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MIL 76000 - High Pressure Letdown Control Valves

MIL 76000

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Introduction

High pressure letdown involving flashing fluids has always been treated as among the toughest applications due to the high velocity expansion and two phase flows in the valve downstream. Such severe applications can shorten the valve life and severely erode body / trims, if improperly designed control valves are employed.

MIL 76000 series high pressure letdown valves are designed with angle body (side inlet and bottom outlet) to handle compressible fluids and flashing / two phase flow effectively, without body / trim erosion, vibration and noise. Their angle design provides flow surfaces that slopes down permitting the valve to self-drain.

Features

Expanding Flow Area

In MIL 76000 series valves, the flow area of the valve trim gradually increases towards the downstream. This compensates for expansion of fluid with the drop in pressure and ensures a nearly constant fluid velocity throughout the throttling process. Thus the advanced design eliminates the damaging erosive effects caused by high kinetic energy spikes and vibration, particularly in applications that include fine particulates in the flow.

Seat Protection

By locating the seating area in the upstream area of valve trim away from the pressure dropping stages, MIL 76000 design helps to minimize seat wear by isolating the critical seating areas from higher velocity downstream flow path.

Single and Multi-stage Trim Options

Single stage trim design allows high flow capacity with contoured plug and clamped seat ring design. Body outlet flow passage is protected by seat ring liner, which ensures long life by limiting erosion of the body flow path area. The liner is easily replaceable in case of any wear.

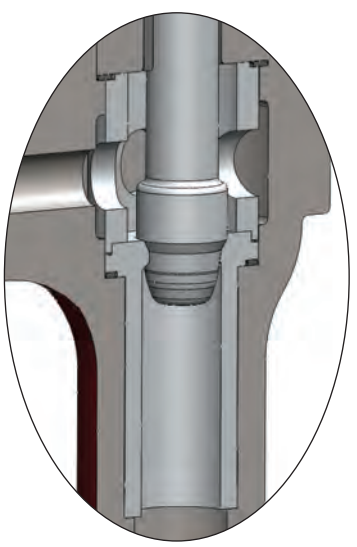
For higher pressure drop applications, Multi-stage trims are employed. Multi-stage trim incorporates a unique design, which integrates the advantage of multi-stage pressure reduction with gradually expanding area, to reduce fluid velocity and the resultant noise generation. Individual pressure drop stages in the valve trim are designed to accommodate the increased specific volume of the medium with reduced fluid velocity. Due to the unique flow path in the valve trim, the fluid is forced through a zig-zag flow path, dissipating the energy and maintaining low noise levels, when the valve is in operation.

Rugged Construction

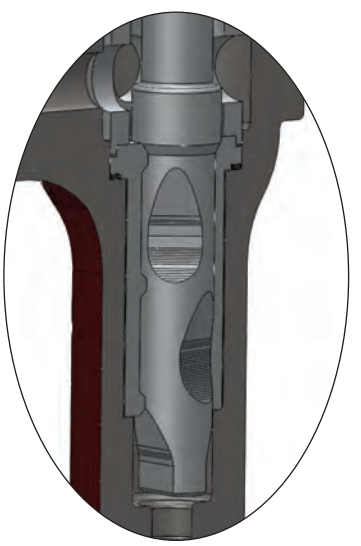
The plug is heavily guided at the top and also by the seat inside the seat ring throughout its travel (for multi-stage valves), eliminating the harmful effects of vibration.
Hardened Martensitic trim material with higher erosion resistance is employed in MIL 76000 series valves to ensure better longevity of internals.

Easy Maintenance

Clamped seat ring design allows easy maintenance of the valve, which also helps in the easy replacement of trim parts.



Single stage Trim



Multi-stage Trim

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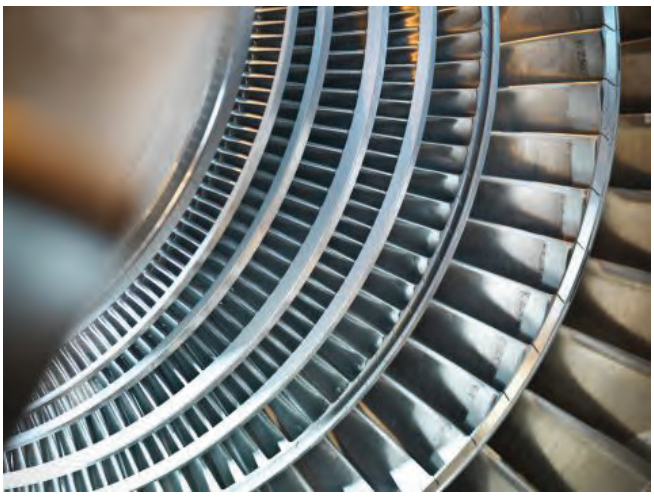
Typical Applications

MIL 76000 series valves are tailored for high pressure drain / letdown applications in energy sector, which includes boiler and turbine drain.

The basic function of the turbine drain valves is for preheating and draining of turbine body, to eliminate the possibility of water getting into the turbine, during the startup process. During startup, when steam is introduced to the turbine, the drain valves are fully opened. They stay open and drain to the condenser until the turbine reaches minimum load (or desired temperature) and subsequently the valves are closed.

Boiler drain valves are used for removal of water from a boiler to control boiler water parameters within prescribed limits, to minimize scaling, corrosion and other associated problems. In addition to the above, blow down is also used to remove suspended solids present in the system.

In both boiler & turbine drain valves, the functional severity arises from the high flashing conditions, high instantaneous velocities and the temperature cycling.



Boiler and turbine drain valves are typically expected to operate only during startup and shutdown, but many power plants are being increasingly operated at lower loads continuously. Many a times, combined cycle plants undergo daily shutdown/startup cycles. Thus the operation mode of many power plants add to the severity of the operating conditions.

Technical Information

Model Decodification

1st	2nd	–	3rd	4th	5th	6th	7th
			7	6	–	–	–

ACTUATOR TYPE	BODY SERIES	BODY TYPE	TRIM CHARACTERISTICS	TRIM TYPE
20. Hand Operated 37. Direct Spring Diaphragm 38. Reverse Spring Diaphragm 90. Electrical Actuator	76. High pressure Letdown Control Valve	0. Undefined 2. Angle	0. Undefined 1. Mod. Linear * 2. Mod. % *	0. Undefined 1. Single stage 2. Multi-stage

* - Mod Linear for Single stage trim and Mod % for Multi-stage trim only

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Standard Sizes / Ratings / End connections

VALVE SIZE (inch)	RATING (ASME Class)	END CONNECTION
1, 1.5 & 2	150# to 2500#	Weld end

General Data

BODY		
Type	:	Angle Forgings
Recommended Flow direction	:	Flow to close

GLAND SEAL		
Type	:	Adjustable double sealed packing box with PTFE or Graphite moulded split rings
Option	:	Eco lock (Varying density for low emission, PTFE or Graphite) or PTFE V rings
Temperature range	:	≤ 180 °C PTFE, > 180 °C Graphite

BONNET		
Type	:	Stud bolted
Temperature Range	:	-27 °C to 566 °C

TRIM		
Type	:	Single stage / Multi-stage
Plug type	:	Unbalanced
Seat type	:	Clamped (quick change) with metal seat
Guiding	:	Top guiding (Single stage valves) Top & Bottom guiding (Multi-stage valves)
Rangeability	:	50 : 1
Characteristic	:	Mod. Linear (Single stage) Mod. % (Multi-stage)

Seat Leakage Class / Temperature Range

NOMINAL VALVE SIZE (inch)	TEMPERATURE RANGE (°C)		SEAT LEAKAGE CLASS (FCI 70.2)	
	MIN.	MAX.	STANDARD	OPTIONAL
1,1.5 & 2	-27	566	Class IV	Class V

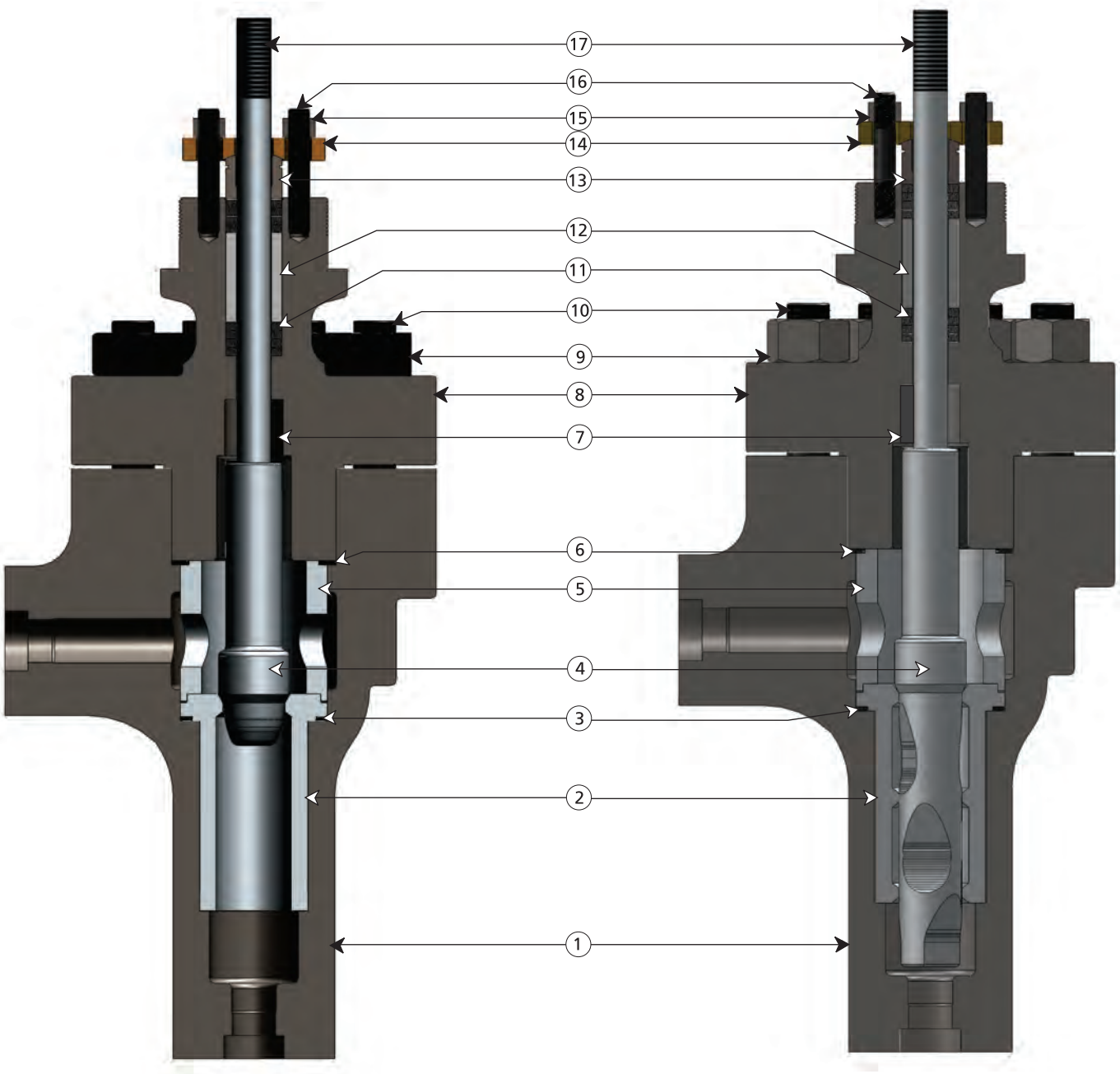
Flow Coefficients (Rated Cv)

NOMINAL VALVE SIZE (inch)	RATING (ASME Class)	ORIFICE DIA (Inch)	STROKE (Inch)	SINGLE STAGE Cv[1]	MULTI-STAGE Cv[2]
1 & 1.5	150 # to 2500 #	1.38	1.25	20	2.5, 6
2				42	

[1] : Critical flow factor C_f or F_L = 0.9

[2] : Critical flow factor C_f or F_L = 0.98

Construction



MIL 76000 Valve (Single Stage)

MIL 76000 Valve (Multi-Stage)

Material of Construction

DRAWING REF. NO.	PART NAME	STANDARD MATERIAL*
1	Valve Body	Carbon Steel : ASTM A 105
		Alloy Steel : ASTM A 182 Gr F11 / F22 / F91
2	Seat Ring	CA6NM Nitrided (< 566°C)
3	Seat Gasket	316L SST + Graphite
4	Plug	440C SST (< 427°C) Inconel 718 (427°C - 566°C)
5	Cage	CA6NM Nitrided (< 566°C)
6	Body Gasket	316L SST + Graphite
7	Guide Bush	440C SST (< 427°C) 316 SST + Stellite (427°C - 566°C)
8	Bonnet	Same as Body Material
9	Body Nut	ASTM A194 Gr 7
10	Body Stud	ASTM A193 Gr B16
11	Gland Packing	PTFE ≤ 180°C
		Graphite > 180°C
12	Spacer	304 SST
13	Packing Follower	304 SST
14	Packing Flange	ASTM A 105
15	Packing Nut	ASTM A 194 Gr. 8
16	Packing Stud	ASTM A 193 Gr. B8
17	Plug Stem	17.4 PH (< 343°C) Super Alloy (343°C - 566°C)

*Material indicated above are for reference only. MIL reserves the right to supply alternate material / forms due to constant product upgradation. Other specific material are available on request.

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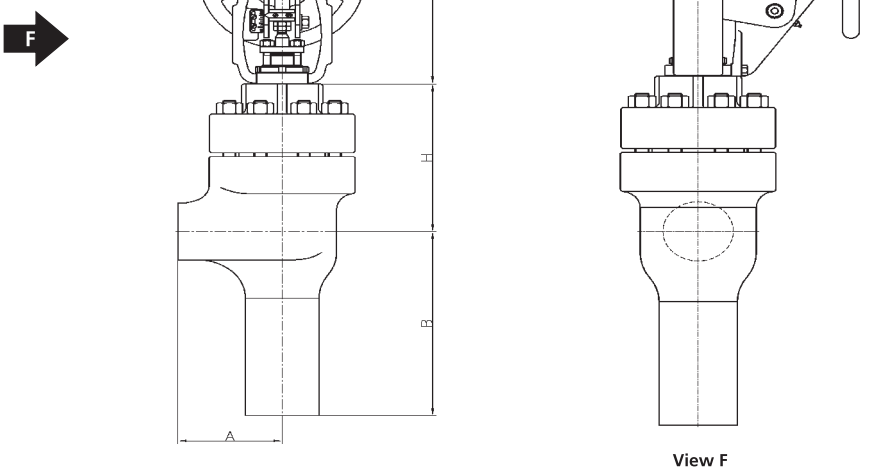
Dimensions and Weights



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VALVE INLET SIZE (inch)	RATING (ASME Class)	DIMENSIONS (mm)			UNPACKED WEIGHT (kg)
		A	B	H	
1, 1.5 & 2	150# & 600#	120	235	195	35
	900# & 1500#	140		206	55
	2500#	150		254	85

ACTUATOR SIZE	ACTUATOR TYPE : 37 DIRECT			ACTUATOR TYPE : 38 REVERSE		
	DIMENSIONS (mm)		UNPACKED WEIGHT (kg)	DIMENSIONS (mm)		UNPACKED WEIGHT (kg)
	C	D		C	D	
11	421	330	21	617	330	25
13	516	381	32	782	381	40
15	654	445	55	943	445	75
18	848*	527	82	1360*	527	178

*Actuator height varies with spring range / stroke. Maximum height is indicated. Contact MIL for exact height.

Product Highlights

- Unbalanced plug design without seal rings
- Larger flow paths
- Smooth axial flow
- Multi-stage pressure reduction for high pressure drop
- Advanced design that eliminates the damaging erosive effects
- No seat damage by isolating the seat from the most severe expansion stages
- Easy maintenance

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