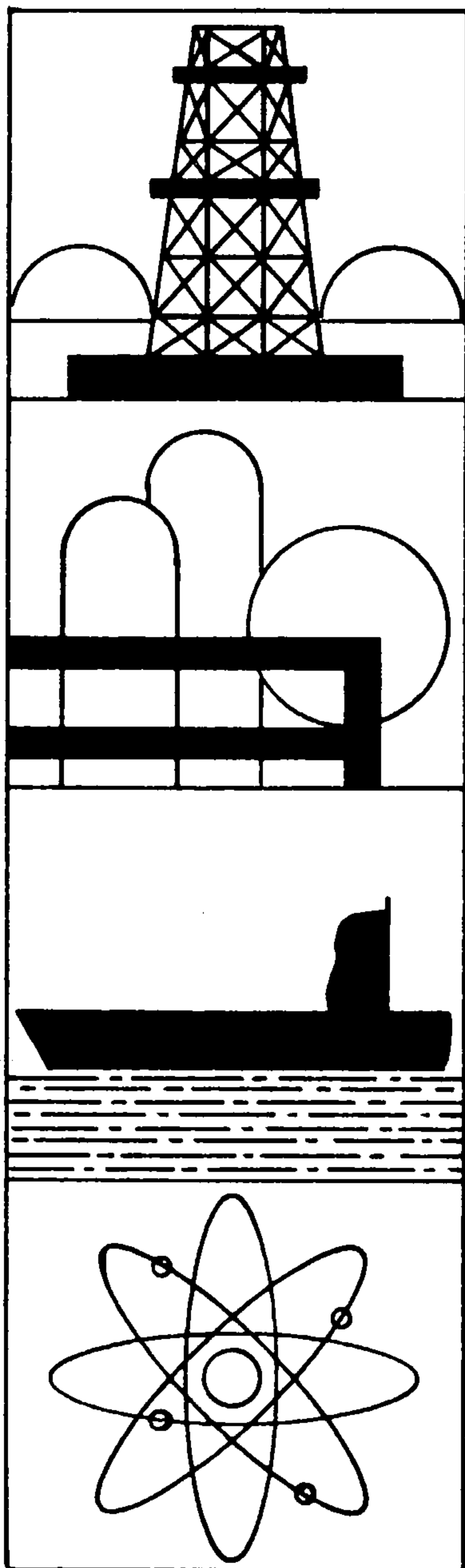


# **valve** **actuators**



**oil/gas**

**chemical**

**marine**

**nuclear**

**HEAVY DUTY SERIES**





## INDEX

Details and technical data shown in this catalog were correct at time of printing. Due to continual improvements, equipment may vary slightly from details shown. Although extreme care has been taken in compiling this catalog, we cannot assure responsibility for errors or omissions.

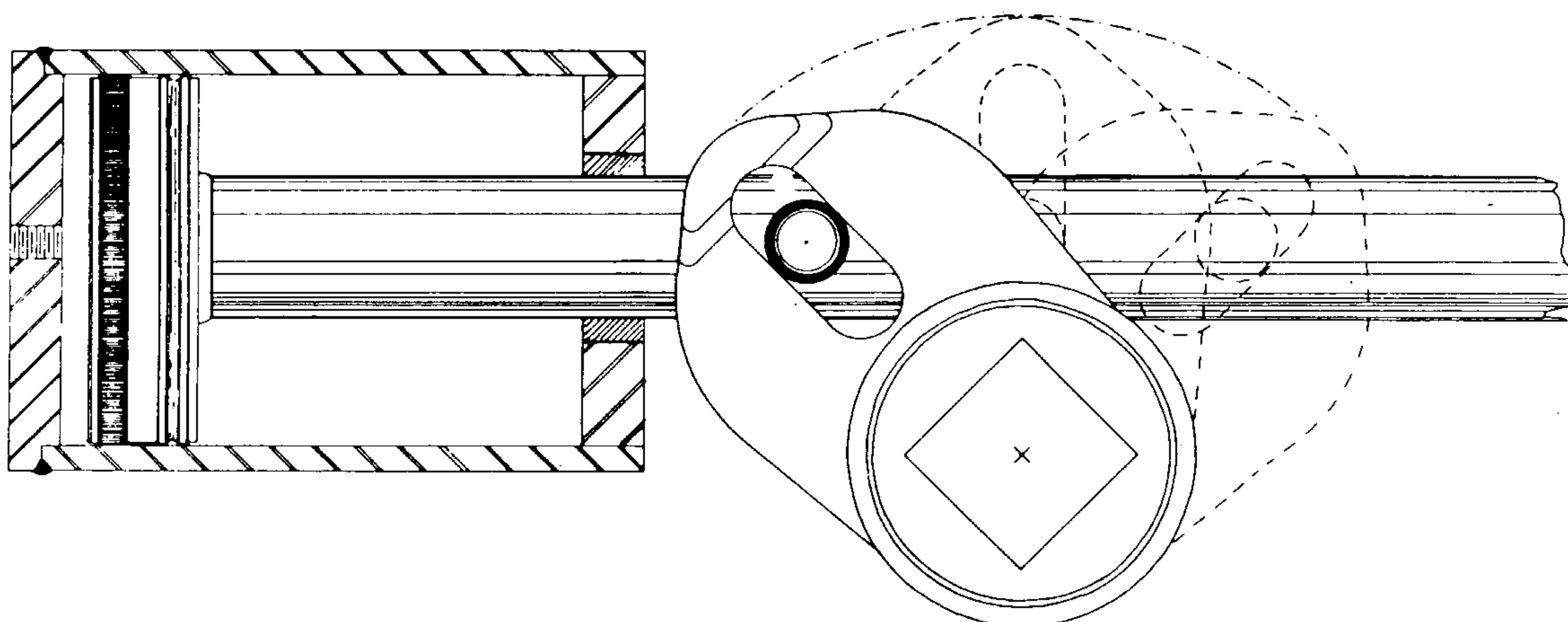
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### SIMPLICITY OF OPERATION

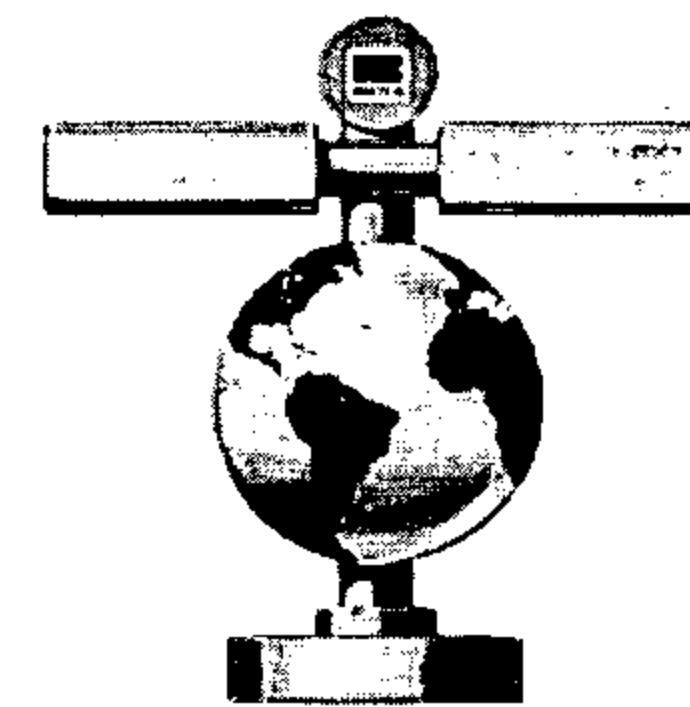
Clean, uncomplicated design, field proven by thousands of units in service, is the key to the HD series Robotarm actuator. To fully utilize the thrust of a linear cylinder, a mechanism commonly referred to as the "scotch yoke" is employed in the actuator.



The HD series Robotarm actuator operates on a scotch yoke attached to the stem of the valve. The yoke is rotated thru a pin and roller connection to the piston rod and piston. When pressure is applied, the piston moves and turns the yoke to drive the actuator and valve open. When reverse pressure is applied, the piston rod moves back and the valve is closed. The design of the scotch yoke is such that the torque output is greatest at the breaking and closing positions. This coincides with most valve requirements.



## HEAVY DUTY SERIES ROBOTARM ACTUATOR



The Bettis heavy duty series, scotch yoke Robotarm actuator is a superior cylinder-type actuator for pneumatic or hydraulic service. Its proven design offers positive control for operation of ball, butterfly or plug valves and many other 90° rotating mechanisms. These rugged, economical and uncomplicated actuators provide a most practical and reliable method for opening and closing valves by remote control without the need for expensive and unnecessary gearing, hydraulic pumps and valving or other complicated motor-driven devices.

### FEATURES

**BODY** - All HD series actuators have a totally enclosed center body which provides complete protection for all moving parts, minimizes the possibility of internal misalignment, and eliminates the chance of injury to operating personnel. External field adjustable body stops are provided on the unit. This feature assures proper and precise valve opening and closing and eliminates any unnecessary load on the valve stops.

**BEARINGS** - Rugged bearing surfaces in the body, yoke and cover assure proper alignment and eliminates any side-thrust on the valve stem. Brass rod bushings support and guide the piston rod. This eliminates the possibility that the piston could rub or score the cylinder bore. The piston rod is designed to absorb many times more side load and bending force than is generated by normal operation of the actuator.

**MODELS AND SIZES** - Double acting HD series actuators are available for torque outputs of 2,000 to 60,000 inch-pounds. Fail-safe, spring return actuators are available for torque outputs of 800 to 15,000 inch-pounds.

**SERVICE TEMPERATURE** - The range for standard HD series Robotarm actuators is -20°F. to +200°F. with non-pressurized temperatures allowable to -50°F. Special seals are available for temperatures beyond these limits.

**PERMANENT LUBRICATION** - All bearing surfaces are coated with a baked-on molybdenum disulfide dry-film lubricant and corrosion inhibitor. This insures long service life, low maintenance and trouble free operation. The cylinder bore is also coated with a baked on molybdenum disulfide dry-film lubricant. This eliminates the possibility of piston seals adhering to the cylinder wall. For additional protection, a generous coating of special lubricants is applied during assembly. For extreme service conditions, the body of the actuator may also be used as an optional oil bath. This allows the yoke, piston rod, yoke pin, and yoke pin rollers to be submerged in oil for increased protection. Oil bath capacities are shown on page 5. A vented fill-plug is provided in the cover of the actuator.

**POSITIVE FAIL-SAFE SPRING RETURN ACTUATORS** - Spring return HD series Robotarm actuators afford positive operation where absolute emergency shut-down is imperative. These units can be assembled to either fail open or fail closed on loss of operating pressures, depending upon application. HD series spring return actuators are equipped with a "service safe" spring cartridge. This cartridge design of internal spring loading makes it practical to safely disassemble and service HD series actuators in the field without special equipment or danger to personnel.



ROBOTARM® VALVE ACTUATORS

**TORQUE OUTPUT**

ALL PUBLISHED TORQUES ARE GUARANTEED  
MINIMUM VALUE

**DOUBLE ACTING**

Actuator Model	TORQUE OUTPUT INCH-LBS.	OPERATING PRESSURE – LBS./SQ. INCH												
		40	50	60	70	80	90	100	125	150	175	200	225	250
521C	BREAK	2200	3000	3700	4500	5400	6600	7000	9000	11000	13000	15000	16875	18750
	RUNNING	1600	2000	2400	2800	3200	3600	4000	5000	6000	7000	8000	9000	10000
522C	BREAK	4400	6000	7400	9000	10800	13200	14000	17500	21000				
	RUNNING	3200	4000	4800	5600	6400	7200	8000	10000	12000				
721C	BREAK	5400	7000	8600	10200	11800	13400	15000	18750	22500				
	RUNNING	3100	4000	4900	5800	6700	7600	8500	10625	12750				
722C	BREAK	11000	14300	17160	20020									
	RUNNING	6300	8200	9840	11480									
731C	BREAK	7500	9500	11400	13400	15400	17400	19400	24200	29000	34000	39000	44500	48300
	RUNNING	4300	5500	6600	7800	8900	10100	11500	14200	17000	20000	23000	25900	28800
732C	BREAK	13600	17000	20400	23800	27200	30600	34000	42500	51000				
	RUNNING	8160	10200	12240	14280	16320	18360	20400	25500	30600				

**DOUBLE ACTING**

with HYDRAULIC MANUAL CONTROL OR SPEED CONTROL

Actuator Model	TORQUE OUTPUT INCH-LBS.	OPERATING PRESSURE – LBS./SQ. INCH												
		40	50	60	70	80	90	100	125	150	175	200	225	250
522C-H	BREAK	2200	3000	3700	4500	5400	6600	7000	9000	11000	13000	15000	16875	18750
	RUNNING	1600	2000	2400	2800	3200	3600	4000	5000	6000	7000	8000	9000	10000
722C-H	BREAK	5400	7000	8600	10200	11800	13400	15000	18750	22500				
	RUNNING	3100	4000	4900	5800	6700	7600	8500	10625	12750				
732C-H	BREAK	7500	9500	11400	13400	15400	17400	19400	24200	29000	34000	39000	44500	48300
	RUNNING	4300	5500	6600	7800	8900	10100	11500	14200	17000	20000	23000	25900	28800

**SPRING RETURN**

Actuator Model	END	OPERATING PRESSURE – LBS./SQ. INCH												
		40	50	60	70	80	90	100	125	150	175	200	225	250
521C-SR	END	830	830	1250	1250	1660	1660	2080	2600	3130	3130	4170	4170	4170
721C-SR	END	1710	1710	2570	2570	3420	3420	4280	5350	6420	6420	7900	7900	7900
722C-SR	END	3150	3150	4750	4750	6300	6300	7900	7900					
732C-SR	END	3500	3500	6150	6150	8200	8200	10300	10300	15500	15500	15500	15500	

**SPRING RETURN**

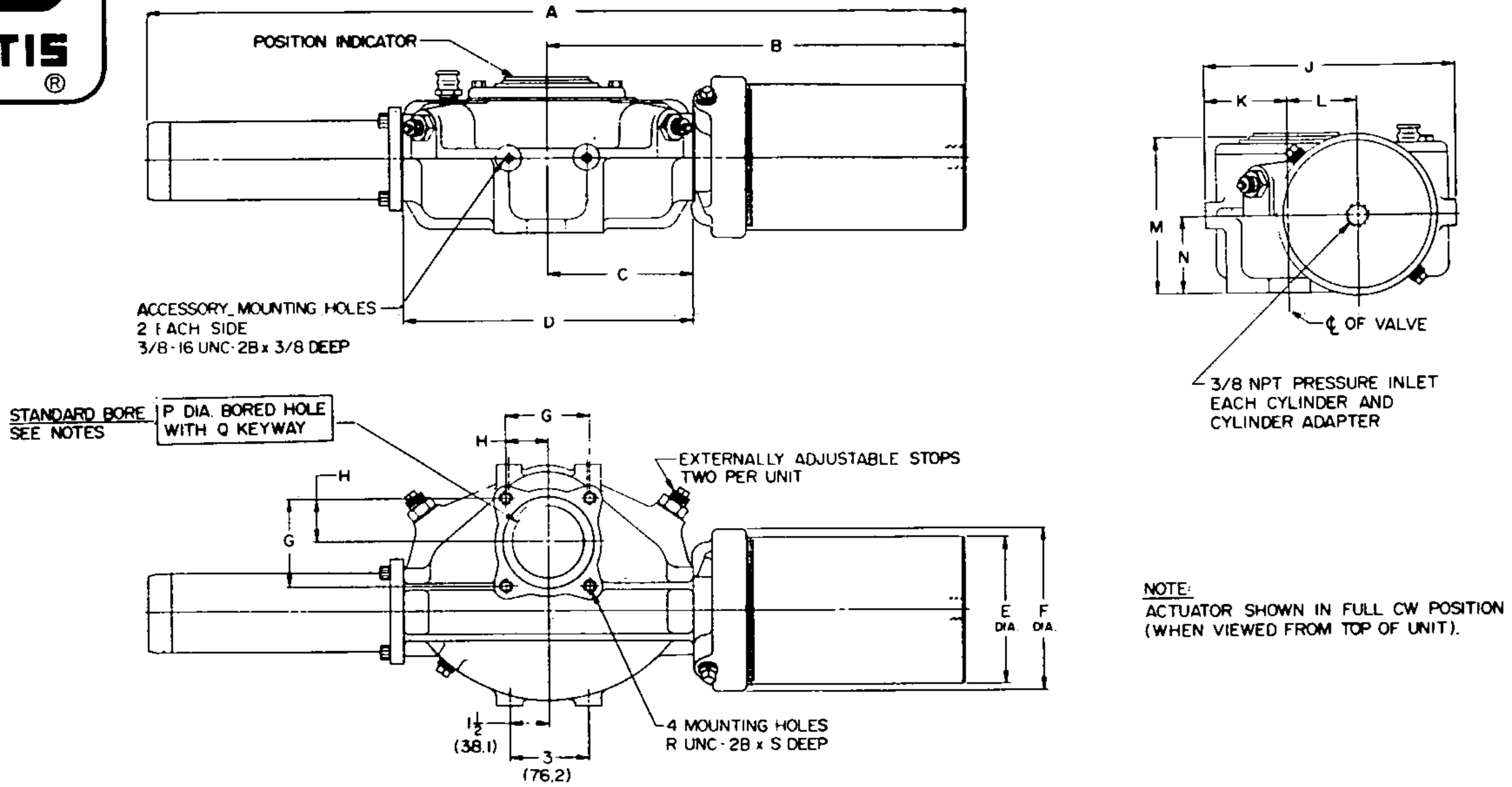
with HYDRAULIC MANUAL CONTROL OR SPEED CONTROL

Actuator Model	END	OPERATING PRESSURE – LBS./SQ. INCH												
		40	50	60	70	80	90	100	125	150	175	200	225	250
722C-SR-H	END	1710	1710	2570	2570	3420	3420	4280	5350	6420	6420	7900	7900	7900
732C-SR-H	END		3500	3500	3500	3500	6150	6150	6150	8200	8200	10300	10300	

All Model "C" Actuators listed in this Bulletin are designed and manufactured to rigid standards to insure maximum efficiency. Bettis Corporation certifies that the Torque Output Values published above represent true, tested and measured torque capabilities. When you purchase a Bettis Actuator you can be certain that your Actuator will develop the published torque. A properly maintained Actuator will continue to produce the advertised torques after a long service life.

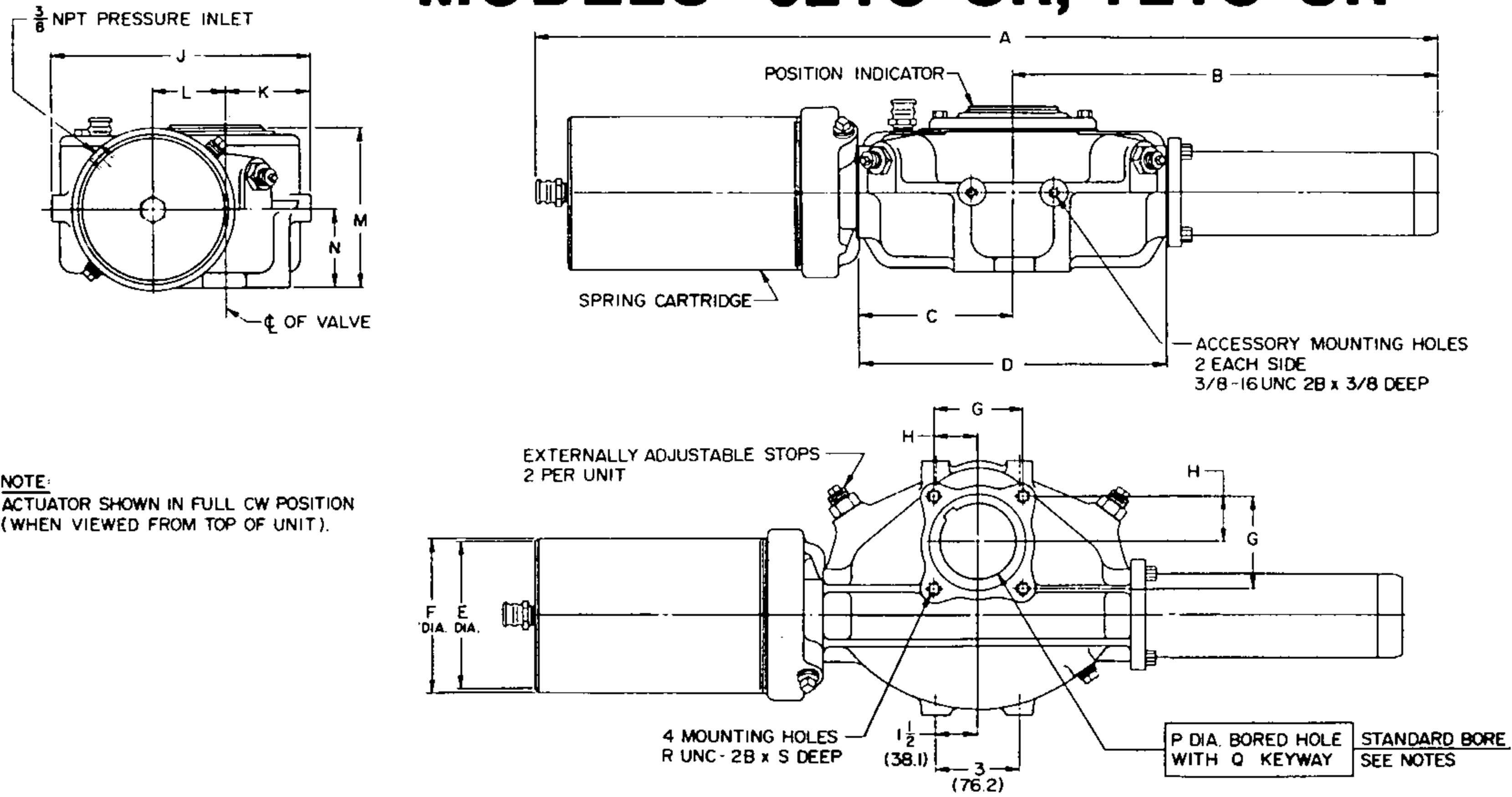


# MODELS 521C, 721C, 731C



MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
521C	31-11/16	16-11/16	5-9/16	11-1/8	5-3/8	5-15/16	3-3/16	1-19/32	8-29/32	2-7/8	2-1/2	5-11/16	2-13/16	2-1/2	1/2 x 3/16	1/2 - 13	3/4
721C	31-11/16	16-11/16	5-9/16	11-1/8	7-1/2	8-1/8	3-3/16	1-19/32	8-29/32	2-7/8	2-1/2	5-11/16	2-13/16	2-1/2	1/2 x 3/16	1/2 - 13	3/4
731C	38-1/2	21	6-13/16	13-5/8	7-1/2	8-1/8	4-1/16	2-1/32	11-3/16	3-5/8	3-3/8	7-5/16	3-9/16	3-1/4	1/2 x 3/16	3/4 - 10	1

# MODELS 521C-SR, 721C-SR

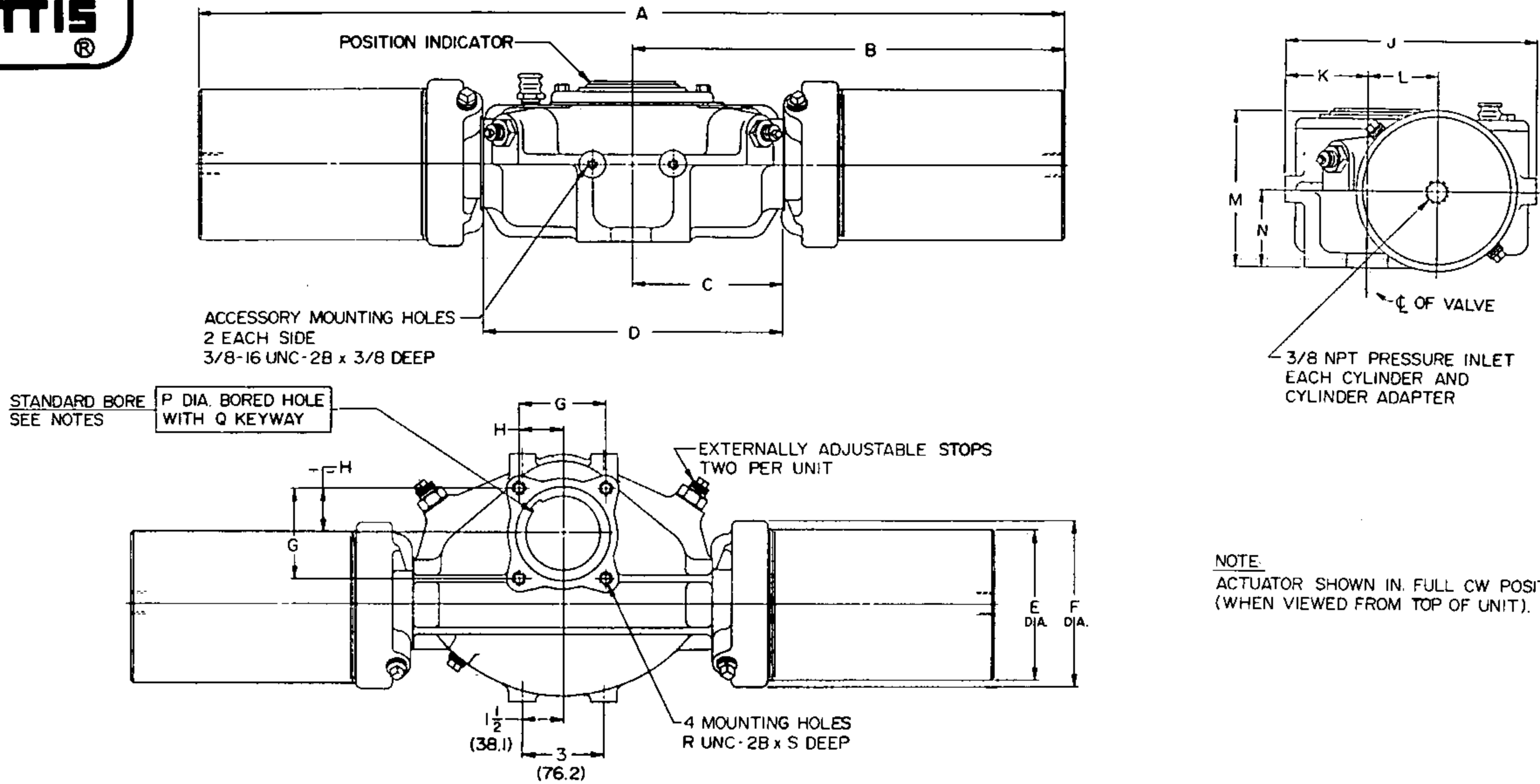


MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
521C-SR			5-9/16	11-1/8	5-3/8	5-15/16	3-3/16	1-19/32	8-29/32	2-7/8	2-1/2	5-11/16	2-13/16	2-1/2	1/2 x 3/16	1/2 - 13	3/4
721C-SR			5-9/16	11-1/8	7-1/2	8-1/8	3-3/16	1-19/32	8-29/32	2-7/8	2-1/2	5-11/16	2-13/16	2-1/2	1/2 x 3/16	1/2 - 13	3/4

MODEL	A	B	MODEL	A	B
521C-SR-40	43-1/2	28-1/2	721C-SR-40	42-7/16	27-7/16
521C-SR-60	43-1/2	28-1/2	721C-SR-60	42-7/16	27-7/16
521C-SR-80	43-1/2	28-1/2	721C-SR-80	44-1/4	29-1/4
521C-SR-100	49-5/16	34-5/16	721C-SR-100	44-1/4	29-1/4
521C-SR-125	49-5/16	34-5/10	721C-SR-125	49-9/16	34-9/16
521C-SR-150	49-5/16	34-5/16	721C-SR-150	49-9/16	34-9/16
521C-SR-200	52-1/2	37-1/2			

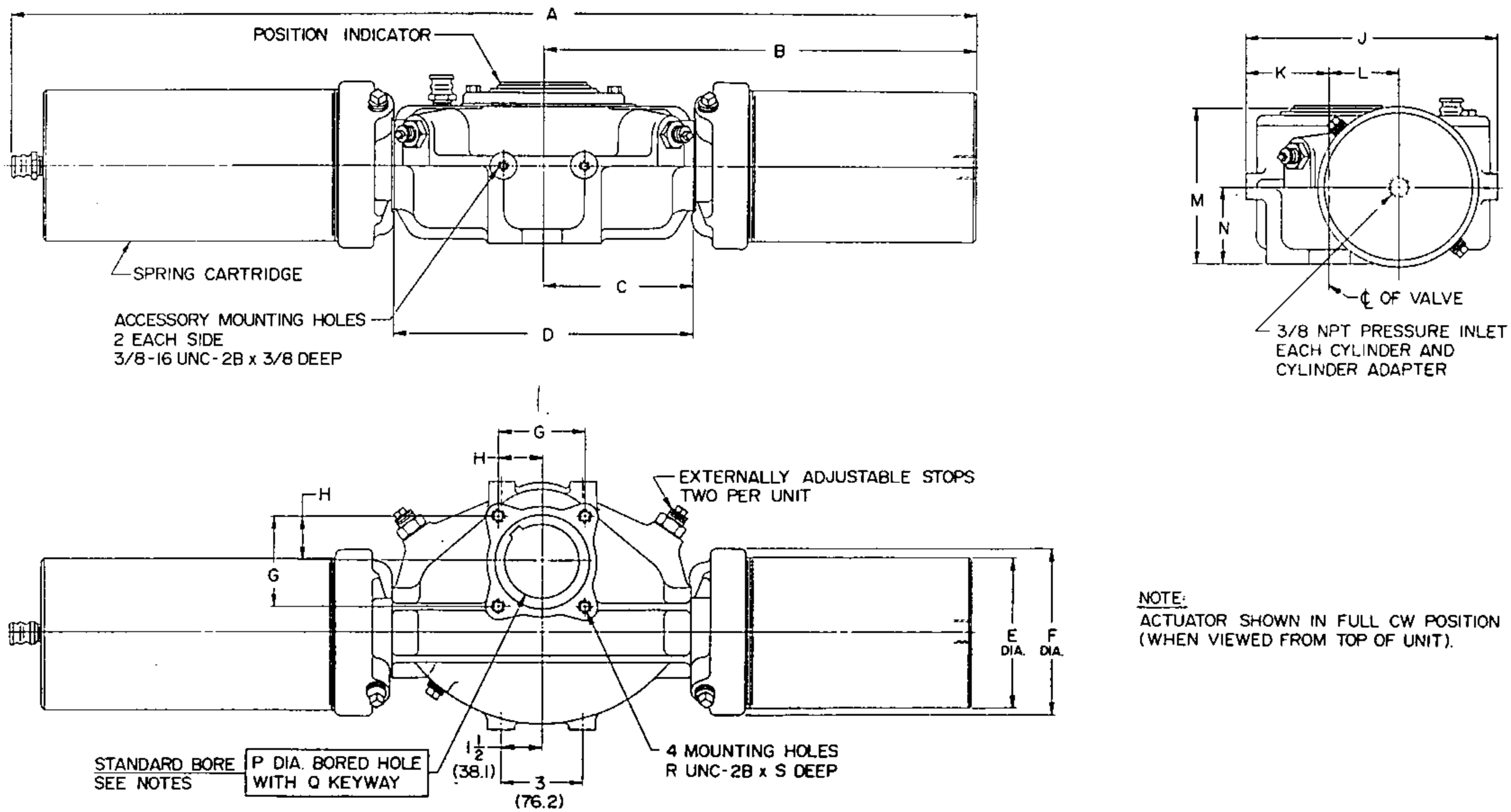


# MODELS 522C, 722C, 732C



MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
522C	33-3/8	16-11/16	5-9/16	11-1/8	5-3/8	5-15/16	3-3/16	1-19/32	8-29/32	2-7/8	2-1/2	5-11/16	2-13/16	2-1/2	1/2 x 3/16	1/2 - 13	3/4
722C	33-3/8	16-11/16	5-9/16	11-1/8	7-1/2	8-1/8	3-3/16	1-19/32	8-29/32	2-7/8	2-1/2	5-11/16	2-13/16	2-1/2	1/2 x 3/16	1/2 - 13	3/4
732C	42	21	6-13/16	13-5/8	7-1/2	8-1/8	4-1/16	2-1/32	11-3/16	3-5/8	3-3/8	7-5/16	3-9/16	3-1/4	1/2 x 3/16	3/4 - 10	1

# MODELS 722C-SR, 732C-SR



MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
722C-SR		16-11/16	5-9/16	11-1/8	7-1/2	8-1/8	3-3/16	1-19/32	8-29/32	2-7/8	2-1/2	5-11/16	2-13/16	2-1/2	1/2 x 3/16	1/2 - 13	3/4
732C-SR		21	6-13/16	13-5/8	7-1/2	8-1/8	4-1/16	2-1/32	11-13/16	3-5/8	3-3/8	7-5/16	3-9/16	3-1/4	1/2 x 3/16	3/4 - 10	1

MODEL	A
722C-SR-40	48-3/4
722C-SR-60	48-3/4
722C-SR-80	52-3/4
722C-SR-100	52-3/4

MODEL	A
732C-SR-40	59-3/16
732C-SR-60	59-3/16
732C-SR-80	64-9/16
732C-SR-100	64-9/16
732C-SR-125	68-11/16
732C-SR-150	68-11/16



## ACTUATOR DATA

ACTUATOR MODEL	OIL CAPACITY		DISPLACEMENT PER STROKE		MAX. OPER. PRESSURE	MAX. ALLOW. WORK. PRESS.	APPROX. WEIGHT
	HORIZ.	VERTICAL					
521 C	2½ PTS.	2 PTS.	118 CU. IN.	0.068 CU. FT.	300 PSIG	325 PSIG	73 LBS.
721 C	2½ PTS.	2 PTS.	231 CU. IN.	0.134 CU. FT.	150 PSIG	250 PSIG	93 LBS.
731 C	4 PTS.	3 PTS.	298 CU. IN.	0.172 CU. FT.	250 PSIG	300 PSIG	162 LBS.
521C-SR	2½ PTS.	2 PTS.	118 CU. IN.	0.068 CU. FT.	330 PSIG	450 PSIG	114 LBS.
721C-SR	2½ PTS.	2 PTS.	231 CU. IN.	0.134 CU. FT.	180 PSIG	300 PSIG	155 LBS.
522 C	2½ PTS.	2 PTS.	225 CU. IN.	0.130 CU. FT.	150 PSIG	250 PSIG	92 LBS.
722 C	2½ PTS.	2 PTS.	560 CU. IN.	0.324 CU. FT.	75 PSIG	125 PSIG	123 LBS.
732 C	4 PTS.	3 PTS.	680 CU. IN.	0.394 CU. FT.	150 PSIG	200 PSIG	200 LBS.
722C-SR	2½ PTS.	2 PTS.	457 CU. IN.	0.264 CU. FT.	105 PSIG	175 PSIG	185 LBS.
732C-SR	4 PTS.	3 PTS.	569 CU. IN.	0.329 CU. FT.	160 PSIG	250 PSIG	285 LBS.

Maximum operating pressure is the pressure required to produce the maximum rated torque of a double acting actuator.

Maximum allowable working pressure is the maximum static pressure that may be applied to a fully stroked actuator against the travel stops.

**NOTE:** Pressures applied to only one end of the cylinder in excess of the maximum allowable working pressure may result in permanent deformation of the torque producing mechanism of the actuator.

Test pressure is 1.25 times the maximum allowable working pressure when applied to both sides of the cylinder simultaneously.

The following formula may be used to determine the (FREE AIR CONSUMPTION) for each actuator.

$$Q = \frac{V \times P + 14.7}{14.7} \times \frac{60}{T}$$

Where:

Q=Free air Consumption per minute

V=Actuator displacement

P=Gauge Pressure

T=Operating time

### HEAVY DUTY MANUAL CONTROLS

M3 - Jackscrew Manual is available on double acting and spring return units. The Jackscrew is an integral part of the actuator.

M4A - Hydraulic Manual Control is a bi-directional hydraulic manual with speed control, available on double acting units. (522C, 722C & 732C)

M7A - Hydraulic Manual Control is a uni-directional hydraulic manual with speed control, available on spring return units. (722C-SR & 732C-SR)

### HYDRAULIC SPEED CONTROL

M8A - Hydraulic Speed Control for operation in either direction is available on double acting and spring return units except the 521C, 721C & 731C.

### HYDRAULIC DAMPENING LOOP

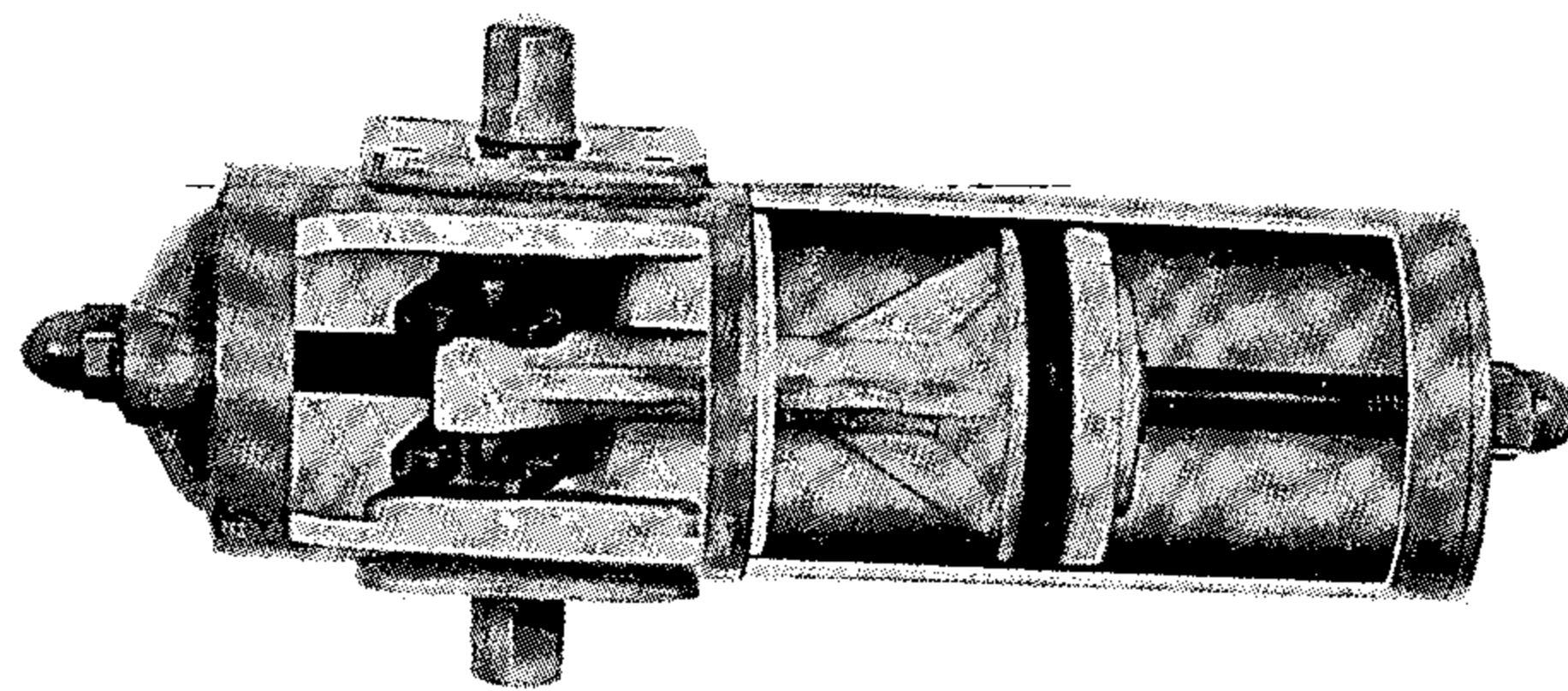
Hydraulic Dampening Loop is available for smoother operation on double acting and spring return units. (522C, 722C, 732C, 722C-SR & 732C-SR)



## OTHER BETTIS PRODUCTS

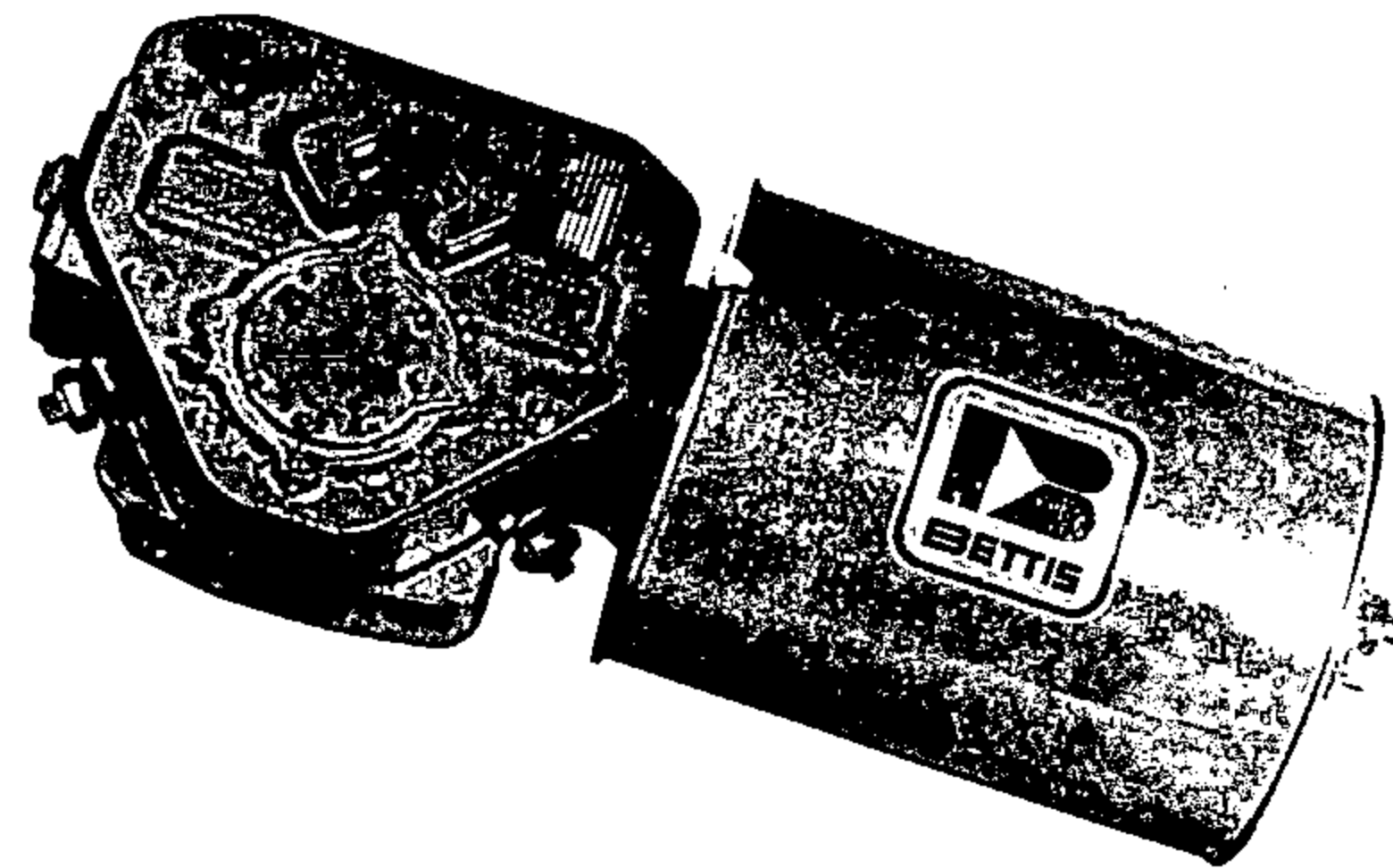
### "CB" SERIES

The Robotarm Model "CB" Series Actuator is a gas or air-driven cylinder-type operator that gives positive remote control for any of 90-degree rotary operation. The model "CB" Robotarm is one of the most economical and compact rotary actuators available. Standard units are manufactured in several sizes from 300 to 9240 inch-pounds torque output for double acting and 200 to 3800 inch-pounds torque output for spring return units. Standard operating pressures are 40 to 120 PSIG.



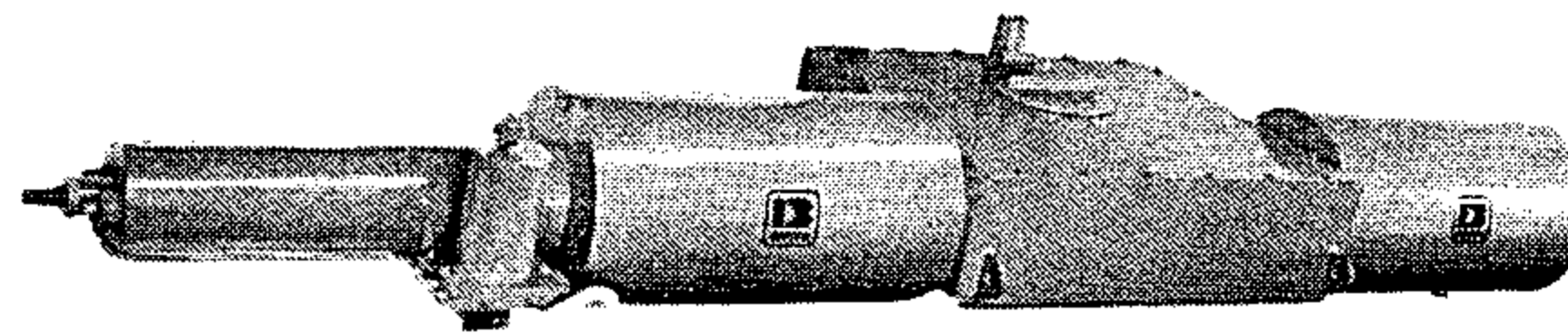
### "T" - SERIES

The "T" (Track-Hi-Torque) Series actuators are designed and engineered to meet the torque requirements of larger, higher pressure ball, plug, and butterfly valves. The rugged, "T" Series features greater torque output at lower operating pressures resulting in dependable, positive drive rotary valve operation. Use of the highly efficient guided track principal provides positive on-off service or precise valve positioning in both double acting and spring return models. Double acting up to 450,000 and spring return units up to 177,000 inch pounds ending torque.



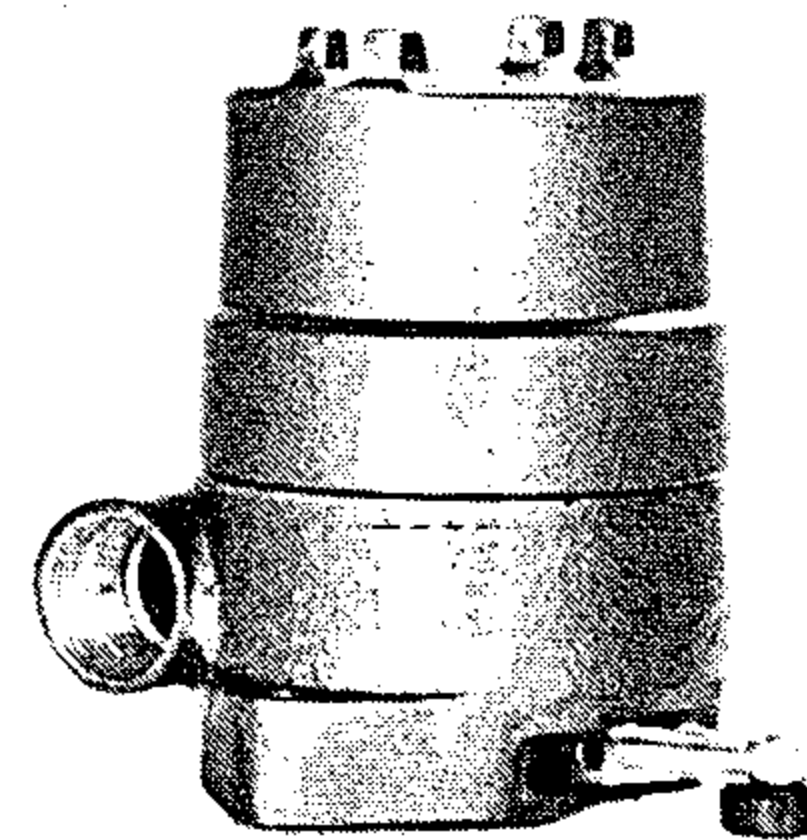
### "TR" & "TRQ" SERIES

The "TR" (Track-Guide Rail) and "TRQ" (Track-Guide Rail - Quad Body) Series represents a further extension of the line of high torque Robotarm actuators. Designed with the same quality and rugged features as the other series Bettis actuator, these units are available for torques up to 2,000,000 inch-pounds.



### BETTISWITCH

The Bettiswitch is a versatile position-indicating switch designed primarily for use with Bettis valve actuators. The Bettiswitch is especially adaptable to sequence cycling or automated systems, with a choice of operating mechanisms, direct-coupled or three position lever/roller operations. All switches are weather and explosion proof.



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