Thru-Tubing Intervention







BAKER HUGHES

Baker Hughes is a leader in well completion and intervention solutions that help exploration and production companies maximize the value of their oil and gas assets by optimizing recovery while reducing capital and operating expense.

Baker Hughes was founded 100 years ago on a simple, fundamental commitment to help our customers solve their oilfield problems by bringing them the highest quality and best performing products and services. Honoring that commitment and providing flawless execution at the well site continues to distinguish us from our competitors a century later.

We believe that integrity is at the heart of our organization and that teamwork leverages individual strengths and contributes to our performance culture. We also believe that learning is never finished and that we can continue to grow and improve—as individuals and as a company—through learning. These are the principles that help guide us in our actions and decisions every day. Delivering unmatched value to our customers by meeting—and sometimes exceeding—their needs and expectations is our ultimate goal.

Baker Hughes doesn't operate alone. We are one of seven divisions of Baker Hughes Incorporated, a Fortune 500 company and one of the most respected names in the oil and gas service industry. Baker Hughes companies provide best-in-class products, systems, and services for every phase of the hydrocarbon life cycle.

Baker Hughes has a long tradition of being the clearly recognized market leader in the provision of thru-tubing intervention products and services to the global oil and gas industry. Our comprehensive thru-tubing intervention portfolio provides solutions for your wells fishing, isolation (both inflatable and metal-to-metal), and casing exit needs. The combination of these premium product lines provides a diversity of thru-tubing intervention second to none. This dynamic offering does not stop at innovative hardware supply but prides itself on continuous improvement, providing best-in-class service through highly trained and experienced personnel, computer aided pre- and post-job analysis, and providing flawlessly executed system installation at the well site. Baker Hughes provides a unique combination of portfolio, people and performance that assures consistently flawless through-tubing intervention operations.

Portfolio

From the first thru-tubing inflatable tools to breakthrough, metal-to-metal sealing technology, our portfolio of thru-tubing intervention solutions is the industry's most comprehensive—and reliable. To ensure that all of our thru-tubing intervention solutions meet or exceed client expectations, Baker Hughes designs and manufactures our products in-house, in ISO 9001-certified facilities. All products undergo rigorous Baker Hughes performance testing.

People

Baker Hughes thru-tubing intervention engineers and field supervisors are among the most experienced and best trained in the industry, with the longest proven track record and the strongest commitment to doing the job right the first time, every time.

Performance

Using proprietary thru-tubing intervention design software, Baker Hughes engineers and field supervisors gather data crucial to implementing viable, client-focused intervention solutions. Project planning and execution is enhanced by our vast thru-tubing intervention interactive data exchange (InDEx™), which captures years of experience and lessons learned for our personnel to query and share with clients during job planning and risk analysis.

Standard Tools

Annular Circulation/Inflation Valve 9
Back Pressure Valve 3
Ball Operated Circulating Valve 7
Coiled Tubing Connector 2
Dual-Actuated Circulating Valve 7
FAU Safety Hydraulic Disconnect 6
High-Load Disconnect 4
Motorhead Assembly 1
Pace BP Back Pressure Valve 3
Universal Hydraulic Disconnect 5

Accessory Tools

Coiled Tubing Fluid Reservoir System 25
Deployment/Spacer Bar 21
Fluid Loading Valve 11
Hydraulic Bent Sub 20
Hydraulic Centralizer and Hydraulic Drilling Centralizer 15
Hydraulic Tubing Punch 24
Lockable Swivel 18
Mechanical Bow Spring Centralizer 14
Nipple Profile Locator 17
Pressure-Operated Circulating Valve 11
Reverse-Circulating and Jetting Tool 23
Single- and Double-Knuckle Joint 16
Single- and Dual-Swivel 18
Sleeve-Type Non-Rotating Stabilizer 13
Spinning Wash Tool 22
Type B Boot Basket 12

Fishing Tools

Bulldog Overshot 38
Center Prong and Crankshaft Rope Spear 37
Continuous Tubing Overshot 31
High-Pressure Pack-Off 33
Hydraulic-Releasing GS Spear and Slick Catch Spear 27
Hydraulic-Releasing Overshot and Slick Catch Overshot 29
Itco-Type Spear 36
Rope Spears 36
Series 10 Sucker Rod Overshot 35
Series 150 Overshot 34
Series 20 Short Catch Sucker Rod Overshot 35
Series 70 Short Catch Overshot 34
Snipper Overshot 32

Rotational Services

Baker Hughes Rotary Shoes 44
Bladed Junk Mill 45
BO Style Mill 47
Diamonds 43
DB Underreamer/Cutter 48
Hydraulic Indexing Tool 52
Hydraulic/Mechanical Tubing Anchor 51
Hydraulic Tubing Cutter 49
METAL MUNCHER 42
METAL MUNCHER Junk Mill 47
METAL MUNCHER Step Mill 46
Natural Diamond Bits 43
Navi-Drill VIP Workover Motor 41
Navi-Drill X-treme Workover Motor 39
Opti-Cut 42
Set Down Indexing Tool 52
SR2 Underreamer 50
SUPERLOY 42
Turbo Scale Mill 46

Impact Services

Block and Blast Tool 57
HB-3 Selective Shifting Tool 59
HIPP-TRIPPER Accelerators 56
HIPP-TRIPPER Accessories 58
HIPP-TRIPPER Bi-Di Vibratory Fishing Jar 55
HIPP-TRIPPER Si-Di Impact Drill 53

Debris Catchers

Venturi Jet Junk Basket 61

Inflatable Systems

Belleville Secondary Pull Release 74
Cement Retainer With Spotting Valve 69
Electric Wireline Setting Tool 71
Hydraulic Disconnect/Running Tools 77
Inflatable Straddle Acidizing Packer (ISAP) 70
Permanent Bridge Plug 66
Positive Fluid Separation Reservoir System 75
Pressure Extender 73
Retrievable Bridge Plug 67
Retrievable Packer 68
Test Pressure Equalizing Valve 72
Thru-Tubing Inflatable Element Rating Table 65
Thru-Tubing Inflatables History 63
Washover Retrieving Head 78
Wireline Retrieving Tool 78

Z-Seal Technology

Z-Seal Metal-to-Metal Sealing Technology 80
Z-Seal Metal-to-Metal Sealing Technology
Shifts the Paradigm 79

Casing Exits

Coiled Tubing-Set Monobore Whipstock 86
Delta Exit System 84
String and Watermelon Mills 87
Thru-Tubing Casing Exits 83

Software/information

Fishing Calculation Software 89
INFLATEDESIGN 92
Thru-Tubing Fishing
Pre-Job Information Request Form 90
Thru-Tubing Inflatable
Pre-Job Information Request Form 93
Z-Seal Pre-Job Information Request Form 95

Product Family No.	Description	Page
H11107	Bulldog Overshot	38
H11210	Series 10 Sucker Rod Overshot	35
H11220	Series 20 Short Catch Sucker Rod Overshot	35
H11230	Series 70 Short Catch Overshot	34
H11507	Series 150 Overshot	34
H12028, H12128, H12228, and H12229	Rope Spears	36
H12028 and H12229	Center Prong and Crankshaft Rope Spear	37
H12210	Itco Type Spear	36
H13016	Type B Boot Basket	12
H13051	Venturi Jet Junk Basket	61
H13200 and H33060	Coiled Tubing Connector	2
H13203	Motorhead Assembly	1
H13204 and H33092	Back Pressure Valve	3
H13209	Universal Hydraulic Disconnect	5
H13211	FAU Safety Hydraulic Disconnect	6
H13213	High Load Disconnect	4
H13218	Dual Actuated Circulating Valve	7
H13220, H13221, and H34017	Hydraulic Centralizer and Hydraulic Drilling Centralizer	15
H13224	Mechanical Bow Spring Centralizer	14
H13225 and H33040	Nipple Profile Locator	17
H13226	Hydraulic/Mechanical Tubing Anchor	51
H13230, H13231, and H34014	Single and Double Knuckle Joint	16
H13236	Hydraulic Bent Sub	20
H13259	Set Down Indexing Tool	52
H13260	Hydraulic Indexing Tool	52
H13264 and H13263	Single and Dual Swivel	18
H13265	Lockable Swivel	18
H13266	Spinning Wash Tool	22
H13280	Navi-Drill VIP Workover Motor	41
H13283	Navi-Drill X-treme Workover Motor	39
H13287 and H33078	Annular Circulation/Inflation Valve	9
H13288	Reverse Circulating and Jetting Tool	23
H13311 and H13310	Hydraulic Releasing GS Spear and Slick Catch Spear	27
H13330 and H13331	Hydraulic Releasing Overshot and Slick Catch Overshot	29
H13332	Continuous Tubing Overshot	31
H13333	High Pressure Pack-Off	33
H13334	Snipper Overshot	32
H13341	Hydraulic Tubing Punch	24
H13400	HIPP-TRIPPER Si-Di Impact Drill	53
H13405	HIPP-TRIPPER Bi-Di Vibratory Fishing Jar	55
H13420	HIPP-TRIPPER Accelerators	56
H13425	Block and Blast Tool	57
H13430	HIPP-TRIPPER Accessories	58
H15008, H15010, H15013, and H15014	Baker Hughes Rotary Shoes	44
H15028	SR2 Underreamer	50

Product Family No.	Description	Page
H15042	Coiled Tubing Set Monobore Whipstock	86
H15097	DB Underreamer/Cutter	48
H15101	Turbo Scale Mill	46
H15102	METAL MUNCHER Junk Mill	47
H15106	Bladed Junk Mill	45
H15106	BO Style Mill	47
H15109	String and Watermelon Mills	87
H15113	METAL MUNCHER Step Mill	46
H15150	Delta Exit System	84
H16055	Deployment/Spacer Bar	21
H17003	Hydraulic Tubing Cutter	49
H17130	Sleeve Type Non-Rotating Stabilizer	13
H33001	Retrievable Packer	68
H33049	Coiled Tubing Fluid Reservoir System	25
H33050	Fluid Loading Valve	11
H33051	Pressure Operated Circulating Valve	11
H33061	Ball Operated Circulating Valve	7
H33072	Hydraulic Disconnect/Running Tools	77
H33080	Belleville Secondary Pull Release	74
H33082	Test Pressure Equalizing Valve (TPEV)	72
H33083	Pressure Extender	73
H33091	Pace BP Back Pressure Valve	3
H33110	Z-Seal Metal-to-Metal Sealing Technology	80
H34001	Permanent Bridge Plug	66
H34010	Retrievable Bridge Plug	67
H34011	Washover Retrieving Head	78
H34013	Wireline Retrieving Tool	78
H34020	Cement Retainer with Spotting Valve	69
H35003	Inflatable Straddle Acidizing Packer (ISAP)	70
H43714	Electric Wireline Setting Tool	71
H43715	Positive Fluid Separation Reservoir System	75
H81198	HB-3 Selective Shifting Tool	59

Motorhead Assembly

Product Family No. H13203

APPLICATION

The motorhead assembly combines the main tool components used in coiled tubing operations in modular form. The combined tool length has been greatly reduced to allow ease of handling and deployment in the well and also to effectively reduce the bending stresses in the BHA. The motorhead assembly consists of the coiled tubing connector, dual back pressure valve, hydraulic disconnect, dual circulation sub, and optional lockable swivel.

Advantages

- High tensile strength
- Full torque-through capabilities
- Shorter overall length
- Full internal pressure integrity
- Standardized connections for ease of use

SPECIFICATION GUIDE

Tool OD		Tool ID ▲				Coiled Tubing OD	Tensile Rating	Standard Connection
		Disconnect		Circulating Sub				
in.	mm	in.	mm	in.	mm	in.	lb	
1.69 ✷	42.9	0.56	14.1	0.44	11.2	1.50	21,000	1-in. AMMT
1.69	42.9	0.56	14.1	0.44	11.2	1.25	26,000	1-in. AMMT
2.13	54.1	0.68	17.2	0.56	14.1	1.25	45,600	1-1/2-in. AMMT
2.13	54.1	0.68	17.2	0.56	14.1	1.50	47,000	1-1/2-in. AMMT
2.25	57.2	0.68	17.2	0.56	14.1	1.75	47,000	1-1/2-in. AMMT
2.88	73.2	0.81	20.4	0.68	17.2	1.50	123,000	2-3/8-in. PAC DSI
2.88	73.2	0.81	20.4	0.68	17.2	1.75	80,000	2-3/8-in. PAC DSI
2.88	73.2	0.81	20.4	0.68	17.2	2.00	84,000	2-3/8-in. PAC DSI
3.50	88.9	1.31	33.3	1.19	30.1	2.00	158,000	2-7/8-in. PAC DSI
3.50	88.9	1.31	33.3	1.19	30.1	2.38	157,000	2-7/8-in. PAC DSI
3.50	88.9	1.31	33.3	1.19	30.1	2.88	89,000	2-7/8-in. PAC DSI

✷ *Internal coiled tubing connector*

▲ *Minimum ID sizes specified are maximum piston IDs possible. Smaller piston sizes are available on request.*



Motorhead Assembly
Product Family No. H13203

Coiled Tubing Connector

Product Family Nos. H13200 and H33060

APPLICATION

Coiled tubing connectors provide a means of attaching a tool string to the end of the coiled tubing. The connectors, when installed correctly, provide a reliable, strong sealed connection to the coiled tubing. All of the connectors have been designed with either a fishing neck or a slick profile on the OD of the top sub. This will accommodate standard external fishing overshots should the need arise. Coiled tubing connectors have been designed for most sizes of coiled tubing. The coiled tubing connectors are of the slip type or collet type design. The slip type connectors are also equipped with set screws to rotationally lock them from spinning when used in conjunction with tools that create torque such as coiled tubing workover motors.

The connectors use o-ring seals to seal off the coiled tubing in order to maintain pressure integrity for the tool string.

Advantages

- High tensile strength
- High torsional strength for motor applications
- Large ID for maximum flow rates and pump through of actuation balls
- Manufactured with fishing profile on top of connector
- High pressure/high temperature tools rated to 10,000 psi *(689 bar)* and 400°F *(204°C)*



Coiled Tubing Connector
Product Family No. H13200

SPECIFICATION GUIDE

Coiled Tubing OD	Tool OD		Tool ID		Tensile Rating	Standard Connection
in.	in.	mm	in.	mm	lb	
1.00	1.69	42.9	0.75	19.1	31,000	1-in. AMMT
1.00	1.81	46.0	0.75	19.1	60,000	1-in. AMMT
1.00	2.13	54.1	0.88	22.4	94,000	1-in. AMMT
1.00	2.13	54.1	0.81	20.4	84,500	1-3/4-in. 6 'P' Acme
1.25	1.69	42.9	0.75	19.1	25,000	1-in. AMMT
1.25	1.81	46.0	0.75	19.1	37,000	1-in. AMMT
1.25	2.13	54.1	0.81	20.4	63,000	1-in. AMMT
1.25	2.13	54.1	0.88	22.4	55,800	1-3/4-in. 6 'P' Acme
1.50	2.13	54.1	0.75	19.1	49,000	1-in. AMMT
1.50	2.13	54.1	1.00	25.4	49,000	1-1/2-in. AMMT
1.50	2.13	54.1	1.00	25.4	43,700	1-3/4-in. 6 'P' Acme
1.50	2.50	63.5	1.00	25.4	96,000	1-1/2-in. AMMT
1.50	2.75	69.9	1.31	33.3	108,000	2-1/4-in. 5 'P' Acme
1.50	2.88	73.2	1.12	28.4	123,000	2-3/8-in. PAC DSI
1.50	3.13	79.5	1.00	25.4	123,000	2-3/8-in. Reg
1.75	2.25	57.2	1.00	25.4	49,000	1-1/2-in. AMMT
1.75	2.50	63.5	1.00	25.4	50,000	1-1/2-in. AMMT
1.75	2.75	69.9	1.50	38.1	65,800	2-1/4-in. 5 'P' Acme
1.75	2.88	73.2	1.50	38.1	80,000	2-3/8-in. PAC DSI
1.75	3.13	79.5	1.50	38.1	80,000	2-3/8-in. PAC DSI
1.75	3.13	79.5	1.50	38.1	80,000	2-7/8-in. PAC DSI
1.75	3.13	79.5	1.00	25.4	80,000	2-3/8-in. Reg
2.00	2.50	63.5	1.00	25.4	53,000	1-1/2-in. AMMT
2.00	2.63	66.8	1.00	25.4	78,000	1-1/2-in. AMMT
2.00	2.88	73.2	1.50	38.1	78,000	2-3/8-in. PAC DSI
2.00	3.13	79.5	1.00	25.4	134,000	2-3/8-in. Reg
2.00	3.13	79.5	1.50	38.1	134,000	2-3/8-in. PAC DSI
2.00	3.50	88.9	1.50	38.1	134,000	2-7/8-in. PAC DSI
2.38	2.88	73.2	1.50	38.1	53,000	2-3/8-in. PAC DSI
2.38	3.38	85.7	1.00	25.4	156,000	2-3/8-in. Reg
2.38	3.50	88.9	1.50	38.1	155,900	2-7/8-in. PAC DSI
2.38	4.75	120.7	1.96	49.8	95,000	3-1/2-in. Reg
2.88	3.38	85.7	1.50	38.1	71,000	2-7/8-in. PAC DSI

Back Pressure Valve

Product Family Nos. H13204 and H33092

APPLICATION

The back pressure valve is a flapper-type valve that allows flow down the tubing, but stops flow coming back up the tubing. The back pressure valve has two flappers and flapper seals. The second flapper is redundant to the first and can be run where redundant seals are required. The flapper is designed so that a ball can be pumped through it at minimum fluid flow rate.

The back pressure valve is normally run directly below the coiled tubing connector in CT operations and at the top of the BHA in snubbing operations. The back pressure valve is run as a well control measure to prevent wellbore pressure from entering the workstring. No pipe manipulation or pressurization sequence is required to operate the tool.

Advantages

- Dual flapper valves
- Field-proven bonded nitrile
- flapper valve seats
- Short length
- Large ID
- High pressure/high temperature tools rated to 10,000 psi *(689 bar)* and 400°F *(204°C)*

Pace BP Back Pressure Valve

Product Family No. H33091

APPLICATION

The primary purpose of the pace BP pressure actuated compensating equalizing back pressure Valve, is as a safety precaution on live wells to prevent flow back up through the tubing. The tool is equipped with two flappers as a redundant safety system. The pace BP is also equipped with an equalizing feature that allows the pressure below the flappers to be vented to the annulus if the pressure compensating volume in the tool is completely used.

Advantages

- Dual flapper configuration with floating flapper design
- Downhole equalizing feature vents pressure to annulus
- Field proven nitrile bonded valve seats
- Large ID allows for high flow rates
- Full ID opening for ball drops



Back Pressure Valve
Product Family No. H13204

SPECIFICATION GUIDE

Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.69	42.9	0.69	17.5	18.13	460.5	31,000	1-in. AMMT
1.69	42.9	0.69	17.5	17.94	455.7	29,100	1-1/4-in. 8 'P' Acme
1.69 ✷	42.9	0.69	17.5	31.63	803.4	22,900	1-1/4-in. 8 'P' Acme
1.81	42.9	0.69	17.5	18.10	459.7	60,000	1-in. AMMT
2.13	54.1	0.81	20.4	16.56	420.6	72,000	1-1/2-in. AMMT
2.13	54.1	0.81	20.4	15.69	398.5	35,700	1-3/4-in. 6 'P' Acme
2.13 ✷	54.1	0.81	20.4	31.94	811.3	32,100	1-3/4-in. 6 'P' Acme
2.25	57.2	0.81	20.4	15.56	395.2	82,000	1-1/2-in. AMMT
2.50	63.5	0.81	20.4	16.94	430.3	140,000	1-1/2-in. AMMT
2.88	73.2	1.00	25.4	23.32	592.3	100,000	2-3/8-in. PAC DSI
3.00	76.2	1.00	25.4	18.07	459.0	94,200	2-1/4-in. 5 'P' Acme
3.00 ✷	76.2	1.00	25.4	37.36	948.9	85,000	2-1/4-in. 5 'P' Acme
3.13	79.4	1.00	25.4	18.94	481.1	150,000	2-3/8-in. PAC DSI
3.13	79.4	1.00	25.4	18.82	478.0	150,000	2-3/8-in. Reg
3.50	88.9	1.00	25.4	24.69	627.1	330,000	2-7/8-in. PAC DSI
3.50	88.9	1.41	35.8	19.56	496.8	103,000	2-7/8-in. PAC DSI
3.75	95.3	1.00	25.4	32.94	836.7	250,000	2-7/8-in. Reg

✷ *PACE back pressure valve*

High Load Disconnect

Product Family No. H13213

APPLICATION

The high load disconnect is a ball actuated tool which uses hydraulic pressure for activation. This tool leaves a GS profile for subsequent retrieving operations.

The disconnect is designed to withstand high tension and torsional stresses encountered in thru-tubing fishing, jarring, and motor applications. High strength locking dogs allow the tool to be run below impact jars if required. Torsional strength is provided by a unique octagonal spline which rotationally locks the tool.

Advantages

- High tensile strength
- Used for jarring and motor applications
- Large ID
- Shear screws have a predetermined value
- Can be fitted with smaller piston to run below jars

SPECIFICATION GUIDE

Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.69	42.9	0.53	13.5	18.38	466.9	40,000	1-in. AMMT
2.13	54.0	0.69	17.5	20.63	524.0	58,000	1-1/2-in. AMMT
2.13	54.0	0.69	17.5	20.63	524.0	58,000	1-1/2-in. AMMT
2.13	54.0	0.69	17.5	20.63	524.0	58,000	1-1/2-in. AMMT
2.13	54.0	0.69	17.5	20.63	524.0	58,000	1-1/2-in. AMMT
2.25	57.2	0.69	17.5	20.63	524.0	58,000	1-1/4-in. Reg
2.25	57.2	0.69	17.5	20.63	524.0	58,000	1-1/4-in. Reg
2.88	73.0	0.41	10.3	23.41	594.6	76,000	2-3/8-in. PAC DSI
2.88	73.0	0.81	20.6	26.00	660.4	76,000	2-3/8-in. PAC DSI
2.88	73.0	0.81	20.6	26.00	660.4	76,000	2-3/8-in. PAC DSI
2.88	73.0	0.81	20.6	26.00	660.4	76,000	2-3/8-in. PAC DSI
3.13	79.4	0.81	20.6	18.20	462.3	94,000	2-7/8-in. PAC DSI
3.13	79.4	0.81	20.6	23.00	584.2	94,000	2-3/8-in. Reg
3.13	79.4	0.81	20.6	23.00	584.2	94,000	2-3/8-in. Reg
3.13	79.4	0.81	20.6	23.00	584.2	94,000	2-3/8-in. Reg Left Hand
3.38	85.7	0.81	20.6	21.25	539.8	94,000	2-3/8-in. Reg



High Load Disconnect
Product Family No. H13213

Universal Hydraulic Disconnect

Product Family No. H13209

APPLICATION

The universal hydraulic disconnect (UHD) is a ball-operated emergency release device designed to be run in a coiled tubing application to provide a method of separating from tools below the disconnect. This disconnect incorporates features to withstand forces encountered during fishing, milling, and drilling operations. The UHD has a high shock load strength, high tensile strength, is rotationally locked, and has a shorter length when compared to other hydraulic disconnects.

The UHD is ideal for applications including use below up or down hydraulic jars, use with impact tools, and with drilling and workover motors. The tool has a positive pressure drop indication when the shear screws have sheared.

Internal debris management is controlled by the use of o-rings and a debris filter at critical locations inside the tool. A rupture disk has been incorporated into the UHD to create a flow path should the lower bottomhole assembly become plugged. The rupture disk can be disabled when required.

After disconnecting, the remaining bottom half of the UHD and tools below can be fished with a standard hydraulic GS spear. A torque-through option is available for the GS spear should rotation through the BHA left in hole be desired.



Universal Hydraulic Disconnect
Product Family No. H13209

SPECIFICATION GUIDE

Service	Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
	in.	mm	in.	mm	in.	mm	lb	
Standard	1.69	42.9	0.44	11.2	14.43	366.5	35,573	1-in. AMMT
Sour	1.69	42.9	0.44	11.2	14.43	366.5	38,807	1-in. AMMT
Standard	1.69	42.9	0.53	13.5	14.43	366.5	35,573	1-in. AMMT
Sour	1.69	42.9	0.53	13.5	14.43	366.5	38,807	1-in. AMMT
Standard	2.13	54.0	0.44	11.2	14.58	370.3	58,680	1-1/2-in. AMMT
Sour	2.13	54.0	0.44	11.2	14.58	370.3	54,768	1-1/2-in. AMMT
Standard	2.13	54.0	0.53	13.5	14.58	370.3	58,680	1-1/2-in. AMMT
Sour	2.13	54.0	0.53	13.5	14.58	370.3	54,768	1-1/2-in. AMMT
Standard	2.13	54.0	0.69	17.5	14.58	370.3	58,680	1-1/2-in. AMMT
Sour	2.13	54.0	0.69	17.5	14.58	370.3	54,768	1-1/2-in. AMMT
Standard	2.88	73.0	0.56	14.2	15.50	393.7	111,696	2-3/8-in. PAC DSI
Sour	2.88	73.0	0.56	14.2	15.50	393.7	120,288	2-3/8-in. PAC DSI
Standard	2.88	73.0	0.81	20.6	15.50	393.7	111,696	2-3/8-in. PAC DSI
Sour	2.88	73.0	0.81	20.6	15.50	393.7	120,288	2-3/8-in. PAC DSI
Standard	3.13	79.4	0.81	20.6	16.52	419.6	148,320	2-7/8-in. PAC DSI
Sour	3.13	79.4	0.81	20.6	16.52	419.6	138,432	2-7/8-in. PAC DSI
Standard	3.13	79.4	1.00	25.4	16.52	419.6	148,320	2-7/8-in. PAC DSI
Sour	3.13	79.4	1.00	25.4	16.52	419.6	138,432	2-7/8-in. PAC DSI
Standard	3.13	79.4	0.81	20.6	20.17	512.3	148,320	2-3/8-in. Reg
Sour	3.13	79.4	0.81	20.6	20.17	512.3	138,432	2-3/8-in. Reg
Standard	3.13	79.4	1.00	25.4	20.17	512.3	148,320	2-3/8-in. Reg
Sour	3.13	79.4	1.00	25.4	20.17	512.3	138,432	2-3/8-in. Reg
Standard	3.50	88.9	1.00	25.4	19.46	494.3	291,720	2-7/8-in. PAC DSI
Sour	3.50	88.9	1.00	25.4	19.46	494.3	291,720	2-7/8-in. PAC DSI
Standard	3.50	88.9	1.25	31.8	19.46	494.3	291,720	2-7/8-in. PAC DSI
Sour	3.50	88.9	1.25	31.8	19.46	494.3	291,720	2-7/8-in. PAC DSI

Advantages

- Able to withstand continuous heavy jarring and impact loads applied in up and down modes
- Increased tensile and torsional strength compared to other disconnects
- Incorporates a debris barrier to prohibit debris and fine sands from entering the tool
- Rotationally locked for downhole motor applications
- Special fishing tools available with probe for transmitting torque after disconnecting
- Positive pressure indication at surface after disconnecting
- Has flow through capability after disconnecting

FAU Safety Hydraulic Disconnect

Product Family No. H13211

APPLICATION

The FAU™ safety hydraulic disconnect is specially designed for thru-tubing fishing operations, and is built to withstand high tensile and torsional stresses encountered in jarring and motor applications. The FAU safety hydraulic disconnect may be run anywhere in the string as long as the actuation ball can be circulated to it. When disconnected, a GS fishing profile remains, and subsequent retrieving operations may continue with the hydraulic releasing GS spear.

Advantages

- Provides controlled method of disconnection from lower portion of BHA
- Disconnected portion has internal GS profile
- Balanced to prevent accidental disconnect
- Torsionally locked
- Large ID permits circulation of smaller size actuation balls below the tool

SPECIFICATION GUIDE

Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.44	36.6	0.44	11.2	18.98	482.1	30,000	3/4-in. CS Hydril
1.69	42.9	0.56	14.2	16.38	416.1	41,000	1-in. AMMT
1.81	46.0	0.56	14.2	16.38	416.1	41,000	1-in. AMMT
2.13	54.0	0.56	14.2	18.90	480.1	72,000	1-1/2-in. AMMT
2.25	57.2	0.44	11.2	21.35	542.3	74,000	1-1/2-in. AMMT
2.50	63.5	0.44	11.2	21.69	550.9	100,000	1-1/2-in. AMMT
2.88	73.0	0.56	14.2	24.25	616.0	139,000	2-3/8-in. PAC DSI
3.13	79.4	0.63	16.0	27.75	704.9	134,000	2-3/8-in. PAC DSI
3.50	88.9	1.44	36.6	26.67	677.4	140,000	2-3/8-in. IF



FAU Safety Hydraulic Disconnect
Product Family No. H13211

Ball Operated Circulating Valve

Product Family No. H33061

APPLICATION

The circulating valve provides a large-----area circulation path between the coiled tubing ID and the annulus. The circulation ports are opened by dropping a ball to its seat in the valve and applying pressure in order to shear some shear screws and move a piston downwards. Once the valve has been opened the ball and seat seal in the mandrel ID below the ports effectively blocking off any further fluid bypass to below. This feature allows for the use of the valve for the spotting of fluids above a set inflatable packer with the knowledge that all fluids are being directed out of the circulating valve and not to below the packer. Applications for the circulating valve include chemical treatments above a set packer, cement placement above a permanent bridge plug, debris barrier placement above a retrievable bridge plug, etc. The tool may be supplied with an integral rupture disc port for use when dropping a ball may not be possible, i.e., in a plugged situation. Here the rupture disc may be over pressured in order to achieve circulation in order to allow further use of drop balls..

Advantages

- Large circulation path between tubing and annulus
- Simple, ball operated design
- Ideal for spotting fluids
- Can be run with a rupture disk in case balls cannot be dropped

Dual Actuated Circulating Valve

Product Family No. H13218

APPLICATION

The dual-actuated circulating valve is designed to allow a circulation path above a mud motor from tubing to annulus. When the motor service is complete, fluids may need to be pumped for several hours to clean or displace the wellbore. The use of this valve can save unnecessary wear on the mud motor during this operation.

The dual-actuated circulating valve is ball actuated and is normally run below the hydraulic disconnect and above the downhole motor. The primary means of actuation is accomplished by pumping a ball which will shift the piston sleeve, exposing circulation ports. The secondary means of actuation is through a rupture disc. In the unlikely event that the bottomhole assembly becomes plugged, increased pressure from the surface will rupture the disc and allow circulation of an actuation ball.

Advantages

- Saves wear on the mud motor
- Large ID permits maximum flow rates
- Predetermined values on shear screws and secondary rupture disc
- Balanced piston



Dual Actuated Circulating Valve
Product Family No. H13218

SPECIFICATION GUIDE

Dual-Actuated Circulating Valve and Ball Operated Circulating Valve

Type	Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
	in.	mm	in.	mm	in.	mm	lb	
Single	1.69	42.9	0.41	10.4	11.06	280.9	47,000	1-in. AMMT
Single	1.69	42.9	0.46	11.7	10.80	274.3	41,000	1-1/4-in. 8 'P' Acme
Dual	1.69	42.9	0.41	10.4	11.06	280.9	47,000	1-in. AMMT
Dual	1.81	46.0	0.41	10.4	11.06	280.9	71,000	1-in. AMMT
Single	2.13	54.1	0.44	11.2	12.13	308.1	84,000	1-1/2-in. AMMT
Single	2.13	54.1	0.56	14.1	12.20	309.9	55,000	1-3/4-in. 6 'P' Acme
Dual	2.13	54.1	0.44	11.2	12.13	308.1	84,000	1-1/2-in. AMMT
Dual	2.13	54.1	0.56	14.1	13.75	349.3	63,000	1-3/4-in. 6 'P' Acme
Dual	2.50	63.5	0.44	11.2	12.38	314.5	115,000	1-1/2-in. AMMT
Single	2.75	69.9	0.56	14.1	11.70	297.2	147,000	2-1/4-in. 5 'P' Acme
Dual	2.75	69.9	0.56	14.1	14.25	362.0	161,000	2-1/4-in. 5 'P' Acme
Dual	2.88	73.2	0.44	11.2	11.63	295.4	172,000	2-3/8-in. PAC DSI
Single	3.13	79.5	0.56	14.1	12.50	317.5	290,000	2-3/8-in. Reg
Dual	3.13	79.5	0.56	14.1	14.25	326.0	178,000	2-3/8-in. PAC DSI
Dual	3.50	88.9	0.56	14.1	15.50	393.7	178,000	2-7/8-in. PAC DSI

Annular Circulation/Inflation Valve

Product Family Nos. H13287 and H33078

APPLICATION

The annular circulation/inflation valve is designed to allow communication of fluid from the tool ID to the annulus. The annular circulation valve is typically run in tubing cutting applications. When circulation is required during running in the hole, fluid is circulated through the flow ports, eliminating the potential for rotation of the motor of function or the DB cutter.

The inflation valve (product family no. H33078) is typically run with retrievable and permanent bridge plugs. An important function of the inflation valve is to equalize pressure from bridge plug ID to casing while going in the hole. This prevents damage to the packing element and insures that the poppet is not seated too tight in the poppet housing due to hydrostatic pressure while tripping in the hole.

When the tool is to be set a ball is landed in the seat on either valve which closes off communication to below the valve and to the circulating ports. Pressure applied to the coiled tubing then shifts a sleeve that closes ports to the annulus and also opens a communication path around the ball to the desired tool configuration below.

Advantages

- Allows the tool string to remain balanced while running in the hole
- Large circulation ports
- Short, simple design
- No pipe manipulation required for operation of the tool

SPECIFICATION GUIDE

Annular Circulation Valve

Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.69	42.9	0.31	7.9	14.80	375.9	30,000	1-in. AMMT
2.13	54.1	0.44	11.2	16.57	420.9	59,000	1-1/2-in. AMMT
2.88	73.2	0.56	14.2	18.00	457.2	123,000	2-3/8-in. PAC DSI
3.13	79.5	0.56	14.2	17.50	444.5	205,000	2-3/8-in. REG

Inflation Valve

Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.69	42.9	0.31	7.9	14.62	371.3	27,300	1-1/4-in. 8 'P' Acme
2.13	54.1	0.44	11.2	15.32	389.1	48,600	1-3/4-in. 6 'P' Acme
3.00	76.2	0.44	11.2	16.75	425.5	123,450	2-1/4-in. 5 'P' Acme



Annular Circulation Valve
Product Family No. H13287

Pressure-Operated Circulating Valve

Product Family No. H33051

APPLICATION

The pressure-operated circulating valve provides a means of opening communication from the inside of the coiled tubing to the annulus. The tool may be used above such tools as packers to allow treating above the set tool or, in the case of a straddle system, to provide communication between the packers. The pressure operated circulating valve is a normally closed valve and is opened by applying tubing pressure. The applied pressure acts on an unbalanced piston inside the housing. This piston is retained in the closed position by shear screws. When the predetermined value of these shear screws are reached, the piston is pumped down opening ports to the annulus.

Advantages

- Large circulation path between tubing and annulus
- Ideal for spotting fluids above packers
- Can be used between two packers as part of a straddle system
- Valve is opened with applied tubing pressure



Pressure-Operated Circulating Valve
Product Family No. H33051

Fluid-Loading Valve

Product Family No. H33050

APPLICATION

The fluid-loading valve (FLV) was designed to allow the coiled tubing to be filled with a limited amount of fluid, prior to running in the hole, with which to fill and pressurize an inflatable element when setting in conditions where a large pressure imbalance would exist between the hydrostatic of a fluid column in the coiled tubing to the setting depth bottom hole pressure in low pressure wells. This allows for the element to be inflated with fluid while allowing for the coiled tubing to be pressurized with a gas. The FLV uses a sleeve type design which allows an exterior port to be either opened or closed to the interior of the tool. After a sufficient amount of fluid has been pumped into the coiled tubing (to inflate the element), the valve is closed by means of rotation of this outer sleeve. The filler hose is then removed and the outer sleeve locked by means of set screws.

Advantages

- Allows coiled tubing to be filled at surface when deploying inflatable tools in a gas well
- Simple design uses a filler port in the side of the tool
- Permits the inflatable element to be inflated with fluid in a gas environment



Fluid-Loading Valve
Product Family No. H33050

SPECIFICATION GUIDE

Pressure Operated Circulating Valve and Fluid Loading Valve

Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.69	42.9	0.69	17.5	17.16	435.9	25,000	1-1/4-in. 8 'P' Acme
2.13	54.1	0.81	20.6	15.63	397.0	54,000	1-3/4-in. 6 'P' Acme
3.00	76.2	1.00	25.4	16.88	428.8	108,000	2-1/4-in. 5 'P' Acme

Type B Boot Basket

Product Family No. H13016

APPLICATION

Boot baskets are used to trap cuttings which are too large to circulate out of the hole during drilling, milling, or junk fishing operations. The design of the boot basket traps junk by producing a sudden decrease in annular velocity when the cuttings pass the larger OD of the boot reaching the smaller OD of the body and top connection.

The boot basket should be run as close as possible to the mill, bit, or junk basket. Milling procedures are carried out as usual with normal circulation.

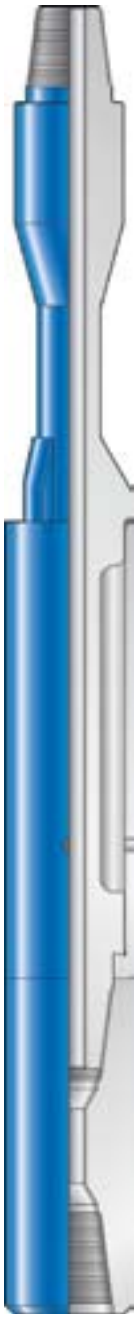
Additional boot baskets may be run in tandem to increase the junk catching capacity.

Advantages

- Simple design and operation
- Constructed from AISI 4140 heat-treated alloy steel
- Can be run in tandem
- Box down, pin up design so that boot basket may be run directly above a mill or bit
- May be ordered with 18-in. *(45.7 cm)* or 36-in. *(94.1 cm)* long baskets
- Boot can be removed for inspection of the entire tool
- Excellent torsion and buckling strength

SPECIFICATION GUIDE

Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.81	46.0	0.63	16.0	37.63	955.8	54,000	1-in. AMMT
2.13	54.1	0.81	20.6	41.40	1051.6	61,000	1-1/2-in. AMMT
2.50	63.5	0.81	20.6	41.40	1051.6	69,000	1-1/2-in. AMMT
2.88	73.2	0.81	20.6	52.40	1331.0	201,900	2-3/8-in. PAC DSI
3.13	79.5	1.00	25.4	52.40	1331.0	202,000	2-3/8-in. Reg
3.50	88.9	1.00	25.4	52.40	1331.0	202,000	2-3/8-in. Reg
3.75	95.3	1.25	31.8	51.90	1318.3	313,000	2-7/8-in. Reg
4.25	108.0	1.25	31.8	51.90	1318.3	313,000	2-7/8-in. Reg



Type B Boot Basket
Product Family No. H13016

Sleeve-Type Non-Rotating Stabilizer

Product Family No. H17130

APPLICATION

The sleeve-type non-rotating stabilizer provides maximum centralization during milling, cutting, and fishing operations. The stabilizer consists of a mandrel, top sub, and sleeve. The stabilizer blades are manufactured from mild steel to reduce the risk of damage to nipple profiles. The stabilizer is usually run directly above the workover motor or directly below the disconnect in a fishing string.

The sleeve-type non-rotating stabilizer is normally run in the string immediately above the fishing assembly. Two stabilizers are recommended to improve centralization. Sleeve rotation begins as string rotation causes the sleeve's mild steel blades to meet the resistance of the casing walls.

Advantages

- Provides maximum control for cutting and milling operations
- Non-rotating sleeve reduces vibration
- Reduces shock load on cutter knives for longer cutting life
- Sleeves made from mild steel to minimize wear on tubing or casing
- Easily field dressed to accommodate different tubing IDs
- Available in all standard thru-tubing connections and sizes

SPECIFICATION GUIDE

Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
2.13	54.1	0.75	19.1	16.38	416.1	75,800	1-1/2-in. AMMT
2.88	73.2	1.06	26.9	17.78	451.6	120,700	2-3/8-in. PAC DSI
3.13	79.5	1.00	25.4	18.25	463.6	130,600	2-3/8-in. Reg
3.75	95.3	1.25	31.8	31.13	790.7	324,200	2-7/8-in. Reg
4.13	104.9	1.25	31.8	30.63	777.9	329,580	2-7/8-in. IF



Sleeve Type Non-Rotating Stabilizer
Product Family No. H17130

Mechanical Bow Spring Centralizer

Product Family No. H13224

APPLICATION

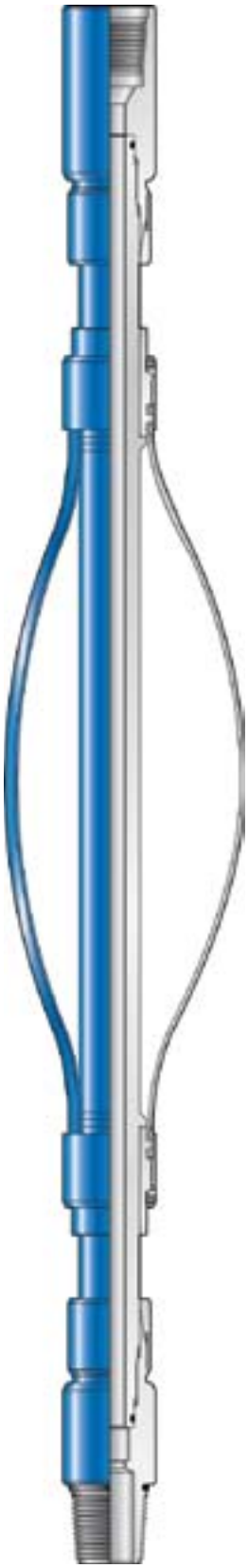
The mechanical bow spring centralizer offers the ability to centralize a fishing tool string in the casing during thru-tubing fishing operations. The mechanical bow spring centralizer can also be used in underreaming applications to stabilize the BHA from excessive side loading incurred with coiled tubing applications.

Advantages

- Up to 8 in. *(203.2 mm)* maximum expansion
- No actuation required
- Available in most thru-tubing

SPECIFICATION GUIDE

Type	Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
	in.	mm	in.	mm	in.	mm	lb	
Standard	1.69	42.9	0.47	11.9	41.50	1054.1	24,000	1-in. AMMT
Drilling	1.69	42.9	0.47	11.9	42.75	1085.9	24,000	1-in. AMMT
Standard	1.81	46.0	0.47	11.9	42.00	1066.8	32,000	1-in. AMMT
Standard	2.13	54.1	0.81	20.6	43.00	1092.2	45,000	1-1/2-in. AMMT
Standard	2.13	54.1	0.81	20.6	41.75	1060.5	51,500	1-3/4-in. 6 'P' Acme
Standard	2.88	73.2	1.00	25.4	48.25	1225.6	12,000	2-3/8-in. PAC DSI
Standard	3.00	76.2	1.00	25.4	38.75	984.3	46,250	2-1/4-in. 5 'P' Acme



Mechanical Bow Spring Centralizer
Product Family No. H13224

Hydraulic Centralizer and Hydraulic Drilling Centralizer

Product Family Nos. H13220, H13221, and H34017

APPLICATION

The hydraulic actuated centralizer offers the ability to centralize a fishing tool string in the casing during thru-tubing fishing operations. The centralizer is run in the hole with the bow springs in a retracted position, thus allowing easy passage through the production tubing. Once fishing operations begin, flow through the centralizer extends the springs to contact the casing wall and centralize the fishing string in the hole.

The hydraulic drilling centralizer can also be used in milling and underreaming operations to stabilize the bottomhole assembly.

Advantages

- Centralizes tool strings in highly deviated wells
- Large flow throughout tool is possible without activating centralizing springs by changing choke size
- Large expansion rating with small run-in diameter
- Collapsible spring allows normal run in hole
- Adjustable sleeve allows running in different casing sizes without changing springs



Hydraulic Centralizer
Product Family No. H13220

SPECIFICATION GUIDE

Type	Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
	in.	mm	in.	mm	in.	mm	lb	
Standard	1.69	42.9	0.47	11.9	45.50	1155.7	22,000	1-in. AMMT
Drilling	1.69	42.9	0.47	11.9	45.50	1155.7	22,000	1-in. AMMT
Standard	1.81	46.0	0.47	11.9	45.75	1162.1	27,000	1-in. AMMT
Standard	1.81	46.0	0.47	11.9	45.75	1162.1	27,000	1-1/4-in. 8 'P' Acme
Standard	2.13	54.1	0.63	16.0	43.00	1092.2	36,000	1-1/2-in. AMMT
Standard	2.13	54.1	0.63	16.0	43.62	1107.9	30,000	1-3/4-in. 6 'P' Acme
Drilling	2.13	54.1	0.63	16.0	63.63	1616.2	48,000	1-1/2-in. AMMT
Standard	2.88	73.2	0.63	16.0	42.50	1079.5	36,000	2-3/8-in. PAC DSI
Drilling	2.88	73.2	0.63	16.0	42.50	1079.5	48,000	2-3/8-in. PAC DSI
Standard	3.00	76.2	1.00	25.4	39.68	1007.9	50,000	2-1/4-in. 5 'P' Acme
Standard	3.00	76.2	1.00	25.4	40.94	1039.9	50,000	2-3/8-in. PAC DSI
Drilling	3.00	76.2	1.00	25.4	40.94	1039.9	50,000	2-3/8-in. PAC DSI
Standard	3.13	79.5	1.00	25.4	40.63	1032.0	50,000	2-3/8-in. Reg
Drilling	3.13	79.5	1.00	25.4	40.63	1032.0	50,000	2-3/8-in. Reg

Single- and Double-Knuckle Joint

Product Family Nos. H13230, H13231, and H34014

APPLICATION

The single- and double-pivot knuckle joints are used in fishing operations in deviated wellbores or in any situation requiring centralization of the catch tool in the casing. The knuckle joints are used in conjunction with a hydraulic or mechanical centralizer in order to allow centralization of the catch tool without having to overcome the weight of the workstring against the bottom side of the casing. The hydraulic or mechanical centralizer therefore, only has to support the weight of itself and the catch tool run below.

The knuckle joints design allows fluid flow through the tool, so it can be used in washover operations. The knuckle joints may be used in either tubing or wireline fishing applications. The standard knuckle joints are not sealed, but the tolerances are such that at a sufficient flow rate, the knuckle joint seals between the ball sub and the ball retainer to activate any hydraulic actuated tools below the knuckle joint.

Advantages

- Less force required to centralize BHA
- Pump through capabilities
- Torque-through capabilities



Single-Knuckle Joint
Product Family No. H13230

SPECIFICATION GUIDE

Type	Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
	in.	mm	in.	mm	in.	mm	lb	
Single	1.69	42.9	0.56	14.1	10.75	273.1	35,000	1-in. AMMT
Single - Sealed/Torque-Through	1.69	42.9	0.56	14.1	9.75	247.7	39,000	1-in. AMMT
Single	1.69	42.9	0.56	14.1	10.00	254.0	34,000	1-1/4-in. 8 'P' Acme
Double - Sealed/Torque-Through	1.69	42.9	0.56	14.1	19.00	482.6	39,000	1-in. AMMT
Single	1.75	44.5	0.56	14.1	10.00	254.0	35,000	1-in. AMMT
Single - Sealed	1.75	44.5	0.56	14.1	11.00	279.4	35,000	1-in. AMMT
Single	2.13	54.1	0.81	20.4	13.63	346.2	29,000	1-1/2 in. AMMT
Single - Sealed/Torque-Through	2.13	54.1	0.81	20.4	10.00	254.0	46,000	1-1/2 in. AMMT
Single	2.13	54.1	0.81	20.4	13.63	346.2	29,000	1-3/4-in. 6 'P' Acme
Double - Sealed/Torque-Through	2.13	54.1	0.81	20.4	20.25	514.4	46,000	1-1/2-in. AMMT
Double	2.13	54.1	0.81	20.4	21.50	546.1	29,000	1-3/4-in. 6 'P' Acme
Single - Sealed/Torque-Through	2.88	73.2	1.00	25.4	13.38	339.9	74,000	2-3/8-in. PAC DSI
Single	3.00	76.2	1.00	25.4	14.00	355.6	68,000	2-1/4-in. 5 'P' Acme
Double	3.00	76.2	1.00	25.4	23.75	603.3	68,000	2-1/4-in. 5 'P' Acme
Single	3.13	79.5	1.00	25.4	14.75	374.7	74,000	2-3/8-in. Reg
Double	3.13	79.5	1.00	25.4	25.00	635.0	68,000	2-3/8-in. Reg

Nipple Profile Locator

Product Family Nos. H13225 and H33040

APPLICATION

The nipple profile locator is a simple means of locating a known position downhole, allowing for more accurate positioning of the tool string. This is especially important with a coiled tubing workstring due to the variation in tubing elongation.

The nipple profile locator consists of three leaf springs retained in a housing. An upset in the middle of the springs is at an expanded diameter greater than the maximum ID of the nipple profile it is intended to locate; however, the spring can collapse enough to allow the locator to pass through the nipple. The contour of the spring allows the tool to move through restrictions easily but with sufficient force to be detected at surface when passing through a restriction. To overcome the effects of hole drag in deviated wells, the adjustment sleeve allows the tension on the spring to be changed so there will be greater or less drag required to pass through the restriction.

Advantages

- Simple design
- Adjustable drag force
- Will locate in most nipples
- Mechanically operated

SPECIFICATION GUIDE

Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.69	42.9	0.69	17.5	22.00	558.8	28,000	1-in. AMMT
1.69	42.9	0.69	17.5	21.75	552.5	23,200	1-1/4-in. 8 'P' Acme
1.81	46.0	0.69	17.5	22.00	558.8	25,000	1-in. AMMT
2.13	54.1	0.81	20.6	25.13	638.3	42,000	1-1/2-in. AMMT
2.13	54.1	0.81	20.6	24.25	616.0	36,800	1-3/4-in. 6 'P' Acme
2.50	63.5	0.88	22.4	32.75	831.9	48,000	1-1/2-in. AMMT
2.50	63.5	0.88	22.4	31.50	800.1	42,600	1-3/4-in. 6 'P' Acme
3.00	76.2	0.94	23.9	38.89	987.8	59,000	2-3/8-in. PAC DSI
3.00	76.2	0.94	23.9	37.63	955.8	55,500	2-1/4-in. 5 'P' Acme
3.38	85.9	1.25	31.8	38.00	965.2	56,000	2-3/8-in. Reg
3.38	85.9	1.25	31.8	37.15	943.6	47,700	2-1/4-in. 5 'P' Acme



Nipple Profile Locator
Product Family No. H13225

Single- and Dual-Swivel

Product Family Nos. H13264 and H13263

APPLICATION

A single- and dual-swivel are used to allow the tool string below the swivel to remain stationary, while turning the connection above. This eliminates the need to turn the whole string of tools in order to make up the top tools. The single-swivel has a bearing for tension only. The dual-swivel has bearings for both tension and compression.

The standard swivel is normally assembled in the tool string just below the coiled tubing connector. Once assembled in the tool string it provides a swivel point below the tubing connector for the purpose of making up tools. The single- and dual-swivels are a typical swivel design with friction type thrust bearing. The mandrel and bottom sub are free to turn with respect to the top sub and housing. The dual-swivel has friction type thrust bearings on top as well as on the bottom, so that the tool can rotate when set-down weight is applied.



Single-Swivel
Product Family No. H13264

Lockable Swivel

Product Family No. H13265

APPLICATION

The lockable swivel is designed to perform the same features as a standard swivel when making up the tool string. When the tool string is ready to be run in the hole, a lockable swivel's clutch will engage to torque lock the tool. When the tool string is broken down coming out of the hole the lockable swivel's clutch can be disengaged to allow the swivel to turn for ease in breaking down the tools.

Advantages

- Used for deployment of long tool strings
- Pressure deployment applications
- Rotationally locked



Lockable Swivel
Product Family No. H13265

SPECIFICATION GUIDE

Single-, Dual- and Lockable-Swivels

Type	Tool OD		Tool ID		Make Up Length		Tensile Rating	Standard Connection
	in.	mm	in.	mm	in.	mm	lb	
Single	1.69	42.9	0.69	17.5	12.54	318.5	27,000	1-in. AMMT
Dual	1.69	42.9	0.69	17.5	11.82	300.2	27,000	1-in. AMMT
Lockable	1.69	42.9	0.69	17.5	13.64	346.5	28,000	1-in. AMMT
Single	1.69	42.9	0.69	17.5	12.51	317.8	27,000	1-1/4-in. 8 'P' Acme
Single	2.13	54.1	0.81	20.6	14.23	361.4	49,000	1-1/2-in. AMMT
Dual	2.13	54.1	0.81	20.6	15.48	393.2	49,000	1-1/2-in. AMMT
Lockable	2.13	54.1	0.75	19.1	15.51	394.0	39,000	1-1/2-in. AMMT
Lockable	2.38	60.5	0.75	19.1	15.51	394.0	39,000	1-1/2-in. AMMT
Single	2.75	69.9	0.81	20.6	15.75	400.1	109,000	2-1/4-in. 5 'P' Acme
Lockable	2.88	73.2	1.00	25.4	19.73	501.1	111,000	2-3/8-in. PAC DSI
Lockable	3.13	79.5	1.00	25.4	19.23	488.4	118,000	2-3/8-in. Reg
Lockable	3.50	88.9	1.50	38.1	22.34	567.4	120,000	2-7/8-in. PAC DSI



Hydraulic Bent Sub

Product Family No. H13236

APPLICATION

The hydraulic bent sub (knuckle joint) is designed to provide a means of hydraulically kicking over a bottomhole assembly for entry into laterals or for fishing applications (i.e., side pocket mandrels or fish lying high-side in the completion or liner).

The tool is generally run below an indexing tool to allow full radial rotation. The BHA is run in the well to depth and the flow rate is increased to activate the hydraulic knuckle joint. As the flow rate is cycled the indexing tool rotates allowing the fishing tool or entry device to find the fish or lateral. The maximum kick over angle is determined by selection of the appropriate anvil from a minimum of two to a maximum of ten degrees in two degree increments. The hydraulic bent sub requires hydraulic pressure to operate.

Either a choke sub or a nozzle below the tool can generate this pressure. The nozzle size can be predetermined to allow maximum kick over force at the tool. The hydraulic pressure can also be generated by a hydraulic release fishing overshot or spear which already uses a nozzle for activation. The tool can also be used with a boost piston to lift larger loads or where only low flow rates are available.

Advantages

- Easily adjusted for deflection of two to ten degrees
- Anvil establishes predetermined deflection angle
- Kick over force easily controlled by hydraulic pressure differential
- Positive rotational control when used with indexing tool



Hydraulic Bent Sub
Product Family No. H13236

Deployment/Spacer Bar

Product Family No. H16055

APPLICATION

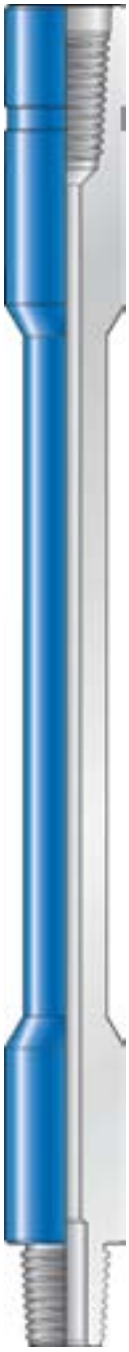
The deployment/spacer bar is used to provide a safe means of handling coiled tubing (CT) or small threaded pipe bottomhole assembly (BHA) at surface in applications where the BHA that is run in hole or retrieved from the hole is longer than the riser height available.

The deployment/spacer bar is used to hang and seal off parts of a BHA. The deployment/spacer bar OD is the same as the CT or threaded pipe used to deploy the BHA in the hole.

The deployment/spacer bar has high tensile and torsion capabilities and the most commonly used small diameter connections.

Advantages

- Increase safety when handling lengthy BHAs
- Available in all standard CT sizes
- High tensile and torsional strength



Deployment Bar
Product Family No. H16055

SPECIFICATION GUIDE

Tool OD		Tool ID		Make Up Length		Available for CT Size						Standard Connection
in.	mm	in.	mm	in.	mm	1 in.	1-1/4 in.	1-1/2 in.	1-3/4 in.	2 in.	2-3/8 in.	
1.69	42.9	0.50	12.7	50.50	1282.7	x						1-in. AMMT
1.69	42.9	0.75	19.1	50.50	1282.7		x	x				1-in. AMMT
2.13	54.0	0.50	12.7	50.00	1270.0	x						1-1/2-in. AMMT
2.13	54.0	0.75	19.1	50.00	1270.0		x	x				1-1/2-in. AMMT
2.13	54.0	1.00	25.4	50.00	1270.0				x			1-1/2-in. AMMT
2.88	73.2	0.50	12.7	49.50	1257.3			x				2-3/8-in. PAC DSI
2.88	73.2	0.75	19.1	49.50	1257.3				x			2-3/8-in. PAC DSI
2.88	73.2	1.00	25.4	49.50	1257.3					x	x	2-3/8-in. PAC DSI
3.13	79.4	0.50	12.7	49.00	1244.6			x				2-3/8-in. Reg
3.13	79.4	0.75	19.1	49.00	1244.6				x			2-3/8-in. Reg
3.13	79.4	1.00	25.4	49.00	1244.6					x	x	2-3/8-in. Reg
3.13	79.4	0.50	12.7	49.50	1257.3			x				2-7/8-in. PAC DSI
3.13	79.4	0.75	19.1	49.50	1257.3				x			2-7/8-in. PAC DSI
3.13	79.4	1.00	25.4	49.50	1257.3					x	x	2-7/8-in. PAC DSI

Spinning Wash Tool

Product Family No. H13266

APPLICATION

The high-flow spinning wash tool is used to efficiently wash sand and debris from the wellbore. Fluid is pumped through a rotating nozzle that directs the flow to the bottom and sides of the hole.

The spinning wash tool has a high speed wash head running on two sets of bearings. The two jetted blades efficiently clear loose scale, sand, and debris-reducing drag on tubing during running in and out of the well. This increases working depth capabilities, particularly in highly deviated wellbores.

Additionally, this tool may be used to impregnate scales with acid or other inhibitors. Also many different corrosives, neutralizers, and other fluids may be circulated, as the bearing assemblies are isolated.

The tool is capable of withstanding pressures commonly used with coiled tubing and snubbing operations and has adequate strength to withstand spudding techniques typically used in sand washing.

Advantages

- High speed rotation
- Sealed bearings
- May be run with a variety of fluids
- Can be run on coiled tubing or conventional threaded pipe

SPECIFICATION GUIDE

Tool OD		Make Up Length		Standard Connection
in.	mm	in.	mm	
1.44	36.6	15.69	398.5	3/4-in. CS Hydril
1.69	42.9	14.69	373.1	1-in. AMMT
1.75	44.5	14.69	373.1	1-in. AMMT
2.13	54.1	16.97	431.0	1-1/2-in. AMMT
2.25	57.2	16.21	411.7	1-1/2-in. AMMT



Spinning Wash Tool
Product Family No. H13266

Reverse-Circulating and Jetting Tool

Product Family No. H13288

APPLICATION

The reverse-circulating and jetting tool is used to clean sand from the hole by reverse circulating. It is used when velocities are not sufficient to carry sand to the surface in the annulus. Sand is retrieved through a large bore in the tool and up the coiled tubing.

The tool can also be used as a jetting sub to break up the sand bridges. In forward circulating mode a flapper closes off the through bore diverting flow to four jet nozzles. The nozzles have tapered carbide inserts for efficient, long-wearing performance and can be redressed in various sizes.

The reverse-circulating and jetting tool is capable of withstanding pressures and flows common with coiled tubing operations.

Advantages

- Full large bore through tool
- Carbide nozzle inserts
- Swirl pattern jetting coverage
- Uses field-proven flapper system

SPECIFICATION GUIDE

Tool OD		Tool ID		Make Up Length		Standard Connection
in.	mm	in.	mm	in.	mm	
2.88	73.0	0.81	20.6	16.90	429.3	2-3/8-in. PAC DSI
3.50	88.9	1.00	25.4	21.49	546.8	2-3/8-in. PAC DSI



Reverse-Circulating and Jetting Tool
Product Family No. H13288

Hydraulic Tubing Punch

Product Family No. H13341

APPLICATION

The hydraulic tubing punch is used to punch a communication hole into tubing using only hydraulic pressure.

The hydraulic tubing punch is used in tubing perforating applications where explosives or chemicals are not desired. The hydraulic tubing punch will create one hole in the tubing when activated. It is recommended to run the tool directly below the hydraulic tubing anchor (product family no. H13226) to ensure punching stability. Hydraulic pressure has to be applied to activate the tool. The hydraulic tubing punch uses two pistons to apply a force to a penetrator. Once the tubing has been punched, pressure will bleed off while dogs release, allowing axial pull on the tool to be used to withdraw the penetrator from the tubing.

An emergency release sub has been designed to allow retrieval of the tool should the punch not be able to fully penetrate the tubing.

Advantages

- Positive tubing perforation using available hydraulic pressure
- Avoids need for explosive or chemical perforation
- Controlled perforation for communication with formation zones outside tubing
- Surface pressure indication of successful perforation
- Easy extraction of penetrator in preparation for next penetration
- Emergency release mechanism in case of jammed or partial penetration



Hydraulic Tubing Punch
Product Family No. H13341

Coiled Tubing Fluid Reservoir System

Product Family No. H33049

APPLICATION

The coiled tubing fluid reservoir system allows for the setting of inflatable products in unsuitable pipe fluids, gas wells, or anywhere the inflation fluid needs to be separated from threaded tubing, coiled tubing, or drill pipe. The coiled tubing reservoir system carries the compatible inflation fluid required to depth. It inflates the element in situations where separation from either the wellbore or from the running string provides the optimum operating conditions of the inflatable element. The design of the reservoir also makes it an ideal tool for dump bailing cement preventing the potential for cement contamination.

The coiled tubing reservoir system kit includes the parts for inflatable bridge plug, packer, and cement retainer applications.

Advantages

- Allows for the setting of inflatable products in unsuitable pipe fluids, gas wells, or anywhere inflation fluid needs to be separated from drill pipe, coiled tubing or threaded pipe
- Provides a benign inflation fluid for improved long-term and reliable inflation tool performance
- A simple and cost effective solution that may eliminate methods like grease plugs (which may dissipate at temperature)
- Offers an alternative method for thru-tubing applications that currently use fluid loading valves
- Ideal for low bottom hole pressure applications when using nitrogen in the string especially in highly deviated or horizontal wellbores
- Highly effective as a coiled tubing bailing system reducing contamination issues in small volume applications

SPECIFICATION GUIDE

Description	Size	
Tool OD	3.00 in.	76.2 mm
Thread Up	2.25-in. Acme Box	
Thread Down	2.25-in. Acme Pin	
Inter Housing Connection	2.75-in. Stub Acme	
Housing ID	2.416 in.	61.3 mm
Housing Volume	0.24 gal/ft	0.90 l/ft
Minimum flow area for packer/retainer application	0.311 $in.^2$	200 mm^2
Minimum flow area for Bridge Plug Application	0.567 $in.^2$	365.8 mm^2
Housing Tensile Strength	45,700 lb	20,729 kg
Maximum Temperature	300°F	149°C
Maximum Burst Pressure	8,500 psi	586 bar
Maximum Collapse Pressure	5,000 psi	344 bar
Makeup length with 3 housings (for 7.00-in. OD Tubing application)	31.54 in.	9.61 mm



Packer Application Bridge Plug Application

Reservoir System
Product Family No. H33049

Hydraulic-Releasing GS Spear and Slick Catch Spear

Product Family Nos. H13311 and H13310

APPLICATION

The hydraulic-releasing GS spear, specifically designed for thru-tubing fishing operations, is engineered to withstand the high tensile and compressive stresses encountered during jarring operations. These spears are designed to engage standard GS fish necks. The hydraulic-releasing slick catch spear, also engineered to withstand high tensile and compressive stresses, is used to engage slick ID fish necks.

A flow path is provided through the tool to allow circulation while running in the hole. Once the profile/slick ID fish is encountered, the flow path can be used to create a jetting action to wash debris from the profile/slick ID fish.

To engage the profile or the slick ID of a fish, minimal set-down weight is applied which moves the collets into the release position allowing it to enter the fish ID. Once the spear has adequately entered this ID, the collets or slip will snap into the catch position. To release from the fish or GS profile, increased flow rate will move the collet or slip into the release position.

Advantages

- Maximum ID on collets or slips
- High tensile strength
- Pump through capabilities
- No shear screws
- Minimized stress on collets or slips
- Tool can be released and re-latched repeatedly without tripping to surface



Hydraulic-Releasing GS Spear
Product Family No. H13311

SPECIFICATION GUIDE

Hydraulic-Releasing GS Spear

Tool OD		Fishing Neck Size (in.)	Make Up Length		Tensile Rating	Standard Connection
in.	mm		in.	mm	lb	
1.44	36.6	1.50 GS	21.88	555.8	23,000	3/4 in. CS Hydril
1.69	42.9	2.00 GS	18.11	460.0	30,000	1.00 in. AMMT
1.81	46.0	2.00 GS	18.11	460.0	30,000	1.00 in. AMMT
2.13	54.1	2.50 GS	20.60	523.2	50,000	1-1/2 in. AMMT
2.13	54.1	2.50 GS	20.60	523.2	50,000	1.75 in. 6 'P' Acme
2.25	57.2	2.50 GS	20.35	516.9	50,000	1-1/4 in. Reg
2.25	57.2	2.50 GS	20.35	516.9	50,000	1-1/4 in. AMMT
2.25	57.2	2.50 GS	20.35	516.9	50,000	1-1/4 in. AMMT (LH)
2.25	57.2	2.50 GS	20.35	516.9	50,000	1-1/2 in. AMMT
2.70	68.6	3.00 GS	23.91	607.3	63,000	1-1/4 in. Reg
2.70	68.6	3.00 GS	24.03	610.4	63,000	1-1/2 in. AMMT
2.88	73.0	3.00 GS	24.91	632.7	63,000	2-3/8 in. PAC DSI
3.00	76.2	3.00 GS	23.53	597.7	77,000	2.25 in. 5 'P' Acme
3.00	76.2	3.50 GS	22.13	562.1	77,000	2-3/8 in. PAC DSI
3.00	76.2	3.50 GS	22.13	562.1	77,000	2-3/8 in. Reg
3.13	79.4	3.00 GS	25.03	635.8	63,000	2-3/8 in. PAC DSI
3.13	79.4	3.00 GS	25.03	635.8	63,000	2-3/8 in. Reg
3.50	88.9	4.00 GS	22.63	574.8	95,000	2-3/8 in. PAC DSI
3.50	88.9	3.50 GS	22.63	574.8	95,000	2-3/8 in. PAC DSI
3.50	88.9	4.00 GS	22.63	574.8	95,000	2-3/8 in. Reg
3.50	88.9	3.50 GS	22.63	574.8	95,000	2-3/8 in. EU 8rd
4.50	114.3	5.00 GS	23.46	595.9	122,000	2-3/8 in. PAC DSI
4.50	114.3	5.00 GS	23.46	595.9	122,000	2-3/8 in. Reg

Slick Catch ID Spear

Tool OD		Catch Range		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.81	46.0	1.343 - 1.500	34.1 - 38.1	18.40	467.4	30,400	1 in. AMMT
2.00	50.8	1.440 - 1.625	36.5 - 41.3	18.40	467.4	30,400	1 in. AMMT
2.00	50.8	1.590 - 1.780	40.4 - 45.2	18.40	467.4	30,400	1 in. AMMT
2.25	57.2	1.750 - 1.970	44.5 - 50.0	20.42	518.7	66,400	1-1/2 in. AMMT
2.25	57.2	1.938 - 2.156	49.2 - 54.8	20.42	518.7	66,400	1-1/2 in. AMMT
2.70	68.6	2.113 - 2.279	53.7 - 57.9	22.03	559.6	97,700	1-1/2 in. AMMT
2.70	68.6	2.206 - 2.489	56.0 - 63.2	22.03	559.6	97,700	1-1/2 in. AMMT
3.00	76.2	2.460 - 2.810	62.5 - 71.4	22.63	574.8	99,000	2-3/8 in. Reg
3.38	85.7	2.794 - 3.080	71.0 - 78.2	24.13	612.9	99,000	2-3/8 in. Reg
3.38	85.7	2.900 - 3.190	73.7 - 81.0	24.13	612.9	99,000	2-3/8 in. Reg
3.50	88.9	3.125 - 3.375	79.4 - 85.7	24.13	612.9	149,600	2-3/8 in. Reg

Hydraulic-Releasing Overshot and Slick Catch Overshot

Product Family Nos. H13330 and H13331

APPLICATION

The hydraulic-releasing overshot is used to catch external JDC type fish necks and the slick catch overshot is used to catch slick OD profiles.

The tools are engineered to withstand high tensile and compressive stresses encountered during jarring operations. The overshot is engaged by applying slight set-down weight at the tool. A flow path is provided through the tool for circulation while running in the hole; this path can also be used to wash debris from the top of the fish or profile. In the event that retrieval is not possible, increased flow rate through the tool will allow release from the fish neck or profile ensuring no additional tools are left in the well.

Advantages

- High-strength
- Can be used for jarring operations
- Flow path permits washing debris from the top of the fish or profile
- No shear screws
- Design minimizes stress on the grapple section
- Tool can be released and re-latched repeatedly without tripping to surface



Slick Catch OD Overshot
Product Family No. H13330

SPECIFICATION GUIDE

Hydraulic-Releasing Overshot

Tool OD		External Fishing Neck Size (in.)	Make Up Length		Tensile Rating	Standard Connection
in.	mm		in.	mm	lb	
1.44	36.6	0.88	16.00	406.4	15,000	3/4 in. CS Hydril
1.44	36.6	1.00	16.00	406.4	17,000	3/4 in. CS Hydril
1.63	41.4	1.19	16.00	406.4	19,000	3/4 in. CS Hydril
1.81	46.0	0.88	17.38	441.5	12,000	1 in. AMMT
1.81	46.0	1.00	17.38	441.5	19,000	1 in. AMMT
1.81	46.0	1.19	17.38	441.5	24,000	1 in. AMMT
1.81	46.0	1.38	17.38	441.5	24,000	1 in. AMMT
2.13	54.1	1.38	13.38	351.3	28,000	1-1/2 in. AMMT
2.25	57.2	1.00	18.63	473.2	16,000	1-1/2 in. AMMT
2.25	57.2	1.19	18.63	473.2	21,000	1-1/2 in. AMMT
2.25	57.2	1.38	18.63	473.2	28,000	1-1/2 in. AMMT
2.28	57.9	1.75	19.19	487.4	24,000	1-1/2 in. AMMT
2.63	66.8	1.19	18.00	457.2	20,000	1-1/2 in. AMMT
2.63	66.8	1.38	18.00	457.2	30,000	1-1/2 in. AMMT
2.63	66.8	1.75	18.00	457.2	54,000	1-1/2 in. AMMT
2.75	69.9	1.75	18.60	472.4	54,000	1-1/2 in. AMMT
2.80	71.1	2.31	18.60	472.4	41,000	1-1/2 in. AMMT
2.88	73.0	2.00	24.00	609.6	46,000	2-3/8 in. PAC DSI
3.00	76.2	1.19	22.25	565.2	24,000	2-3/8 in. PAC DSI
3.00	76.2	1.38	22.25	565.2	32,000	2-3/8 in. PAC DSI
3.00	76.2	1.75	22.25	565.2	41,000	2-3/8 in. PAC DSI
3.00	76.2	2.31	22.25	565.2	59,000	2-3/8 in. PAC DSI
3.38	85.7	1.19	22.25	565.2	27,000	2-3/8 in. PAC DSI
3.38	85.7	1.38	22.25	565.2	34,000	2-3/8 in. PAC DSI
3.38	85.7	1.75	22.25	565.2	63,000	2-3/8 in. PAC DSI
3.38	85.7	2.31	22.25	565.2	86,000	2-3/8 in. PAC DSI
3.50	88.9	1.19	22.25	565.2	27,000	2-3/8 in. PAC DSI
3.50	88.9	1.38	22.25	565.2	34,000	2-3/8 in. PAC DSI
3.50	88.9	1.75	22.25	565.2	63,000	2-3/8 in. PAC DSI
3.50	88.9	2.31	22.25	565.2	86,000	2-3/8 in. PAC DSI
3.75	95.3	2.69	28.88	733.6	101,000	2-3/8 in. PAC DSI
3.75	95.3	2.75	29.00	736.6	117,000	2-3/8 in. PAC DSI
4.00	101.6	2.75	22.00	558.8	103,000	2-3/8 in. Reg
4.00	101.6	3.13	22.00	558.8	116,000	2-3/8 in. Reg
4.50	114.3	2.88	38.38	974.9	89,000	2-3/8 in. Reg

Slick Catch OD Overshot

Tool OD		Catch Size OD		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.81	46.0	0.88	22.2	19.68	499.9	37,000	1 in. AMMT
1.81	46.0	0.94	23.8	19.68	499.9	37,000	1 in. AMMT
1.81	46.0	1.00	25.4	19.68	499.9	37,000	1 in. AMMT
1.81	46.0	1.06	27.0	19.68	499.9	37,000	1 in. AMMT
1.81	46.0	1.13	28.6	19.68	499.9	37,000	1 in. AMMT
1.81	46.0	1.19	30.2	19.68	499.9	37,000	1 in. AMMT
1.81	46.0	1.25	31.8	19.68	499.9	37,000	1 in. AMMT
2.13	54.1	1.13	28.7	19.25	489.0	60,000	1-1/2 in. AMMT
2.13	54.1	1.25	31.8	19.25	489.0	60,000	1-1/2 in. AMMT
2.25	57.2	1.38	35.1	20.42	518.7	80,000	1-1/2 in. AMMT
2.63	66.8	1.25	31.8	20.94	531.9	87,000	1-1/2 in. AMMT
2.63	66.8	1.50	38.1	20.94	531.9	87,000	1-1/2 in. AMMT
2.63	66.8	1.75	44.5	20.94	531.9	87,000	1-1/2 in. AMMT
3.00	76.2	2.00	50.8	24.25	616.0	107,000	1-1/2 in. AMMT
3.00	76.2	2.13	54.1	24.25	616.0	107,000	1-1/2 in. AMMT
3.00	76.2	2.25	57.2	22.63	574.8	107,000	1-1/2 in. AMMT
3.50	88.9	2.25	57.2	24.42	620.3	182,000	2-3/8 in. Reg
3.50	88.9	2.38	60.5	24.42	620.3	182,000	2-3/8 in. Reg
3.50	88.9	2.50	63.5	24.42	620.3	182,000	2-3/8 in. Reg
3.75	95.3	2.88	73.0	23.62	599.9	155,000	2-3/8 in. Reg

Continuous Tubing Overshot

Product Family No. H13332



Continuous Tubing Overshot
Product Family No. H13332

APPLICATION

The continuous tubing overshot has been designed to allow fishing of coiled tubing that has been lost in the hole. The continuous tubing overshot has a catch or anchoring mechanism that washes over the top of the coiled tubing which has been left in the hole.

The continuous tubing overshot uses hardened grapple segments to catch the outside of the coiled tubing. These grapples slide over the coiled tubing when washing over and bite into the tubing when tension is applied to the workstring. Leaf springs attached to each grapple section hold the grapple in the expanded position away from the coiled tubing when the continuous tubing overshot is being moved down over the tubing to prevent wear on the grapple teeth. Once the grapple is engaged with the coiled tubing it can be pushed farther down the tubing to get a bite lower on the string.

Advantages

- Wide catch range
- May be run on threaded or coiled tubing
- Tensile yield equal to top connection

SPECIFICATION GUIDE

Tool OD		Coiled Tubing Size		Catch Diameter (in.)		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	max	min	in.	mm	lb	
1.858	47.2	1.00	25.4	Coil OD + 0.093	Coil OD - 0.063	24.75	628.7	42,000	1-1/4 in. CS Hydril
1.858	47.2	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	24.75	628.7	42,000	1-1/4 in. CS Hydril
2.250	57.2	1.00	25.4	Coil OD + 0.093	Coil OD - 0.063	24.75	628.7	62,000	1-1/2 in. CS Hydril
2.250	57.2	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	24.75	628.7	62,000	1-1/2 in. CS Hydril
2.625	66.7	1.00	25.4	Coil OD + 0.093	Coil OD - 0.063	23.63	600.2	80,000	1-1/2 in. CS Hydril
2.625	66.7	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	23.63	600.2	80,000	1-1/2 in. CS Hydril
2.625	66.7	1.50	38.1	Coil OD + 0.093	Coil OD - 0.063	23.63	600.2	80,000	1-1/2 in. CS Hydril
3.125	79.4	1.00	25.4	Coil OD + 0.093	Coil OD - 0.063	23.19	589.0	81,000	2-7/8 in. Hydril Special Clearance
3.125	79.4	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	23.19	589.0	81,000	2-7/8 in. Hydril Special Clearance
3.125	79.4	1.50	38.1	Coil OD + 0.093	Coil OD - 0.063	23.19	589.0	81,000	2-7/8 in. Hydril Special Clearance
3.125	79.4	1.75	44.5	Coil OD + 0.093	Coil OD - 0.063	23.19	589.0	81,000	2-7/8 in. Hydril Special Clearance
3.125	79.4	2.00	50.8	Coil OD + 0.093	Coil OD - 0.063	23.19	589.0	81,000	2-7/8 in. Hydril Special Clearance
3.375	85.7	1.00	25.4	Coil OD + 0.093	Coil OD - 0.063	23.34	592.8	14,000	2-7/8 in. CS Hydril
3.375	85.7	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	23.34	592.8	14,000	2-7/8 in. CS Hydril
3.375	85.7	1.50	38.1	Coil OD + 0.093	Coil OD - 0.063	23.34	592.8	14,000	2-7/8 in. CS Hydril
3.375	85.7	1.75	44.5	Coil OD + 0.093	Coil OD - 0.063	23.34	592.8	14,000	2-7/8 in. CS Hydril
3.375	85.7	2.00	50.8	Coil OD + 0.093	Coil OD - 0.063	23.34	592.8	14,000	2-7/8 in. CS Hydril

Snipper Overshot

Product Family No. H13334

APPLICATION

The snipper overshot has been designed to allow cutting and retrieval of a section of coiled tubing that has been left in a well. The snipper overshot has a catch and cutting mechanism which washes over the top of the coiled tubing. Once the recommended amount of coiled tubing is swallowed by the overshot, the fishing string will cut the tubing by applying overpull. The coiled tubing above the cut will be retrieved in the same trip.

The snipper overshot uses hardened grapple segments to catch the outside of the coiled tubing. These grapples slide over the coiled tubing when washing over and bite into the tubing when tension is applied to the workstring. Once the grapple is engaged with the coiled tubing it can be pushed farther down the tubing to get a bite lower on the string providing the cut has not been made.

Advantages

- Modular design for multiple sizes of coiled tubing
- Retrieves coiled tubing above cut in same trip
- High tensile strength
- Bowl and slip design for cutting and retrieval

SPECIFICATION GUIDE

Tool OD		Coiled Tubing Size		Catch Diameter(in.)		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	max	min	in.	mm	lb	
1.858	47.2	1.00	25.4	Coil OD 0.093	Coil OD - 0.063	26.60	675.6	40,000	1-1/4 in. CS Hydril
1.858	47.2	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	26.60	675.6	40,000	1-1/4 in. CS Hydril
2.250	57.2	1.00	25.4	Coil OD + 0.093	Coil OD - 0.063	34.97	888.2	62,000	1-1/2 in. CS Hydril
2.250	57.2	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	34.97	888.2	62,000	1-1/2 in. CS Hydril
2.625	66.7	1.00	25.4	Coil OD + 0.093	Coil OD - 0.063	35.63	905.0	78,000	1-1/2 in. CS Hydril
2.625	66.7	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	35.63	905.0	78,000	1-1/2 in. CS Hydril
2.625	66.7	1.50	38.1	Coil OD + 0.093	Coil OD - 0.063	35.63	905.0	78,000	1-1/2 in. CS Hydril
2.625	66.7	1.50	38.1	Coil OD + 0.093	Coil OD - 0.063	35.63	905.0	78,000	2-1/16 in. CS Hydril
3.166	80.4	1.00	25.4	Coil OD + 0.093	Coil OD - 0.063	37.18	944.40	91,000	2-7/8 in. CS Hydril Special Clearance
3.166	80.4	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	37.18	944.40	91,000	2-7/8 in. CS Hydril Special Clearance
3.166	80.4	1.50	38.1	Coil OD + 0.093	Coil OD - 0.063	37.18	944.40	91,000	2-7/8 in. CS Hydril Special Clearance
3.166	80.4	1.75	44.5	Coil OD + 0.093	Coil OD - 0.063	37.18	944.40	91,000	2-7/8 in. CS Hydril Special Clearance
3.166	80.4	2.00	50.8	Coil OD + 0.093	Coil OD - 0.063	37.18	944.40	91,000	2-7/8 in. CS Hydril Special Clearance
3.375	85.7	1.00	25.4	Coil OD + 0.093	Coil OD - 0.063	37.30	947.4	154,000	2-7/8 in. CS Hydril
3.375	85.7	1.25	31.8	Coil OD + 0.093	Coil OD - 0.063	37.30	947.4	154,000	2-7/8 in. CS Hydril
3.375	85.7	1.50	38.1	Coil OD + 0.093	Coil OD - 0.063	37.30	947.4	154,000	2-7/8 in. CS Hydril
3.375	85.7	1.75	44.5	Coil OD + 0.093	Coil OD - 0.063	37.30	947.4	154,000	2-7/8 in. CS Hydril
3.375	85.7	2.00	50.8	Coil OD + 0.093	Coil OD - 0.063	37.30	947.4	154,000	2-7/8 in. CS Hydril



Snipper Overshot
Product Family No. H13334

High-Pressure Pack-Off

Product Family No. H13333

APPLICATION

The high -pressure pack-off is designed to be used in conjunction with the continuous tubing and snipper overshot. The high-pressure pack-off is run directly above the overshot and provides a high-pressure seal [5,000 psi *(344.7 bar)*] between the coiled tubing being fished and the workstring. This allows efficient circulation capability down through the coiled tubing being fished, which may provide sufficient solids removal at the stuck point to free the tubing. The pressure tight seal between the coiled tubing and the workstring also allows a hydraulic release device to be operated in the bottomhole assembly which may allow the workstring to be pulled from the well if the stuck tubing could not be retrieved.

Advantages

- Allows high pressure circulation through a fish
- Packing rings are pressure energized
- May be manufactured with most tubing threads



High-Pressure Pack-Off
Product Family No. H13333

SPECIFICATION GUIDE

Tool OD		Coiled Tubing Size		Max Coiled Tubing OD	Max Burst Pressure	Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	psi	in.	mm	lb	
1.858	47.2	1.00	25.4	Coil OD + 0.031	10,000	12.77	324.4	44,000	1-1/4 in. CS Hydril
1.858	47.2	1.25	31.8	Coil OD + 0.031	10,000	12.77	324.4	52,000	1-1/4 in. CS Hydril
2.250	57.2	1.00	25.4	Coil OD + 0.031	18,000	12.77	324.4	62,000	1-1/2 in. CS Hydril
2.250	57.2	1.25	31.8	Coil OD + 0.031	18,000	12.77	324.4	62,000	1-1/2 in. CS Hydril
2.625	66.7	1.00	25.4	Coil OD + 0.031	18,000	13.50	342.9	62,000	1-1/2 in. CS Hydril
2.625	66.7	1.25	31.8	Coil OD + 0.031	18,000	13.50	342.9	62,000	1-1/2 in. CS Hydril
2.625	66.7	1.50	38.1	Coil OD + 0.031	18,000	13.50	342.9	108,000	1-1/2 in. CS Hydril
2.625	66.7	1.50	38.1	Coil OD + 0.031	20000.0	13.50	342.9	108,000	2-1/16 in. CS Hydril
3.125	79.4	1.00	25.4	Coil OD + 0.031	24,000	12.36	313.9	91,000	2-7/8 in. CS Hydril Special Clearance
3.125	79.4	1.25	31.8	Coil OD + 0.031	24,000	12.36	313.9	91,000	2-7/8 in. CS Hydril Special Clearance
3.125	79.4	1.50	38.1	Coil OD + 0.031	24,000	12.36	313.9	91,000	2-7/8 in. CS Hydril Special Clearance
3.125	79.4	1.75	44.5	Coil OD + 0.031	24,000	12.36	313.9	91,000	2-7/8 in. CS Hydril Special Clearance
3.125	79.4	2.00	50.8	Coil OD + 0.031	24,000	12.36	313.9	91,000	2-7/8 in. CS Hydril Special Clearance
3.375	85.7	1.00	25.4	Coil OD + 0.031	32,000	10.49	266.5	154,000	2-7/8 in. CS Hydril
3.375	85.7	1.25	31.8	Coil OD + 0.031	32,000	10.49	266.5	154,000	2-7/8 in. CS Hydril
3.375	85.7	1.50	38.1	Coil OD + 0.031	32,000	10.49	266.5	154,000	2-7/8 in. CS Hydril
3.375	85.7	1.75	44.5	Coil OD + 0.031	32,000	10.49	266.5	154,000	2-7/8 in. CS Hydril
3.375	85.7	2.00	50.8	Coil OD + 0.031	32,000	10.49	266.5	154,000	2-7/8 in. CS Hydril

Series 150 Overshot

Product Family No. H11507

APPLICATION

Series 150 overshots provide the strongest tool available to externally engage, pack-off and pull a fish. The basic simplicity and rugged construction with which it is designed have made it the standard of all external catch fishing tools. The Series 150 overshot has gained worldwide acceptance for fishing by means of external engagement of a fish. Each overshot is a carefully engineered unit. In service, it takes a positive grip over a large area of fish and is therefore capable of withstanding extremely heavy pulling, torsional and jarring strains without damage or distortion to either the tool or the fish. Overshots are expertly constructed of the highest quality material and continually developed to new standards of strength and efficiency. Each Series 150 overshot is a compact unit designed to engage, pack off and pull a specific size of tubing, pipe, coupling, tool joint, drill collar or smooth OD tool. Through the installation of proper undersize parts, they may be adapted to engage and pack off any smaller size.



Packer



Spiral Grapple



Spiral Grapple Control



Series 150 Overshot with Spiral Grapple
Product Family No. H11507

Series 70 Short Catch Overshot

Product Family No. H11230

APPLICATION

The Series 70 short catch overshot is specifically designed to engage the exposed portion of a fish too short to be engaged with conventional catch overshots and where conditions prevent lowering the overshot past the fish. This tool will firmly engage a very short fish.

The four pieces comprising the assembly cannot be incorrectly assembled. This tool is simple and rugged.

Each assembly is designed to catch a specific maximum OD and each assembly may be dressed with an undersize grapple to engage any diameter smaller than maximum.

The operation of the Series 70 short catch overshot is identical to that of the well known Series 150 overshot: engagement is effected by slowly lowering the assembly over the fish while maintaining slow right hand rotation; release is accomplished by bumping down heavily and then slowly elevating the fishing string while simultaneously rotating slowly to the right.



Series 70 Short Catch Releasing Overshot
Product Family No. H11230

Series 10 Sucker Rod Overshot

Product Family No. H11210

APPLICATION

The Series 10 sucker rod overshot is the best available tool for engaging and retrieving sucker rods, couplings, and similar items from inside tubing strings. The Series 10 overshot is available in sizes to engage up to 2 in. OD inside of 2-7/8 in. tubing and up to 1-5/8 in. OD inside 2-3/8 in. tubing. The Series 10 overshot consists of a top sub, a bowl, a spiral grapple and a control guide. When a basket grapple is used in the Series 10 assembly, a basket grapple control and a plain guide are required.



Series 10 Overshot with Basket Grapple
Product Family No. H11210



Series 10 Overshot with Spiral Grapple
Product Family No. H11210

Series 20 Short Catch Sucker Rod Overshot

Product Family No. H11220

APPLICATION

The Series 20 short catch sucker rod overshot is designed to catch sucker rods, couplings, and the exposed portions of other items which are too short to be engaged by the Series 10 or other conventional overshots. The Series 20 overshot consists of a top sub, a bowl, a grapple control and a basket grapple. It differs from the Series 10 in that there is no guide and the grapple control is above the basket grapple, permitting the basket grapple to be placed at the lowest position in the bowl.

Operation of the Series 20 short catch overshot is identical to that of the Series 10 overshot.



Series 20 Short Catch Sucker Rod Overshot
Product Family No. H11220

Itco-Type Spear

Product Family No. H12210

APPLICATION

Itco-type spears provide a dependable, inexpensive, and simple means of engaging a fish internally.

The itco-type spear consists of a mandrel, grapple, release ring and nut. The Mandrel may be obtained in either a flush type or a shoulder type. Mandrel top connections are furnished to order. The nut can be obtained as a plain bull-nose guide or with a pin connection for the attachment of other tools below the spear.



Itco Type Spear
Product Family No. H12210

Rope Spears

Product Family Nos. H12028, H12128, H12228, and H12229

APPLICATION

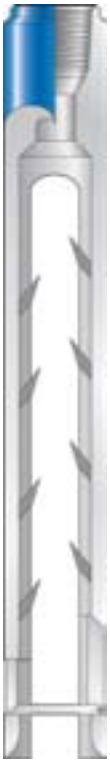
Rope spears are wireline fishing tools designed for fishing wire through restrictions or wire that has become balled up.

The tools are manufactured from high tensile steel so that the prongs may be forced down into or around a reasonably compacted ball of wire. The design incorporates barbs on the ID only so that wire on the outside of the tools may be easily pulled down rather than having to yield the wire creating smaller unfishable pieces.

Similar spears are manufactured without the latch in two and three prong designs.

Advantages

- Tools will fish wire through restrictions
- Tools will fish balls of wire without creating smaller broken pieces of wire
- Manufactured from AISI 4140 heat-treated alloy steel



Latch Jack Spear
Product Family No. H12228

Center Prong and Crankshaft Rope Spear

Product Family Nos. H12028 and H12229

APPLICATION

The rope spear is a reliable and efficient wireline and wire rope retrieval tool. The rope spear retrieves all sizes of electric wireline, slick line, braided line or other types of wire rope that have been left downhole. It can also be used to retrieve control line or ESP cable that has been left downhole. This tool has been very successful in recovering these items in cased or open hole.

Note: It is recommended that a wire pusher always be run above the tool. It is recommended not to run this tool out of the bottom of the tubing end.

Advantages

- One of the industry's most reliable, efficient tools for retrieving wireline
- Proven track record of hundreds of successful runs and many years of maintenance free service
- Retrieves cut wireline and rope still attached to a tool stuck downhole



Center Prong Rope Spear
Product Family No. H12028



Crankshaft Rope Spear
Product Family No. H12229

Bulldog Overshot

Product Family No. H11107

APPLICATION

The bulldog overshot is designed for straight pick-up only of a fish with ODs too large to be caught by any other method. The overshot is a simple design, which incorporates a C grapple. The overshot can be manufactured in one or two pieces. The bulldog overshot is not releasable and has limited tensile and torsional strengths.

Advantages

- Smallest ratio of fish OD to overshot OD
- Simple design



Bulldog Overshot
Product Family No. H11107

SPECIFICATION GUIDE

Tool OD		Maximum Catch OD		Make Up Length		Tensile Rating	Standard Connection
in.	mm	in.	mm	in.	mm	lb	
1.875	47.6	0.375	9.00	228.6	36,650	1-1/4 in. CS Hydril	1-1/4 in. CS Hydril
1.875	47.6	0.500	9.00	228.6	36,650	1-1/4 in. CS Hydril	1-1/4 in. CS Hydril
1.875	47.6	0.750	9.00	228.6	36,650	1-1/4 in. CS Hydril	1-1/2 in. CS Hydril
1.875	47.6	1.000	9.00	228.6	36,650	1-1/4 in. CS Hydril	1-1/2 in. CS Hydril
1.906	48.4	0.750	10.00	254.0	35,240	1-13/16 in. Homco FJ	1-1/2 in. CS Hydril
1.906	48.4	1.000	10.00	254.0	35,240	1-13/16 in. Homco FJ	1-1/2 in. CS Hydril
2.000	50.8	0.750	8.30	210.8	26,600	1-1/2 in. AMMT	1-1/2 in. CS Hydril
2.000	50.8	0.875	8.30	210.8	26,600	1-1/2 in. AMMT	2-1/16 in. CS Hydril
2.125	54.0	1.062	23.60	599.4	31,700	1-1/2 in. CS Hydril	2-7/8 in. CS Hydril Special Clearance
2.125	54.0	1.250	23.60	599.4	31,700	1-1/2 in. CS Hydril	2-7/8 in. CS Hydril Special Clearance
2.797	71.0	1.500	23.60	599.4	30,800	2-3/8 in. CS Hydril	2-7/8 in. CS Hydril Special Clearance
3.375	85.7	2.875	13.50	342.9	48,000	2-3/8 in. Reg	2-7/8 in. CS Hydril Special Clearance
3.375	85.7	2.875	13.50	342.9	48,000	2-3/8 in. PAC DSI	2-7/8 in. CS Hydril Special Clearance
3.640	92.5	3.145	14.25	362.0	26,500	2-3/8 in. Reg	2-7/8 in. CS Hydril

Navi-Drill X-treme Workover Motor

Product Family No. H13283

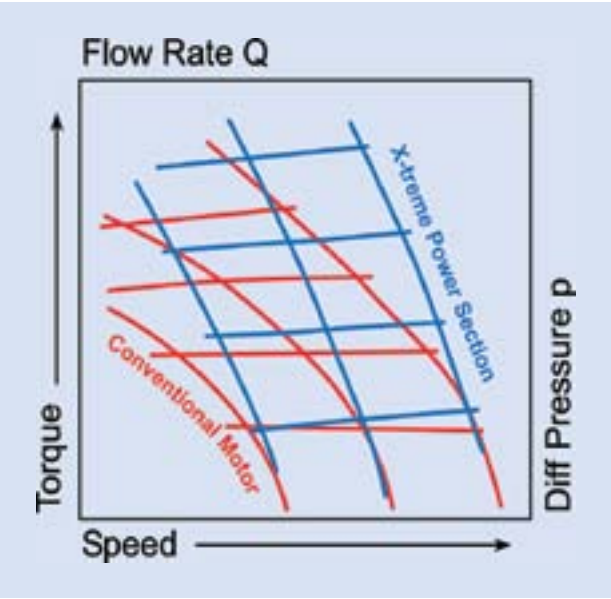
APPLICATION

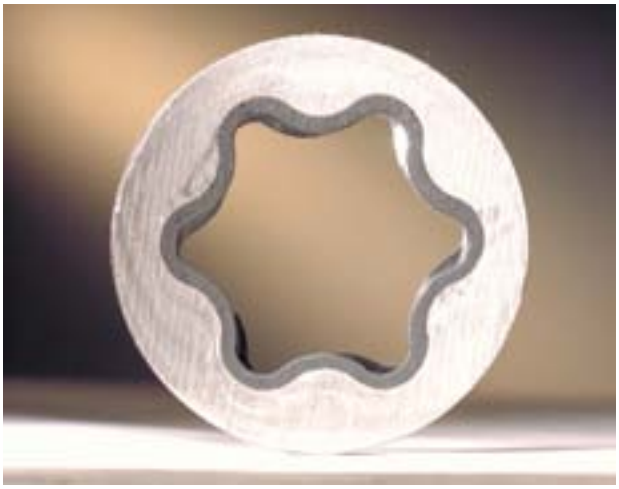
The Navi-Drill™ X-treme™ is the new generation, reduced length workover motor that lowers customer well intervention costs by applying new equidistant power section technology which provides unmatched performance at lower operating pressures than any other workover motor.

The Navi-Drill X-treme is operated as a positive displacement motor, which can operate in temperatures up to 392°F *(200°C)*.

Proprietary equidistant power section technology provides the motor with greatly increased torque and optimum rpm at lower operating pressures. This also allows the motor to be run in more hostile and higher temperature environments. The Navi-Drill X-treme has a similar modular design to the existing Navi-Drill VIP™, offering a broad operating range.

The Navi-Drill X-treme can be configured for fluid, foam, or gas (low torque/high speed, high torque/low speed, high torque/high speed). Components such as the bearing package and drive shaft have been designed to allow the motor to run under higher stress applications such as window milling. The overall motor length can be reduced to suit short riser deployment applications when required.





Navi-Drill X-treme Workover Motor
Product Family No. H13283

Advantages

- Increased performance
- Modular design for customized operations
- Increased reliability in high stress applications
- Short length
- May be powered by fluid/air/foam
- Capable of operating in temperatures up to 392°F *(200°C)*

The X-treme workover motor; the power behind delivering what matters for thru-tubing milling and cutting solutions:

- Equidistant stator technology for increased on bottom performance and reliability
- Ideal for hostile and high temperature environments
- Faster rate of penetration

Three different types of X-treme motors address different application requirements: For restricted riser height applications - the X-treme XS motor is a reduced length motor that provides optimum performance output for short rig-up heights. For reduced on-bottom milling times - the X-treme X motor is a standard length motor with significantly higher operational torque output than conventional workover motors. For foam, nitrogen or air operations - the X-treme AD motor is designed for use with foam or gas (nitrogen or air) for underbalanced well intervention applications. However, when operated with fluid the motor will provide ultra-high torque/low speed.

OPERATING SPECIFICATION GUIDE

X-treme Workover Motor

OD		Power Section	Standard Connection	Make Up Length		Flow		Speed	Op. △P ■		Op. Torque ■		Temperature	
in.	mm			ft	m	gpm	lpm	rpm	psi	bar	ft-lb	Nm	°F	°C
1.69	42.9	XS	1 in. AMMT	5.51	1.68	50	190	640	435	30	75	105	392	200
		X		7.64	2.33	50	190	640	870	60	150	205	392	200
		AD		8.33	2.54	40	150	350	725	50	180	245	392	200
2.13	54.1	XS	1-1/2 in. AMMT	5.94	1.81	65	250	600	435	30	105	145	392	200
		X		8.17	2.49	65	250	600	1,015	70	250	340	392	200
		AD		9.55	2.91	45	175	300	1,015	70	350	475	392	200
2.88	73.2	XS	2-3/8 in. API Reg or 2-3/8 in. PAC DSI	7.80	2.38	120	450	490	580	40	310	420	392	200
		X		10.63	3.24	120	450	490	1,160	80	620	845	392	200
		AD		12.60	3.84	85	325	250	1,160	80	885	1,200	392	200

■ *Operating pressure and operating torque are the maximum values the motor should be run at for continuous operation.*

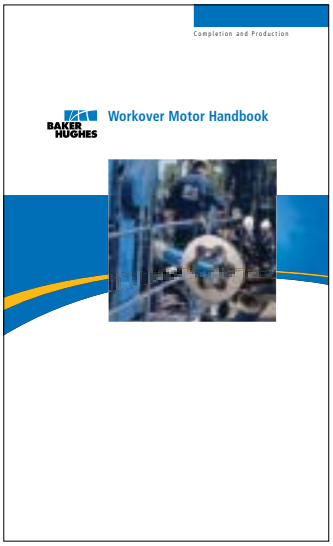
Note: XS = short; X = standard length (mud); AD = air motor

PEAK PERFORMANCE SPECIFICATION GUIDE

X-treme Workover Motor

Tool OD		Power Section	Maximum Torque ■		Maximum △P ■		Stall Torque		Stall △P	
in.	mm		ft-lb	Nm	psi	bar	ft-lb	Nm	psi	bar
1.69	42.9	XS	95	130	545	37.5	115	155	655	45
		X	190	260	1,090	75	230	310	1,305	90
		AD	225	305	905	62.5	270	365	1,090	75
2.13	54.1	XS	135	180	545	37.5	160	220	655	45
		X	315	425	1,270	87.5	375	510	1,525	105
		AD	440	595	1,270	87.5	525	710	1,525	105
2.88	73.2	XS	390	530	725	50	470	635	870	60
		X	830	1,125	1,450	100	935	1,270	1,740	120
		AD	1,105	1,500	1,450	100	1,330	1,800	1,740	120

■ *Maximum pressure and maximum torque are the maximum values the motor can be operated at for a short period of time, taking increased wear rates into account.*



Workover Motor Handbook

Navi-Drill VIP Workover Motor

Product Family No. H13280

APPLICATION

The Navi-Drill™ VIP™ (versatile increased performance) workover motor series incorporates a PDM design with modular capabilities and fit for purpose power section configurations. The Navi-Drill VIP can be configured and aligned to suit a wide range of thru-tubing applications.

The Navi-Drill VIP is a versatile design incorporating separate stator, top sub and bearing housing to allow plug and play of new modular power sections, tailored to suit specific work over applications. The modular design allows the use of proprietary fluid and air power section technology that addresses most well bore temperature ranges and compatibility with well bore fluids. The air power sections specifically address single and two-phase flow applications with nitrogen. A new design 30% higher strength drive sub also increases the ability of the motor to withstand the most severe cyclic and bending stresses encountered during operations.

The operating pressures and flow rates required to run the Navi-Drill VIP are aligned with coiled tubing and slim pipe to achieve optimum horsepower. Slower rotational speeds improve performance of milling and cutting products and increase reliability during workover operations such as milling, underreaming, cutting, wash over, or any other operation requiring rotation of a down hole assembly.

Advantages

- Modular design for customized operations
- Controlled rotational speeds protects cutting matrix
- Increased reliability in high end applications, (i.e., window milling)
- Proprietary stator technology
- May be powered by fluid/air/foam
- Capable of operating in temperatures over 300°F *(149°C)*

PEAK PERFORMANCE CHART

VIP Workover Motor

Tool OD		Power Section	Maximum Torque		Maximum ΔP	
in.	mm		ft-lb	Nm	psi	bar
1.69	42.9	M1V	105	145	650	45
1.69	42.9	M1ADV	95	130	380	26
2.13	54.0	M1V	225	305	1025	70
2.13	54.0	M1ADV	190	255	380	26
2.88	73.0	M1V	670	910	1280	88
2.88	73.0	M1ADV	470	635	380	26
3.38	85.7	M1W2	1150	1560	1390	95
3.38	85.7	M1ADM	1	16	28	705

OPERATING SPECIFICATIONS

VIP Workover Motor

Tool OD		Power Section	Standard Connection	Make Up Length		Flow Rate		Speed	Differential Pressure		Torque	
in.	mm			ft	m	gpm	lpm	rpm	psi	bar	ft-lb	Nm
1.69	42.9	M1V	1 in. AMMT Box x Box	9.37	2.86	12-50	45-190	155-640	400	28	66	90
		M1ADV						100-410	230	16	59	80
2.13	54.1	M1V	1-1/2 in. AMMT Box x Box	11.38	3.47	17-74	65-280	160-700	640	44	140	190
		M1ADV						70-300	230	16	120	160
2.88	73.2	M1V	2-3/8 in. PAC DSI Box x Box ✷	11.98	3.65	25-120	100-450	95-440	800	55	420	570
		M1ADV						40-185	290	20	360	490
3.38	85.8	M1W1	2-7/8 in. PAC DSI Box x 2-3/8 in. API Reg Box	16.78	5.11	80-160	300-600	130-365	800	55	720	975
		M1ADM						65-125	290	20	710	960

✷ *Also available as 2-3/8 in. API Reg Box x Box*

SUPERLOY



SUPERLOY

APPLICATION

SUPERLOY™ is made of crushed, sintered tungsten particles that are suspended in a special copper base brazing-type alloy with high nickel content. Tungsten carbide is the finest milling material available for downhole steel cutting or milling tools.

SUPERLOY is used for all types of downhole cutting and milling. We provide junk mills of all types and sizes, rotary shoes for all sizes, and tapered and string mills of various ODs.

SUPERLOY works well on milling loose junk, removing composite devices, such as bridge plugs and frac plugs, and is ideal for use on watermelon and string mills for effective casing exits.

METAL MUNCHER



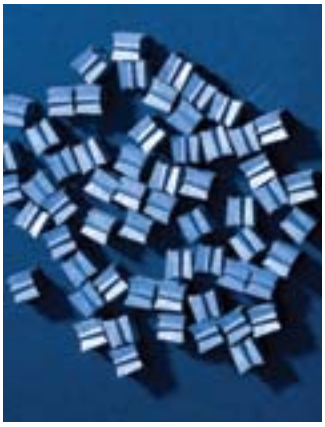
METAL MUNCHER

APPLICATION

In 1985 the fishing industry changed with the introduction of the METAL MUNCHER™ carbide insert. This insert and its patented application for milling tools have increased penetration rates and mill life by as much as 1000%. METAL MUNCHER buttons, as they are referred to, are made by pressing tungsten carbide powder into a mold and heating them in a furnace. The design of the button allows downhole milling similar to what is done using a machine shop lathe.

METAL MUNCHER cutting structures are used primarily on turbo scale mills, step mills, window mills, and junk mills. With the controlled cutting angle and chip breaking features, these mills can be effective on high content chrome steels and are engineered to cut the metal away instead of grinding it. METAL MUNCHER mills produce small, uniform cuttings which eliminate bird nesting and make it easier to circulate the cuttings out of the well. Using this technology, the weight on the mill required can be significantly reduced making it an ideal cutting structure for coiled tubing applications.

Opti-Cut



Opti-Cut

APPLICATION

Opti-Cut™ is an improvement over the traditional SUPERLOY randomly crushed carbide cutters currently in use today. In some very specialized applications they may also be used in place of the METAL MUNCHER insert. The cutters are designed to act much like SUPERLOY, but are no longer randomly shaped. Each piece has identical geometry optimized so that no matter how the cutter is placed on the body of the cutting or milling edge, there is always a sharp cutting edge and/or point looking down. As the cutter is worn down, new cutting edges and points are exposed. The new cutter has a total of sixteen cutting points and eight cutting edges.

Applications for Opti-Cut are similar to the applications for SUPERLOY and are extremely effective in removing composite material as well as milling junk in the hole.

Diamonds

APPLICATION

The application of synthetic polycrystalline diamond compact (PDC) and surface set diamonds for milling tools provides an alternative for cutting and milling operations involving hard material or hard formations. PDC inserts are used in underreaming operations where hard formation or long sections are to be underreamed. Mills and shoes are dressed with surface set diamonds to meet special applications involving hard material or where extra long mill life is required. Diamond speed mills are commonly used to cut hard material and formation together. Diamond rotary shoes are commonly used to cut over stuck BHA with hardened or insert type stabilizers.



PDC Insert Bit

What is polycrystalline diamond?

Polycrystalline diamond consists of a layer of diamond integrally bonded to a carbide substrate. The diamond layer provides high hardness and abrasion resistance, whereas the carbide substrate improves the toughness and weldability.

Polycrystalline diamond is a synthesized, extremely tough, intergrown mass of randomly orientated diamond particles in a metal matrix. It is produced by sintering together selected diamond particles at high pressure and temperature. The sintering process is rigidly controlled within the diamond stable region and an extremely hard and abrasion resistant structure is produced.

Natural Diamond Bits

APPLICATION

Diamond speed mills (DSM) have a long track record of successful use in coiled tubing casing exits. These unique designs allow the DSM to smoothly cross the casing wall as it moves off the whipstock and into the formation. The durable natural diamond cutting structure works well with the high RPM and low WOB characteristic of coiled tubing applications. Baker Hughes provides many sizes and types of natural diamond drill bits for slim-hole, hard formation drilling.



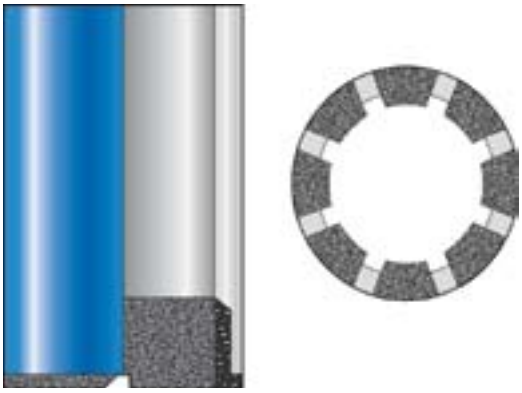
Natural Diamond Bits

Baker Hughes Rotary Shoes

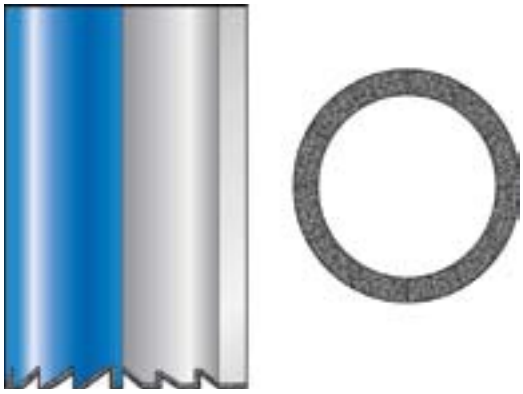
Product Family Nos. H15008, H15010, H15013, and H15014

APPLICATION

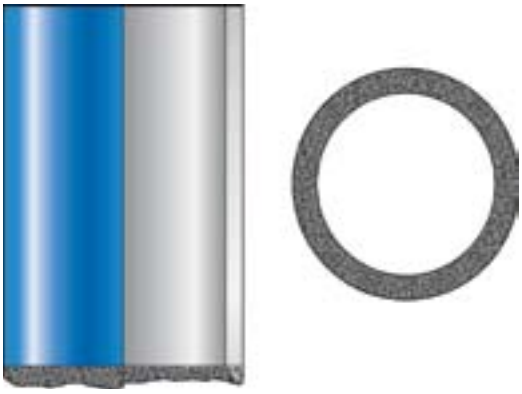
Baker Hughes rotary shoes are made from heat-treated alloy steel and dressed with SUPERLOY, METAL MUNCHER, or Opti-Cut. They are used on the bottom of washpipe in washover or milling operations. The specific application will dictate the type shoe best suited for the job.



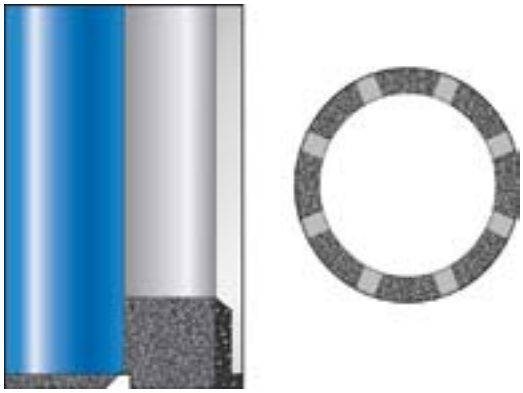
Type D Rotary Shoe (Flat Bottom)
Similar to the Type C shoe, the Type D rotary shoe has an internal upset for use where clearance permits. This shoe cuts on the inside and bottom only.



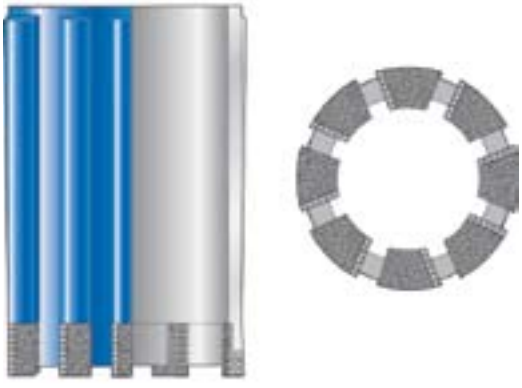
Type B Rotary Shoe (Tooth Type)
The Type B rotary shoe is used for washing over. Mill tooth design permits maximum circulation consistent with limited clearances. This shoe cuts on the bottom only.



Type K Rotary Shoe
The Type K rotary shoe (scallop bottom) is used to wash over and cut on the bottom face only. Does not cut on the ID or OD..



Type C Rotary Shoe (Flat Bottom)
The Type C rotary shoe is used to cut metal on the fish where clearances are small. This shoe cuts on the inside and bottom only.



METAL MUNCHER Rotary Shoe (Crown Type)
The METAL MUNCHER rotary shoe is used to wash over and cut on the bottom face and ID only.

Bladed Junk Mill

Product Family No. H15106

APPLICATION

Bladed junk mills dressed with SUPERLOY and/or Opti-Cut junk mills that are offered by Baker Hughes are designed for the milling of debris where milling inserts are considered too aggressive. These mills operate very well in the removal of composite bridge plugs such as the QUIK Drill™. Opti-Cut dressed mills use the patented Opti-Cut star shaped insert that is ideal for use on workover motor operations since it creates small cuttings and does not need high set down weight to perform optimally. Baker Hughes offers a variety of sizes and configurations accommodating all common casing and tubing sizes.

Advantages

- Increased mill life
- Smaller cuttings
- Accommodates motor operations



Bladed Junk Mill SUPERLOY
Product Family No. H15106

Turbo Scale Mill

Product Family No. H15101

APPLICATION

The turbo scale mill is designed for the removal of scale using a coiled tubing deployed workover motor. The unique mill face design proves to be extremely effective and has been used for the economical removal of any scale type, including barium sulfate and other hard scales. The design allows for only a small contact area which results in low torque consumption to reduce stalling of the motor. Stabilizers on the body behind the milling matrix reduce the risk of damaging the tubing or casing wall. The turbo scale mill has been built in various sizes and configurations.

Advantages

- Unique mill face design
- Multiple cutting matrices available
- Small contact area for low torque consumption
- Non-aggressive to tubing wall through stabilization



Turbo Scale Mill
Product Family No. H15101

METAL MUNCHER Step Mill

Product Family No. H15113

APPLICATION

The METAL MUNCHER™ step mill is designed for the removal of nipple profiles using a coiled tubing deployed workover motor. The design proves to be extremely effective and has been used for the economical removal of any ID restriction, including barium sulfate and other scales. The design allows for only a small amount of cutting per OD increase in the mill. The step feature not only keeps torque and cutting size to a minimum, but also leaves a machine like finish on the surface milled. Wear pads at the largest OD of the mill reduce risk of damage to the tubing or casing string.

The step mill has been built in sizes ranging from 1-1/2 in. *(38.1 mm)* – 8-1/2 in. *(215.9 mm)* OD. The mill may be manufactured with a pilot for additional stabilization.

Advantages

- Low torque requirements for milling
- Machine like finish left on milled surface
- Longer mill life
- Will not damage outer string



METAL MUNCHER Step Mill
Product Family No. H15113

METAL MUNCHER Junk Mill

Product Family No. H15102

APPLICATION

The METAL MUNCHER™ junk mill is designed for the milling of several types of obstructions and loose debris. The METAL MUNCHER junk mill utses the patented METAL MUNCHER cutting technology for maximum rate of penetration and extended mill life. The mill design is ideal for motor operations because of low weight, high speed operations. There are a variety of designs which will meet most milling applications, with special designs manufactured on request. Baker Hughes maintains a large and varied inventory which will accommodate most casing and tubing sizes.

Advantages

- Increased penetration rates
- Increased mill life
- Smaller cuttings
- SUPERLOY backing



METAL MUNCHER Junk Mill
Product Family No. H15102

BO Style Mill

Product Family No. H15106

APPLICATION

The BO style mill is used in conjunction with the Navi-Drill™ series workover motors to form an optimized coiled tubing deployed system for the efficient removal of composite devices from the wellbore. The primary characteristic of the BO style mill is the cluster of SUPERLOY™ placed slightly off center point on the mill face for optimum performance when removing composite bridge plugs and composite frac plugs. The mill can be dressed with several different lightly concaved low aggression face configurations to accommodate a variety of milling applications.

A combination of size and the deign of the off center cluster of SUPERLOY allow the BO style mill to operate eccentrically during milling operations which produces a self cleaning milling environment that constantly exposes fresh cutting areas. The BO style mill can be dressed with SUPERLOY, Opti-Cut, or METAL MUNCHER inserts.



BO Style Mill
Product Family No. H15106

DB Underreamer/Cutter

Product Family No. H15097

APPLICATION

The DB underreamer/cutter was designed to underream scale or cement from cased- or openhole with or without the need for a pilot hole and also designed to cut pipe, tubing and Baker Hughes cut to release premier packers. The tool incorporates three blades that are forced outwards by either weight on bit or applied pressure, which assist in centralizing the tool in the hole during operation.

The back pressure achieved by flow rate through sized orifices in the tool forces the knives out and locked open making the tool ideal for backreaming when used as an underreamer.

When performing a cutting operation, the force required to open the knives is provided by means of pressure only. A variety of knife styles and insert configurations are available to provide a fit for purpose cutting solution for standard or exotic material such as 13% chrome, 25% super duplex chrome, SM2535, and inconel 718.

The tool is available in three different versions: the standard DB with one internal adjustable orifice, the DB with adjustable orifices for the flow ports that spray over the knives, and the DB with a bit box which gives the ability to attach a mill for desired milling matrix.



DB Underreamer/Cutter
Product Family No. H15097

Advantages

- Maximum flow after tool is opened
- Blades designed with METAL MUNCHER matrix
- Sturdy construction for downhole reliability
- Positive indication when blades reach full gauge
- Adjustable nozzles for all flow ports

SPECIFICATION GUIDES

Standard DB Underreamer/Cutter

Tool OD		Maximum Open Gauge		Standard Connection
in.	mm	in.	mm	
2.13	54.1	6.23	158.2	1-1/4 in. API Reg
2.13	54.1	6.23	158.2	1-1/2 in. AMMT
2.25	57.2	6.23	158.2	1-1/4 in. API Reg
2.25	57.2	6.23	158.2	1-1/2 in. AMMT
2.63	66.8	8.12	206.2	1-1/2 in. AMMT
3.00	76.2	8.60	218.4	2-3/8 in. PAC DSI
3.63	92.2	9.99	253.7	2-3/8 in. PAC DSI
3.63	92.2	9.99	253.7	2-3/8 in. API Reg
5.13	130.3	12.00	304.8	3-1/2 in. API Reg

DB Underreamer/Cutter With Adjustable Nozzles

Tool OD		Maximum Open Gauge		Standard Connection
in.	mm	in.	mm	
2.63	66.8	8.12	206.2	1-1/2 in. AMMT
3.00	76.2	8.60	218.4	2-3/8 in. PAC DSI
3.63	92.2	9.99	253.7	2-3/8 in. PAC DSI
3.63	92.2	9.99	253.7	2-3/8 in. API Reg

DB Underreamer/Cutter With Bit Box

Tool OD		Maximum Open Gauge		Standard Connection
in.	mm	in.	mm	
2.63	66.8	8.12	206.2	1-1/2 in. AMMT
3.00	76.2	8.60	218.4	2-3/8 in. PAC DSI
3.63	92.2	9.99	253.7	2-3/8 in. PAC DSI
3.63	92.2	9.99	253.7	2-3/8 in. API Reg

Hydraulic Tubing Cutter

Product Family No. H17003

APPLICATION

The hydraulic tubing cutter is a pressure-activated internal cutter designed to cut small diameter pipe and tubing. The tool provides a safe alternative to chemical and explosive cutters. The cutters are recommended in high-angle holes where friction and drag may restrict mechanical or wireline cutter operations.

Advantages

- Knives are extended by hydraulic pressure and do not require mechanical slips
- A three-knife design stabilizes the cutter and reduces the risk of missed cuts
- Provides safe alternative to explosive or chemical cutters
- Recommended for high-angle holes where friction and drag may restrict mechanical and wireline type cutters
- Bottom subs with ID and check valve are available
- Can be deployed on threaded or coiled tubing workstring

SPECIFICATION GUIDE

Tool OD		Tubing Range		Maximum Knife Swing		Make Up Length		Standard Connection
in.	mm	in.	mm	in.	mm	in.	mm	
1.81	46.0	2.375	60.3	2.500	63.5	22.00	558.8	1 in. AMMT
1.88	47.8	2.375	60.3	3.625	92.1	32.00	812.8	1 in. AMMT
2.13	54.0	2.875	73.0	3.625	92.1	29.00	736.6	1-1/2 in. AMMT
2.13	54.0	3.500	88.9	4.375	111.1	29.00	736.6	1-1/2 in. AMMT
2.50	63.5	3.500	88.9	4.875	123.8	33.00	838.2	1-1/2 in. AMMT



Hydraulic Tubing Cutter
Product Family No. H17003

SR2 Underreamer

Product Family No. H15028

APPLICATION

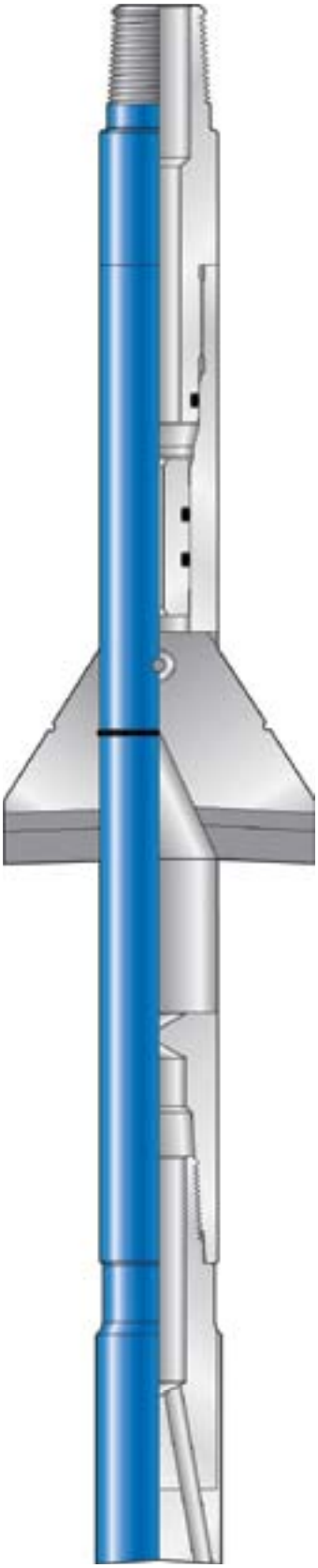
The SR2™ underreamer (simple robust and reliable) is designed to pass through small diameter production tubing and underream to full gauge in the casing below the tubing. The underreamer allows removal of sand, cement, scale, cast iron, and composite bridge plugs without pulling the production tubing. The SR2 Underreamer is a 2-bladed underreamer provided with a bit box, which gives the ability to attach a mill with the desired milling matrix.

The SR2 underreamer is used in conjunction with a positive displacement motor and can be deployed on either coiled tubing or small threaded pipe.

The blades of the SR2 underreamer are actuated by flow; a pressure drop through the tool will activate the piston that pushes out the knives. A flow path is provided through the tool body for circulation through the mill.

Advantages

- Small OD
- Large expanded gauge
- Simple design
- Flow path through the mill
- Interchangeable mill
- SR2 underreamers can be run in tandem



SR2 Underreamer
Product Family No. H15028

Hydraulic/Mechanical Tubing Anchor

Product Family No. H13226

APPLICATION

The hydraulic/mechanical tubing anchor is used to anchor the bottomhole assembly inside the tubing during cutting operations.

The hydraulic/mechanical tubing anchor uses a cone and collet to anchor the tool to the tubing. The collet is attached to a piston so that hydraulic pressure is used to activate the tool. Mechanical downward force then holds the anchor while other operations are performed.

The tool is designed so that the top sub and bottom sub can be reversed. This allows the tool to be run reversed using tension to hold the anchor.

Advantages

- Hydraulically activated
- Will eliminate movement of coiled tubing while cutting
- Can be run in conjunction with a workover mud motor
- Optimum slip design
- Can be run reversed for upward anchoring use

SPECIFICATION GUIDE

Service	Tool OD		Tool ID		Max Catch ID		Make Up Length		Tensile Rating	Standard Connection
	in.	mm	in.	mm	in.	mm	in.	mm	lbs	
Standard	1.69	42.9	0.47	11.9	1.99	50.5	21.88	555.8	21,800	1 in. AMMT
Sour	1.69	42.9	0.47	11.9	1.99	50.5	21.88	555.8	15,855	1 in. AMMT
Standard	2.06	52.4	0.63	15.9	2.44	62.0	31.13	790.7	43,850	1-1/2 in. AMMT
Sour	2.06	52.4	0.63	15.9	2.44	62.0	31.13	790.7	31,891	1-1/2 in. AMMT
Standard	2.50	63.5	0.63	15.9	3.54	89.9	31.13	790.7	43,850	1-1/2 in. AMMT
Sour	2.50	63.5	0.63	15.9	3.54	89.9	31.13	790.7	31,891	1-1/2 in. AMMT
Standard	3.13	79.4	1.00	25.4	4.09	103.9	35.35	897.9	83,000	2-3/8 in. PAC DSI
Sour	3.13	79.4	1.00	25.4	4.09	103.9	35.35	897.9	83,000	2-3/8 in. PAC DSI
Standard	3.13	79.4	1.00	25.4	4.09	103.9	34.85	885.2	83,000	2-3/8 in. Reg
Sour	3.13	79.4	1.00	25.4	4.09	103.9	34.85	885.2	83,000	2-3/8 in. Reg
Standard	3.50	88.9	1.00	25.4	4.89	124.2	35.35	897.9	83,000	2-3/8 in. PAC DSI
Sour	3.50	88.9	1.00	25.4	4.89	124.2	35.35	897.9	83,000	2-3/8 in. PAC DSI
Standard	3.50	88.9	1.00	25.4	4.89	124.2	34.85	885.2	83,000	2-3/8 in. Reg
Sour	3.50	88.9	1.00	25.4	4.89	124.2	34.85	885.2	83,000	2-3/8 in. Reg
Standard	5.25	133.4	1.00	25.4	6.27	159.3	35.35	897.9	83,000	2-3/8 in. PAC DSI



Hydraulic/Mechanical Tubing Anchor
Product Family No. H13226

Hydraulic Indexing Tool

Product Family No. H13260

APPLICATION

The fishing hydraulic indexing tool offers the ability to orient a fishing tool string in the casing during thru-tubing fishing operations.

The hydraulic indexing tool is designed so that all the shifting parts are internal. Thus, the tool length remains the same while indexing the tool. Once washing over or fishing begins, flow through the indexing tool rotates the tools below the indexing tool in 30° increments. The indexing tool can also be used with bent subs and centralizers to help locate fish that are on the high side of the wellbore. In most applications when running hydraulic retrieving tools below the indexing tool, the indexing tool is actuated using back pressure created by pumping through the hydraulic retrieving tools.

Advantages

- Hydraulically actuated
- Large ID
- All shifting parts are internal

Set-Down Indexing Tool

Product Family No. H13259

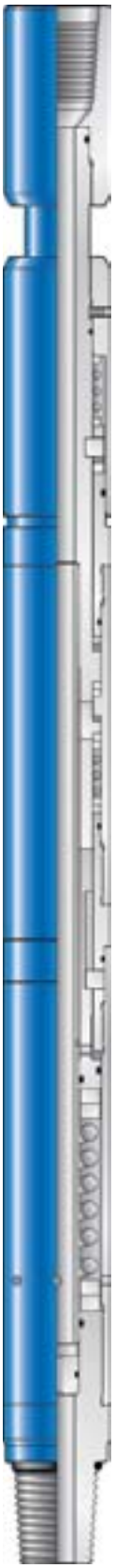
APPLICATION

The set-down indexing tool offers the ability to orient a fishing tool string in the casing during thru-tubing fishing operations by applying set-down weight.

The set down indexing tool is designed such that it will provide 120° of rotation every time it is activated. Once resistance is met, such as shouldering on the top of a liner or the top of a fish, any additional set-down weight applied actuates the set down indexing tool. The tool does not allow the tool string to rotate while resetting.

Advantages

- Indexes 120° when applying set-down weight
- No hydraulic activation needed
- Safe to use with hydraulic activated fishing tools
- Can be used with conventional fishing tools that require rotation to be released
- Tool will reset when weight is released



Hydraulic Indexing Tool
Product Family No. H13260



Set Down Indexing Tool
Product Family No. H13259

HIPP-TRIPPER Si-Di Impact Drill

Product Family Nos. H13400

APPLICATION

The single-directional (Si-Di) HIPP-TRIPPER™ is a rotating impact drill that can be powered by most types of fluids including foam and nitrogen. The drill components are not affected by xylene, oil or diesel. The tool can also be run in acid or high H_2S environments using the extreme service tool which uszes higher grade materials. This tool is available in various sizes to suit a range of completions.

The Si-Di impact drill is powered by fluid pumped through the coiled tubing workstring to produce a reciprocating action as well as rotation. The frequency of the stroke of the tool is dependent on the amount of weight applied to the tool and the volume of fluid being pumped through the tool. The drill will not begin operating until the bit has met resistance. This permits circulation while tripping in and out of the well without damage to the tool or tubing wall. It is always recommended to run the specially designed HIPP-TRIPPER accessories with this tool. Common applications for the Si-Di impact drill are scale milling, cement milling, resin sand removal, gravel removal, breaking KOIV discs, chasing junk downhole, and shifting sleeves (with the rotation feature removed). Although the drill may be run with or without an intensifier, it is always recommended that an intensifier be run where surface testing of the tool is required, working at depths above 600 ft *(182.55 m)* or working with 1-3/4 in. OD coiled tubing or larger.

Advantages

- Activated using pump pressure which eliminates cycling of the coiled tubing
- Operates on most fluid mediums including nitrogen
- Temperature rated up to 600°F *(315°C)*
- Extreme service tools are available
- Does not operate until resistance is met
- Provides rotation as well as impact energy
- Various bits available to use with tool
- Tool is self tightening
- High pressure pulse at bits with each blow
- Allows circulation at all times
- Can be run with or without rotation
- Not recommended for metal milling



HIPP-TRIPPER Si-Di Impact Drill
Product Family No. H13400

SPECIFICATION GUIDES

Tool OD		Operating Pressure		Pump Rate		Frequency	Make Up Length		Maximum Pull ✹		Set-Down Weight	
in.	mm	psi	bar	gpm	lpm	Hz	in.	mm	lb	kg	lb	kg
1.375	34.9	500-2,000	34-138	11-30	42-114	3-17	30.75	781	26,000	11,793	400-1,000	181-454
									18,000	8,165		
									26,000	11,793		
1.688	42.9	600-2,000	41-138	11-70	42-265	3-17	36.40	925	40,000	18,144	800-1,500	363-680
									27,000	12,247		
									40,000	18,144		
									27,000	12,247		
2.125	54.0	400-2,100	28-145	11-70	42-265	3-17	43.63	1108	53,000	24,040	800-2,400	363-1,088
									32,000	14,515		
2.875	73.0	500-1,800	34-124	21-84	80-318	3-17	54.00	1372	55,000	24,948	800-2,800	363-1,270
									32,000	14,515		
4.750	120.6	250-2,500	17-172	11-120	42-454	3-17	47.00	1194	290,000	131,542	500-3,100	227-1,406

✹ *Based on 80% of calculated tensile value*

Single Directional Impact Drill With Rotational Sub

Tool OD		Torque		Speed	Standard Connection
in.	mm	ft-lb	Nm	rpm	
1.375	34.9	40 – 150	54 – 203	7 – 30	3/4 in. CS Hydril Box x 7/8 in. Sonoma Stub Acme Box
1.688	42.9	100 – 250	136 – 339	7 – 30	1 in. AMMT Box x 1-1/8 in. UNF Pin
2.125	54.0	120 – 360	163 – 488	7 – 30	1-1/2 in. AMMT Box x 1-3/4 in. UNC Pin
2.875	73.0	160 – 480	217 – 651	7 – 30	2-3/8 in. PAC DSI Box x Pin
4.750	120.6	50 – 750	68 – 1,017	7 – 30	2-7/8 in. API Reg Pin x 2-1/2 in. Sonoma Acme Pin

In addition to the above table, the torque values and rpm values are added when applying a rotational sub.

HIPP-TRIPPER Bi-Di Vibratory Fishing Jar

Product Family No. H13405

APPLICATION

The bi-directional (Bi-Di) HIPP-TRIPPER™ is capable of delivering both upward and downward impact. This tool can be used as a drill (with the addition of a rotation assembly), a fishing jar or a combination of both. The Bi-Di can be powered by most types of fluids including foam and nitrogen. The components are not affected by xylene, oil or diesel. The Bi-Di is available in different sizes to suit different completions.

The Bi-Di tools are powered by fluid pumped through the coiled tubing workstring and is designed to deliver downward blows when put into compression and upward blows when put into tension. Only enough tension to cock the tool is required, usually about 1,500 – 2,000 lbs *(680.38 – 907.18 kg)* above pipe weight in the up mode. It is not necessary to cycle the tubing, as the Bi-Di cocks and fires itself with the aid of pumped fluid. The tool does not contain any mechanical latches and uses only three moving parts. Blow counts will vary in either configuration depending on fluid volume. At high volume, in the up-mode, the tool becomes a vibratory extractor, a highly effective method of extracting sand-compacted fish for example. Downward blow forces are amplified and accelerated by stored internal energy. Drilling also occurs in the downward mode, but is optional. Common applications for the Bi-Di vibratory fishing jar are shifting sliding sleeves, jarring, swaging open collapsed tubing, resonance, breaking KOIV discs and setting/retrieving wireline tools in deviated wells. Although the Bi-Di vibratory fishing jar may be run with or without an intensifier, it is recommended always that an intensifier be run where surface testing of the tool is required, working at depths above 600 ft *(182.55 m)* or working with 1-3/4 in. OD *(44.45 mm)* coiled tubing or larger.

Advantages

- Operates on most fluid mediums including nitrogen
- Temperature rated up to 600°F *(315°C)*
- Can provide rotation as well as impact energy
- Resonance and vibratory applications
- Allows circulation at all times if fitted with a velocity switch
- Coiled tubing cycling is not required

SPECIFICATION GUIDE

Tool OD		Operating Pressure		Pump Rate		Frequency	Make Up Length		Maximum Pull ✹		Minimum Pull		Standard Connection
in.	mm	psi	bar	gpm	lpm	Hz	in.	mm	lb	kg	lb	kg	
1.750	44.45	800-2,500	55-172	11-70	42-265	Up Mode: 2-29 Down Mode: 3-17	91.0	2311	47,800	21,700	1,600	725	1 in. AMMT Box x Pin
1.750	44.45	800-2,500	55-172	11-70	42-265		91.0	2311	28,200	12,800	1,600	725	1 in. AMMT Box x Pin
2.125	53.98	700-1,800	48-124	11-70	42-265		119.5	3035	71,000	32,200	3,000	1,360	1-1/2 in. AMMT Box x 1-3/4 in. Sonoma Acme Pin
2.125	53.98	700-1,800	48-124	11-70	42-265		119.5	3035	51,000	23,150	3,000	1,360	1-1/2 in. AMMT Box x 1-3/4 in. Sonoma Acme Pin
2.875	73.03	350-1,600	24-110	21-84	80-318		88.6	2250	76,000	34,500	2,000	900	2-3/8 in. PAC DSI Box x Pin

✹ *Based on 80% of calculated tensile value*



HIPP-TRIPPER Bi-Di Vibratory Fishing Jar
Product Family No. H13405

HIPP-TRIPPER Accelerators

Product Family No. H13420

APPLICATION

The HIPP-TRIPPER™ accelerator is used in conjunction with the single-directional impact drill or bi-directional vibratory jar in applications where the pipe that the tool is deployed on is too stiff for the tool to operate. The accelerator also amplifies the impact blows. The accelerator consists of two telescoping tubes, biased downward by means of a coil spring.

It is recommended that a mechanical accelerator always be used when operating above depths of 600 ft *(182.55 m)* or when working with heavy wall coiled tubing or threaded pipe. The single directional impact drill and the bi-directional vibratory jar will continue to run with the accelerator in the bottomed-out position if the depth of operation provides the required flexibility in the coiled tubing. When this condition occurs, the operator should notice a decrease in the frequency of blows.

Advantages

- Variable spring rate
- Impact drill and vibratory jar will continue to run with accelerator bottomed-out
- Allows the tool to operate on surface and at shallow depths
- Simple operation and construction
- Designed to be used with HIPP-TRIPPER products

SPECIFICATION GUIDE

Tool OD		Stroke		Working Load ✸		Make Up Length		Standard Connection
in.	mm	in.	mm	lb	kg	in.	mm	
1.688	42.88	5	127.0	1,600	726	60.75	1,543	1 in. AMMT Box x 1-1/8 in. UNF Pin
2.125	53.98	7	178.0	2,400	1089	56.95	1,447	1-1/2 in. AMMT Box x Pin
2.875	73.03	7.5	191.0	2,500	1134	64.25	1,632	2-3/8 in. PAC DSI Box x Pin
4.750	120.65	10	254.0	3,000	1361	72.63	1,845	2-7/8 in. API Reg Box x Pin

✸ *Maximum applied set-down weight when run in conjunction with a single directional impact drill.*



HIPP-TRIPPER Accelerators
Product Family No. H13420

Block and Blast Tool

Product Family No. H13425

APPLICATION

The block and blast tool provides drilling with impact and the ability to jet-wash tubing in one operation. Until now drilling and acid washing required separate trips.

The tool has been designed to be used in conjunction with a single direction HIPP-TRIPPER. The block and blast tool should be run directly above the single-direction HIPP-TRIPPER. Once the HIPP-TRIPPER BHA is run to the desired depth, drop the specified ball to shift the sleeve to the open position. This allows the block and blast tool to block off the single-direction HIPP-TRIPPER and use all the energy to side blast the tubing, casing or perforations.

The blasting should begin from the bottom of the well, slowly pulling up the hole so no solids fall below the bit.

Advantages

- Used with HIPP-TRIPPER single direction impact drill
- Steel ball operated
- Able to acid wash
- Made out of nickel alloy 925 material
- Capable of handling hostile fluids

SPECIFICATION GUIDE

Tool OD		Tool ID		Overall Length		Standard Connection	
in.	mm	in.	mm	in.	mm	Top	Bottom
1.69	42.9	0.38	9.5	18.25	463.5	1 in. AMMT Box	1-1/8 in. UNF Pin
1.69	42.9	0.44	11.1	18.25	463.5	1 in. AMMT Box	1-1/8 in. UNF Pin



Block and Blast Tool
Product Family No. H13425

HIPP-TRIPPER Accessories

Product Family No. H13430

APPLICATION

A selection of bits, designed to suit various applications, exclusively to be used with HIPP-TRIPPER™ impact drills.

- **Cut button bit** is the optimum impact bit to use on cement rock or hard scales, it is also effective in removing sand and other types of fill. The cut button bit has been successful in removing tubing scale found in geothermal wells
- **Six point carbide bit** works well on resin sands, hard packed sands and fill
- **Asphaltine bit** is a specially designed bladed bit that is dressed with wire and is excellent for removing asphalt and paraffin from tubing walls
- **Paraffin scratcher** (when dressed with wire) serves to remove scale and paraffin from tubing walls. This bit also works extremely well removing paraffin and asphaltine when using diesel and/or lease oil as an operating medium
- **Blind box** is used primarily to drive debris downhole (i.e., wireline tools, gun debris). In some cases it can be used with an extension to place reciprocating members of the hammer drill above the debris. This device has also unlocked wireline set mandrels and has fired tubing conveyed perforating guns
- **Ceramic disk breaker** is a pointed blind box used to fracture ceramic or glass isolation disks in well completions
- **Tubing swage** is used to open collapsed pipe, over-tightened collars, etc. (used in the same manner as a wireline type swage). This device is also available as a metal shaving broaching tool.



HIPP-TRIPPER Impact Tool

Advantages

- Variety of bits handle most clean out operations
- Available for standard and hostile environments
- Impact grade carbide to handle shock loads
- Special connections to match Si-Di and Bi-Di lower connection
- Can be redressed for multiple runs
- Available in a range of sizes

HB-3 Selective Shifting Tool

Product Family No. H81198

APPLICATION

The HB-3™ hydraulic shifting tool is designed for shifting the Baker Hughes Type HL™ or CM™ Series sliding sleeve on coiled tubing. Flow passage allows washing with tubing while running in the well. After washing past the sleeve, an increase of pump pressure causes a piston to compress a spring, allowing a second spring to extend a set of linkage arms extending out. The sliding sleeve can be shifted either by directly pushing or pulling on the coiled tubing or by use of an impact tool. After the sleeve is shifted, the shifting tool will automatically release. A decrease in pump pressure once again retracts the linkage arms and allows unimpeded movement up and down the hole.

Advantages

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

SPECIFICATION GUIDE

Tool Size		OD		Shifts Sleeve Sizes	
in.	mm	in.	mm	in.	mm
3.50	88.9	2.50	63.5	2.56	65.0
3.50	88.9	2.50	63.5	2.75	69.8
3.50	88.9	2.50	63.5	2.81	71.3
4.50	114.3	3.00	76.2	3.43	87.1
4.50	114.3	3.00	76.2	3.68	93.4
4.50	114.3	3.00	76.2	3.75	95.2
4.50	114.3	3.00	76.2	3.81	96.7



HB-3 Selective Shifting Tool
Product Family No. H81198

Venturi Jet Junk Basket

Product Family No. H13051

APPLICATION

The venturi jet junk basket is used to remove various types of high-density debris and formation particles within small diameter cased and open wellbores that are too heavy to be circulated to surface. Flow in the top of the tool passes to the outside via adjustable jets. The jets cause a pressure drop on the inside of the venturi basket, which acts as suction at the bottom inlet of the tool. Fill is stirred up by the flow coming down the outside of the tool. With the suction at the bottom inlet, the fill is then carried through finger cages into the tool's internal filter. The strained fluid then passes out at the top with the pumped fluid.

The fill is then trapped between the filter above and the finger cages below. Extensions increase the amount of fill dirt that can be brought to surface on each trip. Venturi jet junk baskets can be fitted with a dressed shoe and can be run below workover motors to break up and retrieve debris which may be compacted.

Advantages

- Fully closed finger or flutter catchers
- Can be run with any type of dressed shoe
- Have adjustable reservoir through extensions

SPECIFICATION GUIDE

Tool OD		Standard Connection	Minimum Flow Rate		Maximum Flow Rate	
in.	mm		gpm	lpm	gpm	lpm
1.69	42.9	AW Rod Pin	12.5	46.8	85	319
2.06	50.8	AW Rod Pin	12.5	46.8	85	319
2.63	66.6	1-1/4 in. API Reg Pin	12.5	46.8	120	450
3.13	79.3	2-3/8 in. API Reg Pin	12.5	46.8	135	506



Venturi Jet Junk Basket
Product Family No. H13051

Thru-Tubing Inflatables History

Baker Hughes pioneered the research and development of the oil and gas industry's first thru-tubing inflatable tools in 1985. These tools were designed to offer the highest available expansion characteristics with the greatest available differential pressure ratings.

These thru-tubing tools were initially designed to be run on coiled tubing and snubbing pipe, allowing for the inherent advantages of working over a well in a live condition, without removing the completion.

The first tool design was a service packer for selective acid stimulation. Since that time, a wide range of tools have been developed that include not only packers, but also permanent and retrievable bridge plugs, permanent cement retainers, straddle systems, and our unique and highly successful ISAP™ (inflatable straddle acidizing packer) system.

In 1989, Baker Hughes introduced the first-ever setting tool to allow for electric wireline conveyance of inflatable products. Concurrently, Baker Hughes has developed a suite of coiled tubing, wireline running, and retrieving tools that are part of a comprehensive solution. Combined with custom software and expert service, this systems approach allows Baker Hughes to continue its philosophy of providing flawless execution at the wellsite.

What are thru-tubing inflatables?

Thru-tubing inflatables are small diameter well intervention tools designed to run through a restriction in the wellbore and set in a larger diameter below. These inflatable tools are designed with a nitrile-based inflatable packing element that is expanded by the means of hydraulic pressure. These tools are capable of expansions up to 350% of their original run-in diameter while being able to use a variety of fluids with which to inflate the element.

Unlike more traditional mechanical tools, an inflatable tool can be conveyed through a wellbore restriction and deployed in the larger diameter below. A unique advantage of the inflatable element is in its ability to create an effective seal in irregular or eccentric profiles such as open hole, perforations, screens, and slotted liners.



Within the thru-tubing inflatable product line there are three main cover configurations that are used. Each configuration is designed for setting in different environments.

Dual seal elements are designed to have exposed ribs on either end of the element with the nitrile based elastomer outer seal nearer the middle. The exposed ribs provide the greatest metal-to-metal contact area to the casing/tubing wall, resulting in the highest anchoring capability. This style of element is the most common cover configuration used within the product line and is primarily deployed inside blank tubing/casing. The constructed of the dual seal element makes it idea to within stand pressure differentials from both directions.



Dual Seal Element

Modified full cover elements, barring a very small portion of exposed ribs at each end sleeve are completely covered in a nitrile-based outer seal and is normally used for setting in open hole, perforation, slotted liner, sliding sleeves, etc. The expanse of outer elastomer provides an excellent sealing surface that also anchors the element due to the irregularities in the open hole environment. Due to the lack of exposed metal of the ribs this style of element the element is not recommended for cased hole applications.



Modified Full Color Element

Modified single anchor elements are similar in construction to the dual-seal element except that the reinforcing ribs are only exposed on one end of the element and a small section of the outer seal is removed from the opposing end adjacent to the end sleeve. The style of element is designed for use in cased hole applications and when a pressure differential will only been applied to one known direction.



Modified Single Anchor Element



RATING TABLE

Thru-Tubing Inflatable Element

	Size Element is to be Set In - (in.) (mm)															
	OD	2.375	2.875	3.500	4.000	4.500	5.000	5.500	6.625	7.000	7.625	8.625	9.625	10.750	11.750	13.375
	ID	1.195 (51)	2.441 (62)	2.992 (76)	3.548 (90)	3.958 (101)	4.276 (109)	4.892 (124)	5.921 (150)	6.094 (155)	6.765 (172)	7.511 (191)	8.681 (221)	9.760 (248)	10.772 (274)	12.415 (315)
Element OD in. (mm)	**Maximum Applied Differential Pressure - psi (bar) Maximum Temperature - °F (°C)**															
1.69 (42.9)		5,500 (379)	5,500 (379)	4,600 (317)	3,200 (221)	2,600 (179)	2,200 (152)	1,700 (117)								
		300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	250 (121)	250 (121)								
2.13 (54.1)			6,000 (414)	6,000 (414)	5,500 (379)	4,300 (297)	3,600 (248)	2,600 (179)	1,600 (110)	1,500 (103)	1,000 (69)					
			300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	280 (138)	280 (138)	280 (138)					
2.50 (63.5)				6,500 (448)	6,500 (448)	6,300 (434)	5,500 (379)	4,200 (290)	2,500 (172)	2,300 (159)	1,800 (124)	1,550 (107)	1,300 (90)			
				300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	280 (138)	280 (138)	260 (127)	240 (116)			
3.000 (66.8)					8,000 (552)	8,000 (552)	8,000 (552)	8,000 (552)	4,900 (338)	4,500 (314)	3,400 (234)	2,500 (172)	1,600 (110)			
					300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	280 (138)	260 (127)	240 (116)			
3.380 (85.9)					8,500 (586)	8,500 (586)	8,500 (586)	8,500 (586)	6,500 (448)	6,200 (428)	4,900 (338)	3,700 (255)	2,450 (169)	1,700 (117)		
					300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	280 (138)	280 (138)	275 (135)		
4.250 (108.0)								8,500 (586)	8,500 (586)	8,500 (586)	6,550 (452)	4,900 (338)	3,300 (228)	2,350 (162)		
								300 (149)	300 (149)	300 (149)	300 (149)	280 (138)	280 (138)	280 (138)		
5.380 (136.7)									8,500 (586)	8,500 (586)	8,500 (586)	8,100 (559)	5,950 (410)	4,700 (324)	3,800 (262)	2,850 (197)
									300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	280 (138)	280 (138)	260 (127)
5.750 (146.1)									8,500 (586)	8,500 (586)	8,500 (586)	8,500 (586)	6,850 (472)	5,350 (369)	4,350 (300)	3,200 (221)
									300 (149)	300 (149)	300 (149)	300 (149)	300 (149)	280 (138)	280 (138)	260 (127)

Reduce pressure ratings by 10% for acid service elements and by 20% for H_2S service elements. Standard service elements use high strength alloys but are susceptible to stress corrosion cracking (SCC) in H_2S and other highly corrosive environments. Acid service elements use nickel alloy materials, but the material does not meet requirements of NACE MR0175. H_2S service elements use nickel alloy materials that meet the requirements of NACE MR0175. For element ratings in different IDs from above please contact your local Baker Hughes representative.

Permanent Bridge Plug

Product Family No. H34001

APPLICATION

The permanent bridge plug (PBP) is a non-retrievable inflatable bridge plug used to permanently plug the casing below the production tubing.

Applications include: permanent shutoff of lower gas zone, shutoff of a watered-out zone, and well abandonment. The bridge plug can be run on coiled tubing, threaded tubing, or E-line. The tool chassis have the ability to accept different size elements using element adapter subs.

The cross flow permanent bridge plug is run and set using the same procedures as the standard permanent bridge plug. Like the standard permanent bridge plug the cross flow permanent bridge plug can not be released after it is set. The maximum cross flow the bridge plug will accept when running the tool with the electric wireline setting tool is a function of tool string weight, fluid weight, and casing size.

Advantages

- Inflatable packing element allows the tool to be run through the completion and set below
- Well can be worked over live
- Coiled tubing and electric wireline conveyance
- By varying element configuration, tool can be set in most environments (perforations, slotted pipe, screens, openhole, etc.)
- High differential pressure capability
- Crossflow capable version available

SPECIFICATION GUIDE

Chassis Size		OAL With Running Tool		OAL Without Running Tool		Casing Size In Which Tool Can Set In			
						Minimum ID		Maximum ID	
in.	mm	ft	m	ft	m	in.	mm	in.	mm
1.69	42.9	7.54	2.30	6.54	1.99	1.880	47.8	5.012	127.3
2.13	54.1	9.20	2.80	7.70	2.35	2.370	60.2	7.025	178.4
3.00	76.2	10.20	3.11	8.40	2.56	3.120	79.2	12.715	323.0

OAL = Overall length



Permanent Bridge Plug
Product Family No. H34001

Retrievable Bridge Plug

Product Family No. H34010

APPLICATION

The retrievable bridge plug (RBP) provides the ability to temporarily plug the casing below the production tubing. Applications include: temporary shutoff of lower zone, selective acid, or chemical treatments, fracturing of upper perforation intervals, isolation of sensitive zones during recompletions or zonal isolations.

The retrievable bridge plug can be run on coiled or threaded tubing or on electric wireline. The plug is equalized, released and retrieved with either tubing, braided wireline or slick line with a single-trip in the hole.

Advantages

- Inflatable packing element allows for large expansion ratios so the tool can be set below the restrictions
- Coiled tubing and electric wireline set allowing for well to be worked over live
- Equalized and retrieved in a single trip by pipe, coiled tubing, braided or slickline

SPECIFICATION GUIDE

Chassis Size		OAL With Running Tool		OAL Without Running Tool		Casing Size in Which Tool Can Set in			
						Minimum ID		Maximum ID	
in.	mm	ft	m	ft	m	in.	mm	in.	mm
1.69	42.9	9.10	2.77	8.16	2.49	1.88	47.8	5.012	127.3
2.13	54.1	14.59	4.45	11.04	3.36	2.37	60.2	7.025	178.4
3.00	76.2	14.08	4.29	11.59	3.53	3.12	79.3	12.715	323.0



Retrievable Bridge Plug
Product Family No. H34010

Retrievable Packer

Product Family No. H33001

APPLICATION

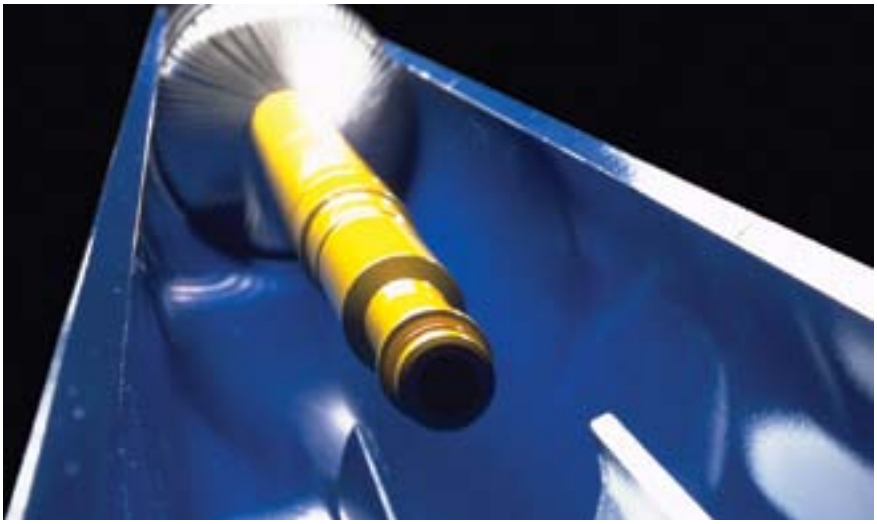
The retrievable packer is a remedial and stimulation packer designed to run on coiled tubing. This tool provides the ability to perform selective chemical and acid treatments, cement squeezes or testing operations without pulling the production tubing and killing the well.

Advantages

- Inflatable packing element allows the tool to be run through the completion and set below
- Zones to be treated can be positively isolated
- High differential pressure capabilities
- Diverse range of fluid compatibilities
- Packer is equalized before being unset
- Hydraulic lock option available

SPECIFICATION GUIDE

Chassis Size		ID		OAL With Spotting Valve		OAL Without Spotting Valve		Casing Size in Which Tool Can Set in			
								Minimum ID		Maximum ID	
in.	mm	in.	mm	ft	m	ft	m	in.	mm	in.	mm
1.69	42.9	0.425	10.8	9.82	2.99	8.49	2.59	1.88	47.6	5.012	127.3
2.13	54.1	0.63	16.0	13.75	4.19	11.69	3.56	2.37	60.2	7.025	178.4
2.13	54.1	0.56	14.2	13.75	4.19	11.69	3.56	2.37	60.2	7.025	178.4
3.00	76.2	0.63	16.0	12.70	3.87	10.90	3.32	3.12	79.3	12.715	323.0
3.00	76.2	0.56	14.2	12.70	3.87	10.90	3.32	3.12	79.3	12.715	323.0





Retrievable Packer
Product Family No. H33001

Cement Retainer With Spotting Valve

Product Family No. H34020

APPLICATION

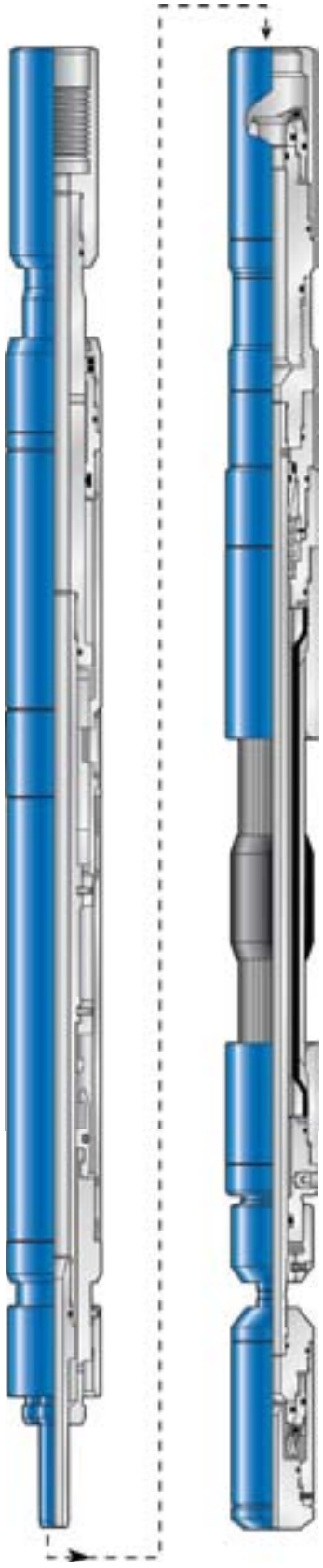
The cement retainer allows permanent isolation and cementation of a lower zone without pulling the production tubing and packer. The built-in retrievable spotting valve provides a means of spotting cement to the top of the tool so unwanted fluids are not pumped into the formation. Because the retainer and spotting valve operations do not require rotation, the tool can be run on coiled tubing as well as threaded tubing.

Advantages

- No tubing manipulation required, therefore can be set on coiled tubing
- Built in retrievable spotting valve allows cement to be spotted to the tool
- Positive seal flapper valves prevent flow through the retainer from either direction once spotting valve is released
- Hydraulic lock option for spotting valve

SPECIFICATION GUIDE

Chassis Size		ID		OAL With Spotting Valve		OAL Without Spotting Valve		Casing Size in Which Tool Can Set in			
								Minimum ID		Maximum ID	
in.	mm	in.	mm	ft	m	ft	m	in.	mm	in.	mm
1.69	42.9	-	-	11.08	337.7	7.81	238.1	1.88	47.7	5.012	127.3
2.13	54.1	0.56	14.2	14.60	4.45	9.40	2.87	2.37	60.2	7.025	178.4
3.00	76.2	0.56	14.2	13.90	4.24	9.40	2.87	3.12	79.3	12.715	323.0



Cement Retainer With Spotting Valve
Product Family No. H34020

Inflatable Straddle Acidizing Packer (ISAP)

Product Family No. H35003

APPLICATION

The inflatable straddle acidizing packer (ISAP™) is a resettable, coiled tubing conveyed selective stimulation tool system. It's designed to allow the operator a means of mechanically diverting (acid, chemicals, scale inhibitors, water control agents such as polymer treatments) into a short section of formation.

Advantages

- Completion stays in place and well can be worked over live
- No rotation or set-down weight required, making it ideal for coiled tubing use
- Injection control valve maintains fluids in underbalanced conditions
- No locked in inflation pressure, minimizes element differentials and temperature effects
- Deflation to annulus not tubing
- True selectivity achieved

SPECIFICATION GUIDE

Tool OD		Overall Length of Hookup from Coiled Tubing Connector to Lower Drain Valve, Less Spacer (Tbg End Locator Included) and PCBPV		Minimum Spacing Between Elements		Maximum Recommended Flow Rate Through Tool		Maximum Operating Temp		Casing Size in Which Tool Can Set In		Length of Complete ISAP Tool String From Top of PCBPV to Bottom Guide, Less Tbg End Locator with (Minimum Spacing) Between Elements	
in.	mm	ft	m	ft	m	bpm	liters/ min	°F	°C	in.	mm	ft	m
1.69	42.9	27.37	8.34	5.85	1.78	1.00	159.0	300	150.0	5.000	127.0	24.6	7.50
2.13	54.1	35.76	10.90	8.25	2.51	1.50	238.5	300	150.0	6.54	166.1	32.50	9.91
3.00	76.2	35.14	10.71	7.73	2.36	4.00	636.0	5.5	139.7	7.025	178.4	32.00	9.75



Inflatable Straddle Acidizing Packer (ISAP)
Product Family No. H35003

Electric Wireline Setting Tool

Product Family No. H43714

APPLICATION

The electric wireline setting tool (EWST) is an electric downhole pump powered from the surface by means of conventional electric wireline. The EWST uses fluid from either the wellbore or a reservoir carrying system to inflate and pressurize inflatable packing elements.

The setting tool incorporates a magnetic casing collar locator to allow for accurate depth control. The setting tool is powered through the electric wireline with a surface DC power supply which requires AC voltage or a minimum 6kW generator to operate. The operation of the system is tracked at surface by monitoring the amperage draw of the tool on the power supply. When used in conjunction with an inflatable packing element, fluid is drawn into the setting tool and filtered before entering the pump section. The pump section forces the fluid into the inflatable element, where it is trapped by a poppet style check valve. At a predetermined pressure, the setting tool hydraulically disconnects from the inflated tool allowing retrieval of the EWST and wireline to surface.

Advantages

- Allows for the setting of inflatable tools without the cost of a workover rig or coiled tubing unit
- Provides for accurate depth control by means of a built-in casing collar locator
- Can be used with any electric wireline unit
- Decreases the amount of time required for inflatable tool operation

SPECIFICATION GUIDE

Tool Size		OD		Overall Length		Makeup Length		Output Pressure		Thread Up	Thread Down
in.	mm	in.	mm	in.	mm	in.	mm	psi	bar		
1.690	42.9	1.687	42.9	100.04	2541.0	97.54	2477.4	2,700	186	1.187 in. N 12 TPI	1.25 in. Acme
1.81	46.0	1.812	46.0	86.81	2205.0	84.23	2139.4	3,200	221	1.187 in. N 12 TPI	1.50 in. Acme
2.125	54.0	2.125	54.0	86.81	2205.0	84.23	2139.4	3,200	221	1.187 in. N 12 TPI	1.50 in. Acme





Electric Wireline Setting Tool
Product Family No. H43714

Test Pressure Equalizing Valve

Product Family No. H33082

APPLICATION

The test pressure equalizing valve (TPEV) has been developed to be used with the electric wireline setting tool (EWST). The TPEV is used to prevent accidental inflation of the inflatable bridge plug during the bleed off of pressure in the wireline lubricator after an aborted run in the well. During a lubricator test or while running in the hole, the fluid that enters the tool string may contain gas. In the event that the lubricator is subsequently bled down with the tool string inside, any gas pressure may be trapped in the tool string below the setting tool check valves. The test pressure equalizing valve eliminates the possibility of setting the inflatable element in the lubricator by keeping the ID of the tool string equalized with the annulus until the setting process begins.

Advantages

- Light-duty liner hanger/packer
- Ideal for running uncemented or slotted liners in vertical or horizontal wells
- Hydraulic set and release
- Most sizes rated to 1,000 psi *(68.9 bar)* at 250°F *(121°C)*
- Adjustable straight-pull release

SPECIFICATION GUIDE

Tool Size		OD		Overall Length		Makeup Length		Tensile Strength		Threads
in.	mm	in.	mm	in.	mm	in.	mm	lb	kg	
1.690	42.9	1.690	42.9	42.29	1074.4	40.00	1016.0	37,500	1,701	1.25 in. Acme
2.125	54.0	2.125	54.0	37.25	946.2	34.87	885.7	79,000	35,834	1.50 in. Acme



Test Pressure Equalizing Valve
Product Family No. H33082

Pressure Extender

Product Family No. H33083

APPLICATION

The pressure extender is run with the electric wireline setting tool (EWST) to improve the set of inflatable elements by increasing the time that pressure is held on the inflatable packing element during the inflation sequence. Without the extender, the element is filled with fluid at low pressure and then the running tool disconnects very quickly as pressure builds up. Experience has shown that inflatable elements achieve a more efficient set when the element has sufficient square off time at pressure to conform better to the ID in which it is set. The tool operation is simple. At a predetermined inflation pressure, less than the final element inflation pressure, a relief valve is opened which allows for fluid to be displaced by means of a piston. During the displacement time of the fluid, the element is not being inflated and is being allowed to square off and conform. Once all the fluid has been displaced, the piston creates a seal and applied pressure is then again directed to the inflatable element.

Advantages

- Extended inflation time - allows element to conform to ID of wellbore
- Does not require setting tool to be stopped and restarted again
- Adjustable pressure relief valve setting

SPECIFICATION GUIDE

Tool Size		OD		ID		Overall Length		Makeup Length		Tensile Strength		Extension Period	Threads
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lb	kg		
2.125	54.0	2.125	54.0	0.19	4.8	49.63	1260.6	47.25	1200.2	78,000	35380	Circa 6 Minutes	1.50 in. Acme
3.00	76.2	3.00	76.2	0.19	4.8	48.44	1230.4	46.06	1169.9	110,000	49895	Circa 15 Minutes	1.50 in. Acme



Pressure Extender
Product Family No. H33083

Belleville Secondary Pull Release

Product Family No. H33080

APPLICATION



The Belleville washer pull release is a secondary disconnect tool designed to be used in conjunction with inflatable tools conveyed via the electric wireline setting tool (EWST). The tool provides a secondary method of disconnecting the setting tool from the inflatable tool in the event that the primary hydraulic release mechanism should fail to operate. By using Belleville washers rather than shear screws, the force required to disconnect is more dependable and is repeatable. Compression of the washers allows the movement required to release the disconnect. The washers act as a buffer and are not affected by shocks while running in and out of the hole. The effects of these shocks can cause fatigue and failure of shear screws on designs that rely on shear screws to carry the load of the assembly.

Advantages

- Belleville washer pull release is not susceptible to premature release caused by fatigue of shear screws during running procedures
- Adjustable release force by means of rotation of an external adjusting sleeve
- Small seal diameter to keep pressure generated forces to a minimum prevents hydraulic release
- Standard 1.375 in. *(34.9 mm)* external wireline fishing neck after activation

SPECIFICATION GUIDE

Tool Size		OD		ID		Overall Length		Makeup Length		Fishing Neck Size and Type		Thread Up	Thread Down
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm		
1.690	42.9	1.690	42.9	0.25	6.35	17.25	438.2	15.00	381.0	1.183	30.1	1.25 in. Acme	1.25 in. Acme
2.125	54.0	2.125	54.0	0.25	6.35	17.65	448.1	14.38	365.3	1.375	34.9	1.50 in. Acme	1.75 in. Acme



Belleville Washer Secondary Pull Release
Product Family No. H33080

Positive Fluid Separation Reservoir System

Product Family No. H43715

APPLICATION

The Baker Hughes electric wireline setting tool (EWST) is a downhole pump powered through conventional electric line. It uses wellbore fluids to inflate, hydraulically pressurize, and disconnect from inflatable tools. The pump in this setting tool is designed to pump fluids with very low solids content, viscosity, and compressibility. These favorable conditions do not exist in some applications; such as running in gas wells, low fluid wells, heavy brines, and muds.

The purpose of the positive fluid separation reservoir for the electric line setting tool is to provide a source of clean inflation fluid for the EWST in wells where there is no fluid or where the fluid is undesirable for inflation. The reservoir is made in four sizes 2.13 in. *(54.1 mm)*, 2.50 in. *(63.5 mm)*, 2.875 in. *(73 mm)* and 3.25 in. *(82.6 mm)* OD.

The reservoir essentially consists of several 10 ft *(3.1 m)* long housings screwed together above a special housing that encloses the EWST. These housings contain a volume of inflation fluid and enclose a standard EWST. A length of 7/32 diameter electromechanical cable runs inside these housings and through a fluid separator dart to electrically connect the EWST with a CCL above the reservoir. The fluid separator dart is only run in applications where the wellbore fluid is incompatible with the EWST due to solid content. Here the separator dart prevents undesirable well bore fluid from mixing or displacing the inflation fluid contained in the reservoir.

Advantages

- Provides improved reliability; experience has shown that most EWST problems are related to the fluid the tool is pumping; dirty or sandy fluid can damage the pump before the job is complete; gas or gas cut fluid will not permit the EWST to inflate a bridge plug or will make inflation long and difficult
- Permits operations in environments a standard EWST tool could not operate; this would include drilling mud and gas wells
- Provides a benign inflation fluid for improved long-term inflatable bridge plug performance; some well fluids are detrimental for long term performance of inflatable elastomers; high aniline point oils or sour gas are examples; the reservoir fluid isolates the internal surfaces of the inflatable element from these type fluids
- This reservoir system is operated downhole in an identical fashion as a standard EWST and can use all the same accessories as those on a standard TTI EWST job



Positive Fluid Separation Reservoir System
Product Family No. H43715

SPECIFICATION GUIDE

Positive Fluid Separation Reservoir System

Description	Size and Material No.			
	H437-15-2103	H437-15-2503	H437-15-2903	H437-15-3203
	2.13	2.50	2.875	3.25
Thread Up	1.187 OD GO Pin			
Thread Down	1.500 OD Stub Acme			
Makeup Length (per BoM) x (ft) (m)	55.8 (16.8)	46.1 (14.1)	36.4 (11.1)	36.4 (11.1)
Housing Tensile Strength (lb) (kg)	7,800 (3,538)	13,000 (5,897)	33,000 (14,696)	40,000 (18,144)
Housing OD (in.) (mm)	2.130 (54.1)	2.500 (63.1)	2.875 (73.0)	3.250 (82.6)
Housing ID (in.) (mm)	1.875 (47.6)	2.250 (57.2)	2.441 (62.0)	2.750 (69.9)
Inter-Housing Connection	2.045 Stub Acme	2.400 Stub Acme	2.688 Stub Acme	3.046 Stub Acme
Housing Volume (gal/ft)	0.14	0.20	0.24	.031
Compatible EWST Size	1.69	2.13	2.13	2.13
Compatible EWST Size	1.81	2.13	2.13	2.13

✷ *This length provides enough fluid volume for inflation in 7 in. (177.8) casing applications.*

Hydraulic Disconnect/Running Tools

Product Family No. H33072

APPLICATION

The purpose of the hydraulic running tool is to connect the conveyance string (be it threaded pipe, coiled tubing, or electric wireline) to the inflatable element being run. For bridge plugs and certain straddle configurations, a hydraulic disconnect running tool is used which is designed to release the running string from the set inflatable tool at a predetermined pressure.



2.13 in. OD *(54.1 mm)* hydraulic disconnect/ running tool

Used as the primary disconnect on both 2.13 in. *(54.1 mm)* OD permanent and retrievable bridge plugs and as a ball operated emergency disconnect on a 2.13 in. *(54.1 mm)* OD retrievable packer.



1.69 in. OD *(42.9 mm)* hydraulic disconnect/ running tool

Used for both 1.69 in. *(42.9 mm)* OD permanent and retrievable bridge plugs (RBP).



3.00 in. OD *(76.2 mm)* hydraulic disconnect/ running tool

Used as the primary disconnect when setting a 3.00 in. *(76.2 mm)* OD or larger retrievable bridge plug conveyed on electric wireline.



3.00 in. OD *(76.2 mm)* hydraulic disconnect/running tool with circulating sub

Used as the primary disconnect when setting a 3.00 in. *(76.2 mm)* OD or larger retrievable bridge plug conveyed on coiled tubing. Has an integral circulating sub to allow for CT circulation while running in the hole. This circulating sub is activated for setting the RBP by the use of a 0.5 in. *(12.7 mm)* drop ball.



3.00 in. OD *(76.2 mm)* hydraulic disconnect/ running tool

Used as the primary disconnect on a 3.00 in. *(76.2 mm)* OD permanent bridge plug and as an emergency ball operated disconnect on a 3.00 in. *(76.2 mm)* OD retrievable packer.

Washover Retrieving Head

Product Family No. H34011

APPLICATION

The washover retrieving head provides a means to allow the circulation of debris or fill off of the top of a fishing neck before latching up. An optional tool is available with a flow release facility that will allow for releasing from the fishing neck should it be required. The tools are designed in that the bottom guides are interchangeable in order that the optimum OD of the guide can be selected to safely pass the minimum restriction yet still allow the largest catch range possible. Both styles of washover retrieving tools incorporate a profile to shift the bridge plug equalizing sleeve prior to engaging the fishing neck.

Advantages

- Tool allows the circulation of debris or fill from the top of fishing neck before latching on to retrieve an inflatable bridge plug
- Designed to equalize the inflatable bridge plug before engagement of the deflating mechanism
- Interchangeable bottom guide configurations for optimum catch range

Wireline Retrieving Tool

Product Family No. H34013

APPLICATION

There are two different designs for both the 2.13 in. *(54.1 mm)* and 3.00 in. *(76.2 mm)* chassis bridge plugs. The 2.13 in. *(54.1 mm)* OD tool is a modified washover retrieving head with a standard 1.375 in. *(34.9 mm)* OD wireline fishing neck made up into the top connection. The rest of the wireline retrieving string is then attached to the retrieving head with a jar down type wireline catch tool. The 3.00 in. *(76.2 mm)* tool is supplied with a sucker rod pin connection for attachment to the wireline retrieving string and the jar down catch tool is housed within the retrieving guide itself. The retrieving tool incorporates a profile in order to shift the bridge plug equalizing sleeve prior to latching the fishing neck.

Advantages

- Uses wireline conveyance for quick retrieval of inflatable bridge plugs
- Designed to equalize the inflatable bridge plug before engagement of the deflate mechanism
- Interchangeable bottom guide configurations for optimum catch range



Wash-Over Retrieving Head
Product Family No. H34011



Wireline Retrieving Tool
Product Family No. H34013

Z-Seal Metal-to-Metal Sealing Technology Shifts the Paradigm



APPLICATION

Z-Seal™ offers an alternative sealing methodology to the more traditional elastomeric approach and addresses the challenges of elastomer-based seals during well suspensions and intervention operations. Using the Z-Seal in place of a traditional elastomer provides a high-integrity pressure seal on the tubular wall with an improved operating envelope. Elimination of elastomers makes the Z-Seal highly insensitive to temperature and chemical attack and immune to explosive decompression. The advantages of a metal sealing alternative in the live well intervention arena make this revolutionary technology ideally suited to a wide range of isolation applications, including those found predominantly in hostile, high-pressure, and/or high-temperature environments.

The seal design utilizes the controlled application of load to expand and achieve a fully formed pressure barrier. The innovative technology may allow for up to 160% expansion ratio of the sealing element beyond its original run-in size, a considerable advantage when compared to roughly a 110% expansion ratio as afforded by conventional elastomer intervention products.



The revolutionary, award-winning Z-Seal high-expansion metal-to-metal seal achieves a level of sealing performance that uses expanding metal to form a high integrity pressure seal and incorporates an extraordinary seal performance envelope.

Z-Seal Metal-To-Metal Sealing Technology

Product Family No. H33110

APPLICATION

Zonal isolation tools using metal-to-metal sealing technology in place of conventional elastomers may radically challenge existing engineering philosophies by providing a pressure sealing system capable of exceeding the limitations of other existing sealing technologies and eliminating many traditional elastomeric failure modes.

Traditional rubber, polymer, and plastic based sealing systems all have their limitations in terms of maximum differential pressure, temperature, chemical, and/or gas resistance. The complete replacement of elastomeric seals with metal-to-metal sealing technology fundamentally revolutionizes downhole equipment performance by eliminating commonplace elastomer failure modes, including:

- Explosive decompression/gasification
- Temperature degradation
- Shearing across extrusion gap
- Dynamic fatigue under pressure cycles
- Compression load catastrophic failures
- Chemical degradation

Advantages

- Low profile design for smaller run-in ODs and larger IDs
- Sub-gauge seal OD protects seal while running in hole
- Higher expansion capabilities when compared to conventional sealing systems
- Active seal retraction results in seal retracting equal to or less than the original run-in OD when retrieved
- May be constructed from advanced CRAs normally using a nickel based alloy favoured in oil and gas applications as that most resistant to chemical attack
- The corrosion resistant properties of the seal typically exceed the qualities of the tubular materials
- Seal does not allow gas penetration and is immune to the effects of gasification and explosive decompression



Z-Seal Metal-to-Metal Sealing Technology
Product Family No. H33110

On a global scale, the oil and gas industry is continually maturing leading to the increasing requirement for the exploitation of deeper, hotter, higher pressure reserves. Drilling and completing wells with these extreme environmental conditions can prove highly problematic, with conventional sealing technology potentially prone to catastrophic failure. The limitations of conventional sealing systems has prevented operators from investing in and exploiting reservoirs which demonstrate these extremes. Metal-to-metal sealing technology has radically challenged pre-existing engineering philosophies and has lead to a ground breaking expandable metal seal capable of superseding existing sealing technologies and eliminating many traditional elastomeric failure modes. The step change in sealing technology will help make your well suspension and intervention operations achieve the best possible return on your investment in most applications including the demands of hostile, high-pressure and/or high-temperature environments.



SPECIFICATION GUIDES

Bridge Plug

Casing Size		Casing Weight		Pressure Rating		Temperature Rating		Tool OD		Tool ID	Expansion Ratio (%)
in.	mm	lb/ft	kg/m	psi	bar	°F	°C	in.	mm		
4.50	114.3	12.60	18.7	8,000	552	350	177	3.600	91.4	N/A	110
4.50	114.3	13.50	20.1	8,000	552	350	177	3.600	91.4	N/A	119
5.00	127.0	18.00	26.8	8,000	552	350	177	3.681	93.5	N/A	116
5.50	139.7	17.00	25.3	5,000	345	350	177	3.850	97.8	N/A	127
5.50	139.7	20.00	29.8	5,000	345	350	177	3.850	97.8	N/A	124
5.50	139.7	23.00	34.2	5,000	345	350	177	4.200	106.7	N/A	111
7.00	177.8	29.00	43.1	5,500	379	350	177	5.200	132.1	N/A	119

Straddle

Casing Size		Casing Weight		Pressure Rating		Temperature Rating		Tool OD		Tool ID		Expansion Ratio (%)
in.	mm	lb/ft	kg/m	psi	bar	°F	°C	in.	mm	in.	mm	
4.50	114.3	13.50	20.1	8,000	552	350	177	3.600	91.4	1.614	41.0	119
5.00	127.0	18.00	26.8	5,000	345	350	177	3.681	93.5	1.614	41.0	116
5.50	139.7	17.00	25.3	5,000	345	350	177	3.850	97.8	1.811	46.0	127
5.50	139.7	20.00	29.8	5,000	345	350	177	3.850	97.8	1.811	46.0	124
5.50	139.7	23.00	34.2	5,000	345	350	177	4.200	106.7	2.402	61.0	111

Thru-Tubing Casing Exits



APPLICATION

Baker Hughes thru-tubing whipstock systems are the most innovative and technically advanced drill bit manufacturer, provides the highest quality window in the industry today.

After the efficient creation of a superior window the advantage of employing Baker Hughes is further exemplified with the use of state-of-the-art coiled tubing drilling systems.

Why use a thru-tubing casing exit?

- Bypassed reserve recovery
- Extend well life
- Collapsed or damaged casing
- Multilateral drilling applications
- Slot recovery
- Loss of bottom hole assembly (BHA) resulting in obstruction to planned drilling trajectory

Advantages

- Window can be cut without pulling existing completion or production tubing
- One-trip orientation and setting on electric line, coiled tubing or threaded pipe
- Ability to set on either the high or low side of the casing ensures the optimal exit point
- Whipstock can be retrieved
- Large bypass flow area allows for continued production from the main bore below
- Single or dual exit possible
- Multiple exit sizes available
- Integral anchor system reduces trips and wellbore restrictions



Advanced anchoring systems allow for anti-vibratory management and stability axis control even during casing exits in exotic materials

Delta Exit System

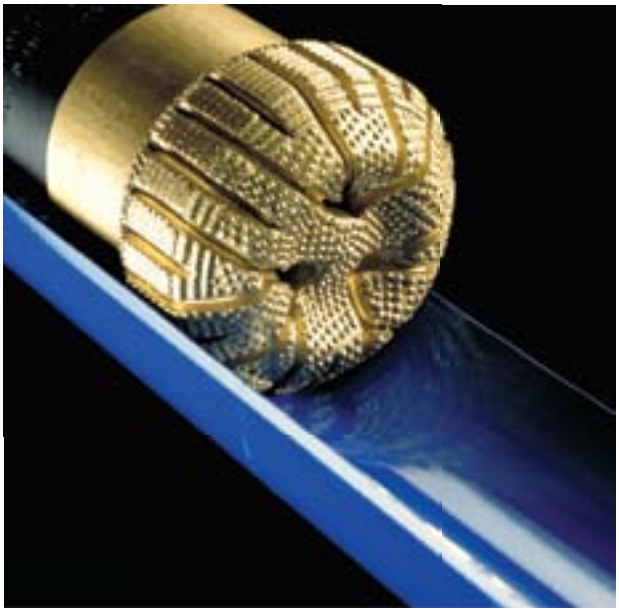
Product Family No. H15150

APPLICATION

The Delta Exit System™ allows the operator to mill a window in the casing in a restricted wellbore environment using coiled tubing deployed mills and motors. The Delta Exit System can be run and set in a live well environment without the necessity of removing the completion equipment eliminating the requirement for a workover rig and negating the need for kill weight fluids. Since the Delta Exit System is designed to be run and set on either electric wireline or coiled tubing, it is ideally suited for restricted bore access and allows the window to be milled below the completion. The whipstock anchor is firmly set by using a Size 10 Baker Hughes E-4™ wireline pressure setting assembly (product family nos. H43702 and H43720) or a Size 10 Baker Hughes J™ hydraulic setting tool (product family no. H41371).

Advantages

- System can be run through the existing completion and set in up to 7-5/8 in. casing
- Can be retrieved from the wellbore for multi-zone applications
- One-trip setting on either electric wireline or coiled tubing
- One-trip window milling
- Accommodates a wide range of mill styles for efficient window cutting in a variety of formation and casing conditions
- Offset whipstock top allows easier access to openhole section
- Can be set for either high- or low-side exits
- Can be dressed for different casing sizes by changing a minimal number of parts



SPECIFICATION GUIDE

Casing Size	Casing Weight	Nominal ID	Drift ID	Dogleg Severity (deg.)	Material No. (2 in. Radius Scoop f/3.8 in. Mill Dia)	Material No. (2-1/8 in. Radius Scoop f/4.3 Mill Dia)	Material No. (2-5/16 in. Radius Scoop f/4.3 Mill Dia)	Material No. (2-1/2 in. Radius Scoop f/4.5 Mill Dia)	Conversion Kit
5.500 (in.)	28.4	4.440	4.315	10.1	H151-50-5501	N/A	N/A	N/A	10175587
	26.8	4.500	4.375	10.3					
	26.0	4.548	4.423	10.4					
	23.8	4.626	4.501	10.6					
	23.8	4.626	4.501	10.6	H151-50-5502	N/A	H151-50-5504	N/A	10175588
	23.0	4.670	4.545	10.7					
	20.0	4.778	4.653	11.0					
	17.0	4.892	4.767	11.3	H151-50-5503	H151-50-5507	H151-50-5505	H151-50-5506	10175583
	15.5	4.950	4.825	11.4					
	14.0	5.012	4.887	11.6					
7.000 (in.)	38.0	5.920	5.795	13.9	H151-50-7001	N/A	H151-50-7004	H151-50-7007	10175589
	35.0	6.004	5.879	14.1					
	32.0	6.094	5.969	14.4					
	29.0	6.184	6.059	14.6	H151-50-7002	N/A	H151-50-7005	H151-50-7008	10175584
	26.0	6.276	6.151	14.8					
	23.0	6.366	6.241	15.1					
	20.0	6.456	6.331	15.3	H151-50-7003	N/A	H151-50-7006	H151-50-7009	10175590
	17.0	6.538	6.413	15.5					
7.625 (in.)	39.0	6.625	6.500	15.7	H151-50-7601	N/A	H151-50-7603	H151-50-7605	10175585
	33.7	6.765	6.640	16.1					
	29.7	6.875	6.750	16.4					
	29.7	6.875	6.750	16.4	H151-50-7602	N/A	H151-50-7604	H151-50-7606	10175601
	26.4	6.969	6.877	16.6					
	24.0	7.025	6.900	16.8					

Coiled Tubing Set Monobore Whipstock

Product Family No. H15042

APPLICATION

The coiled tubing-set monobore whipstock is designed to mill a window exit in the completion or production tubing, liner or casing; eliminating the expense of a costly workover rig. The anchor mechanism is an integral part of this whipstock system, thus reducing the number of trips required to complete the window. The whipstock can be set with either the Baker Hughes E-4™ wireline pressure setting tool or a J™ hydraulic setting tool. When using E-Line, the whipstock is oriented with eccentric weight bars. When run in on coiled tubing, the whipstock can be oriented using an MWD or gyro survey. Once the anchor assembly is set the window is milled using a coiled tubing workstring, mud motor, watermelon mill, and diamond speed mill.



Coiled Tubing-Set Monobore Whipstock
Product Family No. H15042

Advantages

- Window can be cut without pulling existing completion or production tubing
- One-trip to set whipstock on wireline or coiled tubing
- Uses diamond speed mill technology for efficient window cutting
- Anchor is an integral part of the whipstock

SPECIFICATION GUIDE

Tubing/Casing OD		Whipstock OD		Exit Size	
in.	mm	in.	mm	in.	mm
3-1/2	88.9	2.625	66.7	2.800	71.1
4-1/2 - 5	114-127	3.625	92.1	3.800	96.5

String and Watermelon Mills

Product Family No. H15109

APPLICATION

String and watermelon mills are designed to clean and dress casing windows during a coiled tubing window milling operation and are a critical component to the Delta Exit System™ (product family no. H15150) and the coiled tubing set monobore whipstock (product family no. H15042). Each string mill and watermelon mill is specifically sized according to the casing exit application to effectively clean and dress the casing exit for subsequent completion operations including successive drilling BHAs and liners.

Advantages

- Light-duty liner hanger/packer
- Ideal for running uncemented or slotted liners in vertical or horizontal wells
- Hydraulic set and release
- Most sizes rated to 1,000 psi *(68.9 bar)* at 250°F *(121°C)*
- Adjustable straight-pull release



String and Watermelon Mills
Product Family No. H15109

Fishing Calculation Software

APPLICATION

Thru-tubing fishing calculation software is available to assist in gathering and computing data for an efficient and cost effective job. The software is easy to use and can be easily adapted for PDAs.

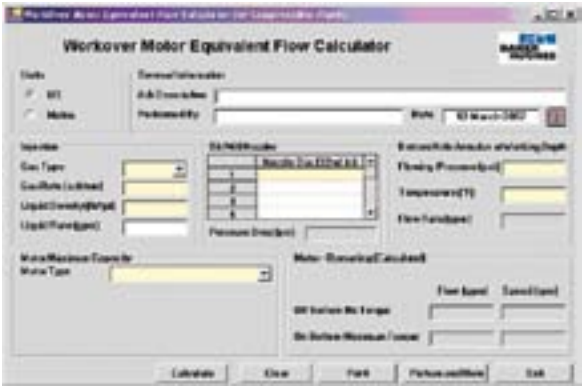
To avoid over speeding the motor during a nitrogen operation, a software package has been developed to optimize the motor selection parameters. With the input of well data and motor selection criteria, the output from the workover motor equivalent flow calculator provides accurate rpm and equivalent fluid flow through the motor.

Advantages

- Standard and metric units
- 21 different unit conversions
- Fishing data tables
- Wash pipe and overshot information
- 16 essential fishing calculations







Thru-Tubing Fishing Pre-Job Information Request Form

Version: Feb 2007

Thru-Tubing Intervention

BAKER HUGHES

Thru-Tubing Fishing Pre-Job Information Request

(To be completed by Baker Hughes Sales/Operations Engineer during planning stage and checked on location by Baker Hughes Supervisor prior to execution.)

Where ever you see this symbol ( ) on the spreadsheet, place your cursor over the cell and a full explanation of the required cell input will be given.

Note: Do not type in units (",ft,degrees etc) with figures

1. General Information

Operator			
Contact Name			
Tel./Fax./ E-Mail			
District / Field / Well			
Well Type			
Anticipated Start Date			

2. Well Information

Tubing (OD (") and Weight (#/ft))			
Casing / Liner (OD (") and Weight (#/ft))			
Working Depth ID (")			
Condition (Scale, Corrosion etc.)			
Min. Restriction (ID (") / Type / Depth (ft))			
Maximum Well Deviation (°)			
Working Depth Deviation (°)			

3. Well Data

Bottom Hole Pressure(psi)	Static		Flowing		Inject	
Wellhead Pressure (psi)	Static		Flowing		Inject	
Bottom Hole Temperature (°F)	Static		Flowing		Inject	
Perforation Intervals (ft)						

4. Well Fluids Information

Description		
Density (p.p.g.)		
Fluid Level (ft)		
CO_2 / H_2S (%)		

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Thru-Tubing Fishing Pre-Job Information Request Form

5. Conveyance Data

Conveyance Method	
Coiled Tubing Company and Contact	
Coiled Tubing OD Size (")	
Coiled Tubing Wall Thickness (")	
Coiled Tubing Grade	
Max. Pull Available at Working Depth (lbs.)	
Max. Set Down Weight at Working Depth (lbs)	
Max. Available Pump Rate (bpm)	
Treatment Fluids to be Used	
Treatment Fluids Density (p.p.g)	
Depth Correlation Method	
Maximum Riser Height (ft)	
Minimum Stack up ID (")	

6. Objective of Intervention

7. Other Information

Note - Please include a copy of the following with this Pre-Job Information Request:

A. Well Schematic
B. Deviation Survey
C. Relevant Tool / Fish Drawings

8. Baker Hughes Contact Personnel

Name	Telephone	Fax	E-Mail

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INFLATEDESIGN

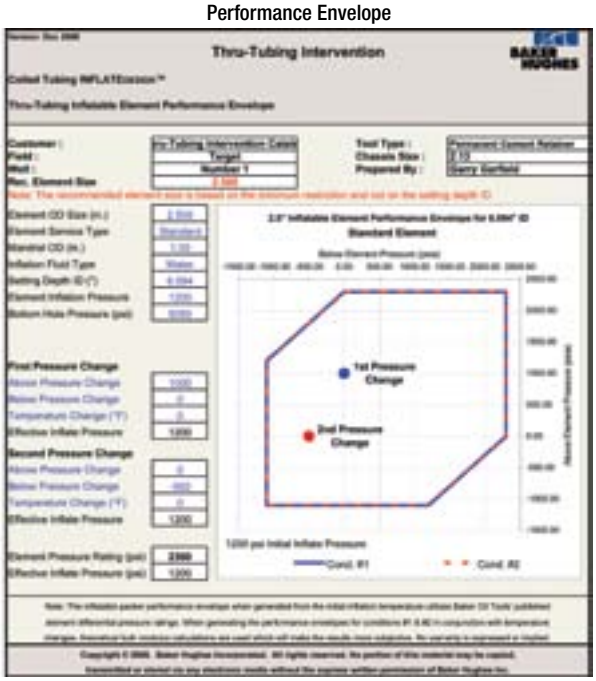
APPLICATION

INFLATEDESIGN™ is our propriety software design program developed to help in the information gathering, engineering, execution and post job reporting phases of an isolation planned with thru-tubing inflatable technology.

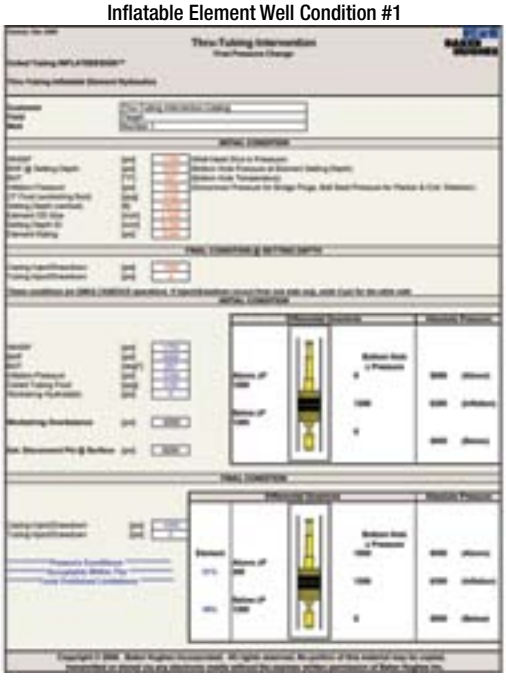
Pre-Job Information Sheets



Performance Envelope



Inflatable Element Well Condition #1



For more information please contact your local Baker Hughes representative.

Thru-Tubing Inflatable Pre-Job Information Request Form

Version: Dec 2006

Thru-Tubing Intervention

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TTI INFLATE DESIGN™

Thru-Tubing Inflatable Pre-Job Information Request
(To be completed by Baker Hughes Sales/Operations Engineer during planning stage and checked on location by Baker Hughes Supervisor prior to execution.)

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Note: Do not type in units (".ft,degrees etc) with figures

1. General Information

Operator			
Contact Name			
Tel./Fax./ E-Mail			
District / Field / Well			
Well Type			
Anticipated Start Date			

2. Well Information

Tubing (OD (") and Weight (#/ft))			
Casing / Liner (OD (") and Weight (#/ft))			
Setting Depth ID (")			
Condition (Scale, Corrosion etc.)			
Min. Restriction (ID (") / Type / Depth (ft))			
Maximum Well Deviation (°)			
Setting Depth Deviation (°)			

3. Well Data

Pressure at Setting Depth (psi)	Static		Flowing		Inject	
Wellhead Pressure (psi)	Static		Flowing		Inject	
Temperature at Setting Depth (°F)	Static		Flowing		Inject	
Perforation Intervals (ft)						
Crossflow (psi / bpd / direction)						

4. Fluids Information

Description			
Density (p.p.g.)			
Fluid Level (ft)			
Inflation Fluid (Type / Density (p.p.g.))			
Treatment Fluid (Type / Density (p.p.g.))			
CO_2 / H_2S (%)			

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Thru-Tubing Inflatable Pre-Job Information Request Form

5. Intervention Data

Setting Depth	MD (ft)	
	TVD (ft)	
First Pressure Change (psi)		
Second Pressure Change (psi)		
Temperature Change After Inflation (°F)		

6. Conveyance Data

Conveyance Method	
Coiled Tubing Company and Contact	
Coiled Tubing OD Size (")	
Max. Pull Available at Setting Depth (Lbs.)	
Max. Set Down Weight at Setting Depth (lbs)	
E-Line Company and Contact	
E-Line Size (")	
Maximum Lubricator / Riser Length (ft)	

7. Reason for Intervention

8. Other Information

Note - Please include a copy of the following with this Pre-Job Information Request:

A. Well Schematic
B. Deviation Survey

9. Baker Hughes Contact Personnel

Name	Telephone	Fax	E-Mail

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Z-Seal Pre-Job Information Request Form

Version: August 2007

Thru-Tubing Intervention

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Z-Seal™ Pre-Job Information Request
(To be completed by Baker Hughes Sales/Operations Engineer during planning stage and checked on location by Service Supervisor prior to execution.)

Where ever you see this symbol ( ) on the spreadsheet, place your cursor over the cell and a full explanation of the required cell input will be given.
Note: Do not type in units (".ft,degrees etc) with figures

1. General Information

Operator			
Contact Name			
Tel./Fax./ E-Mail			
District / Field / Well			
Well Type			
Anticipated Start Date			

2. Well Information

Tubing (OD (") and Weight (#/ft))			
Casing / Liner (OD (") and Weight (#/ft))			
Setting Depth 1 ID (")			
Setting Depth 2 ID (")			
Condition of Tubular (Scale, Corrosion etc.)			
Min. Restriction (ID (") / Type / Depth (ft))			
Maximum Well Deviation (°)			
Setting Depth 1 Deviation (°)			
Setting Depth 2 Deviation (°)			

3. Well Data

Pressure at Setting Depth 1 (psi)	Static		Flowing		Inject	
Pressure at Setting Depth 2 (psi)	Static		Flowing		Inject	
Wellhead Pressure (psi)	Static		Flowing		Inject	
Temperature at Setting Depth (°F)	Static		Flowing		Inject	
Perforation Intervals (ft)						
Crossflow (psi / bpd / direction)						

4. Well Fluids Information

Description		
Density (p.p.g.)		
Fluid Level (ft)		
CO_2 / H_2S (%)		

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Thru-Tubing Inflatable Pre-Job Information Request Form

5. Treatment Fluids Information	
Description	
Density (p.p.g.)	
Volume (gallons)	

6. Intervention Data		
Setting Depth 1	MD (ft)	
	TVD (ft)	
Setting Depth 2	MD (ft)	
	TVD (ft)	
Differential Pressure Requirement (psi)		

7. Conveyance Data	
Conveyance Method	
Provider and Contact	
Size	
Maximum Lubricator / Riser Height (ft)	

8. Reason for Intervention

9. Other Information

Note - Please include a copy of the following with this Pre-Job Information Request:
A. Well Schematic B. Deviation Survey

10. Baker Hughes Contact Personnel			
Name	Telephone	Fax	E-Mail

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