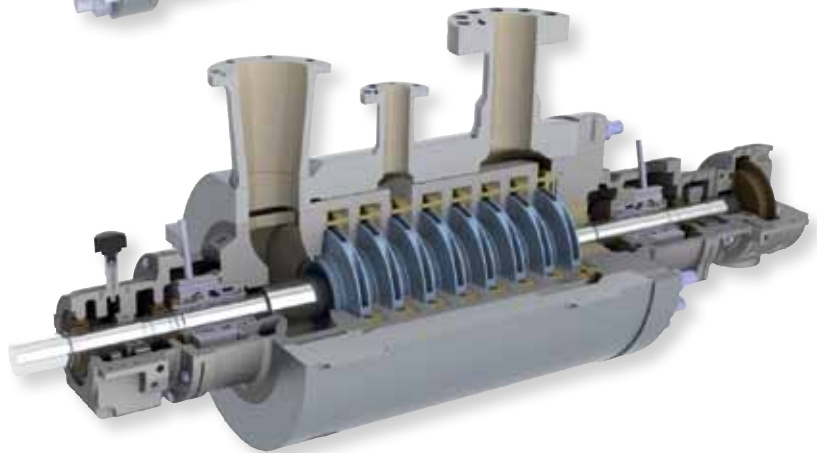
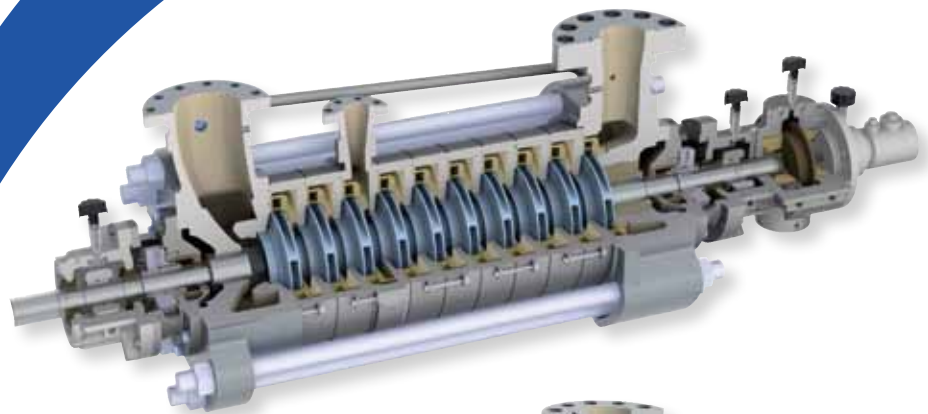


CUP-FT/FK (2 Pole)

2 Pole, Multistage, Ring Section (FT) and Barrel Case (FK) Boiler Feed Pumps



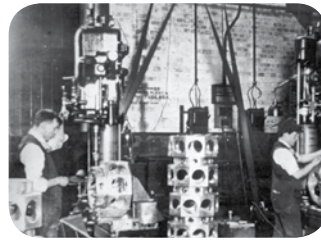
CLYDEUNION Pumps

a leading provider of pumping solutions

300 years of pumping experience

CLYDEUNION Pumps is one of the world's leading providers of pumping solutions. We were formed in November 2008 from the joining of Clyde Pumps and Union Pump, which brought together some of the most respected products, people and heritage brands in the business.

The two companies forming CLYDEUNION Pumps have a rich heritage and combined history of over 300 years of pump production and development. Clyde Pumps was formed in May 2007 when the *Weir Pumps (Glasgow) business was acquired from The Weir Group plc, but its roots go back to 1871 when brothers, George and James Weir, founded the engineering company of G. & J. Weir. Union Pump has an equally impressive pedigree and had been producing high technology pumps since its formation in 1885 in Michigan, USA.



CLYDEUNION Pumps (*Weir) Glasgow facility - assembly of pumps at the beginning of the 20th century



CLYDEUNION Pumps (Union) moving a boiler in the 'early days'

Today, CLYDEUNION Pumps is structured into seven customer focused business units. Our business units are at the heart of everything we do and provide their expertise across the **Upstream Oil, Downstream Oil, Nuclear Power, Conventional Power, Water & Industrial, Minerals & Mining** and **Offshore & Marine** sectors. In addition, our truly global **Aftermarket** capability ensures our customers are fully supported and receive exceptional care.

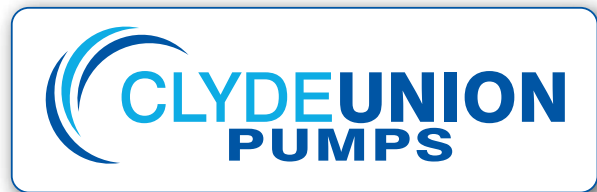
Our Extensive Brand Heritage:



*Weir Pumps - Mather & Platt - Drysdale - WH Allen
Girdlestone - Allen Gwynnes - Harland



Union Pump - David Brown Pumps
DB Guinard Pumps - American Pump - Pumpline



Joint Ventures & Partners

S&N Pumps - IMBIL - Indonesia - China - India

*This is a heritage product acquired when the Weir Pumps business transferred to Clyde Pumps in May 2007

High Technology Pumps

for the most demanding services

CLYDEUNION Pumps is committed to delivering market leading products and services which meet the technical and commercial challenges of our customers operating across the full spectrum of power industry activities.

CLYDEUNION Pumps (*Weir) first manufactured boiler feed pumps in 1893. Our modern boiler feed pump design philosophy was established in the early 1970's, when central power utilities such as the Central Electrical Generating Board (CEGB) of the UK introduced the concept of a new design. This design required a super-reliable, incredibly robust, boiler feed pump that assured generating capacity. This design philosophy remains the cornerstone of our products.



CONVENTIONAL POWER PLANT

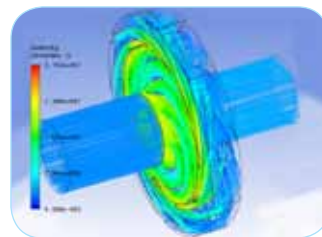
The CLYDEUNION Pumps CUP-FT/FK (2 Pole) is a world class product range designed for boiler feed applications, meeting the demands of modern thermal, combined cycle and solar power plants.

World energy demand is increasing daily and modern power plants require to meet higher loads and efficiencies. CLYDEUNION Pumps understands the demands of the latest generating facilities and our CUP-FT/FK (2 Pole) pump range is designed to exceed these requirements. The design principles of the CUP-FT/FK (2 Pole) product are equally applied to diverse applications such as;

- Desalination
- Descaling
- High pressure injection



We are committed to quality throughout the company. Our Quality Management System is fully approved to ISO 9001:2008 and independently verified to comply with the latest quality standards. CLYDEUNION Pumps is an environmentally responsible firm. In recognition of efforts considering the environment and surroundings, CLYDEUNION Pumps Glasgow facility has been awarded the ISO 14000:2004 series of international standards.



RESEARCH & DEVELOPMENT

CLYDEUNION Pumps recognises the importance of cleaner energy and the significant impact a boiler feed pump can have on the overall station output. This is demonstrated by supplying CUP-FT/FK (2 Pole) boiler feed pumps to one of the world's cleanest and most efficient integrated gasification combined-cycle (IGCC) facilities.

Our efforts are focused on continuously improving and developing our technology to ensure we deliver the most reliable, efficient, and low life cycle cost products.

CUP-FT/FK (2 Pole)

Radially split case diffuser type multistage pumps

Our extensive engineering, manufacturing and operational experience has been incorporated in the design of the 2 pole diffuser pump CUP-FT/FK (2 Pole). A radially split case diffuser type pump with options for throughbolt (FT) or barrel case (FK), designed for low, intermediate and high pressure and high temperature applications. A world leading product, with features such as optimum hydraulic design, sustainable efficiency, and the inherent ability to withstand thermal shock, the CUP-FT/FK (2 Pole) range pump offers reliable operation and low through life cost of ownership.

CLYDEUNION Pumps CUP-FT/FK (2 Pole) pumps are at the heart of global power plants with operating parameters in the range of:

- **Capacities** - up to 1,100m³/ hr / 4,840 USgpm
- **Head** - up to 2,400 m / 7,900 ft
- **Speeds** - up to 3,600 rpm
- **Temperatures** - up to 190°C / 375°F



PROVEN PRODUCT INTEGRITY

The CLYDEUNION Pumps CUP-FT/FK (2 Pole) range encompasses optimal hydraulic designs from our heritage product ranges. The design integrity of our products is demonstrated with operational boiler feed pumps in power stations in every continent.

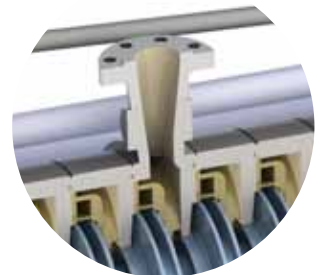
MECHANICALLY STIFF ROTOR DESIGN - THE HEART OF THE MACHINE

CLYDEUNION Pumps mechanically-stiff, large-shaft rotor design differentiates our boiler feed pump. Our rotor design is based on achieving maximum sustainable efficiency, extended mean time between overhauls and reliability in operation. Designed to low-K factors, the resulting high critical speed margins and low static deflections reduce internal wear and increase reliability. The ability to accommodate thermal transients without the need for warm up and superior start-stop capability ensure a breadth of operational requirements can be serviced.



INTERSTAGE TAKE-OFF

To suit low/intermediate pressure for heat recovery steam generators. Available at various stages to service project requirements.



NO WARM-UP REQUIRED

Without the need for expensive warming through, the CUP-FT/FK (2 Pole) pumps can accept full thermal shock without damage hence the pump is always available for start up.

Optional Arrangements and features

Impeller Options

- Low NPSHr single entry first stage as standard offering
- Double entry first stage available
- Reliable performance and long impeller life
- Proven and optimised inlet design criteria assures cavitation free operation
- Designs are optimised by Computational Fluid Dynamics
- Commonly tested in cavitation visualisation rigs
- Routinely NPSH tested



Hydrodynamic Bearings

- Used in conjunction with balance drum
- Hydrodynamic double-acting thrust white metal lined hydrodynamic journal bearing
- Capable of higher load, higher speed operation
- Force-fed or self-contained options available
- Infinite life dependant on oil cleanliness
- Optimum rotor stability
- Proven reliability in the most demanding service conditions



Rolling Element Bearings

- Available depending on hydraulic balance arrangement and absorbed power
- Ring oil lubricated
- Self contained lubrication saves need for forced feed system
- Lower cost than hydrodynamic bearing, plus support system
- Radial and axial compensation
- Rated for full radial and residual thrust load



Balance Drum

- Balance drum arrangement absorbs up to 95% of hydraulic thrust loads, the remainder being compensated by generously rated thrust bearings
- Robust and rugged
- No axial clearance therefore no risk of axial contact
- Pump withstands transients and flow changes without wear
- Long operating life



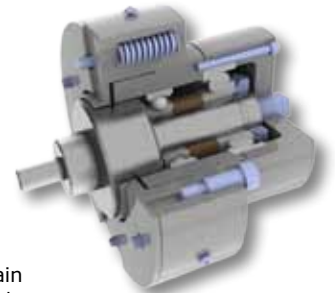
Balance Disc

- At full speed, balance disc carries 100% of axial imbalance created by impellers
- Self regulating axial thrust compensation achieved through leakage control across small axial clearance between the rotating balance disc and stationary seat
- Variable axial clearance during flow changes or suction transients
- Reduced leakage for increased efficiency
- Eliminates requirements for large bearings and support systems
- Lift-off device included to minimise axial contact



Lift-off Device

- Lift-off device holds axial clearance between rotating disc and stationary seat open when operating speed falls below a certain speed and pumping action does not generate sufficient pressure to keep the faces open
- 'Floating' housing allows visual check on rotor position
- Easy maintenance
 - Grease lubricated
 - Standard components
 - Cartridge design
- Reverse thrust capability to protect pump internals



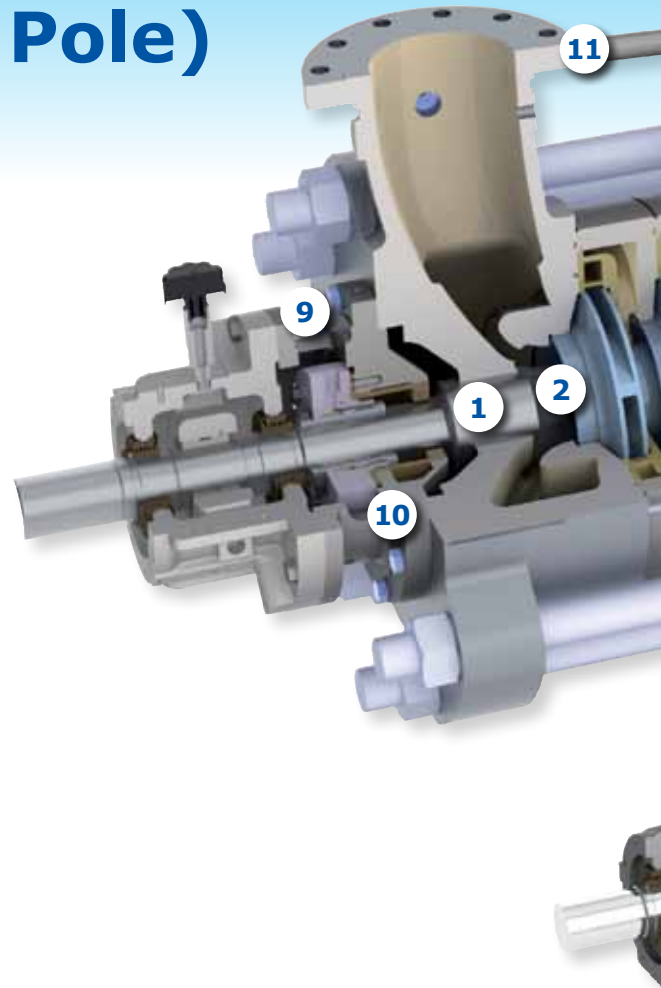
Mechanical Seal

- Cartridge design for easy installation, no seal setting
- Gain in overall feed pumping thermal efficiency (especially where warming through is not required)
- Long seal lives achievable
- Lower capital cost compared to other options - does not require complex support systems
- Lower cooling water quality (station CW system)
- Fewer external components



CLYDEUNION Pumps

features of the CUP-FT/FK (2 Pole)



1 Mechanically Stiff Shaft

- Large shaft-to-impeller diameter proportions
- Optimal span between bearings
- High critical speeds and low static deflection

2 Optimum NPSH Performance

- Optimised by Computational Fluid Dynamics
- First stage impeller with improved suction performance
- Single and double entry available

3 Optimised Hydraulic Performance

- Proven range
- Precision cast components, repeatable performance

4 Replaceable Wearing Parts

- Available for ease of maintenance
- Casing wear rings material and geometry is selected for optimum efficiency and rotor stiffness

5 Hydraulic Thrust Balance

Balance drum

- Full radial clearance
- Absorbs up to 95% of hydraulic thrust, with residual thrusts accommodated by generously rated thrust bearing
- Long operating life

Balance disc *(paired with lift-off device - not shown)*

- Reduced leakage for increased efficiency
- Elimination of hydrodynamic bearing and force feed lubrication system

Lift off device *(not shown)*

- Used in conjunction with a balance disc subject to start-stops
- Eliminates axial contact
- Reduced leakage – highest efficiency
- Eliminates requirements for large bearings and support systems
- Variable axial clearance

6 Sealing

Mechanical Seal

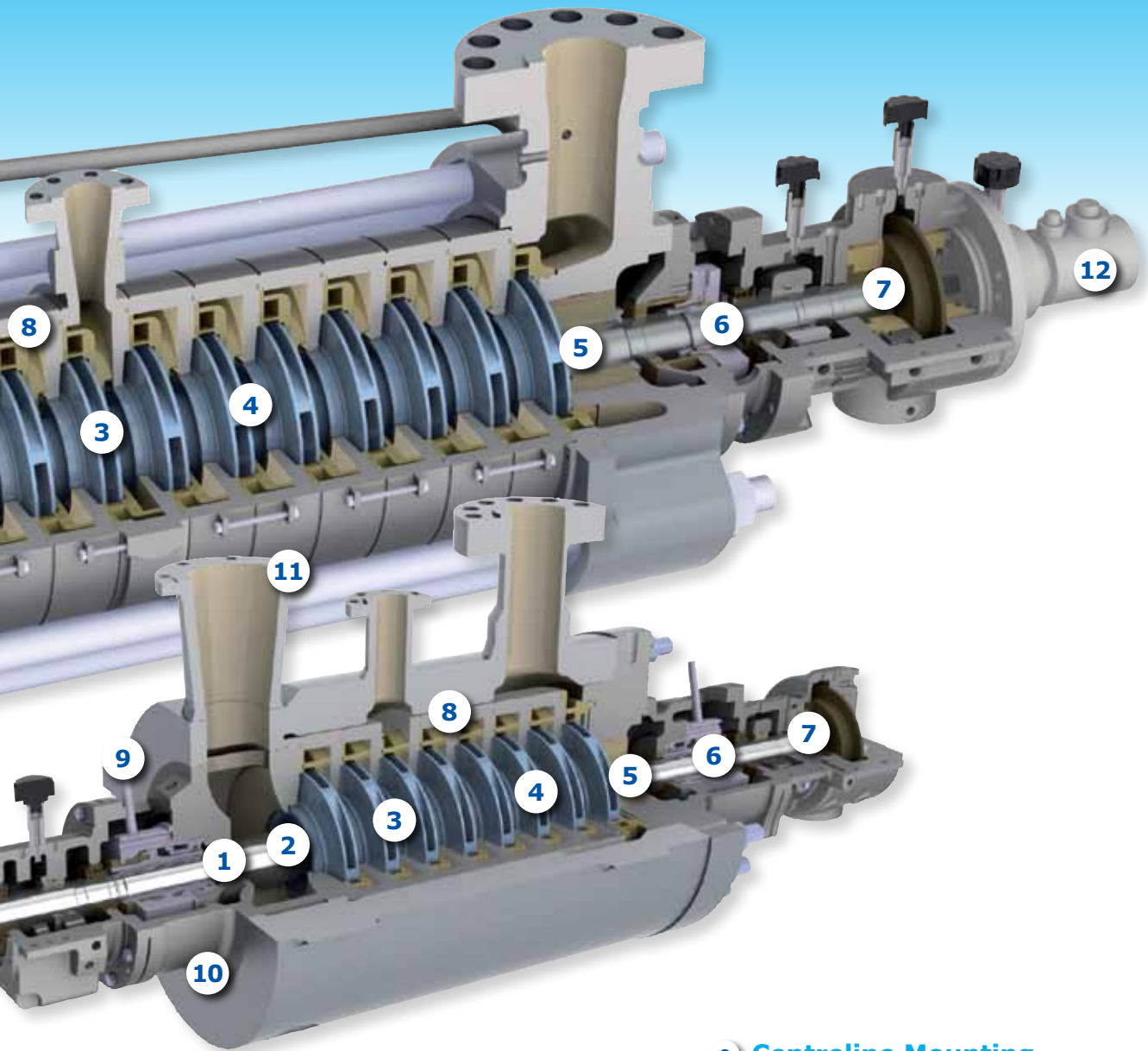
- Cartridge style, no seal setting
- Reduced capital cost
- Long seal lives achievable
- Plan 23 or cooled seat options available

7 Hydrodynamic Bearings (Journal & tilting pad thrust)

- Capable of higher load operation
- Generously rated hydrodynamic double-acting thrust
- White metal lined hydrodynamic journal bearing
- Force-fed or self-contained options available
- Optimum rotor stability
- Infinite life dependant on oil cleanliness

Rolling Element Bearings (Not shown)

- Available depending on hydraulic balance arrangement and absorbed power
- Ring oil lubricated
- Self contained lubrication saves need for forced-feed system
- Radial and axial compensation
- Rated for full radial and residual thrust load



8 Ring Sections (FT)

- 'O' ring sealed joints to prevent leakage between stages
- Tensile steel tie bolts compress the complete pump assembly
- Designed to withstand full pump discharge pressure

Forged Barrel (FK)

- Removable cartridge design
- The barrel casing forms the pressure boundary
- Barrel is centre-line mounted to accommodate thermal expansion
- Key-blocks maintain alignment under thermal growth
- 2¼% chrome material, as standard, providing strength and corrosion resistance

9 Centreline Mounting

- Reduces the effect of thermal growth at elevated process temperatures
- Maintains pump to driver alignment at all operating temperatures
- High strength fabricated steel baseplate accommodates all static and dynamic loads and reduces noise transmission
- Capable of supporting pumpsets grout free

10 360° Bearing Support

- Optimum rotor alignment and support
- Reduced vibration levels
- Maximum component life

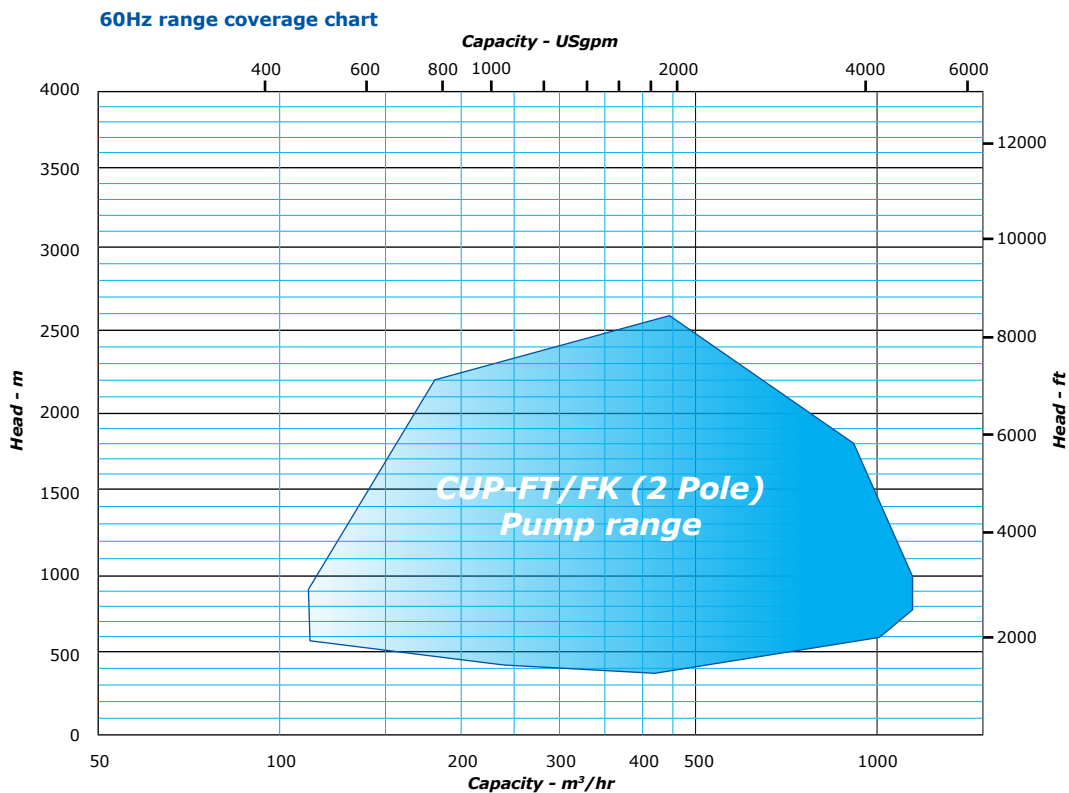
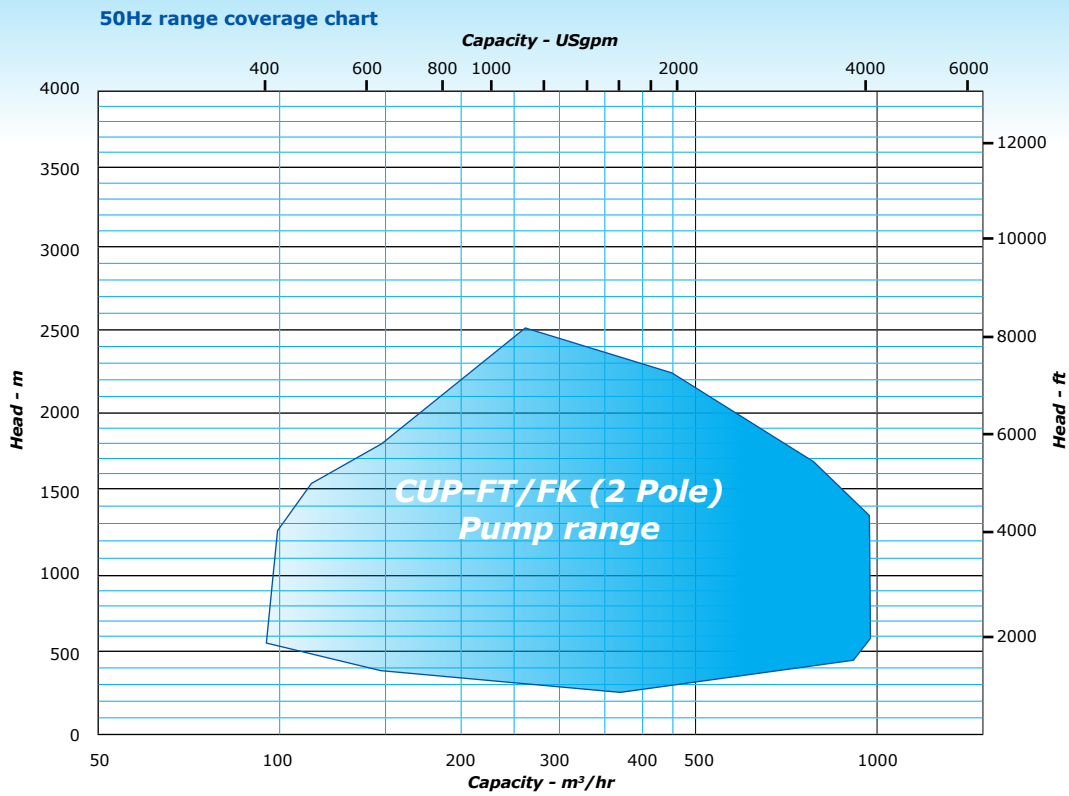
11 Connection Options

- Flanged branch
- Welded branch
- Interstage tapping

12 Oil Pump

- Shaft driven lubrication oil pump when required

Standard Hydraulic Range coverage charts



 Core range

Global Aftermarket Capability

best in service and response

Our customer focused aftermarket organisation is positioned to provide comprehensive care for our varied and diverse product lines. Heritage and obsolete products benefit from the same level of attention and expertise ensuring that reliability and availability is maximised irrespective of a pump's length of service.

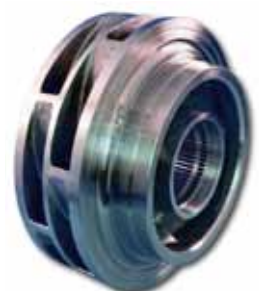
GENUINE HIGH QUALITY

Original or upgraded specification spare parts, coupled with full engineering design capability, enables longevity of reliable operation. Highly skilled and experienced service engineers ensure accuracy in build and optimised performance. The worldwide presence of CLYDEUNION Pumps offers local service facilities in over 40 countries.

SERVICE SOLUTIONS

CLYDEUNION Pumps is committed to supporting our installed base wherever it may be. Depending on your location we will provide either direct service support or support via our local authorised service partners. Whichever option is provided, you can be assured of the best attention from fully qualified and experienced engineers.

- **Upgrades & Re-rates**
- **Service & Overhaul**
- **Installation & Commissioning**
- **Technical Support**
- **Inventory Management**
- **3rd Party Equipment**





SALES	SERVICE FACILITY	MANUFACTURING
●	●	●
●	●	●
●	●	●
●	●	●
●	●	●

EUROPE

Anney:	T. +(33) 45 005 5600	F. +(33) 45 005 5880	E. anney@clydeunion.com
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Moscow:	T. +(7) 495 967 3453	F. +(7) 495 785 0636	E. moscow@clydeunion.com
Paris:	T. +(33) 14 717 1440	F. +(33) 14 717 1412	E. paris@clydeunion.com
Penistone:	T. +(44) 122 676 3311	F. +(44) 122 676 6535	E. penistone@clydeunion.com

SALES	SERVICE FACILITY	MANUFACTURING
●	●	●
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NORTH AMERICA

Baton Rouge, LA:	T. +(1) 225 775 2660	F. +(1) 225 778 0212	E. batonrouge@clydeunion.com
Battle Creek, MI:	T. +(1) 269 966 4600	F. +(1) 269 962 3534	E. battlecreek@clydeunion.com
Burlington, ON:	T. +(1) 905 315 3800	F. +(1) 905 335 8262	E. burlington@clydeunion.com
Calgary, AB:	T. +(1) 403 236 8725	F. +(1) 403 236 7224	E. calgary@clydeunion.com
Downey, CA:	T. +(1) 562 622 2380	F. +(1) 562 622 2375	E. downey@clydeunion.com
Houston, TX:	T. +(1) 281 372 5040	F. +(1) 281 372 5042	E. houston@clydeunion.com

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SALES	SERVICE FACILITY	MANUFACTURING
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ASIA

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Indonesia:	T. +(62) 21 753 5559	F. +(62) 21 753 6031	E. indonesia@clydeunion.com
New Delhi:	T. +(91) 120 4640 400	F. +(91) 120 4640 401	E. newdelhi@clydeunion.com
Shanghai:	T. +(86) 216 160 6969	F. +(86) 216 160 6968	E. shanghai@clydeunion.com
Singapore:	T. +(65) 62 76 7117	F. +(65) 62 78 7117	E. singapore@clydeunion.com

SALES	SERVICE FACILITY	MANUFACTURING
●	●	●
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MIDDLE EAST / AFRICA

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Algeria:	T. +(213) 21 69 2319	F. +(213) 21 69 3046	E. algeria@clydeunion.com
Dubai:	T. +(971) 4 328 9011	F. +(971) 4 328 9012	E. dubai@clydeunion.com

Our Extensive Brand Heritage:



*Weir Pumps - Mather & Platt - Drysdale - WH Allen
Girdlestone - Allen Gwynnes - Harland



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UNION Pump

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DB Guinard Pumps - American Pump - Pumpline

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*This is a heritage product acquired when the Weir Pumps business transferred to Clyde Pumps in May 2007