ENHANCING
PRODUCTIVITY

Coiled Tubing Solutions

Solve Downhole Problems With Reliable, Cost-Effective Technology

BAKER HUGHES

Baker Oil Tools

Coiled Tubing Handbook

The global oil and gas industry is using coiled tubing for an ever-increasing array of well intervention projects. Coiled tubing offers a number of operational and economic advantages, including: live well intervention, elimination of well kill and potentially damaging heavy-weight kill fluids, reduced operational footprint, horizontal intervention, and the ability to intervene without a rig. These advantages have led to the development of truly fit-for-purpose coiled tubing systems from the industry's largest provider of coiled tubing well intervention solutions – Baker Oil Tools.

Baker Oil Tools offers its clients an unparalleled selection of coiled-tubing-conveyed intervention products, services and solutions with which to approach individual well requirements. This handbook was developed to help our clients determine which systems and services will best meet the needs of a particular application. For that reason, we have designed the handbook to highlight system capabilities within eight distinct intervention areas where coiled tubing can offer a highly effective and cost-efficient alternative. These eight categories are: Well Cleaning, Fishing and Milling, Zone Isolation, Stimulation and Fracturing, Sand Control Completions, Flow Management, Plug and Abandonment, and Sidetracking and Re-entry.

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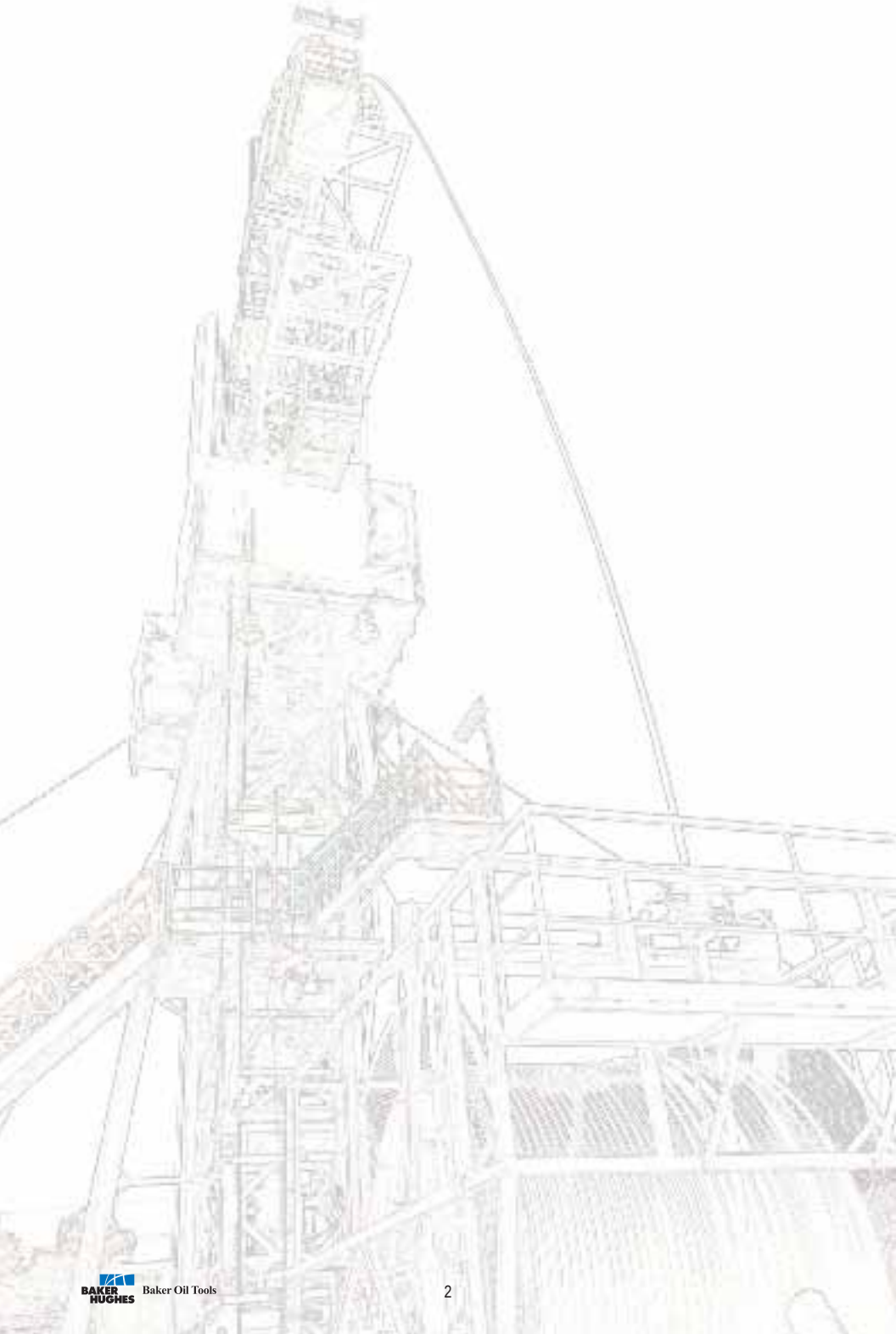
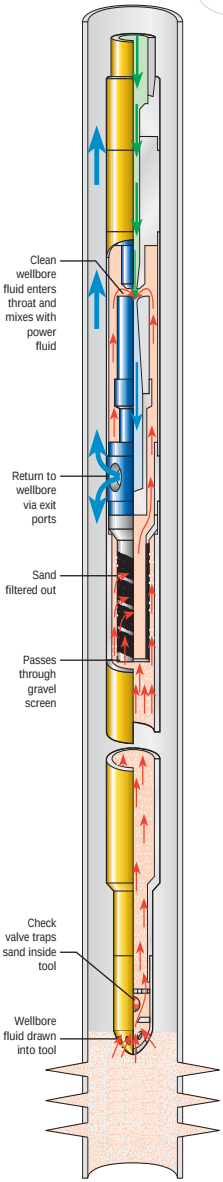


A clean wellbore is not only a prerequisite for trouble-free well testing and completion, it also helps ensure optimum production for the life of the well. Baker Oil Tools' coiled-tubing-conveyed well cleaning solutions have long and highly successful track records.

Sandtrap System

The Sandtrap System is a highly efficient method of cleaning out large volumes of sand or proppant from a wellbore where sufficient annular velocity cannot be obtained to circulate the sand out conventionally using coiled tubing. The system incorporates jet pump technology and is powered by water or nitrogen. No foam is required. The Sandtrap System is extremely cost effective compared to alternatives where foam and chemicals are used. It is also extremely efficient and requires minimal time. The sand is removed as the tool is lowered, creating the space to continue the process. Production can be resumed immediately after cleanout.

The system comes in 5-3/4 in. and 3 in. OD sizes. Each application is flow modeled on an individual well basis.



Jet Pump Sand Cleanout System

Key features and advantages

- Suitable for all sand / proppant types
- No foam system required for effective wellbore cleanout
- Water, nitrogen or mixture can be used as power fluid
- Fast, efficient operation

Case History	North Sea
Objective:	A high volume of sand accumulated in a well causing decline in production. Bottomhole pressure in the well would not hold a fluid column. The sand needed to be cleaned out of the well, with minimum shut-in time requested.
CT Solution:	A 5-3/4 in. OD Sandtrap System with extensions was chosen since a minimal amount of fluid would be introduced into the well and sand could be captured without circulating all the way up to surface, which would require a foam system.
Result:	The full 100% tool capacity was filled with sand during the first two runs. During the third run only 73% of the capacity was filled, indicating that the sand in the well nearly emptied. This was confirmed with the fourth run only recovering 0.5 gallon of sand. A total of 265 gallons of sand was recovered during the operation.

Debris Catching

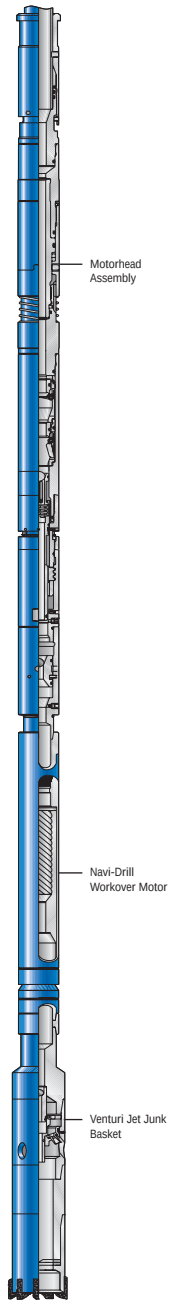
In wellbore cleanout situations where sufficient annular velocity cannot be obtained to carry debris out of the wellbore, foam systems or nitrified fluids can be used. A time- and cost-saving alternative is a debris catching system, which is used to remove various types of high-density debris and formation particles too heavy to be circulated to surface.

Baker Oil Tools Solutions

Baker's Rotary Venturi Cleanout System consists of a Venturi Jet Junk Basket (VJJB) and Navi-Drill® Workover Motor. Typically a VJJB is run alone but can be run with a motor to break up compacted debris that is too heavy to circulate to surface. The jet basket uses the venturi principle to create a pressure drop inside the tool. Extension barrels can be inserted in the tool to increase its solids carrying capacity.

Key features and advantages

- Fully closed finger or flutter catchers
- Can be run with any type of dressed shoe
- Adjustable reservoir through extensions
- Adjustable nozzles to accommodate various flow rates

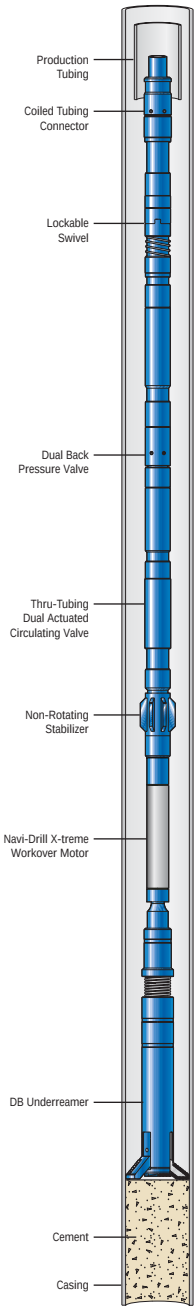


A Venturi Jet Junk Basket (VJJB) with a dressed shoe can be run in conjunction with a Navi-Drill® Workover Motor to break up compacted debris that is too heavy to circulate to surface.

Underreaming

An underreamer is designed to pass through a downhole restriction, open, clean the hole to full gauge, and close for retrieval back through the restriction. The restriction is typically in the production tubing string, in the form of nipple profiles, mandrels, and other completion accessories.

In well cleaning the most common underreaming task is removing cement left from coiled tubing squeeze cementing. Leftover cement is typically the result of large cement nodes forming at the squeezed perforations, or cement hardening before the excess can be reversed out. These cement restrictions must be removed before re perforating. An underreamer is also used to clean out scale and hard fill that cannot be removed from liners by jet-washing tools. A mill could be used in these conditions, but the resulting hole size would be about the same as the internal drift of the tubing, leaving a sheath on the walls of the liner. This sheath could dislodge during subsequent operations, possibly resulting in stuck tools. Perforating would not be as efficient because the charges would have to expend energy penetrating the sheath before reaching the liner.



DB™ Underreamer Assembly

Baker Oil Tools Solutions

The DB™ Underreamer has proven highly successful in removing cement, packed sand, resin-coated sand, formation and other forms of obstructions. Unlike other slimhole underreamers, the DB Underreamer is designed with a positive locking feature to ensure all cutting blades maintain a full extension upon activation and during an underreaming operation.

A proprietary software program models flow and operational characteristics of the DB Underreamer prior to each job and during field operations. The program aids in determining appropriate orifice size to maximize the efficiency of allowable hydraulic power.

Key features and advantages

- Adjustable nozzles for all flow ports
- Pressure indication on surface when arms are fully extended
- Sturdy construction for downhole reliability
- Designed to underream cased or open hole
- Positive locking of arms when activated

Case History | **North Sea**

Objective: Remove cement from a 7 in. 29.00 lb/ft liner which was left partly cemented to a total depth of 13,600 ft. Due to a 3.695 in. restriction in the completion, a conventional fullbore milling assemby could not be run.

CT Solution: A 3 in. OD DB™ Underreamer with lower bit box was used in combination with a 3.35 in. turbo mill. This system was chosen because of the plug form of the cement.

Result: The underreamer used in combination with the turbo mill successfully milled 1,118 ft of cement in a single run. Using water and high viscous pills, an average rate of penetration (ROP) of 74.50 ft/hr was achieved.

Impact Drilling

Downhole conditions such as high temperatures (above 400° F) and hostile fluids can significantly reduce the life of a workover motor and limit milling operations. Impact drill systems are an attractive alternative because they perform reliably in adverse conditions. The most common applications of the impact drill include scale milling, hard cement milling, resin sand removal, and gravel removal.

Single-Directional Impact Drill

Baker Oil Tools Solutions

Baker Oil Tools' Single-Directional Impact Drill (Si-Di) is used to drill hard packed sand and cement, remove scale and drive debris downhole. The industry-leading impact drill can function as a standard impact hammer, or by applying a modular rotational feature, as a rotating impact drill. It has been specifically designed for use on coiled tubing but can be used on threaded pipe in conjunction with an accelerator. Fluid, gas, or foam power the tool, which can operate in temperatures over 600°F.

Key features and advantages

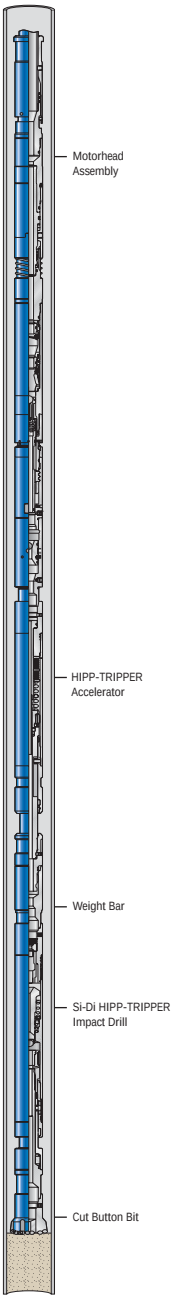
- Does not operate until the bit meets resistance
- Does not store reverse torque
- Can operate in high temperatures (above 600°F)
- Operates with most fluid media including high volumes of nitrogen
- Short make-up length
- Can be equipped to operate in hostile conditions
- Low redress costs (not constructed of elastomers)

Case History | **North Sea**

Objective: Barium sulfate scale needed to be removed from a well which had a restricted tool-string deployment height of 11 ft. This ruled out using a conventional positive displacement motor and underreamer assembly.

CT Solution: A 2-5/8 in. OD Si-Di Impact Drill equipped with a Cut Button Bit was deployed with a conventional motorhead assembly. Overall assembly length was 9 ft.

Result: The assembly successfully drilled out approximately 210 ft of barium sulfate scale at an average rate of 61 ft/hour. The cleanout yielded a 96% increase in oil production in the 7 in. monobore completion.



A well cleaning bottomhole assembly incorporating a Si-Di Impact Drill in combination with a Cut Button Bit for scale removal or hard formation drilling.

Mechanical Scale Removal

Removing scale is one of the most common through-tubing applications on coiled tubing. Although various other methods of scale removal have been attempted, mechanical methods have yielded by far the most consistent success rate.

Baker's METAL MUNCHER® Turbo Scale Mill has proven to be the most effective of all scale removal options.

Baker Oil Tools Solutions

Baker Oil Tools' METAL MUNCHER® Turbo Scale Mill has proven to be the most effective of all options for scale removal. A typical Baker Oil Tools scale removal bottomhole assembly (BHA) consists of a Turbo Scale Mill run below the industry-leading Navi-Drill® X-treme® Workover Motor. The cutting matrix and layout of the Turbo Scale Mill face have been optimized for this setup. The mill has a smaller contact area when milling, which reduces torque consumption. As a result, there are fewer motor stalls and rate of penetration (ROP) is increased. Stabilizer pads and brass dressed on top of the METAL MUNCHER inserts minimize the risk of damaging the tubing or casing wall. The mill is dressed such that if the initial cutting edge breaks due to vibration or hardness of the scale, a second, lower, dressed layer will take over. This design has lengthened mill life per run and reduced trips to surface during extended milling operations, while the improved efficiency has increased cost savings through reduction in overall intervention time.

Key features and advantages
(Navi-Drill® X-treme® Workover Motor)

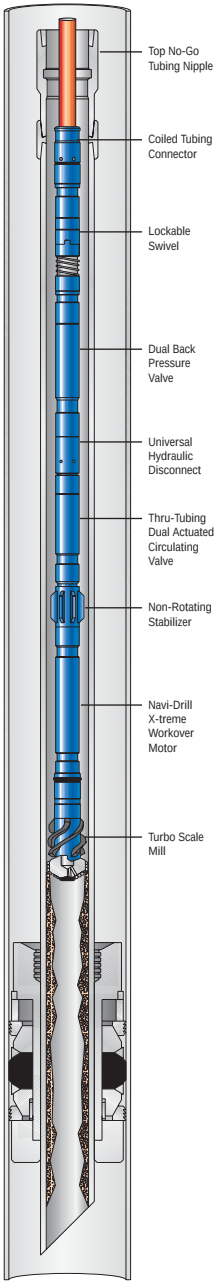
- Higher rates of penetration
- Extended run times
- Reduced milling times
- Minimal flow rates required to achieve maximum horsepower
- Controlled rotational speed protects cutting matrix
- Increased reliability in high-stress applications
- Successful operation in downhole temperatures above 400° F

Case History | North Sea

Objective: The operator required efficient removal of scale from a 14,400 ft well consisting consisting of 4-1/2 in. 13.50 lb/ft tubing and 7 in. 35.00 lb/ft liner. Wellbore fluids were known to be hostile with a history of causing severe damage to conventional workover motor stators. The operation was to be performed from a lower deck with restricted height available for tool-string deployment.

CT Solution: A reduced length 2.88 in. OD Navi-Drill® X-treme® Workover Motor was proposed in conjunction with a 3.61 in. OD METAL MUNCHER® Turbo Scale Mill. The reduced length assembly could be deployed within the restricted riser height.

Result: The hard scale was successfully removed from the 4-1/2 in. tubing using the Turbo Scale Milling Assembly. The same motor was again deployed in conjunction with a DB™ Underreamer to successfully remove scale from the 7 in. liner. Job time for both trips was less than 14 hours, with no fluid damage caused to the X-treme Motor stator.



A typical Baker scale removal bottomhole assembly (BHA) consists of a Turbo Scale Mill run below the industry-leading Navi-Drill® X-treme® Workover Motor.

High-Pressure Jet Washing

Wellbore cleaning solutions also include a variety of high-pressure jet washing tools. These tools are used for sand, paraffin, asphaltine or scale cleanouts. High-pressure jet washing tools are also highly effective for cleaning completion accessories such as nipples, gas lift mandrels and screens where mechanical means are limited.

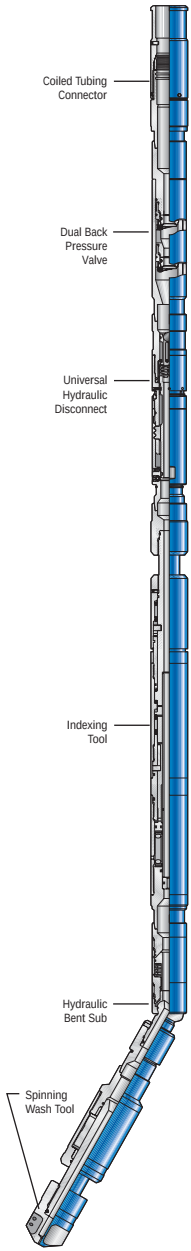
Baker Oil Tools Solutions

Lateral entry and washing

Baker Oil Tools offers an extensive array of tools that can be used as accessories for standard milling and fishing assemblies. The Hydraulic Indexing Tool enables a BHA to rotate in 30° increments with high torque. The Hydraulic Bent Sub is designed to provide a means of hydraulically "kicking over" a tool string for entry into laterals or for fishing applications. The High-Flow Spinning Wash Tool is used to efficiently wash sand and debris.

Key features and advantages

- Kick-over force is easily controllable by hydraulic pressure differential
- Positive rotational control when used with indexing tool
- High speed rotation spinning wash tool
- May be run with a variety of fluids



A lateral wash assembly consisting of a Hydraulic Indexing Tool, a Hydraulic Bent Sub and a High-Flow Spinning Wash Tool.

Vortech Pulsating Jetting Tool

The Vortech Pulsating Jetting Tool effectively cleans out the wellbore or stimulates the reservoir using the fluidic oscillating principle. A vortex is formed inside the tool, which produces oscillating pulses upon exiting. These pulses produce sonic stress waves that have a far greater effective range than a common jetting nozzle. Non-damaging cleanout of complex and delicate structures such as downhole screens, installations, gas lift mandrels, and sliding sleeves is possible because the cleaning radius is not limited by tool standoff.

Key features and advantages

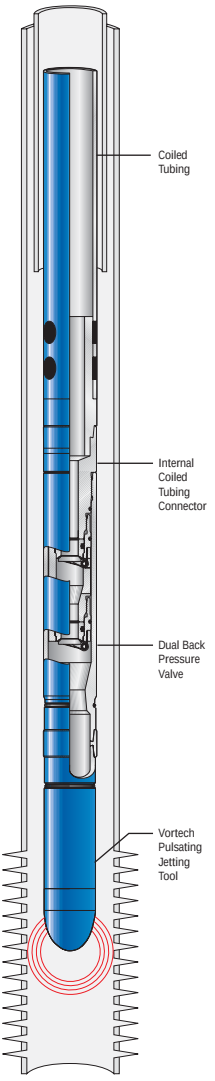
- No moving parts
- Pulsates any fluid, gas, or mixture such as nitrogen, water and/or acid
- Produces sonic stress waves so cleaning radius is not limited by tool geometry
- Effectively stimulates the reservoir
- Available flush with coiled tubing OD

Case History | Texas

Objective: To remove barium sulfate scale from the production tubing and perforated interval in a gas well where previous bailer attempts were unsuccessful. Production in the well had steadily declined to 140 Mcf/day and 600 psi wellhead pressure.

CT Solution: A 1-1/4 in. OD Vortech Pulsating Jetting Tool on 1-1/4 in. OD coiled tubing was selected to clean out the barium sulfate scale. To ensure the fill would return to surface and reduce the hydrostatic pressure acting on the reservoir, a water / nitrogen mixture was used.

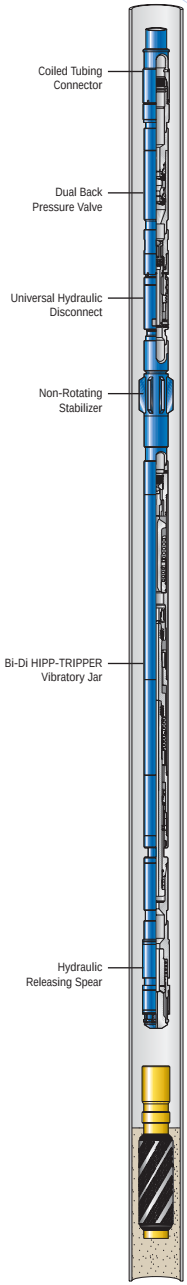
Result: The cyclic stress waves generated by the action created by the Vortech Pulsating Jetting Tool, combined with the water medium, broke up the scale. The scale was successfully removed and production increased to 5 MMscf with a 2,600 psi wellhead pressure.



Wellbore Cleanout and Reservoir Stimulation

Recovering Tools with Downhole Vibration Technology

When fishing on coiled tubing for devices stuck in hole, hydraulic jars are typically used as means of providing impact force to free the device. The drawback is that the pipe must be cycled over the gooseneck multiple times to fire and reset the jar. Downhole vibration technology places impact energy right where the device is stuck and frees it quickly, even from deep or deviated wells.



Bi-Directional Vibratory Fishing BHA

Baker Oil Tools Solutions

Unlike conventional jars, Baker's Bi-Directional Vibratory Jar (Bi-Di) delivers the energy of the impact immediately above the fish. The Bi-Di is used extensively in fishing operations to deliver both upward and downward impact up to 1,000 times per minute. This high-frequency jarring action, combined with a constant overpull, is similar to the action created by a vibratory extractor, which is a highly effective method of extracting sand-compacted fish. The Bi-Directional Vibratory Jar is especially effective for installing and removing equipment in horizontal and highly deviated wells. Because the tool resets and activates itself with the aid of pumped fluid, cycling the coiled tubing is eliminated, which extends its life. In addition to functioning as an excellent alternative to jarring, the vibratory jar can be used to shift sliding sleeves, swage open collapsed tubing, break ceramic or glass disks, and retrieve wireline tools in deviated wells.

Key features and advantages

- May be operated using gas/foam/fluid including nitrogen
- Temperature rated up to 600°F
- Compatible with highly deviated/horizontal wellbore applications
- Can circulate while going in the hole
- Eliminates cycling of pipe

Case History | **Gulf of Mexico**

Objective: A G-Stop Plug installed above a gravel pack screen needed to be removed. Numerous wireline and coiled tubing overpull and jarring methods had been unsuccessful in removing the plug.

CT Solution: Deploy a 2-1/8 in. Bi-Directional Vibratory Jar to retrieve the G-Stop.

Result: G-Stop was retrieved in 18 minutes of on-bottom time.

Recovering Tools with Hydraulically Activated Fishing Tools

Most types of conventional spears and overshots can be conveyed on coiled tubing. These include standard basket and spiral-type overshots, kelo sockets, mousetrap overshots, and releasing spears. However, these types of tools cannot be released conventionally because coiled tubing cannot be rotated. If these tools are run on coiled tubing and the fish cannot be retrieved after latching the overshot, a hydraulic disconnect farther up the tool string must be activated. This leaves additional tools in the hole. To avoid this situation, it is advisable to run hydraulic releasing spears and overshots before running conventional types of spears and overshots when fishing using coiled tubing.

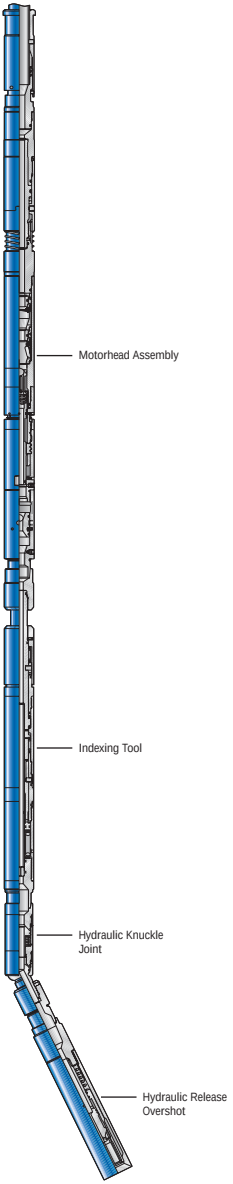
Baker Oil Tools Solutions

Baker's Hydraulic Releasing Spears and Overshots are designed specifically for coiled tubing fishing operations. The overshot is used to catch either external fishnecks or slick ODs, and the spear is used in internal fishnecks or slick IDs. Hydraulic Releasing Spears and Overshots for fishneck profiles are dressed with a collet designed to fit a specific fishneck type. Overshots and spears designed to catch slick fishnecks are dressed with a grapple-type collet in the specific catch range size required.

For fishing in larger-diameter wellbores, Baker Oil Tools' patented hydraulic release fishing tools have been designed to allow engagement of a fish with an internal or external fishing neck. These tools were designed specifically for coiled tubing or threaded pipe operations where no rotation is possible.

Key features and advantages

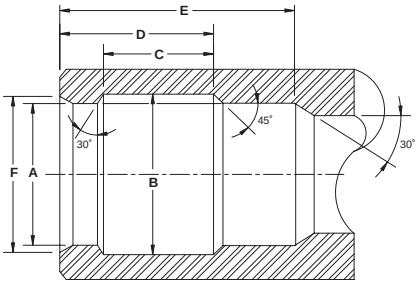
- Designed specifically for coiled tubing conveyance
- Ability to circulate fluid out of the end of the tool provides a means of washing debris or fill from the fishneck to allow proper latching
- Collet-style grapple does not get loaded during jarring operation; grapple section that catches the fish is in compression when pulling or jarring on the fish



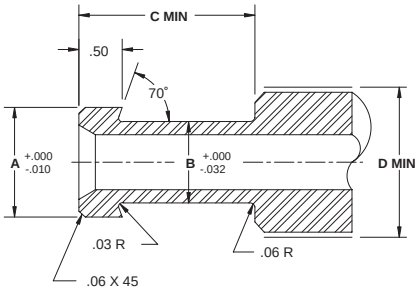
A Baker Oil Tools Hydraulic Release Overshot is combined in a bottomhole assembly with other hydraulically actuated tools to enable fishing through tubing in a larger bore. This BHA can locate a small fishing neck in a larger bore by activating the Indexing Tool and the Hydraulic Bent Sub to systematically search the larger bore and engage the fish.

Internal Fishing Necks

Size	A (In.)		B (In.)		C (In.)	D (In.)	E (In.)	F (In.)	
	Max	Min	Max	Min				Max	Min
1-1/4	.90	.88	1.05	1.03	1	1.38	2	1.03	1.00
1-1/2	1.08	1.06	1.24	1.22	1-1/2	2	3	1.19	1.16
2	1.40	1.38	1.58	1.56				1.62	1.59
2-1/2	1.83	1.81	1.99	1.97				1.94	1.91
3	2.33	2.31	2.52	2.50				2.50	2.47
3-1/2	2.64	2.62	2.83	2.81				2.81	2.78
4	3.14	3.12	3.33	3.31				3.38	3.35
5	4.02	4.00	4.21	4.19				4.19	4.16
7	5.38	5.40	5.62	5.64				5.60	5.64



Internal Fishing Necks



External Fishing Necks

External Fishing Necks

Min tubing size in which neck may be run (In.)	A ♦ (In.)	B (In.)	C ■ (In.)	D ● (In.)	Pulling Tool	
					Otis	Camco
1.660	.875	.688	2-3/4	1-5/16	1-3/16 RB	1-1/4 JDC*
					1-5/16 SM*	1-5/16 JDC*
1.660	1.000	.813	2-3/4	1-7/16	1-1/4 RB*	1-3/8 JDC*
					1-1/2 RB*	
1.900	1.188	1.000	2-1/4	1-1/2	1-1/2 RB*	1-1/2 JDC*
					1-1/2 SB	1-1/2 JUC
2-3/8	1.375	1.188	2-3/8	1-15/16	2 RB*	2 JDC*
					2 SB	2 JUC
2-7/8	1.750	1.500	2-1/4	2-3/8	2-1/2 RB*	2-1/2 JDC*
					2-1/2 SB	2-1/2 JUC
3-1/2	2.313	2.063	2-1/4	2-7/8	3 RB*	3 JDC*
					3 SB	3 JUC

* These dimensions are based on using the pulling tools (overshots) most commonly found on wireline service trucks. They are the Otis RB, RS, SB, and SS, and the Camco JDC, JUC, JDS, and JUS. The RB, RS, JUC, and JUS are all jar-up release tools, and the others are jar-down to release.

■ The minimum recommended distance to allow an Otis SB or Camco JDC pulling tool to release.

♦ Fishing neck type size sometimes referred to by "A" dimension.

● The least recommended diameter immediately surrounding the fishing neck to allow the overshot dogs room to latch and unlatch.

Recovering Coiled Tubing

When coiled tubing parts in tension, it “necks” down over several inches at the point where it parted. It is possible for overshots to engage the top of the parted section, but engaging parted coiled tubing can be difficult because of residual helix and spring in the coil itself.

When coiled tubing parts are in compression, it typically buckles and bends over to form a “shepherd's hook” shape. A compression failure normally requires dressing the coiled tubing using a washover shoe before running tools such as a Snipper or Continuous Tubing Overshots.

Baker Oil Tools Solutions

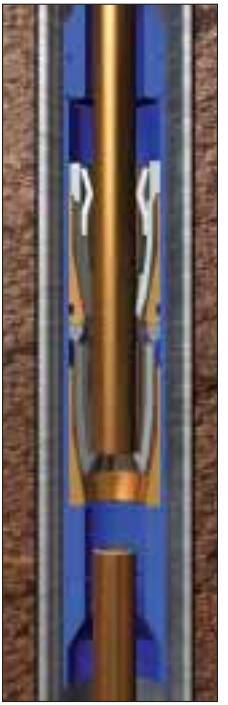
The Snipper Overshot is used to remove the damaged top section of parted coiled tubing remaining in the hole. A catch and cutting mechanism in the overshot washes over the top of the coiled tubing. Once the required amount of coiled tubing (typically 5 to 10 ft) is “swallowed”, overpull is applied, which forces the catch grapple to bite into the coiled tubing. This overpull may be sufficient to free the fish. If not, the overpull is increased to activate the lower cutting grapple, which cuts the coiled tubing. Once the snipper has been run, a round fishneck with a non-restricted ID remains to allow passage of a chemical cutter should one be required later in the fishing operation. The Snipper Overshot has also been used as a primary retrieval tool to recover several thousand feet of coiled tubing in a single trip.

The Continuous Tubing Overshot (CTO) is used to catch coiled tubing that has parted in the hole. The CTO uses an internal grapple sized to the coiled tubing being fished. The grapple segments are arranged in a circumference to provide a nearly complete slip bite. They are spring-loaded against the coiled tubing, so long sections of tubing can be washed over without dragging the grapple teeth against the tubing and causing tooth damage. The CTO moves freely downward over the coiled tubing. The grapple segments engage with any upward movement of the tool. The CTO can be run with either threaded tubing or coiled tubing workstrings when fishing coiled tubing.

Sometimes circulating fluids out around the coiled tubing being fished can help to free it. In these cases, a High Pressure Packoff (HPP) is run above the CTO. The HPP can also allow drop balls to be circulated to seat in circulation subs and hydraulic disconnect tools in the original BHA. Actuation of these tools can also help to free the stuck tubing.

Key features and advantages

- Modular design for multiple sizes of coiled tubing
- Snipper retrieves coiled tubing above cut in same trip
- May be run on threaded or coiled tubing
- High Pressure Packoff allows high pressure circulation through a fish



Cut and retrieve Coiled Tubing using a Snipper Overshot.

Case History | Algeria

Objective: Poor cement quality in a well created problems in setting a cement kickoff plug, which resulted in 2 in. coiled tubing being cemented in the well. The cemented coiled tubing had to be removed so the completion could be recovered.

CT Solution: A Baker Oil Tools Snipper Overshot was deployed to cut and retrieve the coiled tubing which was cemented on the inside.

Result: On the first run of the Snipper Overshot, 1,115 ft of 2 in. CT was successfully recovered with no problems. The final foot of recoverable CT was recovered on the second run. The remaining section of CT was below the existing completion, so the operator was able to remove the entire completion.

Removing and Recovering Obstructions

Breaking completion obstructions such as knock-out isolation valves (KOIV) using an impact hammer and ceramic disk breaker is common practice on coiled tubing. Traditionally the debris is removed with a debris catching device on a subsequent run. However, Baker Oil Tools offers a safe, reliable, one-trip solution.

Baker Oil Tools Solutions

Baker's Single-Directional Impact Drill (Si-Di) is used to drill hard packed sand and cement, remove scale and drive debris downhole. The industry-leading impact drill can function as a standard impact hammer or, by applying a modular rotational feature, as a rotating impact drill. It has been specifically designed for use on coiled tubing but can be used on threaded pipe in conjunction with an accelerator. Fluid, gas, or foam power the tool, which can operate in temperatures over 600°F. The Si-Di can also be run with a Venturi Jet Junk Basket to allow wellbore obstructions to be impacted and debris recovered in a single trip.

Key features and advantages

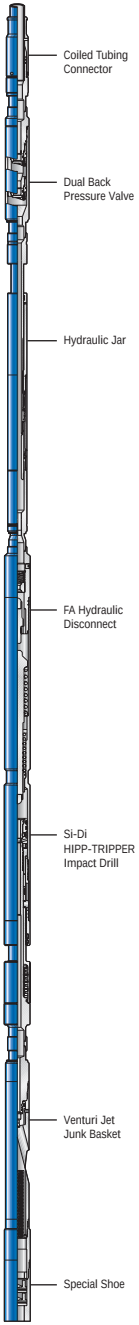
- Does not operate until the bit meets resistance
- Does not store reverse torque
- Can operate in high temperatures (above 600° F)
- Operates with most fluid media including high volumes of nitrogen
- Short make-up length
- Can be equipped to operate in hostile conditions
- Low redress costs (not constructed of elastomers)

Case History | Gulf of Mexico

Objective: On an extremely challenging thru-tubing fishing operation, where operational risk and cost had to be minimized, the following objectives were given;
- To break a pair of ceramic isolation flappers at 26,806 ft measured depth
- Ensure effective cleaning after breakage of the flappers and any other debris encountered
- Shift a fluid loss device at a depth of 27,090 ft MD

CT Solution: The Si-Di HIPP-TRIPPER®, Venturi Jet Junk Basket and custom bit were deployed in the same BHA to allow the flappers to be broken, debris to be collected and the fluid loss device to be shifted open, all in one trip. Extensive testing and prejob planning confirmed the solution's feasibility.

Result: Results of the operations performed are summarized as follows:
- The flappers were broken, debris recovered and fluid loss valve shifted.
- Fewer trips reduced overall risk of the operation and saved the client an estimated $400,000
- The job set a record working depth for coiled tubing in the Gulf of Mexico.



Obstruction Removal and Recovery System

Cutting Pipe

For many years, wireline-conveyed explosive jet and chemical cutters have been the preferred choice for cutting tubulars in slimhole wellbores. Baker Oil Tools offers a safe, efficient alternative in applications where explosive jet or chemical cutters are unable to provide sufficient energy to cut single or multiple strings of pipe downhole.

Baker Oil Tools Solutions

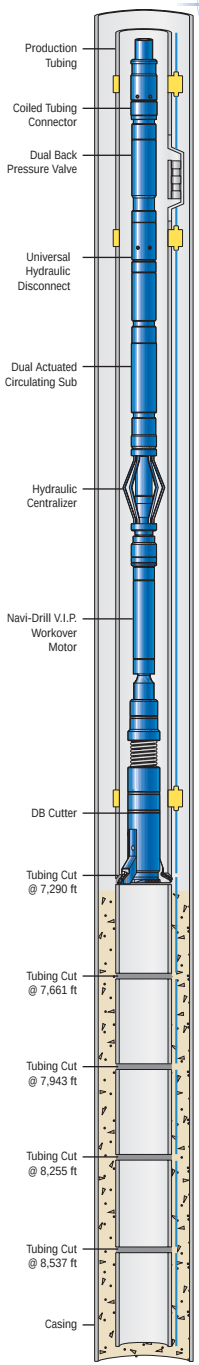
The DB™ Cutter is safer than explosive or chemical cutting methods since it does not contain or use any hazardous materials and is activated by hydraulic pressure and mechanical forces. Its superior cutting ability is proven by the fact that it has successfully cut internally plastic-coated drill pipe and production tubing containing 25% CR and has completed cuts through multiple strings of pipe with cement in between.

The DB Cutter uses several unique cutting blade configurations that were designed specifically to address various metallurgical properties and dimensions. The cutting blades contain METAL MUNCHER® cutting inserts, which were developed by Baker Oil Tools to mill and cut a variety of metals downhole at a high rate of penetration. METAL MUNCHER blades require less applied weight and less torque. They last longer; cuttings are small, uniform, and easy to circulate out. Each cutting insert is placed in a specific pattern to ensure that a new cutting element becomes exposed to the pipe wall when the previous insert diminishes.

When cutting tubing using coiled tubing as means of deployment, it is difficult to keep the knives of the cutting tool in a fixed position, because the coiled tubing is moving when the pumps are started or when the pump rate is increased. The robust, self-stabilizing DB Cutter and a Navi-Drill® V.I.P.™ or X-treme® Workover Motor in combination with the Hydraulic/Mechanical Tubing Anchor constitute the preferred bottomhole assembly for this type of application.

Key features and advantages

- Self-stabilizing
- Superior cutting ability from blades designed with METAL MUNCHER cutting inserts
- Safer than explosive or chemical cutting methods
- Limited maximum knife expansion prevents damage to outer casing strings



DB™ Cutter System, cutting production tubing with sensor wire clamped onto the outside

Case History | South America

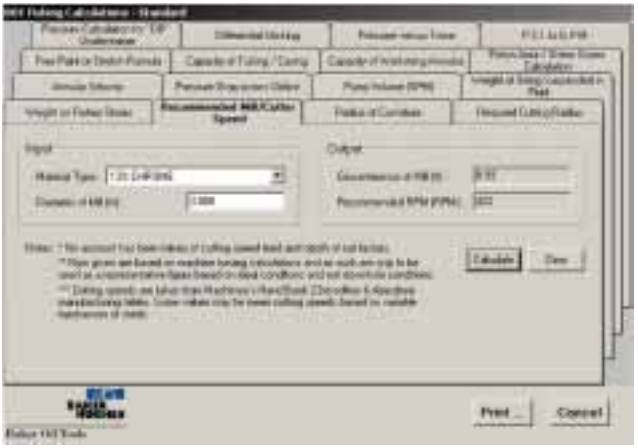
Objective: To perform a series of cuts in 4-1/2 in. 12.75 lb/ft tubing which was stuck inside 9-5/8 in. casing due to a sand filled annulus. A tubing washover was not feasible due to wire and clamps being fixed to the tubing OD. A previous chemical cutter attempt was unsuccessful.

CT Solution: A 2-1/4 in. DB Cutter was deployed with a 2-1/8 in. OD Navi-Drill® Workover Motor, Hydraulic Centralizer and standard running assembly.

Result: Five cuts were made inside the tubing. Two of the cuts were completed in a single trip into the well. Although one of the five cuts had penetrated 90% into the pipe, each cut was pulled successfully and no top dressing was required prior to latching with a fishing overshot.

Milling

Coiled tubing is used to mill materials such as scale, metal, cement and composite and cast-iron bridge plugs, as well as many forms of loose junk. When milling metal, Baker Oil Tools' fishing calculations software helps calculate mill bit speeds to provide optimum milling performance.



Fishing Calculations Software

Baker Oil Tools Solutions

Baker Oil Tools' METAL MUNCHER® Step Mill consists of a series of steps with a wear pad at the top of the largest OD step. Each step is dressed with tungsten carbide cutting inserts, and the length of each step is custom built to suit the dimensions of the nipple being enlarged. The step feature is designed to keep torque consumption of the workover motor low and cutting sizes to a minimum. This mill design is based in part on lathe-cutting principles and leaves a machine-like finish on the milled surface. The mill may be manufactured with a pilot for additional stabilization.

Step Mill

Enlarging or removing nipple profiles is usually performed during through-tubing operations where the ID of the nipple is less than the OD of tools required to pass through it. In many cases, the lower tail-pipe nipple of the completion is removed to allow contingency fishing tools access to the liner below. A profile-enlargement milling assembly includes the same BHA configuration as a scale milling assembly, but with a different mill bit design.

Key features and advantages

- Low torque application
- Machine-like finish left on milled surface
- Will not damage outer string

Case History | North Sea

Objective: An operator in the UK sector of the North Sea required a 3.688 in. ID nickel alloy “AR” Nipple to be milled out to 3.875 in. ID to allow a Baker Oil Tools Coiled Tubing Straddle Assembly consisting of two 3.70 in. OD Model KB Packers to be set below the nipple.

CT Solution: Due to the extreme challenges presented by milling nickel alloy material, two special insert step mills were custom built for this application. The mills were deployed on 1-1/2 in. OD coiled tubing and powered by a 2-7/8 in. Navi-Drill® Workover Motor.

Result: The nipple was milled to 3.875 in. ID out in two runs as planned, with actual on-bottom milling time of 5-1/2 hours for both runs. The second mill drifted the nipple twice upon completion of milling and was measured in gauge upon inspection at surface. The KB straddle assembly could then be set below the nipple depth.

METAL MUNCHER® Milling Assembly with Magnetic Chip Catcher

On a milling job, a Magnetic Chip Catcher can be run above the motor to help remove cuttings from the well. The tool houses magnets that attract metal chips from the wellbore fluid. This tool is ideal for use on coiled tubing, where annular fluid velocities are too low to carry cuttings out of the well. The catcher is usually run directly above the motor. A centralizer is incorporated in the tool to stand it off the casing so cuttings will remain on the tool and not be scraped off while pulling out of the hole.

Key features and advantages

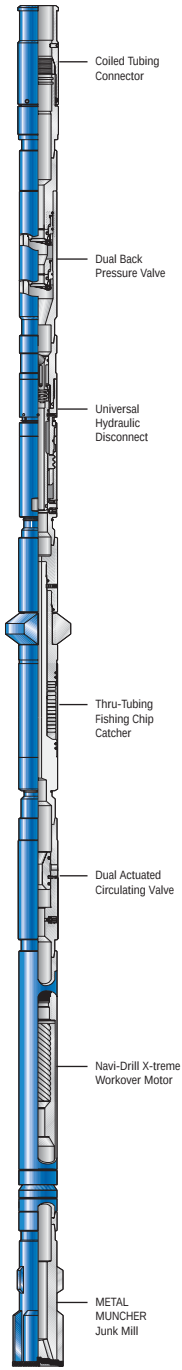
- Helps keep metal cuttings out of mud system
- Magnets are enclosed in housing for easy cutting removal
- Special centralizer feature to maintain standoff from casing

Case History | Alaska

Objective: The operator required approximately 80 ft of 2-7/8 in. 6.40 lb/ft liner – cemented inside 4-1/2 in. 12.60 lb/ft casing – to be milled and circulated out of the well. This would allow a whipstock to be set at a desired kickoff point and a dual exit window to be milled through 4-1/2 in. 12.60 lb/ft and 7 in. 26.00 lb/ft casing.

CT Solution: A high-performance Navi-Drill® X-treme® Workover Motor was deployed on coiled tubing in combination with a custom-designed METAL MUNCHER® Piranha Mill.

Result: The required section of 2-7/8 in. liner was successfully removed in a total of 94 hours milling time. The monobore whipstock was subsequently set at the desired kickoff point and the window milled through two casing strings.



Milling Bottomhole Assembly with Chip Catcher

OPTICUT™ Mills

Baker Oil Tools' OPTICUT™ Junk Mills are designed for milling debris where milling inserts are considered too aggressive. These mills effectively remove composite bridge plugs such as QUIK Drill™ plugs. While a single mill can remove an average of seven to ten composite bridge plugs before redress is required, as many as 14 plugs have been removed successfully using the same OPTICUT™ mill.

OPTICUT™ Star-Shaped Insert

OPTICUT™ dressed mills use the patented OPTICUT™ star-shaped insert that is ideally suited to mud motors since it creates small cuttings and does not need high set-down weight to perform optimally. Baker Oil Tools offers a variety of sizes and configurations accommodating all common casing and tubing sizes.

Key features and advantages

- Optimum shaped geometry assures sharp cutting edges and points are looking up no matter how the insert is positioned
- Sixteen cutting points and eight cutting edges
- Sharp edges and points result in less weight requirement and increased rate of penetration (ROP)

Vortech Pulsating Bit Sub

The Vortech Pulsating Bit Sub, when positioned between a workover motor and a mill, improves milling performance and aids in achieving higher rates of penetration. A vortex is formed inside the tool, which produces oscillating pulses. Upon exiting; these pulses produce sonic stress waves that have a far greater effective range than a common bit nozzle. Because pressure differential created across the bit sub is only 75 psi, the overall performance of the motor is not compromised. Higher penetration rates result from the higher impact pressure created from pulsing the jet stream and the reduction of the "hydraulic hold-down effect" on cuttings that is caused by straight jets. The Vortech Pulsating Bit Sub aids not only in breaking up hard, brittle material, but also in cleaning the bit and removing debris from the hole.

Key features and advantages

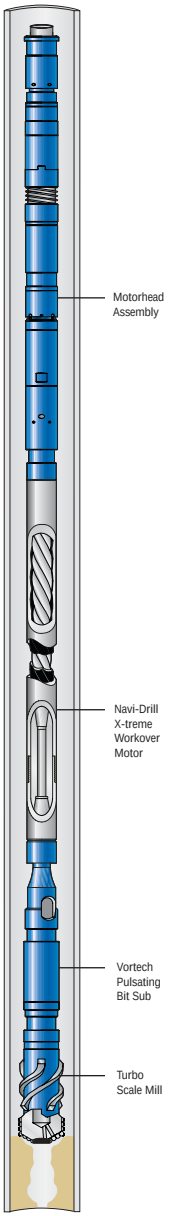
- Pulsates any fluid, gas, or mixture such as nitrogen, water, and/or acid
- Produces sonic stress waves so cleaning radius is not limited by tool geometry
- Increased penetration rate

Case History | Texas

Objective: Mill cement from inside a 2-7/8 in. completion, which was inadvertently set 2,500 ft too high.

CT Solution: A Vortech Bit Sub along with a 1-11/16 in. OD workover motor and cement mill.

Result: 1-11/16 in. workover motor and cement mill showed slow progress. When the Vortech Bit Sub was installed between the motor and mill, rate of penetration (ROP) increased by 40%.



Scale Milling Assembly with Vortech Pulsating Bit Sub

Through Tubing

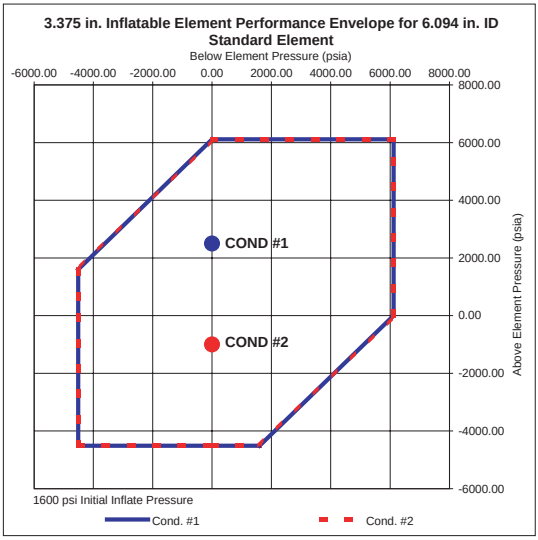
Zone isolation is one of the most common through-tubing well intervention operations where coiled tubing can add value. Through-tubing workover solutions can be carried out in 'live' well conditions, negating any requirements for costly and time-consuming well kill operations and eliminating the chances of irreparable wellbore damage that may result from using kill-weight fluids. A through-tubing zonal isolation system can be engineered to provide a solution whether the zone in question is a lower zone, an intermediate zone or an upper zone.

Section View of Inflatable Element

Baker Oil Tools Solutions

Baker pioneered the development of reliable, high-expansion, Thru-Tubing Inflatable Element Technology beginning in 1985. The most prevalent industry use of Thru-Tubing inflatable products and services has been in the area of zone isolation, with water shutoff ranking as the number one application. The versatility offered by a Thru-Tubing inflatable packing element allows for tools to be set in the most diverse range of wellbore environments, including cased hole, slotted pipe, perforations, open hole and screens.

Our complete line of coiled tubing deployed inflatable products and services includes fit-for-purpose, in-house-designed running and retrieving tools and our INFLATEDESIGN™ proprietary design software package. INFLATEDESIGN aids in the planning, engineering and implementation of our Thru-Tubing inflatable well intervention tools. The software enables structured gathering of relevant completion, reservoir, coiled tubing and post well intervention information which is used to generate an inflatable element performance envelope. This performance envelope identifies the ability of the selected Thru-Tubing element to handle the required differential pressure conditions and enables the Baker Oil Tools operations engineer to make job set-up changes to minimize the effects of these conditions and optimize the results to the operator.



INFLATEDESIGN™ Element Performance Envelope

Retrievable Bridge Plug

A Thru-Tubing Retrievable Bridge Plug may be used to plug off any part of the wellbore where a more temporary or temporary-to-permanent application is required. The Retrievable Bridge Plug is conveyed to setting depth via coiled tubing and set by means of applied coiled tubing pressure. After setting, the bridge plug is disconnected from the running string via a hydraulic release running tool. A high-expansion inflatable packing element may allow for expansion capabilities of greater than 350% and may support applied differential pressures of greater than 8,500 psi. The bridge plug may be retrieved with either coiled tubing or wireline and latched, equalized and released with a single trip in the hole.

Key features and advantages

- No well kill required
- Inflatable packing element can be run through restrictions then seals effectively in larger ID below
- Single trip to equalize, release and retrieve reduces intervention costs
- External fishing neck profile eliminates internal debris problems

Case History | Indonesia

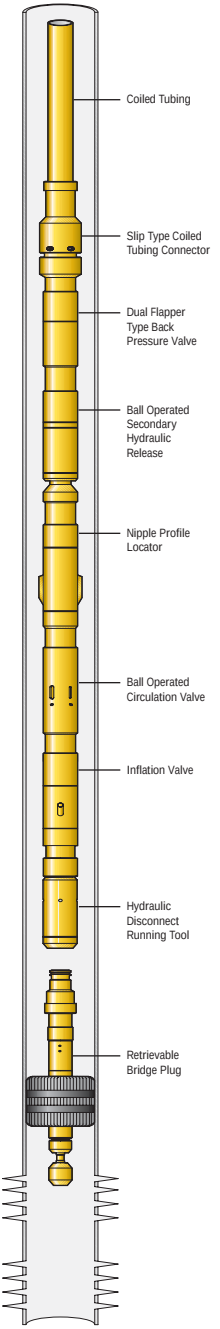
Objective: An operator in Indonesia needed to isolate a lower water-producing zone in 9-5/8 in. 47.00 lb/ft casing through a minimum tubing restriction of 3.13 in.

CT Solution: A Baker Oil Tools 3.00 in. OD Thru-Tubing Inflatable Retrievable Bridge Plug was run, set and disconnected from a setting depth of 8,470 ft and a deviation of 67º.

Result: After returning the well to production, the water cut was reduced from 12,000 bbls/day to 7,300 bbls/day while the production rate was increased from 1,400 bbls/day to 4,500 bbls/day.

Thru-Tubing Inflatable Permanent Bridge Plug. Please refer to Page 58.

Thru-Tubing Inflatable Permanent Cement Retainer. Please refer to Page 59.

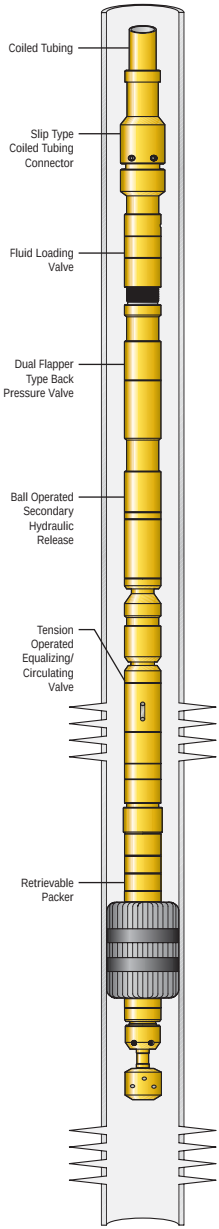


CT Isolation of Lower Zones Using a Thru-Tubing Inflatable Retrievable Bridge Plug

Retrievable Packer

The Thru-Tubing Inflatable Retrievable Packer is a high-expansion retrievable packer designed to carry out various workover operations in a through-tubing environment. Zonal isolation with a packer is typically performed on either a lower or intermediate zone. For lower zone applications, the packer is used to protect the upper zones from the cement or chemical shut-off treatment performed through the coiled tubing. The Thru-Tubing Inflatable Packer is conveyed to setting depth via coiled tubing, set, treating operations conducted, equalized and retrieved in a single trip in hole.

For intermediate zone isolation, the packer will more than likely be used in conjunction with a Thru-Tubing Retrievable Inflatable Bridge Plug. Here the bridge plug will be set below the zone of interest and the packer positioned above the zone of interest. Now coiled tubing treatment operations can be performed selectively to the required isolation zone.



Selective Zonal Treatment Using Thru-Tubing Inflatable Retrievable Packer

Key features and advantages

- Selective treatment eliminates damage to productive zones
- One-trip system reduces intervention costs
- Coiled tubing stays attached so recovery concerns are minimized
- Integral packer equalization negates potentially damaging CT forces

Straddle Systems

Baker Oil Tools has designed a number of Thru-Tubing Inflatable Straddle Systems with different geometries to offer clients a solution to zonal isolation requirements where isolation of either an upper or intermediate zone is required. Both permanent and retrievable systems are available with design criteria that optimize the ratio of straddle ID to straddle OD in order to minimize restrictions for either production or injection through the zone of isolation. These systems can be run as a single unit if coiled tubing lubricator restrictions will allow, or more commonly, in sections. When running a modular system, the straddle system is effectively assembled downhole via multiple coiled tubing runs using a releasable and sealable snap latch mechanism to couple the straddle sections together in the wellbore. To date the longest straddle placed in a producing environment using this technology was in excess of 1,800 ft.

The straddle system may also incorporate flow control devices such as nipples and sliding sleeves, and can be blank pipe or sand screen depending on isolation requirements.

Key features and advantages

- Maximizing straddle OD/ID ratio minimizes pressure drop and may allow the potential of future through-straddle intervention work
- Straddle length is not limited by lubricator constraints
- Availability of exotic alloys means intervention straddle can meet completion metallurgy selection criteria

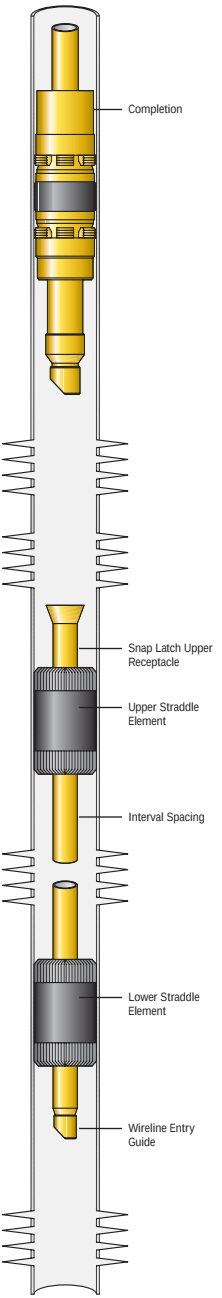
Case History | **UK**

Objective: A well in the UK sector of the North Sea required isolation of an upper gas producing zone in 7 in. 29.00 lb/ft L-80 casing below a 4.313 in. minimum restriction. The zone in question was perforated from 14,622 ft to 14,724 ft. A differential pressure capability of 6,000 psi was required.

CT Solution: A 4-1/4 in. OD x 2.25 in. ID Thru-Tubing Permanent Inflatable Straddle System was run in two sections. The total straddle length was 168 ft with a 2-7/8 in. 6.40 lb/ft straddle pipe used.

Result: After straddle installation, the lower oil producing zone was perforated through the straddle and the well brought back on line with produced fluids in excess of 20,000 bbls per day. This inflatable straddle system was maintained in a producing environment for more than seven years.

Inflatable Straddle Acidizing Packer (ISAP™). Please refer to Page 30.



Intermediate Zonal Isolation Using Thru-Tubing Inflatable Straddle System

Monobore

With coiled-tubing-conveyed systems, zone isolation in a monobore well intervention operation does not require costly kill-weight fluids that can irreversibly damage the formation. Not using kill-weight fluids allows the effective treatment of zones that require fracturing operations in a wide range of injection pressures. A monobore zone isolation system can be targeted to provide a solution whether the treatment of the zone is in a lower, intermediate or upper portion of the wellbore. Baker Oil Tools provides a one-trip, coiled-tubing-conveyed system for single zone isolation in monobore environments.

Baker Oil Tools Solutions

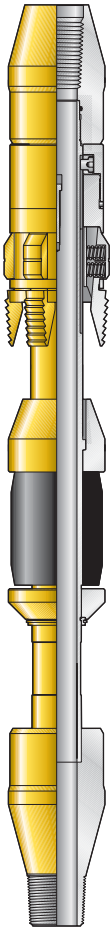
The Model N-1™ Cast Iron Bridge Plug is a high-performance, drillable bridge plug suitable for almost any zone isolation operation. The plug is constructed from select materials that provide a combination of strength and drillability. The CT™ Hydraulic Setting Tool and Model N-1 Bridge Plug are designed to be run and hydraulically operated on coiled tubing. No rotation is required to operate the system, which makes it ideal for coiled tubing applications in highly deviated wells. When running the Model N-1, the CT Setting Tool allows the operator to spot cement on top of the bridge plug and/or circulate the hole clean prior to pulling out of the well.

Key features and advantages

- Construction of drillable materials allow coiled tubing deployed downhole mills and motors to easily remove the bridge plug should it be necessary to do so for future operations
- Drill-out time is minimized
- Swab-resistant element design allows faster run-in speed

Model WG™ Retrievable Bridge Plug. Please refer to Page 34.

CT Setting Tool. Please refer to Page 60.

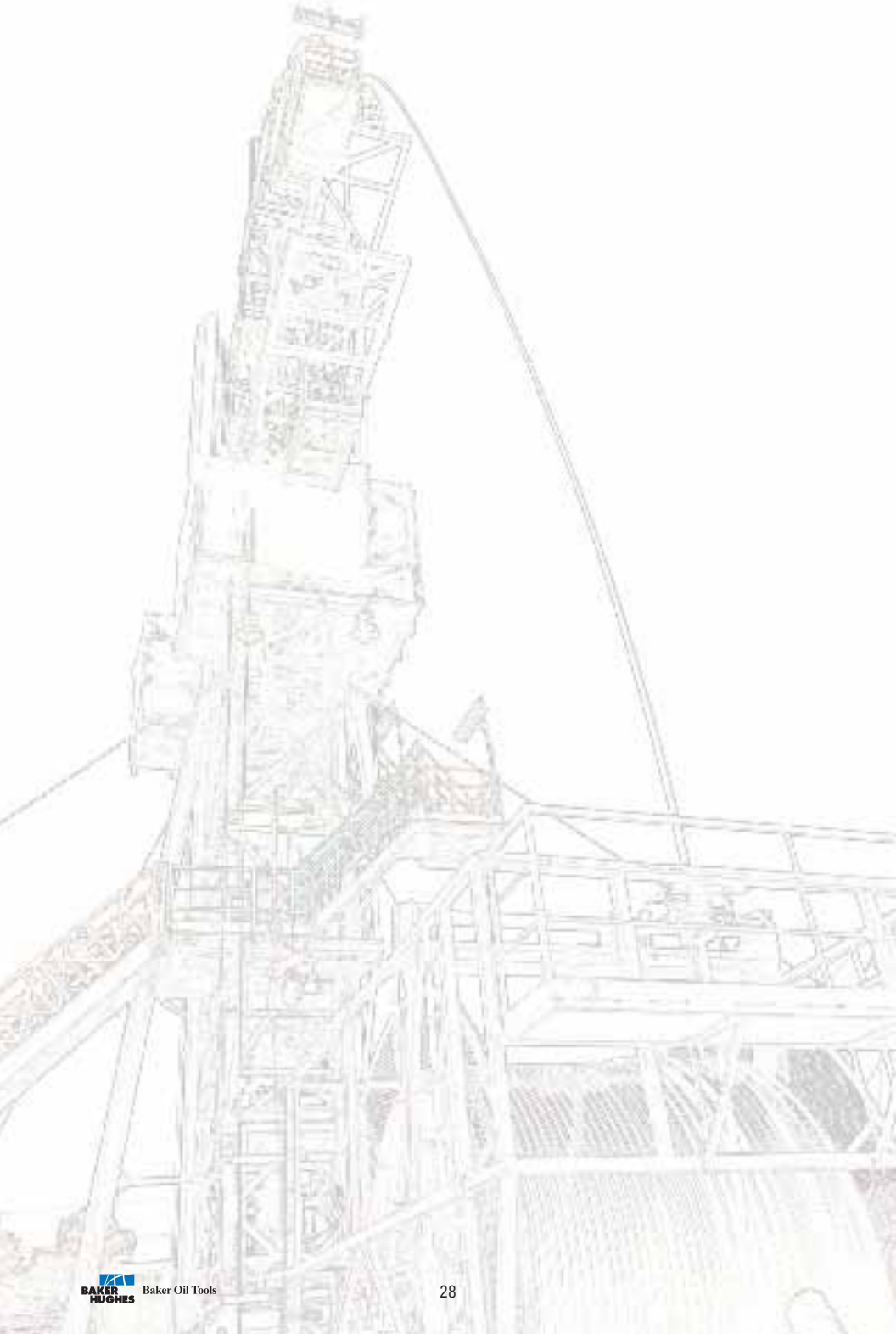


Model CT™ Tension Set Service Packer

The CT™ Service Packer is a compact, economical, retrievable packer designed for use in coiled tubing applications. The CT Packer is a multiple-set-and-release packer that operates efficiently with an "auto-J" mechanism actuated from the surface by axial movement of the coiled tubing, which makes the packer easy to set and release. The emergency shear release values can be adjusted for downhole conditions and pull capabilities.

Key features and advantages

- Short and compact
- Uses an easy-to-operate “auto-J” mechanism for multiple set and release
- Adjustable emergency shear release



Stimulation and Fracturing

Conveying stimulation and fracturing systems on coiled tubing allows these operations to be carried out in a "live" well, so there is no need for a costly and time consuming well kill and no chance of irreparable wellbore damage from the use of kill-weight fluids.

Through Tubing ISAP

We pioneered the development of high-expansion, Thru-Tubing Inflatable Element Technology beginning in 1985. The versatility offered by a Thru-Tubing Inflatable Packing Element allows for service tools to be set in the most diverse range of wellbore environments, including cased hole, slotted pipe, perforations, open hole and screens.

Our complete line of coiled-tubing-deployed inflatable products and services includes fit-for-purpose, in-house designed running and retrieving tools. The product line is complemented by our proprietary INFLATEDESIGN™ software package which aids in both job planning and execution.

2.50 in. OD Inflatable Element in 7.00 in. OD Pipe

Baker Oil Tools Solutions

Baker Oil Tools' Inflatable Straddle Acidizing Packer (ISAP™) System is a unique, through-tubing, coiled-tubing-conveyed well intervention system that provides a versatile and reliable method for accurate and selective fluid placement. The ISAP System is particularly suited to such applications as water shutoff, chemical treatments, screen washing, leak testing and injection testing. Stimulation operations predominantly by means of acid have proven to be the most requested operation for the ISAP System. The system is particularly valuable in mature fields where reservoirs are depleted and production of undesirable fluids is increasing.

The ISAP System uses resettable elements that allow for multiple settings in a single coiled tubing trip with variable element spacing to allow for true selectivity. Several unique features ensure the highest degree of reliability. Additionally, because the ISAP System was designed for coiled tubing deployment, it requires no set-down weight to operate, making it ideal for highly deviated and horizontal wellbore applications.

Key features and advantages

- Resettable operation allows single trip multiple zone settings
- No exposed control line; all plumbing is internal to the system
- Integral injection control valve allows for deflation against CT overbalance
- No locked-in inflation pressure maximizes element longevity and negates detrimental element temperature effects
- No set-down weight required
- Deflation of tool system to the annulus
- Stimulation fluid maintained in CT between sets to eliminate loss of expensive chemicals

Case History | South America

Objective: The operator required a stimulation treatment on a perforated interval at 15,750 ft in a 7.00 in. 32.00lb/ft liner through a 5.95 in. ID safety valve at 285º F.

CT Solution: The ISAP™ tool dressed with two 4.25 in. OD nickel alloy style elements and 16 ft spacing was deployed into the wellbore supporting a maximum CT overbalance of 3,200 psi. Two sets of the system were undertaken with a treatment recipe consisting of solvent, diesel and 7.5% HCL.

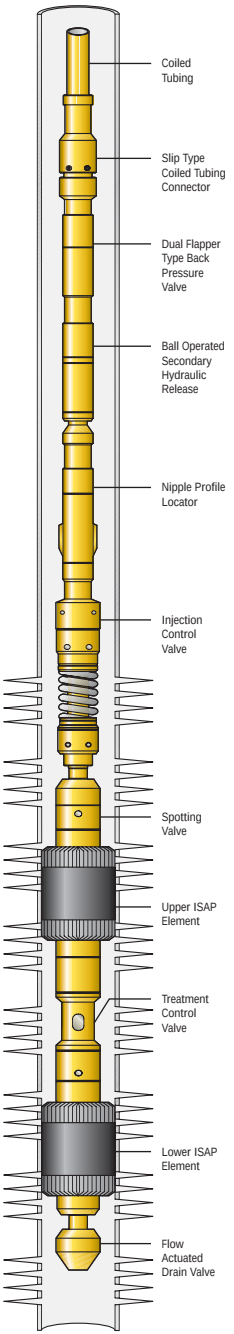
Result: After retrieval of the CT BHA and ISAP tool string, the well was brought back on line with production figures showing an increase of 4,200 bbls per day, to 6,000 bbls per day.

ISAP™ Track Record

- Acid stimulation intervention achieved 22 sets in a single CT trip
- 2,000 bbls HCL pumped with a total of 12 sets in a single CT run at an inclination of 90º
- 1,000 bbl polymer gel water control chemical treatment
- Successful operation in sour gas environment at up to 24.5% H_2S and with aromatic solvents such as xylene
- MSAP™ (mechanical rather than inflatable version for monobore applications) developed and run on coiled tubing

Thru-Tubing Inflatable Retrievable Packer. Please refer to Page 25.

Thru-Tubing Retrievable Bridge Plug. Please refer to Page 24.



Selective Treatment Operations Using Inflatable Straddle Acidizing Packer System (ISAP™)

QUIK Drill™ Composite Products

From the heart of our Remedial & Stimulation product line comes stimulation and fracturing tools including retrievable bridge plugs, cast iron bridge plugs and the highly successful line of QUIK Drill™ Composite Products. Easily deployed, retrieved and removed on coiled tubing, R&S Products meet stimulation and fracturing needs that include low-pressure, low-temperature environments as well as high-pressure applications when needed.

Baker Oil Tools Solutions

QUIK Drill™ Composite Bridge Plug

Increased production, less formation damage, and less rig time are all possible with QUIK Drill™ Composite Products. No other company has more successful experience in designing and manufacturing downhole tools from composites. And no other company has as much experience in milling composites. Now, Baker Oil Tools has leveraged its leadership in these two areas to produce the QUIK Drill System, a revolutionary system of zone isolation tools that includes Composite Bridge Plugs and Composite Frac Plugs manufactured entirely of advanced, high-performance composite materials.

QUIK Drill is the industry's most comprehensive system of optimized composite zone isolation and milling tools – a powerful advantage over ordinary tools. The QUIK Drill System makes it possible to rapidly isolate and treat or test multiple zones, each with different bottomhole pressures, while dramatically lowering the risk of formation damage. QUIK Drill System components are available in many sizes and types.

QUIK Drill Composite Bridge Plugs and Frac Plugs offer a cost-effective way to independently isolate and treat or test multiple zones of interest in a single wellbore. When treatment is complete, the QUIK Drill Plug can be quickly removed in an underbalanced environment, paying significant dividends in increased production and reduced formation damage. The underbalanced removal is typically accomplished with coiled-tubing-deployed downhole motors and milling tools.

Baker Oil Tools developed its QUIK Drill line of composite products for monobore, multi-zone well applications that do not require high expansion elements to provide zone isolation. QUIK Drill products save the operator time and money by enabling quick and easy installation and removal. While easily deployed on either standard electric-line- or coiled-tubing-conveyed Baker setting equipment, QUIK Drill Composite Bridge Plugs and Composite Frac Plugs can be removed in a fraction of the time required to mill traditional cast iron products, and with reduced formation damage.

QUIK Drill Composite Products can be installed under pressure in multi-zone, commingled gas wells without expensive formation kill-weight fluids. After remedial operations, the QUIK Drill Plugs are removed with coiled-tubing-conveyed milling equipment using low-viscosity milling fluids that minimize formation damage and easily remove composite cuttings from the wellbore. This is especially important because of the low annular velocities characteristic of coiled tubing operations. The wellbore is left cleaner than those using cast iron plugs in similar operations. QUIK Drill Composite Products have been tested to withstand high pressures and temperatures without compromising their pressure integrity and without the need for a cement barrier on top of the plug. Field runs have demonstrated that QUIK Drill Composite Products can be milled in as little as thirty minutes, compared to two hours for milling conventional cast iron bridge plugs. Multi-zone, commingled gas wells

using as many as seven QUIK Drill Bridge Plugs have been brought back on production after taking only 12 hours to remove all of the QUIK Drill Plugs, including rig-up and rig-down of the coiled tubing unit. Field runs also indicate QUIK Drill Composite Products can be milled quickly when set at depths exceeding 19,000 ft.

Typical Application for the QUIK Drill™ Composite Bridge Plug

Operator's Objective: Discretely treat two or more zones having varying bottomhole pressures (BHP) while minimizing formation damage.

Solution: Use Baker Oil Tools' QUIK Drill™ Composite Bridge Plug to isolate zones of interest and enable removal in an underbalanced environment.

Procedure: Step 1 - Install QUIK Drill under pressure
Step 2 - Perform treating operations
Step 3 - Remove QUIK Drill with coiled tubing under pressure

Zone 1: BHP is 11.4 lb/g equivalent.
Zone 2: BHP is 8.8 lb/g equivalent.
Zone 3: BHP is 10.2 lb/g equivalent.

Zone 1 has been perforated and treated, then isolated with QUIK Drill™ without kill weight fluids.

Zone 2 has been perforated and treated, then isolated with QUIK Drill™ without kill weight fluids.

Zone 3 has been perforated and treated.

Operator's Objective: Put well on production.

Solution: Utilize Baker Oil Tools' Fishing Services expertise to quickly and efficiently remove QUIK Drill.

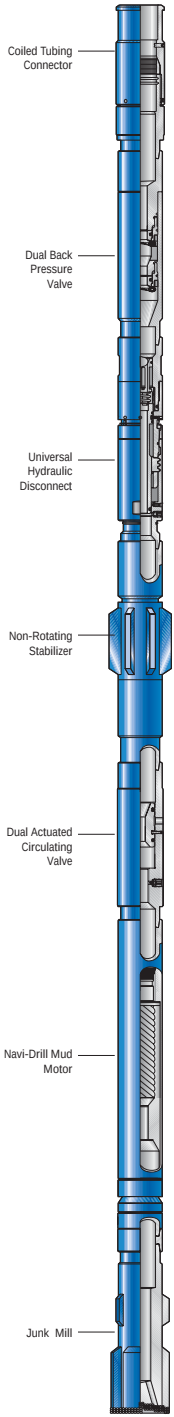
Procedure: Utilize downhole motor and milling tools conveyed on coiled tubing.

Run Baker Oil Tools' QUIK Drill™ Milling Assembly.

Unique dual clutching mechanism prevents plugs from spinning during milling operations.

Low density composite cuttings are easily removed with clear fluids at low annular velocities.

QUIK Drill™ removed and formation damage avoided, maintaining a clean wellbore.



QUIK Drill™ Milling Assembly

Key features and advantages

- Baker performance tested – composite products tested at both temperature and pressure to ensure published ratings
- No brass rings or tungsten carbide chips left in the hole that could inhibit drill-out
- Multiple plugs can be run to isolate multiple zones
- Dual clutching mechanism keeps multiple plugs from rotating during drill-out
- Requires no cement barrier on top of plug for pressure integrity
- Composite material properties maximize cutting removal efficiency
- No shear stud or shear pin pieces left in the hole after setting
- Large slip contact area effectively bites into casing and keeps the plug from moving

QUIK Drill Composite Bridge Plugs and Frac Plugs can be quickly and cleanly milled out in an underbalanced environment using the QUIK Drill Milling Assembly, which consists of downhole motors and mills conveyed on coiled tubing that are engineered to produce cuttings that maximize efficient removal.

The QUIK Drill Milling Assembly provides the most effective and efficient clean-out of the wellbore. Its design is integrated with those of QUIK Drill Composite Bridge Plugs, Composite Frac Plugs and Baker Oil Tools downhole motors to optimize mill engagement, cuttings removal, and drill-out speed. This systems approach delivers higher performance, at a lower cost, than ordinary methods of multiple zone isolation and bridge plug or frac plug removal, especially in underbalanced environments.

Key features and advantages

- Design integrated with those of QUIK Drill™ Composite Bridge and Frac Plugs to maximize performance and efficiency and minimize cost.
- Engineered by experts in composite removal technology
- Jointly engineered with composites and milling tools to provide the best composite removal system in the industry.

Case History | **Louisiana**

Objective: The operator wanted to perforate and frac multiple zones in a commingled gas well and minimize formation damage.

CT Solution: QUIK Drill™ Composite Bridge Plugs were used to isolate each of the six zones to be perforated and fraced. The frac jobs on each zone were at pressure differentials up to 10,000 psi. The QUIK Drill Milling Assembly was run on coiled tubing and light-weight drilling fluids were used to remove the composite plugs from the wellbore.

Result: All six composite plugs were removed from the wellbore, including rig-up and rig-down of the coiled tubing unit, in twelve hours. The wellbore was left clean because composite cuttings had been easily circulated back to surface.

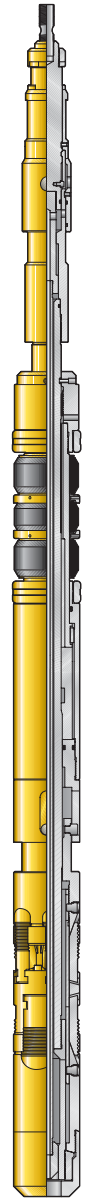
Retrievable Bridge Plug

The Model WG™ Retrievable Bridge Plug is a high-performance retrievable bridge plug that combines the advantages of coiled tubing setting and retrievability with the advantages of high-pressure/high-temperature ratings. Typical applications for this plug are fracturing, acidizing and testing.

The WG Retrievable Bridge Plug can be run on coiled tubing using the Model J™ Hydraulic Setting Tool. Because the Model J is hydraulically balanced while running in the hole, it does not have a hydrostatic chamber. As a result, all of the setting force produced is transmitted to the bridge plug, so the Model J can set bridge plugs in high-angle or deviated wells. A fill-up inflation valve at the top of the setting tool has ports that communicate fluid from the tubing to the annulus and vice-versa while running in the hole.

Key features and advantages

- Body lock ring retains setting force through element system
- Can be lubricated in and out of a live well
- Opposed non-load transferring dovetail slips
- Latching collet prevents premature release of bridge plug during equalization and retrieving operations
- Safety sub or optional shear sub for emergency release
- Straight pickup to release
- Alignment of equalization flow path reduces flow cutting during equalization



Model WG™ Retrievable Bridge Plug

Sand Control Completions

As a leader in sand control and fluids technology, Baker Oil Tools provides a variety of through-tubing sand control systems and solutions designed to enhance wellbore stability while optimizing productivity from unconsolidated formations. Typical through-tubing sand control applications include providing protection in wells that did not have a sand control system installed during the original completion process, and installing a secondary sand control system inside a failed sand control completion. Baker Oil Tools has installed over 150 through-tubing gravel pack completion systems and a combined total over 85,000 ft of sand control screen during these projects. The longest length of screen run through-tubing to date in a single well was 2,748 ft.

Coiled Tubing Application

Production downtime and workover cost can be significantly reduced by conveying through-tubing sand control systems on coiled tubing. Baker Oil Tools' through-tubing sand control systems are available in sizes from 1.5 in. OD and larger, are coiled-tubing conveyable, and can be run through the existing production tubing and within monobore wells. The company's leading sand screen technologies are integrated into each system. Various modular completion and flow control accessories can be added within each system to address specific production requirements. These systems are recommended when the preferred full workover procedure is cost prohibitive for the reserve base.

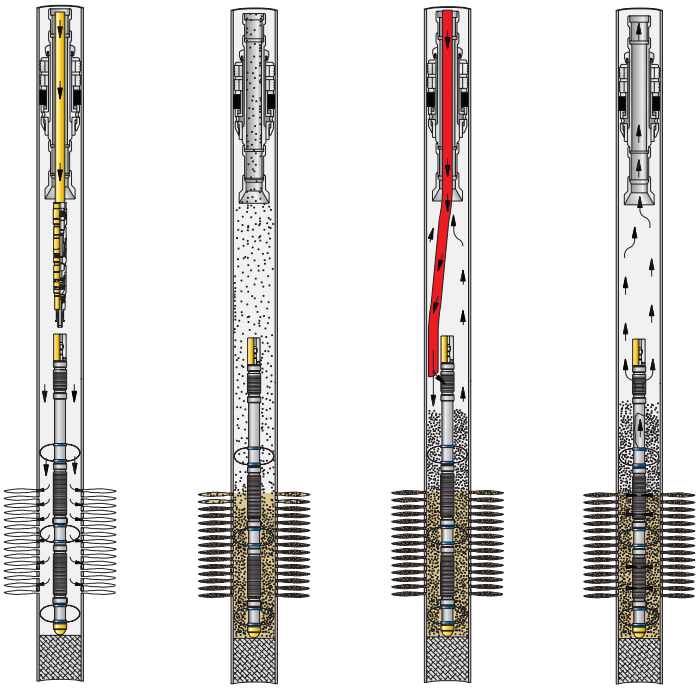
Vent Screen System

Baker Oil Tools Solutions

The Vent Screen System, which compensates for the practical flow limitations of smaller sizes of coiled tubing, is typically applied in treatment lengths of 50 ft or less. It is composed of a lower screen section with a bull plug on bottom, blank pipe and an upper vent screen section with a retrievable bull plug on top. Centralizers are placed on the outside of the system to ensure even distribution of gravel in the annular space between the Vent Screen System and the wellbore (casing / production tubing). The Vent Screen System is typically run and set on bottom or on top of a landing nipple using coiled tubing. It can also be conveyed using wireline or jointed pipe. The gravel pack slurry is then pumped from the surface and through the production tubing. The slurry volume is designed to adequately cover the lower screen section. Once the well is on production, the hydrocarbons flow into the lower screen section and inside the blank pipe, then exit through the upper vent screen and continue up the casing / production tubing.

Key features and advantages

- Enables higher pump rates than conventional circulating gravel pack methods in slimhole wells
- Stackable screens - underbalanced deployment / where longer zones are to be gravel packed
- Can be run with wireline
- Works inside 2-3/8 in. OD tubing and larger pipe sizes



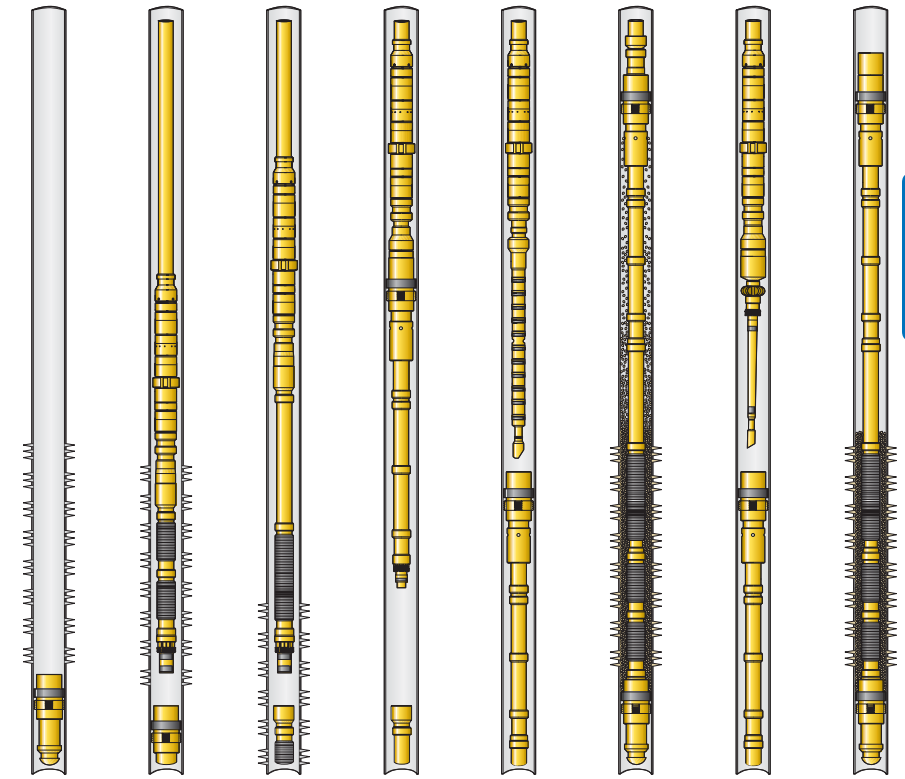
Release and Acidizing | *Pumping Gravel* | *Washing Excess Gravel* | *Producing*

Squeeze-Pack System

The Squeeze-Pack System provides a simple and reliable method for gravel packing perforations while the screen and top packer are in place. The system consists of sand control screens, blank pipe, anchor latch receptacle, gravel pack extension and a hydraulically set gravel pack packer. A Stackable Screen System is incorporated into the Squeeze-Pack System when running and joining specific lengths of screen on coiled tubing, based on well control lubricator length limitations versus the total length of sand control screen needed. Once the total length of screen is run and the packer is set, a crossover tool is engaged below the gravel pack packer to provide a path for the gravel pack slurry to travel on the outside of the screen and across the perforations.

Key features and advantages

- Positive latch packer and crossover tool insures gravel pack slurry is properly placed
- Stackable screens - underbalanced deployment / where longer zones are to be gravel packed
- Variety of packoff methods for setting inside of tubing and casing



Set sump packer below perforations

Run stackable screen sections on coiled tubing

Run blank pipe sections

Run and set packer and extension assembly

Run crossover tool

Perform squeeze pack

Install isolation seal assembly across sleeve in extension leaving up-facing wireline entry guide

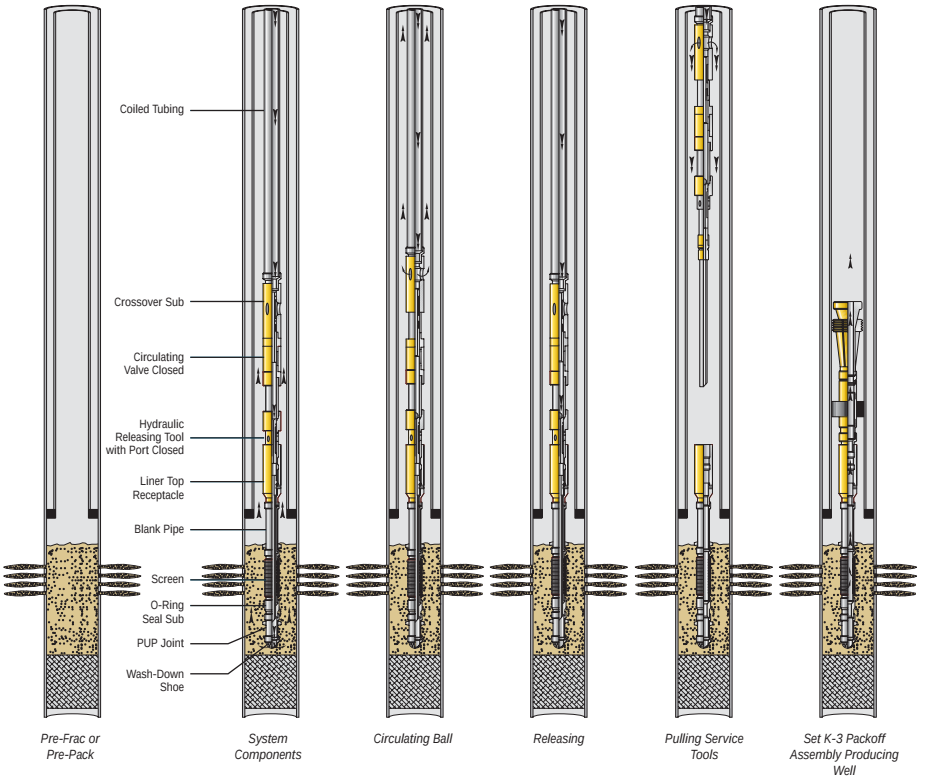
Production

Wash-Down System

The Wash-Down System uses a squeeze pack or frac-pack method to place the gravel pack medium across the perforations. It is typically applied in wells that require treatments of 50 ft or less. The system is used to clean and prepack the wellbore adjacent to the production zone before installing a screen assembly by washing it into place. A packoff is placed above the screen assembly to secure it within the wellbore. The Wash-Down System contains a lower wash-down shoe, spacer pipe, seal sub, sand control screen, blank pipe and a top receptacle, which is connected to a hydraulic release tool. An inner wash string is located between the hydraulic release tool and the wash-down shoe.

Key features and advantages

- Enables higher pump rates than conventional circulating gravel pack method in slimhole wells
- High pump rates can be achieved, since the gravel pack slurry is pumped from the surface and not through the CT
- Screen assembly is washed into place
- Variety of pack-off methods for setting inside tubing and casing
- Works inside 2-3/8 in. OD tubing and larger pipe sizes



Circulating Gravel Pack System

The Circulating Gravel Pack System provides a circulating squeeze pack technique in applications where larger sizes of coiled tubing enable sufficient pump rate to place the gravel around the sand control screen. The system is run into position on coiled tubing. The slurry is pumped through the coiled tubing and exits out the circulating ports, which are located above the screen assembly. The gravel is circulated around the screen and the excess is pumped to the surface. The coiled tubing is then retrieved. A packoff mechanism can then be installed on top of the screen assembly.

Key features and advantages

- One-trip screen and gravel placement
- Enables treatment of longer zones
- Hydraulic Release Tool and Liner Top Receptacle are used in applications inside 3-1/2 in. OD tubing and larger pipe
- Conventional Circulating Gravel Pack Systems are used in applications inside 4-1/2 in. OD tubing and larger pipe sizes (conventional circulating gravel pack)

Gravel Packing *Reversing Out* *Running K-3™ Packer* *Producing*

Sand Control Screens

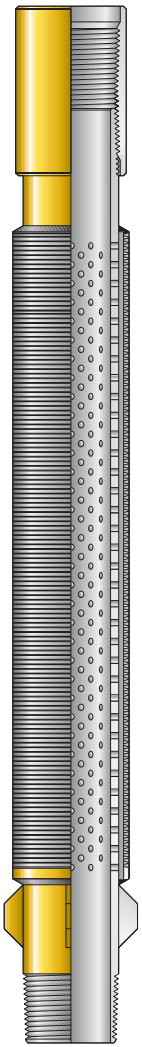
Baker Oil Tools manufactures and provides a variety of sand control screens that can be incorporated into each coiled-tubing-conveyed sand control system.

The BAKERWELD® Gravel Pack Screen is a sand-retention device that is set in the well to provide a simple, reliable and effective method of preventing gravel pack sand from entering the tubulars while allowing production fluid to flow into the well. The wire wrap design has almost ten times more inflow area than slotted pipe of the same opening size, which increases well longevity. BAKERWELD Screens are constructed with keystone shaped wire, allowing a self-cleaning action for greater flow and less chance of plugging. Pull tests are performed on the wire-to-rib weld to ensure the highest strength and durability. For additional strength, the screen jackets are welded directly to the base pipe using ASME Section 9 welding procedures and certified welders.

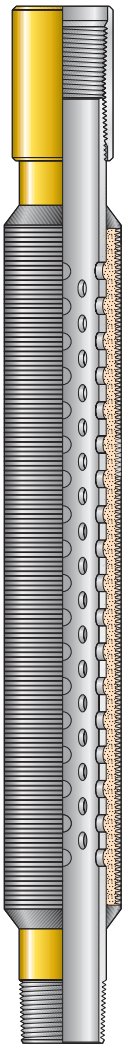
Base Pipe Size	Weight	Pipe Size ID	Coupling OD	Hole Size	No. of Holes		BAKERWELD Screen OD	BAKERWELD 140 Screen OD
					Std	Hi-Flow		
	lb/ft	in.	in.	in.	ft	ft	in.	in.
1.050	1.14	0.824	1.313	3/8	30	60	1.50	1.64
1.315	1.70	1.049	1.660	3/8	30	60	1.76	1.90
1.660	2.30	1.380	2.054	3/8	36	72	2.11	2.25
1.900	2.75	1.610	2.200	3/8	42	84	2.35	2.49
2.063	3.25	1.751	2.500	3/8	42	84	2.51	2.65
2.375	4.60	1.995	2.875	3/8	48	96	2.82	2.96
2.875	6.40	2.441	3.500	3/8	54	108	3.32	3.46
3.500	9.20	2.992	4.250	3/8	66	132	3.95	4.09
4.000	9.50	3.548	4.500	3/8	72	144	4.45	4.59
4.500	11.60	4.000	5.000	3/8	78	156	4.96	5.10
5.000	15.00	4.408	5.563	3/8	84	168	5.47	5.61
5.500	17.00	4.892	6.050	3/8	90	180	5.97	6.11
6.625	24.00	5.920	7.390•	3/8	108	216	7.11	7.25

• Turned-down coupling available on request.

Centering Guides, Product Family No. H48531, are optional.
Recommended applications should give 2 in. radial clearance from screen OD to openhole diameter or 0.75 in. to 1.0 in. radial clearance from screen OD to casing ID for wells with gravel pack to enable retrieval. Less radial clearance will probably make screen retrieval difficult after producing the well because of the inability to wash over the screen to remove formation sand packed around it. Larger sizes available upon request.



BAKERWELD® Screen



SLIM-PAK® Screen

The SLIM-PAK® Screen provides the benefits of a prepacked screen without sacrificing critical OD or ID dimensions. This screen system makes gravel packed or frac packed completions more reliable without dimensional restrictions or performance limitations. The SLIM-PAK consists of a wire cloth wrapped around a perforated pipe base, a pre-cured layer of resin-coated ceramic proppant and a BAKERWELD® screen jacket welded to a perforated pipe base. The surface-cured proppant layer offers maximum permeability and compressive strength to properly inhibit formation sand production through annular pack imperfections, making it particularly well-suited for frac pack and difficult gravel placement applications.

Base Pipe Size	Weight	Pipe Size ID	Coupling OD	Screen OD	No.of Holes		Hole Size
					Std	Hi-Flow	
	lb/ft	in.	in.	in.	ft	ft	in.
1.050	1.14	0.824	1.313	1.64	30	60	.375
1.315	1.70	1.049	1.660	1.90	30	60	.375
1.660	2.30	1.380	2.054	2.25	36	72	.375
1.900	2.75	1.610	2.200	2.49	42	84	.375
2.063	3.25	1.751	2.500	2.65	42	84	.375
2.375	4.60	1.995	2.875	2.96	48	96	.375
2.875	6.40	2.441	3.500	3.46	54	108	.375
3.500	9.20	2.992	4.250	4.09	66	132	.375
4.000	9.50	3.548	4.500	4.59	72	144	.375
4.500	11.60	4.000	5.000	5.10	78	156	.375
5.000	15.00	4.408	5.563	5.61	84	168	.375
5.500	17.00	4.892	6.050	6.11	90	180	.375
6.625	24.00	5.920	7.390	7.25	108	216	.375

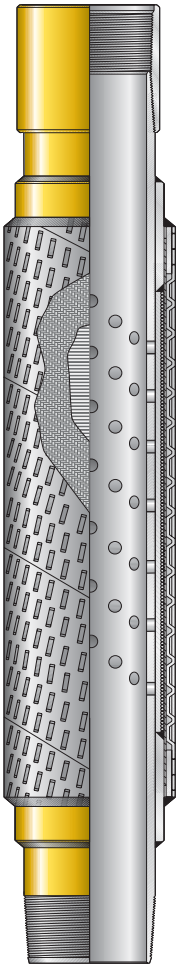
Recommended applications should give 2 in. radial clearance from screen OD to openhole diameter or 0.75 in. to 1.0 in. radial clearance from screen OD to casing ID for wells with gravel pack to enable retrieval. Less radial clearance will probably make screen retrieval difficult after producing the well because of the inability to wash over the screen to remove formation sand packed around it.

The EXCLUDER2000™ Premium Downhole Sand Exclusion Device incorporates the industry-proven EXCLUDER™ Screen sand retention and longevity technology with enhanced mechanical strength and integrity. EXCLUDER2000 employs a unique manufacturing process that enables the individual components to act as one and creates a stronger, more durable product. Additionally, a more robust filtration membrane juncture and cartridge seal design has been incorporated.

The EXCLUDER2000 screen's improved design has increased its already-proven ability to perform in the most challenging of environments, including openhole horizontals, short-radius wells and re-entries. The screen also offers added protection for any gravel pack/frac pack situation. The screen's vector membrane provides increased inflow area to minimize problems associated with high inflow velocities. The uniform openings (in the weave) allow for stringent sizing quality control during the manufacturing process and greater accuracy in selecting the proper weave-to-formation-particle size.

Base Pipe Size	Weight	ID	Screen OD	Weight
in.	lb/ft	in.	in.	lb/ft
3-1/2	9.20	2.992	4.30	14.4
4	9.50	3.548	4.80	15.2
4-1/2	11.60	4.000	5.31	18.3
5-1/2	17.00	4.892	6.32	25.7
6-5/8	24.00	5.920	7.46	33.5
7•	26.00	6.276	7.89	36.7
9-5/8•	43.5	8.775	10.54	57.5

Recommended applications should give 2 in. radial clearance from screen OD to openhole diameter or 0.75 in. to 1.0 in. radial clearance from screen OD to casing ID for wells with gravel pack to enable retrieval. Less radial clearance will probably make screen retrieval difficult after producing the well because of the inability to wash over the screen to remove formation sand packed around it.
• Based on EXCLUDER coarse only.



EXCLUDER2000™ Screen

FRAQ PAQ℠ FLUID SYSTEMS

Sand control completions require the most advanced fluid technology, services and procedures. Baker Oil Tools provides Best-In-Class stimulation fluids and products worldwide to meet these requirements and to assure maximum well productivity.

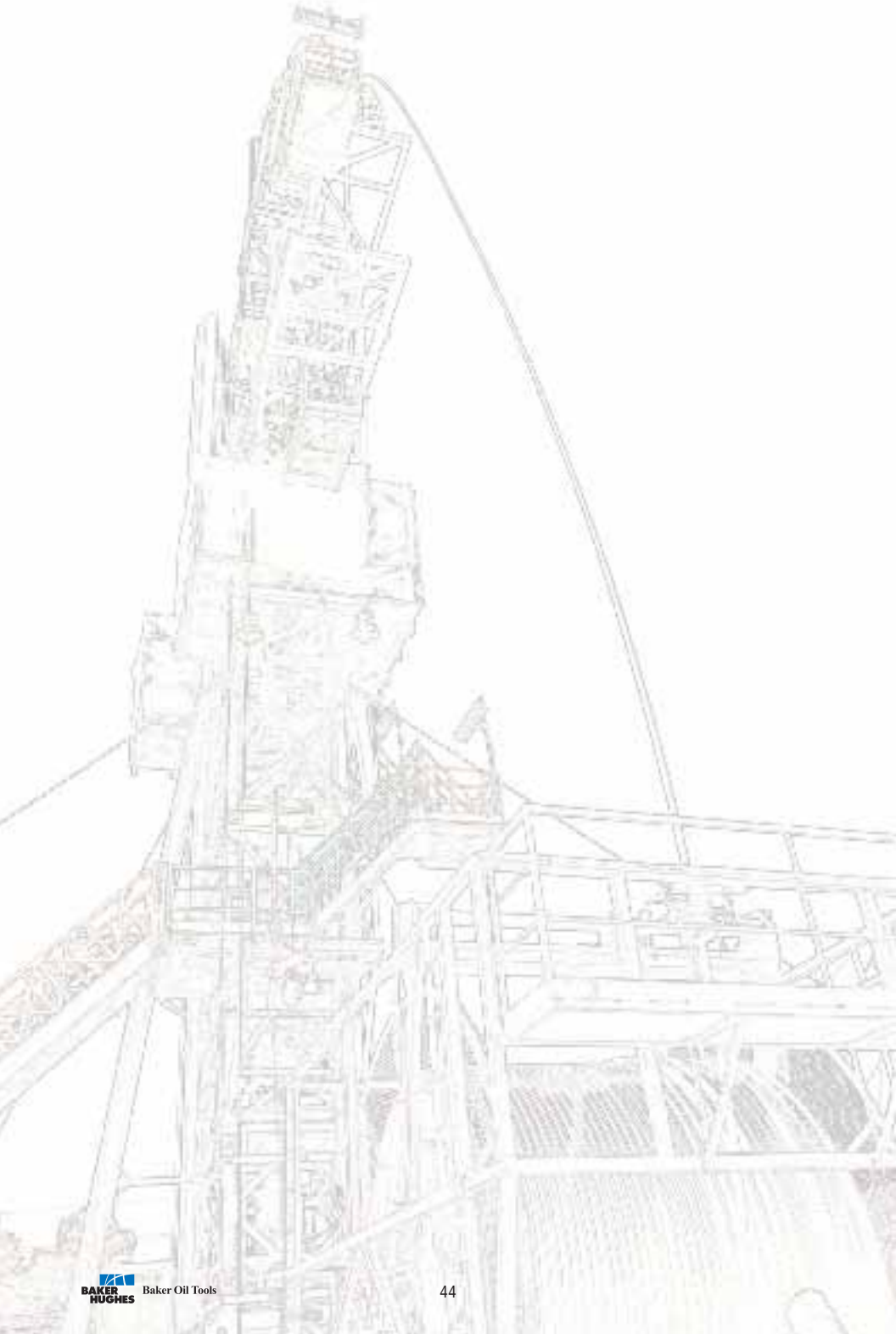
Baker Oil Tools' extensive staff of fluid research and technical support personnel focus on soft formation sandstone completions. They develop specialized chemicals, fluid systems and application processes that meet or exceed the industry and operators' sand control completion requirements. An ideal fracturing fluid system used in frac pack completions should have the following characteristics:

- Viscosity to maintain fracture width and transport the proppant or gravel at reservoir conditions
- Predictable performance and the ability to control break time
- Compatible with formation mineralogy and reservoir fluids
- Good cleanup properties providing maximum fracture and formation conductivity
- Low fluid leakoff to the formation
- Fluid must resist shear thinning and provide good friction reduction properties

Baker Oil Tools' industry-leading frac pack and gravel pack fluid systems include complex crosslinked fluid and surfactant fracturing systems such as SurFRAQ™, BoraFRAQ™ and Emerald FRAQ™ as well as less complex, linear Baker Clean Gel® "I" and various brine systems.

Baker's SurFRAQ Visco-Elastic, Nonionic Surfactant Fracturing and Gravel Packing Fluid is used to treat oil and gas wells. SurFRAQ provides 90% to 100% retained permeability of the formation and proppant pack. The single-component, non-ionic surfactant was built to Baker's specifications and is used in concentrations from 2% to 10% by volume at formation temperatures from 80°F to 250°F. The fluid provides excellent proppant suspension across all normal concentration ranges.

Emerald FRAQ is an oil- and grease-free frac pack fluid specifically developed for offshore frac pack operations that require high-viscosity fracturing fluid. The fluid uses a high-grade guar polymer, cross-linked with borate ions at a high pH. The fluid system is recommended for oil and gas wells from ambient temperatures to >300°F, and it incorporates internal and encapsulated breakers to effect the desired break time.



Flow Management

During the life of a well, the volume of hydrocarbons from a productive zone will naturally decline over time. To address the diversity of production profiles globally, we offer a large portfolio of completion designs and technologies. When designing a new completion, our application specialist use a proactive approach to maximize the amount of oil / gas that can be recovered during the life of the well. In cases where the primary completion design can no longer sustain desired production, Baker Oil Tools offers through-tubing completion methods, which can be conducted in a cost-effective manner using coiled tubing. This enables the operator to extend the life of the existing well, while minimizing shut-in time.

Baker Oil Tools' undisputed role as the industry leader in reliable, performance-based completion and flow management solutions is based on the world's most reliable sealing and anchoring technologies, meticulous planning, and a no-nonsense approach to risk avoidance. We have strategically assembled an extensive portfolio of flow management products that includes industry standards such as the VELOX™ Velocity and Straddle System, CM™ Sliding Sleeves and NPR™ (No Profile Required) Production Bridge Plug. In cases where high-expansion sealing and anchoring capabilities are needed, Baker Oil Tools Thru-Tubing Inflatable technologies are applied. Ongoing new product research and development continually expand both the breadth and depth of big-bore and through-tubing completion solutions available to the industry.

CM™ Sliding Sleeve

Increasing Gas Velocity While Reducing Water Production

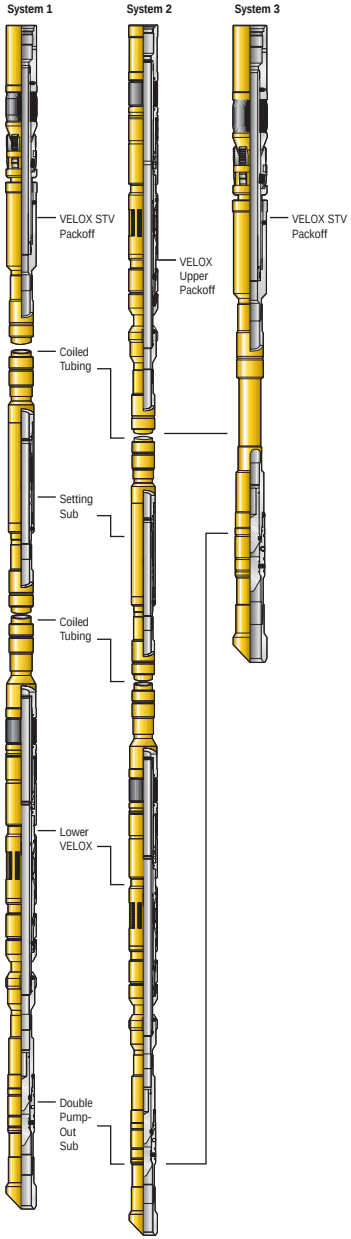
Late in a field's life, flowing gas wells lose pressure and production velocity. Over time, these wells can load up with produced water, whose accumulated weight eventually stops gas flow. Baker Oil Tools offers coiled-tubing-conveyed systems that solve this problem by effectively increasing gas velocity while reducing water production.

Baker Oil Tools Solutions

Velocity String

Using the VELOX™ Velocity String System, Baker Oil Tools can deliver a cost-effective solution by installing smaller ID tubing string, known as a velocity string, that is typically set below the existing downhole safety valve. The velocity string increases gas flow velocity, so water is carried from the well and gas production continues. The VELOX Velocity String System is an economical remedial solution that extends the productive life of a well without having to carry out an expensive workover.

Velocity and Straddle Systems



Baker Oil Tools offers coiled-tubing-conveyed velocity and straddle systems for setting inside production tubing with sizes ranging from 2 in. - 2-7/8 in. OD (Model KB™ System) and from 3-1/2 in. – 7 in. OD (VELOX™ System).

When production tubulars separate or develop holes and leaks, production flows into the annulus, causing a serious problem that usually requires a complete work-over of the well. The VELOX™ Velocity and Straddle System can be used to straddle the damaged location of the tubing, packing off the flow into the annulus and extending the life of the well. The VELOX Velocity and Straddle System also can be used to shut off water or gas perforations, seal damaged gas lift mandrels, and provide downhole selective isolation in other problem situations.

The VELOX Velocity and Straddle System is either a combined mechanically and hydraulically set, or purely hydraulically set system. VELOX uses existing technology to provide the customer with a low-cost and reliable tool that can be run and set in one trip.

The VELOX System is modular and has a number of different applications, which can be configured into three distinct arrangements:

System 1: Long straddle velocity string

System 2: Straddle system

System 3: Velocity string with no lower packoff isolation

Key features and advantages

- Increases flow velocity to maintain production profile
- Reduces salting problems
- Enables water or gas shutoff
- Repairs and shuts off corroded tubing/casing
- Repairs parted tubing
- Isolates perforated sections
- Single-trip system
- Easy makeup
- Underbalanced deployment
- Ability to pressure test prior to setting
- Slim OD can be run/retrieved though restrictions
- Large ID for through-tubing intervention

Case History | Velocity String System – North Sea

Objective: Increase gas flow while minimizing water production on well that had ceased hydrocarbon production.

CT Solution: Install a VELOX™ Velocity String System in one trip with coiled tubing. The VELOX System consisted of a VELOX Packer, 11,226 ft of 2-3/4 in. OD CT and 1-7/8 in. AF and AR Nipples with a double-pump open sub and wireline re-entry guide. The VELOX Velocity String System top packer was set at a depth of 884 ft and inside 5-1/2 in. OD production tubing with the tailpipe passing through 4-1/2 in. OD tubing. The surface wellhead pressure was 650 psi and the bottomhole temperature was approximately 250^0 F. The wellbore deviation was 5^0 at 849 ft and 84^0 at 12,025 ft.

Result: The well produced 3-1/2 Mscf/day within hours after the VELOX System was installed.

VELOX™ STV Packoff

Case History | Velocity and Straddle System – North Sea

Objective: Straddle a large section of 3-1/2 in. OD production tubing to isolate a leak while maintaining gas production.

CT Solution: Install a VELOX™ Velocity and Straddle System in one trip with CT. The VELOX System consisted of a 3-1/2 in. VELOX Upper STV Packoff, 6,740 ft of 2-in. OD coiled tubing and a 3-1/2 in. VELOX Lower Packoff and double-pump open sub. The top of the assembly was set below the existing safety valve at 445 ft deep, and the lower packoff was then pressured up and set at a depth of 7,091 ft. The surface wellhead pressure was 558 psi and the maximum deviation of the wellbore was 40^0.

Result: The leak path was isolated and the well continued to produce gas.

CT™ Tension Packer

CT™ Tension Set Service Packer

Baker Oil Tools offers the CT™ Tension Packer for velocity string installation applications when setting the packer by mechanical functioning is preferred. The CT Tension Packer is a compact, economical, retrievable packer designed for use in coiled tubing applications. The CT Packer is a multiple-set-and-release packer that operates efficiently with an "auto-J" mechanism actuated from the surface by axial movement of the coiled tubing, which makes the packer easy to set and release. The emergency shear release valves can be adjusted for downhole conditions and pull capabilities.

Key features and advantages

- Short and compact
- Uses an easy-to-operate "auto-J" mechanism for multiple set and release
- Adjustable emergency shear release

Inflatable Straddle System

Baker Oil Tools Inflatable Systems tools and services have been used to perform a number of flow management operations in through-tubing environments.

Baker Oil Tools pioneered the development of reliable, high-expansion, Thru-Tubing Inflatable Element technology beginning in 1985. The versatility offered by a Thru-Tubing Inflatable Packing Element allows for tools to be set in the most diverse range of wellbore environments, including cased hole, slotted pipe, perforations, open hole and screens.

Through-tubing solutions allow operators to work over wells in a 'live' condition, negating the need for costly and time-consuming well 'kill' operations and eliminating the chances of irreparable wellbore damage that may be caused by kill-weight fluids.

Baker Oil Tools Solutions

Baker Oil Tools' complete line of coiled-tubing-deployed inflatable products and services includes fit-for-purpose, in-house-designed running and retrieving tools and our proprietary INFLATEDESIGN™ software that aids in both job planning and execution.

Thru-Tubing Inflatable Straddle Systems are also used for isolating leaks in the completion tubing and the cased wellbore. For description, please refer to Page 26.

1.69 in. OD Retrievable Bridge Plug set in 7 in. 26.00 lb/ft (6.276 in. ID) Casing

Scale Inhibition

Deposition of solid materials on the surface of the production tubing or casing can result in a reduced flow area and restrict production. Deposits can also prevent running and retrieving flow control devices. Preventive measures such as spotting inhibition chemicals in the wellbore can reduce the occurrence of solid deposits. Thru-Tubing Inflatable Systems provide a means of placing the inhibition chemicals precisely where the treatment is required, while passing through small restrictions in the wellbore.

Baker Oil Tools Solutions

Both the Thru-Tubing Inflatable Retrievable Packer and the Inflatable Straddle Acidizing Packer (ISAP™) can be used in preventive maintenance scenarios to inject inhibition chemicals to maintain wellbore flow against the potential of future scale build-up. This operation can be conducted on coiled tubing as either a remedial or a preventive measure. The Thru-Tubing Inflatable Retrievable Packer is further discussed on Page 25 and the ISAP System is discussed on Page 30.

Production/Injection Logging

Inflatable Packer Systems can be run and set in open holes to carry production logging tools (PLT) that are used to identify the productive and non-productive areas along the formation face.

Baker Oil Tools Solutions

Baker Oil Tools developed its Flo-Pak™ System to ascertain zonal flow contributions in open-hole applications on coiled tubing. This short tool system is a resettable, large-bore inflatable that allows for the deployment of a memory PLT below. The system allows for the zone below the open-hole inflatable packing element to be isolated in order to direct all produced or injected fluids through the memory PLT string, therefore positively identifying zone contribution. Design considerations and development prior to field usage included maximizing element ID in order to minimize flowing pressure drop through the tool (less than 100 psi at up to 10,000 bbls per day). The tool also incorporates an injection control valve to control coiled tubing hydrostatic imbalance and also to direct element deflation back to the annulus, allowing for coiled tubing back-pressure valves to be used in the bottomhole assembly.

Key features and advantages

- Resettable system allows for single-trip, multi-zone testing
- Large ID mandrel permits less than 100 psi pressure drop at up to 10,000 bbls/per day flow
- Full-time equalization across inflatable element
- Integral injection control valve allows tool to function in overbalanced condition
- Element tensioning device aids in element deflation

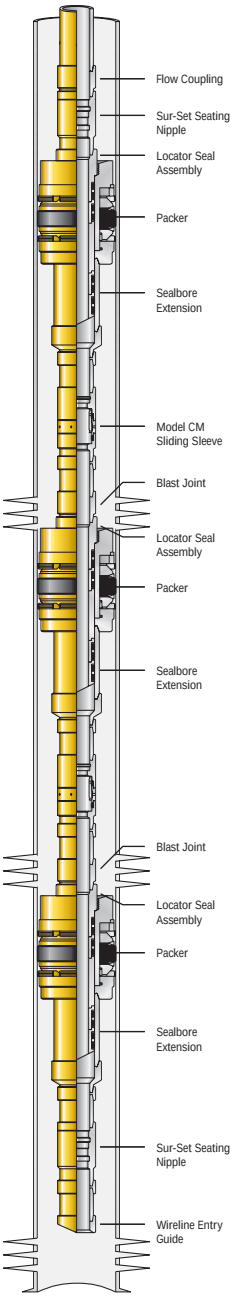
Flo-Pak™ System

Selective-Zone Completion

The Single String Selective-Zone Completion permits selective production, injection, testing, stimulation and isolation of various zones. Selectivity after completion is accomplished by opening and closing sliding sleeves between the packers. Blast joints located adjacent to producing zones resist the erosive forces of produced fluids.

Baker Oil Tools Solutions

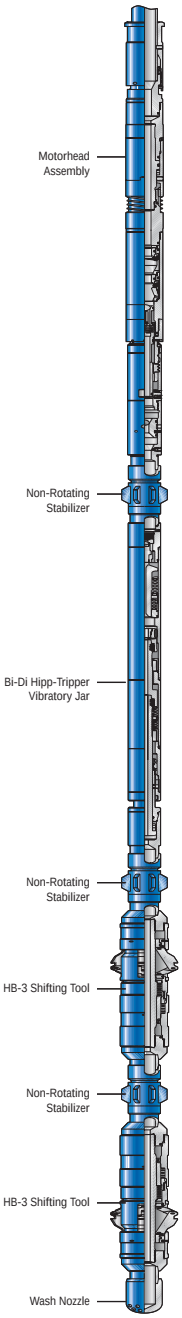
Baker Oil Tools Model CM™ Sliding Sleeves are installed as close as possible to the packers below the sleeves to service the entire zone. While in their closed position these sliding sleeves act as a straight-through flow path for fluids being injected from above or produced from below. In their open position they provide a full, unrestricted, tubing-to-annulus communication for selective injection or production. The seating nipples provide a means of landing blanking plugs or check valves, such as Baker's Sur-Set™ products, which are capable of holding pressure from above for setting hydraulic packers and testing tubing. They may also be used to isolate the perforations and protect the formation from any damage due to kill fluid loss, or used for landing a choke for regulating the production flow rate. Over 10,000 CM™ Sliding Sleeves have been successfully installed worldwide with up to 44 sliding sleeves installed in a single completion.



Single String Selective-Zone Completion

Shifting Sliding Sleeves

Traditionally, wireline methods are used to retrieve and install blanking plugs and/or check valves and to shift sliding sleeves. In many cases, the use of wireline is limited by its lack of pulling and or pushing capability to function the sliding sleeves or other flow control systems within the wellbore. Coiled tubing is typically used to address wireline's limitations and also adds value by facilitating the ability to pump fluids to stimulate production zones upon opening the sliding sleeve located adjacent to it.



Shifting Bottomhole Assembly

Baker Oil Tools Solutions

The Baker Oil Tools Shifting BHA is used in wells that are completed for selective production. The HB-3™ Shifting Tool is a highly efficient and operator friendly tool that will automatically disconnect when the sleeve is fully shifted. It has been designed to shift Baker Oil Tools Type CM™ Series Sliding Sleeves. The energy to shift the sleeve is provided by the Bi-Directional HIPP-TRIPPER® Vibratory Jar. With this BHA the sleeve can be opened and closed in one run; also, the formation can be treated without pulling out of hole.

Key features and advantages

- Fully selective operation, can be run or retrieved through multiple sliding sleeves without manipulating the sleeve
- Application of internal hydraulic pressure down the coiled tubing will allow linkage arms to expand
- Low actuation pressure required to expand linkage
- Linkage system exerts maximum radial force when extended and latched into sleeve insert
- Small run in OD
- Wash ports under linkage arms allow debris to be washed away
- Can be run in tandem to shift up and down in one trip

Case History | North Sea

Objective: A 5-zone horizontal oil producer was completed with 4-1/2 in. OD tubing. Each zone was separated by a Baker Oil Tools ISO™ Packer and included a CMU™ Sliding Sleeve. After the well was completed, the sliding sleeves were in the closed position. The operator's objective was to stimulate each zone of the reservoir individually. The final flow period would involve a commingled test with all sleeves in the open position.

CT Solution: A bottomhole assembly incorporating two HB-3™ Selective Shifting Tools - one to open and one to close the CMU Sliding Sleeves - was selected. Since there was limited set-down weight available in this horizontal application, a Si-Di HIPP-TRIPPER® was included to assist in closing the sleeves in the down mode.

Result: The bottom sliding sleeve was located and opened. 10 bbl of 15% HCL acid were spotted through the coiled tubing and bullheaded into the formation at a flow rate of 17 BPM. After stimulation, the sleeve was closed. This procedure was then repeated successfully for all five sliding sleeves. After stimulating each zone individually, all sliding sleeves were opened before pulling out of hole.

Nipple-Less Completion Technology

The primary feature of a nipple-less completion is that the production string has no restrictions, and there are no permanent diameter restrictions such as restrictive nipples to limit access to the producing zones. As a result, mechanical tools can be run through the tubing and landed in the liner to perform workover tasks.

Completions that do not contain restrictive nipples may create a new set of challenges, such as how to perform functions normally accomplished with the use of nipples and locking mandrels. These functions include a plug or check valve in the well to hydraulically set a packer; pressure testing the tubing; hanging instruments to measure downhole flowing pressures, temperatures, etc.; and running chokes to regulate flow.

A production bridge plug is a tool that can be set anywhere in the production string without locating in a seating nipple. Production bridge plugs have been designed with the ability to run and retrieve through the subsurface safety valve, since this is generally the only restriction in the system. This is easily accomplished with a lock and nipple system but the retrievable production bridge plugs, however, must drift with a small enough OD through the safety valve and when the desired depth is reached, the seal element expanded to contact the pipe ID.

Baker Oil Tools Solutions

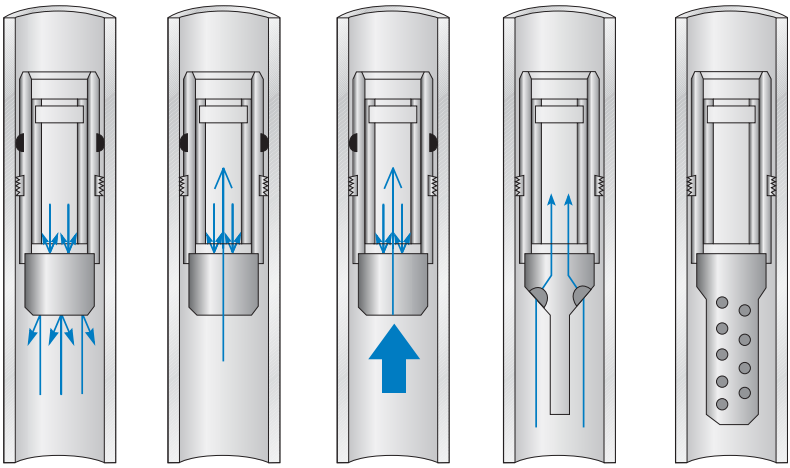
The Model NPR™ (No Profile Required) Production Bridge Plug is a tool that can be can be set on wireline, or coiled tubing and retrieved on wireline. The design accepts various devices such as blanking plugs, check valves, chokes, instrument hangers, and Tubing-Conveyed Perforating (TCP) gun hangers. The packer-type design results in a tool capable of setting anywhere in the tubing string without requiring nipples for location. The NPR may be equalized and retrieved in one or two trips.

NPR™ (No Profile Required) Production Bridge Plug

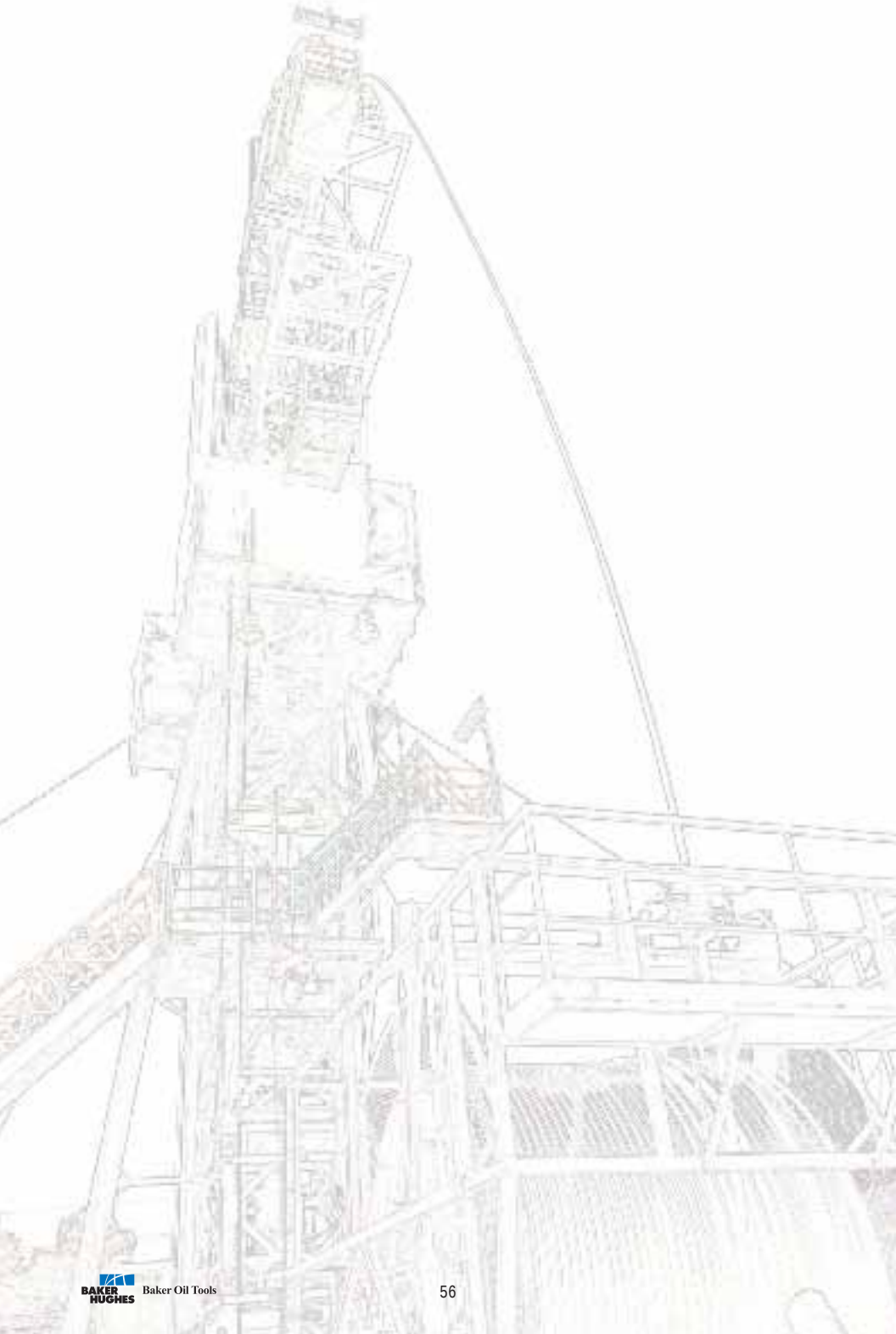
Key features and advantages

- Does not require nipple profile to locate; can be set anywhere in the tubing
- Sets on wireline or coiled tubing and retrieved on wireline
- Can be retrieved in one trip
- Special setting feature allows for centralized setting
- Retrieves on 0.108 in. slickline with a standard Model GS™ Running Tool
- Uses well pressure to help packoff elements
- Elements return within approximately 3% of original OD on retrieval
- Allows for sand/debris fill
- Quick running and retrieval
- Short overall length facilitates easy running/retrieving through tight spots
- Rotationally locked above the slips to enhance emergency milling should retrieval be impossible by conventional methods
- Slips and releasing mechanism located in a protected area below the packing element provide maximum protection from debris
- Available for H_2S Service

Model NPR™ Application

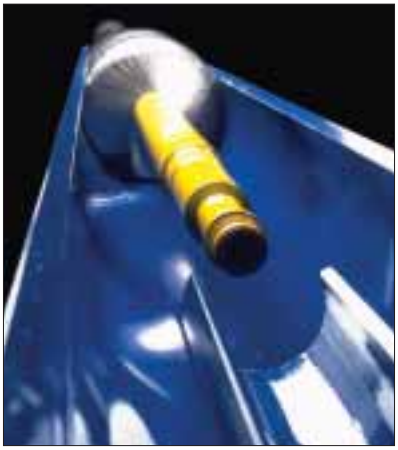


Blanking Plug *Check Valve* *Choke* *Instrument Hanger* *TCP Gun Hanger*



Plug and Abandonment

Reducing the time and expense of plugging and abandoning P&A wells allows the operator to focus more resources on producing oil and gas. Coiled tubing offers a safe, efficient and economical alternative to conventional rig P&A methods. In a rigless environment, coiled tubing can be used to perform a variety of downhole functions. These include cutting pipe and performing zone isolation operations in both through-tubing and monobore wellbore environments.



1.69 in. OD Thru-Tubing Retrievable Bridge Plug Set in 7.00 in. OD Casing

Inflatable Permanent Bridge Plug

Baker Oil Tools pioneered the development of reliable, high-expansion, Thru-Tubing Inflatable Element Technology beginning in 1985. The versatility offered by a Thru-Tubing inflatable packing element allows for tools to be set in the most diverse range of wellbore environments, including cased hole, slotted pipe, perforations, open hole and screens. Coiled-tubing-conveyed, Through-Tubing solutions allow work to take place in a "live" well and eliminate the need for costly, time-consuming well kill procedures as well as the risk of irreparable wellbore damage that may result from using kill-weight fluids.

High-expansion Thru-Tubing inflatable devices are particularly well suited to permanent well plugging and abandonment operations since they eliminate the need to kill the well and recover completion tubulars prior to isolating the production or injection zones. The most commonly used inflatable devices for these plugging or abandonment operations are the Inflatable Bridge Plug and the Permanent Inflatable Cement Retainer.

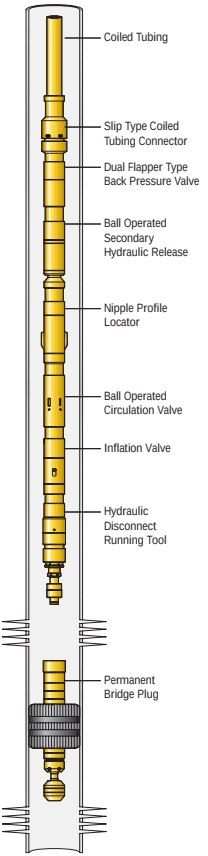
Baker Oil Tools' complete line of coiled-tubing-deployed inflatable products and services includes fit-for-purpose, in-house designed running and retrieving tools and our proprietary INFLATEDESIGN™ software to aid in both job planning and execution.

Baker Oil Tools Solutions

The Thru-Tubing Inflatable Permanent Bridge Plug is a non-retrievable tool designed to be conveyed through either planned or unplanned wellbore restrictions and set in the larger ID below. The bridge plug can expand more than 350%. It may also withstand differential pressures in excess of 8,500 psi. After the bridge plug has been set and disconnected from, cement can be placed via coiled tubing to prolong the integrity of the plug and abandonment operation.

Key features and advantages

- Can be set under "live" well conditions
- Coiled tubing or wireline conveyance enables rigless operation
- By varying element configuration, tool can be set in most environments (perfs. screens, openhole, etc.)
- High differential pressure capability



Lower Zone Abandonment Using Thru-Tubing Inflatable Permanent Bridge Plug

Case History | North Sea

Objective: A major UK North Sea client needed to permanently isolate the main bore of the well prior to performing a through-tubing sidetrack. The well casing was 7 in. 29.00 lb/ft L-80 with a minimum tubing nipple restriction of 4.313 in.

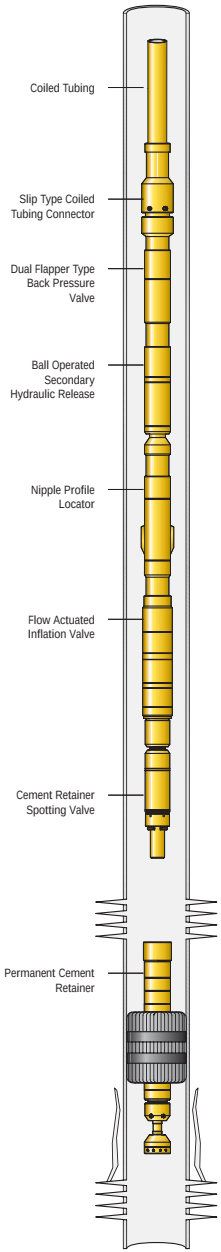
CT Solution: A 3-3/8 in. OD Thru-Tubing Inflatable Bridge Plug was conveyed to a setting depth of 10,200 ft. A coiled tubing fluid separation reservoir system was used as part of the Baker Oil Tools coiled tubing bottomhole assembly to prevent any possible contamination of the element inflation fluid from the running string fluid.

Result: The inflatable bridge plug was set and disconnected from as per procedures and the bottomhole assembly pulled from the well. This permanent isolation was capable of supporting an applied differential pressure of 5,934 psi, which allowed the operator to continue with the planned sidetracking operation.

Coiled Tubing Reservoir System

Permanent Cement Retainer

For situations where wellbore plug and abandonment operations are not enough and behind-pipe cementing operations are preferable in a through-tubing environment, the optimum solution is the Baker Thru-Tubing Inflatable Permanent Cement Retainer. This retainer makes it possible to run a single coiled tubing trip in the hole to set the retainer, perform an injection test, spot the cement to the tool, perform the cement squeeze or placement, disconnect from the retainer, and augment the permanent isolation by spotting cement on top of the set retainer. This variety of single-trip operations via coiled tubing will satisfy even the most stringent of agency requirements in the well abandonment process, allowing operators to fulfill their abandonment obligations in both a timely and cost effective manner.



Coiled Tubing Set Inflatable Cement Retainer Used to Abandon Lower Zone

Key features and advantages

- Ideal for coiled tubing as no rotation required
- Integral spotting valve negates requirement to bullhead cement to zone of interest
- Opposing positive seal flapper valves prevent flow through the retainer from either direction once the spotting valve is released

Case History | North Sea

Objective: A major operator in the North Sea embarked upon a through-tubing abandonment campaign prior to a full platform abandonment. The requirement was to place a cement plug in the production tubing to casing annulus without pulling the 5-1/2 in. 17.00 lb/ft tubing. The minimum restriction in the tubing was 3-13/16 in.

CT Solution: The production tubing was perforated in two places to provide tubing-to-annulus communication. A 3-3/8 in. OD Thru-Tubing Permanent Cement Retainer was run and set on coiled tubing between the two sets of perforations to isolate the production tubing and provide a path for cement from the coiled tubing to the tubing-casing annulus.

Result: A 150 bbl cement plug was successfully placed in the annulus and the cement retainer was disconnected to allow the coiled tubing to be retrieved, while maintaining isolation in the tubing. The annulus cement plug was pressure tested, confirming a successful abandonment.

Monobore

Reducing time and cost is essential during a P&A campaign. Baker Oil Tools offers a wide range of cast iron products that provide cost-effective, premium plugging capability. Additionally, with Baker coiled-tubing-conveyed setting tools, operators can plug and abandon a well without using a workover rig.

Baker Oil Tools Solutions

Baker Oil Tools CT™ Hydraulic Setting Tool and Model K-1™ Cement Retainer are designed to be run and hydraulically operated on coiled tubing to provide a one-trip system for plugging an unwanted zone. No rotation is required to operate the system, which makes it ideal for coiled tubing applications in highly deviated wells. The CT Setting Tool is used to set the K-1 Cement Retainer and squeeze cement in a single trip. The ball seat (or solid seat) will automatically expel after shearing the release device, allowing the ball seat to be pumped down past the ports in the stinger. The ball seat cannot be pumped out until the setting sequence has been completed, and shear screws may be installed to prevent premature setting of the tool while running in the hole.

The CT Setting Tool is also used to set the Baker Model N-1™ Bridge Plug. When running a bridge plug, the CT Setting Tool allows the operator to spot cement on top of the bridge plug and/or circulate the hole clean prior to pulling out of the well.
See page 27 for more information on Model N-1 Bridge Plug.

Key features and advantages

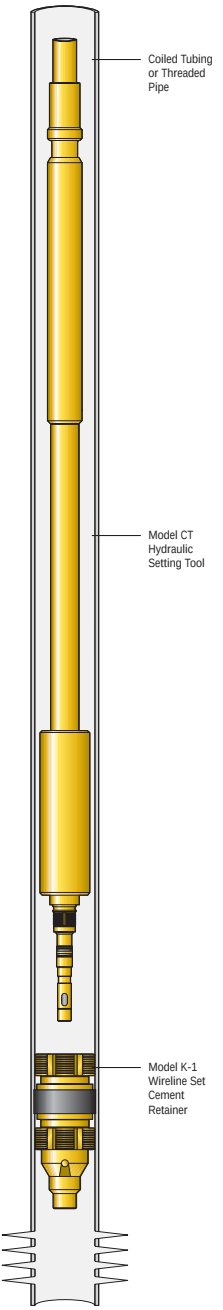
- One-trip system saves time by allowing cement retainers and bridge plugs to be set and cemented in a single trip
- No rotation required - uses only applied pressure to set and release from a cement retainer or bridge plug, making it ideal for coiled tubing applications in highly deviated and horizontal wells
- Designed for coiled tubing can be lubricated into a live well or run on threaded tubing or drillpipe
- Controlled slow set - hydraulic operation allows staging of applied setting pressure

Case History | North Sea

Objective: Permanently plug and abandon a well without using Blow Out Preventers while at the same time confirming no gas migration behind the casing strings.

CT Solution: Run a Model K-1™ Cement Retainer on the Model CT™ Setting Tool. The cement retainer was outfitted with perforation guns on the bottom guide to access the annular space behind the casing to check for gas migration. No gas was found behind the casing, so cementing operations were performed underneath the retainer and cement was placed on top of the retainer. Two cement plugs and the retainer qualified as a barrier for a permanent plug and abandonment.

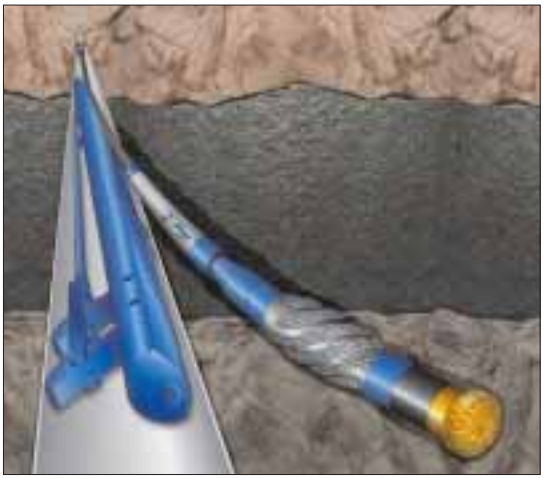
Result: Because neither a Blow Out Preventer nor a marine riser was required for the P&A operation, the operator saved five days of rig time compared to a normal P&A operation, or an estimated $1.5 million in operating costs.



Coiled Tubing Model K-1™ Cement Retainer Used to Abandon Lower Zone

Sidetracking and Re-entry

Through-tubing drilling in the form of coiled-tubing drilling (CTD) or through-tubing rotary drilling (TTRD) enables operators to re-enter and sidetrack wells faster, more efficiently and at lower cost, and also makes it possible to access reserves that otherwise might be beyond economic reach. Deciding whether to use CTD or TTRD must be made on a case-by-case basis, taking into account both technical and economic considerations.



Slimhole Casing Exit System

Slimhole Casing Exit Technology

A critical success factor in through-tubing re-entry operations is the casing exit. Baker Oil Tools' Slimhole Monobore and Restricted Bore Casing Exit Systems enable window cutting without having to pull the existing completion or production tubing. These systems also bring additional time- and risk-reducing features to the economic and operational advantages of through-tubing re-entry drilling technology.

Baker Oil Tools' history of excellence and innovation in whipstock technology and window cutting is unparalleled. Since 1994, more than 350 slimhole casing exits have been successfully executed worldwide using our Thru-Tubing and Coiled Tubing Monobore Whipstock Systems. This level of experience, in conjunction with the ability to access state-of-the-art technologies such as Navi-Drill® X-treme® Workover Motors and custom-designed diamond window mills, has allowed Baker Oil Tools to offer new "Best-In-Class" systems capable of meeting the challenges of today's market.

Baker Oil Tools Solutions

For slimhole monobore applications, the Mechanical-Set Whipstock sets new standards for time saving and efficiency. When deploying the system with electric line, standard tools and methods are used for orientation and setting. MWD tools are used to orient the system when it is used with coiled tubing or threaded pipe.

Key features and advantages

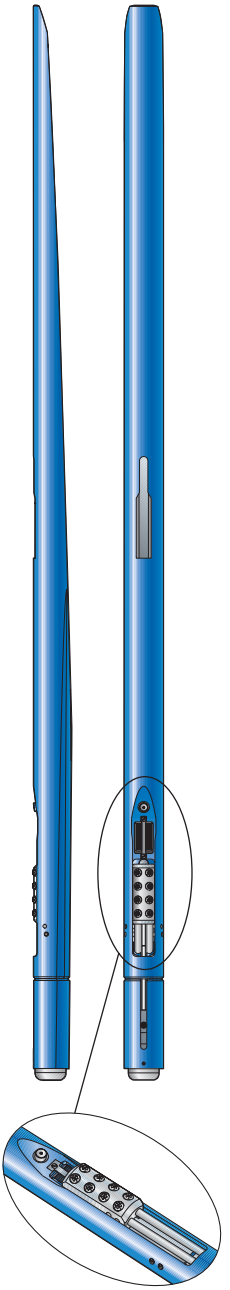
- Window can be cut without pulling existing completion or production tubing.
- One-trip orientation and setting on electric line, coiled tubing or threaded pipe. Previous monobore systems required three runs to orient and set the packer and whipstock.
- Ability to set on either the "high" or "low" side of the casing ensures the optimal exit point. Previous monobore systems could be set only 60° to the left or right of "high" side.
- Whipstock can be retrieved by engaging a fixed lug retrieval tool into a slot in the whipstock body and applying overpull to release.
- Integral anchor system reduces trips and wellbore restrictions.

Case History | Alaska

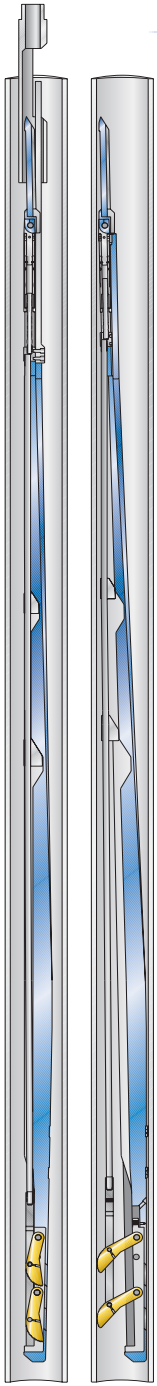
Objective: The operator required a nipple to be milled and a window cut in 4-1/2 in. 12.60 lb/ft tubing. The milling assembly was deployed on 2-3/8 in. coiled tubing with seawater used as a circulating fluid and a circulation rate of 110 GPM.

CT Solution: A mechanical monobore whipstock was set at 12,087 ft with electric line, using eccentric weight bars as a means of orientation. A 2-7/8 in. OD Navi-Drill X-treme Workover Motor in conjunction with a Hughes Christensen Diamond Speed Mill and Superloy® String Reamer were used to perform the milling operations.

Result: The nipple, window and 10 ft of open hole were successfully milled in under 16 hours total milling time.



Mechanical-Set Whipstock for Monobore Applications



Restricted-Bore Whipstock System

Restricted-Bore Whipstock System

Like its monobore counterpart, the Restricted-Bore Whipstock System sets new standards for slimhole, through-tubing re-entries, where the whipstock is set in larger casing below the tubing tailpipe. This system can be used with coiled tubing, threaded pipe or electric line.

Key features and advantages

- Window can be cut in larger casing below tailpipe without pulling existing completion or production tubing
- One-trip orientation and setting on electric line, coiled tubing or threaded pipe
- Large bypass flow area allows for production from the main bore below
- The new system is not sensitive to tubing weight or condition. Previous Thru-Tubing systems did not allow for variance in liner ID due to tubing deterioration or deposits of cement, scale, etc.
- Ability to set on either the “high” or “low” side of the casing ensures the optimal exit point. Previous systems could be set only 45º to the left or right of “high” side.
- Whipstock can be retrieved by using an overshot to engage an external fishneck profile at the top of the whipstock. Applied over-pull will release the setting forces and allow the anchoring slips to retract back into the slip housing.
- Multiple exit sizes possible. Milling systems available from 3.80 in. to 4-1/2 in. OD.

Case History | Alaska

Objective: To accommodate optimum CT drilling trajectory, the operator required a low-side exit to be made through 7 in. 26.00 lb/ft liner. The whipstock and milling assembly had to pass through 4-1/2 in. 12.60 lb/ft completion tubulars with a minimum restriction of 3.80 in.

CT Solution: To set a restricted bore whipstock, conveyed on electric line, at 11,048 ft, 195º right of high side, with a hole inclination of 30º. Eccentric weight bars would be used to orient the whipstock to the low side of the hole. The window and rathole could then be milled in a single trip using coiled tubing.

Slimhole Milling Assemblies

Both monobore and restricted-bore exit systems use proprietary hybrid milling assemblies. The assembly combines a custom-designed Diamond Window Mill from Hughes Christensen followed by a Near-Bit SUPERLOY™ String Reamer which can mill the window and drill the pilot hole in a single trip without the need for excessive reaming.

Navi-Drill® X-treme® Workover Motors with equidistant power section technology deliver significantly increased power and improved reliability when subjected to the stresses encountered during window milling. The heart of the motor is a contoured stator that is manufactured according to a proprietary process that significantly reduces the motor's rubber content compared to conventional positive displacement motors.

Diamond Window Mill

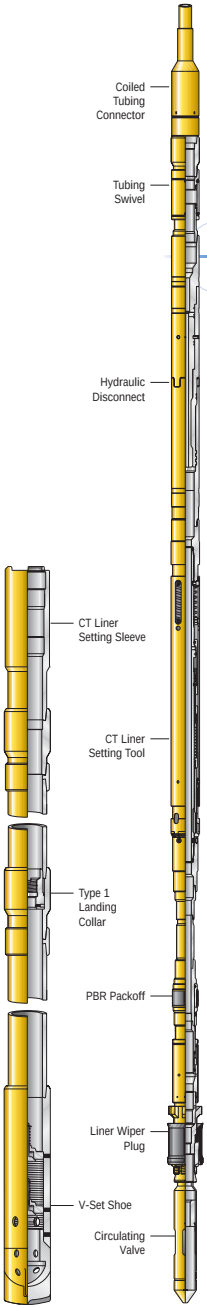
Key features and advantages

- Higher rates of penetration
- Extended run times
- Less wear on milling and cutting tools
- Increased reliability in high-stress applications
- Successful operation in downhole temperatures above 400ºF

The field-proven milling assemblies can also execute multiple string exits in a single trip while maintaining full gauge of the window.

Open-Hole Completions

Coiled-tubing-conveyed liner systems can enhance the speed and efficiency of openhole completion operations and reduce their cost while providing wellbore stability and isolating unwanted zones. CT liner running systems are used to deploy and cement a liner using coiled tubing. These systems can be used in vertical, deviated or horizontal holes where the liner is set on bottom.



Coiled Tubing Deployed Liner System

Open-Hole Liner Systems

Baker Oil Tools is the industry's leading provider of coiled-tubing-conveyed, open-hole liner systems. Since 1995, the company has run more than 200 cemented liner systems on coiled tubing during through-tubing re-entry operations. Most of these liners, 2-7/8 in., have been run through 4-1/2 in. production tubing. Additionally, 2-3/8 in. liner systems have been run through 3-1/2 in. OD.

The most common Baker Oil Tools coiled-tubing-conveyed, open-hole completion systems are liners that are cemented in place to prevent migration of unwanted fluids or gas. When using coiled tubing, the liner running tool function must be hydraulic, since rotation is not possible and set-down weight is sometimes limited. If the liner is to be cemented, only small volumes of cement are required. No over-displacements can be permitted.

Baker Oil Tools Solutions

The Baker Oil Tools CT™ Liner Running System consists of a running tool and setting sleeve. The CT Liner Running Tool runs and cements the liner in one trip, whether in vertical or deviated wellbores where the liner must be pushed to bottom. The tool can handle liner weights of up to 50,000 lb and has a primary hydraulic release function with a mechanical backup. The tool easily makes up to the polished ID of the CT Liner Setting Sleeve with only a one-third turn to engage the torque lugs. This is especially beneficial since the coiled tubing string cannot be rotated to aid in the liner assembly and deployment process.

Key features and advantages

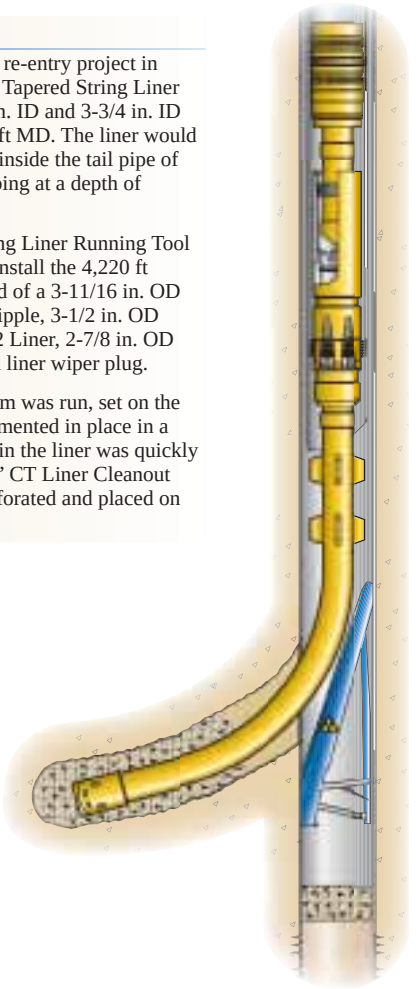
- Allows liner to be pushed or pulled while running downhole
- Collet latch mechanism enables quick connection of setting tool to the liner
- Primary and secondary release features

Case History | Alaska

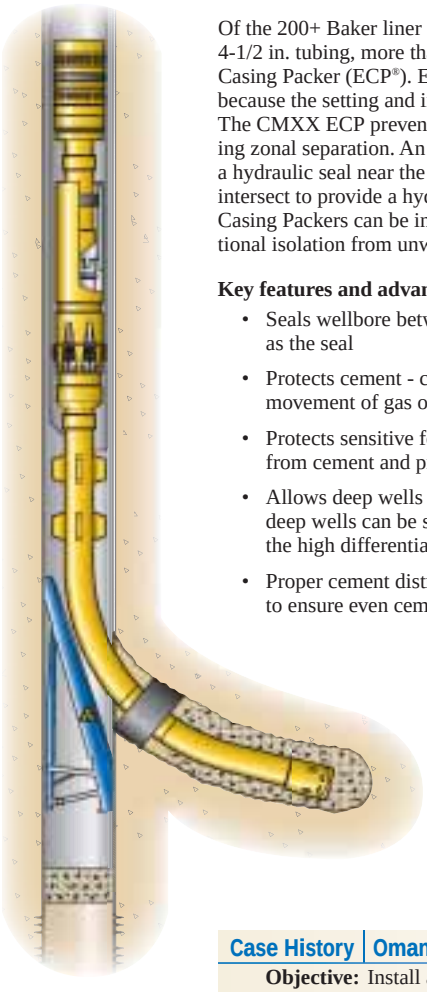
Objective: A coiled tubing through-tubing re-entry project in Alaska required that a 4,220 ft Tapered String Liner System be run inside of 4-1/8 in. ID and 3-3/4 in. ID open hole to a depth of 14,200 ft MD. The liner would be set on bottom and tied back inside the tail pipe of the 4-1/2 in. OD production tubing at a depth of 9,980 ft MD.

CT Solution: A Baker Oil Tools Coiled Tubing Liner Running Tool (CTLRT) was used to run and install the 4,220 ft liner. The liner system consisted of a 3-11/16 in. OD Deployment Sleeve, an XN™ Nipple, 3-1/2 in. OD STL™ Liner, 3-3/16 in. OD TC2 Liner, 2-7/8 in. OD STL Liner, float equipment and liner wiper plug.

Result: The Tapered String Liner System was run, set on the bottom of the open hole and cemented in place in a single trip. Excess cement within the liner was quickly removed using Baker Oil Tools' CT Liner Cleanout System. The liner was then perforated and placed on production.



Cemented Liner and tieback completion



Cemented Liner and Inflatable External Casing Packer

Of the 200+ Baker liner systems deployed on coiled tubing through 4-1/2 in. tubing, more than 20 have used a Baker CMXX™ External Casing Packer (ECP®). ECPs are naturally compatible with coiled tubing because the setting and inflation procedures do not require any rotation. The CMXX ECP prevents water flow and gas migration while providing zonal separation. An ECP can also add value when used to provide a hydraulic seal near the junction where the lateral liner and main bore intersect to provide a hydraulic seal in the annulus. Multiple External Casing Packers can be installed in the liner assembly to provide additional isolation from unwanted zones.

Key features and advantages

- Seals wellbore between zones either as a backup for the cement or as the seal
- Protects cement - channeling damage is prevented by blocking movement of gas or fluid and cement is allowed to set undisturbed
- Protects sensitive formations - sensitive formations are isolated from cement and protected from damage
- Allows deep wells to be cemented without damaging lower zones; deep wells can be stage cemented to protect the lower zones from the high differential pressure of a long column of cement
- Proper cement distribution - the ECP centralizes casing in the hole to ensure even cement distribution around casing

Case History | Oman

Objective: Install a slimhole liner, passing it through 4-1/2 in. OD casing and inside 3-3/4 in. ID open hole to complete a newly drilled lateral. A hydraulic seal was required between the liner, 4-1/2 in. OD casing and 3-3/4 in. open hole to isolate water from diluting the hydrocarbon production.

CT Solution: A CT Liner System was designed that incorporated 2-7/8 in. tubing, a CMXX™ Inflatable External Casing Packer, float equipment and liner wiper plug.

Result: The CT Liner Running Tool was used to the run the liner system and place the top of it inside of the 4-1/2 in. casing. In the same trip with CT, the CMXX ECP™ was permanently inflated upon bumping the liner wiper plug. Excess cement within the liner was quickly removed using Baker Oil Tools' CT Liner Cleanout System. The liner was then perforated and placed on production.

Coiled Tubing Drilling

Baker Hughes INTEQ has redefined the coiled tubing drilling market and produced a state-of-the-art bottomhole assembly (BHA) to further enhance overall performance. Since 1992, the company has performed more than 200 jobs on coiled tubing units in various regions of the world. Most of these drilling jobs have been performed in through-tubing re-entry operations. The hole sizes have varied from 6-1/4 in. run through 7 in. casing to 2-3/4 in. on re-entry through 3-1/2 in. production tubing. The most common hole size drilled to date has been 3-3/4 in. sidetracks through 4-1/2 in. production tubing.

Baker Hughes INTEQ Solutions

Baker Hughes INTEQ introduced the 2-3/8 in. CoilTrak™ BHA system in 2001 as a new-generation E-line coiled-tubing-conveyed drilling and evaluation BHA. This modular system is designed to drill hole sizes from 2-3/4 in. to 3-1/2 in. using any type of drilling fluid, in both underbalanced and overbalanced applications. Due to its modularity and single-pin wet-connectors, the CoilTrak BHA can be tailored at the wellsite to meet all customer requirements.

The BHA provides directional, gamma ray and temperature services as well as improved depth control with a casing collar locator. An optional Drilling Performance Sub features weight on bit (WOB), annular and wellbore pressure sensors.

Baker Hughes INTEQ released the 3 in. CoilTrak BHA system in 2002 as a state-of-the-art, second-generation, E-line coiled-tubing-conveyed drilling and evaluation BHA. This modular 3 in. system is designed to drill hole sizes from 3-1/2 in. to 4-3/4 in. using any type of drilling fluid, in both underbalanced and overbalanced applications. This tool string also offers full modularity with single-pin wet-connectors, which means the BHA can be tailored at the wellsite to meet all customer needs.

CoilTrak™

The BHA provides directional, gamma ray and temperature services, as well as improved depth control with a casing collar locator. An optional Drilling Performance Sub features WOB, annular and wellbore pressure sensors.

The 3 in. CoilTrak BHA system offers a step change in CT drilling technology due to the option of a downhole rib-assisted motor which negates the need for any rotational orienting device. The CoilTrak BHA demonstrates truly outstanding performance with two-way, high-speed, real-time communications that enable instantaneous response which results in smoother trajectories and laser-beam tangent and horizontal sections.

Key features and advantages

- Fully integrated and modular system – 10 ft maximum module length eases logistics to remote areas, making the system helicopter- and plane-transportable or even hand-carryable
- Systems approach makes all components, including motors, compatible
- Hi-speed, bi-directional communication – single conductor E-line provides real-time, precise data, steering and log quality within single-phase or multi-phase operations
- Multiple standard sensors – directional, gamma, temperature and casing collar locator (CCL), with optional sensors for WOB, annular and wellbore pressures
- Borehole quality – rib-steering motor provides smoother trajectory, laser-beam tangent and horizontal sections, automated dogleg severity, inclination and walk control
- Precise steering – near-bit inclination sensor and TVD control, both with basic and geo-steering service
- Automatic toolface control – auto correction algorithm
- Improved hole cleaning – a multi-cycle electrical circulation sub (complete with electrical disconnect) offers effective hole cleaning while tripping and reduces the requirement for wiper trips
- Maximum operating temperature 302^{0}F, maximum survival temperature 347^{0}F
- H_2S resistant – all materials compatible with H_2S and CO_2 environments
- Underbalanced drilling – continuous communication using energized fluids, foam or gas
- Risk-free pressure deployment through 3-1/2 in. , 4-1/2 in. and larger completions

Applications

- Through-tubing re-entry wells 3-1/2 in. and larger
- HP/HT wells
- Slimhole drilling
- Intermediate radius capability
- Underbalanced or overbalanced drilling
- H_2S environments
- Remote locations (transport length of 10 ft maximum)

Options

- 400° Hydraulic Orienter Tool (HOT)
- 3 in. rib-steering motor module
- Ultra-Slim Multiple Propagation Resistivity (USMPR)
- Dual Ball Valve Sub (DBV Sub) for pressure deployment
- Flapper Valve Sub (FV Sub) for pressure deployment
- Mud Pulse Telemetry (if required)
- X-treme® motor technology

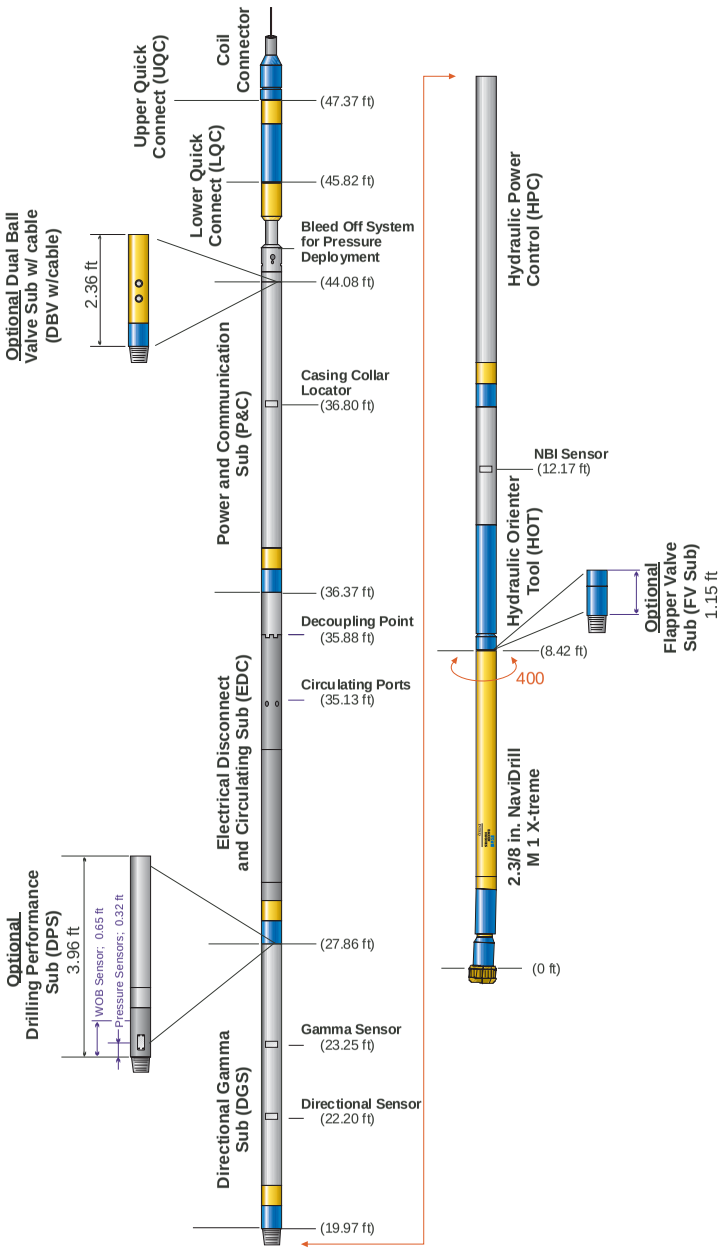
Case History | Alaska

Objective: A coiled-tubing-drilling, through-tubing re-entry, six-well project in Alaska required setting whipstocks, drilling off cement plugs, underbalanced operations with pressure deployment. The challenge was to perform the operation within the AFE with a direct comparison to through-tubing rotary drilling (TTRD). The wells have 3-1/2 in. completions installed in 7 in. casing with MD around 8,500 ft.

CT Solution: A Baker Hughes INTEQ 2-3/8 in. CoilTrak™ BHA was proposed to exit these wells (2.8 in. window), drill the sidetracks with a 3 in. bi-center bit to give the maximum hole size. The average distance required to be drilled per well was 1,800 ft. The maximum dogleg in the build sections was 50°/100 ft.

Result: Five wells were completed successfully with one abandoned due to unsuccessful casing exit from cement plug. The CoilTrak™ BHA performed a total of 48 runs, 755 hours in hole with 653 circulating hours. The overall MTBF for the complete system was 95 hours. One whipstock was set with the orienter, and five windows were milled plus two open-hole sidetracks. The EDC circulating function prevented one fishing operation of a BHA. Finally, the 2-3/8 in. X-treme motor performance was outstanding, which added to the overall project being completed inside the AFE and saving more than 10% per well.

2 3/8 in. CoilTrak™ System Overview



Baker Hughes INTEQ introduced the US MPR® (Ultra Slim Multiple Propagation Resistivity) Tool for CT drilling operations in 1999. The tool provides real-time LWD propagation resistivity measurements with deep and shallow lateral investigation of the formation. The proven MPR system combines compensating antennas and two operating frequencies to produce quality quantitative resistivity measurements with enhanced accuracy over a broad range of high resistivity formations. The tool operates with NaviTrak 1 probe battery-powered MWD systems and is designed to run in combination with CoilTrak™ coiled tubing BHA's.

The MPR service enables the evaluation of permeable zones, Rt calculation, identification of geological markers and lithology changes and detection of oil/water and gas/water contacts (including the selection of coring, casing and kick-off points).

Key features and advantages

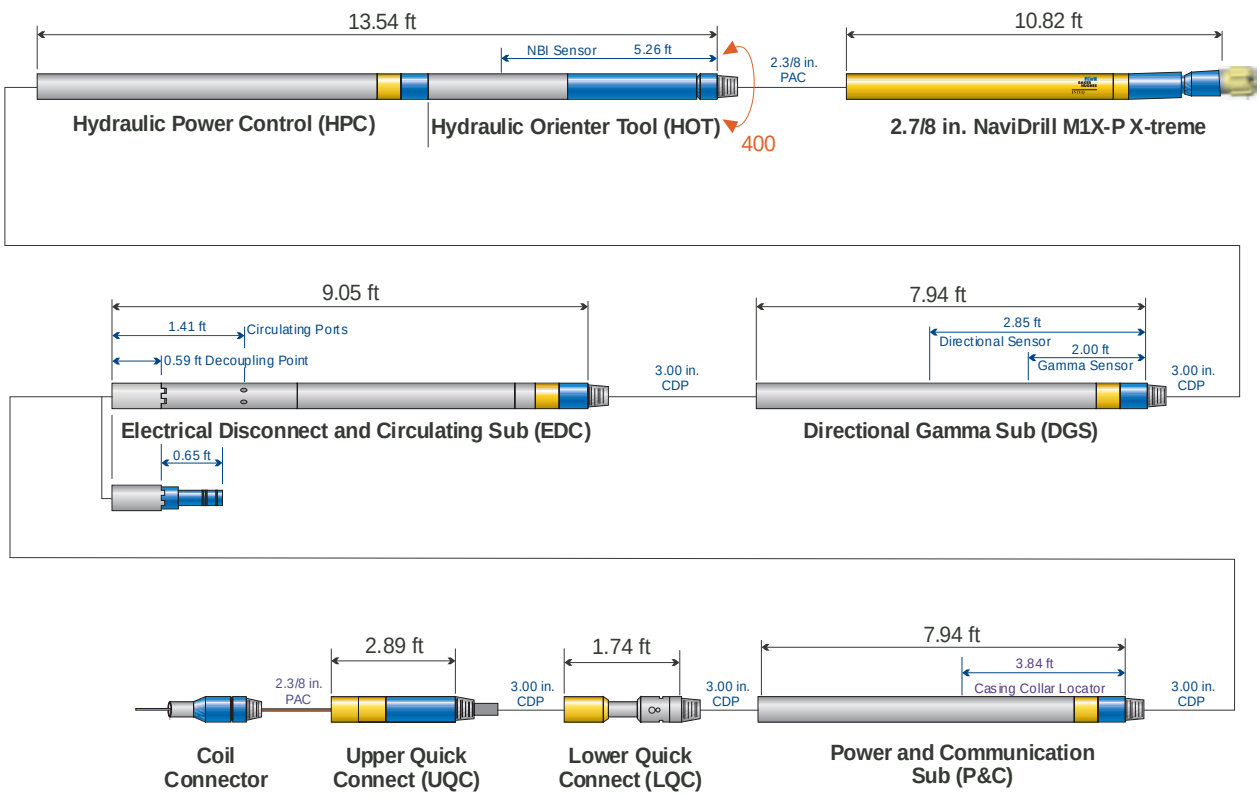
- Applicable in through-tubing re-entry wells 4-1/2 in. and larger with CoilTrak™ BHA
- Can be used for slimhole drilling and hole extensions with high BUR
- Efficient BHA handling with INTEQ custom-collar NaviTrak 1
- Accurate Rt over a broad range of high resistivity formations
- Applicable in underbalanced or overbalanced conditions
- Eight (8) compensated resistivities mitigate borehole and environmental effects
- 2 MHz improves vertical response for thin-bed identification
- 400kHz enables deeper lateral investigation of permeable zones
- Early detection of bed boundary and hydrocarbon/water contact while geosteering
- Advanced MPRTEQ™ post processing with 4 fixed depths of investigation
- Real-time and memory-stored data
- Modular and flexible service upgrades

Case History | Oman

Objective: An operator in Oman wished to perform a multi-well, through-tubing re-entry project with CT drilling. However, the contract required using US MPR® to identify formation and lithology characteristics to aid geo-steering.

CT Solution: Baker Hughes INTEQ proposed to supply a CT BHA complete with US MPR to log the wells while drilling.

Result: 30 wells were drilled with a CT BHA in the total project; 25 used US MPR. A total of 97,490 ft of new hole was drilled and 9,399,606 ft of E-line coiled tubing tripped. Two world-record horizontal sections were drilled (4,813 ft) with over 100 runs performed by the US MPR. Several open-hole sidetracks were completed with high-quality logs giving successful definition of the reservoir. 95% of the formation was logged in 3-3/4 in. hole and 5% logged in 4-1/8 in. hole size.


13.54 ft
NBI Sensor
5.26 ft
2.3/8 in.
PAC
10.82 ft
Hydraulic Power Control (HPC)
Hydraulic Orienter Tool (HOT)
400
2.7/8 in. NaviDrill M1X-P X-treme
9.05 ft
1.41 ft
Circulating Ports
0.59 ft Decoupling Point
3.00 in.
CDP
7.94 ft
2.85 ft
Directional Sensor
2.00 ft
Gamma Sensor
3.00 in.
CDP
Electrical Disconnect and Circulating Sub (EDC)
Directional Gamma Sub (DGS)
0.65 ft
2.89 ft
2.3/8 in.
PAC
3.00 in.
CDP
1.74 ft
3.00 in.
CDP
7.94 ft
3.84 ft
Casing Collar Locator
3.00 in.
CDP
Coil
Connector
Upper Quick
Connect (UQC)
Lower Quick
Connect (LQC)
Power and Communication
Sub (P&C)

Impregnated Bits

Hughes Christensen Impregnated Drill Bits have been deployed for coiled tubing applications where hard and abrasive formations are encountered. When tricone bit life is short and several trips are required to drill the interval, impregnated bits can provide a more economical solution. Impregnated bits can outlast several tricones and save several trips.

Hughes Christensen Impregnated Bits currently hold three world records for 3-3/4 in. bits – single run footage, cumulative run footage, and single run ROP.

Natural Diamond Bits

Hughes Christensen Diamond Speed Mills (DSM) have a long track record of successful use in coiled tubing casing exits. These unique designs allow the DSM to smoothly cross the casing wall as it moves off the whipstock and into the formation. The durable natural diamond cutting structure works well with the high RPM and low WOB characteristic of coiled tubing applications. Hughes Christensen also provides many sizes and types of Natural Diamond Drill Bits for slim-hole, hard formation drilling. Bits are available in many sizes from 1.7 in. up and in a variety of profiles and cutting structures.

Hughes Christensen Natural Diamond Bits currently hold three world records – 6-3/4 in. single run footage, 4-3/4 in. cumulative run footage, and 5-7/8 in. single run ROP.

Genesis Slimhole Bits

The same advanced cutter technology, techniques of providing bit stability, and hydraulic optimization that have taken Genesis Drill Bits to a new level of performance are used in the design of Genesis Slimhole Bits. Most importantly, the "Genesis Process" of combining expertise from research, engineering, and field operations is used to apply this technology properly to the slimhole application. Stability is of particular concern for coiled tubing drilling, as the most unstable drilling occurs at a low depth of cut characteristic of high RPM and low WOB.

Hughes Christensen Slimhole Bits currently hold three world records for 4-3/4 in. bits – single run footage, cumulative run footage, and single run ROP.

Star Tricone Slimhole Bits

The STX™ product line currently holds five world records for 3-7/8 in. – 4-3/4 in. bit sizes for single run footage, cumulative run footage, and/or single run ROP.

Hughes Christensen STX™ Drill Bits are designed for high-performance drilling in slimhole wells. These extremely reliable bits bring new concepts in bearing reliability, carbide material, bit hydraulics and bit stabilization. All-steel-tooth STX bits feature thick applications of a super-wear-resistant hardfacing material. A broad range of modern TCI cutting structures is available for drilling essentially any kind of formation. Hughes Christensen proprietary metal seal technology is currently being downsized for use in 5-7/8 in. through 6-3/4 in. bits, for even longer life and increased reliability at high rotary speeds. These combinations of features provide outstanding life and durability for both tungsten carbide insert and steel tooth-type bits.

Eccentric Hole Opening Bits

The 3 in. DSTRWD™ currently holds world records for single-run footage and ROP, both from drilling on the North Slope.

DSTRWD™ Slimhole Eccentric Drill Bits help the operator eliminate production-limiting compromises associated with decreasing hole size. These one-piece tools use the patented "Pilot Stabilization PAD" which greatly enhances eccentric bit stability, and employ "drill-out" features which eliminate an additional trip to drill the casing shoe. DSTRWD bits are successfully used by coiled tubing rigs on Alaska's North Slope. In one case, a 3 in. DSTRWD was used to kick off at 11,527 ft and drilled 423 ft, building to 61.8 degrees. It then drilled the 324 ft lateral section at 41.8 ft/hour. ROP was maximized through the Genesis Process, "fine-tuning" the bit's depth of cut for the actual WOB and RPM used in the field.

Coiled Tubing Application Well

The right downhole solutions

Baker Oil Tools offers the industry's widest variety of coiled tubing-conveyed intervention solutions: Well Cleaning, Fishing and Milling, Zone Isolation, Stimulation and Fracturing, Sand Control Completions, Flow Management, Plug and Abandonment, and Sidetracking and Re-entry.

Flawless execution at the wellsite

A comprehensive, standardized program of formal and field training for all Baker Tool Supervisors ensures the highest standard of wellsite excellence worldwide.

Only Baker Oil Tools offers the complete range of downhole solutions, wellsite excellence and collective knowledge to assure optimum value from coiled tubing well intervention operations. Put our resources to work for you.
www.coiledtubingsolutions.com

www.bakerhughes.com/bot/

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