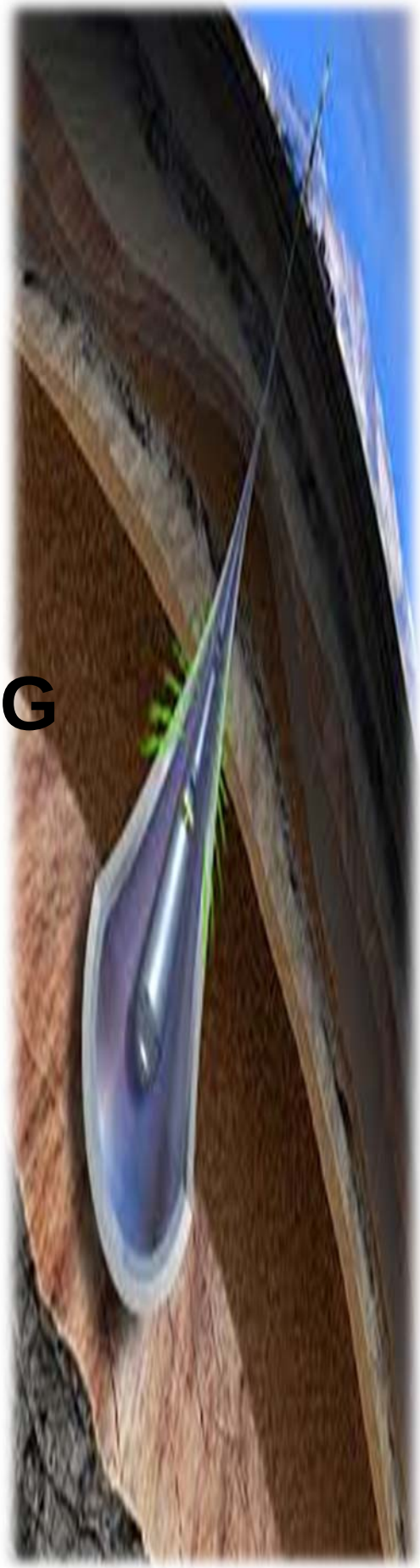
GULF
INTERVENTION
SERVICES

THRU-TUBING
GENERAL CATALOG



APPLICATIONS

BASIC BHA COMPONENTS

The C**oil Tubing Connector (CTC)** is used to join the bottom hole assembly to the **Coiled Tubing (CT)** with a secured, torsionally/axially locked connection. The tool is designed to provide a heavy duty mechanism which is essential for operations such as milling or fishing. A full range of sizes are available from 1" CT to 3 1/2" CT. Various styles are available including **Slip/Grub Screw CTC, External Dimple CTC, Internal Dimple CTC, Crimp-On CTC** and **Internal Slip CTC.**

The **Dual Flapper Check Valves (DFCV)** provided essential pressure integrity for the CT or pipe, to ensure that the surface is protected from formation pressure. This is a critical safety feature of all live well workover operations carried out by the Thru-Tubing Division. The **DFCV** provides a large internal bore to minimize friction at high flow rates and a competent seal for the range of fluids seen in **Thru-Tubing (TT)** workover operations, including gaseous and commingled systems.

Disconnects are a key component of virtually all Thru-Tubing BHAs since they are required to combine the function of a planned release point and also safely handle any torsion or tensile loads that may be exerted during operations. The nature operations, especially TT window milling, mean that the disconnect must be rugged, entirely dependable and heavy-duty. With this in mind, focused a great deal of attention to the design and selection of our Hydraulic Disconnects to ensure that they are dependable and fit for purpose. Disconnect styles available include: **Mechanical Disconnect, Basic Hydraulic Disconnect, Resealable Disconnect, and Heavy-Duty Hydraulic Disconnect.**

Also included in the basic BHA is a circulating valve to provide flexibility in operations whereby communication can be achieved with the annulus either via a **Drop Ball Circulating Valve, Dual Circulating Valve or a Rupture Disc Sub.**

CONTROL VALVES

To optimize the flexibility of our inventory, developed an impressive range of Control Valves for various applications. Control Valves can alter the direction of flow, retain internal pressure in the CT or protect components from over-pressuring. Methods of actuation include drop ball, burst disc, and flow mechanisms. Variants include **Auto Fill Valve, Mechanical Circulating Valve, Adjustable Back-Pressure Valve, Annular Circulating Valve and Multi Function Circulating Valve.**

JETTING/WASHING ASSEMBLIES

We hold a large inventory of Jetting and Washing assemblies ranging from the simplest of bullnose nozzles to rotary jetting tools. The majority of these items are used either for fluid placement operations, i.e. cement/acid or the blasting of softer scales and asphaltines. Our philosophy is based on using Jetting assemblies where the deposit is either relatively soft or soluble in a treatment fluid. With a harder deposit such as a compound scale or Barium Sulfate, we recommend the use of a milling assembly to mechanical break the scale as the most effective option. Types of systems available are as follows:

- **Rotary Jetting Nozzles**
- **Hardened Nose Jetting Nozzles**
- **Spiral Jetting Nozzles**
- **Insert Jetting Nozzles**
- **Bull Nose Nozzles**
- **Displacement Nozzles**

THRU-TUBING FISHING

FISHING BHAs – WIRELINE/LOGGING/CT

Retrieval of various types of BHAs, which for various reasons disconnect or yield in the well bore, is an important component of the TT Division services. By definition, a vast array of potential and actual scenarios exists, hence necessitating an inventory of equipment and pool of expertise that can effectively address and solve each problem. TT BHAs utilized will normally feature a basic BHA, Orientation tools, Jarring assembly and an internal or external catch device. The most common scenarios are external fish necks on slickline BHA, plain ODs due to unplanned tool yield and internal fishing needs for planned disconnects as a contingency in CT tool operations.

PLUG, PACKER, LOCK, SSSV RETRIEVAL

We maintained an inventory of specialized equipment designed specifically to latch and retrieve any number of flow control items that exist in the market place. The more basic components include a full range of **Hydraulic Release GS Spears** for 1" to 7" nominal GS fish necks. **Hydraulic Release Overshots** for external fish necks, from $^{7}/_{8}$" to 3 $^{1}/_{8}$" and a range of options for Plain OD or Plain ID scenarios. One of the more common applications is retrieving SSSVs that have become stuck or are routinely pulled/deployed as part of the sequence of a CT operation. This can minimize the additional cost of slickline services and limit crews on site.

JUNK/DEBRIS RETRIEVAL

A variety of approaches can be taken to junk/debris retrieval including magnetic chip catchers, and reverse circulating basket. However we consider the most efficient system to be the **Venturi Jet Junk Basket (VJJB)**. Fluid pumped through the work string and out nozzles creates a vacuum in the Venturi chamber, drawing fluid/debris through a series of catchers and screens, then exits, less the debris through the Venturi tubes. The tool is essentially a high powered vacuum cleaner. The **VJJB** has the ability to run multi sections of chambers, various shoes and catcher subs. Unlike old drop ball types, the **VJJB** can be run with motorized services.

FISHING FOR COILED TUBING

One of the main requirements of our Thru-Tubing Fishing operations is to provide a range of contingencies designed to retrieve CT from the well, when pipe becomes broken or severed. The contingencies are built about a range of **Continuous Tubing Overshots (CTO)** designed for the full spectrum of CT sizes. The **Continuous Tubing Overshot** is designed to catch a portion of the fish, and then an upward pull will bind the grapple to the CT OD via an internal chamber. The grapple gives 340-degree contact and combined with the ability to swallow the fish, provides the optimum method to latch the relatively "soft" CT material. A variation of this, the **Continuous Tubing Cutting Overshot (CTCO),** is designed to latch the CT and then "trim" the top and retrieve the trimmed piece. This tool is useful when attempting to drop a ball to a BHA at the bottom of the fish, since the potentially damaged top section, when removed, allows full bore access. Cutting the top of the CT is often required were the CT has failed in compression or has been severed using the BOPs.

WIRELINE FISHING

Fishing for wireline or slickline utilizing CT or slimhole pipe is not common for large lengths of wire. Prudent practice limits the engagement of the top few feet of line to ensure that the CT or pipe does not become entangled in a "bird nest" of wire. A variety of spears and grabs are available including **Wire Finders, Wire Grabs, Internal Spears, External Spears** and **Multi Pronged Spears**. One of our most favored techniques is to run a **Corkscrew Spear** complete with a **Wire Finder** beneath a motor. This method allows us to engage the top few feet of the wire by slowly rotating. Meanwhile, the smooth surface of the **Corkscrew Spear** will not nick the wire, hence maximizing the length of wire that can be retrieved in any one run. The most common application is relatively short lengths of wire lost above a fish.

PUSH/PULL SYSTEMS

The **Hydraulic Push/Pull Tool (HPPT)** is a pressure activated device designed to provide a controlled push or pull stroke once the anchoring feature is activated. It has a particular application for retrieving flow control equipment such as safety valves, plugs, and sliding sleeves where conventional methods are either impractical or unsuccessful. The **HPPT** comprises a series of pistons, which convert hydraulic pressure into Push/Pull force. The piston travel is 5.75". After this piston has stroked, the external thrust component transfers to the internal mechanism, hence no further force is applied. The **Hydraulic Push/Pull Tool (HPPT)** used in conjunction with an anchor, provides a stable base to push or pull against. The system also incorporates a specially designed safety feature, a facility to bleed off stored pressure downhole.

JARRING ASSEMBLIES/APPLICATIONS

Jars provide impact force and help overcome the relative lack of axial force available when utilizing CT or slimhole pipe. When selecting jars for use in the TT environment, evaluation of the following parameters is mandatory:

- BHA length limitations due to riser/lubricator length in a live well scenario
- Sufficient time delay within mechanism to ensure that appropriate load can be applied
- Optimum impact
- Durable and rugged design

Three main types of jarring mechanism are retained in the inventory including mechanical, hydraulic and impact. The majority of these tools is Bi-Directional and provides maximum flexibility during operations. For TT work, Houston Engineers provide the heaviest duty options and are available in either a **Bi-Directional Oil Jar** or **Fishing (Up only) Jar** style. Bi-Directional Mechanical Jars are also available. **Impact Tools** tend to be utilized for more specialized applications. Rather than providing the peak impact of the mechanical and hydraulic, it provides a high frequency impact. Applications for these **Impact Tools** include shifting sliding sleeves and breaking knock out Isolation Valves. A full range of Accelerators to match the Jar inventory is available to help maximize the jar impact force applied to the fish. The **ACCM Gas Intensifier** is particularly effective in this respect but has some transport limitations due to the high-pressure gas chamber. In some circumstances, the accelerator is omitted from the fishing BHA due to limited lubricator length.

INFLATABLE RETRIEVAL

One of the most common features of Thru-Tubing Inflatable assemblies is that the fish neck design is primarily to “fit” within the constraints of the slim outside diameter rather than with retrievability in mind.
This fact requires close attention to pre-job design especially if the TT Inflatable has been deployed without consultation regarding retrievability. Ideally the TT Inflatable job design should closely consider retrievability by either optimizing the fish neck size or modifications such as a centralizer immediately below the fish neck to matched to a “twin” centralizer in the retrieval assembly. Although relatively simple these factors can dictate a successful or unsuccessful outcome. To fish TT Inflatables is essentially described in the section “TTF in Liner – Full Bore Searching/Orientation.”

DOWNHOLE SHOOTING CANNON (DSC)

The **Downhole Shooting Canon (DSC)** helps eliminate obstructions in tubing and casing. The **DSC** has been used successfully under a variety of conditions in both oil and gas wells. The **DSC** has a variety of applications, some of which follow below:

- Dislodge obstructions in tubing and casing
- Fragmentation of broken flappers from Sub Surface Safety Valves
- Fragmentation of Ball Valves
- Unsetting of Bridge Plugs
- Removal of Bull Plugs from end of tubing

The bullet has a standard fish neck for easy recovery and is set as standard to be run on electric-line, however the tool can be easily converted to slickline or pipe operation.

TTF in LINER – FULL BORE SEARCHING/ORIENTATION

By definition, Thru-Tubing applications occur either inside the production tubing or "thru" the tubing in the liner. The second scenario creates one of the most challenging environments especially in older wells where the ratio of tubing ID to liner ID can often be in excess of 2:1. Various operations conducted include under-reaming, inflatable applications, and one of the more difficult tasks, which is to locate and retrieve fish in a liner. We used a number of techniques dependent on the specifics of the application. The principles remain the same in trying to alter the axis of approach along the wellbore and to provide overlapping coverage of the liner ID. A number of methods are as follows:

- Using **Torque-Thru Knuckle Joints** and/or **Hydraulic Centralizers.** Exercise extreme care to ensure BHA strength and suitable hydraulics are available.
- Use of **Indexing Tool** and a **Kick-Over Knuckle Joint** to provide a downhole adjustable liner search system, whereby full coverage is achieved in three or four passes along the liner at a different axis of approach each time.
- **"Fishing" drill Positive Displacement Motor (PDM)** in conjunction with a **Bent Sub** and **Bait Receptacle.** This system allows a less specialized and controlled approach, but allows a slightly more dynamic process to help latch the top of the fish.

The above methods are only examples. Other combinations are available, depending on the scenario. One of the key aspects to fishing in a liner is to ensure whenever possible that the planned disconnection points are fishable by simple approaches such as standard fish necks and good centralization.

THRU-TUBING COMPLETIONS

CT SURFACE TIEBACK

This is one of the most conventional applications involving a packer and nipple set deep with a surface hanger as in a standard conventional application. Equipment involved is as follows:

- CT Surface Hanger
- Coiled Tubing as production tubing
- Coil Tubing Connector
- TT Packer
- Nipple
- Shear Out Isolation Plug or Burst Disc

The completion can be deployed in one run or in multiple runs. The main advantage of TT completions is the ability to deploy them in a live pressure environment, saving the costs of killing the well and potential formation damage. Multiple run variants involve the deployment of the packer and nipple assembly, then connecting the Coiled Production Tubing to the packer via a seal assembly or an on/off connector.

CT HAND OFF BELOWWELLHEAD

The main advantage of this application is to deploy an entire completion without uncoupling or altering the Wellhead. Equipment required is as follows:

- Hydraulic Disconnect
- TT Packer
- Top Nipple (Optional)
- Coil Tubing Connector
- Coil Tubing
- Coil Tubing Connector
- Bottom Nipple
- Shear Out Plug or Burst Disc

The equipment can be deployed in one run or multiple runs.

CT HANG OFF BELOW A RESTRICTION

The most common application for this variant would be to deploy and set the assembly below a Sub Surface Safety Valve, retaining the well control aspects of the Wellhead configuration and the Safety Valve assembly. Equipment required is as follows:

- Hydraulic Disconnect
- TT Packer
- Top Nipple (Optional)
- Coil Tubing Connector
- Coil Tubing as production tubing
- Coil Tubing Connector
- Bottom Nipple
- Shear Out Plug or Burst Disc

The equipment can be deployed in one run or multiple runs.

CT COMPLETION BETWEEN PACKERS IN MULTIPLE PACKER COMPLETIONS

The purpose of this application is to enhance the lifting dynamics of the produced fluid by reducing the bore of the production tubing and thereby increasing velocity of the produced fluids. The equipment for this application can vary immensely dependent on the configuration of the wellbore, however a basic configuration based on using nipples in a top and bottom production packer still producing from the intermittent zone. Equipment required would be as follows:

- Lock assembly for nipple
- Coil Tubing Connector
- Coil Tubing – Production Tubing
- Coil Tubing Connector
- Blast Joint
- Perforated Joint
- Blast Joint
- Coil Tubing Connector
- Coil Tubing – Production Tubing
- Coil Tubing Connector
- Expanding Joint
- Lock assembly for nipple
- Shear Out Plug or Rupture Disc or Wireline Retrievable

This format is more complicated. Examples below depict some of the scenarios that may arise. The above system provides the required features of the re-completion but presents challenges concerning deployment of the assembly. A few of the challenges and the issues would be as follows:

- How to isolate the perforated section for deployment?
- Would it be preferable to perforate after deployment?
- How to isolate the end of the CT completion and do we set a wireline retrievable plug or can we use a hydraulic actuated mechanism?

TUBING STRADDLE

This technique considers isolating tubing leaks, old perforations, leaking mandrels, etc. Often the sections to be isolated are relatively short, so commonly conventional tubing is deployed. A typical assembly would be as follows:

- Hydraulic Running Assembly
- Top Packer
- Straddle Tubing
- Bottom Packer
- Shear Out Plug or Rupture Disc

There are a variety of assemblies available which can be set on CT, Slickline or Pipe, depending on the application.

THRU-TUBING INFLATABLE STRADDLE

The TT Inflatable straddle designed to run through the existing tubing or a restriction and then to be set in a larger bore below. The system involves two Inflatable elements that are set to straddle and isolate old perforations or leaks. Deployment is beneath the tubing end in the liner. A typical assembly would be as follows:

- Hydraulic Running Assembly
- Top Inflatable Packer
- Expanding Joint
- Bottom Inflatable Packer
- Shear Out Assembly

FLOW CONTROL COMPONENT MANIPULATION

With the increasing number of horizontal and highly deviated wellbores, the necessity to manipulate flow control equipment using CT is a rapidly developing arena. One of the most common applications is the running or retrieving SSSVs prior to and after a CT operation, utilizing **Bi-Directional Oil Jar** and a **Hydraulic Release GS Spear.** Another common application is the shifting Sliding Sleeve Doors using a centralized BHA including a **Bi-Directional Impact Tool** and a **Hydraulic Shifting Tool (HST).** The assembly provides the ability to selectively open or close sleeves, using the powerful **Bi-Directional Impact Tool.** Stroking the sleeve is very effective, especially concerning the newer generation of SSDs, which are designed with non-elastomer sealing systems.

THRU-TUBING MILLING

UNDERREAMING – SERVCOLOY, DIAMOND, INSERT

The **Thru-Tubing Underreamer (TTU)** is a proven successful and dependable downhole tool utilized in the removal of cement, scale, and hard debris from a liner below the production string. The design of the **Thru-Tubing Underreamer** allows it to pass through restrictions and open to full gauge for any given size and weight of casing. Some design features are as follows:

- Knife configuration allows self-stabilization
- Positive lock out when tool is opened
- Unique design effectively doubles the piston area for optimum performance
- Internal assist in closing knives when tripping
- Maximum flow through fully opened tool
- Accommodate all sizes of nozzles to optimize performance
- Rugged construction for downhole durability

Three types of blades exist for varying applications:

- Servcoloy – For scale/cement applications.
- Diamond – For scale/cement especially where gauge/tubular protection is paramount.
- Inserts – For varying applications including increased ROP, shoe tracks, obstruction milling and section milling.

For optimum performance pre-operation engineering is essential to ensure that all operating parameters are defined as follows:

- Knife size
- Type of milling matrix
- Nozzle size
- Flow rates
- Pressure drops
- Drill parameters
- Size rage from 1 $^{11}/_{16}$" OD to 4 $^{1}/_{8}$" OD

MILLING

We have developed a range of mills specifically designed for Thru-Tubing applications. The **"T" Series** optimize the characteristics required to achieve success in Thru-Tubing milling applications using renowned insert technology. The mill's design, complement existing motor characteristics with turbulent flow, jet flushing, rugged inserts and improved ROP as the outstanding features. Combined with more conventional mills and the flexibility of a range of cutting matrices, we can provided an unrivalled approach to TT milling operations. Some examples of the range of applications are below:

- Wash-over Systems – Using inserts and **VJJB** technology
- Cement/Scale Milling – **Cement Mills** and **"T "Series Mills**
- Plug Milling
- Junk Milling/Debris Retrieval
- Nipple/Restriction Milling – Using a **Stage Mill**
- Deepening/Sidetrack Milling

TUBULAR SEVERANCE

HYDRO-MECHANCIAL SEVERANCE

We carry a comprehensive range of devices to tackle all manner of Tubular Severance applications off CT or small diameter pipe. The inventory includes a full range of **Hydraulic Cutters, Hydraulic Anchors, Mechanical Anchors, Swivel Subs, No Gos, Bullnose Swivels, Bleed Off Subs** and **Cut Compensators.** The essential aspects of severance operations are to ensure that the BHA assembly is designed for the hydraulics available from the work string and that simplicity is the principle. For CT operations, the ability to anchor the assembly within the tubular is advantageous and eliminates any spirographical etching ensuring a clean cut. Blade selection is also critical to ensure that not only can the blade matrix cut the tubular material, but that it also has the durability to complete the job and does not chip when the blades actuate.

EXPLOSIVE SEVERANCE

We can provide a range of devices from our **Hot Forge** division upon request. Please note that the logistics of shipping and storing explosives is subject to tight legislative controls, requiring extended periods of notice and eliminating some geographic areas from the applicability of these tools.

MISCELLANEOUS

DEPLOYMENT

We offer various deployment options including the **Toolstring Deployment System (TDS)** or more conventional approach based on a **TT Quick Connect, Dual Ball Valve Sub** and **Deployment Bar.** The **TDS** is a developmental design to allow extended tool string configurations deployment in restricted height access, thus allowing simultaneous performance of operations. The system uses any completion nipple allowing the system to be either deep set or shallow set. The more conventional approach is to use the **TT Quick Connect Dual Ball Valve Sub** and **Deployment Bar** normally for single or dual deployments, which are relatively common in TT Fishing applications, especially concerning land operations. Prior to deploying the BHA the **Dual Ball Valves** are closed, then the well is opened and the assembly is run in hole until the **Deployment Bar** straddles the CT Pipe rams. The CT pipe rams close on the **Deployment Bar** to provide the annular seal. Hence, with the closed
Dual Ball Valves acting as the internal barrier, the riser can now be broken, ready to deploy the next section. When made up, the **Dual Ball Valve Sub** is opened before running in hole.

THRU-TUBING WORKSHOP CONTAINER

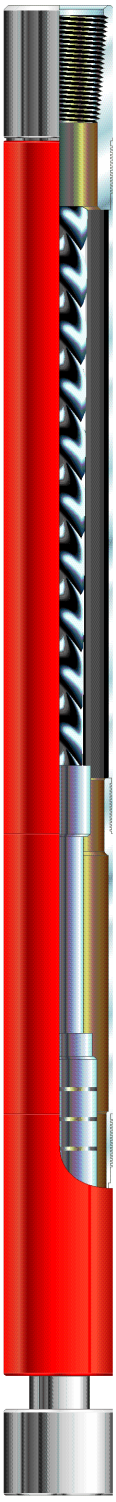
For the more complicated operation or campaign of wells can include the deployment of a comprehensive on-site support unit. The unit is fully equipped to transport and store the relevant tools for the job and includes many on-site contingencies that will cope with most eventualities ensuring client confidence and satisfaction. The primary function of the container is to provide an on-site workshop facility that supports the high quality maintenance and redress of any component of the package. The Thru-Tubing Workshop Container includes the following features:

- Pressure Test Facilities
- Pressure Test Recorders
- Overhead Lifting Assembly
- “G” Vice
- Tool cabinets
- Air Operated Light System
- DNV approved to 2.7.1 standard
- Work Bench with vices
- Thru-Tubing Tool storage racks
- Hydraulic Make and Break Out Unit (Optional)

* International locations only

DOWNHOLE MOTORS

1.69" DOWNHOLE MOTOR



The **1.69**" Downhole Motor features a wide range of torque, speed, and flow rates to convert hydraulic fluid energy, created by flow and pressure, into mechanical energy. This positive displacement motor produces optimum power output with maximum efficiency for today's thru-tubing demands.

TRANSMISSION

The motor's single-piece flexible shaft is the simplest and the most reliable transmission for standard applications in a small-diameter motor.

POWER SECTION

The power section consists of a stainless steel rotor, and an elastomeric lined stator tailored to the planned well intervention whether it is a high-temperature application or an aggressive fluid application.

BEARING ASSEMBLY

Downhole Motor's bearing assembly is well suited for weight on bit, sideloading, and overpulls. For high-pressure tool applications, the sealing system uses mud lubricated bearings and mechanical seal assembly.

SPECIFICATIONS

DESIGNATION	FLOW RANGE (GPM)	SPEED RANGE (RPM)	MAX. OPERATING TORQUE (FT-LBS)	MAX. PRESSURE DIFFERENTIAL (PSI)
MSHP	18-42	270-640	110	700
MSHT	18-42	300-700	170	1000
SSHT	15-45	83-250	157	375

Note:
Specifications are based on water at 70℉. Specific ations are subject to change without notice.

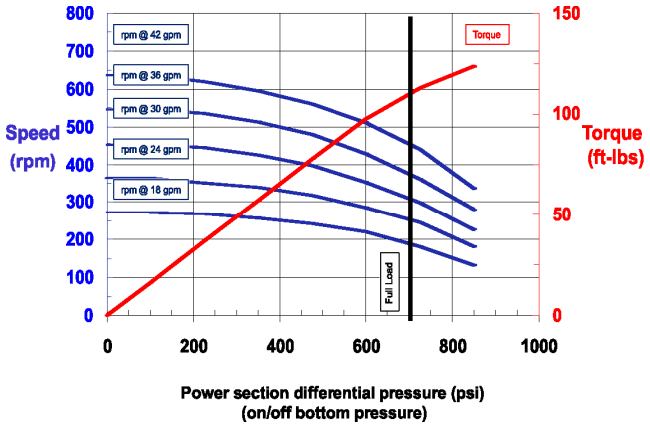
THRU-TUBING
DOWNHOLE MOTORS

MSHP Performance Specifications

Hi-Performance 1.69" Motor

	U.S. UNITS	S.I. UNIT
Outside Diameter	1.688"	43 mm
Overall Length	7.83'	2.39 m
Weight	45 lbs	20 kg
Top Connection	1" AMMT	
Bottom Connection	1" AMMT	
Maximum Weight On Bit	2,500 lbs	1,134 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	18 gpm	68 lpm
Maximum	42 gpm	159 lpm
No Load Bit Speed		
@ Min. Flow Rate	273 rpm	
@ Max. Flow Rate	637 rpm	
No Load Pressure Drop	200 psi	13.8 Bar
Maximum Operating Pressure Differential	700 psi	48.3 Bar
Torque(w/H_2O @ 70℉)		
Maximum Operating	110 ft-lbs	149 Nm
Stall	165 ft-lbs	224 Nm
Maximum Allowable Overpull		
For Re-running	23,980 lbs	10,877 kg
Absolute Maximum	29,970 lbs	13,594 kg

Power Curve



Performance Chart

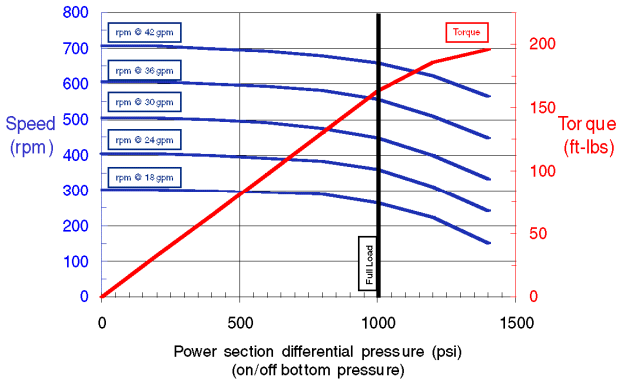
Pressure Differential	Q (gpm)	18	24	30	36	42
200 psi	(ft-lbs)	33	33	33	33	33
	(rpm)	303	404	505	606	707
400 psi	(ft-lbs)	65	65	65	65	65
	(rpm)	300	400	500	600	700
600 psi	(ft-lbs)	98	98	98	98	98
	(rpm)	294	392	490	594	693
800 psi	(ft-lbs)	130	130	130	130	130
	(rpm)	288	384	475	582	679
1,000 psi	(ft-lbs)	163	163	163	163	163
	(rpm)	264	360	449	558	658
1,200 psi	(ft-lbs)	186	186	186	186	186
	(rpm)	224	311	399	509	622
1,400 psi	(ft-lbs)	196	196	196	196	196
	(rpm)	152	243	333	448	566

MSHT Performance Specifications

Hi-Torque 1.69" Motor

	U.S. UNITS	S.I. UNIT
Outside Diameter	1.688"	43 mm
Overall Length	7.83'	2.39 m
Weight	45 lbs	20 kg
Top Connection	1" AMMT	
Bottom Connection	1" AMMT	
Maximum Weight On Bit	2,500 lbs	1,134 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	18 gpm	68 lpm
Maximum	42 gpm	159 lpm
No Load Bit Speed		
@ Min. Flow Rate	303 rpm	
@ Max. Flow Rate	707 rpm	
No Load Pressure Drop	200 psi	13.8 Bar
Maximum Operating Pressure Differential	1000 psi	68.9 Bar
Torque(w/H_2O @ 70°F)		
Maximum Operating	170 ft-lbs	230 Nm
Stall	255 ft-lbs	364 Nm
Maximum Allowable Overpull		
For Re-running	23,980 lbs	10,877 kg
Absolute Maximum	29,970 lbs	13,594 kg

Power Curve



Performance Chart

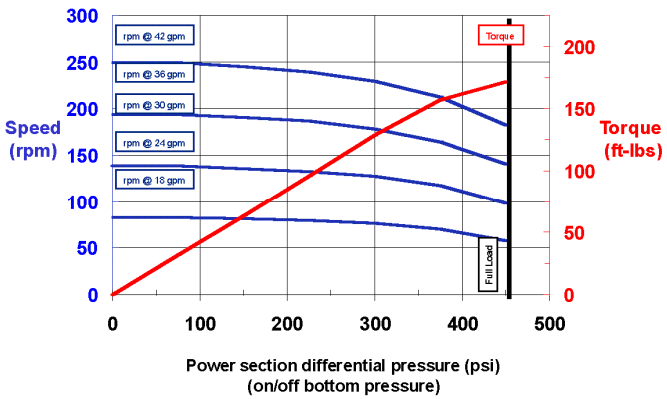
Pressure Differential	Q (gpm)	18	24	30	36	42
200 psi	(ft-lbs)	33	33	33	33	33
	(rpm)	303	404	505	606	707
400 psi	(ft-lbs)	65	65	65	65	65
	(rpm)	300	400	500	600	700
600 psi	(ft-lbs)	98	98	98	98	98
	(rpm)	294	392	490	594	693
800 psi	(ft-lbs)	130	130	130	130	130
	(rpm)	288	384	475	582	679
1,000 psi	(ft-lbs)	163	163	163	163	163
	(rpm)	264	360	449	558	658
1,200 psi	(ft-lbs)	186	186	186	186	186
	(rpm)	224	311	399	509	622
1,400 psi	(ft-lbs)	196	196	196	196	196
	(rpm)	152	243	333	448	566

SSHT Performance Specifications

Slow Speed 1.69" Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	1.688"	43 mm
Overall Length	9.96'	3.04 m
Weight	57 lbs	25.9 kg
Top Connection	1" AMMT	
Bottom Connection	1" AMMT	
Maximum Weight On Bit	2,500 lbs	1,134 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	15 gpm	57 lpm
Maximum	45 gpm	170 lpm
No Load Bit Speed		
@ Min. Flow Rate	83 rpm	
@ Max. Flow Rate	250 rpm	
No Load Pressure Drop	150 psi	10.3 Bar
Maximum Operating Pressure Differential	450 psi	31 Bar
Torque(w/H_2O @ 70°F)		
Maximum Operating	170 ft-lbs	230 Nm
Stall	255 ft-lbs	364 Nm
Maximum Allowable Overpull		
For Re-running	22,980 lbs	10,424 kg
Absolute Maximum	29,970 lbs	13,594 kg

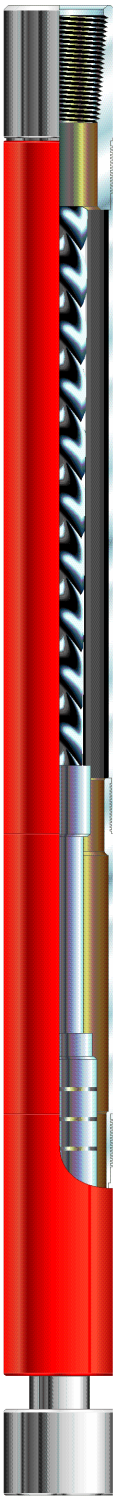
Power Curve



Performance Chart

Pressure Differential	Q (gpm)	15	25	35	45
75 psi	(ft/lbs)	32	32	32	32
	(rpm)	83	139	194	250
150 psi	(ft/lbs)	64	64	64	64
	(rpm)	82	136	191	245
225 psi	(ft/lbs)	96	96	96	96
	(rpm)	80	133	187	240
300 psi	(ft/lbs)	129	129	129	129
	(rpm)	77	128	179	230
375 psi	(ft/lbs)	157	157	157	157
	(rpm)	71	118	165	213
450 psi	(ft/lbs)	172	172	172	172
	(rpm)	58	99	142	183

2.12" DOWNHOLE MOTOR



The **2.12**" Downhole Motor features a wide range of torque, speed, and flow rates to convert hydraulic fluid energy, created by flow and pressure, into mechanical energy. This positive displacement motor produces optimum power output with maximum efficiency for today's Thru-Tubing demands.

TRANSMISSION

The motor's single-piece flexible shaft is the simplest and the most reliable transmission for standard applications in a small-diameter motor.

POWER SECTION

The power section consists of a stainless steel rotor, and an elastomeric lined stator tailored to the planned well intervention whether it is a high-temperature application or an aggressive fluid application.

BEARING ASSEMBLY

Downhole Motor's bearing assembly is well suited for weight on bit, sideloading, and overpulls. For high-pressure tool applications, the sealing system uses mud lubricated bearings and a mechanical seal assembly.

SPECIFICATIONS

DESIGNATION	FLOW RANGE (GPM)	SPEED RANGE (RPM)	MAX. OPERATING TORQUE (FT-LBS)	MAX. PRESSURE DIFFERENTIAL (PSI)
MSHP	25-65	210-545	140	700
MSHT	25-65	230-600	200	1000
SSHT	20-60	67-200	237	400

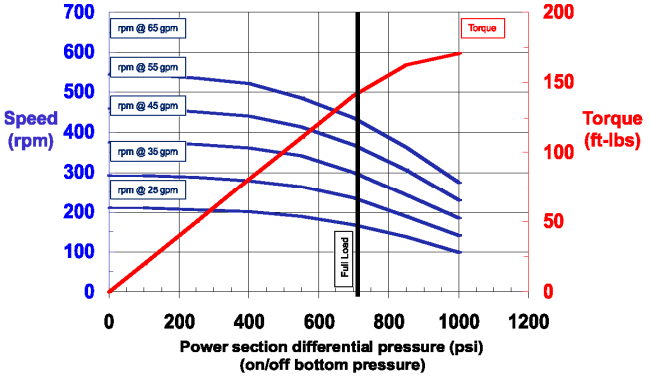
Note:
Specifications are based on water at 70℉. Specific ations are subject to change without notice.

MSHP Performance Specifications

Hi-Performance 2.12" Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	2.125"	54 mm
Overall Length	9.21'	2.81 m
Weight	75 lbs	34 kg
Top Connection	1 1/2" AMMT	
Bottom Connection	1 1/2" AMMT	
Maximum Weight On Bit	2,800 lbs	1,270 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	25 gpm	95 lpm
Maximum	65 gpm	246 lpm
No Load Bit Speed		
@ Min. Flow Rate	210 rpm	
@ Max. Flow Rate	545 rpm	
No Load Pressure Drop	200 psi	13.8 Bar
Maximum Operating Pressure Differential	700 psi	48.3 Bar
Torque(w/H_2O @ 70°F)		
Maximum Operating	140 ft-lbs	190 Nm
Stall	210 ft-lbs	285 Nm
Maximum Allowable Overpull		
For Re-running	30,450 lbs	13,812 kg
Absolute Maximum	38,070 lbs	17,268 kg

Power Curve



Performance Chart

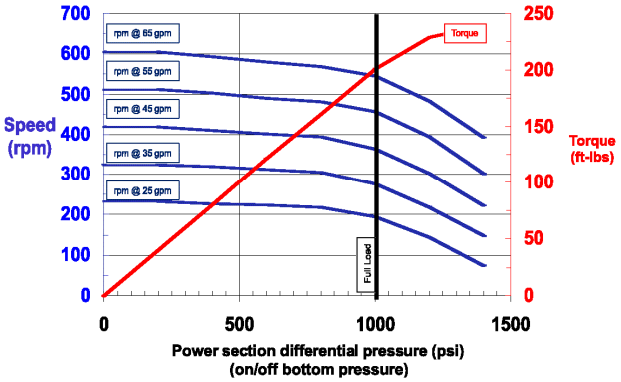
Pressure Differential	Q (gpm)	25	35	45	55	65
100 psi	(ft-lbs)	20	20	20	20	20
	(rpm)	210	293	377	461	545
250 psi	(ft-lbs)	50	50	50	50	50
	(rpm)	205	288	370	452	536
400 psi	(ft-lbs)	81	81	81	81	81
	(rpm)	201	279	362	443	523
550 psi	(ft-lbs)	111	111	111	111	111
	(rpm)	188	264	343	414	488
700 psi	(ft-lbs)	141	141	141	141	141
	(rpm)	168	236	302	369	437
850 psi	(ft-lbs)	163	163	163	163	163
	(rpm)	138	190	243	307	364
1,000 psi	(ft-lbs)	171	171	171	171	171
	(rpm)	100	141	185	230	275

MSHT Performance Specifications

Hi-Torque 2.12” Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	2.125"	54 mm
Overall Length	9.21'	2.81 m
Weight	60 lbs	27.2 kg
Top Connection	1 1/2" AMMT	
Bottom Connection	1 1/2" AMMT	
Maximum Weight On Bit	2,800 lbs	1,270 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	25 gpm	95 lpm
Maximum	65 gpm	246 lpm
No Load Bit Speed		
@ Min. Flow Rate	233 rpm	
@ Max. Flow Rate	605 rpm	
No Load Pressure Drop	200 psi	13.8 Bar
Maximum Operating Pressure Differential	1000 psi	68.9 Bar
Torque(w/H_2O @ 70℉)		
Maximum Operating	200 ft-lbs	271 Nm
Stall	300 ft-lbs	407 Nm
Maximum Allowable Overpull		
For Re-running	30,450 lbs	13,812 kg
Absolute Maximum	38,070 lbs	17,268 kg

Power Curve



Performance Chart

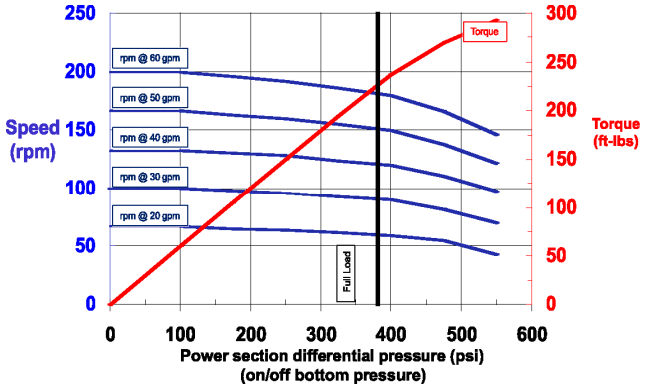
Pressure Differential	Q (gpm)	25	35	45	55	65
200 psi	(ft-lbs)	40	40	40	40	40
	(rpm)	233	326	505	606	707
400 psi	(ft-lbs)	65	65	65	65	65
	(rpm)	300	400	500	600	700
600 psi	(ft-lbs)	121	121	121	121	121
	(rpm)	223	313	402	491	581
800 psi	(ft-lbs)	161	161	161	161	161
	(rpm)	219	306	394	481	569
1,000 psi	(ft-lbs)	201	201	201	201	201
	(rpm)	195	277	364	456	545
1,200 psi	(ft-lbs)	229	229	229	229	229
	(rpm)	144	218	302	394	484
1,400 psi	(ft-lbs)	239	239	239	239	239
	(rpm)	74	147	222	302	393

SSHT Performance Specifications

Slow Speed 2.12" Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	2.125"	54 mm
Overall Length	9.59'	2.92 m
Weight	74 lbs	34 kg
Top Connection	1 1/2" AMMT	
Bottom Connection	1 1/2" AMMT	
Maximum Weight On Bit	2,800 lbs	1,270 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	20 gpm	76 lpm
Maximum	60 gpm	227 lpm
No Load Bit Speed		
@ Min. Flow Rate	67 rpm	
@ Max. Flow Rate	200 rpm	
No Load Pressure Drop	150 psi	10.3 Bar
Maximum Operating Pressure Differential	375 psi	25.9 Bar
Torque(w/H_2O @ 70°F)		
Maximum Operating	220 ft-lbs	298 Nm
Stall	330 ft-lbs	447 Nm
Maximum Allowable Overpull		
For Re-running	30,450 lbs	13,812 kg
Absolute Maximum	38,070 lbs	17,268 kg

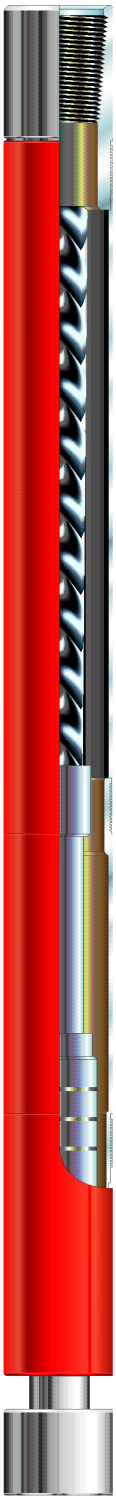
Power Curve



Performance Chart

Pressure Differential	Q (gpm)	20	30	40	50	60
100 psi	(ft-lbs)	60	60	60	60	60
	(rpm)	67	100	133	167	200
175 psi	(ft-lbs)	105	105	105	105	105
	(rpm)	65	98	131	163	196
250 psi	(ft-lbs)	150	150	150	150	150
	(rpm)	64	96	128	160	192
325 psi	(ft-lbs)	195	195	195	195	195
	(rpm)	62	93	124	155	186
400 psi	(ft-lbs)	237	237	237	237	237
	(rpm)	59	90	120	150	180
475 psi	(ft-lbs)	270	270	270	270	270
	(rpm)	55	82	111	138	166
550 psi	(ft-lbs)	293	293	293	293	293
	(rpm)	43	70	97	122	146

2.88" DOWNHOLE MOTOR



The **2.88**" Downhole Motor features a wide range of torque, speed, and flow rates to convert hydraulic fluid energy, created by flow and pressure, into mechanical energy. This positive displacement motor produces optimum power output with maximum efficiency for today's Thru-Tubing demands.

TRANSMISSION

The motor's single-piece flexible shaft is the simplest and the most reliable transmission for standard applications in a small-diameter motor.

POWER SECTION

The power section consists of a stainless steel rotor, and an elastomeric lined stator tailored to the planned well intervention whether it is a high-temperature application or an aggressive fluid application.

BEARING ASSEMBLY

Downhole Motor's bearing assembly is well suited for weight on bit, sideloading, and overpulls. For high-pressure tool applications, the sealing system uses mud lubricated bearings and a mechanical seal assembly.

SPECIFICATIONS

DESIGNATION	FLOW RANGE (GPM)	SPEED RANGE (RPM)	MAX. OPERATING TORQUE (FT-LBS)	MAX. PRESSURE DIFFERENTIAL (PSI)
MSHP	60-120	190-375	350	625
MSHT	60-120	200-415	475	875
SSHT	60-120	60-120	800	375

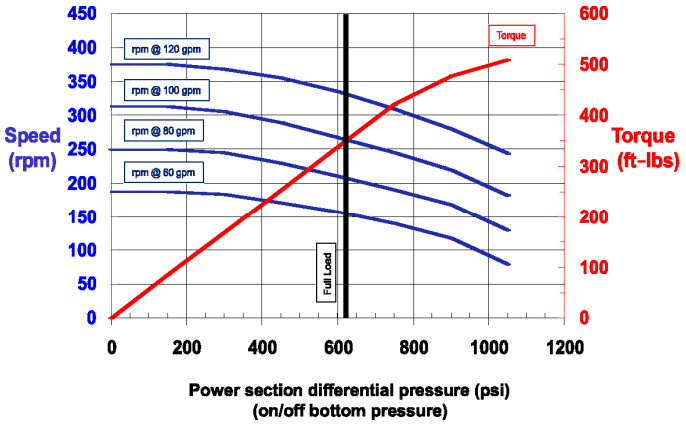
Note:
Specifications are based on water at 70℉. Specific ations are subject to change without notice.

MSHP Performance Specifications

Hi-Performance 2.88" Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	2.875"	73 mm
Overall Length	10.66'	3.25 m
Weight	202 lbs	92 kg
Top Connection	2 3/8" PAC	
Bottom Connection	2 3/8" PAC	
Maximum Weight On Bit	5,200 lbs	2,359 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	60 gpm	227 lpm
Maximum	120 gpm	454 lpm
No Load Bit Speed		
@ Min. Flow Rate	188 rpm	
@ Max. Flow Rate	375 rpm	
No Load Pressure Drop	200 psi	13.8 Bar
Maximum Operating Pressure Differential	625 psi	43.1 Bar
Torque(w/H_2O @ 70°F)		
Maximum Operating	350 ft-lbs	475 Nm
Stall	525 ft-lbs	712 Nm
Maximum Allowable Overpull		
For Re-running	80,250 lbs	36,401 kg
Absolute Maximum	100,300 lbs	45,496 kg

Power Curve



Performance Chart

Pressure Differential	Q (gpm)	60	80	100	120
150 psi	(ft-lbs)	85	85	85	85
	(rpm)	188	250	313	368
300 psi	(ft-lbs)	169	169	169	169
	(rpm)	185	245	306	368
450 psi	(ft-lbs)	254	254	254	254
	(rpm)	172	230	290	355
600 psi	(ft-lbs)	339	339	339	339
	(rpm)	158	210	268	336
750 psi	(ft-lbs)	423	423	423	423
	(rpm)	140	190	246	310
900 psi	(ft-lbs)	478	478	478	478
	(rpm)	118	168	220	280
1,050 psi	(ft-lbs)	510	510	510	510
	(rpm)	80	130	182	244

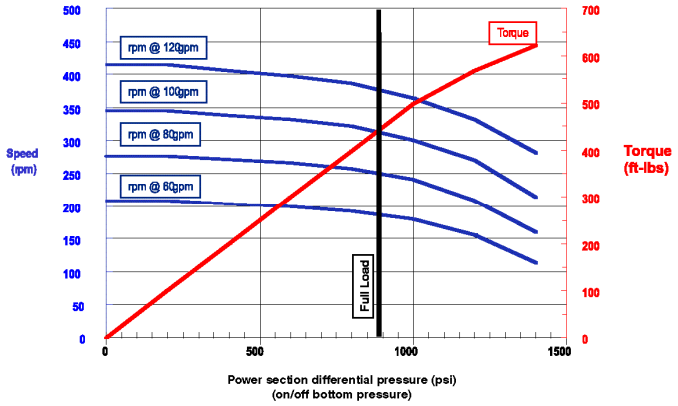
THRU-TUBING
DOWNHOLE MOTORS

MSHT Performance Specifications

Hi-Torque 2.88" Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	2.875"	73 mm
Overall Length	10.66'	3.25 m
Weight	202 lbs	92 kg
Top Connection	2 3/8" PAC	
Bottom Connection	2 3/8" PAC	
Maximum Weight On Bit	5,200 lbs	2,359 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	60 gpm	227 lpm
Maximum	120 gpm	454 lpm
No Load Bit Speed		
@ Min. Flow Rate	208 rpm	
@ Max. Flow Rate	415 rpm	
No Load Pressure Drop	200 psi	13.8 Bar
Maximum Operating Pressure Differential	875 psi	60.4 Bar
Torque(w/H_2O @ 70°F)		
Maximum Operating	475 ft-lbs	644 Nm
Stall	715 ft-lbs	969 Nm
Maximum Allowable Overpull		
For Re-running	80,250 lbs	36,401 kg
Absolute Maximum	100,300 lbs	45,496 kg

Power Curve



Performance Chart

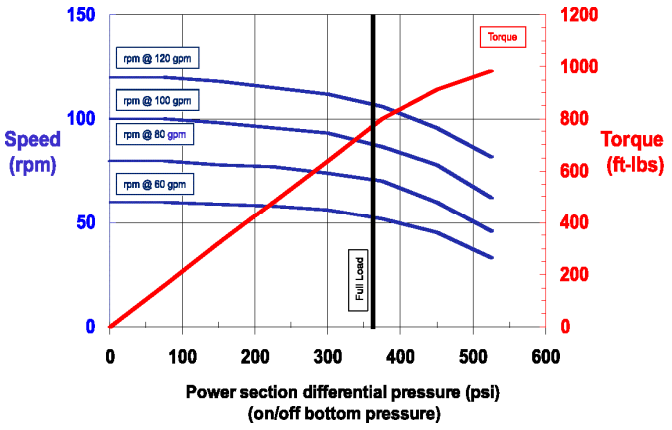
Pressure Differential	Q (gpm)	60	80	100	120
200 psi	(ft-lbs)	100	100	100	100
	(rpm)	208	277	346	415
400 psi	(ft-lbs)	200	200	200	200
	(rpm)	203	271	339	407
600 psi	(ft-lbs)	300	300	300	300
	(rpm)	199	266	332	398
800 psi	(ft-lbs)	400	400	400	400
	(rpm)	193	257	322	386
1,000 psi	(ft-lbs)	499	499	499	499
	(rpm)	181	241	301	365
1,200 psi	(ft-lbs)	569	569	569	569
	(rpm)	156	208	270	332
1,400 psi	(ft-lbs)	622	622	622	622
	(rpm)	114	160	214	282

SSHT Performance Specifications

Slow Speed 2.88" Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	2.875"	73 mm
Overall Length	12.88'	3.93 m
Weight	244 lbs	111 kg
Top Connection	2 3/8" PAC	
Bottom Connection	2 3/8" PAC	
Maximum Weight On Bit	5,200 lbs	2,359 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	60 gpm	227 lpm
Maximum	120 gpm	454 lpm
No Load Bit Speed		
@ Min. Flow Rate	60 rpm	
@ Max. Flow Rate	120 rpm	
No Load Pressure Drop	150 psi	10.3 Bar
Maximum Operating Pressure Differential	375 psi	25.9 Bar
Torque(w/H_2O @ 70℉)		
Maximum Operating	800 ft-lbs	1,085 Nm
Stall	1,200 ft-lbs	1,627 Nm
Maximum Allowable Overpull		
For Re-running	80,250 lbs	36,401 kg
Absolute Maximum	100,300 lbs	45,496 kg

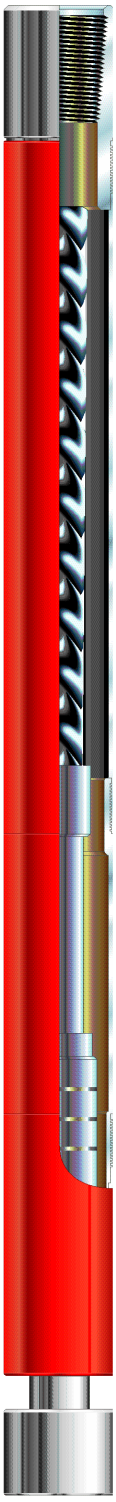
Power Curve



Performance Chart

Pressure Differential	Q (gpm)	60	80	100	120
75 psi	(ft-lbs)	160	160	160	160
	(rpm)	60	80	100	120
150 psi	(ft-lbs)	320	320	320	320
	(rpm)	59	78	98	118
225 psi	(ft-lbs)	480	480	480	480
	(rpm)	58	77	96	115
300 psi	(ft-lbs)	640	640	640	640
	(rpm)	56	74	93	112
375 psi	(ft-lbs)	800	800	800	800
	(rpm)	52	70	87	106
450 psi	(ft-lbs)	912	912	912	912
	(rpm)	45	60	78	96
525 psi	(ft-lbs)	985	985	985	985
	(rpm)	33	46	62	82

3.38" DOWNHOLE MOTOR



The **3.38**" Downhole Motor features a wide range of torque, speed, and flow rates to convert hydraulic fluid energy, created by flow and pressure, into mechanical energy. This positive displacement motor produces optimum power output with maximum efficiency for today's Thru-Tubing demands.

TRANSMISSION

The motor's single-piece flexible shaft is the simplest and the most reliable transmission for standard applications in a small-diameter motor.

POWER SECTION

The power section consists of a stainless steel rotor, and an elastomeric lined stator tailored to the planned well intervention whether it is a high-temperature application or an aggressive fluid application.

BEARING ASSEMBLY

Downhole Motor's bearing assembly is well suited for weight on bit, sideloading, and overpulls. For high-pressure tool applications, the sealing system uses mud lubricated bearings and mechanical seal assembly.

SPECIFICATIONS

DESIGNATION	FLOW RANGE (GPM)	SPEED RANGE (RPM)	MAX. OPERATING TORQUE (FT-LBS)	MAX. PRESSURE DIFFERENTIAL (PSI)
MSHP	80 - 160	178-311	600	550
MSHT	80-160	195-390	900	750
SDSS	80-160	60-120	950	375

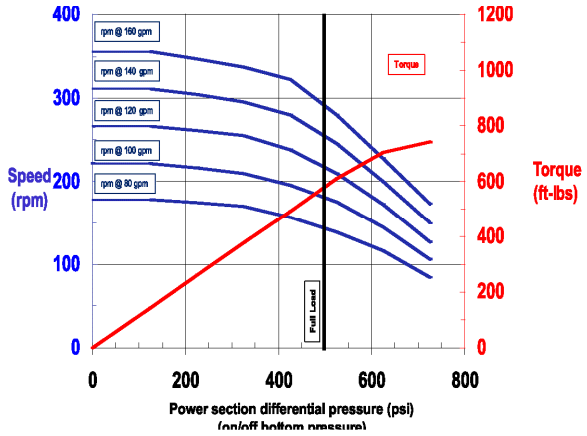
Note:
Specifications are based on water at 70℉. Specific ations are subject to change without notice.

MSHP Performance Specifications

Hi-Performance 3.38" Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	3.375"	86 mm
Overall Length	12.58'	3.83 m
Weight	247 lbs	112 kg
Top Connection	2 3/8" Reg	
Bottom Connection	2 3/8" Reg	
Maximum Weight On Bit	7,500 lbs	3,402 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	80 gpm	302 lpm
Maximum	160 gpm	606 lpm
No Load Bit Speed		
@ Min. Flow Rate	178 rpm	
@ Max. Flow Rate	311 rpm	
No Load Pressure Drop	200 psi	13.8 Bar
Maximum Operating Pressure Differential	550 psi	37.9 Bar
Torque(w/H_2O @ 70°F)		
Maximum Operating	600 ft-lbs	814 Nm
Stall	900 ft-lbs	1,220 Nm
Maximum Allowable Overpull		
For Re-running	121,170 lbs	54,962 kg
Absolute Maximum	151,500 lbs	68,720 kg

Power Curve



Performance Chart

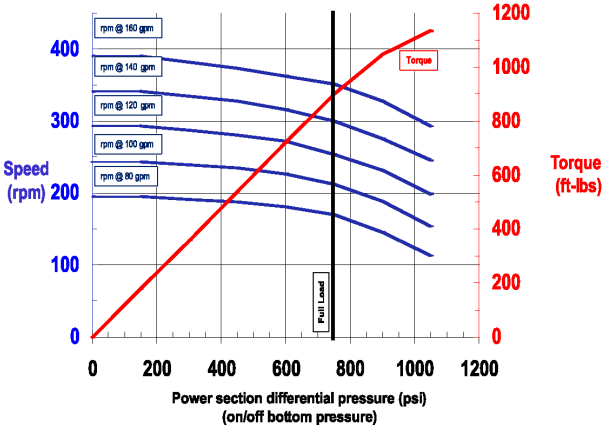
Pressure Differential	Q (gpm)	80	100	120	140	160
125 psi	(ft-lbs)	145	145	145	145	145
	(rpm)	178	222	266	311	356
225 psi	(ft-lbs)	262	262	262	262	262
	(rpm)	174	217	261	304	347
325 psi	(ft-lbs)	378	378	378	378	378
	(rpm)	170	310	255	296	310
425 psi	(ft-lbs)	494	494	494	494	494
	(rpm)	157	196	238	280	322
525 psi	(ft-lbs)	611	611	611	611	611
	(rpm)	139	175	210	245	280
625 psi	(ft-lbs)	705	05	705	705	705
	(rpm)	116	145	172	200	228
725 psi	(ft-lbs)	742	42	742	742	742
	(rpm)	85	106	127	150	173

MSHT Performance Specifications

Hi-Torque 3.38" Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	3.375"	86 mm
Overall Length	12.58'	3.83 m
Weight	247 lbs	112 kg
Top Connection	2 3/8" Reg	
Bottom Connection	2 3/8" Reg	
Maximum Weight On Bit	7,500 lbs	3,402 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	80 gpm	302 lpm
Maximum	160 gpm	606 lpm
No Load Bit Speed		
@ Min. Flow Rate	195 rpm	
@ Max. Flow Rate	390 rpm	
No Load Pressure Drop	200 psi	13.8 Bar
Maximum Operating Pressure Differential	750 psi	51.7 Bar
Torque(w/H_2O @ 70°F)		
Maximum Operating	900 ft-lbs	1,220 Nm
Stall	1,350 ft-lbs	1,830 Nm
Maximum Allowable Overpull		
For Re-running	121,170 lbs	54,962 kg
Absolute Maximum	151,500 lbs	68,720 kg

Power Curve



Performance Chart

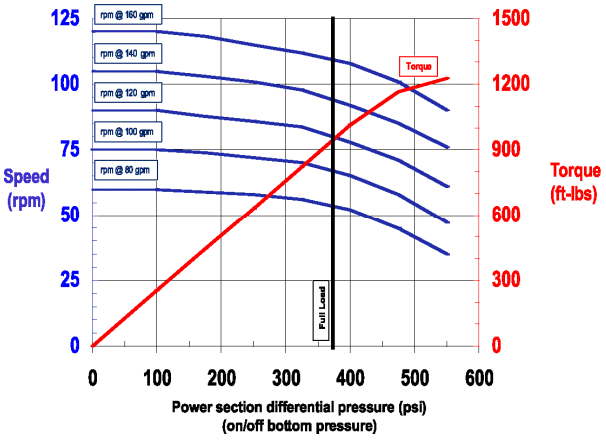
Pressure Differential	Q (gpm)	80	100	120	140	160
150 psi	(ftlbs)	180	180	180	180	180
	(rpm)	195	244	293	341	390
300 psi	(ft-lbs)	360	360	360	360	360
	(rpm)	191	239	287	334	382
450 psi	(ft-lbs)	540	540	540	540	540
	(rpm)	187	234	281	328	374
600 psi	(ft-lbs)	720	720	720	720	720
	(rpm)	181	227	272	317	363
750 psi	(ft-lbs)	900	900	900	900	900
	(rpm)	170	212	254	300	351
900 psi	(ft-lbs)	48	1,048	1,048	1,048	1,048
	(rpm)	146	188	231	276	328
1,050 psi	(ft-lbs)	34	1,134	1,134	1,134	1,134
	(rpm)	113	154	199	246	293

SSHT Performance Specifications

Slow Speed 3.38" Motor

	U.S. UNITS	S.I. UNITS
Outside Diameter	3.375"	86 mm
Overall Length	13.63'	4.15 m
Weight	270 lbs	122 kg
Top Connection	2 3/8" Reg	
Bottom Connection	2 3/8" Reg	
Maximum Weight On Bit	7,500 lbs	3,402 kg
Maximum Bit Pressure Drop	1,500 psi	103 Bar
Flow Rate:		
Minimum	80 gpm	302 lpm
Maximum	160 gpm	606 lpm
No Load Bit Speed		
@ Min. Flow Rate	60 rpm	
@ Max. Flow Rate	120 rpm	
No Load Pressure Drop	150 psi	10.3 Bar
Maximum Operating Pressure Differential	375 psi	25.9 Bar
Torque(w/H_2O @ 70°F)		
Maximum Operating	950 ft-lbs	1,288 Nm
Stall	1,425 ft-lbs	1,932 Nm
Maximum Allowable Overpull		
For Re-running	121,170 lbs	54,962 kg
Absolute Maximum	151,500 lbs	68,720 kg

Power Curve



Performance Chart

Pressure Differential	Q (gpm)	80	100	120	140	160
100 psi	(ft-lbs)	253	253	253	253	253
	(rpm)	60	75	90	105	120
175 psi	(ft-lbs)	444	444	444	444	444
	(rpm)	59	74	88	103	118
250 psi	(ft-lbs)	634	634	634	634	634
	(rpm)	58	72	86	101	115
325 psi	(ft-lbs)	824	824	824	824	824
	(rpm)	56	70	84	98	112
400 psi	(ft-lbs)	1014	1014	1014	1014	1014
	(rpm)	52	65	78	92	108
475 psi	(ft-lbs)	1168	1168	1168	1168	1168
	(rpm)	45	58	71	85	101
550 psi	(ft-lbs)	1227	1227	1227	1227	1227
	(rpm)	35	47	61	76	90

MILLING AND CUTTING TOOLS

THRU-TUBING
MILLING & CUTTING TOOLS

3 ½” PDC

With a matrix body bit, designed with stability enhancing features, the mill handles 2,000 to 20,000 lbs weight on the bit and has a flow rate of 70 to 200 gpm.

This tool is applicable for medium to hard formations.

FEATURES

- Advanced Cutter Placement
- Spiral Blades and Gage
- Force Balanced
- Unsymmetrical Blade Layout
- Incremental Back Rake

SPECIFICATIONS

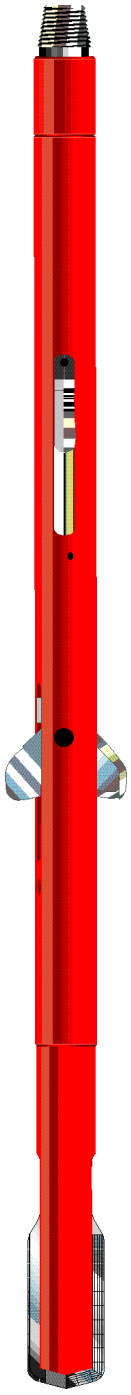
Total Cutters	**21**
Cutter Size	**9 mm (3/8")**
Face cutters	**12**
Gage cutters	**9**
Nozzles	**3 fixed ports**
Junk Slot Area	**1.7 in. sq.**
Gage Length	**1.8"**
Gage Protection	**Options Available**
Make-up Length	**8.0" Overall 11.0"**
Bit Connection	**2 3/8" Reg**
Fishing Neck	**Diameter 3.1" / Length 4.8"**

THRU-TUBING
MILLING & CUTTING TOOLS

UNDERREAMER

The Thru-Tubing Underreamer is designed to pass through restrictions and open to a predetermined diameter. To achieve maximum performance, optimum motor and nozzle selection is essential.

Blades and pilot mill can be configured with standard carbide dressing, diamond or insert technologies depending upon the job requirements.



FEATURES

- Positive locking out system
- Internal assisted knife closure
- Knife configuration allows self-stabilization
- Rugged construction for downhole durability

SPECIFICATIONS

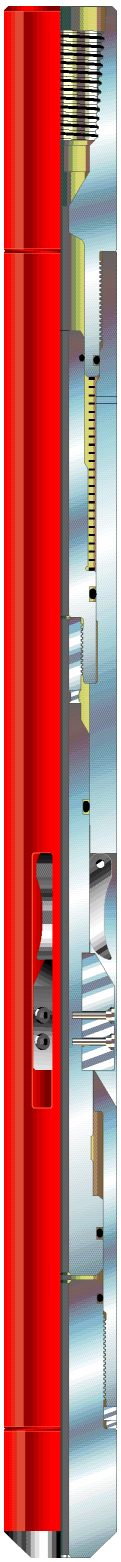
SIZE IN (MM)	OPENING DIAMETER IN (MM)	CONNECTIONS BOX X PIN
1.688 (42.9)	4.00 (101.6)	1" AMMT
2.125 (54.0)	6.00 (152.4)	1 1/2" AMMT
2.688 (68.3)	7.75 (196.9)	1 1/2" AMMT
3.125 (79.4)	8.50 (215.9)	2 3/8" PAC

PIPE CUTTER

The Hydraulic Pipe Cutter is designed to either be run on jointed pipe or on coiled tubing.

When run on coil tubing, an anchoring system must be incorporated to ensure effective pipe cutting.

Through its unique design, the Hydraulic Pipe Cutter can be used to run through the restriction and then be activated to make the tubing cut.



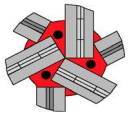
SPECIFICATIONS

TOOL OD IN (MM)	TUBING TO CUT IN	CONNECTIONS BOX X PIN
1.437 (36.5)	2 3/8 - 2 7/8	1" AMMT
1.750 (44.5)	2 3/8 - 3 1/2	1" AMMT
2.25 (57.2)	3 1/2 - 4 1/2	1 1/2" AMMT
2.50 (63.5)	3 1/2 - 5	1 1/2" AMMT
2.625 (65.1)	3 1/2 - 5	1 1/2" AMMT

THRU-TUBING
MILLING & CUTTING TOOLS

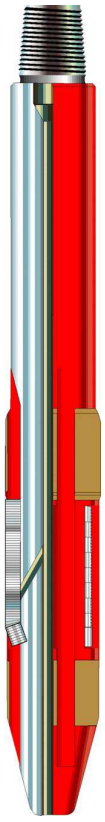
MILLS

Mill is used in conjunction with the motor for milling scale, plug obstructions, etc. This style of mill is specifically designed for low-weight and low-torque operations which makes it ideal for coil tubing and snubbing applications. Employing insert cutting technology, it provides an excellent general purpose mill to cover many downhole applications. It is available in sizes from 1 ¾" and larger.



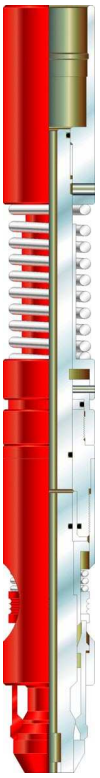
STAGE MILLS

Stage Mills are fit for purpose designed and manufactured. These mills can be dressed with MillMaster™, Servcoloy™ or PDC inserts. Applications include nipple profile enlargement, opening restrictions in tubing or liners and mechanical scale removal. Common scales removed are Barium Sulfate and Calcium Carbonate, available in sizes from 1 ¾" and larger.



OVERSHOTS & SPEARS

MECHANICAL GS



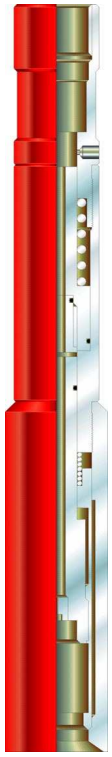
The GS tool is designed to fish standard internal fishing necks with a down shear and release mechanism.

The tool can be utilized in running or pulling "X" and XN locks, G-Stops, or retrieving disconnects. With the adaptation of a GU adapter, it can be made over to a jar up tool.

SPECIFICATIONS

NOMINAL SIZE OD IN	LOCK OD REF IN (MM)	LATCH ID IN (MM)	TOOL IN (MM)
2	1.875 (47.6)	1.38 (34.9)	1.81 (46.0)
2 1/2	2.313 (58.7)	1.81 (46.0)	2.25 (57.2)
3	2.750 (69.9)	2.31 (58.7)	2.72 (69.1)
5	4.56 (115.9)	4.00 (101.6)	4.50 (114.3)

MECHANICAL PULLING TOOL



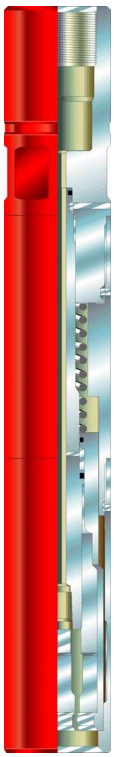
The "J" pulling tools are designed to catch external fishing necks with a Jar Up (JU) or Jar Down (JD) shear and release. The JU can be modified by changing the top sub, core nut, and retainer screw to a JD tool. The core is designated by either a "C" (short), "S" (medium), or "L" (long).

For most Coil Tubing and jointed pipe fishing applications, the JD tool will be utilized. The dog profile on the Camco tool is 90°. The Otis style tools and compatible equipment have a 20° undercut.

SPECIFICATIONS

JDC	Nominal Size in (mm)				
Pulling Tool	1 1/4"	1 1/2"	2"	2 1/2"	3"
Tool OD	1.22 (30.9)	1.43 (36.6)	1.77 (44.9)	2.81(71.4)	2.73 (69.4)
Fishing Neck	1.00 (25.4)	1.187 (47.5)	1.375 (34.9)	1.750 (44.5)	2.312
(58.7) **JDS**	**Nominal Size in (mm)**				
Pulling Tool	1 1/2"	2"	2 1/2"	3"	
Tool OD	1.43 (36.6)	1.77 (44.9)	2.81 (71.4)	2.73 (69.4)	
Fishing Neck	1.187 (47.5)	1.375 (34.9)	1.750 (44.5)	2.31 (58.7)	

HYDRAULIC RELEASE PULLING TOOL



The Hydraulic Release Pulling Tool is designed for retrieving standard wireline profiles. For heavy jarring operations, the collet system provides maximum contact with the fishing neck.

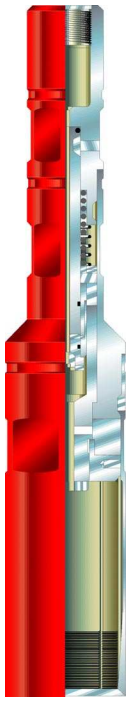
The tool latches by applying weight down. It releases through a combination of weight and increased differential pressure.

Pumping fluid through the tool allows for debris or fill to be washed from the top of the fish before latching.

SPECIFICATIONS

NOMINAL SIZE IN (MM)	TOOL OD IN (MM)	FISH NECKS IN (MM)
1.50 (38.1)	1.422 (36.1)	1.188 (30.2)
2.00 (50.8)	1.850 (47.0)	1.375 (34.9)
2.50 (63.5)	2.250 (57.2)	1.750 (44.5)
3.00 (76.2)	2.796 (71)	2.31 (58.7)

HYDRAULIC RELEASE OVERSHOT



The hydraulic release overshot is designed to catch a fish with a given diameter. An interchangeable bowl and slips will allow the tool to be dressed for a variety of diameters.

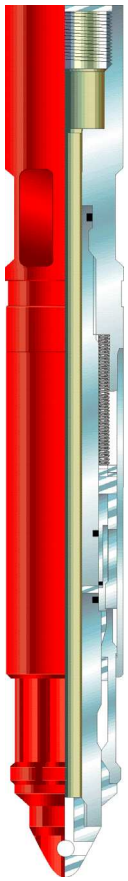
The tool engages by applying set down weight and can be released with a combination of set down weight and differential pressure. This feature makes the tool ideal for horizontal fishing applications where set down weight cannot be achieved to shear pins as with mechanical overshots.

Pumping fluid through the tool allows for debris or fill to be washed from the top of the fish before latching.

SPECIFICATIONS

NOMINAL SIZE IN (MM)	TOOL OD IN (MM)	RANGE OF CATCHES IN (MM)
2.00 (50.8)	1.850 (47.0)	.437 (11.1) to 1.312 (33.3)
2.50 (63.5)	2.25 (57.15)	.687 (17.5) to 1.687 (42.9)
3.00 (76.2)	2.625 (66.7)	.937 (23.8) to 2.062 (52.4)
3.50 (88.9)	3.350 (85.1)	1.312 (33.3) to 2.687 (68.3)

HYDRAULIC RELEASE GS



The Hydraulic Release GS is designed to retrieve tools with internal profiles.

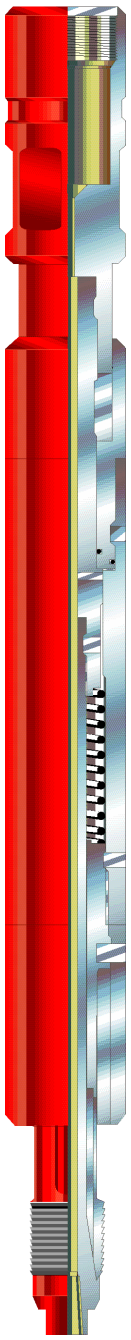
The tool latches by set down weight. Once the tool latches, it can only be released with a combination of weight and an increase of pressure across the tool.

The collet system transfers the load to the central mandrel to allow for jarring operations.

SPECIFICATIONS

NOMINAL SIZE IN (MM)	TOOL OD IN (MM)	LATCH DIA. IN (MM)
1.50 (38.1)	1.470 (37.3)	1.06 (26.9)
2.00 (50.8)	1.850 (47.0)	1.38 (35.1)
2.50 (63.5)	2.250 (57.2)	1.81 (45.9)
3.00 (76.2)	2.790 (70.8)	2.31 (58.7)
4.00 (101.6)	3.625 (92.1)	3.12 (79.2)
5.00 (127.0)	4.500 (114.3)	4.0 (101.6)
7.0 (177.8)	5.500 (139.7)	5.48 (139.2)

HYDRAULIC RELEASE SPEAR



The Hydraulic Release Spear is designed to retrieve damaged internal profiles, or to fish a given internal diameter.

The slips are engaged with the down weight. The tool can be released with a combination of weight and increased pressure.

SPECIFICATIONS

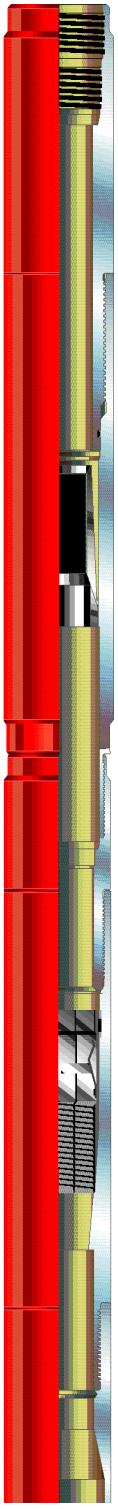
NOMINAL SIZE IN (MM)	TOOL OD IN (MM)	RANGE OF CATCHES IN (MM)
2.00 (50.8)	1.850 (47.0)	0.750 (19.1) to 1.65 (41.3)
2.50 (63.5)	2.250 (57.2)	1.25 (31.8) to 2.00 (50.8)
3.00 (76.2)	2.625 (66.7)	1.75 (44.5) to 2.375 (60.3)
3.50 (88.9)	3.350 (85.1)	2.00 (50.8) to 3.125 (79.4)

CONTINUOUS TUBING OVERSHOT

The Coil Tubing Overshot consists of a body containing a three-piece hardened slip assembly located in a bowl that can be run on either coiled tubing or jointed pipe.

When run in conjunction with jointed pipe, the overshot's larger thrubore design allows it to swallow coil tubing.

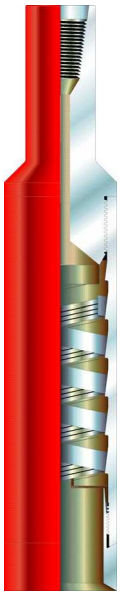
The continuous coil tubing overshot can be run with a high-pressure packoff assembly above that provides a high-pressure seal between the work string and the fish. This allows circulation capability to be restored through the fish.



SPECIFICATIONS

OD IN (MM)	ID IN (MM)	TOOL LENGTH IN	CATCH RANGE MIN/MAX IN
1.858 (41.2)	1.31 (33.3)	24.63 (625.6)	1 (25.4)
2.093 (53.2)	1.31 (33.3)	29.38 (746.3)	1 (25.4) to 1.25 (31.8)
2.295 (58.3)	1.56 (39.7)	31.38 (797.1)	1.25 (31.8) to 1.5 (38.1)
2.27 (57.6)	1.81 (46)	29.5 (749.3)	1.5 (38.1) to 1.75 (44.5)
3.375 (85.7)	2.13 (54.1)	31.67 (804.4)	1.75 (38.1) to 2.375 (60.3)

HE STYLE "A" OVERSHOT
(REPLACES BOWEN SERIES 10)



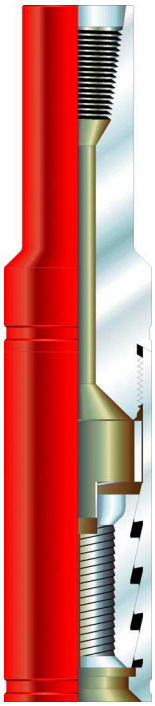
The HE Style "A" overshot is available in sizes to engage up to 2" OD inside of 2 7/8" tubing and up to 1 5/8" OD inside 2 3/8" tubing.

A top sub, bowl, spiral grapple and a control guide make up this overshot. To use a basket grapple instead of the spiral basket requires a basket grapple control and a plain guide.

SPECIFICATIONS

OVERSHOT OD (IN)	HE ASSY. NO	BOWEN ASSY. NO.	STRENGTH	SPRIAL MAX. CATCH (IN)	BASKET MAX. CATCH (IN)
1 9/16	238300	9790	FH	1 1/16	7/8
1.43	238320	17985	SH	1 1/4	1 5/16
3 25/32	238380	13940	SH	1 1/2	1 5/16
1 29/32	238420	9340	SH	1 5/8	1 7/16
2 1/4	238520	16070	SH	1 15/16	1 3/4
2 5/16	238660	9400	SH	2	1 3/16
2 27/32	238740	15860	SH	2 3/8	2 3/16
2 7/8	238780	9530	FS	2	1 13/16

HE STYLE "B" OVERSHOT
(REPLACES BOWEN SERIES 20)

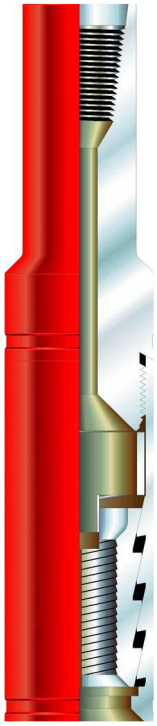


The HE Style "B" Short Catch Overshot is specifically designed to use when the top of the fish is too short to be engaged with a Style "A" overshot. With the grapple positioned at the lower end, the overshot is able to engage a fish with the top end.

SPECIFICATIONS

OVERSHOT OD (IN)	HE ASSY.NO	BOWEN ASSY. NO.	STRENGTH	BASKET/MAX. CATCH (IN)
1 1/4	240400	17315	SH	7/8
1 3/8	240420	25780	SH	1
1 1/2	240440	28774	SH	1 1/8
1 5/8	240460	28760	SH	1 1/4
1 3/4	240480	18355	SH	1 3/8
1 3/4	240500	34601	SH	1 3/8
1 29/32	240520	11555	SH	1 1/2
2 5/16	240540	17438	SH	1 13/16
2 5/16	240560	30421	SH	1 13/16
2 25/32	240580	18305	SH	2 1/8
2 7/8	240600	20170	FS	2 1/8
3 1/8	240620	20645	SH	2 3/8
3 1/4	240640	22270	FS	2 1/2

HE STYLE "J" OVERSHOT
(REPLACE BOWEN STYLE 70)



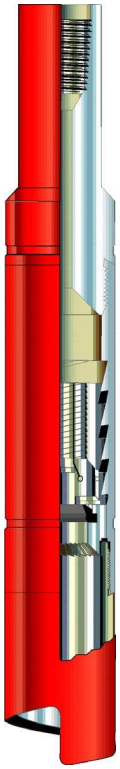
The HE Style "J" Short Catch Overshot is specifically designed to use when the top of the fish is too short to be engaged with a Style "A" overshot. With the grapple positioned at the lower end, the overshot is able to engage a fish with a short top end.

An assembly of a top sub, bowl, basket grapple and basket grapple control is made to catch a specific outside diameter.

SPECIFICATIONS

OVERSHOT OD (IN)	HE ASSY. NO	BOWEN ASSY. NO.	STRENGTH	BASKET/MAX. CATCH (IN)
2 5/16	240000	38506	SH	1 5/8
3 5/8	240010	17615	SH	2 1/2
3 3/4	240020	13535	SH	2 5/8
4 1/8	240030	10434	SH	3 1/16
4 5/8	240030	10290	FS	3 1/16
4 11/16	240060	10543	SH	3 21/32
4 1/4	240080	48881	SH	3 3/4
5 1/2	240090	12785	FS	3 3/4
5 5/8	240100	11297	FS	3 21/32
5 3/4	240110	13065	FS	4 1/4

HE STYLE "G" OVERSHOT
(REPLACE BOWEN SERIES 150)



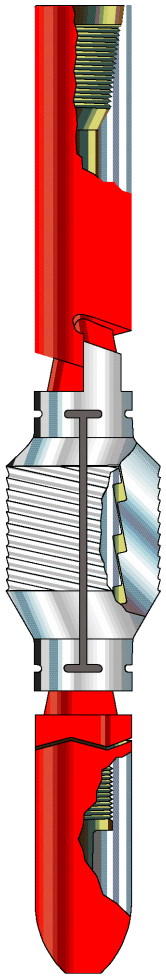
The HE Style "G" overshot is available in sizes to engage up to 3 1/2" OD inside of 5" casing.

A top sub, bowl, spiral grapple, spiral grapple control and packing make up this overshot. To use a basket grapple, a mill control packer is used.

SPECIFICATIONS

OVERSHOT OD (IN)	HE ASSY. NO.	BOWEN ASSY. NO.	STRENGTH	SPIRAL MAX. CATCH (IN)	BASKET MAX. CATCH (IN)
1 9/16	238300	9790	FH	1 1/16	7/8
2 5/16	225000	B8919	SH	2	1 3/4
2 5/8	225050	C10199	SH	2 1/8	1 3/4
2 7/8	225100	16395	SH	2 1/8	1 3/4
3 1/8	225150	9305	XSH	2 3/8	2
3 1/4	225250	C5072	XSH	2 3/8	1 7/8
3 1/2	225350	C4741	FS	2 3/8	1 7/8
4 1/8	225900	1443	FS	2 3/8	1 7/8
3 3/8	225300	C4623	SH	2 1/2	2
3 5/8	225400	C5080	FS	2 1/2	2
3 5/8	225450	9270	XSH	2 7/8	2 19/32
3 5/8	225500	9270	XSH	2 7/8	2 1/2
3 3/4	225550	C1827	SH	2 7/8	2 3/8
4	225800	C4736	FS	2 7/8	2 3/8
4 1/8	225950	4390	FS	2 7/8	2 3/8
3 3/4	225600	37585	SH	3 1/16	2 11/16
3 7/8	226500	C1835	SH	3 7/8	2 5/8

HE RELEASING SPEAR
(REPLACE BOWEN ITCO SPEAR)



The HE Releasing Spear is a superior fishing spear which is designed to assure positive engagement with the fish. It is ruggedly built to withstand severe jarring and pulling strains. It engages the fish over a large area to minimize damage to or distortion of the fish.

The simple design eliminates any small parts which could become lost or damaged in the hole. When used in coil tubing, the tool should be run in conjunction with the Heavy-Duty Disconnect to provide a controlled parting point in the tool string. It is available in a full range of sizes.

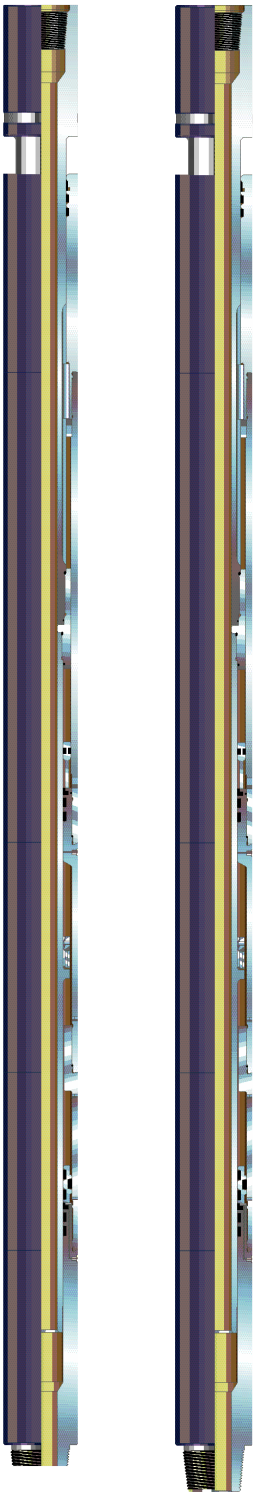
SPECIFICATIONS

NOM. CATCH (IN.)	SPEAR OD (IN.)	SPEAR ID (IN.)	BOWEN ASSY. NO.	HE ASSY. N0.	CLASS
1.050	11/16	-	16455	236500	STD.
1.313	7/8	-	19350	236550	STD.
1.660	1 1/8	-	11195	236600	STD.
1 1/4	1 1/8	-	35841	236650	STD.
1.900	1 3/8	-	9915	236700	STD.
2 3/8	1 11/16	-	9645	236750	STD.
2 3/8	1 7/8	-	17470	236800	H. DUTY
2 3/8	1 7/8	3/8	1344	236850	STD.
2 3/8	1 7/8	3/8	17228	236900	H. DUTY
2 7/8	2 15/16	3/8	1227	236950	STD.
2 7/8	2 15/16	3/8	17231	237000	H. DUTY
2 7/8	2 15/16	3/8	18820	237050	H. DUTY
3 1/2	2 13/16	1/2	9410	237100	STD.
3 1/2	2 1/2	1/2	9945	237150	H. DUTY
4	3 1/4	3/4	530	237200	L. DUTY
4	3 1/4	3/4	9485	237250	STD.
4 1/2	3 5/8	3/4	13200	237300	L. DUTY
4 1/2	3 5/8	3/4	17475	237350	STD.

JARS & ACCELERATORS

THRU-TUBING
JARS & ACCELERATORS

TT™ JAR and ACCELERATOR®



The TT™ Jar and Accelerator® are designed to work in tandem to free stuck drill strings. The jar is the impact device while the accelerator amplifies the effects of the jar.

Both tools can be used in a number of applications including thru-tubing, snubbing, small diameter rotary drilling, and fishing.

FEATURES

- Reliability due to construction of tool with aircraft quality steel
- Applicable in high temperatures ≤500°F and high-pressure ≤20,000 psi
- Extra-large bore permitting the use of drop balls and other thru-bore tools

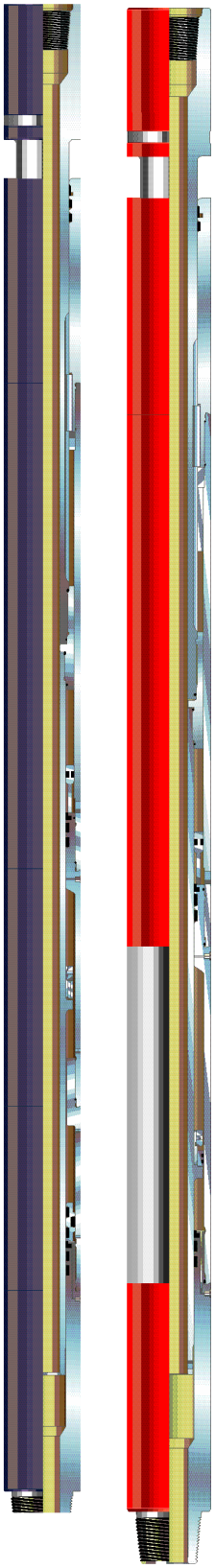
JAR SPECIFICATIONS

Tool OD (inches)	**1 11/16**	**2 1/16**	**2 7/8**
Tool ID (inches)	**9/16**	**11/16**	**31/32**
Tool Joint Connections	**1 AMMT**	**1 1/2 AMMT**	**2 3/8 PAC**
Overall length "extended"	**7'10"**	**7'9"**	**8'3"**
Maximum detent working load (lbf)	**8,000**	**11,000**	**20,000**
Tensile yield strength (lbf)	**56,000**	**86,000**	**200,000**
Torsional yield strength (lbf•ft)	**850**	**1,600**	**5,300**
Free stroke up (inches)	**4**	**4**	**4**
Free stroke down (inches)	**4**	**4**	**4**
Total stroke (inches)	**12**	**12**	**12**

ACCELERATOR SPECIFICATIONS

Tool OD (inches)	1 11/16	2 1/16	2 7/8
Tool ID (inches)	9/16	11/16	31/32
Tool Joint Connections	1 AMMT	1 1/2 AMMT	2 3/8 PAC
Overall length "extended"	8' 6"	8' 9"	9' 1"
Maximum detent working load (lbf)	8,000	11,000	20,000
Tensile yield strength (lbf)	56,000	86,000	200,000
Torsional yield strength (lbf•ft)	850	1,600	5,300
Free stroke up (inches)	6	6	6
Free stroke down (inches)	6	6	6

TMC & TM FISHING JARS AND ACCELERATOR®



"TMC" HYDRAULIC JAR

The "TMC" Hydraulic Fishing Jar is the newest development in the family of "T" type hydraulic fishing jars. The "TMC" Jar adds the advantage of a closed drive system that is not open to the well fluid.

"TM" HYDRAULIC JAR

The "TM" Hydraulic Jar gives you a choice with its open drive operation. Both "TMC" and "TM" Hydraulic Jars are pressure compensated for deep, high hydrostatic pressure wells. The latest hydraulic and mechanical principles have been incorporated to meet "Hot Hole" and hostile well conditions.

FISHING ACCELERATOR®

When used in conjunction with the Fishing Jar, the Accelerator® tool provides a supercharged blow where it's needed, directly above the fish. When run in conjunction with a jar, the jar does not rely on pipe stretch; therefore, in shallow or crooked holes it slugs the fish hard regardless of depth. There is a greater safety margin by using the Accelerator tool. The rebound of the fishing string is cushioned by the same compressed gas that accelerates it. This relieves the tremendous shock loads normally transmitted upwardly.

SPECIFICATIONS

OD (IN)	NAME	O.A.L. (FT)	ID (IN)	TOTAL TRAVEL (IN)	MAX OVERPULL WHILE JARRING (LB)	MAX TENSILE STRAIGHT PULL (LB)	MAX TORQUE YIELD (LB)	TOOL JOINT CONNECTIONS
ACCELERATORS								
1.81	ACCM	5.3	0.38	8.00	19,000	56,000	800	1 13/16" WFJ
1.81	TMCS	5.1	0.56	7.25	17,000	69,000	750	1" AMMT
2.25	ACCM	7.6	0.50	10.00	20,000	95,800	1,900	1 1/2" AMMT
2.25	ACCM*	7.6	0.56	10.00	20,000	95,800	1,900	1 1/4" REG
3.13	ACCM	10.6	1.00	12.00	51,000	192,000	4,100	2 3/8" API REG
3.13	ACCMCM	10.6	1.50	10.50	32,400	185,000	4,200	2 3/8" EUE 8RD
OIL JARS								
1.81	TM	6.3	0.38	9.75	19,000	56,000	800	1 13/16" WFJ
1.81	TMCS	5.6	0.56	7.25	17,000	69,000	750	1" AMMT
2.25	TM	8.5	0.50	12.00	20,000	95,800	1,900	1 1/4" REG
2.25	TM*	8.5	0.56	12.00	20,000	95,800	1,900	1 1/2" AMMT
3.13	TM	12.2	1.00	16.00	51,000	192,000	4,100	2 3/8" API REG
3.13	TMC	12.3	1.50	14.00	32,400	185,000	4,200	2 3/8" EUE 8RD

* Non-standard size

INFLATABLE PACKERS

INFLATABLE PACKERS

Thru-Tubing Services offers a variety of inflatable packers, bridge plugs, and scab liners for completion, recompletions, remedial, stimulation, testing and plugging operations.

Selecting an inflatable packer stems from requirements of the job, tubing, casing, or open hole sizes, expected temperature and differential pressures to be encountered.

MODEL SS

Designed for production, or to treat and test, these models feature a flow path through the tool, therefore limiting expansion ratio capabilities. Model SS is also available in multi-set types of tools.

MODEL RS

Like the Model SS, this inflatable packer system contains a through bore and can be run in straddle configurations to isolate a section of a borehole, tubing, or casing.

This retrievable scab liner can be run and retrieved on coiled tubing or wireline.

SPECIFICATIONS

OUTSIDE DIAMETER (in)	INSIDE DIAMETER (in)	TUBING/CASING OD (in)							
		2 3/8	2 7/8	3 1/2	4 1/2	5 1/2	7	9 5/8	13 3/8
1.69	0.53	5,000	3,800	2,900					
2.13	0.94		5,000	4,000	2,200	1,000			
2.63	1.00			5,000	4,000	2,600	1,000		
3.06	1.25				4,700	3,200	3,100		
3.38	1.25				5,000	4,500	2,300	1,000	
4.25	2.00					5,000	3,800	1,500	
5.25	3.00						5,000	4,000	2,000

THRU-TUBING
INFLATABLE PACKERS

INFLATABLE PACKERS

MODEL RP

Model RP is an inflatable packer system designed for 3:1 (or greater) expansion ratios. This retrievable bridge plug can be run on coiled tubing, work string, or electric wireline.

FEATURES

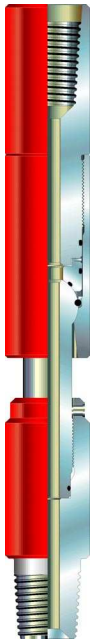
- Equalization from above to below during inflation process
- Can be equalized from above to below before releasing

SPECIFICATIONS

PACKER SIZE	TUBING/CASING OD (in)								
OD (in)	2 3/8	2 7/8	3 1/2	4 1/2	5 1/2	7	7 5/8	9 5/8	13 3/8
1.69	4,500	3,200	2,400	1,500	900				
2.13		5,000	4,100	3,000	2,100	1,100	800		
2.50			5,000	4,300	3,200	2,200	1,700		
2.90				5,000	4,700	3,500	2,800		
2.94					3,900	2,800	1,900	1,200	
3.50					5,000	4,500	4,000	2,400	
5.25						5,000	4,600	4,000	2,000

ACCESSORY TOOLS

TORQUE THRU-KNUCKLE JOINT



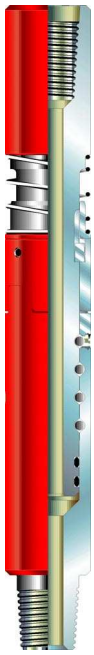
The Torque Thru-Knuckle Joint is specifically designed to centralize and stabilize tool strings in deviated wells.

The Torque Thru-Knuckle Joint is used in fishing operations to add flexibility to the bottomhole assembly. With its ability to convey torque through the tool string, the Torque Thru-Knuckle Joint is designed to transmit torque generated by the motor.

SPECIFICATIONS

OD IN (MM)	ID IN (MM)	TOOL LENGTH IN (MM)	CONNECTIONS BOX & PIN
1.688 (42.9)	0.531 (13.5)	11.37 (288.8)	1" AMMT
1.813 (46.0)	0.531 (13.5)	11.37 (288.8)	1" AMMT
2.125 (54.0)	0.594 (15.1)	13.81 (350.8)	1 1/2" AMMT
2.875 (73.0)	0.781 (19.8)	19.75 (501.7)	2 3/8" PAC
3.500 (88.9)	1.000 (25.4)	21.88 (555.87)	2 3/8" REG

LOCKING SWIVEL JOINT



The Locking Swivel Joint is designed for deploying long tool strings.

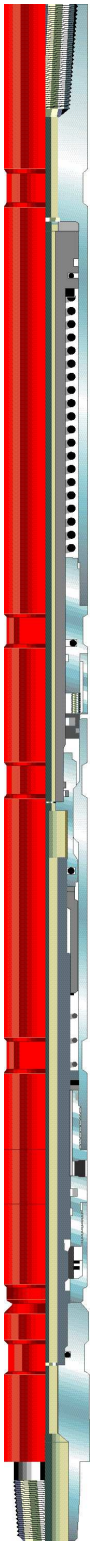
Used in conjunction with a deployment sub, the tool string can be lowered into the wellbore and hung off in the blowout preventors on a set of slip rams.

The Locking Swivel Joint can then be made up to the tool string. By pulling the coupling back, tightening the set screw and disengaging clutch, the upper string is ready to be made up.

SPECIFICATIONS

OD IN (MM)	ID IN (MM)	CONNECTIONS BOX & PIN
1.750 (44.5)	0.650 (14.2)	1" AMMT
2.125 (54.0)	0.810 (20.6)	1 1/2" AMMT
2.875 (73.0)	0.781 (19.8)	2 3/8" PAC
3.125 (79.4)	1.000 (25.4)	2 3/8" REG

HYDRAULIC INDEXING TOOL



The Hydraulic Indexing Tool is used when controlling rotation of a lower string is desired. It has particular application when used in conjunction with fishing or wash tools.

The tool is designed to function using a rotating cam system.

All rotation is achieved hydraulically, versus up and down movement of mechanical tools, maximizing its use in fishing applications.

A 360° rotation can be achieved using the 12 stage predetermined increments.

SPECIFICATIONS

TOOL IN (MM)	TORQUE @1,500 PSI	TOOL LENGTH (IN)	MAX. TENSILE (KIPS)	MIN. ACT PRESSURE (PSI)
1.688 (42.9)	100	45 (1.1)	65	200
2.125 (54.0)	125	45 (1.2)	70	200
3.00 (76.2)	510	56 (1.4)	135	200

HYDRAULIC BOW SPRING CENTRALIZER

The Hydraulic Bow Spring Centralizer (Figure 2) is designed to pass through restrictions in a retracted position, when pressure is applied across the tool, the bow springs are expanded to centralize the tool string. Once pressure is bled off, the bow spring returns to the retracted position.

An adjustable sleeve allows the expansion of the bow spring to be adjusted for different casing sizes.

SPECIFICATIONS

OD IN (MM)	ID IN (MM)	TOOL LENGTH IN (M)	MAX. EXPANSION DIA. IN (MM)
1.688 (42.9)	0.563 (14.3)	59 (1.5)	9.0 (228.9)
2.125 (54.0)	0.563 (14.3)	61.5 (1.6)	9.5 (241.3)
2.875 (73.0)	1.00 (25.4)	63.5 (1.61)	10.0 (254.0)
3.500 (88.9)	1.00 (25.4)	64.5 (1.63)	11.0 (279.4)

MECHANICAL BOW SPRING CENTRALIZER

The Mechanical Bow Spring Centralizer (Figure 1) is designed to centralize a bottomhole assembly inside large tubing or casing while going through a restriction.

The centralizer's springs are designed to be at constant maximum expansion, then collapse when going through a restriction.

SPECIFICATIONS

OD IN (MM)	ID IN (MM)	SPRING OD IN (MM)	CONNECTIONS BOX & PIN
1.70 (44.5)	0.56 (14.2)	10 (254)	1" AMMT
2.125 (54.0)	0.56 (14.2)	10 (254)	1 1/2" AMMT
3.125 (79.4)	1.00 (25.4)	10 (254)	2 3/8" REG

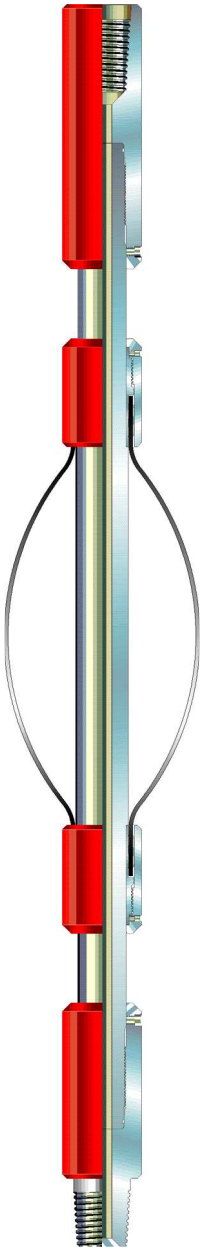


Figure 1

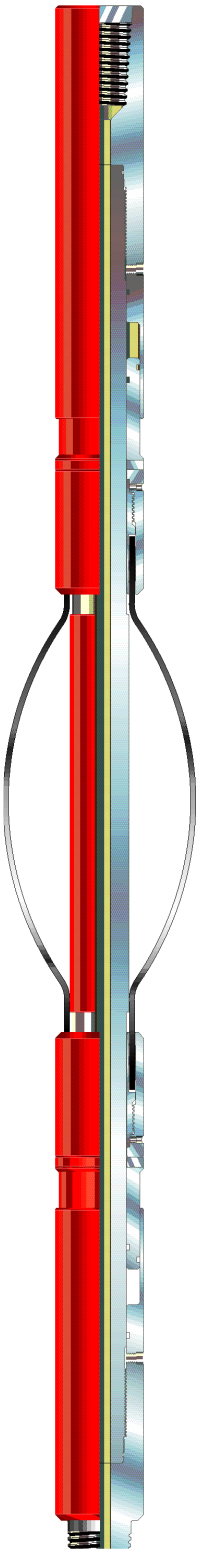


Figure 2

DUAL CIRCULATING SUB

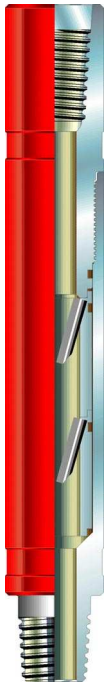
The Circulating Sub is designed as a dual operational tool. By means of a ball drop, a sleeve can be shifted to give full flow to the annulus while isolating the tool string below the tool.

If the tool string below the sub becomes obstructed, the sub is designed so a rupture disc can be burst to give circulation to the annulus. The disc can be preset for 3,000, 5,000, or 6,000 psi.

SPECIFICATIONS

OD IN (MM)	ID IN (MM)	CONNECTIONS BOX & PIN
1.688 (42.9)	0.375 (9.5)	1" AMMT
1.750 (44.5)	0.375 (9.5)	1" AMMT
2.125 (73.0)	0.430 (10.9)	1 1/2" AMMT
3.125 (79.4)	0.563 (14.3)	2 3/8" PAC

DUAL FLAPPER CHECK VALVE



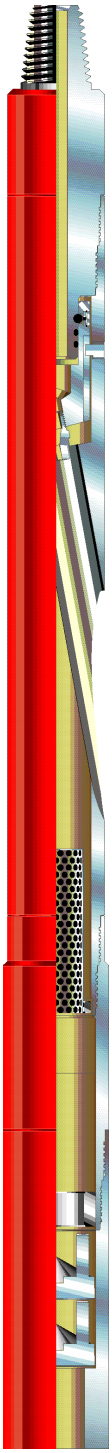
The Dual Flapper Check Valve is a cartridge type check valve assembly.

The design of the valve includes high-pressure cartridges that prohibit wellbore fluids from entering the work string.

SPECIFICATIONS

OD IN (MM)	ID IN (MM)	TOOL LENGTH IN (MM)	CONNECTIONS BOX & PIN
1.688 (42.9)	0.4375 (11.1)	27 (686)	1" AMMT
1.750 (44.5)	0.4375 (11.1)	27 (686)	1" AMMT
2.125 (73.0)	0.688 (17.5)	27 (686)	1 1/2" AMMT
2.875 (73.0)	0.688 (17.5)	27 (686)	2 3/8" PAC
3.125 (79.4)	0.688 (17.5)	27 (686)	2 3/8" REG

VENTURI JET BASKET



The Venturi Jet Basket retrieves gun debris, metal and any other loose obstructions that are not millable.

Fluid pumped down the work string is diverted through a jet nozzle in the upper section, creating a vacuum-like effect in the lower chamber. This effect sucks in debris and traps it above the cages in the lower sub. Fluid is then filtered through the stainer and returned to the annulus.

Extensions are available to increase the amount of debris retrieved.

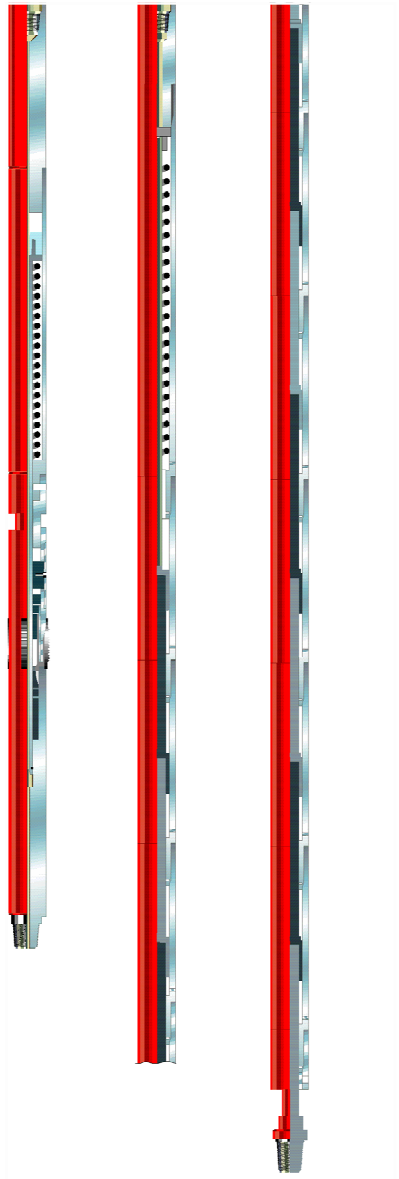
Milling shoes are available that enable the tool to be run in conjunction with a motor.

SPECIFICATIONS

TOOL OD (IN)	LENGTH (FT)	TENSILE (LBS)	TORQUE (FT-LBS)	DEBRIS CHAMBERS ID (IN)	FINGER CAGE ID (IN)	FLUTTER CAGE ID (IN)
1.69	3.21	38K	350	1.063	N/A	1.03
1.81	3.58	38K	350	1.25	N/A	1.21
2.06	3.17	86K	1067	1.5	1.28	1.53
2.25	4.00	86K	1067	1.688	1.28	1.53
2.63	3.22	116K	1788	2	1.53	1.94
3.13	3.50	141K	4825	2.5	2.03	2.44

* Length includes Cage Head - excludes extensions.
**When additional debris chambers used add length as used.

PUSH - PULL ANCHORING TOOL



The Pull Tool is a pressure activated device designed to provide a controlled ‘‘Pull’’ or ‘‘Push’’ stroke once the anchoring feature is activated. It has a particular application for retrieving flow control equipment such as safety valves, plugs, sliding sleeves, etc. where conventional methods are either impractical or unsuccessful.

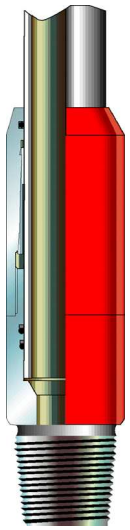
The tool is designed to function using a series of hydraulic pistons, which initially actuates the anchoring system, increasing the pressure generates a force to move the inoperable equipment. The tool has a specially designed safety feature, to facilitate the bleed off of stored pressure downhole.

FEATURES

- Pressure activated-no ball drop
- One trip to anchor, stroke and release
- 6" stroke
- 100,000 lbs push
- 60,000 lbs pull

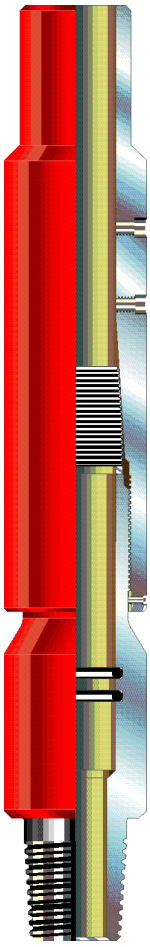
Available in 2.7 and 3.5 OD.

CONNECTORS



HEAVY DUTY CONNECTOR

Coil Tubing Connectors are designed for heavy- duty use. Unlike standard coil tubing connectors which employ set screws to provide an anti-rotational feature, this tool has a dual acting slip to provide this.
The slip section is sealed from wellbore and treating fluids to stop any possibility of fluids affecting or damaging the slip. They are available for all coil sizes in both standard and slimline versions.



STANDARD CONNECTOR

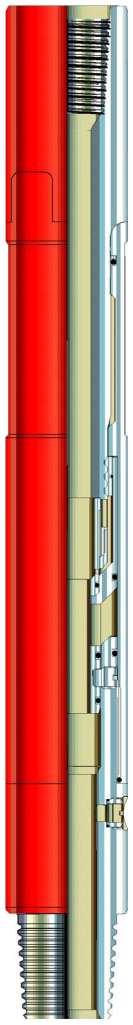
The standard Coiled Tubing Connector is specifically designed to attach the BHA to the coil tubing for operations involving the use of motors and fishing assemblies. Setscrews are positioned to provide an anti-rotational feature. Double O-Ring seals provide sealing.

The Coiled Tubing Connectors are available for coil tubing sizes 1", 1 ¼", 1 ½", 1 ¾" and 2".

HYDRAULIC DISCONNECTS

All Hydraulic Disconnects are designed to provide a defined and controlled parting point in a bottomhole assembly. Several designs are available for specific applications. To activate the hydraulic disconnect being used, a ball is pumped and seats on an inner piston. Controlled pressure is then applied to overcome the predetermined shear pin rating allowing the tool to part, leaving the lower section downhole. All hydraulic disconnects offered have an internal fishing neck in the lower section for subsequent retrieval operations if required. All models, once sheared, have ports opened to facilitate circulation while POOH if necessary. These ports also relieve the applied pressure required for disconnect giving the operator a positive surface indication that the tool has activated. Several models are offered

All Disconnects can be set for varying release pressures depending on operations and are totally balanced during normal operating conditions.



HEAVY DUTY HYDRAULIC DISCONNECT

FEATURES

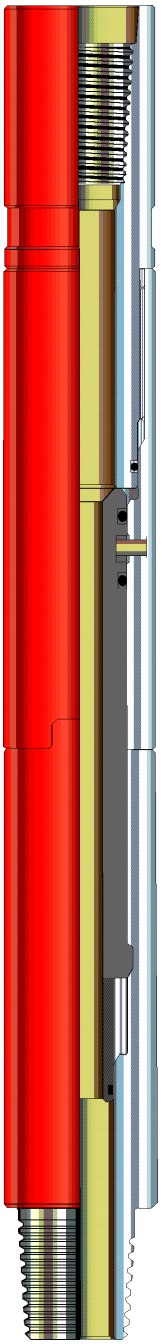
- Leaves both internal and external Fish neck
- Requires deep reach retrieving tool
- Available in sizes 1 ¾ " OD to 4 ⅛" OD

SPECIFICATIONS

AVAILABLE SIZES (IN)	MAX. BALL SIZE (IN)	MAX. W.P. PSI	YIELD LB	MAX. REQ. TENSILE LB	TORQUE FT-LB
1 ¾"	9/16"	5000	40,000	52,000	450
2 ⅛"	¾"	5000	53,000	67,000	800
2 ¼"	⅞"	5000	73,000	92,000	1000
2 ½"	1"	5000	77,000	96,000	1000
2 ⅞"	1"	5000	120,000	144,000	1500
3 ⅛"	1 ⅛"	5000	180,000	144,000	1900
3 ½"	1 ⅛"	5000	180,000	215,000	3000
4 ⅛"	1 ¼"	5000	240,000	288,000	4000

NOTE: Torque is max. recommended operation torque.
All data is based on 120,000 psi material.
Technical data is meant as guidelines and may change without notice.

STANDARD HYDRAULIC RELEASE



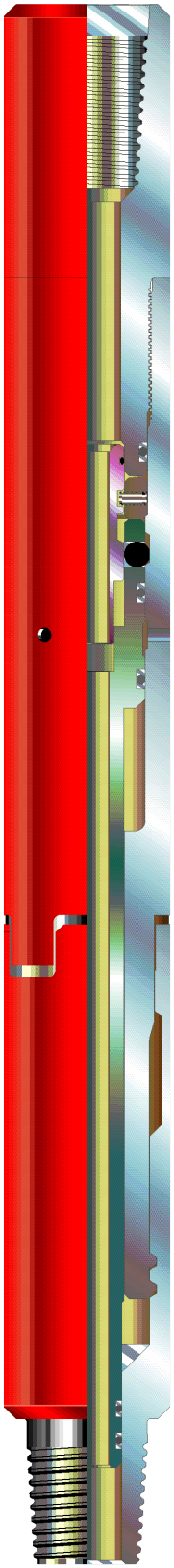
The Hydraulic Release is designed to provide a defined and controlled release point in the BHA. To operate the Hydraulic Release a ball is pumped or dropped to the seat. Pressure is then applied to the inside of the string, thereby shearing the set screws and shifting the piston out from the collet fingers. A light upward pull will then separate the collets from the lower sub. The lower half of the release tool features an internal fishing neck specifically designed for the thru-tubing work stings to combine strength, minimum ODs and maximum IDs. This fishing neck is the standard "GS" configuration. All Hydraulic Release tools can be set for varying release pressures by changing the number of shear screws.

SPECIFICATIONS

AVAILABLE SIZES (IN.)	MAX BALL SIZE (IN.)	MAX W.P. PSI	OVERALL LENGTH (IN.)	G S TOOL SIZE (IN.)
1.68	5/8	5,000	15.1	1 1/2
1.8	5/8	5,000	15.1	2
2.06	5/8	5,000	18	2
2.25	5/8	5,000	19.5	2 1/2

FDL HYDRAULIC DISCONNECT

- Unique design that prevents shear screw fatigue
- Torque Transmitting
- Milling, Underreaming/Jarring
- Standard “G” Profile Internal Fishing Neck



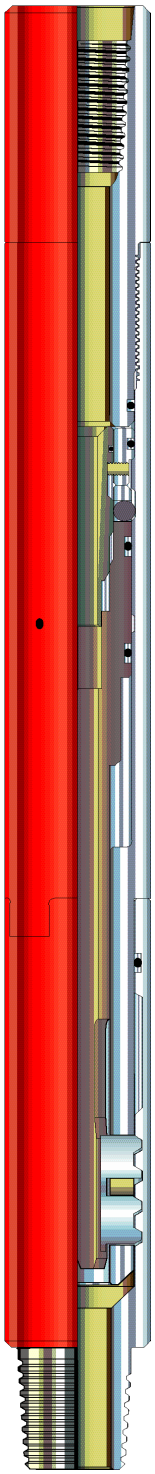
SPECIFICATIONS

SIZE	LENGTH (FT)	PISTON ID (IN)	MAX BALL SIZE	BOTTOM SUB (IN)	MINIMUM TENSILE (80%)	TORQUE (FT-LB)	FN
1.75	1.55	0.46	5/8"	7.58	22800	830	2" G
1.81	1.55	0.46	5/8"	7.58	41200	830	2" G
2.13	1.88	0.53	3/4"	8.37	78500	1128	2 1/2" G
2.25	1.88	0.53	3/4"	8.37	99100	1770	2 1/2" G
2.88	2.42	0.69	7/8"	11.06	15600	4110	3" G
3.13	2.75	0.69	7/8"	15.06	190000	5670	3" G

JAF HYDRAULIC DISCONNECT

- Utilizes Dogs instead of Collet for locking together for higher strength
- Can be run below Jars
- Unique shear-ring feature prevents shear screw fatigue under heavy jarring loads
- Available in 1.69" OD only, ½" Ball Drop only

Note: Requires special GS for BW profile

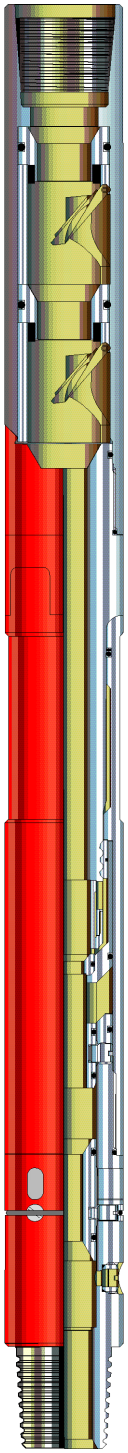


SPECIFICATIONS

SIZE	LENGTH (IN)	PISTON ID (IN)	BALL DROP (IN)	MINIMUM TENSILE (LBS)	MINIMUM TENSILE THRU FN (LBS)	TORQUE (FT-LB)	FN
1.69	17.75	0.469	1/2	44,000	21,000	616	2" BW

MOTORHEAD ASSEMBLY

The Motorhead Assembly consists of a dual flapper check valve, hydraulic disconnect, drop ball circulation sub and emergency rupture disc. The tool has a large bore for circulation and is designed for high-vibration/high-torque and long milling operations. The tool is designed with internal and external fishing necks. All shear pins are isolated from treatment and well fluids and are not affected by jarring or bending momentum.



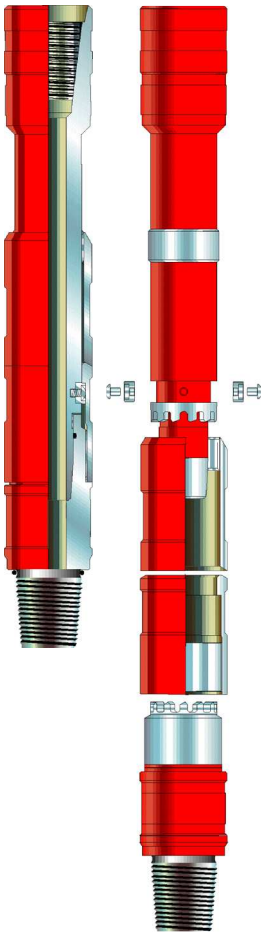
SPECIFICATIONS

AVAILABLE SIZES	MAX. BALL SIZE	MAX. W.P. PSI	YIELD LB	MAX. REQ. TENSILE LB	TORQUE FT-LB
1 3/4"	9/16"	5000	40,000	52,000	450
2 1/8"	3/4"	5000	53,000	67,000	800
2 1/4"	7/8"	5000	73,000	92,000	1000
2 1/2"	1"	5000	77,000	96,000	1000
2 7/8"	1"	5000	120,000	144,000	1500
3 1/8"	1 1/8"	5000	120,000	144,000	1900
3 1/2"	1 1/8"	5000	180,000	215,000	3000
4 1/8"	1 1/4"	5000	240,000	288,000	4000

NOTE: Torque is max. recommended operation torque.
All data is based on 120,000 PSI material.
Technical data is meant as guidelines and may change without notice.
Please call us with your request and we will confirm specifications.

Ratings and specifications are undergoing continuous changes due to market demands.

QUICK CONNECTOR



Quick Connector - Combination Anti- Rotational Self-Aligning Connector (CARSAC) - was developed to allow easy make up of BHAs and to withstand forces encountered during milling or jarring operations.

The CARSAC is designed to help with BHA make up where it is difficult to rotate the tools to engage threads it is particularly suited for longer BHAs.

SPECIFICATIONS

Min. OD	1.687"	1.750"	2.125"	2.250"	2.375"	2.875"	3.125"	4.500"
Min. ID	0.500"	0.500"	0.875"	1.000"	1.000"	1.250"	1.250"	1.500"
Tensile Strength	52,000	70,000	76,000	85,000	100,000	131,000	146,000	235,000
Max Torque (ft-lbs)*	1000	1000	2500	3000	3000	4500	6000	8500
Make-up Length	14.0"	14.0"	13.8"	14.0"	14.0"	20.5"	20.7"	28.7"

***Standard Service**

WHIPSTOCKS

COILED TUBING TRACKMASTER

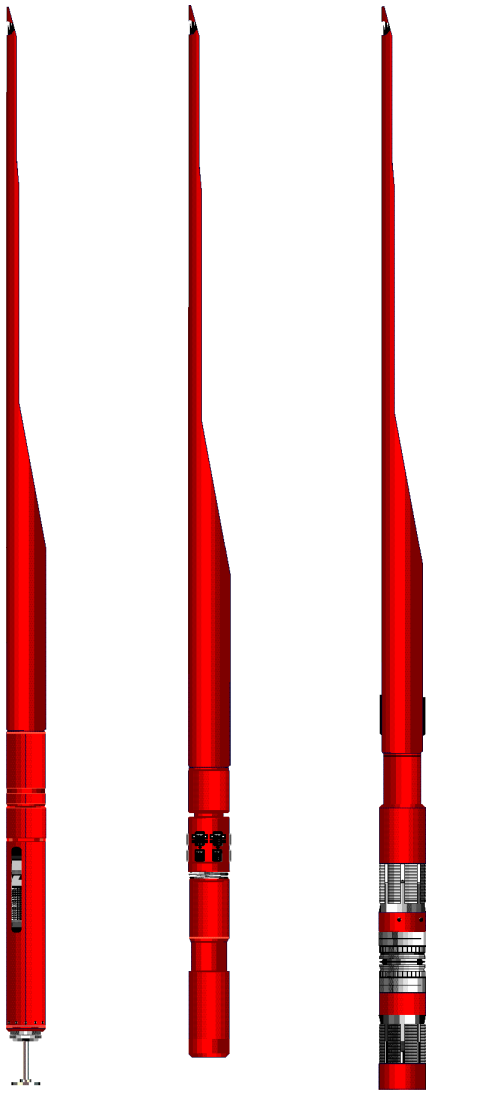
Utilizing unique award winning multi-angle Trackmaster design developed the Coiled Tubing Trackmaster System. Incorporating competencies, the system provides efficient full gage window exiting technology, utilizing Coiled Tubing as the conveyance string.

The unique interface between bit and whip, in conjunction with the specially designed Window Exiting Drill, provides a system that will provide full gage windows, while addressing the problems associated with Coiled Tubing Conveyance.

FEATURES

- Low weight on bit
- Reactive torque
- Motor Sensitivity
- Bit wear

The result is a full gage window completed in minimal time, providing gaged rathole for directional assemblies.

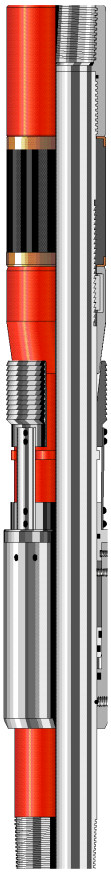


CT Econo-Stock CT Anchor-Stock CT Pack-Stock

COMPLETION TOOLS

THRU-TUBING
COMPLETION TOOLS

HYDRAULIC SET LINER PACKER



Liner hanger packers combine a liner top packer with a liner hanger. Unlike typical weight set packers, this tool's packing element is set when the hanger is hung.

Liner hanger packers are normally used for screen or slotted liners and can also be used for scab liners.

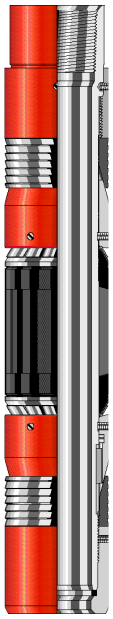
In this function, the liner hanger packer is used as the bottom packer and a weight set packer is used as the top packer. One or more joints of pipe between the two packers effectively straddles a damaged section of casing or perforations.

Uncemented scab liners do not permanently restrict the casing ID since the packers can be retrieved by running a solid nut retrieving tool on a work string and picking up to release the packers and the liner.

FEATURES

- Packer bodies are manufactured from casing to the same specification as the liner L-80 and P-110, using standard casing grades. Other grades are available on request.
- Hydraulic cylinders are manufactured from materials matching or exceeding yield strength of the liner hanger.
- Hydraulic pistons incorporate debris wiper seals for reliable performance.
- This tool can be used as a tension packer when run inverted.
- Slips are manufactured to Rockwell C scale hardness of 55 to 60 for use in the highest grade casing strings.
- A lock ring ensures the packing element remains set.

MDF - MDFBB PERMANENT PACKER



MDF

The MDF and MDFBB Permanent Production Packers are high performance completion packers for the most demanding well conditions.

The MDFBB features a longer bore than the MDF for use with larger diameter production tubing.

Both packers feature:

- a seal bore mandrel
- opposed full circle slips and cones
- a packing element assembly with a back-up system for maximum pressure integrity

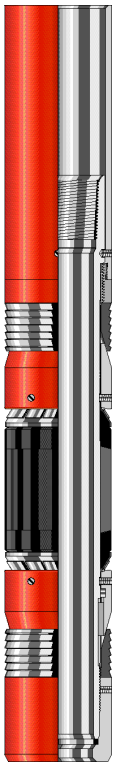
These features provide a standard operating envelope of 10,000 psi pressure rating, in most sizes, at 350° F. A setting sleeve and optional bottom guides complete the packer assembly.

Bottom guides are threaded to the mandrel for including accessories such as:

- seal bore extensions
- millout extensions
- tail pipe assemblies to the completion

A full line of completion accessories are available for both the MDF and the MDFBB packers. Optional elastomers and materials for flow wetted parts ensure compatibility with wellbore fluids.

Setting on wireline, coil tubing, or tubing work string adds operational versatility.

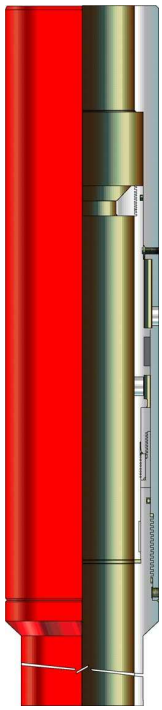


MDFBB

FEATURES

- 10,000 psi pressure rating at 350° F is standard in most sizes.
- Full circle, opposed slips minimize induced loads in supporting casing.
- Seal bore ID in packer mandrel for optimum seal performance.
- Slimline design for fast, easy running.
- Optional bottom guides for quick addition of millout extension, seal bore extensions, and other accessories.

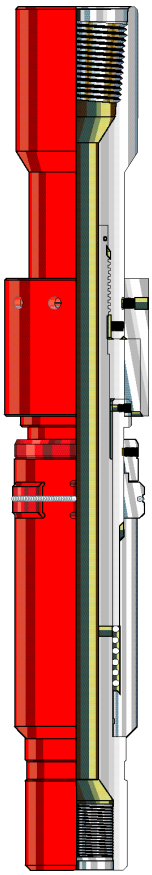
CEMENTING VALVE



The pressure activated stage cementing valve functions by applied pressure to permit upper stage cementing. Opening is controlled by a piston at the end of the first stage cementing. Opening pressure moves an inner sleeve upward aligning the cementing ports.

The Stage Cementing Valve is closed by the wiper plug following the second stage cement. The inner sleeve is held in postion by a ratchet type lock ring and pressure intergity is maintained.

COILED TUBING SETTING TOOL



The coiled tubing setting tool is a hydraulic release liner setting tool for running liner hangers on coiled tubing. Once the liner is conveyed and set in the existing casing string it can be hydraulically released by shifting a piston causing a set of lugs to disengage from a profile in the tool. A mechanical release mechanism is available should the hydraulics fail. The mechanical release is accomplished by slacking off a predetermined weight onto the top of the tool causing a series of pins to be sheared, thus leaving the piston free to disengage.

TECHNICAL REFERENCES

TOTAL FLOW AREA (TFA)

SIZE (IN)	1 JET	2 JETS	3 JETS	4 JETS	5 JETS	6 JETS	7 JETS	8 JETS	9 JETS
7/32	0.038	0.076	0.114	0.152	0.190	0.228	0.226	0.305	0.342
8/32	0.049	0.098	0.147	0.196	0.245	0.295	0.344	0.393	0.442
9/32	0.062	0.124	0.186	0.249	0.311	0.373	0.435	0.497	0.559
10/32	0.077	0.153	0.230	0.307	0.383	0.460	0.537	0.614	0.690
11/32	0.093	0.186	0.278	0.371	0.464	0.557	0.650	0.742	0.835
12/32	0.110	0.221	0.331	0.442	0.552	0.663	0.773	0.884	0.994
13/32	0.130	0.259	0.389	0.518	0.648	0.778	0.907	1.037	1.167
14/32	0.150	0.300	0.450	0.600	0.750	0.900	1.050	1.200	1.350
15/32	0.172	0.344	0.516	0.688	0.860	1.032	1.204	1.376	1.548
16/32	0.196	0.392	0.588	0.784	0.980	1.176	1.372	1.568	1.764
18/32	0.249	0.498	0.747	0.996	1.245	1.494	1.743	1.992	2.241
20/32	0.306	0.612	0.918	1.224	1.530	1.836	2.142	2.448	2.754
22/32	0.371	0.742	1.113	1.484	1.855	2.226	2.597	2.468	3.339

EXAMPLE:

$$\text{TFA} = \left(\frac{10}{64}\right)^2 \pi = 0.077 \text{ or } {}^{10}/_{32} \text{ jet}$$

$$\text{Nozzle size} = 64\sqrt{\frac{0.451}{3\,\pi}} = 3\,{}^{14}/_{32}$$

FORMULAS

HYDRAULIC POWER

$$\text{Power (HP)} = \frac{P_b Q}{1714}$$

P_b = Pressure drop across bit nozzle (psi)

Q = Flow Rate (US gpm)

$$\text{Power (kW)} = \frac{P_b Q}{6000}$$

P_b = Pressure drop across bit nozzle (kPa)

Q = Flow Rate (lpm)

MECHANICAL POWER

$$\text{Power (HP)} = \frac{TN}{5252}$$

T = Torque (ft- lbs)

N = Speed (rpm)

$$\text{Power (kW)} = \frac{TN}{9548.8}$$

T = Torque (N.m.)

N = Speed (rpm)

PRESSURE DROP ACROSS THE BIT JET NOZZLE (P_B)

$$P_b\,(\text{psi}) = \frac{Q^2W}{10858A^2}$$

Q = Flow Rate (US gpm)

W = Mud Weight (lb/gal)

A = Area (in^2)

$$P_b\,(\text{kPa}) = \frac{Q^2W}{6.49643A^2}$$

Q = Flow Rate (lpm)

W = Mud Weight (Kg/m^3)

A = Area (mm^2)

TOTAL FLOW AREA (TFA) TO OBTAIN A SPECIFIC BIT PRESSURE DROP

$$\text{TFA}\,(in^2) = \sqrt{\frac{Q^2W}{10858P_b}}$$

W = Mud Weight (lb/gal)

Q = Flow Rate (US gpm)

P_b = Bit Pressure Drop (psi)

$$\text{TFA}\,(mm^2) = \sqrt{\frac{Q^2W}{6.49643P_b}}$$

W = Mud Weight (Kg/m^3)

Q = Flow Rate (lpm)

P_b = Bit Pressure Drop (kPa)

	CONVERT	SYMBOL	MULTIPLY BY	TO OBTAIN	SYMBOL
Length	millimeters	mm	0.0394	inches	in
	inches	in	25.4	millimeters	mm
	feet	ft	0.0833	inches	in
	inches	in	12	feet	ft
	feet	ft	0.3048	meters	m
	meters	m	3.281	feet	ft
	mile	mi	1.6093	kilometer	km
	kilometer	km	0.6214	mi.	m
	yard	yds	3	feet	ft
	feet	ft	0.3333	yard	yds
	yard	yds	0.9144	meters	m
	meters	m	1.0936	yard	yds
Area	square millimeters	mm^2	0.0016	square inches	in^2
	square inches	in^2	645.1600	square millimeters	mm^2
	square centimeters	cm^2	0.1550	square inches	in^2
	square inches	in^2	6.4516	square centimeters	cm^2
	square feet	ft^2	0.0929	square meters	m^2
	square meters	m^2	10.7639	square feet	ft^2
	square inches	in^2	0.0069	square feet	ft^2
	square feet	ft^2	144	square inches	in^2
Flow	gal/min (US)	gpm (US)	3.7854	liters per minute	lpm
	liters per minute	lpm	0.2642	gal/min (US)	gpm
	gal/min (US)	gpm (US)	0.0038	cubic meters per minute	m^3/min
	cubic meters per minute	m^3/min	264.1720	gal/min (US)	gpm (US)
	barrels per minute	bbl/min	0.1589	cubic meters per minute	m^3/min
	cubic meters per minute	m^3/min	6.2933	barrels per minute	bbl/min
	barrels per day	bbl/d	0.0292	gal/min (US)	gpm (US)
	gal/min (US)	gpm (US)	34.2818	barrels per day	bbl/d
Pressure	pounds per square inch	psi	6.8948	kilopascals	kPa
	kilopascals	kPa	0.1450	pounds per square inch	psi
	pounds per square inch	psi	0.0689	bar	bar
	bar	bar	14.5038	pounds per square inch	psi
	pounds per square inch	psi	0.0680	atmosphere	atm
	atmosphere	atm	14.6959	pounds per square inch	psi
	kilogram force per square centimeter	kgf/cm^2	0.0703	pounds per square inch	psi
	pounds per square inch	psi	14.2233	kilogram force per square	kgf/cm^2
Volume	gallons (US)	gal	3.7854	liters	l
	liters	l	0.2642	gallons (US)	gal
	gallons (US)	gal	0.003785	cubic meters	m^3
	cubic meters	m^3	264.2	gallons (US)	gal
	gallons (US)	gal	0.02381	barrels	bbl
	barrels	bbl	42	gallons (US)	gal
Density	pounds per gallon(US)	lbs/gal	119.82	kilograms per cubic meter	kg/m^3
	kilograms per cubic meter	kg/m^3	0.00835	pounds per gallon(US)	lbs/gal
	pounds per gallon(US)	lbs/gal	0.12	specific gravity	sg
	specific gravity	sg	8.333	pounds per gallon(US)	Lbs/gal
Torque	foot pounds	ft-lbs	1.38255	Newton meters	N•m
	Newton meters	N•m	7.23301	foot pounds	ft-lbs
	foot pounds	ft-lbs	0.13820	kilogram meters	kg.m
	kilogram meters	kg.m	7.23589	foot pounds	ft-lbs
Temperature	degrees fahrenheit	°F	(F-32)/1.8	degrees celsius	°F
	degrees celsius	℃	(C*1.8)+32	degrees fahrenheit	℃
Mass	pounds	lbs.	0.4536	kilograms	kg
	kilograms	kg	2.20462	pounds	lbs.
Force	pounds	lbf	4.4482	newton	N
	newton	N	0.22481	pounds	lbf
Power	horse power	hp	0.7457	kilowatt	kW
	kilowatt	kW	1.341	horse power	hp
Speed	feet per minute	ft/min	0.3048	meters per minute	m/m
	meters per minute	m/m	3.281	feet per minute	ft/min

Coiled Tubing Dimensions Areas & Volumes - US Units

Specified		Calculated	Plain End	Pipe Metal	Flow	Internal	
Outside Diameter D (in.)	Wall Thickness T (in.)	Inside Diameter D (in.)	Weight W (lb./ft)	Crosssec-tional Area A (in.^{2})	Area (in.^{2})	Capacity per 1000 ft. (gals)	(bbl)
1.000	0.087	0.826	0.849	0.250	0.536	27.837	0.6628
1.000	0.095	0.810	0.919	0.270	0.515	26.769	0.6374
1.000	0.102	0.796	0.979	0.288	0.498	25.852	0.6155
1.000	0.109	0.782	1.038	0.305	0.480	24.950	0.5941
1.250	0.087	1.076	1.082	0.318	0.909	47.237	1.1247
1.250	0.095	1.060	1.173	0.345	0.882	45.843	1.0915
1.250	0.102	1.046	1.252	0.368	0.859	44.640	1.0629
1.250	0.109	1.032	1.330	0.391	0.836	43.453	1.0346
1.250	0.118	1.014	1.428	0.420	0.808	41.950	0.9988
1.250	0.125	1.000	1.503	0.442	0.785	40.800	0.9714
1.250	0.134	0.982	1.599	0.470	0.757	39.344	0.9368
1.250	0.145	0.960	1.713	0.503	0.724	37.601	0.8953
1.250	0.156	0.938	1.824	0.536	0.691	35.898	0.8547
1.250	0.175	0.900	2.011	0.591	0.636	33.048	0.7869
1.500	0.095	1.310	1.427	0.419	1.348	70.017	1.6671
1.500	0.102	1.296	1.524	0.448	1.319	68.528	1.6316
1.500	0.109	1.282	1.621	0.476	1.291	67.056	1.5966
1.500	0.118	1.264	1.743	0.512	1.255	65.186	1.5520
1.500	0.125	1.250	1.837	0.540	1.227	63.750	1.5179
1.500	0.134	1.232	1.957	0.575	1.192	61.927	1.4745
1.500	0.145	1.210	2.100	0.617	1.150	59.735	1.4223
1.500	0.156	1.188	2.241	0.659	1.108	57.583	1.3710
1.500	0.175	1.150	2.479	0.728	1.039	53.958	1.2847
1.500	0.188	1.124	2.637	0.775	0.992	51.546	1.2273
1.500	0.203	1.094	2.815	0.827	0.940	48.831	1.1626
1.750	0.109	1.532	1.912	0.562	1.843	95.759	2.2800
1.750	0.118	1.514	2.059	0.605	1.800	93.522	2.2267
1.750	0.125	1.500	2.171	0.638	1.767	91.800	2.1857
1.750	0.134	1.482	2.315	0.680	1.725	89.610	2.1336
1.750	0.145	1.460	2.488	0.731	1.674	86.969	2.0707
1.750	0.156	1.438	2.658	0.781	1.624	84.368	2.0088
1.750	0.175	1.400	2.946	0.866	1.539	79.968	1.9040
1.750	0.188	1.374	3.139	0.923	1.483	77.025	1.8339
1.750	0.203	1.344	3.357	0.987	1.419	73.699	1.7547
2.000	0.109	1.782	2.203	0.648	2.494	129.561	3.0848
2.000	0.118	1.764	2.374	0.698	2.444	126.957	3.0228
2.000	0.125	1.750	2.505	0.736	2.405	124.950	2.9750
2.000	0.134	1.732	2.673	0.786	2.356	122.393	2.9141
2.000	0.145	1.710	2.875	0.845	2.297	119.303	2.8406
2.000	0.156	1.688	3.075	0.904	2.238	116.253	2.7679
2.000	0.175	1.650	3.414	1.003	2.138	111.078	2.6447
2.000	0.188	1.624	3.642	1.070	2.071	107.605	2.5620
2.000	0.203	1.594	3.900	1.146	1.996	103.666	2.4682
2.375	0.109	2.157	2.640	0.776	3.654	189.828	4.5197
2.375	0.118	2.139	2.847	0.837	3.593	186.673	4.4446
2.375	0.125	2.125	3.007	0.884	3.547	184.238	4.3866

PRECISION TUBE TECHNOLOGY

HS-90™ Grade& Coiled Tubing Data

* Available as continuously milled tubing (CM™) or conventional butt-welded (W™)

Dimensions (inches)				Weight (lbs/ft)	Pipe Body Load (lbs)		Internal Pressure (psi)		Tubing Area (sq in)		Torsional Yield (ft-lbs)	
OD spec	Wall spec	Wall min	ID cal	nom	Yield min	Tensile min	Test 90%	Yield min	Wall min	ID min	Yield nom	Ultimate nom
1.000	0.087	0.083	0.826	0.850	22,500	24,200	13,200	14,700	0.239	0.546	439	476
1.000	0.095	0.090	0.810	0.920	24,300	26,200	14,300	15,900	0.257	0.528	466	508
1.000	0.102	0.097	0.796	0.981	25,900	27,900	15,300	17,000	0.275	0.510	491	540
1.000	0.109	0.104	0.782	1.040	27,500	29,600	16,400	18,200	0.293	0.493	515	570
1.250	0.087	0.083	1.076	1.083	28,600	30,800	10,600	11,800	0.304	0.923	721	770
1.250	0.095	0.090	1.060	1.175	31,000	33,400	11,500	12,800	0.328	0.899	769	825
1.250	0.102	0.097	1.046	1.254	33,100	35,700	12,400	13,800	0.351	0.876	814	879
1.250	0.109	0.104	1.032	1.332	35,200	37,900	13,200	14,700	0.374	0.853	858	931
1.250	0.116	0.111	1.018	1.408	37,200	40,100	14,100	15,700	0.397	0.830	900	982
1.250	0.125	0.118	1.000	1.506	39,800	42,900	14,900	16,600	0.420	0.808	941	1,032
1.250	0.134	0.128	0.982	1.601	42,300	45,600	16,200	17,900	0.451	0.776	996	1,100
1.250	0.145	0.138	0.960	1.715	45,300	48,800	17,300	19,300	0.482	0.745	1,048	1,166
1.250	0.156	0.148	0.938	1.827	48,300	52,000	18,500	20,600	0.512	0.715	1,097	1,229
1.250	0.175	0.167	0.900	2.014	53,200	57,300	20,700	23,000	0.568	0.659	1,181	1,342
1.500	0.095	0.090	1.310	1.429	37,700	40,700	9,600	10,700	0.399	1.368	1,148	1,218
1.500	0.102	0.097	1.296	1.527	40,300	43,500	10,400	11,500	0.428	1.340	1,220	1,300
1.500	0.109	0.104	1.282	1.623	42,900	46,200	11,100	12,300	0.456	1.311	1,289	1,380
1.500	0.116	0.111	1.268	1.719	45,400	48,900	11,800	13,100	0.484	1.283	1,357	1,459
1.500	0.125	0.118	1.250	1.840	48,600	52,400	12,500	13,900	0.512	1.255	1,422	1,536
1.500	0.134	0.128	1.232	1.960	51,800	55,800	13,600	15,100	0.552	1.215	1,511	1,643
1.500	0.145	0.138	1.210	2.104	55,600	59,900	14,600	16,200	0.590	1.177	1,596	1,746
1.500	0.156	0.148	1.188	2.245	59,300	63,900	15,600	17,300	0.629	1.139	1,677	1,846
1.500	0.175	0.167	1.150	2.483	65,600	70,700	17,500	19,400	0.699	1.068	1,821	2,028
1.500	0.190	0.180	1.120	2.665	70,400	75,800	18,700	20,800	0.746	1.021	1,911	2,145
1.750	0.109	0.104	1.532	1.915	50,600	54,500	9,500	10,600	0.538	1.867	1,809	1,918
1.750	0.116	0.111	1.518	2.029	53,600	57,800	10,200	11,300	0.572	1.834	1,907	2,030
1.750	0.125	0.118	1.500	2.175	57,400	61,900	10,800	12,000	0.605	1.800	2,003	2,140
1.750	0.134	0.128	1.482	2.318	61,200	66,000	11,700	13,000	0.652	1.753	2,135	2,294
1.750	0.145	0.138	1.460	2.492	65,800	70,900	12,600	14,000	0.699	1.706	2,262	2,444
1.750	0.156	0.148	1.438	2.662	70,300	75,800	13,500	14,900	0.745	1.660	2,384	2,589
1.750	0.175	0.167	1.400	2.951	77,900	84,000	15,100	16,800	0.831	1.575	2,602	2,855
1.750	0.190	0.180	1.370	3.173	83,800	90,300	16,200	18,000	0.888	1.517	2,741	3,029
2.000	0.109	0.104	1.782	2.207	58,300	62,800	8,400	9,300	0.619	2.522	2,416	2,544
2.000	0.116	0.111	1.768	2.340	61,800	66,600	8,900	9,900	0.659	2.483	2,552	2,696
2.000	0.125	0.118	1.750	2.509	66,300	71,400	9,500	10,500	0.698	2.444	2,684	2,845
2.000	0.134	0.128	1.732	2.677	70,700	76,200	10,300	11,400	0.753	2.389	2,867	3,054
2.000	0.145	0.138	1.710	2.880	76,100	82,000	11,000	12,300	0.807	2.334	3,045	3,258
2.000	0.156	0.148	1.688	3.080	81,300	87,700	11,800	13,100	0.861	2.280	3,216	3,458
2.000	0.175	0.167	1.650	3.419	90,300	97,300	13,300	14,800	0.962	2.180	3,525	3,825
2.000	0.190	0.180	1.620	3.682	97,200	104,800	14300	15900	1.029	2.112	3,724	4,066
2.375	0.125	0.118	2.125	3.011	79,500	85,700	8,000	8,900	0.837	3.593	3,894	4,090
2.375	0.134	0.128	2.107	3.215	84,900	91,500	8,700	9,600	0.904	3.527	4,170	4,398
2.375	0.145	0.138	2.085	3.462	91,400	98,500	9,300	10,400	0.970	3.460	4,438	4,700
2.375	0.156	0.148	2.063	3.706	97,900	105,500	10,000	11,100	1.035	3.395	4,699	4,997
2.375	0.175	0.167	2.025	4.122	108,900	117,300	11,200	12,500	1.158	3.272	5,175	5,545
2.375	0.190	0.180	1.995	4.445	117,400	126,500	12,100	13,400	1.241	3.189	5,485	5,908

QT-800 Coiled Tubing Technical Data — SI Units

Specified				Calculated Inside Diameter		Plain End Weight	Pipe Metal Cross-sectional Area	Pipe Body Yield Load	Internal Yield Pressure	Hydro Test Pressure	Collapse Pressure	Torsional Yield Strength
Outside Diameter		Wall Thickness										
D_m (mm)	D (in.)	T_m (mm)	T (in.)	D_m (mm,)	D (in.)	W_m (kg./m)	A_m (mm_2)	L_{ym} (kg.)	P_{rm} (MPa)	P_t (MPa)	P_c (MPa)	(Nm)
25.4	1.000	2.2	0.087	21.0	0.826	1.264	161.0	88.8	90.5	72.4	83.0	550
25.4	1.000	2.4	0.095	20.6	0.810	1.368	174.3	96.1	99.3	79.4	90.3	580
25.4	1.000	2.6	0.102	20.2	0.796	1.457	185.6	102.4	107	85.6	96.6	610
25.4	1.000	2.8	0.109	19.9	0.782	1.545	196.8	108.6	114.7	91.8	102.8	640
25.4	1.000	3.0	0.118	19.4	0.764	1.656	210.9	116.4	124.7	99.7	110.6	680
25.4	1.000	3.2	0.125	19.1	0.750	1.740	221.7	122.3	132.4	103.4	116.5	700
31.8	1.250	2.2	0.087	27.3	1.076	1.610	205.1	113.1	72.4	57.9	60.9	900
31.8	1.250	2.4	0.095	26.9	1.060	1.746	222.4	122.7	79.4	63.5	71.7	970
31.8	1.250	2.6	0.102	26.6	1.046	1.863	237.3	130.9	85.6	68.5	78.9	1020
31.8	1.250	2.8	0.109	26.2	1.032	1.979	252.1	139.1	91.8	73.4	84.1	1070
31.8	1.250	3.0	0.118	25.8	1.014	2.125	270.7	149.3	99.7	79.8	90.7	1130
31.8	1.250	3.2	0.125	25.4	1.000	2.237	285.0	157.2	105.9	84.7	95.8	1180
31.8	1.250	3.4	0.134	24.9	0.982	2.379	303.1	167.2	113.8	91.1	102.1	1240
31.8	1.250	3.7	0.145	24.4	0.960	2.549	324.7	179.1	123.6	98.8	109.7	1300
31.8	1.250	4.0	0.156	23.8	0.938	2.715	345.9	190.8	133.3	103.4	117.1	1370
31.8	1.250	4.4	0.175	22.9	0.900	2.993	381.3	210.3	150	103.4	129.6	1460
38.1	1.500	2.4	0.095	33.3	1.310	2.124	270.5	149.2	66.2	53.0	51.4	1450
38.1	1.500	2.6	0.102	32.9	1.296	2.269	289.0	159.4	71.3	57.1	59.3	1530
38.1	1.500	2.8	0.109	32.6	1.282	2.412	307.3	169.5	76.5	61.2	67.2	1610
38.1	1.500	3.0	0.118	32.1	1.264	2.595	330.5	182.3	83.1	66.5	76.9	1710
38.1	1.500	3.2	0.125	31.8	1.250	2.735	348.4	192.2	88.3	70.6	81.2	1790
38.1	1.500	3.4	0.134	31.3	1.232	2.912	371.0	204.6	94.9	75.9	86.7	1880
38.1	1.500	3.7	0.145	30.7	1.210	3.126	398.2	219.7	103	82.4	93.4	1990
38.1	1.500	4.0	0.156	30.2	1.188	3.336	425.0	234.4	111.1	88.8	99.9	2100
38.1	1.500	4.4	0.175	29.2	1.150	3.689	470.0	259.2	125	100.0	110.9	2260
38.1	1.500	4.8	0.188	28.5	1.124	3.924	499.9	275.7	134.6	103.4	118.2	2370
44.5	1.750	2.8	0.109	38.9	1.532	2.846	362.5	199.9	65.6	52.4	50.4	2270
44.5	1.750	3.0	0.118	38.5	1.514	3.064	390.3	215.3	71.2	57.0	59.1	2420
44.5	1.750	3.2	0.125	38.1	1.500	3.232	411.7	227.1	75.6	60.5	65.9	2530
44.5	1.750	3.4	0.134	37.6	1.482	3.445	438.9	242.1	81.3	65.1	74.6	2670
44.5	1.750	3.7	0.145	37.1	1.460	3.703	471.7	260.2	88.3	70.6	81.2	2830
44.5	1.750	4.0	0.156	36.5	1.438	3.956	504.0	278.0	95.2	76.1	86.9	2990
44.5	1.750	4.4	0.175	35.6	1.400	4.385	558.6	308.1	107.2	85.7	96.7	3240
44.5	1.750	4.8	0.188	34.9	1.374	4.672	595.2	328.3	115.4	92.3	103.3	3400
44.5	1.750	5.2	0.203	34.1	1.344	4.997	636.5	351.1	124.8	99.9	110.7	3580
50.8	2.000	2.8	0.109	45.3	1.782	3.279	417.8	230.4	57.4	45.9	37.8	3030
50.8	2.000	3.0	0.118	44.8	1.764	3.533	450.1	248.3	62.3	49.9	45.4	3240
50.8	2.000	3.2	0.125	44.5	1.750	3.729	475.0	262.0	66.2	53.0	51.4	3390
50.8	2.000	3.4	0.134	44.0	1.732	3.978	506.8	279.5	71.2	56.9	59.0	3590
50.8	2.000	3.7	0.145	43.4	1.710	4.280	545.2	300.7	77.2	61.8	68.3	3820
50.8	2.000	4.0	0.156	42.9	1.688	4.577	583.0	321.6	83.3	66.6	77.0	4040
50.8	2.000	4.4	0.175	41.9	1.650	5.081	647.3	357.1	93.8	75.0	85.8	4400
50.8	2.000	4.8	0.188	41.2	1.624	5.420	690.5	380.9	100.9	80.8	91.7	4630
50.8	2.000	5.2	0.203	40.5	1.594	5.804	739.4	407.8	109.2	87.4	98.4	4890
60.3	2.375	3.2	0.125	54.0	2.125	4.475	570.0	314.4	55.7	44.6	35.3	4930
60.3	2.375	3.4	0.134	53.5	2.107	4.778	608.6	335.7	59.9	47.9	41.7	5220
60.3	2.375	3.7	0.145	53.0	2.085	5.145	655.4	361.5	65	52.0	49.6	5570
60.3	2.375	4.0	0.156	52.4	2.063	5.508	701.6	387.0	70.1	56.1	57.4	5910
60.3	2.375	4.4	0.175	51.4	2.025	6.126	780.3	430.4	79	63.2	70.9	6470
60.3	2.375	4.8	0.188	50.8	1.999	6.542	833.3	459.7	85	68.0	78.5	6840
60.3	2.375	5.2	0.203	50.0	1.969	7.015	893.7	492.9	92	73.6	84.3	7240
73.0	2.875	3.7	0.145	65.7	2.585	6.298	802.3	442.6	53.7	43.0	32.2	8440
73.0	2.875	4.0	0.156	65.1	2.563	6.749	859.7	474.2	57.9	46.4	38.7	8970
73.0	2.875	4.4	0.175	64.1	2.525	7.518	957.7	528.2	65.2	52.2	49.9	9860
73.0	2.875	4.8	0.188	63.5	2.499	8.037	1023.9	564.7	70.2	56.2	57.6	10450
73.0	2.875	5.2	0.203	62.7	2.469	8.630	1099.4	606.4	76	60.8	66.4	11100
88.9	3.500	3.7	0.145	81.5	3.210	7.740	986.0	543.8	44.1	35.3	20.1	12850
88.9	3.500	4.0	0.156	81.0	3.188	8.300	1057.3	583.2	47.6	38.1	23.6	13690
88.9	3.500	4.4	0.175	80.0	3.150	9.258	1179.4	650.5	53.6	42.9	32.0	15110
88.9	3.500	4.8	0.188	79.3	3.124	9.907	1262.0	696.1	57.7	46.1	38.3	16050

Note:
1. Minimum wall thickness is 0.013 mm. less than specified wall thickness
2. Pressures calculated based on (t_m - 0.013) mm.

QT-800 Coiled Tubing Technical Data — US Units

Specified		Calculated	Plain End	Pipe Metal	Pipe Body	Internal	Hydro	Collapse	Torsional
Outside Diameter D (in.)	Wall Thickness T (in.)	Inside Diameter D (in.)	Weight W (lb./ft)	Cross-sectional Area A (in^2)	Yield Load L_y (lb.)	Yield Pressure (psi)	Test Pressure P_t (psi)	Pressure P_c (psi)	Yield Strength (lb.-ft.)
1.000	0.087	0.826	0.849	0.250	19960	13120	10500	12,040	400
1.000	0.095	0.810	0.919	0.270	21610	14400	11500	13,100	430
1.000	0.102	0.796	0.979	0.288	23020	15520	12400	14,010	450
1.000	0.109	0.782	1.038	0.305	24410	16640	13300	14,910	470
1.000	0.118	0.764	1.113	0.327	26160	18080	14500	16,040	500
1.000	0.125	0.750	1.169	0.344	27490	19200	15000	16,900	520
1.250	0.087	1.076	1.082	0.318	25430	10500	8400	8,830	670
1.250	0.095	1.060	1.173	0.345	27580	11520	9200	10,400	710
1.250	0.102	1.046	1.252	0.368	29430	12420	9900	11,450	750
1.250	0.109	1.032	1.330	0.391	31260	13310	10600	12,200	790
1.250	0.118	1.014	1.428	0.420	33570	14460	11600	13,160	840
1.250	0.125	1.000	1.503	0.442	35340	15360	12300	13,890	870
1.250	0.134	0.982	1.599	0.470	37580	16510	13200	14,810	910
1.250	0.145	0.960	1.713	0.503	40270	17920	14300	15,910	960
1.250	0.156	0.938	1.824	0.536	42890	19330	15000	16,990	1010
1.250	0.175	0.900	2.011	0.591	47280	21760	15000	18,800	1080
1.500	0.095	1.310	1.427	0.419	33550	9600	7700	7,450	1070
1.500	0.102	1.296	1.524	0.448	35840	10350	8300	8,600	1130
1.500	0.109	1.282	1.621	0.476	38110	11090	8900	9,740	1190
1.500	0.118	1.264	1.743	0.512	40990	12050	9600	11,150	1260
1.500	0.125	1.250	1.837	0.540	43200	12800	10200	11,780	1320
1.500	0.134	1.232	1.957	0.575	46000	13760	11000	12,580	1390
1.500	0.145	1.210	2.100	0.617	49380	14930	11900	13,540	1470
1.500	0.156	1.188	2.241	0.659	52690	16110	12900	14,490	1550
1.500	0.175	1.150	2.479	0.728	58280	18130	14500	16,080	1670
1.500	0.188	1.124	2.637	0.775	61990	19520	15000	17,140	1750
1.750	0.109	1.532	1.912	0.562	44950	9510	7600	7,310	1670
1.750	0.118	1.514	2.059	0.605	48400	10330	8300	8,570	1780
1.750	0.125	1.500	2.171	0.638	51050	10970	8800	9,560	1860
1.750	0.134	1.482	2.315	0.680	54420	11790	9400	10,820	1970
1.750	0.145	1.460	2.488	0.731	58490	12800	10200	11,780	2090
1.750	0.156	1.438	2.658	0.781	62500	13810	11000	12,610	2200
1.750	0.175	1.400	2.946	0.866	69270	15540	12400	14,030	2390
1.750	0.188	1.374	3.139	0.923	73800	16730	13400	14,980	2510
1.750	0.203	1.344	3.357	0.987	78930	18100	14500	16,050	2640
2.000	0.109	1.782	2.203	0.648	51800	8320	6700	5,480	2240
2.000	0.118	1.764	2.374	0.698	55810	9040	7200	6,590	2390
2.000	0.125	1.750	2.505	0.736	58910	9600	7700	7,450	2500
2.000	0.134	1.732	2.673	0.786	62840	10320	8300	8,560	2650
2.000	0.145	1.710	2.875	0.845	67600	11200	9000	9,910	2810
2.000	0.156	1.688	3.075	0.904	72300	12080	9700	11,170	2980
2.000	0.175	1.650	3.414	1.003	80270	13600	10900	12,440	3250
2.000	0.188	1.624	3.642	1.070	85620	14640	11700	13,300	3420
2.000	0.203	1.594	3.900	1.146	91680	15840	12700	14,270	3610
2.375	0.125	2.125	3.007	0.884	70690	8080	6500	5,120	3640
2.375	0.134	2.107	3.210	0.943	75470	8690	7000	6,050	3850
2.375	0.145	2.085	3.457	1.016	81270	9430	7500	7,190	4110
2.375	0.156	2.063	3.700	1.088	87000	10170	8100	8,330	4360
2.375	0.175	2.025	4.116	1.210	96760	11450	9200	10,290	4770
2.375	0.188	1.999	4.395	1.292	103340	12330	9900	11,380	5040
2.375	0.203	1.969	4.713	1.385	110810	13340	10700	12,230	5340
2.875	0.145	2.585	4.232	1.244	99490	7790	6200	4,670	6220
2.875	0.156	2.563	4.534	1.333	106600	8400	6700	5,610	6620
2.875	0.175	2.525	5.051	1.484	118750	9460	7600	7,240	7270
2.875	0.188	2.499	5.400	1.587	126960	10180	8100	8,350	7710
2.875	0.203	2.469	5.798	1.704	136320	11020	8800	9,630	8190
3.500	0.145	3.210	5.200	1.528	122260	6400	5100	2,920	9480
3.500	0.156	3.188	5.577	1.639	131110	6900	5500	3,420	10100
3.500	0.175	3.150	6.220	1.828	146240	7770	6200	4,640	11140
3.500	0.188	3.124	6.656	1.956	156490	8370	6700	5,550	11840

Note:
1. Minimum wall thickness is 0.005" less than specified wall thickness
2. Pressures calculated based on (t - 0.005) in.

QT-900 Coiled Tubing Technical Data — SI Units

Specified				Calculated Inside Diameter		Plain End Weight	Pipe Metal Crosssection -al Area	Pipe Body Yield Load	Internal Yield Pressure	Hydro Test Pressure	Collapse Pressure
Outside Diameter		Wall Thickness									
D_m (mm)	D (in.)	t_m (mm)	t (in.)	d_m (mm,)	d (in.)	w_m (kg./m)	A_m (mm²)	L_{ym} (kg.)	P_{ym} (MPa)	P_t (MPa)	P_c (MPa)
25.4	1.000	2.0	0.080	21.3	0.840	1.171	149.2	92.6	93.1	74.5	84.5
25.4	1.000	2.2	0.087	21.0	0.826	1.264	161.0	99.9	101.8	81.4	103.8
25.4	1.000	2.4	0.095	20.6	0.810	1.368	174.3	108.1	111.7	89.4	101.6
25.4	1.000	2.6	0.102	20.2	0.796	1.457	185.6	115.2	120.4	96.3	108.7
25.4	1.000	2.8	0.109	19.9	0.782	1.545	196.8	122.1	129.1	103.3	115.6
31.8	1.250	2.0	0.080	27.7	1.090	1.489	189.7	117.7	74.5	59.6	55.6
31.8	1.250	2.2	0.087	27.3	1.076	1.610	205.1	127.3	81.4	65.1	63.8
31.8	1.250	2.4	0.095	26.9	1.060	1.746	222.4	138.0	89.4	71.5	78.7
31.8	1.250	2.6	0.102	26.6	1.046	1.863	237.3	147.3	96.3	77.0	88.8
31.8	1.250	2.8	0.109	26.2	1.032	1.979	252.1	156.4	103.3	82.6	94.7
31.8	1.250	3.0	0.118	25.8	1.014	2.125	270.7	168.0	112.2	89.8	102.0
31.8	1.250	3.2	0.125	25.4	1.000	2.237	285.0	176.9	119.1	95.3	107.7
31.8	1.250	3.4	0.134	24.9	0.982	2.379	303.1	188.1	128.1	102.5	114.9
31.8	1.250	3.7	0.145	24.4	0.960	2.549	324.7	201.5	139.0	103.4	123.4
31.8	1.250	4.0	0.156	23.8	0.938	2.715	345.9	214.6	149.9	103.4	131.8
31.8	1.250	4.4	0.175	22.9	0.900	2.993	381.3	236.6	168.8	103.4	145.8
38.1	1.500	2.4	0.095	33.3	1.310	2.124	270.5	167.9	74.5	59.6	55.6
38.1	1.500	2.6	0.102	32.9	1.296	2.269	289.0	179.4	80.3	64.2	64.5
38.1	1.500	2.8	0.109	32.6	1.282	2.412	307.3	190.7	86.0	68.8	73.6
38.1	1.500	3.0	0.118	32.1	1.264	2.595	330.5	205.1	93.5	74.8	85.1
38.1	1.500	3.2	0.125	31.8	1.250	2.735	348.4	216.2	99.3	79.4	91.4
38.1	1.500	3.4	0.134	31.3	1.232	2.912	371.0	230.2	106.7	85.4	97.6
38.1	1.500	3.7	0.145	30.7	1.210	3.126	398.2	247.1	115.8	92.7	105.0
38.1	1.500	4.0	0.156	30.2	1.188	3.336	425.0	263.7	124.9	99.9	112.4
38.1	1.500	4.4	0.175	29.2	1.150	3.689	470.0	291.6	140.7	103.4	124.7
38.1	1.500	4.8	0.188	28.5	1.124	3.924	499.9	310.2	151.4	103.4	132.9
44.5	1.750	2.8	0.109	38.9	1.532	2.846	362.5	224.9	73.8	59.0	54.5
44.5	1.750	3.0	0.118	38.5	1.514	3.064	390.3	242.2	80.1	64.1	64.3
44.5	1.750	3.2	0.125	38.1	1.500	3.232	411.7	255.5	85.1	68.1	72.1
44.5	1.750	3.4	0.134	37.6	1.482	3.445	438.9	272.4	91.5	73.2	82.0
44.5	1.750	3.7	0.145	37.1	1.460	3.703	471.7	292.7	99.3	79.4	91.4
44.5	1.750	4.0	0.156	36.5	1.438	3.956	504.0	312.8	107.1	85.7	97.8
44.5	1.750	4.4	0.175	35.6	1.400	4.385	558.6	346.6	120.6	96.4	108.9
44.5	1.750	4.8	0.188	34.9	1.374	4.672	595.2	369.3	129.8	103.4	116.2
50.8	2.000	2.8	0.109	45.3	1.782	3.279	417.8	259.2	64.5	51.6	40.1
50.8	2.000	3.0	0.118	44.8	1.764	3.533	450.1	279.3	70.1	56.1	48.8
50.8	2.000	3.2	0.125	44.5	1.750	3.729	475.0	294.8	74.5	59.6	55.6
50.8	2.000	3.4	0.134	44.0	1.732	3.978	506.8	314.5	80.0	64.0	64.2
50.8	2.000	3.7	0.145	43.4	1.710	4.280	545.2	338.3	86.9	69.5	74.8
50.8	2.000	4.0	0.156	42.9	1.688	4.577	583.0	361.8	93.7	75.0	85.4
50.8	2.000	4.4	0.175	41.9	1.650	5.081	647.3	401.7	105.5	84.4	96.5
50.8	2.000	4.8	0.188	41.2	1.624	5.420	690.5	428.5	113.6	90.8	103.1
50.8	2.000	5.2	0.203	40.5	1.594	5.804	739.4	458.8	122.9	98.3	111.2
60.3	2.375	2.8	0.109	54.8	2.157	3.930	500.6	310.7	54.3	43.5	25.9
60.3	2.375	3.0	0.118	54.3	2.139	4.237	539.8	335.0	59.0	47.2	31.6
60.3	2.375	3.2	0.125	54.0	2.125	4.475	570.0	353.7	62.7	50.2	37.3
60.3	2.375	3.4	0.134	53.5	2.107	4.778	608.6	377.7	67.4	53.9	44.6
60.3	2.375	3.7	0.145	53.0	2.085	5.145	655.4	406.7	73.2	58.5	53.5
60.3	2.375	4.0	0.156	52.4	2.063	5.508	701.6	435.4	78.9	63.1	62.5
60.3	2.375	4.4	0.175	51.4	2.025	6.126	780.3	484.2	88.8	71.1	77.8
60.3	2.375	4.8	0.188	50.8	1.999	6.542	833.3	517.1	95.6	76.5	88.4
60.3	2.375	5.2	0.203	50.0	1.969	7.015	893.7	554.6	103.5	82.8	95.3
73.0	2.875	3.2	0.125	66.7	2.625	5.469	696.7	432.3	51.8	41.4	23.3
73.0	2.875	3.4	0.134	66.2	2.607	5.844	744.4	461.9	55.7	44.5	27.2
73.0	2.875	3.7	0.145	65.7	2.585	6.298	802.3	497.8	60.4	48.3	33.8
73.0	2.875	4.0	0.156	65.1	2.563	6.749	859.7	533.5	65.2	52.1	41.2
73.0	2.875	4.4	0.175	64.1	2.525	7.518	957.7	594.3	73.4	58.7	53.8
73.0	2.875	4.8	0.188	63.5	2.499	8.037	1023.9	635.3	79.0	63.2	62.6
73.0	2.875	5.2	0.203	62.7	2.469	8.630	1099.4	682.2	85.5	68.4	73.3
88.9	3.500	3.4	0.134	82.1	3.232	7.176	914.2	567.3	45.7	36.6	17.4
88.9	3.500	3.7	0.145	81.5	3.210	7.740	986.0	611.9	49.6	39.7	21.2
88.9	3.500	4.0	0.156	81.0	3.188	8.300	1057.3	656.1	53.5	42.8	25.1
88.9	3.500	4.4	0.175	80.0	3.150	9.258	1179.4	731.8	60.3	48.2	33.5
88.9	3.500	4.8	0.188	79.3	3.124	9.907	1262.0	783.1	64.9	51.9	40.7
88.9	3.500	5.2	0.203	78.6	3.094	10.649	1356.5	845.7	70.2	56.2	49.5

Note:
1. Minimum wall thickness is 0.013" less than specified wall thickness
2. Pressures calculated based on (t - 0.013) mm.

QT-900 Coiled Tubing Technical Data — US Units

Specified Outside Diameter D (in.)	Specified Wall Thickness T (in.)	Calculated Inside Diameter D (in.)	Plain End Weight W (lb./ft)	Pipe Metal Crosssectional Area A (in.^{2})	Pipe Body Yield Load Ly (lb.)	Internal Yield Pressure (psi)	Hydro Test Pressure Pt (psi)	Collapse Pressure Pc (psi)	Torsional Yield Strength (lb.-ft.)
1.000	0.080	0.840	0.787	0.231	20810	13500	10800	12,250	430
1.000	0.087	0.826	0.849	0.250	22460	14760	11800	15,060	450
1.000	0.095	0.810	0.919	0.270	24310	16200	13000	14,740	480
1.000	0.102	0.796	0.979	0.288	25900	17460	14000	15,770	510
1.000	0.109	0.782	1.038	0.305	27460	18720	15000	16,770	530
1.250	0.080	1.090	1.001	0.294	26460	10800	8600	8,060	700
1.250	0.087	1.076	1.082	0.318	28610	11810	9400	9,260	750
1.250	0.095	1.060	1.173	0.345	31020	12960	10400	11,410	800
1.250	0.102	1.046	1.252	0.368	33110	13970	11200	12,880	850
1.250	0.109	1.032	1.330	0.391	35160	14980	12000	13,730	890
1.250	0.118	1.014	1.428	0.420	37770	16270	13000	14,800	940
1.250	0.125	1.000	1.503	0.442	39760	17280	13800	15,620	980
1.250	0.134	0.982	1.599	0.470	42280	18580	14900	16,660	1030
1.250	0.145	0.960	1.713	0.503	45300	20160	15000	17,900	1080
1.250	0.156	0.938	1.824	0.536	48250	21740	15000	19,120	1130
1.250	0.175	0.900	2.011	0.591	53190	24480	15000	21,150	1210
1.500	0.095	1.310	1.427	0.419	37740	10800	8600	8,060	1200
1.500	0.102	1.296	1.524	0.448	40320	11640	9300	9,360	1270
1.500	0.109	1.282	1.621	0.476	42870	12480	10000	10,670	1340
1.500	0.118	1.264	1.743	0.512	46110	13560	10800	12,340	1420
1.500	0.125	1.250	1.837	0.540	48600	14400	11500	13,250	1490
1.500	0.134	1.232	1.957	0.575	51750	15480	12400	14,150	1560
1.500	0.145	1.210	2.100	0.617	55550	16800	13400	15,230	1650
1.500	0.156	1.188	2.241	0.659	59280	18120	14500	16,300	1740
1.500	0.175	1.150	2.479	0.728	65560	20400	15000	18,090	1880
1.500	0.188	1.124	2.637	0.775	69740	21960	15000	19,280	1960
1.750	0.109	1.532	1.912	0.562	50570	10700	8600	7,900	1880
1.750	0.118	1.514	2.059	0.605	54450	11620	9300	9,330	2000
1.750	0.125	1.500	2.171	0.638	57430	12340	9900	10,450	2100
1.750	0.134	1.482	2.315	0.680	61230	13270	10600	11,890	2210
1.750	0.145	1.460	2.488	0.731	65800	14400	11500	13,250	2350
1.750	0.156	1.438	2.658	0.781	70310	15530	12400	14,190	2480
1.750	0.175	1.400	2.946	0.866	77930	17490	14000	15,790	2690
1.750	0.188	1.374	3.139	0.923	83030	18820	15000	16,850	2820
2.000	0.109	1.782	2.203	0.648	58280	9360	7500	5,820	2510
2.000	0.118	1.764	2.374	0.698	62790	10170	8100	7,080	2690
2.000	0.125	1.750	2.505	0.736	66270	10800	8600	8,060	2810
2.000	0.134	1.732	2.673	0.786	70700	11610	9300	9,310	2980
2.000	0.145	1.710	2.875	0.845	76050	12600	10100	10850	3170
2.000	0.156	1.688	3.075	0.904	81340	13590	10900	12,390	3350
2.000	0.175	1.650	3.414	1.003	90300	15300	12200	14,000	3650
2.000	0.188	1.624	3.642	1.070	96320	16470	13200	14,960	3840
2.000	0.203	1.594	3.900	1.146	103140	17820	14300	16,130	4060
2.375	0.109	2.157	2.640	0.776	69840	7880	6300	3,760	3640
2.375	0.118	2.139	2.847	0.837	75300	8560	6900	4,580	3900
2.375	0.125	2.125	3.007	0.884	79520	9090	7300	5,410	4090
2.375	0.134	2.107	3.210	0.943	84910	9780	7800	6,470	4330
2.375	0.145	2.085	3.457	1.016	91430	10610	8500	7,760	4620
2.375	0.156	2.063	3.700	1.088	97880	11440	9200	9,060	4910
2.375	0.175	2.025	4.116	1.210	108860	12880	10300	11,290	5370
2.375	0.188	1.999	4.395	1.292	116250	13870	11100	12,820	5670
2.375	0.203	1.969	4.713	1.385	124670	15010	12000	13,820	6010
2.875	0.125	2.625	3.675	1.080	97190	7510	6000	3,380	6160
2.875	0.134	2.607	3.926	1.154	103850	8080	6500	3,950	6540
2.875	0.145	2.585	4.232	1.244	111920	8770	7000	4,900	7000
2.875	0.156	2.563	4.534	1.333	119930	9450	7600	5,970	7440
2.875	0.175	2.525	5.051	1.484	133600	10640	8500	7,810	8180
2.875	0.188	2.499	5.400	1.587	142830	11460	9200	9,080	8670
2.875	0.203	2.469	5.798	1.704	153360	12400	9900	10,630	9210
3.500	0.134	3.232	4.822	1.417	127530	6630	5300	2,530	9950
3.500	0.145	3.210	5.200	1.528	137550	7200	5800	3,070	10660
3.500	0.156	3.188	5.577	1.639	147500	7770	6200	3,640	11360
3.500	0.175	3.150	6.220	1.828	164520	8740	7000	4,860	12540
3.500	0.188	3.124	6.656	1.956	176050	9410	7500	5,900	13320
3.500	0.204	3.092	7.188	2.112	190110	10230	8200	7,180	14250

Note:
1. Minimum wall thickness is 0.005" less than specified wall thickness
2. Pressures calculated based on (t - 0.005) in.

QT-1000 Coiled Tubing Technical Data — SI Units

Specified				Calculated Inside Diameter		Plain End Weight	Pipe Metal Cross-sectional Area	Pipe Body Yield Load	Internal Yield Pressure	Hydro Test Pressure	Collapse Pressure PC
Outside Diameter		Wall Thickness									
D_m (mm)	D (in.)	T_m (mm)	T (in.)	D_m (mm,)	D (in.)	W_m (kg./m)	A_m (mm^2)	L_{ym} (kg.)	P_{im} (MPa)	P_t (MPa)	(MPa)
25.4	1.000	2.6	0.102	20.2	0.796	1.457	185.6	128.0	133.8	103.4	120.8
25.4	1.000	2.8	0.109	19.9	0.782	1.545	196.8	135.7	143.4	103.4	128.5
31.8	1.250	2.6	0.102	26.6	1.046	1.863	237.3	163.7	107.0	85.6	97.6
31.8	1.250	2.8	0.109	26.2	1.032	1.979	252.1	173.8	114.7	91.8	105.2
31.8	1.250	3.0	0.118	25.8	1.014	2.125	270.7	186.6	124.7	99.7	113.4
31.8	1.250	3.2	0.125	25.4	1.000	2.237	285.0	196.5	132.4	103.4	119.7
31.8	1.250	3.4	0.134	24.9	0.982	2.379	303.1	209.0	142.3	103.4	127.6
31.8	1.250	4.0	0.156	23.8	0.938	2.715	345.9	238.5	166.6	103.4	146.4
38.1	1.500	2.8	0.109	32.6	1.282	2.412	307.3	211.9	95.6	76.5	79.7
38.1	1.500	3.0	0.118	32.1	1.264	2.595	330.5	227.9	103.9	83.1	92.7
38.1	1.500	3.2	0.125	31.8	1.250	2.735	348.4	240.2	110.3	88.3	101.5
38.1	1.500	3.4	0.134	31.3	1.232	2.912	371.0	255.8	118.6	94.9	108.4
38.1	1.500	4.0	0.156	30.2	1.188	3.336	425.0	293.0	138.8	103.4	124.9
38.1	1.500	4.4	0.175	29.2	1.150	3.689	470.0	324.1	156.3	103.4	138.6
38.1	1.500	4.8	0.188	28.5	1.124	3.924	499.9	344.7	168.2	103.4	147.7
44.5	1.750	2.8	0.109	38.9	1.532	2.846	362.5	249.9	81.9	65.6	58.3
44.5	1.750	3.0	0.118	38.5	1.514	3.064	390.3	269.1	89.0	71.2	69.4
44.5	1.750	3.2	0.125	38.1	1.500	3.232	411.7	283.8	94.6	75.6	78.0
44.5	1.750	3.4	0.134	37.6	1.482	3.445	438.9	302.6	101.6	81.3	89.2
44.5	1.750	4.0	0.156	36.5	1.438	3.956	504.0	347.5	119.0	95.2	108.7
44.5	1.750	4.4	0.175	35.6	1.400	4.385	558.6	385.2	134.0	103.4	120.9
44.5	1.750	4.8	0.188	34.9	1.374	4.672	595.2	410.3	144.2	103.4	129.1
50.8	2.000	2.8	0.109	45.3	1.782	3.279	417.8	288.0	71.7	57.4	42.1
50.8	2.000	3.0	0.118	44.8	1.764	3.533	450.1	310.4	77.9	62.3	51.8
50.8	2.000	3.2	0.125	44.5	1.750	3.729	475.0	327.5	82.7	66.2	59.5
50.8	2.000	3.4	0.134	44.0	1.732	3.978	506.8	349.4	88.9	71.2	69.2
50.8	2.000	4.0	0.156	42.9	1.688	4.577	583.0	402.0	104.1	83.3	93.1
50.8	2.000	4.4	0.175	41.9	1.650	5.081	647.3	446.3	117.2	93.8	107.3
50.8	2.000	4.8	0.188	41.2	1.624	5.420	690.5	476.0	126.2	100.9	114.7
50.8	2.000	5.2	0.203	40.5	1.594	5.804	739.4	509.8	136.5	103.4	123.0
60.3	2.375	2.8	0.109	54.8	2.157	3.930	500.6	345.2	60.4	48.3	27.2
60.3	2.375	3.0	0.118	54.3	2.139	4.237	539.8	372.2	65.6	52.5	32.5
60.3	2.375	3.2	0.125	54.0	2.125	4.475	570.0	393.0	69.7	55.7	39.0
60.3	2.375	3.4	0.134	53.5	2.107	4.778	608.6	419.6	74.9	59.9	47.2
60.3	2.375	4.0	0.156	52.4	2.063	5.508	701.6	483.7	87.7	70.1	67.2
60.3	2.375	4.4	0.175	51.4	2.025	6.126	780.3	538.0	98.7	79.0	84.5
60.3	2.375	4.8	0.188	50.8	1.999	6.542	833.3	574.6	106.3	85.0	96.4
60.3	2.375	5.2	0.203	50.0	1.969	7.015	893.7	616.2	115.0	92.0	96.4
73.0	2.875	3.2	0.125	66.7	2.625	5.469	696.7	480.4	57.6	46.0	24.3
73.0	2.875	3.4	0.134	66.2	2.607	5.844	744.4	513.3	61.9	49.5	28.7
73.0	2.875	3.7	0.145	65.7	2.585	6.298	802.3	553.2	67.1	53.7	35.0
73.0	2.875	4.0	0.156	65.1	2.563	6.749	859.7	592.8	72.4	57.9	43.2
73.0	2.875	4.4	0.175	64.1	2.525	7.518	957.7	660.3	81.5	65.2	57.6
73.0	2.875	4.8	0.188	63.5	2.499	8.037	1023.9	705.9	87.8	70.2	67.4
73.0	2.875	5.2	0.203	62.7	2.469	8.630	1099.4	758.0	95.0	76.0	67.4
88.9	3.500	3.4	0.134	82.1	3.232	7.176	914.2	630.3	50.8	40.7	17.4
88.9	3.500	3.7	0.145	81.5	3.210	7.740	986.0	679.8	55.2	44.1	21.9
88.9	3.500	4.0	0.156	81.0	3.188	8.300	1057.3	729.0	59.5	47.6	26.3
88.9	3.500	4.4	0.175	80.0	3.150	9.258	1179.4	813.1	67.0	53.6	34.7
88.9	3.500	4.8	0.188	79.3	3.124	9.907	1262.0	870.1	72.1	57.7	42.7
88.9	3.500	5.2	0.203	78.6	3.094	10.649	1356.5	935.3	78.0	62.4	52.1

Note:
1. Minimum wall thickness is 0.013 mm. less than specified wall thickness
2. Pressures calculated based on (tm - 0.013) mm.

QT-1000 Coiled Tubing Technical Data — US Units

Specified		Calculated	Plain End	Pipe Metal	Pipe Body	Internal	Hydro	Collapse	Torsional
Outside Diameter D (in.)	Wall Thickness T (in.)	Inside Diameter D (in.)	Weight W (lb./ft)	Cross-sectional Area A (in.^{2})	Yield Load L_y (lb.)	Yield Pressure (psi)	Test Pressure P_t (psi)	Pressure Pc (psi)	Yield Strength (lb.-ft.)
1.000	0.102	0.796	0.979	0.288	28780	19400	15000	17,520	570
1.000	0.109	0.782	1.038	0.305	30510	20800	15000	18,640	590
1.250	0.102	1.046	1.252	0.368	36790	15520	12400	14,160	940
1.250	0.109	1.032	1.33	0.391	39070	16640	13300	15,260	990
1.250	0.118	1.014	1.428	0.42	41960	18080	14500	16,450	1050
1.250	0.125	1	1.503	0.442	44180	19200	15000	17,360	1090
1.250	0.134	0.982	1.599	0.47	46980	20640	15000	18,510	1140
1.250	0.156	0.938	1.824	0.536	53620	24160	15000	21,240	1260
1.500	0.109	1.282	1.621	0.476	47630	13870	11100	11,560	1490
1.500	0.118	1.264	1.743	0.512	51230	15070	12100	13,440	1580
1.500	0.125	1.25	1.837	0.54	54000	16000	12800	14,720	1650
1.500	0.134	1.232	1.957	0.575	57510	17200	13800	15,720	1740
1.500	0.156	1.188	2.241	0.659	65870	20130	15000	18,110	1930
1.500	0.175	1.15	2.479	0.728	72850	22670	15000	20,100	2090
1.500	0.188	1.124	2.637	0.775	77490	24400	15000	21,420	2180
1.750	0.109	1.532	1.912	0.562	56190	11890	9500	8,450	2090
1.750	0.118	1.514	2.059	0.605	60500	12910	10300	10,060	2230
1.750	0.125	1.5	2.171	0.638	63810	13710	11000	11,320	2330
1.750	0.134	1.482	2.315	0.68	68030	14740	11800	12,940	2460
1.750	0.156	1.438	2.658	0.781	78120	17260	13800	15,770	2750
1.750	0.175	1.4	2.946	0.866	86590	19430	15000	17,540	2990
1.750	0.188	1.374	3.139	0.923	92250	20910	15000	18,730	3140
2.000	0.109	1.782	2.203	0.648	64750	10400	8300	6,110	2790
2.000	0.118	1.764	2.374	0.698	69770	11300	9000	7,520	2980
2.000	0.125	1.75	2.505	0.736	73630	12000	9600	8,630	3130
2.000	0.134	1.732	2.673	0.786	78550	12900	10300	10,040	3310
2.000	0.156	1.688	3.075	0.904	90370	15100	12100	13,500	3720
2.000	0.175	1.65	3.414	1.003	100330	17000	13600	15,560	4060
2.000	0.188	1.624	3.642	1.07	107020	18300	14600	16,630	4270
2.000	0.203	1.594	3.9	1.146	114600	19800	15000	17,840	4510
2.375	0.109	2.157	2.64	0.776	77600	8760	7000	3,940	4040
2.375	0.118	2.139	2.847	0.837	83670	9520	7600	4,720	4330
2.375	0.125	2.125	3.007	0.884	88360	10110	8100	5,650	4540
2.375	0.134	2.107	3.21	0.943	94340	10860	8700	6,840	4820
2.375	0.156	2.063	3.7	1.088	108750	12720	10200	9,750	5450
2.375	0.175	2.025	4.116	1.21	120950	14320	11500	12,260	5970
2.375	0.188	1.999	4.395	1.292	129170	15410	12300	13,980	6300
2.375	0.203	1.969	4.713	1.385	138520	16670	13300	13,980	6680
2.875	0.125	2.625	3.675	1.08	107990	8350	6700	3,520	6850
2.875	0.134	2.607	3.926	1.154	115390	8970	7200	4,160	7270
2.875	0.145	2.585	4.232	1.244	124360	9740	7800	5,070	7780
2.875	0.156	2.563	4.534	1.333	133260	10500	8400	6,270	8270
2.875	0.175	2.525	5.051	1.484	148440	11830	9500	8,350	9090
2.875	0.188	2.499	5.4	1.587	158700	12730	10200	9,770	9630
2.875	0.203	2.469	5.798	1.704	170410	13770	11000	9,770	10240
3.500	0.134	3.232	4.822	1.417	141700	7370	5900	2,530	11050
3.500	0.145	3.21	5.2	1.528	152830	8000	6400	3,170	11850
3.500	0.156	3.188	5.577	1.639	163890	8630	6900	3,810	12620
3.500	0.175	3.15	6.22	1.828	182800	9710	7800	5,030	13930
3.500	0.188	3.124	6.656	1.956	195610	10460	8400	6,200	14800
3.500	0.203	3.094	7.155	2.103	210260	11310	9100	7,550	15770

Note:
1. Minimum wall thickness is 0.005" less than specified wall thickness
2. Pressures calculated based on (t - 0.005) in.