TVA

Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

December 21, 1998

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328
		50-390

SEQUOYAH NUCLEAR PLANT (SQN) UNITS 1 AND 2, AND WATTS BAR NUCLEAR PLANT (WBN) UNIT 1, RESPONSE TO NUCLEAR REGULATORY COMMISSION (NRC) REQUEST FOR ADDITIONAL INFORMATION REGARDING RESPONSE TO NRC GENERIC LETTER (GL) 96-06, "ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN BASIS ACCIDENTS" (TAC NOS. M96866, M96867, AND M96884)

This letter provides TVA's reply to the NRC letter dated May 27, 1998, for SQN and WBN regarding equipment operability and containment integrity during design basis accidents.

On September 30, 1996, the NRC issued the referenced GL regarding thermally induced overpressurization of isolated water-filled piping sections inside containment that could jeopardize the ability of accident-mitigating-systems to perform their safety function.

By lett ated January 28, 1997, TVA indicated that overpressurization in several systems is precluded by inherent leakage from isolation valves at high pressures. Enclosures 1 and 2 provide additional details which support TVA's conclusion for SQN and WBN respectively. This response addresses the systems cited in NRC's May 27, 1998, letter as well as the WBN Demineralized Water system for which TVA's January 28, 1997, response also relied on valve leakage to preclude overpressurization.

1/1

Drawings ... A01

TVA's January 28, 1997, response stated that engineering judgment was used to determine that valves in the SQN Spent Fuel Pool Cooling system would leak at pressures below the point of piping failure. Further evaluations did not demonstrate that the valves would leak at a low enough pressure. Accordingly, TVA is modifying the original response to the GL to state that the system is drained prior to power operations in order to eliminate the concern of thermal overpressurization.

TVA's January 28, 1997, response also indicated that the SQN Demineralized Water system was protected by a pressure relief valve. Subsequent re-examination of the system drawings determined that the subject valve was an angle valve rather than a relief valve. TVA is modifying the original response to the GL to state that the system is drained prior to power operations in order to eliminate the concern of thermal overpressurization.

No commitments are made in this response. If you have any questions, please telephone Everett Whitaker at (423) 751-6369 or me at (423) 751-2508.

Sincerely,

Mark J. Burzynski

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Manager
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Enclosures
cc: See page 3

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ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT (SQN)
UNITS 1 AND 2

GENERIC LETTER (GL) 96-06, "ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN BASIS ACCIDENTS" - REQUEST FOR ADDITIONAL INFORMATION

NRC Request 1

Describe the applicable design criteria for the piping and valves. Include the required load combinations.

SQN Response 1

The applicable design criteria for the piping and valves are as follows:

Waste Disposal - The piping and valves are designed to ANSI B31.1 and/or B16.34. The valve and system piping design pressure and temperature is 150 psig and 180°F. The load combinations are for the faulted condition, which consists of:

> Pressure + Deadweight + Other Sustained Loads + Safe Shutdown Earthquake (SSE) Inertia + Valve Thrust + Fluid Transients + Design Basis Accident (DBA) Containment Inertia.

Loads which cannot occur simultaneously are not required to be combined. In this case, DBA Containment Inertia loads are not required to be combined with the design pressure. A diaphragm valve performing the containment isolation function leaks the small amount of process fluid needed to relieve the thermal overpressure.

Safety Injection - The piping and valves are designed to ANSI B31.1. The system design pressure and temperature is 2580 psig and 650 °F. The load combinations are for the faulted condition which consists of:

> Pressure + Deadweight + Other Sustained Loads + SSE Inertia + Valve Thrust + Fluid Transients + DBA Containment Inertia.

Loads which cannot occur simultaneously are not required to be combined. In this case, DBA Containment Inertia loads are not required to be combined with the design pressure.

Primary Makeup Water - The piping and valves are designed to ANSI B31.1. The system design pressure and temperature is 130 psig and 100°F. The load combinations are for the faulted condition, which consists of:

> Pressure + Deadweight + Other Sustained Loads + SSE Inertia + Valve Thrust + Fluid Transients + DBA Containment Inertia .

Loads which cannot occur simultaneously are not required to be combined. Accordingly, DBA Containment Inertia loads are not required to be combined with the design pressure.

Fuel Pool Cooling - The piping and valves are designed to ANSI B31.1 and/or B16.34. The system design pressure and temperature is 150 psig and 200°F. By letter dated January 28, 1997, TVA took credit for valve leakage on this system. Further evaluation indicates that failure of nonsafety-related Schedule 10 piping internal to containment is the leakage mechanism rather than valve leakage. SQN has drained the appropriate piping sections and revised appropriate general and system operating procedures to ensure the fuel pool cooling system piping inside containment is drained prior to power operations to eliminate concerns with thermal overpressurization.

Demineralized Water - By letter dated January 28, 1997, TVA took credit for a relief valve on the system piping inside containment. The valve was subsequently determined to be an angle valve. Sequoyah has drained the appropriate piping sections and revised appropriate general and system operating procedures to ensure the Demineralized Water system piping inside containment is drained prior to power operations to eliminate concerns with thermal overpressurization.

NRC Request 2

Provide a drawing of the valve. Provide the pressure at which the valve was determined to lift off its seat or leak, and describe the method used to estimate this pressure. Discuss any sources of uncertainty associated with the estimated lift off or leakage pressure.

SQN Response 2

System	Leakage Pressure	Method Used	Drawing
Waste Disposal	228 psig	Calculated based on pressure x area on valve disk	ITT Grinnell WAPD-CV-SS-8R (copy attached)
Safety Injection	3960 psig	Manufacturer supplied information	Masonelian CPI-18-55 (copy attached)
Primary Makeup Water	228 psig	Calculated based on pressure x area on valve disk	ITT Grinnell WAPD-CV-SS-8R (copy attached)
Spent Fuel Pool Cooling	NA, System is drained	NA, System is drained	NA, System is drained
Demineralized Water	NA, System is drained	NA, System is drained	NA, System is drained

Treatment of Uncertainty

Waste Disposal - The uncertainty includes friction forces (due to an O-ring on the valve stem). No leakage is assumed in downstream piping in order to maximize the thermally-induced overpressure. Maximum spring force is used in the calculation. Pressure relief occurs below pressures that would result in pipe overpressurization. A 10% margin was added to the v[illegible]lculated (207 psig) to account for any additional uncertainties. The evaluation shows tha[illegible] [illegible]lve will begin leaking at approximately 228 psig.

Safety Injection - A 10% margin above the maximum hydrostatic test pressure (of 3600 psig) is utilized for conservatism. The valves in the system routinely leak at the test pressure thereby justifying the 10% margin to maximum pressure at leakage (3960 psig).

Primary Makeup Water - The uncertainty includes friction forces (due to an O-ring on the valve stem). No leakage is assumed in downstream piping in order to maximize the thermally-induced overpressure. Maximum spring force is used in the calculation. Pressure relief occurs below pressures that would result in pipe overpressurization. A 10% margin was added to the value calculated (207 psig) to account for any additional uncertainties. The evaluation shows that the valve will begin leaking at approximately 228 psig.

NRC Request 3

Provide the maximum-calculated stress in the piping run based on the estimated lift off or leakage pressure.

SQN Response 3

Maximum-calculated stress in piping is:

System	Maximum Working Stress (psi)
Waste Disposal	15,830
Safety Injection	30,743
Primary Water	26,408
Spent Fuel Pool Cooling	NA, The system is drained and will not thermally pressurize.
Demineralized Water	NA, The system is drained and will not thermally pressurize.

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT (WBN)
UNIT 1

GENERIC LETTER (GL) 96-06, "ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN BASIS ACCIDENTS" - REQUEST FOR ADDITIONAL INFORMATION

NRC Request 1

Describe the applicable design criteria for the piping and valves. Include the required load combinations.

WBN Response 1

The applicable design criteria for the piping and valves are as follows:

Waste Disposal - The piping and valves are designed to ASME Section III, Class 2, for containment isolation and ANSI B31.1 for the remainder of the system. The system design pressure and temperature are 150 psig and 180°F. The load combinations are for the faulted condition which consists of:

> Pressure + Deadweight + Other Sustained Loads + SSE Inertia + Fluid Transients + DBA Containment Inertia.

Loads which cannot occur simultaneously are not required to be combined. In this case, DBA Containment Inertia loads are not required to be combined with the design pressure. A diaphragm valve performing the containment isolation function leaks the small amount of process fluid needed to relieve the thermal overpressure.

Safety Injection - The piping and valves are designed to ASME Section III, Class 2, with the exception that the test and fill lines are designed to ANSI B31.1. The system design pressure and temperature are 2485 psig and 650 °F. The load combinations are for the faulted condition which consists of:

> Pressure + Deadweight + Other Sustained Loads + SSE Inertia + Fluid Transients + DBA Containment Inertia.

Loads which cannot occur simultaneously are not required to be combined. In this case, DBA Containment Inertia loads are not required to be combined with the design pressure.

Primary Makeup Water - The piping and valves are designed to ASME Section III, Class 2 for containment isolation and ANSI B31.1 for the remainder of the system. The system design pressure is 150 psig. The system design temperature is 250°F for the ASME piping and 130°F for the ANSI piping. The load combinations are for the faulted condition which consists of:

Pressure + Deadweight + Other Sustained Loads + SSE Inertia + Fluid Transients + DBA Containment Inertia .

Loads which cannot occur simultaneously are not required to be combined. In this case, DBA Containment Inertia loads are not required to be combined with the design pressure.

Fuel Pool Cooling - By letter dated January 28, 1997, TVA indicated that the containment penetration was drained and diaphragm valve leakage would relieve thermal pressure increases on the piping inside containment. Further evaluation indicates that procedural draining of the containment penetration also results in draining of the affected piping inside containment. TVA is revising its response concerning credit for valve leakage to state the system piping is drained to eliminate concerns with thermal overpressurization.

Demineralized Water - This system was discussed in the January 28, 1997, response to the GL, in addition to those identified by NRC in this RAI. The valves and piping are designed to ASME Section III, Class 2, for containment isolation and ANSI B31.1 for the remainder of the system. The system design pressure and temperature are 100 psig and 150°F. The load combinations are for the faulted condition which consists of:

Pressure + Deadweight + Other Sustained Loads + SSE Inertia + Fluid Transients + DBA Containment Inertia .

Loads which cannot occur simultaneously are not required to be combined. In this case, DBA Containment Inertia loads are not required to be combined with the design pressure.

NRC Request 2

Provide the pressure at which the valve was determined to lift off its seat or leak, and describe the method used to estimate this pressure. Discuss any sources of uncertainty associated with the estimated lift-off or leakage pressure.

Watts Bar Response 2

System	Leakage Pressure	Method Used	Drawing
Waste Disposal	444 psig	Calculated based on pressure x area on valve disk	ITT Grinnell SD-C-101646 (copy attached)
Safety Injection	4200 psig	Manufacturer supplied information	Copes Vulcan E-278064 and Fisher 54A0237 (copy attached)
Primary Makeup Water	478 psig	Calculated based on pressure x area on valve disk	ITT Grinnell SD-C-102165 (copy attached)
Spent Fuel Pool Cooling	NA, the system is drained	NA, the system is drained	NA as the system is drained
Demineralized Water	600 psig	Site performed test data	DIA-FLO Valve; Sketch from TVA Vendor Manual Number WBN-VTD-IT04-0030; pages 13/15/65 (copy attached)

Treatment of Uncertainty

Waste Disposal - The uncertainty includes friction forces (due to an O-ring on the valve stem). No leakage is assumed in downstream piping in order to maximize the thermally-induced overpressure. Maximum spring force, in the spring for the diaphragm valve, is used in the calculation. There has been a 10% margin added to the value calculated to account for any additional unknown uncertainties. The evaluation shows that the valve will begin leaking at approximately 444 psig. Pressure relief occurs below pressures that would result in pipe overpressurization.

Safety Injection - TVA utilized the vendor-recommended values for packing leakage at 1.5 times the design test pressure (3870 psig) and then added a 10% margin for conservatism (resulting in a 4200 psig pressure). This represents a maximum system pressure beyond which the valve is expected to leak.

Primary Makeup Water - The uncertainty includes no leakage in downstream piping to maximize the thermally-induced overpressure. Maximum spring force, in the spring for the diaphragm valve, is used in the calculation. There has also been a 10% margin added to the value calculated to account for any additional uncertainties. This shows that the valve will begin leaking at approximately 478 psig. This pressure relief occurs below pressures that would result in pipe overpressurization.

Demineralized Water - TVA performed on-site testing of valves identical to those installed in the demineralized water system to determine the pressure at which the valves would leak. Twenty percent margin was added to the recorded test pressure to account for testing uncertainty.

NRC Request 3

Provide the maximum-calculated stress in the piping run based on the estimated lift-off or leakage pressure.

Watts Bar Response 3

Maximum working stress in piping is:

System	Maximum Working Stress (psi)
Waste Disposal	15,100
Safety Injection	25,000
Primary Water	37,600
Spent Fuel Pool Cooling	NA, system is drained and will not thermally pressurize
Demineralized Water	36,100

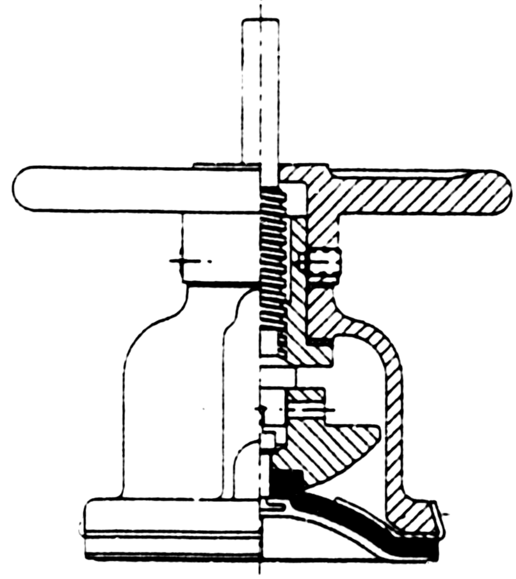
WEIR TYPE VALVES

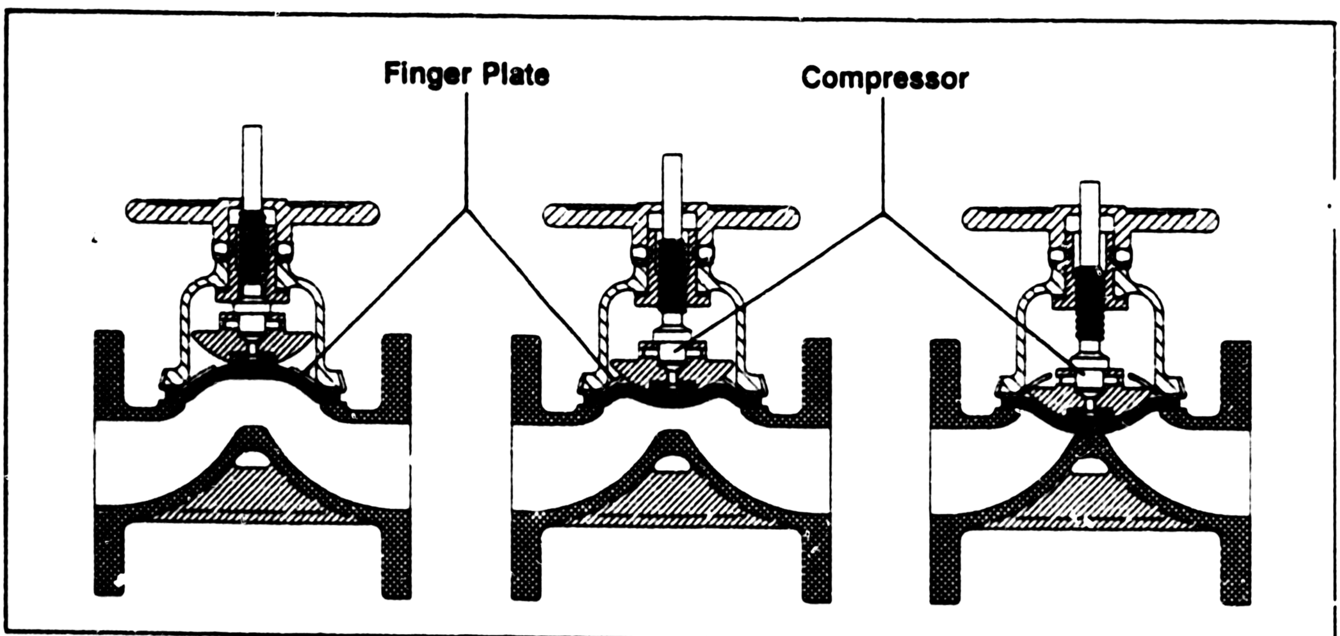
Weir Type Bonnet Assemblies

Bonnet Designed for Dependable Performance

Dia-Flo® diaphragm valves are equipped as standard with:

- Bronze stem bushing
- Finger plate*
- Grease fitting**
- Stem stop collar
- Iron bonnet and handwheel
- Thrust bearing
- Visual position indication

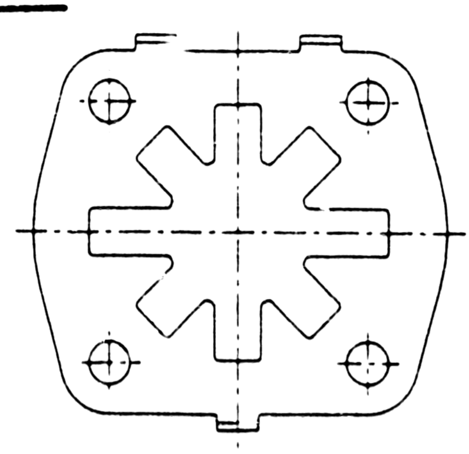




WBN REV 0
WBN PAGE 15

*In conjunction with the compressor, the fingerplate positively supports the diaphragm from the closed to open position. The diaphragm is lifted high when the valve is opened and is pressed tightly against the weir when the valve is closed. It is supported in all positions by alternate fingers of the compressor and fingerplate or bonnet fingers. Please note drawings at right & above.

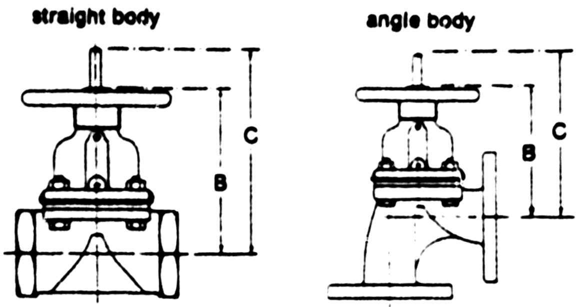
**Not used with sealed bonnet.



DIA-FLO® Diaphragm Valves

Dimensions – Weir Valves

Handwheel operated valves



Other ends

Butt weld, socket (solder), sanitary thread, grooved end (weir bodies only).
Center-to-top dimensions B, C for bodies with these ends are identical to or slightly less than those for flanged *unlined* valves with weir bodies, given above.

Socket weld (weir or angle bodies).
Center-to-top dimensions B,C, for bodies with socket weld ends are identical to those for screwed end valves, given below.

Unlined bodies
with screwed, flanged and pvc socket (solvent weld) ends

Valve size		1/4, 3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14	16	18, 20
Weir bodies of metal and plastic lined																			
screwed	B	2 3/16	2 3/8	3 1/8	4	4 11/16	5 3/8	6 9/32	7 1/16	8	—	—	—	—	—	—	—	—	—
	C	2 13/16	3 1/8	3 13/16	4 11/16	5 3/16	6 23/32	7 15/16	9 15/32	9 1/2	—	—	—	—	—	—	—	—	—
flanged	B	—	2 11/16	3 25/32	3 25/32	4 3/16	5 5/16	6 9/32	7 1/2	8 3/16	10 5/16	11 13/16	14 1/2	20 1/4	23 3/4	27 5/16	30 11/32	—	—
	C	—	3 3/16	4 13/32	4 13/32	5 5/16	6 17/32	7 15/16	9 5/16	9 13/16	12 1/2	15 3/16	17 7/16	25 3/16	29 11/32	33 25/32	38 3/16	44 11/16	45 13/16
Weir bodies of solid plastic																			
screwed socket (solvent weld) flanged	B	—	2 5/8*	3 13/32	3 25/32	4 11/16	5 13/32	6 9/32	—	—	—	—	—	—	—	—	—	—	—
	C	—	3	3 25/32	4 13/16	5 3/16	6 3/16	7 13/32	—	—	—	—	—	—	—	—	—	—	—
Angle bodies of metal																			
screwed	B	2 13/16	2 13/16	3 1/8	4 5/32	—	5 3/8	6 9/32	7 5/8	8 1/4	—	—	—	—	—	—	—	—	—
	C	3 3/16	3 3/16	3 13/16	4 25/32	—	6 23/32	7 13/32	9 13/32	10 1/2	—	—	—	—	—	—	—	—	—
flanged	B	—	2 3/8	3 13/32	3 25/32	4 3/8	5 1/2	6 9/32	7 1/2	8 3/16	10 5/16	11 13/16	14 1/2	—	—	—	—	—	—
	C	—	3 3/16	4 5/16	4 13/32	5 1/2	6 13/32	7 15/16	9 5/16	9 13/16	12 5/8	15 3/16	17 7/16	—	—	—	—	—	—
handwheel diameter		2 3/16	2 1/2	3 1/8	3 1/8	3 1/8	6	6	7 5/8	7 5/8	10	12 1/2	14 1/2	19	23	27 1/2	27 1/4	36	36

*2 1/2 for screwed body

Lined bodies
with flanged ends (weir or angle bodies)
Center-to-top dimensions B, C or flanged *lined* valves are obtained by using the table below. Add the fraction shown here to the center-to-top dimension for flanged *unlined* valves, given above.

WBN REV 0
WBN PAGE 65

Valve size	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14, 16, 18, 20
rubber, neoprene	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	3/16	3/16	3/16	3/16	3/16	3/16
glass	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	—	—

ENGINEERING DATA

STANDARD C. I. FLANGE DIMENSIONS (125 #)

size, in.	diameter of flange, in.	thickness of flange (min.) in.	diameter of bolt circle, in.	number of bolts	diameter of bolt holes, in.	diameter of bolts, in.	length of bolts, in.
1/2	3 1/2	3/8	2 3/8	4	5/8	1/2	1 3/4
3/4	3 7/8	13/32	2 3/4	4	5/8	1/2	1 3/4
1	4 1/4	7/16	3 1/8	4	5/8	1/2	1 3/4
1 1/4	4 5/8	1/2	3 1/2	4	5/8	1/2	2
1 1/2	5	9/16	3 7/8	4	5/8	1/2	2
2	6	5/8	4 3/4	4	3/4	5/8	2 1/4
2 1/2	7	11/16	5 1/2	4	3/4	5/8	2 1/2
3	7 1/2	3/4	6	4	3/4	5/8	2 1/2
4	9	15/16	7 1/2	8	3/4	5/8	3
5	10	15/16	8 1/2	8	7/8	3/4	3
6	11	1	9 1/2	8	7/8	3/4	3 1/4
8	13 1/2	1 1/8	11 3/4	8	7/8	3/4	3 1/2
10	16	1 3/16	14 1/4	12	1	7/8	3 3/4
12	19	1 1/4	17	12	1	7/8	3 3/4
14 O.D.	21	1 3/8	18 3/4	12	1 1/8	1	4 1/4
16 O.D.	23 1/2	1 7/16	21 1/4	16	1 1/8	1	4 1/2

DIA-FLO® Diaphragm Valves

Weir Type Diaphragms

Choice of Diaphragms

WEIR TYPE VALVES

Diaphragm life depends not only upon the nature of the material handled – but also upon the temperature, pressure and frequency of operation.

Diaphragms can be molded in a wide variety of compounds in each basic stock. ITT Engineered Valves, however, has selected the one compound in each basic stock that gives the most satisfactory results. This reduces confusion in diaphragm ordering and replacement and permits adequate inventories of spare diaphragms.

Dia-Flo® elastomer diaphragms are marked with the grade designation, valve size and date of manufacture either on tabs or on the back of the diaphragm flange.

To ensure the best possible diaphragms, ITT Engineered Valves tests samples of every production lot, and maintains a continuing development program to utilize new materials and improve old ones.

Complete service data should accompany all inquiries and orders.

Elastomer Diaphragm

Elastomer diaphragms are molded in the closed position. This unique design offers a number of advantages. (1) Longer diaphragm life because the elastomer is molded to fit the weir contour perfectly without stretching or distortion. (2) Lower closing torques – because when closing the diaphragm, it is returned to its natural molded closed position. (3) A constant closing torque for each size regardless of the type elastomer specified. (4) Special elastomer diaphragm construction permits use under full vacuum conditions through 12" size. (See page 64 for more specifics).

Diaphragm selection[1]

Valve	Grade	Material	Size	Typical Services	Temp. °F[2,4] Min.	Temp. °F[2,4] Max.
	A	Gum Rubber (Faced)	¾"-4"	Abrasives	−20	160
	B	Black butyl	½"-12"	Chemicals, gases, stronger acids	−20	250
	C	Hypalon	½"-20"	Oxidizing fluids, oil resistant	0	225
	H	Ethylene Propylene (EPDM)	½"-4"	Complies w/F.D.A.	−30	300
Weir Type elastomers	LH	Ethylene Propylene (EPDM)	½"-6"	For LPOV	0	150
	M	Ethylene Propylene (EPDM)	½"-14"	Chemicals, acids, hi-temp, abrasives	−30	300
	DP	Buna N	½"-3"	For direct load valve	10	180
	P	Buna N	¼"-12"	Foods, oils	10	180
	S	Natural rubber	½"-14"	Water, abrasives	−30	180
	T	Neoprene	½"-20"	Weak chemicals, air, oil resistant	−20	200
	V	Viton	½"-6"	Specific solvents & chemicals, oils	−20	325
	WB	White butyl	½"-6"	Foods, beverages, pharmaceuticals	0	225
Weir Type plastics[3]	R2	Tetrafluoroethylene (TFE)	½"-10"	Severe chemicals, solvents, pharmaceuticals	−30	350

Notes:

[1]To be used as General guide; for complete service guide see pages 111 – 152.

[2]Diaphragms at maximum temperatures cannot be used satisfactorily at maximum pressures. Pressure/temperature charts are provided on page 64.

[3]With ethylene propylene backing cushion.

[4]Cast Iron, Ductile Iron & Carbon Steel should not be used below −20°F.

OVERSIZE
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DRV-06