




PUMPING SOLUTIONS FOR NUCLEAR POWER

INNOVATION, DESIGN, MANUFACTURE
& AFTERMARKET SERVICES:
PUMPING SOLUTIONS FOR A CLEANER WORLD

 **CLYDEUNION®
PUMPS**





Celeros Flow Technology are a full lifecycle optimisation partner and advisor to the world's critical flow systems. Through our renowned pumps, valves and pipeline access brands, we manufacture and market products, components, services and technologies that are integral to meeting today's challenges and tomorrow's needs. Celeros FT offer an engineering environment where innovation is fostered, and the real needs of industry are understood, transforming ideas into powerful solutions to help customers meet their goals, overcome business challenges and thrive in a complex, constantly changing marketplace.

YOUR SUSTAINABLE LIFECYCLE PARTNER

The energy sector has a major role to play in the fight against climate change. The transition and improvement of the existing energy infrastructure in parallel with the development of new uses and sources, is crucial in this fight. Celeros FT is committed to paving the way for a more sustainable future by developing products for emerging energy applications, such as carbon capture and storage, new nuclear and renewable energy. Simultaneously, we remain dedicated to supporting our existing customers in their journey to decarbonise their operations.

Celeros FT's full lifecycle solutions are designed to minimise emissions, optimise operational efficiency and deliver sustainable returns. Together, we can create a safer, more resilient and cleaner energy future.



SPECIALISED PUMPING SOLUTIONS

ClydeUnion Pumps is the culmination of a long and eventful engineering legacy. Through the highly respected, ground-breaking core companies from which we originate, we can claim a 140-year history. Today we play an instrumental role in securing the vital energy and water resources that a sustainable society will rely on in the future.

Our engineered-to-order pumping technology is used to carry out all kinds of critical industrial

functions. The vast majority of nuclear power plants currently in operation around the world employ our reactor feed pumps.

We are also a valued flow control engineering partner to the oil & gas industry – supporting upstream, downstream, transportation and offshore exploration activities. Other key areas we address include seawater desalination, waste water treatment, mining and steel production.



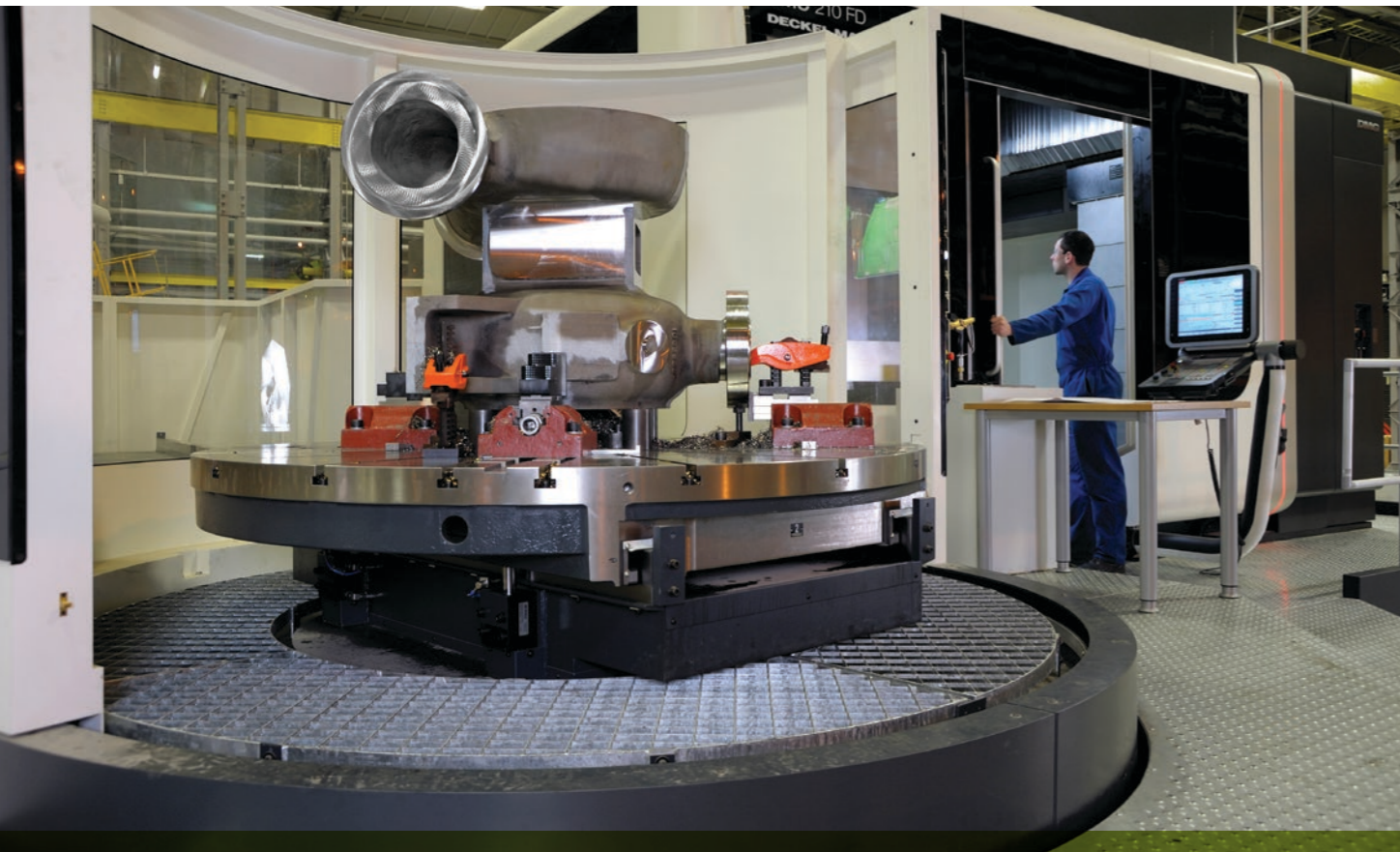
A GLOBAL LEADER IN NUCLEAR PUMPS

The ClydeUnion Pumps team understand the specialised needs of the nuclear power sector. Among our many global facilities, three are fully nuclear qualified, showcasing our commitment to excellence. As the foremost supplier of nuclear pumps worldwide, we take pride in delivering unparalleled quality and reliability to meet the demands of the nuclear industry. We draw on over 60 years of nuclear pump experience to provide coded, safety related and balance of plant pumps for all reactor types.

Our involvement in the nuclear power market began with the first ever industrial scale nuclear power plant. Since then we have been central to all major nuclear power programs globally. Our ability to design a reliable solution for the

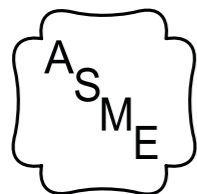
specific needs of the overall nuclear plant, allied to our comprehensive service provision means there are ClydeUnion Pumps nuclear installations in over 65% of operational nuclear power plants worldwide across many technologies.

In addition to our involvement in the commercial nuclear power market we continue to provide pumping solutions to the world's naval nuclear fleets, research reactors and other nuclear facilities. Our market focused research development programs are the driving force behind our ability to stay at the forefront of the industry. Whether it's the demands of generation IV reactors, fusion technology, or small modular reactors (SMRs), our solutions are tailored to meet the evolving needs of the nuclear sector.



NUCLEAR EXCELLENCE

Celeros FT is committed to quality throughout the company. Celeros FT pumps were manufactured in a plant whose Quality Management System was certified as being in conformity with ISO 9001:2015 by a certification body. We also understand the challenges faced to acquire and maintain the high standards required to design and build nuclear coded pumps, and the company has three coded facilities with a long history of excellence; Glasgow, UK, Annecy, France and Houston, USA. In addition we have a global aftermarket organisation that is able to offer full service and upgrade capabilities.



NA, N, NS, NPT

The ClydeUnion Pumps team offers the following:

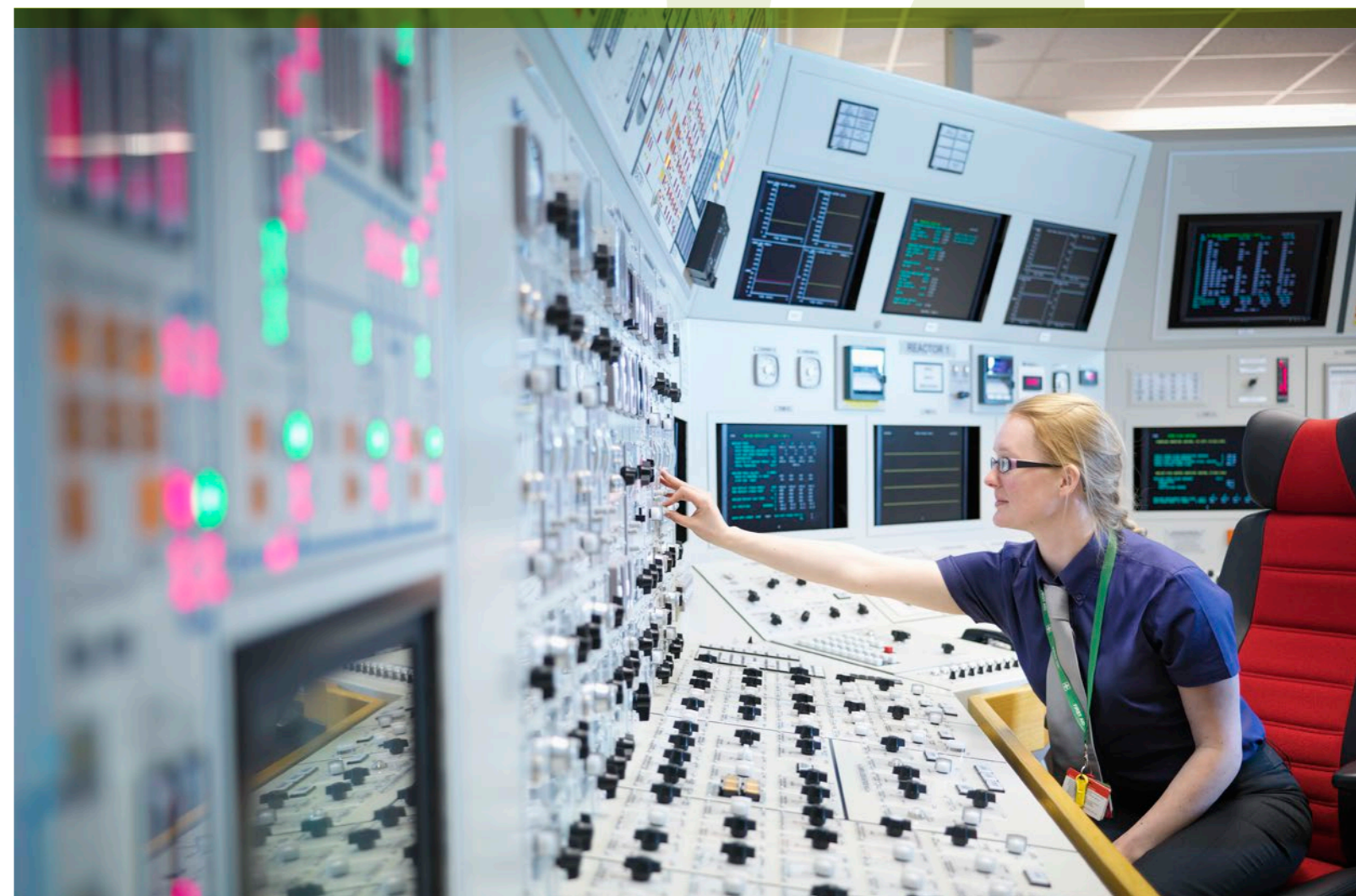
- Dedicated nuclear design department
- In-house seismic, environmental and operability qualification
- Qualification tests under accidental conditions: thermal transients, debris and seismic tests
- Commitment to quality:
 - ASME 'N', 'NPT' and 'NS'
 - 10CFR50 Appendix B Program
 - RCC-M
 - RCC-MX
 - HAF604
- Large, innovative, in-house research and development facilities
- Comprehensive in-house software and analytical capability

MARKET LEADING PRODUCTS

The ClydeUnion Pumps team have gained a wealth of experience supplying specialist safety related pumping equipment for major types of nuclear reactors in commercial operation, leading to a thorough understanding of the steady state, transient system modes and environmental conditions under which safety equipment is required to perform. This understanding is critical, enabling our team of engineers when preparing the necessary seismic, environmental and operational qualification reports, to prove and ensure reliability, availability and maintainability of ClydeUnion Pumps equipment throughout its working life.

The ClydeUnion Pumps team are a dedicated team of nuclear design and project engineers who ensure the pump design is optimised to your duty. Capabilities include the latest software to optimise rotor dynamics, hydraulics, conduct thermal and stress analysis as well as simulation of seismic loading.

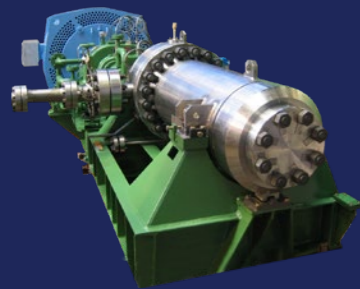
Class leading test facilities enable us to prove pump performance, whether it be a simple duty test or more complex testing as commonly required for nuclear projects. Our capability includes all major test types including hydraulic performance, NPSH, thermal shock, cavitation and seismic testing. Around 80% of pump failures on start-up are attributable to inadequate installation and commissioning procedures. ClydeUnion Pumps installation and commissioning teams use their expertise to ensure best practice processes are utilised enabling trouble free operation and extended pump life.



NUCLEAR SOLUTIONS



Residual heat removal pump



Charging pump

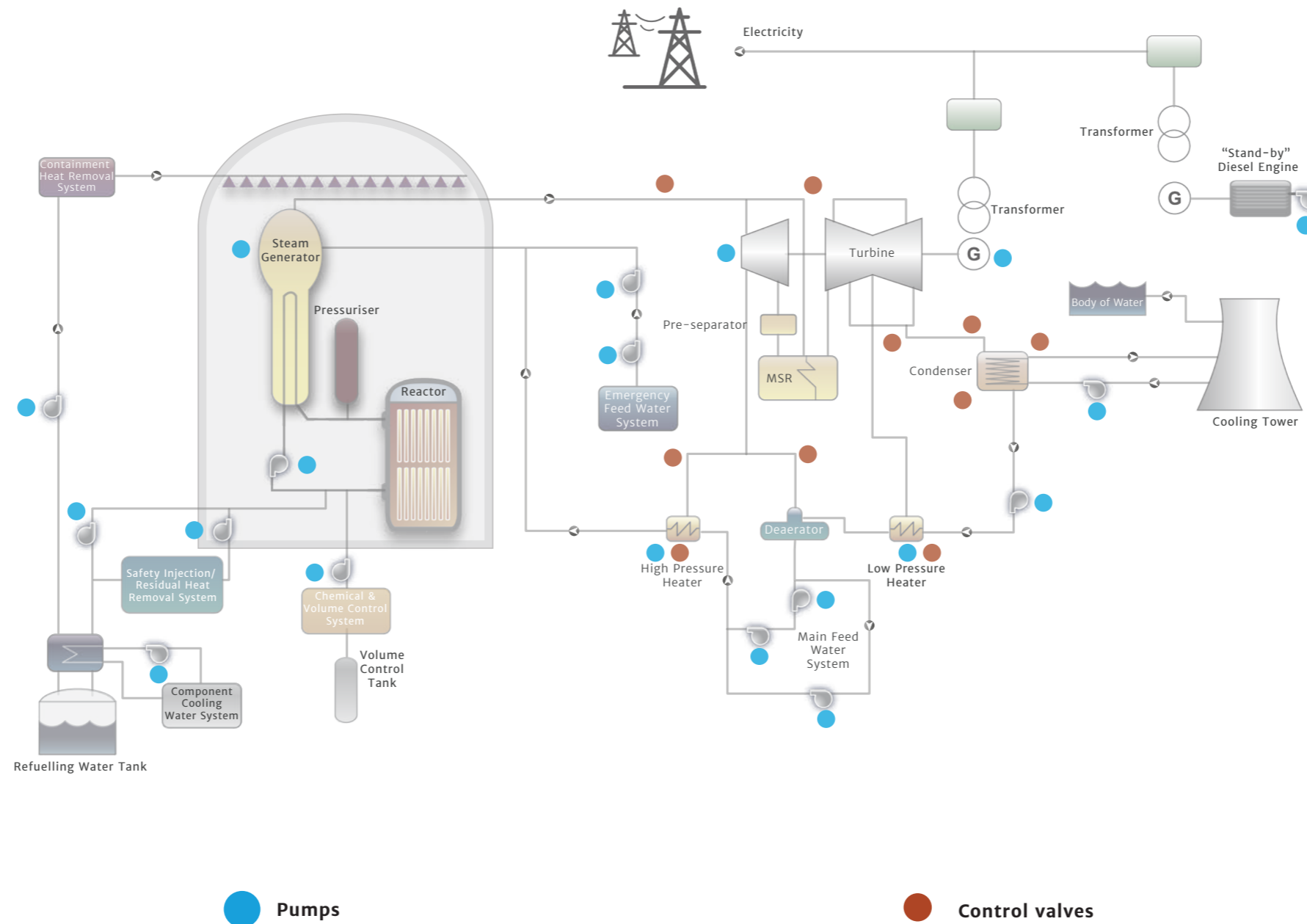


Main feedwater pump



Containment spray pump

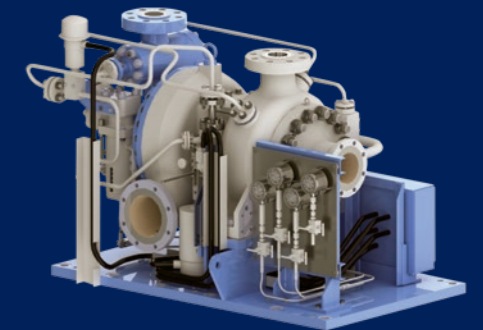
COMPREHENSIVE CAPABILITY FOR ALL NUCLEAR PUMPS



Medium head safety injection pump



Motor driven auxiliary feedwater pump



Turbine driven auxiliary feedwater pump



Concrete volute cooling water pump

TWL™ – COMBINED PUMP & TURBINE FOR NUCLEAR SAFETY APPLICATIONS

Capable of being engineered to match a broad range of system requirements and consuming less physical space than separate turbine/pump configuration, the TWL™ (turbine water lubricated pump) is an excellent solution for turbine driven safety related duties in nuclear power plants.

APPLICATIONS

In a Pressurised Water Reactor (PWR) the TWL™ functions as a turbine driven auxiliary feedwater pump, providing water from the emergency feedwater storage tank to the steam generators to remove decay heat in the event of the main feedwater system being unavailable, or when the plant is in a start up or shutdown condition.

In a Boiling Water Reactor (BWR) the TWL™ serves as the turbine driven pump for reactor core isolation cooling system (RCIC). This system provides water to the reactor for decay heat removal and it is essential that it can operate remotely.

HOW DOES THE TWL OPERATE?

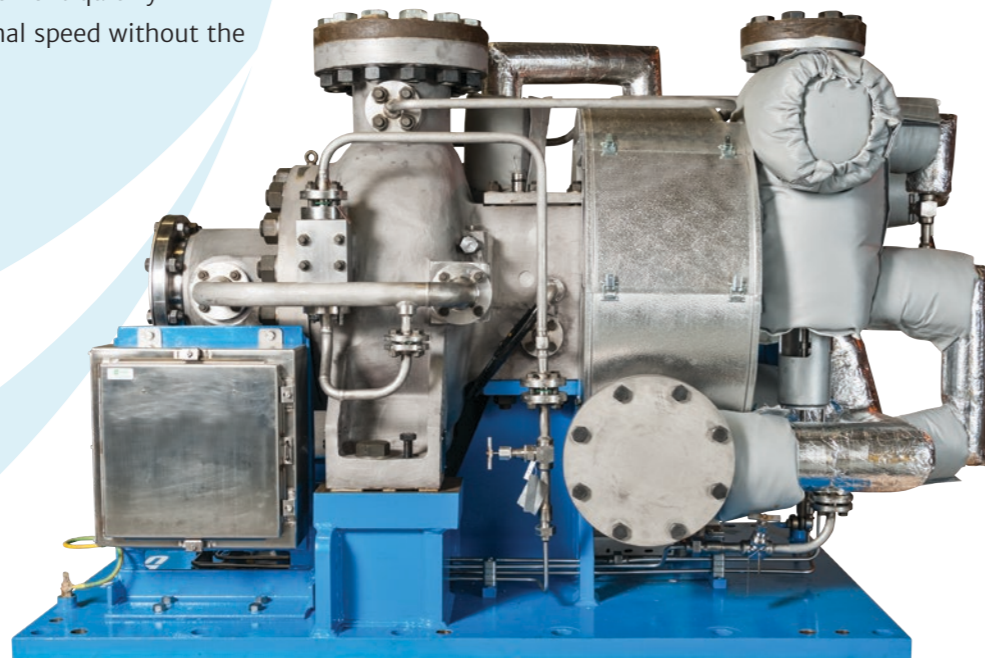
The TWL is designed for simple, reliable operation without the need for any electrical power. On demand, the mechanical governor arrangement quickly accelerates the TWL to operational speed without the

need for any additional supporting services such as oil systems, pneumatics, etc.

The TWL employs a venturi in the pump discharge branch to measure pressure that is proportional to the pump flow. This pressure acts across the piston of the governor, providing a mechanical action that throttles the steam flow to the turbine. At start-up, the throttle is fully open, allowing rapid acceleration. As the speed increases the duty flow and pressure are met.

SUBMERGENCE TESTED FOR COMPLETE PEACE OF MIND

The TWL has a single casing design with no shaft protrusions, enabling it to start and operate while fully submerged. Extensive testing at the Celeros FT Glasgow facility has shown that it will maintain safety performance and continue to operate with no adverse effects or detrimental changes to performance for a minimum eight hours. During this time, the pump can be started and stopped again with no detriment to its performance.



GLOBAL INSTALLED BASE

Celeros FT understands the challenges faced to acquire or maintain the high standards required to design and build nuclear coded pumps, and the company has three coded facilities with a long history of excellence: Glasgow, UK, Ancey, France and Houston, USA, are qualified to ASME “N Stamp” and/or RCC-M qualifications. In addition we have a global aftermarket organisation that is able to offer full service and upgrade capabilities.

Across all of Celeros FT’s coded facilities the approach to quality is rigorous and is at the heart of our offering from the initial design stages through to sourcing, manufacture, testing, installation and commissioning. The experience gained from hundreds of installations allows you to benefit from the reliability which have been proven globally in nuclear power stations of numerous reactor designs.

CLYDEUNION PUMPS NUCLEAR PUMP INSTALLED BASE



LIFETIME WORLDWIDE SUPPORT

All ClydeUnion Pumps product supplied is supported by a full lifetime commitment. The ClydeUnion Pumps team provides a full aftermarket service, drawing on either its own engineers or fully trained and highly experienced service partners, depending on the location of the installation. Global service facilities, specifically supporting ClydeUnion Pumps, are spread globally throughout Europe, America, Asia, the Middle East and Africa.

ClydeUnion Pumps after sales support extends across all of its legacy brands as well as new equipment, and provides full backup for obsolete products and for third party equipment. The parts ClydeUnion Pumps supply meet the original specification, or are upgraded where appropriate, and many components can be covered by a Rapid Response option which can have parts on site within 24 hours.

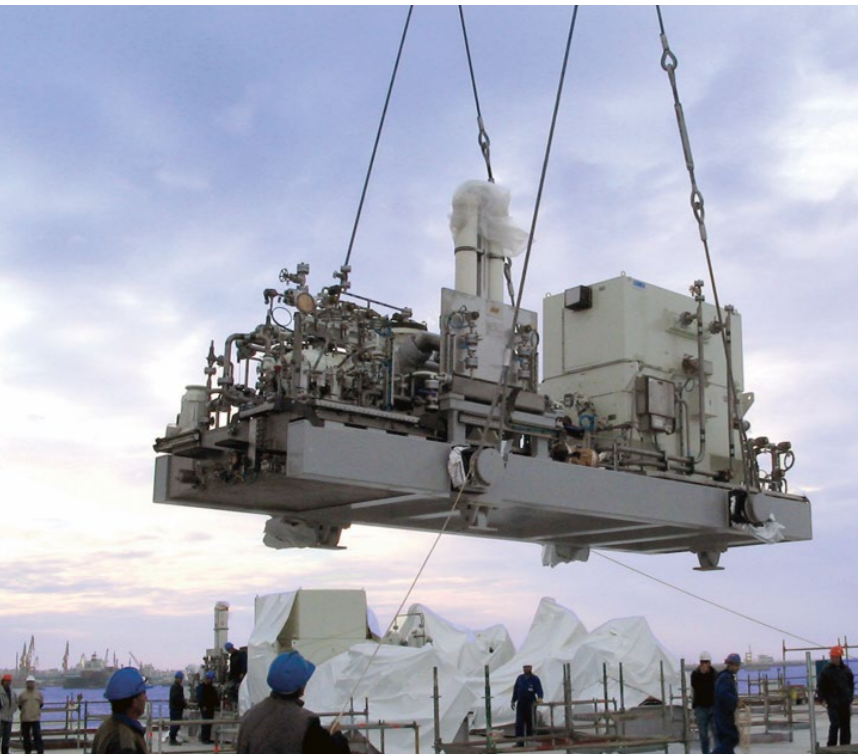
After sales support for ClydeUnion Pumps extends across the same supply chain management as the pump manufacturing, providing customers with the lowest lead times and costs whilst meeting the highest standards of quality assurance.

In addition to spare parts, routine servicing, overhauls and inventory control, the aftermarket support covers upgrades and comprehensive technical advice about the potential refitting of existing installations for greater efficiency and reliability. ClydeUnion Pumps can work with your own engineers to carry out meticulous

inspections and advise on maintenance schedules, carry out full vibration analysis, pressure and pulsation testing, and train your service personnel.

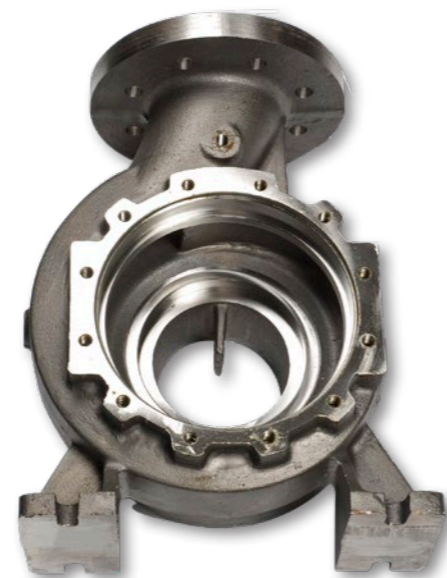
The ClydeUnion Pumps history and breadth of experience, as well as its geographical coverage and expertise, make it the natural first choice for any pump related problem or enquiry, no matter what the location is, the scale of the task or the original manufacturer. We guarantee supply of parts for all heritage brands and/or obsolete products, including:

- Weir Pumps
- Clyde Pumps
- Union Pump
- Girdlestone
- Mather & Platt
- Harland
- Drysdale
- WH Allen
- Allen Gwynnes
- David Brown Pumps
- DB Guinard Pumps
- American Pump
- Pumpline



INSTALLATION & COMMISSIONING:

Trouble free commissioning, anywhere in the world.



PARTS:

Any brand, any material, anytime.





PUMPING SOLUTIONS FOR NUCLEAR POWER

- | SPEED
- | EXCELLENCE
- | PARTNERSHIP



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Celeros Flow Technology reserves the right to incorporate our latest design and material changes without notice or obligation. Design features, materials of construction, and dimensional data, as described in this bulletin, are provided for your information only and should not be relied upon unless confirmed in writing. Please contact your local sales representative for product availability in your region. For more information, visit www.celerosft.com.