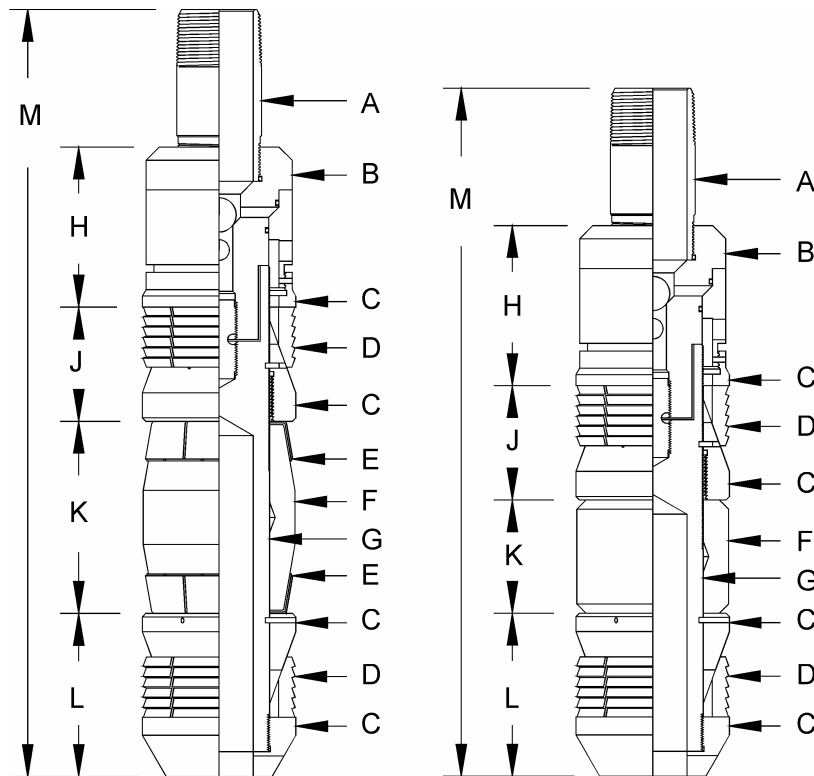


# H-M Bridge Plug

## DIMENSIONAL DATA

| Plug Size O.D. | A     | B     | C     | D      | E      | F      | G      | H      | J     | K      | L      | M      |
|----------------|-------|-------|-------|--------|--------|--------|--------|--------|-------|--------|--------|--------|
| <b>2.75 P</b>  | 2.093 | 2.750 | 2.750 | 2.671  | 2.687  | 2.687  | 1.500  | 7.000  | 2.453 | 5.093  | 4.078  | 23.531 |
| <b>3.12 P</b>  | 2.600 | 3.120 | 3.120 | 3.062  | 3.062  | 3.062  | 1.875  | 6.281  | 2.395 | 5.250  | 3.952  | 22.781 |
| <b>3.50 P</b>  | 2.600 | 3.500 | 3.500 | 3.421  | 3.437  | 3.437  | 2.125  | 8.531  | 3.455 | 5.470  | 4.733  | 27.187 |
| <b>3.50 E</b>  | 2.600 | 3.500 | 3.500 | 3.421  | n/a    | 3.437  | 2.125  | 8.531  | 3.455 | 2.890  | 4.733  | 24.687 |
| <b>3.71 P</b>  | 2.600 | 3.500 | 3.710 | 3.625  | 3.648  | 3.648  | 2.125  | 8.531  | 3.455 | 5.470  | 4.733  | 27.187 |
| <b>3.71 E</b>  | 2.600 | 3.500 | 3.710 | 3.625  | n/a    | 3.648  | 2.125  | 8.531  | 3.455 | 2.890  | 4.733  | 24.687 |
| <b>4.24 P</b>  | 2.600 | 3.500 | 4.240 | 4.187  | 4.187  | 4.187  | 2.750  | 8.531  | 3.623 | 5.390  | 5.028  | 27.375 |
| <b>4.24 E</b>  | 2.600 | 3.500 | 4.240 | 4.187  | n/a    | 4.187  | 2.750  | 8.531  | 3.623 | 3.890  | 5.028  | 25.875 |
| <b>4.75 P</b>  | 2.600 | 3.500 | 4.750 | 4.687  | 4.687  | 4.687  | 2.750  | 8.531  | 3.623 | 5.390  | 5.028  | 27.375 |
| <b>5.34 P</b>  | 3.100 | 5.340 | 5.340 | 5.281  | 5.260  | 5.260  | 3.687  | 9.125  | 4.151 | 7.250  | 5.932  | 31.125 |
| <b>5.34 E</b>  | 3.100 | 5.340 | 5.340 | 5.281  | n/a    | 5.260  | 3.687  | 9.125  | 4.151 | 4.915  | 5.932  | 28.781 |
| <b>5.61 P</b>  | 3.100 | 5.340 | 5.610 | 5.562  | 5.546  | 5.546  | 3.687  | 9.125  | 4.151 | 7.250  | 5.932  | 31.125 |
| <b>5.61 E</b>  | 3.100 | 5.340 | 5.610 | 5.562  | n/a    | 5.546  | 3.687  | 9.125  | 4.151 | 4.915  | 5.932  | 28.781 |
| <b>6.09 P</b>  | 3.100 | 5.340 | 6.090 | 6.015  | 5.968  | 5.968  | 4.125  | 11.031 | 3.860 | 8.859  | 7.132  | 35.437 |
| <b>6.96 P</b>  | 3.100 | 5.340 | 6.960 | 6.875  | 6.843  | 6.843  | 4.625  | 11.031 | 4.900 | 9.796  | 7.400  | 37.687 |
| <b>7.71 P</b>  | 3.100 | 5.340 | 7.710 | 7.640  | 7.593  | 7.593  | 5.125  | 11.031 | 5.125 | 10.046 | 7.625  | 38.375 |
| <b>8.71 P</b>  | 3.100 | 5.340 | 8.710 | 8.640  | 8.593  | 8.593  | 5.687  | 11.031 | 4.867 | 10.562 | 8.235  | 39.250 |
| <b>9.50 P</b>  | 3.100 | 5.340 | 9.500 | 9.375  | 9.375  | 9.375  | 6.750  | 10.781 | 5.644 | 10.562 | 9.011  | 40.781 |
| <b>11.56 P</b> | 3.100 | 5.340 | 11.56 | 11.437 | 11.437 | 11.437 | 9.000  | 11.531 | 5.750 | 10.609 | 8.250  | 41.156 |
| <b>12.00 P</b> | 3.100 | 5.340 | 12.00 | 11.875 | 11.875 | 11.875 | 9.000  | 11.531 | 5.750 | 10.609 | 8.250  | 41.156 |
| <b>14.25 P</b> | 3.100 | 5.340 | 14.25 | 14.125 | 14.125 | 14.125 | 11.500 | 11.343 | 6.985 | 8.859  | 10.235 | 41.750 |
| <b>17.25 P</b> | 3.100 | 5.340 | 17.25 | 17.125 | 17.125 | 17.125 | 14.000 | 10.843 | 6.901 | 7.609  | 9.401  | 40.312 |

The figures contained herein are subject to change without notice.  
Some sizes differ slightly from the illustrations shown



Model P

Model E

## Alpha Oil Tools Guidelines for Running H-M Bridge Plugs:

### **RECOMMENDED PROCEDURE BEFORE RUNNING H-M BRIDGE PLUG:**

1. Run a casing scraper (if necessary) to clean inner wall of casing and free any debris or obstructions.
2. Circulate well to clean well of debris and junk.
3. Check casing I.D. 2 ft.-3 ft. below setting depth to insure no restrictions exist.

### **MAKE-UP PROCEDURE:**

1. Make up tubing on tubing adapter by placing back-up on tubing adapter and rotate tubing to the right until tight.
2. **DO NOT REMOVE TUBING ADAPTER FROM PLUG TO MAKE-UP!!**

### **RUNNING IN:**

1. Run into well at uniform rate - no faster than 30 seconds per 90 foot stand. Be certain tubing is free of debris and excessive scale.
2. Avoid unnecessary right-hand rotation of tubing string.
3. Use slow starts and stops when moving tubing string - no jerking.

### **SETTING H-M PLUG:**

1. Run tubing to desired setting point. Never set in collars or where milling has occurred. Set in static conditions (no fluid or gas movement).
2. Drop ball down tubing string - the ball should be 1 1/4 diameter. Allow approximately 5 minutes per 1000 feet for ball to travel in water. More time is needed in mud or viscous fluids.
3. Apply pump pressure to tubing string until 2000 p.s.i. is reached. This pressure will stroke cylinder down into slip. The slip will break into segments and make contact with casing.

NOTE: If you lose pressure before reaching 2000 p.s.i., go on to the next step. In heavier weights of casing, slip and hydro sleeve travel is limited which prevents pressure loss. Simply stop at 2000 p.s.i. and proceed to the next step.

4. Bleed pressure and pull recommended tension above the pipe weight at the tool, to complete setting the plug. Hold tension for 3 to 5 minutes. It is recommended to calculate tubing stretch versus using weight indicator for true pull. See formula below.
5. The tubing string may be released from the H-M Plug by pulling 500 lbs. tension at the tool and rotating the workstring 9 turns to the right at the tool.

| PLUG<br>Size OD | SETTING FORCES  |                 |
|-----------------|-----------------|-----------------|
|                 | Minimum Tension | Maximum Tension |
| 2.75            | 9,000 lbs.      | 12,000 lbs.     |
| 3.12            | 20,000 lbs.     | 25,000 lbs.     |
| 3.50-4.75       | 22,000 lbs.     | 30,000 lbs.     |
| 5.34-6.09       | 30,000 lbs.     | 45,000 lbs.     |
| 6.96-7.71       | 35,000 lbs.     | 48,000 lbs.     |
| 8.71-9.50       | 35,000 lbs.     | 48,000 lbs.     |
| 11.56-12.00     | 35,000 lbs.     | 48,000 lbs.     |
| 14.25-17.25     | 40,000 lbs.     | 48,000 lbs.     |

### **SPECIAL NOTE: For low fluid level wells**

In low fluid level wells, any fluids placed in the tubing after the setting ball has reached it's seat, will tend to shear the cylinder downward on the H-M Bridge Plug. Chart #1 shows the pressure created in psi. per barrel of fluid added, and Chart #2 shows the feet of fill-up per barrel of fluid added. Since 2000 psi. pressure in favor of the tubing at the tool is required to initiate the setting sequence, we suggest the following method for calculating the required applied pump pressure.

1. Determine fluid weight in pounds per gallon (#/gal) or p.s.i. per foot (psi/ft).
2. Estimate fluid level from surface of well. NOTE: The tubing string will fill during running in through the fluid fill ports.
3. From Chart #1, select the appropriate column for the size of tubing string and line for appropriate fluid weight.
4. From Chart #2, select the appropriate column for the size of tubing string and determine the lineal feet per barrel of fluid.
5. Multiply the depth of fluid level from surface by the lineal feet per barrel from Chart #2 to determine the required amount of barrels of fluid to fill the tubing string.
6. Multiply the barrels required to fill the tubing string by the psi. barrel figure from Chart #1. This figure will give you the total hydrostatic head exerted by the fluid in the tubing string when completely filled. If this figure is less than the required 2000 psi., sufficient pump pressure must be added to achieve the 2000 p.s.i. required pressure. In those cases where the calculated pressure for the fluid to fill the tubing string exceeds the required 2000 p.s.i., you need only to add or fill with the necessary barrels of fluid to achieve the required 2000 p.s.i. This may be calculated by dividing 2000 p.s.i. by the psi. per barrel figure from Chart #1. Over pressuring cannot occur since the tool will be activated at 2000 p.s.i. and the downward travel of the cylinder will vent the excess

fluid into the annulus above the plug before damage occurs. Once the required pressure is created at the plug, sufficient tension must be applied as shown in step #4 under setting H-M plug. Complete setting sequence as described in step #5.

**To Calculate Stretch To Set:**

$$S = ( F \times L \times 12 ) / ( E \times A ) = \text{Elongation due to tension (inches)}$$

F = Tension pulled over normal weight (pounds)  
 E = 30,000,000 = Modulus of elasticity for steel

L = Length of running-in string (feet)  
 A = Cross-sectional area of running-in string (square inches)

**Chart # 1**

| Mud Wt.<br>API GR #/GAL. | PSI/FT | 2 3/8 EU Tubing<br>4.7 #/FT. | 2 7/8 EU Tubing<br>6.5 #/FT. | 2 7/8 IU Drill Pipe<br>10.4 #/FT. | 3 1/2 IU Drill Pipe<br>13.3 #/FT. |
|--------------------------|--------|------------------------------|------------------------------|-----------------------------------|-----------------------------------|
| 8.34                     | .433   | 111.09                       | 74.8                         | 97.6                              | 58.9                              |
| 9.0                      | .468   | 120.8                        | 80.7                         | 105.4                             | 63.6                              |
| 9.2                      | .478   | 123.5                        | 28.5                         | 107.8                             | 65.0                              |
| 9.4                      | .488   | 126.1                        | 84.3                         | 110.1                             | 66.4                              |
| 9.6                      | .499   | 128.8                        | 86.1                         | 112.4                             | 67.8                              |
| 9.8                      | .509   | 131.5                        | 87.9                         | 114.8                             | 69.2                              |
| 10.0                     | .519   | 134.2                        | 89.7                         | 117.1                             | 70.7                              |
| 10.2                     | .530   | 136.9                        | 91.4                         | 119.5                             | 79.1                              |
| 10.4                     | .540   | 139.6                        | 93.2                         | 121.8                             | 73.5                              |
| 10.6                     | .551   | 142.2                        | 95.0                         | 124.2                             | 74.9                              |
| 10.8                     | .561   | 144.9                        | 96.8                         | 126.5                             | 76.3                              |
| 11.0                     | .571   | 147.6                        | 98.6                         | 128.8                             | 77.7                              |
| 11.2                     | .582   | 150.3                        | 100.4                        | 131.2                             | 79.1                              |
| 11.4                     | .592   | 153.0                        | 102.2                        | 133.5                             | 80.5                              |
| 11.6                     | .603   | 155.7                        | 104.0                        | 135.9                             | 82.0                              |
| 11.8                     | .613   | 158.3                        | 105.8                        | 138.2                             | 83.4                              |
| 12.0                     | .623   | 161.0                        | 107.6                        | 140.6                             | 84.8                              |
| 12.2                     | .634   | 163.7                        | 109.4                        | 142.9                             | 86.2                              |
| 12.4                     | .644   | 166.4                        | 111.2                        | 145.2                             | 87.6                              |
| 12.6                     | .655   | 169.1                        | 113.0                        | 147.6                             | 89.0                              |
| 12.8                     | .665   | 171.8                        | 114.8                        | 149.9                             | 90.4                              |
| 13.0                     | .675   | 174.5                        | 116.5                        | 152.3                             | 91.8                              |
| 13.2                     | .686   | 177.1                        | 118.3                        | 154.6                             | 93.3                              |
| 13.4                     | .696   | 179.8                        | 120.1                        | 157.0                             | 94.7                              |
| 13.6                     | .706   | 182.5                        | 121.9                        | 159.3                             | 96.1                              |
| 13.8                     | .717   | 185.2                        | 123.7                        | 161.6                             | 97.5                              |
| 14.0                     | .727   | 187.0                        | 125.5                        | 164.0                             | 98.9                              |
| 14.5                     | .753   | 194.6                        | 130.0                        | 169.8                             | 102.4                             |
| 15.0                     | .779   | 201.3                        | 134.5                        | 175.7                             | 106.0                             |
| 15.5                     | .805   | 208.0                        | 139.0                        | 181.6                             | 109.5                             |
| 16.0                     | .831   | 214.7                        | 143.4                        | 187.4                             | 113.0                             |
| 16.5                     | .857   | 221.4                        | 147.9                        | 193.3                             | 116.6                             |
| 17.0                     | .883   | 220.1                        | 152.4                        | 199.1                             | 120.1                             |
| 17.5                     | .909   | 234.8                        | 156.9                        | 205.0                             | 123.6                             |
| 18.0                     | .935   | 241.5                        | 161.4                        | 210.8                             | 127.2                             |
| 18.5                     | .961   | 248.3                        | 165.8                        | 216.7                             | 130.7                             |
| 19.0                     | .987   | 255.0                        | 170.3                        | 222.6                             | 134.2                             |
| 19.5                     | 1.01   | 261.7                        | 174.8                        | 228.4                             | 137.8                             |
| 20.0                     | 1.04   | 268.4                        | 179.3                        | 234.3                             | 141.3                             |

**Chart # 2**

| O.D.  | Wt. (lbs./ft.) | Barrels per Lineal Ft. | Lineal Ft. per Barrel | A     |
|-------|----------------|------------------------|-----------------------|-------|
| 2 3/8 | 4.7 EU         | .003870                | 258.4                 | 1.304 |
| 2 3/8 | 4.6 NU         | .003870                | 258.4                 | 1.304 |
| 2 7/8 | 6.5 EU         | .005794                | 172.6                 | 1.812 |
| 2 7/8 | 6.4 NU         | .005794                | 172.6                 | 1.812 |
| 2 7/8 | 10.4 IU DP     | .004404                | 222.5                 | 2.858 |
| 3 1/2 | 13.3 IU DP     | .007421                | 134.7                 | 2.915 |