

Glenfield Invicta HYDROPOWER SOLUTIONS



HYDROPOWER SOLUTIONS







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WHO WE ARE



From 'concept to completion', Glenfield Invicta End to End Project Solutions provide market leading valve and penstock engineering excellence, across a multitude of water and non-water infrastructure projects.

Glenfield Invicta combines together the strength and unique proposition of Invicta's site solutions, penstocks and environmental expertise, and Glenfield's experience and expertise in specifying and managing the large Dams, Reservoirs and Hydropower schemes. Supported by the vast product portfolio from AVK UK and its sister businesses.

We are market leaders distinguished by our industry expertise, we have been designing and manufacturing specialist engineered valves, gates and penstocks in the Hydropower industry for more than 160 years and we stand behind every product we install for life, offering some of the best extended warranties in the industry.

Our experienced and multi-skilled project team work closely with our partners and key stakeholders to ensure the project is executed to exacting standards.

Our historical record for the design, supply and installation of engineered valves and pipeline equipment projects delivered safely, on time and to the highest standards, in arduous conditions, are what set us apart.

This specialist capability has made the Glenfield Invicta and AVK brands synonymous with engineering excellence worldwide.

In addition to our proactive programme of strategic acquisitions, we continually invest in our product and service offering. Glenfield Invicta Project Solutions has the people, processes and systems to support optimised operational efficiency when meeting the needs of our partners.

As a leading global manufacturer, we closely monitor our carbon footprint. We at Glenfield Invicta continually work on ways of reducing our footprint as part of our annual climate change programme.

We believe Hydropower to be a green and reliable source of energy that will play a big part in us meeting our global environmental footprint targets.

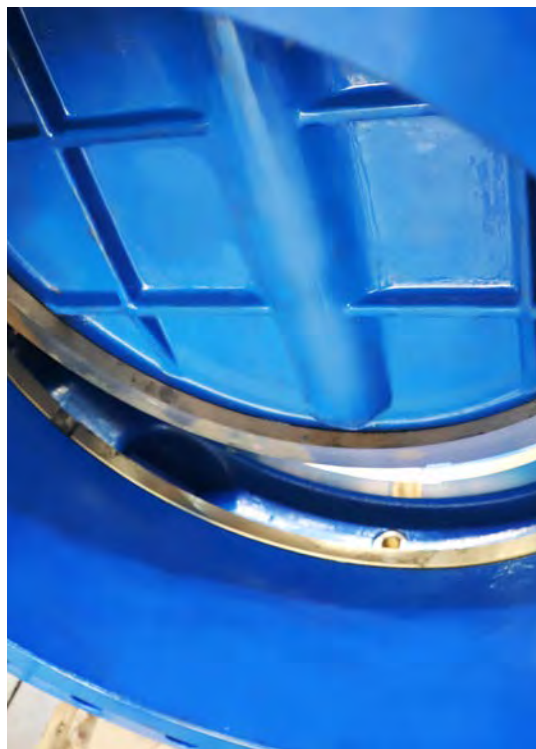
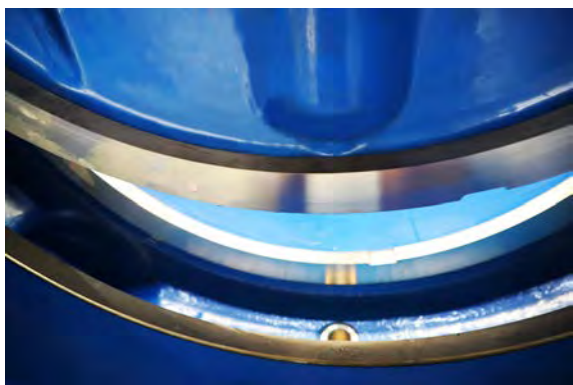
All products and service solutions are provided in accordance with all the relevant UK, European and International standards.

Glenfield Invicta has a clear vision, 'To provide market leading valve and penstock engineering excellence across water and non-utility infrastructure projects'





**DN700 & DN900 S54 METAL SEATED GATE VALVES
(GLENBUCK HYDRO SCHEME - 2019)**



TECHNICAL CAPABILITIES GLOBAL LEADERSHIP & LOCAL COMMITMENT

WHATEVER YOU MAY NEED, WE CAN PROVIDE

GLENFIELD INVICTA is a leading supplier of large diameter valves and penstocks for hydropower installations around the world.

Glenfield Invicta's product portfolio includes an extensive range of:

- Submerged discharge valves
- Free discharge valves
- Reservoir specification metal seated gate valves.
- Auto Self-Closing Butterfly valves
- High performance recoil check valves
- Anti vacuum air valves
- Automatic pressure and level control valves
- Penstocks and sluice gates
- Roller gates
- Bulkheads
- Needle valves
- Stoplogs
- Dismantling Joints
- Flange Adaptors

Within our vast range of capabilities Glenfield Invicta 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 installation and extended warranties.

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
- UK coverage

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.



**WE BUILD ON AND INVEST IN LONG-TERM
PARTNERSHIPS, BECAUSE OUR CUSTOMERS ARE
MUCH MORE VALUABLE THAN A SINGLE TRANSACTION**

TECHNICAL CAPABILITIES QUALITY & A LONG-TERM PARTNERSHIP

QUALITY IS ESSENTIAL! WHEN IT COMES TO VALVES, PENSTOCKS, MECHANICAL FITTINGS AND ANCILLARIES, OUR CUSTOMERS EXPECT LONG LASTING SOLUTIONS

WE COMBINE THE PRODUCT PORTFOLIO AND ENGINEERING SERVICES OF A GLOBAL LEADER WITH THE SUPPORT OF OUR LOCAL TEAMS.

Hydropower is one of the key growth market segments within the group. With over 160 years experience in this field, Glenfield Invicta, Orbinox and Premier valves have installed hundreds of Hydropower projects worldwide.

- WORLD CLASS ENGINEERING
- SALES SUPPORT AND SERVICE
- PIONEERING INNOVATION



WHERE DO YOU GO FOR...

...TECHNICAL INFORMATION



ONLINE PRODUCT SELECTION

PDF BROCHURES



WEBSITES



VIDEO TUTORIALS

INTERACTIVE ANIMATIONS



2D DRAWINGS

3D DRAWINGS



TECHNICAL DOCUMENTS



...ENGINEERING



NETWORK MODELLING

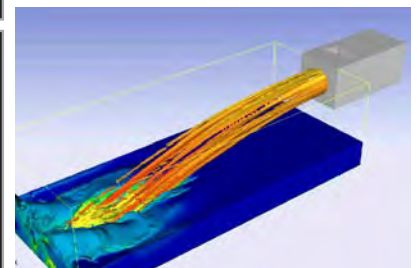


CFD ANALYSIS

FE ANALYSIS

HYDRAULIC SYSTEM CALCULATIONS

FLUID TEST LABORATORY



...SUPPORT



ENGINEERING AND SITE SOLUTIONS



TECHNICAL PRODUCT TRAINING
AFTER SALES MAINTENANCE
AGREEMENTS



...GLENFIELD INVICTA

ENGINEERING AND SITE SOLUTIONS SOLUTIONS, NOT ONLY PRODUCTS

**ENGINEERING AND SITE SOLUTIONS:
INSPECTION / MAINTENANCE / REPAIR OR REPLACE**

**WITH OVER 160 YEARS' EXPERIENCE WE CAN
CONFIDENTLY CLAIM "THERE'S A GLENFIELD INVICTA
VALVE IN EVERY CONTINENT IN THE WORLD"**

Our team of highly qualified engineers and project managers are available to support in the design, procurement, installation and planned maintenance of the complete range of AVK Group products.

From our comprehensive database and archive library we can provide drawings, design calculations, bills of material and operating and maintenance instructions for valves supplied by Glenfield Invicta dating back to circa 1900...120 years of documented supply records so far!



HYDROPOWER

With increasing pressure on the supply and demand of water both in the UK and globally, it has become increasingly necessary to capture and store more water and also, to harness the power of water to produce green electricity.

Our skilled and experienced engineers can advise on valve specification and design working closely with clients to ensure that the optimal valve type, size and operation is chosen for each application. We can also supply site solution teams to install and commission products and also to repair, refurbish and maintain valves previously installed.





PROJECT MANAGEMENT AND ENGINEERING SUPPORT

Glenfield Invicta has the capability to offer a wide variety of valves for all types of Hydropower projects. The extensive range includes:

- Submerged discharge valves
- Free discharge valves
- Reservoir specification metal seated gate valves.
- Auto Self-Closing Butterfly valves
- High performance recoil check valves
- Anti vacuum air valves
- Automatic pressure and level control valves
- Penstocks and sluice gates
- Roller gates
- Bulkheads
- Needle valves
- Stoplogs
- Dismantling Joints
- Flange Adaptors

A complete supply and installation service offer for Glenfield Invicta (AVK group) products.

This provides our customers with a single source solution that offers many benefits such as:

- Considerable cost savings
- Minimal plant shutdowns
- Reductions in site programmes
- Long term solutions
- Extended warranties

The valve supply and installation service offer includes;

- Project engineering and management
- Valve application selection
- Site audit, identification of valve type, size, quantity and condition
- CFD analysis
- Hydraulic calculations
- 3D design
- Air valve sizing and selection software
- Supply and fit under-pressure connections/hot tapping
- Supply and fit repair fittings
- Surge analysis



ENGINEERING AND SITE SOLUTIONS SOLUTIONS, NOT ONLY PRODUCTS



2018 REFURBISHMENT OF NEEDLE DISCHARGE VALVES



ONE 48" AND ONE 12" ON THE SLOY HYDROELECTRIC POWER STATION (END USER - SSE)



VALVE REPAIR, REFURBISHMENT AND REPLACEMENT

Glenfield Invicta has successfully repaired and refurbished valves on numerous projects in the past 160 years and our reputation is such that we are considered 'specialists' by our customers and their delivery partners.

We are frequently called upon to inspect and recommend a resolution for a whole range of valve related issues including:

- Defective installation
- Operational failure
- Frost damage
- Leakage

We often find that repair and refurbishment solutions are more cost effective for our clients than replacement and we can provide these either in-house or on-site depending upon the prevailing circumstances.

The valve repair, refurbishment and replacement service also offers:

- **Valve replacement and refurbishment**
- **Valve/pump chamber refurbishment**
- **Supply, install, replace and refurbishment of penstocks**
- **Feasibility studies**
- **Design input**
- **Bespoke pipework and actuation**
- **Ancillaries**
- **In-house or on-site servicing**

VALVE SUPPLY AND INSTALLATION

Glenfield Invicta has established a reputation within the Hydropower industries of being a solution provider for valve supply and installation.

We can offer supply and installation on a wide range of valves including:

- Submerged discharge valves
- Free discharge valves
- Reservoir specification metal seated gate valves.
- Auto Self-Closing Butterfly valves
- High performance recoil check valves
- Anti vacuum air valves
- Automatic pressure and level control valves
- Penstocks and sluice gates
- Roller gates
- Bulkheads
- Needle valves
- Stoplogs
- Dismantling Joints
- Flange Adaptors





EXPECT... QUALITY IN EVERY STEP

ACCREDITATIONS

Glenfield Invicta hold the following Accreditations:

- **Achilles UVDB Verify**
- **International Accreditation Forum (IAF)**
- **National Accreditation Board (ANAB)**
- **ISO 9001:2015**
- **ISO 14001:2004**
- **OHSAS 18001:2007**

PROJECT DOCUMENTATION

For all projects we prepare:

- Risk Assessments and Method Statements (RAMS)
- Lift plans
- Inspection Test Plans (ITP) / quality plans and inspection checklists
- Project plan
- COSHH assessments
- Employee training records
- Calibration certificate for lifting equipment
- Portable Appliance Test certificate
- Commissioning procedure and site acceptance test certificate

QUALITY, HEALTH AND SAFETY AND ENVIRONMENT

Our quality ethos from project inception to completion is not limited to the service or product itself, we embrace the entire process, from the early specification to the implementation and after-sales. Quality is not the result of a single link in the chain – it is the sum of all steps. One of our customer promises is to expect quality in every step.

The group has ISO 9001:2008 accreditation

The business is committed to providing environmentally sustainable solutions. We endeavour to reduce our impact on the environment at all times, by conducting risk assessments and monitoring our performance.

The group has ISO 14001:2004 accreditation.

The health and safety of our people, visitors to our projects and all stakeholders are paramount to us. We have established robust procedures and processes that minimize risk and ensure that everyone recognizes their responsibility for safe working practices at all times.

The group has OHSAS 18001:2007 accreditation.

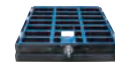
The valve supply and installation service offer includes:

- **Design input**
- **Site audit**
- **Product selection**
- **Associated ancillaries**
- **Installation and actuation**
- **Commissioning**
- **Testing**
- **Maintenance**
- **Extended warranties**



APPLICATION MATRIX

VALVE TYPE



Bonneted Gate

Roller Gate

Penstock /
Sluice Gate

Free
Discharge

Hydro Power & Reverse Pumped Storage

Hydro Power Station

Intake Control

Turbine Protection

Turbine Bypass / Tailrace

Reverse Pumped Storage

Reverse Pumped Storage

	Bonneted Gate	Roller Gate	Penstock / Sluice Gate	Free Discharge
Intake Control	●	●	●	
Turbine Protection		●		
Turbine Bypass / Tailrace	●			●
Reverse Pumped Storage	●			





Submerged
Discharge

Fabricated
Butterfly

Butterfly

Knife Gate

Wedge Gate e

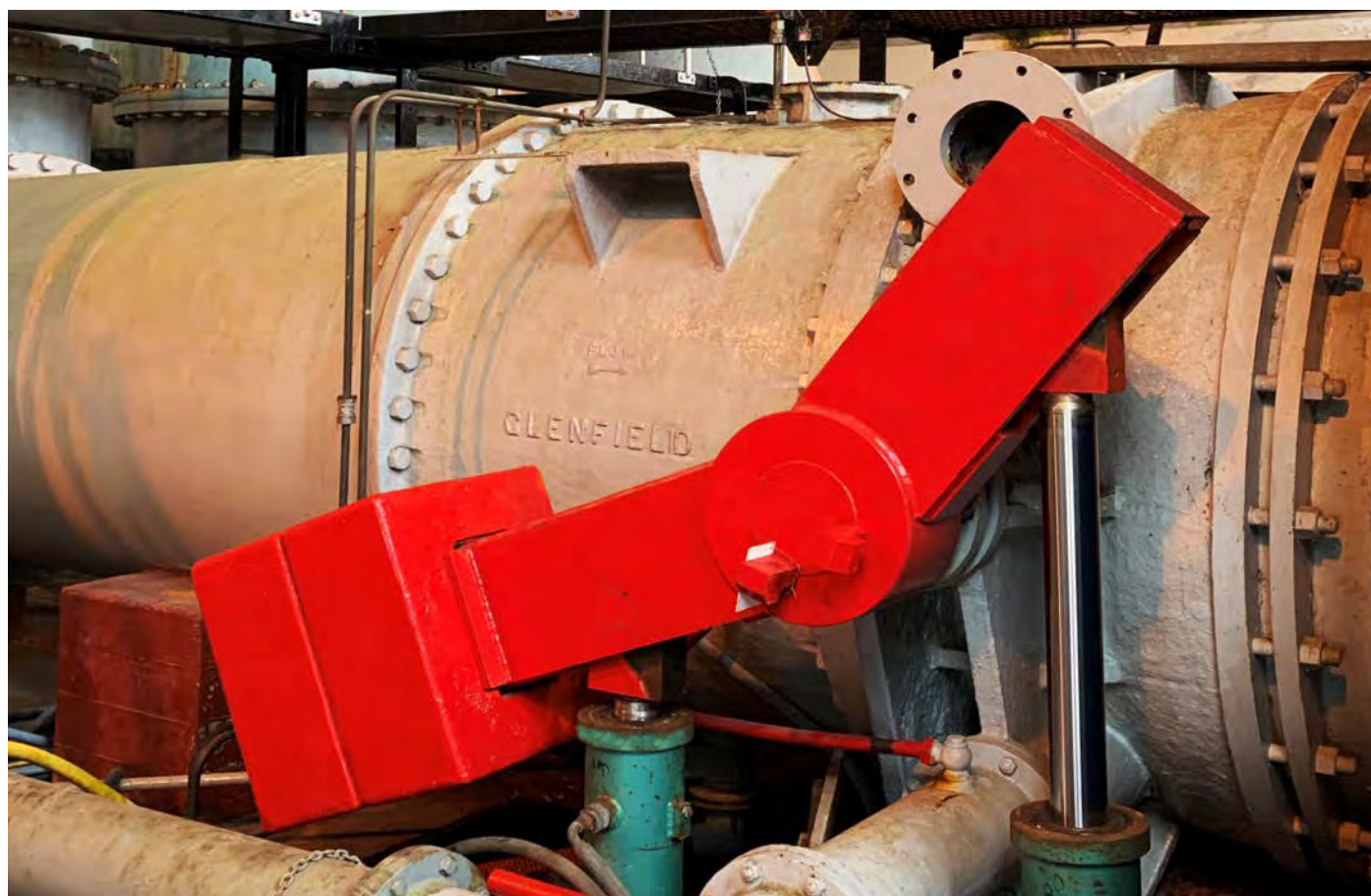
High Performance
Gate

Recoil Check

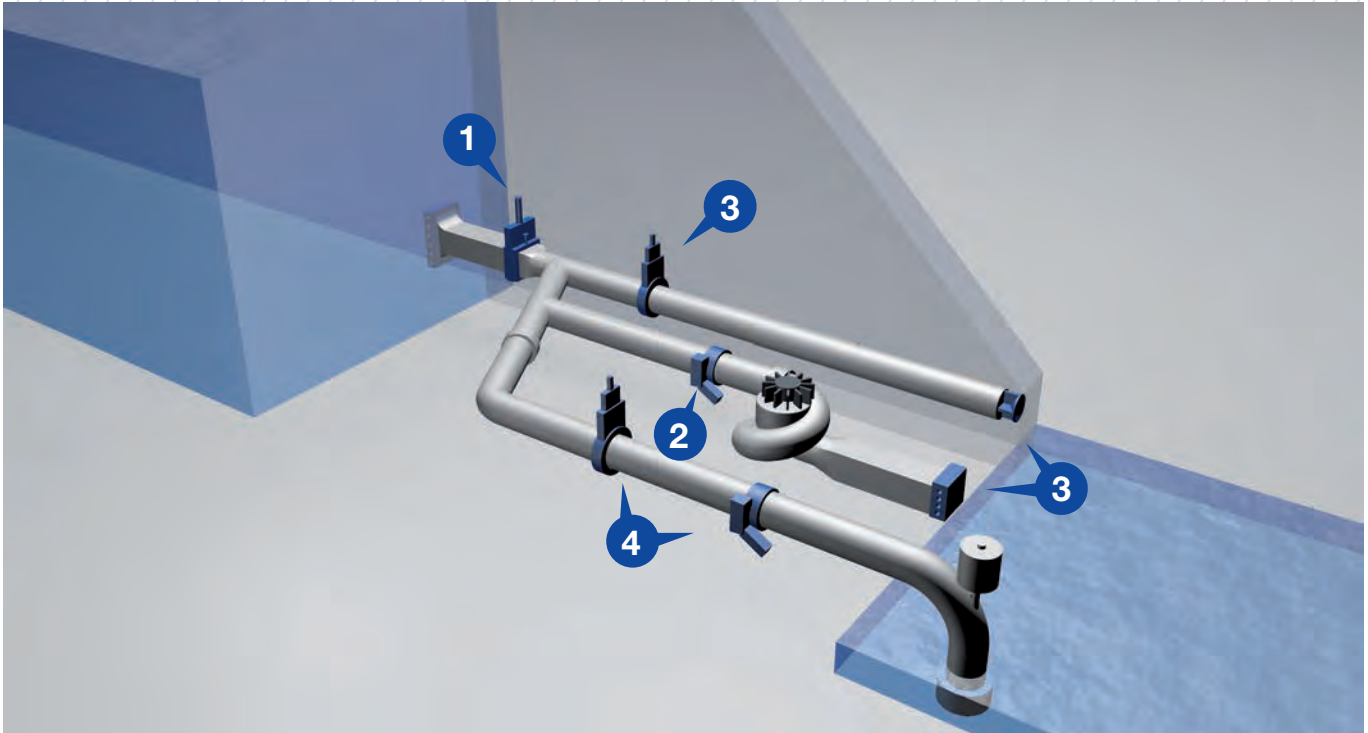
Needle
Control

Air

Spherical



HYDROPOWER STATIONS AND REVERSE PUMPED STORAGE



	Bonneted Gate	Roller Gate	Penstock / Sluice Gate	Free Discharge	Submerged Discharge	Fabricated Butterfly	Butterfly Valve	Knife Gate	Wedge Gate	Recoil Check	Needle Control	Air Valve	Spherical
Hydro Power Station													
1 Intake Control													
2 Turbine Protection													
3 Turbine Bypass / Tailrace													
Reverse Pumped Storage													
4 Reverse Pumped Storage													

SELECTING THE CORRECT AIR VALVE FOR YOUR HYDROPOWER INSTALLATION

GLENFIELD INVICTA OFFER FREE TECHNICAL SUPPORT IN ADDITION TO A SIZING TOOL, "THE ARICAD", TO HELP YOU MAKE THE RIGHT CHOICE:

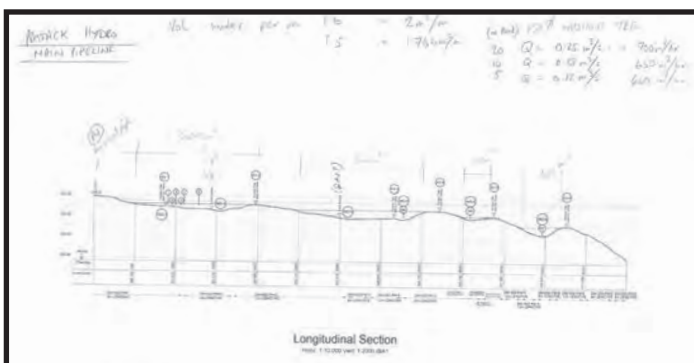


This easy to use software produces reports for engineers as well as procurement teams. With the correct system information, we can help you identify the best product for your scheme; the most suitable location and offer advice on discharge, rupture and inflow characteristics.

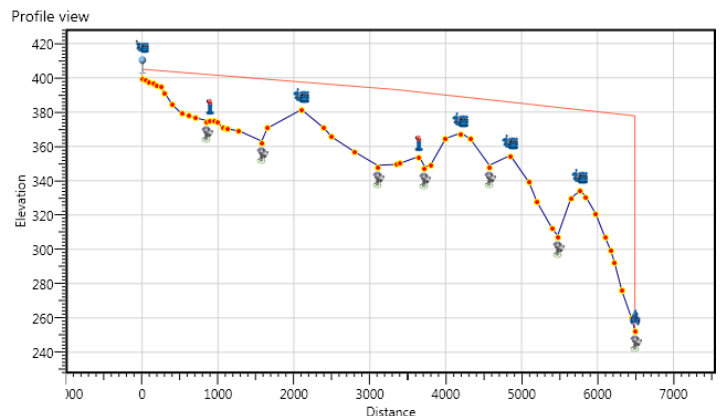


A.R.I VB-060 Air Valve
Supplied to Client from Glenfield Invicta
(Pattack Hydro Scheme)

Client drawing



ARlavCAD project report



HYDROPOWER UK REFERENCE LIST

SUCCESSFULLY SUPPLYING THE WORLDS HYDROPOWER INDUSTRY FOR MORE THAN 150 YEARS. BELOW IS A SAMPLE OF OUR MOST RECENT HYDROPOWER PROJECTS.



2020 - 1000mm x 1000mm Penstocks & Installation - Lochaber (Scotland)

ORDER YEAR	PRODUCT DESCRIPTION	LOCATION
2017	12" & 48" Needle Discharge Valve Refurbishment	Sloy
	1500mm x 1500mm & 3000mm x 1600mm Penstock Installation & Anti-Vacuum Air Valves	Pattack Hydro
	9" Pressure Relief Valve Refurbishment	Kinlochleven
	DN1200 Gate Valve & Ancillaries, 1000mm x 1000mm Penstock, 2000mm x 3800mm Stoplogs	Grudie
	PN25 Gate Valves	Glenfinnart Hydro
	Gate Valves & Ancillaries	Strachur Hydro
	60" Free Discharge Valve Spares	Ffestoiniog
2018	Knife Gate Valves & Butterfly Valves	Lochaber
	Air Valves & Spares	Dinorwig
	DN1800 ASC BFV Refurbishment, Anti Vacuum Valve & Installation (2017/18)	Dolgarrog
2019	60" Electrically Actuated Free Discharge Valve & DN350 Electrically Actuated Needle Valve	Lednock
	DN700 & DN900 Gate Valves & Gearboxes	Glen Buck
	High Capacity Double Orifice Air Valves	Lussa
	Gate Valves	Laggan Hydro
	Gate Valves and mechanical fittings	Allt Mathaig
2020	30" Gate Valve Refurbishment	Loch Dubh
	1250 x 1250mm Penstock Supply and Installation	Glen Noe
	Stainless Steel Scour Gate Valves (2017 - 2020)	Lochaber
	1000mm x 1000mm Penstocks & Installation	Lochaber

*We can provide a historical reference list upon request.

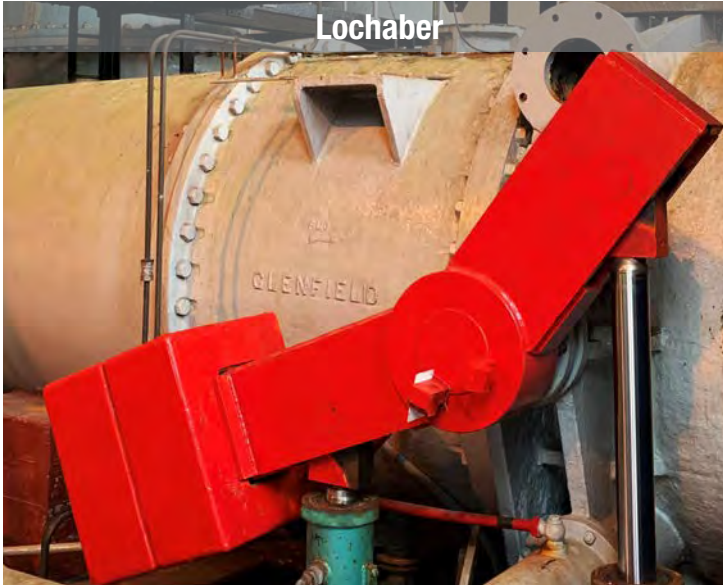
Dolgarrog



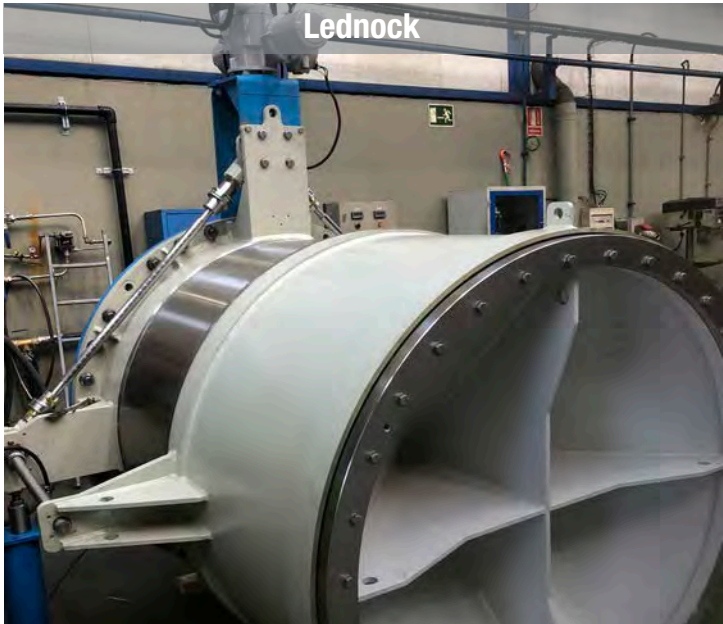
Laggan



Lochaber



Lednock



Sloy

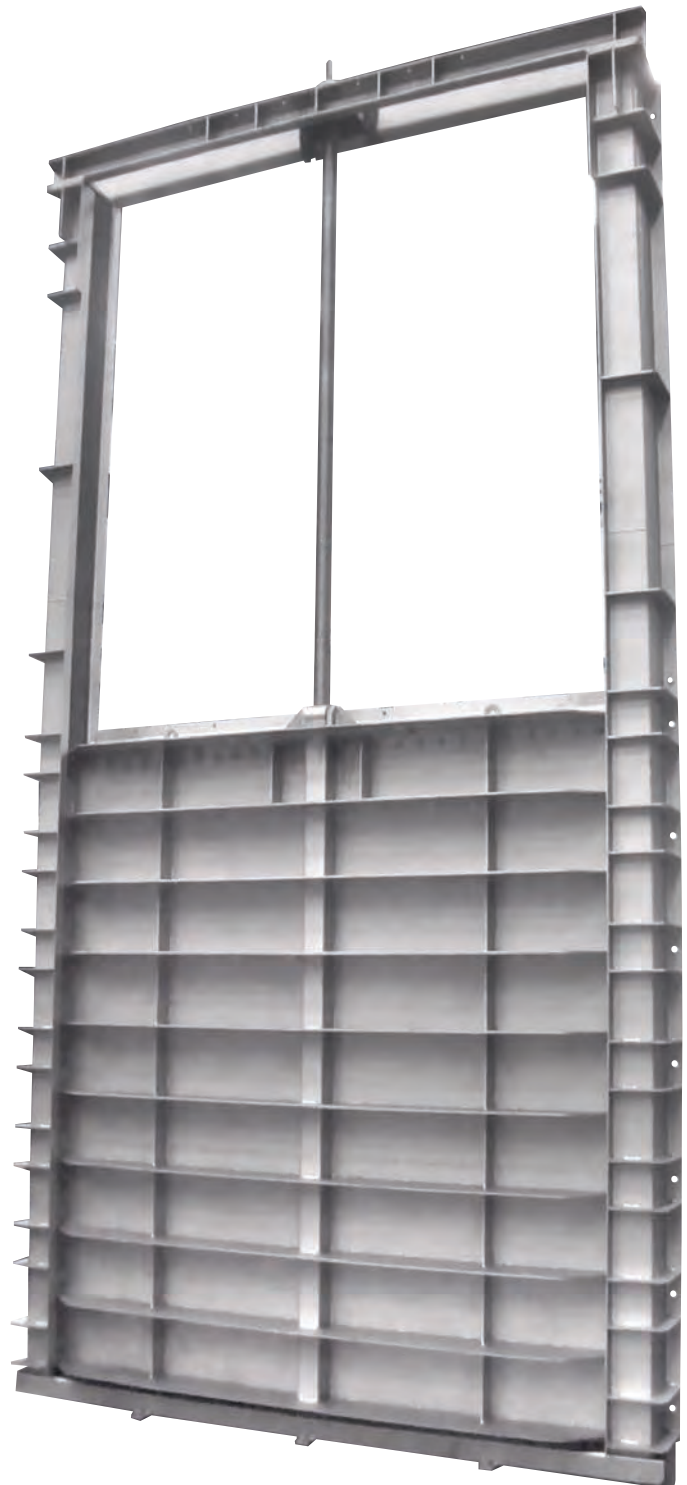




STAINLESS STEEL VS CAST IRON PENSTOCKS

The advantages of stainless steel or HDPE penstocks and flap valves vs cast iron:

- Bespoke fabrication, tailored to suit each unique application and civil structure. Cast iron products are typically available in a range of standard sizes only.
- For channel mounting applications, stainless steel and HDPE penstocks are designed for mounting into rebates, to leave the frame flush with the channel invert and side walls. Cast iron penstocks are designed for face mounting only.
- Much lighter than cast iron, making installation simpler, safer and more economical.
- Less prone to corrosion.
- Vastly superior sealing performance.
- Seals are easily replaceable with product in-situ. Not possible with a cast iron product's bronze sealing faces.
- No adjustment to sealing required throughout lifetime of product. Adjustment of wedges is required with cast iron penstocks and replacement of hinge bushes is required with cast iron flap valves to maintain original sealing performance.
- Lower torque requirement – cheaper actuation and less wear, meaning longer lifetime.
- Generally much shorter delivery lead time. Cast iron penstocks and flap valves > 600mm are generally cast from new.
- Lower carbon foot print.



PRODUCT RANGE



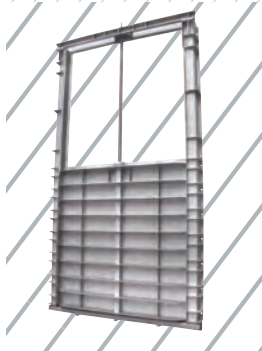
Fabricated Butterfly Valve

Carbon or stainless steel fabricated body and disc, elastomer seal and hydraulic or electric actuator.

Specifics:

Size:
Up to DN3500

Pressure:
Up to 10 bar (DN3500)
Up to 16 bar (DN2000)
Up to 25 bar (DN1000)



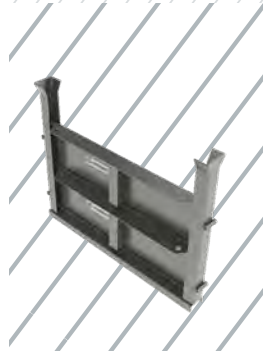
Penstock / Sluice Gate

Three and four side sealing. Stainless steel full frame and gate, EPDM seals, HMWPE guides and various actuation solutions (manual, pneumatic, electric...etc).

Specifics:

Size:
Up to 4000 x 4000 mm

Pressure:
4-side: 1 bar on / 0,6 bar off
3-side: Gate height



Stop logs

3 sided sealing. Stainless steel construction for frame, logs in stainless steel or aluminium, with EPDM sealing. Wall or open channel mounting options available.

Specifics:

Size:
Up to 4000 x 4000 mm

Pressure:
Log height.



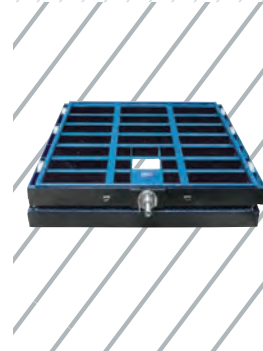
Bonneted Gate

Carbon or stainless steel fabricated body and gate, bronze seat and hydraulic or electric actuation.

Specifics:

Size:
Up to 2500 x 3500 mm

Pressure:
Up to 20 bar



Roller Gate

Carbon steel fabricated gate, roller system for guiding purposes, elastomer seals and hydraulic or electric actuation.

Specifics:

Size:
Up to 6000 x 8000 mm

Pressure:
Up to 10 bar



Knife Gate Valve

Bonneted valve, carbon or stainless steel fabricated body bonnet and gate, elastomer or bronze seat and hydraulic or electric actuation.

Specifics:

Size:
Up to DN3500

Pressure:
Up to 25 bar



Wedge Gate Valve

Metal seated gate valve for isolation. Double Flanged (PN25 available in certain sizes).

Specifics:

Size:
DN50 – 2400

Pressure:
10, 16 & 25 bar



High Performance Gate Valve

Heavy duty ductile iron cast valve with shoes, channel guides, pinned rings, jacking screw and increased corrosion protection. Suitable for or higher flow velocities. Manual, electrical and hydraulic actuation options available.

Specifics:

Size:
DN80 – 1800

Pressure:
PN10, 15, 25, 40 & 64 bar



Butterfly Valve

Double eccentric butterfly valve with seal on disc design. Fully bi-directional with drop tight shut off and double flanged connection.

Specifics:

Size:
DN200 – 2800

Pressure:
PN10, 16 & 25 bar



Recoil Check Valve

Metal seated high performance, fast acting, non-slam check valve.

Specifics:

Size:
DN50 - 1400

Pressure:
PN10, 16 & 25 bar



Air Valve

Triple function ventilation air valves with aerokinetic performance. Large discharge capacities and drop tight shut off for full pressure range.

Specifics:

Size:
DN25 – 250

Pressure:
PN10, 16 & 25 bar



Needle Control Valve

Flow, level and pressure control valve used for in-line and terminal applications.

Specifics:

Size:
DN80 – 2000

Pressure:
PN10, 16, 25, 40, 64 & 100 bar



Submerged Discharge Valve

Terminal discharge valve providing submerged energy dissipation and flow control. Type – End of line single flanged.

Specifics:

Size:
DN200 – 1800

Pressure:
10 & 16 bar



Free Discharge Valve

Cast body or carbon steel / stainless steel fabricated body, elastomer seat and hydraulic or electric actuator.

Specifics:

Size:
Up to DN3000

Pressure:
Up to 20 bar



Spherical Valve

Cast or fabricated, metallic/ soft designs, with movable service seal. Counterweight/ hydraulically operated with digital instrumentation systems.

Specifics:

Size
DN300 - 2000

Pressure:
PN10, 16, 25, 40 & 64 bar



Dismantling Joints

Dismantling joints provide easy installation and disassembly of flanged and fittings, or flanged equipment such as valves, meters and pumps.

Specifics:

Size:
Up to DN3500

Pressure:
Up to 25 bar



Flange Adaptors

Dedicated flange adaptors for all ductile iron, cast iron and steel series 1 pipes, suitable for use with water and neutral liquids (sewage) to a maximum temperature of a +70°C.

Specifics:

Size:
Up to DN3500

Pressure:
Up to 25 bar



INTERNATIONAL SUPPLY SOLUTION PROVIDER

WITH OVER 160 YEARS' EXPERIENCE WE CAN CONFIDENTLY CLAIM "THERE'S A GLENFIELD INVICTA VALVE IN EVERY CONTINENT IN THE WORLD"

WORKING WITH THE AVK GROUP INTERNATIONAL SUPPLY CHAIN, WE HAVE THE CAPABILITY TO SUPPORT AND DELIVER YOUR PROJECT REGARDLESS OF COMPLEXITY OR SIZE. WE DELIVER BASED ON GLOBAL LEADERSHIP AND LOCAL COMMITMENT.







Glenfield Invicta

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A dedicated member of the **AVR** Group