Goulds 3640 i-FRAME®
API BB2 Two-Stage, Between-Bearing, Radially Split
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 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
Goulds Model 3640 between-bearings radially split process pumps are designed for smooth, reliable operation, and meet the toughest specification requirements of API 610 / ISO 13709 to assure extended service life.

Safety and Reliability
We provide engineered solutions with true conformance to the latest API specifications including the stringent emissions containment per API 682.

The result is a safe and rugged between-bearing API process pump designed for a minimum 20-year life.

Versatility
- Capacity to 7,500 GPM (1700 m³/h)
- Total Dynamic Head to 2,500 feet (760 m)
- Temperature to 850° F (455° C)
- Pressure to 1,130 psig (75 bar)

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

Engineered Hydraulics: Dense hydraulic coverage 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, base plates, and QC testing.

Applications
- Refinery: Process feed, reflux, splitter bottoms, high-pressure process transfer
- Boiler Feed Booster

3640 i-FRAME™ Bearing Housing Features
- This modern i-FRAME™ Ball/Ball design bearing housing comes standard on all Goulds between-bearings pumps. A revolutionary oil capture and delivery system provides consistent lubrication to lower bearing temperatures and optimize bearing life.
- See the difference
  - Patent Pending Oil Filter Assembly removes debris and moisture
  - Optimized Housing Design Lowers bearing temperatures up to 6.7 + °C (20 + °F)
  - i-ALERT2 Machine Health Monitor identifies potential problems before they become costly failures
  - Instrumentation provisions as standard

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3640 i-Frame® (API BB2)

API BB2 Two-Stage, Between-Bearing, Radially Split

HEAVY DUTY SHAFT
Minimum shaft deflection for extended seal bearing life. Sized to meet deflection and rotor dynamics requirements of API 610 / ISO 13709.

HEAVY DUTY RADIAL BEARING STANDARD

RENEWABLE WEAR RINGS
API 610 / ISO 13709 running clearances. Positively locked.

CENTERLINE MOUNTED CASING
Heavy duty mounting extensions accept API 610 / ISO 13709 nozzle loads and maintain pump alignment under extreme service conditions.
CLASS 300 RF FLANGES STANDARD
Other classes and facings optional.

RADially SPLIT CASING
Designed specifically for high pressure / high temperature services. Fully confined controlled compression gaskets assure leak-proof sealing.

CASING HEAD ON OUTBOARD END
Allows removal of rotor without disturbing suction and discharge piping.

ENLARGED SEAL CHAMBERS
Conform to API 610 / ISO 13709 dimensional requirements. Allows use of wide range of API 682 / ISO 21049 cartridge mechanical seals to meet specific service conditions.

HEAVY DUTY THRUST BEARING
Duplex 40° angular contact standard. Ring oil lubricated. Other bearing configurations available to meet specific service requirements.

OPPOSED IMPELLERS ARRANGEMENT
Reduced axial forces for maximum bearing life. Impellers are driven by individual keys and positioned on shaft by dual locknuts. Staggered impeller vane tips for reduced pressure pulsations at vane passing frequency. Double suction first stage impeller available as an option. Single suction impeller is standard.
3640 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.

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

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 3640. 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.

Double Suction First Stage Impeller
Available on 4-inch and larger discharge size pumps for services where NPSH<sub>A</sub> is limited.

Instrumentation
The 3640 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.
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.

Bearings & Bearing Housings

- 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.
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

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.

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.

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.
Flow Capacity – 50 Hz

Flow Capacity – 60 Hz

Note: Hydraulics above represent 80% to 110% of best efficiency point (BEP).

**PRO Services® Engineered Upgrade**
Example of our PRO Services® Engineered upgrade capability. The following two-stage API BB2 Model 3640 was upgraded from an old edition of API 610 to the lastest (11th) edition of API.

Original Pump 10th Edition Upgrade
A Leader in API Engineered Pump Package Solutions

API Family of Pumps

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<tr>
<th>API Type</th>
<th>Goulds Model</th>
<th>Capacity GPM (MPH)</th>
<th>TDH Feet (Meters)</th>
<th>Temperature °F (°C)</th>
<th>Pressure PSIG (kPa/cm²)</th>
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<tbody>
<tr>
<td>OH-2</td>
<td>3700</td>
<td>8500 (1360)</td>
<td>1200 (360)</td>
<td>800 (45)</td>
<td>870 (60)</td>
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<tr>
<td>OH-3</td>
<td>3910</td>
<td>6000 (1360)</td>
<td>750 (230)</td>
<td>650 (340)</td>
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<td>BB-1</td>
<td>3610</td>
<td>50000 (11355)</td>
<td>700 (215)</td>
<td>300 (130)</td>
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<td>1500 (760)</td>
<td>850 (455)</td>
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<td>3620</td>
<td>20000 (4540)</td>
<td>1500 (455)</td>
<td>850 (455)</td>
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<td>7230GC3</td>
<td>4000 (610)</td>
<td>9000 (2740)</td>
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<td>VS4</td>
<td>API 3171</td>
<td>3180 (720)</td>
<td>525 (160)</td>
<td>450 (232)</td>
<td>750 (50)</td>
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<td>VI3</td>
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<td>3500 (1060)</td>
<td>500 (260)</td>
<td>2500 (175)</td>
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<td>VI3</td>
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<td>3500 (1060)</td>
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<td>2500 (175)</td>
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An ITT Brand

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