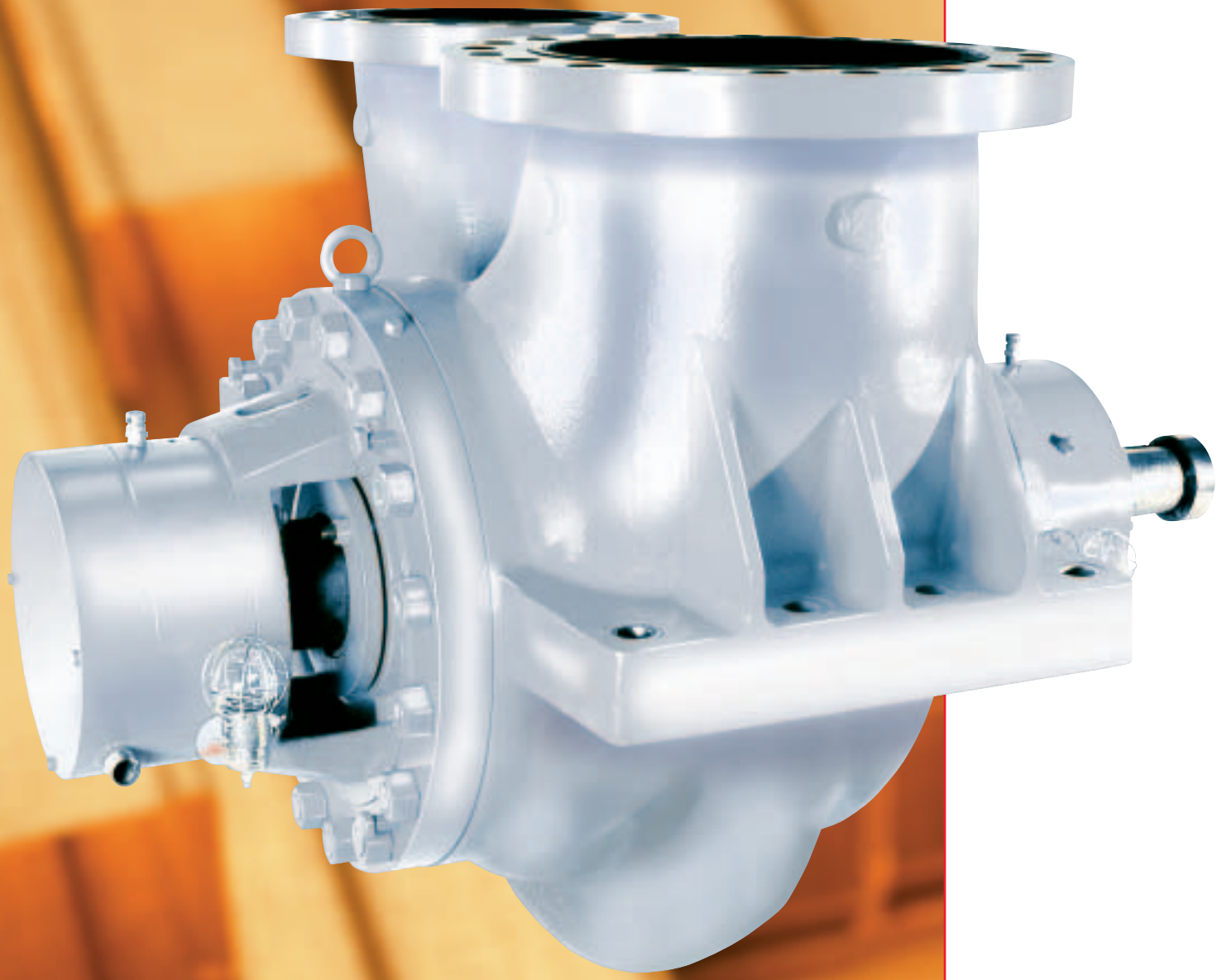
FLOWSERVE

Pump Division

HDX

API 610 Double Suction, Radially Split Process Pump



Bulletin PS-20-4 (E/A4)

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.

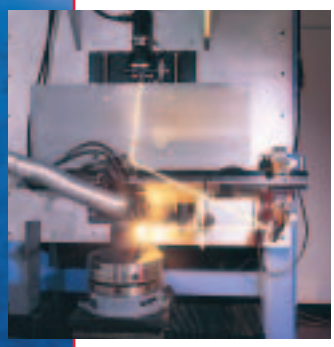
Pumping Solutions
Flowserve is providing pumping solutions which permit customers to continuously improve productivity, profitability and pumping system reliability.

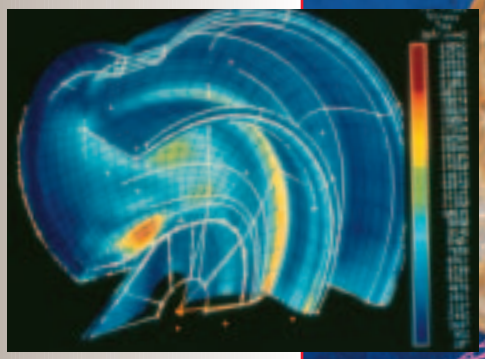
Market Focused Customer Support
Product and industry specialists develop effective proposals and solutions directed toward market and customer preferences. They offer technical advice and assistance throughout each stage of the product life cycle, beginning with the inquiry.

Dynamic Technologies
Flowserve is without peer in the development and application of pump technology, including:
- Hydraulic engineering
- Mechanical design
- Materials science
- Intelligent pumping
- Manufacturing technology

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 bearing single stage
- Between bearing multistage
- Vertical
- Submersible motor
- Rotary
- Reciprocating
- Nuclear
- Specialty





HDX

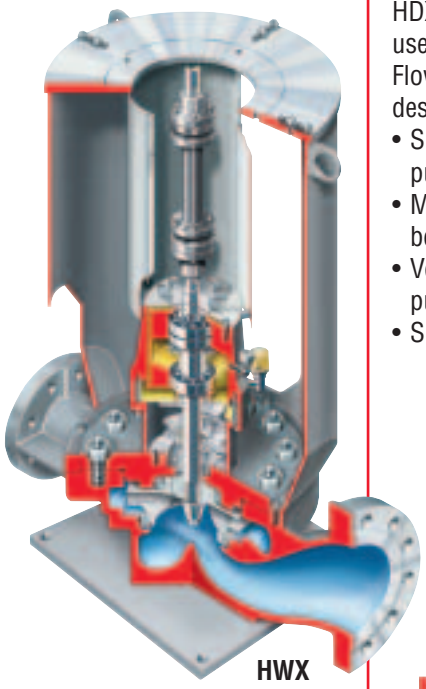
API 610 Double Suction, Radially Split Process Pump

Heavy-Duty Between Bearings Pumping Leader

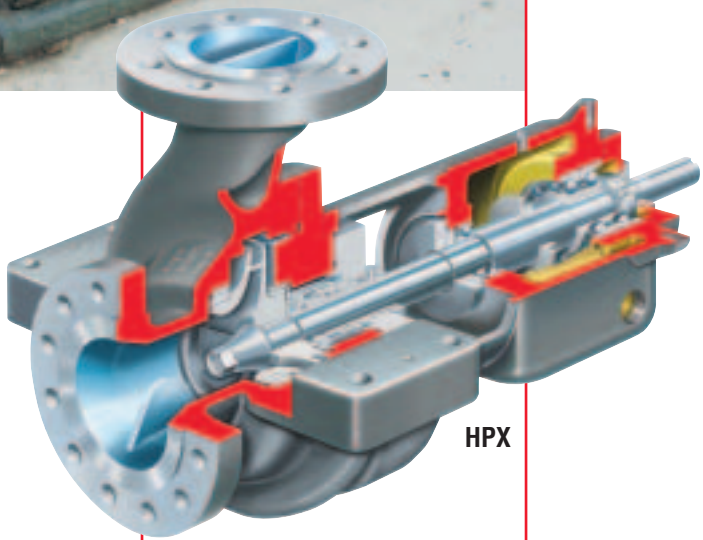
The HDX line of pumps complements flow and pressure requirements between overhung and multistage process pump lines for high temperature applications.

These top suction, top discharge, between bearing, centerline mounted pumps are fully compliant with API 610, type BB2. They incorporate all of the design requirements specified by the demanding hydrocarbon-processing industry, as well as power and specialty users. These include:

- Nozzle-loading capability specified by API 610
- Mechanical seal chambers in accordance with API 682
- Centerline-mounted casing
- Bearing options
- Pressure casing and wear part material options
- Control and monitoring systems
- Low NPSH capabilities



HWX



HPX

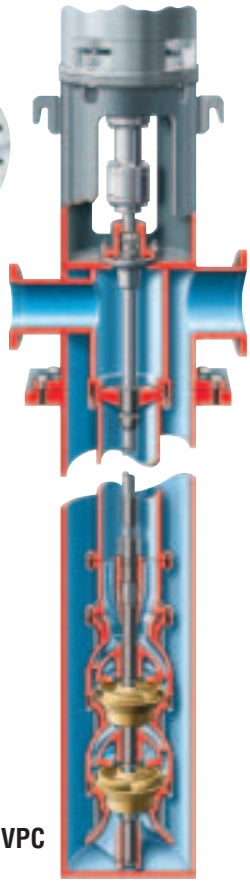
Broad Application

- Petroleum refining, production and distribution
- Petrochemical and heavy-duty chemical processing
- Gas industry services
- Boiler-feed booster and other high temperature services
- Water and general industrial

Complementary Pump Designs

HDX pumps may be used with other Flowserve models of API design. These include:

- Single-stage overhung pumps
- Multistage between bearing pumps
- Vertical, double casing pumps
- Specialty pumps



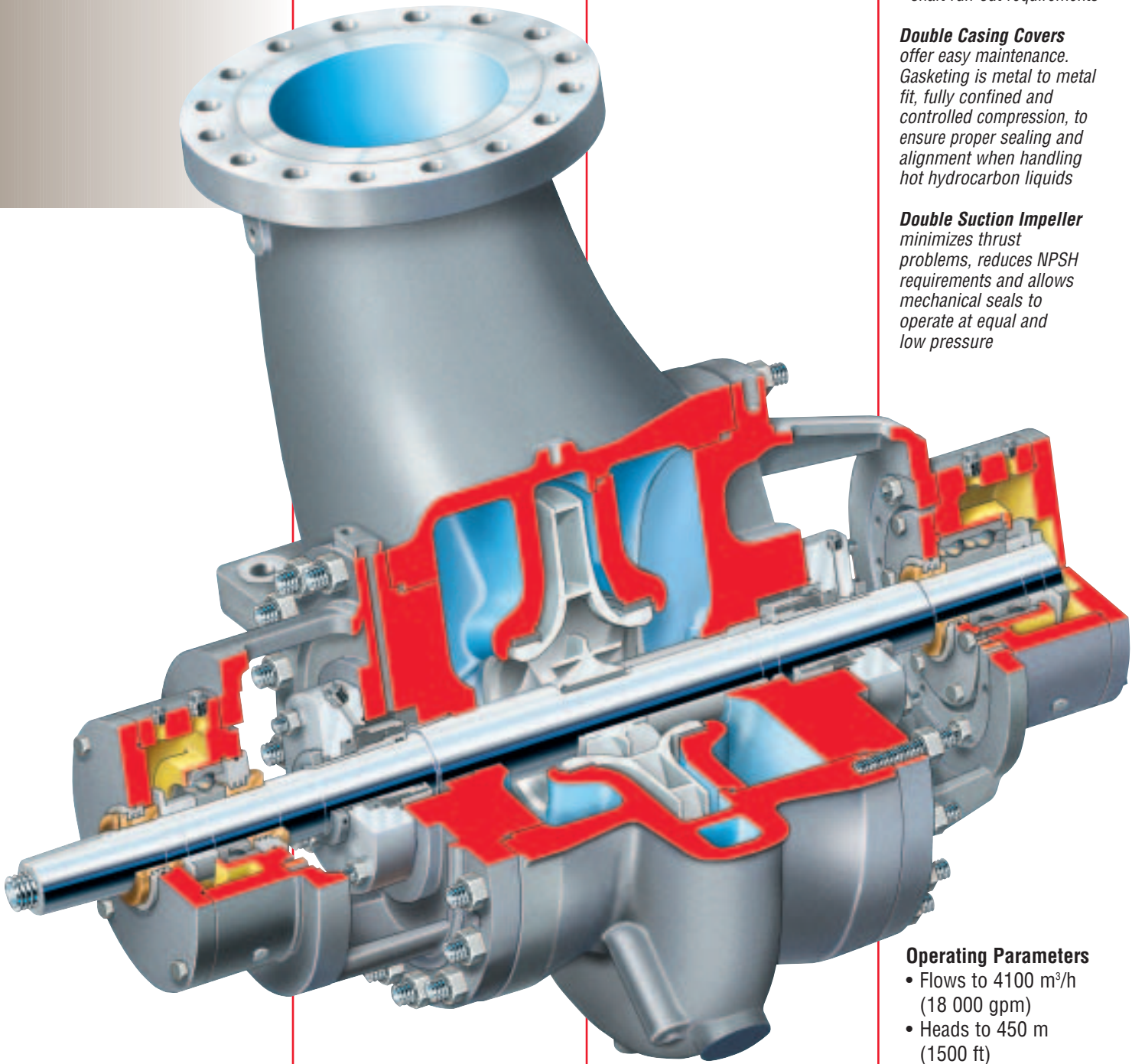
VPC

HDX

API 610 Double Suction, Radially Split Process Pump

Flowserve's HDX pump meets or exceeds the vigorous requirements of API 610, latest edition. It is engineered and built for reliable, safe performance at the elevated temperatures and pressures experienced in refining and power applications.

Further, the HDX represents the most comprehensive range of hydraulic coverage available to the industry, thereby permitting precise selection for best operating efficiency.



Dual-Volute Centerline Supported Casing, *combined with a stiff shaft design, ensures:*

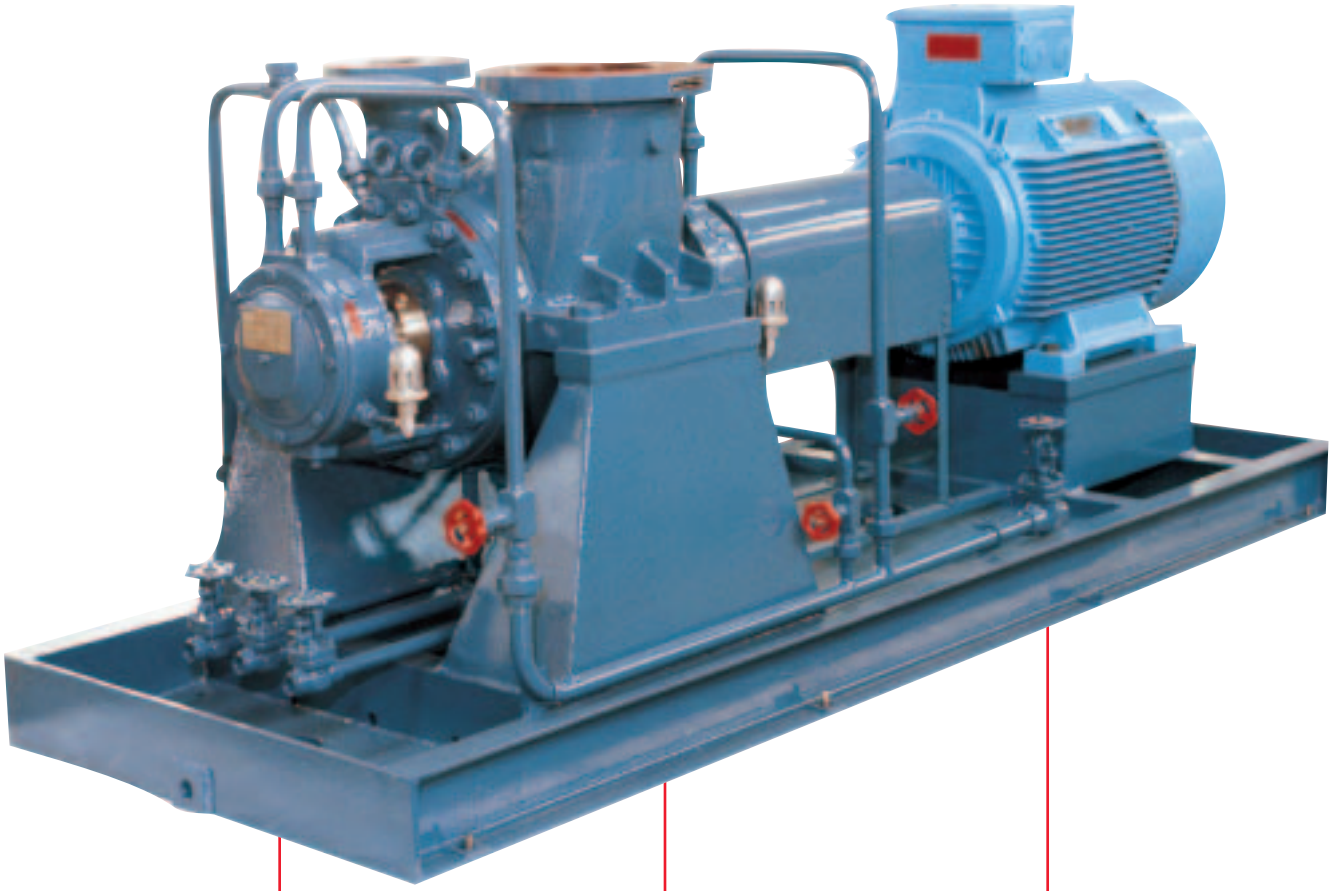
- *Full compliance with API 610 specified nozzle loads*
- *Full compliance with API 610 vibration and shaft run-out requirements*

Double Casing Covers *offer easy maintenance. Gasketing is metal to metal fit, fully confined and controlled compression, to ensure proper sealing and alignment when handling hot hydrocarbon liquids*

Double Suction Impeller *minimizes thrust problems, reduces NPSH requirements and allows mechanical seals to operate at equal and low pressure*

Operating Parameters

- Flows to 4100 m^3/h (18 000 gpm)
- Heads to 450 m (1500 ft)
- Temperatures to 450°C (850°F)
- Pressures to 100 bar (1500 psi)



Dynamically Balanced Rotor *ensures smooth operation for longer mechanical seal and bearing life*

Rotating Elements *include large diameter shafts and short bearing spans to increase shaft stiffness. Final two plane dynamic balancing and TIR verifications are conducted on assembled rotors to assure optimum mechanical performance throughout the operating range*

Self-Venting Casing *eliminates the need for a vent valve and associated piping*

360° Support Bearing Housings *are made of carbon steel to provide added stiffness and reduced vibration. Shaft mounted fans can be provided for air cooling in lieu of water cooling*

Seal Chambers *to API 682 dimensional criteria allow for installation of cartridge design single, dual unpressurized and dual pressurized mechanical seals to meet the required safety and environmental requirements*

Cartridge Seal Mounting Assures:
- *Ease of maintenance*
- *Precise seal face setting for maximum seal life*

Standard Radial Bearing *is antifriction single-row Conrad type*

Standard Thrust Bearing *is dual single-row back-to-back mounted angular contact type. Optional bearing arrangements and lubrication systems are available to meet the requirements of any speed or application*

Casing *is supplied with minimum flange ratings of ASME B16.5 Class 300 suction and discharge. Class 600 and 900 are also available to meet the required operating pressures*

Pump Packages *are provided to specifications and include lube oil piping, seal systems, monitoring instruments and drive train mounting. Pumps mounted with engine or turbine drivers and multiple pump modules are also available*

Certified Testing *is performed on each pump prior to shipment*

Casing and Internal Material Combinations *available to meet service requirements include carbon steel, 12% chrome, austenitic stainless steels, Monel® and duplex*

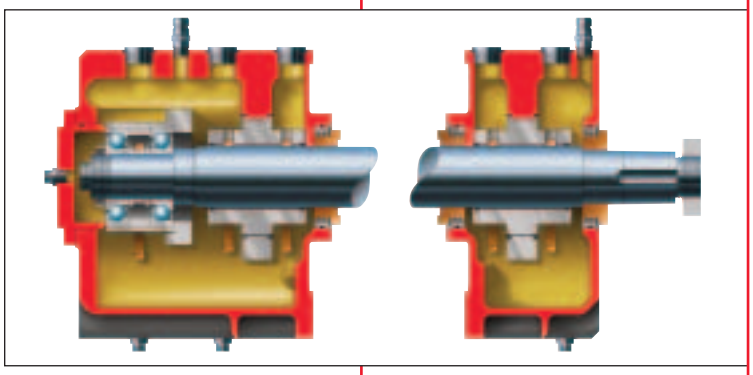
® Monel is a registered trademark of International Nickel Co

Options and Technical Data

In-line Side Nozzles

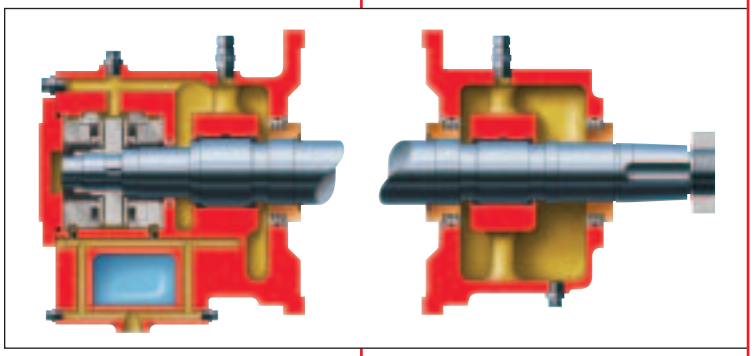
Side-Side Nozzles

Bearing Options



Sleeve Radial and Ball Thrust

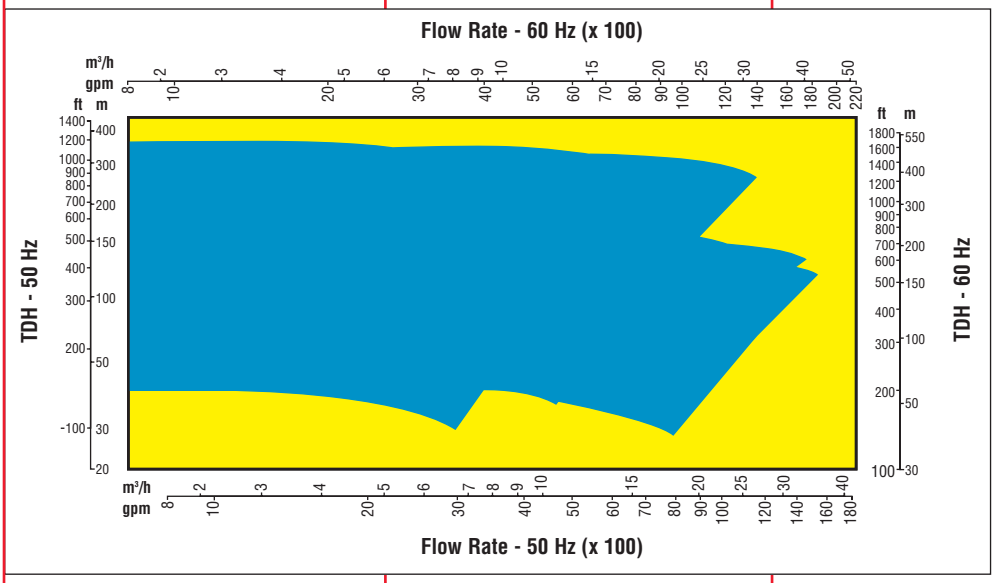
- Applied to energy density (=power x rated speed) ratings of 4.0 million (=kW x rpm) or 5.4 million (=hp x rpm) maximum
- Standard for applications where thrust bearing speed and life for rolling element bearings are within API 610 limits



Sleeve Radial and Tilting Pad Thrust

- Applied when energy density ratings and bearing speed or life is beyond the limits for rolling element bearings as defined by API 610
- Tilting pad thrust bearings normally require an external forced feed lubrication system. Pump shaft driven or separate lube pumps available

HDX Range Chart



Shaft Options

- Hydraulic-fitted coupling
- Double extended

Baseplate Options

- Welded steel with drain rim
- Sub-base under pump only
- Skid type non-grouted
- 3-point design
- Pregrouted design

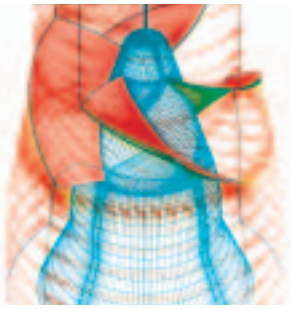
Other Options

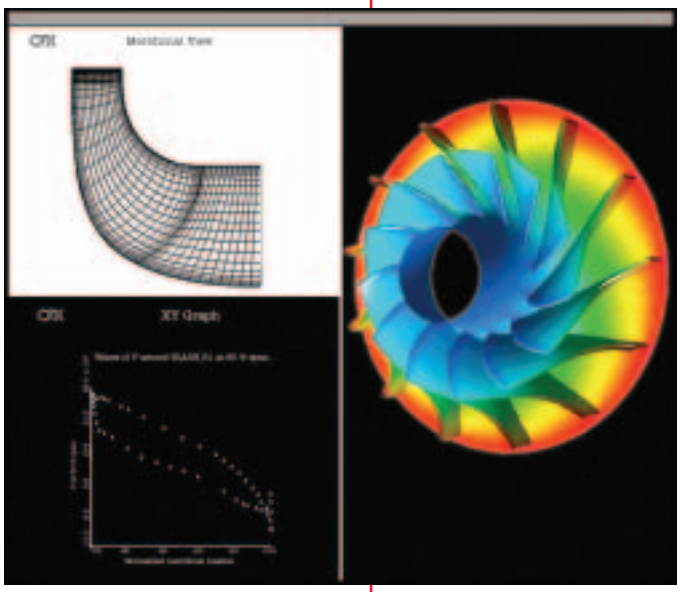
- Pure or oil mist lubrication of bearings
- Water or fan cooled bearings
- Coatings for slurry services
- Coke crusher construction

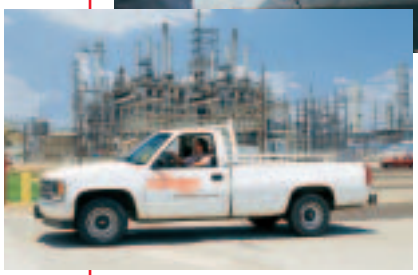
Fan Cooling

Global Service and Technical Support

Advanced Technologies
Few if any pump companies can match Flowserve's capabilities in hydraulic and mechanical design or in materials engineering. These capabilities include:
- Computational fluid dynamics
- Flow visualization
- Cavitation studies
- Efficiency optimization
- Finite element analysis
- Rapid prototyping
- Captive high nickel alloy and light reactive alloy foundries
- Non-metallic materials processing and manufacturing







Service and Repair Group
Flowserve's Service and Repair Group is dedicated to maximizing equipment performance and reliability-centered maintenance programs. Pump related services include:
- Startup and commissioning
- Diagnostics and prognostics
- Routine and repair maintenance
- ANSI and ISO power end exchange program
- Re-rates, upgrades and retrofits
- Spare parts inventory and management programs
- Training

Pump Improvement Engineering Services
Flowserve is committed to helping customers obtain the best possible return on their pump equipment investment. Engineering assistance and technological solutions for pumping problems are readily available.

These services include:
- Field performance testing
- Vibration analysis
- Design analysis and root-cause problem solving
- Material improvements
- Pump and system audit
- Advanced technology solutions
- PumpTrac™ remote pump monitoring and diagnostic services
- Instruction manual updates
- Training courses

Flowserve… Supporting Our Customers With The World's Leading Pump Brands

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