Hydro-Mech Bridge Plug

DESCRIPTION: Map Hydro-Mech Bridge Plug is hydraulically actuated and mechanically set. Compact, with a small OD, this tool can withstand high pressure and is designed for easy drill out. It can be used in zone isolation for squeeze cementing, fracturing, and plug and abandonment either temporary or permanent.

FEATURES:
- The setting mechanism and control are contained in the bridge plug eliminating the need for a complex mechanical setting tool.
- Eliminates the expense of wireline setting tool and equipment.
- Full tubing bore is available for unobstructed passage of fluids and wireline run perforating and logging equipment after the plug is set and tubing released.
- Can be run and set in tandem with retrievable production packers or squeeze packers.
- Top equalizing during drill-out assures safe drill-out without the plug coming up the hole due to pressures contained below the plug.
- Sets securely in most casing, including many premium grades.

<table>
<thead>
<tr>
<th>Casing</th>
<th>Setting Range</th>
<th>Plug max. O.D (in)</th>
<th>Shear Force (lbs)</th>
<th>Thread Box Up</th>
<th>Ball OD (in)</th>
<th>Differential Pressure (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD</td>
<td>WT (T&amp;C)</td>
<td>Min. ID (in)</td>
<td>Max. ID (in)</td>
<td>Thread</td>
<td>Ball OD</td>
<td>Differential Pressure</td>
</tr>
<tr>
<td>4-1/2</td>
<td>9.5-15.1</td>
<td>3.826</td>
<td>4.090</td>
<td>2-3/8” EUE</td>
<td>1-1/2</td>
<td>10,000</td>
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<tr>
<td>5</td>
<td>11.5-20.8</td>
<td>4.154</td>
<td>4.560</td>
<td>2-7/8” EUE</td>
<td>1-3/4</td>
<td>8,000</td>
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<tr>
<td>5-1/2</td>
<td>13.0-23.0</td>
<td>4.580</td>
<td>5.044</td>
<td>2-7/8” EUE</td>
<td>2</td>
<td>3,000</td>
</tr>
<tr>
<td>7</td>
<td>23.0-35.0</td>
<td>6.004</td>
<td>6.366</td>
<td>2-7/8” EUE</td>
<td>2</td>
<td>2-11/64</td>
</tr>
<tr>
<td>7-5/8</td>
<td>20.0-39.0</td>
<td>6.625</td>
<td>7.125</td>
<td>2-7/8” EUE</td>
<td>2</td>
<td>2-11/64</td>
</tr>
<tr>
<td>9-5/8</td>
<td>29.3-58.4</td>
<td>8.435</td>
<td>9.063</td>
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<td>2</td>
<td>2-11/64</td>
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<tr>
<td>13-3/8</td>
<td>48-80.7</td>
<td>12.175</td>
<td>12.715</td>
<td>2-7/8” EUE</td>
<td>2</td>
<td>2-11/64</td>
</tr>
</tbody>
</table>

Specifications
General Setting Procedure:
1. Remove Top Sub from Bridge Plug Setting Assembly, make up Top Sub Box Thread to Work String, then make up Top Sub Pin Thread to Bridge Plug Setting Assembly.

2. Lower tubing to the required setting depth.

3. Drop setting ball into tubing string. Allow at least 5 minutes per 1000 ft. for ball to travel in water, and more in mud or viscous completion fluids.

4. Apply pump pressure to tubing string in 500 psi increments until reaching the appropriate pressure as indicated in the Activation Pressure Chart (fig. 1). Hold pressure for 5 minutes. This moves and breaks upper slip. The application of pressure causes the piston of the Hydro-Mech Bridge Plug to move downward and thus the upper slip to move downward into contact with the upper cone, breaking the upper slip and forcing the slips into contact with the casing.

5. Pick up on the work string to determine if the upper slips have broken. This will be indicated by additional drag on the work string. If no additional drag is noticed, set back down and apply an additional 500 psi higher than the previous attempt.

6. Pull at least the minimum tension shown in the Activation Pressure chart (fig. 1). Hold tension on the plug for a minimum of 10 minutes. Holding tension allows the packing element and backup rings to reach their full limit of expansion.

7. Once properly packed off, the work string may be released from the Hydro-Mech Bridge Plug two different ways. One way is to straight pull the tubing to shear the shear stud at 50,000 lbs. The other one is pulling 500 lbs. tension at the tool and rotating the work string around 10 turns to the right at the tool until running sub is disconnected from Hydro-Mech Bridge Plug.

If max activation pressure is reached without any indication of activation, increase pressure by 500 psi above max activation pressure and hold for 5 minutes. If after 5 minutes, there is still no indication of activation, there may be debris blocking the activation pressure area. Reverse circulate in order to wash out debris that may be lodged in the ball seat area. After sufficiently reverse circulating, pressure up again up to 1000 psi above the max activation pressure and hold for 5 minutes. Repeat process up to 1500 psi above max activation pressure.

FOR LOW FLUID LEVEL WELLS:
In low fluid level wells, any fluids placed in the tubing after the setting ball has reached its seat, will move the cylinder downward on the Hydro-Mech Bridge Plug causing a premature set. Since a minimum 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 psi 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. Multiply fluid column height by lbs/gal (#/gal) times 0.052.

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 pressure, sufficient pump pressure must be added to achieve the minimum required pressure. In those cases where the calculated pressure for the fluid to fill the tubing string exceeds the required minimum pressure, you need only to add or fill with the necessary barrels of fluid to achieve the appropriate pressure as indicated in the Activation Pressure Chart (fig. 1). Once the required pressure is created at the plug, sufficient tension must be applied as shown in step no. 4 of the General Setting Procedure.

### HMBP Activation Pressure

<table>
<thead>
<tr>
<th>Tool Size</th>
<th>Min Pressure (psi)</th>
<th>Max Pressure (psi)</th>
<th>Min Tension (lbs)</th>
<th>Max Tension (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 ½”</td>
<td>1600</td>
<td>1850</td>
<td>25,000</td>
<td>30,000</td>
</tr>
<tr>
<td>5”</td>
<td>1400</td>
<td>1650</td>
<td>30,000</td>
<td>45,000</td>
</tr>
<tr>
<td>5 ½”</td>
<td>1400</td>
<td>1650</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>7”</td>
<td>1000</td>
<td>1250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 5/8”</td>
<td>1000</td>
<td>1250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 5/8”</td>
<td>2000</td>
<td>2250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 3/8”</td>
<td>2750</td>
<td>3000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

fig. 1
Note: When releasing from the plug by shearing the shear stud, the work string drains through the pressure area ports above the ball seat. This flow area is equal to the flow area through the ball seat. The shear method removes the setting adapter above the upper slips from plug, thus this method should always be used when drilling the plug will be required for future operations. When rotationally releasing, the work string drains through the top coupling which has a significantly larger flow area, thus if pumping operations will immediately follow release, the rotational release will yield significantly less resistance to flow.

DRILLING OF HYDRO-MECH BRIDGE PLUGS:
Whenever it is the intent to drill up a Hydro-Mech, the shear release method should be utilized as it is the optimum application for drilling. Rotational release will leave additional material and is not optimized for drill up as some of the setting mechanism is not rotationally locked and will result in increased drill up time. When drilling up the shear released HMBP, please follow the below recommendations for drilling up standard cast iron products.

RECOMMENDED REMOVAL TECHNIQUES FOR CEMENT RETAINERS & BRIDGE PLUGS:
Drilling is the preferred method for removing drillable cement retainers and bridge plugs since it usually can be accomplished in less than 10 percent of the time required to mill-out the same device. This can best be explained by the fact that milling causes small cuttings that tend to block mill penetration while the drilling causes a chiseling effect which breaks pieces away and floats them to the surface. Drilling with a short tooth medium hard formation rock bit is usually the best combination for retainer and plug removal.

SUGGESTED DRILLING TECHNIQUE FOR CEMENT RETAINERS & BRIDGE PLUGS:
Though the best drilling technique will vary with equipment availability, a typical combination would consist of a short or medium tooth hard tricone formation bit (IADC codes 2-1, 2-2, 2-3, 2-4, and 3-1), 75 to 120 RPM rotary speed and drill collars as necessary for weight and bit stabilization.

To drill the cement retainer or bridge plug:

1. Apply 5,000 – 7,000 lbs. until the top end of the mandrel is drilled (4 – 5 in.)
2. Increase weight to 2,000 – 3,000 lbs. per inch of bit diameter to drill out the remainder of the retainer.

EXAMPLE: Use 9,500 – 14,250 lbs. for a 4-3/4” diameter bit.

When normal circulation is to be used, place a junk basket above the bit. If reverse circulation is planned, a casing scraper or other equipment in the tubing string above the bit should have an inside fluid passage as large as the passage through the bit so cuttings will not bridge off the I.D.
Penetration may be stopped by “bit tracking” which is usually caused by insufficient weight on the bit. Bit tracking occurs when bit teeth travel in the same indentation of “track” made by the previous tooth. Successive tooth impact to the same location will sometimes deepen the track until the indentations equal the tooth length, reducing the impact of the teeth to the point they will no longer penetrate. Drilling penetration may be reestablished by raising the bit off of the retainer, and then lowering the bit back onto the retainer while maintaining rotation.

NOTE: Drilling times are directly related to tool size, bit stability, drilling weight, pump rate, bit RPM, type of bit, drilling fluid, etc. The combination of high mud viscosity and high pump rates may lift the bit off of the retainer during drilling. The same consideration should be used when drilling cement retainers and bridge plugs as would be used when drilling medium hard rock formations.

SUGGESTED MILLING TECHNIQUE:
If equipment availability or other considerations dictate that the milling technique must be used, the recommended combination is a concave face junk mill, rotated at 60 – 150 RPM with 5,000 – 8,000 lbs. on the mill. Use mud viscosity of 60 cps and a minimum annular velocity of 120 ft. /min. to assure cutting removal.

When ready to begin milling operations, start the mill above the target and lower it slowly onto the target. Do not apply weight in excess of the recommended amount; high weight can tear out chunks of cast iron and make a bailer trip necessary to remove them and reestablish drilling penetration. Maintain a constant milling rate by adding weight as the retainer is milled away.

Post Run Report:

1. Casing / Tubing Details:
2. Setting Depth / Temperature:
3. Fluid Type:
4. How much fluid was pumped after ball drop?
5. Activation Pressure:
6. Tension pulled to set:
7. Release method used:
8. Did the tool release properly?
9. Describe any unexpected events and actions taken to overcome them.

Post Run Reports can be submitted to sales@mapoiltools.com