

## Tool Manual

Assembly Procedure No.	M-0101-4750-02/H	Revision	B
Tool Assembly Family	0101		
Tool Description	DT 4-3/4" Flapper Safety Valve		

Issued By	Paul Hilliard
Date	18/01/17
Checked By	Jeff Knight
Date	15/04/17

Revision	Date	ECN
B	6/7/17	Jeff Knight



## Table of Contents

1.	Part List .....	2
2.	Parts Drawings .....	4
3.	Assembly Procedure .....	13
4.	Dis-Assembly Procedure .....	21
5.	Operational Procedure.....	26
5.1.	Tool Specifications .....	26
5.1.1.	AISI 4140, Sour Gas Service.....	26
5.1.2.	AISI 4145, Standard Service .....	27
5.2.	Storage .....	28
5.3.	Handling .....	28
5.4.	Lifting .....	28
6.	Post Assembly Testing.....	28
7.	Checklist .....	28
8.	DT Valve running procedure .....	29
9.	Bleed-off procedures .....	30

# 1. Part List

## 1) DT Flapper Safety Valve

### a) Standard Service

*1-0101-4750-02 4-3/4" DT Flapper Safety Valve*

ITEM NO.	Part Description	Drwg/Part No.	Rev	QTY.	Full Redress Kit?	Seal Redress Kit?
1	Top Sub	2-0101-4750-01	A	1		
2	Main Body	2-0101-4750-02	B	1		
3	Bottom Sub	2-0101-4750-03	A	1		
4	4-3/4" Cartridge Housing Assembly	1-0101-4750-04	A	2	Y	
5	Flapper	2-0101-4750-06	B	2	Y	
6	Spring Flange	2-0101-4750-07	A	1		
7	Latch Ring	2-0101-4750-08	B	2		
8	Lug	2-0101-4750-09	A	2		
9	Spring Spacer	2-0101-4750-10	A	1		
10	Torque Spacer 0.438"	2-0101-4750-11	A	1		
11	Torque Spacer 1"	2-0101-4750-12	A	1		
12	Load Collars	2-0101-4750-13	A	1		
13	Locking Ring	2-0101-4750-14	A	1		
14	CV Spring	5-0101-4750-50	A	1		
15	O-Ring 029	OR-029-N90	-	2	Y	Y
16	O-Ring 232	OR-232-N90	-	6	Y	Y
+	API Drift Rod Assembly	1-8001-1250-01	A	1		
+	Assembly Pulling Tool	1-0101-4750-82	A	1		
+	Assembly Tool Cartridge Stopper	2-0101-4750-88	A	1		
+	Assembly Sleeve	2-0101-4750-93	A	1		
+	Disassembly Sleeve	2-0101-4750-94	A	1		
Full Redress Kit (optional)		3-0101-4750-02-1F				
Seal Redress Kit (optional)		3-0101-4750-02-3S				

2) **DT Flapper Safety Valve**

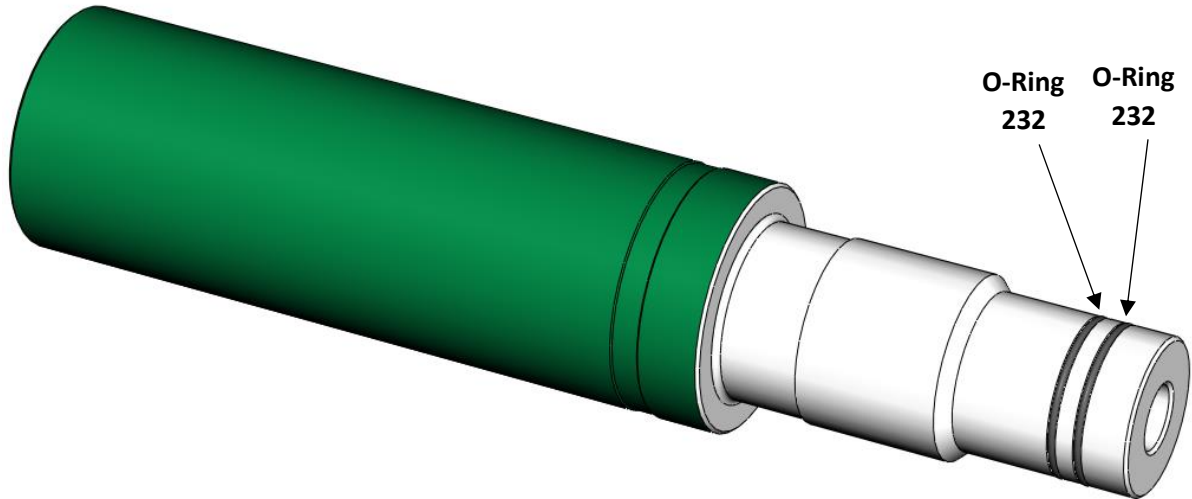
a) H2S (sour gas) Service

*1-0101-4750-02h 4-3/4" DT Flapper Safety Valve*

ITEM NO.	Part Description	Drwg/Part No.	Rev	QTY.	Full Redress Kit?	Seal Redress Kit?
1	Top Sub	2-0101-4750-01h	A	1		
2	Main Body	2-0101-4750-02h	B	1		
3	Bottom Sub	2-0101-4750-03h	A	1		
4	4-3/4" Cartridge Housing Assembly	1-0101-4750-04h	A	2	Y	
5	Flapper	2-0101-4750-06h	B	2	Y	
6	Spring Flange	2-0101-4750-07h	A	1		
7	Latch Ring	2-0101-4750-08h	B	2		
8	Lug	2-0101-4750-09h	A	2		
9	Spring Spacer	2-0101-4750-10h	A	1		
10	Torque Spacer 0.438"	2-0101-4750-11h	A	1		
11	Torque Spacer 1"	2-0101-4750-12h	A	1		
12	Load Collars	2-0101-4750-13h	A	1		
13	Locking Ring	2-0101-4750-14h	A	1		
14	CV Spring	5-0101-4750-50h	A	1		
15	O-Ring 029	OR-029-N90	-	2	Y	Y
16	O-Ring 232	OR-232-N90	-	6	Y	Y
+	API Drift Rod Assembly	1-8001-1250-01	A	1		
+	Assembly Pulling Tool	1-0101-4750-82	A	1		
+	Assembly Tool Cartridge Stopper	2-0101-4750-88	A	1		
+	Assembly Sleeve	2-0101-4750-93	A	1		
+	Disassembly Sleeve	2-0101-4750-94	A	1		
Full Redress Kit (optional)		3-0101-4750-02h-1F				
Seal Redress Kit (optional)		3-0101-4750-02h-3S				

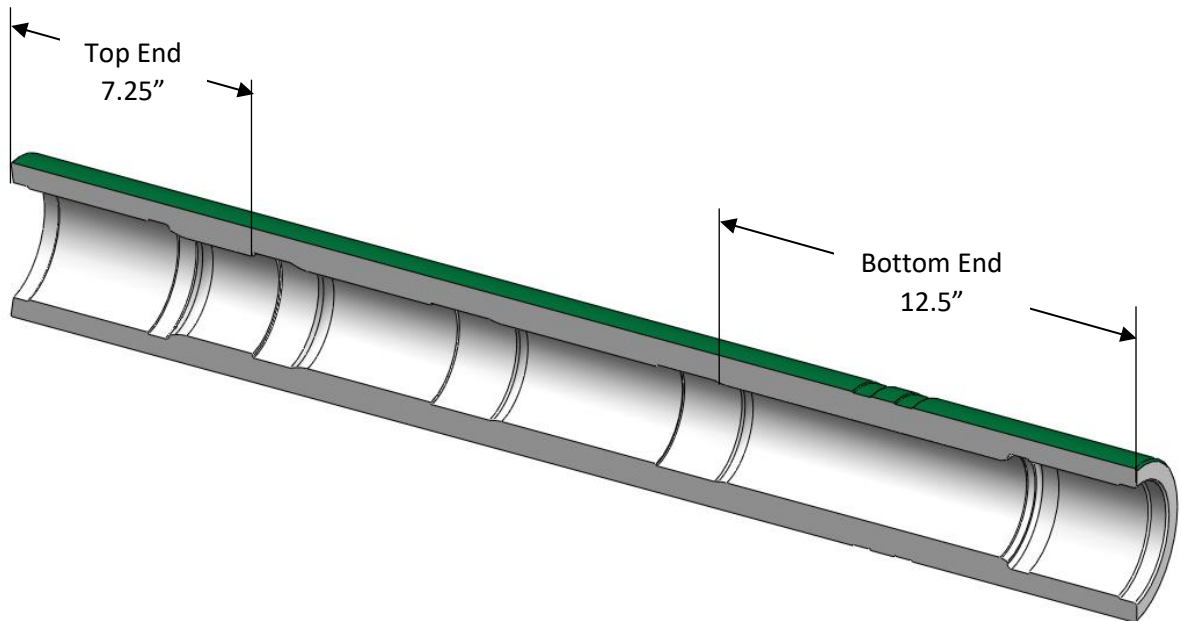
## 2. Parts Drawings

1) Top Sub 2-0101-4750-01(h)

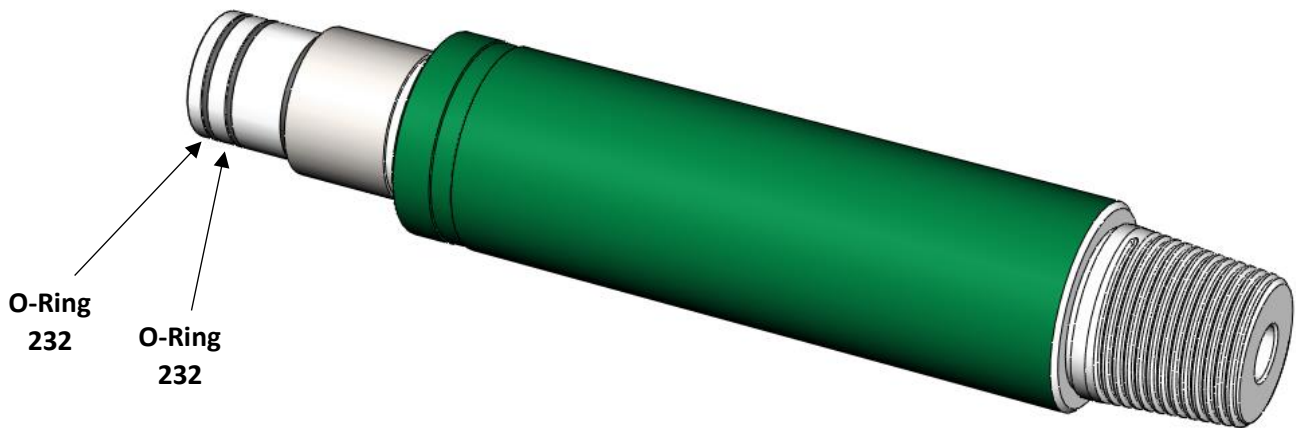


2) Main Body 2-0101-4750-02(h)

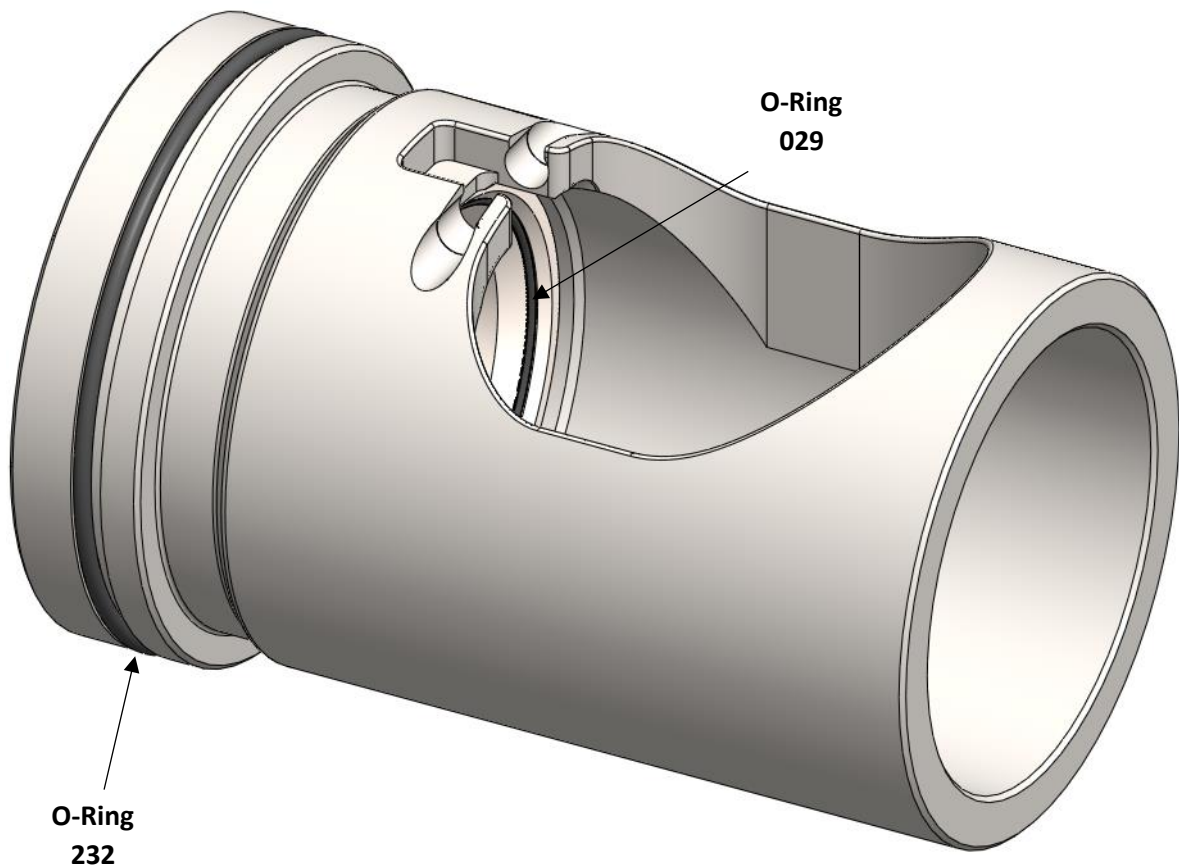
The Main Body will be marked top at the top end, if not visible use the internal grooves to locate the top of the Main Body. The top end has grooves closer to the end of the body.



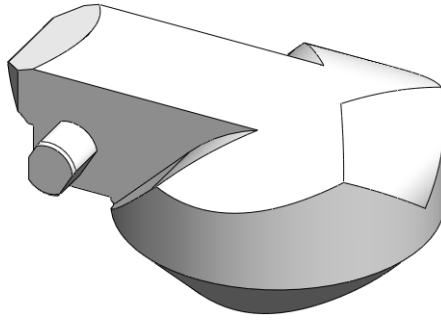
3) Bottom Sub 2-0101-4750-03(h)



4) 4-3/4" Cartridge Housing Assembly 1-0101-4750-04(h)



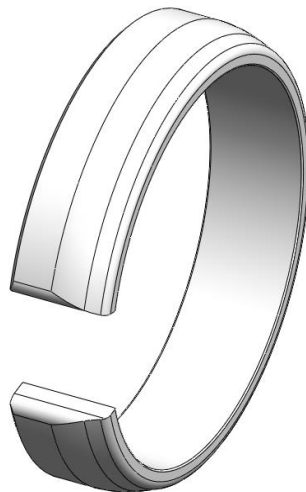
5) Flapper 2-0101-4750-06(h)



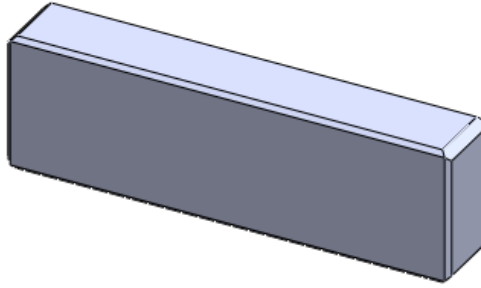
6) Spring Flange 2-0101-4750-07(h)



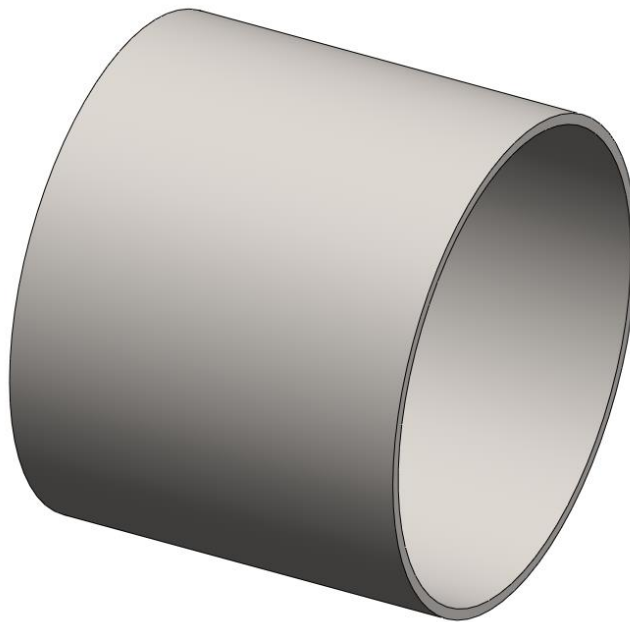
7) Latch Ring 2-0101-4750-09(h)



8) Lug 2-0101-4750-09(h)



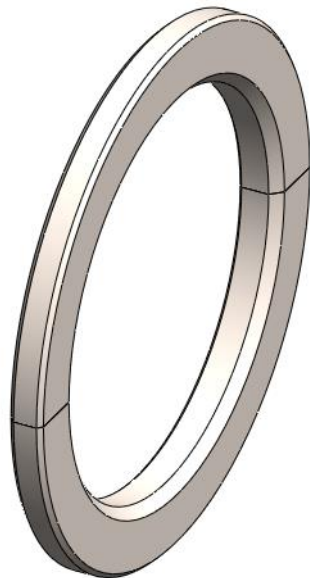
9) Spring Spacer 2-0101-4750-10(h)



10) Sealing Cartridge 2-0101-4750-05(h)



11) 0.438" Torque Spacer 2-0101-4750-11(h) (two equal halves)

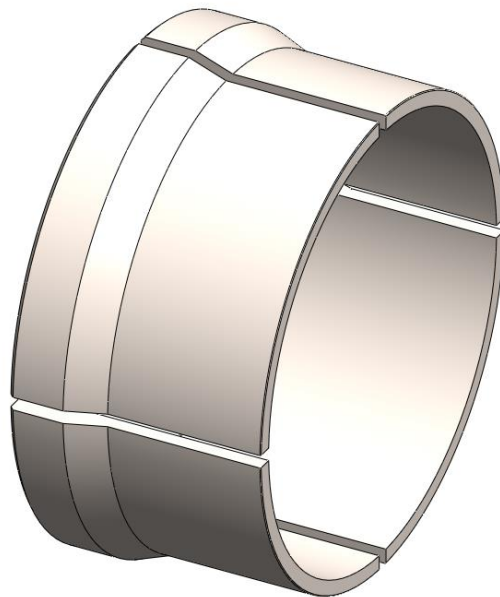




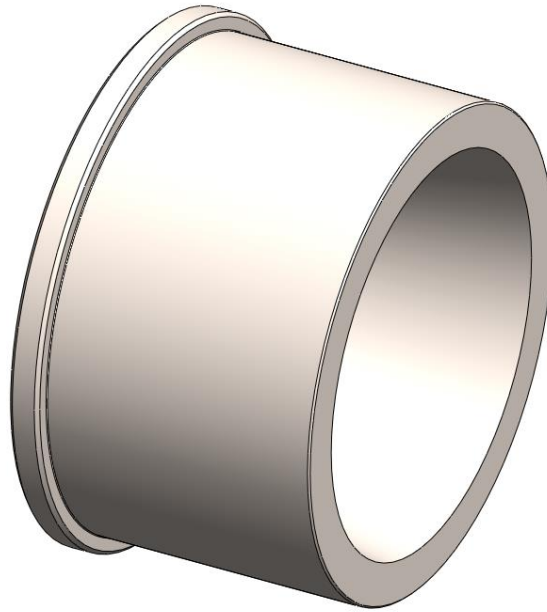
12) 1" Torque Spacer 2-0101-4750-12(h) (two equal halves)



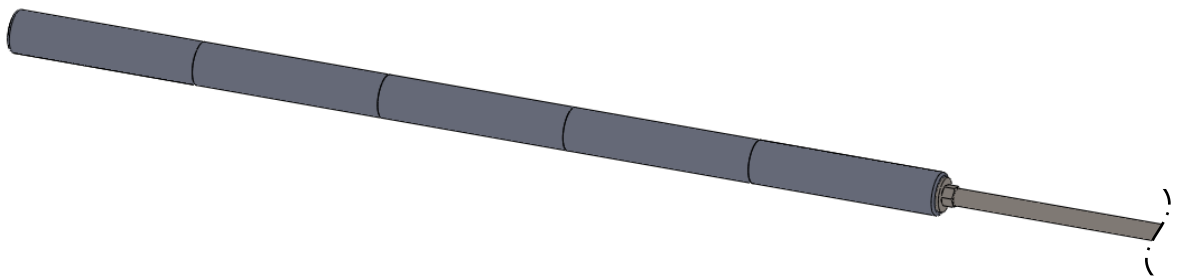
13) Load Collars 2-0101-4750-13(h)



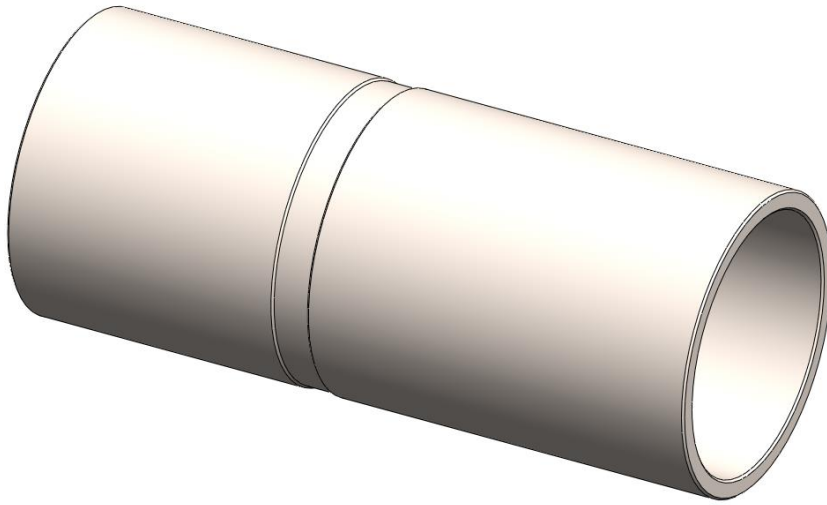
14) Locking Ring 2-0101-4750-14(h)



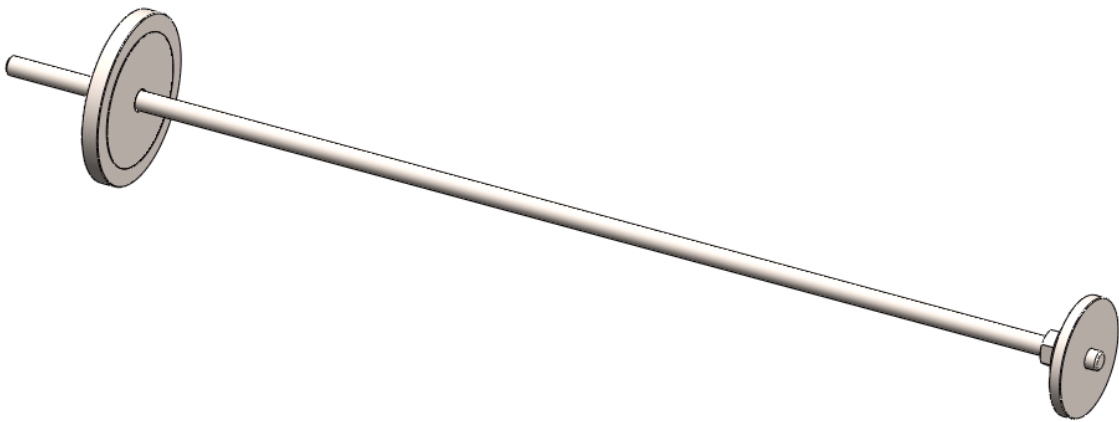
15) API Drift Rod 1-8001-1250-01



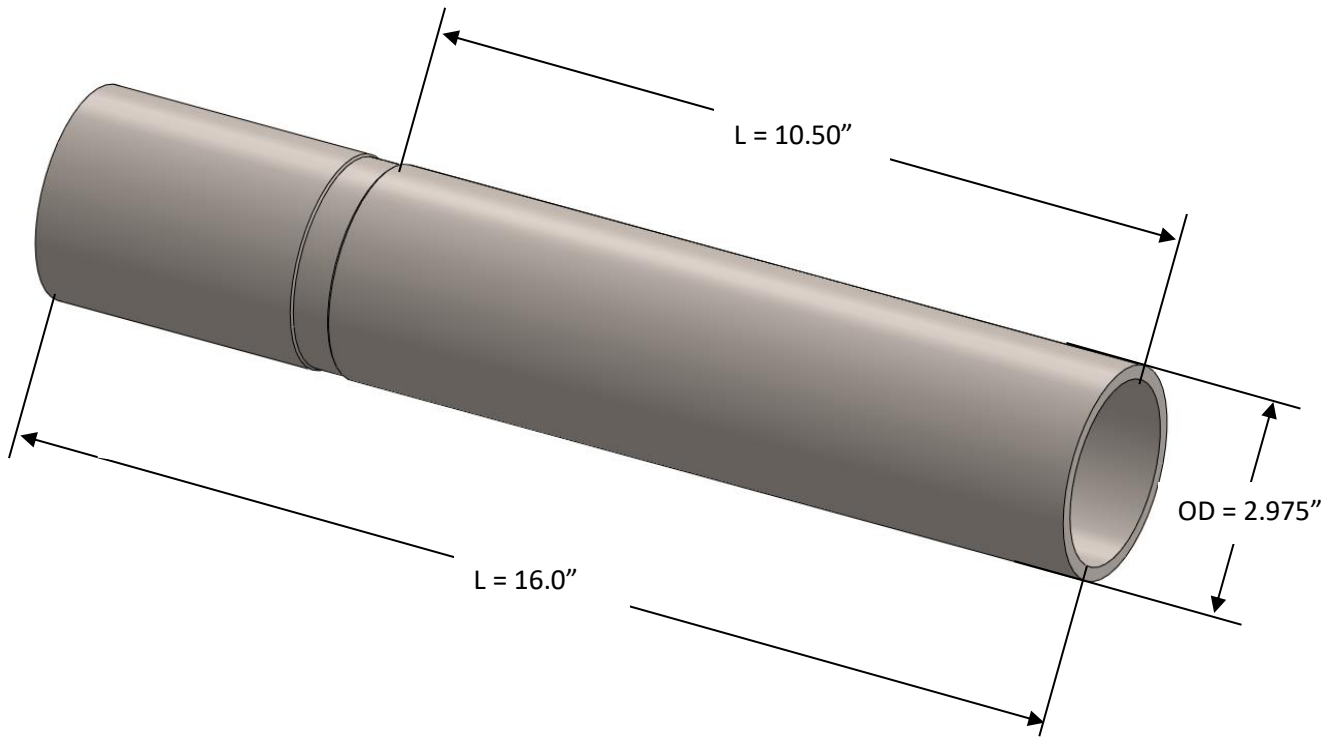
16) Assembly Tool Cartridge Stopper 2-0101-4750-84



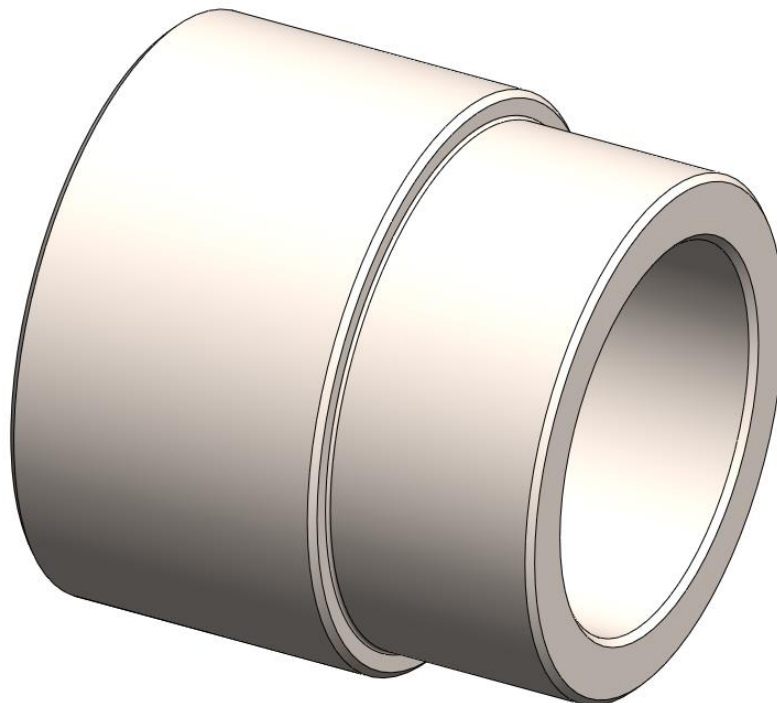
17) Assembly Pulling Tool 1-0101-4750-82



18) Assembly Sleeve 2-0101-4750-93



19) Disassembly Sleeve 1-0101-4750-94



### 3. Assembly Procedure



*Note:*

*Ensure parts are free from burrs and any other damage.*

*Lightly grease all parts prior to assembly.*

*Use Copper Slip for all connections.*

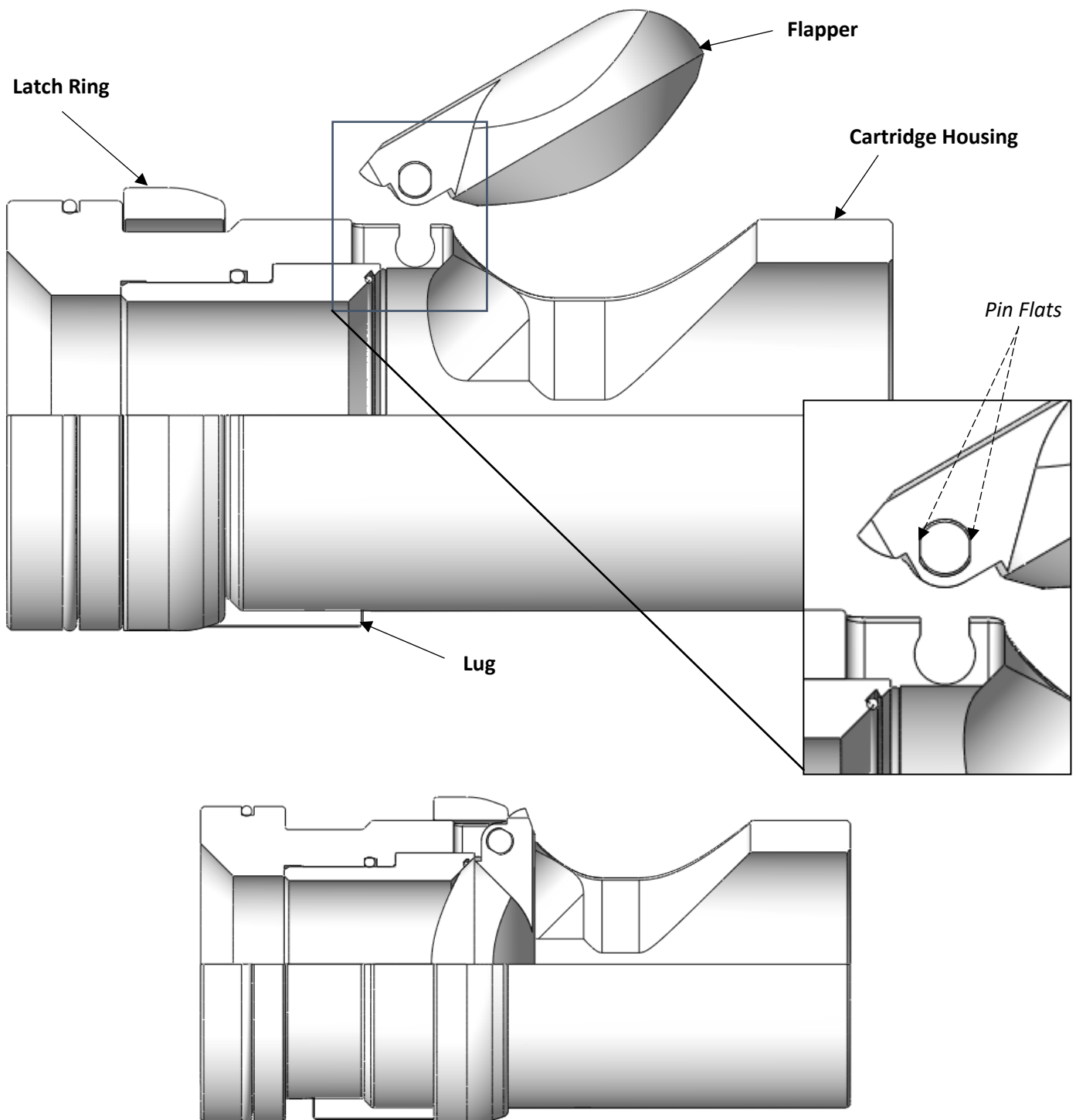
*O-Rings are lightly greased with a suitable lubricant and installed to individual parts before assembling, use assembly drawing as guide.*

*Some images will be sectioned for clarity.*

Tool List:

- Lifting device (min. 1100lbs/500kg)
- 3x Support Stand (suitable for  $\text{Ø } 4 \frac{3}{4}''$ )
- Brass hammer
- 2x Pipe wrenches (suitable for  $\text{Ø } 4 \frac{3}{4}''$ )

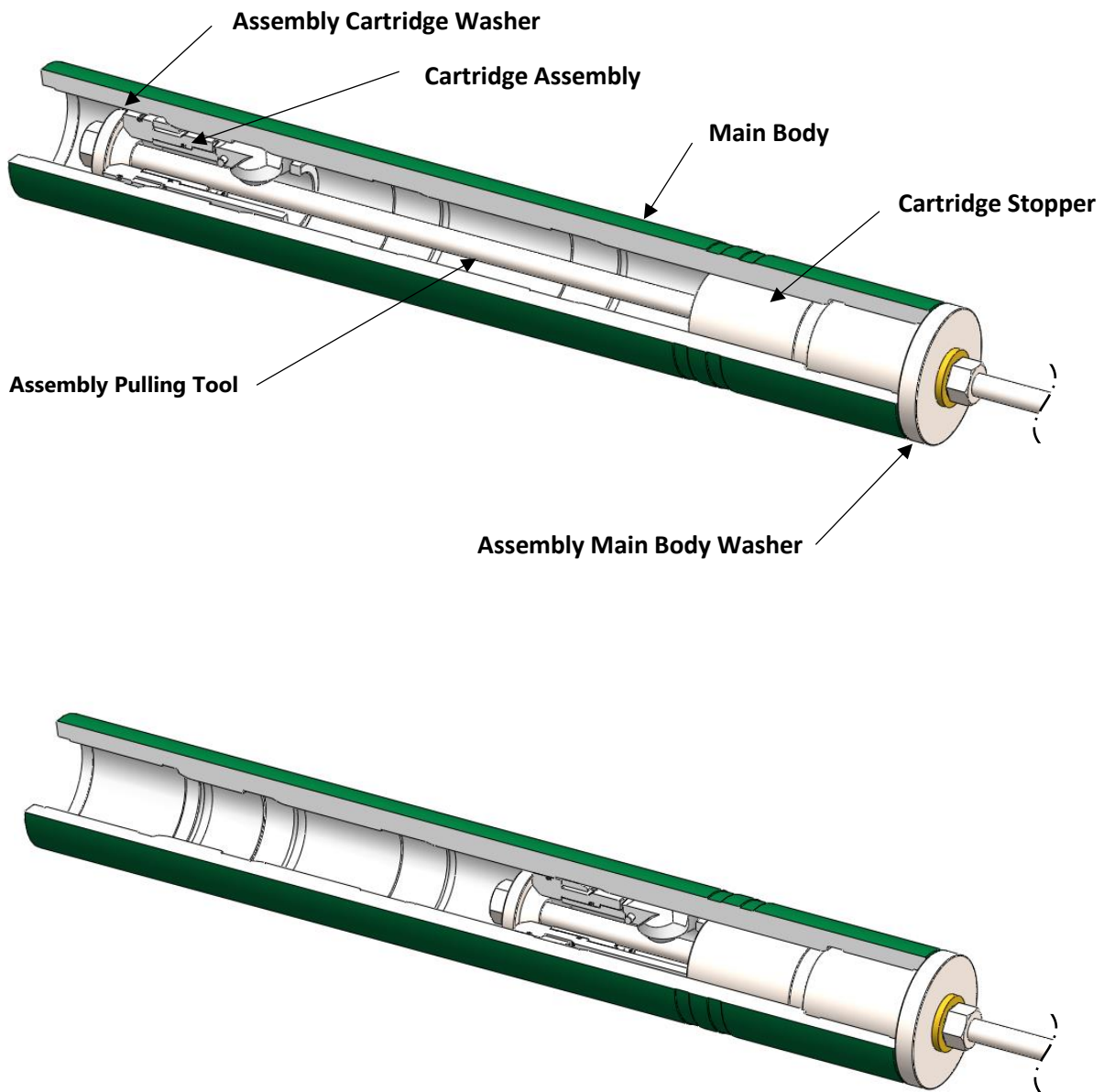
- 1) Assemble the **Cartridge Assemblies (x2)**; slide the **Latch Ring** over the **Cartridge Housing** until it's shoulders out. Assemble the **Flapper** at a 30degree angle (use *Pin Flats* as guide) into the **Cartridge Housing** until it locates into the pivot groove. Allow the **Flapper** to pivot into the closed position and check it travels smoothly and easily from fully open to fully closed. Press the **Lug** into the slot on the opposite side of the **Cartridge Housing** to the **Flapper** such that it prevents the **Latch Ring** rotating. Test whether the **Flapper** is correctly seated by holding the assembled cartridge housing vertically supported by the closed **Flapper** and pouring water in above the **Flapper**. If the **Flapper** and **Seal Cartridge** are correctly installed no water should leak past the **Flapper**.



- 2) Arrange the **Main Body** horizontally in a vice. Use the **Cartridge Stopper** and the **Assembly Main Body Washer** in the bottom of the **Main Body** (as shown below) to prevent the **Cartridge Assembly** traveling too far down inside the body during assembly. Install/pull the first **Cartridge Assembly** into the **Main Body** from the top, the **Latch Ring** will collapse into the groove on the **Cartridge Housing** and expand into the groove on the **Main Body**. Use the **Assembly Tool** to pull the **Cartridge Assembly** down until it bottoms out on the **Cartridge Stopper** (as shown below in the second picture).

UNDER NO CIRCUMSTANCES INSTALL THE CARTRIDGE ASSEMBLIES FROM THE BOTTOM END OF THE TOOL!  
THIS WILL RESULT IN THE CARTRIDGE ASSEMBLIES BEING STUCK IN THE HOUSING!

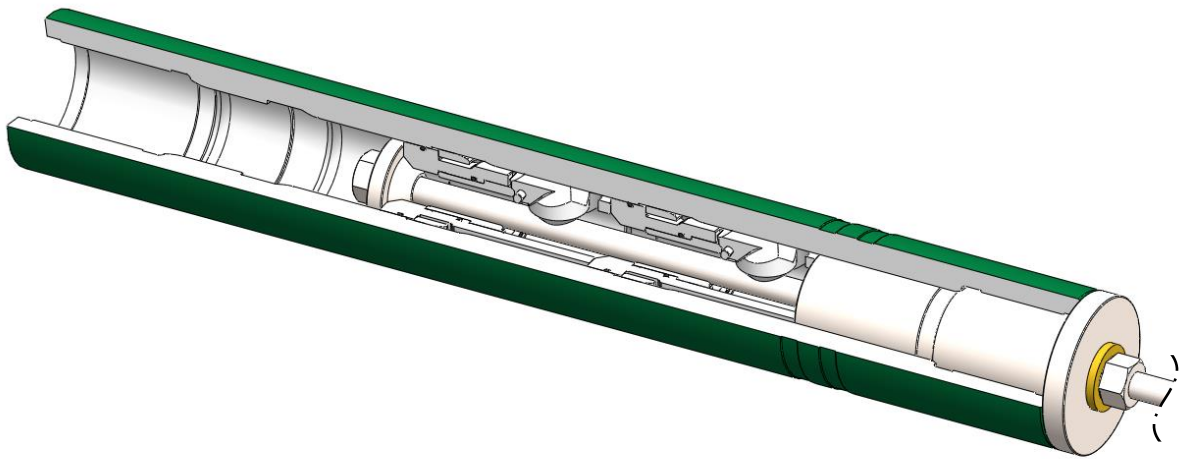
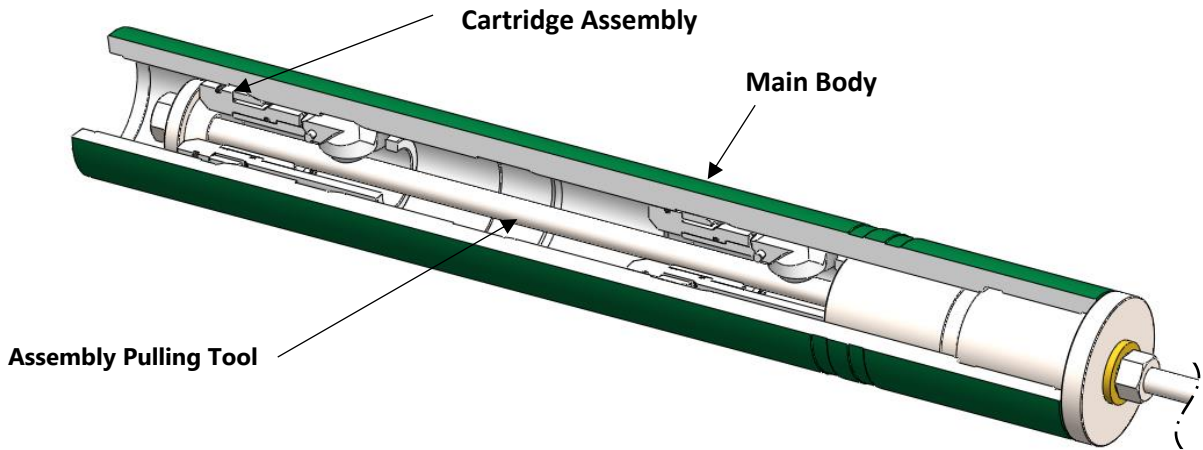
The Main Body will be marked top at the top end, if not visible use the internal grooves to locate the top of the Main Body. The top end has grooves closer to the end of the body.



- 3) Insert the second **Cartridge Assembly** into the top of the **Main Body** and pull it into the **Main Body** using the **Assembly Pulling Tool**. The **Cartridge Assemblies** and the **Assembly Pulling Tool** will stop moving when the **Cartridge Stopper** is reached (as shown below in the second picture).

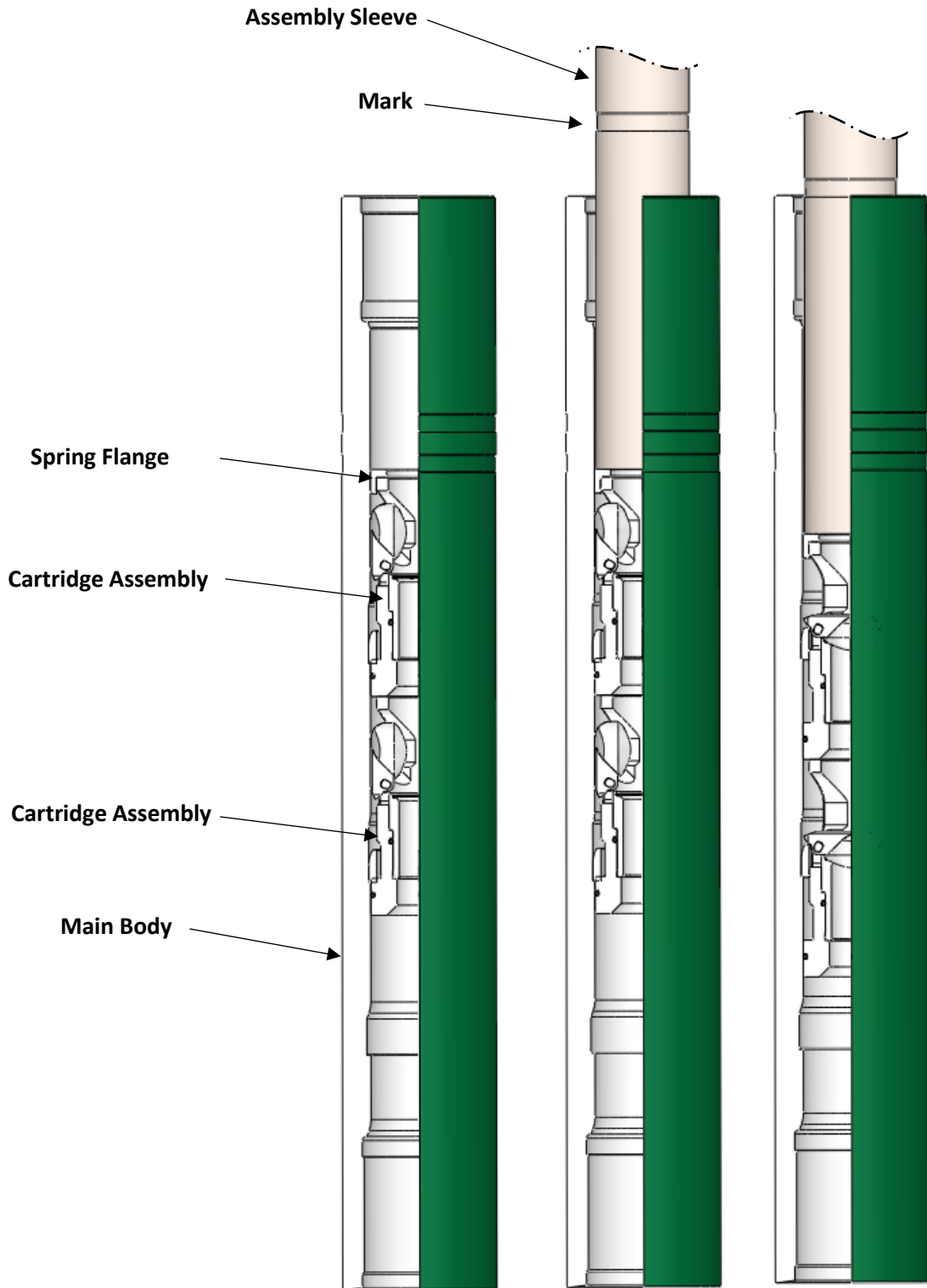
UNDER NO CIRCUMSTANCES INSTALL THE CARTRIDGE ASSEMBLIES FROM THE BOTTOM END OF THE TOOL!  
THIS WILL RESULT IN THE CARTRIDGE ASSEMBLIES BEING STUCK IN THE HOUSING!

The Main Body will be marked top at the top end, if not visible use the internal grooves to locate the top of the Main Body. The top end has grooves closer to the end of the body.

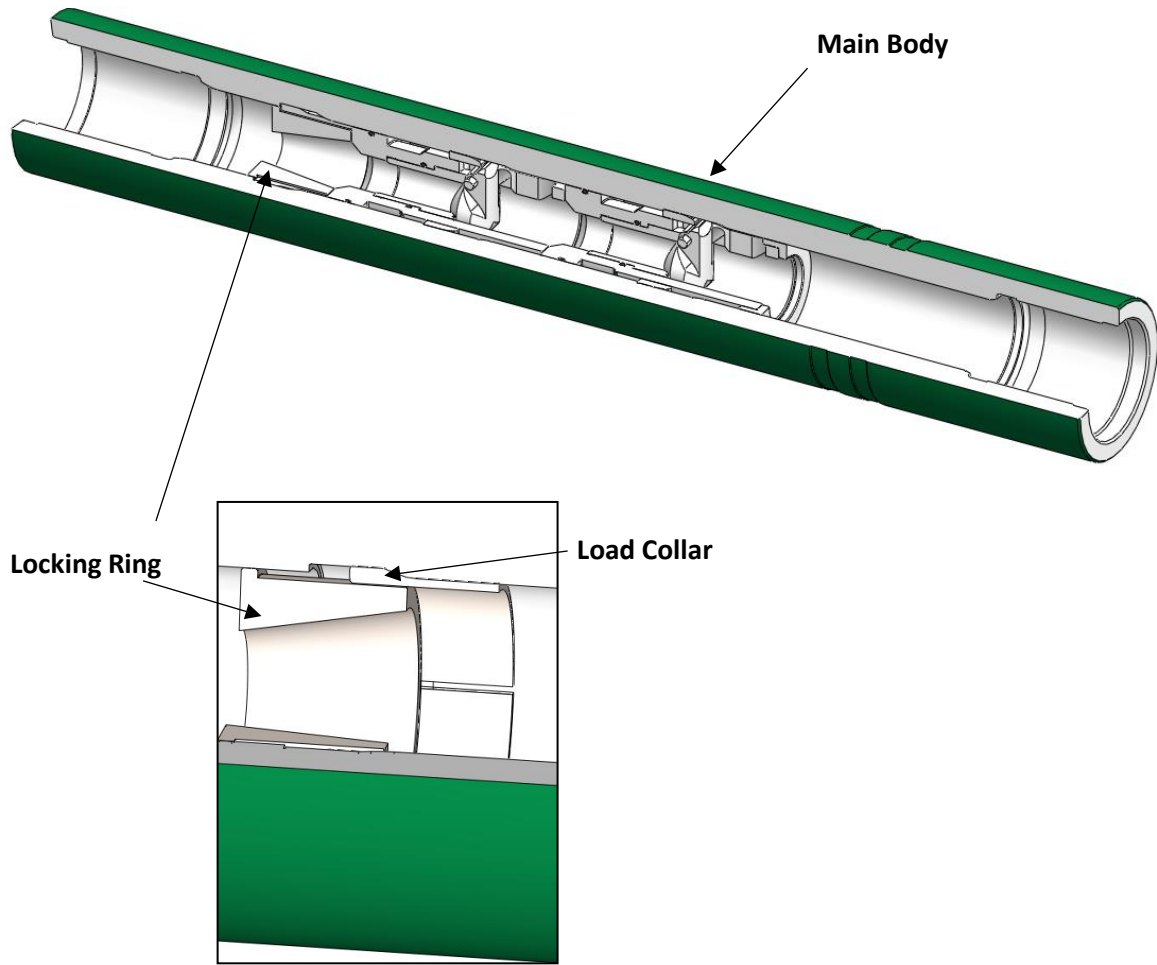




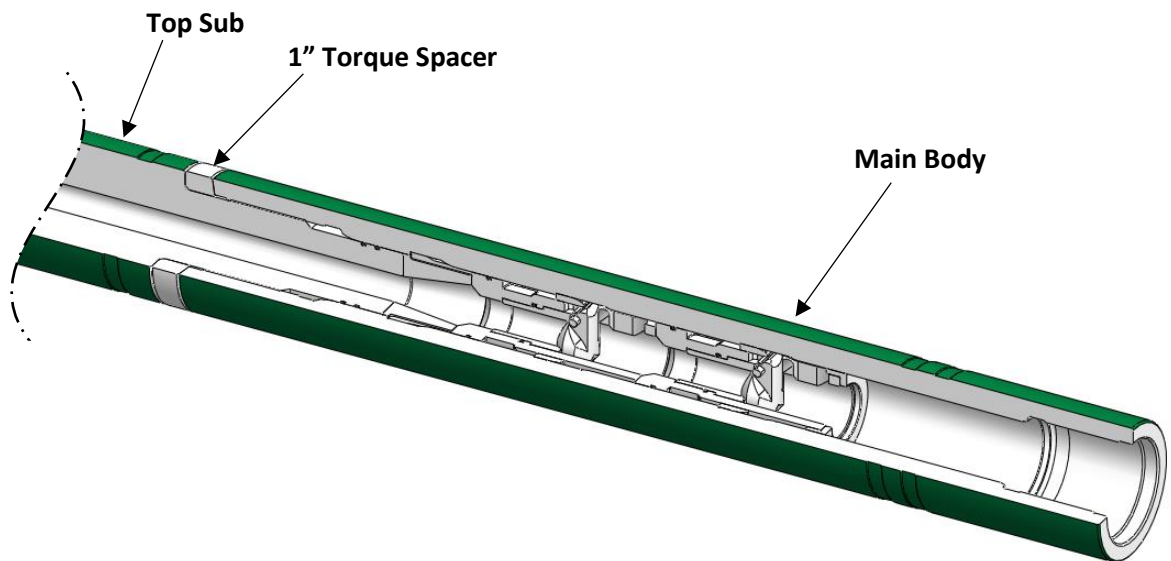
- 4) Turn the **Main Body** over so that it is upside down and remove the **Cartridge Stopper**. Insert the spring flange and use the **Assembly Sleeve** from the bottom end of the **Main Body** to push the **Cartridge Assemblies** and the **Spring Flange** back up the inside of the **Main Body** to correctly locate the **Latch Rings** below the flapper tangs. Ensure that the **Cartridge Assemblies** are pushed into the **Main Body** to the mark on the **Assembly Sleeve**.



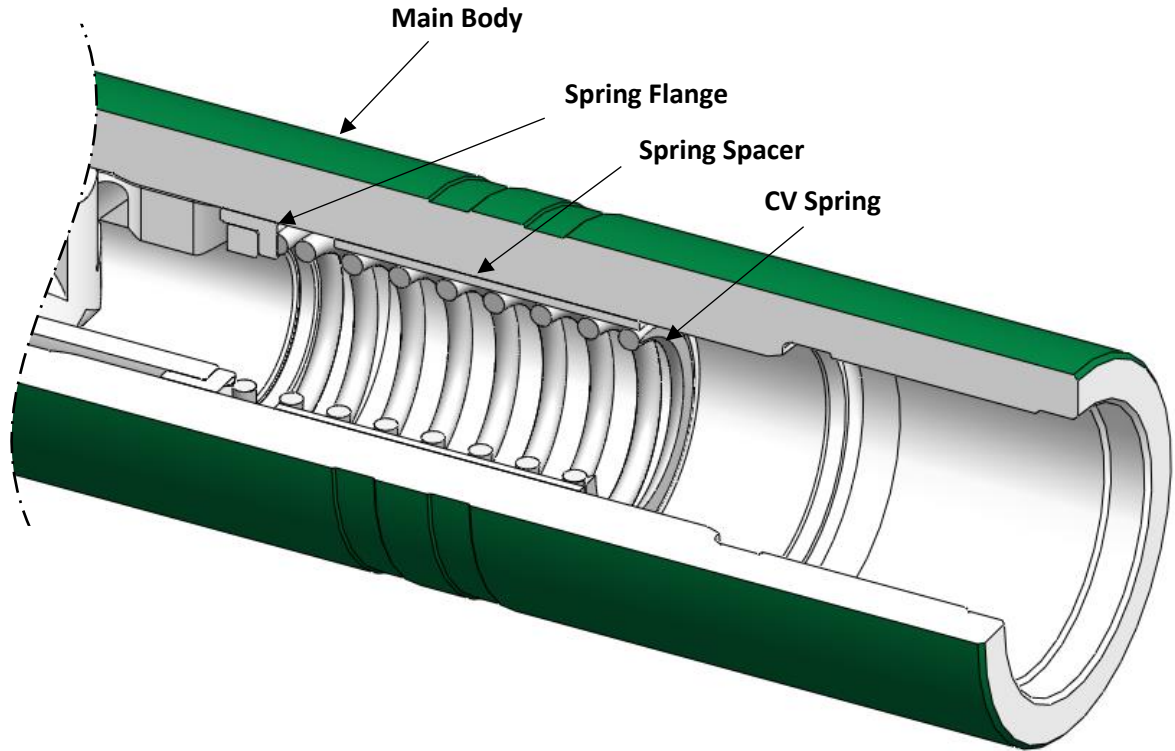
- 5) Insert the **Load Collars** into the **Main Body** and lock them in place with the **Locking Ring**.



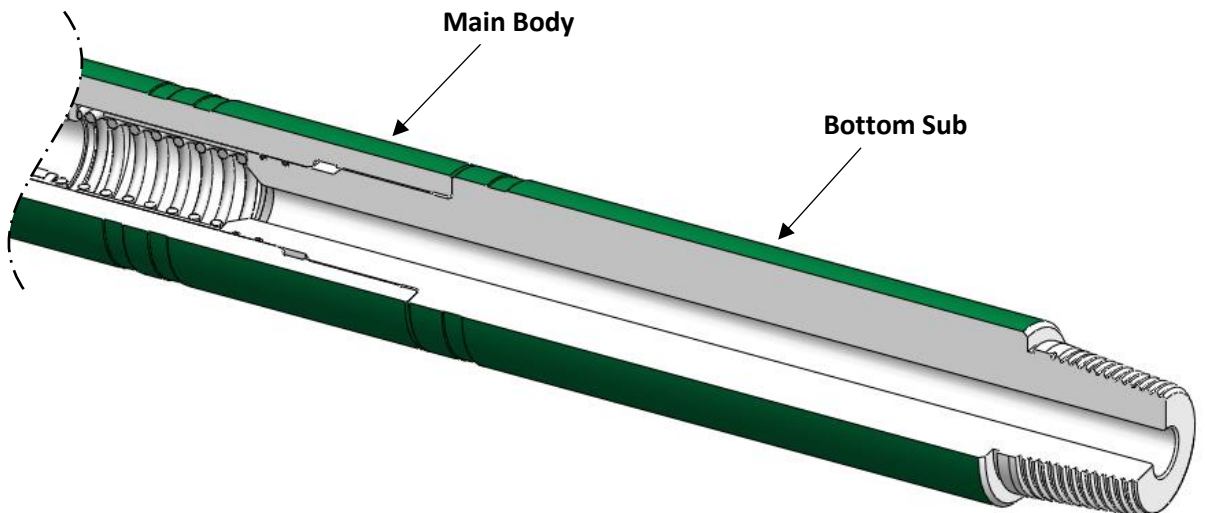
- 6) Screw the **Main Body** onto the **Top Sub** and insert the two half shells of the **1" Torque Spacer** between them with the chamfer on the collar facing the main body.



- 7) Install the **Spring Spacer** and **CV Spring** from the bottom end of the tool. Ensure the **Spring Spacer** is located all the way in against the **Spring Flange**.



- 8) Install the **Bottom Sub** on the **Main Body**.

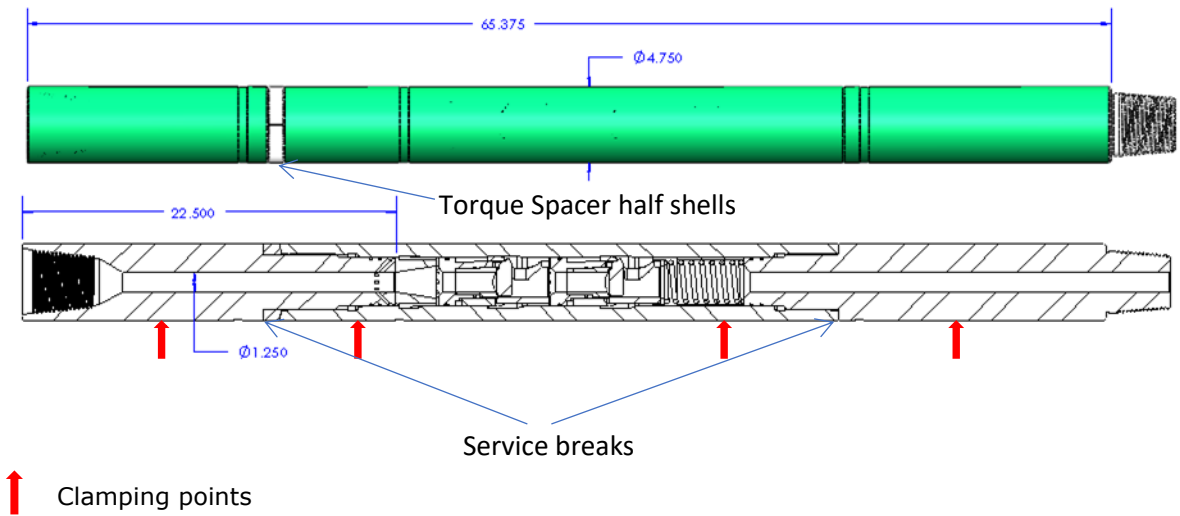


- 9) The tool will normally be shipped pre-torqued. Use a torque machine to torque each service connection in the tool as shown below. Ensure the torque spacer half shells are correctly seated before torquing.

Standard service valve maximum make up torque – 15,000 lbft.  
 Standard service valve minimum make up torque – 12,500 lbft.

Sour service valve maximum make up torque – 10,000 lbft.  
 Sour service valve minimum make up torque – 8,500 lbft.

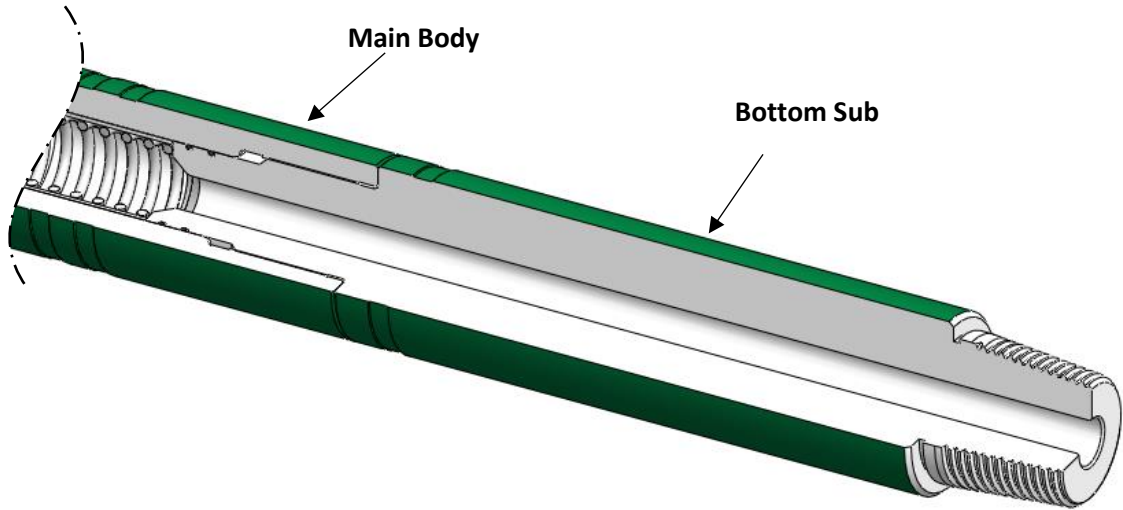
Drift the tool with an API Drift before and after torquing to ensure free opening and closing of the flappers.



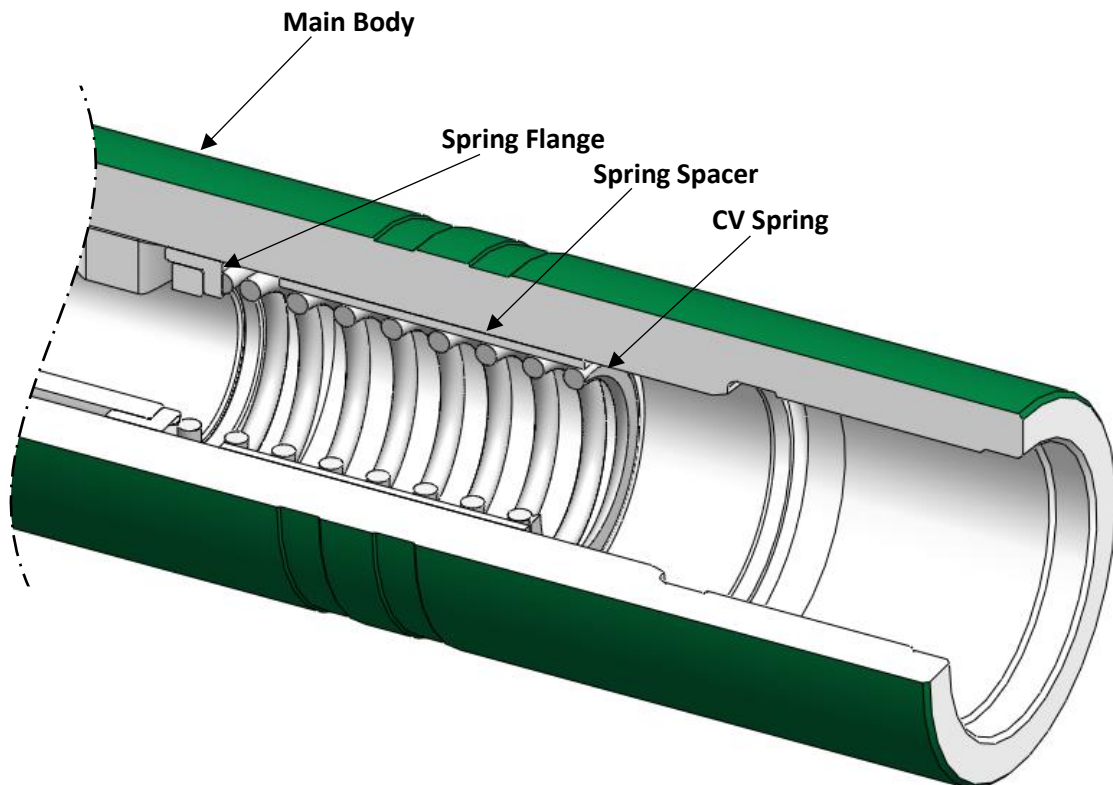
The tool is now fully assembled ready for RIH.

#### 4. Dis-Assembly Procedure

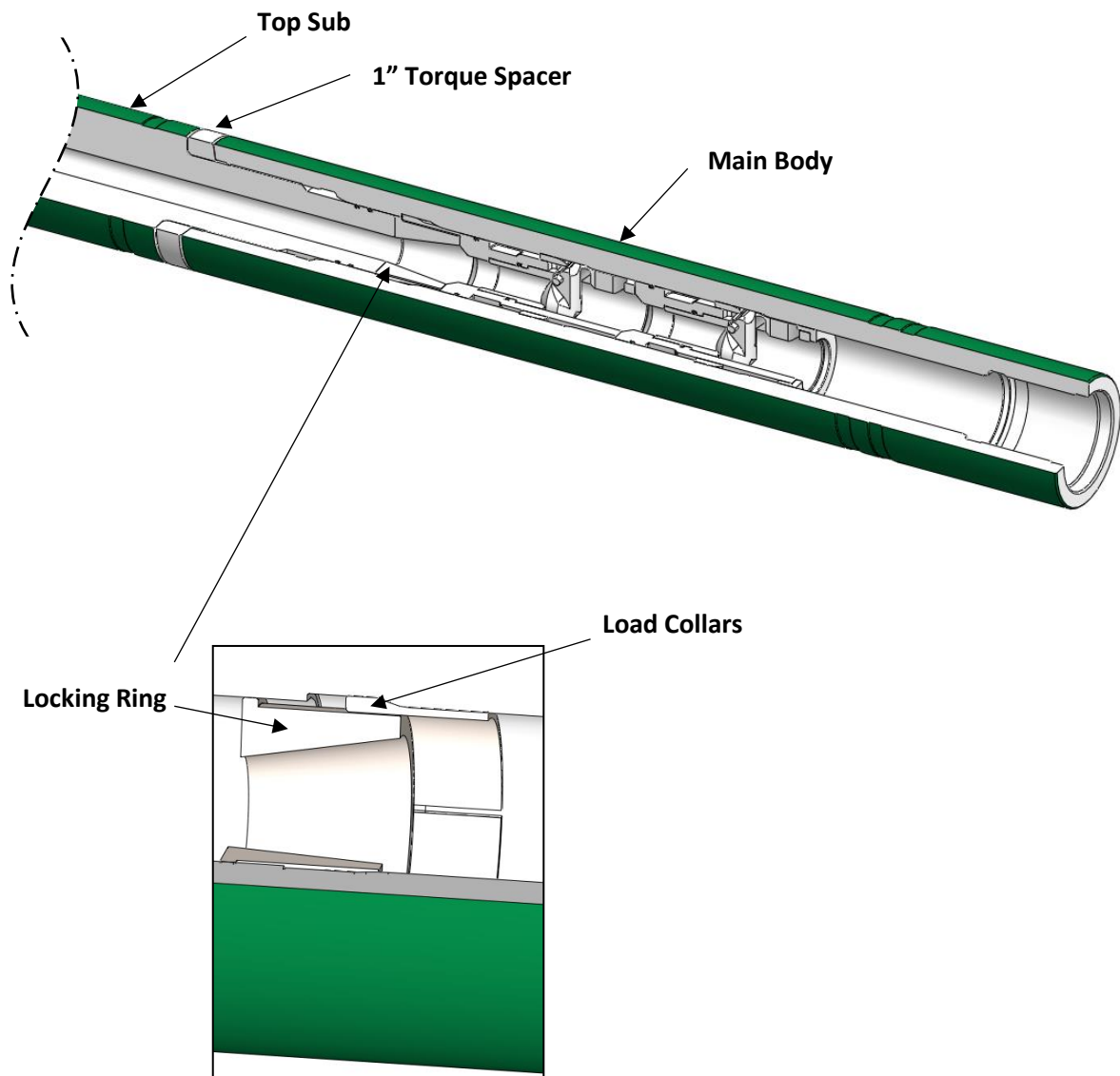
- 1) Remove the **Bottom Sub** from the **Main Body**.



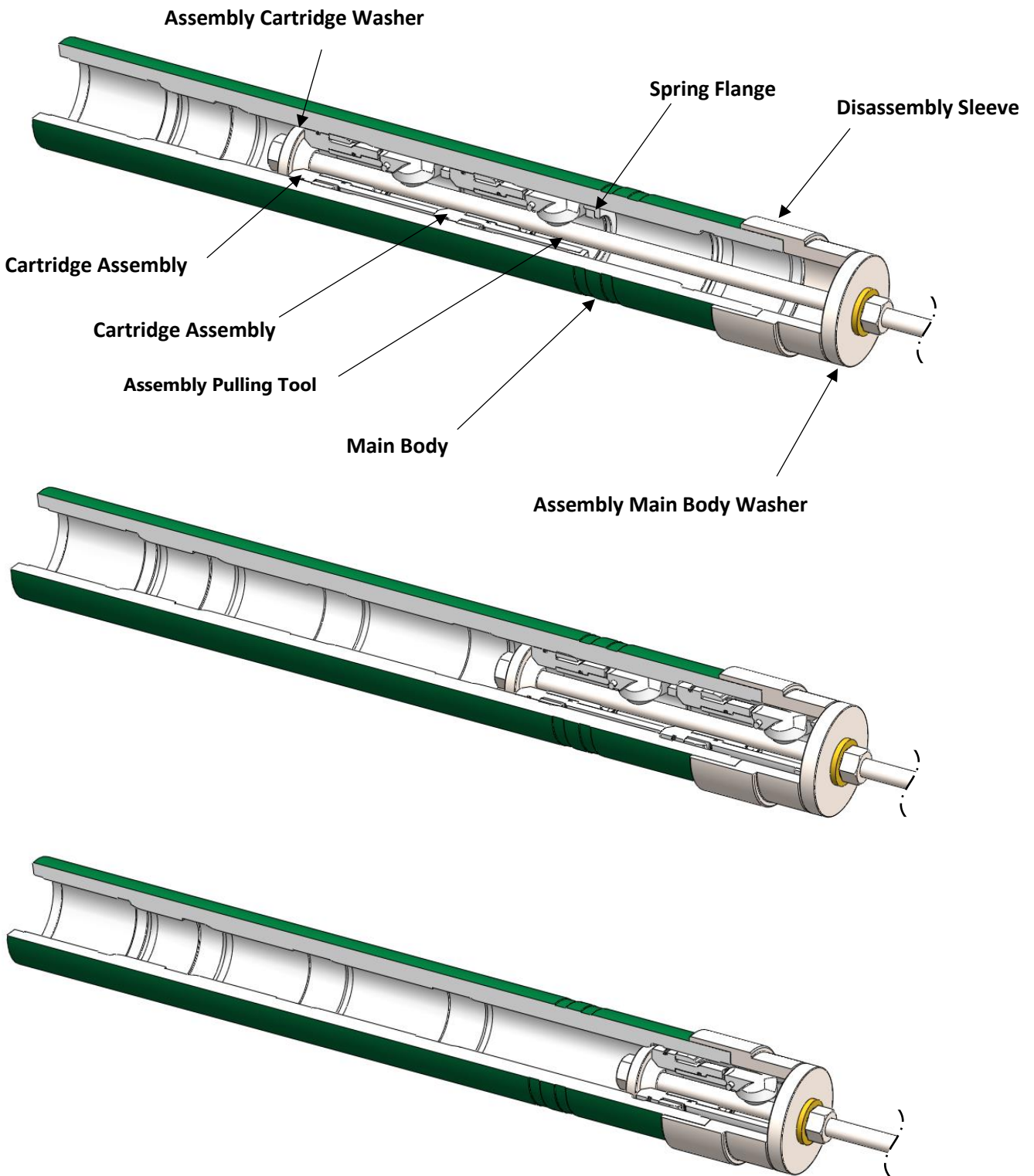
- 2) Pull the **CV Spring**, **Spring Spacer** and **Spring Flange** out of the **Main Body**.



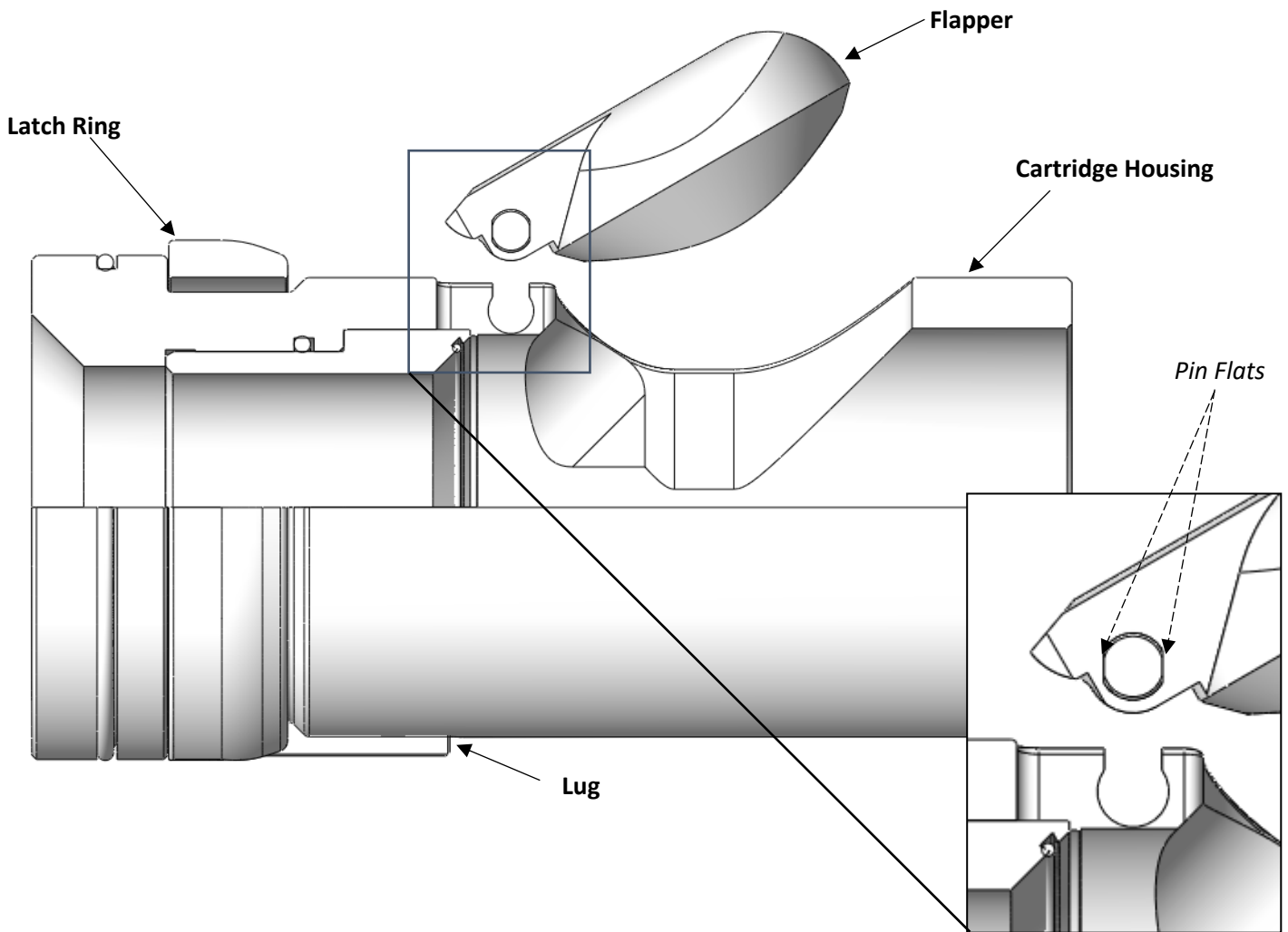
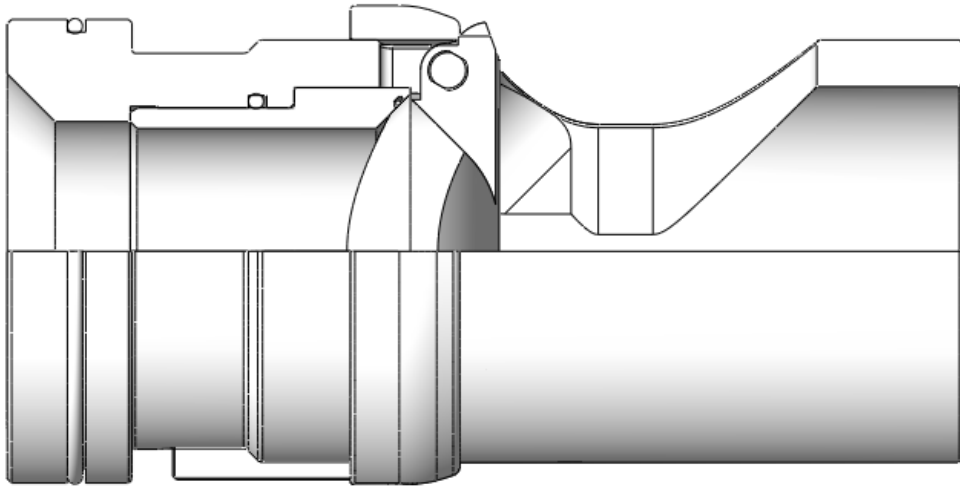
- 3) Unscrew the **Main Body** from the **Top Sub** and remove the **1" Torque Spacer**, the **Locking Ring** and the **Load Collars**.



- 4) Hold the **Main Body** in a vice and pull the two **Cartridge Assemblies** from the bottom end of the **Main Body** with the **Assembly Pulling Tool**. Use the **Disassembly Sleeve** to allow the **Cartridge Assemblies** to be pulled out of the **Main Body** until they can be removed by hand.



- 5) Disassembly of the **Cartridge Assembly (x2)**; Remove the **Flapper** at a 30degree angle (use *Pin Flats* as guide) from the **Cartridge Housing**. Remove the **Latch Ring** from the **Cartridge Housing**. Pull the **Lug** out of the slot of the other side of the **Cartridge Housing**.





6) Clean all parts and remove **O-Rings**.

Tool is now fully disassembled and ready for inspection.

*Before next use replace all O-Rings and any components which fail inspection.*

## 5. Operational Procedure

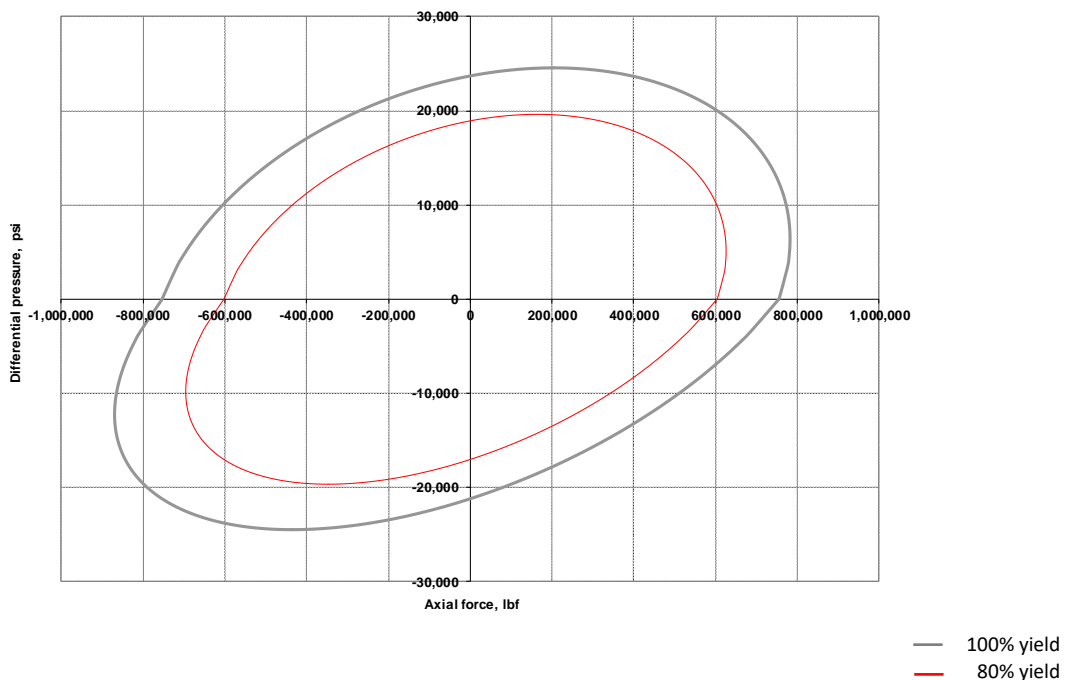
### 5.1. Tool Specifications

#### 5.1.1. AISI 4140, Sour Gas Service

Tool Specification Data Sheet

Equipment Dimensions			
Tool OD	4.750"	OAL	69.25"
Tool ID	1.25" (1.75")	Effective Length	65.375"
		Weight	282.04 lbs (127.46 kgs)
Operational Specification			
Working Pressure Rating	10,000 psi		
Max. Working Temperature Rating (Viton)	190°C		
Max. Working Temperature Rating (Nitrile)	150°C		
Min. Working Temperature Rating (Nitrile)	-4°C		
Yield Specifications			
Tensile Yield (at 20°C WT)	619,339 lbs		
Tensile Yield (at 150°C WT)	588,372 lbs		
Tensile Yield (at 190°C WT)	557,405 lbs		
Torsional Yield (at 20°C WT)	16,969 ft-lbs		
Torsional Yield (at 150°C WT)	16,120 ft-lbs		
Torsional Yield (at 190°C WT)	15,272 ft-lbs		
Make Up Torque Values			
All Connections (min.)	8,500 ft-lbs		
All Connections (max.)	10,000 ft-lbs		

Von Mises Equivalent

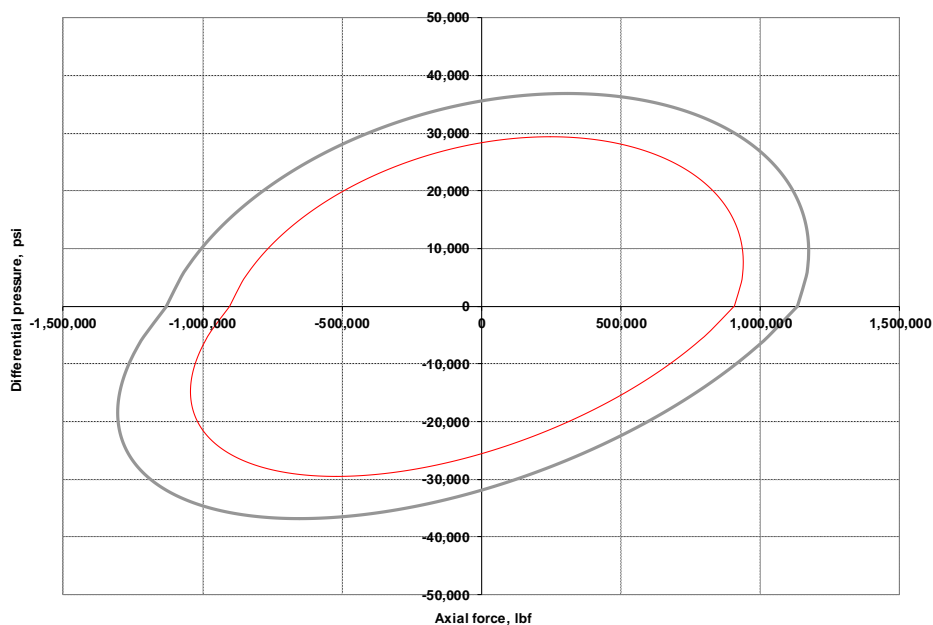


## 5.1.2. AISI 4145, Standard Service

Tool Specification Data Sheet

Equipment Dimensions			
Tool OD	4.750"	OAL	69.25"
Tool ID	1.25" (1.75")	Effective Length	65.375"
		Weight	282.04 lbs (127.46 kgs)
Operational Specification			
Working Pressure Rating		15,000 psi	
Max. Working Temperature Rating (Viton)		190°C	
Max. Working Temperature Rating (Nitrile)		150°C	
Min. Working Temperature Rating (Nitrile)		-4°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 ft-lbs	
Torsional Yield (at 150°C WT)		24,180 ft-lbs	
Torsional Yield (at 190°C WT)		22,908 ft-lbs	
Make Up Torque Values			
All Connections (min.)		12,500 ft-lbs	
All Connections (max.)		15,000 ft-lbs	

Von Mises Equivalent



— 100% yield  
— 80% yield

## 5.2. Storage

After using the tool...

...make sure that there is no water trapped in the flapper area.

...dismantle tool clean and grease all parts and reassemble.

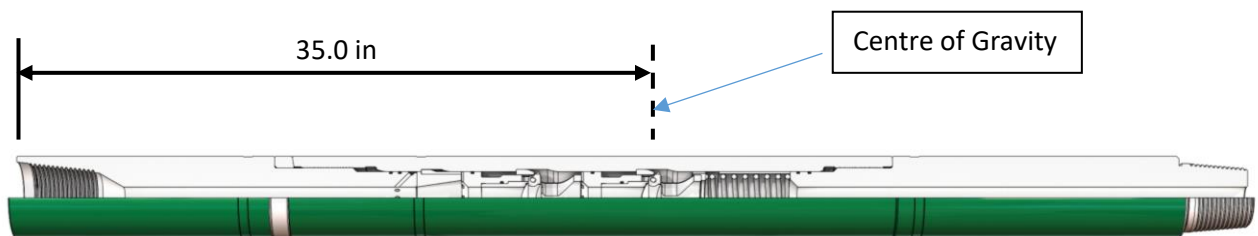
... use thread protectors.

## 5.3. Handling

Use caution when handling the tool will weight in excess of 282 lbs beware of pinch points.

## 5.4. Lifting

To lift the DT Safety Valve please use secure lifting equipment and two lifting points – one on each side of the *Centre of Gravity*.



## 6. Post Assembly Testing

- 1) Drift Tool with an API Drift Rod to ensure Flappers open correctly

## 7. Checklist

Topic	Check
Full Body Pressure Test	
Pressure Test against the flapper	
Drift with API Drift Rod	

## 8. DT Valve running procedure

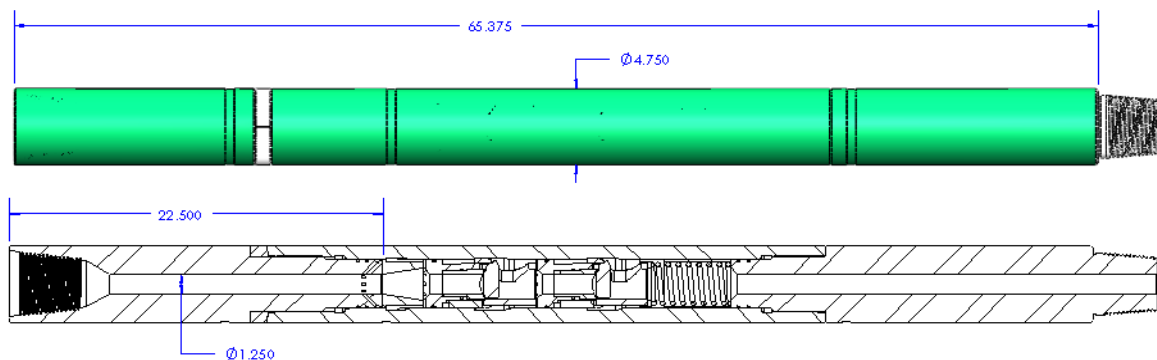
### Running in hole

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. A fishing diagram of the tool is supplied below.



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

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

Run in hole.

### 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 mud weight remains constant. 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. 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 in a closed drain area to remove retained fluid prior to laying out on the pipe deck.

Always fit thread protectors before laying out the tool.

## 9. 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) can be removed allowing manual opening of the valve without losing pressure integrity in the string. The torque spacer rings are 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 top sub and the main body and back off 1.5 turns.
- iii. Remove the torque spacer ring half shells "A" from between the top sub and main body.
- iv. Make up the connection between the top 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 top 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.

