

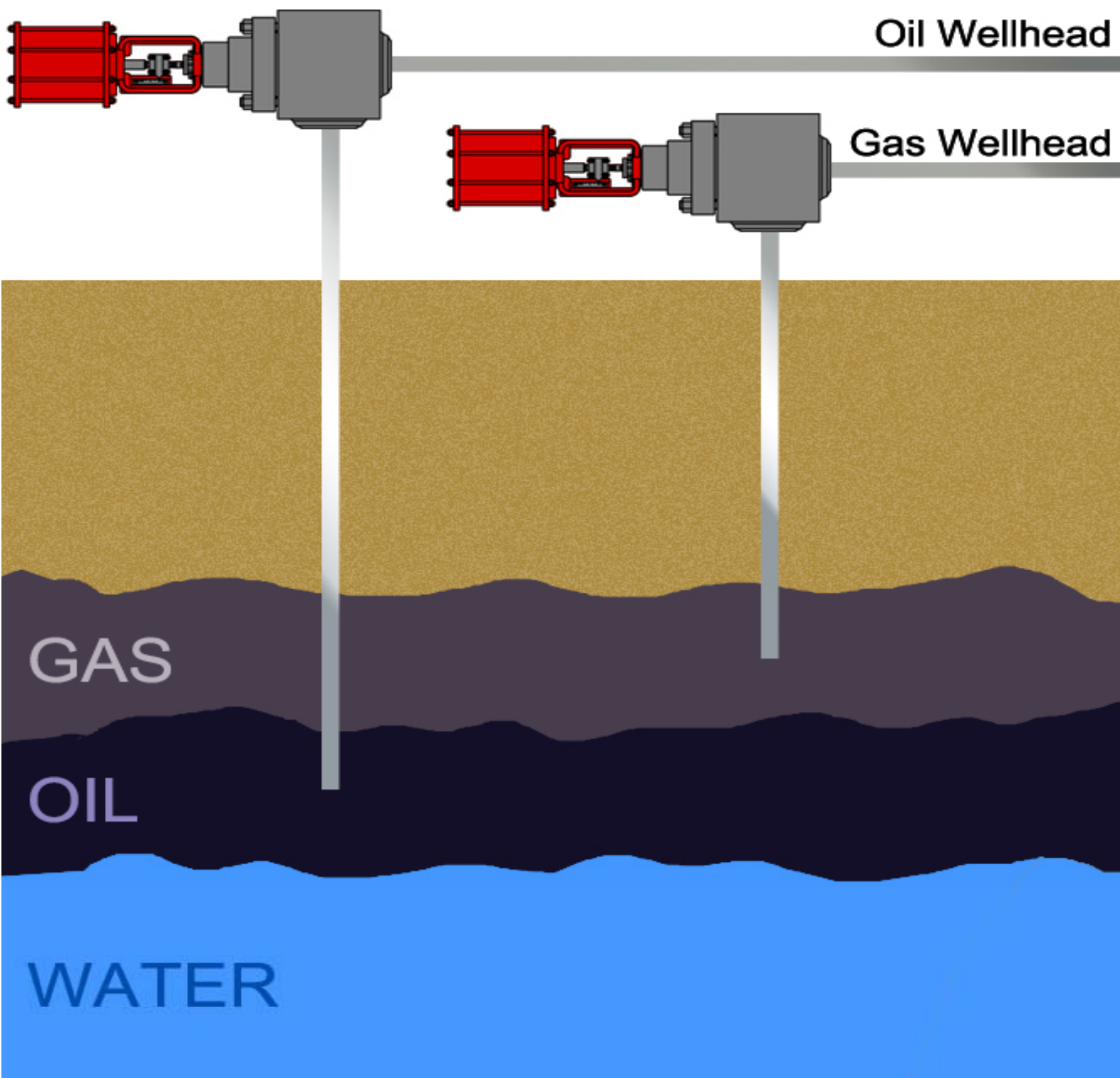


CHOKE VALVES

CC-Series, API 6A Certified

Severe Service X[iks]-trim Application Choke Valve

API-6A License Number / 6A-1929



Introduction

Control valves for the production and processing of crude oil & natural gas.

3D-Flow-Path Disk Stack X[iks]-trim technology for severe service application. Choke valves are almost always Angle type valves. Velocity trim control labyrinth technology (water-jet cutting design or investment Casting) provides for trim velocity of 1/4 or less that of conventional chokes.

Industry Standard

- Hardest of trim materials,
 - ; Tungsten Carbide (Sintered)
 - ; Fully Stellite Hard Facing .
 - ; Entire trim set made of C.V.D Treatment*
- API-6A Approved Monogram / 6A-1929
- ANSI B.16.34, & ISO9000/9001
- Governmental agencies.
- Customer specifications



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Model Numbering System

1	2	3	4	5
Body Type	Trim Design	Trim Type	Rating	Actuator
CC-series	01 -Un-Balanced	01 -Contoured	06 -600#	MH -Manual
Angle type	02 -Balanced	02 -Conven. Cage	09 -900#(PN150)	CS -Spring Cylinder
Choke		03 -Multi-Hole Cage	15 -1500#(PN250)	CD -Double Cylinder
Valve		08 -3D-Flow-Path X[iks]-trim	25 -2500#(PN420)	SM -Step Motor
			50 -5000PSI	EM /Electric Motor
			1T -10000PSI	
			1F -15000PSI	
			2W -20000PSI	

1. Features of Choke Valves

Custom-designed valve, trim and actuator for each unique choke application.

Wide variety of liquid, gas and X[iks]-trim in linear and EQ-% execution.

Sintered Tungsten or Water-jet cutting large hole trim for dirty well clean-up service and high capacity trim for minimized pressure loss at well depletion stage.

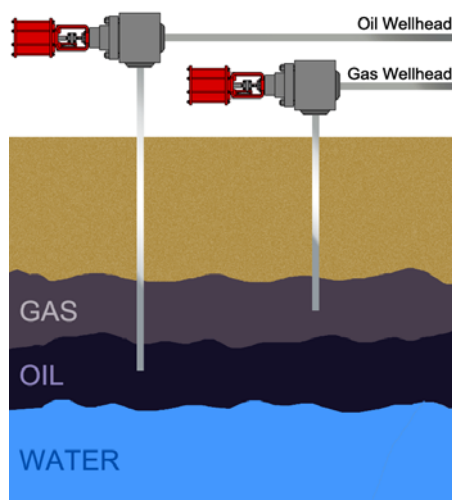
Full range of matching BFS pneumatic, electric and electro-hydraulic actuators with tailored control arrangements is available .

1-1. Gas Wellhead Applications

- Gas wellhead control/High pressure drop
 - Can be > 10,000PSI (690Bar)
- High sand content
 - Can be rapid erosion failure at pressure drops as low as 500PSI (34Bar)
- High noise levels
 - Less than 85dBA is now commonly specified especially on manned platforms.
- Often multi-phase fluid

1-2. Oil Wellhead Applications

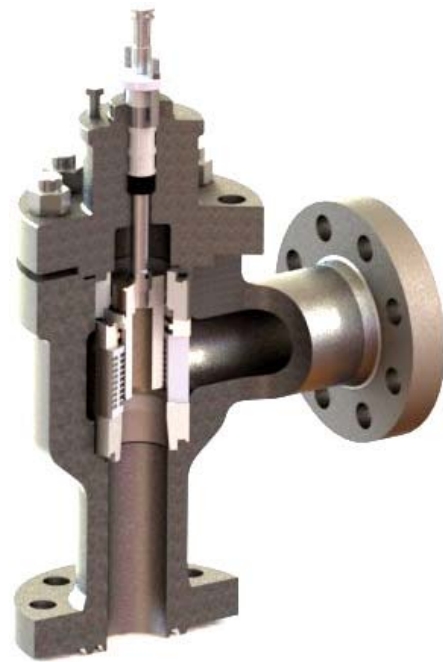
- Oil wellhead control/High pressure drop
 - Can be > 10,000PSI (690Bar)
- High sand content
 - Can cause rapid erosion failure at pressure drops as low as 800PSI (55Bar)
- Often multi-phase fluid
- Fluid with a high "water cut may cause cavitation damage



Wellhead High Pressure Drop Control

2. Body Design for Wellhead

Choke valves selection is often based on early life production process data and capital expenditure, valve price. However, choke valves are critical elements in production facilities. Malfunction or failure of a choke valve can seriously affect safety, the environment and production rates. Valve selection should be based on sound technical and economic arguments and long-term perspectives. BFS's CC-series Choke valves have a proven reliability in terms of performance and will reduce costly maintenance and production loss.



CC-series Section View

3. Trim Design

- 3D-Flow-Path disk stack for Dirty Service
- High Capacity hybrid trim
- Seat with Long Venturi throat.
 - Protects body & seat in critical expansion area.**
- Dual plug wiper rings
 - Protect balance seal from entrained solids.**
- Redundant pressure boundary seals.
 - Two different type of seals for optimum pressure boundary integrity.**

3-1. 3D-Flow-Path X[iks]-Trim

Now's gas field environment means higher wellhead pressure with aggressive fluids with entrained sand and other solid particles. A conventional multi-hole single-



Punched X[iks]-trim Cage

***Control Valves for the production & processing
of crude oil and natural gas***

stage choke valve is not suitable for this kind of severe service. The need to maintain production rates means that frequent choke repair or replacement is no longer acceptable. BFS has responded to this need by developing the world best true severe service choke valve. Based on 30 year field experience and with a new material treatment technology of CVD* treatment applied, BFS has succeeded to develop an innovative choke valve with its life span dramatically extended and is able to supply the advanced choke valve with a fastest delivery lead-time.

3-2. Dirty Service Solution

Provides cavitation-control for application with entrained particulate that could potentially plug the 3-D flow passages or cause erosion damage to conventional anti-cavitation trim.

Large flow passages easily handle solids and dirty fluid.

Ability to pass 14mm particulate depending on valve size

3-3. Trim Materials

- Plug, Disk Stack, Venturi-Seat (3D-Flow Path Multi-Stage Letdown), ; Cobalt Alloy+C.V.D* Treatment.
- Solid Tungsten Carbide
- Fully Stellite Hard Facing.
- Prevents undermining of stainless steel dual wiper retaining members, helps protect balance seal from abrasion.
- All trim seals are PTFE.
- Others Materials application at customer requirement.

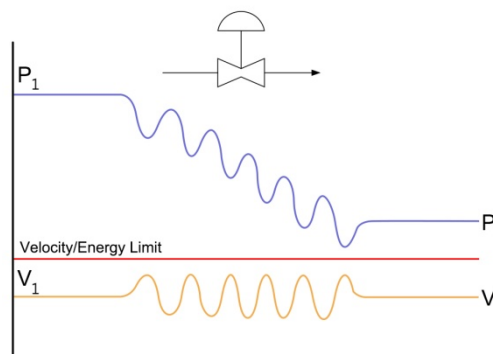
4. BFS's Total-Energy-Management Concept

Total-Energy-Management concept valve design that carefully manages fluid velocity in all areas of the valve, minimizing erosion of body and trim.

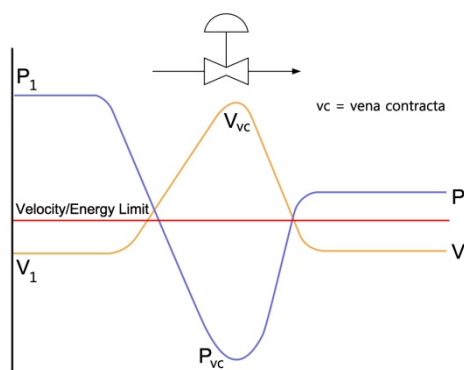
Local high fluid velocities due to preferential flow paths are the prime source of noise, erosion, vibration and malfunction resulting from unbalanced forces. Prevention is better than a cure.

BFS's X[iks]-trim 3D-Flow-Path disk stack controls flowing velocities throughout the valve trim by forcing the process fluid to follow a tortuous path of right angle turns. The resistance to flow provided by these turns limits the trim exit velocity to a safe level, regardless of the pressure drop. The X[iks]-trim choke valve eliminates problems resulting from excessive fluid velocities such as trim and body erosion, noise, vibration and poor process control.

The fluid velocities within the trim of BFS choke valves are typically 1/3 to 1/5 that of multi-hole-single-stage chokes. Velocity control protects the trim from erosion and increase the trim life many fold.



Velocity Characteristic of 3D-Flow-Path X[iks]-trim



Pressure Characteristic of Conventional Cage trim

4-1. Improved Flow Path Design

The basic rules to minimum erosion in valves are:

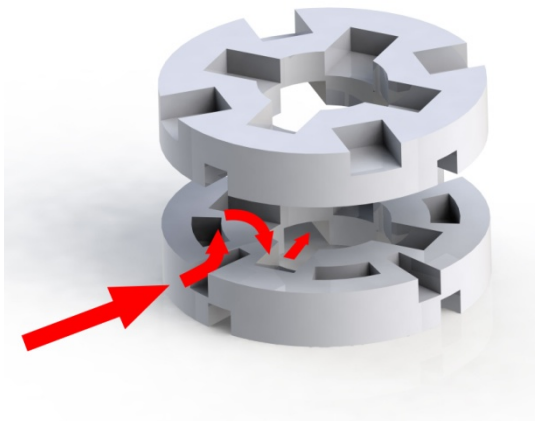
- Minimize the velocity of the medium.
- Minimize abrupt changes in flow direction
- Select erosion resistant materials

4-2. Special Feature

- 3D-Flow-Path designed disk stack X[iks]-trim and actuator for each unique choke application
- Wide variety of liquid, gas and multi-phase trims in linear and Equal-% execution.
- 3D-Flow-Pass Disk Stack X[iks]-trim for dirty well clean-up service and Hybrid large capacity trim for minimized pressure loss at well depletion stage.
- Full range of matching BFS pneumatic and hydraulic actuators with tailored control arrangements is available. Electric and Self contained electro-hydraulic actuation is also available.

4-3. BFS Choke Valves Benefit

- Improves well production time.
- Enhances control at wellhead
- Reduces costs associated with maintenance and repair.
- Improves ability to accommodate change in well operating conditions.
- Enhances the safety and reliability of production facility.
- X[iks]-trim outperforms single stage average of 5-time longer life.
- Reduce the risk of needing replace & maintenance for worn valves.



Exploded view of 3D-Flow-Path X[iks]-Trim



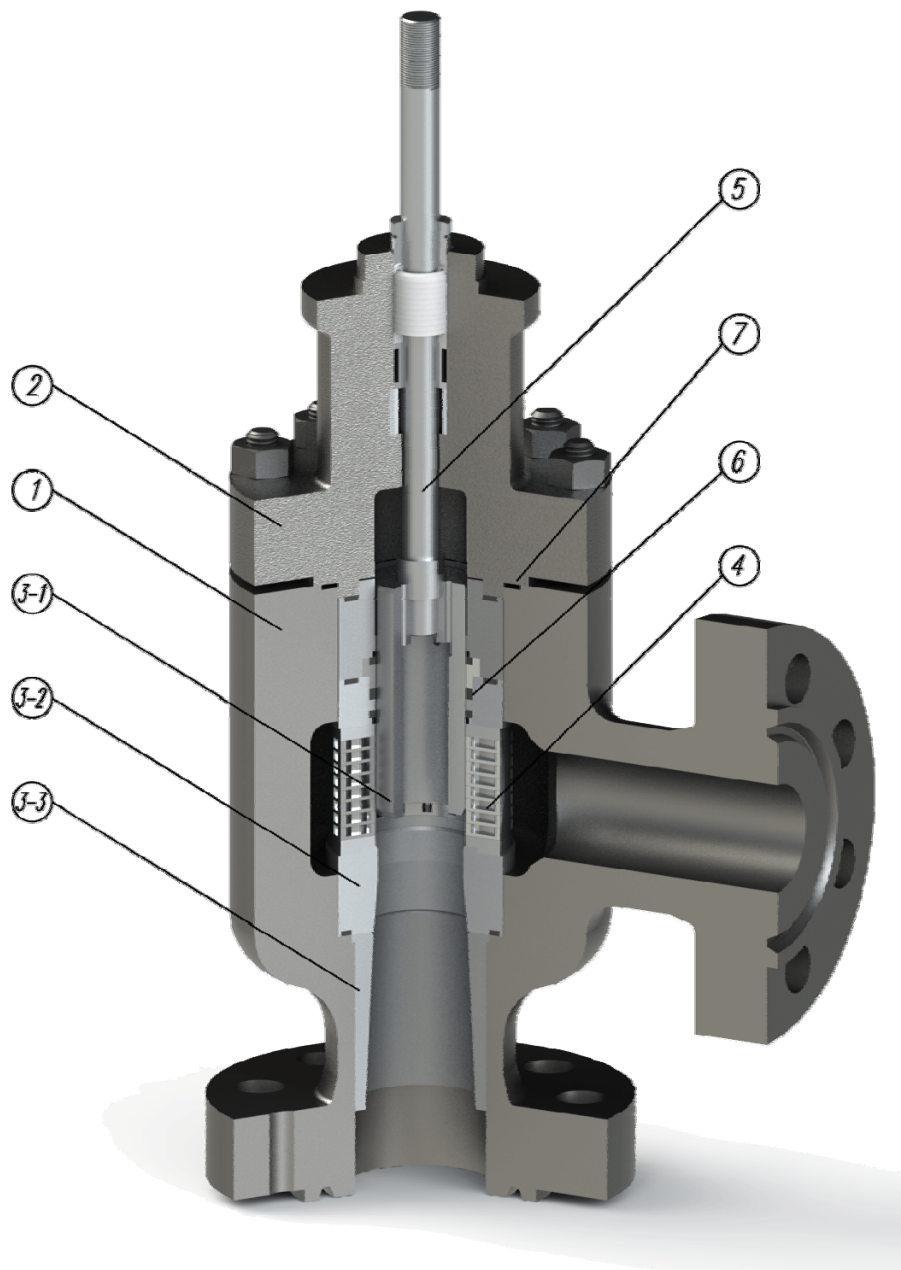
Complete Choke Valve / CC-series

4-4. Control Valves for the production & Processing of crude oil & natural gas.

- Are almost always angle valves
- Are often hand operated
- Are often manufactured by companies
- Have evolved along a different philosophy than control valves
- Are used to control wellhead fluids or process fluids
- Are often the responsibility of the mechanical or piping engineer rather than instrument engineer
- 3D-Flow-Path X[iks]-trim concept intelligent valve design that carefully manages fluid velocity in all areas of the valve, minimising erosion in body and trim.
- High capacity and accurate control features make the valve appropriate for both start-up and well depletion production scenarios. One-valve solution for full process envelope.

5. BFS 3D-Flow-Path X[iks]-Trim Choke Construction

5-1. Section View of Technical Specification and Materials



1. Angle design Body, Flow to close direction.
2. Bolted Bonnet / Easy maintenance & low maintenance cost with quick change trim.
- 3-1. Solid Tungsten Carbide Plug / Solid Tungsten carbide eliminates galling. Excellent erosion resistance, Large balance holes will not clog
- 3-2. Solid Tungsten Carbide Venturi Seat / Tungsten Carbide Venturi Seat in high turbulence zones. Venturi seat transition flows smoothly into valve outlet and piping.
- 3-3. Optional Insert / Extra erosion resistance (Stellite or Solid Tungsten Carbide)
4. Solid Tungsten Carbide 3D Flow-Path X[iks]-Trim / Solid Tungsten carbide for erosion resistance. Multi-step letdown to control velocity, erosion and noise. Large flow passages, easily handle solids and dirty fluids.
6. Metal scrapers to prevent solids from entering sealing areas.

Technical Specification and Materials

No	Component	Standard NACE MR0175-2002 NACE MR0103-2005	NACE MR0175-2005 ISO 15156-2 2003 Cor.2.2005 / Note 3.	Remarks
1	Body	ASTM A958-SC4130	ASTM A958-SC4130	Note 1
		ASTM A352-LCB	ASTM A352-LCB	
		ASTM A216-WCC	ASTM A216-WCC	
		A995-4A (Duplex)	A995-4A (Duplex)	
2	Bonnet	AISI 4130	AISI 4130	
		F51 / S31803	F51 / S31803	
		A350-LF2	A350-LF2	
3	Plug, Seat & Venturi	Tungsten Cabide.	Tungsten Cabide.	Note 4
4	Cage / X[iks]-trim	Tungsten Cabide.	Tungsten Cabide.	Note 4
5	Stem	17-4PH	Inconel 718	Note 2
6	Balance Seal	Teflon	Teflon	
7	Bonnet Seal	17-4PH	Inconel 625	

(1) ASTM A958-SC4130, A352-LCB and A216-WCC are available with or without an Inconel 625 inlay for corrosion resistance.

(2) Inconel 718 is selected for stem material when API material classes FF or HH is specified.

(3) Certification to NACE is dependant on fluid composition and temperature.

(4) Optional trim Materials / Cobalt Alloy + C.V.D Treatment Plug, Seat, Cage & Venturi throat. (HRC 84 °)

Valve Range

Our range of choke valve designs covers the ASME and API rating that are commonly applied in the gas and oil industry, up to API 15000(1035bar design pressure) with related temperature ratings. For the -100deg.C to 200deg.C (-148deg.F to 390deg.F) temperature range we offer special sealing solution. The choke valves can be supplied with a variety of inlet and outlet connections such as flanges and clamp connectors and size up to and including 12" in the ASME rating and 13-5/8" in the API ratings.

Performance Data

No	Component	Specification / Option Available
1	Pressure Rating	ANSI 600, 900,1500, 2500, API 5000-10000
2	Actuator Type	Manual Hand-wheel, Pneumatic Diaphragm or Cylinder, Step-Motor, Hydraulic.
3	Standard Quality Level	API 6A PSL1
4	Optional Quality Level	PSL2 and NACE MR0175
5	Standard Temp. Ratings	-50deg.F to +250deg.F (-45deg.C to +121deg.C)
		API 6A temperature classifications L,P,R,S,T,U)
6	Trim Characteristic	Modified Equal Percent.
7	Seat Leakage Class	ANSI B16-104/FCI 70-2 Standard Class IV, Option Class V.
8	Industry Standard	ANSI B16.34 / API 6A / ISA 9000, 9001 / Governmental Agencies Customer Spec.

Larger size and higher pressure (incl API 15000) on request. The complete table with valve size and ratings request to technical sales dept. of BFS's

Standard Cv Table, Valve Size & End Connection

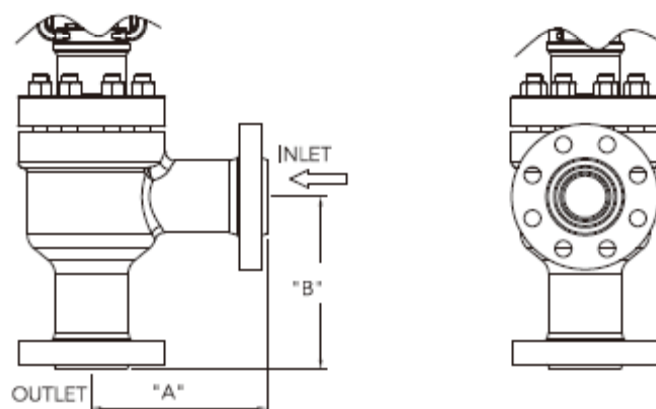
No	Body Size				Cv				Valve Travel (mm)	Connect.
	Pressure Rating				Hi-Capa. X[iks]-trim		Severe X[iks]-trim			
	1500#	2500#	API5000	API10000	trim size	Rated Cv	trim size	Rated Cv		
1	1.5"	1.5"	2. 1/16	1. 13/16	1"	18	1"	9	40	RF. RTJ
	2"	2"	2. 9/16	2. 1/16	1"	18	1"	9	40	RF. RTJ
	3"	3"	3. 1/8	2. 9/16	1"	18	1"	9	40	RF. RTJ
	-	-	-	3. 1/16"	1"	18	1"	9	40	RF. RTJ
2	3"	3"	2. 9/16"	2. 9/16"	1.75"	50	1.75"	24	65	RF. RTJ
	4"	4"	3. 1/8"	3. 1/16"	1.75"	50	1.75"	24	65	RF. RTJ
	-	-	4. 1/16"	4. 1/16"	1.75"	50	1.75"	24	65	RF. RTJ
3	4"	4"	3. 1/8"	3. 1/16"	2.5"	100	2.5"	31	65	RF. RTJ
	6"	6"	4. 1/16"	4. 1/16"	2.5"	100	2.5"	31	65	RF. RTJ
	-	-	5. 1/8"	5. 1/8"	2.5"	100	2.5"	31	65	RF. RTJ
4	4"	4"	4. 1/16"	4. 1/16"	3.25"	160	3.25"	50	90	RF. RTJ
	6"	6"	5. 1/8"	5. 1/8"	3.25"	160	3.25"	50	90	RF. RTJ
	-	-	7. 1/16"	7. 1/16"	3.25"	160	3.25"	50	90	RF. RTJ
5	6"	6"	5. 1/8"	5. 1/8"	4"	250	4"	60	90	RF. RTJ
	8"	8"	7. 1/16"	7. 1/16"	4"	250	4"	60	90	RF. RTJ
	-	-	9"	9"	4"	250	4"	60	90	RF. RTJ
6	6"	6"	-	-	5"	335	5"	105	120	RF. RTJ
	8"	8"	7. 1/16"	7. 1/16"	5"	335	5"	105	120	RF. RTJ
	10"	10"	9"	9"	5"	335	5"	105	120	RF. RTJ

- Larger Size and Higher pressure rating consult technical engineering team of factory.

BFS Choke Valve CC-series Summary

Trim Size	1" through 5"
Process Connection Size	1.5" to 10"
Pressure Rating	ANSI 600, 900, 1500, 2500, API 5000, 10000, 15000, 20000.
Standard Cv Range	up to 340.
Application	Oil & Gas Production (Multi-phase), Water & Gas Injection, Gas Lift. Standard Severe & Severe Service application X[iks]-trim.
Trim Materials	Cobalt Alloy+C.V.D Treatment, Tungsten Carbide. Stellite Fully Hard Facing.
Body Materials	LCC, Duplex, Inconel 625 Available.
Actuator	Full range of actuation available.

CC-series / Valve Body Face to Face Dimension



Angle Body

Unit / inch

In x out size	Trim Size (inch)	ANSI 1500 Class				ANSI 2500 Class			
		A / unit-inch		B / unit-inch		A / unit-inch		B / unit-inch	
		RF	RTJ	RF	RTJ	RF	RTJ	RF	RTJ
1.5 x 1.5	1	8	8	8	8	9.13	9.19	9.13	9.19
1.5 x 2"	1	8	8	8.75	8.81	9.13	9.19	9.73	9.81
2 x 2	1	8.75	8.81	8.75	8.81	9.75	9.81	9.75	9.81
2 x 3	1	8.75	8.81	9.38	9.44	9.75	9.81	11.38	11.5
3 x 3	1	9.38	9.44	9.38	9.19	11.38	11.5	11.38	11.5
3 x 3	1.75	10.12	10.19	10.12	10.19	12.12	12.25	12.12	12.25
3 x 4	1.75	10.12	10.19	10.38	10.44	12.12	12.25	13	13.19
4 x 4	1.75	10.38	10.44	10.38	10.44	13	13.19	13	13.19
4 x 4	2.5	11.62	11.69	11.82	11.89	14.25	14.44	14.25	14.44
4 x 6	2.5	11.62	11.69	13.5	13.62	14.25	14.44	17.5	17.75
6 x 6	2.5	13.5	13.62	13.5	13.62	17.5	17.75	17.5	17.75
4 x 4	3.25	11.62	11.69	11.82	11.89	14.25	14.44	14.25	14.44
4 x 6	3.25	11.62	11.69	13.5	13.62	14.25	14.44	17.5	17.75
6 x 6	3.25	13.5	13.62	13.5	13.62	17.5	17.75	17.5	17.75
6 x 6	4	14.5	14.62	14.5	14.82	18.5	18.75	18.5	18.75
6 x 8	4	14.5	14.62	18.12	18.31	18.5	18.75	22.25	22.56
8 x 8	4	18.12	18.31	18.12	18.31	22.25	22.56	22.25	22.56
6 x 6	5	15.5	16.62	16.5	16.62	20.5	20.75	20.5	20.75
6 x 8	5	16.5	16.62	18.12	18.31	20.5	20.75	22.25	22.56
8 x 8	5	18.12	18.31	18.12	18.31	22.25	22.56	22.25	22.56
8 x 10	5	18.12	18.31	21.5	21.69	22.25	22.56	28	28.44
10 x 10	5	21.5	21.69	21.5	21.69	28	28.44	28	28.44

CC-series / Valve Body Face to Face Dimension

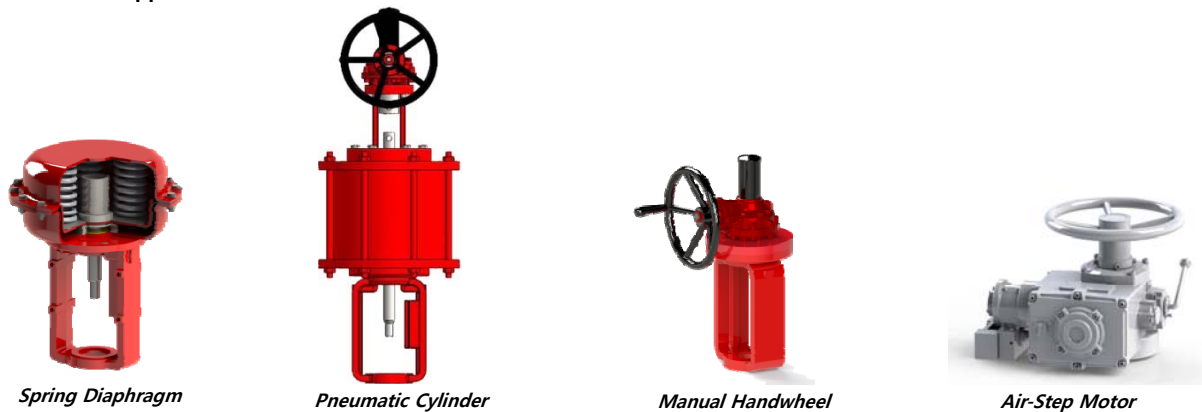
Unit/inch

API 5000/6B				API 10000 / 6BX			
In x out Size	Trim Size	A	B	In x out Size	Trim Size	A	B
		RTJ				RTJ	
2-1/16x2-1/16	1	8.81	8.81	1-13/16x1-13/16	1	8.25	8.25
2-1/16x2-9/16	1	8.81	8.94	1-13/16x2-1/16	1	8.25	8.81
2-9/16x2-9/16	1	8.94	8.94	2-1/16x2-1/16	1	8.81	8.81
2-9/16x3-1/8	1	8.84	9.44	2-1/16x2-9/16	1	8.81	9.38
3-1/8x3-1/8	1	9.44	9.44	2-9/16x2-9/16	1	9.38	9.38
-	-	-	-	2-9/16x3-1/16	1	9.38	10.75
-	-	-	-	3-1/16x3-1/16	1	10.75	10.75
2-9/16x2-9/16	1.75	9.69	9.69	2-9/16x2-9/16	1.75	11.38	11.38
2-9/16x3-1/8	1.75	9.69	10.19	2-9/16x3-1/16	1.75	11.38	12
3-1/8x3-1/8	1.75	10.19	10.19	3-1/16x3-1/16	1.75	12	12
3-1/8x4-1/16	1.75	10.19	10.44	3-1/16x4-1/16	1.75	12	13
4-1/16x4-1/16	1.75	10.44	10.44	4-1/16x4-1/16	1.75	13	13
3-1/8x3-1/8	2.5	10.19	10.19	3-1/16x3-1/16	2.5	12	12
3-1/8x4-1/16	2.5	10.19	11.69	3-1/16x4-1/16	2.5	12	13
4-1/16x4-1/16	2.5	11.69	11.69	4-1/16x4-1/16	2.5	13	13
4-1/16x5-1/8	2.5	11.69	12.94	4-1/16x5-1/8	2.5	13	14.81
5-1/8x5-1/8	2.5	12.94	12.94	5-1/8x5-1/8	2.5	14.81	14.81
4-1/16x4-1/16	3.25	11.69	11.69	4-1/16x4-1/16	3.25	14	14
4-1/16x5-1/8	3.25	11.69	12.94	4-1/16x5-1/8	3.25	14	14.81
5-1/8x5-1/8	3.25	12.94	12.94	5-1/8x5-1/8	3.25	14.81	14.81
5-1/8x7-1/16	3.25	12.94	13.62	5-1/8x7-1/16	3.25	14.81	18.75
7-1/16x7-1/16	3.25	13.82	13.62	7-1/16x7-1/16	3.25	18.75	18.75
5-1/8x5-1/8	4	13.94	13.94	5-1/8x5-1/8	4	14.74	14.74
5-1/8x7-1/16	4	13.94	14.62	5-1/8x7-1/16	4	14.74	16.18
7-1/16x7-1/16	4	14.62	14.62	7-1/16x7-1/16	4	16.18	16.18
7-1/16x9	4	14.62	18.31	7-1/16x9	4	16.18	20.38
9x9	4	18.31	18.31	9x9	4	20.38	20.38
7-1/16x7-1/16	5	16.62	16.62	7-1/16x7-1/16	5	18.18	18.18
7-1/16x9	5	16.62	18.31	7-1/16x9	5	18.18	20.38
9x9	5	18.31	18.31	9x9	5	20.38	20.38

Industry Standards

- API 6A.
- ANSI B16.34.
- ISO9000/9001./ Govenmental agencies./ Customer Specifications.

8. Actuator Application



9. BFS Solution is C.V.D Treatment for Trim

C.V.D / Chemical Vapor Deposition

Using the CVD process to improve the wear life of metal component. This is not for simple coating on the material surface, but for a surface penetration.

So, the CVD treated material has no flaking which usually takes place in the coated material such as in Titanium Carbide and Tungsten Carbide etc.

What is "C.V.D"

CVD is thermo-chemical surface treatment in which metal atoms are diffused into the surface of a work piece to form CVD layer with base material. CVD has been proven more than several times the wear life of metal parts that were previously solid tungsten and titanium carbide coating, carburized, nitride, nitro-carburized or hard chrome plated in numerous applications.

Features

Excellent wear resistance from surface hardness of 1700 – 2300HV achieved on steel and nickel, cobalt alloys, tungsten carbide, titanium carbide. Proven to more than several times the wear life of many components. Hardness is retained at high service temperature 650deg.C. CVD increase acid corrosion resistance Hydrochloric, Sulfuric and Phosphoric acids in particular.

Properties of C.V.D Layers

The hardness of layers on steel ranges between 1700 and 2300HV (77-88HRC). Hardness of layers varies with base material, layers also retain hardness up to subcritical temperature 650deg.C. Layers depths range from 20 to 150micron depending on base materials and application with the layer depth being matched to the intended application.

Resistance to Acids

C.V.D can increase the resistance of low alloy steel to acids such as sulfuric, phosphoric and hydrochloric, C.V.D austenitic stainless steel has excellent resistance to hydrochloric acid.

Material Selection

C.V.D can be applied to a wide range of steel alloys including carbon steel, low alloy steel, tool steel and stainless steel, especially base materials such as nickel based alloys, cobalt based alloys and molybdenum. Nickel alloy, cobalt-alloy can be treated without sacrificing corrosion resistance, as well as producing extreme hard surface wear resistance. The wear resistance of sintered carbide such as tungsten carbide, titanium carbide, is excellent.



Best Flow Solution

BFS Incorporation

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