SPX®

CUP-BB5HP

HEAVY DUTY, RADIALLY SPLIT, MULTI-STAGE PUMPS, API 610 / ISO 13709

ClydeUnion Pumps

SPX - An introduction

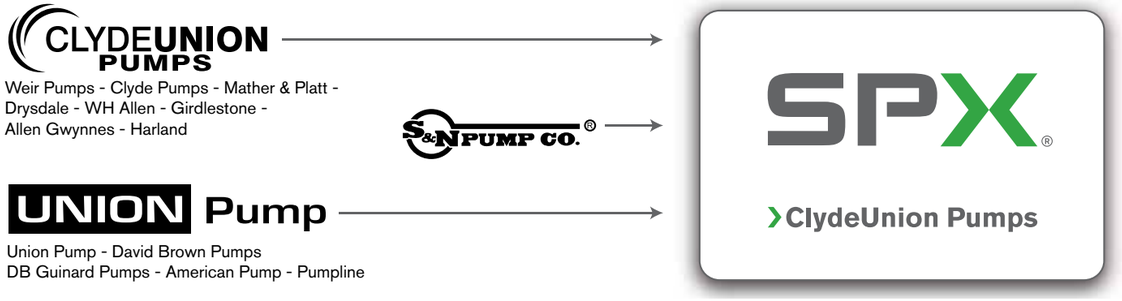
SPX is a Fortune 500 multi-industry manufacturing leader, headquartered in Charlotte, North Carolina. SPX manufactures and markets products, components, services and technologies that are integral to meeting today's challenges and tomorrow's needs. We are a place where innovation is fostered, and the real needs of business are understood. We transform ideas into powerful solutions to help our customers meet their goals, overcome business challenges and thrive in a complex, always changing marketplace.

SPX's Flow Technology segment designs, manufactures and markets engineering solutions and products used to process, blend, meter and transport fluids. We also offer equipment for air and gas filtration and dehydration. Our leading brands have global operations which service the food + beverage, power + energy, and industrial processes.

SPX®

CLYDEUNION PUMPS, AN SPX BRAND - GENERATIONS OF EXPERIENCE

Whilst the name is relatively new, the ClydeUnion Pumps brand is known worldwide for supplying reliable and robust engineered pumping solutions stemming from over 140 years of industry expertise. Our experience spans across several complex industries including oil and gas, nuclear and conventional power generation, desalination and other key markets relevant to our product portfolio.



High technology pumps for the most demanding services

ClydeUnion Pumps, an SPX Brand, specialises in the design and manufacture of API 610 centrifugal pumps and pumping packages. At ClydeUnion Pumps you will find a commitment to quality throughout the company. Our Quality Management System is fully approved to ISO 9001:2008 and independently verified to comply with the latest quality standards. ClydeUnion Pumps has a worldwide reputation for providing optimised reliability in the most severe duty applications.

OIL + GAS EXPLORATION + PRODUCTION

At ClydeUnion Pumps we have built a reputation for providing engineered pumping solutions for some of the most arduous applications in the most hostile environmental conditions imaginable. Our pumps are supplied to satisfy a wide range of pumping services including; produced water injection, seawater injection and main oil lines.

REFINERIES

Today's complex refinery processes demand specialised pumping solutions. Extremes of temperature, high-pressure and the ability to handle volatile fluids, calls for highly engineered pumps that can perform reliably in such arduous conditions.

ClydeUnion Pumps has many years of worldwide experience in supplying process pumps to the refinery industry and is committed in providing its customers with solutions for the most complex of pumping requirements.

POWER

ClydeUnion Pumps has supplied boiler feed pumps, safety related pumps and auxiliary pumps for a wide range of power generation plants over many years. The experience gained in this field enables us to offer our customers engineered products, tailored to their specific requirements.

COMMITMENT TO QUALITY

We are committed to quality throughout our organisation. Our Quality Management System is fully approved to ISO 9001:2008 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.

ClydeUnion Pumps also 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.

CUP-BB5HP - Heavy duty, axially split, multi-stage pumps

ClydeUnion Pumps CUP-BB5HP range encompasses radially split, diffuser type, multi-stage pumps specifically designed for the high pressure and high speed service needs of the market.

ENGINEERING EXCELLENCE

With two main variants of in-line impellers (CUP-BB5HPi) or back-to-back impeller arrangement (CUP-BB5HPb) the units are engineered-to-order solutions, fully compliant with the latest API 610 and API 682 requirements and customer specifications. These highly successful machines are used extensively throughout the oil + gas, exploration, production, transportation and refining sectors.

PROVEN PRODUCT INTEGRITY

The CUP-BB5HP encompasses proven design history, evolving from our legacy Weir Pumps 'OK' and 'DB Guinard HMBS' machines. Both contribute to an enviable heritage of sound engineering, with hundreds of CUP-BB5HP pumps operating worldwide, both onshore and offshore.

RESEARCH + DEVELOPMENT

ClydeUnion Pumps recognises the importance of continually advancing our product offering to meet the requirements of new technical challenges associated with ever deeper waters and remote locations.

Through our culture of innovation and a customer-centric approach we have positioned ourselves at the leading edge of pump design. 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. Beyond our CUP-BB5HP advancements our CUP-BB5UHP has been specifically designed to address the requirements of ultra-high pressure injection duties, pushing the boundaries of pumping technology.

STIFF ROTOR DESIGN – THE HEART OF THE MACHINE

ClydeUnion Pumps dynamically stiff rotor design differentiates our CUP-BB5HP pumps. Our rotor design is based on achieving maximum sustainable hydraulic efficiency, extended mean time between overhauls and reliability in operation. The resulting high critical speed margins and low static deflections reduce internal wear and increase reliability.

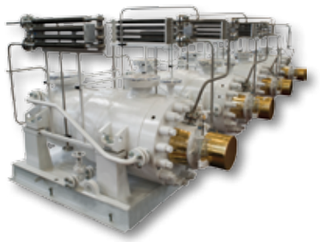
EASE OF MAINTENANCE

The simple construction of the CUP-BB5HP pump offers ease of maintenance and reliability. A complete rotor change-out can be completed in under eight hours.

OPERATING PARAMETERS:

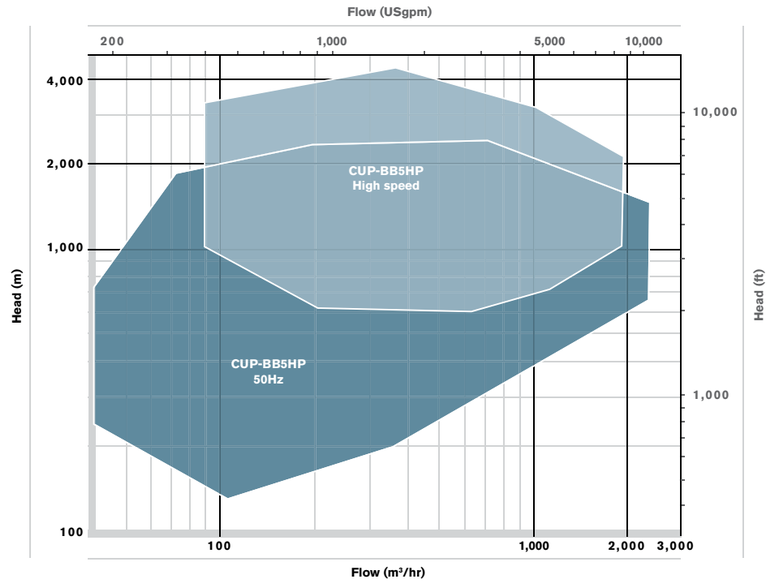
CUP-BB5HP

- **Capacities** – up to 2,800 m^3/hr / 12,330 USgpm
- **Delivery Heads** – up to 4,100 m / 13,450 ft
- **Speeds** – up to 6,600 rpm

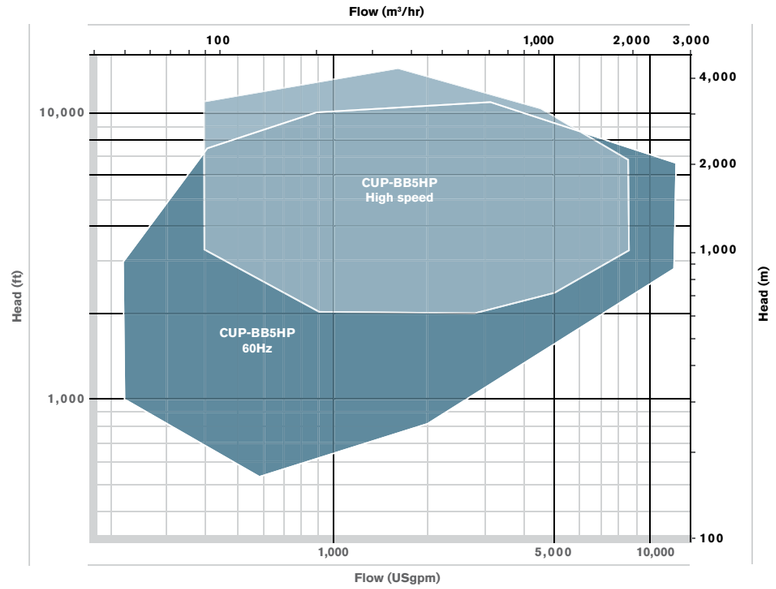


Standard hydraulic range - coverage charts

50HZ RANGE COVERAGE CHART



60HZ RANGE COVERAGE CHART



These charts cover the CUP-BB5HP standard pump range. Other engineering designs exist for extreme applications

CUP-BB5HP - Features

1 HEAVY DUTY PUMP CASING
- All flanges designed and rated for full maximum allowable working pressure and 2 x API 610 nozzle loads
- Studded integral main flange connections top-top orientation as standard. Other types available
- Foot or centre-line mounted

2 HIGH ROTOR STABILITY
- Optimal shaft-to-impeller diameter and bearing span proportions
- Dynamically-stiff design
- Ensures high reliability, higher speeds, longer wear life and low static deflection

3 EASE OF MAINTENANCE
- Cartridge design can be removed from barrel casing as a complete unit
- ClydeUnion Pumps Shear Ring locking system ensures rapid change-out and minimises pump downtime

4 PUMP HEALTHCARE MONITORING
- Temperature and vibration monitoring of critical components as standard
- Wired to skid edge junction box or control panel

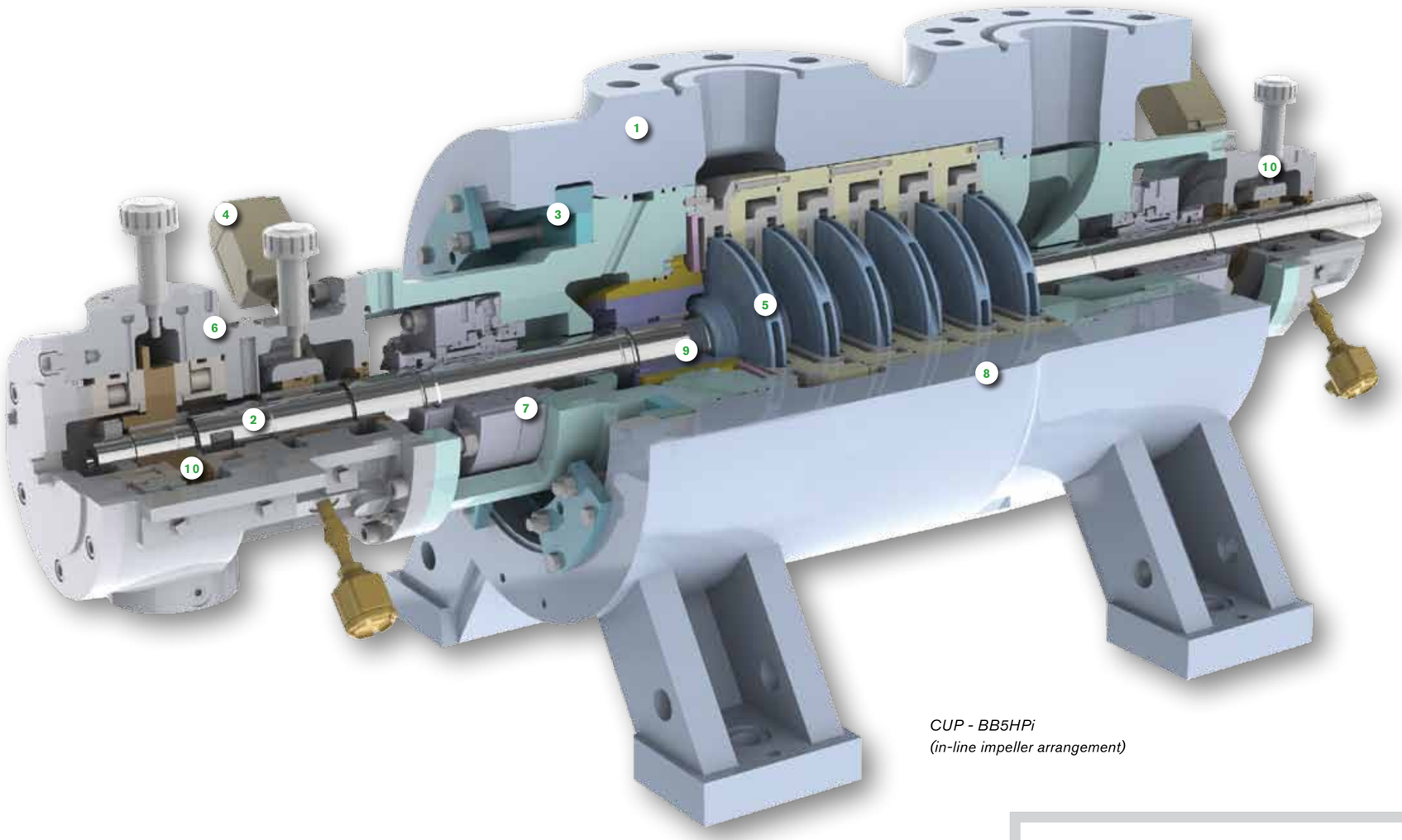
5 PRECISION CAST IMPELLERS
- Statically and dynamically balanced
- Staggered to ensure optimum vibration performance to API 610 requirements
- Shrink-fitted to shaft and individually axially located

6 BEARING HOUSINGS
- Lift off design to facilitate ease of access to mechanical seals and bearings
- 360° mounting for optimum rotor support and low vibration levels
- INPRO™ oil seals fitted as standard

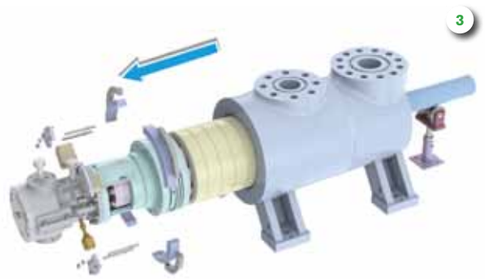
7 ADVANCED MECHANICAL SEALING (TO API 682)
- Cartridge style (single or dual) mechanical seals as standard, with no external seal setting
- API 682 seal chamber ensures maximum seal life and full seal interchangeability

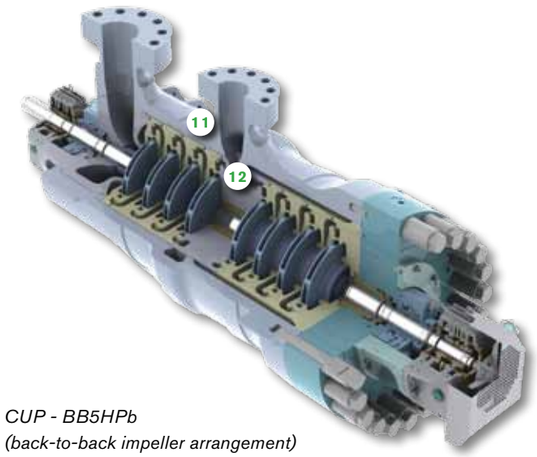
8 ADVANCED METALLURGY
- Super Duplex alloys and high velocity oxygen flame overlays ensure long component life. Solid sintered tungsten carbide option for produced water applications
- NACE and NORSOK certified when required

9 HYDRAULIC BALANCING DEVICE
- Drum and bush arrangement to balance hydraulically generated thrust loads



CUP - BB5HPi
(in-line impeller arrangement)





CUP - BB5HPb
(back-to-back impeller arrangement)

10 BEARINGS
- Generously rated hydrodynamic double acting tilting pad (thrust) bearing
- White metal lined hydrodynamic sleeve (journal) bearings
- Hydrodynamic bearings have force fed lubrication as standard
- Ball or Sleeve / Ball bearing options available

11 BACK-TO-BACK IMPELLER ARRANGEMENT
- Ensures hydraulic balancing of axial thrusts and eliminates the need for full pressure breakdown devices

12 LABYRINTH CENTRE PIECE
- Smoothly transfers pumped fluid under differential pressure between the two banks of opposing impellers
- The centre bush and sleeve ensure a supplementary stiffness to the shaft, aiding rotor stability and low vibration levels

CUP-BB5HP - Complete pump package features

1 DRIVER OPTIONS

The CUP-BB5HP can be packaged with various types of drive equipment to suit the application's needs. Typical options include:

- Electric motors (fixed or variable speed)
- Combustion engines
- Gas or steam turbines

Further drive train options are available in order to achieve the optimal running speed:

- API 677 or API 613 gearbox units
- Fluid couplings (geared and/or variable speed)

2 COUPLINGS

- Flexible element membrane couplings as standard for high torque drives (to API 671 when required)
- Excellent angular, lateral and axial flexibility with low levels of imposed forces on equipment

3 LUBRICATION SYSTEMS

- Forced lubrication systems, for use with hydrodynamic bearings. To API 610 as a minimum, with API 614 options available
- For anti-friction bearing arrangements self-contained lubrication arrangements are commonly used

4 ANTI-VIBRATION MOUNTS (AVMs)

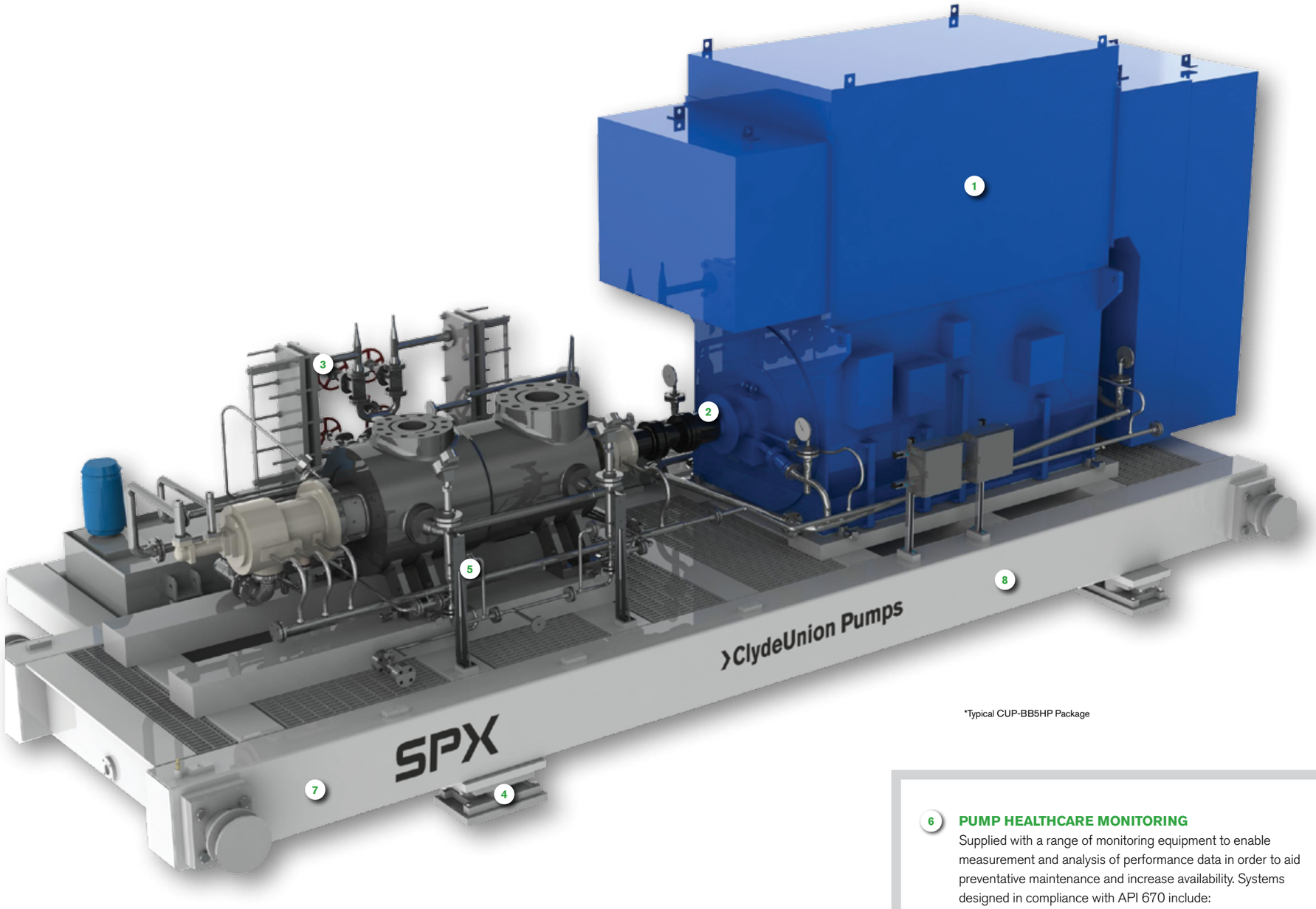
- Designed to reduce the transmission of vibration from machinery to the deck or ground
- 3 or 4 point mounting configurations available

5 ADVANCED SEALING ARRANGEMENTS (TO API 682)

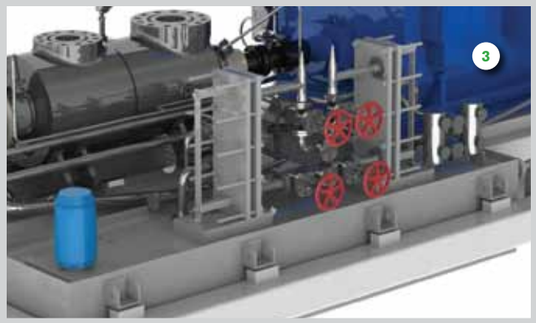
Typically for non-sour service API 682 piping plans 11 and 31 utilise the process fluid as a flush within a single seal configuration.

For more robust solutions multiple seal arrangements are adopted. The options here are varied but fall into two principal categories:

- *Unpressurised tandem arrangements*
  Typically API 682 piping plan 52
- *Pressurised double arrangements*
  Typically API 682 secondary flush plans 53A/B/C, incorporating a variety of vessel-type reservoir sealant systems



*Typical CUP-BB5HP Package



6 PUMP HEALTHCARE MONITORING

Supplied with a range of monitoring equipment to enable measurement and analysis of performance data in order to aid preventative maintenance and increase availability. Systems designed in compliance with API 670 include:

- Instrumentation to continuously measure the equipment temperature, vibration, and pressure levels
- Controls to regulate the system operation

7 BASEPLATE DESIGN

- Static and dynamic analysis of the baseplate performed to ensure optimum structural integrity
- Designs influenced by factors including; customer specifications, equipment setup, and conditions prevailing at site
- Baseplates are all welded fabrications constructed from high quality rolled steel sections

Optional arrangements + features

IMPELLER OPTIONS

- Low NPSHr single entry first stage as standard
- 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
- Cavitation visualisation rig testing capability
- Routinely NPSH tested

HYDRODYNAMIC BEARINGS

- Hydrodynamic double-acting thrust bearing used in conjunction with balance drum
- White metal lined hydrodynamic journal bearing
- Capable of higher load, higher speed operation
- Force-fed or self-contained options available
- Unlimited life dependent on oil cleanliness
- Optimum rotor stability
- Proven reliability in the most demanding service conditions

ROLLING ELEMENT BEARINGS

- Available depending on hydraulic balance arrangement and absorbed power
- Oil ring lubricated
- Self contained lubrication removes need for force-fed system
- Lower cost than hydrodynamic bearing, plus support system
- Rated for full radial and residual thrust load
- INPRO™ bearing isolators throughout give reduced contamination for improved sealing and bearing life

SHEAR RING DESIGN

- The CUP-BB5HP incorporates our pioneering 'Shear Ring' cartridge locking system
- Applicable at temperatures up to 120°C this system reduces cartridge change-out time by 70% compared to the conventional bolted end cover alternatives

WEAR PARTS

- Static, renewable wear parts, fitted to the casing are of solid one piece construction
- Impellers supplied with integral wear surface as standard. Option for renewable wear rings
- Materials selected for hardness differential and low galling properties
- Hard coatings (such as Tungsten Carbide) may be employed depending on service conditions and base material
- Solid sintered Tungsten Carbide used for extreme erosive conditions

FLEXIBLE OPERATION - DE-STAGING

- Cartridge can be supplied initially with 'spacer' stages to enable future uprating with the addition of impellers

CP SEAL SYSTEM OPTION

- Our patented CP System technology offers proven history in improving seal life, particularly under varying suction pressures
- The unique CP System design provides an excellent mechanical sealing environment in the most demanding process conditions

Global aftermarket capability best in service + 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

Parts + maintenance:
Any brand, any material, anytime.
Heritage products, upgrades + improvements

CUP-BB5HP

HEAVY DUTY, RADIALLY SPLIT, MULTI-STAGE PUMPS, API 610 / ISO 13709

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