March 2015 / **CATALOG 744**

SPORLAN

CO_2 Innovations

Energy Conscious Products & Solutions for Supermarkets

SPORLAN

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FOR USE ON AIR CONDITIONING AND REFRIGERATION SYSTEMS ONLY

Catalog 744, March 2015 supersedes Catalog 744, January 2010 and all prior publications.

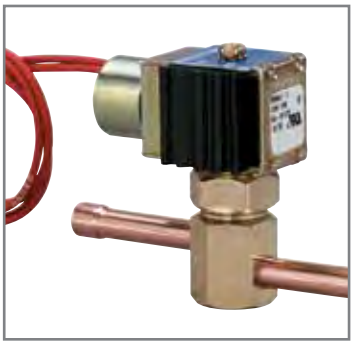
CO_2 Innovations

ENERGY CONSCIOUS PRODUCTS and SOLUTIONS FOR SUPERMARKETS

As a world leader in refrigerant flow controls, Sporlan Division of Parker Hannifin continues to meet the challenges of the future. **Our growing line of products for CO_2 set new standards for robust design and advanced technology.**

This condensed catalog contains product information specifically for CO_2 applications. By including a minimum of engineering information we are able to provide a concise reference to pertinent data and specifications on Sporlan CO_2 products.

For additional engineering information, a complete Sporlan Catalog or CD, please contact your nearest Sporlan Sales Office, Authorized Sporlan Wholesaler or log on to www.sporlanonline.com.



CONTENTS

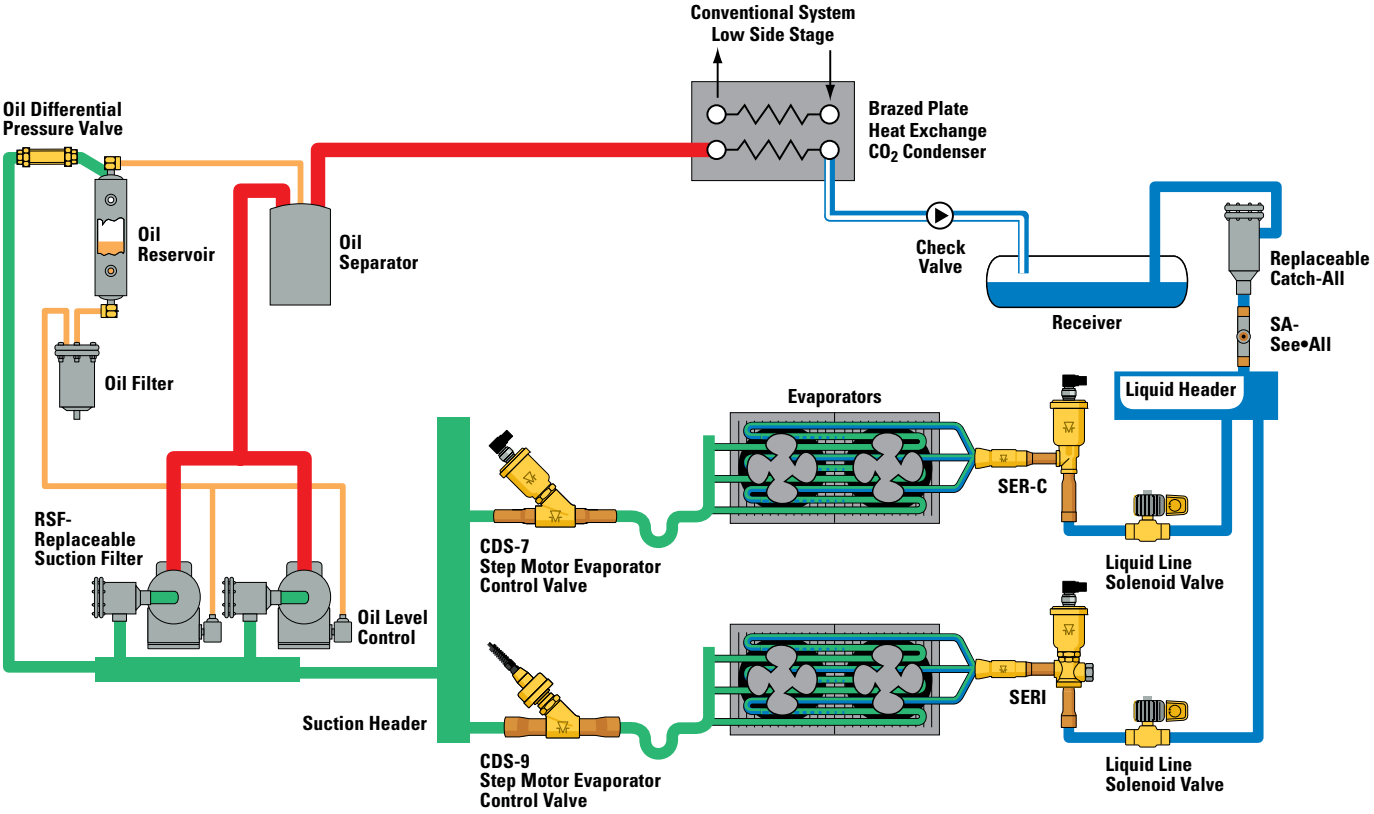
For further information on the products featured in this catalog, see Bulletin number listed below.

50-10
40-10
20-10
100-20, 100-40, 100-80
100-50-2, 100-50-5
Form 40-382
Form 10-135

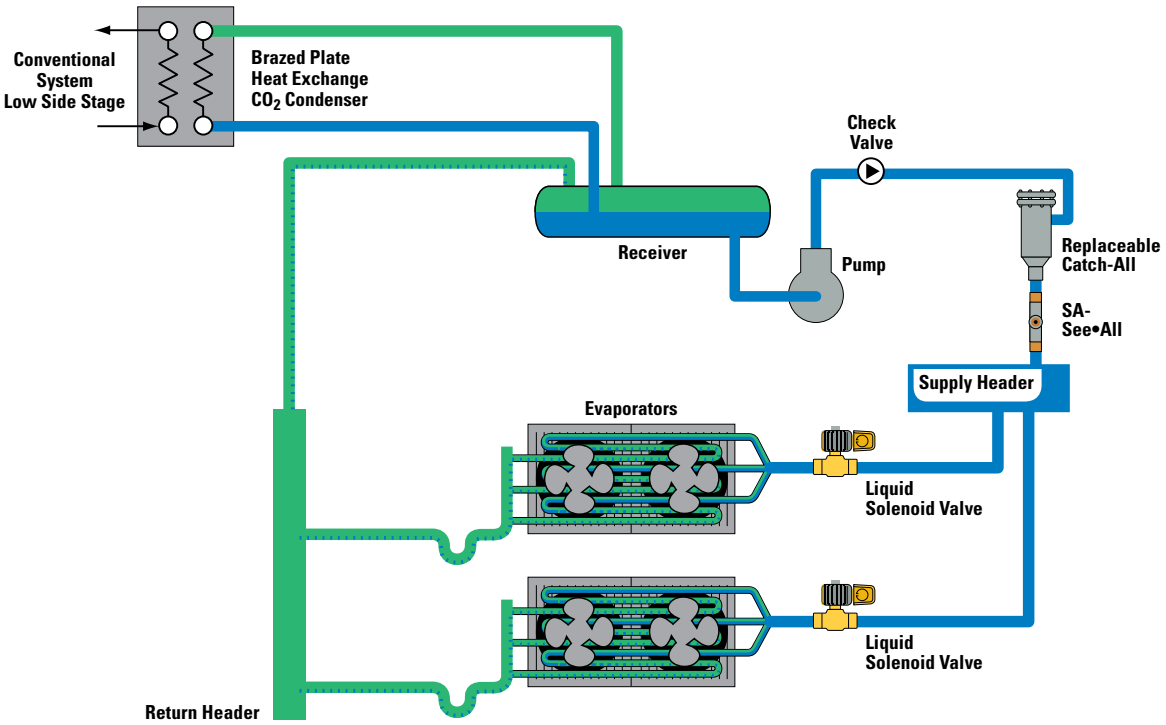
110-10, 110-11
70-10
30-10
80-10

SUBCRITICAL CO_2

R-744 CASCADE SYSTEM SCHEMATIC



R-744 SECONDARY SYSTEM SCHEMATIC*



* For Solenoid Valves for Secondary Coolant CO_2 Systems, please refer to Bulletin 30-10-10, or contact Sporlan Division of Parker.

Note: No pressure relief or ball valves are shown. Relief valves must be present where liquid CO_2 can be trapped.
All components must be properly pressure rated and protected for safe installation.

DISTRIBUTORS

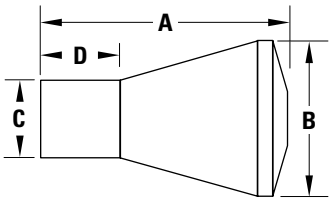
CO_2

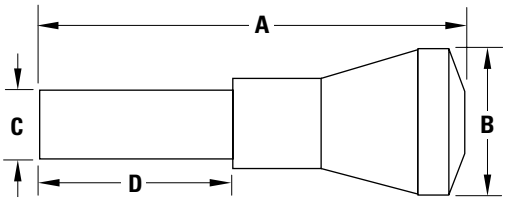
All Sporlan distributors are ready for service with CO_2. The following tables are provided for making selections based on procedure explained in Bulletin 20-10.

QUICK REFERENCE

CONNECTION SIZE Inches	TYPICAL EEV TYPES	DISTRIBUTOR TYPE	MAXIMUM NUMBER OF CIRCUITS 3/16	1/4	5/16	3/8	NOZZLE TYPE	SIDE CONNECTION	MATERIAL
1/2 ODM	SER-AA, A, B, C, DS	1613	6	4	–	–	PERM.	–	#360 BRASS
		1616	8	6	4	–	PERM.	–	
		D260	6	4	–	–	L	–	
		D262	9	6	4	–	L	–	
5/8 ODM	SER-AA, A, B, C, DS SERI-F, G	1620	6	4	–	–	J	–	
		1622	9	7	4	–	J	–	
		1651(R)	7	5	–	–	J (R)	3/8 or 1/2 ODF	
7/8 ODM	SER-DS SERI-F, G(S), J(S)	1112	7	6	4	2	G	–	
		1113	12	8	6	4	G	–	
		1653(R)	12	9	6	4	G (R)	3/8 or 1/2 ODF	
1-1/8 ODM	SER-DS SERI-F, G(S), J(S), K(S), L(S)	1115	15	10	9	6	E	–	
		1116	20	15	–	–	E	–	
		1655 (R)	20	12	10	7	E (R)	1/2 or 5/8 ODF	
1-3/8 ODM	SERI-G(S), J(S), K(S), L(S)	1117	18	15	9	7	C	–	
		1126	24	18	15	12	C	–	#377 BRASS
		1128	28	25	21	16	C	–	
		1657(R)	26	18	14	11	C (R)	5/8 or 7/8 ODF	#360 BRASS

DIMENSIONS





SPECIFICATIONS

NUMBER OF CIRCUITS & TUBING SIZES AVAILABLE	NOZZLE ORIFICE NUMBERS AVAILABLE	NOZZLE & RETAINER RING SIZE	INLET CONNECTION Inches	DISTRIBUTOR	DIMENSIONS Inches A	B	C	D	mm A	B	C	D
Type D260 Net Weight - Approximately 2 oz. (60 g)												
2 to 6 3/16″ 2 to 4 1/4″	1/9 thru 8	L	1/2 ODM Solder		1.96	0.81	.497 / .503	0.82	49.8	21	12.6 / 12.8	21
Type D262 Net Weight - Approximately 3 oz. (80 g)												
7 to 9 3/16″ 5 to 6 1/4″ 2 to 4 5/16″	1/9 thru 8	L	1/2 ODM Solder		2.44	1.00	.497 / .503	0.81	62.0	25.4	12.6 / 12.8	21
Type 1613 Net Weight - Approximately - Approximately 2 oz. (60 g)												
2 to 7 5/32″ 2 to 6 3/16″ 2 to 4 1/4″	1/2 thru 5	PERM.	1/2 ODM Solder		1.17	0.81	.498 / .500	0.50	29.7	21	12.6 / 12.7	13
Type 1616 Net Weight - Approximately - Approximately 3 oz. (80 g)												
8 to 10 5/32″ 7 to 8 3/16″ 5 to 6 1/4″ 2 to 4 5/16″	1/2 thru 5	PERM.	1/2 ODM Solder		1.55	1.00	.498 / .500	0.50	39.4	25.4	12.6 / 12.7	13
Type 1620 Net Weight - Approximately 2 oz. (60 g)												
2 to 6 3/16″ 2 to 4 1/4″	1/9 thru 8	J	5/8 ODM Solder		1.14	0.81	.623 / .625	0.69	29.0	21	15.8 / 15.9	18

DISTRIBUTORS CO_2

SPECIFICATIONS

NUMBER OF CIRCUITS & TUBING SIZES AVAILABLE	NOZZLE ORIFICE NUMBERS AVAILABLE	NOZZLE & RETAINER RING SIZE	INLET CONNECTION Inches	DISTRIBUTOR	DIMENSIONS							
					Inches				mm			
					A	B	C	D	A	B	C	D
Type 1622 Net Weight - Approximately 3 oz. (80 g)					1.63	1.00	.623 / .625	0.63	41.4	25.4	15.8 / 15.9	16
7 to 9 3/16"	1/9 thru 8	J	5/8 ODM Solder									
5 to 7 1/4"												
2 to 4 5/16"												
Type 1112 Net Weight - Approximately 4 oz. (110 g)					1.72	0.91	.873 / .875	1.00	43.7	23	22.2 +/– 0.03	25.4
5 to 7 3/16"	1/6 thru 20	G	7/8 ODM Solder									
4 to 6 1/4"												
2 to 4 5/16"												
2 3/8"												
Type 1113 Net Weight - Approximately 5 oz. (140 g)					1.78	1.16	.873 / .875	0.88	45.2	29.5	22.2 +/– 0.03	22
8 to 12 3/16"	1/6 thru 20	G	7/8 ODM Solder									
7 to 8 1/4"												
5 to 6 5/16"												
3 to 4 3/8"												
Type 1115 Net Weight - Approximately 9 oz. (250 g)					2.44	1.50	1.123 / 1.125	1.12	62.0	38.1	28.52 / 28.58	28.4
11 to 15 3/16"	2 thru 30	E	1-1/8 ODM Solder									
9 to 10 1/4"												
7 to 9 5/16"												
5 to 6 3/8"												
Type 1116 Net Weight - Approximately 9 oz. (250 g)					2.44	1.75	1.123 / 1.125	1.12	62.0	44.4	28.52 / 28.58	28.4
16 to 20 3/16"	2 thru 30	E	1-1/8 ODM Solder									
11 to 15 1/4"												
Type 1117 Net Weight - Approximately 1 lb. (450 g)					2.56	1.75	1.373 / 1.375	1.31	65.0	44.4	34.87 / 34.92	33.3
16 to 18 3/16"	3 thru 50	C	1-3/8 ODM Solder									
11 to 15 1/4"												
9 5/16"												
7 3/8"												
Type 1126 Net Weight - Approximately 1 lb., 6 oz. (620 g)					2.81	2.38	1.373 / 1.375	1.12	71.4	60.5	34.87 / 34.92	28.4
19 to 24 3/16"	3 thru 50	C	1-3/8 ODM Solder									
15 to 18 1/4"												
10 to 15 5/16"												
8 to 12 3/8"												
Type 1128 Net Weight - Approximately 1 lb., 10 oz. (740 g)					3.12	3.00	1.373 / 1.375	1.38	79.2	76.2	34.87 / 34.92	35.1
25 to 28 3/16"	3 thru 50	C	1-3/8 ODM Solder									
19 to 25 1/4"												
16 to 21 5/16"												
13 to 16 3/8"												

DISTRIBUTORS CO_2

CAPACITIES Tons ▪ psi ▪ °F

NOZZLE NUMBER	DISTRIBUTOR NOZZLE CAPACITIES EVAPORATOR TEMPERATURE °F		
	0°	-20°	-40°
1/9	0.42	0.30	0.23
1/6	0.64	0.46	0.35
1/4	1.03	0.74	0.56
1/3	1.35	0.97	0.73
1/2	1.87	1.34	1.01
3/4	2.82	2.02	1.53
1	3.77	2.71	2.05
1-1/2	5.48	3.94	2.98
2	7.53	5.40	4.09
2-1/2	9.39	6.74	5.09
3	11.3	8.09	6.11
4	15.1	10.8	8.18
5	18.6	13.3	10.1
6	22.3	16.0	12.1
8	26.9	19.3	14.6
10	30.1	21.6	16.3
12	37.2	26.7	20.2
15	46.1	33.1	25.0
17	51.6	37.0	28.0
20	62.2	44.6	33.7
25	78.2	56.1	42.4
30	89.3	64.1	48.5
35	107	77.1	58.3
40	120	86.5	65.4
50	156	112	84.8

kW ▪ bar ▪ °C

NOZZLE NUMBER	DISTRIBUTOR NOZZLE CAPACITIES EVAPORATOR TEMPERATURE °C		
	-20°	-30°	-40°
1/9	1.27	0.97	0.76
1/6	1.96	1.49	1.17
1/4	3.15	2.4	1.88
1/3	4.13	3.14	2.46
1/2	5.71	4.34	3.41
3/4	8.62	6.55	5.14
1	11.5	8.77	6.88
1-1/2	16.8	12.8	10.0
2	23.0	17.5	13.7
2-1/2	28.7	21.8	17.1
3	34.5	26.2	20.6
4	46.2	35.1	27.5
5	56.9	43.3	34.0
6	68.3	51.9	40.7
8	82.2	62.5	49.1
10	92.2	70.0	55.0
12	114	86.5	67.9
15	141	107	84.2
17	158	120	94.2
20	190	145	113
25	239	182	143
30	273	208	163
35	329	250	196
40	369	280	220
50	478	364	285

TUBE DIAMETER Inches	DISTRIBUTOR CAPACITY PER TUBE (Tons) EVAPORATOR TEMPERATURE °F		
	0°	-20°	-40°
3/16	1.31	0.84	0.60
1/4	3.80	2.44	1.73
5/16	7.73	4.97	3.54
3/8	14.0	8.99	6.40

TUBE DIAMETER Inches	DISTRIBUTOR CAPACITY PER TUBE (kW) EVAPORATOR TEMPERATURE °C		
	-20°	-30°	-40°
3/16	3.86	2.71	2.02
1/4	11.2	7.86	5.86
5/16	22.8	16.0	11.9
3/8	41.2	29.0	21.6

LIQUID TEMPERATURE °F				
0°	10°	20°	30°	40°
CORRECTION FACTOR FOR NOZZLE AND TUBES				
1.60	1.25	1.00	0.83	0.71

LIQUID TEMPERATURE °C					
-20°	-15°	-10°	-5°	0°	5°
CORRECTION FACTOR FOR NOZZLE AND TUBES					
1.87	1.48	1.19	1.00	0.86	0.75

TUBE LENGTH (Inches)										
12	18	24	30	36	42	48	54	60	66	72
CORRECTION FACTOR, TUBE LENGTH										
1.36	1.16	1.07	1.00	0.95	0.90	0.86	0.82	0.79	0.76	0.73

TUBE LENGTH (mm)										
300	450	600	760	900	1050	1200	1350	1500	1650	1800
CORRECTION FACTOR, TUBE LENGTH										
1.36	1.16	1.07	1.00	0.95	0.90	0.86	0.82	0.79	0.76	0.73

Nozzle ratings based on ΔP = 35 psi (2.4 bar)
Tube ratings based on ΔP = 10 psi (0.69 bar), 30 inches (760 mm) length

SOLENOID VALVES CO_2

SELECTION - CAPACITY RATING

Capacity, MOPD and Electrical specifications are required.

All solenoid valves are tested and rated in accordance with A.R.I. Standard No. 760-2001.

LIQUID CAPACITY SELECTION TABLE

Tons ▪ psi ▪ °F

TYPE NUMBER "E" Series Extended Connections		CONNECTIONS ODF SOLDER Inches	Cv	PORT SIZE Inches	TONS OF REFRIGERATION PRESSURE DROP — psi*				
Without Manual Lift Stem Normally Closed	With Manual Lift Stem Normally Closed				1	2	3	4	5
E2S120-HP	–	1/4	0.15	0.075	0.66	0.95	1.16	1.34	1.51
E5S130-HP	–	3/8	0.53	0.150	2.34	3.33	4.09	4.73	5.30
E6S130-HP	ME6S130-HP	3/8	0.93	3/16	4.20	5.90	7.21	8.30	9.26
E6S140-HP	ME6S140-HP	1/2							
E8S140-HP	ME8S140-HP	1/2	1.20	1/4	5.38	7.60	9.31	10.75	12.02
E9S240-HP	ME9S240-HP	1/2	1.53	9/32	6.84	9.64	11.8	13.6	15.2
E9S250-HP	–	5/8							
E10S140-HP	ME10S140-HP	1/2	2.06	5/16	9.11	12.9	15.9	18.4	20.6
E10S150-HP	ME10S150-HP	5/8							
E14S250-HP	ME14S250-HP	5/8	2.98	7/16	13.3	18.8	23.0	26.5	29.6
E19S270-HP	ME19S270-HP	7/8	4.57	19/32	20.3	28.8	35.3	40.8	45.6
E25S270-HP	–	7/8	7.81	25/32	34.7	49.1	60.2	69.6	77.9
E25S290-HP	ME25S290-HP	1-1/8							
–	ME35S190-HP	1-1/8	13.3	1	56.3	82.2	103	120	136
–	ME35S1110-HP	1-3/8							

Ratings based on 20°F liquid, -20°F evaporator temperature.

kW ▪ bar ▪ °C

TYPE NUMBER "E" Series Extended Connections		CONNECTIONS ODF SOLDER Inches	Kv	PORT SIZE mm	kW OF REFRIGERATION PRESSURE DROP — bar*				
Without Manual Lift Stem Normally Closed	With Manual Lift Stem Normally Closed				0.07	0.1	0.2	0.3	0.4
E2S120-HP	–	1/4	0.13	1.9	2.31	2.76	3.93	4.84	5.60
E5S130-HP	–	3/8	0.46	3.8	8.12	9.73	13.9	17.0	19.7
E6S130-HP	ME6S130-HP	3/8	0.81	4.8	14.6	17.4	24.4	29.8	34.3
E6S140-HP	ME6S140-HP	1/2							
E8S140-HP	ME8S140-HP	1/2	1.02	6.4	18.9	22.7	32.2	39.2	45.5
E9S240-HP	ME9S240-HP	1/2	1.32	7.1	23.7	28.3	39.9	48.8	56.3
E9S250-HP	–	5/8							
E10S140-HP	ME10S140-HP	1/2	1.76	7.9	32.0	38.6	54.6	67.0	77.0
E10S150-HP	ME10S150-HP	5/8							
E14S250-HP	ME14S250-HP	5/8	2.57	11	46.1	55.1	77.8	95.2	110
E19S270-HP	ME19S270-HP	7/8	3.95	15	70.4	84.3	119	147	169
E25S270-HP	–	7/8	6.75	20	120	144	204	250	289
E25S290-HP	ME25S290-HP	1-1/8							
E35S190-HP	ME35S190-HP	1-1/8	11.5	26	196	238	347	433	506
–	ME35S1110-HP	1-3/8							

Ratings based on -5°C liquid, -30°C evaporator temperature.

* Do not use below 1 psi (0.07 bar) pressure drop.

For other liquid line temperatures use liquid correction factors below. Maximum Operating Pressure Differential (MOPD) for the AC coil is 450 psi (31.0 bar). Maximum Rated Pressure (MRP) = 700 psig (48.3 barg).

LIQUID TEMPERATURE °F					LIQUID TEMPERATURE °C					
0°	10°	20°	30°	40°	-20°	-15°	-10°	-5°	0°	5°
CORRECTION FACTOR, LIQUID CAPACITY RATING					CORRECTION FACTOR, LIQUID CAPACITY RATING					
1.13	1.07	1.00	0.93	0.86	1.18	1.12	1.06	1.00	0.94	0.87

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an average evaporator temperature of 40°F (5°C). For each 10°F (10°C) reduction in evaporating temperature, capacities are reduced by approximately 1-1/2%.

The capacity tables above are based on Subcritical CO_2 DX systems.

For Secondary Coolant CO_2 applications and capacities, please refer to Bulletin 30-10-10, or contact Sporlan Division of Parker.

Disclaimer: Some CO_2 systems do not use oil or lubrication in their systems. If so, the lack of lubrication in the system may cause the internal components of the valve to wear prematurely resulting in eventual failure of the valve. This disclaimer is for solenoid valves only.

SUCTION CAPACITY SELECTION TABLE

Tons ▪ psi ▪ °F

TYPE NUMBER "E" Series Extended Connections		SUCTION CAPACITY RATINGS – Tons				
Without Manual Lift Stem	With Manual Lift Stem	EVAPORATOR TEMPERATURE °F				
Normally Closed	Normally Closed	0°	-10°	-20°	-30°	-40°
E2S120-HP	–	0.15	0.13	0.12	0.11	0.10
E5S130-HP	–	0.52	0.47	0.43	0.39	0.35
E6S130-HP	ME6S130-HP	0.98	0.90	0.82	0.75	0.68
E6S140-HP	ME6S140-HP					
E8S140-HP	ME8S140-HP	1.27	1.14	1.02	0.92	0.82
E9S240-HP	ME9S240-HP	1.57	1.45	1.32	1.20	1.09
E9S250-HP	–					
E10S140-HP	ME10S140-HP	2.12	1.90	1.70	1.52	1.35
E10S150-HP	ME10S150-HP					
E14S250-HP	ME14S250-HP	3.04	2.79	2.55	2.32	2.10
E19S270-HP	ME19S270-HP	4.55	4.18	3.81	3.46	3.13
E25S270-HP	–	7.81	7.17	6.55	5.95	5.38
E25S290-HP	ME25S290-HP					
–	ME35S190-HP	11.2	10.2	9.23	8.32	7.45
–	ME35S1110-HP					

kW ▪ bar ▪ °C

TYPE NUMBER "E" Series Extended Connections		SUCTION CAPACITY RATINGS – kW				
Without Manual Lift Stem	With Manual Lift Stem	EVAPORATOR TEMPERATURE °C				
Normally Closed	Normally Closed	-20°	-25°	-30°	-35°	-40°
E2S120-HP	–	0.52	0.46	0.42	0.38	0.35
E5S130-HP	–	1.83	1.65	1.51	1.37	1.23
E6S130-HP	ME6S130-HP	3.45	3.16	2.88	2.64	2.39
E6S140-HP	ME6S140-HP					
E8S140-HP	ME8S140-HP	4.46	4.00	3.59	3.23	2.88
E9S240-HP	ME9S240-HP	5.52	5.10	4.64	4.22	3.83
E9S250-HP	–					
E10S140-HP	ME10S140-HP	7.46	6.68	5.98	5.34	4.75
E10S150-HP	ME10S150-HP					
E14S250-HP	ME14S250-HP	10.7	9.81	8.97	8.16	7.39
E19S270-HP	ME19S270-HP	16.0	14.7	13.4	12.2	11.0
E25S270-HP	–	27.5	25.2	23.0	20.9	18.9
E25S290-HP	ME25S290-HP					
–	ME35S190-HP	39.4	35.9	32.5	29.3	26.2
–	ME35S1110-HP					

Ratings based on 20°F (-5°C) liquid, 25°F (14°C) superheat, 1 psi (0.07 bar) ΔP.

DISCHARGE GAS CAPACITY SELECTION TABLE

Tons ▪ psi ▪ °F

TYPE NUMBER "E" Series Extended Connections		DISCHARGE CAPACITY RATINGS – Tons				
Without Manual Lift Stem	With Manual Lift Stem	ΔP - psi				
Normally Closed	Normally Closed	2	5	10	25	50
E2S120-HP	–	0.21	0.34	0.48	0.77	1.25
E5S130-HP	–	0.75	1.20	1.70	2.72	4.39
E6S130-HP	ME6S130-HP	1.40	2.20	3.09	4.85	7.46
E6S140-HP	ME6S140-HP					
E8S140-HP	ME8S140-HP	1.81	2.89	4.05	6.41	8.78
E9S240-HP	ME9S240-HP	2.26	3.57	5.03	7.91	11.1
E9S250-HP	–					
E10S140-HP	ME10S140-HP	2.90	4.63	6.60	10.5	15.5
E10S150-HP	ME10S150-HP					
E14S250-HP	ME14S250-HP	4.38	6.91	9.76	15.4	23.2
E19S270-HP	ME19S270-HP	6.59	10.5	14.8	23.5	34.5
E25S270-HP	–	11.3	17.9	25.4	40.0	55.0
E25S290-HP	ME25S290-HP					
–	ME35S190-HP	16.7	27.5	40.1	66.2	96.5
–	ME35S1110-HP					

kW ▪ bar ▪ °C

TYPE NUMBER "E" Series Extended Connections		DISCHARGE CAPACITY RATINGS – kW				
Without Manual Lift Stem	With Manual Lift Stem	ΔP - bar				
Normally Closed	Normally Closed	0.15	0.3	0.7	1.5	4.0
E2S120-HP	–	0.78	1.11	1.71	2.52	4.67
E5S130-HP	–	2.75	3.91	6.02	8.87	16.45
E6S130-HP	ME6S130-HP	5.11	7.19	10.9	15.9	27.9
E6S140-HP	ME6S140-HP					
E8S140-HP	ME8S140-HP	6.61	9.36	14.2	20.9	32.8
E9S240-HP	ME9S240-HP	8.27	11.7	17.7	25.9	41.6
E9S250-HP	–					
E10S140-HP	ME10S140-HP	10.6	15.2	23.4	34.5	58.1
E10S150-HP	ME10S150-HP					
E14S250-HP	ME14S250-HP	16.0	22.6	34.5	50.3	87.2
E19S270-HP	ME19S270-HP	24.1	34.2	52.4	76.9	129
E25S270-HP	–	41.3	58.5	89.6	131	206
E25S290-HP	ME25S290-HP					
–	ME35S190-HP	61.3	89.4	142	215	363
–	ME35S1110-HP					

Ratings based on 20°F (-5°C) condensing, isentropic compression plus 50°F (28°C), -20°F (-30°C) evaporator, 5°F (-15°C) suction gas at the compressor.

LIQUID TEMPERATURE °F				
0°	10°	20°	30°	40°
CORRECTION FACTOR, SUCTION AND DISCHARGE RATING				
1.07	1.04	1.00	0.96	0.92

LIQUID TEMPERATURE °C					
-20°	-15°	-10°	-5°	0°	5°
CORRECTION FACTOR, SUCTION AND DISCHARGE RATING					
1.10	1.07	1.03	1.00	0.97	0.93

SOLENOID VALVES CO_2

TYPE E2 and E5 SERIES

The **E2 and E5 Series** are hermetic solenoid valves with pilot operated disc construction. These valves **may be mounted horizontally, on their side or in a vertical line**.

The **E2 and E5** series solenoid valves feature extended solder type connections as standard. One important benefit to the user is that all valves in the **"E2 and E5"** series can be installed using either low or no silver content brazing alloy.

The MKC-l coil is Class "F" temperature rated and is provided as standard, therefore a high temperature coil is not required for discharge service.

Type E5S130-HP

Ordering Instructions

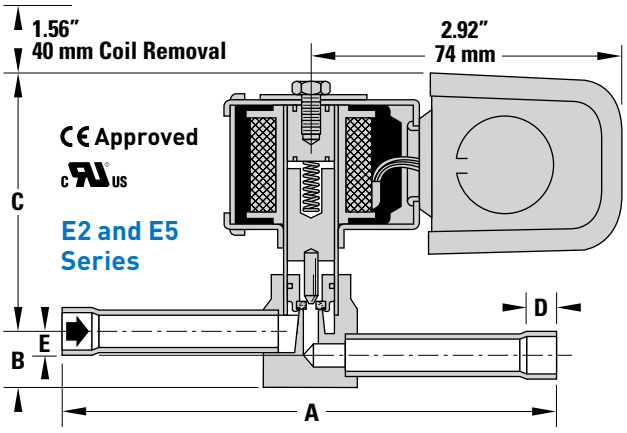
When ordering complete valves, specify Valve Type, Connections, Voltage and Cycles. When ordering Body Assembly, specify Valve Type and Connections. When ordering Coil Assembly ONLY, specify Coil Type, Voltage and Cycles. **Example: MKC-1 120/50-60.**

For Secondary Coolant CO_2 applications, please refer to Bulletin 30-10-10, or contact Sporlan Division of Parker.

DIMENSIONS

VALVE SERIES	TYPE	A	B	C	D FITTING DEPTH ODF	E OFFSET
Inches						
E2	E2S120-HP	4.63	0.55	1.96	0.31	0.29
E5	E5S130-HP	4.56	0.53	2.48		0.23
mm						
E2	E2S120-HP	118	14	50	8	7.4
E5	E5S130-HP	116	13	63		6

COIL RATINGS		
STANDARD VOLTS/CYCLES	WATTS AC	WATTS DC
24/50-60 120/50-60 208-240/50-60 120-208-240/50-60	10	15



SPECIFICATIONS - MKC-1 COIL

Tons ▪ psi ▪ °F

VALVE SERIES	TYPE	CONNECTIONS ODF - Inches	Cv	PORT SIZE Inches	MOPD psi AC	MOPD psi DC	NOMINAL LIQUID CAPACITIES TONS of REFRIGERATION PRESSURE DROP 3 psi
E2	E2S120-HP	1/4	0.15	0.075	450	400	1.16
E5	E5S130-HP	3/8	0.53	0.150			4.09

▪ Capacities based on 20°F (-6.7°C) liquid temperature, -20°F (-29°C) evaporator temperature. For other liquid line temperatures use liquid correction factors below. Maximum Operating Pressure Differential (MOPD) for the AC coil is 450 psi (31 bar). Maximum Rated Pressure (MRP) = 700 psig (48.3 barg).

kW ▪ bar ▪ °C

VALVE SERIES	TYPE	CONNECTIONS ODF - Inches	Kv	PORT SIZE mm	MOPD bar AC	MOPD bar DC	NOMINAL LIQUID CAPACITIES kW of REFRIGERATION PRESSURE DROP 0.2 bar
E2	E2S120-HP	1/4	0.13	1.9	31.0	27.6	3.93
E5	E5S130-HP	3/8	0.46	3.8			13.9

▪ Dual voltage 4-wire coils, 120-208-240/50-60 are available at slight additional cost. For other voltages and cycles, consult Sporlan Division of Parker, Washington, MO.
▪ Available with conduit boss, junction box, or DIN at no extra charge.
▪ For capacity at other pressure drops, see page 6 and 7.
▪ See disclaimer on page 6.

SOLENOID VALVES CO_2

TYPE E6, E8 and E10 SERIES

The **E6, E8 and E10 Series** are compact solenoid valves with pilot operated disc construction for refrigeration and air conditioning. These valves **may be mounted horizontally, on their side or in a vertical line.** They are suitable for suction line service because very low pressure differential, 1 psi, is required for full operation.

The **Type E6, E8 and E10** series solenoid valves feature extended solder type connections as standard. One important benefit to the user is that all valves in the **"E6, E8 and E10"** series can be installed without disassembly using either low or no silver content brazing alloy.

The MKC-l coil is Class "F" temperature rated and is provided as standard, therefore a high temperature coil is not required for discharge service.

Type E6S130-HP

Ordering Instructions

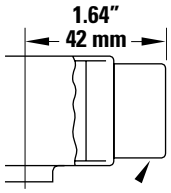
When ordering complete valves, specify Valve Type, Connections, Voltage and Cycles. When ordering Body Assembly, specify Valve Type and Connections. When ordering Coil Assembly ONLY, specify Coil Type, Voltage and Cycles. **Example: MKC-1 120/50-60.**

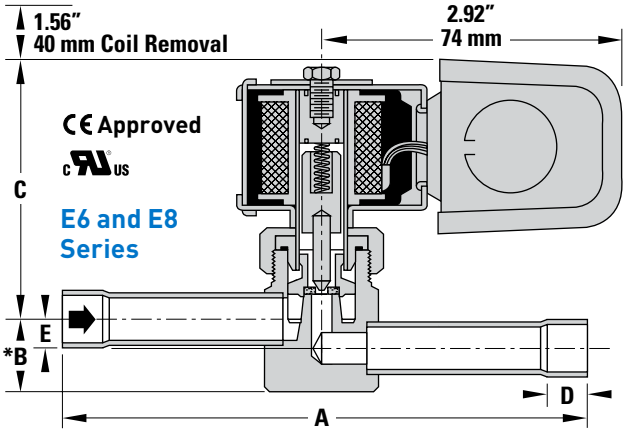
DIMENSIONS

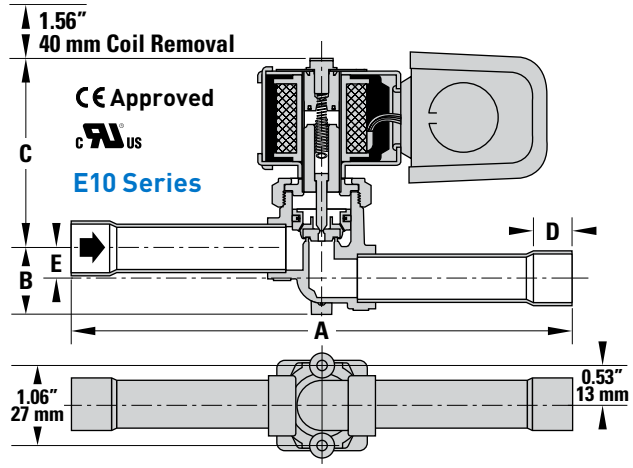
VALVE SERIES	TYPE	A	B*	C	D FITTING DEPTH ODF	E OFFSET
Inches						
E6	E6S130-HP	4.66	0.73	2.59	0.31	0.31
E6	E6S140-HP	5.00			0.38	
E8	E8S140-HP					
E10	E10S140-HP		0.86	2.52		0.39
E10	E10S150-HP	6.49			0.50	
mm						
E6	E6S130-HP	118	19	66	7.9	7.9
E6	E6S140-HP	127			9.7	
E8	E8S140-HP					
E10	E10S140-HP		22	64		10
E10	E10S150-HP	165			13	

* Add 1.12" (28 mm) for valves with Manual Lift Stem.

COIL RATINGS		
STANDARD VOLTS/CYCLES	WATTS AC	WATTS DC
24/50-60 120/50-60 208-240/50-60 120-208-240/50-60	10	15







SPECIFICATIONS - MKC-1 COIL

Tons ▪ psi ▪ °F

VALVE SERIES	TYPE	CONNECTIONS ODF - Inches	Cv	PORT SIZE Inches	MOPD psi AC	MOPD psi DC	NOMINAL LIQUID CAPACITIES TONS of REFRIGERATION PRESSURE DROP 3 psi
E6	E6S130-HP	3/8	0.93	3/16	450	400	7.21
E6	ME6S130-HP	3/8					
E6	ME6S140-HP	1/2					
E8	E8S140-HP	1/2	1.2	1/4	450	450	9.31
E8	ME8S140-HP	1/2					
E10	E10S140-HP	1/2	2.06	5/16	450	450	15.9
E10	E10S150-HP	5/8					

- Capacities based on 20°F (-6.7°C) liquid temperature, -20°F (-29°C) evaporator temperature. For other liquid line temperatures use liquid correction factors below. Maximum Operating Pressure Differential (MOPD) for the AC coil is 450 psi (31 bar). Maximum Rated Pressure (MRP) = 700 psig (48.3 barg).
- Dual voltage 4-wire coils, 120-208-240/50-60 are available at slight additional cost. For other voltages and cycles, consult Sporlan Division of Parker, Washington, MO.

kW ▪ bar ▪ °C

VALVE SERIES	TYPE	CONNECTIONS ODF - Inches	Kv	PORT SIZE mm	MOPD bar AC	MOPD bar DC	NOMINAL LIQUID CAPACITIES kW of REFRIGERATION PRESSURE DROP 0.2 bar
E6	E6S130-HP	3/8	0.81	4.8	31.0	27.6	24.4
E6	ME6S130-HP	3/8					
E6	ME6S140-HP	1/2					
E8	E8S140-HP	1/2	1.02	6.34	31.0	31.0	32.2
E8	ME8S140-HP	1/2					
E10	E10S140-HP	1/2	1.76	7.9	31.0	31.0	54.6
E10	E10S150-HP	5/8					

- Available with conduit boss, junction box, or DIN at no extra charge.
- For mounting holes and/or bracket information, see Bulletin 30-11
- E6, E8 and E10 series with mounting holes are NOT standard.
- For capacity at other pressure drops, see page 6 and 7.
- See disclaimer on page 6.

SOLENOID VALVES CO_2

TYPES E9, E14, E19 and E25 SERIES

Types **E9, E14, E19 and E25 Series** are compact solenoid valves with pilot operated disc construction for refrigeration and air conditioning. These valves **may be mounted horizontally, on their side or in a vertical line.** These valves are also suitable for suction line service because very low pressure differential, 1 psi, is required for full operation.

The **E9, E14, E19 and E25** series solenoid valves feature extended solder type connections as standard. One important benefit to the user is that all valves in the **"E9, E14, E19 and E25 series"** series can be installed without disassembly using either low or no silver content brazing alloy.

The MKC-2 and OMKC-2 coils are Class "F" temperature rated and are provided as standard, therefore a high temperature coil is not required for discharge service.

Type E14S250-HP

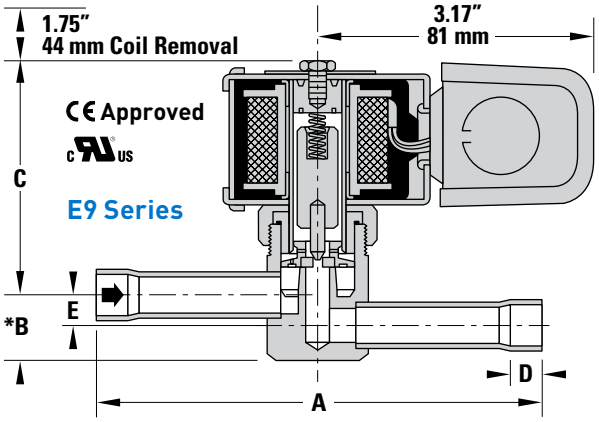
Ordering Instructions

When ordering complete valves, specify Valve Type, Connections, Voltage and Cycles. When ordering Body Assembly, specify Valve Type and Connections. When ordering Coil Assembly ONLY, specify Coil Type, Voltage and Cycles. **Example: MKC-2 120/50-60; OMKC-2 120/50-60.**

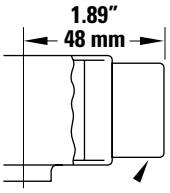
DIMENSIONS

VALVE SERIES	TYPE	A	*B	C NORMALLY CLOSED	D FITTING DEPTH ODF	E OFFSET
Inches						
E9	E9S230-HP	4.63	0.69	2.65	0.31	0.39
	E9S240-HP	5.00	0.75	2.70	0.38	0.33
	E9S250-HP	6.50	0.69	2.74	0.50	0.31
E14	E14S250-HP	6.88	0.46	3.26	0.50	–
E19	E19S270-HP	7.13	0.81	3.41	0.75	–
E25	E25S270-HP	7.50	0.72	3.81	0.75	–
	E25S290-HP	8.50	0.72	3.81	0.91	–
mm						
E9	E9S230-HP	118	18.0	67	7.9	9.9
	E9S240-HP	127	9.7	69	9.7	7.9
	E9S250-HP	165	12.7	69	13.0	9.7
E14	E14S250-HP	175	11.7	83	13.0	–
E19	E19S270-HP	181	21.0	87	19.0	–
E25	E25S270-HP	191	18.0	97	19.0	–
	E25S290-HP	216	18.0	97	23.0	–

* Add 1.12" (28 mm) for valves with Manual Lift Stem.



COIL RATINGS		
STANDARD VOLTS/CYCLES	WATTS AC	WATTS DC
24/50-60 120/50-60 208-240/50-60 120-208-240/50-60	15	18



SPECIFICATIONS - MKC-2 AND OMKC-2 COIL

Tons ▪ psi ▪ °F

VALVE SERIES	TYPE	CONNECTIONS ODF - Inches	Cv	PORT SIZE Inches	MOPD psi AC	MOPD psi DC	NOMINAL LIQUID CAPACITIES TONS of REFRIGERATION PRESSURE DROP 3 psi
E9	E9S230-HP	3/8	1.53	9/32	450	400	11.8
	E9S240-HP	1/2					
	E9S250-HP	5/8					
E14	E14S250-HP	5/8	2.98	7/16			23.0
E19	E19S270-HP	7/8	4.57	19/32			25.3
E25	E25S270-HP	7/8	7.81	25/32			60.2
	E25S290-HP	1-1/8					

kW ▪ bar ▪ °C

VALVE SERIES	TYPE	CONNECTIONS ODF - Inches	Kv	PORT SIZE mm	MOPD bar AC	MOPD bar DC	NOMINAL LIQUID CAPACITIES kW of REFRIGERATION PRESSURE DROP 0.2 bar
E9	E9S230-HP	3/8	1.32	7.1	31.0	27.6	39.9
	E9S240-HP	1/2					
	E9S250-HP	5/8					
E14	E14S250-HP	5/8	2.57	11			77.8
E19	E19S270-HP	7/8	3.95	15			119
E25	E25S270-HP	7/8	6.75	20			204
	E25S290-HP	1-1/8					

- Capacities based on 20°F (-6.7°C) liquid temperature, -20°F (-29°C) evaporator temperature. For other liquid line temperatures use liquid correction factors below. Maximum Operating Pressure Differential (MOPD) for the AC coil is 450 psi (31 bar). Maximum Rated Pressure (MRP) = 700 psig (48.3 barg).
- Dual voltage 4-wire coils, 120-208-240/50-60 are available at slight additional cost. For other voltages and cycles, consult Sporlan Division of Parker, Washington, MO.
- Available with conduit boss, junction box, or DIN at no extra charge.
- For capacity at other pressure drops, see page 6 and 7.
- See disclaimer on page 6.

SOLENOID VALVES CO_2

TYPES E35 SERIES

Types **E35 Series** solenoid valves are pilot operated for refrigeration and air conditioning applications. They are suitable for suction service because very low pressure differential, 1 psi, is required for full operation. The **E35 Series may be mounted horizontally, on their side or in a vertical line.**

The **Type E35** series solenoid valves feature extended solder type connections as standard. One important benefit to the user is that all valves in the **"E35"** series can be installed without disassembly using either low or no silver content brazing alloy.

The MKC-1 and OMKC-1 coils are Class "F" temperature rated and are provided as standard, therefore a high temperature coil is not required for discharge service.

Ordering Instructions

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

Type ME35S1110-HP

① 1-5/8" ODM Type L tubing may be slipped over 1-3/8" fitting, without the use of a coupling.

When ordering Coil Assembly ONLY, specify Coil Type, Voltage and Cycles. **Example: MKC-1 120/50-60; OMKC-1 120/50-60.**

DIMENSIONS

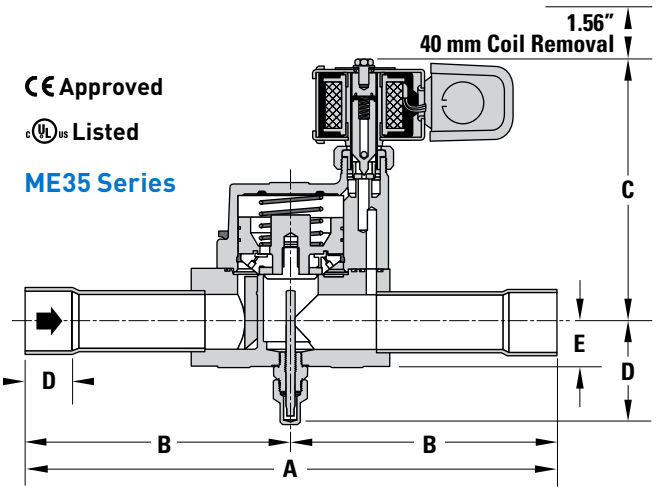
VALVE SERIES	TYPE	A	B	C		D	*E
				NORMALLY CLOSED	NORMALLY OPEN	FITTING DEPTH ODF	OFFSET
Inches							
E35	E35S190-HP	10.06	5.03	4.81	5.94	0.91	0.84
	E35S1110-HP	11.06	5.53			0.97	0.84
mm							
E35	E35S190-HP	256	128	122	151	23	21
	E35S1110-HP	281	140			25	21

* Add 1.12" (28 mm) for valves with Manual Lift Stem.

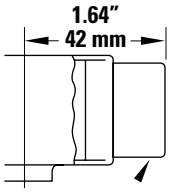
CE Approved

cULus Listed

ME35 Series



COIL RATINGS		
STANDARD VOLTS/CYCLES	WATTS	
	AC	DC
24/50-60 120/50-60 208-240/50-60 120-208-240/50-60	10	15



SPECIFICATIONS - MKC-1 AND OMKC-1 COIL

Tons ▪ psi ▪ °F

VALVE SERIES	TYPE	CONNECTIONS ODF - Inches	Cv	PORT SIZE Inches	MOPD psi		NOMINAL LIQUID CAPACITIES TONS of REFRIGERATION PRESSURE DROP 3 psi
					AC	DC	
E35	ME35S190-HP	1-1/8	13.3	1	450	400	103
	ME35S1110-HP	①1-3/8					

kW ▪ bar ▪ °C

VALVE SERIES	TYPE	CONNECTIONS ODF - Inches	Kv	PORT SIZE mm	MOPD bar		NOMINAL LIQUID CAPACITIES kW of REFRIGERATION PRESSURE DROP 0.2 bar
					AC	DC	
E35	ME35S190-HP	1-1/8	11.5	26	31.0	27.6	347
	ME35S1110-HP	①1-3/8					

- Capacities based on 20°F (-6.7°C) liquid temperature, -20°F (-29°C) evaporator temperature. For other liquid line temperatures use liquid correction factors below. Maximum Operating Pressure Differential (MOPD) for the AC coil is 450 psi (31 bar). Maximum Rated Pressure (MRP) = 700 psig (48.3 barg).
- Dual voltage 4-wire coils, 120-208-240/50-60 are available at slight additional cost. For other voltages and cycles, consult Sporlan Division of Parker, Washington, MO.
- Available with conduit boss, junction box, or DIN at no extra charge.
- For capacity at other pressure drops, see page 6 and 7.
- See disclaimer on page 6.

SOLENOID VALVES CO_2

IDENTIFICATION

NOMENCLATURE - E SERIES

M	E	10	S	2	5	0	S
Manual Lift Stem	Design Series	Port Size in 1/32″	**Connections** Solder	Coil Size ①, ②	Connection Size in 1/8″	***Connections** 0 - ODF X ODF 1 - ODF X ODM 2 - ODM X ODF 3 - ODM X ODM	Coil Connection S- Spade E - DIN 43650A

Type "E" series is identified by an expanded nomenclature. The system of valve identity based on port size. In addition, the "E" series identifies the connection size and type. The advantage of the "E" series nomenclature system is that it allows ease in valve identification of the standard line and can provide considerable information about special valves supplied to manufacturers.

For connections and other special features consult Sporlan Division of Parker, Washington, MO.

① The MKC-1, OMKC-1, MKC-2 and OMKC-2 are fungus proof and meet MIL-I-631C.

② The standard MKC-1 and MKC-2 are class "F" rated.

* Standard connections are ODF inlet x ODF outlet on "E" Series valves. Minimum quantities may be required for other connections.

APPLICATION

COMPRESSOR CAPACITY REDUCTION SERVICE

Sporlan Solenoid Valves may be used in conjunction with Sporlan Discharge Bypass Valves for capacity reduction service. For capacity information and further details on the Discharge Bypass Valves, consult Sporlan Division of Parker, Washington, MO.

FILTER-DRIERS ARE ESSENTIAL

Dirt and other system contaminants present a problem for refrigeration and air conditioning controls. Since pilot operated solenoid valves operate with rather close tolerances, system cleanliness is imperative. The Sporlan **Catch-All® Filter-Drier** filters out minute particles of dirt and other foreign matter, thus protecting the valve.

Sporlan recommends using a **Catch-All® Filter-Drier** ahead of every solenoid valve on all refrigeration and air conditioning applications. Contact Sporlan before adding a **Catch-All® Filter-Drier** in the discharge line.

TRANSFORMER SELECTION FOR LOW-VOLTAGE CONTROL SYSTEMS

Many systems utilize low voltage controls, requiring the use of a transformer for voltage reduction, normally to 24 volts. The selection of a transformer is not accomplished by merely selecting one that has the proper voltage requirements. The volt-ampere (VA) rating is equally important. To determine the VA requirement for a specific solenoid valve, refer to the chart below. It should be noted, that insufficient transformer capacity will result in reduced operating power or lowering of the MOPD value.

If more than one solenoid valve and/or other accessories are operated from the same transformer, then the transformer VA rating must be determined by adding the individual accessories' VA requirements.

FUSING

Sporlan Solenoid Valves are not supplied with fuses. Fusing should be according to local codes. We recommend fusing the hot leg of the valve wiring with fast acting fuses and the valve should be grounded either through the fluid piping or the electrical conduit.

COIL KIT	24 VOLTS/ 50-60 CYCLES		120 VOLTS/ 50-60 CYCLES		240 VOLTS/ 50-60 CYCLES		TRANSFORMER RATING VOLTS-AMPERES
	CURRENT-AMPERES		CURRENT-AMPERES		CURRENT-AMPERES		FOR 100% OF RATED MOPD OF VALVE
	INRUSH	HOLDING	INRUSH	HOLDING	INRUSH	HOLDING	
MKC-1 OMKC-1	1.9	0.63	0.39	0.14	0.19	0.09	60
MKC-2 OMKC-2	3.1	1.4	0.60	0.26	0.31	0.13	100

- All current values are based on 60 cycles.
- Volt-ampere ratings are based on inrush currents.
- Above values are based on the most severe conditions. — Consult Sporlan Division of Parker, Washington, MO for coil characteristics on specific valve types.

Catch-All® FILTER-DRIERS CO_2

The universal acceptance of the **Catch-All® Filter-Drier** is due to its unique molded porous core, consisting of a blend of highly effective desiccants. The quality features built into it assure years of service on any refrigeration system.

Moisture – The **Catch-All Filter-Drier** removes moisture from the refrigerant by adsorbing and retaining it deep within the desiccant granules. The blend of desiccants used in the **Catch-All Filter-Drier** are specially formulated for exceptional water removal.

Foreign Matter – The **Catch-All Filter-Drier** will filter out scale, solder particles, carbon, sludge, dirt or any other foreign matter with negligible pressure drop. Fine particles that would go through an ordinary strainer are removed down to a minimum size in one pass filtration. The large filtering area of the **Catch-All Filter-Drier** core permits it to collect a large amount of dirt without plug up.

Acid – The **Catch-All Filter-Drier** is unexcelled in acid removal ability. The various organic acids are adsorbed and held by the desiccant in a manner similar to the adsorption of moisture. Tests have demonstrated that the **Catch-All Filter-Drier** has superior acid

SEALED TYPE – LIQUID LINE AND SUCTION LINE SPECIFICATIONS

Tons ▪ °F ▪ psi

c UL us LISTED

"C" SERIES LIQUID LINE TYPE		SUCTION LINE TYPE	CONNECTION SIZE Inches	VOLUME of DESICCANT Cubic Inches	OVERALL LENGTH Inches		SOLDER SOCKET DEPTH Inches	DIAMETER of BODY Inches
SAE FLARE	ODF SOLDER	ODF SOLDER			SAE FLARE	ODF SOLDER		
C-032	C-032-S	—	1/4	3	4.19	3.81	0.38	1.75
—	C-032-CAP C-032-CAP-T	—	Extended 1/4 Male		—	5.81	—	
C-032-F	—	—	1/4 Male - Inlet 1/4 Female - Outlet		3.81	—	—	
C-032-FM	—	—	1/4 Female - Inlet 1/4 Male - Outlet		3.81	—	—	
C-033	C-033-S	—	3/8		4.69	3.88	0.44	
C-052 —	C-052-S C-0525-S	—	1/4 5/16	5	4.75 —	4.19 4.38	0.38 0.44	2.44
C-052-F	—	—	1/4 Male - Inlet 1/4 Female - Outlet		4.19	—	—	
C-052-FM	—	—	1/4 Male - Inlet 1/4 Female - Outlet		4.19	—	—	
C-053	C-053-S	—	3/8		5.19	4.31	0.44	
C-082 — C-083 C-084	C-082-S C-0825-S C-083-S C-084-S	— — C-083-S-T-HH C-084-S-T-HH	1/4 5/16 3/8 1/2	9	5.62 — 6.06 6.31	5.12 5.31 5.25 5.44	0.38 0.44 0.44 0.50	2.62
C-162 — C-163 C-164 C-165 — —	C-162-S C-1625-S C-163-S C-164-S C-165-S — C-167-S	— — — C-164-S-T-HH C-165-S-T-HH C-166-S-T-HH C-167-S-T-HH	1/4 5/16 3/8 1/2 5/8 3/4 7/8	16	6.25 — 6.75 6.94 7.25 — —	5.75 5.94 5.88 6.00 6.31 6.75 6.93	0.38 0.44 0.44 0.50 0.62 0.62 0.75	3.00
C-303 C-304 C-305 — — —	C-303-S C-304-S C-305-S C-306-S C-307-S C-309-S	— — C-305-S-T-HH C-306-S-T-HH C-307-S-T-HH C-309-S-T-HH	3/8 1/2 5/8 3/4 7/8 1-1/8	30	9.69 9.88 10.19 — — —	8.88 9.00 9.25 9.65 9.80 9.75	0.44 0.50 0.62 0.62 0.75 0.96	3.00
C-413 C-414 C-415 — —	— C-414-S C-415-S C-417-S C-419-S	— — — C-417-S-T-HH C-419-S-T-HH	3/8 1/2 5/8 7/8 1-1/8	41	9.56 9.94 10.25 — —	— 9.05 9.35 9.81 9.75	— 0.50 0.62 0.75 0.96	3.50
—	C-607-S C-609-S	C-607-S-T-HH C-609-S-T-HH	7/8 1-1/8	60	—	16.00 16.00	0.75 0.96	3.00

UL and UL_C Listed – Guide SMGT-File No. SA-1756. Maximum Rated Pressure of 650 psig.
No CE marking according to art. 3.3 PED 97/23/EC.

removal ability. This ability, along with its excellent ability to clean up the oil, is responsible for the excellent field performance in cleaning up severely contaminated systems.

Oil, Sludge and Varnish – Even the best refrigeration oils break down to produce varnish, sludge and organic acids. Only the **Catch-All Filter-Drier** is capable of efficiently removing these products of oil decomposition.

Special Applications – A special "HH" core **Catch-All Filter-Drier** is available to remove wax which frequently causes difficulty on low temperature refrigeration systems. For cap tube systems, use the C-032-CAP or C-032-CAP-T Catch-All which has fittings suitable for attaching to any size capillary tube.

Remember...It's the CORE that counts!

SEALED TYPE – LIQUID LINE AND SUCTION LINE SPECIFICATIONS

kW ▪ °C ▪ bar

c UL us LISTED

"C" SERIES LIQUID LINE TYPE		SUCTION LINE TYPE	CONNECTION SIZE Inches	VOLUME of DESICCANT cm3	OVERALL LENGTH mm		SOLDER SOCKET DEPTH mm	DIAMETER of BODY mm
SAE FLARE	ODF SOLDER	ODF SOLDER			SAE FLARE	ODF SOLDER		
C-032	C-032-S	—	1/4	49	106	97	10	44
—	C-032-CAP C-032-CAP-T	—	Extended 1/4 Male		—	148	—	
C-032-F	—	—	1/4 Male - Inlet 1/4 Female - Outlet		97	—	—	
C-032-FM	—	—	1/4 Female - Inlet 1/4 Male - Outlet		97	—	—	
C-033	C-033-S	—	3/8		119	99	11	
C-052	C-052-S	—	1/4	82	121	106	10	62
—	C-0525-S		5/16		—	111	11	
C-052-F	—	—	1/4 Male - Inlet 1/4 Female - Outlet		106	—	—	
C-052-FM	—	—	1/4 Male - Inlet 1/4 Female - Outlet		106	—	—	
C-053	C-053-S	—	3/8		132	109	11	
C-082	C-082-S	—	1/4	147	143	130	10	67
—	C-0825-S	—	5/16		—	135	11	
C-083	C-083-S	C-083-S-T-HH	3/8		154	133	11	
C-084	C-084-S	C-084-S-T-HH	1/2		160	138	13	
C-162	C-162-S	—	1/4	262	159	146	10	76
—	C-1625-S	—	5/16		—	151	11	
C-163	C-163-S	—	3/8		171	149	11	
C-164	C-164-S	C-164-S-T-HH	1/2		176	152	13	
C-165	C-165-S	C-165-S-T-HH	5/8		184	160	16	
—	—	C-166-S-T-HH	3/4		—	171	16	
—	C-167-S	C-167-S-T-HH	7/8		—	176	19	
C-303	C-303-S	—	3/8	492	246	226	11	76
C-304	C-304-S	—	1/2		251	229	13	
C-305	C-305-S	C-305-S-T-HH	5/8		259	235	16	
—	C-306-S	C-306-S-T-HH	3/4		—	245	16	
—	C-307-S	C-307-S-T-HH	7/8		—	249	19	
—	C-309-S	C-309-S-T-HH	1-1/8		—	248	24	
C-413	—	—	3/8	672	243	—	—	89
C-414	C-414-S	—	1/2		252	230	13	
C-415	C-415-S	—	5/8		260	237	16	
—	C-417-S	C-417-S-T-HH	7/8		—	249	19	
—	C-419-S	C-419-S-T-HH	1-1/8		—	248	24	
—	C-607-S	C-607-S-T-HH	7/8	983	—	406	19	76
	C-609-S	C-609-S-T-HH	1-1/8			406	24	

UL and UL_C Listed – Guide SMGT-File No. SA-1756. Maximum Rated Pressure of 44.8 barg.
No CE marking according to art. 3.3 PED 97/23/EC.

SEALED TYPE – LIQUID LINE RATINGS AND SELECTION RECOMMENDATIONS

Tons ▪ °F ▪ psi

TYPE	②SURFACE FILTERING AREA Square Inches	①REFRIGERANT FLOW CAPACITY Tons at 1 psi ΔP
SEALED TYPE		
C-032	9	2.02
C-032-CAP		
C-032-S		
C-032-F		
C-032-FM		
C-033		4.90
C-033-S		5.37
C-052	15	2.89
C-052-S		
C-052-F		
C-052-FM		
C-0525-S		4.76
C-053		5.77
C-053-S		6.52
C-082	21	2.89
C-082-S		
C-0825-S		5.06
C-083		6.36
C-083-S		7.22
C-084		12.2
C-084-S		13.5
C-162	33	2.89
C-162-S		
C-1625-S		5.06
C-163		6.36
C-163-S		7.22
C-164		14.2
C-164-S		15.4
C-165		19.4
C-165-S		22.4
C-303	53	6.37
C-303-S		
C-304		14.2
C-304-S		15.4
C-305		20.9
C-305-S		23.8
C-307-S		30.4
C-414	67	16.1
C-414-S		17.4
C-415		22.3
C-415-S		24.8
C-417-S		31.1
C-419-S		34.3
C-607-S	106	41.1
C-609-S		47.0

kW ▪ °C ▪ bar

TYPE	②SURFACE FILTERING AREA cm^2	①REFRIGERANT FLOW CAPACITY kW at 0.07 bar ΔP
SEALED TYPE		
C-032	58	7.03
C-032-CAP		
C-032-S		
C-032-F		
C-032-FM		
C-033		17.0
C-033-S		18.6
C-052	97	10.0
C-052-S		
C-052-F		
C-052-FM		
C-0525-S		16.5
C-053		20.0
C-053-S		22.7
C-082	135	10.0
C-082-S		
C-0825-S		17.6
C-083		22.1
C-083-S		25.1
C-084		42.4
C-084-S		46.9
C-162	213	10.0
C-162-S		
C-1625-S		17.6
C-163		22.1
C-163-S		25.1
C-164		49.4
C-164-S		53.6
C-165		67.4
C-165-S		77.6
C-303	342	22.1
C-303-S		
C-304		49.4
C-304-S		53.6
C-305		72.5
C-305-S		82.5
C-307-S		105
C-414	432	55.7
C-414-S		60.5
C-415		77.4
C-415-S		86.0
C-417-S		108
C-419-S		119
C-607-S	684	143
C-609-S		163

① Ratings based on 20°F (-5°C) liquid, -20°F (-30°C) evaporator temperature.

② The filtration area is equal to the core surface area plus the large internal surface available for depth filtration.

The variation in flow ratings of filter-driers having the same size core and shell is caused by the difference in connection sizes used.

Catch-All® FILTER-DRIERS CO_2

REPLACEABLE CORE TYPE

ODF SOLDER CONNECTIONS

The rugged construction of the Replaceable Core Catch-All has proven itself in the field for many years. The design features include:

1. The famous **molded porous core** for maximum contaminant removal. The core cannot swell, powder or pack – assuring ease of installation and removal.
2. The **bolt and nut attachment** of the end plate provides simple trouble-free installation.
3. The **internal** construction gives a one piece assembly and assures proper core alignment.

RCW-48

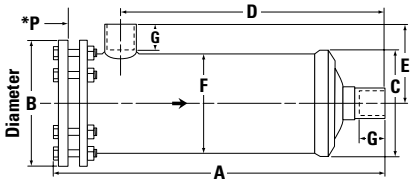
C-969-G

c UL us LISTED

4. A **complete line** of fitting sizes – all with copper fittings.
5. **No plastic parts** are used – all internal parts are plated steel.
6. A **corrosion resistant powder paint** protects the exterior of the shell.

SPECIFICATIONS

TYPE C-R424-G THROUGH C-R427-G
TYPE C-485-G THROUGH C-40033-G
TYPE C-484-P THROUGH C-40016-P



LIQUID LINE - Inches ▪ lb.

TYPE	CONNECTION SIZE Inches ODF Solder	OPTIONAL SECONDARY FILTER **	NO. OF CORES OR FILTER ELEMENTS	CORE PART NUMBER	VOLUME OF DESSICANT Cu. In.	FILTER ELEMENT PART NUMBER	MOUNTING BRACKETS	SHELL DIMENSIONS Inches								SHIPPING WEIGHT lb
								A	B	C	D	E	F	G	*P	
C-R424-G C-R425-G C-R427-G	1/2 5/8 7/8	—	1	RCW-42	42	—	A-175-1	9.00 9.06 9.44	4.75	—	6.76 6.94 7.25	2.81 2.69 3.03	3.50	.50 .62 .75	6.50	6-1/2
C-R420 Series have a maximum rated pressure of 650 psi.																
C-485-G C-487-G C-489-G C-4811-G C-4813-G	5/8 7/8 1-1/8 1-3/8 1-5/8	FS-480	1	RCW-48, RCW-4864, or RC-4864-HH	48	RPE-48-BD	A-685	9.15 9.30 9.50 9.60 9.60	6.00	5.00	5.92 6.07 6.37 6.37 6.37	3.50 3.72 3.78 3.94 3.97	4.75	.50 .75 .91 .97 1.09	7.50	12
C-967-G C-969-G C-9611-G C-9613-G	7/8 1-1/8 1-3/8 1-5/8	FS-960	2		96	RPE-48-BD	A-685	14.84 15.04 15.14 15.14	6.00	5.00	11.61 11.81 11.91 11.91	3.72 3.78 3.94 3.97	4.75	.75 .91 .97 1.09	13.00	16
C-1449-G C-14411-G C-14413-G	1-1/8 1-3/8 1-5/8	FS-1440	3		144	RPE-48-BD	A-685	20.58 20.68 20.68	6.00	5.00	17.45 17.45 17.45	3.94 3.94 3.97	4.75	.97 .97 1.09	18.62	20
C-19211-G C-19213-G C-19217-G	1-3/8 1-5/8 2-1/8	FS-19200	4		192	RPE-48-BD	A-685	26.22 26.22 26.22	6.00	5.00	22.99 22.99 22.43	3.94 3.97 4.65	4.75	.97 1.09 1.38	24.25	23
C-480 through C-19200 Series (including NPT pipe connections) have a maximum rated pressure of 650 psi.																
C-30013-G C-30017-G	1-5/8 2-1/8	—	3	RCW-100, RC-10098, or RC-10098-HH	300	RPE-100	A-175-2	27.83 27.89	7.50	6.25	23.88 24.00	5.12 5.32	6.00	1.12 1.38	25.62	40
C-40017-G C-40021-G C-40025-G C-40029-G C-40033-G	2-1/8 2-5/8 3-1/8 3-5/8 4-1/8	—	4		400	RPE-100	A-175-2	34.42 35.15 34.92 34.92 34.98	7.50	6.25	30.50 30.56 29.81 30.06 29.81	5.31 5.75 5.69 5.75 5.81	6.00	1.38 1.50 1.75 1.53 1.53	32.12	47 47 47 49 49
C-30000 & C-40000 Series (including the C-40016-P) have a maximum rated pressure of 600 psi.																
NPT PIPE CONNECTIONS																
C-484-P C-966-P C-1448-P C-19212-P	1/2 3/4 1 1-1/2	—	1 2 3 4	RCW-48, RC-4864, or RC-4864-HH	48 96 144 192	RPE-48-BD	A-685	9.08 14.67 20.42 25.85	6.00	5.00	5.85 11.44 17.19 22.62	3.41 3.48 3.66 3.76	4.75	—	7.50 13.00 18.62 24.25	12 16 20 23
C-40016-P	2	—	4	RCW-100 RC-10098, or RC-10098-HH	400	RPE-100	A-175-2	34.44	7.50	6.25	30.38	4.38	6.00	—	32.12	51

$_cUL_{US}$ Listed — Guide-SMGT-File No. SA-1756.

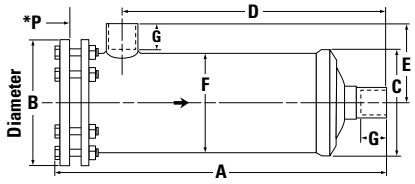
* "P" Dimension is the pull space required to change core.

** Optional Secondary Filter must be purchased separately. O-rings (p/n 621-025) are supplied with each secondary filter, but can be purchased separately. The secondary filter cannot be used if the shell is installed in the suction line.

Type numbers with G suffix indicate that unit is supplied with 1/4" female pipe connection in the end plate and pipe plug. For liquid line service and angle charging valve for system charging purposes can be installed in place of the pipe plug. Angle charging and Schrader type access valves are available from your Sporlan Wholesaler.

SPECIFICATIONS

TYPE C-R424-G THROUGH C-R427-G
TYPE C-485-G THROUGH C-40033-G
TYPE C-484-P THROUGH C-40016-P



LIQUID LINE - mm ▪ kg

TYPE	CONNECTION SIZE Inches ODF Solder	OPTIONAL SECONDARY FILTER **	NO. OF CORES OR FILTER ELEMENTS	CORE PART NUMBER	VOLUME OF DESSICANT cm^3	FILTER ELEMENT PART NUMBER	MOUNTING BRACKETS	SHELL DIMENSIONS mm								SHIPPING WEIGHT kg
								A	B	C	D	E	F	G	*P	
C-R424-G	1/2	—	1	RCW-42	688	—	A-175-1	229	121	—	172	71	71	13	13	3.0
C-R425-G	5/8							230			176	68		16		
C-R427-G	7/8							240			184	77		19		
C-R420 Series have a maximum rated pressure of 44.8 bar.																
C-485-G	5/8	FS-480	1	RCW-48, RCW-4864, or RC-4864-HH	787	RPE-48-BD	A-685	232	152	127	150	89	121	13	191	5.5
C-487-G	7/8							236			154	94		19		
C-489-G	1-1/8							241			162	96		23		
C-4811-G	1-3/8							244			162	100		25		
C-4813-G	1-5/8							244			162	101		28		
C-967-G	7/8	FS-960	2		1573	RPE-48-BD	A-685	377	152	127	295	94	121	19	330	7.3
C-969-G	1-1/8							382			300	96		23		
C-9611-G	1-3/8							385			303	100		25		
C-9613-G	1-5/8							385			303	101		28		
C-1449-G	1-1/8	FS-1440	3		2360	RPE-48-BD	A-685	523	152	127	443	100	121	25	473	9.1
C-14411-G	1-3/8							525			443	100		25		
C-14413-G	1-5/8							525			443	101		28		
C-19211-G	1-3/8	FS-19200	4		3146	RPE-48-BD	A-685	666	152	127	584	100	121	25	616	10.5
C-19213-G	1-5/8							666			584	101		28		
C-19217-G	2-1/8							666			570	118		35		
C-480 through C-19200 Series (including NPT pipe connections) have a maximum rated pressure of 44.8 bar.																
C-30013-G	1-5/8	—	3	RCW-100, RC-10098, or RC-10098-HH	4916	RPE-100	A-175-2	707	191	159	607	130	152	28	651	18.2
C-30017-G	2-1/8							708			610	135		35		
C-40017-G	2-1/8	—	4		6555	RPE-100	A-175-2	874	191	159	775	135	152	35	816	21.4
C-40021-G	2-5/8							893			776	146		38		21.4
C-40025-G	3-1/8							887			757	145		44		21.4
C-40029-G	3-5/8							887			764	146		39		22.3
C-40033-G	4-1/8							888			757	148		39		22.3
C-30000 & C-40000 Series (including the C-40016-P) have a maximum rated pressure of 41.4 bar.																
NPT PIPE CONNECTIONS																
C-484-P	1/2	—	1	RCW-48, RC-4864, or RC-4864-HH	787	RPE-48-BD	A-685	231	152	127	149	87	121	—	191	5.5
C-966-P	3/4		2		1573			373			291	88			330	7.3
C-1448-P	1		3		2360			519			437	93			473	9.1
C-19212-P	1-1/2		4		3146			657			575	96			616	10.5
C-40016-P	2	—	4	RCW-100 RC-10098, or RC-10098-HH	6555	RPE-100	A-175-2	875	191	159	772	111	152	—	816	23.2

$_{C}UL_{US}$ Listed — Guide-SMGT-File No. SA-1756.

* "P" Dimension is the pull space required to change core.

** Optional Secondary Filter must be purchased separately. O-rings (p/n 621-025) are supplied with each secondary filter, but can be purchased separately. The secondary filter cannot be used if the shell is installed in the suction line.

Type numbers with G suffix indicate that unit is supplied with 1/4" female pipe connection in the end plate and pipe plug. For liquid line service and angle charging valve for system charging purposes can be installed in place of the pipe plug. Angle charging and Schrader type access valves are available from your Sporlan Wholesaler.

Catch-All® FILTER-DRIERS CO_2

LIQUID LINE RATINGS and SELECTION RECOMMENDATIONS

Tons ▪ psi ▪ °F

TYPE	②SURFACE FILTERING AREA Square Inches	①REFRIGERANT FLOW CAPACITY Tons at 1 psi ΔP
REPLACEABLE CORE TYPE WITH HIGH WATER CAPACITY CORES (See page 20)		
C-R424-G	67	16.0
C-R425-G		19.1
C-R427-G		26.1
C-485-G	64	20.7
C-487-G		33.7
C-489-G		60.9
C-967-G	128	55.3
C-969-G		68.6
C-1449-G	192	83.6
C-14411-G		94.3
C-19211-G	256	119
C-19213-G		139
C-19217-G		147
C-30013-G	294	123
C-40017-G	392	147

kW ▪ bar ▪ °C

TYPE	②SURFACE FILTERING AREA cm^2	①REFRIGERANT FLOW CAPACITY kW at 0.07 bar ΔP
REPLACEABLE CORE TYPE WITH HIGH WATER CAPACITY CORES (See page 20)		
C-R424-G	432	55.5
C-R425-G		66.4
C-R427-G		90.6
C-485-G	413	72.0
C-487-G		117
C-489-G		211
C-967-G	826	192
C-969-G		238
C-1449-G	1239	290
C-14411-G		327
C-19211-G	1652	412
C-19213-G		484
C-19217-G		509
C-30013-G	1897	431
C-40017-G	2529	516

① Ratings based on 20°F (-5°C) liquid, -20°F (-30°C) evaporator temperature.
② The filtration area is equal to the core surface area plus the large internal surface available for depth filtration.
The variation in flow ratings of filter-driers having the same size core and shell is caused by the difference in connection sizes used.

SUCTION LINE FILTER-DRIER RATINGS

FOR NEW SYSTEMS AND CLEAN-UP AFTER BURNOUT

SELECTION INSTRUCTIONS

The flow capacities are rated at the maximum recommended pressure drop for **permanent** installation.

To ensure the suction line filter-drier has ample contaminant removal ability, selection must be based on flow capacity and the amount of desiccant required for system clean-up. The suction line filter-drier must be large enough to adequately remove acid, moisture and solid contaminants without causing nuisance plug-ups. Sizing is especially important for sealed type suction line filter-driers since they should be sized to clean a small system with one service call.

To reduce the pressure drop through replaceable core shells, substitute cores with filter elements (see page 20) after the system has been cleaned up. The 6171-5 screen should be discarded when cores are replaced with RPE-48-BD elements in RSF shells.

For complete description of the suggested system clean-up procedure, request Bulletin 40-10.

SUCTION LINE FLOW CAPACITY

Tons ▪ psi ▪ °F

EVAPORATOR TEMPERATURE		-20°F	
PRESSURE DROP (psi)		3.0	8.0*
SEALED TYPE	C-083-S-T-HH	4.15	—
	C-084-S-T-HH	4.15	—
	C-144-S-T-HH	4.15	—
	C-145-S-T-HH	7.05	—
	C-146-S-T-HH	9.64	—
	C-147-S-T-HH	10.4	—
	C-149-S-T-HH	13.9	—
	C-164-S-T-HH	5.54	—
	C-165-S-T-HH	6.42	—
	C-166-S-T-HH	8.02	—
	C-167-S-T-HH	9.15	—
	C-305-S-T-HH	6.88	—
	C-306-S-T-HH	8.99	—
	C-307-S-T-HH	10.8	—
	C-309-S-T-HH	11.9	—
	C-417-S-T-HH	12.2	—
	C-419-S-T-HH	12.4	—
	C-437-S-T-HH	16.1	—
	C-439-S-T-HH	20.3	—
	C-4311-S-T-HH	22.3	—
	C-4313-S-T-HH	24.6	—
	C-607-S-T-HH	13.5	—
	C-609-S-T-HH	15.2	—
REPLACEABLE CORE TYPE	RSF-487-T	20.4	35.4
	RSF-489-T	24.6	42.3
	RSF-4811-T	29.9	51.7
	RSF-4813-T	32.2	55.8
	RSF-4817-T	34.8	60.0
	RSF-4821-T	37.5	64.4
	RSF-9611-T	40.7	81.6
	RSF-9613-T	50.9	87.5
	RSF-9617-T	50.9	87.5
	RSF-9621-T	59.1	102
	RSF-9625-T	60.5	104

kW ▪ bar ▪ °C

EVAPORATOR TEMPERATURE		-30°C	
PRESSURE DROP (bar)		0.20	0.55*
SEALED TYPE	C-083-S-T-HH	13.8	—
	C-084-S-T-HH	13.8	—
	C-144-S-T-HH	13.8	—
	C-145-S-T-HH	23.4	—
	C-146-S-T-HH	32.1	—
	C-147-S-T-HH	34.8	—
	C-149-S-T-HH	46.5	—
	C-164-S-T-HH	18.4	—
	C-165-S-T-HH	21.4	—
	C-166-S-T-HH	26.7	—
	C-167-S-T-HH	30.4	—
	C-305-S-T-HH	22.9	—
	C-306-S-T-HH	29.9	—
	C-307-S-T-HH	36.0	—
	C-309-S-T-HH	39.8	—
	C-417-S-T-HH	40.7	—
	C-419-S-T-HH	41.3	—
	C-437-S-T-HH	53.6	—
	C-439-S-T-HH	67.4	—
	C-4311-S-T-HH	74.3	—
	C-4313-S-T-HH	81.8	—
	C-607-S-T-HH	45.0	—
	C-609-S-T-HH	50.5	—
REPLACEABLE CORE TYPE	RSF-487-T	68.0	120
	RSF-489-T	81.8	143
	RSF-4811-T	99.6	175
	RSF-4813-T	107	189
	RSF-4817-T	116	203
	RSF-4821-T	125	218
	RSF-9611-T	135	237
	RSF-9613-T	169	296
	RSF-9617-T	169	296
	RSF-9621-T	197	344
	RSF-9625-T	201	353

*Denotes TEMPORARY INSTALLATION. Cores for system clean-up; RPE-48-BD Filter Elements should be installed after clean-up.
Ratings based on 20°F (-5°C) liquid, 25°F (14°C) superheat.
Rated in accordance with ARI Standard 730.

SIGNIFICANCE OF THE TYPE NUMBER

The letters and numerals in the Catch-All® type number each have a significance. The "C" indicates Catch-All. The **first two or three digits** indicate cubic inches of desiccant. The **last one or two digits** indicate fitting size in eighths of an inch. For sealed models, a **"-S"** following the last digit indicates solder fittings, and **no letter** indicates a flare fitting. Replaceable core models (C-420 and larger) only have solder connections and the "-S" is omitted. Examples are: C-083 is 8 cu. in. and 3/8" flare, C-309-S is 30 cu. in. and 1-1/8" solder, C-19213-G is 192 cu. in. and 1-5/8" solder.

Other suffix letters indicate special qualities. For example:

"-T" indicates a pressure tap consisting of a Schrader type access valve on the inlet end of the Catch-All.

"-HH" indicates a charcoal style core for wax removal and clean-up after a hermetic motor burnout.

"-F" indicates a female flare outlet fitting with a male flare inlet fitting.

"-FM" indicates a female flare inlet fitting with a male flare outlet fitting.

"-CAP" indicates a Catch-All particularly designed for installation on capillary tube systems.

REPLACEABLE CORES AND PLEATED FILTER ELEMENTS – ORDER SEPARATELY

Cores for replaceable core type filter-driers are molded of exactly the same desiccants that are used in the popular sealed filter-driers.

Cores are individually packed in **metal cans**, fully activated and hermetically sealed against moisture and dirt.

Filter Elements are dried and packed in individual sealed metal cans. This method of packaging prevents the element from picking up moisture from the atmosphere.

Detailed **instructions** are printed on each can. Each can contains a **"triple gasket"** consisting of a new end plate gasket, an end plate gasket for certain competitive filter-driers and a core gasket where desired. See the specifications on pages 16 and 17 for the number of cores required for each type drier.

RCW-42 – High Water Capacity Core – Order as separate item – Fits ONLY shell type C-R424, C-R425 and C-R427. **Designed specially for use with POE oils.** This core should be used on systems that have a ruptured water cooled condenser, or that have been exposed to the atmosphere, or for some reason have a high amount of moisture in the system.

RC-4864 – Activated Core – Order as separate item – Fits types C-480 thru C-19200 Series shells and Replaceable Suction Filter (RSF) shells. This is the traditional core suitable for most installations in the liquid or suction line applications in mineral oil systems.

RCW-48 – High Water Capacity Core – Order as separate item – Fits types C-480 thru C-19200 Series shells and Replaceable Suction Filter (RSF) shells. **Designed specially for use with POE oils.** This core should be used on systems that have a ruptured water cooled condenser, or that have been exposed to the atmosphere, or for some reason have a high amount of moisture in the system.

RC-4864-HH – Activated Charcoal Core – Order as separate item – Fits types C-480 thru C-19200 Series shells and Replaceable Suction Filter (RSF) shells. This core should be used for wax removal on low temperature systems, and for clean-up of systems that have had a hermetic motor burnout.

RPE-48-BD – Filter Element – Order as separate item – Fits types C-480 thru C-19200 Series shells and **Replaceable Suction Filter (RSF) shells.** This element should be used in RSF shells installed in the **suction line** to obtain the lowest possible pressure drop. In cleaning up a system after a hermetic motor burnout, cores should be used first. Then after the system is thoroughly clean, this filter element can be installed in the RSF shell.

RC-10098 – Activated Core — Order as separate item—Fits types C-30000 and C-40000 Series shells. This is the traditional core suitable for liquid and suction line applications in mineral oil systems.

RCW-100 – High Water Capacity Core — Order as separate item—Fits types C-30000 and C-40000 Series shells. Designed specially for use with POE lubricants. This core should be used on systems that have a ruptured water cooled condenser, or that have been exposed to the atmosphere, or for some reason have a high amount of moisture in the system.

RC-10098-HH – Activated Charcoal Core — Order as separate item—Fits types C-30000 and C-40000 Series shells. This core should be used for wax removal on low temperature systems, and for clean-up of systems that have had a hermetic motor burnout.

RPE-100 – Filter Element — Order as a separate item—Fits types C-30000 and C-40000 Series shells. This filter element should be used in the suction line to obtain the lowest possible pressure drop after cores were used for system clean-up.

HH STYLE CATCH-ALL FOR WAX REMOVAL

Small amounts of wax are often a problem on **low temperature systems.** Even well engineered systems frequently contain minute quantities of wax which are sufficient to clog expansion valve screens or cause sticking of the valve. Sporlan has developed a special blend of desiccants including activated charcoal which removes small amounts of wax in the liquid line before this wax can cause trouble at the expansion valve. These Catch-All Filter-Driers have been very successful in correcting trouble jobs in the field.

Select an HH Style Catch-All Filter-Drier if wax problems occur on low temperature systems. In addition to their wax removal ability, these filter-driers will remove all of the other harmful contaminants that the standard filter-driers remove. Listed in the table are various Catch-All models that incorporate the HH style core.

TYPE	CONNECTIONS Inches	TYPE	CONNECTIONS Inches
C-052-HH	1/4 SAE Flare	C-303-HH	3/8 SAE Flare
C-082-HH	1/4 SAE Flare	C-304-HH	1/2 SAE Flare
C-083-HH	3/8 SAE Flare	C-304-S-HH	1/2 ODF Solder
C-162-HH	1/4 SAE Flare	C-305-HH	5/8 SAE Flare
C-163-HH	3/8 SAE Flare	C-305-S-HH	5/8 ODF Solder
C-163-S-HH	3/8 ODF Solder	C-414-HH	1/2 SAE Flare
C-164-HH	1/2 SAE Flare	C-415-HH	5/8 SAE Flare
C-164-S-HH	1/2 ODF Solder	C-417-S-HH	7/8 ODF Solder
C-165-HH	5/8 SAE Flare	RC-4864-HH	Replaceable Core
C-165-S-HH	5/8 ODF Solder		

TYPE CO SERIES

FOR TRANSCRITICAL CO_2

Type CO-022-S

The CO Series product offering has been designed to withstand the extreme pressure of transcritical carbon dioxide (R-744) systems while providing complete system protection in a compact design. A unique combination of moisture, acid, and solid debris removal extends the life, reliability, and capacity of these systems that operate under extreme conditions.

The smaller models are ideal for application in vending machine and beverage dispensing equipment. The larger models are ideal for applications up to 10 tons. Combining ideal capability in a compact size, the CO Series enables system optimization while maximizing protection and cost effectiveness. Other fitting sizes are available upon request. Please contact your Sales Engineer for assistance.

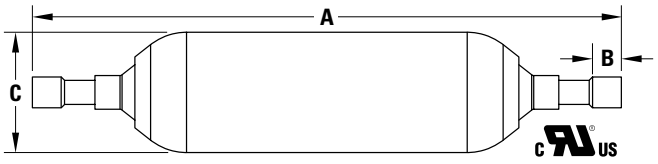
DESIGN FEATURES

- **2,250 psi Maximum Rated Pressure (MRP) (155 bar)**
- **6,750 psi Burst Pressure Rating (465 bar)**
- **cURus Recognized Component in UL File SA1756**
- **Solid copper connections for fast, easy system connection**
- **Desiccants optimized for use with R-744**

DIMENSIONS

TYPE	CONNECTION SIZE ODF Solder - Inches	'A' OVERALL LENGTH Inches (mm)	'B' SOCKET DEPTH Inches (mm)	'C' TYPICAL SHELL DIAMETER Inches (mm)	DROPS OF R-744 WATER CAPACITY @ 140°F (60°C)	R-744 FLOW CAPACITY* Tons (kW)
CO-0115-S	3/16	5.72 (145)	0.20 (5.0)	0.88 (22.4)	30	0.7 (2.5)
CO-012-S	1/4	5.72 (145)	0.25 (6.4)	0.88 (22.4)	30	1.7 (6.0)
CO-022-S	1/4	6.25 (159)	0.25 (6.4)	1.25 (31.8)	60	2.3 (8.0)
CO-082-S	1/4	10.94 (278)	0.25 (6.4)	2.38 (61)	200	2.7 (8.4)
CO-085-S	5/8	10.94 (278)	0.50 (12.7)	2.38 (61)	200	9.8 (34)

*Flow ratings based on 20°F (-5°C) liquid, -20°F (-29°C) evaporator, 1 psi (0.07 bar) differential pressure.



BALL VALVES CO_2

EBV and EBVT SERIES (WITH ACCESS FITTING)

- **Welded body joint.** Factory tested to ensure positive, leak-free performance. Forged brass body construction with extended copper fittings and optional access fittings.
- **Full size ports for unrestricted flow** on most sizes 1/4" (6 mm) through 2-1/8" (54 mm).
- **Dual Teflon seals surround the polished, brass ball to prevent leakage.** Stem seal and stem washer provide the primary stem seal. Bottom load stem for safety.
- **Stainless steel stop plate** ensures fully open to fully closed with a 1/4 turn.
- **Ball internal relief port design** ensures positive shut-off in either flow direction, even during system evacuation.
- **All EBV(T) ball valves are bi-directional** and may be installed in any position.
- **Full refrigeration service temperature range: -40°F to +325°F (-40°C to +149°C).**
- **Design working pressure: 700 psig (49 bar).**
- **U.L. Listed File No. SA13413 (SFJQ)**
- **Suitable for subcritical CO_2 up to 700 psig (49 bar).**
- **Date code stamped** into valve body Yr/Mo/Day

Type EBVT

SPECIFICATIONS

Inches

VALVE TYPE	VALVE TYPE WITH ACCESS FITTING	CONNECTION (ODF)	OVERALL LENGTH 'D'	SOCKET DEPTH 'B'	'L'	OVERALL HEIGHT 'M'	PORT SIZE 'C'	MOUNTING HOLES 'E'	MOUNTING HOLE SIZE 'H'	Cv	WEIGHT EBV & EBVT (lbs.)
EBV-1020**	EBVT-1020**	1/4	6.50	0.31	0.63	2.14	0.50	0.79	#8-36 UNF	2.1	0.725
EBV-1030	EBVT-1030	3/8	6.50	0.31	0.63	2.14	0.50	0.79	#8-36 UNF	4.3	0.725
EBV-1040	EBVT-1040	1/2	6.50	0.38	0.63	2.14	0.50	0.79	#8-36 UNF	7.0	0.725
EBV-1050	EBVT-1050	5/8	6.50	0.50	0.63	2.14	0.50	0.79	#8-36 UNF	13.9	0.725
EBV-1060	EBVT-1060	3/4	7.25	0.62	0.83	2.63	0.75	1.26	#8-36 UNF	21.0	1.375
EBV-1070	EBVT-1070	7/8	7.25	0.75	0.83	2.63	0.75	1.26	#8-36 UNF	30.3	1.405
EBV-1090	EBVT-1090	1-1/8	8.50	0.91	1.00	2.98	1.00	1.57	#10-32 UNF	61.3	2.10
EBV-1110	EBVT-1110	1-3/8	9.25	0.97	1.22	3.70	1.25	1.89	#10-32 UNF	85.2	3.36
EBV-1130	EBVT-1130	1-5/8	10.00	1.09	1.53	4.29	1.50	2.36	1/4-28 UNF	212	5.39
EBV-1170	EBVT-1170	2-1/8	11.38	1.34	1.87	5.18	2.00	2.95	1/4-28 UNF	285	10.09
EBV-1210	EBVT-1210	2-5/8	14.37	1.47	2.36	6.06	2.50	2.95	1/4-28 UNF	301	19.25
EBV-1250	EBVT-1250	3-1/8	16.54	1.66	2.81	7.01	3.15	4.10	5/16-24 UNF	420	40.13
EBV-2210*	EBVT-2210*	2-5/8	12.88	1.47	1.87	5.18	2.00	2.95	1/4-28 UNF	238	11.11
EBV-2250*	EBVT-2250*	3-1/8	14.37	1.66	2.36	6.06	2.50	2.95	1/4-28 UNF	324	19.25

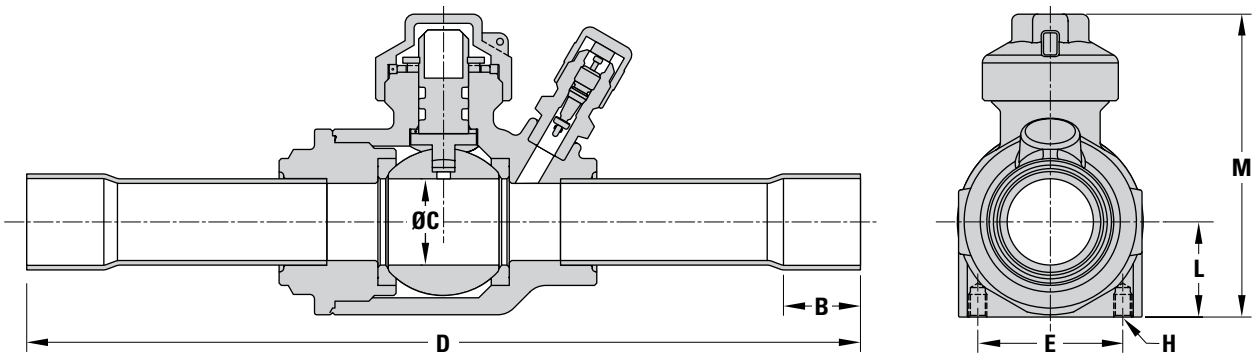
* Reduced port and not a stock item. Minimum order quantity may be required.
** EBV-1020 and EBVT-1020 are not stock items. Minimum order quantity is required.

mm

VALVE TYPE	VALVE TYPE WITH ACCESS FITTING	CONNECTION (ODF)	OVERALL LENGTH 'D'	SOCKET DEPTH 'B'	'L'	OVERALL HEIGHT 'M'	PORT SIZE 'C'	MOUNTING HOLES 'E'	MOUNTING HOLE SIZE 'H'	Kv	WEIGHT EBV & EBVT (lbs.)
EBV-6MM**	EBVT-6MM**	6	165.10	8.00	16.00	54.36	12.70	20.07	#8-36 UNF	1.80	0.725
EBV-10MM	EBVT-10MM	10	165.10	8.00	16.00	54.36	12.70	20.07	#8-36 UNF	3.67	0.725
EBV-12MM	EBVT-12MM	12	165.10	10.00	16.00	54.36	12.70	20.07	#8-36 UNF	5.97	0.725
EBV-16MM	EBVT-16MM	16	165.10	13.00	16.00	54.36	12.70	20.07	#8-36 UNF	11.86	0.725
EBV-18MM	EBVT-18MM	18	184.15	17.00	21.08	66.80	19.05	32.00	#8-36 UNF	17.93	1.375
EBV-22MM	EBVT-22MM	22	184.15	20.00	21.08	66.80	19.05	32.00	#8-36 UNF	25.86	1.405
EBV-28MM	EBVT-28MM	28	215.90	24.00	25.40	75.69	25.40	39.88	#10-32 UNF	52.29	2.10
EBV-35MM	EBVT-35MM	35	234.95	25.00	31.00	93.98	31.75	48.01	#10-32 UNF	72.68	3.36
EBV-42MM	EBVT-42MM	42	254.00	28.00	38.86	108.97	38.10	59.94	1/4-28 UNF	181.18	5.39
EBV-54MM	EBVT-54MM	54	289.50	35.00	47.50	131.57	50.80	74.93	1/4-28 UNF	242.85	10.09
EBV-64MM	EBVT-64MM	64	365.00	35.00	60.00	153.92	63.50	74.93	1/4-28 UNF	256.16	19.25
EBV-76MM	EBVT-76MM	76	420.00	38.00	72.00	178.30	80.00	104.00	5/16-24 UNF	256.16	19.25
EBV-64MM*	EBVT-64MM*	64	327.15	35.00	47.50	131.57	50.80	74.93	1/4-28 UNF	202.59	11.11
EBV-76MM*	EBVT-76MM*	76	365.00	38.00	60.00	153.92	63.50	74.93	1/4-28 UNF	276.71	19.25

* Reduced port and not a stock item. Minimum order quantity may be required.
** EBV-6MM and EBVT-6MM are not stock items. Minimum order quantity is required.

SPECIFICATIONS (CONTINUED)



IDENTIFICATION

NOMENCLATURE - Inches

Example: EVBT-1030

EBV	T	–	1	03	0
Valve Type	Access Fitting		**Series:** 1 = Full Port 2 = Reduced Port	**Fitting Size:** (In eighths of an inch) ie: 03 = 3/8"	**Fitting Configuration:** 0 = ODF x ODF

NOMENCLATURE - mm

Example: EVBT-10mm

EBV	T	–	10MM	R	
Valve Type	Access Fitting		**Metric Fitting Size**	Reduced Port	**Fitting Configuration:** ODF x ODF

For more information on Sporlan EBV Ball Valves, please refer to Bulletin 50-10.

See•All® MOISTURE AND LIQUID INDICATOR CO_2

8 OUTSTANDING BENEFITS

1. **The See•All Moisture and Liquid Indicator provides a true moisture indication for refrigerants.** The dark green indicates dry and a bright yellow indicates wet. The one indicator avoids the confusion found in models with two elements. You **cannot** pick the wrong element when checking the moisture content of the system.
2. **Reliable and accurately calibrated color change points.** The **See•All Moisture and Liquid Indicator** is accurately calibrated in parts per million of moisture for each refrigerant. All moisture indicators change color on the basis of relative saturation of the refrigerant. Therefore, liquid line temperature must be considered if an accurate calibration is to be obtained. For easy comparison, a color chart is part of the label.
3. **Color changes are easily distinguished and reversible.** The indicator's color differs so widely between WET and DRY conditions that there is no possibility of confusion between the two. Colors will reverse as often as moisture concentration in the system changes.
4. **Large full view sight glass.** The **See•All Moisture and Liquid Indicator** has an extra large crystal clear sight glass for viewing the refrigerant. Bubbles indicate a shortage of refrigerants or a restriction in the liquid line.
5. **Indicator protected from discoloration and dirt.** The indicator is protected by a filter pad and screen. This prevents washing of the indicator by the refrigerant and protects it from system contamination and turbulence.
6. **Replaceable indicator element.** The color indicator paper can be changed on the new fused glass models without removing the **See•All** from the line. Replacement is through the bottom (see SA-14SU below). Request the K-SA-4 kit.
7. **Disassembly of the smaller sizes not required.** The extended fittings on solder models in the smaller sizes make it unnecessary to disassemble for installation.
8. **A double duty plastic cap** is supplied to keep the glass free from dust, dirt and grease. It also permits the service engineer to use his own discretion concerning instructions to his customers on observing the **See•All Moisture and Liquid Indicator.**


SA-13FM


SA-14U


SA-14UU


SA-13FU


SA-14SU


SA-13S


SA-213

SPECIFICATIONS

Inches

Listed by Underwriters' Laboratories, Inc. – Guide SEYW – File No. SA3182

CONNECTION SIZES Inches	MALE FLARE		FEMALE & MALE FLARE		MALE FLARE x SWIVEL NUT		SWIVEL NUT x SWIVEL NUT		FEMALE FLARE x SWIVEL NUT		SWIVEL NUT x ODF SOLDER		ODF SOLDER	
	TYPE NO.	OVERALL LENGTH Inches	TYPE NO.	OVERALL LENGTH Inches	TYPE NO.	OVERALL LENGTH Inches	TYPE NO.	OVERALL LENGTH Inches	TYPE NO.	OVERALL LENGTH Inches	TYPE NO.	OVERALL LENGTH Inches	TYPE NO.	OVERALL LENGTH Inches
1/4	**SA-12**	2.87	**SA-12FM**	2.56	—	—	—	—	—	—	—	—	**SA-12S**	4.62
3/8	**SA-13**	3.37	**SA-13FM**	2.97	**SA-13U**	3.64	**SA-13UU**	3.95	**SA-13FU**	3.19	**SA-13SU**	4.19	**SA-13S**	
1/2	**SA-14**	3.81	**SA-14FM**	3.44	**SA-14U**	4.13	**SA-14UU**	4.50	**SA-14FU**	3.75	**SA-14SU**	4.62	**SA-14S**	4.87
5/8	**SA-15**	4.13	—	—	**SA-15U**	4.44	**SA-15UU**	4.75	—	—	**SA-15SU**	4.89	**SA-15S**	
7/8	—	—	—	—	—	—	—	—	—	—	—	—	**SA-17S**	6.31
1-1/8	—	—	—	—	—	—	—	—	—	—	—	—	**SA-19S**	
1-3/8	—	—	—	—	—	—	—	—	—	—	—	—	①**SA-211**	7.97
1-5/8	—	—	—	—	—	—	—	—	—	—	—	—	①**SA-213**	

mm

CONNECTION SIZES Inches	MALE FLARE		FEMALE & MALE FLARE		MALE FLARE x SWIVEL NUT		SWIVEL NUT x SWIVEL NUT		FEMALE FLARE x SWIVEL NUT		SWIVEL NUT x ODF SOLDER		ODF SOLDER	
	TYPE NO.	OVERALL LENGTH mm	TYPE NO.	OVERALL LENGTH mm	TYPE NO.	OVERALL LENGTH mm	TYPE NO.	OVERALL LENGTH mm	TYPE NO.	OVERALL LENGTH mm	TYPE NO.	OVERALL LENGTH mm	TYPE NO.	OVERALL LENGTH mm
1/4	**SA-12**	72.9	**SA-12FM**	65.0	—	—	—	—	—	—	—	—	**SA-12S**	117
3/8	**SA-13**	85.6	**SA-13FM**	75.4	**SA-13U**	92.5	**SA-13UU**	100	**SA-13FU**	81	**SA-13SU**	106	**SA-13S**	
1/2	**SA-14**	96.8	**SA-14FM**	87.4	**SA-14U**	105	**SA-14UU**	114	**SA-14FU**	95.3	**SA-14SU**	117	**SA-14S**	124
5/8	**SA-15**	105	—	—	**SA-15U**	113	**SA-15UU**	121	—	—	**SA-15SU**	124	**SA-15S**	
7/8	—	—	—	—	—	—	—	—	—	—	—	—	**SA-17S**	160
1-1/8	—	—	—	—	—	—	—	—	—	—	—	—	**SA-19S**	
1-3/8	—	—	—	—	—	—	—	—	—	—	—	—	①**SA-211**	202
1-5/8	—	—	—	—	—	—	—	—	—	—	—	—	①**SA-213**	

Maximum Rated Pressure for all models is 650 psig (44.8 barg). Overall width is: 1.31" (33.3 mm) for 1/4" and 3/8" sizes. 1.58" (40.1 mm) for 1/2" and 5/8 sizes, and 1.38" (35.1 mm) for 7/8" and 1-1/8" sizes. Most solder connections can be used as male fittings as well as female fittings. The 1/4" ODF is 3/8" ODM, the 3/8" ODF is 1/2" ODM, the 1/2" ODF is 5/8" ODM, and the 5/8" ODF is 3/4" ODM. Models with female flare and/or swivel nut connections are supplied with a copper gasket in the fitting.

① These models have copper connections and feature a removable element cartridge – for replacement cartridge specify AC-20.

REPLACEABLE *Suction Filters* CO_2

The Replaceable Suction Filter shell, used with RPE-48-BD pleated filter element, is designed to be installed in the suction line of new systems to remove circulating contaminants.

RSF-4817-T

DESIGN BENEFITS

- **High flow capacity**
- **Corrosion resistant coating on shell**
- **Can be used with desiccant cores for clean-up after burnout**
- **Various fitting sizes up to 1-5/8" line size**
- **Access valve supplied for pressure drop measurement or charging**

HOW IT'S USED

Sporlan Replaceable Suction Filters are installed in the suction line of refrigeration or air conditioning systems to remove contaminants that may be in the system at startup.

The Replaceable Suction Filter has large fittings permitting the use of a small shell on a system with large line sizes, resulting in considerable economy. The angle construction is suitable of flow in either direction, which results in easy installation even on compact racks.

The Replaceable Suction Filters should be used with cores for cleaning up a system after a hermetic motor burnout. Select the RC-4864, RC-4864-HH or RCW-48 replaceable cores. After cleanup, install RPE-48-BD elements in the shells.

FLOW CAPACITY SELECTION

This table below gives information for choosing the proper model for a given system. The filter elements are supplied in hermetically sealed metal cans. **For flow capacity WITH CORES, see page 19.**

Tons ▪ psi ▪ °F

TYPE	CONNECTIONS Inches ODF SOLDER	FLOW CAPACITY EVAPORATOR TEMPERATURE -20°F PRESSURE DROP – psi 1	2	3	NUMBER OF FILTER ELEMENTS	FILTER AREA Square Inches	OVERALL LENGTH Inches
RSF-487-T	7/8	12.6	18.5	23.2	One RPE-48-BD	388	9.30
RSF-489-T	1-1/8	19.8	29.0	36.4			9.37
RSF-4811-T	1-3/8	29.2	42.9	53.8			9.60
RSF-4813-T	1-5/8	36.3	53.4	67.0			9.60
RSF-4817-T	2-1/8	48.6	71.4	89.5			9.37
RSF-4821-T	2-5/8	64.1	94.2	118			9.75
RSF-9611-T	1-3/8	31.3	46.1	57.7	Two RPE-48-BD	776	15.14
RSF-9613-T	1-5/8	41.8	61.4	76.9			15.14

kW ▪ bar ▪ °C

TYPE	CONNECTIONS Inches ODF SOLDER	FLOW CAPACITY EVAPORATOR TEMPERATURE 5°C PRESSURE DROP – bar 0.07	0.14	0.20	NUMBER OF FILTER ELEMENTS	FILTER AREA cm^2	OVERALL LENGTH mm
RSF-487-T	7/8	43.1	63.4	77.3	One RPE-48-BD	2503	236
RSF-489-T	1-1/8	67.6	99.3	121			238
RSF-4811-T	1-3/8	99.7	147	179			244
RSF-4813-T	1-5/8	124	183	223			244
RSF-4817-T	2-1/8	166	244	298			238
RSF-4821-T	2-5/8	219	322	393			248
RSF-9611-T	1-3/8	107	157	192	Two RPE-48-BD	5006	385
RSF-9613-T	1-5/8	143	210	256			385

Ratings based on 20°F (-5°C) liquid, 25°F (14°C) superheat.
Listed by Underwriters' Laboratories, Inc. Guide SMGT File No. SA-1756. RSF shells have a 500 psig (34.5 barg) M.R.P. rating.
Note: Ratings are in accordance with ARI Standards 730. Flow capacity (tons/kW) with cores is approximately 40% of the above values.

ELECTRIC VALVES CO_2

ELECTRIC EXPANSION VALVES
TYPE SER

The Sporlan SER family of Electric Expansion Valves are electronically operated bipolar stepper motor valves. When paired with an appropriate controller and sensors, the valves provide precise liquid flow control in subcritical CO_2 applications. With high resolution linear actuators and uniquely characterized pin and port combinations, the valves can control down to 10% of rated (full stroke) capacity. The entire valve family now features removable M12 cables, that can be installed in any of four orientations, and are available in four lengths between 10' (3 m) and 40' (12 m).

Small SER valves (up to SER-C) are rated 1,015 psig (70 bar). SER-D and larger valves are approved for a rated pressure of 700 psig (48 bar).

For more information on Sporlan SER valves, please reference Bulletin 100-20.

FLOW CAPACITY (FULL STROKE)

VALVE TYPE	Tons	kW	Cv_{US}	Kv
SER-AA	1.08	3.74	0.02	0.02
SER-A	2.32	8.08	0.05	0.04
SER-B	4.47	15.5	0.10	0.08
SER-C	12.1	42.1	0.33	0.28
SER-DS	24.7	85.7	0.59	0.50
SERI-F	36.4	127	0.66	0.57
SERI-G(S)	47.4	165	0.73	0.63
SERI-J(S)	85.3	296	1.31	1.13
SERI-K(S)	155	537	2.38	2.05
SERI-L(S)	210	730	5.79	4.99

CONNECTIONS*

VALVE TYPE	INLET (ODF)	OUTLET (ODF)	CONFIGURATION	
			ANGLE	STRAIGHT THROUGH OFFSET
SER-AA	3/8	3/8, 1/2, 5/8	X	–
	10 mm	12 mm		
SER-A	3/8	3/8, 1/2, 5/8	X	–
	10 mm	12 mm		
SER-B	3/8	3/8, 1/2, 5/8	X	–
	10 mm	12 mm		
SER-C	3/8	3/8, 1/2, 5/8	X	–
	1/2	1/2, 5/8		
	10 mm	12 mm		
SER-DS	1/2	1/2, 5/8, 7/8, 1-1/8	–	X
	5/8	5/8, 7/8, 1-1/8		
SERI-F	5/8	5/8, 7/8	X	–
	7/8	7/8, 1-1/8		
SERI-G(S)	5/8	5/8, 7/8	X	X
	7/8	7/8, 1-1/8, 1-3/8		
SERI-J(S)	7/8	7/8, 1-1/8, 1-3/8	X	X
	1-1/8	1-1/8, 1-3/8		
SERI-K(S)	1-1/8	1-1/8, 1-3/8, 1-5/8	X	X
	1-3/8	1-5/8		
SERI-L(S)	1-1/8	1-1/8,1-3/8, 1-5/8	X	X
	1-3/8	1-3/8, 1-5/8		

*Currently available, other combinations may be possible upon request.

CAPACITY CORRECTION FACTORS

Tons ▪ psi ▪ °F

LIQUID TEMPERATURE (°F)				
0°	10°	20°	30°	40°
CORRECTION FACTOR, LIQUID CAPACITY RATING				
1.12	1.06	1.00	0.93	0.86

PRESSURE DROP ACROSS VALVE** – psi						
100	150	200	250	300	350	400
.82	1.00	1.15	1.29	1.41	1.53	1.63

kW ▪ bar ▪ °C

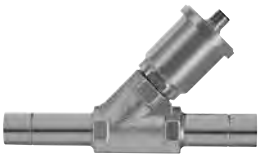
LIQUID TEMPERATURE (°C)				
-15°	-10°	-5°	0°	5°
CORRECTION FACTOR, LIQUID CAPACITY RATING				
1.12	1.06	1.00	0.93	0.86

PRESSURE DROP ACROSS VALVE** – bar						
7.0	10.5	14.0	17.5	21.0	24.5	28.0
0.82	1.00	1.15	1.29	1.41	1.53	1.63

**Excluding distributor and high side losses.

ELECTRIC PRESSURE REGULATING VALVES

TYPE CDS



The Sporlan CDS family of Electric Pressure Regulating Valves are electronically operated bipolar stepper motor valves. When paired with an appropriate controller and sensor, the valves provide precise temperature or pressure control in liquid or suction subcritical CO_2 applications.

With high resolution linear actuators and balanced pistons, the CDS family can provide accuracy and repeatability across the entire operating range, down to 10% of full stroke capacity. Rated 48 bar (700 psig), the small CDS valves (CDS-2, -4 and -7) now feature removable M12 cables that can be installed in any of four orientations. Rated 680 psig (47 bar), the large CDS valves (-9 and -17) feature hermetic cables that are available in four lengths, from 10' (3 m) to 40' (12 m).

With 17 years of field proven reliability, Sporlan CDS valves can be counted on to meet your performance expectations. For more information, please reference Bulletin 100-40.

CONNECTIONS*

VALVE TYPE	PRESSURE TAP	AVAILABLE FITTINGS ODF – Inches
CDS-2	–	1/2, 5/8, 7/8
CDST-2	X	
CDS-4	–	1/2, 5/8, 7/8
CDST-4	X	
CDS-7	–	5/8, 7/8, 1-1/8, 1-3/8
CDST-7	X	
CDS-9	–	5/8, 7/8, 1-1/8, 1-3/8
CDST-9	X	
CDS-17	–	1-1/8, 1-3/8, 2-1/8
CDST-17	X	

*Currently available, other combinations may be possible upon request.

SUCTION CAPACITY (FULL STROKE)

Tons ▪ psi ▪ °F

TYPE	Cv_{US}	ALLOWABLE PRESSURE DROP ACROSS VALVE – psi				
		0.5	1	3	5	10
CDS(T)-2	1.37	0.87	1.22	2.07	2.64	3.69
CDS(T)-4	2.97	1.83	2.57	4.39	5.64	7.92
CDS(T)-7	8.11	5.14	7.11	11.9	15.1	20.9
CDS(T)-9	11.5	7.68	10.7	18.0	22.9	31.8
CDS(T)-17	20.9	13.7	19.1	32.3	41.2	57.4

kW ▪ bar ▪ °C

TYPE	Kv	ALLOWABLE PRESSURE DROP ACROSS VALVE – bar				
		0.03	0.06	0.20	0.40	0.70
CDS(T)-2	1.17	2.99	4.18	7.46	10.4	13.7
CDS(T)-4	2.53	6.27	8.81	15.9	22.3	29.3
CDS(T)-7	6.91	17.7	24.4	42.9	59.4	77.1
CDS(T)-9	9.81	26.4	36.6	64.9	90.1	118
CDS(T)-17	17.8	47.2	65.7	117	162	212

SUCTION CAPACITY CORRECTION FACTORS

Tons ▪ psi ▪ °F

LIQUID TEMPERATURE (°F)				
0°	10°	20°	30°	40°
CORRECTION FACTOR, LIQUID CAPACITY RATING				
1.09	1.05	1.00	0.95	0.90

EVAPORATOR TEMPERATURE (°F)			
-40	-20	0	20
0.83	1.00	1.18	1.38

kW ▪ bar ▪ °C

LIQUID TEMPERATURE (°C)				
-15°	-10°	-5°	0°	5°
CORRECTION FACTOR, LIQUID CAPACITY RATING				
1.08	1.04	1.00	0.96	0.91

EVAPORATOR TEMPERATURE (°C)			
-35	-25	-15	-5
0.85	1.00	1.16	1.33

LIQUID CAPACITY (FULL STROKE)

Tons ▪ psi ▪ °F

TYPE	Cv_{US}	ALLOWABLE PRESSURE DROP ACROSS VALVE – psi				
		0.5	1	3	5	10
CDS(T)-2	1.37	4.03	5.63	10.1	14.1	18.4
CDS(T)-4	2.97	8.65	12.1	21.9	30.7	40.4
CDS(T)-7	8.11	22.8	31.5	55.3	76.5	99.4
CDS(T)-9	11.5	34.7	48.2	85.3	119	155
CDS(T)-17	20.9	62.6	87.1	155	215	281

kW ▪ bar ▪ °C

TYPE	Kv	ALLOWABLE PRESSURE DROP ACROSS VALVE – bar				
		0.03	0.06	0.20	0.40	0.70
CDS(T)-2	1.17	13.9	19.4	34.6	48.4	63.3
CDS(T)-4	2.53	29.8	41.8	75.4	106	139
CDS(T)-7	6.91	78.3	108	190	263	342
CDS(T)-9	9.81	119	166	294	408	532
CDS(T)-17	17.8	215	300	532	741	968

LIQUID CAPACITY CORRECTION FACTORS

Tons ▪ psi ▪ °F

LIQUID TEMPERATURE (°F)				
0°	10°	20°	30°	40°
CORRECTION FACTOR, LIQUID CAPACITY RATING				
1.12	1.06	1.00	0.94	0.88

kW ▪ bar ▪ °C

LIQUID TEMPERATURE (°C)				
-15°	-10°	-5°	0°	5°
CORRECTION FACTOR, LIQUID CAPACITY RATING				
1.11	1.05	1.00	0.94	0.88

ELECTRIC PRESSURE REGULATING VALVES

TYPE GC AND FGB FOR TRANSCRITICAL CO_2

The Sporlan GC and FGB valve families are stepper motor driven pressure regulating valves designed specifically for transcritical CO_2 (R-744) refrigeration systems. The GC family is designed for application as a Gas Cooler valve, but can also be applied as a Flash Gas Bypass valve. The FGB family is designed to extend the capacity range of the GC valves when applied as Flash Gas Bypass valves. Both families are rated for 2030 psi (140 bar) maximum working pressure. Offered with a PSD4 Interface Board and PSS4B Backup Power Module, the GC/FGB valves are easy to implement.

FEATURES

- **High resolution actuators with 2500 steps**
- **Uniquely characterized pin and port combinations for excellent low flow control**
- **Cartridge valve designs with interchangeable bodies**
- **Tight seating capability**
- **Replaceable / serviceable screens**

For more information on Sporlan Transcritical CO_2 valves, including sizing information for Flash Gas Bypass applications, please refer to Bulletin 100-80.

GAS COOLER VALVE CAPACITIES

Tons ▪ psi ▪ °F

TYPE	Cv_{US}	51°F	59°F	100°F
		ALLOWABLE PRESSURE DROP ACROSS VALVE – psi(g)		
		650	725	1450
GC-10	0.19	9.5	6.2	6.6
GC-20	0.55	21.6	14.1	16.6
GC-30	1.69	80.2	52.5	61.9
GC-40	3.24	154	101	111
GC-50	4.80	226	148	163

kW ▪ bar ▪ °C

TYPE	Kv	10°C	15°C	38°C
		ALLOWABLE PRESSURE DROP ACROSS VALVE – bar(g)		
		44	50	100
GC-10	0.16	35.5	21.9	23.3
GC-20	0.48	75.8	49.6	58.4
GC-30	1.46	282	185	218
GC-40	2.80	542	355	390
GC-50	4.15	795	520	572

ELECTRIC VALVE INTERFACE BOARDS

TYPE IB

The Sporlan IB series Interface Boards are designed to translate a 0-10V or 4-20mA signal from an externally supplier controller into a proportional valve position. This signal can correlate to pressure, temperature, superheat or any other system variable that is being controlled by an electric valve. This is the most straightforward implementation of Sporlan SER or CDS valves using third party controllers, without the setup and qualification required to ensure reliable valve response. The 3" (76.2 mm) square board can be mounted using non-metallic standoffs, or with the supplied snap-track.

For more information on Sporlan Interface Boards, please refer to Bulletin 100-50-2.

ELECTRIC VALVE CONTROLS

TYPE KELVIN II

Sporlan offers a variety of standalone electric valve controls, each targeted at precise control of a refrigeration or air conditioning system parameter. Utilizing unique control algorithms, the Kelvin II Series of controls features flexibility for a variety of applications, and can be paired with the proper Sporlan subcritical CO_2 Electric Valve to meet the system requirements. The controls also feature RS-485 communications to enable remote monitoring, or to tie into a higher level system controller.

For more information on Sporlan Kelvin II Series of controls, please refer to Bulletin 100-50-5, or the I/O Manuals in the 100-50-5 series.

ELECTRIC VALVE SERVICE TOOL

TYPE SMA-12

The Sporlan SMA-12 (Stepper Motor Actuator) is a service tool designed to help diagnose systems with Electric Valves by verifying proper operation of the stepper motor. The unit is powered by two 9V alkaline batteries, and will power any SER or CDS 12VDC bipolar stepper motor valve. The step rate is selectable at 1, 50, 100 or 200 steps per second, and will stroke the valve in both the opening and closing directions. Red LEDs indicate continuity of the motor windings and battery power, and binding posts are provided for quick connection of valve cables. In the event of a controller failure, the SMA-12 can be used to manually position a valve to maintain performance until service can be completed. The SMA-12 is the basic troubleshooting tool for Electric Valve operated systems.

ITEM NUMBER	DESCRIPTION	CONNECTOR
953276	SMA-12	Binding Post
953277	SMA-12 w/Pigtail	Delphi Packard Weather Pack, 12034342
953229	SMA-12 w/Pigtail	Phoenix Contact 1803442

REFRIGERATION CONTROLLERS

TYPE PSK

Sporlan PSK electronic controllers manage low and medium temperature self contained refrigeration units by controlling compressors, defrost, lights and fans. There are several models to choose from, ranging from simple logic and wiring (for base compressor and defrost control) to models with multiple I/O and evaporator fan management (for complex compressor, defrost and fan control).

For more information on Sporlan PSK Refrigeration Controllers, please refer to Form 100-359, or the I/O Manuals in the 100-50-6 series.

OIL LEVEL CONTROL SYSTEM CO_2

Sporlan's Oil Level Control System Components were developed to offer the refrigeration industry an oil level control system of the highest quality. The heart of the system is the Oil Level Control which when matched with the Oil Reservoir and Oil Differential Check Valve maintains a minimum oil level in the compressor crankcase during all phases of system operation.

OIL RESERVOIRS

Sporlan oil reservoirs are holding vessels for stand-by oil necessary for the operation of a commercial refrigeration or air conditioning system. The oil reservoir is shipped with service valves so the vessel can be isolated from the rest of the system.

FEATURES AND BENEFITS

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- **High flow capacity**
- **Corrosion resistant coating on shell**
- **Sightglass ports with float ball indicators for oil level monitoring**
- **3/8" male flare rotalock valves shipped with oil reservoir allow for easy adjustment when piping into system**
- **3/8" male flare vent port – for connection to the suction line**
- **Mounting studs and brackets**
- **Powder coating passes 500 hour ASTM salt spray**
- **UL Listed SORT/SORT7 for the USA and Canada with a Maximum Rated Pressure (MRP) of 500 psi (34 bar)**

Type POR

MODEL NO.	TOTAL CAPACITY Gallons	'A' CAPACITY Gallons	'B' CAPACITY Gallons	NUMBER of SIGHT-GLASSES	LENGTH Inches	SHELL DIAMETER Inches
POR-2	2	3/4	3/4	2	18	6.0
POR-3	3	3/4	1-1/2	3	23	6.0
POR-4	4	3/4	2-3/4	3	36	6.0

'A' capacity is the capacity to the first sightglass.
'B' capacity is the capacity **between** the two sightglasses for the POR-2 and the **top** and **bottom** sightglasses for the POR-3 and POR-4.

OIL DIFFERENTIAL CHECK VALVE

TYPES OCV-5, -10, -20 and -30

The Sporlan Oil Level Differential Check Valve (OCV) is installed on the 3/8" SAE fitting on top of the OR-1-1/2, and allows pressure to be relieved from the reservoir to the suction as required to maintain a pressure in the reservoir at a preset level above the suction pressure. The pressure differential created by the OCV assures oil flow from the reservoir to the Oil Level Control providing there is adequate oil in the reservoir.

The OCV will only relieve pressure from the reservoir in excess of its fixed set point. Systems with fluctuating suction pressure as a result of compressor unloaders, staging or other suction line controls must be fitted with an OCV with a differential greater than the suction pressure fluctuation to assure oil flow from the oil reservoir through the oil level control to the compressor crankcase.

Sporlan offers OCVs with a 5, 10, 20 and 30 psi fixed differential setting. However, Sporlan recommends the use of an OCV-20 or OCV-30 on all field built up applications.

OIL LEVEL CONTROLS

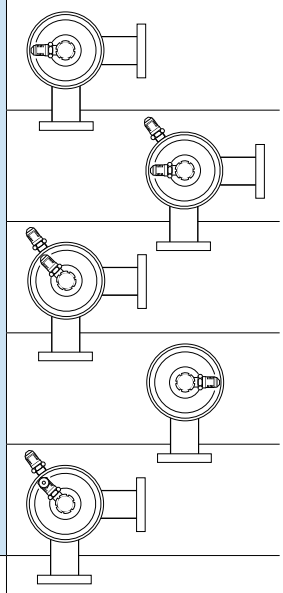
The purpose of the Sporlan Oil Level Control is to regulate the flow of oil to the compressor crankcase to maintain a minimum oil level as specified by the compressor manufacturer for any given application. The Oil Level Control is adjustable between 1/2 sightglass and 1/4 sightglass at any pressure differential between 5 and 90 psid. As the level of oil is lowered in the compressor crankcase by being pumped out, the float of the Oil Level Control is lowered and opens a needle valve allowing oil to flow from the oil reservoir to the compressor crankcase.

OL-60FH

c UL us

UL Recognized under SA5460-SFJQ2/SFJQ8 with a Maximum Rated Pressure (MRP) of 650 psi (45 bar).

OIL LEVEL CONTROLS – SELECTION AND SPECIFICATIONS

MODEL NUMBER	PRODUCT TYPE	FLANGE TYPE	COMPRESSOR MANUFACTURER and MODEL	CONFIGURATION TOP VIEW
OL-60CH	90 psi Max Differential	7 bolt hole universal flange	See page 31 for compressor adaptor requirements.	
OL-60XH				
OL-60FH				
OL-60HH-6				
OL-60NH-2				
S-OL	Sightglass	Included with adaptor kits on page 31 (except AOL-R) or may be purchased separately.		

UL Listed under SFJQ-SA5460 with a Maximum Rated Pressure (MRP) of 650 psi (44.8 barg).
For complete information see your Sporlan Wholesaler, our website at www.sporlanonline.com, or write Sporlan and request Bulletins 110-10 and 110-11.

OIL LEVEL CONTROL SYSTEM CO_2

COMPRESSOR ADAPTOR REQUIREMENTS

COMPRESSOR MANUFACTURER	COMPRESSOR MODEL NUMBER	COMPRESSOR ATTACHMENT PATTERN	SPORLAN ADAPTOR KIT NUMBER	SEALING METHOD	SIGHTGLASS
Bitzer	2KC, 2JC, 2HC, 2GC, 2 FC, 2EC, 2DC, 2CC, 4FC, 4EC, 4DC, 4CC	1-1/8" Thread	AOL-MA/TE	Use seal provided	Use sightglass provided with adaptor
	4VC, 4TC, 4PC, 4NC	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	None	Use seal provided	Use sightglass from compressor
	4J, 4H, 4G, 6J, 6H, 6G, 6F	4 Bolt, 50 mm B.C.	None	Use seal provided with control	Use sightglass from compressor
	8GC, 8FC	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
Bock	F...	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
Carrier	06EA, 06ER	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
	06DA, 06DR, 5F, 5H	1-1/2" – 18 Thread	AOL-C		Use sightglass provided with adaptor
Copeland	Over 5 Ton	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
	Under 5 HP ①	1-1/8" – 12 Thread	AOL-A	Use seal from compressor	Use sightglass provided with adaptor
	8R, 3D Front, 2D, 4D, 6D	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
	8D	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	Use control with standard length arms with AOL-R-1 adaptor. Use sightglass from compressor		
Dorin	4 cyc-15 HP	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	Contact Sporlan		
Dunham-Bush	Big 4	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
Frascold	All models	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
Maneurop	MT..., LT...	1-1/8" – 18 Thread	AOL-MA/TE	Use seal provided	Use sightglass provided with adaptor
Tecumseh	P, R, S, PA, RA, SA, CK, CM, CH, CG	1-1/8" – 12 Thread	AOL-A	Use seal from compressor	Use sightglass provided with adaptor
	—	1-1/8" – 18 Thread	AOL-MA/TE	Use seal provided	
	VS	3/4" – 14 Thread	AOL-K-1	Use seal provided	
Trane	M, R	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
	K	3/4" NPT	AOL-K-1	Use Teflon tape	Use sightglass provided with adaptor
York	GC, GS, JS	3 Bolt, 1-7/8" B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor

NOTE: Shipping weight is 4 lbs. (1.8 Kg) for oil level controls and 1 lb. (0.45 Kg) for adaptors.

① Some compressor models have a smaller diameter port than the arm diameter of the oil level control. This situation can mislead the control in the amount of oil that is actually in the compressor. It is advisable the selection and adjustment of the control be reviewed in this situation.

For complete information see your Sporlan Wholesaler, our website at www.sporlanonline.com, or write Sporlan and request Bulletins 110-10 and 110-11.

OIL LEVEL CONTROL SYSTEM CO_2

OF SERIES OIL FILTERS

DESIGN BENEFITS

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- **Virtually eliminates the need for oil changes due to suspended particulate in circulation**
- **Unsurpassed filtering efficiency**
  99% removal of 3 micron sized particles
  98% removal of 2 micron sized particles
- **Element utilizes a pleated design for maximum surface area**
- **Unsurpassed filtration capacities**
- **High flow capacities with low pressure drop**
- **Filter element utilizes an O-ring seal**
- **Inert microglass filter material ensures lubricant compatibility**
- **Dimensions allow for easy replacement of current filter**
- **UL Listed under SA1756-SMGT/SMGT7 for the USA and Canada with a Maximum Rated Pressure (MRP) of 650 psi (45 bar)**

The Sporlan Catch-All or SF-283-F Suction Filter has been used for many years as an oil filter in refrigeration rack systems with mineral or alkylbenzene oil.

With the use of the new polyolester (POE) oils, system chemistry changed. Unlike mineral and alkylbenzene oils, POE oil has solvent-like tendencies. POE oil has the ability to suspend and recirculate small, solid contaminants left from system installation or retrofit. Analysis of POE oil samples taken from actual systems have shown the oil to suspend and recirculate a high concentration of 2-20 micron sized particles, with the largest percentage between 2-10 microns. Although some particles are smaller than bearing tolerances, studies have shown bearing life can still be affected. Bearing wear depends upon the size, hardness, and concentration of particles in circulation. To effectively remove these small particles, Sporlan developed a new type of oil filter.

The OF Series Oil Filters are designed to be 99% efficient in removing 3 micron sized particles and yet have sufficient flow capacity at a low pressure drop. The unsurpassed filtration ability of the oil filters will assure clean POE, mineral or alkylbenzene oil is returned to the compressors. Clean oil ensures proper operation of the oil level control and minimizes compressor wear. The Sporlan OF Series Oil Filters were designed to virtually eliminate the need for oil changes resulting from suspended solid contaminants in circulation.

SPECIFICATIONS

UNIT	DESCRIPTION	CONNECTIONS	FILTERING AREA Square Inches (Square cm)	OVERALL LENGTH Inches (mm)	SHELL DIAMETER Inches (mm)	UL RATED WORKING PRESSURE psi (bar)
OF-303	Oil Filter	3/8" SAE Flare	325 (2100)	9.69 (246)	3.00 (76)	650 (45)
OF-303-BP	Oil Filter with Bypass Feature			10.63 (270)		
OF-303-T	Oil Filter with Access Fitting			9.62 (244)		
ROF-413-T	Replaceable Oil Filter	Field Support		8.77 (223)	3.50 (89)	

Note: The OF Series Oil Filters are not suitable for use on ammonia systems.

For complete information see your Sporlan Wholesaler, our website at www.sporlanonline.com, or write Sporlan and request Bulletin 110-10.

PRESSURE TEMPERATURE CHART CO_2

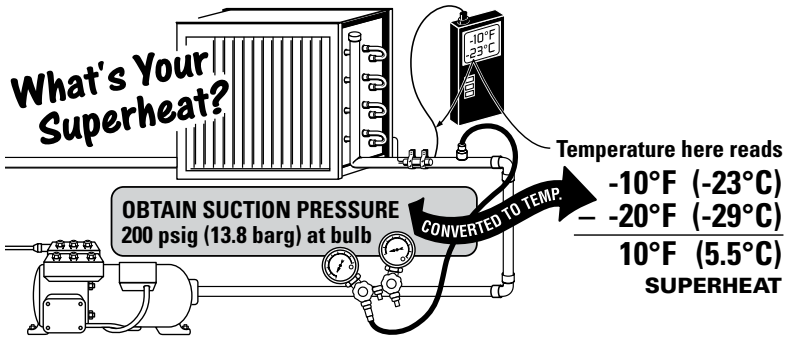
REFRIGERANT 744

At Sea Level

psig	barg	Temperature		psig	barg	Temperature	
		°F	°C			°F	°C
80	5.5	-59.9	-51.1	320	22.1	5.4	-14.8
85	5.9	-57.7	-49.8	335	23.1	8.1	-13.3
90	6.2	-55.5	-48.6	350	24.1	10.7	-11.8
95	6.6	-53.4	-47.4	365	25.2	13.3	-10.4
100	6.9	-51.3	-46.3	380	26.2	15.7	-9.0
105	7.2	-49.4	-45.2	400	27.6	18.9	-7.3
110	7.6	-47.5	-44.1	420	29.0	21.9	-5.6
115	7.9	-45.6	-43.1	440	30.3	24.9	-3.9
120	8.3	-43.8	-42.1	460	31.7	27.8	-2.4
125	8.6	-42.0	-41.1	480	33.1	30.5	-0.8
130	9.0	-40.3	-40.2	500	34.5	33.2	0.7
135	9.3	-38.7	-39.3	525	36.2	36.5	2.5
140	9.7	-37.0	-38.4	550	37.9	39.6	4.2
145	10.0	-35.5	-37.5	575	39.6	42.7	5.9
150	10.3	-33.9	-36.6	600	41.4	45.6	7.6
155	10.7	-32.4	-35.8	625	43.1	48.5	9.2
160	11.0	-30.9	-35.0	650	44.8	51.3	10.7
165	11.4	-29.5	-34.1	675	46.5	54.0	12.2
170	11.7	-28.0	-33.4	700	48.3	56.6	13.7
175	12.1	-26.6	-32.6	725	50.0	59.2	15.1
180	12.4	-25.3	-31.8	750	51.7	61.7	16.5
185	12.8	-23.9	-31.1	775	53.4	64.1	17.8
190	13.1	-22.6	-30.3	800	55.2	66.5	19.2
195	13.4	-21.3	-29.6	825	56.9	68.8	20.4
200	13.8	-20.1	-28.9	850	58.6	71.1	21.7
205	14.1	-18.8	-28.2	875	60.3	73.3	22.9
210	14.5	-17.6	-27.5	900	62.1	75.4	24.1
220	15.2	-15.2	-26.2	925	63.8	77.5	25.3
230	15.9	-12.9	-24.9	950	65.5	79.6	26.4
240	16.5	-10.6	-23.7	975	67.2	81.6	27.6
250	17.2	-8.4	-22.4	1000	68.9	83.6	28.7
260	17.9	-6.3	-21.3				
275	19.0	-3.2	-19.5				
290	20.0	-0.2	-17.9				
305	21.0	2.7	-16.3				

At Altitude – 5,000 ft. (1,524 m) Above Sea Level

psig	barg	Temperature		psig	barg	Temperature	
		°F	°C			°F	°C
80	5.5	-61.1	-51.7	320	22.1	5.0	-15.0
85	5.9	-58.8	-50.4	335	23.1	7.7	-13.5
90	6.2	-56.6	-49.2	350	24.1	10.3	-12.0
95	6.6	-54.4	-48.0	365	25.2	12.9	-10.6
100	6.9	-52.3	-46.9	380	26.2	15.3	-9.3
105	7.2	-50.3	-45.7	400	27.6	18.5	-7.5
110	7.6	-48.4	-44.7	420	29.0	21.6	-5.8
115	7.9	-46.5	-43.6	440	30.3	24.5	-4.1
120	8.3	-44.7	-42.6	460	31.7	27.4	-2.5
125	8.6	-42.9	-41.6	480	33.1	30.2	-1.0
130	9.0	-41.2	-40.7	500	34.5	32.9	0.5
135	9.3	-39.5	-39.7	525	36.2	36.2	2.3
140	9.7	-37.8	-38.8	550	37.9	39.3	4.1
145	10.0	-36.2	-37.9	575	39.6	42.4	5.8
150	10.3	-34.7	-37.0	600	41.4	45.4	7.4
155	10.7	-33.1	-36.2	625	43.1	48.2	9.0
160	11.0	-31.6	-35.4	650	44.8	51.0	10.6
165	11.4	-30.2	-34.5	675	46.5	53.7	12.1
170	11.7	-28.7	-33.7	700	48.3	56.4	13.5
175	12.1	-27.3	-33.0	725	50.0	58.9	15.0
180	12.4	-25.9	-32.2	750	51.7	61.4	16.4
185	12.8	-24.6	-31.4	775	53.4	63.9	17.7
190	13.1	-23.3	-30.7	800	55.2	66.3	19.0
195	13.4	-22.0	-30.0	825	56.9	68.6	20.3
200	13.8	-20.7	-29.3	850	58.6	70.8	21.6
205	14.1	-19.4	-28.6	875	60.3	73.1	22.8
210	14.5	-18.2	-27.9	900	62.1	75.2	24.0
220	15.2	-15.8	-26.5	925	63.8	77.3	25.2
230	15.9	-13.4	-25.2	950	65.5	79.4	26.3
240	16.5	-11.1	-24.0	975	67.2	81.4	27.5
250	17.2	-8.9	-22.7	1000	68.9	83.4	28.6
260	17.9	-6.8	-21.6				
275	19.0	-3.7	-19.8				
290	20.0	-0.7	-18.2				
305	21.0	2.2	-16.6				



Example: Refrigerant 744 at Sea Level

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1. Terms and Conditions. Seller's willingness to offer Products, or accept an order for Products, to or from Buyer is subject to these Terms and Conditions or any newer version of the terms and conditions found on-line at www.parker.com/saleterms/. Seller objects to any contrary or additional terms or conditions of Buyer's order or any other document issued by Buyer.

2. Price Adjustments; Payments. Prices stated on Seller's quote or other documentation offered by Seller are valid for 30 days, and do not include any sales, use, or other taxes unless specifically stated. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2010). Payment is subject to credit approval and is due 30 days from the date of invoice or such other term as required by Seller's Credit Department, after which Buyer shall pay interest on any unpaid invoices at the rate of 1.5% per month or the maximum allowable rate under applicable law.

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 placement of the products with the shipment carrier at Seller's facility. Unless otherwise stated, Seller may exercise its judgment in choosing the carrier and means of delivery. No deferment 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 acts or omissions.

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. 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 DESIGN, 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 30 days after delivery. Buyer shall notify Seller of any alleged breach of warranty within 30 days after the date 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 an amount due on any invoice) must be commenced within 12 months from the date of the breach without regard to the date breach is discovered.

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 WRITTEN CONSENT, EVEN IF SELLER HAS BEEN NEGLIGENT, 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. 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.

8. 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, will be considered obsolete and may be destroyed by Seller after two consecutive years have elapsed without Buyer ordering the items 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.

9. 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.

10. 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.

11. 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.

12. 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.

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

14. Force Majeure. Seller does not assume the risk and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation: accidents, strikes or labor disputes, acts of any government or government agency, acts of nature, delays or failures in delivery from carriers or suppliers, shortages of materials, or any other cause beyond Seller's reasonable control.

15. 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.

16. Termination. Seller may terminate this agreement for any reason and at any time by giving Buyer thirty (30) days written notice of termination. Seller may immediately terminate this agreement, in writing, if Buyer: (a) commits a breach of any provision of this agreement (b) appointments a trustee, receiver or custodian for all or any part of Buyer's property (c) files a petition for relief in bankruptcy on its own behalf, or by a third party (d) makes an assignment for the benefit of creditors, or (e) dissolves or liquidates all or a majority of its assets.

17. 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.

18. 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.

19. 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 sale. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter are herein merged.

20. Compliance with Law, U. K. Bribery Act and U.S. Foreign Corrupt Practices Act. Buyer agrees to comply with all applicable laws and regulations, including both those of the United Kingdom and the United States of America, and of the country or countries of the Territory in which Buyer may operate, including without limitation the U. K. Bribery Act, the U.S. Foreign Corrupt Practices Act ("FCPA") and the U.S. Anti-Kickback Act (the "Anti-Kickback Act"), and agrees to indemnify and hold harmless Seller from the consequences of any violation of such provisions by Buyer, its employees or agents. Buyer acknowledges that they are familiar with the provisions of the U. K. Bribery Act, the FCPA and the Anti-Kickback Act, and certifies that Buyer will adhere to the requirements thereof. In particular, Buyer represents and agrees that Buyer shall not make any payment or give anything of value, directly or indirectly to any governmental official, any foreign political party or official thereof, any candidate for foreign political office, or any commercial entity or person, for the purpose of influencing such person to purchase products or otherwise benefit the business of Seller.

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