
SERIES 98

PNEUMATIC SCOTCH YOKE ACTUATOR

TECHNICAL MANUAL



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THE HIGH PERFORMANCE COMPANY

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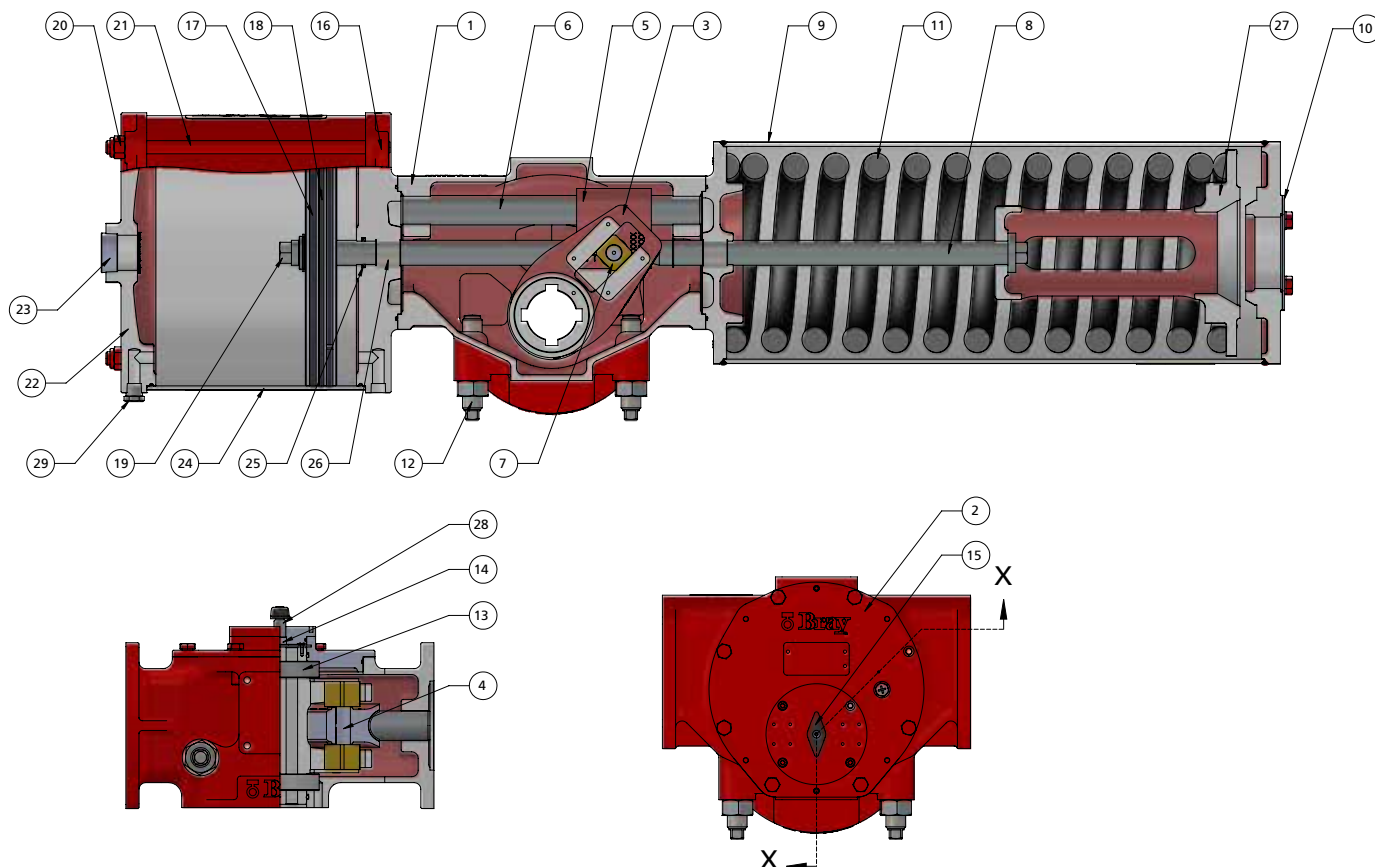
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General Specifications and Features

GENERAL SPECIFICATIONS											
RANGE											
Model	ISO Mounting Base	Rated Torque		Spring End Torque Nm		Spring End Torque Lb-in		Maximum Stem Acceptance Diameter		Maximum Stem Height	Over Travel (on either side)
		Nm	Lb-in	Min	Max	Min	Max	mm	inch	mm	± degrees
12 E2	F07/F12	1,200	10,621	310	660	2,744	5,842	22 A/F	0.87 A/F	130	5
18 E2	F12	1,800	15,932	530	1,035	4,691	9,161	35.0	1.38	163	5
45 E2	F12/F16	4,500	39,830	1,070	2,675	9,471	23,676	50.0	1.97	183	5
73 E2	F12/F16	7,300	64,612	2,130	4,280	18,853	37,882	63.5	2.50	216	5
14 E3	F16/F25	14,000	123,914	3,485	7,845	30,846	69,436	76.2	3.00	240	5
24 E3	F25/F30	24,000	212,424	6,555	15,150	58,018	134,093	114.3	4.50	295	3
45 E3	F30/F35	45,000	398,295	11,950	25,595	105,769	226,541	152.4	6.00	318	3
10 E4	F35/F40	100,000	885,100	25,226	50,306	223,275	445,261	177.8	7.00	402	3
CONFIGURATIONS											
DA		Double Acting- Single Cylinder									
DD		Double Acting- Dual Cylinders									
SR-CW		Spring Return- Fail CW									
SR-CCW		Spring Return- Fail CCW									
OPERATING CONDITIONS											
Pressure Range		40 - 150 psi									
Media		Dry Compressed Air / Inert / Natural Gas						Contact factory for other media			
Temperature Range - Standard Options		Standard : -20°F to 200°F (-29°C to 93°C)						PED and Non-PED		Contact factory for extended ranges	
		High Temp : Up to 300°F (149°C)									
		Low Temp : Down to -50°F (-46°C)						Non-PED			
COMPLIANCES											
Torque Base		Mounting dimensions per ISO 5211									
Accessories		Shaft Driven Accessories Mounting as per NAMUR-VDE									
Testing		In accordance with EN 15714-3:2009									
Ingress Protection		IP67M per IEC 60529									
Safety		ATEX, SIL 3, PED									

Materials of Construction - Standard Actuators



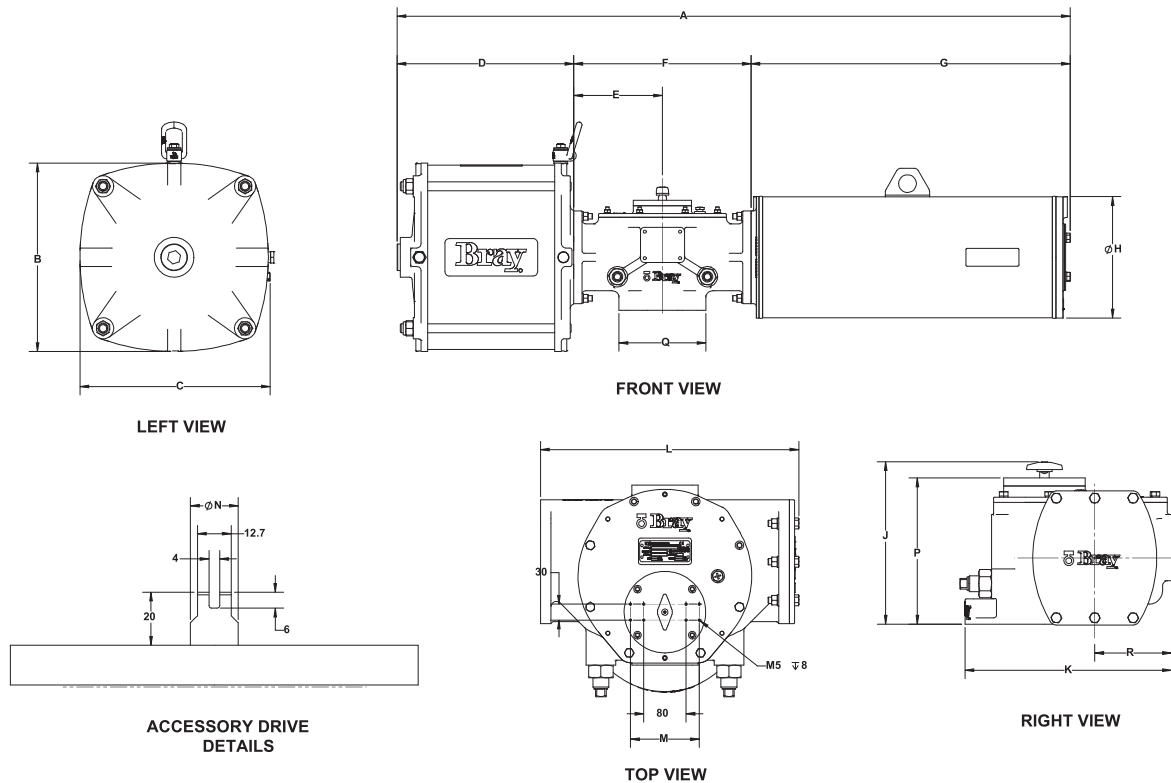
ITEM NO.	DESCRIPTION	MATERIAL
1	HOUSING	DUCTILE IRON
2	HOUSING COVER	DUCTILE IRON
3	YOKE	DUCTILE IRON
4	YOKE PIN	ALLOY STEEL
5	GUIDE BLOCK	CARBON STEEL
6	GUIDE ROD	ALLOY STEEL
7	SLIDER BLOCK	BRONZE
8	SPRING ROD	ALLOY STEEL
9	PIPE	CARBON STEEL
10	END COVER	CARBON STEEL
11	SPRING	ALLOY STEEL
12	STOP BOLT	STEEL
13	YOKE BUSHING	PTFE BRONZE
14	FLANGED BUSHING	PTFE BRONZE

ITEM NO.	DESCRIPTION	MATERIAL
15	POSITION INDICATOR	PLASTIC
16	ADAPTOR PLATE	DUCTILE IRON
17	PISTON	DUCTILE IRON
18	QUAD SEAL	NITRILE
19	PISTON ROD	ALLOY STEEL
20	TIE ROD NUT	CARBON STEEL
21	TIE ROD	ALLOY STEEL
22	END CAP PRESSURE MODULE	DUCTILE IRON
23	PIPE PLUG	CARBON STEEL
24	BARREL	CARBON STEEL
25	SEAL U-CUP	NITRILE
26	PISTON ROD BUSHING	PTFE BRONZE
27	SPRING GUIDE	CARBON STEEL
28	ACCESSORY DRIVE SHAFT	STAINLESS STEEL
29	BREATHER	STAINLESS STEEL

Notes: All fasteners on standard actuators are Zinc plated with Blue trivalent coating.

Actuator standard coating is epoxy base coat (75-150 microns) with polyurethane top coat (50-75 microns).

Nominal Maximum Dimensions



Series 98 Max Dimensions, inch

Model	ISO Base	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R
12E2	F12/F07	35.2	9.8	9.8	10.1	4.6	9.3	15.7	7.1	7.3	6.8	9.8	--	0.6	6.1	4.4	3.0
18E2	F12	42.4	10.8	10.8	12.2	5.5	11.1	19.1	8.1	8.7	8.7	11.7	--	0.6	7.4	4.4	4.0
45E2	F16/F12	52.8	14.8	14.8	14.2	6.3	12.5	26.2	9.4	9.7	9.4	13.1	--	0.7	8.5	7.7	3.8
73E2	F16/F12	60.1	16.8	16.8	15.8	7.9	15.8	28.5	12.8	11.8	11.3	16.5	--	0.7	9.8	7.8	5.1
14E3	F25/16	72.6	21.3	21.3	18.8	9.3	18.5	35.3	13.5	12.1	15.4	19.6	5.1	0.7	10.9	11.8	5.7
24E3	F30/25	90.0	25.1	25.1	21.9	11.5	22.9	45.2	15.6	14.3	19.3	23.8	5.1	1.0	13.1	13.8	7.3
45E3	F35/30	113.3	33.3	33.3	25.8	14.3	28.6	58.9	18.7	15.3	22.8	29.5	5.1	1.0	14.1	16.3	8.3
10E4	F40/F35	138.1	41.7	38.0	32.8	17.8	35.5	69.8	21.9	18.9	28.3	37.6	5.1	1.0	17.8	18.7	11.3

Series 98 Max Dimensions, mm

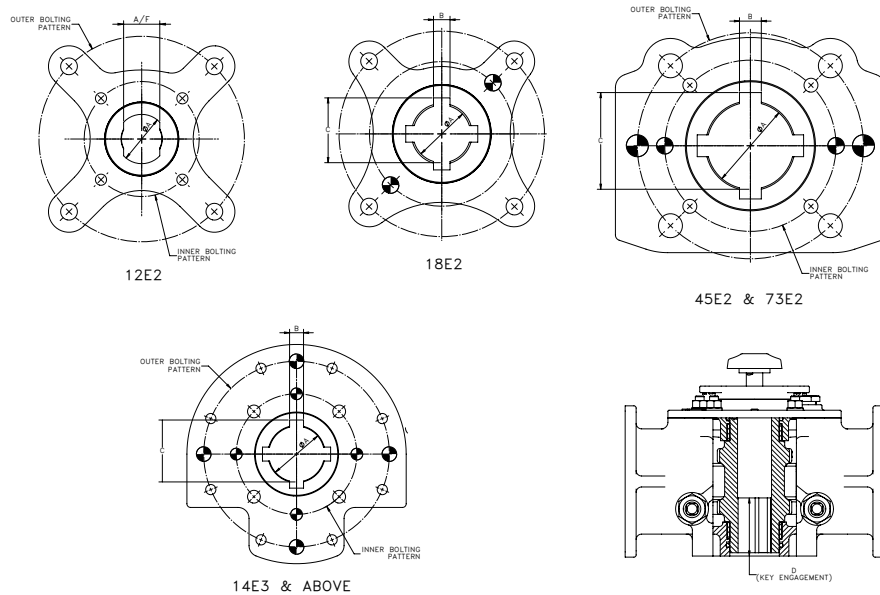
Model	ISO Base	A	B	C	D	E	F	G	H	J	K	L	M	N	P	T	U
12E2	F12/F07	893	248	248	257	118	236	400	180	185	173	248	--	15	155	113	76
18E2	F12	1077	274	274	309	141	281	486	205	222	220	296	--	15	189	113	102
45E2	F16/F12	1342	376	376	360	159	318	664	240	246	240	333	--	18	216	195	96
73E2	F16/F12	1526	427	427	400	201	402	723	326	300	288	420	--	18	249	197	129
14E3	F25/16	1843	542	542	477	235	470	896	342	307	390	498	130	18	276	300	145
24E3	F30/25	2287	638	638	556	291	582	1148	397	364	491	605	130	25	334	350	186
45E3	F35/30	2877	845	845	656	363	726	1495	476	388	580	750	130	25	357	415	212
10E4	F40/F35	3507	1060	964	832	451	902	1773	556	481	720	955	130	25	451	475	286

Note: Refer ES drawings for dimensions of specific models

CYLINDER PORT SIZE					
Cylinder Size	5" - 9"	10"	12" - 16"	18" - 24"	28" - 36"
Ports, NPT	3/8"	1/2"	3/4"	1"	1.5"

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Dimensions - Bolting Pattern



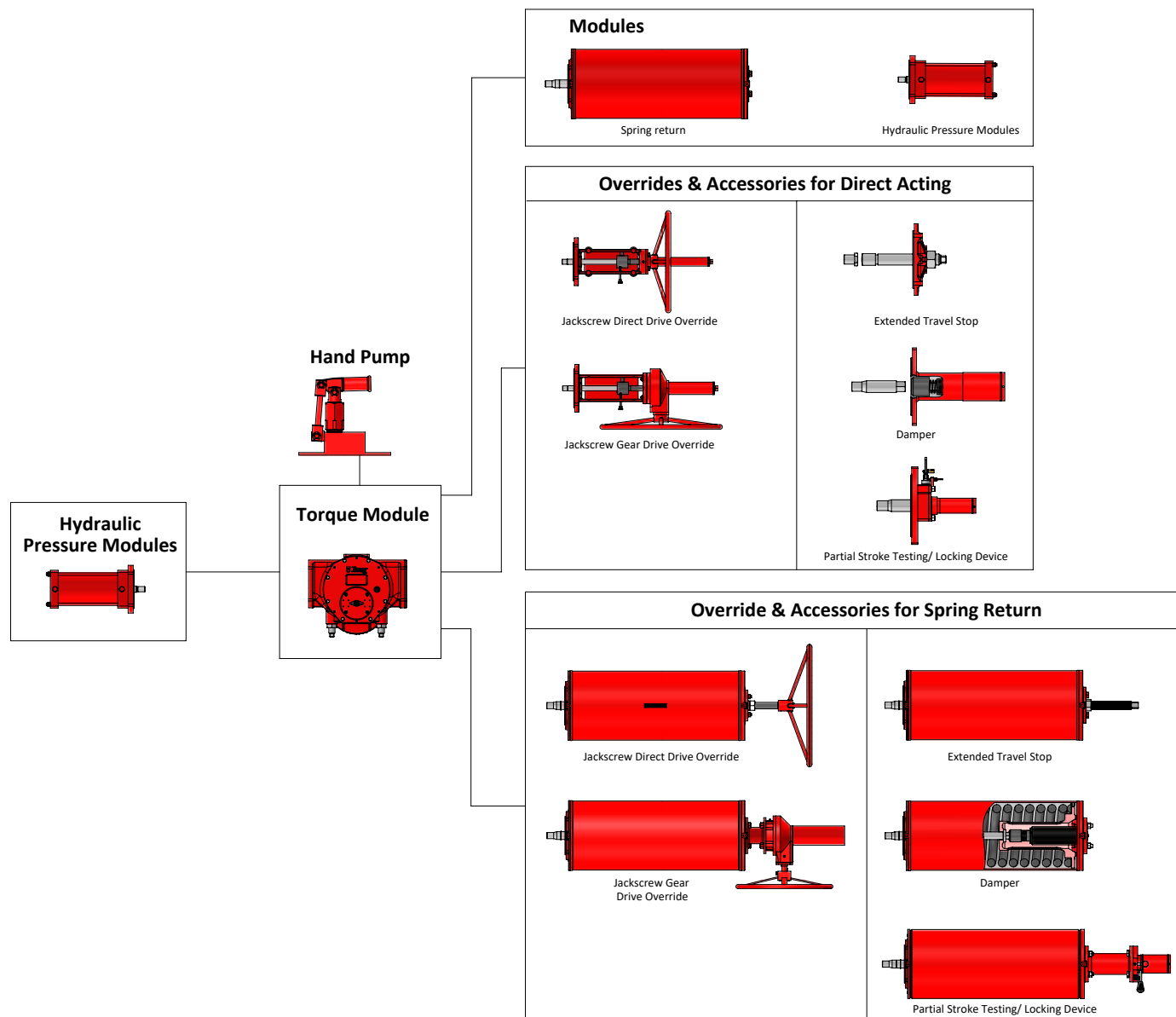
Model	Max Stem Height	Outer Bolting Pattern						Inner Bolting Pattern					
		ISO Base	Thread Size	Bolt Circle	No. of Bolt Holes	Dowel Hole Size Dia. x Depth	No. of Dowel Holes	ISO Base	Thread Size	Bolt Circle	No. of Bolt Holes	Dowel Hole Size Dia. x Depth	No. of Dowel Holes
12E2	130	F12	M12 x 15mm	125	4	–	–	F07	M8 x 12mm	70	4	–	–
18E2	163	F12	M12 x 18mm	125	4	–	–	–	–	88	–	10.1 +0.05/0, x 10mm	2
45E2	183	F16	M20 x 30mm	165	4	16.1 +0.05/0 x 15mm	2	F12	M12 x 18mm	125	4	12.1 +0.05/0 x 13mm	2
73E2	216	F16	M20 x 30mm	165	4	16.1 +0.05/0 x 15mm	2	F12	M12 x 18mm	125	4	12.1 +0.05/0 x 13mm	2
14E3	240	F25	M16 x 24mm	254	8	20.1 +0.05/0 x 17.5mm	4	F16	M20 x 30mm	165	4	16.1 +0.05/0 x 15mm	4
24E3	295	F30	M20 x 30mm	298	8	20.1 +0.05/0 x 17.5mm	4	F25	M16 x 24mm	254	8	20.1 +0.05/0 x 17.5mm	4
45E3	318	F35	M30 x 45mm	356	8	30.1 +0.05/0 x 27mm	4	F30	M20 x 30mm	298	8	20.1 +0.05/0 x 17.5mm	4
10E4	402	F40	M36 x 54mm	406	8	36.1 +0.05/0 x 36mm	4	F35 OPTION	M30 x 45mm	356	8	30.1 +0.05/0 x 27mm	4

All dimensions are in mm

Dimensions - Bore

Model	Bore 1 (Standard)						Bore 2						Bore 3						Bore 4					
	Drive	A	A/F	B	C	D	Drive	A	A/F	B	C	D	Drive	A	A/F	B	C	D	Drive	A	A/F	B	C	D
12E2	Double D	30 +0.18/+0.10	22 +0.08/+0.03	–	–	50																		
18E2	Key	35 +0.18/+0.10	–	10.05 +0.05/0	39.4 +0.3/0	163	Double D	30 +0.18/+0.10	22 +0.08/+0.03	–	–	53												
45E2	Key	50 +0.18/+0.10	–	12.05 +0.05/0	54.5 +0.3/0	183	Key	35 +0.18/+0.10	–	10.05 +0.05/0	39.4 +0.3/0	65	Key	44.45 +0.18/+0.10	–	9.53 +0.05/0	48.82 +0.3/0	183						
73E2	Key	63.5 +0.18/+0.10	–	15.93 +0.08/0	70.6 +0.3/0	216	Key	50 +0.18/+0.10	–	12.05 +0.05/0	54.5 +0.3/0	68	Key	60 +0.18/+0.10	–	18 +0.12/+0.05	64.4 +0.2/0	216						
14E3	Key	76.2 +0.18/+0.10	–	19.1 +0.08/0	84.7 +0.3/0	240	Key	63.5 +0.18/+0.10	–	15.93 +0.08/0	70.6 +0.3/0	119	Key	60 +0.18/+0.10	–	18 +0.12/+0.05	64.4 +0.2/0	117						
24E3	Key	114.3 +0.18/+0.10	–	25.45 +0.08/0	122.6 +0.3/0	295	Key	101.6 +0.18/+0.10	–	25.45 +0.08/0	109.7 +0.3/0	162	Key	88.9 +0.18/+0.10	–	22.28 +0.08/0	95.7 +0.3/0	154	Key	80 +0.18/+0.10	–	22 +0.12/+0.07	85.4 +0.3/0	154
45E3	Key	152.4 +0.18/+0.10	–	38.18 +0.1/0	162.9 +0.3/0	318	Key	127 +0.18/+0.10	–	31.85 +0.1/0	136.3 +0.3/0	175	Key	120 +0.18/+0.10	–	32 +0.18/+0.08	127.4 +0.2/0	170						
10E4	Key	177.8 +0.18/+0.10	–	44.5 +0.15/0.05	194.3 +0.3/0	402	Key	152.4 +0.18/+0.10	–	38.18 +0.1/0	162.9 +0.3/0	172												

Manual Overrides and Accessories



Manual Overrides																																	
Series 98 Actuator Model	12 E2			18 E2			45 E2				73 E2				14 E3					24 E3					45 E3					10 E4			
Spring #	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4
Jack Screw - Direct Drive - DA		o			o			o																									
Jack Screw - Direct Drive - SR	o	o	o	o	o	o	o	o																									
Jack Screw - Bevel Gear Drive - DA								o				o				o					o												
Jack Screw - Bevel Gear Drive - SR									o	o		o	o	o	o	o	o	o	o	o	o	o	o										
Hydraulic Override - DA												o				o					o					o					o		
Hydraulic Override - SR											o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
Sandwich Gear Box - DA		o			o			o				o				o																	
Sandwich Gear Box - SR	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o														

o = Available

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Module Weights

Module Weights (approx) – Imperial – Lbs.																								
Model	Rated Torq. Lb-in	Torque Module																		Spring Modules				
			5	6	7	8	9	10	12	14	16	18	20	22	24	28	32	36	1	2	3	4	5	
12 E2	10,620	33	26	29	35	49	57												53	53	60			
18 E2	15,930	55		35	40	57	66	86											82	86	90			
45 E2	39,830	84				60	68	88	126	183									134	146	152	172		
73 E2	64,612	146						99	134	185	254								214	216	238	293		
14 E3	123,914	236							150	201	271	355	485						362	384	403	430	452	
24 E3	212,424	428									229	293	373	514	613	780			575	593	619	677	679	
45 E3	398,295	666											439	575	679	849	1276		1065	1116	1259	1369	1431	
10 E4	885,100	1312													780	957	1442	1997	2705	2061	2205	2502	2701	

Module Weights (approx) – Metric – Kg																								
Model	Rated Torq. Nm	Torque Module																	Spring Modules					
			5	6	7	8	9	10	12	14	16	18	20	22	24	28	32	36	1	2	3	4	5	
12 E2	1,200	15	12	13	16	22	26												24	24	27			
18 E2	1,800	25		16	18	26	30	39											37	39	41			
45 E2	4,500	38				27	31	40	57	83									61	66	69	78		
73 E2	7,300	66						45	61	84	115								97	98	108	133		
14 E3	14,000	107							68	91	123	161	220						164	174	183	195	205	
24 E3	24,000	194								104	133	169	233	278	354				261	269	281	307	308	
45 E3	45,000	302										199	261	308	385	579			483	506	571	621	649	
10 E4	100,000	595												354	434	654	906	1227	935	1000	1135	1225		

Technical Data - Double Acting Actuators

Model		Maximum Operating Pressure				Volume				Actuator Weight		Assembly Weight (approx)			
		Symmetrical		Canted		Cu.in		Lts		Lbs	Kg	w/Jackscrew Override		w/Hydraulic Override	
		psi	bar	psi	bar	Rod End	Cap End	Rod End	Cap End			Lbs	Kg	Lbs	kg
DA	12E2-05	150	10.3	150	10.3	84	94	1.4	1.5	60	27	86	40		
	12E2-06	140	9.7	116	8.0	124	137	2.0	2.2	62	28	88	41		
	12E2-07	103	7.1	85	5.9	170	187	2.8	3.1	68	31	95	44		
	12E2-08	79	5.4	65	4.5	223	244	3.7	4.0	82	37	108	50		
	12E2-09	62	4.3	51	3.5	285	309	4.7	5.1	90	41	117	54		
DD	12E2-05	103	7.1	85	5.8	178	178	2.9	2.9	86	39				
	12E2-06	71	4.9	58	4.0	261	261	4.3	4.3	90	41				
	12E2-07	52	3.6	43	2.9	358	358	5.9	5.9	104	47				
	12E2-08	40	2.7			468	468	7.7	7.7	130	59				
DA	18E2-06	150	10.3	139	9.6	146	163	2.4	2.7	90	41	134	61		
	18E2-07	124	8.5	102	7.0	200	223	3.3	3.6	95	43	139	63		
	18E2-08	95	6.5	78	5.4	266	289	4.4	4.7	112	51	157	71		
	18E2-09	75	5.2	62	4.2	344	366	5.6	6.0	121	55	165	75		
	18E2-10	61	4.2	50	3.4	429	467	7.0	7.7	141	64	185	84		
DD	18E2-06	85	5.9	70	4.8	310	310	5.1	5.1	126	57				
	18E2-07	62	4.3	51	3.5	423	423	6.9	6.9	134	61				
	18E2-08	48	3.3			555	555	9.1	9.1	170	77				
DA	45E2-08	150	10.3	150	10.3	322	346	5.3	5.7	143	65	207	94		
	45E2-09	144	9.9	119	8.2	417	442	6.8	7.2	152	69	216	98		
	45E2-10	117	8.0	96	6.6	519	560	8.5	9.2	172	78	236	107		
	45E2-12	81	5.6	67	4.6	750	831	12.3	13.6	209	95	273	124		
	45E2-14	59	4.1	49	3.4	1020	1135	16.7	18.6	267	121	331	150		
DD	45E2-08	92	6.3	76	5.2	669	669	11.0	11.0	203	92				
	45E2-09	72	5.0	60	4.1	858	858	14.1	14.1	220	100				
	45E2-10	59	4.0	48	3.3	1079	1079	17.7	17.7	260	118				
	45E2-12	41	2.8			1581	1581	25.9	25.9	335	152				
DA	73E2-10	150	10.3	127	8.7	621	668	10.2	11.0	245	111	331	150	359	163
	73E2-12	107	7.4	88	6.1	902	985	14.8	16.2	280	127	366	166	395	179
	73E2-14	78	5.4	65	4.4	1227	1347	20.1	22.1	331	150	417	189	445	202
	73E2-16	60	4.1	49	3.4	1588	1766	26.0	29.0	399	181	485	220	514	233
DD	73E2-10	77	5.3	64	4.4	1289	1289	21.1	21.1	344	156				
	73E2-12	54	3.7	44	3.0	1887	1887	30.9	30.9	414	188				
DA	14E3-12	150	10.3	142	9.8	1071	1152	17.6	18.9	386	175	534	242	558	253
	14E3-14	127	8.7	104	7.2	1458	1574	23.9	25.8	437	198	584	265	608	276
	14E3-16	97	6.7	80	5.5	1890	2061	31.0	33.8	507	230	655	297	679	308
	14E3-18	77	5.3	63	4.3	2421	2626	39.7	43.1	591	268	739	335	763	346
	14E3-20	62	4.3	51	3.5	2978	3300	48.8	54.1	721	327	869	394	893	405
DD	14E3-12	87	6.0	72	4.9	2223	2223	36.5	36.5	536	243				
	14E3-14	64	4.4	52	3.6	3032	3032	49.7	49.7	637	289				
	14E3-16	49	3.4	40	2.8	3951	3951	64.8	64.8	778	353				

For Dual Cylinder Models, Total Swept volume is Rod End plus Cap End volume

Technical Data - Double Acting Actuators (Cont.)

Model		Maximum Operating Pressure				Volume				Actuator Weight		Assembly Weight (approx)			
		Symmetrical		Canted		Cu.in		Lts		Lbs	Kg	w/Jackscrew Override		w/Hydraulic Override	
		psi	bar	psi	bar	Rod End	Cap End	Rod End	Cap End			Lbs	Kg	Lbs	kg
DA	24E3-14	150	10.3	134	9.2	1831	1954	30.0	32.0	657	298	873	396	910	413
	24E3-16	124	8.6	102	7.1	2387	2560	39.2	42.0	721	327	937	425	974	442
	24E3-18	98	6.8	81	5.6	3059	3255	50.2	53.4	800	363	1016	461	1054	478
	24E3-20	80	5.5	66	4.5	3750	4084	61.5	67.0	941	427	1157	525	1195	542
	24E3-22	66	4.5	54	3.7	4561	5012	74.8	82.2	1041	472	1257	570	1294	587
	24E3-24	55	3.8	46	3.1	5452	5917	89.4	97.0	1208	548	1424	646	1462	663
DD	24E3-14	82	5.6	67	4.6	3785	3785	62.1	62.1	886	402				
	24E3-16	63	4.3	52	3.5	4948	4948	81.1	81.1	1014	460				
	24E3-18	49	3.4			6314	6314	103.5	103.5	1173	532				
	24E3-20	40	2.8			7834	7834	128.5	128.5	1455	660				
DA	45E3-18	150	10.3	123	8.5	3722	3895	61.0	63.9	1105	501			1457	661
	45E3-20	121	8.4	100	6.9	4584	4878	75.2	80.0	1241	563			1594	723
	45E3-22	100	6.9	83	5.7	5591	5973	91.7	98.0	1345	610			1698	770
	45E3-24	84	5.8	69	4.8	6676	7068	109.5	115.9	1515	687			1867	847
	45E3-28	62	4.3	51	3.5	9074	9699	148.8	159.1	1942	881			2295	1041
DD	45E3-18	75	5.2	62	4.3	7617	7617	124.9	124.9	1543	700				
	45E3-20	61	4.2	50	3.5	9462	9462	155.2	155.2	1817	824				
	45E3-22	50	3.5	41	2.9	11564	11564	189.7	189.7	2024	918				
	45E3-24	42	2.9			13745	13745	225.4	225.4	2363	1072				
DA	10E4-22	150	10.3	150	10.3	6875	7205	112.8	118.2	2092	949			2698	1224
	10E4-24	150	10.3	126	8.7	8173	8504	134.0	139.5	2269	1029			2875	1304
	10E4-28	113	7.8	93	6.4	11049	11713	181.2	192.1	2754	1249			3360	1524
	10E4-32	86	5.9	71	4.9	14589	15908	239.3	260.9	3309	1501			3915	1776
	10E4-36	68	4.7	56	3.9	18327	19859	300.6	325.7	4017	1822			4623	2097
DD	10E4-22	92	6.3	76	5.2	14080	14080	230.9	230.9	2873	1303				
	10E4-24	77	5.3	64	4.4	16676	16676	273.5	273.5	3225	1463				
	10E4-28	57	3.9	47	3.2	22763	22763	373.3	373.3	4195	1903				
	10E4-32	43	3.0			30497	30497	500.2	500.2	5306	2407				

Technical Data - Spring Return Actuators

Model	Spring #	Maximum Operating Pressure				Volume		Actuator Weight		Assembly Weight (approx)			
		Symmetrical		Canted		Rod End		Lbs	Kg	w/Jackscrew Override		w/Hydraulic Override	
		psi	bar	psi	bar	Cu.In	Lts			Lbs	Kg	Lbs	Kg
12E2-05	1	150	10.3	150	10.3	84	1.4	112	51	123	57		
12E2-06		150	10.3	150	10.3	124	2.0	115	52	126	58		
12E2-07		132	9.1	113	7.8	170	2.8	121	55	132	61		
12E2-08		101	6.9	86	6.0	223	3.7	134	61	146	67		
12E2-09		79	5.5	68	4.7	285	4.7	143	65	154	71		
12E2-05	2	150	10.3	150	10.3	84	1.4	112	51	123	57		
12E2-06		150	10.3	150	10.3	124	2.0	115	52	126	58		
12E2-07		139	9.5	120	8.3	170	2.8	121	55	132	61		
12E2-08		106	7.3	92	6.3	223	3.7	134	61	146	67		
12E2-09		83	5.7	72	5.0	285	4.7	143	65	154	71		
12E2-06	3	150	10.3	150	10.3	124	2.0	121	55	132	61		
12E2-07		150	10.3	134	9.2	170	2.8	128	58	139	64		
12E2-08		116	8.0	102	7.0	223	3.7	141	64	152	70		
12E2-09		91	6.3	80	5.5	285	4.7	150	68	161	74		
18E2-06	1	150	10.3	150	10.3	146	2.4	172	78	185	84		
18E2-07		150	10.3	141	9.7	200	3.3	176	80	190	86		
18E2-08		125	8.6	108	7.4	266	4.4	194	88	207	94		
18E2-09		98	6.8	85	5.8	344	5.6	203	92	216	98		
18E2-10		79	5.5	69	4.7	429	7.0	223	101	236	107		
18E2-06	2	150	10.3	150	10.3	146	2.4	176	80	190	86		
18E2-07		150	10.3	147	10.1	200	3.3	181	82	194	88		
18E2-08		129	8.9	112	7.7	266	4.4	198	90	212	96		
18E2-09		102	7.0	88	6.1	344	5.6	207	94	220	100		
18E2-10		82	5.7	71	4.9	429	7.0	227	103	240	109		
18E2-06	3	150	10.3			146	2.4	181	82	194	88		
18E2-07		150	10.3	150	10.3	200	3.3	185	84	198	90		
18E2-08		142	9.8	125	8.6	266	4.4	203	92	216	98		
18E2-09		112	7.7	98	6.8	344	5.6	212	96	225	102		
18E2-10		90	6.2	79	5.5	429	7.0	231	105	245	111		
45E2-08	1	150	10.3	150	10.3	322	5.3	278	126	304	138		
45E2-09		150	10.3	150	10.3	417	6.8	287	130	313	142		
45E2-10		146	10.0	125	8.6	519	8.5	306	139	333	151		
45E2-12		101	7.0	87	6.0	750	12.3	344	156	370	168		
45E2-14		74	5.1	63	4.4	1020	16.7	401	182	428	194		
45E2-08	2	150	10.3	150	10.3	322	5.3	289	131	315	143		
45E2-09		150	10.3	150	10.3	417	6.8	298	135	324	147		
45E2-10		150	10.3	135	9.3	519	8.5	317	144	344	156		
45E2-12		108	7.4	93	6.4	750	12.3	355	161	381	173		
45E2-14		79	5.4	69	4.7	1020	16.7	412	187	439	199		
45E2-08	3	150	10.3	150	10.3	322	5.3	295	134	353	160		
45E2-09		150	10.3	150	10.3	417	6.8	304	138	362	164		
45E2-10		150	10.3	148	10.2	519	8.5	324	147	381	173		
45E2-12		117	8.1	103	7.1	750	12.3	362	164	419	190		
45E2-14		86	5.9	75	5.2	1020	16.7	419	190	476	216		
45E2-09	4	150	10.3	150	10.3	417	6.8	324	147	384	174		
45E2-10		150	10.3	150	10.3	519	8.5	344	156	403	183		
45E2-12		121	8.4	107	7.4	750	12.3	381	173	441	200		
45E2-14		89	6.1	79	5.4	1020	16.7	439	199	498	226		

Technical Data - Spring Return Actuators (cont.)

Model	Spring #	Maximum Operating Pressure				Volume		Actuator Weight		Assembly Weight (approx)			
		Symmetrical		Canted		Rod End		Lbs	Kg	w/Jackscrew Override		w/Hydraulic Override	
		psi	bar	psi	bar	Cu.In	Lts			Lbs	Kg	Lbs	Kg
73E2-10	1	150	10.3	150	10.3	621	10.2	459	208	520	236	536	243
73E2-12		139	9.6	120	8.3	902	14.8	494	224	556	252	571	259
73E2-14		102	7.0	88	6.1	1227	20.1	545	247	606	275	622	282
73E2-16		78	5.4	67	4.6	1588	26.0	613	278	675	306	690	313
73E2-10	2	150	10.3	150	10.3	621	10.2	461	209	525	238	538	244
73E2-12		144	9.9	125	8.6	902	14.8	496	225	560	254	573	260
73E2-14		105	7.3	91	6.3	1227	20.1	547	248	611	277	624	283
73E2-16		80	5.5	70	4.8	1588	26.0	615	279	679	308	692	314
73E2-10	3	150	10.3	150	10.3	621	10.2	483	219	549	249	560	254
73E2-12		150	10.3	133	9.2	902	14.8	518	235	584	265	595	270
73E2-14		111	7.7	98	6.7	1227	20.1	569	258	635	288	646	293
73E2-16		85	5.9	75	5.1	1588	26.0	637	289	703	319	714	324
73E2-10	4	150	10.3	150	10.3	621	10.2	538	244	604	274	615	279
73E2-12		150	10.3	141	9.7	902	14.8	573	260	639	290	650	295
73E2-14		117	8.1	103	7.1	1227	20.1	624	283	690	313	701	318
73E2-16		90	6.2	79	5.4	1588	26.0	692	314	758	344	769	349
14E3-12	1	150	10.3	150	10.3	1071	17.6	747	339	842	382	855	388
14E3-14		150	10.3	137	9.5	1458	23.9	798	362	893	405	906	411
14E3-16		122	8.4	105	7.2	1890	31.0	869	394	963	437	977	443
14E3-18		96	6.6	83	5.7	2421	39.7	952	432	1047	475	1060	481
14E3-20		78	5.4	67	4.6	2978	48.8	1082	491	1177	534	1190	540
14E3-12	2	150	10.3	150	10.3	1071	17.6	769	349	869	394	877	398
14E3-14		150	10.3	142	9.8	1458	23.9	820	372	919	417	928	421
14E3-16		126	8.7	108	7.5	1890	31.0	891	404	990	449	999	453
14E3-18		99	6.8	86	5.9	2421	39.7	974	442	1074	487	1082	491
14E3-20		80	5.5	69	4.8	2978	48.8	1105	501	1204	546	1213	550
14E3-12	3	150	10.3	150	10.3	1071	17.6	789	358	888	403	897	407
14E3-14		150	10.3	148	10.2	1458	23.9	840	381	939	426	948	430
14E3-16		130	9.0	113	7.8	1890	31.0	910	413	1010	458	1019	462
14E3-18		103	7.1	89	6.1	2421	39.7	994	451	1093	496	1102	500
14E3-20		83	5.7	72	5.0	2978	48.8	1124	510	1224	555	1232	559
14E3-12	4	150	10.3	150	10.3	1071	17.6	816	370	930	422	924	419
14E3-14		150	10.3	150	10.3	1458	23.9	866	393	981	445	974	442
14E3-16		138	9.5	121	8.3	1890	31.0	937	425	1052	477	1045	474
14E3-18		109	7.5	95	6.6	2421	39.7	1021	463	1135	515	1129	512
14E3-20		88	6.1	77	5.3	2978	48.8	1151	522	1265	574	1259	571
14E3-12	5	150	10.3	150	10.3	1071	17.6	838	380	952	432	946	429
14E3-14		150	10.3	150	10.3	1458	23.9	888	403	1003	455	996	452
14E3-16		143	9.8	126	8.7	1890	31.0	959	435	1074	487	1067	484
14E3-18		113	7.8	99	6.8	2421	39.7	1043	473	1157	525	1151	522
14E3-20		91	6.3	80	5.5	2978	48.8	1173	532	1287	584	1281	581

Technical Data - Spring Return Actuators (cont.)

Model	Spring #	Maximum Operating Pressure				Volume		Actuator Weight		Assembly Weight (approx)			
		Symmetrical		Canted		Rod End		Lbs	Kg	w/Jackscrew Override		w/Hydraulic Override	
		psi	bar	psi	bar	Cu.In	Lts			Lbs	Kg	Lbs	Kg
24E3-14	1	150	10.3	150	10.3	1831	30.0	1232	559	1387	629	1389	630
24E3-16		150	10.3	138	9.5	2387	39.2	1296	588	1451	658	1453	659
24E3-18		126	8.7	109	7.5	3059	50.2	1376	624	1530	694	1532	695
24E3-20		102	7.0	88	6.1	3750	61.5	1517	688	1671	758	1673	759
24E3-22		84	5.8	73	5.0	4561	74.8	1616	733	1770	803	1772	804
24E3-24		71	4.9	61	4.2	5452	89.4	1784	809	1938	879	1940	880
24E3-14	2	150	10.3	150	10.3	1831	30.0	1250	567	1407	638	1407	638
24E3-16		150	10.3	145	10.0	2387	39.2	1314	596	1470	667	1470	667
24E3-18		132	9.1	114	7.9	3059	50.2	1393	632	1550	703	1550	703
24E3-20		106	7.3	92	6.4	3750	61.5	1534	696	1691	767	1691	767
24E3-22		88	6.1	76	5.2	4561	74.8	1634	741	1790	812	1790	812
24E3-24		74	5.1	64	4.4	5452	89.4	1801	817	1958	888	1958	888
24E3-14	3	150	10.3	150	10.3	1831	30.0	1276	579	1468	666	1433	650
24E3-16		150	10.3	150	10.3	2387	39.2	1340	608	1532	695	1497	679
24E3-18		139	9.6	122	8.4	3059	50.2	1420	644	1612	731	1576	715
24E3-20		113	7.8	99	6.8	3750	61.5	1561	708	1753	795	1717	779
24E3-22		93	6.4	81	5.6	4561	74.8	1660	753	1852	840	1817	824
24E3-24		78	5.4	68	4.7	5452	89.4	1828	829	2019	916	1984	900
24E3-14	4	150	10.3	150	10.3	1831	30.0	1334	605	1528	693	1490	676
24E3-16		150	10.3	150	10.3	2387	39.2	1398	634	1592	722	1554	705
24E3-18		145	10.0	127	8.8	3059	50.2	1477	670	1671	758	1634	741
24E3-20		117	8.1	103	7.1	3750	61.5	1618	734	1812	822	1775	805
24E3-22		97	6.7	85	5.8	4561	74.8	1717	779	1911	867	1874	850
24E3-24		81	5.6	71	4.9	5452	89.4	1885	855	2079	943	2041	926
24E3-16	5	150	10.3	150	10.3	2387	39.2	1400	635	1596	724	1556	706
24E3-18		150	10.3	133	9.2	3059	50.2	1479	671	1675	760	1636	742
24E3-20		122	8.4	108	7.4	3750	61.5	1620	735	1817	824	1777	806
24E3-22		101	6.9	89	6.1	4561	74.8	1720	780	1916	869	1876	851
24E3-24		84	5.8	75	5.1	5452	89.4	1887	856	2083	945	2044	927
45E3-18	1	150	10.3	150	10.3	3722	61.0	2169	984			2418	1097
45E3-20		150	10.3	134	9.2	4584	75.2	2306	1046			2555	1159
45E3-22		128	8.8	110	7.6	5591	91.7	2410	1093			2659	1206
45E3-24		107	7.4	93	6.4	6676	109.5	2579	1170			2829	1283
45E3-28	2	79	5.4	68	4.7	9074	148.8	3007	1364			3256	1477
45E3-18		150	10.3	150	10.3	3722	61.0	2220	1007			2469	1120
45E3-20		150	10.3	138	9.5	4584	75.2	2357	1069			2606	1182
45E3-22		132	9.1	114	7.9	5591	91.7	2460	1116			2709	1229
45E3-24		111	7.6	96	6.6	6676	109.5	2630	1193			2879	1306
45E3-28	3	81	5.6	70	4.8	9074	148.8	3058	1387			3307	1500
45E3-18		150	10.3	150	10.3	3722	61.0	2363	1072			2612	1185
45E3-20		150	10.3	147	10.2	4584	75.2	2500	1134			2749	1247
45E3-22		139	9.6	122	8.4	5591	91.7	2604	1181			2853	1294
45E3-24	4	117	8.1	102	7.0	6676	109.5	2773	1258			3023	1371
45E3-28		86	5.9	75	5.2	9074	148.8	3201	1452			3450	1565
45E3-18		150	10.3	150	10.3	3722	61.0	2474	1122			2723	1235
45E3-20		150	10.3	150	10.3	4584	75.2	2610	1184			2859	1297
45E3-22		144	9.9	126	8.7	5591	91.7	2714	1231			2963	1344
45E3-24	5	120	8.3	105	7.3	6676	109.5	2884	1308			3133	1421
45E3-28		88	6.1	77	5.3	9074	148.8	3311	1502			3560	1615
45E3-18		150	10.3	150	10.3	3722	61.0	2535	1150			2784	1263
45E3-20		150	10.3	150	10.3	4584	75.2	2672	1212			2921	1325
45E3-22	5	149	10.2	131	9.0	5591	91.7	2776	1259			3025	1372
45E3-24		125	8.6	110	7.6	6676	109.5	2945	1336			3194	1449
45E3-28		91	6.3	80	5.5	9074	148.8	3373	1530			3622	1643

Technical Data - Spring Return Actuators (cont.)

Model	Spring #	Maximum Operating Pressure				Volume		Actuator Weight		Assembly Weight (approx)			
		Symmetrical		Canted		Rod End		Lbs	Kg	w/Jackscrew Override		w/Hydraulic Override	
		psi	bar	psi	bar	Cu.In	Lts			Lbs	Kg	Lbs	Kg
10E4-22	1	150	10.3	150	10.3	6875	112.8	4153	1884			4429	2009
10E4-24		150	10.3	150	10.3	8173	134.0	4330	1964			4605	2089
10E4-28		143	9.8	123	8.4	11049	181.2	4815	2184			5090	2309
10E4-32		109	7.5	94	6.4	14589	239.3	5370	2436			5646	2561
10E4-36		86	5.9	74	5.1	18327	300.6	6078	2757			6354	2882
10E4-22	2	150	10.3	150	10.3	6875	112.8	4297	1949			4572	2074
10E4-24		150	10.3	150	10.3	8173	134.0	4473	2029			4749	2154
10E4-28		147	10.1	126	8.7	11049	181.2	4958	2249			5234	2374
10E4-32		112	7.7	97	6.7	14589	239.3	5514	2501			5789	2626
10E4-36		88	6.1	76	5.3	18327	300.6	6221	2822			6497	2947
10E4-22	3	150	10.3	150	10.3	6875	112.8	4594	2084			4870	2209
10E4-24		150	10.3	150	10.3	8173	134.0	4771	2164			5046	2289
10E4-28		150	10.3	135	9.3	11049	181.2	5256	2384			5531	2509
10E4-32		119	8.2	103	7.1	14589	239.3	5811	2636			6087	2761
10E4-36		94	6.5	82	5.6	18327	300.6	6519	2957			6795	3082
10E4-22	4	150	10.3	150	10.3	6875	112.8	4793	2174			5068	2299
10E4-24		150	10.3	150	10.3	8173	134.0	4969	2254			5245	2379
10E4-28		150	10.3	141	9.7	11049	181.2	5454	2474			5730	2599
10E4-32		123	8.5	108	7.4	14589	239.3	6010	2726			6285	2851
10E4-36		97	6.7	85	5.9	18327	300.6	6717	3047			6993	3172

Air Consumption - DA Actuators

DA Actuators- Air Consumption/cycle, normal liters, L _n per cycle												
Supply Pr, bar		3	3.5	4	4.5	5	5.5	6	7	8	9	10
Ambient Temp: 25°C												
DA	12E2-05	11	12	13	15	16	17	19	21	24	27	29
	12E2-06	16	18	20	22	24	26	28	31	35	39	43
	12E2-07	22	24	27	30	32	35	38	43	48	54	59
	12E2-08	28	32	35	39	42	46	49	56	63	70	77
	12E2-09	36	40	45	49	54	58	63	72	81	89	98
DD	12E2-05	21	24	27	29	32	35	37	43	48	53	59
	12E2-06	32	35	39	43	47	51	55	63	71	79	86
	12E2-07	43	48	54	59	65	70	75	86	97	108	118
	12E2-08	56	63	70	77	85	92	99	113	127	141	155
DA	18E2-06	19	21	23	26	28	30	33	37	42	47	51
	18E2-07	26	29	32	35	38	41	45	51	57	64	70
	18E2-08	33	38	42	46	50	54	58	67	75	83	92
	18E2-09	43	48	54	59	64	70	75	86	96	107	118
	18E2-10	54	61	68	74	81	88	94	108	121	135	148
DD	18E2-06	37	42	47	51	56	61	65	75	84	93	102
	18E2-07	51	57	64	70	76	83	89	102	115	127	140
	18E2-08	67	75	84	92	100	109	117	134	150	167	184
DA	45E2-08	40	45	50	55	60	65	70	80	91	101	111
	45E2-09	52	58	65	71	78	84	90	103	116	129	142
	45E2-10	65	73	81	89	97	106	114	130	146	162	179
	45E2-12	95	107	119	131	143	155	167	190	214	238	262
	45E2-14	130	146	162	178	195	211	227	259	292	324	357
DD	45E2-08	81	91	101	111	121	131	141	161	181	201	221
	45E2-09	103	116	129	142	155	168	181	207	232	258	284
	45E2-10	130	146	163	179	195	211	227	260	292	325	357
	45E2-12	191	214	238	262	286	309	333	381	428	476	523
DA	73E2-10	78	87	97	107	116	126	136	155	175	194	213
	73E2-12	114	128	142	156	170	185	199	227	256	284	312
	73E2-14	155	175	194	213	233	252	271	310	349	387	426
	73E2-16	202	227	253	278	303	328	353	404	454	505	555
DD	73E2-10	155	175	194	214	233	252	272	310	349	388	427
	73E2-12	228	256	284	313	341	369	398	454	511	568	625
DA	14E3-12	134	151	167	184	201	218	234	268	301	334	368
	14E3-14	183	206	228	251	274	297	319	365	411	456	502
	14E3-16	238	268	298	327	357	387	416	476	535	594	654
	14E3-18	304	342	380	418	456	494	532	608	683	759	835
	14E3-20	379	426	473	520	567	614	662	756	850	944	1039
DD	14E3-12	268	301	335	368	402	435	468	535	602	669	736
	14E3-14	366	411	457	502	548	593	639	730	821	912	1003
	14E3-16	476	536	595	655	714	773	833	951	1070	1189	1307
DA	24E3-14	228	257	285	314	342	370	399	456	513	569	626
	24E3-16	298	336	373	410	447	484	521	596	670	744	819
	24E3-18	381	428	476	523	570	618	665	760	855	950	1045
	24E3-20	472	531	590	649	708	767	825	943	1061	1179	1296
	24E3-22	577	649	721	793	865	937	1009	1153	1296	1440	1584
	24E3-24	686	771	856	942	1027	1113	1198	1369	1540	1710	1881
DD	24E3-14	456	513	570	627	684	741	798	911	1025	1139	1253
	24E3-16	597	671	745	820	894	968	1043	1191	1340	1489	1637
	24E3-18	761	856	951	1046	1141	1236	1331	1520	1710	1900	2090
	24E3-20	945	1062	1180	1298	1416	1533	1651	1886	2122	2357	2593

Air Consumption - DA Actuators (cont.)

DA Actuators- Air Consumption/cycle, normal liters, L _n per cycle												
Supply Pr, bar		3	3.5	4	4.5	5	5.5	6	7	8	9	10
Ambient Temp: 25°C												
DA	45E3-18	459	516	574	631	688	745	803	917	1031	1146	1260
	45E3-20	571	642	713	784	855	926	997	1139	1281	1423	1566
	45E3-22	697	784	871	958	1045	1132	1219	1392	1566	1740	1914
	45E3-24	829	932	1035	1139	1242	1345	1448	1655	1861	2068	2274
	45E3-28	1132	1273	1414	1555	1696	1837	1978	2260	2542	2824	3106
DD	45E3-18	919	1033	1147	1262	1376	1491	1605	1834	2063	2292	2521
	45E3-20	1141	1283	1425	1568	1710	1852	1994	2278	2563	2847	3131
	45E3-22	1395	1568	1742	1916	2090	2263	2437	2785	3132	3480	3827
	45E3-24	1658	1864	2071	2277	2484	2690	2897	3310	3723	4136	4549
DA	10E4-22	849	955	1061	1166	1272	1378	1484	1695	1907	2118	2330
	10E4-24	1006	1131	1256	1381	1507	1632	1757	2008	2258	2509	2759
	10E4-28	1373	1544	1715	1886	2057	2228	2399	2741	3083	3425	3767
	10E4-32	1839	2068	2297	2526	2755	2984	3214	3672	4130	4588	5046
	10E4-36	2303	2589	2876	3163	3450	3737	4024	4597	5171	5745	6319
DD	10E4-22	1698	1910	2121	2333	2544	2756	2967	3390	3813	4237	4660
	10E4-24	2011	2262	2512	2763	3013	3264	3515	4016	4517	5018	5519
	10E4-28	2745	3087	3429	3771	4113	4455	4797	5481	6165	6849	7533
	10E4-32	3678	4136	4594	5053	5511	5969	6427	7344	8260	9176	10093

Air Consumption - SR Actuators

SR Actuators- Air Consumption/cycle, normal liters, L _n per cycle											
Supply Pr, bar	3	3.5	4	4.5	5	5.5	6	7	8	9	10
Ambient Temp: 25°C											
12E2-05	5	6	6	7	8	8	9	10	11	13	14
12E2-06	7	8	9	10	11	12	13	15	17	19	21
12E2-07	10	12	13	14	15	17	18	21	23	26	28
12E2-08	13	15	17	19	20	22	24	27	30	34	37
12E2-09	17	19	22	24	26	28	30	34	39	43	47
18E2-06	9	10	11	12	13	14	15	18	20	22	24
18E2-07	12	14	15	17	18	20	21	24	27	30	33
18E2-08	16	18	20	22	24	26	28	32	36	40	44
18E2-09	21	23	26	29	31	34	36	41	47	52	57
18E2-10	26	29	32	36	39	42	45	52	58	65	71
45E2-08	19	22	24	27	29	32	34	39	44	48	53
45E2-09	25	28	31	35	38	41	44	50	56	63	69
45E2-10	31	35	39	43	47	51	55	62	70	78	86
45E2-12	45	51	56	62	68	73	79	90	102	113	124
45E2-14	61	69	77	84	92	100	107	123	138	153	169
73E2-10	37	42	47	51	56	61	65	75	84	93	103
73E2-12	54	61	68	75	81	88	95	109	122	136	149
73E2-14	74	83	92	102	111	120	129	148	166	185	203
73E2-16	96	108	120	132	143	155	167	191	215	239	263
14E3-12	65	73	81	89	97	105	113	129	145	161	177
14E3-14	88	99	110	121	132	143	154	176	197	219	241
14E3-16	114	128	142	157	171	185	199	228	256	284	313
14E3-18	146	164	182	201	219	237	255	292	328	364	401
14E3-20	180	202	224	247	269	291	314	359	403	448	493
24E3-14	110	124	138	152	165	179	193	220	248	275	303
24E3-16	144	162	180	198	216	234	252	287	323	359	395
24E3-18	184	207	230	253	276	299	322	368	414	460	506
24E3-20	226	254	282	311	339	367	395	452	508	564	621
24E3-22	275	309	344	378	412	446	481	549	618	686	755
24E3-24	329	370	411	452	493	534	575	656	738	820	902
45E3-18	224	252	280	308	336	364	392	448	504	560	616
45E3-20	276	311	345	380	414	449	483	552	621	690	758
45E3-22	337	379	421	463	505	547	589	673	757	841	925
45E3-24	403	453	503	553	603	653	704	804	904	1004	1105
45E3-28	547	615	684	752	820	888	956	1093	1229	1365	1502
10E4-22	415	466	518	570	621	673	724	828	931	1034	1138
10E4-24	493	554	616	677	738	800	861	984	1107	1230	1352
10E4-28	666	749	832	915	998	1081	1164	1330	1496	1662	1828
10E4-32	880	989	1099	1209	1318	1428	1537	1757	1976	2195	2414
10E4-36	1105	1243	1380	1518	1656	1793	1931	2206	2482	2757	3033

Sizing a S98 Pneumatic Actuator

Introduction

Valves in services such as,

- > Frequent and/or fast operation
- > Hazardous areas
- > Remote locations
- > Emergency Shutdown or Venting applications
- > Process control
- > Reliable and consistent operation

are almost always automated, besides the ones that require very high thrust/torque to operate which would be very tedious or not practical, manually.

Valve actuators are required to move the valve's closure element (ball/disc/plug) to end positions of open or close with adequate torque/thrust to seat or unseat, or to move and positively hold the closure element at a desired intermediate position for process control requirements. They also need to accomplish the fail-safe function for an application, to drive the valve to close or open position, on loss of motive power.

Common Terminology

Some of the most used terms in the quarter turn actuator sizing for valves:

- > **DA or Double Acting:** The actuation is by compressed media on either side of the piston.
- > **SR or Spring Return:** Actuation by compressed media on one side and by the compressed spring in other direction.
- > **Fail Safe:** Actuator's response to loss of motive energy to mitigate unsafe consequence of a system's failure.
- > **Fail Close:** The actuator turns the valve stem (normally clockwise) to close the valve, in event of loss of motive power or signal.
- > **Fail Open:** The actuator turns the valve stem (normally counterclockwise) to open the valve, in event of loss of motive power or signal.
- > **Fail Last:** Also referred to as Fail in Place and Fail Freeze, holds the last position on failure of power or signal.
- > **BTO:** Also called as Break to Open Torque, Unseating Torque, Pneumatic / Hydraulic Break or Start Torque is the Actuator's maximum output torque at the start of the power stroke to unseat or open a valve, usually at the Zero degrees position of the quarter turn travel.
- > **RTO:** Run to Open Torque is the torque output of actuator at the mid position of travel or the minimum torque output along the torque curve.
- > **ETO:** End to Open Torque, Pneumatic/Hydraulic End, Air/Hydraulic End Torque is the torque output of the actuator at the end of the quarter turn travel or at the valve's full open or 90-degree position of the travel.

- > **BTC:** Break to Close, Spring Break Torque or Spring Start (for SR actuators) is the actuator's output torque at the start of the return stroke or valve closing stroke, either by the fluid power on DA actuators or by the compressed spring in SR actuators.
- > **RTC:** Run to Close Torque is the torque output of the actuator at mid position of travel or the minimum torque along the torque curve.
- > **ETC:** End to Close, Seating Torque, Spring End Torque, Pneumatic/Hydraulic End Torque is the maximum output torque of actuator at the end of the return power stroke or valve closing/seating position either by fluid power on DA actuator or by the expanded spring in SR actuators, at the zero degree position of travel.
- > **MAST:** The Maximum Allowable Stem Torque of the valve.
- > **FOS:** A factor equal or greater than 1 multiplied by the valve's torque requirement, used for sizing an actuator for the valve.
- > **MOR:** Manual Override
- > **Stroke:** A 90-degree operation in either clockwise (CW) or counterclockwise (CCW) direction. A Power Stroke is by compressed Air or hydraulic pressure and the Spring Stroke is the return stroke by the stored energy in a spring, compressed by the power stroke.
- > **Cycle:** Sequential operation of two strokes of actuator, opening or counterclockwise stroke and closing or clockwise stroke.
- > **Sizing Pressure:** Minimum operating pressure available, at which the actuator is to be sized for the valve.
- > **MOP:** The Maximum Operating Pressure of the actuator that outputs the rated torque/thrust of the actuator.

Series 98 Actuators

S98 are the Pneumatic Scotch Yoke Actuators with an operating pressure range of 40 to 150psig pneumatic pressure. The actuators range from 1200 Nm to 100,000Nm rated torque in 8 sizes, with multiple pressure and spring modules to choose from and optimize the selection. Refer to General Specifications and the Configurations sections for more details.

These pneumatic actuators use dry compressed Air / Inert / Natural Gas as the media.

Sizing S98 for a Valve

1. Establish the Valve's torque requirements for the application and service that it would be put in, from the valve manufacturer's technical documentation. The differential pressure across the valve closure element (Ball/Disc/Plug) bears on this torque value.
2. The maximum torque position during the dynamic operation and direction of rotation in which this is encountered shall also be determined. The maximum torque would normally be the unseating torque of the valve in the selected operating conditions, for most cases.

3. The FOS or the factor of safety in the sizing an actuator for this valve shall be determined, as recommended by the valve manufacturer or by the application engineering.
4. Multiply the FOS factor with each of the 3 (BTO, RTO & ETC), or the 6 (BTO,RTO,ETO,BTC,RTC&ETC) torque values provided by the valve manufacturer, to determine the max. and min. torque requirements of the actuator.
5. Note the MAST or the maximum allowable stem torque value of the valve.
6. Next, determine if the application requires Double Acting or a Spring Return actuator.
7. Note the Sizing Pressure value for selecting the actuator that will output required torques at this pressure.

Selecting a DA actuator (for clockwise to close operation)

8. Look up the torque charts for the required configuration of the actuator, i.e., DA, under the sizing pressure column. Scroll down to locate the Starting and Mid torques that are same or higher than the required.
9. Note the S98 actuator model corresponding to these values.

Selecting a SR actuator (fail close or Fail clockwise)

10. Look up the torque charts for SR actuators for the Spring End Torque that meets or exceeds the ETC torque determined in step 4. Scroll along to the right to the sizing pressure column to check if the Pneumatic Start torque meets or exceeds the BTO value determined in step 4. The Pneumatic End torque also must meet or exceed the ETO value.
11. If the pneumatic torques meet the requirement, note the actuator model and the spring number.
12. If the pneumatic torques fall short, then move down along the sizing pressure column to the next pressure module size with the same spring number as previous one and verify if the pneumatic torque values satisfy. Note the actuator model and the spring #.
13. Check the MOP for the selected model of the actuator to confirm that the maximum supply pressure does not exceed the MOP. If it does, then the supply pressure must be restricted to selected actuator's MOP or select an actuator with higher MOP.

Contact Bray Sales or Distributor for any assistance required with optimizing the sizing.

Output Torque – Imperial – Lb-in

DA - SYMMETRIC YOKE

Double Acting Actuators – Symmetric Yoke										
Actuator Size		Position	Operating Pressure, psig							
			40	50	60	70	80	100	125	150
DA	DD		Torque Output, Lb-in							
12E2-05		Start/End	2038	2548	3057	3567	4076	5096	6370	7643
		Mid	1139	1424	1709	1993	2278	2848	3559	4271
12E2-06		Start/End	2963	3704	4445	5186	5927	7409	9261	
Mid		1656	2070	2484	2898	3312	4140	5175		
12E2-07		Start/End	4057	5071	6085	7099	8114	10142		
Mid		2267	2834	3401	3967	4534	5668			
12E2-08		Start/End	5318	6648	7978	9307	10637			
Mid		2972	3715	4458	5201	5944				
12E2-09		Start/End	6748	8435	10122					
Mid		3771	4714	5657						
	12E2-05	Start/End	4141	5176	6211	7247	8282	10352		
		Mid	2314	2893	3471	4050	4628	5785		
	12E2-06	Start/End	5991	7489	8987	10485				
		Mid	3348	4185	5022	5859				
	12E2-07	Start/End	8178	10222						
		Mid	4570	5713						
	12E2-08	Start/End	10701							
		Mid	5980							

18E2-06		Start/End	3680	4600	5519	6439	7359	9199	11499	13799
		Mid	2056	2570	3084	3598	4113	5141	6426	7711
18E2-07		Start/End	5046	6308	7570	8831	10093	12616	15770	
Mid		2820	3525	4230	4935	5640	7050	8813		
18E2-08		Start/End	6623	8279	9935	11591	13247	16558		
Mid		3701	4627	5552	6477	7403	9253			
18E2-09		Start/End	8411	10513	12616	14718				
Mid		4700	5875	7050	8225					
18E2-10		Start/End	10408	13010	15612					
		Mid	5816	7270	8724					
	18E2-06	Start/End	7464	9330	11197	13063	14929			
		Mid	4171	5214	6257	7300	8343			
	18E2-07	Start/End	10198	12747	15297					
		Mid	5699	7123	8548					
	18E2-08	Start/End	13352							
		Mid	7461							

Output Torque – Imperial – Lb-in

DA - SYMMETRIC YOKE

Double Acting Actuators – Symmetric Yoke											
Actuator Size		Position	Operating Pressure, psig								
			40	50	60	70	80	100	125	150	
DA	DD		Torque Output, Lb-in								
45E2-08		Start/End	8610	10763	12915	15068	17221	21526	26907	32289	
		Mid	4812	6015	7217	8420	9623	12029	15036	18044	
45E2-09		Start/End	10934	13667	16401	19134	21867	27334	34168		
Mid		6110	7638	9165	10693	12220	15275	19094			
45E2-10		Start/End	13530	16913	20296	23678	27061	33826			
Mid		7561	9451	11342	13232	15122	18903				
45E2-12		Start/End	19544	24430	29316	34202	39088				
Mid		10922	13652	16383	19113	21843					
45E2-14		Start/End	26651	33314	39976						
Mid		14893	18616	22340							
	45E2-08	Start/End	17357	21697	26036	30375	34715				
		Mid	9700	12125	14550	16974	19399				
	45E2-09	Start/End	22004	27505	33006	38507					
		Mid	12296	15371	18445	21519					
	45E2-10	Start/End	27198	33997							
		Mid	15199	18998							
	45E2-12	Start/End	39225								
		Mid	21920								
		73E2-10	Start/End	16558	20698	24837	28977	33117	41396	51745	62094
			Mid	9253	11566	13880	16193	18506	23133	28916	34699
		73E2-12	Start/End	23960	29949	35939	41929	47919	59899		
			Mid	13389	16736	20084	23431	26778	33473		
		73E2-14	Start/End	32707	40883	49060	57237	65413			
			Mid	18277	22847	27416	31985	36554			
		73E2-16	Start/End	42799	53499	64199					
			Mid	23917	29897	35876					
		73E2-10	Start/End	33379	41724	50069	58414				
			Mid	18653	23317	27980	32643				
	73E2-12	Start/End	48182	60228							
		Mid	26925	33657							

Output Torque – Imperial – Lb-in

DA - SYMMETRIC YOKE

Double Acting Actuators – Symmetric Yoke											
Actuator Size		Position	Operating Pressure, psig								
			40	50	60	70	80	100	125	150	
DA	DD		Torque Output, Lb-in								
14E3-12		Start/End	28315	35393	42472	49551	56629	70787	88483	106180	
		Mid	15823	19779	23734	27690	31646	39557	49447	59336	
14E3-14		Start/End	38702	48377	58053	67728	77403	96754	120943		
Mid		21627	27034	32441	37848	43255	54069	67586			
14E3-16		Start/End	50687	63358	76030	88702	101374				
Mid		28325	35406	42487	49569	56650					
14E3-18		Start/End	64270	80337	96405	112472					
Mid		35916	44894	53873	62852						
14E3-20		Start/End	79451	99314	119176						
Mid		44399	55499	66599							
		14E3-12	Start/End	57079	71349	85618	99888	114158			
			Mid	31897	39871	47845	55820	63794			
		14E3-14	Start/End	77853	97316	116779					
			Mid	43506	54383	65259					
		14E3-16	Start/End	101823							
			Mid	56901							
24E3-14			Start/End	51497	64372	77246	90120	102995	128743	160929	193115
			Mid	28851	36064	43276	50489	57702	72127	90159	108191
24E3-16	Start/End		67512	84390	101268	118146	135024	168780	210975		
Mid	37823		47279	56734	66190	75646	94557	118197			
24E3-18	Start/End		85662	107077	128493	149908	171324	214155			
Mid	47991		59989	71987	83985	95983	119978				
24E3-20	Start/End		105947	132434	158921	185408	211895				
Mid	59356		74195	89034	103873	118712					
24E3-22	Start/End		128368	160460	192552						
Mid	71917		89896	107875							
24E3-24	Start/End		152924	191155							
Mid	85674		107093								
	24E3-14		Start/End	103812	129765	155718	181671	207624			
			Mid	58160	72700	87240	101780	116319			
	24E3-16		Start/End	135841	169802	203762					
			Mid	76104	95130	114156					
	24E3-18		Start/End	172141	215177						
			Mid	96441	120551						
	24E3-20	Start/End	212712								
		Mid	119170								

Output Torque – Imperial – Lb-in

DA - SYMMETRIC YOKE

Double Acting Actuators – Symmetric Yoke										
Actuator Size		Position	Operating Pressure, psig							
			40	50	60	70	80	100	125	150
DA	DD		Torque Output, Lb-in							
45E3-18		Start/End	104773	130966	157160	183353	209546	261933	327416	392899
		Mid	58698	73373	88047	102722	117396	146745	183432	220118
45E3-20		Start/End	129740	162175	194609	227044	259479	324349	405436	
		Mid	72685	90857	109028	127200	145371	181714	227142	
45E3-22		Start/End	157334	196668	236001	275335	314668	393335		
		Mid	88145	110181	132218	154254	176290	220363		
45E3-24		Start/End	187557	234446	281335	328224	375114			
		Mid	105077	131346	157615	183885	210154			
45E3-28		Start/End	255886	319858	383829					
		Mid	143358	179197	215037					
	45E3-18	Start/End	211209	264012	316814	369616				
		Mid	118328	147910	177492	207074				
	45E3-20	Start/End	261142	326428	391713					
		Mid	146303	182878	219454					
	45E3-22	Start/End	316331	395414						
		Mid	177222	221527						
	45E3-24	Start/End	376777							
		Mid	211086							
	10E4-22	Start/End	190750	238438	286125	333813	381500	476875	596094	715313
		Mid	106866	133583	160299	187016	213732	267165	333956	400748
10E4-24		Start/End	227584	284480	341376	398272	455168	568960	711200	853440
		Mid	127502	159377	191253	223128	255004	318755	398443	478132
10E4-28		Start/End	310860	388575	466291	544006	621721	777151		
		Mid	174157	217696	261235	304774	348313	435392		
10E4-32		Start/End	406949	508686	610423	712160	813897			
		Mid	227989	284987	341984	398981	455979			
10E4-36		Start/End	515849	644811	773773	902735				
		Mid	288999	361249	433499	505749				
	10E4-22	Start/End	384528	480660	576792	672924	769056			
		Mid	215428	269285	323143	377000	430857			
	10E4-24	Start/End	458196	572745	687293	801842				
		Mid	256700	320875	385050	449225				
	10E4-28	Start/End	624749	780936						
		Mid	350010	437512						
	10E4-32	Start/End	816925							
		Mid	457675							

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke										
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig						
				40	50	60	70	80	100	125
				Pneumatic Torque, Lb-in						
12E2-05	1	Start	4166						2354	3628
		Mid	1930						918	1630
		End	2741						930	2204
12E2-05	2	Start	5381							2943
		Mid	2461							1098
		End	3427							988
12E2-06	1	Start	4166				2445	3185	4667	6519
		Mid	1930				968	1382	2210	3245
		End	2741				1020	1761	3243	5095
12E2-06	2	Start	5381					2500	3982	5834
		Mid	2461					851	1679	2714
		End	3427					546	2027	3880
12E2-06	3	Start	6880							4450
		Mid	3267							1908
		End	4811							2380
12E2-07	1	Start	4166		2330	3344	4358	5372	7401	9936
		Mid	1930		904	1471	2037	2604	3738	5155
		End	2741		905	1920	2934	3948	5976	8512
12E2-07	2	Start	5381			2658	3673	4687	6715	9251
		Mid	2461			940	1506	2073	3207	4623
		End	3427			704	1718	2732	4761	7296
12E2-07	3	Start	6880					3303	5331	7867
		Mid	3267					1267	2401	3818
		End	4811					1233	3262	5797
12E2-08	1	Start	4166	2577	3907	5236	6566	7895	10555	
		Mid	1930	1042	1785	2528	3271	4014	5500	
		End	2741	1153	2482	3812	5141	6471	9130	
12E2-08	2	Start	5381		3221	4551	5880	7210	9869	
		Mid	2461		1254	1997	2740	3483	4969	
		End	3427		1267	2596	3926	5256	7915	
12E2-08	3	Start	6880				4496	5826	8485	
		Mid	3267				1934	2677	4163	
		End	4811				2427	3756	6416	
12E2-09	1	Start	4166	4007	5694	7381	9068	10755		
		Mid	1930	1841	2784	3727	4669	5612		
		End	2741	2582	4270	5957	7644	9331		
12E2-09	2	Start	5381	3321	5008	6695	8383	10070		
		Mid	2461	1310	2253	3196	4138	5081		
		End	3427	1367	3054	4741	6428	8115		
12E2-09	3	Start	6880		3624	5311	6998	8685		
		Mid	3267		1447	2390	3333	4275		
		End	4811		1555	3242	4929	6616		

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
18E2-06	1	Start	6124					2647	4487	6787	9087
		Mid	3028					1085	2113	3398	4683
		End	4712					1235	3075	5375	7675
18E2-06	2	Start	7483						3738	6037	8337
		Mid	3617						1524	2809	4094
		End	5461						1716	4016	6316
18E2-06	3	Start	11940								6242
		Mid	5448								2263
		End	7556								1858
18E2-07	1	Start	6124			2858	4119	5381	7904	11058	14212
		Mid	3028			1202	1907	2612	4022	5785	7547
		End	4712			1445	2707	3969	6492	9646	12800
18E2-07	2	Start	7483				3370	4631	7154	10308	13462
		Mid	3617				1318	2023	3433	5196	6958
		End	5461				1348	2610	5133	8287	11441
18E2-07	3	Start	11940							8214	11367
		Mid	5448							3365	5128
		End	7556							3830	6984
18E2-08	1	Start	6124		3567	5223	6879	8535	11846	15986	
		Mid	3028		1599	2524	3450	4375	6226	8539	
		End	4712		2155	3811	5467	7123	10434	14574	
18E2-08	2	Start	7483			4474	6129	7785	11097	15236	
		Mid	3617			1935	2860	3786	5636	7950	
		End	5461			2452	4108	5764	9076	13215	
18E2-08	3	Start	11940						9002	13142	
		Mid	5448						3806	6119	
		End	7556						4618	8758	
18E2-09	1	Start	6124	3699	5801	7904	10007	12109	16315		
		Mid	3028	1672	2847	4022	5197	6372	8722		
		End	4712	2287	4389	6492	8594	10697	14902		
18E2-09	2	Start	7483		5052	7154	9257	11360	15565		
		Mid	3617		2258	3433	4608	5783	8133		
		End	5461		3031	5133	7236	9338	13544		
18E2-09	3	Start	11940				7162	9265	13470		
		Mid	5448				2777	3953	6303		
		End	7556				2778	4881	9086		
18E2-10	1	Start	6124	5696	8298	10900	13502	16104			
		Mid	3028	2789	4243	5697	7151	8605			
		End	4712	4284	6886	9488	12090	14692			
18E2-10	2	Start	7483	4947	7549	10151	12753	15355			
		Mid	3617	2200	3654	5108	6562	8016			
		End	5461	2925	5527	8129	10731	13333			
18E2-10	3	Start	11940			8056	10658	13260			
		Mid	5448			3277	4731	6185			
		End	7556			3672	6274	8876			

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
45E2-08	1	Start	13003					7728	12033	17415	22796
		Mid	6286					3338	5743	8751	11758
		End	9493					4217	8522	13904	19285
45E2-08	2	Start	17219						8675	14056	19438
		Mid	8402						3627	6635	9642
		End	12851						4307	9688	15070
45E2-08	3	Start	24910								14870
		Mid	11827								6216
		End	17419								7378
45E2-09	1	Start	13003			6908	9641	12375	17842	24675	31509
		Mid	6286			2879	4407	5934	8989	12808	16627
		End	9493			3397	6131	8864	14331	21165	27998
45E2-09	2	Start	17219					9016	14483	21317	28150
		Mid	8402					3818	6873	10692	14511
		End	12851					4649	10115	16949	23783
45E2-09	3	Start	24910							16749	23583
		Mid	11827							7267	11085
		End	17419							9258	16091
45E2-09	4	Start	32171								21503
		Mid	14437								8475
		End	19498								8830
45E2-10	1	Start	13003		7421	10803	14186	17568	24334	32790	
		Mid	6286		3166	5056	6946	8837	12617	17343	
		End	9493		3910	7292	10675	14058	20823	29279	
45E2-10	2	Start	17219				10827	14210	20975	29432	37888
		Mid	8402				4830	6720	10501	15227	19952
		End	12851				6460	9842	16607	25064	33520
45E2-10	3	Start	24910						16407	24864	33320
		Mid	11827						7076	11801	16527
		End	17419						8916	17372	25829
45E2-10	4	Start	32171							22784	31241
		Mid	14437							9192	13917
		End	19498							10112	18568

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
45E2-12	1	Start	13003	10051	14937	19824	24710	29596	39368		
		Mid	6286	4636	7366	10097	12827	15558	21019		
		End	9493	6541	11427	16313	21199	26085	35857		
45E2-12	2	Start	17219		11579	16465	21351	26237	36009		
		Mid	8402		5250	7981	10711	13441	18902		
		End	12851		7211	12097	16983	21869	31641		
45E2-12	3	Start	24910			11897	16783	21669	31441		
		Mid	11827			4555	7286	10016	15477		
		End	17419			4406	9292	14178	23950		
45E2-12	4	Start	32171					19590	29362		
		Mid	14437					7406	12867		
		End	19498					6917	16689		
45E2-14	1	Start	13003	17158	23821	30484	37147				
		Mid	6286	8608	12331	16054	19777				
		End	9493	13648	20310	26973	33636				
45E2-14	2	Start	17219	13800	20463	27125	33788	40451			
		Mid	8402	6491	10215	13938	17661	21384			
		End	12851	9432	16095	22758	29420	36083			
45E2-14	3	Start	24910		15895	22557	29220	35883			
		Mid	11827		6789	10512	14236	17959			
		End	17419		8403	15066	21729	28392			
45E2-14	4	Start	32171			20478	27141	33803			
		Mid	14437			7903	11626	15349			
		End	19498			7805	14468	21131			

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke

Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
73E2-10	1	Start	25819					14269	22548	32897	43246
		Mid	12480					6026	10653	16436	22219
		End	18847					7298	15577	25926	36275
73E2-10	2	Start	31339						19930	30279	40628
		Mid	14754						8379	14162	19945
		End	21466						10057	20406	30755
73E2-10	3	Start	41373							25225	35574
		Mid	18970							9946	15729
		End	26520							10372	20721
73E2-10	4	Start	45865								30894
		Mid	21533								13167
		End	31200								16228

73E2-12	1	Start	25819			17092	23082	29072	41052	56026	
		Mid	12480			7604	10951	14298	20993	29361	
		End	18847			10121	16111	22101	34080	49055	
73E2-12	2	Start	31339			14474	20464	26454	38433	53408	
		Mid	14754			5330	8677	12024	18719	27087	
		End	21466			4600	10590	16580	28560	43535	
73E2-12	3	Start	41373					21399	33379	48354	63328
		Mid	18970					7808	14503	22871	31239
		End	26520					6546	18526	33501	48476
73E2-12	4	Start	45865						28699	43674	58649
		Mid	21533						11940	20308	28677
		End	31200						14034	29009	43983

73E2-14	1	Start	25819	13859	22036	30213	38389	46566	62919		
		Mid	12480	5797	10366	14936	19505	24074	33213		
		End	18847	6888	15065	23241	31418	39595	55948		
73E2-14	2	Start	31339		19418	27594	35771	43948	60301		
		Mid	14754		8092	12662	17231	21800	30939		
		End	21466		9544	17721	25898	34074	50428		
73E2-14	3	Start	41373			22540	30717	38893	55246		
		Mid	18970			8446	13015	17584	26723		
		End	26520			7687	15864	24040	40394		
73E2-14	4	Start	45865				26037	34213	50567		
		Mid	21533				10452	15022	24160		
		End	31200				11371	19548	35901		

73E2-16	1	Start	25819	23952	34652	45352	56051				
		Mid	12480	11437	17416	23396	29375				
		End	18847	16981	27680	38380	49080				
73E2-16	2	Start	31339	21334	32034	42733	53433	64133			
		Mid	14754	9163	15142	21122	27101	33080			
		End	21466	11460	22160	32860	43560	54260			
73E2-16	3	Start	41373		26979	37679	48379	59079			
		Mid	18970		10926	16906	22885	28864			
		End	26520		12126	22826	33526	44226			
73E2-16	4	Start	45865		22299	32999	43699	54399			
		Mid	21533		8364	14343	20322	26302			
		End	31200		7634	18334	29033	39733			

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke										
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig						
				40	50	60	70	80	100	125
				Pneumatic Torque, Lb-in						
14E3-12	1	Start	42556					25792	39949	57646
		Mid	20507					9966	17045	25893
		End	30838					14073	28231	45928
14E3-12	2	Start	48762						35454	53151
		Mid	23497						16060	25950
		End	35333						22025	39722
14E3-12	3	Start	56805						29623	47320
		Mid	27373						12184	22073
		End	41163						13982	31679
14E3-12	4	Start	74023							37783
		Mid	34849							14597
		End	50701							14460
14E3-12	5	Start	91521							
		Mid	41554							
		End	57199							
14E3-14	1	Start	42556			27215	36890	46566	65917	90105
		Mid	20507			11934	17341	22748	33562	47079
		End	30838			15497	25172	34848	54198	78387
14E3-14	2	Start	48762			22720	32395	42071	61421	85610
		Mid	23497			8944	14351	19758	30572	44089
		End	35333			9291	18966	28642	47993	72181
14E3-14	3	Start	56805				26565	36240	55591	79779
		Mid	27373				10475	15881	26695	40212
		End	41163				10923	20599	39950	64138
14E3-14	4	Start	74023						46054	70242
		Mid	34849						19219	32736
		End	50701						22731	46920
14E3-14	5	Start	91521							63744
		Mid	41554							26032
		End	57199							29422
14E3-16	1	Start	42556	19849	32521	45193	57864	70536	95879	
		Mid	20507	7818	14899	21980	29062	36143	50305	
		End	30838	8131	20803	33474	46146	58818	84161	
14E3-16	2	Start	48762		28026	40697	53369	66041	91384	123063
		Mid	23497		11909	18990	26072	33153	47315	65019
		End	35333		14597	27269	39940	52612	77955	109635
14E3-16	3	Start	56805			34867	47538	60210	85554	117233
		Mid	27373			15114	22195	29276	43439	61142
		End	41163			19225	31897	44569	69912	101591
14E3-16	4	Start	74023				38001	50673	76016	107695
		Mid	34849				14719	21801	35963	53666
		End	50701				14679	27351	52694	84373
14E3-16	5	Start	91521						69518	101197
		Mid	41554						29258	46961
		End	57199						35196	66875

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
14E3-18	1	Start	42556	33432	49500	65567	81635	97702			
		Mid	20507	15408	24387	33366	42345	51324			
		End	30838	21714	37781	53849	69916	85984			
14E3-18	2	Start	48762	28937	45004	61072	77139	93207	125342		
		Mid	23497	12419	21397	30376	39355	48334	66292		
		End	35333	15508	31576	47643	63711	79778	111913		
14E3-18	3	Start	56805		39174	55241	71309	87376	119511		
		Mid	27373		17521	26500	35479	44458	62415		
		End	41163		23533	39600	55667	71735	103870		
14E3-18	4	Start	74023			45704	61771	77839	109974		
		Mid	34849			19024	28003	36982	54939		
		End	50701			22382	38449	54517	86652		
14E3-18	5	Start	91521				55273	71341	103476		
		Mid	41554				21298	30277	48235		
		End	57199				20951	37019	69154		
14E3-20	1	Start	42556	48613	68476	88339	108201				
		Mid	20507	23892	34992	46092	57191				
		End	30838	36895	56758	76620	96483				
14E3-20	2	Start	48762	44118	63981	83843	103706	123569			
		Mid	23497	20902	32002	43102	54201	65301			
		End	35333	30689	50552	70415	90278	110140			
14E3-20	3	Start	56805	38287	58150	78013	97876	117738			
		Mid	27373	17026	28125	39225	50325	61425			
		End	41163	22646	42509	62372	82234	102097			
14E3-20	4	Start	74023		48613	68476	88338	108201			
		Mid	34849		20650	31749	42849	53949			
		End	50701		25291	45153	65016	84879			
14E3-20	5	Start	91521			61977	81840	101703			
		Mid	41554			25044	36144	47244			
		End	57199			27655	47518	67381			

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
24E3-14	1	Start	86173					44966	70715	102901	135087
		Mid	40682					17876	32302	50333	68365
		End	58028					18168	42986	74009	105031
24E3-14	2	Start	101825						59211	91397	123583
		Mid	48347						24798	42830	60861
		End	69532						28254	59277	90299
24E3-14	3	Start	132017							74991	107177
		Mid	61478							29976	48007
		End	85938							30861	61883
24E3-14	4	Start	154552								95750
		Mid	71044								38642
		End	97365								40674
24E3-16	1	Start	86173			43240	60118	76996	110752	152947	195142
		Mid	40682			16909	26365	35820	54732	78371	102011
		End	58028			16504	32772	49040	81576	122246	162916
24E3-16	2	Start	101825				48614	65492	99248	141443	183638
		Mid	48347				18861	28316	47228	70867	94507
		End	69532				18040	34308	66844	107514	148184
24E3-16	3	Start	132017						82842	125037	167232
		Mid	61478						34374	58013	81653
		End	85938						38428	79098	119768
24E3-16	4	Start	154552							113610	155805
		Mid	71044							48648	72288
		End	97365							57889	98558
24E3-16	5	Start	178697							100535	142730
		Mid	81532							38381	62021
		End	110440							35164	75834
24E3-18	1	Start	86173		49049	70465	91880	113296	156127	209666	
		Mid	40682		20164	32161	44159	56157	80153	110147	
		End	58028		22104	42745	63386	84028	125311	176914	
24E3-18	2	Start	101825			58961	80377	101792	144623	198162	
		Mid	48347			24658	36655	48653	72649	102643	
		End	69532			28013	48654	69296	110579	162182	
24E3-18	3	Start	132017				63971	85386	128217	181756	
		Mid	61478				23801	35799	59795	89790	
		End	85938				20239	40880	82163	133767	
24E3-18	4	Start	154552						116790	170329	
		Mid	71044						50430	80425	
		End	97365						60954	112557	
24E3-18	5	Start	178697						103715	157253	210792
		Mid	81532						40163	70158	100152
		End	110440						38229	89833	141436

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
24E3-20	1	Start	86173	47919	74406	100893	127380	153866	206840		
		Mid	40682	19530	34369	49208	64047	78886	108564		
		End	58028	21014	46544	72073	97603	123132	174191		
24E3-20	2	Start	101825		62902	89389	115876	142363	195336		
		Mid	48347		26865	41704	56543	71382	101060		
		End	69532		31812	57341	82871	108400	159459		
24E3-20	3	Start	132017			72983	99470	125957	178930		
		Mid	61478			28851	43690	58529	88207		
		End	85938			28925	54455	79984	131043		
24E3-20	4	Start	154552				88043	114530	167503		
		Mid	71044				34325	49164	78842		
		End	97365				33245	58775	109834		
24E3-20	5	Start	178697					101454	154428		
		Mid	81532					38897	68575		
		End	110440					36050	87109		
24E3-22	1	Start	86173	70340	102432	134524	166616	198708			
		Mid	40682	32091	50071	68050	86029	104008			
		End	58028	42624	73556	104488	135420	166352			
24E3-22	2	Start	101825	58836	90928	123020	155112	187204			
		Mid	48347	24587	42567	60546	78525	96504			
		End	69532	27892	58824	89756	120688	151620			
24E3-22	3	Start	132017		74522	106614	138706	170798			
		Mid	61478		29713	47692	65671	83650			
		End	85938		30409	61341	92273	123205			
24E3-22	4	Start	154552			95187	127279	159371			
		Mid	71044			38327	56306	74285			
		End	97365			40131	71063	101995			
24E3-22	5	Start	178697				114203	146295	210479		
		Mid	81532				46039	64018	99977		
		End	110440				48339	79271	141135		
24E3-24	1	Start	86173	94896	133127	171357	209588				
		Mid	40682	45849	67267	88686	110104				
		End	58028	66293	103142	139991	176840				
24E3-24	2	Start	101825	83392	121623	159854	198085				
		Mid	48347	38345	59763	81182	102600				
		End	69532	51561	88410	125259	162108				
24E3-24	3	Start	132017	66986	105217	143448	181679				
		Mid	61478	25491	46909	68328	89746				
		End	85938	23145	59994	96843	133692				
24E3-24	4	Start	154552		93790	132021	170252	208483			
		Mid	71044		37544	58963	80381	101800			
		End	97365		38785	75634	112483	149332			
24E3-24	5	Start	178697			118945	157176	195407			
		Mid	81532			48696	70114	91533			
		End	110440			52909	89758	126608			

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
45E3-18	1	Start	158124				77594	103787	156174	221657	287140
		Mid	74444				29845	44520	73869	110555	147241
		End	105759				27903	53150	103643	166759	229875
45E3-18	2	Start	193270						140959	206442	271926
		Mid	88618						59993	96680	133366
		End	120973						70564	133681	196797
45E3-18	3	Start	210693						111764	177247	242731
		Mid	101840						47049	83736	120422
		End	150169						54166	117282	180399
45E3-18	4	Start	246931							161123	226606
		Mid	116579							69307	105993
		End	166293							83176	146292
45E3-18	5	Start	292379							140816	206299
		Mid	135089							51187	87874
		End	186600							40402	103518
45E3-20	1	Start	158124			88850	121285	153720	218590	299677	380765
		Mid	74444			36151	54323	72494	108837	154265	199694
		End	105759			38753	70015	101278	163803	241959	320116
45E3-20	2	Start	193270				106071	138506	203376	284463	365550
		Mid	88618				40447	58619	94961	140390	185818
		End	120973				36937	68199	130724	208881	287037
45E3-20	3	Start	210693					109311	174180	255268	336355
		Mid	101840					45675	82018	127446	172874
		End	150169					51801	114326	192483	270639
45E3-20	4	Start	246931						158056	239144	320231
		Mid	116579						67589	113017	158446
		End	166293						80220	158376	236533
45E3-20	5	Start	292379							218837	299924
		Mid	135089							94897	140326
		End	186600							115602	193759
45E3-22	1	Start	158124		90909	130242	169576	208909	287576	385910	
		Mid	74444		37304	59341	81377	103413	147486	202576	
		End	105759		40737	78648	116560	154472	230296	325075	
45E3-22	2	Start	193270			115028	154361	193695	272362	370696	
		Mid	88618			45465	67502	89538	133610	188701	
		End	120973			45570	83482	121394	197217	291997	
45E3-22	3	Start	210693				125166	164500	243167	341501	
		Mid	101840				54558	76594	120667	175757	
		End	150169				67084	104996	180819	275599	
45E3-22	4	Start	246931					148376	227043	325377	
		Mid	116579					62165	106238	161328	
		End	166293					70889	146713	241492	
45E3-22	5	Start	292379						206736	305070	403403
		Mid	135089						88118	143209	198299
		End	186600						103939	198718	293498

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
45E3-24	1	Start	158124	81798	128687	175576	222465	269355	363133		
		Mid	74444	32200	58469	84739	111008	137277	189816		
		End	105759	31955	77149	122344	167538	212733	303121		
45E3-24	2	Start	193270		113473	160362	207251	254140	347918		
		Mid	88618		44594	70863	97133	123402	175940		
		End	120973		44071	89265	134460	179654	270043		
45E3-24	3	Start	210693			131167	178056	224945	318723		
		Mid	101840			57919	84189	110458	162996		
		End	150169			72867	118062	163256	253645		
45E3-24	4	Start	246931				161932	208821	302599		
		Mid	116579				69760	96029	148568		
		End	166293				83955	129150	219538		
45E3-24	5	Start	292379				141625	188514	282292	399515	
		Mid	135089				51640	77909	130448	196121	
		End	186600				41181	86375	176764	289750	
45E3-28	1	Start	158124	150127	214099	278070	342042	406013			
		Mid	74444	70481	106321	142160	178000	213839			
		End	105759	97815	159474	221133	282793	344452			
45E3-28	2	Start	193270	134913	198884	262856	326827	390799			
		Mid	88618	56606	92445	128285	164124	199964			
		End	120973	64736	126396	188055	249714	311373			
45E3-28	3	Start	210693	105718	169689	233661	297632	361604			
		Mid	101840	43662	79501	115341	151180	187020			
		End	150169	48338	109997	171657	233316	294975			
45E3-28	4	Start	246931		153565	217536	281508	345480			
		Mid	116579		65072	100912	136751	172591			
		End	166293		75891	137550	199210	260869			
45E3-28	5	Start	292379			197230	261201	325173			
		Mid	135089			82792	118632	154471			
		End	186600			94776	156435	218095			

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke										
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig						
				40	50	60	70	80	100	125
				Pneumatic Torque, Lb-in						
10E4-22	1	Start	311558					158224	253599	372818
		Mid	150942					65967	119401	186192
		End	223277					74480	166408	281318
10E4-22	2	Start	395372						222936	342155
		Mid	183135						87886	154677
		End	253939						87524	202433
10E4-22	3	Start	463500							272445
		Mid	222118							116515
		End	323649							138314
10E4-22	4	Start	583231							
		Mid	267905							
		End	366750							
10E4-24	1	Start	311558				174995	231891	345683	487923
		Mid	150942				75364	107239	170990	250679
		End	223277				90646	145485	255164	392263
10E4-24	2	Start	395372					201229	315021	457261
		Mid	183135					75724	139475	219164
		End	253939					66601	176280	313378
10E4-24	3	Start	463500						245311	387551
		Mid	222118						101313	181002
		End	323649						112160	249259
10E4-24	4	Start	583231							344450
		Mid	267905							136178
		End	366750							136570
10E4-28	1	Start	311558		165299	243014	320729	398444	553874	748162
		Mid	150942		69931	113471	157010	200549	287627	396475
		End	223277		81300	156206	231112	306018	455830	643096
10E4-28	2	Start	395372			212352	290067	367782	523212	717500
		Mid	183135			81956	125495	169034	256112	364960
		End	253939			77321	152228	227134	376946	564211
10E4-28	3	Start	463500				220357	298072	453502	647790
		Mid	222118				87333	130872	217950	326798
		End	323649				88108	163014	312826	500091
10E4-28	4	Start	583231						410401	604689
		Mid	267905						173127	281975
		End	366750						200138	387403

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Actuators - Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Lb-in	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
				Pneumatic Torque, Lb-in							
10E4-32	1	Start	311558	183672	285409	387146	488883	590621	794095		
		Mid	150942	80225	137222	194219	251217	308214	422209		
		End	223277	99009	197069	295129	393188	491248	687368		
10E4-32	2	Start	395372		254747	356484	458221	559958	763433		
		Mid	183135		105707	162704	219702	276699	390694		
		End	253939		118184	216244	314304	412364	608484		
10E4-32	3	Start	463500			286774	388511	490248	693722		
		Mid	222118			124542	181540	238537	352532		
		End	323649			152124	250184	348244	544364		
10E4-32	4	Start	583231				345410	447148	650622		
		Mid	267905				136716	193714	307708		
		End	366750				137496	235556	431676		
10E4-36	1	Start	311558	292572	421534	550496	679458	808421			
		Mid	150942	141235	213485	285735	357985	430234			
		End	223277	203973	328273	452574	576875	701176			
10E4-36	2	Start	395372	261910	390872	519834	648796	777758			
		Mid	183135	109720	181970	254220	326470	398720			
		End	253939	125088	249389	373690	497991	622292			
10E4-36	3	Start	463500		321162	450124	579086	708048			
		Mid	222118		143808	216058	288308	360557			
		End	323649		185269	309570	433871	558172			
10E4-36	4	Start	583231			407023	535985	664948			
		Mid	267905			171234	243484	315734			
		End	366750			196882	321183	445483			

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Actuators - Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
DA	DD			Torque Output, Lb-in							
12E2-05		CW	Start	1787	2234	2681	3128	3575	4469	5586	6703
			Mid	1175	1469	1763	2056	2350	2938	3672	4406
			End	2553	3191	3829	4467	5106	6382	7977	9573
		CCW	Start	2475	3093	3712	4331	4949	6186	7733	9280
			Mid	1139	1424	1709	1993	2278	2848	3559	4271
			End	1733	2166	2599	3032	3465	4332	5415	6498
12E2-06		CW	Start	2574	3217	3861	4504	5148	6435		
			Mid	1692	2115	2538	2961	3384	4230		
			End	3676	4595	5514	6433	7352	9190		
		CCW	Start	3598	4497	5397	6296	7196	8994		
			Mid	1656	2070	2484	2898	3312	4140		
			End	2519	3149	3779	4409	5038	6298		
12E2-07		CW	Start	3503	4379	5255	6131	7007			
			Mid	2303	2879	3455	4030	4606			
			End	5003	6254	7505	8756	10007			
		CCW	Start	4925	6157	7388	8619	9850			
			Mid	2267	2834	3401	3967	4534			
			End	3449	4311	5173	6035	6897			
12E2-08	CW	Start	4576	5720	6864						
		Mid	3008	3760	4512						
		End	6535	8169	9803						
	CCW	Start	6457	8071	9685						
		Mid	2972	3715	4458						
		End	4521	5651	6782						
12E2-09	CW	Start	5791	7239							
		Mid	3807	4759							
		End	8271	10339							
	CCW	Start	8193	10241							
		Mid	3771	4714							
		End	5737	7171							
	12E2-05	CW	Start	3520	4400	5280	6160	7040			
			Mid	2314	2893	3471	4050	4628			
			End	5027	6284	7541	8798	10055			
		CCW	Start	5027	6284	7541	8798	10055			
			Mid	2314	2893	3471	4050	4628			
			End	3520	4400	5280	6160	7040			
	12E2-06	CW	Start	5093	6366	7640					
			Mid	3348	4185	5022					
			End	7274	9092	10911					
		CCW	Start	7274	9092	10911					
			Mid	3348	4185	5022					
			End	5093	6366	7640					
	12E2-07	CW	Start	6952							
			Mid	4570							
			End	9929							
		CCW	Start	9929							
			Mid	4570							
			End	6952							

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Actuators - Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
DA	DD			Torque Output, Lb-in							
18E2-06		CW	Start	3217	4022	4826	5631	6435	8044	10054	
			Mid	2115	2644	3173	3701	4230	5288	6609	
			End	4595	5744	6892	8041	9190	11487	14359	
		CCW	Start	4467	5584	6701	7818	8935	11168	13960	
			Mid	2056	2570	3084	3598	4113	5141	6426	
			End	3128	3910	4692	5474	6256	7820	9775	
		CW	Start	4379	5474	6569	7664	8759	10948		
			Mid	2879	3598	4318	5038	5758	7197		
			End	6254	7818	9381	10945	12509	15636		
CCW		Start	6127	7658	9190	10722	12253	15317			
		Mid	2820	3525	4230	4935	5640	7050			
		End	4290	5362	6435	7507	8580	10725			
18E2-07		CW	Start	4379	5474	6569	7664	8759	10948		
			Mid	2879	3598	4318	5038	5758	7197		
			End	6254	7818	9381	10945	12509	15636		
		CCW	Start	6127	7658	9190	10722	12253	15317		
			Mid	2820	3525	4230	4935	5640	7050		
			End	4290	5362	6435	7507	8580	10725		
18E2-08	CW	Start	5720	7150	8580	10010					
		Mid	3760	4700	5640	6580					
		End	8169	10211	12253	14295					
	CCW	Start	8041	1005 1	12062	14072					
		Mid	3701	4627	5552	6477					
		End	5631	7038	8446	9853					
18E2-09	CW	Start	7239	9049	10859						
		Mid	4759	5948	7138						
		End	10339	12923	15508						
	CCW	Start	10211	12764	15317						
		Mid	4700	5875	7050						
		End	7150	8937	10725						
18E2-10	CW	Start	8937	11172							
		Mid	5875	7344							
		End	12764	15955							
	CCW	Start	12636	15795							
		Mid	5816	7270							
		End	8848	11060							
	18E2-06	CW	Start	6345	7932	9518	11105				
			Mid	4171	5214	6257	7300				
			End	9062	11328	13593	15859				
		CCW	Start	9062	11328	13593	15859				
			Mid	4171	5214	6257	7300				
			End	6345	7932	9518	11105				
	18E2-07	CW	Start	8669	10836						
			Mid	5699	7123						
			End	12381	15476						
		CCW	Start	12381	15476						
			Mid	5699	7123						
			End	8669	10836						

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Actuators - Canted Yoke												
Actuator		Rotation Direction	Position	Operating Pressure, psig								
				40	50	60	70	80	100	125	150	
DA	DD			Torque Output, Lb-in								
45E2-08		CW	Start	7436	9295	11154	13013	14872	18590	23237	27884	
			Mid	4888	6110	7332	8554	9776	12220	15275	18330	
			End	10619	13274	15929	18584	21239	26549	33186	39823	
		CCW	Start	10454	13067	15680	18294	20907	26134	32667	39201	
			Mid	4812	6015	7217	8420	9623	12029	15036	18044	
			End	7320	9150	10979	12809	14639	18299	22874	27449	
45E2-09		CW	Start	9411	11764	14116	16469	18822	23527			
			Mid	6186	7733	9280	10826	12373	15466			
			End	13440	16800	20160	23521	26881	33601			
		CCW	Start	13274	16593	19912	23230	26549	33186			
			Mid	6110	7638	9165	10693	12220	15275			
			End	9295	11619	13942	16266	18590	23237			
45E2-10		CW	Start	11619	14523	17428	20332	23237				
			Mid	7638	9547	11456	13366	15275				
			End	16593	20741	24889	29038	33186				
		CCW	Start	16427	20534	24641	28747	32854				
			Mid	7561	9451	11342	13232	15122				
			End	11502	14378	17253	20129	23005				
45E2-12	CW	Start	16731	20913	25096							
		Mid	10998	13748	16497							
		End	23894	29867	35841							
	CCW	Start	23728	29660	35592							
		Mid	10922	13652	16383							
		End	16614	20768	24922							
45E2-14	CW	Start	22772	28465								
		Mid	14970	18712								
		End	32522	40653								
	CCW	Start	32356	40445								
		Mid	14893	18616								
		End	22656	28320								
	45E2-08	CW	Start	14756	18444	22133	25822					
			Mid	9700	12125	14550	16974					
			End	21073	26341	31610	36878					
		CCW	Start	21073	26341	31610	36878					
			Mid	9700	12125	14550	16974					
			End	14756	18444	22133	25822					
		45E2-09	CW	Start	18706	23382	28059					
				Mid	12296	15371	18445					
				End	26715	33393	40072					
	CCW		Start	26715	33393	40072						
			Mid	12296	15371	18445						
			End	18706	23382	28059						
	45E2-10	CW	Start	23121								
			Mid	15199								
			End	33020								
		CCW	Start	33020								
			Mid	15199								
			End	23121								

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Actuators - Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
DA	DD			Torque Output, Lb-in							
73E2-10		CW	Start	14300	17875	21450	25024	28599	35749	44687	
			Mid	9400	11750	14100	16450	18800	23500	29375	
			End	20422	25528	30633	35739	40844	51055	63819	
		CCW	Start	20103	25129	30154	35180	40206	50257	62822	
			Mid	9253	11566	13880	16193	18506	23133	28916	
			End	14076	17595	21114	24633	28153	35191	43988	
73E2-12		CW	Start	20592	25739	30887	36035	41183			
			Mid	13536	16920	20304	23688	27072			
			End	29408	36760	44112	51464	58816			
		CCW	Start	29089	36361	43633	50905	58177			
			Mid	13389	16736	20084	23431	26778			
			End	20368	25460	30552	35644	40736			
73E2-14	CW	Start	28027	35034	42041						
		Mid	18424	23030	27636						
		End	40027	50034	60041						
	CCW	Start	39708	49635	59562						
		Mid	18277	22847	27416						
		End	27804	34755	41706						
73E2-16	CW	Start	36607	45759							
		Mid	24064	30080							
		End	52281	65351							
	CCW	Start	51961	64952							
		Mid	23917	29897							
		End	36384	45480							
	73E2-10	CW	Start	28376	35470	42564					
			Mid	18653	23317	27980					
			End	40525	50656	60788					
		CCW	Start	40525	50656	60788					
			Mid	18653	23317	27980					
			End	28376	35470	42564					
	73E2-12	CW	Start	40960							
			Mid	26925							
			End	58497							
		CCW	Start	58497							
			Mid	26925							
			End	40960							

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Actuators - Canted Yoke												
Actuator		Rotation Direction	Position	Operating Pressure, psig								
				40	50	60	70	80	100	125	150	
DA	DD			Torque Output, Lb-in								
14E3-12		CW	Start	24452	30566	36679	42792	48905	61131	76414		
			Mid	16074	20093	24111	28130	32148	40185	50231		
			End	34922	43652	52383	61113	69844	87304	109131		
		CCW	Start	34376	42970	51564	60158	68752	85940	107425		
			Mid	15823	19779	23734	27690	31646	39557	49447		
			End	24070	30088	36106	42123	48141	60176	75220		
		14E3-14	CW	Start	33283	41603	49924	58244	66565	83206		
				Mid	21879	27348	32818	38288	43757	54696		
				End	47532	59416	71299	83182	95065	118831		
CCW			Start	46987	58733	70480	82227	93974	117467			
			Mid	21627	27034	32441	37848	43255	54069			
			End	32900	41126	49351	57576	65801	82251			
14E3-16		CW	Start	43471	54339	65207	76074	86942				
			Mid	28576	35720	42864	50008	57152				
			End	62083	77604	93125	108646	124166				
			CCW	Start	61538	76922	92306	107691	123075			
				Mid	28325	35406	42487	49569	56650			
				End	43089	53861	64634	75406	86178			
	14E3-18	CW	Start	55018	68773	82527						
			Mid	36167	45208	54250						
			End	78574	98217	117861						
CCW		Start	78028	97535	117043							
		Mid	35916	44894	53873							
		End	54636	68295	81954							
14E3-20	CW	Start	67924	84904								
		Mid	44650	55813								
		End	97005	121256								
	CCW	Start	96459	120574								
		Mid	44399	55499								
		End	67542	84427								
	14E3-12	CW	Start	48523	60654	72784	84915					
			Mid	31897	39871	47845	55820					
			End	69298	86622	103947	121271					
		CCW	Start	69298	86622	103947	121271					
			Mid	31897	39871	47845	55820					
			End	48523	60654	72784	84915					
		14E3-14	CW	Start	66183	82729						
				Mid	43506	54383						
				End	94519	118149						
	CCW		Start	94519	118149							
			Mid	43506	54383							
			End	66183	82729							
	14E3-16	CW	Start	86560								
			Mid	56901								
			End	123621								
		CCW	Start	123621								
			Mid	56901								
			End	86560								

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Actuators - Canted Yoke												
Actuator		Rotation Direction	Position	Operating Pressure, psig								
				40	50	60	70	80	100	125	150	
DA	DD			Torque Output, Lb-in								
24E3-14		CW	Start	44473	55591	66709	77828	88946	111182	138978		
			Mid	29309	36636	43963	51290	58618	73272	91590		
			End	63514	79392	95271	111149	127028	158785	198481		
		CCW	Start	62522	78152	93782	109413	125043	156304	195380		
			Mid	28851	36064	43276	50489	57702	72127	90159		
			End	43778	54723	65667	76612	87556	109445	136806		
		CW	Start	58087	72609	87131	101652	116174	145218			
			Mid	38281	47851	57421	66992	76562	95702			
			End	82957	103696	124435	145175	165914	207392			
CCW		Start	81965	102456	122947	143438	163929	204911				
		Mid	37823	47279	56734	66190	75646	94557				
		End	57392	71740	86088	100436	114784	143480				
24E3-16		CW	Start	73516	91896	110275	128654	147033				
			Mid	48449	60562	72674	84786	96899				
			End	104992	131240	157489	183737	209985				
			CCW	Start	104000	130000	156000	182000	208000			
				Mid	47991	59989	71987	83985	95983			
				End	72822	91027	109232	127438	145643			
	CW	Start	90761	113451	136142							
		Mid	59814	74767	89721							
		End	129620	162025	194430							
24E3-18	CCW	Start	128628	160785	192942							
		Mid	59356	74195	89034							
		End	90066	112583	135099							
		CW	Start	109821	137276							
			Mid	72375	90469							
			End	156840	196051							
	CCW	Start	155848	194810								
		Mid	71917	89896								
		End	109126	136407								
24E3-20	CW	Start	130696									
		Mid	86132									
		End	186653									
		CCW	Start	185661								
			Mid	85674								
			End	130001								
	CW	Start	88251	110314	132376							
		Mid	58160	72700	87240							
		End	126035	157544	189053							
24E3-22	CCW	Start	126035	157544	189053							
		Mid	58160	72700	87240							
		End	88251	110314	132376							
		CW	Start	115479	144349							
			Mid	76104	95130							
			End	164921	206152							
	CCW	Start	164921	206152								
		Mid	76104	95130								
		End	115479	144349								
24E3-24		CW	Start	88251	110314	132376						
			Mid	58160	72700	87240						
			End	126035	157544	189053						
		CCW	Start	126035	157544	189053						
			Mid	58160	72700	87240						
			End	88251	110314	132376						
		CW	Start	115479	144349							
			Mid	76104	95130							
			End	164921	206152							
CCW		Start	164921	206152								
		Mid	76104	95130								
		End	115479	144349								

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Actuators - Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
DA	DD			Torque Output, Lb-in							
45E3-18		CW	Start	90482	113102	135723	158343	180964	226204	282756	
			Mid	59630	74537	89445	104352	119260	149075	186343	
			End	129221	161527	193832	226137	258443	323053	403817	
		CCW	Start	127202	159003	190803	222604	254405	318006	397507	
			Mid	58698	73373	88047	102722	117396	146745	183432	
			End	89068	111335	133602	155869	178136	222670	278338	
45E3-20		CW	Start	111706	139632	167559	195485	223412	279265		
			Mid	73617	92021	110426	128830	147234	184043		
			End	159533	199416	239299	279182	319065	398831		
		CCW	Start	157513	196892	236270	275649	315027	393784		
			Mid	72685	90857	109028	127200	145371	181714		
			End	110292	137865	165438	193011	220584	275730		
45E3-22		CW	Start	135164	168955	202746	236537	270328			
			Mid	89077	111346	133615	155884	178154			
			End	193034	241293	289552	337810	386069			
		CCW	Start	191015	238769	286523	334277	382031			
			Mid	88145	110181	132218	154254	176290			
			End	133750	167188	200626	234063	267501			
45E3-24	CW	Start	160857	201071	241285	281499					
		Mid	106009	132511	159013	185515					
		End	229727	287159	344590	402022					
	CCW	Start	227708	284635	341562	398489					
		Mid	105077	131346	157615	183885					
		End	159443	199303	239164	279025					
45E3-28	CW	Start	218944	273679							
		Mid	144290	180362							
		End	312684	390855							
	CCW	Start	310665	388331							
		Mid	143358	179197							
		End	217530	271912							
	45E3-18	CW	Start	179550	224437	269325					
			Mid	118328	147910	177492					
			End	256424	320530	384636					
		CCW	Start	256424	320530	384636					
			Mid	118328	147910	177492					
			End	179550	224437	269325					
	45E3-20	CW	Start	221998	277498						
			Mid	146303	182878						
			End	317046	396308						
		CCW	Start	317046	396308						
			Mid	146303	182878						
			End	221998	277498						
	45E3-22	CW	Start	268915							
			Mid	177222							
			End	384050							
		CCW	Start	384050							
			Mid	177222							
			End	268915							

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Actuators - Canted Yoke												
Actuator		Rotation Direction	Position	Operating Pressure, psig								
				40	50	60	70	80	100	125	150	
DA	DD			Torque Output, Lb-in								
10E4-22		CW	Start	164731	205914	247097	288280	329463	411828	514785	617742	
			Mid	108562	135703	162843	189984	217125	271406	339257	407109	
			End	235261	294076	352891	411706	470521	588152	735190	882228	
		CCW	Start	231585	289481	347377	405273	463169	578962	723702	868443	
			Mid	106866	133583	160299	187016	213732	267165	333956	400748	
			End	162157	202697	243236	283775	324315	405393	506742	608090	
10E4-24		CW	Start	196044	245055	294066	343077	392088	490110	612637		
			Mid	129198	161498	193797	226097	258396	322995	403744		
			End	279980	349975	419970	489964	559959	699949	874936		
		CCW	Start	276304	345380	414456	483532	552607	690759	863449		
			Mid	127502	159377	191253	223128	255004	318755	398443		
			End	193470	241837	290205	338572	386940	483675	604594		
10E4-28		CW	Start	266837	333547	400256	466966	533675				
			Mid	175853	219816	263779	307743	351706				
			End	381083	476354	571625	666896	762167				
		CCW	Start	377407	471759	566111	660463	754815				
			Mid	174157	217696	261235	304774	348313				
			End	264264	330329	396395	462461	528527				
10E4-32	CW	Start	348522	435653	522784	609914						
		Mid	229686	287107	344528	401950						
		End	497742	622177	746612	871048						
	CCW	Start	494066	617582	741099	864615						
		Mid	227989	284987	341984	398981						
		End	345949	432436	518923	605410						
10E4-36	CW	Start	441099	551373								
		Mid	290696	363370								
		End	629954	787443								
	CCW	Start	626278	782848								
		Mid	288999	361249								
		End	438525	548156								
	10E4-22	CW	Start	326889	408611	490333	572055					
			Mid	215428	269285	323143	377000					
			End	466845	583557	700268	816980					
		CCW	Start	466845	583557	700268	816980					
			Mid	215428	269285	323143	377000					
			End	326889	408611	490333	572055					
		10E4-24	CW	Start	389514	486892	584271					
				Mid	256700	320875	385050					
				End	556283	695354	834425					
	CCW		Start	556283	695354	834425						
			Mid	256700	320875	385050						
			End	389514	486892	584271						
	10E4-28	CW	Start	531101								
			Mid	350010								
			End	758491								
		CCW	Start	758491								
			Mid	350010								
			End	531101								

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
12E2-05	1	Start	3541						2858	4405	5951
		Mid	1930						918	1630	2341
		End	3328						791	1874	2956
12E2-05	2	Start	4574							3573	5119
		Mid	2461							1098	1810
		End	4160							840	1923
12E2-06	1	Start	3541				2968	3867	5666	7915	10163
		Mid	1930				968	1382	2210	3245	4280
		End	3328				867	1497	2757	4331	5906
12E2-06	2	Start	4574						4834	7083	9331
		Mid	2461						1679	2714	3749
		End	4160						1724	3298	4873
12E2-06	3	Start	5849							5402	7651
		Mid	3267							1908	2943
		End	5841							2024	3598
12E2-07	1	Start	3541		2828	4060	5291	6522	8985		
		Mid	1930		904	1471	2037	2604	3738		
		End	3328		770	1632	2494	3356	5080		
12E2-07	2	Start	4574				4459	5690	8153		
		Mid	2461				1506	2073	3207		
		End	4160				1461	2323	4047		
12E2-07	3	Start	5849						6472	9551	
		Mid	3267						2401	3818	
		End	5841						2773	4928	
12E2-08	1	Start	3541	3129	4743	6357	7971	9585			
		Mid	1930	1042	1785	2528	3271	4014			
		End	3328	980	2110	3240	4371	5501			
12E2-08	2	Start	4574		3911	5525	7139	8753			
		Mid	2461		1254	1997	2740	3483			
		End	4160		1077	2207	3338	4468			
12E2-08	3	Start	5849				5459	7073	10301		
		Mid	3267				1934	2677	4163		
		End	5841				2063	3193	5454		
12E2-09	1	Start	3541	4864	6913	8961					
		Mid	1930	1841	2784	3727					
		End	3328	2195	3630	5064					
12E2-09	2	Start	4574	4032	6081	8129	10177				
		Mid	2461	1310	2253	3196	4138				
		End	4160	1162	2596	4030	5465				
12E2-09	3	Start	5849		4400	6448	8497	10545			
		Mid	3267		1447	2390	3333	4275			
		End	5841		1322	2756	4190	5624			

Note: Select Canted Yoke for Fail CW only.

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
18E2-06	1	Start	5206						5448	8240	11032
		Mid	3028						2113	3398	4683
		End	5720						2614	4569	6524
18E2-06	2	Start	6361						4538	7330	10122
		Mid	3617						1524	2809	4094
		End	6631						1459	3414	5369
18E2-07	1	Start	5206				5001	6533	9596	13425	
		Mid	3028				1907	2612	4022	5785	
		End	5720				2301	3374	5519	8200	
18E2-07	2	Start	6361					5623	8686	12515	16344
		Mid	3617					2023	3433	5196	6958
		End	6631					2219	4364	7045	9726
18E2-07	3	Start	10150							9972	13801
		Mid	5448							3365	5128
		End	9174							3256	5937
18E2-08	1	Start	5206		4331	6341	8352	10362	14383		
		Mid	3028		1599	2524	3450	4375	6226		
		End	5720		1832	3240	4647	6055	8870		
18E2-08	2	Start	6361			5431	7442	9452	13472	18498	
		Mid	3617			1935	2860	3786	5636	7950	
		End	6631			2085	3492	4900	7715	11234	
18E2-08	3	Start	10150						10929	15955	
		Mid	5448						3806	6119	
		End	9174						3926	7445	
18E2-09	1	Start	5206	4491	7043	9596	12149	14702			
		Mid	3028	1672	2847	4022	5197	6372			
		End	5720	1944	3731	5519	7306	9094			
18E2-09	2	Start	6361		6133	8686	11239	13792			
		Mid	3617		2258	3433	4608	5783			
		End	6631		2576	4364	6151	7939			
18E2-09	3	Start	10150				8695	11248			
		Mid	5448				2777	3953			
		End	9174				2362	4149			
18E2-10	1	Start	5206	6916	10075	13234					
		Mid	3028	2789	4243	5697					
		End	5720	3642	5854	8066					
18E2-10	2	Start	6361	6006	9165	12324	15483	18642			
		Mid	3617	2200	3654	5108	6562	8016			
		End	6631	2487	4699	6911	9123	11335			
18E2-10	3	Start	10150			9780	12939	16098			
		Mid	5448			3277	4731	6185			
		End	9174			3122	5334	7546			

Note: Select Canted Yoke for Fail CW only.

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
45E2-08	1	Start	11054					9382	14609	21143	27676
		Mid	6286					3338	5743	8751	11758
		End	11525					3585	7245	11820	16395
45E2-08	2	Start	14638							17065	23599
		Mid	8402							6635	9642
		End	15602							8236	12811
45E2-08	3	Start	21176								18053
		Mid	11827								6216
		End	21148								6272
45E2-09	1	Start	11054			8387	11705	15024	21661	29958	38254
		Mid	6286			2879	4407	5934	8989	12808	16627
		End	11525			2888	5212	7535	12183	17992	23801
45E2-09	2	Start	14638					10947	17584	25880	34177
		Mid	8402					3818	6873	10692	14511
		End	15602					3952	8599	14408	20218
45E2-09	3	Start	21176							20334	28631
		Mid	11827							7267	11085
		End	21148							7870	13679
45E2-09	4	Start	27349								26106
		Mid	14437								8475
		End	23673								7507
45E2-10	1	Start	11054		9009	13116	17223	21329	29543	39810	
		Mid	6286		3166	5056	6946	8837	12617	17343	
		End	11525		3324	6199	9075	11950	17702	24891	
45E2-10	2	Start	14638				13145	17252	25465	35732	
		Mid	8402				4830	6720	10501	15227	
		End	15602				5491	8367	14118	21307	
45E2-10	3	Start	21176						19920	30187	40453
		Mid	11827						7076	11801	16527
		End	21148						7579	14768	21957
45E2-10	4	Start	27349							27662	37929
		Mid	14437							9192	13917
		End	23673							8596	15785

Note: Select Canted Yoke for Fail CW only.

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
45E2-12	1	Start	11054	12203	18135	24067	29999	35931			
		Mid	6286	4636	7366	10097	12827	15558			
		End	11525	5560	9714	13868	18021	22175			
45E2-12	2	Start	14638		14058	19990	25922	31854			
		Mid	8402		5250	7981	10711	13441			
		End	15602		6130	10284	14438	18591			
45E2-12	3	Start	21176				20376	26308	38172		
		Mid	11827				7286	10016	15477		
		End	21148				7899	12053	20360		
45E2-12	4	Start	27349						35647		
		Mid	14437						12867		
		End	23673						14187		
45E2-14	1	Start	11054	20832	28921	37010					
		Mid	6286	8608	12331	16054					
		End	11525	11602	17266	22930					
45E2-14	2	Start	14638	16754	24843	32932					
		Mid	8402	6491	10215	13938					
		End	15602	8018	13682	19346					
45E2-14	3	Start	21176		19297	27386	35476				
		Mid	11827		6789	10512	14236				
		End	21148		7144	12808	18472				
45E2-14	4	Start	27349			24862	32951				
		Mid	14437			7903	11626				
		End	23673			6635	12299				

Note: Select Canted Yoke for Fail CW only.

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
73E2-10	1	Start	21948					17324	27376	39940	52504
		Mid	12480					6026	10653	16436	22219
		End	22882					6204	13242	22040	30838
73E2-10	2	Start	26641						24197	36761	49326
		Mid	14754						8379	14162	19945
		End	26061						8549	17347	26145
73E2-10	3	Start	35171							30625	43189
		Mid	18970							9946	15729
		End	32197							8817	17615
73E2-10	4	Start	38990								37508
		Mid	21533								13167
		End	37879								13796
73E2-12	1	Start	21948			20751	28023	35295	49840		
		Mid	12480			7604	10951	14298	20993		
		End	22882			8604	13696	18788	28972		
73E2-12	2	Start	26641				24845	32117	46661	64842	
		Mid	14754				8677	12024	18719	27087	
		End	26061				9003	14095	24279	37009	
73E2-12	3	Start	35171						40525	58705	
		Mid	18970						14503	22871	
		End	32197						15749	28479	
73E2-12	4	Start	38990						34843	53024	
		Mid	21533						11940	20308	
		End	37879						11930	24660	
73E2-14	1	Start	21948	16826	26753	36680	46607	56534			
		Mid	12480	5797	10366	14936	19505	24074			
		End	22882	5856	12807	19758	26708	33659			
73E2-14	2	Start	26641		23575	33502	43429	53356			
		Mid	14754		8092	12662	17231	21800			
		End	26061		8114	15065	22016	28967			
73E2-14	3	Start	35171				37292	47219			
		Mid	18970				13015	17584			
		End	32197				13486	20437			
73E2-14	4	Start	38990				31611	41538	61392		
		Mid	21533				10452	15022	24160		
		End	37879				9667	16618	30520		
73E2-16	1	Start	21948	42070	55060						
		Mid	12480	17416	23396						
		End	22882	23531	32627						
73E2-16	2	Start	26641	38891	51881	64872					
		Mid	14754	15142	21122	27101					
		End	26061	18838	27934	37030					
73E2-16	3	Start	35171	32755	45745	58735					
		Mid	18970	10926	16906	22885					
		End	32197	10308	19404	28500					
73E2-16	4	Start	38990		40063	53054					
		Mid	21533		14343	20322					
		End	37879		15586	24681					

Note: Select Canted Yoke for Fail CW only.

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Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
14E3-12	1	Start	36177					31313	48501	69986	91471
		Mid	20507					11139	19050	28940	38829
		End	37439					11964	23999	39043	54087
14E3-12	2	Start	41452						43044	64529	86014
		Mid	23497						16060	25950	35839
		End	42897						18724	33768	48812
14E3-12	3	Start	48290							57450	78935
		Mid	27373							22073	31962
		End	49975							26930	41974
14E3-12	4	Start	62927								67356
		Mid	34849								24487
		End	61555								27337
14E3-12	5	Start	77802								59467
		Mid	41554								17782
		End	69444								12462
14E3-14	1	Start	36177			33041	44788	56534	80028	109395	
		Mid	20507			11934	17341	22748	33562	47079	
		End	37439			13174	21399	29624	46074	66637	
14E3-14	2	Start	41452				39330	51077	74570	103937	
		Mid	23497				14351	19758	30572	44089	
		End	42897				16123	24349	40799	61362	
14E3-14	3	Start	48290					43998	67491	96858	126225
		Mid	27373					15881	26695	40212	53729
		End	49975					17511	33961	54524	75087
14E3-14	4	Start	62927						55912	85279	114646
		Mid	34849						19219	32736	46254
		End	61555						19324	39887	60450
14E3-14	5	Start	77802							77390	106757
		Mid	41554							26032	39549
		End	69444							25012	45575
14E3-16	1	Start	36177		39483	54867	70252	85636	116405		
		Mid	20507		14899	21980	29062	36143	50305		
		End	37439		17684	28457	39229	50001	71546		
14E3-16	2	Start	41452			49410	64794	80178	110947		
		Mid	23497			18990	26072	33153	47315		
		End	42897			23181	33953	44726	66270		
14E3-16	3	Start	48290			42331	57715	73100	103868		
		Mid	27373			15114	22195	29276	43439		
		End	49975			16344	27116	37888	59433		
14E3-16	4	Start	62927					61520	92289		
		Mid	34849					21801	35963		
		End	61555					23251	44795		
14E3-16	5	Start	77802						84400	122861	
		Mid	41554						29258	46961	
		End	69444						29920	56851	

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Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
14E3-18	1	Start	36177	40589	60096	79603	99110	118618			
		Mid	20507	15408	24387	33366	42345	51324			
		End	37439	18459	32118	45777	59436	73095			
14E3-18	2	Start	41452	35132	54639	74146	93653	113160			
		Mid	23497	12419	21397	30376	39355	48334			
		End	42897	13184	26843	40502	54161	67820			
14E3-18	3	Start	48290		47560	67067	86574	106081			
		Mid	27373		17521	26500	35479	44458			
		End	49975		20005	33664	47323	60982			
14E3-18	4	Start	62927			55488	74995	94502			
		Mid	34849			19024	28003	36982			
		End	61555			19027	32686	46345			
14E3-18	5	Start	77802				67106	86613	125627		
		Mid	41554				21298	30277	48235		
		End	69444				17811	31470	58788		
14E3-20	1	Start	36177	59020	83135	107250					
		Mid	20507	23892	34992	46092					
		End	37439	31365	48250	65135					
14E3-20	2	Start	41452	53563	77677	101792	125907				
		Mid	23497	20902	32002	43102	54201				
		End	42897	26089	42975	59860	76745				
14E3-20	3	Start	48290	46484	70599	94713	118828				
		Mid	27373	17026	28125	39225	50325				
		End	49975	19252	36137	53022	69908				
14E3-20	4	Start	62927		59020	83134	107249				
		Mid	34849		20650	31749	42849				
		End	61555		21500	38385	55270				
14E3-20	5	Start	77802			75245	99360	123475			
		Mid	41554			25044	36144	47244			
		End	69444			23510	40395	57281			

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Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
24E3-14	1	Start	73256						85853	124929	164005
		Mid	40682						32302	50333	68365
		End	70450						36543	62915	89287
24E3-14	2	Start	86562						71887	110963	150039
		Mid	48347						24798	42830	60861
		End	84417						24019	50391	76764
24E3-14	3	Start	112228							91045	130121
		Mid	61478							29976	48007
		End	104335							26235	52607
24E3-14	4	Start	131385								116247
		Mid	71044								38642
		End	118208								34577
24E3-16	1	Start	73256				72988	93479	134461	185689	
		Mid	40682				26365	35820	54732	78371	
		End	70450				27860	41689	69348	103922	
24E3-16	2	Start	86562					79512	120495	171722	
		Mid	48347					28316	47228	70867	
		End	84417					29165	56824	91398	
24E3-16	3	Start	112228						100577	151804	203032
		Mid	61478						34374	58013	81653
		End	104335						32668	67241	101815
24E3-16	4	Start	131385							137931	189159
		Mid	71044							48648	72288
		End	118208							49211	83785
24E3-16	5	Start	151911							122056	173284
		Mid	81532							38381	62021
		End	134083							29893	64467
24E3-18	1	Start	73256		59550	85550	111550	137550	189550		
		Mid	40682		20164	32161	44159	56157	80153		
		End	70450		18790	36338	53885	71432	106527		
24E3-18	2	Start	86562			71583	97583	123583	175583		
		Mid	48347			24658	36655	48653	72649		
		End	84417			23814	41361	58909	94003		
24E3-18	3	Start	112228					103665	155665		
		Mid	61478					35799	59795		
		End	104335					34752	69847		
24E3-18	4	Start	131385						141792	206792	
		Mid	71044						50430	80425	
		End	118208						51817	95685	
24E3-18	5	Start	151911						125917	190917	
		Mid	81532						40163	70158	
		End	134083						32499	76367	

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Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
24E3-20	1	Start	73256	58177	90334	122491	154648	186805			
		Mid	40682	19530	34369	49208	64047	78886			
		End	70450	17864	39567	61270	82972	104675			
24E3-20	2	Start	86562		76368	108525	140682	172839			
		Mid	48347		26865	41704	56543	71382			
		End	84417		27043	48746	70449	92151			
24E3-20	3	Start	112228				120764	152921			
		Mid	61478				43690	58529			
		End	104335				46292	67995			
24E3-20	4	Start	131385					139047	203361		
		Mid	71044					49164	78842		
		End	118208					49965	93370		
24E3-20	5	Start	151911					123173	187487		
		Mid	81532					38897	68575		
		End	134083					30647	74052		
24E3-22	1	Start	73256	85398	124360	163322	202284				
		Mid	40682	32091	50071	68050	86029				
		End	70450	36235	62531	88826	115121				
24E3-22	2	Start	86562	71431	110393	149355	188317				
		Mid	48347	24587	42567	60546	78525				
		End	84417	23711	50007	76302	102598				
24E3-22	3	Start	112228		90475	129437	168399	207361			
		Mid	61478		29713	47692	65671	83650			
		End	104335		25851	52146	78441	104737			
24E3-22	4	Start	131385			115564	154526	193488			
		Mid	71044			38327	56306	74285			
		End	118208			34116	60411	86707			
24E3-22	5	Start	151911				138651	177613			
		Mid	81532				46039	64018			
		End	134083				41093	67388			
24E3-24	1	Start	73256	115210	161625	208041					
		Mid	40682	45849	67267	88686					
		End	70450	56356	87681	119007					
24E3-24	2	Start	86562	101244	147659	194074					
		Mid	48347	38345	59763	81182					
		End	84417	43832	75158	106483					
24E3-24	3	Start	112228		127741	174156					
		Mid	61478		46909	68328					
		End	104335		51001	82327					
24E3-24	4	Start	131385		113868	160283	206698				
		Mid	71044		37544	58963	80381				
		End	118208		32971	64297	95622				
24E3-24	5	Start	151911			144408	190824				
		Mid	81532			48696	70114				
		End	134083			44978	76304				

Note: Select Canted Yoke for Fail CW only.

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke

Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
45E3-18	1	Start	134422					126005	189607	269108	348609
		Mid	74444					44520	73869	110555	147241
		End	128399					45183	88107	141762	195418
45E3-18	2	Start	164299						171135	250636	330138
		Mid	88618						59993	96680	133366
		End	146871						59987	113642	167298
45E3-18	3	Start	179111						135690	215191	294693
		Mid	101840						47049	83736	120422
		End	182316						46047	99702	153358
45E3-18	4	Start	209917							195615	275117
		Mid	116579							69307	105993
		End	201892							70708	124364
45E3-18	5	Start	248552								250463
		Mid	135089								87874
		End	226546								88001

45E3-20	1	Start	134422			107871	147249	186628	265384	363830	
		Mid	74444			36151	54323	72494	108837	154265	
		End	128399			32944	59520	86097	139249	205691	
45E3-20	2	Start	164299					168156	246913	345359	
		Mid	88618					58619	94961	140390	
		End	146871					57977	111129	177570	
45E3-20	3	Start	179111						211468	309914	
		Mid	101840						82018	127446	
		End	182316						97189	163630	
45E3-20	4	Start	209917						191892	290338	388784
		Mid	116579						67589	113017	158446
		End	201892						68195	134636	201077
45E3-20	5	Start	248552							265684	364130
		Mid	135089							94897	140326
		End	226546							98274	164715

45E3-22	1	Start	134422		110370	158124	205878	253631	349139		
		Mid	74444		37304	59341	81377	103413	147486		
		End	128399		34630	66859	99088	131317	195775		
45E3-22	2	Start	164299			139652	187406	235160	330668		
		Mid	88618			45465	67502	89538	133610		
		End	146871			38739	70968	103197	167655		
45E3-22	3	Start	179111				151961	199715	295223		
		Mid	101840				54558	76594	120667		
		End	182316				57028	89257	153715		
45E3-22	4	Start	209917					180139	275647	395031	
		Mid	116579					62165	106238	161328	
		End	201892					60263	124721	205294	
45E3-22	5	Start	248552						250993	370377	
		Mid	135089						88118	143209	
		End	226546						88359	168931	

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Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
45E3-24	1	Start	134422		156236	213162	270089	327016			
		Mid	74444		58469	84739	111008	137277			
		End	128399		65585	104005	142425	180845			
45E3-24	2	Start	164299		137764	194691	251618	308545			
		Mid	88618		44594	70863	97133	123402			
		End	146871		37465	75885	114305	152725			
45E3-24	3	Start	179111			159246	216173	273100	386954		
		Mid	101840			57919	84189	110458	162996		
		End	182316			61945	100365	138785	215624		
45E3-24	4	Start	209917				196597	253524	367378		
		Mid	116579				69760	96029	148568		
		End	201892				71371	109791	186630		
45E3-24	5	Start	248552					228870	342724		
		Mid	135089					77909	130448		
		End	226546					73428	150268		
45E3-28	1	Start	134422	182266	259932	337598					
		Mid	74444	70481	106321	142160					
		End	128399	83153	135569	187986					
45E3-28	2	Start	164299	163794	241460	319126	396793				
		Mid	88618	56606	92445	128285	164124				
		End	146871	55032	107449	159866	212283				
45E3-28	3	Start	179111		206015	283681	361348				
		Mid	101840		79501	115341	151180				
		End	182316		93509	145926	198343				
45E3-28	4	Start	209917		186439	264105	341772				
		Mid	116579		65072	100912	136751				
		End	201892		64515	116932	169349				
45E3-28	5	Start	248552			239451	317118	394784			
		Mid	135089			82792	118632	154471			
		End	226546			80570	132986	185403			

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Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
10E4-22	1	Start	264856						307888	452628	597369
		Mid	150942						119401	186192	252983
		End	271074						141464	239149	336834
10E4-22	2	Start	336108							415402	560142
		Mid	183135							154677	221468
		End	308301							172089	269774
10E4-22	3	Start	394023							330768	475509
		Mid	222118							116515	183306
		End	392934							117581	215266
10E4-22	4	Start	495807								423182
		Mid	267905								138483
		End	445261								119469
10E4-24	1	Start	264856				212457	281533	419685	592375	765065
		Mid	150942				75364	107239	170990	250679	330367
		End	271074				77058	123677	216916	333464	450012
10E4-24	2	Start	336108						382459	555149	727838
		Mid	183135						139475	219164	298852
		End	308301						149856	266404	382952
10E4-24	3	Start	394023							470515	643205
		Mid	222118							181002	260690
		End	392934							211896	328444
10E4-24	4	Start	495807							418188	590878
		Mid	267905							136178	215867
		End	445261							116099	232647
10E4-28	1	Start	264856		200685	295037	389389	483741	672444		
		Mid	150942		69931	113471	157010	200549	287627		
		End	271074		69113	132791	196469	260147	387503		
10E4-28	2	Start	336108				352163	446514	635218	871098	
		Mid	183135				125495	169034	256112	364960	
		End	308301				129409	193087	320443	479638	
10E4-28	3	Start	394023					361881	550585	786465	
		Mid	222118					130872	217950	326798	
		End	392934					138579	265935	425130	
10E4-28	4	Start	495807						498258	734137	
		Mid	267905						173127	281975	
		End	445261						170138	329333	

Note: Select Canted Yoke for Fail CW only.

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig							
				40	50	60	70	80	100	125	150
			Lb-in	Pneumatic Torque, Lb-in							
10E4-32	1	Start	264856	222991	346508	470024	593541	717057			
		Mid	150942	80225	137222	194219	251217	308214			
		End	271074	84168	167529	250890	334251	417612			
10E4-32	2	Start	336108		309282	432798	556314	679831			
		Mid	183135		105707	162704	219702	276699			
		End	308301		100469	183830	267191	350552			
10E4-32	3	Start	394023			348165	471681	595198	842230		
		Mid	222118			124542	181540	238537	352532		
		End	392934			129322	212683	296044	462766		
10E4-32	4	Start	495807				419354	542870	789903		
		Mid	267905				136716	193714	307708		
		End	445261				116886	200247	366969		
10E4-36	1	Start	264856	355204	511774	668343	824913				
		Mid	150942	141235	213485	285735	357985				
		End	271074	173398	279066	384735	490404				
10E4-36	2	Start	336108	317978	474547	631117	787687				
		Mid	183135	109720	181970	254220	326470				
		End	308301	106338	212007	317675	423344				
10E4-36	3	Start	394023		389914	546484	703053				
		Mid	222118		143808	216058	288308				
		End	392934		157498	263167	368835				
10E4-36	4	Start	495807			494156	650726	807296			
		Mid	267905			171234	243484	315734			
		End	445261			167370	273038	378707			

Note: Select Canted Yoke for Fail CW only.

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Beginning of Metric Output Torques

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Actuators – Symmetric Yoke											
Actuator		Position	Operating Pressure, bar								
			3	3.5	4	5	6	7	8	10	
DA	DD		Torque Output, Nm								
12E2-05		Start/End	250	292	334	417	501	584	668	835	
		Mid	140	163	187	233	280	327	373	467	
12E2-06		Start/End	364	425	486	607	728	850	971		
Mid		204	237	271	339	407	475	543			
12E2-07		Start/End	499	582	665	831	997	1163			
		Mid	279	325	371	464	557	650			
12E2-08		Start/End	654	763	871	1089	1307				
		Mid	365	426	487	609	731				
12E2-09		Start/End	829	968	1106						
		Mid	463	541	618						
		12E2-05	Start/End	509	594	679	848	1018	1187		
			Mid	284	332	379	474	569	664		
		12E2-06	Start/End	736	859	982	1227				
			Mid	411	480	549	686				
		12E2-07	Start/End	1005	1173						
			Mid	562	655						
		12E2-08	Start/End	1315							
			Mid	735							

18E2-06		Start/End	452	528	603	754	904	1055	1206	1507	
		Mid	253	295	337	421	505	590	674	842	
18E2-07		Start/End	620	724	827	1034	1240	1447	1654		
		Mid	347	404	462	578	693	809	924		
18E2-08		Start/End	814	950	1085	1357	1628	1899			
		Mid	455	531	607	758	910	1061			
18E2-09		Start/End	1034	1206	1378	1723					
		Mid	578	674	770	963					
18E2-10		Start/End	1279	1492	1706						
		Mid	715	834	953						
		18E2-06	Start/End	917	1070	1223	1529	1835			
			Mid	513	598	684	854	1025			
		18E2-07	Start/End	1253	1462	1671					
			Mid	700	817	934					
		18E2-08	Start/End	1641							
			Mid	917							

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Actuators – Symmetric Yoke											
Actuator		Position	Operating Pressure, bar								
			3	3.5	4	5	6	7	8	10	
DA	DD		Torque Output, Nm								
45E2-08		Start/End	1058	1235	1411	1764	2116	2469	2822	3527	
		Mid	591	690	788	986	1183	1380	1577	1971	
Start/End		1344	1568	1792	2240	2687	3135	3583	4479		
Mid		751	876	1001	1252	1502	1752	2002	2503		
Start/End		1663	1940	2217	2771	3326	3880	4434			
Mid		929	1084	1239	1549	1859	2168	2478			
Start/End		2402	2802	3203	4003						
Mid		1342	1566	1790	2237						
Start/End		3275	3821	4367							
Mid		1830	2135	2440							
45E2-08		Start/End	2133	2489	2844	3555	4266				
		Mid	1192	1391	1589	1987	2384				
45E2-09		Start/End	2704	3155	3606	4507					
		Mid	1511	1763	2015	2519					
45E2-10		Start/End	3343	3900	4457						
		Mid	1868	2179	2491						
73E2-10			Start/End	2035	2374	2713	3392	4070	4748	5427	6783
			Mid	1137	1327	1516	1895	2274	2653	3033	3791
	Start/End		2945	3435	3926	4908	5889	6871			
	Mid		1646	1920	2194	2743	3291	3840			
	Start/End		4020	4690	5359	6699					
	Mid		2246	2621	2995	3744					
	Start/End		5260	6137	7013						
	Mid		2939	3429	3919						
73E2-10	Start/End		4102	4786	5470	6837					
	Mid		2292	2675	3057	3821					
73E2-12	Start/End		5922	6908							
	Mid		3309	3861							

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Actuators – Symmetric Yoke										
Actuator		Position	Operating Pressure, bar							
			3	3.5	4	5	6	7	8	10
DA	DD		Torque Output, Nm							
14E3-12		Start/End	3480	4060	4640	5800	6960	8120	9280	11600
		Mid	1945	2269	2593	3241	3889	4537	5186	6482
14E3-14		Start/End	4756	5549	6342	7927	9513	11098	12684	
Mid		2658	3101	3544	4430	5316	6202	7088		
14E3-16		Start/End	6229	7268	8306	10382	12459			
Mid		3481	4061	4641	5802	6962				
14E3-18		Start/End	7899	9215	10532	13165				
Mid		4414	5150	5885	7357					
14E3-20		Start/End	9764	11392	13019					
Mid		5457	6366	7275						
	14E3-12	Start/End	7015	8184	9353	11692	14030			
		Mid	3920	4573	5227	6534	7840			
	14E3-14	Start/End	9568	11163	12757					
		Mid	5347	6238	7129					
	14E3-16	Start/End	12514							
		Mid	6993							

24E3-14		Start/End	6329	7384	8439	10548	12658	14768	16877	21097
		Mid	3546	4137	4728	5910	7092	8273	9455	11819
24E3-16		Start/End	8297	9680	11063	13829	16594	19360	22126	
Mid		4648	5423	6198	7747	9297	10846	12396		
24E3-18		Start/End	10528	12282	14037	17546	21056			
Mid		5898	6881	7864	9830	11796				
24E3-20		Start/End	13021	15191	17361	21701				
Mid		7295	8511	9726	12158					
24E3-22		Start/End	15776	18406	21035					
Mid		8839	10312	11785						
24E3-24		Start/End	18794	21927						
		Mid	10529	12284						
	24E3-14	Start/End	12758	14885	17011	21264				
		Mid	7148	8339	9530	11913				
	24E3-16	Start/End	16695	19477	22260					
		Mid	9353	10912	12471					
	24E3-18	Start/End	21156							
		Mid	11852							

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Actuators – Symmetric Yoke													
Actuator		Position	Operating Pressure, bar										
			3	3.5	4	5	6	7	8	10			
DA	DD		Torque Output, Nm										
45E3-18		Start/End	12877	15023	17169	21461	25753	30045	34337	42922			
		Mid	7214	8416	9619	12023	14428	16833	19237	24047			
45E3-20		Start/End	15945	18602	21260	26575	31890	37205	42520				
Mid		8933	10422	11911	14888	17866	20844	23821					
45E3-22		Start/End	19336	22559	25782	32227	38673	45118					
Mid		10833	12638	14444	18055	21666	25277						
45E3-24		Start/End	23051	26892	30734	38418							
Mid		12914	15066	17219	21523								
45E3-28		Start/End	31448	36690	41931								
Mid		17619	20555	23491									
45E3-18		Start/End	25957	30284	34610	43262							
		Mid	14542	16966	19390	24237							
		45E3-20	Start/End	32094	37443	42792							
		Mid	17981	20977	23974								
		45E3-22	Start/End	38877	45356								
		Mid	21780	25411									
10E4-22			Start/End	23443	27350	31257	39072	46886	54701	62515	78144		
			Mid	13134	15323	17512	21890	26268	30645	35023	43779		
	10E4-24		Start/End	27970	32632	37293	46617	55940	65263	74586	93233		
	Mid		15670	18282	20893	26117	31340	36563	41786	52233			
	10E4-28		Start/End	38205	44572	50939	63674	76409	89144	101879			
	Mid		21404	24971	28538	35673	42808	49942	57077				
	10E4-32		Start/End	50014	58349	66685	83356	100027					
	Mid		28020	32690	37360	46700	56039						
	10E4-36		Start/End	63397	73964	84530							
	Mid		35518	41438	47357								
	10E4-22			Start/End	47258	55135	63011	78764	94517				
				Mid	26476	30889	35301	44127	52952				
				10E4-24	Start/End	56312	65697	75083	93853				
				Mid	31548	36806	42064	52580					
				10E4-28	Start/End	76781	89578	102375					
				Mid	43016	50185	57355						
				10E4-32	Start/End	100400							
				Mid	56248								

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
12E2-05	1	Start	471						275	358	525
		Mid	218						109	155	249
		End	310						114	197	364
12E2-05	2	Start	608							281	448
		Mid	278							95	189
		End	387							60	227
12E2-06	1	Start	471				297	419	540	661	904
		Mid	218				121	189	257	325	460
		End	310				136	258	379	501	743
12E2-06	2	Start	608					341	463	584	827
		Mid	278					129	197	265	400
		End	387					120	242	363	606
12E2-06	3	Start	777							428	670
		Mid	369							174	309
		End	544							194	437
12E2-07	1	Start	471		272	355	521	687	854	1020	
		Mid	218		107	153	246	339	432	525	
		End	310		111	194	360	527	693	859	
12E2-07	2	Start	608			278	444	610	776	942	
		Mid	278			93	186	279	372	465	
		End	387			57	223	389	555	722	
12E2-07	3	Start	777					454	620	786	1118
		Mid	369					188	281	374	560
		End	544					220	386	552	885
12E2-08	1	Start	471	344	453	562	780	998	1215		
		Mid	218	147	208	269	391	512	634		
		End	310	183	292	401	619	837	1054		
12E2-08	2	Start	608		375	484	702	920	1138		
		Mid	278		148	209	331	452	574		
		End	387		155	264	481	699	917		
12E2-08	3	Start	777				546	764	982		
		Mid	369				240	361	483		
		End	544				312	530	748		
12E2-09	1	Start	471	520	658	796	1073	1349			
		Mid	218	245	323	400	554	709			
		End	310	359	497	635	912	1188			
12E2-09	2	Start	608	442	580	719	995	1272			
		Mid	278	185	263	340	494	649			
		End	387	221	360	498	774	1051			
12E2-09	3	Start	777		424	562	839	1115			
		Mid	369		172	249	403	558			
		End	544		190	328	605	881			

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
18E2-06	1	Start	692					372	523	674	975
		Mid	342					163	248	332	500
		End	532					213	363	514	816
18E2-06	2	Start	845						438	589	890
		Mid	409						181	265	434
		End	617						210	361	662
18E2-06	3	Start	1349								654
		Mid	615								227
		End	854								158
18E2-07	1	Start	692			295	501	708	915	1121	1535
		Mid	342			120	236	351	467	582	813
		End	532			135	342	548	755	962	1375
18E2-07	2	Start	845				417	623	830	1037	1450
		Mid	409				169	285	400	516	747
		End	617				188	395	602	808	1222
18E2-07	3	Start	1349							800	1214
		Mid	615							309	540
		End	854							305	718
18E2-08	1	Start	692		417	553	824	1096	1367	1638	
		Mid	342		189	264	416	568	719	871	
		End	532		258	393	665	936	1207	1479	
18E2-08	2	Start	845			468	740	1011	1282	1554	
		Mid	409			198	350	501	653	804	
		End	617			240	511	783	1054	1325	
18E2-08	3	Start	1349						1046	1317	
		Mid	615						446	598	
		End	854						550	822	
18E2-09	1	Start	692	501	674	846	1190	1535	1880		
		Mid	342	236	332	428	621	813	1006		
		End	532	342	514	686	1031	1375	1720		
18E2-09	2	Start	845		589	761	1106	1450	1795		
		Mid	409		265	362	554	747	939		
		End	617		361	533	877	1222	1566		
18E2-09	3	Start	1349				869	1214	1558		
		Mid	615				347	540	732		
		End	854				374	718	1063		
18E2-10	1	Start	692	747	960	1173	1600	2026			
		Mid	342	373	492	611	849	1088			
		End	532	587	800	1014	1440	1866			
18E2-10	2	Start	845	662	875	1088	1515	1941			
		Mid	409	306	425	544	783	1021			
		End	617	434	647	860	1287	1713			
18E2-10	3	Start	1349			852	1278	1705			
		Mid	615			338	576	814			
		End	854			357	783	1209			

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
45E2-08	1	Start	1469				691	1044	1397	1749	2455
		Mid	710				275	473	670	867	1261
		End	1072				295	647	1000	1353	2058
45E2-08	2	Start	1945						1017	1370	2075
		Mid	949						431	628	1022
		End	1452						524	876	1582
45E2-08	3	Start	2814								1559
		Mid	1336								635
		End	1968								713
45E2-09	1	Start	1469			719	1167	1615	2063	2511	3407
		Mid	710			291	541	792	1042	1292	1793
		End	1072			323	770	1218	1666	2114	3010
45E2-09	2	Start	1945					1236	1683	2131	3027
		Mid	949					553	803	1053	1554
		End	1452					742	1190	1638	2534
45E2-09	3	Start	2814							1615	2511
		Mid	1336							666	1167
		End	1968							769	1665
45E2-09	4	Start	3635								2276
		Mid	1631								872
		End	2203								844
45E2-10	1	Start	1469		868	1145	1699	2253	2808	3362	4470
		Mid	710		374	529	839	1148	1458	1768	2387
		End	1072		471	748	1302	1857	2411	2965	4074
45E2-10	2	Start	1945				1320	1874	2428	2982	4091
		Mid	949				600	909	1219	1529	2148
		End	1452				826	1380	1935	2489	3598
45E2-10	3	Start	2814					1358	1912	2466	3575
		Mid	1336					522	832	1142	1761
		End	1968					511	1066	1620	2729
45E2-10	4	Start	3635							2231	3340
		Mid	1631							847	1466
		End	2203							800	1908

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
45E2-12	1	Start	1469	1329	1730	2130	2931	3731	4532		
		Mid	710	632	856	1080	1527	1974	2422		
		End	1072	933	1333	1733	2534	3335	4135		
45E2-12	2	Start	1945		1350	1751	2551	3352	4153		
		Mid	949		617	840	1288	1735	2183		
		End	1452		857	1257	2058	2858	3659		
45E2-12	3	Start	2814				2035	2836	3637	4437	
		Mid	1336				901	1348	1796	2243	
		End	1968				1189	1989	2790	3591	
45E2-12	4	Start	3635					2601	3402	4202	
		Mid	1631					1053	1501	1948	
		End	2203					1169	1970	2770	
45E2-14	1	Start	1469	2203	2749	3295	4386				
		Mid	710	1120	1425	1730	2340				
		End	1072	1806	2352	2898	3990				
45E2-14	2	Start	1945	1823	2369	2915	4007				
		Mid	949	881	1186	1491	2101				
		End	1452	1330	1876	2422	3514				
45E2-14	3	Start	2814		1853	2399	3491	4583			
		Mid	1336		799	1104	1714	2324			
		End	1968		1007	1553	2645	3736			
45E2-14	4	Start	3635			2164	3256	4348			
		Mid	1631			809	1419	2030			
		End	2203			732	1824	2916			

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
73E2-10	1	Start	2917					1941	2619	3297	4654
		Mid	1410					864	1243	1623	2381
		End	2129					1153	1831	2510	3866
73E2-10	2	Start	3541						2323	3001	4358
		Mid	1667						987	1366	2124
		End	2425						1208	1886	3243
73E2-10	3	Start	4674							2430	3787
		Mid	2143							889	1647
		End	2996							752	2109
73E2-10	4	Start	5182								3258
		Mid	2433								1358
		End	3525								1601
73E2-12	1	Start	2917			1797	2778	3760	4741	5723	
		Mid	1410			784	1333	1881	2430	2978	
		End	2129			1009	1991	2972	3954	4935	
73E2-12	2	Start	3541				2482	3464	4446	5427	
		Mid	1667				1076	1624	2173	2721	
		End	2425				1367	2349	3330	4312	
73E2-12	3	Start	4674					2893	3875	4856	6819
		Mid	2143					1148	1696	2245	3342
		End	2996					1215	2196	3178	5141
73E2-12	4	Start	5182						3346	4327	6290
		Mid	2433						1407	1955	3052
		End	3525						1689	2670	4633
73E2-14	1	Start	2917	1890	2560	3230	4570	5910	7250		
		Mid	1410	836	1211	1585	2334	3082	3831		
		End	2129	1103	1773	2442	3782	5122	6462		
73E2-14	2	Start	3541		2264	2934	4274	5614	6954		
		Mid	1667		954	1328	2077	2826	3574		
		End	2425		1149	1819	3159	4499	5838		
73E2-14	3	Start	4674				3703	5043	6383		
		Mid	2143				1600	2349	3098		
		End	2996				2025	3365	4705		
73E2-14	4	Start	5182				3174	4514	5854	7194	
		Mid	2433				1311	2060	2808	3557	
		End	3525				1517	2857	4197	5537	
73E2-16	1	Start	2917	3131	4007	4884	6637				
		Mid	1410	1529	2019	2509	3489				
		End	2129	2343	3220	4096	5850				
73E2-16	2	Start	3541	2835	3711	4588	6341				
		Mid	1667	1272	1762	2252	3232				
		End	2425	1719	2596	3473	5226				
73E2-16	3	Start	4674		3140	4017	5770				
		Mid	2143		1286	1776	2756				
		End	2996		1462	2339	4092				
73E2-16	4	Start	5182		2612	3488	5242	6995			
		Mid	2433		997	1486	2466	3446			
		End	3525		955	1831	3585	5338			

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
14E3-12	1	Start	4808				2316	3476	4636	5796	8115
		Mid	2317				827	1407	1987	2567	3727
		End	3484				992	2152	3312	4472	6791
14E3-12	2	Start	5509					2968	4128	5288	7608
		Mid	2655					1235	1883	2531	3827
		End	3992					1451	2611	3770	6090
14E3-12	3	Start	6418						3469	4629	6949
		Mid	3093						1445	2093	3389
		End	4651						1702	2862	5182
14E3-12	4	Start	8363								5871
		Mid	3937								2545
		End	5728								3236
14E3-12	5	Start	10340								5137
		Mid	4695								1787
		End	6462								1259
14E3-14	1	Start	4808			2858	4443	6029	7614	9200	12371
		Mid	2317			1227	2113	2999	3885	4771	6543
		End	3484			1534	3119	4705	6290	7876	11047
14E3-14	2	Start	5509				3935	5521	7106	8692	11863
		Mid	2655				1775	2661	3547	4433	6205
		End	3992				2418	4004	5589	7175	10346
14E3-14	3	Start	6418				3277	4862	6448	8033	11204
		Mid	3093				1337	2223	3109	3995	5767
		End	4651				1509	3095	4680	6266	9437
14E3-14	4	Start	8363						5370	6956	10126
		Mid	3937						2265	3151	4923
		End	5728						2735	4321	7492
14E3-14	5	Start	10340							6221	9392
		Mid	4695							2393	4165
		End	6462							2344	5515
14E3-16	1	Start	4808	2745	3784	4822	6898	8975	11051	13128	
		Mid	2317	1164	1744	2325	3485	4645	5806	6966	
		End	3484	1421	2460	3498	5574	7651	9727	11804	
14E3-16	2	Start	5509		3276	4314	6390	8467	10543	12620	
		Mid	2655		1407	1987	3147	4308	5468	6628	
		End	3992		1758	2797	4873	6950	9026	11103	
14E3-16	3	Start	6418			3655	5732	7808	9885	11961	
		Mid	3093			1549	2709	3870	5030	6190	
		End	4651			1888	3964	6041	8117	10194	
14E3-16	4	Start	8363				4654	6730	8807	10883	
		Mid	3937				1865	3025	4185	5346	
		End	5728				2019	4096	6172	8248	
14E3-16	5	Start	10340					5996	8073	10149	
		Mid	4695					2267	3428	4588	
		End	6462					2119	4195	6271	

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
14E3-18	1	Start	4808	4415	5731	7048	9680	12313			
		Mid	2317	2097	2833	3568	5040	6511			
		End	3484	3091	4407	5724	8357	10989			
14E3-18	2	Start	5509	3907	5223	6540	9173	11805			
		Mid	2655	1759	2495	3231	4702	6173			
		End	3992	2390	3706	5022	7655	10288			
14E3-18	3	Start	6418	3248	4564	5881	8514	11147	13780		
		Mid	3093	1321	2057	2793	4264	5735	7207		
		End	4651	1481	2797	4114	6747	9380	12012		
14E3-18	4	Start	8363			4803	7436	10069	12702		
		Mid	3937			1948	3419	4891	6362		
		End	5728			2168	4801	7434	10067		
14E3-18	5	Start	10340				6702	9335	11968		
		Mid	4695				2662	4133	5604		
		End	6462				2824	5457	8090		
14E3-20	1	Start	4808	6280	7908	9535	12790				
		Mid	2317	3140	4049	4959	6777				
		End	3484	4956	6584	8211	11466				
14E3-20	2	Start	5509	5773	7400	9027	12282				
		Mid	2655	2802	3711	4621	6440				
		End	3992	4255	5883	7510	10765				
14E3-20	3	Start	6418	5114	6741	8369	11623				
		Mid	3093	2364	3273	4183	6002				
		End	4651	3347	4974	6601	9856				
14E3-20	4	Start	8363		5664	7291	10546	13801			
		Mid	3937		2429	3338	5157	6976			
		End	5728		3029	4656	7911	11166			
14E3-20	5	Start	10340			6557	9812	13067			
		Mid	4695			2581	4400	6218			
		End	6462			2679	5934	9189			

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
24E3-14	1	Start	9736					6102	8212	10321	14541
		Mid	4596					2592	3774	4956	7320
		End	6556					3037	5071	7104	11171
24E3-14	2	Start	11504						6912	9021	13241
		Mid	5462						2926	4108	6472
		End	7856						3406	5440	9506
24E3-14	3	Start	14915							7168	11387
		Mid	6946							2656	5020
		End	9709							2229	6296
24E3-14	4	Start	17462								10096
		Mid	8027								3961
		End	11000								3900
24E3-16	1	Start	9736				7273	10038	12804	15570	21101
		Mid	4596				3248	4797	6347	7896	10995
		End	6556				4166	6831	9497	12163	17494
24E3-16	2	Start	11504				5973	8739	11504	14270	19801
		Mid	5462				2400	3949	5499	7048	10147
		End	7856				2501	5167	7833	10498	15830
24E3-16	3	Start	14915					6885	9651	12416	17948
		Mid	6946					2497	4047	5596	8695
		End	9709					1956	4622	7288	12620
24E3-16	4	Start	17462							11125	16657
		Mid	8027							4538	7637
		End	11000							4892	10223
24E3-16	5	Start	20189								15180
		Mid	9212								6477
		End	12478								7656
24E3-18	1	Start	9736		5726	7481	10990	14500	18009	21518	
		Mid	4596		2382	3365	5331	7297	9263	11229	
		End	6556		2675	4366	7749	11131	14514	17896	
24E3-18	2	Start	11504			6181	9691	13200	16709	20218	
		Mid	5462			2517	4483	6449	8415	10381	
		End	7856			2702	6084	9467	12849	16232	
24E3-18	3	Start	14915				7837	11346	14856	18365	
		Mid	6946				3031	4997	6963	8929	
		End	9709				2874	6256	9639	13021	
24E3-18	4	Start	17462					10055	13564	17074	24092
		Mid	8027					3939	5905	7871	11803
		End	11000					3860	7243	10625	17390
24E3-18	5	Start	20189						12087	15596	22615
		Mid	9212						4745	6711	10643
		End	12478						4675	8058	14822

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
24E3-20	1	Start	9736	6465	8635	10805	15145	19486	23826		
		Mid	4596	2795	4011	5227	7658	10090	12522		
		End	6556	3387	5479	7570	11754	15937	20121		
24E3-20	2	Start	11504		7335	9505	13846	18186	22526		
		Mid	5462		3163	4379	6811	9242	11674		
		End	7856		3814	5906	10089	14273	18456		
24E3-20	3	Start	14915			7652	11992	16332	20673		
		Mid	6946			2927	5358	7790	10222		
		End	9709			2696	6879	11062	15246		
24E3-20	4	Start	17462				10701	15041	19382	23722	
		Mid	8027				4300	6732	9164	11595	
		End	11000				4483	8666	12849	17033	
24E3-20	5	Start	20189					13564	17904	22245	
		Mid	9212					5572	8004	10435	
		End	12478					6099	10282	14465	
24E3-22	1	Start	9736	9220	11850	14479	19738				
		Mid	4596	4339	5812	7285	10231				
		End	6556	6043	8577	11112	16180				
24E3-22	2	Start	11504	7921	10550	13179	18438	23697			
		Mid	5462	3491	4964	6437	9384	12330			
		End	7856	4378	6913	9447	14516	19585			
24E3-22	3	Start	14915		8696	11326	16585	21843			
		Mid	6946		3512	4985	7931	10877			
		End	9709		3702	6237	11305	16374			
24E3-22	4	Start	17462			10035	15293	20552			
		Mid	8027			3927	6873	9819			
		End	11000			3840	8909	13978			
24E3-22	5	Start	20189				13816	19075	24334		
		Mid	9212				5713	8659	11606		
		End	12478				6342	11410	16479		
24E3-24	1	Start	9736	12238	15371	18503					
		Mid	4596	6030	7785	9540					
		End	6556	8952	11971	14990					
24E3-24	2	Start	11504	10938	14071	17203	23468				
		Mid	5462	5182	6937	8692	12201				
		End	7856	7287	10306	13326	19364				
24E3-24	3	Start	14915	9085	12217	15350	21614				
		Mid	6946	3730	5485	7239	10749				
		End	9709	4077	7096	10115	16153				
24E3-24	4	Start	17462		10926	14059	20323				
		Mid	8027		4426	6181	9691				
		End	11000		4700	7719	13757				
24E3-24	5	Start	20189			12581	18846				
		Mid	9212			5021	8531				
		End	12478			5151	11190				

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
45E3-18	1	Start	17865				9512	13804	18096	22389	30973
		Mid	8411				3790	6194	8599	11004	15813
		End	11949				3871	8008	12145	16282	24556
45E3-18	2	Start	21836					12085	16378	20670	29254
		Mid	10012					4627	7031	9436	14245
		End	13668					4271	8408	12545	20819
45E3-18	3	Start	23804						13079	17371	25956
		Mid	11506						5569	7973	12783
		End	16966						6555	10692	18966
45E3-18	4	Start	27899							15549	24134
		Mid	13171							6343	11153
		End	18788							6839	15113
45E3-18	5	Start	33033								21840
		Mid	15263								9105
		End	21082								10280
45E3-20	1	Start	17865			9311	14626	19941	25256	30571	41201
		Mid	8411			3677	6655	9632	12610	15588	21543
		End	11949			3677	8800	13923	19046	24169	34414
45E3-20	2	Start	21836				12907	18222	23537	28852	39482
		Mid	10012				5087	8065	11042	14020	19975
		End	13668				5063	10186	15309	20431	30677
45E3-20	3	Start	23804					14924	20239	25554	36183
		Mid	11506					6602	9580	12558	18513
		End	16966					8333	13456	18579	28825
45E3-20	4	Start	27899						18417	23732	34362
		Mid	13171						7950	10927	16883
		End	18788						9603	14725	24971
45E3-20	5	Start	33033							21437	32067
		Mid	15263							8880	14835
		End	21082							9893	20138
45E3-22	1	Start	17865		10610	13833	20278	26724	33169	39615	
		Mid	8411		4405	6210	9821	13432	17043	20654	
		End	11949		4929	8036	14248	20461	26673	32885	
45E3-22	2	Start	21836			12114	18559	25005	31450	37896	
		Mid	10012			4643	8254	11865	15476	19087	
		End	13668			4298	10511	16723	22936	29148	
45E3-22	3	Start	23804				15261	21706	28152	34597	
		Mid	11506				6791	10402	14013	17624	
		End	16966				8658	14871	21083	27296	
45E3-22	4	Start	27899				13439	19885	26330	32775	45666
		Mid	13171				5161	8772	12383	15994	23216
		End	18788				4805	11017	17230	23442	35867
45E3-22	5	Start	33033					17590	24036	30481	43372
		Mid	15263					6725	10336	13947	21169
		End	21082					6184	12397	18609	31034

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
45E3-24	1	Start	17865	11102	14944	18785	26469	34152	41836		
		Mid	8411	4680	6832	8985	13289	17594	21899		
		End	11949	5403	9106	12809	20215	27621	35027		
45E3-24	2	Start	21836		13225	17066	24750	32433	40117		
		Mid	10012		5265	7417	11722	16026	20331		
		End	13668		5369	9072	16478	23883	31289		
45E3-24	3	Start	23804			13768	21451	29135	36818	44502	
		Mid	11506			5955	10259	14564	18869	23173	
		End	16966			7219	14625	22031	29437	36842	
45E3-24	4	Start	27899				19630	27313	34997	42680	
		Mid	13171				8629	12934	17238	21543	
		End	18788				10772	18177	25583	32989	
45E3-24	5	Start	33033				17335	25019	32702	40386	
		Mid	15263				6582	10887	15191	19496	
		End	21082				5939	13345	20750	28156	
45E3-28	1	Start	17865	19499	24741	29982	40465				
		Mid	8411	9385	12321	15258	21131				
		End	11949	13497	18549	23601	33705				
45E3-28	2	Start	21836	17780	23022	28263	38746				
		Mid	10012	7817	10754	13690	19563				
		End	13668	9760	14812	19864	29968				
45E3-28	3	Start	23804	14482	19723	24965	35447	45930			
		Mid	11506	6355	9291	12228	18101	23973			
		End	16966	7907	12959	18011	28115	38219			
45E3-28	4	Start	27899		17902	23143	33626	44109			
		Mid	13171		7661	10597	16470	22343			
		End	18788		9106	14158	24262	34366			
45E3-28	5	Start	33033			20849	31331	41814			
		Mid	15263			8550	14423	20296			
		End	21082			9325	19429	29533			

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
10E4-22	1	Start	35200					21660	29474	37289	52917
		Mid	17054					9573	13951	18329	27085
		End	25226					12062	19594	27126	42189
10E4-22	2	Start	44670						26010	33824	49453
		Mid	20691						10390	14768	23524
		End	28690						10681	18213	33277
10E4-22	3	Start	52367							25948	41577
		Mid	25095							10457	19212
		End	36566							10969	26033
10E4-22	4	Start	65894								36708
		Mid	30268								14148
		End	41436								13301
10E4-24	1	Start	35200				21390	30714	40037	49360	68007
		Mid	17054				9422	14645	19868	25092	35538
		End	25226				11802	20788	29775	38761	56734
10E4-24	2	Start	44670					27249	36573	45896	64543
		Mid	20691					11085	16308	21531	31978
		End	28690					11876	20862	29848	47821
10E4-24	3	Start	52367						28697	38020	56667
		Mid	25095						11996	17220	27666
		End	36566						13618	22604	40577
10E4-24	4	Start	65894							33151	51797
		Mid	30268							12155	22602
		End	41436							9872	27845
10E4-28	1	Start	35200		19346	25713	38448	51183	63918	76653	102122
		Mid	17054		8276	11844	18978	26113	33247	40382	54651
		End	25226		9831	15969	28243	40518	52792	65067	89616
10E4-28	2	Start	44670			22249	34984	47719	60454	73188	98658
		Mid	20691			8283	15418	22552	29687	36821	51091
		End	28690			7056	19331	31605	43880	56154	80703
10E4-28	3	Start	52367				27108	39843	52578	65312	90782
		Mid	25095				11106	18241	25375	32510	46779
		End	36566				12086	24361	36635	48910	73459
10E4-28	4	Start	65894					34973	47708	60443	85913
		Mid	30268					13176	20311	27446	41715
		End	41436					11629	23904	36178	60727

SR - SYMMETRIC YOKE

Spring Return Actuators – Symmetric Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
10E4-32	1	Start	35200	24788	33123	41459	58130	74801	91473		
		Mid	17054	11325	15995	20665	30005	39345	48685		
		End	25226	15076	23111	31145	47214	63282	79351		
10E4-32	2	Start	44670		29659	37995	54666	71337	88008		
		Mid	20691		12434	17104	26444	35784	45124		
		End	28690		14198	22233	38301	54370	70439		
10E4-32	3	Start	52367			30119	46790	63461	80132	96804	
		Mid	25095			12793	22133	31473	40813	50152	
		End	36566			14988	31057	47126	63194	79263	
10E4-32	4	Start	65894				41920	58592	75263	91934	
		Mid	30268				17068	26408	35748	45088	
		End	41436				18325	34394	50462	66531	
10E4-36	1	Start	35200	38171	48738	59304	80436	101569			
		Mid	17054	18823	24743	30662	42502	54341			
		End	25226	27976	38161	48345	68714	89082			
10E4-36	2	Start	44670	34707	45273	55840	76972	98105			
		Mid	20691	15263	21182	27102	38941	50780			
		End	28690	19064	29248	39433	59801	80170			
10E4-36	3	Start	52367	26831	37397	47964	69096	90229			
		Mid	25095	10951	16871	22790	34630	46469			
		End	36566	11819	22004	32188	52557	72926			
10E4-36	4	Start	65894		32528	43094	64227	85359			
		Mid	30268		11806	17726	29565	41405			
		End	41436		9272	19456	39825	60194			

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Actuators – Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
DA	DD			Torque Output, Nm							
12E2-05		CW	Start	220	256	293	366	439	513	586	732
			Mid	144	168	193	241	289	337	385	481
			End	314	366	418	523	627	732	837	1046
		CCW	Start	304	355	405	507	608	710	811	1014
			Mid	140	163	187	233	280	327	373	467
			End	213	248	284	355	426	497	568	710
		CW	Start	316	369	422	527	633	738		
			Mid	208	243	277	347	416	485		
			End	452	527	602	753	904	1054		
12E2-06		CCW	Start	442	516	590	737	884	1032		
			Mid	204	237	271	339	407	475		
			End	310	361	413	516	619	722		
		CW	Start	431	502	574	718	861			
			Mid	283	330	377	472	566			
			End	615	717	820	1025	1230			
		CCW	Start	605	706	807	1009	1211			
			Mid	279	325	371	464	557			
			End	424	494	565	706	848			
12E2-07		CW	Start	562	656	750					
			Mid	370	431	493					
			End	803	937	1071					
		CCW	Start	794	926	1058					
			Mid	365	426	487					
			End	556	648	741					
		CW	Start	712	830						
			Mid	468	546						
			End	1016	1186						
12E2-08		CCW	Start	1007	1175						
			Mid	463	541						
			End	705	823						
		CW	Start	433	505	577	721	865			
			Mid	284	332	379	474	569			
			End	618	721	824	1030	1236			
		CCW	Start	618	721	824	1030	1236			
			Mid	284	332	379	474	569			
			End	433	505	577	721	865			
12E2-09		CW	Start	626	730	835					
			Mid	411	480	549					
			End	894	1043	1192					
		CCW	Start	894	1043	1192					
			Mid	411	480	549					
			End	626	730	835					
		CW	Start	854							
			Mid	562							
			End	1220							
12E2-10		CCW	Start	1220							
			Mid	562							
			End	854							

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Actuators – Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
DA	DD			Torque Output, Nm							
18E2-06		CW	Start	395	461	527	659	791	923	1054	
			Mid	260	303	347	433	520	607	693	
			End	565	659	753	941	1129	1318	1506	
		CCW	Start	549	641	732	915	1098	1281	1464	
			Mid	253	295	337	421	505	590	674	
			End	384	449	513	641	769	897	1025	
18E2-07		CW	Start	538	628	718	897	1076	1256		
			Mid	354	413	472	590	708	826		
			End	769	897	1025	1281	1537	1794		
		CCW	Start	753	878	1004	1255	1506	1757		
			Mid	347	404	462	578	693	809		
			End	527	615	703	879	1054	1230		
18E2-08		CW	Start	703	820	937	1172				
			Mid	462	539	616	770				
			End	1004	1171	1339	1673				
		CCW	Start	988	1153	1318	1647				
			Mid	455	531	607	758				
			End	692	807	923	1153				
18E2-09		CW	Start	890	1038	1186					
			Mid	585	682	780					
			End	1271	1482	1694					
		CCW	Start	1255	1464	1673					
			Mid	578	674	770					
			End	879	1025	1172					
18E2-10		CW	Start	1098	1281						
			Mid	722	842						
			End	1569	1830						
		CCW	Start	1553	1812						
			Mid	715	834						
			End	1087	1269						
	18E2-06	CW	Start	780	910	1040	1300				
			Mid	513	598	684	854				
			End	1114	1299	1485	1856				
		CCW	Start	1114	1299	1485	1856				
			Mid	513	598	684	854				
			End	780	910	1040	1300				
	18E2-07	CW	Start	1065	1243						
			Mid	700	817						
			End	1522	1775						
		CCW	Start	1522	1775						
			Mid	700	817						
			End	1065	1243						

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Actuators – Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
DA	DD			Torque Output, Nm							
45E2-08		CW	Start	914	1066	1218	1523	1828	2132	2437	3046
			Mid	601	701	801	1001	1201	1402	1602	2002
			End	1305	1523	1740	2175	2610	3045	3480	4350
		CCW	Start	1285	1499	1713	2141	2569	2998	3426	4282
			Mid	591	690	788	986	1183	1380	1577	1971
			End	900	1050	1199	1499	1799	2099	2399	2999
		CW	Start	1157	1349	1542	1928	2313	2699	3084	
			Mid	760	887	1014	1267	1521	1774	2027	
			End	1652	1927	2202	2753	3304	3854	4405	
45E2-09		CCW	Start	1631	1903	2175	2719	3263	3807	4350	
			Mid	751	876	1001	1252	1502	1752	2002	
			End	1142	1333	1523	1904	2285	2665	3046	
		CW	Start	1428	1666	1904	2380	2856			
			Mid	939	1095	1252	1564	1877			
			End	2039	2379	2719	3399	4079			
		CCW	Start	2019	2355	2692	3365	4038			
			Mid	929	1084	1239	1549	1859			
			End	1414	1649	1885	2356	2827			
45E2-10		CW	Start	2056	2399	2742					
			Mid	1352	1577	1802					
			End	2937	3426	3915					
		CCW	Start	2916	3402	3888					
			Mid	1342	1566	1790					
			End	2042	2382	2723					
		CW	Start	2799							
			Mid	1840							
			End	3997							
45E2-12		CCW	Start	3977							
			Mid	1830							
			End	2784							
		CW	Start	1813	2116	2418	3022				
			Mid	1192	1391	1589	1987				
			End	2590	3022	3453	4316				
		CCW	Start	2590	3022	3453	4316				
			Mid	1192	1391	1589	1987				
			End	1813	2116	2418	3022				
45E2-14		CW	Start	2299	2682	3065					
			Mid	1511	1763	2015					
			End	3283	3830	4378					
		CCW	Start	3283	3830	4378					
			Mid	1511	1763	2015					
			End	2299	2682	3065					
		CW	Start	1813	2116	2418	3022				
			Mid	1192	1391	1589	1987				
			End	2590	3022	3453	4316				
45E2-08		CCW	Start	2590	3022	3453	4316				
			Mid	1192	1391	1589	1987				
			End	1813	2116	2418	3022				
		CW	Start	2299	2682	3065					
			Mid	1511	1763	2015					
			End	3283	3830	4378					
		CCW	Start	3283	3830	4378					
			Mid	1511	1763	2015					
			End	2299	2682	3065					

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Actuators – Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
DA	DD			Torque Output, Nm							
73E2-10		CW	Start	1757	2050	2343	2929	3515	4101	4686	
			Mid	1155	1348	1540	1925	2311	2696	3081	
			End	2510	2928	3346	4183	5020	5856	6693	
		CCW	Start	2471	2882	3294	4118	4941	5765	6588	
			Mid	1137	1327	1516	1895	2274	2653	3033	
			End	1730	2018	2307	2883	3460	4037	4613	
73E2-12		CW	Start	2531	2952	3374	4218	5061			
			Mid	1664	1941	2218	2773	3327			
			End	3614	4217	4819	6024	7228			
		CCW	Start	3575	4171	4767	5958	7150			
			Mid	1646	1920	2194	2743	3291			
			End	2503	2920	3338	4172	5006			
73E2-14	CW	Start	3445	4019	4593						
		Mid	2264	2642	3019						
		End	4919	5739	6559						
	CCW	Start	4880	5693	6507						
		Mid	2246	2621	2995						
		End	3417	3987	4556						
73E2-16	CW	Start	4499								
		Mid	2957								
		End	6425								
	CCW	Start	6386								
		Mid	2939								
		End	4472								
	73E2-10	CW	Start	3487	4069	4650					
			Mid	2292	2675	3057					
			End	4981	5811	6641					
		CCW	Start	4981	5811	6641					
			Mid	2292	2675	3057					
			End	3487	4069	4650					

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Actuators – Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
DA	DD			Torque Output, Nm							
14E3-12		CW	Start	3005	3506	4007	5009	6010	7012	8014	
			Mid	1975	2305	2634	3292	3951	4609	5268	
			End	4292	5007	5722	7153	8584	10014	11445	
		CCW	Start	4225	4929	5633	7041	8450	9858	11266	
			Mid	1945	2269	2593	3241	3889	4537	5186	
			End	2958	3451	3944	4930	5916	6903	7889	
		CW	Start	4090	4772	5454	6817	8181	9544		
			Mid	2689	3137	3585	4481	5378	6274		
			End	5842	6815	7789	9736	11683	13631		
14E3-14		CCW	Start	5775	6737	7700	9624	11549	13474		
			Mid	2658	3101	3544	4430	5316	6202		
			End	4043	4717	5391	6739	8087	9435		
		CW	Start	5343	6233	7123	8904				
			Mid	3512	4097	4683	5853				
			End	7630	8902	10173	12717				
		CCW	Start	7563	8823	10084	12605				
			Mid	3481	4061	4641	5802				
			End	5296	6178	7061	8826				
14E3-16		CW	Start	6762	7889	9016					
			Mid	4445	5186	5926					
			End	9657	11266	12876					
		CCW	Start	9590	11188	12786					
			Mid	4414	5150	5885					
			End	6715	7834	8953					
		CW	Start	8348	9739						
			Mid	5487	6402						
			End	11922	13909						
14E3-18		CCW	Start	11855	13831						
			Mid	5457	6366						
			End	8301	9684						
14E3-20		CW	Start	5963	6957	7951	9939				
			Mid	3920	4573	5227	6534				
			End	8517	9936	11356	14194				
		CCW	Start	8517	9936	11356	14194				
			Mid	3920	4573	5227	6534				
			End	5963	6957	7951	9939				
		CW	Start	8134	9490						
			Mid	5347	6238						
			End	11616	13552						
14E3-22		CCW	Start	11616	13552						
			Mid	5347	6238						
			End	8134	9490						

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Actuators – Canted Yoke												
Actuator		Rotation Direction	Position	Operating Pressure, bar								
				3	3.5	4	5	6	7	8	10	
DA	DD			Torque Output, Nm								
24E3-14		CW	Start	5466	6377	7288	9109	10931	12753	14575		
			Mid	3602	4202	4803	6003	7204	8405	9605		
			End	7806	9107	10408	13010	15612	18214	20816		
		CCW	Start	7684	8964	10245	12806	15368	17929	20490		
			Mid	3546	4137	4728	5910	7092	8273	9455		
			End	5380	6277	7174	8967	10761	12554	14347		
		24E3-16	CW	Start	7139	8329	9518	11898	14278	16657		
				Mid	4705	5489	6273	7841	9409	10978		
				End	10195	11895	13594	16992	20391	23789		
CCW	Start		10073	11752	13431	16789	20147	23505				
	Mid		4648	5423	6198	7747	9297	10846				
	End		7053	8229	9405	11756	14107	16458				
24E3-18	CW		Start	9035	10541	12047	15059					
			Mid	5954	6947	7939	9924					
			End	12904	15054	17205	21506					
	CCW	Start	12782	14912	17042	21303						
		Mid	5898	6881	7864	9830						
		End	8950	10441	11933	14916						
	24E3-20	CW	Start	11154	13014	14873						
			Mid	7351	8576	9801						
			End	15930	18585	21240						
CCW		Start	15808	18443	21078							
		Mid	7295	8511	9726							
		End	11069	12914	14759							
24E3-22		CW	Start	13497	15746							
			Mid	8895	10377							
			End	19276	22488							
	CCW	Start	19154	22346								
		Mid	8839	10312								
		End	13412	15647								
	24E3-24	CW	Start	16062								
			Mid	10586								
			End	22940								
CCW		Start	22818									
		Mid	10529									
		End	15977									
		24E3-14	CW	Start	10846	12654	14461					
				Mid	7148	8339	9530					
				End	15490	18071	20653					
	CCW		Start	15490	18071	20653						
			Mid	7148	8339	9530						
			End	10846	12654	14461						

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Actuators – Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
DA	DD			Torque Output, Nm							
45E3-18		CW	Start	11120	12974	14827	18534	22240	25947	29654	
			Mid	7328	8550	9771	12214	14657	17100	19543	
			End	15881	18528	21175	26469	31762	37056	42350	
		CCW	Start	15633	18239	20844	26055	31266	36477	41688	
			Mid	7214	8416	9619	12023	14428	16833	19237	
			End	10946	12771	14595	18244	21893	25542	29190	
		CW	Start	13729	16017	18305	22881	27457	32033		
			Mid	9048	10555	12063	15079	18095	21111		
			End	19606	22874	26142	32677	39213	45748		
45E3-20		CCW	Start	19358	22585	25811	32264	38717	45169		
			Mid	8933	10422	11911	14888	17866	20844		
			End	13555	15814	18073	22591	27110	31628		
		CW	Start	16612	19380	22149	27686				
			Mid	10947	12772	14597	18246				
			End	23724	27678	31632	39540				
		CCW	Start	23476	27388	31301	39126				
			Mid	10833	12638	14444	18055				
			End	16438	19177	21917	27396				
45E3-22		CW	Start	19769	23064	26359					
			Mid	13028	15200	17371					
			End	28233	32939	37644					
		CCW	Start	27985	32649	37314					
			Mid	12914	15066	17219					
			End	19595	22861	26127					
		CW	Start	26908	31393						
			Mid	17733	20689						
			End	38429	44833						
45E3-24		CCW	Start	38181	44544						
			Mid	17619	20555						
			End	26734	31190						
45E3-28		CW	Start	22067	25744	29422					
			Mid	14542	16966	19390					
			End	31514	36767	42019					
		CCW	Start	31514	36767	42019					
			Mid	14542	16966	19390					
			End	22067	25744	29422					
		CW	Start	27283	31831						
			Mid	17981	20977						
			End	38965	45459						
45E3-18		CCW	Start	38965	45459						
			Mid	17981	20977						
			End	27283	31831						

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Actuators – Canted Yoke											
Actuator		Rotation Direction	Position	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
DA	DD			Torque Output, Nm							
10E4-22		CW	Start	20245	23620	26994	33742	40491	47239	53988	67485
			Mid	13342	15566	17790	22237	26684	31132	35579	44474
			End	28913	33732	38551	48189	57827	67465	77102	96378
		CCW	Start	28462	33205	37949	47436	56923	66410	75898	94872
			Mid	13134	15323	17512	21890	26268	30645	35023	43779
			End	19929	23251	26572	33215	39858	46501	53144	66430
		CW	Start	24094	28109	32125	40156	48187	56219	64250	
			Mid	15878	18525	21171	26464	31757	37050	42342	
			End	34409	40144	45879	57349	68819	80288	91758	
10E4-24		CCW	Start	33958	39617	45277	56596	67915	79234	90554	
			Mid	15670	18282	20893	26117	31340	36563	41786	
			End	23777	27740	31703	39629	47555	55480	63406	
		CW	Start	32794	38260	43726	54657	65588			
			Mid	21612	25214	28816	36020	43224			
			End	46835	54641	62447	78058	93670			
		CCW	Start	46383	54114	61844	77305	92766			
			Mid	21404	24971	28538	35673	42808			
			End	32478	37891	43304	54130	64956			
10E4-28		CW	Start	42833	49972	57111	71389				
			Mid	28228	32933	37638	47047				
			End	61172	71368	81563	101954				
		CCW	Start	60720	70840	80961	101201				
			Mid	28020	32690	37360	46700				
			End	42517	49603	56689	70861				
		CW	Start	54211	63246						
			Mid	35726	41681						
			End	77421	90325						
10E4-32		CCW	Start	76969	89797						
			Mid	35518	41438						
			End	53894	62877						
		CW	Start	40174	46870	53566	66957				
			Mid	26476	30889	35301	44127				
			End	57375	66938	76500	95625				
		CCW	Start	57375	66938	76500	95625				
			Mid	26476	30889	35301	44127				
			End	40174	46870	53566	66957				
10E4-36		CW	Start	47871	55850	63828					
			Mid	31548	36806	42064					
			End	68367	79761	91156					
		CCW	Start	68367	79761	91156					
			Mid	31548	36806	42064					
			End	47871	55850	63828					
		CW	Start	65272							
			Mid	43016							
			End	93218							
		CCW	Start	93218							
			Mid	43016							
			End	65272							

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
12E2-05	1	Start	400						334	435	638
		Mid	218						109	155	249
		End	376						97	168	310
12E2-05	2	Start	517							341	544
		Mid	278							95	189
		End	470							51	193
12E2-06	1	Start	400				361	508	656	803	1098
		Mid	218				121	189	257	325	460
		End	376				116	219	322	426	632
12E2-06	2	Start	517						562	709	1004
		Mid	278						197	265	400
		End	470						206	309	515
12E2-06	3	Start	661							519	814
		Mid	369							174	309
		End	660							165	371
12E2-07	1	Start	400		330	431	633	835	1036		
		Mid	218		107	153	246	339	432		
		End	376		94	165	306	448	589		
12E2-07	2	Start	517				539	741	942		
		Mid	278				186	279	372		
		End	470				190	331	472		
12E2-07	3	Start	661						752	954	
		Mid	369						281	374	
		End	660						328	469	
12E2-08	1	Start	400	418	550	682	947	1211			
		Mid	218	147	208	269	391	512			
		End	376	156	248	341	526	711			
12E2-08	2	Start	517		456	588	853	1117			
		Mid	278		148	209	331	452			
		End	470		131	224	409	594			
12E2-08	3	Start	661				663	927	1192		
		Mid	369				240	361	483		
		End	660				265	450	636		
12E2-09	1	Start	400	631	799	966					
		Mid	218	245	323	400					
		End	376	305	422	540					
12E2-09	2	Start	517	537	705	872	1208				
		Mid	278	185	263	340	494				
		End	470	188	306	423	658				
12E2-09	3	Start	661		515	683	1018	1354			
		Mid	369		172	249	403	558			
		End	660		162	279	514	749			

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
18E2-06	1	Start	588						635	818	1184
		Mid	342						248	332	500
		End	646						309	437	693
18E2-06	2	Start	719						532	715	1081
		Mid	409						181	265	434
		End	749						178	306	563
18E2-07	1	Start	588				609	860	1111	1362	
		Mid	342				236	351	467	582	
		End	646				291	466	642	818	
18E2-07	2	Start	719					757	1008	1259	1761
		Mid	409					285	400	516	747
		End	749					336	512	687	1039
18E2-07	3	Start	1147							971	1473
		Mid	615							309	540
		End	1036							259	611
18E2-08	1	Start	588		507	671	1001	1330	1660		
		Mid	342		189	264	416	568	719		
		End	646		219	334	565	796	1026		
18E2-08	2	Start	719			569	898	1227	1557	1886	
		Mid	409			198	350	501	653	804	
		End	749			204	435	665	896	1127	
18E2-08	3	Start	1147						1269	1599	
		Mid	615						446	598	
		End	1036						468	698	
18E2-09	1	Start	588	609	818	1027	1445	1864			
		Mid	342	236	332	428	621	813			
		End	646	291	437	583	876	1169			
18E2-09	2	Start	719		715	924	1342	1761			
		Mid	409		265	362	554	747			
		End	749		306	453	746	1039			
18E2-09	3	Start	1147				1055	1473			
		Mid	615				347	540			
		End	1036				318	611			
18E2-10	1	Start	588	907	1165	1424					
		Mid	342	373	492	611					
		End	646	499	680	862					
18E2-10	2	Start	719	804	1063	1322	1839	2357			
		Mid	409	306	425	544	783	1021			
		End	749	369	550	731	1094	1456			
18E2-10	3	Start	1147			1034	1552	2069			
		Mid	615			338	576	814			
		End	1036			303	666	1028			

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
45E2-08	1	Start	1249					1267	1696	2124	2980
		Mid	710					473	670	867	1261
		End	1302					550	850	1150	1750
45E2-08	2	Start	1654						1235	1663	2520
		Mid	949						431	628	1022
		End	1763						445	745	1345
45E2-08	3	Start	2393								1893
		Mid	1336								635
		End	2389								606
45E2-09	1	Start	1249				1417	1961	2505	3048	4136
		Mid	710				541	792	1042	1292	1793
		End	1302				655	1036	1417	1797	2559
45E2-09	2	Start	1654					1500	2044	2588	3675
		Mid	949					553	803	1053	1554
		End	1763					631	1012	1392	2154
45E2-09	3	Start	2393							1961	3049
		Mid	1336							666	1167
		End	2389							654	1415
45E2-09	4	Start	3090								2763
		Mid	1631								872
		End	2675								718
45E2-10	1	Start	1249		1053	1390	2063	2736	3409	4082	
		Mid	710		374	529	839	1148	1458	1768	
		End	1302		400	636	1107	1578	2050	2521	
45E2-10	2	Start	1654				1602	2275	2948	3621	
		Mid	949				600	909	1219	1529	
		End	1763				702	1173	1645	2116	
45E2-10	3	Start	2393						2321	2994	4340
		Mid	1336						832	1142	1761
		End	2389						906	1377	2320
45E2-10	4	Start	3090							2709	4055
		Mid	1631							847	1466
		End	2675							680	1622

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
45E2-12	1	Start	1249	1614	2100	2586	3558	4530			
		Mid	710	632	856	1080	1527	1974			
		End	1302	793	1133	1474	2154	2835			
45E2-12	2	Start	1654		1639	2125	3097	4070			
		Mid	949		617	840	1288	1735			
		End	1763		728	1069	1749	2430			
45E2-12	3	Start	2393				2471	3443	4415		
		Mid	1336				901	1348	1796		
		End	2389				1011	1691	2372		
45E2-12	4	Start	3090					3158	4130		
		Mid	1631					1053	1501		
		End	2675					994	1675		
45E2-14	1	Start	1249	2674	3337	4000					
		Mid	710	1120	1425	1730					
		End	1302	1536	2000	2464					
45E2-14	2	Start	1654	2214	2877	3539					
		Mid	949	881	1186	1491					
		End	1763	1131	1595	2059					
45E2-14	3	Start	2393		2250	2913	4238				
		Mid	1336		799	1104	1714				
		End	2389		856	1320	2248				
45E2-14	4	Start	3090			2628	3953				
		Mid	1631			809	1419				
		End	2675			623	1551				

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
73E2-10	1	Start	2480					2356	3180	4003	5650
		Mid	1410					864	1243	1623	2381
		End	2585					980	1557	2133	3287
73E2-10	2	Start	3010						2820	3644	5291
		Mid	1667						987	1366	2124
		End	2944						1027	1603	2757
73E2-10	3	Start	3974							2951	4598
		Mid	2143							889	1647
		End	3638							640	1793
73E2-10	4	Start	4405								3956
		Mid	2433								1358
		End	4280								1361
73E2-12	1	Start	2480			2181	3373	4565	5756	6948	
		Mid	1410			784	1333	1881	2430	2978	
		End	2585			858	1692	2527	3361	4196	
73E2-12	2	Start	3010				3014	4206	5397	6589	
		Mid	1667				1076	1624	2173	2721	
		End	2944				1162	1996	2831	3665	
73E2-12	3	Start	3974					3512	4704	5896	
		Mid	2143					1148	1696	2245	
		End	3638					1033	1867	2702	
73E2-12	4	Start	4405						4062	5254	
		Mid	2433						1407	1955	
		End	4280						1436	2270	
73E2-14	1	Start	2480	2295	3108	3922	5548	7175			
		Mid	1410	836	1211	1585	2334	3082			
		End	2585	937	1507	2076	3215	4354			
73E2-14	2	Start	3010		2749	3562	5189	6816			
		Mid	1667		954	1328	2077	2826			
		End	2944		977	1546	2685	3824			
73E2-14	3	Start	3974				4496	6123			
		Mid	2143				1600	2349			
		End	3638				1721	2860			
73E2-14	4	Start	4405				3854	5481	7107		
		Mid	2433				1311	2060	2808		
		End	4280				1290	2429	3568		
73E2-16	1	Start	2480	3801	4865	5929					
		Mid	1410	1529	2019	2509					
		End	2585	1992	2737	3482					
73E2-16	2	Start	3010	3442	4506	5570					
		Mid	1667	1272	1762	2252					
		End	2944	1462	2207	2952					
73E2-16	3	Start	3974		3813	4877	7006				
		Mid	2143		1286	1776	2756				
		End	3638		1243	1988	3479				
73E2-16	4	Start	4405			4235	6364				
		Mid	2433			1486	2466				
		End	4280			1557	3047				

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
14E3-12	1	Start	4087					4220	5628	7036	9853
		Mid	2317					1572	2221	2869	4165
		End	4230					1829	2815	3801	5773
14E3-12	2	Start	4683					3603	5011	6420	9236
		Mid	2655					1235	1883	2531	3827
		End	4847					1233	2219	3205	5177
14E3-12	3	Start	5456						4212	5620	8436
		Mid	3093						1445	2093	3389
		End	5646						1447	2433	4405
14E3-12	4	Start	7110								7128
		Mid	3937								2545
		End	6955								2751
14E3-12	5	Start	8790								6237
		Mid	4695								1787
		End	7846								1071
14E3-14	1	Start	4087			3470	5394	7319	9244	11169	
		Mid	2317			1227	2113	2999	3885	4771	
		End	4230			1304	2652	4000	5347	6695	
14E3-14	2	Start	4683				4778	6703	8628	10553	
		Mid	2655				1775	2661	3547	4433	
		End	4847				2056	3404	4751	6099	
14E3-14	3	Start	5456					5903	7828	9753	13603
		Mid	3093					2223	3109	3995	5767
		End	5646					2631	3979	5327	8022
14E3-14	4	Start	7110						6520	8445	12294
		Mid	3937						2265	3151	4923
		End	6955						2325	3673	6369
14E3-14	5	Start	8790							7553	11403
		Mid	4695							2393	4165
		End	7846							1992	4688
14E3-16	1	Start	4087	3333	4593	5854	8375	10896	13417		
		Mid	2317	1164	1744	2325	3485	4645	5806		
		End	4230	1208	2091	2973	4739	6504	8269		
14E3-16	2	Start	4683		3977	5237	7758	10279	12800		
		Mid	2655		1407	1987	3147	4308	5468		
		End	4847		1495	2377	4143	5908	7673		
14E3-16	3	Start	5456			4438	6959	9480	12001		
		Mid	3093			1549	2709	3870	5030		
		End	5646			1605	3370	5135	6901		
14E3-16	4	Start	7110					8171	10692	13213	
		Mid	3937					3025	4185	5346	
		End	6955					3482	5247	7012	
14E3-16	5	Start	8790						9801	12322	
		Mid	4695						3428	4588	
		End	7846						3566	5331	

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
14E3-18	1	Start	4087	5360	6958	8556	11753				
		Mid	2317	2097	2833	3568	5040				
		End	4230	2627	3747	4866	7104				
14E3-18	2	Start	4683	4743	6341	7940	11136	14333			
		Mid	2655	1759	2495	3231	4702	6173			
		End	4847	2031	3151	4270	6508	8746			
14E3-18	3	Start	5456		5542	7140	10336	13533			
		Mid	3093		2057	2793	4264	5735			
		End	5646		2378	3497	5735	7974			
14E3-18	4	Start	7110			5832	9028	12225			
		Mid	3937			1948	3419	4891			
		End	6955			1843	4082	6320			
14E3-18	5	Start	8790				8137	11333			
		Mid	4695				2662	4133			
		End	7846				2401	4639			
14E3-20	1	Start	4087	7625	9601	11576					
		Mid	2317	3140	4049	4959					
		End	4230	4213	5597	6980					
14E3-20	2	Start	4683	7008	8984	10960					
		Mid	2655	2802	3711	4621					
		End	4847	3617	5001	6384					
14E3-20	3	Start	5456	6208	8184	10160	14112				
		Mid	3093	2364	3273	4183	6002				
		End	5646	2845	4228	5612	8379				
14E3-20	4	Start	7110		6876	8852	12803				
		Mid	3937		2429	3338	5157				
		End	6955		2575	3958	6725				
14E3-20	5	Start	8790			7961	11912				
		Mid	4695			2581	4400				
		End	7846			2278	5044				

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
24E3-14	1	Start	8277					7408	9969	12531	17653
		Mid	4596					2592	3774	4956	7320
		End	7960					2582	4311	6039	9496
24E3-14	2	Start	9780						8391	10953	16075
		Mid	5462						2926	4108	6472
		End	9538						2896	4624	8081
24E3-14	3	Start	12680								13825
		Mid	6946								5020
		End	11788								5352
24E3-14	4	Start	14844								12258
		Mid	8027								3961
		End	13355								3315
24E3-16	1	Start	8277				8829	12187	15545	18903	
		Mid	4596				3248	4797	6347	7896	
		End	7960				3541	5807	8074	10340	
24E3-16	2	Start	9780					10609	13967	17325	
		Mid	5462					3949	5499	7048	
		End	9538					4392	6659	8925	
24E3-16	3	Start	12680						11717	15074	21790
		Mid	6946						4047	5596	8695
		End	11788						3929	6196	10728
24E3-16	4	Start	14844							13507	20223
		Mid	8027							4538	7637
		End	13355							4158	8691
24E3-16	5	Start	17163								18429
		Mid	9212								6477
		End	15149								6508
24E3-18	1	Start	8277		6952	9082	13343	17603	21864		
		Mid	4596		2382	3365	5331	7297	9263		
		End	7960		2274	3712	6587	9463	12338		
24E3-18	2	Start	9780				11765	16026	20286		
		Mid	5462				4483	6449	8415		
		End	9538				5172	8048	10923		
24E3-18	3	Start	12680					13775	18036	22296	
		Mid	6946					4997	6963	8929	
		End	11788					5319	8194	11069	
24E3-18	4	Start	14844					12208	16468	20729	
		Mid	8027					3939	5905	7871	
		End	13355					3282	6157	9032	
24E3-18	5	Start	17163						14675	18935	
		Mid	9212						4745	6711	
		End	15149						3974	6850	

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
24E3-20	1	Start	8277	7849	10483	13118	18388	23657			
		Mid	4596	2795	4011	5227	7658	10090			
		End	7960	2879	4657	6436	9992	13548			
24E3-20	2	Start	9780		8905	11540	16810	22079			
		Mid	5462		3163	4379	6811	9242			
		End	9538		3243	5021	8577	12133			
24E3-20	3	Start	12680				14559	19829			
		Mid	6946				5358	7790			
		End	11788				5848	9404			
24E3-20	4	Start	14844				12992	18261	23531		
		Mid	8027				4300	6732	9164		
		End	13355				3811	7367	10923		
24E3-20	5	Start	17163					16468	21737		
		Mid	9212					5572	8004		
		End	15149					5184	8741		
24E3-22	1	Start	8277	11194	14386	17579	23963				
		Mid	4596	4339	5812	7285	10231				
		End	7960	5137	7292	9446	13755				
24E3-22	2	Start	9780	9616	12808	16001	22385				
		Mid	5462	3491	4964	6437	9384				
		End	9538	3722	5877	8031	12340				
24E3-22	3	Start	12680		10558	13750	20135				
		Mid	6946		3512	4985	7931				
		End	11788		3147	5302	9611				
24E3-22	4	Start	14844			12183	18567				
		Mid	8027			3927	6873				
		End	13355			3265	7574				
24E3-22	5	Start	17163				16774	23158			
		Mid	9212				5713	8659			
		End	15149				5391	9700			
24E3-24	1	Start	8277	14858	18661	22464					
		Mid	4596	6030	7785	9540					
		End	7960	7610	10176	12743					
24E3-24	2	Start	9780	13280	17083	20886					
		Mid	5462	5182	6937	8692					
		End	9538	6195	8762	11328					
24E3-24	3	Start	12680	11030	14833	18636					
		Mid	6946	3730	5485	7239					
		End	11788	3466	6032	8599					
24E3-24	4	Start	14844		13265	17068					
		Mid	8027		4426	6181					
		End	13355		3995	6562					
24E3-24	5	Start	17163			15275	22880				
		Mid	9212			5021	8531				
		End	15149			4379	9512				

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
45E3-18	1	Start	15187					16759	21970	27181	37604
		Mid	8411					6194	8599	11004	15813
		End	14507					6808	10325	13842	20875
45E3-18	2	Start	18563						19884	25095	35517
		Mid	10012						7031	9436	14245
		End	16594						7148	10664	17698
45E3-18	3	Start	20236						15879	21090	31512
		Mid	11506						5569	7973	12783
		End	20598						5573	9089	16123
45E3-18	4	Start	23717							18878	29300
		Mid	13171							6343	11153
		End	22810							5814	12848
45E3-18	5	Start	28082								26515
		Mid	15263								9105
		End	25596								8739
45E3-20	1	Start	15187				17757	24210	30663	37115	
		Mid	8411				6655	9632	12610	15588	
		End	14507				7481	11836	16191	20546	
45E3-20	2	Start	18563				15670	22123	28576	35028	
		Mid	10012				5087	8065	11042	14020	
		End	16594				4304	8659	13014	17369	
45E3-20	3	Start	20236					18118	24571	31024	43929
		Mid	11506					6602	9580	12558	18513
		End	20598					7084	11439	15794	24504
45E3-20	4	Start	23717						22359	28812	41718
		Mid	13171						7950	10927	16883
		End	22810						8163	12518	21228
45E3-20	5	Start	28082							26027	38932
		Mid	15263							8880	14835
		End	25596							8410	17120
45E3-22	1	Start	15187		12882	16794	24619	32445	40270		
		Mid	8411		4405	6210	9821	13432	17043		
		End	14507		4190	6831	12112	17394	22675		
45E3-22	2	Start	18563				22532	30358	38183		
		Mid	10012				8254	11865	15476		
		End	16594				8935	14217	19498		
45E3-22	3	Start	20236				18528	26353	34178	42003	
		Mid	11506				6791	10402	14013	17624	
		End	20598				7360	12642	17923	23204	
45E3-22	4	Start	23717					24141	31967	39792	
		Mid	13171					8772	12383	15994	
		End	22810					9366	14647	19928	
45E3-22	5	Start	28082						29181	37006	
		Mid	15263						10336	13947	
		End	25596						10539	15820	

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
45E3-24	1	Start	15187	13478	18143	22807	32135	41464			
		Mid	8411	4680	6832	8985	13289	17594			
		End	14507	4593	7741	10889	17185	23480			
45E3-24	2	Start	18563		16056	20720	30048	39377			
		Mid	10012		5265	7417	11722	16026			
		End	16594		4564	7712	14008	20303			
45E3-24	3	Start	20236			16715	26044	35372	44700		
		Mid	11506			5955	10259	14564	18869		
		End	20598			6137	12433	18728	25024		
45E3-24	4	Start	23717				23832	33160	42489		
		Mid	13171				8629	12934	17238		
		End	22810				9157	15453	21748		
45E3-24	5	Start	28082					30375	39703		
		Mid	15263					10887	15191		
		End	25596					11344	17640		
45E3-28	1	Start	15187	23674	30037	36401					
		Mid	8411	9385	12321	15258					
		End	14507	11474	15769	20063					
45E3-28	2	Start	18563	21587	27950	34314					
		Mid	10012	7817	10754	13690					
		End	16594	8297	12592	16886					
45E3-28	3	Start	20236	17582	23946	30309	43036				
		Mid	11506	6355	9291	12228	18101				
		End	20598	6722	11017	15311	23901				
45E3-28	4	Start	23717		21734	28097	40824				
		Mid	13171		7661	10597	16470				
		End	22810		7741	12036	20625				
45E3-28	5	Start	28082			25312	38039				
		Mid	15263			8550	14423				
		End	25596			7927	16517				

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
10E4-22	1	Start	29924					26297	35784	45271	64246
		Mid	17054					9573	13951	18329	27085
		End	30626					10254	16657	23060	35865
10E4-22	2	Start	37974						31578	41065	60040
		Mid	20691						10390	14768	23524
		End	34832						9080	15483	28289
10E4-22	3	Start	44517								50478
		Mid	25095								19212
		End	44394								22130
10E4-22	4	Start	56017								44566
		Mid	30268								14148
		End	50306								11307
10E4-24	1	Start	29924				25970	37289	48608	59927	82565
		Mid	17054				9422	14645	19868	25092	35538
		End	30626				10033	17672	25311	32951	48229
10E4-24	2	Start	37974					33083	44402	55721	78360
		Mid	20691					11085	16308	21531	31978
		End	34832					10096	17735	25374	40653
10E4-24	3	Start	44517						34840	46159	68798
		Mid	25095						11996	17220	27666
		End	44394						11576	19216	34494
10E4-24	4	Start	56017								62886
		Mid	30268								22602
		End	50306								23671
10E4-28	1	Start	29924		23487	31218	46679	62140	77601	93062	
		Mid	17054		8276	11844	18978	26113	33247	40382	
		End	30626		8358	13575	24010	34444	44879	55314	
10E4-28	2	Start	37974				42473	57934	73395	88856	
		Mid	20691				15418	22552	29687	36821	
		End	34832				16433	26868	37302	47737	
10E4-28	3	Start	44517					48372	63833	79294	
		Mid	25095					18241	25375	32510	
		End	44394					20709	31144	41579	
10E4-28	4	Start	56017						57921	73382	
		Mid	30268						20311	27446	
		End	50306						20321	30755	

Note: Select Canted Yoke for Fail CW only.

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Actuators – Canted Yoke											
Actuator	Spring #	Position	Spring Torque Nm	Operating Pressure, bar							
				3	3.5	4	5	6	7	8	10
				Pneumatic Torque, Nm							
10E4-32	1	Start	29924	30094	40214	50334	70574	90814			
		Mid	17054	11325	15995	20665	30005	39345			
		End	30626	12816	19646	26476	40137	53797			
10E4-32	2	Start	37974		36008	46128	66368	86608			
		Mid	20691		12434	17104	26444	35784			
		End	34832		12070	18900	32560	46220			
10E4-32	3	Start	44517			36566	56806	77046	97287		
		Mid	25095			12793	22133	31473	40813		
		End	44394			12742	26402	40062	53722		
10E4-32	4	Start	56017				50894	71134	91375		
		Mid	30268				17068	26408	35748		
		End	50306				15578	29238	42898		
10E4-36	1	Start	29924	46343	59171	71999	97656				
		Mid	17054	18823	24743	30662	42502				
		End	30626	23783	32441	41098	58414				
10E4-36	2	Start	37974	42137	54965	67793	93450				
		Mid	20691	15263	21182	27102	38941				
		End	34832	16206	24864	33522	50837				
10E4-36	3	Start	44517		45403	58231	83888				
		Mid	25095		16871	22790	34630				
		End	44394		18706	27363	44679				
10E4-36	4	Start	56017			52319	77976	103632			
		Mid	30268			17726	29565	41405			
		End	50306			16540	33855	51171			

Note: Select Canted Yoke for Fail CW only.

Sample Part Number

98 F 1 L 4 - 213 C 2 1 G 00 0 S 0

Series	Size Code						Base Number																																																										
98	Actuator Size	Bore Size				Cylinder Size*	Spring Size		Base Code	Action																																																							
98	F	1				L		4	—	213	C																																																						
	A	X	Refer to Table Below				A	0	None (DA)	A	Double Acting, Single Cylinder																																																						
	B	12 E2	<table><tr><th colspan="5">Actuator Bore Selection Table</th></tr><tr><th rowspan="2">Actuator Size</th><th colspan="4">X</th></tr><tr><th>1*</th><th>2</th><th>3</th><th>4</th></tr><tr><td>12 E2</td><td>1.181"</td><td></td><td></td><td></td></tr><tr><td>18 E2</td><td>1.378"</td><td>1.181"</td><td></td><td></td></tr><tr><td>45 E2</td><td>1.969"</td><td>1.378"</td><td>1.75"</td><td></td></tr><tr><td>73 E2</td><td>2.5"</td><td>1.969"</td><td>2.362"</td><td></td></tr><tr><td>14 E3</td><td>3"</td><td>2.5"</td><td>2.362"</td><td></td></tr><tr><td>24 E3</td><td>4.5"</td><td>4.0"</td><td>3.5"</td><td>3.149"</td></tr><tr><td>45 E3</td><td>6.0"</td><td>5.0"</td><td>4.724"</td><td></td></tr><tr><td>10 E4</td><td>7.0"</td><td>6.0"</td><td></td><td></td></tr></table> <p>Select code that matches bore to valve stem.</p> <p>*Select 1 for other valve stems and pick a suitable mounting kit.</p>				Actuator Bore Selection Table					Actuator Size	X				1*	2	3	4	12 E2	1.181"				18 E2	1.378"	1.181"			45 E2	1.969"	1.378"	1.75"		73 E2	2.5"	1.969"	2.362"		14 E3	3"	2.5"	2.362"		24 E3	4.5"	4.0"	3.5"	3.149"	45 E3	6.0"	5.0"	4.724"		10 E4	7.0"	6.0"			B	1	Spring 1	B	Double Acting, Dual Cylinder
Actuator Bore Selection Table																																																																	
Actuator Size	X																																																																
	1*	2					3	4																																																									
12 E2	1.181"																																																																
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14 E3	3"	2.5"					2.362"																																																										
24 E3	4.5"	4.0"					3.5"	3.149"																																																									
45 E3	6.0"	5.0"	4.724"																																																														
10 E4	7.0"	6.0"																																																															
	C	18 E2					C	2	Spring 2	C	Spring Return, Fail CW																																																						
	D	45 E2					D	3	Spring 3	D	Spring Return, Fail CCW																																																						
	E	73 E2					E	4	Spring 4																																																								
	F	14 E3					F	5	Spring 5																																																								
	G	24 E3					G	9"																																																									
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	J	10 E4					J	12"																																																									
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							N	20"																																																									
							P	22"																																																									
							Q	24"																																																									
							R	28"																																																									
							S	32"																																																									
							T	36"																																																									

*Cylinder size is the Pressure Module Size

*Cylinder size is the Pressure Module Size

Base Number					Trim Code		
Mounting/Yoke	Ports		Standard Options		Design Code	MOC	Temp Trim
2	1		G		00	0	S
1 ISO Symmetrical	1	Single, NPT Standard	N	None	00 Standard Pneumatic	0 Standard (DI/CS)	S Standard
2 ISO Canted	2	Dual, NPT	H	Hydraulic*	01 PED		L Low Temp
	3	Single, Custom*	J	Jackscrew Direct Drive*			H High Temp
	4	Dual, Custom*	G	Jackscrew Gear Drive*		XXX-Special Requirements	
			E	Extended Stopper 45°		*Contact factory for special trims assignment	
			F	Extended Stopper 90°			
			D	Damper - Hydraulic			
			P	PST & Locking Device			

*With NPT-Custom thread adaptors

*See pg. 7 for Manual Overrides

NOTE: 1. See "Standard Combinations" for valid cylinder and spring combinations.
2. Refer to ES-00233, to determine actuator orientations.

Pneumatic Actuator Mounting Kits Selection

Actuator Model			Valve Mounting Code		Mounting Kit	
Model	Mtg Flange	Bore (in)	Mounting Code	Stem Dia (In)	Part Number	Contents
12E2	F12/F07	1.181 (0.87" A/F)	C	0.748 (0.51" A/F)	98-B00C-22650-536	(2)
12E2	F12/F07	1.181 (0.87" A/F)	D	0.866 (0.63" A/F)	98-B00D-22650-536	(2)
12E2	F12/F07	1.181 (0.87" A/F)	E	1.181 (0.87" A/F)	98-0F12-22650-536	(1)
12E2	F12/F07	1.181 (0.87" A/F)	E	1.181 (0.87" A/F)	98-B00E-22650-536	(3)
12E2	F12/F07	1.181 (0.87" A/F)	E	1.181 (0.87" A/F)	98-B00E-22652-536 *	(3)
12E2	F12/F07	1.181 (0.87" A/F)	F	1.378	98-B00F-22650-536	(3)
12E2	F12/F07	1.181 (0.87" A/F)	G	1.969	98-B00G-22650-536	(3)
18E2	F12	1.378	D	0.866 (0.63" A/F)	98-C00D-22650-536	(2)
18E2	F12	1.181 (0.87" A/F)	E	1.181 (0.87" A/F)	98-0F12-22650-536	(1)
18E2	F12	1.378	F	1.378	98-0F12-22650-536	(1)
18E2	F12	1.378	F	1.378	98-C00F-22650-536	(3)
18E2	F12	1.378	F25-1	2.5	98-C251-22650-536	(3)
18E2	F12	1.378	G	1.969	98-C00G-22650-536	(3)
18E2	F12	1.378	H	2.5	98-C00H-22650-536	(3)
45E2	F12/F16	1.969	E	1.181	98-D00E-22650-536	(2)
45E2	F12/F16	1.378	F	1.378	98-0F12-22650-536	(1)
45E2	F12/F16	1.969	G	1.969	98-0F16-22650-536	(1)
45E2	F12/F16	1.969	H	2.5	98-D00H-22650-536	(3)
45E2	F12/F16	1.378	F16-1	1.378	98-0F16-22650-536	(1)
45E2	F12/F16	1.969	F16-1	1.378	98-D161-22650-536	(3)
45E2	F12/F16	1.969	F25-1	2.5	98-D251-22650-536	(3)
45E2	F12/F16	1.969	F25-2	3.0	98-D252-22650-536	(3)
45E2	F12/F16	1.969	F30-1	3	98-D301-22650-536	(3)
73E2	F12/F16	2.5	F	1.378	98-E00F-22650-536	(2)
73E2	F12/F16	1.969	G	1.969	98-0F16-22650-536	(1)
73E2	F12/F16	2.5	H	2.5	98-0F16-22650-536	(1)
73E2	F12/F16	2.5	F16-1	1.378	98-E161-22650-536	(2)
73E2	F12/F16	2.5	F25-1	2.5	98-E251-22650-536	(3)
73E2	F12/F16	2.5	F25-2	3.0	98-E252-22650-536	(3)
73E2	F12/F16	2.5	F30-1	3.0	98-E301-22650-536	(3)
73E2	F12/F16	2.5	F30-2	3.5	98-E302-22650-536	(3)
73E2	F12/F16	2.5	F30-3	4	98-E303-22650-536	(3)
73E2	F12/F16	2.5	F35-1	4	98-E351-22650-536	(3)
73E2	F12/F16	2.5	F35-2	6	98-E352-22650-536	(3)
14E3	F25/F16	3.0	G	1.969	98-F00G-22650-536	(2)
14E3	F25/F16	2.5	H	2.5	98-0F16-22650-536	(1)
14E3	F25/F16	3.0	F16-1	1.378	98-F161-22650-536	(2)
14E3	F25/F16	2.5	F25-1	2.5	98-0F25-22650-536	(1)
14E3	F25/F16	3.0	F25-2	3.0	98-0F25-22650-536	(1)

(1) Stud Mounting Kit (SMK) for mounting actuators directly to valves (actuator flange and bore match the valve top plate and stem). Includes only mounting studs.

(2) Adaptor Mounting Kit (AMK) for mounting actuators to valves using a sleeve/shaft adaptor only (no bracket). Includes mounting studs and adaptor.

(3) Direct Mounting Kit (DMK) for mounting actuators to valves when actuator flange and bore do not match the valve top plate and stem. Includes bracket, mounting studs and adaptor/shaft coupler.

*Perpendicular to pipe line

Pneumatic Actuator Mounting Kits Selection - cont.

Actuator Model			Valve Mounting Code		Mounting Kit	
Model	Mtg Flange	Bore (in)	Mounting Code	Stem Dia (In)	Part Number	Contents
14E3	F25/F16	3.0	F30-1	3.0	98-F301-22650-536	(3)
14E3	F25/F16	3.0	F30-2	3.5	98-F302-22650-536	(3)
14E3	F25/F16	3.0	F30-3	4.0	98-F303-22650-536	(3)
14E3	F25/F16	3.0	F30-5	4.5	98-F305-22650-536	(3)
14E3	F25/F16	3.0	F35-1	4.0	98-F351-22650-536	(3)
14E3	F25/F16	3	F35-4	5	98-F354-22650-536	(3)
24E3	F25/F30	4.5	F25-1	2.5	98-G251-22650-536	(2)
24E3	F25/F30	4.5	F25-2	3.0	98-G252-22650-536	(2)
24E3	F25/F30	4.5	F30-1	3.0	98-G301-22650-536	(2)
24E3	F25/F30	3.5	F30-2	3.5	98-0F30-22650-536	(1)
24E3	F25/F30	4.0	F30-3	4.0	98-0F30-22650-536	(1)
24E3	F25/F30	4.5	F30-4	5	98-G304-22650-536	(3)
24E3	F25/F30	4.5	F30-5	4.5	98-0F30-22650-536	(1)
24E3	F25/F30	4.5	F35-1	4.0	98-G351-22650-536	(3)
24E3	F25/F30	4.5	F35-2	6.0	98-G352-22650-536	(3)
24E3	F25/F30	4.5	F35-3	4.5	98-G353-22650-536	(3)
24E3	F25/F30	4.5	F35-4	5.0	98-G354-22650-536	(3)
45E3	F30/F35	6.0	F30-2	3.5	98-H302-22650-536	(2)
45E3	F30/F35	6.0	F30-3	4.0	98-H303-22650-536	(2)
45E3	F30/F35	6.0	F30-5	4.5	98-H305-22650-536	(2)
45E3	F30/F35	6.0	F35-1	4.0	98-H351-22650-536	(2)
45E3	F30/F35	6.0	F35-2	6.0	98-0F35-22650-536	(1)
45E3	F30/F35	6.0	F35-3	4.5	98-H353-22650-536	(2)
45E3	F30/F35	5.0	F35-4	5.0	98-0F35-22650-536	(1)
45E3	F30/F35	6.0	F40-1	7.0	98-H401-22650-536	(3)
45E3	F30/F35	6.0	F40-3	6.0	98-H403-22650-536	(3)
45E3	F30/F35	6.0	F40-4	5.0	98-H404-22650-536	(3)
45E3	F30/F35	6	F48-2	7	98-H482-22650-536	(3)
10E4	F40	7	F30-2	3.5	98-J302-22650-536	(3)
10E4	F40	7	F30-3	4	98-J303-22650-536	(3)
10E4	F40	7	F30-5	4.5	98-J305-22650-536	(3)
10E4	F35	6	F35-2	6	98-0F35-22650-536	(1)
10E4	F40	7	F35-3	4.5	98-J353-22650-536	(2)
10E4	F40	7	F35-4	5	98-J354-22650-536	(3)
10E4	F40	7	F40-1	7	98-0F40-22650-536	(1)
10E4	F40	7	F40-2	7.5	98-J402-22650-536	(3)
10E4	F40	7	F40-3	6	98-0F40-22650-536	(1)
10E4	F40	7	F48-2	7	98-J482-22650-536	(3)

- (1) Stud Mounting Kit (SMK) for mounting actuators directly to valves (actuator flange and bore match the valve top plate and stem). Includes only mounting studs.
- (2) Adaptor Mounting Kit (AMK) for mounting actuators to valves using a sleeve/shaft adaptor only (no bracket). Includes mounting studs and adaptor.
- (3) Direct Mounting Kit (DMK) for mounting actuators to valves when actuator flange and bore do not match the valve top plate and stem. Includes bracket, mounting studs and adaptor/shaft coupler.

Re-breather Kit for Spring Return Actuator					
Cylinder Size	5" - 9"	10"	12"-16"	18"-24"	28"-36"
Part Number	98-0375-22602-536	98-0500-22602-536	98-0750-22602-536	98-1000-22602-536	98-1500-22602-536

Standard Combinations - DA / DD / SR

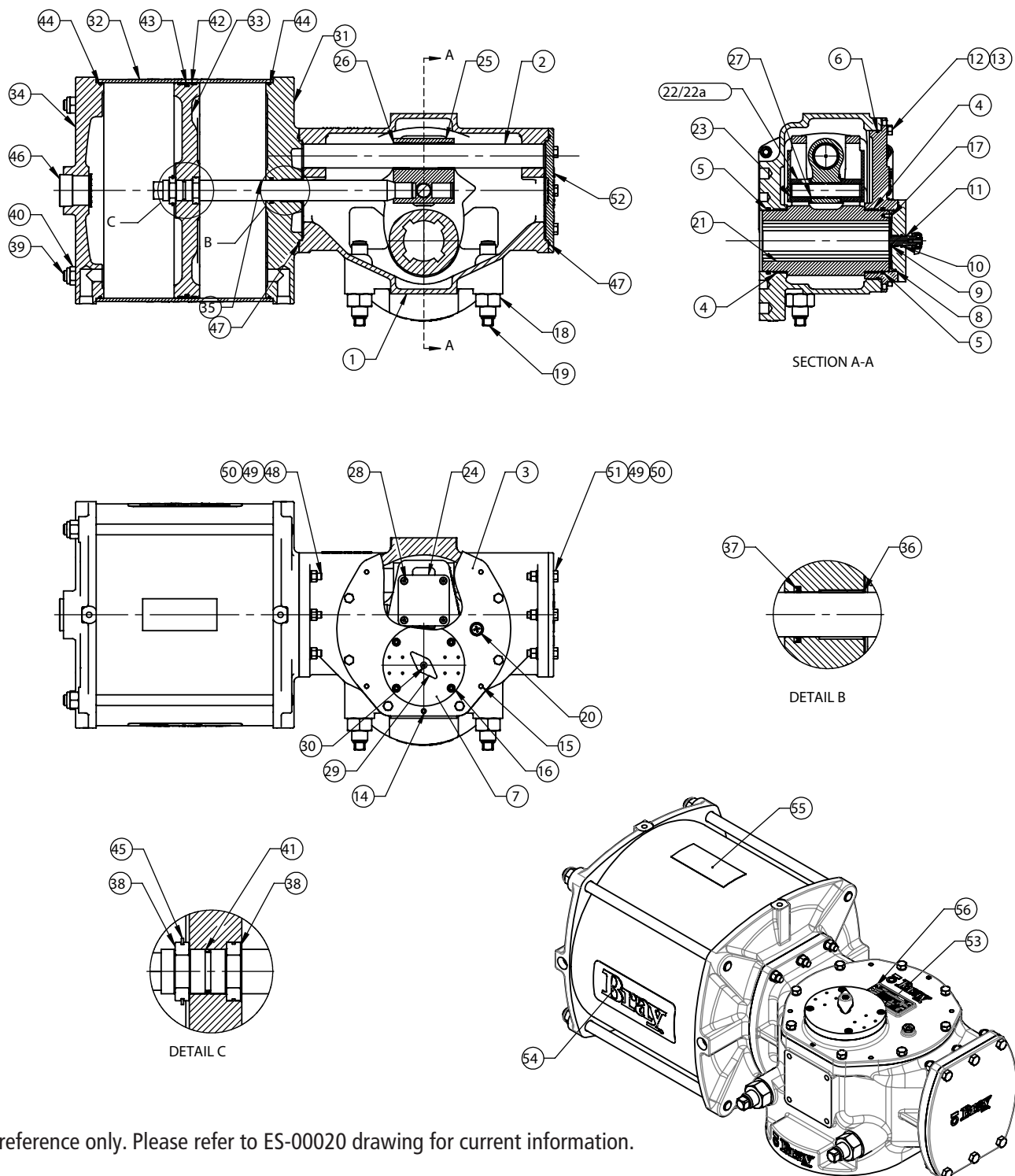
Standard Combinations- DA																	
Torque Module	Yoke	Pressure Modules															
		5	6	7	8	9	10	12	14	16	18	20	22	24	28	32	36
12 E2	Symm & Canted																
18 E2	Symm & Canted																
45 E2	Symm & Canted																
73 E2	Symm & Canted																
14 E3	Symm & Canted																
24 E3	Symm & Canted																
45 E3	Symm & Canted																
10 E4	Symm & Canted																

Standard Combinations- DD																	
Torque Module	Yoke	Pressure Modules															
		5	6	7	8	9	10	12	14	16	18	20	22	24	28	32	36
12 E2	Symm																
	Canted																
18 E2	Symm																
	Canted																
45 E2	Symm																
	Canted																
73 E2	Symm																
	Canted																
14 E3	Symm																
	Canted																
24 E3	Symm																
	Canted																
45 E3	Symm																
	Canted																
10 E4	Symm																
	Canted																

Standard Combinations- SR																						
Torque Module	Yoke	Pressure Modules																Spring Modules				
		5	6	7	8	9	10	12	14	16	18	20	22	24	28	32	36	1	2	3	4	5
12 E2	Symm & Canted																					
18 E2	Symm & Canted																					
45 E2	Symm & Canted																					
73 E2	Symm & Canted																					
14 E3	Symm & Canted																					
24 E3	Symm & Canted																					
45 E3	Symm & Canted																					
10 E4	Symm & Canted																					

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Pneumatic Actuator - Double Acting, Single Cylinder Assembly



For reference only. Please refer to ES-00020 drawing for current information.

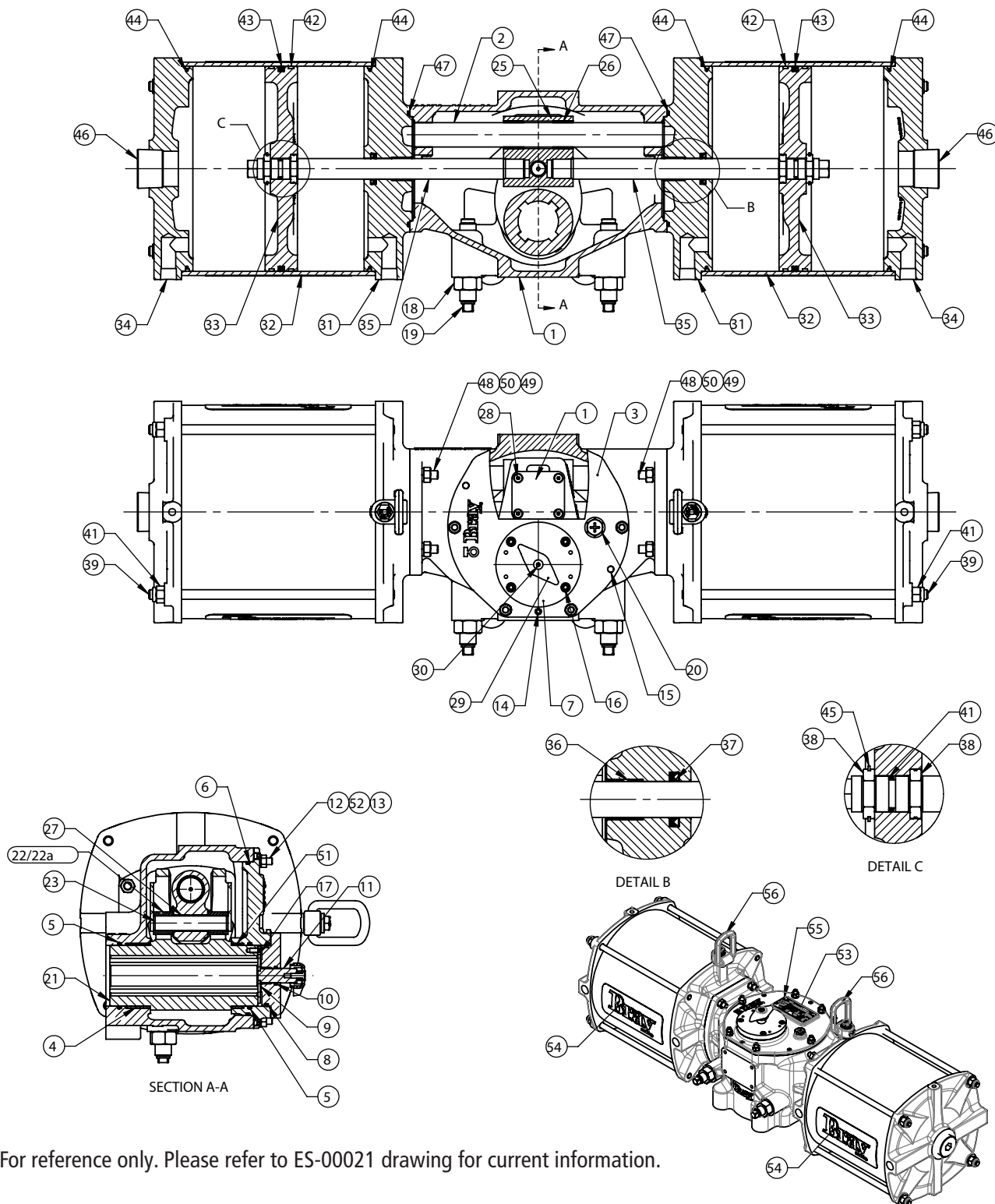
Item		Description	Material	Qty.
1		Yoke Housing	Ductile Iron	1
2		Guide Rod	Alloy Steel	1
3		Housing Cover	Ductile Iron	1
4	**	Bushing (Yoke)	Ptfe Bronze	2
5	*	O-Ring (Yoke)	Buna-N	2
6	*	O-Ring (Cover)	Buna-N	1
7		Top Cover	Ductile Iron	1
8	*	O-Ring (Top Cover)	Buna-N	1
9	**	Flanged Bushing	Ptfe Bronze	1
10	*	O-Ring (Accessory Drive)	Buna-N	1
11		Accessory Drive	Stainless Steel	1
12		Hex Bolt	Steel	8
13		Spring Washer	Spring Steel	8
14		Set Screw, Socket Head	Steel	2
15		Dowel Pin	Hardened Steel	4
16		Socket Head Caps Screw	Steel	4
17		Socket Head Caps Screw, Low Head	Steel	1
18		Seal Nut	Steel	2
19		Stop Bolt	Steel	2
20		Breather Vents	Carbon Steel	1
21		Yoke	Ductile Iron	1
22	**	Slider Block	Bronze	2
22a	**	Roller	Steel	2
23		Yoke Pin	Alloy Steel	1
24		Retainer Plate	Plastic	2
25		Guide Block	Carbon Steel	1
26	**	Bushing (Guide Rod)	Ptfe Bronze	2
27	**	Bushing (Yoke Pin)	Ptfe Bronze	2

Item		Description	Material	Qty.
28		Cap Screw, Flat Head, Hex Socket	Steel	8
29		Position Indicator	Plastic	1
30		Cap Screw, Flat Head, Hex Socket	Steel	1
31		Adaptor, Pressure Module	Ductile Iron	1
32		Barrel Carbon	Steel	1
33		Piston	Ductile Iron	1
34		End Cap, Pressure Module	Ductile Iron	1
35		Piston Rod	Alloy Steel	1
36	**	Bushing (Adaptor)	Ptfe Bronze	1
37	*	Seal, U-Cup	Buna-N	1
38		Split Collar	Alloy Steel	4
39		Tie Rod	Steel	4
40		Locknut, Nylok	Steel	4
41	*	O-Ring (Piston Rod)	Buna-N	1
42	*	Wear Ring	Ptfe	2
43	*	Quad Seal	Buna-N	1
44	*	O-Ring (Barrel)	Buna-N	2
45		Retainer Ring	Stainless Steel	1
46		Pipe Plug	Carbon Steel	1
47	*	O-Ring (Module)	Buna-N	2
48		Stud	Steel	6
49		Spring Washer	Spring Steel	12
50		Nut	Steel	12
51		Hex Bolt	Steel	6
52		End Cover, Da	Ductile Iron	1
53		Name Plate	Stainless Steel	1
54		Label, Logo	Metallized Polyester	2
55		Label, Configuration	Metallized Polyester	1
56		Rivets	Stainless Steel	4

*	Parts in Seal Kits
* & **	Parts in Repair Kits

For reference only. Please refer to ES-00020 drawing for current information.

Pneumatic Actuator - Double Acting, Dual Cylinder Assembly



For reference only. Please refer to ES-00021 drawing for current information.

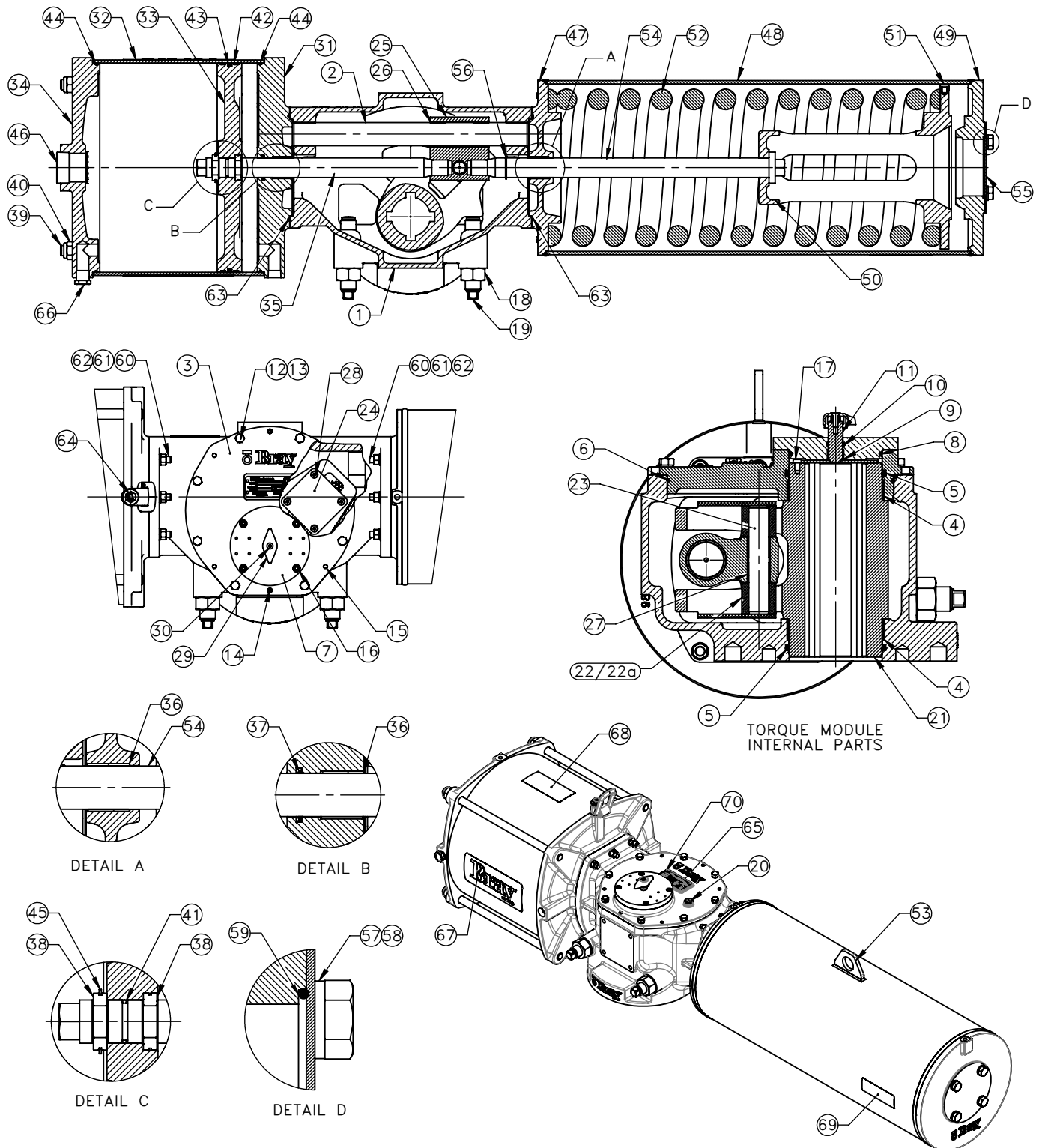
Item		Description	Material	Qty.
1		Yoke Housing	Ductile Iron	1
2		Guide Rod	Alloy Steel	1
3		Housing Cover	Ductile Iron	1
4	**	Bushing (Yoke)	PTFE Bronze	1
5	*	O-Ring (Yoke)	Buna-N	2
6	*	O-Ring (Cover)	Buna-N	1
7		Top Cover	Ductile Iron	1
8	*	O-Ring (Top Cover)	Buna-N	1
9	**	Flanged Bushing	PTFE Bronze	1
10	*	O-Ring (Accessory Drive)	Buna-N	1
11		Accessory Drive	Stainless Steel	1
12		Stud	Steel	6
13		Spring Washer	Spring Steel	6
14		Set Screw Socket Head	Steel	2
15		Dowel Pin	Hardened Steel	2
16		Socket Head Caps Screw	Steel	4
17		Socket Head Caps Screw, Low Head	Steel	1
18		Seal Nut	Steel	2
19		Stop Bolt	Steel	2
20		Breather Vents	Carbon Steel	1
21		Yoke	Ductile Iron	1
22	**	Slider Block	Bronze	2
22a	**	Roller	Steel	2
23		Yoke Pin	Alloy Steel	1
24		Retainer Plate	Plastic	2
25		Guide Block	Carbon Steel	1
26	**	Bushing (Guide Rod)	PTFE Bronze	2
27	**	Bushing (Yoke Pin)	PTFE Bronze	2

Item		Description	Material	Qty.
28		Cap Screw, Flat Head, Hex Socket	Steel	8
29		Position Indicator	Plastic	1
30		Cap Screw, Flat Head, Hex Socket	Steel	1
31		Adaptor, Pressure Module	Ductile Iron	2
32		Barrel	Carbon Steel	2
33		Piston	Ductile Iron	2
34		End Cap, Pressure Module	Ductile Iron	2
35		Piston Rod	Alloy Steel	2
36	**	Bushing (Adaptor)	PTFE Bronze	2
37	*	Seal, U-Cup	Buna-N	2
38		Split Collar	Alloy Steel	8
39		Tie Rod	Steel	8
40		Locknut, Nylok	Steel	8
41	*	O-Ring (Piston Rod)	Buna-N	2
42	*	Wear Ring	PTFE	4
43	*	Quad Seal	Buna-N	2
44	*	O-Ring (Barrel)	Buna-N	4
45		Retainer Ring	Stainless Steel	2
46		Pipe Plug	Carbon Steel	2
47	*	O-Ring (Module)	Buna-N	2
48		Stud	Steel	8
49		Spring Washer	Spring Steel	8
50		Nut	Steel	8
51	**	Bushing (Yoke)	PTFE Bronze	1
52		Nut	Steel	6
53		Name Plate	Stainless Steel	1
54		Label, Logo	Metallized Polyester	4
55		Rivets	Stainless Steel	4
56		Lifting Eye Bolt	Carbon Steel	2

*	Parts in Seal Kits
* & **	Parts in Repair Kits

For reference only. Please refer to ES-00021 drawing for current information.

Spring Return Pneumatic Actuator Assembly



For reference only. Please refer to ES-00019 drawing for current information.

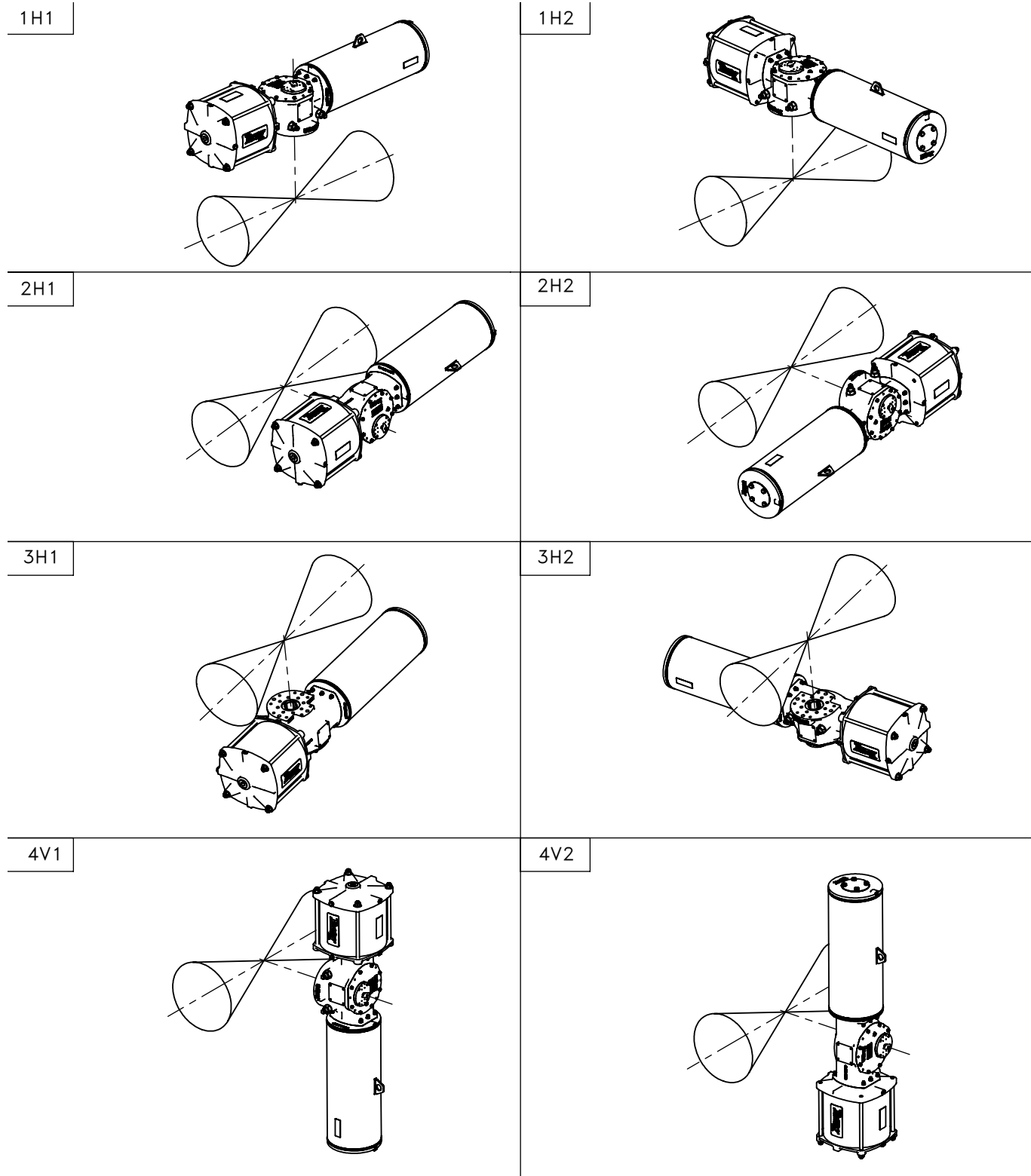
Item		Description	Material	Qty.
1		Yoke Housing	Ductile Iron	1
2		Guide Rod	Alloy Steel	1
3		Housing Cover	Ductile Iron	1
4	**	Bushing (Yoke)	PTFE Bronze	2
5	*	O-Ring (Yoke)	Buna-N	2
6	*	O-Ring (Cover)	Buna-N	1
7		Top Cover	Ductile Iron	1
8	*	O-Ring (Top Cover)	Buna-N	1
9	**	Flanged Bushing	PTFE Bronze	1
10	*	O-Ring (Accessory Drive)	Buna-N	1
11		Accessory Drive	Stainless Steel	1
12		Hex Bolt	Steel	8
13		Spring Washer	Spring Steel	8
14		Set Screw, Socket Head	Steel	2
15		Dowel Pin	Hardened Steel	4
16		Socket Head Caps Screw	Steel	4
17		Socket Head Caps Screw, Low Head	Steel	1
18		Seal Nut	Steel	2
19		Stop Bolt	Steel	2
20		Breather Vents	Carbon Steel	1
21		Yoke	Ductile Iron	1
22	**	Slider Block	Bronze	2
22a	**	Roller	Steel	2
23		Yoke Pin	Alloy Steel	1
24		Retainer Plate	Plastic	2
25		Guide Block	Carbon Steel	1
26	**	Bushing (Guide Rod)	PTFE Bronze	2
27	**	Bushing (Yoke Pin)	PTFE Bronze	2
28		Cap Screw, Flat Head, Hex Socket	Steel	8
29		Position Indicator	Plastic	1
30		Cap Screw, Flat Head, Hex Socket	Steel	1
31		Adaptor, Pressure Module	Ductile Iron	1
32		Barrel	Carbon Steel	1
33		Piston	Ductile Iron	1
34		End Cap, Pressure Module	Ductile Iron	1
35		Piston Rod	Alloy Steel	1

Item		Description	Material	Qty.
36	**	Bushing (Adaptor)	PTFE Bronze	2
37	*	Seal, U-Cup	Buna-N	1
38		Split Collar	Alloy Steel	4
39		Tie Rod	Steel	4
40		Locknut, Nylok	Steel	4
41	*	O-Ring (Piston Rod)	Buna-N	1
42	*	Wear Ring	PTFE	2
43	*	Quad Seal	Buna-N	1
44	*	O-Ring (Barrel)	Buna-N	2
45		Retainer Ring	Stainless Steel	1
46		Pipe Plug	Carbon Steel	1
47		Adaptor, Spring Module	Carbon Steel	1
48		Pipe	Carbon Steel	1
49		End Cap, Spring Module	Carbon Steel	1
50		Spring Guide	Carbon Steel	1
51		Button	Plastic	9
52		Spring, Compression	Alloy Steel	1
53		Lifting Lug	Carbon Steel	1
54		Spring Rod	Alloy Steel	1
55		End Cover	Carbon Steel	1
56		Retainer Ring	Stainless Steel	1
57		Spring Washer	Spring Steel	4
58		Hex Bolt	Steel	4
59	*	O-Ring (End Cover)	Buna-N	1
60		Stud	Steel	12
61		Nut	Steel	12
62		Spring Washer	Spring Steel	12
63	*	O-Ring (Module)	Buna-N	2
64		Lifting Eye Bolt	Carbon Steel	1
65		Name Plate	Stainless Steel	1
66		Breather Vent	Stainless Steel	1
67		Label, Logo	Metallized Polyester	2
68		Label, Configuration	Metallized Polyester	1
69		Label, Caution	Metallized Polyester	1
70		Rivets	Stainless Steel	4

*	Parts in Seal Kits
* & **	Parts in Repair Kits

For reference only. Please refer to ES-00019 drawing for current information.

Actuator Orientations - Where "1H1" is the Standard Actuator Orientation



For reference only. Please refer to ES-00233 drawing for current information.

Definition of Terms and Abbreviations

DA:	Double Acting, Single Cylinder
DD:	Double Acting, Dual Cylinder
SC:	Spring Return, Fail Clockwise
SO:	Spring Return, Fail Counterclockwise
SR:	Spring Return
TM:	Torque Module
PM:	Pressure Module
SM:	Spring Module
MOP:	Maximum Operating Pressure



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