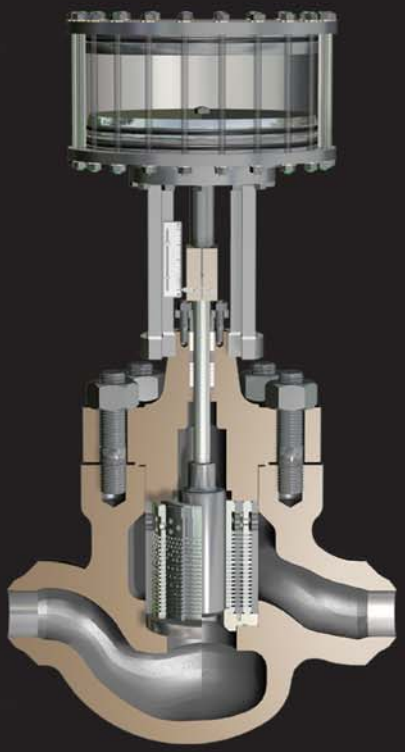
MATRIX

MIL 91000 Extreme Pressure Anti-Cavitation Control Valves with Multi-Stage, Multi-Path Trim

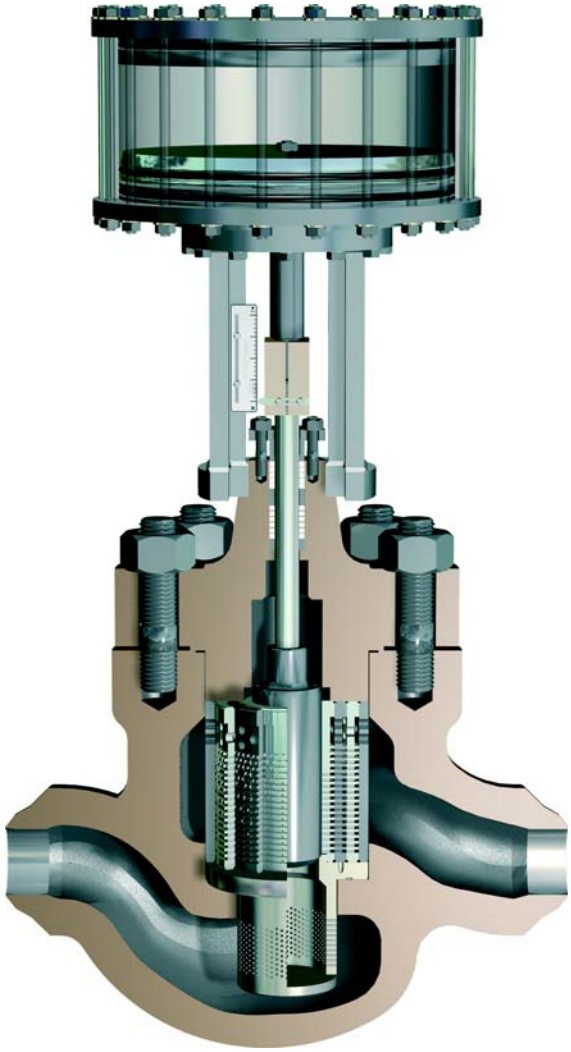


KSB

MIL Controls Limited
A KSB Company

Hostile Process Control applications

One Valve stands up to the Ultimate test



Extreme process control applications involving incompressible fluids. You need a very special Control valve for conditions so demanding. MATRIX Series valves from MIL Controls. Engineered to excel under severest process assaults. By far the most advanced valve today; also the most cost effective.

MATRIX could be the perfect choice for your applications. Read on to find out why.

Pressure Drop, Cavitation and Velocity

A detailed look at why Control Valves fail.

Critical service process control applications are characterised by high Pressure Drops, associated high Trim Velocities and Cavitation. Control valves used in such extreme conditions are plagued by problems like shortened trim life, plug stem failure, vibration, erosion of internals and high noise levels.

Pressure Drop in a Control valve is a two stage process. First the Static Pressure drops to Vena Contracta* pressure (P_{VC}) where it is accelerated to Vena Contracta velocity (V_{VC}) and further it recovers downstream in it's path.

During the first stage, if P_{VC} falls below the vapour pressure of the liquid, the liquid boils forming vapour bubbles.

As the liquid moves further downstream, its pressure recovers, converting almost all its Kinetic Energy to Potential Energy.

If the downstream pressure is greater than vapour pressure, a phase transformation occurs turning the vapour back to liquid.

This phase transformation is typically characterised by implosion of the vapour bubbles. This phenomenon is commonly referred to as *Cavitation.*

This implosion releases large amount of energy causing localised Surface Stresses as high as 200,000 psi. This can lead to severe damage of the internals and the body of a Control valve.

Cavitation could be aggravated further when associated with the sort of extreme Pressure Drops typical of power plant applications like Boiler Feed Pump Minimum Re-circulation, Low Load Feed Water Control etc.

The Cavitation potential of a valve is a direct derivative of its pressure recovery characteristics.

The pressure recovery of a valve is defined in terms of a dimension-less index called the Pressure Recovery Factor, the ratio of the total Pressure Drop across the valve to the Pressure Drop at Vena Contracta.

$$C_f = \sqrt{\frac{P_1 - P_2}{P_1 - P_{vc}}}$$

Since pressure recovery and velocity are complementary, conventional single stage valves with low C_f generate excessive Trim Velocities (and vice versa). This can cause Trim Erosion.

The option of using harder material in single stage valves, to resist Trim Erosion by Cavitation and high Velocity has been tried, but results have not been satisfactory.

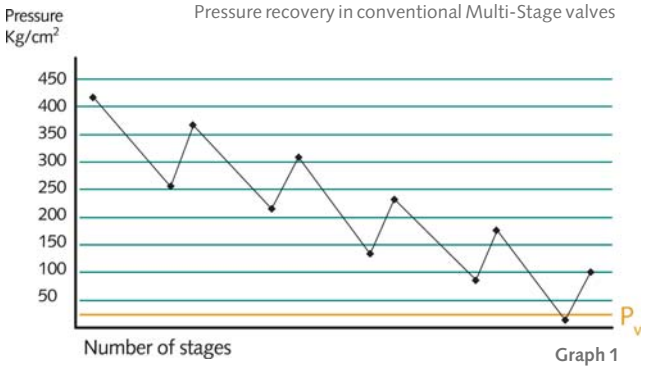
A more sophisticated option is to use Multi-Stage valves which distribute the Pressure Drops over a fixed† number of stages. But here also there are some inadequacies.

Since the Stage wise Pressure Drops are equal and large here, in extreme conditions it is not always possible to keep the final stage (Vena Contracta) pressure from dipping below vapour pressure (refer graphs 1 & 2). Also many of these valves have Linear as their inherent control characteristic which limits their rangeability.

* The point where pressure reaches it's lowest .
† Usually 8, owing to manufacturing constraints.

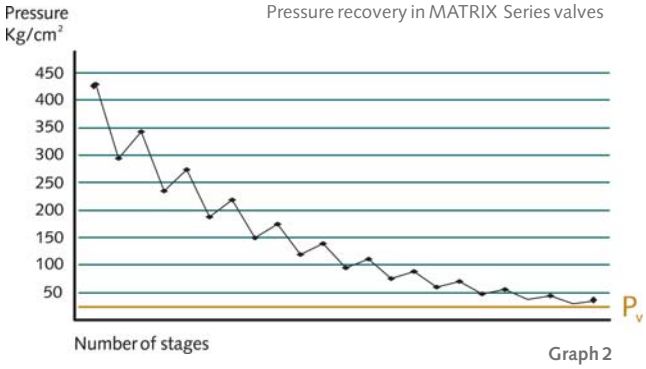
Conventional Multi-Stage valves versus MATRIX! Pressure recovery; a comparison

Pressure recovery in conventional Multi-Stage valves



Graph 1

Pressure recovery in MATRIX Series valves



Graph 2

MATRIX from MIL. Extreme pressure Anti-Cavitation Control Valves with Multi-Stage, Multi-Path Trim.

Feature for feature, the finest Control Valves for Critical applications.

Varying and expanding flow passage ensures near Zero Pressure Recovery thus ensuring that stage wise Pressure Drops are limited below the Critical Pressure Drop. This rules out Cavitation even in extreme conditions.

Ingenious Flow Path with discrete velocity stages reduces downstream velocity. Exit velocity and Kinetic Energy is kept under limits to eliminate Erosion.

Ruggedness of design ensures longevity even in very severe applications.

Ingenious design results in a simpler manufacturing process. This makes MATRIX Series valves the most reasonably priced in their league.

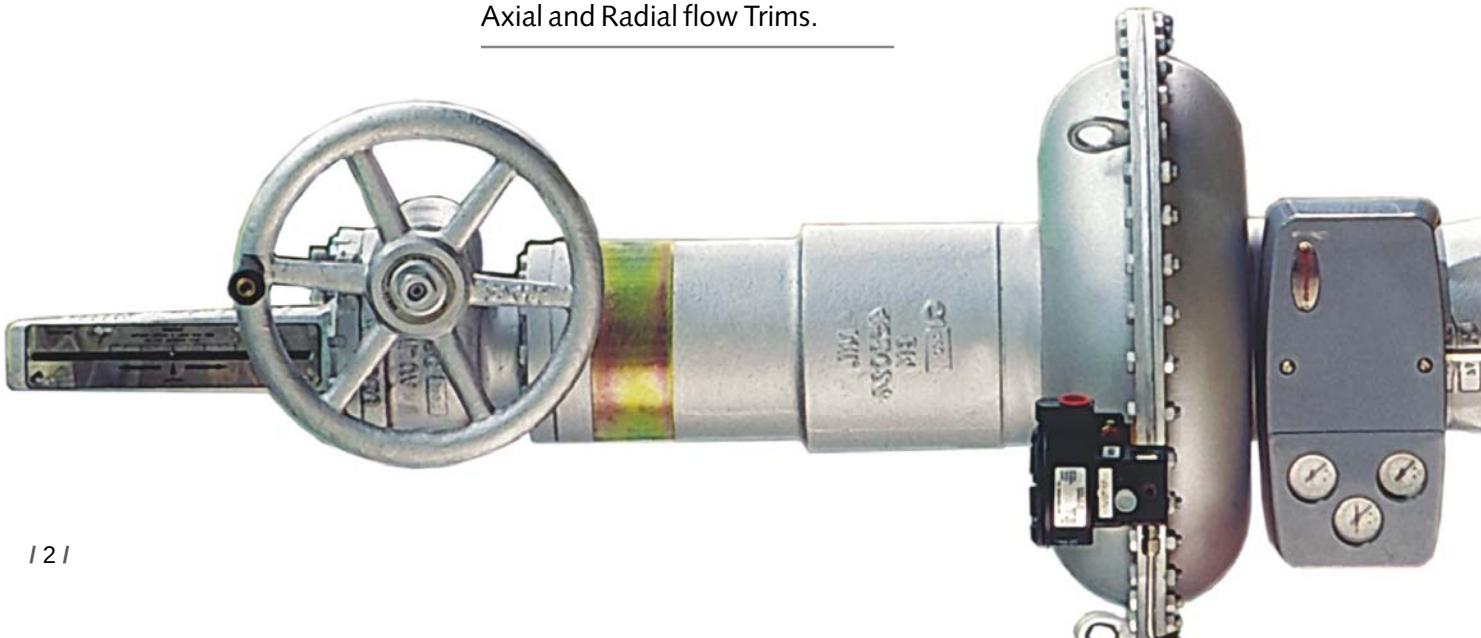
To eliminate wire drawing and cavitation damages on the leading edges of the plug, Matrix Series valves always have *"Flow tending to Open"* design in both Axial and Radial flow Trims.

Available with optional Soft Seat which has a special sliding collar to protect the Soft Seat from high pressure fluid.

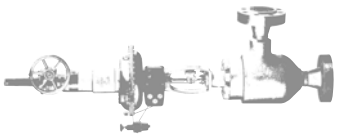
As many as 50 Pressure Dropping stages.

Characteristics can be customised to suit specific process applications.

Self energised Seals provided to ensure Zero Leak and to optimise bonnet/bolting design.



VALVE SERIES	SEAL TYPE	BODY TYPE	TRIM TYPE
91 Multi-Stage, Mult-Path, Anti-Cavitation	0: Undefined 1: Unbalanced 2: With Pressure-energised Polymeric Seal Ring (Static) 5. With Metallic Seal Ring 6. With Polymeric Seal Ring 9. With Graphite Seal Ring	0: Undefined 1: Inline 2: Angle	0: Undefined 1: Axial flow 2: Radial flow



Pressure recovery factor (C_f) as high as 0.9999.

Flow to Open flow direction eliminates Dynamic Instability inherent to Flow to Close valves.

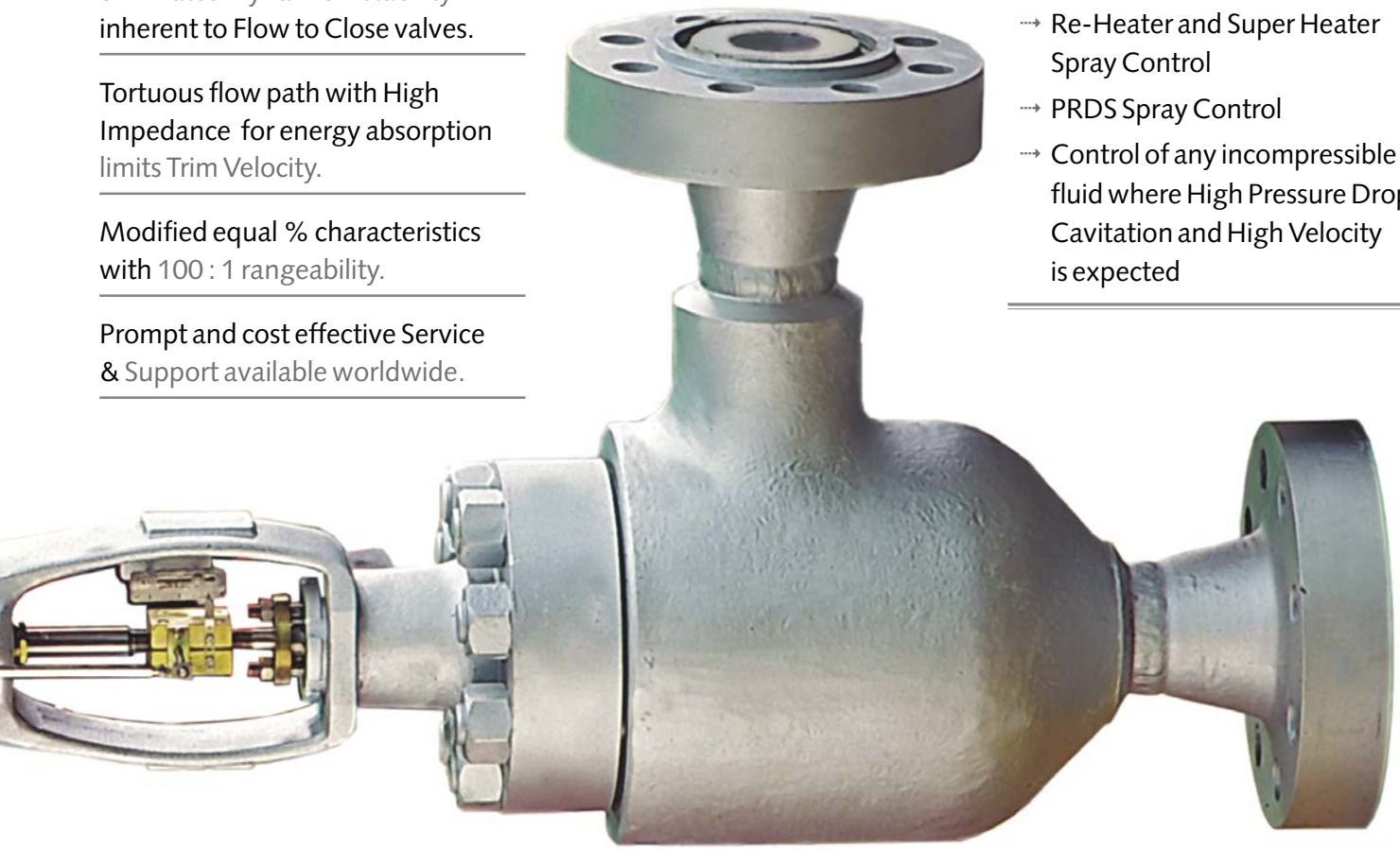
Tortuous flow path with High Impedance for energy absorption limits Trim Velocity.

Modified equal % characteristics with 100 : 1 rangeability.

Prompt and cost effective Service & Support available worldwide.

Typical Applications

- Boiler Feed Water Control
- Boiler Feed Pump Minimum Recirculation Control
- Re-Heater and Super Heater Spray Control
- PRDS Spray Control
- Control of any incompressible fluid where High Pressure Drop, Cavitation and High Velocity is expected



Evolved over several months of specialised R&D, MATRIX Series valves address common Control valve problems to an outstanding level of effectiveness, thereby totally eliminating the potential for Cavitation!

How MATRIX overcomes the problems

Smart design. In terms of design innovation, MATRIX Series valves stand in a class apart from other valves currently available worldwide.

It achieves very low pressure recovery (C_f as high as 0.9999) by forcing the fluid through a Multi-Path, Multi-Stage and progressively declining resistance flow path. This effectively kills the Fluid Energy and also brings down Velocity by arresting its turbulence.

Here the number of stages are decided depending on Pressure Drop, Cavitation potential and Velocity.

The Fluid Pressure gradually recedes from the first stage to the final one in a discrete manner with a, more or less, asymptotic approach.

Ingenious Flow Path. The valve trim consists of a welded cage assembly with a tortuous flow path.

This unique flow path impedes the fluid velocity by forcing it through an array of ruts and throttling stages, that have been allocated over the successive stages of the valve trim.

The number of ruts in each stage is fixed according to the Pressure Drop and thereby, the Velocity Control.

The number of ruts in successive stage increases as the fluid progresses downstream, thereby providing an expanding flow passage.

This proportions the Pressure Drop in the initial few throttling stages and progressively reduces it in the subsequent stages, to a point where Cavitation would not occur (refer Graph 2 in page 1) and Trim Exit Velocities are within safe limits.

Advantageous Flow Direction. MATRIX series valves, both Axial flow and Radial flow, are characterised by flow stream under the plug (flow tending to open) construction. This unique feature conclusively eliminates dynamic instability, a major irritant that afflicts conventional flow to close valves and helps to eliminate the wire drawing and cavitation damage to the plug, which is characterised with the flow to close construction. This ingenious design avoids the last stage pressure drop (where chances of cavitation exists) against the plug thereby eliminating cavitation damage to the seating surface (refer fig.1 & fig.2)

Flow to Close, Radial flow valves vs MATRIX! The Flow Direction advantage!

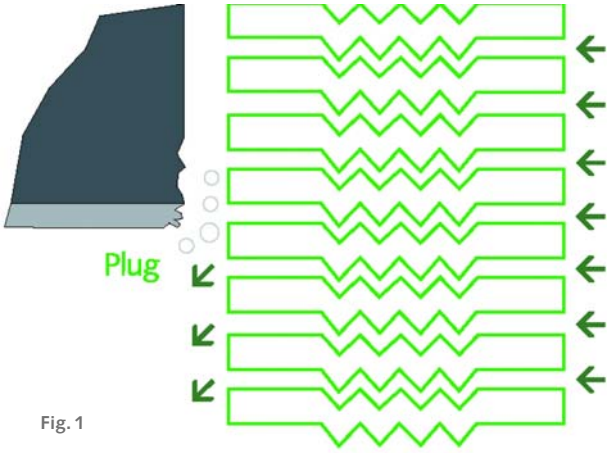


Fig. 1

Radial flow. Could damage Valve Trims in Flow to Close direction

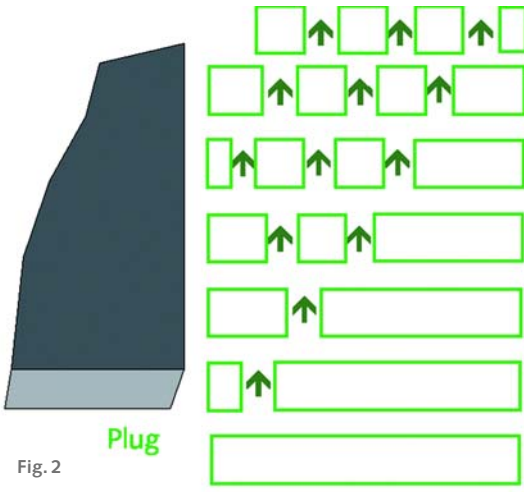


Fig. 2

Axial flow as in MATRIX

Wide Rangeability, Low noise levels…

Further features

Needless to state that it does improve the durability of the plug / seat ring and a better seat leak tightness can be maintained over a longer period of time compared to conventional valves.

Wide Rangeability and Low Pressure Recovery. Having expanding flow passages also lends MATRIX Series valves an added advantage viz. that it facilitates wider rangeability (higher C_v ratios), thus enabling smooth and precise Flow Control even at very low lift conditions. It ensures pressure recovery factors (C_f) as high as 0.9999.

Low Noise Levels. MATRIX Series valves are designed to maintain Flow Conditions as *Sub Critical*. This characteristic ensures that noise levels always stay within stipulated limits.

$SL=10 \log Cv+20 \log(K\triangle P)-30 \log t+5$

(SL: Sound Level, Cv: Flow Coefficient, $\triangle P$: Total Pressure Drop, K: Fraction of terminal stage Pressure Drop to total Pressure Drop, t: Wall thickness of the pipe)

Typical Operating Parameters

High Pressure Feed Pump Testing
P_1: 420 Kg/cm^2 (max.)
P_2: 0 Kg/cm^2
T: 50°C
No. of Pressure Drop stages: 40
91000, 6", 2500# ANSI, Cv: 30

Boiler Feed Pump Min. Recirculation
P_1: 280 Kg/cm^2
P_2: 10 Kg/cm^2
T: 170°C
No. of Pressure Drop stages: 25
91000, 6", 2500# ANSI, Cv: 35

Start-up Feed Water Control
P_1: 205 Kg/cm^2
P_2: 50 Kg/cm^2 (max.)
T: 170°C
No. of Pressure Drop stages: 15
91000, 6", 2500# ANSI, Cv : 70

Re-Heater Spray Control
P_1: 140 Kg/cm^2
P_2: 40Kg/cm^2
T: 170°C
No. of Pressure Drop stages: 12
91000, 2", 2500# ANSI, Cv: 4

Note: Metric units have been followed throughout

It may be noted here that the noise level depends on the last stage Pressure Drop. Since the last stage Pressure Drop is only a small fraction of the total Pressure Drop, it always remains very low. The noise levels generated in the previous stages will be attenuated within the cage assembly.

Self Energised Gaskets. Matrix Series valves employ special self-energised gaskets in larger sizes and higher pressures. As self energised gaskets require lesser gasket seating force, use of these special gaskets optimise the bonnet and bolting design.

Custom Built. MATRIX Series valves offer wide scope to customise control characteristics for specific process control applications. Its trim can be tailored by varying the number of stages and reallocating the Pressure Drop ratio in each stage.

Boiler Feed Pump min. Recirculation

Thermal Power Plant in Orissa, India with **MIL MATRIX Series valve** controlling the BFP Min. Recirculation Flow. These valves have 25 Pressure/ Velocity Reduction Stages and a strainer in-built to the seat, which protects Trim from foreign material.

High Pressure Pump Testing

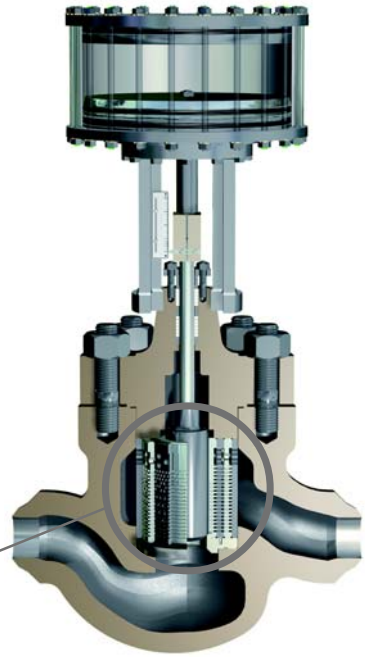
High Pressure Boiler Feed Pump Testing facility at Poona, India controlled by an **MIL MATRIX Series Valve**. Here the valve is used to kill high pressures generated by the Boiler Feed Pumps, which can be as high as 420 Kg/cm^2.

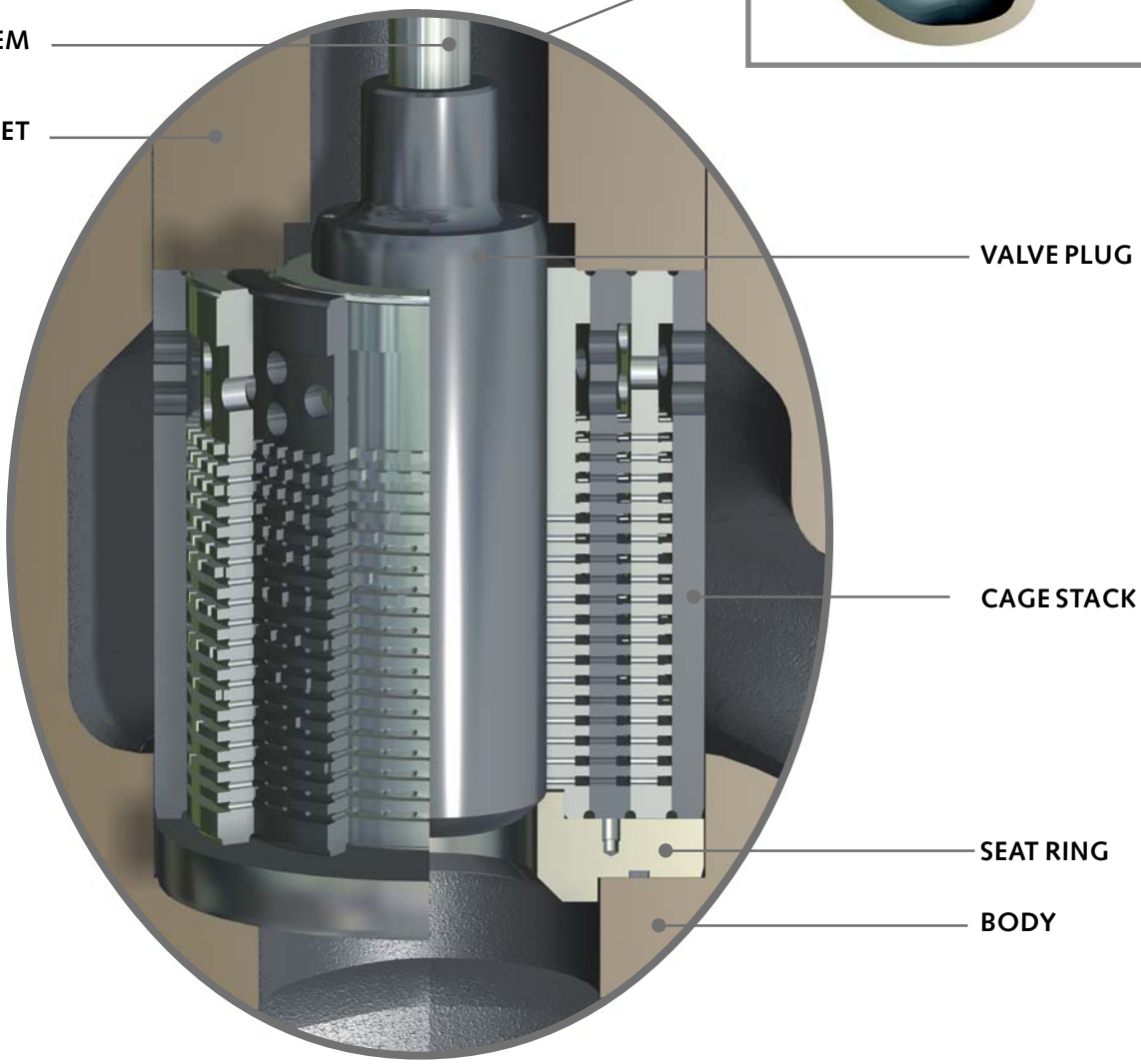
The inside story!

A zoomed in cross sectional view of the internals of a typical MATRIX Series valve shows the Cages in intricate detail.

Specially designed to contain high pressure drops, it eliminates potential for Cavitation and ensures that Trim exit Velocities never exceed limits.

Sectional View of a Typical Matrix Series Axial Flow Valve





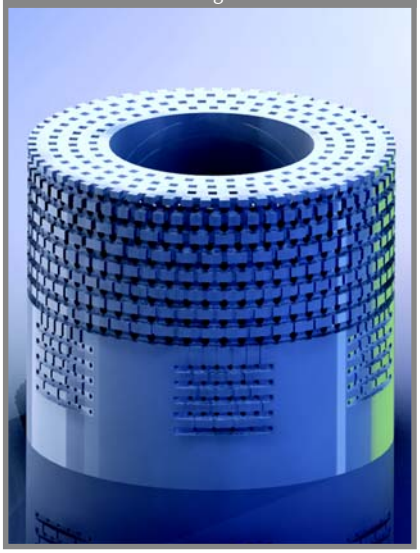
AXIAL FLOW TRIM

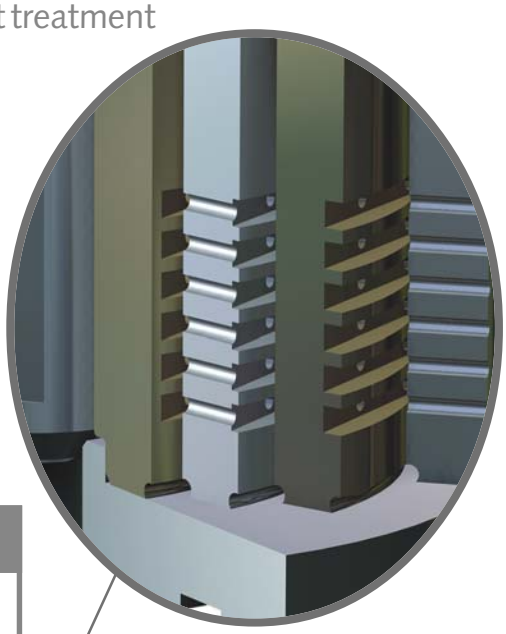
Outstanding engineering. Unbeatable economies

MATRIX. In a class all its own

At the heart of a MATRIX Series valve, is a unique cage assembly, which consists of precisely machined concentric cages which are welded together, thus forming a rugged element, which can withstand any severe condition. Carefully selected material of construction includes tough Martensitic stainless steels which are used after heat treatment and case hardening.

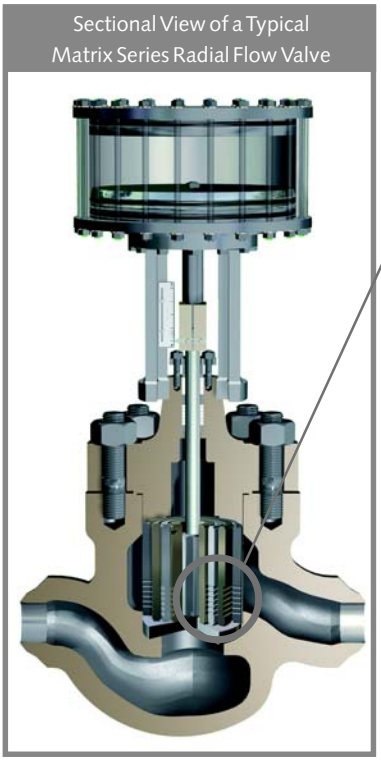
Partial View of a typical Matrix series Axial Flow Cage Stack S/A





RADIAL FLOW TRIM

Sectional View of a Typical Matrix Series Radial Flow Valve



The fluid Flow Channels are designed to offer maximum resistance to the highly erosive flow conditions. The flow path, similar in form to a Matrix, formed in the perfectly aligned cages ensures that the fluid follows a zig-zag pattern of flow, thereby absorbing excess energy associated with high pressure drops.

Each valve is precisely tailored to specific flow parameters. The design is customized, manipulating the number of stages, pressure drop ratios and stage wise pressure drop allocation depending on the stringency of the application.

The valve plug is heavily guided all along its length, thus ensuring stable & smooth operation. The standard plug has a balanced construction, using self-energised polymeric seal rings to achieve perfect sealing and leak tightness.

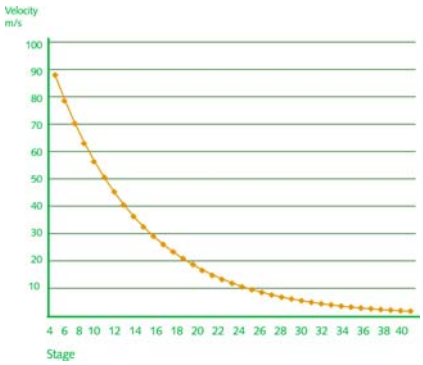
Progressively declining resistance flow path

Typical Velocity Profiles

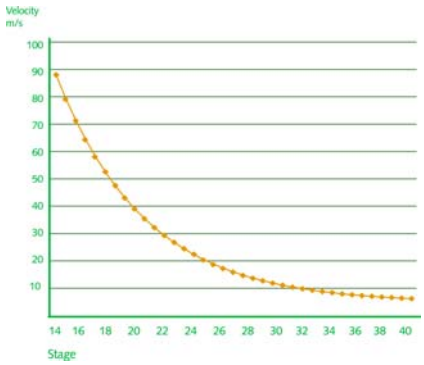
Since the Pressure Drop is effected through a number of stages, the velocity is discretely controlled at every stage by judicious Pressure Drop allocation to each stage, depending on the application and the total Pressure Drop. The expanding flow passage facilitates a continuously reducing velocity towards the outlet of the trim. This results in a very low outlet velocity.

Graphs 1- 3. Stage wise Velocity Profiles of a MATRIX Series valve dropping 420 Kg/cm^2 pressure (350 m^3/hr. flow) in 40 stages.

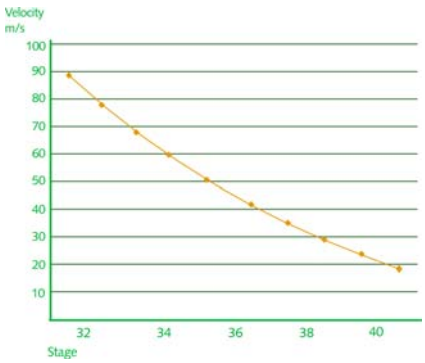
1. Velocity Profile at 10% opening.



2. Velocity Profile at 40% opening.



3. Velocity Profile at 100% opening.



General Data

Body

Type	: Globe & Angle
Material	: Carbon Steel, Alloy Steel (WC6/ WC9), Stainless Steel (CF8/ CF8M)
End Connections	: Flanged, Butt Weld, Socket Weld
Standard Flow direction	: Flow to Open

Bonnet

Type	: Stud Bolted with moderate extension
Material	: Same as Body

Trim

Cage Stack Type	: Multi-Path and Multi-Stage - Radial and Axial flow, Flow stream under the Plug
Material	: CA6NM Nitrided, 17-4PH
Plug type	: Heavily guiding all along its length, Unbalanced without Seal Ring or Balanced with Static Self-Energised Polymeric Seal Rings
Material	: CA6NM Nitrided, 17-4PH, SS 440C

Seat type	: Metal Seated, Quick Change type
Optional	: Diffuser seat ring
Material	: SS 316 + Stellited

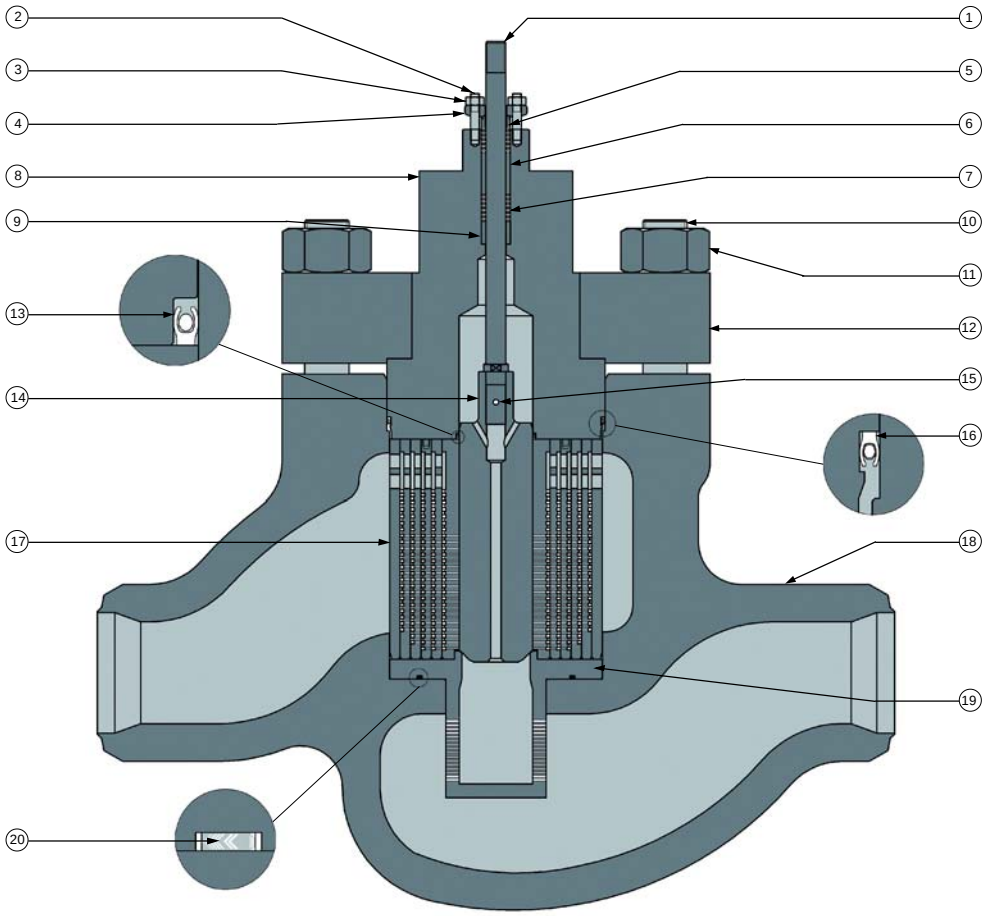
Gland Packing

Type	: With Teflon (<180°C) or Graphite (>180°C) moulded split rings.
Optional	: Eco-Lock Gland Sealing System.

Standard material is listed. Other material available on request. MIL reserves right to provide superior material, owing to constant product upgradation.

Internals diagram & Part description

Typical Construction



Matrix Series. MIL 91000: Axial flow - Pressure Balanced

#	Part Description	Material of Construction
1	Plug Stem	ASTM A 564 Gr. 630 (H-1075)
2	Packing Stud	ASTM A 193 Gr. B8
3	Packing Nut	ASTM A 194 Gr. 8
4	Packing Flange	ASTM A 105 Gr. 2
5	Packing Follower	ASTM A 479 Ty. 304
6	Packing Spacer	ASTM A 479 Ty. 304
7	Packing	PTFE / GRAPHITE
8	Bonnet	Same as body material
9	Guide Bush	ASTM A 276 Ty. 440C
10	Body Stud	ASTM A 193 Gr. B7
11	Body Nut	ASTM A 194 Gr. 2H
12	Bonnet Flange	Same as body material

#	Part Description	Material of Construction
13	Ener Seal Ring (Plug)	PTFE EKONOL+ ELGILOY Spring
14	Plug	ASTM A 276 Ty. 440C or ASTM A 564 Gr. 630
15	Plug Pin	ASTM A 479 Ty. 316
16	Ener Seal Ring (Bonnet)	PTFE EKONOL+ ELGILOY Spring
17	Cage Stack S/A	ASTM A 743 Gr. CA6NM Nitrided
18	Body	ASTM A 216 Gr. WCC or ASTM A 217 Gr. WC6/WC9 or ASTM A 351 Gr. CF8/CF8M
19	Seat Ring	ASTM A 479 Ty. 316 + Stellite
20	Seat Ring Gasket	ASTM A 479 Ty. 316 + Graphite

Standard material is listed. Other material available on request. MIL reserves right to provide superior material, owing to constant product upgradation.

Sizes / Leakage Class / Temperature Range

Valve size (inch)	Category	Temperature	Seat Leakage Class as ANSI/FCI 70.2
0.75	U, B	-29°C to +566°C /+315°C †	IV, V (optional)
1	U, B	-29°C to +566°C /+315°C †	
1.5	U, B	-29°C to +566°C /+315°C †	
2	U, B	-29°C to +566°C /+315°C †	
4	B	-29°C to +315°C	
6	B	-29°C to +315°C	
8	B	-29°C to +315°C	
10*	B	-29°C to +315°C	
12*	B	-29°C to +315°C	

U-Unbalanced, B- Balanced

† : Pressure Balanced designs limited to a maximum temperature of 315°C. Unbalanced designs available upto 566°C. Please consult MIL for applications outside the temperature range.

* : In 10", 12" Sizes, Radial flow valves available as standard. Axial flow available on request, based on parameters.

Cv Charts

Radial Flow- Unbalanced (91102)

Valve Size (Inch)	Travel (Inch)	ANSI Rating	Orifice dia (Inch)	Rated Cv
0.75 to 2	0.75	900# to 2500#	0.5	1, 2, 3.5, 4
0.75 to 2	1.5	900# to 2500#	1	8
1.5 to 2.5	1.5	900# to 2500#	1	10, 12

C_f or F_L at full open position: 0.98

Radial Flow- Pressure Balanced, Tight Shut-Off (91202)

Valve Size (Inch)	Travel (Inch)	ANSI Rating	Orifice dia (Inch)	Rated Cv
1.5 to 2.5	1.5	900# to 2500#	1.37	6
2 to 2.5	1.5	900# to 2500#	1.75	10
2 to 2.5	2	900# to 2500#	1.37	16, 20
3 to 4	2	900# to 2500#	1.57	30
4	2	900# to 2500#	1.89	40
6	3	900# to 2500#	3.5	90
8	4	900# to 1500#	5.75	160
8, 10, 12	4	900# to 2500#	5.2	250

C_f or F_L at full open position: 0.98

Radial Flow- Pressure Balanced (91502, 91602, 91902)

Valve Size (Inch)	Travel (Inch)	ANSI Rating	Orifice dia (Inch)	Rated Cv
3	2	300#, 600#	2.25	56
4	2	900# to 2500#	2.25	30, 60
4	3	900# to 2500#	2.25	65 ††
6	2	300#, 600#	5	105
6	2.5	300#, 600#	5	175, 260
6	3	900# to 1500#	3.25	180
8	3	300#, 600#	6.5	290
10	2.5	300#, 600#	8	375
10	3	300#, 600#	8	300

†† : With Diffuser Seat

C_f or F_L at full open position: 0.98

Axial Flow- Unbalanced & Balanced (91001)

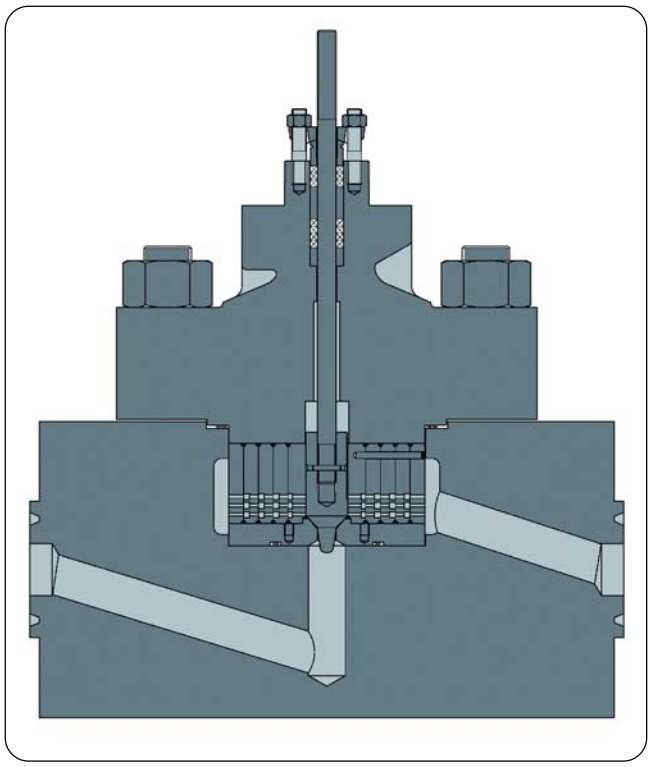
Valve Size (Inch)	Travel (Inch)	ANSI Rating	Orifice dia (Inch)	Rated Cv
0.75 to 2	1.5	900# to 2500#	0.5	0.2, 0.8 **
0.75 to 2	1	900# to 2500#	0.25	0.4, 0.45**
1.5 to 2.5	1.5	900# to 2500#	1.68	1.5
1.5 to 2.5	2.5	900# to 2500#	1.68	2.4, 4
4, 6	3.5	900# to 2500#	2.5	15
6, 8	4	900# to 2500#	5	35

Other Cv's on request

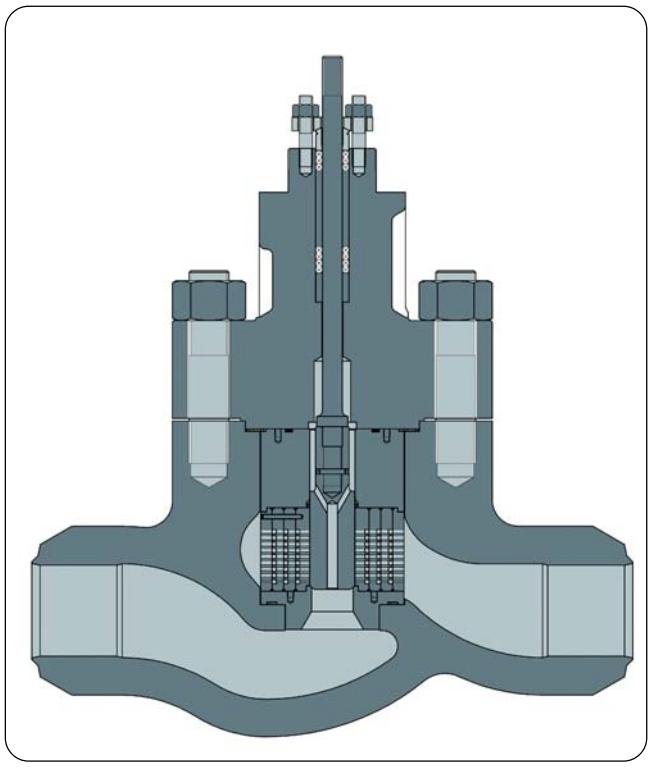
**: Cv's ≤ 0.8 have Unbalanced Construction. All other Cv's are Pressure balanced.

C_f or F_L at full open position: 0.999

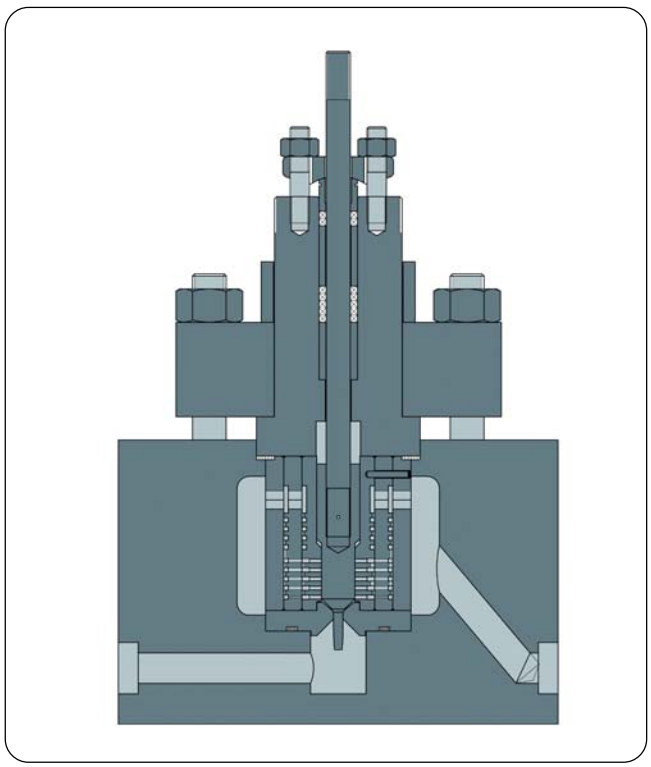
Typical Construction. Overview of Design options



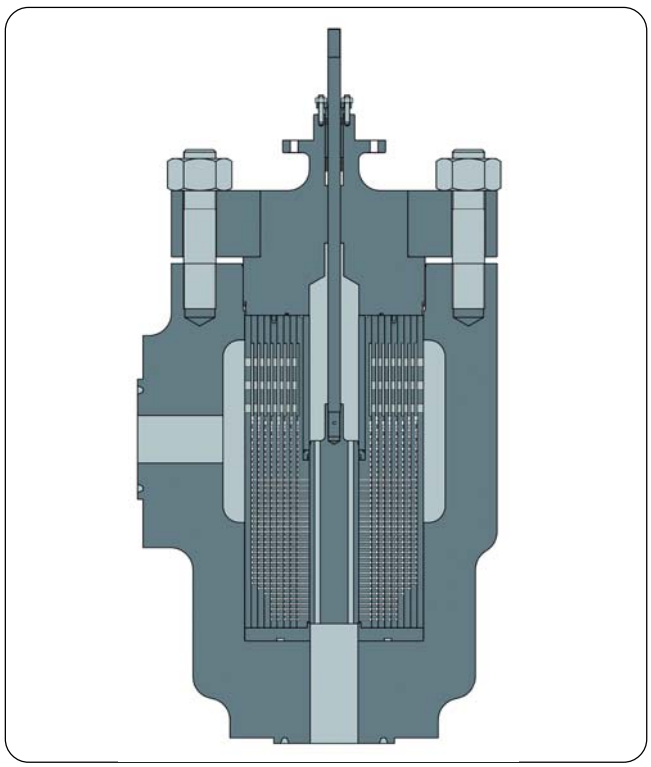
Radial Flow - Unbalanced (MIL 91112)



Radial Flow - Pressure Balanced (MIL 91212)



Axial Flow - Unbalanced (MIL 91111)



Axial Flow - Balanced Angle Valve (MIL 91221)

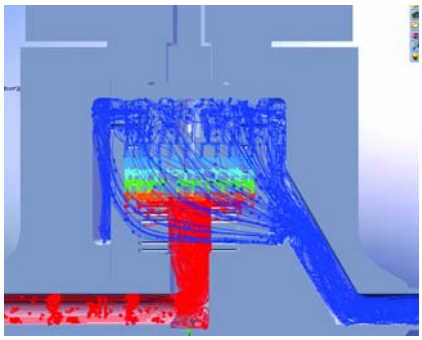
Quality & Reliability delivered through

A Technology Driven company

MIL has earned reputation in the severe service valve industry by developing advanced technologies, strong application knowledge, and great customer relationships. Our intense focus on offering customized solutions to Control valve problems has enabled us to offer products that improve customer's productivity and plant performance.

In May 2000, MIL achieved a milestone in development efforts, when it unveiled the MATRIX series of Extreme pressure, Multi-Stage, Multi-Path, Axial flow Control valves which has been designed to kill up to 420 kg/cm^2 pressure in 40 stages.

MIL uses advanced 3D Modeling & Flow Analysis (CFD) Software to optimize and technically validate the major design parameters for Control valves including Flow Path Contouring of Valve Body, Trim Design, Flow Capacity Optimisation, etc. These design outputs can be easily programmed in NC machines ensuring high degree of accuracy and repeatability in manufacturing.



CFD Analysis of a Matrix Series Axial flow Valve

We have invested greatly in state-of-the-art manufacturing technology because we believe that it confers strong strategic advantages. MIL plant, with a world class design and construction, is equipped to manufacture Globe/ Angle Control valves up to 24" size.

MIL is proud of its own Advanced Testing facility for Cavitation Attenuation (Cf) factor at KSB Pump and Valve Testing Centre in Chinchwad, Maharashtra, the only one of its kind in India.

Our unique combination of practical expertise, cutting edge technology and commitment to product and service excellence ensures that every aspect of our operation is of the highest possible standard.

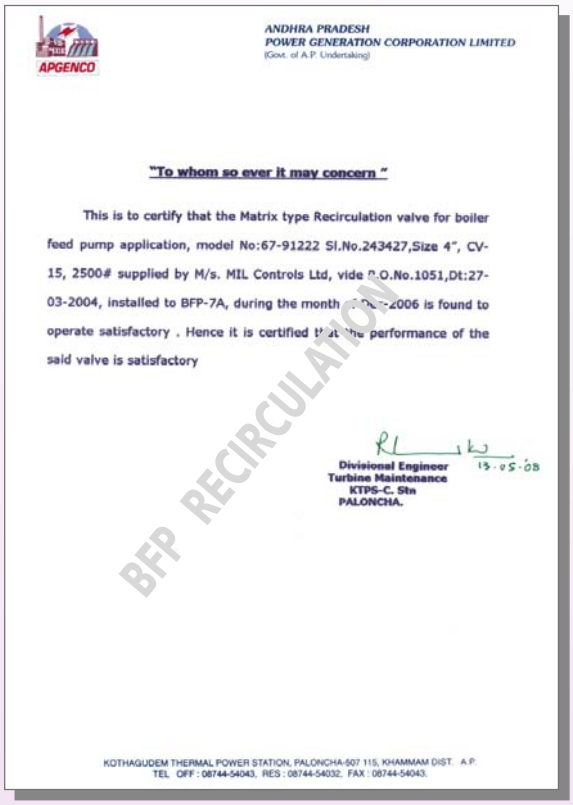
Among the best Customer Service network in India with 7 branch offices in 4 Zones. Overseas Sales support through well spread-out KSB network

High Pressure Test Bench for testing valves upto 24" size

Advanced Cf factor test Set-up

User Testimonies

Reliability in Severe Service



ANDHRA PRADESH
POWER GENERATION CORPORATION LIMITED
(Govt. of A.P. Undertaking)

APGENCO

"To whom so ever it may concern "

This is to certify that the Matrix type Recirculation valve for boiler feed pump application, model No:67-91222 Sl.No.243427,Size 4", CV-15, 2500# supplied by M/s. MIL Controls Ltd, vide P.O.No.1051,Dt:27-03-2004, installed to BFP-7A, during the month of [illegible]2006 is found to operate satisfactory . Hence it is certified that the performance of the said valve is satisfactory

Divisional Engineer
Turbine Maintenance
KTPS-C. Stn
PALONCHA.
13.05.08

BFP RECIRCULATION

KOTHAGUDEM THERMAL POWER STATION, PALONCHA-507 115, KHAMMAM DIST. A.P.
TEL OFF : 08744-54043, RES : 08744-54032, FAX : 08744-54043.

ORISSA POWER GENERATION CORPORATION LIMITED
Ib Thermal Power Station
BANAHARPALI, DIST : JHARSUGUDA, ORISSA – 768 234, INDIA

OPGC

	PHONE	FAX
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FACTORY MANAGER	+91 6645 222254	+91 6645 222225
PURCHASE	+91 6645 222210	+91 6645 222209
CONTRACT CELL	+91 6645 222224	+91 6645 222255
FINANCE	+91 6645 222252	+91 6645 222252

Lr.6721, Dt.20-09-08

TO WHOM IT MAY CONCERN

02 nos of MIL make controls (91000 series) were installed at IB Thermal Power Station in the BFP Recirculation lines on 11.03. 2006. Control valve having Sl. No. 253259 & 253260 were installed on BFP-1A & BFP-2B Recirculation line respectively. Till now the valves were functioning with out any defect.

Dy. General Manager
Mechanical Maintenance

BFP RECIRCULATION

CORPORATE OFFICE : ZONE – A, 7th FLOOR, FORTUNE TOWERS, CHANDRASEKHARPUR, BHUBANESWAR, ORISSA – 751 023, INDIA
PH: +91 674 2303765, +91 674 2303766, FAX: +91 674 2303755, +91 674 2303756, WEBSITE : www.opgc.co.in

MAHARASHTRA STATE ELECTRICITY BOARD
KHAPERKHEDA THERMAL POWER STATION
(ISO 9001:2000 accredited)

Chief Engineer (Gen O & M)
KPKD T.P.S. Khaperkheda
Dist. Nagpur - 441 102

KHG / BM / No 07399

Date> 2 JUN 2004

PERFORMANCE CERTIFICATE

TO WHOMSO EVER IT MAY CONCERN

This is to certify that ***M/s. MIL Controls Ltd. Emakulam, Kerala,*** had manufactured and supplied the Reheater Spray Control Valves and Reheater Block Valves against our Order No. KHG / BM / 01022008000 Dt. 24/09/2002. These valves are erected in Aug. 2003 in our Unit No. 2 during Annual Overhaul.

The performance of valves supplied by ***M/s. MIL Controls Ltd. Emakulam, Kerala*** against above order is satisfactory.

This certificate is being issued to party on their request vide letter no. MIL / MKTG SERV. / K'kheda / 002 Dt. 21/05/2004.

Chief Engineer (Gen. O&M)

RECEIVED ON
06 JUN 2004
MIL CONTROLS LTD.
ALUVA

REHEATER SPRAY

SYNTHITE
INDUSTRIAL CHEMICALS LIMITED

September 30, 2008

To whomsoever it may concern

We hereby certify that the ANSI 4500# control valve (Model:38-70125) supplied by MIL Controls Limited for the high pressure liquid carbon dioxide application is working satisfactorily in our super critical Carbon dioxide extraction plant. The support provided by MIL's team in retrofitting the original valve has been excellent.

For Synthite Industrial Chemicals Ltd.

Saji K Mathews
Assistant General Manager (Engineering)

4500 ANSI ANGLE VALVE

Synthite Valley, Kolenchery 682 311, India
Phone : 91 484 3051200, 3051300 Fax : 91 484 3051351
E-mail : synthite@synthite.com • Web : www.synthite.com

Corporate Headquarters : Ajay Vihar, M G Road, Cochin-682 016
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MIL Controls Limited

A KSB Company

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CAT / MATRIX / REV.B / 03.2009