Weatherford®

Jars, Shocks and Accelerators

Drilling

Evaluation

Completion

Production

Intervention

Well Construction

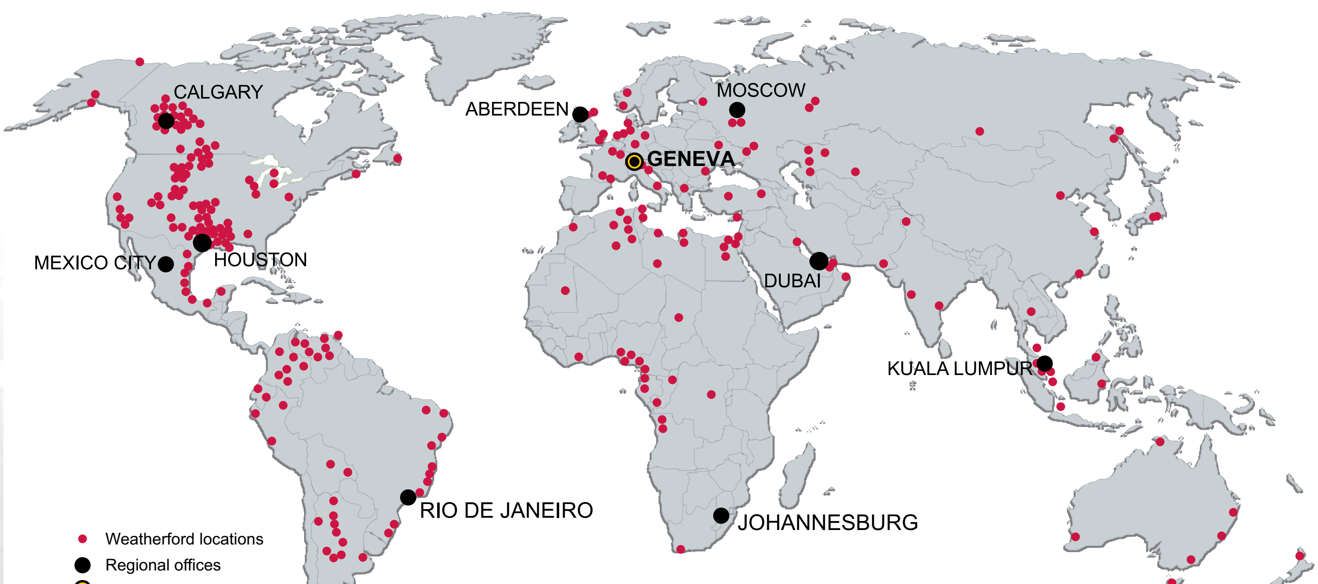
- Cementing products
- Cementing services
- Drilling fluids
- Drilling tools
  - Drillpipe
  - Performance drilling tools
  - Pressure-control equipment
- Inflatable packers
- Liner systems
- Mechanized rig systems
- Swellable Products
- Tubular running services

Weatherford: Your Source for Rental Drilling Tools

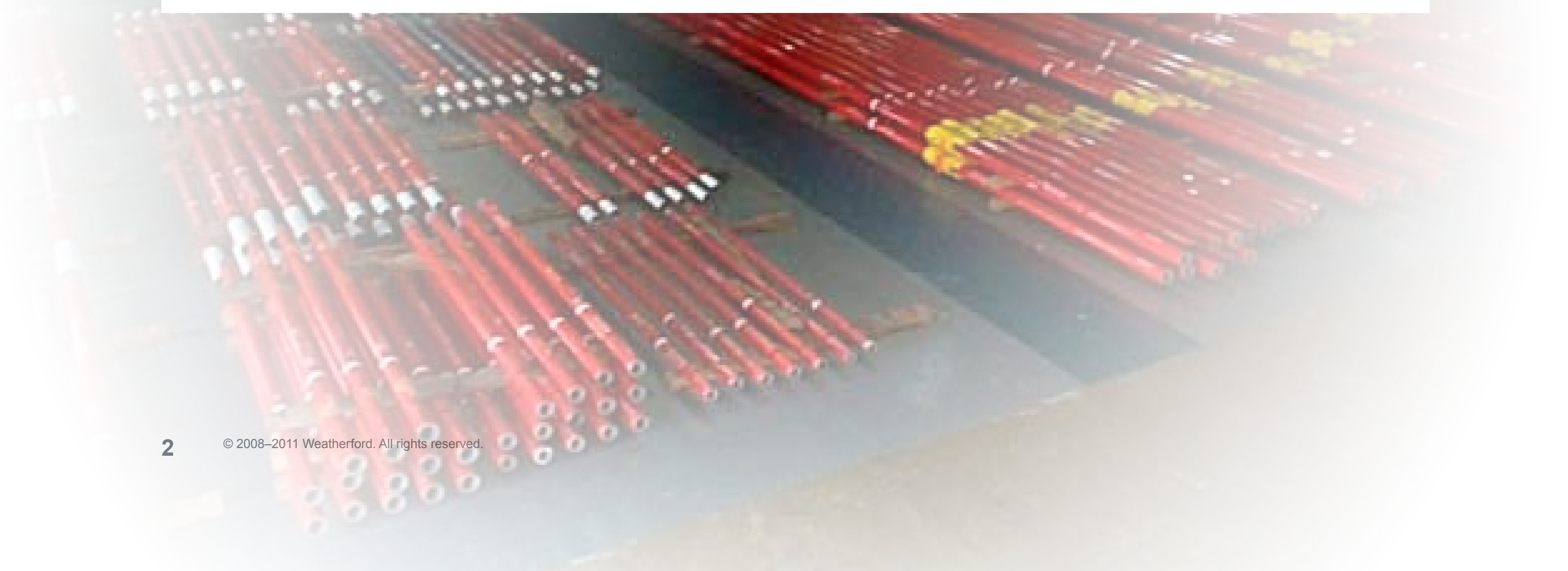
Weatherford is the leading provider of drilling tools and services worldwide, with the rental products you need for virtually any drilling, completion, or workover task. Our highly trained drilling tools team is ready to help you quickly and safely find and deploy the equipment you need. We understand that our job does not stop upon tool delivery. We're with you from startup to completion.

Our team of drilling tool specialists continually innovates to push the operational thresholds of drilling equipment, from drill collars to risers—always in pursuit of equipment that can offer faster, safer drilling with reduced environmental damage and operating costs.

With locations in most petroleum provinces around the world, we offer you unmatched service to support a broad selection of tools from proven conventional technologies to the latest advances for extreme environments.



Weatherford operates in more than 100 countries around the world.



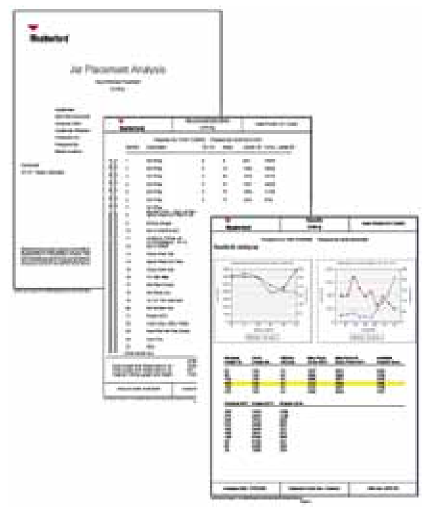
Setting Industry Standards for More Than 60 Years

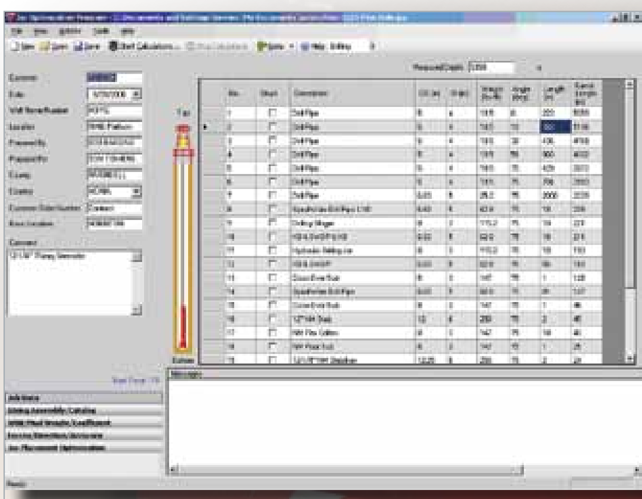
Weatherford's jars are recognized as the industry standard. Rigid quality standards have kept our jars performing in adverse environments to keep your drilling and fishing operations moving forward. Our offerings include an array of types and sizes of jars as well as other downhole tools, such as HyPulse Jar Slinger® tools, MA drilling enhancers, shock absorbers, lubricated bumper subs, and thrusters.

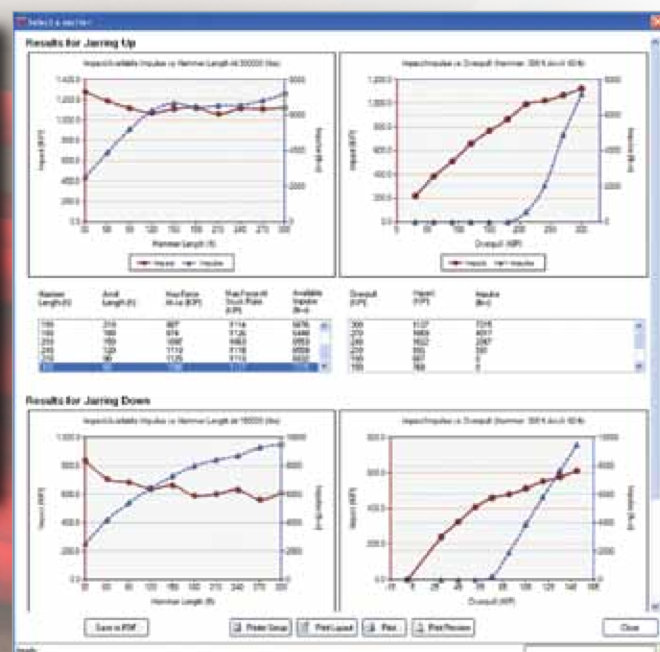
Jar Placement Program

Built upon Microsoft® .NET framework software, the updated Weatherford Jar Placement Program uses stress-wave analysis to help you examine or optimize the location of your jar in your drillstring or fishing assembly.

After years of experience and feedback, we have developed a more user-friendly interface, improved the mathematical functionality, and now provide a clearer, more professional and intuitive output that will help you make better jar-placement decisions.







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Impact Systems

Jar Rotation Hours

Weatherford recommends the following rotation hours for both mechanical and hydraulic drilling jars in a range of tool and hole-size combinations.

Recommended Rotation Hours
Mechanical Jars and Hydraulic Drilling Jars
Underreamers and Shock Tools

Nominal Jar Size (in./*mm*)	**9-1/2** ***241.30***		**7-3/4 to 8** ***203.20***		**6-1/2 to 7** ***165.10***		**6-1/4** ***158.75***		**4-3/4** ***120.65***	
	Hole Size (in./*mm*)	**Hours**	**Hole Size (in./*mm*)**	**Hours**	**Hole Size (in./*mm*)**	**Hours**	**Hole Size (in./*mm*)**	**Hours**	**Hole Size (in./*mm*)**	**Hours**
	12-1/4 *311.15*		9-7/8 *250.83*		8-3/4 *222.25*		7-7/8 *200.03*		6-1/8 *155.58*	
Straight hole	17-1/2 *444.50*	250	12-1/4 *311.15*	250	9-7/8 *250.38*	250	8-3/4 *222.25*	250	6-3/4 *171.45*	250
	26 *660.40*		17-1/2 *444.50*		12-1/4 *311.15*		9-7/8 *250.83*		7-7/8 *200.03*	
	12-1/4 *311.15*	200	9-7/8 *250.83*	250	9-7/8 *250.83*	200	8-3/4 *222.25*	250	6-3/4 *171.45*	200
Directional hole	17-1/2 *444.50*	150	12-1/4 *311.15*	250	12-1/4 *311.15*	150	9-7/8 *250.83*	200	7-7/8 *200.03*	150
	26 *660.40*	100	17-1/2 *444.50*	100						
Hard/abrasive formation	Same as directional hole		Same as directional hole		Same as directional hole		Same as directional hole		Same as directional hole	
Milling operations		50		50		50		50		50
100° to 200°F *38° to 93°C*		250		250		250		250		250
200° to 300°F *93° to 149°C*		250		250		250		250		250
300° to 400°F *149° to 204°C*		200		200		200		200		200
+400°F *+204°C*		100		150		150		150		150

Impulse and Impact

Impulse and impact are terms commonly used in the discussion of jar placement; however, while impact is easily understood, impulse is a harder concept to grasp.

Definitions of these terms are included below to aid interpretation of the jar placement output results. Also included is a technical summary of impulse and its relationship to force, momentum, and time.

Definitions

Impact: The striking of one body against another; collision. The force or impetus transmitted by a collision.

Impulse: The product obtained by multiplying the average value of a force by the time during which it acts. The impulse equals the change in momentum produced by the force in this time interval.

Summary of Introductory Momentum Equations

Impulse is an important concept in the study of momentum. Time passes as a force is applied to an object. When this happens, we say that an impulse is applied to the object. For example, when a tennis racket strikes a tennis ball, an impulse is applied to the ball. The racket puts a force on the ball for a short time. According to Newton's third law of motion, forces come in pairs. So, the ball also puts a force on the racket; and the racket, therefore, also has an impulse applied to it.

Forces applied over time periods impulses.

An impulse is equal to the net force on the object multiplied by the time over which this force is applied. We derive impulse from the equation $F = ma$, which comes from Newton's second law of motion:

$$F = ma$$

$$F = m\frac{\Delta v}{\Delta t}$$

$$F\Delta t = m\Delta v$$

Line 1: Force equals mass multiplied by acceleration.

Line 2: Definition of acceleration.

Line 3: Algebraic rearrangement, the force multiplied by time equals the mass multiplied by the change in velocity.

Impact Systems

The first line is our familiar equation $F = ma$.

The second line expresses the acceleration as the change in velocity divided by the change in time. This is the basic definition of acceleration.

The third line is derived through algebra by multiplying each side of the equation by Δt, canceling it on the right (effectively moving it over to the left).

$$\boxed{F\Delta t} = \boxed{m\Delta v}$$

The impulse (left side) — **The change in momentum** (right side)

The left side of the third line is called the impulse on the object; that is, impulse is equal to the net force multiplied by the length of time over which that force is applied.

The right side of the third line is called the change in momentum. So, we say the impulse equals the change in momentum.

The impulse equals the change in momentum.

Below is a sample calculation for impulse. Imagine that a force of 4.5 lbf (2.0 N) is applied to an object for 3.0 seconds. Here is how to calculate that impulse:

$$Impulse = F\Delta t$$
$$Impulse = (2.0N)(3.0S)$$
$$Impulse = 6.0N \bullet s$$

Line 1: Definition of impulse.

Line 2: Enter example values for force and time.

Line 3: Calculate the resultant impulse.

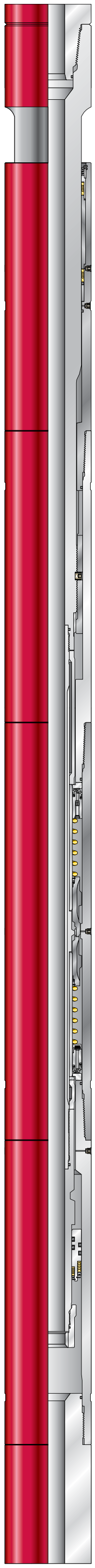
Notice that impulse is measured in N•s (pronounced "Newton seconds") and that change in momentum is measured in kg•m/s (pronounced "kilogram meter per second"). Since the above derivation shows that an impulse is equal to a change in momentum, these two units must be equivalent, and they are. Momentum is typically discussed as kg•m/s unit, while N•s is commonly used in the discussion of impulse; however, there is really nothing wrong with interchanging the use of these units.

Dogleg Severity

Weatherford recommends the following maximum dogleg severities:

Tool Size (in./*mm*)	Type	Maximum Allowable Dogleg (°/100 ft, *°/30.5 m*)	
		Sliding	**Rotating**
9-1/2 *241.3*	Dailey®	12.0	7.0
9-1/2 *241.3*	IPE	12.0	6.5
8 *203.2*	*Dailey*	15.0	8.5
8 *203.2*	IPE	15.0	8.5
7-3/4 *196.9*	*Dailey*	18.0	8.5
7 *177.8*	*Dailey*	18.0	9.5
6-1/2 *165.1*	*Dailey*	20.0	10.5
6-1/2 *165.1*	IPE	20.0	10.0
6-1/4 *158.8*	*Dailey*	20.0	11.0
4-3/4 *120.7*	*Dailey*	25.0	14.0
4-3/4 *120.7*	IPE	25.0	14.0
3-3/8 *85.7*	IPE	25.0	14.0

Values are applicable for both drilling jars and slingers/enhancers.



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

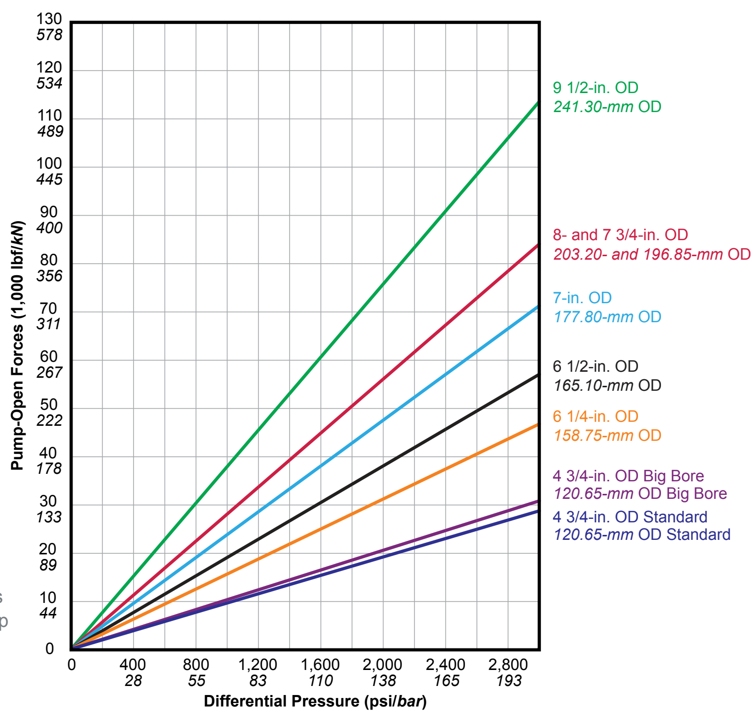
- The one-piece involute spline mandrel provides maximum torque with minimal backlash to ensure effective transfer of drillstring torque through the HDJ. Full torque in either direction can be transmitted at all times without affecting the magnitude or the time delay of the jarring operation. The splines 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 bleedoff 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.

Drilling Jars

Specifications

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*
Circulating pressure (psi/*bar*)	5,000 *345*							
Hydrostatic pressure (psi/*bar*)	None							

*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.



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 *(continued)*

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.

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 pretorqued 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 before 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

The PPE required for using the drilling jar safety clamp is the same as that typically used on drilling rigs. These requirements are determined by other equipment used in conjunction with the servicing of the jar as they require a higher level of protection.

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

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 (preferably 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 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 springs should return the latch to the *closed* position. Be careful while operating the closing mechanism for any finger related injuries. Disregarding 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.

Dailey® Hydraulic Drilling Jar *(continued)*

Opening the HDJ above the Rotary

If the HDJ becomes 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 five 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.

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.)

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 five minutes is required for the jar to trip.

Dailey® Hydraulic Drilling Jar *(continued)*

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 seconds, 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.

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 set down weight	-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.

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.

Dailey® Hydraulic Drilling Jar with Latch

Weatherford's *Dailey* hydraulic drilling jar with latch is designed to provide immediate jarring in either direction to free stuck pipe or bits for improved jarring flexibility and effectiveness.

The jar can be teamed with Weatherford's *Dailey* HyPulse Jar Slinger® to increase the acceleration of the hammer mass for greater impacts.

Applications

- High-angle drillstrings
- Conventional oil and gas wells
- Deviated oil and gas wells

Features, Advantages and Benefits

- In its normal *locked* position, the jar delivers immediate upward or downward blows to free stuck pipe. This two-way flexibility enhances jarring performance.
- The jar comes complete with a mechanical lock mechanism to prevent accidental firing during normal operations and to eliminate the requirement for a safety clamp.
- The hydraulic metering system works independently from fluid viscosity to ensure consistent delay times over the full operating temperature range for optimal performance.

Drilling Jars

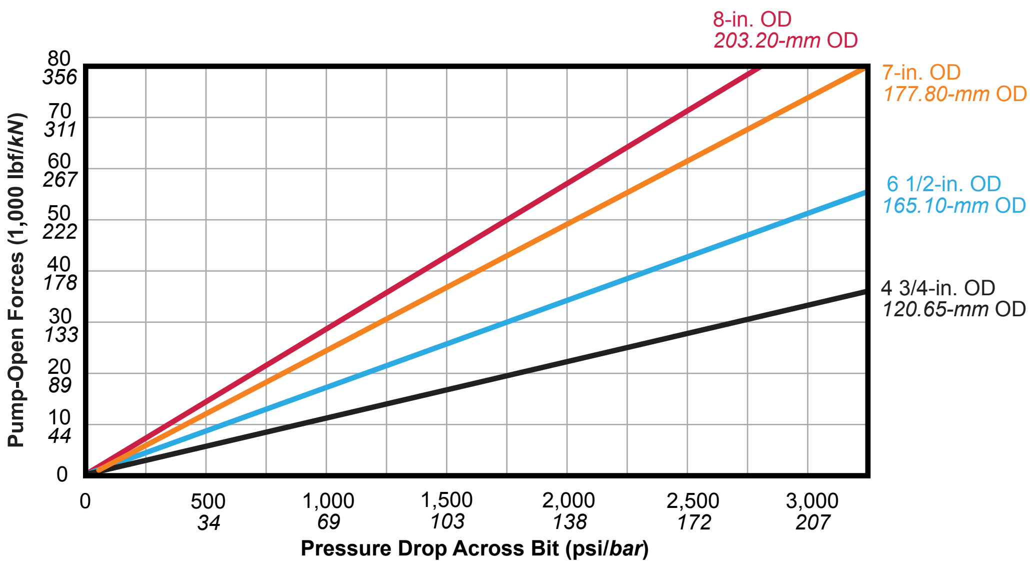
Specifications

OD (in./*mm*)	4-3/4 *120.65*	6-1/2 *165.10*	7 *177.80*	8 *203.20*
ID (in./*mm*)	2.25 *57.15*	2.75 *69.85*		3.00 *76.20*
[1]Tensile yield (lbf/*kN*)	500,000 *2.224*	934,000 *4.155*	1,200,000 *5.338*	1,750,000 *7.784*
Maximum pre-jarring pull (lbf/*kN*)	85,000 *378*	175,000 *778*	220,000 *979*	300,000 *1,334*
Torsional yield (lbf-ft/*kN·m*)	20,000 *27.1*	56,200 *76.2*	71,000 *96.3*	105,000 *142.4*
Maximum temperature (ºF/*ºC*) (standard/high temperature)	400 *204*			
Overall jar stroke (in./*mm*)	15 *381*	17 *432*		19.5 *495*
Poa (in.²/*cm²*)	10.3 *66.5*	19.6 *126.5*	23.8 *153.5*	28.3 *182.6*
Tool length with upper connector (ft/*m*)	33.75 *10.29*	34.50 *10.52*		36 *10.97*
Weight with upper connector (lb/*kg*)	1,600 *725.33*	2,600 *1179.34*	3,500 *1587.57*	4,200 *1905.09*
Standard connections	NC 38	NC 50	5-1/2 FH	6-5/8 Reg
Gap on mandrel in *locked* position (in./*mm*)	8.75 *222.25*	9.63 *244.47*		10.88 *276.22*

Dailey® Hydraulic Drilling Jar with Latch *(continued)*

Specifications *(continued)*

Jar lock tool size settings (in./*mm*)	4-3/4 *120.65*	6-1/2 *165.10*	7 *177.80*	8 *203.20*
Up (lbf/*kN*)	25,000 to 35,000 *111.21 to 155.69*	60,000 to 80,000 *266.89 to 355.86*	60,000 to 80,000 *266.89 to 355.86*	80,000 -100,000 *355.86 to 444.82*
Down (lbf/*kN*)	12,000 to 20,000 *53.38 to 88.96*	25,000 to 35,000 *111.21 to 155.69*	25,000 to 35,000 *111.21 to 155.69*	30,000 to 45,000 *133.44 to 200.17*



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.

Operation

Jarring Up

1. Apply overpull at the jar sufficient to overcome the lock setting. To calculate jar loadings, see the Pump-Open Force graph and the Specifications section.
2. Continue to apply loading as required. Hydraulic metering controls release.
3. Close the jar by applying a sufficient set-down load.
4. Re-engage the lock, and repeat as necessary.

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
Required or maximum overpull	+ 92,000	+ 409
	302,000	1,343
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.

Jarring Down

1. Apply a set-down load at the jar sufficient to overcome the lock setting. To calculate jar loadings, refer to the Pump-Open Force graph and the Specifications section in this document.
2. Continue to apply loading as required. Hydraulic metering then controls release.
3. Open the jar by applying a sufficient pick-up load.
4. Re-engage the lock, and repeat as necessary.

Example: Downward Jarring Jar

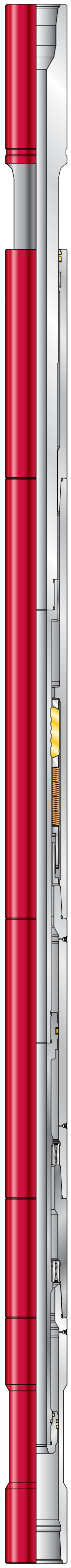
	(lbf)	(kN)
Total string weight	250,000	1,112
Weight below jar	- 40,000	- 178
Weight above jar	210,000	934
Required or maximum overpull	- 37,000	- 165
	173,000	769
Indicator reading to trip jar upward	153,000	680

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

Maintenance

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.



HJ Double-Acting Hydraulic Drilling Jar

Weatherford's HJ double-acting hydraulic drilling jar can provide immediate jarring in either direction to free stuck pipe or bits. This capability results in greater jarring flexibility and effectiveness.

The HJ jar can be teamed with Weatherford's MA drilling impact enhancer to increase the acceleration of the hammer mass for greater impacts.

Applications

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

Features, Advantages and Benefits

- In its normal locked position, the HJ jar delivers immediate upward or downward blows to free stuck pipe. This two-way flexibility enhances jarring performance.
- Fast resetting is achieved by re-engaging the lock to allow continuous up or down jarring.
- The HJ jar comes complete with a mechanical lock mechanism to prevent accidental firing during normal operations and to eliminate the requirement for a safety clamp.
- The hydraulic metering system works independently from fluid viscosity to ensure consistent delay times over the full operating temperature range for optimal performance.

Specifications

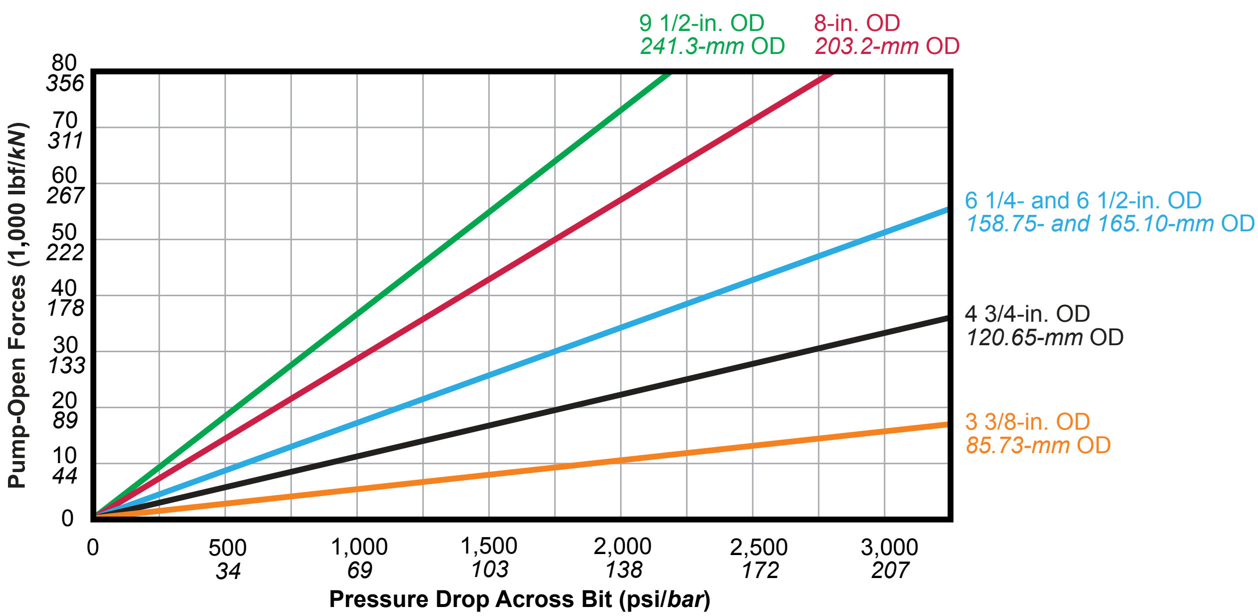
New[a] OD (in./*mm*)	3.420 *86.87*	4.828 *122.63*	6-3/8 *161.93*	6-21/32 *169.07*	8-5/32 *207.17*	9-11/16 *246.06*
Nominal OD (in./*mm*)	3-3/8 *85.73*	4-3/4 *120.65*	6-1/4 *158.75*	6-1/2 *165.10*	8 *203.20*	9-1/2 *241.30*
Nominal ID (in./*mm*)	1.375 *34.93*	2.250 *57.15*	2.520 *64.01*	2.520 *64.01*	2.750 *69.85*	3.000 *76.20*
Standard connections	2-3/8 IF NC26	3-1/2 IF NC38	4-1/2 IF NC50	4-1/2 IF NC50	6-5/8 Reg/FH	7-5/8 Reg
Tensile yield[b] (lbf/*kN*)	164,214 *730*	439,796 *1,956*	827,883 *3,683*	745,094 *3,314*	899,762 *4,002*	1,658,427 *7,377*
Torsional yield[b] (lbf-ft/*kN•m*)	6,840 *9.3*	12,518 *17.0*	41,635 *56.4*	45,980 *62.3*	77,831 *105.5*	140,415 *190.4*
Maximum prejarring pull (lbf/*kN*)	45,000 *200*	100,000 *445*	165,000 *734*	180,000 *801*	295,000 *1,312*	410,000 *1,824*
Tool length (ft/*m*)	16 *4.9*	20 *6.1*				
Tool length c/w top sub (ft/*m*)	31 *9.4*					
Weight (lb/*kg*)	550 *249*	1,000 *454*	1,800 *816*	1,950 *885*	3,000 *1,361*	4,150 *1,882*
Weight c/w top sub (lb/*kg*)	800 *363*	1,500 *680*	2,850 *1,293*	3,000 *1,361*	4,500 *2,041*	6,500 *2,948*
Overall jar stroke (in./*mm*)	21 *533*	18 *457*				
Maximum temperature, standard seals (°F/*°C*)	275 *135*					
Maximum temperature, high-temperature seals[c] (°F/*°C*)	392 *200*					
Pump-open area (in.^{2}/*cm*^{2})	5.4 *34.8*	11.1 *71.6*	16.8 *108.4*	16.8 *108.4*	28.3 *182.6*	35.8 *231.0*
Circulating pressure (psi/*bar*)	5,000 *345*					
Hydrostatic pressure (psi/bar)	None					

[a] New OD is based on nominal OD plus wear allowance.
[b] 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.
[c] The maximum temperature is available upon request only.

HJ Double-Acting Hydraulic Drilling Jar *(continued)*

Specifications

Tool size	(in.)	3-3/8	4-3/4	6-1/4	6-1/2	8	9-1/2
	(mm)	*85.7*	*120.7*	*158.8*	*165.1*	*203.2*	*241.3*
Up	(lbf)	8,000 to 12,000	25,000 to 35,000	60,000 to 80,000		80,000 to 100,000	
	(kN)	*35.6 to 53.4*	*111.0 to 156.0*	*267.0 to 356.0*		*356.0 to 445.0*	
Down	(lbf)	4,000 to 6,000	12,000 to 20,000	25,000 to 35,000		30,000 to 45,000	
	(kN)	*17.8 to 26.7*	*53.0 to 89.0*	*111.0 to 156.0*		*133.0 to 200.0*	



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.

Jarring Up

1. Apply overpull at the jar sufficient to overcome the lock setting. To calculate jar loadings, see the Pump-Open Force graph and the "Specifications" section.
2. Continue to apply loading as required. Hydraulic metering will control release.
3. Close the jar by applying a sufficient set-down load.
4. Re-engage the lock, and repeat as necessary.

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
Mechanical Lock Setting	+ 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.

Jarring Down

1. Apply a set-down load at the jar sufficient to overcome the lock setting. To calculate jar loadings, refer to the Pump-Open Force graph and the Specifications section in this document.
2. Continue to apply loading as required. Hydraulic metering will then control release.
3. Open the jar by applying a sufficient pick-up load.
4. Re-engage the lock, and repeat as necessary.

Example: Downward jarring jar

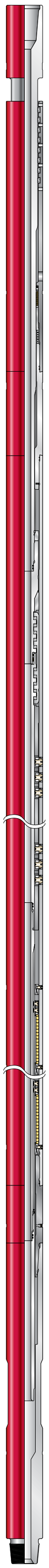
	(lbf)	(kN)
Total string weight	250,000	1,112
Weight below jar	- 40,000	- 178
Weight above jar	210,000	934
Desired or maximum overpull	- 37,000	- 165
	173,000	769
Mechanical Lock Setting	- 20,000	- 89
Indicator reading to trip jar upward	153,000	680

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

Maintenance

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.



Dailey® No-Torque (DNT®) Drilling Jar

Weatherford's *Dailey DNT* mechanical drilling jar is specifically designed to eliminate torque problems associated with hole drag in high-angle drillstrings. This double-acting mechanical jar combines the best features of the proven *Dailey* L.I. mechanical drilling jar and the *Dailey* hydraulic drilling jar. The result is a highly reliable jar for torque-related downhole problems.

The *DNT* jar features upward and downward drillstring tripping using either factory-preset triggering loads or, for specialized downhole conditions, client-specified loads. The jar is delivered operationally ready.

When drillstring sticking occurs, the jar can be activated by simply picking up or slacking off the present triggering load. After triggering, the jar can be instantly recocked by picking up or slacking off the cocking weight.

Applications

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

Features, Advantages and Benefits

- The *DNT* jar is not affected by drilling torque. If sticking occurs while the jar is in the hole, the preset tripping weight can be reached by simply picking up or slacking off to trigger the jar either upward or downward.
- Spring-loaded roller trigger system, proven in the *Dailey* L.I. mechanical drilling jar, has a long-standing reputation for reliability, repeatability, and ease of operation.
- One-piece involute spline mandrel design, proven in the *Dailey* hydraulic drilling jar, provides maximum torque with minimal backlash to ensure effective transfer of drillstring torque through the *DNT* jar in either direction.

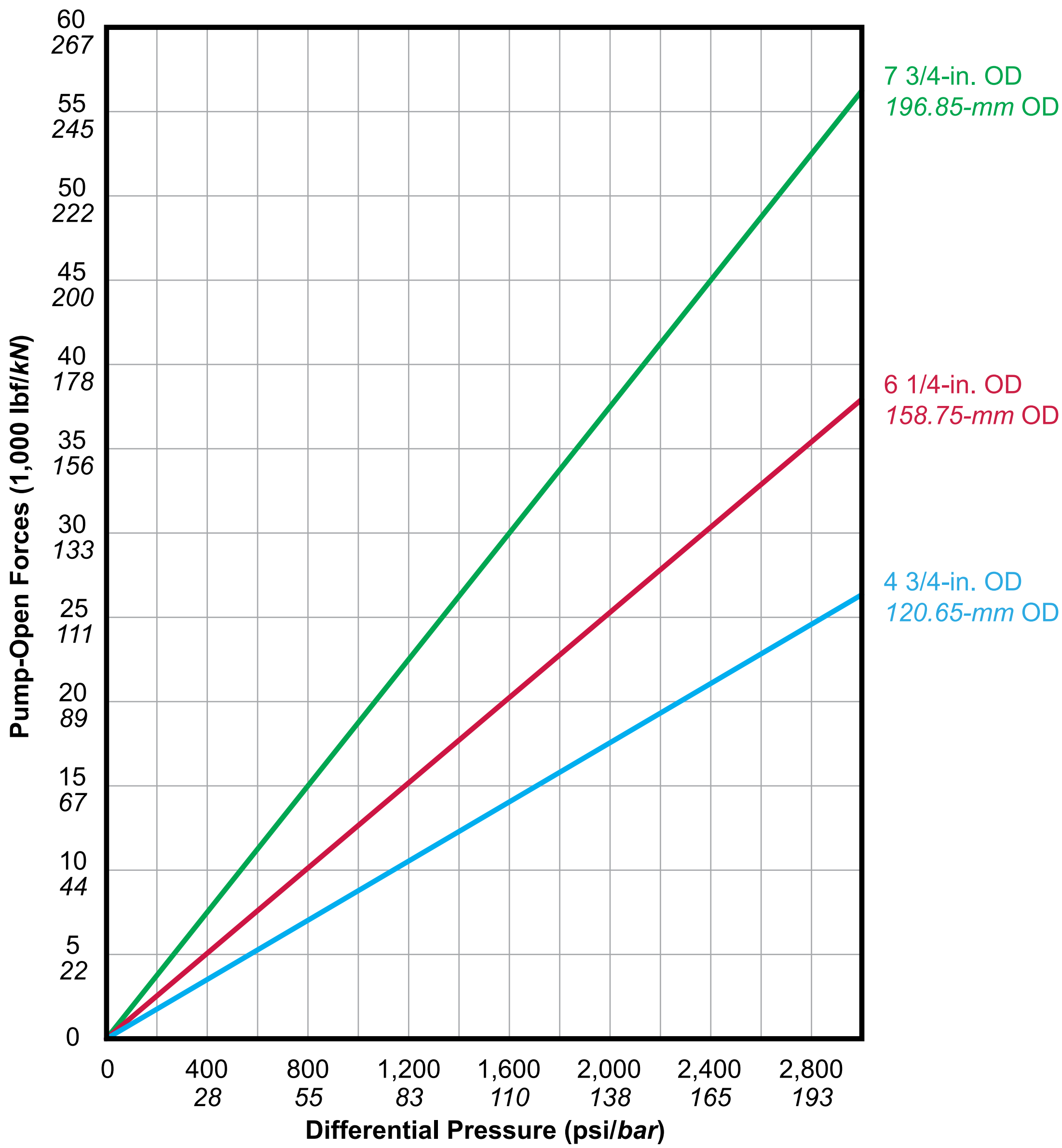
Drilling Jars

Specifications

OD (in./*mm*)	4-3/4 *120.65*	6-1/4 *158.75*	6-1/2 *165.1*	7-3/4 *196.85*
ID (in./*mm*)	2 *50.80*	2-1/4 *57.15*	2-1/4 *57.15*	2-3/4 *69.85*
Tool joint (API)	NC-38 3-1/2 IF	NC-46, 4-1/2 XH, 4-1/2 IF	NC-46, 4-1/2 XH, 4-1/2 IF	6-5/8 Reg
Tensile (lbf/*kN*)	402,600 *1,791*	484,000 *2,151*	484,000 *2,151*	958,000 *4,261*
Torsional (lbf-ft/*kNm*)	24,000 *32.5*	49,500 *67.1*	51,500 *70.2*	100,000 *135.6*
Upstroke factory settings (lbf/*kN*)	69,700 *310*	94,300 *419*	94,300 *419*	102,500 *456*
Downstroke factory settings (lbf/*kN*)	32,900 *146*	37,600 *167*	37,600 *167*	42,300 *188*
Maximum overpull, up/down (lbf/*kN*)	75,000 *334*	118,000 *524*	118,000 *524*	125,000 *556*
Approximate length, extended (ft/*m*)	33.0 *10.1*			34.5 *10.5*
Approximate weight (lb/*kg*)	1,350 *612*	2,500 *1,134*	2,760 *1,253*	4,100 *1,860*
Free-travel upstroke (in./*mm*)	8 *203*	7-1/8 *181*	7-1/8 *181*	8 *203*
Free-travel downstroke (in./*mm*)	8 *203.20*			
Total stroke (in./*mm*)		15-1/8 *384*	15-1/8 *384*	16 *406*
Maximum bottomhole temperature (°F/*°C*)	325 *163*			
Pump-open area (in.^{2}/*cm*^{2})	8.9 *57.4*	12.6 *81.3*	12.6 *81.3*	18.7 *120.6*

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

Dailey® No-Torque (DNT®) Drilling Jar *(continued)*



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.

Operation

The DNT® jar is delivered with a mandrel clamp, which remains in place until the jar is ready for running through the rotary.

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

Caution: Never run the jar directly between drill collars and heavyweight drillpipe or between collar strings with different ODs. Excessive stress can occur at OD-size transition points and can lead to premature tool failure. The same size collars or heavyweight drillpipe should be run directly above and directly below the jar.

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

Upstroke, downstroke, and cocking weights can vary with hole drag, and allowances must be made to compensate for this variance.

Caution: Do not use tongs to try to uncock or stretch open the *DNT* jar, and never attempt to close or open the *DNT* jar on the rig floor. Unintentional operation of the tool on the rig floor could lead to serious injury.

Caution: Never run the *DNT jar* in close proximity to another *DNT* jar 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.

Dailey® No-Torque (DNT®) Drilling Jar *(continued)*

Jarring Upward

Picking up on the drillstring puts the jar in the cocked position. Slacking off the drillstring until the jar's setting force is reached trips the jar. Picking up the drillstring until reaching slightly above "weight above jar" (typically indicated by free travel and a slight movement on the weight indicator) recocks the jar for jarring down.

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
Mechanical lock setting	+ 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.

Jarring Downward

Picking up on the drillstring weight above the jar puts the tool in the cocked position. Slacking off the drillstring until jar setting is reached trips the jar. Picking up on the drillstring to slightly below the weight of the string above the jar recocks the jar. Typically, a noticeable sign, such as a bobble of the weight indicator, demonstrates that the jar has completed its free travel and is recocked.

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
Jar setting for jarring down	- 37,000	- 165
	173,000	769
Hole drag	- 20,000	- 89
Indicator reading to trip jar downward	153,000	680

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

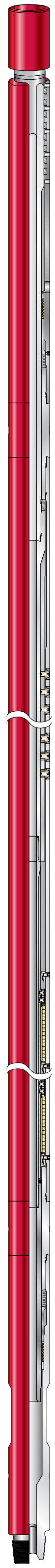
In most cases, the downward stroke of the jar is not as noticeable as the upward stroke. In deep holes and particularly when using a small jar, downward tripping can often only be detected from the weight indicator. In fluid holes where pump pressure can affect the down-jarring results, if possible, reduce the pump to idle before attempting to cock and jar.

Dailey® No-Torque (DNT®) Drilling Jar *(continued)*

Maintaining the Jar

Take the following steps each trip out of the hole:

1. Wash the mud from around the mandrel and through the holes and slots in the upper part of the case to keep mud from hardening or setting in the body (between the mandrel and the case). Hardened mud can affect the proper operation of the jar.
2. Check all roller welds and torque pins for possible leakage. If a washout is suspected, hook up the kelly and pump through the tool.
3. If the *DNT* jar comes out of the hole in the upstroke or stretched-open position (16 in./406 mm of mandrel showing), replace the mandrel clamp to rack back. If the jar comes out of the hole in the neutral or cocked position (8 in./203 mm of mandrel showing), leave the jar cocked and rack back. (To run back in the hole, leave cocked and proceed.)



Dailey® L.I. Mechanical Drilling Jar

Weatherford's patented *Dailey* L. I. mechanical drilling jar, with its spring-loaded trigger system, has long served as the industry standard for mechanical jars. The reputation of this tool comes from its reliability and repeatability and its versatility and ease of operation in conventional wells.

Applications

- Freeing stuck pipe in all conventional nondeviated oil and gas wells with inclination up to 30°
- Freeing stuck pipe in harsh downhole environments
- Geothermal applications

Features, Advantages and Benefits

- Mechanical tripping system provides immediate triggering once the required overpull is reached. This feature makes it easy to anticipate the tripping of the tool.
- The heavy-wall mandrel provides maximum torque and minimum backlash to ensure that the drillstring torque is transmitted through the tool.
- Internal components are constructed to handle the effects of corrosion and abrasion in virtually any downhole environment.

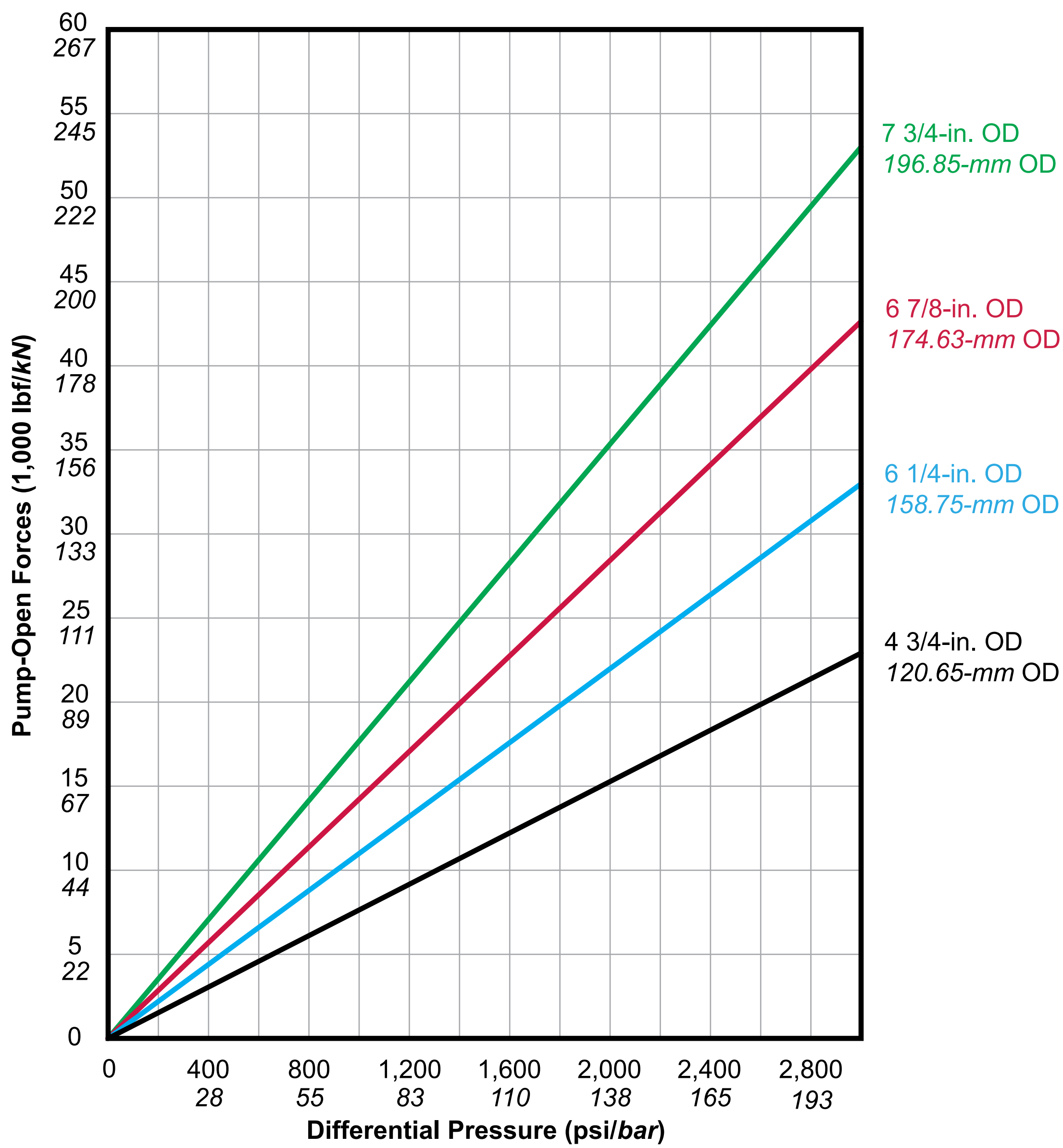
Dailey® L.I. Mechanical Drilling Jar *(continued)*

Specifications

OD (in./*mm*)	4-3/4 *120.65*	6-1/4 *158.75*	6-7/8 *174.63*	7-3/4 *196.85*
ID (in./*mm*)	2 *50.80*	2-1/4 *57.15*	2-1/2 *63.50*	2-3/4 *69.85*
Tool joint (API)	NC-38 3-1/2 IF	NC-46, 4-1/2 XH, 4 IF	5-1/2 Reg	6-5/8 Reg
Tensile (lbf/*kN*)	440,000 *1,957*	740,000 *3,292*	962,000 *4,279*	1,148,000 *5,107*
Torsional (lbf-ft/*kN•m*)	15,000 *20.3*	27,200 *36.9*	46,000 *62.4*	66,300 *89.9*
Circulating pressure (psi/*bar*)	5,000 *345*			
Hydrostatic pressure (psi/*bar*)	None			
Upstroke factory settings (lbf/*kN*)	69,700 *310*	94,300 *419*	98,400 *438*	102,500 *456*
Downstroke factory settings (lbf/*kN*)	32,900 *146*	37,600 *167*	40,600 *181*	42,300 *188*
Maximum overpull, up/down (lbf/*kN*)	75,000 *334*	118,000 *524*	120,000 *534*	125,000 *556*
Approximate length, extended (ft/*m*)	30.5 *9.3*	34.0 *10.4*	34.5 *10.5*	35.5 *10.8*
Approximate weight (lb/*kg*)	1,340 *608*	2,500 *1,134*	3,150 *1,429*	4,000 *1,814*
Free-travel upstroke (in./*mm*)	8-5/8 *219*	7-1/8 *181*	7-7/8 *200*	7-3/4 *197*
Free-travel downstroke (in./*mm*)	8 *203*	8 *203*	8 *203*	8-1/4 *210*
Maximum bottomhole temperature (°F/°*C*)	325 *163*			
Maximum bottomhole temperature, high-temperature packing kit (°F/°*C*)	500 *260*			
Pump-open area (in.^{2}/*cm*^{2})	7.7 *49.7*	11.0 *71.0*	14.2 *91.6*	17.7 *114.2*

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

Dailey® L.I. Mechanical Drilling Jar *(continued)*



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.

Operation

The L.I. mechanical drilling jar is delivered to the work site in the cocked position. Approximately 8 in. (203 mm) of mandrel is exposed. The jar is usually cocked when it is pulled out of the hole.

Weatherford recommends running the jar uncocked in the hole; however, the jar may be run in the cocked position in certain circumstances, such as fishing operations.

Uncocking the Jar

1. If using heavyweight drillpipe (HWDP) or collars above the jar, set the slips on the body of the jar, below the mandrel.
2. Unlock the rotary.
3. Using two sets of tongs, rotate the mandrel 1/8 turn to the left.
4. Hold the 1/8 turn, and pick up the string to open the jar. At this point, about 16-in. (406-mm) of mandrel will be exposed.
5. Pull the slips.
6. Run the jar in the hole.

Important: Do not turn mandrel more than 1/8 turn to the left. Doing so will unscrew the connection and cause the tool to leak.

Placing the Jar in the String

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

Caution: Do not run the jar directly between drill collars and HWDP or directly between collar strings of different ODs. Excessive stress occurs in the OD-size transition points and can cause the tool to crack and break, leaving the BHA and the bottom portion of the tool in the hole. Run collars of the same size or HWDP directly above and directly below the jar.

Important: Avoid running the jar below reamers, stabilizers, key-seat wipers, or any tool with an OD larger than that of the jar. Doing so can restrict jar function.

Jarring Upward

1. Cock the jar. Slack off drillstring weight above the jar to the cocked position.
2. Pull on the drillstring until the jar's setting force is reached to trip the jar.
3. Recock the jar. Slack off on the drillstring until slightly below the weight of the string above the jar. A noticeable sign, such as a bobble or the weight indicator needle, will indicate that the jar has completed the free travel and has recocked.

Example: Estimating total indicator weight (string, block, hook, swivel)

	(lbf)	(kN)
Total string weight	250,000	1,112
Weight below jar	- 40,000	- 178
Weight above jar	210,000	934
Jar setting for jarring up	+ 94,300	+ 419
	304,300	1,353
Hole drag	+ 20,000	+ 89
Indicator reading to trip jar upward	324,300	1,442

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

Dailey® L.I. Mechanical Drilling Jar *(continued)*

Jarring Downward

1. Cock the jar. Pick up drillstring weight above the jar to the cocked position.
2. Slack off drillstring until the jar's setting force is reached to trip the jar.
3. Recock the jar. Pick up on the drillstring until the reading on the weight indicator is slightly above the "weight above jar." Free travel and slight movement on the weight indicator will indicate that the jar has recocked.

Example: Estimating total indicator weight (string, block, hook, swivel)

	(lbf)	(kN)
Total string weight	250,000	1,112
Weight below jar	- 40,000	- 178
Weight above jar	210,000	934
Jar setting for jarring down	- 37,600	- 167
	172,400	767
Hole drag	- 20,000	- 89
Indicator reading to trip jar upward	152,400	678

Pick up from 200,000 to 240,000 lbf (890 to 1,068 kN) to recock the jar.

Note:

- The downward stroke is not as noticeable in most cases as the upward stroke. In deep holes and when a small jar is used, downward tripping can be detected by the weight indicator only.
- In fluid holes, pump pressure affects cocking and down jarring. Reduce pump to idle before attempting to cock and jar down.
- Hole drag and torque friction can cause the specified upstroke, downstroke, and cocking weights to vary. Torque friction can trap drilling torque in the string above the jar at the moment of sticking. To trip the jar under these circumstances, additional pull is required. Applying left-hand torque to the jar will return the jar to its original settings.

Jarring

To make the jar trip at a higher load, apply and hold right-hand torque to the drillstring a half-round at a time until the intended setting is achieved. Excessive right-hand torque makes it impossible to pull enough to trip the jar. If too much right-hand torque is applied, simply release the torque; the jar will return to its original setting.

To make the jar trip at a lighter load, apply and hold left-hand torque to the drillstring a half-round at a time until the intended setting is achieved. Excessive left-hand torque holds the jar out of the latch and diminishes the jarring effect. To remedy this situation, simply release the left-hand torque; the jar will return to its original setting.

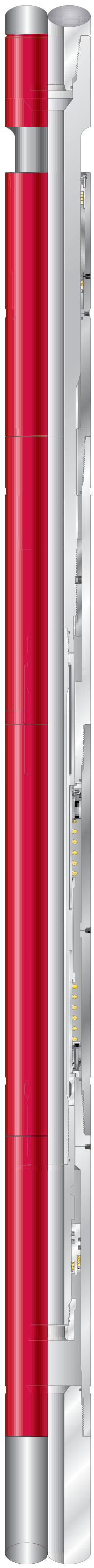
Maintaining the Jar

Take the following steps each trip out of the hole:

1. Wash the mud from the polished mandrel and through the holes and slots in the upper part of the case to keep the mud from hardening or setting in the body.

   Important: Hardened mud can adversely affect proper operation of the jar.

2. Test the jar mechanism. Use two sets of tongs, and repeat the procedure for stretching the jar as explained in “Uncocking the Jar.” Ensure that the mandrel strokes in both directions from the cocked position.
3. Check all roller welds and torque pins for possible oil leakage. If washout is suspected, hook up the kelly, pump through the tool under pressure, and check for leaks.



Dailey® HyPulse Jar Slinger® Drilling Tool

Weatherford's patented *Dailey HyPulse Jar Slinger* drilling tool is designed for use in conjunction with a drilling jar to maximize the impact forces.

Applications

- All conventional, deviated, and extended-reach 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 tool.
  Full torque can be transmitted through the tool at all times without affecting the operation of the slinger.
- The tool requires nothing more than axial motion for operation. The drillers need only be concerned with the operation of the drilling jar.
- The design of this tool provides the storage of energy required to maximize the effectiveness of the jar.

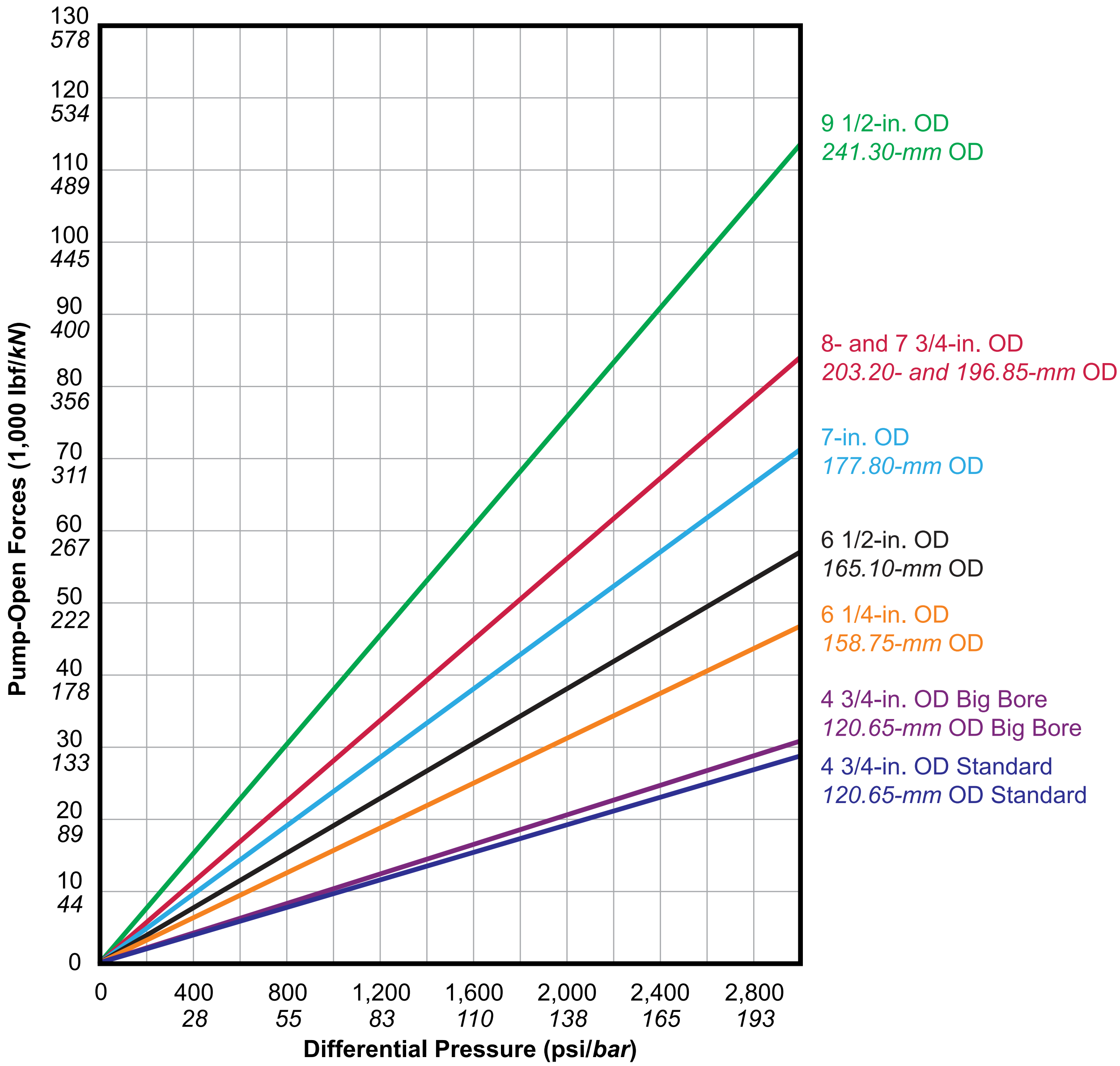
Drilling Accelerators

Specifications

OD (in./*mm*)	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*)	2-1/4 *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-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*)	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*)	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*)	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*)	32.0 *9.8*	33.0 *10.1*	33.0 *10.1*	33.0 *10.1*	33.0 *10.1*	33.0 *10.1*	35.5 *10.8*
Approximate weight (lb/*kg*)	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*)	7.50 *191*	8.25 *210*	8.50 *216*	8.50 *216*	9.75 *248*	9.75 *248*	9.75 *248*
Maximum bottomhole temperature (°F/°*C*)	400 *204*						
Pump-open area (in.^{2}/*cm*^{2})	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*
Circulating pressure (psi/*bar*)	5,000 *345*						
Hydrostatic pressure (psi/*bar*)	N/A						

* 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® HyPulse Jar Slinger® Drilling Tool *(continued)*



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.

Operation

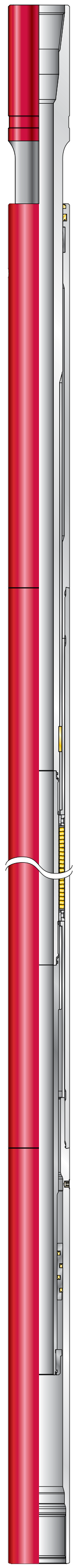
Run the tool above the jar with adequate joints of heavyweight pipe or drill collars between it and the jar. If down-jarring is anticipated, run several joints of heavyweight pipe or drill collars above the tool. The weight above the slinger compresses the fluid during down-jarring, and this compression within the slinger accelerates the weight between jar and slinger downward when the jar releases. The load that the drawworks places on the drillpipe as the pipe is pulled to actuate the jar compresses the fluid during up-jarring. When the jar releases, the fluid compressed within the tool and the stretch of the pipe above it causes the weight between the jar and tool to accelerate upward. For down-jarring the string weight compresses the fluid. When the jar releases, the compressed fluid and the pipe weight accelerate the weight between the jar and tool downward.

The tool is not affected by drilling torque. No pipe manipulation, other than axial motion, is required for operating this tool. If left in tension or compression for an extended period of time, as in normal drilling operations or when the tool is "racked back," the tool will slowly open or close, depending on the direction in which it is loaded. Therefore, when beginning the jarring operation, slack off or pick up enough weight to ensure that the pressure chamber is filled before pulling on the drillpipe.

Maintenance

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.



MA Drilling Impact Enhancer

Weatherford's patented MA drilling impact enhancer is designed for use in conjunction with a drilling jar to maximize the impact forces delivered to the stuck point during jarring operations.

The enhancer features mechanical action both upward and downward to maximize impact and jarring performance. Placed in the string above the jar, the enhancer adjusts automatically to the load applied up or down to provide maximum acceleration of the hammer mass and increased impact and impulse values.

Applications

The MA drilling impact enhancer is designed for use in all conventional, deviated, and extended-reach wells, including:

- Demanding drilling conditions
- Shallow jarring operations
- Extended-reach-drilling jarring operations
- High-temperature applications

Features, Advantages and Benefits

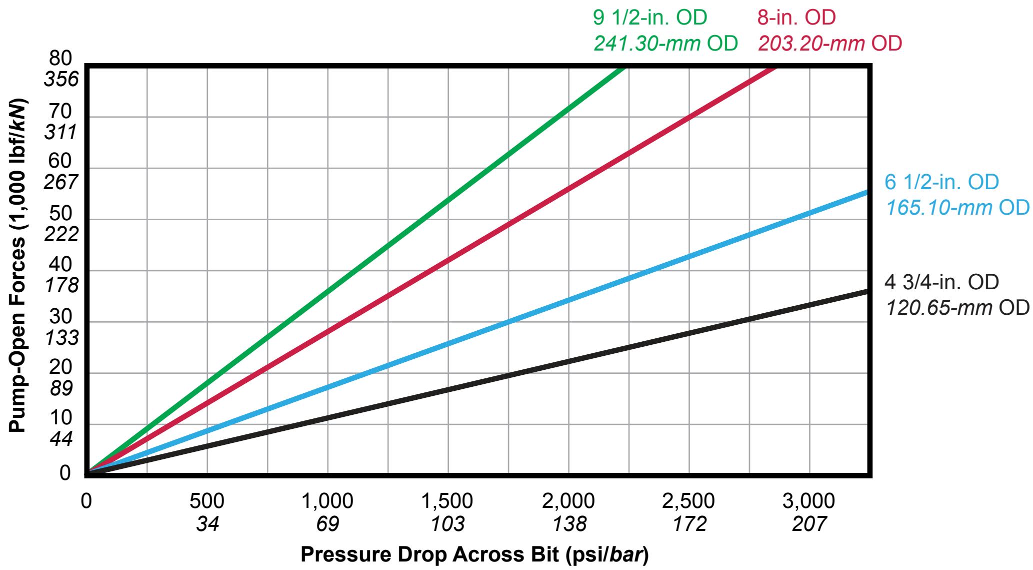
- Unique steel-disk spring system enables upward/downward mechanical action, which increases acceleration of the hammer mass to improve impact and impulse for greater jarring efficiency.
- Bidirectional steel-disk spring system also absorbs and minimizes shock waves during jarring operations to reduce strain on surface equipment.
- Several features make the MA drilling impact enhancer a strong and durable tool:
  - Heat-treated, high-strength steel is tested to meet severe tensile, torsional, impact, and hardness requirements.
  - The combination of design and high-strength steels with stress-relieved threaded connections and load-bearing parts creates one of the most rugged and durable accelerators available today.
  - The accelerator is not affected by high temperatures.

Specifications

New[a] OD (in./*mm*)	4.844 *123.04*	6-21/32 *169.07*	8-5/32 *207.16*	9-11/16 *246.07*
Nominal OD (in./*mm*)	4-3/4 *120.65*	6-1/2 *165.10*	8 *203.20*	9-1/2 *241.30*
Nominal ID (in./*mm*)	2.250 *57.15*	2.520 *64.01*	2.813 *71.45*	3.000 *76.20*
Standard connections	3-1/2 IF NC38	4-1/2 IF NC50	6-5/8 Reg/FH	7-5/8 Reg
Tensile yield[b] (lbf/*kN*)	480,000 *2,135*	916,000 *4,075*	1,681,000 *7,477*	1,942,000 *8,638*
Torsional yield[c] (lbf-ft/*kN•m*)	12,518 *17.0*	45,980 *62.3*	77,831 *105.5*	140,415 *190.4*
Maximum pre-jarring pull (lbf/*kN*)	100,000 *445*	180,000 *801*	295,000 *1,312*	410,000 *1,824*
Tool length (ft/*m*)	23 *7.0*			
Tool length c/w top sub (ft/*m*)	31 *9.4*			
Weight (lb/*kg*)	1,000 *454*	2,250 *1,021*	3,400 *1,542*	4,750 *2,155*
Weight c/w top sub (lb/*kg*)	1,500 *680*	3,000 *1,361*	4,600 *2,087*	6,400 *2,903*
Overall jar stroke (in./*mm*)	14 *356*			
Maximum temperature, standard seals (°F/*°C*)	275 *135*			
Maximum temperature, high-temperature seals[d] (°F/*°C*)	392 *200*			
Pump-open area (in.^{2}/*cm^2*)	11.0 *71.0*	16.8 *108.4*	28.3 *182.6*	35.8 *231.0*
Circulating pressure (psi/*bar*)	5,000 *345*			
Hydrostatic pressure (psi/*bar*)	None			

[a] New OD is based on nominal OD plus wear allowance.
[b] Tensile yield is based on nominal OD and the published yield strength of material.
[c] Torsional yield is based on the weakest tool joint connection at nominal OD and calculated per API RP7G and the published yield strength of material.
[d] The maximum temperature is available upon request only.

MA Drilling Impact Enhancer *(continued)*



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.

Operation

Run the enhancer above the jar with adequate joints of heavyweight pipe or drill collars between it and the jar. If down-jarring is anticipated, run several joints of heavyweight pipe or drill collars above the enhancer. The weight above the enhancer compresses the mechanical springs during down-jarring. After the jar releases,this compression accelerates the weight between the jar and enhancer downward. The load that the drawworks places on the drillpipe as the pipe is pulled to actuate the jar compresses the springs during up-jarring. After the jar releases, the spring force within the enhancer and the stretch of the pipe above it cause the weight between the jar and enhancer to accelerate upward to impact.

The enhancer is not affected by drilling torque. No pipe manipulation, other than axial motion, is required for operating this tool.

Caution: Avoid placement at the transition point between the bottomhole assembly and the string or near stabilizers to prevent excessive loading on the tool and possible premature failure.

Maintenance

Take the following steps each trip out of the hole:

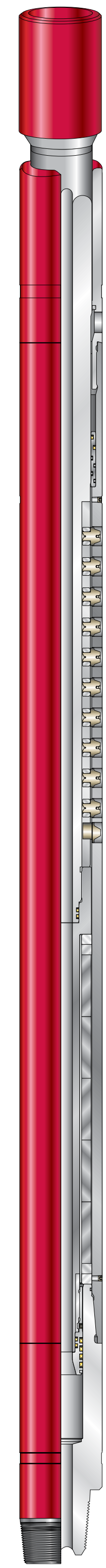
1. Wash the mud from the polished mandrel and from inside the bottom connection.
2. Check the polished mandrel carefully for any signs of corrosion, pitting, or flaking of the coating.

Dailey® R-A-M® Shock Absorber

Weatherford's patented *Dailey R-A-M* shock absorber is a time-proven first line of defense against excessive drill-bit wear and drillstring damage caused by string shock and vibration. The primary benefit of shock absorption is the allowance of optimal weight and rotary speeds while drilling, which translates to increased penetration rates and lower drilling costs per foot.

Incorporating the field-proven Roll-A-Matic® roller/spline drive mechanism, the shock absorber uses drive rollers that ride almost friction-free in the splined mandrel as drilling weight is attained. The rollers transfer torque from the rotary table, through the barrel, directly to the bit. A stacked column of fluid and temperature-resistant rubber elements absorbs vibration while floating pistons equalize internal and external pressure. A unique linear motion bushing reduces mandrel wear, increases stabilization, and virtually eliminates hole deviation.

The *Dailey R-A-M* shock absorber activates immediately and is not limited by drilling weight, torque, type of drilling fluid, or flow rates. It can be modified for high-temperature applications. The shock absorber performs best if placed as close to the drill bit as possible; but, with its unique design, it can be run anywhere in the drillstring.



Applications

- All drilling operations
- High-temperature applications (up to 400°F/204°C)

Features, Advantages and Benefits

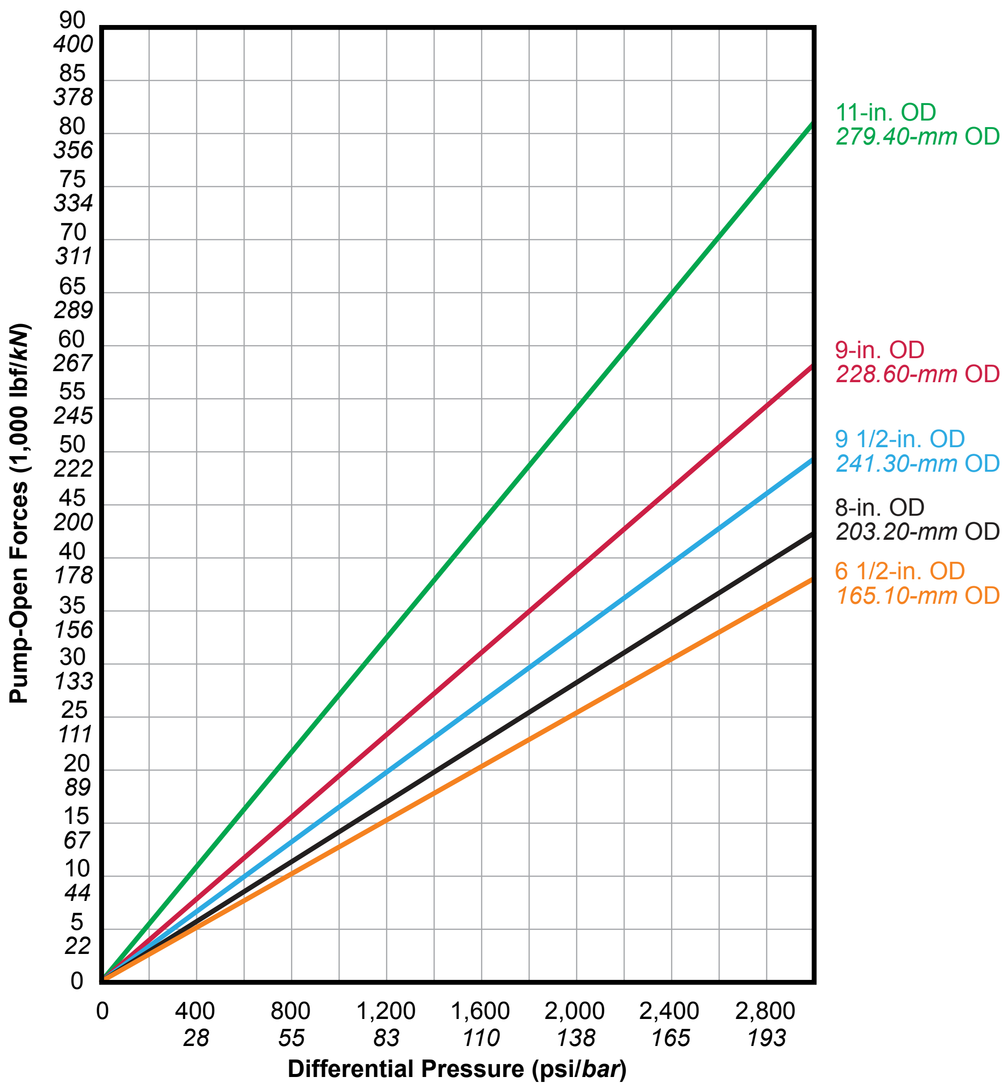
- The *Dailey R-A-M* shock absorber is entirely mechanical. Drilling or hydraulic fluids, which could leak and cause downhole pressure to drop, are not required.
- The shock absorber can be run in tension or in compression for operational flexibility.
- The shock absorber works immediately, without preloading, for operational efficiency.
- Drive rollers minimize friction on the reciprocating motion of the shock absorber to reduce wear and prolong the life of the tool.
- Special rubber elements provide high vibration reduction capability.

Dailey® R-A-M® Shock Absorber *(continued)*

Specifications

OD (in./*mm*)	6-1/2 *165.10*	8 *203.20*	9 *228.60*	9-1/2 *241.30*	11 *279.40*
ID (in./*mm*)	2 *50.80*	2-1/4 *57.15*	2-1/2 *63.50*		2-3/4 *69.85*
Tool joint size (API), top	4-1/2 IF 4-1/2 XH	6-5/8 Reg.	7-5/8 Reg.		
Tool joint size (API), bottom	4-1/2 Reg.	6-5/8 Reg.			7-5/8 Reg.
Tensile yield[1] (lbf/*kN*)	179,000 *796*	598,000 *703*		1,700,000 *7,562*	1,046,000 *4,653*
Torsional yield (lbf-ft/*kN•m*)	35,000 *47.5*	115,000 *155.9*	168,000 *227.8*		364,000 *493.5*
Length (ft/*m*)	12.5 *3.8*	14.0 *4.3*	14.5 *4.4*	18.0 *5.5*	15.0 *4.6*
Weight (lb/*kg*)	1,030 *467*	2,000 *907*	2,400 *1,089*	4,000 *1,814*	4,025 *1,826*
Hole size range (in./*mm*)	7-7/8 to 8-3/4 *200.0 to 222.3*	8-1/2 to 12-1/4 *215.9 to 311.2*	9-5/8 to 14-3/4 *244.5 to 374.7*	12-1/4 to 17-1/2 *311.2 to 444.5*	14-3/4 to 26 *374.7 to 660.4*
Dynamic spring rate[2] (x 1,000 lbf/in., N/*mm*)	63 *11*	90 *16*			110 *19*
Maximum weight on bit (x 1,000 lbf/1,000 *N*)	65 *289*	90 *400*	110 *489*		130 *578*
Lateral deflection ratio[3]	1.24:1	1.21:1	1.18:1		1.14:1
Maximum bottomhole temperature (°F/*°C*)	400 *204*				
Pump-open area (in.^{2}/*cm*^{2})	12.57 *81.1*	14.19 *91.6*	19.63 *126.6*	17.70 *114.2*	27.11 *174.9*

[1]Tensile and torsional yield values are calculated per API RP7G, based on nominal dimensions and published yield strength of material, and do not constitute a guarantee, actual or implied.
[2]Dynamic spring rate values are based on calculations.
[3]These values represent the ratio of deflection of the shock absorber to a drill collar of the same OD, ID, and length under comparable loading conditions.



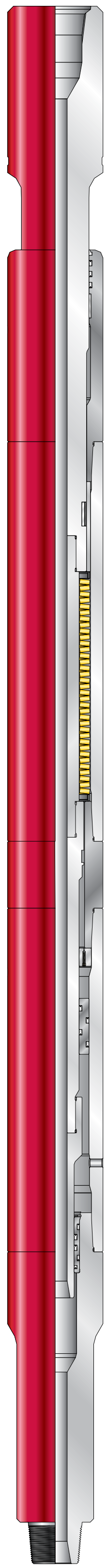
Options

The *Dailey R-A-M* shock absorber can be modified for high-temperature applications.

Maintenance

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.



O.S.T. Shock Tool

Weatherford's shock tool plays an important role in drilling operations, extending bit, motor, and surface-equipment life by reducing bit bounce and impact loads and absorbing shock loads. The tool uses steel disk springs, hydraulic pump-open force, and a one-way dampening valve to reduce weight-on-bit (WOB) variation. During drilling, the tool is usually run partially in compression, enabling it to extend or compress as required to keep the bit on bottom for optimal rate of penetration (ROP), enhanced drilling efficiency, and reduced drilling costs.

Spring rates can be adjusted to as low as 4,000 lbf/in. (452 N•m) if required for low-WOB operations.

The one-way dampening valve restricts oil flow in one direction only, between the balancing chamber below the valve and the spring chamber above the valve. Oil restriction in the closing stroke would tend to stiffen the spring rate; but on the closing stroke, as the bit rolls over a high spot, the dampening valve allows unrestricted oil flow from the spring housing to the balance housing, allowing the tool to close against spring resistance only. The valve then seats, causing an oil restriction so that the pump-open force cannot be applied fully to reopen the tool; therefore, the bit's generated force is not stored and fully returned to the bit, as a certain amount is dissipated through the oil restriction.

Applications

- Full range of WOB applications
- Low bit weights with high pump pressures
- High-temperature holes

Features, Advantages and Benefits

- The shock tool extends bit life and enhances ROP by reducing bit bounce, impact loads, and WOB variation through the action of steel disk springs, hydraulic pump-open force, and a one-way dampening valve.
- The tool enhances the service life and performance of surface equipment by reducing shocks and cushioning impacts.
- The tool is sprung in both directions for effectiveness with low bit weights and high pump pressures.
- Spring rates can be adjusted to as low as 4,000 lbf/in. (701 N•m) for operational flexibility.
- The one-way dampening valve allows unrestricted oil flow from the spring housing to the balance housing, allowing the tool to close against spring resistance only.
- Drilling accuracy is enhanced because the shock tool has a stabilized spline that will not build angle.

Features, Advantages and Benefits *(continued)*

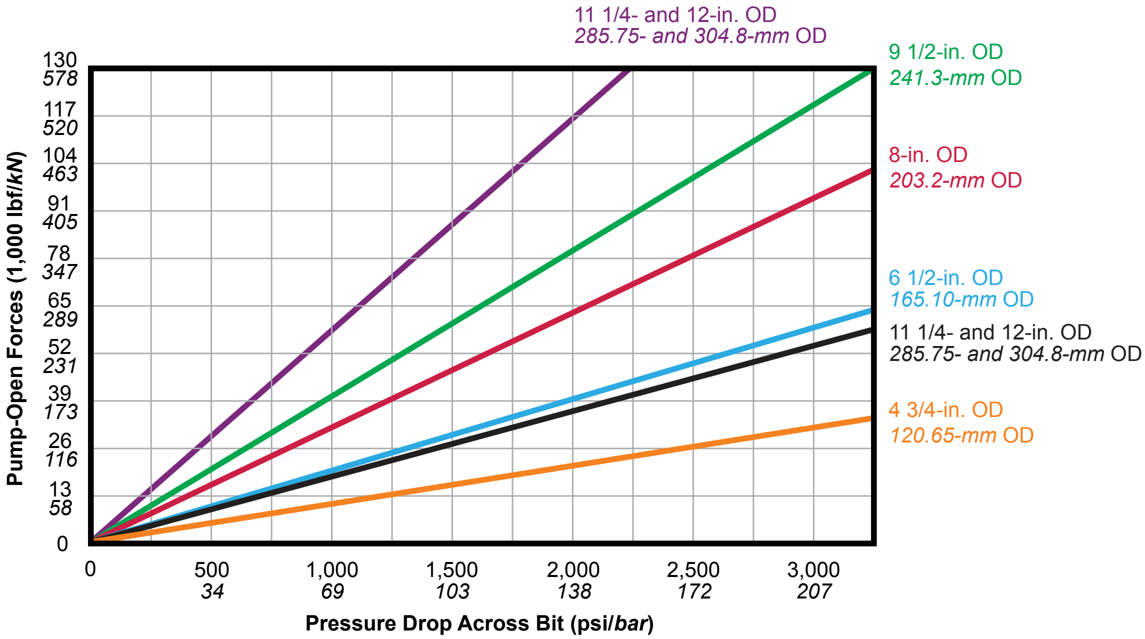
- Minimum-friction drive allows free vertical movement, enhancing the performance of this tool.
- When jarring becomes necessary, an overpull brings the retaining ring in contact with the pin on splined housing. This metal-to-metal contact causes the tool to act as an integral part of the bottomhole assembly (BHA), eliminating any adverse reaction from the spring system during jarring.

Specifications

New OD[a] (in./*mm*)	4.844 *123.04*	6.656 *169.06*	8.156 *207.16*	9.688 *246.07*	11.250 *292.10*	12.000 *311.15*
Nominal OD (in./*mm*)	4-3/4 *120.65*	6-1/2 *165.10*	8 *203.20*	9-1/2 *241.30*	11-1/4 *285.75*	12 *304.80*
ID (in./*mm*)	1.500 *38.10*	2.520 *64.01*	2.750 *69.85*	3.000 *76.20*	3.000 *76.20*	3.000 *76.20*
Tensile yield[b] (lbf/*kN*)	328,300 *1,460*	454,800 *2,023*	825,000 *3,670*	1,350,000 *6,005*	1,482,000 *6,592*	1,482,000 *6,592*
Torsional yield[c] (lbf-ft/*kN•m*)	14,426 *20.91*	39,996 *54.22*	81,166 *110.04*	140,415 *190.37*	190,812 *258.70*	219,429 *297.50*
Maximum temperature[e] (°F/°C)	392 *200*					
Pump-open area (in.^{2}/*cm*^{2})	11.0 *71.0*	19.6 *126.5*	30.7 *198.1*	41.3 *266.5*	56.7 *365.82*	56.7 *365.82*
Approximate tool length (ft/*m*)	12 *3.7*	12 *3.7*	14 *4.3*	16 *4.9*	16 *4.9*	16 *4.9*
Approximate tool weight (lb/*kg*)	600 *272*	1,000 *454*	1,800 *816*	3,000 *1,361*	4,300 *1,950*	4,845 *2,198*
Standard connections	3-1/2 IF	4-1/2 IF	6-5/8 Reg	7-5/8 Reg	8-5/8 Reg	8-5/8 Reg
Spring rate[d] (lbf/in. [*N•m*] in either direction)	18,000 *3,152*	18,000 *3,152*	18,000 *3,152*	25,000 *4,378*	35,000 *6,129*	35,000 *6,129*
Circulating pressure (psi/*bar*)	5,000 *345*					
Hydrostatic pressure (psi/*bar*)	N/A					

[a] New OD is based on nominal OD plus wear allowance.
[b] Tensile yield is based on nominal OD and the published yield strength of the material.
[c] Torsional yield is based on tool joint connections at nominal OD and is calculated per API RP7G and the published yield strength of the material.
[d] Spring rate can be adjusted to as low as 4,000 lb/in. (701 N/mm) of travel, as required for the application.
[e] The maximum temperature is available upon request only.

O.S.T. Shock Tool *(continued)*



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.

Operation

The shock tool incorporates a pressure-balancing piston that equalizes pressure inside the tool with pressure inside the drillstring. The piston also guarantees pressure lubrication throughout the tool. As a result of a difference in pressure inside and outside the tool or pressure drop across the bit, the tool tends to open an amount equal to the pressure drop across the bit, multiplied by the cross-sectional area of the splined mandrel at the seal area.

If the hydraulic force extending the tool exceeds the bit weight, the tool opens, compressing the springs, until the bit weight and load carried by the springs equal the pump-open force. If the pump-open force is less than the bit weight, the tool closes, compressing the springs until the load carried by the springs plus the pump-open force equals the bit weight.

The shock tool is preferably run next to the bit to minimize the oscillating mass, maximizing the ability of the shock-absorbing element to absorb impacts and keep the bit on bottom. If a packed hole assembly is run, the tool should be placed further up the string; however, the effectiveness of the tool will be reduced because of the larger oscillating mass.

Free vertical movement is ensured by guiding the mandrel above and below the spline drive assembly. No lateral loads are taken on drive assembly. The tool is manufactured from 4340 and 4145 quenched and tempered steel. The tool does not use any temperature-sensitive elastomers for shock absorption and may be used to 450°F (232°C) with the use of optional seals for temperatures above 275°F (135°C). The length of run between service periods should be shortened for high-temperature holes.

The tool is sprung in both directions; but when jarring becomes necessary, an overpull brings the retaining ring in contact with the pin on splined housing. This contact causes the tool to act as an integral part of the BHA, eliminating any adverse reaction from the spring system during jarring. On request, Weatherford can alter the amount of overpull required to fully extend the tool.

Dailey® CBC-Thruster™ Tool

Weatherford's patented *Dailey CBC-Thruster* tool is uniquely designed for running low in the bottomhole assembly (BHA) to apply hydraulic weight-on-bit (WOB) during drilling operations by taking advantage of the naturally occurring effect of pump-open forces (POF). The *CBC-Thruster* tool also absorbs weight transfer from the drillstring and prevents the positive-displacement motor (PDM) from stalling.

Applications

- Any drillstring in which a drilling motor will be used

Features, Advantages and Benefits

- Simple construction, with minimal moving parts, reliably keeps the bit on bottom for better rate of penetration (ROP).
- Involute spline design ensures that torque from the drillstring is transferred to the lower portion of the BHA so as not to hinder drilling operations.
- Tandem designs provide increased POF over the standard-size tool at the same differential pressure for operations that require a greater force or WOB.

Dailey® CBC-Thruster™ Tool *(continued)*

Specifications

Standard Version, Standard Stroke

OD (in./*mm*)	3-1/8 *79.38*	4-3/4 *120.65*	6-1/4 *158.75*	6-1/2 *165.10*	7-3/4 *196.85*
ID (in./*mm*)	1-1/4 *31.75*	2-1/4 *57.15*	2-1/4 *57.15*	2-3/4 *69.85*	3 *76.20*
Tool joint (API)	2-3/8 Reg	3-1/2 IF	4-1/2 XH	4-1/2 IF	6-5/8 Reg
Tensile (lbf/kN)	250,000 *1,112*	500,000 *2,224*	832,000 *3,701*	934,000 *4,155*	1,600,000 *7,117*
Torsional (lbf-ft/*kN•m*)	5,000 *6.8*	20,000 *27.1*	49,300 *66.8*	56,200 *76.2*	100,000 *135.6*
Circulating pressure (psi/*bar*)	5,000 *345*				
Hydrostatic pressure (psi/*bar*)	None				
Total travel (in./*mm*)	16.0 *406*	15.0 *381*	16.5 *419*	17.0 *432*	19.5 *495*
Approximate length closed (ft/*m*)	9.25 *2.8*	11.85 *3.6*	12.00 *3.6*	14.33 *4.4*	15.71 *4.8*
Approximate weight (lb/*kg*)	190 *86*	475 *215*	1,000 *454*	1,200 *544*	1,600 *726*
Maximum bottomhole temperature (°F/°*C*)	400 *204*				
Pump-open area (in.^{2}/*cm*^{2})	4.0 *26*	10.3 *66*	15.9 *103*	19.6 *126*	28.3 *183*

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

Specifications

Standard Version, Long Stroke / Tandem Version

	Standard Version, Long Stroke			Tandem Version	
OD (in./*mm*)	4-3/4 *120.65*	6-1/2 *165.10*	7-3/4 *196.85*	4-3/4 *120.65*	6-1/2 *165.10*
ID (in./*mm*)	2-1/4 *57.15*	2-3/4 *69.85*	3 *76.20*	2-1/4 *57.15*	2-3/4 *69.85*
Tool joint (API)	3-1/2 IF	4-1/2 IF	6-5/8 Reg	3-1/2 IF	4-1/2 IF
Tensile (lbf/kN)	500,000 *2,224*	934,000 *4,155*	1,600,000 *7,117*	500,000 *2,224*	934,000 *4,155*
Torsional (lbf-ft/*kN•m*)	20,000 *27.1*	56,200 *76.2*	100,000 *135.6*	20,000 *27.1*	56,200 *76.2*
Circulating pressure (psi/*bar*)	5,000 *345*			5,000 *345*	
Hydrostatic pressure (psi/*bar*)	None			None	
Total travel (in./*mm*)	36.0 *914*			15.0 *381*	17.0 *432*
Approximate length closed (ft/*m*)	18.85 *5.7*	21.00 *6.4*	22.00 *6.7*	14.83 *4.5*	17.75 *5.4*
Approximate weight (lb/*kg*)	756 *343*	1,900 *862*	2,400 *1,089*	600 *272*	1,600 *726*
Maximum bottomhole temperature (°F/°C)	400 *204*			400 *204*	
Pump-open area (in.^{2}/*cm*^{2})	10.3 *66*	19.6 *126*	28.3 *183*	16.4 *106*	31.7 *205*

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

Dailey® CBC-Thruster™ Tool *(continued)*

Operation

Placing the Tool in the String

Run the CBC-Thruster® tool as close as possible to the bit to take full advantage of the POF that the tool generates. If drilling with a PDM, place the *CBC-Thruster* tool in the string, directly above the motor.

POF is determined by multiplying the differential pressure across the tool by the pump-open area of the *CBC-Thruster* tool.

The final WOB produced is equal to the POF less the frictional drag of the BHA between the *CBC-Thruster* tool and the bit. The WOB applied by the tool can be adjusted by varying the flow rate, the bit flow area, and type of PDM used.

Balancing nozzle size and flow rates is important for enhancing bit hydraulics. Doubling the bit differential pressure drop will double the POF and increase the ROP and sliding efficiency.

Running the Tool

If running the *CBC-Thruster* tool, use the standpipe pressure gauge—not the hook load—while drilling. Standpipe pressure will increase after the drillstring has been lowered to bottom, drilling has begun, and when the *CBC-Thruster* tool nears its *closed* position. The tool is fitted with a *closed* position indicator (telltale), which causes a sharp pressure increase. When the increase in standpipe pressure is noted, set the break to allow the motor to drill ahead. When the *CBC-Thruster* tool reaches its full stroke length, the motor will stop drilling, creating a noticeable standpipe pressure drop as a result of motor torque reduction. The break is released, and the operation is repeated. For continuous drilling, note the time to drill the full stroke length of the *CBC-Thruster* tool and close the tool before the end of the stroke.

The *CBC-Thruster* tool can be easily adjusted by selecting telltales of varying sizes as needed for specific flow rates. This feature ensures that the variations in standpipe pressure can be noted at the surface. Weatherford can provide assistance in selecting the optimal size.

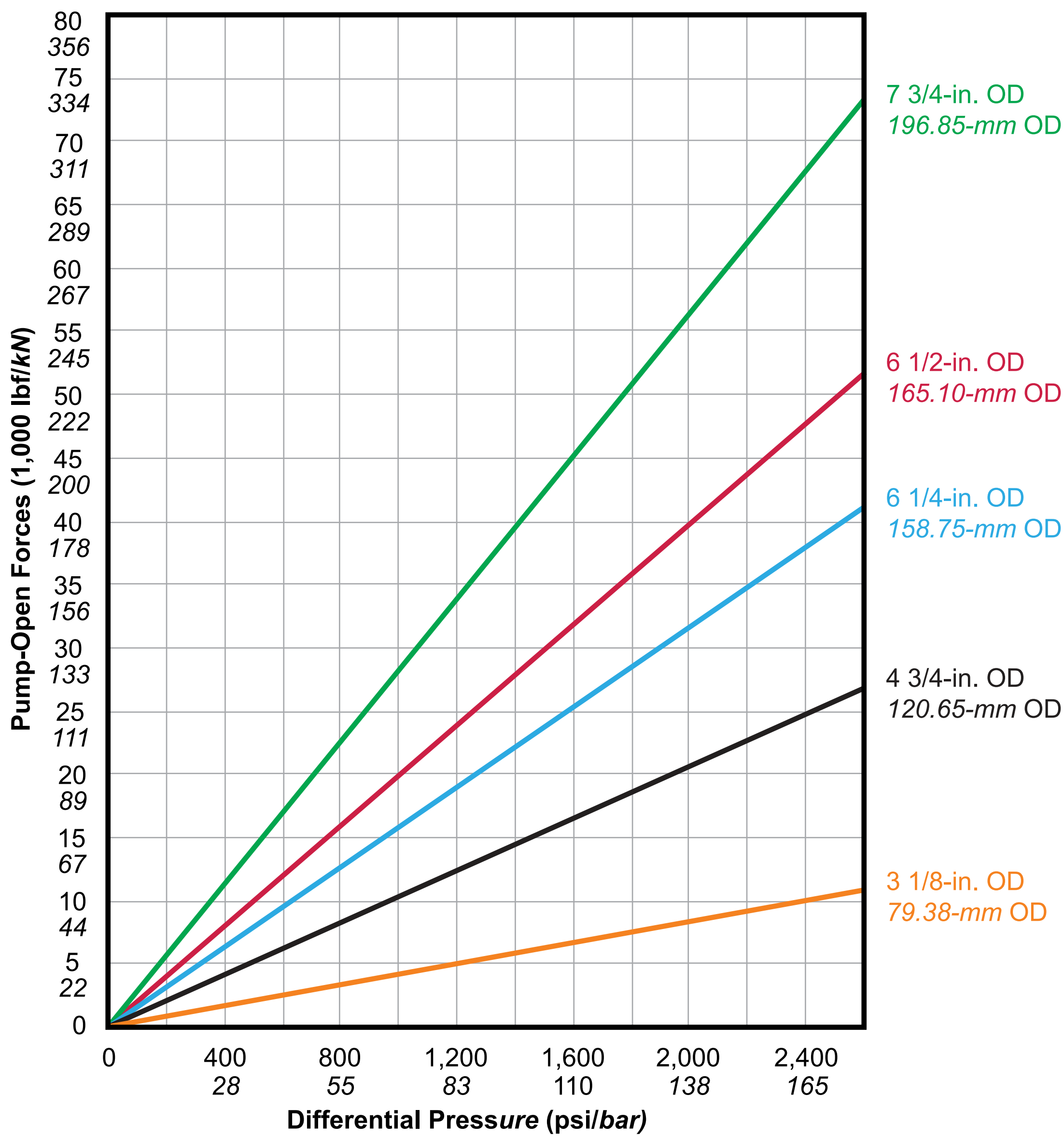
If running the tool above a retrievable measurement-while-drilling (MWD) tool, remove the telltale before operation. Running the tool without the telltale removes the *closed* position indication and the tool is then operated with the motor indication only.

Maintaining the Tool

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 sign of corrosion, pitting, or flaking of the plating.

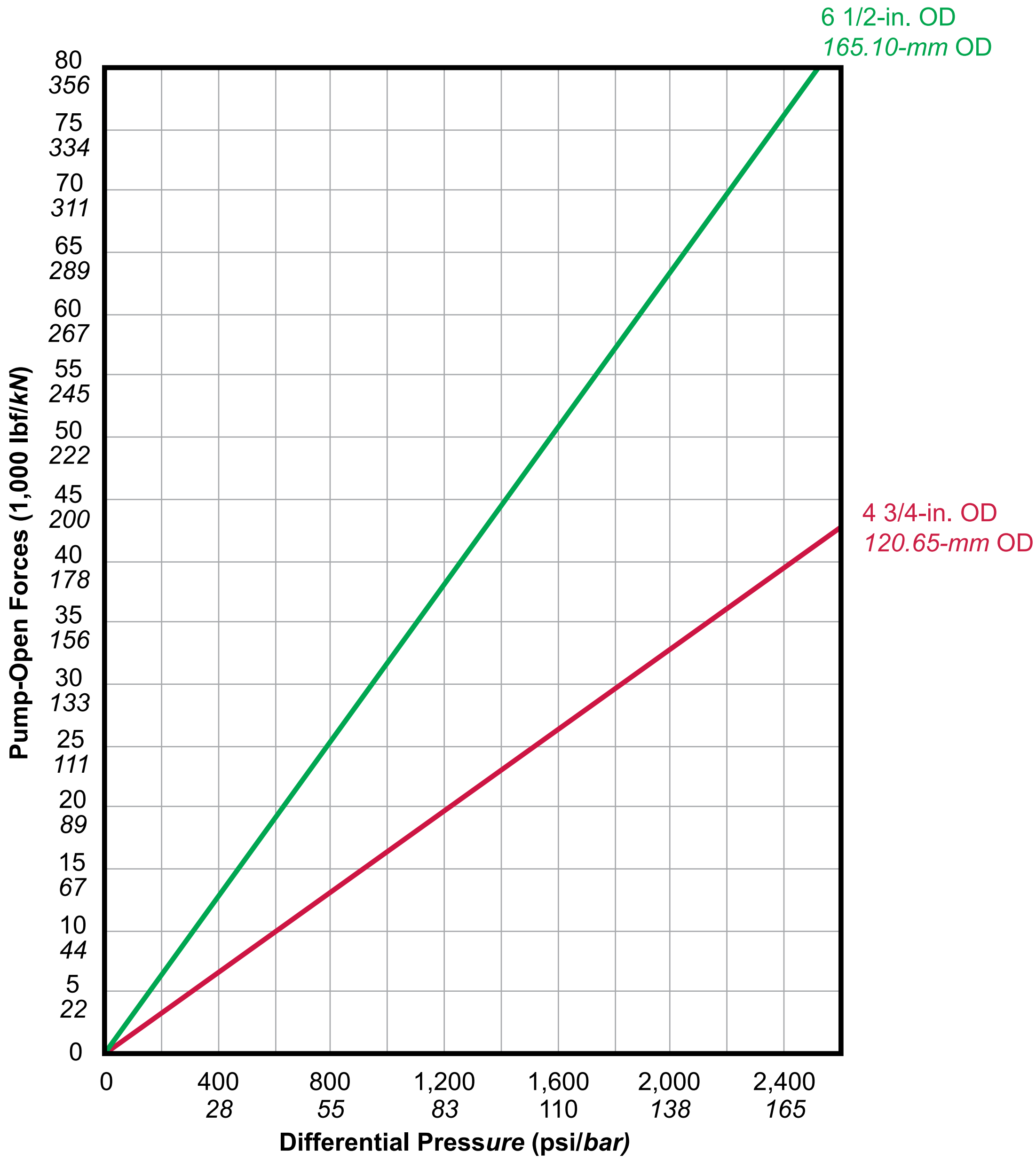
Standard Versions (Standard and Long Stroke)



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® CBC-Thruster™ Tool *(continued)*

Tandem Version



Dailey® Hydraulic Fishing Jar

Weatherford's *Dailey* hydraulic fishing jar, with a patented combination time-delay/mechanical trigger system, is a rugged tool for fishing applications. The jar combines reliability and long operating life under a wide range of fishing conditions and environments.

The jar features a one-piece involute spline for maximum torque capacity with minimal backlash. A fluid-isolated high-pressure chamber lubricates and isolates the moving seals, impact shoulders, and mandrel of the jar from the destructive effects of formation cuttings, sand, and other downhole debris.

Its unique design allows use of this jar in deep, deviated, high-temperature holes without compromising performance. The jar delivers virtually the same time delay in deep, hot holes as it does on the surface.

The jar does not generate internal heat during jarring periods; therefore, this design feature enables uninterrupted jarring without waiting for the jar to cool down or for the viscosity of the oil to return to normal. Elimination of heat build-up also extends packing and seal life as well as the time the jar can remain downhole.

The design also eliminates the need for bleed-off compensation; the trip load at the jar will be the same as set at surface.

With large free-flow paths, the jar can be reset as fast as the string can be lowered, without damage to the internal seals or bursting of any body housings. Resetting does not require preloading—only enough weight to overcome internal seal friction.

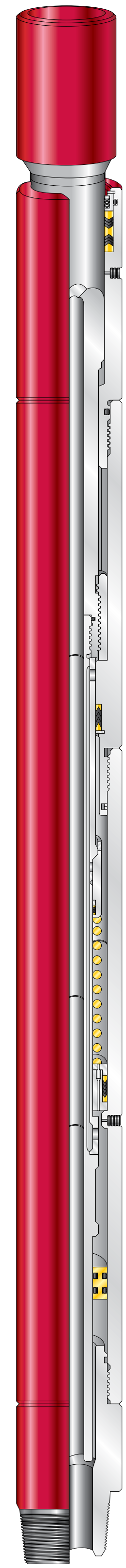
The jar requires only axial manipulation of the string. The rugged involute spline system prevents downhole torque from interfering with the tripping times of the jar.

Overpull to the jar is infinitely variable within the overpull limits established for the jar size. This feature gives the operator complete control of the impact to the fish by simply adjusting the pull on the string.

Jarring load is controlled and varied at the surface by overpull: the greater the overpull, the faster the jar trips, and the higher the impact loads are achieved.

Applications

All fishing, coring, washover, and other applications that require delivery of an upward impact to a stuck point, tight spot, or breakage of a core before retrieval from the wellbore.



Dailey® Hydraulic Fishing Jar *(continued)*

Features, Advantages and Benefits

- Rugged, durable construction for reliability and longer tool life
- Hydraulic time delay for reliability under a wide range of conditions and environments
- Mechanical trigger for durability
- Single-piece involute spline for maximum torque capacity with minimal backlash
- Fluid-isolated high-pressure chamber for protection against formation cuttings, sand, and other downhole debris
- Elimination of the need for bleed-off compensation, simplifying operation
- Elimination of internal heat generation for uninterrupted jarring, longer packing and seal life, and longer downhole time
- Variable overpull for easier, complete control from surface

Specifications

OD (in./*mm*)	1-13/16 *46*	2-1/4 *57*	3-1/8 *79*		3-3/4 *95*			4-1/4 *108*	4-3/4 *121*	6-1/4 *159*	6-1/2 *165*	7-3/4 *197*	8 *203*
ID (in./*mm*)	1/2 *13*	11/16 *17*	1-1/4 *32*	1-1/2 *38*	1-1/2 *38*	1-3/4 *44*	1-15/16 *49*	2-1/8 *54*	2-1/4 *57*	2-1/4 *57*	2-3/4 *70*	3 *76*	3 *76*
Tool joint size (API)	1-13/16 WFJ	1-1/4 Reg	2-3/8 Reg	2-7/8 PAC	2-3/8 IF, EUE	2-3/8 IF	2-3/8 EUE	2-7/8 IF	3-1/2 IF	4-1/2 IF	4-1/2 IF	6-5/8 Reg	6-5/8 Reg
Tensile yield* (× 1,000 lbf) *(× 1,000 N)*	75 *334*	110 *489*	250 *1,112*	200 *890*	328 *1,459*	260 *1,157*		325 *1,446*	500 *2,224*	1,000 *4,448*	1,000 *4,448*	1,600 *7,117*	1,600 *7,117*
Torsional Yield* (× 1,000 lbf-ft) *(× 1,000 N•m)*	1.6 *2.2*	2.5 *3.4*	5.0 *6.8*		9.5 *12.9*	7.8 *10.6*		15 *20.3*	20.0 *27.1*	49.3 *66.8*	56.2 *76.2*	100.0 *135.6*	105.0 *142.4*
Maximum jar load (× 1,000 lbf) *(× 1,000 N)*	20 *89*	30 *133*	45 *200*	35 *156*	66 *294*	45 *200*		55 *245*	85 *378*	200 *890*	175 *778*	260 *1,157*	300 *1,334*
Length closed (ft/*m*)	7.0 *2.1*	7.8 *2.4*	9.0 *2.7*	8.7 *2.6*	10.5 *3.2*	9.0 *2.7*	10.0 *3.0*	9.0 *2.7*	9.9 *3.0*	12.2 *3.7*	12.8 *3.9*	13.8 *4.2*	14.0 *4.3*
Weight (lb/*kg*)	50 *23*	80 *36*	180 *82*	180 *82*	280 *127*	222 *101*	230 *104*	290 *132*	400 *181*	800 *363*	1,100 *499*	1,850 *839*	2,000 *907*
Free travel (in./*mm*)	4 *102*	4 *102*	4-1/8 *105*	4 *102*	4-1/4 *108*			4-1/4 *108*	5 *127*	6 *152*	6-1/2 *165*	7-1/2 *191*	7-1/2 *191*
Total stroke (in./*mm*)	5-1/2 *140*	6 *152*	6-1/8 *156*	6 *152*	6-1/8 *156*			6-1/8 *156*	7 *178*	8-1/4 *210*	8-1/2 *216*	9-3/4 *248*	9-3/4 *248*
Maximum BHT (°F/°*C*)	400 *204*												
Pump open area (in.²/*cm²*)	1.1 *7.1*	1.8 *11.6*	4.0 *25.8*		5.9 *38.1*			7.7 *49.7*	10.3 *66.5*	15.9 *102.6*	19.6 *126.5*	28.3 *182.6*	28.3 *182.6*

Operation

Delivery to Location

Weatherford delivers the *Dailey* hydraulic fishing jar to location with the mandrel in the closed position. The fully closed position leaves an approximate 1-in. gap between the bottom of the box end of the mandrel and the top of the upper housing. This design feature prevents debris in the wellbore fluid from being driven into the upper seals when the jar is completely closed.

Note: Check for any visible indications of leakage.

Note: All service breaks on the jar are pretorqued at the Weatherford Service Center and do not require further tightening before running the tool in the hole.

Picking Up and Laying Down

1. Pick up and lay down the jar as with other jarring tools, except for the following special guidelines:
2. Install two equally spaced slings around the body of the jar, ensuring that the jar is balanced as it is being hoisted to or lowered from the rig floor.

   Note: Do not use the gap at the top of the jar as a tie-on point when picking up or laying down the jar. If necessary, use a tailing rope to control motion.

   Note: Do not break any connections when laying down the jar. Use thread protectors while handling the jar to prevent abuse to the pin or box connections, which can lead to improper makeup torque on the connection, galling of the threads, or washout of the connection.

Positioning in the Fishing String

For fishing applications, Weatherford recommends running the jar with a *Dailey* lubricated bumper sub and a *Dailey* HyPulse Jar Slinger® tool.

1. Run the jar in the lower portion of the bottomhole assembly (BHA), just above the fishing tools and the bumper sub.
2. Run three to five drill collars or joints of heavyweight drillpipe (HWDP) immediately above the jar, depending on operational requirements.
3. Position a slinger at the top of the drill collars or HWDP being used as a hammer.
4. Fishing assembly can be checked by use of the Weatherford *Dailey* jar placement program to provide optimal impact/impulse.

Dailey® Hydraulic Fishing Jar *(continued)*

Installing in the Fishing String

Install the jar in the string as any other BHA component, with pin connection down and box connection up.

1. Tighten the box and pin connections that connect the jar to the other components of the BHA or fishing assembly.

   Note: All service breaks are pretorqued to Weatherford's recommended value.

   Note: Always unlock the rotary and use two pairs of tongs when making up the jar in the string or breaking it out of the string. Never use the rotary to break the torque on the connection or to back into the jar when making it up in the string.

2. Install a drill collar safety clamp on the jar, above the slips, if the jar is left unsupported in the rotary table.
   This step prevents the jar from sliding through the slips.

   Note: When making up the jar or breaking it out of the string, position it as low in the slips as possible, still leaving enough room to install the drill collar safety clamp and grasp the jar with the tongs. Conventional makeup and breakout tongs exert lateral forces that can bend or break the jar. Use of power tongs eliminates this risk; however, if using conventional tongs, position the jar as low in the slips as possible, leaving enough room to install the drill collar safety clamp and grasp the jar with the tongs.

Standback Procedure

Weatherford does not recommend racking back the jar in the derrick while the string is out of the hole. In fishing applications, when the string is out of the hole and the jar will not remain suspended in the elevators, remove the jar from the string, and lay it down.

Downhole Operation

Downhole actuation of the jar requires only raising and lowering of the fishing string.

Set the jar as follows:

1. Slack off on the string until the end of free travel is observed on the weight indicator.
2. Raise the drill string until the indicated weight equals the calculated weight of the fishing string.

Deliver an upward blow as follows:

1. Continue to pull on the fishing string until the desired load is shown on the weight indicator.
2. Set the brake, and wait for the jar to trip.

   Note: It is important to stay within the overpull limits set forth in the specifications for the jar size. Exceeding the maximum jarring load can damage the jar and render it inoperable. After the jar has tripped, the operator can pull the string to the tensile limits of the jar without damaging the jar.

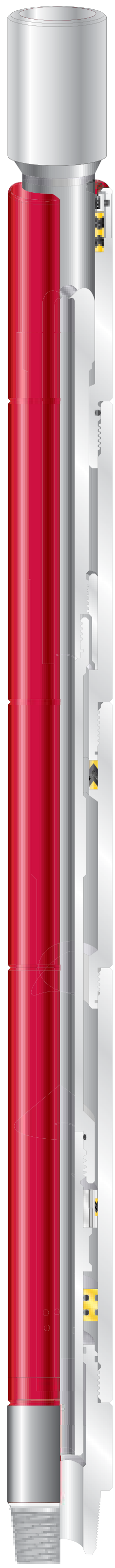
3. Lower the jar to reset, and repeat the jarring process as needed.

   Note: The string can be lowered as fast as the operator wishes, with no adverse effects to the jar.

Maintenance

The *Dailey* hydraulic fishing jar requires very little on-site maintenance; however, for optimal performance, Weatherford recommends the following procedure each trip out of the hole:

1. Wash off the mandrel of the jar and the top of the upper housing where the mandrel goes through the upper seals.
2. Unscrew the jar from the BHA at the pin end, and wash the inside diameter of the pin and the area around the compensating piston with water.



Dailey® HyPulse Jar Slinger® Fishing Tool

The Weatherford *Dailey HyPulse Jar Slinger* fishing tool is a rugged, dependable downhole tool designed specifically for running with the *Dailey* hydraulic fishing jar. The slinger uses a compressible synthetic fluid as a spring for storing energy, which is released when the tripping mechanism in the *Dailey* hydraulic fishing jar opens. This action allows the internal mandrel-hammer assembly of the fishing jar to accelerate unimpeded until it strikes the anvil, resulting in a sharp upward impact to the stuck point.

The fishing tool can be used in deep, deviated, high-temperature holes to ensure optimal performance of the hydraulic fishing jar. The slinger is the best solution for situations requiring a store of energy beyond that supplied by the stretch of the fishing string, such as shallow-depth operations in which larger drill collars or drillpipe are being used.

In deviated and horizontal holes, the slinger can counteract the drag induced by wall contact on the heavyweight pipe or drill collars used above the hydraulic fishing jar.

The fishing tool allows the operator to use fewer drill collars in the fishing string.

The fishing tool reduces the shock impact on the fishing string above its point of installation, thereby reducing shock on the surface equipment. This advantage is highly beneficial on rigs equipped with top drives.

Applications

- All fishing, coring, washover, and other applications that require delivery of an upward impact to a stuck point, tight spot, or breakage of a core before retrieval from the wellbore
- Fishing operations that require a store of energy beyond that supplied by the stretch of the stuck fishing string
- Fishing operations in deviated and horizontal holes

Features, Advantages and Benefits

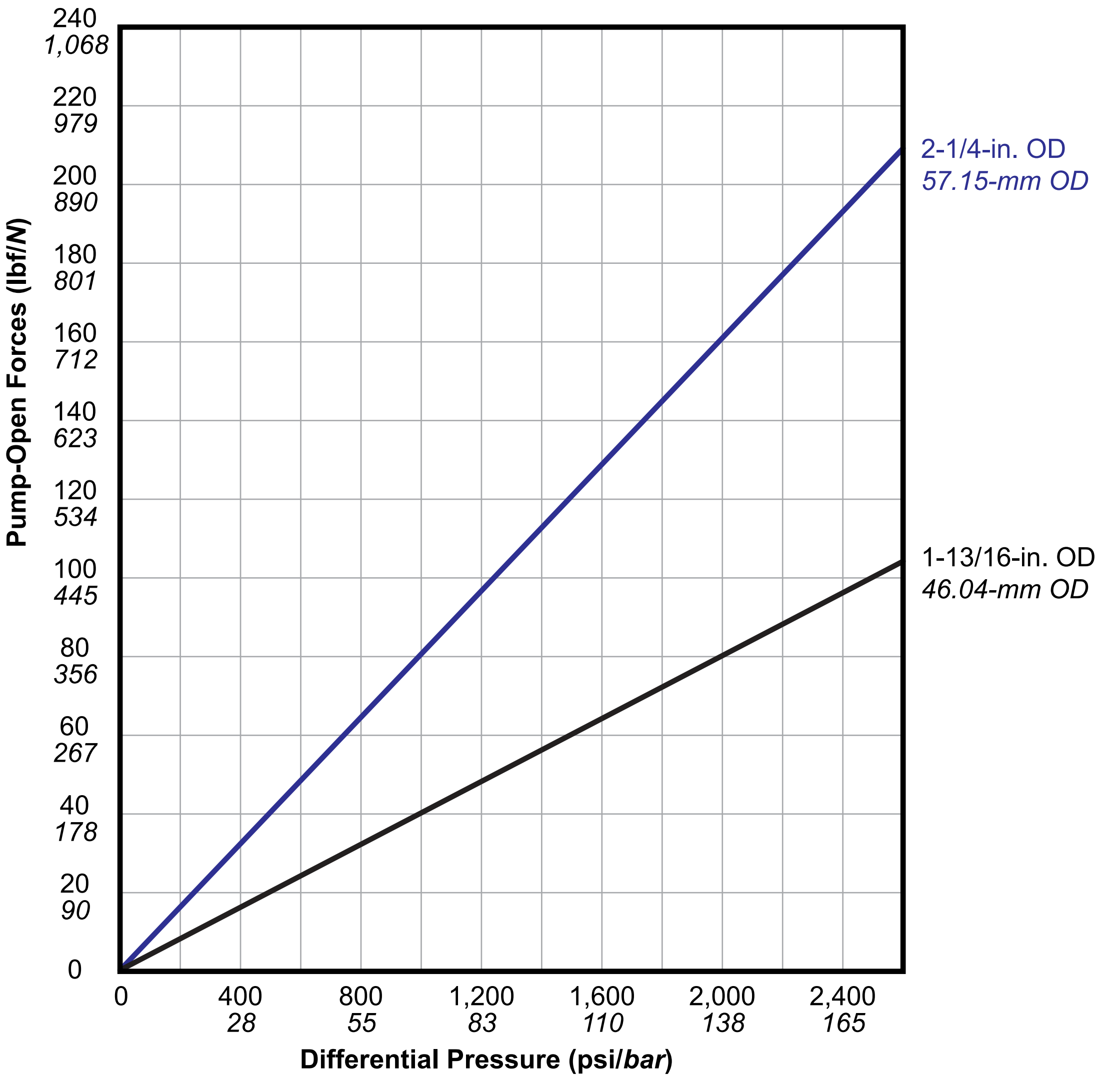
- The tool is designed to reach total stroke at maximum overpull to provide a nearly constant amplification factor across a large range of overpulls with the maximum impact taking place at maximum overpull.
- The internal hammer bottoms out at maximum overpull to provide mechanical overpull protection and prevent accidental damage to the tool. The design means the operator can use fewer drilling collars in the fishing string.
- Rugged, durable construction provides reliability and longer tool life.
- The drilling tool reduces costs associated with shock to surface equipment.
- Single-piece involute spline provides maximum torque capacity with minimal backlash.
- Fluid-isolated high-pressure chamber protects against formation cuttings, sand, and other downhole debris.

Specifications

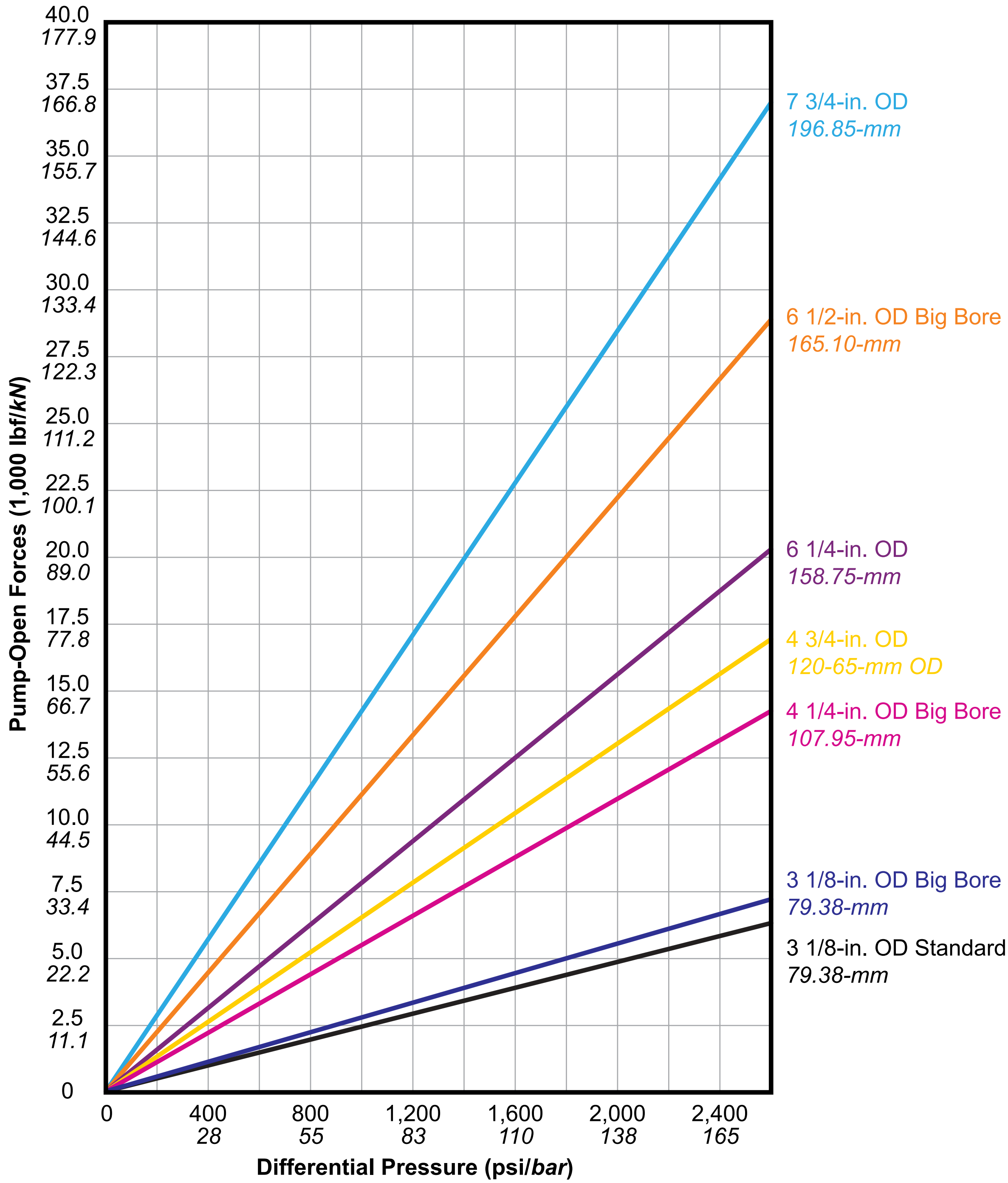
OD (in./*mm*)	1-13/16 *46*	2-1/4 *57*	3-1/8 *79*		3-3/4 *95*		4-1/4 *108*		4-3/4 *121*	6-1/4 *159*	6-1/2 *165*	7-3/4 *197*	8 *203*
ID (in./*mm*)	1/2 *13*	11/16 *18*	1-1/4 *32*	1-1/2 *38*	1-3/4 *45*	1-15/16 *49*	1-15/16 *49*	2-1/8 *54*	2-1/4 *57*	2-1/4 *57*	2-3/4 *70*	3 *76*	3 *76*
Tool Joint Size (API)	1-13/16 WFJ	1-1/4 Reg.	2-3/8 Reg.	2-7/8 Reg.	2-7/8 IF	2-3/8 EUE	2-7/8 IF		3-1/2 IF	4-1/2 IF	4-1/2 IF	6-5/8 Reg.	6-5/8 Reg.
Tensile Yield* (× 1,000 lbf) *(× 1,000 N)*	75 *334*	110 *489*	250 *1,112*	200 *890*	275 *1,223*	225 *1,001*	350 *1,557*	325 *1,446*	500 *2,224*	832 *3,701*	1,000 *4,448*	1,600 *7,117*	1,600 *7,117*
Torsional Yield* (× 1,000 lbf-ft) *(× 1,000 N•m)*	1.6 *2.2*	2.5 *3.4*	5.0 *6.8*		7.8 *10.6*	3.75 *5.1*	15 *20.3*		20 *27.1*	49.3 *66.8*	56.2 *76.2*	100 *135.6*	105 *142.4*
Length Closed (ft-in./*m*)	7 ft, 0 in. *2.1*	8 ft, 9 in. *2.7*	9 ft, 10 in. *3.0*		9 ft, 8 in. *2.9*	9 ft, 10 in. *3.0*	9 ft, 10 in. *3.0*	10 ft, 0 in. *3.0*	9 ft, 10 in. *3.0*	13 ft, 6 in. *4.1*	15 ft, 0 in. *4.6*	15 ft, 7 in. *4.7*	15 ft, 6 in. *4.7*
Weight (lb/*kg*)	50 *23*	100 *45*	198 *90*	175 *79*	242 *110*	224 *102*	340 *154*	316 *143*	400 *181*	1,000 *454*	1,200 *544*	2,000 *907*	1,800 *817*
Total Stroke (in./*mm*)	5-1/2 *140*	6 *152*	6-1/8 *156*	6 *152*	6-1/8 *156*		6-1/8 *156*	6-1/4 *159*	7 *178*	8-1/4 *210*	8-1/2 *216*	9-3/4 *248*	9-3/4 *248*
Maximum BHT (°F/*°C*)	400 *204*												
Pump Open Area (in.^{2}/*cm*^{2})	1.1 *7.1*	0.8 *5.2*	2.4 *15.5*	2.8 *18.1*	4.4 *28.4*	4.4 *28.4*	4.9 *31.6*	5.4 *34.8*	6.5 *41.9*	7.7 *49.7*	11.0 *71.0*	14.2 *91.6*	14.2 *91.6*
Circulating Pressure (psi/*bar*)	5,000 *345*												
Hydrostatic Pressure (psi/*bar*)	None												

Dailey® HyPulse Jar Slinger® Fishing Tool *(continued)*

Pump-Open Force Chart: 1 13/16-in. and 2 1/4-in. OD



Pump-Open Force Chart: 3 1/8-in. OD and Larger



Dailey® HyPulse Jar Slinger® Fishing Tool *(continued)*

Operation

Delivery to Location

Weatherford delivers the *Dailey HyPulse Jar Slinger* fishing tool to location with the mandrel in the *closed* position. The fully *closed* position leaves an approximate 1-in. (2.5-mm) gap between the bottom of the box end of the mandrel and the top of the upper housing. This design feature prevents debris in the wellbore fluid from being driven into the upper seals when the drilling tool is completely closed.

Note: Check for any visible indications of leakage.

Note: All service breaks on the drilling tool are pretorqued at the Weatherford Service Center and do not require further tightening before the slinger is run in the hole.

Picking Up and Laying Down

Pick up and lay down the slinger as other jarring tools, except for the following special guidelines:

- Install two equally spaced slings around the body, ensuring that the slinger is balanced as it is being hoisted to or lowered from the rig floor.

  Note: Do not use the gap at the top of the drilling tool as a tie-on point when picking up or laying down the drilling tool. If necessary, use a tailing rope to control motion.

  Note: Do not break any connections when laying down the drilling tool. Use thread protectors while handling the slinger to prevent damage to the pin or box connections. Damage to the connections can lead to improper makeup torque on the connections, galling of the threads, or washout of the connections.

Positioning in the Fishing String

Position the slinger above the drill collars or heavyweight drillpipe (HWDP) that serves as the hammer for the *Dailey* hydraulic fishing jar. For optimal jarring results, a Weatherford representative can run the Weatherford *Dailey* jar placement program to determine the optimal number of drill collars or HWDP to include in the fishing string.

Installing in the Fishing String

Install the fishing tool in the string as any other bottomhole assembly (BHA) component with pin connection down and box connection up.

1. Tighten the box and pin connections that connect the jar to the other components of the BHA or fishing assembly.

   Note: All service breaks are pre-torqued to Weatherford's recommended value.

   Note: Always unlock the rotary and use two pairs of tongs when making up the drilling tool in the string or breaking it out of the string. Never use the rotary to break the torque on the connection or to back into the drilling tool when making it up in the string.

2. Install a drill collar safety clamp on the drilling tool, above the slips, if the tool is left unsupported in the rotary table. This step prevents the drilling tool from sliding through the slips.

Note: When making up the fishing tool or breaking it out of the string, position it as low in the slips as possible, still leaving enough room to install the drill collar safety clamp and grasp the fishing tool with the tongs. Conventional makeup and breakout tongs exert lateral forces that can bend or break the tool. Use of power tongs eliminates this risk. However, if using conventional tongs, position the tool as low in the slips as possible, leaving enough room to install the drill collar safety clamp, and grasp the tool with the tongs.

Standback Procedure

Weatherford does not recommend racking back the *Dailey HyPulse Jar Slinger* fishing tool in the derrick while the string is out of the hole. In fishing applications, when the string is out of the hole and the tool will not remain suspended in the elevators, remove the tool from the string and lay it down.

Downhole Operation

Downhole activation of the tool requires only raising the string.

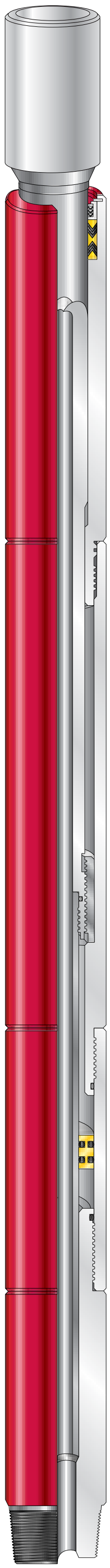
1. Take the slack out of the string and stretch the string to the desired overpull up to the published specifications. The tool will start to compress the internal fluid inside itself, building a store of energy within. This energy, along with the energy stored in the stretched fishing string, will be released automatically when the fishing jar trips and allows free travel of the mandrel.
2. Lower the string after jarring to reset the hydraulic fishing jar and the tool.

   Note: The performance of the tool is not affected by the rate at which the string is raised or lowered. After operating for a while, the tool may appear to bottom out—a natural occurrence resulting from the unique design of this tool. When this happens, simply reset the tool by slacking down slightly farther than usual, thus ensuring that all tools in the string are completely closed.

Maintenance

The *Dailey HyPulse Jar Slinger* fishing tool is a rugged, dependable downhole tool that requires very little on-the-job maintenance. For optimal performance, Weatherford recommends the following procedure every trip out of the hole:

1. Use a water hose to wash the mandrel of the tool and the top of the upper housing where the mandrel goes through the upper seals.
2. Unscrew the tool from the string at the pin end and wash the inside diameter of the pin and the area around the compensating piston with water.



Dailey® Lubricated Bumper Sub

The Weatherford *Dailey* lubricated bumper sub complements the *Dailey* hydraulic fishing jar and the *Dailey*® HyPulse Jar Slinger® fishing tool, providing better control of the fishing string and greatly reducing bottomhole assembly (BHA) vibration. Providing a more subdued upward or downward bump to the fishing string, the bumper sub also aids in disengaging a fish after retrieval.

This easily transported bumper sub can be used in high-angle, shallow or deep wells, including high-temperature and high-pressure formations. The bumper sub is useful in recovery of BHAs, drillpipe, tubing, and packers in a cased or openhole.

With the field-proven Weatherford single-piece mandrel and the same torque-and debris-isolation system used in the *Dailey* hydraulic fishing jar and *Dailey HyPulse Jar Slinger* fishing tool, this reliable bumper sub is a world-class performer.

Applications

- Any application (for example, fishing, coring, and washover) that requires a downward blow to a stuck point or tight spot to release fishing tools, activate shearing mechanisms, or break off a core before retrieving it. The bumper sub can also deliver an upward blow to a stuck point.
- The bumper sub allows the operator to feel for the top of a fish without applying excess weight. When the bumper sub is used with a milling/cutting tool, its sliding-sleeve effect allows adjustment of the weight to the cutting tool to prevent overloading or stalling. The fishing string can be manipulated, taking advantage of the string rebound, to increase upward or downward impact.

Features, Advantages and Benefits

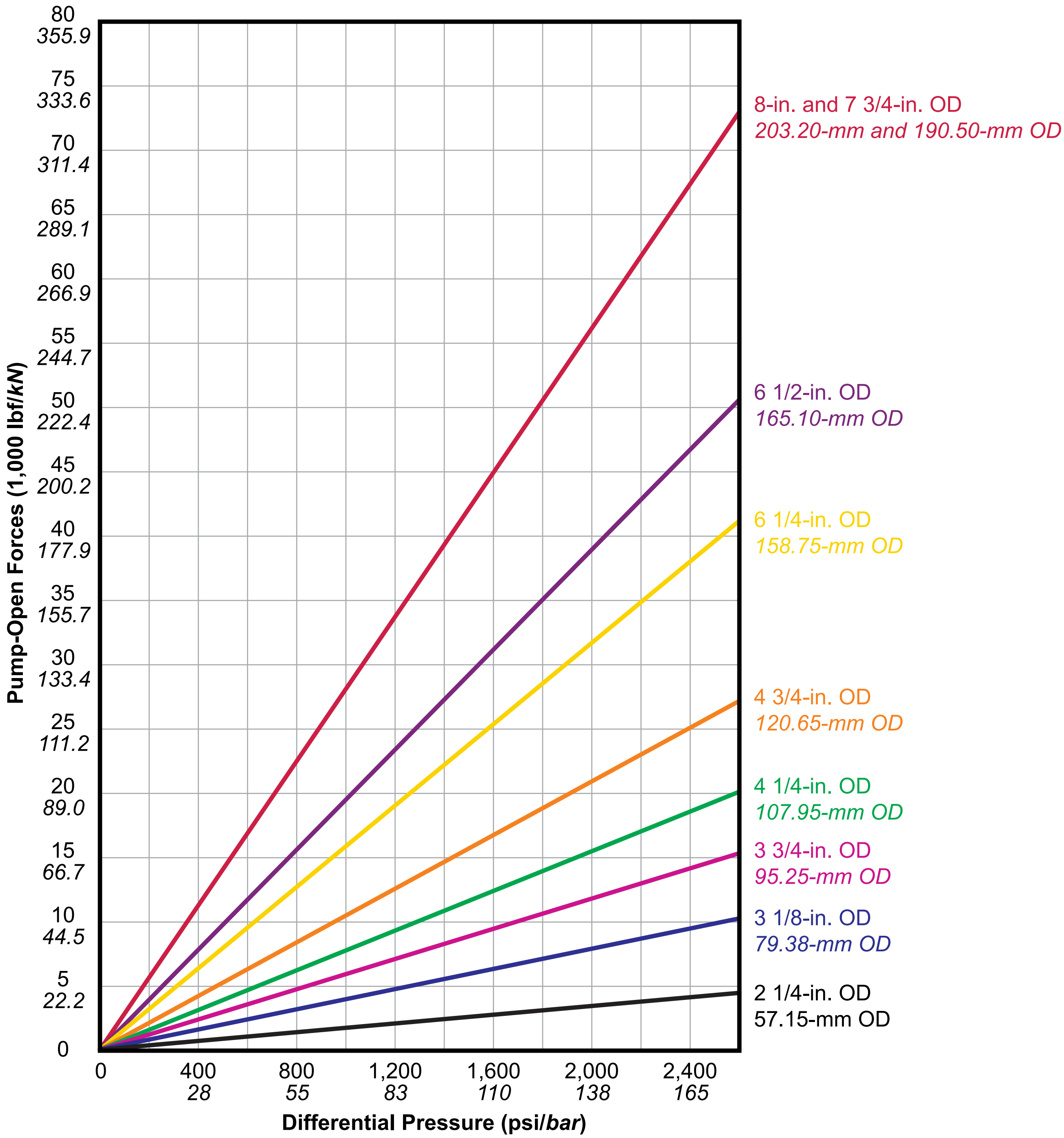
- Rugged, durable construction for reliability and longer tool life.
- Sliding-sleeve effect for weight adjustment to milling/cutting tool and prevention of overloading or stalling.
- Single-piece involute spline for maximum torque capacity with minimal backlash.
- Fluid-isolated chamber for protection against formation cuttings, sand, and other downhole debris.

Specifications

OD (in./*mm*)	1-13/16 *46*	2-1/8 *54*	2-1/4 *57*	2-7/8 *73*	3-1/8 *79*		3-3/4 *95*			4-1/4 *108*	4-3/4 *121*	6-1/4 *159*	6-1/2 *165*	7-3/4 *197*	8 *203*
ID (in./*mm*)	1/2 *13*	11/16 *17*	11/16 *17*	13/16 *21*	1-1/4 *32*	1-1/2 *38*	1-1/2 *38*	1-3/4 *44*	1-15/16 *49*	2-1/8 *54*	2-1/4 *57*	2-1/4 *57*	2-3/4 *70*	3 *76*	3 *76*
Tool Joint Size (API)	1-13/16 WFJ	1-1/2 AMMT	1-1/4 Reg.	2-3/8 PAC	2-3/8 Reg.	2-7/8 PAC	2-3/8 IF, EUE	2-3/8 IF	2-3/8 EUE	2-7/8 IF	3-1/2 IF	4-1/2 IF	4-1/2 IF	6-5/8 Reg.	6-5/8 Reg.
Tensile Yield* (× 1,000 lbf) *(× 1,000 N)*	75 *334*	86 *383*	110 *489*	106 *472*	250 *1,112*	200 *890*	328 *1,459*	260 *1,157*		325 *1,446*	500 *2,224*	1,000 *4,448*	1,000 *4,448*	1,600 *7,117*	1,600 *7,117*
Torsional Yield* (× 1,000 lbf-ft) *(× 1,000 N•m)*	1.60 *2.2*	0.85 *1.2*	2.50 *3.4*	2.60 *3.5*	5.00 *6.8*		9.50 *12.9*	7.80 *10.6*		15.00 *20.3*	20.00 *27.1*	49.30 *66.8*	56.20 *76.2*	100.00 *135.6*	105.00 *142.4*
Length Closed (ft./*m*)	7.50 *2.3*	4.58 *1.4*	7.83 *2.4*	4.08 *1.2*	9.17 *2.8*	9.33 *2.8*	9.33 *2.8*		10.50 *3.2*	9.00 *2.7*	11.33 *3.5*	12.25 *3.7*	13.33 *4.1*	14.92 *4.6*	14.92 *4.6*
Weight (lb/*kg*)	50 *23*	40 *18*	100 *45*	90 *41*	180 *82*		270 *123*	220 *100*	230 *104*	290 *132*	440 *200*	1,000 *454*	900 *408*	1,900 *862*	2,000 *907*
Total Stroke (in./*mm*)	12 *305*	9-1/2 *241*	12 *305*	9-1/2 *241*	16 *406*		16-1/8 *410*			16 *406*	15 *381*	16-1/2 *419*	17 *432*	19-1/2 *495*	19-1/2 *495*
Maximum BHT (°F/*°C*)	400 *204*														
Pump Open Area (in.^{2}/*cm^2*)	1.1 *7.1*	1.2 *7.7*	1.8 *11.6*	2.1 *13.5*	4.0 *25.8*		5.9 *38.1*			7.7 *49.7*	10.3 *66.5*	15.9 *102.6*	19.6 *126.5*	28.3 *182.6*	28.3 *182.6*
Circulating Pressure (psi/*bar*)	5,000 *345*														
Hydrostatic Pressure (psi/*bar*)	None														

Dailey® Lubricated Bumper Sub *(continued)*

Pump-Open Force chart



Operation

Delivery to Location

Weatherford delivers the Dailey® lubricated bumper sub to a location with the mandrel in the *closed* position. The fully *closed* position leaves an approximate 1-in. (2.54-cm) gap between the bottom of the box end of the mandrel and the top of the upper housing. This design feature prevents debris from the wellbore fluid from being driven into the upper seals when the bumper sub is completely closed.

Note: Check for any visible indications of leakage.

Note: All service breaks on the bumper sub are pretorqued at the Weatherford Service Center and do not require further tightening before the tool is run in the hole.

Picking Up and Laying Down

The bumper sub is a sliding mandrel in a sleeve. Pick up and lay down the bumper sub as other jarring tools, except for the following special guidelines:

Install two equally spaced slings around the body of the bumper sub, ensuring that the bumper sub is balanced as it is being hoisted to or lowered from the rig floor.

Note: Never tie on to only one end of the bumper sub, which can allow the mandrel to extend unexpectedly. Do not use the gap at the top of the bumper sub as a tie-on point when picking up or laying down the bumper sub. If necessary, use a tailing rope to control motion.

Note: Do not break any connections when laying down the bumper sub. Use thread protectors while handling the bumper sub to prevent abuse to the pin or box connections. Abuse can lead to improper makeup torque on the connections, galling of the threads, or washing out of the connections.

Positioning in the Fishing String

For fishing operations, Weatherford recommends running the bumper sub directly above the fishing tool and immediately below the fishing jar for maximum effectiveness.

Dailey® Lubricated Bumper Sub *(continued)*

Installing in the Fishing String

1. Install the bumper sub in the string in the same manner as other BHA components, with pin connection down and box connection up.
2. Tighten only the box and pin connections that connect the bumper sub to the other components of the BHA or fishing assembly.

   Note: All service breaks are pretorqued to Weatherford's recommended values.

   Note: Always unlock the rotary and use two pairs of tongs when making up the bumper sub in the string or breaking it out of the string. Never use the rotary to break the torque on the connection or to back into the tool when making it up in the string. Install a drill collar safety clamp on the bumper sub, above the slips, if the tool is left unsupported in the rotary table. This step prevents the bumper sub from sliding through the slips.

   Note: When making up the bumper sub or breaking it out of the string, position it as low in the slips as possible, still leaving enough room to install the drill collar safety clamp, and grasp the bumper sub with the tongs. Conventional makeup and breakout tongs exert lateral forces that can bend or break the tool. Use of power tongs eliminates this risk; however, if using conventional tongs, position the bumper sub as low in the slips as possible, leaving enough room to install the drill collar safety clamp and grasp the bumper sub with the tongs.

Standback Procedure

Weatherford does not recommend racking back the bumper sub in the derrick while the string is out of the hole. In fishing applications, when the string is out of the hole and the tool will not remain suspended in the elevators, remove the bumper sub from the string and lay it down.

Downhole Operation

Raise or lower the string to activate the bumper sub downhole. The impact generated by the bumper sub depends on the speed at which the string is raised or lowered. Careful manipulation of the spring tendency of the drill string can dramatically increase the upward or downward impact generated by the bumper sub.

Maintenance

The Dailey® lubricated bumper sub is a rugged, dependable downhole tool that requires very little on-the-job maintenance. For optimal performance, Weatherford recommends the following procedure every trip out of the hole:

1. Use a water hose to wash the mandrel of the bumper sub and the top of the upper housing where the mandrel goes through the upper seals.
2. Unscrew the tool from the BHA and wash the inside diameter of the pin and the area around the compensating piston with water.

Weatherford provides worldwide service and support from approximately 900 locations in more than 100 countries. To learn more about how our drilling tools can help you expedite projects and lower your operating costs, contact an authorized Weatherford representative or visit **weatherford.com/jars.**

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