Baker Hughes INTEQ

FC-JAR Tool Description and Operations Manual

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FC-JAR Overview

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Introduction

The hydraulic FC-Jar is a heavy duty impact tool, primarily used for Fishing, Coring, and Testing applications. The FC-Jar is used to free the stuck drillstring, by delivering jarring blows in an upward direction.

The FC-Jar also has the following advantages:

- It can be used while coring or testing, avoiding expensive fishing operations if the drillstring becomes stuck.
- It can be run in the drillstring as a single unit, or it may be connected to the accelerator for optimum results.

Note: *For downward blows, when it becomes impossible to pull the fish, the Bumper Sub must be installed above the FC-Jar.*

Tool Description

The FC-Jar is manufactured from high quality SAE 4140/4145 steel. The threads are phosphate coated and made to API specifications. The thread roots are cold rolled upon request and checked by Magna-Flux.

The straight-pull operated jar, which employs a patented hydraulic jarring system, is unique in design, easy to operate, and needs no setting or adjustment before going into the hole, or after the fish has been engaged.

The impact control is made by the overload pulled, whereby drillstring energy is stored in the drillstring as potential energy. A very light or a maximum capacity blow may be created by the amount of overpull imparted to the tool.

The jarring system actually represents a time delay, allowing the operator to take the necessary stretch in the drillstring and/or accelerator before being released. The jarring blow can be repeated if necessary, to deliver a rapid series of blows when desired.

The FC-Jar consists of two major elements as shown in Figure 1. These elements include:

- Torque Transmission System, with: male spline, female spline
- Jarring System, with: Bowl, Valve, and Compensating Piston.

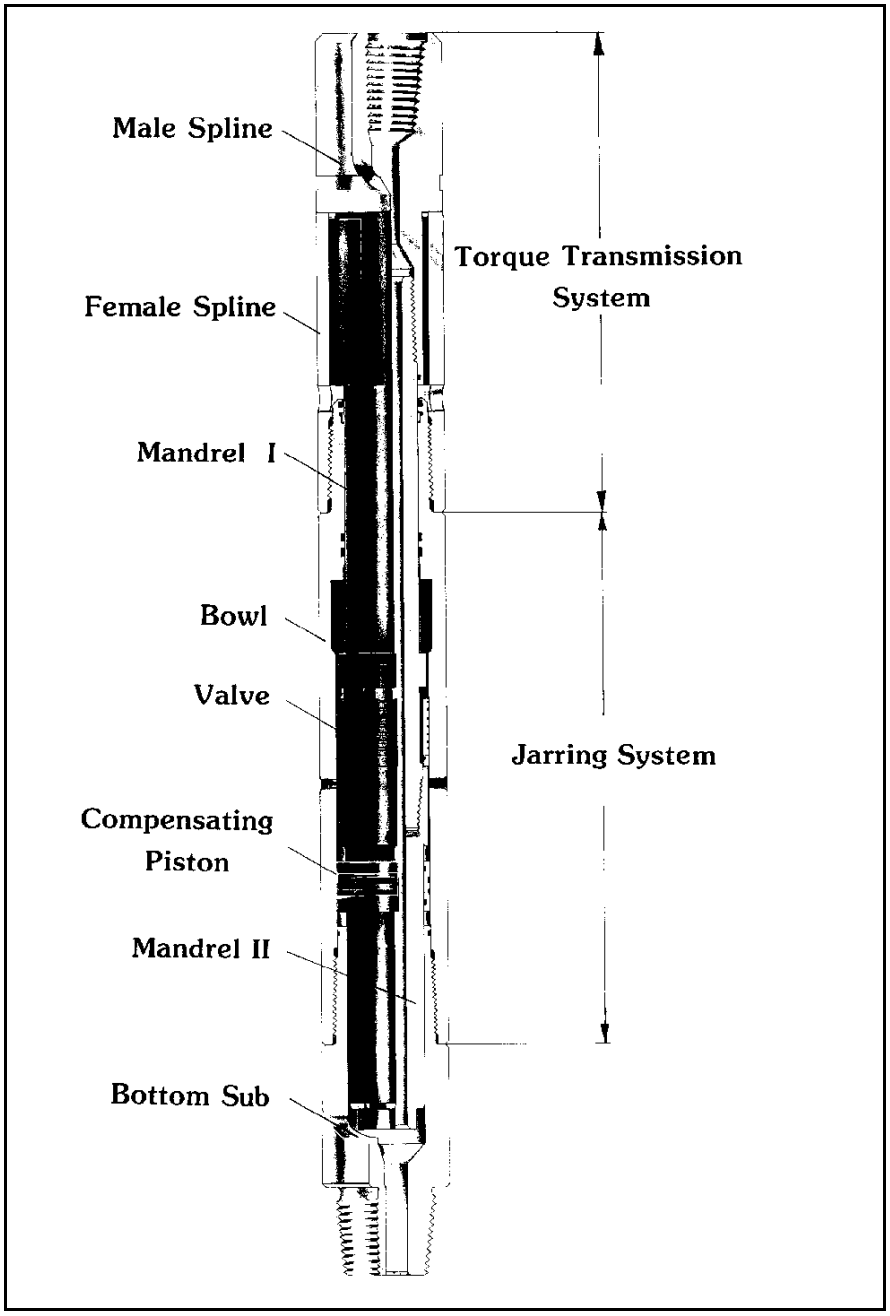

Figure 1. Main Elements of the FC-Jar. *The FC-Jar consists of a Torque Transmission System and a Jarring System.*

Torque Transmission System

The Torque Transmission System is located in the upper part of the tool, featuring an integral spline assembly, promoting long life and reliable transmission of full torque at all times during operation. The jarring stroke for all tool sizes is approximately 4 inches (100 mm). The stroke between open and compressed length is approximately 11 inches (285 mm). The Spline section is open to the annulus rendering mud flow between *Male Spline* and *Female Spline*.

Jarring System

The Jarring System is located below the *Spline Assembly*. It works totally in an oil bath and is sealed below by the *Compensating Piston II*. Intensity of impact is controlled from the rig floor by the amount of jarring load (overpull) applied.

Note: *The FC-Jar is designed for jarring up.*

Figure 2 shows the principle of the hydraulic jarring system in which an axial sliding *Valve* is sealed to the *Bowl I* and pressed onto the *Valve Seat*, when it is pulled. While the *Valve* is being pulled, the oil from the *Upper Chamber* must flow into the *Lower Chamber*, passing through the very narrow annulus between the *Valve* and *Bowl*.

Therefore, the valve movement requires a certain time, depending on the amount of overpull, before it reaches the upper part of the *Bowl I*. Here, the enlarged bore area allows the oil to bypass the *Valve*, resulting in an abrupt release and acceleration of *Valve* and *Mandrel I*, by energy stored in the drillstring. The upward blow is created by hitting the *Hammer* against the *Anvil*. To achieve quick resetting, the *Valve* is designed so that the oil can bypass underneath it and thus does not offer resistance while resetting.

The main advantages of the jarring system are:

- Simple operation, impact control over the whole working range, by overpull only.
- Quick resetting of the valve for producing rapid series of blows.
- Internal jarring system is not exposed to the drillstring torque stresses.

Tool Placement for Fishing

In a fishing string, the FC-Jar should be installed below the drill collars. The recommended numbers of drill collars are given in Table 2, varying with the different diameters. These figures are computed to approach the optimal jarring effect.

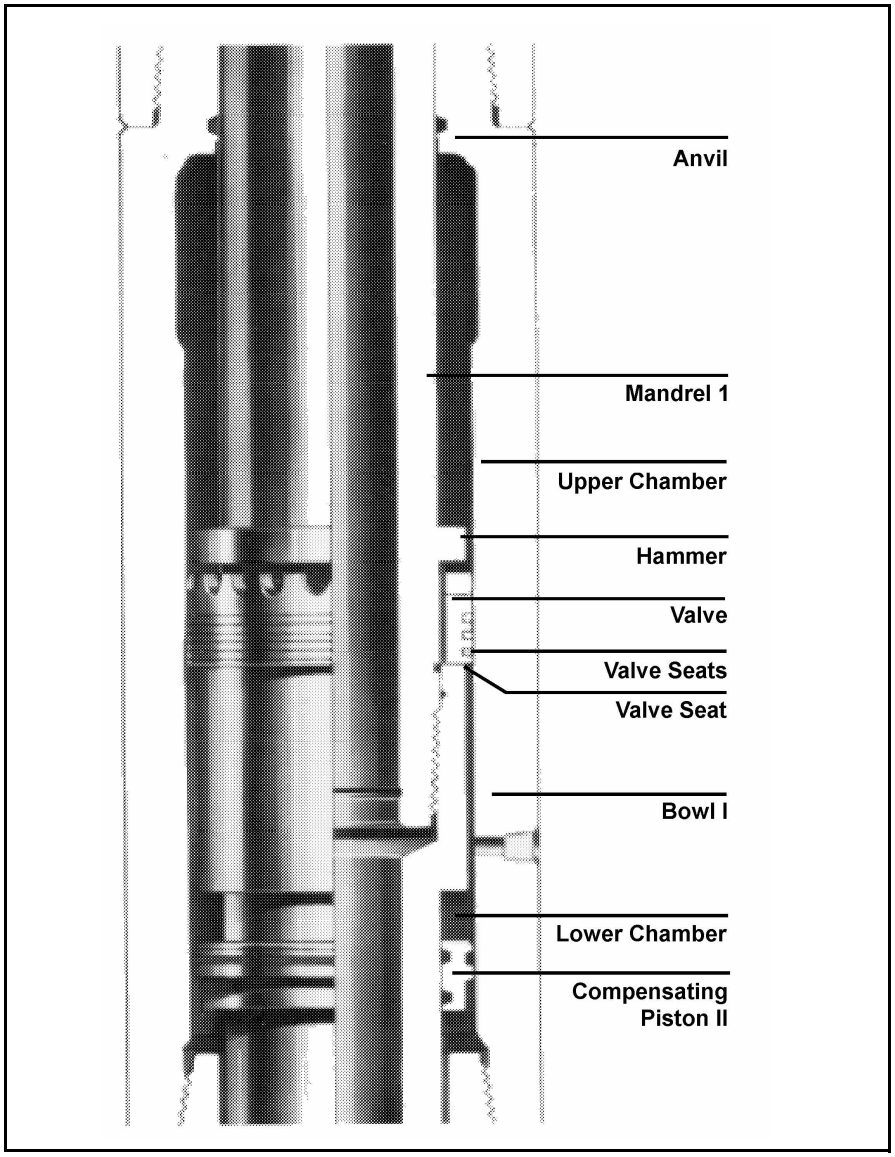

Figure 2. Hydraulic Jarring System for Jarring Up. *The FC-Jar is designed for jarring up.*

It is recommended to run an Accelerator with the Jar in shallow holes (low elasticity of the drillstring, due to short length) or in very deep or deviated wells (a high string mass to be accelerated and in many cases too much hole wall friction). The Accelerator supports the jar action and boosts the impact. It has to be positioned on top of the drill collars forming the connecting part to the drill pipes of the fishing string.

Tool Placement for Coring and Testing

To avoid core washing, it is often necessary to operate with low circulation rates. This fact greatly increases the need for using a jar to guard against sticking. Core breaking without a jar in the drillstring often requires high overpull loads and long washing intervals to reduce the core diameter for breaking the core. When a jar is installed, moderate overpull is all that is required to create a light blow which is usually sufficient for breaking.

For testing operations (drill stem tests), the FC-Jar is not limited within normal parameters by load, torque, type of drilling fluid, flow rate, temperature and pressure drop beneath the tool. In general, the FC-Jar does not interface with any testing equipment, since the impact can be controlled by overpull. Moderate blows to free stuck equipment are often required, thus considerably reducing the expense and risk of the operation.

FC-Jar Operation

General

All FC-Jars are delivered to the rig site properly assembled, filled with hydraulic oil, and all joints made up. Before the tools leave the factory, they are tested in the test press to assure proper performance. The pin and box connections at both ends should be made up to the appropriate torque according to API specifications for drill collar connections.

Note: *No chain tongs or collar clamps should be placed around the integral splines or the male spline.*

The jar will be supplied in the open position with a safety collar for safe and easy transportation. The operator must be careful of inadvertently tripping while going into the hole. This occurs due to the weight of the drillstring below the tool, pulling the jar into the open position and creating a moderate blow. The intensity of the blow depends on the weight below the jar. It is recommended to set the jar in the slips (elevator must be left in place) and suspend the operation for approximately 5 to 10 minutes, thus allowing the jar to trip (jarring blow may be realized on the rig floor). Going in the hole through tight spots may reset the jar into the closed position again, so that the procedure needs to be done again.

> ***CAUTION***
> *Once the jar is closed, it should not be left suspended with any appreciable weight below to avoid unwanted jarring. Cautious action is of substantial importance when picking up or laying down the tool from the pipe rack or derrick floor.*

Jarring Loads

The jarring impact depends on the length of the drillstring above the jar and the amount of overpull. The maximum jarring loads in the Specifications List should not be exceeded.

Jarring Procedure

Following is the jarring procedure:

1. Close the jar, by lowering the drillstring until approximately 20-30 kN weight is placed on the jar.
2. Pick-up the drillstring until the weight increases and overpull the amount of desired jarring load.
3. Set the brake and wait for the blow (2-5 minutes, depending on the overpull).
4. To repeat the jarring, follow-up steps 1 and 3 again.

Note: *When coming out of the hole, after successful fishing or jarring operation, avoid closing the jar, because the weight beneath it could cause the closed jar to fire.*

Checking the Jarring System

The following items need to be checked each round trip to make sure that the jarring system is in good condition:

- Set the jar in the slips and close the tool by pushing it together.
- Lift the tool out of the slips. The tool will open immediately.
- The free opening length should not be more than approximately 1.6 inches (40 mm) for all sizes, before the velocity of the opening slows down or becomes zero. In this case, the tool is ready for further use.
- If the jar opens more than approximately 1.6 inches (40 mm) with constant velocity, the tool should be replaced.

Table 1: FC-Jar Specification List

Tool OD inches	**Range** inches	**Tool ID** inches, mm	**Jarring Stroke** inches, mm	**Total Stroke** inches mm	**Jarring Load** maximum klb, to	**Tension Load** maximum klb, to
3-3/8"	3-1/8"–3-3/8"	1" *25.40*	3.94" *100.0*	16.93" *430*	24 *11*	92 *42*
3-1/2"	3-1/2"	1" *25.40*	4.72" *120.00*	24.41" *620*	24 *11*	92 *42*
4-3/4"	4-3/4"–5"	2" *50.80*	3.94" *100.0*	11.22" *285*	50 *23*	200 *91*

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5-3/4"	5-3/4"–6"	2" *50.80*	3.94" *100.0*	11.22 *285*	103 *47*	661 *300*
6-1/4"	6-1/4"–6-1/2"	2-1/4" *57.15*	3.94" *100.0*	11.22 *285*	116 *53*	568 *258*
6-3/4"	6-3/4"–7-1/2"	2-1/4" *57.15*	3.94" *100.0*	11.22 *285*	127 *58*	661 *300*
8"	7-3/4"–8-1/2"	2-1/2" *63.50*	3.94" *100.0*	11.22 *285*	176 *80*	661 *300*

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Table 2: FC-Jar Specification List

Tool OD inches	**Op. Torque maximum** kftlb, kNm	**Tool Length comp.** approx. ft, mm	**Tool Length** ft, mm ***extended***	**Tool Weight approx.** lb, kg	**DC above # recom. approx.,** pcs
3-3/8"	2.95 *4.00*	10.65 *3245*	12.06 *3675*	300 *135*	2 to 4
3-1/2"	2.95 *4.00*	13.95 *4253*	15.99 *4873*	400 *180*	2 to 4
4-3/4"	8.00 *10.85*	9.89 *3015*	10.83 *3300*	440 *200*	2 to 6
5-3/4"	16.23 *22.00*	9.83 *2997*	10.77 *3282*	510 *230*	2 to 6
6-1/4"	17.00 *23.00*	9.57 *2917*	10.51 *3202*	640 *290*	2 to 6
6-3/4"	17.00 *23.00*	9.75 *2973*	10.67 *3258*	705 *320*	2 to 5
8"	46.00 *62.40*	9.92 *3024*	10.86 *3309*	1280 *580*	2 to 5

Table 3: Specification Legend

Jarring Load	**Maximum overpull before jarring, limited by chamber pressure**
Tension Load	**Maximum overpull after jarring, limited by weakest inner part**
Jarring Stroke	**Approximately 1/3 of the total stroke (extended-compressed length)**
Op. Torque	**Maximum torque without damage on thread connections**
Tool Length	**Depending on manufacturing tolerances and thread connections**
DC above	**Recommended number of drill collars to use above the Jar**