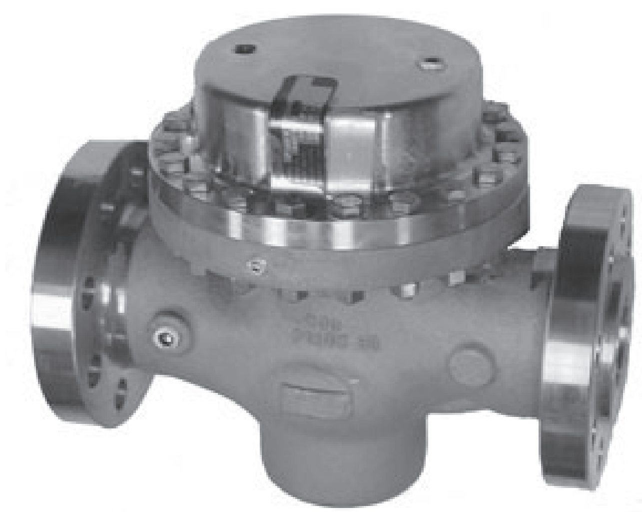
ISO Registered Company

TECHNICAL BULLETIN

DAP-TB
02-20

MODEL DAP

LARGE PISTON DO-ALL HIGH PRESSURE REDUCING REGULATOR, PRESSURE LOADED LARGE PISTON: 1/2" - 2" (DN15 - 50)



MODEL DAP

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.

APPLICATIONS

"DO-ALL" concept allows application of all types of clean gases. Excellent for atmospheric industrial gases – GN2, GOX, Ar, He, H2, CO2, CO – as well as a natural gas regulator. Corrosive and non-corrosive chemical services are possible with broad materials range.

Topworks actuation may be by pressure-loading schemes or pilot-operated schemes.

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 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 P1 or P2 pressures with loading pressure still applied.

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) 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	1225 (84.4)
Flgd	1225 (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 S31603; Type 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, 316 SST (Cond. CW1)
Nuts: ASTM F594, 316 SST (Cond. CW1)

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

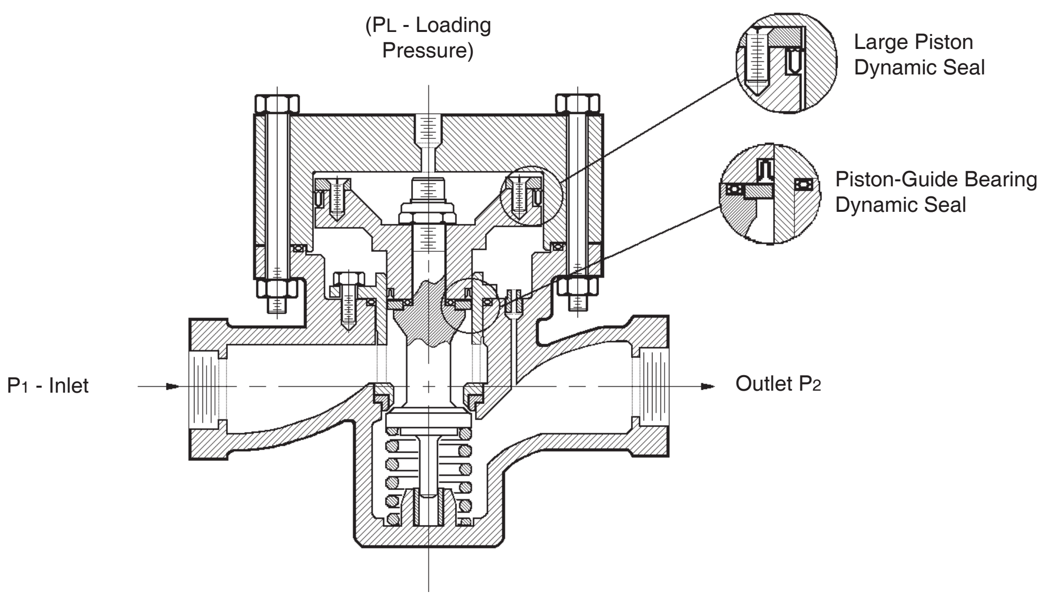


FIGURE 1 - Model DAP

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-Body/Cover Dome	Temperature		End Construction - Inlet Pressure Class / Working Pressure / End Connection - Pressure Class - ASME							
			NPT		150#		300#		600#	
	ºF	ºC	psig	Barg	psig	Barg	psig	Barg	psig	Barg
* SST/SST	–50 to +100	-45 to +38	3600	248.2	275	19.0	720	49.6	1440	99.3
SST/SST	–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-Body/Cover Dome	Temperature		End Construction - Outlet Pressure Class / Working Pressure / End Connection - Pressure Class - ASME							
			NPT		150#		300#		600#	
	°F	°C	psig	Barg	psig	Barg	psig	Barg	psig	Barg
* SST/SST	–50 to +100	-45 to +38	1125	77.5	275	19.0	625	43.0	1125	77.5
SST/SST	–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).

TABLE 3
METALLIC TRIM MATERIAL COMBINATIONS

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.

DAG TECHNICAL APPENDIX INDEX

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

Elastomer			T Maximum		T Minimum	
	ID	Description	°F	(°C)	°F	(°C)
Seats	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°)
Diaphragms	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°)
Static Seals	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°)
Dynamic Seals	"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

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

ABBREVIATIONS			
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
<u>REDUCER</u> RECOMMENDED VELOCITY LIMITS

Application Fluid	Valve		Valve Body Outlet		Downstream Pipe		Units
	Type	Size Range	Recommend	Max.	Recommend	Max.	
Liquid	PRV	1/2"–4"	15	20	5-8	16	Ft/Sec
	PRV	6"	15	25	7–12	20	
		8"–12"	–	–	9–14	24	
Gas	PRV	1/2"–1" 1-1/4"–2"	0.20 0.25	0.40 0.45	0.15 0.20	0.30 0.30	Mach #
	PRV	2-1/2"–6"	0.30	0.50	0.25	0.35	
		8"–12"	–	–	0.25	0.40	
Steam	PRV	1/2"–1" 1-1/4"–2" 2-1/2"–6"	0.20 0.22 0.25	0.30 0.32 0.35	0.10 0.12 0.20	0.30	Mach #
		8"–12"	–	–	0.22		

NOTES:
1. Liquids experiencing <u>no</u> 2-phase flow at valve outlet will have same valve body outlet velocity as inlet velocity.
2. Liquids experiencing 2-phase flow at valve outlet should have average velocity less than 150-200 ft/sec.
3. Liquids experiencing 2-phase flow at <u>outlet pipe</u> should have average velocity less than 20-50 ft/sec.
4. If valve outlet exceeds recommended limits, then can use external sensing to reach maximum limits.
5. 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 <u>ALL</u> applications exceeding 97 dBA noise prediction.

<u>Schemes To Reduce High Noise</u> –

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

TABLE DAG-14
RECOMMENDED INTERNAL MATERIALS
For P_{max}, Reference Individual Technical Bulletins

	LIQUIDS			
	Fluid	**Tmax °F**	**Tmin °F**	**Metal Trim**
LIQUIDS	**Industrial Water** – Cold	180°	32°	P1
	Hot	225°	32°	P4
	DI, DM	225°	32°	PJ
		250°	32°	PL
	Seawater	180°	-20°	MH
	Fuel Oils – Diesel, #1,#2‡	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
	Crude Oils –Sweet‡	225°	0°	PA
		400°	0°	PC
	Sour‡	225°	0°	NS
	Heat Transfer Oils – Dowtherm, Therminol, Mobil-Therm, Silvatherm	400°	0°	PC
LIQUIDS	**Misc. Oils** – Lube Oil‡	180°	-30°	P5
	Naptha‡	400°	0°	PC
	Turbine Oil‡	225°	0°	PA
	Edible Oils – Vegetable Oil‡	180°	-30°	PH
	Animal Fats‡	180°	-30°	PH
	Seed Oils‡	180°	-30°	PH
	Inorganic Acids – Acetic - 5%	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
LIQUIDS	**Misc. Liquids** – Gasoline‡	150°	-30°	P5
	Benzene (C_6H_6)‡	150°	0°	SL
	Chlorine (Cl_2)	150°	0°	ML
	Bromine (Br_2)	150°	0°	CF *
	Ammonia (NH_3)	140°	0°	SL
	Hydrogen Peroxide (H_2O_2)	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			
	Fluid	**Tmax °F**	**Tmin °F**	**Trim**
Atmospheric Gases	**Atmospheric Gases** – O_2 (GOX)	225°	-60°	M7
		350°	-65°	M9
		350°	-325°	TN
	N_2 (GN_2), Air, Argon	180°	-60°	P2
		350°	-65°	P8
	CO_2 (dry)	180°	-40°	P6
	CO_2 (wet)	180°	-40°	P5
Process Gases	**Process Gases** – Nat. Gas (Sweet)	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 and 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", 1"	(15,20,25)	0.03
1-1/4", 1-1/2"	(32,40)	0.04
2"	(50)	0.02
2-1/2", 3", 4"	(65,80, 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:

Psp = P2 + (ISR x DELTA P1)

DELTA P1 = INITIAL INLET - FINAL INLET. (3000 - 284) = 2716

P2 = 100

ISR = 0.03 (1.0" DA1)

Psp = 100 + (0.03 x 2716)

Psp = 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 x 0.03 x 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 = (P1 - P2) x ISR +P2) = (300-50) x 0.054 + 50 = 63.5 psig. In addition, if the DP changes, then a setpoint offset would be observed with a constant loading pressure.

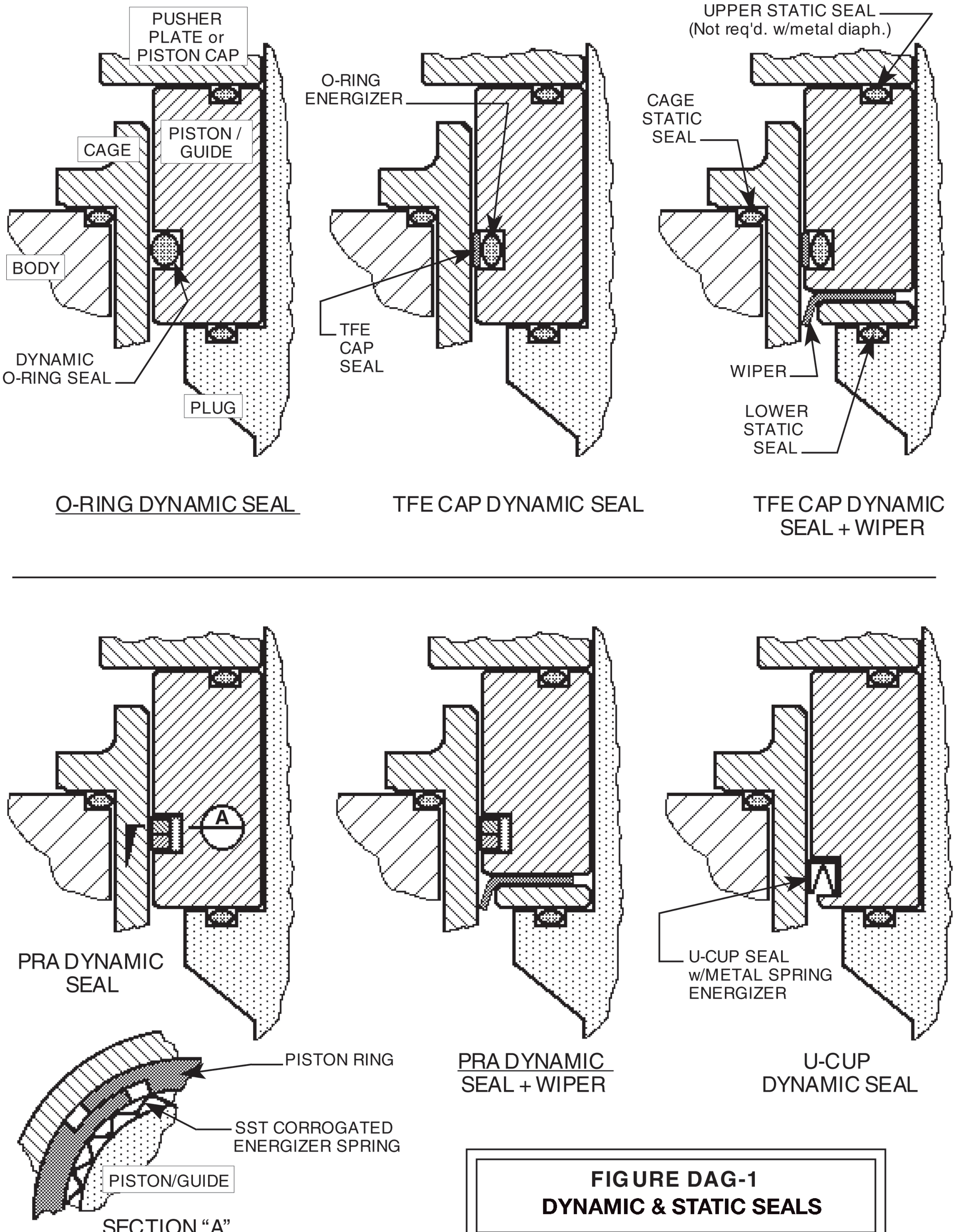
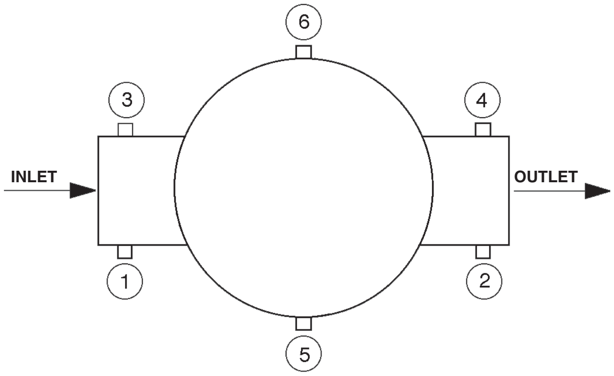
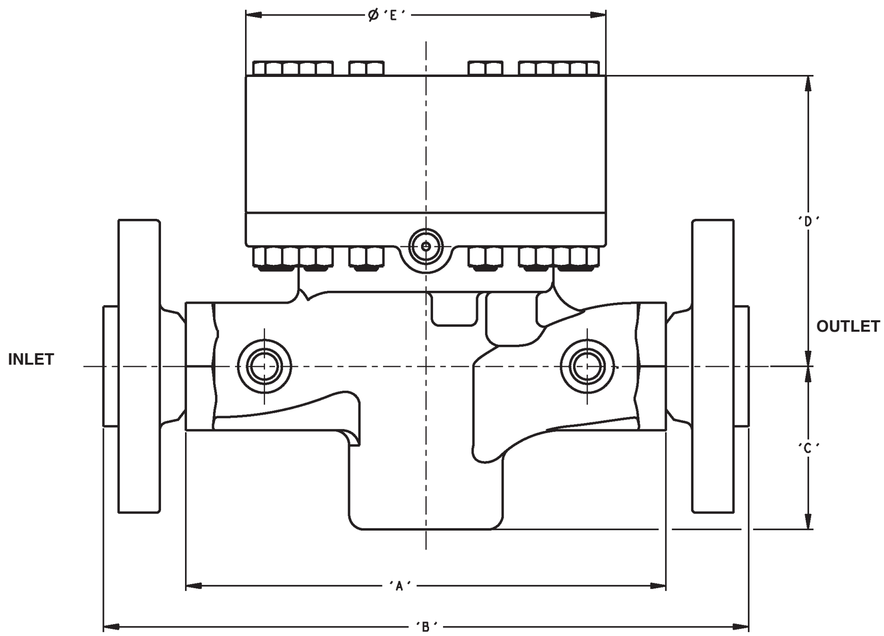


FIGURE DAG-1
DYNAMIC & STATIC SEALS

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)				
		Body Size		
Dimension	End Conn.	1/2", 3/4" & 1"	1-1/2"	2"
A	NPT, BSP	8.25	9.88	9.75
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
C	All	2.72	3.81	4.15
D	All	4.85	5.62	6.50
E	All	6.00	7.00	8.00
Approx. Weight lbs	wo/Flanges	45	65	85
	w/Flanges	55	75	100

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

MODEL DAP PRODUCT CODER 02/07/20

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

DP	POS 3	–	A	POS 6 & 7	7	–	POS 10	POS 11	POS 12	0	0	POS 15	POS 16	0	E

POSITION 3 - SIZE

Size in	Size (DN)	CODE
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 CODE	Sensing WITH Loading Conf. * 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.

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

POSITION 6 & 7 - SEAT/SEAL MATERIALS

Trim Material	Seat	O-ring/Seal Static	O-ring/Seal Dynamic	CODE
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_2 Service.	-57	P

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