Dailey® Hydraulic Drilling Jar

Weatherford's *Dailey* hydraulic drilling jar (HDJ) is a double-acting hydraulic jar designed for simple operation, variable hitting loads, and extended periods of continuous jarring in a wide range of drilling conditions. Using a patented hydraulic time-delay/mechanical-release system, the HDJ combines downhole reliability and long operating life under a wide range of drilling conditions and hostile environments.

Applications

- High-angle drillstrings
- All conventional oil and gas wells
- Deviated oil and gas wells

Features, Advantages and Benefits

- The one-piece involute spline mandrel provides maximum torque with minimal backlash to ensure effective transfer of drillstring torque through the HDJ. Full torque in either direction can be transmitted at all times without affecting the magnitude or the time delay of the jarring operation. The splines and all other working parts of the tool are enclosed within the hydraulic chamber, where they are fully protected and lubricated.
- A fluid-isolated, high-pressure chamber lubricates and isolates the HDJ's moving seals, impact shoulders, and mandrel from downhole debris, protecting the HDJ's operational integrity.
- The HDJ is virtually unaffected by downhole temperatures and generates very little heat when in use. The result is a consistent time delay to trip the HDJ, even in deep, high-temperature holes.
- The design of this tool allows for zero bleed-off during jarring; therefore the driller does not have to apply any compensation to the brake load.
- Overpull is controlled at the surface, enabling the driller to increase or decrease the impact to the stuck point by simply increasing or decreasing the load applied to the jar.
- The hydraulic metering mechanism of the HDJ has no moving parts; it incorporates large flow paths and is protected from contamination.
- Recocking is done quickly by returning to neutral and jarring again in either direction.
- All connections are torqued to the charted makeup torque to ensure no accidental back-offs downhole.

Dailey® Hydraulic Drilling Jar

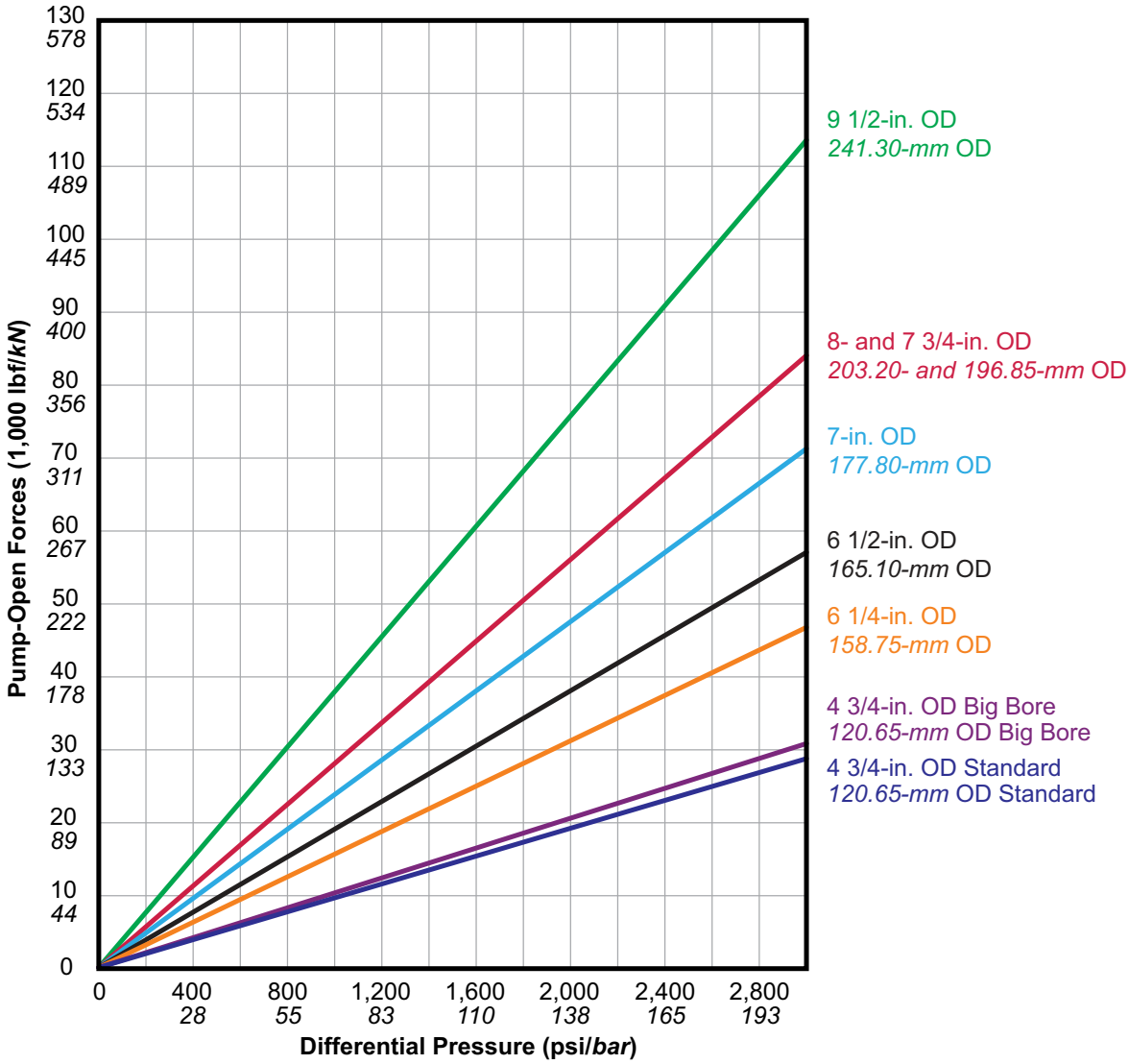
Specifications

Circulating pressure (psi/*bar*)	5,000 *345*							
Hydrostatic pressure (psi/*bar*)	None							
OD *(in./mm)*	4-3/4 *120.65*	4-3/4 *120.65*	6-1/4 *158.75*	6-1/2 *165.10*	7 *177.80*	7-3/4 *196.85*	8 *203.20*	9-1/2 *241.30*
ID (in./*mm)*	2-1/16 *52.39*	2-1/4 *57.15*	2-1/4 *57.15*	2-3/4 *69.85*	2-3/4 *69.85*	3 *76.20*	3 *76.20*	3 *76.20*
Tool joint size (API)	NC-38, 3-1/2 IF	NC-38, 3-1/2 IF	NC-46, 4-1/2 XH	NC-50, 4-1/2 IF	5-1/2 FH	6-5/8 Reg.	6-5/8 Reg.	7-5/8 Reg.
Tensile yield* (lbf/*kN)*	436,000 *1,939*	500,000 *2,224*	832,000 *3,701*	934,000 *4,155*	1,200,000 *5,338*	1,600,000 *7,117*	1,750,000 *7,784*	2,300,000 *10,231*
Torsional yield* (lbf-ft/*kN•m)*	21,200 *28.7*	20,000 *27.1*	49,300 *66.8*	56,200 *76.2*	76,400 *103.6*	76,400 *103.6*	105,000 *142.4*	160,000 *216.9*
Maximum overpull up/down (lbf/*kN)*	95,000 *423*	85,000 *378*	200,000 *890*	175,000 *778*	220,000 *979*	260,000 *1,157*	300,000 *1,334*	500,000 *2,224*
Approximate length extended (ft/*m)*	32 *9.8*	32 *9.8*	33 *10.1*	33 *10.1*	33 *10.1*	33 *10.1*	33 *10.1*	33 *10.1*
Approximate weight (lb/*kg)*	1,200 *544*	1,200 *544*	2,050 *930*	2,400 *1,089*	3,000 *1,361*	3,500 *1,588*	3,800 *1,724*	5,500 *2,495*
Free-travel up/down stroke (in./*mm)*	5.00 *127*	5.50 *140*	6.25 *159*	6.50 *165*	6.50 *165*	7.00 *178*	7.00 *178*	7.00 *178*
Total stroke (in./*mm)*	13.50 *343*	15.00 *381*	16.50 *419*	17.00 *432*	17.00 *432*	19.50 *495*	19.50 *495*	19.50 *495*
Maximum bottomhole temperature (°F/*°C)*	400° *204°*							
Pump-open area (in.^{2}/*cm^2)*	9.6 *61.9*	10.3 *66.5*	15.9 *102.6*	19.6 *126.5*	23.8 *153.5*	28.3 *182.6*	28.3 *182.6*	38.5 *248.4*

*Tensile and torsional yield values are calculated per API RP7G, based on nominal dimensions and the published yield strength of the material. These values do not constitute a guarantee, actual or implied.

Dailey® Hydraulic Drilling Jar

Pump-Open Force Chart



Pump-open force is created by pressure drop across the bit. The pump pressure creates a reaction force in the tool that tries to force it open. Reduce the pump to idle before attempting to jar.

Dailey® Hydraulic Drilling Jar

Operation

During jarring, the mandrels move in response to the push/pull load applied at the surface, while the housings remain stationary. The movement of the mandrels, in either direction, is resisted by two pressure pistons that oppose each other to define a high-pressure chamber. Located between the two pressure pistons is a normally closed "triggering" valve (consisting of upper and lower valve halves) which controls the releasing of fluid from the pressure chamber.

The separate functions of jarring upward or downward may be accomplished in any sequence; that is, up only, down only, or up and down.

Jarring Upward

For **jarring upward**, the lower pressure piston moves upward with the mandrels, while a shoulder in the housing prevents the upper pressure piston from moving. Sufficient pressure is generated between the pressure pistons to resist the applied load until the triggering valve is mechanically opened by an actuating device. The time delay (from when the load is applied until the triggering valve opens) is achieved by a hydraulic metering mechanism that controls the speed at which the lower pressure piston moves toward the upper pressure piston. The lower pressure piston must move a predetermined distance before the actuating devices contact their respective valve halves and force the triggering valve to open.

The built-in delay is designed to allow the operator sufficient time to pull to the required load before the triggering valve opens.

When the triggering valve opens, the high-pressure fluid in the pressure chamber that was resisting the overpull is released from the high-pressure chamber to the hydrostatic pressure chamber; there being no further resistance to motion of the mandrel relative to the housing, the jar travels until the hammer impacts the anvil. For jarring upward again, the tool is returned to neutral by lowering the drillstring and then applying another up-load. This action may be repeated as often as necessary.

Jarring Downward

For **jarring downward**, a similar but opposite action occurs; that is, the upper pressure piston moves down with the mandrels in response to the weight applied from the drillstring above, while a shoulder on the housings prevents the lower pressure piston from moving. In down-jarring, triggering occurs when the upper pressure piston has moved sufficiently toward the lower pressure piston to force open the triggering valve.

The HDJ can be combined with the Weatherford *Dailey HyPulse Jar Slinger®* drilling tool to increase the impact and impulse to the fish.

Dailey® Hydraulic Drilling Jar

Operation (continued)

Picking Up

Always use a lift sub to pick up the HDJ and a thread protector on the pin thread.

Caution: Do not place tongs anywhere on the HDJ except the top and bottom rotary connections. All service connections are pre-torqued before delivery. Placing tongs anywhere other than the top or bottom rotary connection could result in equipment damage.

Removing and Installing the Safety Clamp During Rig Operations

Caution: Use proper manual lifting procedures for the mandrel clamp.

The HDJ arrives on location with a hinged mandrel clamp installed. Leave the mandrel clamp installed until the HDJ is ready to go through the rotary to protect the exposed section of the mandrel and prevent unintentional operation of the tool.

Caution: Ensure that the rig floor is free from tripping obstacles prior removing or reinstalling the mandrel clamp.

Caution: Only remove or reinstall the mandrel clamp when the jar is secured in the rotary table. Do not attempt to remove the mandrel clamp unless the HDJ is in tension. Doing so could result in equipment damage.

Caution: Do not place tongs on the exposed section of the mandrel or place this surface in the slips. Either action could result in equipment damage.

To remove the mandrel clamp:

Caution: Wear the following proper personal protective equipment (PPE):

- Hard hats must be worn to protect the head against falling parts and overhead equipment.
- Eye protection glasses must be worn to protect against flying particles.
- Safety boots must be worn to protect against erroneous rest of the equipment.
- Safety gloves must be worn to protect the hands against aggressive grease, lubricants, and mud.
- Hearing protection must be worn in areas where excessive noise is produced.

Dailey® Hydraulic Drilling Jar

Operation *(continued)*

1. Pick up the weight from the slips to put the HDJ in tension.
2. Remove the shipping strap, and pull both red latches together. The clamp can then be opened.
3. Spread the two body halves, and remove the clamp from the HDJ mandrel.
4. Store the mandrel clamp clean and on a safe horizontal position (preferable on ground level). Keep the mandrel clamp and shipping strap in proximity to be used when reinstalling the mandrel clamp.

To reinstall the mandrel clamp:

1. Visually inspect (See inspection procedure) all parts for cracks or breakage.

   Caution: Do not use the clamp if it is damaged or cannot be operated as described. Serious injury can result.
2. Install the mandrel clamp with the HDJ in tension. Open and then close the two body halves. Both latch spring should return the latch to the closed position. Be careful while operating the closing mechanism for any finger related injuries. Disregard can lead to minor injury.
3. The latch is fully closed when the lock pin is fully seated when red latch fully engaged against hinge.
4. Install the shipping strap around the clamp. If the clamp cannot be used, either rack back jar as a single or lay it down.

Opening the HDJ above the Rotary

Should the HDJ become cocked [9 in. (228.6 mm) of polished mandrel exposed] on the surface, it can easily be triggered open with a slight overpull.

1. Support the weight below the HDJ either in the slips or by closing rams on the bottomhole assembly.

   Caution: If supporting weight in the slips, always ensure that the dog collar is attached to the HDJ to ensure that tool cannot fall downhole during the following procedure.

   Caution: Place the slips only on the designated areas to avoid damaging them.
2. Pick up 5,000 to 10,000 lbf (22.2 to 44.5 kN) with the elevators. At this extremely low load, about 5 minutes will be required for the HDJ to trigger. With the HDJ fully extended, about 17 in. (432 mm) of polished mandrel will be exposed.

Dailey® Hydraulic Drilling Jar

Operation (continued)

Placing the HDJ in the String

The HDJ can be run in tension or compression. Running a minimum 15% safety factor in string weight between the HDJ and the weight transition zone is mandatory. Run the same size drill collar or heavy-wall drillpipe directly above and directly below the HDJ.

Caution: Never run the HDJ as a crossover between the drill collars and the heavy-wall pipe or between the collars of different ODs; excessive stress occurs at these transition points and can lead to premature tool failure.

Important: Avoid running the HDJ below reamers, stabilizers, key-seat wipers, or any other tool with an OD that exceeds that of the HDJ. Doing so can restrict the jarring function.

Caution: Never run the HDJ in close proximity to another HDJ or any other type of jar. Doing so can impose excessive loads during jarring operations, resulting in equipment damage. Maintain a minimum distance of 1,500 ft (500 m) between jars.

Drilling with the HDJ in Compression

The HDJ is normally in tension when the bit reaches the bottom and should be triggered down with a light load to close the tool and prevent the transmission of significant impact forces from the tool.

The HDJ will cock when the string is picked up off the bottom; therefore, this procedure should be followed each time a connection is made.

Important: Pressure differential between the drillpipe ID and the annulus at the jar will tend to pump open the tool, which, during normal drilling, will have no effect on either the weight on the bit or the HDJ itself. If the HDJ is in tension while drilling, this pump-open force only tends to keep the jar extended. Pump-open force increases the up-jar load and decreases the down-jar load. To calculate pump-open force, multiply the pump-open area (see “Specifications”) by the pressure drop across the drill bit to determine the change in weight indicator reading. (See also Pump-Open Force chart.)

Dailey® Hydraulic Drilling Jar

Operation (continued)

Running In

Use care to start and stop slowly when running in to avoid repeatedly opening and closing the tool, which could cause the HDJ to cock. Run through tight spots and doglegs slowly. Be aware that anything that restricts the ID of the pipe or drill collars below the HDJ (float valves, survey tools, etc.) can cause the drill collars to “float” if the pipe is lowered too rapidly and can result in cocking the HDJ.

If it is suspected that the HDJ has inadvertently recocked during run-in or on bottom, suspend the drillpipe in the elevator long enough for the HDJ to trip open (from the weight of the drill collars suspended below it). If it appears that the HDJ has inadvertently recocked at the surface, it can easily be tripped open with as little as 5,000 lbf (22.2 kN). At this extremely low load, about 5 minutes is required for the jar to trip.

Jarring

No presetting or adjustment is required before running or jarring. The HDJ is controlled completely from the surface, using only axial motion.

1. Pull up to the required load. Wait a few seconds for the HDJ to jar up; or, slack off to the required load, and wait for the HDJ to jar down.

   Note: For a stronger impact, pull harder; for a lesser impact, pull more lightly. No other action is required of the operator, and the HDJ can be hit in any sequence (up only, down only, or up and down).

   The waiting time between setting the brake and the jarring action will be in the range of 10 to 120 sec, depending on applied load, and will not be affected by changes in downhole temperature or hydrostatic pressure or the number of times the HDJ is actuated. It is never necessary to “warm up” the HDJ or to circulate to “cool off” the HDJ.

   Drilling does not affect the HDJ. Full torque in either direction can be transmitted at all times without affecting either the magnitude or the time delay of the jarring action.

2. After impact, return the HDJ to neutral with motion in the opposite direction until resistance is met. The HDJ will immediately be ready to jar in the same or the opposite direction.

   Note: It is not necessary to slack off (or pull up, if jarring down) an exact amount of weight or to control the travel of the HDJ to recock. The proper travel occurs automatically if sufficient weight is slacked off (or pulled up) to allow the necessary travel at the tool.

   When the HDJ is recocked to jar again in the same direction, the time delay of the next blow is not affected by overtravel in the direction of neutral.

Dailey® Hydraulic Drilling Jar

Operation (continued)

Example: Upward Jarring Jar

	(lbf)	(kN)
Total string weight	250,000	1,112
Weight below jar	- 40,000	- 178
Weight above jar	210,000	934
Desired or maximum overpull	+ 92,000	+ 409
	302,000	1,343
Hole drag	+ 20,000	+ 89
Indicator reading to trip jar upward	322,000	1,432

Slack off from 200,000 to 190,000 lbf (890 to 845 kN) to recock the jar.

Example: Downward Jarring Jar

	(lbf)	(kN)
Total string weight	250,000	1,112
Weight below jar	- 40,000	- 178
Weight above jar	210,000	934
Desired or maximum overpull	- 37,000	- 165
	173,000	769
Hole drag	- 20,000	- 89
Indicator reading to trip jar upward	153,000	680

Slack off from 220,000 to 240,000 lbf (979 to 1,068 kN) to recock the jar.

Pulling Pipe

Exercise caution when pulling pipe to eliminate any danger associated with the HDJ inadvertently tripping, which can occur if the HDJ is unexpectedly in compression when the bit is lifted off bottom. To guard against inadvertent tripping, allow the pipe to hang off bottom long enough for the HDJ to trip through (as a result of the action of the load hanging below it) before suspending the pipe from the slips.

Racking Back

When the HDJ comes through the rotary, install the mandrel clamp while the tool is still in tension.

Caution: Do not stand the HDJ in the rack unless the mandrel clamp is fitted. Doing so can initiate unintentional operation of the tool and pose a safety hazard.

Dailey® Hydraulic Drilling Jar

Operation (continued)

Maintaining the HDJ

Take the following steps each trip out of the hole:

1. Wash the mud from the polished mandrel and from inside the bottom connection.
2. Check the polished mandrel carefully for any signs of corrosion, pitting, or flaking of the coating.
3. Replace the mandrel clamp while the HDJ is still in tension.
4. Install the shipping strap around the mandrel clamp.