# Guide Bearing and Shaft Selection

## 4500 Series

**Bulletin 4500**

---

**Large Sump or Drainage Pumps**

The proper selection of guide bearing assembly, column closure and shaft material is essential for the successful operation of Vertical Sump and Process Pumps, due to the variety of liquids that may be encountered at the point of installation.

DEMING offers a wide choice of bearing construction and shaft materials to meet requirements of most installations. Listed below are recommendations for the proper selection of these important items.

### BEARING SELECTION

**Maximum Recommended Operating Temperature 400°F**

<table>
<thead>
<tr>
<th>Type of Service</th>
<th>Typical Application</th>
<th>Bearing Material</th>
<th>Max. Liquid Temp °F</th>
<th>BHN</th>
<th>Recommended Lubrication</th>
<th>Abrasion Resistance of Bearing when used in Bearing Assembly Indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Furnished on Standard Fitted and Bronze Fitted Pumps</td>
<td>Bronze</td>
<td>180°</td>
<td>57/64</td>
<td>NR R NR</td>
<td>6 &amp; 8 11 NR</td>
</tr>
<tr>
<td><strong>Clean Liquids</strong></td>
<td>Cold or Hot Water, Sea Water, Cleaning Fluids, Gasoline, Kerosene, Jet Fuels</td>
<td>Babbit-Graphite*</td>
<td>300°</td>
<td>19</td>
<td>R NR R</td>
<td>NR NR NR</td>
</tr>
<tr>
<td><strong>Acids (clean)</strong></td>
<td>Most Acids - Max., 60% Sulfuric</td>
<td>Carbolube*</td>
<td>400°</td>
<td>237</td>
<td>R NR R</td>
<td>6 &amp; 8 11 NR</td>
</tr>
<tr>
<td><strong>Alkaline Caustic</strong></td>
<td>Sodium Hydroxide, etc. Standard on All Iron Pumps</td>
<td>Carbolube*</td>
<td>400°</td>
<td>--</td>
<td>R NR R</td>
<td>NR NR NR</td>
</tr>
<tr>
<td><strong>Chemical</strong></td>
<td>General Service with most clean Acids and Solvents</td>
<td>Teflon*</td>
<td>350°</td>
<td>--</td>
<td>R R NR</td>
<td>10 NR NR</td>
</tr>
<tr>
<td><strong>Mild Abrasive</strong></td>
<td>General Service with Compatible Liquids</td>
<td>Cast Iron</td>
<td>180°</td>
<td>180</td>
<td>R NR NR</td>
<td>6 &amp; 8 11</td>
</tr>
<tr>
<td><strong>General Abrasives</strong></td>
<td>Used in Compatible Liquids except Concentrated Acids and Solvents</td>
<td>Rubber* (Buna)</td>
<td>150°</td>
<td>--</td>
<td>R NR NR</td>
<td>NR NR 12</td>
</tr>
<tr>
<td><strong>Molten Sulphur</strong></td>
<td>Used as bottom bearing with Carbolube Intermediate Bearing</td>
<td>Babbit-Graphite*</td>
<td>360°</td>
<td>220</td>
<td>NR NR R</td>
<td>NR NR 6</td>
</tr>
<tr>
<td><strong>Nuclear</strong></td>
<td>Demineralized Water</td>
<td>Nickel Graphite*</td>
<td>400°</td>
<td>--</td>
<td>R NR R</td>
<td>6 &amp; 8 11 NR</td>
</tr>
</tbody>
</table>

(*) Requires Type 416, Carp. 20 or 316 Stainless Steel Shaft.  
R - Recommended  
NR - Not Recommended

**Important! - Pump Should be Minimum 1 HP.**

**Note:**
1. Clean liquid flush to bearing requires approx. ½ gpm per bearing at pressure equal to or greater than ½ of the pump discharge pressure. Solenoid valve is required.
2. Standard grease lubricated pump includes grease fitting on lube line to each bearing assembly. Spring loaded grease cup optional when specified.
3. Bearings indicated for dry lubrication are lubricated by the liquid being pumped.
4. Add ½ hp per Intermediate Bearing.

### RECOMMENDED SHAFT MATERIALS

Listed below is genera recommendation of shaft materials for various types of chemical service

<table>
<thead>
<tr>
<th>Shaft Material</th>
<th>Brinell Hardness</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>4140 SAE Steel</td>
<td>163</td>
<td>General Service - Furnished in standard fitted pumps</td>
</tr>
<tr>
<td>416 Stainless Steel</td>
<td>207 - 241</td>
<td>General Service in mild acids and chloride solutions</td>
</tr>
<tr>
<td>316 Stainless Steel</td>
<td>135 - 185</td>
<td>Industrial chemicals, solvents, chlorides, brines and most acids</td>
</tr>
<tr>
<td>Carp. 20 Stainless Steel</td>
<td>160</td>
<td>Most active acids except those requiring Hastelloy or other metals</td>
</tr>
</tbody>
</table>

For specific applications, contact Factory with full information.
**STANDARD SHAFT GUIDE BEARING ASSEMBLIES**

For standard drainage service - non-corrosive liquids without abrasives or vapors.

**DESIGN 1 - TOP**

Design 1 is the standard cast iron column top closure. On Standard Fitted and All Iron pumps, it is of Fianite material. On alloy pumps, it will be of the same material as the liquid end parts.

Normally furnished with pressurized grease lubrication with bearings of Bronze or Cast Iron.

For pressurized liquid lubrication, specify Babbit-Graphite, Nickel Graphite or Carbolube bearing material. If liquid being pumped is compatible, it may be used to lubricate the bearing.

**DESIGN 6 - BOTTOM**

Design 6 is the standard bottom shaft guide bearing assembly with choker ring and two guide bearings of the material selected.

Design 8 is the standard intermediate shaft guide bearing assembly including two guide bearings of the material as selected. Used where pit depth is greater than 6 ft. For pressurized grease lubrication, specify bearings of Bronze or Cast Iron.

For pressurized liquid lubrication, specify Babbit-Graphite, Nickel Graphite or Carbolube bearing material. If liquid being pumped is compatible, it may be used to lubricate the bearing.

**FOR SPECIAL APPLICATIONS**

When pumping abrasive, corrosive or hot liquids, the standard construction as shown above must be modified to meet the requirements of the particular installation. Shown below are recommendations for specific applications.

**DESIGN 3 - TOP**

Design 3 top closure is used instead of Design #1 and is recommended to seal the shaft when gas or obnoxious vapors are present in the liquid. Includes three rings of packing and lantern ring. May be grease lubricated or liquid flushed. Has 1/8" inlet and outlet connections.

---

**ALTERNATE TOP COLUMN CLOSURE**

**DESIGN 5**

Top closure is also used in place of Design #1 and is recommended for containment of hot or corrosive vapors, high pumping pressures, abrasives and with pressurized column assembly. Includes five rings of packing and lantern ring. May be grease lubricated or liquid flushed. Has 1/8" connections.
ALTERNATE GUIDE BEARING ASSEMBLIES
BOTTOM OR INTERMEDIATE

FOR SLIGHTLY ABRASIVES LIQUIDS

DESIGN 11 includes bearings of the material selected, five rings of packing under spring tension plus choker ring in bottom of the housing to form a seal to exclude abrasives from the bearings.

For pressurized grease lubrication, specify bearing of Bronze or Cast Iron.

For pressurized liquid lubrication, specify bearings of Babbit Graphite, Nickel Graphite or Carbolube.

FOR CHEMICAL SERVICE

DESIGN 10 includes Teflon bearing with lock screw and is lubricated by the liquid being pumped, or may be pressured with compatible liquid.

FOR ABRASIVE LIQUIDS

DESIGN 12 is recommended for abrasive liquids and includes two rubber bearings separated by lantern ring for flush connection. Requires pressurized liquid lubrication.

For installation requiring maximum protection against abrasives, refer full information to Factory.
**Total Pumping Head:**

Often overlooked in selecting vertical pumps that take suction from open sumps is the need to add the losses in the sump below the mounting plate to the head above the mounting plate to determine the total pumping head for selecting the pump. These additions include the elevation from the lowest liquid in the sump to the support plate plus friction loss in the discharge elbow and discharge pipe plus velocity head in the discharge pipe to the support plate.

The pump characteristic curves indicate the pump performance measured at the casing discharge flange; therefore in selecting the pump size and motor horsepower, the total pumping head must include the data as above.

**Example of Total Head Calculations:**

Pump required - 400 GPM, Pit depth 10'-6", lowest liquid level 7ft. below support plate, highest point in discharge line 38ft., pressure required at the discharge 8 p.s.i., friction loss in 4" discharge line beyond the pump 4 ft.

- Highest Elevation .........................................................38 ft.
- Pressure Required 8 p.s.i. x 2.31............................18.48 ft.
- Friction Loss - Discharge line.........................................4 ft.
- Lift in Sump ....................................................................7 ft.
- Friction in elbow and discharge pipe..............................2.05 ft.
- Velocity head in pump discharge pipe ......................1.58 ft.

Total Pumping Head ...................................................71.11 ft.

Normally the “pit depth” can be substituted to compensate for the low liquid level and pipe losses below the support plate; when added to the pumping head above the pump, this will give the approximate total pumping head for selecting the pump.

When the capacity and the total pumping head are specified by the customer, it will be assumed that the total pumping head includes all friction losses and velocity head beyond the pump casing plus allowance for lowest liquid level in the sump; otherwise the indicated total pumping head must be corrected as above.

**Minimum Submergence:**

The distance from the surface of a liquid in a sump or tank to the pump suction inlet is known as submergence. Depending on the pump size, a "minimum submergence" is required to prevent vortex formation around the pump suction which will reduce pump capacity and may cause pump damage and rapid wear.

Submergence should not be confused with Net Positive Suction Head or NPSH. It is possible to have sufficient submergence but insufficient net positive head or vice versa depending on the installation and liquid characteristics.

Proposed installations must be checked for both required submergence and available NPSH to be sure they are equal to or greater than that required by the pump.

The table below shows minimum submergence above the pump suction nozzle in 65°F water, where pump is fitted with standard strainer and where tank liquid velocity is negligible. Omission of pump strainer, liquid velocity, sump obstructions or other pumps installed in the same sump may require greater submergence.

<table>
<thead>
<tr>
<th>Pump Size</th>
<th>1</th>
<th>1½</th>
<th>2½</th>
<th>1¼ S</th>
<th>1½ S</th>
<th>1½ M</th>
<th>1½ L</th>
<th>2 S</th>
<th>2 M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Subm.</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pump Size</th>
<th>3 S</th>
<th>3 MD</th>
<th>4 S</th>
<th>4 MD</th>
<th>5 MSD</th>
<th>5 MD</th>
<th>6 MD</th>
<th>6 MLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Subm.</td>
<td>24&quot;</td>
<td>24&quot;</td>
<td>24&quot;</td>
<td>24&quot;</td>
<td>24&quot;</td>
<td>24&quot;</td>
<td>24&quot;</td>
<td>24&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pump Size</th>
<th>4 x 4 x 12</th>
<th>6 x 4 x 12</th>
<th>6 x 6 x 12</th>
<th>8 x 6 x 12</th>
<th>8 x 8 x 12</th>
<th>10 x 10 x 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Subm.</td>
<td>18&quot;</td>
<td>20&quot;</td>
<td>24&quot;</td>
<td>30&quot;</td>
<td>36&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>