ISO Registered Company

MODEL HP-1+6+S

HIGH PRESSURE DIFFERENTIAL REDUCING REGULATOR

MODEL HP-1+6+S

OVERVIEW

Model “HP-1+6+S” is a heavy duty, high pressure reducing differential regulator. The internal trim is of a pressure balanced design, with the diaphragm having both up and down stops. Inlet pressure may be as high as 3000 psig (207 Barg). Outlet pressure may be as high as 1500 psig (103 Barg). Differential pressures may vary from 15-150 psid (1.0-10.3 Bard).

FEATURES

- High pressure operation.
- CS and SST body/spring chamber materials.
- NACE or Non-NACE constructions.
- Anit-blowout adjusting screw assembly with closing cap.

APPLICATIONS

Most commonly applied to develop a constant differential pressure across a rotating shaft seal to provide proper sealing and lubricating conditions over varying pressure ranges.

For gaseous and non-flashing, non-cavitating liquid services.

LINE SIZES AVAILABLE

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

END CONNECTIONS

NPT, RF FLANGED

COMMON APPLICATIONS

GASEOUS & NON-FLASHING, NON-CAVITATING LIQUID SERVICES

DESIGN PRESSURE

INLET: UP TO 3000 psig (207 Barg)
OUTLET: UP TO 1500 psig (103 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 (4922)49-43-18
Волгоград (844)278-03-48
Вологда (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
Коломна (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
Ноябрьск (3496)41-32-12
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 (8352)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

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STANDARD/GENERAL SPECIFICATIONS

Body Sizes: 1/2", 3/4", 1, 1-1/2" (DN15, 20, 25, 40)

End Connections: Std. – NPT.
Opt-30 or Opt-34 – Welded-on RF flanges; pressure classes 600#, 900#, 1500#.

Body/Spring Chamber/ Spacer Materials: CS/CS/CS or SST/SST/SST.
CS = Carbon Steel
SST = Stainless Steel

Inlet Pressure: Up to 3000 psig (207 Barg). May be limited by end connection.

Outlet Pressure: Up to 1500 psig (103 Barg). May be limited by end connection.

Temperature Range: -20° to +400°F (-29° to +205°C).

Maximum Pressure Drop: Liquid – 600 psid (41.4 Bard).
Gas – 1500 psid (103 Bard).

Differential Pressure Range: 15-150 psid (1.0-10.3 Bard) with multiple range springs.

Body Size		Diff. Pressure Range	
inch	(DN)	psid	(Bard)
1/2", 3/4" & 1"	(15, 20, & 25)	15 - 40	(1.0-2.8)
		30 - 150	(2.1-10.3)
1-1/2"	(40)	30 - 100	(2.1-6.9)
		80 - 150	(5.5-10.3)

Capacity: Up to 4.40 Cv.

Internal Valve Trim: Design is pressure-balanced.
Composition Seat –
Trim Designation No. S40T.
Temp Range: -20° to +400°F (-29° to 205°C)
Materials –
Piston and Cylinder –316 SST.
Diaphragm and Quad Ring – Fluorocarbon elastomer.
Seat and Backup Ring – TFE.
Piston Spring –
Nace - Inconel X-750
Non-Nace - 302 SST

Gaskets/Seals Standard: Graphite/NBR.
- Cylinder Gasket
O-rings –
Fluorocarbon Elastomer (FKM).
Backup Rings – PTFE-split.

Flange Bolting: All bolting is alloy steel, zinc plated.
Studs: ASTM A-193, Gr. B7.
Nuts: ASTM A-194, Gr. 2H.
Cap Screws: ASTM A-193, Gr. B7.
Note: All studs are elongated to allow bracket mounting; bracket supplied by customer.

Body Cap: ASTM A479, S31600, Annealed.

Miscellaneous Internals Materials: Spring Chamber Zone –
Closing Cap – 316 SST.
Adj. Screw Jam Nut – 316 SST.
Adj. Screw – 17-4 PH SST.
Adj. Screw Housing* – 316 SST.
Pressure Plate -
Std. – Sizes 1/2"–1" (DN15-25) – 316 SST.
Size 1-1/2" (DN40) – CS with CS body; SST with SST body.
Opt-40 – 316 SST, all sizes.
Spring Button -
Std. – CS body, All sizes except 1-1/2" (DN40) – CS.
CS body 1-1/2" (DN40) – Brass.
SST body – SST.
Opt-40 – All sizes, all body materials – SST.
Range Spring – Epoxy coated if CS.
Std. – CS body – Steel.
SST body – Inconel X-750.
Opt-40 – Inconel X-750.

*Welded to spring chamber.

Body Zone –
Pusher Plate – 316 SST.

Painting: Standard: All non-corrosion resistant portions to be painted with corrosion resistant epoxy paint per Cashco Spec #S-1606.

OPTION SPECIFICATIONS

Option -30: FLANGED END CONNECTIONS. Welded-on pressure classes 600#, 900# or 1500# raised face flanges for CS or SST bodies. Pipe nipples and flanges of same basic materials as body. Nipples and Flanges are socket welded to pipe nipples. Flange pressure class is same for inlet and outlet.
With 900# and 1500# flanges, the outlet pressure rating is limited by the body's rating. For 600# flanges, the outlet pressure rating is limited by the flange's rating. **See Table 2.**

All welding procedures in compliance with ASME Boiler & Pressure Vessel Code, Section IX, and American Petroleum Institute API-614 requirements.

Option -34: SPECIAL 14" FACE TO FACE DIMENSION FOR FLANGED END CONNECTIONS.

Option -40: NACE CONSTRUCTION. For applications where gas or liquid is classified as "sour" due to presence of H_2S. Both CS and SST body/spring chamber constructions available to meet NACE requirements.

Internal wetted portions meet NACE Standard MRO175 revision, when the exterior of the regulator is not directly exposed to a sour gas environment, buried, insulated, or otherwise denied direct atmospheric exposure. Either of the available trim designs are in compliance.

Diaphragm flange bolting is standard bolting, and meets NACE MRO175 Section 6.3 requirements.

APPLICATION AND SELECTION
FUNCTIONAL OPERATION
OF DIFFERENTIAL PRESSURE REDUCING REGULATORS

Differential pressure reducing regulators operate in accordance with the parameters as indicated in Fig. 1. Sometimes called "tracking" regulators, a differential reducer always has the P_2-Outlet Pressure greater than the P_{LOAD} - loading Pressure by a relatively constant pressure differential – determined by the range spring setting. (See Graph 1.)

If P_{LOAD} decreases by 15 psig (1 barg), then P_2 will also decrease by the same 15 psig (1 Barg). If P_{LOAD} increases by 29 psig (2 Barg), then P_2 increases by 29 psig (2 Barg). Thus, P_2 "tracks" P_{LOAD}, with the differential pressure between P_{LOAD} and P_2 being relatively constantly at ΔP diff, as determined by the range spring set pressure.

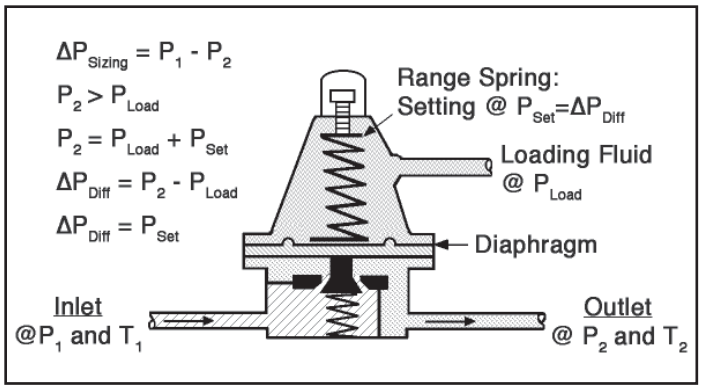
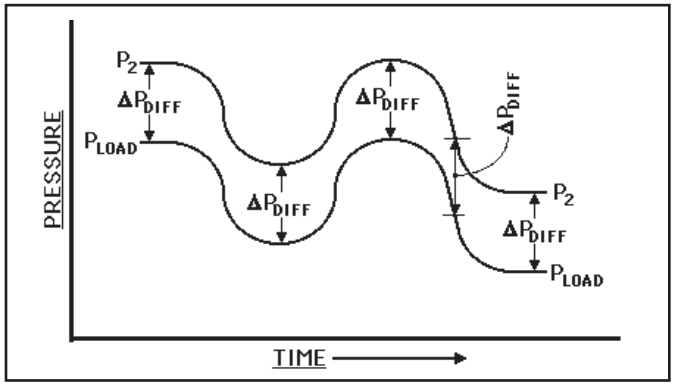


Figure1: HP-1+6+S



Graph 1

Cashco recommends that all Model HP-1+6+S units be sized and selected by Factory personnel. The following data must be available for a proper sizing and selection –

a. Body Service Fluid – What is it? Liquid or gas? Specific gravity or weight density? Is it corrosive?

b. Loading Service Fluid – What is it? Liquid or gas? Specific gravity or weight density? Is it corrosive?

c. Inlet Pressure – P_1 (upstream pressure? Max, Norm, Min conditions?)

d. Loading Pressure – $P_{LOAD\ MAX}$, $P_{LOAD\ NORM}$, $P_{LOAD\ MIN}$?

e. Differential Pressure – ΔP_{DIFF} or P_{SET}? Allowable deviation of ΔP_{DIFF} from $P_{LOAD\ MAX}$ to $P_{LOAD\ MIN}$; i.e., acceptable "droop"?

f. Desired Capacity – Cv, GPM, SCFH at $P_{LOAD\ MAX}$ and $P_{LOAD\ MIN}$ through body?

g. Body Fluid Temperature – T_1?

h. Loading Fluid Temperature – T_{LOAD}?

i. Minimum Ambient Temperature – T_{AMB}?

j. Body Fluid Viscosity – CP, SSU, CS?

TECHNICAL SPECIFICATIONS

TABLE 1
CAPACITY TABLE - Cv – FULL PORT

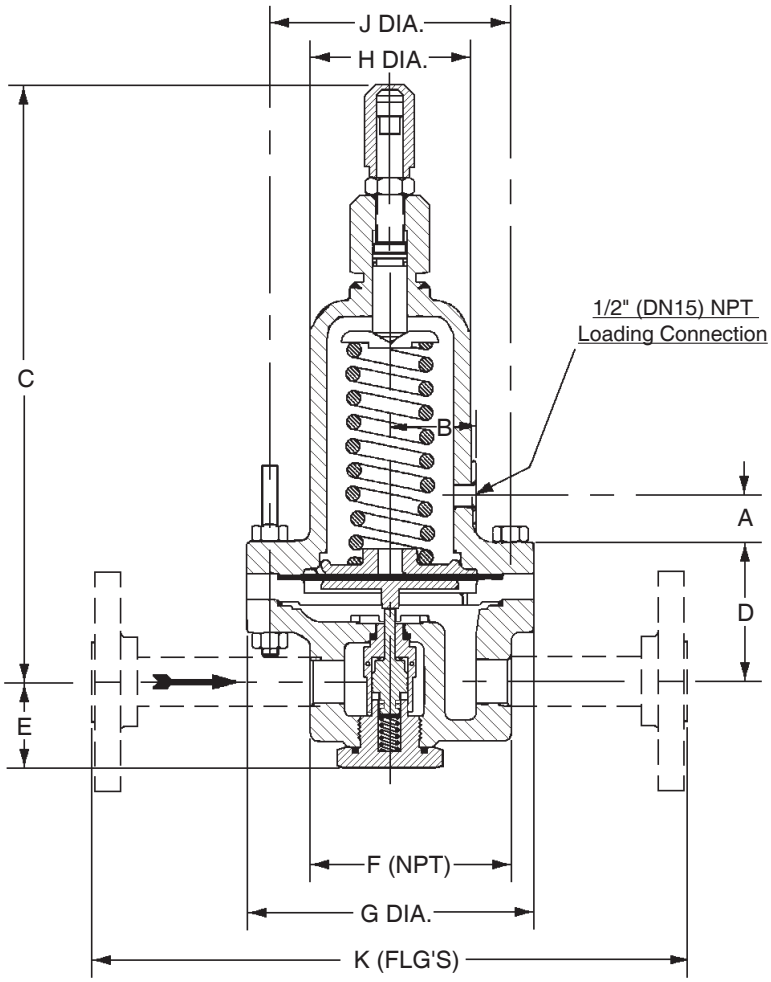
Differential Pressure ΔP Diff		SIZES 1/2", 3/4", 1" (DN15, 20, 25)			SIZES 1-1/2" (DN40)		
		Cv @ % Droop					
psid	(Bard)	10%	20%	30%	10%	20%	30%
15	(1.0)	.24	.44	.61	.42	.84	1.27
25	(1.7)	.51	.92	1.33	.98	1.96	2.95
40	(2.8)	.53	.83	1.11	1.69	2.71	3.65
50	(3.4)	.55	1.05	1.50	1.75	3.30	4.00
75	(5.2)	.61	1.15	1.65	1.80	3.90	4.23
100	(6.9)	.55	1.10	1.59	1.70	3.24	3.92
150	(10.3)	.63	1.28	1.70	1.80	3.96	4.40

METRIC CONVERSION FACTOR: Cv / 1.16 = kv

TABLE 2
PRESSURE - TEMPERATURE - MATERIAL RATINGS

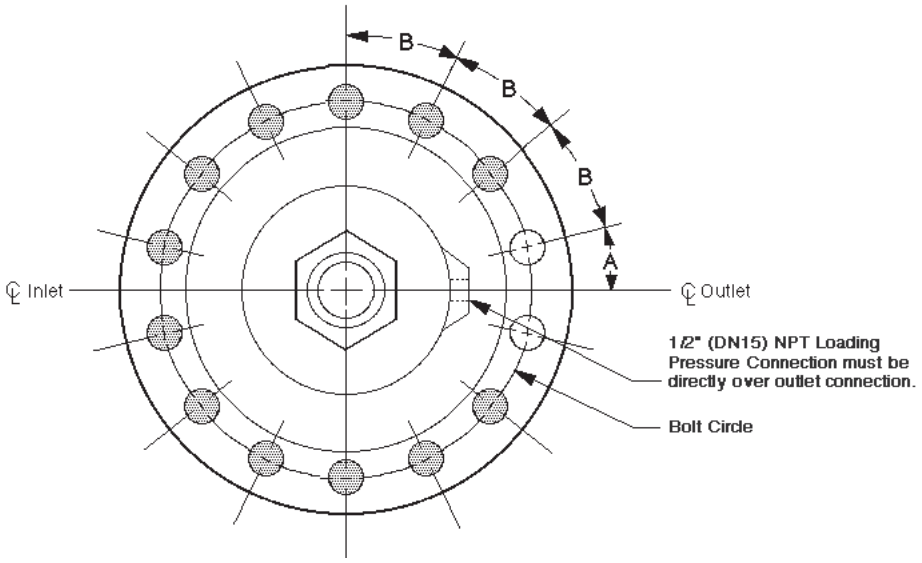
Material Specifications		End Connections	Inlet Pressure		Outlet Pressure		Temperature	
Body & Spring Chamber	ASTM No.		psig	(Barg)	psig	(Barg)	° F	(°C)
Carbon Steel CS/CS	A216 Gr.WCB	600# ASME B16.5 Flanged	1480	(102.1)	1480	(102.1)	-20 to 100	(-29 to +38)
			1360	(93.8)	1360	(93.8)	200	(93)
			1310	(90.3)	1310	(90.3)	300	(149)
			1265	(87.2)	1265	(87.2)	400	(204)
		900# ASME B16.5 Flanged	2220	(153.1)	1500	(103.4)	-20 to 100	(-29 to +38)
			2035	(140.3)			200	(93)
			1965	(135.5)			300	(149)
			1900	(131.0)			400	(204)
		1500# ASME B16.5 Flanged or NPT	3000	(206.9)	1500	(103.4)	-20 to 400	(-29 to 204)
Stainless Steel SST/SST	A351 Gr. CF8M	NPT	3000	(206.9)	1500	(103.4)	-20 to 400	(-29 to 204)
		600# ASME B16.5 Flanged	1440	(99.3)	1440	(99.3)	-20 to 100	(-29 to 38)
			1240	(85.5)	1240	(85.5)	200	(93)
			1120	(77.2)	1120	(77.2)	300	(149)
			1025	(70.7)	1025	(70.7)	400	(204)
		900# ASME B16.5 Flanged	2160	(149.0)	1500	(103.4)	-20 to 100	(-29 to 38)
			1860	(128.3)			200	(93)
			1680	(115.9)			300	(149)
			1540	(106.2)			400	(204)
		1500# ASME B16.5 Flanged	3000	(206.9)	1500	(103.4)	-20 to 200	(-29 to 93)
			2795	(192.8)			300	(149)
			2570	(177.2)			400	(204)

WEIGHTS & DIMENSIONS



ENGLISH in.												SHIPPING WEIGHT LBS
SIZE IN	A	B	C	D	E	F	G	H	J	K	K (OPT-34)	
1/2	1.00	1.88	12.85	3.07	1.94	4.38	6.25	3.62	5.38	12.00	14.00	30
3/4, 1										13.00	14.00	
1-1/2	1.66	2.44	14.47	3.56	2.19	6.69	7.62	4.00	6.75	15.00	14.00	60
METRIC UNITS (mm)												SHIPPING WEIGHT KGS
SIZE (DN)	A	B	C	D	E	F	G	H	J	K	K (OPT-34)	
(15)	25	48	326	78	49	111	159	92	137	305	356	13.6
(20, 25)										330	356	
(40)	42	62	368	90	56	170	194	102	171	381	356	27.2

POSITION OF MOUNTING BRACKET STUDS



Position of longer studs used for mounting customer supplied bracket.

Position of two "Short" Cap Screws must straddle 1/2" (DN15) NPT Loading Pressure Connection.

Figure 2
1/2", 3/4" & 1" Body Size
(DN15, 20, 25)

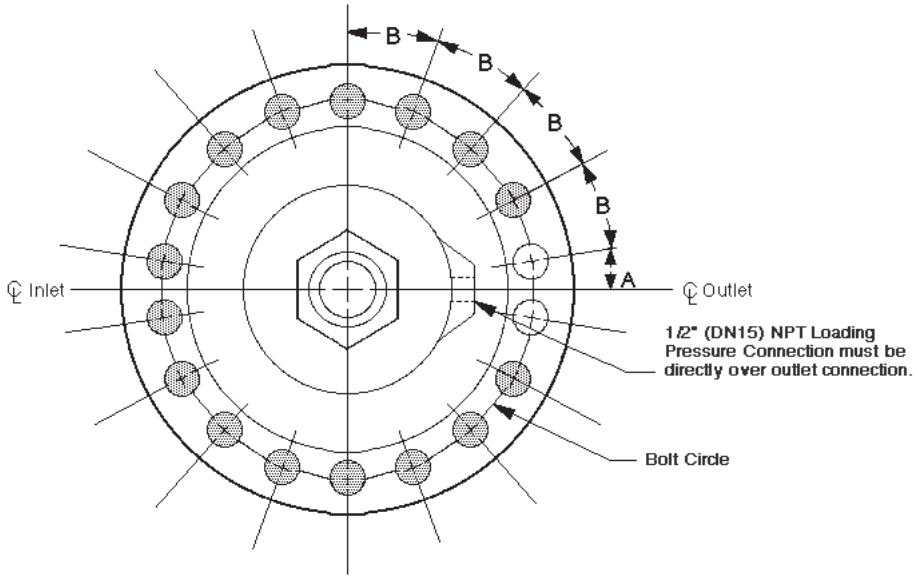


Figure 3
1-1/2" (DN40) Body Size

BODY SIZE		NUMBER OF BOLT HOLES	BOLT CIRCLE	POSITION	
in	(DN)			A	B
1/2, 3/4, 1	(15, 20, 25)	14	5-3/8	12° - 51'-25"	25° - 42'-51"
1-1/2	(40)	18	6-3/4	10°	20°

MODEL HP-1+6+S PRODUCT CODER 02/07/20

"HIGH" PRESSURE DIFFERENTIAL

POS 1 & 2	POS 3	—	POS 5	4	T	7	—	POS 10	POS 11	X	POS 13	POS 14	POS 15	POS 16	POS 17	A

POSITION 1 & 2 - MODELS	
Description	CODE
Model HP-1+6+S (Opt-40) **"NACE"** Construction Differential Pressure Reducing Regulator	**3N**
Model HP-1+6+S **"NON-NACE"** Construction Differential Pressure Reducing Regulator	**3S**

POSITION 3 - SIZES		
Size		CODE
in	(DN)	
1/2"	(15)	**4**
3/4"	(20)	**5**
1"	(25)	**6**
1-1/2"	(40)	**8**

POSITION 5 - BODY /SPRING CHAMBER MATERIALS	
Body / Sp. Ch.	CODE
CS/CS	**5**
SST/SST	**A**

POSITION 10 - END CONNECTIONS	
Description	CODE
NPT - Screwed	**1**
-30 Opt.- 600 LB RF Flgs. *	**8**
-30 Opt.- 900 LB RF Flgs. *	**9**
-30 Opt.- 1500 LB RF Flgs. *	**A**
-34 Opt. - 600 LB RF Flgs. 14" F to F Dim. *	**Y**
-34 Opt. - 900 LB RF Flgs. 14" F to F Dim. *	**Z**
-34 Opt. - 1500 LB RF Flgs. 14" F to F Dim. *	**U**
*Nipples & flanges of same material as body.	

POSITION 11 - RANGE SPRINGS			
SIze	psid	(Bard)	CODE
All	15-40	(1.03-2.76)	**1**
1/2"-1"	30-150	(2.1-10.3)	**2**
1-1/2"	30-100	(2.1-6.9)	**3**
	80-150	(5.5-10.3)	**4**

POSITION 13 THROUGH 17 - OPTIONS		
Service Application	Body Material	CODE DRAWING #
NACE Service (Opt -40)	SST	**32907**
NACE Service (Opt -40)	CS	**32909**
Non-NACE Service.	CS	**32911**