Useful Pump Formulas

Pressure (PSI) = \frac{\text{Head (Feet) \times Specific Gravity}}{2.31}

Head (Feet) = \frac{\text{Pressure (PSI) \times 2.31}}{\text{Specific Gravity}}

Vacuum (Inches of Mercury) = \text{Dynamic Suction Lift (Feet) \times 0.883 \times Specific Gravity}

Horsepower (Brake) = \frac{\text{GPM \times Head (Feet) \times Specific Gravity}}{3960 \times \text{Pump Efficiency}}

Horsepower (Water) = \frac{\text{GPM \times Head (Feet) \times Specific Gravity}}{3960}

Efficiency (Pump) = \frac{\text{Horsepower (Water)}}{\text{Horsepower (Brake)}} \times 100 \text{ Per Cent}

NPSH (Available) = \text{Positive Factors - Negative Factors}

Affinity Laws: Effect of change of speed or impeller diameter on centrifugal pumps.

\[
Q_2 = \frac{D_2^2}{D_1^2}Q_1
\]

\[
H_2 = \left(\frac{D_2}{D_1}\right)^3H_1
\]

\[
P_2 = \left(\frac{D_2}{D_1}\right)^3P_1
\]

\[
Q_2 = \frac{\text{RPM}_2}{\text{RPM}_1}Q_1
\]

\[
H_2 = \left(\frac{\text{RPM}_2}{\text{RPM}_1}\right)^3H_1
\]

\[
P_2 = \left(\frac{\text{RPM}_2}{\text{RPM}_1}\right)^3P_1
\]

Where Q = GPM, H = Head, P = BHP, D = Impeller Dia., RPM = Pump Speed
Take away these seven standard features and you’ll have a pump like everyone else’s.

**True Back Pullout**
A B&G standard in design and construction. Ease in service is assured, while piping and motor remain undisturbed. Extended delays for repairs are virtually eliminated.

**Internally Self-Flushing Mechanical Seal**
This design is way ahead of its time. This unique seal design is proven in many years of service. It requires no special external flushing provisions, since the design provides for constant efficient flushing action internally. This standard feature ensures maximum seal face lubrication, heat dissipation and debris removal without vulnerable, external flush tubing. The internal flushing action passes two and a half to three times the flow over the seal faces – compared to a few GPM for conventional, stuffing-box designed pumps.

**Solid-Foot Mounted Volute**
All Series e-1510 pumps are provided as standard with an integrally cast volute foot located directly beneath the pump volute. This integrally cast foot ensures that the alignment between the volute and motor assembly is maintained. Without solid support beneath the volute, the piping weight alone will cause distortion which can lead to premature failure of the bearings, shaft and mechanical seal. This feature is equally important on hot water applications. The Series e-1510 volute foot provides a solid foundation and eliminates the deflections which would otherwise exist within an unsupported overhung volute during the normal thermal expansion of the system piping against the volute.

**Computer Controlled Impeller Balancing**
e-1510 impellers are balanced to ANSI/HI 9.6.4-2009, balance grade G6.3 standards. This method of computer balancing impellers provides for quiet, efficient, vibration free performance. Diameters are computer selected at the factory to furnish assurance that your capacity requirements will be met.

**Center Drop-Out Spacer Coupling**
Unlike conventional jaw type or rigid style couplings, a center drop-out spacer coupling allows removal of the bearing frame and rotating element without disturbing the pump end pipe alignment or motor electrical connections.

**Heavy Duty, Rugged Baseplate**
The Bell & Gossett fabricated heavy duty baseplate is supplied as standard on every Series e-1510 pump. Unlike rolled steel and “C” channel baseplates, the Series e-1510 baseplate provides a heavy duty saddle assembly, full seam welds, closed baseplate ends and an open top to provide ease of access for proper equipment grouting.

**ANSI/OSHA-Compliant Coupling Guard**
The coupler guard complies with ANSI B15.1 and OSHA 1910.219. The guard offers increased protection against potential injuries and is standard on all e-1510 pumps. The guards include slotted viewing windows for easy inspection.

**Patented i-ALERT™ Condition Monitor Option**
Continuously measures vibration and temperature at the outboard bearing and automatically indicates when pre-set levels of vibration and temperature have been exceeded, so that changes can be made before failure occurs. A visual indication of pump health makes walk-around inspections more efficient and accurate. This onboard pump intelligence helps minimize life-cycle costs while maximizing performance.
Materials of Construction

Standard Configuration

Optional - S Configuration

<table>
<thead>
<tr>
<th>Description</th>
<th>SM, LG, &amp; XL Bearing Frames</th>
<th>ES Bearing Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Shaft</td>
<td>ASTM 108 Grade 1144</td>
<td>ASTM 108 Grade 1144</td>
</tr>
<tr>
<td>2  Volute</td>
<td>Cast Iron ASTM A48 Class 30B</td>
<td>Cast Iron ASTM A48 Class 30B</td>
</tr>
<tr>
<td>3  Impeller</td>
<td>ASTM A743 Grade CF8 - 304 Stainless Steel</td>
<td>ASTM A743 Grade CF8 - 304 Stainless Steel</td>
</tr>
<tr>
<td>4  Shaft Sleeve</td>
<td>ASTM 312 Grade TP304 - 304 Stainless Steel</td>
<td>ASTM 312 Grade TP304 - 304 Stainless Steel</td>
</tr>
<tr>
<td>5  Impeller Key</td>
<td>#304 Stainless Steel</td>
<td>NA</td>
</tr>
<tr>
<td>6  Impeller Washer</td>
<td>Steel</td>
<td>NA</td>
</tr>
<tr>
<td>7  Impeller Lock Washer</td>
<td>#304 Stainless Steel (18-8 XL FRM)</td>
<td>NA</td>
</tr>
<tr>
<td>8  Impeller Cap Screw</td>
<td>#304 Stainless Steel</td>
<td>NA</td>
</tr>
<tr>
<td>8  Impeller Nut</td>
<td>NA</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>9  Volute Gasket</td>
<td>Cellulose Fiber</td>
<td>Cellulose Fiber</td>
</tr>
<tr>
<td>10 Seal Assembly</td>
<td>Reference Seal Data Tables</td>
<td>Reference Seal Data Tables</td>
</tr>
</tbody>
</table>

Pump Options

- Stainless Steel Volute Wear Ring
- Galvanized Steel Drip Pan
- Stainless Steel Shaft
- Rexnord Omega Spacer Coupling
- Falk T31 Spacer Coupling
- External Flush Line

- Stuffing Box Configuration
- Epoxy Coated Internal Cast Iron Components
- Special Impeller Balancing (ISO 1940 G2.5 or G1.0)
- Certified Performance Tests (Per HI Standard 14.6)
- iALERT™ Condition Monitor
- 250 PSI Working Pressure
## Seal Assemblies

### Standard Mechanical Configuration

<table>
<thead>
<tr>
<th>Standard Mechanical Seal</th>
<th>SM, LG, &amp; XL Bearing Frames</th>
<th>ES Bearing Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Range</td>
<td>-20 to 225°F</td>
<td>-20 to 225°F</td>
</tr>
<tr>
<td>Maximum Pressure</td>
<td>175 PSI</td>
<td>175 PSI</td>
</tr>
<tr>
<td>pH Limitations</td>
<td>7.0 - 9.0</td>
<td>7.0 - 9.0</td>
</tr>
<tr>
<td>Elastomer</td>
<td>Buna</td>
<td>Buna</td>
</tr>
<tr>
<td>Rotating Face</td>
<td>Carbon</td>
<td>Carbon</td>
</tr>
<tr>
<td>Stationary Face</td>
<td>Ceramic</td>
<td>Silicon Carbide</td>
</tr>
<tr>
<td>Hardware</td>
<td>Stainless Steel / Brass</td>
<td>Stainless Steel</td>
</tr>
</tbody>
</table>

### Mechanical Seal Options

<table>
<thead>
<tr>
<th>Mechanical Seal Options</th>
<th>SM, LG, &amp; XL Bearing Frames</th>
<th>ES Bearing Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Range</td>
<td>-20 to 250°F</td>
<td>-10 to 225°F</td>
</tr>
<tr>
<td>Maximum Pressure</td>
<td>175 PSI</td>
<td>175 PSI</td>
</tr>
<tr>
<td>pH Limitations</td>
<td>7.0 - 11.0</td>
<td>7.0 - 9.0</td>
</tr>
<tr>
<td>Elastomer</td>
<td>EPR (Ethylene Propylene Rubber)</td>
<td>FKM (Viton™ or Fluoroelastomer)</td>
</tr>
<tr>
<td>Rotating Face</td>
<td>Carbon</td>
<td>Carbon</td>
</tr>
<tr>
<td>Stationary Face</td>
<td>Tungsten Carbide</td>
<td>Ceramic</td>
</tr>
<tr>
<td>Hardware</td>
<td>Stainless Steel / Brass</td>
<td>Stainless Steel</td>
</tr>
</tbody>
</table>

### Stuffing Box Configuration

<table>
<thead>
<tr>
<th>Mechanical Seal</th>
<th>SM, LG, &amp; XL Bearing Frames</th>
<th>Packing Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Range</td>
<td>-20 to 250°F*</td>
<td>Temperature Range</td>
</tr>
<tr>
<td>Maximum Pressure</td>
<td>175 PSI (Optional 250 PSI)</td>
<td>Maximum Pressure</td>
</tr>
<tr>
<td>pH Limitations</td>
<td>7.0 - 11.0</td>
<td>pH Limitations</td>
</tr>
<tr>
<td>Elastomer</td>
<td>EPR (Ethylene Propylene Rubber)</td>
<td>Material</td>
</tr>
<tr>
<td>Rotating Face</td>
<td>Tungsten Carbide</td>
<td></td>
</tr>
<tr>
<td>Stationary Face</td>
<td>Carbon</td>
<td></td>
</tr>
<tr>
<td>Hardware</td>
<td>Stainless Steel</td>
<td></td>
</tr>
</tbody>
</table>

*For operating temperatures above 250°F a cooled flush is required and is recommended for temperatures above 225°F for optimum seal life. On closed systems cooling is accomplished by inserting a small heat exchanger in the flush line to cool the seal flushing fluid. Flush-line Filters and Sediment Separators are available on special request.
Series e-1510 Performance Curves
The Bell & Gossett End Suction Pump System

Consists of:
B&G Series e-1510 Pump
B&G Triple Duty Valve
B&G Suction Diffuser

Triple Duty Valve
- Lowest Pressure Drop
- ASHRAE 90.1 Energy Efficient Design
- Three Valves in one!
  - Nonslam drip-tight check valve
  - Positive shutoff valve
  - Calibrated system balance valve
- EPDM Disc Soft Seat Design
- Repack Under Pressure
- Brass Seat & Bronze Disc
- Stainless Steel Stem
- Multi-turn Valve (8-9 turns) vs 1/4 turn range of control
- Available connections – Threaded – Flanged – Grooved
- ESP-Plus System Selection

Suction Diffuser
- Full length stainless steel straightening vanes
- Oversize cylinder assures minimum strainer pressure drop
- Pressure gauge tap
- Space saving design reduces the “footprint” size of the unit
- Available connections – Threaded – Flanged – Grooved
- Reducer and elbow provide multiple combinations of inlet and pump suction configurations which eliminate the need for reducer fittings
- ESP-Plus System Selection
Typical Specification for Series e-1510
Base Mounted, Flexible Coupled, End-Suction Pumps

Furnish and install pumps with performance characteristics as shown on plans. Pumps shall be base mounted, single stage, end suction design with a foot mounted volute to allow removal and service of the entire rotating assembly without disturbing the pump piping, electrical motor connections or pump to motor alignment.

Pump volute shall be Class 30 cast iron with integrally-cast pedestal support feet. The impeller shall be a cast stainless steel enclosed type, balanced to ANSI/HI 9.6.4-2009 balance grade G6.3 and secured to the shaft by a locking capscrew or nut.

The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 225°F (107°C). A replaceable stainless steel shaft sleeve shall completely cover the wetted area under the seal.

Pump shall be rated for minimum of 175 psi (12 bar) working pressure. Volute shall have gauge tappings at the suction and discharge nozzles and vent and drain tappings at the top and bottom.

The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 9.6.4-2009 for recommend acceptable unfiltered field vibration limits (as measured per ANSI/HI 9.6.4-2009 Figure 9.6.4.2.3.1) for pumps with rolling contact bearings.

Baseplate shall be of structural steel or fabricated steel channel with fully enclosed sides and ends, and securely welded cross members. Grouting area shall be fully open. The combined pump and motor baseplate shall be sufficiently stiff as to limit the susceptibility of vibration. The minimum baseplate stiffness shall conform to ANSI/HI 1.3.8.2.1-2009 for grouted Horizontal Baseplate Design standards.

A flexible type, center drop-out design coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor. Pumps for variable speed application shall be provided with a suitable coupling sleeve. The coupling shall be shielded by a dual rated ANSI B15.1 & OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling.

Motor shall meet NEMA and EISA 2007 (where applicable) specifications and shall be of the size, voltage and enclosure called for on the plans. Pump and motor shall be factory aligned, and shall be realigned by the contractor per factory recommendations after installation.

The pump(s) selected shall conform to ANSI/HI 9.6.3.1-2012 standards for Preferred Operating Region (POR) unless otherwise approved by the engineer.

Each pump shall be factory hydrostatically tested per Hydraulic Institute standards. It shall then be thoroughly cleaned and painted with at least one coat of high grade paint prior to shipment.

The pump(s) shall be manufactured, assembled and tested in an ISO 9001 approved facility.

A pump condition monitoring system should be provided on the pump power end to continuously measure pump vibration and temperature at the outboard bearing. The system shall record the baseline vibration at start-up and have local alarm indication at the pump when the vibration levels are double the baseline values or when alarm limits are reached for vibration and temperature. Vibration modes shall be based on ANSI/HI 9.6.4-2009 and ISO 101816 recommended levels. The sensors and condition monitors’ electronics shall be provided in a stainless steel enclosure potted in epoxy for protection from the environment. A battery powered system is preferred with no external power source required. The acceptable ambient temperature range shall be -40°F to 212°F (-40°C to 100°C). CSA certification is required.

Pumps shall be Series e-1510 as manufactured by Xylem Bell & Gossett or equal.