

## MODEL 3381

### PRESSURE REDUCING REGULATOR

The Model 3381 is an inexpensive, bronze pressure reducing regulator designed to handle small to mid capacity flow rates in general service. This unit is capable of controlling outlet pressure to a level between 5 and 300 psig (.34 and 20.6 Barg).

#### FEATURES

- High Stability:** High mass plug allows dampening of high frequency disturbances from inlet or outlet side of regulator.
- Trim Removal:** Easily removeable trim from regulator while in-line.
- Trim Selections:** Four different trim combinations for metallic or composition seated designs.
- Non-Asbestos Construction:** Standard gasketing of non-asbestos material.

#### APPLICATIONS

Designed to control a wide range of fluids including industrial gases, air, oil, steam and water. See Table 1 for more information. Available for cryogenic service.

## STANDARD/GENERAL SPECIFICATIONS

**Body Size:** 1/4" or 3/8" (DN8 or DN10) with NPT female pipe threads.

**Body Material:** Bronze - ASTM B62, Alloy C83600. Side inlet and side outlet.

**Spring Chamber:** Same specifications as body.

**Diaphragms:** Phosphorous Bronze or Neoprene. See Table 3.

**Trims:** Brass; metallic seated or composition seated. See Table 3.

**Gaskets:** Non-asbestos, Aramid/SBR. Applicable temperature range -20 to +400°F (-29° to +205°C). NOT SUITABLE FOR OXYGEN SERVICE.

**Operating Temperatures:** See Tables 2 and 3.

**Inlet Pressure:** 400 psig maximum (27.5 Barg).

**Outlet Pressure:** Up to 400 psig (27.5 Barg) (includes 100 psi (6.9 Bar) pressure build when set at 300 psig (20.6 Barg) under high flow rate.

**Range Springs:** Standard: Epoxy coated steel.  
Cryogenic: SST; See Option -5.

Spring Ranges	
psig	Barg
5-30	(.34-2.1)
20-80	(1.4-5.5)
70-140	(4.8-9.6)
130-200	(9.0-13.8)
190-300 <sup>1</sup>	(13.1-20.7)

<sup>1</sup>Not available in SST.

**Cv's / Capacities:** See Tables 4, 5, 6 and 7.

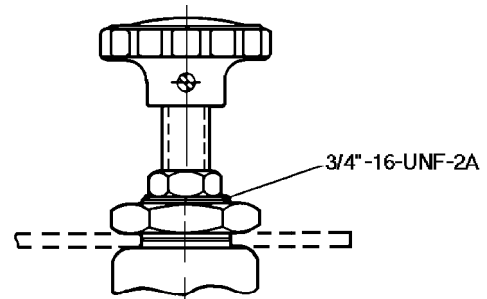
**NOTE:** Refer to "OPTION SPECIFICATIONS" for alternative designs, and to the "TECHNICAL SPECIFICATIONS" tables for a more complete description of the above specifications.

## OPTION SPECIFICATIONS

**Option-2:** HANDWHEEL. Plastic handwheel for frequent setpoint changes.

**Option-5:** CRYOGENIC SERVICE. Includes standard body and spring chamber of bronze. All wetted internal parts are of brass or bronze, except for the piston spring which is of 302 SST. The range spring is SST, and the adjusting screw, spring button and pressure plate are brass. Standard TFE gasketing for diaphragm and pressure plate. Cleaned and packaged for oxygen service per Cashco Specification #S-1134. The spring chamber has a 1/8" NPT female connection for purge gas plus a 1/8" drilled drain hole. Mount in horizontal piping with the adjusting screw oriented downwards. Use B0 or B5 trims. Applicable temperature range -325°F to +100°F (-198° to +38°C).

**Option-20:** DOME LOADING. Spring chamber and range spring replaced by bronze dome for external pressure loading up to 100 psig (6.9 Barg); 1/4" NPT loading connection. Maximum capacity = 0.5 C<sub>v</sub>.



**Figure 1:** Option -22 Panel Mounting (handwheel portion is same for Option -2 Handwheel).

**Option-22:** PANEL MOUNTING. Includes a mounting nut and a handwheel.

**Option-45:** NON-ASBESTOS GASKETS. TFE gaskets as alternate to standard non-asbestos gaskets for oxygen service, from -20 to +400°F (-29° to +205°C).

**Option-55:** SPECIAL CLEANING. Cleaning per Cashco Specification #S-1134. With properly selected materials, cleanliness level suitable for oxygen service.

**Option-85:** OUTLET GAUGE TAP. 1/4" NPT female connection on side of body, outlet end, for incorporation of gauge. Gauge not included.

## APPLICATION AND SELECTION

The following procedure will help determine a suitable selection for an application.

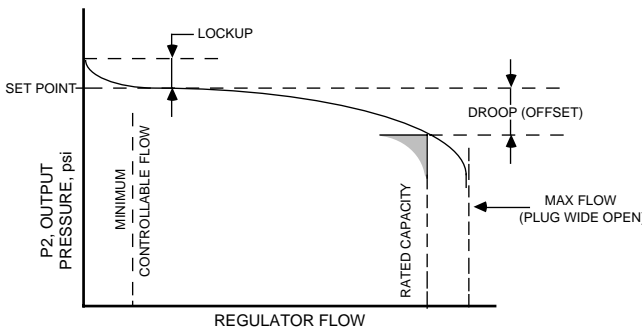
- STEP 1.** FIVE KNOWNNS. The following minimal parameters / information must be available before a selection procedure can begin:
- a. Service Fluid - What is it? Liquid or gas? SG (std. cond.).
  - b. Inlet Pressure -  $P_1$  (upstream pressure).
  - c. Outlet Pressure -  $P_2$  (downstream pressure). How much can  $P_2$  vary as flow varies?
  - d. Desired capacity -  $C_v$ , GPM, SCFH; minimum & maximum.
  - e. Fluid temperature -  $T_1$ , SG (actual).

- STEP 2.** INLET PRESSURE. Assure that the actual design inlet pressure and temperature limits do not exceed the limits established in Table 2. Both body and spring chamber must comply.

- STEP 3.** PRESSURE DROP. Check the maximum pressure drop ( $P_1 - P_2$ ) against limits established in Table 1 to assure not exceeding.

- STEP 4.** OUTLET PRESSURE. All self-contained pressure reducing regulators "droop" or "falloff" from a setpoint pressure level at a given flow as the flow rate increases.

This deviation in setpoint is described as "% droop". Droop is expressed on increasing flow, starting from a minimum flow level.



The "% droop" must be known to enter the capacity tables. The acceptable level of setpoint deviation should be known for the min-to-max flow variation.

A regulator may have a setpoint up to 15% below the lower stated range spring level. (Tags will show the stan-

ard ranges.) A setpoint above the higher range spring level is not recommended. Setpoint at the upper limit of a range spring is acceptable. If final setpoint is questionable and expected near the upper limit, the next higher range spring should be utilized. Best performance will be obtained when the lowest range spring is utilized.

- STEP 5.** DIAPHRAGM MATERIAL. Select the diaphragm first considering its pressure-temperature limits. See Tables 2 and 3.

Composition diaphragms will give approximately an extra 50% in capacity over a metal diaphragm at equal levels of droop.

Systems subject to pulsating inlet or outlet pressures should be provided with metal diaphragms.

Refer to Table 1 as a guide for diaphragm recommended for various services.

- STEP 6.** GASKET MATERIAL. Considering the fluid, determine the compatibility of the gasket material. (**NOTE:** Composition diaphragms do not require gasket selection.)

- STEP 7.** CAPACITY. The five knowns of Step 1 allow proper sizing of the regulator. (Specific Gravity tables are required.) With  $P_1$ ,  $P_2$ , % droop, flow rate ( $C_v$ , GPM, SCFH or #/HR), and diaphragm type per Step 5, enter the capacity tables and confirm Model 3381 capability. Refer to Tables 4 thru 7 for capacities.

- STEP 8.** TRIM MATERIAL. Combining diaphragm material choice of Step 5, and the use of Table 3 allows proper selection of "Trim Designation Numbers" for materials and temperatures. See Table 1 for type of service and allowable pressure drops.

Composition trim will initially provide bubble-tight shutoff in clean service and without downstream over-pressurization. Minute leakage should be expected with metal seated designs. A downstream safety relief valve is recommended.

# TECHNICAL SPECIFICATIONS

**TABLE 1  
APPLICATIONS**

Fluid	Recommended Construction	Trim Designation Number
Air, Inert or Industrial Gases	Metal Seat & Diaphragm	B0
	Composition Seat & Metal Diaphragm	B5
	Composition Seat & Diaphragm	B2, B3
Cryogenic Gases or Liquids	Metal Seat & Diaphragm	B0
	Composition Seat & Metal Diaphragm	B5
Sour Gas, Hydrocarbons, Chemicals	-----	NR
Water and Condensate	Metal Seat & Diaphragm	B0
	Composition Seat & Metal Diaphragm	B5
	Composition Seat & Diaphragm	B2, B3
Saturated Steam <sup>1</sup> 150 psig & lower (10.3 Barg)	Metal Seat & Diaphragm	B0

NR: Not Recommended

<sup>1</sup> Pressure drops above 60 psi (4.14 Barg) can cause accelerated trim and body wear. Maximum recommended pressure drop of 120 psi (8.28 Bar).

**TABLE 2  
BODY AND SPRING CHAMBER  
MAXIMUM PRESSURE WITH TEMPERATURE RATINGS**

Materials	Inlet Pressure		Temperature	
	(psig)	(Barg)	(°F)	(°C)
BRZ Body & Spring Chamber	250	(17.2)	-20 to +400	(-29 to +205)
	300	(20.6)	-20 to +350	(-29 to +177)
	400	(27.5)	-20 to +150	(-29 to +65)
BRZ Body & Spring Chamber specified with Option -5	400	(27.5)	-325 to +100	(-198 to +38)

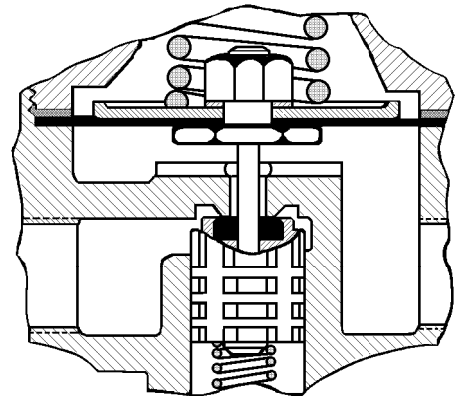


Figure 2: Composition Seat Design

**TABLE 3  
BRASS TRIM MATERIAL COMBINATIONS**

Part	Brass Trim Designation Number			
	B0	B2	B3	B5
Diaphragm	Phos. Bronze	Neoprene	Neoprene	Phos. Bronze
Valve Piston	Brass	Brass	Brass	Brass
Valve Seat <sup>1</sup>	Brass	Buna-N	TFE	TFE
Valve Spring	302 SST	302 SST	302 SST	302 SST
Pusher Plate	Brass	Brass	Brass	Brass
Body Cap	Brass	Brass	Brass	Brass
Temperature Range	-325 to +400°F (-198 to +205°C)	-20 to +180°F (-29 to +82.6°C)	-20 to +180°F (-29 to +82.6°C)	-325 to +400°F (-198 to +205°C)

<sup>1</sup> The fixed portion of the seat is integral to the body. Indicated seat is the moving portion, and is attached or integral with the piston.

**TABLE 4**  
**CAPACITY - C<sub>v</sub> (F<sub>L</sub> = 0.95)**  
**1/4" or 3/8" Sizes**

Outlet (P <sub>2</sub> ) Pressure (psig)	METAL DIAPHRAGM			COMPOSITION DIAPHRAGM		
	% Droop			% Droop		
	10%	20%	30%	10%	20%	30%
10	.05	.09	.15	.13	.22	.35
25	.13	.24	.33	.35	.47	.50
50	.07	.15	.22	.35	.47	.50
75	.12	.23	.32	.45	.50	.50
100	.11	.21	.30	.39	.49	.50
125	.13	.24	.33	.42	.50	.50
150	.10	.19	.28	.38	.48	.50
200	.11	.21	.30	.35	.47	.50
250	.13	.24	.34	.40	.49	.50
300	.16	.28	.38	.42	.50	.50

**TABLE 5**  
**WATER CAPACITY - GPM**  
**S.G. = 1.0 T = 60°F F<sub>L</sub> = 0.95**  
**All Sizes - Composition Diaphragm Only**

Outlet Flowing Pressure (psig)	Inlet Pressure (psig)	1/4" Body			3/8" Body		
		10% Droop	20% Droop	30% Droop	10% Droop	20% Droop	30% Droop
5	50	0.9	1.5	2.3	0.9	1.5	2.3
	75	1.1	1.8	2.9	1.1	1.8	2.9
	100	1.3	2.1	HI VEL	1.3	2.1	3.4
	125	1.4	2.4	HI VEL	1.4	2.4	3.8
	150	1.6	2.6	HI VEL	1.6	2.6	HI VEL
	175	1.7	2.9	HI VEL	1.7	2.9	HI VEL
	200	1.8	3.1	HI VEL	1.8	3.1	HI VEL
10	50	2.2	3.0	3.2	2.2	3.0	3.2
	75	2.8	HI VEL	HI VEL	2.8	3.8	4.0
	100	HI VEL	HI VEL	HI VEL	3.3	HI VEL	HI VEL
	125	HI VEL	HI VEL	HI VEL	3.8	HI VEL	HI VEL
	150	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL
15	50	2.1	2.8	3.0	2.1	2.8	3.0
	75	2.7	HI VEL	HI VEL	2.7	3.6	3.9
	100	3.2	HI VEL	HI VEL	3.2	HI VEL	HI VEL
	125	HI VEL	HI VEL	HI VEL	3.7	HI VEL	HI VEL
	150	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL
25	50	2.3	2.5	2.5	2.3	2.5	2.5
	75	3.2	HI VEL	HI VEL	3.2	3.5	3.5
	100	HI VEL	HI VEL	HI VEL	3.9	HI VEL	HI VEL
	125	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL
35	50	1.5	1.9	1.9	1.5	1.9	1.9
	75	2.5	3.1	3.2	2.5	3.1	3.2
	100	3.1	HI VEL	HI VEL	3.1	4.0	4.0
	125	HI VEL	HI VEL	HI VEL	3.7	HI VEL	HI VEL
	150	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL
50	75	1.9	2.4	2.5	1.9	2.4	2.5
	100	2.7	HI VEL	HI VEL	2.7	3.4	3.5
	125	HI VEL	HI VEL	HI VEL	3.3	HI VEL	HI VEL
	150	HI VEL	HI VEL	HI VEL	3.8	HI VEL	HI VEL
	175	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL	HI VEL
75	100	1.8	2.4	2.5	1.8	2.4	2.5
	125	2.5	HI VEL	HI VEL	2.5	3.3	3.5
	150	3.0	HI VEL	HI VEL	3.0	HI VEL	HI VEL
	175	HI VEL	HI VEL	HI VEL	3.5	HI VEL	HI VEL
100	125	2.0	2.5	2.5	2.0	2.5	2.5
	150	2.8	HI VEL	HI VEL	2.8	3.5	3.5
	175	HI VEL	HI VEL	HI VEL	3.5	HI VEL	HI VEL
	200	HI VEL	HI VEL	HI VEL	4.0	HI VEL	HI VEL
125	150	2.1	2.5	2.5	2.1	2.5	2.5
	175	3.0	HI VEL	HI VEL	3.0	3.5	3.5
	200	HI VEL	HI VEL	HI VEL	3.6	HI VEL	HI VEL

**NOTE:** Where "HI VEL" is indicated, the flow has reached or exceeded the velocities to the right based on Schedule 40 pipe.

SIZE	MAX. VEL
1/4"	10 fps
3/8"	12.5 fps

**TABLE 6**  
**AIR CAPACITY - SCFH**  
**S.G. = 1.0 T = 60°F F<sub>L</sub> = 0.95**

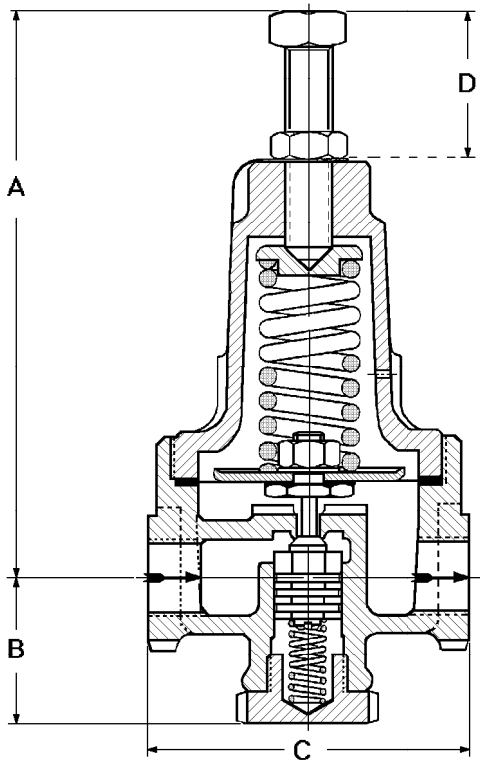
**All Sizes - Composition Diaphragm Only**

Outlet Flowing Pressure (psig)	Inlet Pressure (psig)	1/4" and 3/8" Bodies		
		10% Droop	20% Droop	30% Droop
5	25	100	200	300
	50	200	400	600
	75	300	600	900
	100	500	800	1200
	125	600	1000	1500
	150	700	1200	1900
	175	800	1400	2200
	200	900	1600	2500
	250	1200	2000	3100
10	25	300	400	400
	50	600	800	900
	75	900	1200	1300
	100	1200	1700	1800
	125	1500	2100	2200
	150	1900	2500	2700
	175	2200	2900	3100
	200	2500	3300	3500
	250	3100	4200	4400
15	25	300	400	400
	50	600	800	900
	75	900	1200	1300
	100	1200	1700	1800
	125	1500	2100	2200
	150	1900	2500	2700
	175	2200	2900	3100
	200	2500	3300	3500
	250	3100	4200	4400
25	50	700	800	800
	75	1200	1300	1300
	100	1600	1800	1800
	125	2000	2200	2200
	150	2400	2700	2700
	175	2800	3100	3100
	200	3200	3500	3500
	250	4000	4400	4400
	35	50	600	700
75		1000	1200	1300
100		1400	1700	1700
125		1700	2200	2200
150		2100	2600	2700
175		2400	3000	3100
200		2800	3500	3500
250		3500	4300	4400
50		75	800	1100
	100	1300	1600	1700
	125	1600	2100	2200
	150	2000	2500	2600
	175	2300	3000	3100
	200	2700	3400	3500
	250	3400	4300	4400
75	100	900	1300	1300
	125	1400	1800	2000
	150	1800	2400	2500
	175	2100	2800	3000
	200	2400	3300	3500
	250	3100	4100	4400
100	125	1200	1500	1500
	150	1800	2200	2200
	175	2200	2700	2800
	200	2700	3300	3300
	250	3500	4200	4300
150	175	1600	1900	1900
	200	2200	2700	2700
	250	3300	3900	3900
	300	4200	5000	5000
	350	5000	6000	6000
	400	5900	7000	7000
200	250	2100	2900	3100
	300	3100	4200	4500
	350	3900	5300	5600
	400	4700	6400	6700
250	300	2700	3300	3400
	350	3800	4800	4900
	400	4800	6100	6200
300	350	3100	3700	3700
	400	4500	5400	5400

@Q  
@QA

**TABLE 7**  
**STEAM - LBS/HR**  
**S.G. = Actual T = Saturated  $F_L = 0.95$**   
**All Sizes - Metal Diaphragm Only**

Outlet Flowing Pressure (psig)	Inlet Pressure (psig)	1/4" and 3/8" Bodies		
		10% Droop	20% Droop	30% Droop
5	25	2	3	5
	50	3	6	9
	75	5	8	13
	100	6	10	16
10	25	4	5	8
	50	7	8	14
	75	9	12	20
	100	12	15	25
	125	15	19	31
15	25	4	10	14
	50	8	19	28
	75	12	27	39
	100	15	35	50
	125	19	43	62
25	50	13	25	30
	75	20	38	46
	100	26	49	59
	125	31	60	72
	150	37	71	85
35	50	6	10	15
	75	10	17	26
	100	14	23	35
	125	17	29	43
	150	20	34	51
50	75	10	21	30
	100	14	31	44
	125	18	40	56
	150	22	47	67
75	100	17	32	45
	125	24	46	65
	150	30	58	82
100	125	16	36	50
	150	23	51	72



**DIMENSIONS AND WEIGHTS**

ENGLISH UNITS (Inches)					
Body Size	A	B	C	D	Shipping Weight
1/4" & 3/8"					
Standard	5.12	1.22	2.63	—	3 lbs.
-2 (Handwheel)	5.56	1.22	2.63	—	
-20 (Dome Load)	2.00	1.22	2.63	—	
-22 (Panel Mount)	4.97	1.22	2.63	2.2	
METRIC UNITS (mm)					
Body Size	A	B	C	D	Shipping Weight
DN8 & DN10					
Standard	130	31	67	—	1.36 kgs.
-2 (Handwheel)	141	31	67	—	
-20 (Dome Load)	51	31	67	—	
-22 (Panel Mount)	126	31	67	56	

# PRODUCT CODE 05/15/95

TABLE 2

SIZE	CODE
1/4"	<b>2</b>
3/8"	<b>3</b>

TABLE 1

*SERVICE		GASKETS	OPTIONS	CODE
Basic (Above -20°F)	Non-Oxygen	Std: Non-Asbestos	—	<b>B</b>
	All	Non-Asbestos TFE	-45	<b>D</b>
Cryogenic	All	Non-Asbestos TFE	-5 **	<b>C</b>

\* Refer to Tech Bulletin for complete temperature range.  
 \*\*Cryogenic construction includes special cleaning #S-1134 (Opt.-55)

TABLE 3

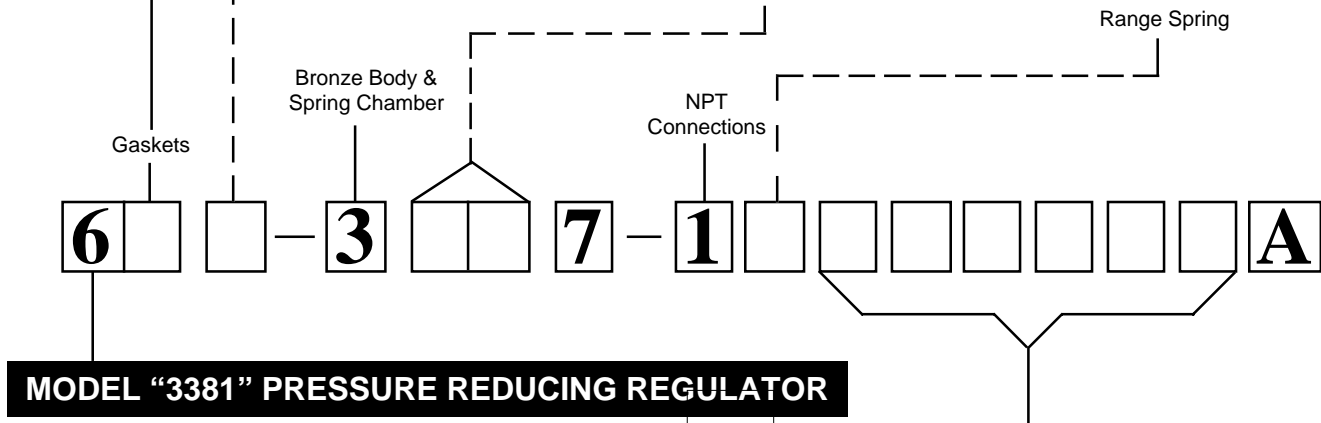
BRASS TRIM	
DESIG.	CODE
B0 *	<b>B0</b>
B2	<b>B2</b>
B3	<b>B3</b>
B5 *	<b>B5</b>

\* Suitable for Cryogenic Service.

TABLE 4

STANDARD		CRYO (OPT-5)	
STEEL RANGE SPRING (psig)	CODE	SST RANGE SPRING (psig)	CODE
5-30	<b>1</b>	5-30	<b>A</b>
20-80	<b>2</b>	20-80	<b>B</b>
70-140	<b>3</b>	70-140	<b>C</b>
130-200	<b>4</b>	130-200	<b>D</b>
190-300	<b>5</b>		
Opt-20*	<b>Y</b>		
Dome Loaded			

\* Must specify in TABLE 5.



- ASSIGNMENT OF "OPTION" CODES
- When ordering a valve per one of Cashco's special drawings, the code "X" and the 5-digit number following override all other options. Otherwise, proceed with the following.
  - NUMERIC digits assigned first in "ascending" order.
  - ALPHA designations are assigned second (excluding the "X") in "alphabetical order".
  - Left justify.
  - Add "0" to all unused squares.
  - If insufficient quantity of squares, consult factory for proper code.

TABLE 5

DESCRIPTION	OPTION	CODE
SPECIAL CONSTRUCTION	—	<b>X</b>
HANDWHEEL	-2	<b>2</b>
AIR PRESSURE(DOME)LOADED	-20	<b>B</b>
PANEL MOUNTING	-22	<b>C</b>
SPECIAL CLEANING: Per Cashco Spec #S-1134. With properly selected materials, this procedure suitable for oxygen service.	-55	<b>M</b>
SIDE BODY PRESSURE GAUGE CONNECTION - 1/4" NPT (No Gauge)	-85	<b>V</b>

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