# 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<br>Very low friction mechanical seals - optional (can not be overtightened)<br>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**

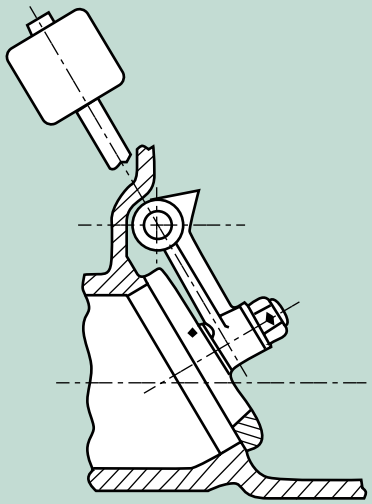


**Figure 2**

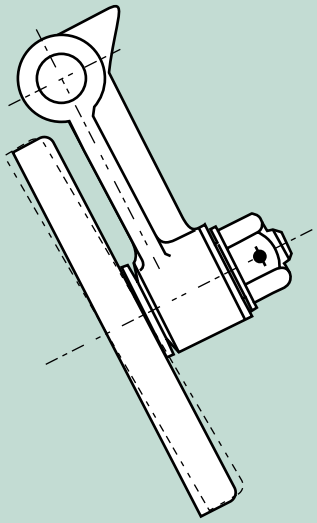
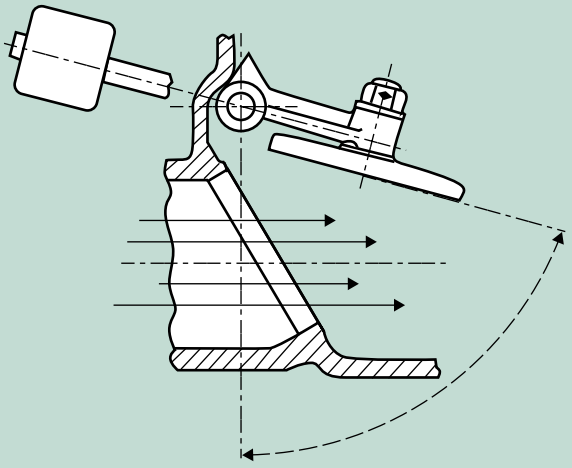


**Figure 3**



## FREE FLOW REVERSE CURRENT VALVE

Figure 4

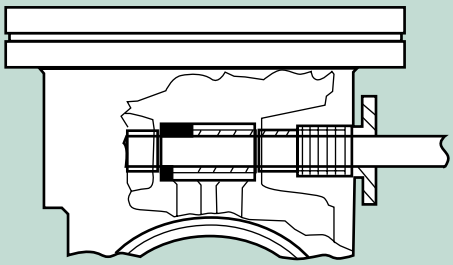


Figure 5

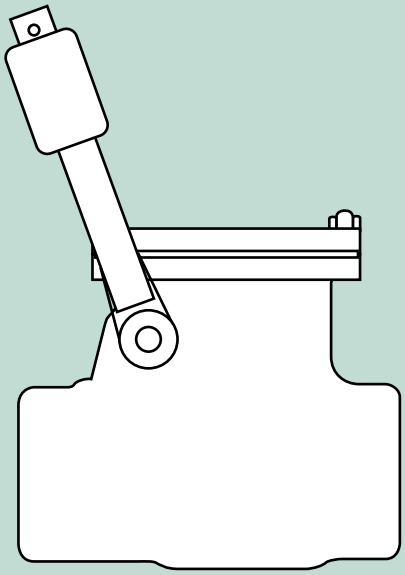
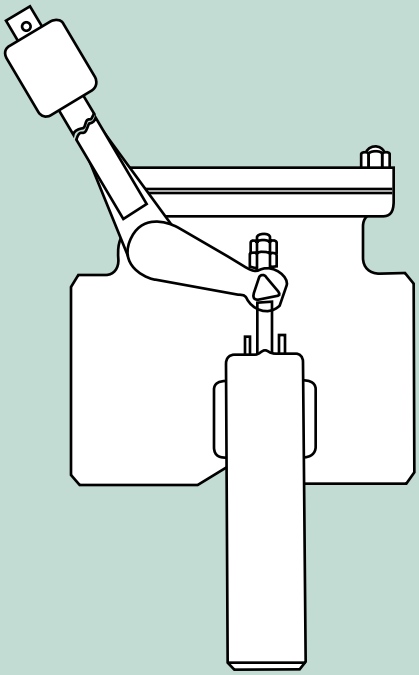


Figure 6



# 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**

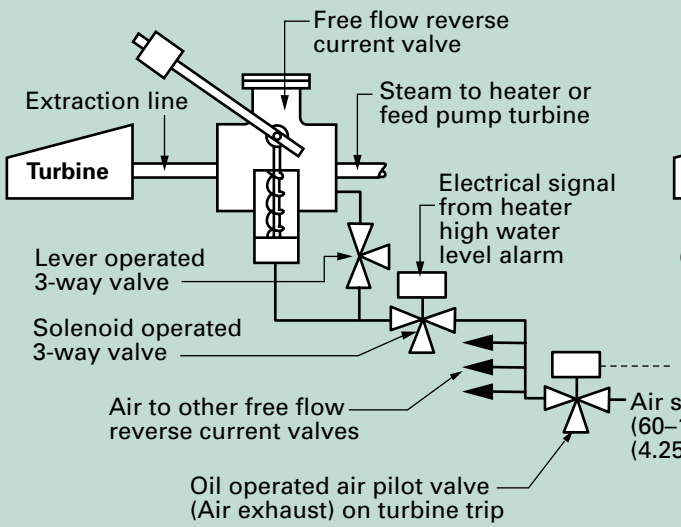
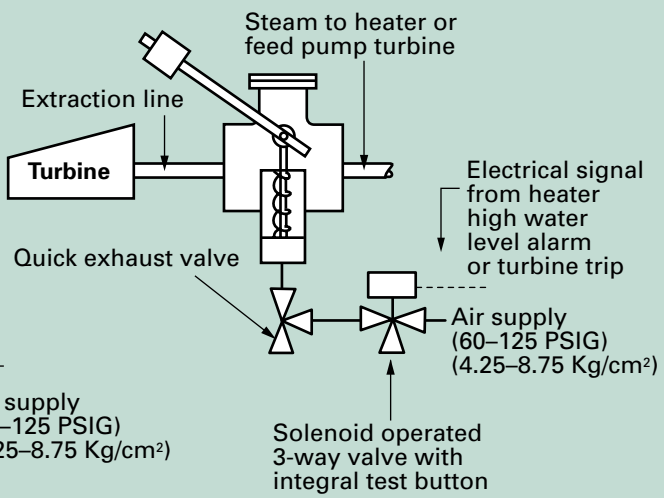



**Figure 8**



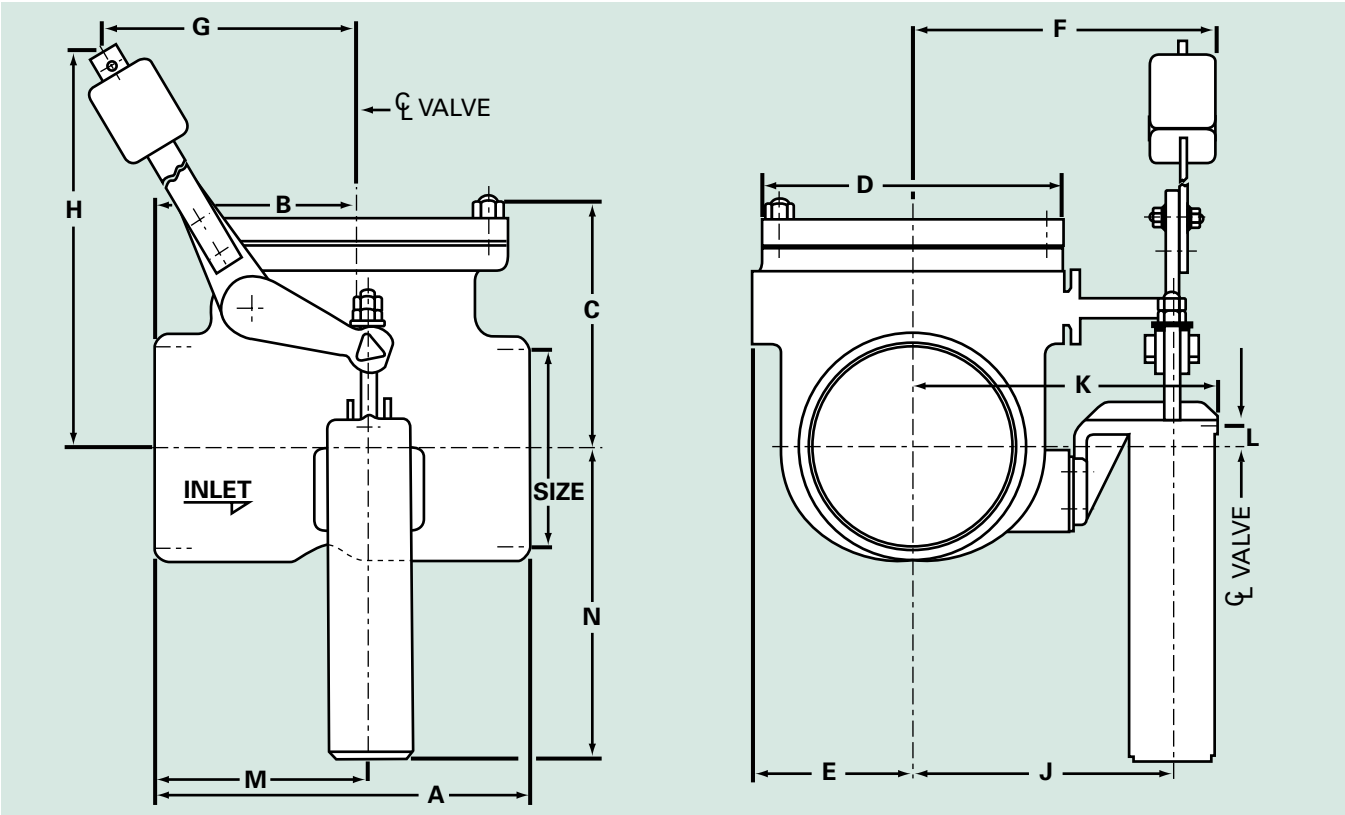
## FREE FLOW REVERSE CURRENT VALVE

### 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

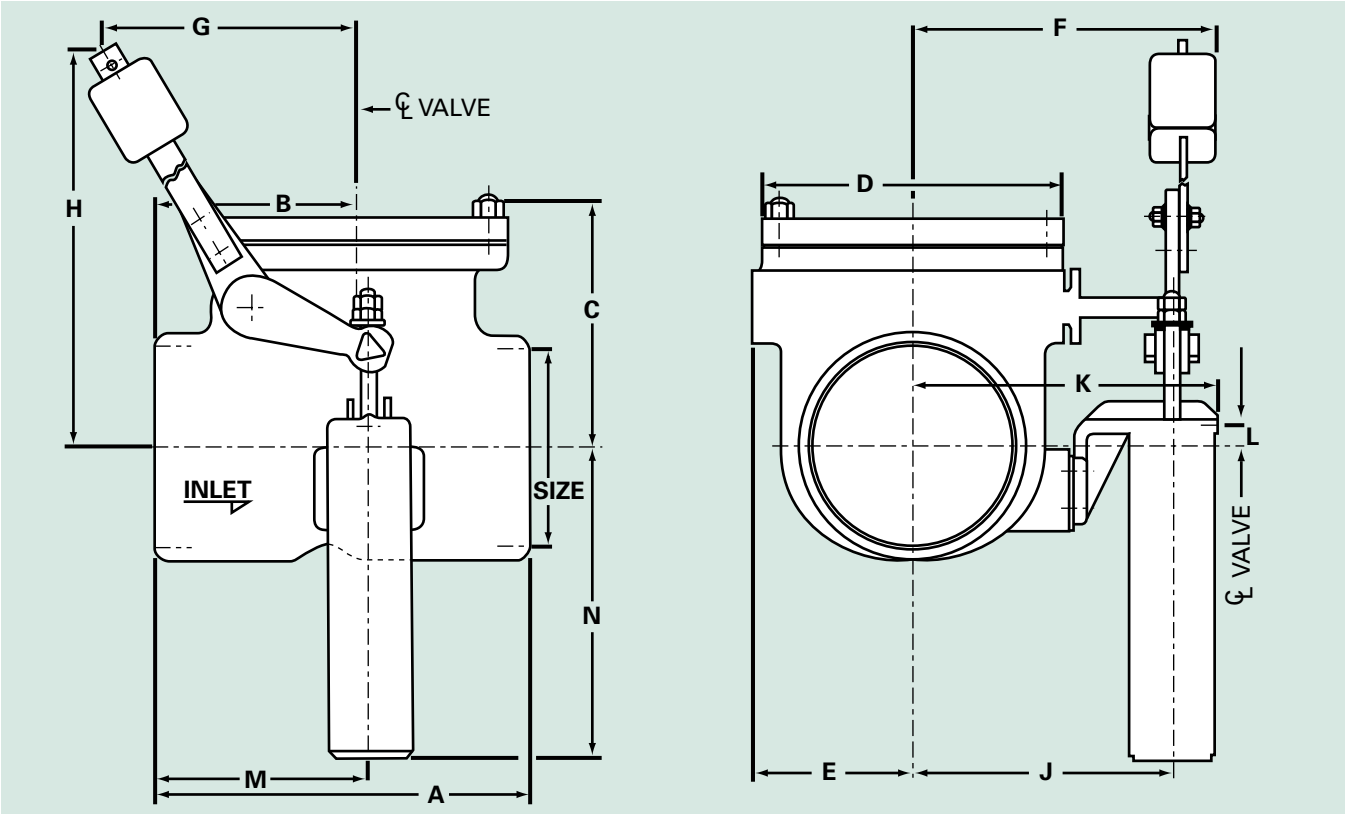
### CLASS 400 - 600

| 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.

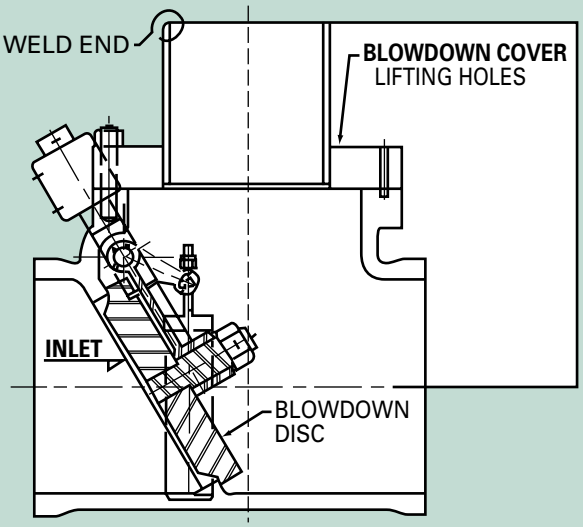
### CONSTRUCTION

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

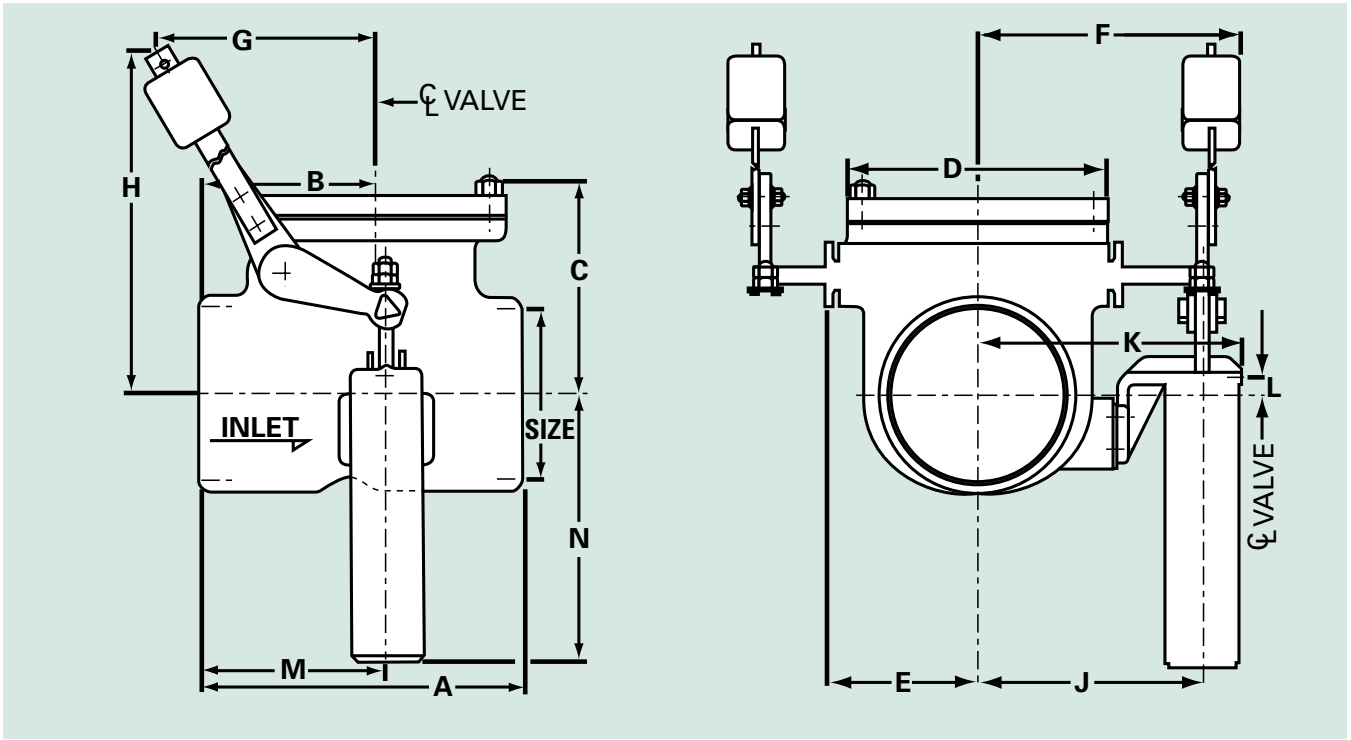
## CLASS 300

| 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 |

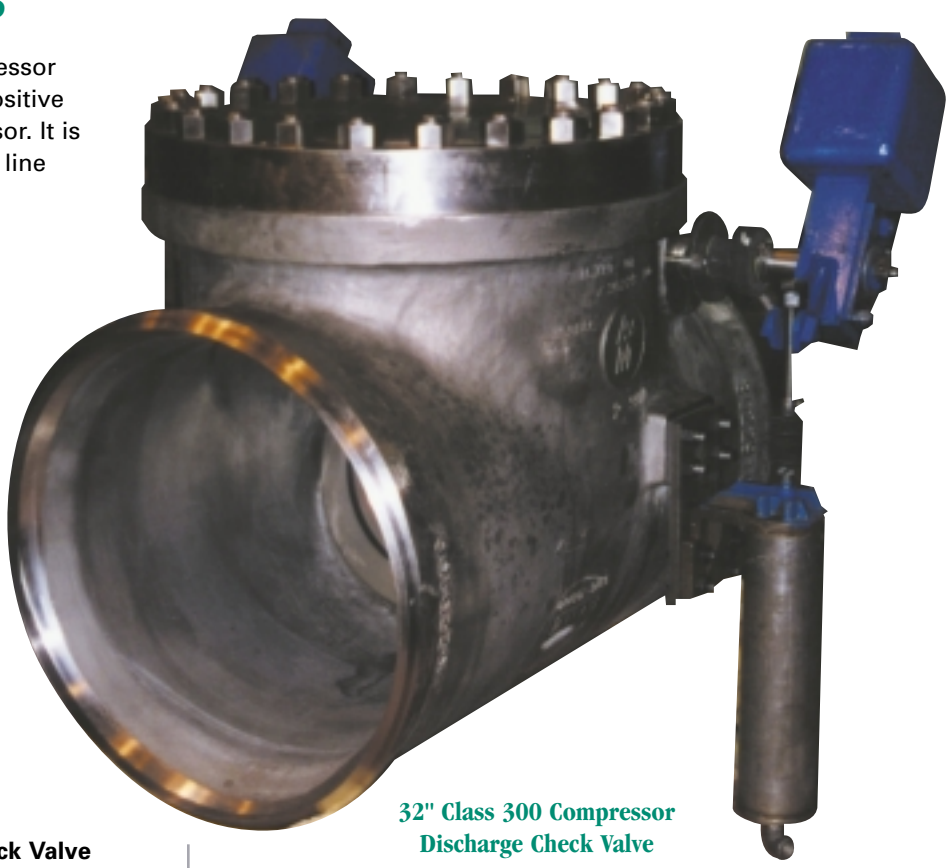
NOTE: ALL DIMENSIONS IN INCHES



## 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

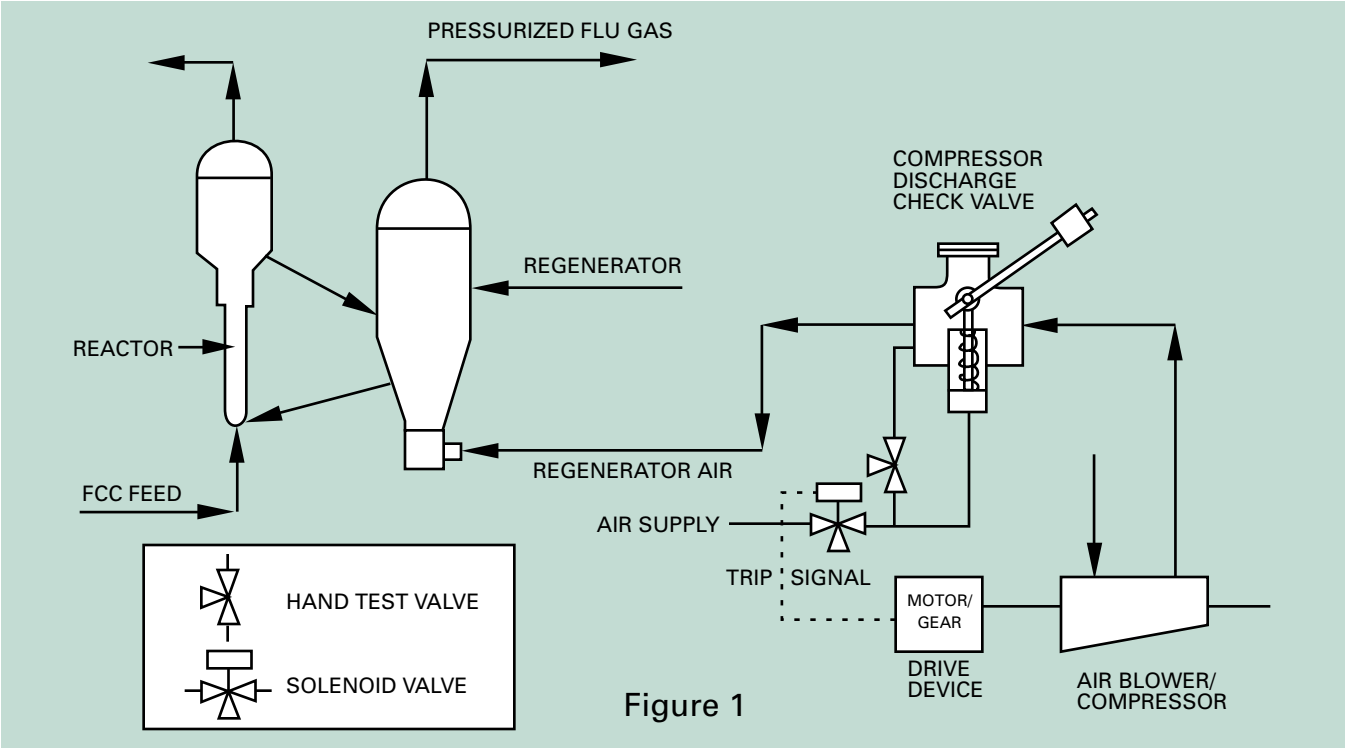
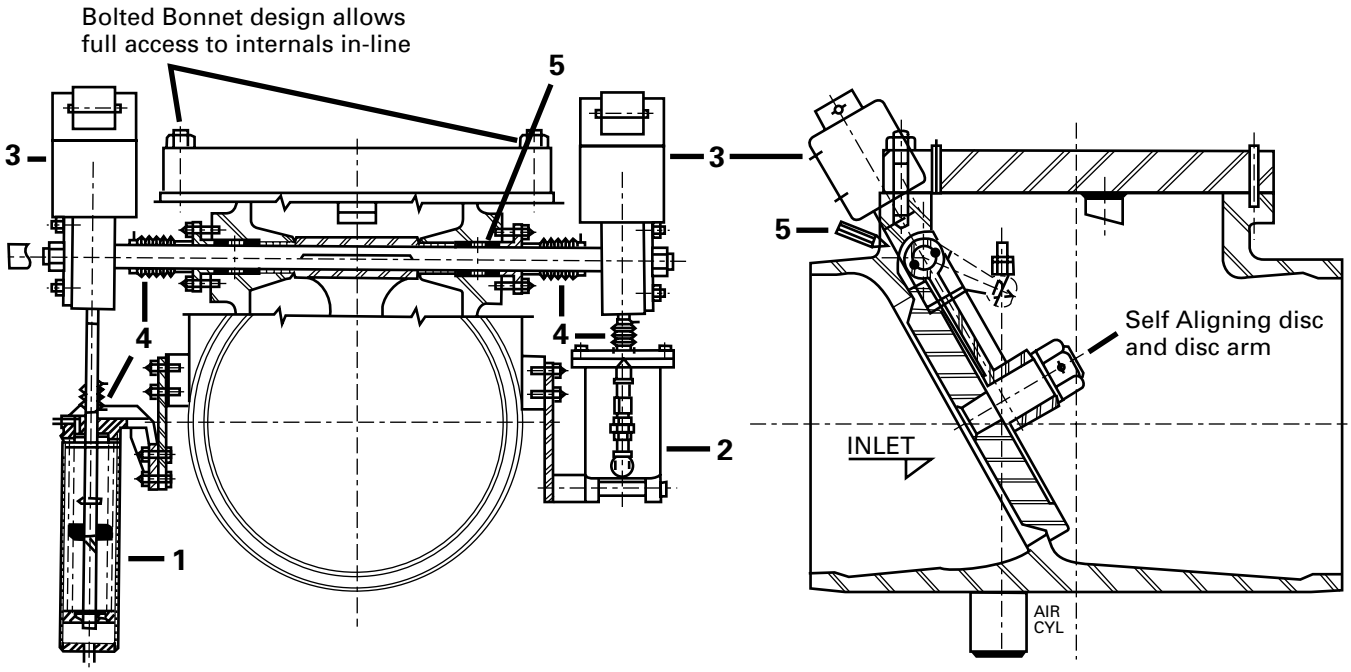



Figure 1

**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

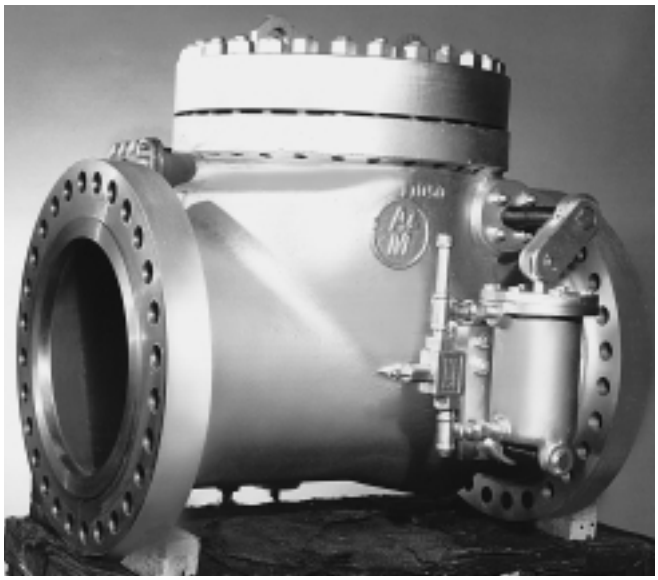
## MATERIALS

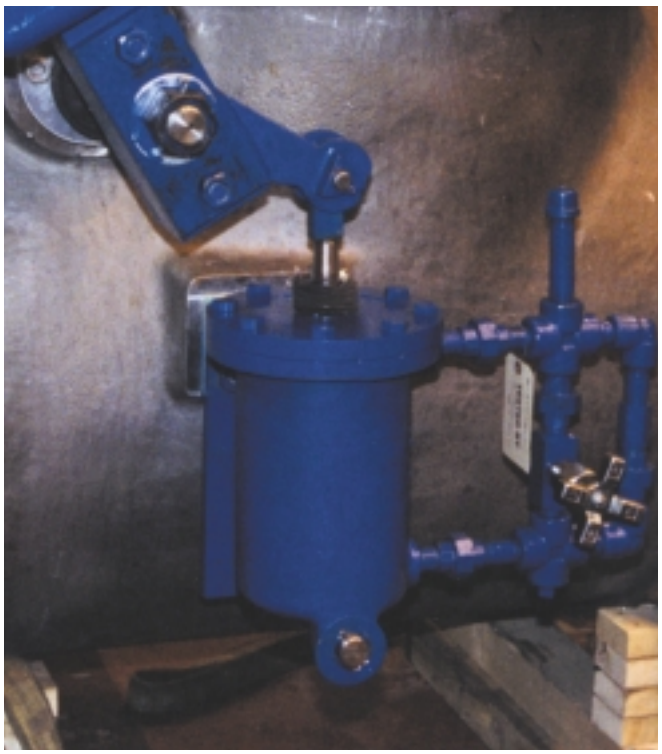
Cast Carbon, Alloy and Stainless Steel

## CONSTRUCTION

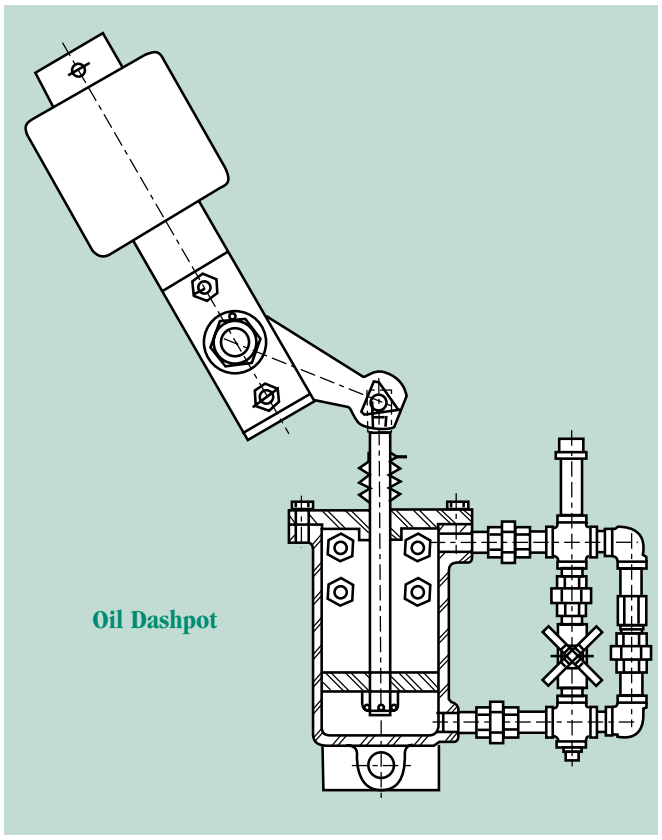
| | |
|---|---|
| **Design Standard:** | ANSI B16.34 |
| **Sizes:** | 4 - 60 inches<br>sizes 44" thru 60"<br>(fabricated) |
| **Pressure Ratings:** | ANSI Class 150<br>through 2500 |
| **Cover Design:** | Bolted Bonnet<br>(pressure seal for class<br>900 and higher) |
| **End Connection:** | Butt weld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

Compressor Check Valve with Oil Dashpot





Actual Oil Dashpot

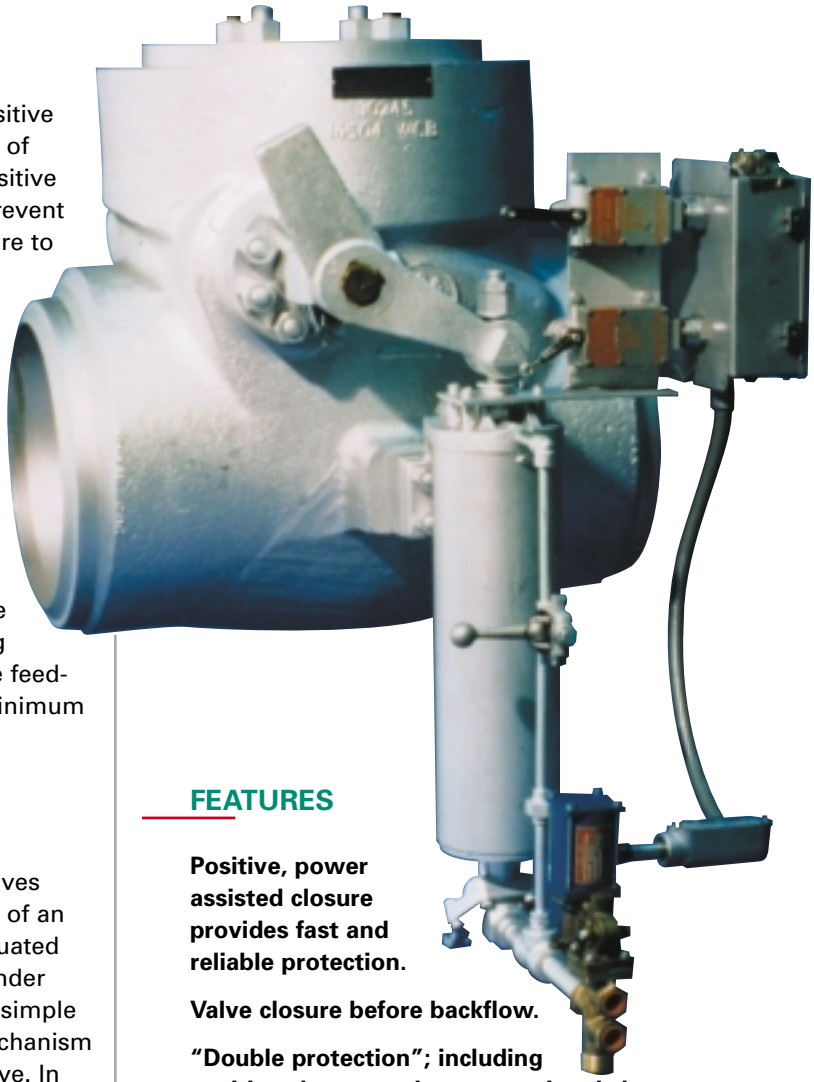


# POSITIVE CLOSING CHECK VALVES - FEEDWATER

## 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.**

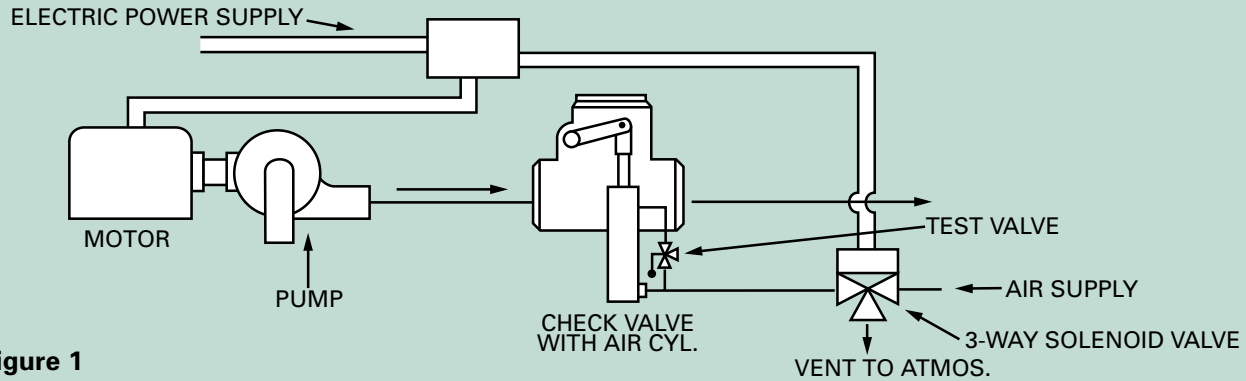



**Figure 1**

# 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

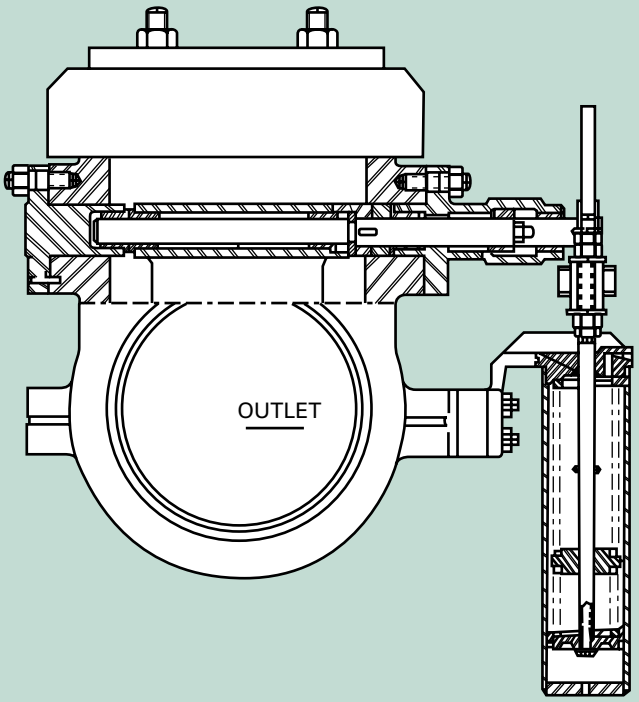
Portions of oscillograph tapes of tests made on production line A&M Valves are shown. The tests were conducted by an independent research facility to verify the advantages of fast closing and to demonstrate the effect of positive closing over a swinging disc check valve which was not positive closing. 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.

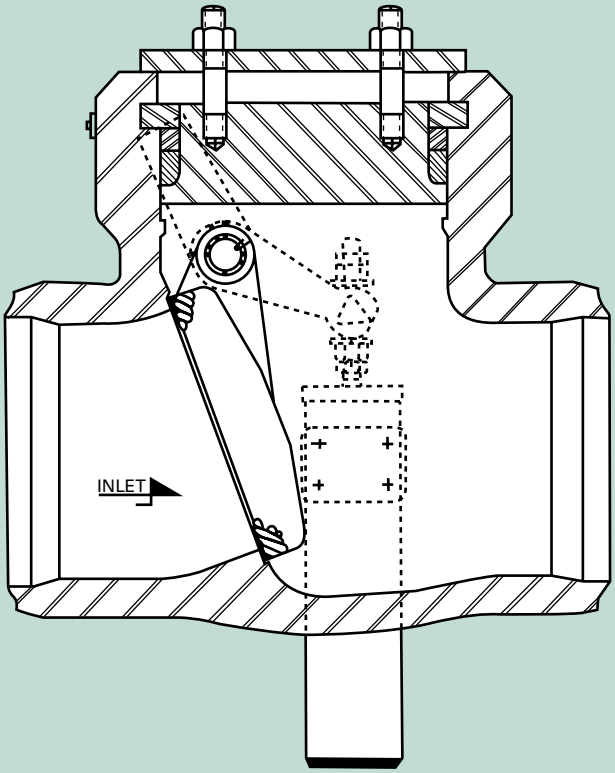
II. The same valve as in (I.) above, but with a positive closing cylinder arranged so that air pressure could be released simultaneously with the opening of the electrical circuit of the motor drive.

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



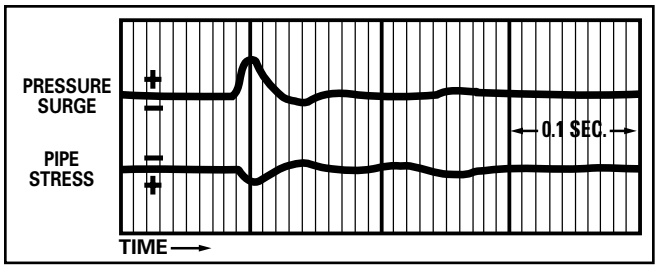

Cross Section Showing Inclined Seat & Swinging Disc



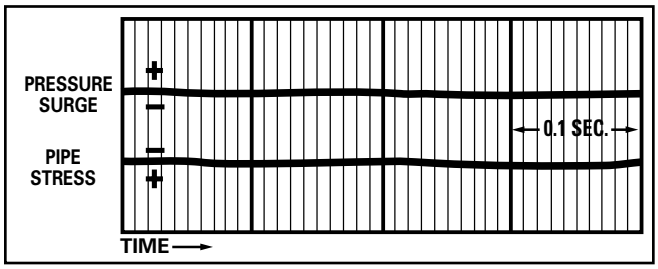
## POSITIVE CLOSING CHECK VALVES - FEEDWATER

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

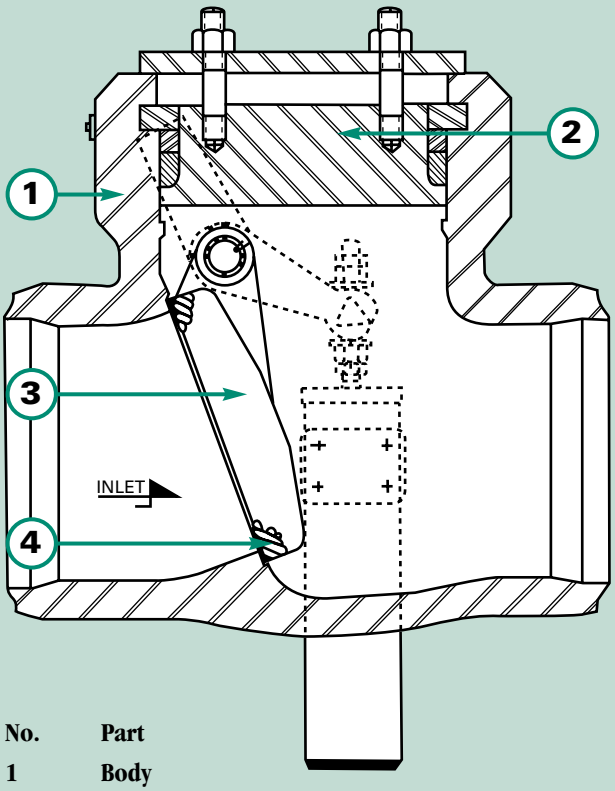
**Class 1500**

| 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 |

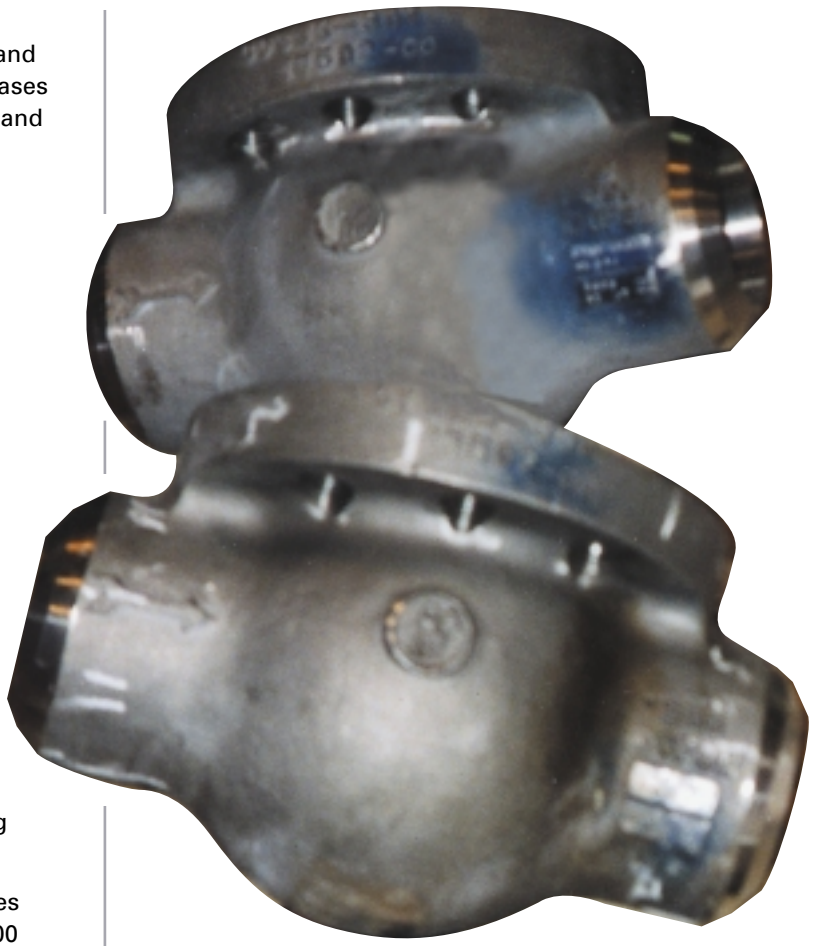
NOTE: ALL DIMENSIONS IN INCHES




| 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.

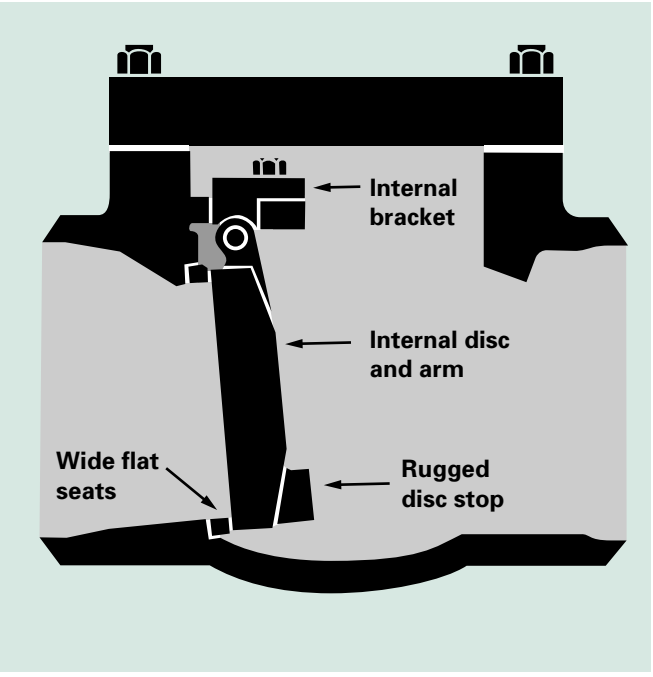
Wide, flat, permanently aligned seats that minimize leakage.

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.



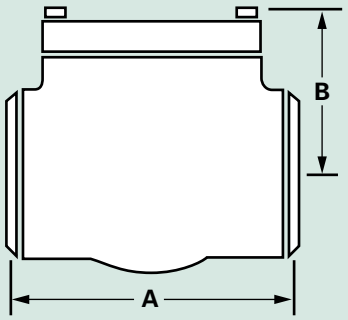

## SPECIFICATIONS

| | |
|---|---|
| **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 |

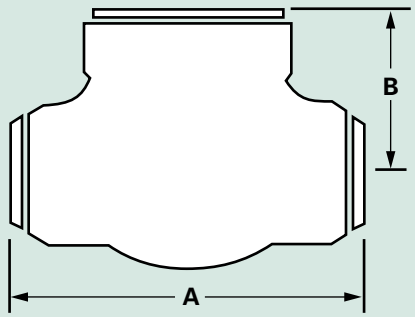
## SWING CHECK VALVE

### 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