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NewYorkPower Authority

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. Eisenhut 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.

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

Notary Public

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	1.9[illegible]

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 Δ P 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

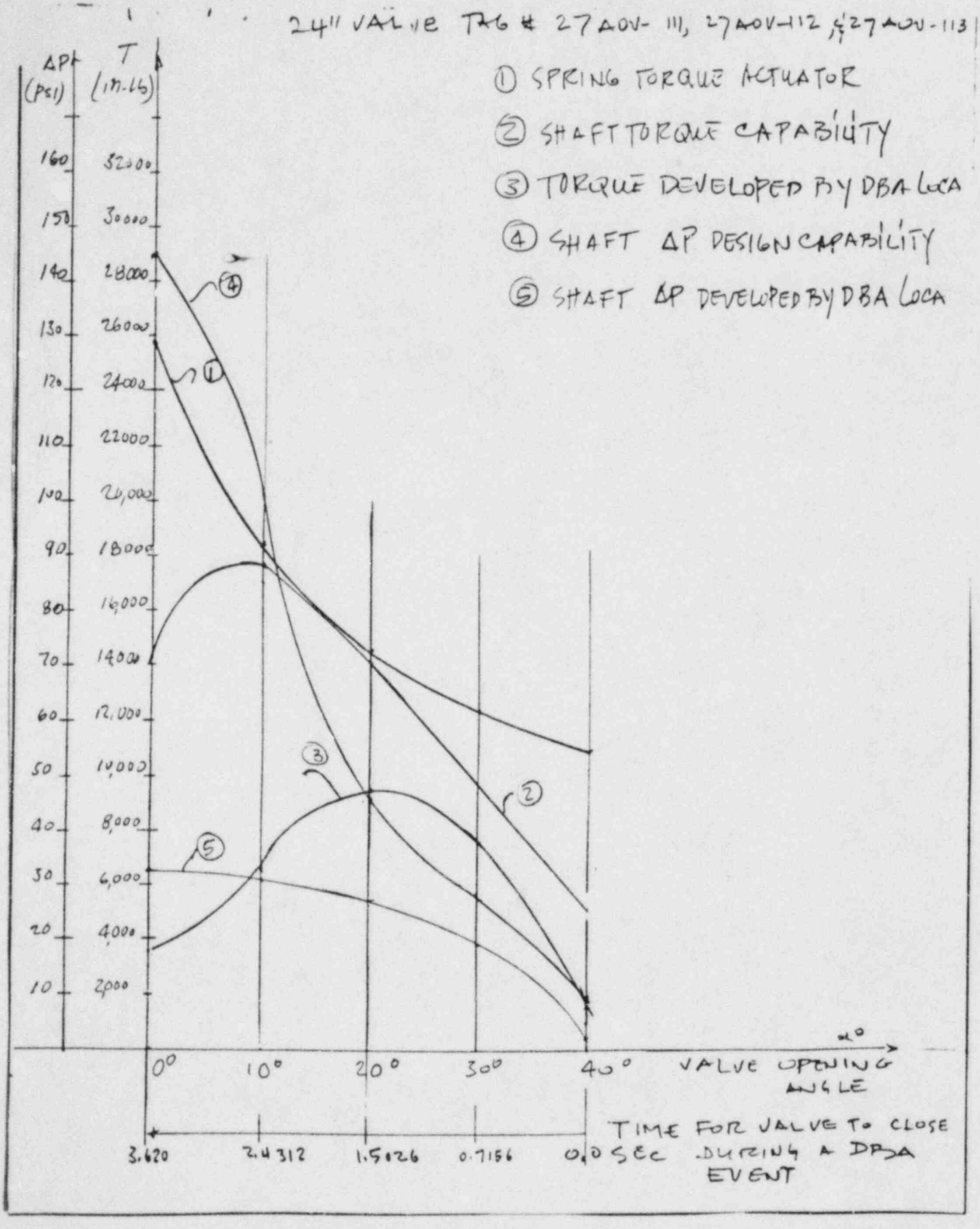

24" VALVE TAG # 27AOV-111, 27AOV-112 & 27AOV-113
① SPRING TORQUE ACTUATOR
② SHAFT TORQUE CAPABILITY
③ TORQUE DEVELOPED BY DBA LOCA
④ SHAFT ΔP DESIGN CAPABILITY
⑤ SHAFT ΔP DEVELOPED BY DBA LOCA
ΔP (PSI)
T (IN-LB)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
52000
30000
28000
26000
24000
22000
20,000
18000
16,000
14000
12,000
10,000
8,000
6,000
4,000
2000
0°
10°
20°
30°
40°
α°
VALVE OPENING ANGLE
3.620
2.4312
1.5026
0.7156
0.0 SEC
TIME FOR VALVE TO CLOSE DURING A DBA EVENT

FIGURE # 1

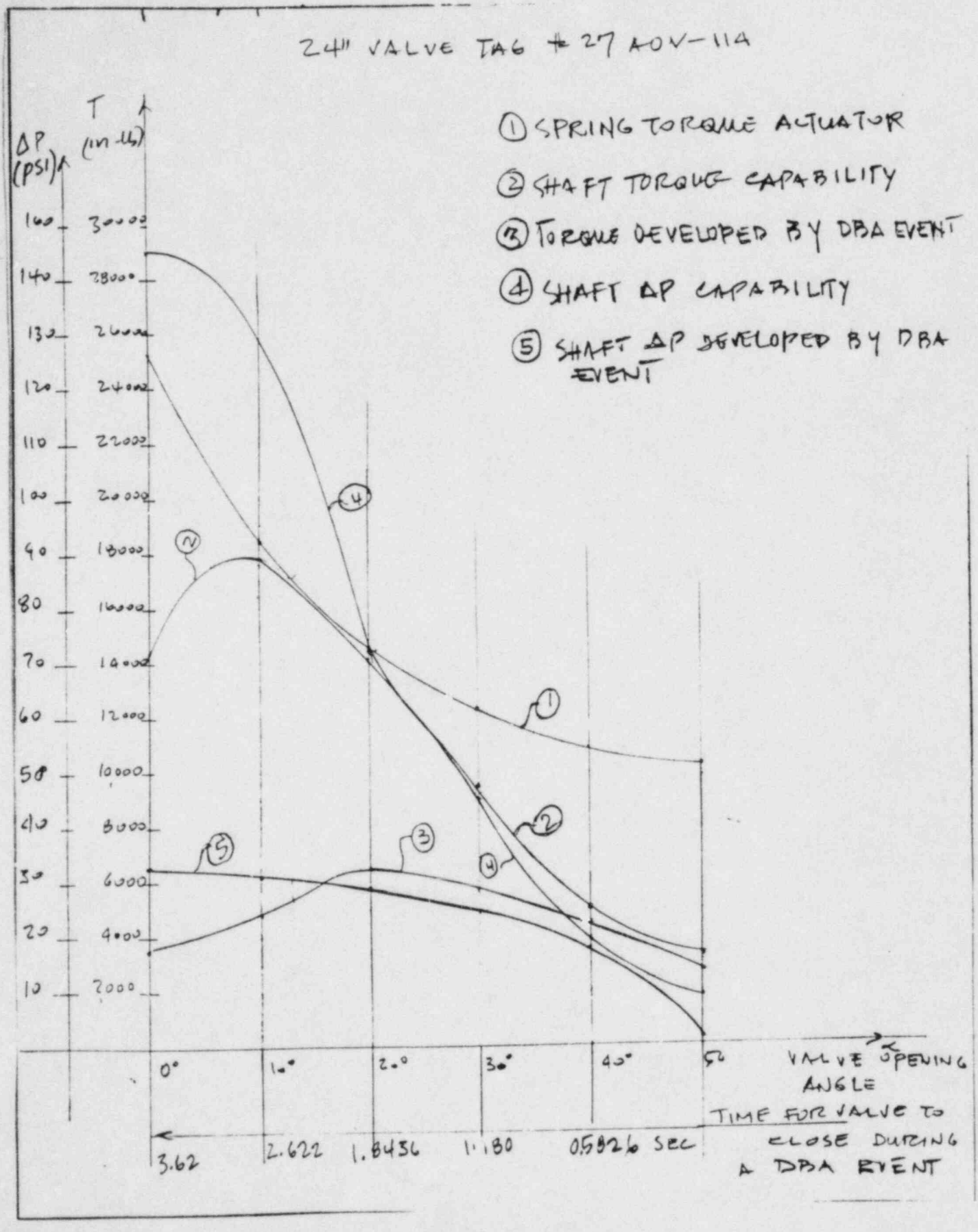

24" VALVE TAG # 27 AOV-114
T (in-lb)
ΔP (PSI)
160
140
130
120
110
100
90
80
70
60
50
40
30
20
10
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
① SPRING TORQUE ACTUATOR
② SHAFT TORQUE CAPABILITY
③ TORQUE DEVELOPED BY DBA EVENT
④ SHAFT ΔP CAPABILITY
⑤ SHAFT ΔP DEVELOPED BY DBA EVENT
0°
10°
20°
30°
40°
52°
VALVE OPENING ANGLE
3.62
2.622
1.8436
1.180
0.5926 SEC
TIME FOR VALVE TO CLOSE DURING A DBA EVENT

FIGURE # 2

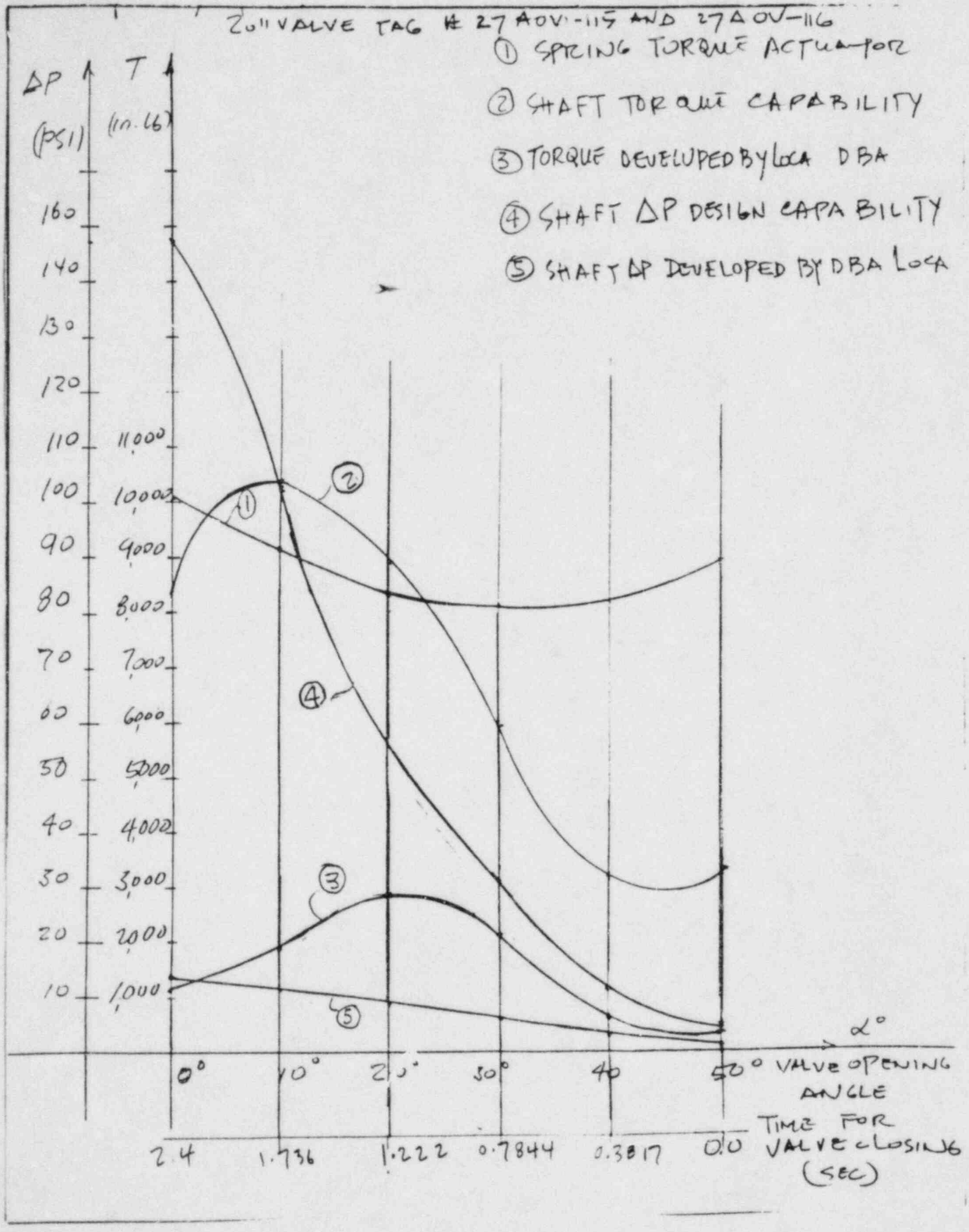

20" VALVE TAG # 27AOV-115 AND 27AOV-116
① SPRING TORQUE ACTUATOR
② SHAFT TORQUE CAPABILITY
③ TORQUE DEVELOPED BY LOCA DBA
④ SHAFT ΔP DESIGN CAPABILITY
⑤ SHAFT ΔP DEVELOPED BY DBA LOCA
ΔP (PSI)
T (in.-lb)
160
140
130
120
110
100
90
80
70
60
50
40
30
20
10
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0°
10°
20°
30°
40°
50°
α°
VALVE OPENING ANGLE
2.4
1.736
1.222
0.7844
0.3817
0.0
TIME FOR VALVE CLOSING (SEC)

FIGURE # 3

GFV TORQUE DETERMINATION

Objective

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).

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

where: A, B, C = Tabulated coefficients
$\Delta P_{act\text{-}\alpha^\circ}$ = Actual pressure drop at angle α°
$\Delta P_{eff\text{-}\alpha^\circ}$ = Effective pressure drop at angle α°

Procedure

1. From the above table, determine the effective pressure drop, $\Delta P_{eff\text{-}\alpha^\circ}$*, 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 value 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, $\Delta P_{eff\text{-}\alpha^\circ}$, 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 ($\Delta P_{eff\text{-}\alpha^\circ}$ < $\Delta P_{act\text{-}\alpha^\circ}$) and then only when it is less than the actual pressure drop ($\Delta P_{act\text{-}\alpha^\circ}$).

EFFECTIVE PRESSURE DROP

NOTE: P_1 = Upstream pressure [illegible] the indicated angle of opening (α°)

TABLE 1

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

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 coefficient 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:

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

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

where:

FTF = Friction Torque Factor
SDR = Shaft Diameter Ratio
$\Delta P_{act\text{-}\alpha^\circ}$ = Actual Pressure Drop at Angle α°
DTF = Dynamic Torque Factor
$\Delta P_{eff\text{-}\alpha^\circ}$ = Effective Pressure Drop at Angle α°

The general equation can now be written:

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

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

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

Types 9100 and 9500

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

Type 9200

$T_p + T_u + T_s = B$

thus, in each case

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

* 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:

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

Where A, B, B_1, B_2, = tabulated coefficients

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

For inflatable seal, B_1 & B_2 = 0.

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

Where A, B, C = Tabulated coefficients

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

$\Delta P_{DYN-\alpha°}$ = Dynamic pressure drop at angle $\alpha°$

Procedure:

1. Determine shaft class.

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

TABLE 3 — TYPE 9200-A/B TORQUE COEFFICIENTS - CLASS 2

Body Size Dia.	A (Select One Bushing Mat'l) TFE Lined *	Graphite Filled Bronze	Bronze	None, Alloy 6	B (Select Sealing Type or Angle) Adjustable @ 0° B	B_1	B_2	Inflatable @ 0° (Select One) Other "Elastomers"	Viton	10°-90°
	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

* TFE lined SST or TFE lined fiberglass.

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

Body Size Dia.	A (Select One Bushing Mat'l) TFE Lined *	Graphite Filled Bronze	Bronze	None, Alloy 6	B (Select Sealing Type or Angle) Adjustable @ 0° B	B_1	B_2	Inflatable @ 0° (Select One) Other "Elastomers"	Viton	10°-90°
	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	69.0	138	1.9	269	469	69.0
6	0.600	2.10	2.63	4.20	69.8	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	169	212	339	696	5,860	62.3	2,056	3,216	696
36	68.6	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	149	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	8,300	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	11,600	30,610	491.3	14,800	18,600	11,600

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°
	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
		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
14	Plate	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
		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
16	Plate	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
	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	234	423	802	1,620	2,560
		1 1/2 [2]	0	34.3	58.8	58.8	58.8	136	315	720	892
18		1 3/4 [3]	0	34.4	58.9	58.9	58.9	137	299	627	750
	Plate	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
		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
20	Plate	2 [4]	0	48.0	82.0	82.0	82.0	191	418	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
	Cast-Flat	All	0	53.0	106	173	303	667	1260	2550	40
	Cast-Hub	All	0	79.5	159	260	552	1,200	1,890	3,820	6,080
		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
24	Plate	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	1,320	2,520	5,090	8,050
	Cast-Hub	All	0	158	316	516	1,100	2,100	3,780	7,640	12,100
		2 [2]	0	171	293	293	293	680	1,580	3,980	5,200
		2 1/2 [3]	0	171	293	293	293	682	1,480	3,510	4,620
32	Plate	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	2,660
		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

e of sc	Type of Fluid	Angle of Disc Opening 0°	10°	20°	30°	40°	50°	60°	70°	80° 90°
t	Liquid	$\Delta P_{act-0°}$	$0.570P_1$	$0.730P_1$	$0.500P_1$	$0.690P_1$	$0.650P_1$	$0.450P_1$	$0.390P_1$	$0.350P_1$
	Gas	$\Delta P_{act-0°}$	$\Delta P_{act-10°}$	$0.500P_1$	$0.250P_1$	$0.250P_1$	$0.200P_1$	$0.200P_1$	$0.140P_1$	$0.140P_1$
te	Liquid	$\Delta P_{act-0°}$	$0.700P_1$	$0.700P_1$	$0.700P_1$	$0.700P_1$	$0.670P_1$	$0.600P_1$	$0.500P_1$	$0.450P_1$
	Gas	$\Delta P_{act-0°}$	$0.260P_1$	$0.350P_1$	$0.350P_1$	$0.350P_1$	$0.250P_1$	$0.180P_1$	$0.110P_1$	$0.090P_1$

P_1 = 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)
Inflatible-All Except TFE(1) and Viton(2)

Size	Type - Class & 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 Opening								
							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
			STELL. #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
			STELL. #3	269	ADJ.	153	180	→	140	88	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
			STELL. #3	351	ADJ.	288	244	→	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
			STELL #3	158	ADJ.	124	104	103	70	49	25	15	8	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	292	→	154	98	45	25	13	7	4
			STELL #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
			STELL. #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	8	4	2
					INFLATE	105	193	165	88	56	26	14	8	4	2
			STELL #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	197	→	130	83	38	21	11	6	4
					INFLATE	123	243	242	130	83	38	21	11	6	4
			STELL #3	192	ADJ.	123	136	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
			STELL #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
			STELL #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

CORAOPOLIS, PENNSYLVANIA

OUR SHIP ORDER P-96940-01

DATE: 3-30-72 | SUBJECT TO INSPECTION: X

2-17961 | ODTTZ | BF 171050

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

SHIP TO:
Same
Center Street Plant
Receiving Plant
Marshalltown, Iowa

1 3/4" ⌀ SHAFT

VIA: Truck - Prepay

B.M. 171050 Pages 1 thru 4

VALVE DESCRIPTION

QUAN.	SIZE	TYPE	FLANGE	CLASS	BODY	SEAT	DISC		
1	24"	9222	150 RF	2	SA 516 Gr. 70	EPT	SA 516 (Gr. 70)	FOLLOWERS A193 STUDS	A194 NUTS
			SHAFT (2536) 17-4PH		PINS 3357 316 S/S				

PACKING	TEFL.	PLAIN	STUFFING BOX PURGED	LUB.	GRAPHITAR	STAINLESS	LANTERN GLAND		
2 CRJ		X							

INBOARD BUSHINGS	ROLLER BEARINGS	OPEN	EXTENSIONS PLAIN	CAST ON	OTHER	SEAL SYSTEM	SCHEMATIC NO.
#5 (BRONZE)						NO	J-10570

BRACKET AND LINKAGE

B.M.

PUSH ROD PERPENDICULAR	PARALLEL	PIPE RUN HORIZONTAL	VERTICAL	LINKAGE SET MINIMUM DEGREES	MAXIMUM DEGREES
		X		0	90°

POWER ACTUATOR DESCRIPTION

B.M.

QTY.	ACTUATOR TYPE	MODEL NO.	SIZE	STROKE	POSITIONER	MODEL NO.
1	BETTIS 733 -SR					

HANDWHEEL SIDE MTD. | TOP MTD. | TO | INST. SIGNAL | TO | BENCH SET 90 TO 120# PRESSURE TO ACTUATOR | AIR POSITION TO: OPEN X CLOSE ☐

MANUAL ACTUATOR DESCRIPTION

B.M.

QTY.	DESCRIPTION		DE CLUTCH	POSITION	CHAIN LINEAR FT	LEVER DISC CLOSED	DIA HOLE	CENTERS
1	LIMITORQUE H2BC W/SPUR		X	#3				

VALVE SERVICE

FLUID	MAX. SHUT OFF PRES.	TEMP.	STAT PRES.
AIR	56 PSI	350°F	

MOUNTING INSTRUCTIONS: X | ITEM | PRICE

PRINT INSTRUCTIONS

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

SPECIAL INSTRUCTIONS: ADJ. T-RING FOR INTERFERENCE FIT

Design Δ Po 56 PSI At 350F Max. Casing Pres. PSI CWT

Cust. Item # 1 Tag: 27 ACV-114 Act. Serial #

* CHROME PLATE DISC EDGE

1D – FURNISH (2) D-2900-X LIMIT SWITCHES (TO INDICATE OPEN & CLOSED POSITION)

1E – FURNISH ASCO 3-WAY SOL. #HT-8316 S5 (120V, 60HZ) (ENERGIZE TO OPEN VALVE)

SUBJECT TO INSPECTION — NUCLEAR

"ADHERENCE TO NHB-29 IS REQUIRED"

ET/cz

P-76940-01

FISHER CONTROLS COMPANY
CONTINENTAL DIVISION
CORAOPOLIS, PENNSYLVANIA

SHOP ORDER P-96940-05

	Date		Subject to Inspection	
	3-30-72		X	

	Valve Type	Serial No.	Rev. No. 1	Rev. No. 2
2-17761	ODTR	BF 171054		

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

SHIP TO:
Same
Center Street Plant
Receiving Plant
Marshalltown, Iowa

via: Truck - Prepay

VALVE DESCRIPTION

B.M. 171054 Page 1 thru 4

Quan.	Size	Type	Flange	Class	Body	Seat	Disc
1	20"	9222	150RF	2	SA 516 Gr.70	EPT	* SA516 Gr.70
			17-4PH (Shaft)		316 S/S		A193 Studs / A194 Nuts

Packing	Stuffing Box	Inboard Bushings	Seal System	Schematic No.
2CRJ	Plain X	#5 (Bushing)	NO	J-10570

BRACKET AND LINKAGE

Pipe Run: Horizontal X

Linkage Set: 0 Minimum Degrees, 90° Maximum Degrees

POWER ACTUATOR DESCRIPTION

Qty.	Actuator Type
1	BETTIS 732-SR

Bench set 90-120# pressure to actuator: AIR, to: Open X Close

MANUAL ACTUATOR DESCRIPTION

Qty.	Description	Position
1	LIMITORQUE HIBC w/SPUR	#3

VALVE SERVICE

Fluid	Max. Shut Off Press.	Temp.
AIR, N_2, H_2O	56 PSI	350°F

PRINT INSTRUCTIONS

Cert. Trans.	Prints	Install Lubr. & Maint. Inst.	Part List	Hold for Approval
1	1	40	40	NO

SPECIAL INSTRUCTIONS: ADJ. T-RING FOR INTERFERENCE FIT

Design Δ Po 56 PSI At 350°F Max. Casing Pres. PSI CWT

Cust. Item # 5 Tag: 27AOV-115 Act. Serial #

* CHROME-PLATE DISC EDGE

1D - FURNISH (2) D-2400X LIMIT SWITCH (TO INDICATE OPEN & CLOSE POSIT.)

1E - FURNISH ASCO 3-WAY SOL. #HT 831655 (120V, 60 HZ) (ENERGIZE TO OPEN VALVE)

- FURNISH (1 SET) SPARE PACKING WITH VALVE

SUBJECT TO INSPECTION

NUCLEAR

ADHERENCE TO NHS-29 IS REQUIRED / NUCLEAR 3 - N STAMP

RT/cz

P-96940-05

Power Authority of the State of New York — Spec. No. 330-70

Item No.	1	2	3
Operator Mark No.	27AOV-114	27AOV-113	27AOV-111
Valve Mark No.	VVE-7E3S	VVE-7E3S	VVE-7E3S
Quantity	1	1	1
Manufacturer			
Manufacturer's model No.			
Valve type			
Min valve ID, in.			
Min body thickness			
Min shaft diam. ID			
Size length along pipe, in.			
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)	BRAID	BRAID	BRAID
Materials			
Valve body, steel - ASTM	A516 GR70	A516GR70	A516 GR70
Shaft, 13-8 St. St. - ASTM	17-4 PH	17-4 PH	17-4 PH
Disc, Stl. - ASTM	A515 GR70	A515 GR70	A515 GR70
Seating surfaces	CAT FACED	CAT FACED	CAT FACED
Seat retainer, 13-8 St. Stl. - ASTM	A516 GR70	A516 GR70	A516 GR70
Seat retainer fastening	ALLEN SCREW	ALLEN SCREW	ALLEN SCREW
Shaft bearing	BRONZE	BRONZE	BRONZE
Shaft packing and seals	CRANE 2C23	CRANE 2C23	CRANE 2C23
Tapered pins and keys	17-4PH/STL	17-4PH/STL	17-4PH/STL
Manual operator, mfr. and model			
Operating gear ratio			
Handwheel diam, in.			
Torque to operate valve manually			
at max unbal. pressure, ft-lb			
Orientation of handwheel operator			
Pneumatic operator, mfr. and model			
Pneumatic operator type			
Min air pressure required			
3-way solenoid valve, mfr. and model			
Position indicator switches,			
mfr. and model No.			
Total valve weight			
operators, lb			

(Supplementary Sheet)

CONTAINMENT SYSTEM [illegible]

Manufacturer's Data: Air Operated [illegible]

Page	IS-9
Spec. No.	APC-70
P.O. No.	11825
By	APH
Date	11/15/71

Owner: Power Authority of the State of New York

Project: James A. FitzPatrick Nuclear Power Plant

DATA COMPLETED BY SELLER

Item No.	4	5	6
Operator Mark No.	27AOV-112	27AOV-115	27-AOV-116
Valve Mark No.	VVM-7ENS	VVF-7ENS	VVM-7ENS
Quantity	1	1	1
Manufacturer			
Manufacturer's model No.	[illegible]	[illegible]	[illegible]
Valve type	[illegible]	[illegible]/150" [illegible]	[illegible]
Min valve ID, in.	[illegible]	19 ½"	19 ½"
Min body thickness	[illegible]	2"	[illegible] 2"
Min shaft diam, ID	1 ¾"	1 ½"	1 ½"
Size length along pipe, in.	[illegible]	[illegible]	[illegible]
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)	BRAID	BRAID	BRAID
Materials			
Valve body, steel - ASTM	A 516 GR 70	A 516 GR 70	A 516 GR 70
Shaft, 18-8 St. St. - ASTM	17-4 PH	17-4 PH	17-4 PH
Disc, Stl. - ASTM	A 515 GR 70	A 515 GR 70	A 515 GR 70
Seating surfaces	[illegible]	[illegible]	[illegible]
Seat retainer, 18-8 St. Stl. - ASTM	A 516 GR 70	A 516 GR 70	A 516 GR 70
Seat retainer fastening	ALLOY STEEL	ALLOY STEEL	ALLOY STEEL
Shaft bearing	BRONZE	BRONZE	BRONZE
Shaft packing and seals	CRANE [illegible]	CRANE [illegible]	CRANE [illegible]
Tapered pins and keys	17-4 PH/STEEL	17-4 PH/STEEL	17-4 PH/STEEL
Manual operator, mfr. and model	[illegible] H 315	[illegible] H 315	[illegible] H 315
Operating gear ratio	280:1	280:1	280:1
Handwheel diam, in.	[illegible]	[illegible]	[illegible]
Torque to operate valve manually	[illegible]	625 [illegible]	625 [illegible]
at max unbal. pressure, ft-lb			
Orientation of handwheel operator	[illegible] MOUNTED	ON END OPPOSITE	ACTUATOR
Pneumatic operator, mfr. and model	[illegible]	[illegible]	[illegible]
Pneumatic operator type	[illegible]	[illegible]	[illegible]
Min air pressure required	[illegible]	[illegible]	[illegible]
3-way solenoid valve, mfr. and model			
Position indicator switches,	[illegible]	[illegible]	[illegible]
mfr. and model No.			
Total weight including			
operator, lb	[illegible]	[illegible]	[illegible]

Completed by: [illegible] Date [illegible]

Checked by: [illegible] Date [illegible]

BETTIS

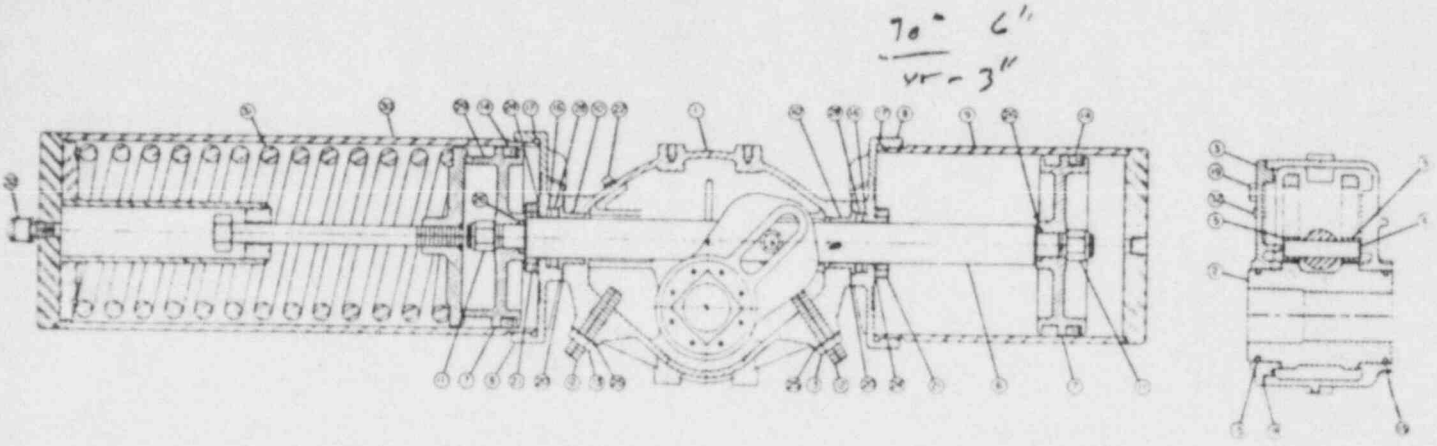
PRICE SHEET NO. 1-7320-SR

EFFECTIVE MARCH, 1970

ALWAYS FURNISH SERIAL NUMBER OF ACTUATOR WHEN ORDERING PARTS

ROBOTARM® VALVE ACTUATOR PARTS

LIST PRICES
MODEL 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		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	208388	PISTON RETAINER NUT	STEEL & NYLON	ASTM-A194-65 GRADE 2	2		6.00
12	211336	STOP ADJUSTING SCREW	STEEL	45/53 R_c	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	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	208383	CYLINDER SEAL	BUNA-N	DURO 70A	2	2	2.65
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 R_c	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 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 B145-4A GRADE BB555	3		5.00

☆ INCLUDES ITEM 28

BETTIS

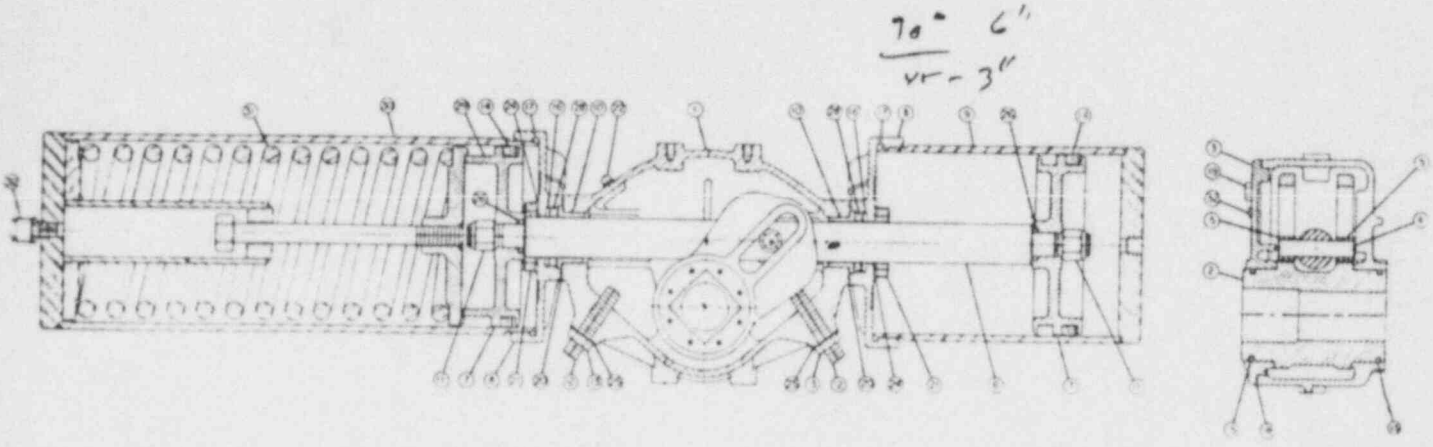
PRICE SHEET NO. 1-732C-SR

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		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 8B-10-2	2		12.40
11	208388	PISTON RETAINER NUT	STEEL & NYLON	ASTM-A194-65 GRADE 7	2		6.00
12	211335	STOP ADJUSTING SCREW	STEEL	45/53 R_c	2		5.50
13	211336	ADJUSTING SCREW JAM NUT	STEEL	ASTM-A194-65 GRADE 1	2		4.00
14	208387	PISTON SEAL	BUNA-N	DURO 70A	2	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	208388	CYLINDER SEAL	BUNA-N	DURO 70A	2	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 R_c	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 4A GRADE BB555	3		5.00

☆ INCLUDES ITEM 28

Must Ship today Express Mail Next Day
OR Federal Express

GH BETTIS
A Galveston-Houston Company

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 Lefter

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

THIS SECTION FOR GH-BETTIS OFFICE USE ONLY

DATE RECEIVED _____ DATE SHIPPED _____
FULL ORDER SHIPPED ☐ METHOD OF SHIPMENT _____
PARTIAL ORDER SHIPPED ☐

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 Elgis 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

		SPRING	AIR @ 80PSI
OPEN	0	[illegible],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,[illegible]	13,770
	80	11,480	10,560
CLOSED	90	12,[illegible]00 END	24600

733 SC 100

OPEN	0°	3[illegible] BREAK	1[illegible]
	10	22[illegible]	[illegible]
	20	174[illegible]	[illegible]
	30	14[illegible]	[illegible]
	40	[illegible]	[illegible]
	50	[illegible]	
		[illegible]	
		[illegible]80	
		[illegible]	
CLOSED		[illegible] END	

[illegible]

[illegible]

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