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U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: McGuire Nuclear Station
Docket No. 50-369/50-370
Request for Additional Information
Related to Generic Letter 96-06

Generic Letter 96-06, "Assurance of Equipment Operability and Containment Integrity During Design Basis Conditions", dated September 30, 1996, requested licensees to evaluate cooling water systems that serve containment air coolers to assure that they are not vulnerable to waterhammer and two-phase flow conditions. Duke Energy provided its assessment of these issues for McGuire Units 1 and 2 by letter dated September 28, 1997. By letter dated August 19, 1998, the NRC requested additional information related to the subject Generic Letter. McGuire's response to this request is enclosed.

Questions regarding this submittal should be directed to Julius Bryant, McGuire Regulatory Compliance at (704) 875-4162.

Very truly yours,

H B Barron

H. B. Barron, Vice President
McGuire Nuclear Station

100054

A072

Attachments

Drawings located in Central Files

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NRC Request for Additional Information Related to Generic Letter 96-06 for McGuire Nuclear Station, Units 1 & 2

Item #1: McGuire's submittal of January 28, 1997 indicated that a total of five pipe segments are isolated by at least one soft seated diaphragm valve in each unit, and are susceptible to thermally induced pressurization. This submittal also stated that these soft seated valves are capable of slight leakage or displacement. For each of these pipe segments, describe the applicable design criteria for the piping and valves. Include the required load combinations.

Response

The design criteria and the loading combinations for the piping and valves associated with the five pipe segments is provided on Attachment 1 and its referenced attachments.

Item #2: McGuire's submittal of January 28, 1997 indicated that a total of five pipe segments are isolated by at least one soft seated diaphragm valve in each unit, and are susceptible to thermally induced pressurization. This submittal also stated that these soft seated valves are capable of slight leakage or displacement. For each of these pipe segments, provide a drawing of the valve. Identify 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 this estimated liftoff or leakage pressure.

Response

Attachment 1 and its referenced attachments provide the drawings of the soft seated valve associated with each of the five pipe segments and the estimated leakage pressure for each valve.

The estimated leakage pressure for each valve was obtained by identifying the maximum line pressure at 100% pressure differential (P.D.) shown on vendor literature associated with the subject valves (reference Attachment 5). Assuming a 100% P.D. exists across each closed valve during Design Basis Conditions is conservative since a P.D. of less than 100% will result in upwards force on the respective valves diaphragm on both the downstream and upstream side of the valve. This would result in an upward force on a larger area of the valve diaphragm and result in a lower estimated seat leakage pressure. Additional estimated leakage pressure uncertainty is associated with the allowed tolerances in each valve actuator's as-left spring compression. These tolerances could result in leakage pressures slightly above those shown in Attachment 1. However, these higher pressures will not result in valve seat leakage pressures that approach the maximum working pressure rating for the subject piping and valves. The maximum working pressure rating for the valves is > 250 psig as per ANSI B16.5-1968 and > 1100 psig for the piping as per Pipe Fabrication Institute Technical Bulletin TB1-1974.

Item #3 McGuire's submittal of January 28, 1997 indicated that a total of five pipe segments are isolated by at least one soft seated diaphragm valve in each unit, and are susceptible to thermally induced pressurization. This submittal also stated that these soft seated valves are capable of slight leakage or displacement. Provide the maximum calculated stress in the piping run based on the estimated leakage pressure for the valves.

Response

The estimated seat leakage pressures for the subject valves as shown in Attachment 1 and its referenced attachments are at or below the design pressure of the piping containing these valves. The existing maximum stress calculations for these five piping segments utilize these design pressure values plus some margin. Consequently, these existing calculations bound the stresses that would be experienced if pressure in the piping was to reach the estimated seat leakage pressures. Therefore, there are no stress concerns associated with using a soft seated valve in each of the piping segments as overpressure protection for the respective penetration.

ATTACHMENT 1

PIPING AND VALVES DESIGN CRITERIA FOR FIVE PIPE SEGMENTS

PENETRATION	PIPE SIZE	PIPING DESIGN CRITERIA	SOFT SEATED ISOLATION VALVES DESIGN CRITERIA	VALVE LEAKAGE PRESSURE
M372	4 Inch, Schedule 40	Design Pressure 150 PSIG Design Temperature 180 Degrees F ASME Class 2 Reference Attachments 2 and 3	ITT Grinnell Air Operated Diaphragm Valve # 101 Air Motor, Springs 96 and 98 Reference Attachments 4, 5, and 7	150 PSIG
M307	6 Inch, Schedule 40	Design Pressure 135 PSIG Design Temperature 250 Degrees F ASME Class 2 Reference Attachments 2 and 3	ITT Grinnell Air Operated Diaphragm Valve # 130 Air Motor, Spring 130 Reference Attachments 4, 5, and 6	125 PSIG
M315	6 Inch, Schedule 40	Design Pressure 135 PSIG Design Temperature 250 Degrees F ASME Class 2 Reference Attachments 2 and 3	ITT Grinnell Air Operated Diaphragm Valve # 130 Air Motor, Spring 130 Reference Attachments 4, 5, and 6	125 PSIG
M385	6 Inch, Schedule 40	Design Pressure 135 PSIG Design Temperature 180 Degrees F ASME Class 2 Reference Attachments 2 and 3	ITT Grinnell Air Operated Diaphragm Valve # 130 Air Motor, Spring 130 Reference Attachments 4, 5, and 6	125 PSIG
M390	6 Inch, Schedule 40	Design Pressure 135 PSIG Design Temperature 180 Degrees F ASME Class 2 Reference Attachments 2 and 3	ITT Grinnell Air Operated Diaphragm Valve # 130 Air Motor, Spring 130 Reference Attachments 4, 5, and 6	125 PSIG

MNS PIPE SPECIFICATION
ATTACHMENT 2
Pg 1 of 5

E.1 PS-150.2 Class B & D (Table 8.2-1)

MATERIAL: CARBON STEEL OF DESIGNATED ASME SPECIFICATION (SEE NOTE 7)

Flange Design Conditions:

Pressure (psig)	275	240	210	180	150	130	120	110
Temperature (øF)	100	200	300	400	500	600	650	700

PIPE:	Size Range	=/< 2"	2-1/2" - 24"	> 24"
	Construction	Seamless	Seamless	EFW
	ASME Spec.	SA-106	SA-106	SA-155 C1. 1
	Grade	B	B	KC-70
	Schedule		(See Table 6.1-2)	
	Dimensional Std.	ANSI B36.10	ANSI B36.10	ANSI B36.10
FITTINGS:	Size Range	=/< 2"	2-1/2" - 24"	> 24"
	Construction	Forged Steel	Seamless or EFW	Seamless or EFW
	Joint Type	Socket Weld	Butt Weld	Butt Weld
	ASME Spec.	SA-105	SA-234	SA-234
	Grade		WPB	WPC or WPBW-70
	Rating/ Schedule	3000#	(To match pipe)	To match pipe
	Dimensional Std.	ANSI B16.11	ANSI B16.9	ANSI B16.9
FLANGES:	Size Range	=/< 2"	2-1/2" - 24"	> 24"
	Joint Type	Socket Weld	Weld Neck	Weld Neck
	ASME Spec.	SA-105 or SA-181	SA-105 or SA-181	SA-105 or SA-181
	Grade	I or II	I or II	I or II
	Rating	150#	150#	Class E
	Facing	RF	RF	RF See Note
	Dimensional	ANSI B16.5	ANSI B16.5	AWWA C207

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ATTACHMENT 2
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	Std.		
GASKET CODE:	G-4	G-4	G-4
BOLTING CODE:	B-4	B-4	B-4

Note: AWWA C207 flanges are normally furnished flat face. These flanges comply with all dimensions of AWWA C207, Class E, except for the raised face.

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ATTACHMENT 2
Pg 3 of 5

E.85 Table 8.2-2 General Notes and Requirements Applicable to Section 8.2 & Table 8.2-1

1. Piping materials and components will comply with one or more of Appendix A, "Table 4.4-1 Dimensional and Manufacturing Standards Applicable to Piping Materials and Components."

2. Austenitic Stainless Steel Pipe shall conform to the applicable ASME or ASTM manufacturing standard, as specified; i.e., SA-312, SA-376, etc. The use of the "S" Schedule numbers shall be avoided (10S, 20S, 40S, 80S). Where the wall thickness is specified "Schedule 10" or "Schedule 20", it will be in accordance with the following:

	Schedule 10		Schedule 20	
NPS	Nom. Wall	Min. Wall	Nom. Wall	Min. Wall
2-1/2"	.120"	.105"		
3"	.120"	.105"		
4"	.120"	.105"		
5"	.134"	.117"		
6"	.134"	.117"		
8"	.148"	.130"	.250"	.219"
10"	.165"	.144"	.250"	.219"
12"	.180"	.158"	.250"	.219"
14"	.250"	.219"	.312"	.273"
16"	.250"	.219"	.312"	.273"
18"	.250"	.219"	.312"	.273"
20"	.250"	.219"	.375"	.328"
24"	.250"	.219"	.375"	.328"

3. Where pipe of heavier wall than Schedule 20 is specified, it will conform to the normal wall thicknesses stipulated in ANSI B36.10 both as relates to nominal and minimum dimensions; i.e., Schedule 30, 40, 60, 80, 100, 120, 140, 160, Standard Weight (SW), Extra Strong (XS) or Double Extra Strong (XXS). However, the use of the following listed sizes and Schedule Numbers are to be avoided in favor of SW or XS wall thicknesses:

NPS	Avoid Sch. No.	Use Next Heavier Wall
8"	30	SW
8"	60	XS
10"	30	Sch. 40
12"	30	SW
12"	40	XS
14"	40	XS

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18"	30	XS

4. Pipe schedule numbers and wall thicknesses were determined by the use of equations 1, 2 and 3, of sub-article NB-3640 of ASME Section III; and subparagraph 104.1.2, equations (3), (3A), (4) and (4A), of ANSI B31.1; all as applicable.

5. Where EFW pipe, larger than 24" size, is specified, minimum wall thickness of piping shall be determined by the following equation:

$$t_m = \frac{Pd}{2S + 2yP - 2P}$$

Ref. Eq. 3, Par. NB-3641.1, ASME Sec III
Ref. Eq. 5, Par. 104.1.2, ANSI B31.1

where t_m is minimum wall thickness in inches

d is inside diameter of pipe in inches

S is the code allowable stress for material used, in psi

P is design pressure, in psi

y is constant equal to .4

Actual wall thickness of straight pipe to be specified is t_r:

$t_r = t_m + .068''$ where t_r is the required wall thickness

Note: In all cases McGuire Plantside Engineering must verify all calculations before material procurement.

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6. The need for and the minimum spacing of stiffener rings shall be in accordance with ASME Boiler Code Section VIII, Paragraph UG-28.

7. All materials required for use in DPCo classification A, B, C & D will be procured to ASME Section II

ATTACHMENT 2
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Specifications having like ASTM designation number; e.g.,

Class A, B, C & D: ASME Section II, SA-312

For materials procured for use in the DPCo classifications E, F, G & H, they shall conform to ASTM Standards; e.g.,

Class E, F, G & H: ASTM A312

8. The following pipe bends have been evaluated based on maximum design conditions and assuming that the pipe is initially at the specification allowed minimum wall. These bends were found acceptable. Cases not listed below shall be verified by calculation prior to bending.

5D Bends

Pipe Size	Schedule	Material
1/2, 3/4, 1, 1-1/2, 2, 2-1/2, 3, 4, 6"	40	SA/A 106 Gr. B
1/2, 4, 6"	80	SA/A 106 Gr. B
3/4, 2"	160	SA/A 106 Gr. B
2-1/2, 3, 8"	10	SA/A 312 or 376 TP 304
1/2, 3/4, 1, 1-1/2, 2, 2-1/2, 3, 4"	40	SA/A 312 or 376 TP 304
1/2, 3/4, 1, 1-1/2, 4"	80	SA/A 312 or 376 TP 304
1/2, 3/4, 1, 1-1/2, 3, 4"	160	SA/A 312 Smls or 376 TP 304
1/2"	XXS	SA/A 312 Smls or 376 TP 304
1-1/2"	.481" Wall	SA/A 312 Smls or 376 TP 304

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4D Bends

Pipe Size	Schedule	Material
2"	80	SA/A 312 or 376 TP 304
2"	160	SA/A 312 Smls or 376 TP 304

ATTACHMENT 3

NOTE: ASME CLASS 2 CORRESPONDS TO DUKE CLASS B

Table 3-47. Design Conditions, Load Combinations, and Code Compliance Criteria for Duke Classes B, C, and F Piping

	Condition	Loads	Code Compliance Criteria
5	1. Sustained Loads(5)	Pressure Weight Other Sustained Mechanical loads	Σ Primary stresses $\le S_h$ (3), (7), (8)
5 5	2. Thermal Expansion	Thermal Expansion Thermal Anchor Movements	Maximum Secondary Stress Envelope (3), (7), (8)
6	3. Upset Loads	Pressure Weight OBE (Inertia) OBE (Anchor Movements)(1) DFL (2) Wind(4)	Σ (Primary Stresses) $\le 1.2\ S_h$ (7), (8)
	4.		
6	a. Faulted Loads	Pressure Weight SSE (Inertia) DFL (2) Tornado (4)	Σ (Primary Stresses) $\le 2.4\ S_h$ (7), (8)
5	b. Faulted Loads	Pressure Weight Pipe Rupture (6)	Σ (Primary Stresses) $\le 2.4\ S_h$ (7), (8)

Notes:

1. Stresses due to seismic displacements such as anchor movements may alternatively be considered as secondary stresses and combined with thermal expansion.
2. Dynamic Internal Fluid Loads are occasional loads such as relief valve thrust, steamhammer, waterhammer or loads associated with Plant Upset or Faulted Condition where appropriate.
3. The allowable stress, S_A, may be increased when primary stresses due to sustained loads are less than S_h per ASME Section III, Subsection NC-3611.1(b)(4)(a).

6 4. Wind as defined in UFSAR Section 3.3.1.1 is applicable to the Upset Condition, but not concurrent with seismic
6 loads inertia or anchor movement loadings per ASME III 1971, Subsection NC-3622.

6 Tornado as defined in UFSAR Section 3.3.2.1 is applicable to the Faulted Condition, but not concurrent with
6 seismic loads inertia or anchor movement loadings per ASME III 1971, Subsection NC-3622.

5. If, during operation, the system normally carries a medium other than water (air, gas, steam), sustained loads should be checked for weight loads during hydrotest as well as normal operation weight loads.
6. Pipe rupture loadings include LOCA and MSLB as applicable.

5 7. ASME Code Case N-318-4, "Procedure for Evaluation of the Design of Rectangular Cross Section Attachments
5 on Class 2 or 3 Piping, Section III, Division 1", may be used in case of pipe welded attachment qualification. It
5 should be documented in appropriate calculations.

5 8. ASME Code Case N-392-1, "Procedure for Evaluation of the Design of Hollow Circular Cross Section Welded
5 Attachments on Class 2 or 3 Piping, Section III, Division 1", may be used in case of pipe welded attachment
5 qualification. It should be documented in appropriate calculations.

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ATTACHMENT 3

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Table 3-48. Stress Criteria For Reactor Containment Mechanical Penetrations Duke Class B

Condition	Piping Loads	Criteria
1. Normal	Thermal Displacement Pressure Weight	ASME III, Class 2
2. Upset	Thermal Displacement OBE (Displacement) Pressure Weight OBE (Inertia)	(Secondary Stresses) $\leq S_A$ (Primary Stresses) $\leq 1.2\ S_h$
3. Faulted	Thermal Displacement* SSE (Displacement)* Pressure Weight SSE (Inertia) Pipe Rupture	(Primary Stresses) $\leq 2.4\ S_h$

Note:

*For the faulted condition, the displacement induced stresses are considered primary stresses.

Table 3-49. Stress Criteria For Supports, Restraints, and Anchors Duke Class A

Condition	Piping Loads	Criteria
1. Normal	Thermal Displacement Pressure (As Applicable) Weight	ASME III, Class 1
2. Upset	Thermal Displacement OBE (Displacement) Pressure (As Applicable) Weight OBE (Inertia)	ASME III, Class 1
3. Faulted	Thermal Displacement SSE (Displacement) Pressure (As Applicable) Weight SSE (Inertia) Pipe Rupture	(Primary Stresses) ≤ Yield Stress At Operating Temperature 6 or ASME III, Class 1 (Note 1)
4. Faulted	Thermal Displacement SSE (Displacement) Pressure (As Applicable) Weight SSE (Inertia) Pipe Rupture	(Primary Stresses) ≤ Yield Stress At Operating Temperature 6 or ASME III, Class 1 (Note 1)

6 **Note:**

6 (1) ASME III, Class 1 allowables (i.e. Level D) may be used for standard vendor supplied pipe support
6 components provided a certified Design Report Summary (DRS) or Load Capacity Data Sheet (LCDS)
6 is available for the component.

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Table 3-50. Stress Criteria For Supports, Restraints, and Anchors Duke Classes B, C, and F

	Condition	Piping Loads	Criteria
	1. Normal	Thermal Displacement Pressure (As Applicable) Weight	ASME III, Class 2
6	2. Upset	Thermal Displacement OBE (Displacement) Pressure (As Applicable) Weight OBE (Inertia) wind(1)	ASME III, Class 2
6 6	3. Faulted	Thermal Displacement SSE (Displacement) Pressure (As Applicable) Weight SSE (Inertia) tornado(1)	(Primary Stresses) ≤ Yield Stress At Operating Temperature or ASME III, Class 2 (Note 2)
6 6	4. Faulted	Thermal Displacement SSE (Displacement) Pressure (As Applicable) Weight SSE (Inertia) Pipe Rupture Tornado(1)	(Primary Stresses) ≤ Yield Stress At Operating Temperature or ASME III, Class 2 (Note 2)

6 **Note:**

6 (1) Wind as defined in UFSAR Section 3.3.1.1 is applicable to the Upset Condition, but not concurrent with
6 seismic loads inertia or anchor movement loadings per ASME III 1971, Subsection NC-3622.

6 Tornado as defined in UFSAR Section 3.3.2.1 is applicable to the Faulted Condition, but not concurrent
6 with seismic loads inertia or anchor movement loadings per ASME III 1971, Subsection NC-3622.

6 (2) ASME III, Class 2 allowables (i.e. Level D) may be used for standard vendor supplied components
6 provided a certified Design Report Summary (DRS) or Laod Capacity Data Sheet (LCDS) is available
6 for the component.

Table 3-51. Stress Criteria For Safety Class 2 and 3 Cylindrical Shell Type Equipment and Components And Their Supports

Condition	Loads	Criteria
1. Normal & Upset (includes Normal Operating Effects Plus <u>OBE</u> Effects)	Nozzle Loads Pressure Weight Support Reactions	ASME Section III Class 2 or 3 (See Table 3-4)
2. Faulted (includes Normal Operating Effects Plus <u>SSE</u> Effects)	Nozzle Loads Pressure Weight Support Reactions	<u>Pressure Boundary</u> - ASME Section III, Class 2 and 3 and Par. NB-3225 <u>Supports</u> - (Primary Stresses) ≤ Yield Stress At Operating Temperature

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DUKE ITT GRINNEL VENDOR MANUAL-SEISMIC CALCULATION

ATTACHMENT 4

VALVE LOAD COMBINATIONS

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APPLICABLE DESIGN CRITERIA

	YES	NO	A	N/A
FSAR/PSAR				
ASME Section III				
General Design Specification				
Individual Equipment Specification				
Other: MCS-1205.04-1, Add. 5	X		X	

ANALYTICAL PROCEDURE

	YES	NO	A	N/A
Manual Calculations	X		X	
Computer Calculations				
Test Results				
Other:				

LOADS CONSIDERED

	YES	NO	A	N/A
Self-Weight	X		X	
Thermal				
Pressure	X		X	
Seismic OBE	X		X	
Seismic DBE	X		X	
Rupture				
External/Mechanical	X		X	
Other: as per specification	X		X	

LOAD COMBINATIONS

	YES	NO	A	N/A
Normal				
Upset (INCLUDES OBE)				
Emergency				
Faulted (INCLUDES DBE)				
Other: as per specification *	X		X	

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7. **SUMMARY OF REVIEW**

The report, as submitted by ITT Grinnell is acceptable without any modifications or additions.

8. **CONCLUSIONS**

Acceptable as Presented	X
Acceptable with Modifications/Additions	
Not Acceptable	

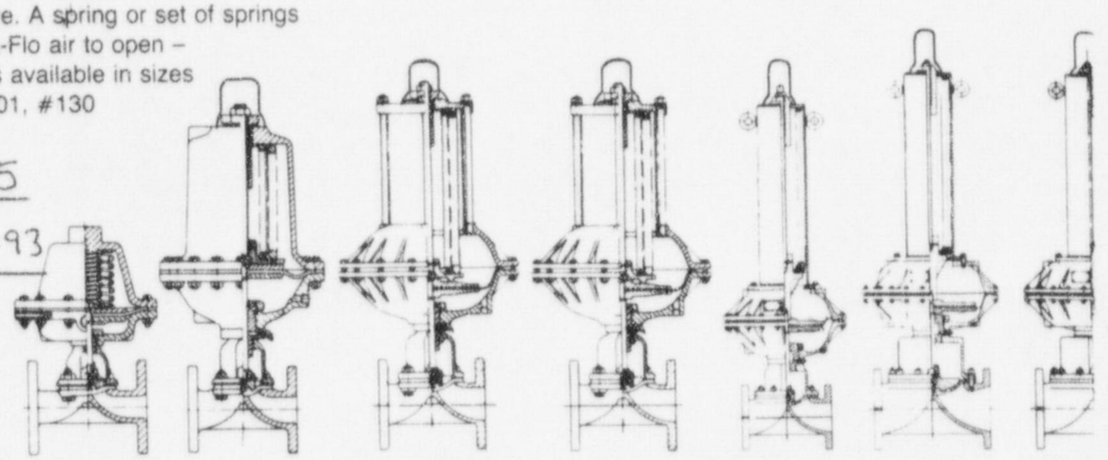
* SPECIFICATION LISTS NORMAL, UPSET, AND FAULTED AS THE APPLICABLE LOAD COMBINATIONS FOR THE VALVES

Reverse acting actuators — 3200 series
Air to open, spring to close — 100% Δp

Air pressure on the under side of the actuator diaphragm opens the valve. A spring or set of springs closes the valve. This Dia-Flo air to open – spring to close Actuator is available in sizes #12, #25, #50, #75, #101, #130 and #250.

ATTACHMENT 5

ITT BULLETIN DV-93



#12 #25 #50 #75 #101 #130 #25

ACTUATION & CONTROL

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Use chart below to determine size and spring requirements for any application

Diaphragm Material	Actuator Size	Spring Number	Maximum line pressures (psi) @ 100% P.D. (Bubble Tight Shut Off) Weir Type Valves ½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	6"	8"	10"	■Air Required at Full Stroke @ 0 psi Line
Elastomers (See next page for TFE diaphragms)	#12	89	60	30	60	40	25 •								23
		88	200	170	165	120	95 •	50 •							45
		88 & 89		200	200	175	150 •	80 •							60
	#25	102A			200	175	175	95	50	15					30
		101						175	110	40	10				55
		101 & 102A							150	85	35				85
	#50	102A			200	175	155	75	35						17
		101					175	135	70	20					26
		101 & 102A						175	130	50					38
	#50L	97			200	175	175	175	130	60	25				30
		96							150	135	70	25 ††			48
		96 & 97								150	110	40 ††			71
	#75	96							150	125	70	23 ††			29
		96 & 97							150	150	120	40 ††			42
		97 & 98							150	150	150	56 ††			47
		96 & 98							150	150	150	73 ††			63
		96, 97 & 98							150	150	150	89 ††			76
	#101	96							150	125	70	23			20
		97							118	53	22				10
		98							150	150	117	39			28
		96 & 97							150	150	120	40			30
		96 & 98							150	150	150	73			48
		97 & 98							150	150	150	56			38
		96, 97 & 98							150	150	150	89			58
		130							150	150	150	125	46 †		85
	#130	96							150	125	70	23			16
		97							118	53	22				9
		98							150	150	117	39			23
		96 & 97							150	150	120	40			24
		96 & 98							150	150	150	73			39
		97 & 98							150	150	150	56			32
		96, 97 & 98							150	150	150	89			48
		130							150	150	150	125	46 **		67
	#250	130							150	150	150	125	34		32
		129							150	150	150	125	47		30
		129 & 130							150	150	150	125	100	35 *	62

•Stroke limited to ⅝"
*Stroke limited to 4⅝"
**Stroke limited to 3½"
†Stroke limited to 3⅛"
††Stroke limited to 3"
■ In vacuum applications additional operating air pressure is required

See page 35 for TFE diaphragms

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