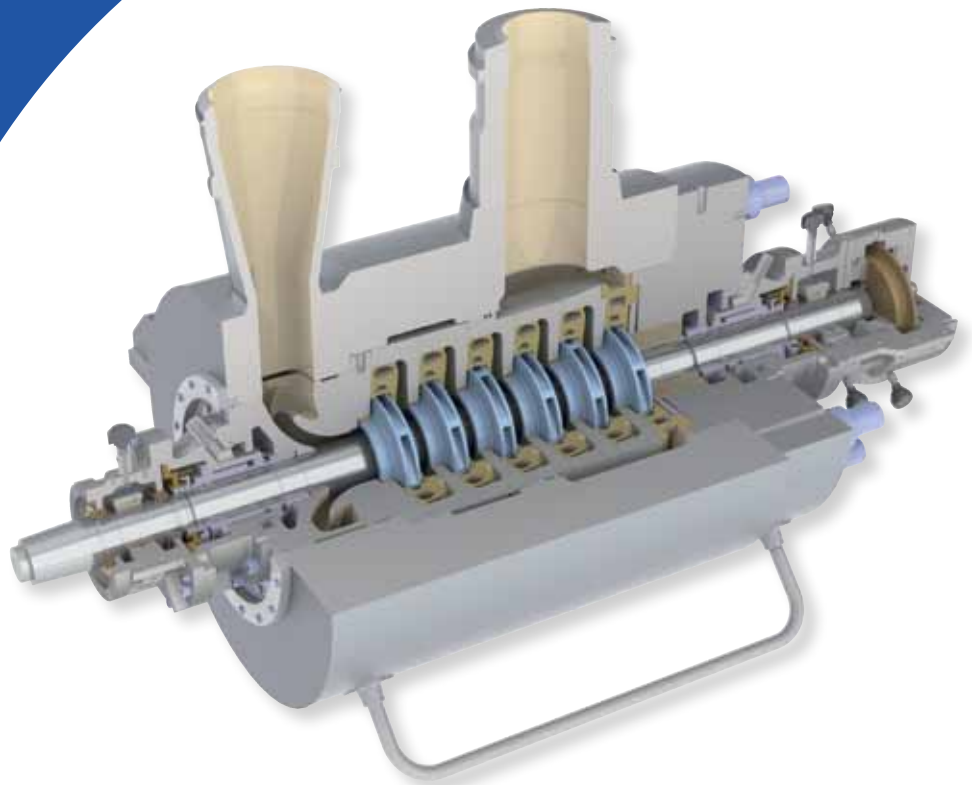


CUP-FK

High Energy, Multistage, Diffuser Type, Barrel Case Pump



 **CLYDEUNION
PUMPS**

CLYDEUNION Pumps

a leading provider of pumping solutions

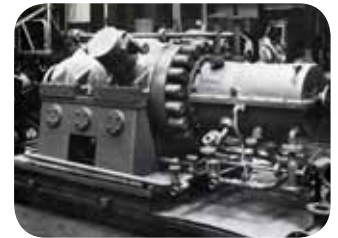
300 years of pumping experience

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, with its roots going 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.



First manufacturing order of two BFPs taken in 1893, installed in RMS Campania by the Fairfield company



CLYDEUNION Pumps (*Weir) Boiler Feed Pump 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.

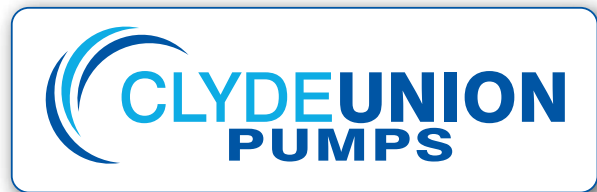
Our Extensive Brand Heritage:



*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 which assured generating capacity. This design philosophy remains the cornerstone of our products.

CONVENTIONAL POWER PLANT

The CLYDEUNION Pumps CUP-FK boiler feed pump is a world class product designed for sub and supercritical applications, meeting the demands of modern power plants, regardless of fuel type or pressure requirements.



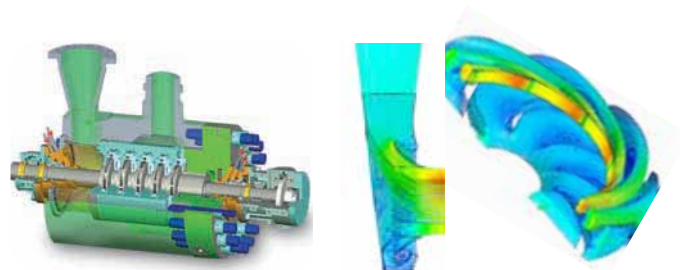
World energy demand is increasing daily and modern power plants require to meet higher loads and efficiencies. CLYDEUNION Pumps understands the demands of the latest generating facilities and our CUP-FK pumps are designed to exceed these requirements.



We are committed to quality throughout the company. Our Quality Management System is fully approved to ISO 900 1:2008 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 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-FK Radially split case diffuser type multistage pumps

Our extensive engineering, manufacturing and operational experience has been incorporated in the design of the CUP-FK, a radially split, barrel case, multistage diffuser pump designed for high pressure, high temperature and high speed applications. A world leading product with features such as optimum hydraulic design, sustainable efficiency, full cartridge withdrawal, and the inherent ability to withstand thermal shock. This CUP-FK range pump offers reliable operation and low through life cost of ownership.

CLYDEUNION pumps CUP-FK are at the heart of global power plants with operating parameters in the range of:

- **Capacities** - up to 2,800 m³/hr / 12,300 USgpm
- **Head** - up to 5,000 m / 16,400 ft
- **Speeds** - up to 7,000 rpm
- **Temperatures** - up to 250°C / 480°F



PROVEN PRODUCT INTEGRITY

The CLYDEUNION Pumps CUP-FK range encompasses optimal hydraulic designs from our heritage product ranges. The design integrity of our products is demonstrated with operational boiler feed pumps that achieved performance of up to 75,000 hours mean time between overhauls.

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 requirements can be serviced.



CARTRIDGE WITHDRAWAL

CLYDEUNION Pumps (*Weir) pioneered the full cartridge design in the early 1970's, producing an advanced class of pump where all the pump internals can be withdrawn without disturbing pump alignment or pipe work. This feature reduces outage time and increases ease of maintenance and inspection.



NO WARM-UP REQUIREMENT

Without the need for expensive warming through, the CUP-FK pumps can accept full thermal shock without damage hence the pump is always available for start up. No warming through can reduce plant power consumption and increase overall plant thermal efficiency.

Optional Arrangements and features

Mechanical Seal

- Cartridge design for easy installation, no seal setting, leak-free design option
- 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



Labyrinth Gland

- Long lasting, wear free, sealing that controls hot leakage from the pump
- Non-contacting components for extended reliability
- Does not suffer from system transients i.e. thermal shocks
- Low maintenance
- Designed for infinite life



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



Interstage Tapping

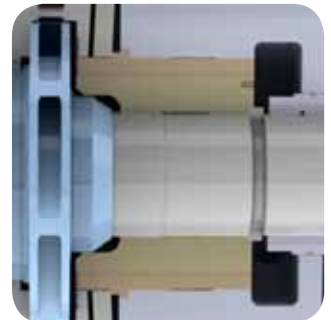
- Available at various stages to serve project requirements

Kicker Stage

- Placed after the final stage to generate additional pressure

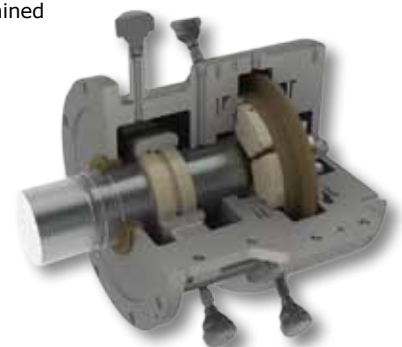
Balance Drum

- A balance drum is the most robust and rugged axial thrust balancing system
- Balance drum arrangement absorbs up to 90% of hydraulic thrust loads, the remainder being compensated by generously rated thrust bearings
- No axial clearance therefore no risk of axial contact
- Pump withstands transients and flow changes without wear
- Long operating life



Hydrodynamic Bearings

- Used in conjunction with balance drum hydrodynamic double-acting thrust white metal lined 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



CLYDEUNION Pumps

features of the CUP-FK

1 Mechanically Stiff Shaft

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

2 Optimum NPSH Performance

- Optimised by Computational Fluid Dynamics
- First stage impeller with inlet designed specifically for improved cavitation erosion providing extended life

3 Optimised Hydraulic Performance

- Proven range
- Precision cast components, repeatable performance and advanced manufacturing techniques

4 Replaceable Wearing Parts

- Available for ease of maintenance
- Casing wear rings material and geometry is selected for anti galling properties

5 Hydraulic Thrust Balance

- Balance drum removes the requirement for axial alignment
- Extended pump performance with ability to handle transients and flow changes without wear

6 Sealing Options

- Mechanical seals and Labyrinth glands are interchangeable within the same housing
- Does not suffer from system transients i.e. thermal shocks

Labyrinth Gland

- Non-contacting components for extended reliability
- Low maintenance
- Designed for infinite life

Mechanical Seal

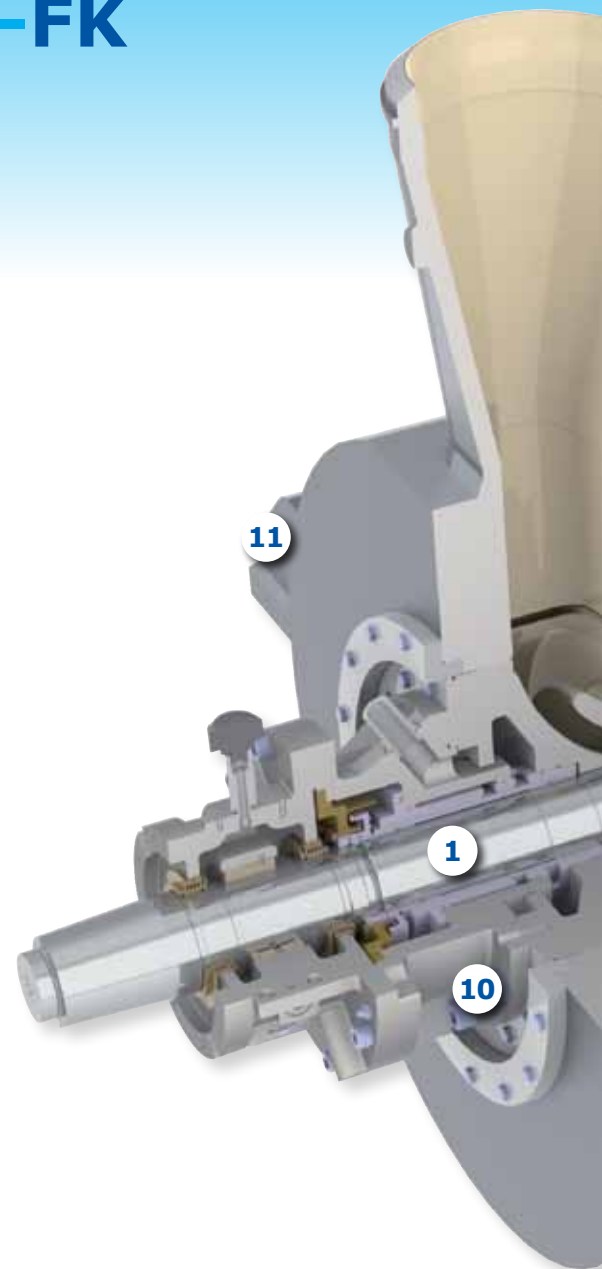
- Cartridge style, no seal setting
- Reduced capital cost
- Gain in overall feed pumping efficiency
- Long seal lives achievable
- Optional dosing system based on water quality

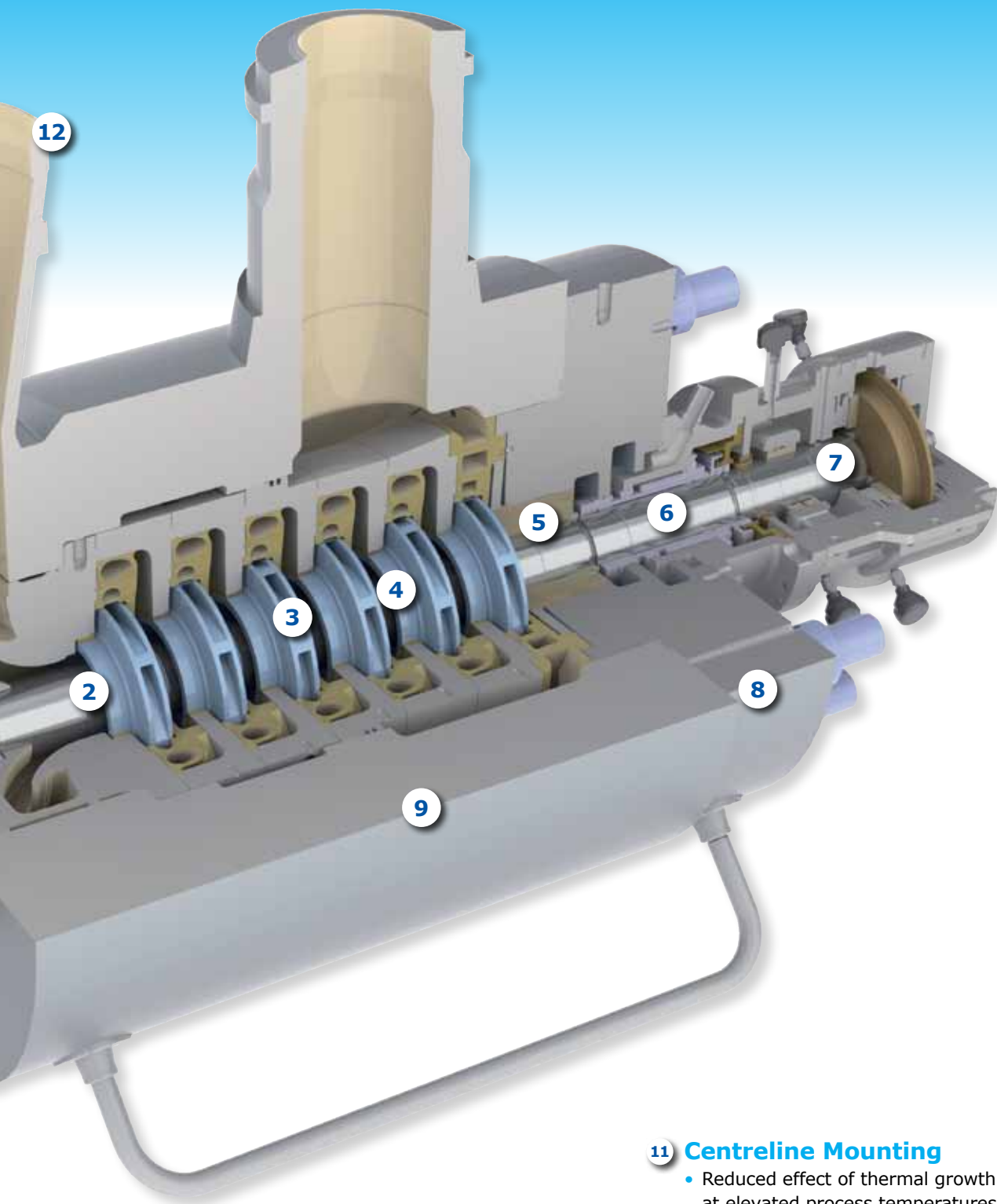
7 Hydrodynamic Bearings (Journal and Tilting Pad Thrust)

- Hydrodynamic double-acting thrust
- White metal lined hydrodynamic journal bearing
- Optimum rotor stability
- Infinite life dependant on oil cleanliness

8 Removable Cartridge Design

- Allows rapid overhaul within one working shift
- Entire cartridge can be withdrawn from the barrel as one component, complete with bearings, seals and half coupling





9 Forged Barrel

- The barrel casing forms the pressure boundary
- Key-blocks maintain alignment under thermal growth

10 360° Bearing Support

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

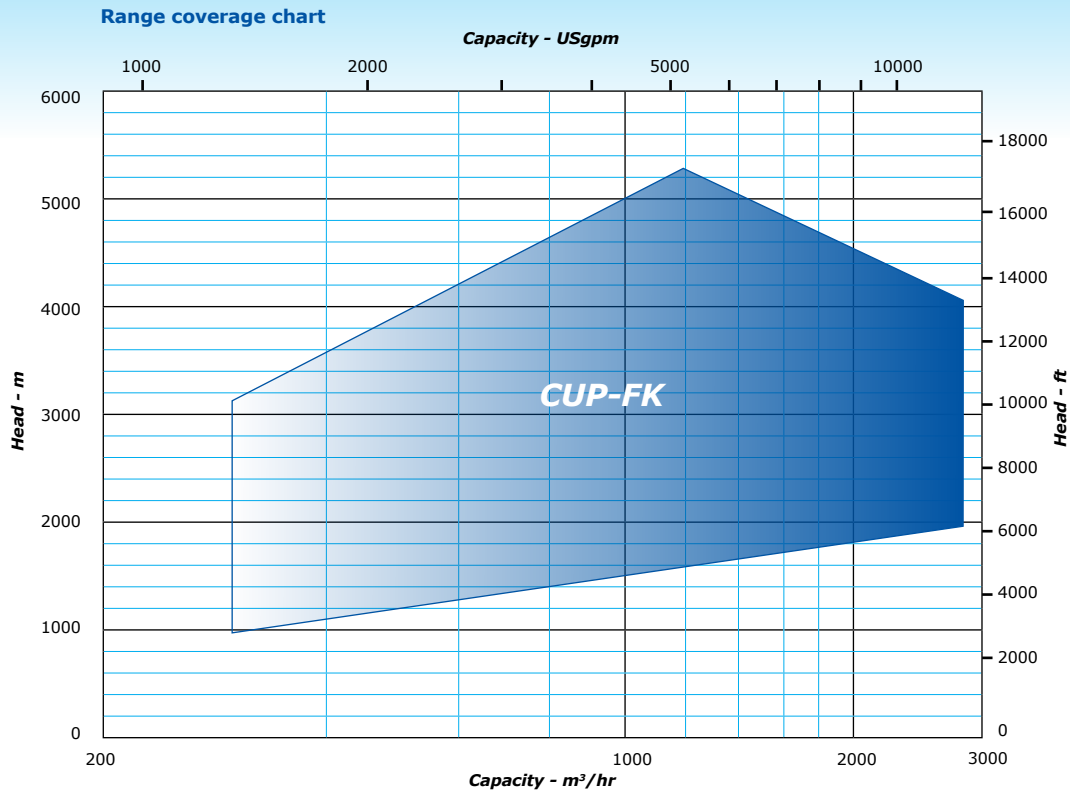
11 Centreline Mounting

- Reduced 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

12 Connection Options

- Flanged branch
- Welded branch
- Interstage tapping
- Orientation to suit station pipework
- Kicker stage connection

Standard Hydraulic Range coverage chart



The chart shows our core high speed CUP-FK boiler feed pump range. Additional hydraulic solutions are also available within the CLYDEUNION Pumps product portfolio on an engineered to order basis.



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.

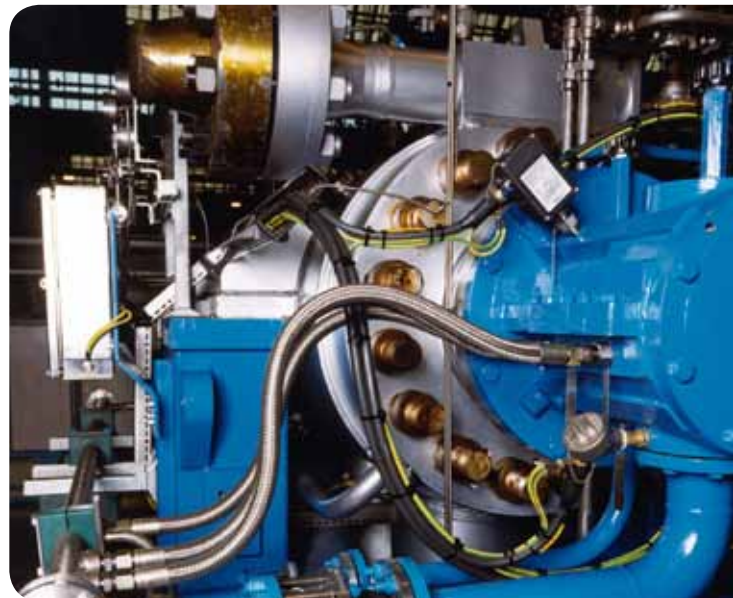
GENUINE HIGH QUALITY

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
Glasgow:	T. +(44) 141 637 7141	F. +(44) 141 637 7358	E. glasgow@clydeunion.com
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

SALES	SERVICE FACILITY	MANUFACTURING
●	●	●

SOUTH AMERICA

Itapira:	T. +(55) 19 3843 2520	F. +(55) 19 3843 2531	E. brasil@clydeunion.com
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SALES	SERVICE FACILITY	MANUFACTURING
●	●	●
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ASIA

Beijing:	T. +(86) 106 598 9500	F. +(86) 106 598 9505	E. beijing@clydeunion.com
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

Abu Dhabi:	T. +(971) 2 631 1959	F. +(971) 2 635 1242	E. abudhabi@clydeunion.com
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



CLYDEUNION Pumps
Tel: +(44) 141 637 7141
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UNION Pump

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