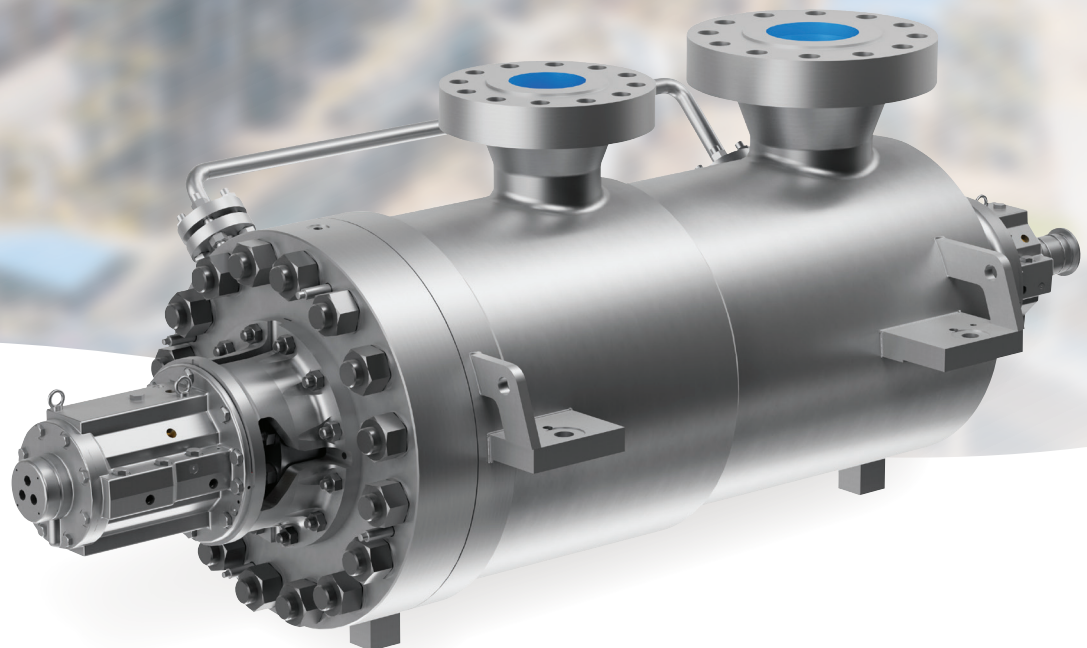




HSO/HDO General and Special Purpose Barrel Pumps for the Oil and Gas Industry

API 610 (BB5)



Experience In Motion



Uptime and reliability with low total cost of ownership

Oil and gas plant operators can improve efficiency and ensure long-lasting performance in rigorous high-pressure applications by specifying HSO and HDO volute-style double case pumps from Flowserve. These proven pump designs provide outstanding performance, reliability and uptime, all of which enable companies to realize a lower total cost of ownership (TCO).

Rated for discharge pressures to 450 bar (6,525 psi), HSO and HDO pumps are built to specifications often exceeding the requirements of API 610. And, with the industry's most extensive and sophisticated library of barrel pump hydraulics, pump performance can be customized and optimized for the most difficult applications.

HSO and HDO pumps feature opposed impellers and double volute designs, resulting in nearly balanced axial hydraulic thrust over the full operating range of the pumps. Standard single-suction (HSO) or optional double-suction (HDO) first-stage impellers provide the flexibility to meet a variety of NPSH requirements.



Configurations to meet your pumping and business requirements

HSD and HDO pumps are unique in that they are offered in both General and Special Purpose configurations.

General Purpose HSD and HDO pumps are ideal for users who prefer an installed spare and a volute design. With a hydraulic envelope that fits many general service applications, they offer an economical solution for those who do not need the premium design features and expense of a Special Purpose pump.

For applications that require the highest reliability — or are unspared — **Special Purpose** HSD and HDO pumps are the ideal choice. In addition to offering hydraulic balance, these Special Purpose design pumps have an extreme focus on durability and reliability. They achieve this through a no-compromise rotor design with an extra-large diameter shaft as well as auxiliary seal and lubrication systems, all precisely engineered for unspared service.

Operating parameters

- Flows to 4,000 m³/h (17,610 US gpm)
- Heads to 5,500 m (18,000 ft)
- Pressures to 450 bar (6,525 psi)
- Temperatures to 450°C (840°F)
- Speeds to 9,000 rpm

A foundation of innovation and leadership

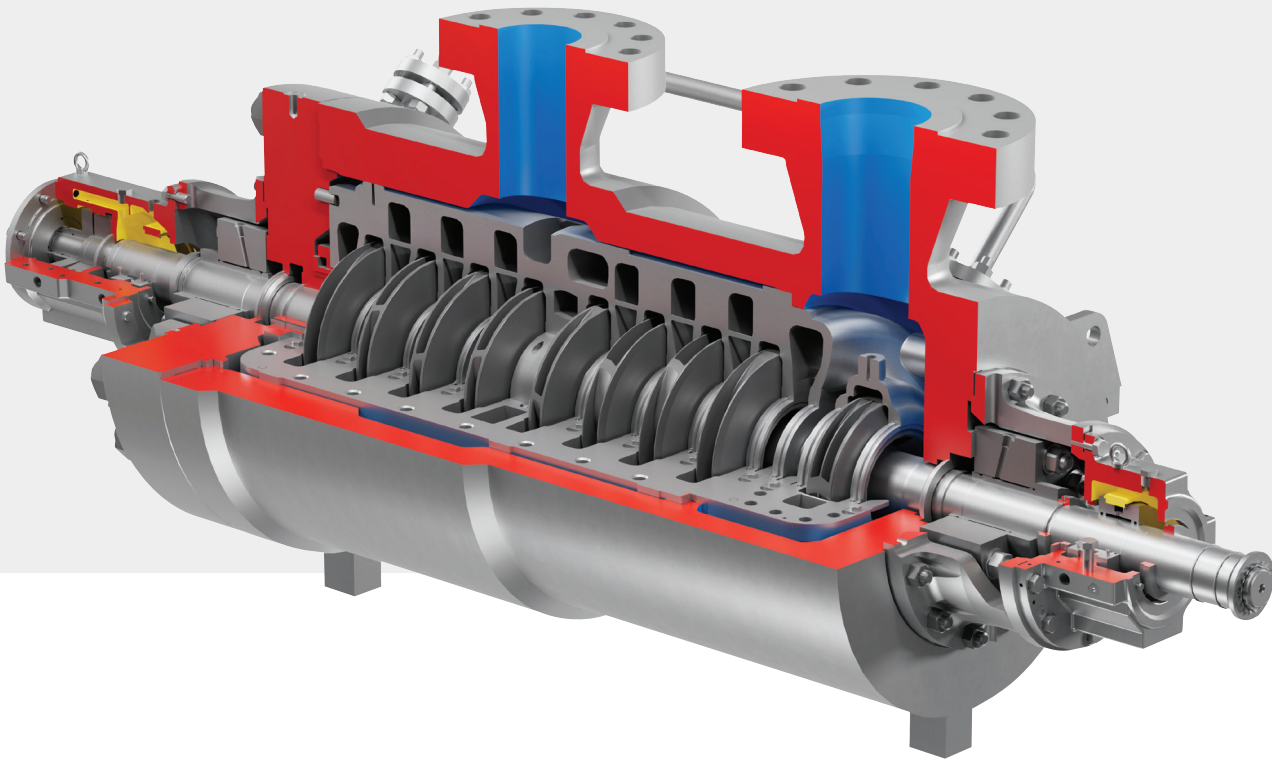
Since 1926 when the company developed the first double-case pump for hot oil, Flowserve has been in the vanguard of pump development for the oil and gas industry. This leadership position was reinforced in 1934 with the introduction of high-pressure water and CO₂ injection pumps and cemented in 1982 when it built the world's largest water injection pump: a 17,900 kW (24,000 hp) behemoth.

Reflecting its leadership position, Flowserve was heavily involved in establishing the API 610 (BB5) standard governing the construction of double-case pumps. From water injection and pipeline to charge, decoking and many other applications, Flowserve is the preferred provider of double-case pump technology worldwide.

Typical applications

- Water injection
- Pipeline
- Amine feed
- Hydrocarbon charge
- Ethylene feed
- Acid gas reinjection
- CO₂ injection
- Hydraulic power recovery turbine





Uncompromised reliability and versatility

Double volute casing consists of two identical halves which feature double volutes with outlets 180° apart. This design essentially balances radial loads at all operational points, reducing harmful vibration and ensuring dependable performance.

A volute locating ring is used to align and position the discharge cover and volute. This hard metal ring replaces metal spacer gaskets, which may become dislodged during assembly.

Precision-cast impellers improve hydraulic efficiency and performance repeatability. Impellers are secured with split rings and a shrink fit to prevent axial movement.

Dynamically balanced rotor provides excellent rotor dynamic stability. The fully assembled rotor is balanced as a complete unit and installed in the volute casing.

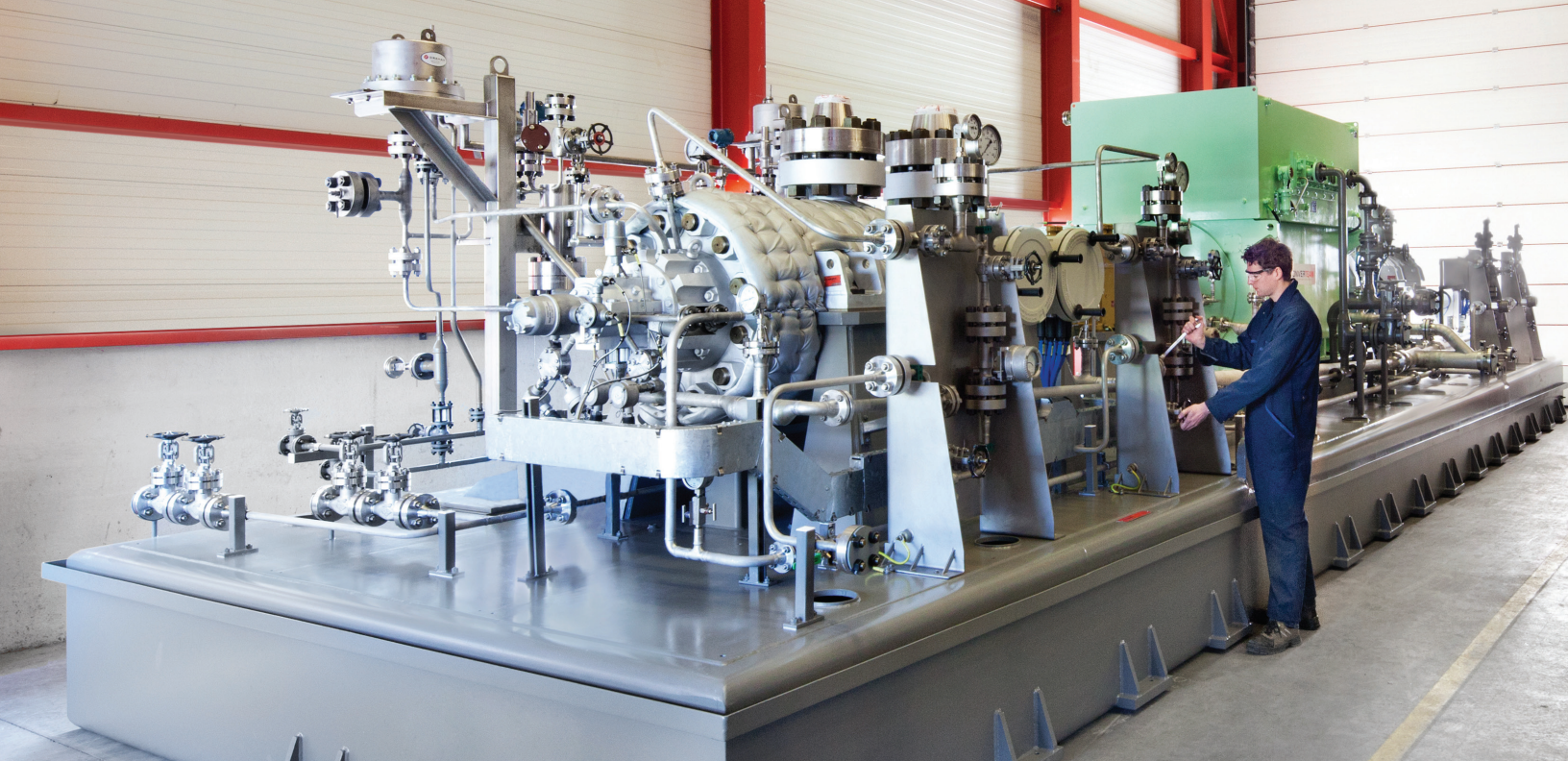
Split construction stage pieces ease installation in the volute casing.

Center stage piece breaks down 50% of the discharge pressure to the intermediate stage before the long crossover. It is overlaid with a hard wear surface to eliminate damage from the mating impeller wear surfaces.

Nozzles have standard raised face flanges. Nozzle orientation can be adjusted to suit site requirements. Several nozzle configurations are available. Weld-end, ring-type joint, and tongue and groove flanges are optional.

Optional grooved impeller running fits increase the pump's tolerance to foreign materials and desensitizes it during start-up, stopping and system transients.

Wrought shafts are incrementally stepped at each impeller fit for ease of assembly. The standard shaft extension is a NEMA taper.



Sag boring prolongs wear ring life

Sag boring can be applied to pumps with high stage counts. The bottom volute casing is bored in incremental steps toward the center. This design accommodates the static deflection of the rotating assembly caused by the weight of the shaft and impellers when the pump is not operating. During start-up, the shaft will straighten and casing rings will slide upward to maintain clearances. This process eliminates rubbing of wear rings commonly found with slender shaft and high numbers of stages.

Rated for maximum safety

The barrel casing and discharge cover house the pump inner bundle, which is a full-discharge, pressure-rated design for higher reliability and safety.

Pressure containment parts may be made in the following materials:

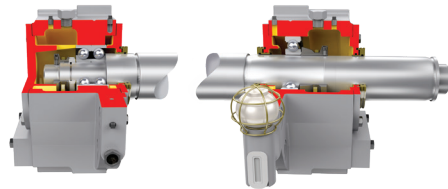
- Carbon steel overlaid with stainless steel at all critical metal-to-metal seating fits and high-velocity areas
- Austenitic stainless steels
- Duplex and super duplex stainless steels
- Carbon steel overlaid with Inconel® on all wetted areas

Other materials are available to suit service requirements.

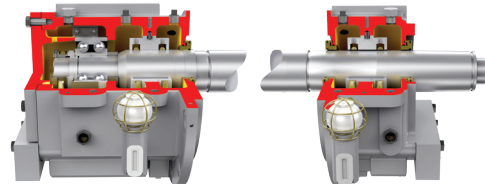
The bolted discharge cover features only one high-pressure, fully confined, circular compression gasketed sealing joint to the atmosphere for superior reliability.

Robust bearing system

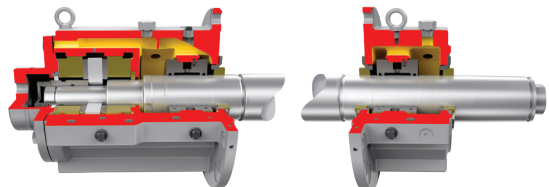
Sleeve journal radial bearings and tilting pad thrust bearings are standard, utilizing either air or water cooling as needed. Duplex ball and sleeve/ball thrust bearings are available where appropriate and permitted by API 610 (BB5).



Ball radial and ball thrust



Split sleeve radial and ball thrust

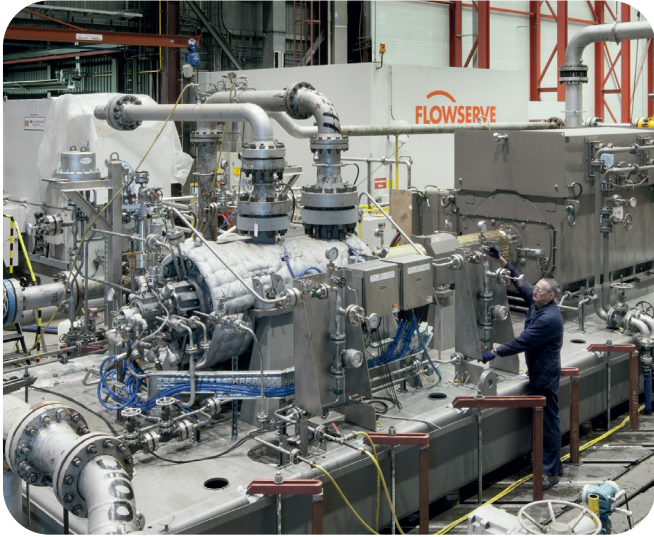


Split sleeve radial and tilting pad thrust

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Tested to ensure performance

Each HSO and HDO pump is performance tested in accordance with API and 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).



Global network for engineering, repair and reliability services

When you need maintenance or repairs — planned or unplanned, after-hours or during an emergency — Flowserve can help. Our team can quickly join you on-site at your plant or remotely to provide diagnostic services as well as critical parts, management and support.

The Flowserve global network of Quick Response Centers (QRCs) enables customers to quickly turn around any repair or remanufacturing project, including plant shutdowns. Our technicians and engineers are fluid motion and control experts. We specialize in repairing and upgrading engineered pumps, valves, seals and automation equipment. Flowserve Quick Response Centers provide machining, repair, assembly, testing, automation packages and inventory. As a result, you can minimize downtime and carrying costs.

And, we service most types of rotating equipment, regardless of the original manufacturer.

Contact the nearest Quick Response Center to extend service life and optimize performance.

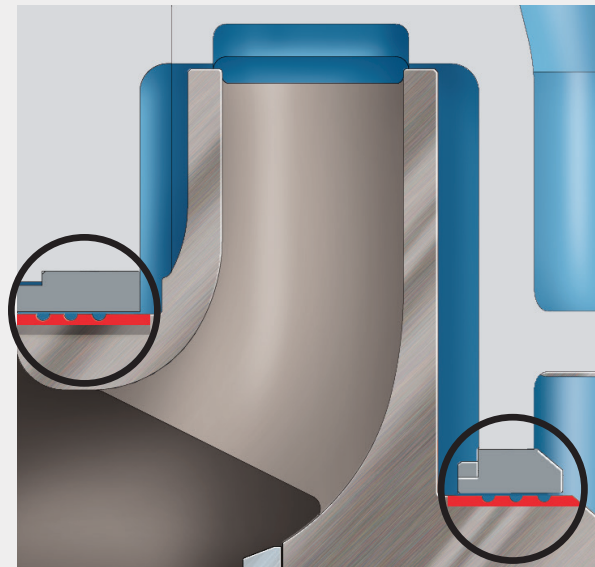
Advanced close-clearance technologies

For severe services, the HSO and HDO pumps are available with state-of-the-art erosion- and abrasion-resistant materials in the running fits. These materials are applied by various processes to ensure the ultimate in reliability for even the harshest environments:

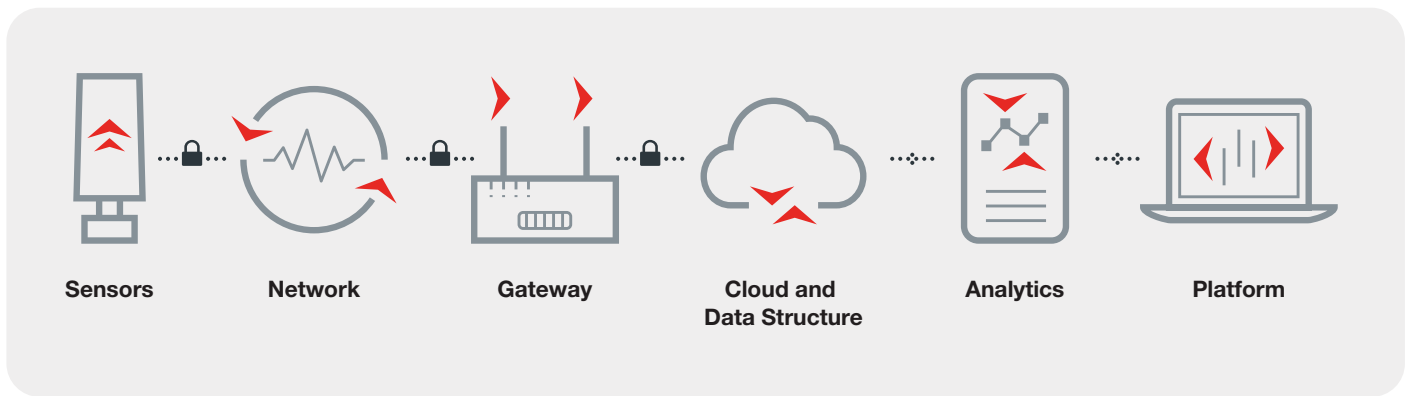
- Through hardening: Metallurgically alters the microstructure of the metal component, resulting in a solid hard wearing part.
- Super-hard overlay: A second material possessing the desired wear characteristics, like tungsten carbide or Stellite® 6, is overlaid onto the base metal via direct laser deposit processes.
- Non-metallic and ceramic materials

Ask our Flowserve specialists which materials and processes are recommended based on the specifics of the actual application.

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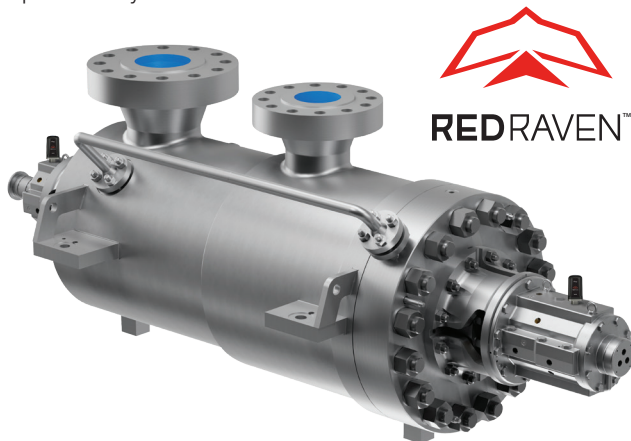
Optional grooved wear surface shown on impeller hub



Increase uptime with predictive maintenance

Flowserve HSO and HDO barrel pumps are RedRaven Ready. RedRaven is a predictive maintenance service from Flowserve that improves plant performance by detecting anomalies in pumps, valves and seals. It enables you to predict when and why your critical assets may experience issues so you can take preventive action.

RedRaven is a complete end-to-end proactive maintenance solution. It enables you to leverage the internet of things (IoT) for a connected platform of smart products, software and services. It gives you the tools you need to monitor, analyze and predict the performance of your pumps, seals and valves, as well as the insights you need to make more informed decisions for improving your plant's reliability, efficiency, productivity and bottom line.



A ready-to-deploy, scalable solution

Most Flowserve fluid motion and control equipment is RedRaven Ready. That means it's designed and built to accept RedRaven wired or wireless sensors using cloud architecture for condition monitoring and predictive analytics services.

RedRaven Ready pumps, seals and valves securely connect to an IoT platform that includes hazardous area-certified equipment sensors, secure communication, performance analytics and trend reporting tools — all tailored to your plant's unique needs.

Options include:

Condition monitoring: Enables you to capture asset performance data for analysis

Predictive analytics: Applies data analysis software and algorithms to help you identify and diagnose equipment problems

For more information on RedRaven, contact your Flowserve representative or visit www.flowserve.com/redraven



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