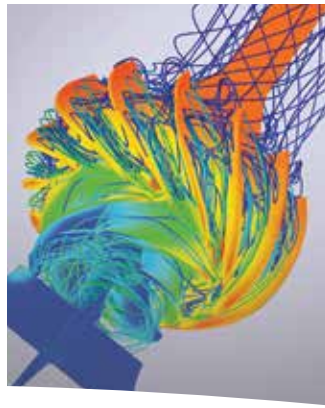




***CHTA and CA
Between Bearings, Multistage,
Double-Casing, Utility Barrel Pumps***



Experience In Motion



Pump Supplier to the World

Flowserve is the driving force in the global industrial pump marketplace. No other pump company in the world has the depth or breadth of expertise in the successful application of pre-engineered, engineered, and special purpose pumps and systems.

Life Cycle Cost Solutions

Flowserve provides pumping solutions that permit customers to reduce total life cycle costs and improve productivity, profitability and pumping system reliability.

Market-Focused Customer Support

Product and industry specialists develop effective proposals and solutions directed toward market and customer preferences. They offer technical advice and assistance throughout each stage of the product life cycle, beginning with the initial inquiry.

Broad Product Lines

Flowserve offers a wide range of complementary pump types, from pre-engineered process pumps to highly engineered and special purpose pumps and systems. Pumps are built to recognized global standards and customer specifications.

Pump designs include:

- Single-stage process
- Between bearings single-stage
- Between bearings multistage
- Vertical
- Submersible motor
- Positive displacement
- Nuclear
- Specialty

Product Brands of Distinction

ACEC™ Centrifugal Pumps

Aldrich™ Pumps

Byron Jackson® Pumps

Calder™ Energy Recovery Devices

Cameron™ Pumps

Durco® Process Pumps

Flowserve® Pumps

IDP® Pumps

INNOMAG™ Sealless Pumps

Lawrence Pumps®

Niigata Worthington™ Pumps

Pacific® Pumps

Pleuger® Pumps

Scienco™ Pumps

Sier-Bath® Rotary Pumps

TKL™ Pumps

United Centrifugal® Pumps

Western Land Roller™ Irrigation Pumps

Wilson-Snyder® Pumps

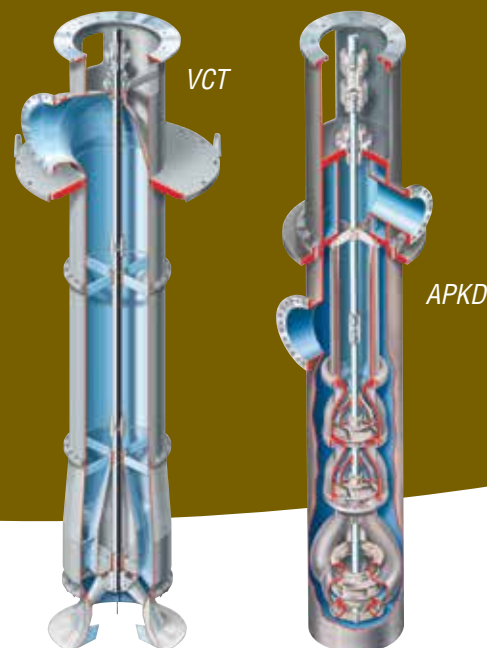
Worthington® Pumps

Worthington Simpson™ Pumps

CHTA and CA
Between Bearings,
Multistage, Double-
Casing, Utility
Barrel Pumps



Complementary Pumps



Supplier of Choice to the Global Power Industry

With over 200 years of technological and manufacturing leadership, FlowsERVE has unparalleled experience in the power generation industry. This experience has produced many pump firsts, including:

- The highest pressure supercritical barrel type boiler feed pump
- The highest horsepower multistage boiler feed pump
- The first installation to have the booster and main pump on a common shaft

Unsurpassed Knowledge

In addition to offering the most comprehensive selection of pumps of any manufacturer, FlowsERVE provides unsurpassed systems knowledge, hydraulic expertise and application experience. In addition, its leading-edge research programs and unmatched testing capabilities ensure FlowsERVE remains in the forefront of pump and system development.

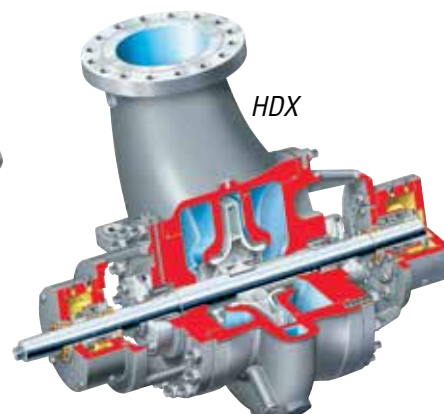
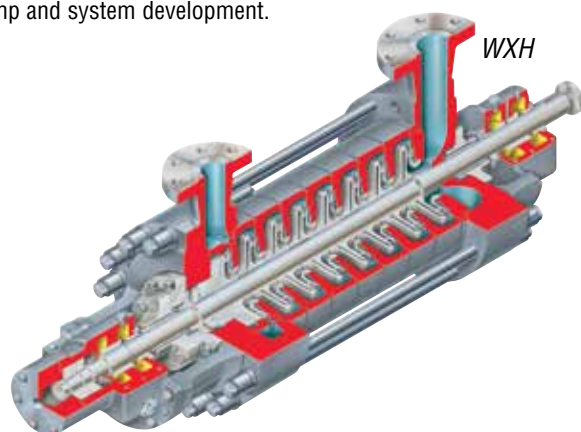
Boiler Feed Applications

- Subcritical steam cycle plants
- Supercritical steam cycle plants
- Ultra-supercritical steam cycle plants
- Combined cycle plants

Complementary Pump Designs

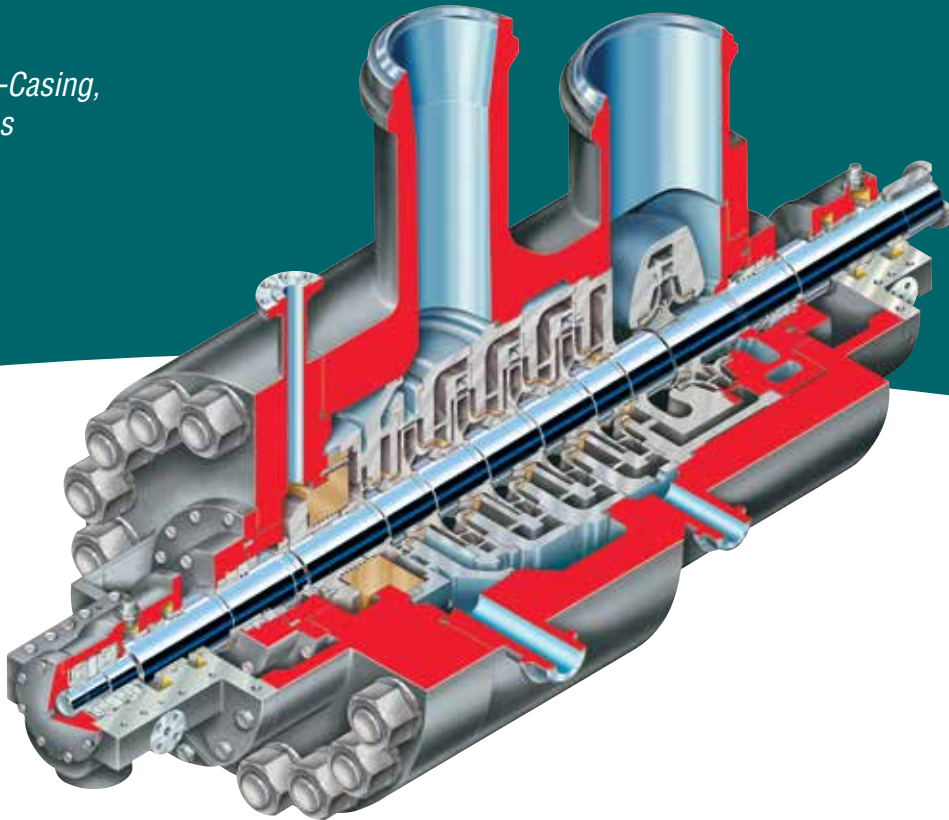
FlowsERVE provides pumps for all power plant services, including circulating water, condensate and raw water. Complementary pump designs include the following:

- WXH multistage segmental ring diffuser pumps
- APKD and QLQC canned vertical condensate pumps
- VCT circulating water pumps
- HDX feed water booster pumps



CHTA and CA

*Between Bearings,
Multistage, Double-Casing,
Utility Barrel Pumps*



The advanced design of the CHTA and CA high-pressure barrel pumps has been developed and refined through more than 50 years of experience. Flowserve uses industry-leading technology throughout every aspect of design and manufacturing to produce the most reliable high-energy boiler feed pumps in the world. The design of the model CHTA and CA incorporates hydraulic and mechanical features resulting from many years of experience in building this class of equipment.

As the world's most powerful boiler feed pump (52 000 kW [70 000 hp]), the CHTA diffuser barrel pump is a true giant, capable of handling the most demanding and high-energy applications. It is often applied unspared in supercritical coal fired power plants and in other applications requiring extended service runs. Having accumulated millions of hours of successful operation, the CHTA is the standard by which reliability is judged.

Operating Parameters

- Flows to 5225 m³/h (23 000 gpm)
- Heads to 4300 m (14 000 ft)
- Pressures to 517 bar (7500 psi)
- Temperatures to 250°C (480°F)
- Speeds to 7000 rpm

Features and Benefits

Precision Cast Diffusers increase pump reliability and efficiency. Diffusers are fully shrouded on high-energy applications. Each diffuser is 100% NDE inspected and all critical dimensions are recorded to ensure component integrity.

Suction and Discharge Connections can be located on the top or the bottom of the barrel and may be supplied with flanged or weld end design to suit installation requirements.

Precision Cast In-Line Impellers minimize bearing spans and are positively locked and keyed to the shaft. Running fits are serrated to reduce the effect of rotor contact in the event of system upset or turning gear operation.

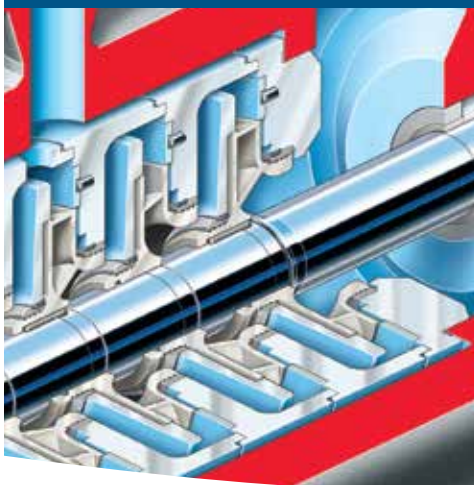
Compensator Gasket Group maintains sealing integrity while allowing for expansion of the rotor and the barrel during thermal transients.

Casing Rings facilitate maintenance and enable running clearances to be renewed easily. For maximum reliability at the running fits, no impeller rings are used.

Belleville Springs located in the thrust bearing housing, reduce the sensitivity to turning gear operation by opening the balancing drum and sleeve face. This allows free passage of liquid which may contain suspended solids.



**Single-Suction
First-Stage Impeller**

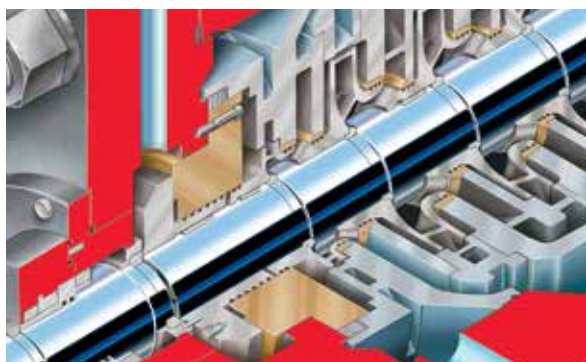


**Double-Suction
First-Stage Impeller**



Rugged Rotor Design

The advanced rotor design of the CHTA ensures smooth operation. By understanding the demands placed on the pump in supercritical service, Flowserve has been able to refine the design to one that is fail-safe. Features include large diameter shafts, shrink fit impellers, impeller split rings and a compact bearing span. Each running fit on the rotor is checked to ensure proper clearance and concentricity.



**Forged and Hardened Stainless Steel
Balance Drum and Sleeve**

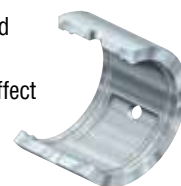
The CHTA's flanged balance drum is self-compensating and conservatively sized to completely balance hydraulic thrust loads at all operating points. Residual loads on the thrust bearing are minimal and leakage across the balance device is low making this design the most efficient method of balancing axial thrust. Clearance is easily renewed via an adjustment mechanism in the thrust bearing. Pioneered by Flowserve, this design has been field proven over many years in the utility industry.

Advanced First-Stage Impeller

Most Flowserve barrel pumps are available with either single- or double-suction first-stage impellers. Flowserve hydraulic engineers are able to precisely fit a pump to the system requirements with either impeller design. Furthermore, Flowserve engineers have optimized various diameter suction eyes that also can be implemented. The available "leading edge hook" and "bias-wedge" Flowserve designs virtually eliminate cavitation damage, contributing to a smoother running pump while prolonging pump life.

Advanced Bearing Designs

The CHTA employs three element tapered land sleeve type (tri-land) radial journal bearings. The enhanced hydrodynamic effect of tri-land bearings results in smooth pump operation, which prolongs pump life and facilitates shaft sealing.



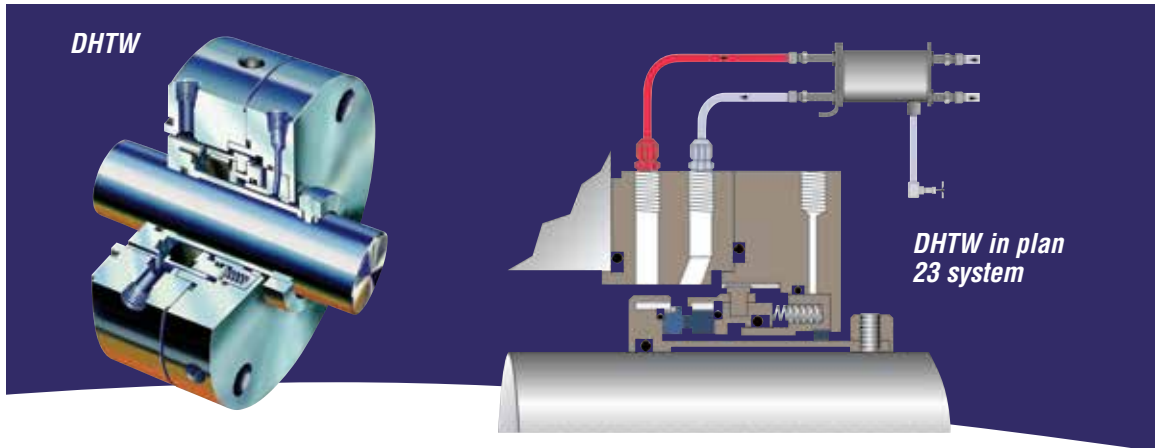
In addition, self-aligning, double-acting tilt-pad thrust bearings are conservatively rated to carry axial loads that may be encountered during transient operating conditions.

12% Chromium Steel Construction

For improved performance, the CHTA features 12% chromium steel components:

- Diffusers
- Channel and casing rings
- Impellers
- Shaft
- Balance drum and sleeve

Mechanical Seal Solutions



The modern barrel design of the CHTA and CA pumps allows for the use of either fixed serrated-labyrinth throttle bushings or cartridge type mechanical seals for shaft sealing. Throttle bushings are the standard design and are well suited for most applications while cartridge mechanical seals, such as the Flowserve DHTW, are preferred for modern combined cycle and steam cycle boiler feed service. When used in conjunction with a plan 23 system, the DHTW improves pump efficiency and provides long life, even in a cycling environment.

Throttle Bushings

The standard sealing system used on the CHTA and CA utility barrel pumps is a controlled leakage design which employs a fixed serrated bushing over a straight shaft sleeve at each end of the pump. Cold condensate is injected at pressures exceeding pump suction pressure. Seal water injection is controlled by measuring seal drain temperature against a set point. This system has proved to be more reliable than differential pressure systems.



Serrated sealing bushings

Custom Engineered DHTW

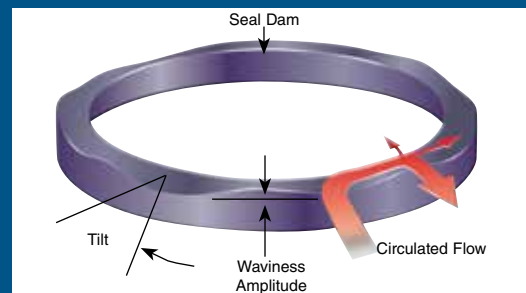
Specifically engineered for the power industry, the DHTW provides reliable high-speed, high-pressure operation and is capable of withstanding “hot standby” conditions. Although it is commonly found in supercritical steam plants as a field installed upgrade to a condensate injection system, the DHTW is also available in new equipment.

Operating Parameters

- Pressures to 2500 psi (172 bar)
- Temperatures to 200°C (400°F)

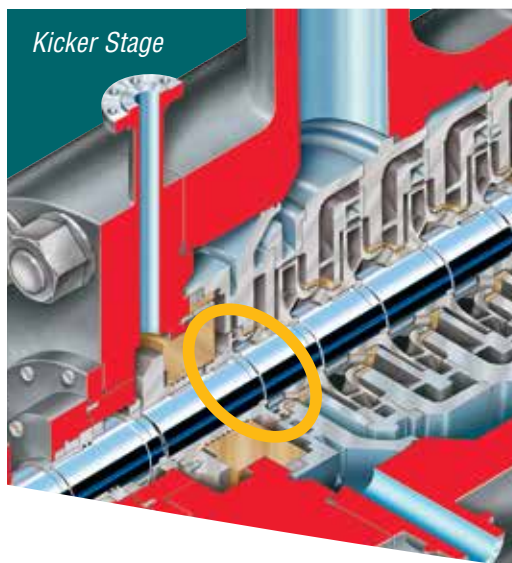
Features and Benefits

- Seal components remain flat under all conditions
- Precise seal balance reduces friction and energy needs
- Cartridge design simplifies installation and reduces downtime
- Integral pumping ring for use with plan 23 eliminates the need for cold condensate injection or make-up water – even in hot stand-by conditions

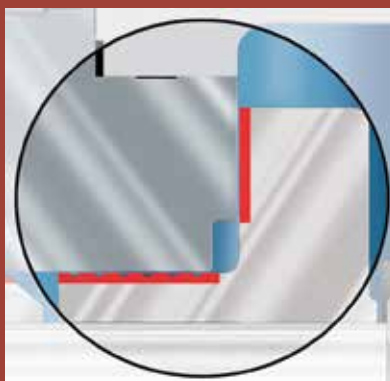


Innovative Wavy Face Technology

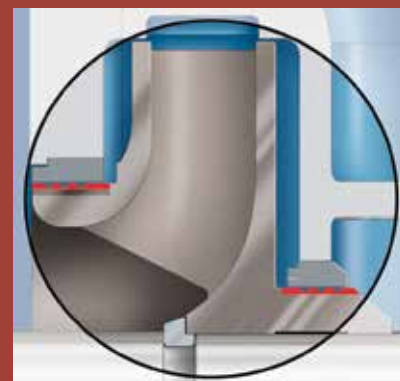
Non-contacting design allows seal faces to run cooler with less wear and with low running torque losses to the motor. Low heat loads allow other system components to have a wider band range, increasing their tolerance for normal operation transients. Self-cleaning Wavy Face technology enables the seal faces to endure boiler system additives, conditioners and water scale residue.



Laser hardened balancing drum



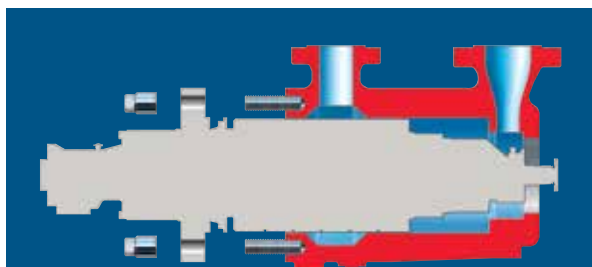
DLD treated impeller with front and back integral wear rings



Hydraulic Options

CHTA and CA pumps can be supplied with hydraulic modifications to ensure the pumps meet system requirements. Available options include:

- Interstage takeoff (ITO)
- Kicker stage for attenuation spray



Optional Cartridge-Type Inner Element

CHTA and CA pumps are available with an optional cartridge-type inner element. In this design, the inner element includes the rotor, diffusers, discharge head, suction head and bearing assembly, allowing the entire assembly to be removed as a single unit. This configuration eases maintenance and reduces downtime, allowing major assembly and disassembly in the workshop rather than in the field.

Laser-Processing Technologies

In addition to through hardening stationary wear parts, Flowsolve offers two advanced laser treatments that create superior surface properties on critical clearance parts:

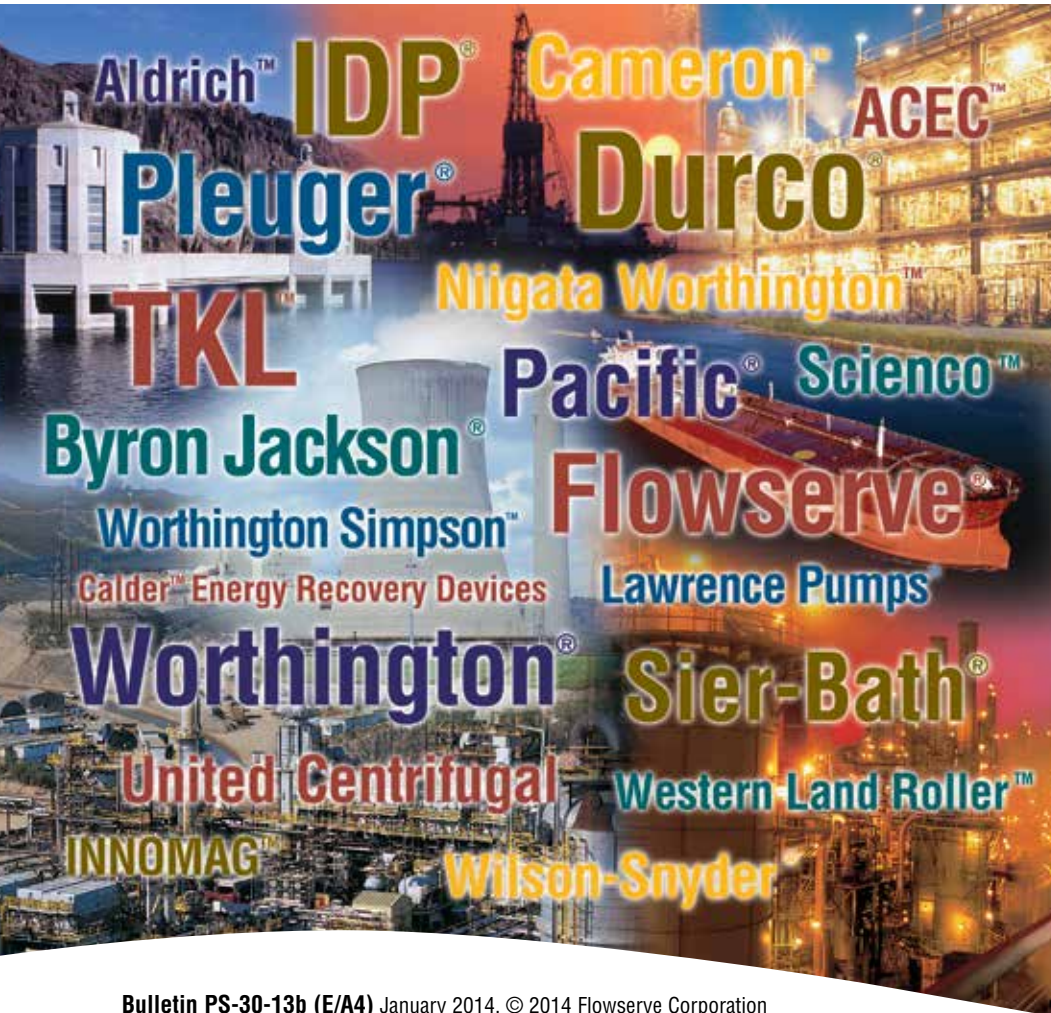
- Laser hardening: Metallurgically alters the micro-structure of the exterior of the metal component, resulting in an extra-hard surface.
- Ultra-supercritical steam cycle plants
- Direct Laser Deposition (DLD): A second material possessing the desired characteristics, e.g., 420 stainless steel for wear resistance, is overlaid onto the base metal.

Both processes improve component reliability and durability. For this reason, they are often applied to impeller hubs, casing wear rings, balance sleeves and channel ring bushings. Furthermore, these surface treatments allow more precise optimization of the corresponding clearances.

Flowsolve will recommend which laser-processing technology is best for the application.

Tested to Ensure Performance

Each CHTA and CA pump is performance tested in accordance with Hydraulic Institute testing standards to ensure the unit meets the specified design conditions. Pumps can be tested at full flow, pressure and speed, up to 18 650 kW (25 000 hp).



Bulletin PS-30-13b (E/A4) January 2014. © 2014 Flowserve Corporation

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