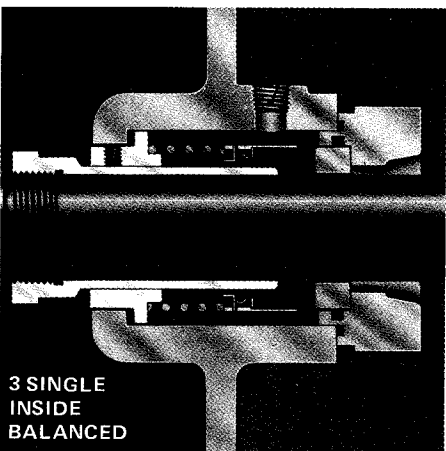
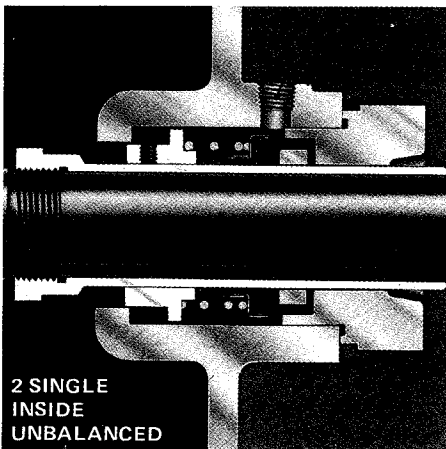
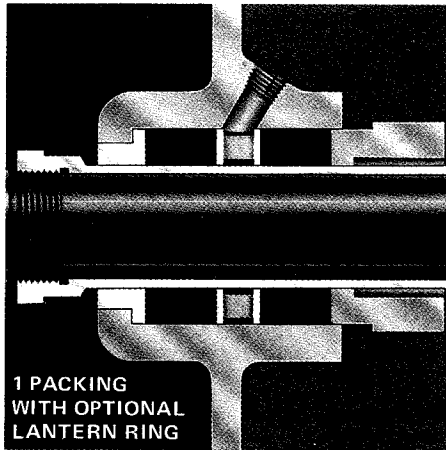


# 410 SERIES ENGINEERING DATA MECHANICAL SEALS AND PACKING



Standard packing on horizontal pumps and the standard mechanical seals on vertical pumps are suitable for most applications. Special sealing arrangements may however, be required due to higher pressure or temperature requirements and the nature of the liquid to be pumped. Factory option seals are of high quality and supplied by leading mechanical seal manufacturers. Various seal arrangements and types that better suit your specific needs are available. Seal faces are carbon vs. Ni-Resist on standard seals and carbon vs. Tungsten carbide on high temperature seals. Corrosion resistant alloy metal parts and Buna-N secondary sealing elements are provided. Various other metals are also available. Gland plates are cast iron and can be supplied in alternate materials. Recommendations and limitations are general. Specific selections can be offered only after rotating speeds, pressures, temperatures, type of equipment and liquid nature are known. The following illustrations describe the basic seal and packing options available. For options not shown refer to the factory. For quick reference for the type of seal best suited to your application, refer to the condensed information that heads each option. The following comments govern these recommendations:

**1 PACKING** Standard on Model 411. Not avail. on 412 & 413. **PRESSURES** (suction): Below atmospheric up to 250\* P.S.I.G. (Maximum pump limitation) Lantern rings are required on suction lift applications.

**TEMPERATURES:** From minus 100°F. up to 275°F.\* with high temperature packing, or 225°F. with standard packing.

**LIQUIDS:** All liquids that are compatible with braided fiber packing. Other packings available for special applications.

**2 SINGLE — UNBALANCED** Standard on Model 412 and 413. Optional Model 411.

**PRESSURES** (suction): Below atmospheric up to 100 P.S.I.G.

**TEMPERATURES:** From minus 100°F. up to 275°F. with high temperature seals, or 225°F. with standard seals.

**LIQUIDS:** All liquids that are compatible with the seal materials of construction and with a specific gravity higher than .6.

**3 SINGLE — BALANCED** Optional on all Models.

**PRESSURES** (suction): Up to 250 P.S.I.G. (Max. pump limit)

**TEMPERATURES:** Minus 100°F. up to 275°F. with high temperature seals, or 225°F. with standard seals.

**LIQUIDS:** All liquids that are compatible with the seal materials of construction. Required on liquids with a specific gravity of .6 or lower.

## PRESSURES

## TEMPERATURES

## LIQUIDS

**PRESSURES** — The pressures referred to are those found at the pump suction. Most seal manufacturers recommend a flushing arrangement from the discharge to the stuffing box where "below atmospheric pressure" is encountered. The 410 Series stuffing boxes incorporate internal bypass arrangements which permit flushing to the mechanical seals. External bypasses are available to both seal faces. An external bypass is standard on vertical pumps to the upper seal face.

**TEMPERATURES** — The temperature limitation of a mechanical seal is frequently determined by the shaft sealing material. The various elastomer "O" ring materials have varying temperature limits, depending upon the chemical and/or physical properties of the process fluid. Filled TEFLON<sup>†</sup>, shaft seal rings are available.

**LIQUIDS** — Due to varying degrees of resistance of various sealing compounds in different pumped liquids, the following mechanical seal sealing rings are available: BUNA-N, NEOPRENE, VITON, TEFLON<sup>†</sup> and other synthetic elastomers.

<sup>†</sup>DUPONT registered trademark.

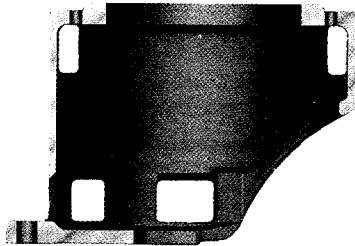
\*NOTE: Hardened stainless steel (450 minimum brinell) shaft sleeves are available with this option and are required when the suction pressure is over 100 P.S.I.G. or when the temperature exceeds 225°F.

# 410 SERIES ENGINEERING DATA INTERCHANGEABILITY AND POWER SERIES

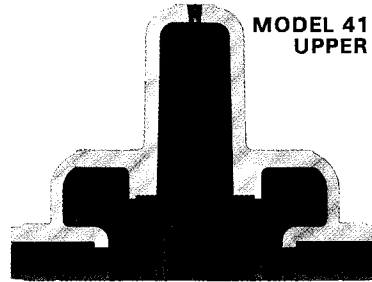
Aurora Models 411, 412 and 413 were designed for maximum interchangeability. Each model is available in 34 different sizes, offering a model and

size precisely fitted to the installation requirements. The 34 sizes are divided into 7 "power series." Within each power series, all parts are completely

interchangeable except for the impeller, casing, and case wearing rings for either right hand or left hand rotation. See the illustration below for all details.

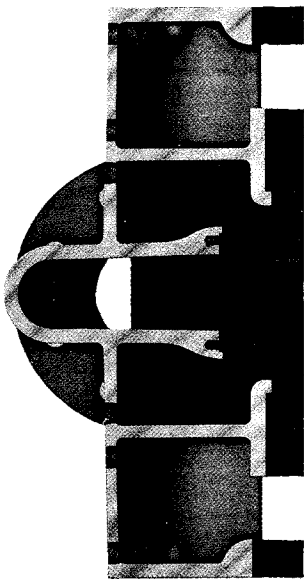


**MODEL 413  
 MOTOR BRACKETS**

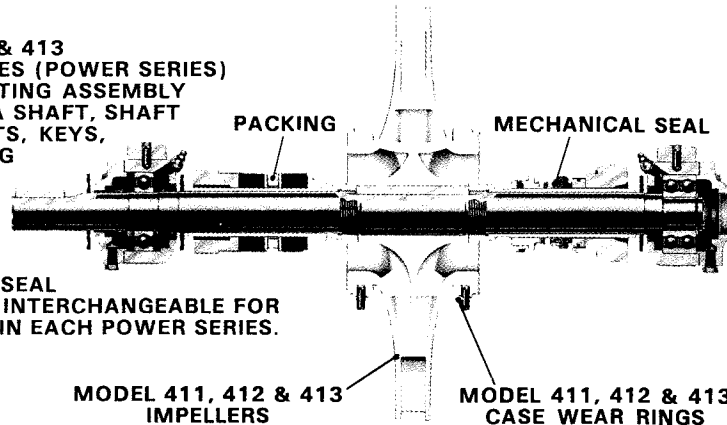


**MODEL 411, 412 & 413  
 UPPER CASINGS**

**MODEL 412 & 413  
 LOWER CASINGS**



**MODEL 411, 412 & 413  
 SHAFT ASSEMBLIES (POWER SERIES)  
 COMPLETE ROTATING ASSEMBLY  
 CONSISTING OF A SHAFT, SHAFT  
 SLEEVES, GASKETS, KEYS,  
 INBOARD BEARING  
 ASSEMBLY,  
 OUTBOARD  
 BEARING  
 ASSEMBLY  
 AND PACKING  
 OR MECHANICAL SEAL  
 ASSEMBLIES ARE INTERCHANGEABLE FOR  
 ALL PUMPS WITHIN EACH POWER SERIES.**



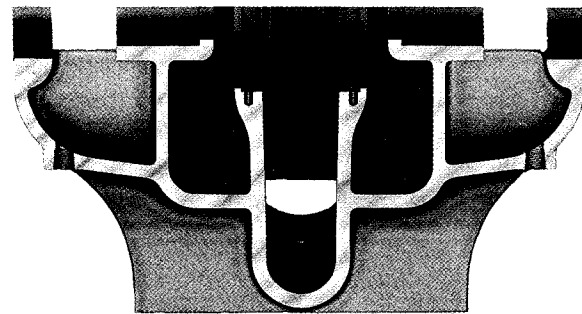
**MODEL 411, 412 & 413  
 IMPELLERS**

**MODEL 411, 412 & 413  
 CASE WEAR RINGS**

**MODEL 412 & 413  
 DRIP RIM BASES**



**MODEL 411  
 LOWER CASINGS**



**POWER SERIES**

Pump Size Example: 3 x 4 x 14 (3-Discharge Dia.) (4-Suction Dia.) (14-Approx. Max. Impeller Dia.).

| 1           | 2            | 3           | 4           | 5           | 6B          | 7*           |
|-------------|--------------|-------------|-------------|-------------|-------------|--------------|
| 2 x 2½ x 9  | 2½ x 3 x 10B | 4 x 5 x 11A | —           | 5 x 6 x 17  | 6 x 8 x 15  | 8 x 10 x 12  |
| 2 x 2½ x 10 | 2½ x 3 x 12  | 4 x 5 x 11C | 4 x 6 x 18B | 6 x 8 x 11  | 6 x 8 x 18A | —            |
| 2 x 2½ x 12 | 3 x 4 x 10B  | 4 x 5 x 15  | 5 x 6 x 11  | 8 x 8 x 11B | 6 x 8 x 18B | 8 x 10 x 15A |
|             | 3 x 4 x 14   |             | 5 x 6 x 11C |             | 6 x 8 x 18C | 8 x 10 x 15B |
|             | 4 x 5 x 10B  |             | 5 x 6 x 15  |             | 6 x 8 x 20  | 8 x 10 x 17B |
|             |              |             |             |             |             |              |

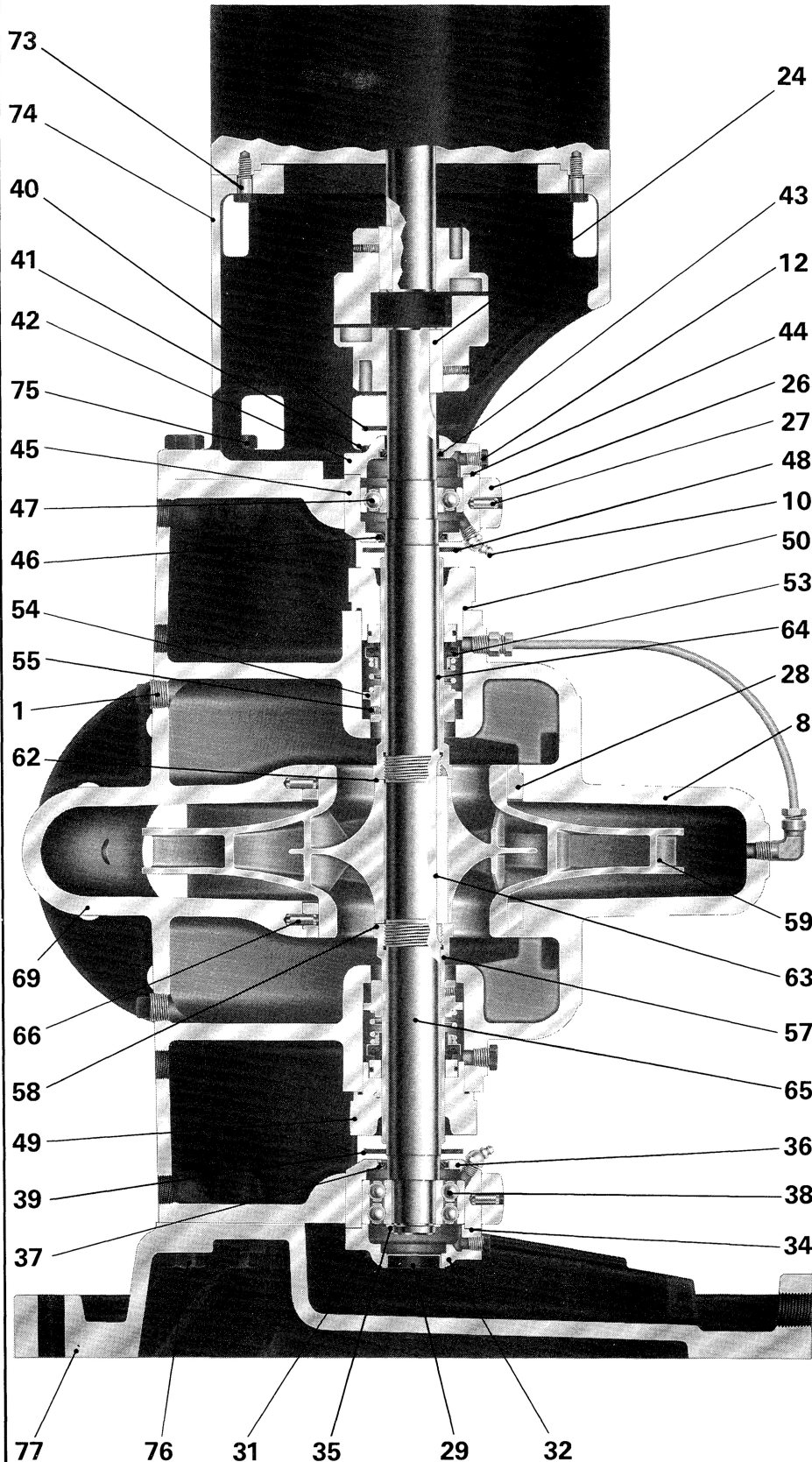
\*Model 411 Pumps Only

# 410 SERIES

## ENGINEERING DATA

### MATERIALS OF CONSTRUCTION

SECTION **410** PAGE **73**  
 DATED **MARCH 2004**  
 SUPERSEDES PAGE 73  
 DATED JULY 1985

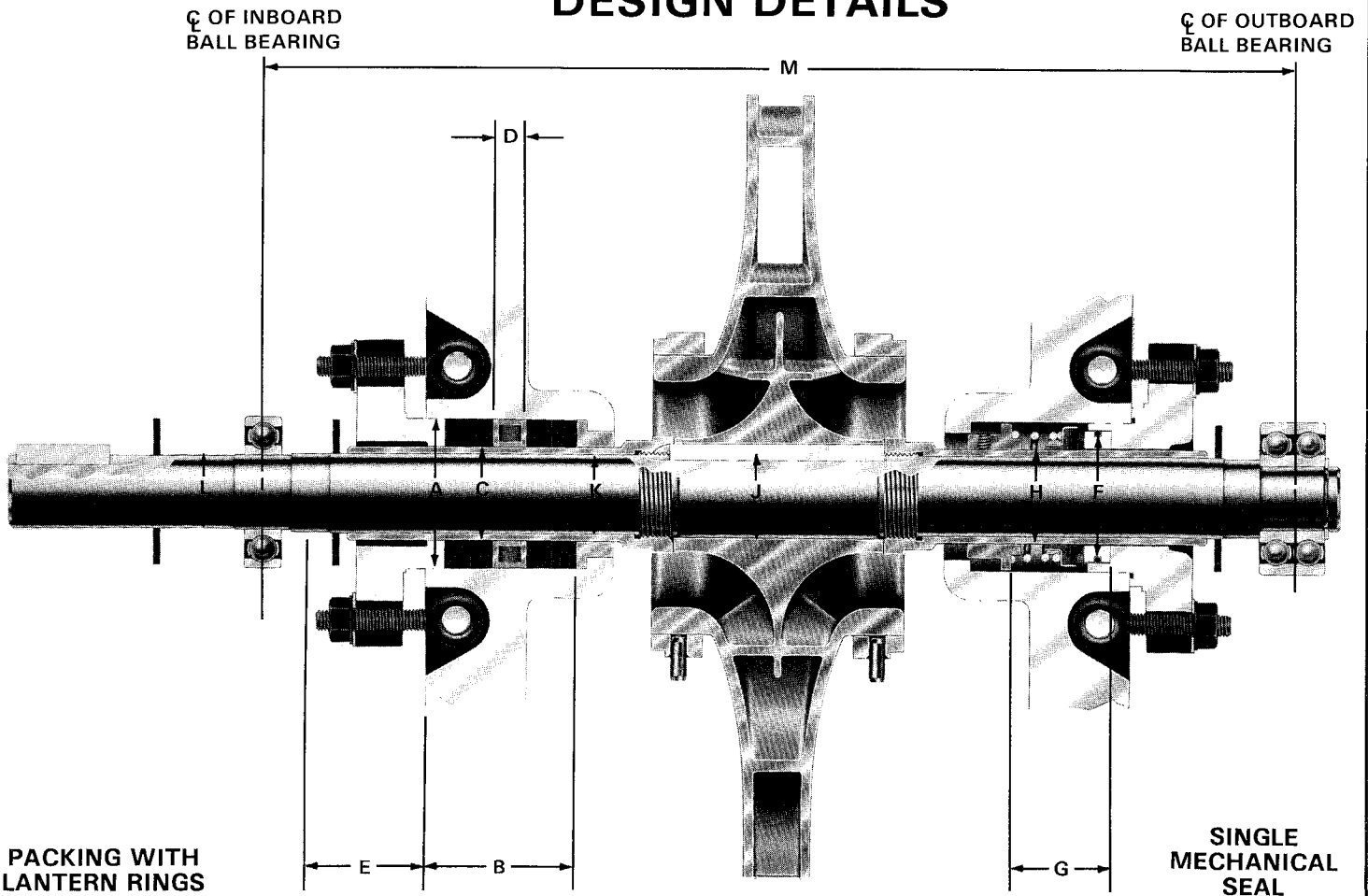


†DUPONT registered trademark.

| Pc No | Descrip. (*Not Shown) | PUMP CONSTRUCTION        |                        |                      |                          |
|-------|-----------------------|--------------------------|------------------------|----------------------|--------------------------|
|       |                       | Bronze Fitted            | All Bronze             | All Iron             | Stain. Steel             |
| 1     | Plug                  | Mall. Iron               | Bronze                 | Mall. Iron           | Stain. Stl.              |
| 2     | *Plug                 | A197                     | Wrought                | A197                 | AISI 316                 |
| 6     | *Capscrew             | Steel                    | Steel                  | Steel                | Stain. Stl.              |
| 7     | *Capscrew             | SAE 2                    | SAE 2                  | SAE 2                | AISI 316                 |
| 8     | Casing Half           | Cast Iron A48            | Bronze B62             | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 9     | *Gasket               | Buna-N Treated Cellulose |                        |                      |                          |
| 10    | Gr. Ftg.              | Steel Zerk               |                        |                      |                          |
| 12    | Plug                  | Malleable Iron ASTM A197 |                        |                      |                          |
| 18    | *Nut                  | Bronze Wrought           | Steel SAE 2            | Stain. Stl. AISI 316 |                          |
| 19    | *Washer               | Cad. Plated Steel        | Bronze Wrought         | Cad. Plated Steel    | Stain. Stl. AISI 316     |
| 20    | *Gland Clamp          | Cast Iron A48            | Bronze B62             | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 21    | *Gland                | Cast Iron A48            | Bronze B62             | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 22    | *Swing Bolt           | Cad. Plated Steel        | Silicon Bronze Wrought | Cad. Plated Steel    | Stain. Stl. AISI 316     |
| 23    | *Packing              | Graphited Acrylic        |                        |                      |                          |
| 24    | Key                   | Steel Wrought            |                        |                      |                          |
| 25    | *Capscrew             | Steel SAE 2              | Bronze Wrought         | Steel SAE 2          | Stain. Stl. AISI 316     |
| 26    | Bearing Cap           | Cast Iron A48            | Bronze B62             | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 27    | Pin                   | Cad. Plated Steel        | Stain. Steel AISI 416  | Cad. Plated Steel    | Stain. Stl. AISI 316     |
| 28    | Case Ring             | Bronze ASTM B62          | Cast Iron A48          | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 29    | Protector             | Steel Wrought            |                        |                      |                          |
| 31    | Capscrew              | Steel SAE 2              |                        |                      |                          |
| 32    | Cart. Cap             | Cast Iron ASTM A48       |                        |                      |                          |
| 34    | Gasket                | Buna-N Treated Cellulose |                        |                      |                          |
| 35    | Ret. Ring             | Spring Steel             |                        |                      |                          |
| 36    | Cartridge             | Cast Iron ASTM A48       |                        |                      |                          |
| 37    | Gr. Seal              | Buna-N and Steel         |                        |                      |                          |
| 38    | Bearing               | Steel Commercial         |                        |                      |                          |
| 39    | Slinger               | Neoprene                 |                        |                      |                          |
| 40    | Slinger               | Neoprene                 |                        |                      |                          |
| 41    | Capscrew              | Steel SAE 2              |                        |                      |                          |
| 42    | Cart. Cap             | Cast Iron ASTM A48       |                        |                      |                          |
| 43    | Gr. Seal              | Buna-N and Steel         |                        |                      |                          |
| 44    | Gasket                | Buna-N Treated Cellulose |                        |                      |                          |
| 45    | Cartridge             | Cast Iron ASTM A48       |                        |                      |                          |
| 46    | Gr. Seal              | Buna-N and Steel         |                        |                      |                          |
| 47    | Bearing               | Steel Commercial         |                        |                      |                          |
| 48    | Slinger               | Neoprene                 |                        |                      |                          |
| 49    | Gland                 | Cast Iron A48            | Bronze B62             | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 50    | O-Ring                | Buna-N                   |                        |                      |                          |
| 52    | *Lantern Ring         | Bronze ASTM B62          | Cast Iron A48          | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 53    | Seal                  | Stain. Stl. (1)          | Stain. Stl. (2)        | Stain. Stl. (1)      | Stain. Stl. (2)          |
| 54    | Collar                | Bronze ASTM B62          | Cast Iron A48          | Cast Iron A48        | Stain. Stl. AISI 316     |
| 55    | Setscrew              | Stainless Steel AISI 316 |                        |                      |                          |
| 56    | *Bushing              | Bronze ASTM B62          | Cast Iron A48          | Cast Iron A48        | Stain. Stl. AISI 316     |
| 57    | Sleeve                | Bronze High Lead Tin     | Cast Iron A48          | Cast Iron A48        | Stain. Stl. AISI 316     |
| 58    | Gasket                | DuPont TFE Coated Steel  |                        |                      |                          |
| 59    | Impeller              | Bronze ASTM B584         | Cast Iron A48          | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 61    | *Imp. Ring            | Bronze ASTM B62          | Cast Iron A48          | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 62    | Gasket                | DuPont TFE Coated Steel  |                        |                      |                          |
| 63    | Key                   | Stain. Stl. AISI 416     | Stain. Stl. AISI 316   | Stain. Stl. AISI 416 | Stain. Stl. AISI 316     |
| 64    | Sleeve                | Bronze High Lead Tin     | Cast Iron A48          | Cast Iron A48        | Stain. Stl. AISI 316     |
| 65    | Shaft                 | P.S. 1-5 Alloy Stl. (3)  | Stl. AISI C1045 (3)    | Stl. AISI C1045 (3)  | Stain. Stl. AISI 316 (3) |
| 66    | Pin                   | Cad. Plated Steel        | Stain. Steel AISI 416  | Cad. Plated Steel    | Stain. Steel AISI 316    |
| 67    | *Pin                  | Cad. Plated Steel        | Stain. Steel AISI 416  | Cad. Plated Steel    | Stain. Steel AISI 316    |
| 68    | *Pin                  | Cad. Plated Steel        | Stain. Steel AISI 416  | Cad. Plated Steel    | Stain. Steel AISI 316    |
| 69    | Casing Half           | Cast Iron A48            | Bronze B62             | Cast Iron A48        | Stain. Stl. ACI CF8M     |
| 70    | *Drive Screw          | Steel Bronze Plated      |                        |                      |                          |
| 71    | *Nameplate            | Stainless Steel AISI 303 |                        |                      |                          |
| 73    | Capscrew              | Steel SAE 2              |                        |                      |                          |
| 74    | Bracket               | Cast Iron ASTM A48       |                        |                      |                          |
| 75    | Capscrew              | Steel SAE 2              |                        |                      |                          |
| 76    | Capscrew              | Steel SAE 2              |                        |                      |                          |
| 77    | Base                  | Cast Iron ASTM A48       |                        |                      |                          |

All material specifications are in accordance with ASTM unless otherwise noted. (1) B30P66 171 (JC) (2) XP66 1C1 (JC) (3) AISI 416 chrome steel heat treated power series 6B-7.

# 410 SERIES ENGINEERING DATA DESIGN DETAILS



| PUMP PART     |         | DIMENSION  | POWER SERIES 1 | POWER SERIES 2 | POWER SERIES 3 | POWER SERIES 4 | POWER SERIES 5 | POWER SERIES 6B | POWER SERIES 7 |
|---------------|---------|--|----------------|----------------|----------------|----------------|----------------|-----------------|----------------|
| STUFFING BOX  | PACKING | A Stuffing Box Bore Diameter                                 | 2-1/16         | 2-7/16         | 2-13/16        | 3-1/16         | 3-7/16         | 3-11/16         | 3-15/16        |
|               |         | B Stuffing Box Depth   | 2-3/8          | 3-1/8          | 3              | 3-1/2          | 3-3/4          | 3-3/4           | 3-7/8          |
|               |         | C Outside Dia., Sleeve for Packing                           | 1-1/8          | 1-1/2          | 1-3/4          | 2              | 2-3/8          | 2-1/2           | 2-7/8          |
|               |         | — No. of Packing Rings without Lantern Ring                  | 10             | 12             | 10             | 12             | 12             | 12              | 14             |
|               |         | — Total number of Packing Rings with Lantern Ring            | 8              | 10             | 8              | 10             | 10             | 10              | 12             |
|               |         | — No. of rings in front of Lantern Ring                      | 1              | 2              | 2              | 2              | 2              | 2               | 3              |
|               |         | — Packing Size   | 7/16 Sq.       | 7/16 Sq.       | 1/2 Sq.        | 1/2 Sq.        | 1/2 Sq.        | 9/16x1/2        | 1/2 Sq.        |
| STUFFING BOX  | M. SEAL | D Width of Lantern Ring                                      | 1/2            | 5/8            | 5/8            | 5/8            | 3/4            | 3/4             | 3/4            |
|               |         | E Distance from Box to Nearest Obstruction                   | 1-1/4          | 1-5/8          | 1-11/16        | 1-11/16        | 2              | 2-3/8           | 2-1/2          |
|               |         | F Dia. of Mechanical Seal Seat                               | 1-3/4          | 2-1/8          | 2-1/2          | 2-3/4          | 3-1/4          | 3-3/8           | 3-3/4          |
|               |         | G Length of Mechanical Seal                                  | 1-1/2          | 1-9/16         | 1-7/8          | 2              | 2-3/8          | 2-3/8           | 2-7/8          |
|               |         | H Outside Dia., sleeve for Mech. Seal                        | 1-1/8          | 1-1/2          | 1-3/4          | 2              | 2-3/8          | 2-1/2           | 2-7/8          |
|               |         | J Dia. at Impeller (Max. Shaft Dia.)                         | 1-1/8          | 1-3/8          | 1-5/8          | 1-7/8          | 2-1/8          | 2-3/8           | 2-3/4          |
|               |         | K Diameter at Shaft Sleeve                                   | 7/8            | 1-1/4          | 1-1/2          | 1-3/4          | 2              | 2-1/4           | 2-5/8          |
| SHAFT         |         | L Diameter at Coupling End                                   | 3/4            | 1-1/8          | 1-3/8          | 1-1/2          | 1-3/4          | 2-1/8           | 2-1/2          |
|               |         | — Max. deflection at Sealing Face                            | .002           | .002           | .002           | .002           | .002           | .002            | .002           |
|               |         | — Ball Bearing No. (Inboard Radial)                          | 204            | 206            | 207            | 208 †          | 309            | 211             | 213            |
| BALL BEARINGS |         | — Ball Bearing No. (Outboard Thrust)                         | 5303           | 5305           | 5306           | 5307           | 5309           | 5211            | 5213           |
|               |         | M Bearing Centers  | 14-3/4         | 18-3/8         | 19-3/8         | 21-1/4         | 24             | 28-3/8          | 33-1/8         |
|               |         | — Minimum Life of Bearing under worst conditions of load (*) | 6 YEARS        | 6 YEARS        | 6 YEARS        | 6 YEARS        | 6 YEARS        | 6 YEARS         | 6 YEARS        |

\*Average life of bearing is 5 times minimum life.

†5208 is provided as standard on 5 x 6 x 11B when operating at 3500 R.P.M. only.

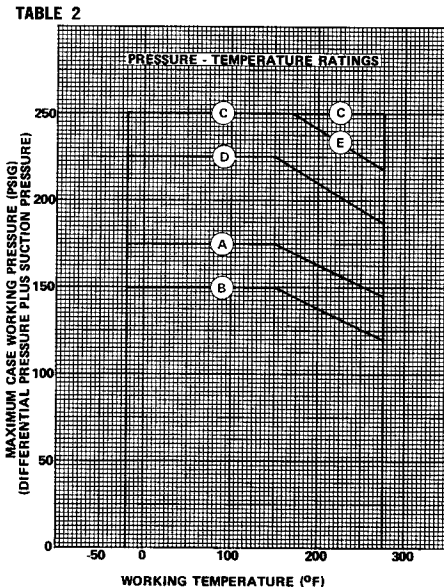
# 410 SERIES ENGINEERING DATA

**MAXIMUM CASE WORKING PRESSURE** is the sum of the differential pressure and the suction pressure. Table 2 indicates the maximum case working pressure for the 410 Series Split Case Pumps in various materials and at various operating temperatures. These maximum allowable pressures are based on wall thickness for the particular series of pumps, ratings for American Standard Flange Specifications, see Table 1, and take into account the material at various allowable temperatures. Table 1 offers the available casing materials and flange ratings for the 410 Series Split Case Pumps.

| PUMP CASING MATERIAL                | MINIMUM REQUIREMENT FOR STANDARD SUCTION AND DISCHARGE FLANGES |                   | PIPE SIZE     | CODE   |
|-------------------------------------|--|-------------------|---------------|--------|
|                                     | A.S.A. SPEC.   | CLASSIFICATION    |               |        |
| Cast Iron ASTM A48                  | B16.1  | 125 PSI Flat Face | 1-12<br>14-24 | A<br>B |
|                                     |  | 250 PSI Flat Face | 1-12<br>14-24 | C      |
| Bronze ASTM B62                     | B16.24   | 150 PSI Flat Face | All           | D      |
|                                     |  | 300 PSI Flat Face |               | C      |
| Stainless Steel ASTM 296 Grade CF8M | B16.5  | 150 PSI Flat Face | All           | E      |
|                                     |  | 300 PSI Flat Face |               | C      |

Maximum Hydrostatic Pressure 1½ times maximum case working pressure at 100°F.

**EXAMPLE:** A model 410 Pump with a bronze casing has been selected for operating at a case working pressure of 240 P.S.I.G. at 150°F. Enter Table 2 at 150°F. and read upward to 240 P.S.I.G. It is determined that the selection is within the recommended maximum case working pressure area for 300 PSI flanges and is therefore acceptable. Note that the example exceeds the maximum case working pressure unit if the material selected would have been 125 PSI flanged cast iron or 150 PSI flanged bronze.



**EXTERNAL INERTIA OR FLY-WHEEL EFFECT** is the Kinetic energy stored in the rotating assembly that must be overcome when the pump impeller is caused to rotate within the casing. This energy frequently must

be calculated to determine the torque required to start, accelerate or decelerate the pump. If the acceleration is rapid, the torque may be several times greater than the torque required to run the pump at normal or constant speed.  $WR^2$  values in  $LBS-FT^2$  are provided for these calculations. See tables 3 thru 8.

$WR^2$  values given in tables are for bronze impeller ...  $LB-FT^2$

**EXAMPLE 1:** Find  $WR^2$  value for a 15" diameter 8x10x15B bronze fitted pump handling cold water. From chart the "WET" value for a 15" diameter impeller ... **10.38  $LB-FT^2$**   
 Add power series 5 rotating element less impeller ... **0.15  $LB-FT^2$**   
**Total 10.53  $LB-FT^2$**

**EXAMPLE 2:** Find  $WR^2$  value for a 15" diameter 8 x 10 x 15B all iron pump handling 0.67 specific gravity gasoline. From chart select "DRY" value and correct for difference in materials.

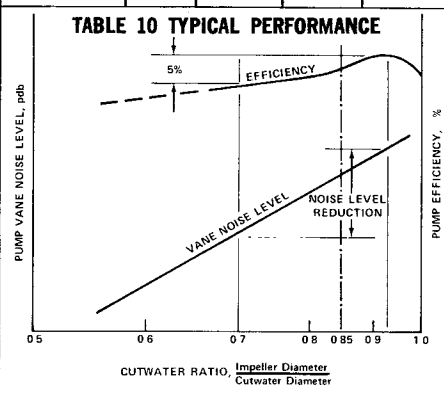
Sp. Gr. cast iron x 9.29  $LB-FT^2$  ... **7.54  $LB-FT^2$**   
 Sp. Gr. bronze x 9.29  $LB-FT^2$  ... **0.73  $LB-FT^2$**   
 Take difference ("WET"- "DRY") values and correct for difference in specific gravities.  
 1.09 x 0.67 ... **0.73  $LB-FT^2$**   
 Add power series 5 rotating element less impeller ... **0.15  $LB-FT^2$**   
**Total 8.42  $LB-FT^2$**

| TABLE 3<br>SPECIFIC GRAVITY OF COMMON METALS |      | TABLE 4<br>$WR^2$ VALUE OF ROTATING ELEMENT LESS IMPELLER |        |
|--|------|---|--------|
| METALS                                       | S.G. | POWER SERIES  | $WR^2$ |
| Bronze                                       | 8.86 | 1   | 0.006  |
| Cast Iron                                    | 7.20 | 2   | 0.020  |
|  |      | 3   | 0.038  |
|  |      | 4   | 0.075  |
| Carbon Steel                                 | 7.84 | 5   | 0.154  |
|  |      | 6B  | 0.294  |
| Stainless Steel                              | 7.90 | 7   | 0.536  |

| TABLE 5   |        |      |         |      |          |      |         |      |         |      |         |      | TABLE 6   |         |      |         |      |         |      |         |      |               |      |         |      |         |      |         |      |           |      |      |     |  |  |  |  |  |  |  |  |  |  |
|-----------|--------|------|---------|------|----------|------|---------|------|---------|------|---------|------|-----------|---------|------|---------|------|---------|------|---------|------|---------------|------|---------|------|---------|------|---------|------|-----------|------|------|-----|--|--|--|--|--|--|--|--|--|--|
| DIA.      | 2x2½x9 |      | 2x2½x10 |      | 2½x3x10B |      | 3x4x10B |      | 4x5x10B |      | 4x5x10B |      | DIA.      | 2x2½x12 |      | 2½x3x12 |      | 4x5x11A |      | 4x5x11C |      | 5x6x11 6x8x11 |      | 5x6x11C |      | 8x8x11B |      | 8x10x12 |      | 10x12x12B |      |      |     |  |  |  |  |  |  |  |  |  |  |
|           | DRY    | WET  | DRY     | WET  | DRY      | WET  | DRY     | WET  | DRY     | WET  | DRY     | WET  |           | DRY     | WET  | DRY     | WET  | DRY     | WET  | DRY     | WET  | DRY           | WET  | DRY     | WET  | DRY     | WET  | DRY     | WET  | DRY       | WET  | DRY  | WET |  |  |  |  |  |  |  |  |  |  |
| 10"       | —      | —    | —       | —    | —        | —    | 1.17    | 1.30 | —       | —    | —       | —    | 12"       | 1.55    | 1.82 | 1.70    | 1.95 | —       | —    | —       | —    | —             | —    | —       | —    | 2.91    | 3.43 | 4.10    | 4.60 | 5.80      | 6.75 |      |     |  |  |  |  |  |  |  |  |  |  |
| 9.5"      | —      | —    | —       | —    | 0.72     | 0.88 | 0.84    | 0.95 | 0.98    | 1.10 | 0.90    | 1.03 | 11.5"     | 1.25    | 1.45 | 1.40    | 1.55 | —       | —    | —       | —    | —             | —    | —       | —    | —       | 2.55 | 3.00    | 3.80 | 4.00      | 5.32 | 6.10 |     |  |  |  |  |  |  |  |  |  |  |
| 9.0"      | 0.56   | 0.63 | 0.60    | 0.70 | 0.70     | 0.85 | 0.80    | 0.90 | 0.80    | 0.90 | 0.80    | 0.90 | 11.0"     | 1.05    | 1.20 | 1.10    | 1.25 | 1.90    | 2.10 | 1.65    | 1.80 | 2.04          | 2.47 | 3.00    | 3.60 | 2.15    | 2.45 | 3.40    | 3.80 | 5.00      | 5.60 |      |     |  |  |  |  |  |  |  |  |  |  |
| 8.5"      | 0.37   | 0.43 | 0.46    | 0.54 | 0.62     | 0.73 | 0.70    | 0.75 | 0.68    | 0.75 | 0.56    | 0.63 | 10.5"     | 0.93    | 1.04 | 0.98    | 1.10 | 1.60    | 1.75 | 1.45    | 1.55 | 1.80          | 2.10 | 2.90    | 3.20 | 1.95    | 2.20 | 3.10    | 3.30 | 4.90      | 5.50 |      |     |  |  |  |  |  |  |  |  |  |  |
| 8.0"      | 0.28   | 0.32 | 0.40    | 0.47 | 0.56     | 0.65 | 0.56    | 0.60 | 0.56    | 0.63 | 10.0"   | 0.81 | 0.90      | 0.83    | 0.90 | 1.35    | 1.52 | 1.22    | 1.35 | 1.60    | 1.85 | 2.65          | 3.10 | 1.73    | 1.95 | 2.85    | 3.10 | 4.80    | 5.40 |           |      |      |     |  |  |  |  |  |  |  |  |  |  |
| 7.5"      | 0.23   | 0.26 | 0.36    | 0.41 | 0.47     | 0.56 | 0.46    | 0.50 | 0.48    | 0.54 | 9.5"    | 0.75 | 0.83      | 0.68    | 0.75 | 1.20    | 1.33 | 1.08    | 1.19 | 1.45    | 1.65 | 2.50          | 2.90 | 1.50    | 1.66 | 2.70    | 2.90 |         |      |           |      |      |     |  |  |  |  |  |  |  |  |  |  |
| 7.0"      | 0.19   | 0.22 | 0.29    | 0.33 | 0.42     | 0.49 | 0.36    | 0.40 | 0.43    | 0.46 | 9.0"    | 0.70 | 0.78      | 0.60    | 0.67 | 1.05    | 1.22 | 1.00    | 1.10 | 1.30    | 1.45 | 2.40          | 2.80 | 1.40    | 1.50 | 2.60    | 2.70 |         |      |           |      |      |     |  |  |  |  |  |  |  |  |  |  |
| 6.5"      | 0.18   | 0.19 | 0.27    | 0.31 | 0.39     | 0.44 | 0.32    | 0.36 | 0.38    | 0.41 | 8.5"    | —    | —         | —       | —    | 0.95    | 1.05 | 0.88    | 0.99 | 1.20    | 1.35 | 2.35          | 2.60 | 1.30    | 1.40 | 2.50    | 2.60 |         |      |           |      |      |     |  |  |  |  |  |  |  |  |  |  |
| 6.0"      | 0.16   | 0.18 | —       | —    | 0.35     | 0.41 | 0.28    | 0.31 | 0.33    | 0.36 | 8.0"    | —    | —         | —       | —    | 0.83    | 0.95 | 0.75    | 0.84 | 1.06    | 1.15 | 2.00          | 2.40 | 1.15    | 1.20 |         |      |         |      |           |      |      |     |  |  |  |  |  |  |  |  |  |  |
|           |        |      |         |      |          |      |         |      |         |      | 7.5"    | —    | —         | —       | —    | —       | —    | —       | —    | 0.73    | 0.80 | 0.93          | 1.05 | 1.90    | 2.20 | 1.09    | 1.12 |         |      |           |      |      |     |  |  |  |  |  |  |  |  |  |  |
|           |        |      |         |      |          |      |         |      |         |      | 7.0"    | —    | —         | —       | —    | —       | —    | —       | —    | —       | —    | —             | —    | —       | —    | —       | —    | —       |      |           |      |      |     |  |  |  |  |  |  |  |  |  |  |
| IMP. WGT. | 10#    |      | 12#     |      | 14#      |      | 18#     |      | 15#     |      |         |      | IMP. WGT. | 15#     |      | 17#     |      | 26#     |      | 22#     |      | 27#           |      | 32#     |      | 29#     |      | 43#     |      | 59#       |      |      |     |  |  |  |  |  |  |  |  |  |  |

# 410 SERIES ENGINEERING DATA QUIET PUMP SELECTION

| TABLE 9<br>PUMP<br>SIZE | MAX.<br>IMP.<br>DIA. | CUT-<br>WATER<br>DIA. | QUIET<br>IMP.<br>DIA.            | SPHERE<br>SIZE<br>DIA.          |
|-------------------------|----------------------|-----------------------|----------------------------------|---------------------------------|
| 2x2½x9                  | 9.0                  | 10.4                  | 8 <sup>1</sup> / <sub>16</sub>   | ⅛                               |
| 2x2½x10                 | 9.5                  | 10.3                  | 8 <sup>1</sup> / <sub>16</sub>   | ¼                               |
| 2x2½x12                 | 12.0                 | 13.3                  | 11¼                              | ¼                               |
| 2½x3x10B                | 9.5                  | 10.3                  | 8 <sup>1</sup> / <sub>16</sub>   | ⅜                               |
| 2½x3x12                 | 12.0                 | 13.3                  | 11⅜                              | ⅜                               |
| 3x4x10B                 | 10.0                 | 10.5                  | 8 <sup>1</sup> / <sub>16</sub>   | ½                               |
| 3x4x14                  | 14.0                 | 15.4                  | 13¼                              | ⅝                               |
| 4x5x10B                 | 9.5                  | 10.6                  | 9¼                               | ⅝                               |
| 4x5x11A                 | 11.3                 | 12.8                  | 10⅞                              | ⅝                               |
| 4x5x11C                 | 11.3                 | 12.8                  | 10⅞                              | ½                               |
| 4x5x15                  | 15.0                 | 16.4                  | 13 <sup>15</sup> / <sub>16</sub> | ⅝                               |
| 4x6x18B                 | 18.3                 | 22.6                  | 18¼                              | ⅞                               |
| 5x6x11                  | 11.0                 | 12.6                  | 10¾                              | 1                               |
| 5x6x11C                 | 11.0                 | 12.6                  | 10¾                              | ⅝                               |
| 5x6x15                  | 15.0                 | 16.4                  | 13⅞                              | 1 <sup>1</sup> / <sub>16</sub>  |
| 5x6x17                  | 16.5                 | 17.4                  | 14¾                              | 1 <sup>1</sup> / <sub>16</sub>  |
| 6x8x11                  | 11.0                 | 12.8                  | 10⅞                              | 1                               |
| 8x8x11B                 | 12.0                 | 13.3                  | 11¼                              | 1¼                              |
| 6x8x15                  | 15.0                 | 16.6                  | 14⅞                              | 1 <sup>15</sup> / <sub>16</sub> |
| 6x8x18A                 | 18.0                 | 20.5                  | 17⅞                              | 1                               |
| 6x8x18B                 | 18.0                 | 20.5                  | 17⅞                              | 1                               |
| 6x8x18C                 | 18.0                 | 20.5                  | 17⅞                              | 1                               |
| 6x8x20                  | 19.5                 | 20.6                  | 17 <sup>1</sup> / <sub>16</sub>  | 1 <sup>13</sup> / <sub>16</sub> |
| 8x10x12                 | 12.0                 | 14.4                  | 12¼                              | 1 <sup>15</sup> / <sub>16</sub> |
| 8x10x15A                | 15.0                 | 16.8                  | 14¼                              | 1 <sup>15</sup> / <sub>16</sub> |
| 8x10x15B                | 15.0                 | 16.8                  | 14¼                              | 1 <sup>15</sup> / <sub>16</sub> |
| 8x10x17B                | 17.5                 | 18.5                  | 15¾                              | 1 <sup>15</sup> / <sub>16</sub> |
| PUMP<br>SIZE            | MAX.<br>IMP.<br>DIA. | CUT-<br>WATER<br>DIA. | QUIET<br>IMP.<br>DIA.            | SPHERE<br>SIZE<br>DIA.          |
| 10x12x12B               | 12.0                 | 14.0                  | 11 <sup>15</sup> / <sub>16</sub> | 1 <sup>15</sup> / <sub>16</sub> |
| 10x12x15B               | 15.0                 | 17.1                  | 14 <sup>1</sup> / <sub>16</sub>  | 1 <sup>1</sup> / <sub>16</sub>  |
| 10x12x15C               | 15.0                 | 17.1                  | 14 <sup>1</sup> / <sub>16</sub>  | 1⅞                              |
| 10x12x18                | 18.0                 | 20.5                  | 17 <sup>1</sup> / <sub>16</sub>  | 1 <sup>1</sup> / <sub>16</sub>  |
| 12x14x15B               | 15.0                 | 17.8                  | 15                               | 1 <sup>1</sup> / <sub>16</sub>  |
| 12x14x18                | 18.0                 | 21.1                  | 18                               | 1 <sup>1</sup> / <sub>16</sub>  |
| 14x16x18                | 18.0                 | 22.0                  | 18                               | 1½                              |



QUIET PUMP operation is always desirable and sometimes essential. One of the most important factors for noise control in a pumping installation is the correct selection of a pumping unit for the system. To insure that the pump will run quietly, it should be selected so that it will operate as close as possible to the best efficiency point. At this point the hydraulic shock within the pump is at a minimum since the flow angle of the fluid from the tip of the impeller is correct for the casing design. Every pump is designed for the best efficiency point and operation at any other point on the characteristic curves is a compromise. The amount of turbulence on either side of the best efficiency point increases as the point of operation is moved along the curve from the maximum efficiency. Therefore, the greater the turbulence, the greater the noise generated.

Hydraulic shock is also a factor if the periphery of the impeller passes too close to the cutwater. If the ratio of the impeller diameter to the cutwater diameter in centrifugal pumps is greater than 0.92, the pump is likely to be hydraulically noisy. In such instances the hydraulic pulses are actually differential pressures that occur when the impeller vanes pass the cutwater. Cutwater ratios of 0.9 to 0.95 are typical; however, significantly lower noise levels are achieved in pumps designed with a ratio of 0.7 to 0.75. Although there is an optimum gap for pump efficiency, increases of only 3%-5% may be realized by using the optimum. A cutwater ratio of 0.85 is commonly specified by practicing engineers, thereby realizing a minimum reduction in pump efficiency with a mean reduction in noise level. Table 9 offers recommended quiet impeller diameter at 85% cutwater ratio.

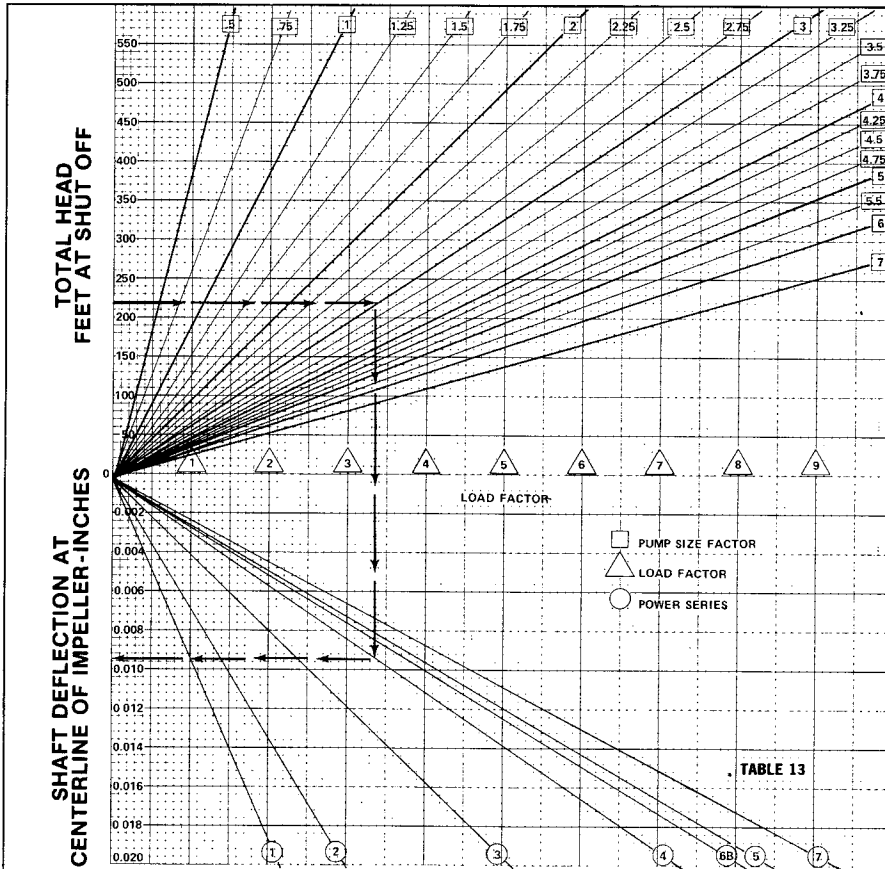
BEARING LIFE is based on the radial and thrust loads imposed on the bearings at the specific operating head and suction pressure. The Split case pump is designed for a six year minimum B<sub>10</sub> life at the maximum recommended loads. Bearing life at any other point of greater capacity on the curves will greatly exceed the minimum life shown. Average bearing life is equal to five (5) times the minimum bearing life. Tables 11, 12, 13 and 14 will enable you to determine the minimum radial and thrust bearing life for any type 410 Series pump size. SHAFT DEFLECTION is the consequence of the unbalanced hydraulic force acting inside the pump on the impeller and shaft in a radial direction. This unbalance occurs when the pump is operating away from its best efficiency point. At shut-off condition (zero flow) the unbalance is greatest and therefore the resultant radial load is maximum. *Radial load and shaft deflection approach zero at the best efficiency point of the pump.* 410 Series pumps are designed for a maximum deflection of .002" at the mechanical seal faces when operating at the maximum recommended differential pressure. Deflection in a twin volute pump is minimized by a splitter blade that is cast within the casing thereby nearly balancing the resultant forces acting on the shaft. See Table 13 on page 77.

**PROCEDURE FOR DETERMINING MAXIMUM SHAFT DEFLECTION AND MINIMUM BEARING LIFE.**

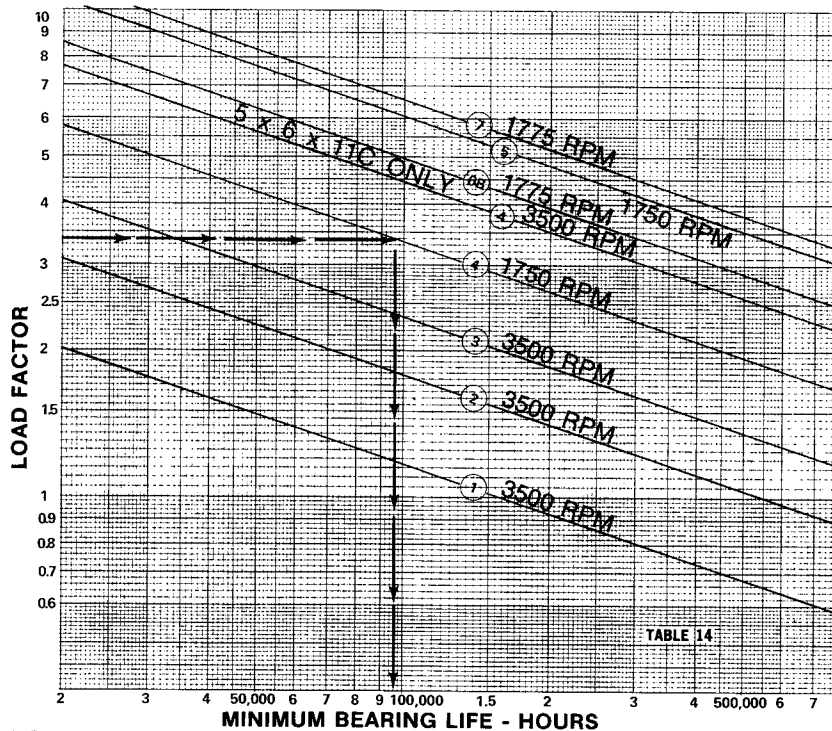
1. Determine the proper Pump Size, approximate Shut-Off Head in feet, Power Series number, and Speed from the range charts illustrated in the 410 Bulletin.
2. From table 11 on page 77 determine the Pump Size Factor based on Pump Size and R.P.M.
3. On table 13 on page 77 locate the correct Shut-Off Head in feet and read across to the proper Pump Size Factor and down to the applicable Power Series. Note the Load Factor in the process. Read to the scale on the left for the maximum Shaft Deflection value.
4. From table 14 on page 77 using the Load Factor from step 3 above read across to the correct Power Series number and down for the minimum Bearing Life in hours.

**NOTE:** 1. One (1) year life is based on 8740 HOURS (continuous operation). 2. Additional bearing information can be found on page 74. 3. Specific information on Bearing Life and Shaft Deflection can be obtained from the factory.

# 410 SERIES ENGINEERING DATA SHAFT DEFLECTION AND BEARING LIFE



The charts reflect the *worst* impeller, shaft sleeves, wear-possible conditions at pump ing rings and packing will re-duce the amount of deflection.



| TABLE 11<br>PUMP<br>SIZE | POWER<br>SERIES | PUMP SIZE FACTOR |             |             |
|--------------------------|-----------------|------------------|-------------|-------------|
|                          |                 | 3500<br>RPM      | 1750<br>RPM | 1150<br>RPM |
| 2x2½x9                   | 1               | 0.40             | 0.50        |             |
| 2x2½x10                  | 1               | 0.55             | 0.65        |             |
| 2x2½x12                  | 1               |                  | 0.65        | 0.80        |
| 2½x3x10B                 | 2               | 1.00             | 1.00        |             |
| 2½x3x12                  | 2               |                  | 1.00        | 1.20        |
| 3x4x10B                  | 2               | 1.25             | 1.50        |             |
| 3x4x14                   | 2               |                  | 1.40        | 1.60        |
| 4x5x10B                  | 2               | 1.30             | 1.40        |             |
| 4x5x11A                  | 3               |                  | 2.00        | 2.25        |
| 4x5x11C                  | 3               | 1.50             | 1.70        |             |
| 4x5x15                   | 3               |                  | 2.00        | 2.25        |
| 4x6x18B                  | 4               |                  | 1.70        | 1.80        |
| 5x6x11                   | 4               |                  | 4.00        | 4.50        |
| 5x6x11C                  | 4               | 2.00             | 2.13        |             |
| 5x6x15                   | 4               |                  | 3.00        | 3.25        |
| 5x6x17                   | 4               |                  | 3.00        | 3.25        |
| 6x8x11                   | 4               |                  | 4.00        | 4.50        |
| 8x8x11B                  | 4               |                  | 5.25        | 5.50        |
| 6x8x15                   | 5               |                  | 3.75        | 4.00        |
| 6x8x18A                  | 5               |                  | 3.00        | 3.25        |
| 6x8x18B                  | 5               |                  | 2.75        | 3.50        |
| 6x8x18C                  | 5               |                  | 3.75        | 4.75        |
| 6x8x20                   | 5               |                  | 3.20        | 3.40        |
| 8x10x12                  | 5               |                  | 3.50        | 4.00        |
| 8x10x15A                 | 5               |                  | 4.00        | 4.50        |
| 8x10x15B                 | 5               |                  | 4.50        | 5.00        |
| 8x10x17B                 | 5               |                  | 4.00        | 5.00        |
| PUMP<br>SIZE             | POWER<br>SERIES | PUMP SIZE FACTOR |             |             |
|                          |                 | 1775<br>RPM      | 1175<br>RPM | 885<br>RPM  |
| 10x12x12B                | 6B              | 4.50             | 5.00        |             |
| 10x12x15B                | 6B              | 3.25             | 3.75        |             |
| 10x12x15C                | 6B              | 3.50             | 4.75        |             |
| 10x12x18                 | 6B              | 3.25             | 3.75        |             |
| 12x14x15B                | 7               | 4.75             | 5.50        |             |
| 12x14x18                 | 7               | 4.00             | 4.50        |             |
| 14x16x18                 | 7               |                  | 7.00        | 7.50        |

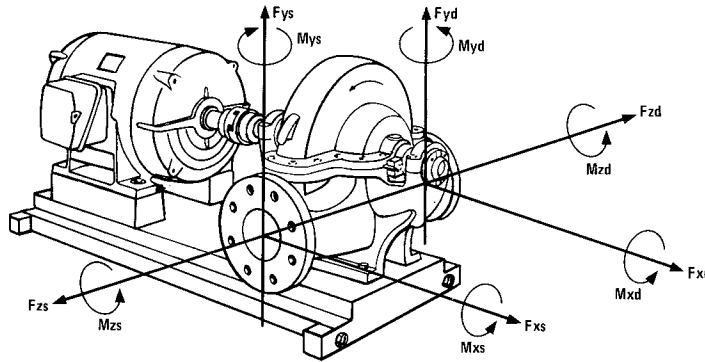
**EXAMPLE:** A 5x6x15 pump operating at 1750 R.P.M. on a No. 4 power series with a shut-off head of 225 ft. T.D.H. has a Size Factor of 3.00, a Load Factor of 3.35, a maximum Shaft Deflection at the centerline of the impeller of .0092, and a minimum Bearing Life of 97,000 hours @ 1750 R.P.M.

| TABLE 12                     | CHART<br>SPEED<br>R.P.M. | DESIRED<br>SPEED<br>R.P.M. | MULTIPLY<br>CHART<br>LIFE BY |
|------------------------------|--------------------------|----------------------------|------------------------------|
| SPEED<br>(R.P.M.)<br>FACTORS | 3500                     | 1750                       | 2                            |
|                              | 3500                     | 1150                       | 3                            |
|                              | 1750                     | 1150                       | 1.5                          |
|                              | 1775                     | 1175                       | 1.5                          |
|                              | 1775                     | 875                        | 2                            |
|                              | 1175                     | 875                        | 1.3                          |

# AURORA 410 SERIES

## ENGINEERING DATA

### PUMP NOZZLE LOADING PUMPS WITH GROUTED BASEPLATES



| PUMP SIZE      |           | FORCES - LBS. |     |      | MOMENTS - FT. LBS. |      |      |
|----------------|-----------|---------------|-----|------|--------------------|------|------|
|                |           | Fx            | Fy  | Fz   | Mx                 | My   | Mz   |
| 2 x 2-1/2 x 9  | DISCHARGE | 200           | 250 | 750  | 250                | 350  | 300  |
|                | SUCTION   | 200           | 250 | 750  | 250                | 350  | 300  |
| 2 x 2-1/2 x 10 | DISCHARGE | 200           | 250 | 750  | 250                | 350  | 300  |
|                | SUCTION   | 200           | 250 | 750  | 250                | 350  | 300  |
| 2 x 2-1/2 x 12 | DISCHARGE | 200           | 250 | 750  | 250                | 350  | 300  |
|                | SUCTION   | 200           | 200 | 750  | 250                | 350  | 300  |
| 2-1/2 x 3 x 10 | DISCHARGE | 500           | 550 | 1350 | 600                | 800  | 700  |
|                | SUCTION   | 450           | 550 | 1350 | 600                | 800  | 700  |
| 2-1/2 x 3 x 12 | DISCHARGE | 400           | 500 | 1350 | 600                | 800  | 700  |
|                | SUCTION   | 400           | 500 | 1350 | 600                | 800  | 700  |
| 3 x 4 x 10     | DISCHARGE | 450           | 550 | 1350 | 600                | 800  | 700  |
|                | SUCTION   | 400           | 500 | 1350 | 600                | 800  | 700  |
| 3 x 4 x 14     | DISCHARGE | 400           | 450 | 1400 | 600                | 800  | 700  |
|                | SUCTION   | 350           | 400 | 1400 | 600                | 800  | 700  |
| 4 x 5 x 10     | DISCHARGE | 450           | 550 | 1400 | 650                | 800  | 700  |
|                | SUCTION   | 400           | 500 | 1400 | 650                | 800  | 700  |
| 4 x 5 x 11     | DISCHARGE | 250           | 850 | 750  | 1200               | 550  | 1400 |
|                | SUCTION   | 250           | 850 | 750  | 1200               | 550  | 1400 |
| 4 x 5 x 15     | DISCHARGE | 700           | 850 | 2200 | 1200               | 1600 | 1450 |
|                | SUCTION   | 650           | 750 | 2200 | 1200               | 1600 | 1450 |
| 4 x 6 x 18     | DISCHARGE | 650           | 800 | 2200 | 1250               | 1600 | 1450 |
|                | SUCTION   | 550           | 700 | 2200 | 1250               | 1600 | 1450 |
| 5 x 6 x 11     | DISCHARGE | 800           | 400 | 2200 | 500                | 1600 | 600  |
|                | SUCTION   | 700           | 350 | 2200 | 500                | 1600 | 600  |
| 5 x 6 x 15     | DISCHARGE | 700           | 850 | 2200 | 1250               | 1600 | 1450 |
|                | SUCTION   | 600           | 750 | 2200 | 1250               | 1600 | 1450 |
| 5 x 6 x 17     | DISCHARGE | 650           | 800 | 2250 | 1250               | 1600 | 1500 |
|                | SUCTION   | 600           | 750 | 2250 | 1250               | 1600 | 1500 |
| 6 x 8 x 11     | DISCHARGE | 800           | 950 | 2200 | 1250               | 1600 | 1450 |
|                | SUCTION   | 650           | 750 | 2200 | 1250               | 1600 | 1450 |

Values tabled are for forces and moments acting alone at the suction or discharge flange.

Combined forces and moments must be reduced so:

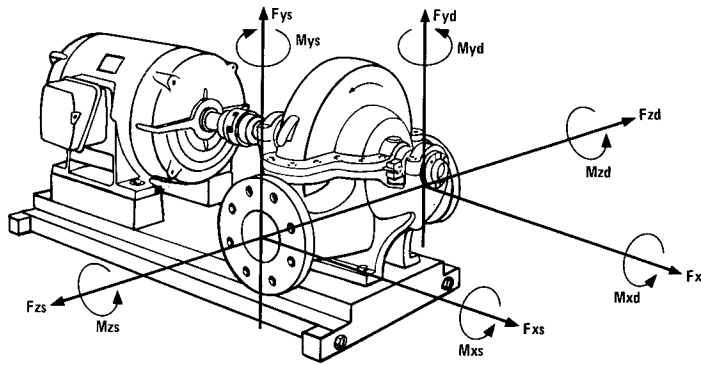
$$\frac{F_{xd}}{F_{xdmax}} + \frac{F_{yd}}{F_{ydmax}} + \frac{F_{zd}}{F_{zdmax}} + \frac{M_{xd}}{M_{xdmax}} + \frac{M_{yd}}{M_{ydmax}} + \frac{M_{zd}}{M_{zdmax}} + \frac{F_{xs}}{F_{xsmax}} + \frac{F_{ys}}{F_{ysmax}} + \frac{F_{zs}}{F_{zsmax}} + \frac{M_{xs}}{M_{xsmax}} + \frac{M_{ys}}{M_{ysmax}} + \frac{M_{zs}}{M_{zsmax}} \leq 1.0$$



## ENGINEERING DATA

DATED MARCH 1986

### PUMP NOZZLE LOADING PUMPS WITH GROUTED BASEPLATES



| PUMP SIZE     |           | FORCES - LBS. |      |      | MOMENTS - FT. LBS. |      |      |
|---------------|-----------|---------------|------|------|--------------------|------|------|
|               |           | Fx            | Fy   | Fz   | Mx                 | My   | Mz   |
| 8 x 8 x 11    | DISCHARGE | 750           | 750  | 2250 | 1000               | 1600 | 1200 |
|               | SUCTION   | 650           | 600  | 2250 | 1000               | 1600 | 1200 |
| 6 x 8 x 15    | DISCHARGE | 1150          | 1300 | 3250 | 2100               | 2800 | 2550 |
|               | SUCTION   | 950           | 1100 | 3250 | 2100               | 2800 | 2550 |
| 6 x 8 x 18    | DISCHARGE | 1000          | 1200 | 3300 | 2150               | 2850 | 2600 |
|               | SUCTION   | 900           | 1050 | 3300 | 2150               | 2850 | 2600 |
| 6 x 8 x 20    | DISCHARGE | 1050          | 1250 | 3300 | 2200               | 2850 | 2650 |
|               | SUCTION   | 900           | 1100 | 3300 | 2200               | 2850 | 2650 |
| 8 x 10 x 12   | DISCHARGE | 950           | 1150 | 3300 | 2150               | 2850 | 2600 |
|               | SUCTION   | 900           | 1100 | 3300 | 2150               | 2850 | 2600 |
| 8 x 10 x 15   | DISCHARGE | 950           | 1150 | 3300 | 2200               | 2850 | 2600 |
|               | SUCTION   | 900           | 1100 | 3300 | 2200               | 2850 | 2600 |
| 8 x 10 x 17   | DISCHARGE | 950           | 1150 | 3300 | 2200               | 2850 | 2650 |
|               | SUCTION   | 900           | 1100 | 3300 | 2200               | 2850 | 2650 |
| 8 x 10 x 21   | DISCHARGE | 1650          | 2000 | 3300 | 4000               | 4350 | 3350 |
|               | SUCTION   | 1400          | 1700 | 3300 | 4000               | 4350 | 3350 |
| 10 x 12 x 12B | DISCHARGE | 1350          | 1700 | 3350 | 3000               | 4450 | 4650 |
|               | SUCTION   | 1150          | 1400 | 3350 | 3000               | 4450 | 4650 |
| 10 x 12 x 15B | DISCHARGE | 1300          | 1600 | 3400 | 3050               | 4500 | 4700 |
|               | SUCTION   | 1100          | 1350 | 3400 | 3050               | 4500 | 4700 |
| 10 x 12 x 15C | DISCHARGE | 1300          | 1600 | 3400 | 3050               | 4500 | 4700 |
|               | SUCTION   | 1100          | 1350 | 3400 | 3050               | 4500 | 4700 |
| 10 x 12 x 18  | DISCHARGE | 1200          | 1500 | 3400 | 3050               | 4500 | 4700 |
|               | SUCTION   | 1000          | 1250 | 3400 | 3050               | 4500 | 4700 |
| 12 x 14 x 15B | DISCHARGE | 1300          | 1700 | 3450 | 3250               | 4600 | 5050 |
|               | SUCTION   | 1000          | 1300 | 3450 | 3250               | 4600 | 5050 |
| 12 x 14 x 18  | DISCHARGE | 1250          | 1650 | 3500 | 3300               | 4650 | 5100 |
|               | SUCTION   | 950           | 1250 | 3500 | 3300               | 4650 | 5100 |
| 14 x 16 x 18  | DISCHARGE | 1050          | 1450 | 3600 | 3550               | 4800 | 5500 |
|               | SUCTION   | 850           | 1150 | 3600 | 3550               | 4800 | 5500 |

Values tabled are for forces and moments acting alone at the suction or discharge flange.

Combined forces and moments must be reduced so:

$$\frac{F_{xd}}{F_{xdmax}} + \frac{F_{yd}}{F_{ydmax}} + \frac{F_{zd}}{F_{zdmax}} + \frac{M_{xd}}{M_{xdmax}} + \frac{M_{yd}}{M_{ydmax}} + \frac{M_{zd}}{M_{zdmax}} + \frac{F_{xs}}{F_{xsmax}} + \frac{F_{ys}}{F_{ysmax}} + \frac{F_{zs}}{F_{zsmax}} + \frac{M_{xs}}{M_{xsmax}} + \frac{M_{ys}}{M_{ysmax}} + \frac{M_{zs}}{M_{zsmax}} \leq 1.0$$

# AURORA MODEL 412-C PUMPS

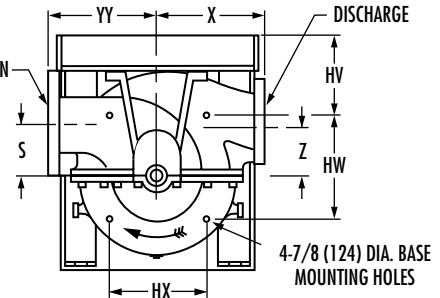
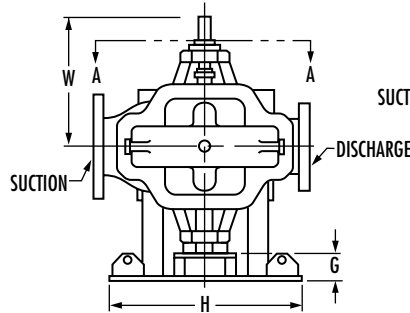
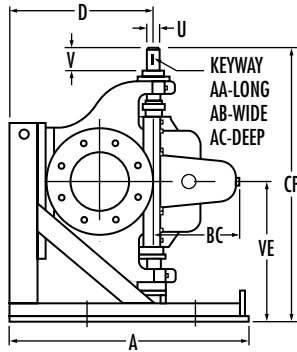
10"-12"-14" PUMPS

Date **January 2003**

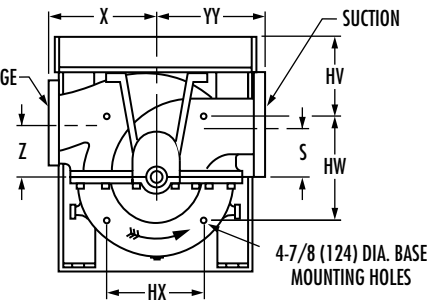
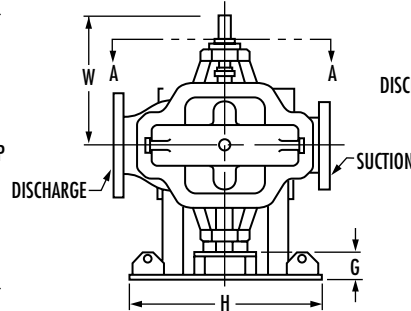
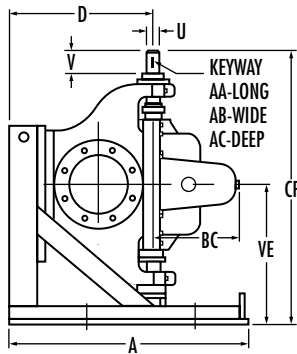
POWER SERIES NO. 6B-7

Supersedes Section 410 PAGE 205  
DATED August 1986

VERTICAL CHAIR MOUNTED



**RIGHT HAND ROTATION**



**LEFT HAND ROTATION**

| PUMP SIZE |      |           | POWER SERIES | BASE | D               | S               | U             | V               | W               | X           | Z               | AA             | AB          | AC          | BC              | CP               | VE              | YY          |
|-----------|------|-----------|--------------|------|-----------------|-----------------|---------------|-----------------|-----------------|-------------|-----------------|----------------|-------------|-------------|-----------------|------------------|-----------------|-------------|
| DISCH     | SUCT | CASE BORE |              |      |                 |                 |               |                 |                 |             |                 |                |             |             |                 |                  |                 |             |
| 8         | 10   | 21        | 6B           | 4    | 25-1/4<br>(641) | 9-1/2<br>(241)  | 2-1/8<br>(54) | 5-7/16<br>(138) | 21-7/8<br>(556) | 18<br>(457) | 9-1/2<br>(241)  | 4-3/4<br>(121) | 1/2<br>(13) | 1/4<br>(6)  | 14<br>(356)     | 47<br>(1194)     | 25-1/8<br>(638) | 21<br>(533) |
| 10        | 12   | 15        | 6B           | 1    | 31-3/4<br>(806) | 13-1/2<br>(343) | 2-1/8<br>(54) | 5-7/16<br>(138) | 21-7/8<br>(556) | 17<br>(432) | 13-1/2<br>(343) | 4-3/4<br>(121) | 1/2<br>(13) | 1/4<br>(6)  | 13-1/2<br>(343) | 47<br>(1194)     | 25-1/8<br>(638) | 20<br>(508) |
| 10        | 12   | 18        | 6B           | 1    | 31-3/4<br>(806) | 13-1/2<br>(343) | 2-1/8<br>(54) | 5-7/16<br>(138) | 21-7/8<br>(556) | 18<br>(457) | 13-1/2<br>(343) | 4-3/4<br>(121) | 1/2<br>(13) | 1/4<br>(6)  | 14-1/2<br>(368) | 47<br>(1194)     | 25-1/8<br>(638) | 22<br>(559) |
| 12        | 14   | 15        | 7            | 2    | 33-3/4<br>(857) | 15<br>(381)     | 2-1/2<br>(64) | 6-5/8<br>(168)  | 25-1/4<br>(641) | 17<br>(432) | 15<br>(381)     | 5<br>(127)     | 5/8<br>(16) | 5/16<br>(8) | 15<br>(381)     | 51-1/4<br>(1302) | 26<br>(660)     | 22<br>(559) |
| 12        | 14   | 18        | 7            | 2    | 33-3/4<br>(857) | 15<br>(381)     | 2-1/2<br>(64) | 6-5/8<br>(168)  | 25-1/4<br>(641) | 18<br>(457) | 15<br>(381)     | 5<br>(127)     | 5/8<br>(16) | 5/16<br>(8) | 16-1/8<br>(410) | 51-1/4<br>(1302) | 26<br>(660)     | 23<br>(584) |
| 14        | 16   | 18        | 7            | 3    | 36<br>(914)     | 16<br>(406)     | 2-1/2<br>(64) | 6-5/8<br>(168)  | 25-1/4<br>(641) | 22<br>(559) | 16<br>(406)     | 5<br>(127)     | 5/8<br>(16) | 5/16<br>(8) | 18-1/4<br>(464) | 51-1/4<br>(1302) | 26<br>(660)     | 27<br>(686) |

| BASE | 1               | 2            | 3            | 4               |
|------|-----------------|--------------|--------------|-----------------|
| A    | 38<br>(965)     | 46<br>(1168) | 48<br>(1219) | 40<br>(1016)    |
| G    | 9-5/8<br>(244)  | 8<br>(203)   | 8<br>(203)   | 9-5/8<br>(244)  |
| H    | 36-1/2<br>(927) | 35<br>(889)  | 35<br>(889)  | 36-1/2<br>(927) |
| HV   | 8<br>(203)      | 8<br>(203)   | 8<br>(203)   | 8<br>(203)      |
| HW   | 26<br>(660)     | 34<br>(864)  | 36<br>(914)  | 28<br>(711)     |
| HX   | 22<br>(559)     | 19<br>(483)  | 19<br>(483)  | 22<br>(559)     |

|                   |                   |
|-------------------|-------------------|
| STD. 125# FLANGES | OPT. 250# FLANGES |
|-------------------|-------------------|

- NOTES:
- All dimensions in inches (mm).
  - Dimensions may vary  $\pm 3/8"$  (10).
  - Not for construction purposes unless certified.
  - Discharge and suction flanges - ANSI Standard flat face.