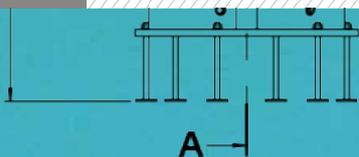


GLENFIELD TECHNICAL GUIDANCE

Glenfield
Dams, Reservoirs & Hydro Solutions



EXPECT GLOBAL LEADERSHIP & LOCAL COMMITMENT

Over 60 years of experience in dams, reservoirs and hydro installations



WE CAN PROVIDE WHATEVER YOU MAY NEED

GLENFIELD is a leading supplier of large diameter valves for dams, reservoirs and hydropower installations around the world.

Glenfield's product portfolio includes an extensive range of:

- Free discharge valves
- Submerged discharge valves
- Needle control valves
- Parallel seated gate valves for dams and reservoir applications
- Butterfly valves
- High performance recoil check valves
- Double orifice air valves
- Automatic pressure and level control valves
- Penstocks and sluice gates

Within our vast range of capabilities Glenfield can provide a comprehensive range of engineering and site solution packages. Our specialist teams come to you to identify the perfect solution - from feasibility and site audit to network leakage management and repair.

DAMS, RESERVOIRS AND HYDROPOWER

Dams and Reservoirs is one of the key market segments with over a 100 years involvement. With control valves installed in well over 100 dams around the world Glenfield continue to be a highly rated supplier of valve products and solutions for dams, reservoirs and hydro power projects.

Within the range we also offer specialist terminal discharge valves which provide accurate flow control as well as excellent energy dissipating characteristics. These discharge valves can be used for a number of applications such as emergency drawdown, compensation / ecological flow, flood control, pressure relief and also for turbine bypass flow in hydroelectric power installations.

Because of the nature of these projects, flexibility in product design is highly important and Glenfield work closely with customers to ensure that the optimal valve size and type is chosen for each application.

Glenfield also offers supervisory support for valve selection, installation and commissioning on products and are available to discuss requirements and projects.

ENGINEERING AND SITE SOLUTIONS:

- Valve, penstock and actuator: site surveys and health checks
- Valve supply, installation, refurbishment and replacement
- Design and manufacture of ancillary equipment
- All associated enabling, electrical and civil engineering services
- Equipment commissioning
- Scheduled maintenance and servicing Contracts
- Extended warranties
- Post contract training

WHEREVER YOU ARE, SO ARE WE

Our geographical presence and product range may be global, but our focus is local. We stay close to our customers throughout the entire process. The proximity allows us to better understand our customers' needs and tailor our solutions to fit them.

Being a global player, we are able to provide highly engineered products and service solutions approved to international standards whilst always understanding and adapting to local specifications and project requirements.

EXPECT QUALITY & A LONG-TERM PARTNERSHIP

WHERE DO YOU GO FOR...

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...SUPPORT

-  ENGINEERING AND SITE SOLUTIONS
-  SUSTAINABLE SMART WATER MANAGEMENT SOLUTIONS

...GLENFIELD

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SERIES 857 FREE DISCHARGE VALVES (FDV)



Glenfield have been designing and supplying Free Discharge and Fixed Cone Valves since the 1950's. These valves have been developed from extensive in-house laboratory testing and thorough field installations.

Fixed cone valves are used to pass a controlled amount of water downstream with no damage to the immediate surroundings due to its fantastic energy dissipating characteristics. These valves also offer an effective method of aeration due to atmospheric dispersion.

The valve body is designed to operate with minimum vibration over its full stroke and uses multiple, specially shaped aerodynamically designed ribs leading to a downstream cone.

The outlet cone ensures that discharge is in the form of a hollow expanding jet, which is ideal for energy dissipation as the water is spread over a rapidly increasing surface area, thus permitting effective atmospheric cushioning. If partial / controlled containment of the jet is desired, a hood can be installed downstream of the valve.

The valve bodies are manufactured in either ductile iron or fabricated stainless steel dependant on installation and application. The sleeve is made from stainless steel and uses upstream and downstream seals to ensure drop-tight shutoff. Operation of the valve sleeve is via twin screwed spindles, worm gearboxes, intermediate rods and a double bevel input gearbox. Actuating gear may be manually, electrically or hydraulically operated.

Features and benefits

There are a number of important features and benefits when using a FDV, these include:

- Terminal Siting - Low civil building costs
- Free discharge - No cavitation
- Resilient seal - Drop tight closure
- External operating mechanism - Simple and effective maintenance
- Cylindrical geometry - Hydraulic balance with low operating torque
- Low head loss characteristics - Maximum flow discharge potential
- Atmospheric dispersion - Maximum energy dissipation / Minimum erosion
- High velocity capabilities - most economical sizing of terminal discharge valve products

SERIES 857 SPECIFICATION



Valve assembly comprises of; body, sleeve, seal retaining ring, operating screws and nuts, worm and double bevel gear units, face and back end seals, intermediate drive shafts and universal couplings.

Valve Body Is a cylindrical single piece unit in ductile iron or fabricated stainless steel, with a flange at the inlet, faced and drilled to specific requirements (BS EN1092-2). The downstream end is formed as an inverted cone integral with, and attached to, the cylinder by integral radial ribs.

The outer edge of the ribs and adjacent body sections are faced with extruded bronze strips of length to suit control sleeve travel.

Facings are provided at the upstream end to carry the worm gear units on the horizontal centre-line and the double bevel drive on top of the valve. A support foot is situated adjacent to the inlet flange on the underside of the valve.

Valve Sleeve Is a fabricated assembly comprising stainless steel cylinder and side brackets on which are mounted the operating nuts. The bore has a fine machined finish on

which the back end sealing ring makes the sliding contact throughout the full length of the valve travel. The downstream end is chamfered to mate with the face seal and provides droptight contact in the closed position.

Valve Seals The back end seal is housed in a body recess adjacent to the upstream end of the valve ports and provides sealing contact with the bore of the sleeve through the full valve travel. The face seal is located between the downstream end of the body and the retaining ring, thus providing a combination of resilient seal and positive stop with the end of the valve sleeve in the closed position. Both seals are formed from extruded or moulded rubber sections, sized and formed to suit.

Valve operating gear Controls axial movement of the sleeve, when covering or uncovering the body ports, comprising of:-

Two operating nuts, mounted on side brackets of the sleeve, threaded to match the mating operating screws which are protected by resilient gaiters.

Each screw is keyed at the back end, to a worm gear unit mounted to the upstream end of the valve body.

The drive is taken from each side of the valve via the worm gear units, up to the double bevel unit mounted on top of the body, by steel intermediate shafts and totally enclosed

universal couplings. The worm and double bevel gear units are all totally enclosed grease filled assemblies, designed for long periods of maintenance free service.

The valve assembly can be operated by electrical actuator coupled direct to, or alternatively remote from, the double bevel unit input shaft.

For smaller valves (DN200 & 300), operation of the valve is by a lever/ crank mechanism which can be connected to a manual gearbox or electrical actuator.

Valves can be supplied with hydraulic actuation, especially suitable for submerged applications.

SERIES 857 SIZING



The size of the valve is determined by the required flow rates at the minimum net head at the valve. The net head is measured from the minimum upstream water surface to the centre line of the valve, less any friction losses from the conduit.

The graph below can be used as a general guide for valve size selection. Please contact Glenfield Valves for final valve selection:

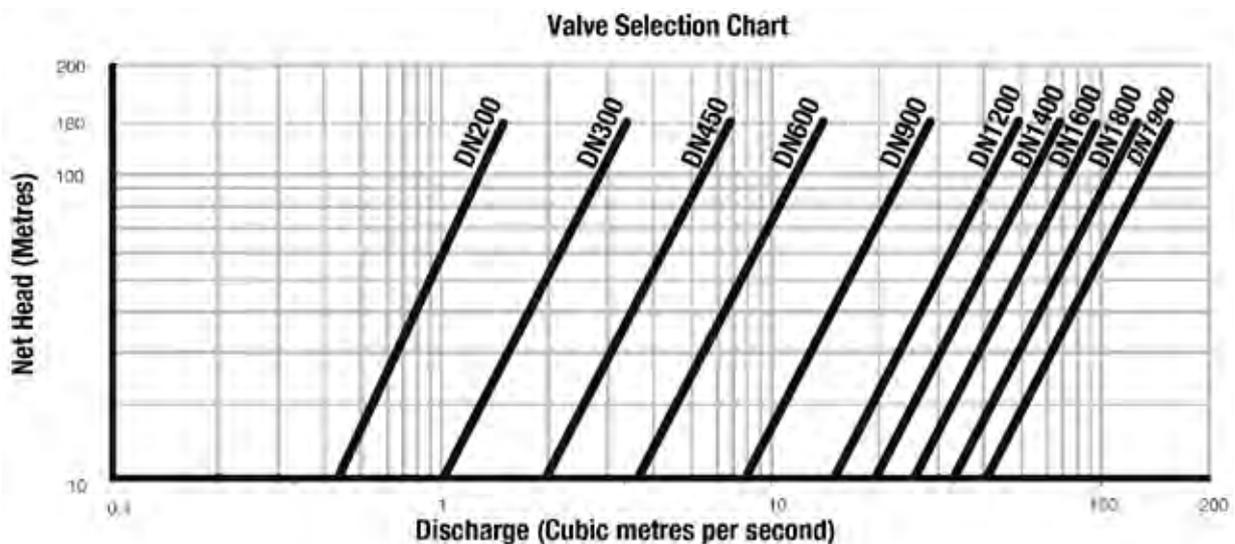
T: +44 (0) 1292 670404
E: drh@glenfield.co.uk

The equation to determine discharge is:

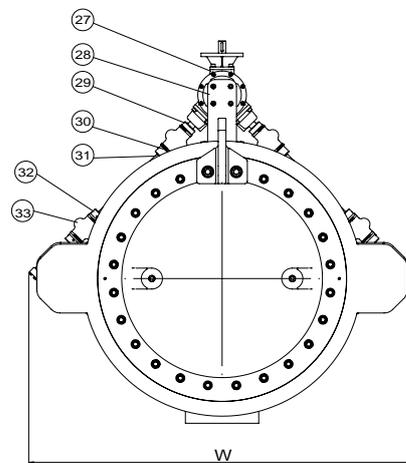
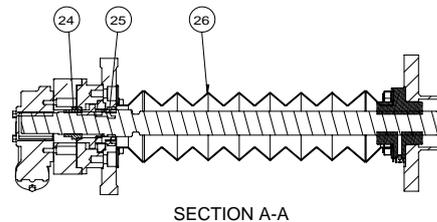
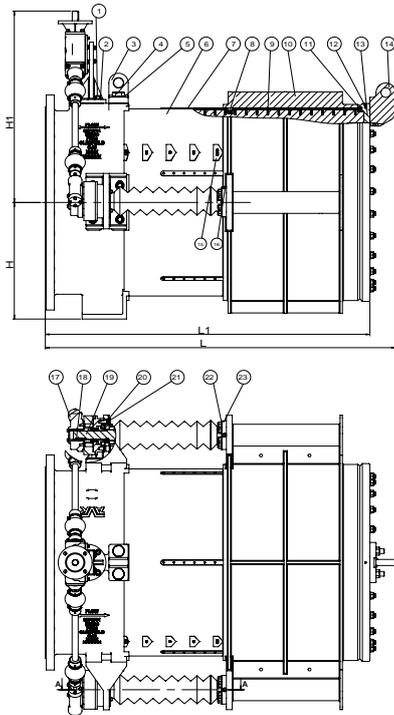
$$Q = C_d A \sqrt{2gH}$$

Where :

- Q = Flow Discharge (m³/s)
- C_d = Discharge coefficient of valve in fully open position without hood (0.83)
- A = Area of valve based on nominal valve diameter (m²)
- H = Net head (m)



SERIES 857 CAST VERSION



Components	Material
1 Stud bolt	Grade A4-70
2 Washer	Stainless steel, 1.4401
3 Lift bracket, Top	Stainless steel, 1.4301
4 Bolt	Grade A4-70
5 Lock washer	Grade A4-70
6 Body	Ductile Iron GJS-500-7
7 Guide strip upstream	Al.bronze CW307G
8 Sealing Strip	Neoprene
9 Rivet Pin	Phosphor Bronze PB102
10 Sleeve	Stainless steel, 1.4401
11 Face ring seal	NBR, 70 Shore
12 Screw	Grade A4-70
13 Seal retaining ring	Ductile Iron GJS-500-7
14 Lift bracket, End	Stainless steel, 1.4301
15 Indicator plate, close	Stainless steel, 1.4401
16 Nipple	Brass EN 12165 CW602N
17 Gear unit	Cast Alloy steel

18 Key	Stainless steel, 1.4401
19 Drive shaft, LH	Al.Bronze CC333G
20 Bracket side gearbox	EN 10025 S275JR
21 Backing plate bracket	Stainless steel, 1.4401
22 Backing plate nut	Stainless steel, 1.4401
23 Drive nut, LH	Stainless steel, 1.4401
24 Lock nut	Stainless steel, 1.4401
25 Bushing	Al.bronze CW307G
26 Protection cover	Flexible PVC
27 Gearbox housing	Ductile Iron GJS-500-7
28 Bracket main gearbox	EN 10025 S275JR
29 Universal joint 30/30	Stainless steel, 1.4301
30 Jubilee clip	Stainless steel, 1.4401
31 Transfer shaft	Stainless steel, 1.4401
32 Universal joint 30/15	Stainless steel, 1.4301
33 Cover Single Joint	Rubber

Ref	DN	Flange drilling	L1	L	H	H1	W	Approx Weight
	mm		mm	mm	mm	mm	mm	Kg
857-0400-1-1010000	400	PN16	1059	1135	381	770.5	1052	1200
857-0600-1-1010000	600	PN16	1351	1446	457	851	1259	1500
857-0700-1-1010000	700	PN16	1524	1619	550	807	1410	1900
857-0800-1-1010000	800	PN16	1524	1619	533	972.5	1412	2000
857-0900-1-1010000	900	PN16	1676	1808	610	1001.5	1592.5	2700
857-1000-1-1010000	1000	PN16	1796	1928	720	1075.5	1690	3800
857-1200-1-1210000	1200	PN16	2132	2264	838	1334.5	2074	4500
857-1400-1-1210000	1400	PN16	2414	2546	916	1456.5	2524	6000
857-1500-1-1010000	1500	PN16	2415	2521	916	1339	2286	6500
857-1900-1-1210000	1900	PN16	2803	2929	1344	1642	2894	11200
857-2200-4-3210000	2200	PN10	3347	3515	1350	2239	3492	15300

NOTE: DN200 & 300 valves with lever & crank operating mechanism also available. Please contact Glenfield for further information. T: +44 (0) 1292 670404

SERIES 857 SELECTED GLOBAL REFERENCE LIST

Over 60 years experience and over 75 global installations



ORDER YEAR	DN	CUSTOMER	LOCATION
1955	84/72	N.O.S.H.E.B.	Ericht Dam (Scotland)
1955	72	N.O.S.H.E.B.	Lubreoch Dam (Scotland)
1955	60	N.O.S.H.E.B.	Lednock Dam (Scotland)
1955	48	Govt. of India	Madupatty Dam (India)
1956	48	N.O.S.H.E.B.	Giorra Dam (Scotland)
1958	36	C.E.G.B.	Stwlan Dam (Wales)
1959	48	Central Elec. Authority	Tan-Y-Grisiau (Wales)
1959	48	C.E.G.B.	Dinas Dam (England)
1960	36	City of Revelstoke	Cranberry Creek (England)
1960	72	N.O.S.H.E.B.	Monar Dam (Scotland)
1961	36	Commonwealth Dept. of Works	Upper Cotter Dam (Australia)
1963	36	Govt. of Hong Kong	Plover Cove (Hong Kong)
1963	54	Swaziland Elec. Board	Edwaleni Dam (South Africa)
1964	48	C.E.G.B.	Mentwrog Dam (Wales)
1965	60	Govt. of Tanzania	Nyumba-Ya-Mungu Dam (Tanzania)
1966	72	Ceb. Fed. of Malaya	Batang Padang (Malaya)
1966	46	N.Z. Elec Dept	Mangahad P.S. (New Zealand)
1967	21	City of Birmingham	Craig Goch (England)
1967	30	Dundee Corporation	Backwater Dam (Scotland)
1967	66	Dept. Water Affairs	Oppermansdrift Dam (South Africa)
1967	90	I.N.O.S.	Ocumarito Dam (Venezuela)
1968	8	Mid Scotland Water Board	Longhill Weir (Scotland)
1969	24	Pembroke Water Board	Llysyfran (Wales)
1970	36	Govt. of Hong Kong	Plover Cove (Hong Kong)
1971	36	Ayrshire & Bute W.B.	Loch Brandan (Scotland)
1973	42	Govt. of Hong Kong	High Island
1974	30	Auckland Reg. Authority	Mangatangi Dam (New Zealand)
1974	12	Electricidade de Portugal	Amadora Project
1974	54	Fife & Kinross W.B.	Castlehill Dam
1975	18	Fife & Kinross W.B.	Castlehill Dam
1975	24	South West W.A.	Wimbleball Res
1975	12	South West W.A.	Wimbleball Res
1976	36	Wyoming City CL	Greybull Valley Irr Project
1976	36	Northumbrian W.A.	Keilder Dam
1976	66	Northumbrian W.A.	Keilder Dam
1976	30	West Coast Elec. P.B. (N.Z.)	Dillmans Hydro Elec Scheme
1977	18	Electricidade de Portugal	Amadora Project
1979	66	Nigerian W.A.	Oyan River Dam
1980	24	Isle of Man W.B.	Sulby Reservoir
1980	24	Irish W.B.	Caban Dam
1981	36	Govt. of New Zealand	Cosseys Dam
1982	8	Strathclyde R.C.	Daer Reservoir
1984	12	Sri Lanka W.S.	Kotemale Dam
1985	30	Govt. of Hong Kong	High Island Scheme
1985	12	U.A.E.	Khor Fakkan

SERIES 857

SELECTED GLOBAL REFERENCE LIST



ORDER YEAR	DN	CUSTOMER	LOCATION
1990	18	Cyprus W.D.D.	S. Conveyor
1991	8	N.O.S.H.E.B.	St. Fillans
1991	54 (1400)	Malaysia W.B.	Linggu Dam
2002	54 (1400)	Govt. of Malaysia	Sungai Selangor
2002	39 (1000)	Govt. of Malaysia	Jus Dam
2002	18 (400)	Govt. of Malaysia	Jus Dam
2002	12 (300)	Govt. of Malaysia	Jus Dam
2002	30 (700)	Govt. of Panama	Chiriqui Dam (Esti.)
2002	18 (400)	Govt. of Panama	Barrigon Dam (Esti.)
2003	48 (1200)	Govt. of Malaysia	Chereh Dam
2003	48 (1200)	Govt. of Malaysia	Chereh Dam
2003	48 (1200)	Government of Iran	Aydogmoosh Dam
2003	18 (450)	Government of Iran	Aydogmoosh Dam
2003	36 (900)	Government of Malaysia	Kelalong Dam
2003	16 (400)	Government of Malaysia	Sungai Kesang Dam
2003	18 (450)	Government of Malaysia	Sungai Muar
2004	48 (1200)	Snowy Hydro, Australia	Jindabyne Dam
2004	76 (1900)	Snowy Hydro, Australia	Jindabyne Dam
2005	48 (1200)	Government of Iran	Vanyar Dam
2006	600	Government of Sarawak	Gerugu Dam
2007	1000	Government of Iran	Gheighaj Dam
2008	600	Sydney Catchment Authority	Tallowa Dam
2008	200	Sydney Catchment Authority	Cordeaux Dam
2008	300	Sydney Catchment Authority	Nepean Dam
2008	300	Sydney Catchment Authority	Broughtons pass Dam
2009	1200	AVK Philippines	Angat dam - Manilla Water
2009	1400	AVK Philippines	Angat dam - Manilla Water
2009	600	AVK Australia	Mardi Dam
2010	600	AVK Malaysia	Sungai Teriang
2010	1000	AVK Malaysia	Sungai Teriang
2010	1200	AVK UK	Abberton Reservoir
2011	200	HydroPlan	Rannoch Dam
2012	300	Sino Hydro, Brunei	Ulu Tutong Dam
2012	1200	Sino Hydro, Brunei	Ulu Tutong Dam
2013	900	AVK India	Wilson Dam
2013	2200	AVK Malaysia	Pedu Dam
2014	900	Scottish Water	Backwater Dam
2014	900	Welsh Water	Ystradfellite Reservoir
2014	400	Specialist Maintenance Contractors JV, Cyprus	Symvoulos Dam
2015	900	AVK India	Wilson Dam Phase II
2016	600	AVK Australia	White Swan
2016	600	Czech Water	Prague,
2016/2017	2000	UJVN Ltd	Khatima, India

SERIES 856 SUBMERGED DISCHARGE VALVES (SDV)



Glenfield have been designing and successfully supplying Submerged Discharge Valves since the 1960's. The valve and corresponding sump sizing were developed through extensive laboratory testing and field investigations.

The SDV is always used in the terminal position of the system. One of the key advantages it has over other terminal discharge valves is the combination of a compact stilling sump to assist with kinetic energy dissipation quietly and, at the same time, providing a tranquil water surface in the sump. Because the jet velocity of the partially closed valve can be excessive, cavitation can occur as the jet leaves the valve. However, as the jet disperses in the body of water in the sump surrounding the valve, any cavitation under severe flows is quite harmless as the implosions are directed away from the valve.

In common with so many of the best engineered products, the basic valve form is simple. It consists of an inlet pipe bend and a vertical down pipe terminated by the valve outlet and base plate. Flow is regulated by the vertical movement of an internal cylindrical sleeve operated by a central spindle.

The valve operates on the principle of throttling pressure across multiple ports (or orifices) which are specially sized, shaped and positioned around a circular sleeve. The design of the optimised port area and geometry is based on the hydraulic consideration of each specific site. Energy is dissipated in the water immediately surrounding the submerged part of the valve.

This valve, in ductile iron construction, is suitable for flow control and energy dissipation over a wide range of flows and pressures throughout its full travel and is not subject to vibration and cavitation.

The vertical moving stainless steel sleeve uncovers the customised ports in the bronze body thus creating a horizontal radial existing jet. The large porting shapes help to minimize potential port plugging from any contamination / debris contained within the medium. The sleeve is operated by a central vertical spindle rising through a sealed gland in the inlet bend.

Features and benefits

- Stilling sump - compact energy dissipation
- Resilient seal - drop tight shut off
- External mechanism - simple maintenance
- Submerged discharge - quiet, safe, cavitation free
- Ported sleeve - near linear flow control
- Cylindrical sleeve - low operating effort
- Rising stem design - improved visual indication
- Cast construction - minimum vibration
- Fine screw thread - smooth flow transition

SERIES 856 SPECIFICATION



The Series 856 SDV is designed to control the discharge of water at the reservoir inlet or terminal point of a pipe or dam, discharging into a compact stilling sump.

The vertical sleeve type, regulating valve is designed primarily to present an optimum means of controlling flow under submerged discharge conditions. Jet energy is dissipated in the turbulence of the water immediately surrounding the submerged part of the valve.

The basic assembly of the valve comprises of the following components:

Inlet Bend Ductile iron cast, double flanged 90° bend. The inlet flange is drilled to requirements. The bend incorporates a stuffing box gland and mounting flange facing to take the support pillar/ thrust tube. External bosses are cast on the bend for fixation of suitable lifting eyebolts.

Guide Spiders Ductile iron cast, flange with a centrally located boss which is attached to the flange by integrally cast radial ribs. The spiders are fitted with bronze bushes to aid support and alignment of the valve spindle. The top face of the flange has a spigot and the bottom face recessed for location purposes. Both faces seal

by means of resilient cord joints. The boss and ribs require to be streamlined to reduce flow disturbance.

Taper Pipe (for unequal inlet / outlet size valve) Ductile iron cast, double flanged concentric taper which is located between the two guide spiders. The top flange has a spigot and the bottom flange is recessed for location purposes. Both faces sealed by means of resilient cord joints.

Extension Pipe (depending on required height of valve) Ductile iron cast, double flanged pipe which is located between the guide spider on the taper pipe and the guide spider on the stopper pipe, provides the required height between inlet bore centreline and the base of the sump.

Stopper Pipe Ductile iron cast, double flanged pipe, with four internal stopper pads integrally cast to limit the travel of the sliding sleeve. Located at the lower end of the stopper pipe are two openings faced, studded and provided with cast hand-hole covers / gaskets, which can be removed to allow inspection of the valve internals.

Upper Valve Body Ductile iron cast, double flanged pipe, with its top portion machined to accommodate the gland and guide rings and dynamically activated resilient sealing ring. The upper valve body top flange has a spigot and cord joint and is bolted to the stopper pipe. The

bottom flange is recessed to suit the contour of the cord joint on the ported body.

Ported Body Bronze cast cylindrical component which has external bosses cast, and has the required porting equally spaced between the bosses. The ports are specially designed to provide suitable flow control for the conditions specified. The top face of the ported body has a spigot which is located in the upper valve body and the bore of the lower part of the ported body is machined to suit the contour of the resilient face ring.

Base Plate Ductile iron casting having its top end cast solid with the underside having internal radial ribs each of which has a rectangular shaped hole adjacent to the solid end. These holes allow passage of grout between the ribs, the grout being introduced through tapped holes inside of the cylinder portion.

Through this flange, the foundation bolts are located offset from equally spaced bosses, which are on the same centreline as the ribs. The top surface of the base plate is machined to accept the ported body and to suit the contour of the resilient face ring.

The ported body is secured to the baseplate by means of stainless steel stay bars through the upper valve body flange held in place by stainless steel nuts.

SERIES 856 SPECIFICATION



Resilient Face Ring A rubber face ring is securely clamped in position between a check formed on top of the baseplate and a check in the lower end of ported body and clamped by stay bars as previously described.

Sleeve A stainless steel fabrication with a centrally located inner boss connected with radial ribs. The outside diameter of the sleeve is accurately machined and is a close fit in the ported body. The sleeve is guided by means of bronze ring located in the upper valve body.

The resilient sealing ring, also located in the upper valve body, is pressurised by the passage of water through a series of holes in a retaining gunmetal gland ring, to ensure positive contact with the sliding sleeve thus forming a seal which is effective at all positions of valve travel.

In the closed position, the lower or leading edge of the sleeve makes contact with the rubber face ring which is secured between ported body and baseplate as previously described.

In the open position the sleeve is raised to expose the full area of the ports.

Operating Spindle manufactured from stainless steel and operates as a rising spindle. It comprises of sections (dependent on valve length) valve spindle, extension spindle and a screwed headstock spindle. The sections are machined at the ends to make them suitable for joining together. The lower end of the valve

spindle is secured to the stainless steel valve sleeve by a shoulder formed on the spindle, bearing on the top of the centrally located boss. A stainless steel lifting nut is screwed to the bottom end of the spindle and bears on the underside of the boss and so locks the spindle to the sleeve. The valve spindle can be extended.

Headstock Pillar Ductile iron cast pillar which is mounted onto the inlet bend. The height is adjusted to position the handwheel at a convenient height above the operating platform. Two hand hole openings are provided for access to the gland and stuffing box and two machined slots are provided for engagement of the torque plate.

Valve Control Equipment The valve can be operated manually or fitted with an electric / hydraulic actuator.



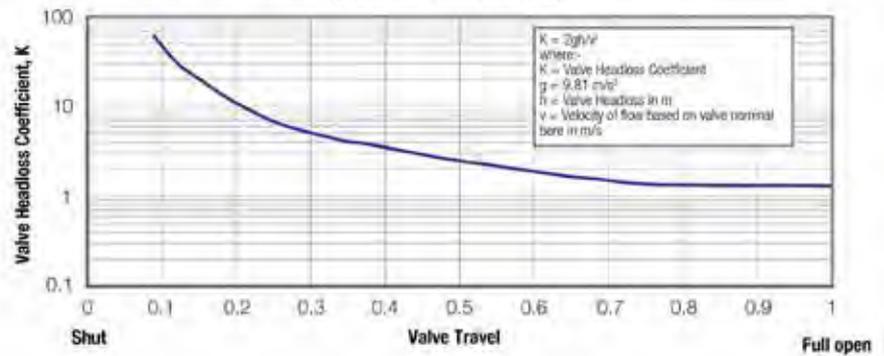
SERIES 856 SIZING



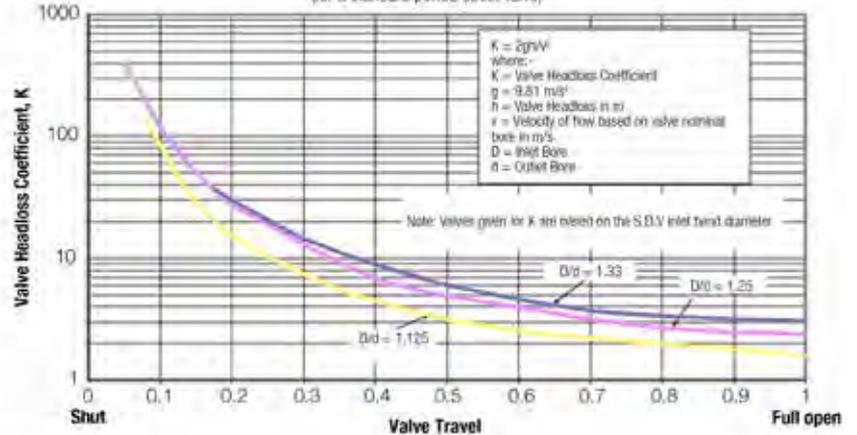
The flow velocity in the inlet bend should be limited to 6m/s and the flow velocity in the vertical section of the valve should be limited to 12m/s. A larger elbow can be used with a smaller downstream valve to provide the desired maximum flow rate.

The headloss characteristics for standard ported valves are shown in the curves on the graphs (please note that the porting design of the valve can be modified to achieve a near-linear flow control across the valve stroke and that this will modify the headloss curves below).

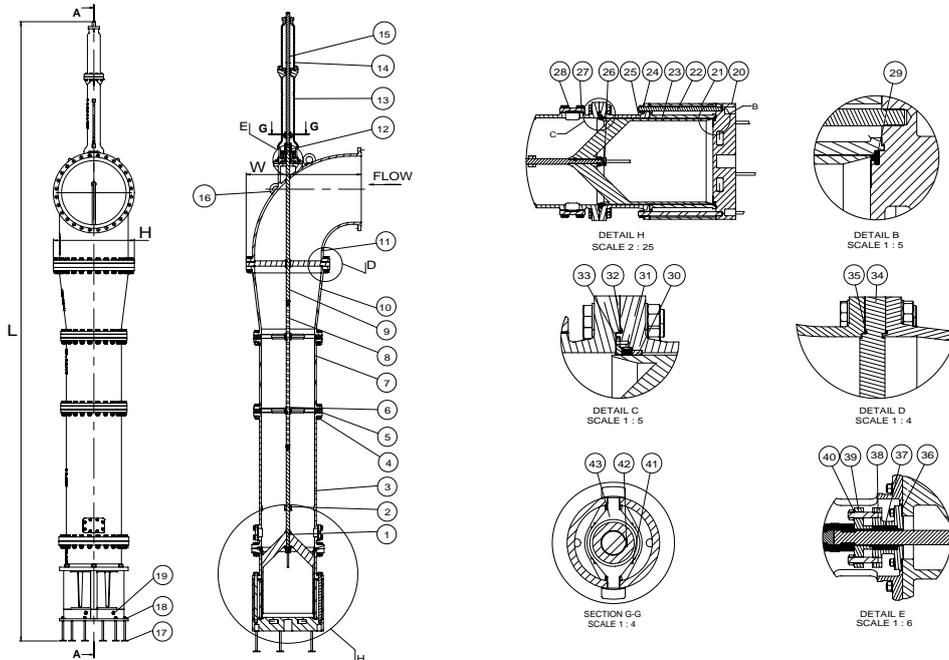
Series 856 Submerged Discharge Valve (Inlet/ Outlet Diameter Equal)
Graph showing the relationship between valve headloss coefficient and valve travel (for a standard ported outlet valve)



Submerged Discharge Valve (Tapered outlet type)
Graph showing the relationship between valve headloss coefficient and valve travel (for a standard ported outlet valve)



SERIES 856 CAST VERSION



Components	Material
1 Stopper pipe	Ductile Iron GJS-500-7
2 Bottom valve spindle	Stainless steel, 1.4057
3 Guide spider	Ductile Iron GJS-500-7
4 Bush	Alu-Bronze; BS EN12163; CW307G
5 Screw	Grade A4-70
6 Extension pipe	Ductile Iron GJS-500-7
7 Bolt	Grade A4-70
8 Intermediate spindle	Stainless steel, 1.4057
9 upper spindle	Stainless steel, 1.4057
10 Taper pipe	Ductile Iron GJS-500-7
11 Inlet bend	Ductile Iron GJS-500-7
12 Tensional coupling	Ductile Iron GJS-500-7
13 Extended stool	Ductile Iron GJS-500-7
14 Upper pillar	Ductile Iron GJS-500-7
15 Screwed spindle	Stainless steel, 1.4057
16 Eye bolt	Hot dip galvanized steel
17 Foundation bolt	Stainless steel, 1.4401
18 Spring washer	Grade A4-70
19 Plug	Bronze
20 Baseplate	Ductile Iron GJS-500-7
21 Ported body	Alu-Bronze; EN1982; CC333G
22 Stay bar	Stainless steel, 1.4057

23 Sleeve	Stainless steel, 1.4401
24 Washer	Grade A4-70
25 Upper valve body	Ductile Iron GJS-500-7
26 Lifting nut	Stainless steel, 1.4057
27 Gasket	EPDM
28 Handhole cover	Ductile Iron GJS-500-7
29 Face ring	Neopren
30 Guide ring	Bronze
31 Seal ring	Neopren
32 O-ring	EPDM
33 Gland ring	Bronze
34 Guide spider	Ductile Iron GJS-500-7
35 O-ring	EPDM
36 Gasket	EPDM
37 Packing	PTFE
38 Stuffing box	Ductile Iron GJS-500-7
39 Gland	Ductile Iron GJS-500-7
40 Washer	Stainless steel, 1.4401
41 Hexagon nut	Grade A4-70
42 Key	Grade A4-70
43 Torque plate	Stainless steel, 1.4401

Ref	DN/DN	Flange drilling	H	W	L	Approx Weight
	mm		mm	mm	mm	Kg
856-0200-0-110000000100	200 - 200	PN16	515	563	4760	1000
856-0300-0-110020020200	300 - 300	PN16	460	660	8150	1500
856-0300-1-110010010100	300 - 250	PN16	460	660	8150	1300
856-0400-2-110090090100	400 - 250	PN16	580	790	6991	1481
856-0450-1-110030030200	450 - 400	PN16	714	853	6894	3000
856-0600-2-110040040100	600 - 450	PN16	840	1120	8250	5000
856-0800-1-100050050200	800 - 600	PN10	1025	1214.5	11480	7000
856-1000-2-110060060200	1000 - 800	PN16	1255	1727.5	12840	12500
856-1400-1-110070070300	1400 - 1200	PN16	1685	2122.5	16150	20000
856-1600-2-110080080000	1600 - 1200	PN16	1930	2222	16500	21000

SERIES 856 - STILLING SUMP / BASIN SIZING



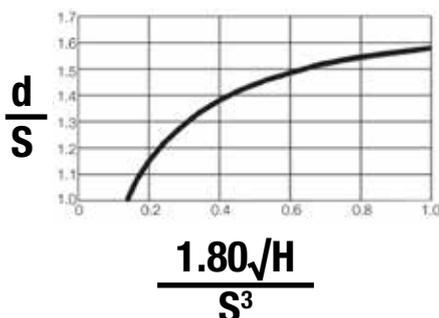
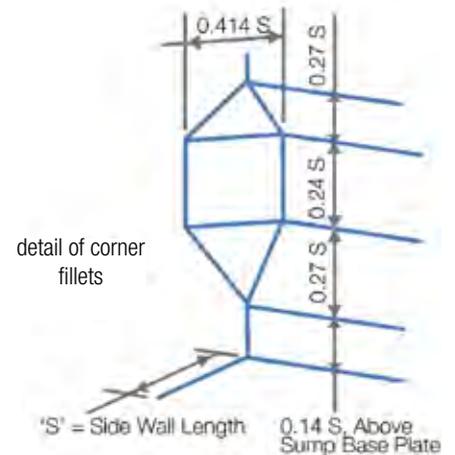
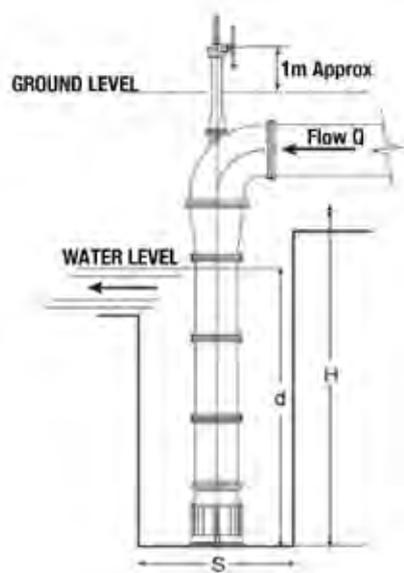
The design of the stilling sump (or chamber) is crucial for the optimization of energy dissipation. Dimensions from the valve to the stilling sump wall are critical.

Please contact Glenfield for stilling sump dimensions to suit your application +44 (0) 1292 670404.

The following calculations and graphs can be used as a guideline for stilling sump requirements:

Where:

- Q** = maximum discharge flow (m³/s)
- H** = maximum head of water (m)
- d** = minimum submergence depth (m)
- S** = side length of sump wall (m)



The uniformity of free surface conditions in the stilling well can be improved by the addition of short corner fillets. The diagram to the right can be used as a guideline for sizing and positioning of the fillets.

SERIES 856 SELECTED GLOBAL REFERENCE LIST

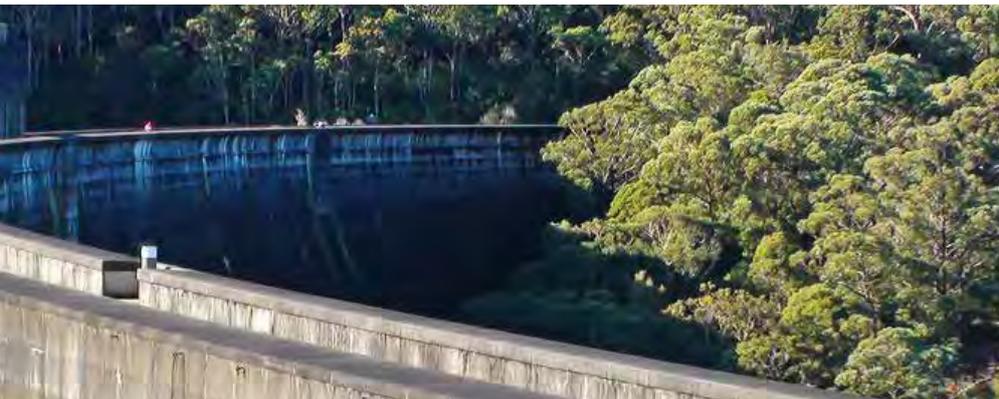
Over 60 years experience and over 80 global installations



ORDER YEAR	DN	CUSTOMER	LOCATION
1968	36/36	Central Scotland W.B.	Glen Hove (Scotland)
1968	24/18	East Scotland W.B.	Backwater Dam (Scotland)
1969	42/30	Essex River Authority	Ely-Ouse (England)
1969	72/72	Dept. of Water Affairs	Orange River (S. Africa)
1969	24/18	Ross & Cromarty Water Board	Invergordon (Scotland)
1969	18/18	Central Scotland W.B.	Blairlinnans (Scotland)
1969	24/24	Central Scotland W.B.	Balmore (Scotland)
1969	30/30	Central Scotland W.B.	Gowanbank (Scotland)
1970	24/24	Furness Water Board	River Duddon (England)
1970	30/24	E.S.B. Dublin	Turlough Hill (Ireland)
1970	18/15	Ayrshire & Bute W.B.	Loch Bradan (Scotland)
1972	30"/600mm	Auckland R. Auth.	Wairoa Dam (New Zealand)
1973	42/42	Hong Kong W.A.	High Island Scheme
1973	1600/1200mm	The Dee & Llwd River Auth.	Brenig Reservoir (Wales)
1974	42"/800mm	Crane Australia Pty. Ltd	Melbourne & Metro WB (Australia)
1974	800/600mm	Farid Ahmar & Farouk At-tar Sir M. MacDonald & Part. (cCons. Eng)	Mandali Irrig. Project (Iraq)
1975	42/42	Ward Ashcroft & Parkman	Kangimi Res. (Nigeria)
1976	1000/800	Welsh National W.D.A.	Marchlyn Reservoir
1976	500/400	Northumbrian W.A.	Keilder Scheme
1976	500/400	Welsh National W.D.A.	Towy & Lliw Res.
1976	500/400	Northumbrian W.A.	Keilder Scheme
1976	1200/1067	Northumbrian W.A.	Keilder Dam
1978	450/400	North West W.A.	High Lane Res.
1978	450/450	Central Scotland W.B.	Blairlinnans
1978	1000/800	Lothian Reg. Council	Megget Dam
1978	1200/800	Lothian Reg. Council	Megget Dam
1979	800/800	Lothian Reg. Council	Megget Dam
1980	300/300	Southern W.A.	Darwell/Beauport
1980	400/300	U.A.E.	Al Ain Wed 24 Pump
1981	400/400	Auckland R. Auth.	Cosseys Dam
1981	800/600	Government of Cyprus	Asprokremmos Dam
1982	800/800	Kenya Water Dept.	Chania Thika
1983	1000/1000	Government of Nigeria	Balanga Dam
1984	200/200	Government of Sri Lanka	Kotmale Dam
1985	500/400	Bombay M.W.C.	Panjarapur PS
1985	200/200	Government of U.A.E.	Khor Fakkan Dam
1986	600/600	Algiers W.S.	Gue De Constantine
1986	400/400	Government of Hong Kong	Harbour Island
1987	600/600	Central Scotland W.B.	Balmore T.W.
1987	900/800	Government of Hong Kong	Pak Kong T.W.
1987	600/600	Strathclyde R.C.	Bradand Dam
1988	1200/1200	Government of Hong Kong	Harbour Island Sch.
1988	600/600	Government of Thailand	Lat Phrao Dam
1988	1200/1200	Government of Brunei	Benutan Dam
1988	400/400	Government of Brunei	Benutan Dam

SERIES 856

SELECTED GLOBAL REFERENCE LIST



ORDER YEAR	DN	CUSTOMER	LOCATION
1989	900/800	Government of Hong Kong	Au Tau P.S.
1989	800/600	S.W.W.A. England	Roadford Dam
1989	300/300	Strathclyde W.A.	Afton Res.
1990	900/36	Central Scotland W.B.	Blairlinnans
1990	300/300	Malaysia R.W.S.S.	
1990	1200/1000	Government of Singapore	Pak Kong T.W.
1990	450/300	Anglian W.A.	Littlehempston
1992	800/600	North West Water	Woodford Reservoir
1992	800/600	North West Water	Shap Aqueduct
1993	600/600	Bombay Municipal Corporation	Panjarapur Pumping Station
1993	1600/1200	Government of Hong Kong	Tai Po Tau Pumping Station
1995	800/800	WOSWA 65/6411	Baltimore WTW
1997	400/300	Government of Zimbabwe	Pungwe to Matare Christmas Pass
1997	400/300	Government of Zimbabwe	Odzani Scheme
1999	800/600	Government of Malaysia	Sungai Kelinchi
2000	400/400	Government of Malaysia	Sungai Kelinchi
2002	1100/800	Sydney Catchment Authority	Woronora Dam
2002	1000/800	Sydney Catchment Authority	Woronora Dam
2003	375/250	Sydney Catchment Authority	Woronora Dam
2003	450/300	Government of Malaysia	Sungai Muar
2004	800/600	Government of Iran	Sanegerd Dam
2004	600/450	Government of Malaysia	Sungai Kinta TW
2004	800/600	Snowy Hydro, Australia	Jindabyne Dam
2005	1000/800	Government of Iran	Tangab Dam
2005	1400/1200	Government of Hong Kong	Lower Shing Mun
2006	400/300	Government of UAE	Shobaisi Dam
2006	400/300	Government of Australia	Goro Nickel Project
2006	450/400	Government of Ethiopia	Koga Dam
2006	400/300	Government of Australia	Mooney Mooney Dam
2007	600/450	Government of Iran	Gheighaj Dam
2007	800/600	Government of Australia	Palmtree Creek
2008	1000/800	Melbourne Water	Sugarloaf Reservoir
2009	300/300	Government of Malaysia	Kargu Dam
2009	1000/800	Government of Malaysia	Kargu Dam
2009	300/300	Alstom / EDF	Rizzanese Dam, Corsica
2011	1000/800	American AVK	Citrus Reservoir
2011	450/400	American AVK	Citrus Reservoir
2011	1000/800	ACM	Baghdad
2011	800/600	ACM	Baghdad
2013	400/250	AVK Australia	Onkaparinga Dam
2012	200/200	Fred Olsen / Hydroplan	Burnhead 2
2013	300/250	Bristol Water	Heron Green
2013	1000/800	Watercare, New Zealand	Hunua No. 4
2014	600/450	Sinohydro, Malaysia	Hulu Terengganu
2014	1400/1200	JN Bentley, UK	Eccup Reservoir
2016 / 2017	750/900	Scottish Water	West of Scotland
2017	450/600	Salamah Trading	Beirut

NEEDLE / PLUNGER VALVES PRODUCT SPECIFICATION



Main Features

- Product range from DN80-2000
- Pressure classes PN10/16/25/40/64/100
- Design and manufactured according to EN 1074-1 / EN 1074-5 / EN 1349
- Face-to-face according to EN 558 S15 (F5)
- Flanges according to EN 1092-1/2 or ANSI B16.5 CL 150/300/600
- Easy installation
- Corrosion protection by FBE coating 300 microns, color RAL 5005.
- Potable water approved DM174 / WRAS / ACS / DVGW
- Class A tightness according to EN 12266
- Standardised face-to-face for the whole range

Benefits

- State of the art design.
- Innovative design for flow optimisation with a reduced pressure loss in open position.
- Reduced torque.
- Long life sealing systems. All gaskets are located safely in the no-flow zone.
- Long-Life of the valve in all conditions with all internal and moving parts in stainless steel. The body is completely protected by Heavy Duty Corrosion Protection FBE coating. (Small diameter valves supplied with stainless steel body)
- Linear flow control up to 96% of the total stroke of the valve.
- Cavitation prevention using bespoke solutions for all conditions.
- Compact, lightweight and economic efficient design.

Application Fields



DRINKING WATER / WATER TREATMENT

- Flow control
- Pressure control



IRRIGATION

- Flow control
- Pressure control
- District Metering Area (DMA)
- Level control



SNOW MAKING

- Pressure control
- Flow control



PRESSURE MANAGEMENT

- Dynamic pressure control
- District Metering Area (DMA)
- District Metering Zone (DMZ)



INDUSTRY

- Flow control
- Pressure control



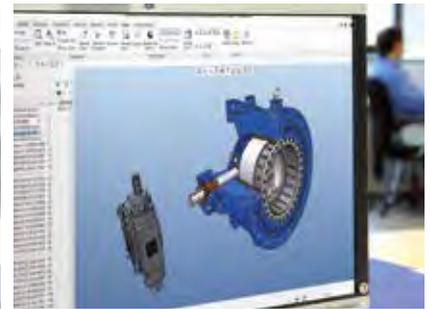
HYDROPOWER

- By-pass valve
- Turbine control
- Turbine by-pass
- Safety overflow valve
- Pipe burst protection

NEEDLE / PLUNGER VALVES TECHNICAL EXPERTISE

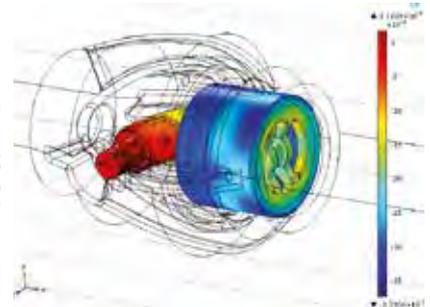
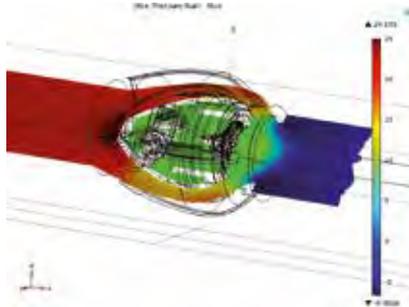
DESIGN

State of the art design and cutting edge technology. Using the most sophisticated CAD-CAE programs available on the market (SolidWorks, Pro/E).



KNOW-HOW

Calculations using COMSOL software (FEM + FLUID DYNAMICS) and in depth CFD analysis are used to optimise valve design.



MANUFACTURING - HIGH QUALITY MATERIALS

- Castings
- Machining
- Painting / Coating
- Assembly



QUALITY CONTROL

The quality control is carried out using state-of-the-art equipment, in addition to static and dynamic test apparatus.

Stringent quality parameters are carefully checked by highly qualified staff.



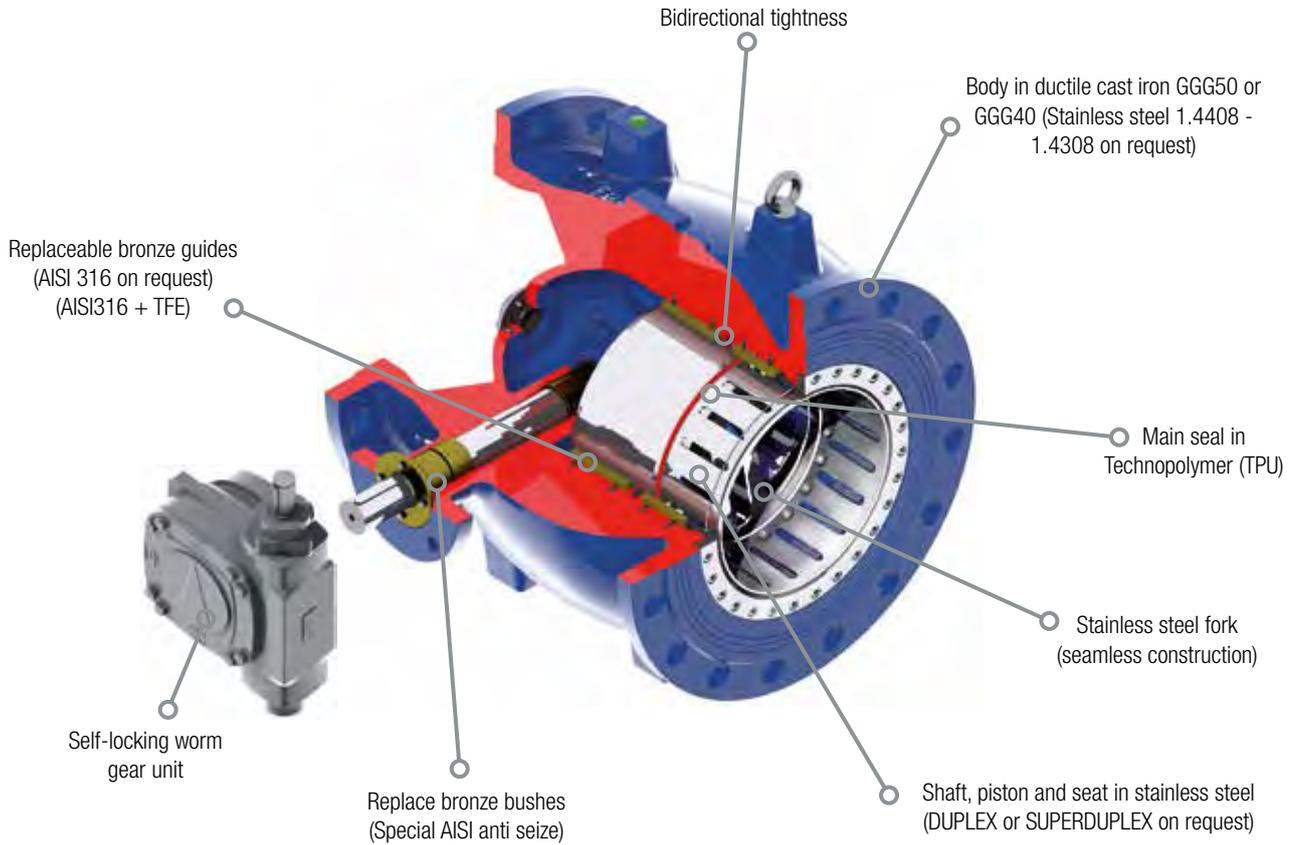
TRAINING AND TECHNICAL SUPPORT

A highly skilled team of engineers is available for:

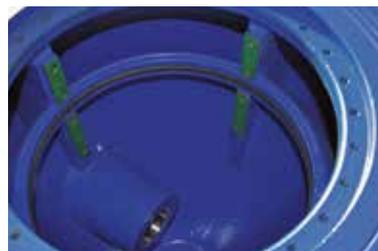
- Training courses on or off site
- Pre-post sales support
- "On-site" technical assistance



FEATURES AND BENEFITS



State of the art solutions for a high performance long lasting product.



A special and innovative internal gasket for a perfect and bidirectional seal.

High performance seal, located in the no-flow zone, easily replaceable without disassembling the valve from the pipeline.



Compact piston with bronze guide strips (Replaceable).

One-piece body (L=DN+200 mm) EN 558 S15 (F5).



Heavy duty corrosion protection by FBE epoxy coating 300 microns.

CONFIGURATIONS

“THE MOST RELIABLE SOLUTION FOR CONTROL”



Worm gear box and handwheel



Electric actuator



Hydraulic brake and lift unit



Double acting hydraulic piston



Simple acting hydraulic piston



Double and single acting pneumatic actuator

Dedicated software and accessories for sizing and cavitation analysis

**INTRUSIVE
Dissipating cylinder**



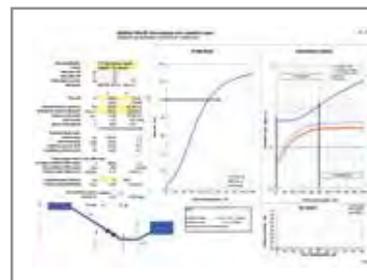
**NON INTRUSIVE
Dissipating plate**



**NON INTRUSIVE
Venting device**



Flow & Cavitation Analysis



Certifications and construction standards

The high quality standards and strict controls during the manufacturing have led to obtain major awards with internationally recognized certification bodies.

**EN 1074-1
EN 1074-5
EN 1349**



SERIES 756 BUTTERFLY VALVE

LARGE DIAMETER BUTTERFLY VALVES



The Series 756 butterfly valve is a double eccentric, resilient seal design. These valves are used for general isolation purposes, protection valves or turbine inlet valves for hydropower applications.

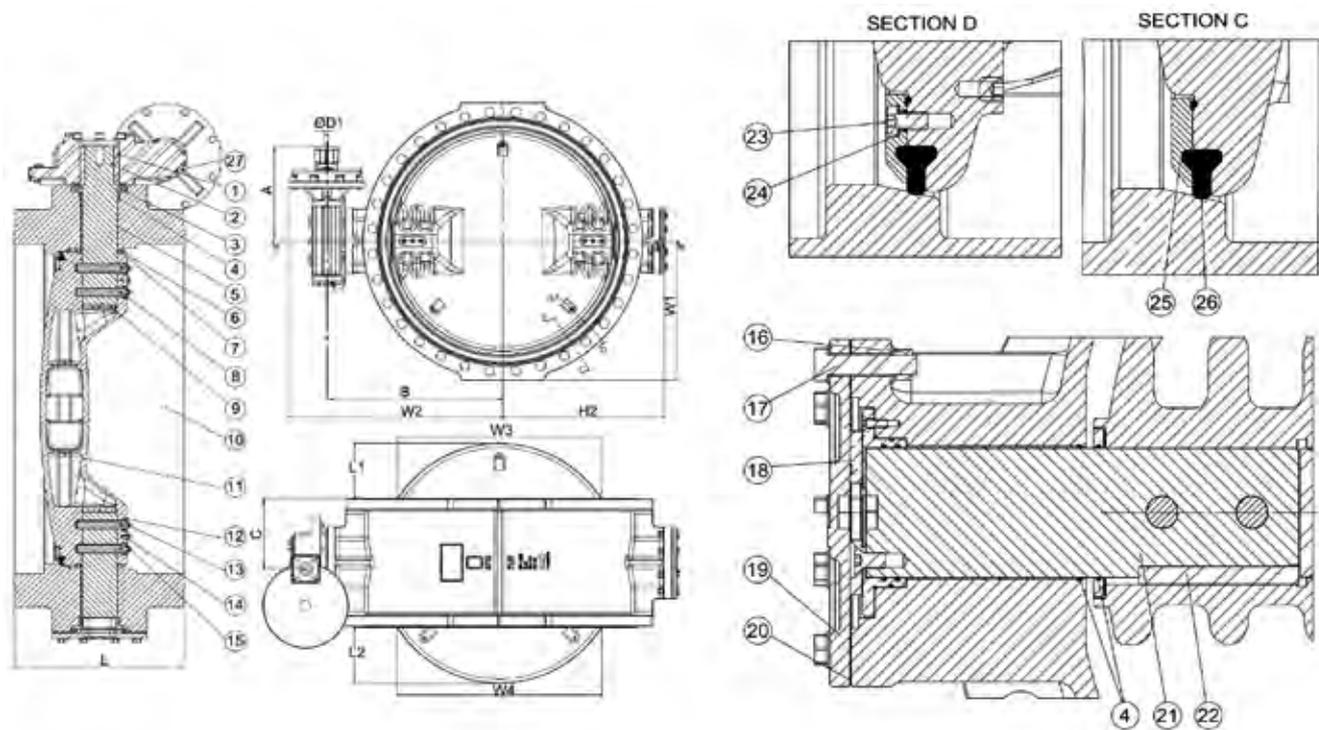
The standard valve complies with EN1074 Parts 1 & 2 and is manufactured from ductile iron with plate disc design and integral seat.

These valves have a number of key features and benefits as follows:

- Tilted disc design reduces seal wear, increases longevity and minimises operating torques.
- Pin and disc fixation ensures anti-flutter and reduction in wear. Safety key mounted as extra back-up.
- Replaceable stainless steel seat ring to increase abrasion resistance during initial opening of valve.
- Flow through disc design provides less sensitivity to cavitation at high flow velocities (available for DN700 – 1200 sizes)
- Disc seal optimization for reliable functionality due to secure fixation in the correct position.
- Protected shaft end zones for maximum corrosion protection
- Locking device providing possibility of locking the disc in the fully open or closed position
- Valves are fully bi-directional as standard
- Hydraulic opening / gravity weight closing for fast closure of valve to protect the system from emergency flow rates caused by pipe bursts etc.



SERIES 756 BUTTERFLY VALVE SIZING



Components	Material
1 Key	Stainless steel A2.
2 Valve shaft	Stainless steel 431
3 Seal housing	Bronze
4 O-ring	EPDM rubber
5 Self-lubricating bearing	Steel, PTFE coated
6 Disc cover	Stainless steel
7 Disc cover gasket	EPDM rubber
8 Dowel	Stainless steel A2
9 Plug	Steel
10 Body	Ductile iron GJS-500-7 (GGG-50)
11 Disc	Ductile iron GJS-500-7 (GGG-50)
12 Security plate	Stainless steel
13 Screw	Stainless steel A2.
14 Spring washer	Stainless steel A2

15 Washer	Zinc
16 Nut	Stainless steel A2
17 Screw	Stainless steel A2.
18 Thrust bearing	Bronze
19 End plate	Ductile iron GJS-500-7 (GGG-50)
20 Gasket	EPDM rubber
21 Stub shaft	Stainless steel 431
22 Safety key	Stainless steel A2
23 Bolt	Stainless steel A2.
24 Washer	Stainless steel A2
25 Seal retainer ring	Steel
26 Disc seal	EPDM rubber
27 Gearbox	Cast iron

Ref	DN	Flange Drilling	L	L1	L2	H2	W1	W2	W3	W4	D1	A	B	C	ISO Flange	Weight
	mm															Kg
756-0700-1-0400201	700	PN10	430	127	133	550	448	656	533	543	20	313	605	287	F10	469
756-0700-1-1400201	700	PN16	430	127	133	550	455	656	533	543	20	313	600	329	F10	538
756-0800-1-0400201	800	PN10	470	156	162	620	508	735	627	636	20	313	670	349	F10	632
756-0800-1-1400201	800	PN16	470	156	162	620	513	756	627	636	20	313	670	349	F10	697
756-0900-1-0400201	900	PN10	510	186	192	690	558	1057	722	730	20	313	740	369	F10	780
756-0900-1-1400201	900	PN16	510	186	192	690	563	1057	722	730	20	342	740	336	F10	885
756-1000-1-0400201	1000	PN10	550	216	222	770	615	1137	816	824	20	313	820	389	F10	996
756-1000-1-1400201	1000	PN16	550	216	222	770	628	1137	816	824	20	469	837	306	F10	1131
756-1200-1-0400201	1200	PN10	630	269	275	855	728	1222	986	993	20	469	837	346	F10	1541
756-1200-1-1400201	1200	PN16	630	269	275	855	743	1222	986	993	20	505	930	382	F10	1745

NOTE: Valves are available from DN200 - 2800. Please contact Glenfield for further information. T: +44 (0) 1292 670404

ASSOCIATED PRODUCTS



Glenfield's design quality is based on exceptional historic engineering detail and thorough research of the customers' needs. Glenfield products have been manufactured in Scotland for over 100 years using experienced personnel and equipment to ensure high precision and uniformity.

The overall framework for quality from development to distribution is our extensive quality assurance system.

METAL SEATED GATE VALVE

- Standard size range: DN350-2400
- Designed to operate under high flow and considerable unbalanced pressures
- Operates from fully open position to closed under high velocity
- Valve operates in bidirectional flow conditions
- Body and gate are single piece castings
- Optional accessories include bypasses, clean-outs, indicators, shoe and channels, scrapers, extension stems, and floor-stands
- Available with outside stem and yoke to facilitate limit switches
- Available with manual or electrical actuation
- Available for high velocity application such as scour valve and terminal discharge guard valve

3 AND 4 SIDED HIGH PRESSURE PENSTOCK

- Standard size range: up to 4000x4000, larger sizes available
- Three and four side sealing.
- 4-sided closed frame design
- Suitable for wall mounting with a square or rectangular opening
- Fabricated stainless steel frame and slide, resilient rubber sealing with either non-rising spindle or rising spindle
- Flush invert available
- Bi-directional up to and including 1200 x 1200mm
- Uni-directional and bi-directional available on larger sizes
- Designed according to DIN 19569-4
- Leakage allowance – lower than allowable in DIN 19569-4 (class 5)
- Replaceable seals



BONNETED GATE VALVE

- Standard size range: DN200-1800
- Completely enclosed rectangular port sliding gate for the isolation of flow through the outlet works of dams
- Robust, fabricated construction of carbon steel, with high-performance bronze or stainless steel seats
- May be equipped with air vent piping system to avoid cavitation and with bypass for pressure balancing
- Wide range of sizes and special materials to match specific requirements and head conditions under which the gate will operate
- Available with hydraulic, electric or manual actuator



HIGH PRESSURE KNIFE GATE VALVE

- Standard size range: up to DN3500
- Fabricated body and bonnet with robust design. Gate guiding and closure design incorporates half-wedges on the body and gate
- Can be manufactured with flanges of any size and to any standard
- Wide range of sizes and special materials to match specific requirements and head conditions under which the gate will operate
- Available with hydraulic, pneumatic, electric or manual actuator



TILTING DISC CHECK VALVE

- Standard size range: up to DN2000
- Fabricated tilting disc non return valve designed to prevent back flow on the pressure sides of pumping systems
- Available with counterweight and adjustable hydraulic damping systems to prevent water slamming
- Available with integrated HPU to operate as a butterfly valve while opening and as a check valve while closing
- Wide range of sizes and special materials (including duplex materials for sea water) to match specific requirements and head conditions under which the valve will operate

PRODUCT CHECKLISTS



In order to ensure that your enquiry can be processed as quickly and accurately as possible, it is important that the following information is provided to allow us to correctly select the optimum valve type and size for your specific application:

1. Maximum flow rate = _____ m³/s
2. Minimum flow rate = _____ m³/s
3. Maximum pressure head at valve = _____ m
4. Minimum net pressure head at valve* = _____ m
5. Method of operation = manual or electrical
6. Any other information that is relevant to the enquiry

*Net pressure head is the height difference between the minimum upstream water surface and the centerline level of the valve bore minus any system headlosses.

Alternatively use the documents to the right for the chosen product, these are available to download from our website.

EXPECT... SOLUTIONS NOT ONLY PRODUCTS

FREE DISCHARGE VALVE SPECIFICATION

FOR USE WHEN ORDERING

Also known as: Fixed Cone Valve, Energy Dissipation Valve, Terminal Discharge Valve, Howell Bungler Type Valve

Valve series no		LNS No (if known)	
Size (DN)			

Pressure Rating (Circle)			
PN10	PN16	PN25	Other:

Maximum Unbalanced Operating Pressure (difference between the upstream and downstream pressures)			

Flow Details			
Minimum Flow:		Minimum Net Head:	
Maximum Flow:		Maximum Static Head:	

Closure (Circle)	Clockwise to Close (CWC)	Clockwise to Open (CWO)
------------------	--------------------------	-------------------------

Flange Drilling (Circle)			
PN10	PN16	ANSI	Other:

Coating - Preferred Thickness (Circle)			
250 Microns	300 Microns	Other:	

Fluid Details		Max Temperature	
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Method of Operation (Circle)			
Manual	Electric	Hydraulic	Other:

Mounted Operation (Circle)	Direct Mounted	Floor Mounted	Other:
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Datum Levels			
Inlet Valve Bore Centreline			
Operating Platform Level			
Supply levels Minimum:		Maximum:	

Power Supply	Electric (V / Ph / Hz)	Pressure Supply	Hydraulic
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Time to Open:		Close:	
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Operation (Circle)	Standard	Modulating	Other:
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Discharge (Circle)	Atmospheric	With Hood	Submerged
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Method of Construction (Circle)	Cast	Fabricated
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EXPECT... SOLUTIONS NOT ONLY PRODUCTS

SUBMERGED DISCHARGE VALVE SPEC

FOR USE WHEN ORDERING

Valve series no	LNS No (if known)		
Size (DN)			
Pressure Rating (Circle Box)			
PN16	PN25	Other:	
Maximum Unbalanced Operating Pressure (difference between the upstream and downstream pressures)			
Flow Details			
Minimum Flow:	Minimum Net Head:		
Maximum Flow:	Maximum Static Head:		
Direction of Operation (Circle one)			
Clockwise to open (CWO)		Clockwise to Close (CWC)	
Flange Drilling (Circle one)			
PN16	PN25	ANSI	Other:
Coating - Preferred Thickness (Circle one)			
250 Microns	300 Microns	Other:	
Fluid Details			
Maximum Temperature			
Method of Operation (Circle one)			
Manual	Electric	Hydraulic	Other:
Power Supply		Pressure Supply	
Electric (V / Ph / Hz)		Hydraulic (bar)	
Time to Open:	Close:		
Datum Levels			
Inlet Valve Bore Centreline			
Operating Platform Level			
Sump Base (if known)			
Supply levels Minimum:	Maximum:		

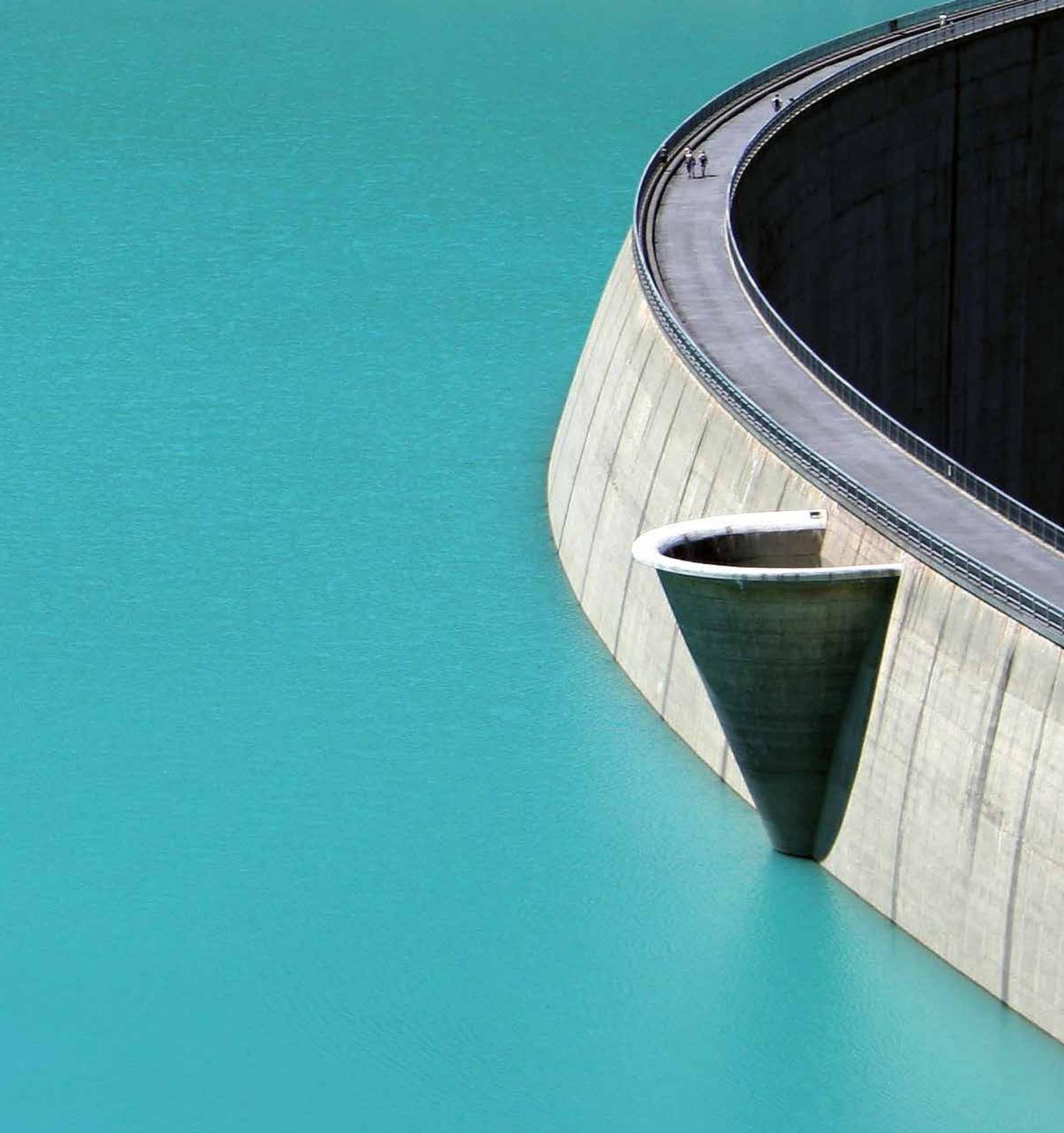
EXPECT... SOLUTIONS NOT ONLY PRODUCTS

NEEDLE VALVE SPECIFICATION

FOR USE WHEN ORDERING

Valve series no	LNS No (if known)		
Size (DN)			
NECESSARY HYDRAULIC DATA (please specify the value of data)			
Max Flow (Qmax)	Min Flow (Qmin)	Static Pressure (Pst)	
Upstream Pressure at Max Flow (Pmqmax)	Upstream Pressure at Min Flow (Pmqmin)	Downstream Pressure (backpressure) at Max Flow (Pvqmax)	Downstream Pressure (backpressure) at Min Flow (Pvqmin)
INSTALLATION DETAILS (please specify the characteristics) (Circle)			
Valve Installed		If end-line, the discharge is	
In-line	End of line	In the atmosphere	Intubated
Type of Operation		Hydraulic Right (std)	Hydraulic Left
ACCESSORIES REQUESTED BY THE CLIENT (Circle)			
Manual (with handwheel)	Yes	No	
With Electric Actuator	Yes	No	Opening / Closing Time
With Pneumatic Actuator	Yes	No	Double Acting
Single Acting	Spring closing	Spring opening	Air Pressure
With Hydraulic Actuator	Yes	No	Double Acting
Single Acting	Spring closing	Spring opening	Air Pressure
With Lever, Counterweight and Hydraulic Piston	Yes	No	Type of Counterweight and Hydraulic Piston
Oil Pressure			Counterweight opening / Counterweight closing
Other Requirements - Additional Options			
Documentation (Standard, Special O&M's, Drawing, Test Certification)			

Note: It is mandatory to know the sizes of the chamber where the valve will be installed. Please provide .dwg or .dxf drawing of the chamber



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W: www.glenfield.co.uk

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