



November 26, 1984
JPN-84-74

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Mr. Domenic B. Vassallo, Chief
Operating Reactors Branch No. 2
Division of Licensing

Subject: James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
Containment Vent and Purge Valves Operability

- References:
1. NRC letter, D. B. Vassallo to J. P. Bayne, dated January 13, 1984, "Containment Vent Valve Operability."
 2. NYPA letter, J. P. Bayne to D. B. Vassallo (NRC), dated February 24, 1984 (JPN-84-14), "Containment Vent and Purge Valve Operability."
 3. NYPA letter, J. P. Bayne to D. B. Vassallo (NRC), dated June 14, 1984 (JPN-84-35), "Containment Vent and Purge Valve Operability."
 4. NRC letter, D. G. Eisenhower to J. P. Bayne, dated October 9, 1984, "Containment Purge/Vent Valve Operability."

Dear Sir:

In response to your letter dated January 13, 1984 (Reference 1), the Authority provided information regarding the operability of containment vent and purge valves under design basis accident (DBA) conditions via References 2 and 3. By letter dated October 9, 1984 (Reference 4), the NRC requested additional information to complete its review for the FitzPatrick vent and purge valves.

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In response to Reference 4, the Authority has performed detailed calculations which demonstrates that these valves and actuators are operable under DBA conditions, taking into account the effect of increased dynamic loads resulting from upstream elbows or other fittings.

Structural integrity of the actuator mounting hardware has been verified. As shown in the curve in Attachment I the increase in dynamic torque due to elbows or other fittings has been offset by reductions in maximum opening angle of the valve, and reduced, recalculated differential pressure loads due to a DBA. Therefore, the loads to which the mounting hardware is subjected to are no larger than the original design loads of the hardware.

From the tables and graphs shown in Attachment I, it can be seen that with the maximum angle of opening for three 24" valves (27 AOV-111, 27 AOV-112 and 27 AOV-113) restricted to 40° instead of the present limit of 50°, the valve and the actuator would be capable of performing its design function and maintaining its structural integrity under DBA conditions.

For the 24" valve (27 AOV-114) and the 20" valves (27 AOV-115 and 27 AOV-116), with the maximum opening angle maintained at the present limit of 50°, the valve and the actuator would be capable of performing its design function and maintaining its structural integrity under DBA conditions. These results are based on calculations taking into account the increase in the dynamic torque coefficient by a factor of three for the three 24" valves (27 AOV-111, 27 AOV-112 and 27 AOV-113) and the two 20" valves (27 AOV-115 and 27 AOV-116), due to an upstream fitting 90° out of plane with the shaft of the valve. For the 24" valve (27 AOV-114) a factor of 1.5 has been used for the dynamic torque coefficient since the fitting upstream of this valve is in-plane with the valve shaft.

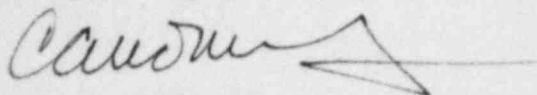
Valves 27 AOV-117 and 27 AOV-118 are located 11.5 and 13 diameters (respectively) downstream of a fitting and their operability is not affected by the fitting's presence.

The explanation for the constants used in the Fisher equations are as shown in Attachment I.

The seismic qualification requirements for these valves are contained in Purchase Specification APO-70 which was provided to Fisher Control Company. The Authority is reviewing the available information on these valves for documentation that assures that the valves were manufactured in accordance with APO-70.

If you have any questions please, please contact
Mr. J. A. Gray, Jr. of my staff.

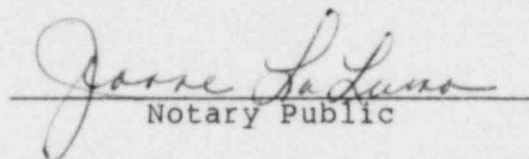
Very truly yours,



C. A. McNeill, Jr.
Senior Vice President
Nuclear Generation

State of New York
County of Westchester

Subscribed and Sworn to before
me this 26 day of November 1984.


Notary Public

JEANNE LA LUNA
NOTARY PUBLIC, STATE OF NEW YORK
NO. 60-4614305
QUALIFIED IN WESTCHESTER COUNTY
COM EXPIRES MARCH 30th 1985....

cc: Office of the Resident Inspector
U.S. Nuclear Regulatory Commission
P.O. Box 136
Lycoming, New York 13093

Enclosure

ATTACHMENT I

JPN-84-74

CONTAINMENT VENT AND PURGE
VALVE OPERABILITY

NEW YORK POWER AUTHORITY
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
DOCKET NO. 50-333

TABLE #1

Loading capacity for 24 inch valves tag number 27 AOV-111, 27 AOV-112 and 27 AOV-113, shaft laying 90° out of plane, dynamic torque multiplication factor = 3.

α°	0°	10°	20°	30°	40°
Spring torque actuator in - lb	25700	18420	14500	12260	10990
Shaft torque capability in - lb	14159	17688	14026	9370	5005
Torque developed by DBA/LOCA in - lb	3534	6344	9353	7489	1531
Shaft ΔP capability (PSI)	145	101	46	27	9.20
Shaft ΔP developed by DBA/LOCA (PSI)	32.45	30.41	26.76	19.23	1.97

TABLE #2

Loading capacity for 24 inch valve tag number 27 AOV-114,
shaft laying in the plane of the upstream elbow, dynamic
torque multiplication factor = 1.5

α°	0°	10°	20°	30°	40°	50°
Spring torque actuator in - lb	25700	18420	14500	12260	10990	10370
Shaft torque capability in - lb	14159	17688	14026	9370	5005	4232
Torque developed by DBA/LOCA in - lb	3534	4869	6454	5754	4583	2734
Shaft ΔP capability (PSI)	145	128.80	72.65	45.44	19.92	8.50
Shaft ΔP developed by DBA/LOCA (PSI)	32.45	30.66	28.39	24.30	17.45	1.99

TABLE #3

Loading capacity for 20 inch valve tag number 27 AOV-115 and 27 AOV-116 shaft laying 60° out of the plane of the upstream elbow, dynamic torque multiplication factor = 3.

	0°	10°	20°	30°	40°	50°
Spring torque actuator in - lb	10060	9187	8313	8149	8166	8740
Shaft torque capability in - lb	8401	10419	8941	5928	3165	3381
Torque developed by DBA/LOCA in - lb	1078	1929	2799	2104	1084	455
Shaft ΔP capability (PSI)	147	103	52.16	30.80	11.22	4.84
Shaft ΔP developed by DBA/LOCA (PSI)	13.85	11.50	8.63	5.94	2.55	0.15

24" VALVE TAG # 27A0V-111, 27A0V-112, 27A0V-113

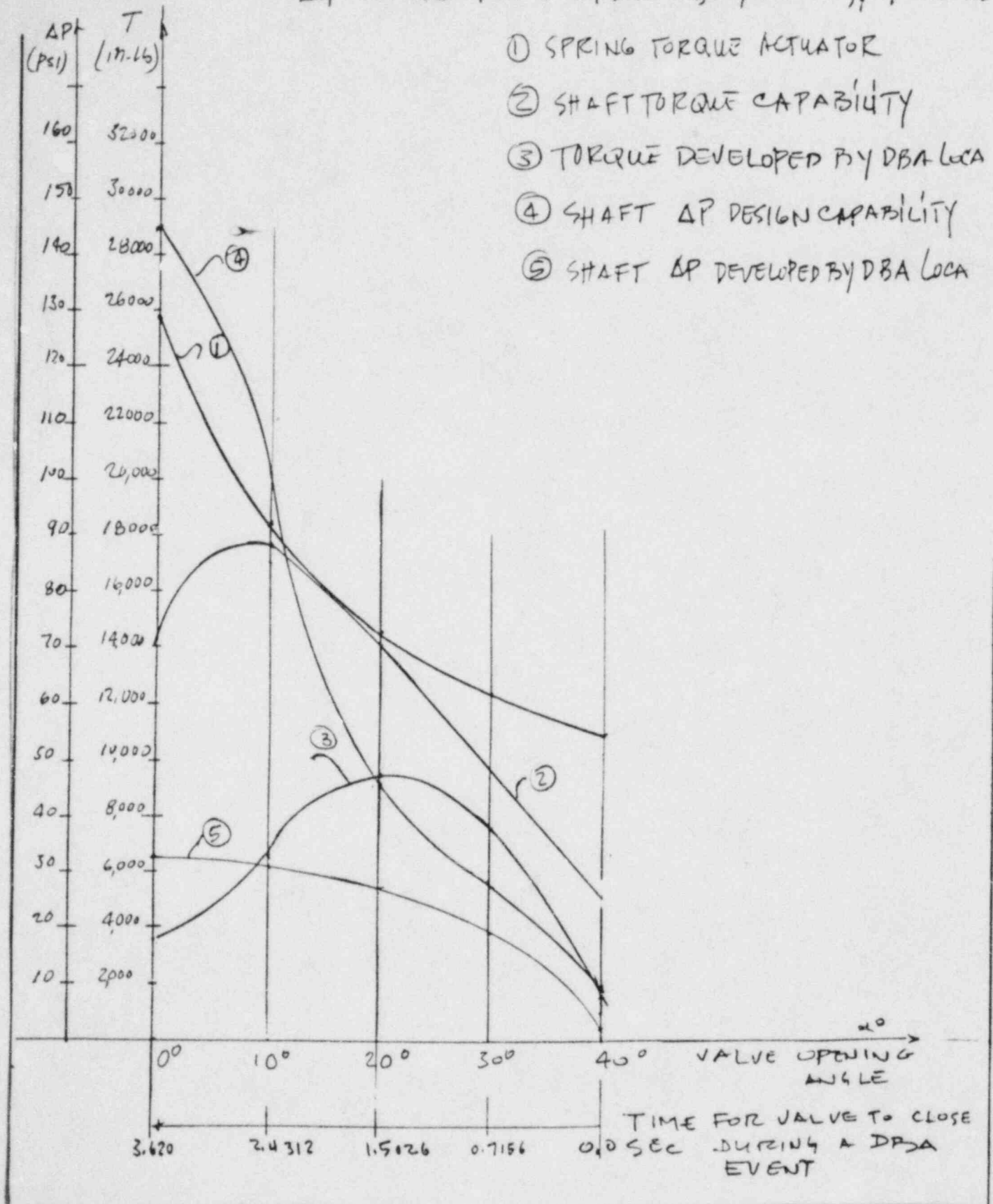


FIGURE # 1

24" VALVE TAG # 27 AOV-114

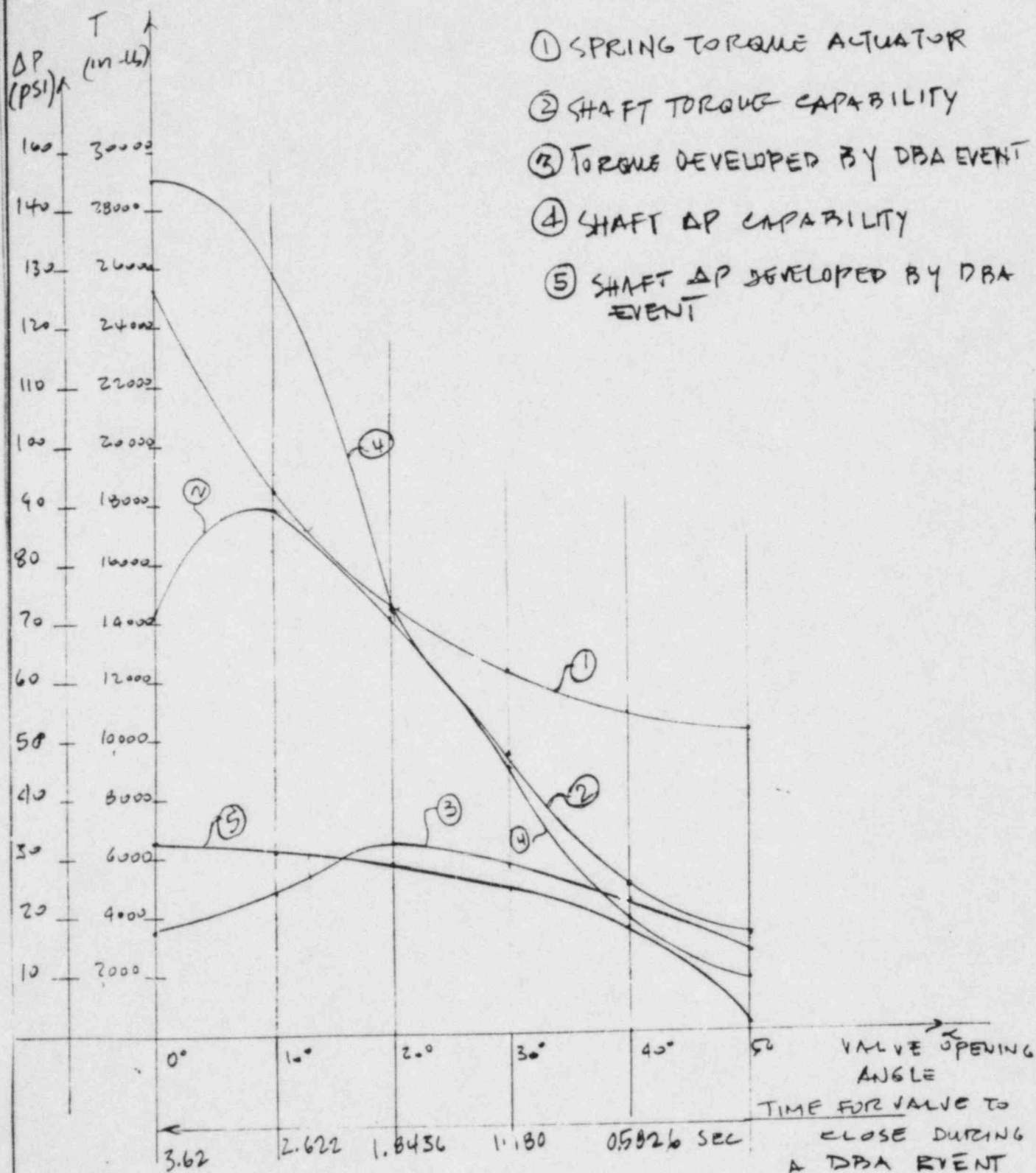


FIGURE # 2

20" VALVE TAG # 27 AOV-115 AND 27 AOV-116

① SPRING TORQUE ACTUATOR

② SHAFT TORQUE CAPABILITY

③ TORQUE DEVELOPED BY LOCA DBA

④ SHAFT ΔP DESIGN CAPABILITY

⑤ SHAFT ΔP DEVELOPED BY DBA LOCA

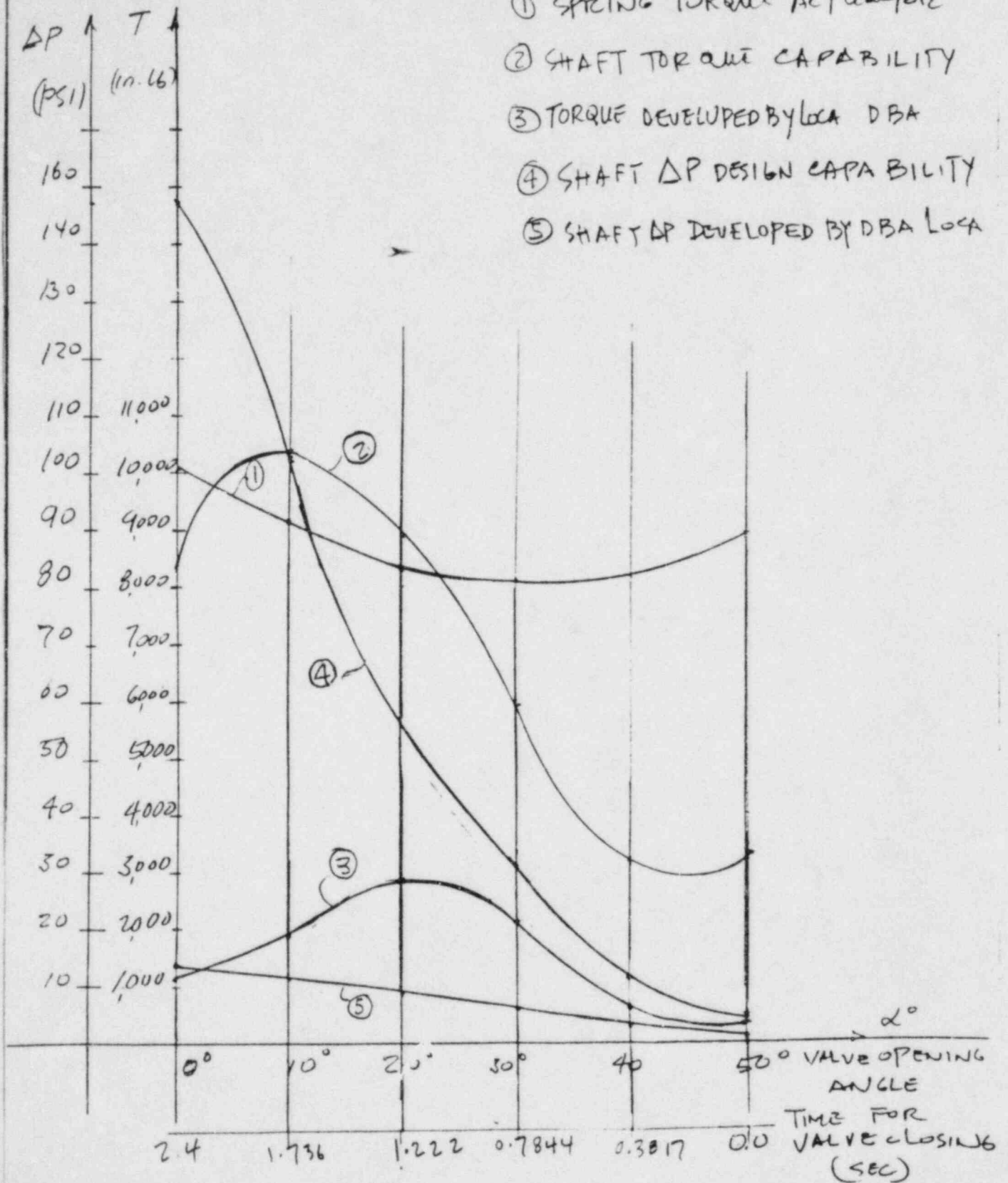


FIGURE # 3



GFV TORQUE DETERMINATION

Objective

To determine the determining factor in accurately selecting the most economical actuator for a butterfly valve is the torque required to open and close the valve. The following is a quick and easy method of determining actuator torque required in both the open and the closed position of a butterfly valve.

It should be noted at this point that before valve torque is determined, the user should consult CFG 20D-20 to ensure that the pressure drop limitations are not exceeded for the specific valve construction in consideration.

Introduction

Butterfly valve torque is actually

the sum of a number of torque components. To avoid confusion, a number of these have been combined and a number of calculations have been performed in advance. Thus, each valve type can be represented with the same simple, practical formula shown below. The various torque components and the process of simplification are explained fully in the appendix (See Page 23).

$$\text{TOTAL TORQUE (IN-LBS)} = A (\Delta P_{\text{act}-\alpha^\circ}) + B + C \left(\begin{array}{l} \Delta P_{\text{act}-\alpha^\circ} \text{ whichever} \\ \text{or} \text{ is} \\ \Delta P_{\text{eff}-\alpha^\circ} \text{ smaller} \end{array} \right)$$

where: A, B, C = Tabulated coefficients

$\Delta P_{\text{act}-\alpha^\circ}$ = Actual pressure drop at angle α°

$\Delta P_{\text{eff}-\alpha^\circ}$ = Effective pressure drop at angle α°

Procedure

1. From the above table, determine the effective pressure drop, $\Delta P_{\text{eff}-\alpha^\circ}$, at the desired maximum angle of opening.

2. Turn to the table for the valve type, class and disc type in consideration.

3. From the table, choose values for A, B and C according to the characteristics of the valve in the closed position (0°). Write the equation shown using the selected values and perform the simple calculation required. This determines the required actuator torque to move the valve disc away from its seat.

4. Select values for A, B and C again, this time according to the characteristics of the valve at the desired maximum open angle (α°). Write the equation shown using the new values and perform the simple calculation required. This determines the required actuator torque (valve torque required) at the desired angle of opening.

5. An actuator may now be selected with either:

a) A constant torque output greater than the larger of the torques determined in 3 and 4.

b) A varying torque output which equals or exceeds both of the determined torques at their respective valve positions.

Refer to CFG 40F-20 for Fisher actuator selection.

* The effective pressure drop term, $\Delta P_{\text{eff}-\alpha^\circ}$, arises due to the flow conditions near the disc. It is a calculated value and will usually vary from the actual pressure drop. It may be described as the pressure drop seen by the disc in the region of flow which affects only the "C" multiplier in the torque formula. Note that, due to its nature, the effective pressure drop is used only at open angles ($\Delta P_{\text{eff}-\alpha^\circ}$) and then only when it is less than the actual pressure drop ($\Delta P_{\text{act}-\alpha^\circ}$).

EFFECTIVE PRESSURE DROP

NOTE: P_1 = Upstream pressure at the indicated angle of opening (0°)

TABLE 1

Type of Disc	Type of Fluid	Angle of Disc Opening								
		0°	10°	20°	30°	40°	50°	60°	70°	$80^\circ - 90^\circ$
Conventional or Offset	Liquid	$\Delta P_{\text{act } 0^\circ}$	$0.570P_1$	$0.710P_1$	$0.500P_1$	$0.690P_1$	$0.550P_1$	$0.450P_1$	$0.390P_1$	$0.350P_1$
	Gas	$\Delta P_{\text{act } 0^\circ}$	$\Delta P_{\text{act } 10^\circ}$	$0.500P_1$	$0.250P_1$	$0.250P_1$	$0.200P_1$	$0.200P_1$	$0.140P_1$	$0.140P_1$
Fishtail	Liquid	$\Delta P_{\text{act } 0^\circ}$	$0.700P_1$	$0.700P_1$	$0.700P_1$	$0.700P_1$	$0.670P_1$	$0.600P_1$	$0.500P_1$	$0.450P_1$
	Gas	$\Delta P_{\text{act } 0^\circ}$	$0.260P_1$	$0.350P_1$	$0.350P_1$	$0.350P_1$	$0.250P_1$	$0.180P_1$	$0.110P_1$	$0.090P_1$

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APPENDIX

There are actually five torque components which add to produce the total torque in a butterfly valve. These are: friction torque (on shaft), packing torque (on shaft), unbalance torque (on offset discs), seating torque (on tight shutoff discs) and dynamic torque (on all discs).

Derivation of Formulas

The general formula for butterfly valve torque is:

$$T_t = T_f + T_p + T_u + T_s + T_d$$

where:

- T_t = Total torque
- T_f = Friction torque
- T_p = Packing torque
- T_u = Unbalance torque
- T_s = Seating torque
- T_d = Dynamic torque

Both friction torque and dynamic torque must be calculated. Friction torque is a function of the bushing coef-

ficient of friction (friction torque factor), the shaft size (shaft diameter ratio - based on Type 7600 Class 2 shaft) and the actual pressure drop. Dynamic torque is a function of the valve size and disc opening (dynamic torque factor) and the actual or effective pressure drop whichever is smaller. From these factors the following equations are derived:

$$T_f = (FTF) (SDR) (\Delta P_{act-\alpha^\circ})$$

$$T_d = (DTF) \begin{pmatrix} \Delta P_{act-\alpha^\circ} & \text{whichever} \\ \text{or} & \text{is} \\ \Delta P_{eff-\alpha^\circ} & \text{smaller} \end{pmatrix}$$

where:

FTF = Friction Torque Factor

SDR = Shaft Diameter Ratio

$\Delta P_{act-\alpha^\circ}$ = Actual Pressure Drop at Angle α°

DTF = Dynamic Torque Factor

$\Delta P_{eff-\alpha^\circ}$ = Effective Pressure Drop at Angle α°

The general equation can now be written:

$$T_t = (FTF)(SDR)(\Delta P_{act-\alpha^\circ}) + T_p + T_u + T_s + (DTF) \begin{pmatrix} \Delta P_{act-\alpha^\circ} & \text{whichever} \\ \text{or} & \text{is} \\ \Delta P_{eff-\alpha^\circ} & \text{smaller} \end{pmatrix}$$

where:

$$(FTF) (SDR) = A$$

$$DTF = C$$

and for

Types 7500, 7600*, 7700 and 7800

$$T_p = B; \quad T_u = T_s = 0$$

Types 8200 and 8300

$$T_p + T_u = B; \quad T_s = 0$$

Types 9100 and 9500

$$- + T_s = B; \quad T_u = 0$$

Type 9200

$$T_p + T_u + T_s = B$$

thus, in each case

$$\text{TOTAL-TORQUE (IN-LBS)} = A (\Delta P_{act-\alpha^\circ}) + B + C \begin{pmatrix} \Delta P_{act-\alpha^\circ} & \text{whichever} \\ \text{or} & \text{is} \\ \Delta P_{eff-\alpha^\circ} & \text{smaller} \end{pmatrix}$$

* NOTE - The elastomer lined Type 7600 is ignored at this point since it is a special case and is treated as such in the tables. Were it to be included here, it would be simplified in the same manner as the Type 9100 and 9500 since it has a seating torque component at closed angles.

Additional Comments

Note that the tables give values for "B" at both 0° and open angles when seating torque is present. This is due to the fact that seating torque applies only when the disc is near the seat.

A value of zero is given for "C" for all valve types at 0° since dynamic torque is present only at angles of 10° or more.

9200 & 9280 BUTTERFLY VALVE TORQUE DETERMINATION

Introduction: Use the following procedure and tables to determine actuator torque required for 4-inch through 72-inch 9200 and 9280 series valves.

Warning: This procedure does not consider mechanically adjustable, non-inflatable Type 9200 with TFE seat 0°, see Table 33.

Butterfly valve torque is actually the sum of a number of torque components. To avoid confusion, a number of these have been combined and a number of calculations have been performed in advance. Thus, the following formulas are used in torque determination. The various torque components and the process of simplification are explained fully in the appendix.

Necessary Equations:

$$\text{Torque @ } 0^\circ \text{ (in-lbs)} = A\Delta P_{\text{shutoff}} + B + \overbrace{B_1 + B_2}^{T_s} \Delta P_{\text{shutoff}}$$

Where A, B, B₁, B₂ = tabulated coefficients

$\Delta P_{\text{shutoff}}$ = shutoff pressure drop ✓

For inflatable seal, B₁ & B₂ = 0.

$$\text{Torque @ } \alpha^\circ \text{ (in-lbs)} = A\Delta P_{\text{ACT-}\alpha^\circ} + B + C\Delta P_{\text{DYN-}\alpha^\circ}$$

Where A, B, C = Tabulated coefficients

$\Delta P_{\text{ACT-}\alpha^\circ}$ = Actual pressure drop at angle α°

$\Delta P_{\text{DYN-}\alpha^\circ}$ = Dynamic pressure drop at angle α° ✓

Procedure:

1. Determine shaft class.

Using Table 1, determine the shaft class by valve size and shaft diameter.

Body Size In.	A (Select One Bushing Mat'l)				B (Select Sealing Type or Angle)					
	TFF Lined *	Graphite Filled Bronze	Bronze	None, Alloy 6	Adjustable @ 0°			Inflatable @ 0° (Select One)		10°- 90°
					B	B ₁	B ₂	Other "Elastomers"	Viton	
1	0.299	0.800	1.00	1.60	52.2	79	1.6	212.2	372.2	52.2
5	0.357	1.25	1.56	2.50	54.0	138	1.9	254	454	54.0
6	0.500	1.75	2.19	3.50	54.8	197	2.2	294.8	534.8	54.8
8	1.07	3.75	4.69	7.50	76.0	313	2.5	396	716	76.0
10	2.24	7.85	9.81	15.7	116	469	3.2	516	916	116
12	3.29	11.5	14.4	23.0	123	665	4.1	603	1,083	123
14	5.14	18.0	22.5	36.0	185	889	5.0	715	1,245	185
16	6.71	23.5	29.4	47.0	198	1,212	6.6	808	1,418	198
18	10.3	36.0	45.0	72.0	260	1,603	8.1	940	1,620	260
20	12.6	44.0	55.0	88.0	316	2,188	11.3	1,076	1,836	316
24	21.6	75.5	94.4	151	471	3,634	24.1	1,391	2,311	471
30	38.7	136	169	271	782	5,860	62.3	1,942	3,102	782
36	54.9	192	240	384	995	8,110	101.3	2,395	3,795	995
42	94.3	330	413	660	2,040	10,360	140.3	3,680	5,320	2,040
48	124	434	543	868	2,200	12,610	179.3	4,080	5,960	2,200
54	189	662	828	1,320	2,420	14,860	218.3	4,540	6,660	2,420
60	234	820	1,020	1,840	4,520	17,110	257.3	6,880	9,240	4,520
66	332	1,160	1,450	2,320	5,760	19,360	296.3	8,360	10,960	5,760
72	396	1,390	1,730	2,770	6,860	21,610	335.3	9,700	12,540	6,860
84	619	2,170	2,710	4,330	9,150	26,110	413.3	12,470	15,790	9,150
96	911	3,190	3,990	6380	11,400	30,610	491.3	15,200	19,000	11,400

* TFF lined SST or TFF lined fiberglass.

C

TABLE 4
TYPE 9200-A/B TORQUE COEFFICIENTS - CLASS 3

Body Size In.	A (Select One Bushing Mat'l)				B (Select Sealing Type or Angle)					
	TFF Lined *	Graphite Filled Bronze	Bronze	None, Alloy 6	Adjustable @ 0°			Inflatable @ 0° (Select One)		10°- 90°
					B	B ₁	B ₂	Other "Elastomers"	Viton	
1	0.274	0.960	1.20	1.92	67.2	79	1.6	227.2	387.2	67.2
5	0.429	1.50	1.88	3.00	67.0	138	1.9	269	469	69.0
6	0.600	2.10	2.63	4.20	67.8	197	2.2	309.8	549.8	69.8
8	1.43	4.99	6.23	9.98	111	313	2.5	431	751	111
10	2.80	9.81	12.3	19.6	156	469	3.2	556	956	156
12	4.11	14.4	18.0	28.8	163	665	4.1	643	1,123	163
14	6.17	21.6	27.0	43.2	229	889	5.0	759	1,289	229
16	8.06	28.2	35.3	56.4	242	1,212	6.6	852	1,462	242
18	12.0	42.1	52.7	84.2	308	1,603	8.1	988	1,668	308
20	14.7	51.5	64.4	103	364	2,188	11.3	1,124	1,884	364
24	24.6	86.1	108	172	521	3,634	24.1	1,441	2,361	521
30	48.4	160	212	339	876	5,860	62.3	2,056	3,216	876
36	63.6	240	300	480	1,110	8,110	101.3	2,510	3,910	1,110
42	113	396	495	792	2,160	10,360	140.3	3,800	5,440	2,160
48	144	521	651	1,040	2,320	12,610	179.3	4,200	6,080	2,320
54	221	775	969	1,550	3,560	14,860	218.3	5,680	7,800	3,560
60	274	959	1,200	1,920	4,660	17,110	257.3	7,020	9,380	4,660
66	378	1,320	1,660	2,650	5,900	19,360	296.3	8,500	11,100	5,900
72	451	1,580	1,970	3,160	7,000	21,610	335.3	9,840	12,680	7,000
84	699	2,450	3,060	4,890	9,310	26,110	413.3	12,630	15,950	9,310
96	1,030	3,610	4,510	7,210	11,000	30,610	491.3	14,800	18,600	11,000

Valve Size in.	Disc Type Flow Direction	Shaft Dia. [Shaft Class]	Torque Factor C (Select One Angle)							
			0°	10°	20°	30°	40°	50°	60°	70° 80°-90°
14	Cast-Flat	All	0	10.3	21.0	33.0	72.0	129	245	495 763
	Cast-Hub	All	0	15.4	31.5	49.5	108	194	368	742 1140
	Plate	1 1/4 [2]	0	16.3	29.0	29.0	29.0	64.8	144	323 392
		1 1/2 [3]	0	16.2	27.8	27.8	27.8	65.0	139	276 313
		1 3/4 [4]	0	16.3	29.0	29.0	29.0	64.8	134	239 280
		2 [5]	0	16.4	28.2	28.2	28.2	65.8	134	216 254
		2 1/2 [6]	0	16.5	28.2	28.2	28.2	65.8	113	151 177
		3 [7]	0	16.4	28.3	28.3	28.3	65.8	94.1	120 144
	Cast-Flat	All	0	15.0	31.0	51.0	108	195	370	750 1,160
	Cast-Hub	All	0	22.5	46.5	76.5	162	292	555	1,120 1,740
	Plate	1 1/4 [2]	0	24.7	42.3	42.3	42.3	99.0	224	515 627
		1 1/2 [3]	0	24.8	42.6	42.6	42.6	99.3	220	475 572
		1 3/4 [4]	0	24.7	42.3	42.3	42.3	99.0	210	402 472
		2 [5]	0	25.1	42.9	42.9	42.9	100	207	365 426
		2 1/2 [6]	0	25.1	42.9	42.9	42.9	100	201	305 355
		3 [7]	0	25.1	42.9	42.9	42.9	100	154	201 236
16	Cast-Flat	All	0	22.0	45.0	73.0	156	282	535	1,080 1,710
	Cast-Hub	All	0	33.0	67.5	110	224	423	802	1,620 2,560
	Plate	1 1/2 [2]	0	34.3	58.8	58.8	58.8	136	315	720 892
		1 3/4 [3]	0	34.4	58.9	58.9	58.9	137	299	627 750
		2 [4]	0	34.3	58.8	58.8	58.8	136	290	535 630
		2 1/2 [5]	0	34.4	58.9	58.9	58.9	137	279	452 529
		3 [6]	0	34.4	58.8	58.8	58.8	138	260	373 442
		3 1/2 [7]	0	34.4	58.8	58.8	58.8	137	206	260 309
	Cast-Flat	All	0	32.0	61.0	99.0	210	381	720	1,460 2,310
	Cast-Hub	All	0	48.0	91.5	148	315	572	1,080	2,190 3,460
	Plate	1 1/2 [2]	0	48.0	82.0	82.0	82.0	191	438	1,030 1,280
		1 3/4 [3]	0	48.0	82.3	82.3	82.3	193	425	920 1,110
		2 [4]	0	48.0	82.0	82.0	82.0	191	413	857 1,020
		2 1/2 [5]	0	47.9	82.3	82.3	82.3	192	398	688 803
		3 [6]	0	47.9	82.3	82.3	82.3	192	384	583 678
		3 1/2 [7]	0	47.9	82.3	82.3	82.3	192	329	453 534
20	Cast-Flat	All	0	53.0	106	173	313	567	1,260	2,550 4,040
	Cast-Hub	All	0	79.5	159	260	552	1,000	1,890	3,820 6,080
	Plate	1 3/4 [2]	0	85.0	146	146	146	340	783	1,910 2,410
		2 [3]	0	85.0	146	146	146	340	766	1,730 2,100
		2 1/2 [4]	0	85.0	146	146	146	340	730	1,470 1,720
		3 [5]	0	85.2	146	146	146	341	706	1,300 1,540
		3 1/2 [6]	0	85.2	146	146	146	341	682	1,070 1,270
		4 [7]	0	85.2	146	146	146	341	621	876 1,040
	Cast-Flat	All	0	105	211	344	734	1,220	2,520	5,090 8,050
	Cast-Hub	All	0	158	316	516	1,100	2,100	3,780	7,640 12,120
	Plate	2 [2]	0	171	293	293	293	680	1,580	3,980 5,000
		2 1/2 [3]	0	171	293	293	293	682	1,480	3,510 4,220
		3 [4]	0	171	293	293	293	680	1,510	3,240 3,720
		3 1/2 [5]	0	171	293	293	293	683	1,480	2,830 3,320
		4 [6]	0	171	293	293	293	683	1,390	2,270 2,680
		5 1/2 [7]	0	171	293	293	293	684	1,370	2,100 2,490

STANDARD SHAFT DIAMETERS

TABLE 1. SHAFT DIAMETERS (INCHES) FOR TYPE 9200

Valve Size In Shaft Class	2	3	4	5	6	7
4	5/8	3/4	1	1 1/4	-	-
5	5/8	3/4	1	1 1/4	-	-
6	5/8	3/4	1	1 1/4	1 1/2	-
8	3/4	1	1 1/4	1 1/2	1 3/4	-
10	1	1 1/4	1 1/2	1 3/4	2	2 1/2
12	1	1 1/4	1 1/2	1 3/4	2	2 1/2
14	1 1/4	1 1/2	1 3/4	2	2 1/2	3
16	1 1/4	1 1/2	1 3/4	2	2 1/2	3
18	1 1/2	1 3/4	2	2 1/2	3	3 1/2
20	1 1/2	1 3/4	2	2 1/2	3	3 1/2
24	1 3/4	2	2 1/2	3	3 1/2	4
30	2	2 1/2	3	3 1/2	4	4 1/2
36	2	2 1/2	3	3 1/2	4	4 1/2
42	2 1/2	3	3 1/2	4	4 1/2	5
48	2 1/2	3	3 1/2	4	4 1/2	5
54	3	3 1/2	4	4 1/2	5	5 1/2
60	3	3 1/2	4	4 1/2	5	5 1/2
66	3	3 1/2	4	4 1/2	5	5 1/2
72	3 1/2	4	4 1/2	5	5 1/2	6
84	4	4 1/2	5	5 1/2	6	6 1/2
96	4 1/2	5	5 1/2	6	6 1/2	7

E 2

EFFECTIVE PRESSURE DROP

TABLE 2

Type of Fluid	Angle of Disc Opening								
		0°	10°	20°	30°	40°	50°	60°	70° 80° 90°
Liquid	ΔP_{act-0°		0.570P ₁	0.730P ₁	0.500P ₁	0.690P ₁	0.650P ₁	0.450P ₁	0.390P ₁ 0.350P ₁
Gas	ΔP_{act-0°	ΔP_{act-10°		0.500P ₁	0.250P ₁	0.250P ₁	0.200P ₁	0.200P ₁	0.140P ₁ 0.140P ₁
Liquid	ΔP_{act-0°		0.700P ₁	0.700P ₁	0.700P ₁	0.700P ₁	0.670P ₁	0.600P ₁	0.500P ₁ 0.450P ₁
Gas	ΔP_{act-0°		0.260P ₁	0.350P ₁	0.350P ₁	0.350P ₁	0.250P ₁	0.180P ₁	0.110P ₁ 0.090P ₁

P₁ = Upstream pressure (psia) at the indicated angle of opening (α°).

Section 2A. Type 9200-Flow Against Hub Side of Disc (Continued)

T-Ring Material: Adjustable-All Except TFE⁽¹⁾
Inflatable-All Except TFE⁽¹⁾ and Viton⁽²⁾

SIZE	TYPE - GRADE & SHAFT DIAMETER	MAXIMUM ΔP VALVE DESIGN (ALL ANGLES)	BUSHING TYPE	MAXIMUM Δ BUSHING (ALL ANGLES)	SEAL TYPE	MAXIMUM ΔP C/S - DISC (ALL ANGLES)	MAX ΔP OF 17-4PH SHAFT									
							DISC ANGLE OF CLOSING									
							0°	10°	20°	30°	40°	50°	60°	70°	80-90°	
18"	9200 2 1-1/2"		TFE #1	197	ADJ	109	181	→	136	86	40	22	12	6	4	
					INFLATE	109	234	→	136	86	40	22	12	6	4	
			STEEL #3	197	ADJ	109	127	→	93	67	35	20	11	6	4	
					INFLATE	109	167	133	93	67	35	20	11	6	4	
	9200 3 1-3/4"		TFE #1	269	ADJ	153	258	→	213	136	63	35	19	9	6	
					INFLATE	153	348	→	213	136	63	35	19	9	6	
			STEEL #3	269	ADJ	153	180	→	140	92	54	32	18	9	6	
					INFLATE	153	233	190	140	102	54	32	18	9	6	
	9200 4 2"		TFE #1	351	ADJ	288	349	→	314	201	93	52	28	14	9	
					INFLATE	288	427	→	314	201	93	52	28	14	9	
			STEEL #3	351	ADJ	288	264	→	197	146	79	47	26	14	9	
					INFLATE	288	311	257	197	146	79	47	26	14	9	
20"	9200 2 1-1/2"	→	TFE #1	158	ADJ	124	147	→	98	62	29	23	8	4	3	
					INFLATE	124	190	184	98	62	29	23	8	4	3	
			STEEL #3	158	ADJ	124	104	103	70	49	25	15		4	3	
					INFLATE	124	135	103	70	49	25	15	8	4	3	
	9200 3 1-3/4"		TFE #1	215	ADJ	161	210	→	154	98	45	25	13	7	4	
					INFLATE	161	282	→	154	98	45	25	13	7	4	
			STEEL #3	215	ADJ	161	147	→	105	75	40	23	13	7	4	
					INFLATE	161	190	147	105	75	40	23	13	7	4	
	9200 4 2"		TFE #1	281	ADJ	188	284	→	228	145	67	37	20	10	6	
					INFLATE	188	353	→	228	145	67	37	20	10	6	
			STEEL #3	281	ADJ	188	200	→	148	108	58	34	19	10	6	
					INFLATE	188	253	200	148	108	58	34	19	10	6	
24"	9200 2 1-3/4"	→	TFE #1	147	ADJ	105	145	→	88	56	26	14	9	4	2	
					INFLATE	105	193	165	88	56	26	14	9	4	2	
			STEEL #3	147	ADJ	105	101	95	63	44	23	13	7	4	2	
					INFLATE	105	127	95	63	44	23	13	7	4	2	
	9200 3 2"		TFE #1	192	ADJ	123	127	→	120	83	38	21	11	6	4	
					INFLATE	123	243	242	120	83	38	21	11	6	4	
			STEEL #3	192	ADJ	123	135	129	90	64	34	20	11	6	3	
					INFLATE	123	171	129	90	64	34	20	11	6	3	
	9200 4 2-1/2"		TFE #1	300	ADJ	202	320	→	250	159	74	41	22	11	7	
					INFLATE	202	403	→	250	159	74	41	22	11	7	
			STEEL #3	300	ADJ	202	223	215	161	118	63	35	21	11	7	
					INFLATE	202	272	215	161	118	63	35	21	11	7	
30"	9200 2 2"		TFE #1	120	ADJ	80	124	→	66	42	19	11	6	3	2	
					INFLATE	80	157	125	66	42	19	11	6	3	2	
			STEEL #3	120	ADJ	80	85	74	48	34	17	10	5	3	2	
					INFLATE	80	107	74	48	34	17	10	5	3	2	

1. Consult factory. 2. See Section 2C.



FISHER CONTROLS COMPANY

CONTINENTAL DIVISION

CORADPOL, PENNSYLVANIA 15109

PHONE: (412) 284-2010-1051 710-795-301 - TELE: 006-790

OUR ORDER # **P46940-01**

DATE 3-30-72	REPORT <input type="checkbox"/>	SUBJECT TO INSPECTION <input checked="" type="checkbox"/>	ESTIMATED DELIVERY DATE
2-1761	ODTTZ	BF171050	

Fisher Controls Company
P.O. Box 190
Marshalltown, Iowa 50158

Same
Center Street Plant
Receiving Plant
Marshalltown, Iowa

1 3/4" shaft

VIA: Truck - Proper

VALVE DESCRIPTION										D.M. 171050 Pages 1 thru 4			
QTY. 1	SIZE 24"	TYPE 9222	FLANGE 150RF	CLASS 2	BODY/GEA SA516 G-70	SEAT EPT	DISC SA516 (30,70)	FACE DISC	DISC DIA.				
			SHAFT (5556) 17-APU		FINE (5557) 1316 8/8		ALLOY REF	STITTLE	GT/ST.	FOLLOWERS A192 STUBS OTHER A192 NUTS			
PACKING 2 CRJ		TEFL.	PLAI	STUFFING BOX PURGED		LUB.	GRAPHITIC	STAINLESS	1/4 PLUG	OTHER LUG.	100% VALVE	ALERTS	
INDICATOR BUSHINGS		MOLLER BEARING		OPEN	EXTENSIONS PLAIN		OTHER	SEAL SYSTEM NO		SCHEMATIC NO. J-10510			

BRACKET AND LINKAGE				D.M.	
PUSH ROD	PARALLEL	HORIZONTAL	VERTICAL	MINIMUM DEGREE 0	MAXIMUM DEGREE 90

POWER ACTUATOR DESCRIPTION						D.M.					
QTY. 1	ACTUATOR TYPE BETTS 733-SR	MODEL NO.	PSI	STROKE	POSITIONER	MODEL NO.	STROKE	DAWSES	DIRECT	REVERSE	ARMSET
HANDWHEEL		TO		THRT SIGNAL		TO		BENCH SET		PRESSURE TO ACTUATOR 90 TO 120 #	
BYDE MTD. 10P MTD.										AIR <input checked="" type="checkbox"/> CLOSE <input type="checkbox"/>	

MANUAL ACTUATOR DESCRIPTION						D.M.					
QTY. 1	DESCRIPTION LIMITORQUE HZBC 4SPUR		PSI	CLUTCH	POSITION #3	CHAIN	LEVER				
VALVE SERVICE						MOUNTING INSTRUCTIONS			ITEM PRICE		

FLUID AIR	MAX. SHUT OFF PRES. 50 PSI	TEMP. 350°F	STAT PRES.	COIL TURN X	COIL TURN COIL ST	COIL TURN ARE WT.
------------------	-----------------------------------	--------------------	------------	--------------------	--------------------------	--------------------------

PRINT INSTRUCTIONS					
LEFT TRANS. 1	PRINTS 1	INSTALL OPER. & MAINT. INST. 40	PART LIST 40	PRICED PARTS LIST	NO HOLD FOR APPROVAL

SPECIAL INSTRUCTIONS: **AMT. T-RING FOR INTERFERENCE FIT**
 Design A To **50 PSI** At **350°F** Max. Casting Pres. **PSI CWT**
 Cust. Item # **1** Tag: **27ACV-114** Act. Serial #

- 10 - FURNISH (2) **D-2900-X** LIMIT SWITCHES (TO INDICATE OPEN & CLOSED POSITION)
- 12 - FURNISH **3-WAY** VALVE **316 SS (120X 60H)** (ENERG. TO OPEN VALVE)

SUBJECT TO INSPECTION

ADHERENCE TO NBS-29 IS REQUIRED

P. 26940-01

WILLIAM

ISSUED BY DATE FOR SHIPPING POINT



FISHER CONTROLS COMPANY

CONTINENTAL DIVISION

POCAHONTAS, PENNSYLVANIA 15106

PHONE: (412) 264-3010 - EXT: 710-793-3010 - TEL: 800-750

JB
SHOP
ORDER P.96940-05
ISSUED DATE: 1-1-72

DATE	3-30-72	ESTIMATE NO.		SUBJECT TO INSPECTION	<input checked="" type="checkbox"/>	ESTIMATED SUPPLY DATE	
LEFT HAND NO.	2-17961	VALVE TYPE	ODTR	SERIAL NO.	BF 171054	REV. NO. 1	REV. NO. 2

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Fisher Controls Company
P.O. Box 190
Marshalltown, Iowa 50158

S
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P
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O

Same
Center Street Plant
Receiving Plant
Marshalltown, Iowa

VIA: Truck - Prepay

VALVE DESCRIPTION				B.M. 171054 Page 1 thru 4			
QUANTITY	SIZE	TYPE	FLANGE	CLASS	PORTS	SEAT	ENDS
1	20"	9222	150RF	2	SA 516 G. TO	EPT	SA 516 G. TO
			SHAFT (2534)	FINISH 3557	ALLOY	NET WT.	FOLLOWERS
			17-4PH	316 S/S			A193 STUDS A194 NUTS
PACKING	TYPE	PLAIN	STUFFING BOX	LEAD	GRAPHITE	STAINLESS	LANTERN GLAND
2 CRT			PURGED				OTHER LND.
INBOARD BUSHINGS	ROLLER LARINGS	OPEN	EXTENSION	FLANG	CAST ON	OTHER	SEAL SYSTEM
#5 (BUSHING)							No
BRACKET AND LINKAGE				B.M.			
PUSH ROD	PARALLEL	HORIZONTAL	PIPE RUN	VERTICAL	LINKAGE SET	MINIMUM DEGREE	
PERPENDICULAR						90° MAXIMUM DEGREE	

POWER ACTUATOR DESCRIPTION				B.M.			
QTY.	ACTUATOR TYPE	MODEL NO.	TYPE	STROKE	POSITIONS	MODEL NO.	STROKE
1	BETTS 732-SR						
MINI WHEEL	SLIDE MTD.	TOP MTD.	TO	INSTR. S'GVAL	TO	SENSE SET	90° 120°
				PRESSURE TO ACTUATOR			
				AIR			
				PRESSURE TO OPEN			
				CLOSE			

MANUAL ACTUATOR DESCRIPTION				B.M.			
QTY.	DESCRIPTION	PER	OR	POSITION	CHAM	LEVER	
1	LIMITORQUE HIB C 4 STUR			#3			
VALVE SERVICE				MOUNTING INSTRUCTIONS			
FLUID	MAX. SHUT OFF PRES.	TEMP.	STAT. PRES.	SHUT. FURN. SHUT. & MT.	SHUT. FURN. SHUT. & MT.	ITEM	
AIR N ₂ H ₂ O	50 PSI	350°F				PRICE	
PRINT INSTRUCTIONS							
CERT. TRANS.	PRINTS	INSTALL UPON & AGAINST INDS.	PART LIST	PRICE PARTS LIST	NO HOLD FOR APPROVAL		

SPECIAL INSTRUCTIONS: ATT. T-RING FOR INTERFERENCE FIT
 Design A Fo 50 PSI At 350°F Max. Casing Pres. PSI CNT
 Cust. Item # 5 Tag: 27A0V-115 Act. Serial #
 * CHROME-PLATE DISC EDGE
 10- FURNISH (2) D-2400X LIMIT SWITCH (TO INDICATE OPEN & CLOSE POSIT)
 1E- FURNISH ASCO 3-WAY SOL. #HT B31655 (120V, 60 HZ)
 (WIRING TO OPEN VALVE)

NUCLEAR

SUBJECT-TO-INSPECTION

REFERENCE TO NBS-29 IS REQUIRED RT/CZ

P. 96940-05

VALVE SET TO DATE P.O. SHIPPING POINT

Power Authority of the State of New York

6. API

11/15/71

Power Authority of the State of New York

11/15/71

Item No.	1	2	3
Operator Mark No.	27AOV-114	27AOV-113	27AOV-111
Valve Mark No.	VV-7EES	VV-7EES	VV-7EES
Quantity	1	1	1
Manufacturer	Flow	Flow	Flow
Manufacturer's model No.	9222	9222	9222
Valve type	Gate	Gate	Gate
Min valve ID, in.	23 1/2"	23 1/2"	23 1/2"
Min body thickness	2 3/4"	2 3/4"	2 3/4"
Min shaft diam. ID	1 1/2"	1 1/2"	1 1/2"
Size length along pipe, in.	22 1/2"	22 1/2"	22 1/2"
Max distance from C.L., in.			
Pressure drop, in. water @ max flow			
Shaft bearing lubrication	None	None	None
Shaft adjustment (yes or no)			
Packing gland (bolted preferred)	Bolted	Bolted	Bolted
Packing shape (Chevron preferred)	Round	Round	Round
Materials			
Valve body, steel - ASTM	A516 GR 70	A516 GR 70	A516 GR 70
Shaft, 12-8 St. St. - ASTM	A516 GR 70	A516 GR 70	A516 GR 70
Disc, 316 - ASTM	A516 GR 70	A516 GR 70	A516 GR 70
Seating surfaces	Cast Iron	Cast Iron	Cast Iron
Seat retainer, 12-8 St. St. - ASTM	A516 GR 70	A516 GR 70	A516 GR 70
Seat retainer fastening	Allen Steel	Allen Steel	Allen Steel
Shaft bearing	Ball	Ball	Ball
Shaft packing and seals	CRANE 2023	CRANE 2023	CRANE 2023
Tapered pins and keys	10-400/Steel	10-400/Steel	10-400/Steel
Manual operator, mfr. and model	Flow 4320-5820	Flow 4320-5820	Flow 4320-5820
Operator gear ratio	25:1	25:1	25:1
Handwheel diam. in.	15"	15"	15"
Torque to operate valve manually at max upbal. pressure, ft-lb	1000	1000	1000
Orientation of handwheel operator	Flow 4320-5820	Flow 4320-5820	Flow 4320-5820
Pneumatic operator, mfr. and model	Flow 4320-5820	Flow 4320-5820	Flow 4320-5820
Pneumatic operator type	Flow 4320-5820	Flow 4320-5820	Flow 4320-5820
Min air pressure required	50 psi	50 psi	50 psi
3-way solenoid valve, mfr. and model			
Position indicator switches, mfr. and model No.			
Notes			

Power Authority of the State of New York

Robert J. Birnbaum, Nuclear Energy Plant

By: ADW

Date 11/15/71

DATE RECEIVED BY GWT 120

Item No.	4	5	6
Generator Mark No.	27AOV-112	27AOV-115	27AOV-116
Valve Mark No.	VV1-7EES	VV2-7EES	VV3-7EES
Quantity	1	1	1
Manufacturer			
Manufacturer's model No.	4227	4227	4227
Valve type	WATER/STEAM	WATER/STEAM	WATER/STEAM
Min valve ID, in.	22 1/2"	19 1/2"	19 1/2"
Min body thickness	4 1/2" 2 1/2"	2"	2" 2"
Min shaft diam, ID	1 1/2"	1 1/2"	1 1/2"
Size length along pipe, in.	22 1/2"	22 1/2"	22 1/2"
Max distance from C.L., in.			
Pressure drop, in. water @ max flow			
Shaft bearing lubrication	NONE	NONE	NONE
Shaft adjustment (yes or no)			
Packing gland (bolted preferred)	BOLTED	BOLTED	BOLTED
Packing shape (Chevron preferred)	CHEVON	CHEVON	CHEVON
Materials			
Valve body, steel - ASTM	A 516 GR 70	A 516 GR 70	A 516 GR 70
Shaft, 13-8 St. St. - ASTM	A 516 GR 70	A 516 GR 70	A 516 GR 70
Disc, Stl. - ASTM	A 516 GR 70	A 516 GR 70	A 516 GR 70
Seating surfaces	BRASS/BRASS	BRASS/BRASS	BRASS/BRASS
Seat retainer, 13-8 St. Stl. - ASTM	A 516 GR 70	A 516 GR 70	A 516 GR 70
Seat retainer fastening	ALUM. STAIN	ALUM. STAIN	ALUM. STAIN
Shaft bearing	BRASS/BRASS	BRASS/BRASS	BRASS/BRASS
Shaft packing and seals	CRANE 2003	CRANE 2003	CRANE 2003
Tapered pins and keys	10-90-1000	10-90-1000	10-90-1000
Manual operator, mfr. and model	Full Gear H315	Full Gear H315	Full Gear H315
Operating gear ratio	230:1	230:1	230:1
Handwheel diam, in.	12"	12"	12"
Torque to operate valve manually at max uncal. pressure, ft-lb	1000	625	625
Orientation of handwheel operator	RIGHT HAND	RIGHT HAND	RIGHT HAND
Pneumatic operator, mfr. and model	Full Gear H315	Full Gear H315	Full Gear H315
Pneumatic operator type	CRANE 2003	CRANE 2003	CRANE 2003
Min air pressure required	90 PSI	90 PSI	90 PSI
3-way solenoid valve, mfr. and model			
Position indicator switches			
mfr. and model no.			
Limit switch included			
operation, in	12"	12"	12"



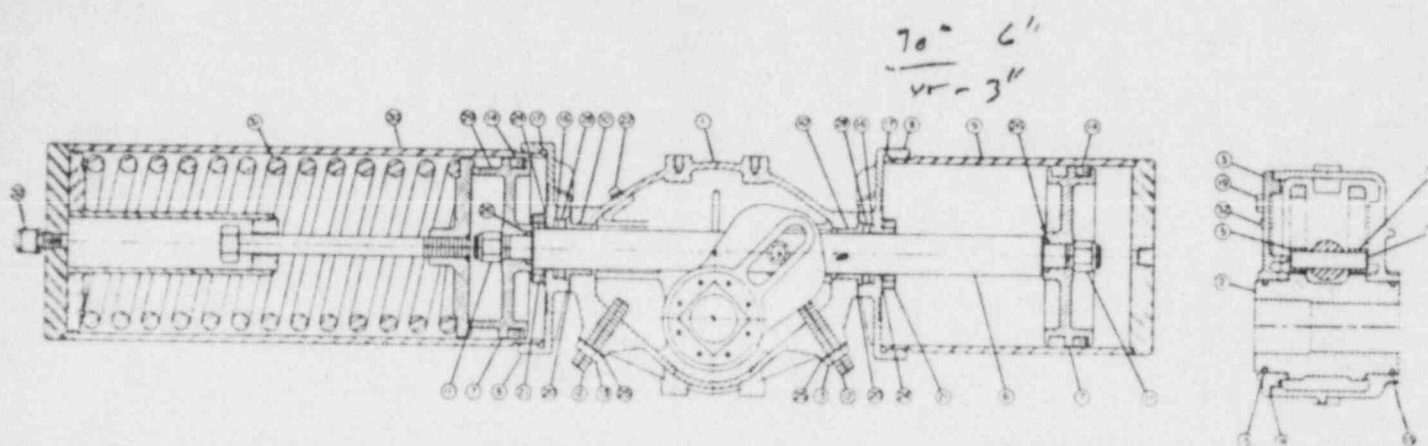
PRICE SHEET NO. 1-7320-SR

EFFECTIVE MARCH, 1970

ALWAYS FURNISH SERIAL NUMBER OF ACTUATOR WHEN ORDERING PARTS

ROBOTARM® VALVE ACTUATOR PARTS

LIST PRICES MODEL 732 B-SR



MODEL 732 B-SR

ITEM NO	PART NO	DESCRIPTION	MATERIAL	MATERIAL SPEC	QUAN	SPARE PARTS	PRICE EACH
1	211326	HOUSING	DUCTILE IRON	ASTM-A445-63T GRADE 60-45-15	1		\$103.00
2	211329	YOKE	DUCTILE IRON	ASTM-A536-65T GRADE 65-45-12	1		62.00
3	211330	HOUSING COVER	DUCTILE IRON	ASTM-A536-65T GRADE 65-45-12	1		26.00
4	211331	YOKE PIN	STEEL	STRESSPROOF	1		6.60
5	211415	YOKE PIN ROLLER	STEEL	STRESSPROOF	2		5.00
6	211332	PISTON ROD	STEEL	STRESSPROOF	1		54.00
7	203780	PISTON	GRAY IRON	ASTM-A126-61T CLASS B	1		33.80
8	202062	CYLINDER ADAPTER	DUCTILE IRON	ASTM-A536-65T GRADE 60-45-15	2		46.00
9	211333	CYLINDER	STEEL	TUBING AISI 1018 PLATE ASTM A7	1		58.00
10	209096	PISTON ROD GUIDE BUSHING	BRONZE	ASTM-B143-52 GRADE 88-10-2	2		12.40
11	208386	PISTON RETAINER NUT	STEEL & NYLON	ASTM-A194-65 GRADE 2	2		6.00
12	211336	STOP ADJUSTING SCREW	STEEL	45/53 Rc	2		5.50
13	211335	ADJUSTING SCREW JAM NUT	STEEL	ASTM-A194-65 GRADE 1	2		4.00
14	208387	PISTON SEAL	BUNA-N	DURO 70A	2		5.00
15	205244	YOKE SEAL	BUNA-N	DURO 70A	2		2.00
16	210828	PISTON ROD SEAL	BUNA-N	DURO 65A	2		10.00
17	208183	CYLINDER SEAL	BUNA-N	DURO 70A	2		2.60
18	211334	HOUSING COVER GASKET	COMPRESSED ASBESTOS	ASTM-D1170	1	1	2.00
19	204684	HOUSING COVER SCREW	STEEL	ASTM-A307-65 GRADE A	4		1.00
20	209094	CYLINDER ADAPTER GASKET	COMPRESSED ASBESTOS	ASTM-D1170	2	2	1.00
21	204670	CYLINDER ADAPTER SCREW	STEEL	38/42 Rc	8		1.00
22	204632	OIL FILL & DRAIN PLUG	STEEL	COMMERCIAL	1		1.00
23	203727	CYLINDER ADAPTER PLUG	STEEL	COMMERCIAL	4		1.00
24	209017	ADAPTER SCREW LOCK WASHER	STEEL	COMMERCIAL	8		.60
25	211337	ADJUSTING SCREW SEAL	NYLON	ZYTEL 101	2	2	.60
26	205216	PISTON HEAD SEAL	BUNA-N	DURO 70A	2	2	1.00
27	203294	SERIAL NUMBER TAG	ALUMINUM		1		N.C.
28	210921	PISTON ROD ANTI-EXTRUSION SEAL	MOLYTHANE®	CUP DURO 90A, O-RING DURO 70A	2 SETS	2 SETS	SEE ITEM 1A
29	209267	SPRING PISTON	GRAY IRON	ASTM-A126-61T GRADE B	1		44.50
30		SPRING CYLINDER	STEEL	TUBING AISI 1018 PLATE ASTM A7	1		ON APPL.
31		SPRING ASSEMBLY	STEEL & DUCTILE IRON		1		ON APPL.
32	211523	AIR BREATHER & BODY PLUG	ALUMINUM & BUNA-N	ASTM-B145-4A GRADE 88-5-5	3		5.00

* INCLUDES ITEM 28



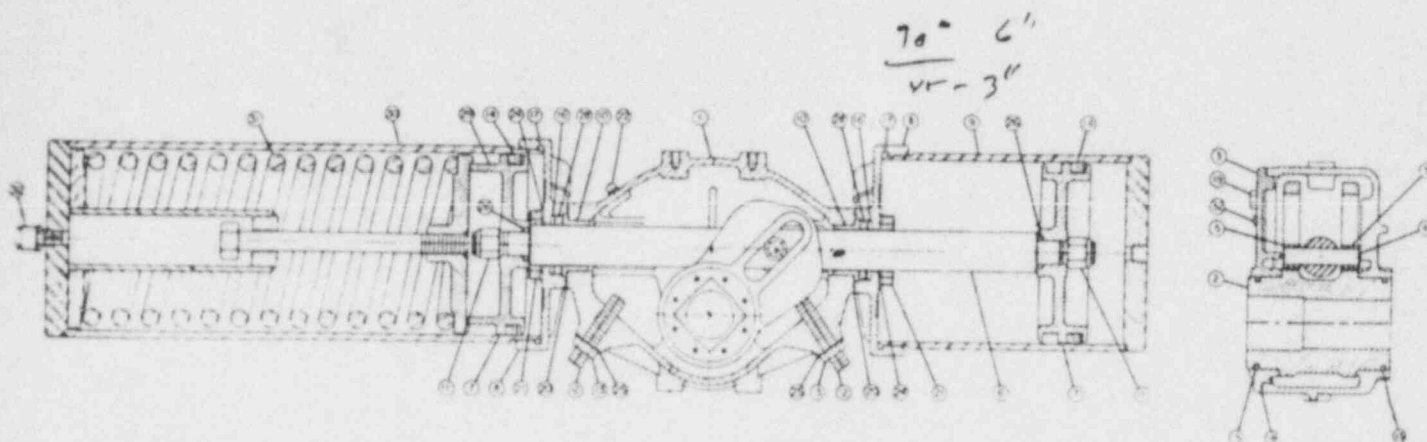
PRICE SHEET NO. 1-732C-SR

EFFECTIVE MARCH, 1970

ALWAYS FURNISH SERIAL NUMBER OF ACTUATOR WHEN ORDERING PARTS

ROBOTARM® VALVE ACTUATOR PARTS

LIST PRICES MODEL 732B-SR



MODEL 732B-SR

ITEM NO	PART NO	DESCRIPTION	MATERIAL	MATERIAL SPEC	QUAN	SPARE PARTS	PRICE EACH
1	211328	HOUSING	DUCTILE IRON	ASTM-A445-63T GRADE 60-45-15	1		\$103.00
2	211329	YOKE	DUCTILE IRON	ASTM-A536-65T GRADE 65-45-12	1		82.00
3	211330	HOUSING COVER	DUCTILE IRON	ASTM-A536-65T GRADE 65-45-12	1		26.00
4	211331	YOKE PIN	STEEL	STRESSPROOF	1		6.60
5	211415	YOKE PIN ROLLER	STEEL	STRESSPROOF	2		5.00
6	211332	PISTON ROD	STEEL	STRESSPROOF	1		34.00
7	203780	PISTON	GRAY IRON	ASTM-A126-61T CLASS B	1		33.80
8	202062	CYLINDER ADAPTER	DUCTILE IRON	ASTM-A536-65T GRADE 60-45-15	2		46.00
9	211333	CYLINDER	STEEL	TUBING AISI 1018 PLATE ASTM A7	1		58.00
10	209096	PISTON ROD GUIDE BUSHING	BRONZE	ASTM-B143-52 GRADE B8-10-2	2		12.40
11	208388	PISTON RETAINER NUT	STEEL & NYLON	ASTM-A194-65 GRADE 1	2		6.00
12	211336	STOP ADJUSTING SCREW	STEEL	45/53 Rc	3		5.50
13	211335	ADJUSTING SCREW JAM NUT	STEEL	ASTM-A194-65 GRADE 1	2		4.00
14	208387	PISTON SEAL	BUNA-N	DURO 70A	2		5.00
15	205244	YOKE SEAL	BUNA-N	DURO 70A	2	2	2.00
16	210828	PISTON ROD SEAL	BUNA-N	DURO 65A	2	2	10.00
17	208384	CYLINDER SEAL	BUNA-N	DURO 70A	2	2	2.80
18	211334	HOUSING COVER GASKET	COMPRESSED ASBESTOS	ASTM-D1170	1	1	2.00
19	204684	HOUSING COVER SCREW	STEEL	ASTM-A307-65 GRADE A	4		1.00
20	209094	CYLINDER ADAPTER GASKET	COMPRESSED ASBESTOS	ASTM-D1170	2	2	1.00
21	204670	CYLINDER ADAPTER SCREW	STEEL	3B/42 Rc	8		1.00
22	204732	OIL FILL & DRAIN PLUG	STEEL	COMMERCIAL	1		1.00
23	203727	CYLINDER ADAPTER PLUG	STEEL	COMMERCIAL	4		1.00
24	209017	ADAPTER SCREW LOCK WASHER	STEEL	COMMERCIAL	8		.60
25	211337	ADJUSTING SCREW SEAL	NYLON	ZYTEL 101	2	2	.60
26	205216	PISTON HEAD SEAL	BUNA-N	DURO 70A	2	2	1.00
27	203294	SERIAL NUMBER TAG	ALUMINUM		1		N.C.
28	210921	PISTON ROD ANTI-EXTRUSION SEAL	MOLYTHANE®	CUP DURO 90A, O-RING DURO 70A	2 SETS	2 SETS	SEE ITEM 16
29	209267	SPRING PISTON	GRAY IRON	ASTM-A126-61T GRADE B	1		44.50
30		SPRING CYLINDER	STEEL	TUBING AISI 1018 PLATE ASTM A7	1		ON APPL
31		SPRING ASSEMBLY	STEEL & DUCTILE IRON		1		ON APPL
32	211523	AIR BREATHER & BODY PLUG	ALUMINUM & BUNA-N	ASTM-B145-44 GRADE B8-5-5	3		5.00

* INCLUDES ITEM 28



Must Ship today Express Mail Next Day
OR Federal Express

LITERATURE ORDER FORM .1628

DATE 11-5-84
9:05 AM

SHIP ORDER TO: COMPANY New York Power Authority
ADDRESS 123 Main St.
CITY White Plains STATE New York ZIP 10601
TELEPHONE 914 681-6291
ATTN: Jan Leftor

SPECIAL SHIPPING INSTRUCTIONS Calculations for 732C-SRPO
and 733C-SR80

THIS SECTION FOR GH-BETTIS OFFICE USE ONLY

DATE RECEIVED _____
FULL ORDER SHIPPED ☐
PARTIAL ORDER SHIPPED ☐

DATE SHIPPED _____
METHOD OF SHIPMENT _____

CATALOGS

____ Catalog
____ Price Book

BULLETINS

____ 10 20-1 Robotarm Story: An Introduction To
Valve Actuation
____ 10 00-1 Valve Actuator Selection Guide
____ 10 10-1 Valve Actuator Composite Bulletin
____ 10 30-1 Actuator Control Systems
____ 15 00-1 GT-Series
____ 20 00-1 CB-Series Pneumatic Actuators
____ 30 00-1 Heavy Duty Product Series:
Pneumatic Actuators
____ N/A Rack And Pinion Series
____ 50 00-1 Heavy Duty Product Series:
Hydraulic Actuators
____ 60 00-1 High Pressure Gas/Hydraulic Actuator
____ 70 00-1 Linear Actuator
____ N/A 80 00-1 C-Series Electric
____ N/A 80 10-1 End C-Series Electric
____ 90 60-1 PMV Positioner

SALES DATA SHEETS

____ 15 10-1 GT-Series
____ 20 10-1 CB-Series Rack And Pinion Actuators
____ 30 10-1 Submersible Hydraulic Actuators
____ 90 10-1 Bettiswitch
____ 90 20-1 Hydraulic Manual Overrides
____ 90 30-1 Gas/Hydraulic Ordering Information
____ 90 40-1 T-Series Hydraulic (5000 PSI Rated)
____ 90 50-1 TR & TRQ Series Actuators

AD REPRINTS

____ Gas/Hydraulic Series
____ HD-Series
____ CB-Series

SERVICE INSTRUCTIONS

____ 30 00-2 HD-Service Instructions
____ 60 00-2 Gas/Hydraulic Installation Instructions
____ 10 00-2 Operation, Storage, & Maintenance Instructions
For Rotary Valve Actuators
____ 20 00-2 Maintenance And Operating Instructions -
Models CB, CBL, And CB-SR
____ 90 00-2 Bettiswitch Operating Instructions - Model 5R
____ 90 10-2 Bettiswitch Operating Instructions - Model 3R
____ 90 20-2 Hydraulic Control System - M4 And M4A-10
____ 90 60-2 PMV Service Inst

BINDERS & DIVIDERS

____ 1" General Sales (Binder Only)
____ 1" Price Book (Binder Only)
____ Set of Product Dividers

SOUND/SLIDE PROGRAMS

____ Valve Actuation - Meeting The Challenge
____ CB-Series
____ Gas/Hydraulic
____ Heavy Duty Product Lines
____ GT-Series
____ Accessories & Service

OTHER

733C SR80

		SR 112	A. C @ 80 PSI
OPEN	0	24,700 BREAK	11,700
	10	18,420	10,560
	20	14,500	9,850
	30	12,260	9,580
	40	10,990	9,740
	50	10,370	10,360
	60	10,260	11,600
	70	10,620	13,770
	80	11,480	10,560
CLOSED	90	12,900 END	24,600

733 SC 100

OPEN	0	31,000 BREAK	15,500
	10	22,200	12,400
	20	17,430	12,100
	30	14,730	11,000
	40	13,280	10,100
	50	12,100	9,800
	60	12,100	9,800
CLOSED	70	12,100	9,800
	80	12,100	9,800

Very little
11/5/84

732 SR80

YOKE ARM ANGLE (degrees)	SPRING TORQUE (in lb)	PRESSURE TORQUE (70)psi	PRESSURE TORQUE (80)psi	PRESSURE TORQUE (90)psi	PRESSURE TORQUE (100)psi
0	10060	16541	20286	24031	27776
15	8687	10508	13222	15937	18651
30	8149	7933	10219	12504	14790
45	8412	6784	8955	11126	13297
60	9648	6417	8726	11036	13345
75	12544	6605	9381	12157	14933
90	19350	7138	11033	14928	18822

