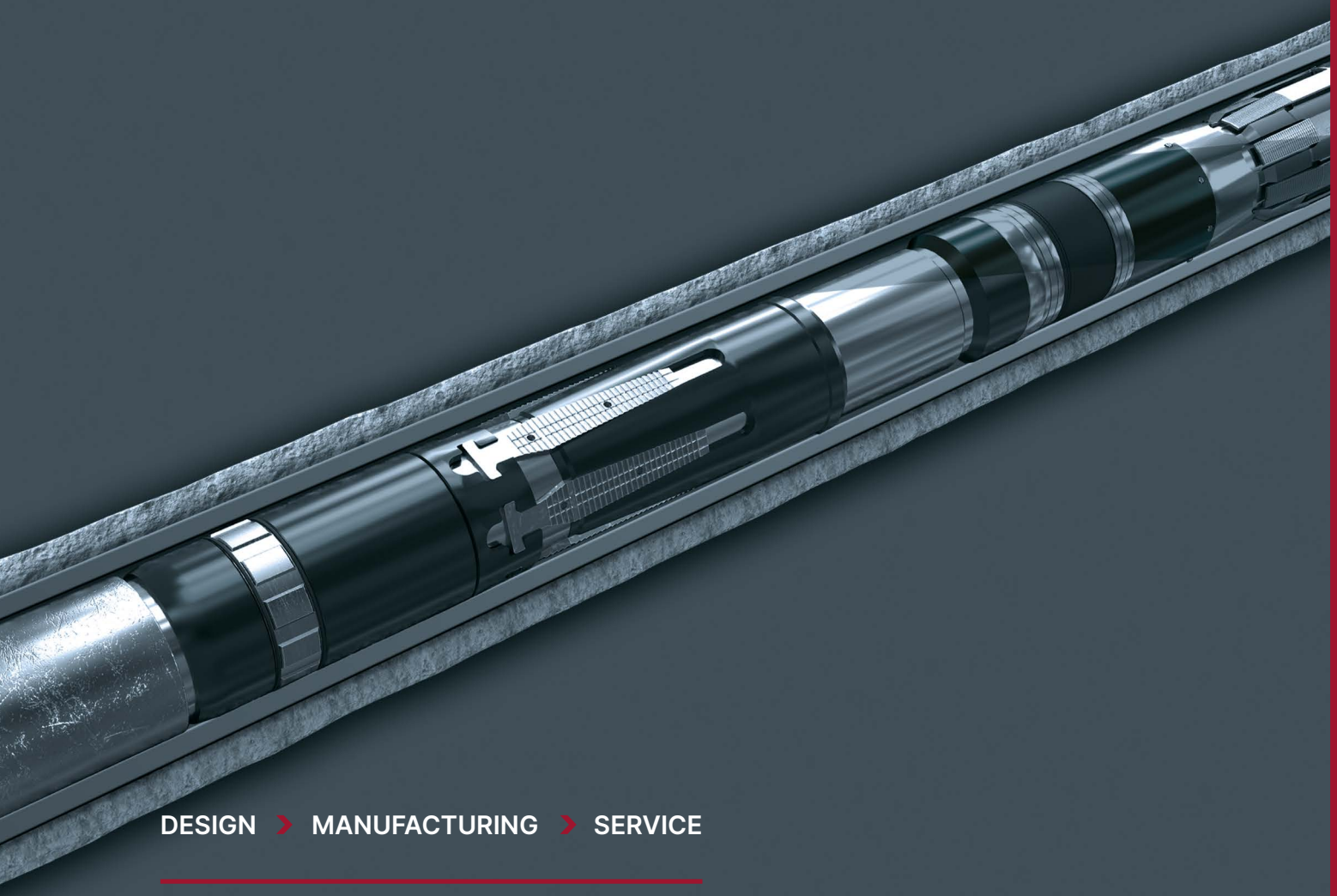
TSS GROUP



DESIGN › MANUFACTURING › SERVICE

WELL COMPLETION SYSTEMS

2025

Content

30%
MARKET SHARE

12 YEARS
ON MARKET

3
PLANTS

ABOUT THE COMPANY

TSS Group is the leading Russian company which provides a full cycle of Well Completion services: design, manufacturing and engineering support on the rig site.

FOR OUR PARTNETS

- Customized and flexible approach to our Customer's needs.
- High quality cost effective equipment.
- High professional engineering support.
- Traceable production cycle.
- High manufacturing capacity.

ADVANCED TECHNOLOGIES

- Dual casing well completion (reduces well construction time by 7-9 days).
- Rotating liner hanger with the ability to rotate liner while running, flushing and cementing.
- Hydraulic driven drillable casing reaming shoe (made from easy drilliable materials).
- Selective multistage hydraulic fracturing technologies with Straddle packer module (PVZ).
- Various types of full-bore frac sleeves and flow control equipment.
- Expandable steel packer (V0 validation grade).
- Well completion equipment made of composite and dissolvable materials.

R&D

An in-house R&D department provides the design and implementation of new products that meet the latest technological trends and customer requirements.

OVER 450
NOMENCLATURE ITEMS

MANUFACTURING

METTOIL's and BULAT own full-cycle plants are equipped with new high-tech machines and modern tools. Tools testing is carried out on a certified testing stand (GOST ISO14310) for V0 - V5 validation grades in the presence of the customer. Quality Management System meets the requirements of ISO 9001, INTI.QS.S.QS.1–07-2022-1 and API standard.

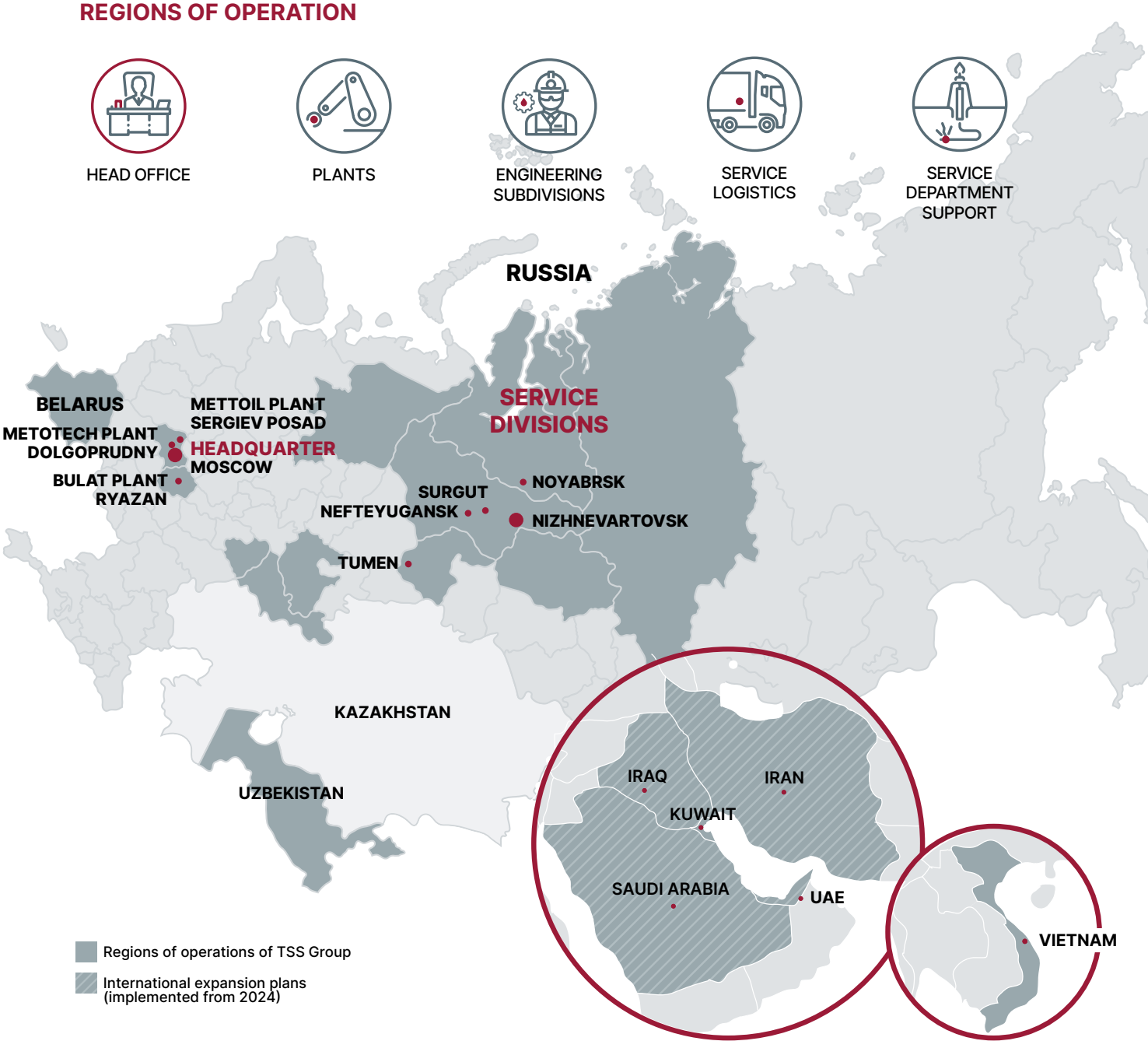
15 000+
WELLS

SERVICE

We provide a full cycle of expert and technological support at all stages of the operation: control of the assembly make-up, deployment and activation of downhole systems, field supervision, analysis and work adjustment and other functions as agreed with the customer.

40 000+
MHF STADIES

REGIONS OF OPERATION



HMR LINER HANGER SYSTEM WITH MECHANICAL RELEASE

HMR

APPLICATION

HMR Liner Hanger System is specially designed for non-cemented liner applications. HMR is used to suspend the liner in a previous casing using a liner hanger. Work string is used to run in hole the liner to the desired setting depth without rotation. Running tool with mechanical release is then retrieved from the well once the liner is in place.

FEATURES AND BENEFITS

- Hydraulic activation eliminates the need of drillstring manipulation.
- Hydraulic Liner Hanger System with mechanical release running tool without rotation during RIH makes HMR the low-cost option in TSS product line, that makes it ideal for conventional wells providing an economic benefit to the customer.
- Full-bore ID after running tool retrieve imposes no restrictions to liner access for future intervention and remedial operations.
- HMR Liner Hanger System withstands high tensile loads.
- HMR Liner Hanger System withstands high differential pressures.
- Ball seat is located in the running tool.

LHS COMPONENTS

- **Polished Bore Receptacle** provides a mean of tying back into the liner with seal assembly for multistage hydraulic fracturing or with second isolation packer.
- **Liner Top Packer** provides high integrity annulus sealing.
- **Hydraulic Hanger** provides a specified holding force.
- **Rental equipment**: Debris barrier, running tool with mechanical release, pack-off bushing and ball seat.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE				
Liner size, in	**4.000**			**4.500**	
Casing OD, in	**5.500**	**5.750**	**6.625**	**6.625**	**7.000**
Length, ft	12.2			11.9	
Max OD, in	4.606	4.764	5.551	5.984	
Min ID after activation, in	3.465			3.898	
Material*	P-110				
Tensile, kip	180				
Max differential pressure, psi	10,000				
Burst, psi	10,000				
Collapse, psi	10,000				
Max working temperature, °F	248				
Design Validation Grade / Quality Grade	V3 / Q2				

* Other options are available as per Customer request.

HMR-MSF LINER HANGER SYSTEM WITH MECHANICAL RELEASE FOR MSF

APPLICATION

HMR-MSF Liner Hanger System is specially designed for multistage hydraulic fracturing and for non-cemented liner applications. HMR-MSF is used to suspend the liner in a previous casing using a liner hanger. Work string is used to run in hole the liner to the desired setting depth without rotation. Running tool with mechanical release is then retrieved from the well once the liner is in place.

FEATURES AND BENEFITS

- Hydraulic Liner Hanger with mechanical release running tool without rotation during RIH makes HMR the low-cost option in TSS product line, that makes it ideal for conventional wells providing an economic benefit to the customer.
- Ball seat is located in the landing collar or activation sub below the Liner Hanger Systems.
- HMR-MSF allows activation of hydraulic elements for multistage hydraulic fracturing system (frac sleeves, mechanical hydraulic packers).
- Full-bore ID after running tool retrieve imposes no restrictions to liner access for future intervention and remedial operations.
- Hydraulic activation of the Liner Hanger eliminates the need for drillstring manipulation.
- HMR-MSF Liner Hanger System withstands high tensile loads.
- HMR-MSF Liner Hanger System withstands high differential pressures.

LHS COMPONENTS

- **Polished Bore Receptacle** provides a mean of tying back into the liner with seal assembly for multistage hydraulic fracturing or with second isolation packer.
- **Liner Top Packer provides** high integrity annulus sealing.
- **Hydraulic Hanger provides** a specified holding force.
- **Rental equipment**: Debris barrier, running tool with mechanical release, pack-off bushing.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE				
Liner size, in	**4.000**			**4.500**	
Casing size, in	**5.500**	**5.750**	**6.625**	**6.625**	**7.000**
Length, ft	12.2	12.2	13.0	11.9	
Max OD, in	4.606	4.764	5.551	5.551	5.984
ID after activation, in	3.465			3.898	
Material*	P-110				
Tensile, lbf	180				
Max differential pressure, psi	10,000				
Burst, psi	10,000				
Collapse, psi	10,000				
Max working temperature, °F	248				
Design Validation Grade / Quality Grade	V3 / Q2				

* Other options are available as per Customer request.

HMR-MSF

SHMR LINER HANGER SYSTEM WITH MECHANICAL RELEASE

SHMR

APPLICATION

SHMR Liner Hanger System is specially designed for non-cemented liner applications to run in hole the slotted liner or screens where pressure integrity between the work string and the shoe track must be maintained during the installation, in order to ensure the circulation is provided through a liner shoe. Work string is used to run in hole the liner to the desired setting depth without rotation. Running tool with mechanical release is then retrieved from the well once the liner is in place.

FEATURES AND BENEFITS

- SHMR Liner Hanger System allows circulation through the bottom of slotted liner.
- Running tool at the bottom is connected to the inner string . Stinger of the inner is stabbed in o-ring seal sub to provide a reliable seal ensuring the circulation is provided through the shoe.
- Inner String Swivel allows rotation without transferring torque to the liner string.
- Ball seat is located in the running tool.
- Full-bore ID after running tool retrieve imposes no restrictions to liner access for future intervention and remedial operations.
- Hydraulic activation eliminates the need of drillstring manipulation.
- SHMR Liner Hanger System withstands high tensile loads.
- SHMR Liner Hanger System withstands high differential pressure.

LHS COMPONENTS

- **Polished Bore Receptacle** provides a mean of tying back into the liner with seal assembly for multistage hydraulic fracturing or with second isolation packer.
- **Liner Top Packer** provides high integrity annulus sealing.
- **Hydraulic Hanger** provides a specified holding force.
- **Rental equipment**: Debris barrier, running tool with mechanical release, pack-off bushing and ball seat.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE	
Liner size, in	**4.500**	
Casing OD, in	**6.625**	**7.000**
Length, ft	12.8	
Max OD, in	5.551	5.984
Min ID after activation, in	3.898	
Material*	P-110	
Tensile, kip	180	
Max differential pressure, psi	10,000	
Burst, psi	10,000	
Collapse, psi	10,000	
Max working temperature, °F	248	
Design Validation Grade / Quality Grade	V3 / Q2	

* Other options are available as per Customer request.

HHR LINER HANGER SYSTEM WITH HYDRAULIC RELEASE

APPLICATION

HHR Liner Hanger System is specially designed for non-cemented liner applications. HHR is used to suspend the liner in a previous casing using a liner hanger. Work string is used to run in hole the liner to the desired setting depth without rotation. Running tool with hydraulic release is then retrieved from the well once the liner is in place.

FEATURES AND BENEFITS

- Hydraulic activation eliminates the need of drillstring manipulation.
- Mechanical release can be used as a back-up option.
- Full-bore ID after running tool retrieve imposes no restrictions to liner access for future intervention and remedial operations.
- Ball Seat can be located either in running tool or in landing collar / activation sub.
- Hold down slips above the packer sealing element allow to prevent the upward movement of the liner.
- HHR Liner Hanger System withstands high tensile loads.
- HHR Liner Hanger System withstands high differential pressures.

LHS COMPONENTS

- **Polished Bore Receptacle** provides a mean of tying back into the liner with seal assembly for multistage hydraulic fracturing or with second isolation packer.
- **Liner Top Packer** provides high integrity annulus sealing.
- **Hydraulic Hanger** provides specified holding force.
- **Rental equipment**: Debris barrier, running tool with hydraulic release, pack-off bushing and ball seat.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Liner size, in	**4.500**		**5.000**
Casing OD, in	**6.625**	**7.000**	**7.000**
Length, ft	12.3		12.1
Max OD, in	5.551	5.984	5.984
Min ID after activation, in	3.898		4.409
Material*	P-110		
Tensile, kip	180		
Max differential pressure, psi	10,000		
Burst, psi	10,000		
Collapse, psi	10,000		
Max working temperature, °F	248		
Design Validation Grade / Quality Grade	V3 / Q2		

* Other options are available as per Customer request.

HHR

HMR-MSF SA LINER HANGER SYSTEM FOR MSF WITH SEAL ASSEMBLY

HMR-MSF SA

APPLICATION

HMR-MSF SA Liner Hanger System with Seal Assembly is designed for non-cemented liner applications to run in hole the liner on 4 ½" tubing. Work string is used to run in hole the liner to the desired setting depth without rotation. Running tool with mechanical release is then retrieved from the well once the liner is in place.

FEATURES AND BENEFITS

- The liner is run on the production tubing, instead of drill pipe string.
- Tie-back Seal Assembly for multistage hydraulic fracturing is a part of the running tool thus reducing time for run-in-hole/pull-out-of-hole operations (RIH/POOH).
- Hold down slips above the packer sealing element allow to prevent the upward movement of the liner.
- Ball Seat can be located either in running tool or in landing collar / activation sub.
- Running tool includes Tie-back Seal Assembly for multistage hydraulic fracturing which helps to reduce time for completion operations.
- Full-bore ID after running tool retrieve imposes no restrictions to liner access for future intervention and remedial operations.

LHS COMPONENTS

- **Polished Bore Receptacle** provides a mean of tying back into the liner with seal assembly for multistage hydraulic fracturing or with second isolation packer.
- **Liner Top Packer** provides high integrity annulus sealing.
- **Hydraulic Hanger** provides specified holding force.
- **Rental equipment**: Debris barrier, running tool with mechanical release, pack-off bushing.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**4.500**
Casing OD, in	**7.000**
Length, ft	19.8
Max OD, in	5.984
Min ID after activation, in	3.898
Material*	P-110
Tensile, kip	157
Max differential pressure, psi	10,000
Burst, psi	10,000
Collapse, psi	10,000
Max working temperature, °F	248
Design Validation Grade / Quality Grade	V3 / Q2

* Other options are available as per Customer request.

X-1 LINER HANGER PACKER

APPLICATION

X-1 Liner Hanger Packer is designed to run in hole liners without rotation, suspend the liner in the previous casing at the desired depth. The work string is retrieved from the well after the liner is in place and the setting tool is hydraulically released.

FEATURES AND BENEFITS

- X-1 Liner Hanger Packer is designed to be run in vertical, highly deviated and horizontal wells.
- X-1 Liner Hanger Packer is an economical version of X-series hanger packer which makes it ideal for running liners without any rotation.
- Hydraulically released running tool.
- Secondary mechanical release is available.
- Liner hanger is activated by applying differential pressure across the hydraulic cylinder eliminating any drillstring manipulation.
- Hold down slips above the packer sealing element allow to prevent the upward movement of the liner.

LINER HANGER PACKER COMPONENTS

- Hydraulic liner hanger.
- Mechanical liner top packer with hold-down slips.

Compatible equipment (Polished Bore Receptacle, Running Tool, Pack-off bushing, Landing Collar or Activation Sub) should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Compatible running tool	**RT-1**
Liner size, in	**4.500**
Casing OD, in	**7.000**
Length, ft	6.9
Max OD, in	5.984
Min ID after activation, in	3.898
Material*	P-110
Tensile, kip	225
Max differential pressure, psi	10,000
Burst, psi	10,000
Collapse, psi	10,000
Max working temperature, °F	302
Design Validation Grade / Quality Grade	V3 / Q2

* Other options are available as per Customer request.

X-1

CRM-3 CEMENTED LINER HANGER SYSTEM

CRM-3

APPLICATION

CRM-3 Liner Hanger System is specially designed for cemented liner applications. CRM-3 is used to suspend the liner in a previous casing using a liner hanger followed by cementing operations. Work string is used to run in hole the liner to the desired setting depth without rotation. Running tool with mechanical release is then retrieved from the well once the liner is in place.

FEATURES AND BENEFITS

- CRM-3 Liner Hanger System is designed for cemented liners in vertical, highly deviated and horizontal wells.
- Hydraulic activation of the Liner Hanger allows for using in deep, deviated wells without the need for drillstring manipulation.
- Running tool design with the float nut allows release prior to cementing.
- Full-bore ID after running tool retrieve imposes no restrictions to liner access for future intervention and remedial operations.
- 10 ft Polished Bore Receptacle (PBR) allows to set the floating type of Tie-back Seal Assembly without using a hydraulic anchor.
- Running tool at the bottom has a profile for Liner Wiper Plug.
- CRM-3 Liner Hanger System withstands high tensile loads.
- CRM-3 Liner Hanger System withstands high differential pressures.

SUPPLY PACKAGE

- **Polished Bore Receptacle** provides a mean of tying back into the liner with seal assembly for multistage hydraulic fracturing or with second isolation packer.
- **Liner Top Packer** provides high integrity annulus sealing.
- **Hydraulic Hanger** provides specified holding force.
- **Running tool** with mechanical release.
- **Liner Wiper Plug.**
- **Drill Pipe Dart.**

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE				
Liner size, in	**4.000**			**4.500**	
Casing OD, in	**5.500**	**5.750**	**7.000**	**6.625**	**7.000**
Length, ft	19.1			19.0	
Max OD, in	4.606	4.764	5.984	5.551	5.984
Min ID after activation, in	3.465			3.898	
Tensile, kip	157			202	
Material*	P-110				
Max differential pressure, psi	10,000				
Burst, psi	10,000				
Collapse, psi	10,000				
Max working temperature, °F	248				
Design Validation Grade / Quality Grade	V3 / Q2				

* Other options are available as per Customer request.

CRM-3S CEMENTED LINER HANGER SYSTEM WITH HOLD-DOWN SLIPS

APPLICATION

CRM-3S Liner Hanger System with Hold-Down Slips is specially designed for cemented liner applications. CRM-3S is used to suspend the liner in previous casing using a liner hanger followed by cementing operations. Work string is used to run in hole the liner to the desired setting depth without rotation. Running tool with mechanical release is then retrieved from the well once the liner is in place.

FEATURES AND BENEFITS

- Hydraulic activation of the Liner Hanger allows for using in deep, deviated wells without the need for drillstring manipulation.
- Hold-down slips above the packer sealing element allow to prevent the upward movement of the liner.
- Running Tool design with float nut allows release prior to cementing operations.
- Full-bore ID after running tool retrieve imposes no restrictions to liner access for future intervention and remedial operations.
- 10 ft Polished Bore Receptacle (PBR) allows to set the floating stinger without using a hydraulic anchor.
- Running tool at the bottom has a profile for Liner Wiper Plug.
- CRM-3S Liner Hanger System withstands high tensile loads.
- CRM-3S Liner Hanger System withstands high differential pressures.

SUPPLY PACKAGE

- **Polished Bore Receptacle** provides a mean of tying back into the liner with seal assembly for multistage hydraulic fracturing or with second isolation packer.
- **Liner Top Packer** provides high integrity annulus sealing.
- **Hydraulic hanger** provides specified holding force.
- **Running Tool** with a mechanical release.
- **Liner Wiper Plug.**
- **Drill Pipe Dart Plug.**

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Liner size, in	**4.500**		**5.000**
Casing OD, in	**6.625**	**7.000**	**7.000**
Length, ft	19.4		
Max OD, in	5.551	5.984	5.984
Min ID after activation, in	3.898		4.409
Tensile, kip	202		214
Material*	P-110		
Max differential pressure, psi	10,000		
Burst, psi	10,000		
Collapse, psi	10,000		
Max working temperature, °F	248		
Design Validation Grade / Quality Grade	V3 / Q2		

* Other options are available as per Customer request.

CRM-3S

X-2 ROTATING LINER HANGER PACKER

X-2

APPLICATION

X-2 Liner Hanger Packer is designed to run in hole the liner with rotation, suspend the liner in the previous casing at the desired depth. The work string is retrieved from the well after the liner is in place and the setting tool is hydraulically released.

FEATURES AND BENEFITS

- X-2 Liner Hanger is ideal for running liners with rotation for wellbore reaming.
- X-2 Liner Hanger Packer is designed for vertical, highly deviated and horizontal wells.
- Hydraulically released Running tool.
- Secondary mechanical release is available.
- Liner hanger is activated by applying differential pressure across the hydraulic cylinder eliminating any drillstring manipulation.
- Hydraulic activation of the Liner Hanger allows for using in deep deviated wells without the need of drillstring manipulation.
- Hold down slips above the packer sealing element allows to prevent the upward movement of the liner.

LINER HANGER PACKER COMPONENTS

- Hydraulic liner hanger.
- Mechanical liner top packer with hold-down slips.

Compatible equipment (Polished Bore Receptacle, Running Tool, Pack-off bushing, Landing Collar or Activation Sub) should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Compatible running tool*	**HRT, POB**
Liner size, in	**4.500**
Casing OD, in	**7.000**
Length, ft	6.9
Max OD, in	5.984
Min ID after activation, in	3.898
Material**	P-110
Tensile, kip	225
Max differential pressure, psi	10,000
Burst, psi	10,000
Collapse, psi	10,000
Max working temperature, °F	302
Design Validation Grade / Quality Grade	V3 / Q2

* Compatible equipment should be requested by the manufacturer.
** Other options are available as per Customer request.

X-3 ROTATING LINER HANGER PACKER

APPLICATION

X-3 Liner Hanger Packer is designed to run in hole the liner with rotation, suspend the liner in the previous casing at the desired depth. The work string is retrieved from the well after the liner is in place and the setting tool is hydraulically released.

FEATURES AND BENEFITS

- X-3 Liner Hanger is designed for running liners with rotation for wellbore reaming.
- Hanger includes a bearing system, which allows rotation of the X-3 Liner Hanger after activation during cementing operations, which improves the cement bond quality.
- X-3 Liner Hanger is designed for vertical, directional and horizontal wells.
- Running tool is released from the Liner Hanger Packer hydraulically.
- Back up mechanical release is available.
- Liner hanger is activated by applying differential pressure across the hydraulic cylinder eliminating any drillstring manipulation.
- Hydraulic Hanger activation allows it for use in deep, deviated wells without the need for drillstring manipulation.
- Hold down slips above packer sealing element allow to prevent the upward movement of the liner.

LINER HANGER PACKER COMPONENTS

- Hydraulic liner hanger.
- Mechanical liner top packer with hold-down slips.

Compatible equipment (Polished Bore Receptacle, Running Tool, Pack-off bushing, Landing Collar or Activation Sub) should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Compatible running tool*	**HRT, POB**
Liner size, in	**4.500**
Casing OD, in	**7.000**
Length, ft	6.9
Max OD, in	5.984
Min ID after activation, in	3.898
Material**	P-110
Tensile, kip	225
Max differential pressure, psi	10,000
Burst, psi	10,000
Collapse, psi	10,000
Max working temperature, °F	302
Design Validation Grade / Quality Grade	V3 / Q2

* Compatible equipment should be requested by the manufacturer.
** Other options are available as per Customer request.

X-3

HRT ROTATING RUNNING TOOL

HRT

APPLICATION

HRT Running Tool is designed to run in hole X-series Liner Hanger Packer with rotation, suspend the liner in the previous casing and set the liner top packer.

FEATURES AND BENEFITS

- HRT Running Tool is designed for run in hole liners with rotation.
- HRT Running Tool is ideal for vertical, highly deviated and horizontal wells.
- Hydraulically released Running tool.
- Secondary mechanical release is available.
- Liner Top Debris barrier prevents debris from entering the PBR and protects the Running Tool during run in hole and cementing operations.
- An axial thrust bearing allows rotation during slacking-off weight to set the packer and provides the ability to transfer additional setting force to the liner top packer, which is especially useful in highly deviated, ERD and horizontal wells.

RUNNING TOOL COMPONENTS

- Liner Top Debris barrier.
- Packer activator.
- Hydraulic release running tool.

Compatible equipment should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Max OD, in	**5.984**
Min Running Tool ID, in	**2.323**
Min lift sub ID, in	2.402
Lift Sub length (after stab-in with the liner hanger), ft	4
Lift Sub OD, in	3.500
Lift sub coupling OD, in	5.000
Length, ft	17.8
Maximum working temperature, °F	302
Burst, psi	12,500
Tensile, kip	157
Material*	P-110

* Other options are available as per Customer request.

PBR POLISHED BORE RECEPTACLE

APPLICATION

PBR Polished Bore Receptacle provides a mean of tying back into liner with the tie-back packer or provides a mean of sealing the Tie-back Seal Assembly for multistage hydraulic fracturing, usually installed as a part of completion string. PBR provides a protection of running tool from cuttings and debris during run in hole the liner. Another main function is to provide the weight transferring to set the liner top packer.

FEATURES AND BENEFITS

- PBR is connected to the Liner Top Packer and secured with the set screws to prevent back-off during rotation of the liner string.
- PBR acts as a receptacle for Tie-back Seal Assembly, which protects the string from high pressure during multistage hydraulic fracturing.
- PBR enables the liner to be tied back, providing reliable pressure integrity.
- PBR is suitable for vertical, highly deviated, ERD and horizontal wells.

Compatible equipment should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE				
Liner size, in	**4.000**	**4.500**		**5.000**	**7.000**
Casing OD, in	**5.750**	**7.000**		**7.000**	**9.625**
Max OD, in	4.764	5.984		5.984	8.346
Sealing ID, in	4.252	5.252		5.252	7.500
Length, ft	10	5	10	10	
Material*	P-110				
Burst, psi	10,000				
Maximum working temperature, °F	302				

* Other options are available as per Customer request.

PBR

LTP LINER TOP PACKER

LTP

APPLICATON

LTP Liner Top Packer is a part of Liner Hanger System which provides sealing the annulus at the top of the liner string. The packer is set mechanically by transferring the weight through the top of PBR with a packer actuator.

FEATURES AND BENEFITS

- Packing element provides high-integrity seal that prevents fluid migration.
- Packer incorporates a profile for the running tool to transfer the torque from the drill pipe string to the liner.
- PBR is connected to the Liner Top Packer and secured with the set screws to prevent back-off during rotation of the liner string.
- Hold-down slips above the packer element allow to prevent the upward movement of the liner string.
- LTP Liner Top Packer is suitable for vertical, highly deviated and ERD wells.

Compatible equipment should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Compatible running tool*	**RTH, RCP**		
Liner size, in	**4.000**	**5.000**	**7.000**
Casing OD, in	**5.750**	**7.000**	**9.625**
Max OD, in	4.803	5.984	8.386
Min ID, in	3.465	4.370	6.260
Length, ft	4.4	4.5	5.2
Tensile, kip	200	393	562
Max differential pressure, psi	10,000		5,500
Burst, psi	10,000		9,950
Collapse, psi	10,000		5,500
Material*	P-110		
Max working temperature, °F	302		
Design Validation Grade / Quality Grade	V3 / Q2		

* Compatible equipment should be confirmed by the manufacturer.
** Other options are available as per Customer request.

TLH HYDRAULIC LINER HANGER

APPLICATION

TLH Hydraulic Hanger is part of the Liner Hanger System that provides suspending the liner in the previous casing. The Hanger is set hydraulically by applying a differential pressure across the cylinder that pushes the slips onto the cone. The slips cut into the inner diameter of the previous casing and hang the liner after slacking off the weight.

FEATURES AND BENEFITS

- Hydraulic Hanger activation allows it for use in deep, deviated wells without the need of drillstring manipulation.
- Hydraulic Hanger allows to run in hole the liner with rotation which makes it ideal for wellbore reaming operations.
- Liner Hanger includes a gauge ring that protects the hydraulic cylinder and the slips while passing through wellbore restrictions.
- Hydraulic Liner Hanger is suitable for vertical, highly deviated and ERD wells.

Compatible equipment should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS		VALUE		
Liner size, in		**4.000**	**5.000**	**7.000**
Casing	**OD, in**	**5.750**	**7.000**	**9.625**
	Weight, ppf	**19.9 - 22.0**	**26.0 - 29.0**	**40.0 - 47.0**
Max OD, in		4.803	5.984	8.386
Min ID, in		3.465	4.370	6.260
Tensile, kip		200	393	562
Burst, psi		10,000		9,950
Collapse, psi		10,000		5,500
Material*		P-110		
Max working temperature, °F		302		
Design Validation Grade / Quality Grade		V3 / Q2		

* Other options are available as per Customer request.

TLH

TLHR ROTATING LINER HANGER

TLHR

APPLICATION

TLHR Rotating Liner Hanger is part of Liner Hanger System that provides suspending the liner in the previous casing. TLHR Hanger is activated hydraulically by applying differential pressure to the cylinder that pushes the slips onto the cone. The slips cut into the inner diameter of the previous casing and hang the liner after slacking off the weight.

FEATURES AND BENEFITS

- Hydraulic Hanger activation allows it for use in deep, deviated wells without the need of drillstring manipulation.
- Hydraulic Hanger allows to run in hole the liner with rotation which makes it ideal for wellbore reaming operations.
- TLHR Hanger incorporates a bearing system, which allows to rotate the liner after cementing, which improves the cement quality.
- TLHR Hanger incorporates a centralizer that protects the hydraulic cylinder and hanger elements while passing through wellbore restrictions.
- TLHR Hanger is designed for vertical, directional and horizontal wells.

Compatible equipment should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS		VALUE		
Liner size, in		**4.000**	**5.000**	**7.000**
Casing	**OD, in**	**5.750**	**7.000**	**9.625**
	Weight, ppf	**19.9 - 22.0**	**26.0 - 29.0**	**40.0 - 47.0**
Max OD, in		4.803	5.984	8.386
Min ID, in		3.464	4.370	6.260
Bearing capacity, kip		81	112	247
Torque, ft-lbs		7,154	11,000	30,900
Tensile, kip		200	393	562
Burst, psi		10,000		9,950
Collapse, psi		10,000		5,500
Material*		P-110		
Max working temperature, °F		302		
Design Validation Grade / Quality Grade		V3 / Q2		

* Other options are available as per Customer request.

LWP LINER WIPER PLUG

APPLICATION

LWP Liner Wiper Plug is a hollow core plug designed to separate cement slurry from mixing with other fluids inside the casing during cementing operations.

LWP

FEATURES AND BENEFITS

- LWP Liner Wiper Plug includes locking mechanism, which allows plug to be secured in the landing collar profile after finishing the cementing operation.
- After cement is pumped and plug is landed on landing collar profile it holds the bump pressure and can withstand pressure from the above and below.
- LWP effectively wipes casing inner diameter from the cement slurry.
- LWP is made from easy drillable materials.
- LWP includes an anti-rotating mechanism that prevents rotation while drilling out.

Compatible equipment should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE				
Liner size, in	**4.000**	**4.500**	**4.500 / 5.000**	**5.000**	**7.000**
Wiper OD, in	3.937	4.409	4.921	4.921	6.693
Max body OD, in	3.150			3.543	5.118
Drift ID, in	1.063	1.417			2.008
Length, ft	1.3				
Material*	PDC drillable				
Max working temperature, °F	302				

* Other options are available as per Customer request.

DPD DRILL PIPE DART

DPD

APPLICATION

DPD Drill Pipe Dart is designed to wipe work string inner diameter and to separate fluids during cementing operation. After the desired amount of cement is pumped the drillpipe dart is launched from the cementing head. Dart is displaced through the drillpipe and running tools with displacement fluid. When the Dart reaches the LWP Liner Wiper Plug at the bottom of the running tool string, it latches into the wiper plug and seals.

FEATURES AND BENEFITS

- Dart includes a locking mechanism, which allows the dart to be secured in the Liner Wiper Plug profile.
- Dart latchs in Liner Wiper Plug profile providing a pressure-tight seal.
- Dart effectively wipes the work string ID from the cement slurry.
- Dart is made from easy drillable materials.
- Dart features an anti-rotating mechanism that prevents rotation while drilling out.

Compatible equipment should be confirmed by the manufacturer.

TECHNICAL DATASHEET

SERIES	Wiper OD, in		Length, ft	Drill pipe ID, in	Compatible liner size
	Top	Bottom			
DPD.1.102.78.64	3.000	2.520	0.95	3.500	4.000 - 5.500 4.000 - 5.750 4.000 - 6.625
DPD.1.102.64.52	2.520	2.047		2.874	
DPD.1.102.64.57		2.244		2.874	
DPD.1.102.78.52	3.000	2.047		3.500	
DPD.1.102.78.57		2.244		3.500	
DPD.1.102.78.78		3.000		3.500	
DPD.1.102.93.64	3.661	2.520		4.000	
DPD.1.102.93.93		3.661		4.000	
DPD.1.114.78.64	3.000	2.520	0.96	3.500	4.500 - 6.625 4.500 - 7.000 5.000 - 7.000
DPD.1.114.64.52	2.520	2.047		2.874	
DPD.1.114.64.57		2.244		2.874	
DPD.1.114.78.52	3.000	2.047		3.500	
DPD.1.114.78.57		2.244		3.500	
DPD.1.114.78.78		3.000		3.500	
DPD.1.114.93.64	3.661	2.520		4.000	
DPD.1.114.93.93		3.661		4.000	
DPD.1.178.115.115	4.528	4.528	1.44	5.000	5.750 - 9.625 6.625 - 9.625 7.000 - 9.625
DPD.1.178.127.127	5.000	5.000		5.500	

RTH ROTATING RUNNING TOOL

APPLICATION

RTH Running Tool is designed for running the liner with rotation, setting hydraulic liner hanger and activate liner top packer. The main feature of the tool is the ability to rotate the liner during run in hole and after hanger is set.

FEATURES AND BENEFITS

- The Running tool is designed for run in hole the liner with rotation in vertical, directional and horizontal wells.
- RTH back-up mechanical release mechanism to ensure release from the liner.
- Liner top debris barrier is designed to prevent cuttings and other debris from entering the PBR protecting the running tool during RIH and cementing.
- The ability to rotate the drill string during slacking off the weight and run the packer assembly eliminates static friction between the drill string and the casing and provides the ability to transfer additional load to the liner top packer, which is especially useful while running liners in horizontal and ERD wells.
- RTH is stabbed in the Liner Top Packer. Packer activation is carried out by transferring weight through the PBR after releasing the running tool when the packer activator dogs are forced outward above the PBR.
- The setting tool assembly consists of RTH Running Tool, packoff bushing, liner wiper plug adapter.

RUNNING TOOL COMPONENTS

- Liner Top Debris barrier.
- Packer activator.
- Running tool with hydraulic release.

Compatible equipment should be confirmed by the manufacturer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Max OD, in	4.803	5.984	8.386
Tool body OD, in	4.252	5.252	7.500
Min ID, in	2.008	2.087	3.681
Min lift sub ID, in	2.008	2.087	3.740
Lift sub OD, in	2.875	3.500	5.000
Lift sub coupling OD, in	4.250	5.000	6.625
Length, ft	17.9	18.2	16.3
Tensile, kip	202	202	495
Compression, lbf	101	100	247
Torque, ft-lbs	7,376	11,000	30,978
Lift sub length (after stab-in), ft	4		
Max working temperature, °F	302		
Burst, psi	5,000		
Material*	P-110		

* Other options are available as per Customer request.

RTH

BALL DROP FRAC SLEEVE

BALL DROP
FRAC SLEEVE

APPLICATION

Ball Drop Frac Sleeve is a part of an openhole fracturing system designed to allow operators to perform selective single-point multistage fracturing. The inner sleeve is run in a pinned configuration and sheared after pressure increasing when activation ball is landed, providing positive indication that the specified port has opened before fracturing.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Ball seats are pre-installed to capture the corresponding balls.
- Can be used as a toe sleeve for the first fracturing stage.
- Compatible with dissolvable or composite frac balls.
- Hydraulic activation of the sleeve does not require the tubing string movement.
- Activation pressure can be adjusted prior to RIH.
- Locking mechanism holds the sleeve in open position.
- Withstands high tensile loads and high differential pressures.
- All internal components are PDC drillable.
- Fullbore ID after milling.

SUPPLY PACKAGE

- Ball Drop Frac sleeve.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner OD, in	**4.500**
Max OD, in	5.500
Min ID after milling, in	3.898
Length, ft	2.2
Ports ID, in	0,866
Number of ports, ea	20
Max working temperature, °F	302
Burst, psi	12,500
Collapse, psi	12,500
Tensile, kip	247
Material*	Q-125

* Other options are available as per Customer request.

BALL DROP FRAC PORT

BALL DROP FRAC PORT

APPLICATION

Ball Drop Frac Sleeve is a part of an openhole fracturing system designed to allow operators to perform selective single-point multistage fracturing. The inner sleeve is run in a pinned configuration and sheared after pressure increasing when activation ball is landed, providing positive indication that the specified port has opened before fracturing.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Ball seats are pre-installed to capture the corresponding balls.
- Allows to perform up to 21 stages of multistage fracturing.
- Compatible with dissolvable or composite frac balls.
- Hydraulic activation of the sleeve does not require the tubing string movement.
- Activation pressure can be adjusted prior to RIH.
- All internal components are PDC drillable.
- Fullbore ID after milling.
- Withstands high tensile loads and high differential pressures.

SUPPLY PACKAGE

- Ball Drop Frac Port.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE			
Liner size, in	**4.000**	**4.000 / 5.500**	**4.500**	**5.750**
Max OD, in	4.646	3.465	3.465	3.465
Min ID, in	3.465		3.900	5.080
Actuation pressure, psi	2,300			2,900
Ports flow area, in²	10.65	10.65	16.53	24.19
Number of ports, ea	6			
Burst, psi	10,000			
Collapse, psi	10,000			
Tensile, kip	157	157	202	315
Material*	P-110			
Max working temperature, °F	248			
Length, in	2.1		2.3	

* Other options are available as per Customer request.

HYDRAULIC ACTIVATED TOE SLEEVE WITH ISOLATION VALVE

TOE SLEEVE WITH ISOLATION VALVE

APPLICATION

Hydraulic Activated Toe Sleeve with Isolation Valve is designed to be used as a first stage for multistage hydraulic fracturing. Hydraulic activated Toe Sleeve in terms of construction consists of an activation sleeve and a toe sleeve.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Acid-resistant design of all assembly elements (HCL 14%).
- Lock mechanism that prevents spontaneous closing of ports.
- Withstands high tensile loads and high differential pressures.
- Can be milled out after operations providing the fullbore ID.
- Re-closable Toe Sleeve.

OPERATION SEQUENCE

- Activation Ball is pumped down to the landing seat to achieve bump pressure.
- After pressure increasing the inner sleeve is sheared down to close circulation ports in activation valve.
- Provide well casing and Tie-back Seal Assembly stab in.
- Increase pressure to the desired value to open the circulation frac ports.

SUPPLY PACKAGE

- Hydraulic Activated Toe Sleeve with isolation valve.
- Activation Ball - primary.
- Activation Ball - back-up.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner OD, in	**4.500**
Max OD, in	5.500
Min ID after milling, in	3.819
Length, ft	2.2
Max pressure against the ball, psi	10,000
Closing pressure, psi	1,450
Opening pressure, psi	4,500
Ports flow area, in^2	11.78
Material*	Q-125
Max working temperature, °F	320
Burst, psi	14,500
Collapse, psi	14,500
Tensile, kip	247

* Other options are available as per Customer request.

HYDRAULIC FRAC PORT

APPLICATION

Hydraulic Frac port is a part of a robust cemented or openhole fracturing system designed to allow operators to perform selective multistage hydraulic fracturing. Fullbore sleeve designed for the most common high-pressure and high-rate hydraulic fracturing. Hydraulic activation eliminates the need of ball usage.

- Cemented casing / liner applications.
- Vertical, directional and horizontal wells.

HYDRAULIC FRAC PORT

FEATURES AND BENEFITS

- Fullbore design.
- Circulation ports are opened by applying pressure.
- Milling out of the ball seat and ball is not required.
- Hydraulic activation of the sleeve does not require drill string manipulation.
- Activation pressure can be adjusted prior to RIH.
- Withstands high tensile loads and high differential pressures.

OPERATIONS SEQUENCE

- Hydraulic Frac Port is run to the setting depth as part of the liner.
- Pressure is increased up to the activation pressure value.
- Screws are sheared, the sleeve is shifted.
- Frac ports are opened.

SUPPLY PACKAGE

- Hydraulic Frac Port.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**4.500**
Max OD, in	5.236
Min ID, in	3.898
Opening pressure (wellhead pressure), psi	4,350
Ports flow area, in²	16.52
Burst, psi	10,000
Collapse, psi	10,000
Tensile, kip	202
Material*	P-110
Max working temperature, °F	248
Length, ft	2.5

* Other options are available as per Customer request.

BALL DROP FRAC PORT RECLOSABLE

BALL DROP FRAC PORT RECLOSABLE

APPLICATION

Ball Drop Frac Port Reclosable is a Key-operated Frac Sleeve is designed to provide access for the process fluid to the isolation zone during multistage hydraulic fracturing. The sleeve is opened hydraulically by pumping an activation ball into a special seat and applying pressure.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Activation pressure can be adjusted prior to RIH.
- Can be opened/closed with shifting tool after milling out operations.
- Locking mechanism holds the sleeve in open/closed position.
- The ball seat design eliminates rotation while milling out.
- Allows to perform up to 13 stages of hydraulic fracturing.
- Withstands high tensile loads and high differential pressures.

SUPPLY PACKAGE

- Ball Drop Frac Port Reclosable.
- Activation balls.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Liner size, in	**4000**	**4.500**	**5.000**
Max OD, in	4.567	5.236	5.748
Min ID, in	3.464	3.898	4.409
Opening pressure, psi	3,300	5,000	3,200
Ports flow area, in²	10.23	12.09	15.19
Number of ports, ea	6		
Burst, psi	10,000		
Collapse, psi	10,000		
Tensile, kip	157	202	213
Material*	P-110		
Max working temperature, °F	248		
Length, ft	2.9	3.1	2.7

* Other options are available as per Customer request.

BALL DROP FRAC SLEEVE RECLOSABLE

APPLICATION

Ball Drop Frac Sleeve Reclosable is designed for multistage hydraulic fracturing with activation balls of the corresponding size. The sleeve is opened hydraulically by pumping an activation ball into a special seat and increasing the tubing pressure.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- The Sleeve can be shifted mechanically with the indication of open/closed position.
- Acid-resistant design of all sleeve elements (HCL 14%).
- Can be used as the first toe sleeve.
- Circulation ports are opened by applying pressure after activation ball is seated in the ball seat.
- Locking mechanism holds the sleeve in open/closed position.
- Ball-seat design provides a pressure-tight seal during multistage fracturing.
- Withstands high tensile loads and high differential pressures.
- Ball seat locking mechanism prevents the seat rotation while milling out operations.

SUPPLY PACKAGE

- Ball Drop Frac Sleeve reclosable.
- Activation balls.

FRAC SLEEVE RECLOSABLE

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE			
Liner OD, in	**4.000**	**4.500**	**5.500**	**4.500 mod**
Max OD, in	4.567	5.236	6.732	5.630
Min ID after milling, in	3.465	3.898	4.764	3.898
Circulation ports opening pressure, psi	4,800	4,600	4,500	5,100
Ports flow area, in^2	10.36	12.69	19.92	11.78
Number of ports, ea	6	6	8	20
Material*	P-110			Q-125
Max working temperature, °F	248			302
Burst, psi	10,000			14,500
Collapse, psi	10,000			14,500
Tensile, kip	157	157	303	225

* Other options are available as per Customer request.

HYDRAULIC TOE SLEEVE RECLOSABLE

HYDRAULIC TOE SLEEVE RECLOSABLE

APPLICATION

Hydraulic Toe Sleeve Reclosable is designed to provide access for the process fluid to the isolation zone during multistage hydraulic fracturing. The sleeve is opened hydraulically by pumping an activation ball into a special seat and applying pressure. Circulation ports are opened after activation ball is seated and the pressure is increased to the activation pressure value.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Hydraulic Toe Sleeve Reclosable is run as the first stage of multistage fracturing assembly.
- Activation pressure can be adjusted prior to RIH.
- Locking mechanism holds the sleeve in open/closed position.
- Can be opened/closed using special shifting tool after milling out operations.
- Ball-seat design eliminates rotation while milling out operations.
- Withstands high tensile loads and high differential pressures.

SUPPLY PACKAGE

- Hydraulic Toe Sleeve Reclosable.
- Activation ball.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE	
Liner size, in	**4.000**	**4.500**
Max OD, in	4.567	5.236
Min ID, in	3.465	3.898
Opening pressure, psi	5,000	
Closing pressure, psi	1,650	1,600
Ports flow area, in²	10.23	12.09
Number of ports, ea	6	6
Burst, psi	10,000	
Collapse, psi	10,000	
Tensile, kip	157	202
Torque, ft-lbs	2,350	2,550
Material*	P-110	
Max working temperature, °F	248	
Length, ft	2.89	2.91

* Other options are available as per Customer request.

HYDRAULIC FRAC SLEEVE

APPLICATION

Hydraulic Frac Port is designed to provide access for the process fluid to the isolation zone during multistage hydraulic fracturing without activation balls.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Used as a first fracturing stage for multistage hydraulic fracturing.
- Provides multiple mechanical closing/opening cycles with shifting tool.
- Locking mechanism holds the sleeve in open/closed position.
- Cannot be used in cementing interval.
- Withstands high tensile loads and high differential pressures.
- Hydraulic activation does not require activation balls.
- Full-bore ID design thus milling out is not required.

SUPPLY PACKAGE

- Hydraulic Frac Sleeve.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE	
Liner OD, in	**5.500**	**4.500**
Max OD, in	6.732	5.669
Min ID, in	4.763	3.898
Length, ft	3.9	2.3
Opening pressure, psi	5,000	
Opening/closing Axial force, lbf	2,200	
Ports flow area, in²	19.92	11.78
Number of ports, ea	8	20
Material*	P-110	
Max working temperature, °F	248	302
Burst, psi	10,000	14,500
Collapse, psi	10,000	14,500
Tensile, kip	337	157
Torque, ft-lbs	4,200	5,750

* Other options are available as per Customer request.

HYDRAULIC FRAC SLEEVE

HYDRAULIC ACTIVATED TOE SLEEVE WITH ISOLATION VALVE RECLOSABLE

TOE SLEEVE WITH ISOLATION VALVE RECLOSABLE

APPLICATION

Hydraulic Activated Toe Sleeve with Isolation Valve Reclosable is designed for the first interval of multistage hydraulic fracturing using activation balls, without the ability to close the sleeve. The sleeve design includes an activation sleeve and a hydraulic toe sleeve.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Used as a first stage for multistage fracturing.
- Locking mechanism holds the sleeve in open position.
- All internal components are PDC drillable.
- Can be opened/closed mechanically using a special shifting tool.
- Can be used with acid-resistant, composite and soluble balls.
- Withstands high tensile loads and high differential pressures.
- Acid-resistant design of all elements (HCL 14%).

SUPPLY PACKAGE

- Hydraulic Activated Toe Sleeve with isolation valve reclosable.
- Activation ball.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Liner OD, in	**4.500**	**5.500**	**4.500**
Max OD, in	5.236	6.732	5.630
Min ID, in	3.898	4.764	3.898
Length, ft	3.7	3.9	2.5
Closing pressure, psi	1,450		
Opening pressure, psi	4,500		5,000
Opening/closing Axial force, lbf	2,200		
Ports flow area, in²	12.69	19.92	11.78
Number of ports, ea	6	8	20
Material*	P-110		Q125
Max working temperature, °F	248		302
Burst, psi	10,000		14,500
Collapse, psi	10,000		14,500
Tensile, kip	157	303	225

* Other options are available as per Customer request.

FULL BORE HYDRAULIC FRAC PORT RECLOSABLE

APPLICATION

Full Bore Hydraulic Frac Port Reclosable is designed to provide access for the process fluid to the isolation zone during multistage hydraulic fracturing. The sleeve is opened hydraulically by pumping an activation ball into a special seat and applying pressure.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Adjustable shear pressure prior to RIH.
- Locking mechanism holds the sleeve in open/closed position.
- Can be opened/closed using a special shifting tool after milling out operations.
- Withstands high tensile loads and high differential pressures.

SUPPLY PACKAGE

- Full Bore Hydraulic Frac Port Reclosable.

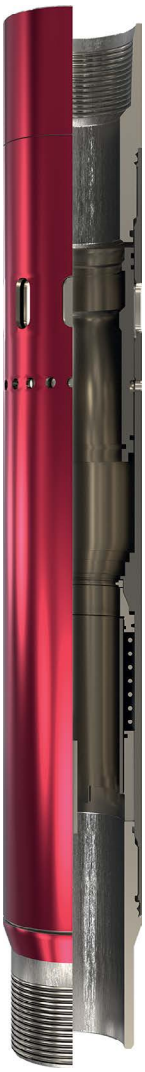
TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**4.500**
Max OD, in	5.236
Min ID, in	3.898
Opening Axial force, lbf	337
Number of shear pins for ports opening	1
Ports flow area, in²	12.09
Number of ports, ea	6
Burst, psi	10,000
Collapse, psi	10,000
Tensile, kip	202
Compression, kip	101
Torque, ft-lbs	2,550
Material*	P-110
Max working temperature, °F	248
Length, ft	3.2

* Other options are available as per Customer request.

FULL BORE HYDRAULIC FRAC PORT RECLOSABLE

FULL ID ONE-SIZE BALL OPERATED FRAC SLEEVE (REVOLVER)



REVOLVER

APPLICATION

REVOLVER Full ID One-Size Ball Operated Frac Sleeve is designed for multistage hydraulic fracturing without the need to mill out the seats. The sleeve can be used with hydromechanical packers for isolating the fracturing zones.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FRATURES AND BENEFITS

- Full-bore ID.
- Actuation is carried out using One-Size soluble balls.
- Unique revolving-sliding mechanism to ensure stages shifting.
- Mill out is not required.
- REVOLVER Frac sleeve allows RIH the liner with reciprocating and rotation.
- REVOLVER Sleeve allows the cement plug to pass through without restrictions.
- No internal elements that can be damaged or plugged during cementing. All mechanisms are isolated.
- The tool is equipped with shear screws to prevent actuation of the stage-counting
- mechanism before the activation ball is seated.
- Can be closed using a special mechanical shifting tool after fracturing.

SUPPLY PACKAGE

- REVOLVER Full ID One-Size Ball operated Frac Sleeve.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	4.500
Max OD, in	5.630
Min ID (seat), in	3.543
Min ID (after cleanout, if required), in	3.858
Ball diameter, in	3.700
Length, ft	4.4
Max number of stages	20
Tensile, kip	415
Burst, psi	10,000
Collapse, psi	10,000
Material*	Q-125
Max working temperature, °F	266
Design Validation Grade / Quality Grade	V3 / Q1

* Other options are available as per Customer request.

PLUG OPERATED FRAC PORT

APPLICATION

Plug Operated Frac Port is designed to provide an access for the process fluid to the isolation zone during hydraulic fracturing using a soluble key-plug.

- Uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Adjustable shear pressure prior to RIH.
- Mill out is not required.
- Full-bore ID.
- Activation of the sleeve is carried out by applying pressure after pumping the soluble key-plug.
- Locking mechanism holds the sleeve in the open/closed position.
- After fracturing the sleeve can be opened/closed using a special mechanical shifting tool.
- Frac port withstands high tensile loads and high differential pressures.
- Up to 6 fracturing stages with the toe sleeve as a part of the assembly.

SUPPLY PACKAGE

- Plug Operated Frac Port.
- Key-Plug.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**4.500**
Max OD, in	5.236
Min ID, in	3.858
Length, ft	3.1
Tensile, kip	202
Burst, psi	10,000
Collapse, psi	10,000
Material*	P-110
Max working temperature, °F	248

* Other options are available as per Customer request.

PLUG OPERATED FRAC PORT

FRAC PORT FOR CEMENTING OPERATIONS

FRAC PORT FOR CEMENTING OPERATIONS

APPLICATION

Frac port for cementing operations is designed for multistage hydraulic fracturing. The sleeve is opened hydraulically by pumping an activation ball into a special seat and then pressurizing the liner.

- Cemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Full-bore ID after milling.
- Locking mechanism holds the sleeve in open/closed position.
- Tool is used used with acid resistant, composite and soluble balls.
- Tool is used withstands high tensile loads and high differential pressures.
- Up to 5 frac ports with the toe sleeve can be installed as part of the assembly.

SUPPLY PACKAGE

- Frac Port for Cementing Operations.
- Activation ball.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE	
Liner size, in	**4.000**	**4.500**
Max OD, in	4.567	5.236
Min ID, in	3.465	3.898
Length, ft	2.3	
Tensile, kip	157	202
Burst, psi	10,000	
Collapse, psi	10,000	
Material*	P-110	
Max working temperature, °F	266	

* Other options are available as per Customer request.

BURST-PORT FRAC SLEEVE

APPLICATION

Burst-Port Frac Sleeve is designed to perform multistage fracturing using selective packer in cemented/non-cemented wells. The tool can also be used as the first fracturing stage.

- Cemented / non-cemented casing / liner applications.
- Vertical, directional and horizontal wells.

BURST-PORT
FRAC SLEEVE

FEATURES AND BENEFITS

- Full bore ID.
- Burst disks can be adjusted to a pre-determined activation pressure.
- Unlimited number of fracturing stages.
- No need to mill out the sleeve.
- Locking mechanism holds the sleeve in the open/closed position.
- Frac sleeve sleeve withstands high tensile loads and high differential pressures.

SUPPLY PACKAGE

- Burst-Port Frac Sleeve.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Liner size, in	**4.000**	**4.500**	**5.500**
Max OD, in	4.567	5.236	7.087
Min ID, in	3.465	3.898	4.803
Length, ft	1.8	1.9	2.0
Tensile, kip	157	202	
Burst, psi	10,000		
Collapse, psi	10,000		
Material*	P-110		
Max working temperature, °F	266		

* Other options are available as per Customer request.

BURST-PORT FRAC SLEEVE RECLOSABLE

BURST-PORT FRAC SLEEVE RECLOSABLE

APPLICATION

Burst-Port Frac Sleeve is designed to perform multistage fracturing using selective packer in cemented/non-cemented wells. The tool can also be used as the first fracturing stage.

- Cemented / non-cemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Burst disks can be adjusted to a pre-determined activation pressure.
- Frac sleeve is opened by applying pressure at the target depth (hydrostatic + wellhead). Unlimited number of fracturing stages.
- Full-bore ID.
- No need to mill out the sleeve.
- Locking mechanism holds the sleeve in open/closed position.
- Ability to be closed and opened multiple times with Shifting tool.
- Frac sleeve withstands high tensile loads and high differential pressures.

SUPPLY PACKAGE

- Burst-Port Frac Sleeve Reclosable.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE	
Liner size, in	**4.500**	**5.500**
Max OD, in	5.630	6.988
Min ID, in	3.898	4.803
Length, ft	3.1	3.2
Tensile, kip	202	
Burst, psi	10,000	12,500
Collapse, psi	10,000	11,000
Material*	P-110	
Max working temperature, °F	266	

* Other options are available as per Customer request.

B-SERIES MHP MECHANICAL-HYDRAULIC PACKER

APPLICATION

B-series Mechanical-Hydraulic Packer is a production packer that can be used for single or multiple-zone completions. It is designed to provide mechanical isolation for downhole pressures up to 10,000 psi. B-series Mechanical-Hydraulic Packer can be also used for stage cementing zone isolation. Packer is set hydraulically without the need for a running tool.

- Non-cemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Mechanical-Hydraulic Packer is run as part of the liner string.
- The activation pressure of the packer can be adjusted before run in hole by installing the required number of shear screws.
- Mechanical-Hydraulic Packer is securely fixed after activation.
- The tool withstands high tensile loads.
- The tool withstands high differential pressure.
- The tool is compact, so it facilitates the run-in-hole.

SUPPLY PACKAGE

- Mechanical-Hydraulic Packer B-series.

B-SERIES MHP

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE							
Liner size, in	**4.000**		**4.500**				**5.000**	**5.500**
Max OD, in	4.567	5.236	5.236	5.750	5.630	7.637	5.750	7.637
Min ID, in	3.465		3.898				4.409	4.842
Length, ft	2.4	4.9	2.3	2.5	2.4	5.2	2.5	5.0
Tensile, kip	157		202				214	292
Max working temperature, °F	302	212	302			248	302	248
Material*	P-110							
Max Diff Pressure, psi	10,000							
Burst, psi	10,000							
Collapse, psi	10,000							

* Other options are available as per Customer request.

M-SERIES MHP MECHANICAL-HYDRAULIC PACKER

M-SERIES
MHP

APPLICATION

M-series Mechanical-Hydraulic Packer is a production packer that can be used for single or multiple-zone completions. It is designed to provide mechanical isolation for downhole pressures. M-series Mechanical-Hydraulic Packer can be also used for stage cementing zone isolation. Packer is set hydraulically without the need for a running tool.

- Non-cemented casings/liners.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- M-series MHP does not restrict the liner drift diameter after actuation.
- Milling out is not required.
- The activation pressure of the packer can be adjusted before run in hole by installing the required number of shear screws.
- Mechanical-Hydraulic Packer is securely fixed after activation.
- The tool withstands high tensile loads.
- The tool withstands high differential pressure.

SUPPLY PACKAGE

- M-series MHP Mechanical-Hydraulic Packer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE							
Liner size, in	**4.500**	**4.500**	**4.500**	**4.500**	**5.500**	**6.625**	**7.000**	**9.875**
Max OD, in	5.630	5.819	5.500	5.819	7.913	8.071	8.071	11.102
Min ID, in	3.898	3.898	3.819	3.898	4.764	5.791	6.260	8.622
Length, ft	2.5	3.2	4.9	4.1	5.4	5.0	5.0	4.2
Tensile, kip	202	220	220	220	281	337	281	427
Max working temperature, °F	248	392**	302**	302	248	266	248	266
Max differential pressure, psi	10,000	10,000	14,500	12,500	10,000	5,000	5,000	4,350
Burst, psi	10,000	12,500	14,500	12,500	10,000	6,526	5,000	6,236
Collapse, psi	10,000	12,500	14,500	12,500	10,000	5,000	5,000	4,350
Material*	P-110							

* Other options are available as per Customer request.
** For fluoroelastomer sealings.

ESP EXPANDABLE STEEL PACKER

APPLICATION

Expandable Steel Packer ESP is a production packer that can be used for consistent zonal isolation protection. It is designed to provide mechanical isolation for downhole pressures providing a permanent, high-pressure seal against the most hostile wellbore conditions. ESP Packer can be also used for stage cementing zone isolation. Packer is set hydraulically without the need for a running tool. The rubber element is reinforced by expandable peace of steel.

- Cemented / uncemented casing / liner applications.
- Vertical, directional and horizontal wells

FEATURES AND BENEFITS

- ESP Packer does not restrict the liner drift diameter after actuation.
- Milling out is not required.
- After activation, the packer withstands the differential pressure of fluid/gas within the technical characteristics.
- The pressure in the string does not affect the tool's functioning.
- Expandable steel and valve system.
- The tool withstands high tensile loads.
- The tool withstands high differential pressure.

SUPPLY PACKAGE

- ESP Expandable Steel Packer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE	
Liner size, in	**4.500**	**7.000**
Max OD, in	5.750	8.189
Min ID, in	3.898	6.275
Length, ft	4.2	4.8
Tensile, kip	337	605
Max working temperature, °F	302	302
Max differential pressure, psi	10,000	6,222
Burst, psi	10,000	9,950
Collapse, psi	10,000	6,222
Material*		
- Mandrel	P-110	
- Expandable steel and valve system	13Cr	

* Other options are available as per Customer request.
** For fluoroelastomer sealings.

ESP

ECP EXTERNAL CASING PACKER

ECP

APPLICATION

External Casing Packer ECP is a production packer that can be used for consistent zonal isolation protection. It is designed to provide mechanical isolation for downhole pressures providing a permanent, high-pressure seal against the most hostile wellbore conditions. ECP Packer can be also used for stage cementing zone isolation. Packer is set hydraulically by inflating the rubber element without the need for a running tool.

- Cemented / uncemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- The tool helps to form high-quality cement bond.
- ECP Packer does not restrict the liner drift diameter after actuation.
- Milling out is not required.
- The valve system consists of an opening valve and a closing valve.
- The opening valve shear pressure can be adjusted before run in hole by installing the required shear screw.
- The closing valve shear pressure is adjusted before run in hole by installing the required shear screw thus preventing the re-inflation, providing safety activation of the tool.
- When pressure inside the inflatable element is sufficient, the screw shears and the closing valve shuts off.
- After inflation is finished, casing pressure is bled off and the opening valve is moved into its lock-shut position, preventing further inflation.
- The tool withstands high tensile loads.
- The tool withstands high differential pressure.

SUPPLY PACKAGE

- ECP External Casing Packer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**4.000**
Max OD, in	4.606
Min ID, in	3.465
Length, ft	7.3
Tensile, kip	157
Max working temperature, °F	248
Max differential pressure, psi	5,000
Burst, psi	1.889
Collapse, psi	5,000
Material*	P-110

* Other options are available as per Customer request.
** For fluoroelastomer sealings.

B-SERIES STAGE TOOL

APPLICATION

B-series Stage Tool is designed to ensure cement integrity in wells that require selective zonal isolation. The tool is run with the corresponding open-hole packer. When the ball is dropped and then lands on the circulation sub, increased internal casing pressure hydraulically sets the open-hole packer, opens the stage tool, enabling circulation and then cement to pass though the ports into the annulus above the packer. The plug when released, pushes the slurry and wipes the casing ID clean of cement before bumping on a landing seat. Increased pressure shifts the closing sleeve downward and closing the tool. Locking mechanism ensures the Stage tool is in closed position.

- Collar cemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Hydraulically actuated tool.
- Adjustable activation pressure.
- Locking mechanism holds the tool in open/closed position.
- All internal components are PDC drillable.
- After the WOC period, the milling of the technological elements of the collar is required.
- Guiding screws eleminate rotation during mill out operations.
- Full-bore ID after milling.
- Stage Tool withstands high tensile loads.
- Stage Tool withstands high differential pressure.

SUPPLY PACKAGE

- B-series Stage Tool.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Liner size, in	**4.000**	**4.500**	**5.000**
Max OD, in	4.567	5.236	5.748
Min ID, in	1.850	1.850	1.968
ID after milling, in	3.465	3.898	4.409
Length, ft	3.4	3.6	3.5
Tensile, kip	157	202	214
Burst, psi	10,000		
Collapse, psi	10,000		
Material*	P-110		
Max working temperature, °F	212		

* Other options are available as per Customer request.

B-SERIES STAGE TOOL

STAGE COLLAR WITH DISSOLVABLE INSERT

STAGE COLLAR WITH DISSOLVABLE INSERT

APPLICATION

Stage Collar with Dissolvable Insert is designed to ensure cement integrity in wells that require selective zonal isolation. The tool is run with the corresponding open-hole packer. When the ball is dropped and then lands on the circulation sub, increased internal casing pressure hydraulically sets the open-hole packer, opens the stage tool, enabling circulation and then cement to pass though the ports into the annulus above the packer. The plug when released, pushes the slurry and wipes the casing ID clean of cement before bumping on a landing seat. Increased pressure shifts the closing sleeve downward and closing the tool. Locking mechanism ensures the Stage tool is in closed position.

- Collar cemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Hydraulically actuated tool.
- Adjustable activation pressure.
- Locking mechanism holds the collar in open/closed position.
- Tool cannot be used in a conjunction with Liner Hanger.
- Internal elements of the sleeve are made of a soluble material.
- All internal components are PDC drillable.
- Full-bore ID after milling/dissolution.

SUPPLY PACKAGE

- Stage Collar with Dissolvable insert.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**7.000**
Max OD, in	7.913
ID after milling, in	6.260
Length, ft	4.2
Tensile, kip	281
Burst, psi	7,977
Collapse, psi	5,000
Material*	P-110
Max working temperature, °F	248

* Other options are available as per Customer request.

MSC MECHANICAL STAGE COLLAR

APPLICATION

Mechanical Stage Collar is designed to ensure cement integrity in wells that require selective zonal isolation. The tool can be either run for collar or stage cementing with the corresponding open-hole packer. When the ball is dropped and then lands on the landing collar, increased internal casing pressure hydraulically sets External Packer. Mechanical Cementing tool is then run to open the stage collar, enabling circulation and then cement to pass though the ports into the annulus above the packer. The plug when released, pushes the slurry and wipes the running string ID clean of cement before bumping on a landing seat inside Mechanical Cementing Tool. Mechical Cementing Tool should be put in tension to close the MSC circulation ports.

- Collar cemented casing / liner applications.
- Vertical, directional and horizontal wells.

MSC

FEATURES AND BENEFITS

- Mechanical activation of the MSC stage collar.
- To operate the MSC stage collar a special Mechanical Cementing tool is needed.
- Activation by Mechanical Cementing tool eliminates the need for stage collar drill out. Mechanical Cementing tool and wiper plugs are POOH after cementing is finished.
- Activation load can be adjusted before RIH by installing the required number of shear screws.
- External Packer can be also operated by Mechanical Cementing tool if required.

SUPPLY PACKAGE

- Mechanical Stage Collar.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**7.000**
Max OD, in	8.189
ID after milling, in	6.260
Length, ft	3.9
Tensile, kip	281
Burst, psi	7,977
Collapse, psi	5,000
Material*	P-110
Max working temperature, °F	248

* Other options are available as per Customer request.

MECHANICAL CEMENTING TOOL FOR MSC

MECHANICAL CEMENTING TOOL FOR MSC

APPLICATION

Mechanical Cementing Tool is specially designed to operate the MSC Stage Collar. It is used to provide stage cementing in conjunction with MSC, mechanically open-close the Stage Collar. After Cementing Tool is run in hole to the desired setting depth in front of MSC, the keys are latched in the MSC profile to open the circulation ports. When the needed volume of a cement slurry is pumped, the plug is landed inside the tool, circulation ports are mechanically closed and the Cementing Tool is pulled out of the hole.

- Casing / liner applications with stage cementing.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- External Packer can be also activated by Mechanical Cementing tool if required.
- Using of the Mechanical Cementing tool eliminates the need for stage collar drill out. Mechanical Cementing tool and wiper plugs are fully POOH after cementing is finished.
- Mechanical Cementing Tool is a rental equipment which can be used several times with maintenance after each RIH.
- The tool withstands high tensile loads.
- The tool withstands high differential pressure.

SUPPLY PACKAGE

- Mechanical Cementing Tool for MSC.
- Dropping ball.
- Wiper plug.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Max. OD of the body, in	5.984
Outer diameter of the caps, in	6.457
Max. OD (keys), in	6.535
Min ID, in	0.787
Length, ft	7.5
Weight, lbs	302
Burst, psi	5,000
Tensile, kip	112
Compression, kip	56
Max. torque, ft-lbs	11,023
Max. working temperature, °F	248
Material*	P-110
Sealings material	Hydrogenated nitrile

* Other options are available as per Customer request.

M-SERIES STAGE COLLAR

APPLICATION

M-series Stage Collar is designed to ensure cement integrity in wells that require selective zonal isolation. The tool is run with the corresponding open-hole packer. When the ball is dropped and then lands on the circulation sub, increased internal casing pressure hydraulically sets the open-hole packer, opens the stage tool, enabling circulation and then cement to pass though the ports into the annulus above the packer. The plug when released, pushes the slurry and wipes the casing ID clean of cement before bumping on a landing seat. Increased pressure shifts the closing sleeve downward and closing the tool. Locking mechanism ensures the Stage tool is in closed position.

- Collar cemented casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Hydraulically actuated tool.
- Adjustable activation pressure.
- Locking mechanism holds the collar in open/closed position.
- Tool cannot be used in a conjunction with Liner Hanger.
- All internal components are PDC drillable.
- Full-bore ID after milling.

SUPPLY PACKAGE

- M-series Stage Collar.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**7.000**
Max OD, in	7.913
ID after milling, in	6.260
Length, ft	4.2
Tensile, kip	281
Burst, psi	7,977
Collapse, psi	5,000
Material*	P-110
Max working temperature, °F	248

* Other options are available as per Customer request.

M-SERIES.
STAGE COLLAR

M-SERIES STAGE TOOL

M-SERIES.
STAGE TOOL

APPLICATION

M-series Stage Tool is designed to ensure cement integrity in wells that require selective zonal isolation. The tool can be either run for collar or stage cementing with the corresponding open-hole packer. When the ball is dropped and then lands on the circulation sub, increased internal casing pressure hydraulically sets the open-hole packer, opens the stage tool, enabling circulation and then cement to pass though the ports into the annulus above the packer. The plug when released, pushes the slurry and wipes the casing ID clean of cement before bumping on a landing seat. Increased pressure shifts the closing sleeve downward and closing the tool. Locking mechanism ensures the Stage tool is in closed position.

- Stage Tool casing / liner applications.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Tool is actuated hydraulically or by dropping the blind plug, when specified in job procedure or hydraulic opening is not available.
- Adjustable activation pressure.
- The locking mechanism holds the collar in open/closed position.
- All internal components are PDC drillable.
- Full-bore ID after milling.

SUPPLY PACKAGE

- M-series Stage Tool.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**7.000**
Max OD, in	7.913
Min ID after milling, in	6.260
Length, ft	3.6
Tensile, kip	281
Burst, psi	7,977
Collapse, psi	5,000
Material*	P-110
Max working temperature, °F	248

* Other options are available as per Customer request.

B-SERIES DEBRIS SUB

B-SERIES
DEBRIS SUB

APPLICATION

B-series Debris Sub is designed to indicate the activation ball is landed in the seat inside the sub, as well as to prevent the string below the sub from junk during milling out.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- B-series Debris Sub is installed below the cementing collar and the annulus packer.
- All internal components are PDC drillable.

SUPPLY PACKAGE

- B-series Debris Sub.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE	
Liner size, in	**5.750**	**7.000**
Max OD, in	6.535	7.874
ID after milling, in	5.079	6.260
Min Ball seat ID, in	1.300	
Length, ft	1.1	1.2
Tensile, kip	266	
Burst, psi	10,000	
Material*	P-110	
Max working temperature, °F	248	

* Other options are available as per Customer request.

M-SERIES DEBRIS SUB

M-SERIES
DEBRIS SUB

APPLICATION

M-series Debris Sub is designed to indicate the activation ball is landed in the seat inside the sub, as well as to prevent the string below the sub from junk during milling out.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- M-series Debris Sub is installed below the cementing collar and the annulus packer.
- All internal components are PDC drillable.

SUPPLY PACKAGE

- M-series Debris Sub.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**7.000**
Max OD, in	7.637
ID after milling, in	6.260
Min Ball seat ID, in	1.654
Length, ft	1.3
Tensile, kip	831
Burst, psi	10,000
Collapse, psi	5,366
Material*	P-110
Max working temperature, °F	248

* Other options are available as per Customer request.

BULAT DRILLABLE REAMING SHOE

APPLICATION

BULAT Reaming Shoe provides reaming during RIH without the need to rotate the liner or casing. BULAT is installed at the bottom of the casing/liner string to ream through unstable wellbore zones and guide the completion assembly to the target depth. Reaming shoe is a product of positive displacement motor evolution: the power section consists of a mud-motor-like power section, transforming pressure created by mud pumps into planetary motion of the rotor, then transferred via drive shaft to a shoe head. Rotational speed varies from steady powerful 5-10 rpm to about 120 rpm. Vibrations created by the power section planetary motion is insignificant compared to a full-size mud motor (it is much shorter and made of much lighter materials), but will also contribute to release of the drill string being stuck.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Low rpm, allowing to use PDC cutters on a shoe nose.
- High torque at any speed.
- Made of light materials.
- Can be stopped only by shaft or rotor rapture.
- Slight vibration during operation.
- Pressure drop depends on well conditions and is valve-protected from premature set.

SUPPLY PACKAGE

- BULAT Drillable Reaming Shoe.

TECHNICAL DATASHEET

Shoe size	OD, in	ID, in (after milling out)	Max flow rate, gal/min	Max Diff Pressure, psi	Length, ft	Max allowable tensile, kip	Compression, kip	Material*	Max working temperature, °F
4”	4.528	3.465	476	1131	5	198	337	P-110	150
4.5”	5.236	3.780	476		6	223	101		
5”	5.551	4.409	476		6	223	101		
5.5”	7.638	4.843	476		6.3	223	101		
5.75”	7.638	5.079	476		6.3	270	124		
6.625”	7.913	6.024	476		7.5	270	124		
7”	7.913	6.260	476		7.5	314	143		
7.625”	8.583	6.732	476	1131	7.9	368	175		
9.625”	10.630	8.622	476		11	443	191		
10.75”	10.866	9.724	555		10.8	443	191		
12.75”	13.819	11.968	555		11	551	223		
13.375”	14.528	13.386	555		11.5	551	223		

* Other options are available as per Customer request.

BULAT Shoe

FREE ROTATING GUIDE SHOE

FREE ROTATING GUIDE SHOE

APPLICATION

Free rotating guide shoe is installed at the bottom of the casing/liner to guide the completion assembly through the wellbore and to protect the assembly during RIH.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Cleanout is carried out through the circulation ports of the shoe.
- Rotating shoe nose.
- All internal components and the guide nose are PDC drillable.

SUPPLY PACKAGE

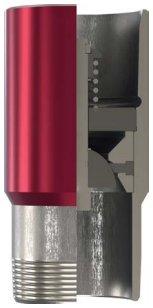
- Free Rotating Guide Shoe.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE				
Liner size, in	**4.000**	**4.500**	**5.000**	**5.500**	**5.750**
Max OD, in	4.331	5.000	5.563	6.063	6.535
Central circulation port ID, in	1.575	1.575	7,977	132.2	2.559
Side ports ID, in	0.472	0.472	0.551	0.590	0.590
Eccentric nose angle, deg.	30				
Min ID after milling, in	3.465	3.898	4.409	4.842	5.079
Max flow rate, liter/sec (gal/min)	12 (190)	14 (222)	15 (238)	16 (254)	18 (285)
Material*	P-110				
Max working temperature, °F	302				
Length, ft	0.7	0.7	0.9	0.8	0.9
Tensile, kip	157	202	214	292	314
Compression, kip	110	142	146	205	220

* Other options are available as per Customer request.

FLOAT COLLAR



FLOAT COLLAR

APPLICATION

Float Collar is designed to prevent the backflow of cement from entering the casing. The tool is placed one to three joints above the guide shoe or float shoe.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- All internal parts are PDC-drillable.
- Acid-resistant material.

SUPPLY PACKAGE

- Float Collar.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE					
Liner size, in	**4.000**	**4.500**	**5.000**	**5.500**	**5.750**	**7.000**
Differential Pressure, psi	497					
Max OD, in	4.331	5.000	5.563	6.063	6.535	7.677
Min ID, in	3.465	3.898	4.409	4.764	5.000	4.409
Material*	P-110					
Max working temperature, °F	302					
Tensile, kip	157	202	213	292	310	342
Compression, kip	110	142	146	205	220	146
Max. length, ft	0.8	0.8	1.0	1.2	1.2	1.4

* Other options are available as per Customer request.

B-SERIES ACTIVATION SUB

B-SERIES ACTIVATION SUB

APPLICATION

B-series activation sub is designed to provide circulation between completion toolstring and annulus. B-series activation sub is kept open while running the liner in a well to allow circulation through the tubing string. The sub is closed by pumping a ball to indicate bump pressure.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- All internal parts are PDC-drillable.
- Reliable barrier between tubing string and annulus after activation.

SUPPLY PACKAGE

- B-series Activation Sub.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE	
Liner size, in	**4.000**	**4.500**
Max OD, in	4.567	5.236
Circulation ports ID, in	0.433	
ID after milling, in	3.465	3.898
Closing pressure, psi	1,668	1,595
Burst, psi	10,000	
Collapse, psi	10,000	
Material*	P-110	
Max working temperature, °F	302	
Length, ft	1.2	1.6

* Other options are available as per Customer request.

M-SERIES ACTIVATION SUB

APPLICATION

M-series activation sub is designed to provide free circulation of the drilling fluid with a subsequent pressure-tight mechanical closing. M-series activation Sub is used in wells with liners of the corresponding size.

- Vertical, directional and horizontal wells.

M-SERIES ACTIVATION SUB

FEATURES AND BENEFITS

- Tool is designed to be installed in the liner assembly at a target depth.
- Additional operations are not required during RIH.

SUPPLY PACKAGE

- M-series Activation Sub.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE			
Liner size, in	**4.000**	**4.500**	**5.500**	**7.000**
Max OD, in	4.500	5.000	6.260	7.913
Min ID after milling, in	3.465	3.858	4.764	6.260
Length, ft	1.5	1.6	1.7	1.7
Weight, lbs	50.4	60.0	99.9	140.9
Max working temperature, °F	248			
Burst, psi	10,000			
Collapse, psi	10,000			
Tensile, kip	270	382	629	629
Compression, kip	134	193	314	314
Material*	P-110			

* Other options are available as per Customer request.

CIRCULATION SUB

CIRCULATION SUB

APPLICATION

Circulation sub is designed to provide circulation between completion toolstring and the annulus. Circulation sub is kept open while running the liner in a well to allow circulation through the tubing string. The sub is closed by pumping a ball to indicate bump pressure.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Can be re-opened to restore the circulation in a conjunction with stage tool.
- Installed in the casing string below the stage tool.
- All internal parts are PDC-drillable.

SUPPLY PACKAGE

- Circulation Sub.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Liner size, in	**4.000**	**4.500**	**5.000**
Open hole, in	4.874	5.626	6.000
Max OD, in	4.567	5.236	5.748
Min ID, in	0.787	1.063	1.063
ID after milling, in	3.465	3.898	4.409
Opening pressure, psi		2,320	
Closing pressure, psi	1740	1595	1450
Burst, psi		10,000	
Collapse, psi		10,000	
Tensile, kip	157	202	213
Compression, kip	79	101	108
Material*		P-110	
Max working temperature, °F		302	
Length, ft	2.3	2.5	2.4

* Other options are available as per Customer request.

B-SERIES BC LANDING COLLAR

APPLICATION

B-series BC Landing collar is installed near the bottom of the casing string on which the cement plugs land during the primary cementing operation. B-series Landing Collar allows hydraulic elements of the system to be activated after the ball is dropped and pumped to the ball seat.

- Vertical, directional and horizontal wells.

B-SERIES BC LANDING COLLAR

FEATURES AND BENEFITS

- All internal parts are PDC-drillable.
- B-series BC Landing collar is compatible with Liner Hanger Systems manufactured by BULAT plant.

SUPPLY PACKAGE

- B-series BC Landing collar.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Liner size, in	**4.000**	**4.500**	**5.000**
Max OD, in	4.409	5.000	5.563
ID after milling, in	3.465	3.898	4.409
Burst, psi	10,000		
Collapse, psi	10,000		
Tensile, kip	157	202	213

* Other options are available as per Customer request.

M-SERIES BC LANDING COLLAR

M-SERIES BC LANDING COLLAR

APPLICATION

M-series BC Landing collar is installed near the bottom of the casing string on which the cement plugs land during the primary cementing operation. M-series BC Landing collar allows hydraulic elements of the system to be activated after the ball is dropped and pumped to the ball seat.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- All internal parts are PDC-drillable.
- M-series BC Landing collar is compatible with Liner Hanger Systems manufactured by METTOIL plant.

SUPPLY PACKAGE

- M-series BC Landing collar.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE		
Liner size, in	**4.500**	**5.000**	**7.000**
Max OD, in	5.039	5.591	7.913
Min ID after milling, in	3.819	4.370	6.260
Burst, psi	10,000		
Collapse, psi	10,000		
Tensile, kip	191	214	281

* Other options are available as per Customer request.

PERMANENT QUARTZ GAUGES

APPLICATION

The Permanent Quartz Gauges is a downhole pressure and temperature measurement sensors designed for permanent installation. To achieve very high measurement stability and long life, the sensor incorporates hermetically sealed quartz resonator crystals, TSS electronics and mechanical sealing technology.

Pressure and temperature are measured using very precise, stable quartz crystal resonators. The measurements are directly digitized downhole, avoiding analog cable signals, and then sent digitally up the cable to maintain high precision and noise immunity. This eliminates the drift, noise sensitivity and additional cost inherent in gauges that send analog signals to the surface to be filtered and digitized.
Each gauge automatically sends its serial number and quality status with every measurement, ensuring quality results.
The sensor is hermetically sealed (welded), eliminating the need for elastomeric O-ring primary seals. The cable head and pressure connections use only metal-to-metal seals. Every seal can be pressure tested during installation. Up to nine sensors may be connected to the same cable, electrically in parallel. If one tool sensor or circuit fails, the other continue to operate.
Alternatively, tubing and annulus pressures can be measured, as required. The sensor is tested under shock and vibration conditions.

TECHNICAL DATASHEET

PRESSURE MEASUREMENTS	VALUE	
Pressure Range1 (psia | bar)	0 to 10,000 0 to 690	0 to 10,000 0 to 690
Available Calibration Temperature Ranges (°C)	25-150	25-150
Accuracy (% FS) 25-150 °C	0.02	0.02
Typical Accuracy (% FS) 25-150 °C	0.012	0.015
Resolution (psi * sec)	less than 0.006	less than 0.008
Frequency Output Range (kHz)	10 to 70	10 to 80
Response Time	less than 1 sec	less than 1 sec
Acceleration Sensitivity (psi / g - any axis)	less than 0.02	less than 0.02
Drift at max pressure and temp. (% FS / year)	0.02	0.02

TEMPERATURE MEASUREMENTS	VALUE
Temperature Range (°C / °F)	25-150
Accuracy (°C)	0.5
Typical Accuracy (°C)	0.15
Achievable Resolution3 (°C / sec)	less than 0.005
Average Sensitivity (Hz / °C)	180
Frequency Output Range (kHz)	10 to 100
Drift at 177 °C (°C / year)	less than 0.1

GAUGE MANDREL FOR PERMANENT MONITORING

GAUGE MANDREL FOR PERMANENT MONITORING

APPLICATION

The gauge mandrel for permanent monitoring provides a protective recess for permanent gauges. It is used with various monitoring systems. The mandrel is available in various grades of metal to ensure characteristics equivalent or superior to the tubing. Various modifications of mandrels can carry single or multiple gauges, cable splices and cable heads. It is rated for various working pressures according to tubing weight and material grade. No inherent weak points or highly stressed areas exist in the mandrel because the mandrels are CNC machined from a single block with no weld seams. All SGMs are designed and manufactured to specifications for collapse pressures, burst pressures, tensile strengths, and drift. Mandrels are custom cut with premium connections.

The design features an internal bore with no sudden upsets that could cause flow to become turbulent or scale deposits to build up. Optionally, the design can include grooves to allow control line passage and protection. The gauge is fitted to the mandrel with a lower radial connector that provides a metal-to-metal seal between the gauge and the mandrel. This seal is pressure testable on the rig floor before the completion is run.

FEATURES AND BENEFITS

- Mechanical strength equal to or exceeding the tubing characteristics.
- Compact design.
- Wide range of metals to suit various downhole conditions.
- Construction from a single piece of metal with no welding.
- Highly reliable metal-to-metal connection to the gauge.
- Optional protective bypass grooves for electric lines.

INTELLIGENT ELECTRIC FLOW VALVES

APPLICATION

The REWOLTDRIVE™ (RWD™) full electric system is a revolutionary solution for smart well completion or for specific needs in upper completion components. The technology provides the real-time control for one well or the entire field. The control system is highly functional, robust and stable. The downhole sensors data is processed by a user-friendly software REWOLTSOFT™ (RWS™), so the user is able to shift the valves remotely, collect and transfer the real-time data from the gauges, make immediate decisions and plan for a field development even from the office. The RWD can be used in production and injector wells, capable to withstand fracturing, can be used as open/close valve or multi-position inflow control device.

FEATURES AND BENEFITS

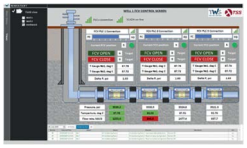
- The smart REWOLT completion is run with up to nine RWD valves and nine gauges operated with a single electrical line.
- Up to 12 positions for each RWD™ are available providing broad production/injection regimes.
- The inner diameter is comparable to the inner diameter of the liner or tubing.
- Data on the current position of the inflow control valve is transferred to the surface real-time.
- The REVOLT system can be equipped with screens providing additional control of sand production.
- Managed by RWS™ software with friendly interface and broad functionality.

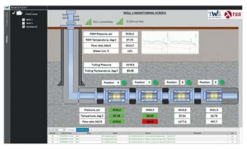
TECHNICAL DATASHEET

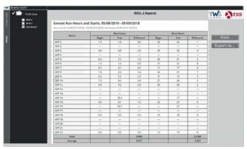
TECHNICAL CHARACTERISTICS	VALUE				
	RWD.60.114	RWD.89.140	RWD.102.156	RWD.89.178	RWD.140.216
Outer diamter, in	3.500	4.500	5.750	5.750	7.700
Inner Diameter, in	1.570-1.970	2.910-2.990	3.350-3.540	2.990	4.880-5.000
Temperature rating, °C	20-120	20-120	20-120	20-120	20-120
Burst pressure rating, psi	5 000	5 000	5 000	12 500	10 000
Basepipe size, in	2.375	3.500	4.000	3.500	5.500
Size of liner, casing, open hole for installation, in	4.500	5.500	6.000 - 6.125	7.000	8.500
Number of positions RWD, ea	12	12	12	12	12
Gauges incorporation	yes	yes	yes	yes	yes
Max number of RWD using one cable, ea	5	5-9	5-9	1	9

REVOLT

SURFACE ACQUISITION SYSTEMS







APPLICATION

The Surface Acquisition System is a fully featured technology. It consists of the hardware and software required to record, display, store and transmit various downhole tools data. The data is obtained through downhole tools as well as can be used for obtaining surface equipment. This system sets downhole valves operations.

Permanent gauges data, DTS data, RWD data collects at surface unit and its displayed in the REWOLTSOFT™ software. The system's functionality is increased by using a digital signal processor. This system supports data from many different tool manufacturers.

The Portable Acquisition Systems can be made in a waterproof case and used for short period data collection and/or tools managing in field. This system is fully customizable to meet Client's needs.

FEATURES AND BENEFITS

- Long-term real-time monitoring of downhole operational parameters and real-time flow management.
- Short-term real-time monitoring and flow management.
- Ability to connect multiple tools including downhole equipment and surface equipment.
- Fully customizable to meet Client's needs.

SELECTIVE C2C PACKER

APPLICATION

Selective Cup-to-Cup packer is ideal in shallow, tight formations for providing zonal isolation. Selective C2C Packer is designed for multistage hydraulic fracturing in use with the corresponding Burst Frac Sleeves.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Min 7 stages of MSF can be performed with C2C packer in any order. Allows Reversed cleanout of the proppant.
- Selective C2C Packer has an emergency disconnection optionfrom the tubing/coiled tubing string.
- Mechanical locator allows to activate the packer precisely at the frac sleeve depth.
- Cleanout is not required.
- Design allows to perform re-fracturing.
- 10,000 psi is a mininmum differential pressure for the sealing element.
- Autonomous downhole temperature and pressure gauges.

SUPPLY PACKAGE

- Selective C2C Packer.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE			
Liner size, in	**4.000**	**4.500**	**5.500**	**5.750**
Weight, ppf	**10.7**	**13.5**	**20.0**	**22.02**
Max OD, in	3.74	3.74	4.646	4.803
Body OD, in	3.307	3.307	4.173	4.252
Min ID, in	1.811	1.772	1.811	2.362
Length, ft	14.2	14.1	16.4	18.1
Tensile, kip	101	110		
Collapse, psi	10,000			
Total circulation ports area, in²	18.6			
Burst, psi	10,000			
Compression, kip	495			
Material*	P-110			
Max working temperature, °F	248			

* Other options are available as per Customer request.

SELECTIVE C2C PACKER

4” SHIFTING TOOL

4” SHIFTING TOOL

APPLICATION

4” Shifting Tool is designed to close and/or open reclosable frac ports manufactured by Bulat plant. All operations with the Shifting Tool can be done only after milling out the frac ports. The tool is fully selective, allowing specific ports to be opened or closed without affecting other frac ports.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Shifting Tool is run in hole on tubing and hydraulically activated.
- To shift the sleeve and open/closed the ports, upward/downward moving should be done.
- Once reclosable frac port is opened/closed, Shifting Tool will release after pressure drop.
- Choke nozzles may be set up and adjusted on location as per Customer request.
- Shifting Tool withstands high tensile loads.

SUPPLY PACKAGE

- 4” Shifting Tool.
- Choke nozzle.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**4.000**
Max OD, in	3.150
Min ID, in	0.787
Activation Pressure, psi	725-870
Tensile, kip	110
Burst, psi	3,625
Material*	P-110
Max. torque, ft-lbs	958
Max working temperature, °F	248
Length, ft	6.3

* Other options are available as per Customer request.

B-4 SERIES SHIFTING TOOL

APPLICATION

B-4 Shifting Tool is designed to close and/or open reclosable frac ports manufactured by Bulat plant. All operations with the Shifting Tool can be done only after milling out the frac port. The tool is fully selective, allowing specific ports to be opened or closed without affecting other frac ports.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Shifting Tool is run in hole on tubing and hydraulically activated.
- To shift the sleeve and open/closed the ports, upward/downward moving should be done.
- Once reclosable frac port is opened/closed, Shifting Tool will release after pressure drop.
- Choke nozzles may be set up and adjusted on location as per Customer request.
- Shifting Tool withstands high tensile loads.

SUPPLY PACKAGE

- B-4 Shifting Tool.
- Choke nozzles.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner size, in	**4.500**
Max OD, in	3.583
Min ID, in	0.709
Activation Pressure, psi	725-870
Tensile, kip	110
Burst, psi	3,625
Material*	P-110
Max. torque, ft-lbs	958
Max working temperature, °F	248
Length, ft	4.5

* Other options are available as per Customer request.

B-4 SHIFTING TOOL

B-5 SERIES SHIFTING TOOL

B-5 SHIFTING TOOL

APPLICATION

B-5 Shifting Tool is designed to close reclosable frac ports manufactured by Bulat plant. The tool is fully selective, allowing specific ports to be closed without affecting other frac ports.
B-5 Shifting Tool is run in hole until it reaches the frac port ball seat; after pressure increasing the collet will collapse as it passes through the ball seat. When upward force is applied, the ball seat will shift and close the ports. Once the seat is shifted, the shifting tool is moved down off the seat and circulation is applied. This allows the tool to collapse, enabling it to be pulled up through the seat.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Shifting Tool is run in hole and hydraulically activated.
- No need to drill out frac ports.
- Nozzles may be set up and adjusted on location as per Customer request.
- The tool is equipped with an emergency shear-out via straight pull to prevent damage to the shifting tool or the ball seat.
- Shifting Tool withstands high tensile loads.

SUPPLY PACKAGE

- B-5 Shifting Tool.
- Nozzles.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE			
Liner size, in	4.000; 4.500; 5.500			
Max OD, in	1.673	2.126	2.539	3.012
OD (when collet collapse), in	1.417	1.693	2.087	2.441
Frac Sleeve ball seat ID, in	1.524 1.638	1.780 1.921 2.063	2.205 2.346 2.492	2.642 2.799 2.965
Emergency shear-out load, kip	20			
Tensile, kip	26	33	40	46
Compression, kip	22			
Burst, psi	2,175			
Material*	P-110			
Max working temperature, °F	266			
Length, ft	2.0	2.0	2.1	2.1

* Other options are available as per Customer request.

M-SERIES SHIFTING TOOL

APPLICATION

M-series Shifting Tool is designed to close and/or open reclosable frac sleeves manufactured by Mettoil plant. All operations with the Shifting Tool can be done only after milling out the frac sleeve. The tool is fully selective, allowing specific frac sleeves to be opened or closed without affecting the others.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Shifting Tool is run in on tubing and hydraulically activated.
- To shift the sleeve and open/closed the ports, upward/downward moving should be done.
- Once reclosable frac sleeve is opened/closed, Shifting Tool will release after pressure drop.
- To reestablish circulation if required, tool can be run in hole without the plug, but in this case activation ball should be dropped for the tool hydraulic activation.
- Shifting Tool withstands high tensile loads.

SUPPLY PACKAGE

- M-series Shifting Tool.
- Activation Ball.
- Different sizes of activation plugs.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Casing / Liner size, in	**5.000**
Max OD, in	4.567
Length, ft	5.5
Activation Pressure, psi	145
Max working temperature, °F	248
Tensile, kip	46
Material*	P-110
Activation ball OD, in	0.748

* Other options are available as per Customer request.

M-SERIES
SHIFTING TOOL

TBSA PS TIE-BACK SEAL ASSEMBLY WITH PROTECTIVE SLEEVE

TBSA PS

APPLICATION

TBSA PS Tie-back Seal Assembly is designed to provide a pressure-tight connection between tubing and PBR (Polished Bore Receptacle) of the liner string. TBSA PS protects the string from high pressure during multistage hydraulic fracturing. Multiple seal set is used to create a reliable seal between production tubing and the liner top. When tool reaches the PBR downward force is applied to seal the tool inside the PBR. To prevent string movement during well treatment and production, hydraulic anchor should be installed above the TBSA PS.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- TBSA PS is equipped with a protective sleeve that protects seals during run in hole. Protective sleeve is also used as an indication for tool installation.
- Shear force for tool installation can be adjusted by installing the required number of shear screws.
- TBSA PS provides a reliable pressure-tight isolation between the tubing and annulus.
- The tubing should be equipped with a hydraulic anchor to prevent Seal Assembly from upward movement during hydraulic fracturing.
- Hydraulic anchor should be installed one joint above the tool.
- The tool is removed from the PBR after fracturing is finished.
- The tool withstands high tensile loads.
- The tool withstands high differential pressure.

SUPPLY PACKAGE

- TBSA PS Tie-back Seal Assembly with protective sleeve.

The hydraulic anchor available separately.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE						
Max OD, in	4.606	4.803	5.551		5.984		
PBR, in	4.154	4.252	4.843	4.843	4.843	4.843	5.354
Length, ft	1.8	1.8	1.7	3.6	1.7	3.6	1.7
ID, in	2.795	3.000	3.000	3.898	3.000	3.898	3.000
Max Diff pressure between isolated zones, psi	10,000						
Burst, psi	10,000						
Max working temperature, °F	302						

* Other options are available as per Customer request.

TBSA TIE-BACK SEAL ASSEMBLY

APPLICATION

TBSA Tie-back Seal Assembly is designed to provide a pressure-tight connection between tubing and PBR (Polished Bore Receptacle) of the liner string. TBSA protects the string from high pressure during multistage hydraulic fracturing. Multiple seal set is used to create a reliable seal between production tubing and the liner top. When tool reaches the PBR downward force is applied to seal the tool inside the PBR. To prevent string movement during well treatment and production hydraulic anchor should be installed above the TBSA.

- Vertical, directional and horizontal wells.

TBSA

FEATURES AND BENEFITS

- TBSA has a seal stack that acts as an indication for tool installation.
- Shear force for tool installation can be adjusted by installing the required number of shear screws.
- TBSA PS provides a reliable pressure-tight isolation between the tubing and annulus.
- The tubing should be equipped with a hydraulic anchor to prevent Seal Assembly from upward movement during hydraulic fracturing.
- Hydraulic anchor should be installed one joint above the tool.
- The tool is removed from the PBR after fracturing is finished.

SUPPLY PACKAGE

- TBSA Tie-back Seal Assembly.

The hydraulic anchor available separately.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE					
Casing/liner OD, in	**5.500**	**6.625**		**7.000**		
PBR ID, in	4.252	4.843		4.843		5.354
Seals OD, in	4.291	4.882		4.882		5.393
Max OD, in	4.803	5.551		5.984		5.984
Min ID, in	3.000	3.000	3.898	3.000	3.898	3.898
Differential pressure, psi	10,000					
Burst, psi	10,000					
Collapse, psi	10,000					
Tensile, kip	202					
Compression, kip	101					
Material*	P-110					
Max working temperature, °F	302					

* Other options are available as per Customer request.

MSA TIE-BACK SEAL ASSEMBLY

MSA TIE-BACK
SEAL ASSEMBLY

APPLICATION

MSA Seal Assembly is designed to provide a pressure-tight connection between the tubing and PBR (Polished Bore Receptacle) of the liner string. MSA protects the string from high pressure during multistage hydraulic fracturing. Multiple seal set is used to create a reliable seal between production tubing and the liner top. When tool reaches the PBR downward force is applied to seal the tool inside the PBR. To prevent string movement during well treatment and production hydraulic anchor should be installed above the MSA.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- The tubing can be equipped with a hydraulic anchor to prevent MSA from upward movement during hydraulic fracturing.
- Sleeve at the top of Seal Assembly acts as an indication after stab in the PBR.
- Seal Assembly provides a reliable pressure-tight isolation between the tubing and the annulus.
- Seal Assembly is removed from the PBR with straight pull.

SUPPLY PACKAGE

- MSA Tie-back Seal Assembly.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Casing/liner OD, in	**7.000**
Max OD, in	5.500
ID, in	3.898
Seal OD, in	5.291
PBR ID, in	5.252
Length, ft	11.5
Max working temperature, °F	302
Max Diff pressure between isolated zones, psi	10,000
Burst, psi	10,000
Collapse, psi	10,000
Tensile, kip	214
Compression, kip	107
Material*	P-110

* Other options are available as per Customer request.

TIE-BACK LTP LINER TOP PACKER

APPLICATION

The Tie-Back Packer is designed to eliminate the leakage of the corresponding liner top packer. After running to the target depth, the tie-back packer is stabbed in the PBR and activated by slacking off the weight. After pressure test of the annulus, the running tool is released by applying pressure or by pulling the work string.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- The tool allows to perform clean out with no pressure or rate restrictions.
- The tool is activated mechanically by slacking-off the weight.
- The shear force can be adjusted by installing the required number of shear screws.
- Reliable pressure-tight isolation of the annular space.
- After stab in the liner top packer, the Seal-Stem collet slips latch into a special groove in the PBR.
- When the packer is activated, the backward movement of the pusher is prevented by the fixing mechanism.

SUPPLY PACKAGE

- Tie-back LTP Liner Top Packer.
- Seal-Stem.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE			
Liner size, in	**4.000**	**4.500**	**5.000**	**7.637**
Previous casing ID range, in	4.906 to 5.197	from 5.748 to 6.535	7.000 0.318 to 0.433	9.646 0.433 to 0.472
Max OD, in	4.764	5.551	5.984	8.268
Drift diameter, in	3.465	3.898	4.409	6.614
Burst, psi	10,000			7,252
Collapse, psi	10,000			7,252
Tensile, kip	157	202	202	419
Compression, kip	79	101	101	180
Length of the packer assembly, ft	6.3	5.7	5.8	5.6
Length of the stab-up assembly, ft	1.68	1.72	1.65	1.68
Material*	P-110			
Max working temperature, °F	212			

* Other options are available as per Customer request.

TIE-BACK LTP

TIE-BACK PACKER

TIE-BACK PACKER

APPLICATION

Tie-back Packer is designed to isolate the leakages in the liner top packer and annular fluid migration. The packer provides reliable fluid separation and prevents annular fluid migration. The packer allows to perform hydraulic fracturing with the UGRH stinger.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- The tool is run in hole as a part of the tie-back packer assembly.
- The packer is activated mechanically by slacking-off the weight through the polished bore receptacle.
- The activation pressure can be adjusted by installing the required number of shear screws.
- Run in hole and activation of the packer is carried out with the special running tool.
- Reliable pressure-tight isolation of the annular space.
- Hold-down slips prevent the upward movement of the packer.
- Locking mechanism prevents the backward movement of the packer after activation.

SUPPLY PACKAGE

- Tie-Back Packer.

The packer is used as an assembly with the PBR and MSA Seal Assembly. PBR and MSA Seal Assembly are not included in the supply package and should be purchased separately.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Casing/liner OD, in	**4.500**
Previous casing OD, in	7.000
Max OD, in	5.984
Drift diameter (after actuation), d, in	3.898
Packer length, ft	6.5
Max differential pressure, psi	10,000
Burst, psi	10,000
Collapse, psi	10,000
Max working temperature, °F	248
Tensile, kip	224
Compression, kip	94
Material	P-110

* Other options are available as per Customer request.

ERT RUNNING TOOL

APPLICATION

ERT (E-running tool) is designed to RIH the liner and release the work string after the liner is set. The tool consists of a left crossover, a hydraulic disconnector unit and a coupling. Disconnection is performed by applying sufficient pressure inside the string, so the screws are sheared and the piston is moved upwards thus releasing the dogs form the profile.

- Any liners.
- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- Hydraulic activation eliminates the need to push/pull the string.
- Pressure value to disconnect the tool is adjustable.
- The backup mechanical release is carried out by rotating the work string to the right.
- The tool withstands high tensile loads.

SUPPLY PACKAGE

- ERT (E-running tool).
- Plug.
- Activation ball.

ERT RUNNING TOOL

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE
Liner/casing size, in	**4.500**
Max OD, in	5.236
Min ID, in	1.024
ID after milling, in	3.898
Tensile, kip	157
Burst, psi	3,625
Length, ft	3.2
Material*	P-110
Max. working temperature, °F	212

* Other options are available as per Customer request.

HDS HOLD-DOWN SUB

HDS

APPLICATION

HDS is designed to hold the Seal Assembly against the upward movement during multistage hydraulic fracturing. HDS is installed on the tubing above the Seal Assembly. HDS slips cut into the casing under the increased pressure, thus holding the Seal Assembly against the upward movements. HDS is deactivated by equalizing the pressure inside the tubing string and annulus by pulling the tubing string in tension.

- Vertical, directional and horizontal wells.

FEATURES AND BENEFITS

- HDS slips are activated and remain engaged into the casing under the increased pressure.
- After deactivation springs return slips into initial position.
- Hydraulic activation of the tool eliminates the need of mechanical movement of the work string.
- HDS is a reusable tool with a service life of 7 activations.
- Withstands high tensile loads and high differential pressures.

SUPPLY PACKAGE

- Hold-Down Sub.
- A set of spare parts.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE					
Liner ID, in	5.750		6.625		7.000	
Max OD, in	4.606	4.803	5.551	5.551	5.827	5.984
Min ID, in	2.795	2.992	2.992	3.898	2.992	3.898
Length, ft	1.0					
Material*	P-110					
Tensile, kip	202					
Burst, psi	10,000					
Collapse, psi	10,000					
Max working temperature, °F	212					

* Other options are available as per Customer request.

FORMATION ISOLATION VALVE

APPLICATION

The Formation Isolation Valve is used to isolate the inner diameter of tubing from above and below. The tool has multiple use, mainly for prevention of formation damage and well control during well completion and workovers. It has ball type valve with seals qualified for gas with up to 10,000 psi differential pressure from above and below. Formation Isolation Valve is operated remotely (by pressure cycles) for first open and mechanically for any required number of open/close operations. It is designed for multi-stage fracturing operations through the ID of the tool.

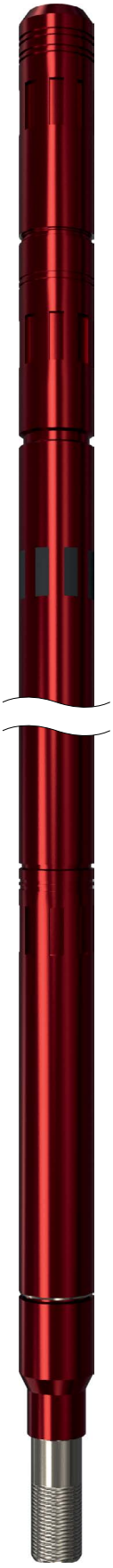
FEATURES AND BENEFITS

- The Valve has trip saver section for ball opening by pressure without the need of intervention.
- Designed and tested by gas as mechanical downhole barrier for mid- and long-term isolation.
- The tool is opened or closed with a mechanical shifting tools. Two types of Shifting Tools are available for various needs.
- The tool can be operated in heavy drilling fluids up to 2.0SG, brines, oil and gas at temperatures up to 300 °F.
- The tool is pressure-tested at the manufacturer site. Additional pressure test before use is not required.

TECHNICAL DATASHEET

TECHNICAL CHARACTERISTICS	VALUE	
Liner size, in	7.000	9.625
OD, in	5.90	8.00
ID when ball opened, in	2.99	4.55
Length, ft	16.1	
Max working temperature, °F	300	
Ball Diff Pressure, psi	10,000	7,500
Collapse pressure, psi	10,000	7,500

* Other options are available as per Customer request.



FORMATION ISOLATION VALVE

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