

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                      |                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------|
| Size 50 to 11,600<br>cc/rev,<br>up to 250 bar,<br>36,000Nm, 240kW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Fixed Displacement Radial Piston Hydraulic Motor<br>Staffa, Series B | Data Sheet<br>M-1001/03.00<br>GB |
| <div data-bbox="228 362 349 394" data-label="Section-Header"> <h3>Features</h3> </div> <div data-bbox="228 407 834 806" data-label="List-Group"> <ul style="list-style-type: none"> <li>◇ Rugged, reliable, proven design.</li> <li>◇ Unique Hydrostatic balancing provides minimum wear and extended life.</li> <li>◇ High volumetric and mechanical efficiency.</li> <li>◇ Capacities range from 50 to 11600 cc per rev.</li> <li>◇ Large variety of Shaft and Porting options.</li> <li>◇ Output torque up to 36000 Nm.</li> <li>◇ Wide range of mounting interfaces available.</li> <li>◇ Highly accurate electronic positional and velocity control systems also available.</li> </ul> </div> <div data-bbox="892 418 1402 864" data-label="Image"> </div> <div data-bbox="234 1028 392 1061" data-label="Section-Header"> <h3>Description</h3> </div> <div data-bbox="228 1079 1469 1173" data-label="Text"> <p>The Kawasaki "Staffa" range of high torque low speed fixed displacement radial piston hydraulic motors consists of 13 frame sizes ranging from the HMB010 to HMB700. Capacity ranges from 50 to 11,600cc/rev.</p> </div> <div data-bbox="228 1193 1450 1258" data-label="Text"> <p>The rugged, well proven design incorporates high efficiency, combined with good breakout torque and smooth running capability.</p> </div> <div data-bbox="228 1276 1398 1339" data-label="Text"> <p>Various features and options are available including, on request, mountings to match competitors' interfaces.</p> </div> <div data-bbox="228 1357 1500 1424" data-label="Text"> <p>The Kawasaki "Staffa" range also includes dual and continuously variable displacement motors. To obtain details of this product range please refer to data sheet M-1002</p> </div> |                                                                      |                                  |
| Model<br>Staffa B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Page<br>1.70                                                         | Data Sheet<br>M-1001/03.00       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                      |                                  |

|     |      |     |    |     |    |   |      |
|-----|------|-----|----|-----|----|---|------|
| F11 | HM*B | 060 | S3 | FM3 | Tx | * | PL** |
|-----|------|-----|----|-----|----|---|------|

|        |                                     |
|--------|-------------------------------------|
| Blank: | Mineral oil.                        |
| F3:    | Phosphate ester (HFD fluid).        |
| F11:   | Water-based fluids (HFA, HFB & HFC) |
| * :    | Consult                             |

Blank: Standard (HMB)  
HD: Heavy duty (HMHDB)

(See options page 7)

See shaft type option list on Page 3

See Port Connection details on Page 4

PL\*\*: Non-catalogued features, (\*\*) = number assigned as required.

eg:  
Stainless steel shaft  
sleeves.  
Alternative port  
connections.  
Shaft variants.  
Alternative displacement.  
Special mountings.  
Special paint.

Blank: None  
T: Staffa original tacho drive.  
Tx: Customer specific  
encoder drive.

**Shaft Options****MOTOR TYPE****SHAFT DESCRIPTION**

|                                           |        |   |                                             |
|-------------------------------------------|--------|---|---------------------------------------------|
| HMB010                                    | P*     | = | Parallel keyed shaft Ø 40mm                 |
| HMB010                                    | S*     | = | Involute spline 13 teeth BS3550             |
| HMB030/045                                | (H)S*  | = | Involute spline 17 teeth to BS3550          |
| HMB030/045                                | (H)P   | = | Parallel keyed shaft Ø 55mm                 |
| HMB030/045                                | (H)Z*  | = | Involute spline to DIN5480 (W55x3x17x7h)    |
| HMB045                                    | Q*     | = | Internal involute spline 21 teeth to BS3550 |
| HMB060/080/100                            | (H)P*  | = | Parallel keyed shaft Ø 60mm                 |
| HMB060/080/100                            | (H)S*  | = | Involute spline 14 teeth to BS3550          |
| HMB060/080/100                            | (H)Z*  | = | Involute spline to DIN5480 (W70x3x22x7h)    |
| HMB060/080/100                            | (H)Q*  | = | Internal involute spline 24 teeth to BS3550 |
| HMB060/080/100/125/150/200/<br>HMB270/325 | T*     | = | Long tapered keyed shaft                    |
| HMB060/080/100/270/325                    | X*     | = | Short tapered keyed shaft                   |
| HMB125/150/200/270/325                    | (H)P1* | = | Parallel keyed shaft Ø 85mm                 |
| HMHDB125/150/200/270 & 325                | (H)P2* | = | Parallel keyed shaft Ø 100mm                |
| HMB125/150/200/270/325                    | (H)S3* | = | Involute spline 20 teeth to BS3550          |
| HMB125/150/200                            | (H)S4* | = | Involute spline 16 teeth at 20°             |
| HMHDB125/150/200, 270/325                 | (H)S5* | = | Involute spline 23 teeth to BS3550          |
| HMB125/150/200                            | (H)Z3* | = | Involute spline to DIN5480 (W85x3x27x7h)    |
| HMHDB125/150/200                          | (H)Z5* | = | Involute spline to DIN5480 (W100x4x24x7h)   |
| HMHDB125/150/200/270/325                  | (H)Q*  | = | Internal involute spline 34 teeth to BS3550 |
| HMHDB125/150/200/270/325                  | (H)X*  | = | Short taper, keyed shaft                    |
| HMB270/325 + HMHDB270/325                 | (H)Z*  | = | Involute spline to DIN5480 (W100x4x24x7h)   |
| HMHDB400                                  | P*     | = | Parallel shaft with two keys Ø 100mm        |
| HMHDB400                                  | S*     | = | Involute spline 23 teeth to BS3550          |
| HMHDB400                                  | Z*     | = | Involute spline to DIN5480 (W100x4x24x7h)   |
| HMHDB400                                  | Q*     | = | Internal involute spline 31 teeth to BS3550 |
| HMHDB400                                  | X*     | = | Tapered keyed shaft                         |
| HMB700                                    | Z*     | = | Involute spline to DIN5480 (W120x4x28x7h)   |
| HMB700                                    | P      | = | Parallel keyed shaft at 120° 120 Ø          |

**Notes:**

\* - For installations where shaft is vertically upwards specify "V" after shaft type letter to ensure that additional high level drain port is provided.

(H) - Use "H" prefix code as noted to specify "hollow" shaft with through hole Ø 26.2. Hollow shafts are available only with type "S04" main port connection.

For all shaft dimensions see the motor installation drawings



**Main Port Connections****Product Type****HMB010**

Blank = Two, four bolt flange ports of 20mm Ø

**HMB030 Mono bloc**

Blank = Rear entry ports G 3 /4" (BSPF)  
 F = Side port SAE 1" -4 Bolt (UNC) flange  
 FM = Side port SAE 1" -4 Bolt (Metric) flange

**HMB045 Mono bloc**

Blank = Rear entry ports G 1" (BSPF)  
 D = Dual entry ports G 1" (BSPF)

**HMB030/045 Two part build (TPB)**

See detail below

**HMB060/080/100**

F2 = SAE 1", 4 Bolt (UNC) flanges  
 FM2 = SAE 1", 4 Bolt (Metric) flanges  
 S03 = 6-Bolt (UNF) flange. (Staffa original valve housing)  
 F3 = SAE 1 1/4" 4 Bolt (UNC) flanges  
 FM3 = SAE 1 1/4" 4 Bolt (Metric) flanges  
 S04 <sup>(1)</sup> = 6 Bolt (UNF) flanges. (Staffa original valve housing)

**HMB125/150/200 + Heavy Duty Variants** Details as above, plus the following:

F4 = SAE 1 1/4" 4 Bolt (UNC) flanges  
 FM4 = SAE 1 1/2" 4 Bolt (Metric) flanges

**HMB270/325 + Heavy Duty Variants**

F4 = SAE 1 1/2" 4 Bolt (UNC) flanges  
 FM4 = SAE 1 1/2" 4 Bolt (Metric) flanges  
 S04 <sup>(1)</sup> = 6 Bolt (UNF) flanges. (Staffa original valve housing)

**HMHDB400**

Blank = Combined 6-Bolt flange and 4 Bolt SAE connection  
 Ports "B" and "C" 6-Bolt UNF flange  
 Ports "A" and "C" SAE, 2" 4-Bolt UNF flanges  
 S045 = 2 x 6 Bolts (UNF) flanges (2 inlet and 2 outlet ports available)

**HMB700**

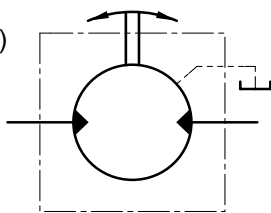
FM = Standard code 62  
 SAE 2" 4 Bolt (Metric) flanges

Note:<sup>(1)</sup>

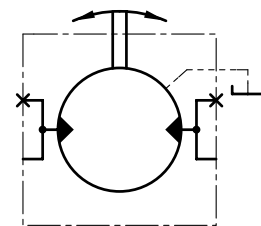
Obligatory for hollow shafts type: HP, HS, HZ or HQ

**.Functional Symbols**

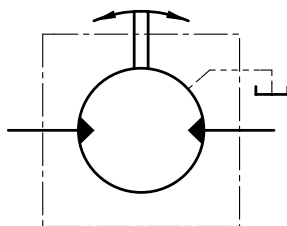
HMB010  
HMB030(Mono Block)



HMB045-\*\*-D-30  
(Mono Block)

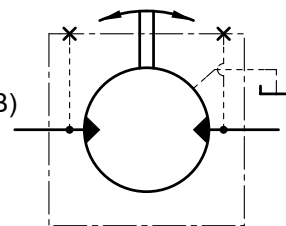


HMB045-\*\*-30



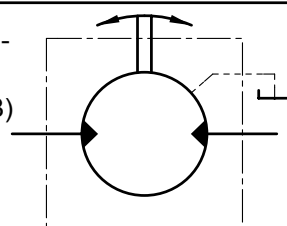
-F(M)3-; F(M)4-

HMB030\*/045\*(TPB)  
HMB060/080  
HMB100/125  
HMB150/200  
\*F(M)3 ONLY



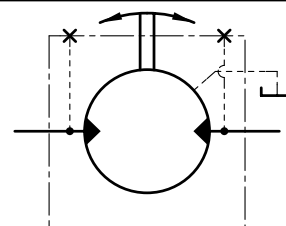
-F(M)2-;-S03-;-S04-

HMB030-045(TPB)  
HMB060/080  
HMB100/125  
HMB150/200



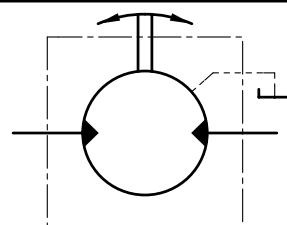
-F(M)4-

HMB270  
HMB325



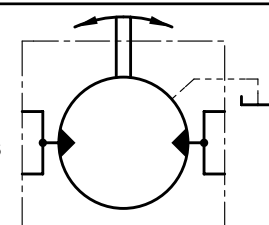
-S04-

HMB270  
HMB325

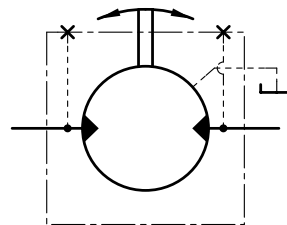


HMHDB400-\*\*-  
S045-030

Dual ports

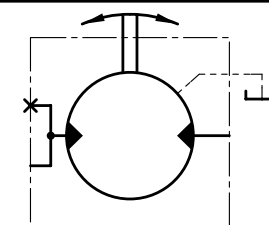


HMB 700



HMHDB400-\*\*-030

Removable  
plug



**Performance Data****Intermittent max pressure**

B010 up to 241 bar

B700 up to 250 bar

All other models to 293 bar.

These pressures are allowable on the following basis:

- (a) Up to 50 r/min: 15% duty for periods up to 5 minutes maximum.
- (b) Over 50 r/min: 2% duty for periods up to 30 seconds maximum.

**Continuous rating**

For continuous duty the motor must be operating within each of the maximum values for speed, pressure and power.

**Intermittent rating**

Operation within the intermittent power rating (up to the maximum continuous speed) is permitted on a 15% duty basis, for periods up to 5 minutes maximum .

**Limits for fire resistant fluids**

| Fluid Type                      | Pressure, bar |              | Max Speed r/min               | Model type        |
|---------------------------------|---------------|--------------|-------------------------------|-------------------|
|                                 | Continuous    | Intermittent |                               |                   |
| HFA 5/95% oil in emulsion       | 103           | 138          | 50% of limits for Mineral Oil | All models        |
| HFB 60/40 water in oil emulsion | 138           | 172          | As for Mineral Oil            | All models        |
| HFC water glycol                | 103           | 138          | 50% of limits or Mineral Oil  | All models        |
| HFD phosphate ester             | 207           | 241          | As for Mineral Oil            | B010              |
|                                 | 207           | 293          |                               | B030              |
|                                 | 250           | 293          |                               | B045 to B400 inc. |
|                                 | 210           | 250          |                               | B700              |

Performance Data Tables

| Motor type             | Geometric displacement<br>(cc/rcv) | Average actual running torque<br>(Nm/bar) | Max. continuous speed<br>(rev/min) | Max. continuous output<br>(kW) | Max. continuous pressure.<br>(bar) | Max. intermittent pressure<br>(bar) |
|------------------------|------------------------------------|-------------------------------------------|------------------------------------|--------------------------------|------------------------------------|-------------------------------------|
| <b>B10</b>             | 188                                | 2.79                                      | 500                                | 25                             | 207                                | 241                                 |
| <b>B030</b>            | 442                                | 6.56                                      | 450                                | 42                             | 207                                | 293                                 |
| <b>B045</b>            | 740                                | 10,95                                     | 400                                | 60                             | 250                                | 293                                 |
| <b>B060</b>            | 983                                | 14.5                                      | 300                                | 80                             | 250                                | 293                                 |
| <b>B060 F2/FM2</b>     | 983                                | 14.5                                      | 200                                | 75                             | 250                                | 293                                 |
| <b>B080</b>            | 1344                               | 19.9                                      | 300                                | 100                            | 250                                | 293                                 |
| <b>B080 F2/FM2</b>     | 1344                               | 19.9                                      | 150                                | 77                             | 250                                | 293                                 |
| <b>B100</b>            | 1639                               | 24.3                                      | 250                                | 110                            | 250                                | 293                                 |
| <b>B100 F2/FM2</b>     | 1639                               | 24.3                                      | 125                                | 80                             | 250                                | 293                                 |
| <b>B125</b>            | 2050                               | 30.66                                     | 220                                | 100                            | 250                                | 293                                 |
| <b>B125 F2/FM2</b>     | 2050                               | 30.66                                     | 100                                | 75                             | 250                                | 293                                 |
| <b>B150</b>            | 2470                               | 36.95                                     | 220                                | 115                            | 250                                | 293                                 |
| <b>B150 F3/FM3/S03</b> | 2470                               | 36.95                                     | 168                                | 115                            | 250                                | 293                                 |
| <b>B150 F2/FM2</b>     | 2470                               | 36.95                                     | 80                                 | 75                             | 250                                | 293                                 |
| <b>B200</b>            | 3080                               | 46.07                                     | 175                                | 130                            | 250                                | 293                                 |
| <b>B200 F3/FM3/S03</b> | 3080                               | 46.07                                     | 135                                | 130                            | 250                                | 293                                 |
| <b>B200 F2/FM2</b>     | 3080                               | 46.07                                     | 65                                 | 75                             | 250                                | 293                                 |
| <b>B270</b>            | 4310                               | 63.79                                     | 125                                | 140                            | 250                                | 293                                 |
| <b>B325</b>            | 5310                               | 79.4                                      | 100                                | 140                            | 250                                | 293                                 |
| <b>B400</b>            | 6800                               | 101                                       | 120                                | 190                            | 250                                | 293                                 |
| <b>B700</b>            | 11600                              | 171.7                                     | 100                                | 240                            | 210                                | 250                                 |

## Non-Standard Displacements

| Motor           | Displacements cc/rev |      |      |      |      |       |     |     |     |
|-----------------|----------------------|------|------|------|------|-------|-----|-----|-----|
| <b>HMB010</b>   | 177                  | 130  | 94   | 50   |      |       |     |     |     |
| <b>HMB030</b>   | 492                  | 477  | 455  | 330  | 320  | 300   | 278 | 251 | 213 |
| <b>HMB045</b>   | 800                  | 700  | 634  | 570  | 500  | 440   |     |     |     |
| <b>HMB080</b>   | 1250                 | 1100 | 1000 |      |      |       |     |     |     |
| <b>HMB100</b>   | 1530                 | 1500 |      |      |      |       |     |     |     |
| <b>HMB125</b>   | 1800                 |      |      |      |      |       |     |     |     |
| <b>HMB150</b>   | 1880                 | 2130 |      |      |      |       |     |     |     |
| <b>HMB200</b>   | 3630*                | 2870 |      |      |      |       |     |     |     |
| <b>HMHDB200</b> | 3630*                | 2785 |      |      |      |       |     |     |     |
| <b>HMB270</b>   | 4588                 | 4500 | 3688 | 3600 |      |       |     |     |     |
| <b>HMHDB270</b> | 4000                 |      |      |      |      |       |     |     |     |
| <b>HMB325</b>   | 6100*                | 5187 |      |      |      |       |     |     |     |
| <b>HMHDB400</b> | 6137                 | 6468 | 5322 | 4340 | 4000 | 8000* |     |     |     |
| <b>HMB700</b>   | 10600                | 9600 | 8850 |      |      |       |     |     |     |

Note:

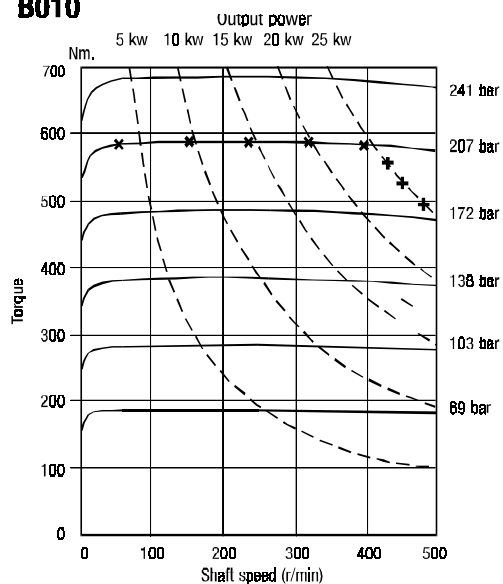
\* Reduced pressure and power rating.



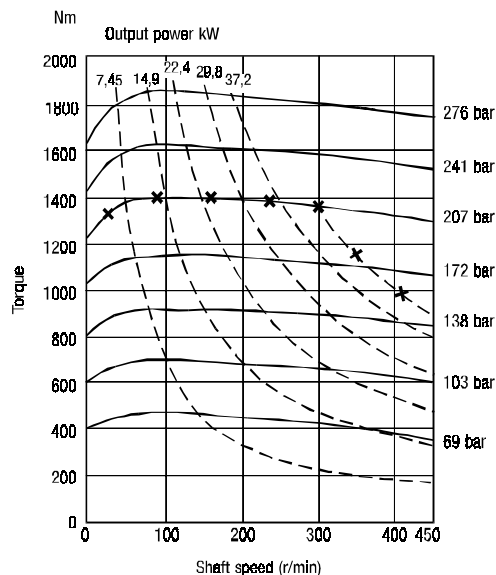
## Output Torque

These torque curves indicate the maximum output torque and power of a fully run-in motor for a range of pressures and speeds when operating with zero outlet pressure on Mineral Oil of 50 cSt (232 SUS) viscosity. High return line pressures will reduce torque for a given pressure differential. – x – x – x – Upper limit of continuous rating envelope.

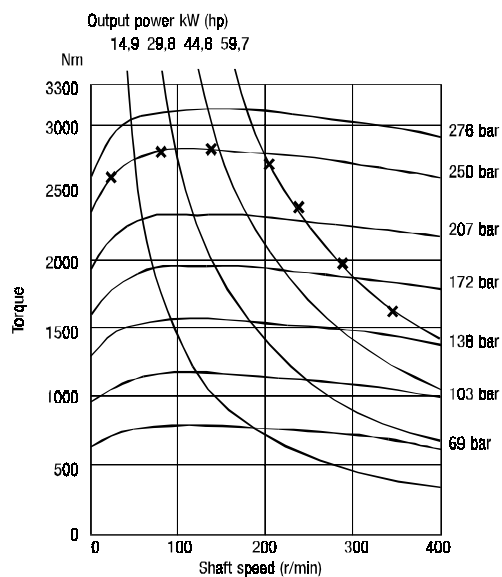
### B010



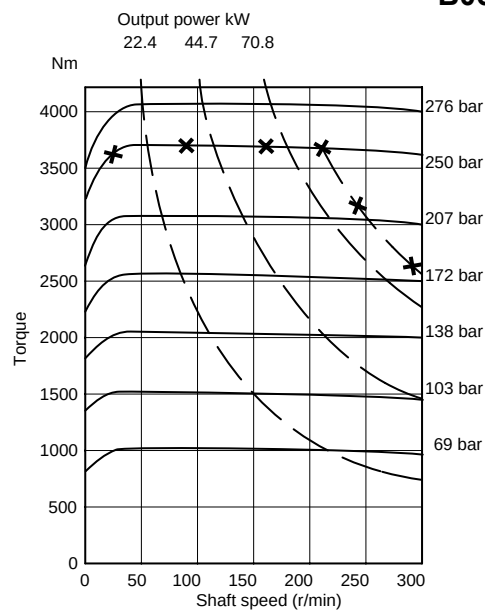
### B030



### B045

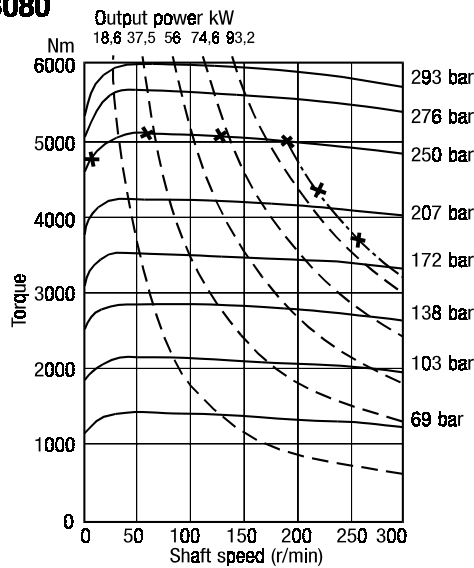


### B060

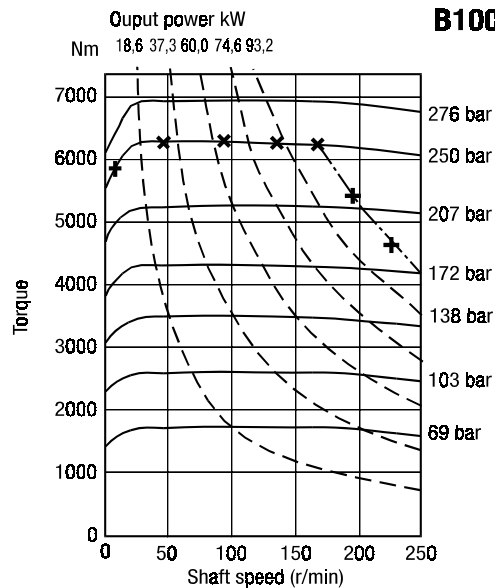


Output Torque (continued)

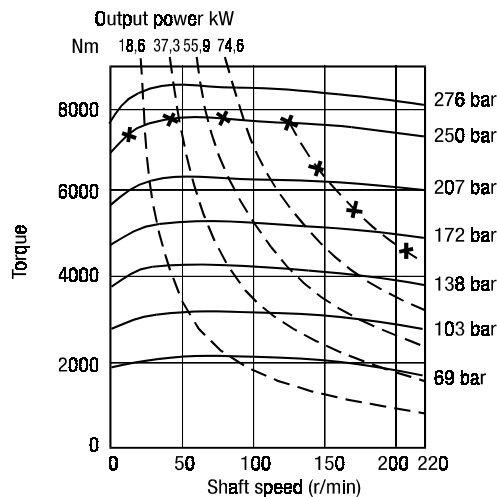
B080



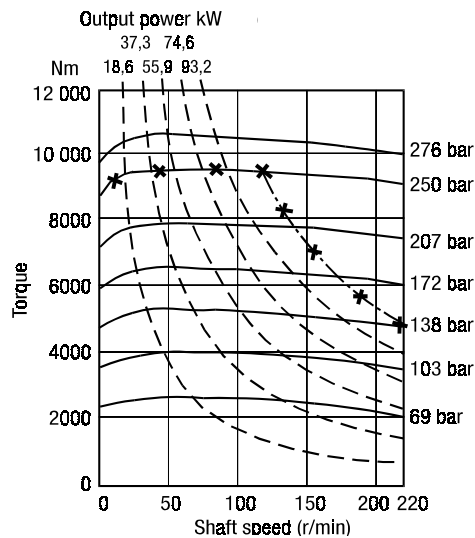
B100



B125

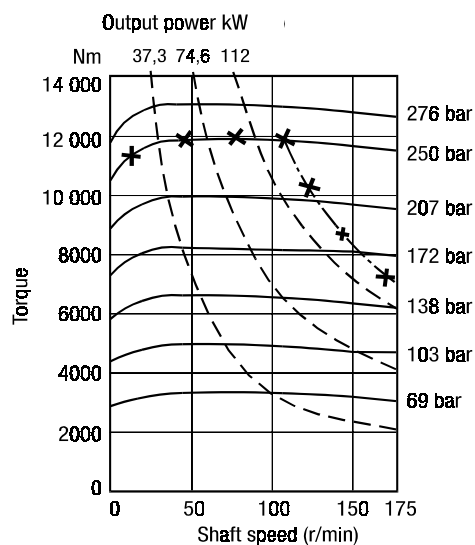


B150

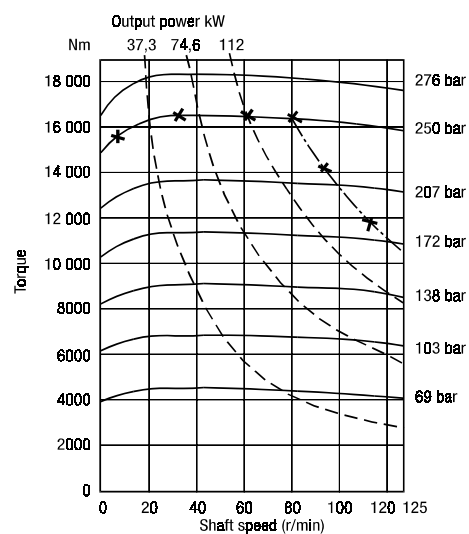


## Output Torque (continued)

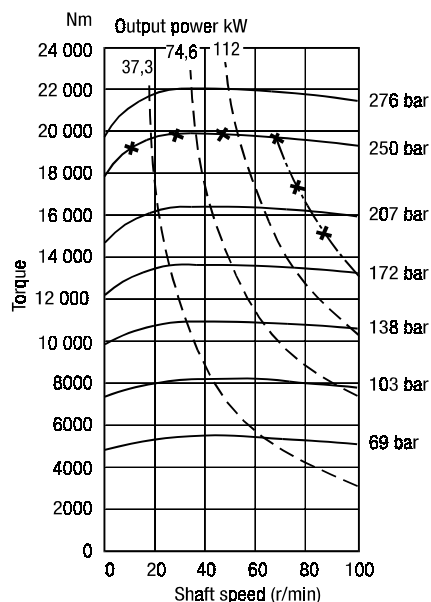
## B200



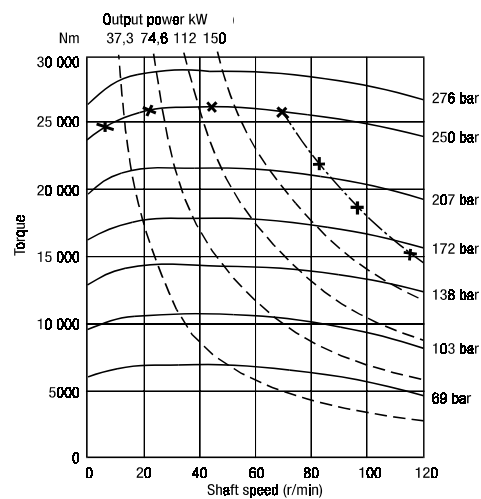
## B270



## B325

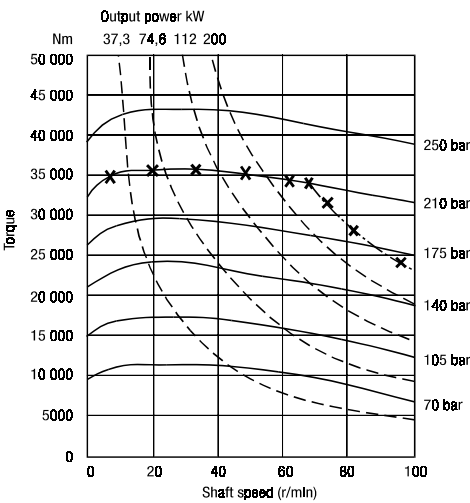


## B400



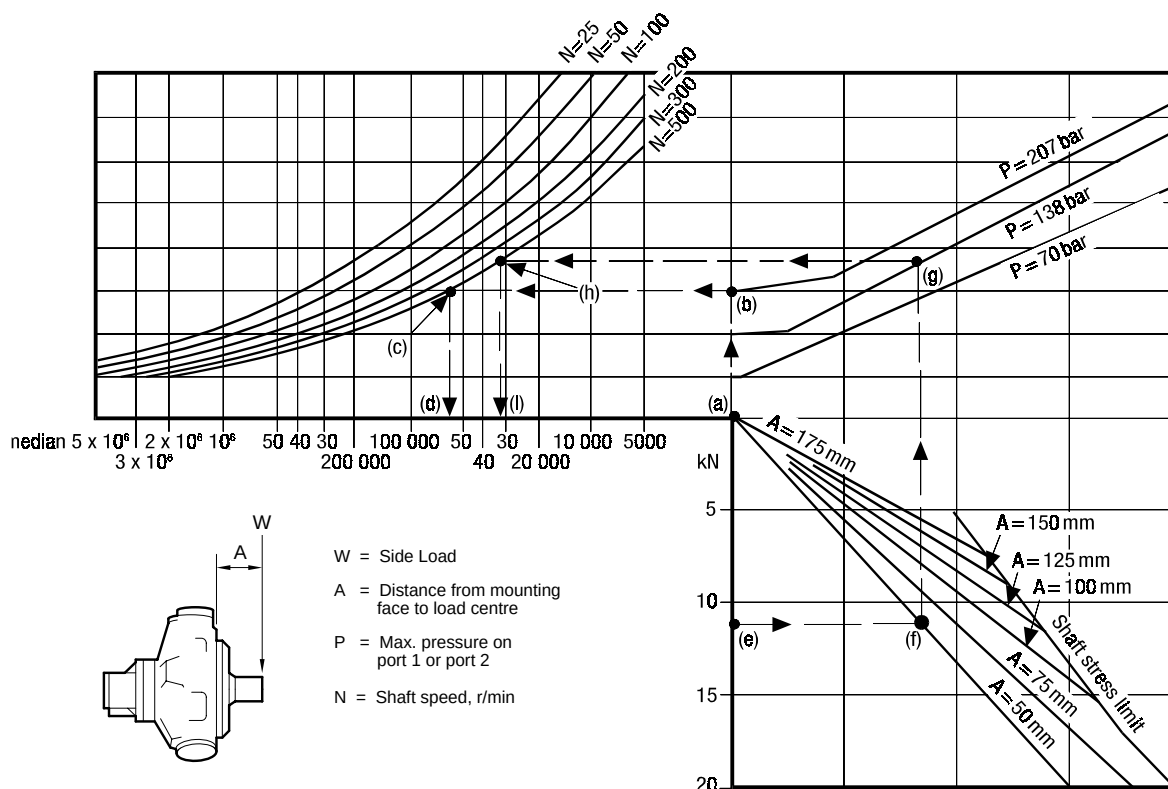
Output Torque (continued)

**B700**



## Bearing Life Graphs

### HMB 010 Shaft Types P and S



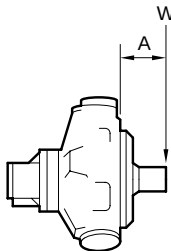
#### Example 1 (follow chain dotted line):

|                                   |                 |
|-----------------------------------|-----------------|
| Side load (W)                     | (a) 0           |
| System pressure (P)               | (b) 207 bar     |
| Speed (N)                         | (c) 500 r/min.  |
| Median bearing life               | (d) 55,000 hrs. |
| L10 bearing rating = median x 0.2 | 11,000 hrs.     |

#### Example 2 (follow chain dotted line):

|                                          |                 |
|------------------------------------------|-----------------|
| Side load (W)                            | (e) 11 kN       |
| Load offset (A) from motor mounting face | (f) 50 mm       |
| System pressure (P)                      | (g) 138 bar     |
| Speed (N)                                | (h) 500 r/min.  |
| Median bearing life                      | (i) 31,000 hrs. |
| L10 bearing rating = median x 0.2        | 6,200 hrs       |

## HMB030 Shaft Types P, S, and Z

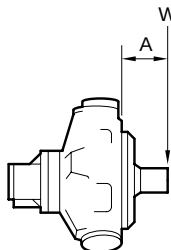


The figure consists of three parts: a schematic, a top design chart, and a bottom design chart.

**Schematic:** A cross-section of a shaft-hub assembly. The shaft diameter is labeled  $\phi$ . The hub has an outer diameter  $\phi_1$  and an inner diameter  $\phi_2$ . The distance from the mounting face to the load center is  $A$ . The side load is  $W$ .

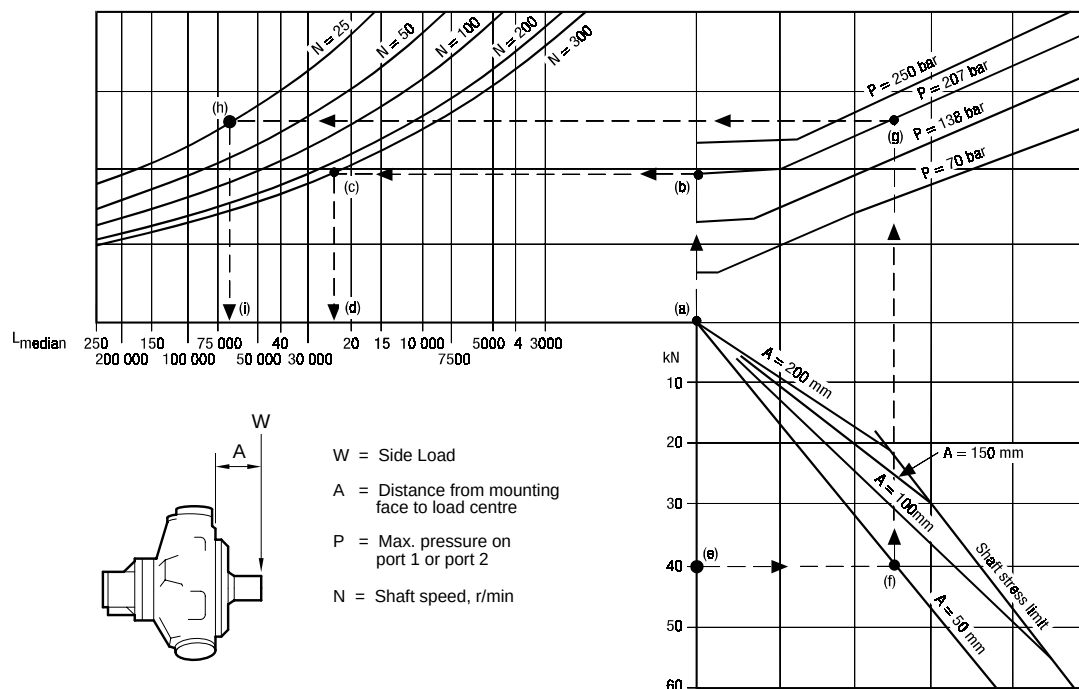
**Top Design Chart:** A graph showing the relationship between the median shaft length  $L_{\text{median}}$  (mm) on the x-axis and the side load  $W$  (kN) on the y-axis. The x-axis is logarithmic, ranging from 2000 to 200,000 mm. The y-axis is linear, ranging from 0 to 100 kN. The chart contains several curves for different shaft speeds  $N$  (r/min):  $N=25$ ,  $N=50$ ,  $N=100$ ,  $N=200$ , and  $N=400$ . A horizontal dashed line is drawn at  $W=10$  kN. A vertical dashed line is drawn at  $L_{\text{median}}=100,000$  mm. The intersection of these lines is labeled (c). A point (d) is marked on the  $N=25$  curve at  $L_{\text{median}}=100,000$  mm. A point (e) is marked on the  $N=25$  curve at  $L_{\text{median}}=20,000$  mm. A point (f) is marked on the  $N=25$  curve at  $L_{\text{median}}=10,000$  mm. A point (g) is marked on the  $N=25$  curve at  $L_{\text{median}}=5,000$  mm. A point (h) is marked on the  $N=25$  curve at  $L_{\text{median}}=2,000$  mm. A point (i) is marked on the  $N=25$  curve at  $L_{\text{median}}=1,000$  mm.

**Bottom Design Chart:** A graph showing the relationship between the shaft diameter  $A$  (mm) on the x-axis and the side load  $W$  (kN) on the y-axis. The x-axis is logarithmic, ranging from 50 to 200 mm. The y-axis is linear, ranging from 0 to 40 kN. The chart contains several curves for different shaft diameters  $A$  (mm):  $A=200$ ,  $A=150$ ,  $A=100$ , and  $A=50$ . A horizontal dashed line is drawn at  $W=10$  kN. A vertical dashed line is drawn at  $A=100$  mm. The intersection of these lines is labeled (f). A point (g) is marked on the  $A=100$  curve at  $W=10$  kN. A point (h) is marked on the  $A=100$  curve at  $W=20$  kN. A point (i) is marked on the  $A=100$  curve at  $W=30$  kN. A point (j) is marked on the  $A=100$  curve at  $W=40$  kN. A point (k) is marked on the  $A=100$  curve at  $W=10$  kN. A point (l) is marked on the  $A=100$  curve at  $W=20$  kN. A point (m) is marked on the  $A=100$  curve at  $W=30$  kN. A point (n) is marked on the  $A=100$  curve at  $W=40$  kN. A point (o) is marked on the  $A=100$  curve at  $W=10$  kN. A point (p) is marked on the  $A=100$  curve at  $W=20$  kN. A point (q) is marked on the  $A=100$  curve at  $W=30$  kN. A point (r) is marked on the  $A=100$  curve at  $W=40$  kN. A point (s) is marked on the  $A=100$  curve at  $W=10$  kN. A point (t) is marked on the  $A=100$  curve at  $W=20$  kN. A point (u) is marked on the  $A=100$  curve at  $W=30$  kN. A point (v) is marked on the  $A=100$  curve at  $W=40$  kN. A point (w) is marked on the  $A=100$  curve at  $W=10$  kN. A point (x) is marked on the  $A=100$  curve at  $W=20$  kN. A point (y) is marked on the  $A=100$  curve at  $W=30$  kN. A point (z) is marked on the  $A=100$  curve at  $W=40$  kN. A point (aa) is marked on the  $A=100$  curve at  $W=10$  kN. A point (ab) is marked on the  $A=100$  curve at  $W=20$  kN. A point (ac) is marked on the  $A=100$  curve at  $W=30$  kN. A point (ad) is marked on the  $A=100$  curve at  $W=40$  kN. A point (ae) is marked on the  $A=100$  curve at  $W=10$  kN. A point (af) is marked on the  $A=100$  curve at  $W=20$  kN. A point (ag) is marked on the  $A=100$  curve at  $W=30$  kN. A point (ah) is marked on the  $A=100$  curve at  $W=40$  kN. A point (ai) is marked on the  $A=100$  curve at  $W=10$  kN. A point (aj) is marked on the  $A=100$  curve at  $W=20$  kN. A point (ak) is marked on the  $A=100$  curve at  $W=30$  kN. A point (al) is marked on the  $A=100$  curve at  $W=40$  kN. A point (am) is marked on the  $A=100$  curve at  $W=10$  kN. A point (an) is marked on the  $A=100$  curve at  $W=20$  kN. A point (ao) is marked on the  $A=100$  curve at  $W=30$  kN. A point (ap) is marked on the  $A=100$  curve at  $W=40$  kN. A point (aq) is marked on the  $A=100$  curve at  $W=10$  kN. A point (ar) is marked on the  $A=100$  curve at  $W=20$  kN. A point (as) is marked on the  $A=100$  curve at  $W=30$  kN. A point (at) is marked on the  $A=100$  curve at  $W=40$  kN. A point (au) is marked on the  $A=100$  curve at  $W=10$  kN. A point (av) is marked on the  $A=100$  curve at  $W=20$  kN. A point (aw) is marked on the  $A=100$  curve at  $W=30$  kN. A point (ax) is marked on the  $A=100$  curve at  $W=40$  kN. A point (ay) is marked on the  $A=100$  curve at  $W=10$  kN. A point (az) is marked on the  $A=100$  curve at  $W=20$  kN. A point (ba) is marked on the  $A=100$  curve at  $W=30$  kN. A point (bb) is marked on the  $A=100$  curve at  $W=40$  kN. A point (bc) is marked on the  $A=100$  curve at  $W=10$  kN. A point (bd) is marked on the  $A=100$  curve at  $W=20$  kN. A point (be) is marked on the  $A=100$  curve at  $W=30$  kN. A point (bf) is marked on the  $A=100$  curve at  $W=40$  kN. A point (bg) is marked on the  $A=100$  curve at  $W=10$  kN. A point (bh) is marked on the  $A=100$  curve at  $W=20$  kN. A point (bi) is marked on the  $A=100$  curve at  $W=30$  kN. A point (bj) is marked on the  $A=100$  curve at  $W=40$  kN. A point (bk) is marked on the  $A=100$  curve at  $W=10$  kN. A point (bl) is marked on the  $A=100$  curve at  $W=20$  kN. A point (bm) is marked on the  $A=100$  curve at  $W=30$  kN. A point (bn) is marked on the  $A=100$  curve at  $W=40$  kN. A point (bo) is marked on the  $A=100$  curve at  $W=10$  kN. A point (bp) is marked on the  $A=100$  curve at  $W=20$  kN. A point (bq) is marked on the  $A=100$  curve at  $W=30$  kN. A point (br) is marked on the  $A=100$  curve at  $W=40$  kN. A point (bs) is marked on the  $A=100$  curve at  $W=10$  kN. A point (bt) is marked on the  $A=100$  curve at  $W=20$  kN. A point (bu) is marked on the  $A=100$  curve at  $W=30$  kN. A point (bv) is marked on the  $A=100$  curve at  $W=40$  kN. A point (bw) is marked on the  $A=100$  curve at  $W=10$  kN. A point (bx) is marked on the  $A=100$  curve at  $W=20$  kN. A point (by) is marked on the  $A=100$  curve at  $W=30$  kN. A point (bz) is marked on the  $A=100$  curve at  $W=40$  kN. A point (ca) is marked on the  $A=100$  curve at  $W=10$  kN. A point (cb) is marked on the  $A=100$  curve at  $W=20$  kN. A point (cc) is marked on the  $A=100$  curve at  $W=30$  kN. A point (cd) is marked on the  $A=100$  curve at  $W=40$  kN. A point (ce) is marked on the  $A=100$  curve at  $W=10$  kN. A point (cf) is marked on the  $A=100$  curve at  $W=20$  kN. A point (cg) is marked on the  $A=100$  curve at  $W=30$  kN. A point (ch) is marked on the  $A=100$  curve at  $W=40$  kN. A point (ci) is marked on the  $A=100$  curve at  $W=10$  kN. A point (cj) is marked on the  $A=100$  curve at  $W=20$  kN. A point (ck) is marked on the  $A=100$  curve at  $W=30$  kN. A point (cl) is marked on the  $A=100$  curve at  $W=40$  kN. A point (cm) is marked on the  $A=100$  curve at  $W=10$  kN. A point (cn) is marked on the  $A=100$  curve at  $W=20$  kN. A point (co) is marked on the  $A=100$  curve at  $W=30$  kN. A point (cp) is marked on the  $A=100$  curve at  $W=40$  kN. A point (cq) is marked on the  $A=100$  curve at  $W=10$  kN. A point (cr) is marked on the  $A=100$  curve at  $W=20$  kN. A point (cs) is marked on the  $A=100$  curve at  $W=30$  kN. A point (ct) is marked on the  $A=100$  curve at  $W=40$  kN. A point (cu) is marked on the  $A=100$  curve at  $W=10$  kN. A point (cv) is marked on the  $A=100$  curve at  $W=20$  kN. A point (cw) is marked on the  $A=100$  curve at  $W=30$  kN. A point (cx) is marked on the  $A=100$  curve

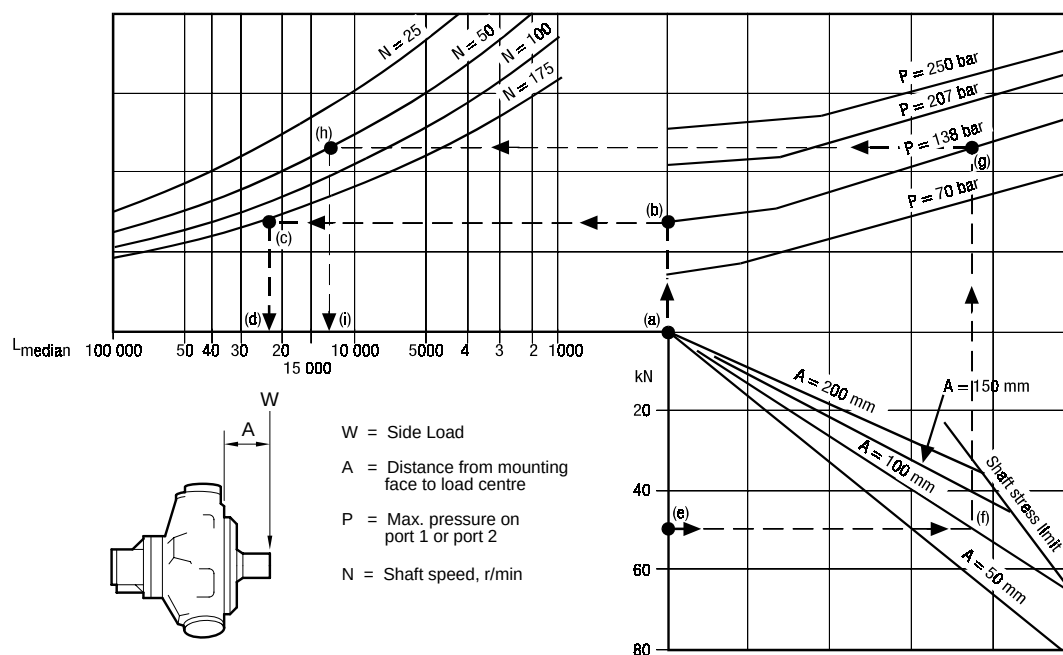


## Bearing Life Graphs (continued)

## HMB 060, HMB080, HMB100 Shaft Types P, S, Z, X

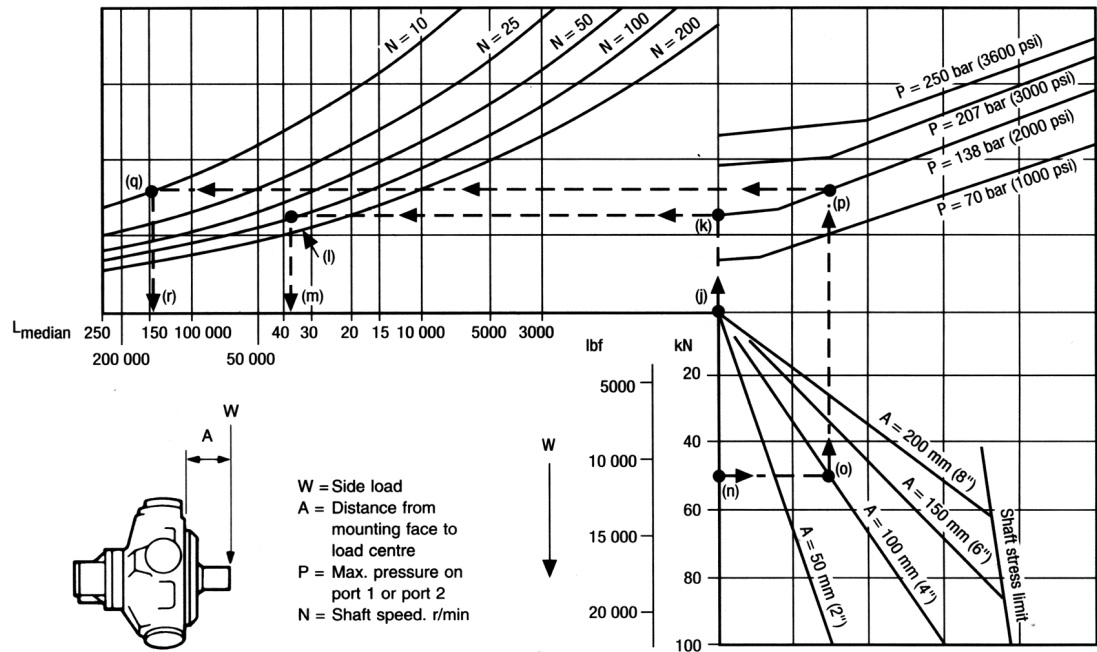


## HMB125, HMB 150, HMB200 Shaft Types P1, S3, S4, Z3, T

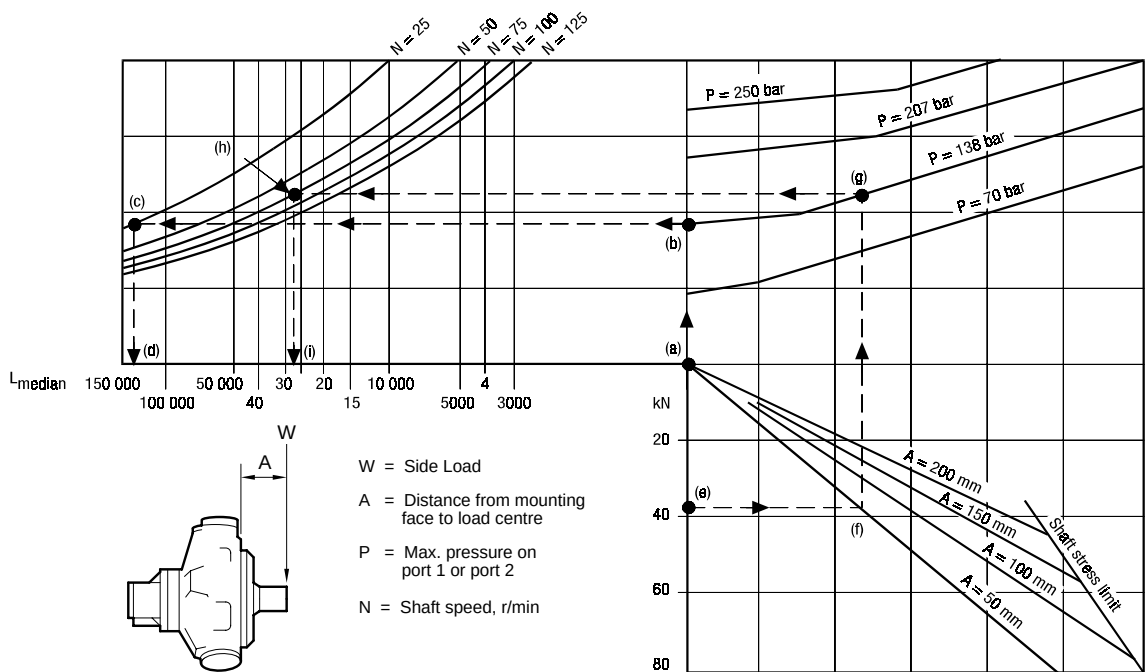


Bearing Life Graphs (continued)

HMHDB125, 150, 200 Shaft Types S5, Z5 and P2



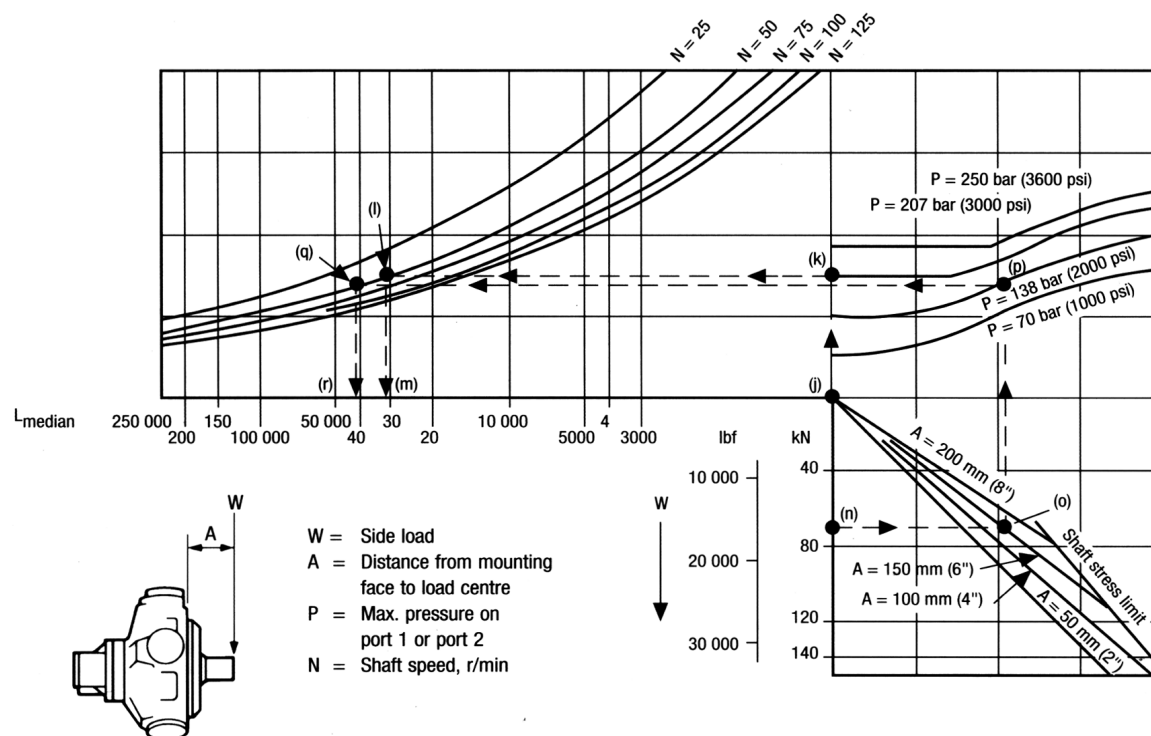
HMB270, HMB325 Shaft Types P1, S3, Z, T, X



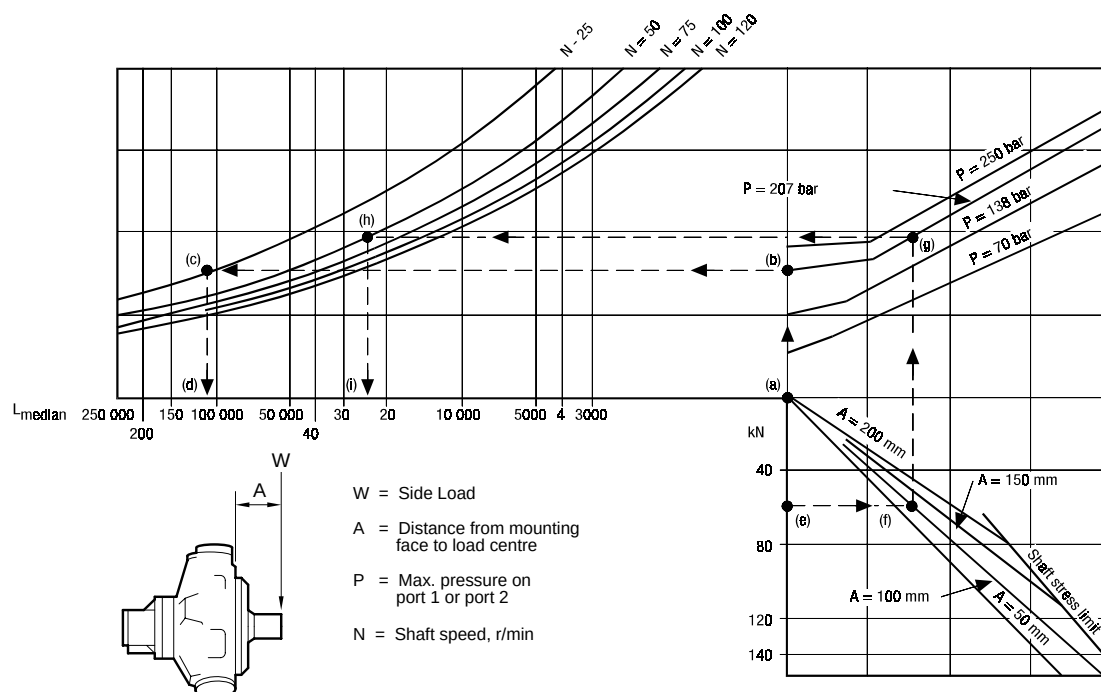


## Bearing Life Graphs (continued)

## HMHDB270, 325 Shaft Type P2, S5, Z and X

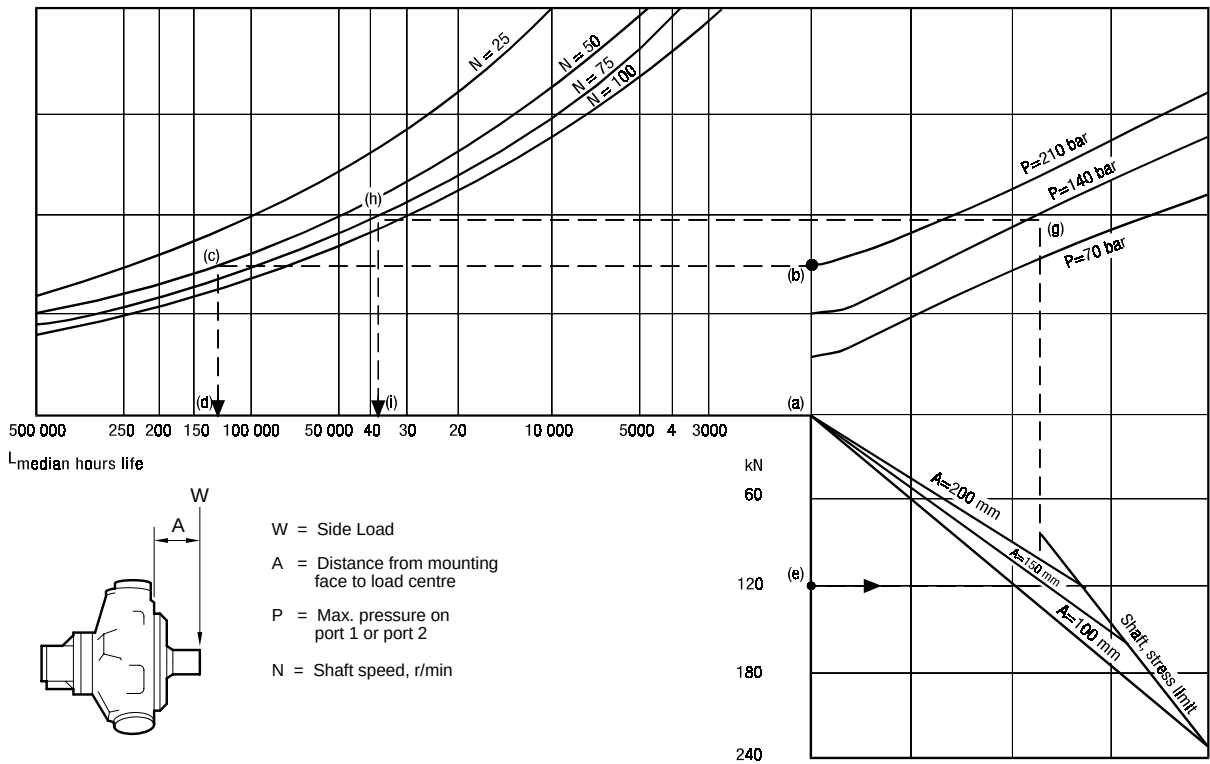


## HMHDB400 Shaft Types P, S, Z, and X



Bearing Life Graphs (continued)

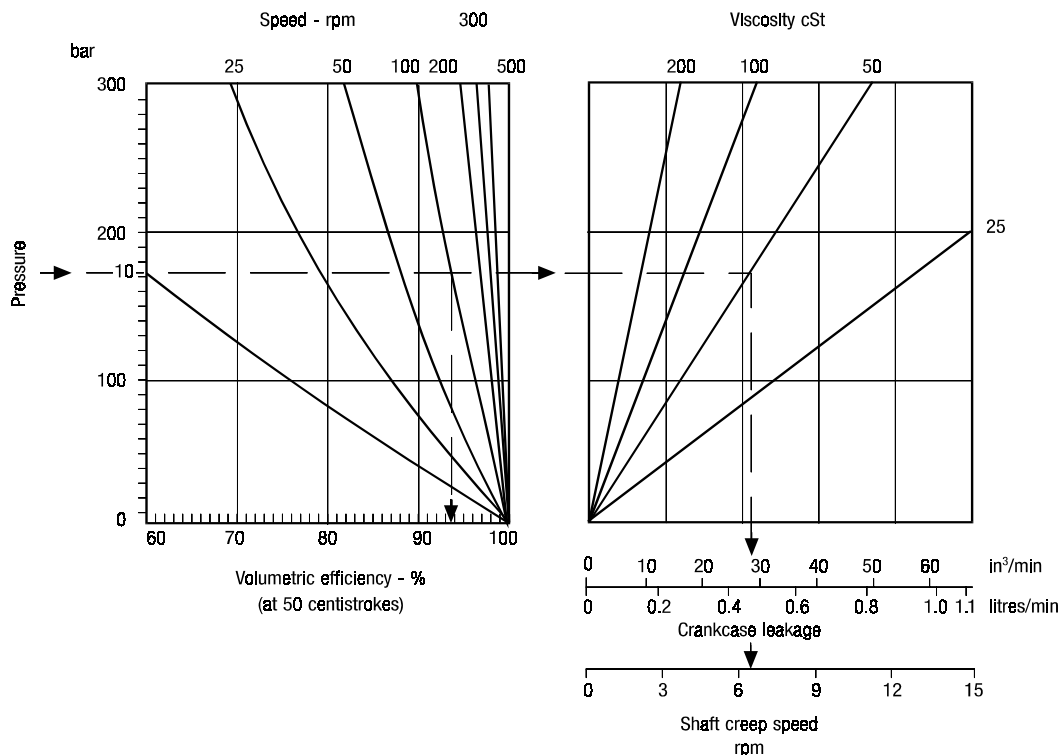
HMB700 Shaft Type P and Z



### Volumetric Efficiency

These nomographs enable the average volumetric efficiency, crankcase (drain) leakage and “winch slip”/shaft creep speed to be estimated. The shaft creep occurs when the load attempts to rotate the motor against the closed ports as may occur, for example in winch applications.

#### B010



Example (follow chain dotted line):

Given:

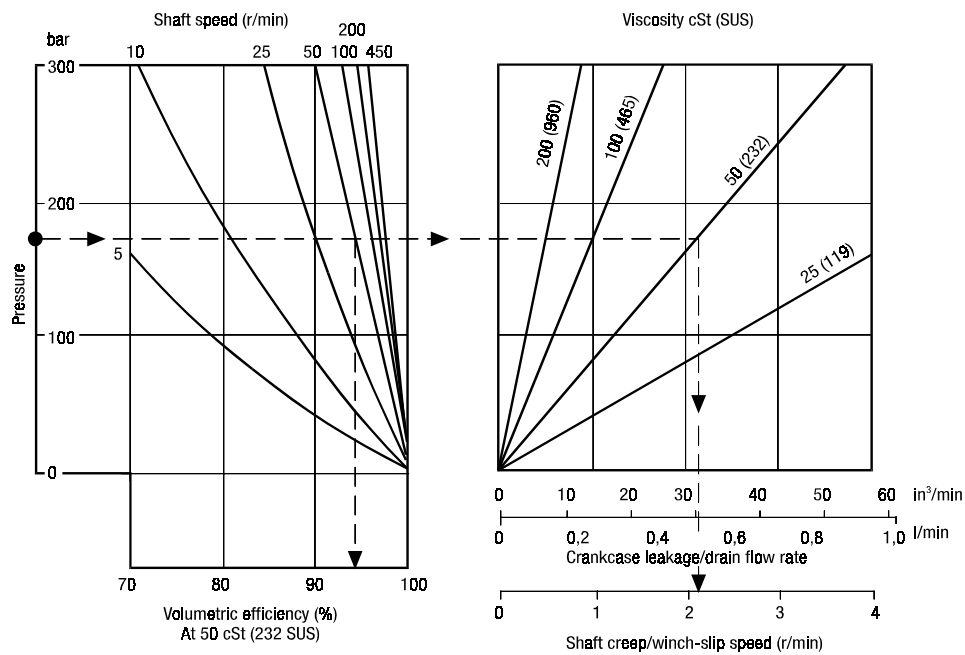
1. Pressure..... 175 bar
2. Speed..... 100 r/min
3. Viscosity..... 50 cSt (232 SUS)

To obtain:

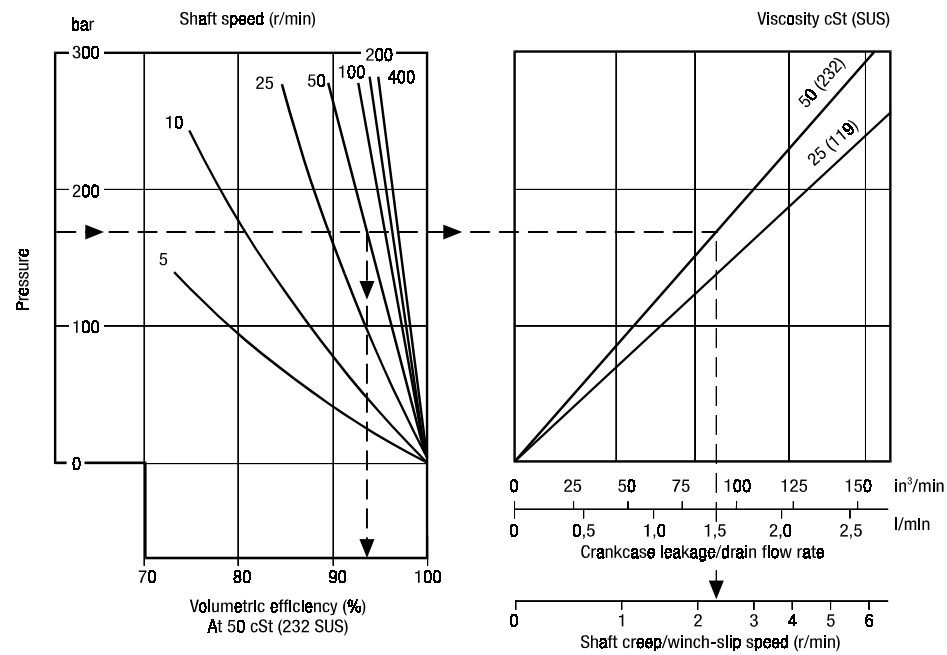
4. Volumetric efficiency ..... 94.2%
5. Crankcase leakage .... 0.451 l/min  
(27.4 in³/min)
6. Shaft creep speed ..... 6.4 r/min

Volumetric Efficiency (continued)

B030

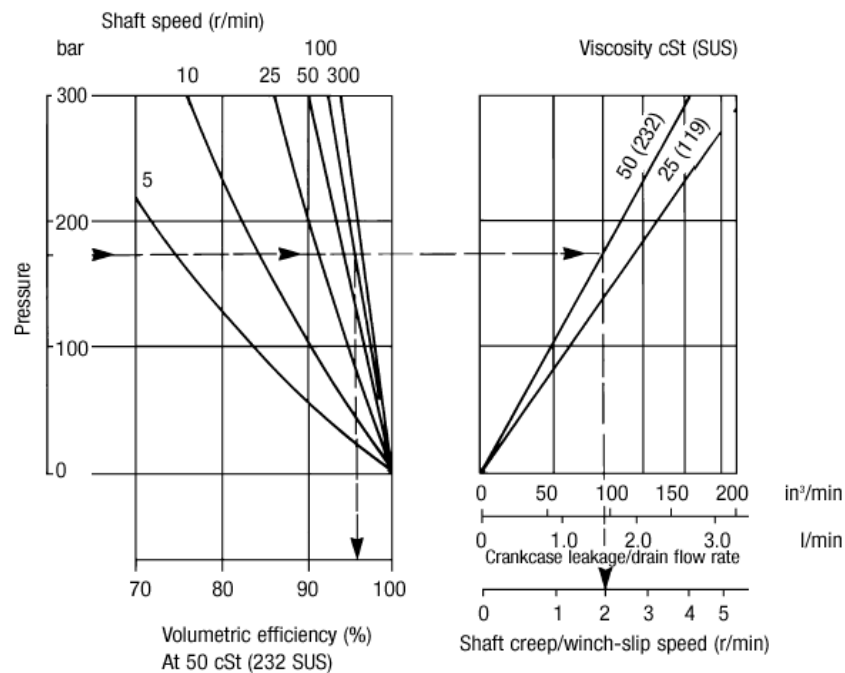


B045

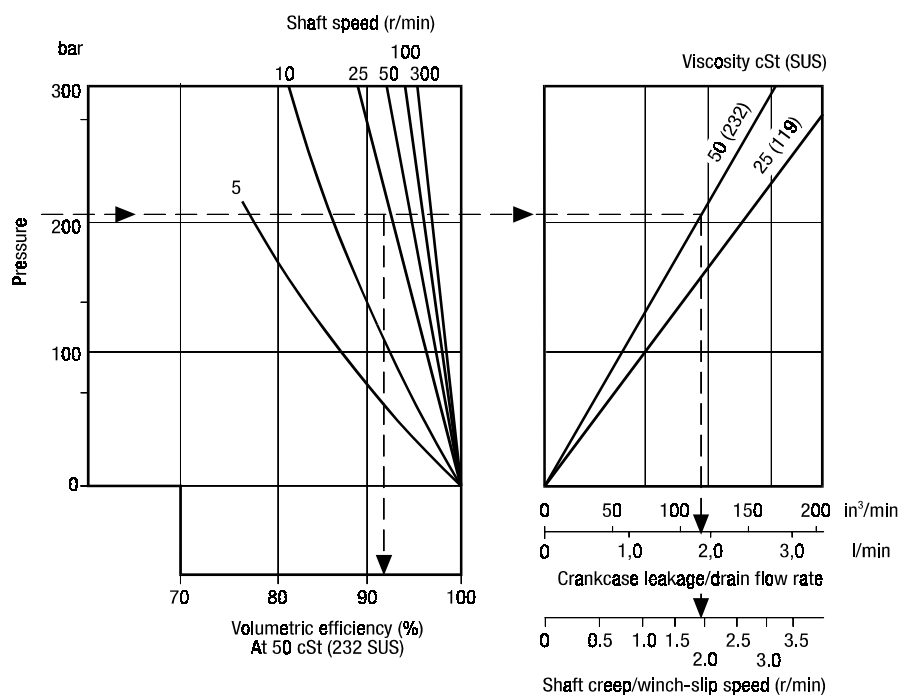


## Volumetric Efficiency (continued)

## B060

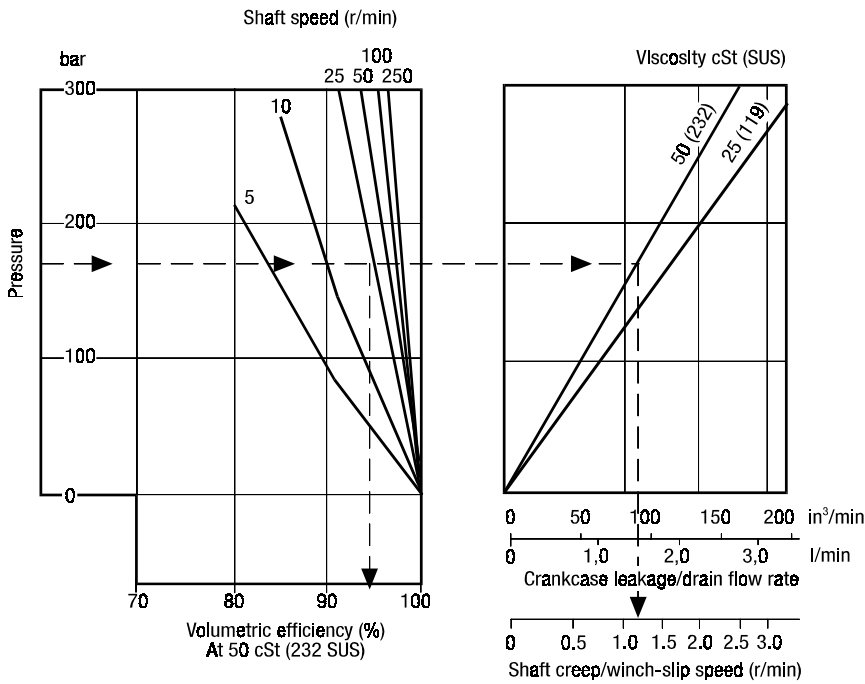


## B080

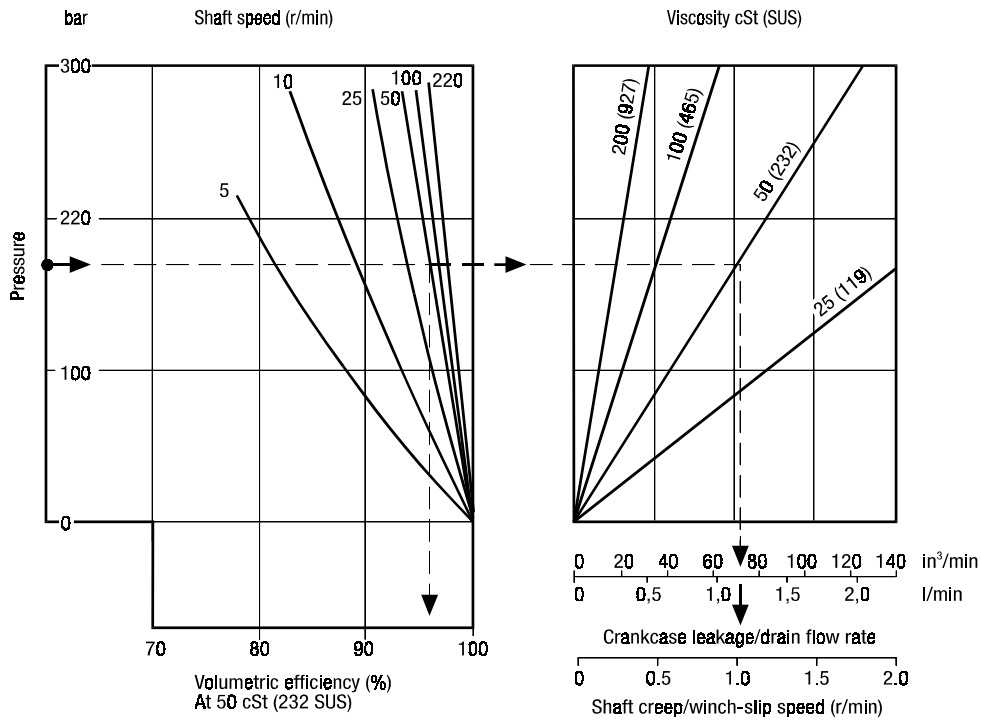


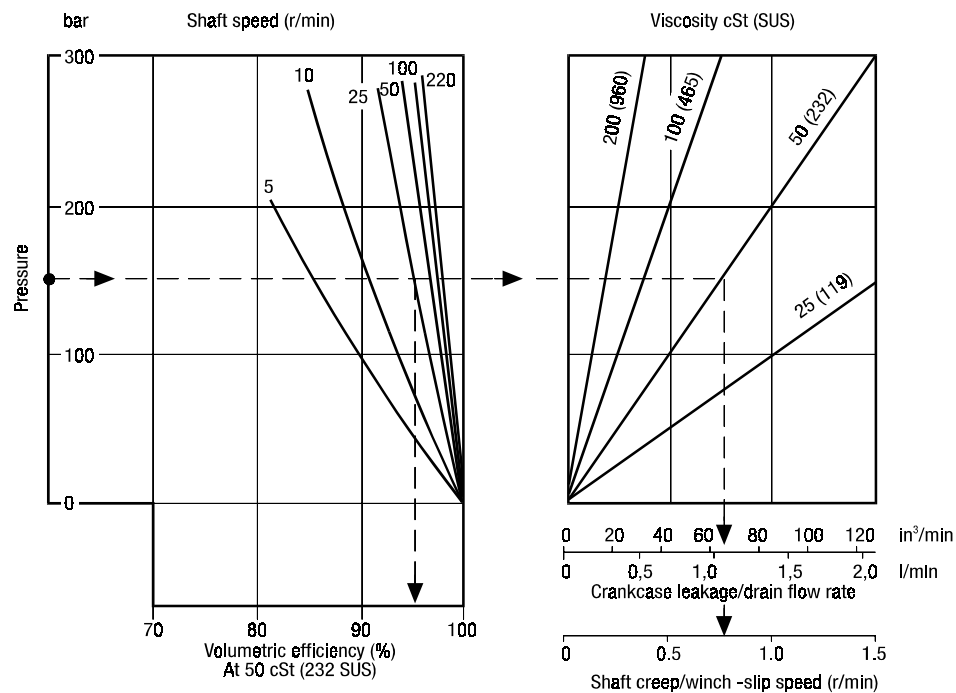
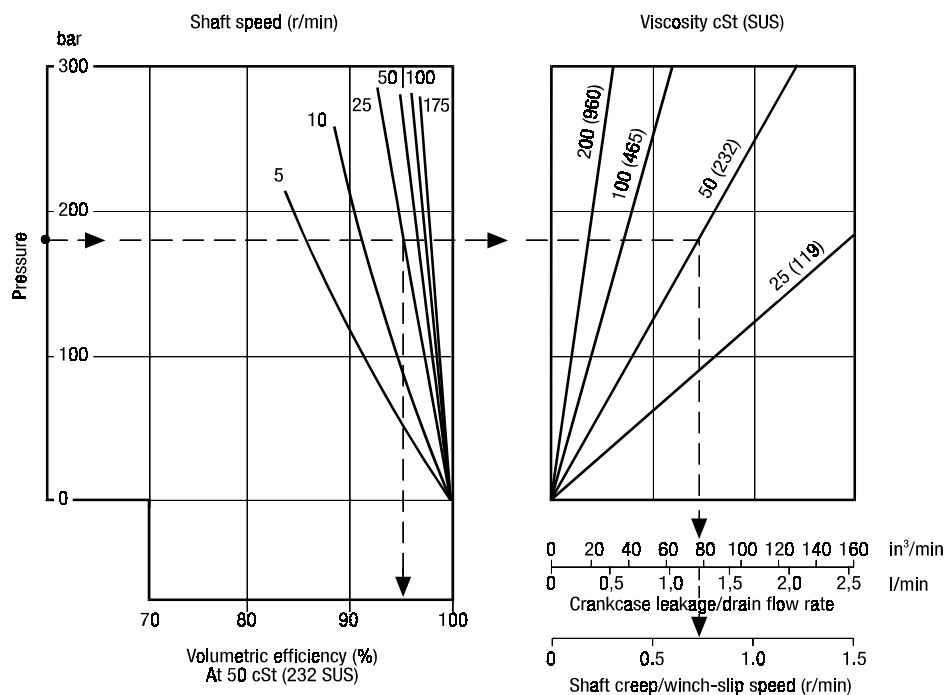
Volumetric Efficiency (continued)

B100



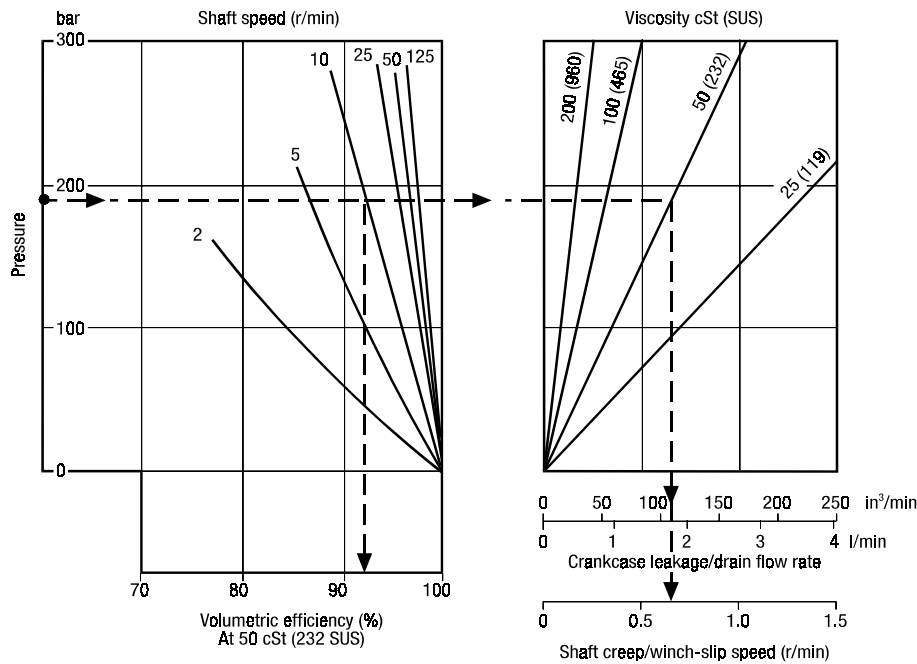
B125



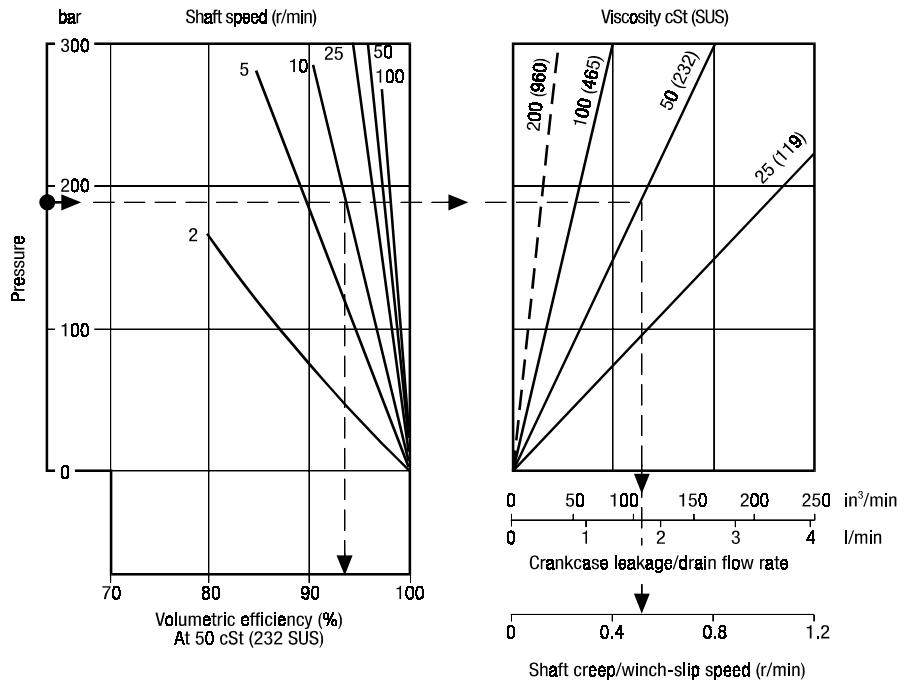
**Volumetric Efficiency (continued)****B150****B200**

Volumetric Efficiency (continued)

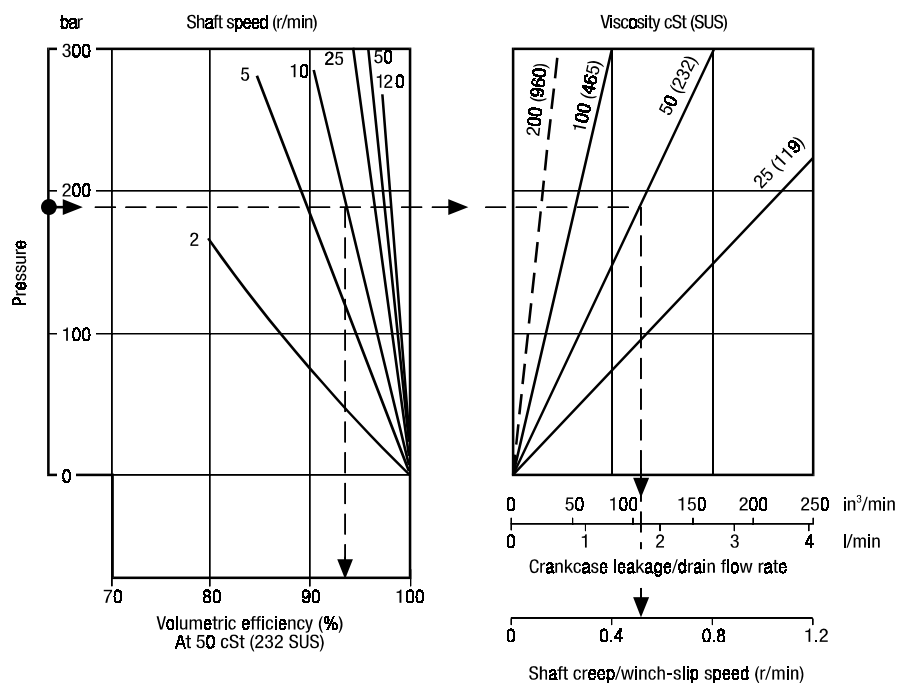
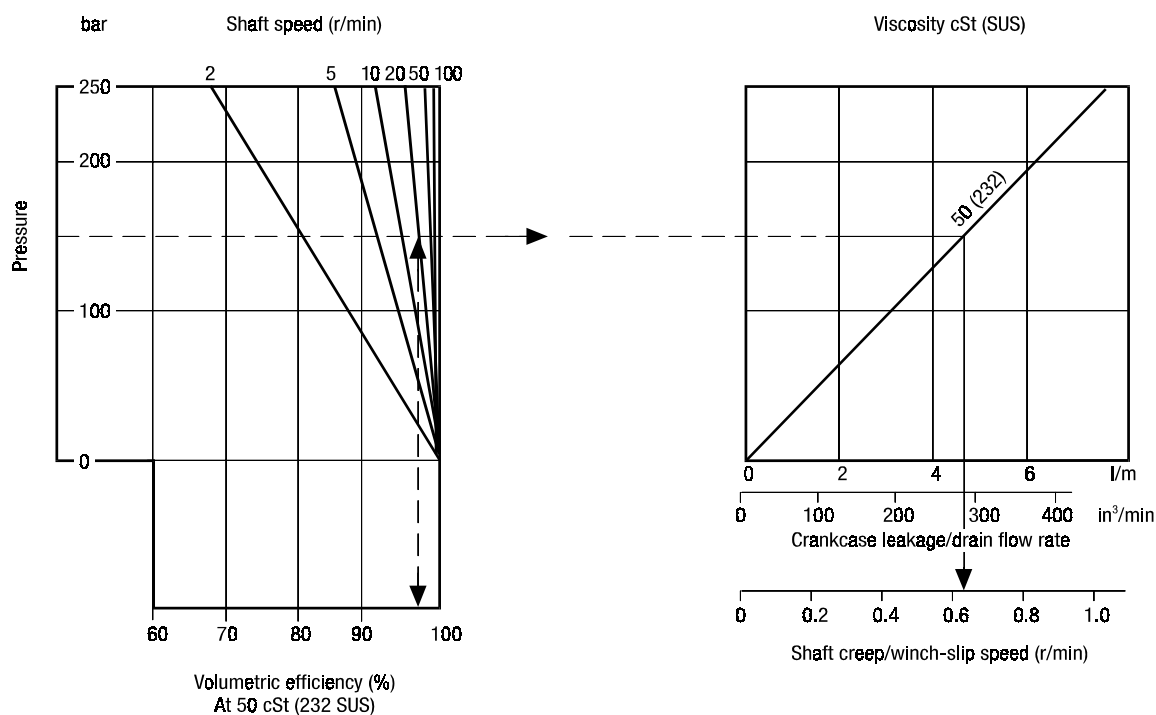
B270



B325





**Volumetric Efficiency (continued)****B400****B700**

**Circuit and Application Notes****Starting Torque**

The starting torques shown on the graphs on pages 9 to 12 are average and will vary with system parameters.

**Low Speed Operations**

Minimum operating speeds are determined by the hydraulic system and load conditions (load inertia, drive elasticity, etc.) Recommended minimum speeds are shown below:

| Model Type             | r/min |
|------------------------|-------|
| B010                   | 20    |
| B030                   | 5     |
| B045                   | 6     |
| B06080/100/125/150/200 | 3     |
| B270/B325/HMB400       | 2     |
| B700                   | 1     |

Note: Speed as low as 0.025 rpm can be accurately achieved using electronic control systems. For operation at speeds below these figures please contact Kawasaki Precision Machinery (UK) Ltd.

**High Back Pressure**

When both inlet and outlet ports are pressurised continuously, the lower port pressure must not exceed 70 bar at any time.

Note: High back pressure reduces the effective torque output of the motor.

**Boost Pressure**

When operating as a motor the outlet pressure should equal or exceed the crankcase pressure. If pumping occurs (i.e. overrunning loads) then a positive pressure, "P", is required at the motor ports. Calculate "P" (bar) from the operating formula

$$\text{Boost Formula } P = 1 + \frac{N^2 \times V^2}{K} + C$$

Where P is in Bar, N = motor speed (RPM), V = motor displacement (cc/rev.), C=Crankcase pressure (BAR) and K=a constant from the table below:

| MOTOR              | PORTING    | CONSTANT             |
|--------------------|------------|----------------------|
| HMB010             | Standard   | $8 \times 10^8$      |
| HMB030             | Standard   | $3.7 \times 10^9$    |
|                    | SO3, F(M)3 | $7.5 \times 10^9$    |
| HMB045             | Standard   | $1.3 \times 10^{10}$ |
|                    | SO3, F(M)3 | $1.6 \times 10^{10}$ |
| HMB060/080/100     | F(M)2      | $2.7 \times 10^9$    |
|                    | F(M)3, SO3 | $1.8 \times 10^{10}$ |
| HM(HD)B125/150/200 | F(M)2      | $4.2 \times 10^9$    |
|                    | F(M)3, SO3 | $4.0 \times 10^{10}$ |
|                    | F(M)4, SO4 | $8.0 \times 10^{10}$ |
| HM(HD)B270/325     | F(M)4, SO4 | $7.2 \times 10^{10}$ |
| HMHDB400           | Standard   | $6.0 \times 10^{10}$ |
|                    | SO45       | $7.2 \times 10^{10}$ |
| HMB700             | Standard   | $1.3 \times 10^{11}$ |



**Circuit and Application Notes (continued)**

The flow rate of oil needed for the make-up system can be estimated from the crankcase leakage figure (see Volumetric Efficiency graphs pages 19 to 29). Allowances should be made for other system losses and also for "fair wear and tear" during the life of the motor, pump and system components.

**Cooling Flow**

Operating within the continuous rating does not require any additional cooling.

For operating conditions above "continuous", up to the "intermittent" rating, additional cooling oil may be required.

This can be introduced through the spare crankcase drain holes, or in special cases through the valve spool end cap. Consult Kawasaki about such applications.

**Motor Casing Pressure**

With the standard shaft seal fitted, the motor casing pressure should not exceed 3.5 bar.

**Notes:**

1. The casing pressure at all times must not exceed either the motor inlet or outlet pressure.
2. High pressure shaft seals are available for casing pressures of:
  - 6 Bar for HMB700
  - 9 Bar for HMB 010
  - 10 Bar for all remaining frame sizes.
3. Check installation dimensions for maximum crankcase drain fitting depth.

**Hydraulic Fluids**

Dependent on motor (see Ordering Code.) suitable fluids include:

- (a) Antiwear hydraulic oils.
- (b) Phosphate ester (HFD fluids)
- (c) Water glycols (HFC fluids)
- (d) 60/40% water-in-oil emulsions (HFB fluids).
- (e) 5/95% oil-in-water emulsions (HFA fluids)

Reduce pressure and speed limits, see page 6.

Viscosity limits when using any fluid except oil-in-water (5/95) emulsions are;

|               |                    |
|---------------|--------------------|
| Max. off load | 2000cSt (9270 SUS) |
| Max. on load  | 150 cSt (695 SUS)  |
| Optimum       | 50 cSt (232 SUS)   |
| Minimum       | 25cSt (119 SUS)    |



**Circuit and Application Notes (continued)****Mineral Oil recommendations**

The fluid should be a good hydraulic grade, non-detergent Mineral Oil. It should contain anti-oxidant, anti-foam and demulsifying additives. It should contain antiwear or EP additives. Automatic transmission fluids and motor oils are not recommended.

**Temperature limits**

|                                   |                   |
|-----------------------------------|-------------------|
| Ambient min.                      | -30°C (-22°F)     |
| Ambient max.                      | + 70°C (158°F)    |
| Max. operating temperature range. |                   |
| Mineral Oil                       | Water- containing |
| Min -20°C (-4°F)                  | +10°C (50°F)      |
| Max. + 80°C (175°F)               | +54°C (130°F)     |

Note: To obtain optimum services life from both fluid and hydraulic systems components, a fluid operating temperature of 40°C is recommended.

**Filtration**

Full flow filtration ( open circuit ), or full boost flow filtration ( close circuit ) to ensure system cleanliness to ISO4406/1986 code 18/14 or cleaner.

**Noise levels**

The airborne noise level is less than 66.7 dB(A) DIN (&) dB (A) NFPA) through the “continuous” operating envelope. Where noise is a critical factor, installation resonances can be reduced by isolating the motor by elastomeric means from the structure and the return line installation. Potential return line resonances originating from liquid borne noise can be further attenuated by providing a return line back pressure of 2 to 5 bar.

**Polar Moment of Inertia & Mass:**

| Model Type                 | Polar moment of Inertia<br>(kg.m <sup>2</sup> )<br>(Typical data) | Mass (kg)<br>(Approx. all models) |
|----------------------------|-------------------------------------------------------------------|-----------------------------------|
| HMB010                     | 0.0076                                                            | 40                                |
| HMB030                     | 0.015                                                             | 73                                |
| HMB045                     | 0.047                                                             | 120                               |
| HMB060                     | 0.055                                                             | 144                               |
| HMB080                     | 0.060                                                             | 144                               |
| HMB100                     | 0.076                                                             | 144                               |
| HMB125                     | 0.22                                                              | 217                               |
| HMB150                     | 0.25                                                              | 265                               |
| HMB200                     | 0.27                                                              | 265                               |
| HMB270                     | 0.91                                                              | 420                               |
| HMB325                     | 0.95                                                              | 429                               |
| HMHDB400 (With 4" valve)   | 0.54                                                              | 481                               |
| HMHDB400 (With 4.5" valve) | 0.54                                                              | 510                               |
| HMB700                     | 2.38                                                              | 1050                              |



## Crankcase Drain

### Motor axis horizontal.

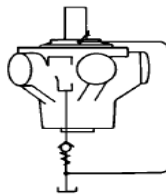
The crankcase drain must be taken from a position above the horizontal centre line of the motor to ensure lubrication of the shaft bearing

### Axis vertical, shaft down.

Use either drain position. The drain line should be run above the level of the uppermost bearing. If there is a risk of syphoning then a syphon breaker should be fitted.

### Axis vertical, shaft up.

An additional G  $\frac{1}{4}$ " (BSPF) drain port is provided when "V" (shaft vertically upwards) designator is given after the shaft type (see Ordering Code). This additional drain should be connected into the main motor casing drain line downstream of a 0.35 bar check valve to ensure lubrication of the upper bearing, see diagram.



## Installation Data

### GENERAL

#### Spigot:

The motor should be located by the mounting spigot on a flat, robust surface using correctly sized bolts. The diametrical clearance between the motor spigot and the mounting must not exceed 0.15mm. If the application incurs shock loading, frequent reversing or high speed running, then high tensile bolts should be used, including one fitted bolt.

#### Bolt Torque:

The recommended torque wrench setting for bolts are as follows:

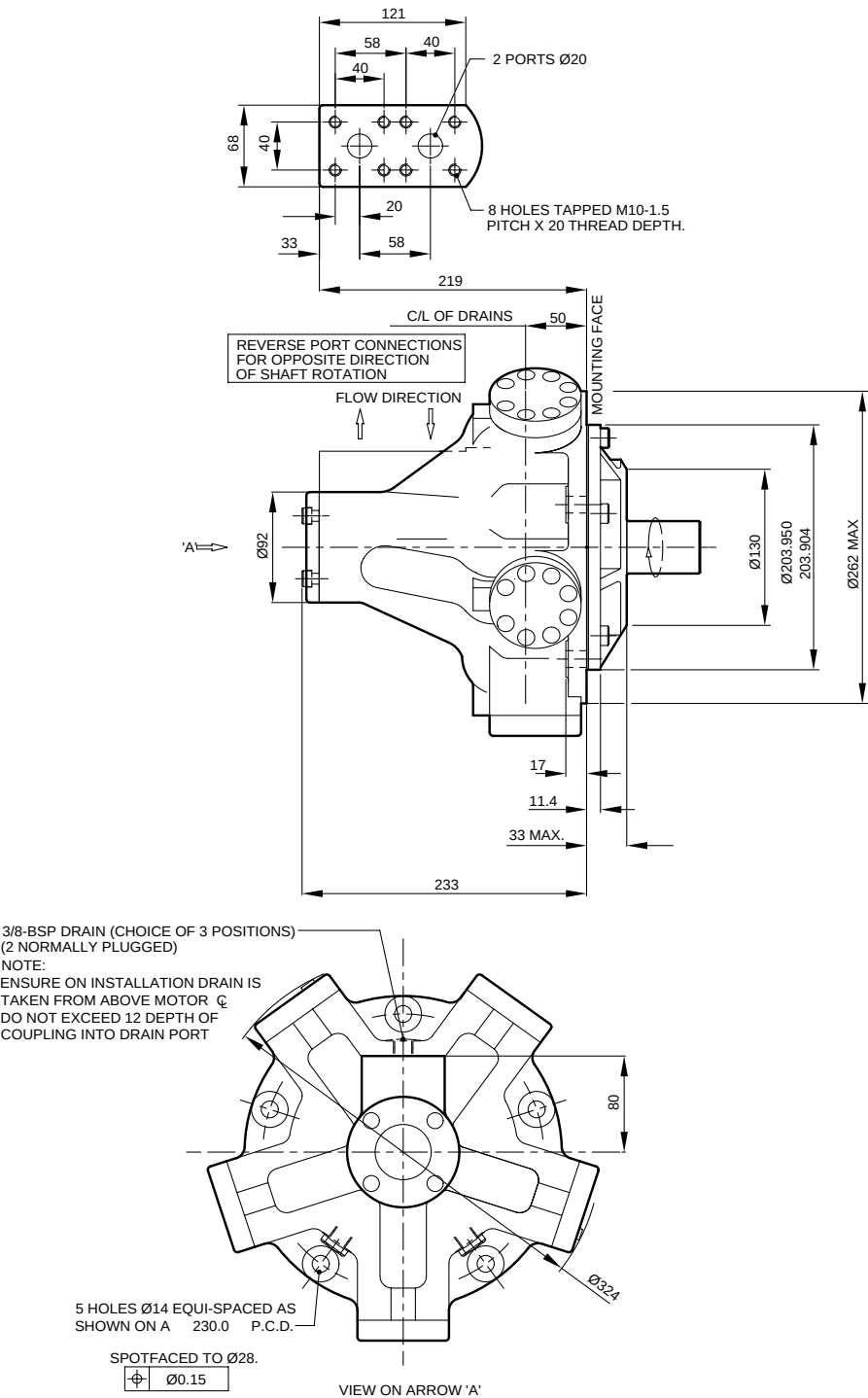
|                                        |               |
|----------------------------------------|---------------|
| <b>M12</b>                             | 97 +/- 7Nm    |
| <b>M14</b>                             | 160 +/- 21Nm  |
| <b>M18</b>                             | 312 +/- 14Nm  |
| <b>M20</b>                             | 407 +/- 14Nm  |
| <b>M24</b>                             | 690 +/- 27Nm  |
| <b><math>\frac{1}{2}</math>" UNF</b>   | 97 +/- 7Nm    |
| <b><math>\frac{5}{8}</math>"</b>       | 265 +/- 14 Nm |
| <b><math>\frac{3}{4}</math>" bolts</b> | 393 +/- 14 Nm |
| <b>1"</b>                              | 810 +/- 27Nm  |

#### Shaft Coupling:

Where the motor is solidly coupled to a shaft having independent bearings the shaft must be aligned to within 0.13mm TIR

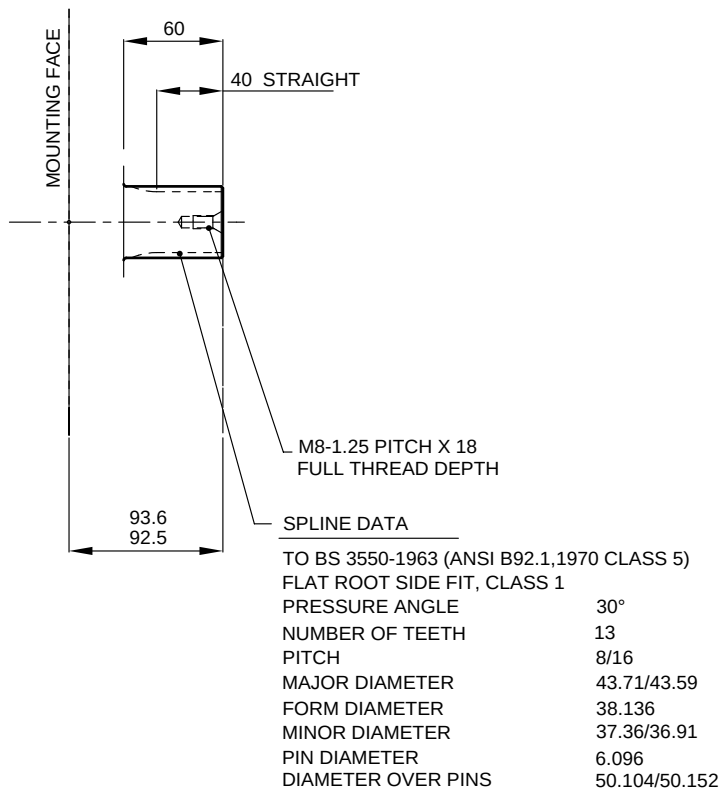
Installation Drawings HMB010 Motor

(See additional views for shaft types)



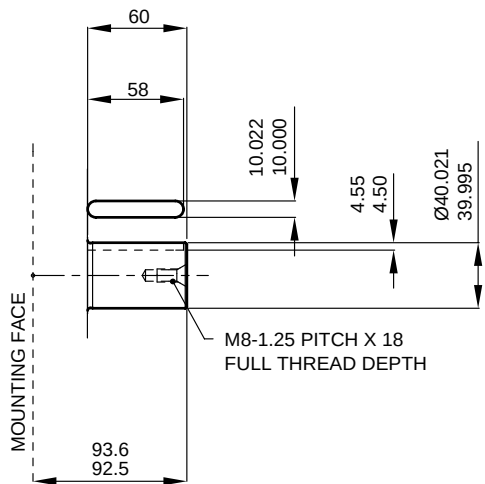
Shaft Specification HMB010

SHAFT TYPE 'S'  
13 SPLINES TO BS 3550-



SHAFT TYPE 'P'  
CYLINDRICAL SHAFT WITH KEY

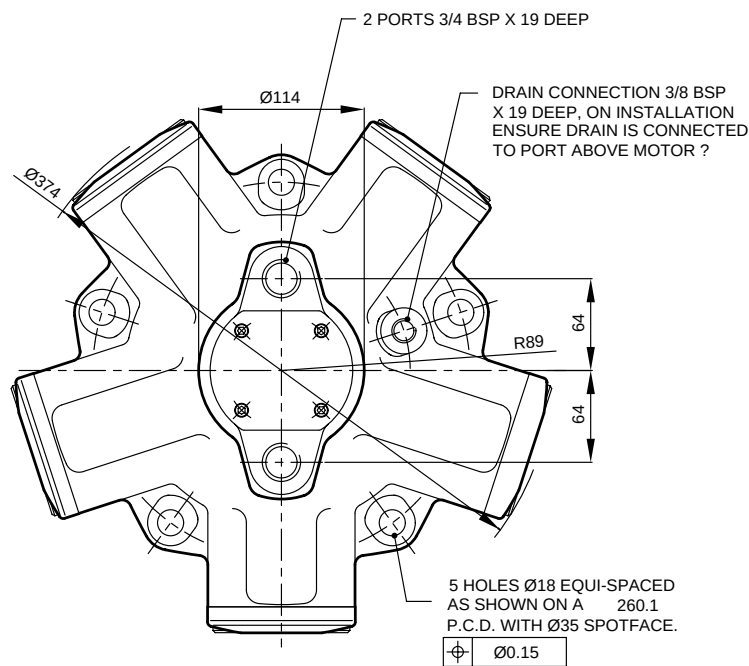
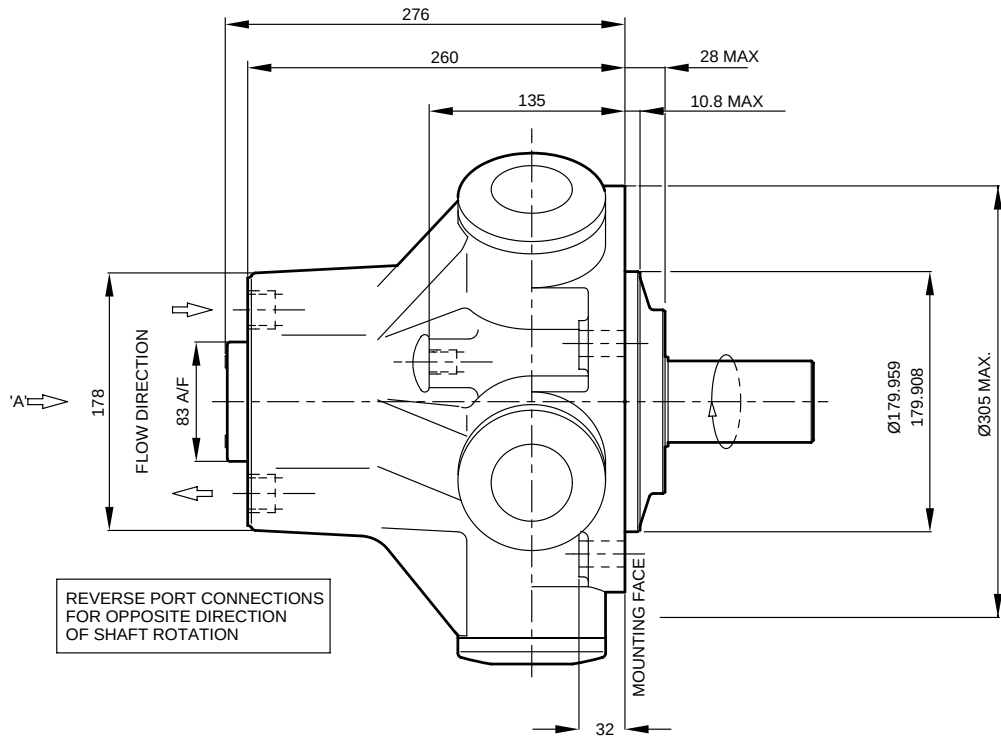
KEY (SUPPLIED):  
10.030/10.015 WIDE  
8.000/7.964 THICK



Installation Drawings

HMB030 motor with rear entry ports (Mono block)

See additional views for side entry model and for shaft types



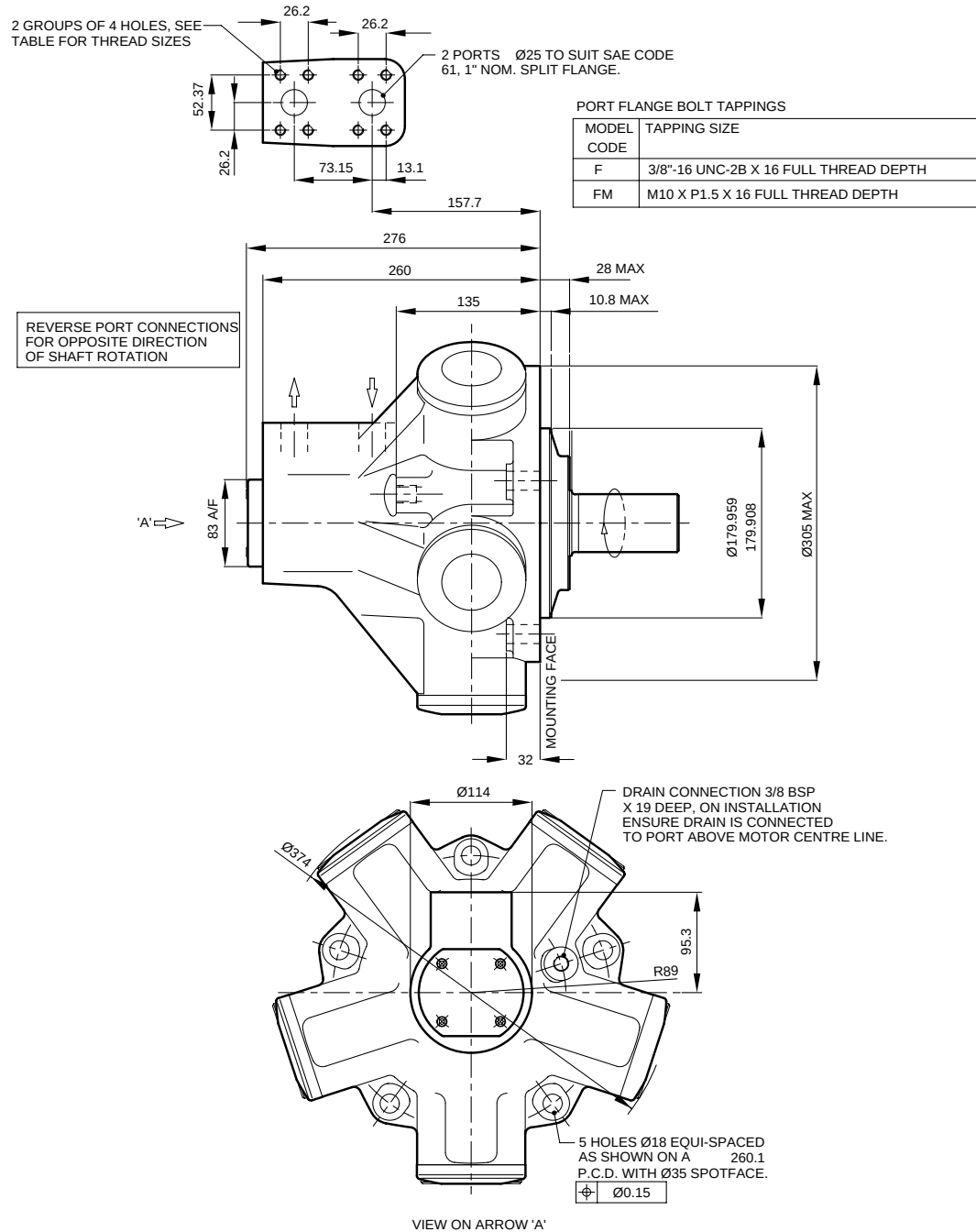
VIEW ON ARROW 'A'





**HMB030 Motor****HMB030 motor with side entry ports (Mono block)**

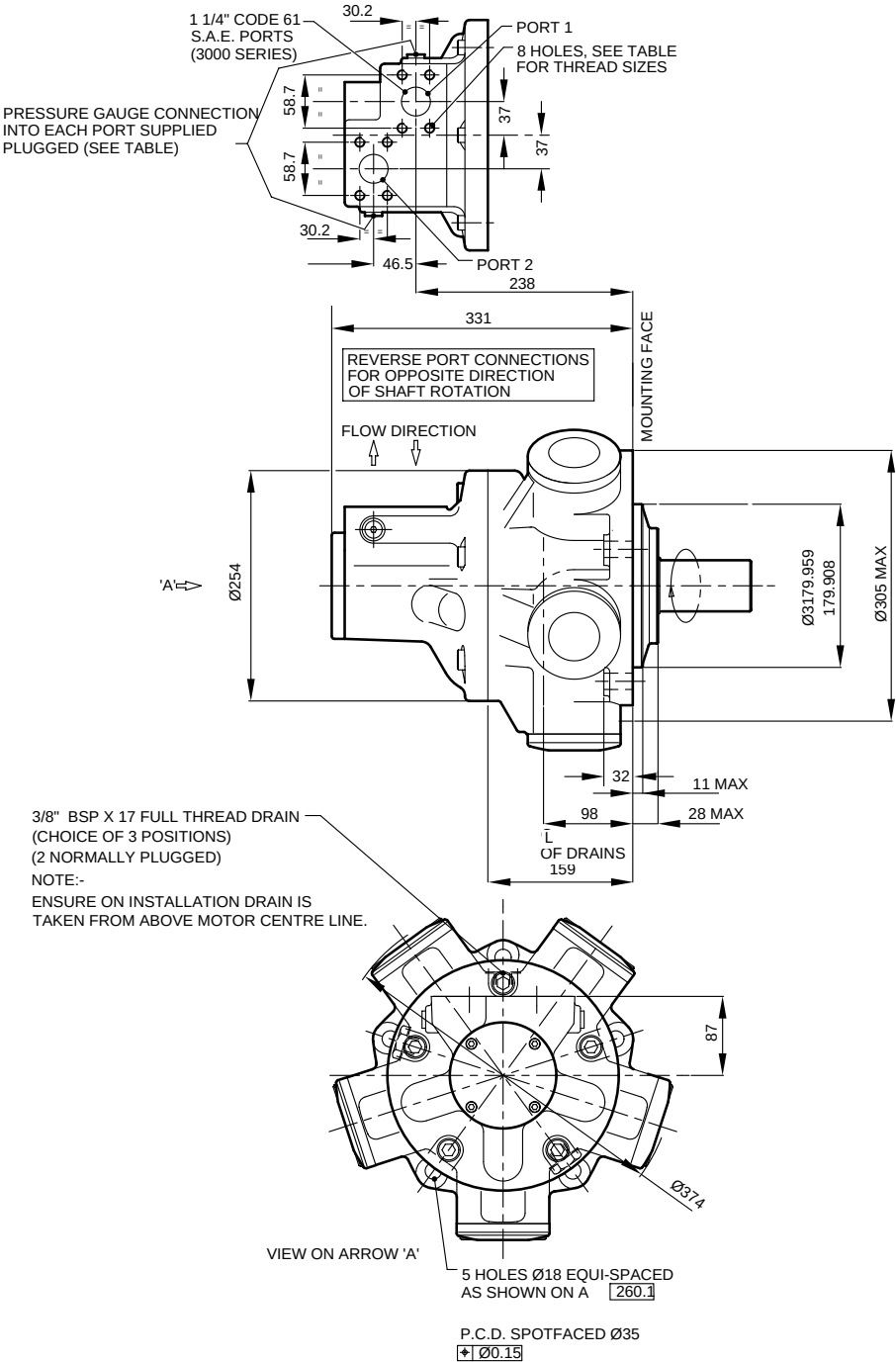
See view of rear entry motor for additional shaft types.



Installation Drawing

HMB030 with F3/FM3 Main Port Connections

| PORT FLANGE BOLT TAPPINGS |                                        |                            |
|---------------------------|----------------------------------------|----------------------------|
| MODEL CODE                | TAPPING SIZE                           | GAUGE CONNECTIONS          |
| F3                        | 7/16"-14 UNC-2B X 27 FULL THREAD DEPTH | 19/16"-18 UNF-2B, SAE J475 |
| FM3                       | M12 X P1.75 X 27 FULL THREAD DEPTH     | G1/4" (BSPF)               |

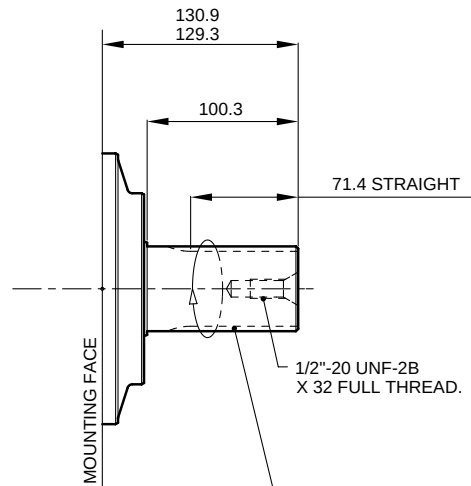


**HMB30 Shaft Specification****Shaft Type "P"** Parallel keyed shaft**Shaft Type "S"** Involute spline, 17 teeth to BS3550**Shaft Type "Z"** Involute spline, 17 teeth to DIN 5480

SHAFT TYPE 'S'  
17 SPLINES TO BS 3550-1963

SHAFT TYPE 'Z'  
17 SPLINES TO DIN 5480

FOR SHAFT TYPE 'Z'  
DIN 5480, W55 X 3 X 17 X 7h

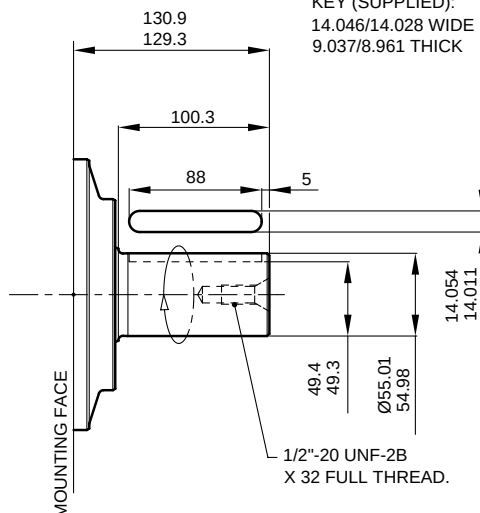
**SPLINE DATA**

FOR SHAFT TYPE 'S'  
TO BS 3550-1963 (ANSI B92.1, 1970 CLASS 5)  
FLAT ROOT SIDE FIT, CLASS 1

|                    |               |
|--------------------|---------------|
| PRESSURE ANGLE     | 30°           |
| NUMBER OF TEETH    | 17            |
| PITCH              | 8/16          |
| MAJOR DIAMETER     | 56.41/56.28   |
| FORM DIAMETER      | 50.703        |
| MINOR DIAMETER     | 50.07/49.60   |
| PIN DIAMETER       | 6.096         |
| DIAMETER OVER PINS | 62.985/62.931 |

**SHAFT TYPE 'P'  
CYLINDRICAL SHAFT WITH KEY**

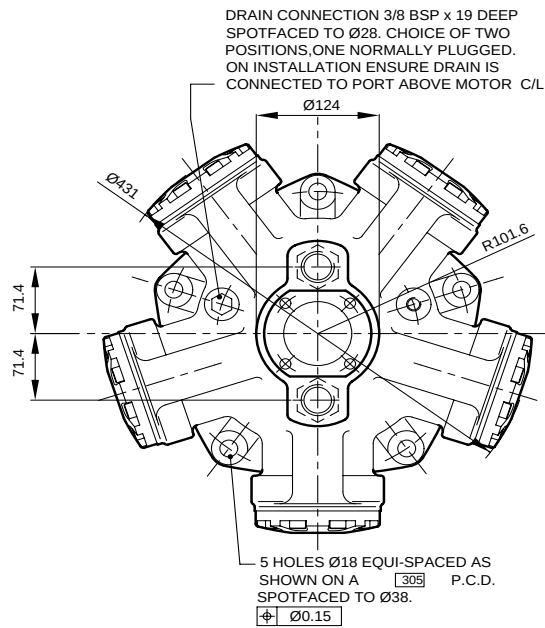
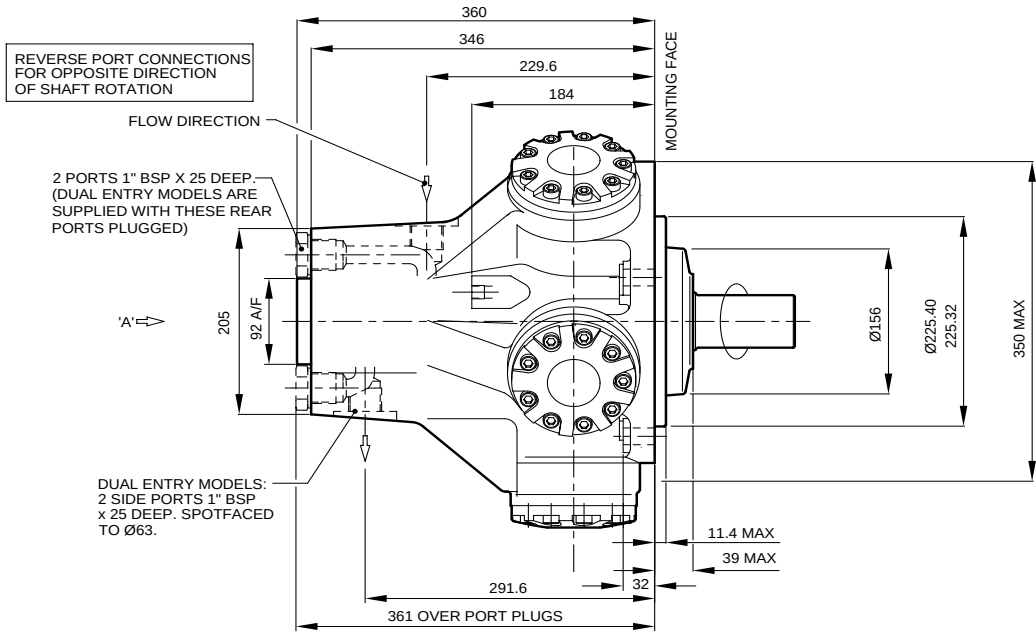
KEY (SUPPLIED):  
14.046/14.028 WIDE  
9.037/8.961 THICK



Installation Drawings

HMB045-\*\*-3\* Motor with rear entry ports  
HMB045-\*\*-D-3\* Motor with dual entry ports

SEE VIEWS FOR ADDITIONAL SHAFT TYPES



VIEW ON ARROW 'A'

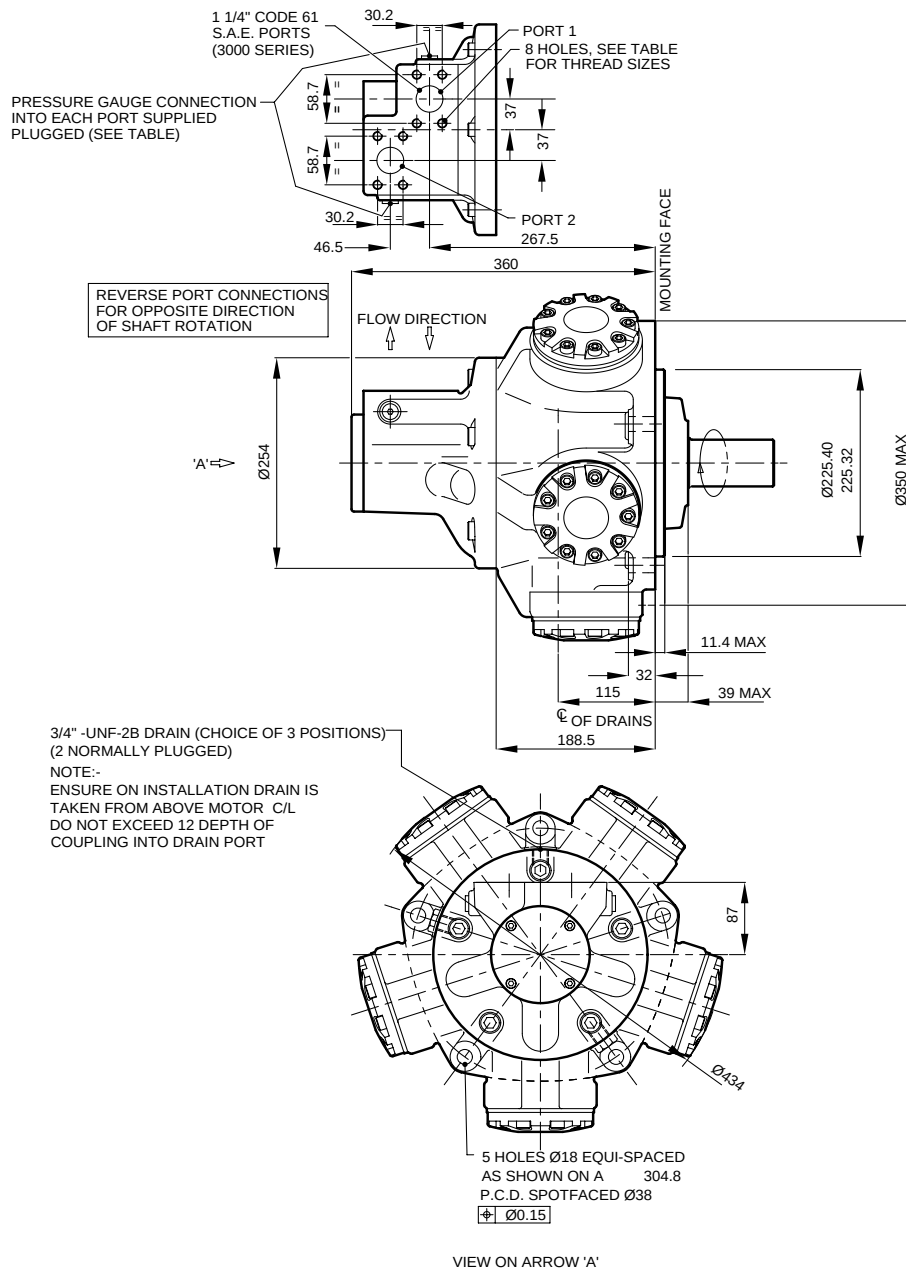


## Installation Drawing

## HMB045-FM3 Motor

PORT FLANGE BOLT TAPPINGS

| MODEL CODE | TAPPING SIZE                           | GAUGE CONNECTIONS         |
|------------|----------------------------------------|---------------------------|
| F3         | 7/16"-14 UNC-2B X 27 FULL THREAD DEPTH | 9/16"-18 UNF-2B, SAE J475 |
| FM3        | M12 X P1.75 X 27 FULL THREAD DEPTH     | G1/4 (BSPF)               |

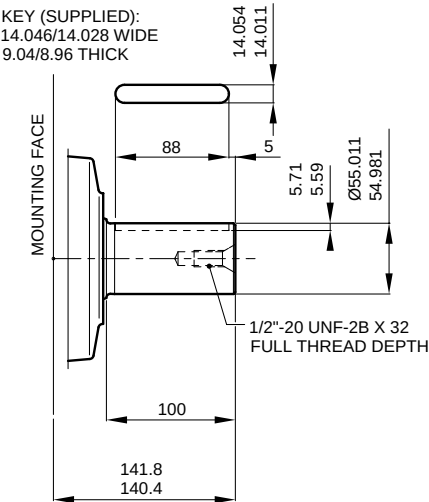


B045 Shaft Specification

- Shaft type “P”, Parallel keyed shaft
- Shaft type “S”, Involute spline, 17 teeth to BS3550
- Shaft type “Z”, Involute spline to DIN 5480
- Shaft type “Q”, Internal Involute spline, 21 teeth to BS 3550

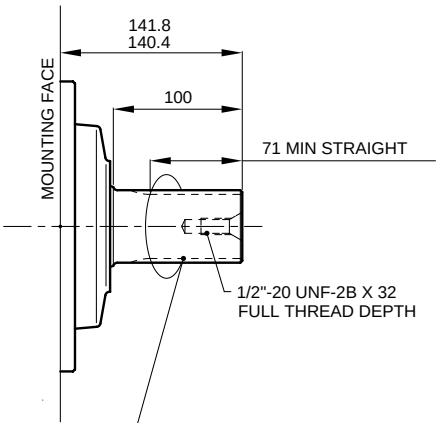
B045 SHAFT VARIATIONS

SHAFT TYPE 'P'  
CYLINDRICAL SHAFT WITH KEY



SHAFT TYPES 'S'  
17 SPLINES TO BS 3550-1963

SHAFT TYPES 'Z'  
17 SPLINES TO DIN 5480



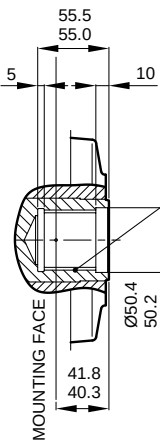
SPLINE DATA

FOR SHAFT TYPE 'S'  
TO BS 3550-1963 & ANSI B92.1,1970  
FLAT ROOT SIDE FIT, CLASS 1

|                    |               |
|--------------------|---------------|
| PRESSURE ANGLE     | 30 °          |
| NUMBER OF TEETH    | 17            |
| PITCH              | 8/16          |
| MAJOR DIAMETER     | 56.41/56.28   |
| FORM DIAMETER      | 50.703        |
| MINOR DIAMETER     | 50.07/49.60   |
| PIN DIAMETER       | 6.096         |
| DIAMETER OVER PINS | 62.985/62.931 |

FOR SHAFT TYPE 'Z'  
DIN 5480, W55 X 3 X 17 X 7h

SHAFT TYPE 'Q'  
FEMALE SHAFT WITH 21 SPLINES TO BS 3550



SPLINE DATA

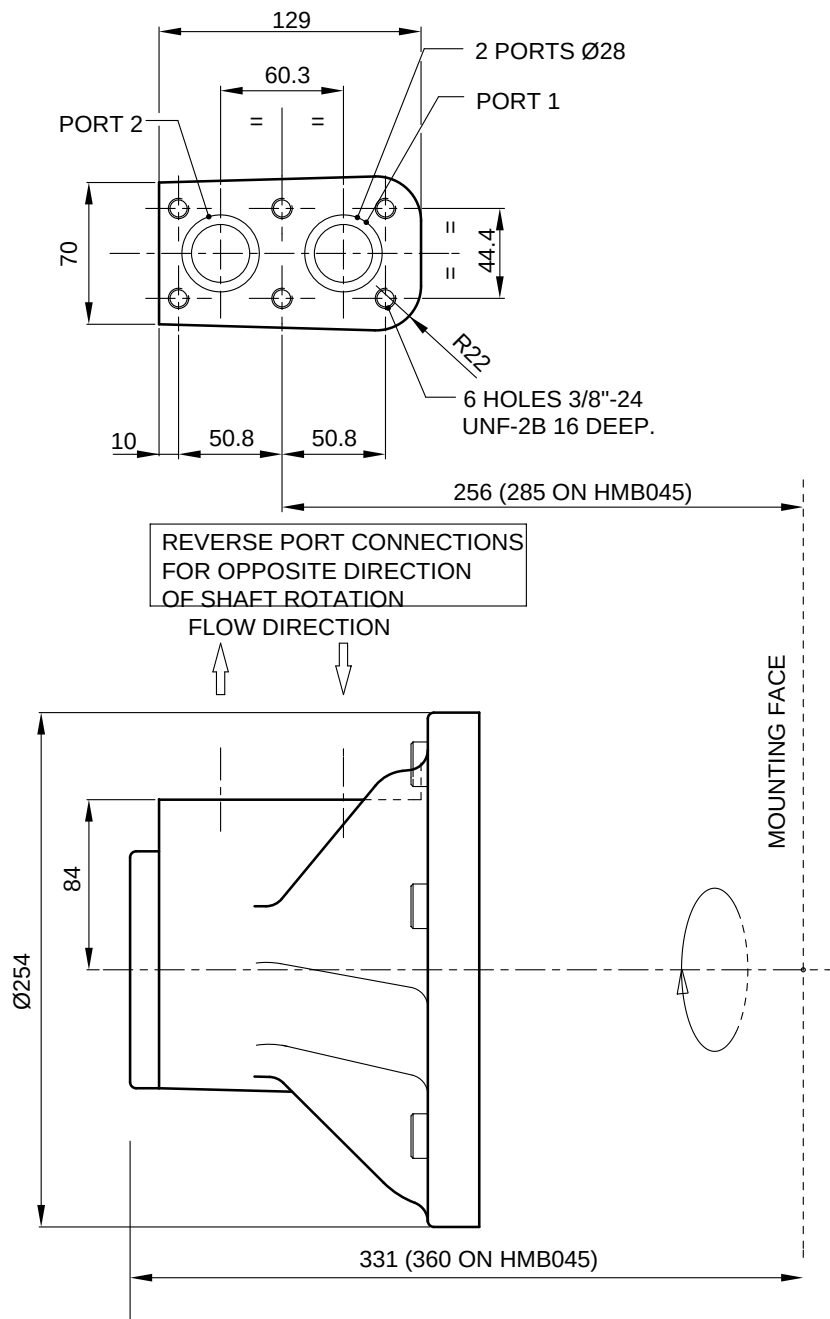
INTERNAL SPLINE TO BS 3550-1963  
FLAT ROOT SIDE FIT

|                        |               |
|------------------------|---------------|
| PRESSURE ANGLE         | 30 °          |
| NUMBER OF TEETH        | 21            |
| PITCH                  | 12/24         |
| MAJOR DIAMETER         | 46.566/46.896 |
| FORM DIAMETER          | 46.144        |
| MINOR DIAMETER         | 42.334/42.461 |
| PIN DIAMETER           | 3.658         |
| PIN FLATTED TO         | 3.556         |
| DIMENSION BETWEEN PINS | 39.169/39.103 |

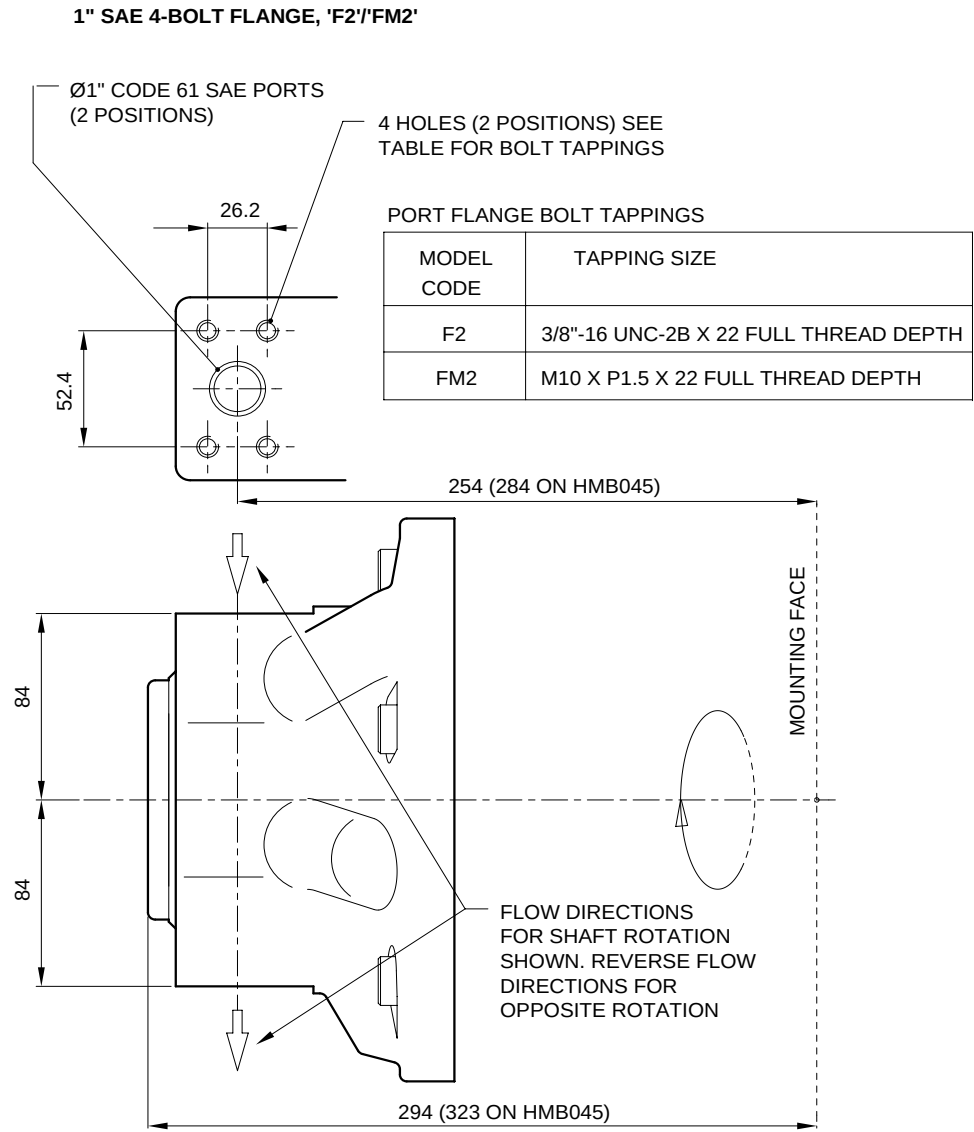


**HMB030/HMB045 Valve Housings**

**3" VALVE HOUSING WITH 6-BOLT FLANGE, 'S03'  
SUPPLIED WITH 2 'O' RING SEALS**



HMB030/HMB045 Valve Housings (continued)



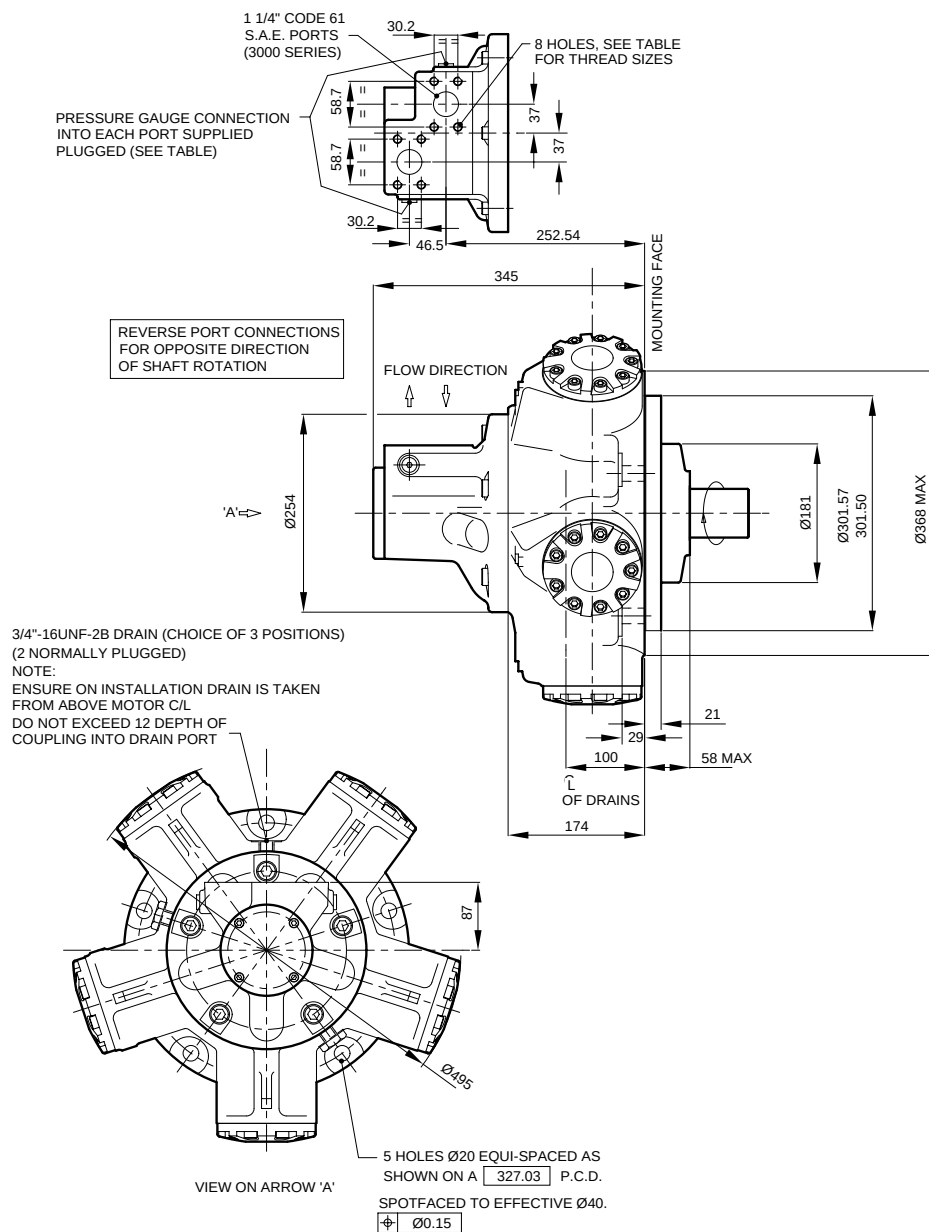


**Installation Drawings****HMB060/80 motors with type "F3"/"FM3" (1<sup>1</sup>/<sub>4</sub>" SAE) port connection**

See additional views for shaft types and for types "S03" and "S04" port connection.  
See drawing of dual-mount model for details of types "F2" and "FM2" port connection.

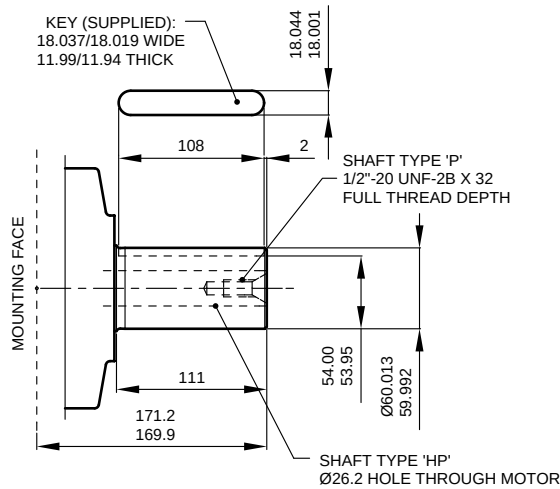
PORT FLANGE BOLT TAPPINGS

| MODEL CODE | TAPPING SIZE                           | GAUGE CONNECTIONS         |
|------------|----------------------------------------|---------------------------|
| F3         | 7/16"-14 UNC-2B X 27 FULL THREAD DEPTH | 9/16"-18 UNF-2B, SAE J475 |
| FM3        | M12 X P1.75 X 27 FULL THREAD DEPTH     | G1/4" (BSPF)              |

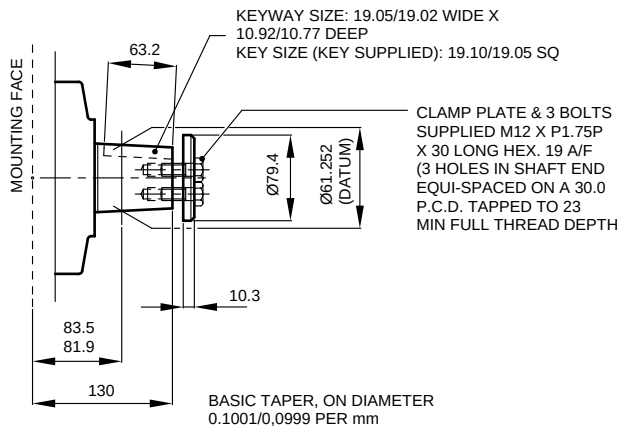


HMB060/080/100 Shaft Specification

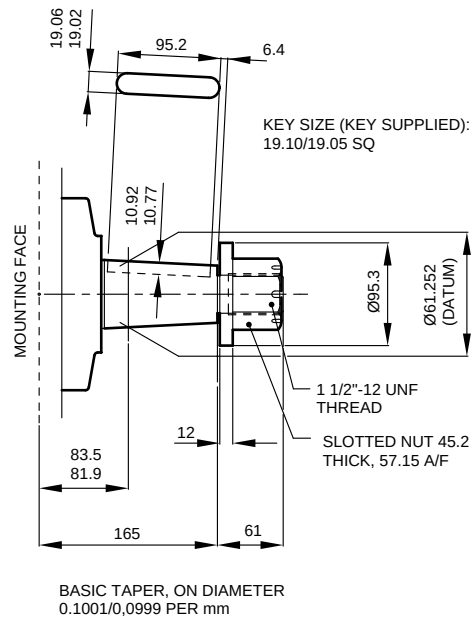
SHAFT TYPES 'P' & 'HP'  
CYLINDRICAL SHAFT WITH KEY



SHAFT TYPE 'X'  
SHORT TAPER WITH KEY



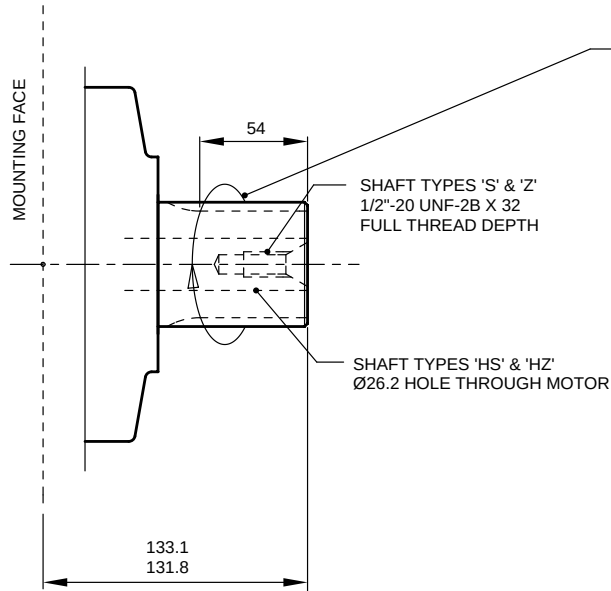
SHAFT TYPE 'T'  
LONG TAPER WITH KEY



**HMB060/080/100 Shaft Specification (continued)**

**SHAFT TYPES 'S' & 'HS'**  
14 SPLINES TO BS 3550-1963

**SHAFT TYPES 'Z' & 'HZ'**  
22 SPLINES TO DIN 5480

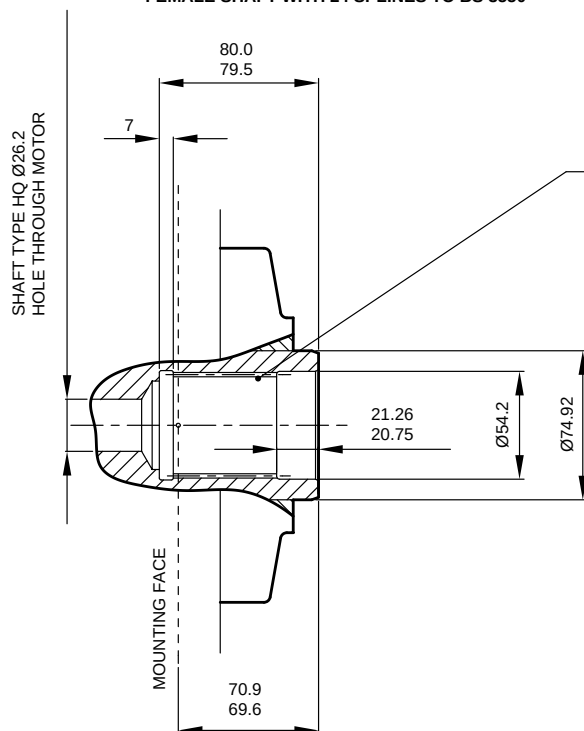
**SPLINE DATA**

FOR SHAFT TYPES 'S' & 'HS'  
TO BS 3550/ANSI B92.1 1970 CLASS 5  
FLAT ROOT SIDE FIT, CLASS 1

|                    |               |
|--------------------|---------------|
| PRESSURE ANGLE     | 30°           |
| NUMBER OF TEETH    | 14            |
| PITCH              | 6/12          |
| MAJOR DIAMETER     | 62.553/62.425 |
| FORM DIAMETER      | 55.052        |
| MINOR DIAMETER     | 54.084/53.525 |
| PIN DIAMETER       | 8.128         |
| DIAMETER OVER PINS | 71.593/71.544 |

FOR SHAFT TYPES 'Z' & 'HZ'  
DIN 5480 W70 X 3 X 30 X 22 X 7h

**SHAFT TYPE 'Q' & 'HQ'**  
FEMALE SHAFT WITH 24 SPLINES TO BS 3550

**SPLINE DATA**

TO BS 3550  
FLAT ROOT SIDE FIT, MODIFIED  
PRESSURE ANGLE

|                       |               |
|-----------------------|---------------|
| NUMBER OF TEETH       | 30°           |
| PITCH                 | 24            |
| MAJOR DIAMETER        | 12/24         |
| MINOR DIAMETER        | 53.246/52.916 |
| PIN DIAMETER          | 48.811/48.684 |
| PIN FLATTED TO        | 3.658         |
| DIAMETER BETWEEN PINS | 3.560         |
|                       | 45.626/45.550 |

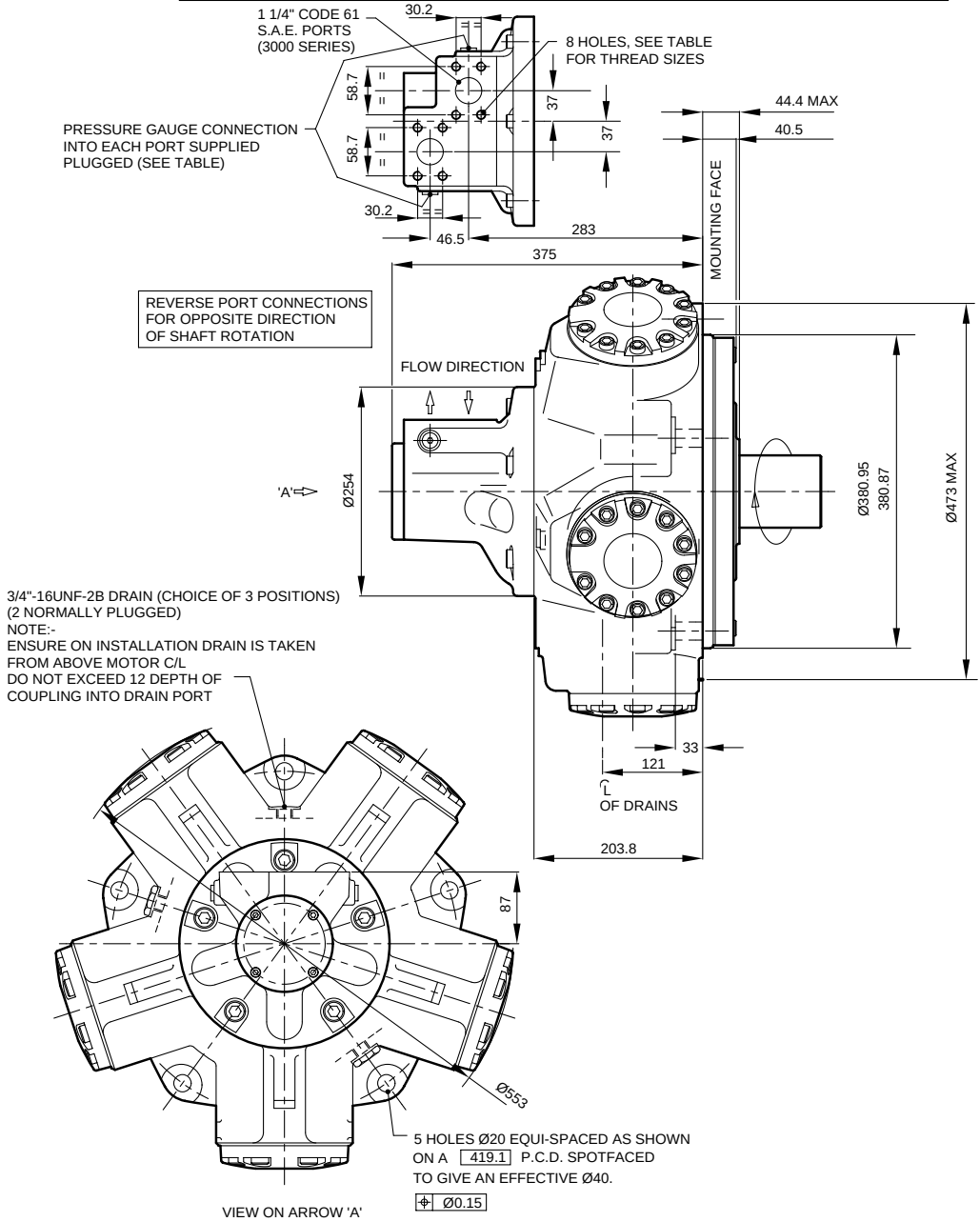


Installation Drawings  
HMB125 Motor with type "F3"/FM3 (1 1/4" SAE) Port Connection

SEE VIEWS FOR SHAFT TYPES & 'F2','FM2','S03','S04','F4' & 'FM4' PORT CONNECTION.

PORT FLANGE BOLT TAPPINGS

| MODEL CODE | TAPPING SIZE                           | GAUGE CONNECTIONS         |
|------------|----------------------------------------|---------------------------|
| F3         | 7/16"-14 UNC-2B X 27 FULL THREAD DEPTH | 9/16"-18 UNF-2B, SAE J475 |
| FM3        | M12 X P1.75 X 27 FULL THREAD DEPTH     | G1/4" (BSPF)              |

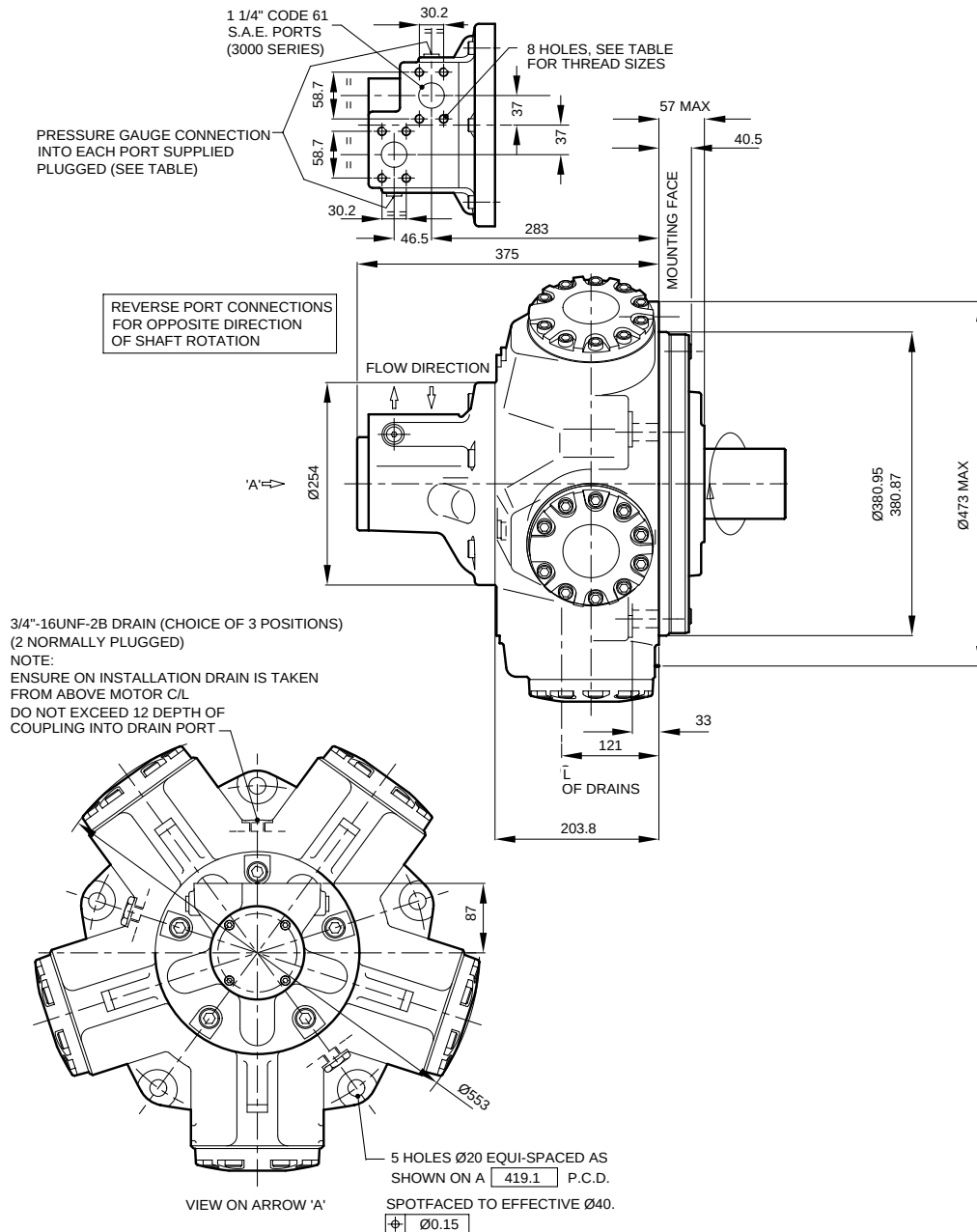


**Installation Drawings****HDB125 Motor with type "F3"/FM3 (1<sup>1</sup>/<sub>4</sub>" SAE) Port Connection**

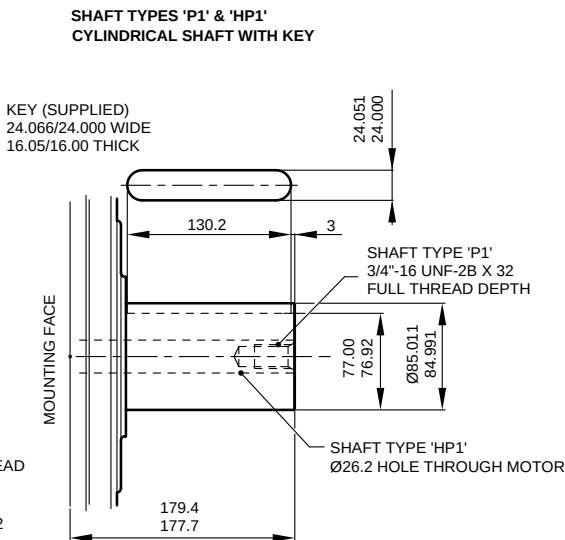
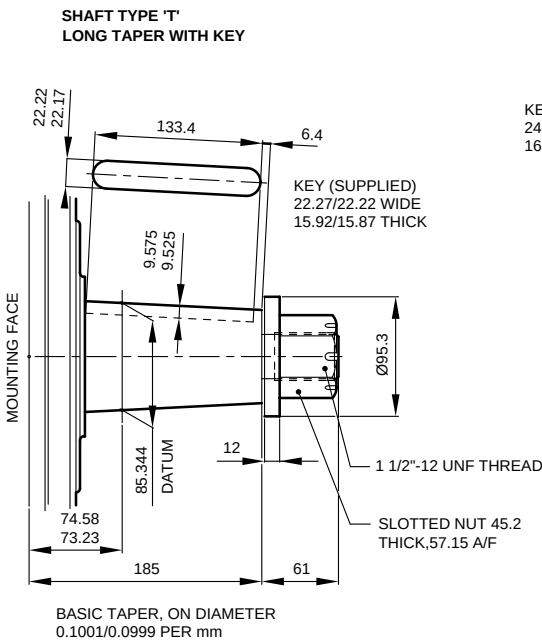
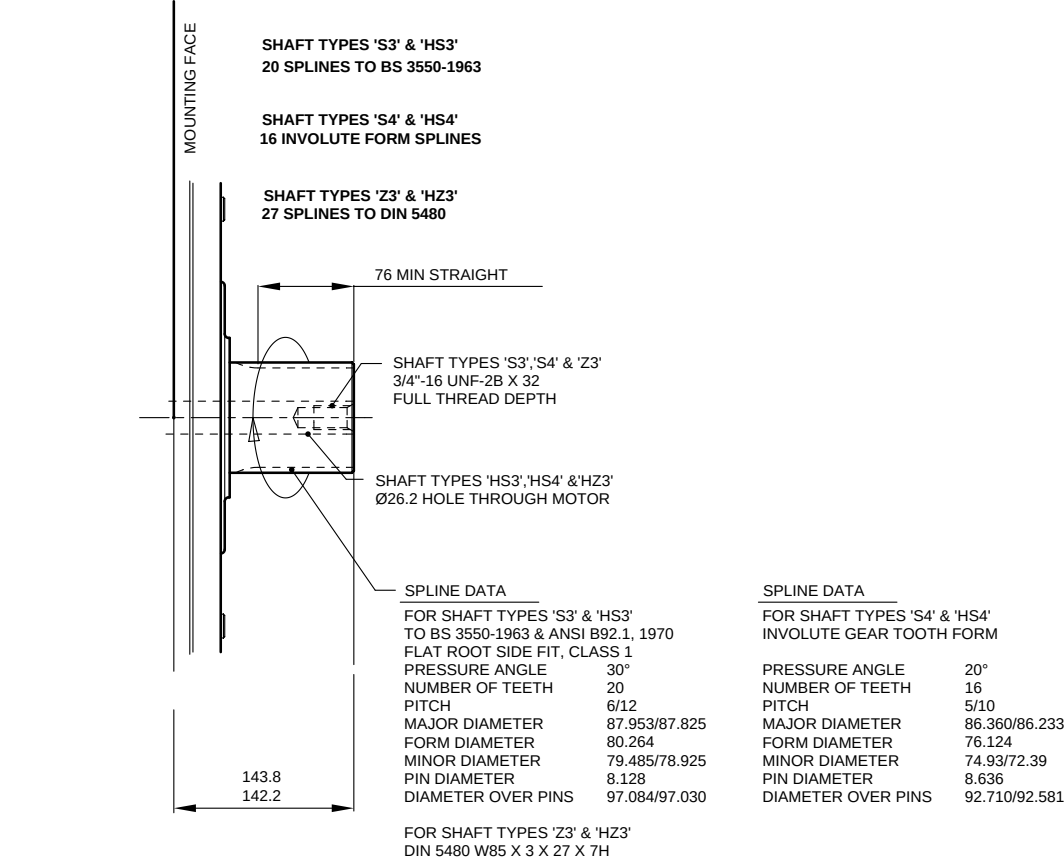
SEE VIEWS FOR SHAFT TYPES &amp; 'F2','FM2','S03','S04'F4' &amp; 'FM4' PORT CONNECTION.

## PORT FLANGE BOLT TAPPINGS

| MODEL CODE | TAPPING SIZE                           | GAUGE CONNECTIONS         |
|------------|----------------------------------------|---------------------------|
| F3         | 7/16"-14 UNC-2B X 27 FULL THREAD DEPTH | 9/16"-18 UNF-2B, SAE J475 |
| FM3        | M12 X P1.75 X 27 FULL THREAD DEPTH     | G1/4" (BSPF)              |

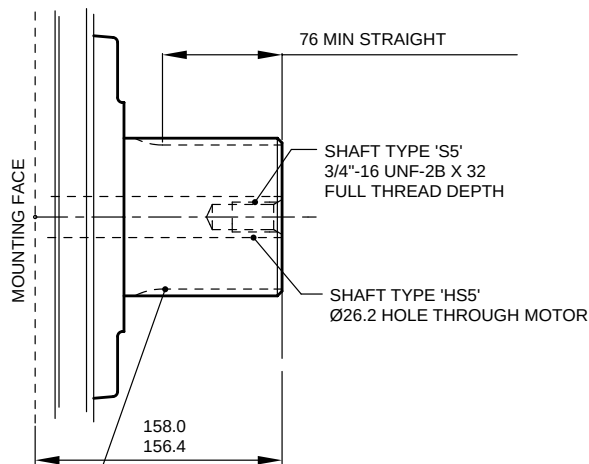


Motor HMB125 Shaft Specification



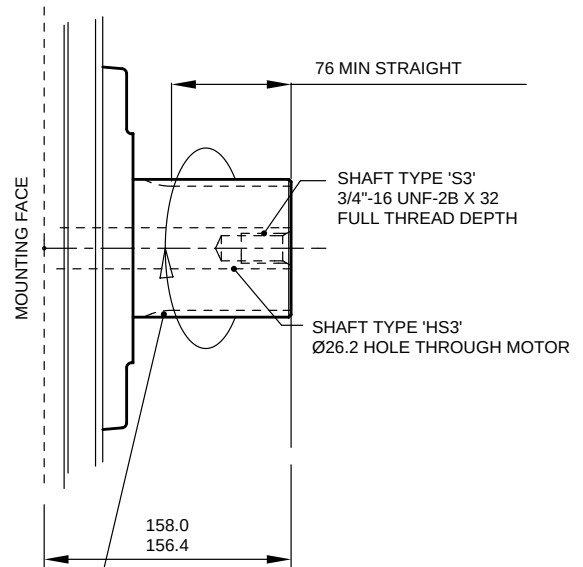
**Motor HDB125 Shaft Specification**

SHAFT TYPES 'S5' & 'HS5'  
23 SPLINES TO BS 3550-1963

**SPLINE DATA**

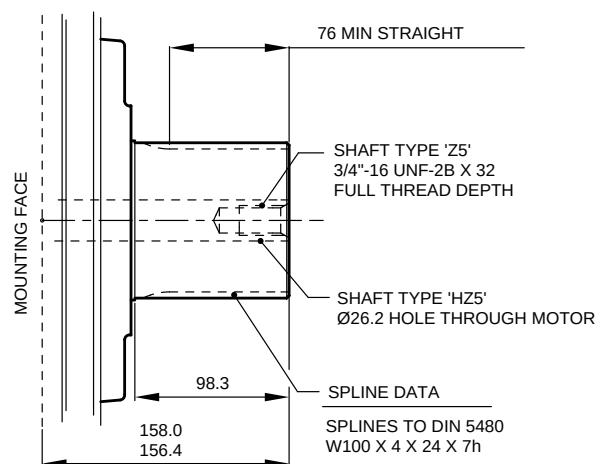
FOR SHAFT TYPES 'S5' & 'HS5'  
TO BS 3550-1963 & ASA, B5.15-1960  
FLAT ROOT SIDE FIT, CLASS 1  
PRESSURE ANGLE 30°  
NUMBER OF TEETH 23  
PITCH 6/12  
MAJOR DIAMETER 100.652/100.526  
FORM DIAMETER 92.939  
MINOR DIAMETER 92.184/91.626  
PIN DIAMETER 8.128  
DIAMETER OVER PINS 109.573/109.517

SHAFT TYPES 'S3' & 'HS3'  
20 SPLINES TO BS 3550-1963

**SPLINE DATA**

FOR SHAFT TYPES 'S3' & 'HS3'  
TO BS 3550-1963 & ASA, B5.15-1960  
FLAT ROOT SIDE FIT, CLASS 1  
PRESSURE ANGLE 30°  
NUMBER OF TEETH 20  
PITCH 6/12  
MAJOR DIAMETER 87.953/87.825  
FORM DIAMETER 80.264  
MINOR DIAMETER 79.485/78.925  
PIN DIAMETER 8.128  
DIAMETER OVER PINS 97.084/97.030

SHAFT TYPES 'Z5' & 'HZ5'  
24 SPLINES TO DIN 5480

**SPLINE DATA**

SPLINES TO DIN 5480  
W100 X 4 X 24 X 7h

Model  
Staffa

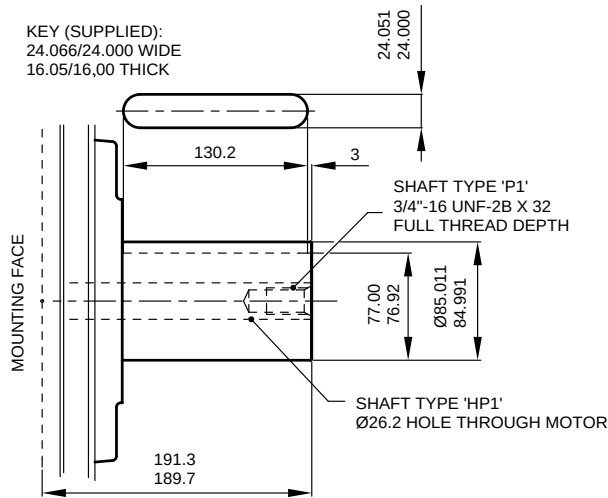
Page  
47.70

Data Sheet  
M-1001/03.00

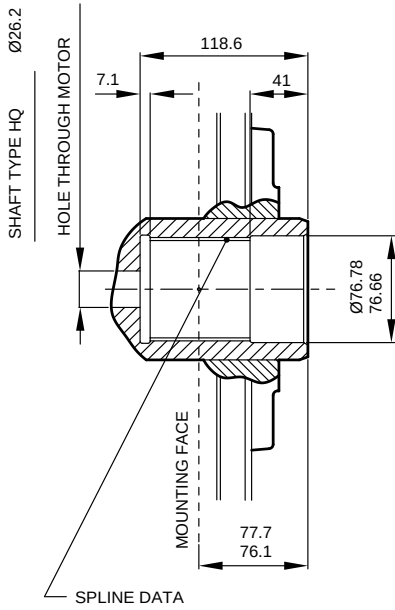
**Kawasaki**  
Hydraulic Products

Motor HDB125 Shaft Specification (continued)

SHAFT TYPES 'P1' & 'HP1'  
CYLINDRICAL SHAFT WITH KEY

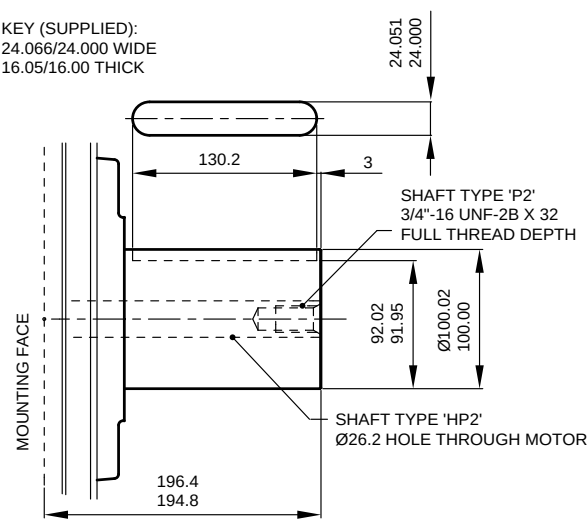


SHAFT TYPE 'Q' & 'HQ'  
FEMALE SHAFT WITH 34 SPLINES TO BS 3550

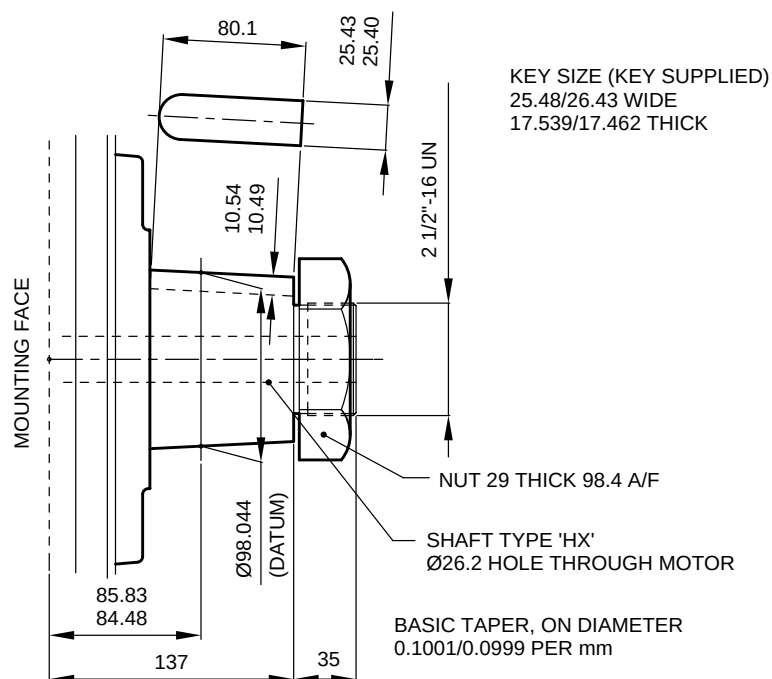
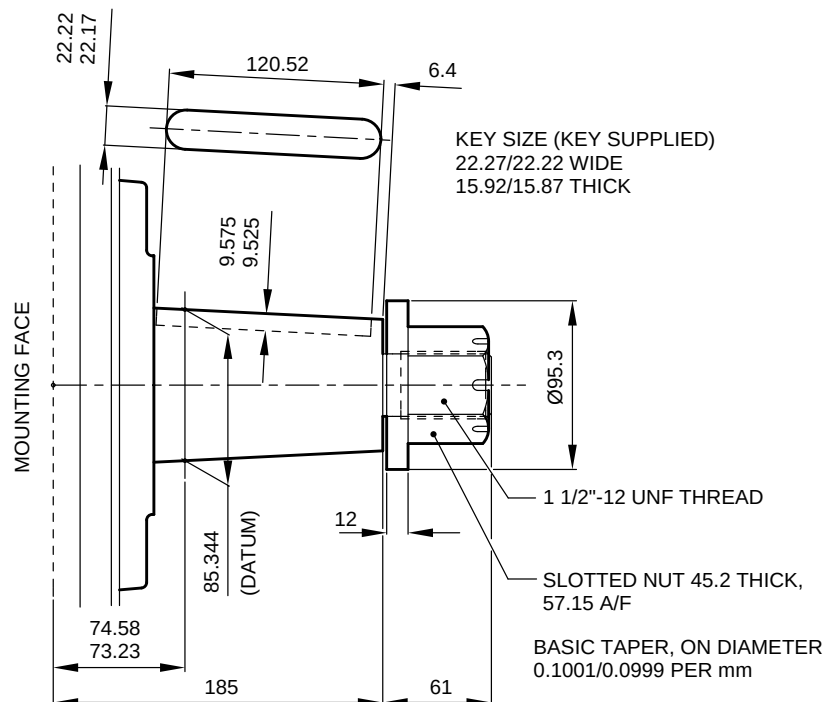


TO BS 3550-1963 & ASA,B5.15-1960  
FLAT ROOT SIDE FIT,  
PRESSURE ANGLE 30°  
NUMBER OF TEETH 34  
PITCH 12/24  
MAJOR DIAMETER 74.414/74.084  
MINOR DIAMETER 69.977/69.850  
PIN DIAMETER 3.658  
PIN FLATTED TO 3.556  
DIAMETER BETWEEN PINS 66.815/66.744

SHAFT TYPES 'P2' & 'HP2'  
CYLINDRICAL SHAFT WITH KEY

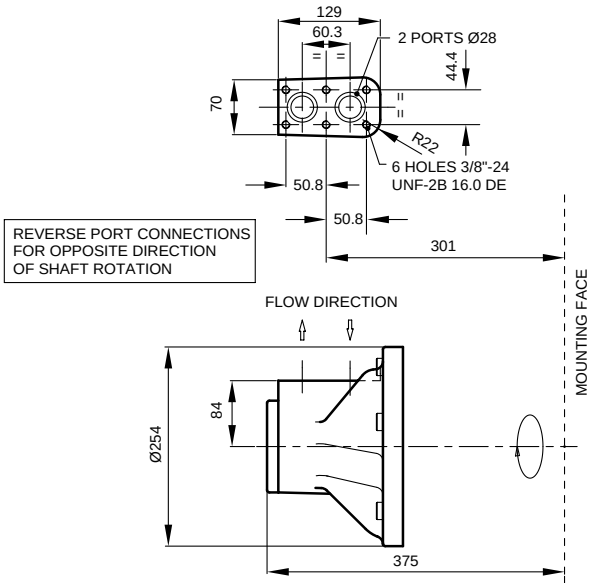




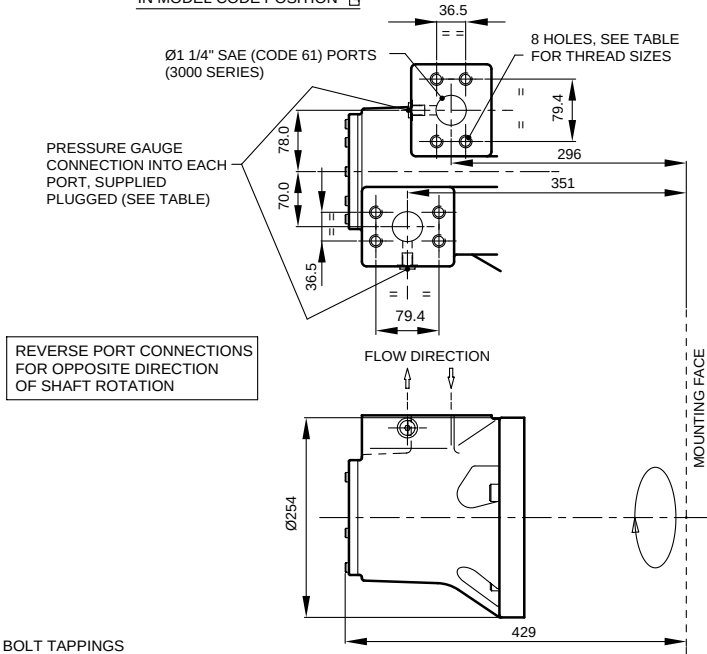
**Motor HDB125 Shaft Specification (continued)****SHAFT TYPE 'X' & 'HX'  
SHORT TAPER WITH KEY****SHAFT TYPE 'T'  
LONG TAPER WITH KEY**

Motor HMB125/HDB125 Valve Housings

3" VALVE HOUSING WITH 6-BOLT FLANGE, 'S03'  
SUPPLIED WITH 2 'O' RING SEALS



4" VALVE HOUSING WITH 1 1/2" SAE 4-BOLT FLANGES, 'F4'/FM4'  
IN MODEL CODE POSITION 4



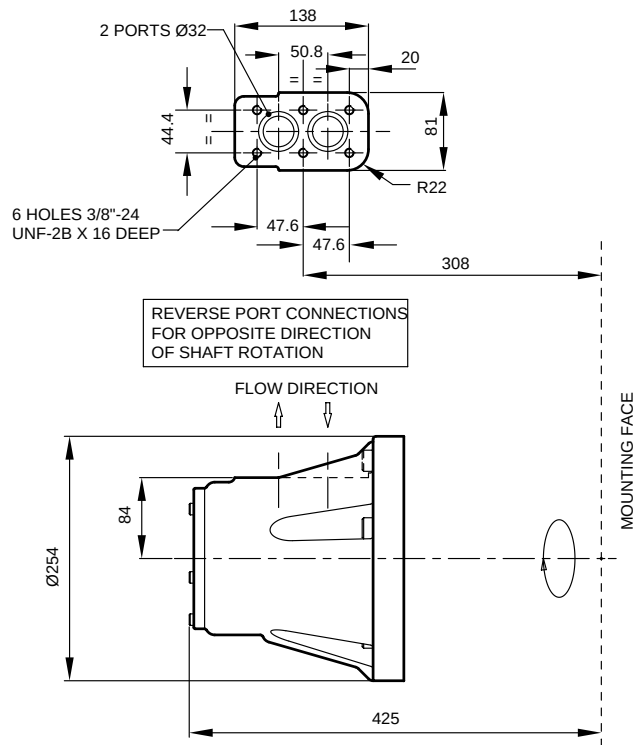
PORT FLANGE BOLT TAPPINGS

| MODEL CODE | TAPPING SIZE                          | GAUGE CONNECTIONS         |
|------------|---------------------------------------|---------------------------|
| F4         | 5/8"-11 UNC-2B X 35 FULL THREAD DEPTH | 9/16"-18 UNF-2B, SAE J475 |
| FM4        | M16 X P2 X 35 FULL THREAD DEPTH       | G1/4" (BSPF)              |

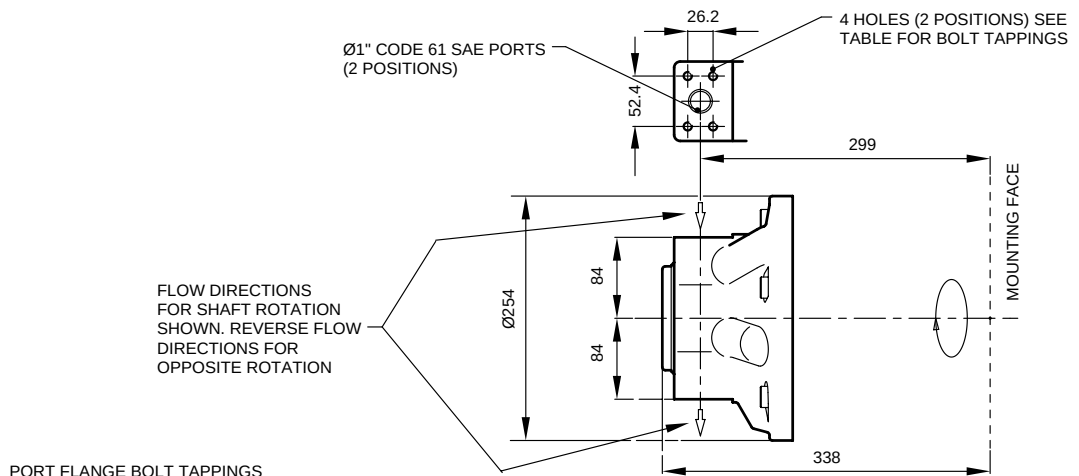


**Motor HMB125/HDB125 Valve Housings (continued)**

4" VALVE HOUSING WITH 6-BOLT FLANGE, 'S04'  
SUPPLIED WITH 2 'O' RING SEALS



2 1/4" VALVE HOUSING WITH 1" SAE 4-BOLT FLANGES,  
F2'/FM2'



PORT FLANGE BOLT TAPPINGS

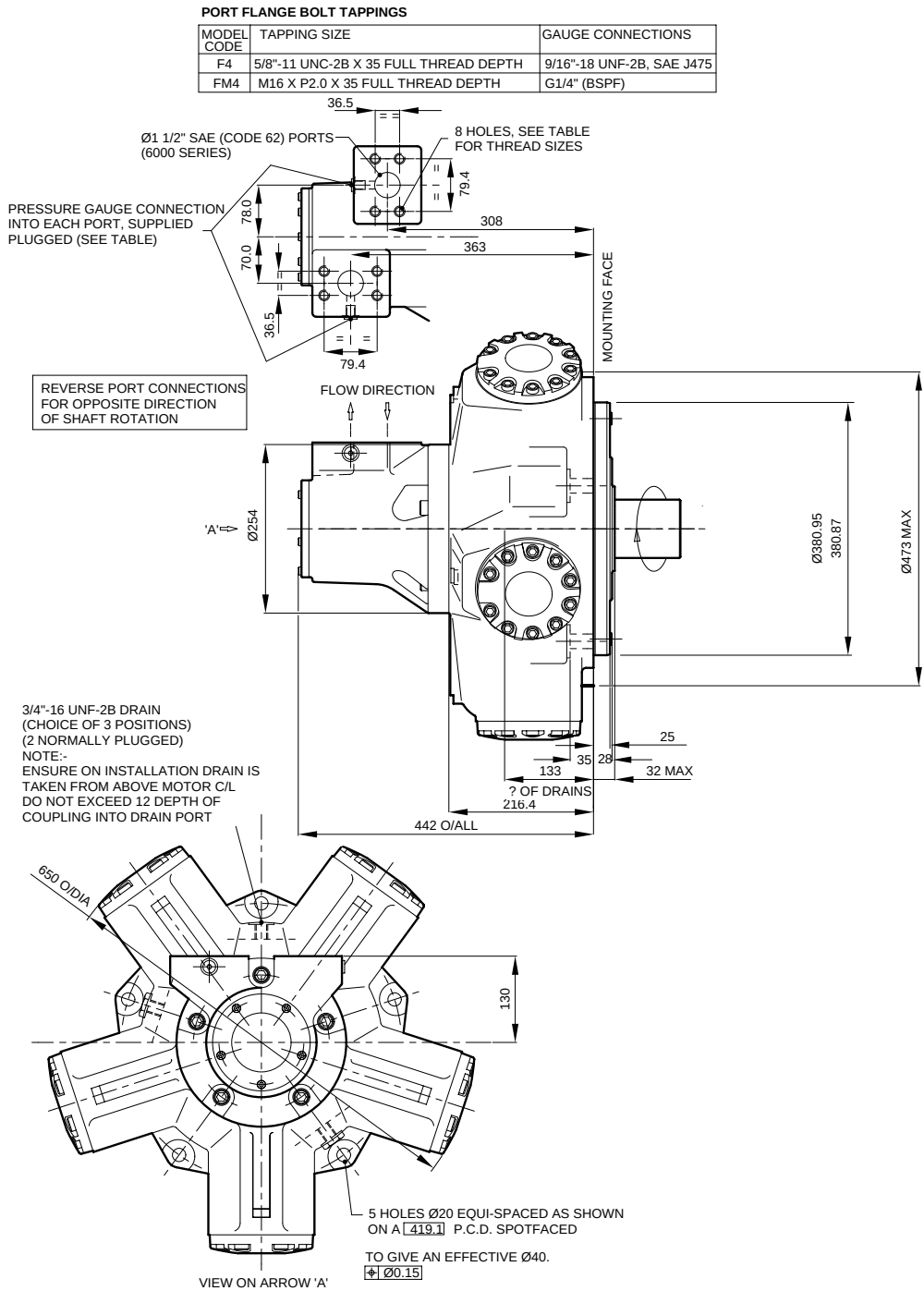
| MODEL<br>CODE | TAPPING SIZE                          |
|---------------|---------------------------------------|
| F2            | 3/8"-16 UNC-2B X 22 FULL THREAD DEPTH |
| FM2           | M10 X P1.5 X 22 FULL THREAD DEPTH     |

**Kawasaki**  
Hydraulic Products

Installation Drawings

HMB150/200 Motors with type "F4"/"FM4" (1½" SAE) port connection

See additional views for shaft types and for types "S04", "F3", "FM3" and "S03" port connection



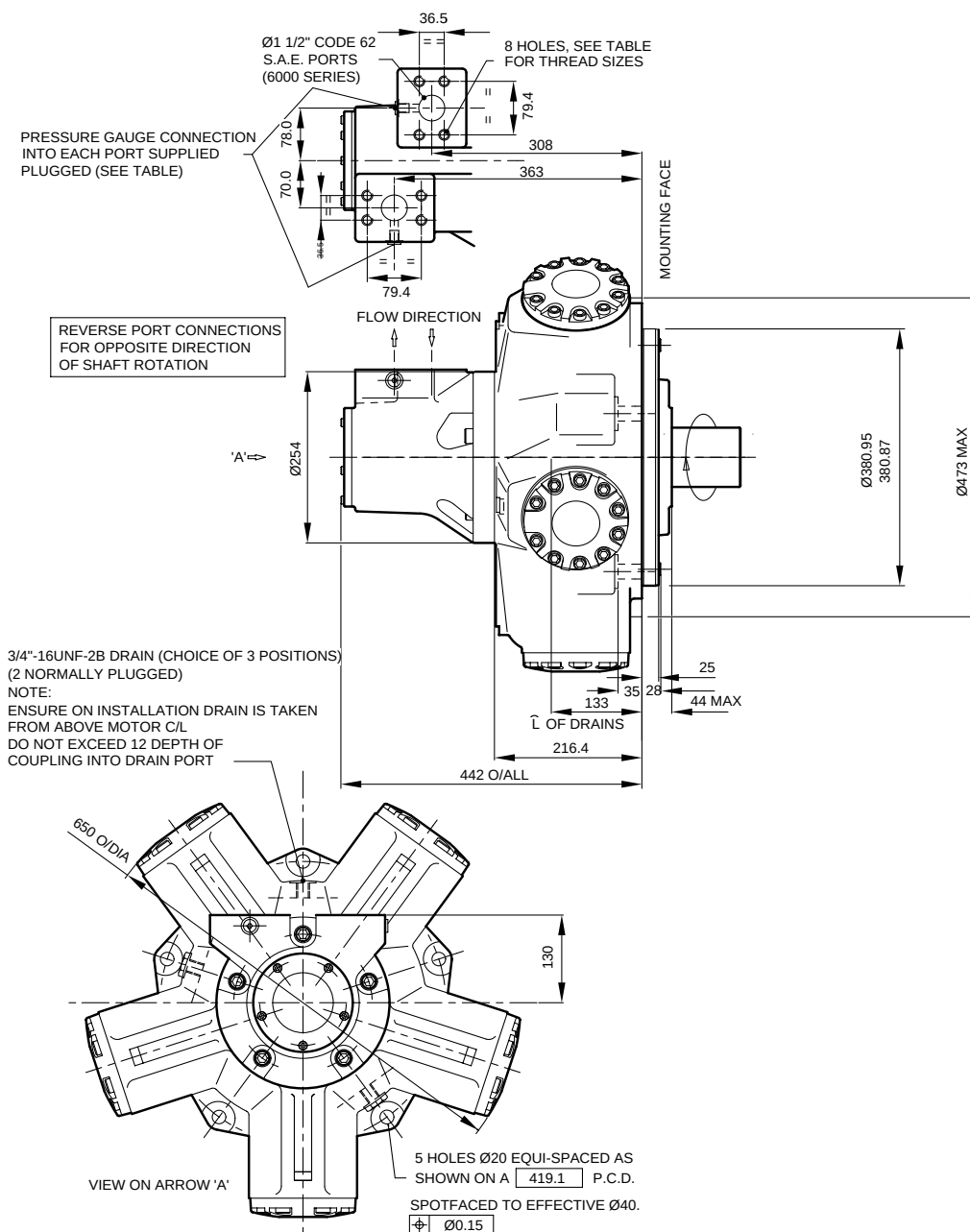
## Installation Drawings

## HMHDB 150/200 Motors with type "F4"/...(1 1/2" SAE) Port Connection

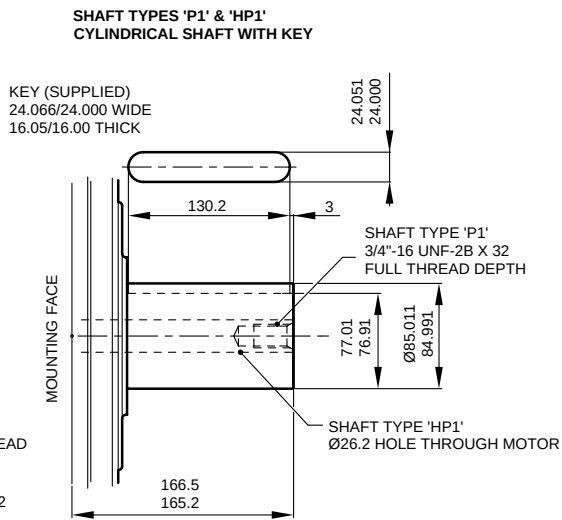
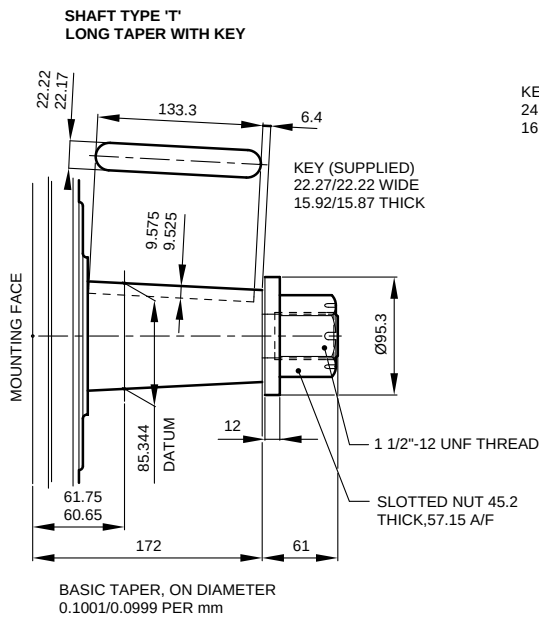
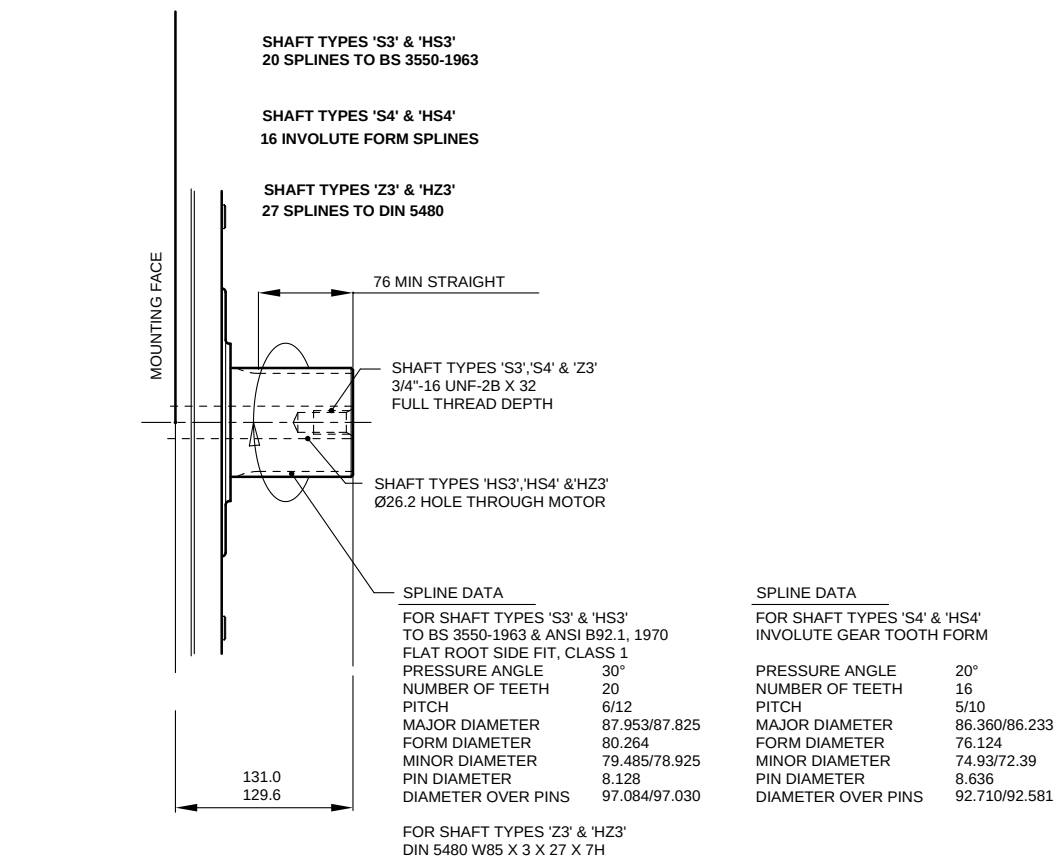
SEE VIEWS FOR SHAFT TYPES &amp; 'F2','FM2','F3','FM3','S03' &amp; 'S04' PORT CONNECTION.

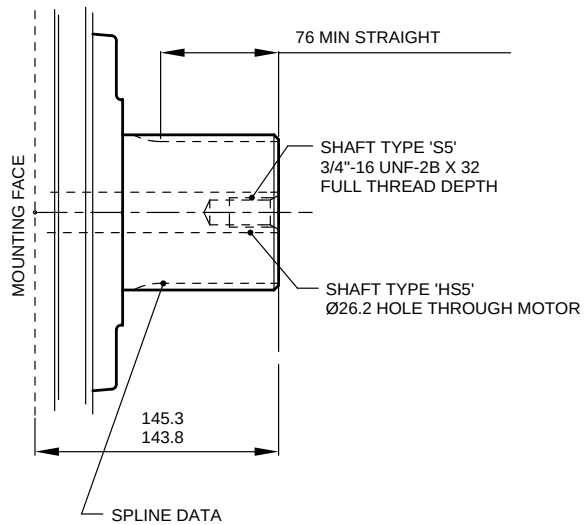
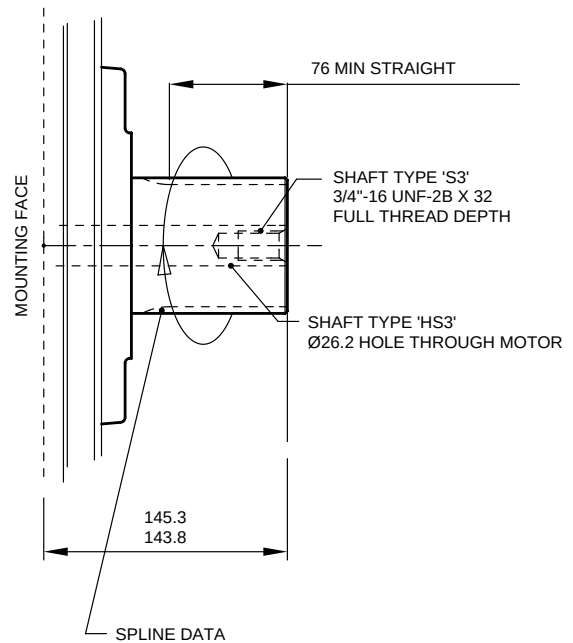
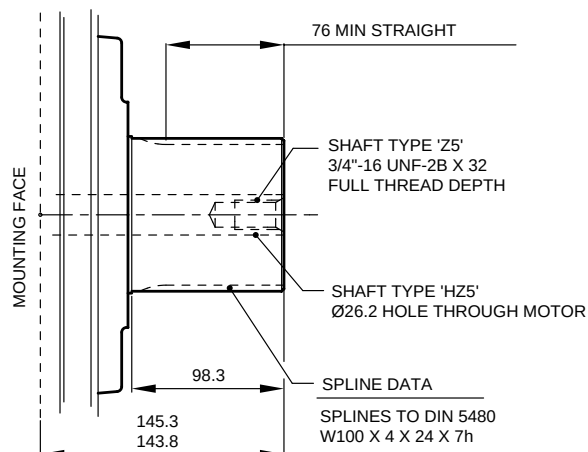
## PORT FLANGE BOLT TAPPINGS

| MODEL CODE | TAPPING SIZE                          | GAUGE CONNECTIONS         |
|------------|---------------------------------------|---------------------------|
| F4         | 5/8"-11 UNC-2B X 35 FULL THREAD DEPTH | 9/16"-18 UNF-2B, SAE J475 |
| FM4        | M16 X P2.0 X 35 FULL THREAD DEPTH     | G1/4" (BSPF)              |



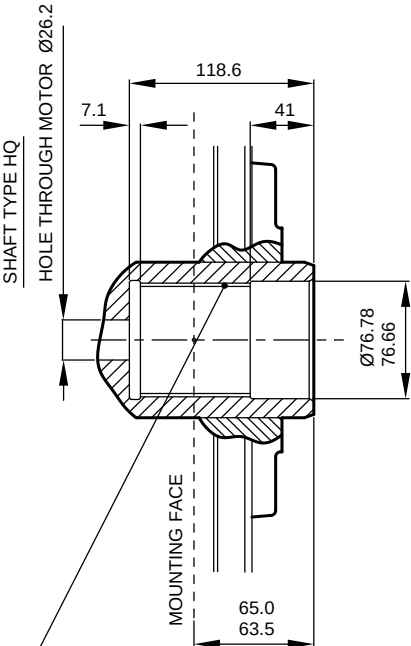
HMB150 Shaft Specification



**HDB 150/200 Shaft Specifications****SHAFT TYPES 'S5' & 'HS5'**  
23 SPLINES TO BS 3550-1963**SHAFT TYPES 'S3' & 'HS3'**  
20 SPLINES TO BS 3550-1963**SHAFT TYPES 'Z5' & 'HZ5'**  
24 SPLINES TO DIN 5480

HDB 150/200 Shaft Specifications (continued)

SHAFT TYPE 'Q' & 'HQ'  
FEMALE SHAFT WITH 34 SPLINES TO BS 3550

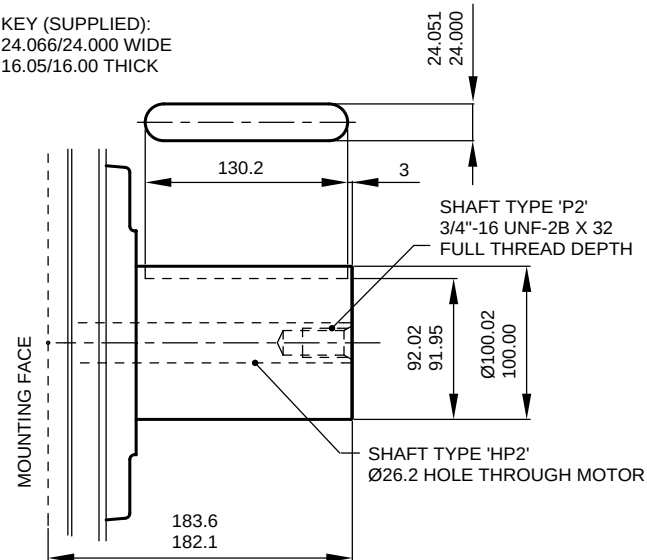


SPLINE DATA

|                                  |               |
|----------------------------------|---------------|
| TO BS 3550-1963 & ASA,B5.15-1960 |               |
| FLAT ROOT SIDE FIT,              |               |
| PRESSURE ANGLE                   | 30°           |
| NUMBER OF TEETH                  | 34            |
| PITCH                            | 12/24         |
| MAJOR DIAMETER                   | 74.414/74.084 |
| MINOR DIAMETER                   | 69.977/69.850 |
| PIN DIAMETER                     | 3.658         |
| PIN FLATTED TO                   | 3.556         |
| DIAMETER BETWEEN PINS            | 66.815/66.744 |

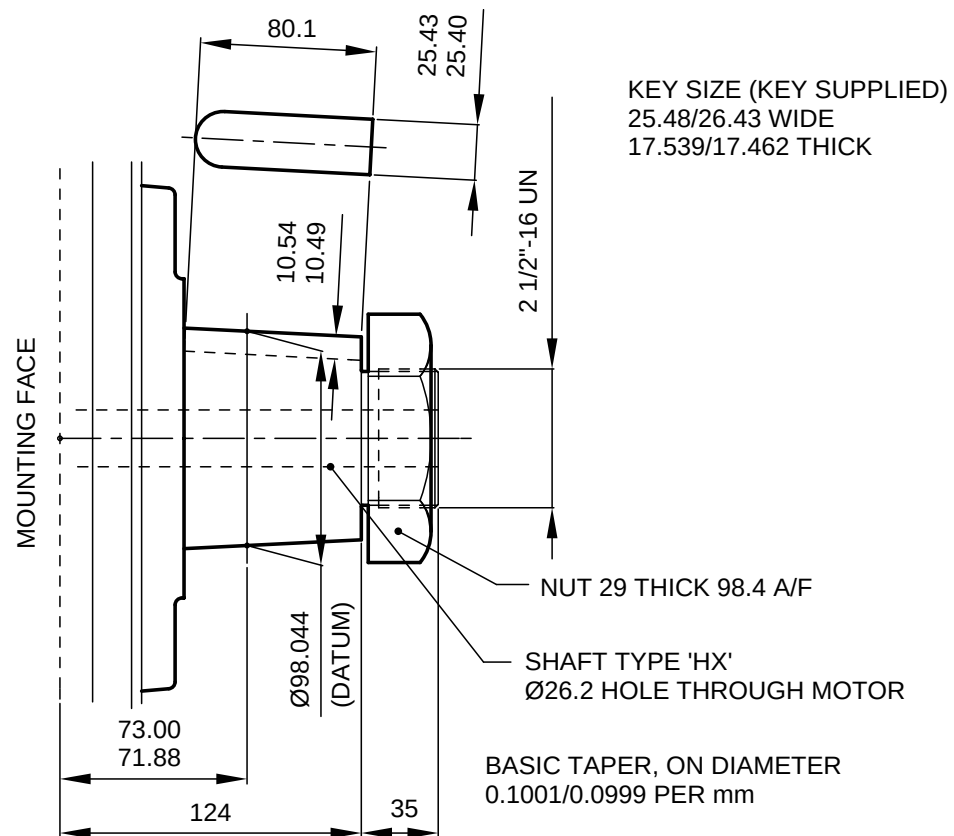
SHAFT TYPES 'P2' & 'HP2'  
CYLINDRICAL SHAFT WITH KEY

KEY (SUPPLIED):  
24.066/24.000 WIDE  
16.05/16.00 THICK

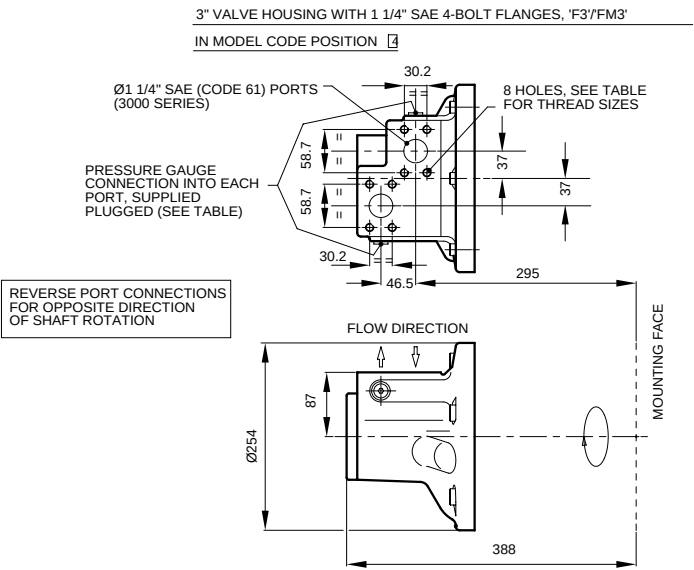
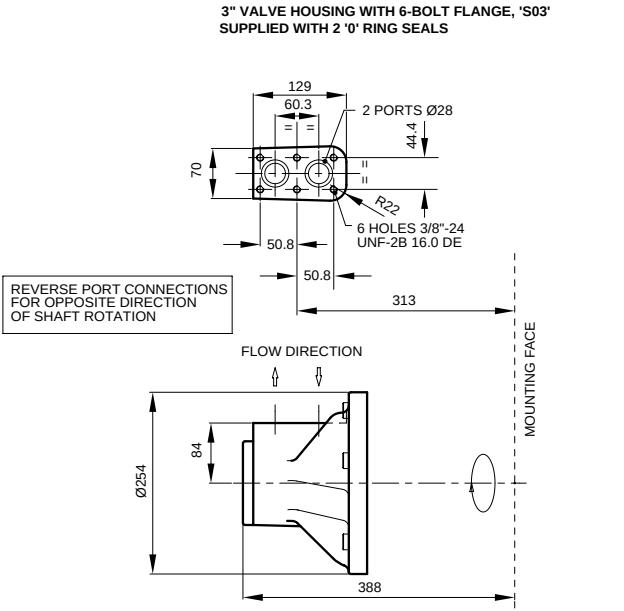




## HDB 150/200 Shaft Specifications (continued)

SHAFT TYPE 'X' & 'HX'  
SHORT TAPER WITH KEY

HMB150/200 Valve Housings  
3" Valve Housing with 6-Bolt Flange, "S03"



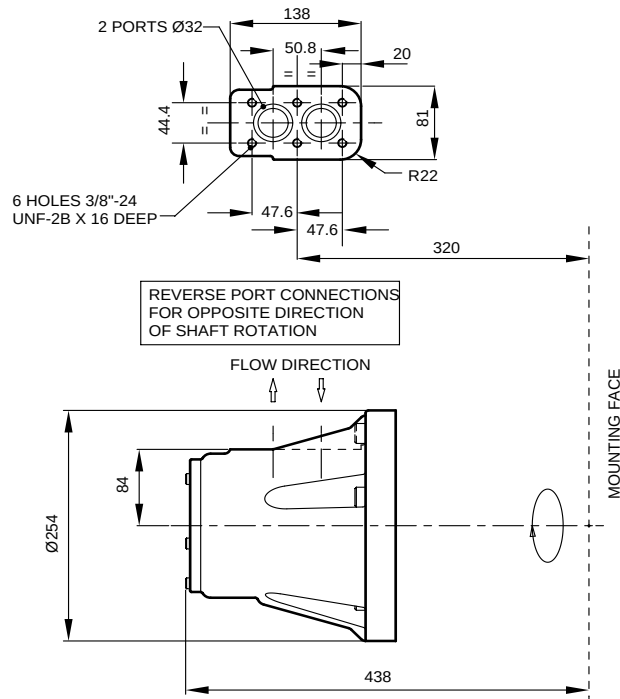
PORT FLANGE BOLT TAPPINGS

| MODEL CODE | TAPPING SIZE                           | GAUGE CONNECTIONS         |
|------------|----------------------------------------|---------------------------|
| F3         | 7/16"-14 UNC-2B X 27 FULL THREAD DEPTH | 9/16"-18 UNF-2B, SAE J475 |
| FM3        | M12 X R1.75 X 27 FULL THREAD DEPTH     | G1/4" (BSPF)              |

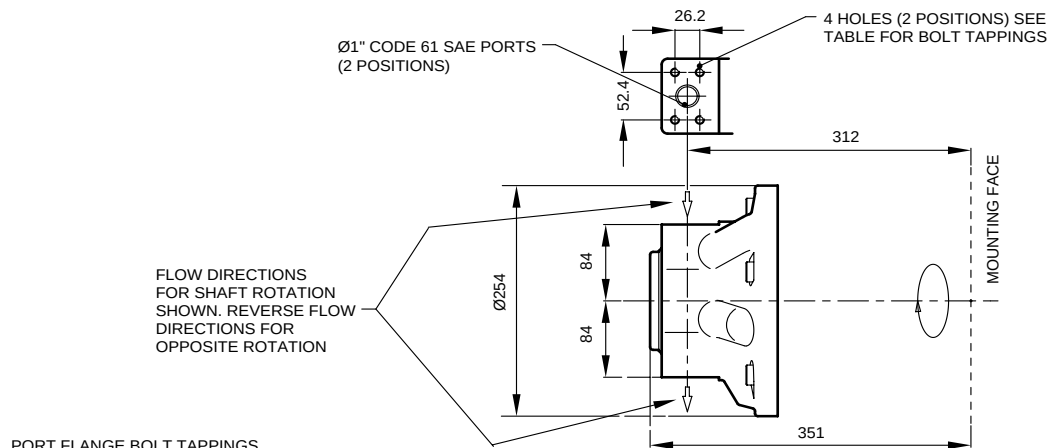


**HMB150/HMB200 Valve Housings (continued)****4" Valve Housing with 6-Bolt Flange, "S04"**

4" VALVE HOUSING WITH 6-BOLT FLANGE, 'S04'  
SUPPLIED WITH 2 'O' RING SEALS



2 1/4" VALVE HOUSING WITH 1" SAE 4-BOLT FLANGES,  
F2/'FM2'

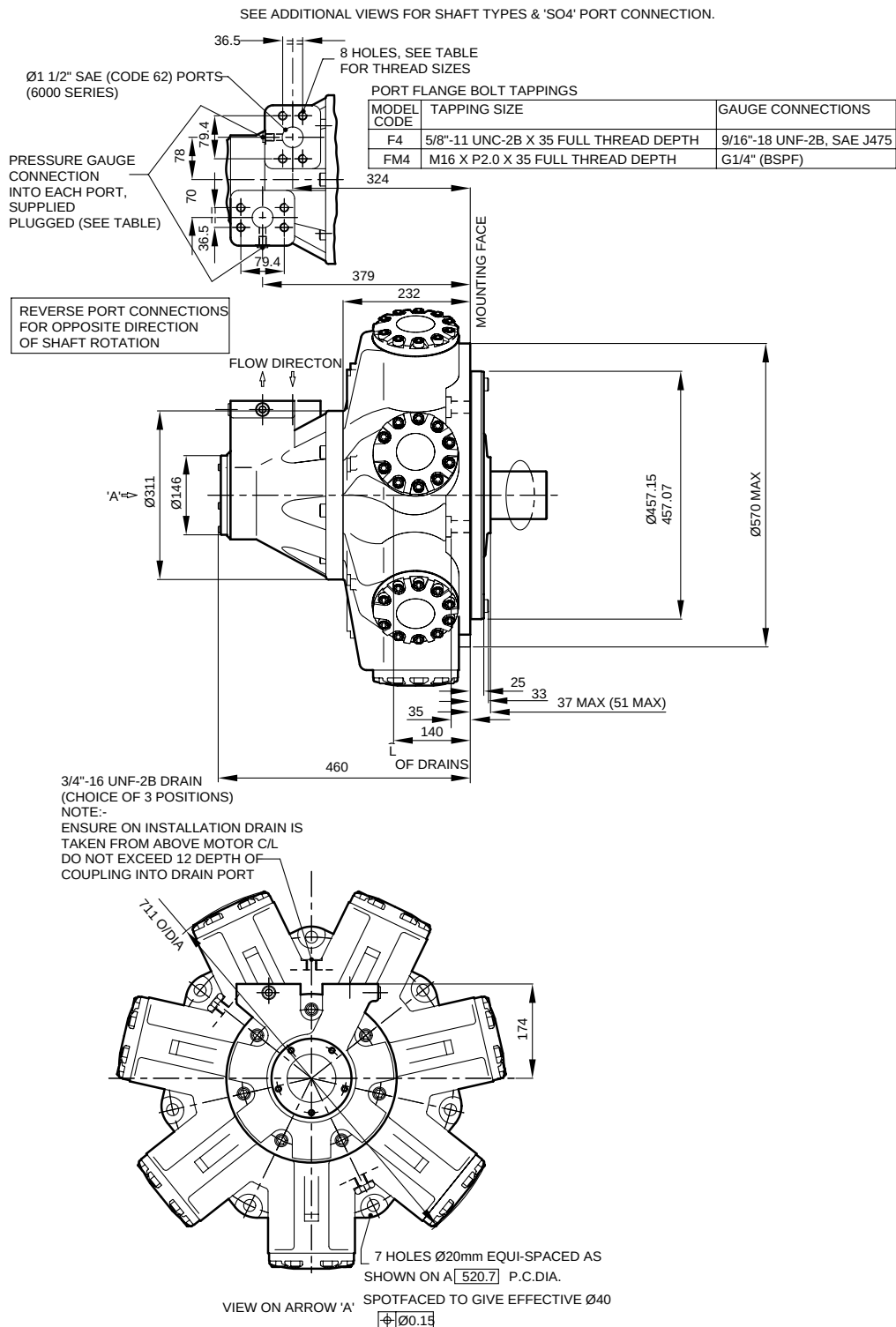


PORT FLANGE BOLT TAPPINGS

| MODEL CODE | TAPPING SIZE                          |
|------------|---------------------------------------|
| F2         | 3/8"-16 UNC-2B X 22 FULL THREAD DEPTH |
| FM2        | M10 X P1.5 X 22 FULL THREAD DEPTH     |

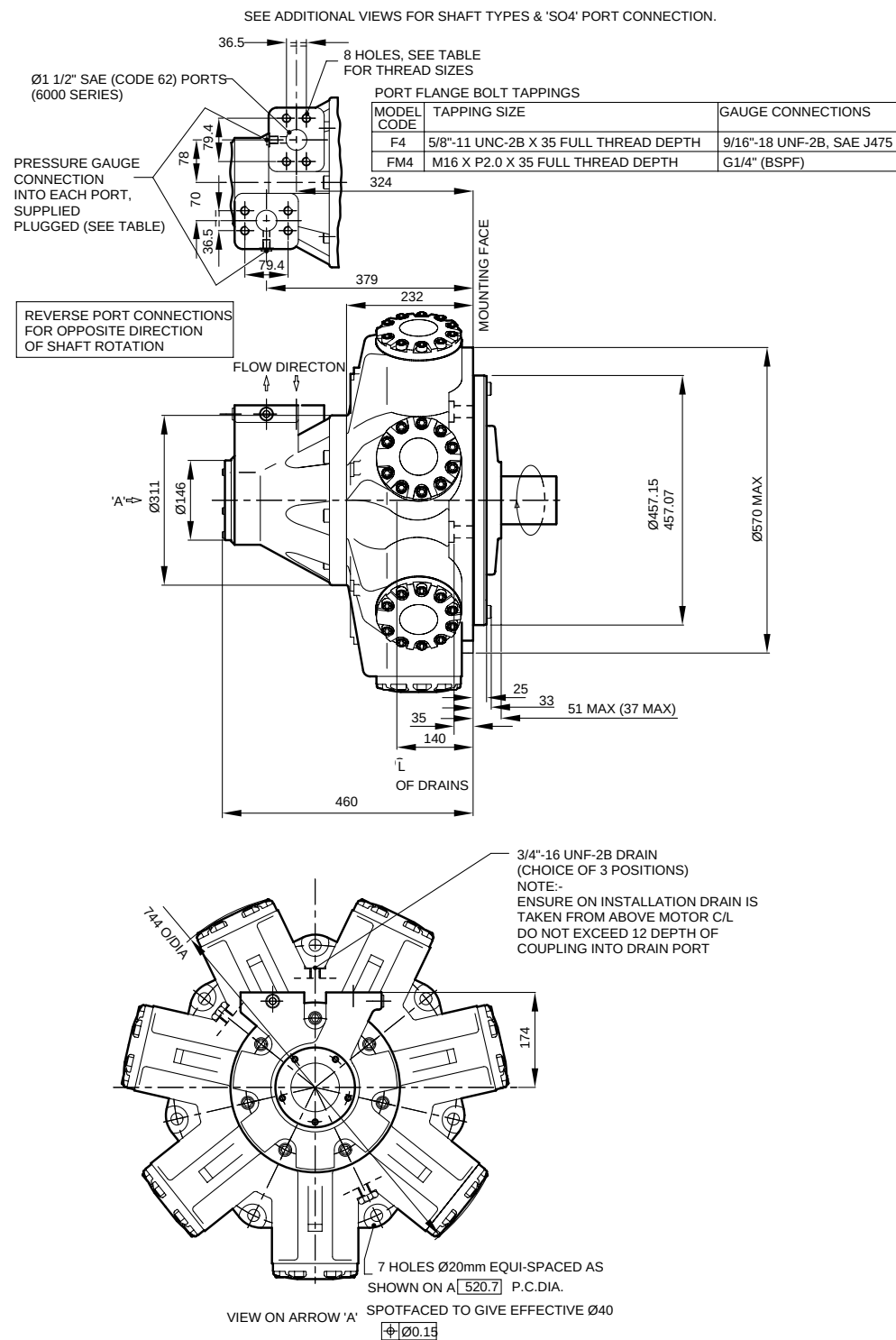
Installation Drawings

HMB270 Motor with Type F4/FM4 (1 1/2 SAE) Port Connection (HMHDB270 Dimensions in brackets)



## Installation Drawings

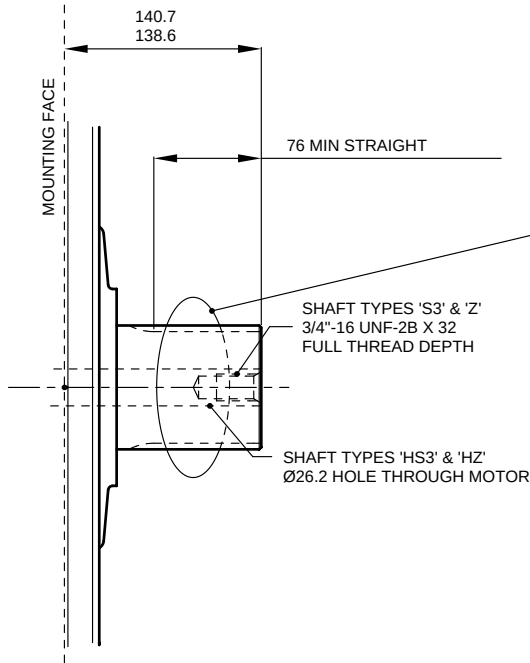
## HMDB 325 Motor with Type F4/FM4 (1 1/2" SAE) Port Connection HM325 (Dimensions in Brackets)



HMB270/325 Shaft Specification

SHAFT TYPES 'S3' & 'HS3'  
20 SPLINES TO BS 3550-1963

SHAFT TYPES 'Z' & 'HZ'  
24 SPLINES TO DIN 5480

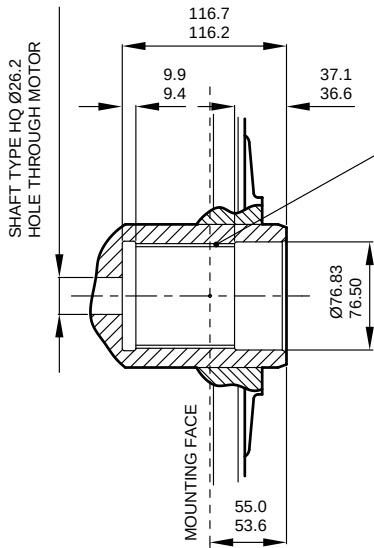


SPLINE DATA

FOR SHAFT TYPES 'S3' & 'HS3'  
TO BS 3550-1963 (ANSI B92.1,1970 CLASS 5)  
FLAT ROOT SIDE FIT, CLASS 1  
PRESSURE ANGLE 30 °  
NUMBER OF TEETH 20  
PITCH 6/12  
MAJOR DIAMETER 87.953/87.825  
FORM DIAMETER 80.264  
MINOR DIAMETER 79.485/78.925  
PIN DIAMETER 8.128  
DIAMETER OVER PINS 97.084/97.030

FOR SHAFT TYPES 'Z' & 'HZ'  
DIN 5480, W100 X 4 X 24 X 7h

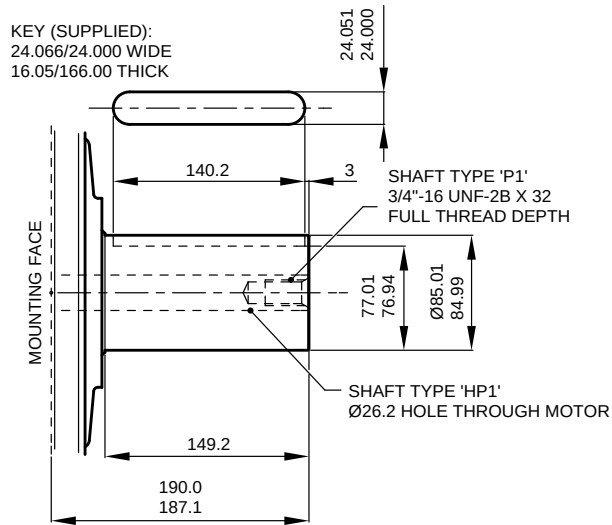
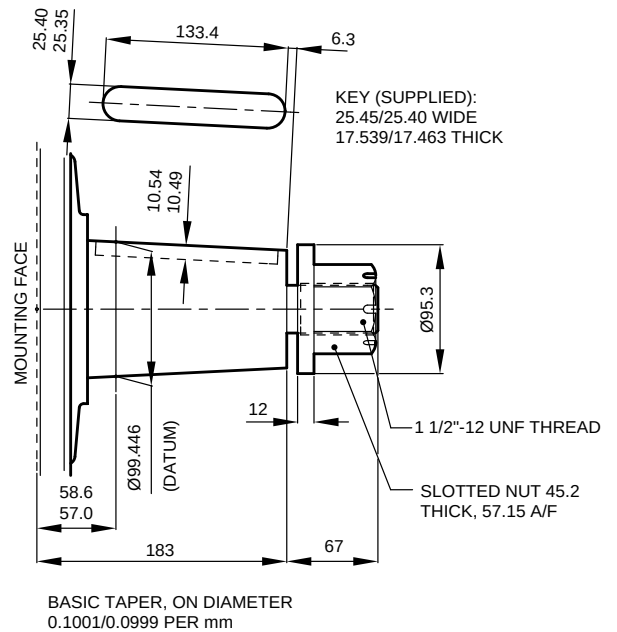
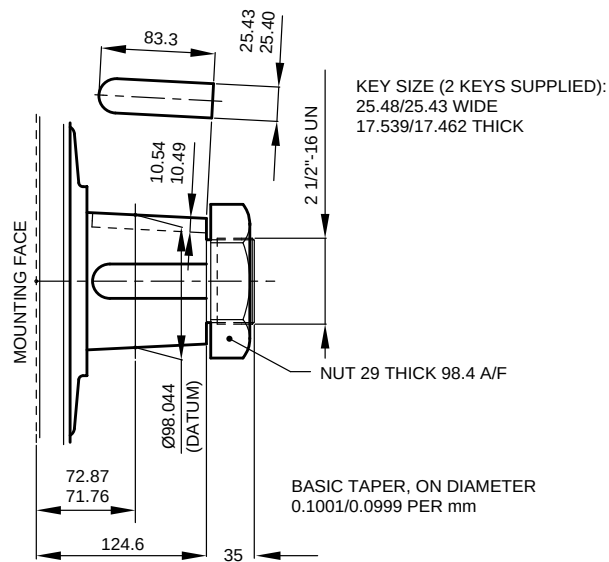
SHAFT TYPE 'Q' & 'HQ'  
FEMALE SHAFT WITH 34 SPLINES TO BS 3550



SPLINE DATA

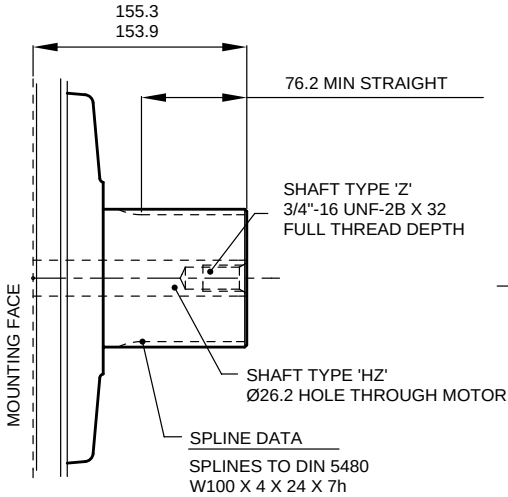
TO BS 3550-1963  
FLAT ROOT SIDE FIT  
PRESSURE ANGLE 30 °  
NUMBER OF TEETH 34  
PITCH 12/24  
MAJOR DIAMETER 74.414/74.084  
MINOR DIAMETER 69.977/69.850  
PIN DIAMETER 3.658  
PIN FLATTED TO 3.556  
DIMENSION BETWEEN PINS 66.815/66.744



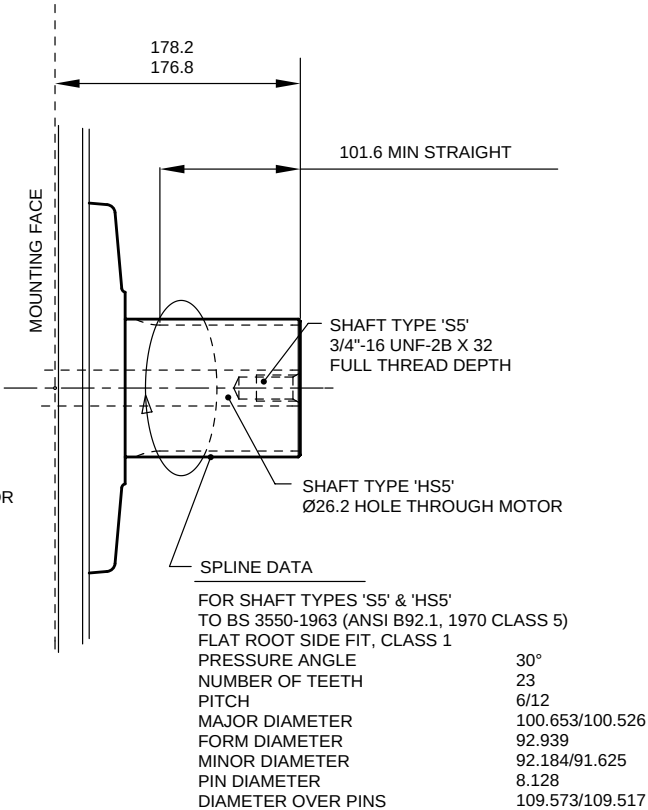
**HMB270/325 Shaft Specification (continued)****SHAFT TYPES 'P1' & 'HP1'**  
**CYLINDRICAL SHAFT WITH KEY****SHAFT TYPE 'T'**  
**LONG TAPER WITH KEY****SHAFT TYPE 'X'**  
**SHORT TAPER WITH 2 KEYS**

HMHDB270/325 Shaft Specification

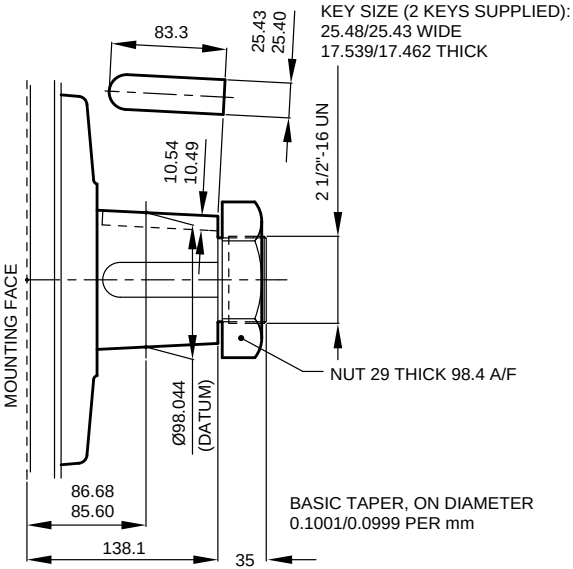
SHAFT TYPES 'Z' & 'HZ'  
24 SPLINES TO DIN 5480



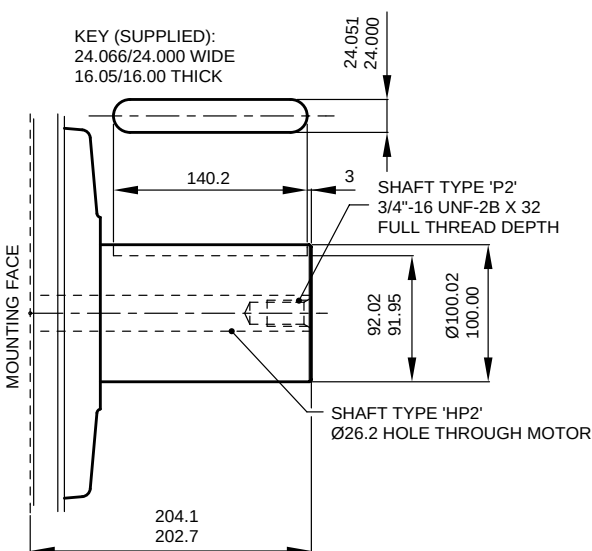
SHAFT TYPES 'S5' & 'HS5'  
23 SPLINES TO BS 3550-1963



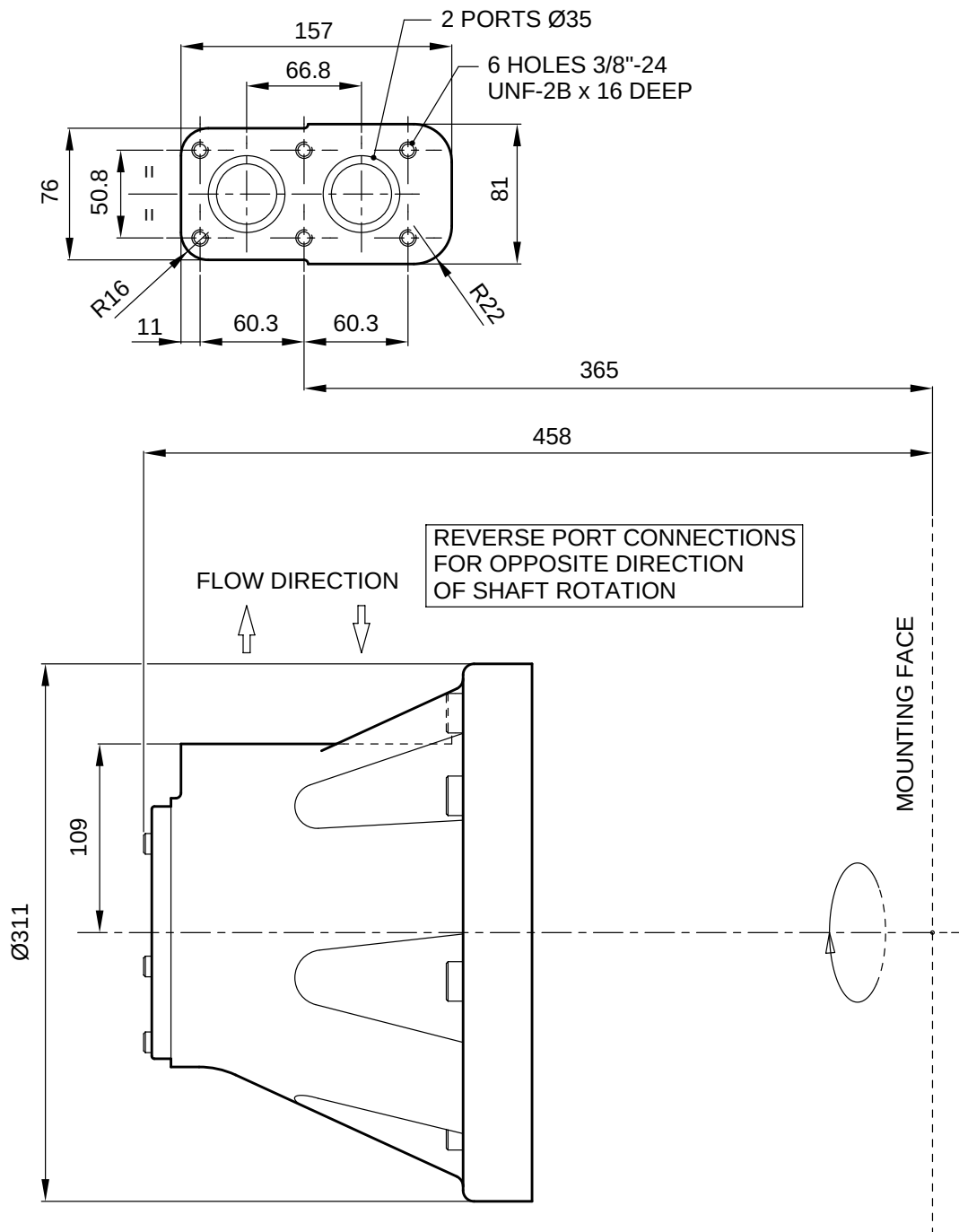
SHAFT TYPE 'X'  
SHORT TAPER WITH 2 KEYS



SHAFT TYPES 'P2' & 'HP2'  
CYLINDRICAL SHAFT WITH KEY

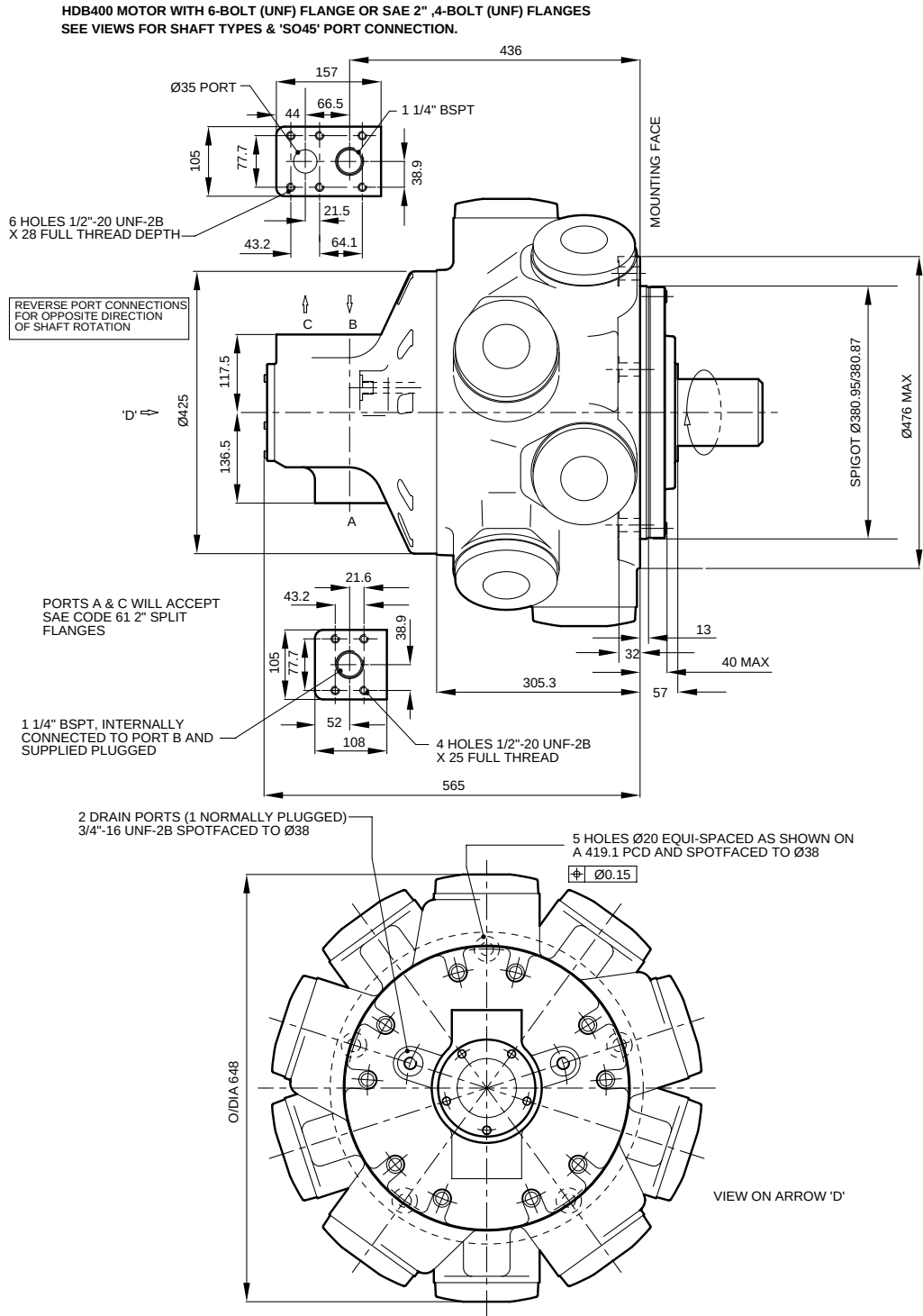




**HMHDB270/325 Valve Housings****4" Valve Housing with 6-Bolt Flange, "S04"****SUPPLIED WITH 2 'O' RING SEALS**

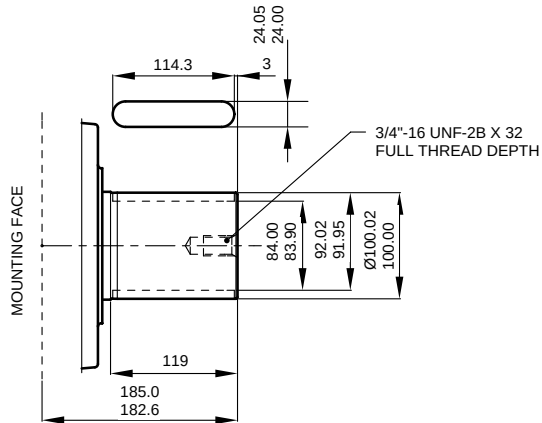
Installation Drawings

HMHDB400 Motor with 6-Bolt (UNF) Flange or SAE 2", 4-Bolt (UNF) Flanges



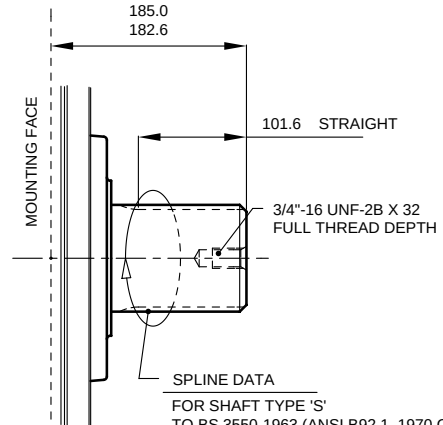
## HMHDB400 Shaft Specification

**SHAFT TYPE 'P'**  
CYLINDRICAL SHAFT WITH 2 KEYS



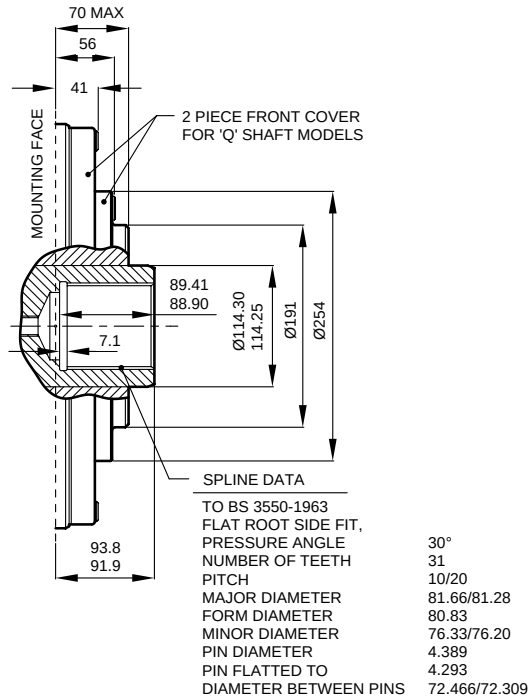
**SHAFT TYPE 'S'**  
23 SPLINES TO BS 3550-1963

**SHAFT TYPE 'Z'**  
24 SPLINES TO DIN 5480

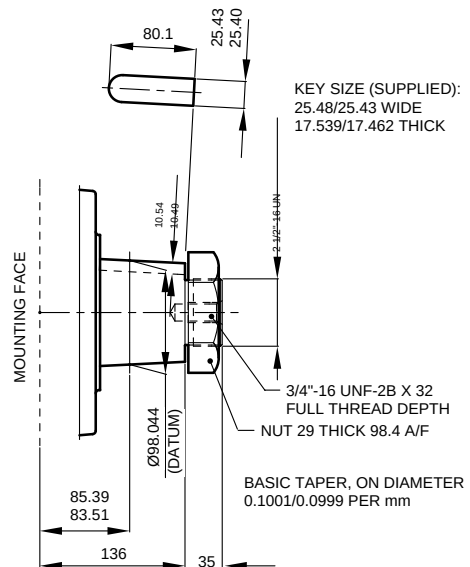


FOR SHAFT TYPE 'Z'  
DIN 5480, W100 X 4 X 24 X 7h

**SHAFT TYPE 'Q'**  
FEMALE SHAFT WITH 31 SPLINES TO BS 3550

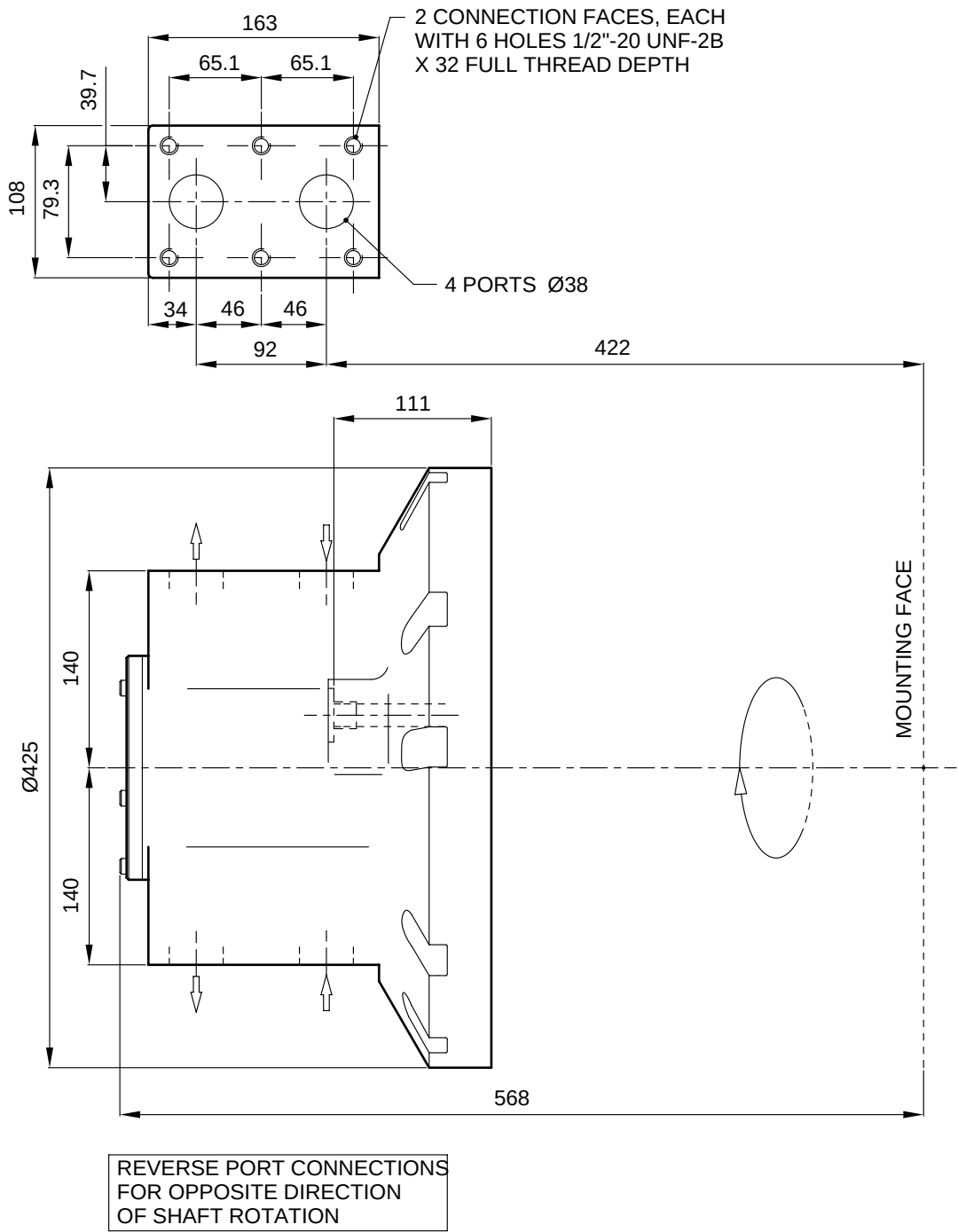


**SHAFT TYPE 'X'**  
SHORT TAPER WITH KEY



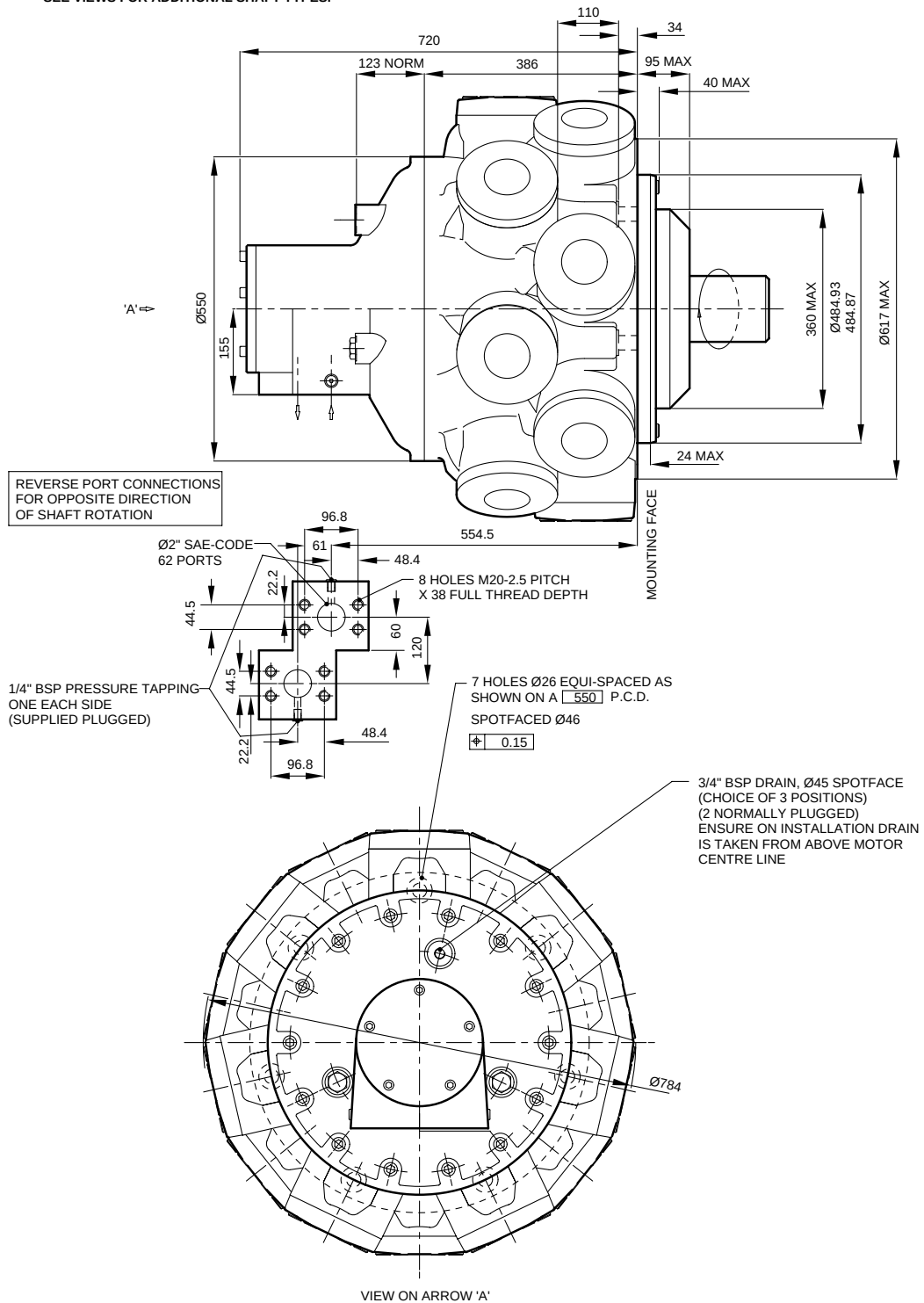
HMHDB400 Valve Housings  
Dual Port, 6-Bolt HDB400 Valve Housing

DUAL PORT, 6-BOLT FLANGE CONNECTION, 'SO45'



# **Installation Drawings** **HMB700 Motor with 2 SAE (Code 62) Port** **Flanges**

SEE VIEWS FOR ADDITIONAL SHAFT TYPES.



Model  
Staffa

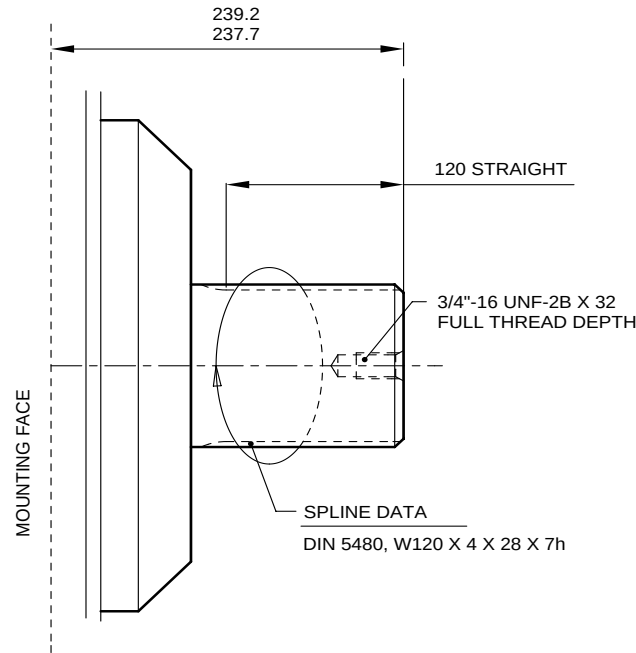
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Data Sheet  
M-1001/03.00

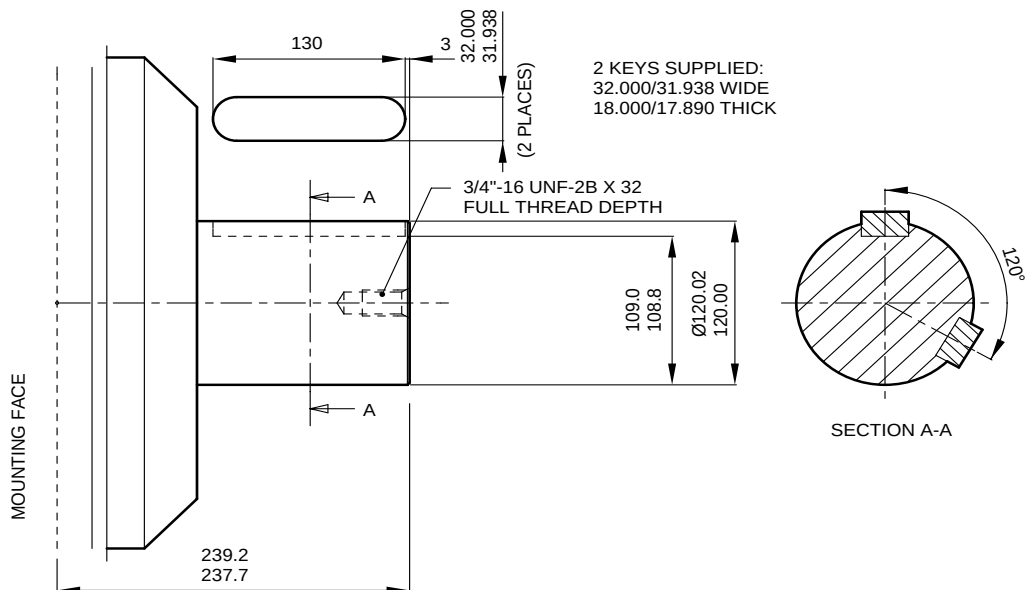
**Kawasaki**  
Hydraulic Products

HMB700 Shaft Specification

SHAFT TYPE 'Z'  
28 SPLINES TO DIN 5480.



SHAFT TYPE 'P'  
CYLINDRICAL SHAFT WITH 2 KEYS.



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Model  
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