



Restoring Fluid Flow in Tubing Strings

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Fike Hydraulic Tubing Drains (HTD) for use with deep hole drilling tools, downhole devices and other oil and off shore drilling applications provide an accurate method to equalize the fluid level in tubing strings, without mechanical manipulation. Fike HTD rupture discs, used as standard equipment, drastically reduce the frequency of stuck tubing strings, having to pull wet strings and other oil field equipment and tubing concerns.

Abstract

Restoring flow in tubing strings is critical to the performance and overall cost effectiveness of a drilling operation. If not quickly solved, equipment failure and related issues can delay and even halt oil production and compromise workers' safety and the environment. While there are several common methods used to resolve this issue, only one has been proven effective with tubing strings stuck due to solid material, sand, paraffin or corrosion.

Restoring Fluid Flow in Tubing Strings

The drilling, completion and production of a new oil well is rarely problem-free. If not quickly solved, equipment failure and related issues can delay and even halt oil production at a well and compromise workers' safety and the environment. As a result, during the planning process, experienced oil field engineers will anticipate what could go wrong and what should be done to prevent or minimize problems that occur.

One example of a potential problem concerns the tubing strings, which can become clogged, especially after steam flood is applied to thin the oil in the reservoir and help push it up the well. In addition, tubing strings, pumps, packers, anchors, seating nipples, and other equipment can get stuck downhole or malfunction due to accumulations of mud, sand, paraffin, corrosion, scale, rock fragments, and other debris between the tool, casing string, and tubing string wall.

The following describes the most common approaches that have been used to restore circulation to tubing strings and retrieve stuck or malfunctioning equipment.

- Wireline, which is usually employed for well intervention and reservoir evaluation.
- Rotating drain, which typically is used in conjunction with a rotating anchor and must have a backup to actuate both the drain and anchor downhole.
- Drop bar, which is lowered on the tubing string from the surface to shear a plug type device.
- Shear pins, multiples of which are placed to provide resistance to applied pressure or mechanical manipulations.
- Burst disc device, which applies a predetermined amount of pressure to trigger the draining mechanism.

The burst disc device is the only one of the above approaches that has proven effective with tubing strings that become stuck due to solid material, sand, paraffin, or corrosion.

Fike's Pressure Relief Device

Fike's burst disc device, the Hydraulic Tubing Drain (HTD), is a solution in which hydraulic pressure is applied at the wellhead to rupture the device's engineered metal disc. The rupture opens a fluid drain port to the casing annulus with no restrictions.

Composed of black oxide coated alloy steel, the Fike HTD consists of a sub and the circulation disc assembly (CDA) and is available in single port and dual port designs. On the dual port HTDs, which are normally used in highly deviated or horizontal wells, the CDAs are installed at 180° apart.

The two disc options for the Fike HTD are the A8219 (scored CDA) and A8659 (non-scored CDA). Both options allow for fluid circulation with different specifications. The standard burst pressure range of the scored CDA option is 1,500 to 8,500 pounds per square inch gauge (PSIG) in 500 PSIG increments. For the non-scored option, the range is 2,500 to 12,000 PSIG in 500 PSIG increments



A8219



A8659

For both options, the assembly body material is stainless steel 17-4, and the rupture disc material is Inconel® 600. The plug size of the rupture disc of the scored CDA totals 7/8" ID, with 1 1/4" external

thread, while the plug size of the non-scored option is 5/8" ID, with 1 1/4" external thread.

Burst tolerance is ±5 percent for both options. The operating ratios are 70 percent of burst pressure for

the scored CDA and 90 percent for the non-scored CDA.

The CDAs in Fike's products are often used as circulation ports for emergency or other unplanned uses.

Fike's HTDs have been successfully used in the following situations:

- Tubing strings must be emptied before the well is killed.
- Tubing cannot be rotated or pulled to actuate mechanical draining devices.
- Corrosion build-up prevents a sliding sleeve-type drain from operating effectively.
- Excessive well fluids have accumulated around the work zone.
- Tubing pumps are oversized and do not have operating drain valves.
- Drain tubing for submersible pumps is located in a high angle or straight hole and equipped with a check valve.

Benefits of Fike's HTD

- Allows for increased flow because of its large orifice.
- Provides positive indication of open drain, thereby reducing the risk the crew will attempt to correct the situation by pulling wet tubing strings.
- Drains tubing above anchors and packers.
- Contains CDA discs that are more accurate and dependable than brass or lead plugs, shear pins, sliding sleeves, or other tubing drain designs.
- Drains or circulates tubing strings despite presence of solid materials, sand, paraffin, or corrosion.
- Allows oil well crews to pull dry tubing strings even when using double traveling and standing valves.
- Because of its simple design, the HTD is easy to install box up and pin down at the desired depth in the tubing string.
- Dependable at high pressures and temperatures because of metal-to-metal seal.
- Cost effective.
- Resists corrosion, thereby increasing the device's reliability and cost-efficiency.
- Does not contain mechanical moving parts, thereby improving device's accuracy and reliability.
- Does not have fragile O-rings, which can become damaged during assembly and can lead to device failure in the oil field.
- Available for most tubing string sizes.

Fike is known for its rapid response delivery of HTDs of required sizes and pressures to customers.

"I have been supplying the Fike Hydraulic Tubing Drain for about 10 years and have had great service with the product. The Fike drain has made for a good option when sanded pumps might require draining of the tubing while pulling the well. The product works accurately when the specific pressure is applied to rupture the disc and works well in most rod pump, PCP, and ESP applications. I would recommend this product for wells that require a tubing drain. The Fike drain is one of the easiest ones to use. The customers I supply it to have had no issues with it doing its job."

Bob Tarpley, Snow Well Service,
Bakersfield, CA.

A8327 HTD



Fike's HTD was designed for use with the following applications:

Packers/Anchors

Packers typically employ a flexible rubber sealing element to close the space between the outside of the tubing string and the inside of the casing string. Mechanical dogs dig into the casing to prevent the packer from being pumped up or down the wellbore because of pressure differential. Anchors, which unlike packers do not employ sealing elements, are used primarily to prevent tubing reciprocation during production.

The packer or anchor can become trapped by debris in the wellbore. The Fike HTD can be used to dislodge and circulate the debris from the packer or anchor. The packer/anchor can then be worked loose and retrieved.

Sucker Rod Pumps (SRPs)

The crew uses a rodstring to insert SRPs into the wellbore. The SRPs are then latched into a seating nipple at the bottom of the tubing string. The SRP consists of two telescoping cylinders, the plunger and barrel, and the two ball and seat valves. As a result of reciprocating motion, fluid is passed through the plunger and barrel, allowing the two valves to stage the fluid until the entire fluid column is lifted to and spills over the surface.

In addition to breaking, SRPs frequently get stuck in the wellbore. Because of inoperative drain valves, oversized tubing pumps often cannot be pulled from the wellbore. Installing a Fike HTD in all SRP

applications eliminates the hazards of handling stuck pumps. In addition, pulling dry rather than wet tubing strings minimizes well production downtime and protects the safety of the crewmembers.

Electrical Submersible Pumps (ESPs)

Many companies use the Fike HTD to protect their substantial financial investments in such sophisticated, high performance equipment as ESPs, which are expensive to purchase, repair, and operate. ESPs are used to help provide energy to drive hydrocarbons to surface if reservoir pressure is insufficient. Fike's HTD enables crew members to circulate the debris that often traps ESPs downhole. With the HTD, the tubing string can be drained above the check valve. As a result, fluid is not dumped back through the ESP.

Progressive Cavity Pumps (PCPs)

A PCP's rotating worm-shaped rotor, which is located inside a flexible stator, is driven by a rod string inside the tubing. The rod string is rotated by a surface motor. PCPs can pump more produced solid material than can be handled by other artificial lift systems. However, large amount of debris can trap a PCP's rotor in the tubing string. And, if backlash occurs in the rod string, the rod can become unscrewed. The Fike HTD enables the safe and effective drainage of excess fluid and the retrieval of the PCP.

Fike and the Oil Field Industry

Introduced about two decades ago, the Fike HTD was the first rupture disc-based tubing drain designed for oil well production. Fike's engineers, who specialize in the design and manufacture of rupture disc solutions, developed the HTD in collaboration with the company's oil and gas exploration customers. An estimated 50,000 Fike HTDs have been used thus far in oil field operations worldwide and in many different types of wells to actuate drain openings downhole and restore circulation to tubing strings without mechanical manipulation. The HTD is among the Fike technologies that have become standard equipment in many oil fields in California and worldwide.

From designing the right product to the complete support from our customer service and highly-trained technical staff, you can be assured of a quality solution. Let Fike design the precise solution for your unique oil recovery requirements.

Fike has experts worldwide ready to answer your questions about our products and services. They can also help you determine the best solution for your need. TEL: 1-800-YES-FIKE (1-800-937-3453).

Conclusion

Of the common approaches for restoring circulation to tubing strings and retrieving stuck or malfunctioning equipment, the burst disc device is the only one proven effective with tubing strings stuck due to solid material, sand, paraffin or

corrosion. When investigating solutions for dealing with this issue, the burst disc and Hydraulic Tube Drain (HTD) deserve consideration because of their performance record.

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