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NOV's Completion Tools business unit offers a wide range of customized and standard liner hanger systems for your well completion needs. Our extensive technical knowledge and experience in the oil and gas industry allow us to develop and provide innovative solutions for our customers. In order to provide the highest quality, we are certified according to DIN EN ISO 9001:2008 and SCC**:2011.

Our offerings:

- Solutions through new developments
- Customized designs
- Wellbore completion
- Innovative liner hanger systems
- Short lead times
- A fast and reliable service

Many successfully completed projects in the world indicate our performance, for example:

- 9.88" Straddel PIP for cavern, welded connection test, Germany
- 7" ESP Compl. w. SCSSV and Zone Isolation Valve, Germany
- 3 7/8" Inflatable Open Hole Cement Job, Lithuania
- 5 7/8" Double Anchor PIP shutoff, France
- 10.38" PIP w. 13 7/8 Casing Patch, Germany
Design and Development

In our Design & Development Department, innovative products and customer specific components are designed by mechanical engineers with 3D-CAD-Software. By using additional analysis tools, e.g. the Finite Element Analysis (FEA) or Flow Simulation, various calculations can be made that are important for verification and ideal design of our products.

Engineering

The Finite Element Analysis (FEA) is a numerical method for solving complex calculations. It is used to calculate tension and displacement of components resulting from exterior loads, whereby each design step can be optimized. Nowadays, the FEA is an inherent part of our design process. In this way, it can be verified with virtual prototypes whether the requirements for stability and safety are fulfilled. Potential weak spots can thus be revealed and rectified. This makes it possible to reduce the periods and cost, since the number of necessary prototypes is reduced.

Flow Simulation

Flow Simulation is a numerical method for solving complex flow systems. This software enables our designers to simulate the liquid flow, heat transfer and flow force rapidly and in a straightforward manner. This numerical method is used during development for flow examination and optimization of relevant components, in order to ensure a perfect function of the products.
Whether in the harsh conditions of the North Sea, in the heat of the Kazakh steppe or in the swamps of the Niger Delta, our field engineers cope with their demanding missions even in the most extreme conditions.

Our service quality is the basis of our success. We continually invest in training for our new engineers and advanced education for our experienced staff. We offer vocational training with the training alliance for mining technicians specializing in drilling engineering (AVBT).

Consisting of the theoretical and practical part, this dual vocational education and training allows a broad and comprehensive training of the skilled worker on the drilling and production plant. In addition to the theoretical knowledge of liner hanger and wellbore completion installation and with the use of our field software, the focus of training is on working on rig sites.

Our new employees are advised and supported by senior colleagues during the first period within the mentor program. During this “on the job training”, junior engineers acquire the necessary knowledge necessary to perform subsequent operations independently and successfully on their own. In addition to technical training, we attach great importance to language and intercultural training for all employees.
Running Procedure

The Running Procedure (RP) is a complete manual which documents the precise sequence description and installation instructions as well as the target values of the liner hanger installation. Prior to each operation the RP is discussed in a pre-job meeting by project manager and field engineer. During installation of the liner hanger system, deviations between target values and actual values can be determined directly at the drill rig. The field engineer can react promptly and initialize appropriate measures in coordination with the customer. Any variation within the procedure is recorded in a new revision of the RP. Based on this audit-proof process, original documents can be compared with actual data and all changes can be retraced.

Operator Software

The specially designed operator software comprises several modules: calculating, investigating or obtaining information can be done with the software. Necessary documents supporting the workflow and facilitating the subsequent analysis are provided by this software.

Data Sheets

The operator software provides the field engineer with access to the entire data sheets of all products. The data sheets include technical data and information on both sales and rental equipment.

End-of-Well Report

After job completion, all data is summarized and discussed in a working group together with the project manager, design engineer, fitter, quality manager as well as the field engineer. The customer is provided with all relevant data for the order in an End-of-Well Report.
Liner Hanger Systems
Open Hole Equipment

Polished Bore Receptacle

The Polished Bore Receptacle (PBR-Extension) is a honed pipe of highest quality with very tight manufacturing tolerances, that guarantees best sealing properties. The top PBR-end is provided with a special chamber, in order to allow an easier running-in of drilling tools. The lower PBR-end can be optionally connected with a liner packer or setting sleeve.

Features/Benefits:

To accommodate:
• Bottom set tie back packer
• Tie back seal stem

Length:
• 6 ft through 30 ft

Materials:
• L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
VXP - Packer

The VXP Liner Top Packer was developed for high differential pressures and is ISO 14310/14998 VO certified. It is used for additional sealing of the annular space between the liner and casing. The VXP Packer is activated by means of loading through the drill pipe and the packer actuator. After setting, the packer element is held in the desired position by controlled deformation of the support rings. In addition to the internal snap ratchet, the additional external hold down slips keep the VXP Packer in position, so that displacements of the packer element do not occur with high differential pressures. The packer element of the VXP Packer is available in various elastomers for different well requirements.

Features/Benefits:
• High differential pressure rating from below and above
• Mechanical lock to avoid premature setting while running liner
• Full bore offers — no restrictions for subsequent tool runs
• Hardened hold down slips
• Internal body lock ring positively locks in applied setting force
• Can be run with hydraulic set or mechanical set liner hanger
• With FKM packing element (max. 210° C)
• ISO 14310/14998 VO: Qualified with max. diff. pressure 10,000 psi

Thread Connections:
• Standard VAM® TOP/VAM® 21 or on customer’s request

Materials:
• L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request

completions@nov.com  nov.com/completions
Features/Benefits:
• High differential pressure rating from below and above
• Mechanical lock to avoid premature setting while running Liner
• Full bore offers — no restrictions for subsequent tool runs
• Hardened hold down slips
• Internal body lock ring positively locks in applied setting force
• Can be run with hydraulic set or mechanical set liner hanger

Thread Connections:
• Standard ‘VAM’ TOP/VAM’ 21 or on customer’s request

Materials:
• L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request

ILR - Packer
The ILR Liner Top Packer was designed for medium differential pressures. It is applied for additional sealing of the annular space between the liner and casing. The ILR Packer is activated by load on the drill string and packer actuator. After setting the packer element is put in position by controlled deformation. The inner mounted snap ratchets in the sliding sleeve secure and stabilize the ILR Packer, so that displacements of the packer element do not occur with high differential pressures. The packer element of the ILR Packer is available in various elastomers for different well requirements.

Features/Benefits:
• Medium duty compression set liner top packer
• Full bore offers — no restrictions for subsequent tool runs
• Internal body lock ring positively locks in applied setting force
• Can be run with hydraulic set or mechanical set liner hanger

Thread Connections:
• Standard ‘VAM’ TOP/VAM’ 21 or on customer’s request

Materials:
• L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
Setting Sleeve & Pack-off Nipple

The Setting Sleeve is the connection to the setting tool and is used to run-in the liner with the liner hanger into the well. It is necessary if no liner top packer is used. The pack-off profile is integrated in the setting sleeve where the pack-off bushing is placed, which serves as sealing between setting tool and liner. For rotating installation, the setting sleeve is available as rotating version.

The pack-off nipple is the connection between liner top packer and liner hanger. An additional main function of the pack-off nipple is the placement of the retrievable pack-off bushing, which serves as sealing between setting tool and liner.

Features/Benefits:

- A torque locking profile is also provided to enable torque transfer between the running tool and the liner string while running in and cementing
- The type “S” setting sleeve is used to carry liner and tie back packer into the hole where rotation is not required
- Available with PBR profile
- Available with pack-off profile
- Rotating & non-rotating version

Materials:

- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
GSP - Liner Hanger

The GSP Liner Hanger was primarily designed for deviated and horizontal holes and for heavy liner. Its slips are recessed into a special profile at the rotating body. This ensures trouble-free installation and uniform load distribution in the setting section. In set and non-set state, the GSP liner hanger allows a very high bypass, so a high flow rate with low pressure loss is ensured.

Features/Benefits:

- Non-weld design, one-piece body with premium threads
- Slips are recessed into a special profile at the rotating body to prevent from premature setting during running
- Slips and cone are designed to minimize casing stress
- All hydraulic seals remain stationary during rotation of the liner
- Improved seal stack in the hydraulic cylinder; HP/HT seals
- Capable of hanging long, heavy liners
- Large annular flow area in set and unset position
- Hydraulic lock of slips prevents premature setting during running (optional)
- Rotating/non-rotating (optional)

Thread Connections:

- Standard VAM® TOP/VAM® 21 or on customer’s request

Materials:

- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
GS - Liner Hanger

The GS Liner Hanger was primarily designed for vertical and slightly deviated holes. The special design with the external slips means that large slip segments are formed. This allows high vertical loads to be achieved with the GS liner hanger. As the position of the slips in the GS liner hanger is below the cone, a trouble-free running-in is ensured. In set and non-set condition, the GS liner hanger allows a very high bypass, so a high flow rate with low pressure loss is ensured.

Features/Benefits:
- Non-weld design, one-piece body with premium threads
- Slips and cone are designed to minimize casing stress
- All hydraulic seals remain stationary during rotation of the liner
- Improved seal stack in the hydraulic cylinder; HP/HT seals
- Capable of hanging long, heavy liners
- Large annular flow area in set and unset position
- Hydraulic lock of slips prevents premature setting during running (optional)
- Rotating/non-rotating (optional)

Thread Connections:
- Standard VAM® TOP/VAM® 21 or on customer’s request

Materials:
- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
GSL - Liner Hanger

The GSL Liner Hanger was designed especially for tight clearance. Often it is also used for the hanging of an intermediate liner. Its slips are recessed into a special profile at the body. This ensures trouble-free installation and uniform load distribution in the setting section. Due to the tight clearance, the GSL liner hanger is only available as a non-rotating version. The robust and sturdy body with cone is made of one piece.

Features/Benefits:
- Non-weld design, one-piece body
- Capable to hang liners of short and medium length without distortion of the cone or body
- Large annular flow area in set condition ensures minimum pressure drop during cementing
- Suitable for short liner in highly deviated wells
- Non-rotating during cementing

Thread Connections:
- VAM® FJL/VAM® SLIJ-II or on customer’s request

Materials:
- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
Mechanical Set Liner Hanger

The Mechanical Set Liner Hanger was primarily designed for vertical and slightly deviated holes. It can be set clockwise or counterclockwise. As the mechanical set liner hanger is set purely mechanically, no hydraulic pressure is necessary. Thus it is ideal for holes within critical formations.

Features/Benefits:
• Non-weld design, one-piece body with premium threads
• Large annular flow area in set position ensures minimum pressure drop during cementing
• Slips and cones are designed to minimize casing stress
• Suitable for short and medium liner
• Inner/outer slips (optional)
• Rotating/non-rotating version

Thread Connections:
• Standard ‘VAM® TOP/VAM® 21 or on customer’s request

Materials:
• L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
The Hold Down Sub was especially designed for short, cemented or slotted liners and serves as counter anchor to the liner hanger. The hold down sub is hydraulically set together with the liner hanger and can be retrieved if necessary.

As tension anchor the hold down sub was especially modified for steam injection holes. By means of the tension anchor, the pipe string can be pulled in tensile strength, in order to counteract the negative effects of thermal expansion during steam injection.

**Features/Benefits:**
- Non-weld design, one-piece body with premium threads
- Capable to anchor liners of short and medium length
- Large annular flow area in set position ensures minimum pressure drop during cementing
- Straight pull release (optional)
- Suitable for short liner in highly deviated wells
- Rotating/non-rotating version
- HP/HT seals

**Thread Connections:**
- VAM® FJL/VAM® SLJ-II or on customer’s request

**Materials:**
- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
Liner Hanger Packer

The Liner Hanger Packer was developed for non-cemented liners. The slips of the liner hanger packer are activated by pressure and the liner packer is set by applying weight.

Features/Benefits:

- Non-weld design, one-piece body with premium threads
- Suitable for short and medium liner without cementation
- Slips and cone are designed to minimize casing stress
- HP/HT seals

Thread Connections:

- Standard VAM® TOP/VAM® 21 or on customer’s request

Materials:

- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
The Single Wiper Plug with integrated ball seat is attached to the setting tool and located in the first liner casing joint below the liner hanger. By closing the ball seat with the setting ball the hydraulic liner hanger is activated. By further increase in pressure, the setting ball with the ball seat is sheared and pumped into the catcher underneath the wiper plug. The wiper plug is used as a barrier between cement and mud and is released by the drill pipe dart. The drill pipe dart and wiper plug are jointly pumped down to the landing collar (limit stop). The single wiper plug with ball seat interlocks in the landing collar and thus enables an optimized drilling out.

Features/Benefits:
- Ball seat located in the wiper plug reduces shock loading of the formation
- Time saving due to reduced ball travel
- High strength design allows high bump pressure
- Anti-rotating mechanism to reduce drill-out time
- Reliable and simple release mechanism
- Locking device

Materials:
- Aluminium/Rubber

The Duo Wiper Plug system ensures a bilateral separation of the cement column in the drill pipe and liner. It is attached to the setting tool and located in the first liner casing joint below the liner hanger. The lower part of the duo wiper plug is released by the first drill pipe dart and pumped to the landing collar. By the landing on the landing collar, a short pressure increase takes place and the cement can be displaced further. The upper part of the duo wiper plug is released by a second drill pipe dart and pumped down to the landing collar (limit stop). The duo wiper plug interlocks in the landing collar, allowing an optimized drilling out.

Features/Benefits:
- No contamination of the cement with mud
- Simple and reliable duo wiper plug system
- Emergency release feature for the top plug
- No risk of a stuck inner sleeve of the top wiper plug
- High strength design allows high bump pressure
- Anti-rotating mechanism to reduce drill-out time

Materials:
- Aluminium/Rubber
Drill Pipe Darts & Setting Ball

Drill Pipe Darts (DPD) are used to separate the cement column in the drill string and for activating/releasing the wiper plugs. For the duo wiper plug system, one drill pipe dart is pumped respectively before and behind the cement column. With the single wiper plug only the drill pipe dart behind the cement column is used. The sponge ball drill pipe dart provides outstanding sealing properties in the drill pipe combined with optimal cleaning.

Features/Benefits:
- Available for all drill pipe sizes
- One-size string or combined string
- Available with lock feature

Materials:
- Aluminium/Rubber

DPD – with Sponge Ball

DPD – for Duo Wiper Plug

DPD – for Single Wiper Plug

Setting Ball
Open Hole Equipment

Tie Back Stem

The Tie Back Stem provides the possibility to install a new casing string to cover abrasive wear which is caused by drilling or corrosion, or to protect a weak casing string against shut-off or extreme production pressure. It can also be used to isolate a leaking liner. A typical tie back liner system includes a tie back string with a tie back stem below, which is inserted in an existing polished bore receptacle.

Features/Benefits:
- Mule shoe configuration supports stabbing and facilitates re-entry with well intervention tools
- Available from 6 ft to 30 ft
- HP/HT seals
- Flow optimized gage/shear ring to protect the seal stack during installation

Thread Connections:
- VAM® TOP, VAM® 21, VAM® SLIJ-II, VAM® FJL or on customer’s request

Materials:
- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request

Tie Back Stem with Cementing Ports & Orifice Float Collar

The Orifice Float Collar and the Tie Back Stem with Cementing Ports were designed in order to cement a tie back string to surface. The cementation is done with conventional cementing plugs. After landing of the cementing plugs on the orifice float collar, the tie back stem is run-in into an existing PBR.

Features/Benefits:
- Mule shoe configuration supports stabbing and facilitates re-entry with well intervention tools
- Available from 6 ft to 30 ft
- HP/HT seals
- The orifice float collar serves as a bump for a cementing plug
- Required for tie back cementing ports
- The auto-fill function of the orifice float collar ensures that the Tie Back Stem can be stapped into the PBR successfully
- PDC bits drillable internals

Thread Connections:
- VAM® TOP, VAM® 21, VAM® SLIJ-II, VAM® FJL or on customer’s request

Materials:
- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
Bottom Set Packer (BST Packer)

The Bottom Set Packer (BST Packer) is run secondary to isolate leaks at the liner top. The BST packer can withstand high differential pressures and is used after the liner has been installed and cemented and the liner polished bore receptacle seal bore has been cleaned out. The BST packer seals the existing PBR and is weight set, sealing the annular area between the liner and the casing. A new polished bore receptacle is integrated for future operations. The packer element of the BST packer is available in various elastomers for different hole requirements.

**Features/Benefits:**
- High differential pressure rating from below and above
- Mechanical lock to avoid premature setting while running BST packer
- Full bore offers — no restrictions for subsequent tool runs
- Hardened hold down slips
- Internal body lock ring positively locks in applied setting force
- Integral PBR
- Available from 6 ft to 30 ft
- HP/HT seals

**Internal Threads:**
- Standard ‘VAM™ TOP/VAM™ 21

**Materials:**
- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
Open Hole Equipment

Landing Collar & Float Equipment

The Landing Collar is installed in the pipe above the float equipment. It acts as stopper plate and for this purpose it includes a seat and a locking mechanism. By this system, the pressure is maintained from above and below as soon as the wiper plug is landed and locked. The landing collar can also be equipped with a ball seat, pinned to shear at approximately 1000 psi above the pressure required to set the liner hanger.

The float equipment has the important function to prevent the uncured cement in the annulus from flowing back into the liner.

Features/Benefits:
- All internal parts are PDC drillable
- Provides the landing seat for wiper plugs
- Acts as a backup to the float collar/shoe with the plugs latched and sealed
- Landing collar available with or without ball seat
- Various shoe configurations available
- Floats are spring loaded poppet type valve
- Floats molded in place with high strength concrete
- Floats are available with single or double poppet valve
- Float shoes available with cement round nose, blade guide nose or profiled eccentric nose

Thread Connections:
- VAM® TOP, VAM® 21, VAM® SLIJ-II, VAM® FJL or on customer’s request

Materials:
- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
Multilateral Junction System

The Multilateral Junction System allows access into a lateral hole coming off the main hole. This enables an efficient, concurrent production. The system is run-in together with the casing into the lateral hole, oriented by torsion and fixed into the casing window. By cementation and use of open-hole packers integrity to the main hole is ensured. Different completions of lateral holes are possible, additional hole sections can be drilled and cased. There are no restrictions in diameters caused by this system. If required, various diverter sleeves belonging to the system can be exchanged during intervention.

Features/Benefits:
- Lateral junction provides full access to main and lateral hole
- Integrity of the lateral junction is provided through cementation or means of open hole packer/swell packer
- Access to main and lateral hole is provided by exchanging diverter sleeves
- Consolidated production out of the main and lateral hole
- Field development through one hole with several laterals in environmental sensitive areas

Materials:
- L 80, P 110, Q 125; other materials on request
Float Equipment - Special Shoes

The eccentric guide nose of the revolver shoe is especially designed for long liners in deviated or horizontal holes. A special profile inside the revolver shoe triggers a rotation of the guide nose when weight is slacked off and the liner is pulled again. Every time the weight is applied on the guide nose and the string reciprocated the guide nose turns about 20 degrees by itself until the eccentric nose is newly oriented to guide the liner back on track.

For drilling through lost circulation materials the CB drill shoe can be provided with tungsten carbide inserts. For drilling sections with liner it can be provided with PDC inserts. Both types of drill shoes are drillable to enable drilling the next sections below.

Features/Benefits:

- All internal parts are PDC drillable
- Provides the landing seat for cementing plugs
- Acts as a backup to the float collar/shoe with the plugs latched and sealed
- Various shoe configurations available
- Floats are spring loaded poppet type valve
- Floats molded in place with high strength concrete
- Floats are available with single or double poppet valve
- Float shoes available with cement round nose, blade guide nose or profiled eccentric nose (supports passing obstruction)

Materials:

- L 80, T 95, P 110, Q 125, 22Cr 125ksi; other materials on request
Stage Cementing Collars

**Primary Application:**

When cementing a casing string, it is sometimes necessary to pump cement in two stages to separate fluids from each other in the annulus or similar cases of application due to bore hole stability issues like a low frac gradient, lost zone, depleted reservoirs, or off bottom cementing.

For those reasons, a stage cementing collar is needed in the casing string to allow access to the casing annulus at an optimal place of the section, to overcome these difficult zones.

Can be combined with liner hanger equipment as well.

**There are several types of stage cementing collar available:**

- **Mechanically opened cementing collar**
  - Allows access to the annulus by dropping or pumping down an opening device
- **Hydraulically opened cementing collar**
  - Requires no opening device
  - Internal casing pressure activates the differential-piston opening sleeve
- **Mechanically or hydraulically opened cementing collar with a built-in inflatable packer**
  - Is run above an open hole completion or slotted casing, loss zone etc.
  - Allows access to the annulus above the inflatable packer

Tools can be drilled out after completion of the cementing operations, leaving no ID restriction.

External Casing Packer (ECP)

Continuous Mandrel ECP assemblies are designed with packer elements in 4 Foot (1.22m), 10 foot (3.05m), and 20 foot (6.10m) lengths. The packer elements soundly conform to irregular or washed-out hole diameters. Steel reinforcement slats are used within the elements to ensure that the ECP self-centers itself in vertical, deviated, or horizontal wellbores.

Tools are available in standard and special clearance models. Standard clearance tools are used where higher differential pressures are encountered across the packer element. Special clearance tools are used for applications where restricted hole diameters may occur.

**Features/Benefits:**

- The continuous one-piece mandrel eliminates the need for internal threaded connections
- Mandrel specifications are identical to the casing used in the well
- The Valve system is located above the packer element. Valve operation is not affected by unpredictable pressure changes below the element
- Superior anchoring system prevents element rotation, and packer shoe travel, while tools are run into the well
- Useable in vertical, deviated, or horizontal wellbores
- Suitable for H2S and CO2 environments
- May be used for temperatures up to 240° F (115° C) and advanced elastomer compounds are made available for applications in which temperatures reach up to 350° F (180° C).
- Shear pins in the valves may be easily replaced in the field, allowing the operator greater flexibility when well conditions change

**Internal Threads:**

- Internal threads may be specified on all ECPs.

**Materials:**

- Manufactured with high strength steel materials suitable for H2S and CO2 environments
Open Hole Equipment

Swell Packer (HP Well Screen)

Isolation seals can be critical to a successful well screen / ICD screen installation, particularly in shorter heterogeneous horizontal wells. Proper compartmentalization decreases water intrusion, increases output and ensures that the Inflow control systems perform as per design. Swellable isolation seals provide a very cost effective means of establishing zonal isolation and inflow control.

Features/Benefits:

- Available for water or oil activation or a combination of both (hybrid)
- Elastomers designed according to well data
- Designed for cased and open hole completions
- Multi-element design:
  - Higher sealing performance, holding higher pressure than single-element packers
  - Stronger initial setting than single-element seals
- Zonal isolation and inflow control
- Decreased water influx and isolation of loss zones
- Improved recovery
- Prevents annular flow and enhanced screen life
- Strong, durable and self-healing seal so no additional running tools or site crew

Materials:

- Elastomers designed according well data
- Base pipe in all standard material types available

Production Inflatable Packer (PIP)

The Inflatable Single Set Production-Injection Packer is used for isolating zones in open-hole or in casing. The tool is retrievable and may be used for testing, treating, production, or injection. The single set, pull release production-injection packer may be used in vertical or deviated wells. Inflatable packers elements for this tool are 1.67 m. (66 inches) in length. High strength aircraft cable is used to provide good expansion characteristics in washed out or irregular well bores, as well as to provide high differential pressure capabilities. Cable reinforcement allows these inflatable packer elements to return very close to the original run-in diameter. In addition, these elements are less likely to lose rubber down hole because superior bonding occurs between the rubber and cable.

Features/Benefits:

- Inflatable packer elements provide greater clearance through restrictions in a well
- Tool requires no rotation for setting or releasing the packer
- The system does not depend on a poppet valve to maintain pressure in the packer element
- A sliding sleeve is mechanically shifted to maintain inflation pressure in the packer
- A cable-reinforced packer element provides superior bonding of rubber to cable, and therefore less rubber is likely to be lost downhole
- The system allows pressure to be fully equalized across the packer element prior to unsetting the packer. This minimizes packer element period damage

Internal Threads:

- Internal threads may be specified on all ECPs

Materials:

- Rubber compounds available up to 600° F (316° C)
Cementing Head - Double Plug - Rental Equipment

The Top Drive Cementing Head is located between the top drive system of the drilling rig and the drill pipe. It also provides the interface through the top drive cementing head swivel to the cementing lines of the cementing unit. The top drive cementing head consists of a solid body with an integral bypass system, to displace mud, spacer and cement slurry during the entire operation. Two drill pipe darts can be accommodated inside the top drive cementing head to avoid contamination of the cement slurry with mud. With the top drive cementing head the liner can be rotated, depending on the liner hanger system provided, to enhance the quality of the cement in the annulus.

A remotely controlled version of the top drive cementing head is also available.

Features/Benefits:

- Unrestricted bore after plug or ball has been dropped
- Large flow area accommodates high displacement rates
- Anti-rotation tie-off integral to swivel housing
- Drill pipe darts and setting ball are completely separated from the bypass
- High load capacity
- Flag-sub-indicator
- Non-top drive cementing head suitable for long and heavy liner

Top Drive Cementing Head

Non-Top Drive Cementing Head

Top Drive Cementing Head with remote control
Open Hole Equipment

Cementing Head - Single Plug - Rental Equipment

The Single Plug Cementing Head is used for short and medium liners in shallow holes and is suitable for mechanically and hydraulically set liner hangers (rotating or non-rotating).

Features/Benefits:
- Unrestricted bore after plug or ball has been dropped
- Large flow area accommodates high displacement rates
- Anti-rotation tie-off integral to swivel housing
- Flag-sub-indicator

The top drive casing cementing head can be used for 7” to 13 3/8”.

Features/Benefits:
- Unrestricted bore after plugs have been dropped
- For three cementing plugs
- Large flow area accommodates high displacement rates
- Allows rotation and reciprocation during cementing of string
- Available for API or premium connections
- Flag-sub-indicator
- For casing cementation 7” to 13 3/8”
Lift Nipple & Junk Bonnet - Rental Equipment

The Lift Nipple provides the safe connection between the setting tool and the working string.

Features/Benefits:
- Connection to operator’s working string
- Available in various lengths to complement liner polished bore receptacle length
- Heavy wall tubular body manufactured of 4100 series alloy steel

The Liner Top Junk Bonnet serves as a retrievable closure to the polished bore receptacle. It is designed to prevent the risk of debris falling into the PBR.

Features/Benefits:
- Reduces the risk of debris falling into the PBR extension
- Attached to the top of PBR extension by shear pins
Open Hole Equipment

Packer Actuator - Rental Equipment

The Packer Actuator is a part of the setting tool. Integrated between lift nipple and setting tool, the integrated liner packer is set through the packer actuator. For slightly deviated and horizontal holes a rotatable packer actuator is used.

Features/Benefits:

- Large dogs for optimum weight transfer to the packer
- Setting dogs of rotatable packer actuator supported by a bearing system for deviated and horizontal holes
- Smooth ID matched to liner setting tool and extension assembly for trouble free passage of drill pipe darts
- Tensile rating equal to or higher than the liner setting tool
The HRS - Setting Tool was especially designed for running rotatable liner hanger systems. It allows to wash and ream down the liner through tight spots and obstruction in the hole. Only when reaching the shear pressure especially adjusted after the liner hanger is set, the hydraulic lock is activated. By clockwise rotation, the setting tool is released from the liner hanger system. Moreover, the complete liner can be rotated with the HRS - setting tool during cementation to ensure equal distribution of cement. Thereby, the HRS - setting tool is especially suitable for deviated or challenging holes.

**Features/Benefits:**
- The liner can be pushed and reamed down to bottom without the risk of prematurely releasing
- After the hanger has been set and the tool released the liner can be rotated
- High torque rating for the toughest well conditions
- Emergency release function

The HRC - Setting Tool was designed for the use in the most difficult hole conditions. The setting tool is a full hydraulic setting tool and needs no rotation of the running string for releasing the liner hanger system. The HRC - setting tools allows to wash and ream down the liner through tight spots and obstruction in the hole. Only when reaching the shear pressure especially adjusted after the liner hanger is set, the hydraulic release system is activated. By its solid design, a rotation of the liner when running or after setting the liner hanger during cementation is possible.

**Features/Benefits:**
- The liner can be pushed and reamed down to the bottom without the risk of prematurely releasing
- After the hanger has been set and the tool has been released, the liner can be rotated during cementing
- High torque rating for difficult well conditions
- Full hydraulic release
- Left-hand emergency release
MRS - Setting Tool - Rental Equipment

The MRS - Setting Tool supports the installation of rotating liner hanger systems. The mechanical safety device allows the liner to rotate in tension and enables to circulate at the same time. Only when reaching a preset load the mechanical lock will be released through shearing of shear pins. The MRS - setting tool is released from the liner hanger system by clockwise rotation. During the cementation, the complete liner can be rotated in order to enhance the quality of cementation.

Features/Benefits:

• Used to run right-hand mechanical and hydraulic set liner hangers
• Dependable roller bearing/floating nut system ensures positive release from the liner top
• High load capacity to carry long and heavy liners to target depth
• Liner can be rotated to improve the quality of the cement job

S - Setting Tool - Rental Equipment

The S - Setting Tool is a robust setting tool for running heavy non-rotating liners. The S - setting tool is particularly suitable for vertical and slightly deviated holes. The setting tool is released from the liner hanger system by rotation. Moreover, BST packer and special-equipment can be run with this tool.

Features/Benefits:

• Suitable for hydraulic set liner hangers and BST packers
• Dependable roller bearing/floating nut system ensures positive release from the liner top
• High load capacity to carry long and heavy liner
Stinger & Pack-Off Bushing - Rental Equipment

The Stinger is used together with the Pack-Off Bushing.

The retrievable pack-off bushing is a seal element to provide the pressure integrity for setting the liner hanger and during liner cementation.

Features/Benefits:

• Fully retrievable leaving full bore liner top requiring no drill-out time
• High differential pressure capability
• Minimizes the pump out forces exerted on the running string during cementing
• Locking dogs supported by an inner sleeve and not by the slick stinger
Plug Holder - Rental Equipment

The Plug Holder was designed to retain the liner wiper plug with integrated ball seat during the setting of the liner hanger and cementing of the liner until the wiper plug is released from the plug holder by the drill pipe dart. A second feature of the plug holder is to act as a pick up to shear and to retrieve the shear pins of the sleeves from the retrievable pack-off bushing.

The plug holder with integrated equalizing valve prevents the premature release of Liner wiper plug from the plug holder and provides a clearer indication when releasing the Liner wiper plug by drill pipe dart.

In addition, the plug holder is required to release and retrieve the pack-off bushing.

Features/Benefits:

- Connects wiper plug to the setting tool strings
- Acting as a pick up sub to release and retrieve the retrievable pack-off bushing
- Equipped with ventilation ports to transfer the pressure during setting of the liner hanger plug holder with equalizing valve:
- Integrated collet prevents premature release of wiper plug system
- Small pressure area allows high bump pressure; obvious indication
Drill Pipe Dart Test Sub - Rental Equipment

The system consists of a Drill Pipe Dart, a Test Sub and an additional safety mechanism. By pumping the drill pipe dart, the exact volume of the drill pipe string is determined and the inside diameter of the drill string is confirmed. After reaching the test sub, it is possible to perform a pressure test with previously specified opening pressure. After reaching the opening pressure and shearing the inner sleeve (pressure drop), work can be continued.

A burst disc sub is used additionally to the drill pipe dart test sub and activated with pressure if required.

Features/Benefits:

• Determines exact drill pipe string volume
• Drift the drill pipe string
• Pressure test drill pipe string
• Available for all drill pipe sizes
• One size string or combined string
Travel Joint - Rental Equipment

The Travel Joint compensates the length of the inner string and provides safe and damage-free connection of the liner hanger in the liner. While connecting the liner hanger to the liner, the travel joint avoids a torque at the inner string, while releasing the setting tool. The risk of damaging the inner string is thereby minimized.

Features/Benefits:

- Unrestricted bore after plug or ball has been dropped
- Spacing out the inner string
- Compensates the weight and torque of the inner string while making up the liner hanger
- Compensates the weight and torque of the inner string while releasing the setting tool
Milling & Cleaning Assembly - Rental Equipment

The Tie Back Clean Out Assembly consists of a tie back mill, spacer and top dressing mill. The tie back clean out assembly has precision-fit, hardened blades to ensure an accurate cleaning of the PBR.

The top dressing mill removes burrs at the top of the PBR for damage-free entry of the seals of the tie back stem or BST packer.

Features/Benefits:

- Ground dressing surfaces clean honed PBRs without damaging seal surfaces
- Drill pipe connections on all components for maximum performance