

## Baumann™ 51000 Series High Pressure Low Flow Control Valves

The unique 51000 series control valve is optimally designed for demanding low flow, high pressure control applications often found in laboratories and pilot plants. Assemblies, 1/4 inch or 1/2 inch in size, come standard in either investment cast stainless steel or N10276 nickel alloy. Constructions with other high nickel alloys are available.

With a small footprint, less than 10 inches tall, and multiple trim capacity reductions available to meet changing process requirements, the 51000 is a perfect fit where space is at a premium and flexibility is a must. Suited for demanding control of gases, chemical/dye injection and acid/caustic solutions in paper production, textiles, specialty chemicals and many other industries.

### FEATURES:

- Compact Size
- Suitable for sticky fluids and corrosive atmospheres
- Quick Trim Change Out - Matched trims not required
- Investment cast stainless steel body in 1/4" (6.35 mm) and 1/2" (12.7 mm) sizes or barstock N10276 Nickel Alloy. Other alloys available.
- Class VI shutoff with soft seat available. Up to 3000 psig (207 barg) at 100°F (37°C)
- Rugged bolted bonnet design
- Wide flow capacity range. Maximum rated Cv ranges from 0.00013 to 2.5 (0.0002 to 2.16 Kv)
- Corrosion resistant actuator
- Available without positioner for fail open or fail close applications



Figure 1. 51000 Series Valve with TA6000 Electropneumatic Transducer (I/P)

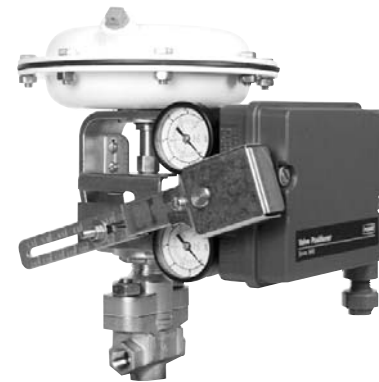


Figure 2. 51000 Series Valve with Type 16 Actuator and 3660 Pneumatic Positioner

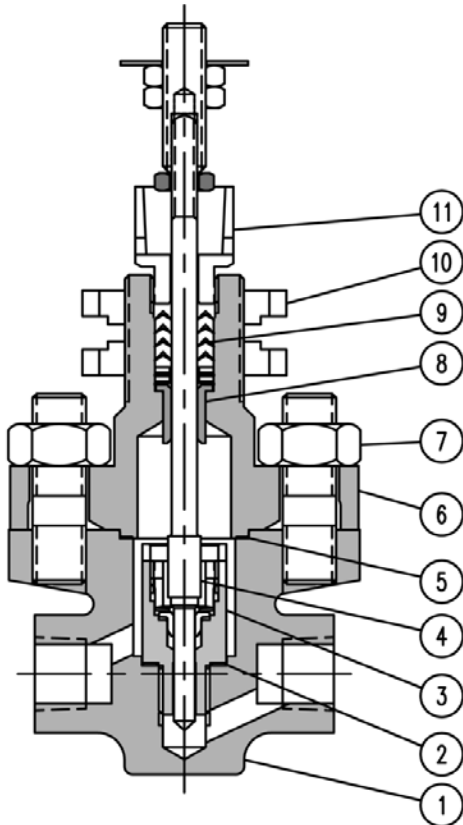


Figure 3. 51000 Series Valve with Type 16 Actuator and FIELDVUE® DVC2000

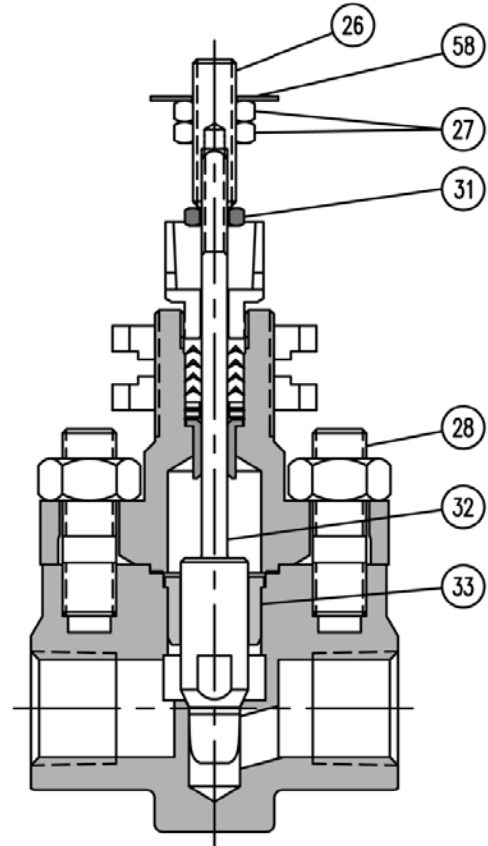


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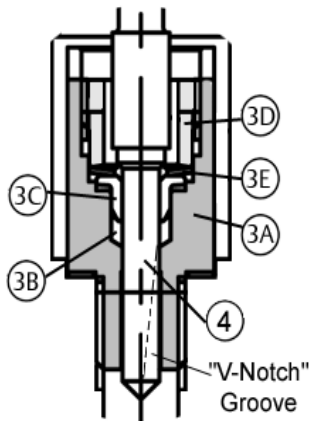
**Bulletin**  
51.LF:BTN  
April 2007



**Figure 4.** 0.25 & 0.50 in (6.35 & 12.7 mm)  
Soft Seat Cage Design for  $C_v = 0.00013 - 0.45$   
Class VI Shutoff  
(N10276 Nickel Alloy Construction Available)



**Figure 5.** 0.50 in (12.7 mm)  
Integral Seating for  $C_v = 1.0, 1.5, \& 2.5$   
Class IV Shutoff



**Figure 6.** Soft Seat Cage Assembly

The PTFE ring (3B) surrounds the valve plug (4) to eliminate clearance flow typical of lapped-in metal-to-metal close clearance micro trims. Flow is directed over the valve plug and forced through a single v-notch path as the plug moves above the PTFE ring providing precise and predictable control over its entire travel range. When the v-notch moves below the PTFE ring, CLVI primary shutoff is achieved.

A live loaded metal seat collar (3C) fully retains the PTFE ring (3B). The valve plug (4) seats against the metal collar providing CLIV secondary shutoff. In addition, the fluid process pressure combines with the actuator seating force to form a hydraulic seal within the fully retained PTFE ring (3B). Therefore, the higher the process pressure the tighter the shutoff.

**Table 2. 51000 SOFT SEAT CAGE ASSEMBLY**

KEY NO.	PARTS	MATERIAL
3A	Cage	316 SST (ASTM A276 S31600 Condition A) or N10276 Nickel Alloy (ASTM B574 N10276, 35 HRC Max)
3B	Ring	PTFE (Polytetrafluoroethylene)
3C	Collar	316 SST (ASTM A276 S31600 Condition A) or N10276 Nickel Alloy (ASTM B574 N10276, 35 HRC Max)
3D	Retainer	
3E	Spring	

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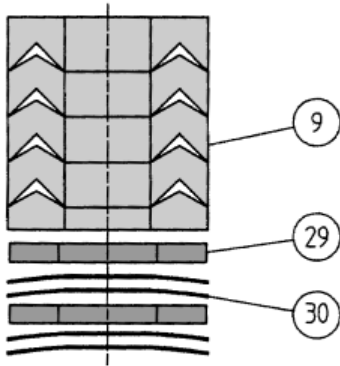


Figure 7. V-Ring Packing Kit

Table 3. 51000 V-RING PACKING KIT 51607

KEY NO.	QTY	DESCRIPTION
9*	1	Packing Set
29	2	Flat Washer
30	4	Disc Spring

Table 1. MATERIALS OF CONSTRUCTION

KEY NO.	PARTS	MATERIAL
1	Body, 1/4" Size ONLY	ASTM A743 CF8M
	Body, 1/2" Size ONLY	Cast 316 SST (ASTM A351 CF8M) or N10276 Nickel Alloy (ASTM B575 N10276, 35 HRC Max)
2	Seat Cage Gasket	Reinforced Graphite
3	Figure 4 ONLY! Soft Seat Cage Assy, (Cv's 0.00013 to 0.45), (Kv's 0.0002 to 0.39)	See Figure 6, Table 2
	Seat, Body (Integral Seat) (Cv's 1.0, 1.5, 2.5); (Kv's 0.86, 1.29, 2.16)	Cast 316 SST (ASTM A351 CF8M) or N10276 Nickel Alloy (ASTM B575 N10276, 35 HRC Max)
4	Plug/Stem (Cv's 0.00013 - 0.5); (Kv's 0.0002 to 0.39)	S21800 SST (ASTM A479 S31800 Annealed) or N10276 Nickel Alloy (ASTM B574 N10276, 35 HRC Max)
5	Bonnet Gasket	GRAFKOTE® <sup>(1)</sup>
6	Bonnet	Cast 316 SST (ASTM A351 CF8M) or N10276 Nickel Alloy (ASTM B574 N10276, 35 HRC Max)
7	Hex Nuts	18-8 Stainless Steel
8	Stem Guide	303 SST (ASTM A582 S30300 Condition A) or VESPEL CR-6100
9	V-Ring Packing Kit	PTFE (Polytetrafluoroethylene) & 304 SST & 301 SST
10	Clamp Nut	304 SST (ASTM A240 S30400)
11	Packing Follower Nut	303 SST (ASTM A582 S30300 Condition A) or N10276 Nickel Alloy (ASTM B574 N10275, 35 HRC Max)
26	Stem Adapter, Type 16 Actuator	18-8 Stainless Steel
27	Hex Jam Nut, Type 16 Actuator	18-8 Stainless Steel
28	Body Studs	304 SST (ASTM A193, B8 Class 1)
31	Stem Adapter Nut	18-8 Stainless Steel
32	Plug and Stem S/A (for metal seated plugs) Integral Seat, Cv's 1.0, 1.5, & 2.5; (Kv's 0.86, 1.29, 2.16)	316 SST (ASTM A276 S31600 Condition A) or N10276 Nickel Alloy (ASTM B574 N10276, 35 HRC Max)
33	Plug Guide	S21800 SST (ASTM A479 S21800 Annealed) or VESPEL CR-6100 or N10276 Nickel Alloy (ASTM B574 N10276, 35 HRC Max)
34	Flange, Bonnet	Cast 304 SST (ASTM A743 CF8)
35	Travel Indicator Disc, Type 16 Actuator	18-8 Stainless Steel

<sup>(1)</sup> GRAFKOTE® is a registered trademark of Advanced Energy Technology, Inc.

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Table 4. FLOW COEFFICIENTS (ANSI/ISA/IEC) NOTE:  $K_v = 0.86 (C_v)$

BODY SIZE		PORT DIA.		PLUG TRAVEL		TRIM NO.	Cv at VALVE OPENING - PERCENT OF PLUG TRAVEL										(F <sub>d</sub> )	(F <sub>L</sub> )	(X <sub>T</sub> )	
in	mm	in	mm	in	mm		5	10	20	30	40	50	60	70	80	90				100
0.25 & 0.50	6.35 & 12.7	.156	3.97	0.5	12.7	16	.00001	.000003	.00001	.00002	.00003	.00005	.00006	.00008	.0001	.0012	.00013	0.035	0.98	0.80
						15	.00002	.000006	.00002	.00004	.00006	.00009	.00011	.00015	.0002	.00023	.00025	0.04		
						14	.00004	.000014	.00004	.00006	.00009	.00013	.00021	.00031	.0004	.00045	.0005	0.05		
						13	.00001	.00003	.00008	.00012	.00017	.00025	.00037	.0006	.0008	.0009	.001	0.06		
						12	.00002	.00007	.00017	.00025	.00036	.0005	.0007	.0010	.0015	.0018	.002	0.075		
						11	.00004	.0001	.00025	.00040	.00058	.0009	.0014	.0020	.0029	.0036	.004	0.10		
						10	.00008	.00015	.00030	.00057	.0010	.0017	.0029	.0046	.0062	.0072	.008	0.11		
						09	.00009	.00018	.00040	.0008	.0016	.0031	.0057	.0087	.011	.014	.015	0.15		
						08	.00010	.00020	.0005	.0012	.0028	.006	.010	.016	.022	.026	.03	0.18		
						07	.00012	.00025	.0007	.0019	.005	.011	.022	.035	.046	.054	.06	0.22		
						06	.00015	.0003	.001	.003	.008	.021	.040	.062	.08	.09	.10	0.25		
						05	.0002	.0005	.002	.006	.016	.04	.079	.12	.16	.18	.20	0.3		
0.50	12.7	.375	9.53	0.5	12.7	04	.0017	.005	.011	.02	.034	.06	.11	.19	.29	.38	.45	0.4	0.95	0.75
						03	.009	.014	.030	.06	.11	.17	.25	.35	.45	.60	1.0	0.23		
						02	.015	.020	.050	.10	.15	.25	.37	.50	.72	1.2	1.5	0.31		
						01	.023	.035	.075	.15	.25	.42	.61	.88	1.2	1.7	2.5	0.60	0.88	0.65

F<sub>d</sub> = Pressure Recovery Factor  
F<sub>L</sub> = Valve Style Modifier  
X<sub>T</sub> = Rated Pressure Drop Ratio Factor, dimensionless

Table 5. BODY S/A PRESSURE-TEMPERATURE RATINGS

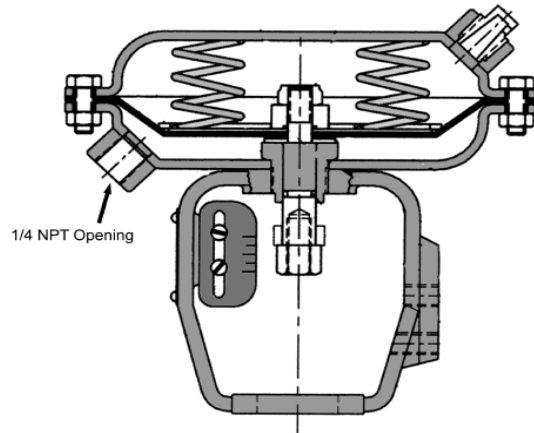
TEMPERATURE (°F)	WORKING PRESSURE (psig)		TEMPERATURE (°C)	WORKING PRESSURE (barg)	
	Cast 316 SST (ASTM A351 CF8M)	N10276 NICKEL ALLOY (ASTM B575 N10276, 35 HRC Max)		Cast 316 SST (ASTM A351 CF8M)	N10276 NICKEL ALLOY (ASTM B575 N10276, 35 HRC Max)
-320 to 100	3000	3000	-195 to 37.8	207	207
200	2580	3000	93.3	178	207
300	2330	3000	149	161	207
350	2235	3000	176	154	207

## TYPE 16 ACTUATOR

The type 16 actuator is single acting, pneumatic with spring return action. It is a compact, multi-spring actuator with low operating friction. It can be reversed in the field (air to open or air to close) without special tools or additional parts.

Multiple springs determine the bench set; there is no need for a bench set adjustment.

It can be mounted with the TA6000 Transducer, type 3660 pneumatic or 3661 electropneumatic valve positioners, as well as, digital valve controllers.



**Figure 8.** Type 16 Actuator Sectional

**Table 6. ACTUATOR CONSTRUCTION**

ACTUATOR TYPE	PARTS	MATERIAL
16	Diaphragm	Dacron Reinforced PA (Polyamide or Nylon)
	Diaphragm Plate	302 or 304 Stainless Steel
	Diaphragm Casing	Carbon Steel (AISI G10080/G10090/G10100)
	Yoke	Cast 316 SST (ASTM A743 CF8)
	Stem	303 SST (ASTM A582 S30300 Condition A)

**Table 7. ACTUATOR SPECIFICATIONS**

TYPE	16 Multi-Spring Diaphragm (Single Acting)
NOMINAL SIZE	16 in <sup>2</sup> , (103 cm <sup>2</sup> )
AIR FAILURE	Open or Closed (Field Reversible)
BENCH SPRING RANGE	3-12 psi (0.21 - 0.83 bar), fail open / 4-13 psi (0.28 - 0.90 bar), fail closed
TRAVEL	0.5 inch (12.7 mm)
AMBIENT TEMPERATURE RANGE	-20°F to 160°F (-29°C to 71°C)
MAXIMUM AIR PRESSURE	35 psig (2.41 barg)
DIAPHRAGM MATERIAL	CR (Chloroprene), TPES (Polyester Thermoplastic)
SPRING CASES	Steel, Powder Epoxy-Coated Appliance White per FDA 21 CFR 175.300 with Stainless Steel Fasteners
YOKE	CF8M
WEIGHT	4.6 lbs (2.1 kg)

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**Table 8. 51000 SERIES VALVE WITH TYPE 16 ACTUATOR AND POSITIONER**

PERFORMANCE SPECIFICATIONS				ALLOWABLE PRESSURE DROPS			
VALVE SIZE (in)	Cv RANGE	PROCESS TEMPERATURE RANGE	SEAT LEAKAGE (per ANSI/FCI 70-2)	BENCH SPRING RANGE	AIR-TO-OPEN (A)	BENCH SPRING RANGE	AIR-TO-CLOSE (A)
0.25 & 0.50	0.00013 - 0.45	-20°F to 350°F	Class VI	4-13 psi	3000 psi	3-12 psi	3000 psi
0.50	1.0, 1.5, 2.5	-20°F to 450°F	Class IV	4-13 psi	400 psi	3-12 psi	800 psi

Note A: Based on 20 psig air supply to positioner.

**Table 9. 51000 SERIES VALVE WITH TYPE 16 ACTUATOR AND POSITIONER (METRIC)**

PERFORMANCE SPECIFICATIONS				ALLOWABLE PRESSURE DROPS			
VALVE SIZE (in)	Kv RANGE	PROCESS TEMPERATURE RANGE	SEAT LEAKAGE (per ANSI/FCI 70-2)	BENCH SPRING RANGE	AIR-TO-OPEN (A)	BENCH SPRING RANGE	AIR-TO-CLOSE (A)
6.35 & 12.7	0.0002 - 0.39	-28.9°C to 177°C	Class VI	0.3 - 0.9 bar	207 bar	0.21-0.83 bar	207 bar
12.7	0.86, 1.29, 2.16	-28.9°C to 232°C	Class IV	0.9 - 0.9 bar	28 bar	0.21-0.83 bar	55 bar

Note A: Based on 1.4 barg air supply to positioner.

**Table 10. 51000 SERIES VALVE WITH TYPE 16 ACTUATOR WITHOUT POSITIONER OR WITH TRANSDUCER**

PERFORMANCE SPECIFICATIONS				ALLOWABLE PRESSURE DROPS			
VALVE SIZE (in)	Cv RANGE	PROCESS TEMPERATURE RANGE	SEAT LEAKAGE (per ANSI/FCI 70-2)	BENCH SPRING RANGE	AIR-TO-OPEN (A)	BENCH SPRING RANGE	AIR-TO-CLOSE (A)
0.25 & 0.50	0.00013 - 0.45	-20°F to 350°F	Class VI	4-13 psi	1000 psi	3-12 psi	3000 psi
0.50	1.0, 1.5, 2.5	-20°F to 450°F	Class IV	4-13 psi	100 psi	3-12 psi	300 psi

Note A: Based on 3-15 psi air output signal to actuator.

**Table 11. 51000 SERIES VALVE WITH TYPE 16 ACTUATOR AND WITHOUT POSITIONER OR WITH TRANSDUCER**

PERFORMANCE SPECIFICATIONS				ALLOWABLE PRESSURE DROPS			
VALVE SIZE (mm)	Kv RANGE	PROCESS TEMPERATURE RANGE	SEAT LEAKAGE (per ANSI/FCI 70-2)	BENCH SPRING RANGE	AIR-TO-OPEN (A)	BENCH SPRING RANGE	AIR-TO-CLOSE (A)
6.35 & 12.7	0.0002 - 0.39	-28.9°C to 177°C	Class VI	0.3 - 0.9 bar	69 bar	0.21-0.83 bar	207 bar
12.7	0.86, 1.29, 2.16	-28.9°C to 232°C	Class IV	0.3 - 0.9 bar	6.8 bar	0.21-0.83 bar	20.6 bar

Note A: Based on 0.2 - 1.0 bar air output signal to actuator.

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## TYPE 16 ACTUATOR WITH TA6000 TRANSDUCER SPECIFICATIONS

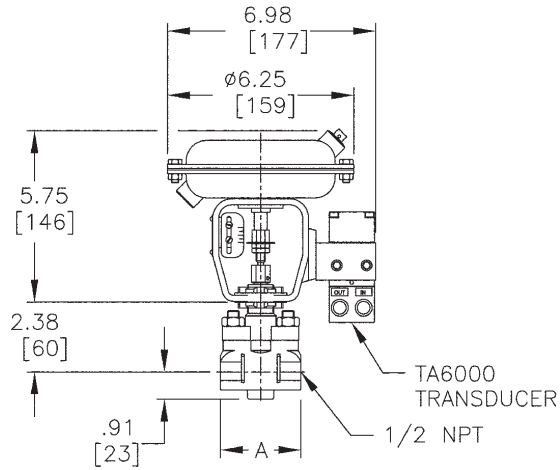


Figure 9. Type 16 Actuator Front

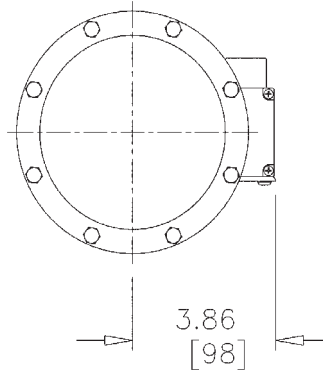


Figure 10. Type 16 Actuator Top

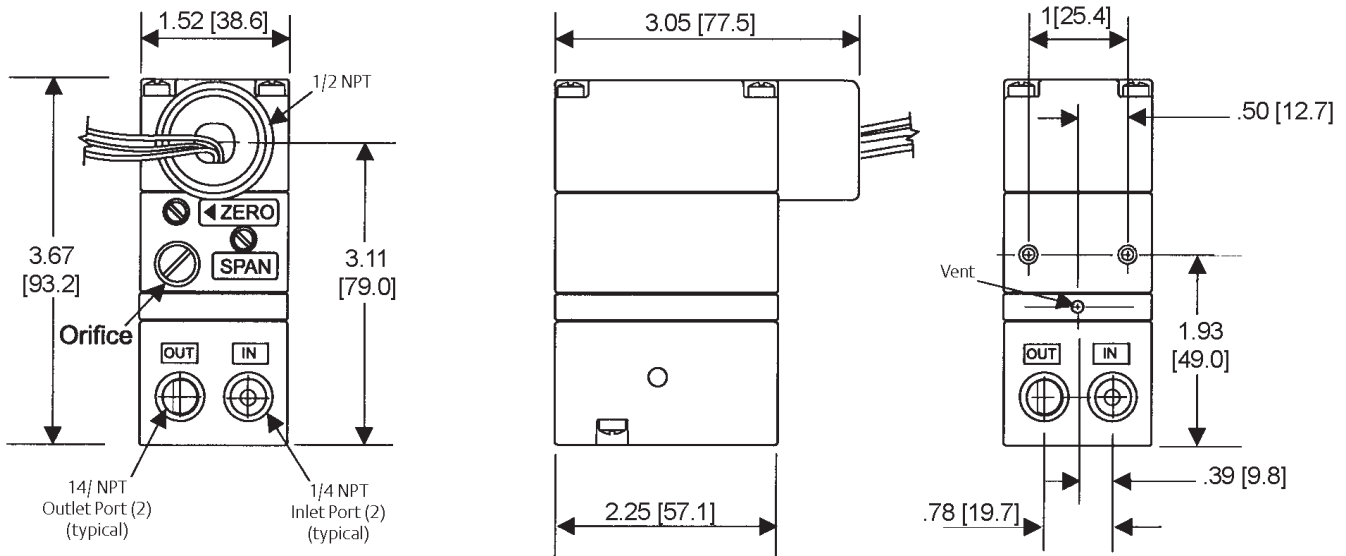


Figure 11. TA6000 Electropneumatic Transducer Dimensions, inches [millimeters]

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**Table 12. TA6000 TRANSDUCER FUNCTIONAL SPECIFICATIONS**

	PSI	BAR	kPa
OUTPUT RANGE	3-15	0.2-1.0	20-100
SUPPLY PRESSURE <sup>1</sup>	20-120	1.5-8.0	150-800
MINIMUM SPAN	5	0.35	35
SUPPLY PRESSURE EFFECT ON OUTPUT	Output Change	0.25	1.7
	Supply Change	25	170
INPUT SIGNAL, 4-20 mA	Impedance (OHMS), 197		
ENCLOSURE RATING	NEMA 2		
AIR CONSUMPTION (per ISA S51.1) SCFH	5.0 / (.14m <sup>3</sup> /HR)		
FLOW RATE (SCFM)	2.5 (4.25m <sup>3</sup> /HR) @ 25 psig (1.7 bar) / 170 kPa Supply & 9 psig (0.6 bar) / 60 kPa Output		
TEMPERATURE RANGE (per ISA S51.1)	-20°F to + 150°F /(-28.9°C to +65°C)		
<sup>1</sup> Supply Pressure must be no less than 5 psi, (0.35 bar), (35 kPa) above maximum output.			

**Table 13. TA6000 TRANSDUCER PERFORMANCE SPECIFICATIONS**

	PSI	BAR	kPa
OUTPUT RANGE	3-15	0.2-1.0	20-200
INDEPENDENT LINEARITY (per ISA S51.1)	±0.5% FS		
HYSTERESIS & REPEATABILITY (per ISA S51.1)	0.25% FS		
RFI/EMI EFFECT	Less than 0.5% of Span @ 30 v/m Class 3 Band ABC (20-1000 mHz) per SAMA PMC 33.1 1978 and Less than 0.5% of Span @ 10 v/m Level 3, 27-500 mHz Band per IEC Standard 801-3 1984. EMC Directive 89/336/EEC European Norms EN50081-2 and EN50082-2		

**Table 14. TA6000 TRANSDUCER MATERIALS OF CONSTRUCTION**

PARTS	MATERIAL
Body & Housing	Aluminum
Orifice	Nickel Plated Brass
Trim	Zinc Plated Steel
Diaphragm	NBR (Nitrile)

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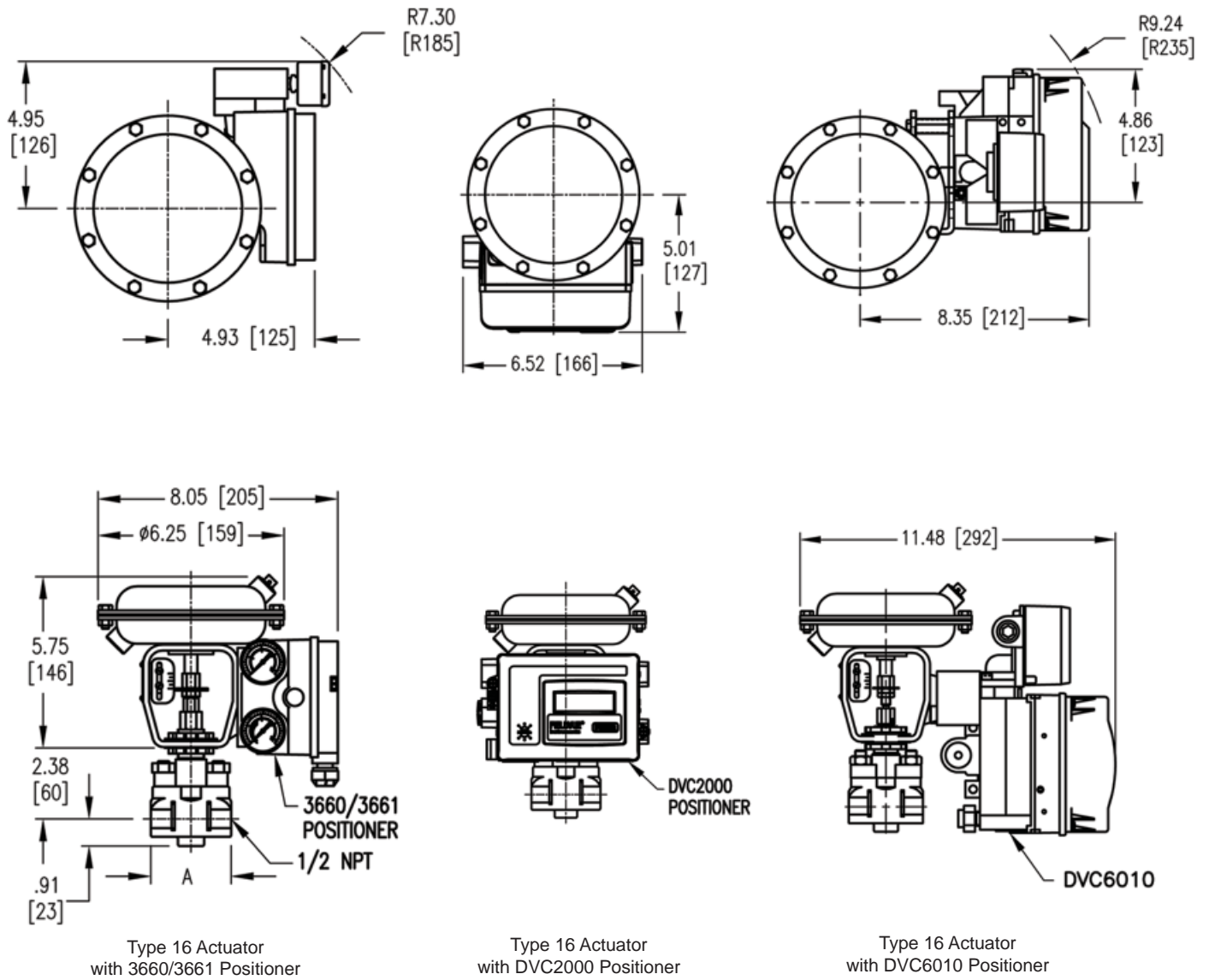


Figure 12. Dimensional Drawings

Table 15. DIMENSION AND WEIGHTS, BODY SUBASSEMBLY

VALVE SIZE		A		MATERIAL	APPROXIMATE WEIGHTS	
inch	mm	inch	mm		lbs	kgs
0.25	6.35	2.20	55.9	Stainless Steel	1.4	0.64
				N10276 Nickel Alloy	2.2	1.0
0.50	12.7	2.70	68.6	Stainless Steel	1.8	0.82
				N10276 Nickel Alloy	2.6	1.18

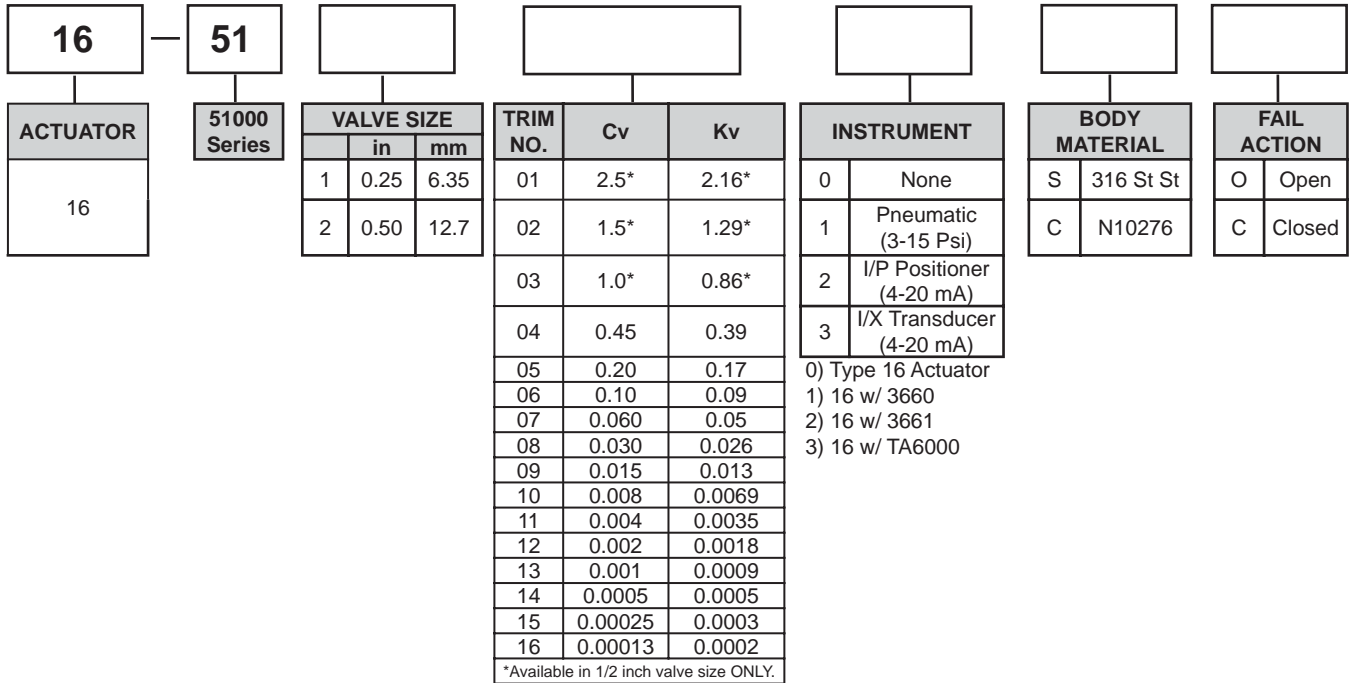
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Table 16. WEIGHTS, ACTUATOR AND INSTRUMENTS ONLY

ACTUATOR TYPE	INSTRUMENT	APPROXIMATE WEIGHT	
		lbs	kg
16	Actuator without instrument	4.0	1.8
	Type 3660/3661 Positioner	8.0	3.6
	FIELDVUE® DVC2000	8.3	3.8
	FIELDVUE® DVC6010 (Aluminum)	12.7	5.8
	FIELDVUE® DVC6010 (St Steel)	22.0	10.0
	FIELDVUE® DVC6010f	11.0	5.0
	TA6000 Electropneumatic Transducer	5.5	2/5

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Table 17. MODEL NUMBERING SYSTEM



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Table 18. RATED Cv COMPARISON CHART

VALVE SIZE	51000 TRIM NUMBER	51000 RATED Cv	COMPETITIVE RATED Cv	COMPETITIVE TRIM DESIGNATION
0.50 inch only	01	2.5	2.5 / 2.0	A & B
	02	1.5	1.25	C
	03	1.0	0.80	D
0.25 inch or 0.50 inch	04	0.45	0.50 / 0.32	E & F
	05	0.20	0.20 / 0.13	G & H
	06	0.10	0.08	I
	07	0.06	0.05	J
	08	0.03	0.03 / 0.02	K & L
	09	0.015	0.01	M
	10	0.008	0.006	N
	11	0.004	0.003	O
	12	0.002	0.002 / 0.0013	P1 & P2
	13	0.001	0.001 / 0.0006	P3 & P4
	14	0.0005	0.0004 / 0.00027	P5 & P6
	15	0.00025	0.00018	P7
	16	0.00013	0.00012 - 0.00001	P8 - P14*

\* P10 - P14 Trims in 1/4 inch size ONLY.

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