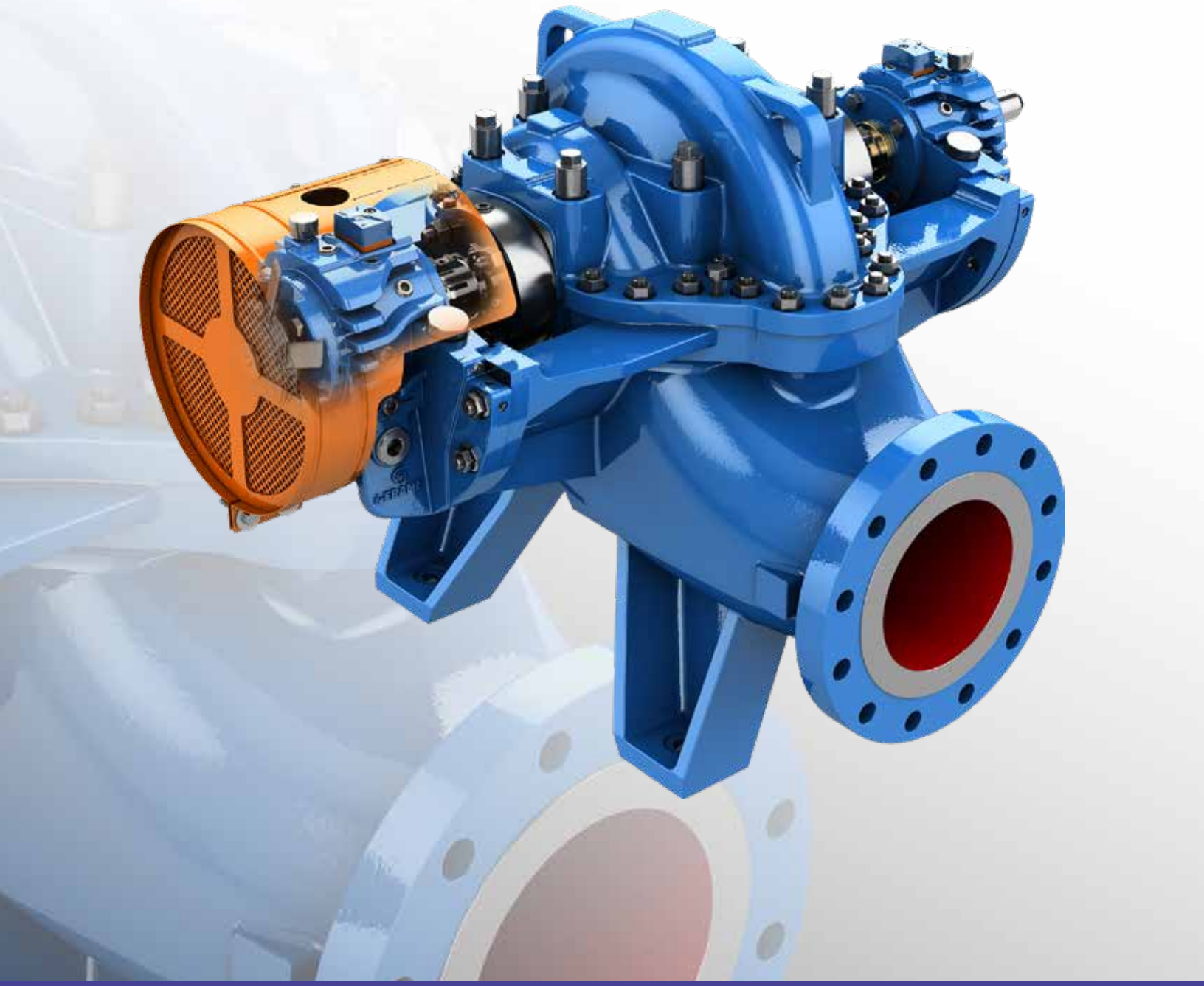
GOULDS PUMPS

An ITT Brand

Goulds API 3610 i-FRAME®

API 610 11th Edition / ISO 13709 2nd Edition

API BB1 Axially-Split, Between-Bearing Pump



3610 *i-FRAME®*

A Leader in API Engineered Pump Package Solutions…

Proven API Leadership

ITT Goulds Pumps is a proven leader in API Pumps

- Over 20,000 units installed
  - Over 17,000 OH2 / OH3s
  - Over 3,000 BB1 / BB2 / BB3 / BB5 pumps
- 50+ years of API expertise
- Participating member on API 610 and API 682 committees

Family of API Pumps

ITT Goulds Pumps has a family of proven API pumps:

- Overhung pumps
- Single and two-stage between-bearing
- Multistage between-bearing pumps – axially split
- Barrel multistage - radially split
- Vertical, double casing pumps
- Specialty pumps

Global Coverage

ITT Goulds Pumps has the global coverage needed to serve multi-national companies in any region.

Industry Leading Hydraulic Coverage

- We offer extensive coverage to meet your process needs.
- Better hydraulic fits can mean improved efficiency and long-term reliability and parts life.

8000 HP / 6000 kW Testing Capability

- Our expanded test facility can test your pump in the most demanding conditions.
- Testing at rated speeds is critical to assess the impact of dynamic conditions including vibration.

API Engineering Expertise

- We are experts in packaging engineered pumps that meet your demanding applications – with true conformance to the latest API specifications.
- We have extensive experience in nearly every type of driver, bearing, seal, piping configuration, nozzle configuration, flange and baseplate design to meet your application needs.
- ITT is a world leader in technology and engineering including hydraulics, materials science, mechanical design and fluid dynamics.

Broad Applications

- Petroleum refining, production and distribution
- Petrochemical and demanding chemical processing
- High temperature applications including boiler circulation
- General industrial requiring high temperature or high pressures

Double Suction API 610 / ISO 13709 Process Pump

- Designed for optimum reliability
- State-of-the-art mechanical design features
- 48 casing sizes – choice of impellers with most casings.

Brazil Refinery - Crude Transfer Pipeline 30x36-32
600 psi (42 Bar), 3500 HP (2600 kW)

Refinery in UAE - centerline mount for higher temperatures

Refinery Cooling Tower Service (Brazil)

Process Pumps that Meet or Exceed 610 API 11th Edition and ISO 13709 2nd Edition

Safety, reliability, and versatility are the key words for our double suction API 610 between-bearing (BB1) pump.

Safety and Reliability

We provide engineered solutions with true conformance to the latest API specifications. The result is a safe and rugged API process pump designed for a minimum of 20 year design life.

Versatility

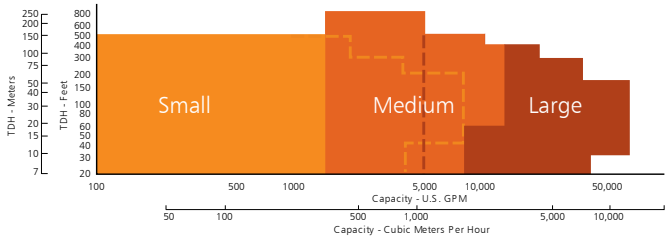
- Capacity to 50,000 GPM (11355 m^3/h)
- Total Dynamic Head to 700 feet (215 m)
- Temperature to 300° F (150°C)
  [Optional 400° F (205° C)]
- Pressure to 300 psig (21 bar)
  [Optional 600 psig (42 bar)]

Materials: Available in a wide range of materials including all API 610 constructions and custom application needs.

Engineered Hydraulics: Industry-leading hydraulic combinations to better match your process for efficiency and reliability. Custom hydraulics are available.

Engineered Packaging with a wide range of drivers, seals, piping, nozzle configurations, flanges, baseplates, and QC testing. Option of Near center line casing is available.

Optional Near Center Line Casing Mounting is Available.



3610 *i-FRAME*® (API BB1)

API 610 11th Edition / ISO 13709 2nd Edition
API BB1 Axially-Split, Between-Bearing Pump

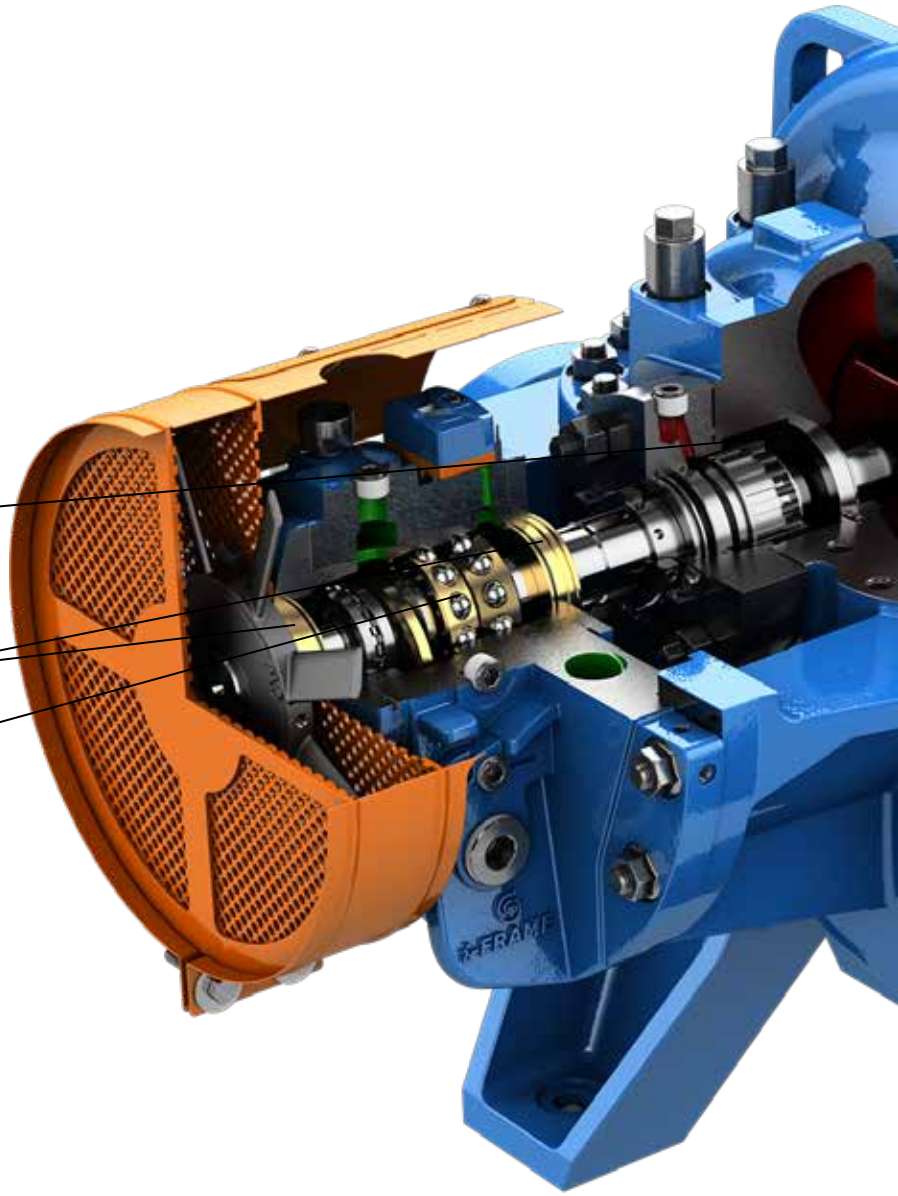
LARGE INLET AREAS
Reduce NPSH requirements and assure smooth, quiet flow to the impeller.

RENEWABLE IMPELLER WEAR RINGS
Positively locked on impeller hubs by axial set screws and protect impeller hubs from wear.

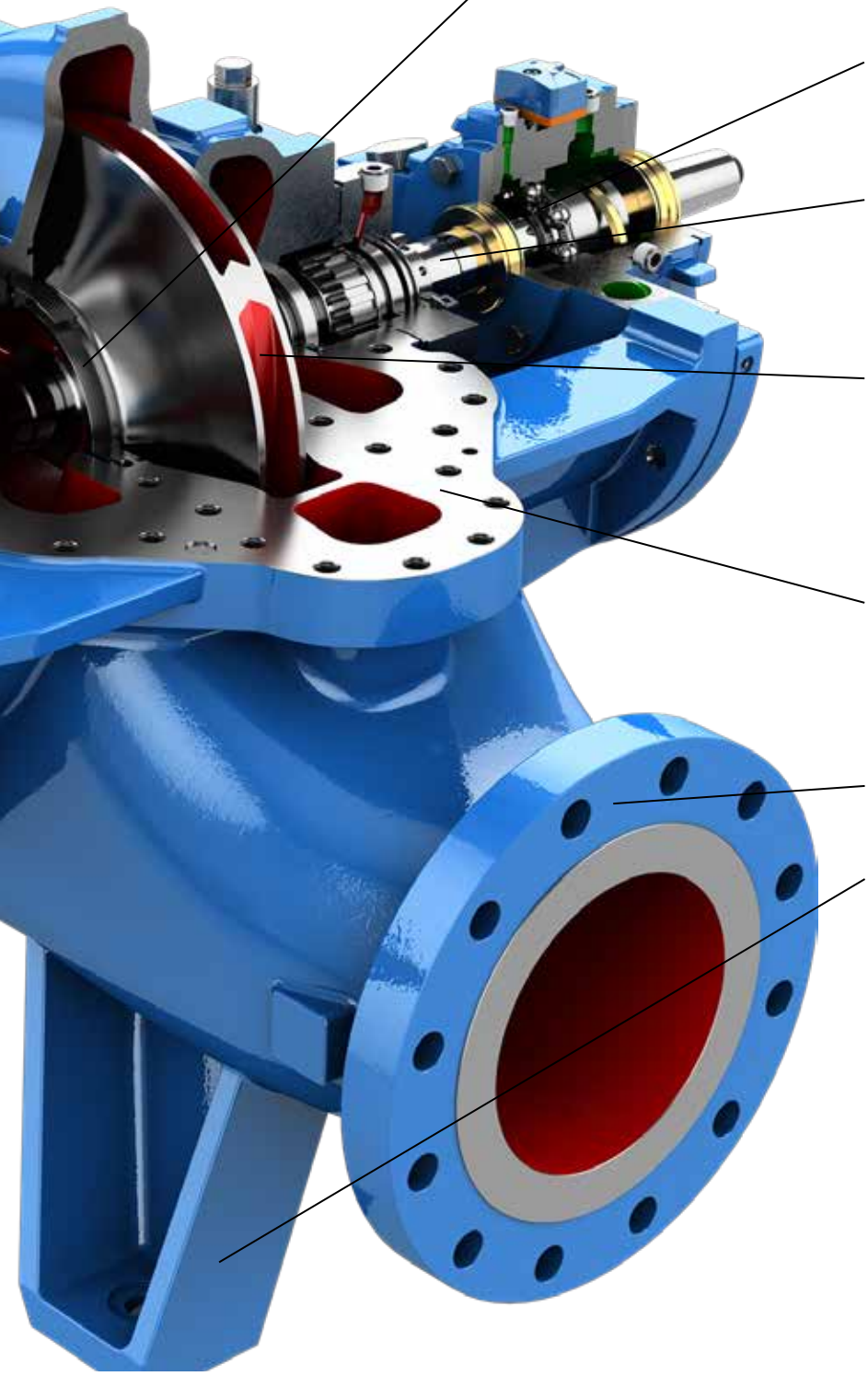
ENLARGED SEAL CHAMBERS
Conforms to API 610 / ISO13709 dimensional requirements. Allows use of a wide variety of API 610 / ISO 13709 cartridge mechanical seals.

LABYRINTH BEARING PROTECTION
Standard on all 3610 pumps. Significantly reduces the chance for bearing contamination and greatly improves mean time between failure.

HEAVY-DUTY THRUST BEARING
duplex 40 degree angular contact standard with ring oil lube.



Fully compliant to ISO 13709 and API 610 11th Edition.



RENEWABLE CASING WEAR RINGS
The rings are positively prevented from rotation by anti-rotation pins between the upper and lower half casings.

RADIAL BEARING
Deep grove ball bearing

HEAVY DUTY SHAFTS
Designed for minimum deflection in the toughest services means excellent shaft seal and bearing life. Sized to meet deflection and rotor dynamic requirements of API 610 / ISO 13709.

DOUBLE SUCTION IMPELLER
Minimizes axial thrust for longer bearing life. Polished waterways and fully machined exterior surfaces assure highly efficient performance. Dynamically balanced as standard for smooth operation.

AXIALLY-SPLIT HEAVY-DUTY CASINGS
Rugged foot-mounted design to resist external forces and vibration. Casings designed to withstand high working pressures with minimum distortion and are 100% hydrostatically tested. Suction and discharge connections are in the lower half casing, allowing removal of upper half casing for inspection or removal of complete rotating element without disturbing piping or driver.

CLASS 300 RF FLANGES STANDARD

FOOT-MOUNTED CASINGS
Heavy-duty mounting to accept API 610 / ISO 13709 nozzle loads and maintain pump alignment.

3610 i-FRAME®

Design Features for Optimum Reliability

Low Vibration / Smooth Performance

- Individual impellers and complete rotor assembly dynamically balanced.
- Precision cast impellers have equal volumes between vanes for reduced pressure pulsations.

Serviceability

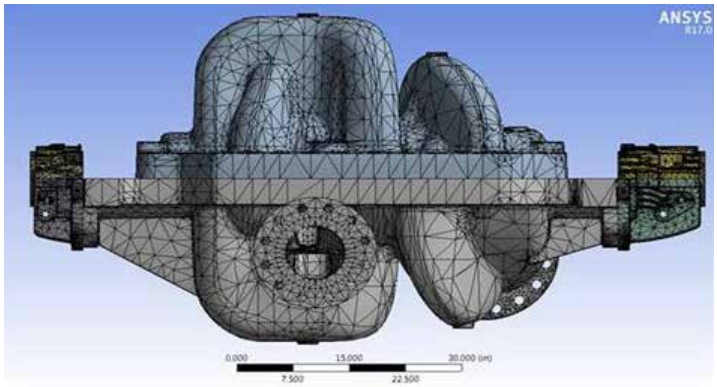
- Cartridge type mechanical seals for ease of assembly, proper installation.
- Single row bolting with stud nuts located on upper half for easy accessibility.

Entire rotating assembly can be removed for maintenance without disturbing suction/discharge piping.

Single row bolting simplifies disassembly / reassembly.

Design / Analysis Capabilities

Goulds utilizes FEA and CFD analysis to check the pressure capability, structure integrity of the casings and flow pattern in the pump. Goulds Engineering staff is fully equipped to perform the Rotor Lateral response analysis, Torsional analysis and Rotor residual unbalance checks to ensure stable operation, low vibration level and trouble free operation of the pumps.



Designed for API 610 11th Edition / ISO 13709 Services

- Casing, nozzles and baseplate meet API 610 / ISO 13709 nozzle load requirements.
- Impellers are secured against axial movement by impeller locknuts.
- Seal chambers meet dimensional requirements of API 610 / ISO 13709 and can be fitted with single, double or tandem cartridge mechanical seals.
- Non metallic rings available for applications with low specific gravity, or for increased efficiency or ability to withstand short periods of dry running
- Impellers and rotating equipment element dynamically balanced to API 610 / ISO 13709 requirements.

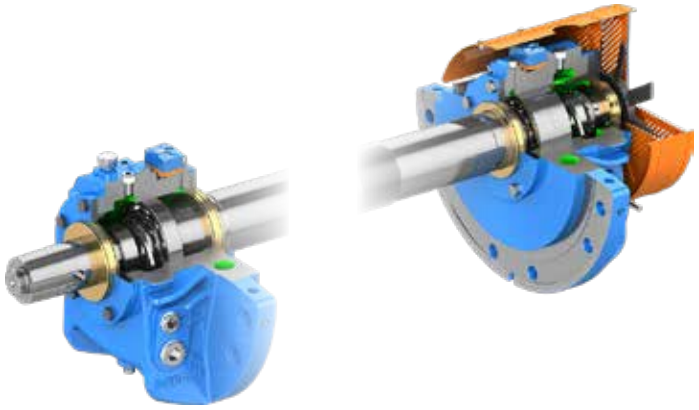
Optional Features for Application Flexibility

Bearing Arrangements

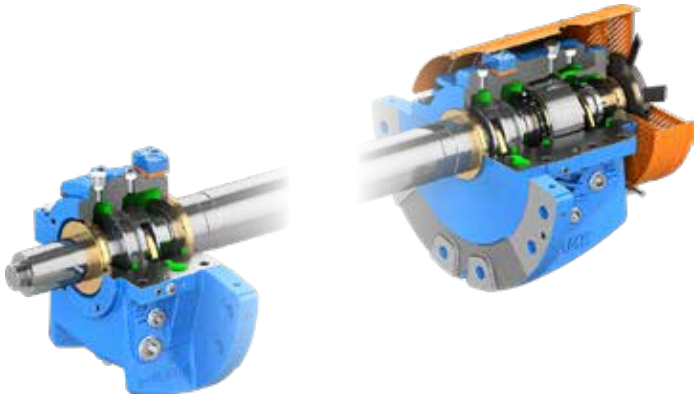
Oil lubricated Ball/Ball bearings are standard on the Model 3610. Ring oil lubricated Sleeve/Ball or pressure lubricated Sleeve/Tilt bearings can be furnished to meet customer or operating requirements.
Hydrodynamic bearings are offered with pressurized oil lube system.

Instrumentation

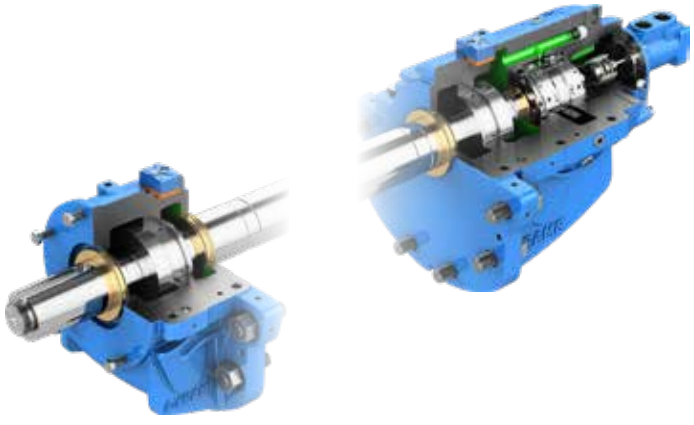
The 3610 can be furnished with instrumentation options to measure vibration and temperature. RTDs or thermocouples can be furnished to measure bearing temperatures and to monitor temperature rise in the casing. Bearing housing vibration can be monitored on pumps furnished with ball bearings. Pumps supplied with sleeve bearings can be furnished with non-contacting vibration probes to measure actual rotor vibration.



Ball / Ball



Sleeve / Ball



Sleeve / Tilt

Bearings & Bearing Housings

To get superior MTBF you need two things: Optimum pump hydraulics and a robust pump structure. The new i-FRAME housings delivers on the second point by providing a premium robust housing with unique new and improved features that raises the bar on what you can expect from your pump's long term performance. These i-FRAME bearing housings include the new patented one piece design bearing housing for the ball/ball bearing arrangement, as well as the patent pending split bearing housing for the sleeve/ball and sleeve/tilt pad bearing arrangement.

Bearing housings constructed in ASTM A216 Grade WCB carbon steel. Three bearing arrangements available:

- Ball/Ball bearings
  - Duplex 40° Angular Contact Bearing Set on the Non-Drive End (NDE) to handle radial and axial loads. Bearing set is supplied with a light clearance
  - Deep Groove Ball Bearing on the Drive End (DE) to handle radial loads

- Sleeve/Ball bearings
  - Duplex 40° Angular contact Bearing Set on the Non-Drive End (NDE) handle axial loads. Bearing set is supplied with a light clearance.
  - Babbitt lined Sleeve Bearings handle radial loads on NDE and DE (Non Drive End and Drive End)

- Sleeve/Tilt pad bearings
  - Babbitt lined Sleeve Bearings handle radial loads and are installed on NDE and DE (Non Drive End and Drive End).
  - Tilting pad Bearings are installed on NDE to handle axial load.
  - This bearing configuration utilizes an external pressurized LOS to lubricate and cool the bearings. Both API, standard and custom designed systems can be offered.

All bearing housings feature a 180° bearing saddle bolted to the casing positioned with precision dowels for accurate, repeatable alignment. The 180° bearing saddle is optimized for stiffness and rigidity of connection between the pump casing and housing along with increased bolt diameters. This provides significantly increased stiffness compared to the previous design housings, resulting in reduced vibration.

The bearing housing exterior includes distinctive cooling fins optimized by CFD/FEA analysis to aid in heat dissipation.

The Ball/Ball and Sleeve/Ball i-FRAME bearing housings have enhanced air cooling with axial fans and achieves metal and oil temperature reductions of up to 30° F from previous design without the need for cooling water. The NDE side comes standard with a guarded extension to accept a fan for ease of field retrofit, so if your process needs change the fan can be fitted without the need for expensive pump disassembly and installation.

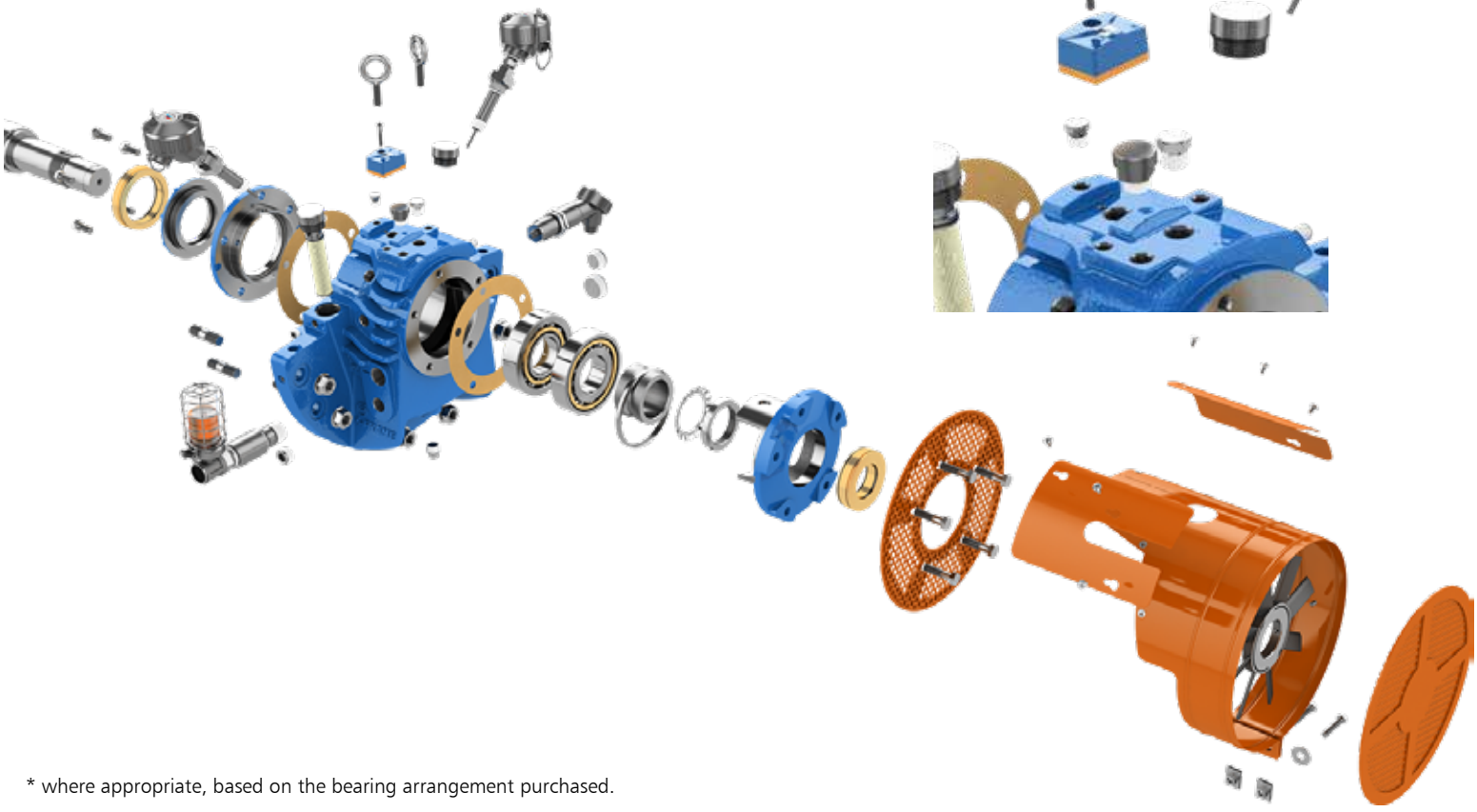
Bearing housing put through rigorous testing.

Patented Filters and Monitoring

Bearing oil contamination by wind-blown sand and dust together with atmospheric moisture are major contributors to bearings failing well before their design life. In an industry first, all self-contained bearing housings include a cartridge filter assembly that will help safeguard the bearing oil from debris contamination. The patent pending filter cartridge will also continuously work to scrub dissolved water from the bearing oil utilizing specifically engineered moisture absorbing materials built into the filter. The design allows for easy changeover of filter cartridges even while the pump is operating – no need to stop your process. All this additional reliability is achieved ***without*** the need for additional oil pumps or piping – no additional system complexity, monitoring or control overhead.

Another smart feature included as standard is the award winning, i-ALERT. This provides class leading continuous machine monitoring with comprehensive wireless reporting including diagnostic quality vibration FFTs and operating history to the mobile phone or tablet of your choice. The bearing housings come equipped ***as standard*** with constant level oilers*, sight window* and provisions for instrumentation including: RTD's, proximity probes*, and accelerometers. If your monitoring needs change in the future, this comprehensive approach allows field retrofitting of almost any monitoring scheme without replacing your bearing housings or relying on ad-hoc instrument mounting.

It is important to note these new i-FRAME bearing housings are not interchangeable with the previous design.



* where appropriate, based on the bearing arrangement purchased.

i-ALERT® Monitoring Solution

Sensor | App | Ai Platform

www.i-alert.com

Bluetooth®

What it Does:

Monitor
Tracks vibration, temperature & run-time hours 24/7/365.

Alarm
Takes high resolution data when an alarm condition occurs and stores it for later analysis.

Trend
Captures data every 1-60 minutes and has up to 170 days of hourly on-board storage.

Analyze
Diagnose machine faults with vibration tools
Fast Fourier Transform (FFT) & Time Wave Form Analysis.

Environment
Rated for any industrial environment. water & dust resistant.
Intrinsically Safe with a 3-year battery life (use dependent).
- ATEX Zone 0 AEx ia IIB Ga (Groups C & D)

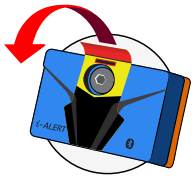
Wireless
Sync data via Bluetooth Smart enabled smartphones and tablets.

Online Monitoring
Monitor and manage all of your i-ALERT enabled machines in one place - i-ALERT Ai Online Platform. This subscription service requires no software to download or dedicated hardware to run.

Spend less time collecting data and more time fixing problems. The i-ALERT mobile app has the ability to scan multiple i-ALERT2 sensors within range to quickly and safely inspect multiple machines.

How it Works:

1. ACTIVATE
The i-ALERT2 devices are light activated by removing the sticker. The sensor begins wirelessly broadcasting once activated.



2. AUTO CONFIGURATION
The i-ALERT device averages the vibration over 25 hours of run-time and sets the alarm levels to 2 x average (0.1-1.5ips minimum). Temperature alarm default to 80°C (176°F)

OR

2. MANUAL CONFIGURATION
User manually sets the alarm thresholds via the i-ALERT mobile application.

3. Monitor
The i-ALERT2 sensor is configurable to check every 1-5 minutes. If two consecutive readings are above alarm threshold the i-ALERT device will go into alarm.

Dashboard
Simple, intuitive dashboard to track vibration, temperature, run-time & battery life.

Trending
Trend vibration, temperature, & kurtosis to monitor any changes in the equipment operation.

BOM
Load the as built of materials based on the pump serial number.

Materials of Construction

Part Description	S-4	S-6	C-6	A-8
Casing	Carbon Steel	Carbon Steel	12% Chrome	316 SS
Impeller	Carbon Steel	12% Chrome	12% Chrome	316 SS
Shaft	Carbon Steel	Carbon Steel	12% Chrome	316 SS
Impeller Locknut	12% Chrome Hard[1]	12% Chrome Hard[1]	12% Chrome Hard[1]	316 SS Hard
Casing Wear Ring	Cast Iron	12% Chrome Hard[1]	12% Chrome Hard[1]	316 SS Hard
Bearing Housings	Carbon Steel			
Impeller Wear Ring	Cast Iron	12% Chrome Hard[1]	12% Chrome Hard[1]	316 SS Hard

[1]Also available in hardened/hard metal coated materials.

Refinery Cooling Tower Service (Brazil)

Refinery Crude Oil Service (Middle East)

Offshore Platform Service (Gulf of Mexico)

Cooling Water Service (Canadian Oil Sands)

A Leader in API Engineered Pump Package Solutions

API Family of Pumps

Model 3700
OH-2

Model 3910
OH-3

Model 3620
3640
BB-2

Model 3610
BB-1

API Type	Goulds Model	Capacity GPM (M³/Hour)	TDH Feet (Meters)	Temperature °F (°C)	Pressure PSIG (kg/cm2)
OH-2	3700	8500 (1930)	1200 (360)	800 (425)	870 (60)
OH-3	3910	6000 (1360)	750 (230)	650 (340)	600 (42)
BB-1	3610	50000 (11355)	700 (215)	300 (150)	300 (21)
BB-2	3640	7500 (1700)	2500 (760)	850 (455)	1130 (75)
BB-2	3620	20000 (4540)	1500 (455)	850 (455)	1000 (70)
BB-3	3600	8500 (1930)	9000 (2740)	400 (205)	4000 (275)
BB-5	7200CB	4000 (910)	9000 (2740)	800 (425)	4000 (275)
VS4	API 3171	3180 (720)	525 (160)	450 (232)	750 (50)
VS1	VIT	70000 (14760)	3500 (1060)	500 (260)	2500 (175)
VS6	VIC	70000 (14760)	3500 (1060)	500 (260)	2500 (175)

Model 3600
BB-3

Model 7200CB
BB-5

GOULDS PUMPS
An ITT Brand

240 Fall Street
Seneca Falls, NY 13148
Phone: 315.568.2811
Fax: 315.568.2418
www.gouldspumps.com

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