LFV

Lockable Float Valve

OCEAN DRILLING PROGRAM
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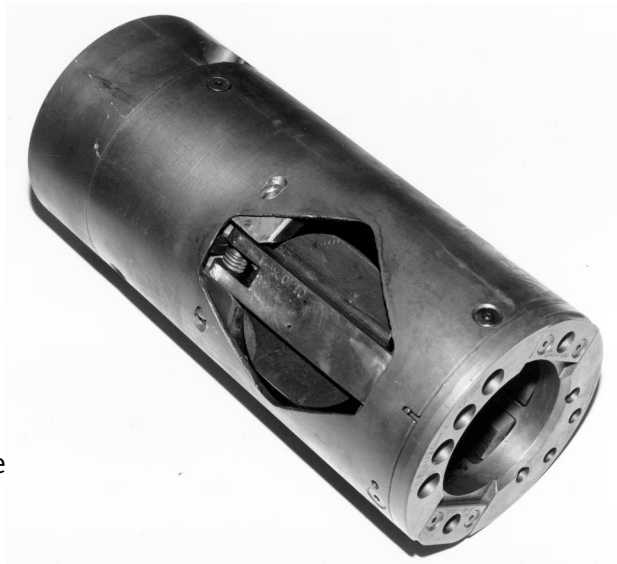
Scientific Application

The Lockable Float Valve (LFV) is a flapper-type valve used in the Advanced Piston Corer/Extended Core Barrel (APC/XCB) bottom-hole assembly (BHA) when logging is anticipated following or during coring. This tool allows the crew to continue to core in the same hole or move to a new hole after logging without tripping the pipe; thus, more cruise time is available to acquire core.

The LFV is located just above the core bit and seals the throat of the Outer Core Barrel (OCB) when not coring or logging to prevent or reduce backflow (U-tubing) of mud, sand, and drill cutting debris into the bore of the OCB. The backflow debris could prevent the Inner Core Barrel from landing properly, plug the bottom of the drill string, or contaminate the core.

Tool Operations

During coring, the core barrel pushes the flapper valve open and extends down through it. During logging, the LFV flapper is forced down and latched open by the logging tools to deploy the tools through the APC/XCB BHA and bit without releasing the bit. This leaves an unobstructed bore. The LFV is held open by a latch until the logging tools are retrieved, at which time the latch releases and the flapper closes. The LFV prevents entrapment of the logging tool and wireline, which can happen when using a standard spring-loaded (non-latching) flapper valve. The LFV can be used with the Rotary Core Barrel (RCB) BHA, but a more economical disposable spring-loaded flapper valve is commonly used instead because the RCB bit and spring-loaded flapper valve are released and dropped to log the hole.



Photograph of the LFV showing the flapper in the locked-open position.

The LFV flapper latch is activated by a 3.70 in. diameter ring or "upset" near the bottom of the logging tool. The latch can also be activated using an expendable aluminum Go-Devil that can be pumped down the drill string (leaves Go-Devil "junk" in the hole), deployed on wireline, or pinned on the end of a logging tool. The operation of the LFV can be described in six steps (see schematic):

1. The spring-actuated flapper remains in the closed position when the core barrel or logging tool is not in place. Pumping fluid down the drill string will force the flapper valve partially open.
2. The flapper is pushed down into the open position when a core barrel or logging tool passes through it and is held open by the tool body extending down through it.
3. A 3.70 in. outer diameter (OD) section on a logging tool or Go-Devil actuates the ball-wedge plunger and latches the flapper valve in the full-open position.

4-5. The flapper remains latched open as the logging tool continues downhole.

6. When the logging tool is retrieved through the LFV, a 3.70 in. OD section of the logging tool releases the ball-wedge plunger, which allows the spring-loaded flapper to close and seal the BHA bore.

Design Features

1) Compatibility

The LFV can be used with all tools that are compatible with APC/XCB BHA (i.e., tool OD is less than 3.75 in. minimum inner diameter [ID] of the LFV), when logging through the unreleased bit is possible.

Benefit: The LFV allows a float valve to be run in the APC/XCB BHA when logging is planned, and it allows coring operations to continue after logging.

2) Flapper Design

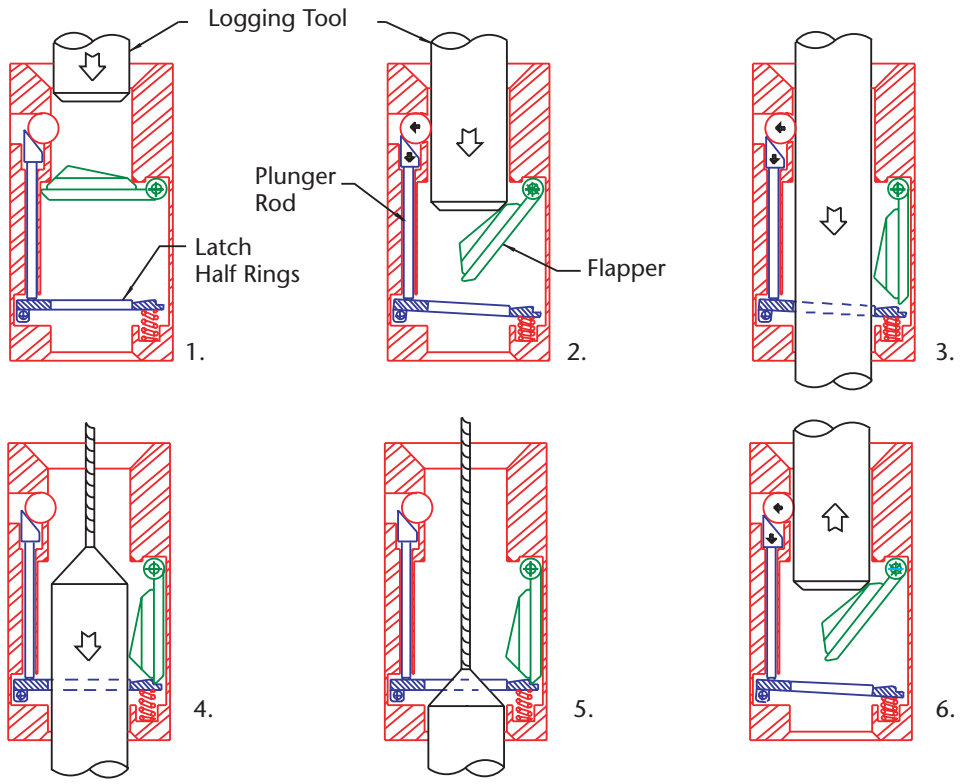
The spring-loaded flapper design reduces the back flow (U-tube) of cuttings, mud, sand, sloughing formations, and potential water and gas flows.

Benefit: It reduces the inflow (by U-tube) of debris into the BHA, which could result in an inability to land the inner core barrel, a plug in the bottom of the drill string, or contamination of the core.

3) Clearances and Flow Paths

The LFV actuation mechanism has additional flow paths and clearances intended to let fluid from the mud pumps flow through the mechanism to clean out the cuttings and debris.

Benefit: The additional flow paths and clearances help to wash away the cuttings and debris and keep the parts clean for uninterrupted operations.



Schematic illustrating the operational steps of the LFV described in the Tool Operations section.

Specifications

Minimum Bore Diameter: 3.80 in.

Outside Diameter: 6.985 in.

Length: 15 11/16 in.

Weight: 78 lb

Typical Operating Range

Formation:
All formation types

Depth Range:
All depths

Limitations

The LFV is activated by a 3.70 in. diameter x 24 in. long profile (a short tool will not activate the LFV). Not all logging tools have this activation profile, but when used, the preferred method is to attach an aluminum Go-Devil to actuate the LFV. The Go-Devil can also be dropped; however, this will leave aluminum junk in the hole, which must be drilled if further coring is planned.