
SERIES 98H

HYDRAULIC SCOTCH YOKE ACTUATOR

TECHNICAL SALES MANUAL



Bray[®]

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THE HIGH PERFORMANCE COMPANY

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For information on this product and other Bray products please visit us at our web page - www.bray.com



S98H SCOTCH YOKE ACTUATOR

Bray’s engineering excellence and precision manufacturing have produced a modular product line optimized for mounting on Bray valves. In addition all Bray accessories are fully configurable and directly mount to the actuator – providing flexibility and efficiency at reduced cost.

The Series 98H actuator is designed for hydraulic operation to a maximum pressure of 3000 psi (207 Bar) and for temperature ranges of -50°F to 212°F (-46°C to 100°C).

- > Compact design offers a high torque-to-weight ratio.
- > Modular design offers easy configuration in the field.
- > Module alignment ensured by precision machined centering rings.
- > Torque output ranging from 2,744 to 885,100 lb-in (310 to 100,000 Nm).
- > Spring end torque ranging from 2,744 to 445,261 lb-in (310 to 50,306 Nm).
- > Premium epoxy/polyurethane coating as standard.

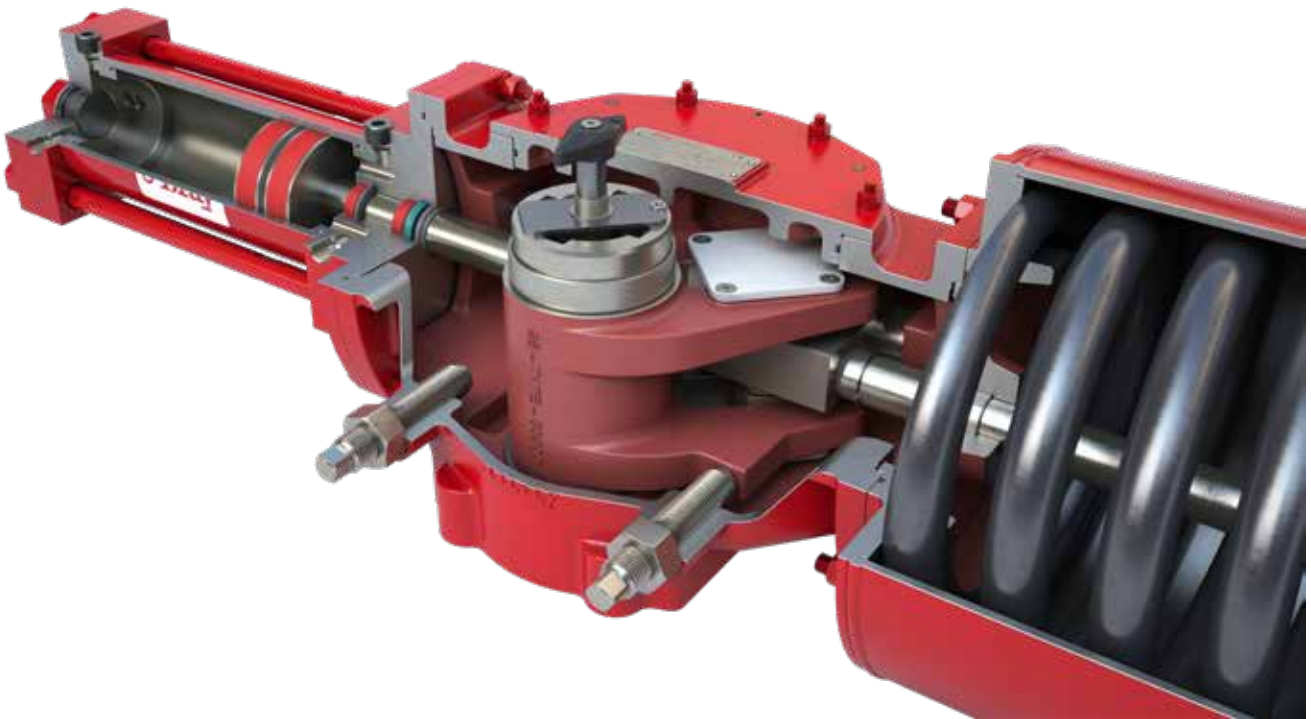
OPERATING CONDITIONS

Pressure Range	500 to 3000 psi (35 to 207 bar)
Media	Hydraulic Fluid - ISO VG 32/46, flash point>157°C
Temperature Range	Standard: -20°F to 212°F (-29°C to 100°C)
Options	Low Temperature: Down to -50°F (-46°C)

Contact factory for other media or non-standard temperature range.

COMPLIANCES

Torque Base	Mounting Dimensions as per ISO 5211: 2001(E)
Accessories	Shaft Driven Accessories mounting per NAMUR-VDE
Performance Testing	EN 15714-4:2009
Ingress Protection	IP67M & IP68
Safety	ATEX, SIL 3 suitable, PED on request



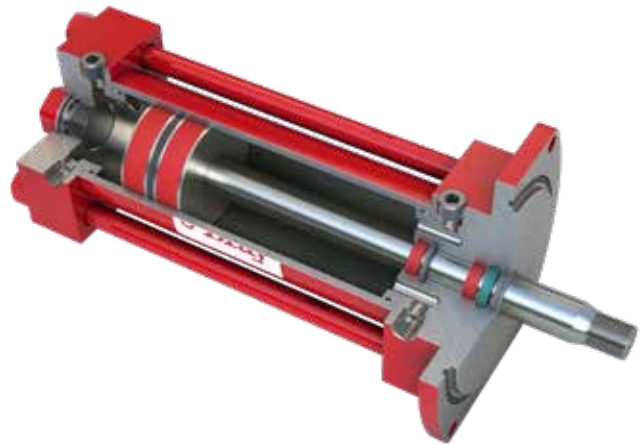
TORQUE MODULE

- > Integral single piece cast housing for rigidity
- > Two ISO drilling patterns in base to maximize direct mounting
- > Symmetrical and Canted Yoke options
- > Integral travel stops
- > Replaceable self lubricating metal backed PTFE bearings for enhanced service life
- > NAMUR mounting for shaft driven accessories, standardized across models
- > Guided drive supports side loads
- > Relief vent prevents ingress and over pressurization



PRESSURE MODULES

- > Corrosion protected external tie rods designed for long seal life and reliability
- > Honed and hard chrome plated cylinder barrel for wear and corrosion protection and enhanced seal performance
- > Multiple ports available
- > Quad ring and U-cup seals for dynamic sealing
- > Dual wear bands for better guidance of piston



SPRING MODULES

- > Fully enclosed and welded design for safety
- > Guided and centered springs for smooth operation
- > No metal to metal contact of spring or guide
- > Thrust base for mounting jackscrew and hydraulic override
- > Tectyl coated springs for corrosion protection



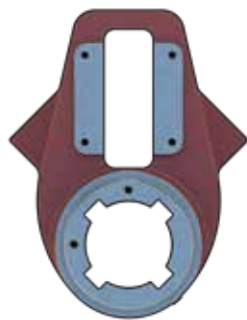
SYMMETRICAL AND CANTED YOKES

The heart of the Series 98 actuator is the scotch yoke. This mechanism converts linear motion into rotational motion. The piston and/or springs directly couple to a rotating yoke with a slot that engages the sliding blocks. This type of actuator has a distinct torque curve which starts high then dips toward the middle of the stroke and ends with increasing torque, thus offering an inherent optimization of torque requirements associated with many valve applications.



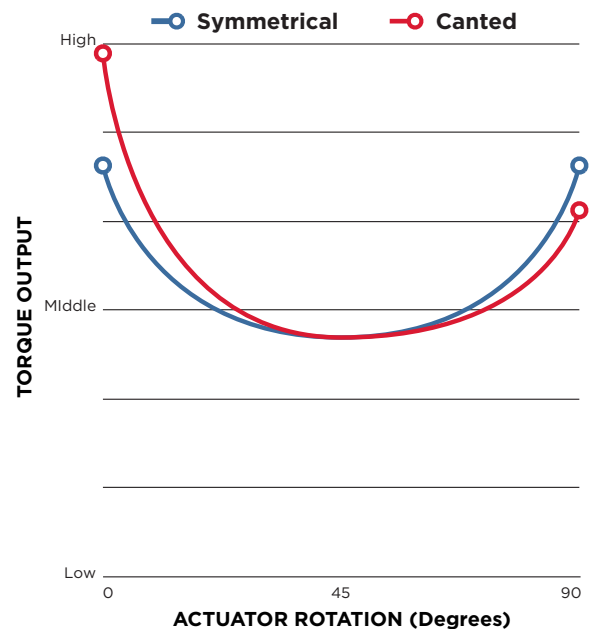
SYMMETRICAL

The symmetrical yoke provides a balanced torque output curve. This is the best choice in applications where the torque requirements at the seat break out and end positions are similar. As the name suggests, the output torque curve is symmetrical about the mid rotation point.



CANTED

The torque demands of some valve types are not the same at the break and end points. These applications call for optimizing the torque output vs shaft angle curve. The canted yoke option shifts the torque output curve. The torque output is matched to the application requirements.





Failsafe Spring Return



Double Acting



Failsafe Spring Return with Geared Manual Override



Double Acting with Handwheel Manual Override



Failsafe Spring Return with Hydraulic Manual Override



Double Acting with
Integral Mechanical Partial Stroke Testing Device



Spring Return with Extended End Travel Stops

- > **Fast Acting** - Provides quick response when speed is critical in reducing the escalation of a hazard. The Bray Series 98 is capable of full-open to full-close in **less than one second**.
- > **Rugged Design** - designed for reliability and high cycle life and cycle tested to over 1 million cycles under load exceeding standards. (EN15714-3 Actuator Performance Standard).
- > **Customizable Configurations** - Bray offers application solutions to meet specific requirements with accessories like the Bray Valve Status Monitor, proximity sensors, smart positioners and solenoid valves.
- > **Manual and Automatic Release Options** - Provide flexibility on resumption of system operation after shutdown.
- > **Certified Safety Integrity Level (SIL) per IEC 61508** - Bray Series 98 scotch yoke actuators are certified to SIL Level 3, including accessories.



Partial Stroke Device

Bray's proprietary mechanical partial stroke device option allows ESD valve function verification without disruption of running process.

How it Works

With the hand lever set in free mode the push rod is free to move through the device allowing full range of travel. When the hand lever is activated the push rod travel is limited. This travel limit can be adjusted anywhere in the valve rotation profile.

Application

By manually limiting the rotation of the valve to a small degree of movement the solenoid can be used to activate a partial stroke test. This test can be done at the unit by a technician without the use of outside electronics.

Dampener

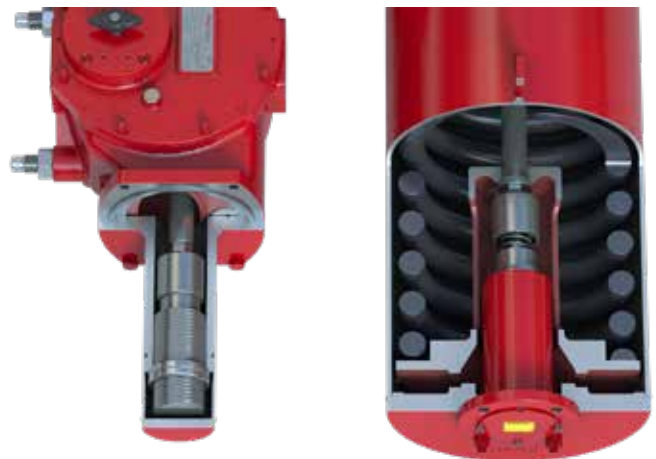
This option for the Series 98 scotch yoke actuator provides adjustable cushioning before valve seating, preventing slamming and seat damage to the valve and vibration shock to the piping.

How it Works

The dampener functions by using a controlled rate of oil displacement in a closed loop. As the piston rod of the dampener is pressed down into the dampener's hydraulic cylinder, oil is displaced by the piston and forced through varying orifices that are progressively closed off as the piston strokes. This results in constant linear deceleration of the piston rod over its stroke.

Application

By decelerating fast stroking valves, the forces of inertia are controlled, avoiding damage to valves, vibration and shock to piping and piping supports.



Add to the versatility of the S98 by choosing the applicable accessories from Bray's complete line of positioners, status monitors and solenoids. The combination of actuators and accessories offer the best compatibility, economy and quality performance in the flow control industry.



S5A/5B/5C VALVE STATUS MONITORS

- > High visibility position indicator with double seal to prevent water ingress.
- > Shatter and UV resistant dome.
- > Stainless steel captive cover bolts.
- > Easy access terminals.
- > Splined cams for easy and accurate adjustment without tools.

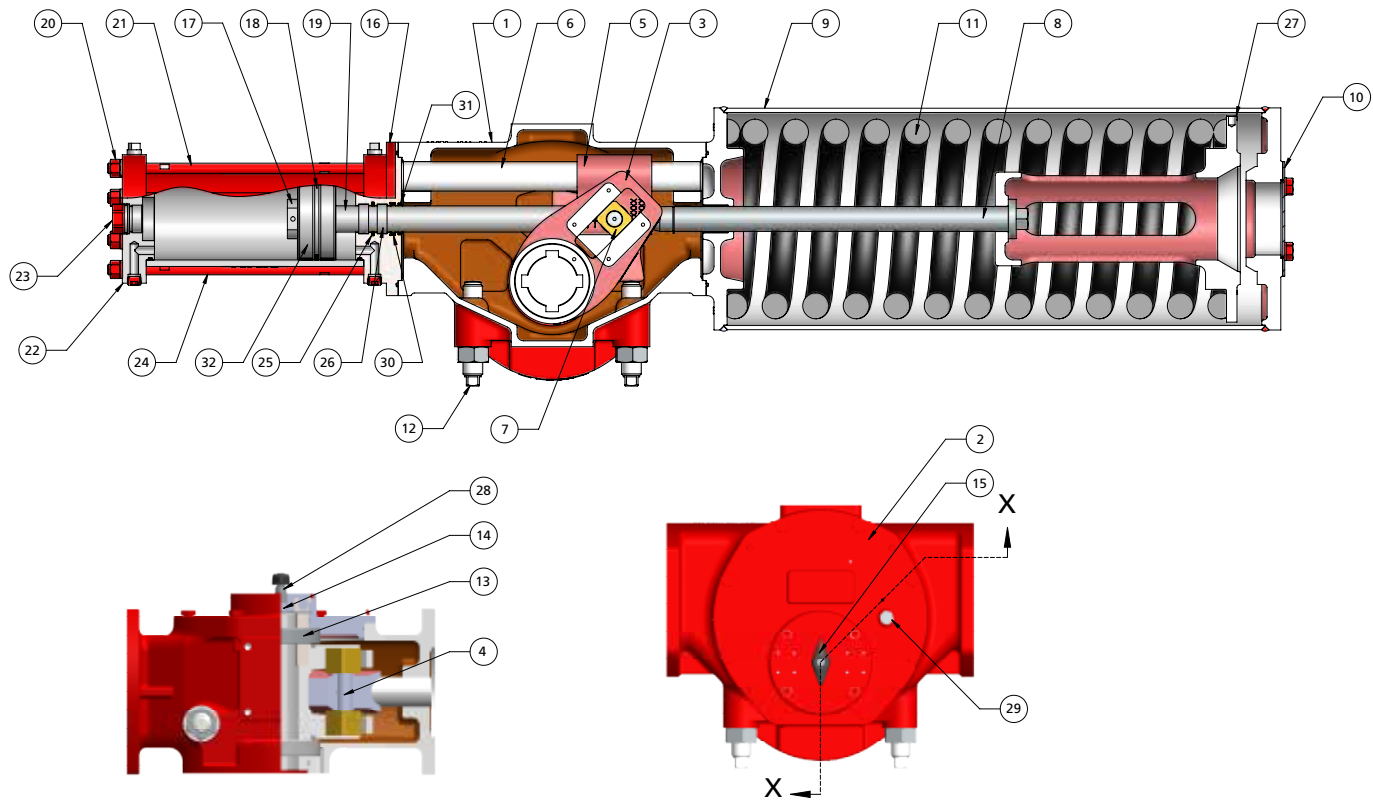
S54 VALVE STATUS MONITORS

- > Two independent sensors for open and close valve position indication.
- > Optimized for indoor and outdoor use.
- > Rugged design resistant to shock, vibration, UV and corrosion.
- > Hermetically sealed to protect against the ingress of liquids or solids.
- > Maintenance free design.
- > Non-contact sensor eliminates the effect of mechanical wear.
- > Eliminates potential switch welding, arcing and sparking.
- > Quick and easy installation.
- > LED indication for sensor power, switch and solenoid status.
- > AS-i sensor available for digital network solution for valve actuator interface.
- > DC 2-wire sensor available for hazardous area process environments.



Series 54

GENERAL SPECIFICATIONS											
RANGE											
Model	ISO Base	Rated Torque		Spring End Torque Nm		Spring End Torque Lb-in		Maximum Stem Acceptance Diameter		Maximum Stem Height	Over Travel
		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		500 to 3000 psig									
Media		Hydraulic Fluid (Standard Trim) - ISO VG 32/46, ISO-L-HV, flash point>157°C									
Temperature Range - Standard Options		Standard : -20°F to 212°F (-29°C to 100°C)						Non-PED			
		Low Temp : Down to -50°F (-46°C)									
		Standard : -20°F to 176°F (-29°C to 80°C)						PED			
COMPLIANCES											
Torque Base		Mounting dimensions per ISO 5211									
Accessories		Shaft Driven Accessories Mounting as per NAMUR-VDE									
Testing		In accordance with EN 15714-4:2009									
Ingress Protection		IP67M & IP68									
Safety		ATEX, SIL 3, PED									

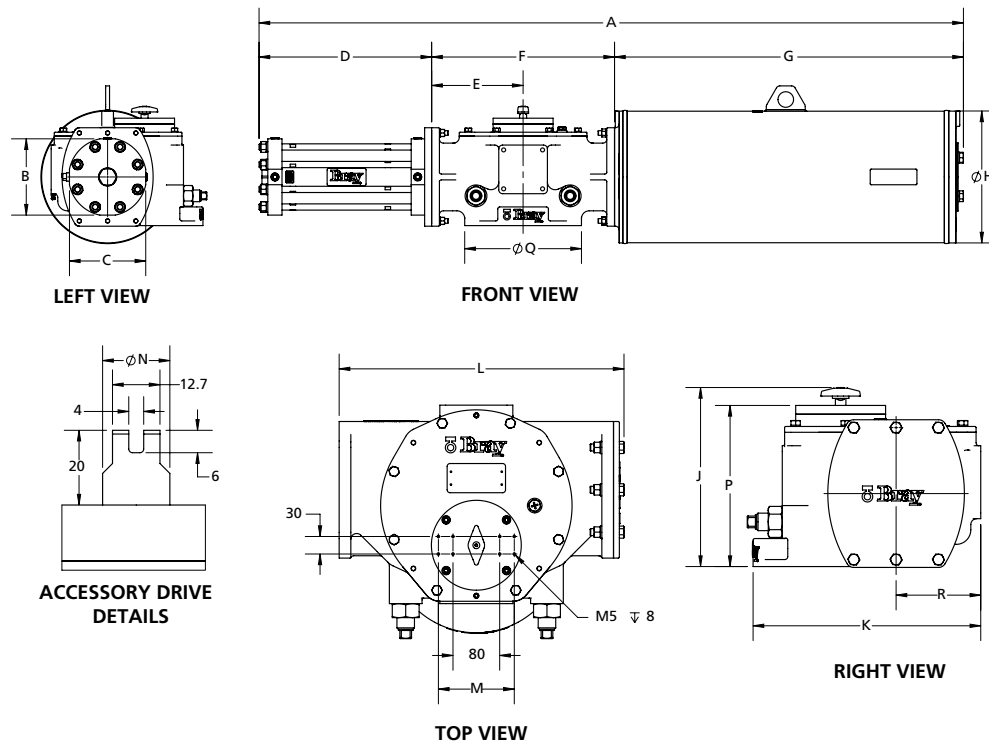


ITEM NO.	DESCRIPTION	MATERIAL
1	HOUSING	DUCTILE IRON
2	HOUSING COVER	DUCTILE IRON
3	YOKE	DUCTILE IRON
4	YOKE PIN	ALLOY STEEL
5	GUIDE BLOCK	CARBON STEEL
6	GUIDE ROD	ALLOY STEEL
7	SLIDER BLOCK	BRONZE
8	SPRING ROD	ALLOY STEEL
9	PIPE	CARBON STEEL
10	END COVER	CARBON STEEL
11	SPRING	ALLOY STEEL
12	STOP BOLT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

ITEM NO.	DESCRIPTION	MATERIAL
17	PISTON	CARBON STEEL
18	PISTON SEAL	PTFE + NITRILE
19	PISTON ROD	ALLOY STEEL
20	TIE ROD NUT	CARBON STEEL
21	TIE ROD	ALLOY STEEL
22	END CAP PRESSURE MODULE	CARBON STEEL
23	PIPE PLUG	CARBON STEEL
24	BARREL	CARBON STEEL
25	ROD SEAL	PTFE + NITRILE
26	PISTON ROD BUSHING	PHENOLIC RESIN
27	SPRING GUIDE	CARBON STEEL
28	ACCESSORY DRIVE SHAFT	STAINLESS STEEL
29	BREATHER	STAINLESS STEEL
30	SEAL U-CUP	POLYURETHANE
31	WIPER	POLYURETHANE
32	GUIDE RING	PHENOLIC RESIN

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).



Series 98H 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	36.9	4.5	4.5	11.9	4.6	9.3	15.7	7.1	7.3	6.8	9.8	--	0.6	6.1	4.4	3.0
18E2	F12	43.7	4.5	4.5	13.5	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	54.0	5.5	5.5	15.3	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	60.6	7.7	7.7	16.3	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	9.6	9.6	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	90.4	10.8	10.8	22.3	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	12.2	12.2	25.6	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	136.3	14.6	14.6	30.9	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 98H Max Dimensions, mm

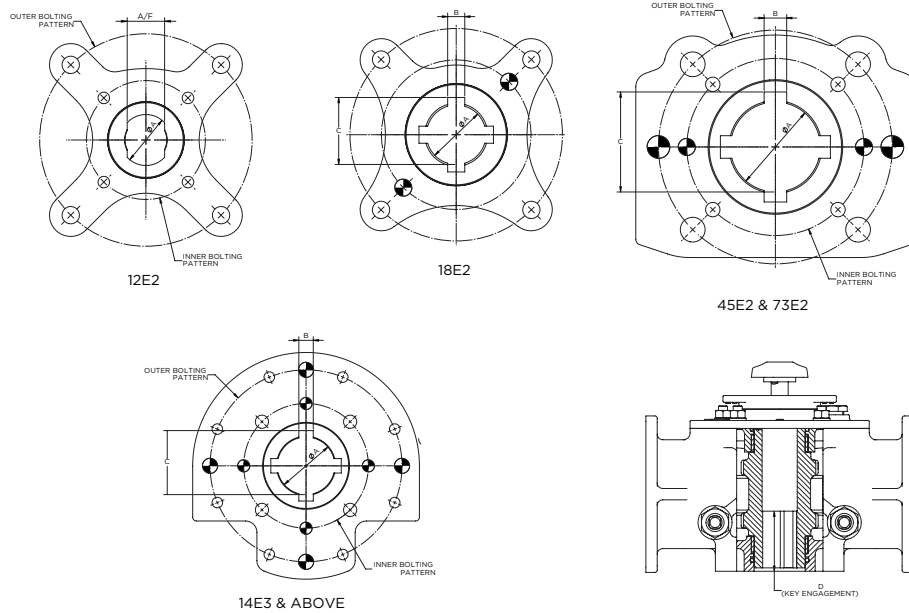
Model	ISO Base	A	B	C	D	E	F	G	H	J	K	L	M	N	P	T	U
12E2	F12/F07	937	115	115	301	118	236	400	180	185	173	248	--	15	155	113	76
18E2	F12	1110	115	115	342.5	140.5	281	486	205	222	220	296	--	15	189	113	102
45E2	F16/F12	1371	140	140	388	159	318	664	240	246	240	333	--	18	216	195	96
73E2	F16/F12	1540	196	196	415	201	402	723.45	326	300	288	420	--	18	249	197	129
14E3	F25/16	1845	244	244	478	235	470	896	342	307	390	498	130	18	276	300	145
24E3	F30/25	2296	275	275	566	291	582	1148	397	364	491	605	130	25	334	350	186
45E3	F35/30	2871	310	310	650	363	726	1495	476	388	580	750	130	25	357	415	212
10E4	F40/F35	3461	372	372	786	451	902	1773	556	481	720	955	130	25	451	475	286

Note: Refer ES drawings for dimensions of specific models

HYDRAULIC CYLINDER PORT SIZE

Cylinder Size	32-50mm	63-140mm	160-250mm
Ports, NPT	1/4"	1/2"	3/4"

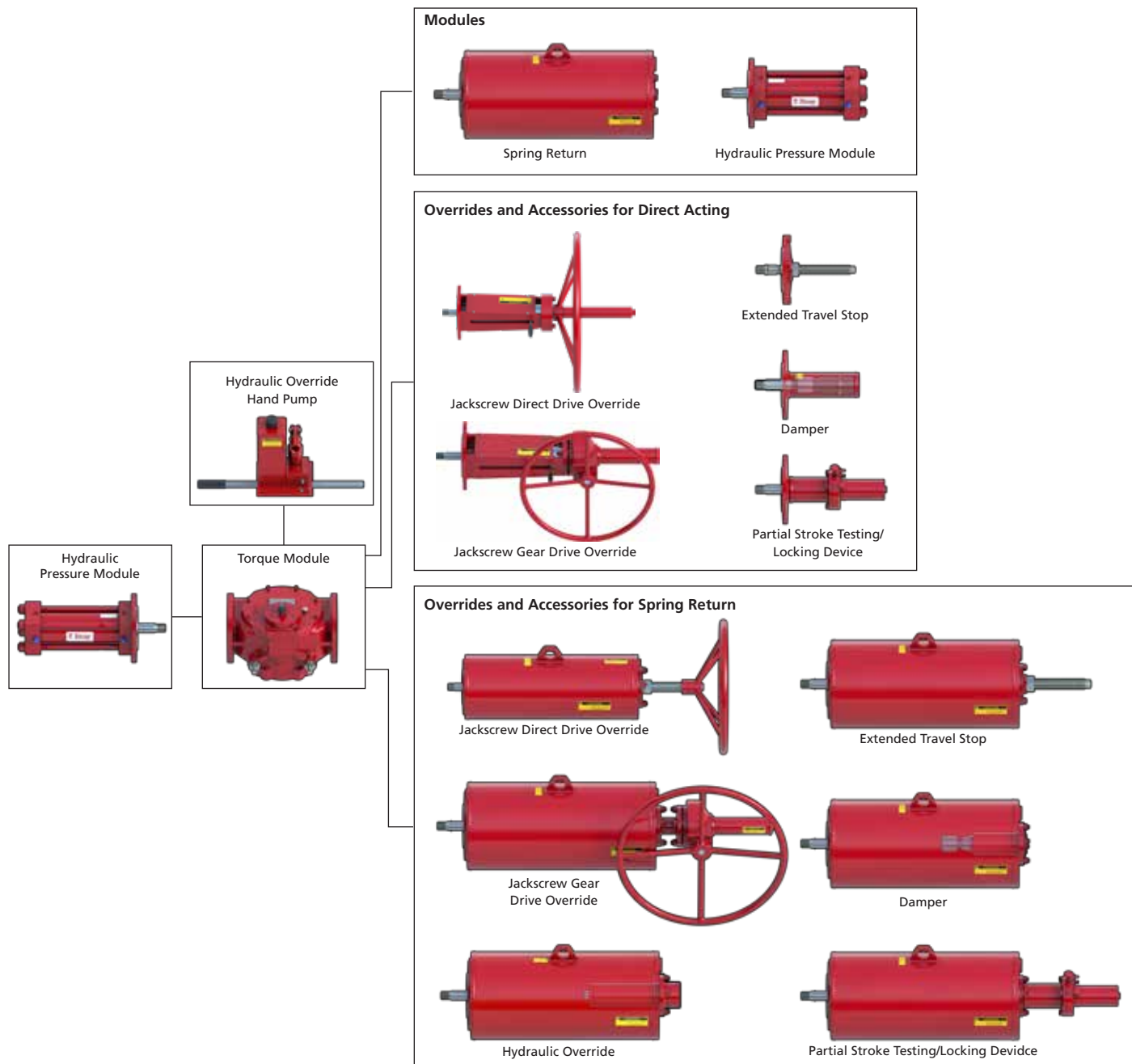
Note: 3 NPT ports, 90 degrees apart provided on the end cap and adaptor.



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

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																								
Series 98 Actuator Model	12 E2			18 E2			45 E2				73 E2				14 E3					24 E3				
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
Jack Screw - Direct Drive - DA		o			o			o																
Jack Screw - Direct Drive - SR	o	o	o	o	o	o	o	o	o															
Jack Screw - Bevel Gear Drive - DA								o				o				o								
Jack Screw - Bevel Gear Drive - SR	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
Hydraulic Override - DA		o			o			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	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

MODULE WEIGHTS (APPROX), Lbs																				
Model	Rated Torq, Nm	Torque Module	Hydraulic Pressure Modules, mm													Spring Modules				
			32	40	50	63	80	100	125	140	160	180	200	220	250	1	2	3	4	5
12 E2	1200	33	13	14	18	25	39									53	53	60		
18 E2	1800	55		19	22	31	46									82	86	90		
45 E2	4500	84			23	32	49	68								134	146	152	172	
73 E2	7300	146			32	42	61	80	111							214	216	238	293	
14 E3	14000	236				53	74	90	122	149	188					362	384	403	430	452
24 E3	24000	428					100	104	157	188	220	282				575	593	619	677	679
45 E3	45000	666						174	177	239	276	335	406			1065	1116	1259	1369	1431
10 E4	100000	1312							249	278	365	433	521	648	802.5	2061	2205	2502	2701	
MODULE WEIGHTS (APPROX), Kg																				
Model	Rated Torq, Nm	Torque Module	Hydraulic Pressure Modules, mm													Spring Modules				
			32	40	50	63	80	100	125	140	160	180	200	220	250	1	2	3	4	5
12 E2	1200	15	6.0	6.5	8.0	11.5	17.5									24	24	27		
18 E2	1800	25		8.5	10.0	14.0	21.0									37	39	41		
45 E2	4500	38			10.5	14.5	22.0	31.0								61	66	69	78	
73 E2	7300	66			14.5	19.0	27.5	36.5	50.5							97	98	108	133	
14 E3	14000	107				24.0	33.5	41.0	55.5	67.5	85.5					164	174	183	195	205
24 E3	24000	194					45.5	47.0	71.0	85.5	100.0	128.0				261	269	281	307	308
45 E3	45000	302						79.0	80.5	108.5	125.0	152.0	184.0			483	506	571	621	649
10 E4	100000	595							113.0	126.0	165.5	196.5	236.5	294.0	364.0	935	1000	1135	1225	

Model		Maximum Operating Pressure				Volume				ActuatorWeight		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	12E2-32	3000	206.7	2620	180.5	3.0	5.5	0.05	0.10	49	22	77	35		
	12E2-40	2036	140.3	1677	115.5	5.5	8.5	0.10	0.15	50	23	78	35.5		
	12E2-50	1303	89.8	1073	74.0	10.5	13.5	0.20	0.25	53	24	82	37		
	12E2-63	841	57.9	692	47.7	19.0	21.5	0.35	0.35	61	28	89	41		
DD	12E2-32	2083	143.5	1716	118.2	8.5	8.5	0.15	0.15	60	27				
	12E2-40	1199	82.6	1012	69.7	14.0	14.0	0.25	0.25	62	28				
	12E2-50	739	50.9	608	41.9	24.0	24.0	0.39	0.39	68	31				
DA	18E2-40	2443	168.3	2012	138.7	6.5	10.0	0.10	0.20	78	36	122	56		
	18E2-50	1564	107.7	1288	88.7	12.0	16.0	0.20	0.30	82	37	126	57		
	18E2-63	1009	69.5	831	57.2	22.0	25.5	0.40	0.45	90	41	134	61		
	18E2-80	626	43.1	515	35.5	33.0	41.5	0.55	0.70	106	48	150	68		
DD	18E2-40	1518	104.6	1250	86.2	16.5	16.5	0.30	0.30	93	42				
	18E2-50	915	63.0	754	51.9	28.0	28.0	0.46	0.46	99	45				
	18E2-63	547	37.7			47.5	47.5	0.80	0.80	117	53				
DA	45E2-50	3000	206.7	2477	170.7	14.5	20.5	0.25	0.35	111	51	175	79.5		
	45E2-63	1894	130.5	1560	107.5	27.0	31.5	0.45	0.50	120	55	184	83.5		
	45E2-80	1175	80.9	991	68.3	41.5	52.0	0.70	0.85	137	62	201	91		
	45E2-100	770	53.1	634	43.7	67.0	82.5	1.10	1.35	157	71	220	100		
DD	45E2-50	1718	118.4	1415	97.5	35.0	35.0	0.60	0.60	130	59				
	45E2-63	1028	70.8	867	59.7	58.5	58.5	1.00	1.00	148	67				
	45E2-80	632	43.6	521	35.9	93.5	93.5	1.55	1.55	181	82				
DA	73E2-50	3000	206.7	3000	206.7	13.5	26.5	0.25	0.45	186	85	272	123.5	301	136.5
	73E2-63	2497	172.0	2056	141.7	28.0	38.0	0.50	0.65	196	89	282	128	311	141
	73E2-80	1548	106.7	1275	87.9	51.0	61.5	0.85	1.05	215	98	301	136.5	330	149.5
	73E2-100	1015	69.9	836	57.6	79.0	99.0	1.35	1.65	235	107	321	145.5	349	158.5
	73E2-125	649	44.7	535	36.9	127.5	142.0	2.10	2.35	266	121	352	160	380	172.5
DD	73E2-50	2492	171.7	2053	141.4	40.0	40.0	0.70	0.70	209	95				
	73E2-63	1433	98.7	1180	81.3	66.0	66.0	1.15	1.15	229	104				
	73E2-80	862	59.4	710	48.9	112.5	112.5	1.90	1.90	267	121				
DA	14E3-63	3000	206.7	3000	206.7	26.5	46.0	0.45	0.75	304	138	452	205	476	216
	14E3-80	2500	172.3	2060	141.9	52.0	71.5	0.85	1.20	325	148	473	214.5	497	225.5
	14E3-100	1600	110.3	1318	90.8	89.0	114.0	1.50	1.90	342	155	489	222	514	233
	14E3-125	1024	70.6	864	59.5	148.0	167.5	2.45	2.75	374	170	521	236.5	546	247.5
	14E3-140	836	57.6	689	47.5	190.0	217.0	3.15	3.60	400	182	548	248.5	572	259.5
DD	14E3-63	2525	174.0	2080	143.3	72.5	72.5	1.20	1.20	342	155				
	14E3-80	1429	98.4	1177	81.1	123.5	123.5	2.05	2.05	384	174				
	14E3-100	891	61.4	734	50.5	203.0	203.0	3.40	3.40	417	189				
	14E3-125	553	38.1			315.5	315.5	5.20	5.20	481	218				

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

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	24E3-80	3000	206.7	2642	182.0	62.0	91.5	1.05	1.50	554	252	771	350	808	366.5
	24E3-100	2053	141.5	1691	116.5	116.5	145.0	1.95	2.40	558	253	774	351	811	368
	24E3-125	1314	90.5	1082	74.6	186.0	216.5	3.05	3.55	611	277	827	375	864	392
	24E3-140	1047	72.2	884	60.9	240.0	278.0	3.95	4.60	643	292	859	390	896	406.5
	24E3-160	822	56.6	677	46.6	322.5	365.5	5.30	6.00	675	306	891	404	928	421
DD	24E3-80	1905	131.3	1569	108.1	153.5	153.5	2.55	2.55	628	285				
	24E3-100	1142	78.7	964	66.4	261.5	261.5	4.35	4.35	635	288				
	24E3-125	720	49.6	592.9	40.9	402.5	402.5	6.60	6.60	741	336				
	24E3-140	566	39.0			518.0	518.0	8.55	8.55	805	365				
DA	45E3-100	3000	206.7	2576	177.5	122.0	171.50	2.00	2.85	877	398			1230	558
	45E3-125	2002	138.0	1649	113.6	212.5	267.5	3.50	4.40	881	400			1233	560
	45E3-140	1596	110.0	1314	90.6	276.5	336.5	4.55	5.55	942	428			1295	588
	45E3-160	1222	84.2	1031	71.0	382.5	437.0	6.30	7.20	979	444			1332	604
	45E3-180	989	68.1	815	56.2	498.0	558.0	8.20	9.15	1038	471			1391	631
DD	45E3-100	1855	127.8	1528	105.3	293.5	293.5	4.85	4.85	1014	460				
	45E3-125	1112	76.7	939	64.7	480.0	480.0	7.90	7.90	1021	463				
	45E3-140	889	61.2	732	50.4	613.0	613.0	10.10	10.10	1144	519				
	45E3-160	667	45.9	549.2	37.8	819.5	819.5	13.50	13.50	1217	552				
DA	10E4-125	3000	206.7	3000	206.7	235.0	342.0	3.85	5.60	1640	744			2246	1019
	10E4-140	2910	200.5	2397	165.1	309.5	412.0	5.10	6.75	1669	757			2275	1032
	10E4-160	2228	153.5	1835	126.4	431.50	548.00	7.10	9.00	1756	797			2362	1071.5
	10E4-180	1760	121.3	1450	99.9	575.50	697.50	9.40	11.45	1824	828			2431	1102.5
	10E4-200	1426	98.2	1174	80.9	731.00	862.00	12.00	14.15	1912	868			2519	1142.5
	10E4-220	1178	81.2	994	68.5	916.0	1032.0	15.05	16.95	2039	925			2646	1200
	10E4-250	935	64.4	770	53.1	1212.5	1334.0	19.90	21.90	2194	995			2800	1270
DD	10E4-125	2164	149.1	1783	122.8	577.0	577.0	9.45	9.45	1810	821				
	10E4-140	1663	114.6	1369	94.4	721.5	721.5	11.85	11.85	1867	847				
	10E4-160	1232	84.9	1015	69.9	979.5	979.5	16.1	16.1	2041	926				
	10E4-180	976	67.2	804	55.4	1273.0	1273.0	20.9	20.9	2178	988				
	10E4-200	778	53.6	641.0	44.2	1593.0	1593.0	26.2	26.2	2355	1068				

Model		Maximum Operating Pressure				Volume		Actuator Weight		Assembly Weight (approx)			
	Spring #	Symmetrical		Canted		Rod end		Lbs	Kg	w/Jackscrew Override		w/Hydraulic Override	
		psi	bar	psi	bar	cu.in	Lts			Lbs	Kg	Lbs	Kg
12E2-40	1	3000	206.7	3000	206.7	5.5	0.10	100	45.5	114	51.5		
12E2-50		2134	147.0	1831	126.2	10.5	0.20	104	47	117	53		
12E2-63		1234	85.1	1059	73.0	19.0	0.35	111	51	125	57		
12E2-80		727	50.1	624	43.0	28.0	0.50	125	57	138	63		
12E2-40	2	3000	206.7	3000	206.7	5.5	0.10	100	45.5	114	51.5		
12E2-50		2238	154.2	1936	133.4	10.5	0.20	104	47	117	53		
12E2-63		1295	89.2	1120	77.1	19.0	0.35	111	51	125	56.5		
12E2-80		763	52.6	660	45.4	28.0	0.50	125	57	138	62.5		
12E2-40	3	3000	206.7	3000	206.7	5.5	0.10	107	48.5	120	54.5		
12E2-50		2449	168.7	2146	147.9	10.5	0.20	110	50	123	56		
12E2-63		1417	97.6	1241	85.5	19.0	0.35	118	54	131	59.5		
12E2-80		834	57.5	731	50.4	28.0	0.50	131	60	144	65.5		
18E2-50	1	2702	186.1	2334	160.8	12.0	0.20	159	72	172	78		
18E2-63		1515	104.4	1309	90.2	22.0	0.40	168	76	181	82		
18E2-80		893	61.6	771	53.1	33.0	0.55	183	83	196	89		
18E2-50	2	2800	192.9	2432	167.6	12.0	0.20	163	74	176	80		
18E2-63		1570	108.2	1364	94.0	22.0	0.40	172	78	185	84		
18E2-80		925	63.8	803	55.3	33.0	0.55	187	85	201	91		
18E2-50	3	3000	206.7	2706	186.5	12.0	0.20	168	76	181	82		
18E2-63		1723	118.7	1517	104.5	22.0	0.40	176	80	190	86		
18E2-80		1014	69.9	892	61.5	33.0	0.55	192	87	205	93		
45E2-63	1	2784	191.8	2388	164.5	27.0	0.45	250	114	277	125.5		
45E2-80		1612	111.1	1382	95.3	41.5	0.70	267	121	293	133		
45E2-100		1012	69.7	868	59.8	67.0	1.10	287	130	313	142		
45E2-63	2	2973	204.9	2577	177.6	27.0	0.45	261	119	288	130.5		
45E2-80		1722	118.6	1492	102.8	41.5	0.70	278	126	304	138		
45E2-100		1061	73.1	935	64.4	67.0	1.10	298	135	324	147		
45E2-63	3	3000	206.7	2835	195.3	27.0	0.45	268	122	325	147.5		
45E2-80		1871	128.9	1642	113.1	41.5	0.70	284	129	342	155		
45E2-100		1153	79.4	1027	70.8	67.0	1.10	304	138	362	164		
45E2-63	4	3000	206.7	2952	203.4	27.0	0.45	288	131	347	157.5		
45E2-80		1939	133.6	1710	117.8	41.5	0.70	304	138	364	165		
45E2-100		1194	82.3	1069	73.7	67.0	1.10	324	147	384	174		
73E2-63	1	3000	206.7	3000	206.7	28.0	0.50	401	182	463	210	478	217
73E2-80		2381	164.0	2056	141.6	51.0	0.85	420	191	482	218.5	497	225.5
73E2-100		1426	98.2	1231	84.8	79.0	1.35	440	200	502	227.5	517	234.5
73E2-125		893	61.5	770	53.1	127.5	2.10	471	214	532	241.5	548	248.5
73E2-63	2	3000	206.7	3000	206.7	28.0	0.50	403	183	467	212	481	218
73E2-80		2455	169.2	2130	146.8	51.0	0.85	422	192	486	220.5	499	226.5
73E2-100		1471	101.3	1276	87.9	79.0	1.35	442	201	506	229.5	519	235.5
73E2-125		920	63.4	798	55.0	127.5	2.10	473	215	537	243.5	550	249.5
73E2-63	3	3000	206.7	3000	206.7	28.0	0.50	425	193	492	223	503	228
73E2-80		2600	179.1	2275	156.7	51.0	0.85	444	202	510	231.5	521	236.5
73E2-100		1557	107.3	1362	93.9	79.0	1.35	464	211	530	240.5	541	245.5
73E2-125		974	67.1	851	58.6	127.5	2.10	495	225	561	254.5	572	259.5
73E2-63	4	3000	206.7	3000	206.7	28.0	0.50	481	218	547	248	558	253
73E2-80		2733	188.3	2408	165.9	51.0	0.85	499	227	565	256.5	577	261.5
73E2-100		1637	112.8	1442	99.4	79.0	1.35	519	236	585	265.5	596	270.5
73E2-125		1023	70.5	900	62.0	127.5	2.10	550	250	616	279.5	627	284.5

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
14E3-80	1	3000	206.7	3000	206.7	52.0	0.85	671	305	766	347.5	779	353.5
14E3-100		2379	163.9	2043	140.8	89.0	1.50	688	312	783	355	796	361
14E3-125		1425	98.2	1224	84.3	148.0	2.45	720	327	815	370	828	375.5
14E3-140		1110	76.5	971	66.9	190.0	3.15	746	339	841	382	854	387.5
14E3-160		849	58.5	728	50.2	253.5	4.15	786	357	881	400	894	405.5
14E3-80	2	3000	206.7	3000	206.7	52.0	0.85	693	315	793	359.5	801	363.5
14E3-100		2448	168.7	2112	145.5	89.0	1.50	710	322	809	367	818	371
14E3-125		1466	101.0	1265	87.2	148.0	2.45	742	337	841	382	850	385.5
14E3-140		1143	78.7	1003	69.1	190.0	3.15	768	349	868	394	876	397.5
14E3-160		873	60.1	753	51.9	253.5	4.15	808	367	907	412	916	415.5
14E3-80	3	3000	206.7	3000	206.7	52.0	0.85	713	324	812	368.5	821	372.5
14E3-100		2538	174.9	2202	151.7	89.0	1.50	730	331	829	376	838	380
14E3-125		1520	104.7	1319	90.9	148.0	2.45	762	346	861	391	870	394.5
14E3-140		1184	81.6	1028	70.8	190.0	3.15	788	358	887	403	896	406.5
14E3-160		904	62.3	784	54.0	253.5	4.15	828	376	927	421	936	424.5
14E3-80	4	3000	206.7	3000	206.7	52.0	0.85	740	336	854	387.5	848	384.5
14E3-100		2685	185.0	2349	161.8	89.0	1.50	756	343	871	395	864	392
14E3-125		1608	110.8	1407	96.9	148.0	2.45	788	358	903	410	896	406.5
14E3-140		1253	86.3	1096	75.5	190.0	3.15	815	370	929	422	923	418.5
14E3-160		956	65.8	835	57.5	253.5	4.15	854	388	969	440	962	436.5
14E3-80	5	3000	206.7	3000	206.7	52.0	0.85	762	346	876	397.5	870	394.5
14E3-100		2784	191.8	2449	168.7	89.0	1.50	778	353	893	405	886	402
14E3-125		1668	114.9	1467	101.0	148.0	2.45	810	368	925	420	918	416.5
14E3-140		1299	89.5	1143	78.7	190.0	3.15	837	380	951	432	945	428.5
14E3-160		991	68.3	870	60.0	253.5	4.15	876	398	991	450	984	446.5
24E3-100	1	3000	206.7	2824	194.5	116.5	1.95	1107	502	1261	572	1263	573
24E3-125		1922	132.4	1656	114.1	186.0	3.05	1160	526	1314	596	1316	597
24E3-140		1487	102.5	1281	88.3	240.0	3.95	1192	541	1346	611	1348	612
24E3-160		1109	76.4	973	67.0	322.5	5.30	1224	555	1378	625	1380	626
24E3-180		877	60.4	755	52.0	422.5	459.50	1285	583	1440	653	1442	654
24E3-100	2	3000	206.7	2963	204.2	116.5	1.95	1124	510	1281	581	1281	581
24E3-125		2004	138.1	1738	119.7	186.0	3.05	1177	534	1334	605	1334	605
24E3-140		1551	106.8	1345	92.6	240.0	3.95	1209	549	1366	620	1366	620
24E3-160		1156	79.6	1020	70.3	322.5	5.30	1241	563	1398	634	1398	634
24E3-180		914	63.0	792	54.5	422.5	459.50	1285	583	1442	654	1442	654
24E3-100	3	3000	206.7	3000	206.7	116.5	1.95	1151	522	1343	609	1307	593
24E3-125		2120	146.1	1854	127.7	186.0	3.05	1204	546	1396	633	1360	617
24E3-140		1641	113.0	1435	98.9	240.0	3.95	1236	561	1427	648	1392	632
24E3-160		1223	84.3	1070	73.7	322.5	5.30	1268	575	1459	662	1424	646
24E3-180		966	66.6	844	58.1	422.5	459.50	1329	603	1521	690	1486	674
24E3-100	4	3000	206.7	3000	206.7	116.5	1.95	1208	548	1402	636	1365	619
24E3-125		2202	151.7	1935	133.3	186.0	3.05	1261	572	1455	660	1418	643
24E3-140		1704	117.4	1498	103.2	240.0	3.95	1293	587	1487	675	1450	658
24E3-160		1270	87.5	1116	76.9	322.5	5.30	1325	601	1519	689	1481	672
24E3-180		1002	69.1	880	60.7	422.5	459.50	1387	629	1581	717	1543	700
24E3-100	5	3000	206.7	3000	206.7	116.5	1.95	1210	549	1407	638	1367	620
24E3-125		2294	158.1	2028	139.7	186.0	3.05	1263	573	1459	662	1420	644
24E3-140		1775	122.3	1570	108.1	240.0	3.95	1295	588	1491	677	1452	659
24E3-160		1324	91.2	1170	80.6	322.5	5.30	1327	602	1523	691	1484	673
24E3-180		1044	71.9	922	63.5	422.5	459.50	1389	630	1585	719	1545	701

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
45E3-125	1	3000	206.7	2728	187.9	212.5	3.50	1908	866			2157	979
45E3-140		2404	165.6	2069	142.6	276.5	4.55	1970	894			2219	1006.5
45E3-160		1762	121.4	1517	104.5	382.5	6.3	2006	910			2255	1023
45E3-180		1353	93.2	1164	80.2	498.0	8.2	2066	937			2315	1050
45E3-200		1074	74.0	941	64.9	618.5	10.15	2136	969			2385	1082
45E3-125	2	3000	206.7	2823	194.5	212.5	3.50	1959	889			2208	1002
45E3-140		2477	170.6	2142	147.6	276.5	4.55	2021	917			2270	1029.5
45E3-160		1815	125.1	1570	108.2	382.5	6.30	2057	933			2306	1046
45E3-180		1393	96.0	1205	83.0	498.0	8.20	2116	960			2366	1073
45E3-200		1106	76.2	974	67.1	618.5	10.15	2187	992			2436	1105
45E3-125	3	3000	206.7	3000	206.7	212.5	3.50	2102	954			2351	1067
45E3-140		2616	180.2	2281	157.2	276.5	4.55	2164	982			2413	1094.5
45E3-160		1917	132.1	1672	115.2	382.5	6.30	2200	998			2449	1111
45E3-180		1472	101.4	1283	88.4	498.0	8.20	2260	1025			2509	1138
45E3-200		1168	80.5	1019	70.2	618.5	10.15	2330	1057			2579	1170
45E3-125	4	3000	206.7	3000	206.7	212.5	3.50	2212	1004			2461	1117
45E3-140		2693	185.5	2358	162.5	276.5	4.55	2274	1032			2523	1144.5
45E3-160		1974	136.0	1728	119.1	382.5	6.30	2310	1048			2560	1161
45E3-180		1515	104.4	1327	91.4	498.0	8.20	2370	1075			2619	1188
45E3-200		1203	82.9	1053	72.6	618.5	10.15	2440	1107			2690	1220
45E3-125	5	3000	206.7	3000	206.7	212.5	3.50	2274	1032			2523	1145
45E3-140		2790	192.2	2455	169.1	276.5	4.55	2336	1060			2585	1172.5
45E3-160		2045	140.9	1799	124.0	382.5	6.30	2372	1076			2621	1189
45E3-180		1569	108.1	1381	95.2	498.0	8.20	2432	1103			2681	1216
45E3-200		1246	85.8	1096	75.5	618.5	10.15	2502	1135			2751	1248
10E4-160	1	3000	206.7	2964	204.2	431.5	7.10	3738	1696			4013	1820.5
10E4-180		2597	178.9	2231	153.7	575.5	9.40	3806	1727			4082	1851.5
10E4-200		2035	140.2	1748	120.4	731.0	12.00	3894	1767			4170	1891.5
10E4-220		1642	113.1	1411	97.2	916.0	15.05	4021	1824			4297	1949
10E4-250		1240	85.4	1065	73.4	1212.5	19.90	4176	1894			4451	2019
10E4-160	2	3000	206.7	3000	206.7	431.5	7.10	3881	1761			4157	1885.5
10E4-180		2669	183.9	2303	158.7	575.5	9.40	3950	1792			4225	1916.5
10E4-200		2091	144.1	1804	124.3	731.0	12.00	4038	1832			4313	1956.5
10E4-220		1687	116.2	1456	100.3	916.0	15.05	4164	1889			4440	2014
10E4-250		1274	87.8	1100	75.8	1212.5	19.90	4319	1959			4594	2084
10E4-160	3	3000	206.7	3000	206.7	431.5	7.10	4179	1896			4454	2020.5
10E4-180		2832	195.1	2466	169.9	575.5	9.40	4247	1927			4523	2051.5
10E4-200		2219	152.9	1932	133.1	731.0	12.00	4335	1967			4611	2091.5
10E4-220		1790	123.4	1559	107.4	916.0	15.05	4462	2024			4738	2149
10E4-250		1352	93.2	1178	81.1	1212.5	19.90	4616	2094			4892	2219
10E4-160	4	3000	206.7	3000	206.7	431.5	7.10	4377	1986			4653	2110.5
10E4-180		2933	202.1	2567	176.9	575.5	9.40	4446	2017			4721	2141.5
10E4-200		2298	158.3	2011	138.6	731.0	12.00	4534	2057			4809	2181.5
10E4-220		1854	127.8	1623	111.8	916.0	15.05	4661	2114			4936	2239
10E4-250		1400	96.5	1226	84.5	1212.5	19.90	4815	2184			5090	2309

1.0 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.

2.0 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 hydraulic pressure or compressed air 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.

3.0 Series 98H Actuators

- 3.1 S98H are Hydraulic Scotch Yoke Actuators with an operating pressure range of 500 to 3000psig hydraulic 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.
- 3.2 These hydraulic actuators use mineral oil as the media which gives them of a higher degree of corrosion protection compared to Air or gas operation and makes them suitable for corrosive environments in offshore and in gas-over-oil applications. However, the hydraulic system is closed operation system in the sense that all fluid must return to the hydraulic reservoir unlike the pneumatic actuators, where the media is exhausted to atmosphere. As the hydraulic fluid is incompressible, the operation is with a finer control. As with the Pneumatic S98, all the optional modules and build configurations are available here too.

4.0 Sizing S98H for a Valve

- 4.1 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.
- 4.2 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.
- 4.3 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.
- 4.4 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.
- 4.5 Note the MAST or the maximum allowable stem torque value of the valve.
- 4.6 Next, determine if the application requires Double Acting or a Spring Return actuator.
- 4.7 Note the Sizing Pressure value for selecting the actuator that will output required torques at this pressure.
- 4.8 Selecting a DA actuator (for clockwise to close operation)
- 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.
- 4.9 Note the S98H actuator model corresponding to these values.
- 4.10 Selecting a SR actuator (fail close or Fail clockwise)
- 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 Hydraulic Start torque meets or exceeds the BTO value determined in step 4. The Hydraulic End torque also must meet or exceed the ETO value.
- If the hydraulic torques meet the requirement, note the actuator model and the spring number.
- If the hydraulic 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 hydraulic torque values satisfy. Note the actuator model and the spring #.
- 4.11 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 another 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 Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, psig											Limiting MOP, psi
			500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
DA	DD		Hydraulic Torque, Lb-in											
12E2-32	Cap End	Start/End	1629	2444	3259	4172	5006	5840	6675	7509	8343	9178	10012	3000
		Mid	913	1369	1826	2331	2797	3264	3730	4196	4662	5129	5595	
	Rod End	Start/End	859	1289	1719	2200	2640	3080	3520	3960	4400	4840	5280	
		Mid	481	722	963	1229	1475	1721	1967	2213	2459	2705	2950	
12E2-40	Cap End	Start/End	2546	3819	5092	6518	7822	9125	10429					2036
		Mid	1426	2140	2853	3643	4371	5100	5828					
	Rod End	Start/End	1776	2664	3552	4546	5456	6365	7274					
		Mid	995	1492	1990	2541	3049	3557	4065					
12E2-50	Cap End	Start/End	3978	5967	7956	10185								1303
		Mid	2229	3343	4457	5691								
	Rod End	Start/End	3208	4812	6416	8213								
		Mid	1797	2696	3594	4590								
12E2-63	Cap End	Start/End	6316	9473										821
		Mid	3538	5307										
	Rod End	Start/End	5545	8318										
		Mid	3107	4660										
	12E2-32	Start/End	2489	3733	4977	6372	7646	8920	10194					2083
		Mid	1394	2091	2788	3561	4273	4985	5697					
	12E2-40	Start/End	4322	6483	8643									1199
		Mid	2421	3632	4842									
	12E2-50	Start/End	7186	10779										739
		Mid	4026	6039										
	18E2-40	Start/End	3182	4774	6365	8148	9777	11407	13036	14666				2443
		Mid	1783	2674	3566	4553	5464	6374	7285	8196				
18E2-50	Cap End	Start/End	4973	7459	9945	12731	15277							1564
		Mid	2786	4179	5572	7114	8537							
	Rod End	Start/End	3729	5594	7459	9548	11458							
		Mid	2089	3134	4179	5336	6403							
18E2-63	Cap End	Start/End	7894	11842	15789									1009
		Mid	4423	6634	8846									
	Rod End	Start/End	6651	9977	13302									
		Mid	3726	5589	7453									
18E2-80	Cap End	Start/End	12730											626
		Mid	7132											
	Rod End	Start/End	11487											
		Mid	6435											
	18E2-40	Start/End	5122	7683	10243	13113	15735							1518
		Mid	2869	4304	5739	7328	8793							
	18E2-50	Start/End	8702	13053										915
		Mid	4875	7313										
	18E2-63	Start/End	14546											547
		Mid	8149											

Output Torque – Imperial – Lb-in

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, psig											Limiting MOP, psi
			500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
DA	DD		Hydraulic Torque, Lb-in											
45E2-50	Cap End	Start/End	6464	9696	12929	16550	19860	23170	26480	29790	33100	36410	39720	3000
		Mid	3622	5432	7243	9249	11098	12948	14798	16647	18497	20347	22197	
	Rod End	Start/End	4848	7272	9696	12413	14895	17378	19860	22343	24825	27308	29790	
		Mid	2716	4074	5432	6936	8324	9711	11098	12486	13873	15260	16647	
45E2-63	Cap End	Start/End	10263	15394	20525	26275	31530	36785						1894
		Mid	5750	8624	11499	14683	17620	20556						
	Rod End	Start/End	8647	12970	17293	22137	26565	30992						
		Mid	4844	7266	9688	12371	14845	17319						
45E2-80	Cap End	Start/End	16549	24823	33097									1175
		Mid	9271	13907	18542									
	Rod End	Start/End	14932	22399	29865									
		Mid	8366	12549	16732									
45E2-100	Cap End	Start/End	25857	38786										752
		Mid	14486	21729										
	Rod End	Start/End	24241	36362										
		Mid	13581	20371										
	45E2-50	Start/End	11312	16969	22625	28963	34755	40548						Symmetric
		Mid	6338	9507	12675	16185	19422	22659						
	45E2-63	Start/End	18909	28364	37819									
		Mid	10594	15891	21188									
	45E2-80	Start/End	31481											1718
		Mid	17637											
		Start/End												
		Mid												
		Start/End												1028
		Mid												
		Start/End												
		Mid												
		Start/End												632
		Mid												
		Start/End												
		Mid												
73E2-50	Cap End	Start/End	7956	11934	15912	20369	24443	28517	32591	36665	40739	44813	48886	3000
		Mid	4457	6686	8915	11383	13659	15936	18213	20489	22766	25042	27319	
	Rod End	Start/End	4697	7046	9394	12026	14431	16837	19242	21647	24052	26457	28863	
		Mid	2632	3947	5263	6720	8065	9409	10753	12097	13441	14785	16129	
73E2-63	Cap End	Start/End	12631	18947	25262	32338	38806	45274	51741	58209	64677			2497
		Mid	7076	10615	14153	18071	21686	25300	28914	32529	36143			
	Rod End	Start/End	9372	14058	18744	23995	28794	33593	38392	43191	47990			
		Mid	5251	7876	10501	13409	16091	18773	21454	24136	26818			
73E2-80	Cap End	Start/End	20367	30551	40735	52146	62575							1548
		Mid	11411	17116	22821	29140	34968							
	Rod End	Start/End	17109	25663	34217	43802	52563							
		Mid	9585	14377	19170	24478	29373							
73E2-100	Cap End	Start/End	31824	47736	63648									1015
		Mid	17829	26744	35658									
	Rod End	Start/End	28565	42848	57131									
		Mid	16003	24005	32007									
73E2-125	Cap End	Start/End	49725											649
		Mid	27858											
	Rod End	Start/End	46466											
		Mid	26032											
	73E2-50	Start/End	12653	18980	25307	32395	38875	45354	51833	58312	64791			Symmetric
		Mid	7089	10633	14178	18103	21724	25345	28965	32586	36207			
	73E2-63	Start/End	22003	33005	44006	56334								
		Mid	12327	18491	24654	31481								
	73E2-80	Start/End	37476	56214										2492
		Mid	20996	31493										
		Start/End												
		Mid												
		Start/End												1433
		Mid												
		Start/End												
		Mid												
		Start/End												862
		Mid												
		Start/End												
		Mid												

Output Torque – Imperial – Lb-in

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, psig										Limiting MOP, psi	
			500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
DA	DD		Hydraulic Torque, Lb-in											
14E3-63	Cap End	Start/End	14999	22499	29999	38402	46082	53763	61443	69123	76804	84484	92164	3000
		Mid	8403	12605	16806	21460	25752	30044	34336	38628	42920	47212	51504	
	Rod End	Start/End	8953	13429	17905	22921	27505	32090	36674	41258	45842	50427	55011	
		Mid	5016	7524	10031	12809	15371	17932	20494	23056	25618	28180	30741	
14E3-80	Cap End	Start/End	24186	36280	48373	61923	74307	86692	99077	111461	123846			2500
		Mid	13550	20325	27100	34604	41525	48446	55366	62287	69208			
	Rod End	Start/End	18140	27210	36280	46442	55731	65019	74307	83596	92884			
		Mid	10163	15244	20325	25953	31144	36334	41525	46715	51906			
14E3-100	Cap End	Start/End	37791	56687	75582	96755	116105							1600
		Mid	21172	31758	42344	54069	64882							
	Rod End	Start/End	31745	47617	63489	81274	97529							
		Mid	17785	26677	35569	45418	54501							
14E3-125	Cap End	Start/End	59049	88573	118097									1024
		Mid	33082	49622	66163									
	Rod End	Start/End	53002	79503	106004									
		Mid	29694	44541	59388									
14E3-140	Cap End	Start/End	74071	111106										816
		Mid	41497	62246										
	Rod End	Start/End	68024	102036										
		Mid	38110	57165										
	14E3-63	Start/End	23952	35928	47904	61323	73588	85852	98117	110381	122646			2525
		Mid	13419	20128	26838	34269	41122	47976	54830	61684	68537			
	14E3-80	Start/End	42326	63489	84652	108365								1429
		Mid	23713	35569	47426	60557								
	14E3-100	Start/End	69536	104304										891
		Mid	38957	58435										
	14E3-125	Start/End	112051											553
		Mid	62775											

Symmetric

Output Torque – Imperial – Lb-in

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, psig											Limiting MOP, psi
			500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
DA		DD	Hydraulic Torque, Lb-in											
24E3-80	Cap End	Start/End	32300	48449	64599	82743	99291	115840	132388	148937	165486	182034	198583	3000
		Mid	18144	27215	36287	46356	55627	64898	74169	83441	92712	101983	111254	
	Rod End	Start/End	22080	33120	44160	56562	67875	79187	90500	101812	113125	124437	135750	
		Mid	12403	18604	24806	31689	38026	44364	50702	57039	63377	69715	76053	
24E3-100	Cap End	Start/End	50468	75702	100936	129286	155143	181000	206857					2053
		Mid	28349	42524	56699	72431	86917	101404	115890					
	Rod End	Start/End	40248	60372	80497	103105	123726	144347	164968					
		Mid	22609	33913	45217	57764	69317	80869	92422					
24E3-125	Cap End	Start/End	78856	118285	157713	202009								1314
		Mid	44296	66444	88592	113174								
	Rod End	Start/End	68637	102955	137273	175828								
		Mid	38555	57833	77110	98506								
24E3-140	Cap End	Start/End	98918	148376	197835									1047
		Mid	55565	83347	111130									
	Rod End	Start/End	88698	133047	177395									
		Mid	49824	74736	99648									
24E3-160	Cap End	Start/End	129198	193798										802
		Mid	72574	108862										
	Rod End	Start/End	118979	178468										
		Mid	66834	100250										
	24E3-80	Start/End	54379	81569	108759	139305	167166	195027						1905
		Mid	30546	45820	61093	78045	93653	109262						
	24E3-100	Start/End	90716	136075	181433									1142
		Mid	50958	76437	101916									
	24E3-125	Start/End	147493											720
		Mid	82851											
	24E3-140	Start/End	187615											566
		Mid	105389											

Symmetric

Output Torque – Imperial – Lb-in

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, psig											Limiting MOP, psi
			500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
DA	DD		Hydraulic Torque, Lb-in											
45E3-100	Cap End	Start/End	62115	93172	124229	159121	190945	222769	254593	286417	318241	350066	381890	3000
		Mid	34892	52337	69783	89146	106975	124804	142634	160463	178292	196121	213950	
	Rod End	Start/End	42635	63953	85271	109220	131065	152909	174753	196597	218441	240285	262129	
		Mid	23950	35924	47899	61190	73428	85666	97904	110142	122380	134618	146855	
45E3-125	Cap End	Start/End	97054	145581	194108	248626	298351	348077	397802					2002
		Mid	54518	81777	109036	139291	167149	195007	222865					
	Rod End	Start/End	77575	116362	155150	198726	238471	278216	317961					
		Mid	43576	65364	87152	111334	133601	155868	178135					
45E3-140	Cap End	Start/End	121745	182617	243489	311877	374252							1596
		Mid	68387	102581	136775	174726	209671							
	Rod End	Start/End	102265	153398	204531	261976	314372							
		Mid	57445	86168	114891	146770	176124							
45E3-160	Cap End	Start/End	159013	238520	318027									1222
		Mid	89322	133984	178645									
	Rod End	Start/End	139534	209301	279069									
		Mid	78380	117571	156761									
45E3-180	Cap End	Start/End	201251	301877	402503									965
		Mid	113049	169573	226097									
	Rod End	Start/End	181772	272658	363544									
		Mid	102107	153160	204213									
	45E3-100	Start/End	104750	157125	209500	268341	322009	375678						1855
		Mid	58841	88262	117682	150336	180403	210470						
	45E3-125	Start/End	174629	261944	349258									1112
		Mid	98094	147141	196188									
	45E3-140	Start/End	224010	336015										889
		Mid	125833	188749										
	45E3-160	Start/End	298548											667
		Mid	167703											

Symmetric

Output Torque – Imperial – Lb-in

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, psig											Limiting MOP, psi
			500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
DA	DD		Hydraulic Torque, Lb-in											
10E4-125	Cap End	Start/End	118285	177427	236569	303013	363616	424218	484821	545424	606026	666629	727232	3000
		Mid	66444	99666	132888	169760	203712	237665	271617	305569	339521	373473	407425	
	Rod End	Start/End	81191	121786	162381	207988	249586	291184	332781	374379	415976	457574	499172	
		Mid	45607	68411	91214	116524	139828	163133	186438	209742	233047	256352	279656	
10E4-140	Cap End	Start/End	148376	222564	296753	380100	456120	532140	608160	684179	760199	836219		2910
		Mid	83347	125021	166694	212947	255537	298126	340716	383305	425895	468484		
	Rod End	Start/End	111282	166923	222564	285075	342090	399105	456120	513135	570150	627164		
		Mid	62510	93766	125021	159711	191653	223595	255537	287479	319421	351363		
10E4-160	Cap End	Start/End	193798	290696	387595	496457	595748	695039	794331					2228
		Mid	108862	163292	217723	278135	333762	389390	445017					
	Rod End	Start/End	156704	235055	313407	401432	481718	562005	642291					
		Mid	88025	132037	176050	224899	269878	314858	359838					
10E4-180	Cap End	Start/End	245275	367913	490550	628328	753994	879659						1760
		Mid	137778	206667	275556	352015	422418	492821						
	Rod End	Start/End	208181	312271	416362	533303	639964	746624						
		Mid	116941	175412	233882	298778	358534	418290						
10E4-200	Cap End	Start/End	302809	454213	605617	775714								1426
		Mid	170096	255144	340192	434587								
	Rod End	Start/End	265715	398572	531429	680689								
		Mid	149259	223889	298519	381350								
10E4-220	Cap End	Start/End	366399	549598	732797									1178
		Mid	205816	308725	411633									
	Rod End	Start/End	329304	493957	658609									
		Mid	184980	277470	369959									
10E4-250	Cap End	Start/End	473139	709708										912
		Mid	265775	398663										
	Rod End	Start/End	436045	654067										
		Mid	244939	367408										
	10E4-125	Start/End	199475	299213	398950	511001	613202	715402	817602					2164
		Mid	112051	168076	224102	286284	343541	400797	458054					
	10E4-140	Start/End	259658	389488	519317	665174	798209							1663
		Mid	145858	218786	291715	372658	447190							
	10E4-160	Start/End	350501	525752	701002	897889								1232
		Mid	196886	295330	393773	503034								
	10E4-180	Start/End	453456	680184										976
		Mid	254719	382079										
	10E4-200	Start/End	568523	852785										778
		Mid	319356	479034										

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig												Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
			Lb-in	Hydraulic Torque, Lb-in												
12E2-40	1	Start	4166					2555	3410	4266	5122	5978	6834	7689	3000	
		Mid	1930					1060	1541	2023	2504	2986	3467	3948		
		End	2741					1214	2070	2926	3782	4637	5493	6349		
12E2-40	2	Start	5381						2765	3621	4477	5333	6189	7044	3000	
		Mid	2461						1038	1520	2001	2482	2964	3445		
		End	3427						926	1782	2638	3493	4349	5205		
12E2-40	3	Start	6880									4030	4886	5742	3000	
		Mid	3267									1719	2201	2682		
		End	4811									2082	2938	3794		
12E2-50	1	Start	4166		2058	3604	5150	6696	8242	9788					2134	
		Mid	1930		780	1650	2520	3389	4259	5128						
		End	2741		717	2263	3809	5355	6901	8447						
12E2-50	2	Start	5381			2959	4505	6051	7597	9143	10688				2238	
		Mid	2461			1147	2017	2886	3756	4625	5495					
		End	3427			1119	2665	4211	5757	7303	8849					
12E2-50	3	Start	6880				3202	4748	6294	7840	9386				2449	
		Mid	3267				1253	2123	2993	3862	4732					
		End	4811				1254	2800	4346	5892	7438					
12E2-63	1	Start	4166	2765	5437	8110	10782								1234	
		Mid	1930	1178	2681	4185	5688									
		End	2741	1424	4097	6769	9442									
12E2-63	2	Start	5381		4792	7465	10137								1295	
		Mid	2461		2178	3682	5185									
		End	3427		2953	5625	8298									
12E2-63	3	Start	6880		3490	6162	8834								1417	
		Mid	3267		1415	2918	4422									
		End	4811		1542	4214	6887									
12E2-80	1	Start	4166	6493											727	
		Mid	1930	3275												
		End	2741	5153												
12E2-80	2	Start	5381	5848	10385										763	
		Mid	2461	2772	5324											
		End	3427	4009	8545											
12E2-80	3	Start	6880	4545	9082										834	
		Mid	3267	2009	4561											
		End	4811	2598	7134											

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
			Lb-in	Hydraulic Torque, Lb-in											
18E2-50	1	Start	6124			2858	4836	6746	8656	10565	12475	14384			2702
		Mid	3028			1215	2308	3375	4442	5510	6577	7644			
		End	4712			1479	3424	5334	7243	9153	11063	12972			
18E2-50	2	Start	7483				4087	5996	7906	9816	11725	13635	15544		2800
		Mid	3617				1719	2786	3853	4920	5988	7055	8122		
		End	5461				2065	3975	5885	7794	9704	11614	13523		
18E2-50	3	Start	11940						5811	7721	9630	11540	13450	15359	3000
		Mid	5448						2022	3090	4157	5224	6291	7358	
		End	7556						1427	3337	5247	7156	9066	10975	
18E2-63	1	Start	6124		5376	8702	12317	15723							1515
		Mid	3028		2626	4489	6488	8392							
		End	4712		3997	7323	10905	14311							
18E2-63	2	Start	7483		4644	7970	11567	14973							1570
		Mid	3617		2049	3912	5899	7803							
		End	5461		2670	5996	9546	12952							
18E2-63	3	Start	11940			5924	9472	12878							1723
		Mid	5448			2120	4069	5972							
		End	7556			1643	5089	8494							
18E2-80	1	Start	6124	6886	12629										893
		Mid	3028	3471	6689										
		End	4712	5507	11250										
18E2-80	2	Start	7483	6154	11897										925
		Mid	3617	2895	6112										
		End	5461	4180	9923										
18E2-80	3	Start	11940		9851	15595									1014
		Mid	5448		4320	7538									
		End	7556		5571	11314									

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
			Lb-in	Hydraulic Torque, Lb-in											
45E2-63	1	Start	13003			8024	12645	17072	21500	25927	30355	34782	39210		2784
		Mid	6286			3535	6085	8559	11034	13508	15982	18456	20930		
		End	9493			4596	9134	13562	17989	22417	26844	31272	35699		
45E2-63	2	Start	17219					13714	18141	22569	26996	31424	35851	40279	2973
		Mid	8402					6443	8917	11392	13866	16340	18814	21288	
		End	12851					9346	13774	18201	22629	27056	31483	35911	
45E2-63	3	Start	24910						13573	18001	22428	26856	31283	35711	3000
		Mid	11827						5492	7966	10440	12915	15389	17863	
		End	17419						6082	10510	14937	19365	23792	28219	
45E2-63	4	Start	32171								20349	24776	29204	33631	3000
		Mid	14437								7831	10305	12779	15253	
		End	19498								7676	12104	16531	20959	
45E2-80	1	Start	13003	5663	13130	20596	28738	36384							1612
		Mid	6286	2213	6395	10578	15079	19351							
		End	9493	2235	9701	17168	25227	32874							
45E2-80	2	Start	17219		9850	17316	25380	33026							1722
		Mid	8402		4324	8507	12962	17235							
		End	12851		5585	13051	21012	28658							
45E2-80	3	Start	24910			12856	20812	28458	36104						1871
		Mid	11827			5153	9537	13810	18083						
		End	17419			5541	13320	20967	28613						
45E2-80	4	Start	32171					26378	34025						1939
		Mid	14437					11200	15473						
		End	19498					13706	21352						
45E2-100	1	Start	13003	14972	27092	39213									1012
		Mid	6286	7428	14218	21008									
		End	9493	11544	23664	35785									
45E2-100	2	Start	17219	11692	23813	35933									1061
		Mid	8402	5356	12146	18937									
		End	12851	7427	19548	31668									
45E2-100	3	Start	24910		19352	31473									1153
		Mid	11827		8793	15583									
		End	17419		12037	24158									
45E2-100	4	Start	32171		17322	29442									1194
		Mid	14437		6238	13028									
		End	19498		4947	17068									

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
			Lb-in	Hydraulic Torque, Lb-in											
73E2-63	1	Start	25819						14746	19545	24344	29143	33942	38741	3000
		Mid	12480						6292	8974	11656	14338	17020	19702	
		End	18847						7775	12574	17373	22172	26971	31770	
73E2-63	2	Start	31339						16927	21726	26525	31324	36123	3000	
		Mid	14754						6700	9382	12064	14746	17428		
		End	21466						7053	11852	16651	21450	26249		
73E2-63	3	Start	41373									21470	26269	31068	3000
		Mid	18970									7848	10530	13212	
		End	26520									6617	11416	16215	
73E2-63	4	Start	45865											26389	3000
		Mid	21533											10649	
		End	31200											11723	
73E2-80	1	Start	25819			15814	24955	33716	42476	51236	59997				2381
		Mid	12480			6953	11998	16893	21789	26684	31580				
		End	18847			9006	17984	26744	35505	44265	53026				
73E2-80	2	Start	31339					31097	39858	48618	57379				2455
		Mid	14754					14619	19515	24410	29306				
		End	21466					21224	29984	38745	47505				
73E2-80	3	Start	41373					26043	34803	43564	52324	61085			2600
		Mid	18970					10403	15299	20194	25090	29985			
		End	26520					11190	19950	28711	37471	46232			
73E2-80	4	Start	45865					21363	30124	38884	47644	56405	65165		2733
		Mid	21533					7840	12736	17632	22527	27423	32318		
		End	31200					6698	15458	24218	32979	41739	50500		
73E2-100	1	Start	25819		24444	38727	54287								1426
		Mid	12480		11788	19790	28389								
		End	18847		17637	31920	47316								
73E2-100	2	Start	31339		21888	36170	51669								1471
		Mid	14754		9562	17563	26115								
		End	21466		12247	26529	41795								
73E2-100	3	Start	41373			31235	46614	61241							1557
		Mid	18970			13436	21899	30073							
		End	26520			16731	31761	46388							
73E2-100	4	Start	45865			26665	41935	56561							1637
		Mid	21533			10927	19336	27510							
		End	31200			12345	27269	41896							
73E2-125	1	Start	25819	28063	51296										893
		Mid	12480	13815	26831										
		End	18847	21255	44489										
73E2-125	2	Start	31339	25506	48739										920
		Mid	14754	11589	24605										
		End	21466	15865	39098										
73E2-125	3	Start	41373	20570	43804										974
		Mid	18970	7462	20478										
		End	26520	6067	29300										
73E2-125	4	Start	45865		39234	62467									1023
		Mid	21533		17969	30985									
		End	31200		24914	48147									

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig												Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
			Lb-in	Hydraulic Torque, Lb-in												
14E3-80	1	Start	42556					24893	34181	43470	52758	62047	71335	80624	3000	
		Mid	20507					10637	15827	21018	26208	31399	36590	41780		
		End	30838					13175	22463	31752	41040	50328	59617	68905		
14E3-80	2	Start	48762						29686	38975	48263	57551	66840	76128	3000	
		Mid	23497						12837	18028	23218	28409	33600	38790		
		End	35333						16257	25546	34834	44123	53411	62700		
14E3-80	3	Start	56805							33144	42432	51721	61009	70298	3000	
		Mid	27373							14151	19342	24532	29723	34914		
		End	41163							17503	26791	36080	45368	54656		
14E3-80	4	Start	74023									42184	51472	60760	3000	
		Mid	34849									17057	22247	27438		
		End	50701									18861	28150	37438		
14E3-80	5	Start	91521											54262	3000	
		Mid	41554											20733		
		End	57199											19940		
14E3-100	1	Start	42556			17505	33377	50436	66691	82946	99200	115455				2379
		Mid	20507			6602	15494	24911	33994	43078	52161	61245				
		End	30838			6062	21935	38718	54973	71227	87482	103737				
14E3-100	2	Start	48762				28988	45941	62196	78450	94705	110960				2448
		Mid	23497				12567	21921	31004	40088	49171	58255				
		End	35333				15875	32512	48767	65022	81277	97531				
14E3-100	3	Start	56805						56365	72620	88875	105129	121384			2538
		Mid	27373						27128	36211	45295	54378	63462			
		End	41163						40724	56979	73233	89488	105743			
14E3-100	4	Start	74023						46828	63082	79337	95592	111847			2685
		Mid	34849						19652	28736	37819	46903	55986			
		End	50701						23506	39760	56015	72270	88525			
14E3-100	5	Start	91521							56584	72839	89094	105349	121603		2784
		Mid	41554							22031	31114	40198	49281	58365		
		End	57199							22262	38517	54772	71027	87281		
14E3-125	1	Start	42556	22890	49391	75892	104861									1425
		Mid	20507	9619	24466	39313	55324									
		End	30838	11448	37949	64450	93142									
14E3-125	2	Start	48762			45002	71503	100365								1466
		Mid	23497				21539	36386	52334							
		End	35333				31889	58390	86937							
14E3-125	3	Start	56805			39308	65809	94535	121674							1520
		Mid	27373				17744	32591	48458	63624						
		End	41163					24035	50536	78893	106033					
14E3-125	4	Start	74023				56496	84997	112137							1608
		Mid	34849					25272	40982	56148						
		End	50701					33723	61675	88815						
14E3-125	5	Start	91521				50151	78499	105639							1668
		Mid	41554					18709	34277	49444						
		End	57199						16637	44177	71317					

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi	
				500	750	1000	1250	1500	1750	2000	2250	2500	2750			3000
			Lb-in	Hydraulic Torque, Lb-in												
14E3-140	1	Start	42556	37912	71924	105936									Symmetric	1110
		Mid	20507	18035	37090	56145										
		End	30838	26470	60482	94494										
14E3-140	2	Start	48762	33523	67535	101547										1143
		Mid	23497	15108	34163	53217										
		End	35333	20410	54422	88434										
14E3-140	3	Start	56805	27829	61841	95853										1184
		Mid	27373	11313	30368	49423										
		End	41163	12556	46568	80580										
14E3-140	4	Start	74023		52528	86540	123457								1253	
		Mid	34849		23049	42104	62474									
		End	50701		29755	63767	100135									
14E3-140	5	Start	91521		46183	80195	116959								1299	
		Mid	41554		16486	35541	55770									
		End	57199		12669	46681	82637									
14E3-160	1	Start	42556	60587	105936										Symmetric	849
		Mid	20507	30738	56145											
		End	30838	49144	94494											
14E3-160	2	Start	48762	56197	101547											873
		Mid	23497	27811	53217											
		End	35333	43085	88434											
14E3-160	3	Start	56805	50504	95853											904
		Mid	27373	24016	49423											
		End	41163	35231	80580											
14E3-160	4	Start	74023	41191	86540										956	
		Mid	34849	16698	42104											
		End	50701	18418	63767											
14E3-160	5	Start	91521		80195	125545									991	
		Mid	41554		35541	60947										
		End	57199		46681	92030										

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
			Lb-in	Hydraulic Torque, Lb-in											
24E3-100	1	Start	86173					65698	86319	106940	127561	148182	168803	189425	3000
		Mid	40682					29491	41044	52596	64149	75702	87255	98808	
		End	58028					39581	60202	80823	101444	122066	142687	163308	
24E3-100	2	Start	101825					54195	74816	95437	116058	136679	157300	177921	3000
		Mid	48347					21987	33540	45093	56645	68198	79751	91304	
		End	69532					24297	44918	65539	86160	106781	127402	148023	
24E3-100	3	Start	132017							79031	99652	120273	140894	161515	3000
		Mid	61478							32239	43791	55344	66897	78450	
		End	85938							36058	56679	77300	97921	118542	
24E3-100	4	Start	154552									108846	129467	150088	3000
		Mid	71044									45979	57532	69085	
		End	97365									55295	75916	96537	
24E3-100	5	Start	178697									95770	116391	137012	3000
		Mid	81532									35712	47265	58818	
		End	110440									31718	52339	72961	
24E3-125	1	Start	86173			46325	80643	117800	152966	188132					1922
		Mid	40682			18864	38141	58681	78382	98083					
		End	58028			20838	55156	91683	126849	162015					
24E3-125	2	Start	101825				69417	106297	141462	176628	211794				2004
		Mid	48347				30799	51177	70878	90579	110281				
		End	69532				40240	76399	111565	146730	181896				
24E3-125	3	Start	132017						125056	160222	195388				2120
		Mid	61478						58024	77725	97427				
		End	85938						82083	117249	152415				
24E3-125	4	Start	154552						113629	148795	183961				2202
		Mid	71044						48659	68360	88062				
		End	97365						60079	95244	130410				
24E3-125	5	Start	178697						100554	135719	170885	206051			2294
		Mid	81532						38392	58093	77795	97496			
		End	110440						36502	71668	106833	141999			
24E3-140	1	Start	86173				76417	120766	169191	214635					1487
		Mid	40682				35767	60679	87472	112932					
		End	58028				50929	95278	143074	188518					
24E3-140	2	Start	101825				65190	109539	157688	203132					1551
		Mid	48347				28424	53336	79968	105428					
		End	69532				36013	80362	127790	173234					
24E3-140	3	Start	132017					93529	141282	186726					1641
		Mid	61478					40759	67114	92574					
		End	85938					51591	98309	143753					
24E3-140	4	Start	154552					82377	129855	175298					1704
		Mid	71044					31595	57749	83209					
		End	97365					30116	76304	121748					
24E3-140	5	Start	178697						162223	207667					1775
		Mid	81532						72942	98401					
		End	110440						98171	143615					

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig										Limiting MOP, psi	
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		3000
			Lb-in	Hydraulic Torque, Lb-in											
24E3-160	1	Start	86173	62349	121838	181327									1109
		Mid	40682	27865	61281	94698									
		End	58028	36861	96350	155840									
24E3-160	2	Start	101825	51122	110612	170101									1156
		Mid	48347	20522	53939	87356									
		End	69532	21945	81434	140924									
24E3-160	3	Start	132017		94601	154090									1223
		Mid	61478		41361	74778									
		End	85938		52663	112153									
24E3-160	4	Start	154552		83449	142938	207426								1270
		Mid	71044		32198	65615	101208								
		End	97365		31189	90678	153875								
24E3-160	5	Start	178697			130178	194350								1324
		Mid	81532			55568	90941								
		End	110440			67670	130299								
24E3-180	1	Start	86173	96667	173316										877
		Mid	40682	47142	90198										
		End	58028	71179	147828										
24E3-180	2	Start	101825	85441	162089										914
		Mid	48347	39800	82855										
		End	69532	56263	132912										
24E3-180	3	Start	132017	69430	146078										966
		Mid	61478	27222	70278										
		End	85938	27492	104141										
24E3-180	4	Start	154552		134927	211575									1002
		Mid	71044		61114	104170									
		End	97365		82666	159315									
24E3-180	5	Start	178697		122166	198815									1044
		Mid	81532		51068	94123									
		End	110440		59658	136306									

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig												Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
			Lb-in	Hydraulic Torque, Lb-in												
45E3-125	1	Start	158124				92967	132712	172457	212202	251948	291693	331438	371183	3000	
		Mid	74444				38458	60724	82991	105258	127525	149792	172059	194326		
		End	105759				44322	84068	123813	163558	203303	243048	282793	322539		
45E3-125	2	Start	193270					117498	157243	196988	236733	276478	316224	355969	3000	
		Mid	88618					46849	69116	91383	113650	135917	158184	180450		
		End	120973					49749	89494	129239	168984	208729	248475	288220		
45E3-125	3	Start	210693						128048	167793	207538	247283	287028	326774	3000	
		Mid	101840						56172	78439	100706	122973	145240	167507		
		End	150169						72481	112226	151971	191716	231462	271207		
45E3-125	4	Start	246931							151669	191414	231159	270904	310649	3000	
		Mid	116579							64010	86277	108544	130811	153078		
		End	166293							76841	116586	156331	196076	235821		
45E3-125	5	Start	292379									210852	250597	290342	3000	
		Mid	135089									90424	112691	134958		
		End	186600									111953	151698	191443		
45E3-140	1	Start	158124			101320	156217	208613	261008	313403	365799				2404	
		Mid	74444			43581	73893	103247	132601	161955	191309					
		End	105759			53848	107573	159968	212363	264759	317154					
45E3-140	2	Start	193270				141003	193398	245793	298189	350584	402979			2477	
		Mid	88618				60018	89372	118726	148080	177434	206788				
		End	120973				73254	125649	178045	230440	282835	335230				
45E3-140	3	Start	210693					164203	216598	268994	321389	373784			2616	
		Mid	101840					76428	105782	135136	164490	193844				
		End	150169					108636	161032	213427	265822	318217				
45E3-140	4	Start	246931					148079	200474	252869	305265	357660			2693	
		Mid	116579					61999	91353	120707	150061	179415				
		End	166293					73251	125646	178041	230437	282832				
45E3-140	5	Start	292379						180167	232563	284958	337353	389748		2790	
		Mid	135089						73233	102587	131941	161295	190649			
		End	186600						81268	133663	186058	238454	290849			
45E3-160	1	Start	158124		106091	175858	251690	323180	394669						1762	
		Mid	74444		46261	85451	127381	167432	207484							
		End	105759		58618	128386	203045	274535	346025							
45E3-160	2	Start	193270			161010	236475	307965	379455						1815	
		Mid	88618			71874	113505	153557	193608							
		End	120973			94894	168726	240216	311706							
45E3-160	3	Start	210693			132518	207280	278770	350260						1917	
		Mid	101840			59209	100561	140613	180664							
		End	150169			78291	151713	223203	294693							
45E3-160	4	Start	246931					262646	334136	405625					1974	
		Mid	116579					126184	166236	206287						
		End	166293					187818	259308	330797						
45E3-160	5	Start	292379					242339	313829	385318					2045	
		Mid	135089					108064	148116	188167						
		End	186600					143440	214929	286419						

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig										Limiting MOP, psi	
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		3000
			Lb-in	Hydraulic Torque, Lb-in											
45E3-180	1	Start	158124	78562	169448	260334	359892								1353
		Mid	74444	30797	81850	132904	188000								
		End	105759	31089	121975	212861	311247								
45E3-180	2	Start	193270		154600	245486	344677								1393
		Mid	88618		68273	119327	174125								
		End	120973		88483	179369	276929								
45E3-180	3	Start	210693		126108	216994	315482								1472
		Mid	101840		55608	106661	161181								
		End	150169		71880	162766	259916								
45E3-180	4	Start	246931			201259	299358	392488							1515
		Mid	116579			92543	146752	198927							
		End	166293			128234	224530	317660							
45E3-180	5	Start	292379			181441	279051	372181							1569
		Mid	135089			74813	128632	180808							
		End	186600			84925	180152	273282							
45E3-200	1	Start	158124	125769	240258	354748									1074
		Mid	74444	57315	121627	185939									
		End	105759	78296	192786	307276									
45E3-200	2	Start	193270	110921	225410	339900									1106
		Mid	88618	43738	108050	172362									
		End	120973	44804	159294	273784									
45E3-200	3	Start	210693		196919	311409									1168
		Mid	101840		95384	159696									
		End	150169		142691	257181									
45E3-200	4	Start	246931		181183	295673									1203
		Mid	116579		81266	145578									
		End	166293		108158	222648									
45E3-200	5	Start	292379		161366	275855	399983								1246
		Mid	135089		63536	127848	196383								
		End	186600		64849	179339	301084								

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
			Lb-in	Hydraulic Torque, Lb-in											
10E4-160	1	Start	311558				178155	258442	338728	419014	499301	579587	659873	740160	3000
		Mid	150942				77134	122114	167093	212073	257053	302033	347012	391992	
		End	223277				97205	177491	257778	338064	418350	498637	578923	659209	
10E4-160	2	Start	395372					227779	308066	388352	468638	548925	629211	709498	3000
		Mid	183135					90599	135578	180558	225538	270518	315497	360477	
		End	253939					95649	175935	256221	336508	416794	497080	577367	
10E4-160	3	Start	463500						238356	318642	398928	479215	559501	639787	3000
		Mid	222118						97416	142396	187376	232356	277335	322315	
		End	323649						109411	189697	269983	350270	430556	510843	
10E4-160	4	Start	583231									436114	516400	596687	3000
		Mid	267905									187532	232512	277492	
		End	366750									233356	313642	393928	
10E4-180	1	Start	311558			198466	310027	416687	523348	630008	736669	843330			2597
		Mid	150942			89296	151014	210769	270525	330281	390036	449792			
		End	223277			119466	229076	335737	442397	549058	655719	762379			
10E4-180	2	Start	395372				279364	386025	492686	599346	706007	812667			2669
		Mid	183135				119499	179254	239010	298766	358521	418277			
		End	253939				147234	253894	360555	467215	573876	680537			
10E4-180	3	Start	463500					316315	422975	529636	636297	742957	849618		2832
		Mid	222118					141092	200848	260604	320359	380115	439871		
		End	323649					187370	294031	400691	507352	614013	720673		
10E4-180	4	Start	583231						379875	486535	593196	699857	806517		2933
		Mid	267905							156025	215780	275536	335292	395047	
		End	366750							177116	283777	390438	497098	603759	
10E4-200	1	Start	311558		180676	313533	457412	593550	729688	865825					2035
		Mid	150942		79302	153932	233585	309855	386125	462395					
		End	223277		101676	234533	376462	512599	648737	784875					
10E4-200	2	Start	395372			283609	426750	562888	699025	835163					2091
		Mid	183135			123095	202070	278340	354610	430880					
		End	253939			154663	294619	430757	566895	703032					
10E4-200	3	Start	463500			215579	357040	493177	629315	765453	901591				2219
		Mid	222118			85754	163908	240178	316448	392718	468988				
		End	323649			89741	228095	364233	500370	636508	772646				
10E4-200	4	Start	583231					450077	586215	722352	858490				2298
		Mid	267905					195355	271625	347895	424165				
		End	366750					247318	383456	519594	655732				

Symmetric

Output Torque – Imperial – Lb-in

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
			Lb-in	Hydraulic Torque, Lb-in											
10E4-220	1	Start	311558		276060	440713	620312	789030							1642
		Mid	150942		132883	225373	324848	419371							
		End	223277		197060	361713	539362	708079							
10E4-220	2	Start	395372		246137	410789	589650	758367							1687
		Mid	183135		102046	194535	293333	387856							
		End	253939		117190	281842	457519	626237							
10E4-220	3	Start	463500			342759	519940	688657	857375						1790
		Mid	222118			157194	255171	349694	444217						
		End	323649			216921	390995	559713	728430						
10E4-220	4	Start	583231			300697	476839	645557	814274						1854
		Mid	267905			113335	210348	304871	399393						
		End	366750			102824	274081	442798	611516						
10E4-250	1	Start	311558	218148	436170	654193	893751								1240
		Mid	150942	100352	222821	345290	478040								
		End	223277	139148	357171	575193	812801								
10E4-250	2	Start	395372	188225	406247	624269	863089								1274
		Mid	183135	69515	191984	314453	446525								
		End	253939	59278	277300	495322	730958								
10E4-250	3	Start	463500		338217	556239	793379								1352
		Mid	222118		154643	277112	408363								
		End	323649		212379	430401	664434								
10E4-250	4	Start	583231		296155	514177	750278								1400
		Mid	267905		110783	233252	363540								
		End	366750		98282	316304	547520								

Symmetric

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, psig												Limiting MOP,psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
DA	DD	Pressure on		Hydraulic Torque, Lb-in												
12E2-32		CW / Rod End	Start	730	1096	1461	1870	2244	2618	2992	3366	3740			Canted	2620
			Mid	481	722	963	1229	1475	1721	1967	2213	2459				
			End	1043	1565	2086	2671	3205	3739	4273	4807	5342				
		CCW / Cap End	Start	1978	2967	3956	5065	6078	7091	8104	9116	10129				
			Mid	913	1369	1826	2331	2797	3264	3730	4196	4662				
			End	1385	2078	2770	3546	4256	4965	5674	6383	7093				
12E2-40		CW / Rod End	Start	1510	2264	3019	3865	4638								1677
			Mid	995	1492	1990	2541	3049								
			End	2156	3234	4312	5520	6624								
		CCW / Cap End	Start	3091	4636	6182	7914	9496								
			Mid	1426	2140	2853	3643	4371								
			End	2164	3246	4329	5541	6649								
12E2-50	CW / Rod End	Start	2727	4091	5454									1073		
		Mid	1797	2696	3594											
		End	3895	5842	7789											
	CCW / Cap End	Start	4830	7244	9659											
		Mid	2229	3343	4457											
		End	3382	5073	6763											
12E2-63	CW / Rod End	Start	4714											676		
		Mid	3107													
		End	6732													
	CCW / Cap End	Start	7667													
		Mid	3538													
		End	5369													
	12E2-32	CW / Rod End	Start	2116	3173	4231	5416	6500	7583					1716		
			Mid	1394	2091	2788	3561	4273	4985							
			End	3021	4532	6043	7736	9283	10830							
		CCW / Cap End	Start	3021	4532	6043	7736	9283	10830							
			Mid	1394	2091	2788	3561	4273	4985							
			End	2116	3173	4231	5416	6500	7583							
	12E2-40	CW / Rod End	Start	3674	5511	7348								1012		
			Mid	2421	3632	4842										
			End	5247	7870	10494										
		CCW / Cap End	Start	5247	7870	10494										
			Mid	2421	3632	4842										
			End	3674	5511	7348										
	12E2-50	CW / Rod End	Start	6109										608		
			Mid	4026												
			End	8724												
		CCW / Cap End	Start	8724												
			Mid	4026												
			End	6109												

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, psig											Limiting MOP,psi	
DA	DD	Pressure on		500	750	1000	1250	1500	1750	2000	2250	2500	2750			3000
Hydraulic Torque, Lb-in																
18E2-40		CW / Rod End	Start	1649	2473	3297	4221	5065	5909	6753					Canted	2012
			Mid	1086	1630	2173	2775	3329	3884	4439						
			End	2354	3532	4709	6028	7234	8439	9645						
		CCW / Cap End	Start	3864	5796	7727	9892	11870	13849	15827						
			Mid	1783	2674	3566	4553	5464	6374	7285						
			End	2705	4058	5411	6926	8312	9697	11082						
18E2-50		CW / Rod End	Start	3170	4756	6341										1288
			Mid	2089	3134	4179										
			End	4528	6792	9056										
		CCW / Cap End	Start	6037	9056	12074										
			Mid	2786	4179	5572										
			End	4227	6341	8454										
18E2-63		CW / Rod End	Start	5654	8481											831
			Mid	3726	5589											
			End	8075	12113											
		CCW / Cap End	Start	9584	14377											
			Mid	4423	6634											
			End	6711	10067											
18E2-80		CW / Rod End	Start	9765											515	
			Mid	6435												
			End	13945												
		CCW / Cap End	Start	15455												
			Mid	7132												
			End	10822												
	18E2-40	CW / Rod End	Start	4354	6531	8708	11147								1250	
			Mid	2869	4304	5739	7328									
			End	6218	9327	12436	15920									
		CCW / Cap End	Start	6218	9327	12436	15920									
			Mid	2869	4304	5739	7328									
			End	4354	6531	8708	11147									
	18E2-50	CW / Rod End	Start	7398	11096										754	
			Mid	4875	7313											
			End	10565	15847											
		CCW / Cap End	Start	10565	15847											
			Mid	4875	7313											
			End	7398	11096											

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, psig											Limiting MOP,psi	
				500	750	1000	1250	1500	1750	2000	2250	2500	2750			3000
DA	DD	Pressure on		Hydraulic Torque, Lb-in												
45E2-50		CW / Rod End	Start	4121	6182	8243	10552	12662	14773	16883	18994	21104			Canted	2477
			Mid	2716	4074	5432	6936	8324	9711	11098	12486	13873				
			End	5886	8829	11772	15070	18084	21098	24112	27126	30140				
		CCW / Cap End	Start	7848	11772	15696	20093	24112	28130	32149	36168	40186				
			Mid	3622	5432	7243	9249	11098	12948	14798	16647	18497				
			End	5495	8243	10991	14069	16883	19697	22511	25325	28139				
45E2-63		CW / Rod End	Start	7351	11026	14701	18819	22583								1560
			Mid	4844	7266	9688	12371	14845								
			End	10498	15746	20995	26876	32252								
		CCW / Cap End	Start	12460	18690	24919	31900	38280								
			Mid	5750	8624	11499	14683	17620								
			End	8724	13087	17449	22336	26804								
45E2-80	CW / Rod End	Start	12694	19041	25388									991		
		Mid	8366	12549	16732											
		End	18129	27194	36258											
	CCW / Cap End	Start	20091	30137	40182											
		Mid	9271	13907	18542											
		End	14068	21102	28136											
45E2-100	CW / Rod End	Start	20607												634	
		Mid	13581													
		End	29430													
	CCW / Cap End	Start	31392													
		Mid	14486													
		End	21981													
	45E2-50	CW / Rod End	Start	9617	14425	19234	24621									1415
			Mid	6338	9507	12675	16185									
			End	13734	20601	27468	35163									
		CCW / Cap End	Start	13734	20601	27468	35163									
			Mid	6338	9507	12675	16185									
			End	9617	14425	19234	24621									
	45E2-63	CW / Rod End	Start	16075	24112									867		
			Mid	10594	15891											
			End	22957	34436											
		CCW / Cap End	Start	22957	34436											
			Mid	10594	15891											
			End	16075	24112											
	45E2-80	CW / Rod End	Start	26762										521		
			Mid	17637												
			End	38220												
		CCW / Cap End	Start	38220												
			Mid	17637												
			End	26762												

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, psig											Limiting MOP,psi	
				500	750	1000	1250	1500	1750	2000	2250	2500	2750			3000
DA	DD	Pressure on		Hydraulic Torque, Lb-in												
73E2-50		CW / Rod End	Start	3993	5990	7986	10223	12268	14313	16357	18402	20447	22492	24536	Canted	3000
			Mid	2632	3947	5263	6720	8065	9409	10753	12097	13441	14785	16129		
			End	5703	8554	11406	14601	17521	20441	23361	26281	29201	32121	35041		
		CCW / Cap End	Start	9659	14489	19318	24730	29676	34622	39568	44514	49460	54406	59352		
			Mid	4457	6686	8915	11383	13659	15936	18213	20489	22766	25042	27319		
			End	6763	10145	13527	17316	20779	24243	27706	31169	34632	38095	41559		
73E2-63		CW / Rod End	Start	7967	11951	15935	20398	24478	28558	32637						2056
			Mid	5251	7876	10501	13409	16091	18773	21454						
			End	11379	17068	22757	29132	34958	40785	46611						
		CCW / Cap End	Start	15335	23002	30670	39261	47113	54966	62818						
			Mid	7076	10615	14153	18071	21686	25300	28914						
			End	10738	16106	21475	27491	32989	38487	43986						
73E2-80		CW / Rod End	Start	14544	21816	29088	37237									1275
			Mid	9585	14377	19170	24478									
			End	20771	31157	41542	53179									
		CCW / Cap End	Start	24728	37091	49455	63309									
			Mid	11411	17116	22821	29140									
			End	17314	25972	34629	44329									
73E2-100	CW / Rod End	Start	24284	36425										836		
		Mid	16003	24005												
		End	34680	52021												
	CCW / Cap End	Start	38637	57955												
		Mid	17829	26744												
		End	27054	40581												
73E2-125	CW / Rod End	Start	39501											535		
		Mid	26032													
		End	56414													
	CCW / Cap End	Start	60370													
		Mid	27858													
		End	42272													
	73E2-50	CW / Rod End	Start	10757	16135	21513	27539	33047	38555	44063					2053	
			Mid	7089	10633	14178	18103	21724	25345	28965						
			End	15362	23043	30724	39330	47197	55063	62929						
		CCW / Cap End	Start	15362	23043	30724	39330	47197	55063	62929						
			Mid	7089	10633	14178	18103	21724	25345	28965						
			End	10757	16135	21513	27539	33047	38555	44063						
	73E2-63	CW / Rod End	Start	18705	28058	37410									1180	
			Mid	12327	18491	24654										
			End	26714	40070	53427										
		CCW / Cap End	Start	26714	40070	53427										
			Mid	12327	18491	24654										
			End	18705	28058	37410										
	73E2-80	CW / Rod End	Start	31859											710	
			Mid	20996												
			End	45499												
		CCW / Cap End	Start	45499												
			Mid	20996												
			End	31859												

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, psig												Limiting MOR,psi
DA	DD	Pressure on		500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
Hydraulic Torque, Lb-in																
14E3-63		CW / Rod End	Start	7611	11416	15221	19485	23382	27279	31177	35074	38971	42868	46765	3000	
			Mid	5016	7524	10031	12809	15371	17932	20494	23056	25618	28180	30741		
			End	10869	16304	21739	27828	33394	38959	44525	50090	55656	61222	66787		
		CCW / Cap End	Start	18210	27315	36421	46623	55947	65272	74596	83921	93245	102570	111895		
			Mid	8403	12605	16806	21460	25752	30044	34336	38628	42920	47212	51504		
			End	12751	19126	25502	32646	39175	45704	52233	58762	65291	71820	78349		
14E3-80		CW / Rod End	Start	15421	23131	30841	39481	47377	55273	63169					2060	
			Mid	10163	15244	20325	25953	31144	36334	41525						
			End	22023	33035	44046	56384	67661	78938	90215						
		CCW / Cap End	Start	29364	44046	58728	75179	90215	105251	120286						
			Mid	13550	20325	27100	34604	41525	48446	55366						
			End	20561	30841	41122	52641	63169	73697	84225						
14E3-100		CW / Rod End	Start	26986	40479	53972	69091								1318	
			Mid	17785	26677	35569	45418									
			End	38540	57810	77081	98672									
		CCW / Cap End	Start	45881	68822	91763	117467									
			Mid	21172	31758	42344	54069									
			End	32126	48190	64253	82251									
14E3-125		CW / Rod End	Start	45057	67586										864	
			Mid	29694	44541											
			End	64349	96523											
		CCW / Cap End	Start	71690	107534											
			Mid	33082	49622											
			End	50198	75296											
14E3-140		CW / Rod End	Start	57828											689	
			Mid	38110												
			End	82586												
		CCW / Cap End	Start	89927												
			Mid	41497												
			End	62968												
	14E3-63	CW / Rod End	Start	20362	30543	40723	52131	62557	72983	83409					2080	
			Mid	13419	20128	26838	34269	41122	47976	54830						
			End	29080	43619	58159	74451	89341	104231	119121						
		CCW / Cap End	Start	29080	43619	58159	74451	89341	104231	119121						
			Mid	13419	20128	26838	34269	41122	47976	54830						
			End	20362	30543	40723	52131	62557	72983	83409						
	14E3-80	CW / Rod End	Start	35982	53972	71963									1177	
			Mid	23713	35569	47426										
			End	51387	77081	102774										
		CCW / Cap End	Start	51387	77081	102774										
			Mid	23713	35569	47426										
			End	35982	53972	71963										
	14E3-100	CW / Rod End	Start	59113											734	
			Mid	38957												
			End	84422												
		CCW / Cap End	Start	84422												
			Mid	38957												
			End	59113												

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke															
DA Configuration: HPM on Right Side of TM															
Actuator		Rotation Direction	Position	Operating Pressure, psig											Limiting MOP,psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
DA	DD	Pressure on		Hydraulic Torque, Lb-in											
24E3-80		CW / Rod End	Start	18770	28155	37540	48084	57701	67318	76934	86551	96168			2642
			Mid	12403	18604	24806	31689	38026	44364	50702	57039	63377			
			End	26807	40210	53613	68671	82405	96139	109874	123608	137342			
		CCW / Cap End	Start	39214	58821	78428	100456	120547	140638	160729	180821	200912			
			Mid	18144	27215	36287	46356	55627	64898	74169	83441	92712			
			End	27458	41187	54916	70340	84408	98476	112544	126612	140680			
24E3-100		CW / Rod End	Start	34215	51323	68431	87650	105180							1691
			Mid	22609	33913	45217	57764	69317							
			End	48864	73297	97729	125177	150213							
		CCW / Cap End	Start	61272	91908	122544	156962	188355							
			Mid	28349	42524	56699	72431	86917							
			End	42903	64355	85806	109906	131887							
24E3-125		CW / Rod End	Start	58348	87522	116697									1082
			Mid	38555	57833	77110									
			End	83330	124995	166660									
		CCW / Cap End	Start	95738	143606	191475									
			Mid	44296	66444	88592									
			End	67036	100554	134072									
24E3-140		CW / Rod End	Start	75402	113103										884
			Mid	49824	74736										
			End	107686	161528										
		CCW / Cap End	Start	120093	180140										
			Mid	55565	83347										
			End	84090	126135										
24E3-160		CW / Rod End	Start	101144											677
			Mid	66834											
			End	144449											
		CCW / Cap End	Start	156856											
			Mid	72574											
			End	109832											
	24E3-80	CW / Rod End	Start	46228	69342	92456	118424	142109							1569
			Mid	30546	45820	61093	78045	93653							
			End	66021	99031	132041	169127	202952							
		CCW / Cap End	Start	66021	99031	132041	169127	202952							
			Mid	30546	45820	61093	78045	93653							
			End	46228	69342	92456	118424	142109							
	24E3-100	CW / Rod End	Start	77118	115678										964
			Mid	50958	76437										
			End	110136	165205										
		CCW / Cap End	Start	110136	165205										
			Mid	50958	76437										
			End	77118	115678										
	24E3-125	CW / Rod End	Start	125384											593
			Mid	82851											
			End	179068											
		CCW / Cap End	Start	179068											
			Mid	82851											
			End	125384											

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke															
DA Configuration: HPM on Right Side of TM															
Actuator		Rotation Direction	Position	Operating Pressure, psig											Limiting MOR,psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
DA	DD	Pressure on		Hydraulic Torque, Lb-in											
45E3-100		CW / Rod End	Start	36245	54367	72489	92849	111418	129988	148558	167128	185697			2576
			Mid	23950	35924	47899	61190	73428	85666	97904	110142	122380			
			End	51763	77644	103525	132602	159122	185642	212163	238683	265203			
		CCW / Cap End	Start	75412	113118	150823	193184	231821	270458	309095	347732	386369			
			Mid	34892	52337	69783	89146	106975	124804	142634	160463	178292			
			End	52804	79206	105608	135269	162323	189377	216431	243484	270538			
45E3-125		CW / Rod End	Start	65947	98920	131893	168938	202725						1649	
			Mid	43576	65364	87152	111334	133601							
			End	94182	141273	188363	241268	289522							
		CCW / Cap End	Start	117831	176746	235662	301851	362221							
			Mid	54518	81777	109036	139291	167149							
			End	82506	123759	165012	211358	253630							
45E3-140		CW / Rod End	Start	86936	130404	173873	222707							1314	
			Mid	57445	86168	114891	146770								
			End	124158	186237	248316	318059								
		CCW / Cap End	Start	147807	221710	295614	378641								
			Mid	68387	102581	136775	174726								
			End	103496	155243	206991	265128								
45E3-160		CW / Rod End	Start	118619	177928	237237								1031	
			Mid	78380	117571	156761									
			End	169405	254107	338810									
		CCW / Cap End	Start	193054	289581	386108									
			Mid	89322	133984	178645									
			End	135178	202767	270356									
45E3-180		CW / Rod End	Start	154525	231788									815	
			Mid	102107	153160										
			End	220685	331027										
		CCW / Cap End	Start	244334	366501										
			Mid	113049	169573										
			End	171085	256627										

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke															
DA Configuration: HPM on Right Side of TM															
Actuator		Rotation Direction	Position	Operating Pressure, psig											Limiting MOP,psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	
DA	DD	Pressure on		Hydraulic Torque, Lb-in											
	45E3-100	CW / Rod End	Start	89048	133573	178097	228118	273741							1528
			Mid	58841	88262	117682	150336	180403							
			End	127174	190762	254349	325786	390943							
		CCW / Cap End	Start	127174	190762	254349	325786	390943							
			Mid	58841	88262	117682	150336	180403							
			End	89048	133573	178097	228118	273741							
	45E3-125	CW / Rod End	Start	148453	222679										939
			Mid	98094	147141										
			End	212013	318019										
		CCW / Cap End	Start	212013	318019										
			Mid	98094	147141										
			End	148453	222679										
	45E3-140	CW / Rod End	Start	190432											732
			Mid	125833											
			End	271965											
		CCW / Cap End	Start	271965											
			Mid	125833											
			End	190432											
	45E3-160	CW / Rod End	Start	253796											549
			Mid	167703											
			End	362459											
		CCW / Cap End	Start	362459											
			Mid	167703											
			End	253796											

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke															
DA Configuration: HPM on Right Side of TM															
Actuator		Rotation Direction	Position	Operating Pressure, psig											Limiting MOR,psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
DA	DD	Pressure on		Hydraulic Torque, Lb-in											
10E4-125		CW / Rod End	Start	69020	103531	138041	176812	212174	247536	282899	318261	353623	388985	424348	3000
			Mid	45607	68411	91214	116524	139828	163133	186438	209742	233047	256352	279656	
			End	98571	147857	197143	252513	303016	353518	404021	454524	505026	555529	606031	
		CCW / Cap End	Start	143606	215409	287213	367880	441456	515033	588609	662185	735761	809337	882913	
			Mid	66444	99666	132888	169760	203712	237665	271617	305569	339521	373473	407425	
			End	100554	150831	201108	257593	309111	360630	412148	463667	515185	566704	618222	
10E4-140		CW / Rod End	Start	94601	141902	189203	242343	290812	339280	387749	436218				2397
			Mid	62510	93766	125021	159711	191653	223595	255537	287479				
			End	135105	202657	270210	346102	415322	484543	553763	622983				
		CCW / Cap End	Start	180140	270210	360280	461469	553763	646057	738351	830644				
			Mid	83347	125021	166694	212947	255537	298126	340716	383305				
			End	126135	189203	252270	323124	387749	452374	516999	581624				
10E4-160		CW / Rod End	Start	133214	199821	266428	341259	409510	477762						1835
			Mid	88025	132037	176050	224899	269878	314858						
			End	190250	285374	380499	487368	584842	682315						
		CCW / Cap End	Start	235285	352927	470569	602735	723282	843829						
			Mid	108862	163292	217723	278135	333762	389390						
			End	164748	247122	329496	422040	506448	590856						
10E4-180		CW / Rod End	Start	176975	265463	353951	453363								1450
			Mid	116941	175412	233882	298778								
			End	252747	379121	505494	647469								
		CCW / Cap End	Start	297782	446673	595564	762837								
			Mid	137778	206667	275556	352015								
			End	208509	312764	417018	534144								
10E4-200		CW / Rod End	Start	225885	338828	451770									1174
			Mid	149259	223889	298519									
			End	322597	483896	645194									
		CCW / Cap End	Start	367632	551448	735264									
			Mid	170096	255144	340192									
			End	257419	386128	514838									
10E4-220		CW / Rod End	Start	279943	419914	559886									994
			Mid	184980	277470	369959									
			End	399800	599700	799600									
		CCW / Cap End	Start	444835	667252	889670									
			Mid	205816	308725	411633									
			End	311477	467215	622954									
10E4-250		CW / Rod End	Start	370683	556025										770
			Mid	244939	367408										
			End	529390	794085										
		CCW / Cap End	Start	574425	861638										
			Mid	265775	398663										
			End	402217	603325										

Output Torque – Imperial – Lb-in

DA - CANTED YOKE

Double Acting Canted Yoke															
DA Configuration: HPM on Right Side of TM															
Actuator		Rotation Direction	Position	Operating Pressure, psig											Limiting MOP,psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
DA	DD	Pressure on		Hydraulic Torque, Lb-in											
	10E4-125	CW / Rod End	Start	169575	254362	339149	434404	521285	608166						1783
			Mid	112051	168076	224102	286284	343541	400797						
			End	242178	363267	484355	620393	744472	868551						
		CCW / Cap End	Start	242178	363267	484355	620393	744472	868551						
			Mid	112051	168076	224102	286284	343541	400797						
			End	169575	254362	339149	434404	521285	608166						
	10E4-140	CW / Rod End	Start	220737	331105	441473	565467								1369
			Mid	145858	218786	291715	372658								
			End	315245	472867	630489	807571								
		CCW / Cap End	Start	315245	472867	630489	807571								
			Mid	145858	218786	291715	372658								
			End	220737	331105	441473	565467								
	10E4-160	CW / Rod End	Start	297962	446943	595925									1015
			Mid	196886	295330	393773									
			End	425534	638301	851068									
		CCW / Cap End	Start	425534	638301	851068									
			Mid	196886	295330	393773									
			End	297962	446943	595925									
	10E4-180	CW / Rod End	Start	385485	578227										804
			Mid	254719	382079										
			End	550529	825794										
		CCW / Cap End	Start	550529	825794										
			Mid	254719	382079										
			End	385485	578227										
	10E4-200	CW / Rod End	Start	591420											641
			Mid	390796											
			End	844635											
		CCW / Cap End	Start	844635											
			Mid	390796											
			End	591420											

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
			Lb-in	Hydraulic Torque, Lb-in											
12E2-40	1	Start	3541					3102	4141	5180	6219	7258	8297	9336	3000
		Mid	1930					1060	1541	2023	2504	2986	3467	3948	
		End	3328					1032	1760	2487	3215	3942	4670	5397	
12E2-40	2	Start	4574							4396	5435	6474	7513	8552	3000
		Mid	2461							1520	2001	2482	2964	3445	
		End	4160							1515	2242	2970	3697	4425	
12E2-40	3	Start	5849									4893	5932	6971	3000
		Mid	3267									1719	2201	2682	
		End	5841									1770	2498	3225	
12E2-50	1	Start	3541			4375	6252	8129	10006						1831
		Mid	1930			1650	2520	3389	4259						
		End	3328			1924	3238	4552	5867						
12E2-50	2	Start	4574			3592	5469	7346	9223						1936
		Mid	2461			1147	2017	2886	3756						
		End	4160			952	2266	3580	4894						
12E2-50	3	Start	5849					5764	7641	9518					2146
		Mid	3267					2123	2993	3862					
		End	5841					2380	3695	5009					
12E2-63	1	Start	3541	3357	6601	9846									1059
		Mid	1930	1178	2681	4185									
		End	3328	1211	3483	5755									
12E2-63	2	Start	4574		5818	9063									1120
		Mid	2461		2178	3682									
		End	4160		2510	4782									
12E2-63	3	Start	5849		4237	7481	10726								1241
		Mid	3267		1415	2918	4422								
		End	5841		1311	3583	5854								
12E2-80	1	Start	3541	7883											624
		Mid	1930	3275											
		End	3328	4380											
12E2-80	2	Start	4574	7100											660
		Mid	2461	2772											
		End	4160	3408											
12E2-80	3	Start	5849	5519											731
		Mid	3267	2009											
		End	5841	2208											

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi	
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
			Lb-in	Hydraulic Torque, Lb-in												
18E2-50	1	Start	5206				5872	8190	10509	12827	15145				Canted	2334
		Mid	3028				2308	3375	4442	5510	6577					
		End	5720				2911	4534	6158	7781	9404					
18E2-50	2	Start	6361				4962	7280	9598	11917	14235					2432
		Mid	3617				1719	2786	3853	4920	5988					
		End	6631				1756	3379	5003	6626	8249					
18E2-50	3	Start	10150							9374	11692	14010				2706
		Mid	5448							3090	4157	5224				
		End	9174							2837	4460	6083				
18E2-63	1	Start	5206		6527	10564	14954								Canted	1309
		Mid	3028		2626	4489	6488									
		End	5720		3398	6225	9270									
18E2-63	2	Start	6361		5638	9676	14044							1364		
		Mid	3617		2049	3912	5899									
		End	6631		2270	5097	8115									
18E2-63	3	Start	10150				11500	15635						1517		
		Mid	5448				4069	5972								
		End	9174				4326	7221								
18E2-80	1	Start	5206	8360	15332										Canted	771
		Mid	3028	3471	6689											
		End	5720	4681	9564											
18E2-80	2	Start	6361	7471	14444									803		
		Mid	3617	2895	6112											
		End	6631	3553	8436											
18E2-80	3	Start	10150		11960									892		
		Mid	5448		4320											
		End	9174		4736											

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
			Lb-in	Hydraulic Torque, Lb-in											
45E2-63	1	Start	11054			9742	15352	20727	26102	31478	36853				2388
		Mid	6286			3535	6085	8559	11034	13508	15982				
		End	11525			3907	7765	11529	15293	19056	22820				
45E2-63	2	Start	14638				11274	16650	22025	27400	32776	38151			2577
		Mid	8402				3969	6443	8917	11392	13866	16340			
		End	15602				4181	7945	11709	15473	19237	23000			
45E2-63	3	Start	21176						16479	21854	27230	32605	37980		2835
		Mid	11827						5492	7966	10440	12915	15389		
		End	21148						5170	8934	12698	16462	20226		
45E2-63	4	Start	27349								24705	30080	35456		2952
		Mid	14437								7831	10305	12779		
		End	23673								6526	10289	14053		
45E2-80	1	Start	11054		15940	25005	34890								1382
		Mid	6286		6395	10578	15079								
		End	11525		8247	14594	21446								
45E2-80	2	Start	14638		11959	21023	30813	40096							1492
		Mid	8402		4324	8507	12962	17235							
		End	15602		4748	11095	17862	24362							
45E2-80	3	Start	21176			15608	25267	34550							1642
		Mid	11827			5153	9537	13810							
		End	21148			4710	11324	17824							
45E2-80	4	Start	27349					32025							1710
		Mid	14437					11200							
		End	23673					11651							
45E2-100	1	Start	11054	18177	32892										868
		Mid	6286	7428	14218										
		End	11525	9813	20117										
45E2-100	2	Start	14638	14195	28911										935
		Mid	8402	5356	12146										
		End	15602	6314	16618										
45E2-100	3	Start	21176		23495	38211									1027
		Mid	11827		8793	15583									
		End	21148		10233	20537									
45E2-100	4	Start	27349			35745									1069
		Mid	14437			13028									
		End	23673			14509									

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig												Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
			Lb-in	Hydraulic Torque, Lb-in												
73E2-63	1	Start	21948						17903	23729	29555	35382	41208	47034	3000	
		Mid	12480						6292	8974	11656	14338	17020	19702		
		End	22882						6609	10689	14769	18848	22928	27008		
73E2-63	2	Start	26641							20550	26377	32203	38029	43856	3000	
		Mid	14754							6700	9382	12064	14746	17428		
		End	26061							5996	10076	14155	18235	22315		
73E2-63	3	Start	35171									26066	31893	37719	3000	
		Mid	18970									7848	10530	13212		
		End	32197									5625	9705	13785		
73E2-63	4	Start	38990											32038	3000	
		Mid	21533											10649		
		End	37879											9966		
73E2-80	1	Start	21948			19199	30297	40933	51569	62205					2056	
		Mid	12480			6953	11998	16893	21789	26684						
		End	22882			7656	15288	22735	30183	37630						
73E2-80	2	Start	26641				27119	37754	48390	59026					2130	
		Mid	14754				9724	14619	19515	24410						
		End	26061				10595	18042	25490	32937						
73E2-80	3	Start	35171					31618	42254	52890	63525				2275	
		Mid	18970					10403	15299	20194	25090					
		End	32197					9513	16960	24407	31854					
73E2-80	4	Start	38990						36572	47208	57844				2408	
		Mid	21533							12736	17632	22527				
		End	37879							13141	20588	28036				
73E2-100	1	Start	21948		29677	47017									1231	
		Mid	12480		11788	19790										
		End	22882		14993	27135										
73E2-100	2	Start	26641		26573	43913	62730								1276	
		Mid	14754		9562	17563	26115									
		End	26061		10411	22553	35530									
73E2-100	3	Start	35171			37921	56593								1362	
		Mid	18970			13436	21899									
		End	32197			14223	27000									
73E2-100	4	Start	38990			32373	50912								1442	
		Mid	21533			10927	19336									
		End	37879			10494	23181									
73E2-125	1	Start	21948	34070	62277										770	
		Mid	12480	13815	26831											
		End	22882	18069	37820											
73E2-125	2	Start	26641	30966	59173										798	
		Mid	14754	11589	24605											
		End	26061	13487	33237											
73E2-125	3	Start	35171		53181										851	
		Mid	18970		20478											
		End	32197		24908											
73E2-125	4	Start	38990		47633										900	
		Mid	21533		17969											
		End	37879		21179											

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Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig												Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
			Lb-in	Hydraulic Torque, Lb-in												
14E3-80	1	Start	36177					30222	41499	52776	64052	75329	86606	97883	3000	
		Mid	20507					10637	15827	21018	26208	31399	36590	41780		
		End	37439					11200	19096	26992	34888	42784	50681	58577		
14E3-80	2	Start	41452						36041	47318	58595	69872	81149	92425	3000	
		Mid	23497						12837	18028	23218	28409	33600	38790		
		End	42897						13821	21717	29613	37509	45405	53301		
14E3-80	3	Start	48290							40239	51516	62793	74070	85347	3000	
		Mid	27373							14151	19342	24532	29723	34914		
		End	49975							14879	22775	30671	38568	46464		
14E3-80	4	Start	62927									51214	62491	73768	3000	
		Mid	34849									17057	22247	27438		
		End	61555									16034	23930	31826		
14E3-80	5	Start	77802											65878	3000	
		Mid	41554											20733		
		End	69444											16951		
14E3-100	1	Start	36177			40522	61233	80968	100702	120437					2043	
		Mid	20507			15494	24911	33994	43078	52161						
		End	37439			18647	32914	46732	60551	74369						
14E3-100	2	Start	41452			35193	55776	75510	95245	114979					2112	
		Mid	23497			12567	21921	31004	40088	49171						
		End	42897			13495	27639	41457	55275	69093						
14E3-100	3	Start	48290					68431	88166	107900					2202	
		Mid	27373					27128	36211	45295						
		End	49975					34619	48438	62256						
14E3-100	4	Start	62927					56852	76587	96321	116056				2349	
		Mid	34849					19652	28736	37819	46903					
		End	61555					19982	33800	47619	61437					
14E3-100	5	Start	77802						68698	88432	108167				2449	
		Mid	41554						22031	31114	40198					
		End	69444						18925	32744	46562					
14E3-125	1	Start	36177	27790	59965	92139	124313								1224	
		Mid	20507	9619	24466	39313	54160									
		End	37439	9732	32260	54789	77318									
14E3-125	2	Start	41452		54635	86810	121851								1265	
		Mid	23497		21539	36386	52334									
		End	42897		27109	49638	73905									
14E3-125	3	Start	48290		47723	79897	114772								1319	
		Mid	27373		17744	32591	48458									
		End	49975		20432	42961	67068									
14E3-125	4	Start	62927			68591	103193								1407	
		Mid	34849			25272	40982									
		End	61555			28668	52430									
14E3-125	5	Start	77802			60887	95304								1467	
		Mid	41554			18709	34277									
		End	69444			14143	37555									

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig										
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
			Lb-in	Hydraulic Torque, Lb-in										
14E3-140	1	Start	36177	46028	87321									
		Mid	20507	18035	37090									
		End	37439	22502	51416									
14E3-140	2	Start	41452	40699	81992	123285								
		Mid	23497	15108	34163	53217								
		End	42897	17351	46264	75178								
14E3-140	3	Start	48290	33787	75080	116373								
		Mid	27373	11313	30368	49423								
		End	49975	10674	39588	68501								
14E3-140	4	Start	62927		63773	105066								
		Mid	34849		23049	42104								
		End	61555		25295	54209								
14E3-140	5	Start	77802			97363								
		Mid	41554			35541								
		End	69444			39683								
14E3-160	1	Start	36177	46028	87321									
		Mid	20507	18035	37090									
		End	37439	22502	51416									
14E3-160	2	Start	41452	40699	81992	123285								
		Mid	23497	15108	34163	53217								
		End	42897	17351	46264	75178								
14E3-160	3	Start	48290	33787	75080	116373								
		Mid	27373	11313	30368	49423								
		End	49975	10674	39588	68501								
14E3-160	4	Start	62927		63773	105066								
		Mid	34849		23049	42104								
		End	61555		25295	54209								
14E3-160	5	Start	77802			97363								
		Mid	41554			35541								
		End	69444			39683								

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig												Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
			Lb-in	Hydraulic Torque, Lb-in												
24E3-100	1	Start	73256					79762	104798	129833	154869	179904	204940		2824	
		Mid	40682					29491	41044	52596	64149	75702	87255			
		End	70450					33648	51178	68708	86238	103768	121298			
24E3-100	2	Start	86562					90832	115867	140903	165938	190974	216009	2963		
		Mid	48347					33540	45093	56645	68198	79751	91304			
		End	84417					38185	55715	73245	90775	108305	125835			
24E3-100	3	Start	112228						95949	120985	146020	171056	196091	3000		
		Mid	61478						32239	43791	55344	66897	78450			
		End	104335						30653	48183	65713	83243	100773			
24E3-100	4	Start	131385								132147	157182	182218	3000		
		Mid	71044								45979	57532	69085			
		End	118208								47006	64537	82067			
24E3-100	5	Start	151911									141308	166343	3000		
		Mid	81532									47265	58818			
		End	134083									44494	62024			
24E3-125	1	Start	73256		56242	97907	143018	185712							1656	
		Mid	40682		18864	38141	58681	78382								
		End	70450		17714	46888	77940	107835								
24E3-125	2	Start	86562			84277	129052	171746	214439						1738	
		Mid	48347			30799	51177	70878	90579							
		End	84417			34208	64947	94842	124736							
24E3-125	3	Start	112228				109134	151828	194522						1854	
		Mid	61478				38323	58024	77725							
		End	104335				39885	69779	99674							
24E3-125	4	Start	131385					137954	180648						1935	
		Mid	71044					48659	68360							
		End	118208					51073	80967							
24E3-125	5	Start	151911						164773	207467					2028	
		Mid	81532						58093	77795						
		End	134083						60925	90819						
24E3-140	1	Start	73256		92776	146618	205411								1281	
		Mid	40682		35767	60679	87472									
		End	70450		43295	80996	121628									
24E3-140	2	Start	86562		79146	132989	191445								1345	
		Mid	48347		28424	53336	79968									
		End	84417		30615	68316	108635									
24E3-140	3	Start	112228			113551	171527								1435	
		Mid	61478			40759	67114									
		End	104335			43858	83573									
24E3-140	4	Start	131385			100011	157653	212825							1498	
		Mid	71044			31595	57749	83209								
		End	118208			25602	64866	103498								
24E3-140	5	Start	151911				141779	196951							1570	
		Mid	81532				47482	72942								
		End	134083				44824	83456								

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig										
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
			Lb-in	Hydraulic Torque, Lb-in										
24E3-160	1	Start	73256	75696	147920									
		Mid	40682	27865	61281									
		End	70450	31336	81908									
24E3-160	2	Start	86562	62066	134291	206515								
		Mid	48347	20522	53939	87356								
		End	84417	18656	69228	119800								
24E3-160	3	Start	112228		114853	187077								
		Mid	61478		41361	74778								
		End	104335		44769	95341								
24E3-160	4	Start	131385		101313	173538								
		Mid	71044		32198	65615								
		End	118208		26514	77086								
24E3-160	5	Start	151911			158046								
		Mid	81532			55568								
		End	134083			57526								
24E3-180	1	Start	73256	117361	210418									
		Mid	40682	47142	90198									
		End	70450	60510	125669									
24E3-180	2	Start	86562	103731	196788									
		Mid	48347	39800	82855									
		End	84417	47830	112989									
24E3-180	3	Start	112228	84293	177350									
		Mid	61478	27222	70278									
		End	104335	23371	88531									
24E3-180	4	Start	131385		163811									
		Mid	71044		61114									
		End	118208		70275									
24E3-180	5	Start	151911		148319									
		Mid	81532		51068									
		End	134083		50715									

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
			Lb-in	Hydraulic Torque, Lb-in											
45E3-125	1	Start	134422				112869	161122	209376	257629	305883	354137	402390		2728
		Mid	74444				38458	60724	82991	105258	127525	149792	172059		
		End	128399				37679	71466	105254	139041	172829	206616	240404		
45E3-125	2	Start	164299						190904	239158	287412	335665	383919		2823
		Mid	88618						69116	91383	113650	135917	158184		
		End	146871						76079	109867	143654	177442	211229		
45E3-125	3	Start	179111						155459	203713	251967	300220	348474	396727	3000
		Mid	101840						56172	78439	100706	122973	145240	167507	
		End	182316						61616	95404	129191	162979	196766	230554	
45E3-125	4	Start	209917							184137	232391	280644	328898	377151	3000
		Mid	116579							64010	86277	108544	130811	153078	
		End	201892							65322	99110	132898	166685	200473	
45E3-125	5	Start	248552									255990	304244	352497	3000
		Mid	135089									90424	112691	134958	
		End	226546									95171	128959	162746	
45E3-140	1	Start	134422			123010	189659	253271	316883	380495					2069
		Mid	74444			43581	73893	103247	132601	161955					
		End	128399			45776	91448	135990	180531	225072					
45E3-140	2	Start	164299			171188	234800	298411	362023					2142	
		Mid	88618			60018	89372	118726	148080						
		End	146871			62274	106815	151356	195898						
45E3-140	3	Start	179111					199355	262966	326578	390190			2281	
		Mid	101840					76428	105782	135136	164490				
		End	182316					92352	136894	181435	225976				
45E3-140	4	Start	209917					179779	243390	307002	370614			2358	
		Mid	116579					61999	91353	120707	150061				
		End	201892					62271	106812	151354	195895				
45E3-140	5	Start	248552						218736	282348	345960			2455	
		Mid	135089						73233	102587	131941				
		End	226546						69086	113628	158169				
45E3-160	1	Start	134422		128802	213505	305570	392364							1517
		Mid	74444		46261	85451	127381	167432							
		End	128399		49832	109141	172610	233383							
45E3-160	2	Start	164299			195478	287099	373892						1570	
		Mid	88618			71874	113505	153557							
		End	146871			80669	143435	204209							
45E3-160	3	Start	179111			160887	251654	338447						1672	
		Mid	101840			59209	100561	140613							
		End	182316			66555	128972	189746							
45E3-160	4	Start	209917				232078	318871	405665					1728	
		Mid	116579				86133	126184	166236						
		End	201892				98891	159665	220438						
45E3-160	5	Start	248552				207424	294217	381011					1799	
		Mid	135089				68013	108064	148116						
		End	226546				61165	121938	182712						

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig										
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
			Lb-in	Hydraulic Torque, Lb-in										
45E3-180	1	Start	134422		205722	316064								
		Mid	74444		81850	132904								
		End	128399		103692	180954								
45E3-180	2	Start	164299		187696	298038								
		Mid	88618		68273	119327								
		End	146871		75220	152483								
45E3-180	3	Start	179111		153105	263447	383019							
		Mid	101840		55608	106661	161181							
		End	182316		61106	138368	220955							
45E3-180	4	Start	209917			244343	363443							
		Mid	116579			92543	146752							
		End	201892			109012	190874							
45E3-180	5	Start	248552			220283	338789							
		Mid	135089			74813	128632							
		End	226546			72195	153148							
45E3-200	1	Start	134422	152693	291691									
		Mid	74444	57315	121627									
		End	128399	66560	163888									
45E3-200	2	Start	164299	134666	273665									
		Mid	88618	43738	108050									
		End	146871	38088	135416									
45E3-200	3	Start	179111		239074	378073								
		Mid	101840		95384	159696								
		End	182316		121302	218630								
45E3-200	4	Start	209917		219970	358969								
		Mid	116579		81266	145578								
		End	201892		91946	189274								
45E3-200	5	Start	248552		195910	334909								
		Mid	135089		63536	127848								
		End	226546		55129	152457								

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig											Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750		
			Lb-in	Hydraulic Torque, Lb-in											
10E4-160	1	Start	264856				216294	313767	411241	508714	606188	703662	801135	898609	2964
		Mid	150942				77134	122114	167093	212073	257053	302033	347012	391992	
		End	271074				82634	150886	219138	287389	355641	423893	492145	560396	
10E4-160	2	Start	336108						374015	471488	568962	666435	763909	861383	3000
		Mid	183135						135578	180558	225538	270518	315497	360477	
		End	308301						149563	217815	286066	354318	422570	490822	
10E4-160	3	Start	394023							386855	484328	581802	679276	776749	3000
		Mid	222118							142396	187376	232356	277335	322315	
		End	392934							161262	229514	297766	366017	434269	
10E4-160	4	Start	495807								432001	529475	626948	724422	3000
		Mid	267905								142552	187532	232512	277492	
		End	445261								130125	198376	266628	334880	
10E4-180	1	Start	264856			240952	376395	505889	635383	764877	894371				2231
		Mid	150942			89296	151014	210769	270525	330281	390036				
		End	271074			101558	194738	285411	376084	466756	557429				
10E4-180	2	Start	336108				339169	468663	598157	727651	857145				2303
		Mid	183135				119499	179254	239010	298766	358521				
		End	308301				125164	215836	306509	397182	487854				
10E4-180	3	Start	394023					384030	513523	643017	772511	902005			2466
		Mid	222118					141092	200848	260604	320359	380115			
		End	392934					159284	249957	340629	431302	521974			
10E4-180	4	Start	495807						461196	590690	720184	849678			2567
		Mid	267905							156025	215780	275536	335292		
		End	445261							150567	241240	331912	422585		
10E4-200	1	Start	264856		219354	380652	555332	720614	885895						1748
		Mid	150942		79302	153932	233585	309855	386125						
		End	271074		86435	199377	320032	435763	551494						
10E4-200	2	Start	336108			344323	518106	683387	848669						1804
		Mid	183135			123095	202070	278340	354610						
		End	308301			131479	250457	366188	481919						
10E4-200	3	Start	394023				433473	598754	764035						1932
		Mid	222118				163908	240178	316448						
		End	392934				193904	309636	425367						
10E4-200	4	Start	495807					546427	711708	876989					2011
		Mid	267905						195355	271625	347895				
		End	445261						210246	325977	441709				
10E4-220	1	Start	264856		335158	535058	753105								1411
		Mid	150942		132883	225373	324848								
		End	271074		167522	307493	458513								
10E4-220	2	Start	336108		298828	498728	715878								1456
		Mid	183135		102046	194535	293333								
		End	308301		99624	239595	388939								
10E4-220	3	Start	394023			416134	631245	836081							1559
		Mid	222118			157194	255171	349694							
		End	392934			184405	332386	475814							
10E4-220	4	Start	495807				578918	783754							1623
		Mid	267905				210348	304871							
		End	445261				232997	376424							

Canted

Output Torque – Imperial – Lb-in

SR - CANTED YOKE

Spring Return Canted Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, psig												Limiting MOP, psi
				500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000		
			Lb-in	Hydraulic Torque, Lb-in												
10E4-250	1	Start	264856	264848	529543	794238									Canted	1065
		Mid	150942	100352	222821	345290										
		End	271074	118290	303632	488974										
10E4-250	2	Start	336108	228519	493214	757909										1100
		Mid	183135	69515	191984	314453										
		End	308301	50392	235734	421075										
10E4-250	3	Start	394023		410620	675315										1178
		Mid	222118		154643	277112										
		End	392934		180544	365886										
10E4-250	4	Start	495807		359554	624249									1226	
		Mid	267905		110783	233252										
		End	445261		83550	268891										

Note: Select Canted Yoke only for Fail CW.

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Beginning of Metric Output Torques

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, bar											Limiting MOP, bar
			35	50	70	85	100	125	140	160	175	190	207	
DA	DD		Hydraulic Torque, Nm											
12E2-32	Cap End	Start/End	187	267	374	465	547	684	766	875	957	1039	1132	207
		Mid	105	150	209	260	306	382	428	489	535	581	633	
	Rod End	Start/End	99	141	197	245	288	360	404	461	505	548	597	
		Mid	55	79	110	137	161	201	226	258	282	306	334	
12E2-40	Cap End	Start/End	292	417	584	726	855	1068	1196					140
		Mid	164	234	327	406	478	597	669					
	Rod End	Start/End	204	291	407	507	596	745	834					
		Mid	114	163	228	283	333	416	466					
12E2-50	Cap End	Start/End	456	652	913	1135								90
		Mid	256	365	511	634								
	Rod End	Start/End	368	526	736	915								
		Mid	206	295	412	511								
12E2-63	Cap End	Start/End	724	1035										58
		Mid	406	580										
	Rod End	Start/End	636	909										
		Mid	356	509										
	12E2-32	Start/End	285	408	571	710	835	1044	1169					144
		Mid	160	228	320	397	467	583	653					
	12E2-40	Start/End	496	708	991									
		Mid	278	397	555									
	12E2-50	Start/End	824	1178										51
		Mid	462	660										
18E2-40	Cap End	Start/End	365	522	730	908	1068	1335	1495	1709				168
		Mid	205	292	409	507	597	746	836	955				
	Rod End	Start/End	222	318	445	553	651	814	911	1041				
		Mid	125	178	249	309	364	455	509	582				
18E2-50	Cap End	Start/End	570	815	1141	1419	1669							108
		Mid	320	457	639	793	933							
	Rod End	Start/End	428	611	856	1064	1252							
		Mid	240	342	479	595	699							
18E2-63	Cap End	Start/End	906	1294	1811									70
		Mid	507	725	1015									
	Rod End	Start/End	763	1090	1526									
		Mid	427	611	855									
18E2-80	Cap End	Start/End	1460											43
		Mid	818											
	Rod End	Start/End	1318											
		Mid	738											
	18E2-40	Start/End	588	839	1175	1461	1719							105
		Mid	329	470	658	817	961							
	18E2-50	Start/End	998	1426										
		Mid	559	799										
	18E2-63	Start/End	1669											38
		Mid	935											

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, bar											Limiting MOP, bar
			35	50	70	85	100	125	140	160	175	190	207	
DA	DD		Hydraulic Torque, Nm											
45E2-50	Cap End	Start/End	742	1059	1483	1844	2170	2712	3038	3471	3797	4122	4491	207
		Mid	415	593	831	1031	1212	1516	1697	1940	2122	2304	2510	
	Rod End	Start/End	556	794	1112	1383	1627	2034	2278	2604	2848	3092	3368	
		Mid	312	445	623	773	909	1137	1273	1455	1591	1728	1882	
45E2-63	Cap End	Start/End	1177	1682	2354	2928	3445	4306						131
		Mid	660	942	1319	1636	1925	2406						
	Rod End	Start/End	992	1417	1984	2467	2902	3628						
		Mid	556	794	1111	1379	1622	2027						
45E2-80	Cap End	Start/End	1898	2712	3797									81
		Mid	1063	1519	2127									
	Rod End	Start/End	1713	2447	3426									
		Mid	960	1371	1919									
45E2-100	Cap End	Start/End	2966	4237										53
		Mid	1662	2374										
	Rod End	Start/End	2781	3972										
		Mid	1558	2225										
	45E2-50	Start/End	1298	1854	2595	3227	3797							118
		Mid	727	1039	1454	1804	2122							
	45E2-63	Start/End	2169	3099	4338									71
		Mid	1215	1736	2430									
	45E2-80	Start/End	3611											44
		Mid	2023											
	73E2-50	Start/End	913	1304	1825	2270	2670	3338	3738	4273	4673	5074	5528	207
		Mid	511	730	1023	1268	1492	1865	2089	2388	2611	2835	3089	
	73E2-63	Start/End	539	770	1078	1340	1577	1971	2207	2523	2759	2995	3264	172
		Mid	302	431	604	749	881	1101	1233	1410	1542	1674	1824	
	73E2-80	Start/End	2336	3338	4673	5811	6836							107
		Mid	1309	1870	2618	3247	3820							
	73E2-100	Start/End	1963	2804	3925	4881	5742							70
		Mid	1099	1571	2199	2728	3209							
	73E2-125	Start/End	3651	5215	7301									45
		Mid	2045	2922	4090									
	73E2-50	Start/End	3277	4681	6553									172
		Mid	1836	2622	3671									
	73E2-63	Start/End	5704											99
		Mid	3196											
	73E2-80	Start/End	5330											59
		Mid	2986											
	73E2-50	Start/End	1451	2073	2903	3610	4247	5309	5946	6795	7432			172
		Mid	813	1162	1626	2017	2373	2967	3323	3797	4153			
	73E2-63	Start/End	2524	3606	5048	6277	7385							99
		Mid	1414	2020	2828	3508	4127							
	73E2-80	Start/End	4299	6141										59
		Mid	2408	3441										

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, bar											Limiting MOP, bar
			35	50	70	85	100	125	140	160	175	190	207	
DA	DD		Hydraulic Torque, Nm											
14E3-63	Cap End	Start/End	1721	2458	3441	4279	5034	6293	7048	8055	8810	9565	10421	207
		Mid	964	1377	1928	2391	2813	3517	3939	4501	4923	5345	5824	
	Rod End	Start/End	1027	1467	2054	2554	3005	3756	4207	4808	5259	5709	6220	
		Mid	575	822	1151	1427	1679	2099	2351	2687	2939	3190	3476	
14E3-80	Cap End	Start/End	2774	3963	5549	6900	8118	10147	11365	12989	14206			172
		Mid	1554	2220	3109	3856	4536	5671	6351	7258	7939			
	Rod End	Start/End	2081	2973	4162	5175	6088	7611	8524	9741	10655			
		Mid	1166	1665	2331	2892	3402	4253	4763	5444	5954			
14E3-100	Cap End	Start/End	4335	6193	8670	10782	12684							110
		Mid	2429	3469	4857	6025	7088							
	Rod End	Start/End	3641	5202	7283	9056	10655							
		Mid	2040	2914	4080	5061	5954							
14E3-125	Cap End	Start/End	6773	9676	13547									71
		Mid	3795	5421	7590									
	Rod End	Start/End	6080	8685	12160									
		Mid	3406	4866	6812									
14E3-140	Cap End	Start/End	8497	12138										58
		Mid	4760	6800										
	Rod End	Start/End	7803	11147										
		Mid	4372	6245										
	14E3-63	Start/End	2748	3925	5495	6833	8039	10049	11255	12863	14069			174
		Mid	1539	2199	3079	3819	4493	5616	6290	7188	7862			
	14E3-80	Start/End	4855	6936	9710	12075	14206							99
		Mid	2720	3886	5440	6748	7939							
	14E3-100	Start/End	7976	11395										61
		Mid	4469	6384										
	14E3-125	Start/End	12853											38
		Mid	7201											

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke													
DA Configuration: HPM on Right Side of TM													
Actuator		Position	Operating Pressure, bar										
			35	50	70	85	100	125	140	160	175	190	207
DA	DD		Hydraulic Torque, Nm										
24E3-80	Cap End	Start/End	3705	5293	7410	9220	10847	13559	15186	17356	18983	20610	22454
		Mid	2081	2973	4162	5166	6077	7596	8508	9723	10635	11546	12580
	Rod End	Start/End	2533	3618	5066	6303	7415	9269	10381	11864	12976	14089	15349
		Mid	1423	2032	2845	3531	4154	5193	5816	6647	7270	7893	8599
24E3-100	Cap End	Start/End	5789	8270	11578	14407	16949	21186	23728				
		Mid	3252	4646	6504	8071	9495	11869	13294				
	Rod End	Start/End	4617	6596	9234	11489	13517	16896	18923				
		Mid	2593	3705	5187	6437	7573	9466	10602				
24E3-125	Cap End	Start/End	9046	12922	18091	22510							
		Mid	5081	7259	10162	12611							
	Rod End	Start/End	7873	11248	15747	19593							
		Mid	4423	6318	8845	10977							
24E3-140	Cap End	Start/End	11347	16210	22694								
		Mid	6374	9105	12748								
	Rod End	Start/End	10174	14535	20349								
		Mid	5715	8165	11431								
24E3-160	Cap End	Start/End	14820	21172									
		Mid	8325	11893									
	Rod End	Start/End	13648	19497									
		Mid	7666	10952									
	24E3-80	Start/End	6238	8911	12476	15523	18262	22828					
		Mid	3504	5006	7008	8697	10231	12789					
	24E3-100	Start/End	10406	14866	20812								
		Mid	5845	8351	11691								
	24E3-125	Start/End	16919	24170									
		Mid	9504	13577									
	24E3-140	Start/End	21521										
		Mid	12089										
		Start/End											
		Mid											
		Start/End											
		Mid											

Symmetric

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke														
DA Configuration: HPM on Right Side of TM														
Actuator		Position	Operating Pressure, bar											Limiting MOP, bar
			35	50	70	85	100	125	140	160	175	190	207	
DA	DD		Hydraulic Torque, Nm											
45E3-100	Cap End	Start/End	7125	10179	14250	17731	20860	26075	29204	33376	36505	39634	43181	207
		Mid	4002	5718	8005	9934	11687	14608	16361	18699	20452	22205	24192	
	Rod End	Start/End	4891	6987	9781	12171	14318	17898	20046	22909	25057	27205	29639	
		Mid	2747	3925	5494	6818	8022	10027	11230	12835	14038	15241	16605	
45E3-125	Cap End	Start/End	11133	15904	22266	27705	32594	40742	45632					138
		Mid	6254	8934	12507	15521	18260	22826	25565					
	Rod End	Start/End	8899	12712	17797	22144	26052	32565	36473					
		Mid	4999	7141	9997	12406	14596	18244	20434					
45E3-140	Cap End	Start/End	13965	19950	27930	34753	40886							110
		Mid	7845	11207	15689	19470	22906							
	Rod End	Start/End	11731	16758	23462	29193	34344							
		Mid	6590	9414	13179	16355	19241							
45E3-160	Cap End	Start/End	18240	26058	36481	45392								84
		Mid	10246	14637	20492	25430								
	Rod End	Start/End	16006	22866	32012	39831								
		Mid	8991	12844	17982	22315								
45E3-180	Cap End	Start/End	23085	32979										68
		Mid	12968	18525										
	Rod End	Start/End	20851	29787										
		Mid	11713	16732										
	45E3-100	Start/End	12016	17165	24032	29902	35179	43973						128
		Mid	6750	9642	13499	16752	19708	24636						
	45E3-125	Start/End	20032	28617	40063									77
		Mid	11252	16075	22505									
	45E3-140	Start/End	25696	36709										61
		Mid	14434	20620										
	45E3-160	Start/End	34246											46
		Mid	19237											

Output Torque – Metric – Nm

DA - SYMMETRIC YOKE

Double Acting Symmetrical Yoke															
DA Configuration: HPM on Right Side of TM															
Actuator		Position	Operating Pressure, bar												Limiting MOP, bar
			35	50	70	85	100	125	140	160	175	190	207		
DA	DD		Hydraulic Torque, Nm												
10E4-125	Cap End	Start/End	13568	19383	27137	33765	39724	49655	55614	63558	69517	75475	82229	Symmetric	207
		Mid	7622	10888	15243	18917	22255	27819	31157	35608	38946	42284	46068		
	Rod End	Start/End	9313	13305	18627	23177	27267	34083	38173	43626	47716	51806	56442		
		Mid	5232	7474	10463	12984	15276	19095	21386	24441	26733	29024	31621		
10E4-140	Cap End	Start/End	17020	24314	34040	42355	49830	62287	69762	79728	87202	94676			201
		Mid	9561	13658	19121	23729	27917	34896	39083	44667	48854	53042			
	Rod End	Start/End	12765	18236	25530	31766	37372	46715	52321	59796	65401	71007			
		Mid	7171	10244	14341	17797	20937	26172	29312	33500	36641	39781			
10E4-160	Cap End	Start/End	22230	31758	44461	55321	65084	81355	91117						154
		Mid	12487	17839	24975	30993	36463	45578	51048						
	Rod End	Start/End	17975	25679	35951	44732	52626	65783	73677						
		Mid	10097	14425	20195	25061	29483	36854	41277						
10E4-180	Cap End	Start/End	28135	40193	56271	70016	82372								121
		Mid	15804	22578	31609	39226	46148								
	Rod End	Start/End	23880	34115	47761	59427	69914								
		Mid	13414	19163	26828	33293	39169								
10E4-200	Cap End	Start/End	34735	49621	69470	86439	101693							98	
		Mid	19512	27874	39023	48427	56973								
	Rod End	Start/End	30480	43543	60960	75850	89236								
		Mid	17121	24459	34243	42495	49994								
10E4-220	Cap End	Start/End	42029	60042	84059									81	
		Mid	23609	33727	47218										
	Rod End	Start/End	37774	53963	75549										
		Mid	21219	30313	42438										
10E4-250	Cap End	Start/End	54273	77533										64	
		Mid	30487	43553											
	Rod End	Start/End	50018	71455											
		Mid	28097	40138											
	10E4-125	Start/End	22882	32688	45763	56942	66990	83738	93787					149	
		Mid	12853	18362	25707	31901	37531	46913	52543						
	10E4-140	Start/End	29785	42550	59571	74122	87202								115
		Mid	16731	23902	33462	41526	48854								
	10E4-160	Start/End	40206	57437	80412	100053									85
		Mid	22585	32264	45169	56054									
	10E4-180	Start/End	52016	74308											67
		Mid	29219	41741											
	10E4-200	Start/End	65215	93164											54
		Mid	36633	52333											

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar												Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207		
			Nm	Hydraulic Torque, Nm												
12E2-40	1	Start	471					269	410	494	606	690	774	870	Symmetric	207
		Mid	218					109	188	235	298	346	393	447		
		End	310					118	258	342	455	539	623	718		
12E2-40	2	Start	608						337	421	533	617	701	797	207	
		Mid	278						131	178	241	289	336	390		
		End	387						129	213	325	409	494	589		
12E2-40	3	Start	777									470	554	650	207	
		Mid	369									203	250	304		
		End	544									250	334	430		
12E2-50	1	Start	471		215	418	570	722	975	1127					147	
		Mid	218		78	192	278	363	506	591						
		End	310		64	266	418	570	824	976						
12E2-50	2	Start	608			345	497	649	902	1054					154	
		Mid	278			136	221	307	449	535						
		End	387			137	289	441	694	846						
12E2-50	3	Start	777				350	502	755	907	1110				169	
		Mid	369				135	220	363	448	562					
		End	544				130	282	535	687	890					
12E2-63	1	Start	471	322	584	935	1197								85	
		Mid	218	138	286	483	631									
		End	310	170	433	783	1046									
12E2-63	2	Start	608		511	862	1125								89	
		Mid	278		229	426	574									
		End	387		304	654	917									
12E2-63	3	Start	777		364	715	977								98	
		Mid	369		143	340	488									
		End	544		144	495	757									
12E2-80	1	Start	471	749	1195										50	
		Mid	218	379	630											
		End	310	598	1044											
12E2-80	2	Start	608	676	1122										53	
		Mid	278	322	573											
		End	387	469	915											
12E2-80	3	Start	777	529	975										58	
		Mid	369	236	487											
		End	544	309	755											

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar												Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207		
			Nm	Hydraulic Torque, Nm												
18E2-50	1	Start	692			336	532	719	1032	1220	1470	1658			186	
		Mid	342			144	252	357	532	637	777	882				
		End	532			180	372	560	873	1060	1311	1499				
18E2-50	2	Start	845				447	635	948	1135	1386	1573	1761		193	
		Mid	409				186	291	466	571	711	815	920			
		End	617				219	406	719	907	1157	1345	1533			
18E2-50	3	Start	1349						711	899	1149	1337	1525	1737	207	
		Mid	615						259	364	504	609	714	832		
		End	854						216	403	654	841	1029	1242		
18E2-63	1	Start	692			570	1006	1365	1700						104	
		Mid	342			276	520	718	905							
		End	532			414	850	1206	1540							
18E2-63	2	Start	845			487	923	1280	1615						108	
		Mid	409			211	455	652	839							
		End	617			264	700	1052	1387							
18E2-63	3	Start	1349				692	1044	1379						119	
		Mid	615				252	445	632							
		End	854				209	548	883							
18E2-80	1	Start	692	798	1362										62	
		Mid	342	403	720											
		End	532	642	1207											
18E2-80	2	Start	845	715	1280										64	
		Mid	409	338	655											
		End	617	492	1057											
18E2-80	3	Start	1349			1049	1802								70	
		Mid	615			452	874									
		End	854			565	1318									

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
45E2-63	1	Start	1469			936	1394	1830	2555	2990	3571	4006	4442	
		Mid	710			416	668	912	1317	1560	1885	2128	2371	
		End	1073			549	998	1433	2158	2594	3174	3610	4045	
45E2-63	2	Start	1945					1450	2176	2611	3191	3627	4062	4555
		Mid	949					672	1078	1321	1646	1889	2132	2408
		End	1452					957	1682	2118	2698	3133	3569	4062
45E2-63	3	Start	2814						1660	2095	2675	3111	3546	4039
		Mid	1336						691	934	1259	1502	1745	2021
		End	1968						813	1249	1829	2264	2700	3193
45E2-63	4	Start	3635								2440	2876	3311	3804
		Mid	1631								964	1207	1450	1726
		End	2203								1009	1444	1879	2373
45E2-80	1	Start	1469	666	1400	2379	3188	3939						
		Mid	710	264	676	1224	1670	2091						
		End	1073	278	1012	1991	2791	3543						
45E2-80	2	Start	1945		1029	2008	2808	3560						
		Mid	949		442	990	1431	1851						
		End	1452		547	1526	2315	3066						
45E2-80	3	Start	2814			1504	2292	3044	4297					
		Mid	1336			611	1044	1464	2165					
		End	1968			678	1446	2197	3450					
45E2-80	4	Start	3635					2809	4062					
		Mid	1631					1170	1870					
		End	2203					1377	2630					
45E2-100	1	Start	1469	1733	2925	4514								
		Mid	710	863	1530	2420								
		End	1073	1346	2538	4127								
45E2-100	2	Start	1945	1363	2555	4144								
		Mid	949	629	1296	2186								
		End	1452	881	2073	3662								
45E2-100	3	Start	2814		2051	3640								
		Mid	1336		917	1808								
		End	1968		1224	2813								
45E2-100	4	Start	3635		1821	3410								
		Mid	1631		629	1519								
		End	2203		423	2012								

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
73E2-63	1	Start	2917						1803	2274	2904	3375	3847	4382
		Mid	1410						787	1051	1403	1666	1930	2229
		End	2129						1015	1487	2116	2588	3060	3594
73E2-63	2	Start	3541							1979	2608	3080	3552	4086
		Mid	1667							794	1146	1409	1673	1972
		End	2425							863	1492	1964	2436	2971
73E2-63	3	Start	4675									2509	2980	3515
		Mid	2143									933	1197	1495
		End	2996									830	1302	1837
73E2-63	4	Start	5182											2986
		Mid	2433											1206
		End	3525											1329
73E2-80	1	Start	2917			1846	2752	3613	5048	5910	7058			
		Mid	1410			819	1318	1799	2601	3082	3724			
		End	2129			1077	1964	2825	4261	5122	6271			
73E2-80	2	Start	3541					3317	4753	5614	6762			
		Mid	1667					1542	2344	2826	3467			
		End	2425					2202	3637	4498	5647			
73E2-80	3	Start	4675					2746	4182	5043	6191	7053		
		Mid	2143					1066	1868	2349	2991	3472		
		End	2996					1068	2503	3365	4513	5375		
73E2-80	4	Start	5182					2217	3653	4514	5663	6524	7385	
		Mid	2433					776	1578	2060	2701	3183	3664	
		End	3525					560	1996	2857	4006	4867	5728	
73E2-100	1	Start	2917		2602	4474	6020							
		Mid	1410		1242	2291	3144							
		End	2129		1833	3705	5232							
73E2-100	2	Start	3541		2313	4185	5724	7162						
		Mid	1667		991	2040	2887	3691						
		End	2425		1224	3096	4609	6047						
73E2-100	3	Start	4675			3628	5153	6591						
		Mid	2143			1573	2411	3214						
		End	2996			1989	3475	4913						
73E2-100	4	Start	5182			3111	4624	6063						
		Mid	2433			1290	2121	2925						
		End	3525			1493	2967	4406						
73E2-125	1	Start	2917	3251	5535									
		Mid	1410	1606	2886									
		End	2129	2482	4766									
73E2-125	2	Start	3541	2962	5246									
		Mid	1667	1354	2634									
		End	2425	1873	4157									
73E2-125	3	Start	4675	2404	4689									
		Mid	2143	888	2168									
		End	2996	766	3050									
73E2-125	4	Start	5182		4172	7218								
		Mid	2433		1884	3591								
		End	3525		2554	5600								

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar											Limiting MOP, bar	
				35	50	70	85	100	125	140	160	175	190			207
			Nm	Hydraulic Torque, Nm												
14E3-80	1	Start	4808					2604	4126	5040	6257	7171	8084	9119	Symmetric	207
		Mid	2317					1085	1732	2189	2798	3254	3711	4228		
		End	3484					1280	2802	3716	4933	5847	6760	7795		
14E3-80	2	Start	5509						3618	4532	5749	6663	7576	8611	207	
		Mid	2655						1598	2108	2789	3299	3810	4388		
		End	3992						2101	3014	4232	5145	6059	7094		
14E3-80	3	Start	6418							3873	5091	6004	6917	7952	207	
		Mid	3093							1670	2351	2861	3372	3950		
		End	4651							2106	3323	4237	5150	6185		
14E3-80	4	Start	8363									4926	5840	6875	207	
		Mid	3937									2017	2527	3105		
		End	5728									2291	3204	4240		
14E3-80	5	Start	10340											6140	207	
		Mid	4695											2348		
		End	6463											2263		
14E3-100	1	Start	4808		1800	3881	5572	7171	9834	11432	13563				164	
		Mid	2317		646	1812	2744	3637	5126	6019	7210					
		End	3484		507	2588	4248	5847	8510	10108	12239					
14E3-100	2	Start	5509			3385	5064	6663	9326	10925	13055				169	
		Mid	2655			1481	2406	3299	4788	5681	6872					
		End	3992			1903	3547	5145	7809	9407	11538					
14E3-100	3	Start	6418					6004	8668	10266	12397	13995			175	
		Mid	3093					2861	4350	5243	6434	7327				
		End	4651					4237	6900	8499	10629	12228				
14E3-100	4	Start	8363					4926	7590	9188	11319	12917			185	
		Mid	3937					2017	3505	4398	5589	6482				
		End	5728					2291	4955	6553	8684	10282				
14E3-100	5	Start	10340						6856	8454	10585	12183	13781		192	
		Mid	4695						2748	3641	4832	5725	6618			
		End	6463						2978	4576	6707	8305	9903			
14E3-125	1	Start	4808	2678	5283	8757	11637								98	
		Mid	2317	1138	2598	4544	6133									
		End	3484	1385	3990	7465	10313									
14E3-125	2	Start	5509		4787	8262	11129	13797							101	
		Mid	2655		2267	4213	5795	7286								
		End	3992		3306	6780	9612	12280								
14E3-125	3	Start	6418		4144	7618	10470	13139							105	
		Mid	3093		1838	3785	5357	6848								
		End	4651		2418	5893	8703	11371								
14E3-125	4	Start	8363			6566	9393	12061							111	
		Mid	3937			2958	4513	6004								
		End	5728			3993	6758	9426								
14E3-125	5	Start	10340			5849	8659	11327							115	
		Mid	4695			2216	3755	5246								
		End	6463			2063	4781	7449								

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
14E3-140	1	Start	4808	4401	7745	12204								
		Mid	2317	2103	3977	6475								
		End	3484	3108	6452	10911								
14E3-140	2	Start	5509	3905	7249	11708								
		Mid	2655	1773	3646	6144								
		End	3992	2423	5767	10226								
14E3-140	3	Start	6418	3262	6606	11065								
		Mid	3093	1344	3217	5715								
		End	4651	1536	4880	9339								
14E3-140	4	Start	8363		5554	10012	13678							
		Mid	3937		2391	4889	6908							
		End	5728		2980	7439	11043							
14E3-140	5	Start	10340		4837	9295	12944							
		Mid	4695		1649	4147	6150							
		End	6463		1050	5509	9066							
14E3-160	1	Start	4808	7002	11461									
		Mid	2317	3561	6059									
		End	3484	5709	10168									
14E3-160	2	Start	5509	6506	10965									
		Mid	2655	3230	5728									
		End	3992	5024	9483									
14E3-160	3	Start	6418	5863	10321									
		Mid	3093	2801	5299									
		End	4651	4137	8596									
14E3-160	4	Start	8363	4810	9269									
		Mid	3937	1974	4472									
		End	5728	2237	6696									
14E3-160	5	Start	10340		8552									
		Mid	4695		3731									
		End	6463		4766									

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar											Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190		
			Nm	Hydraulic Torque, Nm											
24E3-100	1	Start	9736					6960	10340	12367	15070	17098	19125	21423	207
		Mid	4596					3073	4966	6102	7617	8752	9888	11176	
		End	6556					4010	7389	9416	12120	14147	16175	18473	
24E3-100	2	Start	11505					5661	9040	11067	13771	15798	17826	20124	207
		Mid	5463					2225	4118	5254	6769	7905	9040	10328	
		End	7856					2283	5662	7689	10393	12420	14448	16746	
24E3-100	3	Start	14916							9214	11917	13945	15972	18270	207
		Mid	6946							3802	5316	6452	7588	8876	
		End	9710							4358	7062	9089	11117	13415	
24E3-100	4	Start	17462									12654	14681	16979	207
		Mid	8027									5394	6530	7817	
		End	11001									6603	8631	10928	
24E3-100	5	Start	20190									11176	13204	15502	207
		Mid	9212									4234	5370	6657	
		End	12478									3939	5967	8265	
24E3-125	1	Start	9736		4849	9348	13037	16494	22257						133
		Mid	4596		1915	4442	6477	8414	11643						
		End	6556		1970	6469	10086	13543	19306						
24E3-125	2	Start	11505			8080	11737	15194	20957	24415					138
		Mid	5463			3613	5629	7566	10795	12732					
		End	7856			4783	8359	11816	17579	21037					
24E3-125	3	Start	14916					13341	19103	22561					146
		Mid	6946					6114	9342	11280					
		End	9710					8486	14248	17706					
24E3-125	4	Start	17462					12050	17812	21270					152
		Mid	8027					5056	8284	10221					
		End	11001					5999	11762	15220					
24E3-125	5	Start	20190					10572	16335	19793	24403				158
		Mid	9212					3896	7124	9061	11644				
		End	12478					3336	9098	12556	17166				
24E3-140	1	Start	9736		8137	13951	18763	23231							103
		Mid	4596		3762	7028	9685	12189							
		End	6556		5257	11071	15812	20281							
24E3-140	2	Start	11505		6868	12682	17463	21932							107
		Mid	5463		2932	6198	8838	11341							
		End	7856		3572	9386	14085	18554							
24E3-140	3	Start	14916			10873	15610	20078							113
		Mid	6946			4777	7385	9888							
		End	9710			6135	10755	15223							
24E3-140	4	Start	17462			9613	14319	18787							117
		Mid	8027			3742	6327	8830							
		End	11001			3709	8268	12736							
24E3-140	5	Start	20190					17310							122
		Mid	9212					7670							
		End	12478					10073							

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
24E3-160	1	Start	9736	7250	13099	20898								
		Mid	4596	3264	6549	10930								
		End	6556	4370	10219	18018								
24E3-160	2	Start	11505	5981	11830	19629								
		Mid	5463	2434	5720	10100								
		End	7856	2685	8534	16333								
24E3-160	3	Start	14916		10021	17820	24254							
		Mid	6946		4298	8679	12228							
		End	9710		5283	13082	19398							
24E3-160	4	Start	17462		8761	16560	22963							
		Mid	8027		3263	7644	11170							
		End	11001		2857	10656	16912							
24E3-160	5	Start	20190			15119	21485							
		Mid	9212			6509	10010							
		End	12478			8056	14248							
24E3-180	1	Start	9736	11186	18723									
		Mid	4596	5475	9708									
		End	6556	8307	15843									
24E3-180	2	Start	11505	9918	17454									
		Mid	5463	4645	8879									
		End	7856	6621	14158									
24E3-180	3	Start	14916	8109	15645									
		Mid	6946	3224	7458									
		End	9710	3371	10907									
24E3-180	4	Start	17462		14385	24434								
		Mid	8027		6422	12067								
		End	11001		8481	18529								
24E3-180	5	Start	20190		12943	22992								
		Mid	9212		5287	10932								
		End	12478		5881	15929								

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar											Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190		
			Nm	Hydraulic Torque, Nm											
45E3-125	1	Start	17866				10195	14103	20616	24524	29734	33642	37550	41979	207
		Mid	8411				4172	6362	10010	12200	15119	17308	19498	21979	
		End	11949				4699	8607	15120	19028	24238	28146	32054	36483	
45E3-125	2	Start	21837					12384	18897	22805	28015	31923	35831	40260	207
		Mid	10012					4794	8443	10632	13551	15741	17930	20411	
		End	13668					4729	11243	15150	20361	24269	28177	32605	
45E3-125	3	Start	23805						15599	19506	24717	28625	32533	36961	207
		Mid	11506						6980	9170	12089	14278	16467	18949	
		End	16967						9320	13228	18439	22346	26254	30683	
45E3-125	4	Start	27899							17685	22895	26803	30711	35140	207
		Mid	13172							7539	10458	12648	14837	17318	
		End	18789							9230	14441	18348	22256	26685	
45E3-125	5	Start	33034									24509	28416	32845	207
		Mid	15263									10601	12790	15271	
		End	21083									13334	17242	21671	
45E3-140	1	Start	17866			11800	17243	22395	30981	36133	43002				166
		Mid	8411			5122	8121	11007	15817	18703	22552				
		End	11949			6437	11747	16899	25485	30637	37505				
45E3-140	2	Start	21837				15524	20676	29262	34414	41283				171
		Mid	10012				6553	9439	14250	17136	20984				
		End	13668				7870	13021	21607	26759	33628				
45E3-140	3	Start	23805					17377	25963	31115	37984	43136			180
		Mid	11506					7977	12787	15673	19521	22408			
		End	16967					11099	19685	24837	31706	36857			
45E3-140	4	Start	27899					15556	24142	29293	36162	41314			186
		Mid	13172					6347	11157	14043	17891	20777			
		End	18789					7101	15687	20839	27708	32859			
45E3-140	5	Start	33034						21847	26999	33868	39019	44171		192
		Mid	15263						9110	11996	15844	18730	21616		
		End	21083						10673	15825	22694	27845	32997		
45E3-160	1	Start	17866		11204	20351	27882	34911							121
		Mid	8411		4787	9925	14081	18019							
		End	11949		5841	14987	22386	29415							
45E3-160	2	Start	21837			18673	26163	33192	44907						125
		Mid	10012			8391	12513	16451	23015						
		End	13668			11203	18508	25538	37253						
45E3-160	3	Start	23805			15454	22864	29894	41609						132
		Mid	11506			6960	11051	14989	21552						
		End	16967			9327	16586	23615	35330						
45E3-160	4	Start	27899					28072	39787						136
		Mid	13172					13359	19922						
		End	18789					19617	31332						
45E3-160	5	Start	33034					25777	37492	44521					141
		Mid	15263					11311	17875	21813					
		End	21083					14603	26318	33347					

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
45E3-180	1	Start	17866	9190	18126	30041	39939							
		Mid	8411	3656	8675	15368	20836							
		End	11949	3826	12762	24677	34443							
45E3-180	2	Start	21837		16448	28363	38220							
		Mid	10012		7141	13834	19268							
		End	13668		8978	20893	30566							
45E3-180	3	Start	23805		13229	25144	34922	44078						
		Mid	11506		5710	12403	17806	22936						
		End	16967		7102	19017	28643	37800						
45E3-180	4	Start	27899			23366	33100	42257						
		Mid	13172			10808	16176	21306						
		End	18789			15115	24645	33802						
45E3-180	5	Start	33034			21127	30805	39962						
		Mid	15263			8805	14128	19258						
		End	21083			10222	19631	28788						
45E3-200	1	Start	17866	14605	25862	40871								
		Mid	8411	6697	13021	21452								
		End	11949	9241	20498	35507								
45E3-200	2	Start	21837	12927	24184	39193								
		Mid	10012	5164	11487	19918								
		End	13668	5457	16714	31723								
45E3-200	3	Start	23805		20965	35974								
		Mid	11506		10056	18487								
		End	16967		14838	29847								
45E3-200	4	Start	27899		19187	34196	45453							
		Mid	13172		8461	16892	23215							
		End	18789		10936	25946	37202							
45E3-200	5	Start	33034		16948	31957	44281							
		Mid	15263		6457	14888	21678							
		End	21083		6043	21052	33107							

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar											Limiting MOP, bar	
				35	50	70	85	100	125	140	160	175	190			207
			Nm	Hydraulic Torque, Nm												
10E4-160	1	Start	35201				19505	27399	40556	48450	58975	66869	74763	83710	207	
		Mid	17054				8366	12788	20159	24582	30478	34901	39323	44335		
		End	25227				10359	18253	31410	39304	49829	57723	65617	74563		
10E4-160	2	Start	44671					23935	37092	44986	55511	63405	71299	80245	207	
		Mid	20691					9228	16598	21021	26918	31340	35763	40775		
		End	28691					9006	22163	30057	40582	48476	56370	65316		
10E4-160	3	Start	52368						29215	37109	47635	55529	63423	72369	207	
		Mid	25096						12287	16709	22606	27028	31451	36463		
		End	36567						14647	22541	33066	40960	48854	57800		
10E4-160	4	Start	65896									50659	58553	67499	207	
		Mid	30269									21964	26387	31399		
		End	41437									27750	35644	44591		
10E4-180	1	Start	35201				23142	34200	44687	62166	72653	86636	97123			179
		Mid	17054				10492	16598	22474	32266	38141	45975	51850			
		End	25227				14216	25054	35541	53020	63507	77490	87977			
10E4-180	2	Start	44671					30736	41223	58701	69189	83171	93659			184
		Mid	20691					13038	18913	28705	34580	42414	48289			
		End	28691					15807	26294	43773	54260	68243	78730			
10E4-180	3	Start	52368						33347	50825	61312	75295	85782	96269		195
		Mid	25096						14601	24393	30269	38102	43978	49853		
		End	36567						18778	36256	46744	60726	71214	81701		
10E4-180	4	Start	65896							45956	56443	70425	80913	91400		202
		Mid	30269							19329	25204	33038	38913	44789		
		End	41437							23047	33534	47517	58004	68491		
10E4-200	1	Start	35201				18924	36341	50624	64009	86318	99703				140
		Mid	17054				8123	17907	25799	33298	45797	53296				
		End	25227				9998	27415	41477	54863	77172	90557				
10E4-200	2	Start	44671					32960	47159	60545	82854	96239				144
		Mid	20691					14423	22239	29738	42236	49735				
		End	28691					18391	32230	45616	67925	81310				
10E4-200	3	Start	52368						25274	39283	52668	74977	88363			153
		Mid	25096						10204	17927	25426	37924	45423			
		End	36567						11056	24714	38100	60409	73794			
10E4-200	4	Start	65896							47799	70108	83493	101340			158
		Mid	30269							20362	32860	40359	50358			
		End	41437							24890	47199	60584	78432			

Symmetric

Output Torque – Metric – Nm

SR - SYMMETRIC YOKE

Spring Return Symmetrical Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
10E4-220	1	Start	35201		29344	50930	68776	85365						
		Mid	17054		13977	26102	35969	45263						
		End	25227		20419	42004	59630	76218						
10E4-220	2	Start	44671		25963	47549	65312	81900						
		Mid	20691		10492	22618	32408	41702						
		End	28691		11394	32980	50383	66971						
10E4-220	3	Start	52368			39862	57435	74024	101672					
		Mid	25096			18399	28097	37390	52880					
		End	36567			25645	42867	59455	87103					
10E4-220	4	Start	65896			35110	52566	69154	96802					
		Mid	30269			13443	23032	32326	47815					
		End	41437			12753	29657	46246	73894					
10E4-250	1	Start	35201	25399	46836	75418	99246							
		Mid	17054	11761	23802	39857	53039							
		End	25227	16474	37910	66492	90100							
10E4-250	2	Start	44671	22019	43455	72037	95781							
		Mid	20691	8277	20318	36373	49479							
		End	28691	7449	28886	57468	80853							
10E4-250	3	Start	52368		35769	64351	87905							
		Mid	25096		16099	32154	45167							
		End	36567		21551	50133	73336							
10E4-250	4	Start	65896		31016	59598	83035							
		Mid	30269		11144	27199	40103							
		End	41437		8660	37242	60127							

Symmetric

Limiting MOP, bar

113

116

123

128

85

88

93

97

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, bar												Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207		
DA	DD	Pressure on		Hydraulic Torque, Nm												
12E2-32		CW / Rod End	Start	84	120	168	208	245	306	343	392	429			Canted	181
			Mid	55	79	110	137	161	201	226	258	282				
			End	120	171	239	298	350	438	490	560	613				
		CCW / Cap End	Start	227	324	454	564	664	830	930	1062	1162				
			Mid	105	150	209	260	306	382	428	489	535				
			End	159	227	318	395	465	581	651	744	814				
12E2-40		CW / Rod End	Start	173	247	346	431	507							116	
			Mid	114	163	228	283	333								
			End	247	353	495	615	724								
		CCW / Cap End	Start	355	507	709	882	1037								
			Mid	164	234	327	406	478								
			End	248	355	497	617	726								
12E2-50		CW / Rod End	Start	313	447	626									74	
			Mid	206	295	412										
			End	447	638	893										
		CCW / Cap End	Start	554	791	1108										
			Mid	256	365	511										
			End	388	554	776										
12E2-63		CW / Rod End	Start	541											48	
			Mid	356												
			End	772												
		CCW / Cap End	Start	880												
			Mid	406												
			End	616												
	12E2-32	CW / Rod End	Start	243	347	485	604	710							118	
			Mid	160	228	320	397	467								
			End	347	495	693	862	1014								
		CCW / Cap End	Start	347	495	693	862	1014								
			Mid	160	228	320	397	467								
			End	243	347	485	604	710								
	12E2-40	CW / Rod End	Start	421	602	843									70	
			Mid	278	397	555										
			End	602	860	1204										
		CCW / Cap End	Start	602	860	1204										
			Mid	278	397	555										
			End	421	602	843										
	12E2-50	CW / Rod End	Start	701											42	
			Mid	462												
			End	1001												
		CCW / Cap End	Start	1001												
			Mid	462												
			End	701												

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke																	
DA Configuration: HPM on Right Side of TM																	
Actuator		Rotation Direction	Position	Operating Pressure, bar												Limiting MOP, bar	
DA	DD	Pressure on		35	50	70	85	100	125	140	160	175	190	207			
Hydraulic Torque, Nm																	
18E2-40		CW / Rod End	Start	189	270	378	470	553	692	775					Canted	139	
			Mid	125	178	249	309	364	455	509							
			End	270	386	540	672	790	988	1106							
		CCW / Cap End	Start	443	633	886	1102	1297	1621	1816							
			Mid	205	292	409	507	597	746	836							
			End	310	443	621	772	908	1135	1271							
18E2-50		CW / Rod End	Start	364	520	727	883							89			
			Mid	240	342	479	582										
			End	519	742	1039	1261										
		CCW / Cap End	Start	693	989	1385	1682										
			Mid	320	457	639	776										
			End	485	693	970	1178										
18E2-63		CW / Rod End	Start	649	927											57	
			Mid	427	611												
			End	926	1323												
		CCW / Cap End	Start	1099	1571												
			Mid	507	725												
			End	770	1100												
18E2-80		CW / Rod End	Start	1120										36			
			Mid	738													
			End	1600													
		CCW / Cap End	Start	1773													
			Mid	818													
			End	1241													
	18E2-40	CW / Rod End	Start	499	713	999	1242								86		
			Mid	329	470	658	817										
			End	713	1019	1427	1774										
		CCW / Cap End	Start	713	1019	1427	1774										
			Mid	329	470	658	817										
			End	499	713	999	1242										
	18E2-50	CW / Rod End	Start	849	1212									52			
			Mid	559	799												
			End	1212	1731												
		CCW / Cap End	Start	1212	1731												
			Mid	559	799												
			End	849	1212												

Canted

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, bar												Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207		
DA	DD	Pressure on		Hydraulic Torque, Nm												
45E2-50		CW / Rod End	Start	473	675	946	1176	1383	1729	1937	2213				Canted	171
			Mid	312	445	623	773	909	1137	1273	1455					
			End	675	965	1350	1679	1976	2469	2766	3161					
		CCW / Cap End	Start	900	1286	1801	2239	2634	3293	3688	4215					
			Mid	415	593	831	1031	1212	1516	1697	1940					
			End	630	901	1261	1568	1844	2306	2582	2951					
45E2-63		CW / Rod End	Start	843	1205	1686	2097	2467								108
			Mid	556	794	1111	1379	1622								
			End	1204	1720	2408	2995	3523								
		CCW / Cap End	Start	1429	2042	2858	3555	4182								
			Mid	660	942	1319	1636	1925								
			End	1001	1430	2002	2489	2928								
45E2-80		CW / Rod End	Start	1456	2080											68
			Mid	960	1371											
			End	2080	2971											
		CCW / Cap End	Start	2305	3292											
			Mid	1063	1519											
			End	1614	2305											
45E2-100		CW / Rod End	Start	2364											44	
			Mid	1558												
			End	3376												
		CCW / Cap End	Start	3601												
			Mid	1662												
			End	2521												
	45E2-50	CW / Rod End	Start	1103	1576	2206	2744								98	
			Mid	727	1039	1454	1804									
			End	1575	2251	3151	3918									
		CCW / Cap End	Start	1575	2251	3151	3918									
			Mid	727	1039	1454	1804									
			End	1103	1576	2206	2744									
	45E2-63	CW / Rod End	Start	1844	2634										60	
			Mid	1215	1736											
			End	2633	3762											
		CCW / Cap End	Start	2633	3762											
			Mid	1215	1736											
			End	1844	2634											
	45E2-80	CW / Rod End	Start	3070											36	
			Mid	2023												
			End	4384												
		CCW / Cap End	Start	4384												
			Mid	2023												
			End	3070												

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke															
DA Configuration: HPM on Right Side of TM															
Actuator		Rotation Direction	Position	Operating Pressure, bar											Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207	
DA	DD	Pressure on		Hydraulic Torque, Nm											
73E2-50	CW / Rod End	Start		458	654	916	1139	1340	1675	1876	2144	2345	2546	2774	207
		Mid		302	431	604	749	881	1101	1233	1410	1542	1674	1824	
		End		654	935	1308	1627	1914	2393	2680	3063	3350	3637	3962	
	CCW / Cap End	Start		1108	1583	2216	2756	3242	4053	4539	5187	5674	6160	6711	
		Mid		511	730	1023	1268	1492	1865	2089	2388	2611	2835	3089	
		End		776	1108	1552	1930	2270	2838	3178	3632	3973	4313	4699	
73E2-63	CW / Rod End	Start		914	1306	1828	2273	2674	3343	3744					142
		Mid		602	860	1205	1494	1758	2197	2461					
		End		1305	1865	2610	3246	3819	4774	5347					
	CCW / Cap End	Start		1759	2513	3518	4375	5147	6434	7206					
		Mid		812	1160	1623	2014	2369	2961	3317					
		End		1232	1760	2463	3063	3604	4505	5046					
73E2-80	CW / Rod End	Start		1668	2383	3337	4149								88
		Mid		1099	1571	2199	2728								
		End		2383	3404	4765	5926								
	CCW / Cap End	Start		2836	4052	5673	7055								
		Mid		1309	1870	2618	3247								
		End		1986	2837	3972	4940								
73E2-100	CW / Rod End	Start		2786	3979										58
		Mid		1836	2622										
		End		3978	5683										
	CCW / Cap End	Start		4432	6331										
		Mid		2045	2922										
		End		3103	4433										
73E2-125	CW / Rod End	Start		4531											37
		Mid		2986											
		End		6471											
	CCW / Cap End	Start		6925											
		Mid		3196											
		End		4849											
	73E2-50	CW / Rod End	Start	1234	1763	2468	3069	3610	4513	5054					142
			Mid	813	1162	1626	2017	2373	2967	3323					
			End	1762	2517	3524	4383	5156	6445	7219					
		CCW / Cap End	Start	1762	2517	3524	4383	5156	6445	7219					
			Mid	813	1162	1626	2017	2373	2967	3323					
			End	1234	1763	2468	3069	3610	4513	5054					
	73E2-63	CW / Rod End	Start	2146	3065	4291	5211								81
			Mid	1414	2020	2828	3434								
			End	3064	4378	6129	7442								
		CCW / Cap End	Start	3064	4378	6129	7442								
			Mid	1414	2020	2828	3434								
			End	2146	3065	4291	5211								
	73E2-80	CW / Rod End	Start	3654											49
			Mid	2408											
			End	5219											
		CCW / Cap End	Start	5219											
			Mid	2408											
			End	3654											

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, bar												Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207		
DA	DD	Pressure on		Hydraulic Torque, Nm												
14E3-63		CW / Rod End	Start	873	1247	1746	2171	2554	3193	3576	4087	4470	4853	5288	207	
			Mid	575	822	1151	1427	1679	2099	2351	2687	2939	3190	3476		
			End	1247	1781	2494	3101	3648	4560	5107	5837	6384	6931	7552		
		CCW / Cap End	Start	2089	2984	4178	5195	6112	7640	8557	9779	10696	11613	12652		
			Mid	964	1377	1928	2391	2813	3517	3939	4501	4923	5345	5824		
			End	1463	2090	2925	3638	4280	5350	5992	6848	7490	8131	8859		
14E3-80		CW / Rod End	Start	1769	2527	3538	4399	5176	6470	7246					142	
			Mid	1166	1665	2331	2892	3402	4253	4763						
			End	2526	3609	5052	6283	7392	9240	10348						
		CCW / Cap End	Start	3368	4812	6737	8377	9856	12320	13798						
			Mid	1554	2220	3109	3856	4536	5671	6351						
			End	2359	3369	4717	5866	6901	8626	9661						
14E3-100		CW / Rod End	Start	3096	4422	6191	7699								91	
			Mid	2040	2914	4080	5061									
			End	4421	6316	8842	10995									
		CCW / Cap End	Start	5263	7519	10526	13090									
			Mid	2429	3469	4857	6025									
			End	3685	5265	7370	9165									
14E3-125		CW / Rod End	Start	5168	7384										60	
			Mid	3406	4866											
			End	7381	10545											
		CCW / Cap End	Start	8223	11748											
			Mid	3795	5421											
			End	5758	8226											
14E3-140		CW / Rod End	Start	6633											47	
			Mid	4372												
			End	9473												
		CCW / Cap End	Start	10316												
			Mid	4760												
			End	7223												
	14E3-63	CW / Rod End	Start	2336	3337	4671	5809	6834	8543	9568					143	
			Mid	1539	2199	3079	3819	4493	5616	6290						
			End	3336	4765	6671	8296	9760	12200	13664						
		CCW / Cap End	Start	3336	4765	6671	8296	9760	12200	13664						
			Mid	1539	2199	3079	3819	4493	5616	6290						
			End	2336	3337	4671	5809	6834	8543	9568						
	14E3-80	CW / Rod End	Start	4127	5896	8255									81	
			Mid	2720	3886	5440										
			End	5895	8421	11789										
		CCW / Cap End	Start	5895	8421	11789										
			Mid	2720	3886	5440										
			End	4127	5896	8255										
	14E3-100	CW / Rod End	Start	6781	9687										51	
			Mid	4469	6384											
			End	9684	13834											
		CCW / Cap End	Start	9684	13834											
			Mid	4469	6384											
			End	6781	9687											

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, bar												Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207		
DA	DD	Pressure on		Hydraulic Torque, Nm												
24E3-80		CW / Rod End	Start	2153	3076	4306	5358	6304	7880	8825	10086	11031			Canted	182
			Mid	1423	2032	2845	3531	4154	5193	5816	6647	7270				
			End	3075	4393	6150	7652	9003	11253	12604	14404	15754				
		CCW / Cap End	Start	4498	6426	8996	11194	13169	16462	18437	21071	23046				
			Mid	2081	2973	4162	5166	6077	7596	8508	9723	10635				
			End	3150	4500	6299	7838	9221	11527	12910	14754	16137				
24E3-100		CW / Rod End	Start	3925	5607	7850	9767	11491								117
			Mid	2593	3705	5187	6437	7573								
			End	5605	8007	11210	13949	16410								
		CCW / Cap End	Start	7028	10041	14057	17491	20577								
			Mid	3252	4646	6504	8071	9495								
			End	4921	7031	9843	12247	14408								
24E3-125		CW / Rod End	Start	6693	9562	13386										75
			Mid	4423	6318	8845										
			End	9559	13655	19117										
		CCW / Cap End	Start	10982	15689	21964										
			Mid	5081	7259	10162										
			End	7690	10985	15379										
24E3-140		CW / Rod End	Start	8649	12356										61	
			Mid	5715	8165											
			End	12353	17646											
		CCW / Cap End	Start	13776	19680											
			Mid	6374	9105											
			End	9646	13780											
24E3-160		CW / Rod End	Start	11602											47	
			Mid	7666												
			End	16570												
		CCW / Cap End	Start	17993												
			Mid	8325												
			End	12599												
	24E3-80	CW / Rod End	Start	5303	7575	10606	13196	15525							108	
			Mid	3504	5006	7008	8697	10231								
			End	7573	10819	15146	18846	22172								
		CCW / Cap End	Start	7573	10819	15146	18846	22172								
			Mid	3504	5006	7008	8697	10231								
			End	5303	7575	10606	13196	15525								
	24E3-100	CW / Rod End	Start	8846	12637										66	
			Mid	5845	8351											
			End	12634	18048											
		CCW / Cap End	Start	12634	18048											
			Mid	5845	8351											
			End	8846	12637											
	24E3-125	CW / Rod End	Start	14383											41	
			Mid	9504												
			End	20541												
		CCW / Cap End	Start	20541												
			Mid	9504												
			End	14383												

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke																
DA Configuration: HPM on Right Side of TM																
Actuator		Rotation Direction	Position	Operating Pressure, bar												Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207		
DA	DD	Pressure on		Hydraulic Torque, Nm												
45E3-100		CW / Rod End	Start	4158	5939	8315	10346	12172	15215	17041	19475	21301			Canted	178
			Mid	2747	3925	5494	6818	8022	10027	11230	12835	14038				
			End	5938	8482	11875	14776	17384	21730	24337	27814	30421				
		CCW / Cap End	Start	8650	12358	17301	21527	25326	31657	35456	40521	44320				
			Mid	4002	5718	8005	9934	11687	14608	16361	18699	20452				
			End	6057	8653	12114	15073	17733	22167	24827	28373	31033				
45E3-125		CW / Rod End	Start	7565	10807	15129	18825	22147							114	
			Mid	4999	7141	9997	12406	14596								
			End	10804	15434	21607	26885	31629								
		CCW / Cap End	Start	13516	19309	27033	33636	39572								
			Mid	6254	8934	12507	15521	18260								
			End	9464	13520	18928	23552	27708								
45E3-140		CW / Rod End	Start	9972	14246	19945	24817								91	
			Mid	6590	9414	13179	16355									
			End	14242	20346	28484	35442									
		CCW / Cap End	Start	16955	24221	33910	42193									
			Mid	7845	11207	15689	19470									
			End	11872	16960	23744	29544									
45E3-160		CW / Rod End	Start	13607	19438	27213									71	
			Mid	8991	12844	17982										
			End	19432	27760	38865										
		CCW / Cap End	Start	22145	31636	44290										
			Mid	10246	14637	20492										
			End	15506	22152	31012										
45E3-180		CW / Rod End	Start	17725	25322										56	
			Mid	11713	16732											
			End	25315	36164											
		CCW / Cap End	Start	28027	40039											
			Mid	12968	18525											
			End	19625	28036											

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke																	
DA Configuration: HPM on Right Side of TM																	
Actuator		Rotation Direction	Position	Operating Pressure, bar										Limiting MOP, bar			
DA	DD	Pressure on		35	50	70	85	100	125	140	160	175	190		207		
Hydraulic Torque, Nm																	
	45E3-100	CW / Rod End	Start	10215	14592	20429	25420	29905							Canted	105	
			Mid	6750	9642	13499	16752	19708									
			End	14588	20840	29176	36303	42709									
		CCW / Cap End	Start	14588	20840	29176	36303	42709									65
			Mid	6750	9642	13499	16752	19708									
			End	10215	14592	20429	25420	29905									
	45E3-125	CW / Rod End	Start	17029	24327											50	
			Mid	11252	16075												
			End	24320	34743												
		CCW / Cap End	Start	24320	34743												38
			Mid	11252	16075												
			End	17029	24327												
	45E3-140	CW / Rod End	Start	21844	31206											38	
			Mid	14434	20620												
			End	31197	44567												
		CCW / Cap End	Start	31197	44567												
			Mid	14434	20620												
			End	21844	31206												
	45E3-160	CW / Rod End	Start	29113												38	
			Mid	19237													
			End	41577													
		CCW / Cap End	Start	41577													
			Mid	19237													
			End	29113													

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke															
DA Configuration: HPM on Right Side of TM															
Actuator		Rotation Direction	Position	Operating Pressure, bar											Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190		
DA	DD	Pressure on		Hydraulic Torque, Nm											
10E4-125		CW / Rod End	Start	7917	11310	15835	19702	23179	28974	32451	37087	40564	44041	47981	207
			Mid	5232	7474	10463	12984	15276	19095	21386	24441	26733	29024	31621	
			End	11307	16153	22614	28138	33104	41379	46345	52966	57931	62897	68524	
		CCW / Cap End	Start	16473	23533	32946	40994	48228	60285	67519	77164	84399	91633	99832	
			Mid	7622	10888	15243	18917	22255	27819	31157	35608	38946	42284	46068	
			End	11535	16478	23069	28704	33769	42212	47277	54031	59097	64162	69903	
10E4-140		CW / Rod End	Start	10852	15502	21703	27005	31770	39713	44478	50833				165
			Mid	7171	10244	14341	17797	20937	26172	29312	33500				
			End	15498	22140	30996	38567	45373	56716	63522	72596				
		CCW / Cap End	Start	20664	29520	41327	51422	60497	75621	84696	96795				
			Mid	9561	13658	19121	23729	27917	34896	39083	44667				
			End	14469	20670	28938	36006	42360	52951	59305	67777				
10E4-160		CW / Rod End	Start	15281	21830	30562	38027	44738	55922						127
			Mid	10097	14425	20195	25061	29483	36854						
			End	21823	31176	43647	54308	63892	79865						
		CCW / Cap End	Start	26989	38556	53979	67164	79016	98771						
			Mid	12487	17839	24975	30993	36463	45578						
			End	18898	26997	37796	47029	55328	69160						
10E4-180		CW / Rod End	Start	20301	29001	40601	50519	59434							100
			Mid	13414	19163	26828	33293	39169							
			End	28992	41418	57985	72149	84881							
		CCW / Cap End	Start	34158	48798	68317	85004	100005							
			Mid	15804	22578	31609	39226	46148							
			End	23918	34169	47836	59521	70024							
10E4-200		CW / Rod End	Start	25911	37016	51822									81
			Mid	17121	24459	34243									
			End	37005	52864	74010									
		CCW / Cap End	Start	42171	60244	84342									
			Mid	19512	27874	39023									
			End	29528	42183	59057									
10E4-220		CW / Rod End	Start	32112	45874										69
			Mid	21219	30313										
			End	45861	65515										
		CCW / Cap End	Start	51027	72895										
			Mid	23609	33727										
			End	35729	51042										
10E4-250		CW / Rod End	Start	42521	60744										53
			Mid	28097	40138										
			End	60726	86751										
		CCW / Cap End	Start	65892	94131										
			Mid	30487	43553										
			End	46138	65911										

Output Torque – Metric – Nm

DA - CANTED YOKE

Double Acting Canted Yoke															
DA Configuration: HPM on Right Side of TM															
Actuator		Rotation Direction	Position	Operating Pressure, bar											Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207	
DA	DD	Pressure on		Hydraulic Torque, Nm											
	10E4-125	CW / Rod End	Start	19452	27788	38904	48407	56949	71186						123
			Mid	12853	18362	25707	31901	37531	46913						
			End	27780	39686	55560	69132	81331	101664						
		CCW / Cap End	Start	27780	39686	55560	69132	81331	101664						
			Mid	12853	18362	25707	31901	37531	46913						
			End	19452	27788	38904	48407	56949	71186						
	10E4-140	CW / Rod End	Start	25321	36172	50641	63011								94
			Mid	16731	23902	33462	41526								
			End	36162	51659	72323	89989								
		CCW / Cap End	Start	36162	51659	72323	89989								
			Mid	16731	23902	33462	41526								
			End	25321	36172	50641	63011								
	10E4-160	CW / Rod End	Start	34179	48827	68358									70
			Mid	22585	32264	45169									
			End	48813	69733	97626									
		CCW / Cap End	Start	48813	69733	97626									
			Mid	22585	32264	45169									
			End	34179	48827	68358									
	10E4-180	CW / Rod End	Start	44219	63170										55
			Mid	29219	41741										
			End	63151	90216										
		CCW / Cap End	Start	63151	90216										
			Mid	29219	41741										
			End	44219	63170										
	10E4-200	CW / Rod End	Start	67841											44
			Mid	44828											
			End	96888											
		CCW / Cap End	Start	96888											
			Mid	44828											
			End	67841											

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
			Nm	35	50	70	85	100	125	140	160	175	190	207
				Hydraulic Torque, Nm										
12E2-40	1	Start	400					327	497	600	736	838	940	1056
		Mid	218					109	188	235	298	346	393	447
		End	376					100	220	291	386	458	529	611
12E2-40	2	Start	517							511	647	749	852	967
		Mid	278							178	241	289	336	390
		End	470							181	277	348	420	501
12E2-40	3	Start	661									571	673	789
		Mid	369									203	250	304
		End	660									213	284	365
12E2-50	1	Start	400			507	692	876	1184					
		Mid	218			192	278	363	506					
		End	376			226	356	485	700					
12E2-50	2	Start	517			419	603	788	1095					
		Mid	278			136	221	307	449					
		End	470			117	246	375	590					
12E2-50	3	Start	661					609	917	1101				
		Mid	369					220	363	448				
		End	660					239	455	584				
12E2-63	1	Start	400	390	709	1135								
		Mid	218	138	286	483								
		End	376	145	368	666								
12E2-63	2	Start	517		621	1046								
		Mid	278		229	426								
		End	470		258	556								
12E2-63	3	Start	661		442	868	1187							
		Mid	369		143	340	488							
		End	660		123	420	644							
12E2-80	1	Start	400	910										
		Mid	218	379										
		End	376	508										
12E2-80	2	Start	517	821										
		Mid	278	322										
		End	470	398										
12E2-80	3	Start	661	643	1184									
		Mid	369	236	487									
		End	660	263	642									

Canted

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
18E2-50	1	Start	588				645	873	1253	1481	1785			
		Mid	342				252	357	532	637	777			
		End	646				316	476	742	902	1114			
18E2-50	2	Start	719				543	771	1150	1378	1682			
		Mid	409				186	291	466	571	711			
		End	749				186	345	611	771	984			
18E2-50	3	Start	1147							1091	1395	1623		
		Mid	615							364	504	609		
		End	1037							343	556	715		
18E2-63	1	Start	588		692	1221	1657							
		Mid	342		276	520	718							
		End	646		352	723	1025							
18E2-63	2	Start	719		592	1121	1555							
		Mid	409		211	455	652							
		End	749		225	595	894							
18E2-63	3	Start	1147				1267	1674						
		Mid	615				445	632						
		End	1037				466	751						
18E2-80	1	Start	588	969	1654									
		Mid	342	403	720									
		End	646	546	1026									
18E2-80	2	Start	719	868	1554									
		Mid	409	338	655									
		End	749	418	898									
18E2-80	3	Start	1147		1273									
		Mid	615		452									
		End	1037		480									

Canted

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar											Limiting MOP, bar	
				35	50	70	85	100	125	140	160	175	190	207		
			Nm	Hydraulic Torque, Nm												
45E2-63	1	Start	1249			1137	1693	2221	3102	3631	4335				165	
		Mid	710			416	668	912	1317	1560	1885					
		End	1302			467	848	1218	1835	2205	2698					
45E2-63	2	Start	1654				1232	1761	2641	3170	3875	4403			178	
		Mid	949				429	672	1078	1321	1646	1889				
		End	1763				443	813	1430	1800	2294	2664				
45E2-63	3	Start	2393						2015	2543	3248	3777	4305		195	
		Mid	1336						691	934	1259	1502	1745			
		End	2389						691	1061	1555	1925	2295			
45E2-63	4	Start	3090								2963	3491	4020		204	
		Mid	1631									964	1207	1450		
		End	2675									857	1227	1598		
45E2-80	1	Start	1249			1699	2888	3870							95	
		Mid	710			676	1224	1670								
		End	1302			861	1693	2373								
45E2-80	2	Start	1654			1250	2438	3409	4322						103	
		Mid	949			442	990	1431	1851							
		End	1763			465	1297	1968	2607							
45E2-80	3	Start	2393				1826	2783	3695						113	
		Mid	1336				611	1044	1464							
		End	2389				576	1229	1868							
45E2-80	4	Start	3090						3410						118	
		Mid	1631							1170						
		End	2675							1171						
45E2-100	1	Start	1249		2104	3551									60	
		Mid	710		863	1530										
		End	1302		1144	2157										
45E2-100	2	Start	1654		1655	3101									64	
		Mid	949		629	1296										
		End	1763		749	1762										
45E2-100	3	Start	2393			2490	4419								71	
		Mid	1336			917	1808									
		End	2389			1041	2391									
45E2-100	4	Start	3090				4140								74	
		Mid	1631				1519									
		End	2675				1710									

Canted

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
73E2-63	1	Start	2480						2189	2761	3525	4098	4671	5320
		Mid	1410						787	1051	1403	1666	1930	2229
		End	2585						863	1264	1799	2200	2601	3056
73E2-63	2	Start	3010							2402	3166	3739	4312	4961
		Mid	1667							794	1146	1409	1673	1972
		End	2944							734	1269	1670	2071	2525
73E2-63	3	Start	3974									3046	3618	4268
		Mid	2143									933	1197	1495
		End	3638									706	1107	1562
73E2-63	4	Start	4405											3626
		Mid	2433											1206
		End	4280											1130
73E2-80	1	Start	2480			2241	3341	4386	6129	7175				
		Mid	1410			819	1318	1799	2601	3082				
		End	2585			915	1669	2402	3622	4354				
73E2-80	2	Start	3010				2981	4027	5770	6816				
		Mid	1667				1061	1542	2344	2826				
		End	2944				1139	1872	3092	3824				
73E2-80	3	Start	3974					3334	5077	6122				
		Mid	2143					1066	1868	2349				
		End	3638					908	2128	2860				
73E2-80	4	Start	4405						4435	5481	6875			
		Mid	2433						1578	2060	2701			
		End	4280						1697	2429	3405			
73E2-100	1	Start	2480		3159	5432	7137							
		Mid	1410		1242	2291	3078							
		End	2585		1558	3150	4343							
73E2-100	2	Start	3010		2808	5081	6950							
		Mid	1667		991	2040	2887							
		End	2944		1040	2632	3918							
73E2-100	3	Start	3974			4404	6256							
		Mid	2143			1573	2411							
		End	3638			1691	2954							
73E2-100	4	Start	4405			3777	5614	7360						
		Mid	2433			1290	2121	2925						
		End	4280			1269	2523	3745						
73E2-125	1	Start	2480	3947	6720									
		Mid	1410	1606	2886									
		End	2585	2110	4052									
73E2-125	2	Start	3010	3596	6369									
		Mid	1667	1354	2634									
		End	2944	1592	3534									
73E2-125	3	Start	3974		5692									
		Mid	2143		2168									
		End	3638		2593									
73E2-125	4	Start	4405		5066									
		Mid	2433		1884									
		End	4280		2171									

Canted

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar												Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207		
			Nm	Hydraulic Torque, Nm												
14E3-80	1	Start	4087					3162	5010	6118	7597	8706	9814	11071	Canted	207
		Mid	2317					1085	1936	2446	3127	3637	4147	4726		
		End	4230					1088	2382	3159	4194	4970	5747	6626		
14E3-80	2	Start	4683						4393	5502	6980	8089	9198	10454	207	
		Mid	2655						1598	2108	2789	3299	3810	4388		
		End	4847						1786	2563	3598	4374	5150	6030		
14E3-80	3	Start	5456							4702	6180	7289	8398	9655	207	
		Mid	3093							1670	2351	2861	3372	3950		
		End	5646							1790	2825	3602	4378	5258		
14E3-80	4	Start	7110									5981	7090	8346	207	
		Mid	3937									2017	2527	3105		
		End	6955									1948	2724	3604		
14E3-80	5	Start	8790											7455	207	
		Mid	4695											2348		
		End	7846											1923		
14E3-100	1	Start	4087			4711	6765	8706	11939	13880					Canted	141
		Mid	2317			1812	2744	3637	5126	6019						
		End	4230			2200	3612	4970	7235	8593						
14E3-100	2	Start	4683			4109	6149	8089	11323	13263					146	
		Mid	2655			1481	2406	3299	4788	5681						
		End	4847			1618	3015	4374	6639	7997						
14E3-100	3	Start	5456					7289	10523	12463					152	
		Mid	3093					2861	4350	5243						
		End	5646					3602	5866	7225						
14E3-100	4	Start	7110					5981	9215	11155	13742				162	
		Mid	3937					2017	3505	4398	5589					
		End	6955					1948	4212	5571	7382					
14E3-100	5	Start	8790						8323	10264	12851				169	
		Mid	4695						2748	3641	4832					
		End	7846						2532	3890	5702					
14E3-125	1	Start	4087	3251	6414	10632	13796								Canted	84
		Mid	2317	1138	2598	4544	6004									
		End	4230	1177	3392	6346	8561									
14E3-125	2	Start	4683		5812	10030	13511								87	
		Mid	2655		2267	4213	5795									
		End	4847		2810	5764	8171									
14E3-125	3	Start	5456		5031	9249	12712								91	
		Mid	3093		1838	3785	5357									
		End	5646		2056	5009	7398									
14E3-125	4	Start	7110			7972	11403								97	
		Mid	3937			2958	4513									
		End	6955			3394	5745									
14E3-125	5	Start	8790			7101	10512	13752							101	
		Mid	4695			2216	3755	5246								
		End	7846			1753	4064	6332								

Canted

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke																	
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar												Limiting MOP, bar	
				35	50	70	85	100	125	140	160	175	190	207			
			Nm	Hydraulic Torque, Nm													
14E3-140	1	Start	4087	5343	9403										Canted	67	
		Mid	2317	2103	3977												
		End	4230	2642	5485												
14E3-140	2	Start	4683	4741	8801	14214								69			
		Mid	2655	1773	3646	6144											
		End	4847	2060	4903	8693											
14E3-140	3	Start	5456	3960	8020	13433								71			
		Mid	3093	1344	3217	5715											
		End	5646	1306	4149	7939											
14E3-140	4	Start	7110		6742	12156								76			
		Mid	3937		2391	4889											
		End	6955		2534	6324											
14E3-140	5	Start	8790			11285								79			
		Mid	4695			4147											
		End	7846			4683											
14E3-160	1	Start	4087	8501	13914											Canted	50
		Mid	2317	3561	6059												
		End	4230	4853	8644												
14E3-160	2	Start	4683	7899	13312									52			
		Mid	2655	3230	5728												
		End	4847	4271	8062												
14E3-160	3	Start	5456	7118	12531									54			
		Mid	3093	2801	5299												
		End	5646	3517	7307												
14E3-160	4	Start	7110	5840	11254									58			
		Mid	3937	1974	4472												
		End	6955	1902	5692												
14E3-160	5	Start	8790		10383									60			
		Mid	4695		3731												
		End	7846		4051												

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
24E3-100	1	Start	8277					8450	12553	15015	18297	20758	23220	
		Mid	4596					3073	4966	6102	7617	8752	9888	
		End	7960					3409	6281	8005	10303	12027	13750	
24E3-100	2	Start	9780						10975	13437	16719	19180	21642	24432
		Mid	5463						4118	5254	6769	7905	9040	10328
		End	9538						4813	6537	8835	10559	12282	14236
24E3-100	3	Start	12680							11186	14468	16930	19391	22181
		Mid	6946							3802	5316	6452	7588	8876
		End	11788							3705	6003	7727	9450	11404
24E3-100	4	Start	14845									15362	17824	20614
		Mid	8027									5394	6530	7817
		End	13356									5613	7337	9290
24E3-100	5	Start	17164										16030	18820
		Mid	9212										5370	6657
		End	15149										5072	7026
24E3-125	1	Start	8277		5887	11349	15827	20025						
		Mid	4596		1915	4442	6477	8414						
		End	7960		1674	5499	8574	11513						
24E3-125	2	Start	9780			9809	14249	18447						
		Mid	5463			3613	5629	7566						
		End	9538			4066	7106	10045						
24E3-125	3	Start	12680				11999	16197	23193					
		Mid	6946				4177	6114	9342					
		End	11788				4274	7214	12112					
24E3-125	4	Start	14845					14629	21626					
		Mid	8027					5056	8284					
		End	13356					5100	9999					
24E3-125	5	Start	17164						19832	24030				
		Mid	9212						7124	9061				
		End	15149						7734	10674				
24E3-140	1	Start	8277		9878	16937	22780							
		Mid	4596		3762	7028	9685							
		End	7960		4469	9411	13442							
24E3-140	2	Start	9780		8339	15397	21202							
		Mid	5463		2932	6198	8838							
		End	9538		3036	7979	11974							
24E3-140	3	Start	12680			13201	18952	24376						
		Mid	6946			4777	7385	9888						
		End	11788			5215	9142	12941						
24E3-140	4	Start	14845			11671	17384	22809						
		Mid	8027			3742	6327	8830						
		End	13356			3153	7029	10827						
24E3-140	5	Start	17164				15590	21015						
		Mid	9212				5167	7670						
		End	15149				4764	8563						

Canted

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke																	
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar											Limiting MOP, bar		
				35	50	70	85	100	125	140	160	175	190	207			
			Nm	Hydraulic Torque, Nm													
24E3-160	1	Start	8277	8802	15903										Canted	67	
		Mid	4596	3264	6549												
		End	7960	3715	8687												
24E3-160	2	Start	9780	7262	14363	23831								70			
		Mid	5463	2434	5720	10100											
		End	9538	2282	7255	13884											
24E3-160	3	Start	12680		12167	21635								74			
		Mid	6946		4298	8679											
		End	11788		4491	11121											
24E3-160	4	Start	14845		10637	20105								77			
		Mid	8027		3263	7644											
		End	13356		2429	9058											
24E3-160	5	Start	17164			18355								81			
		Mid	9212			6509											
		End	15149			6848											
24E3-180	1	Start	8277	13581	22731											52	
		Mid	4596	5475	9708												
		End	7960	7061	13468												
24E3-180	2	Start	9780	12041	21191									55			
		Mid	5463	4645	8879												
		End	9538	5629	12035												
24E3-180	3	Start	12680	9845	18994									58			
		Mid	6946	3224	7458												
		End	11788	2865	9272												
24E3-180	4	Start	14845		17465									61			
		Mid	8027		6422												
		End	13356		7209												
24E3-180	5	Start	17164		15714									64			
		Mid	9212		5287												
		End	15149		4999												

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke														
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar										
				35	50	70	85	100	125	140	160	175	190	207
			Nm	Hydraulic Torque, Nm										
45E3-125	1	Start	15188				12378	17122	25030	29774	36100	40844	45589	
		Mid	8411				4172	6362	10010	12200	15119	17308	19498	
		End	14507				3995	7317	12854	16176	20605	23927	27249	
45E3-125	2	Start	18563						22943	27687	34013	38757	43502	
		Mid	10012						8443	10632	13551	15741	17930	
		End	16594						9557	12879	17309	20631	23953	
45E3-125	3	Start	20237						18938	23682	30008	34752	39497	44874
		Mid	11506						6980	9170	12089	14278	16467	18949
		End	20599						7923	11245	15675	18997	22319	26084
45E3-125	4	Start	23717							21470	27796	32541	37285	42662
		Mid	13172							7539	10458	12648	14837	17318
		End	22811							7847	12276	15598	18920	22685
45E3-125	5	Start	28083									29755	34500	39877
		Mid	15263									10601	12790	15271
		End	25596									11336	14658	18423
45E3-140	1	Start	15188			14327	20935	27189	37613	43868				
		Mid	8411			5122	8121	11007	15817	18703				
		End	14507			5472	9986	14366	21665	26044				
45E3-140	2	Start	18563				18848	25102	35526	41781				
		Mid	10012				6553	9439	14250	17136				
		End	16594				6690	11070	18369	22748				
45E3-140	3	Start	20237					21097	31522	37776				
		Mid	11506					7977	12787	15673				
		End	20599					9435	16734	21114				
45E3-140	4	Start	23717					18886	29310	35564	43903			
		Mid	13172					6347	11157	14043	17891			
		End	22811					6037	13336	17715	23554			
45E3-140	5	Start	28083						26524	32779	41118			
		Mid	15263						9110	11996	15844			
		End	25596						9073	13453	19292			
45E3-160	1	Start	15188		13603	24707	33851	42385						
		Mid	8411		4787	9925	14081	18019						
		End	14507		4965	12740	19030	25006						
45E3-160	2	Start	18563			22670	31764	40298						
		Mid	10012			8391	12513	16451						
		End	16594			9524	15734	21710						
45E3-160	3	Start	20237			18762	27759	36293						
		Mid	11506			6960	11051	14989						
		End	20599			7929	14100	20075						
45E3-160	4	Start	23717				25547	34081						
		Mid	13172				9421	13359						
		End	22811				10701	16677						
45E3-160	5	Start	28083				22762	31296	45519					
		Mid	15263				7373	11311	17875					
		End	25596				6439	12414	22373					

Canted

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke																	
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar												Limiting MOP, bar	
				35	50	70	85	100	125	140	160	175	190	207			
			Nm	Hydraulic Torque, Nm													
45E3-180	1	Start	15188		22006	36472									Canted	80	
		Mid	8411		8675	15368											
		End	14507		10849	20978											
45E3-180	2	Start	18563		19969	34435	45284									83	
		Mid	10012		7141	13834	18854										
		End	16594		7632	17761	25358										
45E3-180	3	Start	20237		16061	30527	42397									88	
		Mid	11506		5710	12403	17806										
		End	20599		6038	16167	24350										
45E3-180	4	Start	23717			28368	40186									91	
		Mid	13172			10808	16176										
		End	22811			12850	20951										
45E3-180	5	Start	28083			25650	37400									95	
		Mid	15263			8805	14128										
		End	25596			8690	16689										
45E3-200	1	Start	15188	17731	31398											Canted	65
		Mid	8411	6697	13021												
		End	14507	7856	17425												
45E3-200	2	Start	18563	15695	29361												67
		Mid	10012	5164	11487												
		End	16594	4639	14209												
45E3-200	3	Start	20237		25453	43675											70
		Mid	11506		10056	18487											
		End	20599		12614	25373											
45E3-200	4	Start	23717		23295	41517											73
		Mid	13172		8461	16892											
		End	22811		9297	22056											
45E3-200	5	Start	28083		20576	38798											76
		Mid	15263		6457	14888											
		End	25596		5137	17897											

Output Torque – Metric – Nm

SR - CANTED YOKE

Spring Return Canted Yoke															
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar											Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190		
			Nm	Hydraulic Torque, Nm											
10E4-160	1	Start	29925				23681	33265	49238	58822	71600	81184	90768	101630	204
		Mid	17054				8366	12788	20159	24582	30478	34901	39323	44335	
		End	30627				8806	15517	26702	33412	42360	49071	55781	63387	
10E4-160	2	Start	37975						45032	54616	67394	76978	86562	97424	207
		Mid	20691						16598	21021	26918	31340	35763	40775	
		End	34833						18841	25551	34499	41210	47920	55526	
10E4-160	3	Start	44519							45054	57832	67416	77000	87861	207
		Mid	25096							16709	22606	27028	31451	36463	
		End	44396							19162	28109	34820	41531	49136	
10E4-160	4	Start	56019								51920	61504	71087	81949	207
		Mid	30269								17541	21964	26387	31399	
		End	50308								16880	23591	30301	37907	
10E4-180	1	Start	29925			28096	41522	54254	75474	88206					154
		Mid	17054			10492	16598	22474	32266	38141					
		End	30627			12085	21298	30214	45072	53987					
10E4-180	2	Start	37975				37316	50048	71268	84000	100976				159
		Mid	20691				13038	18913	28705	34580	42414				
		End	34833				13438	22353	37211	46126	58013				
10E4-180	3	Start	44519					40485	61706	74438	91414				170
		Mid	25096					14601	24393	30269	38102				
		End	44396					15963	30822	39737	51624				
10E4-180	4	Start	56019						55793	68526	85502	98234			177
		Mid	30269						19329	25204	33038	38913			
		End	50308						19592	28507	40394	49309			
10E4-200	1	Start	29925		22975	44121	61461	77712							121
		Mid	17054		8123	17907	25799	33298							
		End	30627		8499	23306	35260	46639							
10E4-200	2	Start	37975			40016	57255	73506	100590						124
		Mid	20691			14423	22239	29738	42236						
		End	34833			15634	27399	38778	57743						
10E4-200	3	Start	44519				47693	63943	91028						133
		Mid	25096				17927	25426	37924						
		End	44396				21010	32389	51354						
10E4-200	4	Start	56019					58031	85116	101367					139
		Mid	30269					20362	32860	40359					
		End	50308					21159	40124	51503					

Canted

SR - CANTED YOKE

Spring Return Canted Yoke																
Actuator	Spring #	Position	Spring Torque	Operating Pressure, bar												Limiting MOP, bar
				35	50	70	85	100	125	140	160	175	190	207		
			Nm	Hydraulic Torque, Nm												
10E4-220	1	Start	29925		35626	61832	83499								Canted	97
		Mid	17054		13977	26102	35969									
		End	30627		17358	35708	50691									
10E4-220	2	Start	37975		31522	57728	79293	99433						100		
		Mid	20691		10492	22618	32408	41702								
		End	34833		9686	28036	42831	56933								
10E4-220	3	Start	44519			48396	69731	89871						108		
		Mid	25096			18399	28097	37390								
		End	44396			21801	36441	50543								
10E4-220	4	Start	56019				63819	83958						112		
		Mid	30269				23032	32326								
		End	50308				25212	39314								
10E4-250	1	Start	29925	30837	56862	91563										73
		Mid	17054	11761	23802	39857										
		End	30627	14004	32228	56525										
10E4-250	2	Start	37975	26732	52758	87458								76		
		Mid	20691	8277	20318	36373										
		End	34833	6333	24556	48854										
10E4-250	3	Start	44519		43426	78126								81		
		Mid	25096		16099	32154										
		End	44396		18320	42618										
10E4-250	4	Start	56019		37656	72357	98382							85		
		Mid	30269		11144	27199	39240									
		End	50308		7362	31659	49882									

Note: Select Canted Yoke only for Fail CW.

Sample Part Number

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

Series	Size Code						Base Number				
98H	Actuator Size	Bore Size			Cylinder Size*	Spring Size		Base Code	Action		
98H	F	1			F	4	-	213	C		
	A	X	Refer to Table Below			A	32mm	0	None (DA)	A	Double Acting, Single Cylinder
	B	12 E2				B	40mm	1	Spring 1	B	Double Acting, Dual Cylinder
	C	18 E2				C	50mm	2	Spring 2	C	Spring Return, Fail CW
	D	45 E2				D	63mm	3	Spring 3	D	Spring Return, Fail CCW
	E	73 E2				E	80mm	4	Spring 4		
	F	14 E3				F	100mm	5	Spring 5		
	G	24 E3				G	125mm				
	H	45 E3				H	140mm				
	J	10 E4				J	160mm				
						K	180mm				
						L	200mm				
						M	220mm				
						N	250mm				
								</			

Base Number					Trim Code			
Mounting/Yoke	Ports	Standard Options		Design Code	MOC	Temp Trim	Coating	
2	1	G		00	0	S	0	
1 ISO / Symmetrical	1 NPT	N	None	00 Standard	0 Standard (DI/CS)	S Standard	0	Standard
2 ISO / Canted	2 Custom*	H	Hydraulic Override ¹	01 PED		L Low Temp		
		K	Hand Pump Override with 2500 psi ²					
		M	Hand Pump Override with 3000 psi ²					
		J	Jackscrew Direct drive		XXX-Special Requirements			
		G	Jackscrew Gear drive					
		E	Extended Stopper 45 deg					
		F	Extended Stopper 90 deg					
		D	Damper - Hydraulic					
		P	PST & Locking Device					

*With NPT-Custom thread adaptors

*See pg. 7 for Manual Override
¹ Using secondary cylinder
² Using primary cylinder

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

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)	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-B00E-22652-536 *	(3)
12E2	F12/F07	1.181 (0.87" A/F)	E	1.181 (0.87" A/F)	98-0F12-22650-536	(1)
12E2	F12/07	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)	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	1.378	F16-1	1.378	98-0F16-22650-536	(1)
45 E2	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)
45 E2	F12/F16	1.969	F30-1	3.0	98-D301-22650-536	(3)
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)
73E2	F12/F16	2.5	F	1.378	98-E00F-22650-536	(2)
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)
73 E2	F12/F16	2.5	F30-3	4.0	98-E303-22650-536	(3)
73 E2	F12/F16	2.5	F35-1	4.0	98-E351-22650-536	(3)
73 E2	F12/F16	2.5	F35-2	6.0	98-E352-22650-536	(3)
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)
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)
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	3.0	F35-4	5.0	98-F354-22650-536	(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)

(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

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
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	5.0	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	6.0	F48-2	7.0	98-H482-22650-536	(3)
10E4	F40	7.0	F30-2	3.5	98-J302-22650-536	(3)
10E4	F40	7.0	F30-3	4.0	98-J303-22650-536	(3)
10E4	F40	7.0	F30-5	4.5	98-J305-22650-536	(3)
10E4	F35	6.0	F35-2	6.0	98-0F35-22650-536	(1)
10E4	F40	7.0	F35-3	4.5	98-J353-22650-536	(2)
10E4	F40	7.0	F35-4	5.0	98-J354-22650-536	(3)
10E4	F40	7.0	F40-1	7.0	98-0F40-22650-536	(1)
10E4	F40	7.0	F40-2	7.5	98-J402-22650-536	(3)
10E4	F40	7.0	F40-3	6.0	98-0F40-22650-536	(1)
10E4	F40	7.0	F48-2	7.0	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.

Cylinder Size,MM					Purge Valve Kit Part Number		
					DA	SR	DD
32	40	50			98H-0250-25800-580	98H-0250-25801-580	98H-0250-25802-580
63	80	100	125	140	98H-0500-25800-580	98H-0500-25801-580	98H-0500-25802-580
160	180	200	220	250	98H-0750-25800-580	98H-0750-25801-580	98H-0750-25802-580

Standard Combinations - DA / DD / SR

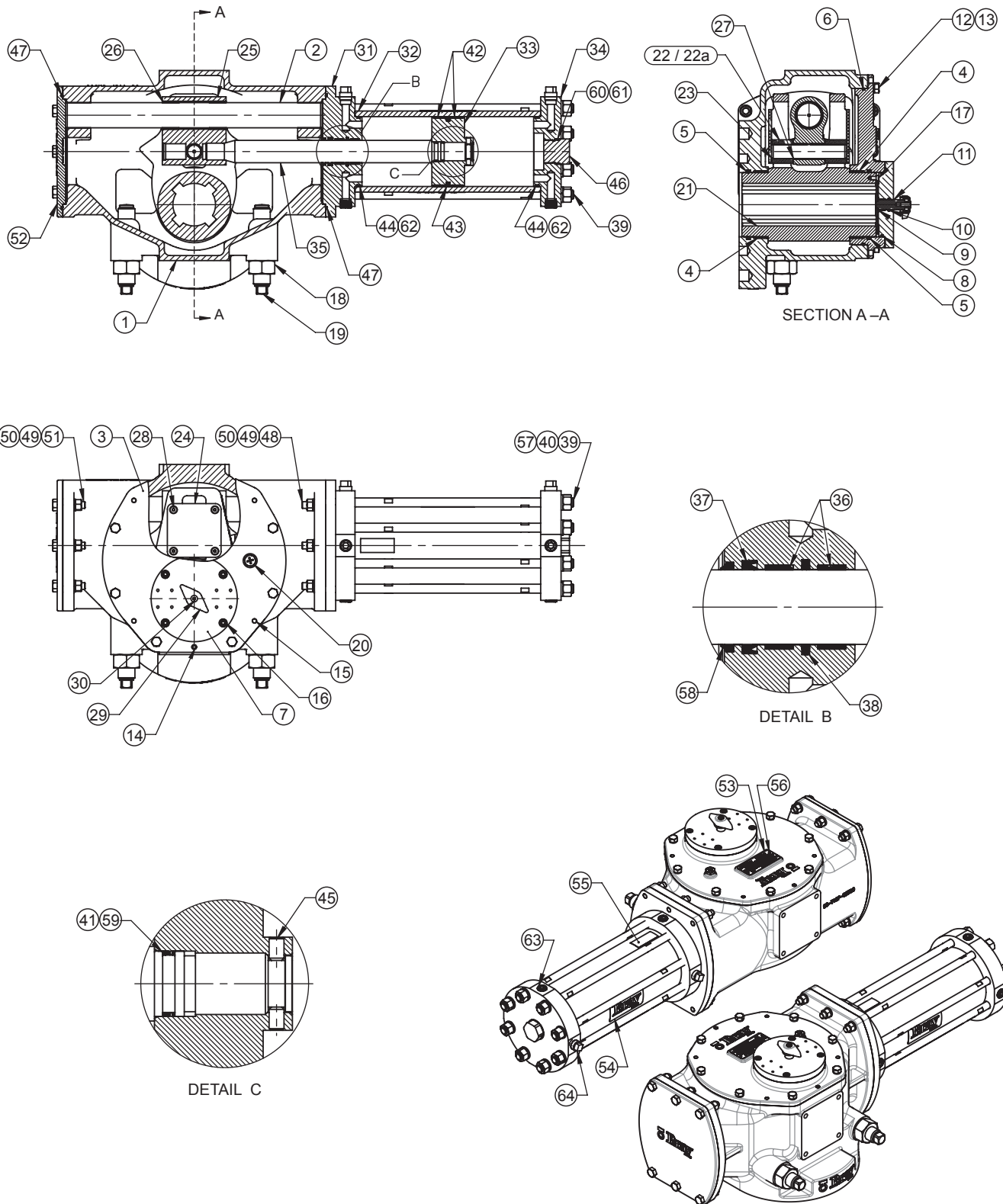
Standard Combinations- DA														
Torque Module	Yoke	Hydraulic Pressure Modules, mm												
		32	40	50	63	80	100	125	140	160	180	200	220	250
12 E2	Symm & Canted													
18 E2	Symm & Canted													
45 E2	Symm & Canted													
73 E2	Symm & Canted													
14 E3	Symm & Canted													
24 E3	Symm & Canted													
45 E3	Symm & Canted													
10 E4	Symm & Canted													

Standard Combinations- DD														
Torque Module	Yoke	Hydraulic Pressure Modules, mm												
		32	40	50	63	80	100	125	140	160	180	200	220	250
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	Hydraulic Pressure Modules, mm													Spring Modules				
		32	40	50	63	80	100	125	140	160	180	200	220	250	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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Hydraulic Actuator - Double Acting, Single Cylinder Assembly



For reference only. Please refer to ES-00688 drawing for current information.

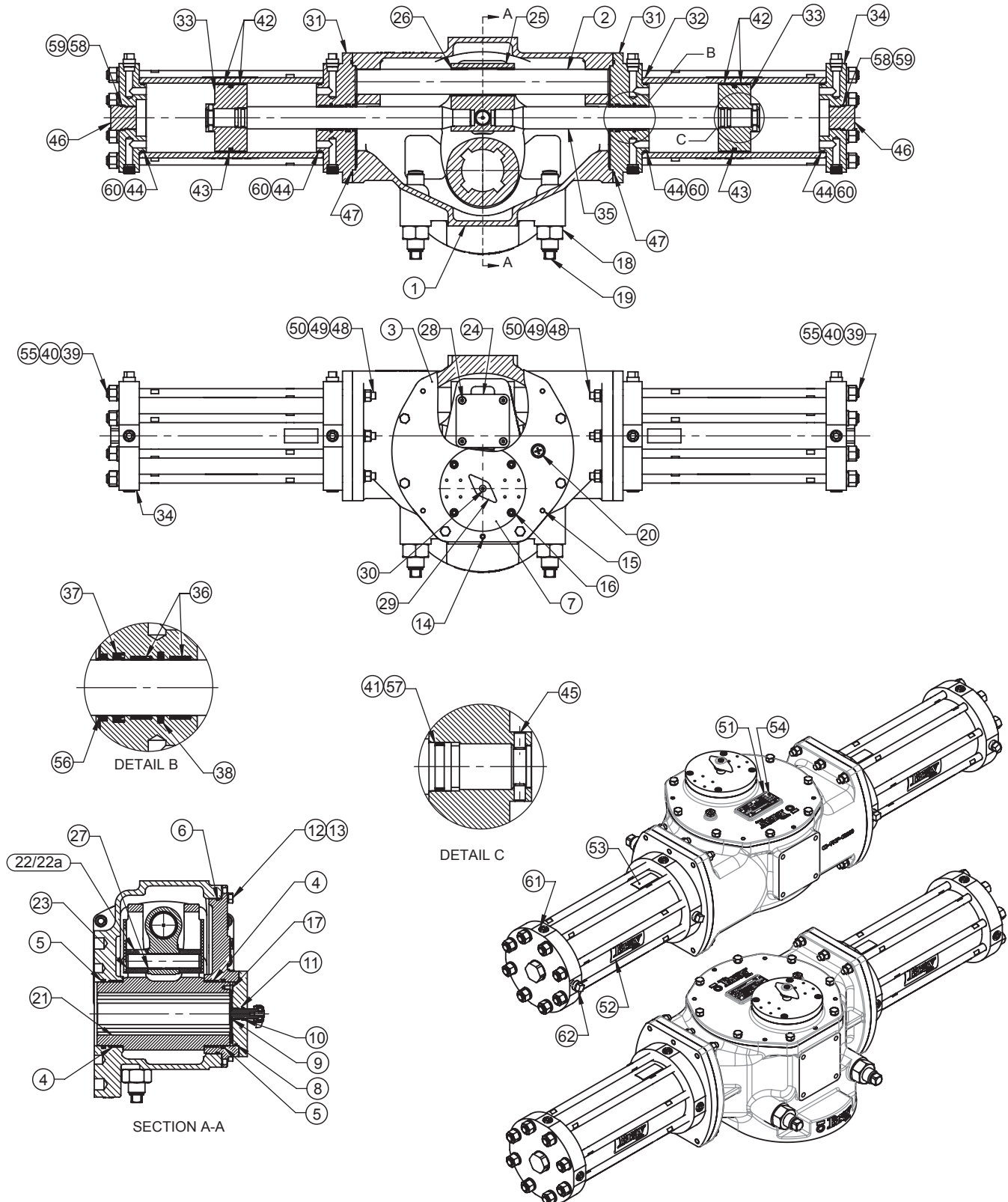
Item		Description	Material	Qty.
1		Yoke Housing	Ductile Iron	1
2		Guide Rod	Alloy Steel	1
3		Housing Cover	Ductile Iron	1
4	**	Bushing (Yoke)	PTFE Bronze	2
5	*	O-Ring (Yoke)	Buna-N	2
6	*	O-Ring (Cover)	Buna-N	1
7		Top Cover	Ductile Iron	1
8	*	O-Ring (Top Cover)	Buna-N	1
9	**	Flanged Bushing	PTFE Bronze	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	Carbon Steel	1
32		Barrel	Carbon Steel	1

Item		Description	Material	Qty.
33		Piston	Alloy Steel	1
34		End Cap, Pressure Module	Carbon Steel	1
35		Piston Rod	Alloy Steel	1
36	*	Guide Ring, Piston Rod	Phenolic Resin	2
37	*	Lip Seal	Polyurethane	1
38	*	Sealing Set, Piston Rod	PTFE & Buna-N	1
39		Tie Rod	Alloy Steel	8
40		Nut, Tie Rod	Steel	8
41	*	O-Ring (Piston Rod)	Buna-N	1
42	*	Guide Ring, Piston	Phenolic Resin	2
43	*	Sealing Set, Piston	PTFE & Buna-N	1
44	*	O-Ring (Barrel)	Buna-N	2
45		Set Screw, Piston Lock	Steel	2
46		End Plug	Steel	1
47	*	O-Ring (Module)	Buna-N	2
48		Stud / Bolt (Module)	Steel	6
49		Spring Washer (Module)	Spring Steel	12
50		Nut (Module)	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
57		Spring Washer, Tie Rod	Spring Steel	8
58	*	Wiper	Polyurethane	1
59	*	Backup Ring (Piston Rod)	PTFE	2
60	*	O-Ring (End Plug)	Buna-N	1
61	*	Backup Ring (End Plug)	PTFE	1
62	*	Backup Ring (Barrel)	PTFE	2
63		Pipe Plug	Carbon Steel	4
64		Protective Plug	Plastic	2

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

For reference only. Please refer to ES-00688 drawing for current information.

Hydraulic Actuator - Double Acting, Dual Cylinder Assembly



For reference only. Please refer to ES-00689 drawing for current information.

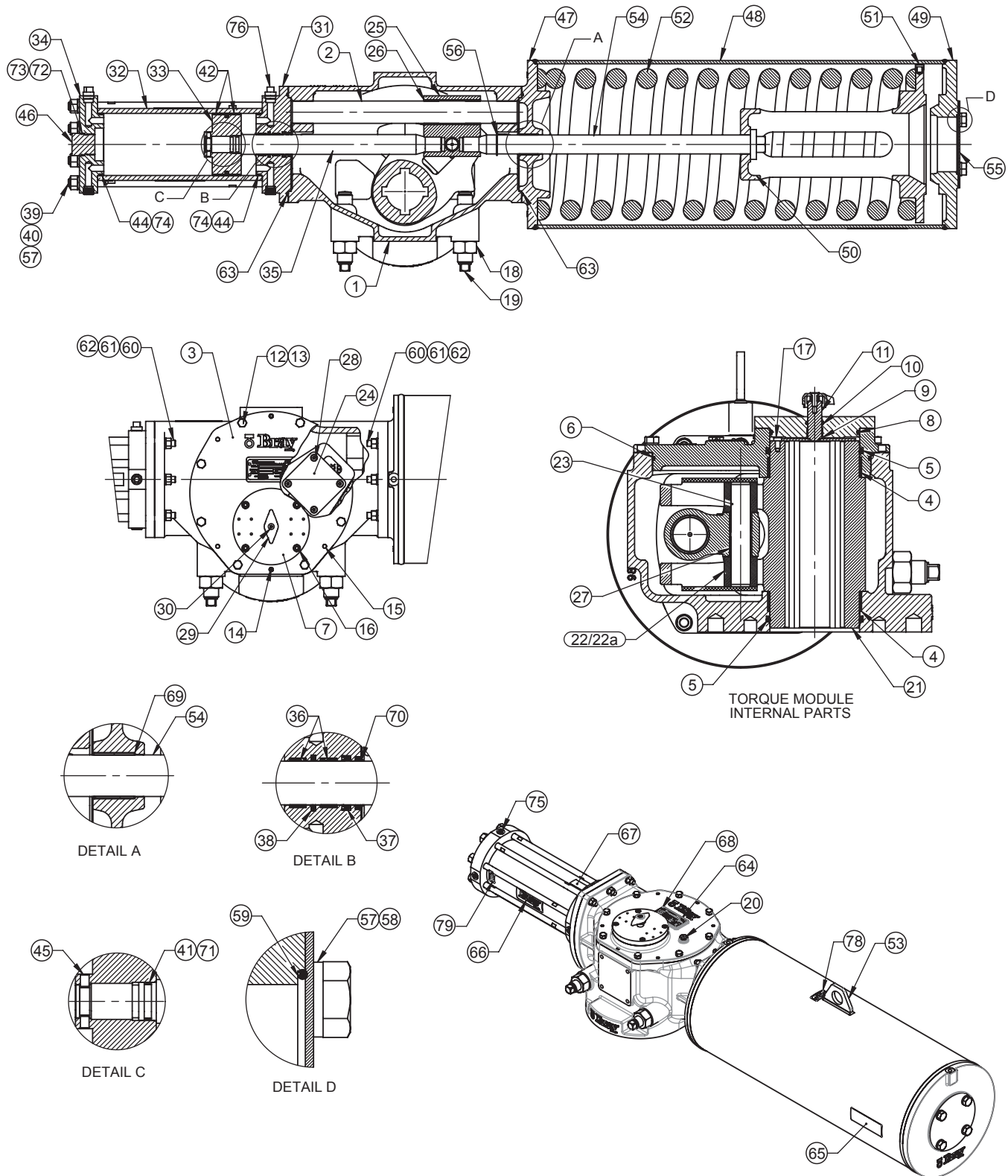
Item		Description	Material	Qty.
1		Yoke Housing	Ductile Iron	1
2		Guide Rod	Alloy Steel	1
3		Housing Cover	Ductile Iron	1
4	**	Bushing (Yoke)	PTFE Bronze	2
5	*	O-Ring (Yoke)	Buna-N	2
6	*	O-Ring (Cover)	Buna-N	1
7		Top Cover	Ductile Iron	1
8	*	O-Ring (Top Cover)	Buna-N	1
9	**	Flanged Bushing	PTFE Bronze	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	Carbon Steel	2

Item		Description	Material	Qty.
32		Barrel	Carbon Steel	2
33		Piston	Alloy Steel	2
34		End Cap, Pressure Module	Carbon Steel	2
35		Piston Rod	Alloy Steel	2
36	*	Guide Ring, Piston Rod	Phenolic Resin	4
37	*	Lip Seal	Polyurethane	2
38	*	Sealing Set, Piston Rod	PTFE & Buna-N	2
39		Tie Rod	Steel	16
40		Nut, Tie Rod	Steel	16
41	*	O-Ring (Piston Rod)	Buna-N	2
42	*	Guide Ring, Piston	Phenolic Resin	4
43	*	Sealing Set, Piston	PTFE & Buna-N	2
44	*	O-Ring (Barrel)	Buna-N	4
45		Set Screw, Piston Lock	Steel	4
46		End Plug	Steel	2
47	*	O-Ring (Module)	Buna-N	2
48		Stud / Hex Bolt (Module)	Steel	12
49		Spring Washer (Module)	Spring Steel	12
50		Nut (Module)	Steel	12
51		Name Plate	Stainless Steel	1
52		Label, Logo	Metallized Polyester	4
53		Label, Configuration	Metallized Polyester	2
54		Rivets	Stainless Steel	4
55		Spring Washer, Tie Rod	Spring Steel	16
56	*	Wiper	Polyurethane	2
57	*	Backup Ring (Piston Rod)	PTFE	4
58	*	O-Ring (End Plug)	Buna-N	2
59	*	Backup Ring (End Plug)	PTFE	2
60	*	Backup Ring (Barrel)	PTFE	4
61		Pipe Plug	Carbon Steel	8
62		Protective Plug	Plastic	4

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

For reference only. Please refer to ES-00689 drawing for current information.

Spring Return Hydraulic Actuator Assembly



For reference only. Please refer to ES-00690 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	Carbon Steel	1
32		Barrel	Carbon Steel	1
33		Piston	Alloy Steel	1
34		End Cap, Pressure Module	Carbon Steel	1
35		Piston Rod	Alloy Steel	1
36	*	Guide Ring, Piston Rod	Phenolic Resin	2
37	*	Lip Seal	Polyurethane	1
38	*	Sealing Set, Piston Rod	PTFE & Buna-N	1
39		Tie Rod	Alloy Steel	8

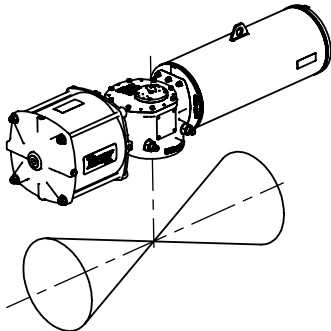
Item		Description	Material	Qty.
40		Nut, Tie Rod	Steel	8
41	*	O-Ring (Piston Rod)	Buna-N	1
42	*	Guide Ring, Piston	Phenolic Resin	2
43	*	Sealing Set, Piston	PTFE & Buna-N	1
44	*	O-Ring (Barrel)	Buna-N	2
45		Set Screw, Piston Lock	Steel	2
46		End Plug	Steel	1
47		Adaptor, Spring Module	Carbon Steel	1
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	12
58		Hex Bolt	Steel	4
59	*	O-Ring (End Cover)	Buna-N	1
60		Stud / Hex Bolt (Module)	Steel	12
61		Nut (Module)	Steel	12
62		Spring Washer (Module)	Spring Steel	12
63	*	O-Ring (Module)	Buna-N	2
64		Name Plate	Stainless Steel	1
65		Label, Caution	Metallized Polyester	1
66		Label, Logo	Metallized Polyester	2
67		Label, Configuration	Metallized Polyester	1
68		Rivets	Stainless Steel	4
69	**	Bushing (Adaptor)	PTFE Bronze	1
70	*	Wiper	Polyurethane	1
71	*	Backup Ring (Piston Rod)	PTFE	2
72	*	O-Ring (End Plug)	Buna-N	1
73	*	Backup Ring (End Plug)	PTFE	1
74	*	Backup Ring (Barrel)	PTFE	2
75		Pipe Plug	Carbon Steel	4
76		Protective Plug	Plastic	2
78		Label, Lifting	Metallized Polyester	1
79		Label, Venting	Metallized Polyester	1

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

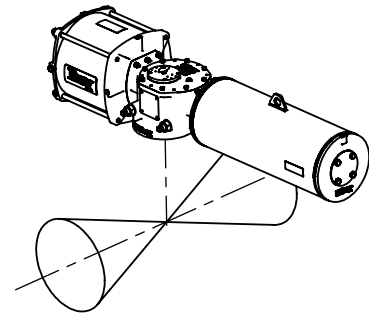
For reference only. Please refer to ES-00690 drawing for current information.

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

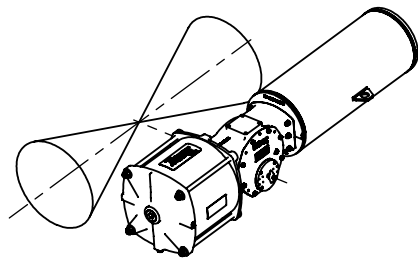
1H1



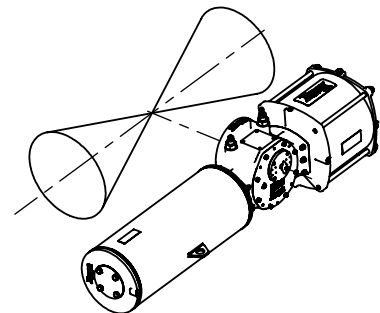
1H2



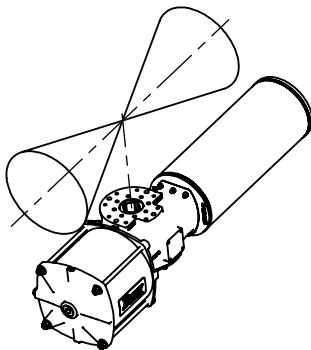
2H1



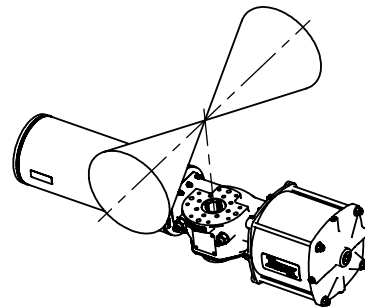
2H2



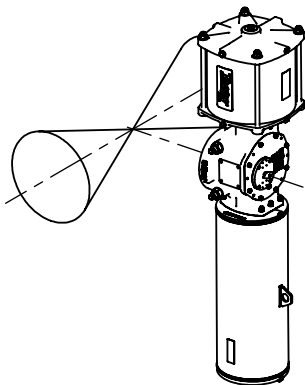
3H1



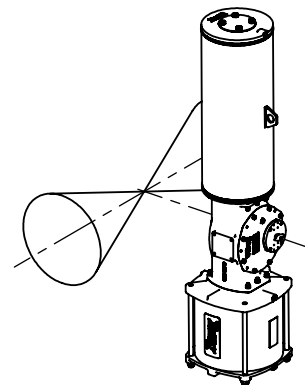
3H2



4V1



4V2



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 Cockwise
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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