THRU TUBING TOOLS CATALOG

DOWNHOLE

NATIONAL OILWELL VARCO

NOV Downhole is the largest independent downhole tool and equipment provider in the world. We have the expertise to optimize BHA selection and performance, supporting over 150 locations in more than 80 countries.

Our complete range of solutions for the bottom hole assembly and related equipment includes:

- **Thru Tubing Tools**
- **Fishing Tools**
- **Drill Bits**
- **Drilling Motors**
- **Borehole Enlargement**
- **Drilling Tools and Products**
- **Coring Services**
- **Service Equipment**
- **Advanced Drilling Solutions**

We take pride in delivering superior performance and reliability. Our objective is to exceed our customer's expectations, improve their economics and be an integral part of their strategies.

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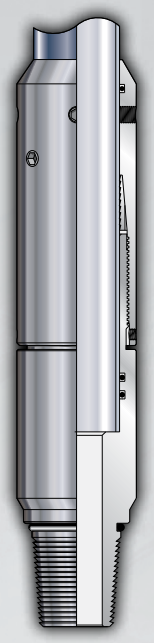
PRIMARY TOOLS

Slim Line Dimple / Slip Connector



Slim Line Dimple / Slip Connector

External combination dimple and slip connectors are the solution for high torque and tensile loads.

Drilling, fishing, and completion work are ideal for these premium connectors.

Available with a wide variety of OD's and pin connections to accommodate most jobs without the need for any crossovers.

A slim line series of connectors accommodate tight ID's or nipple systems for thru tubing applications. Full size will provide extra strength where OD of connectors is not critical.

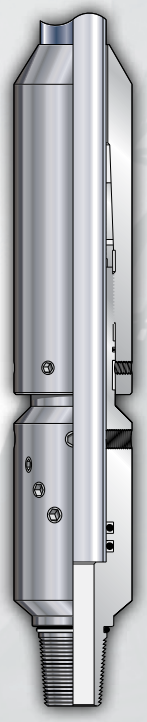
Features and Benefits

- High tensile strength
- High torsional strength
- Internal pressure seal
- Replaceable hardened slips

Slim Line Dimple / Slip Connector Technical Specifications

Part Number	Tool Description	OD	ID	Coiled Tubing Size	Service Type	Connection
621-050	1¼" Slim Line Slip Dimple Connector	1.687"	13/16"	1¼"	H2S	1" AMMT
622-200	1½" Slim Line Slip Dimple Connector	2.125"	¾"	1½"	H2S	1" AMMT
623-100	1¾" Slim Line Slip Dimple Connector	2.375"	1"	1¾"	H2S	1½" AMMT
624-050	2" Slim Line Slip Dimple Connector	2.875"	1¼"	2"	H2S	2⅜" PAC

Full Size Dimple / Slip Connector



Full Size Dimple / Slip Connector

External combination dimple and slip connectors are the solution for high torque and tensile loads.

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Features and Benefits

- High tensile strength
- High torsional strength
- Internal pressure seal
- Replaceable slips

Full Size Dimple / Slip Connector Technical Specifications

Part Number	Tool Description	OD	ID	Coiled Tubing Size	Service Type	Connection
632-050	1½" Full Size Dimple / Slip Connector	2.875"	1⅛"	1½"	H2S	2⅜" PAC
633-050	1¾" Full Size Dimple / Slip Connector	2.875"	1¼"	1¾"	H2S	2⅜" PAC
634-050	2" Full Size Dimple / Slip Connector	2.875"	1"	2"	H2S	2⅜" PAC
632-150	1½" Full Size Dimple / Slip Connector	3.125"	1"	1½"	H2S	2⅜" REG
635-150	2⅜" Full Size Dimple / Slip Connector	3.375"	1"	2⅜"	H2S	2⅜" PAC
635-200	2⅜" Full Size Dimple / Slip Connector	3 .375"	1"	2⅜"	H2S	2⅜" REG

Sleeved Dimple Connector

To meet the high load demands of today's aggressive coil drillers, NOV is again in the forefront of innovation.

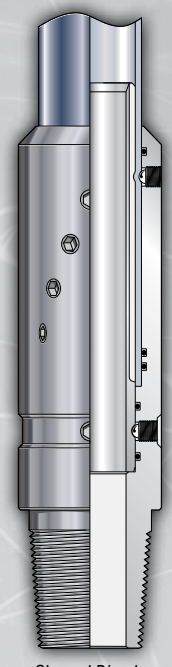
The Sleeved dimple connector is ideal for CT drilling applications.

The connector already has an excellent track record in many deep and difficult well bores. Installation is simple and does not require special tools which results in a very secure connection. This allows high tensile, compressive and torsional loads to be applied.

The tool is available with various pin thread connections and can also be ordered in a slimline configuration, by reducing the OD for certain applications.

Features and Benefits

- High tensile strength
- High torsional strength
- Internal pressure seal
- Easy make up



Sleeved Dimple Connector

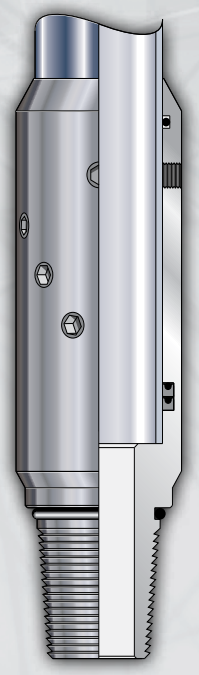
Sleeved Dimple Connector Technical Specifications

Part Number	Tool Description	OD	ID	Coiled Tubing Size	Service Type	Connection
605-1175	2⅜" Sleeved Dimple Connector	3½"	1"	2⅜"	H2S	2⅜" REG

Dimple Connector

For quick latch onto the coil while still benefiting from all the torque and tensile features. This dimple connector is very popular and simple. Having 16 places of large knurled point set screws and dual poly pack seals make this connector a premium one.

Easy to install with or without dimple applicator or special tools.



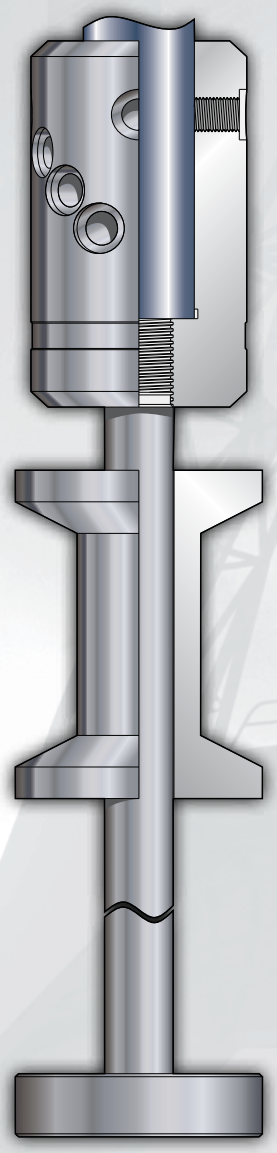
Dimple Connector

Dimple Connector Technical Specifications

Part Number	Tool Description	OD	ID	Coiled Tubing Size	Service Type	Connection
601-062	1¼" Dimple Connector	1¾"	¾"	1¼"	H2S	1" AMMT
602-055	1½" Dimple Connector	2⅛"	¾"	1½"	H2S	1½" AMMT
602-063	1½" Dimple Connector	2⅞"	1⅛"	1½"	H2S	2⅜" PAC
603-062	1¾" Dimple Connector	2⅞"	1⅛"	1¾"	H2S	2⅜" PAC
603-054	1¾" Dimple Connector	3⅛"	1"	1¾"	H2S	2⅜" REG
604-056	2" Dimple Connector	3⅜"	1½"	2"	H2S	2⅜" PAC
605-053	2⅜" Dimple Connector	3⅜"	1"	2⅜"	H2S	2⅜" PAC
605-054	2⅜" Dimple Connector	3⅜"	1⅛"	2⅜"	H2S	2⅜" REG
608-054	2⅝" Dimple Connector	3⅜"	1⅛"	2⅝"	H2S	2⅜" REG
606-067	2⅞" Dimple Connector	3½"	1⅛"	2⅞"	H2S	2⅜" REG
606-065	2⅞" Dimple Connector	3¾"	1⅛"	2⅞"	H2S	2⅜" REG
606-053	2⅞" Dimple Connector	3⅞"	1⅛"	2⅞"	H2S	2⅜" REG

Dimple Applicator

The Dimple Applicator is used to accurately produce the indentations in the coiled tubing wall, required when using Dimple Connectors. The dimples are produced by screwing the round headed cap screws into the tubing wall by the same amount. The slide hammer aids installation and removal of the tool.



Dimple Applicator

Dimple Applicator Technical Specifications

Part Number	Coiled Tubing Size	OD	ID
640-051	1¼″	3.17″	1.290″
641-051	1½″	3.42″	1.540″
642-051	1¾″	3.68″	1.78″
643-051	2″	3.93″	2.03″
644-051	2⅜″	4.29″	2.39″
647-051	2⅝″	4.460"	2.650″
645-051	2⅞″	4.71″	2.90″
646-051	3½″	5.335″	3.525″

Slimconnect External Slip Connector

The Slimconnect External Slip Connectors allows the attachment of coiled tubing to the CT Tool Work String via the provision of a threaded connection.

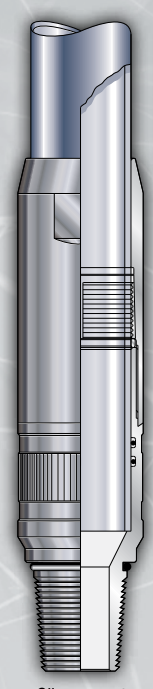
The Slimconnect, as it's name suggests, has an OD which is smaller than a standard external slip connector. This enables the Slimconnect to be used in operations where the CT is to be run through a restriction/restricted ID

The design of the Slimconnect utilizes a set of helical 'wicker' type slips that grip the tubing in a 'wedging' action, thus, an increase in tension results in increased grip.

The External Slip Type Connectors have 'o' ring pressure seals as standard.

Features and Benefits

- High tensile strength for size
- Slimline body OD
- Internal pressure seal
- Replaceable slips



Slimconnect External Slip Connector

Slimconnect External Slip Connector Technical Specifications

Part Number	Tool Size	Max OD	CT Size	Service	Min ID	Top Connection	Bottom Connection	Working Pressure
C206-001-08	1 11/16"	1.687"	1¼"	STD	0.75"	1¼" CT	1" AMMT PIN	5000 PSI
C206-002-08	1 15/16"	1.937"	1½"	STD	0.75"	1½" CT	1" AMMT PIN	5000 PSI
C206-003-09	2 3/16"	2.188"	1¾"	STD	1"	1¾" CT	1½" AMMT PIN	5000 PSI
C206-005-09	2 1/16"	2.06"	1½"	H2S	1"	1½" CT	1½" AMMT PIN	5000 PSI

Internal Dimple Connector

The Internal Dimple Connector has a slimline OD with very little ID change, high tensile loads and high torque loads are key features. With the Internal Dimple Connector easy and positive applications to coil are also made convenient. As an option the outer dimple sleeve can be added.

Features and Benefits

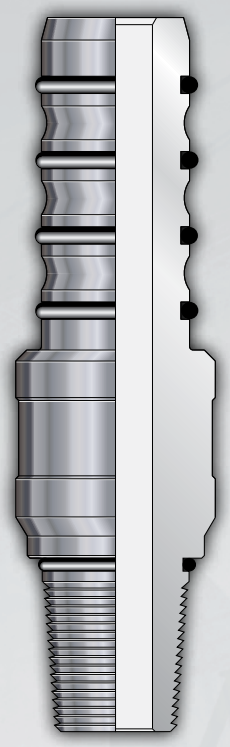
- High tensile strength
- High torsional strength
- Easy make up

Internal Dimple Connector

Internal Dimple Connector Technical Specifications

Part Number	Tool OD	CT Size	CT Wall Thickness	Service Type	Connection
606-2188-15AMTP	2⅞"	2⅞"	.188"	H2S	1½" AMMT
606-2188-23PAP	2⅞"	2⅞"	.188"	H2S	2⅜" PAC
607-2224-23REGP	3.490"	3½"	.244"	H2S	2⅜" REG
609-2188-23 REGP	3¼"	3¼"	.188"	H2S	2⅜" REG

Roll-On x Thread Connectors



Roll-On x Thread Connector

The Roll-On Connector allows the attachment of Coiled Tubing to the CT Tool/Work String via the provision of a threaded connection.

Featuring triple roll-on grooves and quadruple seal points, this connector is easy to install, reliable and very practical.

Available for all sizes of CT and wall thickness and are box or pin with a variety of thread types.

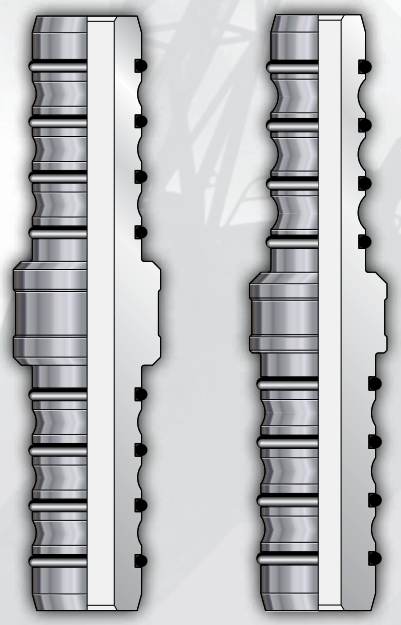
Common thread types and sizes: AMMT, PAC, API, EUE and more, or any custom request.

- A full range of connectors are available
- Contact an NOV Sales Representative for part number and technical data

Features and Benefits

- High tensile strength
- Internal pressure seal
- Easy make up

Roll-On x Roll-On Connectors



Typical Roll-On x Roll-On Connectors

Featuring triple roll-on grooves and quadruple seal points, this connector is easy to install, reliable and very practical.

For specialty work a multi size connector is available allowing two different sizes of tubing to be joined.

Also available are plastic x plastic and steel x plastic connectors.

- A full range of connectors are available
- Contact an NOV Sales Representative for part number and technical data

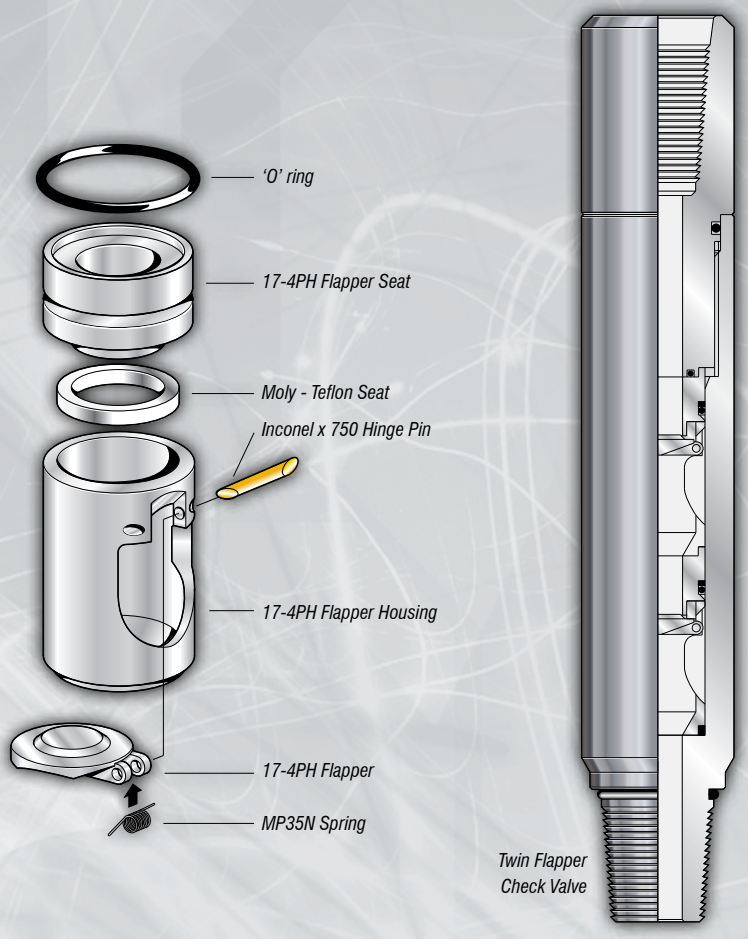
Twin Flapper Check Valve

The Twin Flapper Check Valve is a standard coiled tubing string component. It provides a means of preventing the back flow of well fluids into the coiled tubing in the event of failure or damage to the coiled tubing string or surface equipment.

The design of the Twin Flapper Check Valve incorporates a dual sealing system in each flapper assembly for increased safety. A teflon seal provides the primary low pressure seal, while at higher pressure the flapper seals on a metal to metal arrangement.

Maximum flow area through the Flapper Cartridges reduces unnecessary back pressure on the surface pumps.

The flow path through the Flapper Cartridges does not restrict the passage of balls or darts if required during operations such as cementing.



Twin Flapper Check Valve

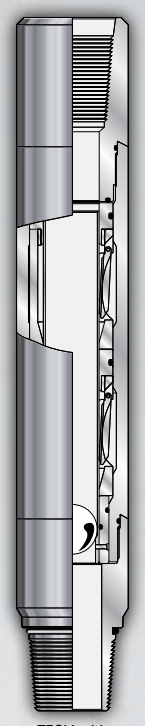
Features and Benefits

- Full flow through bore
- Dual sealing in each flapper cartridge i.e. low pressure teflon seat/seal and high pressure full metal to metal seat/seal
- Full bore fluid passage for balls, darts and plugs
- Removable flapper cartridges

Twin Flapper Check Valve Technical Specifications

Part no.	Tool Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C165-072-08	1 1⁄16″	STD	1.687″	0.750″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C165-033-09	2 1⁄8″	STD	2.125″	0.890″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C165-019-23	2 7⁄8″	STD	2.875″	1.375″	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C165-023-10	3 1⁄8″	STD	3.125″	1″	2⅜″ REG Box	2⅜″ REG Pin	5000 PSI
C165-127-08	1½″	H2S	1.5″	0.50″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C165-076-08	1 1⁄16″	H2S	1.687″	0.750″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C165-066-08	1¾″	H2S	1.750″	0.750″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C165-129-09	2″	H2S	2″	0.89″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C165-067-09	2 1⁄8″	H2S	2.125″	0.890″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C165-082-09	2¼″	H2S	2.25″	1.03″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C165-083-09	2⅜″	H2S	2.375″	1.032″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C165-106-23	2 7⁄8″	H2S	2.875″	1.375″	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C165-084-23	3 1⁄8″	H2S	3.125″	1.375″	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C165-122-08	1 1⁄16″	STD	1.687″	0.687″	1″ AMMT Box	1″ AMMT Pin	10000 PSI
C165-113-09	2 1⁄8″	STD	2.125″	0.89″	1½″ AMMT Box	1½″ AMMT Pin	10000 PSI
C165-142-09	2⅜″	H2S	2.375″	0.687″	1½″ AMMT Box	1½″ AMMT Pin	10000 PSI

Twin Flapper Check Valve with Lock Out Sleeve



TFCV with Lock-Out Sleeve

The Twin Flapper Check Valve with Lock-Out Sleeve is a coiled tubing string component that can be run in the locked out position and activated with a drop ball when required to perform as a downhole safety barrier. It provides a means of preventing the back flow of well fluids into the coiled tubing in the event of failure or damage to the coiled tubing string or surface equipment.

The design of the Twin Flapper Check Valve incorporates a dual sealing system in each flapper assembly for increased safety. A teflon seat provides the primary low pressure seal, while at higher pressure the flapper seals on a metal to metal arrangement.

It is ideally suited to CT velocity string systems allowing activation by a drop ball prior to pulling the string from the well.

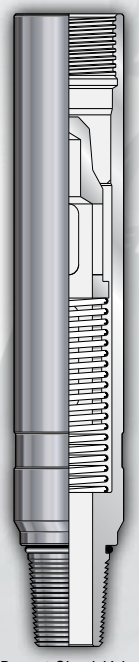
Features and Benefits

- Dual sealing in each flapper cartridge i.e. low pressure teflon seat/seal and high pressure full metal to metal seat/seal
- Full bore fluid passage for balls, darts & plugs
- Removable flapper cartridges
- Simple drop ball activation

Twin Flapper Check Valve with Lock Out Sleeve Technical Specifications

Part Number	Tool Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C165-130-08	1.69″	STD	1.69″	0.47″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C165-139-09	2.875″	STD	2.875″	0.75″	1.5″ AMMT Box	1.5″ AMMT Pin	5000 PSI

Poppet Check Valve



Poppet Check Valve

Safety, well control, and advanced operations are a few of the applications for check valves.

Standard with modular box up, pin down threads or made to customer specifications. Good for acid, H2S, or CO2 applications. These valves can be stacked in tandem or more and fit anywhere in your bottom hole assembly.

Incorporating a specially engineered dynamic flow poppet as opposed to a standard ball, these valves have proven to be durable, giving long life under all working conditions.

Features and Benefits

- Easy redress
- Metal to metal seal

Poppet Check Valve Technical Specifications

Part Number	OD	ID	Service Type	Connection
443-510	1¾″	¾″	H2S	1″ AMMT
444-100	2⅛″	13/16″	H2S	1½″ AMMT

Burst Disc Circulation Sub

The Burst Disc Circulation Sub is a standard coiled tubing tool string component that is used in conjunction with tools that require drop balls etc., and that need to be circulated into the coiled tubing.

The Burst Disc Circulation Sub is incorporated into the coiled tubing tool string just below the tool that requires a drop ball.

Should circulation be lost due to a down hole restriction, a predetermined pressure applied to the coil will burst the disc in the sub and re-establish circulation.

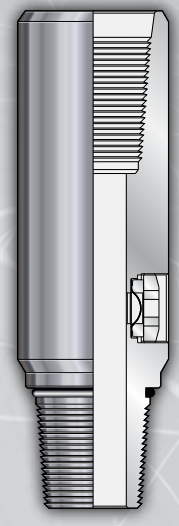
Burst Disc Circulation Subs are supplied with a blanking plug for the Burst Disc. When ordering Burst Disc Circulation Subs, customers should choose the Burst Discs they require, seperately.

Features and Benefits

- Various burst disc pressure ratings available

Burst Disc Assembly (½")

Part Number	Rupture Pressure
P0-17656	4880 psi
P0-17665	6000 psi
P0-49326	3000 psi
P0-49313	2000 psi



Burst Disc Circulation Sub

Burst Disc Circulation Sub Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C166-021-08	1 11/16"	H2S	1.688"	0.39"	1" AMMT Box	1" AMMT Pin	5000 PSI
C166-037-08	1¾"	H2S	1.750"	0.406"	1" AMMT Box	1" AMMT Pin	5000 PSI
C166-038-09	2⅛"	H2S	2.125"	0.875"	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C166-039-09	2¼"	H2S	2.250"	0.875"	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C166-047-09	2⅜"	H2S	2.375"	0.875"	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C166-052-23	2⅞"	H2S	2.875"	1.38"	2⅜" PAC Box	2⅜" PAC Pin	5000 PSI

Dual Activated Circulation Valve

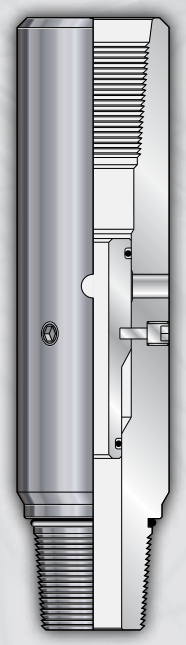
The Dual Activated Circulation Valve offers the traditional method of returning circulation of the toolstring through use of a drop ball. In addition, the valve is capable of operating through internal over pressure within the tubing string.

Conventional dual circulation valves use a burst or rupture disc to facilitate the function of returning circulation through over pressure. However, the Dual Activated Circulation Valve offers a pressure differential activated piston. The piston activation pressure can be predetermined at surface through shear pins, offering superior flexibility and considerable savings on redress.

As with many other tools in the standard BHA tool range, the emphasis is on simplicity and the Dual Activated Circulation Valve has very few component parts, seals and thread connections.

Features and Benefits

- Simple drop ball design and pressure differential to operate

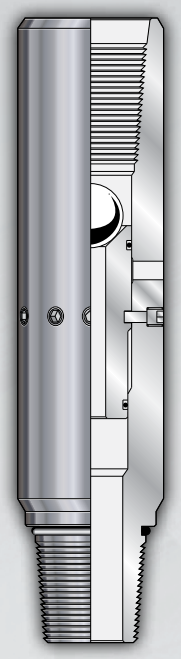


Dual Activated Circulation Valve

Dual Activated Circulation Valve Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connector	Bottom Connector	Working Pressure
C166-031-08	1 11/16"	H2S	1.687"	0.406"	1" AMMT Box	1" AMMT Pin	5000 PSI
C166-032-08	1¾"	H2S	1.75"	0.406"	1" AMMT Box	1" AMMT Pin	5000 PSI
C166-033-09	2⅛"	H2S	2.125"	0.406"	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C166-034-09	2¼"	H2S	2.25"	0.625"	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C166-035-09	2⅜"	H2S	2.375"	0.625"	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C166-046-23	2⅞"	H2S	2.875"	0.75"	2⅜" PAC Box	2⅜" PAC Pin	5000 PSI
C166-048-23	3⅛"	H2S	3.125"	0.75"	2⅜" PAC Box	2⅜" PAC Pin	5000 PSI

Ball Activated Circulation Sub



Ball Activated Circulation Sub

The Ball Activated Circulation Valve is designed to allow circulation above the coiled tubing work/tool string.

The tool is activated by using a drop ball and can be adjusted on surface to shear out by varying the number and type of shear pin used. Pressure applied to the drop ball causes the pins to shear and the sleeve to move down allowing circulation via the side ports.

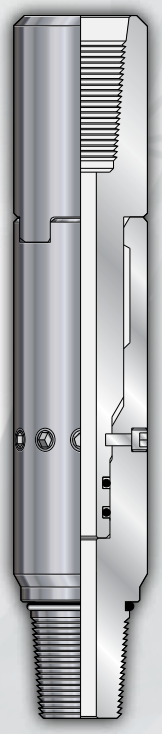
Features and Benefits

- Simple drop ball design to activate

Ball Activated Circulation Sub Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Conn.	Bottom Conn.	Working Pressure
C166-028-08	1 1⁄16″	STD	1.687″	0.312″	1″ AMMT Box	1″ AMMT Pin	5500 PSI
C166-016-08	1¾″	STD	1.750″	0.312″	1″ AMMT Box	1″ AMMT Pin	5500 PSI
C166-010-09	2⅛″	STD	2.125″	0.500″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C166-049-09	2⅜″	STD	2.375″	0.437″	1½″ AMMT Box	1½″ AMMT Pin	3000 PSI
C166-050-23	2⅞″	STD	2.875″	0.750″	2⅜″ PAC Box	2⅜″ PAC Pin	3000 PSI
C166-012-23	3⅛″	STD	3.125″	0.750″	2⅜″ PAC Box	2⅜″ PAC Pin	3000 PSI

Shear Release Joint



Shear Release Joint

The Shear Release Joint allows the parting of the coiled tubing work string by applied predetermined tension.

The Shear Release Joint was designed for and used primarily in cement stinger operations as a simple effective emergency release.

The Shear Release Joint incorporates shear screws that can be used in various combinations to allow a wide range of predetermined shear settings.

The released part of the Shear Release Joint can be retrieved using an industry standard GS type Pulling Tool (see page 40).

Features and Benefits

- Simple design
- On location adjustable settings
- Internal pressure seal
- Internal standard GS type fish neck after release
- Torque Thru capability

Shear Release Joint Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C167-070-09	2⅛″	H2S	2.125″	0.75″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C167-079-09	2¼″	H2S	2.25″	0.75″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C167-071-09	2⅜″	H2S	2.375″	0.75″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C167-080-23	3⅛″	H2S	3.125″	0.50″	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C167-105-10	3⅛″	STD	3.125″	1.25″	2⅜″ REG	2⅜″ Reg Pin	5000 PSi

Heavy Duty Hydraulic Disconnect

The Heavy Duty Hydraulic Disconnect (HDHD) allows the toolstring to detach at a predetermined point via the deployment of a suitable drop/trip ball through the coiled tubing. The drop ball locates on a piston sleeve creating sufficient back pressure to shear the pins and disconnect the tool. The piston sleeve pushes the tool apart to ensure a clean disconnect. Circulation is immediately returned to the toolstring, providing a surface indication of a positive disconnect. All piston sleeves and drop balls are returned to surface leaving a standard GS internal fish neck for retrieval purposes.

The HDHD utilizes a heavy duty, one piece, threaded collet slip to disconnect. The collet slip endures higher tensile loading than collet finger type release mechanisms and is far less susceptible to fatigue. The collet slip is backed up with a collet slip sleeve to give maximum tensile strength to the disconnect during heavy jarring operations. Only by dropping a ball and shearing the pins can the collet sleeve shift, allowing the collet and top sub to part. The piston sleeve is pressure balanced, therefore internal pressure does not affect the hydraulic configuration and shear values.

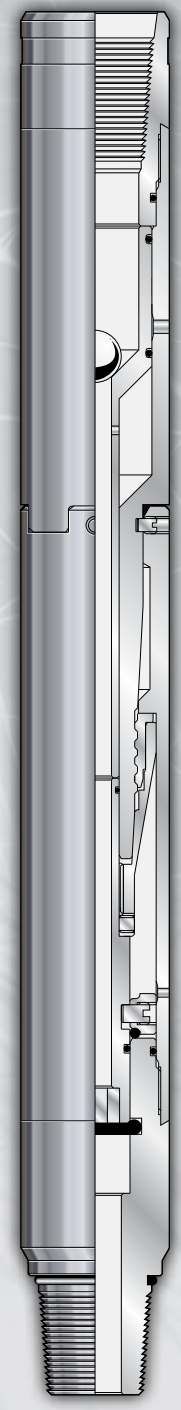
High torque capabilities are achieved through positive torque drive teeth between the top sub and the main body of the tool. The HDHD is therefore ideally suited for high torque, heavy duty coiled tubing drilling operations where maximum performance and durability is essential.

Shear screws can be supplied in either brass or steel to give a comprehensive pressure range to suit virtually any coiled tubing application. Shear screws are also integrally situated to eliminate the possibility of shear screws vibrating free during CT drilling operations. By interchanging the piston sleeve, the drop/trip ball size can be varied to suit the desired toolstring requirements. This is a particularly useful feature when the HDHD is situated below jars and accelerators, and ID restrictions are a factor for consideration. Running the HDHD below jars and accelerators ensures that if disconnection of the toolstring is necessary, a greater proportion of the toolstring is safely returned to surface.

The HDHD has been designed to ensure assembly and disassembly of the tool is trouble free.

Features and Benefits

- Retrieved with a standard GS running tool (see page 40).

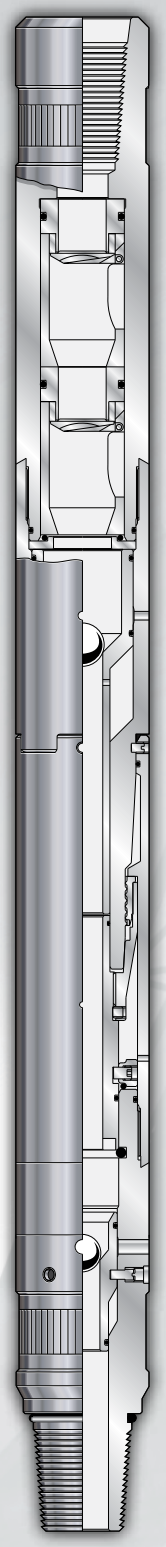


Heavy Duty Hydraulic Disconnect

Heavy Duty Hydraulic Disconnect Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Fish Neck / GS	Top Connection	Bottom Connection	Working Pressure
C167-112-08	1 11/16"	STD	1.69"	0.469"	1.38" / 2" GS	1" AMMT Box	1" AMMT Pin	5000 PSI
C167-113-08	1¾"	STD	1.75"	0.469"	1.38" / 2" GS	1" AMMT Box	1" AMMT Pin	5000 PSI
C167-114-09	2⅛"	STD	2.12"	0.469"	1.38" / 2" GS	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C167-115-23	2⅞"	STD	2.87"	0.875"	2.31" / 3" GS	2⅜" PAC Box	2⅜" PAC Pin	5000 PSI
C167-116-23	3⅛"	STD	3.125"	1.06"	2.31" / 3" GS	2⅜" PAC Box	2⅜" PAC Pin	5000 PSI
C167-096-08	1½"	H2S	1.500"	0.345"	1.06" / 1½"	1" AMMT Box	1" AMMT Pin	5000 PSI
C167-088-08	1 11/16"	H2S	1.687"	0.469"	1.38" / 2" GS	1" AMMT Box	1" AMMT Pin	5000 PSI
C167-094-08	1¾"	H2S	1.750"	0.469"	1.38" / 2" GS	1" AMMT Box	1" AMMT Pin	5000 PSI
C167-095-09	2"	H2S	2.00"	0.469"	1.38" / 2" GS	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C167-085-09	2⅛"	H2S	2.125"	0.469"	1.38" / 2" GS	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C167-089-09	2¼"	H2S	2.25"	0.780"	1.38" / 2" GS	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C167-097-09	2⅜"	H2S	2.375"	0.780"	1.81" / 2½" GS	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C167-101-23	2⅞"	H2S	2⅞"	0.875"	2.31" / 2" GS	2⅜" PAC Box	2⅜" PAC Pin	5000 PSI
C167-098-23	3⅛"	H2S	3.125"	1.062"	2.31" / 3" GS	2⅜" PAC Box	2⅜" PAC Pin	5000 PSI

Motorhead Assembly (MHA)



Motorhead Assembly

The Motorhead Assembly (MHA) is a compact, versatile, robust upper BHA that offers the following components:

- The MHA's compact design reduces the overall length compared to standard tools
- Twin Flapper Check Valve
- Heavy Duty Hydraulic Disconnect
- Dual Circulation Valve

Features and Benefits

- The MHA's compact design gives an overall length saving of approximately 30% over the use of conventional individual components.
- The high torque capability of the MHA provides the ideal Motorhead for today's high demand coiled tubing drilling applications.
- The choice of tubing connector is not dictated by the MHA, therefore giving the operator the flexibility to choose. Most Coiled Tubing connectors can be used with the MHA.
- With a considerable reduction in the number of component parts, seals and thread connections, the MHA is uncomplicated to assemble/disassemble and inexpensive to redress.
- Retrieved with a standard GS running tool (see page 40).

Rupture Disc Assembly (8 mm)

Part Number	Rupture Pressure
P0-49418	3000 psi
P0-49399	4000 psi
P0-49400	5000 psi
P0-49401	6000 psi
P0-49402	7500 psi

Motorhead Assembly Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Fish Neck / GS	Top Connection	Bottom Connection	Working Pressure
C200-045-08	1 1⁄16″	STD	1.687″	0.406″	1.38″ / 2″ GS	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C200-046-08	1¾″	STD	1.75″	0.406″	1.38″ / 2″ GS	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C200-047-09	2⅛″	STD	2.125″	0.406″	1.38″ / 2″ GS	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C200-044-23	2⅞″	STD	2.875″	0.75″	2.31″ / 3″ GS	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C200-051-10	3⅛″	STD	3.125″	0.812″	2.31″ / 3″ GS	2⅜″ API REG Box	2⅜″ API REG Pin	5000 PSI
C200-052-08	1 1⁄16″	H2S	1.687″	0.406″	1.38″ / 2″ GS	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C200-056-08	1¾″	H2S	1.75″	0.406″	1.38″ / 2″ GS	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C200-053-09	2⅛″	H2S	2.125″	0.406″	1.38″ / 2″ GS	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C200-036-09	2¼″	H2S	2.25″	0.59″	1.38″ / 2″ GS	1½″ AMMT Box	1½″ AMMT PIN	5000 PSI
C200-054-23	2⅞″	H2S	2.875″	0.75″	2.31″ / 2″ GS	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI

Motorhead Assembly (MHA) Continued

The Motorhead Assembly (MHA) has been developed in recognition to industry demands for compact, heavy duty, integrated BHA components. The MHA combines the Double Flapper Check Valve with the Heavy Duty Hydraulic Disconnect and the Dual Circulation Valve, standard components for virtually all toolstring designs.

Double Flapper Check Valve - The MHA incorporates two Flapper Cartridge assemblies. Each Flapper Cartridge assembly incorporates a primary, metal to metal seal providing high pressure sealing integrity, and a secondary PTFE seal for low pressure sealing. The Flapper Cartridge Assemblies simply drop-in to the Valve housing providing simple and easy redress of the MHA..

Heavy Duty Hydraulic Disconnect - The Disconnect allows the toolstring to detach at a predetermined point via the deployment of a suitable drop/trip ball through the coiled tubing.

The drop ball locates on a piston sleeve creating sufficient back pressure to shear the pins and disconnect the tool. The piston sleeve pushes the tool apart to ensure a clean disconnect. Circulation is immediately returned to the toolstring, providing a surface indication of a positive disconnect. All piston sleeves and drop balls are returned to surface leaving a standard 'GS' internal fish neck for retrieval purposes.

The Hydraulic Disconnect utilises a heavy duty, one piece, threaded collet slip to hold the tool together. The collet slip endures higher tensile loading than collet finger type release mechanisms and is far less susceptible to fatigue. The collet slip is backed up with a collet slip sleeve to give maximum tensile strength to the disconnect during heavy jarring operations.

Only by dropping a ball and shearing the pins can the collet sleeve shift, allowing the collet and top sub to part. The piston sleeve is pressure balanced, therefore internal pressure does not affect the hydraulic configuration and shear values.

High torque capabilities are achieved through positive torque drive teeth between the top sub and the main body of the tool. The Hydraulic Disconnect is therefore ideally suited for high torque, heavy duty coiled tubing drilling operations where maximum performance and durability is essential.

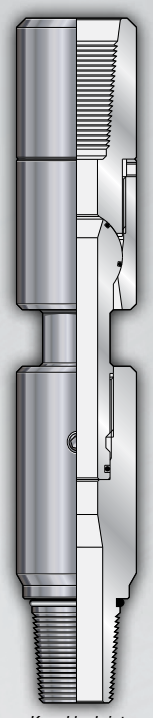
Shear screws can be supplied in either brass or steel to give a comprehensive pressure range to suit virtually any coiled tubing application. Shear screws are also integrally situated to eliminate the possibility of shear screws vibrating free during CT drilling operations.

The standard configuration consists of the maximum flow through bore available, while maintaining maximum tensile strength in the tool. By interchanging the piston sleeve, the drop/trip ball size can be varied to suit the desired toolstring requirements. This is a particularly useful feature when the Hydraulic Disconnect is situated below jars and accelerators, and ID restrictions are a considering factor. Running the Heavy Duty Hydraulic Disconnect below jars and accelerators ensures that if disconnection of the toolstring is necessary, a greater proportion of the toolstring is safely returned to surface.

The Hydraulic Disconnect has been methodically designed to ensure assembly & disassembly of the tool is trouble free.

Dual Circulation Valve - The Dual Circulation Valve offers the traditional method of returning circulation of the toolstring through use of a drop ball. In addition, the valve is capable of operating through internal over pressure within the tubing string.

Knuckle Joint



Knuckle Joint

The Knuckle Joint, when incorporated between the jars and the manipulation tool, will provide additional flexibility in the toolstring. This additional flexibility is often necessary when the bore of the hole the tool is running through is restricted and/or highly deviated.

The Knuckle Joint allows full 360° rotation of the toolstring and provides full 15° angular deviation and internal pressure sealing throughout the full rotation of the tool. The ball and socket of the knuckle provide the rotation and angular deviation of the tool. Seals in the ball provide the sealing capability.

The full flow through bore also allows the use of flow activated tools below the coiled tubing knuckle joint. Multiple coiled tubing knuckle joints can be incorporated in particularly long toolstrings. Where rotation under load is required see the Coiled Tubing Swivel Joint.

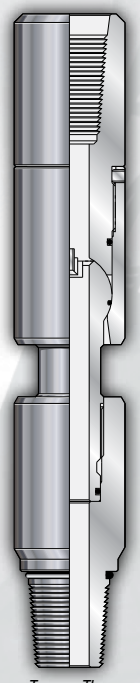
Features and Benefits

- Full flow through bore
- Internal pressure seal
- 15° angular deviation

Knuckle Joint Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C064-061-08	1 11/16″	STD	1.688″	0.500″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C064-052-08	1¾″	STD	1.750″	0.500″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C064-019-09	2⅛″	STD	2.125″	0.750″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C064-050-23	2⅞″	STD	2.875″	1″	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C064-077-10	3⅛″	STD	3.125″	1″	2⅜″ REG Box	2⅜″ REG Pin	5000 PSI
C064-102-08	1½″	H2S	1.500″	0.375″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C064-067-08	1¾″	H2S	1.750″	0.500″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C064-105-09	2⅛″	H2S	2.125″	0.750″	1½″ AMMT Box	1½″ AMMT Pin	3000 PSI

Torque-Thru Knuckle Joint



Torque-Thru Knuckle Joint

The Torque Thru Knuckle Joint, when incorporated between the jars and the manipulation tool, will provide additional flexibility in the toolstring. This additional flexibility is often necessary when the bore of the hole the tool is running through is restricted and/or highly deviated. The Torque Thru Knuckle Joint can be used when rotation of the toolstring is not required, for example, coiled tubing drilling applications.

The Knuckle Joint provides full 15° angular deviation and internal pressure sealing throughout the full deviation of the tool. The ball and socket of the knuckle have a key that prevents rotation but still allows full angular movement.

The full flow through bore also allows the use of flow activated tools below the Knuckle Joint.

Multiple coiled tubing torque thru knuckle joints can be incorporated in particularly long toolstrings.

Features and Benefits

- Full flow through bore
- Internal pressure seal
- 15° angular deviation
- Torque Thru capability

Torque-Thru Knuckle Joint Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C064-064-08	1 11/16″	STD	1.688″	0.50″	1″ AMMT Box	1″ AMMT Pin	3000 PSI
C064-053-08	1¾″	STD	1.75″	0.50″	1″ AMMT Box	1″ AMMT Pin	3000 PSI
C064-066-08	1 11/16″	H2S	1.688″	0.50″	1″ AMMT Box	1″ AMMT Pin	3000 PSI
C064-059-08	1¾″	H2S	1.75″	0.50″	1″ AMMT Box	1″ AMMT Pin	3000 PSI
C064-060-09	2⅛″	H2S	2.125″	0.75″	1½″ AMMT Box	1½″ AMMT Pin	3000 PSI
C064-073-09	2¼″	H2S	2.25″	0.75″	1½″ AMMT Box	1½″ AMMT Pin	3000 PSI
C064-085-09	2⅜″	H2S	2.375″	0.75″	1½″ AMMT Box	1½″ AMMT Pin	3000 PSI
C064-078-23	3⅛″	H2S	3.125″	1.00″	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI

Swivel Joint

The Swivel Joint is a standard toolstring component which when used, permits full rotation of the Bottom Hole Assembly (BHA) made up below the joint.

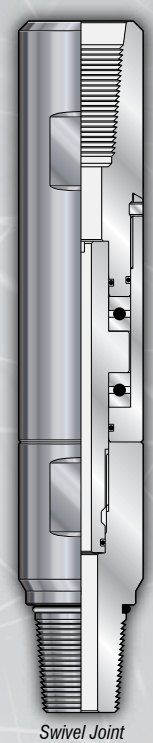
The Swivel's design includes integral sealed bearings which ensure full integrity of flow through the joint.

The inclusion of a Swivel Joint in a typical BHA gives the operator orientation flexibility. A CT Swivel Joint in a BHA will allow the toolstring to be broken and made-up below the joint without the need to disconnect from the coil.

The Swivel Joint is necessary where toolsting orientation is required such as in the running and pulling of gas lift mandrels.

Features and Benefits

- Full range of sizes available
- Sealed bearings for integrity of flow
- Maximum flow area



Swivel Joint

Swivel Joint Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C091-027-09	2⅛"	STD	2.125"	0.375"	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C091-024-09	2¼"	STD	2.25"	0.375"	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C091-041-23	2⅞"	STD	2.875"	0.87"	2⅜" PAC Box	2⅜" PAC Pin	5000 PSI
C091-034-10	3⅛"	STD	3.125"	1.125"	2⅜" REG Box	2⅜" REG Pin	5000 PSI
C091-029-08	1 1⁄16"	H2S	1.687"	0.5"	1" AMMT Box	1" AMMT Pin	5000 PSI
C091-058-08	1¾"	H2S	1.75"	0.5"	1" AMMT Box	1" AMMT Pin	5000 PSI
C091-031-09	2⅛"	H2S	2.125"	0.375"	1½" AMMT Box	1½" AMMT Pin	5000 PSI

Back Pressure Valve

The Coiled Tubing Back Pressure Valve is a coiled tubing string component that provides a circulation path against a predetermined back pressure. It is ideally suited to operations when the hydrostatic pressure within the coiled tubing needs to be higher than the pressure in the annulus areas.

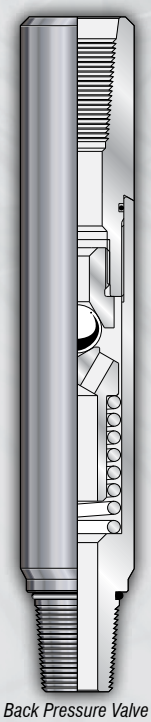
The design of the Coiled Tubing Back Pressure Valve allows for an on-site determination of back pressure to be set at surface. This is achieved with the use of different ball diameters to increase/ decrease the piston area and pressure required to open the valve.

*Coiled Tubing Back Pressure Valves are not ideally suited for cementing or abrasive fluids.

For calibrated fluid delivery valves please see Coiled Tubing Cement Valves (see page 75).

Features and Benefits

- Metal to metal sealing
- Ball & cage design protects components from 'wash out'
- Site adjustable settings
- Simple design allows easy maintenance

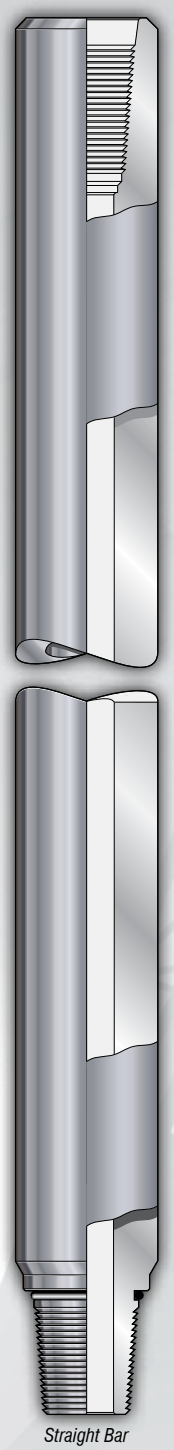


Back Pressure Valve

Back Pressure Valve Technical Specifications

Part Number	Size	Service	Max OD	Top Connection	Bottom Connection	Working Pressure
C180-008-08	1 1⁄16"	STD	1.688"	1" AMMT Box	1" AMMT Pin	5000 PSI
C180-003-08	1¾"	STD	1.750"	1" AMMT Box	1" AMMT Pin	5000 PSI
C180-009-09	2⅛"	STD	2.125"	1½" AMMT Box	1½" AMMT Pin	5000 PSI
C180-014-08	1 1⁄16"	H2S	1.688"	1" AMMT Box	1" AMMT Pin	5000 PSI
C180-037-08	1¾"	H2S	1.750"	1" AMMT Box	1" AMMT Pin	5000 PSI
C180-015-09	2⅛"	H2S	2.125"	1½" AMMT Box	1½" AMMT Pin	5000 PSI

Straight Bar



Straight Bar

The Straight Bar provides a means of extending the toolstring, while maintaining the maximum through bore. The tubular section between the top & bottom sub can be interchanged to vary the length of the straight bar. This approach offers an ideal way of spacing out tools within the toolstring, without compromising the flow requirements of flow activated or jetting tools.

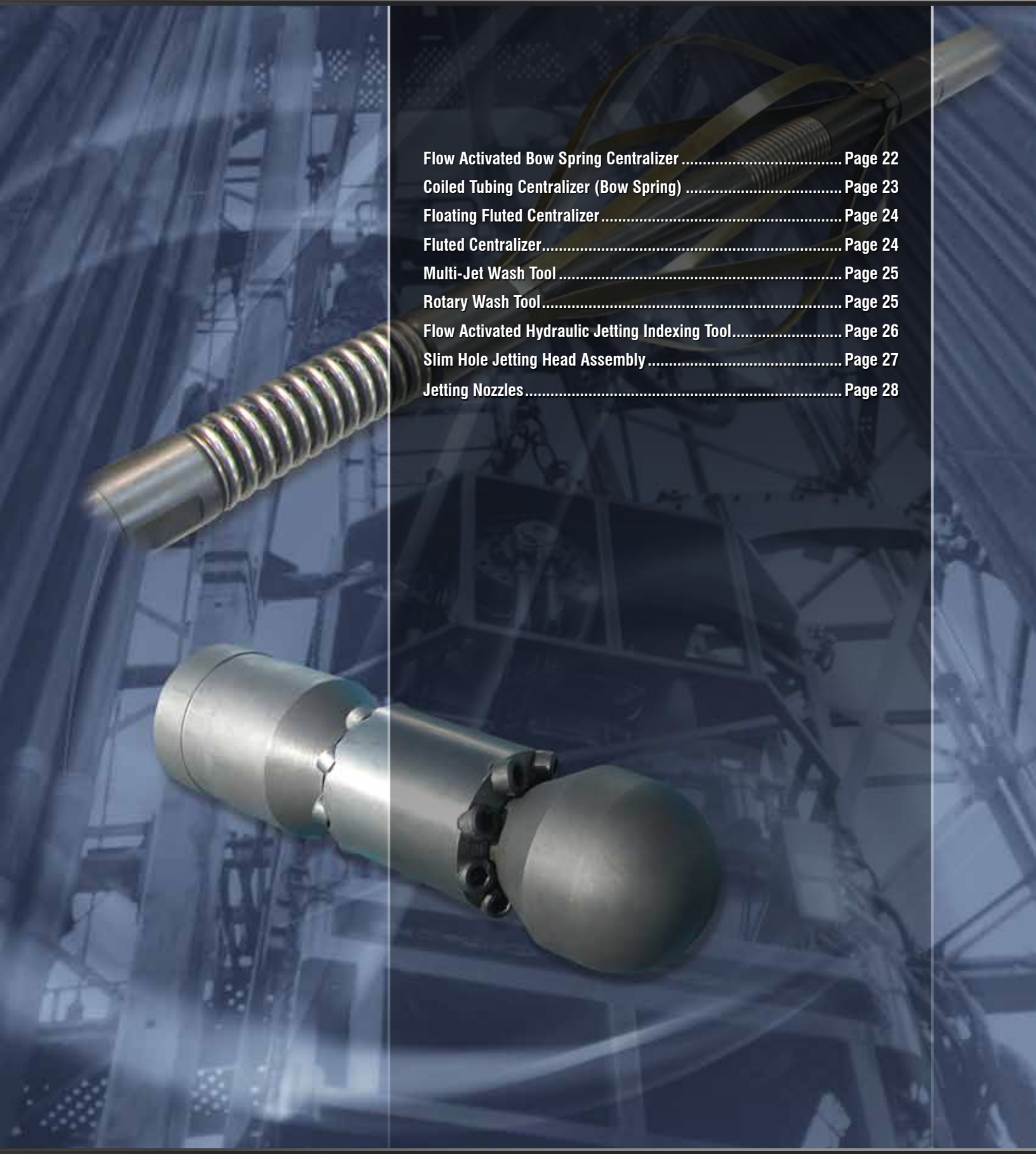
Features and Benefits

- Full flow through bore
- Solid construction

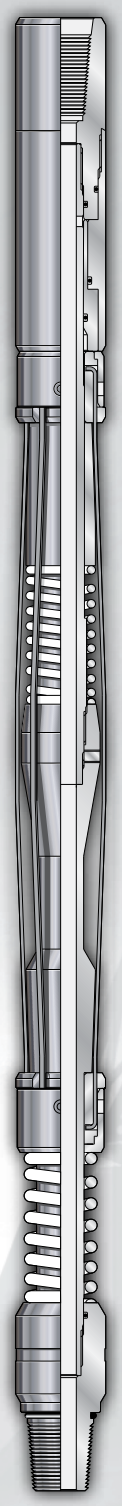
Straight Bar Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Length	Top Connection	Bottom Connection	Working Pressure
C193-001-08	1 1/16″	H2S	1.688″	0.75″	2 ft	1″ AMMT BOX	1″ AMMT PIN	5000 PSI
C193-027-08	1 1/16″	H2S	1.688″	0.75″	3 ft	1″ AMMT BOX	1″ AMMT PIN	5000 PSI
C193-003-08	1 1/16″	H2S	1.688″	0.75″	5 ft	1″ AMMT BOX	1″ AMMT PIN	5000 PSI
C193-006-08	1¾″	H2S	1.750″	0.75″	3 ft	1″ AMMT BOX	1″ AMMT PIN	5000 PSI
C193-045-08	1¾″	H2S	1.750″	0.75″	4 ft	1″ AMMT BOX	1″ AMMT PIN	5000 PSI
C193-020-08	1¾″	H2S	1.750″	0.75″	5 ft	1″ AMMT BOX	1″ AMMT PIN	5000 PSI
C193-037-09	2″	H2S	2.000″	1″	3 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-046-09	2″	H2S	2.000″	1″	5 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-009-09	2⅛″	H2S	2.125″	1″	2 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-028-09	2⅛″	H2S	2.125″	1″	3 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-030-09	2⅛″	H2S	2.125″	1″	4 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-032-09	2⅛″	H2S	2.125″	1″	5 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-033-09	2¼″	H2S	2.250″	1″	3 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-034-09	2¼″	H2S	2.250″	1″	5 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-029-09	2⅜″	H2S	2.375″	1″	3 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-040-09	2⅜″	H2S	2.375″	1″	5 ft	1½″ AMMT BOX	1½″ AMMT PIN	5000 PSI
C193-031-23	2⅞″	H2S	2.875″	1.25″	2 ft	2⅜″ PAC BOX	2⅜″ PAC PIN	5000 PSI
C193-041-23	2⅞″	H2S	2.875″	1.25″	5 ft	2⅜″ PAC BOX	2⅜″ PAC PIN	5000 PSI
C193-047-23	3⅛″	H2S	3.125″	1.25″	4 ft	2⅜″ PAC BOX	2⅜″ PAC PIN	5000 PSI
C193-014-23	3⅛″	H2S	3.125″	1.25″	5 ft	2⅜″ PAC BOX	2⅜″ PAC PIN	5000 PSI

REMEDIAL TOOLS



Flow Activated Bow Spring Centralizer



Flow Activated Bow Spring Centralizer

The Flow Activated Bow Spring Centralizer is designed so that it's bow springs are normally retracted. The bow springs only expand when a pressure differential is achieved across the tool. This enables the centralizer to pass, for example, through the restricted bores of the tail pipe and expand into the casing liner below without any unnecessary wear on the bow springs.

As a safety precaution, the bow springs are mounted above a coil spring. This is to allow the bow springs the necessary movement they require in order to pass through a restricted bore while still expanded.

Features and Benefits

- Full flow through bore
- Safety feature which allows bow springs movement when meeting restrictions in expanded condition, therefore preventing bow spring damage

Flow Activated Bow Spring Centralizer Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C082-062-08	1 11/16" - 5"	Std	5"	0.51"	1" AMMT Box	1" AMMT Pin	300 Psi
C082-065-09	2 1/8" - 7"	Std	7"	.75"	1 1/2" AMMT Box	1 1/2" AMMT Pin	500 Psi
C082-057-09	2.7" - 8"	Std	8"	15/16"	1 1/2" AMMT Box	1 1/2" AMMT Pin	500 Psi
C082-076-23	3 1/8"	Std	8"	15/16"	2 3/8" Pac Box	2 3/8" Pac Pin	500 Psi
C082-083-08	1 11/16" - 6.5"	H2s	6.5"	0.51"	1" AMMT Box	1" AMMT Pin	300 Psi
C082-084-09	2 1/8" - 7"	H2s	7"	.75"	1 1/2" AMMT Box	1 1/2" AMMT Pin	500 Psi

Coiled Tubing Centralizer (Bow Spring)

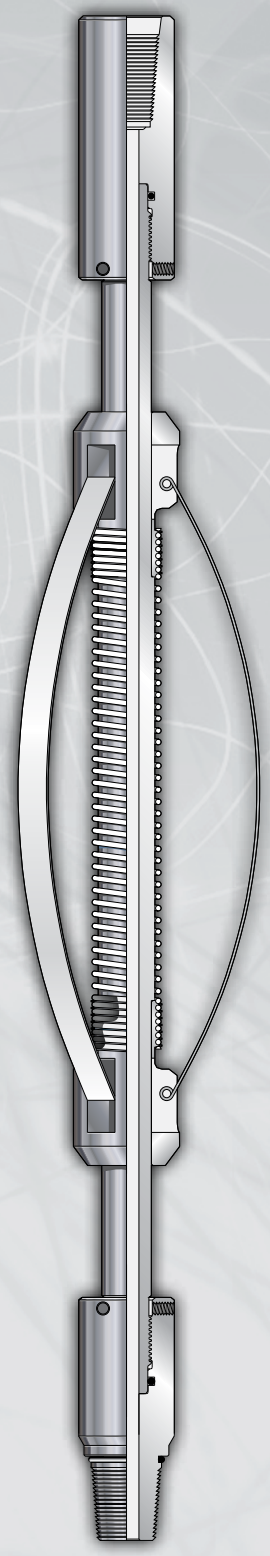
The Coiled Tubing Centralizer (Bow Spring) is designed for use with coiled tubing toolstrings or when running downhole gauges out through the tail pipe and into the casing.

The Coiled Tubing Centralizer (Bow Spring) is able to pass through the restricted bores of the tail pipe and expand into the casing liner below thus enabling the tools to be held away from the casing.

Logging, fishing, camera work, liner lap crossing, etc. are only a few challenges for this proven tool. A full pump through bore, modular or custom threads and resistance to corrosion makes this centralizer a necessary component for speciality work.

Features and Benefits

- Ease of use
- Easy redress
- Multiple applications

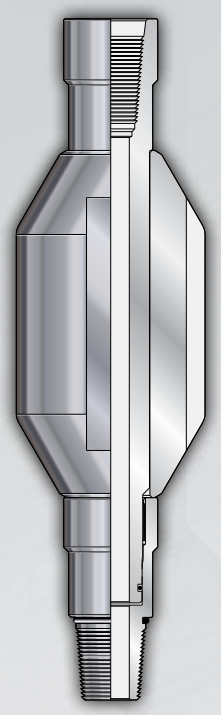


CT Centralizer (Bow Spring)

Mechanical Bow Spring Centralizer Technical Specifications

Part Number	Size	Service	Top Connection	Bottom Connection	OD	ID	Free OD
831-060	1 11/16″	STD	1″ AMMT	1″ AMMT	1 11/16″	¼″	19″
833-100	2⅛″	H2s	1½″ AMMT	1½″ AMMT	2⅛″	¾″	21″

Floating Fluted Centralizer



Floating Fluted Centralizer

The NOV Floating Fluted Centralizer is a CT tool designed to ensure that the work string and BHA is at its most central position, especially during operations in deviated wells.

The NOV Floating Fluted Centralizer comprises a central carrier mandrel capable of housing a number of interchangeable 'floating' slip over fluted centralisers of different sizes. As such, it is more versatile/ economical than a single piece centralizer.

Normally attached to the tool string just above the running/ pulling tool or fishing tool, the Floating Centralizer OD is machined to suit the ID of the tubing in which it is to be run. This allows the tool to be used as a tubing drift or gauge in addition to centralizing the tool string.

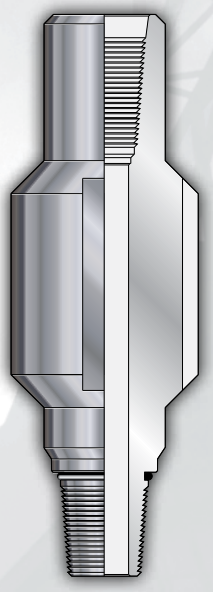
Features and Benefits

- Single mandrel suits multiple centralizer diameters
- Tool string can be oriented without rotating the centralizer
- String tensile strength is maintained
- Bore diameter is maintained

Floating Fluted Centralizer Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Length	Top Connection	Bottom Connection	Working Pressure
C082-127-08	1.687″ x 1.25″	H2s	1.687″	0.63″	18.8″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C082-122-09	2.12″	H2s	2.125 ″	1″	17.4″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C082-126-09	2⅜″	H2s	2.375″	1″	23.3″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI

Fluted Centralizer



Fluted Centralizer

The Fluted Centralizer is designed to be included as part of the coiled tubing work string to assist in providing centralization to allow easier location of tools during fishing or to provide general stability in the tubing.

The Fluted Centralizer has a full flow through bore allowing passage of darts or drop balls and is available in any specific length.

The Fluted Centralizers are available in all common sizes.

Features and Benefits

- Full flow through bore
- Solid one piece construction

Fluted Centralizer Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C082-073-08	1.562″	STD	1.75″	0.75″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C082-132-08	1¾″	STD	2.75″	0.5″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C082-117-08	1½″	H2S	1.65″	0.75″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C082-125-08	1½″	H2S	1.7″	0.75″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C082-103-08	1 1⁄16″	H2S	2″	0.75″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C082-119-09	2.0″	H2S	2.25″	1″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C082-124-09	2.125″	H2S	2.35″	1″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C082-120-09	2.0″	H2S	2.5″	1″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C082-079-09	2.125″	H2S	2.87″	1″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI

Multi-Jet Wash Tool

The Multi-Jet Wash Tool is a non-rotational wash tool with simple grub screw nozzles that are field adjustable.

Multi-Jet Wash Tools are normally used in conjunction with the Flow Activated Hydraulic Jetting Indexing Tool.

The Multi-Jet Wash Tools are available a range of sizes.

Features and Benefits

- Simple and robust construction
- Easily field redressed
- Adjustable flow ports

Rotary Wash Tool

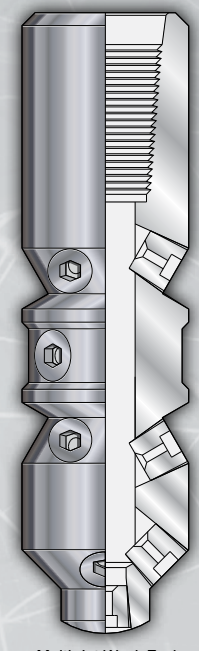
The Rotary Jet Wash Tool is designed to be used for both jetting and circulating operations when cleaning and washing the inside of the tubing. It can also be used to assist in the manipulation of the coiled tubing string both in and out of the well.

The design of the Rotary Jet Wash Tool works on the principal of applied fluid pressure causing the nozzle to rotate and jet the fluid against the tubing wall in a full 360° rotating action.

The Rotary Jet Wash Tools are available in a range of sizes.

Features and Benefits

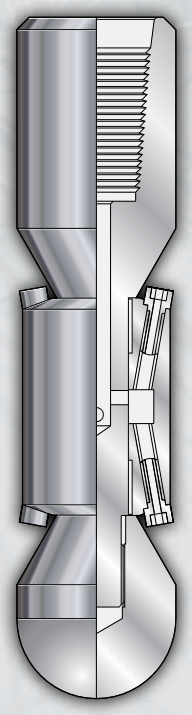
- Forward and reverse jetting
- Numerous jetting options
- Simple design



Multi-Jet Wash Tool

Multi-Jet Wash Tool Technical Specifications

Part Number	Size	Service	Max OD	Top Connection	Working Pressure
C162-006-08	1¾″	STD	1.75″	1″ AMMT Box	5,000 PSI
C162-009-09	2⅛″	STD	2.125″	1½″ AMMT Box	5,000 PSI
C162-003-10	3⅛″	STD	3.125″	2⅜″ REG Box	5,000 PSI
C162-038-08	1 11⁄16″	H2S	1.688″	1″ AMMT Box	5,000 PSI
C162-022-08	1¾″	H2S	1.75″	1″ AMMT Box	5,000 PSI
C162-039-09	2⅛″	H2S	2.125″	1.5″ AMMT Box	5,000 PSI
C162-040-09	2⅜″	H2S	2.375″	1.5″ AMMT Box	5,000 PSI
C162-007-23	2⅞″	H2S	2.875″	2⅜″ PAC Box	5,000 PSI

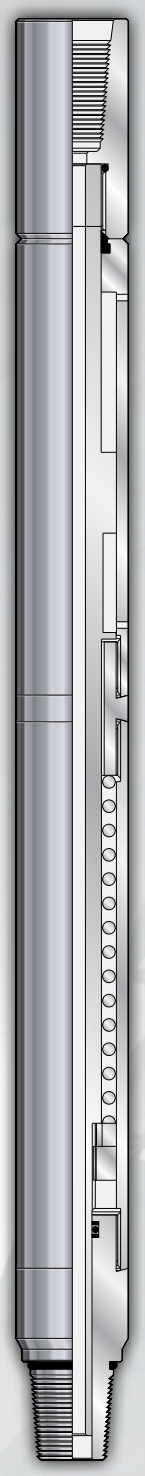


Rotary Wash Tool

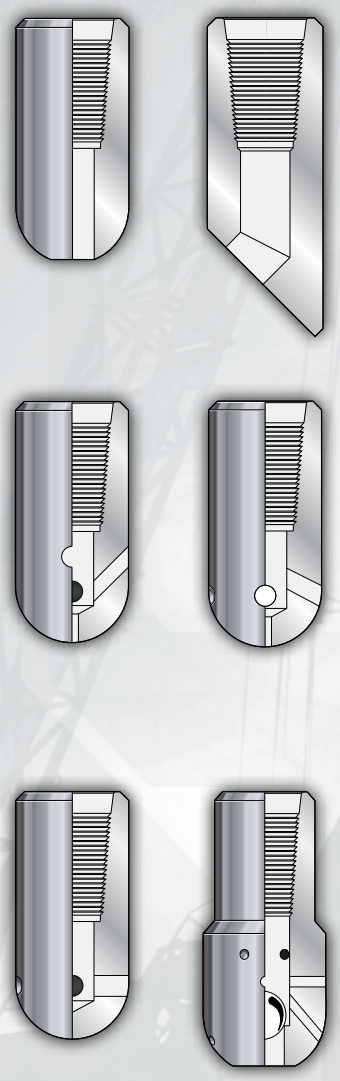
Rotary Wash Tool Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Working Pressure
C162-018-08	1 11⁄16″	STD	1.688″	0.312″	1″ AMMT Box	5,000 PSI
C162-005-08	1¾″	STD	1.75	0.312″	1″ AMMT Box	5,000 PSI
C162-014-09	2⅛″	STD	2.125″	0.160″	1½″ AMMT Box	150PSI
C162-044-23	2⅞″	STD	2⅞″	0.750″	2⅜″ PAC Box	5,000 PSI
C162-015-10	3.125″	STD	3.125″	0.88″	2⅜″ API Reg Box	5,000 PSI
C162-033-08	1 11⁄16″	H2S	1.688″	0.312″	1″ AMMT Box	5,000 PSI
C162-016-08	1¾″	H2S	1.75″	0.312″	1″ AMMT Box	5,000 PSI
C162-017-09	2⅛″	H2S	2.125″	0.750″	1½″ AMMT Box	5,000 PSI
C162-034-09	2⅜″	H2S	2.375″	0.750″	1½″ AMMT Box	5,000 PSI

Flow Activated Hydraulic Jetting Indexing Tool



Flow Activated Hydraulic Jetting Indexing Tool



Nozzle Options (See page XX)

The Flow Activated Hydraulic Jetting Indexing Tool is designed to rotate jetting wash nozzles, to allow full 360° bore coverage.

The Jetting Indexing Tool is rotated in a controlled 45° or 60° incremental manner by applying intermittent surface pump pressure.

When flow pressure is increased to the index operating pressure, the lower half of the tool strokes downwards and indexes. Maintaining the pressure then allows the increased flow to jet through the jetting wash nozzle. When the flow pressure is decreased the tool strokes back and completes the indexing cycle. By repeating this operation, a full 360° wash cycle can be achieved.

A range of jetting nozzles can be supplied with the Jetting Indexing Tool, (see page 28) for more detail.

Features and Benefits

- Flow activated (No drop balls required)
- Low pressure actuation
- Full bore opening for high pressure rates
- Easy to operate
- Simple construction
- 6 x 60° or 8 x 45° rotation options available

Flow Activated Hydraulic Jetting Indexing Tool Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connector	Bottom Connector	Working Pressure
C163-019-08	1¾"	STD	1.750"	0.250"	1" AMMT Box	1" AMMT Pin	3000 PSI
C163-035-09	2.375"	STD	2.375"	0.5"	1½" AMMT Box	1½" AMMT Pin	3000
C163-020-10	3.125"	STD	3.12"	0.75"	2⅜" REG Box	2⅜" REG Pin	5000 PSI
C163-021-08	1¾"	H2s	1.750"	0.250"	1" AMMT Box	1" AMMT Pin	3000 PSI

Slim Hole Jetting Head Assembly

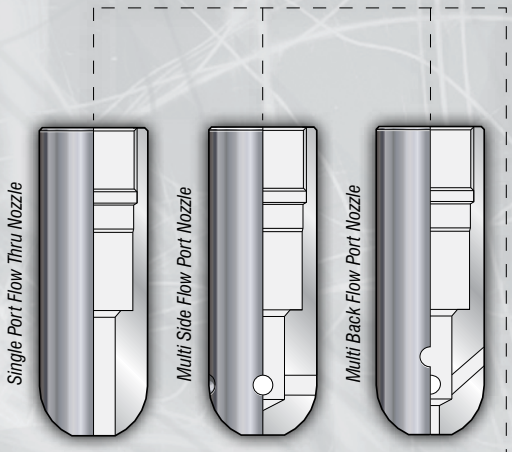
The Slim Hole Jetting Head Assembly provides the operator with a jetting wash tool assembly that is the same diameter as the coiled tubing. The Flapper Check Valve Cartridge is used as the prime safety barrier to prevent back flow up the coiled tubing should control of the pump or ancillary surface equipment be lost at surface for any reason. By incorporating a conventional Roll-On Connector, and facilitating the choice of Jetting Nozzles, Wash Tools or other slim hole tools into the integrated design, the Slim Hole Jetting Head Assembly becomes the ideal tool for all slim hole applications.

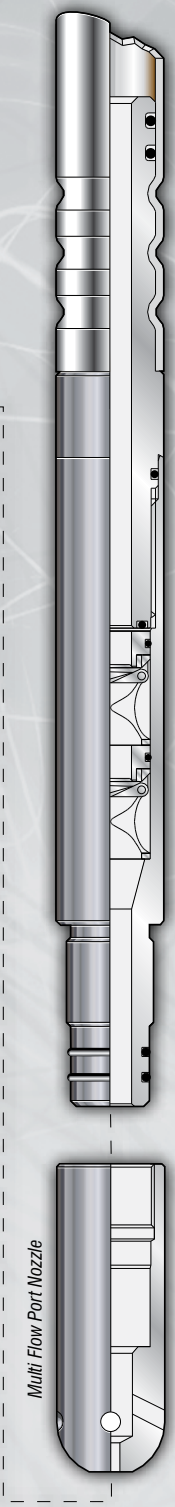
Features and Benefits

- One simple roll-on connection to the coiled tubing for easy field service
- Roll-on connectors are interchangeable to accommodate different coil weights
- Twin Flapper Cartridges are used in the assembly to give a double safety barrier
- Maximum flow area through the Flapper Cartridges reduces unnecessary back pressure on the surface pumps
- The flow path through the Flapper Cartridges does not restrict the passage of balls or darts if required during operations such as cementing
- The Flapper Cartridges are a field proven construction using the latest material technology to provide the best possible field life
- The unique characteristic of the cartridge and flapper seal is the twin seal. This provides a low pressure Teflon seal and a high pressure metal to metal seal

Other sizes are available on request together with details of other application tools which can be used with the Slim Hole Jetting Head Assembly.

For larger coil sizes (1¾″, 2″, 2⅜″ etc.), please see page 10 for Roll-On Connectors, page 11 for Twin Flapper Check Valves & page 28 for Jetting Nozzles.





Slim Hole Jetting Head Assembly

Slim Hole Jetting Head Assembly Technical Specifications

Part Number	Flow Port Nozzle Type	Size	Service	Max OD	Min ID	Top Connection	Working Pressure
C189-010/087	Multi Flow Port Nozzle	1.25″	STD	1.25″	0.375″	1.00″ X 0.087″ CT	5000 PSI
C189-001/095	Multi Flow Port Nozzle	1.25″	STD	1.25″	0.5″	1.25″ X 0.095″ CT	5000 PSI
C189-006/095	Single Flow Port Nozzle	1.25″	STD	1.25″	0.5″	1.25″ X 0.095″ CT	5000 PSI
C189-007/095	Multi Side Flow Port Nozzle	1.25″	STD	1.25″	0.5″	1.25″ X 0.095″ CT	5000 PSI
C189-001/102	Multi Flow Port Nozzle	1.25″	STD	1.25″	0.5″	1.25″ X 0.102″ CT	5000 PSI
C189-004/109	Multi Back Flow Port Nozzle	1.25″	STD	1.25″	0.5″	1.25″ X 0.109″ CT	5000 PSI
C189-001/109	Multi Flow Port Nozzle	1.25″	STD	1.25″	0.5″	1.25 X 0.109″ CT	5000 PSI
C189-001/125	Multi Flow Port Nozzle	1.25″	STD	1.25″	0.5v	1.25″ X 0.125″ CT	5000 PSI
C189-011/109	Multi Back & Down Flow Port Nozzle	1.50″	STD	1.5″	0.5″	1.50″ X 0.109″ CT	5000 PSI
C189-002/109	Multi Flow Port Nozzle	1.50″	STD	1.5″	0.5″	1.50″ X 0.109″ CT	5000 PSI
C189-005/109	Multi Side Flow Port Nozzle	1.50″	STD	1.5″	0.5″	1.50″ X 0.109″ CT	5000 PSI
C189-003/109	Multi Back Flow Port Nozzle	1.50″	STD	1.5″	0.5″	1.50v X 0.109″ CT	5000 PSI
C189-009/109	Multi Side +1D Flow Port Nozzle	1.50″	STD	1.5″	0.5″	1.50″ X 0.109″ CT	5000 PSI
C189-002/125	Multi Flow Port Nozzle	1.50″	STD	1.5″	0.5″	1.50″ X 0.125″ CT	5000 PSI

Jetting Nozzles

Single Port Flow Thru Nozzle Technical Specifications

Part Number	Size	Service	Max OD	Nozzle Port Configuration	Top Connetion	Working Pressure
02-29228	1.687″	H2S	1.687″	1″ x 0.25″	1″ AMMT Box	5000 PSI
02-29236	2.125″	H2S	2.125″	1″ X 0.5″	1½″ AMMT Box	5000 PSI
02-29245	2.375″	H2S	2.375″	1″ x 0.75″	1½″ AMMT Box	5000 PSI

Single Port Muleshoe Nozzle Technical Specifications

02-29230	1.687″	H2S	1.687″	1″ x 0.625″ @ 45°	1″ AMMT Box	5000 PSI
02-29243	2.125″	H2S	2.125″	1″ x 0.875″ @ 45°	1½″ AMMT Box	5000 PSI
02-29249	2.375″	H2S	2.375″	1″ x 0.875″ @ 45°	1½″ AMMT Box	5000 PSI

Multiple Back Flow Nozzle Technical Specifications

02-33788	1.687″	H2S	1.687″	4″ x .25″ @ 135°	1″ AMMT Box	5000 PSI
02-30229	2.125″	H2S	2.375″	4″ x .25″ @ 135°	1½″ AMMT Box	5000 PSI

Multiple Side Flow Nozzle Technical Specifications

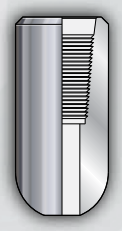
02-29233	1.687″	H2S	1.687″	4″ x .25″ @ 90°	1″ AMMT Box	5000 PSI
02-29238	2.125″	H2S	2.125″	4″ x .25″ @ 90°	1½″ AMMT Box	5000 PSI
02-29247	2.375″	H2S	2.375″	4″ x .312″ @ 90°	1½″ AMMT Box	5000 PSI

Multiple Flow Port Nozzle Technical Specifications

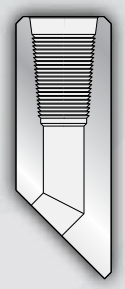
02-29229	1.687″	H2S	1.687″	4″ x .25″ @ 45°	1″ AMMT Box	5000 PSI
02-29237	2.125″	H2S	2.125″	4″ x .25″ @ 45°	1½″ AMMT Box	5000 PSI
02-29246	2.375″	H2S	2.375″	4″ x .312″ @ 45°	1½″ AMMT Box	5000 PSI

Multiple Up Flow Nozzle Technical Specifications

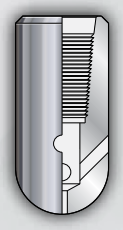
C162-035-08	1.687″	H2S	1.687″	4″ x .25″ @ 45°	1″ AMMT Box	5000 PSI
C162-036-09	2.125″	H2S	2.125″	4″ x .25″ @ 45°	1½″ AMMT Box	5000 PSI
C162-037-09	2.375″	H2S	2.375″	4″ x .312″ @ 45°	1½″ AMMT Box	5000 PSI



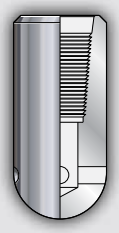
Single Port Flow Thru Nozzle



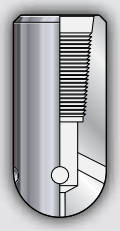
Single Port Muleshoe Nozzle



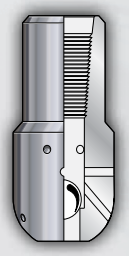
Multiple Back Flow Nozzle



Multiple Side Flow Nozzle

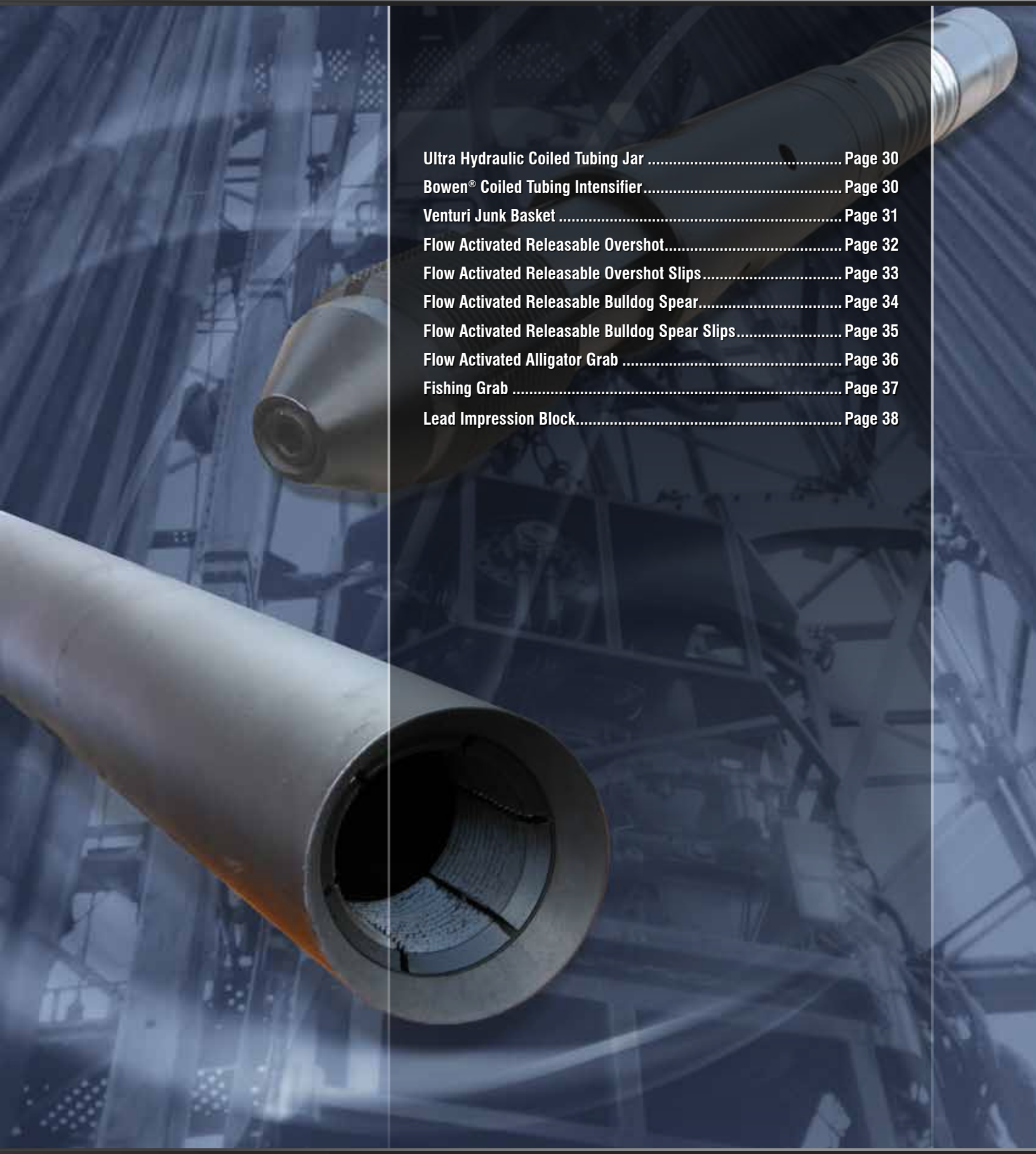


Multiple Flow Port Nozzle

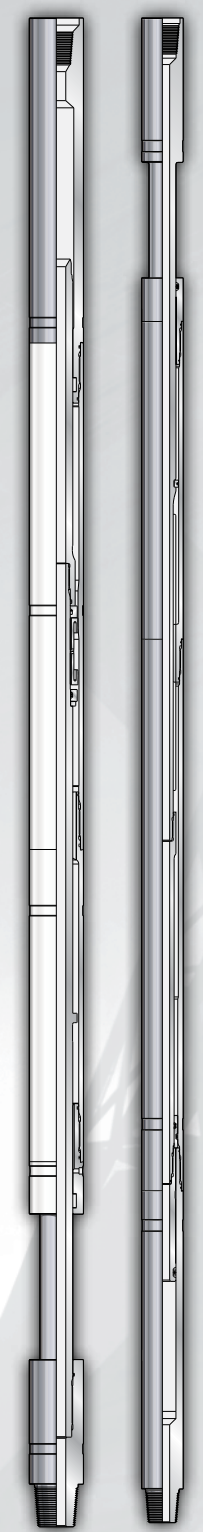


Multiple Up Flow Nozzle

FISHING TOOLS



Ultra Hydraulic Coiled Tubing Jar



Ultra Hydraulic CT Jar *Bowen CT Intensifier*

The Ultra Coiled Tubing Jar is a new bi-directional hydraulic CT jarring assembly. It is designed to operate in conjunction with the NOV Coiled Tubing Jar Intensifier. This jar's unique design allows for easy, dependable, hard hitting operation. No setting or adjustment is required before going in the hole or during operation. The assembly allows the operator to easily control the intensity of jarring impacts by varying the applied load. The jar can deliver a wide range of impacts, from low to very high impact and impulse forces. The new Patent Pending technology within the assembly allows the tool to deliver higher impacts.

To compliment the new Ultra CT Jar we have designed a new jar placement program that provides impacts at the stuck point for Service Companies and Operators to use. We are excited to offer this new Ultra CT Jar solution to the industry.

Features and Benefits

- Full hydraulic operation
- Variable impact control
- A series of impacts can be applied without having to apply the reverse jarring cycle
- Increased Impact Ratios above existing industry tools
- Industry leading Impact Values
- Shorter more robust design
- Enhanced Seal Technology to ensure reliability
- New CT Jar Placement Program, which provides Service Companies and Operators:
  - Impacts at STUCK POINT, not just Jar
  - Allows Service Company to optimize the BHA to deliver the hardest impact & impulse
  - Considers configuration and length of fish, hole profile, friction, mud weight affects, CT size, etc
  - Program designed only for NOV tools - All calculations and results are based on NOV tools
  - Customers can download program for free to run themselves at www.nov.com
  - NOV offers free technical support on the program and our tools 24-7 at: 1-888-DHT-TOOL

  We will run jar impact calculations for customers through the 24-hr Hotline.

Ultra Hydraulic Coiled Tubing Jar Technical Specifications

Part Number	OD	ID	Length	Connection	Stroke	Service
505485/005	1 11/16″	0.562″	57½″	1″ AMMT	11″	Standard
505494/005	2⅛″	0.75″	61¾″	1½″ AMMT	12″	Standard
504980/005	2⅞″	1″	68¼″	2⅜″ AM-PAC	12″	Standard

Bowen® Coiled Tubing Intensifier

The Coiled Tubing Intensifier are straight pull-and-push jarring tools that employ patented combinations of hydraulics and mechanics. Their unique design allow for easy and dependable operation. No setting or adjustment is required before going in the hole or after the fish is engaged. The operator can easily and simply control the intensity of the jarring blows by varying the applied load.

The Ultra Coiled Tubing Jar can deliver a wide range of blows, from low to very high impact and impulse forces. The Coiled Tubing Intensifier is designed to operate in conjunction with the Ultra Coiled Tubing Jar to supply force acceleration during the jarring stroke. The comparatively large I.D. permits the use of drop balls to actuate the tools below the Jar.

Bowen Coiled Tubing Intensifier Technical Specifications

Part Number	OD	ID	Length in Neutral Position	Total Stroke	Connection	Service
155969/010	1 11/16″	9/16″	76″	6″	1″ AMMT	STD
154412/010	2⅛″	¾″	87″	7″	1½″ AMMT	STD
156341/010	2⅞″	1″	104″	8″	2⅜″ AM PAC	STD
154440/010	3⅛″	1¼″	104″	8″	2⅜″ REG	STD

Venturi Junk Basket

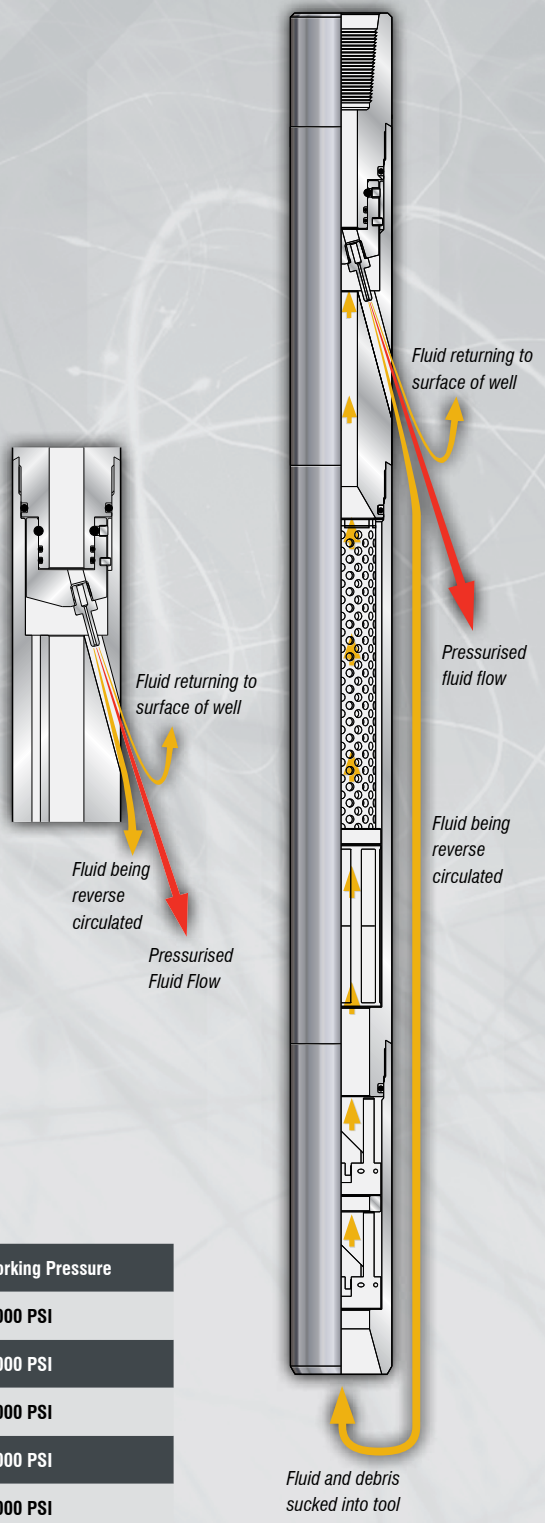
The Venturi Junk Basket is a tool which is used to retrieve junk and debris out of the well bore. When fluid is pumped through the string of the coiled tubing and out through the nozzles in the venturi chamber, a vacuum is created in the venturi chamber. Fluid is sucked from the bottom of the tool exit back through the venturi tubes. Most of this fluid mixes with the pressurised fluid to be re-circulated around the bottom of the tool.

The tool is essentially a high powered vacuum cleaner that may be used with fluid, nitrogenated fluids or gases. The nozzles in the tool are simply changed out for the available pump rate, fluid or gas. A debris filter screen is placed before the venturi chamber to prevent debris from blocking the venturi tubes.

A hollow magnetic section with a finger type trap catches junk and debris, which is then carried from the well inside the tool.

Barrel extensions are available to increase the volume of junk which may be carried.

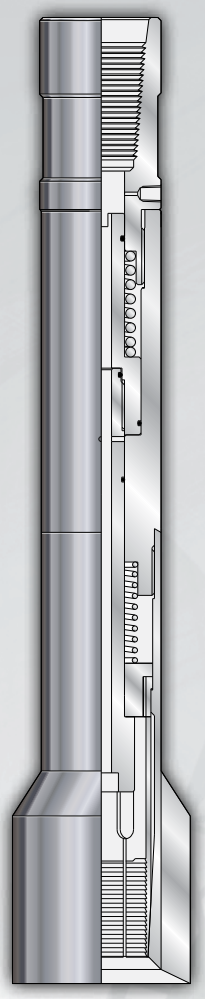
The tool is not dependent on hole size to work, so for example you could use a 3⅛″ OD tool to retrieve debris from 7″ casing.



Venturi Junk Basket Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Working Pressure
C183-006-08	1¾″	STD	1.75″	0.469″	1″ AMMT Box	5,000 PSI
C183-007-09	2 1/16″	STD	2.062″	1″	1½″ AMMT Box	5,000 PSI
C183-011-09	2¼″	STD	2.062″	1″	1½″ AMMT Box	5,000 PSI
C183-002-09	2⅝″	STD	2.625″	1.40″	1½″ AMMT Box	5,000 PSI
C183-014-23	3⅛″	STD	3.125″	1″	2⅜″ PAC Pin	5,000 PSI
C183-001-10	3⅛″	STD	3.125″	1″	2⅜″ REG Box	5,000 PSI

Flow Activated Releasable Overshot



Flow Activated
Releasable Overshot

The Flow Activated Releasable Overshot is a variable catch external overshot used to retrieve a lost cylindrical fish from the well bore.

The Flow Activated Releasable Overshot operates in the same way as a standard non-releasable overshot. The tool is run in hole until it latches on the fish and butts out. Pulling up will cause the slips to set into the fish.

Should the fish be irretrievable, the tool can be released from the fish by flow activation and returned to surface.

The Flow Activated Releasable Overshot can be used to fish lost or broken tubing, coil and also coiled tubing tools that have backed off down hole.

The Flow Activated Releasable Overshot can be supplied to overshoot and seal onto a specific fish in order to form a pressure tight seal. This is of importance if there is a flow activated tool beneath the fish that requires operation before the fish can be retrieved.

The Flow Activated Releasable Overshot is also available with 'pack-off' 'o' rings, please contact NOV for more details.

A complete range of hardened and double tempered slips are available for each size tool. See table on page 33 for slip and catch size details.

Features and Benefits

- Internal hammer action assists release
- Flow or drop ball activated
- Hardened & double tempered slips
- Robust construction
- Variable slips sizes for each tool
- Optional bell guides available

Flow Activated Releasable Overshot Technical Specifications

Part Number	Size	Service	Max OD	ID (No Choke)	Top Connection	Size of Grapple in Assy
C090-058-08	1.850″	STD	1.850″	0.390″	1″ AMMT Box	15/16″ to 1 1/16″
C090-068-09	2.125″	STD	2.125″	0.390″	1½″ AMMT Box	13/16″ to 15/16″
C090-064-09	2.250″	STD	2.250″	0.390″	1½″ AMMT Box	1 7/16″ to 1 9/16″
C090-055-09	3″	STD	2.625″	0.390″	1½″ AMMT Box	1 7/8″ to 2 1/16″
C090-056-23	3.250″	STD	3.25″	0.390″	2 3/8″ PAC Box	2" to 2 3/16″
C090-057-23	3.800″	STD	3.800″	0.390″	2 3/8″ PAC Box	2 3/8″ to 2 5/8″
C090-124-10	4.500″	STD	4.500″	0.390″	2 3/8″ REG Box	2 7/8″ to 3 1/8″
C090-086-08	2″	H2S	1.850″	0.390″	1" AMMT Box	15/16″ to 1 1/16″
C090-110-09	2.125″	H2S	2.125″	0.390″	1½″ AMMT Box	1 7/16″ to 1 9/16″
C090-087-09	2.500″	H2S	2.250″	0.390″	1½″ AMMT Box	1 7/16″ to 1 9/16″
C090-088-09	3″	H2S	2.625″	0.390″	1½″ AMMT Box	1 7/8″ to 2 1/16″
C090-089-23	3.500″	H2S	3.250″	0.390″	2 3/8″ PAC Box	2″ to 2 3/16″
C090-123-23	3.800″	H2S	3.800″	0.390″	2 3/8″ PAC Box	2 3/8″ to 2 5/8″

Flow Activated Releasable Overshot Slips

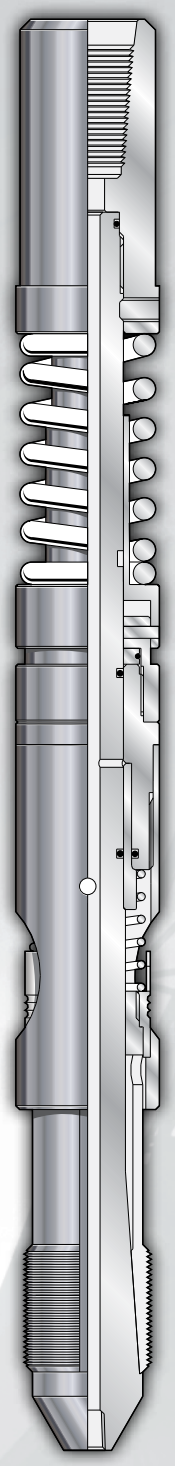
Typical Flow Activated Releasable Overshot Slips Flow Activated Releasable Overshot Slips

Flow Activated Releasable Overshot Hardened Slips

Nominal Size	2″	2½″	3″	3½″	4″
Actual O.D.	1.850″	2.250″	2.625″	3.250″	3.800″
Nominal Slip Size	Catch Range (Part Number)	Catch Range (Part Number)	Catch Range (Part Number)	Catch Range (Part Number)	Catch Range (Part Number)
½″	7⁄16″ to 9⁄16″ (00-16024)	7⁄16″ to 9⁄16″ (00-16032)	3⁄8″ to 9⁄16″ (00-16038)	-	3⁄8″ to 5⁄8″ (00-16042)
5⁄8″	9⁄16″ to 11⁄16″ (00-16025)	9⁄16″ to 11⁄16″ (00-16033)	9⁄16″ to ¾″ (00-16039)	½″ to 11⁄16″ (00-17491)	-
¾″	11⁄16″ to 13⁄16″ (00-16026)	11⁄16″ to 13⁄16″ (00-16034)	-	11⁄16″ to 7⁄8″ (00-17492)	5⁄8″ to 7⁄8″ (00-16043)
7⁄8″	13⁄16″ to 15⁄16″ (00-16027)	13⁄16″ to 15⁄16″ (00-16047)	¾″ to 15⁄16″ (00-16040)	-	-
1″	15⁄16″ to 1 1⁄16″ (00-13769)	15⁄16″ to 1 1⁄16″ (00-16035)	15⁄16″ to 1 1⁄8″ (00-16041)	7⁄8″ to 1 1⁄16″ (00-17493)	7⁄8″ to 1 1⁄8″ (00-16044)
1 1⁄8″	1 1⁄16″ to 1 3⁄16″ (00-16028)	1 1⁄16″ to 1 3⁄16″ (00-16036)	-	1 1⁄16″ to 1 1⁄4″ (00-17494)	-
1 1⁄4″	1 3⁄16″ to 1 5⁄16″ (00-16029)	1 3⁄16″ to 1 5⁄16″ (00-16048)	1 1⁄8″ to 1 5⁄16″ (00-13807)	-	1 1⁄8″ to 1 3⁄8″ (00-16045)
1 3⁄8″	1 5⁄16″ to 1 7⁄16″ (00-16030)	1 5⁄16″ to 1 7⁄16″ (00-16049)	1 5⁄16″ to 1 ½″ (00-13806)	1 ¼″ to 1 7⁄16″ (00-17495)	-
1 ½″	1 7⁄16″ to 1 9⁄16″ (00-16031)	1 7⁄16″ to 1 9⁄16″ (00-13764)	-	1 7⁄16″ to 1 5⁄8″ (00-17496)	1 3⁄8″ to 1 5⁄8″ (00-13198)
1 5⁄8″	-	1 9⁄16″ to 1 11⁄16″ (00-16050)	1 ½″ to 1 11⁄16″ (00-13805)	-	-
1 ¾″	-	1 5⁄8″ to 1 ¾″ (00-16037)	1 11⁄16″ to 1 7⁄8″ (00-13804)	1 5⁄8″ to 1 13⁄16″ (00-17497)	1 5⁄8″ to 1 7⁄8″ (00-13195)
1 7⁄8″	-	-	-	1 13⁄16″ to 2″ (00-17498)	-
2″	-	-	1 7⁄8″ to 2 1⁄16″ (00-13799)	2″ to 2 3⁄16″ (00-16582)	1 7⁄8″ to 2 1⁄8″ (00-13196)
2 1⁄4″	-	-	-	2 1⁄8″ to 2 5⁄16″ (00-17499)	2 1⁄8″ to 2 3⁄8″ (00-13197)
2 ½″	-	-	-	-	2 3⁄8″ to 2 5⁄8″ (00-13765)
2 ¾″	-	-	-	-	2 5⁄8″ to 2 7⁄8″ (00-16046)

Sizes highlighted in red indicate Overshot Slip standard fitment

Flow Activated Releasable Fishing/Bulldog Spear



Flow Activated Releasable Fishing/Bulldog Spear

The Flow Activated Releasable Fishing/Bulldog Spear is a variable catch internal spear used to retrieve a lost cylindrical fish from the well bore.

A complete range of slips is available for each size tool. To operate simply run into the fish and set down weight, pick up, and retrieve the fish.

To release from the fish simply set down weight, circulate in conjunction with a Hydraulic Sequencing Tool above the spear. The spear will then release due to the flow created differential.

A complete range of hardened slips are available for each size tool. See table on page 35 for slip and catch size details.

Features and Benefits

- Flow or drop ball activated
- Hardened & double tempered slips
- Robust construction
- Variable slip sizes for each tool

Flow Activated Releasable Fishing/Bulldog Spear Technical Specifications

Part No	Size	Service	Max OD	ID No Choke	Top Connection	Size of Grapple in Assy	Working Pressure
C087-038-08	2″	STD	1.85″	0.250″	1.0″ AMMT Box	1⅜″ to 1½″	5000 PSI
C087-037-09	2½″	STD	2.25″	0.39″	1½″ AMMT Box	2″ to 2⅛″	5000 PSI
C087-048-23	3″	STD	2.875″	0.39″	2⅜″ PAC Box	2¼″ to 2⅜″	5000 PSI
C087-048-09	3″	STD	2.73″	0.39″	1½″ AMMT Box	2¼″ to 2⅜″	5000 PSI
C087-066-10	3½″	STD	3.110″	0.39″	2⅜″ PAC DSI Box	2⅝″ to 2¾″	5000 PSI
C087-065-23	4″	STD	3.63″	0.39″	2⅜″ PAC Box	3⅛″ to 3¼″	5000 PSI

Flow Activated Releasable Bulldog Spear Slips

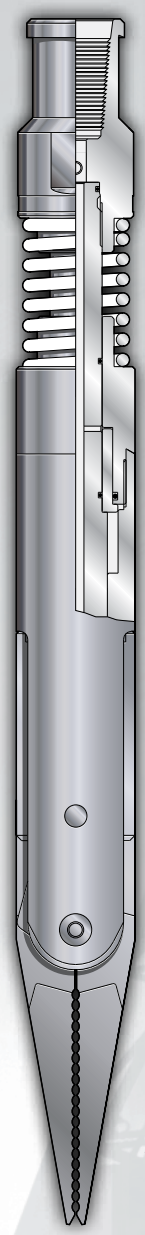
Typical Flow Activated Releasable Fishing/Bulldog Spear Slip

Flow Activated Releasable Bulldog Spear Slips

Spear Size	2″	2½″	3″	3½″	4″
Spear O.D.	1.810″	2.250″	2.625″	3.110″	3.625″
Bulldog Spear Nominal Size Range	1⅛″- 1⅞″	1⅞″ - 2½″	2⅜″ - 2⅞″	2⅝″- 3⅛″	3⅛″- 3¾″
Nominal Slip Size	Catch Range (Part Number)	Catch Range (Part Number)	Catch Range (Part Number)	Catch Range (Part Number)	Catch Range (Part Number)
1⅛″	1⅛″ to 1¼″ (00-21155)		-	-	-
1¼″	1¼″ to 1⅜″ (00-21156)	-	-	-	-
1⅜″	1⅜″ to 1½″ (00-21157)	-	-	-	-
1½″	1½″ to 1⅝″ (00-21158)	-	-	-	-
1⅝″	1⅝″ to 1¾″ (00-21159)	-	-	-	-
1¾″	1¾″ to 1⅞″ (00-24282)	1¾″ to 2⅞″ (00-24187)	-	-	-
1⅞″	-	1⅞″ to 2″ (00-20832)	-	-	-
2″	-	2″ to 2⅛″ (00-29546)	-	-	-
2⅛″	-	2⅛″ to 2¼″ (00-21124)	-	-	-
2¼″	-	2¼″ to 2⅜″ (00-29547)	2¼″ to 2⅜″ (00-30548)	-	-
2⅜″	-	2⅜″ to 2½″ (00-21125)	2⅜″ to 2½″ (00-27971)	-	-
2½″	-	-	2½″ to 2⅝″ (00-27972)	-	-
2⅜″	-	-	2⅝″ to 2¾″ (00-27973)	2⅝″ to 2¾″ (00-30549)	-
2¾″	-	-	2¾″ to 2⅞″ (00-27974)	2¾″ to 2⅞″ (00-30550)	-
2⅞″	-	-	-	2⅞″ to 3″ (00-30551)	-
3″	-	-	-	3″ to 3⅛″ (00-30552)	-
3⅛″	-	-	-	-	3⅛″ to 3¼″ (00-30553)
3¼″	-	-	-	-	3¼″ to 3⅜″ (00-30554)
3⅜″	-	-	-	-	3⅜″ to 3½″ (00-30555)
3½″	-	-	-	-	3½″ to 3⅝″ (00-30556)
3⅝″	-	-	-	-	3⅝″ to 3¾″ (00-30557)

Sizes highlighted in red indicate Bulldog Spear Slip standard fitment

Flow Activated Alligator Grab



Flow Activated Alligator Grab

The Flow Activated Alligator Grab is a fishing tool used to catch and retrieve loose objects from within the well bore. The Flow Activated Alligator Grab is run in the permanently closed position and is flow activated to the open grab position by circulating fluid and creating a pressure differential at the tool.

Please note The Flow Activated Alligator Grab is not designed to withstand heavy jarring operations in the event that the jaws have gripped onto any firmly stuck 'fish'.

Features and Benefits

- Flow or drop ball activated
- Variable grab lengths available
- Optional external fishneck

Flow Activated Alligator GrabTechnical Specifications

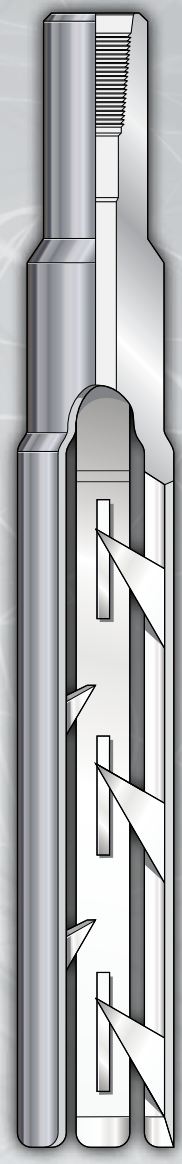
Part Number	Size	Service	Max OD	Top Connection
C115-018-08	1 1⁄16″	STD	1.69″	1″ AMMT Box
C115-020-09	2⅛″	STD	2.125″	1½″ AMMT Box
C115-019-09	2¼″	STD	2.25″	1½″ AMMT Box
C115-021-09	2⅜″	STD	2.375″	1½″ AMMT Box

Fishing Grab

The Fishing Grab is a tool used to retrieve wire that has broken in the tubing.

The Fishing Grab consists of a box up connection in a housing with either two or three flexible prongs extending downwards. Pointed barbs are welded to the inside of the prongs so as to form hooks that will catch the looped end of the broken line. The Coiled Tubing Fishing Grab also has a large flow through bore.

When a line breaks below the stuffing box, a full gauge such as a slotted skirt wirefinder is normally used to both locate and ball up the broken end of the line before running the Fishing Grab. The Fishing Grab is flexible enough to bend and can be gauged for the tubing it is to be run in. The prong ends of the grab should fit snugly against the walls of the tubing to help prevent line bypass.



Fishing Grab

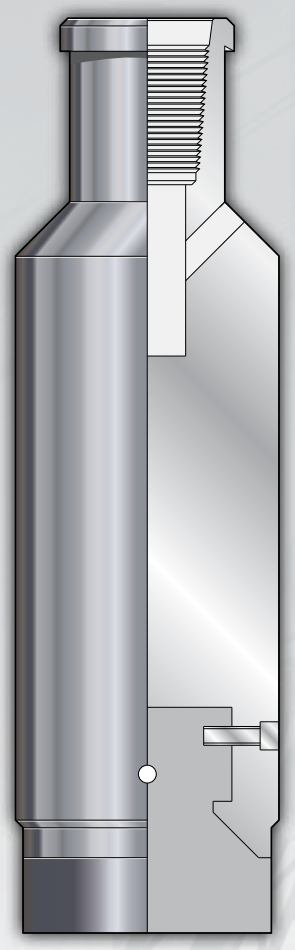
Features and Benefits

- Flow or drop ball activated
- Flow through facility
- Simple flexible design
- Robust construction
- External fish neck available

Fishing Grab Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection
C040-062-08	1¾″	STD	1.75″	0.75″	1″ AMMT Box
C040-081-09	2⅛″	STD	2.125″	1″	1½″ AMMT Box
C040-063-09	2¼″	STD	2.25″	1″	1½″ AMMT Box
C040-080-09	2⅜″	STD	2.375″	1″	1½″ AMMT Box
C040-082-09	2½″	STD	2.5″	1″	1½″ AMMT Box
C040-065-09	2.867″	STD	2.867″	1″	1½″ AMMT Box

Lead Impression Block



Lead Impression Block

The Lead Impression Block is an adapted standard wireline service tool used to obtain impressions of foreign objects in the tubing string to assist in identification of the object and thus selection of the correct fishing tool.

The Lead Impression Blocks are available in a range of sizes

Features and Benefits

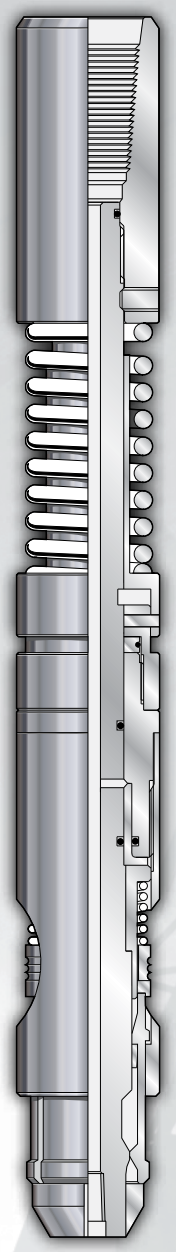
- Flow or drop ball activated
- 'Wash out' prevention sleeve
- Easily refillable
- Optional external fish neck

Lead Impresssion Block Technical Specifications

Part Number	Size	Service	Max OD	Top Connection
C080-023-08	1.75″	STD	1.750″	1″ AMMT Box
C080-039-08	2″	STD	2.00″	1″ AMMT Box
C080-040-08	2.125″	STD	2.125″	1″ AMMT Box
C080-040-09	2.125″	STD	2.125″	1½″ AMMT Box
C080-043-09	2.25″	STD	2.25″	1½″ AMMT Box
C080-025-09	2.5″	STD	2.50″	1½″ AMMT Box
C080-026-09	2.75″	STD	2.75″	1½″ AMMT Box
C080-027-09	3″	STD	3.00″	1½″ AMMT Box
C080-028-09	3.25″	STD	3.25″	1½″ AMMT Box
C080-022-09	3.5″	STD	3.50″	1½″ AMMT Box

RUNNING AND PULLING TOOLS

Flow Activated 'GS' Type Running/Pulling Tool



Flow Activated 'GS' Type Running/Pulling Tool

The Flow Activated 'GS' Type Running/Pulling Tool is designed to run and retrieve downhole tools with conventional internal fish necks.

The latching mechanism is a robust dog/core design which releases positively from the internal fish neck when a hydraulic differential is applied to the tool.

The tool does not require shear pins or drop balls since the differential required to activate the tool is provided by circulating through a choke insert in the core.

Flow Activated 'GS' Type Running/Pulling Tools are available for all standard internal fish neck sizes.

Features and Benefits

- Full hydraulic operation
- Multiple latch & release capability
- Proven dog/core design
- Available to catch internal fish necks from 2″ to 7″
- Safety shear function

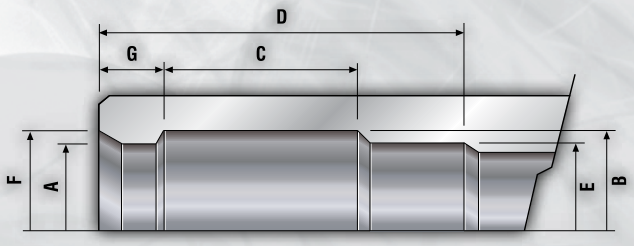
Flow Activated 'GS' Type Running/Pulling Tool Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connector	Working Pressure
C086-081-08	1½″	STD	1.47″	0.25″	1″ AMMT Box	5000PSI
C086-160-08	2″	STD	1.69″	0.25″	1″ AMMT Box	5000PSI
C086-072-08	2″	STD	1.81″	0.25″	1″ AMMT Box	5000PSI
C086-072-09	2″	STD	2.125″	0.25″	1½″ AMMT Box	5000PSI
C086-068-09	2½″	STD	2.25″	0.39″	1.5″ AMMT Box	5000PSI
C086-067-23	3″	STD	2.73″	0.39″	2⅜″ PAC Box	5000PSI
C086-073-09	3½″	STD	3.11″	0.39″	1.5″ AMMT Box	5000PSI
C086-074-23	4″	STD	3.62″	0.39″	2⅜″ PAC Box	5000PSI
C086-079-23	5″	STD	4.50″	0.39″	2⅜″ PAC Box	5000PSI
C086-110-10	7″	STD	5.83″	0.912″	2⅜″ REG Box	5000PSI
C086-118-08	2″	H2S	1.81″	0.25″	1″ AMMT Box	5000PSI
C086-118-09	2″	H2S	2.125″	0.25″	1½″ AMMT Box	5000PSI
C086-117-09	2½″	H2S	2.25″	0.39″	1½″ AMMT Box	5000PSI

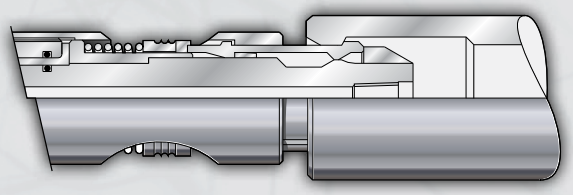
‘GS’ Internal Fishneck Reference Table

‘GS’ Internal Fishneck Reference Table

Nominal Tool Size	Tubing Size O.D.	A	B	C	D	E	F	G
1¼″	1.66″	0.88″	1.03″	0.97″	1.97″	0.88″	1.00″	0.42″
1½″	1.90″	1.06″	1.22″	1.47″	2.97″	1.06″	1.16″	0.54″
1½″	2.062″	1.06″	1.22″	1.47″	2.97″	1.06″	1.16″	0.54″
2″	2⅜″	1.38″	1.57″	1.47″	2.97″	1.38″	1.59″	0.54″
2½″	2⅞″	1.81″	2.00″	1.47″	2.97″	1.81″	1.98″	0.54″
3″	3½″	2.31″	2.50″	1.47″	2.97″	2.31″	2.47″	0.54″
3½″	4″	2.62″	2.81″	1.47″	2.97″	2.62″	2.78″	0.54″
Special 4″	4″	2.75″	2.94″	1.47″	2.97″	2.75″	2.91″	0.54″
4″	4½″	3.12″	3.31″	1.47″	2.97″	3.12″	3.35″	0.54″
5″	5½″	4.00″	4.19″	1.47″	2.97″	4.00″	4.16″	0.54″
5.62″	5⅝″	4.75″	5.00″	1.47″	2.97″	4.75″	4.98″	0.54″
7″	7″	5.38″	5.62″	1.47″	2.97″	5.38″	5.60″	0.54″
7¾″	7¾″	6.25″	6.50″	1.47″	2.97″	6.25″	6.48″	0.54″
8⅝″	8⅝″	7.12″	7.50″	1.58″	3.23″	7.12″	7.47″	0.77″
9⅝″	9⅝″	7.62″	8.00″	1.58″	3.23″	7.62″	7.98″	0.77″

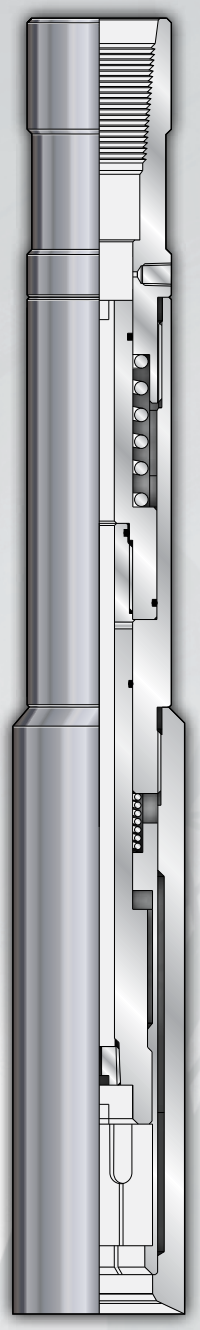


‘GS’ Running/Pulling Internal Fishneck Dimensions

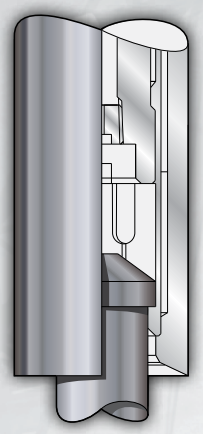


Flow Activated ‘GS’ Running/Pulling Tool Shown Latching ‘GS’ Fishneck

Flow Activated Heavy Duty Running/Pulling Tool



Flow Activated Heavy Duty Running/Pulling Tool



A Heavy Duty Running/Pulling Tool Shown Latching a Rope Socket Fishneck

The Flow Activated Heavy Duty Running/Pulling Tool is a collet type running/ pulling tool designed to run or retrieve downhole tools that have conventional external fishing necks.

The running/pulling tool design is extremely robust in construction and allows a full 360° engagement of the fishing neck to be latched.

The tool is fully hydraulically activated and therefore does not require the use of shear pins or drop balls to operate, since this is achieved by circulating through a choke in the core of the tool.

Hydraulic Heavy Duty Running/Pulling Tools are available for all sizes of standard external fish necks. Adaptor kits are available to increase a standard tool's catch size.

Features and Benefits

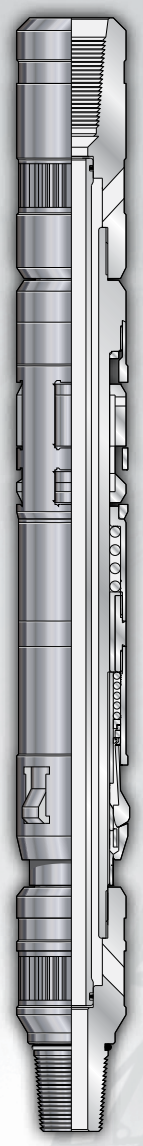
- Full hydraulic operation
- Heavy duty construction
- Available to catch all standard external fish necks

Flow Activated Heavy Duty Running/Pulling Tool Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Operating Pressure
C138-016-08	2″	STD	1.875″	0.39″	1″ AMMT BOX	500-700 DPSI
C138-016-09	2″	STD	2.125″	0.39″	1½″ AMMT BOX	500-700 DPSI
C138-017-09	2½″	STD	2.3″	0.39″	1½″ AMMT BOX	500-700 DPSI
C138-026-09	3″	STD	2.87″	0.39″	1½″ AMMT BOX	350 DPSI
C138-026-23	3″	STD	2.87″	0.39″	2⅜″ PAC BOX	350 DPSI
C138-043-08	2″	H2S	1.875″	0.39″	1" AMMT B	500-700 PSI
C138-044-09	2½″	H2S	2.3″	0.39″	1½″ AMMT BOX	500-700 DPSI
C138-045-09	3″	H2S	2.87″	0.39″	1½″ AMMT BOX	350 DPSI
C138-045-23	3″	H2S	2.87″	0.39″	2⅜″ PAC BOX	350 DPSI
C138-051-23	4″	H2S	3.75″	0.39″	2⅜″ PAC BOX	800 DPSI

COMPLETION TOOLS

Short Selective Type Profile Position Locator



Selective Type Profile Position Locator

The Short Selective Profile Locator System (SSPL) is designed to provide a simple and effective means of accurate depth location for secondary well intervention devices within a well bore.

The SSPL is run with the locator keys in the retracted position.

It is designed so that the keys are held in this position until the desired selective profile has been reached.

As the tool string is lowered through the selective profile, the dogs contact the inside diameter of the bore. This restriction forces the dogs up far enough to retract into the upper groove on the catch mandrel. As the dogs pass out of the restriction, compression on the spring is removed and the dogs move down and out to their original position.

The tool string is then raised back through the selective profile until the dogs again contact the lower restriction in the selective profile. An upward pull on the tool string is required to shear the shear pins (if fitted) and compress the upper spring, allowing the dogs, dog retainer and spring housing to move downward.

The dogs move down far enough to engage the lower groove on the catch mandrel. At this point the slider/spring housing releases the locator keys allowing them to expand, under spring pressure.

To engage the profile in the selective profile a downward motion is required, the locator keys will stop downward travel of the assembly as the keys find their matching profile.

Once activated the mechanism will not be able to progress further down the well but can withdrawn and set at a higher installation.

Features and Benefits

- The SSPL is deployed as part of the secondary well intervention tool string. This can be coiled tubing, wireline, slickline or even tractor deployed operations.
- Typical uses would include accurate location of Packer release tools in multi zone wells. Also, accurate location of any remedial repair tools or well stimulation tools can be achieved in horizontal and high deviation wells where conventional mechanical depth correlation could prove difficult.
- The SSPL, when deployed as part of a tool string can pass through as many same size nipple profiles as is required to reach the required depth. At the required SSPLN Nipple a single manipulation of the tool string will activate the SSPL Tool and provide a firm No-Go downward facing shoulder and a positive location for the toolstring.
- The SSPL is a further development of and compatible with our Lock and Plug System.
- The SSPL can be configured for tubing sizes from 3½″ to 7″ and can be supplied with material and thread specifications to meet any customer's completion design.

Selective Type Profile Position Locator Technical Specifications

Part Number	Size	Service	Nipple Type	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C209-018-09	2.545″	H2S	SSA	2.545″	0.62″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C209-001-09	2.81″	H2S	AAS	2.79″	1.0″	1½″ AMMT Box	1½″ AMMT Pin	10000 PSI
C209-012-09	3.81″	H2S	SSA	3.795″	1.0″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C209-002-09	4.56″	H2S	AAS	4.535″	1.0″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C209-016-09	4.56″	H2S	SSA	4.535″	1.0″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI

No-Go Type Profile Position Locator

The NOV No-Go Profile Locator System (NGPLS) is designed to provide a simple and effective means of accurate depth location for secondary well intervention devices within a well bore.

The NGPLS is deployed as part of the secondary well intervention tool string. This can be coiled tubing, wireline, slickline or even tractor deployed operations.

Typical uses would include accurate location of packer release tools in multi zone wells. Also, accurate location of any remedial repair tools or well stimulation tools can be achieved in horizontal and high deviation wells where conventional mechanical depth correlation could prove difficult.

As the tool string is lowered through the target nipple profile, the dogs contact the inside diameter of the bore. This restriction forces the dogs up far enough to retract into the upper groove on the catch mandrel. As the dogs pass out of the restriction, compression on the spring is removed and the dogs move down and out to their original position.

To engage the No-Go profile in the nipple a downward motion is required, the No-Go shoulder on the Upper connection will stop downward travel of the assembly when it contacts the matching restriction.

The tool string is then raised back through the nipple profile until the dogs again contact the lower restriction in the nipple and an over-pull is then registered at surface.

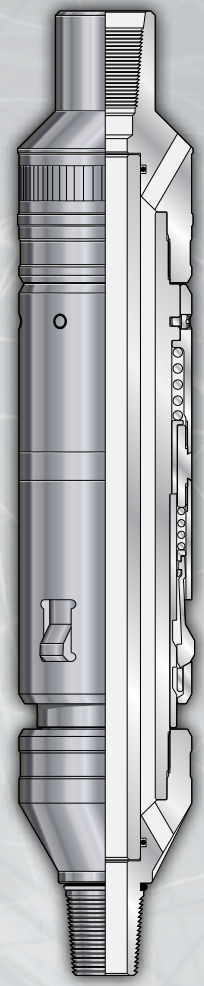
These significant actions will determine the position the Locator assembly in a well bore.

An upward pull on the tool string is required to shear the shear pins (if fitted) and compress the upper spring, allowing the dogs, dog retainer and spring housing to move downward.

The dogs move down far enough to engage the lower groove on the catch mandrel allowing the tool string to be retrieved from the well bore.

Features and Benefits

- The NGPLS, when deployed as part of a tool string, will, at the required nipple provide a firm No Go downward facing shoulder and a positive location for the toolstring.
- The NGPLS is a further development of the NOV Selective and No-Go Lock and Plug System which uses well established industry standard devices that are simple and easy for field operations and maintenance.
- The NGPLS can be configured for tubing sizes from 3½″ to 7″ and can be supplied with material and thread specifications to meet any customer's completion design.

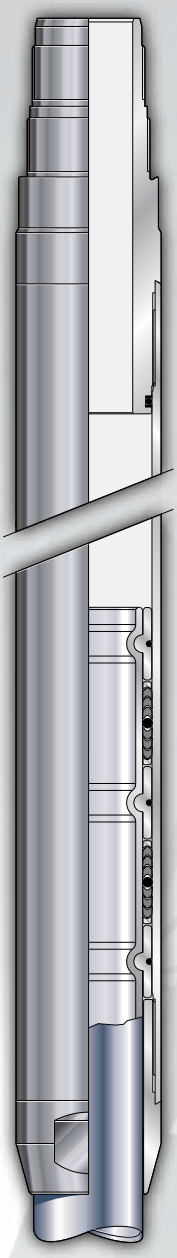


No-Go Type Profile Position Locator

No-Go Type Profile Position Locator Technical Specifications

Part Number	Size	Service	Nipple Type	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C209-015-09	2.75″	H2S	ATN	2.8″	0.88″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-009-09	3.68″	H2S	ATN	3.735″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-017-09	3.75″	H2S	ATN	3.795″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-014-09	3.81″	H2S	XN	3.795″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-010-09	4.21″	H2S	ATN	4.26″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-006-09	4.312″	H2S	AOF	4.385″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-005-09	4.437″	H2S	ATN	4.495″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-011-09	4.5″	H2S	ATN	4.56″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-007-09	4.56″	H2S	AOF	4.615″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-004-09	4.75″	H2S	ATN	4.8″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi
C209-003-09	5.625″	H2S	ATN	5.7″	1″	1½″ AMMT Box	1½″ AMMT Pin	5,000 psi

Travel Joint Connector



Travel Joint Connector

The NOV Travel Joint Connector is a coiled tubing connector with linear movement, which has minimal growth on the outside diameter of the selected coiled tubing.

Typical usage would be where the maximum diameter of the tool string is required to be positioned in a well bore with size restrictions.

This method of connecting coiled tubing to a work-string is simple to prepare, using a conventional pipe cutter and Roll-on crimping wheel.

Connection to the Coiled Tubing

The connector consists of an upper connection, a sleeve that house the seals and a threaded bottom sub.

The end face of the coiled tubing is prepared and three controlled deformations at a pre-determined point are then created, using the spacing fixture and designated roll-on crimping wheel, these grooves serve as the fixing point of the tool.

The bottom sub is loaded on to the coiled tubing followed by the seal stacks which are then correctly positioned with clamp rings located at each of the pre-formed grooves on the coiled tubing.

The seal sleeve is then located over the seal stacks and the threaded bottom sub is brought together and made tight.

The upper connection is then made up to the seal sleeve and the connector is ready for use.

Travel Joint Connector Technical Specifications

Part Number	Tool Size	CT Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C233-002	1½″	1″	H2S	1½″	0.68″	¾″ CS PIN	1″ X 0.087″ WALL	5,000 psi
C233-001	2″	1½″	H2S	2″	1.0″	1¼″ CS PIN	1½″ X 0.095″ WALL	5,000 psi

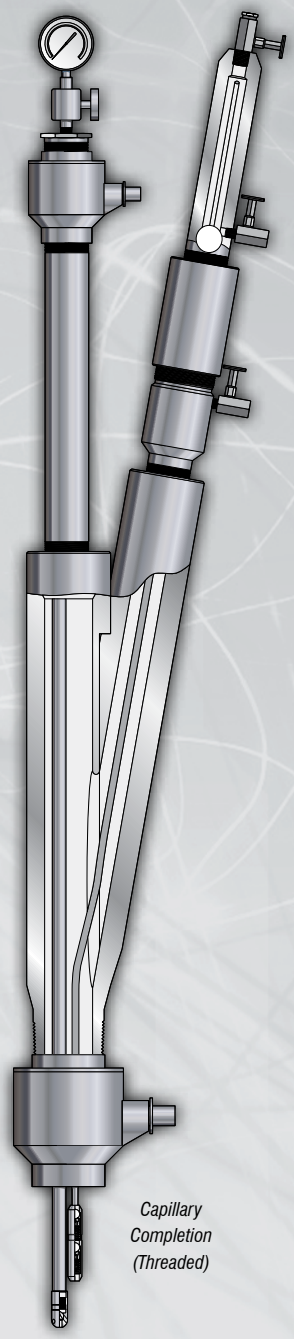
Capillary Completion (Threaded)

The Threaded Capillary Completion provides the operator with the ability to install a capillary string for injection purposes.

Installation is safe and easy utilizing our new model 140-000 Capillary Hanger Assembly dressed for ¼″ or other sizes of capillary tubing.

The Dual Pack Off System, comprised of a primary hydraulic element and a secondary mechanical element that operates independently of each other.

The Bi-directional internal slip set has been designed for total control of the capillary tubing once it is installed.



Capillary Completion (Threaded)

Features and Benefits

- 2″ LP top box
- 2″ and 2⅜″ EUE pin down.
- 3,000 PSI WP

Capillary Completion (threaded) Technical Specifications

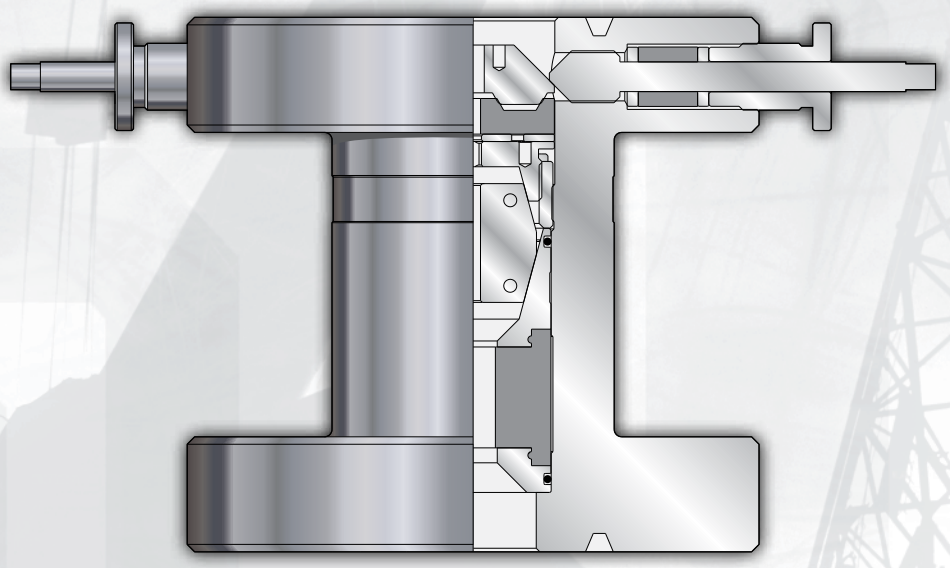
Part Number	Capillary Size	Service	Max OD	Min ID	Length/Height	Top Connection	Bottom Connection	Working Pressure
140-025BP	¼″	H2S	3¾″	1.937″	12″	2″ NPT	2″ NPT	3,000 psi
140-025BP-20	¼″	H2S	3¾″	1.937″	12″	2″ NPT	2⅜″ EUE	
140-050BP	½″	H2S	3¾″	1.937″	12″	2″ NPT	2″ NPT	3,000 psi
140-0312BP	5⁄16″	H2S	3¾″	1.937″	12″	2″ NPT	2″ NPT	3,000 psi

Capillary Completion (Flanged)

The Flanged Capillary Completion Assembly provides the operator with the ability to install a capillary string onto a flanged well head.

Features and Benefits

- Can be produced for a variety of flange sizes
- Can be produced for a variety of capillary sizes
- 3,000 PSI WP



Capillary Completion (Flanged)

Capillary Completion (flanged) Technical Specifications

Part Number	CT Size	Service	Max OD	Min ID	Length/Height	Top Connection	Bottom Connection	Working Pressure
171-025PB-API	¼″	H2S	9.63″	2.13″	9″	R27 - Flange	R27 - Flange	3,000 psi
171-025PB-20-API	¼″	H2S	9.63″	2.09″	10″	R27 - Flange	R24 - Flange	3,000 psi
171-025PB-10-API	¼″	H2S	10.50″	2.13″	10.5″	R35 - Flange	R35 - Flange	5,000 psi

MOTORS

Coiled Tubing Motor Bearing Assembly

The National Oilwell Varco Coiled Tubing (CT) Motor is an "Engineered Solution" for the CT Market. This motor line was designed by NOV Engineers specializing in coiled tubing and drilling motors to ensure the tool's ability to meet the demands of CT applications. We utilized NOV design methodology, best practices, years of senior experience, and field information at the well site to develop this product offering. The CT Motor is not only reliable; it has many features applicable to the growing needs of the coiled tubing industry.

The bearing assembly has class-leading torque ratings and is a sealed bearing unit that provides maximum tool life with low redress cost. With a zero bypass sealed bearing assembly, the assembly delivers 100% flow to the mill for effective returns.

The slick, true-stated OD options (1 11/16", 2 1/8", 2 7/8" and 3 1/2") provide a comprehensive tool selection range to meet the well requirements. The "Titanium" Flex Rod within the assembly is designed to deliver the longest stator life which will meet the demands of the extended reach wells.

Features

- High torque capacity - Can be run with CT HEMIDRIL® or CT PowerPLUS™ Stators
- Sealed bearing assembly
- Zero bypass
- Slick, true-stated OD
- Flex Rod designed to maximize the Stator life

Benefits

- Class-leading torque ratings
- Eliminates downhole failures
- Maximum tool life with low redress cost
- 100% flow to the mill - Reduces stuck BHA's
- Ease of assembly

Coiled Tubing Motor Bearing Pack Sub Assembly Technical Specifications

Part Number	OD	Description	Top Connection	Bottom Connection	Pull to Yield	Theoretical Static Yield Torque
TBD	1 11/16"	1 11/16" OD Motor Bearing Pack, Flex Shaft, Straight Housing, Top Sub, & Motor Catch for 1.68" - 5/6-5.0 Power Sect.	1" AMMT	1" AMMT	28,000 lb	550 ft-lbs
TBD	2 1/8"	2 1/8" OD Motor Bearing Pack, Flex Shaft, Straight Housing, Top Sub, & Motor Catch for 2.12" - 5/6-6.0 Power Sect.	1 1/2" AMMT	1 1/2" AMMT	55,000 lb	1,100 ft-lbs
287-36C-4 0	2 7/8"	2 7/8" OD Motor Bearing Pack, Flex Shaft, Straight Housing, Top Sub, & Motor Catch	2 3/8" PAC	2 3/8" PAC	123,000 lb	2,000 ft-lbs
TBD	3 1/2"	3 1/2" OD Motor Bearing Pack, Flex Shaft, Straight Housing, Top Sub, & Motor Catch for 3.5" - 5/6-3.0 Power Sect.	2 3/8" REG	2 3/8" REG	163,000 lb	4,500 ft-lbs

Coiled Tubing PowerPLUS™ Power Sections

National Oilwell Varco proudly introduces a new series of high performance power sections for coiled tubing operations. The CT PowerPLUS™ Power Sections deliver more power and more torque than conventional coiled tubing power sections. NOV's PowerPLUS Power Sections utilize high performance elastomer that delivers 50% more power and torque than traditional power sections. The elastomer has proven to perform remarkably in both water based fluids and nitrogen; which makes this power section ideal for CT milling operations. Selection of the new NOV Power Sections will provide high performance CT operations and reduce your milling and drilling time.

Extensive research and analysis was conducted by NOV Downhole to design and manufacture this impressive addition to our fleet of power sections.

This included:

- Elastomer formulation testing
- Fluid immersion testing
- Performance Research
- Endurance testing
- Field Testing

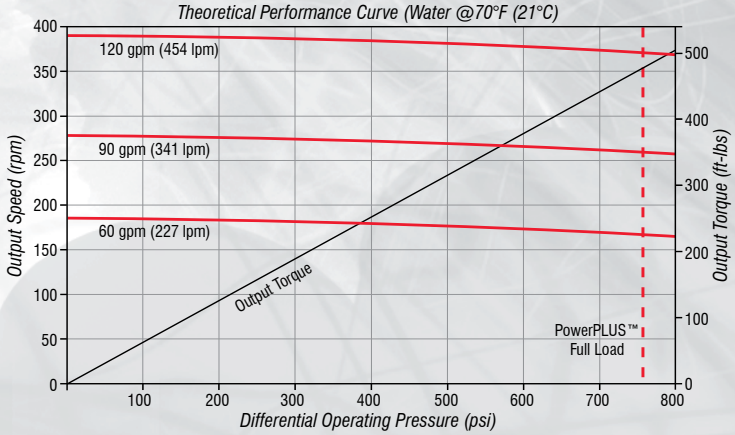
The results of extensive testing provided the strong base for the PowerPLUS Power Section; another quality National Oilwell Varco solution for the coiled tubing industry.

Features

- High performance elastomer power section
- Performs well with water based fluids
- Generates 50% more power than conventional power sections
- Performs well with nitrogen and air milling/drilling
- Generates 50% higher torque than traditional power sections
- Less stress on the coiled tubing
- Improved CT milling/drilling performance
- Reduced operational cost
- Increased speed at which plugs are milled

2⅞ - 5⁄6 - 3.5 Stage CT PowerPLUS Power Section

Theoretical Performance Curve (Water @70°F (21°C)



Coiled Tubing PowerPLUS Power Section Technical Specifications

Size	1 1⁄16″	2⅛″	2⅞″	2⅞″	2⅞″
Configuration	5/6, 5.0 stage	5/6, 6.0 stage	5/6, 3.5 stage	5/6, 4.7 stage	5/6, 7.0 stage
Rev/gal / Rev/l	12.93 rev/gal / 3.42 rev/l	10.3 rev/gal / 2.73 rev/l	3.1 rev/gal / 0.82 rev/l	3.76 rev/gal / 1 rev/l	5.28 rev/gal / 1.4 rev/l
Min Flow (gpm / lpm)	25 gpm / 95 lpm	20 gpm / 79 lpm	60 gpm / 227 lpm	50 gpm / 189 lpm	20 gpm / 76 lpm
Max flow (gpm / lpm)	45 gpm / 170 lpm	50 gpm / 189 lpm	120 gpm / 454 lpm	125 gpm / 473 lpm	80 gpm / 303 lpm
Full Load Torque (lb-ft / Nm)	182 ft-lbs / 247 Nm	276 ft-lbs / 374 Nm	472 ft-lbs / 640 Nm	646 ft-lbs / 875 Nm	773 ft-lbs / 1048 Nm
Full Load Pressure (psi / kPa)	1092 psi / 7530 kPa	1307 psi / 9009 kPa	757 psi / 5218.5 kPa	1020 psi / 7033.5 kPa	1530 psi / 10549.5 kPa

Coiled Tubing PowerPLUS™ Stators and Rotors

PowerPLUS™ Blank Stators and Rotors

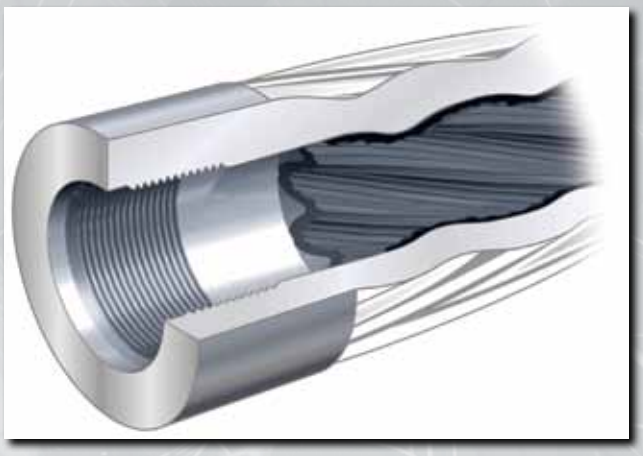
Part Number	Product	Description	Product Type	Connection	Fit
PRR16F6500AG	Stator	1 11/16″ OD (5/6), 5.0 Stage	PowerPLUS™	Blank	STD
PRR16F6504AG	Stator	1 11/16″ OD (5/6), 5.0 Stage	PowerPLUS™	Blank	1 x OS
PRR16F6507AG	Stator	1 11/16″ OD (5/6), 5.0 Stage	PowerPLUS™	Blank	2 x OS
SZ 16E5500ZGT02	Rotor	1 11/16″ OD (5/6), 5.0 Stage	Chrome Plated	Blank	Standard Fit
TBD	Rotor	1 11/16″ OD (5/6), 5.0 Stage	Tungsten Carbide Plated	Blank	Standard Fit
PRR21F6600AG	Stator	2 1/8″ OD (5/6), 6.0 Stage	PowerPLUS™	Blank	STD
PRR21F6604AG	Stator	2 1/8″ OD (5/6), 6.0 Stage	PowerPLUS™	Blank	1 x OS
PRR21F6607AG	Stator	2 1/8″ OD (5/6), 6.0 Stage	PowerPLUS™	Blank	2 x OS
SZ 21E5600ZGT02	Rotor	2 1/8″ OD (5/6), 6.0 Stage	Chrome Plated	Blank	Standard Fit
TBD	Rotor	2 1/8″ OD (5/6), 6.0 Stage	Tungsten Carbide Plated	Blank	Standard Fit
PRR28F6350AG	Stator	2 7/8″ OD (5/6), 3.5 Stage	PowerPLUS™	Blank	STD
PRR28F6354AG	Stator	2 7/8″ OD (5/6), 3.5 Stage	PowerPLUS™	Blank	1 x OS
PRR28F6357AG	Stator	2 7/8″ OD (5/6), 3.5 Stage	PowerPLUS™	Blank	2 x OS
SZ 28E535TZG	Rotor	2 7/8″ OD (5/6), 3.5 Stage	Chrome Plated	Blank	1 x OS Fit
SZ 28E5350ZG	Rotor	2 7/8″ OD (5/6), 3.5 Stage	Chrome Plated	Blank	Standard Fit
TBD	Rotor	2 7/8″ OD (5/6), 3.5 Stage	Tungsten Carbide Plated	Blank	Standard Fit
PRR28F6470AG	Stator	2 7/8″ OD (5/6), 4.7 Stage	PowerPLUS™	Blank	STD
PRR28F6474AG	Stator	2 7/8″ OD (5/6), 4.7 Stage	PowerPLUS™	Blank	1 x OS
PRR28F6477AG	Stator	2 7/8″ OD (5/6), 4.7 Stage	PowerPLUS™	Blank	2 x OS
SZ 28E5470ZGT02	Rotor	2 7/8″ OD (5/6), 4.7 Stage	Chrome Plated	Blank	Standard Fit
TBD	Rotor	2 7/8″ OD (5/6), 4.7 Stage	Tungsten Carbide Plated	Blank	Standard Fit
PRR28F6700AG	Stator	2 7/8″ OD (5/6), 7.0 Stage	PowerPLUS™	Blank	STD
SZ 28E5700ZG	Rotor	2 7/8″ OD (5/6), 7.0 Stage	Chrome Plated	Blank	Standard Fit
SZ 28E5704ZG	Rotor	2 7/8″ OD (5/6), 7.0 Stage	Chrome Plated	Blank	1 x Under Size
TBD	Rotor	2 7/8″ OD (5/6), 7.0 Stage	Tungsten Carbide Plated	Blank	Standard Fit

PowerPLUS™ Threaded Stators and Rotors

Part Number	Product	Description	Product Type	Connection	Fit
PRR28F6350ZG	Stator With Threads for Nov Bearing Pack	2 7/8″ OD (5/6), 3.5 Stage	PowerPLUS™	Threaded for NOV Bearing Pack	STD
PRR28F6354ZG	Stator with Threads for NOV Bearing Pack	2 7/8″ OD (5/6), 3.5 Stage	PowerPLUS™	Threaded for NOV Bearing Pack	1 x OS
PRR28F6357ZG	Stator with Threads for NOV Bearing Pack Threaded	2 7/8″ OD (5/6), 3.5 Stage	PowerPLUS™	Threaded for NOV Bearing Pack	2 x OS
SZ 28E5350XGTHT	Rotor with NOV Threads for Drive Shaft & Rotor Catch	2 7/8″ OD (5/6), 3.5 Stage	Chrome Plated	Nov Drive Shaft & Rotor Catch Thd	Standard Fit
PRR28F6470ZG	Stator with Threads for NOV Bearing Pack	2 7/8″ OD (5/6), 4.7 Stage	PowerPLUS™	Threaded for NOV Bearing Pack	STD
PRR28F6474ZG	Stator with Threads for NOV Bearing Pack	2 7/8″ OD (5/6), 4.7 Stage	PowerPLUS™	Threaded for NOV Bearing Pack	1 x OS
PRR28F6477ZG	Stator with Threads for NOV Bearing Pack	2 7/8″ OD (5/6), 4.7 Stage	PowerPLUS™	Threaded For NOV Bearing Pack	2 x OS
SZ 28E5470XGTHT	Rotor with NOV Threads for Drive Shaft & Rotor Catch	2 7/8″ OD (5/6), 4.7 Stage	Chrome Plated	Nov Drive Shaft & Rotor Catch Thd	Standard Fit

Coiled Tubing HEMIDRIL Power Sections

NOV's high performance CT HEMIDRIL Power Sections are ideal for straight hole and lateral coiled tubing milling and drilling operations. The CT HEMIDRIL utilizes the same Evenwall Technology that NOV has used with success for years in the well-respected HEMIDRIL® Drilling Motors. This evenwall stator includes a patented Power Rib surface that improves efficiency and tool life. The uniform elastomer thickness, thin wall design, and power rib technology combine to deliver increased torque, horsepower, and efficiency. CT HEMIDRIL Power Sections have proven to withstand the harsh conditions that often plague coiled tubing operations.



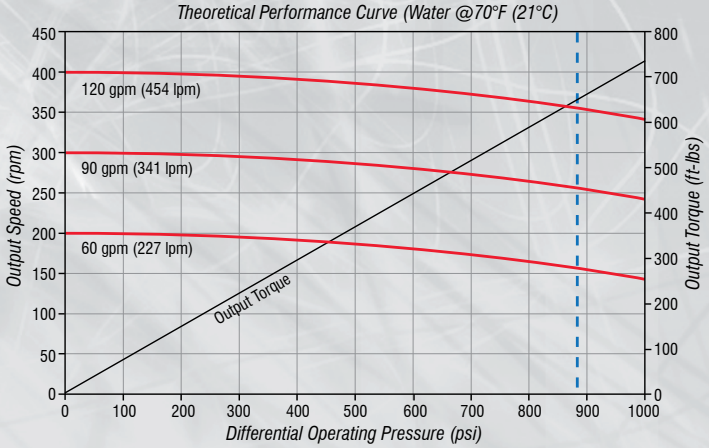
Cut-a way view of CT HEMIDRILwith PowerRib Technology

Features and Benefits

- Even layer of rubber
- Patented "Power Rib" technology which increases efficiency and tool life
- 75% more power than conventional stators
- 75% more torque than conventional stators
- Improved CT milling/drilling performance
- Increased speed at which plugs are milled
- Reduced rubber swelling in hot hole environments
- Reduced rubber swell while using nitrogen
- Less stress on the coiled tubing
- Reduced operational cost

2⅞ - ⅝ - 3.5 Stage CT HEMIDRIL Power Section

Theoretical Performance Curve (Water @70°F (21°C)



CT HEMIDRIL Power Section Technical Specifications

Size	2⅞"
Configuration	5/6, 3.5 stage
Rev/gal / Rev/l	3.3 rev/gal / 0.88 rev/l
Min Flow (gpm / lpm)	60 gpm / 227 lpm
Max flow (gpm / lpm)	120 gpm / 454 lpm
Full Load Torque (lb-ft / Nm)	644 ft-lbs / 873 Nm
Full Load Pressure (psi / kPa)	883 psi / 6088 kPa

PowerRib Technology improves efficiency and tool life

Coiled Tubing HEMIDRIL Stators and Rotors

HEMIDRIL Blank Stators and Rotors

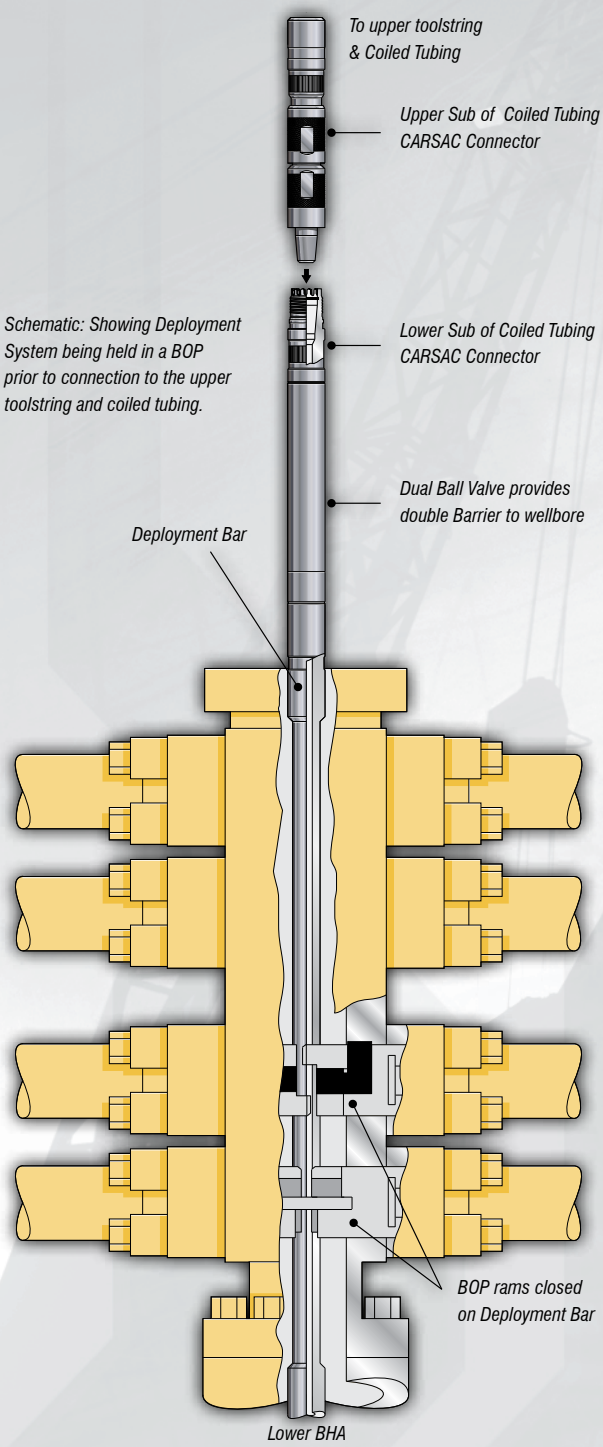
Part Number	Product	Description	Product Type	Connection	Fit
3804-B-58	Stator	2⅞″ OD (5/6), 3.5 Stage	HEMIDRIL®	Blank	1 Fit
SZ 28E535TZG	Rotor	2⅞″ OD (5/6), 3.5 Stage Rotor	Chrome Plated	Blank	1 x OS Fit
SZ 28E5350ZG	Rotor	2⅞″ OD (5/6), 3.5 Stage Rotor	Chrome Plated	Blank	Standard Fit

HEMIDRIL Threaded Stators and Rotors

Part Number	Product	Description	Product Type	Connection	Fit
3804-B-67	HEMIDRIL Stator with Threads for NOV Bearing Pack	2⅞″ OD (5/6), 3.5 Stage	HEMIDRIL™	Threaded for NOV Bearing Pack	1 Size
SZ 28E5350XGTHT	Rotor with NOV Threads for Drive Shaft & Rotor Catch	2⅞″ OD (5/6), 3.5 Stage Rotor	Chrome Plated	NOV Drive Shaft & Rotor Catch THD	Standard Fit

DEPLOYMENT TOOLS

Deployment System



Schematic: Showing Deployment System being held in a BOP prior to connection to the upper toolstring and coiled tubing.

The Deployment System is an application workstring used where the toolstring length exceeds the capacity of the lubricator section. By using a Deployment System the BHA deployment can be staggered.

The Deployment System is a combination of three components, a Deployment Bar, a Dual Ball Kelly Cock Valve (see page 59) and a CARSAC HT (see page 58).

The diameter of the waisted section of the Deployment bar is matched to the size of coiled tubing being used and retains full bore flow through.

Closing the ball valves in the Kelly Cock Valve gives a double barrier to the wellbore.

The CARSAC connector allows connection with the upper tool string without the need to rotate the work string.

By running a combination of a Deployment Bar, a Dual Ball Kelly Cock Valve and a CARSAC HT, the BHA can be deployed in multiple stages as follows:

- Lower BHA assy made up to the Deployment System and positioned in the lubricator
- Connect upper (male) section of CARSAC, Check Valve & Connector to coiled tubing
- Upper string is lowered onto lower BHA section and connected via the CARSAC
- Lower BHA section below the BOP & close pipe rams around the Deployment Bar creating a seal between the well and surface
- Close ball valves on the Dual Ball Kelly Cock and bleed off the remaining pressure in the upper string
- Separate the CARSAC leaving the female lower sub facing upwards
- Make up remaining BHA with upper male section of CARSAC and stab into the lower BHA section
- Open BOP pipe rams and the complete BHA can then be run in hole

As rotation of either BHA section is not possible, the 'stab-in' feature of the CARSAC HT is vital. The Coiled Tubing Deployment Bar System is available to suit most applications and configurations of coiled tubing pipe rams.

Deployment System Technical Specifications

Part Number	Size	Service	Max OD	Min OD	Top Connection	Bottom Connection	Working Pressure
TBD	2⅞″	H2S	2.875″	0.968″	2⅜″ PAC DSI Box	Customer To Cut	5000PSI

Deployment Bar

Deployment Bar Technical Specifications

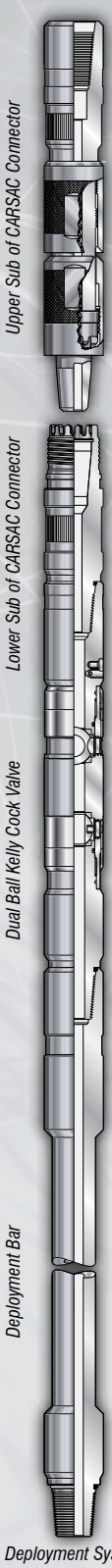
Part Number	OD /CT Size	Service	Max OD	Sealing OD/BOP RAM	Min ID	Length/Height	Top Connection	Bottom Connection	Working Pressure
C194-034-08	1 1⁄16″	STD	1.688″	1.50″	0.75″	132″ Make Up	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C194-026-08	1 1⁄16″	STD	1.688″	1.50″	0.75″	72″ Make Up	1″ AMMT Box	1″ AMMT Pin	5000PSI
C194-035-08	1¾″	STD	1.75″	1.50″	0.75″	72″ Make Up	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C194-041-08	1¾″	STD	1.75″	1.25″	0.625″	48″ Make Up	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C194-038-10	3⅛″ X 3″	STD	3.125″	3.00″	1″	3 ft Seal Length	2⅜″ REG Pin	2⅜″ REG Pin	5000PSI
C194-039-10	2⅞″ X 2″	STD	3.125″	3.00″	1″	5 ft Seal Length	2⅜″ REG Box	2⅜″ REG Pin	5000PSI
C194-040-10	3⅛″ X 3″	STD	3.125″	3.00″	1″	10 ft Seal Length	2⅜″ REG Box	2⅜″ REG Pin	5000PSI
C194-031-09	2⅛″	H2S	2.125″	1.50″	0.875″	76″ Make Up	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C194-037-09	2⅛″	H2S	2.125″	1.75″	1″	82.6″ Make Up	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C194-029-09	2⅜″ X 1¾″	H2S	2.375″	1.75″	1″	76″	1½″ AMMT Box	1½″ AMMT Pin	5000PSI
C194-028-23	2⅞″ X 1¾″	H2S	2.875″	1.75″	1″	83″	2⅜″ PAC Box	2⅜″ PAC Pin	5000PSI
C194-030-23	2⅞″ X 2″	H2S	2.875″	2.00″	1″	83″	2⅜″ PAC Box	2⅜″ PAC Pin	5000PSI
C194-032-23	2⅞″ X 2⅜″	H2S	2.875″	2.39″	1.38″	83″	2⅜″ PAC Box	2⅜″ PAC Pin	5000PSI
C194-042-23	3⅛″ X 1 ¾″	H2S	3.125″	1.75″	1″	71″	2⅜″ PAC Box	2⅜″ PAC Pin	5000PSI

CARSAC HT Connector Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C169-014-08	1¾″	STD	1.75″	0.437″	1″ AMMT Box	1″ AMMT Pin	3000 PSI
C169-022-10	3⅛″	STD	3.125″	1.25″	2⅜″ REG Box	2⅜″ REG Pin	5,000 PSI
C169-032-08	1 1⁄16″	H2S	1.687″	0.500″	1″ AMMT Box	1″ AMMT Pin	3,000 PSI
C169-026-08	1¾″	H2S	1.750″	0.500″	1″ AMMT Box	1″ AMMT Pin	5,000 PSI
C169-039-09	2⅛″	H2S	2.125″	0.875″	1½″ AMMT Box	1½″ AMMT Pin	5,000 PSI
C169-028-09	2¼″	H2S	2.25″	1.00″	1½″ AMMT Box	1½″ AMMT Pin	5,000 PSI
C169-037-09	2⅜″	H2S	2.375″	1.00″	1½″ AMMT Box	1½″ AMMT Pin	5,000 PSI
C169-030-23	2⅞″	H2S	2.875″	1.250″ Nom	2⅜″ PAC Box	2⅜″ PAC Pin	5,000 PSI
C169-029-10	3⅛″	H2S	3.125″	1.25″	2⅜″ REG Box	2⅜″ REG Pin	5,000 PSI

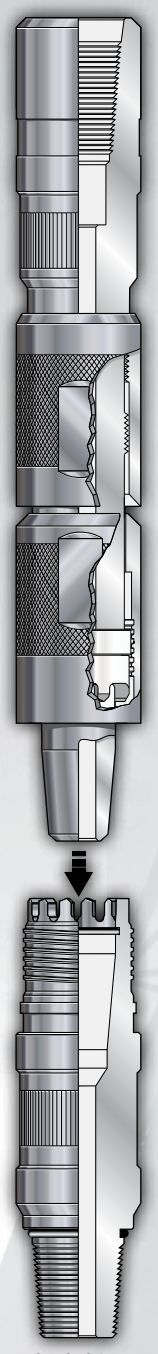
Dual Ball Kelly Cock ValveTechnical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C204-006-23	2⅞″	STD	2.875″	0.968″	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C204-007-10	3⅛″	STD	3.125″	1.258″	2⅜″ REG Box	2⅜″ REG Pin	5000 PSI
C204-001-08	1 1⁄16″	H2S	1.687″	0.5″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C204-003-09	2⅛″	H2S	2.125″	0.780″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C204-005-09	2⅜″	H2S	2.375″	0.968″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI



Deployment System

CARSAC 'HT' Connector



CARSAC 'HT'

The CARSAC 'HT' (Combination Anti-Rotation Self Aligning Connector – High Torque) was developed to create a dedicated self aligning tool string connector, capable of withstanding high degrees of torque in both directions.

The CARSAC 'HT' is designed to assist with the tubing 'make-up' where it is difficult to rotate the tools to engage threads and is particularly suited for long toolstring applications. It is especially useful when utilized in conjunction with integral ball valves and deployment bars.

By incorporating the CARSAC 'HT' in the BHA, the string can be divided into smaller, more manageable sections. Each section can be torqued up accordingly before loading into the lubricator section. The CARSAC 'HT' matches the torsion yield strengths of all coiled tubing drilling thread connections where high torque tolerance is a major consideration).

The locking taper feature allows each section of the toolstring to simply 'stab-in' and centralize before the torque drive teeth positively engage into the female lower sub. The primary locking collar is then screwed down to lock the two sections together. The secondary locking collar can then be screwed down to secure the joint and prevent the primary collar from backing off.

The CARSAC 'HT' is also a fundamental component of the Coiled Tubing Deployment System. For applications where the toolstring length exceeds the capacity of the lubricator section, BHA deployment can be staggered by use of a Coiled Tubing Deployment System. By running a combination of a Deployment Bar, Dual Ball Kelly Cock Valve and a CARSAC 'HT', the BHA can be deployed in multiple stages, (see pages 56-57).

Features and Benefits

- Features/Benefits
- Anti Rotation
- High Tensile/High Torque
- Self-aligning
- Easy stabbing/easy break-out

CARSAC 'HT' Technical Specifications

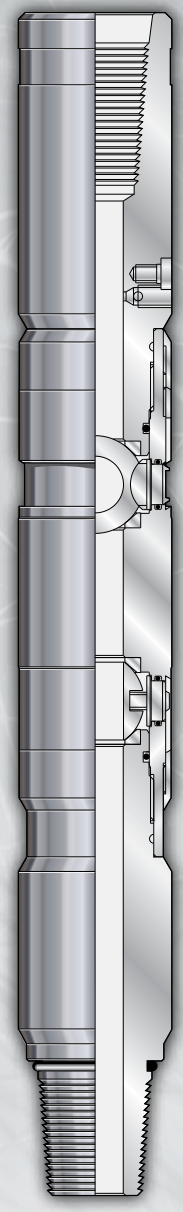
Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C169-032-08	1 1⁄16″	H2S	1.687″	0.500″	1″ AMMT Box	1″ AMMT Pin	3,000 PSI
C169-026-08	1¾″	H2S	1.750″	0.500″	1″ AMMT Box	1″ AMMT Pin	5,000 PSI
C169-039-09	2⅛″	H2S	2.125″	0.875″	1½″ AMMT Box	1½″ AMMT Pin	5,000 PSI
C169-028-09	2¼″	H2S	2.25″	1.00″	1½″ AMMT Box	1½″ AMMT Pin	5,000 PSI
C169-037-09	2⅜″	H2S	2.375″	1.00″	1½″ AMMT Box	1½″ AMMT Pin	5,000 PSI
C169-030-23	2⅞″	H2S	2.875″	1.250″ Nom	2⅜″ PAC Box	2⅜″ PAC Pin	5,000 PSI
C169-029-10	3⅛″	H2S	3.125″	1.25″	2⅜″ REG Box	2⅜″ REG Pin	5,000 PSI
C169-014-08	1¾″	STD	1.75″	0.437″	1″ AMMT Box	1″ AMMT Pin	3000 PSI
C169-022-10	3⅛″	STD	3.125″	1.25″	2⅜″ REG Box	2⅜″ REG Pin	5,000 PSI

Dual Ball Kelly Cock Valve

The Dual Ball Kelly Cock Valve is designed to be used in conjunction with the Combination Anti Rotation Self Aligning Connector (CARSAC), in order to safely deploy coiled tubing downhole assemblies in or out of the wellbore (see page 58).

The Dual Ball Valves can be opened or closed at surface by the use of an Allen wrench. By sliding a locking plate to allow a wrench to be inserted into the ball key, the locking slot can be rotated into the horizontal or vertical position. When both balls have been turned into the open position, pressure can be bled off via the bleed screws and balls.

A locking feature is incorporated in the design to hold the balls securely in the open position when run into the wellbore.

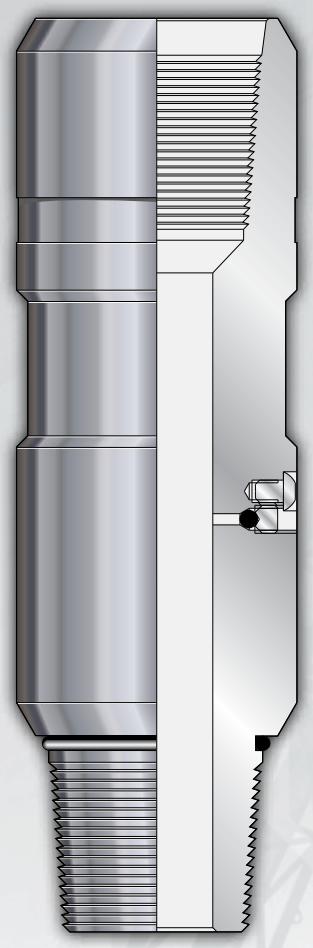


Dual Ball Kelly Cock Valve

Dual Ball Kelly Cock Valve Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C204-006-23	2⅞″	STD	2.875″	0.968″	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C204-007-10	3⅛″	STD	3.125″	1.258″	2⅜″ REG Box	2⅜″ REG Pin	5000 PSI
C204-001-08	1 1⁄16″	H2S	1.687″	0.5″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C204-003-09	2⅛″	H2S	2.125″	0.780″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C204-005-09	2⅜″	H2S	2.375″	0.968″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI

Coiled Tubing Bleed Off Sub



Coiled Tubing Bleed Off Sub

The NOV CT Bleed Off Sub is a short tool that can be placed anywhere in a CT toolstring where there is a possibility of trapped residual CT pressure.

Features and Benefits

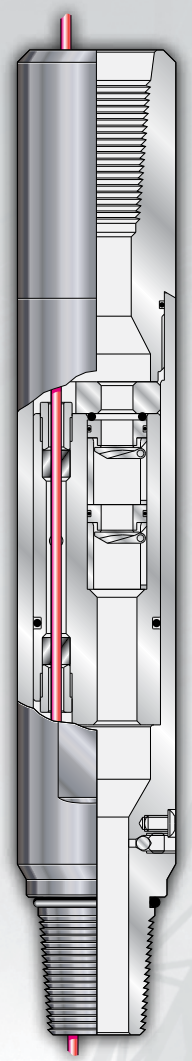
- The NOV CT Bleed Off Sub enables the CT operator to manually bleed the tool string at surface using a hex socket wrench
- The NOV CT Bleed Off Sub utilizes a ball seat and has a captive bleed screw to prevent it completely backing out of the sub body
- The NOV CT Bleed Off Sub is particularly useful when used in conjunction with the dual ball Kelly cock valve for deploying tools into the well

Coiled Tubing Bleed Off Sub Technical Specifications

Part Number	Object Name	Size	Service	Max OD	Min ID	Top Connection	Working Pressure
C169-035-24	BLEED OFF SUB	2⅞″	H2S	2.875″	1.25″	2⅜″ PAC DSI	5000PSI
C169-031-24	BLEED OFF SUB	3⅛″	STD	3.125″	1.25″	2⅜″ PAC DSI	5000PSI

LOGGING TOOLS

Twin Flapper Check Valve with Cable Bypass



Twin Flapper Check Valve with Cable By-pass

The Twin Flapper Check Valve with Cable By-pass is used for logging cable by-pass operations. It provides a means to accomodate the Twin Flapper Check Valve in Coiled Tubing logging operations. It prevents the back flow of well fluids into the coiled tubing in the event of failure or damage to the coiled tubing string or surface equipment.

The design of the Twin Flapper Check Valve incorporates a dual sealing system in each flapper assembly for increased safety. A teflon seal provides the primary low pressure seal, while at higher pressure, the flapper seals on a metal to metal arrangement.

The Twin Flapper Check Valve assemblies with Cable By-pass are available in a range of sizes.

NOV also manufacture a range of cable logging associated tools to be used in conjunction with the Twin Flapper Check Valve with By-pass.

This includes an Over Pressure Release Joint and the Logging Cable Termination Sub (see page 63).

Features and Benefits

- Dual sealing in each flapper cartridge i.e. low pressure teflon seat/seal and high pressure full metal to metal seat/seal
- Fluid passage for balls, darts & plugs
- Removable flapper cartridges
- Electric Line bypass facility

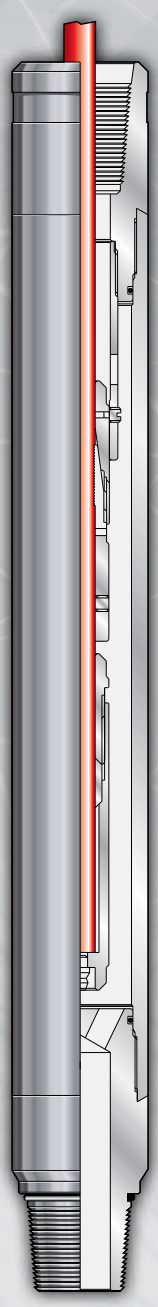
Twin Flapper Check Valve with Cable Bypass Technical Specifications

Part Number	Tool Size	Service	Max OD	Cable Size	Min ID	Top Connection	Bottom Connection	Working Pressure
C165-048-08	2.25″	H2S	2.25″	7/32″	N/A	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C165-048-09	2.25″	H2S	2.25″	7/32″	N/A	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C165-116-24	2.88″	H2S	2.875″	7/16″	N/A	2⅜″ PAC DSI Box	2⅜″ PAC DSI Pin	5000 PSI
C165-140-23	3.12″	H2S	3.12″	.233″	N/A	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C165-128	3.12″	H2S	3.12″	5/16″	N/A	2⅜″ REG Box	2⅜″ PAC Pin	5000 PSI

Logging Cable Termination Sub

The Logging Cable Termination Sub provides a method of securing the Cable and inhibits the ingress of fluids into the Logging Cable, during normal coiled tubing operations.

The Logging Cable Termination Sub allows the operator to use Logging coiled tubing for conventional runs, without the added expense of having to provide two types of Coiled Tubing on the rig, when both logging and manipulation work is required.



Logging Cable Termination Sub

Fitting Method

The coil should be cut back to allow sufficient cable length protruding below, to reach the position in the BHA where the Logging Cable Termination Sub will be positioned.

After securing the Coiled Tubing Connector and the upper part of the BHA to the coil, the Logging Cable is secured into the Cable Anchor, which is retained with Shear Pins into a Shear Sub. The Shear Pins allow the Cable to release from its mounting if the Logging Cable encounters a tensile strain greater than the shear value of the Shear Pins.

The remaining Cable is inserted into a Termination Body with a rubber element. The rubber element is compressed around the Cable and into the bore of the Body, a suitable fluid repellent can then be injected through a nipple at the bottom of the Body.

The Outer sleeve is secured around the Cable Anchor and Termination Body to the Top Sub and the Bottom Sub is then fitted to complete the assembly.

The remaining components of the BHA, which normally include a Twin Flapper Check Valve and Over Pressure Shear Sub Release Joint, can then be attached.

Features and Benefits

- Size/Nipple
- Thread connection

Logging Cable Termination Sub Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Cable Size	Top Connection	Bottom Connection	Working Pressure
C139-091-09	2⅛″	H2S	2.125″	N/A	5⁄16″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C139-090	2¼″	H2S	2.25″	N/A	7⁄16″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C139-094-24	2⅜″	H2S	2.875″	N/A	7⁄16″	2⅜″ PAC - DSI Box	2⅜″ PAC - DSI Pin	5000 PSI

CT Logging Cable Head (Mono Conductor)

Introduction

The Coil Tubing Cable Logging Head for Mono-Conductor Cables is a robust tool that integrates 6 standard NOV products into an optimised assembly. The assembly provides a Coiled Tubing BHA with the required standard Coiled Tubing safety and disconnect features while also providing an electrical path for a mono-conductor cable. Although the tool is primarily for Cable Logging applications the tool can be used for any application where an electrical connection is required below the tool.

The tool can be connected quickly and simply to the coiled tubing using the CARSAC connector. This allows the majority of the tool to be pre-assembled away from the rig floor providing time savings and improving safety.

The tool consists of a Cable Anchor Sub, Coiled Tubing quick Connect (CARSAC), Twin Flapper Check Valve, Hydraulic Disconnect, Circulation Control Valve, and the Electrical Connectors of choice. It is made from Alloy Steel and is suitable for mild H2S environments. However, due to the complexity of the internals of the tool it is not advisable to circulate large amounts of corrosive fluid through the tool.

Cable Anchor Sub

The Cable Anchor Sub is located at the top end of the assembly and has several functions. It provides a connection to the pre-installed coiled tubing connector while also providing an anchor point for the armoured cable. The armoured cable is clamped in place using a slip assembly. Once fully installed, the top half of the CARSAC connector can be threaded to the lower end.

Carsac Joint

The CARSAC connector is a Torque resistant Coiled Tubing Quick Connect. It allows for fast and simple connection of the tool or BHA to the coiled tubing. The upper section is attached to the coil by threading to the lower end of the Cable Anchor Sub. The lower section is threaded to the remainder of the Cable Logging Tool.

This provides both time savings and improvements in safety. Time spent on the rig floor attaching the tools to the coil is minimised, and the majority of the Cable Head assembly can be assembled in a safe comfortable environment.

Once the top half of the CARSAC is connected to the Cable Anchor Sub and the lower half of the Cable Head is assembled, the two sections can be mated and secured quickly and easily. The mating process consists of aligning and stabbing the two sections together then securing with a double collar. This secures the whole Cable Head assembly to the coiled tubing.

Twin Flapper Check Valve

The Twin Flapper Check Valve with Electrical Bypass is a high integrity safety device used to prevent the inflow of fluids into the Coiled Tubing in the event of failure or damage to the coiled tubing string or surface equipment. It is a one-way valve that allows fluid and drop balls to pass down through the flappers but prevents inflow of fluids and pressure into the Coiled Tubing. The Flappers provide a high integrity seal and can be supplied with dual seals to provide elastomeric sealing at low pressure and metal-to metal sealing at high pressures. Dual Flappers provide redundancy for additional safety. The flappers are housed in cartridges that can be easily replaced allowing for simple and quick assembly and disassembly.

The upper part of this assembly houses the primary electrical bulkhead into which the flying lead from the Cable Anchor Sub is passed through the CARSAC and connected to the top of this bulkhead. Below this bulkhead the fluid path and the electrical paths are separated and isolated. The fluid path maintains pressure integrity through the check valves while the electrical path by-passes the check valves without compromising the integrity of the check valves.

CT Logging Cable Head (Mono Conductor) Continued

Heavy Duty Over Pressure Release Joint (Double Safe)

The Heavy Duty Over-Pressure Release Joint is a robust, high strength assembly used to disconnect the Coil Tubing from the tool/work string should it become stuck downhole. When activated, the tool will disconnect in a controlled manner at a pre-determined point in the tool.

The Release Joint is designed to withstand vibration and torsional loading and provides an electrical connection through the tool. The release joint is flow activated, and leaves an internal fish neck facing upwards after disconnect. This enables the remainder of the work/tool string left downhole to be easily latched with a standard GS Pulling Tool. Shear pins ensure that the release joint is not activated accidentally by a pressure surge at the tool.

To release the HDOP Release Joint the circulation pump rate is increased to a pre determined level (see Circulation Control Valve below). An internal piston with varying diameters is exposed to this internal pressure causing the piston to move down after shearing retaining shear screws. The movement of this piston releases the latching device. To ensure that the tool is not released accidentally by a pressure surge a secondary over pull on the coiled tubing is required to complete release. This secondary over pull will shear a second set of pins all of which are pre set by the operative to suit the specific operation.

Circulation Control Valve

The Circulation Control Valve is a standard, robust, downhole device that allows fluid circulation to be established through the Coiled Tubing above the work/toolstring.

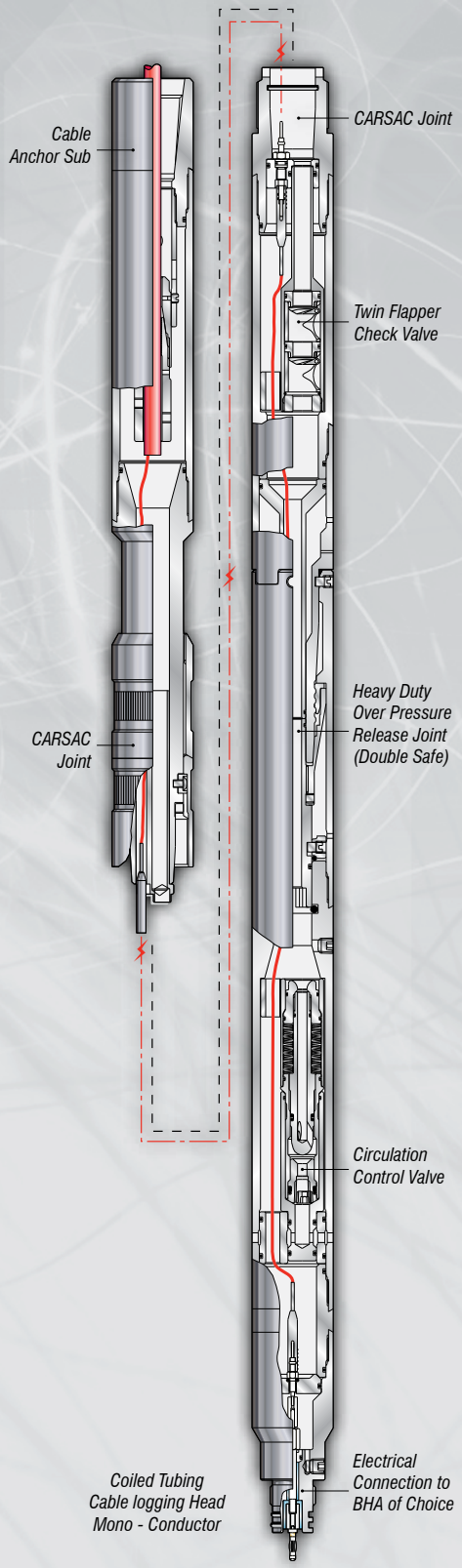
The Circulation Control Valve has two principle functions:

1) To provide a controlled back pressure on the circulated fluid when working in an under balanced well operation. The flow rate and back pressure is controlled by changing choke beans in the assembly.

2) To provide an adjustable maximum circulation shut off control valve to enable the HDOP Release Joint to operate effectively. At a pre-determined internal flow pressure the internal piston of the Circulation Control will move forward and close the flow path. Internal pressure in the coil will then build to the required release pressure. If the maximum flow rate is reached as a result of a pressure surge, the internal piston will return and open the circulation path. The fluid path exits the coiled tubing assembly at this point into the annular volume. The electrical conduit by-passes the Circulation Control Valve and is terminated at the lower internal bulk head.

Electrical Connection to BHA of Choice

The Tool can be supplied with a variety of industry standard CT Mono-Conductor Electrical Connectors dependant. Please specify the connection required when ordering.



CT Logging Cable Head (Mono Conductor) Technical Specifications

Part Number	Tool Size	Service	Max OD	Min ID	Cable Size	Top Connection	Bottom Connection	Working Pressure
C205-003	1 1⁄16″	H2S	1.687″	N/A	7⁄16″	1″ AMMT Box	1 3⁄16″ GO Pin	5000 PSI
C205-004	2 1⁄8″	H2S	2.125″	N/A	7⁄16″	1 1⁄2″ AMMT Box	1 3⁄16″ - 12 'GO' Pin	5000 PSI
C205-011-23	2 7⁄8″	H2S	2.875″	N/A	7⁄16″	2 3⁄8″ PAC Box	1 3⁄16″ - 12 'GO' Pin	5000 PSI

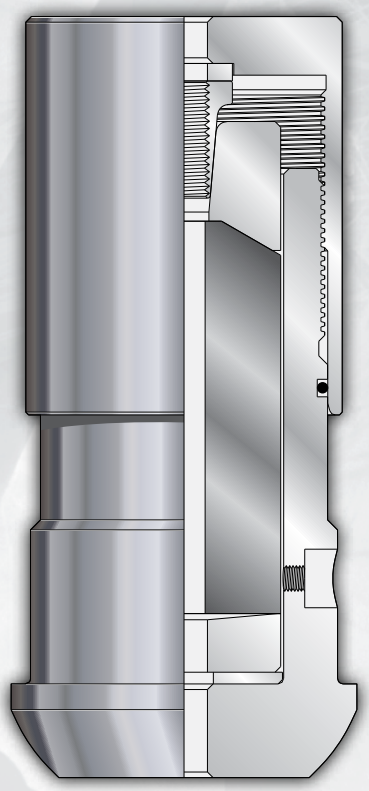
Cable Reel Assembly

The Cable Reel assembly is the primary component of the E-line system and works in conjunction with NOV's model #1000-000 cable head assembly mounted directly into the reel core allowing access to the coil ID.

Using a durable and fully adjustable dual packoff (hydraulic and mechanical) which can accommodate a variety of cable sizes.

Features and Benefits

- Easy to make up/breakout
- Easy to redress



Cable Reel Assembly

Cable Reel Assembly Technical Specifications

Part Number	Cable Size	OD	ID
1010-2188	7/32″	3.687″	7/32″
1010-025	1/4″	3.687″	1/4″
1010-3125	5/16″	3.687″	5/16″
1010-375	3/8″	3.687″	3/8″
1010-4375	7/16″	3.687″	7/16″
1010-050	1/2″	3.687″	1/2″

EXTENDED REACH TOOLS

Coiled Tubing Agitator™ Tool

CT Agitator Tool

The CT Agitator creates gentle pressure pulses that have been proven to help you complete CT operations in extended reach wells and reduce the time to complete an operation. The tool generates a pressure pulses which create an axial movement in the CT Pipe in the well thus reducing the onset of lock up. This axial movement reduces friction between the well bore and the OD of the CT.

How It Works

The CT Agitator comprises a short Positive Displacement Motor section which powers a rotating valve. The rotor of the short motor section oscillates an upper valve plate with an off-centered hole above a static plate with a central hole. As the two holes align, the total flow area increases. Then, as the rotation continues, it partially restricts the static hole and decreases the flow area. The changing flow area creates pressure pulses which travel outward from the tool to break static friction with the wellbore.

Features

- Variable pressure pulses (Frequency and size of the pulses is directly proportional to the flow rate)
- No downhole settings or adjustments required

Benefits

- Helps you complete CT operations in extended reach wells
- Reduces friction between the BHA and borehole
- Reduces helical buckling
- Improves weight transfer
- Allows you to complete operations faster

Field Proven Applications

- Extending Coiled Tubing reach
  - Acid treatments
  - Well cleanouts
  - Sliding sleeve manipulation
  - Logging
- Drilling
  - Coiled tubing drilling (CTD
  - Through tubing rotary drilling (TTRD)
- Fishing
  - Plugs
  - Sand Screens
- Milling
  - Composite plugs
  - Window milling
  - Scale

Coiled Tubing Agitator Tool Technical Specifications

Tool Size (OD)	2⅛″	2⅜″	2⅞″	2⅞″ (High Flow)	3⅛″ (High Flow)	3⅜″ (High Flow)
Overall Length	72″	72″	61⅜″	84″	84″	84″
Weight	80 lbs	90 lbs	100 lbs	100 lbs	125 lbs	145 lbs
Recommended Flow Range	40-80 gpm	40-80 gpm	40-80 gpm	40-140 gpm	40-140 gpm	40-140 gpm
Temp Range	150°C	150°C	150°C	150°C	150°C	150°C
Operating frequency	9 Hz @ 40 gpm	9 Hz @ 40 gpm	15 Hz @ 40 gpm	9 Hz @ 120 gpm	9 Hz @ 120 gpm	9 Hz @ 120 gpm
Operational Pressure Drop Generated	600-800 psi	600-800 psi	600-800 psi	500-700 psi	500-700 psi	500-700 psi
Max Pull	51,000 lbs	51,000 lbs	78,000 lbs	78,000 lbs	129,000 lbs	184,000 lbs
Connections	12″ AMMT pin/box	12″ AMMT pin/box	2⅜″ PAC pin/box	2⅜″ PAC pin/box	2⅜″ REG pin/box	2⅞″ REG pin/box or 2⅜″ REG

SPECIAL PURPOSE TOOLS

Fluid-Hammer™ Impact Drill Jar

Fluid-Hammer Impact Drill Jar

The Fluid-Hammer is a tool that transmits multiple downward impact forces at high frequency when fluid is pumped through it, thus eliminating the need to cycle the coil. The tool operates through a combination of layoff weight and controlled flow activation through the tool-string, converting flow and pressure into mechanical energy.

Applications

- Under balanced and over balanced clean outs
- Shifting stubborn sliding sleeves
- Breaking ceramic and glass discs
- Swaging collapsed tubing and screens
- Broaching operations
- Driving debris downhole
- Scale clean out including: cement, resin coated sand, plastic, barium, calcium and iron

The Fluid-Hammer comprises of a single piece, non flexible impact shaft, for simplicity and maximum efficiency in transmitting impacts. Internally, a fluted dart ensures that fluid can flow through the tool with the minimum of interruption. When the Fluid-Hammer is set down, the impact shaft becomes seated onto the fluted dart. The dart is extended upwards against a spring under piston pressure. At a critical point, the dart comes into contact with a tappet valve. The fluid flow path through the tool is interrupted as the tappet valve becomes seated, a rapid pressure drop results in a downward impact between dart and seat. Continuous flow with set down weight will recommence the cycle.

In order to function correctly, the Fluid-Hammer requires a small but necessary amount of movement/ stroke at the BHA.

The Fluid-Hammer Intensifier allows this function at shallow operating depths and during surface testing, when pick up or sit down weight is applied (see page 72). When operating at deeper depths this movement is usually taken up through the coil.

*Operations where large diameter/ heavy wall coil is used may require an extra intensifier to optimize the performance of the Fluid-Hammer.

The Fluid-Hammer has a non-typical power section which does not rely on rubber components for efficient functionality. Operators are not limited to pumping only water as a circulating medium. Nitrogen, Foam, Xylene, Diesel and light bodied fluids up to 12ppg can all be used at temperatures above 350°F.

The Fluid-Hammer is dressed to function in hostile environments such as H2S, Co2 and HcL. An Extreme Service Roto-Hammer is available when extreme PH or H2S is a problem. The Fluid-Hammer is currently available in 1.69″ & 2.125″ sizes.

Fluid-Hammer Impact Drill Jar (shown with a Ceramic Disc Breaker Bit fitted)

Fluid-Hammer Impact Drill Jar Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C182-022-08	1.695″	H2S	1.695″	NA	1″ AMMT Box	1″ AMMT Pin	500-2500 PSI
C182-023-09	2.125″	H2S	2.125″	NA	1½″ AMMT Box	1½″ AMMT Pin	500-2500 PSI

Fluid-Hammer™ Impact Drill Jar Bits

Fluid-Hammer Impact Drill Jar Bits Technical Specifications

Part Number	Tool Description	Service Type	Bit max OD	Upper Connection
00-31647	1 11/16″ Chisel Point (Rotor Hammer Bit)	STD	1.75″	1″ MT
00-31651	1 11/16″ Parafin Wax Cutter (RHB)	STD	2″	1″ MT
00-31649	1 11/16″ Star Chisel Bit (RHB)	STD	1.75″	1″ MT
C230-009-08	1 11/16″ Balistic Button Bit (RHB), 45mm	STD	45mm	1″ MT
C230-014-08	1 11/16″ Cross Blade Bit (RHB), 45mm	STD	45mm	1″ MT
00-31942	1 11/16″ Ceramic Disc Breaker (RHB)	STD	1.69″	1″ MT
00-31940	1 11/16″ Flat Blade Sand Bit	STD	1.69″	1″ MT
00-31648	2 1/8″ Chisel Point Bit (RHB)	STD	2.25″	1½″ MT
00-31652	2 1/8″ Parafin Wax Cutter	STD	2.5″	1½″ MT
00-31650	2 1/8″ Star Chisel Bit (RHB)	STD	2.5″	1½″ MT
C230-012-09	2 1/8″ Balistic Button Bit (RHB), 57 mm	STD	57mm	1½″ MT
00-31951	2 1/8″ Ceramic Disc Breaker	STD	2.12″	1½″ MT
C230-016-09	2 1/8″ Cross Blade Bit for (RHB), 57mm	STD	57mm	1½″ MT
00-31949	2 1/8″ Flat Blade Sand Bit	STD	2.19″	1½″ MT

Star Chisel Bit

Chisel Point Bit

Parafin Wax Cutter

Ballistic Button Bit

Flat Blade Sand Bit

Ceramic Disc Breaker

Fluid-Hammer™ Intensifier

Fluid-Hammer Intensifier

The Fluid-Hammer™ Intensifier is used in conjunction with the Coil Tubing Fluid-Hammer Impact Jar, its purpose being to provide the necessary tool movement and acceleration for the Fluid-Hammer to operate efficiently. This is achieved by storing upward energy in the discs and compression spring that will impart a predictable downward blow.

Operations where large diameter/heavy wall coil is used may require an extra intensifier to optimize the performance of the Fluid-Hammer Impact Jar.

The full 'pump thru' capability of the Intensifier is compatible with the Fluid-Hammer Impact Jar.

Features and Benefits

- Full flow through bore
- Maximized Stroke
- High sit down load
- Simple redress
- Only one dynamic seal

Fluid-Hammer Intensifier Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C182-020-08	1 1⁄16″	H2S	1.687″	0.44″	1″ AMMT Box	1″ AMMT Pin	450-750 (Up Impact) 500-800 (Down Impact)
C182-021-09	2⅛″	H2S	2.125″	0.39″	1½″ AMMT Box	1½″ AMMT Pin	500-800 (Up/Down Impact)

Flow Activated Multi-Shot Tubing End Locator

The Flow Activated Multi-Shot Tubing End Locator can be used as part of the standard tool string assembly to locate the end of the production tubing for depth correlation.

The Tubing End Locator is flow activated and therefore offers the ability to 're-tag' the end of the tubing as many times as required without the need to retract from the well for redress.

The tool is flow activated by surface pump volume and pressure, and the force required to pull through the tubing end can therefore be infinitely varied.

The Hydraulic Tubing End Locator is available in a range of toolstring sizes, with fingers to suit the tubing ID as required.

Features and Benefits

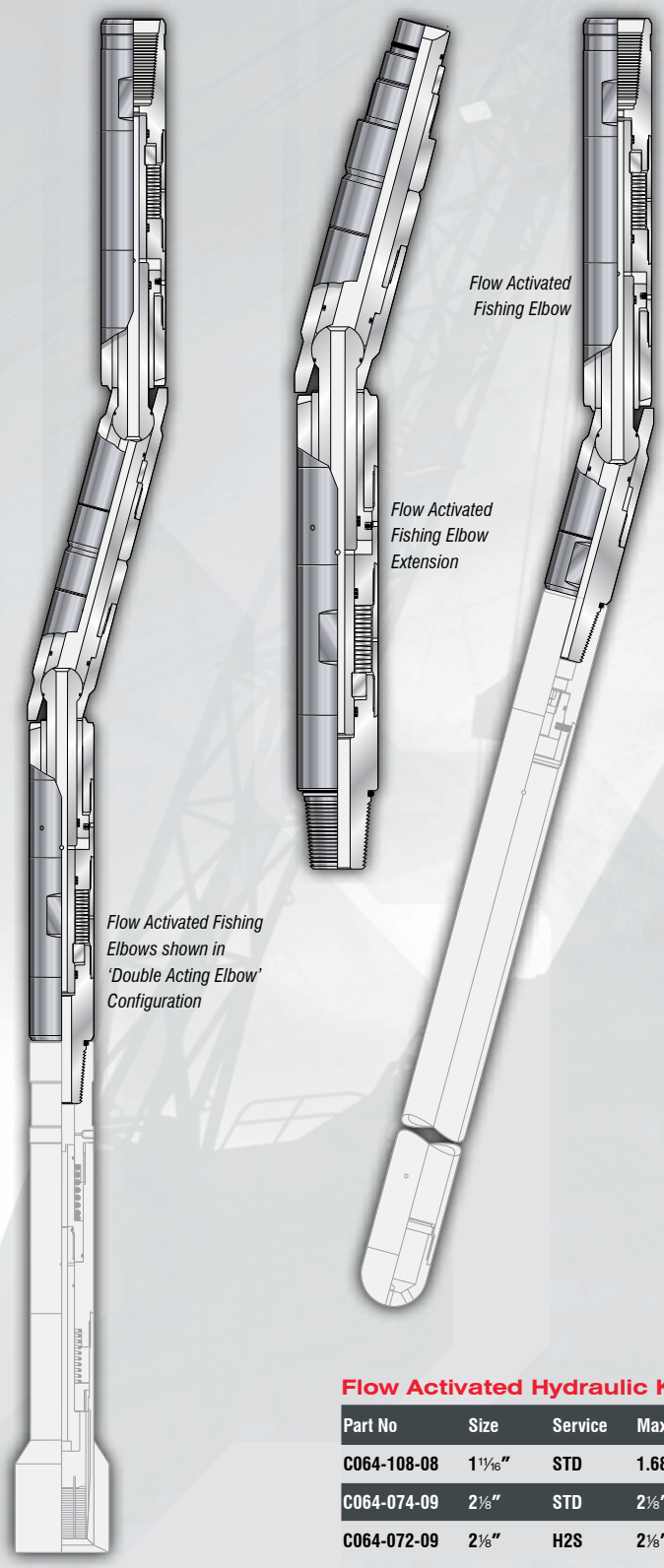
- Design allows multiple 're-tagging'
- Fingers retract within body diameter
- Flow or drop ball activated
- Optional external fish neck

Flow Activated Multi-Shot Tubing End Locator

Flow Activated Multi-Shot Tubing End Locator Technical Specifications

Part Number	Tubing Size Range	Service	Tool OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C062-063-08	2⅜" - 3½"	STD	1.69"	.375" (No Choke)	1" AMMT Box	1" AMMT Pin	500 PSI
C062-064-09	2⅞" - 3½"	STD	2.125"	.72" (No Choke)	1.5" AMMT Box	1.5" AMMT Pin	500 PSI
C062-065-09	3½" - 4½"	STD	2.625"	.930" (No Choke)	1.5" AMMT Box	1.5" AMMT Pin	500 PSI

Flow Activated Hydraulic Knuckle Joint



The Coiled Tubing Flow Activated Fishing Elbow, when incorporated within the Coiled Tubing has the flexibility of being a straight semi rigid tool string, but when pressure is applied to the tool string the Flow Activated Elbow bends and becomes inclined.

An additional Flow Activated Elbow Extension is also available to add greater re-configuration options to the Flow Activated Elbow. With an Elbow Extension the Flow Activated Elbow can be re-configured into a 'Double Acting Elbow' end form to aid side wall fishing operations.

The Flow Activated Elbow has a ball and socket knuckle with a key that gives a torque thru' capability.

Operation

The Elbow is flow activated and will allow normal through circulation without activating the bending mechanism.

By increasing the flow rate above the normal circulating flow rate, a pressure differential is achieved at the tool, typically in the range of 1000 psi, whereupon the Elbow, if unrestrained, will bend and become rigid giving a pressure drop indication of full inclination. (Under normal circumstances, in order to achieve the necessary operating pressure differentials, a choke will be installed at a point below the Elbow).

To repeat the cycle the flow rate is reduced back to normal circulation and the tool will straighten. The piston will automatically return to its start position so that the tool is reset. The pressure cycle can now be repeated as before to make the Elbow joint bend.

When adding an Elbow Extension to a single Elbow there are six positions of possible alignment, giving the operator control over the orientation selection of the extension elbow.

Features and Benefits

- Full flow through bore
- Internal pressure seal
- 15º or 30º inclusive angular deviation
- Torque thru' capability
- Lifting ability 200 lbs @ 12″
- Re-configure to give 'Double Acting Elbow' arrangement
- Pressure bleed off at full inclination

Flow Activated Hydraulic Knuckle Joint Technical Specifications

Part No	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C064-108-08	1 1⁄16″	STD	1.68″	.312″	1″ AMMT	1″ AMMT	5000 PSI
C064-074-09	2 1⁄8″	STD	2 1⁄8″	0.375″	N/A	1 1⁄2″ AMMT Pin	5000 PSI
C064-072-09	2 1⁄8″	H2S	2 1⁄8″	0.375″	1.5″ AMMT Box	1.5″ AMMT Pin	5000 PSI

Cement Valve

The Cement Valve is a check valve designed to support a column of fluid, until such time as an increase in pressure is applied to the column from above. Once the increased pressure is seen at the valve it will open and the column of fluid will be allowed to flow through the valve. By reducing pressure to the column of fluid to its original level the valve will close and the fluid will cease to flow.

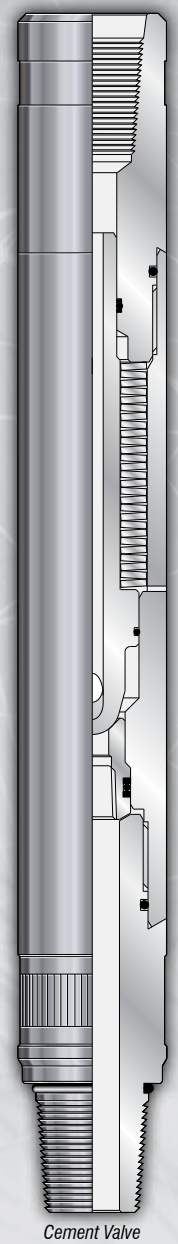
As pressure is applied to the column of fluid, it sees the selected cross sectional area and begins to compress the disc springs.

The disc springs are compressed, holding the piston nose on seat, preventing the from travelling through the tool. Pressure acting on the piston

When the pressure is increased the force acting on the piston the fluid is allowed to bypass the piston seat and travel down the tool.

The Cement Valve can be reconfigured to operate at different pressures in a range from 500psi.

The Cement Valve was originally developed as a control valve, capable of accurately delivering cement during coiled tubing cementing operations. The same tool can also be used to deliver any fluid downhole using the same principle.



Cement Valve

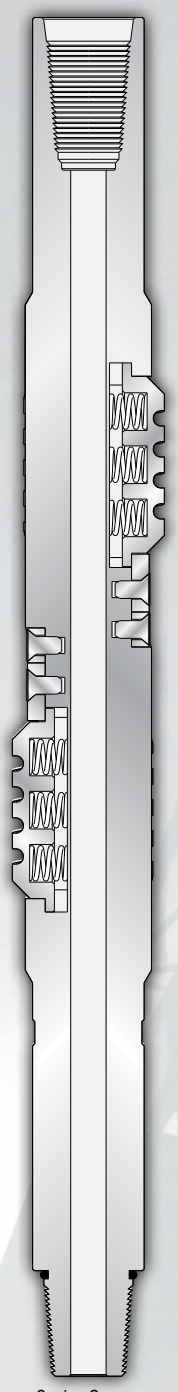
Features and Benefits

- Works in under balanced situations
- Suitable for most fluid applications
- Multiple operating delivery pressure configuration
- Precision calibrated valve opening pressure against pre-determined B.H.P.

Cement Valve Technical Specifications

Part Number	Size	Service	Max OD	Top Connection	Bottom Connection	Working Pressure
C180-032-08	1 11/16″	H2S	1.687	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C180-033-09	2⅛″	H2S	2.125	1.5″ AMMT Box	1.5″ AMMT Pin	5000 PSI
C180-039-23	2⅞″	H2S	2.875	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C180-040-23	3⅛″	H2S	3.125	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI

Coiled Tubing Casing Scraper



Casing Scraper

The NOV CT Casing Scraper is used to remove cement scale, mud, mill scale, rust, paraffin, perforation burrs and other substances from the inside walls of casing. This operation produces a smooth inside casing diameter that will assist in a successful down hole operation such as setting packers, bridge plugs, etc.

The NOV CT Casing Scraperr is a versatile and rugged tool manufactured from a solid piece of heat treated alloy steel. The scraper blades fit into precision-machined pockets and are securely held by a tenon retainer and lock block. The scraper blades feature left hand helical grooves and are heat treated for maximum service. The blades are arranged to produce a complete 360 degree coverage within the casing.

The NOV CT Casing Scraper is simple to operate. The tools generally run pin up and box down installed in the drilling string between the bit and the bit sub, The NOV CT Casing Scraper may be either reciprocated or rotated in the hole, however for best results it is recommended that the scraper first be run through the section to be scraped without rotation and then rotated as it is withdrawn, If rotation is not possible then the scraper should be run vertically twice. For maximum results the tool should be rotated from 30-45 degrees before making the second run.

NOV CT Casing Scraper are available to condition pipe ranging from 4½″ tubing to 13⅜″ casing.

Features and Benefits

- Maximised blade contact
- Large fluid/ debris flow path
- Short, compact, easy to assemble and disassemble
- Guide taper on blades for passing through joints without hanging
- Robust construction
- May be run on coiled tubing or drill pipe

Casing Scraper Technical Specifications

Part Number	Tool Description	OD	ID	Service	Thread Connection
0105-450	4.5″	3.56″	1″	Standard	2⅜″ REG
0105-500	5″ Casing Scraper	3.56″	1″	Standard	2⅜″ REG
0105-550	5.5″ Casing Scraper	4.37″	1″	Standard	2⅞″ REG
0105-600	6″ Casing Scraper	4.37″	1″	Standard	2⅞″ REG
0105-658	6.625″ Casing Scraper	4.37″	1″	Standard	2⅞″ REG
0105-700	7″ Casing Scraper	5.5″	1.25″	Standard	3½″ REG
0105-758	7.625″ Casing Scraper	5.5″	1.25″	Standard	3½″ REG
0105-858	8.625″ Casing Scraper	7.35″	2″	Standard	4½″ REG
0105-958	9.625″ Casing Scraper	7.35″	2″	Standard	4½″ REG
0105-133	13.375″ Casing Scraper	9.5″	3.5″	Standard	6⅝″ REG

Tubing Anchor with Mechanical Shear Release

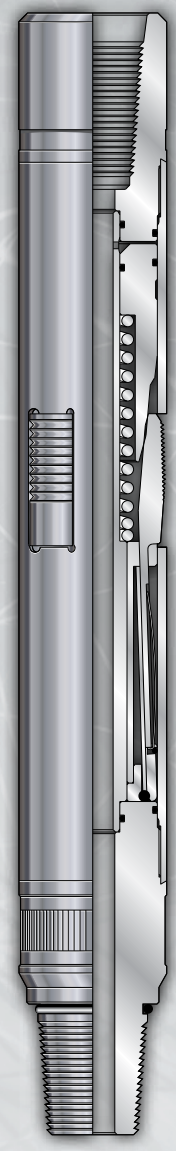
The Coiled Tubing Anchor provides a fixed anchor point within the tubing to assist in the performance of other coiled tubing downhole tools. The Coiled Tubing Anchor also can be supplied in a double unit for increased holding forces.

The Coiled Tubing Anchor is a flow activated tool. Increasing the flow at surface generates a back pressure at the tool. This back pressure activates the slip mechanism and the slips are set against the tubing wall. Once set, the anchor can withstand large axial loads, subject to the tool size and application.

The Anchor can be re-set at another location within the tubing string by reducing coiled tubing pressure. The slips are then able to retract away from the tubing wall and release the toolstring. Once the toolstring has been moved to a new location the slips can again be set with the application of pressure. This operation can be repeated as many times as required in a single deployment.

Typical CT operations that could benefit from the Coiled Tubing Anchor are:

- Works in under balanced situations
- Completion Tubing Cutting where coil motors need to be stationary for knives to be effective.
- Production Logging Surveys to hold coiled tubing deployed survey tools rigidly and to dampen vibration caused by high production flow rates.
- Accurate spotting of well treatments where changes in flow pressures can cause the end of coiled tubing to move significantly.

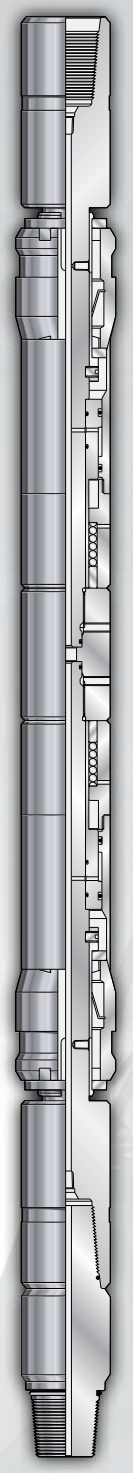


Tubing Anchor with Mechanical Shear Release

Tubing Anchor with Mechanical Shear Release Technical Specifications

Part Number	Tubing Size	Service	Tool OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C195-006-08	2⅜″	H2S	1.81″	0.312″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C195-007-09	2⅞″	H2S	2.18″	0.438″	2½″ AMMT Box	2½″ AMMT Pin	5000 PSI
C195-008-09	3½″	H2S	2.72″	0.812″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C195-009-24	4½″	H2S	3.62″	1.25″	2⅜″ PAC DSI Box	2⅜″ PAC DSI Pin	5000 PSI

Flow Activated Double Ended Selective Shifting Tool



Flow Activated Double Ended Selective Shifting Tool

The Double Ended Selective Shifting Tool (DESST) has been designed specifically to selectively shift PCE, Otis, Camco, Baker sliding sleeves (SSD's) in horizontal well bores.

The DESST shifting keys are normally retracted during the running operation and are hydraulically flow activated to the open shift position by increasing surface pump volume and therefore, pressure at the downhole location of the DESST and SSD. The DESST can selectively open or close multiple SSD's in a single coiled tubing trip.

Features and Benefits

- Flow activated (No drop balls required)
- Dual action for opening or closing sliding sleeves
- Positive or selective key options
- Optional external fish neck

Flow Activated Double Ended Selective Shifting Tool Technical Specifications

Part Number	SSD Size	Service	Key Range OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C084-106-08	1.875″	STD	1.85″ - 2.16″ Keys	0.25″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C084-093-08	2.312″	STD	2.15″ - 2.60″ Keys	0.25″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C084-093-09	2.312″	STD	2.15″ - 2.60″ Keys	0.25″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C084-135-09	2.53″	STD	2.53″ - 3.00″ Keys	0.14″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C084-094-09	2.75″	STD	2.72″ - 3.02″ Keys	0.39″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C084-110-09	2.812″	STD	2.72″ - 3.16″ Keys	0.39″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C084-142-23	3.688″	STD	3.66″ - 4.15″ Keys	0.44″	2⅜″ PAC Box	2⅜″ PAC Box	5000 PSI
C084-108-23	3.813″	STD	3.75″ Keys In	0.72″	2⅜″ PAC Box	2⅜″ PAC Box	5000 PSI
C084-117-09	4.562″	STD	4.52″ - 4.99″ Keys	0.72″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI

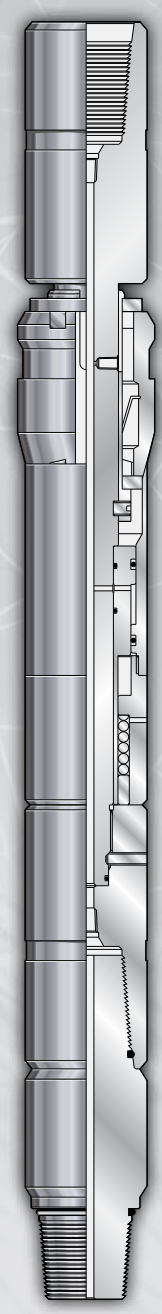
Flow Activated Shifting Tool

The Flow Activated Shifting Tool is designed to be used as a work tool for opening and closing sliding sleeves.

The normally closed shifting tool is flow activated and therefore does not require the use of drop balls to activate it. The shifting tool by design can be used to either open or close sliding sleeves.

Flow Activated Shifting Tools are supplied with a 'pin-pin' crossover, enabling the tool to be run shifting either up or down.

The Flow Activated Shifting Tools are available to suit all sizes and makes of sliding sleeves and can be supplied with either positive or selective keys.



Flow Activated Shifting Tool

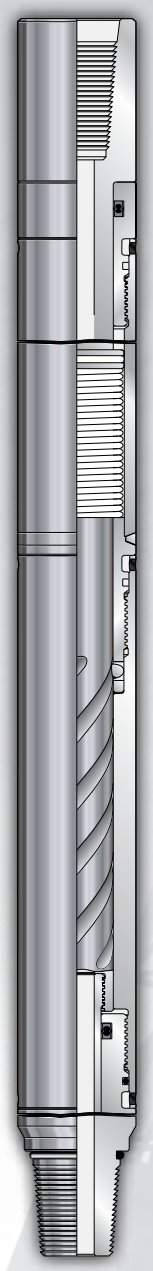
Features and Benefits

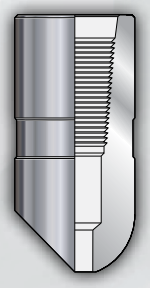
- Flow activated (No drop balls required)
- Positive or selective key options
- Optional external fish neck

Flow Activated Shifting Tool Technical Specifications

Part Number	SSD Size	Service	Key Range OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C084-104-08	1.875″	STD	1.875″ - 2.16″ Keys	0.25″	1″ AMMT Box	1″ AMMT Box	5000 PSI
C084-105-08	2.312″	STD	2.15″ -2.60″ Keys	0.25″	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C084-105-09	2.312″	STD	2.15″ - 2.60″ Keys	0.25″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C084-087-09	2.562″	STD	2.53″- 2.97″ Keys	0.14″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C084-111-09	2.75″	STD	2.72″ - 3.00″ Keys	0.39″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C084-118-09	2.812″	STD	2.72″ - 3.16″ Keys	0.39″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C084-089-09	3.313″	STD	3.600″ Keys Out	0.72″	1½″ AMMT Box	1½″ AMMT Box	5000 PSI
C084-077-23	3.688″	STD	3.66″ - 4.15″ Keys	0.437″	2⅜″8 PAC Box	2⅜″ PAC Box	5000 PSI
C084-119-23	3.812″	STD	3.74″ - 4.07″ Keys	0.72″	2⅜″ PAC Box	2⅜″ PAC Box	5000 PSI
C084-121-09	4.562″	STD	4.52″ - 4.99″ Keys	0.72″	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI

Kick Off Tool





Kick Off Tool

This unique tool is used to get the tip of your tubing past wellhead ledges, across liners or other restrictions in the well. Pump or spring open and push down to activate giving a 380° rotation.

Pump through and easy serviceability are featured here. Half and full mule shoes and some drilling bits are available to compliment the use of this tool.

Features and Benefits

- Simple mechanical design
- Automatic reset with release of pressure
- Variety of wash shoes to utilize
- Easy redress

Kick Off Tool Technical Specifications

Part Number	Tool Description	Service Type	Upper Connection	Lower Connection	OD	ID
811-050	1 1⁄16″ Kick Off Rotation Tool	H2S	1″ AMMT	1″ AMMT	1 1⁄16″	5⁄8″
812-050	2 1⁄8″ Kick Off Rotation Tool	H2S	1 1⁄2″ AMMT	1 1⁄2″ AMMT	2 1⁄8″	5⁄8″
813-000	2 7⁄8″ Kick Off Rotation Tool	H2S	2 3⁄8″ PAC	2 3⁄8″ PAC	2 7⁄8″	1 1⁄16″

Pull Test Plate

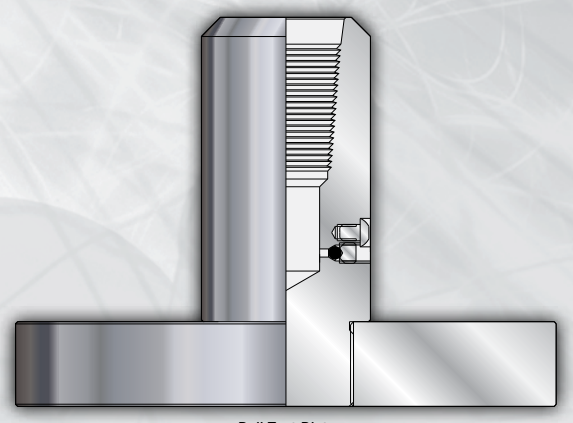
In CT tool string intervention operations, once the coiled tubing has been fed from the reel, over the goose neck and through the CT Injector, a CT Connector is fitted.

The NOV CT Pull Test Plate can be threaded onto the bottom of a CT Connector which enables the CT operator to take a pull in order to proof test the strength of the connector joint. The CT connector pressure integrity can also be tested at this point.

An integral bleed off port is incorporated to allow for the possibility of bleeding down trapped residual CT pressure.

Features and Benefits

- The pull plate is detachable and available in different diameters
- The connector/ bleed sub is tool string diameter
- The bleed off port utilizes a ball seat and has a captive bleed screw to prevent it completely backing out of the sub body.



Pull Test Plate

‘Strong Arm’ Orientation Tool

‘Strong Arm’ Orientation Tool

The ‘Strong Arm’ Orientation Tool was developed to deliver a higher torque turn than existing indexing tools on the market size for size.

The ‘Strong Arm’ Orientation Tool is suitable for most coiled tubing applications where a downhole rotation of the lower string is required e.g ‘hookwall’ overshot use for fishing below the tailpipe.

In coiled tubing drilling applications, the ‘Strong Arm’ Orientation Tool would be positioned in the bottom hole assembly above the PDM and MWD. The ‘Strong Arm’ Orientation Tool is operated by flow activation.

By increasing the flow rate above the drilling flow rate, a pressure is achieved at the tool, typically in the range of 1000 psi, whereupon a piston will stroke downwards. This downward movement will rotate a Drive Shoe by means of a helical Drive Shaft, converting linear motion into torque. The degree of orientation imparted is dependent upon the distance the piston moves. This ensures that rotation is truly stepless.

The Drive Shoe will normally rotate a maximum 45° in a single cycle. During coiled tubing drilling operations, this would be monitored using MWD. To repeat the cycle, the flow rate is reduced back to normal circulation, the tool will stop rotating and become rigid. The piston will automatically return to its start position so that the tool is reset. The indexing cycle can now be repeated as before.

Features and Benefits

- Stepless clockwise orientation
- Simple and robust orientation mechanism
- Precise rotational control

‘Strong Arm’ Orientation Tool Technical Specifications

Part Number	Size	Service	Max OD	Min ID	Top Connection	Bottom Connection	Working Pressure
C163-038-08	1 11/16″	STD	1.69″	0.312″	1″ AMMT Box	1″ AMMT Pin	500 - 1000 PSI
C163-030-08	1.75″	STD	1.75″	0.312″	1″ AMMT Box	1″ AMMT Pin	500 - 1000 PSI
C163-031-09	2.25″	STD	2.25″	0.39″	1.5″ AMMT Box	1.5″ AMMT Pin	500 - 1000 PSI
C163-032-10	3.125″	STD	3.125″	0.937″	2 3/8″ REG Box	2 3/8″ REG Pin	1000 - 4000 PSI
C163-036-09	2.125″	H2S	2.125″	0.39″	1.5″ AMMT Box	1.5″ AMMT Pin	500 - 1000 PSI

Threading Snake

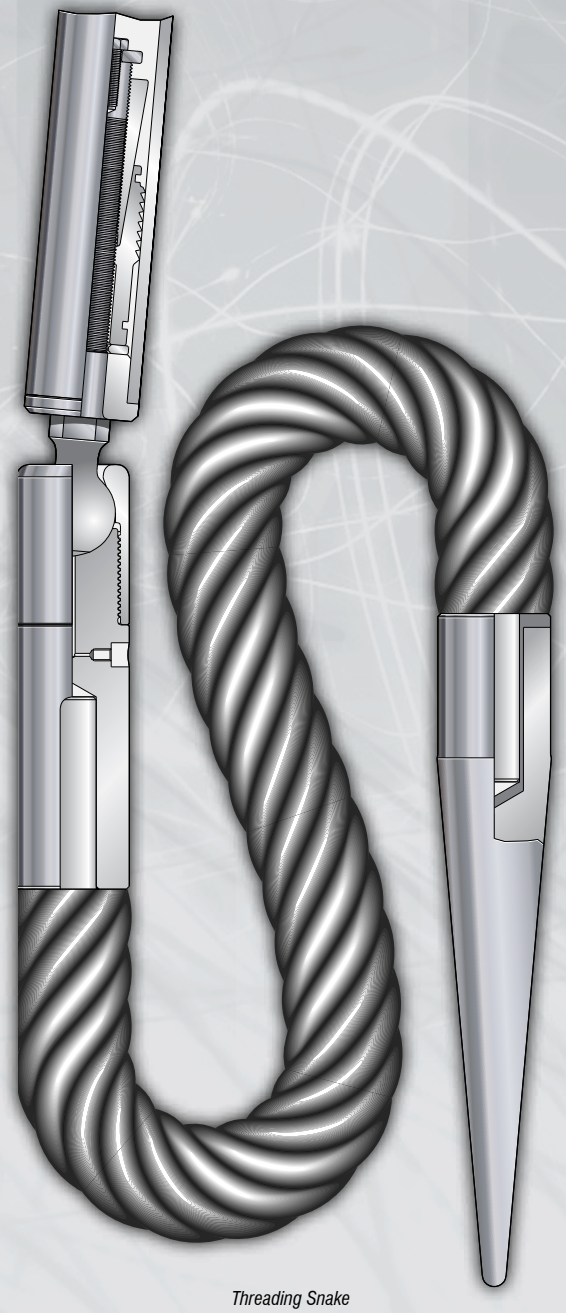
This special tool is a must when handling larger pipe or when stabbing pipe to the injector.

Simply attach the slip-end to the coil tubing on the spool and place the nose cone into the top of the injector and start up the injector to pull coil through chains.

After coil is out of the bottom of injector, simply release slips and remove threading snake.

Features and Benefits

- Ease of use
- Allows for easy stabbing of tubing into injector



Threading Snake

Threading Snake Technical Specifications

Part Number	Coiled Tubing Size	Connector Type	OD	Cable Length
801-100	1¼″	Roll On Connector	1¼″	15′
802-000	1½″	Slip	1½″	20′
803-000	1¾″	Slip	1¾″	20′
804-000	2″	Slip	2″	20′
806-000	2⅜″	Slip	2⅜″	20′
809-000	2⅞″	Slip	2⅞″	20′

Tube x Tube Internal Connector

Tube x Tube Internal Connector

This unique tool has speciality applications where larger and heavy wall tubing is being manipulated at surface. Stabbing into injectors, spooling, loading or unloading pipe are common uses for this tool. Simple insertion and tightening of the slips after both tubes are brought together will fully assemble this handy tool.

The center ball joint gives total flexibility against stiff pipe.

Features and Benefits

- Ease of use
- Ability to connect two mis-aligned strings

Tube x Tube Internal Connector Technical Specifications

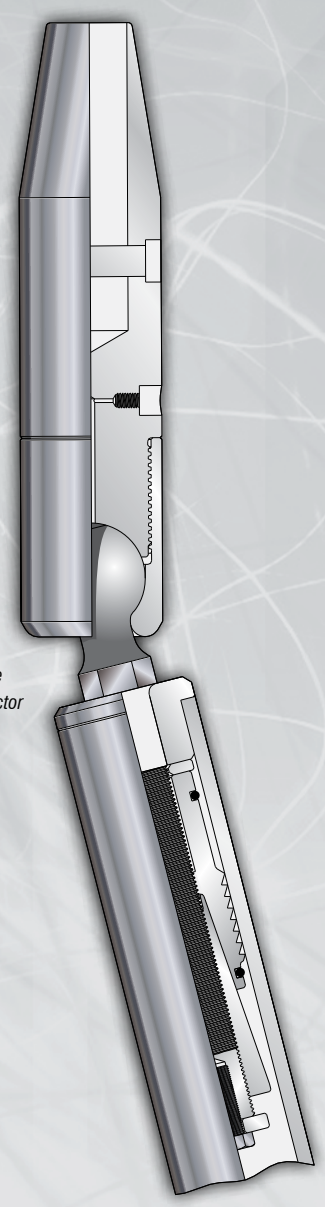
Part Number	Tool Description	Coiled Tubing Size
8095-500	2″ Tube x 2″ Tube - Double Joint Type	2″
8095-000	2″ Tube x 2″ Tube Connector - Ball Joint Type	2″ x 2″
8092-000	2⅜″ Tube x 2⅜″ Tube Connector - Ball Joint Type	2⅜″ x 2⅜″
8093-000	2⅝″ Tube x 2⅝″ Tube Connector - Ball Joint Type	2⅝″ x 2⅝″
8094-000	2⅞″ Tube x 2⅞″ Tube Connector - Ball Joint Type	2⅞ x 2⅞
8094-500	2⅞″ Tube x 2⅞″ Tube - Double Joint Type	2⅞
8087-500	3¼″ Tube x 3¼″ Tube - Double Joint Type	3¼″
8097-000	3¼″ Tube x 3¼″ Tube Connector - Ball Joint Type	3¼″ x 3¼″
8096-000	3½″ Tube x 3½″ Tube Connector - Ball Joint Type	3½″ x 3½″

Tube x Cable Internal Connector

This unique tool has speciality applications where larger and heavy wall tubing is being manipulated at surface. Stabbing into injectors, spooling, loading or unloading pipe are common uses for this tool. Simple insertion and tightening of the slips after both tubes are brought together will fully assemble this handy tool.

The center ball joint gives total flexibility against stiff pipe.

The Tube x Cable Connector allows the operator to thread a winch cable through his injector in reverse and tie into this unique tool. Using the pull of the winch, the coil can now be threaded into the injector safely.



Tube x Cable Internal Connector

Features and Benefits

- Versatile
- Allows attachment to other pulling sources

Tube x Cable Internal Connector Technical Specifications

Part Number	Coiled Tubing Size	Cable Range (max/min)
8085-000	2″	¼″ - 5⁄16″
8082-000	2⅜″	¼″ - 5⁄16″
8083-000	2⅝″	¼″ - 5⁄16″
8084-000	2⅞″	¼″ - 5⁄16″
8087-000	3¼″	¼″ - 5⁄16″

Tube x Cable x Tube Connector

A special application tool for the manipulation of larger and heavier walled tubing during surface operations. Operations such as stabbing into injectors, spooling, loading, or unloading pipes are common uses for this tool. Simple insertion and tightening of the slips makes it an easy tool to use.

The center cable allows for more flexibility when working with stiff pipe.

Features and Benefits

- Ease of use
- Allows connection of mis-aligned tubing

Tube x Cable x Tube Connector

Tube x Cable x Tube Internal Slip Connector Technical Specifications

Part Number	Tool Description	Coiled Tubing Size	OD
8094-600	2⅞" Tube X Cable X Tube W/ ⅝" Cable Button 8.5" Long	2⅞" Tube x ⅝" Cable x 2⅞" Tube	2⅞"

Part Number	Tool Description (With Out Cable)	Coiled Tubing Size	Cable Size & Length
8081-000	1¼" Tube Slip Connector X Cable For ⅜" Cable Button - No Cable Included	1¼"	⅜" Cable OD & No Cable
8088-100	1½" Tubing Slip Connector X Cable For ⅜" Cable Button - No Cable Included	1½"	⅜" Cable OD & No Cable
8095-300	2" Tube X Cable - Ball Joint Type For ⅜" Cable Button - No Cable Included	2"	⅜" Cable OD & No Cable
8094-100	2⅞" Tube X Cable - Ball Joint Type For ⅜" Cable Button -No Cable Included	2⅞"	⅜" Cable OD & No Cable

Part Number	Tool Description (With Cable)	Coiled Tubing Size	Cable Size & Length
8084-200	2⅞" Tube X Cable - Button Style w/⅝" Cable Button 20' Long	2⅞"	⅝" Cable OD & 20' Long Cable
8087-200	3¼" Tube X Cable - Button Style w/ ⅝" Cable Button 20' Long	3¼"	⅝" Cable OD & 20' Long Cable
8086-200	3½" Tube X Cable - Button Style w/ ⅝" Cable Button 20' Long	3½"	⅝" Cable OD & 20' Long Cable

Tube x Cable Connector (Button Style)

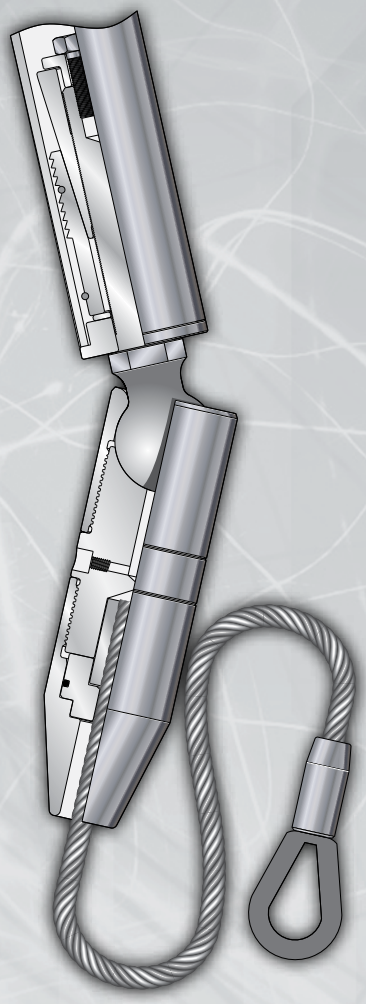
In response to industry demand NOV has developed and tested this addition to our line of tubing handling equipment.

Featuring a fail safe tubing slip insert to anchor to the tubing end and a cable loop for pulling and threading on the other end. Our unique omni-directional swivel offers flexibility of angles for ease of operation.

Available for coil sizes 1″, 2⅜″, 2⅝″, 2⅞″, 3¼″, 3½″ and cable sizes 7⁄16″ x 10 ft to 40 ft and 2″ x 10 ft to 40 ft.

Features and Benefits

- Easy installation
- Ease of use



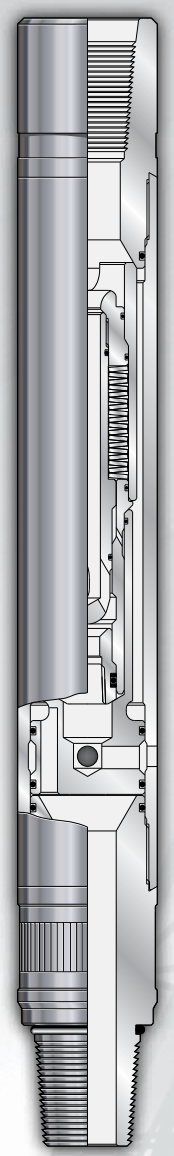
Tube x Cable Connector (Button Style)

Tube x Cable Connector (Button Style) Technical Specifications

Part Number	Tool Description (With Out Cable)	Coiled Tubing Size	Cable Size & Length
8081-000	1¼″ Tube Slip Connector X Cable for ⅜″ Cable Button - No Cable Included	1¼″	⅜″ Cable OD & No Cable
8088-100	1½″ Tubing Slip Connector X Cable for ⅜″ Cable Button - No Cable Included	1½″	⅜″ Cable OD & No Cable
8095-300	2″ Tube X Cable - Ball Joint Type for ⅜″ Cable Button - No Cable Included	2″	⅜″ Cable OD & No Cable
8094-100	2⅞″ Tube X Cable - Ball Joint Type for ⅜″ Cable Button -No Cable Included	2⅞″	⅜″ Cable OD & No Cable

Part Number	Tool Description (With Cable)	Coiled Tubing Size	Cable Size & Length
8084-200	2⅞″ Tube X Cable - Button Style w/ 19⁄32″ Cable Button 20′ Long	2⅞″	⅝″ Cable OD & 20′ Long Cable
8087-200	3¼″ Tube X Cable - Button Style w/ 19⁄32″ Cable Button 20′ Long	3¼″	⅝″ Cable OD & 20′ Long Cable
8086-200	3½″ Tube X Cable - Button Style w/ 19⁄32″ Cable Button 20′ Long	3½″	⅝″ Cable OD & 20′ Long Cable

Sequencing Valve



Sequencing Valve

The Flow Activated Sequencing Valve is designed to actuate downhole coiled tubing tools at a predetermined pressure and to operate as a controlled bleed valve when bleeding down internal coil pressure.

The Flow Activated Sequencing Valve is a 'normally open' valve which allows circulation through the tool to the annulus, whilst running into the well. Once a pre-determined differential pressure is exceeded, the flow path to the annulus is closed and diverted into the internal bore of the toolstring, thereby enabling hydraulic activation of any tools in the lower and upper end of the tool string.

When pulling a toolstring out of the well, a Sequencing Valve can be used to safely bleed off internal coil pressure. When the coil pressure is decreased to a pre-determined pressure, the Sequencing Valve opens and allows bleed through its bypass ports. Therefore during bleed down the internal/ external pressures are balanced, thus eliminating the possibility of prematurely releasing flow activated manipulation tools in the lubricator.

The closing differential pressure of the Sequencing Valve can be field adjusted to between 500 to 2000psi.

Features and Benefits

- 'Normally Open' allowing circulation to the annulus whilst running into well bore
- Flow activated, no drop ball required
- Simple field adjustment of closing differential pressure
- Quick to dump internal coil pressure at the tool
- Eliminates the possibility of dropping tools in the lubricator
- Suitable for fluid & gas applications

Sequencing Valve Technical Specifications

Part Number	Size	Max OD	Min ID	Service	Top Connection	Bottom Connection	Working Pressure
C168-028-08	1 1⁄16″	1.687″	0.250″	H2S	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C168-029-08	1¾″	1.687″	0.250″	H2S	1″ AMMT Box	1″ AMMT Pin	5000 PSI
C168-027-09	2⅛″	2.125″	0.393″	H2S	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C168-030-09	2¼″	2.25″	0.375″	H2S	1½″ AMMT Box	1½″ AMMT Pin	5000 PSI
C168-031-23	2⅞″	2.875″	0.375″	H2S	2⅜″ PAC Box	2⅜″ PAC Pin	5000 PSI
C168-032-23	3⅛″	3.125″	0.375″	H2S	2⅜″ PAC Box	2⅜″ PAC Pin	5000PSI

SERVICE TOOLS

8079 Mini Service Center

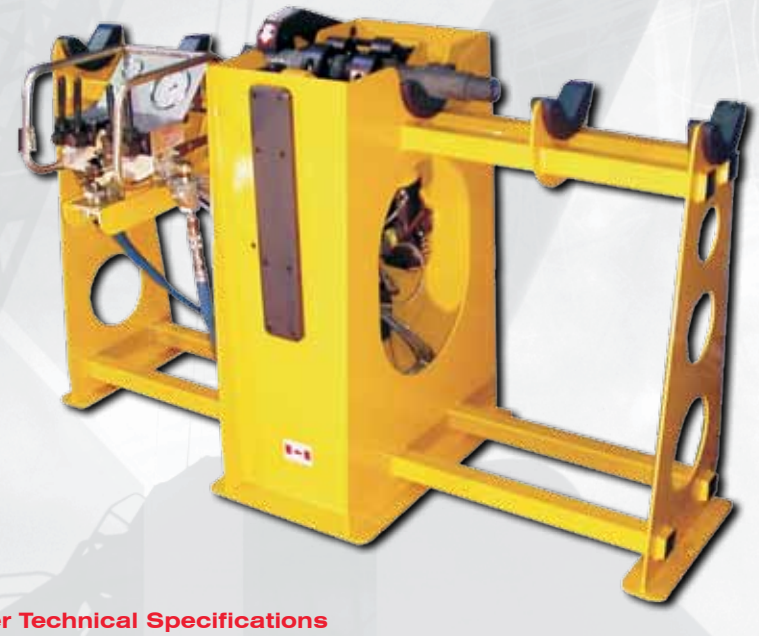
The 8079 Mini Service Center provides a safe and easy way to make up and break out tool joint connections on small OD tools and pipes. This fully hydraulic system is designed for practicality and with service shop safety in mind.

The back-up and tong are mounted into a compact, rigid, frame that integrates the unit controls making it easily handled and operated by one person. A single set of jaws can grip the full 1 1⁄16″ to 3½″ OD range and the unit can accommodate a different OD on either side of the connection.

The Mini Service Center operates at a low working pressure and can be powered by a variety of power sources.

Features and Benefits

- **Operated by One Person** – *Safe and easy to use*
- **Open Mouth Design** – *Allows for easy loading and unloading of the work piece*
- **Rigid, Compact Design** – *Easily maneuverable to accommodate various shop layouts*
- **Adjustable Clamp Force** – *Reduces risk of crushing thin walled tools*
- **Clamp Force Proportional to Torque** – *Reduces risk of slippage during make/break*
- **Clamp Arm** – *Secures work piece into service center*
- **Tong Dies** – *One set for entire OD range and can be easily changed when worn*



8079 Mini Service Center Technical Specifications

Description	Griffith® 8079 Mini Service Center
Part No.	8079-0001
Tool OD Range	1 1⁄16″ - 3½″
Distance Between Jaws	3″
Minimum Torque	400 ft/lbf
Maximum Torque	5,000 ft/lbf
Operating Pressure	2,900psi
Required Flow	3.9 gpm
Dimensions (L x W x H)	68″ x 28″ x 39″
Weight	750 lbs

8079 Mini Service Center Optional Accessories

Optional Accessory	Part Number
Electric Power Pack - Shop Version	8039-0002
Electric Power Pack - Explosion Proof	8044-0001
Pneumatic Power Pack	20670726
Logmaster Computer System	8089-B-4

8071 Little Jerk II Mini Tong

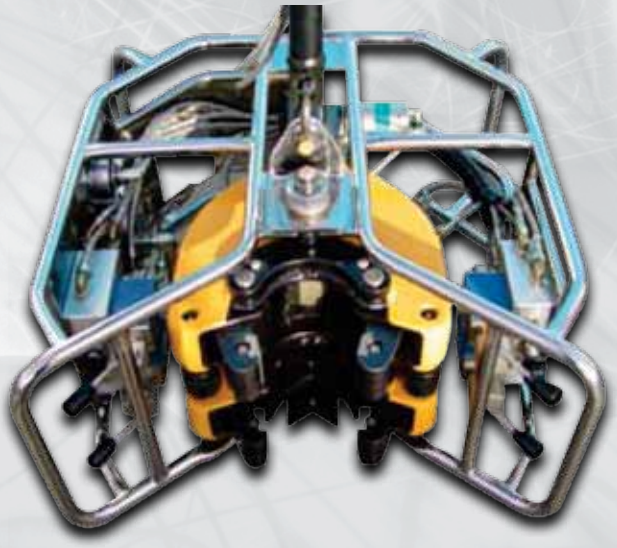
The 8071 Little Jerk 2 Mini Tong provides a safe and easy way to make up and break out tool joint connections on small OD tools and pipes. This portable compact service tool offers a fully hydraulic system designed for practicality and with rig floor and service shop safety in mind.

The back-up and tong are mounted into a durable crash frame that integrates the unit controls making it easily handled and operated by one person. A single set of jaws can grip the full 1 1/16″ to 3½″ OD range and the unit can accommodate a different OD on either side of the connection.

The Little Jerk 2 Mini Tong operates at a low working pressure and can be powered by a variety of power sources.

Features and Benefits

- **Operated by One Person** – *Safe and easy to use*
- **Open Mouth Design** – *Allows for easy loading and unloading of the work piece*
- **Rigid, Compact Design** – *Easily maneuverable and operable in various horizontal or vertical positions*
- **Hydraulic Lifting Cylinder** – *Hydraulically adjust the vertical position of the tong when operated from a suspended position*
- **Adjustable Clamp Force** – *Reduces risk of crushing thin walled tools*
- **Clamp Force Proportional to Torque** – *Reduces risk of slippage during make/break*
- **Tong Dies** – *One set for entire OD range and can be easily changed when worn*



8071 Little Jerk II Mini Tong Technical Specifications

Description	Griffith® 8071 Little Jerk Mini Tong II c/w Lift Cylinder
Part No.	8071-B-15
Tool OD Range	1 1/16″ - 3½″
Distance Between Jaws	3″
Minimum Torque	400 ft/lbf
Maximum Torque	5,000 ft/lbf
Operating Pressure	2,900psi
Required Flow	3.9 gpm
Dimensions (L x W x H)	24¼″ x 23″ x 15¼″
Weight	226 lbs

8071 Little Jerk II Mini Tong Optional Accessories

Optional Accessory	Part No.
Electric Power Pack - Shop Version	8039-0002
Electric Power Pack - Explosion Proof	8044-0001
Pneumatic Power Pack	20670726

8118 CT Motor Test Stand

The 8118 Coiled Tubing Motor Test Stand is a coiled tubing motor dynamometer test unit used to verify the performance of new coiled tubing motors as well as evaluate the performance of used motors being returned from the field.

The complete unit is designed to be operated safely and efficiently by one person and its modular design allows flexibility to place the frame, control console, HPU and fluid tank to accommodate your shop space.

The frame and brake system utilize three clamps for securing the test piece with a fast and simple means to connect the motor to both the brake system and the fluid supply line. A pneumatically modulated disc brake provides accurate, repeatable load application and the precise control required to evaluate small diameter motors at low torque and slow speed.

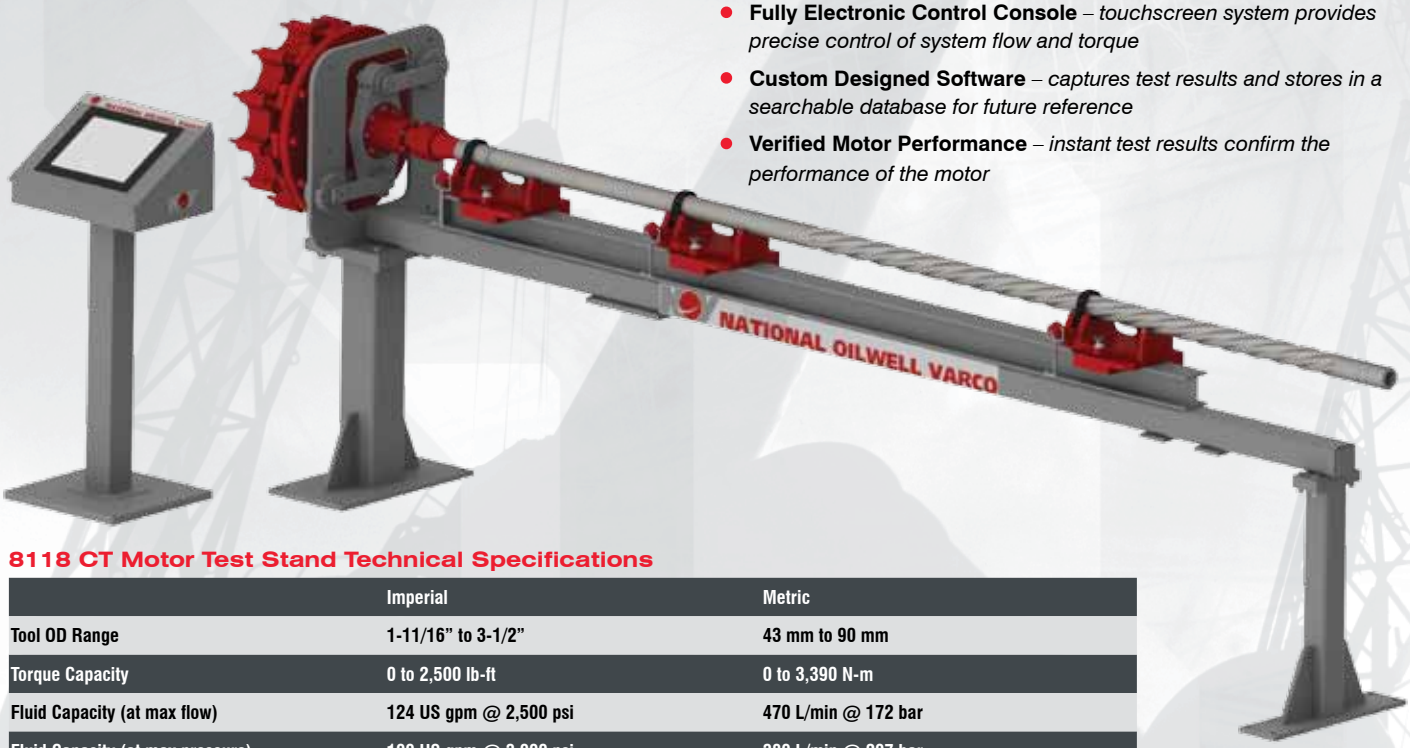
The high pressure pump unit is capable of producing 124 GPM @ 2,500 PSI and is powered by a 200 hp, 460V 3 PH 1800 RPM TEFC electric motor with a variable frequency drive.

The pump unit includes a suction strainer to remove contaminants that enter the test loop that may otherwise cause damage to the pump if left to flow through the system. An accumulator reduces flow pulsation created by the pump, allowing for more accuracy during testing.

The control console incorporates a custom designed touchscreen data acquisition system. The system compiles operator and motor information, records and stores the motor test results in a searchable database and provides the option to print the test results in both imperial and metric units.

Features and Benefits

- **Safe and Easy to Use** – *can be operated by one person*
- **Modular Design** – *component orientation can be altered to best suit your shop space*
- **Accurate and Reliable** – *return line suction strainer removes fluid contaminants and an accumulator reduces flow pulsations, producing more accurate test results*
- **Fully Electronic Control Console** – *touchscreen system provides precise control of system flow and torque*
- **Custom Designed Software** – *captures test results and stores in a searchable database for future reference*
- **Verified Motor Performance** – *instant test results confirm the performance of the motor*



8118 CT Motor Test Stand Technical Specifications

	Imperial	Metric
Tool OD Range	1-11/16" to 3-1/2"	43 mm to 90 mm
Torque Capacity	0 to 2,500 lb-ft	0 to 3,390 N-m
Fluid Capacity (at max flow)	124 US gpm @ 2,500 psi	470 L/min @ 172 bar
Fluid Capacity (at max pressure)	100 US gpm @ 3,000 psi	380 L/min @ 207 bar
Electrical	200 hp, 460V, 3PH, 245 Amp	149 kW, 460V, 3 PH, 245 Amp
Tank Capacity	550 US Gallon	2,090 L
Frame Dims	180" x 30" x 48"	455 cm x 76 cm x 122 cm
HPU Dims	84" x 48" x 36"	213 cm x 122 cm x 91 cm
Console Dims	21" x 18" x 48"	53 cm x 46 cm x 122 cm
Tank Dims	48" x 48" x 77"	122 cm x 122 cm x 196 cm

Specifications shown are approximations only and are subject to change.

1387 Mini-Torque II

The 1387 Mini-Torque II provides a safe and easy way to make up and break out tubular tool joint connections. This fully hydraulic unit is designed for practicality and with service shop safety in mind.

The compact, self-contained design incorporates a fixed headstock and tailstock and offers fully integrated controls allowing for safe and efficient operation by one person. A single set of tong dies is used over the full 2⅝″ to 8¾″ OD range of the unit, eliminating the need to constantly change them as the tool OD changes.

The Mini Torque II operates at a low working pressure and comes complete with a standalone electric driven HPU.

Features and Benefits

- **Operated by One Person** – Safe and easy to use
- **Rigid, Compact Design** – Easily maneuverable and operable while suspended from a crane or resting on the ground
- **Clamp Force Proportional to Torque** – Reduces risk of slippage during make/break
- **Self-Centering Clamp Cylinders** – Ensures torque is applied about axial center line of the tool, ensuring accurate torque measurements and preventing thread damage
- **Tong Dies** – One set for entire OD range and can be easily changed when worn

1387 Mini-Torque II Technical Specifications

Part No.	1387-D-1
Tool OD Range	2⅝″ - 8¾″ (Standard tong die) - 1⅝″ - 7¾″ (Extra-tall tong die)
Distance Between Jaws	11⅝″
Minimum Torque	3,000 ft/lbf
Maximum Torque	56,000 ft/lbf (Make) / 70,000 ft/lbf (Break)
Operating Pressure	3,250psi
Required Flow	10 gpm
Dimensions (L x W x H) Breakout	36⅝″ x 23⅝″ x 36½″
Dimensions (L x W x H) HPU	36¾″ x 21¾″ x 32¼″
Weight	1900 lbs (Breakout / 450 lbs (HPU)

1289 TorqueMaster™ Jr.

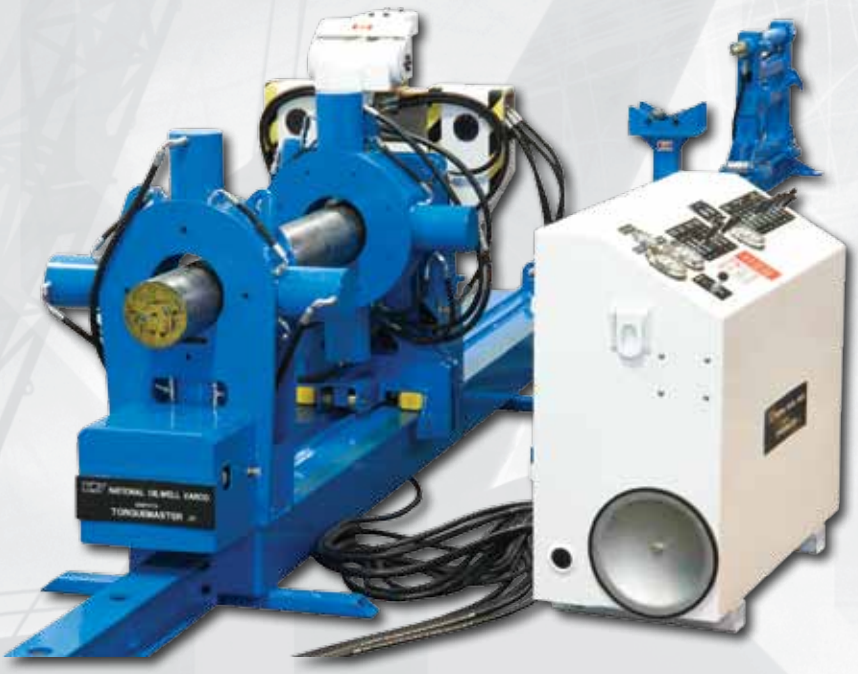
The 1289 TorqueMaster Jr. provides a safe and easy way to make up and break out tubular tool joint connections. This fully hydraulic unit is designed for practicality and with service shop safety in mind.

Consisting of a standard fixed headstock and a traversing tailstock chuck, the unit can be custom configured to include various optional accessories, including extensions beams, rolling tool support jacks, a spinner assembly, a push/pull assembly and torque logging systems, that have been designed to increase the functionality of the unit. A single set of tong dies is used over the full 2⅝″ to 8¾″ OD range of the unit, eliminating the need to constantly change them as the tool OD changes.

The TorqueMaster Jr. is safely and efficiently operated by one person from a low pressure, electric powered, standalone hydraulic control console.

Features and Benefits

- **Operated by One Person** – *Safe and easy to use*
- **Fully Customizable** – *Accessories can be chosen to suit the exact requirements of the shop*
- **Compact Design** – *Ideal for shops where space is limited*
- **Increased Shop Floor Efficiency** – *Provides fast and accurate make/break capabilities that will increase shop production*
- **Clamp Force Proportional to Torque** – *Reduces risk of slippage during make/break*
- **Self-Centering Clamp Cylinders** – *Ensures torque is applied about axial center line of the tool, ensuring accurate torque measurements and preventing thread damage*
- **Tong Dies** – *One set for the full OD range and can be easily changed when worn*



1289 TorqueMaster Jr. Technical Specifications

Tool OD Range	2⅝″ to 8¾″ (Standard tong die) 1⅝″ to 7¾″ (Extra-tall tong die)
Minimum Distance Between Jaws	16″
Minimum Torque	3,000 ft-lbs
Maximum Torque	56,000 ft-lbs (Make) / 70,000 ft-lbs(Break)
Operating Pressure	3250 psi
Required Flow	10 GPM
Dimensions (L x W x H) Breakout - 12′ bed only	120″ x 40″ x 59¼″
Dims (L x W x H) HPU & Console	60⅜″ x 20⅛″ x 40″
Weight	3,900 lbs (Breakout -12' Bed Only) 1,240 lbs (Console)

Coiled Tubing Jar Tester

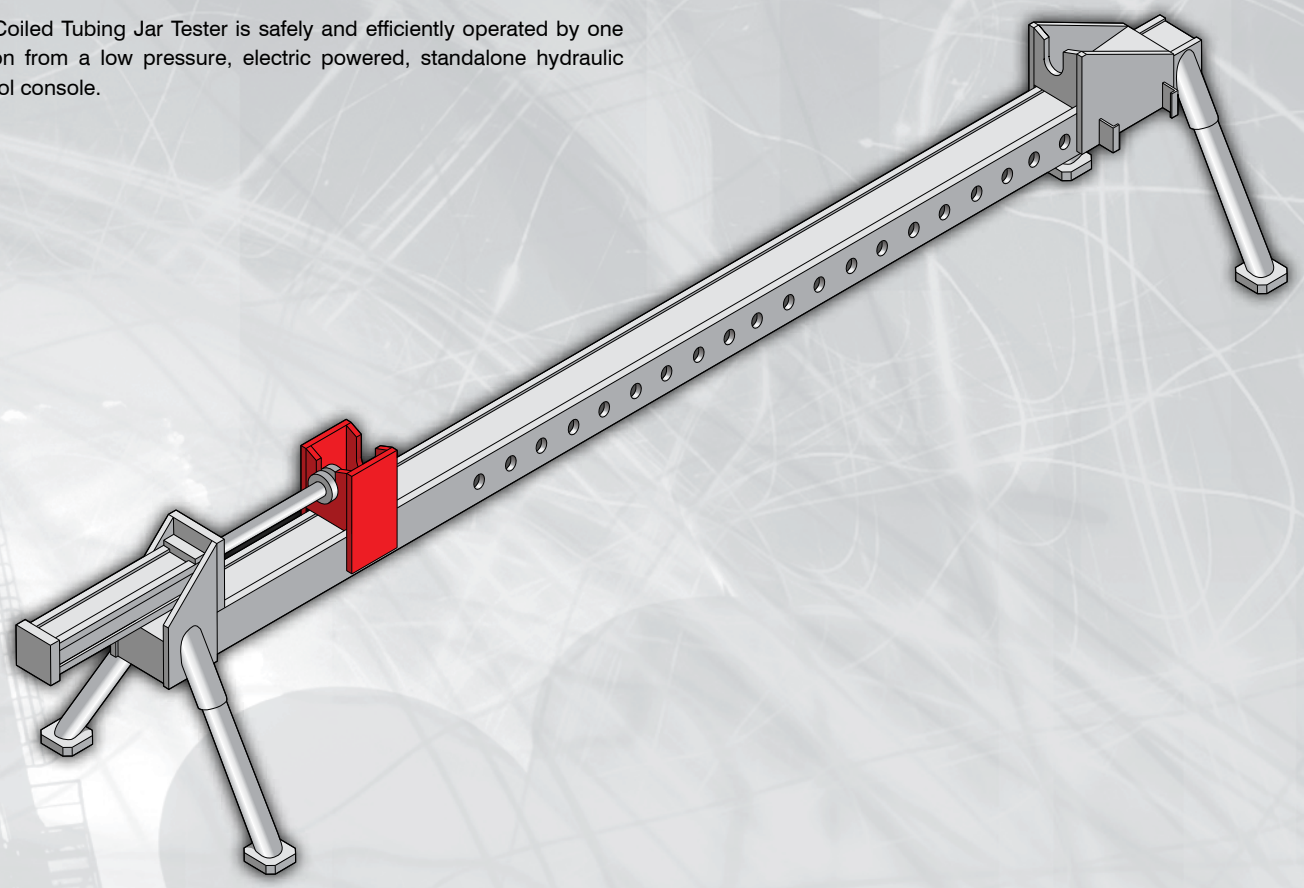
The Coiled Tubing Jar Tester is a rugged, self-contained unit designed to test the operation of coiled tubing drilling jars. The horizontal main frame includes a hydraulic cylinder that applies tension and compression forces in direct axial alignment with the test piece.

The cylinder is balanced and applies the same force in both tension and compression. This allows for use with an optional chart recorder to record the load applied by the cylinder.

The Coiled Tubing Jar Tester is safely and efficiently operated by one person from a low pressure, electric powered, standalone hydraulic control console.

Features and Benefits

- **Operated by One Person** – *Safe and easy to use*
- **Compact Design** – *Simple frame design and standalone console can accommodate any shop space*
- **Recordable Test Results** – *Optional chart recorder available to record test data*



Coiled Tubing Jar Tester Technical Specifications

Part Number	504865/005
Tool OD Range	1 1⁄16″ to 12″
Stroke	24″
Tool Length Capacity	24″ - 132″
Maximum Tension	50,000 lbs
Maximum Compression	50,000 lbs
Operating Pressure	3,000 psi
Required Flow	3.25 GPM
Dimensions (L x W x H) Tester	224″ x 46″ x 36″
Weight	1,340 lbs Tester

**Test nubbins are required for testing and are sold separately*

1609 Service Vise

The 1609 Service Vise is a floor mounted vise designed to hold a variety of tubular components while service work is carried out.

The work piece rests on a "V" shaped tool support plate containing a series of tong dies and is secured to the vise by a heavy duty leaf chain.

A floor mounted air over hydraulic pump controls a hydraulic cylinder that is used to engage the chain latch and secures the work piece.

Features and Benefits

- **Operated by One Person** – *Safe and easy to use*
- **Simple and Robust Design** – *Allows for easy loading and unloading of the work piece and requires minimal maintenance*
- **Air Over Hydraulic Operation** – *No external HPU required*

1609 Service Vise Technical Specifications

Description	Griffith® 1609-0001 Service Vise
Part No.	1609-0001
Tool OD Range	3¾″ - 12″
Torque Capacity	20,000 ft/lbs
Working Height	36″
Dimensions (L x W)	29″ x 18¼″
Weight	460 lbs (No Mount)

1609 Service Vise Optional Accessories

Optional Accessory	Part Number
Light Duty Rolling "A" Frame Support	1388-C-1
Foundation Mount	1609-B-39
Nubbin for Foundation Mount	1609-A-3
1½″ - 3½″ Adapter	1609-A-14

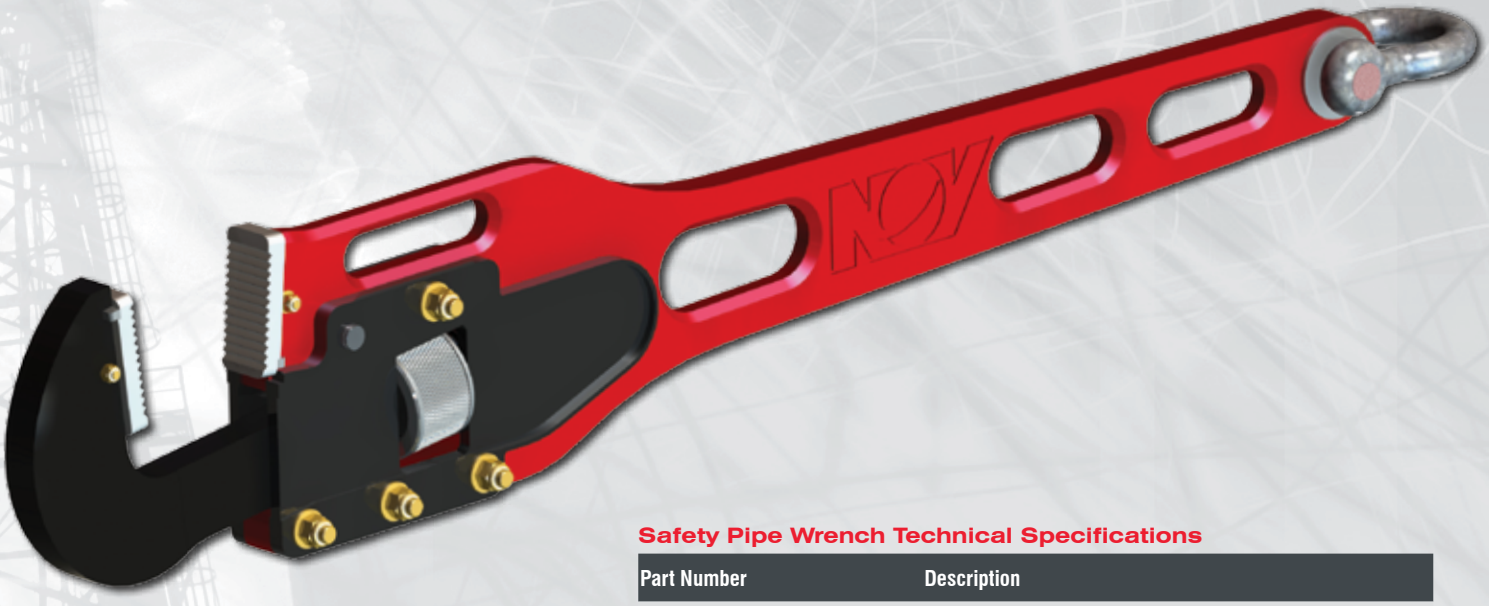
Safety Pipe Wrench

The NOV Safety Pipe Wrench provides a safe and effective means to manually make and break tool joint connections on Downhole tools. The wrench is designed using lightweight, ductile, material and eliminates the risk of unexpected catastrophic wrench failure that is commonly experienced while torqueing with other brand pipe wrenches. The balanced aluminum alloy carry-handle has been ergonomically designed and features four gripping locations for easy handling.

To further enhance the safety and reliability of the NOV Safety Pipe Wrench, NOV recommends the use of a digital Alarmed Load Scale to measure the force applied to the wrench while applying torque to a connection. The scale has an 80db audible alarm that sounds once a pre-programmed force had been reached and will reduce the risk of overloading the wrench when tightening tool joint connections.

Features and Benefits

- **Lightweight Aluminum Alloy Handle** – *Almost 5 lbs lighter than a standard 60" Pipe Wrench*
- **Up To 8" Outside Diameter (OD) Tong Areas** – *Completely replaces need for standard wrenches*
- **No Critical Load Bearing Cast Parts** – *Tool yield is predictable*
- **Only Ductile Alloy Materials Used** – *Brittle failures no longer a concern*
- **Industry Leading Load Rating** – *8,500 ft-lbs (3" - 8" OD Parts)* and *6,500 ft-lbs (0 - 3" OD Parts)*
- **Easily Inspected** – *Tool designed for easy disassembly and inspection*
- **Balanced Carry Handle** – *Oriented for use with load scale and crane*
- **Fewer Pinch Points Than Competition**



Safety Pipe Wrench Technical Specifications

Part Number	Description
505874/005	Safety Pipe Wrench - 2" to 8" O.D. Range
505874/006	Safety Pipe Wrench - 0" to 5" O.D. Range
505629/005	5,000 lb Alarm Scale (Standard)
505629/010	10,000 lb Alarm Scale

Part Number	Optional Accessories Description
505630/005	Optional padded carry case for Alarm Scales

NOV Downhole Offerings

NOV® Downhole is the largest independent downhole tool and equipment provider in the world. We have the expertise to optimize BHA selection and performance, supporting over 150 locations in more than 80 countries.

Our complete range of solutions for the bottom hole assembly and related equipment includes:

Thru Tubing Tools

- Coiled Tubing Tools
- Ultra CT Jars
- CT Agitator™ Tools
- PCE/Progressive CT Tools
- CT Motors
- CT HEMIDRIL® Motors
- CT PowerPLUS™ Motors

Bowen® Fishing Tools

- External Catch Tools
- Internal Catch Tools
- Junk Retrieval Tools
- Milling and Cutting Tools
- Accessory Tools
- Repair and Remedial Tools

Drilling Motors

- HEMIDRIL® Drilling Motors
- PowerPLUS™ Drilling Motors
- Vector™ Drilling Motors

ReedHycalog® Drill Bits

- Fixed Cutter Bits
- Roller Cone Bits
- Bi-Center Bits
- TuffCutter™ Bits

Borehole Enlargement

- ReedHycalog® CSD® Bi-Center Bits
- Anderreamer™ Concentric Hole Openers
- Concentric String (CS) Tools
- Eccentric String (ES) Tools

Advanced Drilling Solutions

- Complete Drilling Optimization Services
- SystemMatched™ Drill Bits
- BHA Optimization and Vibration Mitigation
- TerraSCOPE®, VibraSCOPE™, BlackBox® Analysis
- Hydraulics and MSE Analysis

Drilling Tools

- Agitator™ Tools
- Drilling Jars
- Anderdrift™ Tools
- Drilling Jar Intensifier™ Tools
- Drilling Bumper Subs
- Collars, Stabilizers and Drillstring Components
- Reamers and Wipers
- V-Stab® Vibration Dampening Tools

Coring Services

- Corion Express® Wireline Coring
- OrientExpress™ Oriented Wireline Coring
- Conventional Coring

Service Equipment

- Connection Tools
- TorqueMaster™ Make-Up/Break-Out Machines
- Product Testing
- Jar and Motor Test Stands
- Workshop Accessories
- Vises, Skids, Service Tool Packages

We take pride in delivering superior performance and reliability. Our objective is to exceed our customers' expectations, improve their economics and be an integral part of their strategies.

Standard Sizes and End Connections

For all tools we have standardized on the following sizes and threads:

Size – Outside Diameter	Thread
1 11/16″	1″ AMMT
2⅛″	1½″ AMMT
2⅞″	2⅜″ PAC
3⅛″	2⅜″ PAC 2⅜″ REG
3½″	2⅜″ REG

Materials

- Springs for all Tools are suitable for H2S Service.
- NOV does not recommend stainless steel materials for tools exposed to Acid.

The designs and specifications for the tools described in this catalogue were in effect at the time this document was approved for printing. National Oilwell Varco, whose policy is one of continuous improvement, reserves the right to discontinue models at any time, or to change designs and specifications without notice or without incurring obligation.

Downhole Solutions

Drilling Solutions

Engineering and Project Management Solutions

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Lifting and Handling Solutions

For a complete list of NOV Downhole locations, visit us online:

www.nov.com/downholelocations

Production Solutions

Supply Chain Solutions

Tubular and Corrosion Control Solutions

Well Service and Completion Solutions

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