Below Packer Hydraulic Safety Joint

PROVIDES A RELEASE POINT BETWEEN PACKER AND GUNS

OVERVIEW

The below packer hydraulic safety joint is designed for use in test strings or shoot and pulls to enable a packer to be unset and disconnected from tubing-conveyed perforating (TCP) guns if the guns become stuck following perforation and testing.

A tensile load at the safety joint, above the load at which the tool was configured, must be applied to enable the tool to be functioned to back off or disconnect the packer from TCP guns or other equipment below the packer.

FEATURES

» The tool is ideal for use in test strings and shoot and pull operations.
» Before the safety joint is activated, splines on the operating piston and the lower nipple lock the tool against rotation.
» The tool is operated by pulling a preset amount and rotating to the right 30 turns, which releases the tool from the perforating guns and leaves the nipple profile facing up for fishing operations.
» The nipple has a 4 3/4-in. outside diameter (OD), and a 3 1/2-in. inside diameter (ID) internal-flush (IF) tool joint box inside that faces up.
» The tool can be set for a predetermined release force by pinning the shear set at the top of the tool.
» The shear set can be used with the rupture disc (RD) to provide two different releases in the tool.
» The tool is pressure balanced when in a bull-plugged condition and below the packer, as it will be when used on the TCP job.
» The tool provides 36 in. of travel to unset the packer.
» The shear set can be pinned for a relatively small axial load to help eliminate any bounce or extension in the tool that might be caused by the perforating guns below the tool.
» The shear set can be set to a release value (almost as high as the RD burst. setting, which is 80%) to protect from accidentally releasing the tool by rupturing the RD at the time of perforation.

BENEFITS

» The tool enables a packer to be unset and disconnected from TCP guns when the guns become stuck following perforation and testing.
» The dimensions of the IF tool joint box inside the nipple enable picking up guns with a standard overshot or a 3 1/2-in. IF pin thread.
» The tool’s hydraulic RD can be selected for release forces of up to 100,000 lbf.
» An axial load of up to tool rating can be applied.
» Depending on the number of shear pins used, the release force can be set for up to 125,000 lbf (approximately 2,100 lbf per pin).
OPERATION

When an axial load is applied to the tool, the load is transmitted through the top adapter to the operating mandrel and into the operating piston. As the piston starts to move up inside the oil case, it begins to compress the oil inside the casing, causing the oil pressure inside the case to rise. Greater axial loads create greater pressures inside the case. When the load and pressure become great enough, the RD will burst, enabling the oil to dump into the ID of the tool. This action lets the top adapter, operating mandrel, and operating piston slide up inside the oil case.

As the operating piston moves up out of the lower nipple, the splines on both pieces disengage, freeing the operating assembly to rotate. The operating assembly can stroke up 36 in., which unsets the packer. Lugs on the bottom of the lugged adapter match lugs on the top of the lugged floating piston, and lugs on the top of the operating piston match lugs on the bottom of the lugged floating piston.

When the tool is traveled into the fully extended position, the lugs on all the parts lock the operating assembly to the rest of the tool. At this point, if desired, an axial load of up to tool rating may be applied.

When right-hand rotation is applied, the left-hand thread on the bottom of the oil case will back off, shearing the brass locking screws located at the bottom of the case. After 30 turns of right-hand rotation, the case will be backed completely off the bottom nipple and the equipment above the bottom nipple can be pulled out of the well. The packer and rest of the workstring can then be retrieved. The bottom nipple and bottom adapter will be left in the well, facing up toward top of the gun assembly.

RELEASE OPTIONS

The initial release force is controlled by using the shear set. It is used in conjunction with the RD to provide two different releases in the tool.

The shear set can be pinned to support the weight of the guns without movement while enabling the RD to control the secondary activation force for extending the tool if it is necessary to back the tool off. If the shear set is set to a relatively high release value, it can help protect the RD from a pressure spike at the time of perforation.

<table>
<thead>
<tr>
<th>Nominal Tool Size in.</th>
<th>Outer Diameter in. (cm)</th>
<th>Inner Diameter in. (cm)</th>
<th>Makeup Length in. (cm)</th>
<th>End Connections</th>
<th>Differential Pressure¹ psi (bar)</th>
<th>Tensile Load² lb (kg)</th>
<th>Service Temperature °F (°C)</th>
<th>Maximum Release Setting Load lb (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 7/8</td>
<td>3.90 (9.91)</td>
<td>1.785 (45.339)</td>
<td>122.85 (311.53)</td>
<td>2 7/8 CAS</td>
<td>15,000 (1034)</td>
<td>130,000 (59,422)</td>
<td>400 (204)</td>
<td>100,000 (45,360)</td>
</tr>
<tr>
<td>5</td>
<td>5.03 (127.76)</td>
<td>2.25 (57.15)</td>
<td>112.40 (285.50)</td>
<td>3 7/8 CAS</td>
<td>15,000 (1034)</td>
<td>250,000 (113,400)</td>
<td>400 (204)</td>
<td>125,000 (56,700)</td>
</tr>
</tbody>
</table>

Notes:

¹ Differential pressure is the difference in pressure between the casing annulus and the tool ID.

² The values of tensile, burst, and collapse strength are calculated with new tool conditions, Lame’s formulas with Von-Mise’s Distortion Energy Theory for burst and collapse strength, and stress area calculations for tensile strength.

» Meets NACE MR0175 requirements (>175°F / 79°C).

» These ratings are guidelines only. Refer to the equipment data book for individual equipment specifications.

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