



# Rapid Cycle

BULLETIN 230-10-1  
February 2005  
Supersedes April 2000

## SOLENOID VALVES

NOT FOR USE WITH HAZARDOUS OR CORROSIVE FLUIDS

Sporlan Rapid Cycle Solenoid Valves are designed for applications that require a solenoid valve to cycle frequently in a short period to maintain very close temperatures. An environmental test chamber using a mechanical refrigeration system is the most common application of rapid cycle solenoid valves. When rapid cycling a standard solenoid valve, typical failures are knocking out the enclosing tube top plug, cracking the enclosing tube, and mushrooming the plunger at the point of impact. Damage to the plunger is caused by the plunger striking the bottom of the top plug with considerable force each time the valve is cycled.

Developing a way to reduce the impact between the plunger and the top plug is an obvious design target. One way to accomplish this is through the use of a low force coil. By applying a low force coil on a standard valve, the impact force is reduced since the low force coil has less pulling power.

Sporlan developed the rapid cycle solenoid valve as a better means of reducing the impact between plunger and top plug and the associated premature failures. The rapid cycle series valves, can operate at a 250 psi maximum operating pressure differential (MOPD) on AC voltage and are suitable for either liquid or vapor refrigerant flow.

### CONSTRUCTION

When comparing a rapid cycle valve with a standard valve, several design changes can be observed. The changes that increase the cycle life are as follows:

**Enclosing Tube** — The enclosing tube is extended and the enclosing tube magnetic top plug is eliminated. This design changes the direction of magnetic pull on the plunger before it hits the top of the enclosing tube.

**Plunger** — A hammer blow plunger replaces the standard plunger and is used to assist in lifting the plunger stem off the pilot port. To further decrease the force of impact between the plunger and the enclosing tube, a synthetic bumper is added to the top of the plunger.

**Coil** — An OMKC coil is used to allow the coil to “sit” further down on the enclosing tube. This slows the plunger once it accelerates across the coil center line.

NOTE: Even though the rapid cycle valve uses an OMKC coil, they are **normally closed** valves.

### RAPID CYCLE SOLENOID

### STANDARD SOLENOID

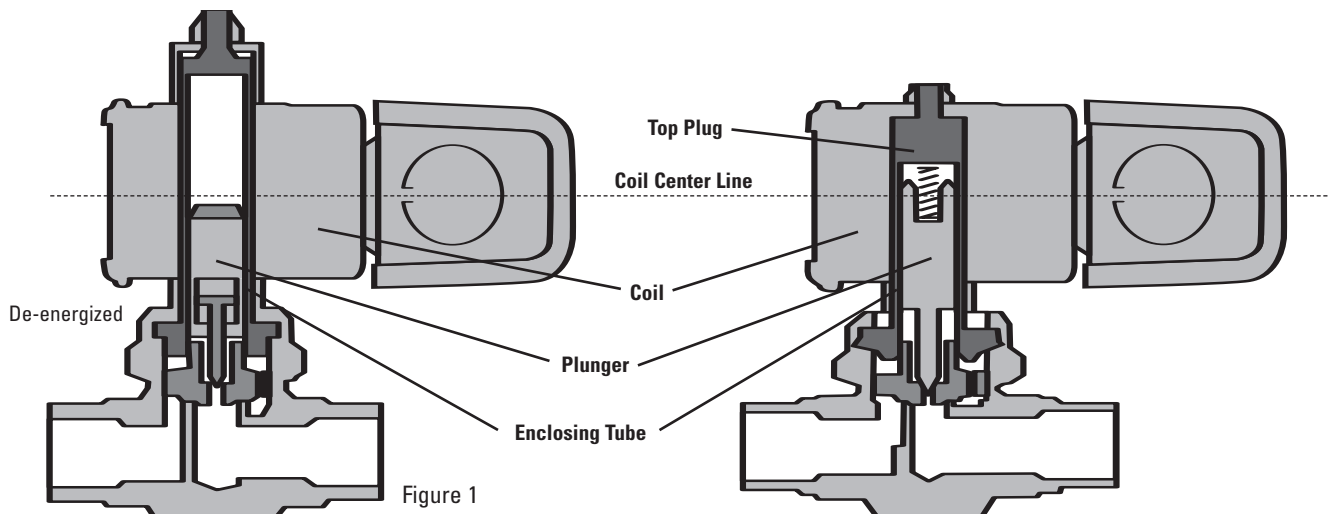


Figure 1

### OPERATION

The operation of a rapid cycle valve is slightly different from a standard valve. When a standard valve is energized, the top plug creates a magnetic force that helps pull up the plunger. As mentioned, this top plug is eliminated on rapid cycle valves, see Figure 1. Therefore, the magnetic field created by the coil is the only pulling force acting on the plunger.

Notice that the plunger shown in Figure 1 is in a de-energized position and is below the coil center line. Energizing

the coil creates a magnetic field that pulls the plunger toward the center of the field or the coil center line. As soon as the midpoint of the plunger accelerates across the coil center line, the magnetic field acts against plunger travel and causes the plunger to slow. This, along with the nylon bumper on top of the plunger, decreases the impact between the plunger and the top of the enclosing tube. It is the combination of these two design features that increases the solenoid valve cycle life.

### CAPACITY RATINGS

Listed below are the capacity ratings for each valve series using Refrigerants 22, 134a, 401A, 402A, 404A, 407C, 502 and 507. As with all standard Sporlan Solenoid Valves, Rapid Cycle Valve selection should be based on **valve capacity** and not **line size**.

CAPACITY - TONS OF REFRIGERATION												
REFRIGERANT	VALVE	LIQUID Pressure Drop - psi*					DISCHARGE GAS Pressure Drop - psi					
		1	2	3	4	5	2	5	10	25	50	100
22	XWG	0.44	0.62	0.76	0.89	0.99	0.12	0.19	0.28	0.31	0.39	0.42
	XXF	1.14	1.64	2.03	2.36	2.66	0.31	0.50	0.71	1.00	1.29	1.47
	XUP	2.88	4.05	4.94	5.69	6.35	0.84	1.31	1.85	3.10	3.89	4.15
	XRN	4.69	6.61	8.09	9.32	10.4	1.35	2.13	3.00	4.65	6.20	7.71
	XRM	9.13	12.9	15.8	18.2	20.3	2.62	4.13	5.83	9.73	12.8	15.5
	XPO	13.9	19.8	24.2	28.0	31.4	3.93	6.24	8.84	14.4	19.1	23.4
134a	XWG	0.41	0.58	0.71	0.83	0.93	0.10	0.16	0.23	0.24	0.27	0.27
	XXF	1.07	1.53	1.90	2.20	2.48	0.25	0.41	0.59	0.78	0.94	0.95
	XUP	2.68	3.77	4.61	5.31	5.92	0.70	1.09	1.54	2.39	2.70	2.70
	XRN	4.38	6.17	7.54	8.69	9.71	1.12	1.77	2.50	3.72	4.75	5.30
	XRM	8.51	12.0	14.7	17.0	18.9	2.17	3.43	4.84	7.73	9.65	10.3
	XPO	13.0	18.4	22.6	26.1	29.2	3.26	5.17	7.34	11.5	14.5	15.8
401A	XWG	0.44	0.62	0.77	0.89	0.99	0.10	0.17	0.23	0.25	0.28	0.28
	XXF	1.15	1.65	2.04	2.37	2.66	0.26	0.42	0.60	0.81	0.97	0.99
	XUP	2.88	4.05	4.95	5.70	6.36	0.72	1.12	1.58	2.46	2.79	2.79
	XRN	4.70	6.63	8.10	9.34	10.4	1.16	1.82	2.56	3.83	4.90	5.49
	XRM	9.14	12.9	15.8	18.2	20.4	2.23	3.52	4.97	7.95	9.96	10.6
	XPO	14.0	19.8	24.3	28.1	31.4	3.35	5.31	7.53	11.8	15.0	16.3
402A	XWG	0.29	0.41	0.50	0.58	0.65	0.11	0.17	0.24	0.28	0.35	0.40
	XXF	0.75	1.08	1.34	1.55	1.75	0.27	0.44	0.63	0.89	1.16	1.39
	XUP	1.90	2.67	3.26	3.76	4.19	0.73	1.14	1.60	2.76	3.55	3.99
	XRN	3.09	4.36	5.33	6.15	6.87	1.18	1.85	2.61	4.09	5.52	7.05
	XRM	6.02	8.49	10.4	12.0	13.4	2.28	3.59	5.07	8.59	11.5	14.3
	XPO	9.20	13.0	16.0	18.5	20.7	3.43	5.45	7.73	12.7	17.1	21.5
404A	XWG	0.29	0.41	0.50	0.58	0.65	0.11	0.17	0.25	0.28	0.36	0.40
	XXF	0.75	1.08	1.34	1.56	1.75	0.28	0.45	0.64	0.91	1.18	1.40
	XUP	1.91	2.68	3.27	3.77	4.21	0.75	1.17	1.65	2.82	3.60	3.99
	XRN	3.11	4.38	5.35	6.17	6.89	1.21	1.90	2.68	4.19	5.64	7.16
	XRM	6.04	8.52	10.4	12.0	13.4	2.34	3.69	5.21	8.79	11.7	14.5
	XPO	9.20	13.1	16.0	18.5	20.7	3.52	5.59	7.93	13.0	17.4	21.8
407C	XWG	0.40	0.57	0.70	0.81	0.91	0.12	0.19	0.27	0.30	0.38	0.40
	XXF	1.05	1.51	1.86	2.17	2.43	0.30	0.49	0.71	0.98	1.26	1.41
	XUP	2.65	3.73	4.55	5.24	5.85	0.83	1.30	1.83	3.05	3.78	3.98
	XRN	4.32	6.09	7.44	8.58	9.58	1.34	2.10	2.97	4.58	6.08	7.50
	XRM	8.39	11.8	14.5	16.7	18.7	2.59	4.08	5.76	9.57	12.6	15.0
	XPO	12.8	18.2	22.3	25.8	28.8	3.88	6.17	8.74	14.2	18.7	22.7
502	XWG	0.28	0.40	0.50	0.57	0.64	0.10	0.16	0.22	0.25	0.31	0.34
	XXF	0.74	1.07	1.32	1.53	1.72	0.25	0.40	0.57	0.80	1.04	1.20
	XUP	1.87	2.63	3.20	3.69	4.12	0.66	1.04	1.46	2.49	3.14	3.41
	XRN	3.04	4.29	5.24	6.05	6.75	1.07	1.69	2.38	3.71	4.97	6.24
	XRM	5.92	8.35	10.2	11.8	13.2	2.08	3.28	4.63	7.77	10.3	12.6
	XPO	9.04	12.8	15.7	18.2	20.3	3.13	4.97	7.05	11.5	15.3	19.0
507	XWG	0.28	0.40	0.49	0.57	0.64	0.11	0.17	0.24	0.27	0.35	0.39
	XXF	0.74	1.06	1.31	1.52	1.71	0.27	0.44	0.63	0.88	1.16	1.37
	XUP	1.87	2.62	3.20	3.69	4.12	0.73	1.14	1.60	2.75	3.52	3.92
	XRN	3.04	4.28	5.24	6.04	6.75	1.18	1.85	2.61	4.09	5.50	6.99
	XRM	5.91	8.34	10.2	11.8	13.2	2.28	3.59	5.07	8.56	11.4	14.2
	XPO	9.01	12.8	15.7	18.1	20.3	3.43	5.45	7.72	12.7	17.0	21.3

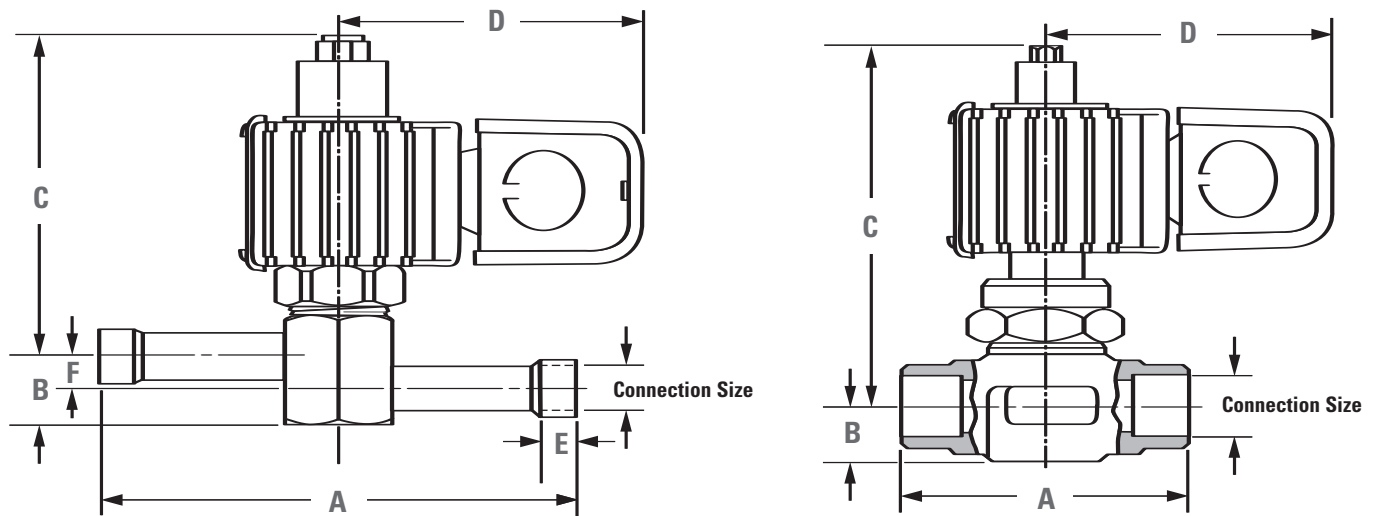
\* Do not use below 1 psi, except XWG.

Liquid capacities shown in the above table are based on 40°F evaporating and 100°F liquid temperature.

Discharge capacities based on 100°F condensing and 40°F evaporator temperature. Valve inlet conditions are based on 40°F evaporator, 65°F suction gas, isentropic compression plus 50°F.

LIQUID TEMPERATURE CORRECTION FACTORS (°F)											
REFRIGERANT	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°
22	1.26	1.22	1.18	1.13	1.09	1.05	1.00	0.95	0.91	0.86	0.81
134a	1.32	1.27	1.22	1.17	1.11	1.06	1.00	0.94	0.88	0.83	0.76
401A	1.27	1.22	1.18	1.14	1.09	1.05	1.00	0.95	0.90	0.85	0.80
402A	1.43	1.36	1.30	1.23	1.15	1.08	1.00	0.92	0.83	0.74	0.63
404A	1.45	1.38	1.31	1.23	1.16	1.08	1.00	0.92	0.83	0.73	0.63
407C	1.34	1.29	1.23	1.18	1.12	1.06	1.00	0.94	0.87	0.80	0.72
502	1.39	1.33	1.27	1.20	1.13	1.07	1.00	0.93	0.86	0.79	0.71
507	1.43	1.36	1.29	1.22	1.15	1.08	1.00	0.92	0.83	0.73	0.61

**SPECIFICATIONS**



SPECIFICATIONS							DIMENSIONS - Inches					
VALVE TYPE	MODIFICATION of	PORT SIZE Inches	MOPD	REPLACEMENT PARTS KITS	CONNECTION SIZE Inches	COIL SIZE	A	B	C	D	E	F
											Extended End Connections ONLY	
XWG	E3S130	0.075	250	N/A	3/8 ODF Extended	OMKC-1	4.63	.46	2.61	2.89	.31	.19
XXF	E6S130	0.115	250	KS-XUP/XXF			4.63	.72	2.94	2.89	.31	.31
XUP	E6S130	6/32	250				4.63	.72	2.94	2.89	.31	.31
XRN	B9S2	9/32	250	KS-XRN	1/2 ODF	OMKC-2	2.88	.56	3.64	3.17	-	-
XRN-1	E9S230		250		3/8 ODF Extended		4.63	.81	3.57	3.17	.31	.38
XRM**	B14S2	14/32	250	KS-XRM	5/8 ODF		3.00	.56	4.00	3.17	-	-
XRM-1	E14S250		250		5/8 ODF Extended		6.88	.47	4.00	3.17	.50	-
XPO-1	B19S2	19/32	250	KS-XPO	7/8 ODF	3.88	.81	4.19	3.17	-	-	
XPO-3	E19S270		250		7/8 ODF Extended	7.13	.81	4.19	3.17	.75	-	

\*\*Standard replacement for XRM-3.  
MRP for all valves is 500 psi.

**INSTALLATION / SERVICE**

The installation and field service instructions in Bulletin 30-11 for all Sporlan solenoid valves also apply to the rapid cycle series. However, rapid cycle solenoid valves **MUST BE INSTALLED IN HORIZONTAL LINES WITH THE COIL HOUSING NO MORE THAN 45 DEGREES FROM VERTICAL.**

**COIL KITS**

COIL KITS			
VALVE SERIES	COIL SIZE	WATTS	RATING VOLTS/CYCLES
XUP XWG XXF	OMKC-1	10	24/50-60
			120/50-60
			208-240/50-60
XRN XRM XPO	OMKC-2	15	24/50-60
			120/50-60
			208-240/50-60
			Dual 120-208-240/50-60

Other AC voltages and cycles available on special order. When ordering any Coil Kit, specify coil size, voltage and cycles.

**Example: OMKC-2-120/50-60**



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