Atwood & Morrill Co., Inc.

Valve and Flow Control Equipment Specialists Since 1900

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ABOUT ATWOOD & MORRILL...

When A&M began operations, its sole product was a single seat, piston type reducing valve. From this modest start A&M developed engineering and manufacturing capabilities producing a growing line of products for the steam lines of New England's mills, such as steam traps, regulators, back pressure valves and check valves. In 1929, A&M introduced its Free Flow Reverse Current Check Valve for turbine extraction applications. The modern version continues to be the power industry standard for turbine protection.

Currently, A&M is a leading manufacturer and supplier of high technology valves to the power industry. A&M is best known for Check, Gate and Globe Valves. Standard A&M valves are designed to ANSI standards. Nuclear service valves meet ASME Section lll, Class 1, 2, or 3 requirements. A&M also supplies valves to the process, petroleum, chemical, steel and pulp and paper industries. A&M is a power plant valve specialist meeting the following needs: Fossil Plants, Coal Burning Plants, Nuclear Plants, Boiling Water Reactors and Pressurized Water Reactors, Combined Cycle Gas Plants, Simple Cycle Plants, Geothermal Plants and Cogeneration Plants. Our quality and management systems are ISO 9001 certified for Design, Manufacture and Service at both our Washington, North Carolina, and Salem, Massachusetts, plants.

We understand that our customer responsibility does not end with the sale. Our highly computerized company-wide communication network uses the latest information technology systems to assure efficient Contract Administration and rapid response to customer delivery needs.

Behind each valve we sell, stand capable Spare Parts and Field Service departments, working closely with Engineering and Manufacturing groups to assure total product satisfaction. Comprehensive instruction manuals and customer training schools provide classroom and shop training for installation and maintenance knowledge.

In 1995, Atwood & Morrill acquired the TRICENTRIC® product line. TRICENTRIC®, a unique sealing butterfly valve, has process, commercial power, and nuclear applications. Its metal seat is inherently fire safe as verified by testing to API 607 4th edition.

Atwood & Morrill has built its reputation and success on the development of new technology, with uncompromising standards of design excellence, product quality and integrity. Every valve that carries the A&M name meets these strict standards.

Salem, Massachusetts Plant

PHYSICAL PLANT AREA

Indoors:	86,400 square feet
Outdoors:	73,738 square feet

WELDING EQUIPMENT WITH ASME CODE QUALIFIED WELDERS

Processes include:

Shielded Metal Arc

Gas Tungsten Arc

Gas Metal Arc

Plasma Arc

QUALITY ASSURANCE EQUIPMENT & CERTIFIED NON-DESTRUCTIVE EXAMINATION LEVEL 1 PERSONNEL

in Radiography, Liquid Penetrant, Magnetic Particle and Ultrasonic Tests

PRESSURE AND LEAK TIGHTNESS EQUIPMENT

High Pressure:	MSIV, 40"+ Valves to 10,000 psi
Medium Press:	Check Valves, 1,500 to 10,000 psi
Low Pressure:	Valves, 150 to 1,000 psi

QUALITY PROGRAMS

Quality Policy Manual — ISO 9001

Quality Assurance Manual — Nuclear (10 CFR 50 Appendix B)

Quality Assurance Manual Adjunct (CMS) — Nuclear Safety Related Program

SHIPPING FACILITIES

Truck:	From plant at Salem, Massachusetts
Air:	From Boston, Massachusetts (15 Miles)
Ocean:	From Boston, Massachusetts (15 Miles) From New York, New York (200 Miles)

NORTH CAROLINA

Washington, North Carolina Plant

PHYSICAL PLANT, AREA

Indoor area: 40,000 square feet

Outdoor area: 3,087,040 square feet

Crane Capacity: 20 Ton Capacity
High Bay

5 Ton Capacity Low Bay

WELDING EQUIPMENT WITH ASME CODE QUALIFIED WELDERS

Processes include:

Shielded Metal Arc

Gas Tungsten Arc

Gas Metal Arc

QUALITY ASSURANCE EQUIPMENT & CERTIFIED NON-DESTRUCTIVE EXAMINATION LEVEL 1 PERSONNEL

in Radiography Test, Liquid Penetrant, Magnetic Particle and Ultrasonic Tests

PRESSURE AND LEAK TIGHTNESS EQUIPMENT

Medium Press: to 15,000 psi

QUALITY PROGRAMS

Quality Policy Manual — ISO 9001

Quality Assurance Manual Adjunct (CMS) — Nuclear Safety Related Parts

SHIPPING FACILITIES

Truck: From plant at Washington, North Carolina

Air: From Greenville, North Carolina (23 Miles)
From New Bern, North Carolina (15 Miles)

Ocean: From New York, NY (700 Miles)
From Norfolk, Virginia (100 Miles)
From Savannah, Georgia (210 Miles)
From Wilmington, North Carolina (120 Miles)

The American Society of Mechanical Engineers

CERTIFICATE OF AUTHORIZATION

This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Code symbol and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

ATWOOD & MORRILL CO., INC.
285 CANAL STREET
SALEM, MASSACHUSETTS 01970

SCOPE:

CLASS 1, 2 & 3 CONSTRUCTION OF VALVES AND AS A MATERIAL ORGANIZATION SUPPLYING FERROUS & NONFERROUS MATERIAL AT THE ABOVE LOCATION ONLY

CERTIFICATE NUMBER: **N-2606**

CHAIRMAN OF THE BOILER AND PRESSURE VESSEL COMMITTEE

DIRECTOR, ACCREDITATION AND CERTIFICATION

The American Society of Mechanical Engineers

CERTIFICATE OF AUTHORIZATION

This certificate accredits the named company as authorized to use the indicated symbol of the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the Code symbol and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this symbol shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

ATWOOD & MORRILL CO., INC.
285 CANAL STREET
SALEM, MASSACHUSETTS 01970

SCOPE:

CLASS 1, 2 & 3 FABRICATION WITH DESIGN RESPONSIBILITY OF APPURTENANCES AND SUPPORTS AND AS A MATERIAL ORGANIZATION SUPPLYING FERROUS & NONFERROUS MATERIAL AT THE ABOVE LOCATION ONLY

CERTIFICATE NUMBER: **N-2607**

CHAIRMAN OF THE BOILER AND PRESSURE VESSEL COMMITTEE

DIRECTOR, ACCREDITATION AND CERTIFICATION

ISO 9001

CERTIFICATE

The TÜV CERT Certification Body
of TÜV Management Service GmbH

certifies in accordance
with TÜV CERT procedures that

Atwood & Morrill Co. Inc.

285 Canal Street
Salem, MA 01970
USA

Old Bath Highway 264
Washington, NC 27889
USA

has established
and applies a quality system for

Design, Manufacture and Service of
Valves and Flow Control Equipment

An audit was performed, Report No. **24007416**

Proof has been furnished that the requirements
according to

DIN EN ISO 9001 :1994

Certificate Registration No. **12 100 4475**

TÜV CERT
ISO 9001

TGA-ZM-18-96-00

TÜV
MANAGEMENT SERVICE

TÜV CERT Certification Body
of TÜV Management Service GmbH
Unternehmensgruppe TÜV Süddeutschland

FREE FLOW REVERSE CURRENT VALVE

Atwood & Morrill Free Flow Reverse Current Valves are designed to give maximum protection to extraction steam turbines. Their rapid, tight closure insures that the high level of energy found in feed-water heaters or process lines is quickly isolated from the turbine in the event of a load rejection.

The power cylinder is designed to give a strong closing moment to the valve when signalled to do so by plant instrumentation. A lost motion feature allows the valve disc to close independently of the power cylinder.

APPLICATIONS

Turbine Protection

Extraction steam non-return

Bled steam non-return

Over 70 years of experience

SPECIFICATIONS

Design Standard:	ANSI B16.34 and applicable international specifications as required
Pressure Classes:	ANSI 150-1500
Sizes:	Cast construction 3"-44"
Materials:	Carbon steel, alloy steel and stainless steel per ASTM specifications or applicable international standards
Trim:	Stainless steel ASTM A479 Type 410
Seats:	Stainless steel overlay or hardfacing alloy
Bonnet Design:	Bolted bonnet with non-asbestos gasket
End Connections:	Butt weld or flange end
Power Cylinder:	Pneumatic or hydraulic
Drain Connections:	As required
Limit Switches:	1, 2, or 3 SPDT or DPDT switches available
Cylinder Valves:	Solenoid operated air valves or pilot operated oil relay valves
Exerciser Valves:	Optional solenoid or manual valves available
Special Features:	Low friction stuffing boxes - standard Very low friction mechanical seals - optional (can not be overtightened) Nondestructive examination as required by customer specification or ANSI B16.34 Special Class
Installation:	Horizontal or vertical upflow as specified.

FREE FLOW REVERSE CURRENT VALVE

DESIGN FEATURES

The important role of a Non-Return Valve as a protective device demands a high level of reliability. The features found in all Atwood & Morrill Free Flow Reverse Current Valves assure that reliability. These features along with a high grade of workmanship and materials assure a superior and completely dependable valve.

Free Swinging Disc

(Fig. 1) Atwood & Morrill utilizes a basic swinging disc Check Valve design. This uncomplicated design provides independent movement of the disc in the flow stream with fast closure upon loss or reversal of flow. The valve disc is of sturdy construction to prevent distortion under full design pressure.

Self Aligning Disc and Disc Arm

(Fig. 2) The disc and disc arm assembly are self aligning with the seat, assuring tight sealing. An internal stop provides the proper degree of disc opening while maintaining the edge of the disc within the flow stream, so that flow reversal will cause closure.

Inclined Seat Design

(Fig. 3) Atwood & Morrill Free Flow Reverse Current Valves have an inclined seat to improve the performance and operating characteristics of the valve. This design offers advantages not available with other seat configurations.

The inclined seat combined with flat disc and body seat contact provides the best configuration available in Check Valve design.

An opening angle of 75° from the vertical or 45° from the inclined seat results in low pressure drop.

The reduced swing also enables the valve to close quickly. Full opening with a vertical seat would require a greater swing and a longer closing time.

The center of gravity of the disc assembly causes a positive seating moment, therefore, the weight of the disc is always acting to seat it and hold it firmly against its seat. A portion of the disc weight can be counterbalanced in larger valves to reduce pressure drop at low flows, so the flow is not required to raise the full weight of the disc.

The Atwood & Morrill inclined seat design features - ***POSITIVE, TIGHT SEATING - FAST CLOSURE - LOW PRESSURE DROP*** - all important Check Valve considerations.

Figure 1

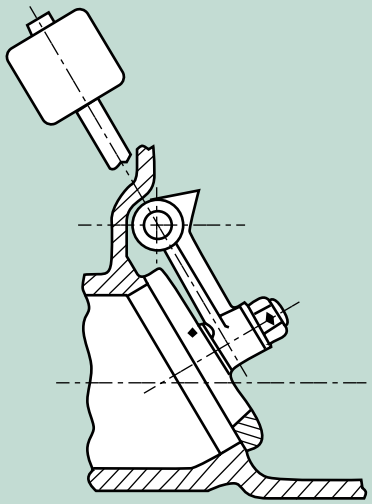


Figure 2

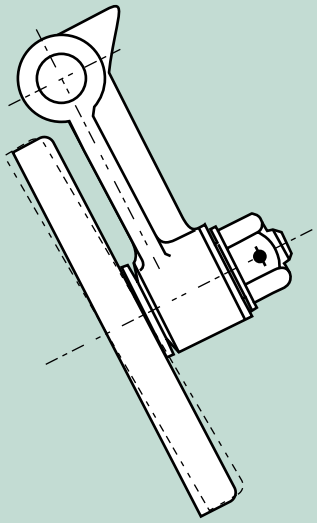
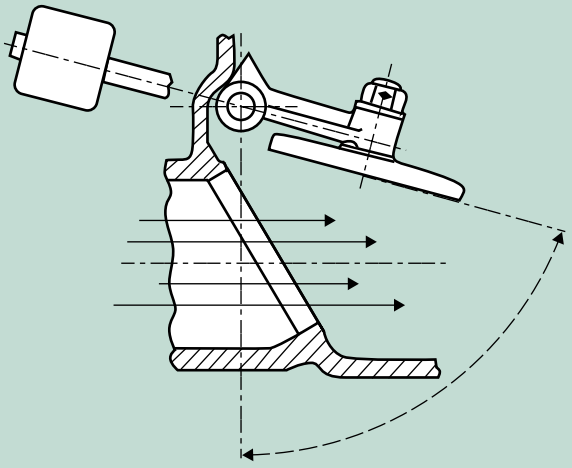


Figure 3



FREE FLOW REVERSE CURRENT VALVE

Figure 4

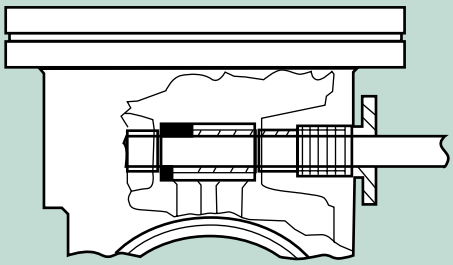


Figure 5

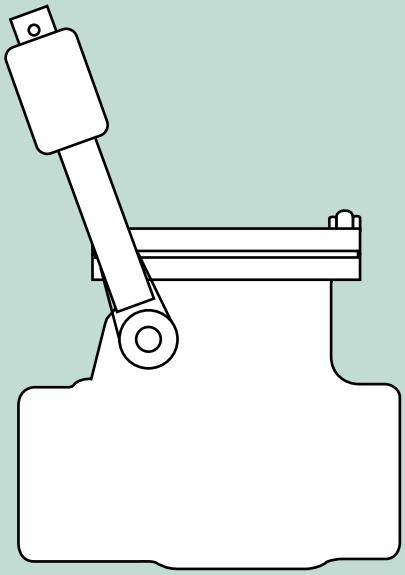
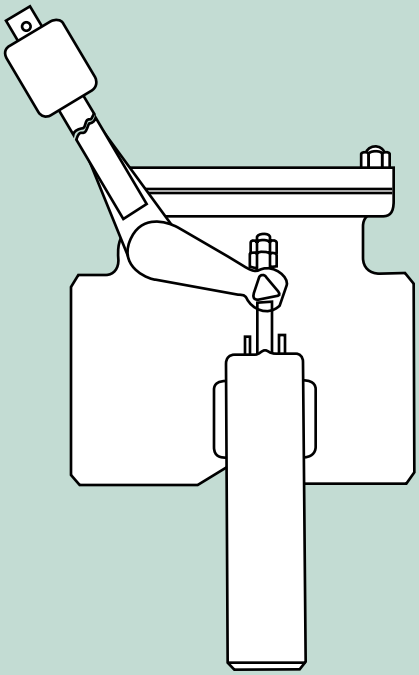


Figure 6



DESIGN FEATURES

Shaft and Bushing Assembly

(Fig. 4) Large diameter stainless steel shafts together with hardened stainless steel bushings are used on all A&M Free Flow Reverse Current Valves. The results are lower stresses, less wear and longer life.

Positive Closing

The powerful spring in the power cylinder assures rapid positive closing before reverse flow can occur.

Balanced Shaft Construction - Internal Lost Motion Device

An "internally balanced" design is standard on all 12" and smaller valves equipped with a closure assisting cylinder. This feature eliminates stuffing box friction and shaft end thrust which might prevent free swinging of the valve disc.

Valve Body & Bonnet

Atwood & Morrill employs a streamlined body contour designed for minimum flow resistance. Heavy body wall thickness assures rigidity and resistance to pipe strain distortion. A bolted top cover is provided for ease of access to valve internals, thus the valve need not be removed from the line for maintenance and inspections.

External Lever

(Fig. 5) Valves of all sizes are available with shaft mounted lever to manually exercise the valve. Larger size valves are supplied with a counter weight to reduce pressure drop at low flows to maintain full disc opening and reduce disc slamming.

Cylinder Operated

(Fig. 6) Spring loaded positive closing air cylinders can be provided on all Free Flow Reverse Current Valves. Oil operated cylinders are also available. Oil cylinders may be ordered with an optional oil relay valve. Both types can be exercised by a lever operated Test Valve or Solenoid Valve.

FREE FLOW REVERSE CURRENT VALVE

APPLICATIONS FOR TURBINE EXTRACTION SYSTEMS

Air Operated Systems

Figure 7 shows an A&M Air Operated Free Flow Reverse Current Valve operated by turbine overspeed trip and high water level in the feedwater heater.

The oil operated Air Relay Dump valve (normally supplied by the turbine manufacturer) translates oil pressure from the turbine overspeed trip system into air pressure. With oil pressure established, compressed air flows through the Air Relay Dump Valve with the atmospheric vent closed. Upon loss of oil pressure due to turbine overspeed trip, incoming air pressure is closed off, and the atmospheric vent is opened to release air pressure from the Check Valve cylinder. This action allows the spring force to assist in closing the Free Flow Reverse Current Valve. IT IS IMPORTANT THAT THE SOLENOID OPERATED 3-WAY VALVE USED ALLOWS FLOW IN THE REVERSE DIRECTION.

The Solenoid Operated 3-Way Valve is installed in the air supply line to the cylinder. Upon receipt (or loss) of an electrical signal from the heater high water level alarm, the Solenoid Valve trips, closing the air supply and opening the vent to atmosphere.

Air is exhausted from the air cylinder, and the spring starts to close the valve.

The lever operated Air Test Valve equalizes pressure on both sides of the cylinder piston so that the spring force moves the piston downward and exercises the valve during operation.

The system shown in Figure 8 differs from Figure 7 as the oil operated Air Relay Dump Valve is replaced by an oil pressure switch which converts the loss of oil pressure due to a turbine overspeed trip to an electrical signal. This signal is connected to the solenoid valve in series with the heater high water level alarm circuit and trips the solenoid operated 3-Way Valve as in Figure 7.

The quick exhaust valve shown in Figure 8 senses a loss of pressure at its inlet and will shift allowing the air cylinder to exhaust more rapidly through its vent port. This valve can be used in any control system and is recommended whenever a solenoid valve with a low Cv factor is used.

Local exercising of the Free Flow Reverse Current Valve can also be accomplished by actuating an integral test switch on the solenoid operated 3-Way Valve. Using this method for exercising, the solenoid valve is exercised as well as the Free Flow Reverse Current Valve.

Combinations of control systems shown in Figures 7 and 8 can also be used.

Control for Turbine Extraction Systems

Figure 7

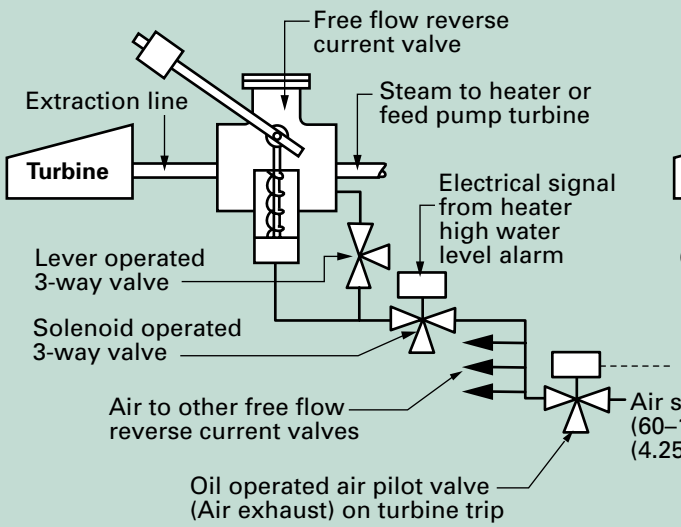
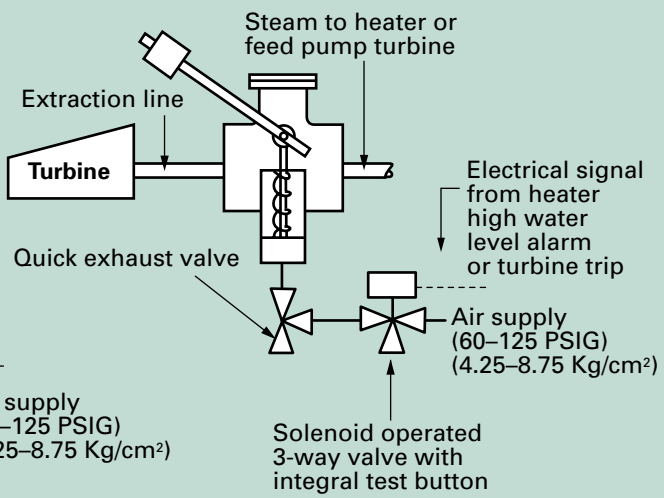


Figure 8



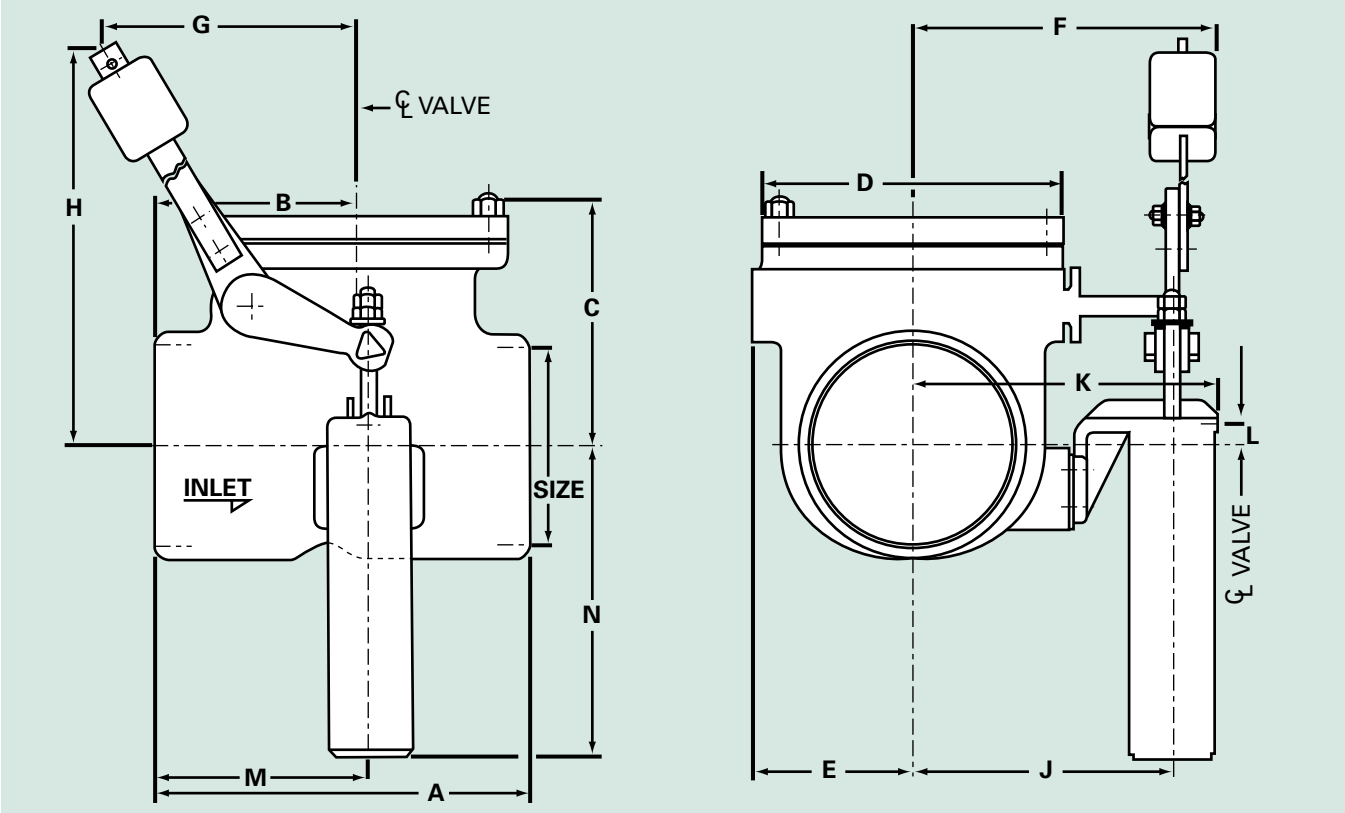
FREE FLOW REVERSE CURRENT VALVE

DIMENSIONS

CLASS 150 - 300

SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	Weight Lbs.	CV
4	14	7.75	10.75	9.00	6.75	–	–	–	12.06	15.13	3.88	7.75	18.75	300	510
6	14.00	7.75	10.75	9.00	6.75	–	–	–	12.06	15.13	3.88	7.75	18.75	300	870
8	21.00	9.63	13.69	12.50	7.00	–	–	–	13.25	16.13	.69	10.75	15.50	490	1180
10	22.7	11.00	15.50	16.00	9.00	–	–	–	14.75	17.63	.88	10.25	14.00	700	3180
12	24.75	11.50	15.50	17.88	9.31	–	–	–	15.75	18.63	.94	10.50	14.00	730	4810
14	24.00	12.13	16.75	19.50	11.38	18.00	16.00	24.50	16.63	19.50	1.88	10.00	13.00	1100	6300
16	26.00	14.00	19.25	21.75	11.25	19.50	17.13	26.25	17.88	20.75	2.38	13.88	19.31	1900	8940
18	29.00	15.50	21.50	25.00	13.25	21.50	17.00	25.88	19.63	22.50	3.69	14.50	18.00	2100	10720
20	31.00	17.38	23.00	26.25	14.63	24.50	20.88	31.75	22.63	25.50	5.19	15.00	16.50	3100	13650
24	37.00	19.50	24.75	30.00	12.63	24.50	27.00	42.00	22.63	25.50	6.50	16.00	15.19	3700	17050
26	44.00	22.50	27.00	34.00	–	27.50	24.25	34.00	23.88	26.75	–	16.38	13.50	3850	24120
28	46.00	23.50	28.50	34.00	–	27.50	24.25	34.00	23.88	26.75	–	17.38	13.50	3960	25120
30	50.00	25.00	28.25	36.75	–	29.00	23.13	30.75	24.25	27.13	–	17.94	13.50	5200	29800
32	50.00	25.00	28.25	36.75	–	29.00	23.13	30.75	24.25	27.13	–	17.94	13.50	5200	36200
34	53.00	26.50	34.38	40.00	32.13	31.25	28.00	40.13	26.63	29.50	12.13	17.69	9.56	5800	–
36	53.00	26.50	34.38	40.00	32.13	31.25	28.00	40.13	26.63	29.50	12.13	17.69	9.56	6100	40120
42	66.00	33.00	45.00	49.00	35.38	34.75	41.63	64.25	29.88	32.75	17.50	21.50	4.19	14250	58320
44	66.00	33.00	45.00	49.00	35.38	34.75	41.63	64.25	29.88	32.75	17.50	21.50	4.19	14250	58320

NOTE: ALL DIMENSIONS IN INCHES



FREE FLOW REVERSE CURRENT VALVE - TABLE OF DIMENSIONS

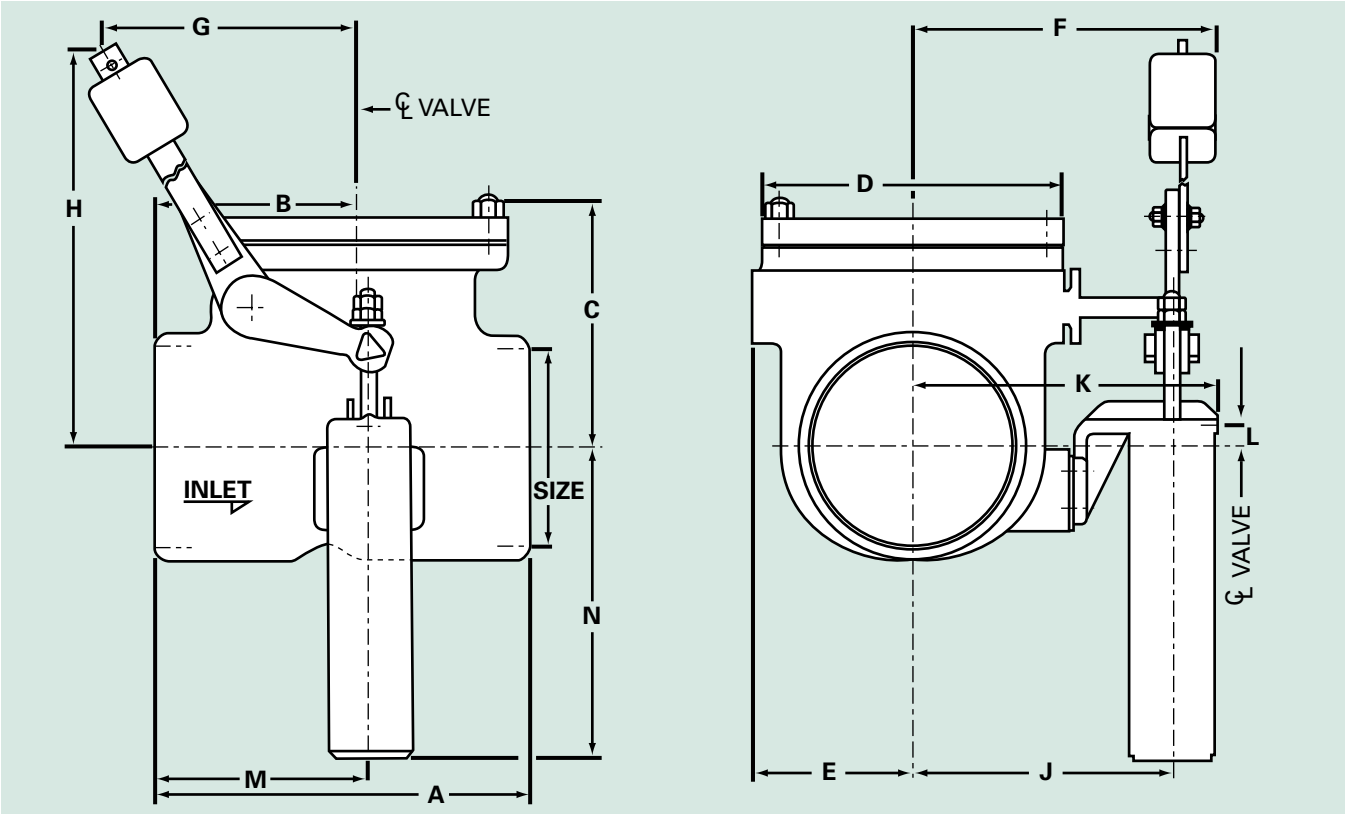
CLASS 400 - 600

SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	Weight Lbs.	CV
4	14	7.75	10.75	10	6.19	–	–	–	9.75	12.75	3.88	7.75	18.5	300	510
6	14	7.75	10.75	10	6.19				9.75	12.75	3.88	7.75	18.5	300	870
8	21	11.5	16.5	15	9	–	–	–	14.13	17	0.25	11.75	14.63	650	2500
10	22.75	12	19.19	18.63	9.69	–	–	–	14.5	17.38	1.5	10.69	13.38	970	4025
12	24.75	12.75	19.75	21.5	9.5	–	–	–	15.63	18.5	1.88	10.63	13	1470	5960

CLASS 900

SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	Weight Lbs.	CV
8	21	11.5	19.81	18	10.38	–	–	–	15.13	18	0.25	11.75	14.63	800	2500
10	22.75	12	21.38	19	9.88	–	–	–	14.5	17.38	1.5	10.69	13.38	1150	4025

NOTE: ALL DIMENSIONS IN INCHES



COLD REHEAT CHECK VALVES

The Atwood & Morrill Cold Reheat Check is a reliable, sturdy valve that protects the High Pressure (HP) Steam Turbine from damage caused by reverse flow during unit trip.

In newer Rankine and Combined Cycle plants the Cold Reheat Check Valve must also accommodate the increased demands of a Turbine Bypass System and isolate the HP Turbine Exhaust when the bypass is in use.

APPLICATIONS

Rankine and Combined Cycle Power Plants with Reheat

Prevents Reheat Steam from Returning to Turbine on Trip

Simplifies Hydrotesting of the Reheater.

Protects the High Pressure Turbine Exhaust from Bypass Steam and Water when the Turbine Bypass system operates.

Isolates High Pressure turbine exhaust when auxiliary steam is supplied to the IP turbine in a combined cycle unit, to synchronize the steam turbine generator or start the gas turbine on a single shaft machine.

FEATURES

Proven, Swinging Disc Design

Wide, Flat, Non-jamming Seats for Tight Seal

Closure Assisting or Double Acting Air Cylinder

Smooth Flow Passages for Low Pressure Drop

In Line Maintenance through Bolted Top Cover

Inclined Seat for Short Travel & Quick Operation

Rugged Construction

Ability to Withstand Multiple Rapid Closures

OPERATION

During normal operation, the Atwood & Morrill Cold Reheat Check is open to forward flow. It becomes a critical, quick closing valve which protects the turbine during trips or equipment failure.

42" Class 600 Cold Reheat Check

DEMANDS

Quick Acting, Turbine Bypass Systems rapidly change pressure and flow in the reheat piping, requiring the Cold Reheat Check valve to close quickly.

The frequent Start ups and Shutdowns of Cycling Units require the Cold Reheat Check valve to operate several times per day.

Very Tight Sealing is necessary to prevent steam and water from entering the HP turbine.

Low pressure drop is important to overall combined cycle unit performance.

AVAILABLE

Sizes:	20" to 42" and ANSI Classes 300 to 600
Materials:	Carbon and Alloy Steels

SIZING AND SELECTION

Proper sizing requires verification of flow conditions. Ideally the disc should be in the Full Open Position, Not Chattering or Fluttering in Flow Stream. This allows for Low Wear and Low Pressure Drop.

The counterweight must be properly sized to allow optimum operating conditions and full open disc.

COLD REHEAT CHECK VALVES

BLOWDOWN COVERS FOR COLD REHEAT CHECK VALVES

The Atwood & Morrill Blowdown Cover allows cleanout/blowdown of the pipeline to be easily and efficiently done. The simple design bolts on in place of the valve's existing cover and provides an easy blowdown connection. An optional blowdown disc can also be supplied when large amounts of damaging debris are anticipated.

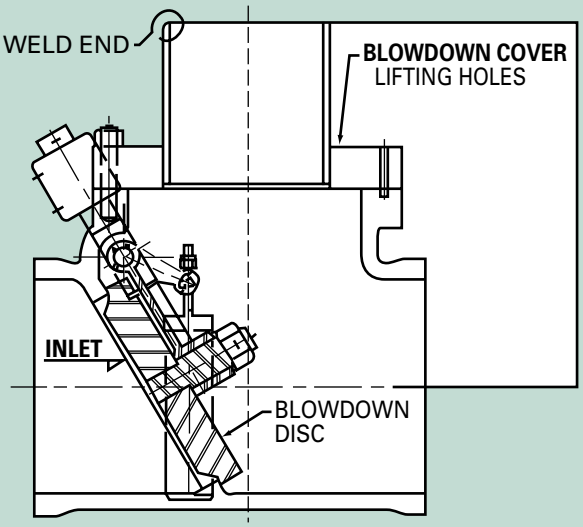
CONSTRUCTION

The fabricated blowdown cover has a weld end for easy pipe connection and lifting holes for easy removal after blowdown is complete. The optional valve disc is carbon or alloy steel.

OPERATION

After startup and blowdown, the Cold Reheat Check Valve's standard cover is replaced.

When using Cold Reheat Check Valves consider your blowout requirements carefully. When blowdown is started upstream of the Cold Reheat Check Valve, remove the disc to prevent damage. A seat protector ring is available. When blowdown is required but a cover is not provided, field fabrication can be time consuming. If blowdown is expected to carry a lot of debris, an additional disc may be useful. For help meeting your system's requirements, contact A&M's sales or service department.



A&M has 70 Years Extraction and Reheat Steam Service Experience.

44" Cold Reheat Check Valves

COLD REHEAT CHECK VALVES - TABLE OF DIMENSIONS

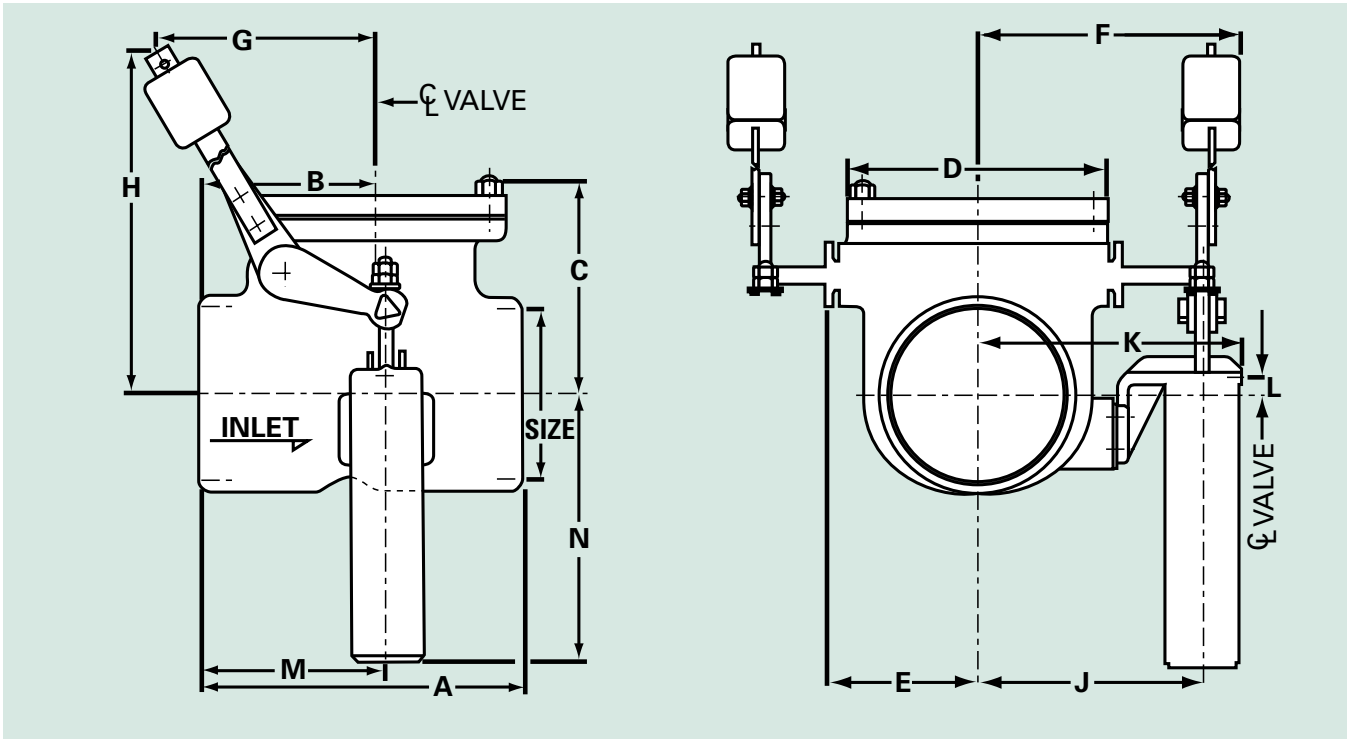
CLASS 300

SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	Weight Lbs.	CV
28	46.00	23.50	28.50	34.00	–	27.50	24.25	34.00	23.88	26.75	–	17.38	13.50	3960	25120
30	50.00	25.00	28.25	36.75	–	29.00	23.13	30.75	24.25	27.13	–	17.94	13.50	5200	29800
32	50.00	25.00	28.25	36.75	–	29.00	23.13	30.75	24.25	27.13	–	17.94	13.50	5200	36200
34	53.00	26.50	34.38	40.00	32.13	31.25	28.00	40.13	26.63	29.50	12.13	17.69	9.56	5800	–
36	53.00	26.50	34.38	40.00	32.13	31.25	28.00	40.13	26.63	29.50	12.13	17.69	9.56	6100	40120
42	66.00	33.00	45.00	49.00	35.38	34.75	41.63	64.25	29.88	32.75	17.50	21.50	4.19	14250	58320
44	66.00	33.00	45.00	49.00	35.38	34.75	41.63	64.25	29.88	32.75	17.50	21.50	4.19	14250	58320

CLASS 600

SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	Weight Lbs.	CV
14	28.00	14.00	21.75	24.00	11.25	19.00	17.13	26.25	17.88	20.75	4.19	13.81	19.31	2100	8050
16	28.00	14.00	21.75	24.00	11.25	19.00	17.13	26.25	17.88	20.75	4.19	13.81	19.31	2100	8470
18	30.00	15.00	25.38	27.00	12.50	22.25	16.88	26.38	19.00	21.88	4.19	14.00	17.56	2750	10780
20	33.00	17.38	29.50	29.25	16.00	25.81	20.88	31.75	22.63	25.50	4.19	16.00	17.56	3100	13460
24	44.00	22.00	38.63	37.00	–	29.25	22.75	34.00	23.75	26.63	9.50	16.50	12.25	7600	19960
26	44.00	22.00	38.63	37.00	–	29.25	22.75	34.00	23.75	26.63	9.50	16.50	12.25	7600	23560
28	50.00	27.13	32.00	37.00	–	29.50	26.00	35.13	24.25	27.13	8.25	19.81	13.50	7800	27500
30	50.00	27.13	32.00	37.00	–	29.50	26.00	35.13	24.25	27.13	8.25	19.81	13.50	7800	32330
32	55.00	27.50	36.50	42.00	–	31.75	32.00	45.50	27.13	30.00	11.00	18.69	10.75	9500	37650
34	55.00	27.50	36.50	42.00	–	31.75	32.00	45.50	27.13	30.00	11.00	18.69	10.75	9500	43425
36	59.00	29.50	43.75	47.50	–	33.50	35.25	50.13	28.50	31.88	13.75	18.31	8.00	15000	49665
38	59.00	29.50	43.75	47.50	–	33.50	35.25	50.13	28.50	31.88	13.75	18.31	8.00	15000	56425

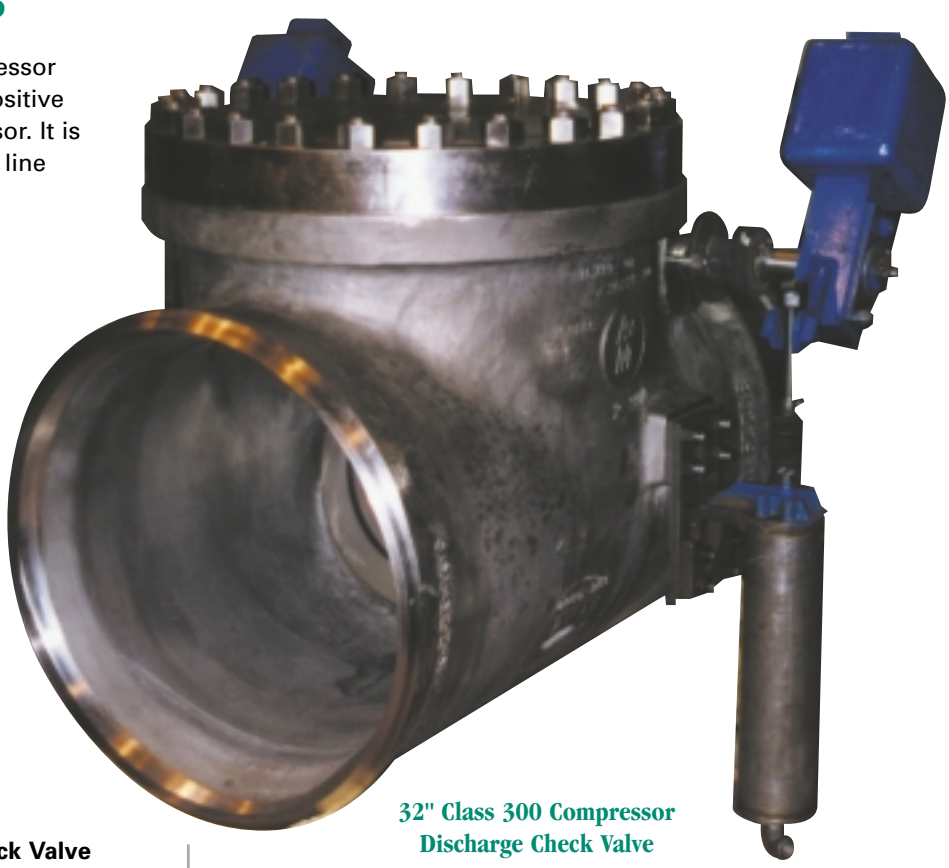
NOTE: ALL DIMENSIONS IN INCHES



COMPRESSOR CHECK VALVES

The Atwood & Morrill Co. Inc. Compressor Check Valve is designed to provide positive protection for the blower or compressor. It is installed in the compressor discharge line when specified as:

- Tight sealing pressure
- Low differential pressure
- Power assisted
- Dashpot, non-slam valve



32" Class 300 Compressor Discharge Check Valve

APPLICATIONS

Fluid Catalytic Cracking Air Blower Discharge

Compressor Discharge and Process Application

Fluids: Hydrocarbon (Cracked Gas), Ethylene, Propylene, Other Process Fluids

OPERATION/FEATURES

The A&M Compressor Discharge Check Valve is important in providing protection for critical equipment.

CLOSURE ASSIST AIR CYLINDER

The Compressor Check Valve operates normally with the disc in the open position for long periods. To ensure the check valve will close in the event of a blower/compressor trip, it is furnished with a closure assist air cylinder. Upon loss of power to the drive device of the blower/compressor, a three-way solenoid valve is de-energized. When the solenoid valve is tripped, the side air cylinder is vented allowing the internal spring to apply a closing force to the lever arm which, in turn, rotates the shaft and disc assembly to the closed position.

EXTERNAL COUNTER WEIGHTS

External counter weights help the valve remain in the full open position at normal operating flow. These weights counter balance approximately 50% of the disc closing moment assuring the valve disc will be fully open providing the lowest pressure drop possible. A&M check valves will be fully open at lower flow rates compared to conventional swing or wafer type check valves.

OIL DASHPOT

Years of experience with blower check valves has indicated that the valve disc will tend to flutter at various flow rates. This constant motion during operation may result in premature packing wear and/or valve failure. To prevent this flutter motion, A&M Compressor check valves are supplied with an oil dashpot which can be adjusted to dampen the motion and reduce disc slamming.

DEPENDABILITY

Compressor Check Valves are protective devices critical to safeguard the compressor/blower systems. A&M valves are designed to be completely reliable over extended periods of time. Severe damage may occur if the disc in a check valve is prevented from self closure. The A&M Compressor Check Valve offers positive protection against sticking or hang-up and insures rapid, reliable closing in the event of a trip-out or system shutdown.

COMPRESSOR CHECK VALVES

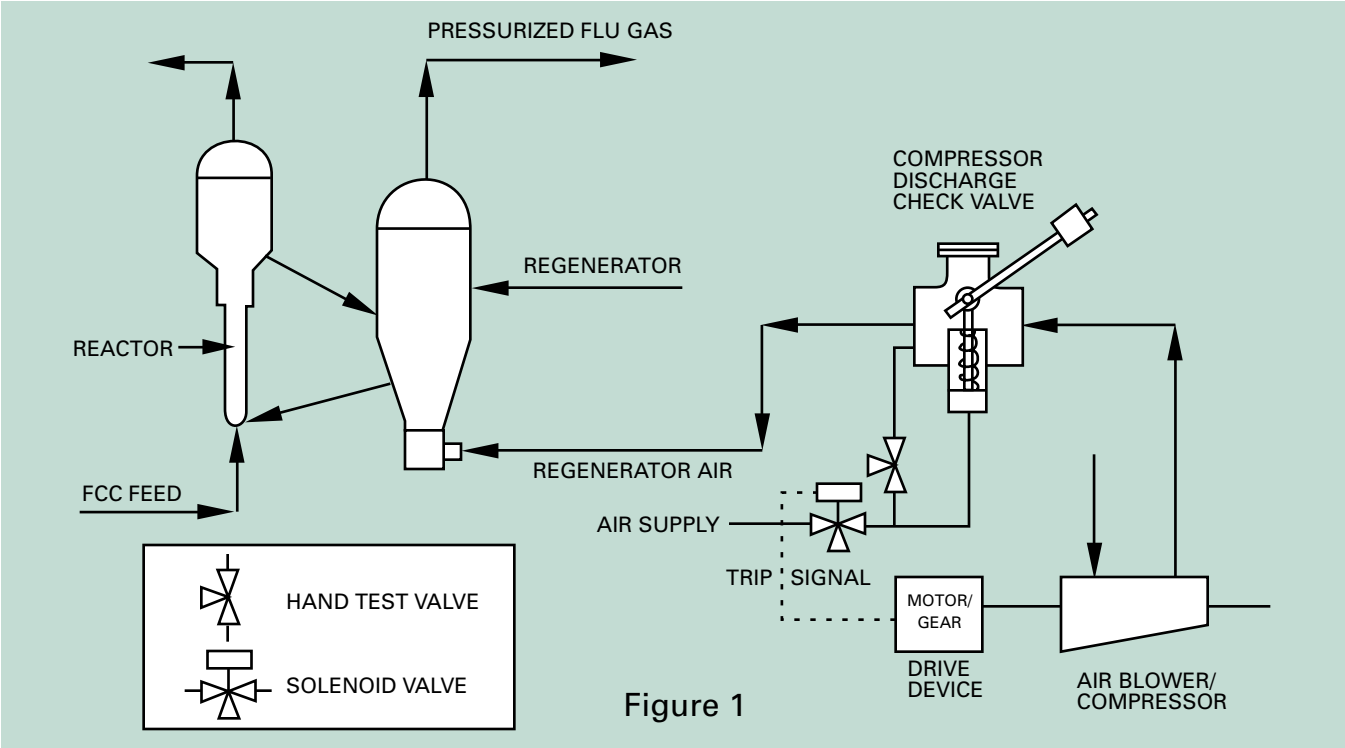
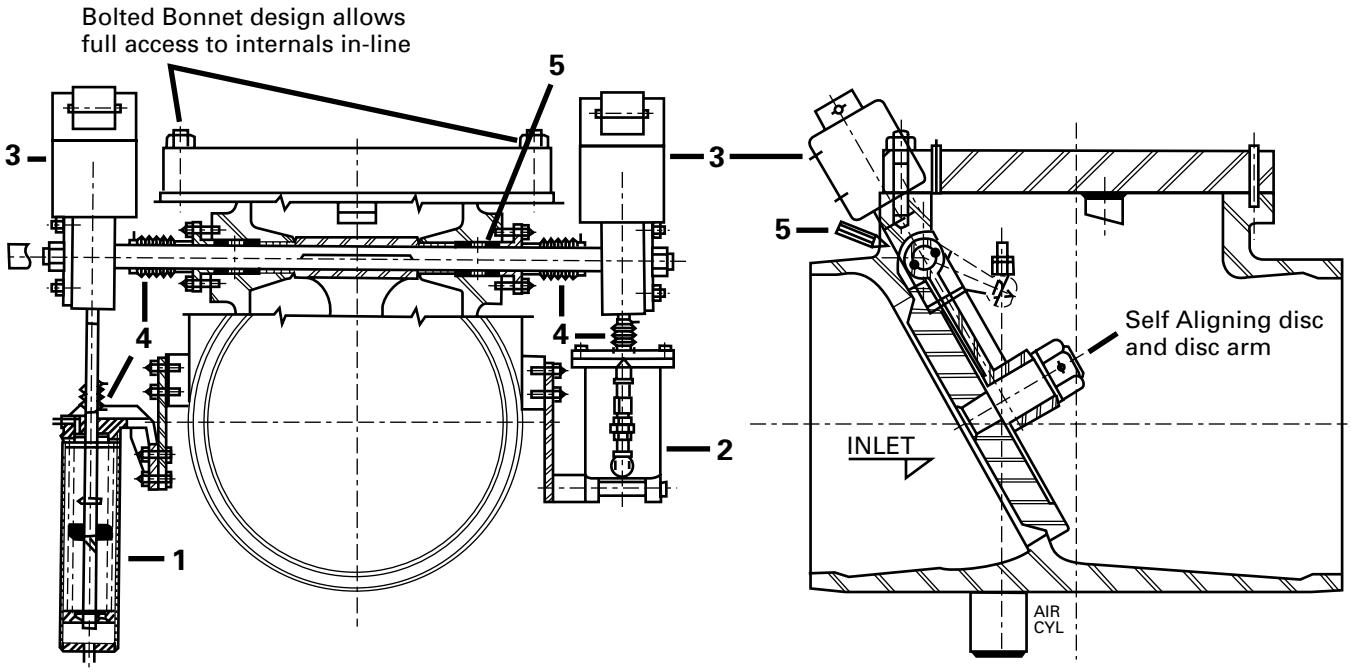


Figure 1

Typical Installation of A&M Compressor Discharge Check Valve in a Fluid Catalytic Cracking Process Unit



1 - Closure Assist Air Cylinder
2 - Oil Dashpot
3 - Counterweights act to counterbalance the disc providing the lowest pressure drop
4 - Protective Sleeves cover external linkages
5 - Lubricated Stuffing Boxes

COMPRESSOR CHECK VALVES

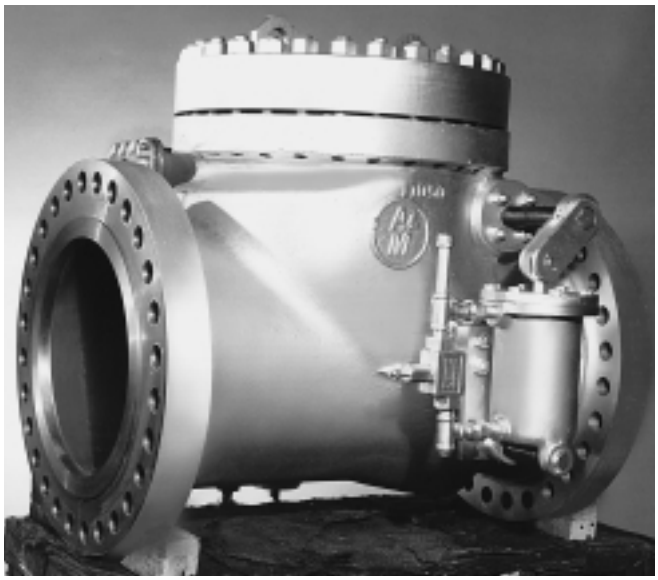
MATERIALS

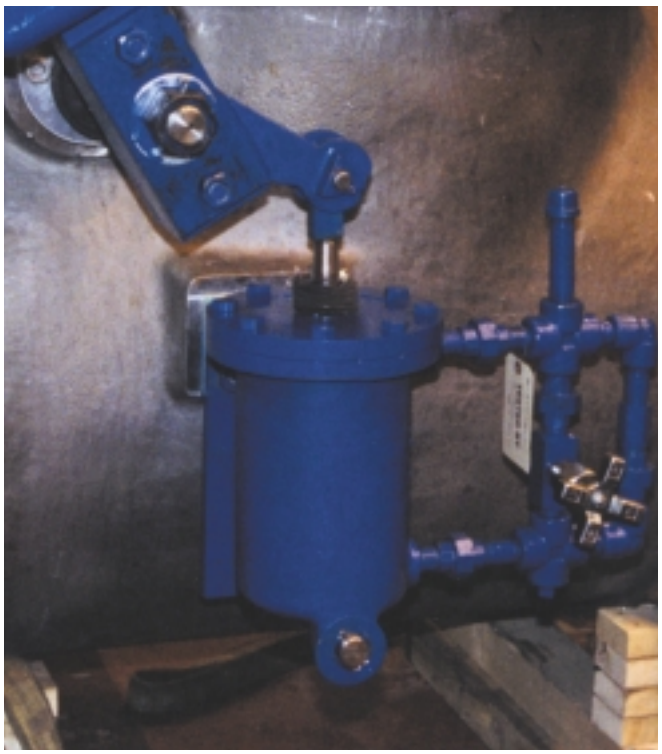
Cast Carbon, Alloy and Stainless Steel

CONSTRUCTION

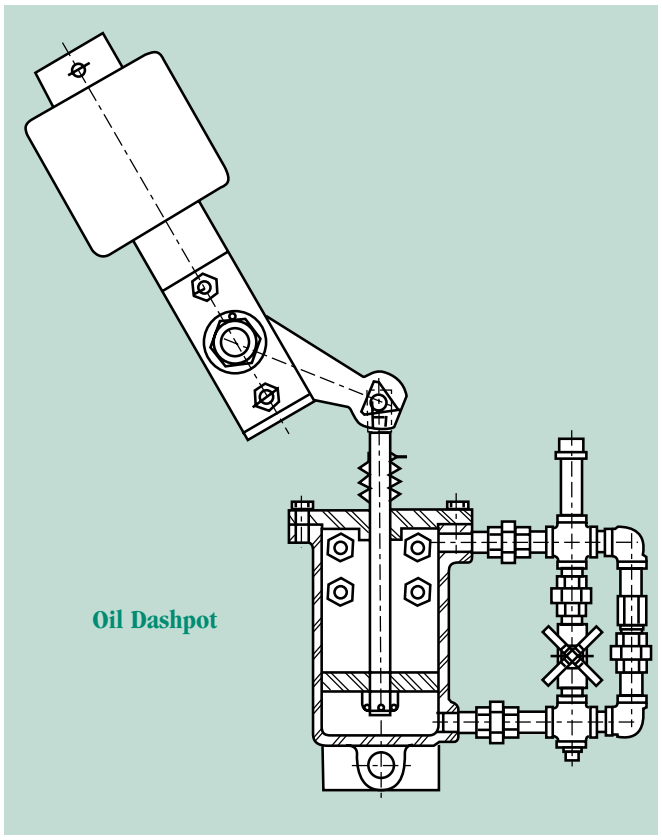
Design Standard:	ANSI B16.34
Sizes:	4 - 60 inches sizes 44" thru 60" (fabricated)
Pressure Ratings:	ANSI Class 150 through 2500
Cover Design:	Bolted Bonnet (pressure seal for class 900 and higher)
End Connection:	Butt weld or flanged
Positive Closing Device:	Spring loaded cylinder (air controlled)
Disc Stabilization:	Oil Dashpot
Body Type:	Swinging disc design with inclined seat
Optional Equipment:	Hand Test valve Three-way solenoid valve Limit switches Protective Sleeves

Compressor Check Valve with Oil Dashpot





Actual Oil Dashpot

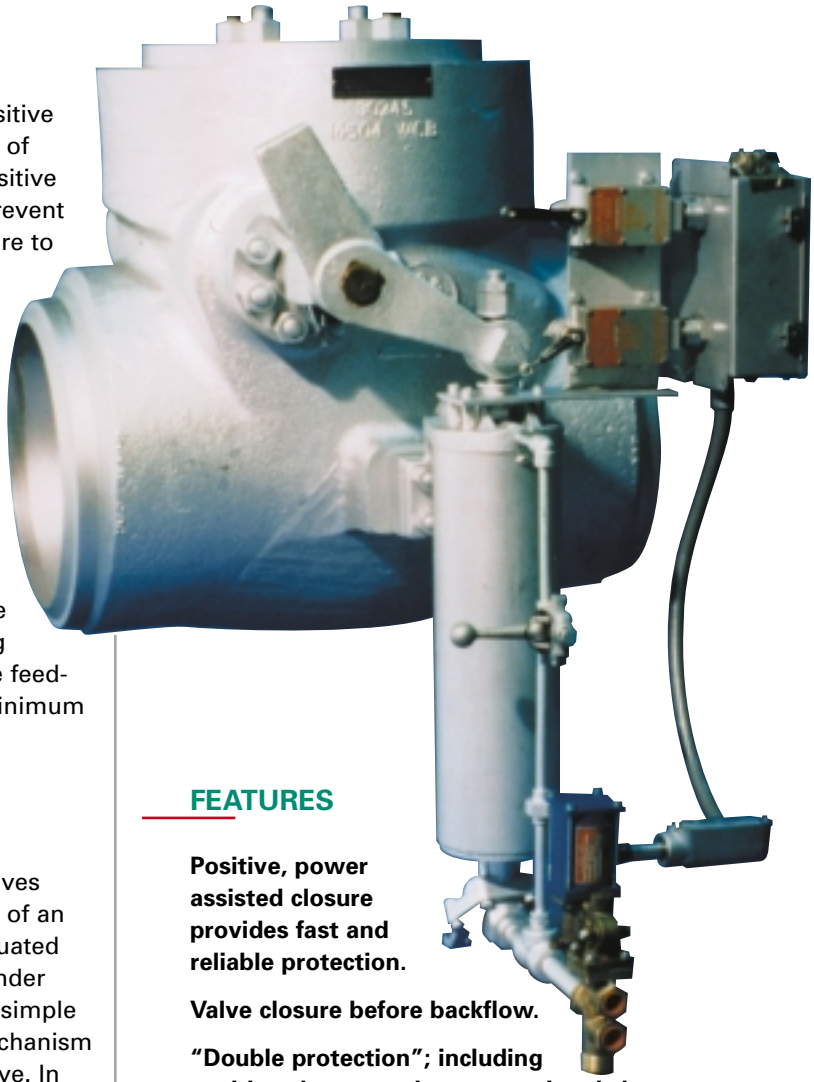


POSITIVE CLOSING CHECK VALVES - FEEDWATER

APPLICATION

Atwood & Morrill Co., Inc. manufactures Positive Closing Check Valves for the discharge lines of boiler feed pumps. These valves provide positive protection for feedwater systems and can prevent damage to costly pumping equipment. Failure to provide such protection could cause serious damage to the feed pumps and their drive mechanisms and may result in a plant outage with a loss of revenues far exceeding the initial investment necessary to provide protective equipment. Figure No. 1 illustrates the typical use of an A&M Valve with a motor-driven feed pump.

Positive Closing Check Valves can be used to protect pumps that are motor-driven, turbine-driven, or those that are run by drive shaft off the main turbine thereby improving the reliability and dependability of the entire feed-water system. The A&M Valve also offers minimum pressure drop for every day operation.



DESCRIPTION

Atwood & Morrill Positive Closing Check Valves achieve reliable and rapid closure by means of an auxiliary, spring loaded cylinder, usually actuated by compressed air. The positive closing cylinder acts to close the disc of the valve through a simple engaging mechanism. But, the engaging mechanism does not permit the cylinder to open the valve. In the case of a turbine drive, an Oil Operated Air Relay Valve is used to translate turbine control oil pressure to air pressure. An alternate method is to use a switch, actuated by the turbine trip mecha-nism, operating a solenoid valve which controls air pressure to the closing cylinder.

FEATURES

Positive, power assisted closure provides fast and reliable protection.

Valve closure before backflow.

"Double protection"; including positive closure and power assisted closure.

Streamlined flow design minimizes pressure drop.

Fast closing minimizes water hammer.

Flat seats for maximum tightness without wedging action.

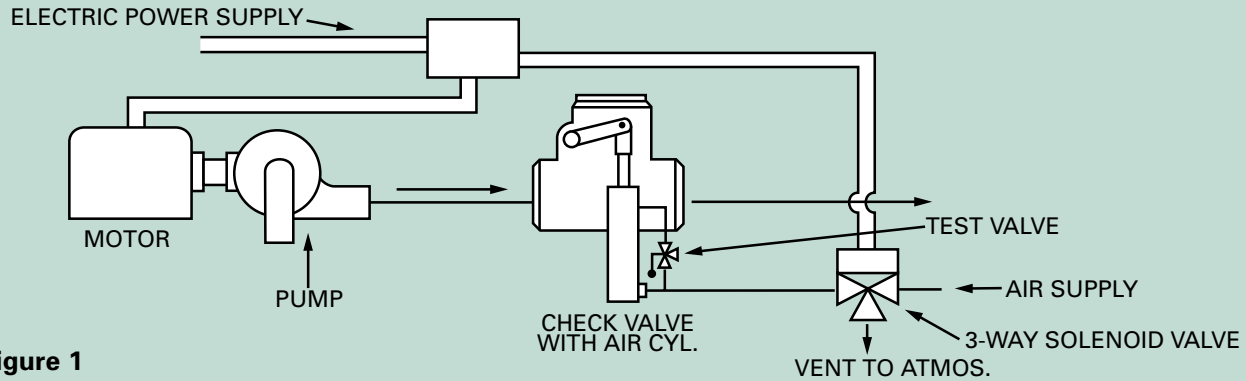


Figure 1

POSITIVE CLOSING CHECK VALVES - FEEDWATER

OPERATION

When the piston of the closing cylinder is pushed upward by air pressure, the disc assembly of the valve is free to swing from a closed to a wide open position solely in response to feedwater flow. Disc movement is completely independent of the shaft. A stop on the back of the disc holds it at a slight incline into the flow when the valve is wide open. Normal velocities swing the disc to the full open position and the stop prevents undue flutter or movement.

WATER HAMMER PROTECTION

High pressure Boiler Feed Pumps operating at high speeds and low inertia can lose speed and stop almost instantaneously, particularly in close coupled systems with short runs of pipe. Should one of these pumps be tripped-out or shut-off, it could go into reverse rotation in a matter of seconds. If reverse flow starts due to the slow closing or failure of a check valve, serious water hammer will result when the valve finally closes. In systems where parallel pumps are used, if one pump is shut down, any surges caused by the working pump will be isolated from the pump which the valve is protecting.

Tests and experience have shown that when an A&M Positive Closing Check Valve is used, water hammer is reduced to a minimum and the pump is assured maximum protection against reverse flow.

WATER HAMMER TESTS AND RESULTS

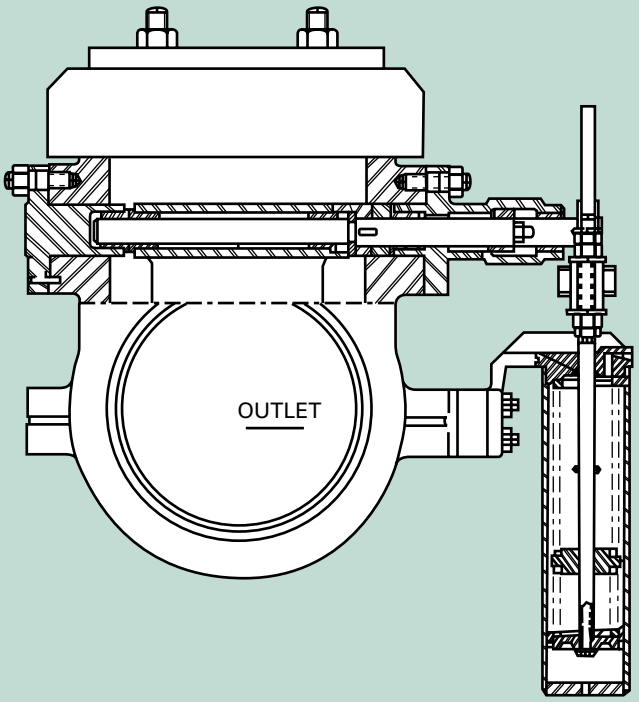
Portions of oscillograph tapes of tests made on production line A&M Valves are shown. The tests were conducted by an independent research facility to verify the advantages of fast closing and to demonstrate the effect of positive closing over a swinging disc check valve which was not positive closing. No numerical values are indicated. The following tests were run with the valve in the discharge of a motor driven pump.

I. A Swinging Disc Check Valve with added weight at the outer edge of the disc, with the valve depending only on gravity for its closing moment.

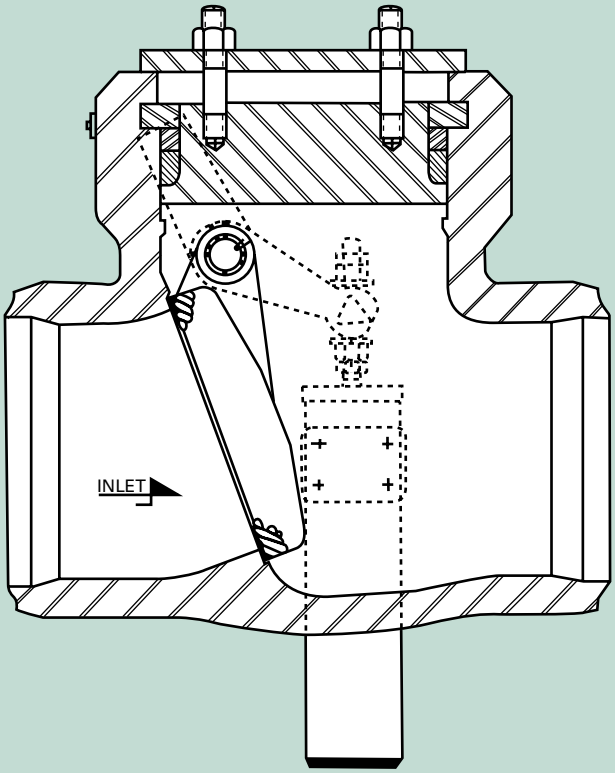
II. The same valve as in (I.) above, but with a positive closing cylinder arranged so that air pressure could be released simultaneously with the opening of the electrical circuit of the motor drive.

The trace lines indicate pressure during the test and at the moment of valve closure. The height of the line indicates the magnitude of the water hammer.

Cross Section Showing Positive Closing Cylinder & Shaft



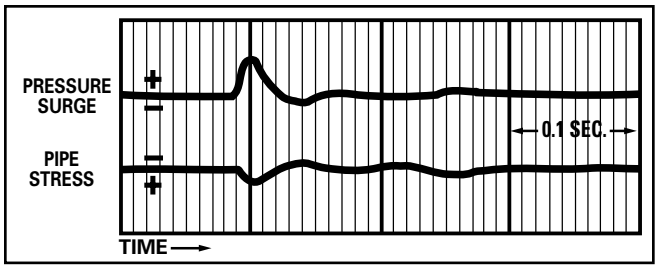
Cross Section Showing Inclined Seat & Swinging Disc



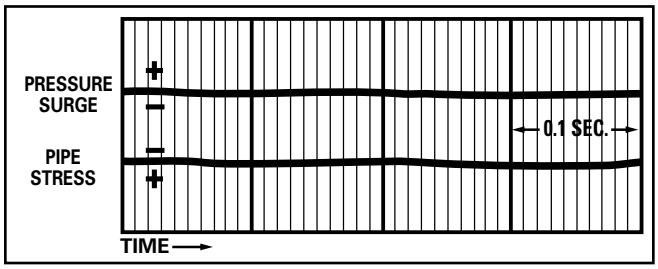
POSITIVE CLOSING CHECK VALVES - FEEDWATER

A comparison of the tapes shows the almost amazing results obtained when the positive closing cylinder was used. During the series of tests, it was also demonstrated that sluggish or retarded closing would severely increase water hammer, further proving the advantage of fast, positive closing. When summarizing the results of the tests, the laboratory report states: **"This intensity of water hammer (i.e., when positive closing was used) was almost inaudible and with no apparent vibration."**

Valve Closure Test Tapes



With Added Weight On Outer Edge of Disc



With Positive Closing Cylinder

FEATURES AND DESIGN ADVANTAGES

DEPENDABILITY AND POSITIVE CLOSURE

Positive Closing Check Valves are protective devices that must be completely reliable over extended periods of time. An average pump is "on stream" for a number of months and flow holds the valve in a wide open position for long intervals. Serious damage may result if foreign matter or sediment accumulates between the shaft and the bushings and retards or prevents free self closure. A&M valves offer positive protection against sticking or hanging-up and insure rapid, reliable closing in the event of a trip-out or shutdown.

DOUBLE PROTECTION

Some plants use two simple check valves in series as a means of insuring positive closure. Such double valving may be unnecessary, since a single Atwood & Morrill valve provides double protection with two methods of closure. First, the A&M Valve acts as a self-closing Check Valve when air pressure is admitted to the cylinder. Second, it acts as a Power Actuated Valve when air pressure is released from the cylinder on a trip-out.

MINIMUM PRESSURE DROP AND FULL FLOW EFFICIENCY

A&M Boiler Feed Pump Check Valves assist in keeping pressure drop in the feedwater piping system at a minimum, particularly when a single A&M Valve replaces a "double valve" installation. The streamlined characteristics of the A&M design make it an efficient valve to use, which is particularly important when longterm installed costs are considered.

"INTERNAL BALANCE"

The A&M Valve is designed so that the disc assembly is "pressure balanced". This means that the disc assembly is free to swing independently of the operating shaft. The disc is not subject to stuffing box friction or end-thrust tending to force it against the side of the valve. The operating shaft, which passes through the stuffing box is stationary under normal operating conditions. It is rotated only on a trip-out or shut-down by the closing cylinder, which has ample power to overcome stuffing box friction or other causes for sticking. In very high pressure installations, the operating shaft is "pressure balanced" by using double stuffing box construction.

ONE-PIECE BODY CONSTRUCTION AND SIMPLE DESIGN

A&M Boiler Feed Pump Check Valves are designed with a one-piece body and relatively few moving parts to minimize operating difficulties and simplify maintenance. Once installed, a valve can be inspected easily without removing it from line and the internals can be removed through the top cover. The closing mechanism can also be inspected easily without removing it from the valve by taking off the cylinder to expose the piston. The cylinder and piston assembly can then be examined for wear. If it becomes necessary to remove the piston, the threaded piston rod allows gradual backing off of the spring load so the rest of the cylinder can be dismantled without danger or the need for any special tools.

Atwood & Morrill does not use internal springs, which are difficult to replace. A&M provides a closing spring external to valve which is readily

POSITIVE CLOSING CHECK VALVES - FEEDWATER

accessible and can be removed from the cylinder assembly with ease. Possible spring failure could not seize the shaft or prevent self-closing of the valve.

SPECIFICATIONS

Size: 3" through 24" standard

Pressure Ratings: ANSI Class 400, 600, 900, 1500, 2500 (Special and higher ratings as applicable)

Materials: Cast steel with stainless steel or Cobalt Alloy Hard Facing trim. Other materials furnished on request.

Cover Design: Pressure Seal, Bolted Bonnet as specified.

Closing Device: Spring loaded cylinder (air controlled).

Body Type: Swinging disc design with inclined seat. Suitable for full ANSI test pressures.

Disc Assembly: One-piece construction, pressure balanced against lateral thrust. Positive stop on disc. Disc suitable for full pump shut-off pressure.

Shaft Bearing Design: Single stuffing box for lower pressures. Double stuffing box for higher pressures. Outboard shaft support bearing on cylinder side. Shaft bushings are nitrided stainless steel.

Seats: Integral stainless steel facings on both disc and body. Cobalt Alloy Hard Facings also available.

Stuffing Box Packing: Graphoil type. Leak-off bushings available.

DIMENSIONS

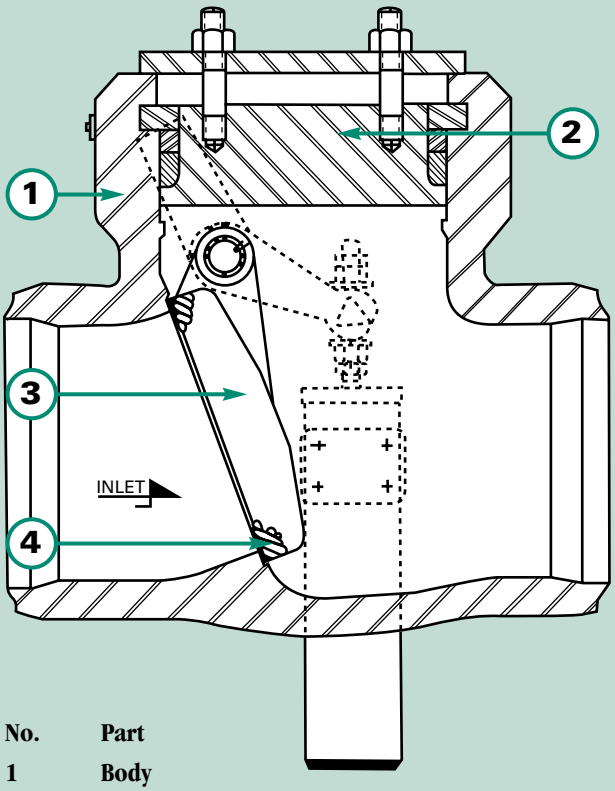
Class 1500

SIZE	END TO END	Cv
4	13	357
6	15	826
8	18	1603
10	23	2585
12	25	3926
14	25	3926
16	29	5927

Class 2500

SIZE	END TO END	Cv
4	13	357
6	18.5	826
8	23.5	1603
10	23.5	1603
12	28	2585
14	35	3926
16	35	3926
18	41	5927

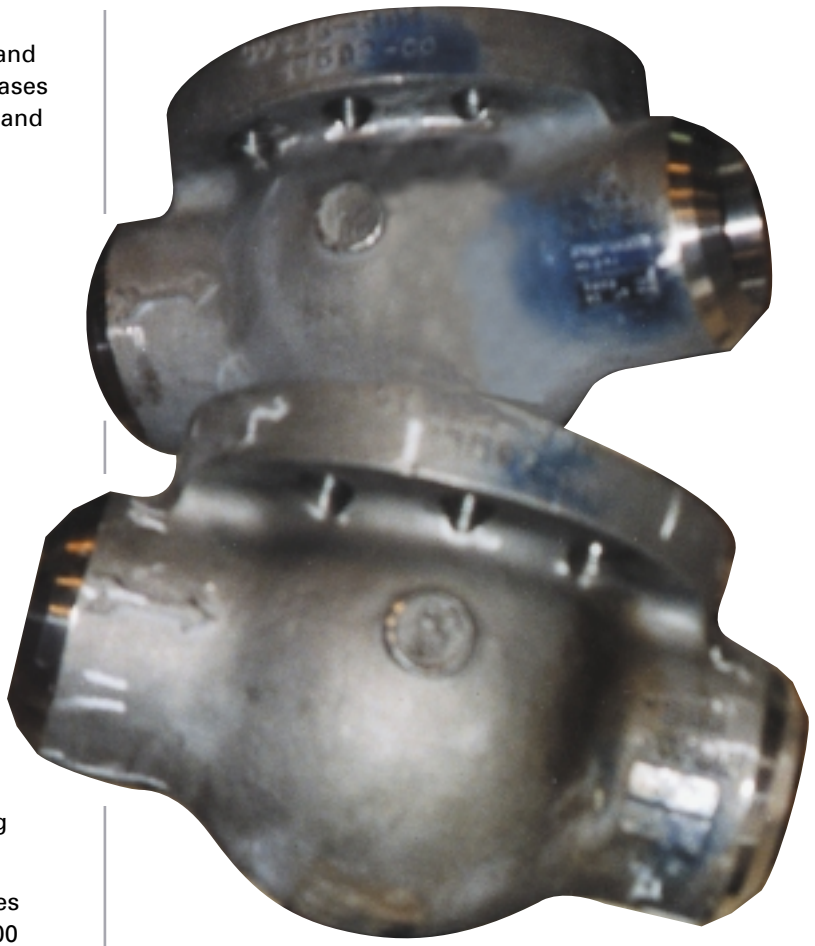
NOTE: ALL DIMENSIONS IN INCHES



No.	Part
1	Body
2	Cover
3	Disc
4	Seats

SWING CHECK VALVE - BALANCE OF PLANT

The Atwood & Morrill Swing Check Valve is designed to effectively prevent reverse flow and is ideally suited for liquid, steam and other gases requiring assured performance, tight shutoff and low maintenance.



APPLICATION

Condensate pump discharge

Heater drains

Liquid, steam and gas check valve

DESCRIPTION

A unique one piece disc and disc arm that cannot spin or flutter. The valve is flow engineered to hold the disc in the full open position during a wider range of flows, and the swinging disc design prevents wedging or jamming.

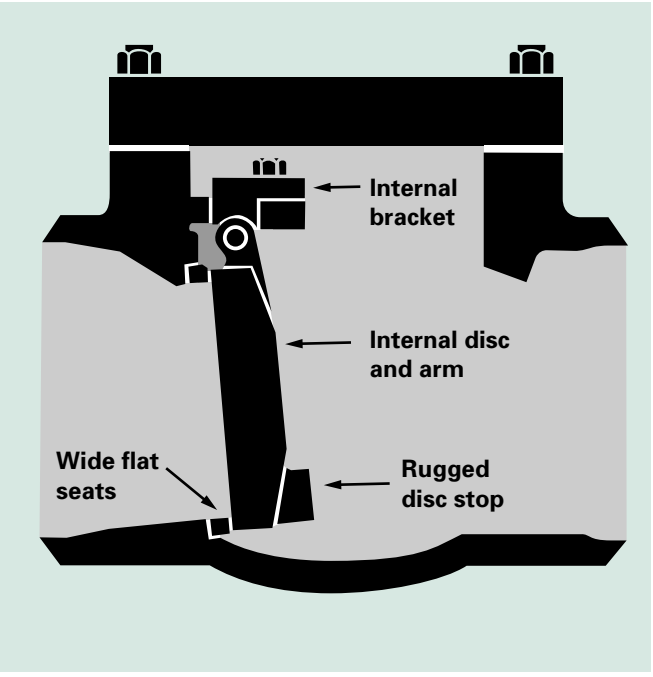
Wide, flat, permanently aligned seats that minimize leakage.

Stainless steel seat facings and hardsurfacing alloy available.

Bolted bonnet on 150 through 600 class valves and pressure seal bonnet on 900 through 1500 class valves.

An internal bracket on 2½-18 inch valves, eliminates side body penetrations for the shaft, removing two potential leak paths.

For larger sizes, a conventional double bearing cover design is used.



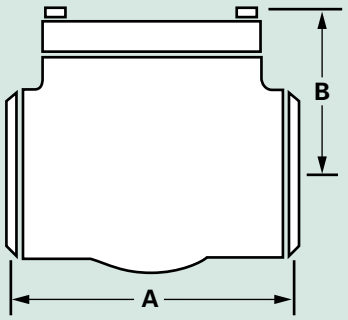
SPECIFICATIONS

Size:	2½ - 48 inch
Pressure Ratings:	ANSI Class 150-1500
Materials:	Carbon steel, Alloy steel or stainless steel, all with stainless steel trim.

SWING CHECK VALVE

CLASS 150, BOLTED BONNET

NOMINAL SIZE INCH	MM	A DIMENSION INCH	MM	B DIMENSION INCH	MM	WEIGHT LB.	KG.	Cv
2.5	65	12	305	5.25	133	95	43	198
3	75	12	305	5.25	133	95	43	208
4	100	12	330	5.375	137	110	50	370
6	150	14.5	368	6.5	165	140	64	868
8	200	17	432	8.5	216	235	107	1672
10	250	18.5	470	9.5	241	300	136	2688
12	300	20.5	521	10.75	273	450	204	3983
14	350	23	584	11.5	292	550	249	4892
16	400	25	635	13	330	660	299	6582
18	450	27	686	14.75	375	1015	460	8559
20	500	31	787	23.125	587	2474	1113	16400
24	600	37	940	23.75	603	3445	1550	21900
26	650	44	1118	27	686	3730	1679	27200
30	750	50	1270	25.625	651	4608	2074	36800



CLASS 300, BOLTED BONNET

NOMINAL SIZE INCH	MM	A DIMENSION INCH	MM	B DIMENSION INCH	MM	WEIGHT LB.	KG.	Cv
2.5	65	12	305	5.25	133	95	43	198
3	75	12	305	5.25	133	95	43	204
4	100	13	330	6	152	110	50	370
6	150	15.5	394	7.5	191	200	91	868
8	200	17.5	445	9.25	235	310	141	1628
10	250	20	508	10.75	273	450	204	2651
12	300	21.5	546	12	305	669	299	3838
14	350	24	610	13	330	698	313	4892
16	400	25	635	14	356	825	374	6420
18	450	27.5	699	15.5	394	1215	551	8559
20	500	31	787	23.125	587	2474	1113	16400
24	600	37	940	25.125	638	3495	1573	21900
26	650	44	1118	28.625	727	3780	1701	27200
30	750	50	1270	25.625	651	5030	2264	36800

CLASS 600, BOLTED BONNET

NOMINAL SIZE INCH	MM	A DIMENSION INCH	MM	B DIMENSION INCH	MM	WEIGHT LB.	KG.	Cv
2.5	65	12.5	318	6.25	159	125	57	187
3	75	12.5	318	6.25	159	125	57	193
4	100	13.5	343	7	178	150	68	370
6	150	15.5	394	9.25	235	250	113	868
8	200	17.5	445	10.5	267	375	170	1796
10	250	20	508	12.25	311	550	249	2651
12	300	21.5	546	13	330	780	354	3838
14	350	25	635	14.5	368	975	442	4833
16	400	27	686	15.52	394	1315	596	6295
18	450	31	787	17.5	445	1950	885	8290
20	500	40	1016	34	864	4000	1800	15300
24	600	40	1016	31.25	794	5270	2372	17500
26	650	50	1270	28.5	724	5700	2565	31650
30	750	52	1321	37.5	953	8300	3735	35700

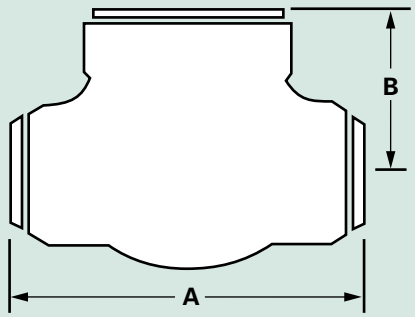
SWING CHECK VALVE

CLASS 900, PRESSURE SEAL BONNET

NOMINAL SIZE INCH	NOMINAL SIZE MM	A DIMENSION INCH	A DIMENSION MM	B DIMENSION INCH	B DIMENSION MM	WEIGHT LB.	WEIGHT KG.	Cv
2.5	65	12.5	318	7.5	191	95	43	202
3	75	12.5	318	7.5	191	95	43	209
4	100	13	330	8.75	222	120	54	363
6	150	15.5	394	11	279	235	107	801
8	200	17.5	445	12.5	318	370	168	1517
10	250	22.5	572	19	483	800	363	2346
12	300	27	686	17.25	438	1150	522	3658
14	350	27	686	17.25	438	1150	522	4207
16	400	31	787	20	508	1600	726	5629
18	457	34	864	22	559	2300	1043	7558
20	500	44	1118	28.37	720	6380	14036	15235
24	600	44	1118	29.5	750	6000	13200	18878

CLASS 1500, PRESSURE SEAL BONNET

NOMINAL SIZE INCH	NOMINAL SIZE MM	A DIMENSION INCH	A DIMENSION MM	B DIMENSION INCH	B DIMENSION MM	WEIGHT LB.	WEIGHT KG.	Cv
2.5	65	12.5	318	8	203	140	64	202
3	75	12.5	318	8	203	140	64	209
4	100	14	356	8.75	222	336	152	345
6	150	16.5	419	13.5	343	800	363	801
8	200	19.5	495	15.5	394	1200	544	1517
10	250	25	635	19.5	495	1600	726	2346
12	300	30	762	23	584	2170	984	3658
14	350	30	762	23	584	2170	984	4207
16	400	34.5	876	27	686	2800	1270	5629
18	450	38	965	30	762	3500	1588	7558



RECOMMENDATIONS AND REQUIREMENTS

MAINTENANCE, INSPECTION, EXERCISING

Atwood & Morrill Co., Inc. recommends a standard program of maintenance, inspection, and exercise for their products. For more information, please refer to the service manual supplied with each valve, or contact your local A&M representative or the home office in Salem, Massachusetts.

INSTALLATION RECOMMENDATIONS

For longest service life of these or any check valves, installation near sharp bends, elbows, eccentric reducers or expanders or other valves should be avoided. When possible, a length of 10 pipe diameters of straight pipe upstream and 5 pipe diameters of straight pipe downstream is recommended.

Atwood & Morrill Check Valves are engineered products. It is strongly recommended that a representative or factory sales engineer be consulted before selecting a valve.

ORDERS AND INQUIRIES

When specifying Check Valves, please supply:

1. Flow Conditions: Temperature, Pressure and Flow Rate
2. Style of valve (series or description)
3. Number of valves
4. Service
5. Size or Flow capacity
6. Operating and design temperatures and pressures
7. Special material requirements
8. Maximum allowable pressure drop
9. Pipe run (horizontal or vertical)
10. Mounting of auxiliary equipment (left or right side when facing inlet)
11. Other pertinent data
12. Accessory equipment
13. Available air and electrical supply

WYE GLOBE VALVE

The Atwood & Morrill "Wye" Globe Valve is a highly engineered valve for utilities, power generation, industrial and process applications. Design variations assure optimum performance under a wide range of operating conditions and environments.

CONFIGURATIONS

Lift Check
Stop-Check
Stop

APPLICATIONS

POWER
Boiler Feedwater Pump non-return and stop
Economizer inlet and stop
Boiler outlet stop & non-return (multiple boilers)
Feedwater Heater Isolation
Main Steam Stop
Auxiliary Equipment

PROCESS & REFINING
Hydrogen service
Hydro Cracker
Hydrotreater
Steam Service
Pump Discharge

FEATURES

Designed for High Pressure, High Temperature operation to ANSI B16.34.

TIGHT SHUTOFF
Hard-faced (CoCr), poppet fitting into the hard-faced seat in the body provides tight shutoff. The sturdy design is more resistant to pipeline stresses so the seat will remain tighter than wedge-type gate valve seat construction.

LOW PRESSURE DROP
Streamlined flow passages and lack of internal obstructions behind the poppet keep pressure drop low. Pressure drop may be as much as 70% less than conventional Globe and "Tee" pattern Globe Valves.

FAST OPERATION
A Wye Globe Valve can be closed considerably faster than a Gate Valve since the stroke is shorter. In the event of a tube failure in a feedwater heater, fast operation is important.

Removal of the valve cover, alone, allows full access to the internals. The interior of the valve body is easily inspected. Minor seat repairs may be made with ordinary lapping equipment. Major seat refurbishing can also be performed with portable grinding tools (available from A&M).

"DIRECT" SEATING OFFERS RESISTANCE TO THERMAL DISTORTION
Relatively few internal pieces in the valve design mean less problems of concentricity and movement with temperature change. When closed, valves cannot jam shut due to thermal contractions of the valve body.

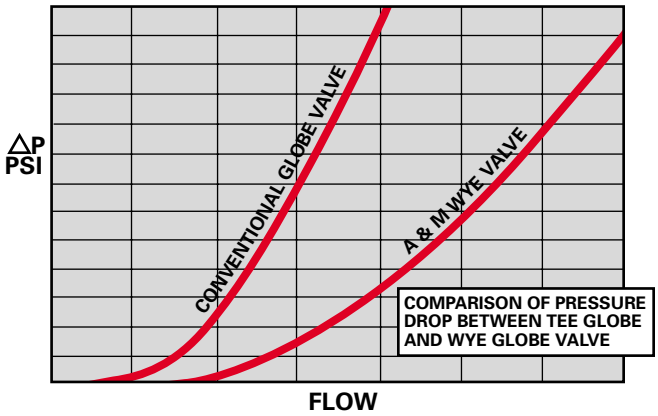
SPACE REQUIREMENTS
The overall height of a Wye Globe Valve is less than a Gate Valve. This is an advantage when installing near catwalks, beneath the turbine floor and other restricted areas.

WYE GLOBE VALVE

BY-PASS PIPING

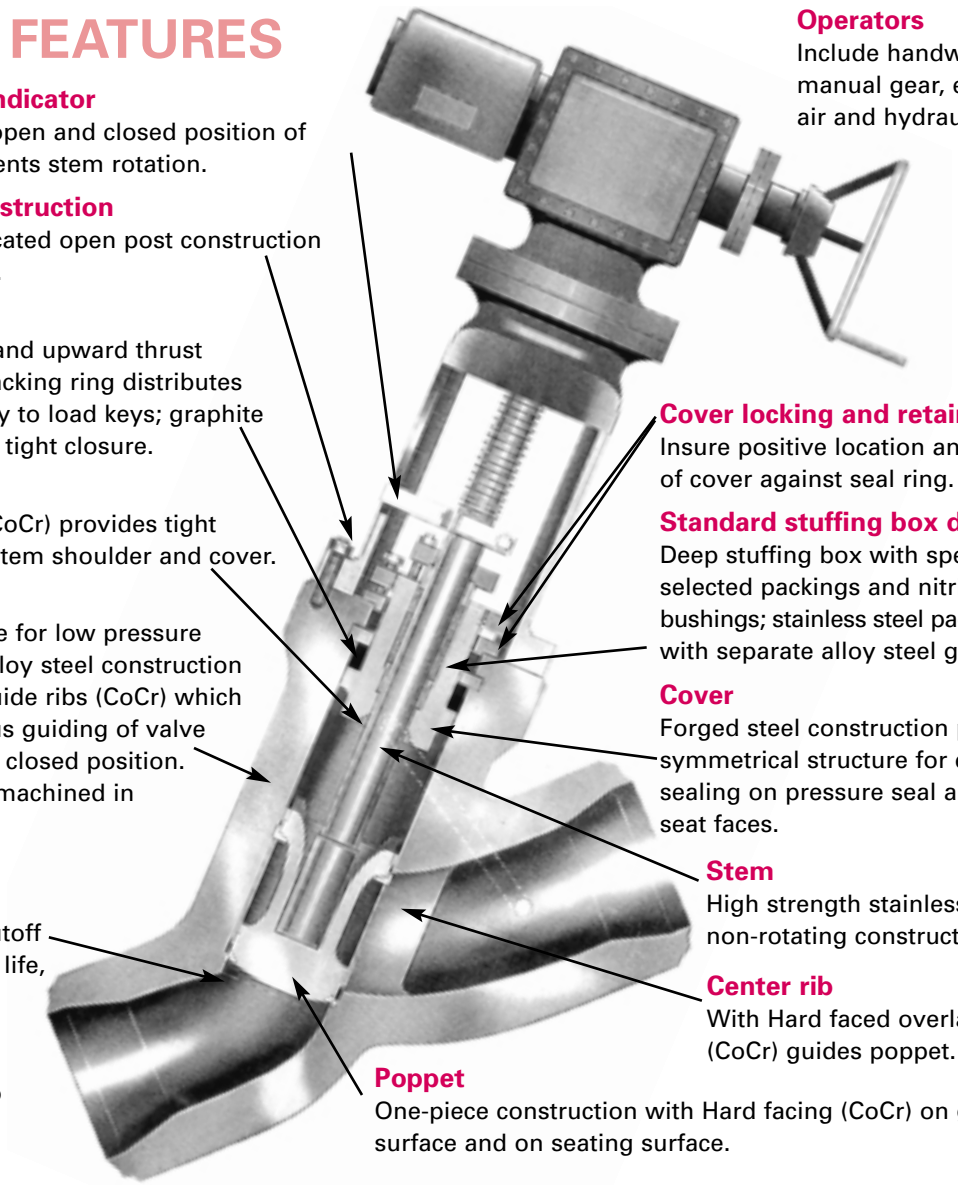
Bosses can be provided on the body permitting the use of integral by-pass piping.

Wye Type Globe Valves may have up to 70% lower pressure drop than conventional Globe Valves. Streamlined flow passages and a contoured entrance and exit reduce turbulence and pressure drop. Feedwater velocities up to 35 feet per second are normally satisfactory for A&M Valves, even higher flows may also be acceptable.



COMPARISON OF PRESSURE DROP BETWEEN TEE GLOBE AND WYE GLOBE VALVE

DESIGN FEATURES



Valve position indicator
Clearly indicates open and closed position of valve. Collar prevents stem rotation.

Bolted yoke construction
With cast or fabricated open post construction for easy servicing.

Soft Seal
Load keys with stand upward thrust of bonnet load; backing ring distributes pressure uniformly to load keys; graphite seal ring provides tight closure.

Backseat
Hardfaced inlay (CoCr) provides tight closure between stem shoulder and cover.

Body
Streamlined shape for low pressure drop; carbon or alloy steel construction with Hardfaced guide ribs (CoCr) which provide continuous guiding of valve poppet in open or closed position. Guiding surfaces machined in same setup.

Seats
Hard faced (CoCr) seats for tight shutoff and long services life, Stellite-to-Stellite contact increases seat tightness in valves exposed to high temperature

Operators
Include handwheels, manual gear, electric, air and hydraulic types.

Cover locking and retaining plate
Insure positive location and securing of cover against seal ring.

Standard stuffing box design
Deep stuffing box with specially selected packings and nitrided guide bushings; stainless steel packing gland with separate alloy steel gland plate.

Cover
Forged steel construction provides symmetrical structure for even sealing on pressure seal and back-seat faces.

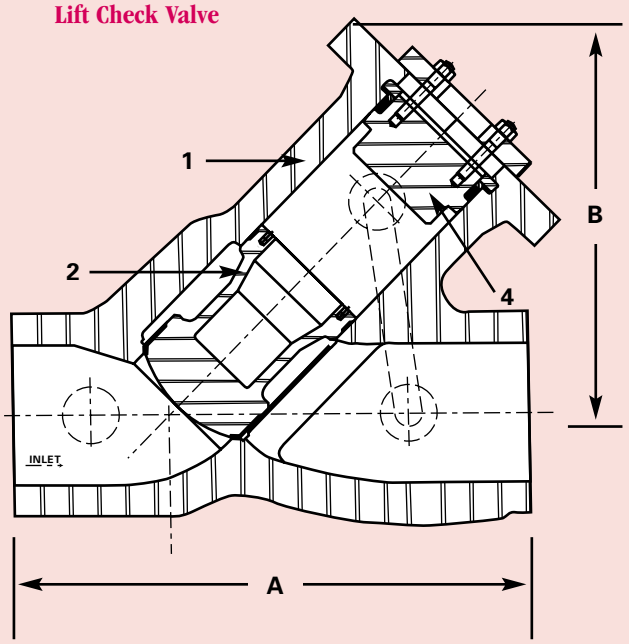
Stem
High strength stainless steel, non-rotating construction.

Center rib
With Hard faced overlay (CoCr) guides poppet.

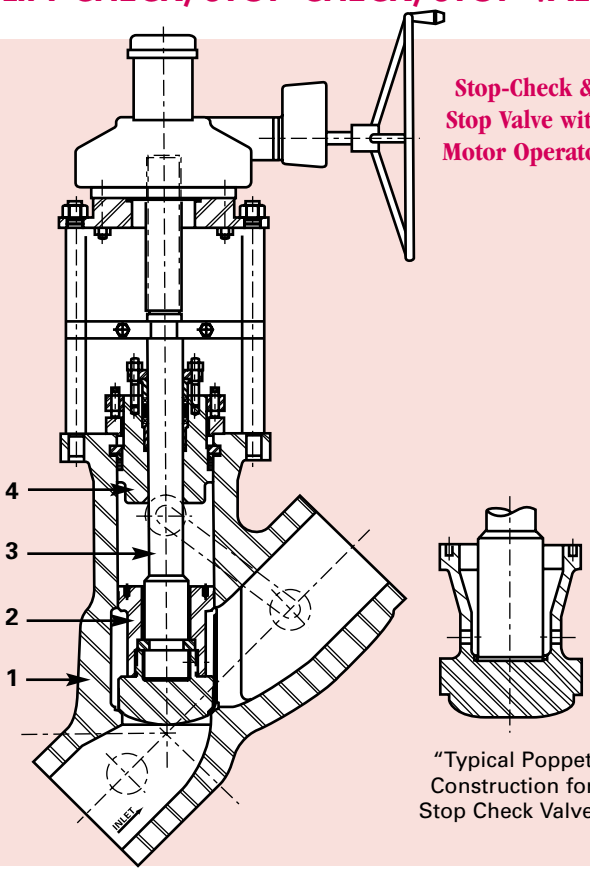
Poppet
One-piece construction with Hard facing (CoCr) on guide surface and on seating surface.

WYE GLOBE VALVE - LIFT CHECK/STOP-CHECK/STOP VALVE

Lift Check Valve



Stop-Check & Stop Valve with Motor Operator



"Typical Poppet Construction for Stop Check Valve"

1. Body
2. Poppet
3. Stem
4. Cover

SPECIFICATIONS

Design Standard:	ANSI B16.34 and as required
Pressure Class:	ANSI Class 900-2500 and above
Sizes:	Cast construction 6" - 24"
Materials:	Carbon steel, alloy steel and stainless per ASTM specifications or applicable international standards
Trim:	Stainless Steel
Seats:	Hardfacing alloy #21 (CoCr)
Bonnet Design:	Pressure seal with forged cover and graphite seal ring
End connections:	Butt weld

DIMENSIONS

Class 1500 LIFT CHECK, STOP CHECK AND STOP "WYE" GLOBE VALVES

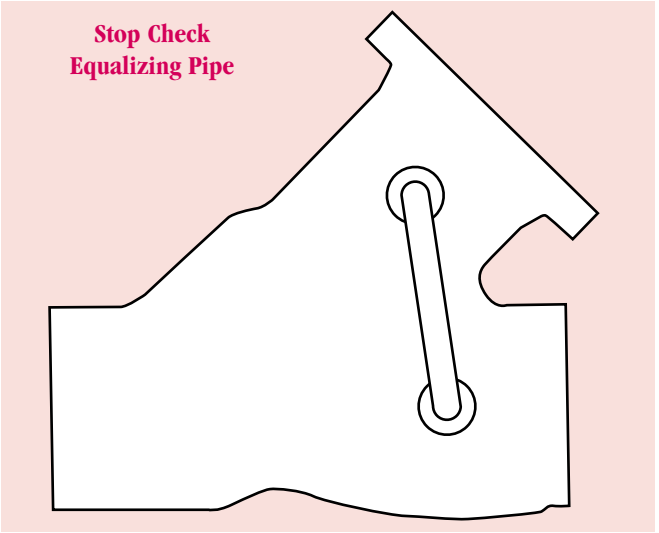
SIZE	A END TO END	WEIGHT (lbs)	Cv
6	27 3/4	505	950
8	30	958	1610
10	36 1/4	1785	2550
12	43	2910	3525
14	43	2840	3525
16	54	4090	6220
18	63	5000	6220
20	54 1/2	6700	8500
24	59 1/2	11300	12500

Class 2500 LIFT CHECK, STOP CHECK AND STOP "WYE" GLOBE VALVES

SIZE	A END TO END	WEIGHT (lbs)	Cv
6	24	505	630
8	30	1158	1125
10	36	2050	1790
12	43	3570	2620
14	49	5400	3790
16	49	5480	3790
18	58	8000	5000
20	58	8180	5000

EQUALIZING PIPE - WYE GLOBE VALVE

Wye Stop/Check Valves are provided with an equalizing pipe connecting the area above the disc to the valve outlet. The equalizing pipe reduces any pressure build up over the disc allowing the higher pressure below to fully open the disc. This full disc lift reduces pressure drop.



ELBOW DOWN VALVES

Elbow Down Valves are a special globe valve design used for downward vertical flow off a circulating pump. Elbow Down Valves are available for high pressure service in a range of sizes.

3-WAY VALVES

Atwood & Morrill has been manufacturing 3-Way By-Pass Valves since 1925. We have continued to expand this product line by furnishing the largest 3-Way Valves required for power plants, worldwide.

FEATURES

IN-LINE BODY DESIGN

The A&M 3-Way Valve features a "T" shape body. The inlet and bypass outlet are on the same center line. Therefore, piping layout is simplified and less expensive.

UNINTERRUPTED FLOW

When an A&M 3-Way Valve is used, accidental shut-off cannot occur. Full flow is maintained through one port or the other, or through both ports during operation of the valve. Transfer is automatic, so special sequencing required with dual or multi valve installations is not necessary.

DISC AND SEAT DESIGN

A&M utilizes flat seats as experience proves it is easier to establish and maintain tightness. A flat seat can move in a horizontal plane and the valve will still remain tight. Alternate seating arrangements may not remain tight if subjected to lateral movement.

GUIDED POPPET

Stabilized seating in both directions ensures proper sealing. The guides also stay out of the normal flow path.

TYPICAL SERVICE

The A&M 3-Way Valve is designed for installations where uninterrupted flow control from one line to another is essential. The 3-Way Valve permits selection of two different flow patterns from the same valve.

TESTED

Seat Tightness in accordance with MSS SP-61

APPLICATIONS

High and Low Pressure Feedwater Heater By-Pass

Dual Safety Valve Installations

Continuous Process Application

Bulk Storage Tank Switching

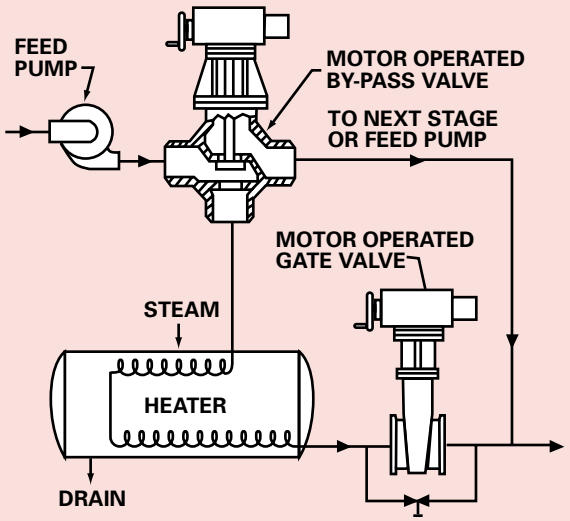
HRSG Economizer Diverting

3-WAY VALVES

FEEDWATER HEATER BY-PASS SERVICE

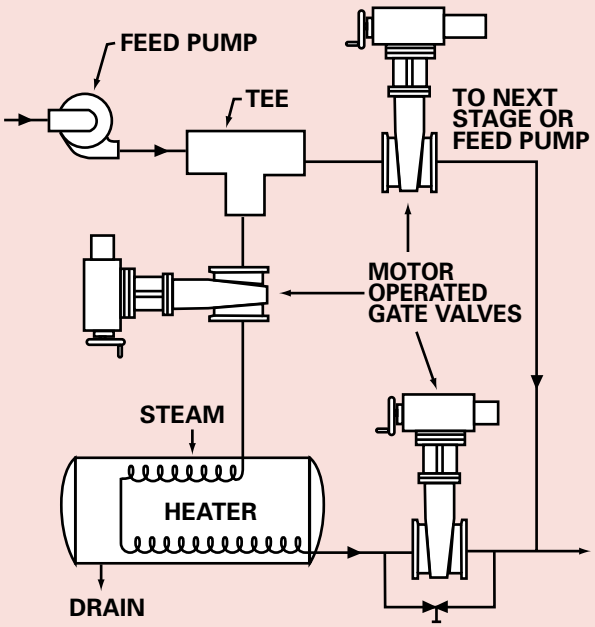
Valves in this service are designed to seat against full differential pressure of the feed pump. The motor or gear operators are sized, as standard construction, to move the disc from seat to seat against differential pressures of up to 200 to 400 psi for high pressure valves rated ANSI Class 1500, and above, and against 100 psi differential for low pressure bypass valves rated to ANSI Classes 150 and 300.

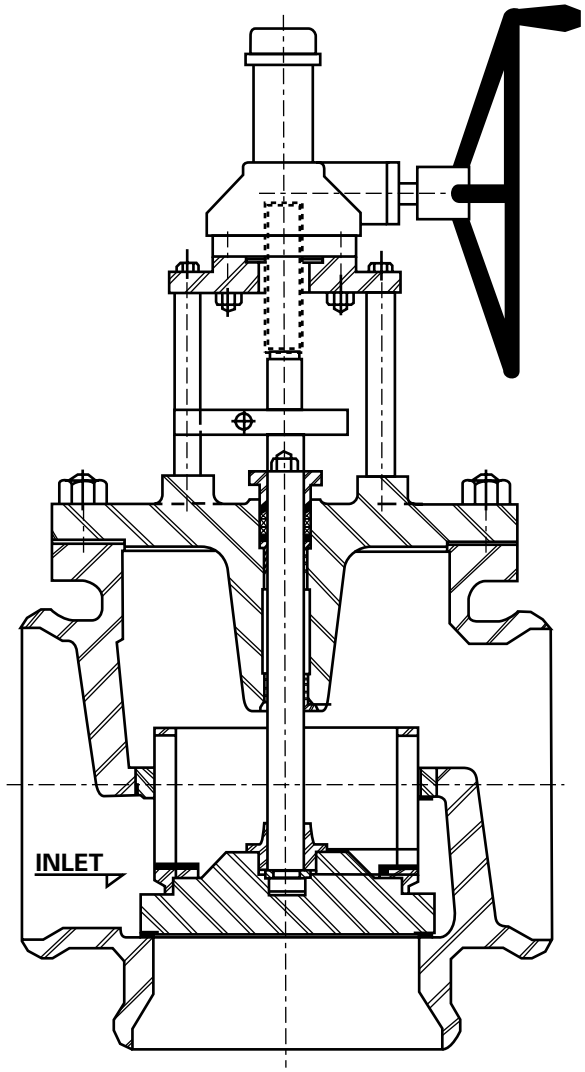
3-Way Valve Installation



VERSUS

Gate Valve Installation





ADVANTAGES

Eliminate two stop valves

Eliminate one "Tee" fitting

Eliminate side mounting of stop valves (which increases wear and maintenance)

Make three field welds, not seven

Simplify piping layout

Eliminate one motor operator connection

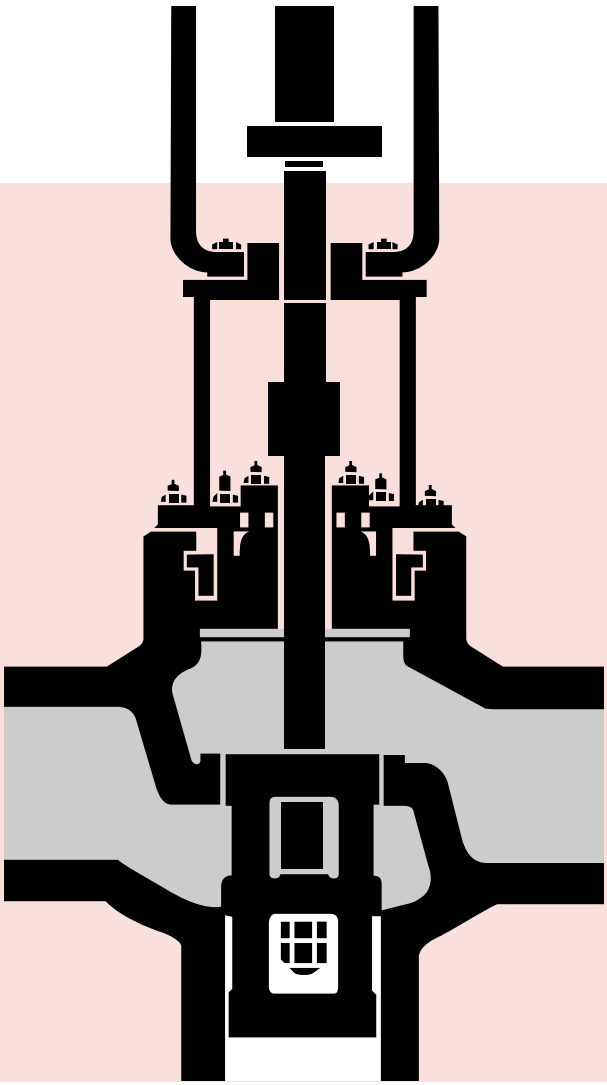
COST SAVINGS

An A&M 3-Way Valve can cut the typical total installed cost in half

3-WAY VALVES

SPECIFICATIONS

Sizes:	6 - 24 inch
Pressure Class:	150, 300, 1500 and 2500 ANSI B16.34 Standard or Special Class, other ratings on request
Design Standard:	ANSI B16.34 and as required
Base Materials:	Cast Carbon Steel, Alloys and Stainless Steel
Type of Operator:	Manual, Gear, Motor or Pneumatic
Trim Material:	Stainless Steel
Seating Surfaces:	Hardfacing Alloy #21 (CoCr)
Bonnet Design:	Bolted or Pressure Seal
End Connections:	Butt weld or Flanged



3-WAY MODULATING VALVE

This valve is similar to our standard 3-Way Valve design, except a guided cage is added which allows the valve to be used for modulating, diverting, and isolation.

FEATURES

Combination high pressure control valve, diverting valve and flow balancing valve.

Isolates flow

Large sizes available

Designed for high capacity service

APPLICATION

Multi boiler feedwater balancing

Economizer bypass

High and low pressure feedwater heater bypass

3-WAY VALVES

CLASS 300

SIZE OF VALVE	℄ TO END	FACE TO FACE	OVERALL VALVE HEIGHT	APPROX WT.
	A	B	C	LBS.
6	8 3/8	16 3/4	34	600
8	10	20	46	700
10	12	24	50 7/8	1000
12	12	24	48 1/8	1400
14	13	26	52 1/2	2000
16	13	26	54 5/8	2200
18	18 1/2	37	59 7/8	2500
20	20	40	69 1/2	3600

CLASS 1500

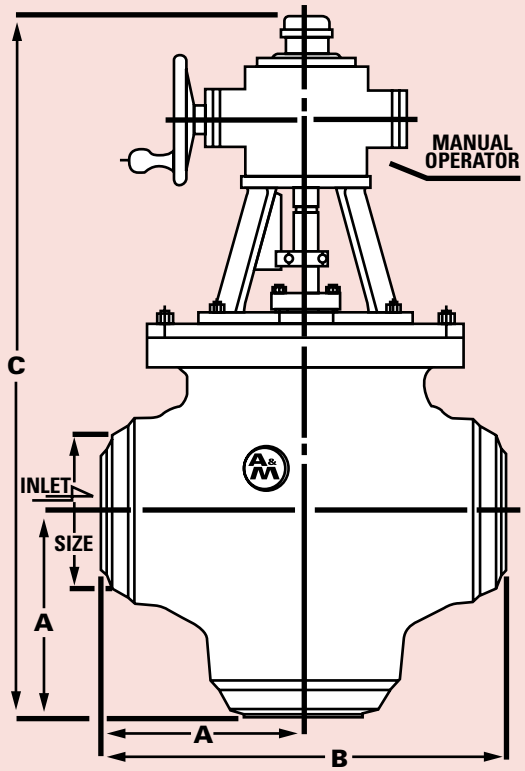
SIZE OF VALVE	℄ TO END	FACE TO FACE	OVERALL VALVE HEIGHT	APPROX WT.
	A	B	C	LBS.
6	10 1/2	21	41	1500
8	12 1/2	25	45 3/4	1600
10	15	30	51 1/2	2000
12	17	34	61 3/8	3000
14 & 16	19 1/2	39	65 3/4	7400
18 & 20	24	48	78 1/4	8100

CLASS 2500

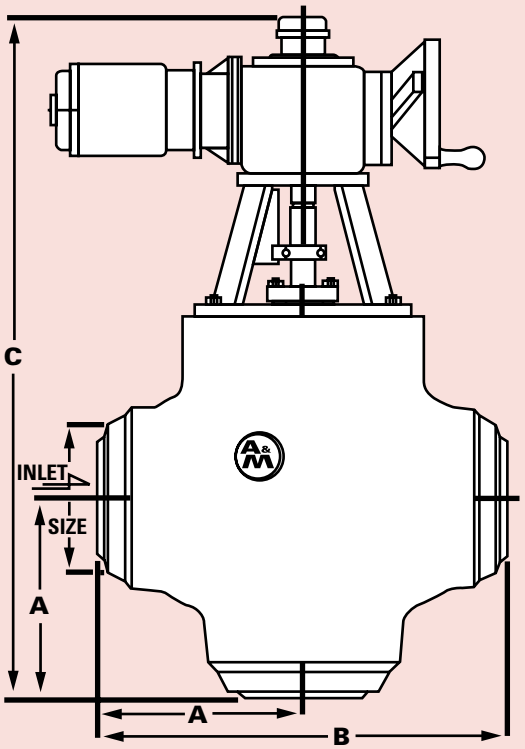
SIZE OF VALVE	℄ TO END	FACE TO FACE	OVERALL VALVE HEIGHT	APPROX WT.
	A	B	C	LBS.
6	12	24	42 7/8	1600
8	15	30	52 3/4	3900
10	16	32	60 1/4	7000
12 & 14	19	38	66 1/8	7400
16 & 18	22	44	70 7/8	8500
20	27	54	82	10500

NOTE: ALL DIMENSIONS IN INCHES

SPECIFIC ORDER REQUIREMENTS MAY CAUSE DIMENSIONS TO VARY



Low Pressure Design: Bolted Bonnet



High Pressure Design: Pressure Sealed Bonnet

PARALLEL SLIDE GATE VALVE

Atwood & Morrill Parallel Slide Gate Valves are designed for high pressure, high temperature applications where tight shutoff and reliable operation are important.

Parallel slide gate valves are designed with independent discs and wide flat seats. More than just assuring fluid tightness, our design provides freedom from sticking and binding associated with wedge gate valves.

The wide flat seats in our gate valves assure a flat, intimate contact with the disc which creates a long difficult path for any incipient leakage.

The wide seating surfaces are designed to reduce seat bearing stress and guarantee long life. They also minimize the effect of minor damage to the surface as sealing occurs over the entire surface.

OTHER EXCEPTIONAL DESIGN FEATURES INCLUDE

Position seating and independent discs assure easy operation and perfect seating.

The higher the differential pressure, the tighter the shut off.

Hard faced seats (CoCr) reduce wear.

Self-cleaning action cleans seat every time valve is closed.

Slight rotation of the disc every time the valve closes equalizes wear.

External anti-rotation device and travel stop shows valve position and eliminates seat wear due to torquing forces associated with wedge gate valves.

Available Venturi design can reduce weight and costs.

APPLICATIONS

Feedwater heater isolation.

Mainsteam stop and isolation.

Temperature boiler blow-off.

Recovery boiler emergency drain system.

Boiler circulating pump isolation.

Heater drains.

Turbine drain systems.

Sootblower steam.

Safety valve isolation.

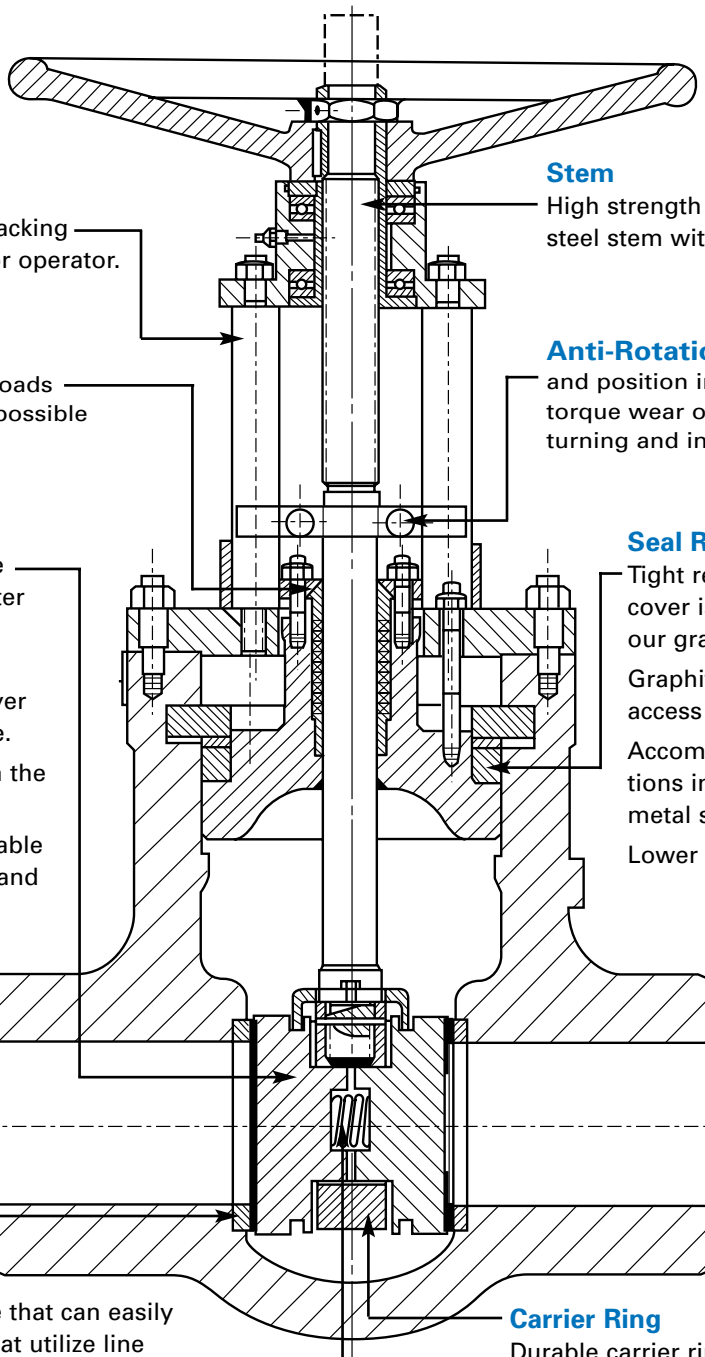
Mud drum drain system.

Blowdown.

Pressure Relief Valve block valve.

Cold reheat isolation.

DESIGN FEATURES



Yoke Rod Design
Provides easy access to packing gland and rigid support for operator.

Stem
High strength heat treated stainless steel stem with backseat.

Packing Gland
Two piece packing gland loads packing evenly, reducing possible damage to the stem.

Anti-Rotation Device
and position indicator eliminate torque wear of seats. Prevents stem turning and indicates valve position.

Discs
Slight wiping action of the disc removes foreign matter from the seat.

Rotating disc movement distributes wear evenly over the whole working surface.

Completely removed from the flow passage when open.

Self aligning, interchangeable discs assure tight shutoff and long life.

Seal Ring
Tight reliable closure of the cover is assured by the use of our graphite seal ring.

Graphite seal ring allows quick access to internal parts.

Accommodates minor variations in mating parts where metal seals will not.

Lower cost for replacements.

Seat
Wide, flat seating surfaces are relatively immune to minor damage that can easily cause leakage in valves that utilize line contact seating.

Parallel seats can be lapped quickly (if required).

Carrier Ring
Durable carrier ring is securely threaded and pinned to the stem.

Disc Spring
A light, non-corrodible spring keeps the discs in close contact with the seats when the valve is not under pressure.

TABLE OF DIMENSIONS

CLASS 900 Figure Number 2827

SIZE	L	H	W	CV	WEIGHT Lbs.
6"	20	38	24	2300	360
8"	26	45	24	3950	675
10"	31	52	36	6200	1000
12"	36	58	36	8700	1400
14"	39	64	36	10550	1850
16"	43	69	*	13800	2500
18"	48	76	*	17500	4000
20"	52	82	*	21550	4500
24"	61	97	*	31000	6800

CLASS 1500 Figure Number 2828

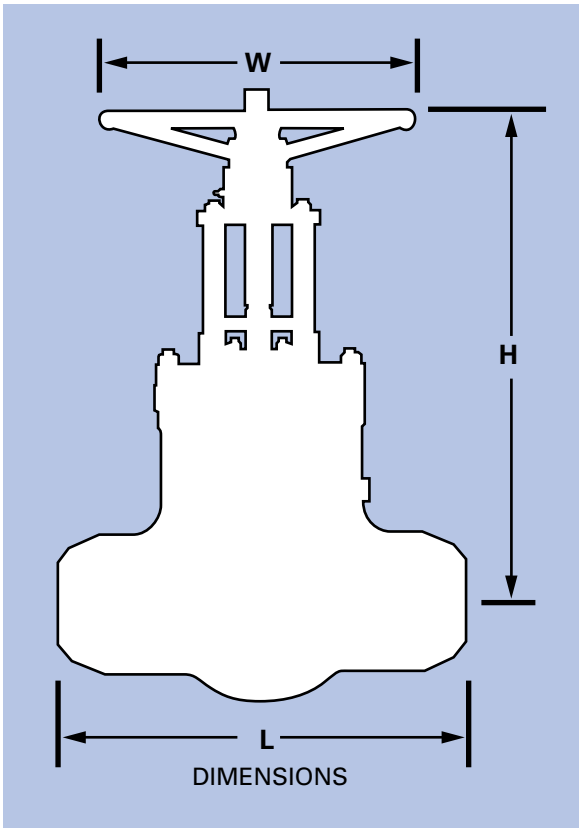
SIZE	L	H	W	CV	WEIGHT Lbs.
6"	22	40	24	1900	560
8"	28	48	36	3250	950
10"	34	55	36	5100	1620
12"	39	60	36	7150	2440
14"	42	69	48	8600	3800
16"	47	75	*	11300	4750
18"	53	83	*	14250	5650
20"	58	87	*	17900	7800
24"	60	100	*	25700	11000

CLASS 2500 Figure Number 2829

SIZE	L	H	W	CV	WEIGHT Lbs.
6"	24	38	30	1150	850
8"	30	49	36	1950	1620
10"	36	58	36	3150	2750
12"	41	63	48	4450	3540
14"	44	69	48	5400	4850
16"	49	74	*	7050	6730
18"	55	77	*	8950	9060
20"	55	84	*	10900	10600
24"	62	103	*	15750	14680

*Gear or power operation recommended.

NOTE: ALL DIMENSIONS IN INCHES



DIMENSIONS

TABLE OF DIMENSIONS - VENTURI PORT VALVES

CLASS 900

SIZE	L	H	W	CV	WEIGHT Lbs.
8x6x8"	26	38	24	1840	680
10x8x10"	31	45	24	3160	970
12x10x12"	36	52	36	4990	1270
14x12x14"	39	58	36	6960	1650

CLASS 1500

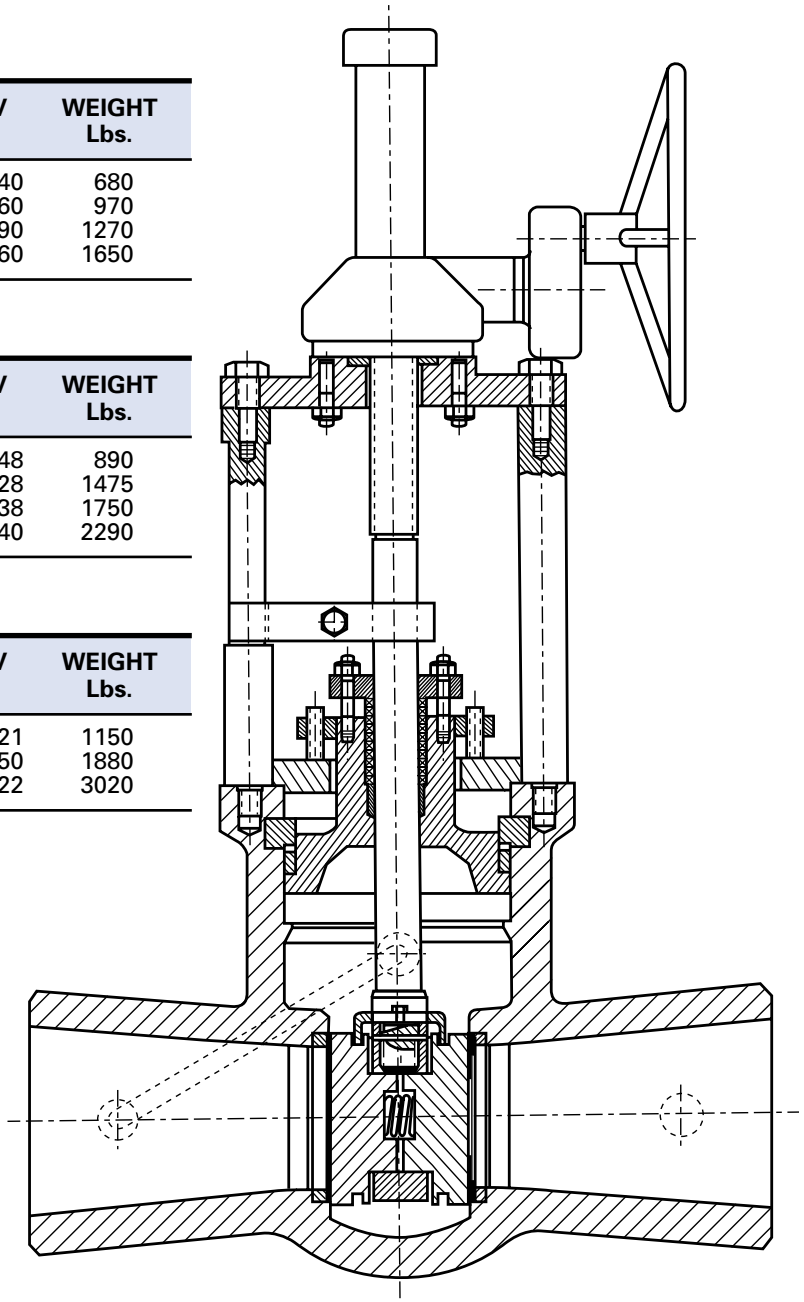
SIZE	L	H	W	CV	WEIGHT Lbs.
8x6x8"	28	40	24	1648	890
10x8x10"	34	48	36	2928	1475
12x10x12"	39	55	32	4638	1750
14x12x14"	42	60	36	6340	2290

CLASS 2500

SIZE	L	H	W	CV	WEIGHT Lbs.
8x6x8"	30	38	30	1021	1150
10x8x10"	36	49	36	1750	1880
12x10x12"	41	58	36	2922	3020

*Gear or power operation recommended.

NOTE: ALL DIMENSIONS IN INCHES



MATERIALS OF CONSTRUCTION

CLASS 900-2500, Sizes 6" and Larger, Regular and Venturi Ports

DESCRIPTION	CARBON STEEL	1¼%Cr ½%Mo	2¼%Cr 1%Mo	MODIFIED 9% Chrome
Body	A216 - WCB	A217 - WC6	A217 - WC9	A217 C12A
Cover	A216 - WCB	A217 - WC6	A217 - WC9	A217 C12A
Stem	A479 - 410 CLASS 3 (STAINLESS STEEL)			
Seat/Disc	A515 Grade 70	A387 Grade 11 CL 2	A387 Grade 22 CL 2	A182 F91
	CoCr Hard Faced			

EQUALIZING DEVICE

An equalizing device allows the relief of fluid which might otherwise become trapped in the intergate space (center cavity) of the valve body. It also provides an escape for fluid displaced by the stem assembly when closing the valve.

INTERGATE RELIEF

ASME standards, ANSI B16.34, Valves - Flanged, Threaded and Welded End, paragraph 2.3.3, and ANSI B31.1, Power Piping Code, paragraph 107.1, require purchasers of double seated valves to provide a means in design, installation, or operation to prevent over pressurization due to thermal expansion of trapped fluids within the valve body. This fluid expansion can cause pressures that exceed the valve materials' strength causing excessive leakage or possibly even rupture.

Atwood & Morrill can provide an equalizing system on all 6" and larger Parallel Slide Gate Valves to meet ANSI B16.34 paragraph 2.3.3 requirements.

EXTERNAL INTERGATE LINE WITH ISOLATION VALVE

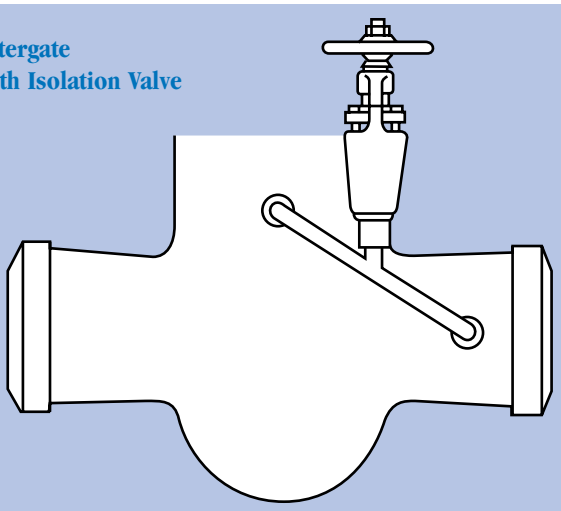
The equalizing pipe connects the valve's center cavity to the inlet end of the valve allowing displaced fluid to transfer up-stream. The intergate relief isolation valve is kept open during normal operating conditions. Closing the intergate valve isolates flow in the up-stream direction when required for hydrostatic testing or other reason.

Note: in certain instances such as Feedwater Heater Isolation the intergate is installed to the "downstream" side of the outlet valve for isolation.

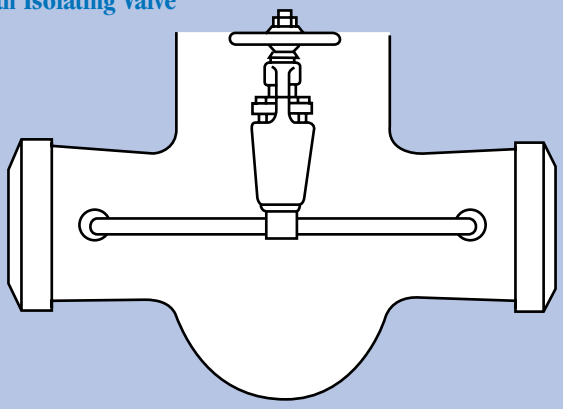
INTERGATE LINE ONLY

A&M can provide external equalizing pipe only, without valve. However, "Upstream" isolation is not possible and the intergate line cannot be closed during start up or shut down.

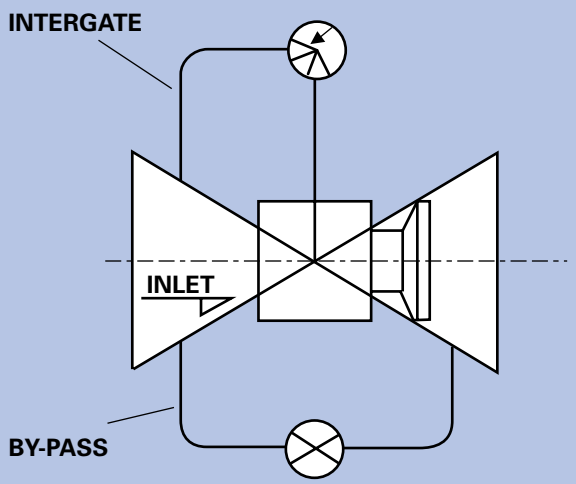
Intergate
with Isolation Valve



By-Pass
with Isolating Valve



Intergate and By-Pass Diagram



EQUALIZING DEVICES

INTERNAL DRILLED DISC

Drilling a hole through the center of the upstream valve disc can be a cost-effective design protection method, but it causes the valve to be permanently unidirectional. This method is also recommended for smaller valves where an external piping arrangement may not fit or be suitable.

OTHER METHODS

Customer Requirements

To meet customer requirements a bonnet vent, drain or relief valve can also be used for over pressurization protection. These methods require additional customer piping to remove fluid from the bonnet cavity.

Operation - Procedure

If a double seated valve does not have a design feature for over pressurization protection, the user can revise operating procedures to include opening and closing the valve disc to relieve built up bonnet cavity pressure. This must be done after any heating or cooling of the line, during a start up or shut down, and any other time fluid thermal expansion is suspected.

CONCLUSION

To meet ANSI requirements and prevent damage, some type of over pressurization protection, by method or design, is required. Determining the most suitable protection for your system is the responsibility of the valve purchaser and should be decided at time of specification prior to purchase. For additional help call Atwood & Morrill's Service or Sales Department.

24" Parallel Slide Gate Valve with Stem Extension

VEE PORT

VEE PORT DESIGN FOR FLOW REGULATION

A "Vee" port design is an optional feature for smaller gate valves. The "Vee" port is integrally cast into the outlet seat ring. Flow regulation is accomplished by progressive opening of the disc which uncovers the "Vee" notch.

The "Vee" Port Seat was originally developed for tight shut off drain applications where control or throttling was required for short durations. This severe service is very tough on standard gate valves which are designed to be used in the full open or closed position. The "Vee" Port Parallel Slide Gate meets these demanding requirements.

OPERATION

Progressive opening of the valve disc uncovers more of the "Vee" notch for flow regulation. Unlike globe valves the "Vee" is slightly recessed protecting the actual seating surface from wear.

CONSTRUCTION

"Vee" Ported Seats can be supplied in any A&M Parallel Slide Gate valve. Located on the outlet side of the valve and paired with a standard inlet seat, the "Vee" is integrally cast into the outlet seat ring and possesses excellent hardness and wear properties.

SIZING

"Vee" Ported Seats reduce the valve orifice resulting in a lower flow capacity. The capacity is about half that of a full ported gate valve, very similar to a wye pattern globe valve.

APPLICATIONS

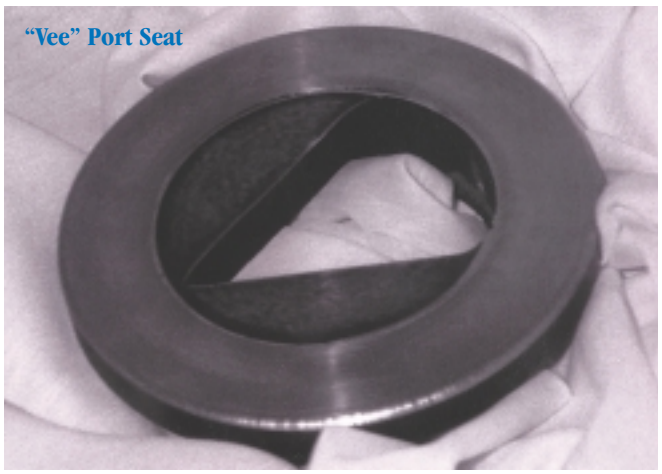
Above and Below Seat Turbine Drains

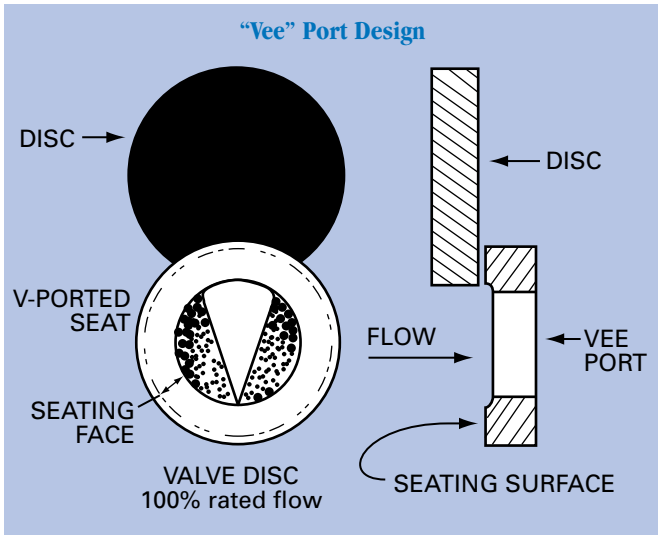
Turbine Case Drains

Main Steam Drains

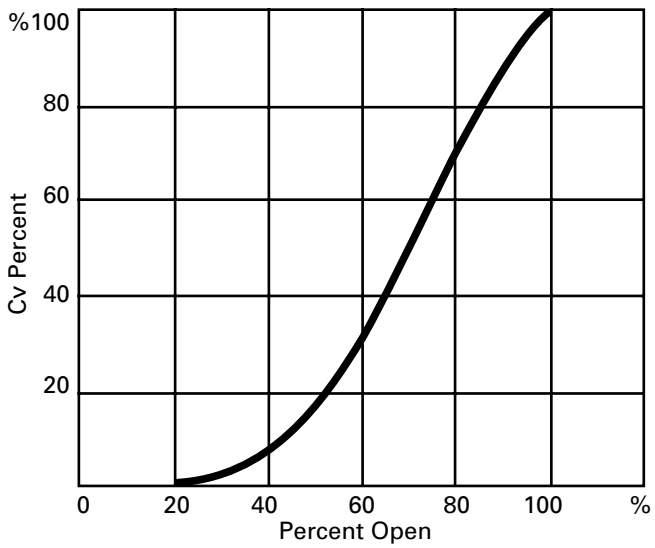
Feedwater Regulating Bypass

Steam Line Vents





Flow Characteristic of Vee-Port Parallel Slide Gate Valves

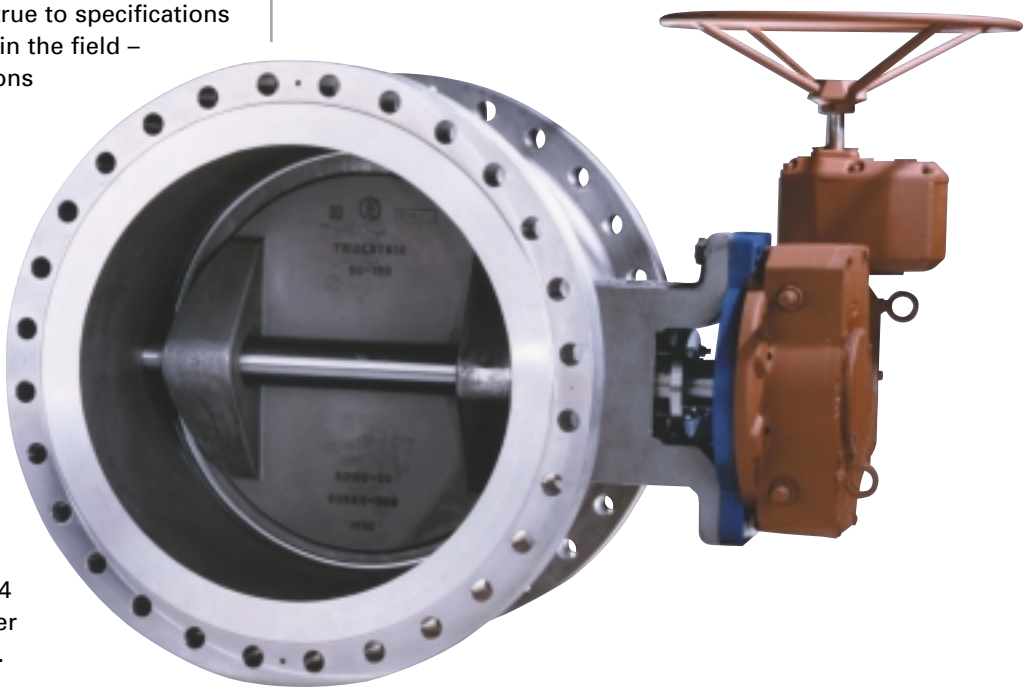


TRICENTRIC® METAL SEATED BUTTERFLY VALVE

Today's demanding projects require a quality valve that is reliable, cost-effective, true to specifications and most importantly, proven in the field – over a wide range of applications and conditions.

Throughout the world, today's engineers, as well as project and maintenance managers, specify TRICENTRIC® Valves for their Power, Processing, Refinery and most critical applications worldwide.

Atwood & Morrill designs, manufactures and services engineered, high-specification valves in accordance with a comprehensive quality assurance program. The design standard is ANSI B16.34 with international and customer standards invoked as required.



TRICENTRIC® GUARANTEES A "TIGHT" SEAL

Dye Test showing no wear or rubbing

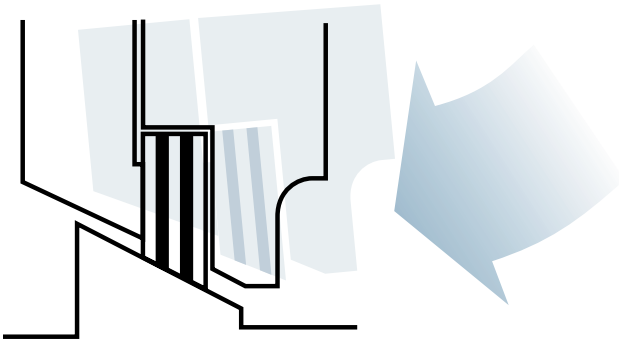
The *Prussian Blue Seat Test* clearly demonstrates TRICENTRIC®'s superior, leak-tight, positive seal. Dye applied to the disc produces seating line contacts only- with absolutely no rubbing or wear. The non-jamming seating of TRICENTRIC® valves remains bubble tight after 50,000 cycles, as tests have proven. Specifically designed to never rub or gall, TRICENTRIC® Valves actually remain bubble tight for more than 50,000 cycles.

TRIPLE OFFSET

The shaft is offset from the disc centerline

The shaft is located behind the disc mounted seal element

The cone axis is offset from the disc centerline



Seat contact does not occur until the disc is seated closed.

On opening the seal lifts cleanly off the seat at all points allowing long life and quality sealing for many cycles.

TRICENTRIC® APPLICATIONS

PULP & PAPER MILLS

Isolation and check valves for steam
Alcohol reduction process applications
Green, Red and Black liquors
Oxygen systems
Boiler water
Lime mud slurries
Stock solutions

REFINERIES

Fuel oil storage isolation valves
Steam supply stop and control valves
Sulphur condenser switch valves
Flare gas hydrogen and sour gas control, isolation or check valves
Refinery Desulphurization cooling water
Dirty hot cracking gas stop and control
Fluidized catalytic cracker check, stop and control valves

POWER PLANTS

Pump isolation and check valves
Condenser cooling
Condensate pump and extraction steam isolation and check valves
High temperature, quarter turn valves
Heat exchanger, suppression system and condenser cooling water isolation valves
Hydraulic cushion and positive shut off check valves
Fuel gas supply and isolation lines
Steam Turbine generation stop and control valves
TRICENTRIC® Valves for nuclear power plants meet ASME III, 10CFR50 Appx. B and ANSI B31.1 as required.

STEEL MILLS

Blast furnace gas isolation control and check valves
Coke battery stop valves
Recirculation pump discharge check valves
Compressor discharge check valves
Expander inlet and bypass control valves

HYDROCARBON PROCESSING

Hydrogen gas
Brine
Propylene
Ethylene
CO_2 Vapor
Liquid or Gaseous oxygen
Steam
Cooling water
Power assisted check valves for Compressor or Propylene discharge lines
Emergency closure valves to isolate in 1 second or less
Flare inlet control and manifold isolation

SPECIAL APPLICATIONS AND OPTIONS

Special body, shaft and disc materials available
Geothermal plant applications
Molten sulphur
CO_2 recovery
Steam jackets
Large sizes up to 96"
Propane gas
“Man Safe” valves
NACE trim materials

TRICENTRIC® TESTING

TRICENTRIC® VALVES have surpassed the most stringent tests for many worldwide industries including Chemical, Petroleum, Power, Pulp/Paper, Steel, Nuclear and many others

FIRE TESTED

TRICENTRIC® Valves meet or exceed API 607, Fourth Addition.

SULFUR TESTED

TRICENTRIC® breaks through solidified sulphur in seating and bearing areas with no seal damage nor interruption of service. Make cheater bars obsolete.

CRYOGENIC TESTED

TRICENTRIC® Valves have proven seal reliability for liquid oxygen, liquid nitrogen, liquid and natural gas services as required by NASA, aerospace industry and oil field recovery services.

In an independent laboratory test a TRICENTRIC® Valve measured zero leakage with Helium. After more than three hours submerged in liquid Nitrogen at -321 deg F and 145 psig the TRICENTRIC® Valve then met all specification requirements!

Cryogenic Testing

Fire Testing

TRICENTRIC® ADVANTAGES

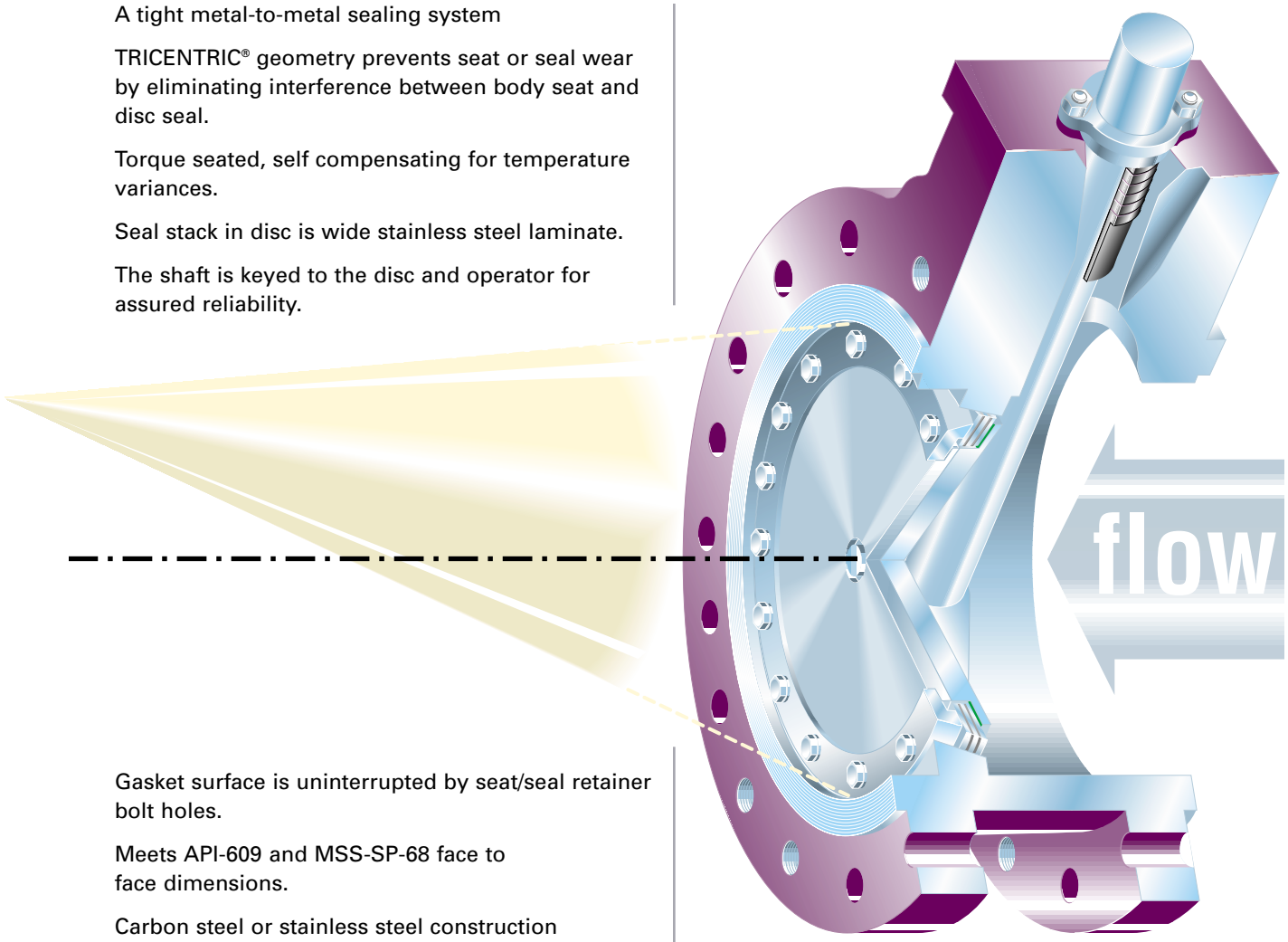
A tight metal-to-metal sealing system

TRICENTRIC® geometry prevents seat or seal wear by eliminating interference between body seat and disc seal.

Torque seated, self compensating for temperature variances.

Seal stack in disc is wide stainless steel laminate.

The shaft is keyed to the disc and operator for assured reliability.



Gasket surface is uninterrupted by seat/seal retainer bolt holes.

Meets API-609 and MSS-SP-68 face to face dimensions.

Carbon steel or stainless steel construction

Seat leak tested to meet ANSI Class V, Class VI, Bubble tight, Zero leakage or API598, Resilient seated, shutoff requirements.

Shell tested to ANSI and MSS standards.

Efficient operation with hand lever, worm gear, electric, pneumatic and hydraulic actuators.

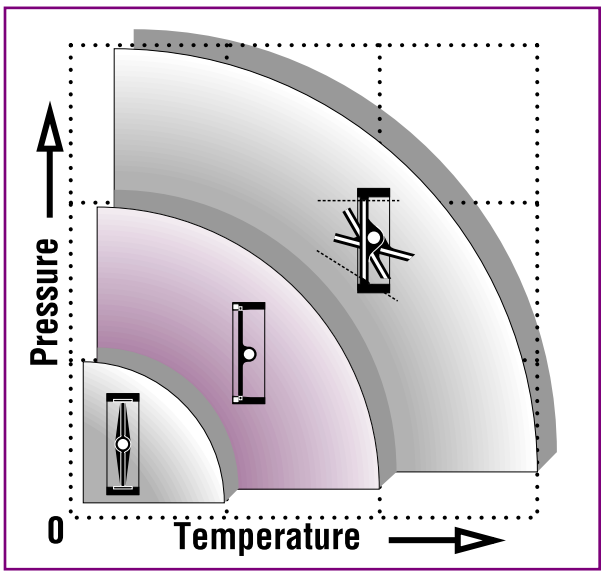
Metal seat is inherently fire safe, verified by tests to API 607.

Excellent flow and throttling characteristics covering a wide range of applications, cryogenic to high temperatures.

TRICENTRIC® PERFORMANCE

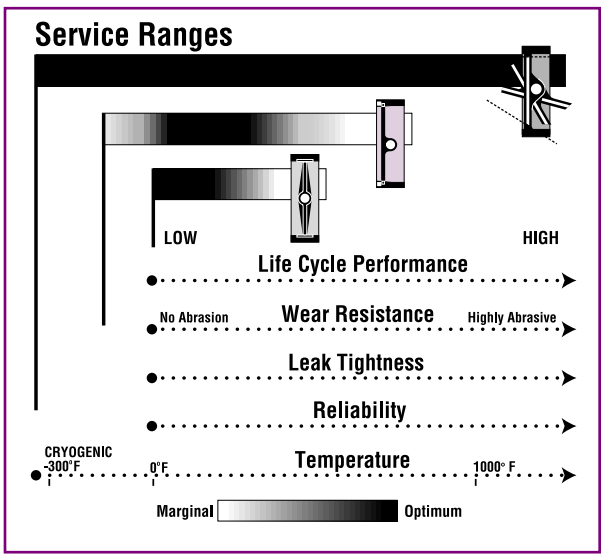
PRESSURE/TEMPERATURE

TRICENTRIC® Metal Seated Valves outperform resilient seated and high performance butterfly valves at high pressure and temperature levels.



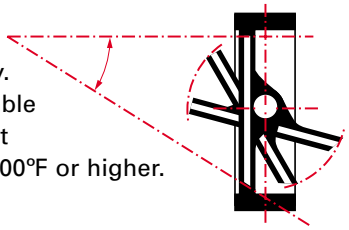
SERVICE RANGES

TRICENTRIC® Valves outperform conventional and high performance butterfly valves over all service ranges.



TRICENTRIC®

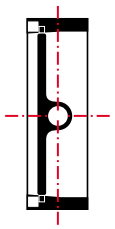
Has 3-Way eccentricity. The metal seat is capable of very tight shut off at temperatures up to 1200°F or higher.



vs.

HIGH-PERFORMANCE

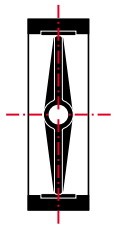
The eccentric shaft results in uninterrupted seal which can be used at higher pressures and temperatures. However, the resilient seats wear and can plug with solids.



or

CONVENTIONAL

Center shaft which penetrates a resilient seal. Suitable for low temperature, low pressure services only.



TRICENTRIC® VALVES

LUG VALVE

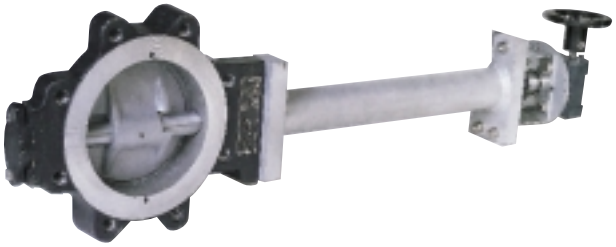
Metal seated butterfly valve with compact light weight design.

WAFER VALVE

Tight isolation valve with light weight construction and compact body dimensions

CRYOGENIC VALVE

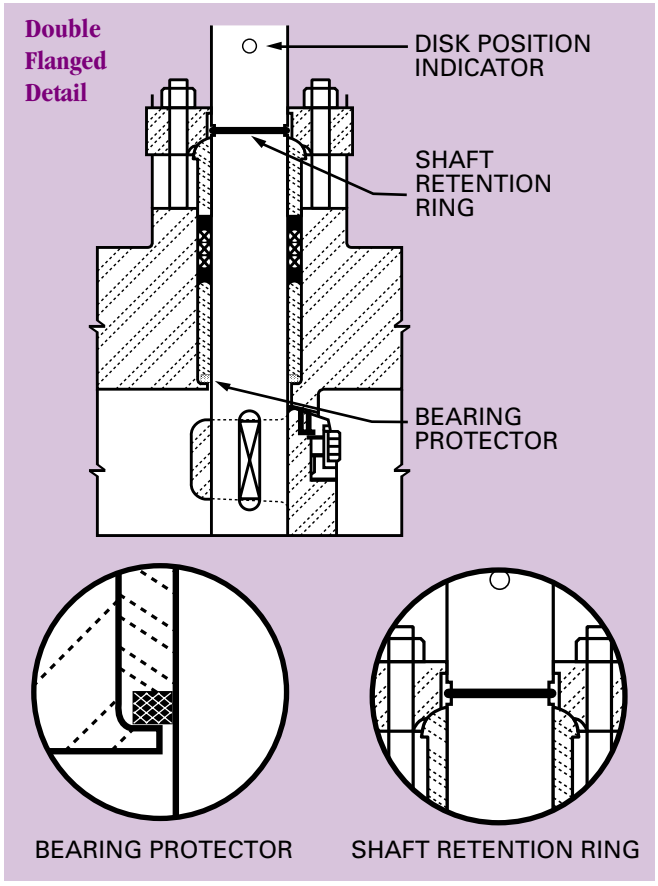
Stem extensions are available for Cryogenic application. Testing and materials to meet requirements for LN_2, LO and other Cryogenic services.



AIR OPERATED ISOLATION VALVE

Pneumatic operators available on all TRICENTRIC® Butterfly valves.

DOUBLE FLANGED VALVES



GATE VALVE FACE TO FACE

Dimensions to ANSI B16.10

Can directly replace Gate Valves in line

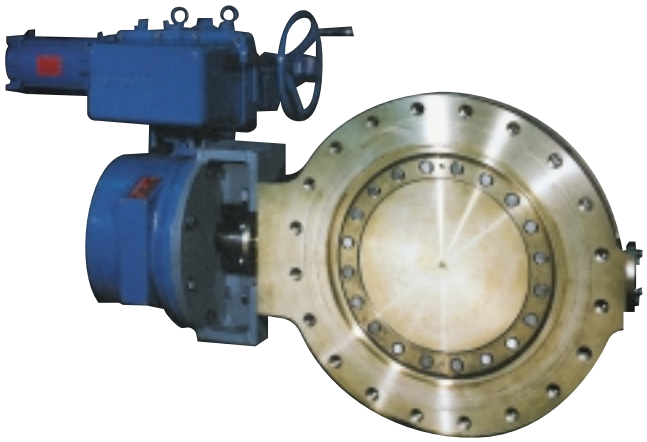
- Less weight
- Lower cost
- Smaller Operators

ISO 5752 DOUBLE FLANGED

Meets API 609 5th Edition, Blowout proof Stem, Bearing Protectors, Shaft Retention Ring

MOTOR OPERATED ISOLATION VALVE

Motor Operators available for TRICENTRIC® butterfly valves.



OTHER SERVICES AND APPLICATIONS

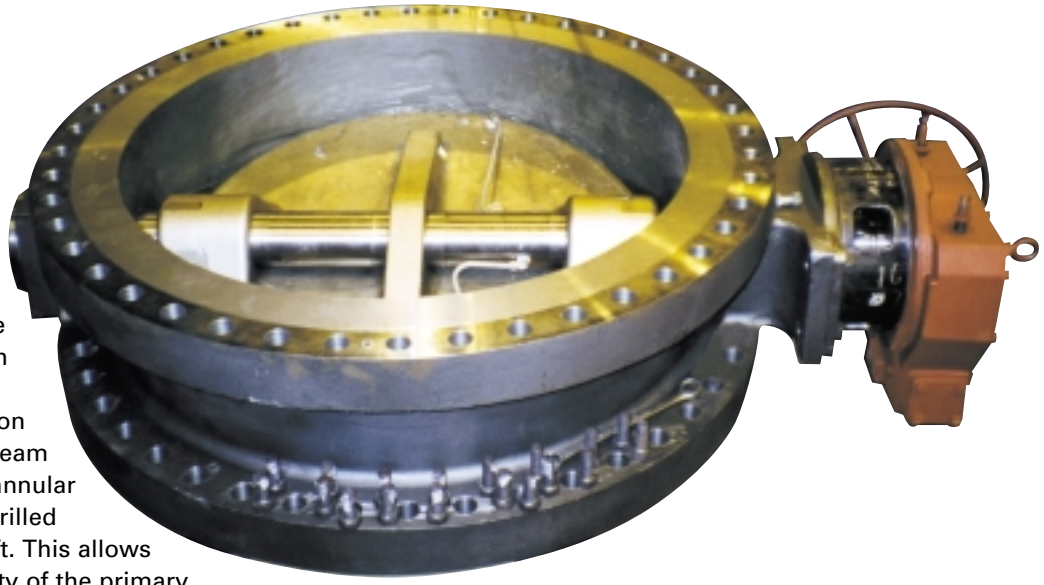
TRICENTRIC® BLOCK AND BLEED VALVES

Replace Two Isolation Valves with One Valve!

Positive Protections!

Secure, Verifiable Seal!

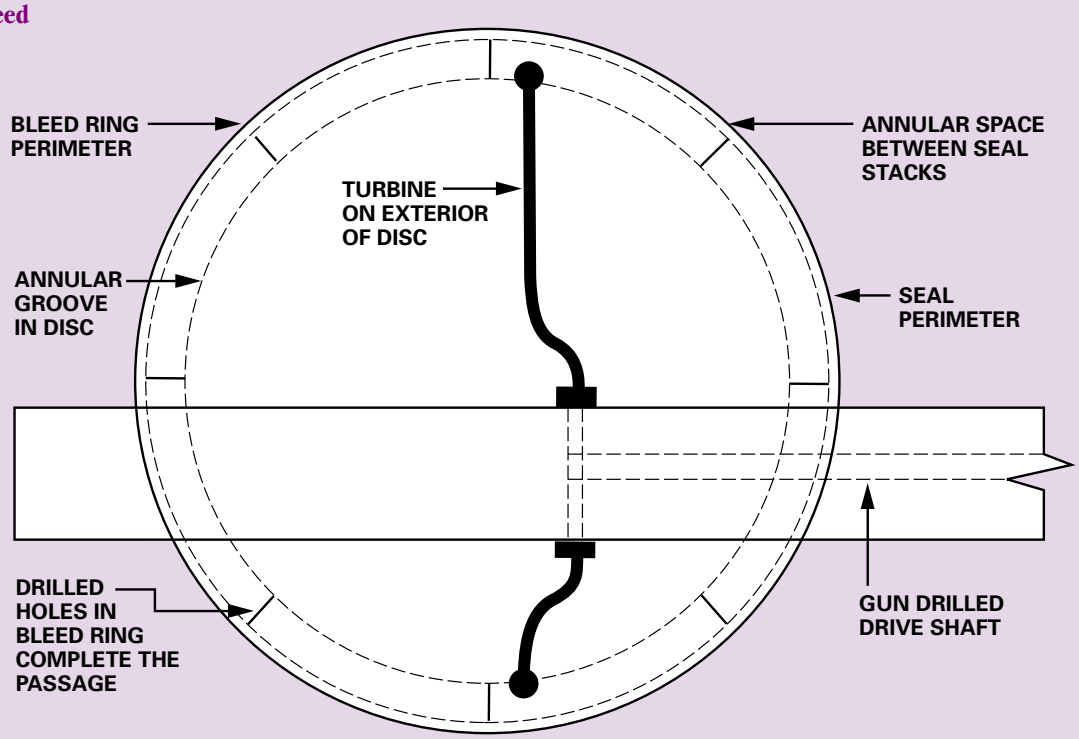
54" Class 150 Double
Block & Bleed TRICENTRIC® Valve



DESCRIPTION

TRICENTRIC® Block & Bleed Valves provide positive protection for toxic and hazardous fluids. Block & Bleeds use a double seal system with an interseal chamber to assure complete separation of upstream and downstream media. This chamber or annular space is connected to a drilled passage through the shaft. This allows users to verify the integrity of the primary seal or introduce an inert gas or fluid. A vacuum can also be applied to pull out any fluid in the chamber creating a high security seal.

Block & Bleed



Modern power plants require advanced design steam turbine bypass valves and systems for optimal performance. These systems allow boilers and heat recovery steam generators to operate independently of the steam turbine. This allows for quick start-up, recovery after a trip and avoids noise problems associated with accidental safety valve lifting.

Turbine bypass valves operate under the most severe conditions, reducing pressure by 1500-2000 psig and temperatures from 1075°F to 400°F on a fraction of a second's notice. This process requires a rugged valve design and an engineered systems approach.

Atwood & Morrill analyzes the entire application. We match the steam pressure reducing valve with a desuperheating or spraywater injection system that matches the system water pressure(s) and available space for installation.

Atwood & Morrill turbine bypass valves feature forged steel bodies with smooth contours to reduce the effect of thermal stresses. Fully guided plug trim reduces the effects of vibration and controls flow. Hardfaced seating and guiding surfaces reduce wear.

High pressure designs are used for main steam conditions. These feature pressure seal bonnets and pressure balanced construction.

Valves for reheat and low pressure bypasses may be equipped with bolted bonnets because of their large size. Reheat bypass valves with pressure balanced designs may be operated with pneumatic position actuators.

MATERIALS AVAILABLE

Modified 9% chrome steel, F91, A215 C12A

Chrome moly steels, A216-WCB, WC9, F11, F22

Carbon steel, A216-WCB, A105

WATER INJECTION SYSTEMS

Water Injection Systems are the heart of the Turbine Bypass System. Usually, the available water pressure is too high or too low. Atwood & Morrill has a range of spray nozzle types and sizes available to solve these problems.

Fixed Multi-nozzles

Feature (12) individual nozzles with spray atomizing inserts.

This nozzle is controlled by an external spray valve.

Best suited for applications where the spraywater pressure is more than 800 psig greater than the steam pressure.

Variable Orifice Multi-nozzles

Similar to Fixed Multi-nozzles, but include a movable plug operated by a diaphragm actuator.

Plug movement increases or decreases the number of nozzles in use and controls the flow rate at a constant pressure drop.

Most efficient when the water pressure is at least 50-80 psig, but less than 500 psig greater than the steam pressure.

Separate control valves are not required.

Spring Loaded Poppet Nozzles

Most efficient nozzle.

Inherently an anti-flashing design, because it generates a back pressure in the water system.

Can be adjusted to stage the number of nozzles (when multiple nozzles are used) and automatically isolates the water system from the steam side.

An external spray control valve is used to regulate flow.

LPI 41

The LPI-41 is a combined pressure reducing valve and desuperheating section in a single assembly.

FEATURES

Linear Trim Standard

Low Noise Trim

Water Injection after Pressure Reduction

Low Water Pressure Required

Compact Body

Graphite Pressure Seal Ring

Pneumatic, Hydraulic or Electric Actuators

APPLICATION

Turbine Bypass

Process Steam Control

Cogeneration

Pulp & Paper

Refinery

District Heating

Combined Cycle

SPECIFICATIONS

Sizes: 2" - 26" Inlet
2½" - 60" Outlet

ANSI Rating: 150 - 2800+

DESIGN

Forged Steel

Angle Body

Fully Contoured Body

Thermal Break Seat Shield

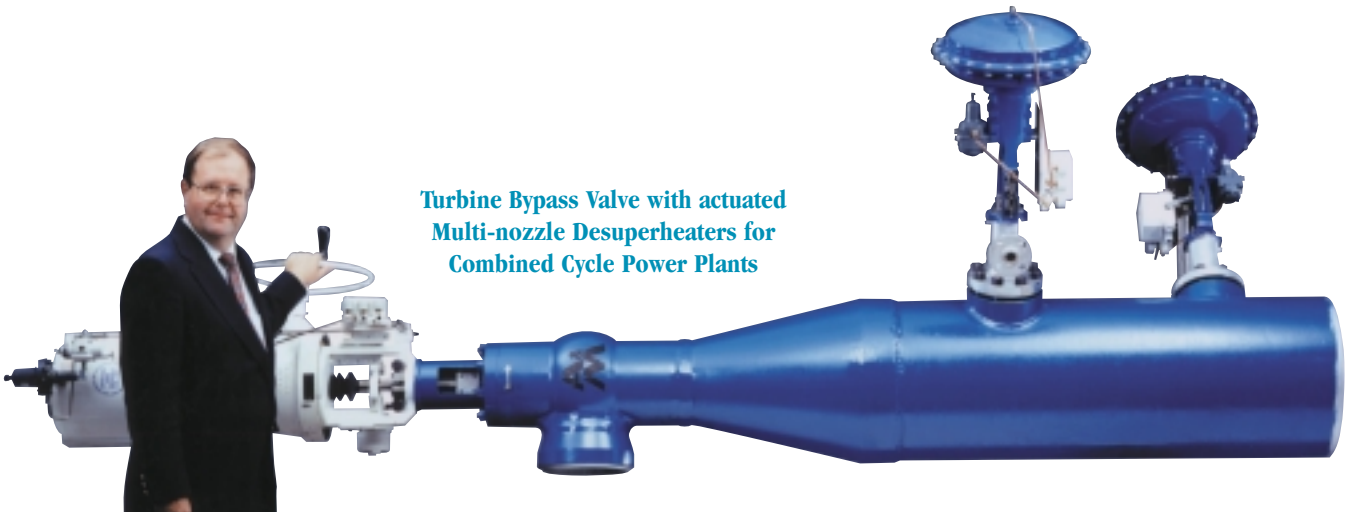
Balanced Design

Class V Shut off

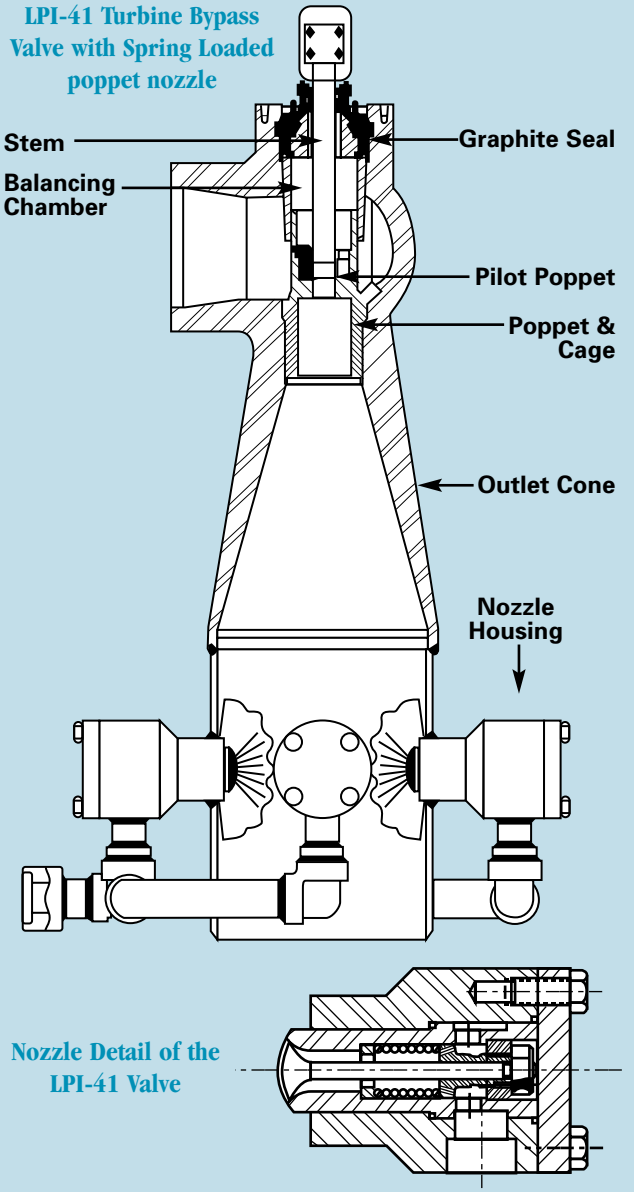
Heat Resistant Trim

Butt Weld End - Standard

LPI-41
Turbine Bypass Valve for
Combined Cycle Plant



Turbine Bypass Valve with actuated Multi-nozzle Desuperheaters for Combined Cycle Power Plants



LPI-41 Turbine Bypass Valve with Spring Loaded poppet nozzle

Nozzle Detail of the LPI-41 Valve

Desuperheating is a convenient and efficient method of obtaining steam for process work from a superheated supply.

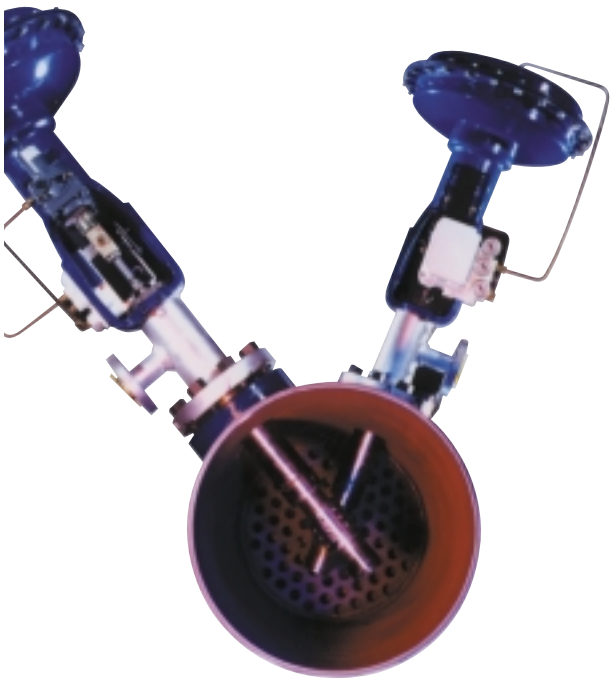
APPLICATIONS

Process Steam Temperature Control

Boiler Superheater Attemperation

Boiler Reheater Attemperation

Combined Cycle HRSG to Steam Turbine Temperature Control



REHEAT ISOLATION DEVICE FOR COLD AND HOT REHEAT LINES

The Atwood & Morrill Reheat Isolation Device provides a **timesaving** method for hydrostatic testing, wet or dry lay and chemical cleaning, It allows an open pipeline during normal operation, and isolating closure that can be installed in 2 to 3 hours. Whatever your needs, the Atwood & Morrill Reheat Isolation Device will help prevent any unplanned or undesired shutdowns.

The Reheat Isolation Device allows hydrostatic testing of the reheater to be conducted easily and efficiently. The simple design has many features similar to our Parallel Slide Gate Valve. It offers a **lower weight** and **less costly** option that either blanking flanges or a conventional stop valve.

CONSTRUCTION

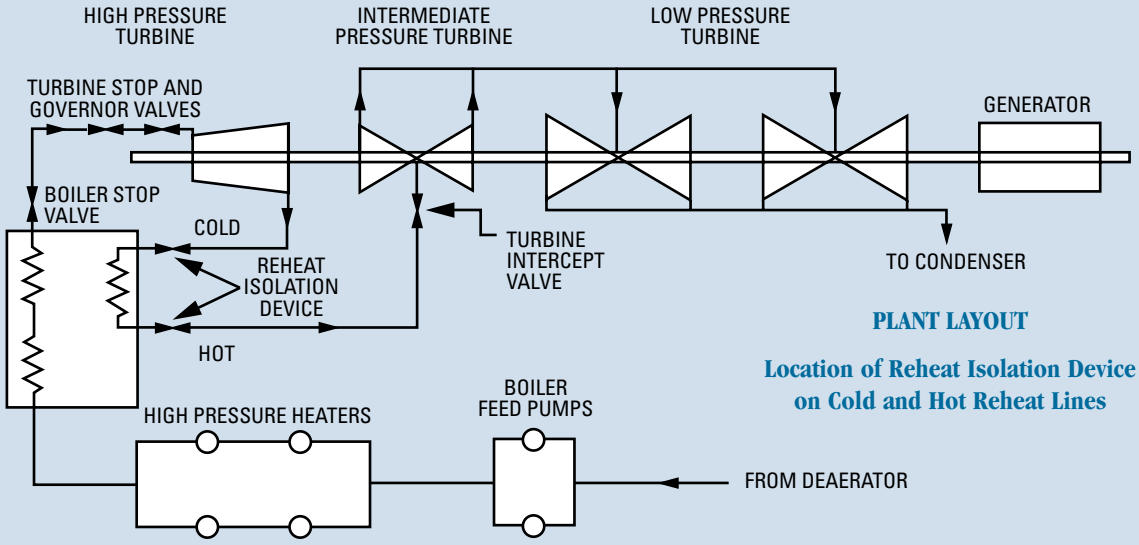
The cast carbon or alloy steel body has two parallel faces inside a center seat area. The turbine end seating face is supplied in stainless steel to prevent corrosion. Access to the Reheat Isolation Device is via a simple bolted bonnet cover. A pressure seal bonnet is also available for higher pressure applications. A spiral wound Flexitallic type, cover gasket is used to provide a tight seal for full system cycles.

OPERATION

During normal operation, the Reheat Isolation Device effectively becomes part of the pipe offering an unobstructed flow passage with low pressure drop. To meet very low pressure loss requirements, the Reheat Isolation Device can be supplied with a bolt on flow guide.

44" Class 400 Reheat Isolation Device

Before testing, the bonnet cover is removed and the disc closure assembly is lowered into the body. The disc closure assembly consists of a disc with an "O" ring face seal and locking bar. The middle of the locking bar is fitted with an adjusting screw that, when turned clockwise, compresses the "O" ring to provide the initial seal. The test fluid provides additional sealing. Replacing the bonnet cover completely isolates the reheater.



PLANT LAYOUT

Location of Reheat Isolation Device on Cold and Hot Reheat Lines

ATMOSPHERIC RELIEF VALVES

Atmospheric Relief Valves are protective devices for emergency service, providing automatic protection for costly turbine and condenser equipment. They should be considered equally as important as Trip Throttle Valves, overspeed governors, and other devices for power plant protection.

The Atwood & Morrill Atmospheric Relief Valve for condenser service was developed after long experience in manufacturing protective equipment. The finest materials and workmanship, assure our customers a completely dependable valve when an emergency occurs.

SPECIFICATIONS

4" through 36"
Larger Sizes and Special Designs on application.

MATERIALS

Cast Iron
Cast Steel available

TRIM MATERIALS

Bronze
Stainless steel available

SEATING SURFACES

Standard - Bronze to Bronze
Stainless steel

BODY STYLE

Globe - Horizontal or Vertical

WATERSEAL

Standard on all sizes

GAUGE GLASS

Available

FEATURES

Materials of Construction

To insure that the valve will function properly, the materials used must resist corrosion over long periods of time. To meet this requirement, Atwood & Morrill uses bronze to bronze trim throughout the valve. All moving surfaces are faced with bronze and operate in bronze guides to assure freedom with a minimum of corrosion.

When special temperature or corrosive conditions exist, valves are available in cast steel construction with trim material as required.

Alignment and Guide of Valve Disc

An important feature is adequate guiding of all moving parts to eliminate binding and insure perfect alignment of all operating parts.

Heavy guides are provided both above and below the disc.

All discs are machined on centers to assure alignment.

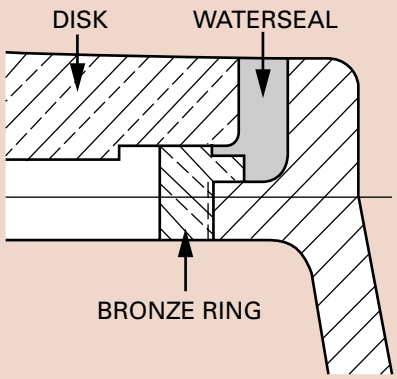
ATMOSPHERIC RELIEF VALVES

Seating Surfaces
Seating surfaces are cast integrally with the bronze disc. In larger valve sizes, the seat is made up of a screwed bronze disc ring. This surface is machined on centers at the same time the finish ship is taken on the guiding surfaces to assure proper seat-guide alignment.

Waterseal
All valves are provided with a waterseal around the valve disc of ample depth to insure proper sealing of the seat. Supply and overflow connections are provided.

An optional gauge glass can be provided to permit examination of the water level in the waterseal groove.

For valves equipped with bottom lifting devices, the stem stuffing box can also be watersealed.



DESCRIPTION

Horizontal Type
Sizes 4" through 36". These valves are equipped with a screw lifting mechanism, top or bottom mounted as required. A bottom hydraulic lifting mechanism is also available.

Vertical Type
Sizes 4" through 36" with side mounted screw lifting mechanisms.

Sizing
To properly safeguard equipment, the valve must be correctly sized. In recommending Atmospheric Relief Valve sizes, we are guided by the Heat Exchange Institute standards: *The size of Atmospheric Relief Valves is dependent upon the local operating conditions. It is always understood that they must be of sufficient size to pass all of the steam which can be admitted to a turbine or engine through any openings, except from the lines which are already protected by relief valves set to open at pressures not exceeding 10# gage. For example, an extraction or bleeder turbine would normally require an Atmospheric Relief Valve of sufficient size to take care of the full throttle steam flow to the condenser under normal operation.

The size of Atmospheric Relief Valves for normal operation of condensing turbines should be based on the following criteria for selection:

1. Valve size in associated piping should be selected to prevent pressure in condenser from exceeding 10 psig± 10% accumulation.
2. Tolerance or set pressure of relief valve should not exceed ±5%.**

Design Features Recommended:

1. Waterseal on valve disc. Provision for adequate drain must be provided to prevent buildup of hydrostatic head on valve disc.
2. Valve shall be equipped with manual lifting or opening device.

When valves are designed for maximum non-condensing operation they must be sized to flow all incoming steam at the design non-condensing pressure. It is suggested that in lieu of an Atmospheric Relief Valve being sized for this flow, a Relief Valve for protection be provided and a separate Gate or Butterfly Valve be provided for additional flow for non-condensing operation.

The sizes listed “for protection” are normally used under ordinary condensing operation and are for general reference only. If it is desired to operate the turbine temporarily, non-condensing and its maximum non-condensing capacity, the sizes listed under “For Maximum Non-condensing Operation” should be used. Actual design conditions, i.e., flow, relieving pressure, should be established by the user and condenser manufacturer. The valve relieving capacity and design should be certified by the valve supplier.”

*Reprinted from the “STANDARDS FOR DIRECT CONTACT BAROMETRIC AND LOW LEVEL CONDENSERS”. FOurth Edition, Copyright 1970 by the Heat Exchange Institute, 122 East 42nd Street, New York, N.Y. 10017.

**If the disc is spring loaded the tolerance for the set pressure is ±2 psi.

ATMOSPHERIC RELIEF VALVES

ATMOSPHERIC RELIEF VALVE SIZES - LOW LEVEL CONDESNSERS ONLY

POUNDS OF STEAM PER HOUR			FOR PROTECTION	FOR MAXIMUM NONCONDENSING OPERATION
Up	to	7,500	6"	8"
7,501	to	11,800	8	10
11,801	to	17,000	8	12
17,001	to	20,000	8	14
20,001	to	23,100	10	14
23,001	to	30,200	10	16
30,201	to	38,200	12	18
38,201	to	45,000	12	20
45,001	to	47,200	14	20
47,201	to	62,000	14	24
62,001	to	68,000	16	24
68,001	to	82,000	16	30
82,001	to	106,000	18	30
106,001	to	120,000	18	–
120,001	to	170,000	20	–
170,001	to	250,000	24	–
250, 001	to	380,000	30	–
380,001	to	550,000	36	–

APPROXIMATE WEIGHTS OF ATMOSPHERIC RELIEF VALVES

VALVE SIZE inches	HORIZONTAL*	VERTICAL*
4	115	87
5	140	108
6	190	167
8	350	290
10	520	430
12	725	560
14	950	705
16	1200	1060
18	1500	1360
20	1850	1625
24	2550	2255
30	5200	4200

*IN POUNDS

OPERATION

Atwood & Morrill Atmospheric Relief Valves are designed to be tight under full vacuum conditions and to open automatically at a pressure slightly above atmospheric. Valves will reseat after opening and remain tight in service.

Internally spring loaded valves are available where relief pressures higher that atmospheric are desired.

INSPECTION AND MAINTENANCE

We strongly recommend that Atmospheric Relief Valves be opened at least once every six months, preferably at more frequent intervals, and at any time the unit is down for periodic inspection.

We also urge that valves be opened, inspected internally and cleaned, if necessary, during the regular turbine or condenser inspection.

NUCLEAR POWER PLANT VALVES

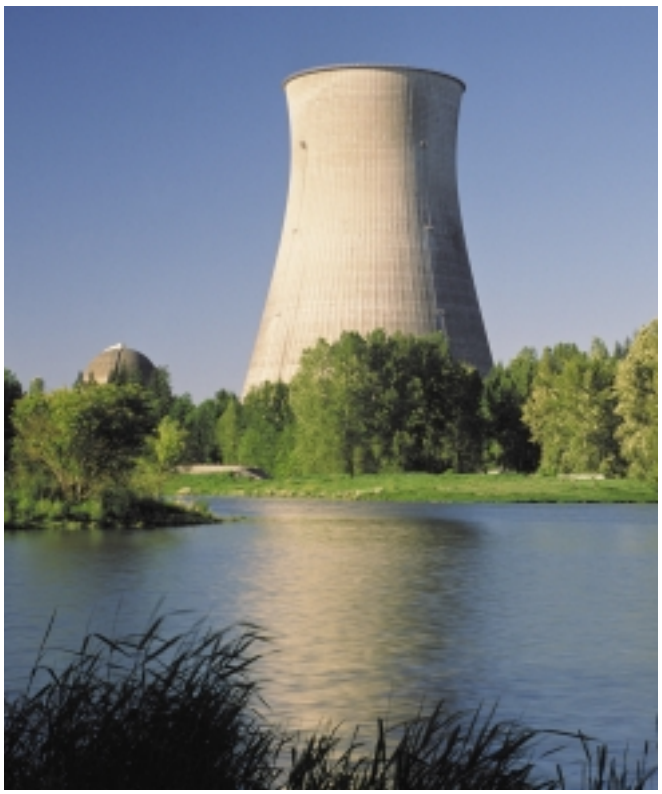
Atwood & Morrill is a leading engineer and manufacturer of valves for Nuclear Power plants. The company was a pioneer in the development of large safety related valves such as Main Steam Isolation Valves and Testable Check Valves.

The company remains committed to its nuclear plant customers by maintaining its rigorous quality assurance program and ASME 'N' stamp certification. Customers have access to support services including engineering service teams and replacement parts.

Atwood & Morrill engineers are designing and testing new families of valves for the Advanced Boiling water Reactor (ABWR) and other advanced power reactors.

Atwood & Morrill has the capacity to furnish the majority of safety and non-safety related valves for new plant construction or upgrades anywhere in the world.

The products displayed in this section are representative of the range of Nuclear equipment Atwood & Morrill supplies.



MAIN STEAM ISOLATION VALVE (MSIV)

Tight shutoff valves for high pressure and high temperature during emergency and faulted conditions.

APPLICATIONS

Wye Globe or Parallel Slide Gate Valve types for Nuclear PWR & BWR Units

Quick closing for primary containment

SIZES

16" - 34" ANSI Class 600 - 900
Repairs and modifications available

MSIV MODIFICATIONS

Stem design Improvement

Main Steam Isolation Valves (MSIV's) manufactured by Atwood & Morrill Co., Inc. and by licensees, have long been used in Nuclear Power Plants to isolate the Main Steam Lines. We continuously strive for product improvements. One improvement has been the development of a one piece forged stem for greater strength and security.

The MSIV stem sees forces that can cause loosening of the threaded and pinned collar joint on a two piece stem. In addition to axial movement, the stem also transmits rotational forces acting on its poppet to an external reaction stop.

The new design is constructed in one solid piece. The top spring seat (collar) is an integral part of the stem, which prevents any vibration from damaging the stem.

Recommendations

A&M recommends inspecting the MSIV stem at your next scheduled outage. If any signs of stem damage are present, consider stem replacement. Using the upgraded, proven design can reduce future repairs and improve valve operability. Contact the A&M Service Department for further information.

MSIV QUALIFICATION AND TESTING

Nuclear durability testing

Environmental and Seismic qualification testing

Static Bend Test

CONTROLLED CLOSURE CHECK VALVE

An automatic, self-regulated check valve to reduce water hammer effects and piping loads after feedwater line break.

FEATURES

Internal dashpot provides self-controlled closure

Slow closure rate reduces pressure surge to acceptable levels

Reverse flow is checked with throttling effect

APPLICATIONS

Feedwater lines in nuclear power stations

MATERIALS

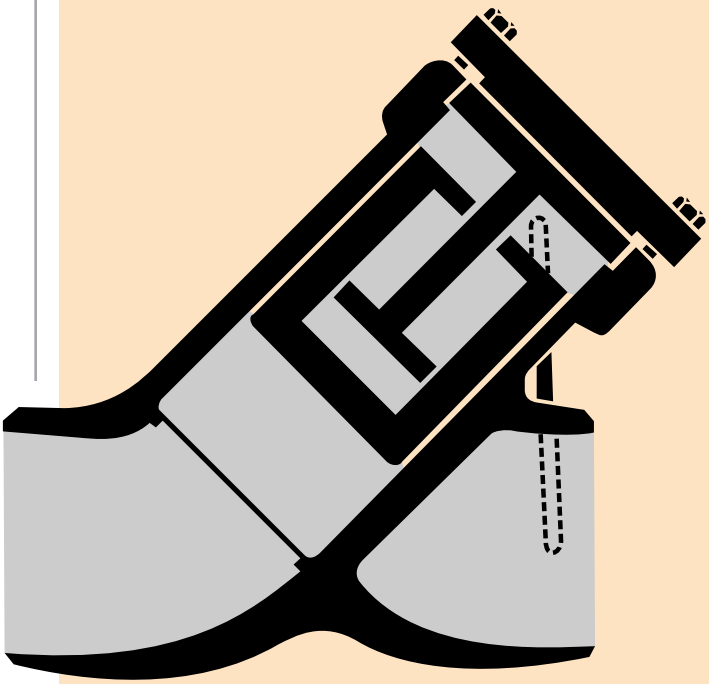
To customer specifications. Usual materials include carbon steel with stainless steel trim and hardfacings for seats and guides.

SIZES

10 - 24 inches.

PRESSURE RATINGS

ANSI Class 600, 900 and 1500



TESTABLE CHECK VALVES

A check valve for emergency cooling systems which may be remotely or manually exercised and tested.

FEATURES

Manual lever or air cylinder actuator permits local or remote testing

Internal lost motion device allows free swing of disc independent of actuator and packing friction

Magnetically tripped switches give positive (direct) indication of disc position

APPLICATION

High and low pressure core cooling systems in nuclear power stations

MATERIALS

Carbon steel or stainless steel as specified

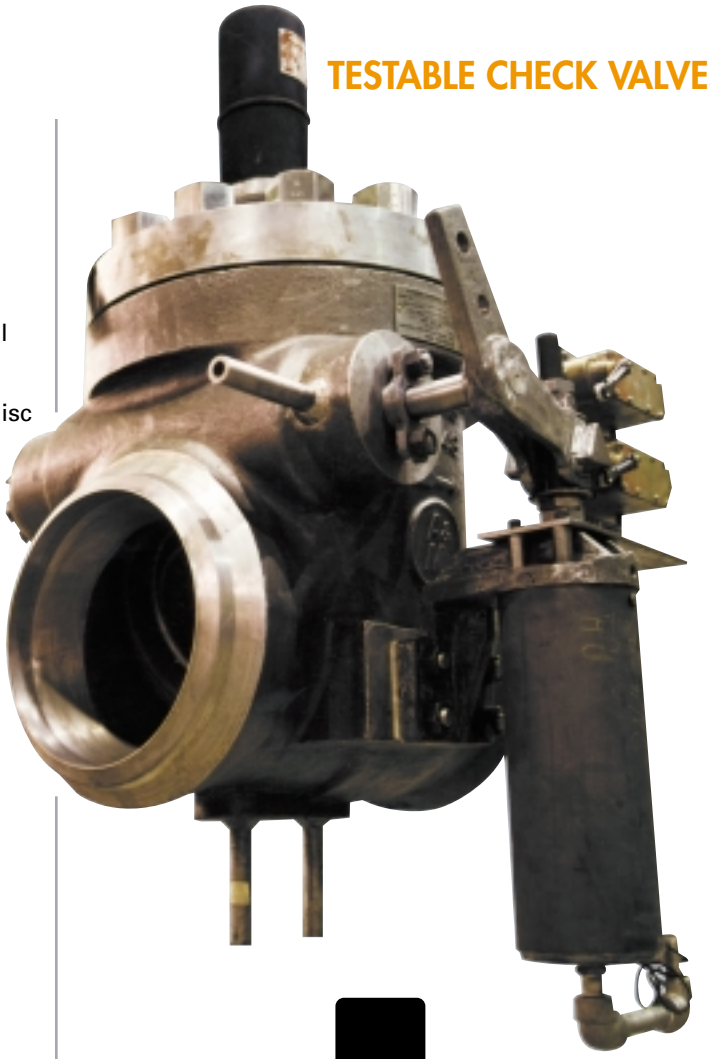
Trim materials: Stainless steel and hardfacings

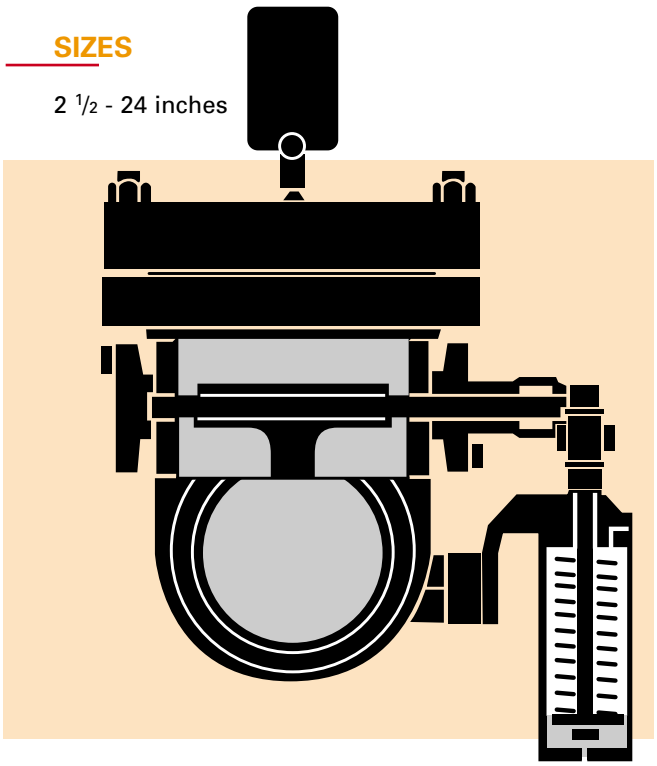
PRESSURE RATINGS

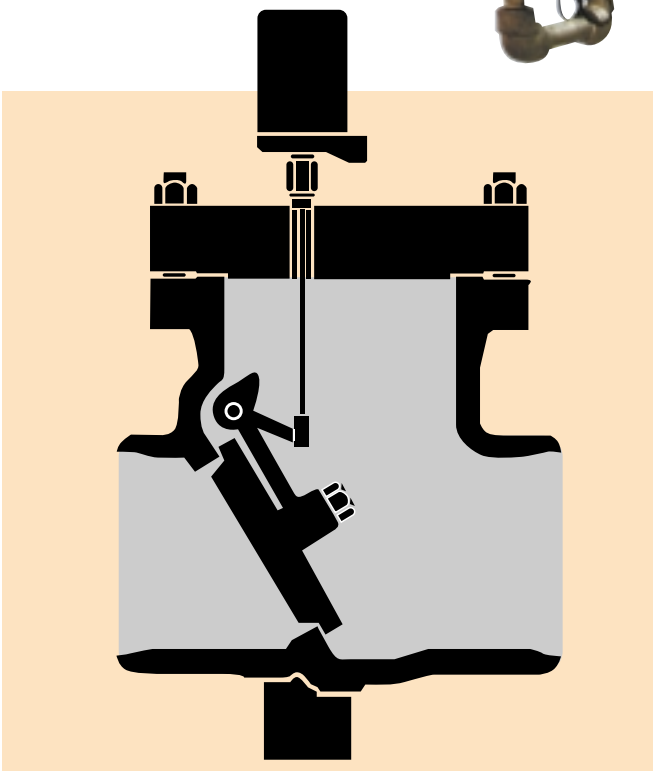
ANSI Class 600, 900 and 1500

SIZES

2 ½ - 24 inches







PARALLEL SLIDE GATE VALVE

A valve for high pressure, high temperature shutoff applications

FEATURES

Position Seated

Non wedging, non binding Parallel Slide Gate Valves for high pressure, high temperature service

Seismic Qualifications

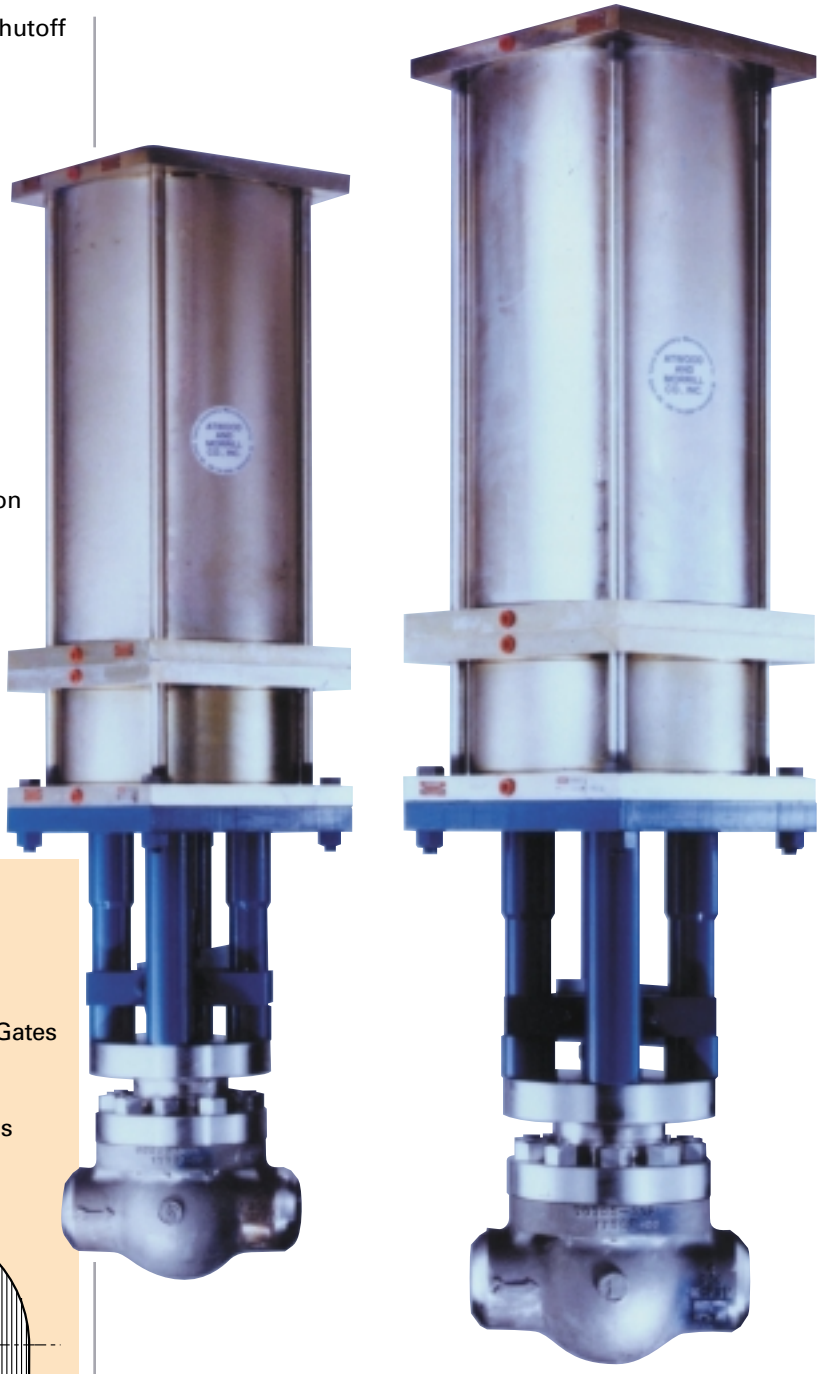
ASME III, 10CFR50 App. B, and ANSI B31.1

*Predictable loading & unloading forces to assure ability to perform safety-related function according to all GL 89-10.

APPLICATIONS

Main steam Isolation

Feedwater Isolation



Air Operated Parallel Slide Gate Valves

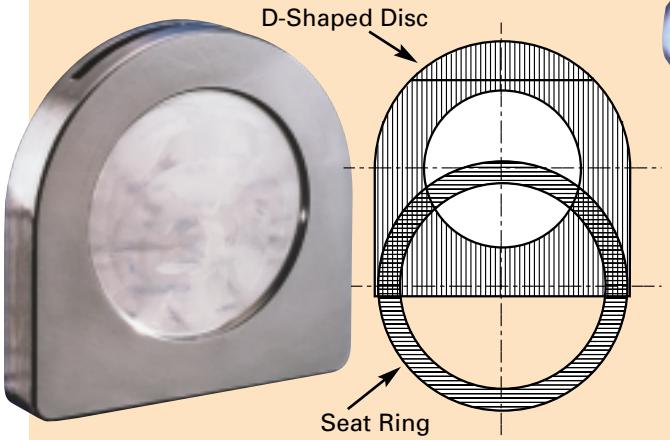
D-SHAPED DISC

Safety Related, GL89-10, High Flow Isolation Applications

Eliminates Disc Tilting Associated with Wedge Gates

Fully Guided Throughout Entire Valve Stroke

*Flow Tested Under Full Blowdown Conditions



Disc Anti-Tilt Feature

TRICENTRIC® BUTTERFLY VALVE

FEATURES

- Tight Shut-off Metal Seat
- Wafer, Lug, or Double Flanged Style Body ISO 5272 or Gate Valve Face to Face (ANSI B16.10)
- Flow Tested
- Predictable Seating/ Unseating Torque Value
- Quick Acting
- Seismic Qualified Designs
- Full Range of Materials
- Minimal Maintenance
- Available in Corrosion Resistant Materials (MIC)

APPLICATIONS

- Isolation, Control and Combination Valves
- Containment isolation
- Core spray system
- Service water system
- Pump discharge isolation
- Brackish cooling water

SIZES

3" - 96"

30" Stainless Steel Nuclear TRICENTRIC® Valve

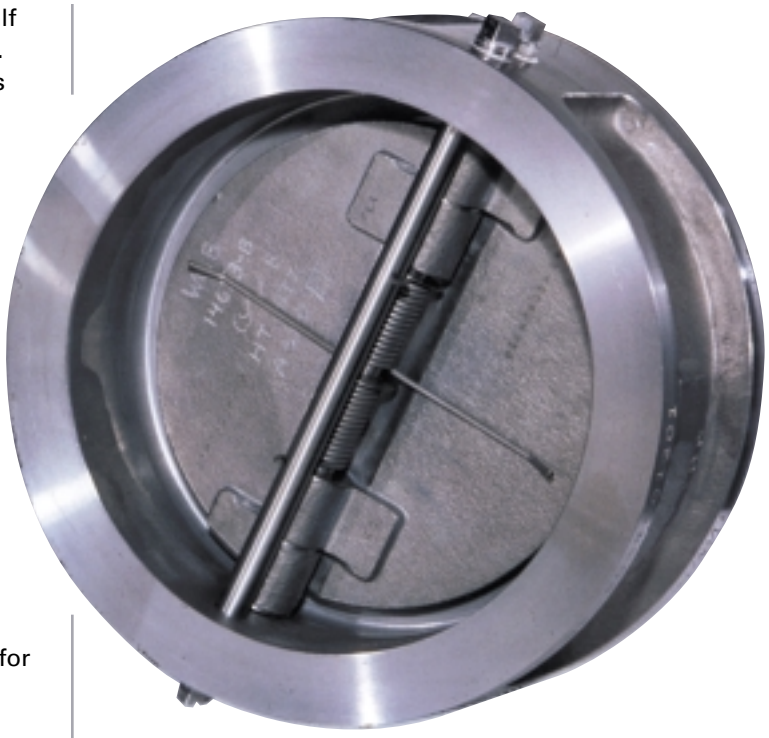
You Can't Fight "Killer Mussels" With A Resilient-Seated Valve!

Infestation of barnacles and mollusks, especially the Zebra Mussel, can cause nuclear plant water systems no end of corrective maintenance. Rubber-seated valves at a nuclear power plant have required more than 300 hours of corrective maintenance. TRICENTRIC® Valves installed, however, required no non-routine maintenance. Because TRICENTRIC® Valves have a metal-to-metal shutoff design, the seal crushes everything in its path. At point of closure, the seal is virtually self-cleaning.

TRICENTRIC® DUAL PLATE CHECK VALVE

The valve employs two spring-loaded plates (half discs) suspended on a central vertical hinge pin. This dual-plate design offers several advantages over one-piece disc designs. When the flow decreases, the plates close rapidly by torsion spring action without requiring reverse flow.

After extensive endurance and performance tests, the spring action and hinge design has been perfected so the location of the spring force prevents the plate heel from dragging and causing seal wear.



APPLICATIONS

Service water check

PROCESS CONDITIONS

A wide variety of cast and fabricated materials for bodies, plates and trim for all types of service and temperature conditions

Full line of valves, designed and rated in accordance with ANSI Class 150 and 300

For operational temperatures from -450°F through 1000°F

FEATURES

Dual-plate design for light weight, small size, and strength

Spring action closes each plate independently

Stop pin

One-piece body casting for maximum corrosion resistance

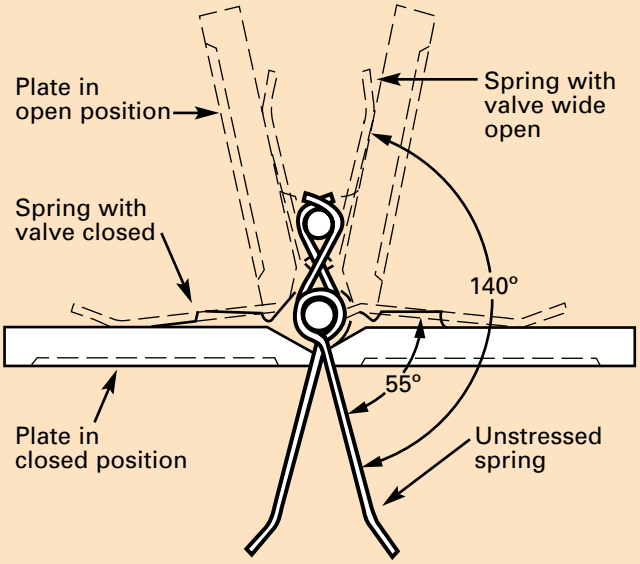
Long-leg spring action eliminates seat scrubbing

Hinge sleeve provides independent plate suspension

Hinge pin

Pin retainer

TRICENTRIC® SPRING DESIGN
(Two independent springs)



SIZE AND PRESSURE RATINGS

2" - 36"

ANSI Class 150 - 900

TRIP THROTTLE VALVE (TTV)

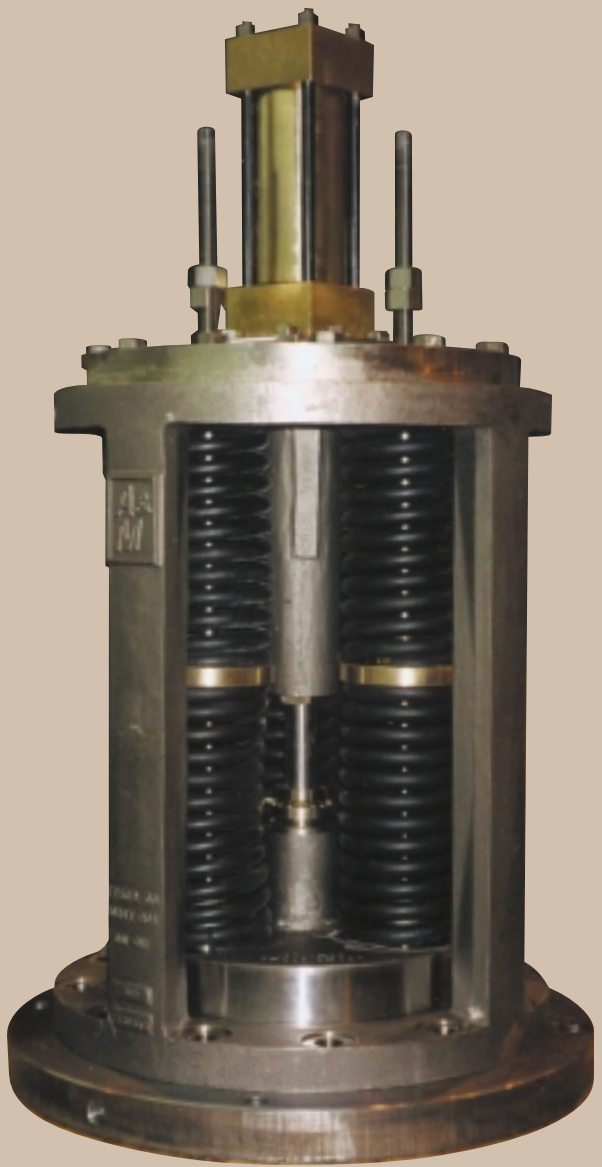
Trip Throttle Valves are designed to protect steam turbines from over speed during upset conditions. The valves close quickly upon the loss of turbine lube oil pressure or a mechanical trip of the turbine.

A&M can provide maintenance and repair Trip Throttle Valves.

6" Class 600 Inverted Hydraulically Actuated Trip Throttle Valve

BALLAST TANK VALVE

Special Application Ballast Valve used in Navy ships



SPRING RELIEF VALVES

The Spring Relief Valve opens at a "set" pressure, gives relief to increasing quantities of steam up to a "full" relief pressure, and reseats without blow-down at approximately the same pressure at which is initially opened.

A&M can repair your existing A&M Spring Relief Valves.

SIZES

1 1/2" thru 24"
Special Larger Designs on request.

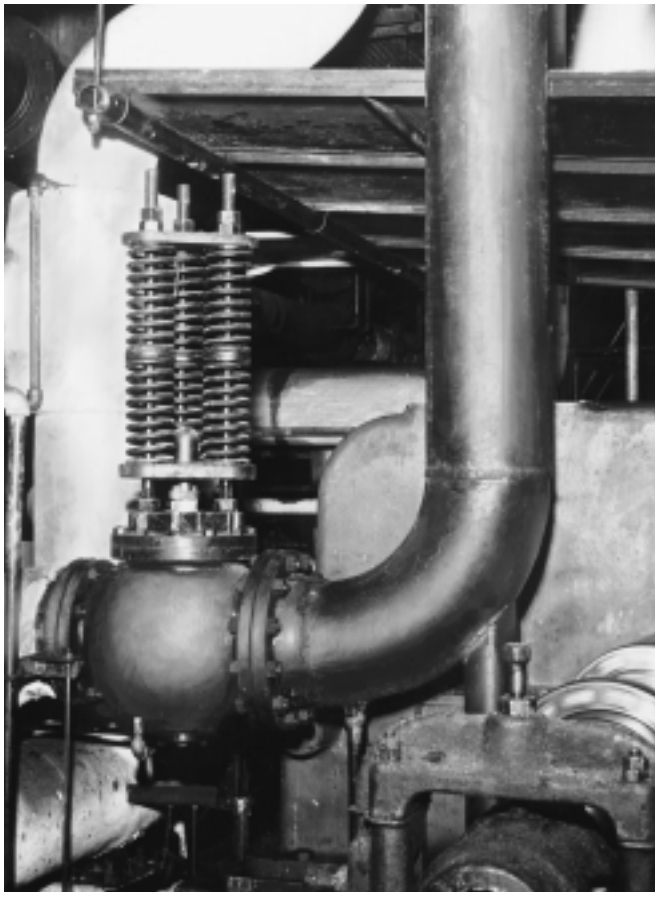
PRESSURE CLASSES

Through Class 300 Rated Flanges

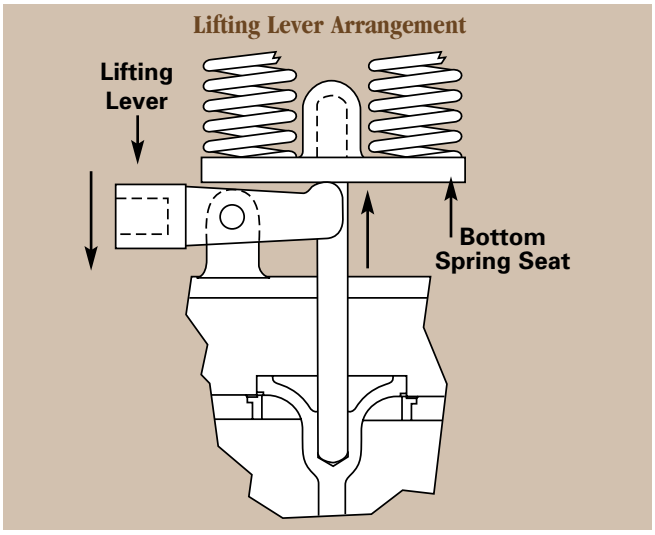
Non Code

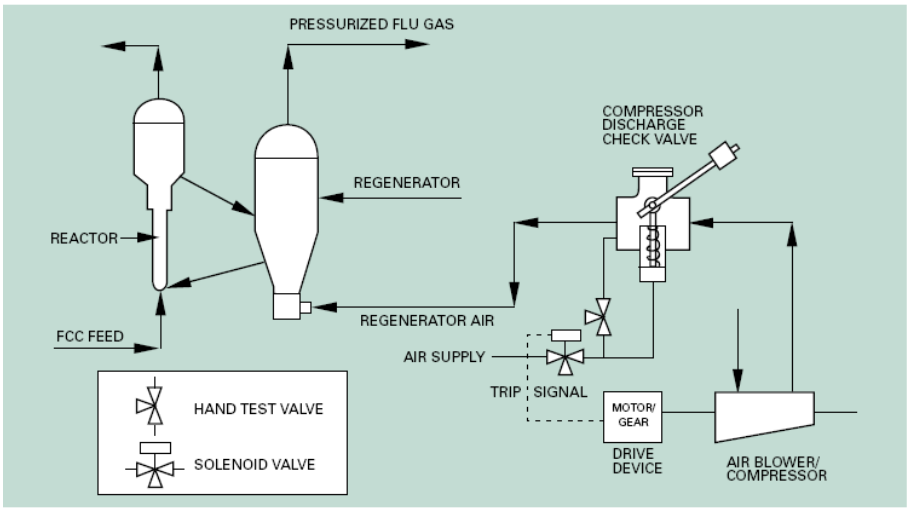
BODY STYLE

Globe or Angle Type, Single Seated with external springs.



High-Lift
High-Capacity
Spring Loaded
Relief Valve





Typical Installation of A&M Compressor Discharge Check Valve in a Fluid Catalytic Cracking Process Unit

A Company of the **Weir Valve Operations**

Designer and Manufacturer of Valves serving the needs of the Hydrocarbon Processing and Nuclear and Power Generation Industries over 100 years