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Tool Offshore Running Manual			
Assembly Procedure No.	M-0101-7000/8500	Revision	C
Tool Assembly Family	0101		
Tool Description	DT Surface Flapper Safety Valve		

Issued By	Jeff Knight
Date	26/07/2018
Checked By	Paul Hilliard
Date	26/7/2018

Revision	Date	Changes
B	05/08/2019	Incl 8.5" tools
C	25/03/2020	POOH MPD / 4 ¾" ball drop

Table of Contents

1. Description

DT Valves are drillstring non-return valves which are used to prevent flow back in the drillstring during conventional drilling operations or to hold pressure when drilling statically underbalanced during managed pressure drilling (MPD) operations. They consist of a dual flapper design with a positive spring closure mechanism and a dual seal (elastomer and metal/metal) for reliable sealing at both high and low differential pressures. The valves have a high working pressure rating of 15,000psi for body burst and collapse as well as for sealing across the flapper itself. This pressure rating allows the valves to be used both at surface and downhole without compromising well control capability at surface. The valves have a test pressure rating of 22,500psi for body burst, collapse and for sealing across the flappers.

The valves are currently available in 8 ½” OD, 7” OD and 4 ¾” OD standard and H2S service with the 8 ½” and 7” versions having two configurations - with or without lock open facility. The lock open facility is primarily intended for valves in a surface application where the flappers can be held open using a lock open sleeve to allow the passage of wireline through the valve in the event of back-off operations, source retrieval, logging through the bit etc being required.

DT valves can be used in place of conventional string floats, as a drilling valve in a drilling stand in place of FOSVs or in any drill string check valve application.

2. Arrival on rig

Tools will arrive on the rig ready to run with a full certification package containing traceability information, maintenance history, last pressure test charts etc. Valves are all fully magnetic particle inspected, thread inspected, fully serviced and pressure tested prior to leaving the Drilltools facility.

Tool packages will vary depending on how the tool is configured.

Without lock open facility package (8 ½"OD, 7"OD or 4 ¾"OD):

Valve

API drift with handle sections (2.656" OD for 8 ½" and 7" tools, 1.219" OD for 4 ¾" tools)

Set of half ring spacers for preventing valve closure (painted red for surface use only).

With lock open facility package (8 ½"OD and 7"OD):

Valve

API drift with handle sections (2.656" OD for 8 ½" and 7" tools, 1.219" OD for 4 ¾" tools)

Set of half ring spacers for preventing valve closure (painted red for surface use only).

Lock open sleeve

Lock open sleeve wireline running tool

Wireline running tool crossover (to fit wireline company toolstring connector)

Spare shear pins for running tool

The valve will normally arrive loose in a basket or container with the other items being contained in a spares box.

The tool will normally be shipped pre-torqued. In the full tool with lock open facility there are 4 service breaks. If the lock open facility is removed the tool has 2 service breaks. Ensure the **Torque Spacers** are correctly seated before torqueing.

The tool is drifted and function tested before leaving the Drilltools facility, however the drift is provided to allow this to be done on the rig if required.

Note: The closure spring exerts 400lbs closure force on the flappers. Significant resistance will be felt to the drift when forcing the flappers open against this spring force. Once the first flapper is open the drift should pass through the second flapper more easily. When the valve has been filled with fluid (water or mud) there will be a volume trapped between the two flappers. This will make it harder to open the flappers and they may need to be 'bumped' to relieve trapped pressure due to changing internal volume before the flappers can be opened completely.

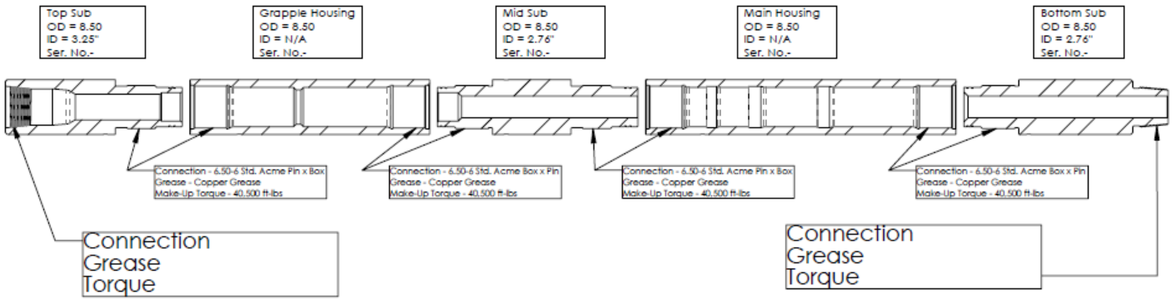
The 8 ½" tool service connections have a 6.5" Standard Acme thread and single o-ring seals. They will normally be torqued to 50% shoulder yield unless otherwise requested.

Standard Service
Maximum make up torque – 84,000 lbft.
Minimum make up torque – 70,000 lbft.

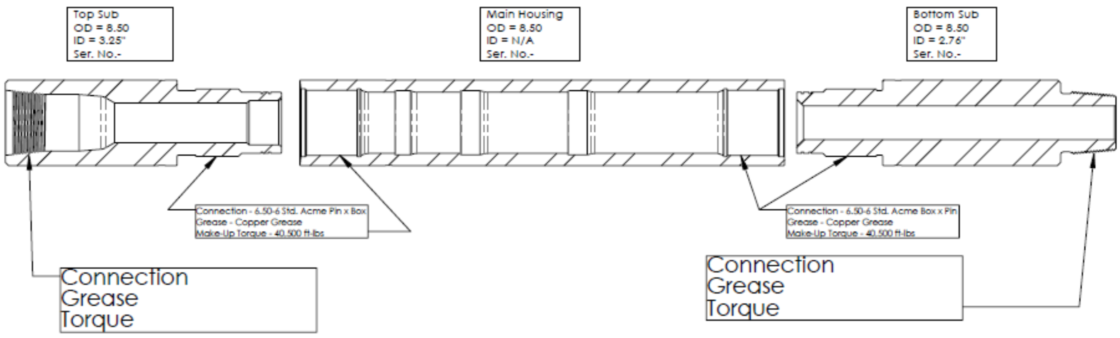
API drift diameter – 2.656”

H2S Service
Maximum make up torque – 46,500 lbft.
Minimum make up torque – 55,800 lbft.
API drift diameter – 2.656”

Dimensions with Lock Open Facility (8 ½” Surface)



Dimensions without Lock Open Facility (7” BHA)

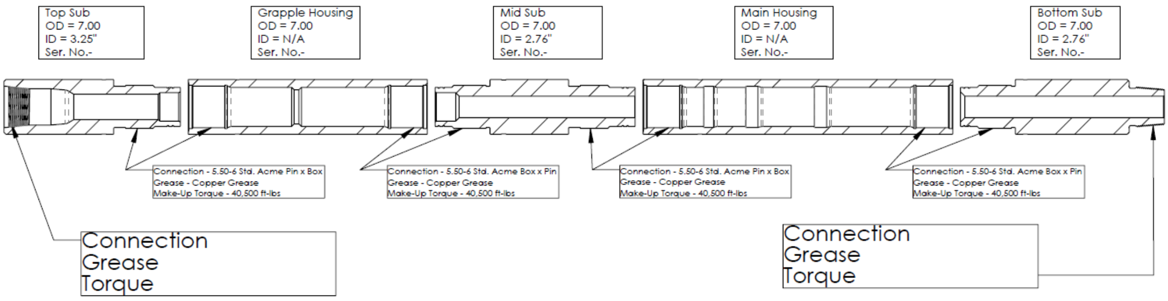


The 7” tool service connections have a 5.5” Standard Acme thread and single o-ring seals. They will normally be torqued to 60% shoulder yield unless otherwise requested.

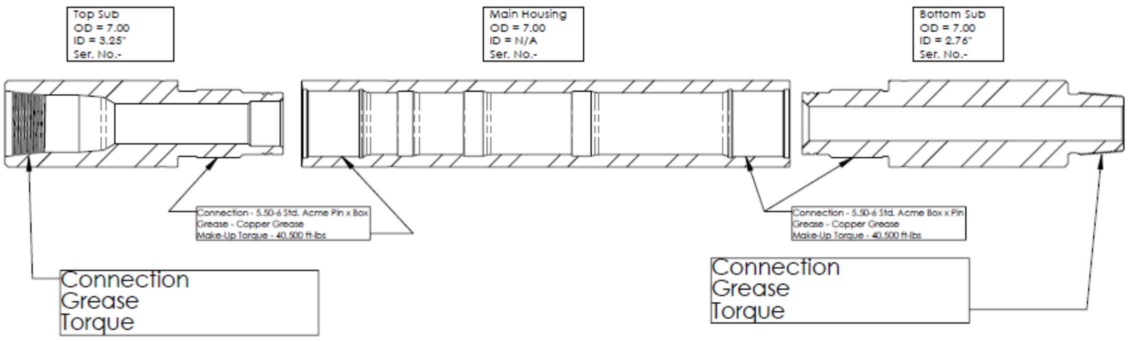
Standard Service
Maximum make up torque – 40,500 lbft.
Minimum make up torque – 33,750 lbft.
API drift diameter – 2.656”

H2S Service
Maximum make up torque – 40,500 lbft.
Minimum make up torque – 33,750 lbft.
API drift diameter – 2.656”

Dimensions with Lock Open Facility (7" Surface)



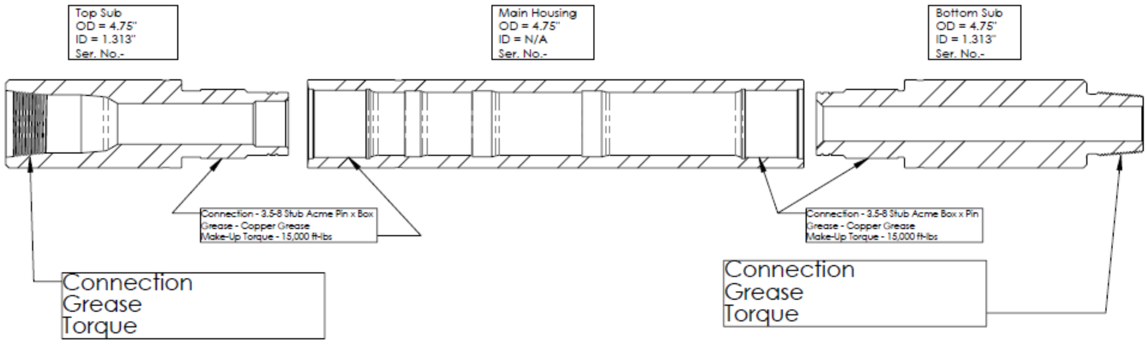
Dimensions without Lock Open Facility (7" BHA)



The 4 ¾" tool service connections have a 3.5" 8 TPI Stub S=Acme thread and single o-ring seals. They will normally be torqued to 50% shoulder yield unless otherwise requested.

Standard Service
Maximum make up torque – 15,000lbft
Minmum make up torque – 12,500lbft.
API drift diameter – 1.21875"

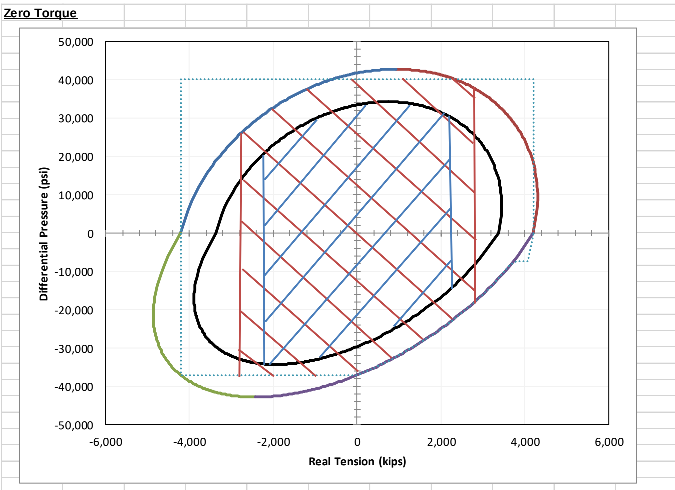
H2S Service
Maximum make up torque – 10,200lbft
Minmum make up torque – 8,500lbft.
API drift diameter – 1.21875"


Top Sub
OD = 4.75"
ID = 1.313"
Ser. No.-
Main Housing
OD = 4.75"
ID = N/A
Ser. No.-
Bottom Sub
OD = 4.75"
ID = 1.313"
Ser. No.-
Connection - 3.5-8 Stub Acme Pin x Box
Grease - Copper Grease
Make-Up Torque - 15,000 ft-lbs
Connection - 3.5-8 Stub Acme Box x Pin
Grease - Copper Grease
Make-Up Torque - 15,000 ft-lbs
Connection
Grease
Torque
Connection
Grease
Torque

3. Tool Specifications

3.1. 8 ½" DT SFSV AISI 4145, Standard Service Class 1

Equipment Dimensions			
Tool OD	8.5"	**OAL**	115"
Tool ID	2.75" (2.25")	**Effective Length**	110.5"
Drift Diameter	2.656" (min 42" long)	**Weight**	1634 lbs (742 kgs)
Operational Specification			
Working Pressure Rating	15,000 psi		
API Internal Yield Pressure (at 190degC)	36,132 psi		
API Collapse Pressure (at 190 degC)	33,399 psi		
Min. Working Temperature Ration (Nitrile)	-4^{o}C		
Working Temperature Rating (Nitrile)	150^{o}C		
Working Temperature Rating (Viton)	190^{o}C		
Yield Specifications			
Tensile Yield (at 20^{o}C WT)	2,700,000 lbs		
Tensile Yield (at 150^{o}C WT)	2,565,000 lbs		
Tensile Yield (at 190^{o}C WT)	2,436,750 lbs		
Torsional Yield (at 20^{o}C WT)	140,000 lb-ft		
Torsional Yield (at 150^{o}C WT)	133,000 lb-ft		
Torsional Yield (at 190^{o}C WT)	126,350 lb-ft		
Make Up Torque Values			
All Connections (min.)	70,000 lb-ft		
All Connections (max.)	84,000 lb-ft		



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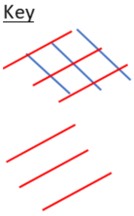
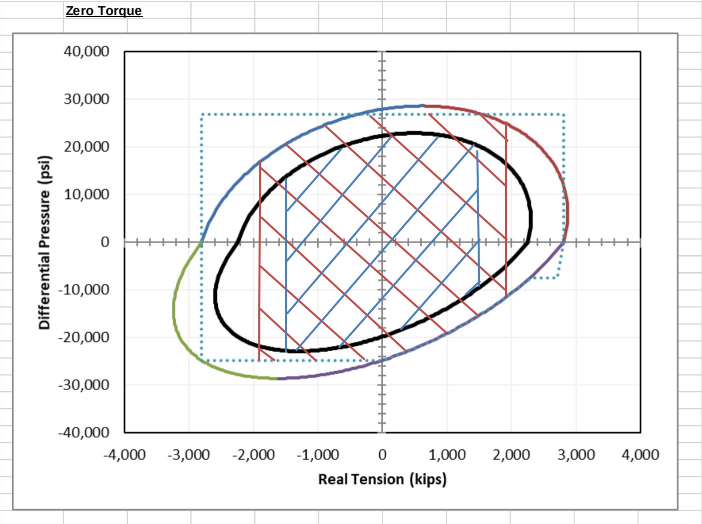


Loading to 80% VME yield

Loading to 100% VME yield (or API collapse / burst)

3.2. 8 ½” DT SFSV AISI 4140, H2S Service Class 2S

Equipment Dimensions			
Tool OD	8.5”	**OAL**	115”
Tool ID	2.75” (2.25”)	**Effective Length**	110.5”
Drift Diameter	2.656” (min 42” long)	**Weight**	1634 lbs (742 kgs)
Operational Specification			
Working Pressure Rating	15,000 psi		
API Internal Yield Pressure (at 200degC)	24,088 psi		
API Collapse Pressure (at 200 degC)	22,266 psi		
Min. Working Temperature Rating (HNBR)	-4^{o}C		
Working Temperature Rating (HNBR)	150^{o}C		
Working Temperature Rating (Aflas)	200^{o}C		
Yield Specifications			
Tensile Yield (at 20^{o}C WT)	1,800,000 lbs		
Tensile Yield (at 150^{o}C WT)	1,710,000 lbs		
Tensile Yield (at 190^{o}C WT)	1,620,000 lbs		
Torsional Yield (at 20^{o}C WT)	93,000 lb-ft		
Torsional Yield (at 150^{o}C WT)	88,350 lb-ft		
Torsional Yield (at 190^{o}C WT)	83,700 lb-ft		
Make Up Torque Values			
All Connections (min.)	46,500 lb-ft		
All Connections (max.)	55,800 lb-ft		



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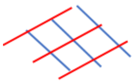

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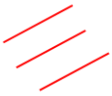
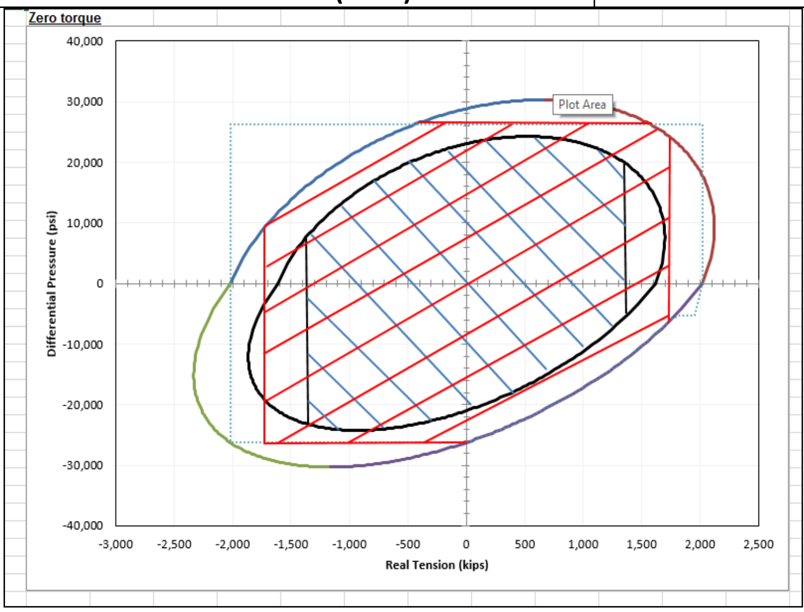


Loading to 100% VME yield (or API collapse / burst)

3.3. 7" DT SFSV AISI 4145, Standard Service Class 1

Equipment Dimensions			
Tool OD	7.0"	**OAL**	115" (73.5")
Tool ID	2.75" (2.25")	**Effective Length**	110.5" (69")
Drift Diameter	2.656" (min 42" long)	**Weight**	907 lbs (412 kgs)
Operational Specification			
Working Pressure Rating	15,000 psi		
API Internal Yield Pressure (at 190degC)	23,625 psi		
API Collapse Pressure (at 190 degC)	23,625 psi		
Min. Working Temperature Rating (Nitrile)	-4°C		
Working Temperature Rating (Nitrile)	150°C		
Working Temperature Rating (Viton)	190°C		
Yield Specifications			
Tensile Yield (at 20°C WT)	1,619,881 lbs		
Tensile Yield (at 150°C WT)	1,538,887 lbs		
Tensile Yield (at 190°C WT)	1,457,893 lbs		
Torsional Yield (at 20°C WT)	67,500 lb-ft		
Torsional Yield (at 150°C WT)	64,125 lb-ft		
Torsional Yield (at 190°C WT)	60,750 lb-ft		
Make Up Torque Values			
All Connections (min.)	33,750 lb-ft		
All Connections (max.)	40,500 lb-ft		



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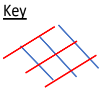

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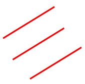


Loading to 100% VME yield (or API collapse / burst)

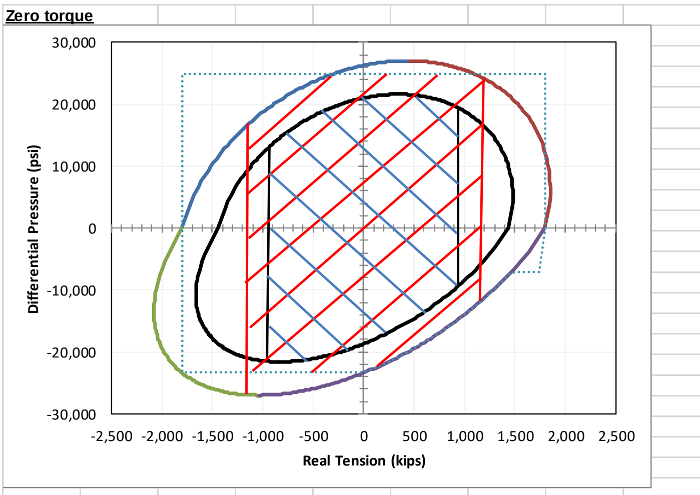
3.4. 7” DT SFSV AISI 4140, Standard Service Class 2S

Equipment Dimensions			
Tool OD	7.0”	**OAL**	116” (73.5”)
Tool ID	2.25” (1.75”)	**Effective Length**	111” (69”)
Drift Diameter	2.156” (min 42” long)	**Weight**	907 lbs (412 kgs)

Operational Specification	
Working Pressure Rating	15,000 psi
API Internal Yield Pressure (at 190degC)	22,410 psi
API Collapse Pressure (at 190 degC)	21,056 psi
Min. Working Temperature Rating (HNBR)	-4°C
Working Temperature Rating (HNBR)	150°C
Working Temperature Rating (Aflas)	200°C

Yield Specifications	
Tensile Yield (at 20°C WT)	1,150,300 lbs
Tensile Yield (at 150°C WT)	1,092,785 lbs
Tensile Yield (at 190°C WT)	1,035,270 lbs
Torsional Yield (at 20°C WT)	48,000 lb-ft
Torsional Yield (at 150°C WT)	45,600 lb-ft
Torsional Yield (at 190°C WT)	43,200 lb-ft

Make Up Torque Values	
All Connections (min.)	24,000 lb-ft
All Connections (max.)	28,800 lb-ft



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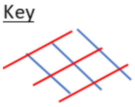

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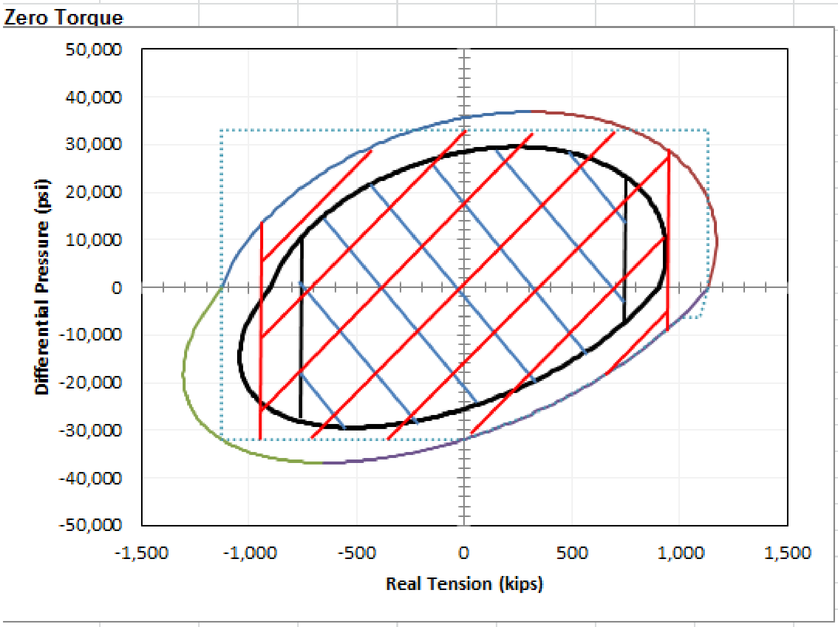
Loading to 100% VME yield (or API collapse / burst)

3.5. 4.75" DT SFSV AISI 4145, Standard Service Class 1

Equipment Dimensions			
Tool OD	4.75"	**OAL**	69.25"
Tool ID	1.313"	**Effective Length**	65.4"
Drift Diameter	1.21875" (min 42" long)	**Weight**	283 lbs (128 kgs)
Operational Specification			
Working Pressure Rating		15,000 psi	
API Internal Yield Pressure (at 190degC)		33,877 psi	
API Collapse Pressure (at 190 degC)		33,877 psi	
Min. Working Temperature Rating (Nitrile)		-4°C	
Working Temperature Rating (Nitrile)		150°C	
Working Temperature Rating (Viton)		190°C	
Yield Specifications			
Tensile Yield (at 20°C WT)		929,000 lbs	
Tensile Yield (at 150°C WT)		882,558 lbs	
Tensile Yield (at 190°C WT)		836,108 lbs	
Torsional Yield (at 20°C WT)		25,453 lb-ft	
Torsional Yield (at 150°C WT)		24,180 lb-ft	
Torsional Yield (at 190°C WT)		22,908 lb-ft	
Make Up Torque Values			
All Connections (min.)		12,500 lb-ft	
All Connections (max.)		15,000 lb-ft	



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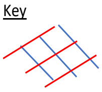

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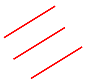


Loading to 100% VME yield (or API collapse / burst)

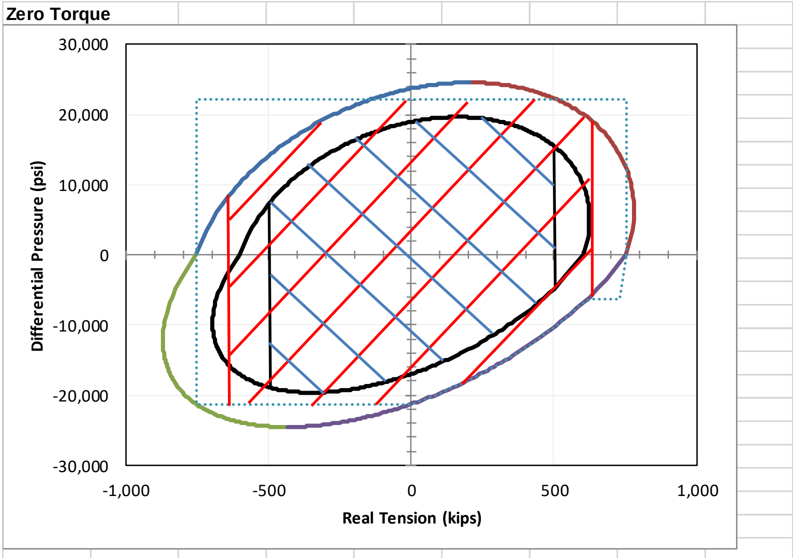
3.6. 4.75" DT SFSV AISI 4140, H2S Service Class 2S

Equipment Dimensions			
Tool OD	4.75"	**OAL**	69.25"
Tool ID	1.313"	**Effective Length**	65.4"
Drift Diameter	1.21875" (min 42" long)	**Weight**	283 lbs (128 kgs)

Operational Specification	
Working Pressure Rating	10,000 psi
API Internal Yield Pressure (at 190degC)	19,894 psi
API Collapse Pressure (at 190 degC)	19,146 psi
Min. Working Temperature Rating (HNBR)	-4^{o}C
Working Temperature Rating (HNBR)	150^{o}C
Working Temperature Rating (Aflas)	200^{o}C

Yield Specifications	
Tensile Yield (at 20^{o}C WT)	620,900 lbs
Tensile Yield (at 150^{o}C WT)	589,855 lbs
Tensile Yield (at 190^{o}C WT)	558,810 lbs
Torsional Yield (at 20^{o}C WT)	17,000 lb-ft
Torsional Yield (at 150^{o}C WT)	16,150 lb-ft
Torsional Yield (at 190^{o}C WT)	15,300 lb-ft

Make Up Torque Values	
All Connections (min.)	8,500 lb-ft
All Connections (max.)	10,200 lb-ft



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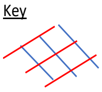

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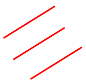

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3.7. After using in hole

After using the tool…

Make sure the tool is drained and that there is no mud trapped in the flapper area.

Flush the tool – especially if water based fluids have been used containing corrosive salts. This is to reduce corrosion damage while the tools are transported to and from the wellsite.

Use thread protectors on end threads.

Store on a rack in a vertical position to allow any water or condensation to drain from the tool.

3.8. Handling

Use caution when handling. Beware of pinch points.

When lifting use suitable lifting equipment and two lifting points, one on each side of the Centre of Gravity.

Do not use a rotary table pin to aid in breaking out the tool on the rig floor. The pin may be long enough to hit the underside of the lower flapper and damage the closure mechanism of the valve.

4. DT Valve running procedure

4.1. Running in hole

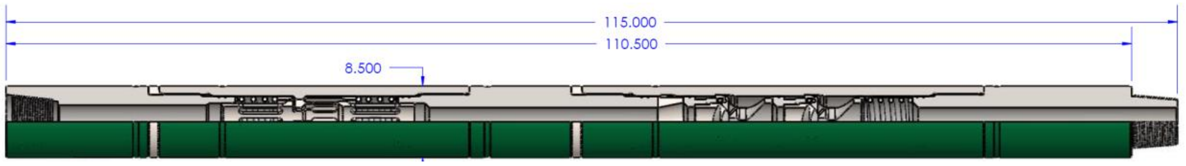
The DT Valve will be supplied on the rig torqued up to either the optimum drillpipe torque or the maximum recommended make-up torque of the valve, whichever is the greater. If optimum drillpipe torque is greater than the maximum recommended make-up torque of the valve discussion will be held to determine the make-up torque to be applied to the valve depending on positioning in the drillstring and torsional yield of the valve.

Before lifting the DT Valve to the rig floor drift using the API drift supplied to ensure the flappers of the valve open and close freely.

Ensure thread protectors are used on the upper and lower connections.

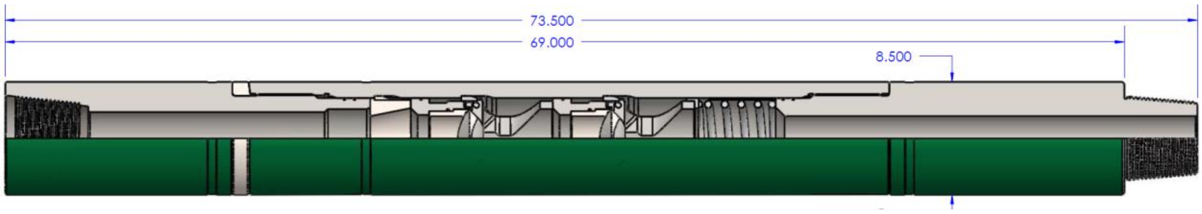
Confirm the OD, ID and length of the valve for fishing purposes. Fishing diagrams of the tools are given below. Further detailed drawings are available on request.

8 ½" Surface configuration



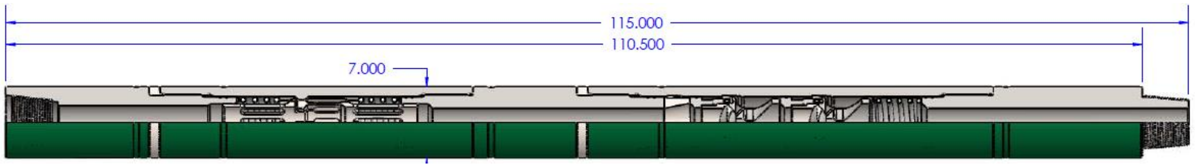
Top sub ID 3.25"

8 ½" BHA configuration



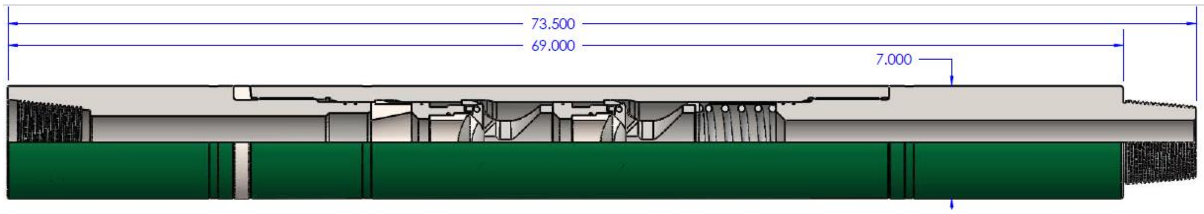
Top sub ID 3.25"

7" Surface configuration



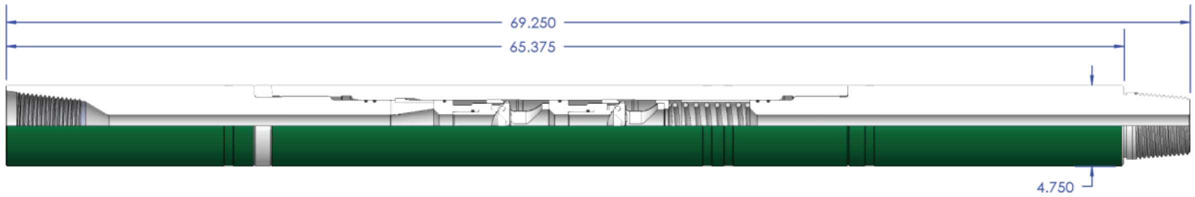
Top sub ID 3.25" (2.5" on H2S version)

7" BHA configuration



Top sub ID 3.25" (2.5" on H2S version)

4 ¾” BHA configuration



Top sub ID 1.313”

Make up the DT Valve to the drillstring and run in hole one stand below the rotary table.

Install the top drive and initiate slow circulation to determine the flapper opening pressure for the valve.

Run in hole.

4.2. Pulling out of hole

Pull out of hole until the valve is one stand below the rotary.

Make up the top drive and initiate slow circulation to bump the flapper valves open. Record the flapper opening pressure. Compare this pressure to the initial flapper opening pressure recorded when running in hole. If the pressure when pulling out of hole is greater than that when running in hole there is trapped pressure below the valve (assuming the same mud weight). Circulate the drillstring to condition the mud and remove the trapped pressure. When it is confirmed there is no trapped pressure below the valve continue to pull out of hole and remove the DT Valve from the drillstring.

The flappers require a minimal pressure to open (6-8psi). This may result in some drilling fluids being retained above the flappers when the tool is broken out. In order to prevent spills lay the tool out on the drillfloor to remove retained fluid in a closed drain area prior to laying out on the pipe deck.

Always fit thread protectors before laying out the tool from the drillfloor.

4.3. Pulling out of hole (ABP MPD Mode)

If pulling out of hole from TD in an applied back pressure MPD environment it is important that a high enough back pressure is maintained on the annulus at surface to ensure that the flappers remain closed at all times. If the differential pressure across the flappers is reduced to zero they will open slightly as a stand is pulled out of hole allowing fluid to drain through the restricted opening of the almost closed flapper. This results in debris getting stuck between the flapper and seat preventing the valve sealing correctly for connections. This is especially important when wellbore strengthening materials are being used in the drilling mud.

Minimum applied back pressure example:

Distance from RCD to topdrive Kelly hose at highest pulling position – 120ft

Mud weight – 17ppg

Pulling speed – 3min/stand

Hole size - 8 ½”

Swab pressure when pulling out of hole – 65psi (Lubinski et. al.)

Hydrostatic pressure of mud in stand above rotary table – 120*17*.052 = 106psi.

Reduction of differential across flappers as pipe is pulled to the top of the derrick – 106+65= 171 psi.

In this example a minimum of 171psi applied back pressure is required on the annulus to prevent the flappers from opening when tripping out of hole at 3 min/stand. If the tripping speed is higher then this the minimum pressure will increase due to higher swab pressures.

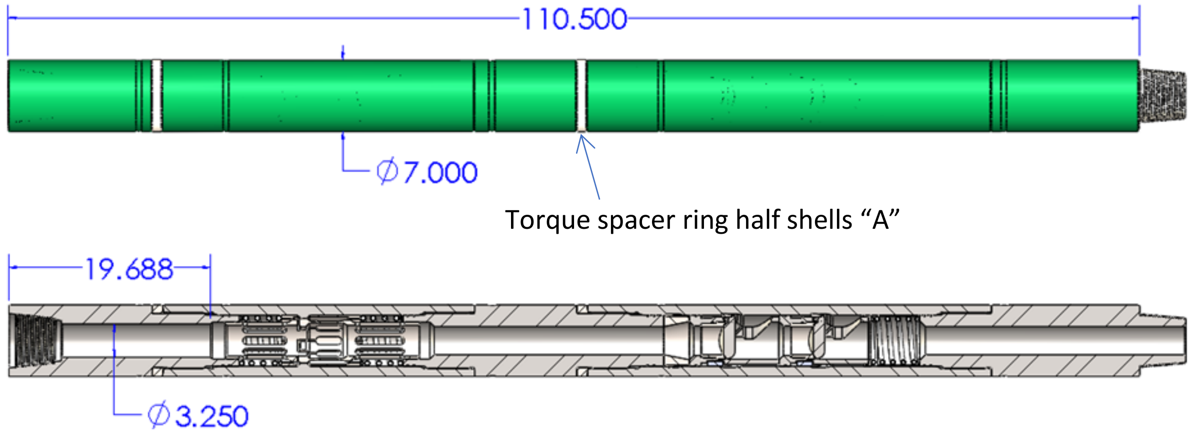
When pulling out of hole in ABP MPD mode the pipe should always be pulled wet.

4.4. Bleed-off procedures

During drilling operations using drillstring non-return valves either downhole or at surface it is not unusual to trap pressure below the valve. In conventional non-return valves this pressure is bled off by breaking the drillstring above the main body and using a bleed off tool to force the valve flappers open, thus allowing the pressure below the valve to be relieved to a bleed-off line.

For the DT valve pressure is bled off from below the valve either by running the lock open sleeve or the torque spacer rings (half shells) between the mid sub and main body can be removed allowing manual opening of the valve without losing pressure integrity in the string. The torque spacer ring is dovetailed into the connection such that when the connection is torqued up they cannot be dislodged from their correct position, however when the connection is backed out 1.5 turns they can easily be removed. The operating procedure is as follows:

i. Pick up the drillstring and set the slips below the DT valve.
ii. Break the connection between the mid sub and the main body (or top sub and main body for a BHA configuration tool) and back off 1.5 turns.
iii. Remove the two piece torque spacer ring half shells “A” from between the mid sub (top sub) and main body.
iv. Make up the connection between the mid sub and main body by 6 turns. At this point the flapper closure spring is disengaged by pushing the cartridge housings down with respect to the main body using the pin end of the mid sub.
v. Pump through the flappers to ensure they are in the open position.
vi. Bleed off any pressure in the drillstring slowly at surface.
vii. At this point either the valve can be re-activated by re-installing the original torque spacer ring half shells using the reverse of the removal procedure or the closure spring can be kept in the disengaged position by installing the thin torque spacer ring half shells. In either case the connection is re-torqued using the appropriate set of half shells prior to picking up the string to break the connection below the valve. When re-installing the half shells ensure they are the correct way round with the chamfered side facing downwards to enable full contact of the shoulder faces.



Note: If the valve is being used without the lock open facility then the torque spacer ring half shells are located between the top sub and the main body. The bleed off procedure remains the same.
Note: The thin (1/2" thick) torque spacer rings are painted red and are not for downhole use as they prevent the valve from closing. If the thin torque spacer rings have been installed they should be removed and replaced with the thick (1" thick) torque spacer rings before running in hole again.

5. Lock open sleeve running procedure

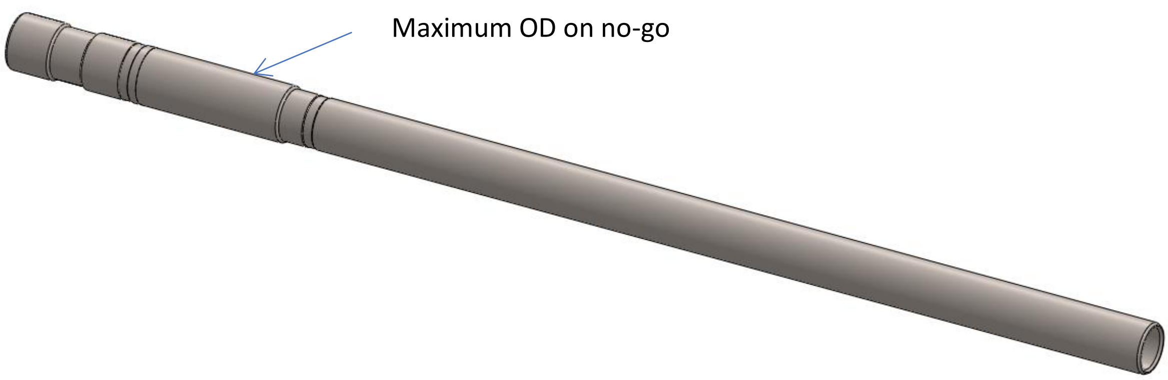
5.1. Introduction

The lock open sleeve for the DT Valve is run in order to facilitate wireline runs through the flappers. This may be required in the event of stuck pipe situations where freepoint and back-off tools are required.

The lock open sleeve is run in hole to be located in the upper grapple section of the tool and extends through the lower section of the tool including the flappers giving a free clear passage for wireline tools through the valve. The lock open sleeve is retained by the grapple and as standard requires a 300lb force to latch it in place and a 300lb overpull to remove it from the grapple. The force requirements can be changed on request by changing the strength of the grapple springs.

The lock open sleeve for both of the 8 ½” valves and the 7” standard service valve has an industry standard 3” internal GS latch profile to be run on standard slickline tools or a wireline running tool in a dedicated run in hole. A GS type wireline running tool is supplied with the valve. The sleeve is 65” long with an ID of 2.25” and an upper no-go OD of 3”.

The lock open sleeve for the 7” H2S service valve has an industry standard 2.5” internal GS latch profile to be run on standard slickline tools or a wireline running tool in a dedicated run in hole. A GS type wireline running tool is supplied with the valve. The sleeve is 65” long with an ID of 1.75” and an upper no-go OD of 2.48”.



5.2. Running procedure

Make up the running / pulling toolstring to the lock open sleeve. It is recommended that the running / pulling string should as a minimum consist of enough layoff weight (standard 300lbs spring) to allow the lock open sleeve to fully engage in the grapple downhole and a set of spang jars to facilitate release of the running tool from the lock open sleeve. For electric line operations the tool can be run in place using cable speed to facilitate shearing of the shear pins and setting of the sleeve rather than spang jars but a minimum of 300lbs layoff weight is still required.

Run in hole with the lock open sleeve taking care not to hang up in any restrictions in the drillstring.

At 100ft above the DT Valve stop to record up and down weights.

Run in hole slowly until lock open sleeve engages the grapple in the valve and lay off a minimum of 300lbs string weight to lock the sleeve in place.

If running on slickline

Pick up slowly and take a 150lb overpull to confirm that the sleeve has located correctly. If no overpull is seen repeat weight layoff procedure increasing layoff weight to maximum toolstring weight. Increasing the running speed will help to engage the sleeve and shear the running tool shear pins. Repeat overpull test. Be careful not to exceed 300lbs overpull as this will disengage the sleeve downhole.

When an overpull is obtained lay off weight on the running tool and jar down to release the running tool from the sleeve. Pick up slowly ensuring no overpull is seen. If possible check the up weight to ensure the weight of the lock open sleeve (36 lbs) has been lost.

Pull out of hole with slickline.

If running on electric line

Pick up slowly – no overpull should be seen and the running tool should release from the sleeve. If overpull is seen repeat weight layoff procedure increasing layoff weight to maximum toolstring weight. Increasing the running speed will help to engage the sleeve and shear the running tool shear pins.

Once no overpull is seen when picking up run back in hole and lay off 300lbs again to re-engage the running tool in the sleeve. Again pick up slowly and take a 150lb overpull to confirm that the sleeve has located correctly. Be careful not to exceed 300lbs overpull as this will disengage the sleeve downhole.

When an overpull is obtained, lay off weight on the running tool to release the running tool from the sleeve again. Pick up slowly ensuring no overpull is seen. If possible check the up weight to ensure the weight of the lock open sleeve (36 lbs) has been lost. If overpull is seen do not exceed 150lbs. Run in and lay off weight again to cycle the running tool and pick up again slowly. Repeat until the running tool releases from the sleeve with no overpull.

Pull out of hole with electric line.

5.3. Pulling procedure

Run in hole with the running / pulling tool.

At 100ft above the DT Valve stop to record up and down weights.

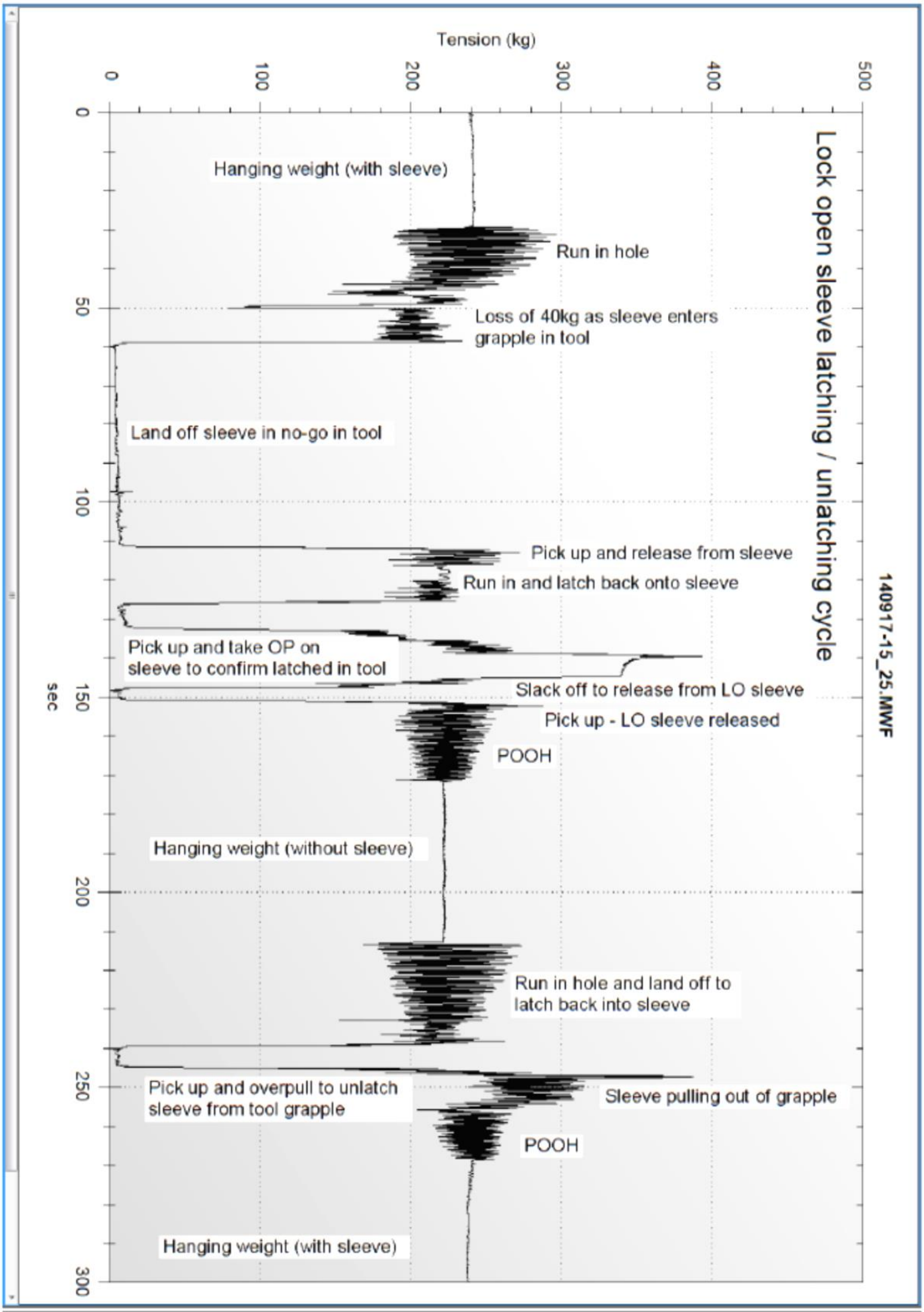
Run in slowly to the top of the DT Valve and engage the pulling tool in the lock open sleeve. Lay off 400lbs weight to ensure the pulling tool is engaged.

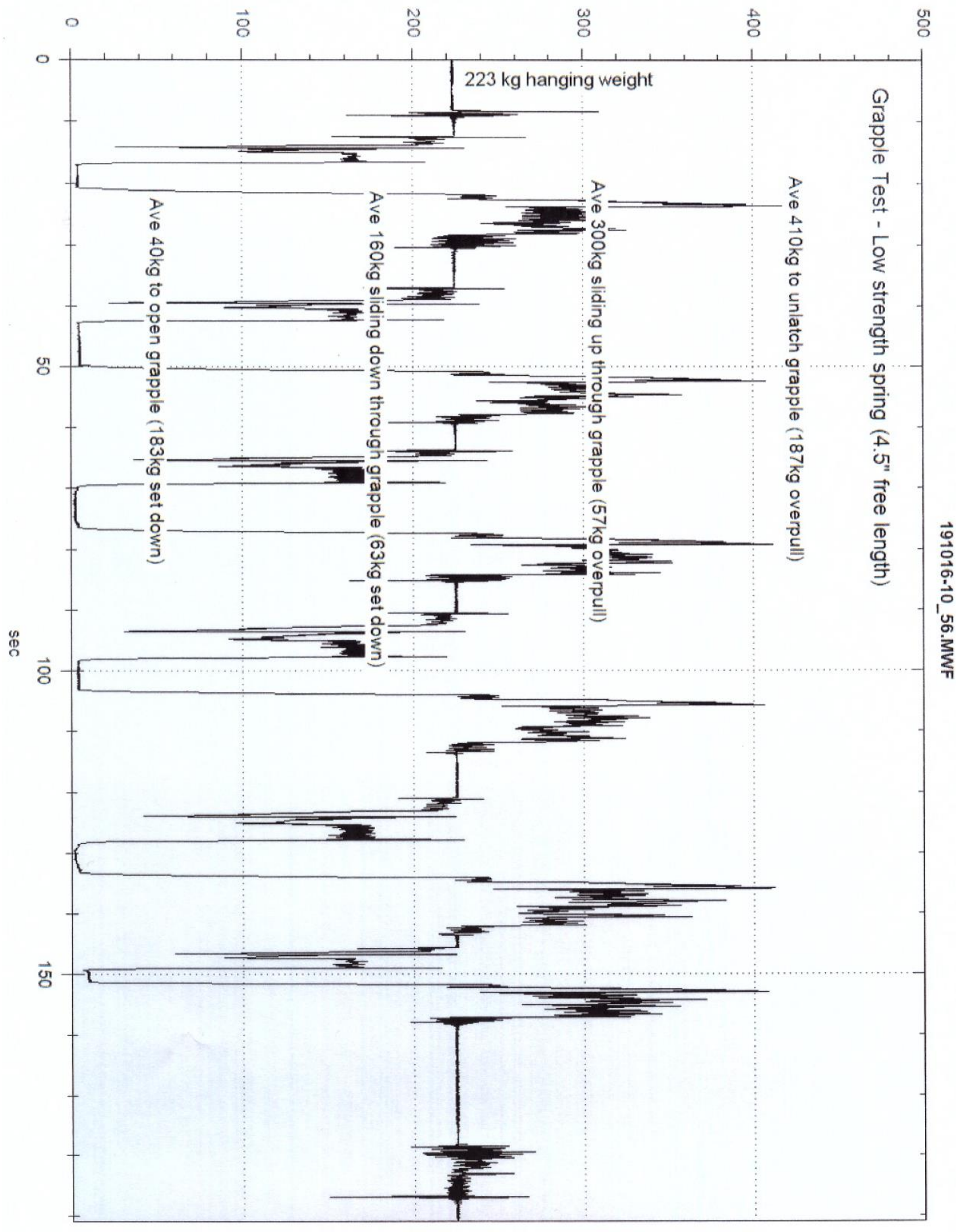
Pick up slowly. If the pulling tool is engaged in the lock open sleeve a 300lb overpull will be seen which will drop back to normal up weight with the addition of the lock open sleeve weight (additional 36 lbs) once the sleeve disengages from the grapple in the DT Valve.

If no overpull or additional weight is seen a further attempt should be made to engage the pulling tool in the lock open sleeve as above. If a high overpull is seen attempts to remove the sleeve from the DT Valve can be made by jarring up and maintaining overpull. If the sleeve cannot be removed from the DT Valve the running / pulling tool can be disengaged from the sleeve by laying off weight then picking up again.

Once the lock open sleeve has been disengaged from the DT Valve it can be pulled out of hole using normal wireline procedure.

A sequence of latching and unlatching load profiles is given below for reference when running and pulling the sleeve.


Lock open sleeve latching / unlatching cycle
140917-15_25.MWF
Tension (kg)
0
100
200
300
400
500
sec
0
50
100
150
200
250
300
Hanging weight (with sleeve)
Run in hole
Loss of 40kg as sleeve enters grapple in tool
Land off sleeve in no-go in tool
Pick up and release from sleeve
Run in and latch back onto sleeve
Pick up and take OP on sleeve to confirm latched in tool
Slack off to release from LO sleeve
Pick up - LO sleeve released
POOH
Hanging weight (without sleeve)
Run in hole and land off to latch back into sleeve
Pick up and overpull to unlatch sleeve from tool grapple
Sleeve pulling out of grapple
POOH
Hanging weight (with sleeve)



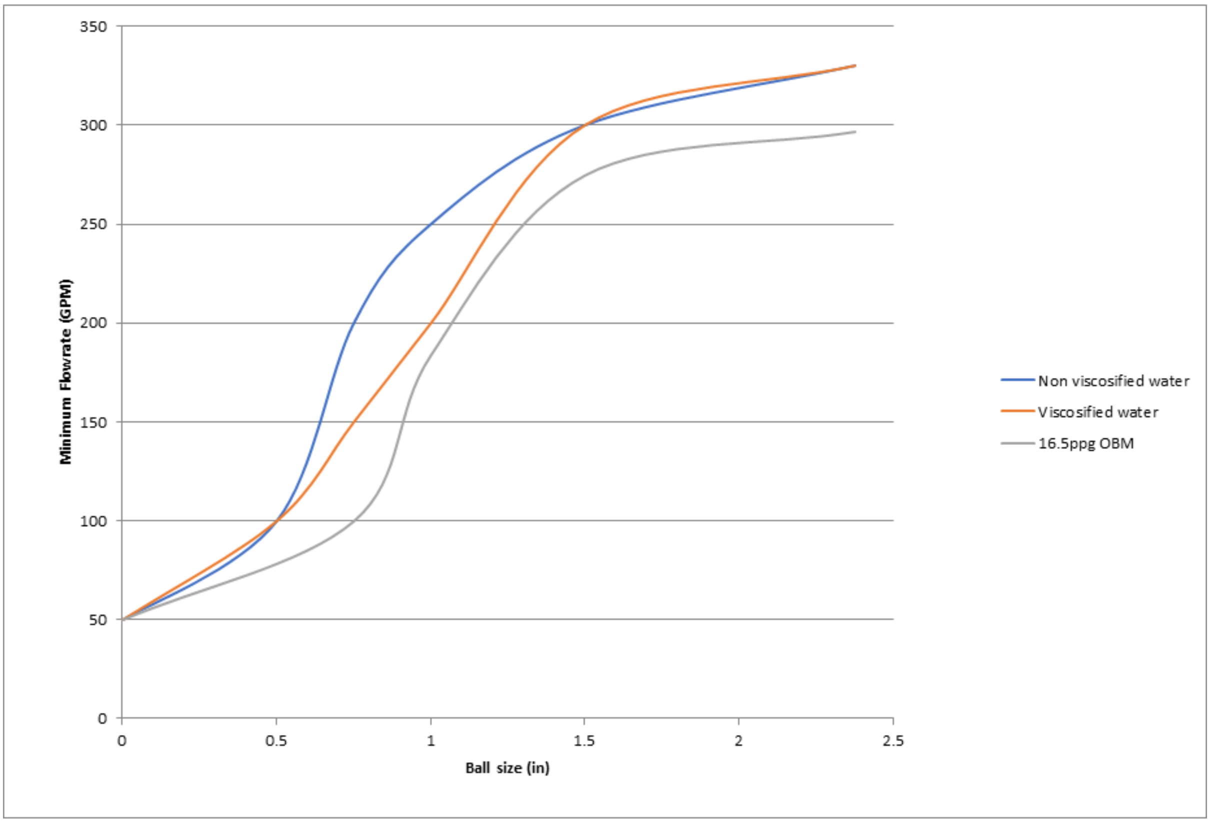
Grapple Test - Low strength spring (4.5" free length)
191016-10_56.MWF
223 kg hanging weight
Ave 410kg to unlatch grapple (187kg overpull)
Ave 300kg sliding up through grapple (57kg overpull)
Ave 160kg sliding down through grapple (63kg set down)
Ave 40kg to open grapple (183kg set down)
0
100
200
300
400
500
0
50
100
150
sec

6. Dropping Balls Through The Valves

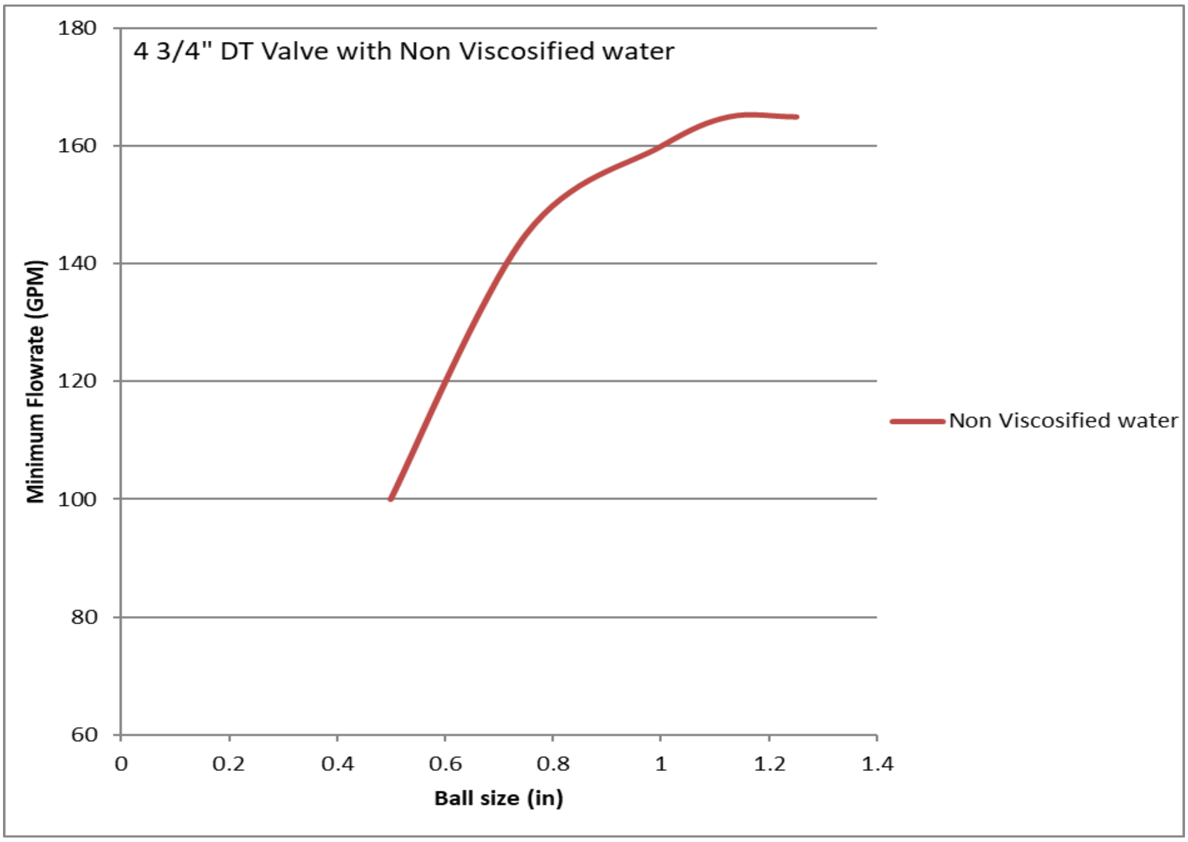
DT valves have a positive spring closure force of approximately 400lbs. This means that they require a significant force to open. This can be done at surface by forcing a drift through the valve. In this case once the upper flapper is forced open with the drift the lower will open more easily as the closure spring force has already been overcome.

When the valves are downhole fluid flow and differential pressure is used to open the valves. A differential of 6-8psi is required across the seal seats in order to open the valves. This means that the valve flappers open progressively with flowrate as the further open the flappers are, the greater the flow area and the higher the flowrate required to generate a 6-8psi differential. A flowrate of approximately 300gpm (1125 lpm) is required to fully open the flappers on an 8 ½" or 7" valve.

When dropping balls and darts this characteristic must be taken into account. The balls (regardless of size) are not heavy enough to open the flappers without flow and must be pumped through the valves. The larger the ball the higher the flowrate required to pass it through the valve. A chart of ball size versus minimum flowrate required for the balls to pass through 8 ½" and 7" tools using different fluids is given below.



When using 4 ¾" valves the ID of the valve is 1.313" giving a maximum ball passthrough diameter of 1.25". A chart of minimum flowrate required for balls to pass through 4 ¾" tools with non viscosified water is given below.


4 3/4" DT Valve with Non Viscosified water
180
160
140
120
100
80
60
Minimum Flowrate (GPM)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Ball size (in)
Non Viscosified water

7. Cementing Through The Valves and Debris

The valves have been designed to be debris tolerant with most areas being flow washed. However this means that a minimum flowrate of approximately 100gpm (375 lpm) is required in order to adequately remove cement or debris from around the valve mechanism.

If low rate circulation is used (<50gpm) there is a possibility that due to the low opening angle of the flappers debris can be pumped into the area between the flapper and seat on the pivot side of the flapper and become trapped. When circulation is stopped the closure spring will try to close the flappers on the debris compacting it and preventing the valve from closing properly. If this is the case a short period of increased flowrate will dislodge the debris and allow the flappers to seat again. Flushing can also be performed at surface with a cement unit.

In addition if the valve has been cemented through, after the cement has been displaced from the drillstring a string circulation rate of greater than 100gpm (375 lpm) is required to remove cement from the valve mechanism. If this can not be achieved it is likely that cement will be retained between the cartridge housings and the main body of the valve and the flappers will be cemented in a partially open position. When a valve has had cement pumped through it, it should be flushed and pressure tested using a cement unit on retrieval to surface. In addition the drift supplied should be passed several times through the valve to ensure it is opening and closing correctly ‘snapping’ shut.

If in any doubt about the operation of a valve it is better to return it to Drilltools for inspection and run the backup tool.

8. Contact

In the event of any queries when running Drilltools valves please feel free to contact the following personnel at Drilltools:

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07801072170