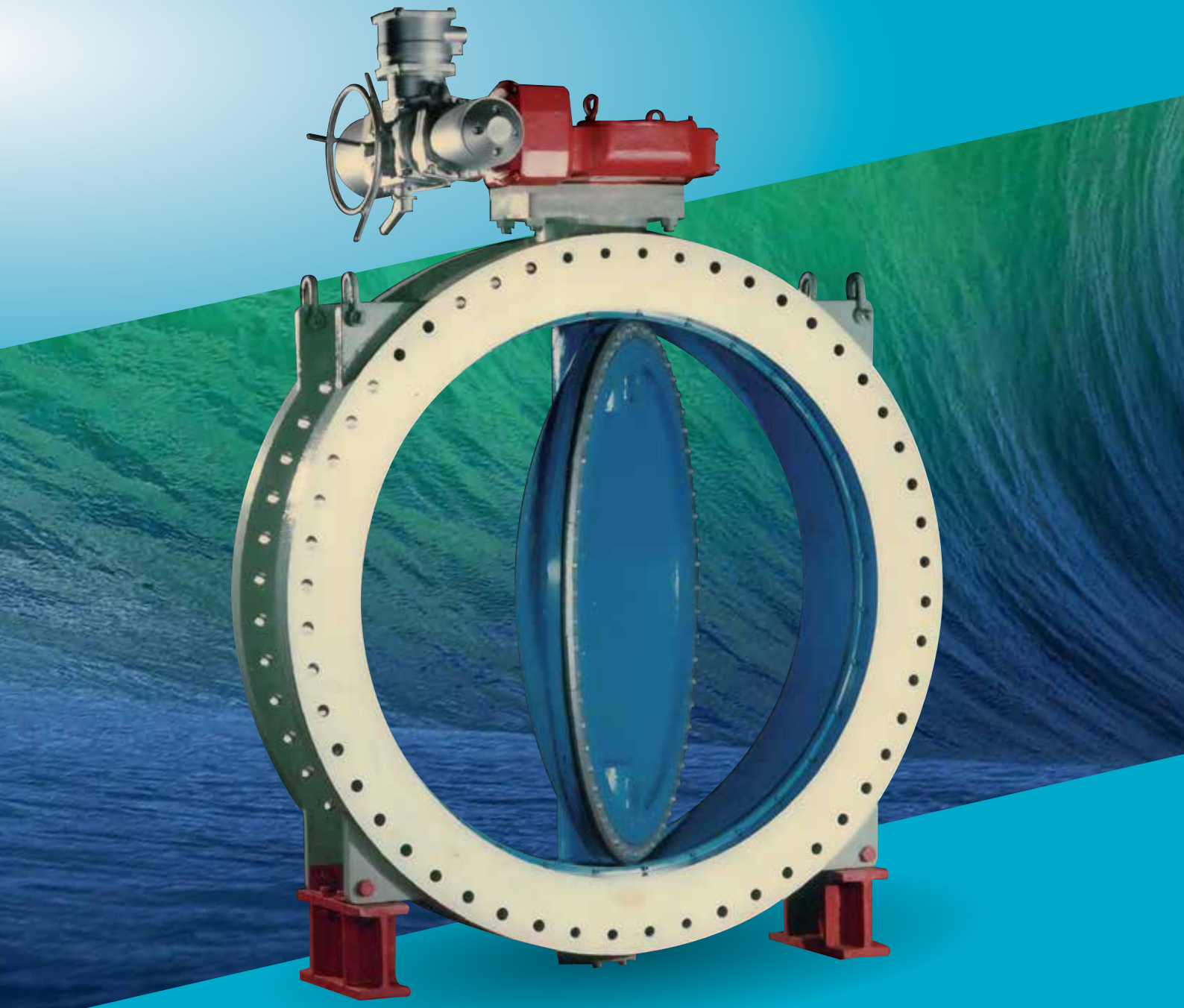
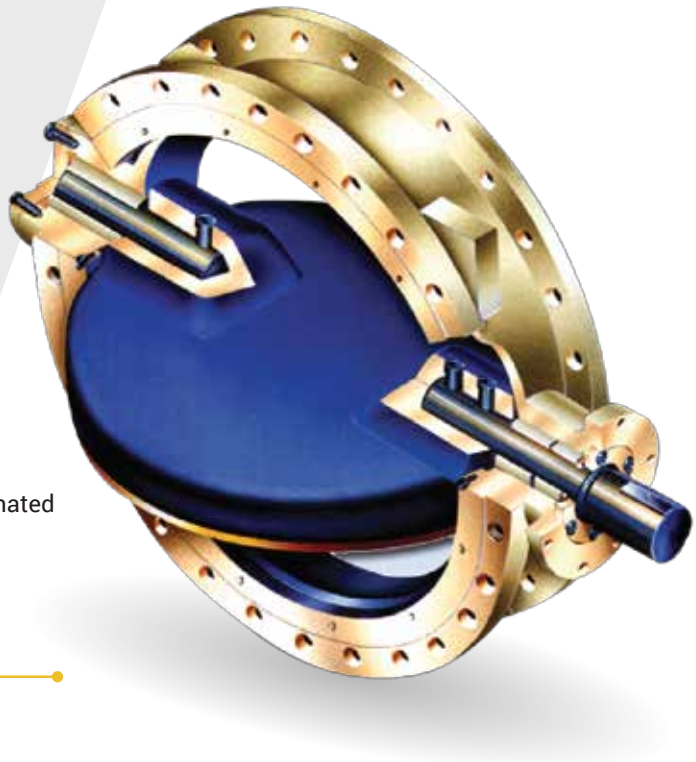
FOURESS
ENGINEERING (INDIA) LIMITED



BUTTERFLY VALVES

BUTTERFLY VALVES



Product Range

Size
100 mm to 4000 mm

Pressure Class
Upto 33 bar

Temperature
Upto 200^{0}C (Bubble tight shut off)
On request upto 300^{0}C (in triple offset design with laminated metallic sealing system)

Service
River water, sea water, DM water, Steam, Air, etc.

Product Features

- Fouress Butterfly Valves are mechanically superior, structurally sound, of fool-proof design, easy to operate and totally reliable.
- A streamlined disc profile provides smooth flow and ensures low pressure drop. Disc designed for strength and deflection eliminates possibility of flutter.
- Single piece insitu replaceable seals in resilient rubber. This in conjunction with SS seat ring, provides drop tight sealing. Seat ring is electrically insulated from the body to resist galvanic corrosion.
- Static shaft seal in 'O' ring / SCN ring construction.
- Clamping ring is segmental form or in one piece. Segments facilitate uniform seal seating and local adjustments.
- Thrust pad allows vertical shaft orientation. It also acts as centralising device for shaft disc assembly.
- Drive shafts generously designed for transmitting maximum operating output torque.
- Self-lubricating bearings capable of withstanding hydrostatic disc load and designed specially for edge loading characteristics
- Designed in such a way that the valve is suitable for both horizontal as well as vertical installation.
- Specially designed ebonite lined valve for sea water application, which is the most economical, reliable option for such corrosive duties. EPDM lined or FRP lined options are also available to handle corrosive fluids.
- Stainless steel cladded valve as an alternative to fully stainless steel valve. Besides providing substantial saving on the basic cost of the valve, this fully retains the advantage of a complete stainless steel valve.
- Special self energising sealing system to handle varying pressure conditions.
- Unique dual seal arrangement available on request for critical applications such as penstock protection, turbine inlet isolation, pump discharge, etc. In Dual Seal Arrangement, the Disc incorporates an additional inflatable hose seal to ensure on-load replacement of service seal without having to dewater upstream pipe.

Standards

Fouress Butterfly Valves are manufactured in both flanged and flangeless construction, generally conforming to the following standards

British Standards	BS EN593 in Metric Units
American Water Works Association	AWWA C-504 in Imperial Units
Japanese Industrial Standards	JIS B 2064
Indian Standards	IS 13095
ISO Standards	ISO 10631

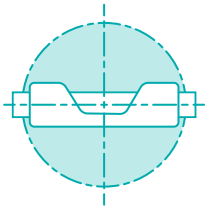
Essentially, these standards vary in face-to-face dimensions and nominal sizes do not coincide for metric and imperial standards. Flanges are drilled in accordance with BS EN 1092-1, BS EN 1092-2 or ANSI B16.1 Class 125/ANS B 16.5/Class 150

Material of Construction*

Sl. No.	Components	Material	British Standard	American Standard	Indian Standard
1.	Body & Disc	Cast Iron	BSEN 1561	ASTM A 126 C1. Class A, B & C	IS 210 FG 150 to FG 300
		Ductile Iron (S.G. Iron)	BS 2789 Gr. 500/7	ASTM A 536 GR. 65-45-12	IS 1865 Gr. SG 400/12, 500/7
		Austenitic Cast Iron	BS 3468 Gr.I-Ni.Cr.203	ASTM A 436 Type 1	IS 2749 Gr. AFG Ni 15 Cu6 Cr3
		Carbon Steel Casting	BS 1504-161-480	ASTM A 216 Gr. WCB	IS 1030 Gr.27-54
		Weldable Structural Steel		ASTM A 36	IS: 2062 Gr. E250BR
		Cast St. Steel		ASTM A 351 CF 8	
				ASTM A 351 CF 8M	
		Ni-Resist Cast Iron		ASTM A 439 type D2	
	Option	Body & Disc can be offered with Ebonite / FRP / EPDM			
2.	Shafts	Stainless Steel	BS-970 431 S29 (EN57)	A479/A182 type 431	
			BS-970 304 S15	A479/A182 type 304	
			BS-970 316 S16	A479/A182 type 316	
			BS-970 410 S21	A479/A182 type 410	
3.	Seat Ring	Stainless Steel	-do-	ASTM A 351 CF8/CF8M	
				ASTM A240 type 304/316	
4.	Clamping Ring	Stainless Steel	BS 970 304 S15	ASTM 304, AISI 316	
			BS 970 316 S16	ASTM A 351 CF8/CF 8M/CF3/CF3M	
5.	Bearings	Leaded Bronze	BS 1400 LB 2		IS 318 Gr.3
		Gun Metal	BS 1400 LG 2		IS 318 Gr.2
		Steel Backed PTFE			

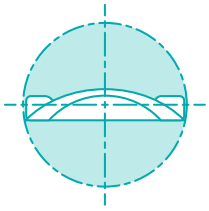
* Other grades of materials can also be offered on request

VALVE DISC/BLADE PROFILES (CONTOURS)



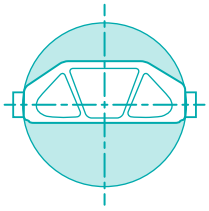
Flat Slab Blade

Popularly used in low to medium pressure services. Head loss co-efficient is 0.11



Spherical Blade

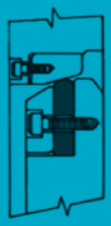
Strength of this Blade is higher than the slab type due to contained deflection. Used for high pressure at the expense of greater operating torque and higher headloss co-efficient of the order of 0.15



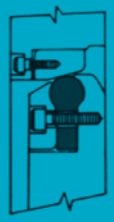
Lattice Blade

Used for high pressure application with very low headloss co-efficient (0.08 - 0.09) used in Turbine inlet valves, Penstock valves and Pump inlet valves and Pump inlet valves where low disturbance to flow is essential.

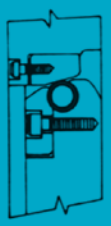
Seals



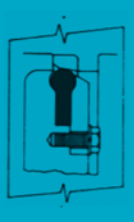
Flat Round Nose seal
Standard Resilient seal



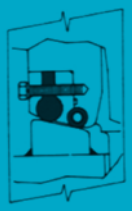
Musical Note Seal
Resilient seal for higher pressures and where severe duties are likely to be encountered.



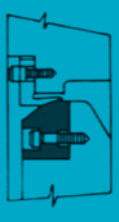
Hose seal
An inflatable seal for either internal or external inflation



Self energising seal
Works effectively under under varying pressure conditions



Innovative Dual Seal System
Inflatable hose type seal to facilitate maintenance of main-seal on-load



Metal to Metal Seal
For use with temperatures and fluids which preclude the use of resilient seals

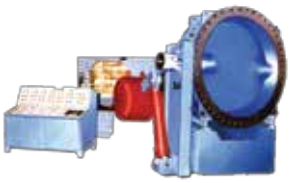
Operators

Manual: Two types of manual operators are offered. Worm and worm wheel type and travelling nut type. Gear boxes are offered in weather-proof enclosures, grease-packed for life. Operators are suitable for all manual and chain wheel operations. End stops are provided to ensure open and shut positions.

Electrical: Recommended where frequent and remote operations are called for. Normally used in conjunction with gear operators. Includes automatic start/stop and remote position indicators. Additional limit switches for remote control duty could be provided; Auto/Manual operation, in case of power failure can also be incorporated.

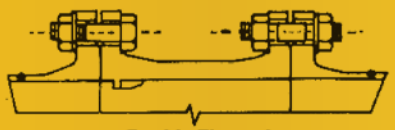
Pneumatic: Recommended for fast operation if air supply is available. Fail-safe arrangement possible with the help of air accumulator. Can also be provided with manual override with the help of de-clutching mechanism. This is the most economical form of operator.

Hydraulic: Used where high actuating forces and variable timing are required. Two kinds of operators are available. Single acting and Double acting. Fail-safety arrangements can also be provided. Recommended specially for pump discharge valves with dead weight to ensure emergency closure on flow reversal or cessation.

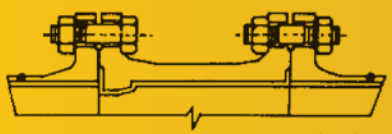


End Connections

Flangeless
For Clamping between Pipe Flanges Using Through Bolting

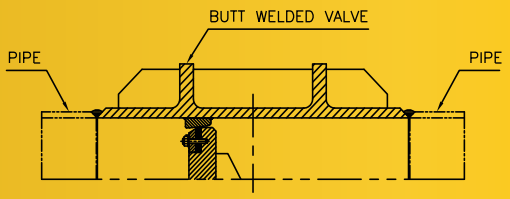


Double Flanged
For Connection to Pipe Flanges by Individual Bolting



Typical arrangement of valve with Vulcanised ebonite lining installed in cement lined pipe

Solid body or lugged
For Connection to Pipe Flanges by Individual Bolting



Valve Accessories

Flange Adaptors: Recommended for mounting of meters, valves, fittings, pumps, for easy dismantling for maintenance. Allows for lateral expansion and contraction. Flange adaptors are offered in ductile iron or steel depending upon the size and/or customer requirement with appropriate rubber or polymer joint ring. Fouress flange adaptors are available in size range of 300mm to 2500mm and pressure rating upto 25kg/cm^2.

Pipe Couplings: These are used for correcting two pipe lines of almost any size for catering to thermal expansion, misalignments and for negotiating generous pipe bends. Couplings are capable of taking an angular deflection upto 60 and lateral displacement upto 15mm. These pipe couplings are manufactured to suit plain ended pipes of steel and cast iron. Fouress pipe couplings are available in both Metric as well as imperial sizes and are manufactured from malleable cast iron or steel depending upon the size. Rubber rings are provided in suitable composition for various temperatures and corrosion conditions. Pipe couplings could be offered upto 2500 mm size and pressure rating upto 25Kg/cm^2.

Pump Discharge Butterfly Valves

Pump discharge valve for the large pumping schemes is a cost effective solution to the option of utilizing an isolating valve and a non-return valve on the pump outlet.

Owing to its butterfly type of construction, the pump discharge valve has high flow capacity and low head loss (i.e. pressure drop) which would reduce the pumping energy substantially on a continuous basis.

Hailed as a major breakthrough in modern pumping design, the butterfly type pump discharge valve has made inroads into modern thermal power stations, nuclear power stations, lift irrigation projects, metro water supply schemes, etc., which are the largest consumer of centrifugal pumps.

Requirements of Pump Discharge Butterfly Valves

- Replaces two valves, i.e., check valve and guard valve
- Rubber seated, 100% leak proof in both directions
- High flexibility in adjusting opening and closing time at site.
- Start the pump as per pump characteristics demand - Crack open, close valve partially or fully before pump stops
- To isolate pump for maintenance
- To provide tight shut-off sealing in direction opposite to normal flow and to permit other pumps running without affecting flow from running pumps.

Advantages of Pump Discharge Butterfly valves

- Dual speed closing time: 90% of the valve closure will take 10% of the time and 10% of the remaining travel will take 90% of the time, hence best suitable on an operating system.
- Pressure drop: In conventional pumping system, head loss co-efficient of reflux valve is 0.6 and for isolating valve is 0.15, while in case of pump discharge valve it is 0.15.
- Will not exhibit flow induced flutter of blade.
- Valves can be ebonite lined for resistance to corrosion/long life.
- Comon power unit can be provided for gang of valves limiting space and operational conveniences.
- With crack opening feature provided in pump discharge valves, pump starting current will be substantially lower. Accordingly, switch gear designs of pumps will be economical.
- By providing double seal arrangement on the pump discharge valve, seal replacement is possible with other pumps in service.

Operation philosophy

- When the pump starts, hydraulic oil is fed into the head end of the cylinder and the valve crack opens.
- Once the pump picks up full speed / down stream filled up, valve fully opens (time to full open after crack opening can be adjusted)
- Valve can be closed before the pump stops / pump trip. Valve closes due to counter weight without any external power.
- Valve closing time 90% fast and 10% slow. This is achieved by cushioning provided in the cylinder and therefore avoiding slam shut-off.
- Opening and closing time can be controlled
- Hydraulic system provided with accumulators to facilitate opening of the valve in case of electrial power failure.
- The operation philosophy is more reliable than automatic self operated reflux valves

Additional Features

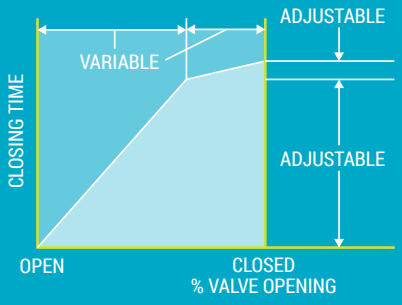
Dual Speed controlled closing time, achieved by use of throttle valves and adjustable damping in the cylinders. It is possible to achieve optimum valve closing characteristics and eliminate the possibility of pipeline surges.

Independent opening time controlled by a throttle valve.

Choice of controls options - Local control / Remote control / Auto control by linking to main pump circuitry with local and remote valve position indication by lamps, in addition to mechanical position indication valve.

'Crack Open' facility for priming downstream pipework.

The valves are very efficient, having a very low head-loss charasteristic. This is a big saving when compared against head-loss of the traditional separate isolating and non-return valve arrangement. With the cost of energy effectively doubling every five years or so, the savings achieved over the life of the installation can be considerable.



Typical graph of % closure versus time.

Butterfly valves for control duty

Fouress BV 895 Butterfly type control valve body assemblies are flangeless construction in smaller sizes upto 600mm and in flanged construction in larger sizes that use a bi-directional Nitrile/EPDM/Viton seals or of meal seated construction. Valves are suitable for low pressure liquids, steam or gas service and installations where large volumes approaching full line capacity must be handled with low pressure drop. The action of the eccentrically mounted disc minimises the moving contact of the seal with the seat ring to reduce seal wear and seating torque requirements. Full closure is at 90^0 to the body axis in both cases.

The valves for control duty are offered with pneumatic cylinder/electric actuators. In case of pneumatic actuators, the change of action from air-to-close to air-to-open or the reverse is effected by adjustment of the linkage between actuators stem and valve disc shaft using the same actuator. Pneumatically operated butterfly valves can be offered with positioner, air set, position transmitter, solenoid valve, limit switches, etc., with all the accessories mounted on the actuator/valve body. For electrically operated butterfly valves, positioner, position transmitter, limit and torque switches are provided inbuilt with the actuator.

BUTTERFLY VALVES FOR HYDRO POWER PLANTS

Fouress Engineering specializes in design, manufacture and supply of isolation valves for hydro power applications. With its more than 50 years of experience in design and manufacture of hydro valves, Fouress can offer tailor made solutions to Hydro Power Plant. Some of the unique valves are:

3700mm(30bar) penstock protection butterfly valve supplied to Bhira Hydro Power plant of TATA Power

PENSTOCK PROTECTION VALVE: Normally fitted on the downstream of the dam outlet and is provided for isolation of the penstock for maintenance and to close the valve in emergency situations when there is a rupture of the penstock on the downstream of the valve. These valves come with complete solutions - standalone hydraulic power pack, electric control panel, over velocity detection device, upstream and downstream connecting pipe pieces that can be directly welded to the penstock and foundation bolts. The valve is opened by hydraulic cylinder and closed by counterweight. These valves have low pressure drop across the valve and operating time of the valve can be designed to suit the penstock piping requirement.

Penstock protection valve with bypass arrangement

TURBINE INLET VALVE OR MAIN INLET VALVE: The turbine inlet valve or the main inlet valve (as it is commonly referred to) is fitted on the upstream of the turbine spiral casing and is used for the isolation of the penstock during maintenance of the turbine without having to dewater the entire penstock or the pressure shaft. Fouress specializes in designing and manufacturing MIVs from 400mm to 4000mm and a pressure of up to 33 bar. We can offer the valves in single body design or split body design to meet the transportation limitations to the site. These valves are with low pressure drop and can be provided with single seal or dual seal arrangement. These valves are normally hydraulically operated and closed by counterweights. The valves can also be supplied with bypass arrangement (for opening the valve under pressure equalized condition), upstream and downstream connecting pipe piece with flange matching to the turbine spiral casing.

Fouress also manufactures Spherical valves for Turbine inlet and Howell Bunger valves or Fixed cone valves (up to 3000mm size) which are used extensively in Hydro Power projects

Typical Installations (complete reference list can be provided on request)

Sl. No.	Valve size and pressure	Installation site/project
Penstock protection valve		
1	3700mm and 30 bar	Bhira pumped storage unit, India
2	3000mm and 9.5 bar	AD Hydro Project, India
3	2900mm and 21 bar	Chuzachen, India
4	2600mm and 2.5 bar	Kashang HEP, India
5	2400mm and 14.1 bar	GE Energy Norway, Nygard Power Station
6	2000mm and 6 bar	AES, Panama
Turbine Inlet valve		
1	3900mm and 6.5 bar	Basavanna HEP, India
2	3000mm and 21 bar	URI HEP, India
3	2590mm and 12 bar	Deanie Power Station, Scotland

Proof of design test as per AWWA C504/C516

Proof of design is a method of design validation of the butterfly valve as per the governing norms of AWWA (American Water Works Association) C504 and C516 codes. The significance of the testing is that it validates the design of complete butterfly valve for a designated number of cycles under the specified differential pressure across the valve. The leakage test is carried out before and after the commencement of the test. As per the governing norm, the valve should be leak tight in either direction after completion of the tests without any adjustments made to the sealing after completion of the test. This test establishes the adequacy of seal design, bearing life and valve operation for the minimum valve life cycles as specified by the code.

Proof of design tests on 2400mm pump discharge butterfly valve was conducted as per AWWA C 504. The valve was successfully tested and approved by NTPC.

In the recent past, Fouress Engineering has successfully conducted various proof of design tests for electrically operated, hydraulically operated, double flanged and butt-welded valves for power plants and water works in India.

Fouress has qualified its Butterfly Valves through Proof of Design Test as per AWWA standard upto 2900mm size for customers like NTPC, NPCIL and BHEL.

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