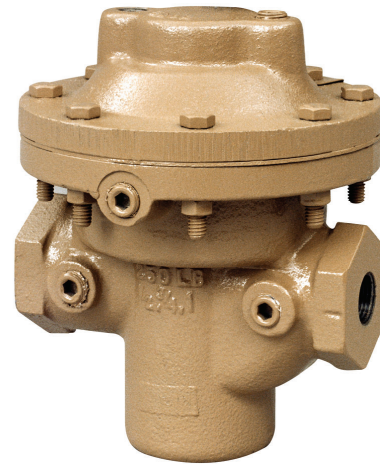




# MODEL DAP

LARGE PISTON DO-ALL  
HIGH PRESSURE  
REDUCING REGULATOR



MODEL DAP

## OVERVIEW

Model DAP is a high performance, piston-style, pressure reducing regulator with balanced trim. Primarily applied in high outlet pressure applications.

**NOTE:** Must be applied where the fluids are the same in topworks and main valve. Can only be applied in clean gas or liquid service. May be pressure-loaded or pilot-operated.

## FEATURES

- Versatile:** SST body material and multiple trim material combinations to select from. Multiple methods of pressure loading.
- Tight Shutoff:** Designed as a soft-seated valve to provide Class IV or VI inboard leakage rates.
- Capacity:** High capacity allows smaller body sizes than competitors in a majority of applications.
- High Pressure Droop:** Highly accurate outlet pressure control, due to absence of range spring in design; provides negligible "droop effect".
- Pressure Drop:** One of highest in the industry when coupled with high flow capacity.
- Trim Design:** "DO-ALL" trim design provides FTO and pressure balancing for higher inlet pressure. Results in unmatched sensitivity and stability. Internals are cage-contained within easily removable quick change trim.
- Rangeability:** Basic valve gives outstanding rangeability due to close tolerances, balanced trim, and multiple soft seats. Can be as high as 2000:1.
- Triple Heavy-Duty Guiding:** Top and bottom guided to maintain stability and increased trim and seal life.
- Failure Position:** Fails closed on loss of loading pressure. Fails open on loss of P<sub>1</sub> or P<sub>2</sub> pressures with loading pressure still applied.



## LINE SIZES AVAILABLE

1/2" (DN15), 3/4" (DN20), 1" (DN25), 1-1/2" (DN40), 2" (DN50)



## END CONNECTIONS

NPT, FLANGED, BSPT



## COMMON APPLICATIONS

CLEAN GASES, ATMOSPHERIC  
INDUSTRIAL GASES, NATURAL GAS,  
CORROSIVE & NON-CORROSIVE  
CHEMICAL SERVICES



## DESIGN PRESSURE

INLET: 3600 psig (248.2 Barg)  
OUTLET: 1125 psig (84.4 Barg)

Алматы (7273)495-231  
Ангарск (3955)60-70-56  
Архангельск (8182)63-90-72  
Астрахань (8512)99-46-04  
Барнаул (3852)73-04-60  
Белгород (4722)40-23-64  
Благовещенск (4162)22-76-07  
Брянск (4832)59-03-52  
Владивосток (423)249-28-31  
Владикавказ (8672)28-90-48  
Владимир (4822)48-43-18  
Волгоград (844)278-03-48  
Волгодла (8172)26-41-59  
Воронеж (473)204-51-73  
Екатеринбург (343)384-55-89

Иваново (4932)77-34-06  
Ижевск (3412)26-03-58  
Иркутск (395)279-98-46  
Казань (843)206-01-48  
Калининград (4012)72-03-81  
Калуга (4842)92-23-67  
Кемерово (3842)65-04-62  
Киров (8332)68-02-04  
Колпазна (4966)23-41-49  
Кострома (4942)77-07-48  
Краснодар (861)203-40-90  
Красноярск (391)204-63-61  
Курск (4712)77-13-04  
Курган (3522)50-90-47  
Липецк (4742)52-20-81

Магнитогорск (3519)55-03-13  
Москва (495)268-04-70  
Мурманск (8152)59-64-93  
Набережные Челны (8552)20-53-41  
Нижний Новгород (831)429-08-12  
Новокузнецк (3843)20-46-81  
Новосибирск (383)227-86-73  
Новосибирск (383)227-86-73  
Омск (3812)21-46-40  
Орел (4862)44-53-42  
Оренбург (3532)37-68-04  
Пенза (8412)22-31-16  
Петрозаводск (8142)55-98-37  
Псков (8112)59-10-37  
Пермь (342)205-81-47

Ростов-на-Дону (863)308-18-15  
Рязань (4912)46-61-64  
Самара (846)206-03-16  
Санкт-Петербург (812)309-46-40  
Саратов (845)249-38-78  
Севастополь (8692)22-31-93  
Саранск (8342)22-96-24  
Симферополь (3652)67-13-56  
Смоленск (4812)29-41-54  
Сочи (862)225-72-31  
Ставрополь (8652)20-65-13  
Сургут (3462)77-98-35  
Сыктывкар (8212)25-95-17  
Тамбов (4752)50-40-97  
Тверь (4822)63-31-35

Тольятти (8482)63-91-07  
Томск (3822)98-41-53  
Тула (4872)33-79-87  
Тюмень (3452)66-21-18  
Ульяновск (8422)24-23-59  
Улан-Удэ (3012)59-97-51  
Уфа (347)229-48-12  
Хабаровск (4212)92-98-04  
Чебоксары (8552)28-53-07  
Челябинск (351)202-03-61  
Череповец (8202)49-02-64  
Чита (3022)38-34-83  
Якутск (4112)23-90-97  
Ярославль (4852)69-52-93

Россия +7(495)268-04-70

Казахстан +7(7172)727-132

Киргизия +996(312)96-26-47

## STANDARD / GENERAL SPECIFICATIONS

### Body / Cover Dome Materials

SST/SST  
SST = Stainless Steel

### Body Sizes

1/2", 3/4", 1", 1-1/2", 2"  
(DN15, 20,25,40,50)

### End Connections

Standard: Female NPT (screwed).  
ASME Flanged: 150#, 300#, 600#; Opt-30.  
DIN Flanged: PN16, PN25, PN40; Opt-30.  
Opt-31 British Standard Pipe Threads.

### Inlet Pressure Range

| Maximum Inlet Pressure - psig (Barg)   |               |
|--|---------------|
| End Conns  | Body Material |
|  | SST           |
| NPT/BSP  | 3600 (248.2)  |
| Flgd   | See Table 1   |
| Minimum Inlet Pressure = 50 psig. (3.4 Barg)<br>See Table 1 for design P vs. T limits. |               |

### Cv Capacity

| Body Size |      | Port |
|-----------|------|------|
| in        | (DN) | Full |
| 1/2"      | (15) | 4.0  |
| 3/4"      | (20) | 6.0  |
| 1"        | (25) | 12   |
| 1-1/2"    | (40) | 30   |
| 2"        | (50) | 50   |

### Outlet Pressure Range

| Maximum Outlet Pressure - psig (Barg)   |               |
|---|---------------|
| End Conn.   | Body Material |
|   | SST           |
| NPT/BSP   | 1125 (84.4)   |
| Flgd  | 1125 (84.4)   |
| Minimum Outlet Pressure = 5 psig when pressure-loaded; = 10" WC when pilot-operated. See Table 2 for design P vs. T limits. |               |

### Pressure Drop Limits

15–3000 psid (1.03-207 Barg)  
Function of service fluid, base trim material, and dynamic seal design. See Table DAG-2, DAG-3 & DAG-4.

### Temperature Range

-20° to +400°F (-29° to +204°C)  
Limited by body/cover dome material combinations and by elastomeric - seat, static seal, dynamic seals - materials. See Tables 2 and 3 and Table DAG-5.

### Inboard Leakage Rates

See Table DAG-10.

### Optional Constructions

Opt-30: Weld-on Flanges  
Opt-31: BSP End Conns.  
Opt-56: Special Cleaned  
Opt-57: Chlorine Cleaned  
Opt-85: Extra Set Pressure Taps

### ABBREVIATIONS

|                          |              |                                |
|--------------------------|--------------|--------------------------------|
| FK = Fluorosilicone      | NBR = Buna-N | PTFE = Polytetrafluoroethylene |
| FKM = Fluorocarbon       | PA = PolyAll | V-TFE = Virgin TFE             |
| EPR = Ethylene Propylene |              | CTFE = Chlorotrifluoroethylene |

## MATERIAL SPECIFICATIONS

### Body

SST ASTM A351, Grade CF3M.

SST = Stainless Steel

### Cover Dome

SST - ASTM A479, Alloy S31600/S31603;  
Type 316/316L barstock.

### Metallic Trim \*

Plug, Cage, Piston: 17-4PH SST, 316L SST.  
Lower Guide Bushing: Function of trim basic material:  
17-4PH trim = 17-4PH SST bushing,  
316L trim = Monel 400 bushing.

Lower Piston Spring: Std. 17-7PH SST  
2-5 psig for Pressure Loaded  
4-10 psig for Pilot Loaded

Cage: Standard burnished finish.

See Table 3 for Metallic Trim Material Combinations.  
**(NOTE:** See Table DAG-4 for pressure drop limits for base trim material.)

### Bolting

Bolts: ASTM F593, Group 1 CW1

Nuts: ASTM F594, Group 1 CW1

OR

Bolts: ASTM A193 B8 Class 2

Nuts: ASTM A194 Grade 8

### Seat \*

PolyAll, V-TFE, CTFE

### Static Seals (See Fig. DAG-F1) \*

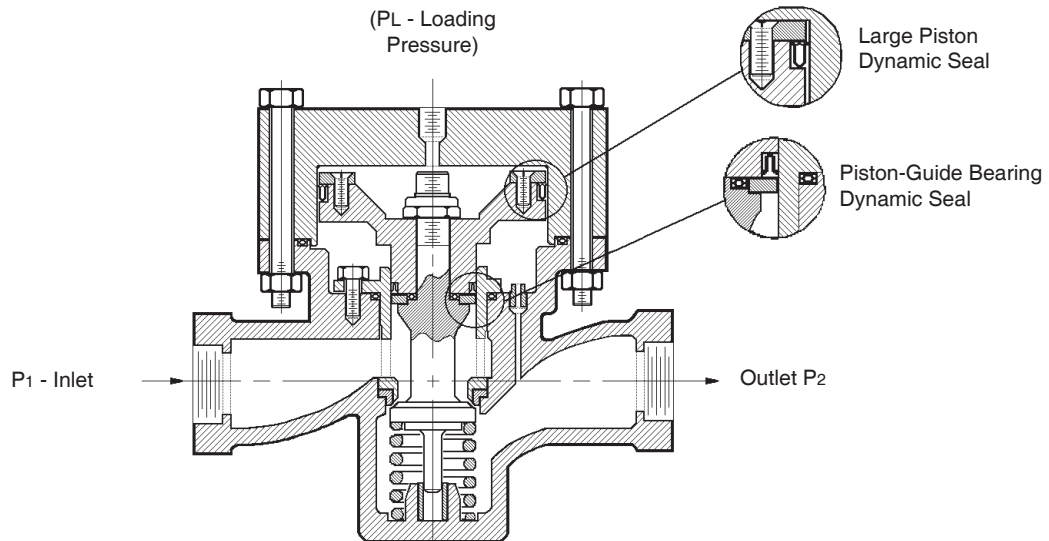
NBR, FKM, FK, EPR, TFE/SST U-Cup

### Dynamic Seals (See Fig. DAG-F1) \*

U-Cup Designs:

Actuator Seal (Upper): Std. - 302 SST/TFE,

Balancing Side Seal (Lower): Std. - 301 SST/TFE



**FIGURE 1 - Model DAP**

## OPTION SPECIFICATIONS

**OPT-30: FLANGED END CONNECTIONS.** Welded-on flange of same general chemistry as body. Available in ASME 150# RF, 300# RF, 600# RF. DIN PN40.

**NOTES:**

1. The body P vs. T ratings are the limiting variables for flanged end connections, unless further restricted by ASME B16.5.
2. No post-weld stress relieving performed.

**OPT-31: BSPT END CONNECTIONS.** British Standard Pipe threads per ISO 7/1; used as an alternate to NPT ends.

**OPT-56: SPECIAL CLEANING.** Cleaning per Cashco Spec. #S-1542 for all body & spring chamber materials. Higher cleaning level than standard commercial cleaning. NOT suitable for oxygen service.

**OPT-57: SPECIAL CLEANING -** Cleaning per Cashco Spec. #S-1589. For chlorine gas service.

**OPT-85: PRESSURE TAPS.** Provides **second set** of inlet and outlet 1/4" (DN8) - FNPT taps with plugs (same basic material as body) on backside of body. Includes second remote sensing vent.

**TECHNICAL SPECIFICATIONS**

For Pilot or Loader Systems, depending on the method used to pressurize the cover dome, the Pressure/Temperature rating of the system must not exceed the Pressure/Temperature ratings listed on the Hookup Schematic selected.

**TABLE 1**  
**INLET PRESSURE vs. TEMPERATURE vs END CONNECTION RATINGS**  
(Per ASME B16.5 and B16.34) See NOTE 1

| Material-<br>Body/Cover<br>Dome | Temperature |            | End Construction - <u>Inlet</u> Pressure Class |       |      |      |      |      |      |      |
|---------------------------------|-------------|------------|--|-------|------|------|------|------|------|------|
|                                 |             |            | Working Pressure                               |       |      |      |      |      |      |      |
|                                 |             |            | End Connection - Pressure Class - ASME         |       |      |      |      |      |      |      |
|                                 |             |            | NPT  |       | 150# |      | 300# |      | 600# |      |
|                                 | °F          | °C         | psig   | Barg  | psig | Barg | psig | Barg | psig | Barg |
| <b>* SST/SST</b>                | -50 to +100 | -45 to +38 | 3600   | 248.2 | 275  | 19.0 | 720  | 49.6 | 1440 | 99.3 |
| <b>SST/SST</b>                  | -20 to +100 | -28 to +38 | 3600   | 248.2 | 275  | 19.0 | 720  | 49.6 | 1440 | 99.3 |
|                                 | 180         | 82         | 3495   | 221.8 | 265  | 17.0 | 700  | 44.3 | 1400 | 88.7 |
|                                 | 200         | 100        | 3095   | 211   | 235  | 16.2 | 620  | 42.2 | 1240 | 84.4 |
|                                 | 225         | 107        | 3020   | 208.4 | 230  | 16.0 | 605  | 41.7 | 1210 | 83.4 |
|                                 | 300         | 150        | 2795   | 192.5 | 215  | 14.8 | 560  | 38.5 | 1120 | 77.0 |
|                                 | 350         | 177        | 2680   | 184.8 | 205  | 14.2 | 535  | 37.0 | 1070 | 73.9 |
|                                 | 400         | 200        | 2570   | 178.3 | 195  | 13.7 | 515  | 35.7 | 1025 | 71.3 |

\* Data included for low ambient temperature operation together with Joule-Thompson cooling effects that may be present to further suppress actual valve temperature.

**TABLE 2**  
**OUTLET PRESSURE vs. TEMPERATURE vs END CONNECTION RATINGS**  
(Per ASME B16.5 and B16.34) See NOTE 1

| Material-<br>Body/Cover<br>Dome | Temperature |            | End Construction - <u>Outlet</u> Pressure Class |      |      |      |      |      |      |      |
|---------------------------------|-------------|------------|---|------|------|------|------|------|------|------|
|                                 |             |            | Working Pressure                                |      |      |      |      |      |      |      |
|                                 |             |            | End Connection - Pressure Class - ASME          |      |      |      |      |      |      |      |
|                                 |             |            | NPT   |      | 150# |      | 300# |      | 600# |      |
|                                 | °F          | °C         | psig  | Barg | psig | Barg | psig | Barg | psig | Barg |
| <b>* SST/SST</b>                | -50 to +100 | -45 to +38 | 1125  | 77.5 | 275  | 19.0 | 625  | 43.0 | 1125 | 77.5 |
| <b>SST/SST</b>                  | -20 to +100 | -28 to +38 | 1125  | 77.5 | 275  | 19.0 | 625  | 43.0 | 1125 | 77.5 |
|                                 | 180         | 82         | 1125  | 77.5 | 265  | 17.0 | 620  | 42.7 | 1125 | 77.5 |
|                                 | 200         | 100        | 1125  | 77.5 | 235  | 16.2 | 620  | 42.7 | 1125 | 77.5 |
|                                 | 225         | 107        | 1120  | 77.0 | 230  | 16.0 | 605  | 41.7 | 1120 | 77.0 |
|                                 | 300         | 150        | 1120  | 77.0 | 215  | 14.8 | 560  | 38.5 | 1120 | 77.0 |
|                                 | 350         | 177        | 1070  | 73.9 | 205  | 14.2 | 535  | 37.0 | 1070 | 73.9 |
|                                 | 400         | 200        | 1025  | 71.3 | 195  | 13.7 | 515  | 35.7 | 1025 | 71.3 |

\* Data included for low ambient temperature operation together with Joule-Thompson cooling effects that may be present to further suppress actual valve temperature.  
**Note:** 600# Flange is derated due to bolting on this product.

**NOTE 1:** These pressure ratings may be further derated by limitations through the Pressure Equipment Directive (2014/68/EU).

| <b>TABLE 3</b><br><b>METALLIC TRIM MATERIAL COMBINATIONS</b> |                  |          |
|--|------------------|----------|
| PART   | TRIM DESIGNATION |          |
|  | P                | S        |
| Plug   | 17-4 PH SST      | 316L SST |
| Guide Bearing  | 17-4 PH SST      | 316L SST |
| Cage   | 316L SST         | 316L SST |
| Body Bushing   | 17-4 PH SST      | Monel†   |

† Monel™ is registered trade names:  
Monel™ is a mark owned by International Nickel Co.

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**TABLE DAG-2  
MAXIMUM PRESSURE DROP FOR  
COMPOSITION SEATS**

| Body Size       |          | Max. Pressure Drop - psid (Bard) |        |     |        |       |       |          |        |      |         |         |            |
|-----------------|----------|----------------------------------|--------|-----|--------|-------|-------|----------|--------|------|---------|---------|------------|
|                 |          | Seat Material                    |        |     |        |       |       |          |        |      |         |         |            |
| in              | (DN)     | POLYALL *                        |        |     |        |       |       | GF-TFE   |        |      |         |         |            |
|                 |          | Liquid *                         |        | Gas |        | Steam |       | Liquid * |        | Gas  |         | Steam √ |            |
| 1/2" – 1"       | (15-25)  | 600                              | (41.3) | 750 | (51.7) | DNA   |       | 450      | (31.0) | 1000 | (68.9)  | 150/125 | (10.3/8.6) |
| 1-1/4" – 1-1/2" | (32-40)  | 600                              | (41.3) | 600 | (41.3) | DNA   |       | 450      | (31.0) | 900  | (62.0)  | 150/125 | (10.3/8.6) |
| 2"              | (50)     | 600                              | (41.3) | 600 | (41.3) | DNA   |       | 450      | (31.0) | 750  | (51.7)  | 150/125 | (10.3/8.6) |
| 2-1/2" – 4"     | (65-100) | 500                              | (34.4) | 600 | (41.3) | DNA   |       | 450      | (31.0) | 750  | (51.7)  | 125     | (8.6)      |
|                 |          | V-TFE                            |        |     |        |       |       | CTFE     |        |      |         |         |            |
| 1/2" – 1"       | (15-25)  | 300                              | (20.7) | 600 | (41.3) | 125   | (8.6) | 600      | (41.3) | 3000 | (206.9) | DNA     |            |
| 1-1/4" – 1-1/2" | (32-40)  | 300                              | (20.7) | 600 | (41.3) | 125   | (8.6) | 600      | (41.3) | 3000 | (206.9) | DNA     |            |
| 2"              | (50)     | 300                              | (20.7) | 600 | (41.3) | 125   | (8.6) | 600      | (41.3) | 2000 | (137.9) | DNA     |            |
| 2-1/2" – 4"     | (65-100) | 300                              | (20.7) | 450 | (31.0) | 125   | (8.6) | 500      | (34.4) | 1500 | (103.4) | DNA     |            |

\* Only seat material to be applied in liquid "partially cavitating" service is PolyAll.  
 √ Steam Service: metal diaphragm/composition diaphragm.  
 N/A = Not Available  
 DNA = Do Not Apply

**TABLE DAG-3  
MAXIMUM PRESSURE DROP FOR  
DYNAMIC SEAL DESIGNS**

| Body Size       |          | Max. Pressure Drop - psid (Bard) |        |       |        |       |         |                                  |        |     |        |       |       |                        |            |      |         |      |         |     |
|-----------------|----------|----------------------------------|--------|-------|--------|-------|---------|----------------------------------|--------|-----|--------|-------|-------|------------------------|------------|------|---------|------|---------|-----|
|                 |          | Dynamic Seal Design              |        |       |        |       |         |                                  |        |     |        |       |       |                        |            |      |         |      |         |     |
| in              | (DN)     | "OR" – O-RING *                  |        |       |        |       |         | "CP" – TFE CAP                   |        |     |        |       |       | "CW" – TFE CAP w/WIPER |            |      |         |      |         |     |
|                 |          | Liquid *                         |        | Gas * |        | Steam |         | Liquid                           |        | Gas |        | Steam |       | Liquid                 |            | Gas  | Steam   |      |         |     |
| 1/2" – 1"       | (15-25)  | 600                              | (41.3) | 750   | (51.7) | DNA   |         | 600                              | (41.3) | 600 | (41.3) | DNA   |       | 450                    | (31.0)     | 600  | (41.3)  | DNA  |         |     |
| 1-1/4" – 1-1/2" | (32-40)  | 600                              | (41.3) | 750   | (51.7) | DNA   |         | 600                              | (41.3) | 600 | (41.3) | DNA   |       | 450                    | (31.0)     | 600  | (41.3)  | DNA  |         |     |
| 2"              | (50)     | 600                              | (41.3) | 750   | (51.7) | DNA   |         | 600                              | (41.3) | 600 | (41.3) | DNA   |       | 450                    | (31.0)     | 600  | (41.3)  | DNA  |         |     |
| 2-1/2" – 4"     | (65-100) | 600                              | (41.3) | 750   | (51.7) | DNA   |         | 600                              | (41.3) | 600 | (41.3) | DNA   |       | 450                    | (31.0)     | 600  | (41.3)  | DNA  |         |     |
|                 |          | "PR" – PISTON RING ASSY.         |        |       |        |       |         | "PW" – PISTON RING ASSY. w/WIPER |        |     |        |       |       | "UC" – U-CUP           |            |      |         |      |         |     |
| 1/2" – 1"       | (15-25)  | DNA                              |        | DNA   |        | √     | 150/125 | (10.3/8.6)                       | DNA    |     | DNA    |       | √     | 150/125                | (10.3/8.6) | 600  | (41.3)  | 3000 | (206.9) | DNA |
| 1-1/4" – 1-1/2" | (32-40)  | DNA                              |        | DNA   |        | √     | 150/125 | (10.3/8.6)                       | DNA    |     | DNA    |       | √     | 150/125                | (10.3/8.6) | 600  | (41.3)  | 3000 | (206.9) | DNA |
| 2"              | (50)     | DNA                              |        | DNA   |        | √     | 150/125 | (10.3/8.6)                       | DNA    |     | DNA    |       | √     | 150/125                | (10.3/8.6) | 600  | (41.3)  | 3000 | (206.9) | DNA |
| 2-1/2" – 4"     | (65-100) | DNA                              |        | DNA   |        | 125   | (8.6)   | DNA                              |        | DNA |        | 125   | (8.6) | 600                    | (41.3)     | 3000 | (206.9) | DNA  |         |     |

\* Only seat material to be applied in liquid "partially cavitating" or "flashing" service is PolyAll.  
 √ Steam Service: metal diaphragm/composition diaphragm.  
 N/A = Not Available      DNA = Do Not Apply      wo/ = without      w/ = with

**TABLE DAG-4  
MAXIMUM PRESSURE DROP FOR  
BASIC TRIM MATERIAL**

| Body Size   |          | Max Pressure Drop - psid (Bard) |         |                |        |             |         |                |         |  |  |
|-------------|----------|---------------------------------|---------|----------------|--------|-------------|---------|----------------|---------|--|--|
|             |          | Basic Trim Material             |         |                |        |             |         |                |         |  |  |
| in          | (DN)     | "P" – 17-4PH SST                |         | "S" – 316L SST |        | "M" – Monel |         | "T" – Hybrid * |         |  |  |
| 1/2" – 2"   | (15-50)  | 3000                            | (206.9) | 800            | (55.1) | 1500        | (103.4) | 3000           | (206.9) |  |  |
| 2-1/2" – 4" | (65-100) | 3000                            | (206.9) | 800            | (55.1) | 1500        | (103.4) | 3000           | (206.9) |  |  |

\* 17-4PH SST plug & piston, Monel cage.

**TABLE DAG-5  
TEMPERATURE LIMITS  
FOR ELASTOMERIC MATERIALS**

|                      |           | <b>Elastomer</b>   | <b>T Maximum</b>                       |             | <b>T Minimum</b> |             |         |
|----------------------|-----------|--------------------|--|-------------|------------------|-------------|---------|
| <b>Seats</b>         | <b>ID</b> | <b>Description</b> | <b>°F</b>                              | <b>(°C)</b> | <b>°F</b>        | <b>(°C)</b> |         |
|                      |           | PolyAll            | Proprietary Polyurethane Derivative    | 225°        | (107°)           | -60°        | (-51°)  |
|                      |           | GF-TFE             | Glass-filled Polytetrafluorethylene    | 425°        | (218°)           | -325°       | (-198°) |
|                      |           | V-TFE              | Virgin TFE                             | 400°        | (205°)           | -325°       | (-198°) |
|                      |           | CTFE               | Chlorotrifluoroethylene TFE            | 300°        | (148°)           | -325°       | (-198°) |
| <b>Diaphragms</b>    |           | 3-Ply              | 3-Ply TFE/FKM/TFE                      | 400°        | (205°)           | 0°          | (-17°)  |
|                      |           | BC                 | Neoprene (Polychloroprene)             | 250°        | (121°)           | -65°        | (-53°)  |
|                      |           | EPR                | Ethylene Propylene                     | 300°        | (148°)           | -40°        | (-40°)  |
|                      |           | FK                 | Fluorosilicone                         | 350°        | (177°)           | -65°        | (-54°)  |
|                      |           | FKM                | Fluorocarbon Elastomer                 | 400°        | (205°)           | 0°          | (-17°)  |
|                      |           | NBR                | Buna-N (Nitrile)                       | 250°        | (121°)           | -70°        | (-56°)  |
|                      |           | FKM+TFE            | Fluorocarbon Elastomer + TFE           | 400°        | (205°)           | 0°          | (-17°)  |
| <b>Static Seals</b>  |           | RTFE               | Bronze-filled TFE                      | 425°        | (218°)           | 70°         | (21°)   |
|                      |           | V-TFE              | Virgin TFE                             | 400°        | (205°)           | -325°       | (-198°) |
|                      |           | EPR                | Ethylene Propylene                     | 300°        | (148°)           | -40°        | (-40°)  |
|                      |           | FK                 | Fluorosilicone                         | 350°        | (177°)           | -65°        | (-54°)  |
|                      |           | FKM                | Fluorocarbon Elastomer                 | 400°        | (205°)           | -20°        | (-28°)  |
|                      |           | NBR                | Buna-N                                 | 212°        | (100°)           | -40°        | (-40°)  |
|                      |           | SST/TFE            | 301/302 SST U-cup / TFE                | 400°        | (205°)           | -325°       | (-198°) |
|                      |           | HC/TFE             | Hastelloy C U-cup / TFE                | 400°        | (205°)           | -325°       | (-198°) |
| <b>Dynamic Seals</b> |           | "PR"               | Piston Ring Assy, GF-TFE / SST         | 425°        | (218°)           | -40°        | (-40°)  |
|                      |           | "PW"               | PRA* w/Wiper, GF-TFE / SST / GF-TFE    | 425°        | (218°)           | 70°         | (21°)   |
|                      |           | "CW" – EPR/TFE     | TFE Cap Seal, EPR O-ring, GF-TFE Wiper | 300°        | (148°)           | -40°        | (-40°)  |
|                      |           | "CW" – NBR/TFE     | TFE Cap Seal, NBR O-ring, GF-TFE Wiper | 212°        | (100°)           | -40°        | (-40°)  |
|                      |           | "CW" – FK/TFE      | TFE Cap Seal, FK O-ring, GF-TFE Wiper  | 350°        | (177°)           | -40°        | (-40°)  |
|                      |           | "CW" – FKM/TFE     | TFE Cap Seal, FKM O-ring, GF-TFE Wiper | 400°        | (205°)           | -20°        | (-28°)  |
|                      |           | "CP" – EPR/TFE     | TFE Cap Seal, EPR O-ring               | 300°        | (148°)           | -40°        | (-40°)  |
|                      |           | "CP" – NBR/TFE     | TFE Cap Seal, NBR O-ring               | 212°        | (100°)           | -40°        | (-40°)  |
|                      |           | "CP" – FK/TFE      | TFE Cap Seal, FK O-ring                | 350°        | (177°)           | -10°        | (-23°)  |
|                      |           | "CP" – FKM/TFE     | TFE Cap Seal, FKM O-ring               | 400°        | (205°)           | -20°        | (-28°)  |
|                      |           | SST/TFE            | 301/302 SST U-cup / TFE                | 400°        | (205°)           | -325°       | (-198°) |
|                      |           | HC/TFE             | Hastelloy C U-cup / TFE                | 400°        | (205°)           | -325°       | (-198°) |
|                      |           | ELG/TFE            | Elgiloy / TFE U-cup                    | 400°        | (205°)           | -325°       | (-198°) |

\* PRA - Piston Ring Assembly

| <b>Metal Diaphragm</b> |                    | <b>T Maximum</b> |             | <b>T Minimum</b> |             |
|------------------------|--------------------|------------------|-------------|------------------|-------------|
| <b>ID</b>              | <b>Description</b> | <b>°F</b>        | <b>(°C)</b> | <b>°F</b>        | <b>(°C)</b> |
| BE-CU                  | Beryllium Copper   | 400°             | (205°)      | -325°            | (-198°)     |

| <b>ABBREVIATIONS</b>         |                         |                                    |                  |
|------------------------------|-------------------------|------------------------------------|------------------|
| FK = Fluorosilicone          | NBR = Buna-N            | PTFE = Polytetrafluoroethylene     | PRA = GF-TFE/SST |
| FKM = Fluorocarbon Elastomer | RTFE = Brz-fill TFE     | V-TFE = Virgin TFE                 | BC = Neoprene    |
| EPR = Ethylene Propylene     | GF-TFE = Glass-fill TFE | CTFE = Chlorotrifluoroethylene TFE | ELG = Elgiloy    |

**TABLE DAG-10  
INBOARD LEAKAGE RATINGS \*  
Per ANSI/FCI 70-2**

| Seat Material           | Dynamic Seal |                             |
|-------------------------|--------------|-----------------------------|
|                         | O-Ring       | Dynamic Seals Except O-Ring |
| CTFE, GF-TFE, and V-TFE | IV           | IV                          |
| PolyAll                 | VI           | IV                          |

\*Inboard leak rates are the composite leakage of the seat leakage + dynamic seal leakage, considered as a single inboard leakage value.

**TABLE DAG-11  
REDUCER RECOMMENDED VELOCITY LIMITS**

| Application Fluid | Valve |   | Valve Body Outlet         |                           | Downstream Pipe              |                              | Units  |
|-------------------|-------|---|---------------------------|---------------------------|------------------------------|------------------------------|--------|
|                   | Type  | Size Range                                  | Recommend                 | Max.                      | Recommend                    | Max.                         |        |
|                   |       |   |                           |                           |                              |                              |        |
| Gas               | PRV   | 1/2"-1"<br>1-1/4"-2"<br>2-1/2"-6"<br>8"-12" | 0.20<br>0.25<br>0.30<br>- | 0.40<br>0.45<br>0.50<br>- | 0.15<br>0.20<br>0.25<br>0.25 | 0.30<br>0.30<br>0.35<br>0.40 | Mach # |
| Steam             | PRV   | 1/2"-1"<br>1-1/4"-2"<br>2-1/2"-6"<br>8"-12" | 0.20<br>0.22<br>0.25<br>- | 0.30<br>0.32<br>0.35<br>- | 0.10<br>0.12<br>0.20<br>0.22 | 0.30                         | Mach # |

**NOTES:**

- Liquids experiencing no 2-phase flow at valve outlet will have same valve body outlet velocity as inlet velocity.
- Liquids experiencing 2-phase flow at valve outlet should have average velocity less than 150-200 ft/sec.
- Liquids experiencing 2-phase flow at outlet pipe should have average velocity less than 20-50 ft/sec.
- If valve outlet exceeds recommended limits, then can use external sensing to reach maximum limits.
- On gas service, a pilot operated prv can work with a outlet Mach = 0.75.

**TABLE DAG 13  
MAXIMUM RECOMMENDED NOISE LIMITS \***

| Criteria   | Body Sizes |          | Noise Level - dBA |
|--|------------|----------|-------------------|
|  | in         | (DN)     |                   |
| Per OSHA Regs. w/noise attenuation methods incorporated. | All        | All      | 85-95             |
| Sch. 80 pipe, no insulation.                             | 1/2"-2"    | (15-50)  | 95                |
| Std. wt. pipe, no insulation.                            | 2-1/2"-4"  | (65-100) | 98                |

\* Consult Factory for ALL applications exceeding 97 dBA noise prediction.

**Schemes To Reduce High Noise –**

- Staging – using two separate throttling valves in series.
- dB Plates – using 1, 2 or 3-stage dB Plate cartridges downstream of a throttling valve.
- Paralleling – using two separate throttling valves in parallel.
- Combinations – using multiple methods of above three possibilities.

**TABLE DAG-14**  
**RECOMMENDED INTERNAL MATERIALS**  
**For P<sub>max</sub>, Reference Individual Technical Bulletins**

|  |  | LIQUIDS                        |         |            |    |
|--|--|--------------------------------|---------|------------|----|
| LIQUIDS  | Fluid  | Tmax °F                        | Tmin °F | Metal Trim |    |
|  |  | <b>Industrial Water – Cold</b> | 180°    | 32°        | P1 |
| Hot  |  | 225°                           | 32°     | P4         |    |
|  | DI, DM   | 225°                           | 32°     | PJ         |    |
|  |  | 250°                           | 32°     | PL         |    |
|  | Seawater   | 180°                           | -20°    | MH         |    |
|  | <b>Fuel Oils – Diesel, #1,#2‡</b>  | 180°                           | -30°    | P5         |    |
|  | Bunker C, #3 - #6‡   | 180°                           | -30°    | P5         |    |
|  |  | 400°                           | 0°      | PC         |    |
|  | Jet Fuel JP3, JP4, JP5, JP6‡   | 400°                           | 0°      | PC         |    |
|  | Kerosene‡  | 400°                           | 0°      | PC         |    |
|  | <b>Crude Oils – Sweet‡</b>   | 225°                           | 0°      | PA         |    |
|  |  | 400°                           | 0°      | PC         |    |
|  | Sour‡  | 225°                           | 0°      | NS         |    |
|  | <b>Heat Transfer Oils – Dowtherm, Therminol, Mobil-Therm, Silvatherm</b> | 400°                           | 0°      | PC         |    |
|  | <b>Misc. Oils – Lube Oil‡</b>  | 180°                           | -30°    | P5         |    |
|  | Naptha‡  | 400°                           | 0°      | PC         |    |
|  | Turbine Oil‡   | 225°                           | 0°      | PA         |    |
| <b>Edible Oils – Vegetable Oil‡</b>                | 180°   | -30°                           | PH      |            |    |
| Animal Fats‡                                       | 180°   | -30°                           | PH      |            |    |
| Seed Oils‡   | 180°   | -30°                           | PH      |            |    |
|  | <b>Inorganic Acids – Acetic - 5%</b>                                     | 100°                           | 0°      | SL         |    |
|  | Acetic - 30%   | 100°                           | 0°      | SL         |    |
|  | Sulfuric - conc.   | 100°                           | 0°      | CF *       |    |
|  | Sulfuric - dilute  | 100°                           | 0°      | CF *       |    |
|  | Nitric - conc.   | 140°                           | 0°      | SL         |    |
|  | Nitric - dilute  | 140°                           | 0°      | SL         |    |
|  | Hydrofluoric (air free) - dilute, concentrate                            | 100°                           | 0°      | CF *       |    |
|  | Hydrobromic  | 140°                           | 0°      | CF *       |    |
|  | Phosphoric - dilute, concentrate   | 150°                           | 0°      | SL         |    |
|  | <b>Misc. Liquids – Gasoline‡</b>   | 150°                           | -30°    | P5         |    |
|  | Benzene (C <sub>6</sub> H <sub>6</sub> )‡                                | 150°                           | 0°      | SL         |    |
|  | Chlorine (Cl <sub>2</sub> )  | 150°                           | 0°      | ML         |    |
| Bromine (Br <sub>2</sub> )                         | 150°   | 0°                             | CF *    |            |    |
| Ammonia (NH <sub>3</sub> )                         | 140°   | 0°                             | SL      |            |    |
| Hydrogen Peroxide (H <sub>2</sub> O <sub>2</sub> ) | 125°   | 0°                             | SL      |            |    |
| Hydrogen Chloride (HCl)                            | 125°   | 0°                             | ML      |            |    |
| Hydrogen Bromide (HBr)                             | 125°   | 0°                             | SL      |            |    |
| Cane Sugar Liquor                                  | 180°   | 0°                             | PH      |            |    |

‡ In accordance with ASME B31.3 "Process Piping", do not use Ductile Iron Body for hydrocarbon or flammable service with inlet pressures greater than 150 psig (10.3 Barg) or temperatures greater than 300 deg F (149 deg C).  
 \* CF = Consult Factory

|   |   | GASES  |         |      |    |
|---|---|--|---------|------|----|
| GASES   | Fluid                                   | Tmax °F  | Tmin °F | Trim |    |
|   | Atmospheric Gases                       | <b>Atmospheric Gases – O<sub>2</sub> (GOX)</b> | 225°    | -60° | M7 |
| 350°  |   |  | -65°    | M9   |    |
| 350°  |   |  | -325°   | TN   |    |
| N <sub>2</sub> (GN <sub>2</sub> ), Air, Argon |   | 180°   | -60°    | P2   |    |
|   |   | 350°   | -65°    | P8   |    |
| CO <sub>2</sub> (dry)                         |   | 180°   | -40°    | P6   |    |
| CO <sub>2</sub> (wet)                         | 180°                                    | -40°   | P5      |      |    |
| Process Gases                                 | <b>Process Gases – Nat. Gas (Sweet)</b> | 180°   | -65°    | P9   |    |
|   | Nat. Gas (Sour)                         | 180°   | -40°    | NR   |    |
|   | LPG (propane)                           | 180°   | -40°    | PH   |    |
|   | Ammonia                                 | 120°   | -40°    | CF * |    |
|   | Hydrogen                                | 180°   | -325°   | SN   |    |
|   | Helium                                  | 180°   | -325°   | SN   |    |
|   | Chlorine (dry)                          | 200°   | 0°      | ME   |    |
|   | Hydrogen Chloride (dry)                 | 120°   | -40°    | SJ   |    |
|   | Hydrogen Bromide (dry)                  | 120°   | 0°      | PE   |    |
|   | Hydrogen Fluoride (dry)                 | 120°   | 0°      | PE   |    |
|   | Hydrogen Sulfide (dry)                  | 140°   | 0°      | NS   |    |
|   | Hydrogen Sulfide (wet)                  | 140°   | 0°      | NS   |    |
|   | Sulfur Dioxide (dry)                    | 120°   | 0°      | PE   |    |
| STEAM   | P1 ≤ 125 psig                           | 350°   | —       | PG   |    |

## DAG-14 SUPPLEMENT CHEMICAL RESISTANCE

**General Statement:** Statements located within this technical bulletin concerning suitability of fluids with TFE materials are general statements, and should not be construed as recommendations. Any statements of suitability are the result of a compilation of various sources of information based on experience, tests, and published technical literature. No guarantee or warranty is in anyway implied for a given particular service or application.

**Additional Reference:** For an inclusive listing covering a broader range of service application fluids, reference "Handbook of Corrosion Resistant Piping", P.A. Schweitzer, Industrial Press; or "Compass Corrosion Guide", 2nd Edition, K.M. Pruett, Compass Publications. This publication will include information based on the following fluid variables:

1. Solution concentration
2. Pressure
3. Temperature

### DAG-15

#### Inverse Sympathetic Ratio (ISR) - effect on regulator performance.

DAP regulators utilize a top and bottom guide, "flow to open" trim design. The top guide also acts as a "balancing" piston to oppose the forces generated by the inlet pressure acting on the valve plug. A small residual imbalance between the piston and the valve plug helps to reduce seat leakage at high differential pressures across the seat joint. This same imbalance produces an Inverse Sympathetic Ratio, ISR effect, as the delta pressure across the seat (DP) changes. The magnitude of the ISR effect is given in Table DAG-15 for both the pressure reducing and back pressure designs.

| TABLE DAG-15      |                 |                       |
|-------------------|-----------------|-----------------------|
| Body Size         |                 | PRV - DA1/DA2/DA4/DAP |
| in                | (DN)            |                       |
| 1/2", 3/4",<br>1" | (15,20,25)      | 0.03                  |
| 1-1/4",<br>1-1/2" | (32,40)         | 0.04                  |
| 2"                | (50)            | 0.02                  |
| 2-1/2", 3",<br>4" | (65,80,<br>100) | 0.054                 |

A typical example of the ISR effect is the rise in outlet setpoint as the inlet pressure decays from a pressure vessel or compressed gas bottle. A 1" DA1 connected to a nitrogen bottle at 3000 psig can be adjusted to deliver downstream pressure, P2, of 100 psig. The P2 will rise to 181.48 psig as the compressed gas bottle pressure decays to 284 psig, because of the ISR effect. The calculation follows below:

$$P_{sp} = P_2 + (ISR \times \Delta P_1)$$

$$\Delta P_1 = \text{INITIAL INLET} - \text{FINAL INLET}. (3000 - 284) = 2716$$

$$P_2 = 100$$

$$ISR = 0.03 \text{ (1.0" DA1)}$$

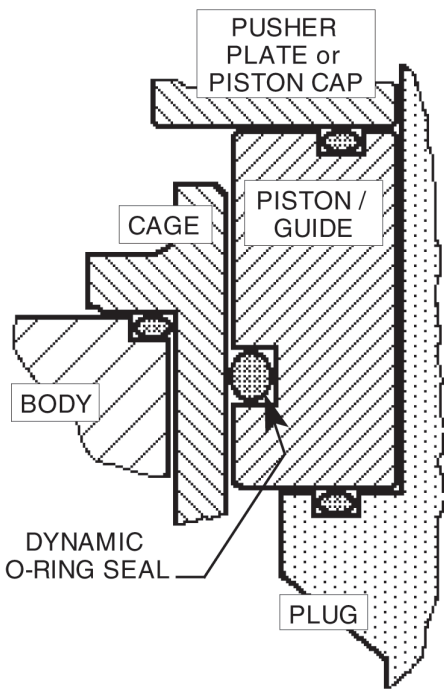
$$P_{sp} = 100 + (0.03 \times 2716)$$

$$P_{sp} = 181.48$$

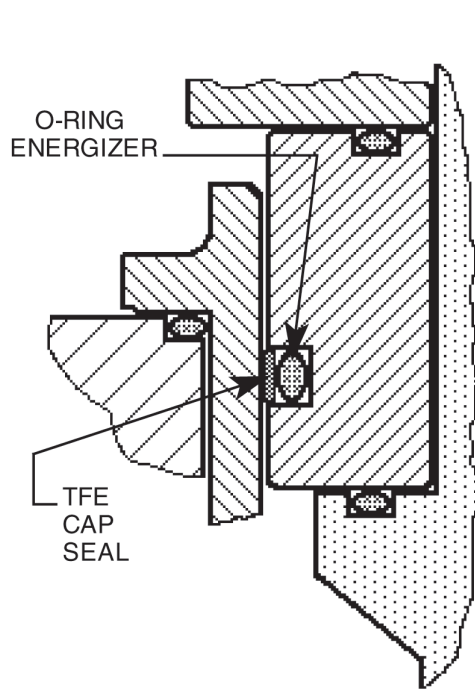
**NOTE:** For a rising DP across the seat, the ISR effect would cause a downward shift or offset in the setpoint.

If the ISR effect is unacceptable, then two regulators installed in series will greatly reduce the overall ISR effect. Overall ISR effect = ISR (first stage regulator) x ISR (second stage regulator). For example, in the same application of a N2 bottle source using two 1" DA1 regulators, the setpoint offset -  $0.03 \times 0.03 \times 2716 = 2.44$ . In summary, the outlet pressure will rise from 100 psig to 102.44 psig as the inlet pressure decays from 3000 psig to 200 psig.

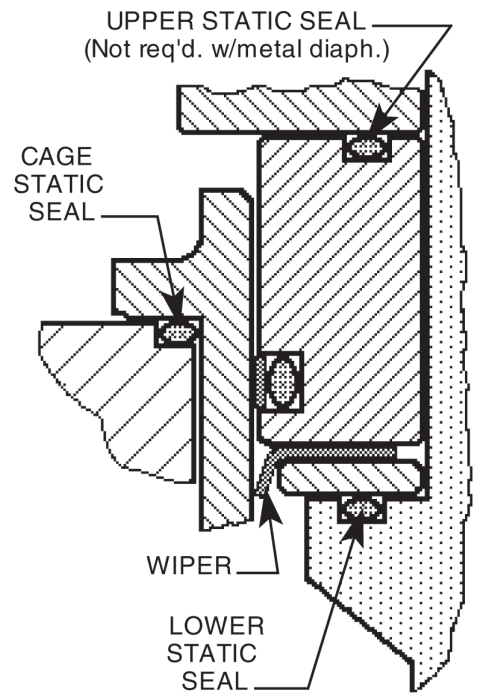
In a similar manner the ISR effect will produce an offset between the loading pressure, PL, and the pressure setpoint of a dome loaded regulator. For example, a 4" DA4 with an inlet pressure, P1 of 300 psig and an outlet pressure, P2 of 50 psig would require a loading pressure,  $PL = (P_1 - P_2) \times ISR + P_2 = (300 - 50) \times 0.054 + 50 = 63.5$  psig. In addition, if the DP changes, then a setpoint offset would be observed with a constant loading pressure.



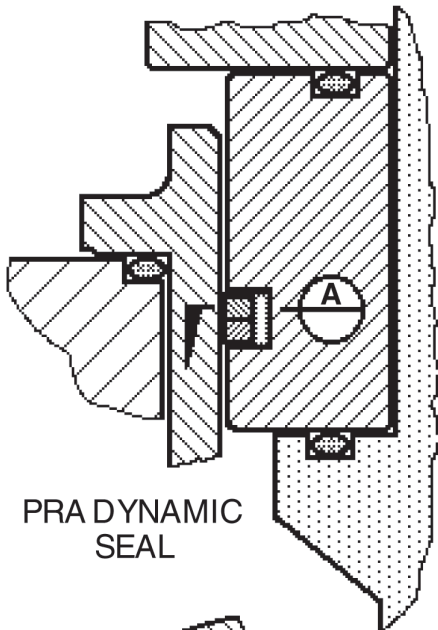
O-RING DYNAMIC SEAL



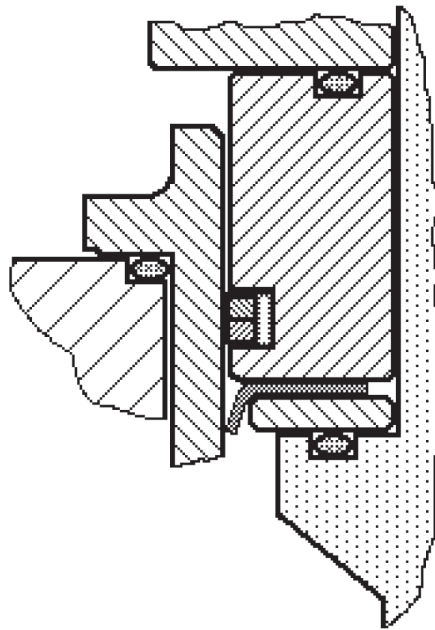
TFE CAP DYNAMIC SEAL



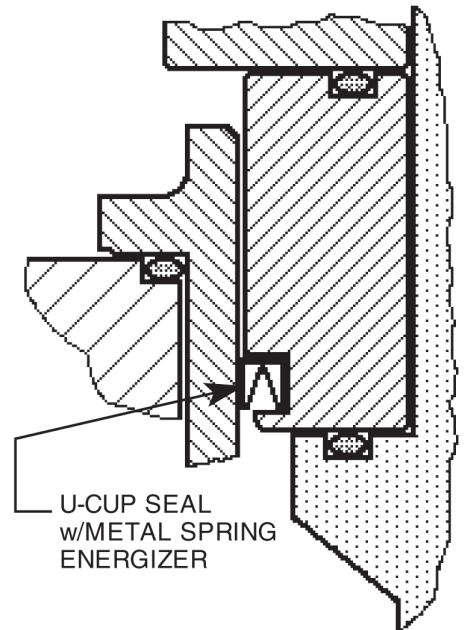
TFE CAP DYNAMIC SEAL + WIPER



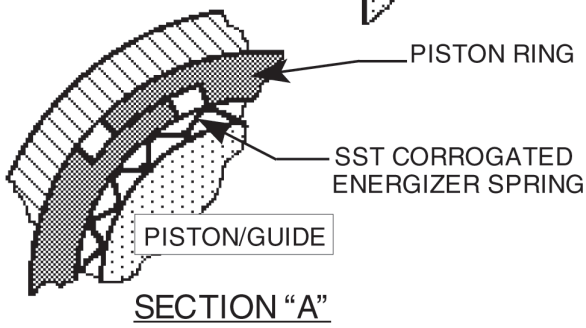
PRA DYNAMIC SEAL



PRA DYNAMIC SEAL + WIPER



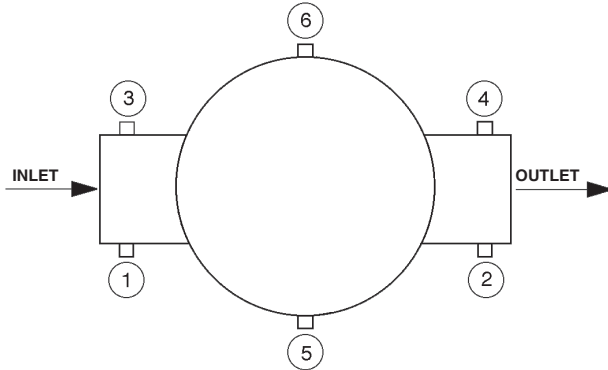
U-CUP DYNAMIC SEAL



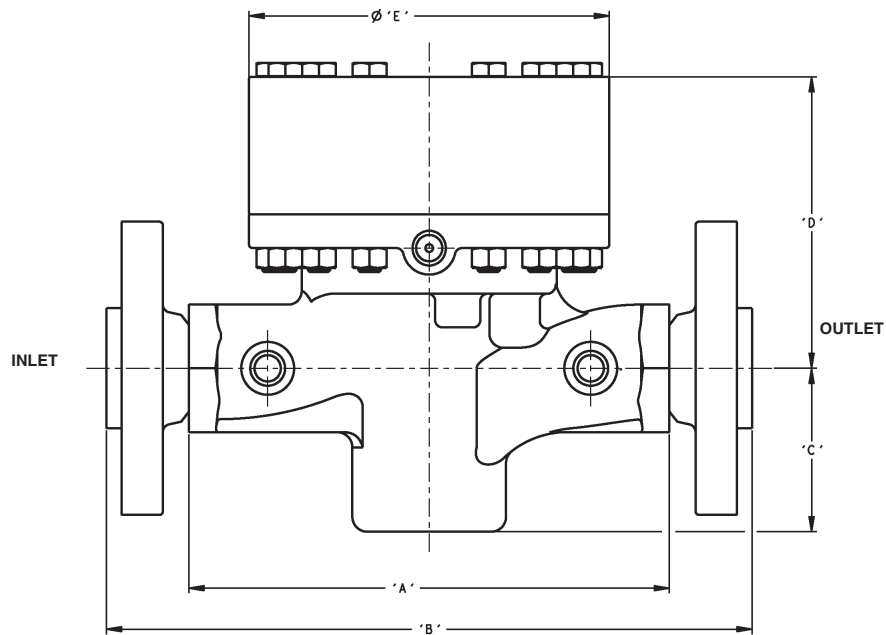
SECTION "A"

**FIGURE DAG-1  
DYNAMIC & STATIC SEALS**

## TECHNICAL SPECIFICATIONS



| PRESSURE TAP LOCATIONS |     |     |        |        |     |        |
|------------------------|-----|-----|--------|--------|-----|--------|
| Body Mat'l             | ①   | ②   | ③      | ④      | ⑤   | ⑥      |
| SST                    | Std | Std | Opt-85 | Opt-85 | Std | Opt-85 |



| DIMENSIONS AND WEIGHTS - ENGLISH UNITS (in) |             |                       |        |       |
|---|-------------|-----------------------|--------|-------|
| Dimension                                   | End Conn.   | Body Size             |        |       |
|   |             | 1/2",<br>3/4" &<br>1" | 1-1/2" | 2"    |
| <b>A</b>                                    | NPT,<br>BSP | 8.25                  | 9.88   | 9.75  |
| <b>B</b>                                    | 150# RF     | 10.75                 | 12.38  | 10.00 |
|   | 300# RF     | 10.75                 | 12.38  | 10.50 |
|   | 600# RF     | 10.75                 | 12.38  | 12.38 |
| <b>C</b>                                    | All         | 2.72                  | 3.81   | 4.15  |
| <b>D</b>                                    | All         | 4.85                  | 5.62   | 6.50  |
| <b>E</b>                                    | All         | 6.00                  | 7.00   | 8.00  |
| <b>Approx.<br/>Weight lbs</b>               | w/Flanges   | 45                    | 65     | 85    |
|   | w/Flanges   | 55                    | 75     | 100   |

| DIMENSIONS AND WEIGHTS - METRIC UNITS (mm) |             |                         |      |      |
|--|-------------|-------------------------|------|------|
| Dimension                                  | End Conn.   | Body Size               |      |      |
|  |             | DN15,<br>DN20<br>& DN25 | DN40 | DN50 |
| <b>A</b>                                   | NPT,<br>BSP | 210                     | 251  | 248  |
| <b>B</b>                                   | 150# RF     | 273                     | 314  | 254  |
|  | 300# RF     | 273                     | 314  | 267  |
|  | 600# RF     | 273                     | 314  | 314  |
| <b>C</b>                                   | All         | 69                      | 87   | 105  |
| <b>D</b>                                   | All         | 123                     | 143  | 165  |
| <b>E</b>                                   | All         | 152                     | 178  | 203  |
| <b>Approx.<br/>Weight kgs</b>              | w/Flanges   | 20.5                    | 29.6 | 38.7 |
|  | w/Flanges   | 25.0                    | 34.1 | 45.5 |

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# MODEL DAP PRODUCT CODER 02/07/20

An "X" in POS 12 followed by a 5-digit control number overrides remaining selections.



| POSITION 3 - SIZE |      |      |
|-------------------|------|------|
| Size              |      | CODE |
| in                | (DN) |      |
| 1/2"              | (15) | 4    |
| 3/4"              | (20) | 5    |
| 1"                | (25) | 6    |
| 1-1/2"            | (40) | 8    |
| 2"                | (50) | 9    |

| POSITION 10 - END CONNECTIONS / ASME |        |  |      |          |      |          |      |   |
|--------------------------------------|--------|--|------|----------|------|----------|------|---|
| Size                                 | Method | End Conn                                 | CODE | End Conn | CODE | End Conn | CODE |   |
| 1/2" - 2"                            | -      | NPT                                      | 1    | -        | -    | -        | -    |   |
|                                      | Opt-30 | 150#RF                                   | 4    | 300#RF   | 5    | 600#RF   | 8    |   |
|                                      | Opt-31 | BSPT                                     | P    |          |      |          |      |   |
| END CONNECTIONS FOR ISO DIN FLANGES  |        |  |      |          |      |          |      |   |
| DN15-25, 40, 50                      | Opt-30 | PN40 RF - will mate with PN16, 25 and 40 |      |          |      |          |      | D |

| POSITION 11 - LOWER SPRING |                |      |
|----------------------------|----------------|------|
| Range psig                 | Loading Method | CODE |
| None                       | Loaded         | 0    |
| 2-5                        | Loaded         | 3    |
| 4-10                       | Piloted        | 6    |

| POSITION 12 - SENSING /LOADING CONFIGURATION (FLOW TO OPEN) |              |                              |
|---|--------------|------------------------------|
| Option  | Sensing Only | Sensing WITH Loading Conf. * |
|   | CODE         | CODE                         |
| Internal  | 1            | A                            |
| External  | 2            | B                            |
| Large Internal  | 4            | C                            |
| For Special Construction Contact Cashco for Special Code    | X            |                              |

\*Requires Additional Loading Schematic. See Product Coders 93 thru 98.

| POSITION 6 & 7 - SEAT/SEAL MATERIALS |              |               |               |               |    |
|--------------------------------------|--------------|---------------|---------------|---------------|----|
| Trim Material                        | O-ring/Seal  |               |               | CODE          |    |
|                                      | Seat         | Static        | Dynamic       |               |    |
| 17-4PH SST "P"                       | PA           | NBR           | SST/TFE u-cup | P1            |    |
|                                      | PA           | EPR           | SST/TFE u-cup | P2            |    |
|                                      | PA           | FK            | SST/TFE u-cup | P3            |    |
|                                      | PA           | FKM           | SST/TFE u-cup | P4            |    |
|                                      | PA           | SST/TFE u-cup | SST/TFE u-cup | P5            |    |
|                                      | V-TFE        | NBR           | SST/TFE u-cup | P6            |    |
|                                      | V-TFE        | EPR           | SST/TFE u-cup | P7            |    |
|                                      | V-TFE        | FK            | SST/TFE u-cup | P8            |    |
|                                      | V-TFE        | FKM           | SST/TFE u-cup | P9            |    |
|                                      | V-TFE        | SST/TFE u-cup | SST/TFE u-cup | PA            |    |
|                                      | CTFE         | NBR           | SST/TFE u-cup | PB            |    |
|                                      | CTFE         | EPR           | SST/TFE u-cup | PC            |    |
|                                      | CTFE         | FK            | SST/TFE u-cup | PD            |    |
|                                      | CTFE         | FKM           | SST/TFE u-cup | PE            |    |
|                                      | CTFE         | SST/TFE u-cup | SST/TFE u-cup | PF            |    |
|                                      | 316L SST "S" | PA            | NBR           | SST/TFE u-cup | S1 |
|                                      |              | PA            | EPR           | SST/TFE u-cup | S2 |
| PA                                   |              | FK            | SST/TFE u-cup | S3            |    |
| PA                                   |              | FKM           | SST/TFE u-cup | S4            |    |
| PA                                   |              | SST/TFE u-cup | SST/TFE u-cup | S5            |    |
| V-TFE                                |              | NBR           | SST/TFE u-cup | S6            |    |
| V-TFE                                |              | EPR           | SST/TFE u-cup | S7            |    |
| V-TFE                                |              | FK            | SST/TFE u-cup | S8            |    |
| V-TFE                                |              | FKM           | SST/TFE u-cup | S9            |    |
| V-TFE                                |              | SST/TFE u-cup | SST/TFE u-cup | SA            |    |
| CTFE                                 |              | NBR           | SST/TFE u-cup | SB            |    |
| CTFE                                 |              | EPR           | SST/TFE u-cup | SC            |    |
| CTFE                                 |              | FK            | SST/TFE u-cup | SD            |    |
| CTFE                                 |              | FKM           | SST/TFE u-cup | SE            |    |
| CTFE                                 |              | SST/TFE u-cup | SST/TFE u-cup | SF            |    |

Abbreviations defined on page 2.

| POSITION 15 - BODY OPTIONS                             |        |      |
|--|--------|------|
|  | Option | CODE |
| No Option  | -      | 0    |
| Second "Set" of 1/4" (DN8) FNPT Pressure Taps & Plugs. | -85    | T    |

| POSITION 16 - CERTIFICATE OPTIONS                                  |        |      |
|--|--------|------|
|  | Option | CODE |
| No Option  | -      | 0    |
| SPECIAL CLEANING: Per Cashco Spec #S-1542.                         | -56    | N    |
| SPECIAL CLEANING: Per Cashco Spec #S-1589 Cl <sub>2</sub> Service. | -57    | P    |

**\* For information on ATEX see pages 12 & 13 on the IOM.**

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