Goulds HT 3196i-FRAME™
High-Temperature Process Pumps with i-ALERT™ Patented Intelligent Monitoring

Engineered for life
Global ANSI
Process Pump Leader

Introducing the newest member to the world’s most popular ANSI pump family... HT 3196 i-FRAME™

Goulds HT 3196 i-FRAME Severe Duty Process Pump
- Capacities to 4,500 gpm (1,023 m³/hr.)
- Heads to 925 ft (282m)
- Temperatures up to 700°F (372°C)
- Pressures up to 450 Psig (3,102 kPa)

- Material of Construction
  • Carbon Steel
  • Duplex SS (CD4MCu)
  • Ductile Iron
  • Alloy 20
  • 316SS Stainless Steel
  • Hastelloy C

- Performance Features for Extreme Temperatures
  Extended Pump Life
  • Centerline mounted design allows bi-directional thermal expansion which maintains shaft alignment for improved seal and bearing life
  • Comprehensive range of seal chambers including patented TaperBore Plus™ and Big Bore™ designs maintain cool and clean seal environments critical for extended seal life
  • i-FRAME Power ends featuring heavy duty, large capacity oil sump with finned tube oil cooler maintains cooler oil temperatures for extended bearing life

- Reduced Maintenance Cost
  • Interchangeability with 3196 reduces MRO inventories (All parts except casing are the same as 3196)
  • Standard ANSI dimensions simplify installation and support pump retrofits of standard foot mounted design
  • Back-pull out design facilitates safe and simple maintenance activities

- Markets
  • Chemical/Petrochemical
  • Food & Beverage
  • Pharmaceutical
  • Rubber & Plastic Manufacturing
  • Pulp & Paper
  • Power/Utility

- Applications
  • Hot Water
  • Thermal Oils / Heat Transfer Fluids
  • Die/Mold Pre-heating Systems
  • Pilot Plants
  • Electronic Heating and Cooling
  • Reactor Heating
  • Urea
The HT 3196 is \textit{i-FRAME}™ furnished with the following standard features:

- Centerline-mounted casing
- ANSI Class 300 RF flanges
- Graphite casing gasket
- Graphite impeller O-ring
- High temperature bolting
- Stainless steel shaft
- Finned tube oil cooler

Thermal expansion due to high temperature process fluids handling is optimally controlled with centerline mounted casings. Centerline mounting minimizes shaft misalignment since the casing can expand bi-directionally. This same feature minimizes pipe strain as the casing is permitted to grow in two directions theoretically negating strain on suction piping.

ANSI Class 300 raised face flanges provide a positive sealing surface to prevent tough-to-seal liquids like hot hydrocarbons and heat transfer liquids from escaping into your regulated environment.

The HT 3196 \textit{i-FRAME}™ delivers...

\textbf{ANSI and PIP Compliance}

ANSI B73.1M and PIP RESP 73H-97 dimensional compliance and rugged construction for proven performance. Heavy duty centerline mounted casing stabilizes shaft alignment and minimizes piping strain while compensating for thermal expansion when pumping fluids up to process temperatures of 700° F (372° C).

\textbf{Sealing Flexibility}

The HT 3196 \textit{i-FRAME} offers the industry’s greatest cartridge sealing flexibility with optimum seal environments including Standard Bore, Big Bore and Goulds patented Taper Bore Plus™ with VPE rings. Jacketed seal chambers are available for controlling the temperature of the mechanical seal’s environment and maximizing seal life. High performance, high temperature cartridge mechanical seals are available from nearly all manufacturers for optimum sealing reliability.

\textbf{High Alloy Availability}

Liquid ends are available in Carbon Steel, Ductile Iron, 316SS, CD4MCu, Alloy 20 and Hastelloy C constructions to provide materials flexibility for pumping heat transfer fluids, hot oils and moderate to highly aggressive hot chemicals.

\textbf{Interchangeability}

Completely interchangeable with the Goulds model 3196 \textit{i-FRAME}, the world’s most installed ANSI process pump. All internal components are common between models except for the casing. The \textit{i-FRAME} power end provides common inventory for models 3196, CV 3196, HT 3196, LF 3196, NM 3196, 3198 and 3796.

\textbf{Lead-times}

Maximized parts interchangeability with the Goulds 3196 \textit{i-FRAME} results in optimized lead-times with our ANSI product line for fast response to customer needs.

\textbf{Five-Year Standard Warranty}

\textit{i-FRAME} pumps feature a 5-year warranty that acknowledges superior performance, optimum run time, and extended pump life.
High Temperature Oils and Heat Transfer Fluids
The use of synthetic heat transfer liquids continues to expand as these liquids offer chemical stability and efficient heat transfer properties. In addition, the use of these liquids allows system pressures to be reduced for added safety and lower design costs. Hot natural oils and synthetic oils are used in heat transfer, food processing, oil refining and petrochemical mining applications. Some applications for hot oils and heat transfer fluids include computer and power supply, energy storage, transformer cooling, recirculating chillers, train traction rectifiers, re-flow soldering, industrial processing, pharmaceutical processing and semiconductor processing.

High Temperature Chemical Processing
The Goulds HT 3196 ™-FRAME™ features superior chemical corrosion resistance through optimal manufacturability of high alloy wetted pump components. Offered in Carbon Steel, Ductile Iron, 316ss, CD4MCu, Alloy 20 and Hastelloy C, the HT 3196 ™-FRAME™ provides a well-rounded selection of materials to maximize pump life when pumping hot, aggressive solvents, acids and chlorides. High temperature fluid applications include asphalt, tars, Naphtha, Naphthalene, aromatics, hydrocarbons, urethanes, epoxies, paints, zinc compounds, magnesium compounds, adhesives, plastisizers, polymers, monomers, resins, oxide slurries, pigments, dyes, inks and many more.

Bonus Interchangeability
™ Power Ends Fit 7 Different Process Pumps
Minimize inventory, reduce downtime.

High Temperature Pumping Expertise
In addition to ANSI Process Pump Expertise, ITT-Goulds Pumps delivers decades of premier experience in centerline mounted, high temperature pump applications with thousands of pump models installed including the Models 3700, 3910, 3900, 3600, 3620, 3640, 3181, and high temperature vertical turbine pumps.
Goulds HT 3196 LF i-FRAME™
Designed for High Temperature, Low Flow Services

**Reduced Radial Loads For Optimum Reliability**
Radial loads are reduced by as much as 85% compared to end suction expanding volute pumps at low flows. Bearing, mechanical seal and overall pump life are optimized.

<table>
<thead>
<tr>
<th>LOW FLOW OPERATING RANGE — GPM</th>
<th>EXPANDING VOLUTE PUMP</th>
<th>HT 3196 LF i-FRAME PUMP CURVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>INCREASING RADIAL LOAD</td>
<td>85% Reduction</td>
<td>Circular Volute</td>
</tr>
</tbody>
</table>

**Options High and Low Temperature Capability**
Goulds offers users a variety of options to meet specific plant and process requirements.

- **HEAT JACKET**
  Economical clamp-on jacket provides practical method of heating or cooling the casing. Excellent heat transfer characteristics. Easy to install or remove for pump servicing.

- **JACKETED SEAL CHAMBER**
  Maintains proper temperature control of sealing environment. Ideal for maintaining temperature for services such as molten sulphur and polymerizing liquids. Available in BigBore™ and TaperBore™ designs.

- **CUSTOM FITTED INSULATED FABRIC THERMAL JACKET**
  Insulates and provides thermal retention of the process fluid within the pump. Insulation jackets are custom fitted and easily removable for installing and servicing the pump.

**High Temperature Seal Selection**

**Shaft Sealing Systems**
The most difficult challenge for pumping hot fluids is to effectively seal the rotating shaft from emitting excessive or undesirable fluids into the atmosphere for the purposes of safety and equipment reliability. The selection of the optimum sealing device for specific pumping systems is simplified by combining the world’s premier sealing suppliers with the perfect high temperature pumping system.

- Single and dual cartridge mechanical seals for moderate temperature applications.

Multiple high temperature sealing devices and mechanical seal flushing systems are designed and available for a multitude of challenging high temperature sealing applications. The standard HT 3196 i-FRAME configuration includes graphite packing rings in a standard bore box for basic high temperature fluid applications.

- Single and dual cartridge mechanical seals for high temperature applications.
Seal Flush Plans

All ANSI B73.1 seal flush and cooling plans are available to control emission levels and meet seal installation requirements. Goulds can also provide other special arrangements of user preference.

CPI PLAN 7311
By-pass flush
lubricates single seal faces.

CPI PLAN 7353
Pressurized circulation
lubricates double seal faces.

Engineered Seal Chamber Selection Guide

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>Water-Based Liquids with Flush</th>
<th>Entained Air or Vapor</th>
<th>Solids 0-10%, no Flush</th>
<th>Solids Greater than 10% with Flush</th>
<th>Paper Stock 0-5%, no Flush</th>
<th>Paper Stock 0-5%, with Flush</th>
<th>Skimmed Water 0-5%, no Flush</th>
<th>Skimmed Water 0-5%, with Flush</th>
<th>High Boiling Point Liquids, no Flush</th>
<th>Temperature Control</th>
<th>Self-Venting and Draining</th>
<th>Seal Face Heat Removal</th>
<th>Molten or Polymerized Liquid, no Flush</th>
<th>Molten or Polymerized Liquid with Flush</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>A</td>
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<td>A</td>
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## Baseplate Selection Guide

**PLANT REQUIREMENTS**

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<tr>
<th>Requirement</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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<tbody>
<tr>
<td>Corrosion Resistance (mild/moderate)</td>
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<tr>
<td>Corrosion Resistance (severe)</td>
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<tr>
<td>Machined Pump &amp; Motor Parts</td>
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<tr>
<td>Circular Grout Holes (4 in. min.)</td>
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<tr>
<td>Vent Holes (1 in. min.)</td>
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<tr>
<td>Vent Holes (1/2 in. min.)</td>
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<tr>
<td>Non-Overhang</td>
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<tr>
<td>Full Drain Rim</td>
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<tr>
<td>Built-in Drain Pan (under pump)</td>
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<tr>
<td>Drain Pan Under Pump</td>
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<tr>
<td>Baseplate Leveling Screws</td>
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<tr>
<td>Motor Alignment Adjusters</td>
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<tr>
<td>Lifting Feature</td>
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<td>Continuous Welding Used</td>
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<tr>
<td>Flexibly Mounted</td>
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<tr>
<td>Spring Loaded*</td>
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<tr>
<td>Available in 304 and 316 SS</td>
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<tr>
<td>ANSI B73.1-1991 Conformance</td>
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<tr>
<td>ANSI-610 Conformance</td>
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<tr>
<td>PIP RESP 002 Conformance</td>
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</table>

*Engineered option—requires special baseplate

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**Construction Details**

All dimensions in inches and (mm).

### Shaft

<table>
<thead>
<tr>
<th>Diameter at Impeller</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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<tbody>
<tr>
<td></td>
<td>.75</td>
<td>1</td>
<td>1.25</td>
<td>1.5</td>
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<table>
<thead>
<tr>
<th>Diameter in Stuffing Box/Seal Chamber (Less Sleeve)</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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</thead>
<tbody>
<tr>
<td>(With Sleeve)</td>
<td>1.375</td>
<td>1.75</td>
<td>2.125</td>
<td>2.5</td>
</tr>
<tr>
<td>(With Sleeve)</td>
<td>1.125</td>
<td>1.5</td>
<td>1.875</td>
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<table>
<thead>
<tr>
<th>Diameter Between Bearings</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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</thead>
<tbody>
<tr>
<td>(With Sleeve)</td>
<td>1.5</td>
<td>2.125</td>
<td>2.5</td>
<td>3.125</td>
</tr>
<tr>
<td>(With Sleeve)</td>
<td>1.5</td>
<td>2.125</td>
<td>2.5</td>
<td>3.125</td>
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<table>
<thead>
<tr>
<th>Overhang</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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</thead>
<tbody>
<tr>
<td>(With Sleeve)</td>
<td>6.125</td>
<td>8.375</td>
<td>8.375</td>
<td>9.969</td>
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<table>
<thead>
<tr>
<th>Maximum Shaft Deflection</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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<tbody>
<tr>
<td>(With Sleeve)</td>
<td>0.002</td>
<td>(0.05)</td>
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<table>
<thead>
<tr>
<th>Shaft Deflection Index (L3/D4)</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
</tr>
</thead>
<tbody>
<tr>
<td>(With Sleeve)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(With Sleeve)</td>
<td>143</td>
<td>116</td>
<td>48</td>
<td>62</td>
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<tr>
<td>(Less Sleeve)</td>
<td>64</td>
<td>63</td>
<td>29</td>
<td>25</td>
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<table>
<thead>
<tr>
<th>Sleeve O.D. thru Stuffing Box/Seal Chamber</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
</tr>
</thead>
<tbody>
<tr>
<td>(With Sleeve)</td>
<td>1.375</td>
<td>1.75</td>
<td>2.125</td>
<td>2.5</td>
</tr>
<tr>
<td>(With Sleeve)</td>
<td>1.375</td>
<td>1.75</td>
<td>2.125</td>
<td>2.5</td>
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<table>
<thead>
<tr>
<th>Bearings</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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<tr>
<td>Radial</td>
<td>6207</td>
<td>6309</td>
<td>6311</td>
<td>6313</td>
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<tr>
<td>Thrust</td>
<td>3306</td>
<td>3309</td>
<td>7310</td>
<td>3313</td>
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<table>
<thead>
<tr>
<th>Bearing Span</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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<tr>
<td></td>
<td>4.125</td>
<td>6.75</td>
<td>6.875</td>
<td>9.25</td>
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<table>
<thead>
<tr>
<th>BigBore™ Seal Chamber</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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<tbody>
<tr>
<td>Bore</td>
<td>2.875</td>
<td>2.5</td>
<td>2.875</td>
<td>3.375</td>
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<table>
<thead>
<tr>
<th>Power Limits</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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</thead>
<tbody>
<tr>
<td>HP (kW) per 100 RPM</td>
<td>1.1</td>
<td>3.4</td>
<td>5.6</td>
<td>14</td>
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<table>
<thead>
<tr>
<th>Temperature</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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<tbody>
<tr>
<td>Maximum Liquid Temperature—Oil/Grease Lubrication</td>
<td>350°F</td>
<td>(177°C)</td>
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</tr>
<tr>
<td>Maximum Liquid Temperature—Oil Lubrication with High Temp. Option</td>
<td>700°F</td>
<td>(370°C)</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Casing</th>
<th>STf</th>
<th>MTf</th>
<th>LTf</th>
<th>XLTf</th>
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</thead>
<tbody>
<tr>
<td>Corrosion Allowance</td>
<td>125</td>
<td>(3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 17 inch sizes have 2% inch (57) shaft diameters in stuffing box/seal chamber with sleeve. Shaft sleeve O.D. is 2% inches (70) for packing and 2% inches (64) for mechanical seals.

** 17 inch sizes power limit per 100 RPM is 20HP (15kW).
HT 3196 i-FRAME™ High-Temperature Process Pumps

Featuring i-ALERT™ Patented Monitoring

**i-ALERT CONDITION MONITOR** (PATENT PENDING)
- Constantly measures vibration and temperature at the thrust bearing. Colored LED's indicate general pump health. Provides early warning of improper operation before catastrophic failure occurs.

**INPRO VBXX-D HYBRID LABYRINTH SEALS**
- Prevents premature bearing failure caused by lubricant contamination or loss of oil. Stainless steel rotors for optimal performance in corrosive environments.

**CONTINUOUS RENEWABLE PERFORMANCE**
- Original flow, pressure and efficiency are maintained by simple external adjustment resulting in long-term energy and repair parts savings.

**HEAVY DUTY SHAFT AND BEARINGS**
- Rigid shaft designed for minimum deflection at seal faces — less than 0.002 in. (.05 mm). Bearings sized for 10-year average life under tough operating conditions. Available with or without shaft sleeve.

**OPTIMIZED OIL SUMP DESIGN**
- Increased oil capacity provides better heat transfer for reduced oil temperature. Bearings run cooler and last longer. Contaminants directed away from bearings to magnetic drain plug.

**ONE-INCH BULLS EYE SIGHT GLASS**
- Assures proper oil level critical to bearing life. Allows visual inspection of the oil condition. Bottle oiler optional.

**FINNED TUBE OIL COOLER**
- Delivers supplemental cooling to the oil sump for high process fluid operating temps.

**RIGID FRAME FOOT**
- Reduces effects of pipe loads on shaft alignment; pump vibration reduced. Especially significant for high process fluid operating temperatures.

**MAGNETIC DRAIN PLUG**
- Standard magnetic drain plug helps protect bearings and prolong life.

**MTI POWER END**
- Designed for reliability, and extended pump life supported by a 3-year warranty.

**DUCTILE IRON FRAME ADAPTER**
- With material strength equal to carbon steel for safety and reliability.

**HIGH-STRENGTH A193 B7 STEEL BOLTS AND STUDS**
- Extends the pressure and temperature retaining capabilities while enhancing safety.

**TOP CENTERLINE DISCHARGE**
- For optimum air handling and self-venting by design.

**CARBON GRAPHITE CASE GASKET AND IMPELLER O-RING**
- For positive sealing at elevated temps.

**ANSI CLASS 300 CASING**
- Wall thickness increases reliability and longer casing life.

**FULLY OPEN IMPELLER**
- Preferred design for handling solids that also allows adjustment to maintain original efficiencies over time.

**ANSI CLASS 300 FLANGES**
- Raised face flanges for positive sealing and high-pressure retention and stability at high operating temps comply with ANSI B16.5 requirements.

**HEAVY-DUTY STEEL CASING SUPPORT**
- Rigid design prevents against distortion caused by pipe strain to maintain shaft alignment. Mounting dimensions are identical to foot-mounted pumps, which makes retrofits simple and extends interchangeability.

**LOW-THERMAL CONDUCTIVITY 316SS SHAFT**
- Provides optimum heat dissipation to protect bearings. Minimizes heat transfer from pumpage through shaft to bearings. Bearings run cooler and last longer.

**CENTERLINE MOUNTING**
- Allows for bi-directional thermal growth which minimizes shaft deflection and flange loading for improved seal and bearing life.
Goulds Patented i-FRAME™ Power Ends

Extended Pump Life Through Intelligent Design

Goulds i-FRAME Power Ends are the result of 160 years of design experience, customer interaction, and continuous improvement. Customers get extended Mean Time Between Failure (MTBF) and lower life cycle costs (LCC)... guaranteed!

1 Patented i-ALERT™ Condition Monitor

The heart of the i-FRAME, the i-ALERT condition monitor unit continuously measures vibration and temperature at the thrust bearing and automatically indicates when pre-set levels of vibration and temperature have been exceeded, so that changes to the process or machine can be made before failure occurs.

A visual indication of pump health makes walk-around inspections more efficient and accurate. The result is a more robust process to monitor and maintain all your ANSI pumps so that your plant profitability is maximized.

2 Inpro VBXX-D Hybrid Bearing Isolators

Most bearings fail before reaching their potential life. They fail for a variety of reasons, including contamination of the lubricant. INPRO VBXX-D has long been considered the industry standard in bearing lubricant protection. The i-FRAME now improves upon that design by offering stainless steel rotors, for maximum protection against contaminants and the corrosive effects of seal leakage or environmental conditions. These seals are non-contacting and do not wear.

3 Optimized Oil Sump Design

Internal sump geometry is optimized for longer bearing life. Sump size increased by 10%-20% results in better heat transfer and cooler bearings. Contoured design directs contaminants away from bearings, to the magnetic drain plug for safe removal.

A reliability program centered around walk-arounds captures equipment condition on average once a month; the failure process, however, can begin and end quite frequently within this time period.
Shaft and Bearings Engineered for Maximum Reliability

Every 3196 i-FRAME Power End is engineered and manufactured for optimal pump performance and increased MTBF.

<table>
<thead>
<tr>
<th>ANSI B73.1 Shaft Specification</th>
<th>Meets</th>
<th>Exceeds</th>
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<tbody>
<tr>
<td>Diameter Tolerance</td>
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<tr>
<td>Surface Finish</td>
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<tr>
<td>Runout</td>
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<tr>
<td>Deflection</td>
<td>✔</td>
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</table>

The rugged shaft and bearing combination maintains shaft deflection of less than 0.002 inches at all operating points. The result is longer seal and bearing life.

Premium severe-duty thrust bearings increase bearing fatigue life by 2-5X.
- High purity steels have fewer inclusions than standard steel — better grain structure and wear resistance.
- Heat treatment of bearing elements increases hardness for increased fatigue life.

Forty-degree contact angle on the MT1 thrust bearing for higher thrust load capability.
- 35% higher dynamic load rating vs. major competitor.
- Increases L’10 bearing life 2X.

Fatigue life more than double that of conventional bearing steels.

L5 Power End for High Load Applications

Increased L’10 Bearing Life 150% to 200% on the Toughest Applications

Ideal for tough conditions when a power end is pushed beyond ANSI limits: operating at low flows and higher heads, pumping high specific gravity liquids, fluctuating process conditions, overhung belt drive.

Oversized shaft and bearing assembly significantly expands the limits for long, trouble-free bearing and seal life. On high load applications, the L5 power end improves bearing life 150%–200%; oil operating temperature reduced by 45°F (25°C).

Duplex thrust bearings (40°/40° angular contact) with machined brass cages, are ideally sized for high load applications.

Our Guarantee

We are so confident that the i-FRAME is the most reliable Power End in the industry, that we are proud to offer a standard 5-year warranty on every i-FRAME ANSI Process Pump.
### Parts List and Materials of Construction

<table>
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<tr>
<th>Item Number</th>
<th>Part Name</th>
<th>MATERIAL</th>
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*STi: Power End features Duplex Angular Contact

®Teflon is a registered trademark for Fluoropolymer Resins, Films, Fibers manufactured by DuPont.
### Dimensions HT 3196 i-Frame™

All dimensions in inches and (mm).
Not to be used for construction.

#### DIMENSIONS

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<th>Suction Size</th>
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<th>A</th>
<th>B</th>
<th>D</th>
<th>SP</th>
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PUMP SMART

PumpSmart® is the latest advancement in pump control and protection to reduce energy consumption, increase uptime and decrease maintenance cost. It allows the pump to be right-sized to the application by dialing in the speed and torque which increases flow economy, reduces heat and vibration, and improves overall system reliability.

- Simplified Pump Control — PumpSmart was designed specifically to optimize pumping applications and can be used to control a single pump or coordinate between multiple pumps without the need for an external controller.
- Pump Protection — PumpSmart guarantees to protect the pump from upset conditions with patented sensorless pump protection algorithms.
- Smart Flow — PumpSmart features a sensorless flow function for centrifugal pumps that can calculate the flow of the pump within ± 5% of the pump rated flow.
- Drive for the DCS — While most VFDs can only provide basic information, PumpSmart offers unparalleled insight to the pump operation which allows for smoother process control and efficiency.
- Pump Experts — PumpSmart is a variable speed drive with pump-specific algorithms imbedded into the drive. With over 150 years of pump knowledge, let the pump experts take responsibility of your pump system.

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