.06	0.87	0.67	0.72	0.79	0.81	0.77	1.03	0.81	0.80	0.60	0.72	0.62
R36E105	5/8" ODF														

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10. Coils available separately. Use Coil PKC-1 with R36 and coil OPKC-1 with R37 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Specifications

### R37 Series Valve — Normally Open

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22 3 psi ↘	R134a 2 psi ↘	R404A 3 psi ↘	R407A 3 psi ↘	R407C 3 psi ↘	R407F 3 psi ↘	R410A 5 psi ↘	R448A 3 psi ↘	R449A 3 psi ↘	R450A 2 psi ↘	R507A 3 psi ↘	R513A 2 psi ↘
R37E104	1/2" ODF	5/16"	2.06	10.93	8.30	7.05	9.46	10.29	9.37	13.21	9.48	9.40	7.72	6.83	7.04
R37E105	5/8" ODF														

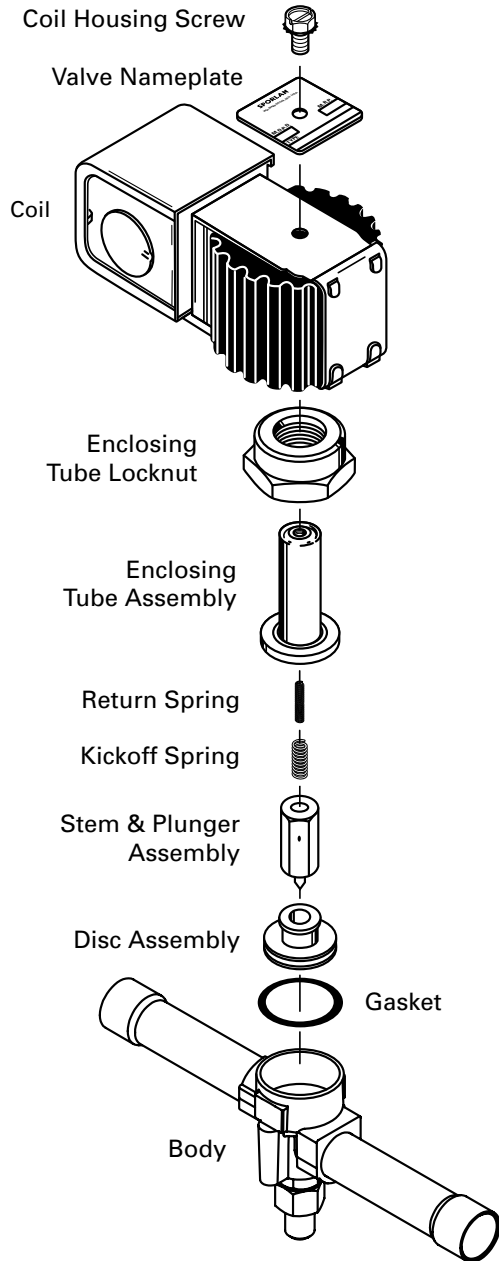
Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22 5 psi ↘	R134a 5 psi ↘	R404A 5 psi ↘	R407A 5 psi ↘	R407C 5 psi ↘	R407F 5 psi ↘	R410A 5 psi ↘	R448A 5 psi ↘	R449A 5 psi ↘	R450A 5 psi ↘	R507A 5 psi ↘	R513A 5 psi ↘
R37E104	1/2" ODF	5/16"	2.06	2.98	2.50	2.54	2.84	2.91	2.75	3.54	2.91	2.90	2.27	2.53	2.30
R37E105	5/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22 1 psi ↘ at 40°F	R134a 1 psi ↘ at 40°F	R404A 1 psi ↘ at 40°F	R407A 1 psi ↘ at 40°F	R407C 1 psi ↘ at 40°F	R407F 1 psi ↘ at 40°F	R410A 1 psi ↘ at 40°F	R448A 1 psi ↘ at 40°F	R449A 1 psi ↘ at 40°F	R450A 1 psi ↘ at 40°F	R507A 1 psi ↘ at 40°F	R513A 1 psi ↘ at 40°F
R37E104	1/2" ODF	5/16"	2.06	0.87	0.67	0.72	0.79	0.81	0.77	1.03	0.81	0.80	0.60	0.72	0.62
R37E105	5/8" ODF														

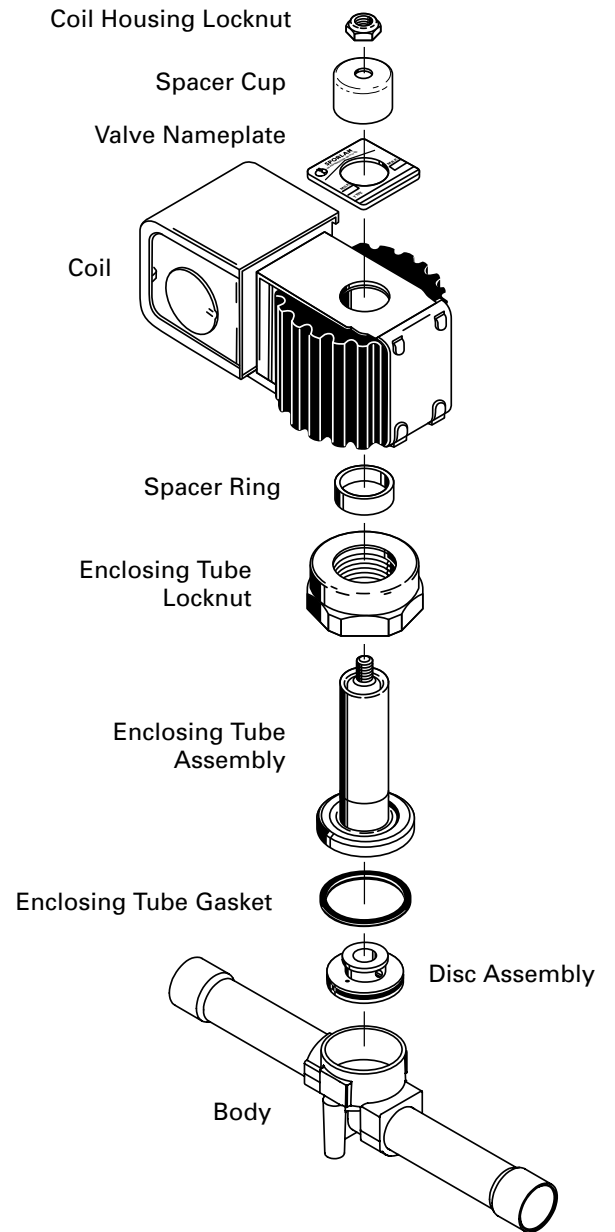
① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10. Coils available separately. Use Coil PKC-1 with R36 and coil OPKC-1 with R37 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Call-Outs

### R36 Pilot-Operated Valves

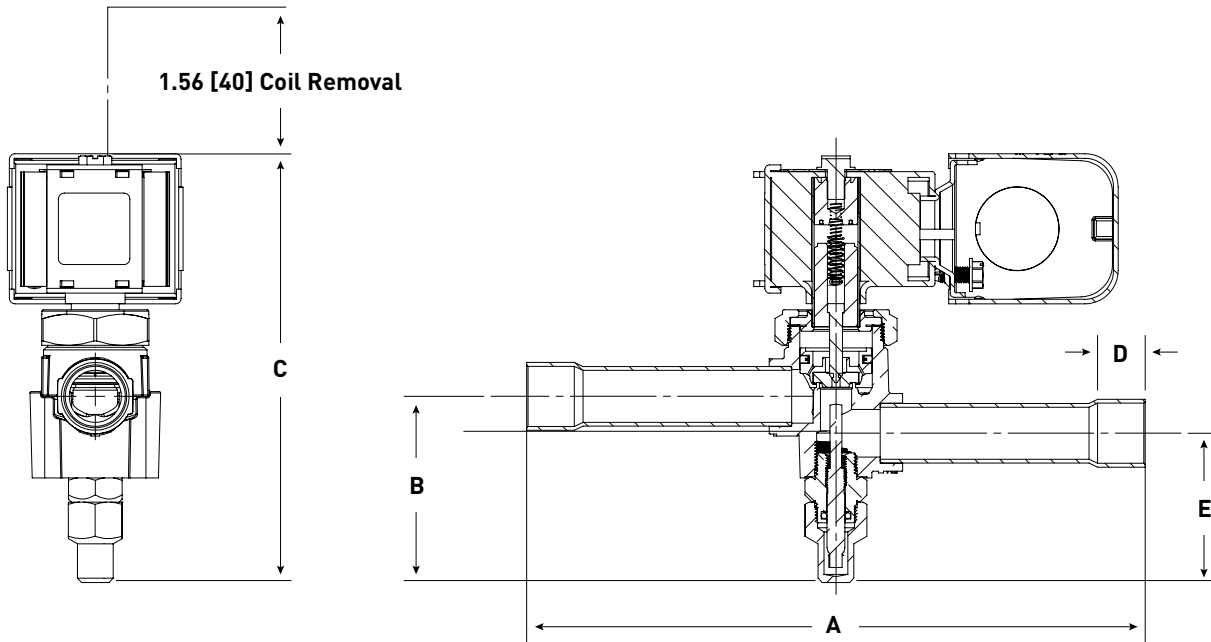


### R37 Pilot-Operated Valves



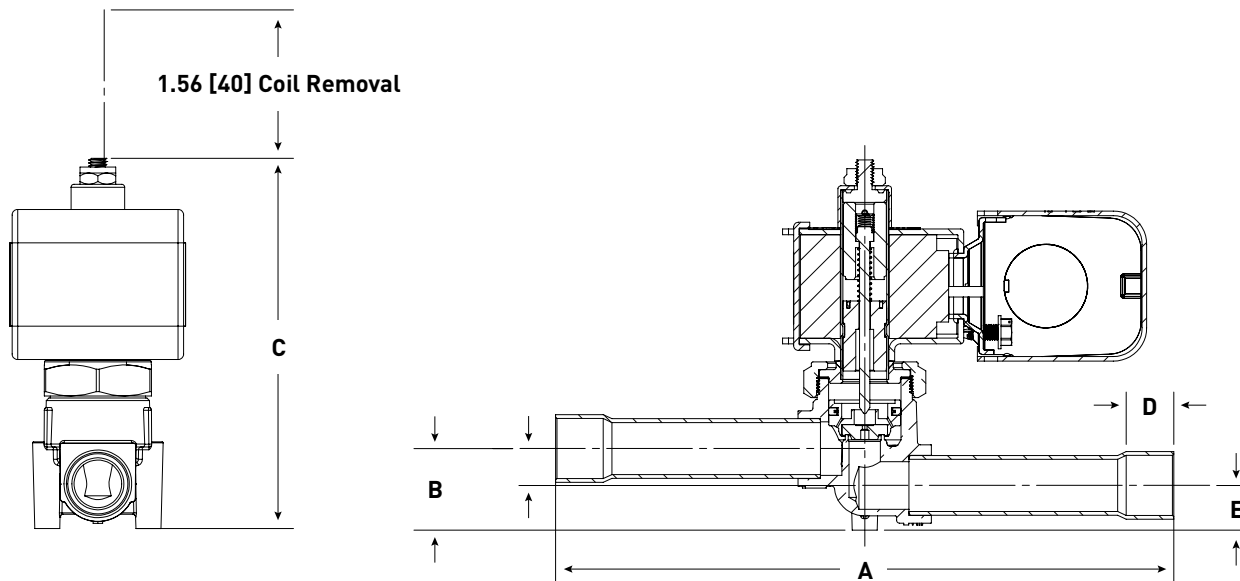
## Dimensions - Inches

### R36 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions					
		A	B	C	D	E	Offset
R36E104M	1.2" ODF	5.00	1.95	4.48	0.38	1.57	0.38
R36E105M	5/8" ODF	6.49	1.95	4.48	0.50	1.57	0.38

### R37 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions					
		A	B	C	D	E	Offset
R37E104	1.2" ODF	5.00	0.86	3.89	0.38	0.47	0.39
R37E105	5/8" ODF	6.49	0.86	3.89	0.50	0.47	0.39



# Series R38 and R39 Pilot-Operated Valves

Series R38 — 2-Way Pilot-Operated Normally Closed Valves

Series R39 — 2-Way Pilot-Operated Normally Open Valves



## Materials of Construction

Body .....	Brass
Seating Material .....	Teflon®
Seals .....	Gasket
Plunger .....	Stainless
Sleeve Tube .....	Stainless
Stop .....	Stainless
Piston .....	Brass
Springs .....	Stainless
Shading Ring .....	Copper
Connections .....	Extended Ends - Copper
Manual Stem .....	Brass



## Specifications

### R38 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22 3 psi ↘	R134a 2 psi ↘	R404A 3 psi ↘	R407A 3 psi ↘	R407C 3 psi ↘	R407F 3 psi ↘	R410A 5 psi ↘	R448A 3 psi ↘	R449A 3 psi ↘	R450A 2 psi ↘	R507A 3 psi ↘	R513A 2 psi ↘
R38E145	5/8" ODF	7/16"	3.0	15.77	12.03	10.19	13.67	14.86	13.53	19.01	13.69	13.58	11.18	9.88	10.19
R38E147	7/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				5 psi ↘											
R38E145	5/8" ODF	7/16"	3.0	4.39	3.69	3.73	4.18	4.29	4.05	5.21	4.28	4.26	3.35	3.72	3.39
R38E147	7/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				1 psi ↘ at 40°F											
R38E145	5/8" ODF	7/16"	3.0	1.30	1.00	1.08	1.19	1.22	1.16	1.55	1.22	1.21	0.90	1.07	0.93
R38E147	7/8" ODF														

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10. Coils available separately. Use Coil PKC-2 with R38 series valves and Coil OPKC-2 with R39 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Specifications

### R39 Series Valve — Normally Open

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R39E145	5/8" ODF	7/16"	3.0	3 psi ↘	2 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	5 psi ↘	3 psi ↘	3 psi ↘	2 psi ↘	3 psi ↘	2 psi ↘
R39E147	7/8" ODF			15.77	12.03	10.19	13.67	14.86	13.53	19.01	13.69	13.58	11.18	9.88	10.19

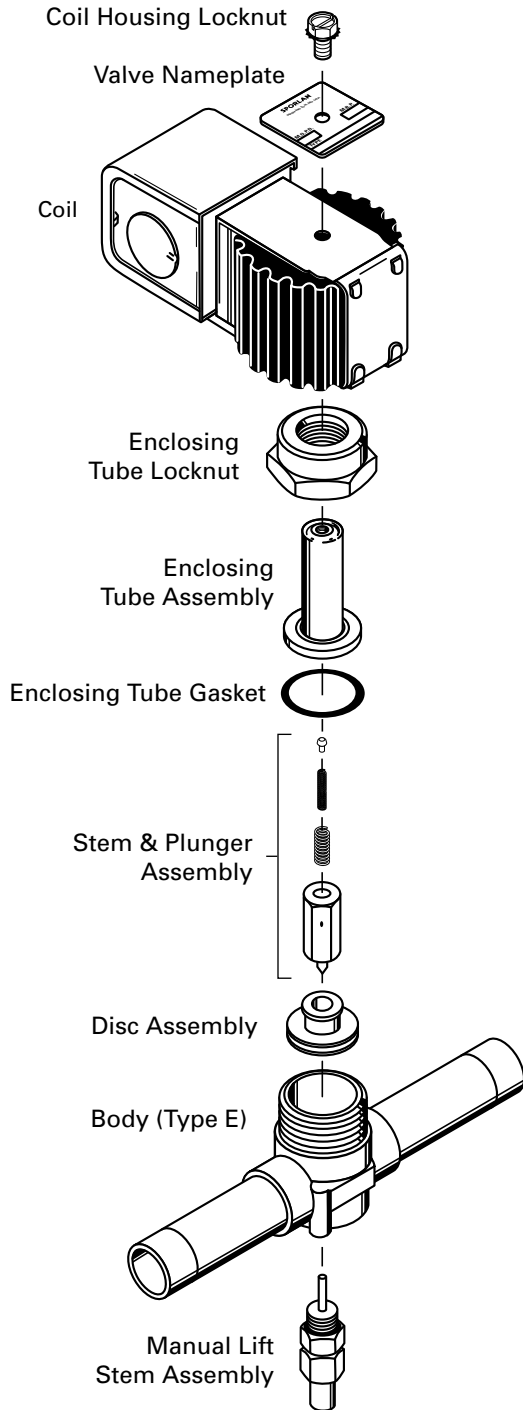
Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R39E145	5/8" ODF	7/16"	3.0	5 psi ↘											
R39E147	7/8" ODF			4.39	3.69	3.73	4.18	4.29	4.05	5.21	4.28	4.26	3.35	3.72	3.39

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R39E145	5/8" ODF	7/16"	3.0	1 psi ↘ at 40°F											
R39E147	7/8" ODF			1.30	1.00	1.08	1.19	1.22	1.16	1.55	1.22	1.21	0.90	1.07	0.93

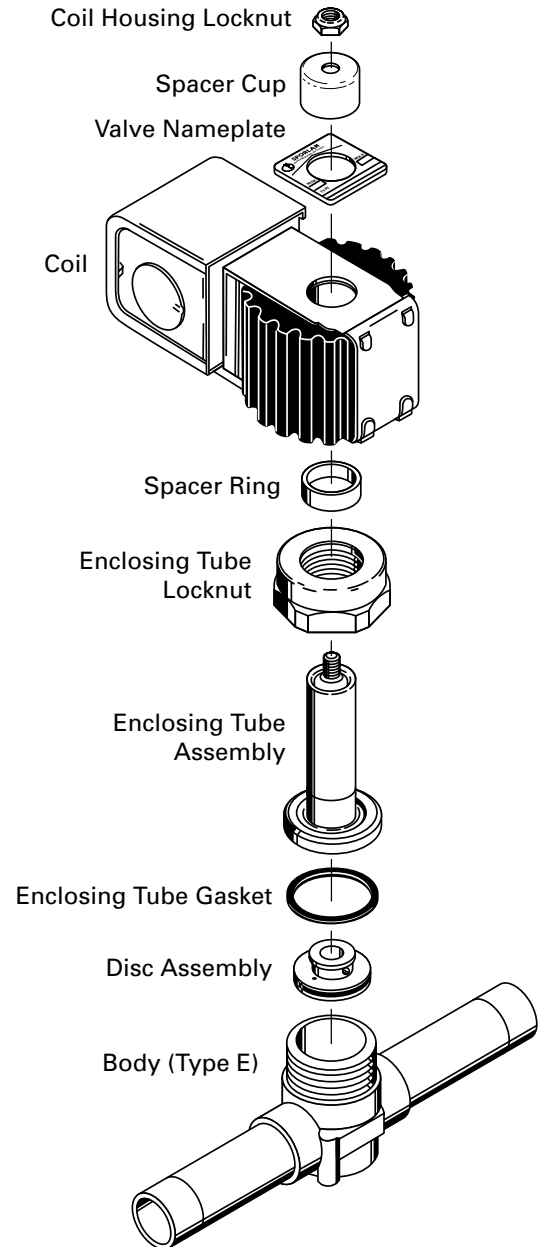
① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil PKC-2 with R38 series valves and Coil OPKC-2 with R39 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Call-Outs

### R38 Normally Closed Pilot-Operated Valves

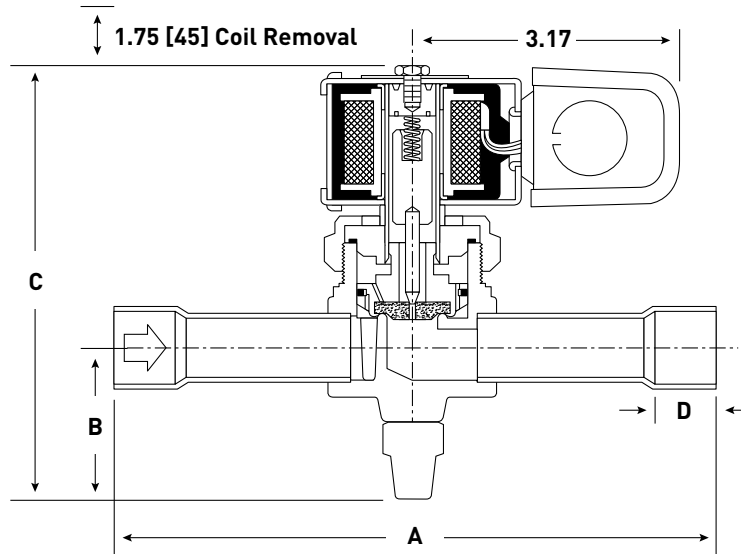


### R39 Normally Open Pilot-Operated Valves



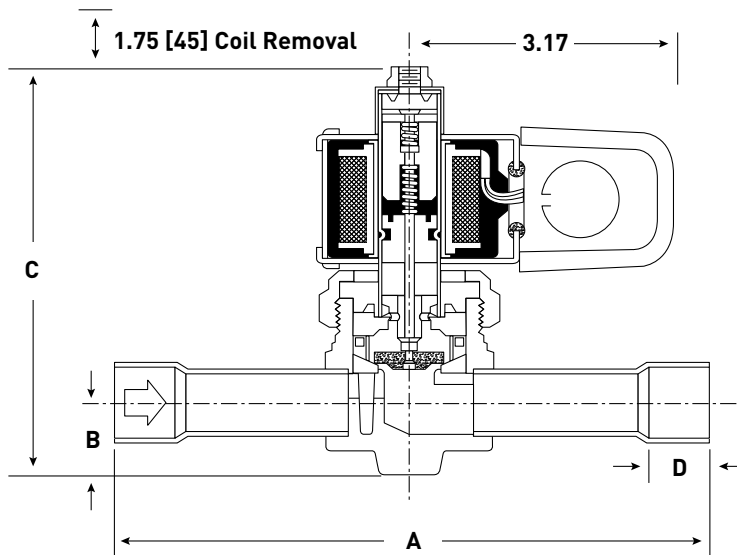
## Dimensions - Inches

### R38 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions			
		A	B	C	D
R38E145M	5/8" ODF	6.88	1.57	4.81	0.50
R38E147M	7/8" ODF	7.13	1.57	4.81	0.75

### R39 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions			
		A	B	C	D
R39E145	5/8" ODF	6.88	0.48	4.02	0.50
R39E147	7/8" ODF	7.13	0.48	4.02	0.75

# Series R42, R46 and R43, R47 Pilot-Operated Valve

Series R42 & R46 — 2-Way Pilot-Operated Normally Closed Valve



Series R43 & R47 — 2-Way Pilot-Operated Normally Open Valve

## Materials of Construction

Body .....	Brass
Seating Material .....	Teflon®
Seals .....	Gasket
Plunger .....	Stainless
Sleeve Tube .....	Stainless
Stop .....	Stainless
Piston .....	Brass
Springs .....	Stainless
Shading Ring .....	Copper
Connections .....	Extended Ends – Copper
Manual Stem .....	Brass



## Specifications

### R42 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22 3 psi ↘	R134a 2 psi ↘	R404A 3 psi ↘	R407A 3 psi ↘	R407C 3 psi ↘	R407F 3 psi ↘	R410A 5 psi ↘	R448A 3 psi ↘	R449A 3 psi ↘	R450A 2 psi ↘	R507A 3 psi ↘	R513A 2 psi ↘
R42E195	5/8" ODF	19/32"	4.6	24.26	18.45	15.66	21.01	22.85	20.80	29.30	21.05	20.87	17.15	15.17	15.63
R42E197	7/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22 5 psi ↘	R134a 5 psi ↘	R404A 5 psi ↘	R407A 5 psi ↘	R407C 5 psi ↘	R407F 5 psi ↘	R410A 5 psi ↘	R448A 5 psi ↘	R449A 5 psi ↘	R450A 5 psi ↘	R507A 5 psi ↘	R513A 5 psi ↘
R42E195	5/8" ODF	19/32"	4.6	6.64	5.57	5.65	6.33	6.49	6.12	7.89	6.48	6.45	5.06	5.64	5.12
R42E197	7/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22 1 psi ↘ at 40°F	R134a 1 psi ↘ at 40°F	R404A 1 psi ↘ at 40°F	R407A 1 psi ↘ at 40°F	R407C 1 psi ↘ at 40°F	R407F 1 psi ↘ at 40°F	R410A 1 psi ↘ at 40°F	R448A 1 psi ↘ at 40°F	R449A 1 psi ↘ at 40°F	R450A 1 psi ↘ at 40°F	R507A 1 psi ↘ at 40°F	R513A 1 psi ↘ at 40°F
R42E195	5/8" ODF	19/32"	4.6	1.94	1.49	1.61	1.78	1.81	1.72	2.31	1.81	1.80	1.34	1.60	1.39
R42E197	7/8" ODF														

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
Coils available separately. Use Coil PKC-2 with R42 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Specifications

### R43 Series Valve — Normally Open

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
				3 psi ↘	2 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	5 psi ↘	3 psi ↘	3 psi ↘	2 psi ↘	3 psi ↘	2 psi ↘
R43E195	5/8" ODF	19/32"	4.6	24.26	18.45	15.66	21.01	22.85	20.80	29.30	21.05	20.87	17.15	15.17	15.63
R43E197	7/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
				5 psi ↘											
R43E195	5/8" ODF	19/32"	4.6	6.64	5.57	5.65	6.33	6.49	6.12	7.89	6.48	6.45	5.06	5.64	5.12
R43E197	7/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
				1 psi ↘ at 40°F											
R43E195	5/8" ODF	19/32"	4.6	1.94	1.49	1.61	1.78	1.81	1.72	2.31	1.81	1.80	1.34	1.60	1.39
R43E197	7/8" ODF														

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.

Coils available separately. Use Coil OPKC-2 with R43 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

### R46 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
				3 psi ↘	2 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	5 psi ↘	3 psi ↘	3 psi ↘	2 psi ↘	3 psi ↘	2 psi ↘
R46E257	7/8" ODF	25/32"	7.8	41.41	31.51	26.74	35.88	39.02	35.51	50.00	35.94	35.63	29.29	25.91	26.71
R46E259	1 1/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
				5 psi ↘											
R46E257	7/8" ODF	25/32"	7.8	11.37	9.54	9.68	10.84	11.12	10.49	13.52	11.10	11.05	8.67	9.66	8.77
R46E259	1 1/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
				1 psi ↘ at 40°F											
R46E257	7/8" ODF	25/32"	7.8	3.33	2.56	2.77	3.05	3.12	2.96	3.97	3.11	3.09	2.31	2.75	2.39
R46E259	1 1/8" ODF														

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.

Coils available separately. Use Coil PKC-2 with R46 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Specifications

### R47 Series Valve — Normally Open

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22 3 psi ↘	R134a 2 psi ↘	R404A 3 psi ↘	R407A 3 psi ↘	R407C 3 psi ↘	R407F 3 psi ↘	R410A 5 psi ↘	R448A 3 psi ↘	R449A 3 psi ↘	R450A 2 psi ↘	R507A 3 psi ↘	R513A 2 psi ↘
R47E257	7/8" ODF	25/32"	7.8	41.41	31.51	26.74	35.88	39.02	35.51	50.00	35.94	35.63	29.29	25.91	26.71
R47E259	1 1/8" ODF														

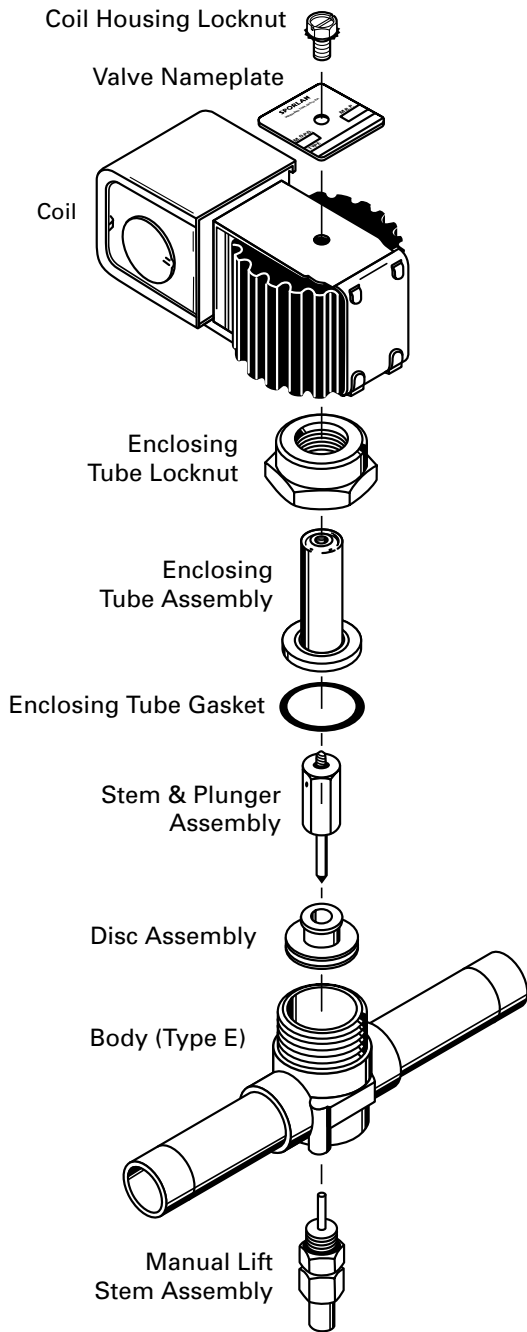
Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				5 psi ↘											
R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A				
R47E257	7/8" ODF	25/32"	7.8	11.37	9.54	9.68	10.84	11.12	10.49	13.52	11.10	11.05	8.67	9.66	8.77
R47E259	1 1/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				1 psi ↘ at 40°F											
R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A				
R47E257	7/8" ODF	25/32"	7.8	3.33	2.56	2.77	3.05	3.12	2.96	3.97	3.11	3.09	2.31	2.75	2.39
R47E259	1 1/8" ODF														

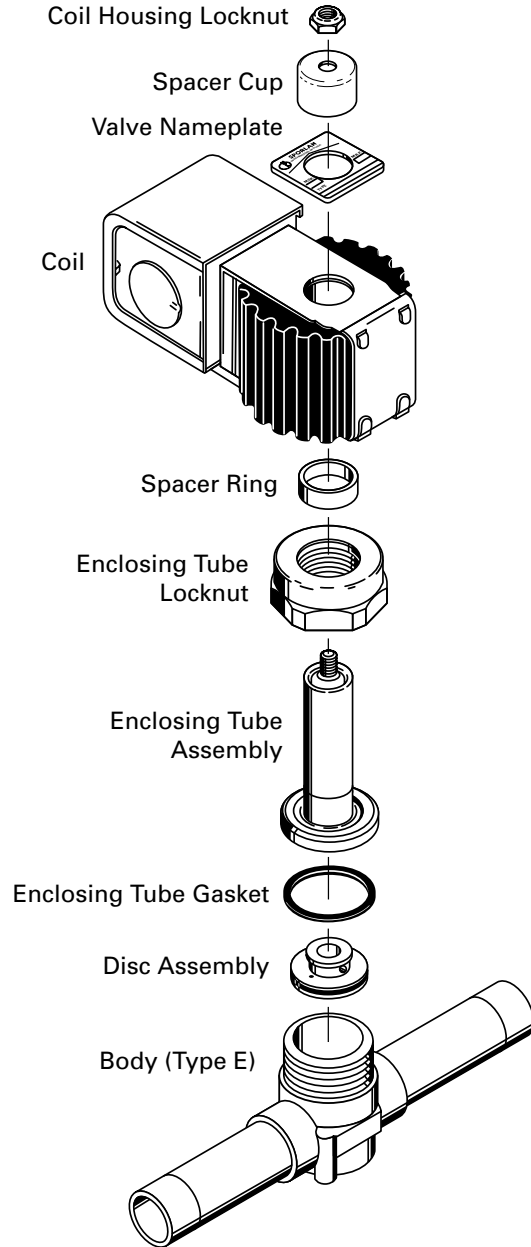
① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil OPKC-2 with R47 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Call-Outs

### R42 and R46 Normally Closed Pilot Operated Valves



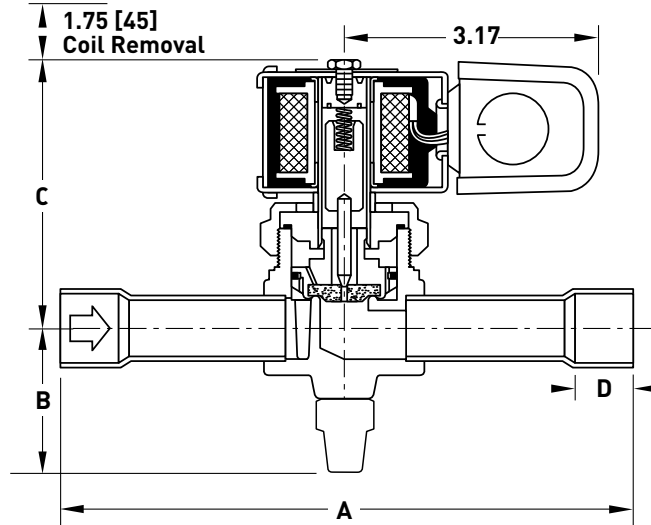
### R43 and R47 Normally Open Pilot Operated Valves





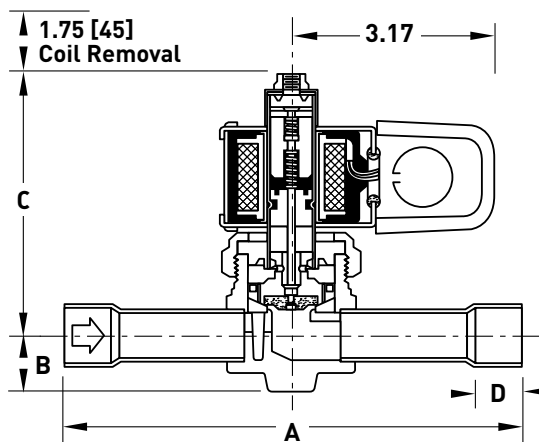
## Dimensions - Inches

### R42 and R46 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions			
		A	B	C	D
R42E195	5/8" ODF	6.88	1.93	3.41	0.50
R42E197	7/8" ODF	7.13	1.93	3.41	0.75
R46E257	7/8" ODF	7.50	1.84	3.81	0.75
R46E259	1 1/8" ODF	8.50	1.84	3.81	0.91

### R43 and R47 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions			
		A	B	C	D
R43E195	5/8" ODF	6.88	0.81	3.87	0.50
R43E197	7/8" ODF	7.13	0.81	3.87	0.75
R46E257	7/8" ODF	7.50	0.72	4.06	0.75
R46E259	1 1/8" ODF	8.50	0.72	4.06	0.91

# Series R52, R56 and R53, R57 Pilot-Operated Valves

Series R52, R56 — 2-Way Pilot-Operated Normally Closed Valves



Series R53, R57 — 2-Way Pilot-Operated Normally Open Valves

## Materials of Construction

### R52, R53

Body ..... Brass  
 Seating Material ..... Teflon®  
 Seals ..... Gasket  
 Plunger ..... Stainless  
 Sleeve Tube ..... Stainless  
 Stop ..... Stainless  
 Piston ..... Aluminum  
 Springs ..... Stainless  
 Shading Ring ..... Copper  
 Connections ..... Extended Ends - Copper  
 Manual Stem ..... Brass

### R56, R57

Body ..... Brass  
 Seating Material ..... Teflon®  
 Seals ..... Gasket  
 Plunger ..... Stainless  
 Sleeve Tube ..... Stainless  
 Stop ..... Stainless  
 Piston ..... Aluminum  
 Springs ..... Stainless  
 Shading Ring ..... Copper  
 Connections ..... Extended Ends - Copper  
 Manual Stem ..... Brass



## Specifications

### R52 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22 3 psi ~	R134a 2 psi ~	R404A 3 psi ~	R407A 3 psi ~	R407C 3 psi ~	R407F 3 psi ~	R410A 5 psi ~	R448A 3 psi ~	R449A 3 psi ~	R450A 2 psi ~	R507A 3 psi ~	R513A 2 psi ~
R52E359	1 1/8" ODF	1"	13.4	71.01	53.15	45.56	61.40	66.76	60.79	87.12	61.39	60.85	49.35	44.15	44.98
R52E3511	1 3/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				5 psi ~											
R52E359	1 1/8" ODF	1"	13.4	17.46	14.53	15.13	16.75	17.09	16.18	21.06	17.15	17.08	13.16	15.13	13.43
R52E3511	1 3/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				1 psi ~ at 40°F											
R52E359	1 1/8" ODF	1"	13.4	4.61	3.49	3.89	4.23	4.30	4.11	5.58	4.31	4.29	3.13	3.88	3.27
R52E3511	1 3/8" ODF														

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil PKC-1 with R52, OPKC-1 for R53, PKC-1 for R56, OPKC-1 for R57 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Specifications

### R53 Series Valve — Normally Open

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R53E359	1 1/8" ODF	1"	13.4	3 psi ↘	2 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	5 psi ↘	3 psi ↘	3 psi ↘	2 psi ↘	3 psi ↘	2 psi ↘
R53E3511	1 3/8" ODF			71.01	53.15	45.56	61.40	66.76	60.79	87.12	61.39	60.85	49.35	44.15	44.98

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R53E359	1 1/8" ODF	1"	13.4	5 psi ↘											
R53E3511	1 3/8" ODF			17.46	14.53	15.13	16.75	17.09	16.18	21.06	17.15	17.08	13.16	15.13	13.43

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R53E359	1 1/8" ODF	1"	13.4	1 psi ↘ at 40°F											
R53E3511	1 3/8" ODF			4.61	3.49	3.89	4.23	4.30	4.11	5.58	4.31	4.29	3.13	3.88	3.27

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil PKC-1 with R52, OPKC-1 for R53, PKC-1 for R56, OPKC-1 for R57 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

### R56 Series Valve — Normally Closed

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R56E43S1130	1 5/8" ODF	1 5/16	20.2	3 psi ↘	2 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	3 psi ↘	5 psi ↘	3 psi ↘	3 psi ↘	2 psi ↘	3 psi ↘	2 psi ↘
R56E43S1170	2 1/8" ODF			127.36	97.04	82.28	110.37	120.02	109.23	153.60	110.57	109.61	90.20	79.72	82.24

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R56E43S1130	1 5/8" ODF	1 5/16	20.2	5 psi ↘											
R56E43S1170	2 1/8" ODF			35.24	29.59	29.97	33.59	34.46	32.49	41.80	34.39	34.24	26.89	29.90	27.18

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22	R134a	R404A	R407A	R407C	R407F	R410A	R448A	R449A	R450A	R507A	R513A
R56E43S1130	1 5/8" ODF	1 5/16	20.2	1 psi ↘ at 40°F											
R56E43S1170	2 1/8" ODF			10.40	8.01	8.63	9.53	9.73	9.25	12.40	9.71	9.66	7.21	8.59	7.46

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
 Coils available separately. Use Coil PKC-1 with R52, OPKC-1 for R53, PKC-1 for R56, OPKC-1 for R57 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

## Specifications

### R57 Series Valve — Normally Open

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Liquid											
				R22 3 psi ↘	R134a 2 psi ↘	R404A 3 psi ↘	R407A 3 psi ↘	R407C 3 psi ↘	R407F 3 psi ↘	R410A 5 psi ↘	R448A 3 psi ↘	R449A 3 psi ↘	R450A 2 psi ↘	R507A 3 psi ↘	R513A 2 psi ↘
R57E43S1130	1 5/8" ODF	1 5/16	20.2	127.36	97.04	82.28	110.37	120.02	109.23	153.60	110.57	109.61	90.20	79.72	82.24
R57E43S1170	2 1/8" ODF														

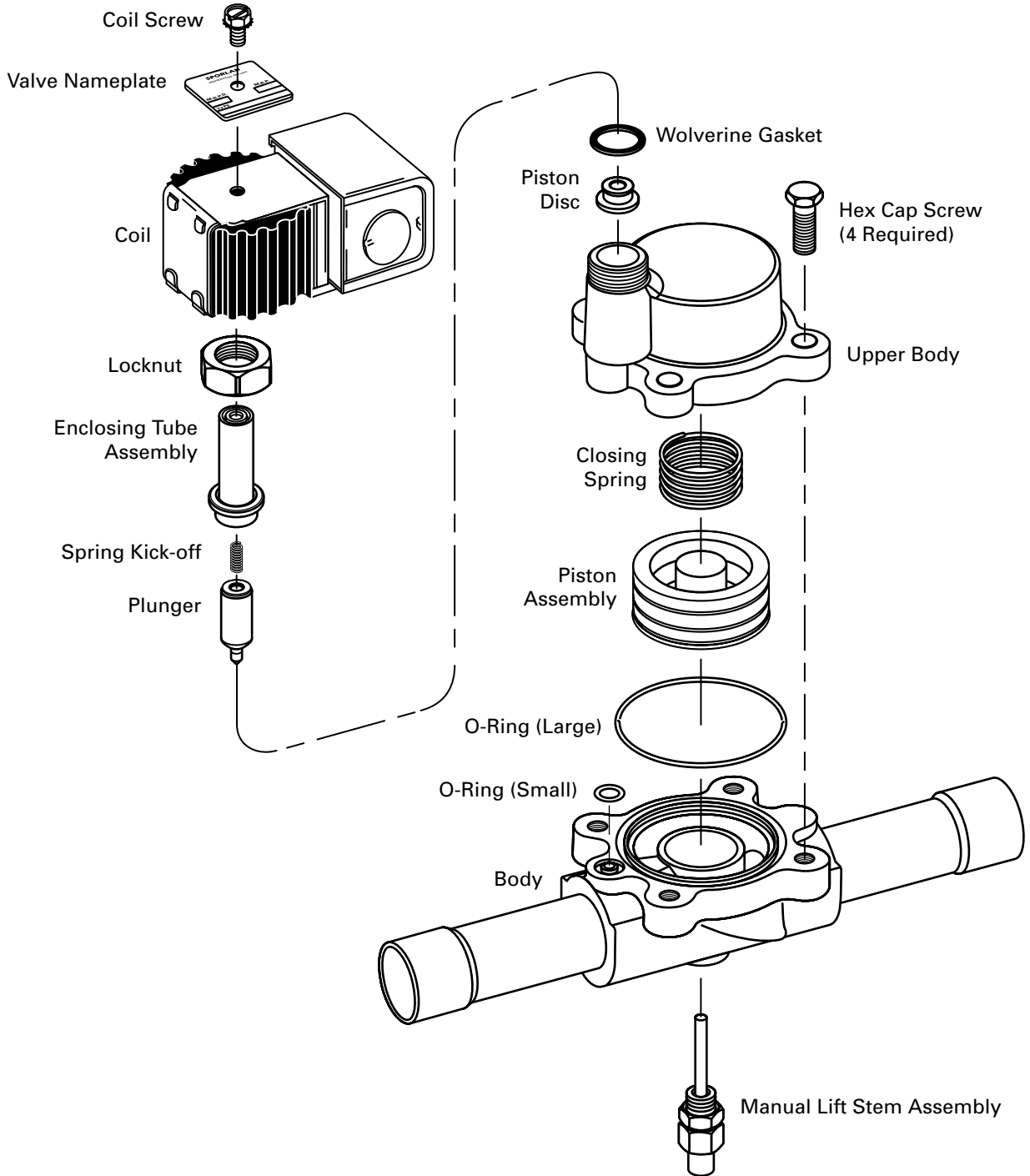
Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Discharge											
				R22 5 psi ↘	R134a 5 psi ↘	R404A 5 psi ↘	R407A 5 psi ↘	R407C 5 psi ↘	R407F 5 psi ↘	R410A 5 psi ↘	R448A 5 psi ↘	R449A 5 psi ↘	R450A 5 psi ↘	R507A 5 psi ↘	R513A 5 psi ↘
R57E43S1130	1 5/8" ODF	1 5/16	20.2	35.24	29.59	29.97	33.59	34.46	32.49	41.80	34.39	34.24	26.89	29.90	27.18
R57E43S1170	2 1/8" ODF														

Valve Type	Connection (Inches)	Port (Inches)	Cv	Nominal Capacity - Tons ①											
				Suction											
				R22 1 psi ↘ at 40°F	R134a 1 psi ↘ at 40°F	R404A 1 psi ↘ at 40°F	R407A 1 psi ↘ at 40°F	R407C 1 psi ↘ at 40°F	R407F 1 psi ↘ at 40°F	R410A 1 psi ↘ at 40°F	R448A 1 psi ↘ at 40°F	R449A 1 psi ↘ at 40°F	R450A 1 psi ↘ at 40°F	R507A 1 psi ↘ at 40°F	R513A 1 psi ↘ at 40°F
R57E43S1130	1 5/8" ODF	1 5/16	20.2	10.40	8.01	8.63	9.53	9.73	9.25	12.40	9.71	9.66	7.21	8.59	7.46
R57E43S1170	2 1/8" ODF														

① For capacities at other ratings, refer to Extended Capacity tables on pages 6 through 10.  
Coils available separately. Use Coil PKC-1 with R52, OPKC-1 for R53, PKC-1 for R56, OPKC-1 for R57 series valves. Reference Coil Enclosure page 41 for electrical coil enclosure options.

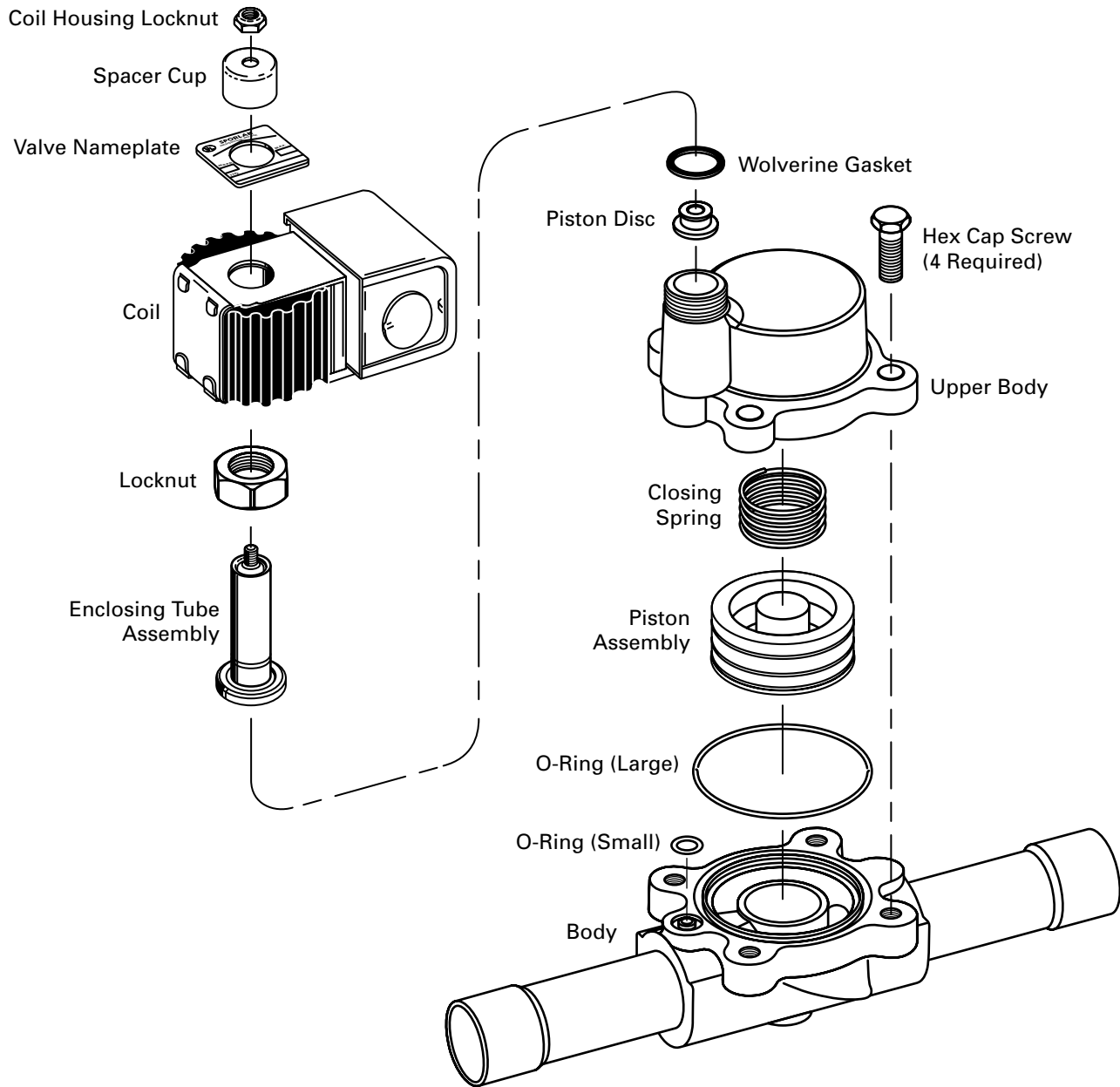
## Call-Outs

### R52 & R56 Normally Closed Pilot Operated Valve



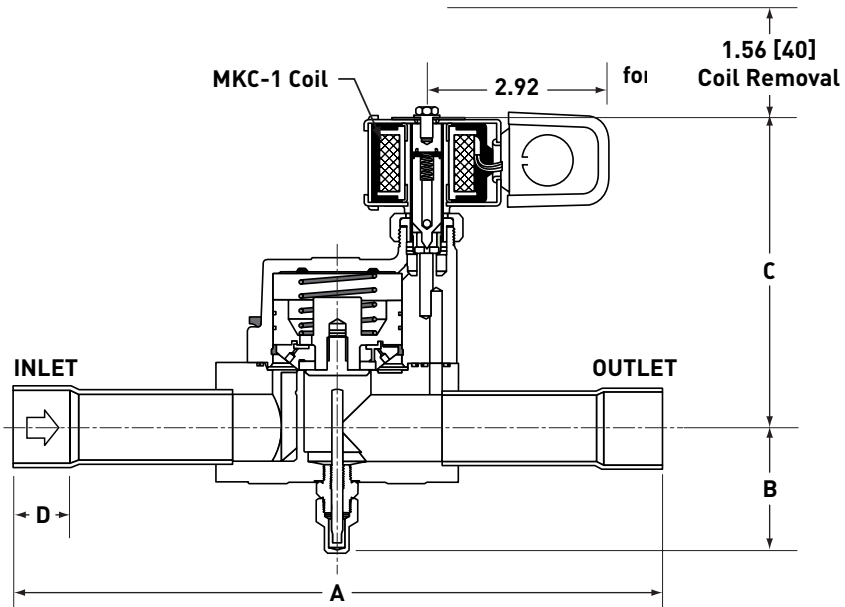
## Call-Outs

### R53 & R57 Normally Open Pilot Operated Valve



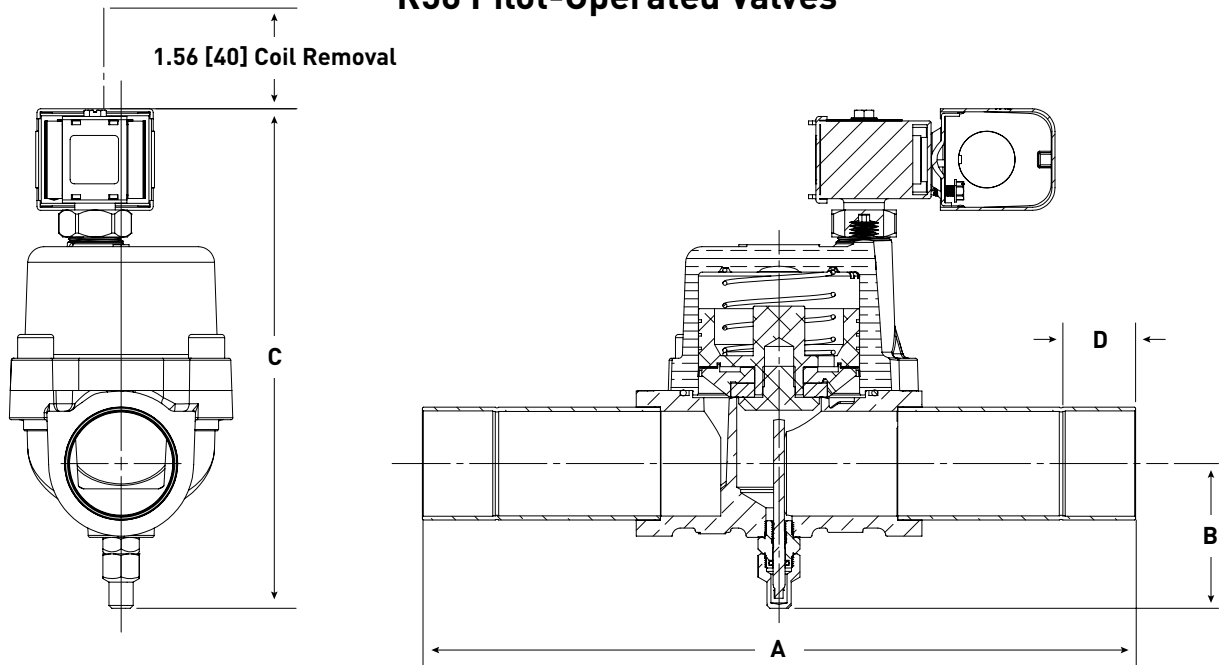
Dimensions - Inches

R52 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions			
		A	B	C	D
R52E359	1 1/8" ODF	10.06	1.96	4.81	0.91
R52E3311	1 3/8" ODF	11.06	1.96	4.81	0.97

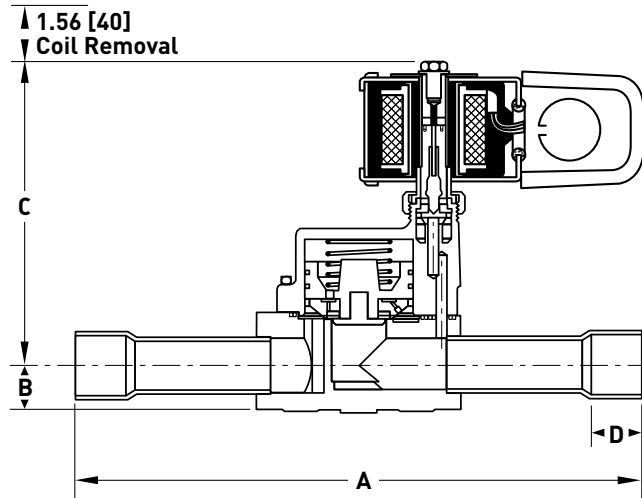
R56 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions			
		A	B	C	D
R56E43S1130	1 5/8" ODF	11.06	2.24	7.75	1.11
R56E43S1170	2 1/8" ODF	11.06	2.24	7.81	1.36

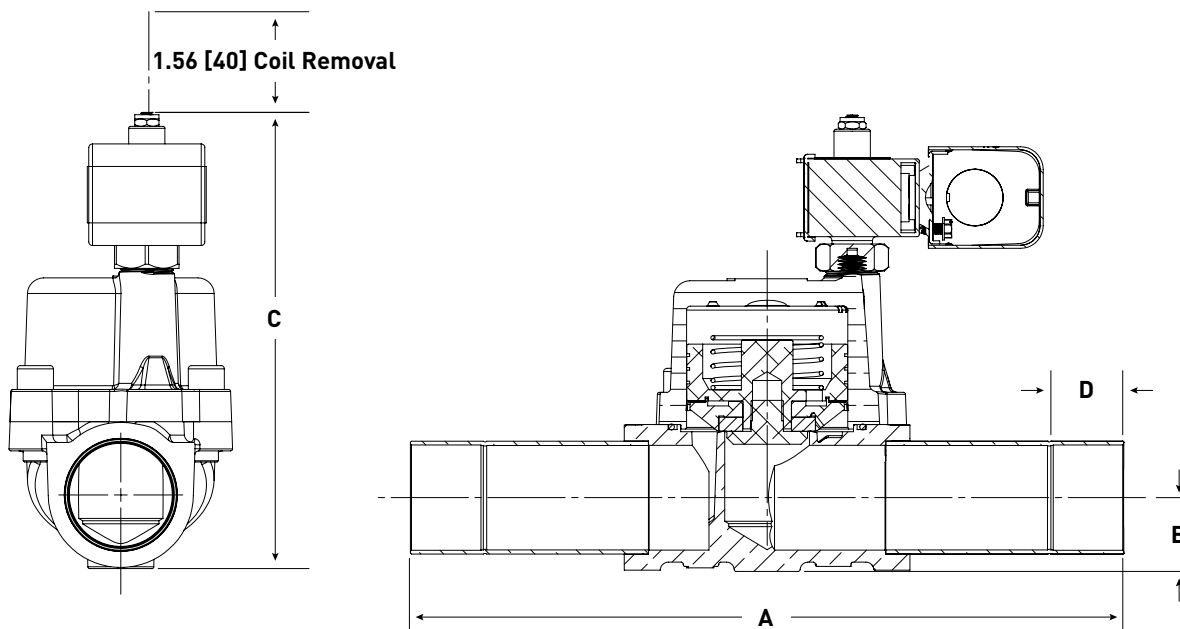
## Dimensions - Inches

### R53 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions			
		A	B	C	D
R53E359	1 1/8" ODF	10.06	0.84	5.94	0.91
R53E3311	1 3/8" ODF	11.06	0.84	5.94	0.97

### R57 Pilot-Operated Valves



Valve Series	Connection (Inches)	Dimensions			
		A	B	C	D
R57E43S1130	1 5/8" ODF	11.06	1.14	7.08	1.11
R57E43S1170	2 1/8" ODF	11.06	1.14	7.08	1.36



# Coil Enclosures

## Standard Features



- Suitable for all Parker 'R' Series Refrigeration Solenoid Valves.
- Encapsulated waterproof designs.
- Meets UL, CSA, NEMA & other acceptable standards.
- Easy installation with nut and washer.

## Junction Box Electrical Characteristics

### Materials of Construction

Encapsulant ..... Molded Coil  
 Metal Enclosure ..... Plated Carbon Steel  
 Conduit Cable..... 1/2" NPT with 6" leads

### R12 thru R57 Valves

Coil Code	Wattage	Class
PKC-1	10	F
PKC-2	15	F
OPKC-1	10	F
OPKC-2	15	F



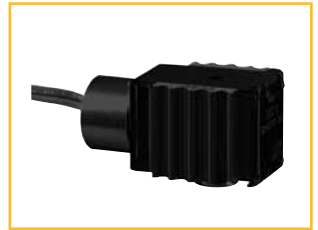
## Conduit Coil Electrical Characteristics

### Materials of Construction

Encapsulant ..... Molded Thermoplastic  
 Conduit & Yoke ..... Plated Carbon Steel  
 Conduit Cable..... 1/2" NPT with 20" leads  
 Safety Code ..... NEMA Type 4

### R12 thru R57 Valves

Coil Code	Wattage	Class
PKC-1	10	F
PKC-2	15	F
OPKC-1	10	F
OPKC-2	15	F



Minimum order may be required.

# Design Terminology

**Continuous Duty** – A rating given to a valve that can be energized continuously without overheating.

**Correction Factor** – A mathematical relationship related to a fluids specific gravity used to convert specific flows from a standard media to the media in question.

**Current Drain** – The amount of current (expressed in amperes) that flows through the coil of a solenoid valve when it is energized.

**Cv Factor** – A mathematical factor that represents the flow of water at 60°F, in gallons per minute, that will pass through a valve with a 1 psi pressure drop across the valve.

**Flow** – Movement of fluid created by a pressure differential.

**Flow Capacity** – the quantity of fluid that will pass through a valve under a given set of temperature and pressure conditions.

**Manual Stem** – A mechanical device that permits the manual opening of a valve in the case of emergency or power failure. A manual stem is available on all normally closed valves.

**Maximum Operating Pressure Differential (MOPD)** – The maximum pressure difference between the inlet and outlet pressures of the valve must not be exceeded, allowing the solenoid to operate in both the energized and de-energized positions.

**Minimum Operating Pressure Differential** – The minimum pressure difference between the inlet and outlet

pressures required for proper operation. This minimum operating pressure differential must be maintained throughout the operating cycle of pilot operated valves to assure proper shifting from the closed position to the open position and visa versa. In the absence of the minimum operating pressure, the valve may close or will not fully open.

**Orifice** – The main opening through which fluid flows.

**Maximum Rated Pressure** – The maximum pressure a valve may be exposed to without experiencing any damage. The valve does not have to be operable at this pressure, but merely withstand the pressure without damage.

# Electrical Specifications

All Parker R12 thru R57 Series Refrigeration Solenoid Valves use standard coil designs. They are available in a wide variety of standard voltages and frequencies. Coils are labeled with electrical data providing easy identification.

## Construction

Numerous construction options are available including junction box housing, DIN terminals, conduit hub housing and spade termination coils.

Encapsulated moistureproof coils are standard on all valves listed in the catalog. The special compound is moistureproof and impervious to oil, dust and most corrosive fumes and vapors.

All coils are Class "F" rated for high temperature application requirements. The coils are molded in accordance with UL, NEMA and other accepted standards.

## Electrical Supply Requirements

The solenoid coil must be connected to electrical lines of correct voltage and frequency as indicated on the coil label. The supply circuits must be properly sized to give adequate voltage at the coil leads even when other electrical equipment is operating. The molded coil is designed to operate with line voltage from 85% to 110% of the coil AC rated voltage. Operating with a line voltage above or below these limits may result in reduced coil

life or coil burn out. Also, operating with line voltage below the limit will result in lowering the maximum operating pressure differential (MOPD).

## Wiring

Check the electrical specifications of the coil to make sure they correspond to the available electrical service. Wiring and fusing must comply with prevailing local and national wiring codes and ordinances.

## Conversion from AC to DC Coils

The same valve assembly can be used for both AC and DC service requirements. AC and DC coils are interchangeable. To convert a valve assembly from AC to DC service, select the appropriate DC coil wattage and voltage per the valve specification chart based on the system pressure requirements.

## Electrical Data

To determine the approximate Holding or Inrush Current for AC voltages including 24/60, 120/60, 208/60 and 240/60 in amperes, divide the voltage into the VA rating indicated in the AC Power Consumption tables. DC valves have no inrush current. The current rating in amperes are shown in the DC table. Figures are based on nominal values and will vary slightly depending on operating voltage and coil tolerances.

## Standard Coil Options

Coil Type	Standard Termination	Protection
Junction Box	6" lead length	Junction box equipped with grounding screw provision
Conduit Hub	20" lead length - 2 wires	Type 1, 2, 3, 3S, 4, 4X

Coil Kit	24 Volts 50-60 Cycles		120 Volts 50-60 Cycles		240 Volts 50-60 Cycles		Transformer Rating Volts-Amperes  For 100% of Rated MOPD of Valve
	VA		VA		VA		
	Holding	Inrush	Holding	Inrush	Holding	Inrush	
R12, R16, R22, R26, R27, R28, R29, R36, R37, R52, R53, R56, R57	15	46	17	47	21.5	46	60
R38, R39, R42, R43, R46, R47	33.5	74.5	31	72	31	74.5	100

All current values are based on 60 cycles. Contact Parker for coil characteristics on specific valve types.

## Standard Voltage

DC Current Consumption Ratings (Amperes) R12 thru R57		
Coil Type	12 VDC	24 VDC
10 watt	1.08	0.52
15 watt	1.48	0.75

# Operating Principles

## Introduction

Solenoid valves are highly engineered products which can be used in many diverse and unique system applications. This section provides a brief overview of the components and functional varieties of solenoid valves.

## General Information

### Valve Construction and Basic Operation

A solenoid valve is an electrically operated device. It is used to control the flow of liquids or gases in a positive, fully-closed or fully-open mode. The valve is commonly used to replace a manual valve or where remote control is desirable. A solenoid valve is operated by opening and closing an orifice in a valve body which permits or prevents flow through the valve. The orifice is opened or closed through the use of a plunger that is raised or lowered within a sleeve tube by energizing the coil. The bottom of the plunger contains a compatible sealing material, which closes off the orifice in the body, stopping flow through the valve.

The solenoid assembly consists of a coil, plunger and sleeve assembly. In a normally closed valve, a plunger, return spring holds the plunger against the orifice, preventing flow through the valve. When the coil is energized, a magnetic field is produced raising the plunger allowing flow through the valve. In a normally open valve, when the coil is energized, the plunger seals off the orifice, stopping flow through the valve.

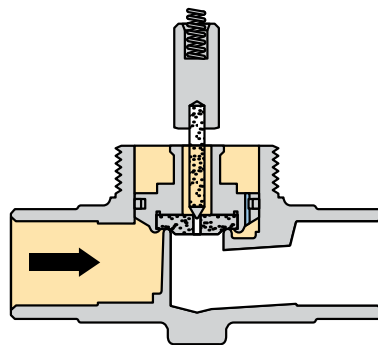


## Two-Way Solenoid Valves

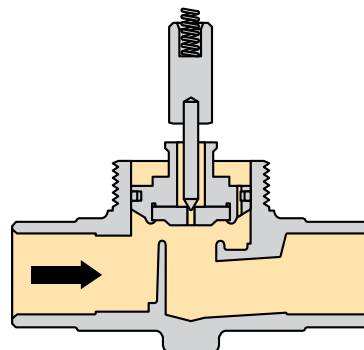
Two way valves control flow in one direction. They may be direct operated or pilot operated.

### Direct Operated Solenoid Valves

Direct operated solenoid valves function to directly open or close the main valve orifice, which is the only flow path in the valve. Direct operated valves are used in systems requiring low flow capacities or in applications with low pressure differential across the valve orifice. The sealing surface that opens and closes the main valve orifice is connected to the solenoid plunger. The valve operates from zero pressure differential to maximum rated pressure differential (MOPD) regardless of line pressure. Pressure drop across the valve is not required to hold the valve open.



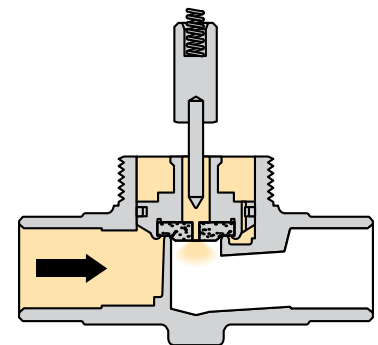
**Coil De-Energized  
Pilot Port Closed  
Main Port Closed**



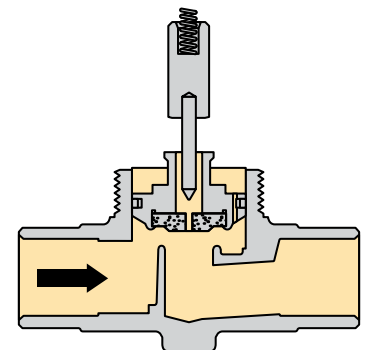
**Coil Energized  
Pilot Port Open  
Main Port Open**

## Pilot Operated Valves

Pilot operated valves are the most widely used solenoid valves. Pilot operated valves utilize system line pressure to open and close the main orifice in the valve body. In a piston style valve, the main orifice is held closed with a piston seal pressed against the main orifice by the combined fluid pressure and spring pressure. In a normally closed valve, the piston is shifted, or opened, when the pilot operator is energized. This allows process fluid behind the piston to evacuate through the valve outlet. At this point, the system line pressure moves the piston, opening the main orifice of the valve, allowing high capacity flow through the valve. When energizing the coil of a normally open valve, fluid pressure builds up behind the piston forcing the piston to seal the main orifice of the valve.



**Coil Energized  
Pilot Port Open  
Main Port About to Open**



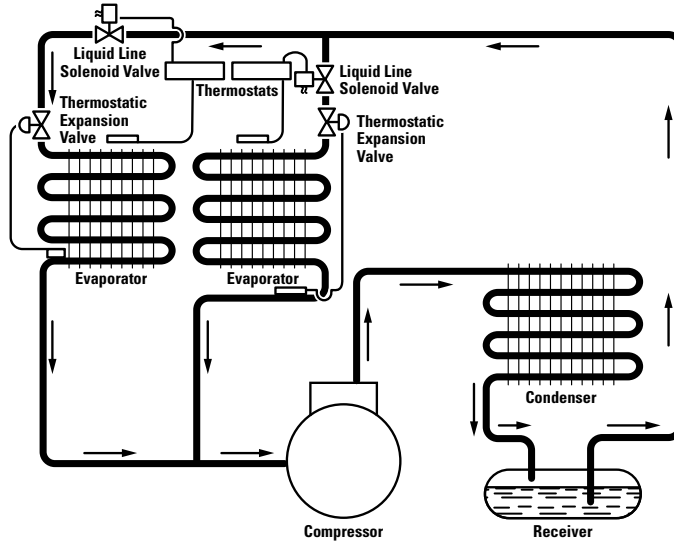
**Coil De-Energized  
Pilot Port Closed  
Main Port Closing**

# Typical Applications

## Evaporator Temperature Control

A solenoid valve installed in the liquid line as close to the evaporator as possible, in conjunction with a narrow differential thermostat, is an excellent temperature control. By mounting the thermostat bulb in the supply or discharge air across the evaporator, the temperature swing is limited only by the differential of the thermostat.

This type of temperature control can be used on a single or multiple evaporator system and is particularly useful on multiplexed systems with evaporators at different temperatures.



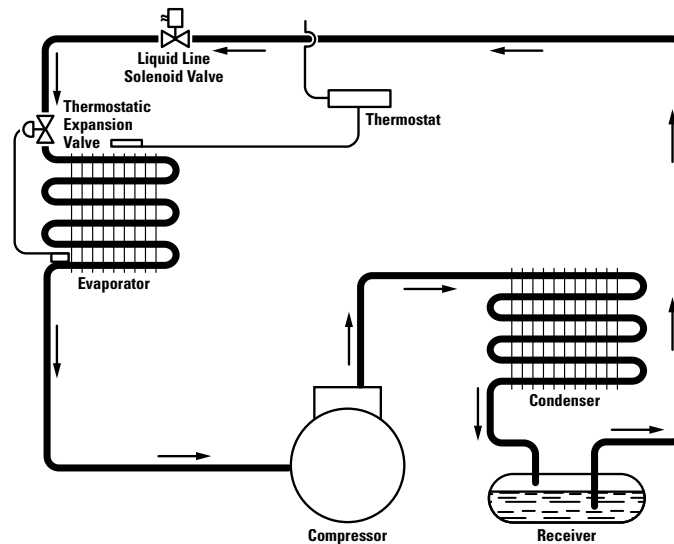
Thermostatic Control of Two Separate Evaporators

## Defrost Pump Down

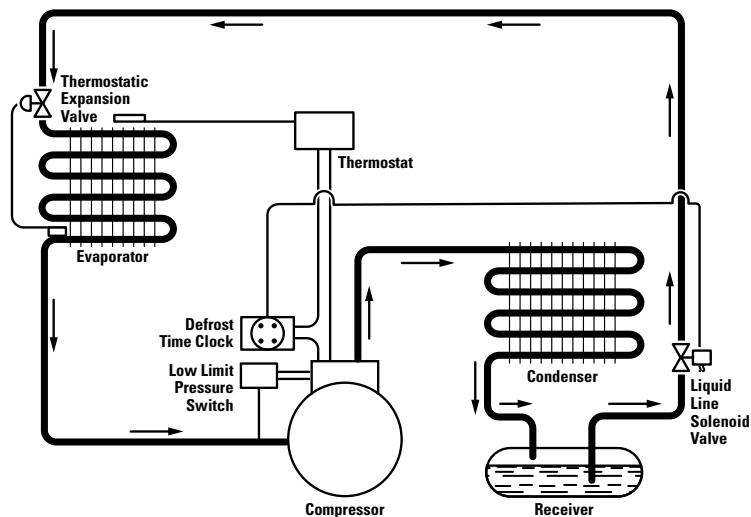
In situations where the condensing unit is installed in a low ambient, such as on a rooftop in northern climates, and the evaporator is operating at a temperature above the ambient, a pump down solenoid valve should be used. This allows the pressure control to be set at a cut out of 1 to 2 psi and the cut in to be set at a pressure below the pressure corresponding to the ambient temperature. This will ensure that the condensing unit will start after cooling down during the defrost.

When a system has a defrost pump down solenoid valve, a thermostat should be used in series with the time clock defrost to control the temperature of the space or fixture. An alternative to the thermostat would be an evaporator pressure regulator.

**Note:** System diagrams are for illustrative purposes and are intended to show application of solenoid valves only.



Thermostatic Control of Evaporator Temperature



Pump Down Defrost with Low Ambient Conditions

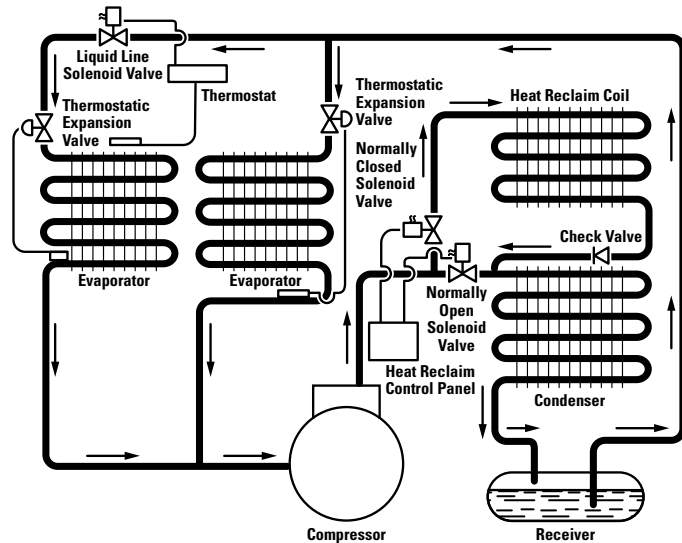
# Typical Applications

## Heat Reclaim Systems

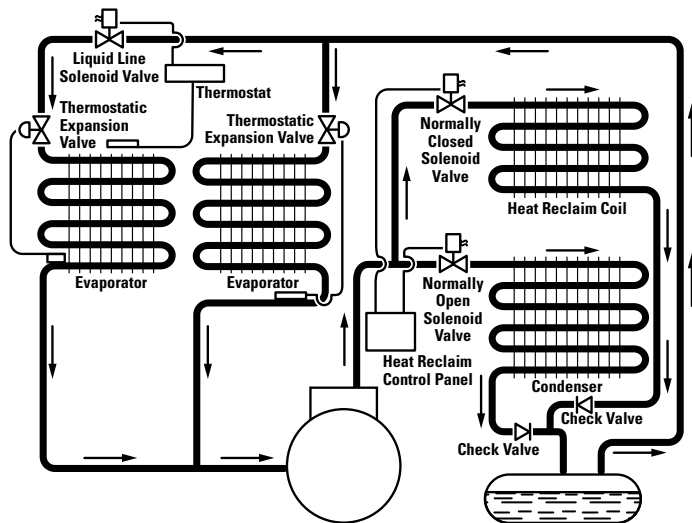
There are basically 2 types of heat reclaim systems: The series system and the parallel system.

In the series system, during normal operation, the discharge gas is condensed completely in the condenser. During the heating mode, the normally opened solenoid valve closes off the condenser and the normally closed solenoid opens to allow the discharge gas to flow into the heat reclaim coil. Complete condensation can occur in the heat reclaim coil if so designed, but manufacturers often prefer to take advantage of all the sensible heat available but only part of the latent heat, depending on the condenser for complete condensation.

In the parallel systems there are, in effect, two separate condensers. During normal operation, the condenser is used for complete condensation of the discharge gas. In the heat reclaim mode the discharge gas is completely condensed in the heat reclaim coil thus maximizing the use of both sensible and latent heat. Some manufacturers recommend installing a 1/4" line from the heat reclaim coil, at its lowest point, back to the receiver to ensure the proper drainage of oil and liquid refrigerant during the off cycle. Other manufacturers suggest the installation of a pressure control, to ensure that the system will switch from the heat reclaim mode to the condenser in the event of fan stoppage or clogged filters.



Heat Reclaim System (Series)



Heat Reclaim System (Parallel)

# Typical Applications

## Split Evaporator — Humidity Control

There are often times when the air temperature is satisfactory but the humidity level is too high. This can be remedied by using only half the evaporator to dehumidify the air without excessive cooling and the addition of auxiliary heat. This can best be accomplished by using a normally open solenoid valve on one half of the evaporator controlled by a humidistat.

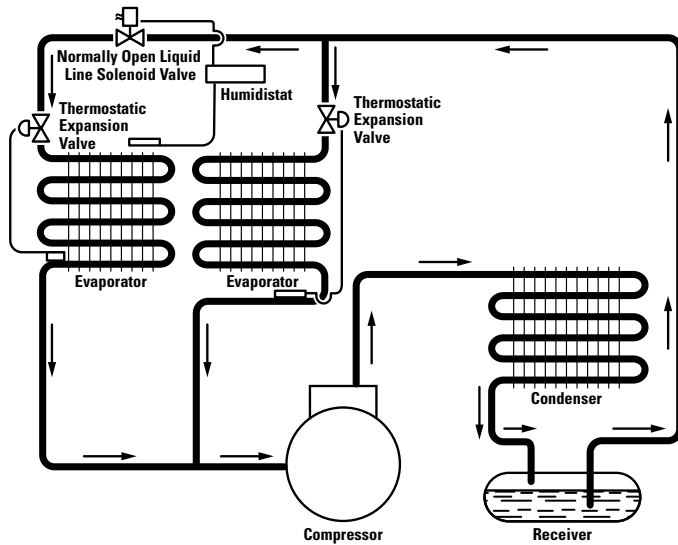
## Hot Gas Defrost System

Hot gas defrost offers an excellent alternative to electric or air defrost. In this system the hot compressor discharge gas is routed to the outlet of the evaporator. This hot gas warms the evaporator, thaws any frost that has accumulated, condenses into a liquid and flows into the common liquid line to feed the other evaporators.

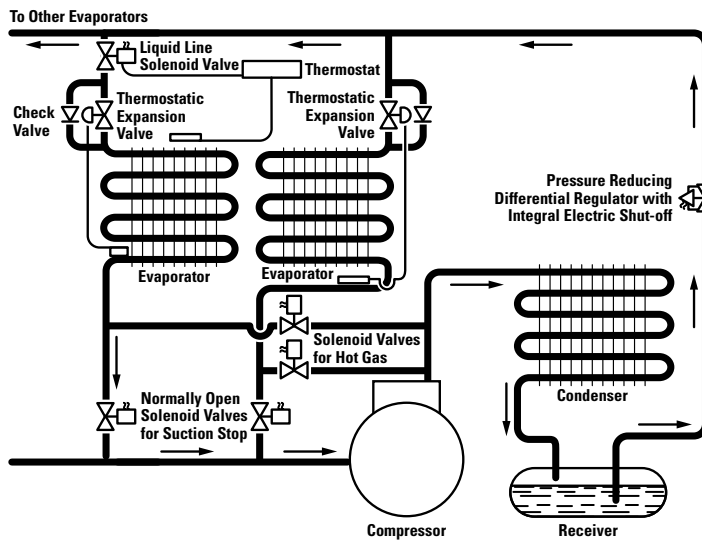
In order for this system to work properly, check valves must be installed to allow flow around the expansion valves. A pressure reducing valve should be used in the liquid line to provide a pressure differential between the condensed refrigerant leaving the defrosting evaporator and the common liquid line.

This system is drawn with only two evaporators but it is recommended that only twenty-five percent of any multiplexed system be hot gas defrosted at any given time.

An alternative to the hot gas defrost system is the cool gas defrost which uses the gas from the top of the receiver to defrost the evaporators. Because the cool gas defrost operates at a lower temperature, the thermal expansion of the refrigeration lines is reduced. This often eliminates the need for special piping techniques and leaks caused at line connections by excessive thermal flexing.



Split Coil Air Conditioning Dehumidification System



Hot Gas Defrost Systems

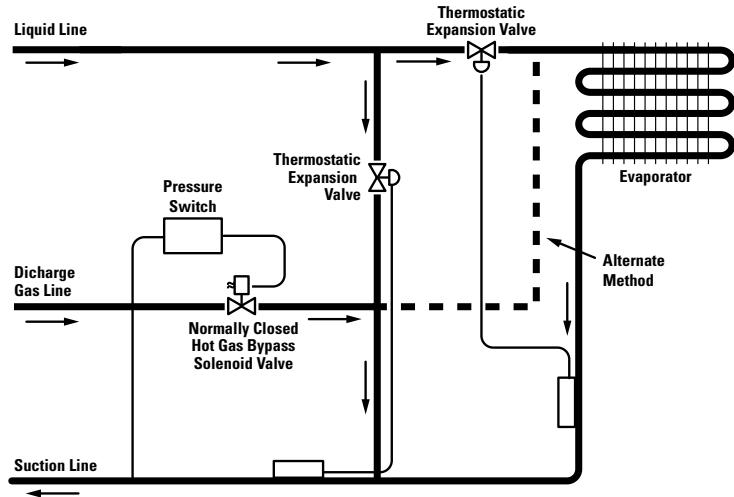
# Typical Applications

## Capacity Control System

A simple method of providing compressor unloading is to use a solenoid valve connecting the discharge and suction lines of the compressor. The solenoid valve is controlled by a pressure control which responds to suction pressure. When the switch closes, it opens the normally closed solenoid valve and discharge gas is short circuited back to the suction side of the compressor.

In order to prevent overheating of the compressor, a thermostatic expansion valve should be installed to provide cooling to the compressor suction gas. An alternative method consists of injecting hot gas into the evaporator inlet. This prevents overheating of the compressor and increases the velocity of the gas through the evaporator.

This type of unloading should not be attempted without thorough analysis of solenoid valve and expansion valve sizing.



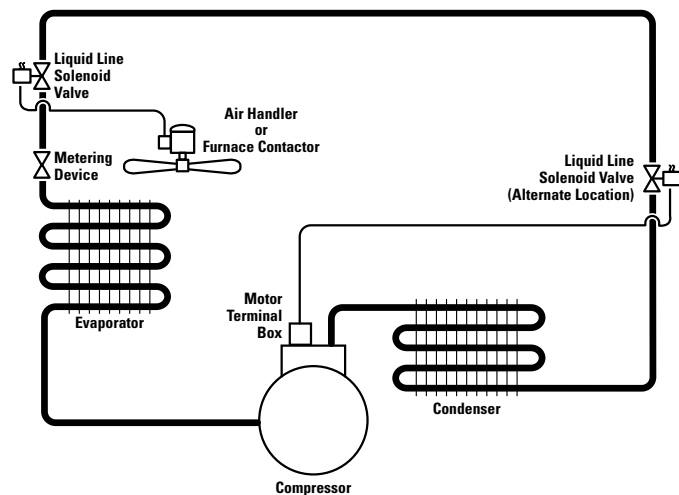
Capacity Control System

## Liquid Line Shut-Off

In an effort to obtain a higher efficiency rating on residential and commercial air conditioning systems, a normally closed solenoid valve typically is installed in the liquid line located near the air handler or furnace. In this case, the solenoid valve is wired in parallel with the contactor circuit (24 VAC) and may require a larger transformer to accommodate the valve.

As an alternative method, a normally closed solenoid valve may be located in the liquid line near the condensing unit and wired directly to the compressor motor terminal box. This solution improves system efficiency and maintains the refrigerant charge in the condenser coil during the off-cycle of the compressor which prevents refrigerant migration when long piping runs are used.

If the application requires a fail-safe or open mode, a normally open solenoid valve may be used. In this instance, the valve may also be located in the condensing unit and wired in series with the compressor crankcase heater.



Liquid Line Shut-Off

# Introduction

## CR26 Series — Solenoid Valve with Built-In Check Valve

- For Refrigerants 22, 134a, 401A, 402A, 404A, 407C, 407F, 410A, 507
- Bi-Directional Solenoid Valve
- Supermarket Pumpdown Control

- Prevents Heat Pump Refrigerant Migration
- Extended Solder Type Connections
- PKC-1 Coil, Class F

### Application

A solenoid valve with a built-in check valve is designed to replace a liquid line solenoid valve in parallel with a check valve for reverse flow. This valve may be applied in the liquid line of a supermarket case for positive shutoff during pumpdown control, while allowing full flow in the reverse direction during reverse gas defrost. It may also be used in the liquid line of a heat pump to prevent migration of refrigerant to the outdoor unit during the heating mode, while allowing full flow in the reverse direction during the cooling mode. **CAUTION: This valve will not close in the reverse flow/cooling mode.**

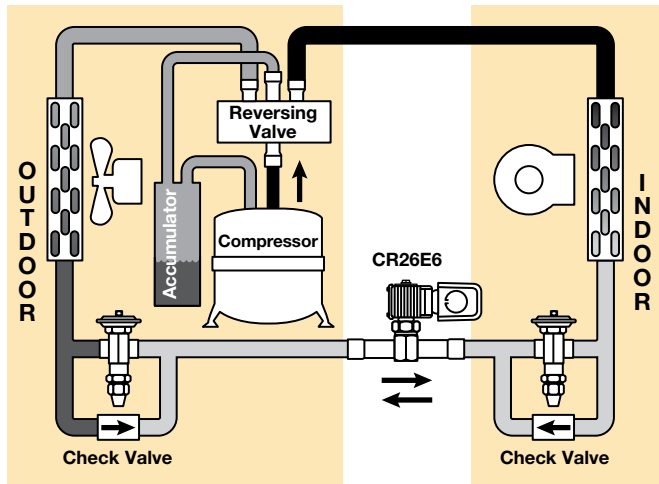
See Figure 1. The check ball is small and inserted into the pilot port of the disc. When the valve is energized for operation in the refrigeration flow direction, the pressure on top of the disc is bled off through the pilot port and the disc raises. When the evaporator goes into defrost or the heat pump switches to the cooling mode, the solenoid valve **must be energized**. The reverse flow causes the check ball to close the pilot port from the bottom, pushing the disc up, fully opening the valve.

The check valve disc also requires a modification in the stem and plunger assembly. Therefore, the disc and stem and plunger assembly must be changed to convert a standard solenoid valve to one with a built-in check valve. Internal parts kits are available for solenoid valves with the built-in check valve.

evaporator temperature, see page 45.) For heat pumps with long lines that require shut off in both directions, use two solenoid valves with the outlets pointing towards each other.

**Extreme care should be taken when brazing connections to avoid damage to internal synthetic parts.**

Figure 2



#### HEATING MODE

- Discharge Gas – High Pressure Vapor
- Saturated – High Pressure Liquid & Vapor
- Liquid – High Pressure
- Saturated – Low Pressure Liquid & Vapor
- Suction Gas – Low Pressure Vapor

#### CR26 BI-DIRECTIONAL SOLENOID

HEATING MODE (shown above)

Typically, the valve is installed with normal flow to the outdoor coil. When de-energized, this prevents migration of refrigerant to the outdoor coil during heating mode.

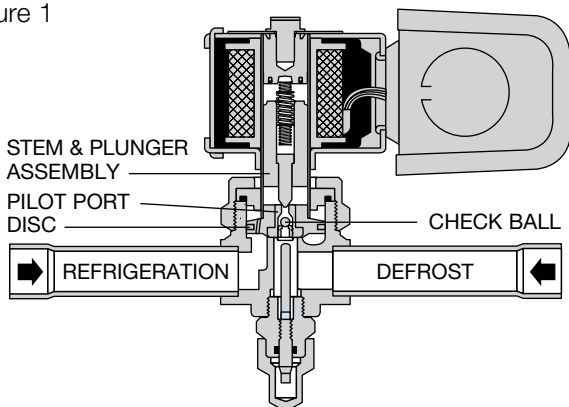
COOLING MODE

Typically the valve is installed with normal flow to the outdoor coil. When in cooling mode, the valve is in reverse flow.

#### For Supermarkets

See Figure 3 on page 44. For reverse gas defrost, a liquid line solenoid valve can be installed with a check valve in parallel, to allow reverse flow to the liquid header. This adds the expense of labor and materials. Or, a Sporlan liquid line solenoid valve with the built-in check valve feature can be installed, saving time and money.

Figure 1



#### CR26\* BI-DIRECTIONAL SOLENOID VALVE

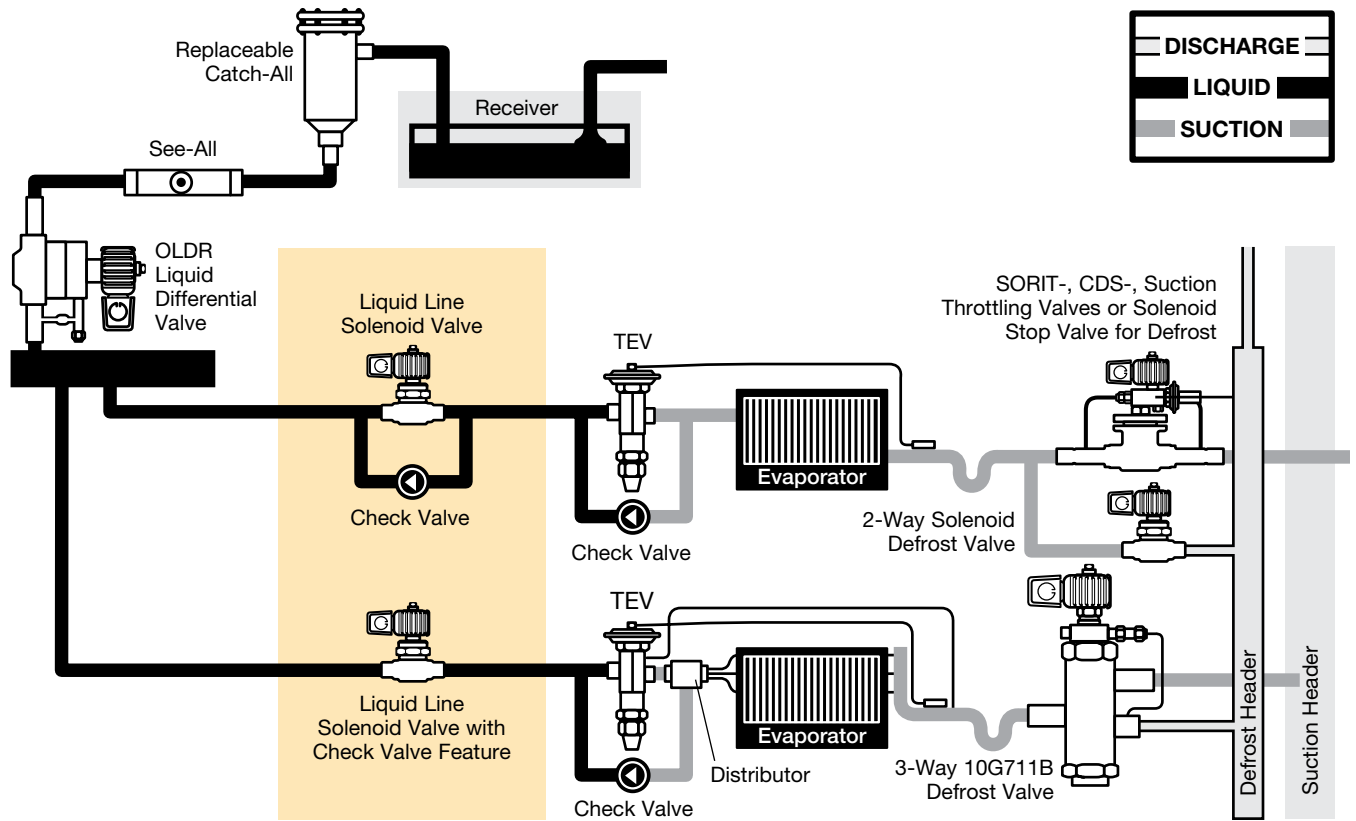
\* The "C" is used in this nomenclature to represent the check valve feature.

#### For Heat Pumps

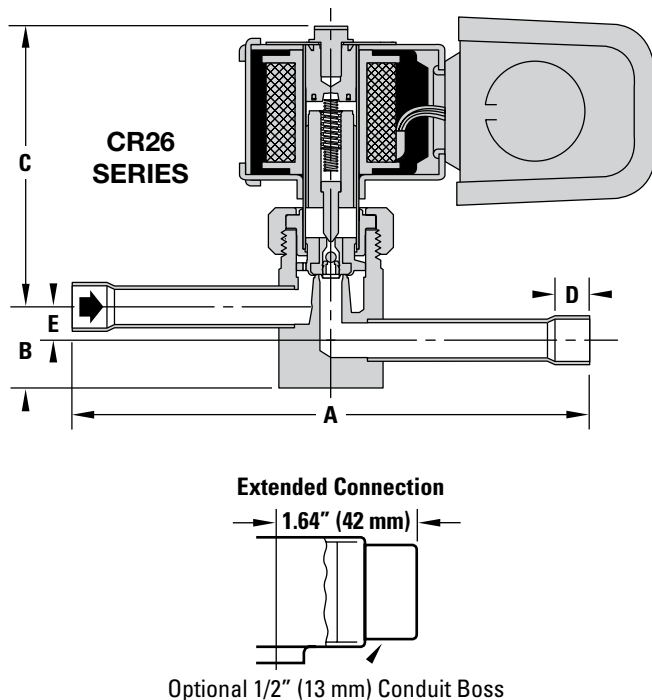
See Figure 2. This valve may be used on some heat pump applications when sized correctly. (Refer to capacities at 40°F



Figure 3  
REVERSE HOT GAS DEFOST



Dimensions - Inches



Inches (mm)

VALVE SERIES	TYPE	A	B	C	D Fitting Depth ODF	E Offset
CR26	CR26E63	4.66 (118)	0.73 (19)	2.59 (66)	0.31 (8)	0.30 (8)
	CR26E64	5.03 (128)	0.73 (19)	2.59 (66)	0.38 (10)	0.30 (6)

Ordering Instructions

When ordering complete valves, specify Valve Type, Connections, Voltage and Cycles.

When ordering Body Assembly, specify Valve Type and Connections.

**Example: CR26E63\***  
**Kit: KS-CR26**

When ordering Coil Assembly ONLY, specify Coil Type, Voltage and Cycles.

**Example: PKC-1 120/50-60**

\* The "C" is used in this nomenclature to represent the check valve feature.

# Specifications

## PKC-1 Coil

VALVE SERIES	TYPE	STANDARD CONNECTION Inches	PORT SIZE Inches	MOPD psi (bar)		NOMINAL LIQUID CAPACITIES Tons (kW) of Refrigerant										STANDARD COIL RATINGS										
						REFRIGERANTS																				
						22	134a	401A	402A	404A	407C	407F	410A	507A	VOLTS/CYCLES		WATTS									
						Pressure Drop – psi (bar)											AC	DC								
CR26 NORMAL FLOW	CR26E63	3/8" ODF	0.197	450 (31)	400 (27)	3	2	2	3	3	3	3	5	3	24/50-60 120/50-60 208/50-60 208-240/50-60 120-208-240/50-60	10	15									
	CR26E64	1/2" ODF				(0.20)	(0.14)	(0.14)	(0.20)	(0.20)	(0.20)	(0.20)	(0.34)	(0.20)				(12.75)	(9.81)	(10.59)	(8.57)	(8.48)	(11.75)	(12.17)	(15.42)	(8.29)
CR26 REVERSE FLOW	CR26E63	3/8" ODF				3	2	2	3	3	3	3	5	3				(10.66)	(8.10)	(8.74)	(7.15)	(7.03)	(9.78)	(10.13)	(13.04)	(6.90)
	CR26E64	1/2" ODF				3	2	2	3	3	3	3	5	3				(12.75)	(9.67)	(10.43)	(8.56)	(8.41)	(11.71)	(12.13)	(15.65)	(8.25)

Maximum Rated Pressure is 700 psi (48 bar).

Liquid capacity is based on 110°F (43.3°C) condensing temperature, 100°F (38°C) liquid temperature and 40°F (4°C) evaporating temperature.

For each 10°F (-12°C) reduction in evaporating temperature, capacities are reduced by approximately 1.5%.

### Refrigerant Liquid Temperature Correction Factors

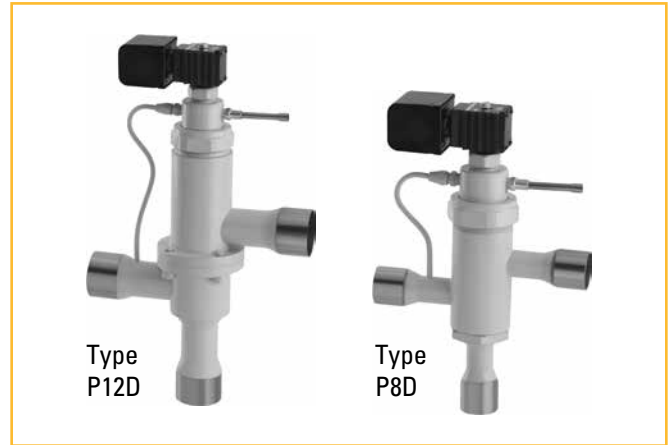
TEMPERATURE °F	40	50	60	70	80	90	100	110	120	130	140
TEMPERATURE °C	4	10	16	21	27	32	38	43	49	54	60
R-22	1.33	1.27	1.22	1.17	1.11	1.06	1.00	0.94	0.89	0.83	0.77
R-134a	1.39	1.33	1.26	1.20	1.13	1.07	1.00	0.93	0.87	0.80	0.73
R-401A	1.34	1.29	1.23	1.17	1.12	1.06	1.00	0.94	0.88	0.82	0.75
R-402A	1.57	1.48	1.39	1.29	1.20	1.10	1.00	0.90	0.79	0.68	0.56
R-404A	1.58	1.49	1.39	1.30	1.20	1.10	1.00	0.90	0.79	0.68	0.57
R-407C	1.45	1.38	1.30	1.23	1.15	1.08	1.00	0.92	0.84	0.75	0.67
R-407F	1.42	1.35	1.28	1.21	1.14	1.07	1.00	0.93	0.85	0.78	0.70
R-410A	1.45	1.38	1.30	1.23	1.15	1.08	1.00	0.92	0.83	0.74	0.64
R-507A	1.54	1.45	1.36	1.27	1.18	1.09	1.00	0.90	0.80	0.69	0.56

# Introduction

Parker 3-Way Heat Reclaim Valves Offer the Following Advantages   

## Materials of Construction

Body .....	Brass
Seating Material .....	Teflon®
Seals .....	Gasket
Plunger .....	Stainless
Sleeve Tube .....	Stainless
Stop .....	Stainless
Piston .....	Brass
Springs .....	Stainless
Shading Ring .....	Copper
Connections .....	Extended Ends - Copper



## General

Today more and more applications are utilizing “heat reclaim” as a means of providing a supplementary or even a primary heat source. Heat reclaim can significantly lower energy costs. Heat reclaim is best described as the process of reclaiming heat that would normally be rejected by an outdoor condenser. Typically, the refrigerant is diverted to an air handler in an area that requires heat. One of the older applications of heat reclaim is in a supermarket, since a supermarket has a constant supply of heat removed from the many refrigerated display fixtures and coolers. Today there are many cost-effective applications of heat reclaim in refrigeration, air conditioning, dehumidification and heat pump systems.

While the most popular application of heat reclaim is air, water heating is popular in supermarkets, convenience stores and restaurants, which all use considerable amounts of hot water. Essentially any application that requires heat can recover the heat from a refrigeration or air conditioning system. The energy efficiency of recovered heat will almost always be more efficient than any other purchased heat source. The common sense question is “Why reject heat to the outdoors when additional heat is required in any other moder-

ate temperature application within the system or building?” 3-Way refrigerant heat reclaim valves make it convenient to recover rejected or waste heat.

## Application

Valves may be installed in either a horizontal or vertical position. However, it should not be mounted with the coil housing below the valve body.

### Series versus Parallel Piping Schematics

Figures 2 & 3, Pages 53 & 54 show typical piping schematics for the two basic types of piping arrangements, series and parallel condensers. The selection of the piping arrangement will depend on the sizing of the reclaim coil and the control scheme of the system.

If the parallel piping arrangement is used, the reclaim condenser must be sized to handle 100% of the rejected heat at the conditions and time at which the reclaim coil is being utilized.

If the series piping arrangement is used, care and safety measures should be taken to prevent the mixing of sub-cooled refrigerant with hot gas vapors. These safety measures could include pressure or temperature lockout controls and time delay relays.

For both parallel and series piping, when the idle condenser is pumped down to suction pressure, a small solenoid valve can be used to pressurize the idle condenser prior to the 3-way valve shifting. This may reduce the potential for stress and fatigue failure of the refrigerant piping.

### Heat Reclaim with or without a Bleed Port

3-Way Heat Reclaim Valves with 3-way pilot valves are available in a variety of different sizes. These valves are available with an optional “bleed” port, see Figure 1 on page 52. The bleed port allows the refrigerant to be removed from the heat reclaim coil or heat exchanger when it is not being used. There are two reasons why the refrigerant is removed from the heat reclaim coil. One is to maintain a proper balance of refrigerant in the system (i.e., refrigerant left in the reclaim coil could result in the remainder of the system operating short of charge). A second reason is to eliminate the potential of having condensed refrigerant in an idle coil. When an idle reclaim coil has condensed or even subcooled liquid refrigerant sitting in the tubes there is a potential for a problem. When refrigerant liquid, either saturated or subcooled, is mixed with hot gas refrigerant, the reaction of the mixing can cause severe liquid hammer. Hot gas

# Application

mixed with liquid can create thousands of pounds of force and has the potential of breaking refrigerant lines and valves.

An alternate method of removing the refrigerant from a heat reclaim coil is to use a separate normally open solenoid valve and an optional fixed metering device, see Figures 2 & 3, Pages 53 & 54. The separate solenoid valve allows the flexibility of pumping out the reclaim heat exchanger as a liquid instead of a vapor. There are

two benefits to pumping out the reclaim coil as a liquid: (1) Removal of any oil that may be present in the reclaim heat exchanger. (2) The refrigerating effect of the liquid can be used to lower the superheat of vapor entering the compressor, instead of cooling the heat reclaim heat exchanger.

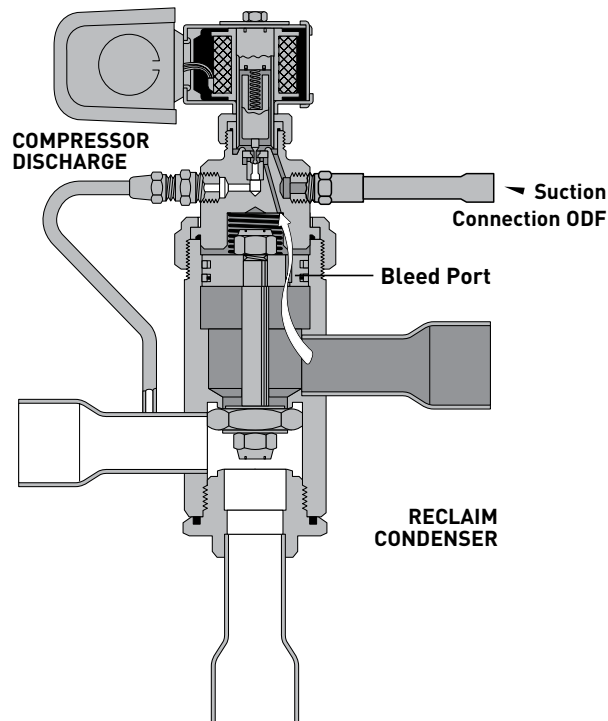
Parker recommends that recognized piping references be consulted for assistance in piping procedures. Parker is not responsible for system design, any

damage resulting from system design, or for misapplication of its products.

**Note: A check valve should be installed in the heat reclaim pump out or bleed line whenever the reclaim heat exchanger is exposed to temperatures lower than the saturated suction temperature of the system. This will prevent migration of refrigerant to the coldest location in the system.**

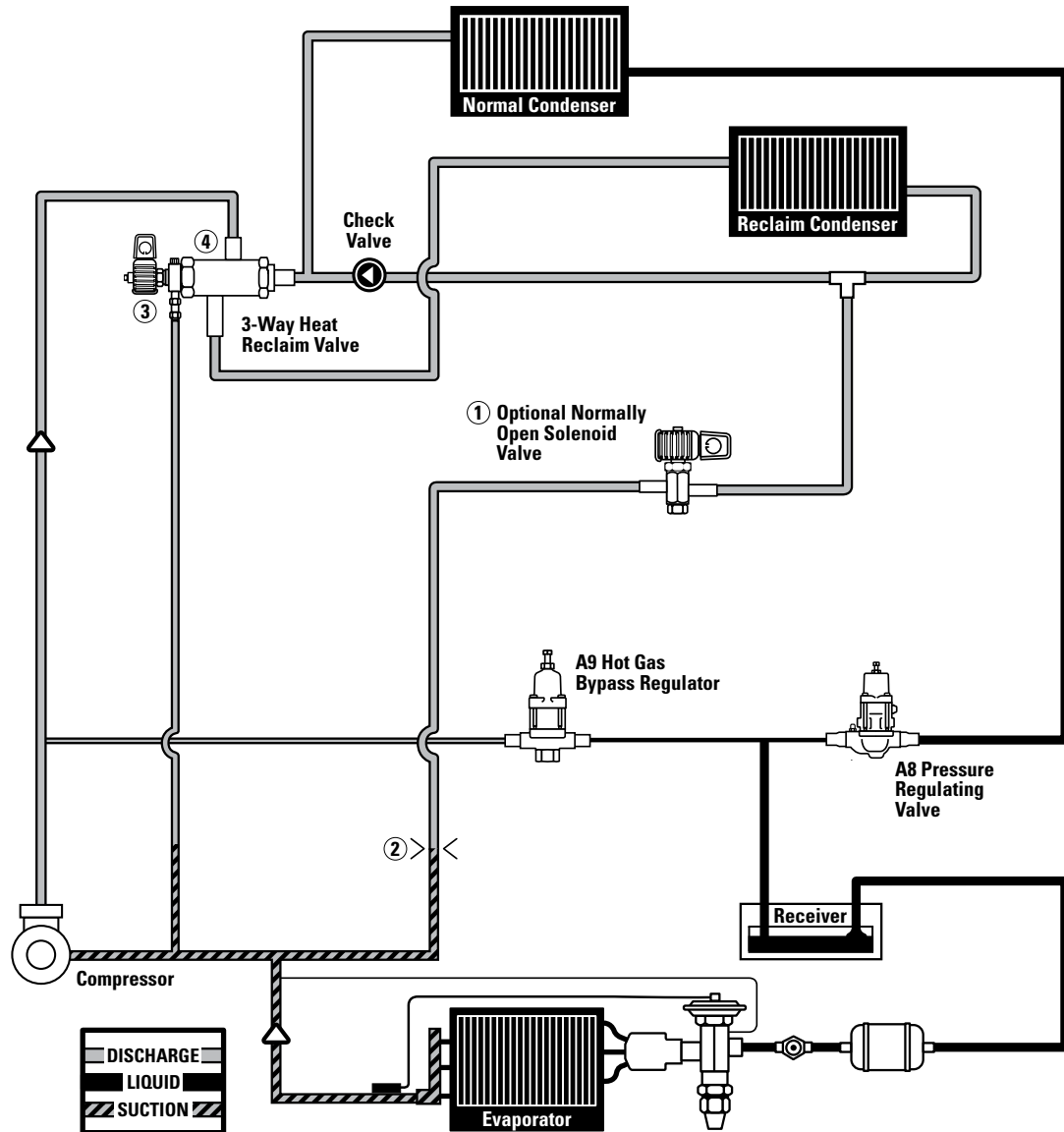
## TYPE B - Reclaim Condenser Pump Out

Figure 1



## Schematic

Figure 2

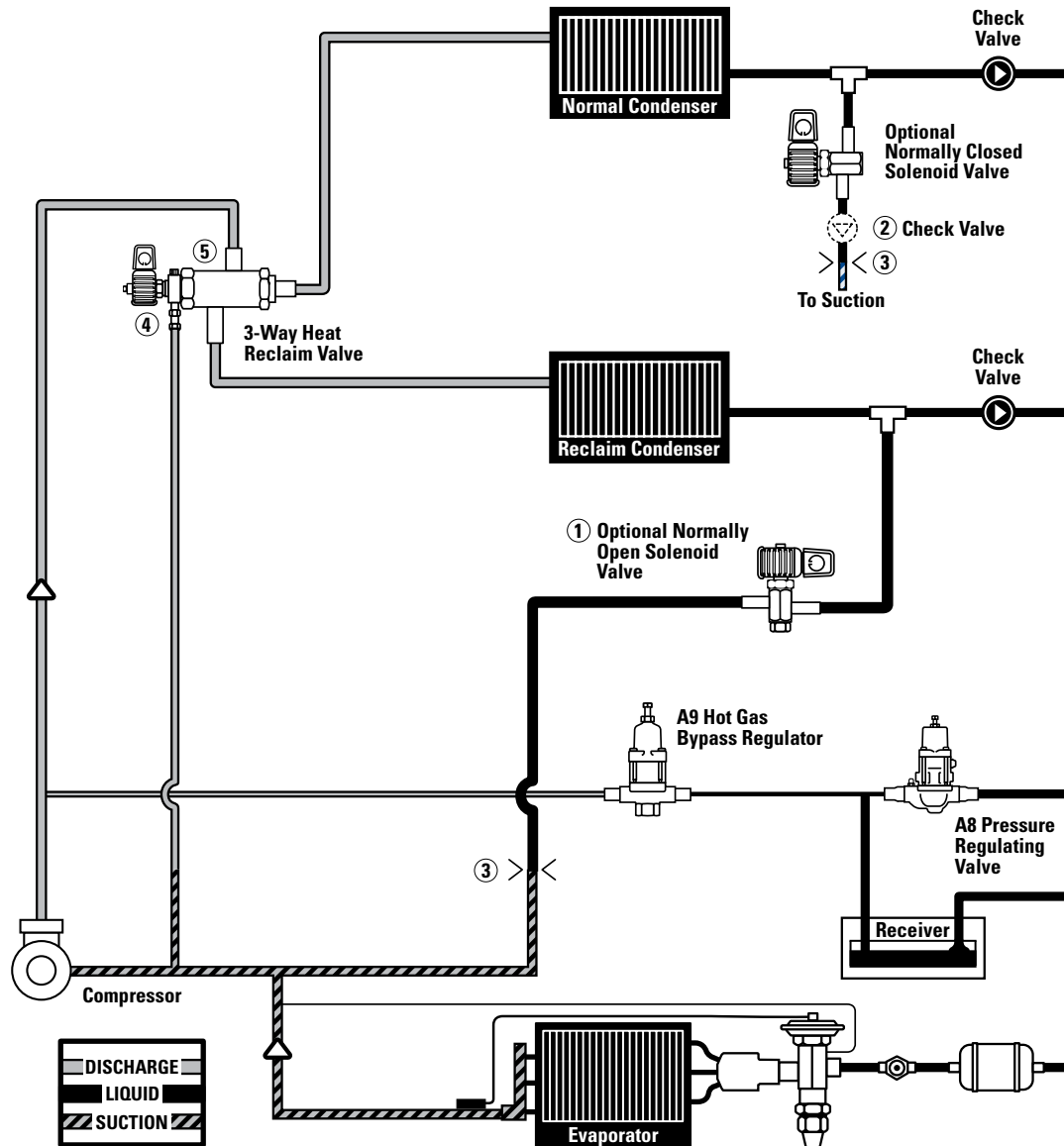


- ① Use optional solenoid valve and piping if pump out is required and "C" model Heat Reclaim Valve is used, see Note 4. It is optional to omit this solenoid valve and piping on systems using "B" model Heat Reclaim Valve.
- ② A restrictor may be required to control pump out rate on inactive condenser.
- ③ Pilot suction line must be open to common suction whether or not Heat Reclaim Coil is installed at time of installation and regardless of Heat Reclaim Valve model/type.
- ④ Proper support of heat reclaim valves is essential. Concentrated stresses resulting from thermal expansion or compressor vibrations can cause fatigue failure of tubing, elbows and valve fittings. Fatigue failures can also result from vapor propelled liquid slugging, and condensation induced shock. The use of piping brackets close to each of the 3-Way valve fittings is recommended.

## Schematic

Figure 3

### Parallel Condenser Typical Piping



- ① Use optional solenoid valve and piping if pump out is required and "C" model Heat Reclaim Valve is used, see Note 4. It is optional to omit this solenoid valve and piping on systems using "B" model Heat Reclaim Valve.
- ② This check valve is required if lowest operating ambient temperature is lower than evaporator temperature.
- ③ A restrictor may be required to control pump out rate on inactive condenser.
- ④ Pilot suction line must be open to common suction whether or not Heat Reclaim Coil is installed at time of installation and regardless of Heat Reclaim Valve model/type.
- ⑤ Proper support of heat reclaim valves is essential. Concentrated stresses resulting from thermal expansion or compressor vibrations can cause fatigue failure of tubing, elbows and valve fittings. Fatigue failures can also result from vapor propelled liquid slugging, and condensation induced shock. The use of piping brackets close to each of the 3-Way valve fittings is recommended.

# Operation

All Parker 3-Way Heat Reclaim Valves have a pilot operated design that shifts the refrigerant flow to either the normal condenser or the reclaim condenser based on the heating requirements of the application.

## “B” Type Normal (Outdoor) Condenser – De-energized

See Figure 4. With the pilot valve de-energized, high side pressure ① is prevented from entering the cavity above the piston-seat assembly ②. At the same time the upper pilot port is opened to suction pressure ③. The resulting pressure differential across the piston moves the piston-seat assembly to close the reclaim condenser port (upper main port). In this mode the system refrigerant flows to the normal condenser.

The pilot valve opens the cavity above the piston ②, to suction ③. This allows the reclaim condenser to be pumped out through a small bleed hole in the piston. The pump out process reduces the reclaim condenser to suction pressure. Once the suction pressure is reached, the flow through the bleed hole in the piston stops. There is no remaining high to low side bleed, with continued operation in the normal condenser mode. For a more efficient pump out of the reclaim condenser, a normally open solenoid valve can be added to the lowest physical location of the heat reclaim coil to remove liquid.

## “C” Type Normal (Outdoor) Condenser – De-energized

See Figure 4. With the pilot valve de-energized, high side pressure ① is prevented from entering cavity above the piston-seat assembly ②. At the same time the upper pilot port is opened to suction pressure ③. The resulting pressure differential across the piston moves the piston-seat assembly to close the reclaim (upper) main port. We use a solid piston ring on the piston thereby eliminating high to low side bleed, and the resulting capacity loss with the system in the normal condenser mode.

**Note: When the heat reclaim condenser is used for heating hot water, some form of bleed is required. Type C valves with no method of bleed in the heat reclaim condenser may result in isolated reclaim condenser pressures higher than the saturated discharge pressure of the system. In this condition, the higher reclaim condenser pressure could prevent the valve from shifting into the reclaim mode. Or, the balance of pressures and spring forces could result in flow to both the reclaim and normal condenser connections. One solution is to install a check valve in the reclaim condenser line and either use a Type B valve or provide a pump out solenoid connected to the tubing between the reclaim connection of the 3-way valve and the check valve.**

## “B” and “C” Type Reclaim (Reheat) Condenser – Energized

See Figure 5. When the pilot valve is energized, high side pressure ① is permitted to flow through the lower pilot port. At the same time, the upper pilot port is closed to suction ③. High side pressure ①, builds up on top of the piston ②, moves the piston-seat assembly to close the normal condenser port, and opens the reclaim (upper) main port. With the upper pilot port closed, there is no high to low side bleed with the system in the reclaim mode.

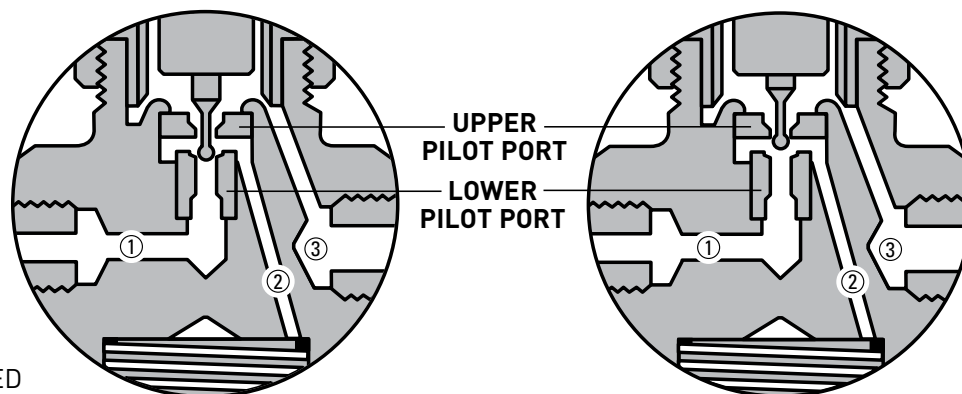


Figure 4  
PILOT VALVE  
DE-ENERGIZED

Figure 5  
PILOT VALVE  
ENERGIZED

## Selection

1. For a given refrigerant, select a valve having a port size with capacity most closely matching the evaporator maximum load requirements in tons at the design evaporator temperature. Refer to the tables on Page 58. Take into account the allowable pressure drop across the valve port.
2. Select the proper coil assembly for the valve type and match the voltage requirements. All standard AC voltage options are available. For voltages not listed in coil specification, consult Parker, Broadview, IL.

## Ordering Instructions

When ordering complete valves, specify Valve Type, Voltage and Cycles.

When ordering Valve Body ONLY, specify Valve Type.

When ordering Coil Assembly ONLY, specify Coil Type, Voltage and Cycles.

**Example: PKC-1 120/50-60**

### Valve Nomenclature

<b>P12D</b>	<b>11</b>	<b>C</b>
Valve Type	Connections in 1/8"	Non-Bleed Version

## Specifications

Valve Series	Type	Standard Connections Inches	Port Size Inches	MOPD psi*	MRP psi**	Standard Coil Ratings		
						VOLTS/CYCLES	WATTS	COIL
P8D	P8D7B	7/8	3/4	400	680	24/50-60 120/50-60 208-240/50-60	10	PKC-1
	P8D7C							
	P8D9B	1-1/8						
	P8D9C							
P12D	P12D11B	1-3/8	1-1/4					
	P12D11C							
	P12D13B	1-5/8						
	P12D13C							

\*MOPD stands for Maximum Operating Pressure Differential.

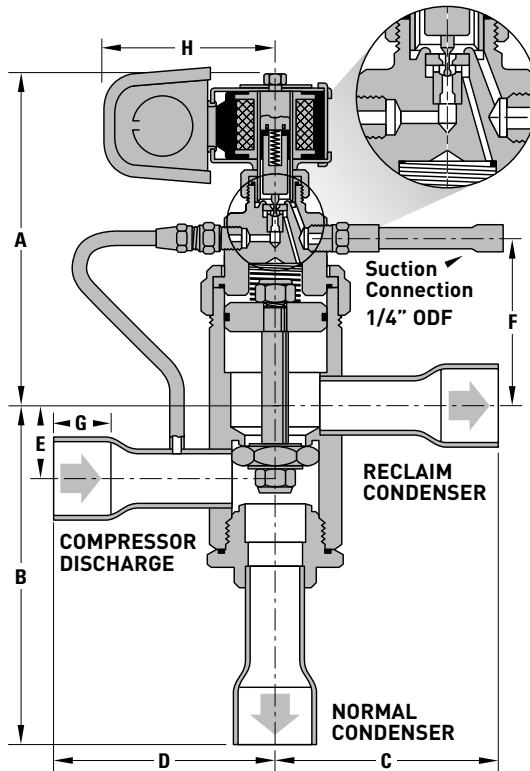
\*\* MRP stands for Maximum Rated Pressure.



## Dimensions – Inches

Figure 6

### TYPE P8D - P12D



Type	A	B	C	D	E	F	G	H	J
P8D7B	5.11	5.06	3.44	3.44	1.12	2.62	0.75	2.92	1.64
P8D7C		5.12					0.91		
P8D9B									
P8D9C		6.73					6.94		
P12D11B									
P12D11C									
P12D13B									
P12D13C	---	---	---	---	---	---	---	2.92	1.64
PKC-1									

## Evaporator Capacities — Tons

Capacities are based on 100°F condensing temperature isentropic compression plus 50°F, evaporator temperature as shown plus 25°F superheat suction gas. For capacities at other conditions, use the correction table below. All capacity ratings are in accordance with ARI Standard No. 760-80.

Evaporator Temperature °F	R22				R134a				R401A				R402A			
	PSI - Pressure Drop				PSI - Pressure Drop				PSI - Pressure Drop				PSI - Pressure Drop			
	2		4		2		4		2		4		2		4	
	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D
40	10.1	29.1	14.2	41.8	8.4	24.0	11.8	34.5	9.2	26.2	12.9	37.7	8.8	25.9	12.4	37.3
30	9.9	28.6	13.9	41.0	8.2	23.5	11.5	33.7	9.0	25.6	12.6	36.8	8.6	25.3	12.1	36.3
20	9.7	28.0	13.7	40.2	8.0	22.9	11.2	32.9	8.8	25.0	12.3	36.0	8.4	24.6	11.7	35.3
10	9.5	27.4	13.4	39.4	7.8	22.3	10.9	32.0	8.6	24.4	12.0	35.1	8.1	23.8	11.4	34.2
0	9.3	26.8	13.1	38.5	7.6	21.7	10.7	31.1	8.3	23.8	11.7	34.1	7.9	23.1	11.0	33.1
-10	9.1	26.2	12.8	37.6	7.4	21.0	10.3	30.2	8.1	23.1	11.4	33.2	7.6	22.3	10.7	32.0
-20	8.9	25.5	12.5	36.7	---	---	---	---	---	---	---	---	7.3	21.5	10.3	30.9
-30	8.7	24.9	12.2	35.8	---	---	---	---	---	---	---	---	7.1	20.7	9.9	29.7
-40	8.4	24.2	11.8	34.7	---	---	---	---	---	---	---	---	6.8	19.9	9.5	28.6

Evaporator Temperature °F	R404A				R407C				R410A				R502			
	PSI - Pressure Drop				PSI - Pressure Drop				PSI - Pressure Drop				PSI - Pressure Drop			
	2		4		2		4		2		4		2		4	
	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D	P8D	P12D
40	9.0	26.4	12.7	38.0	10.6	30.8	14.9	44.2	12.0	34.7	16.9	49.9	8.0	23.4	11.2	33.6
30	8.8	25.7	12.3	37.0	10.4	30.0	14.5	43.1	11.7	34.1	16.4	49.1	7.8	22.8	10.9	32.8
20	8.6	25.0	12.0	35.9	10.1	29.3	14.2	42.1	11.5	33.5	16.1	48.2	7.6	22.2	10.7	31.9
10	8.3	24.2	11.6	34.9	9.9	28.5	13.8	40.9	---	---	---	---	7.4	21.6	10.3	31.0
0	8.0	23.4	11.2	33.7	9.6	27.7	13.5	39.8	---	---	---	---	7.2	21.0	10.1	30.2
-10	7.7	22.6	10.8	32.5	9.3	26.9	13.0	38.7	---	---	---	---	7.0	20.3	9.8	29.3
-20	7.5	21.8	10.4	31.3	9.0	26.1	12.7	37.4	---	---	---	---	6.7	19.7	9.4	28.3
-30	7.2	20.9	10.0	30.1	8.7	25.2	12.2	36.3	---	---	---	---	6.5	19.0	9.1	27.3
-40	6.9	20.0	9.6	28.8	---	---	---	---	---	---	---	---	6.3	18.3	8.8	26.3

Evaporator Temperature °F	R507A			
	PSI - Pressure Drop			
	2		4	
	P8D	P12D	P8D	P12D
40	8.8	25.7	12.3	36.9
30	8.5	25.0	12.0	35.9
20	8.3	24.3	11.6	34.9
10	8.0	23.5	11.2	33.8
0	7.8	22.8	10.9	32.7
-10	7.5	22.0	10.5	31.6
-20	7.3	21.2	10.1	30.5
-30	7.0	20.4	9.8	29.3
-40	6.7	19.6	9.4	28.1

## Evaporator Temperature Correction Factors

Evaporator Temperature °F	40	30	20	10	0	-10	-20	-30	-40
Multiplier	1.00	0.96	0.93	0.90	0.87	0.84	0.81	0.78	0.75

## Head Pressure Control for Reclaim Systems

When employing heat reclaim on a refrigeration system, the addition of head pressure controls is important not only to maintain liquid pressure at the expansion valve inlet, but also to assure the availability of quality hot gas at the reclaim heat exchanger. Typically, the additional energy required to maintain a higher head pressure, is not enough to pay for an alternate method of heating.

Split condenser controls are also important to minimize the required refrigerant charge for winter time operation. See Page 10.

See Parker, Head Pressure Control Valves for high and low ambient stability. When low ambient conditions are encountered during fall-winter-spring operation, the Parker head pressure controls hold back liquid refrigerant so a portion of the condenser surface is inactive. This results in a rise in condensing pressure.

## OFFER OF SALE

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods or work described will be referred to as "Products".

1. **Terms and Conditions.** Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is expressly conditioned on Buyer's assent to these Terms and Conditions and to the terms and conditions found on-line at [www.parker.com/saleterms/](http://www.parker.com/saleterms/). Seller objects to any contrary or additional term or condition of Buyer's order or any other document issued by Buyer.

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3. **Delivery Dates; Title and Risk; Shipment.** All delivery dates are approximate and Seller shall not be responsible for any damages resulting from any delay. Regardless of the manner of shipment, title to any products and risk of loss or damage shall pass to Buyer upon tender to the carrier at Seller's facility (i.e., when it's on the truck, it's yours). Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferral of shipment at Buyers' request beyond the respective dates indicated will be made except on terms that will indemnify, defend and hold Seller harmless against all loss and additional expense. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's changes in shipping, product specifications or in accordance with Section 13, herein.

4. **Warranty.** Seller warrants that the Products sold hereunder shall be free from defects in material or workmanship for a period of twelve months from the date of delivery to Buyer or 2,000 hours of normal use, whichever occurs first. This warranty is made only to Buyer and does not extend to anyone to whom Products are sold after purchased from Seller. The prices charged for Seller's products are based upon the exclusive limited warranty stated above, and upon the following disclaimer: **DISCLAIMER OF WARRANTY: THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO PRODUCTS PROVIDED HEREUNDER. SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS AND IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

5. **Claims; Commencement of Actions.** Buyer shall promptly inspect all Products upon delivery. No claims for shortages will be allowed unless reported to the Seller within 10 days of delivery. No other claims against Seller will be allowed unless asserted in writing within 60 days after delivery or, in the case of an alleged breach of warranty, within 30 days after the date within the warranty period on which the defect is or should have been discovered by Buyer. Any action based upon breach of this agreement or upon any other claim arising out of this sale (other than an action by Seller for any amount due to Seller from Buyer) must be commenced within thirteen months from the date of tender of delivery by Seller or, for a cause of action based upon an alleged breach of warranty, within thirteen months from the date within the warranty period on which the defect is or should have been discovered by Buyer.

6. **LIMITATION OF LIABILITY.** UPON NOTIFICATION, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE A DEFECTIVE PRODUCT, OR REFUND THE PURCHASE PRICE. **IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRIT-**

**TEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENCE, WHETHER IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS.**

7. **Contingencies.** Seller shall not be liable for any default or delay in performance if caused by circumstances beyond the reasonable control of Seller.

8. **User Responsibility.** The user, through its own analysis and testing, is solely responsible for making the final selection of the system and Product and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application and follow applicable industry standards and Product information. If Seller provides Product or system options, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products or systems.

9. **Loss to Buyer's Property.** Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

10. **Special Tooling.** A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture Products. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the Products, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

11. **Buyer's Obligation; Rights of Seller.** To secure payment of all sums due or otherwise, Seller shall retain a security interest in the goods delivered and this agreement shall be deemed a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect its security interest. Seller shall have a security interest in, and lien upon, any property of Buyer in Seller's possession as security for the payment of any amounts owed to Seller by Buyer.

12. **Improper use and Indemnity.** Buyer shall indemnify, defend, and hold Seller harmless from any claim, liability, damages, lawsuits, and costs (including attorney fees), whether for personal injury, property damage, patent, trademark or copyright infringement or any other claim, brought by or incurred by Buyer, Buyer's employees, or any other person, arising out of: (a) improper selection, improper application or other misuse of Products purchased by Buyer from Seller; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, plans, drawings, or specifications furnished by Buyer to manufacture Product; or (d) Buyer's failure to comply with these terms and conditions. Seller shall not indemnify Buyer under any circumstance except as otherwise provided.

13. **Cancellations and Changes.** Orders shall not be subject to cancellation or change by Buyer for any reason, except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage. Seller may change product features, specifications, designs and availability with notice to Buyer.

14. **Limitation on Assignment.** Buyer may not assign its rights or obligations under this agreement without the prior written consent of Seller.

15. **Entire Agreement.** This agreement contains the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive

expression of the terms of the agreement. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

16. **Waiver and Severability.** Failure to enforce any provision of this agreement will not waive that provision nor will any such failure prejudice Seller's right to enforce that provision in the future. Invalidation of any provision of this agreement by legislation or other rule of law shall not invalidate any other provision herein. The remaining provisions of this agreement will remain in full force and effect.

17. **Termination.** This agreement may be terminated by Seller for any reason and at any time by giving Buyer thirty (30) days written notice of termination. In addition, Seller may by written notice immediately terminate this agreement for the following: (a) Buyer commits a breach of any provision of this agreement (b) the appointment of a trustee, receiver or custodian for all or any part of Buyer's property (c) the filing of a petition for relief in bankruptcy of the other Party on its own behalf, or by a third party (d) an assignment for the benefit of creditors, or (e) the dissolution or liquidation of the Buyer.

18. **Governing Law.** This agreement and the sale and delivery of all Products hereunder shall be deemed to have taken place in and shall be governed and construed in accordance with the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to this agreement. Disputes between the parties shall not be settled by arbitration unless, after a dispute has arisen, both parties expressly agree in writing to arbitrate the dispute.

19. **Indemnity for Infringement of Intellectual Property Rights.** Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Section. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets ("Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that a Product sold pursuant to this Agreement infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If a Product is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Product, replace or modify the Product so as to make it noninfringing, or offer to accept return of the Product and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to Products delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any Product sold hereunder. The foregoing provisions of this Section shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

20. **Taxes.** Unless otherwise indicated, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of Products.

21. **Equal Opportunity Clause.** For the performance of government contracts and where dollar value of the Products exceed \$10,000, the equal employment opportunity clauses in Executive Order 11246, VEVRAA, and 41 C.F.R. §§ 60-1.4(a), 60-741.5(a), and 60-250.4, are hereby incorporated.



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