

DWCRT

CASING RUNNING TOOL

by **MCCOY**

DWCRTII Manual



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Project Name: DWCRT II

Internal Size: 4-1/2"-20" 450 Ton 7"-26" 1000 Ton

External Size: 4-1/2" – 7-5/8"

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Section 2 - Introduction

2.1 DWCRT Description

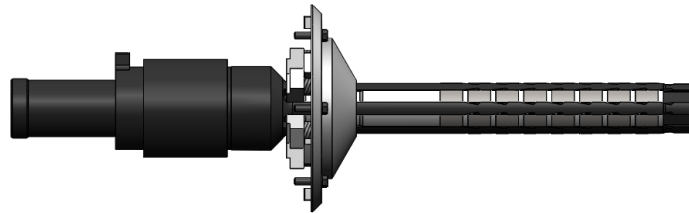
The McCoy Casing Running Tool (DWCRT) by McCoy is a mechanically operated Casing Running Tool that attaches to the Top Drive quill and uses controlled movements of the Top Drive to rotate and reciprocate the Casing for makeup/breakout operations, hoisting, as well as drilling with casing and cementing operations. Using this tool displaces the need for a tong, fill and circulating equipment, as well as conventional hoisting elevators.

The tool's operating temperature range is between -40°F to 180°F. The main components of DWCRT are shown in the figure below:

Head Assembly: Mechanical device that converts rotation from the Top Drive into axial movement of the Gripping Actuator or Mandrel. It can include an optional compensator (which allows unrestricted axial movement of the CRT to make up thread loss or gain when making-up or breaking-out connections) to assist on setting or releasing the tool in a controlled manner.



Gripping Assembly: Used in conjunction with Head Assembly to transmit axial and rotational movement generated from Top Drive to the Casing. Available in external or internal grip for a variety of Casing diameters and weights.



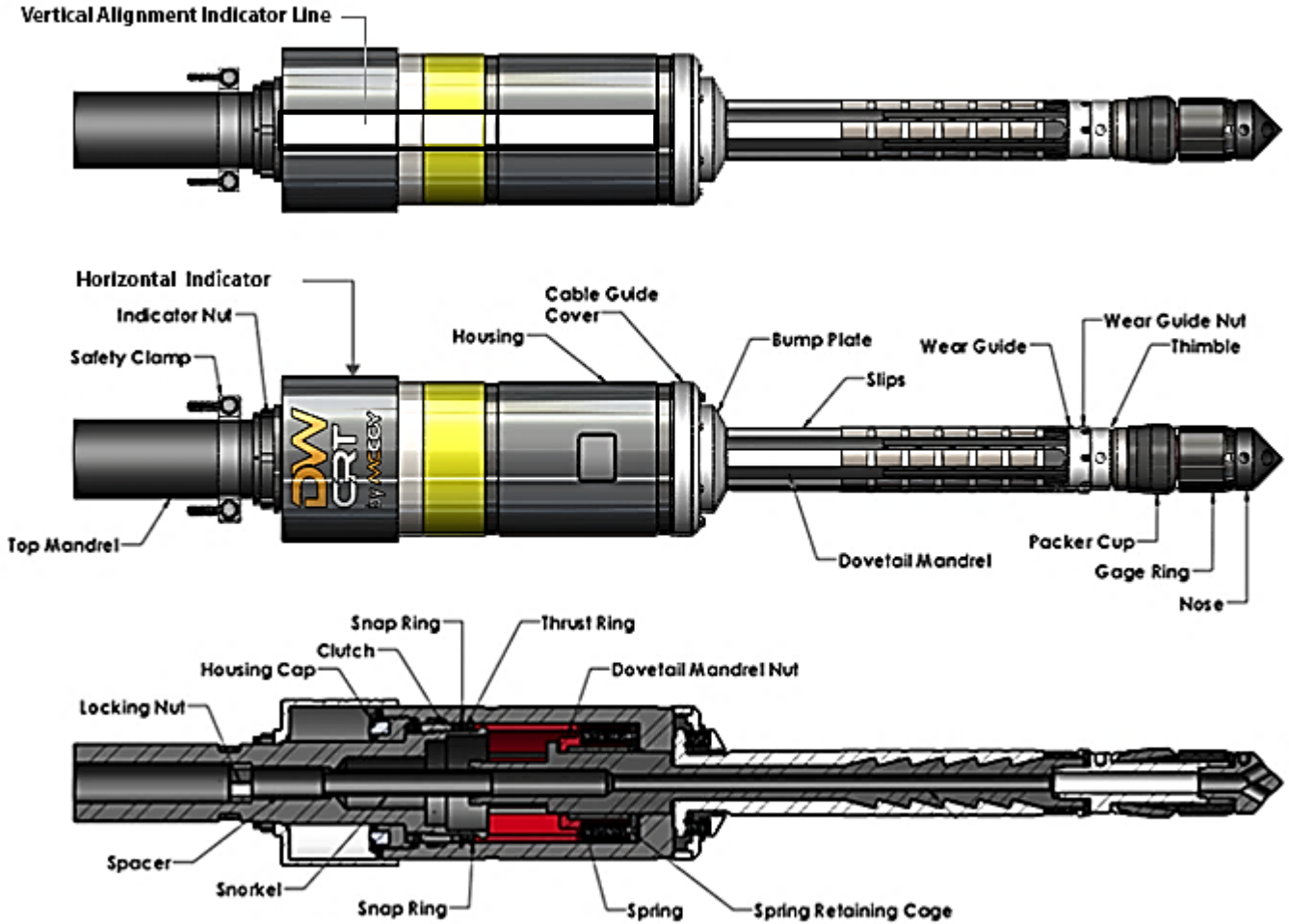
Circulator Assembly: Seal Guide Assembly. This keeps pressurized mud below the Gripping Assembly and contained in the ID of the Casing, allowing for operations where circulating is required. McCoy also offers an optional mud valve. Contact sales for details.



DWCRT Assembly: CRT Assembly is made up of Head, Gripping and Circulator Assemblies. Figure below provides more detail of parts that go into making DWCRT. Refer to Assembly – BOMs section for more details.

NOTE:

All illustrations and figures in this manual are for illustrative purposes. Details shown may not represent all surface features of the actual tool.



2.2 Terms and Definitions

- Bail Extensions (Extend-a-Bails, Buddy Bails, Add-a-Links) – Second set of bails places in series with the drilling bails to extend the overall length of the bail assembly. Necessary to avoid interference between the CRT and elevators.
- Base Slips – Intermediate tapered segment in the gripping assembly that retains the Inserts (Dies).
- Bell Guide - External pipe guide on the External Gripping Assembly used to guide the pipe into the tool. Creates friction to resist rotation on the tubular when setting and unsetting the tool.
- Break Out – The process of unthreading the casing connection typically counter clock-wise.
- Bridge - Downhole obstruction that resists casing being advanced into the well.
- Bump Plate - Sacrificial component mounted to the bottom of the housing to create friction between the CRT and the tubular for connection make-up
- Circulate - Pumping mud under pressure inside the casing while taking returns from the well.
- Circulating Assembly - Sub assembly of the CRT that provides a means for sealing internally of the tubular to allow fluid to be pumped into the casing or to receive pressurized mud returns.
- Clutch - Component of Head Assembly used to prevent incremental torque make-up during rotation.
- Dovetail Mandrel – Primary component of the Internal Gripping Assembly that moves axially to set and unset the Slips (Dies).
- Fill Up - Pumping mud inside the casing while it is not pressurized.
- Floor Slips - Device used to hold the tubular at the rig floor, flush mount spider, hand slips,
- Gage Ring -Sacrificial component of the Circulator Assembly that centralizes the tool prior to the packer cup entering the ID of the casing.
- Grabber Box (tool handler, tool joint handler)– External tool joint clamp below the top drive quill used to react top drive torque for make-up or break-out of tool joints.
- Gripping Assembly – Sub assembly of the CRT that uses axial movement of relative members to grip and release the tubular, can be configured to grip the internal or external of the tubular.
- Head Assembly – Common sub assembly of the CRT assembly used to selectable transmit top-drive rotation into axial movement of the Gripping Assembly for selective grip or release of a tubular
- Housing – Main body of the Head Assembly that contains the drive components necessary for setting and unsetting of the CRT.
- Housing Cap -Component of the Head Assembly that retains the components inside the head.
- Indicator - External cover that exposes yellow and white bands on the housing to indicate if the tool is in the lock or unlocked position.
- Inserts - Interchangeable components mounted to the base slips that have teeth to engage the casing.
- Lift Nubbin – Upset installed into a threaded connection of a flush joint tubular, designed to lift the tubular with an elevator.
- Locked Position – Position of the Head Assembly to prevent axial movement of the gripping assembly from the Set to Unset position, identified with white exposed under the Indicator.
- Lower Housing – Component of the External Bell Assembly that houses the Ramp Segments
- Make Up - The act of threading together the casing connection (typically clockwise).
- Packer Cup - Elastomer component of the Circulating Assembly that utilizes an interference fit to create a seal.
- Packer Saver (seal guide, packer cup guide)- Beveled entry guide installed into the tubular threaded connection to guide the CRT into the tubular ID. Designed to prevent rips and tear in the packer cup from sharp edges or rig misalignment.

- Reciprocate - The process of lifting and lowering the casing string to work it through a bridge or into a long lateral
- Rig down - Removing the CRT from the top drive.
- Rig up – Installing the CRT onto the top drive.
- Rotary Table – Mechanical device on a drilling rig that provides rotation or resist rotation and supports the drill string when the top drive does not.
- Safety Swivel (safety cable attachment, safety ring, swivel ring) - Rotary ring on the Top Mandrel intended for a secondary retention point.
- Set – a state when the CRT is gripping the casing
- Slips (dies) – Component of the Gripping Assembly that moves radially to grip the tubular, could have teeth or lugs, identified by a tapered surface.
- Snorkel – Internal mud tube passage between the Top Mandrel and the Dovetail Mandrel, preventing mud from contaminating the internal components of the Head Assembly.
- Stabbing Guide (False Stabbing Guide) -Beveled entry used to assist placing the threaded connection into the mating connection, installed prior to stabbing and removed before casing make-up.
- Stump Guide – Aluminum plate placed between the pin and box when activating the CRT to prevent casing thread damage. Commonly used when a high amount of set down weight is required to activate the CRT.
- Thimble – Metal Back Up plate to support the packer cup allowing for higher fluid pressures to be pumped through the CRT. In larger diameters the Thimble may be integrated into the Packer Cup.
- Top Mandrel – Component of the Head Assembly that connects to the Top Drive using a tool joint connection.
- Unlocked Position – Position of the Head Assembly that allows the Gripping Assembly to be moved axially to set or unset the tool, indicated by some or no yellow exposed under the indicator.
- Unset – a state when the CRT is completely released from the casing
- Upper Housing – Component of the External Bell Assembly
- Vertical Indicator Line – Line on the Housing and Indicator that identifies when the tool is completely unset.
- Wear Guide - Sacrificial surface that allows the Slips or Inserts to be retracted behind the Wear Guide preventing the teeth from contacting the tubular during insertion or removal.

Section 3 - McCoy Customer Service

Congratulations, and thank you for purchasing quality tubular connection equipment from McCoy Global. This unit will provide years of outstanding performance. Proper maintenance and care will extend its life and ensure years of excellent service and reliability. The installation and commissioning, operating, and maintenance instructions in this manual will assist you in giving your equipment the care it requires. Please read the manual before installing and using your equipment. Replacement parts are readily available from McCoy Global. Should you need replacement parts, or should you experience any difficulty not covered in this manual, please contact:

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Standard Terms and Conditions of Sale (including warranty information):

<https://www.mccoyglobal.com/download/terms-conditions-sales/>

Section 4 - Safety Requirements

McCoy equipment is typically installed and operated in a controlled drilling rig environment involving hazardous situations. Only authorized, trained, and competent personnel shall operate, maintain, and repair this equipment. Appropriate procedures and protocols should be established to address hazards and situations that may arise.

Fully review this manual and comply with all safety and environmental protection instructions before operating equipment.

4.1 Recommended Tools

Assembly and Maintenance operation may require the use of tools designed specifically for the purposes, refer to DWCRT Assembly Tools section for tool details. McCoy recommends that only the specified tools be used, and used as intended, to ensure personal safety.

4.2 Identification Numbers

All McCoy primary load carrying parts are engraved with part and serial numbers. Since McCoy parts are modular, no identification number exists for the complete assembly. When documenting maintenance, be sure to include all applicable serial numbers of individual parts.

4.3 Limited Warranty

The limitations outlined by this manual are for ideal operating conditions. The limits of the tool may be further reduced by less than ideal conditions, and it is up to the equipment operator or technician to determine a safe operating limit for each scenario.

For claims against warranty, documentation, digital documentation of rig operating parameters, and load applied to the tool should be provided (such as a Pason report).

Standard Terms and Conditions of Sale (including general warranty information) may be viewed here:

<https://www.mccoyglobal.com/download/terms-conditions-sales/>

Section 5 - DWCRT Training Outline

McCoy requires that users receive a training course before the use or maintenance of the DWCRT.

The following is an example course outline of the topics covered.

1. DWCRT Introduction
 - a. Overall Explanation of the tool (mechanical, modular)
 - i. Handout manual
 - b. Show parts of the tool (Head, Dovetail Mandrel, Wear Guides)
 - c. Basic operation (set and release)
2. DWCRT Assembly and Disassembly
 - a. Assembly Tools
 - b. Assembly Video – hands-on disassembly
 - i. Show inspection points and key components (seals, wear items, seal areas)
 - ii. Lubrication
 - c. Circulator Assembly
 - i. Show parts and how to select Packer Cups and Gage Rings
 - ii. Check for wear on Packer Cup
 - d. Pre-job checklist for assembling tool
3. DWCRT Procedures
 - a. Using with Casing Tongs
 - b. Using without Tongs
 - c. Fill-up only
4. DWCRT Capacity and Modular Parts
 - a. Ratings
 - b. Flowrates
 - c. Valve options
 - d. Space out
 - e. Wear Guides, Bump Plates, Slips and Inserts
5. DWCRT Maintenance Schedule
 - a. Category I
 - b. Category II
 - c. Category III
 - d. Category IV
6. DWCRT Calculations
 - a. Reduced reciprocate ratings
 - b. Unlocked torque limits
 - c. Max tension and torque to keep from damaging Casing
 - d. Recommended set torque
 - e. Test

Section 6 - DWCRT General Information

6.1 General Information

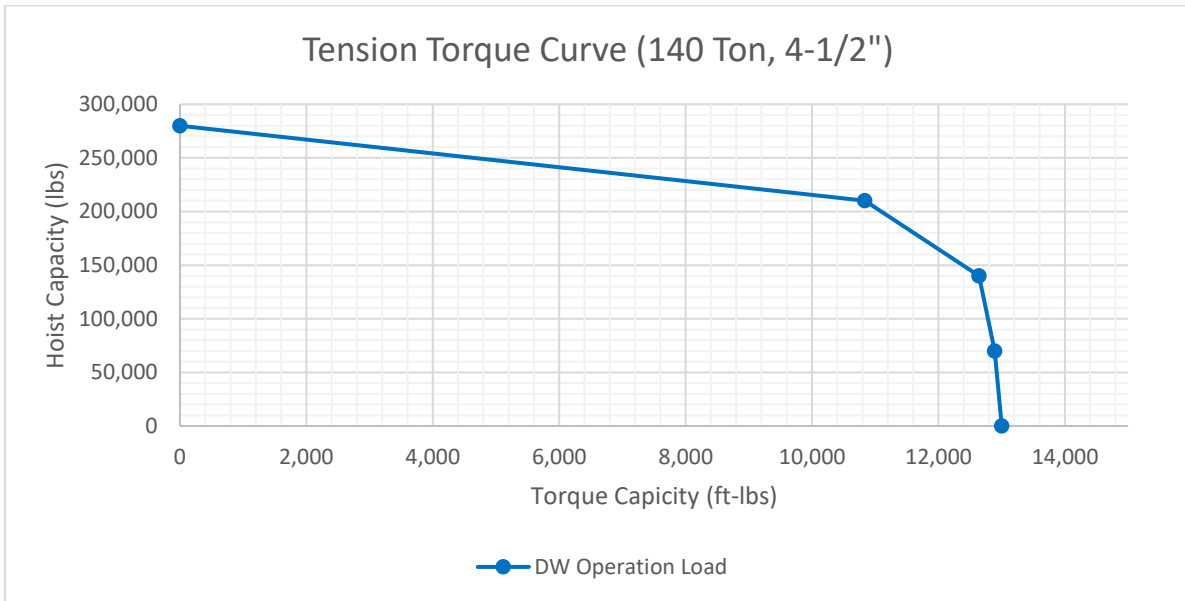
DWCRT represents a new generation of Casing Running Tools. It is a mechanical tool with modular design which meets design requirements of the API 8C standard. The DWCRT is designed to make up Casing, run it in the well, and provide rotation, reciprocation, and circulation. Minimal Top Drive set down weight is required to activate the tool. The compensating locking mechanism allows Slips to be set with low torque with easy release and the ability to achieve high torque for making Casing joints.



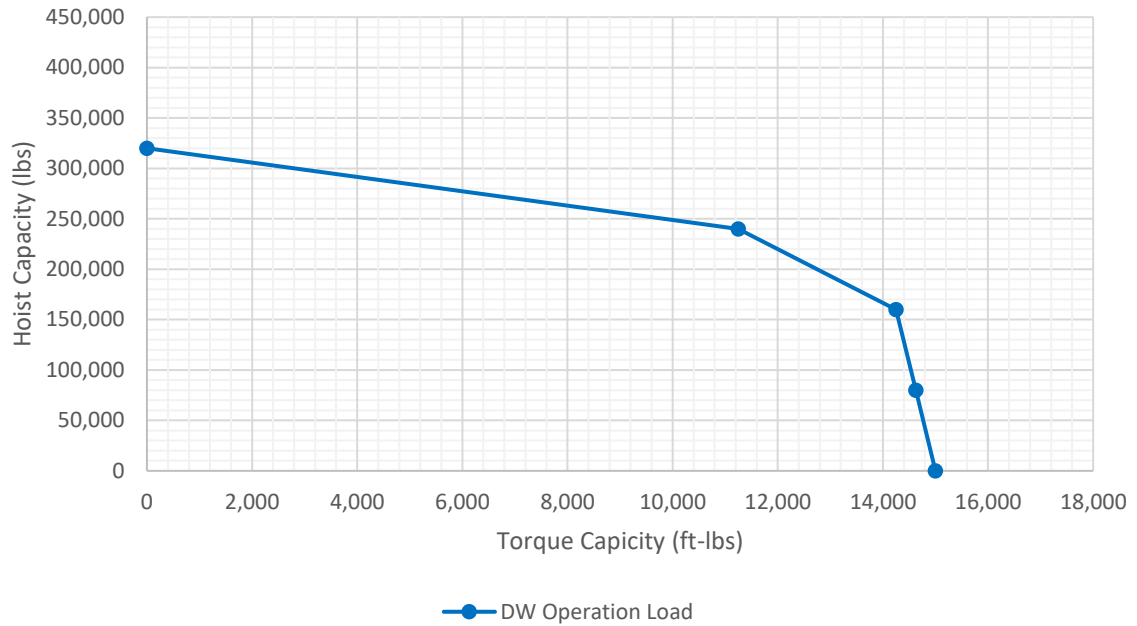
6.2 Tension vs. Torque Capacities

The graphs below provide rated Tension vs. Torque capacities for various sizes of DWCRT. Please use the correct load capacity limits for your application. If you have any questions, please contact McCoy.

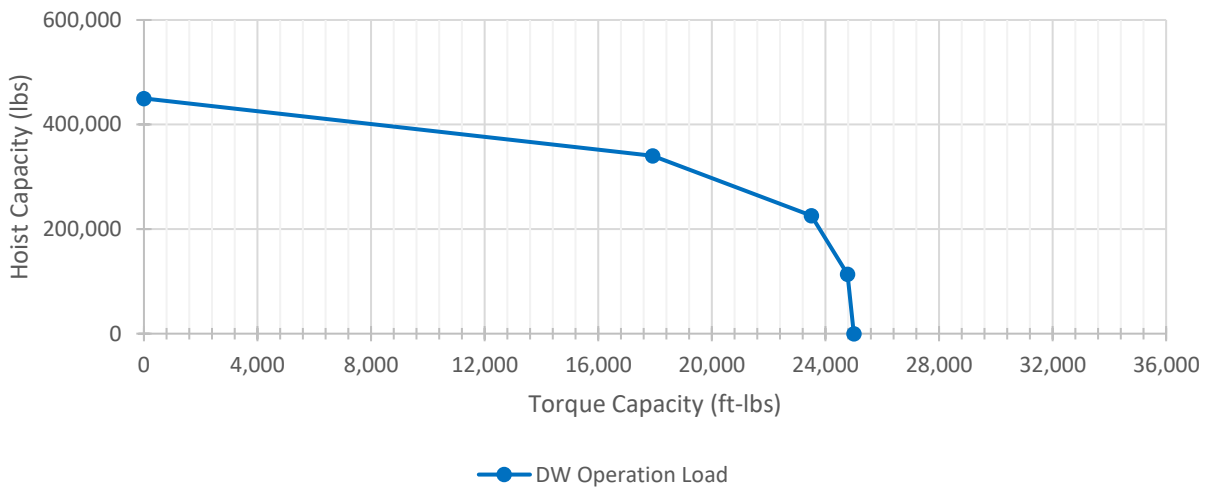
- Blue line - DW Operation Load



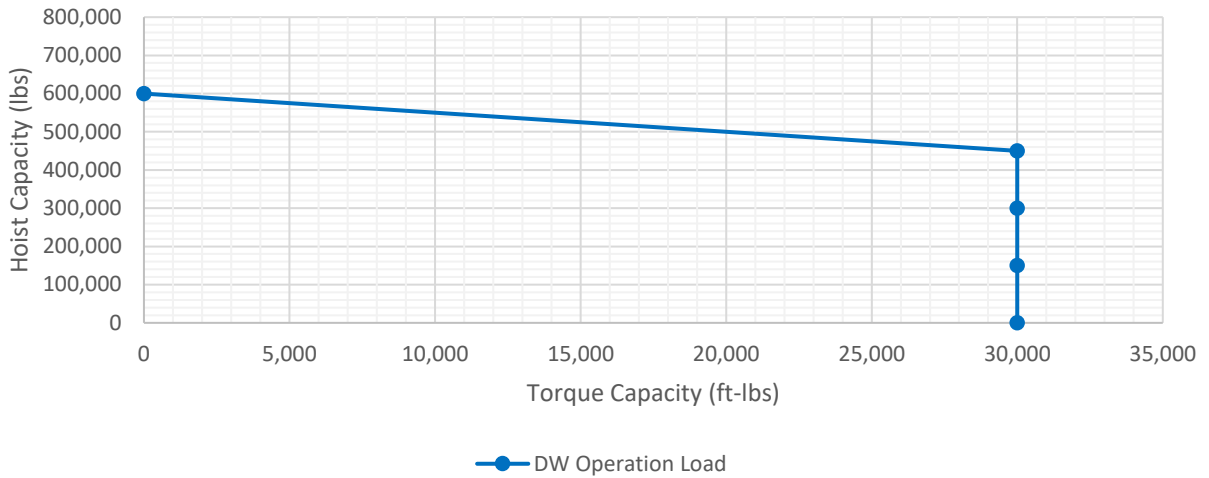
Tension Torque Curve (160 Ton, 5")



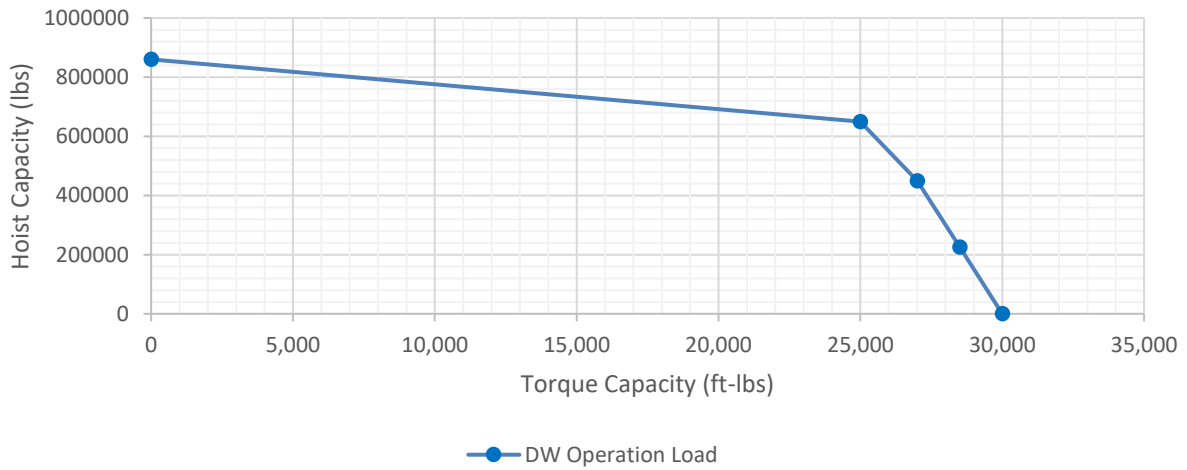
Tension Torque Curve (225 Ton, 5-1/2")



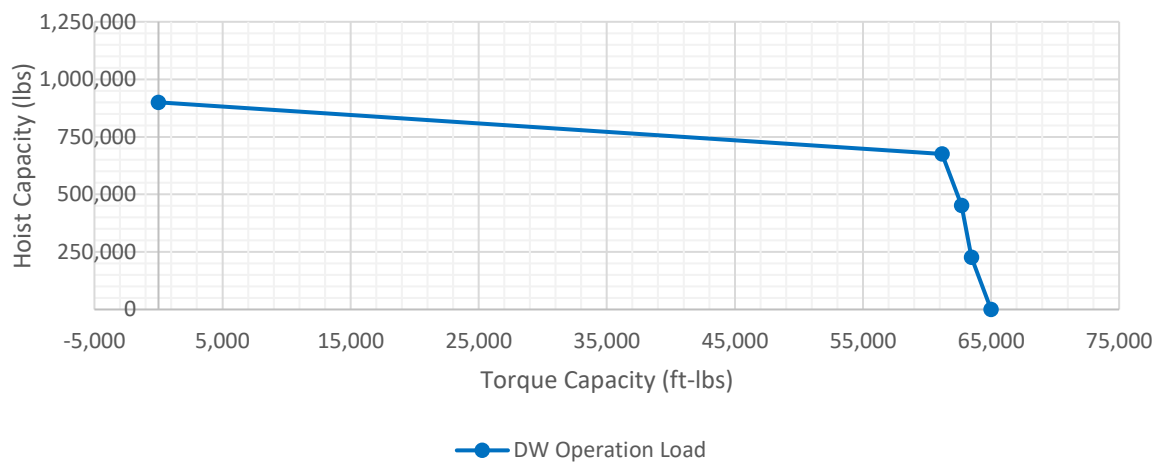
Tension Torque Curve (300 Ton 5-1/2")

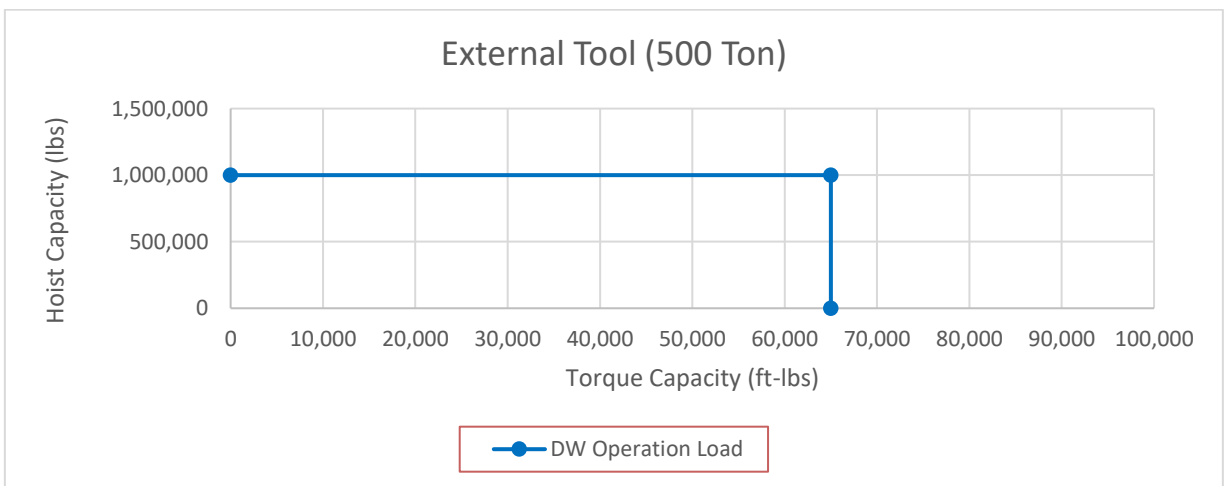
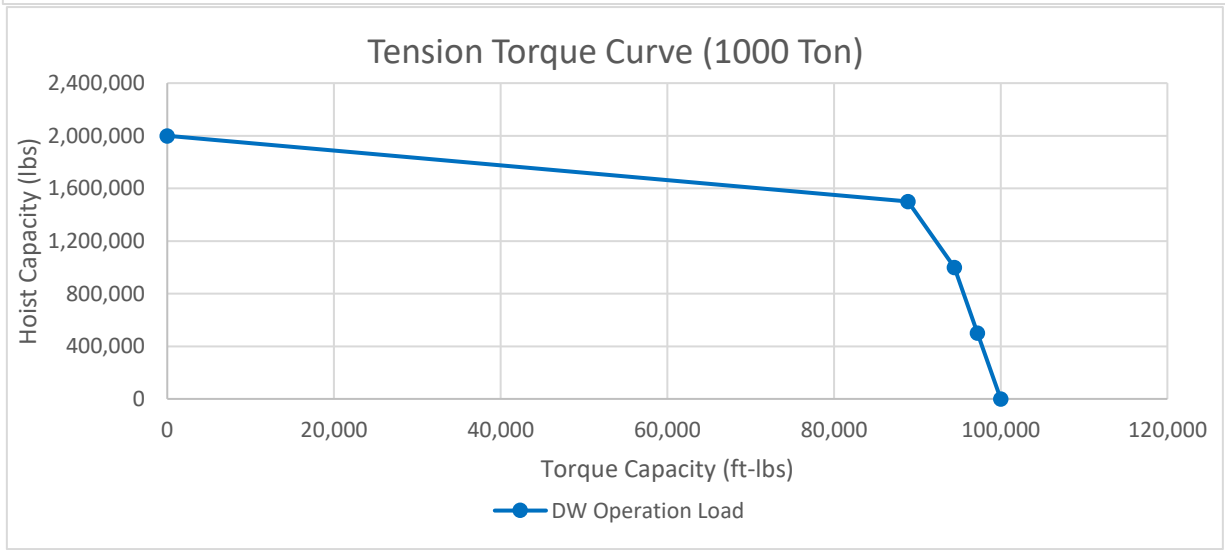
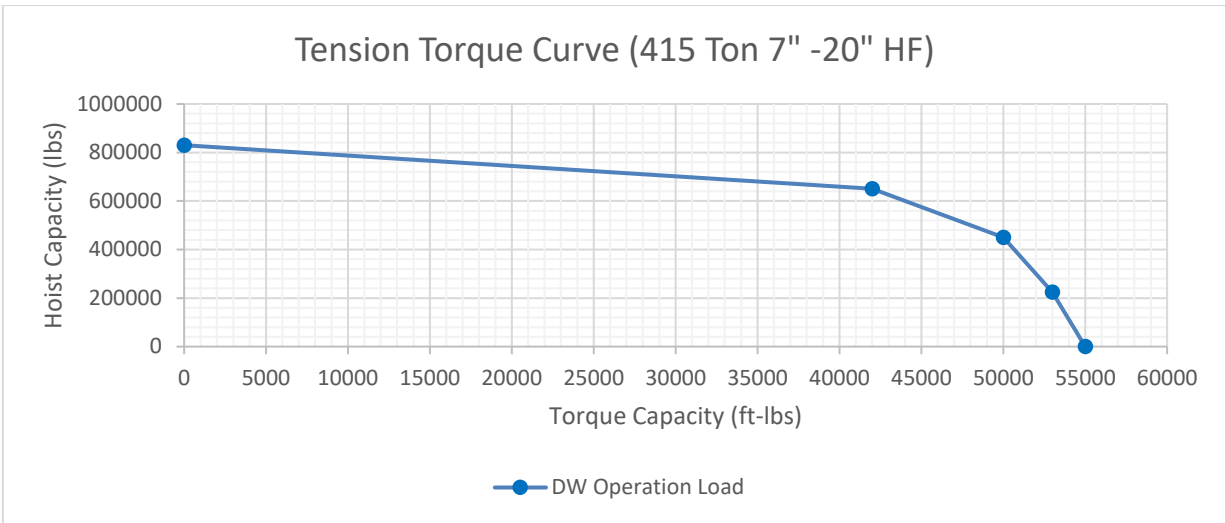


Tension Torque Curve (430 Ton 6" 20-24.5#)



Tension Torque Curve (450 Ton, 7"-20")





Section 7 - Operational Procedures

7.1 DWCRT Operational Positions



7.1.1 Locked Position

(Note the white showing below the Horizontal Indicator)

Once the slips are set at the appropriate minimum setting torque, the tool can rotate the string while in the locked position.

While in the locked position, the slips will not extend or retract.



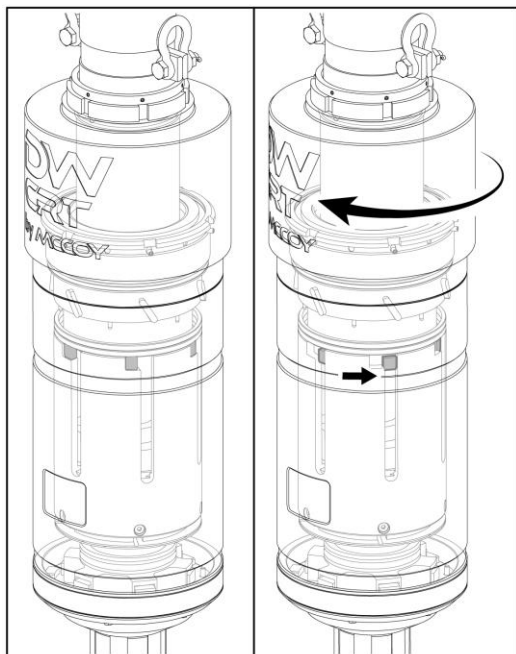
7.1.2 Unlocked Position

(There is no white visible below the Horizontal Indicator and the Indicator is in the yellow area to extend or retract Slips)

Clockwise rotation of the tool in the unlocked position extends the slips toward the pipe while counterclockwise rotation retracts the slips.

NOTE: Count number of rotations required to completely extend the Slips during Casing make up. The exact same number of rotations is required to retract the Slips completely. The number of rotations change with internal diameter of the Casing.

During pre-job function test in Unlocked position, rotate Top Mandrel by hand clockwise to extend the Slips. Note required torque to activate the tool. Verify torque does not change at Rig site.



7.1.3 Push Position (Gen 2 Only)

In the Locked position, 12 degrees clockwise rotation of the tool rotates the Top Mandrel. Any further rotation applies torque to the casing. At this position:

1. The tool is ready to reach maximum torque capacity.
2. Top Drive weight can be applied to the tool while rotating clockwise without the tool going into the unlocked position.

WARNING!

Do not exceed 10 RPM when activating (setting or unsetting) the tool. Impact of setting or release at high RPM are a safety hazard and may cause internal damage to the Timing Lug on the Dovetail Mandrel Nut.

7.2 Rig Up Procedure

Use the following procedure to install the DWCRT on the rig's Top Drive. Note that the safety clamp is used as a secondary retention method and is **not to be used as a primary lifting method**.

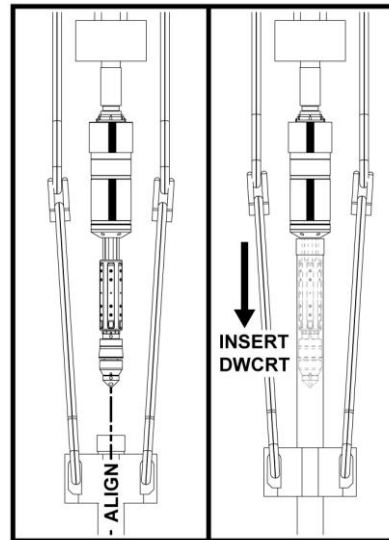
1. Lower the first joint of Casing into the rotary on the rig.
2. Set the Floor Slips to hold the Casing.
3. Insert a Packer Saver (a device inserted into the box of a section of casing to guide the packer cup past any sharp edges or ledges, intended to extend the life of a packer cup (similar to a "safety nubbin")) into the coupling. The use of a Packer Saver is not required but will extend the life of the Packer Cup. Only Steel Packer Savers are to be used. Lubricate the Packer Cup Lip to prevent rips and tears when inserting into the casing.
4. Thread a Lifting Cap into the CRT. Verify the lifting cap is approved for the intended weight and angle of the lift.
5. Hoist the DWCRT via the Lifting Cap. Tag line may be used to guide the tool in the joint of Casing.
6. Insert the DWCRT into the first joint of Casing. Lower the DWCRT until the tool lands on the Casing.
7. Remove the DWCRT Lifting Cap.

WARNING!

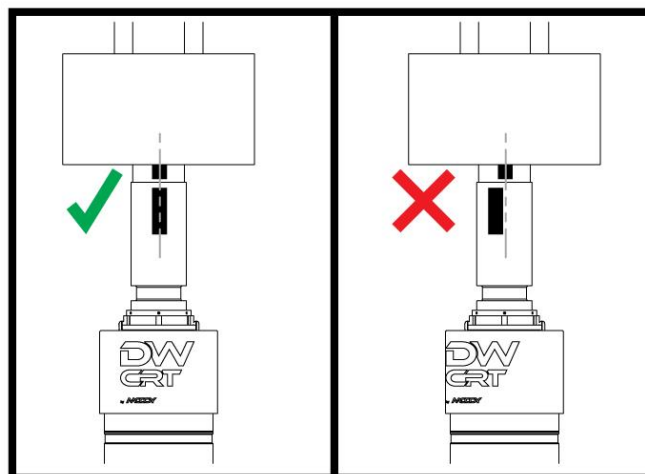
The DWCRT must be inserted into Casing before proceeding to step 8. If the DWCRT is not in a joint of Casing, there is a chance for potential damage to the Slips and Mandrel if the tool is activated.

WARNING!

The tool cannot tolerate large Top Drive to wellbore misalignment. Excessive misalignment may cause difficulty inserting the CRT. Misalignment must be less than $\frac{1}{2}$ the diameter of the casing being run or 6", whichever is less.



8. Using the Tool Joint Handler (Top Drive back-up or Tongs), make-up the DWCRT to the Top Drive. Mark the tool joint connection with chalk or paint to represent where the tool joint backed off. This mark should be monitored periodically, as misalignment indicates that the tool joint is backing off.



7.3 Stump Test Procedure

Use this procedure to ensure the CRT is properly installed and that tool is suitable for the casing to be run.

1. During Rig Up Procedure, the tool may have been partially activated. Rotate the Top Drive counterclockwise. The Indicator should rotate as the Housing is held stationary. This indicates the Slips are being retracted. When the housing starts spinning on the Casing and the lines are lined up, this indicates the Slips are fully retracted.
2. Rotate the tool clockwise and make-up to set torque of 3500 ft-lb. The Indicator should rotate while the Housing stays stationary, this indicates that the Slips are being extended. Count number of rotations to set tool and document the Procedure for later use.
3. Rotate the Top Drive counterclockwise. The same number of rotations are required to retract Slips completely. Verify that the Line on the Housing lines up with the Line on the Indicator and remove tool from the casing. Also verify Slips are retracted below Mandrel or Wear Guide.

NOTE: Perform Rig Up and Stump Test procedure before starting Setting Procedure

7.4 Setting Procedure (Activating the Slips)

Use this procedure to extend the slips using top drive rotation to apply torque or tension to the casing via the DWCRT.

1. Insert the DWCRT into the Casing by lowering the Top Drive. Lower the tool until the Indicator is near the bottom of the unlocked (yellow) stripe.
2. Rotate the tool clockwise. The Vertical Indicator should rotate while the Housing stays stationary, this indicates that the Slips are being extended. Certain situations (rig misalignment, inadequate tool maintenance) may require minor set down weight to activate the Slips and to keep the housing from rotating on the top of the casing.
3. The DWCRT Indicator should be rotated until either the Casing make-up torque, or the Dovetail Mandrel's maximum unlock torque is reached. Do not exceed the torque value corresponding to the lesser of these two values. *The Casing may also be partially made up to the minimum set torque before moving to the locked position. This will allow a lower release torque to be applied when unsetting the tool. Refer to Appendix 1.1: Size and Ratings for unlock torque ratings to ensure a firm grip on the Casing.*
4. After setting the Slips, raise the Top Drive. The tool is placed in the locked position once approximately 2" of white band is showing under the Indicator. The DWCRT can now hold the Casing string weight and the Slips at the rig floor may be released. The Casing can now be rotated, reciprocated and circulated.

NOTE for Gen 2: Tool can be placed in Push position by rotating the Indicator 12 degree clockwise relative to the Housing. The tool will lug out indicated by a torque increase. To verify- when the tool is engaged in the Push position, setting down weight will not allow the tool to go into the Unlocked position (see page 17 for visual reference).

7.5 Unsetting Procedure (Releasing the Slips)

NOTE for Gen 2: If the tool was in the Push position, set the floor slips, rotate the Indicator 12-degree counter-clockwise (vertical lines aligned) with neutral weight before going to the Unlocked position.

1. In the locked position, lower the Casing to the floor and set the floor Slips. Slack off the Top Drive until the Indicator partially covers the yellow band. The tool is now in the unlocked position.
2. Verify Mud Pump is turned off and pressure is bled off to Stand Pipe.
3. Count rotations of the Top Drive while rotating counter-clockwise at a maximum of 10 RPM. The Indicator should start to rotate as the Housing is held stationary. This indicates the Slips are being retracted. When the housing starts spinning on the Casing verify:
 - Number of rotations are completed as per Stump Test.
 - Lines are lined up; this indicates the Slips are fully retracted.
 If the Indicator lines are not lined up, apply set down weight and continue to retract the Slips by rotating counterclockwise.
4. Once the Lines are lined up, raise the tool out of the Casing.

NOTE: Inspect the Slip's teeth and Packer Cup for wear after every ten joints. The teeth should be sharp and have no visible flat spots. Also, make sure the teeth are fully retracted when removing the tool from the Casing to ensure that the teeth will not contact the Casing upon the next insertion.

7.6 Connection Make-up with Conventional Tongs

1. Using appropriate Casing elevator, hoist next joint of the Casing. Insert the hoisted joint into the Casing string and make-up to the specified torque with Tongs.
2. Follow DWCRT Setting procedure, lower the string, then perform Unsetting procedure.

7.7 Running the DWCRT to Reciprocate, Rotate and Make-Up Casing

1. Install Steel Packer Saver in the coupling of the next joint and then hoist with an elevator. Insert the hoisted joint into the string.
2. Follow DWCRT Setting procedure, lower the string, then perform Unsetting procedure.

7.8 Using the DWCRT to Back Out a Joint of Casing

1. Insert the DWCRT by lowering the Top Drive. Slack off until the tool lands on the casing and continue to lower until the indicator is in the unlocked position.
2. Rotate the tool clockwise and set with the recommended torque. ***Refer to Appendix 1.4: Minimum Set Torque.***
3. Raise the tool in the locked position.
4. Rotate the tool counterclockwise to apply torque to break out the connection.

NOTE: If high break out torque is required refer to the troubleshooting section of the manual.

5. Back out the connection.
6. Lower the tool until the indicator is in the unlocked position.
7. Rotate counterclockwise to release the tool.

NOTE: If the casing begins to rotate a backup tong may be required.

8. Once the slips are fully retracted, lift the CRT out of the casing and lay down the joint of Casing.

7.9 Running the DWCRT to Drill with Casing (Gen 2 Modification Recommended)

1. Push position is required for drilling with Casing. Begin pumping mud through the tool once drilling operations resume. The internal valve (if optionally used) may need to be removed if a higher flow rate is required.
2. Begin rotating the DWCRT at the desired RPM.
3. Maintain positive clockwise rotation.
4. Monitor the gap between the Casing and the bump plate. If this gap is more than $\frac{1}{4}$ inch, the DWCRT may need to be released and reset to better grip the Casing.
5. Set the floor Slip once the Casing has been drilled to the floor.
6. Follow Unsetting procedure.

7.10 Fill-Up Procedures with DWCRT

Use this procedure to use the DWCRT to fill the casing up with mud, but not to apply any pressure or circulation. Volume of mud will need to be monitored so that it does not over fill.

1. Lower the Casing and set the floor Slips. Be mindful of the bails and how low the Top Drive can get to the floor.
2. Insert the Nose into the Casing. Use link tilts to center the Casing if the Casing is off-center.
3. Turn the pumps on and fill to the desired amount.
4. Turn the pumps off. Open the drain on the standpipe and bleed pressure to zero.
5. Allow the mud to drain out of the tool.

7.11 Circulating Procedures with DWCRT

Procedure for taking returns from the casing, pumping pressurized mud or cement.

1. Follow Setting procedure.
2. Turn the pumps on. Fill and circulate to the desired amount.
3. When complete, turn the pumps off. Open the drain on the standpipe and bleed pressure to zero.
4. Follow Unsetting procedure.

NOTE:

- **Slowly raise the Top Drive to remove the tool. An air pressure may have formed under the Packer Cup which can be released once the Packer Cup slides out of the internal diameter. Use caution when hoisting the tool out of the Casing. Ensure the tool does not snag on the Casing.**
- **Allow the mud to drain out after the Packer Cup exits the Casing before continuing to hoist the tool.**
- **Occasionally the Indicator will continue to completely cover the yellow stripe on the Housing as the tool is raised out of the Casing. This is indicative of an air pressure trapped below the Packer Cup which will lift the Housing and Mandrel until the Packer Cup releases its seal. Usually, the seal is released in the coupler. Verify Stand Pipe is open to bleed of pressure.**

7.12 Rig Down

Procedure to remove the CRT from the Top Drive.

1. With the tool in a joint of Casing, use the Tool Joint Handler (Top Drive back-up or Tongs) to break-out the DWCRT from the Top Drive.
2. Thread a Lifting Cap into the CRT.

3. Hoist the DWCRT via the Lifting Cap from the Casing joint.
4. Place the tool in the assembly stand. Remove Lifting Cap.

7.13 Operating Specifications

7.13.1 DWCRT Load Rating

Often the McCoy DWCRT is stronger than the Casing it is gripping on. To keep from damaging the Casing, we recommend not exceeding 80% of the pipe body tensile yield strength for the Casing used. The manufacturer should provide a tensile rating for the Casing or it can be looked up in a reference such as the manufacturer's spec sheet or API 5CT.

Example 1: When running 5-1/2" 17# J-55 Casing, the rated tensile load is 273,000 lb. This number should be multiplied by 0.80 to get the recommended max tensile load.

$$0.8 \times 273,000 = 218,400.$$

Even though the 5-1/2" internal Dovetail Mandrel is rated for 225 Tons, the limit for this Casing is 218,400 lb. or 109.2 tons.

Example 2: When running 5-1/2" 23# P110 Casing, the rated tensile load is 729,000 lb. This number should be multiplied by 0.8 to get its recommended tension load.

$$0.8 \times 729,000 = 583,200.$$

Even though the maximum load for the Casing is 583,200 lb. (or approximately 290 tons), the 5-1/2" internal Dovetail Mandrel is only rated at 225 tons. As such, 225 Tons is the maximum axial load that should be applied.

7.13.2 DWCRT Torque Rating

Often the McCoy' DWCRT is stronger than the Casing it is gripping. To keep from damaging the Casing, we recommend a Safe Setting Torque based on the Casing used. The manufacturer should have a tensile rating for the Casing, or it can be looked up in a reference such as Baker Hughes Tech Facts Engineering Handbook or API 5CT.

Example 1: When running 7" 17# H-40 Casing, the rated tensile load is 196,000 lb. This number should be multiplied by 0.8 to get the recommended maximum tension load.

$$0.8 \times 196,000 = 156,800 \text{ lb.}$$

The recommended tension load should then be multiplied by 0.054 to get maximum setting torque.

$$156,800 \times 0.054 = 8,500 \text{ ft-lb}$$

Even though the internal Dovetail Mandrel is rated for 50,000 ft-lb in the unlocked position, the limit for this size Casing is 8,500 ft-lb. 8,500 ft-lb is the maximum torque that should be applied.

Example 2: When running 7" 35# Q-125 Casing, the rated tensile load is 1,370,000 lb. This number should be multiplied by 0.8 to get its recommended tension load.

$$0.8 \times 1,370,000 = 1,096,000$$

The recommended tension load should then be multiplied by 0.054 to get maximum setting torque.

$$1,096,000 \times 0.054 = 59,000 \text{ ft-lb}$$

While the maximum setting torque for this Casing is 59,000 ft-lb, the 7" internal Dovetail Mandrel is only rated at 50,000 ft-lb in the unlocked position. 50,000 should be the maximum torque applied in the unlocked position.

Refer to Appendix 1.1: Size and Ratings for Locked and Unlocked Torque Limits.

Section 8 - Packer Cups and Gage Rings

8.1 Packer Cups

Packer Cups are an interference seal used to seal off the mud system of the DWCRT, enabling flowback, circulation, or pumping cement thru the DWCRT. Use this rule for determining the best Packer Cup size for a given Casing size and weight.

- a. The OD sealing area on the cup should be .100"-.250" over the Casing ID for 4-1/2" to 6-5/8" Casing sizes.
- b. The OD sealing area on the cup should be .250"-.350" over the Casing ID for 7" to 20" Casing sizes.
- c. Packer Cups used in Premium Connections may require less interference and the use of specialty GageRings and Packer Cups.

Before storage, it is good practice to measure and label the OD of the Packer Cups after returning from a job. Packer Cups are made of rubber which will wear after several jobs.

8.2 Gage Rings

Gage Rings are used to both center the Packer Cups and prevent wear and tear on the Packer Cups, thereby extending their use life. Drifts for Gage Rings are normally smaller than the ID of the Casing by:

- 0.125" for 4-1/2" to 8-5/8"
- 0.156" for 9-5/8"-14"
- 0.188" for 16"-20"

Hint for internal flush Casing: A thread protector can be bored out and screwed into the internal flush Casing of all the joints where the Packer Cup will be inserted. The modified thread protector covers the sharp corners on the Casing thread that damages the Packer Cups and acts like a "lift nubbin".

Section 9 - DWCRT Lubrication and Maintenance

Only McCoy manufactured parts are to be used on the DWCRT. Welding should never be performed on any primary load carrying components of the DWCRT. The DWCRT utilizes modern heat-treated alloys and special processes which can be dangerously altered by heating or welding. Repairs of any DWCRT part should only be undertaken by McCoy or a McCoy authorized shop with the proper knowledge and procedures to ensure the safety and performance of the tool are not compromised. McCoy recommends maintenance and inspection in accordance with API RP8B guidelines.

Customers should work with McCoy to jointly develop and update inspection, maintenance, and repair procedures consistent with equipment application, loading, work environment, and storage conditions. These factors may change from time-to-time as a result of equipment history, product improvements, new maintenance techniques, and service conditions. NDE should be performed per ASTM E165 and ASTM E709. Ensure the parts are free of metal shavings after Magnetic Particle Inspection. The components should be free of debris prior to assembly and lubrication should not be contaminated. McCoy recommends a performance pull test every 5 years followed by NDE. Inspection of gauging rotary connection should be performed to API 7-2.

Tool documentation should be kept by the user and updated as the tool components are changed out on the tools. It is recommended to establish a serial or asset number to tie all documentation to. The serial or asset number will contain all the individual parts and serial numbers. The documentation is the responsibility of the user and should be checked prior to the job in the event documentation needs to be provided prior to rig up.

Schedule frequency listed below is based on 1 to 4 jobs per month under normal operating conditions.

Category I

During the job

Observation of equipment during operation for indications of inadequate performance.

- a. Check for tears and rips in the Packer Cup.
- b. Verify after every joint that the Indicator line is lined up before removing from Casing.
- c. Check that Slips are recessed below Dovetail Mandrel or Wear Guide before inserting Casing.
- d. Make sure the teeth are sharp and free of debris.
- e. Check paint or chalk line on Top Drive-DWCRT connection to verify the connection is properly torqued.

Category II

After every job

Category I inspection plus further inspection for corrosion or missing components, deterioration, proper lubrication, visible external cracks, and adjustment.

- a. Wash OD and ID of the tool.
- b. Visually Inspect tool joint threads.
- c. If used, remove the internal valve, clean and redress.
- d. Replace internal wiper seal in Dovetail Mandrel.
- e. Lubricate Dovetail Mandrel threads.
- f. Clean, lubricate, and check for wear on the Clutch and mating teeth and slots.
- g. Re-tape the vertical line.
- h. Remove and disassemble Circulating Assembly, replace seals and reassemble.
- i. Remove Bump Plate, Slips and Inserts, and inspect Dovetail grooves on the Slips and Dovetail Mandrel for

wear, lubrication, chips or cracks.

- j. Wash Slips and Dovetail Mandrel before re-applying grease.
- k. Inspect components in the mud flow path for erosion.
- l. Inspect and repair as required, the White and Yellow indicator stripes on Housing.

Category III

Every 6 months.

Category II inspection plus further inspection which should include NDE of exposed critical areas and may involve some disassembly to access specific components and identify wear that exceeds allowable tolerances.

- a. Replace all seals in the Housing.
- b. Carry out NDE on critical load-bearing components which include:
 - 1- Dovetail Mandrel
 - 2- Slips (when applicable)
 - 3- Inserts

(Contact McCoy for more details)

Category IV

Every 12 months.

Category III inspection plus further inspection which should include NDE of all primary load carrying components and critical dimension measurement.

Carry out NDE on all primary load carrying components which include:

- a. Dovetail Mandrel
- b. Slips
- c. Inserts
- d. Housing
- e. Housing Cap
- f. Dovetail Mandrel Nut
- g. Top Mandrel
- h. Upper Housing- External tool only
- i. Lower Housing- External tool only
- j. Ramp Segments- External tool only

9.1 DWCRT Spring Replacement Guide

Replace the family of springs when damaged or when the uncompressed length of any individual spring is less than:

Part# 701254 Bump Plate Springs (Qty-6): 2.5".

Part# 701250 Mandrel Nut Springs (Qty-10): 5.51".

Part# 605721 Bevel Spring (Qty-4): 1.614".

Part# 700110 Clutch Spring (QTY-6): 4.25".

9.2 Results of Inspections

Parts with indications less than 3/16" located in non-critical areas are permitted. A follow-up examination is recommended to check for indication growth. External tool dogs have a max wear limit of 3/16" to provide proper friction on the Casing.

NOTE: McCoy requires replacement of dies whose teeth have been worn flat or broken. To measure the flatness of DWCRT Dies, use optical micrometer to measure the width of the flat on the tip of the tooth. If the flat is more than 0.025" wide, the tooth is considered damaged. If more than 10% of the teeth within any 2" x 2" square is damaged, the Die needs to be replaced.

9.3 Recommended Lubrication

McCoy recommends using the following lubrication. The use of other lubricants may affect the performance and accelerate wear on critical components, reducing the life expectancy of the parts and/or effectiveness of the tool.

Area	Lubrication
Dovetail Threads and Slip/Die Taper Surfaces above 32°F (0°C)	Klüberplex AG 11-462 (McCoy P/N: 700053)
Dovetail Threads and Slip/Die Taper Surfaces below 32°F (0°C)	Klüberplex ELM 44-80 ARTIC (McCoy P/N: 700095)
Bolt and Set Screw Threads	Loctite 76764 (McCoy P/N: 700093)
Square Threads, Seals, Splines and other	NLGI No. 2 Lithium equivalent

Keep all parts lubricated to prevent corrosion.

9.3.1 Stocking Quantity

McCoy suggests enough spare parts of seal kits, Packer Cups, Slips, Inserts and springs be stocked to properly operate and maintain the tool for 3 months using DWCRT Lubrication and Maintenance schedule. McCoy also recommends additional set of Slips be purchased. For additional details, please contact customer service as detailed on page 9 of this manual.

Common wear items for the circulator assembly such as packer cups and gage rings are listed on the table in Appendix 1.7. Select the appropriate part number for your DWCRT size and configuration. A complete tool requires a Head Assembly, Gripping Assembly, and Circulator Assembly.

Use the table below for generalized spare part recommendations.

Part Number	Description (DWCRT 450)	QTY Per 3 Month	Qty per Year
606476	Head Assembly Redress Kit	3	10
606475	Head Assembly Rebuild Kit	-	2
606201	Internal Gripping Assembly Redress Kit 4-1/2" - 6-5/8"	3	10
606202	Internal Gripping Assembly Redress Kit 7" - 8-5/8"	3	10
606203	Internal Gripping Assembly Redress Kit 9-5/8" - 20"	3	10
606205	Internal Gripping Assembly Overhaul Kit 4-1/2" - 6-5/8"	-	1
606206	Internal Gripping Assembly Overhaul Kit 7" - 8-5/8"	-	1
606207	Internal Gripping Assembly Overhaul Kit 9-5/8" - 20"	-	1
606213	External Gripping Assembly Redress Kit 4-1/2" - 7-5/8"	3	10
606212	External Gripping Assembly Rebuild Kit 4-1/2" - 7-5/8"	-	1
605105	Internal Circulator Assembly Redress Kit 4-1/2" - 6-5/8"	3	12

605149	Internal Circulator Assembly Redress Kit 7"-7-5/8"	3	12
605098	Internal Circulator Assembly Redress Kit 8-5/8" – 20"	3	12
606522	External Circulator Assembly Rebuild Kit 4-1/2" – 7-5/8"	3	12
Ref Table	Packer cup	2	10
Ref Table	Gage Ring	-	2
605739	Snorkel	-	1
Part Number	Description (DWCRT1K)	QTY Per 3 Month	Qty per Year
606253	Head Assembly Redress Kit	3	10
606252	Head Assembly Rebuild Kit	-	2
606313	Internal Gripping Assembly Redress Kit 7" - 11-3/4"	3	10
606316	Internal Gripping Assembly Redress Kit 13-3/8"- 26"	3	10
606314	Internal Gripping Assembly Overhaul Kit 7" - 7-5/8"	-	1
606315	Internal Gripping Assembly Overhaul Kit 9-5/8"- 11-3/4"	-	1
606317	Internal Gripping Assembly Overhaul Kit 13-3/8"- 26"	-	1
605149	Internal Circulator Assembly Redress Kit 7" -7-5/8"	3	12
605678	Internal Circulator Assembly Redress Kit 9-5/8" – 13 3/8"	3	12
605598	Internal Circulator Assembly Redress Kit 16" – 20"	3	12
605602	Internal Circulator Assembly Redress Kit 22" – 26"	3	12
Ref Table	Packer cup	2	10
Ref Table	Gage Ring	-	2
605451	Snorkel	-	1

9.4 DWCRT Inspection Chart

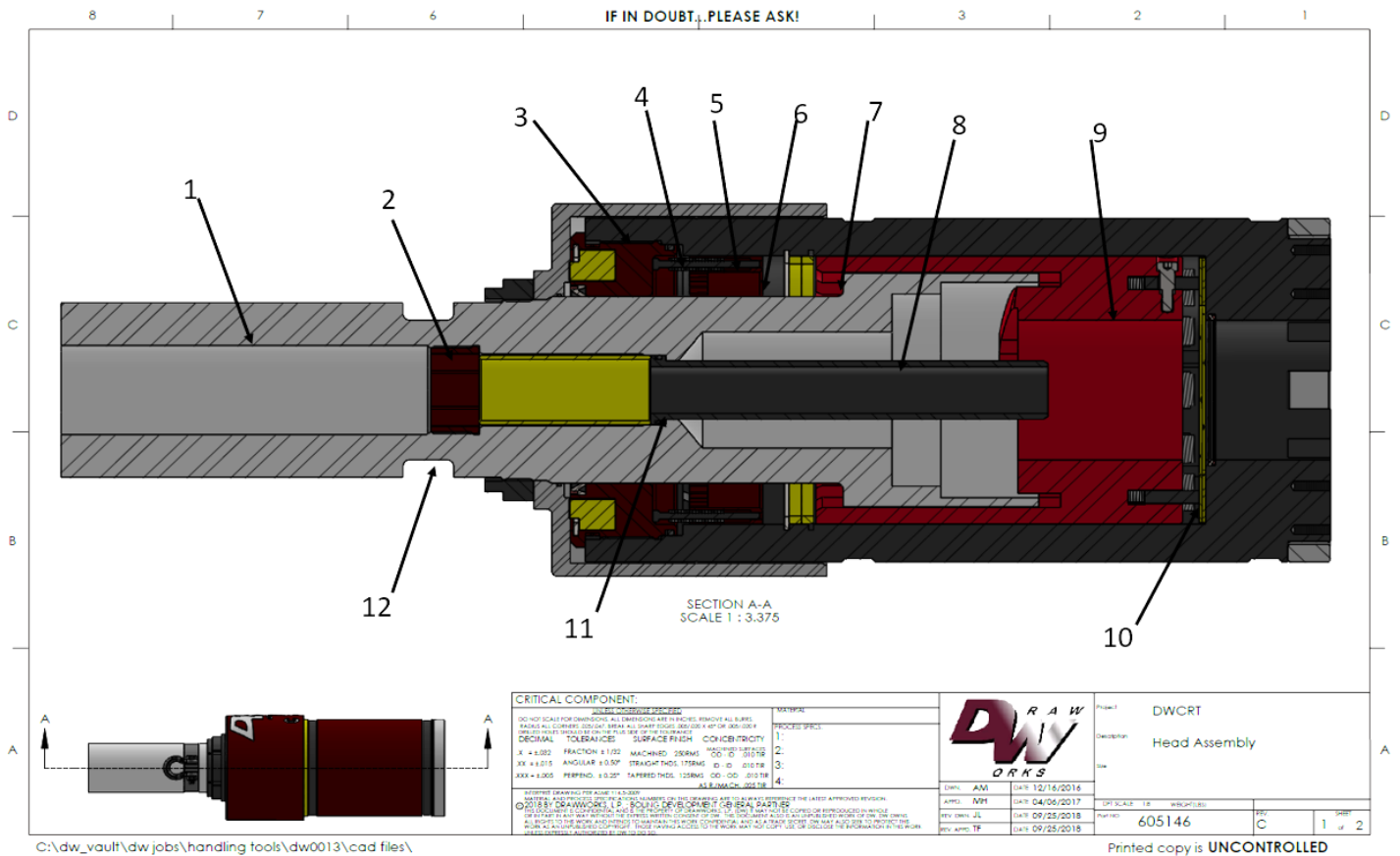
9.4.1 Head Assembly

- 1. Inspect tool joint for thread and seal area damage.
- 2. Inspect internal threads and the threaded nut that holds the Snorkel.
- 3. Inspect Housing Cap male and female threads and seal areas.
- 4. Inspect internal Clutch teeth for deformation (black coating worn away is acceptable).
- 5. Inspect external lugs on the Clutch. Make sure the Clutch moves and rotates freely in the Housing.
- 6. Inspect wiper seal surface for corrosion and cracks.
- 7. Inspect external splines on Top Mandrel for deformation (black coating worn away is acceptable).
- 8. Inspect Snorkel wiper seal area for corrosion and cracks.
- 9. Inspect internal threads on Dovetail Mandrel Nut for scaring or galling.
- 10. Inspect Thrust Washers for scaring or galling.
- 11. Inspect seal area on Snorkel for rust or pits.
-

12. Inspect critical cross-section of Top Mandrel for cracks.

Checked By: _____

Date: _____

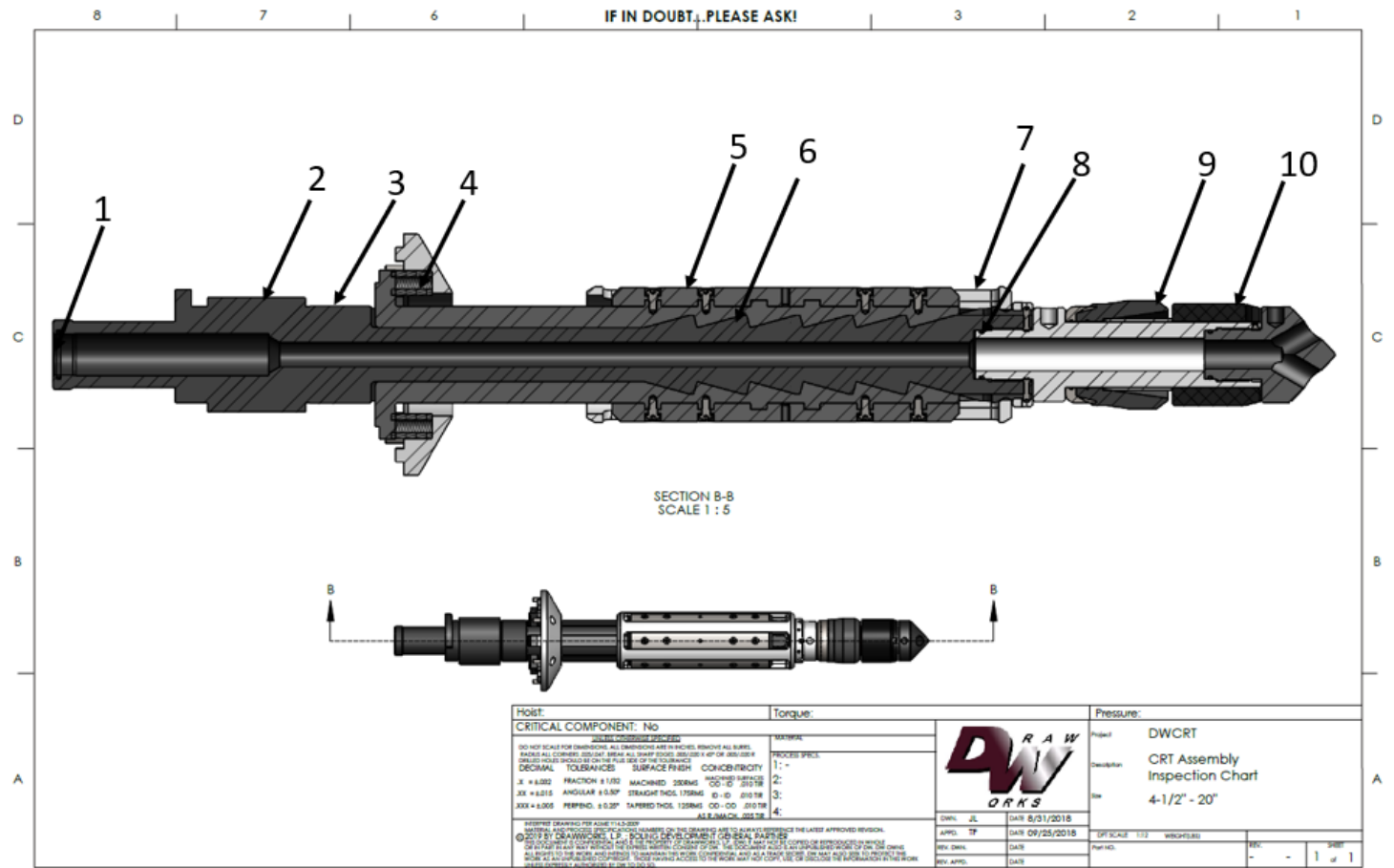


9.4.2 Internal Assembly

- 1. Inspect seal groove for corrosion.
- 2. Inspect thread for wear.
- 3. Inspect seal area for corrosion or pitting.
- 4. Check for broken springs or short springs.
- 5. Inspect Insert teeth per acceptance criteria.
- 6. Inspect Slip contact areas for wear or corrosion.
- 7. Inspect Wear Guide OD, verify Slips are recessed when tool is released.
- 8. Inspect internal seal diameter.
- 9. Inspect Packer Cup OD for tears, cracks, or excessive wear.
- 10. Inspect Gage Ring OD based on Casing being run.

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Date: _____



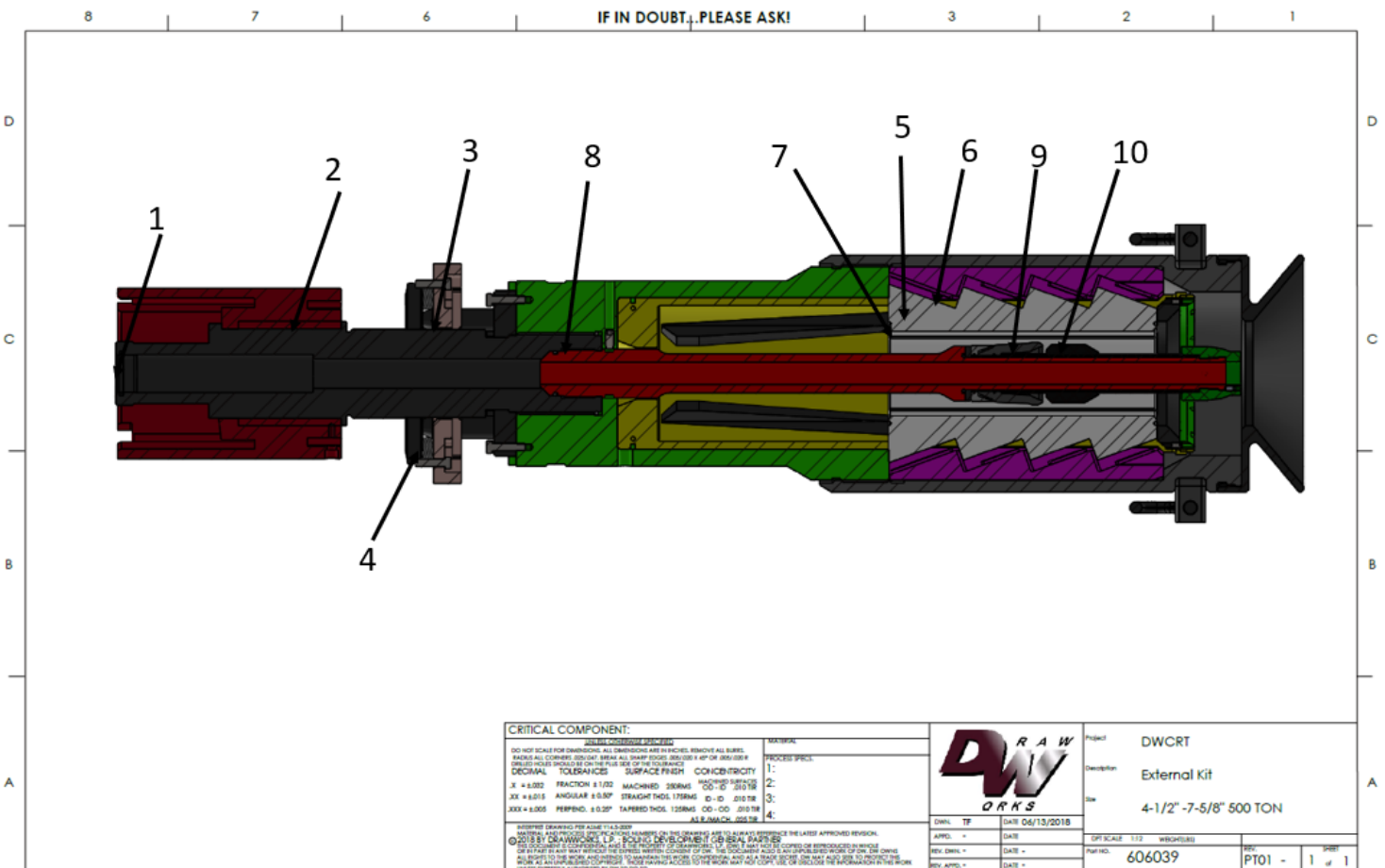
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9.4.3 External Assembly

- 1. Inspect seal groove for corrosion.
- 2. Inspect thread for wear.
- 3. Inspect seal area for corrosion or pitting.
- 4. Check for broken springs or short springs.
- 5. Inspect Insert teeth per acceptance criteria.
- 6. Inspect Slip contact areas for wear or corrosion.
- 7. Inspect Wear Guide OD, verify Slips / Ramps are recessed when tool is released.
- 8. Inspect seal internal diameter.
- 9. Inspect Packer Cup OD for tears, cracks, or excessive wear.
- 10. Inspect Gage Ring OD for proper size based on Casing being run.

Checked By: _____

Date: _____



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9.4.4 Slip Teeth Inspection Criteria

WARNING

The DWCRT cannot tolerate wellbore misalignment in excess of 1" less than half of the pipe diameter. For example, a 20" casing can tolerate 9" of wellbore misalignment ($20"/2 - 1" = 9"$).

Once top drive weight has been set down on the DWCRT, the tool must be retorqued before a tensile load can be applied.

The DWCRT compensator will unlock the tool if the top drive continues to lower after the casing gets stuck. Any rotation of the tool while in the unlocked position, even clockwise rotation, has the potential to retract the Slips and release the casing string.

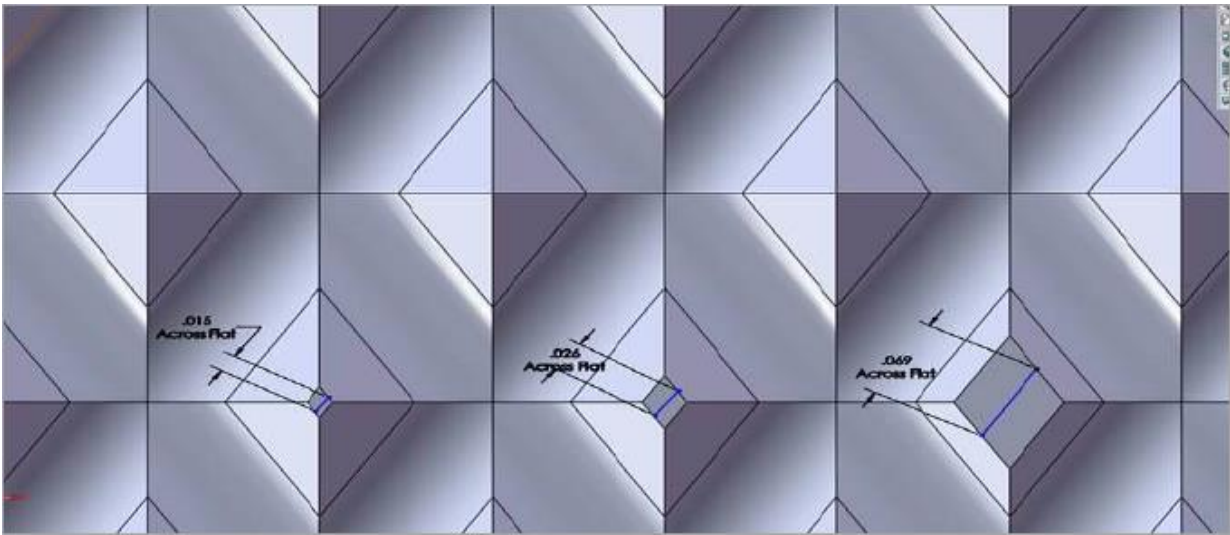
Up to 100,000 lbs. of set-down weight may be applied to the tool in the unlocked position as long as the tool isn't rotated. Gen 2 tool will allow set down weight combined with rotation while in the push position. Do not use the DWCRT compensator as a jar for hammering the casing into the well.

Occasionally the Indicator will continue to completely cover the yellow stripe on the Housing as the tool is raised out of the casing. This is indicative of an air bubble trapped below the Packer Cup which will lift the Housing and Mandrel until the Packer Cup releases its seal. Usually, the seal is released in the coupler.

Slips that are not fully retracted can drag along the casing ID and threads which may result in damage to the casing or damage to the tool. The Housing will spin with the Top Mandrel and Indicator once the Slips are fully retracted. Verify that the Retract Line on the Housing lines up with the Retract Line on the Indicator. If the two are not lined up, apply set down weight and continue to retract the Slips.

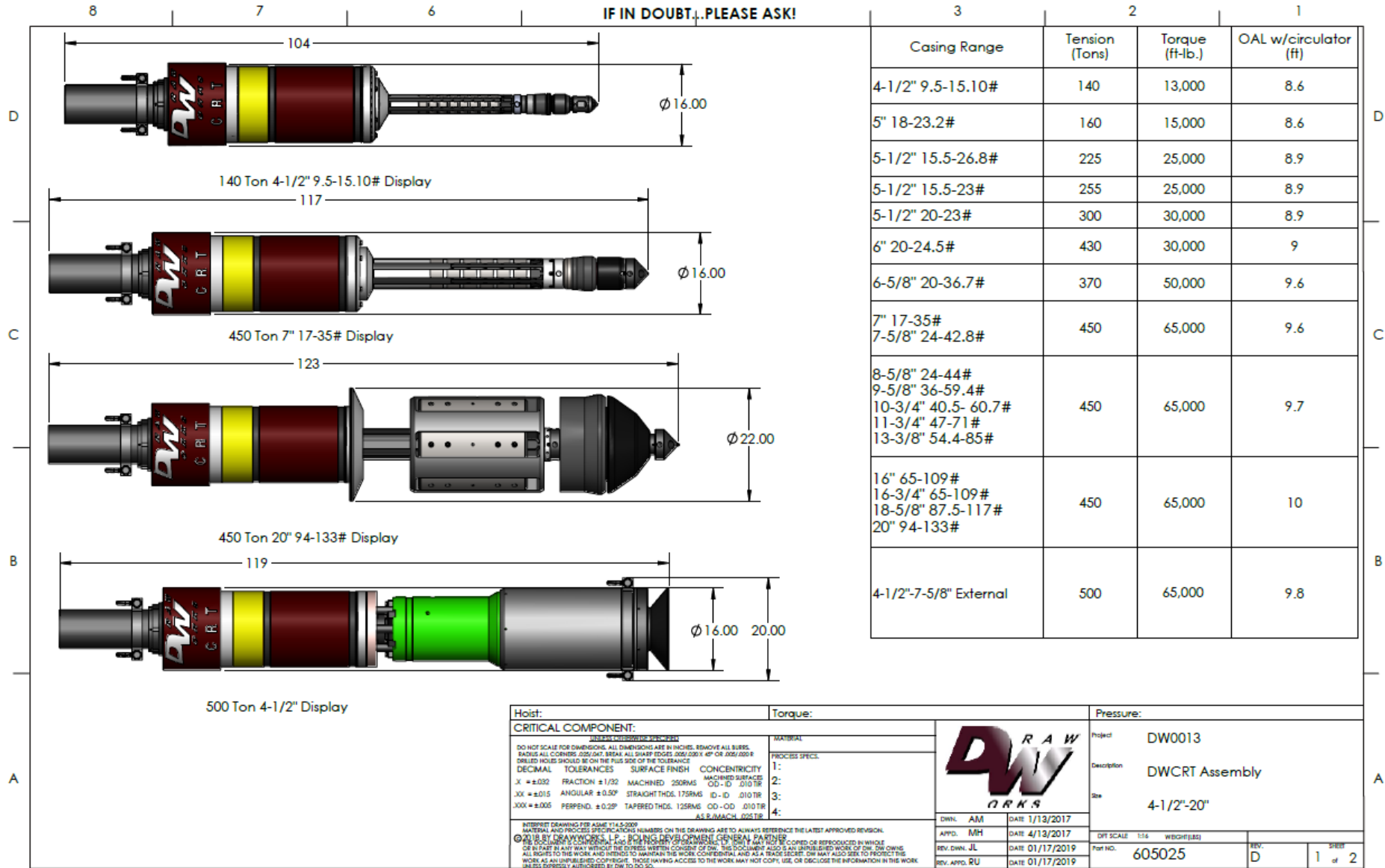
Dies whose teeth that have been worn flat or broken must be replaced. To measure the flatness of DWCRT dies, use a caliper to measure the width of the flat on the tip of the tooth. If the flat is more than 0.025" wide, the tooth is considered damaged.

Count both the total number of teeth and the number of damaged teeth in a 2" x 2" square. If the number of damaged teeth is more than 10% of the total number of teeth in that square, the die should be replaced.



Section 10 - Assembly – BOMs

10.1 DWCRT Assembly



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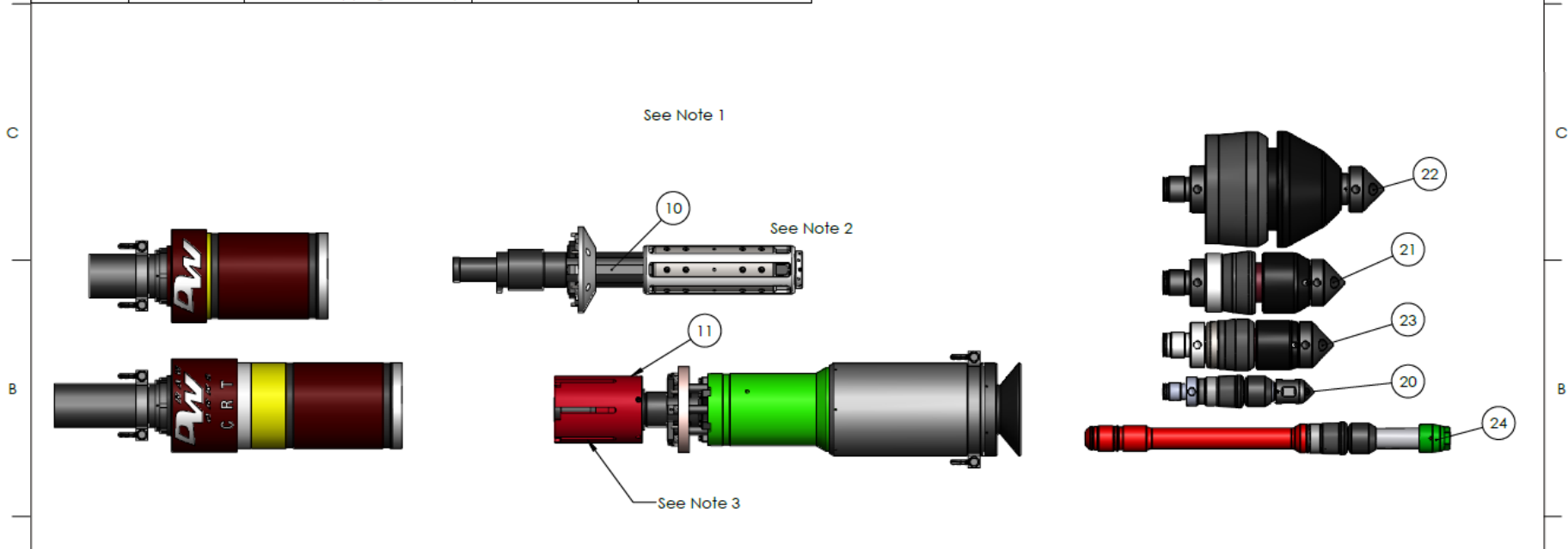
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IF IN DOUBT, PLEASE ASK!

ITEM NO.	PART NUMBER	DESCRIPTION	Size	Head Assembly Options/QTY.
1	606474	Head Assembly Anti-collapse 1/4" Travel	500 Ton	1
2	606479	Head Assembly Shorty Anti-collapse 1/4" Travel	500 Ton	1

ITEM NO.	PART NUMBER	DESCRIPTION	Size	Circulator Assembly Options/QTY.
20	605101	Circulator Assembly	4-1/2" - 6-5/8"	1
21	605090	Circulator Assembly	8-5/8" 13-3/8"	1
22	605351	Circulator Assembly	16" 20"	1
23	605071	Circulator Assembly	7" 7-5/8"	1
24	606188	Circulator Assembly External	4-1/2"-7-5/8"	1

ITEM NO.	PART NUMBER	DESCRIPTION	Size	Internal and External Kit/QTY.
10	605730	Internal Gripping Assembly	4-1/2" 20"	1
11	606280	External Gripping Assembly	4-1/2-7-5/8"	1



Notes:

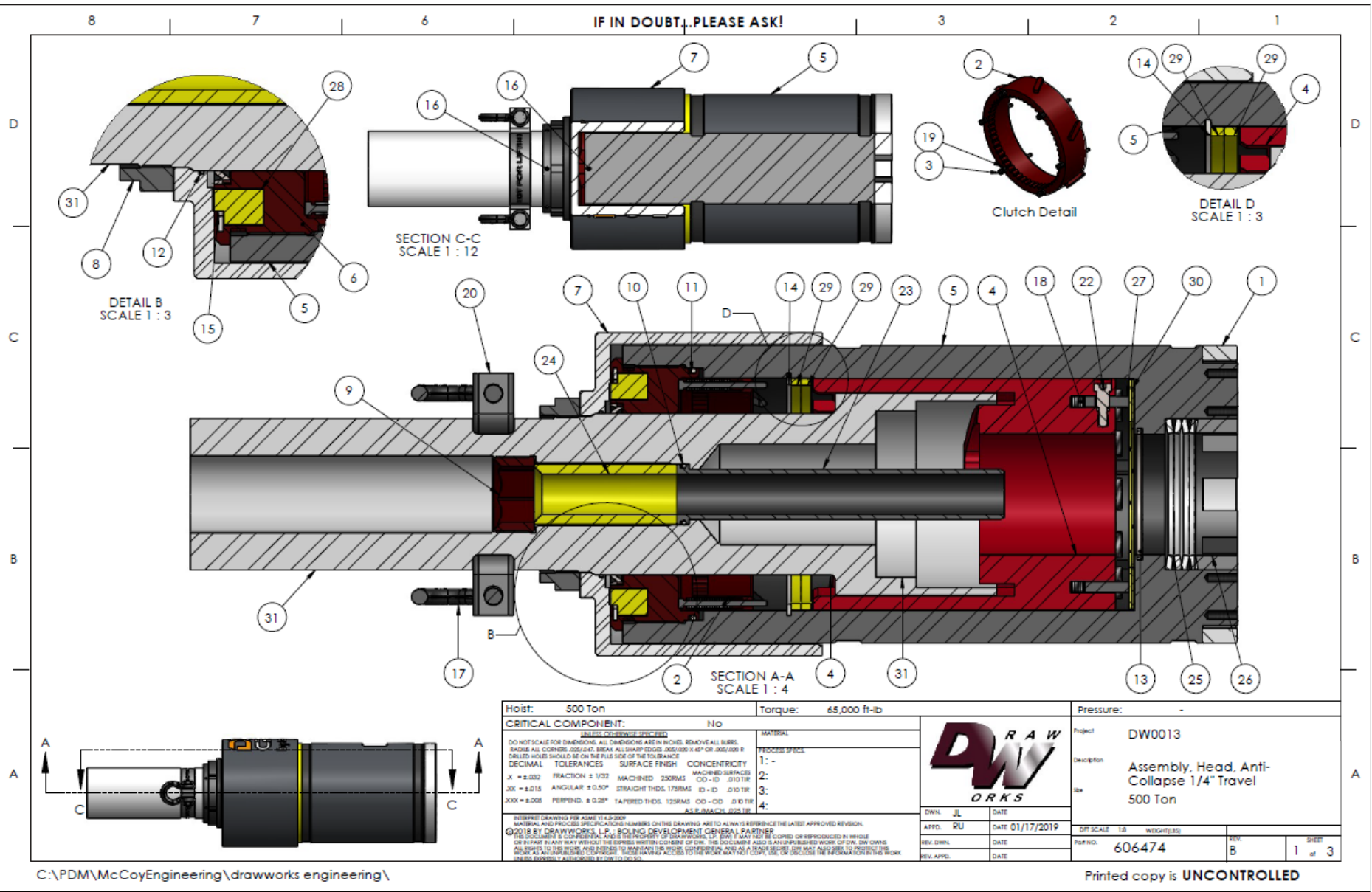
- Select one each for a complete tool: Head Assembly, Grip Assembly, Circulators Assembly. Not all components can be used together.
- Refer to 605730 for other Internal gripping assembly sizes.
- Currently External takes a different Dovetail Mandrel Nut. When External is quoted You'll need to take that into consideration.

Hoist:	Torque:	Pressure:								
CRITICAL COMPONENT: DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .005/047. BREAK ALL SHARP EDGES .005/000 X 45° OR .005/000 R DRAILED HOLES SHOULD BE ON THE FLUX SIDE OF THE TOOL BRANCHES MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2018 BY DRAWWORKS, LP - SOLELY DEVELOPMENT GENERAL PARTS USE IN FABRICATING OR REPAIRING THE SERVICE INSTRUMENT. THE TOOL IS NOT TO BE COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY MANNER WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. DW OWNS ALL RIGHTS TO THE WORK AND INTENDS TO MAINTAIN THE WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THIS FROM AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK WITHOUT EXPRESS AUTHORIZATION BY DW TO DO SO.	MATERIAL: PROCESS SPEC: 1: 2: 3: 4:	Project: DW0013 Description: DWCRT Assembly Size: 4-1/2"-20" 140 Ton 4-1/2" DW SCALE: 1:38 W/80#(185) Part No.: 605025 REV. D SHEET 2 of 2								
<table border="1"> <tr> <td>DWNL AM</td> <td>DATE 1/13/2017</td> </tr> <tr> <td>APPD. MH</td> <td>DATE 4/13/2017</td> </tr> <tr> <td>REV. DWNL J.L</td> <td>DATE 01/17/2019</td> </tr> <tr> <td>REV. APPD. RU</td> <td>DATE 01/17/2019</td> </tr> </table>	DWNL AM	DATE 1/13/2017	APPD. MH	DATE 4/13/2017	REV. DWNL J.L	DATE 01/17/2019	REV. APPD. RU	DATE 01/17/2019		
DWNL AM	DATE 1/13/2017									
APPD. MH	DATE 4/13/2017									
REV. DWNL J.L	DATE 01/17/2019									
REV. APPD. RU	DATE 01/17/2019									

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10.1.1 Head Assembly, 500 Ton



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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	605398	Cable Guide Cover	1
2	605620	Clutch	1
3	605749	Clutch Spring Alignment Pin	6
4	606041	Dovetail Mandrel Nut, 500 Ton	1
5	606473	Housing, 500 Ton	1
6	605016	Housing Cap	1
7	605390	Indicator	1
8	605018	Indicator Nut	1
9	604079	LOCKING NUT, 2 3/4"	1
10	700601	O-RING, DWCRT SNORKEL, 3.020" OD X 2.600" ID X 0.210" CS	1
11	700600	O-RING, 12.525"OD X 11.975" ID, .275"CS, 2-453, 70 DURO	1
12	700602	O-RING, 8.262" OD x 7.984" ID x 0.139" CS (Replaces Part #2226601)	1
13	700800	PolyPak, 6.5" OD x 6.0" ID x 0.25" CS	1
14	701200	Ring, Snap, 12" OD x 11.38" ID x 0.56" W x 0.19" T (Replaces Part # 505166)	1
15	701201	Ring, Snap, 12.50" OD x 11.38" ID x 0.56" W x 0.19" T (Replaces Part #505166)	1
16	700002	SET SCREW, HEX, CUP POINT, 3/8"-16 X 5/8" LG, STEEL	12
17	701160	SHACKLE, 3/4" BOLT TYPE ANCHOR, 4-3/4" TON	2
18	701250	COMPRESSION SPRING	10
19	700110	SPRING, 1/2, 3 3/8 L, 103-218-00	6
20	605318	Safety Clamp	2
21	700801	Seal, Wiper, 9 OD x 8 ID x 0.625" CS	1
22	700000	BOLT, SHOULDER, 5/8" SH X 1" SHLG, 1/2"-13 THREAD, STEEL, 5/16" DRIVE SIZE	5
23	605739	Snorkel	1
24	1006174	SPACER, DWCRT, 7" LG, 1" ID	1
25	605721	Spring	4
26	605720	Spring Plate	1
27	605020	SPRING RETAINING CAGE	1
28	605222	Thrust Bearing	1
29	605686	Thrust Ring	2
30	605022	Thrust Washer	2
31	605900	Top Mandrel Blank	1


IF IN DOUBT, PLEASE ASK!

PART NUMBER	Redress Kit 606476/Redress Kit /QTY.	Rebuild Kit 606475/Rebuild Kit/QTY.	Overhaul Kit 606477/Overhaul Kit/QTY.
605749	-	-	6
700601	1	1	1
700600	1	1	1
700602	1	1	1
700800	1	1	1
701200	-	1	1
701201	-	1	1
700002	-	12	12
701250	-	-	10
700110	-	-	6
700801	1	1	1
700000	-	-	5
605721	-	-	4
605686	-	-	2
605022	-	-	2

ITEM NO.	PART NUMBER	DESCRIPTION	Options/QTY.
50	605118	Safety Ring	1

Notes:
 1. Refer to 60590X for available connections.
 2. Safety ring available in place of cable guide cover.

 Internal Spring Valve
 Part Number 602870
 Can Replace Item # 605113

Hoist: 500 Ton	Torque: 65,000 ft-lb	Pressure: -
CRITICAL COMPONENT: No	MATERIAL:	Project: DW0013
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS. DEBUR. BREAK ALL SHARP EDGES. DRILL DIA. X .010 OR .005 DIA. IF DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE. DECIMAL TOLERANCES SURFACE FINISH MACHINED SURFACES X = ±.002 FRACTION ± 1/32 MACHINED 250RMS OD-ID .010 TR XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID-ID .010 TR XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD-ID .010 TR AS P. MACH. .005 TR	PROCESS SPECS: 1: - 2: 3: 4:	Description: Assembly, Head, Anti-Collapse 1/4" Travel Size: 500 Ton
<small>INTERNET DRAWING PER ASME Y14.5-2009 MATERIAL AND PROCESS SPECIFICATIONS LISTED ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. ©2018 BY DRAWWORKS, L.P. - BOULDER DEVELOPMENT GENERAL PARTNER THIS DOCUMENT IS THE PROPERTY OF DRAWWORKS, L.P. IT IS TO BE USED ONLY FOR THE PROJECT AND NOT TO BE COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THIS WORK AND INTENDS TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THIS WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK UNLESS EXPRESSLY AUTHORIZED BY DW. IN DOCS.</small>		 DWN: JL DATE: 01/17/2019 APPR: RU DATE: 01/17/2019 REV: DWN DATE: REV: APPR DATE:
DW0013 Assembly, Head, Anti-Collapse 1/4" Travel 500 Ton		DPT SCALE: 1:8 WEIGHT(LBS) Part No: 606474 REV: B 2 of 3



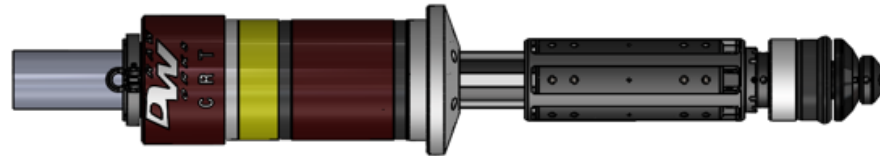
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10.1.2 DWCRT 1,000 Ton Assembly

IF IN DOUBT, PLEASE ASK!

Tubular Size	Weight Range	Casing ID (in.)	API 8C Hoist Capacity (Tons)	Torque Capacity (Locked ft-lb)	Torque Capacity (Unlocked ft-lb)	Set Down Weight (Tons)	Minimum ID (in.)	Flow Rate (bbl/min)	OAL (in.)	OAL w/ Autovalve (in.)	Aprox Weight (lbs.)
7"	17-35#	6.538 - 6.004	400	60,000	20,000	50	1.5	12	122	137	2950
7-5/8"	39-55.3#	6.625 - 6.125	500	65,000	25,000	50	1.5	12	122	137	3000
9-5/8"	36 -59.4 #	8.921 - 8.407	1000	100,000	75,000	50	2.25	20	130	153	3350
9-7/8"	62.8 #	8.625	1000	100,000	75,000	50	2.25	20	130	153	3350
10-3/4"	40.5 - 60.7#	10.050 - 9.660	1000	100,000	75,000	50	2.25	20	130	153	3580
11-3/4"	47 - 71#	11.000 - 10.586	1000	100,000	75,000	50	2.25	20	130	153	3600
13-3/8"	54.4 - 85#	12.615 - 12.159	1000	100,000	75,000	50	2.25	20	130	153	4000
13-5/8"	88.2#	12.375	1000	100,000	75,000	50	2.25	20	130	153	4000
16"	65 -109#	15.250 - 14.688	1000	100,000	75,000	50	2.25	20	135	162	4400
16-3/4"	65 - 109#	16.250 - 15.750	1000	100,000	75,000	50	2.25	20	135	162	4500
18-5/8"	87.5 - 136#	17.755 - 17.239	1000	100,000	75,000	50	2.25	20	135	162	5050
20"	94 - 133#	19.124 - 18.730	1000	100,000	75,000	50	2.25	20	135	162	5300
20"	163-187#	18.625 - 18.125	1000	100,000	75,000	50	2.25	20	135	162	5350
22"	170-224#	20.438 - 19.938	1000	100,000	75,000	50	2.25	20	138	N/A	5850
24"	171-216#	22.685 - 22.185	1000	100,000	75,000	50	2.25	20	138	N/A	6500
26"	202-275#	24.550 - 24.050	1000	100,000	75,000	50	2.25	20	138	N/A	7100



1000 Ton 13-3/8" Display

Hoist:	Torque:	Pressure:
CRITICAL COMPONENT: <small>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REVISE ALL DIMENSIONS TO REFLECT THE LATEST APPROVED REVISION. DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY X = ±.002 FRACTION ± 1/32 MACHINED SURFMS FINISHED SURFMS .001 ±.010 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR .001 ±.002 PERPEND. ± 0.25° TAPERED THDS. 125RMS CO - CO .010 R AS B.M.A.S.H. 024218</small>		DW0004 DWCRT1K Assembly 7"-26"
<small>INTERPRET DRAWING PER ASME Y14.2-2009 MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THE DRAWING ARE TO ALWAYS REFLECT THE LATEST APPROVED REVISION. GOOD ENGIN. MANUFACTURING PRACTICES AND GENERAL ASSEMBLY PRACTICES ARE TO BE USED UNLESS OTHERWISE SPECIFIED. ALL RIGHTS TO THE WORK AND INTEND TO MAINTAIN THE WORK CONFIDENTIAL AND AS A TRADE SECRET. YOU MAY ALSO WISH TO PROTECT THE WORK AS AN INVENTION UNDER PATENT LAW. THE WORK MAY NOT BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.</small>		
DW: MH APP: RU REV: JNL REV: APP: RU	DATE 2/23/2017 DATE 1/4/2019 DATE 01/21/2019 DATE 01/21/2019	OFFSCALE (1) #20-1181 PartNo: 605444 REV: A SHEET 1 of 2

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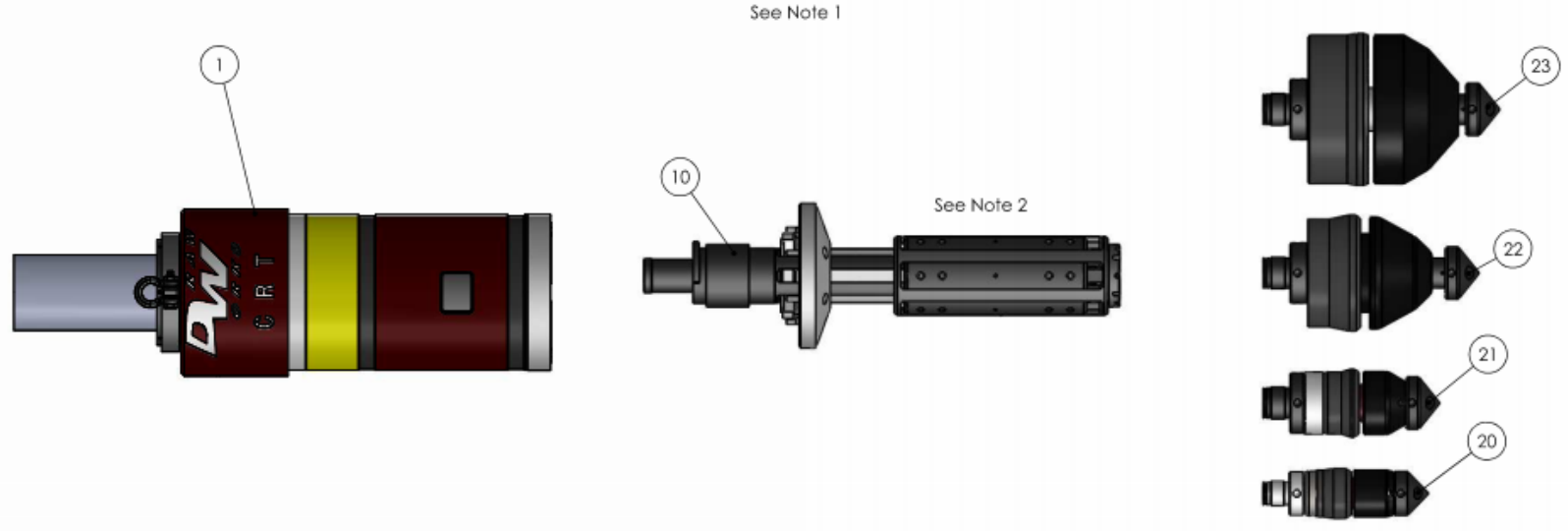
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	Head Assemblies/QTY.
1	606521	Head Assembly	1000 Ton	1

ITEM NO.	PART NUMBER	DESCRIPTION	Size	Circulator Assemblies/QTY.
20	605071	Circulator Assembly	7" 7-5/8"	1
21	605494	Circulator Assembly	9-5/8"-13-3/8"	1
22	605495	Circulator Assembly	16"-20"	1
23	605550	Circulator Assembly	22"-26"	1

ITEM NO.	PART NUMBER	DESCRIPTION	Size	Gripping Assembly/QTY.
10	606289	Internal Grip Assembly	7"-26"	1



- Notes:
- Select one each for a complete tool: Head Assembly, Gripping Assembly, Circulator Assembly.
 - Not all components can be used together.
 - Refer to 606289 for other internal gripping assembly sizes.

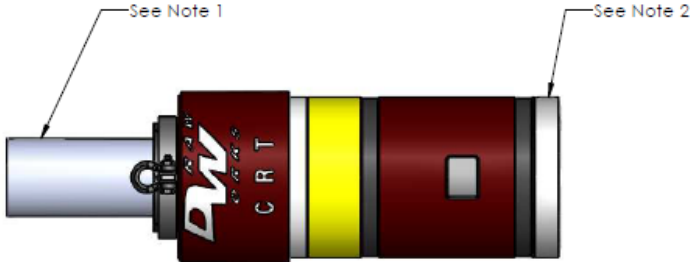
Hoist:		Torque:		Pressure:	
CRITICAL COMPONENT: DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. BREAK ALL CORNERS. DODGE/CHAMFER ALL SHARP EDGES. DODGE/CHAMFER 45° OR 30°/100° R. CHILLED STEEL SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE. DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY .X = ±.030 RACON ± .032 MACHINED .25SRMS MACHINED SURFACES .XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 17SRMS CD-CD .010 TR .XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 12SRMS CD-CD .010 TR AS B. MACH. 0.25 TR		MATERIAL: PROCESS SPEC: 1: 2: 3: 4:		Project: DW0004 Description: DWCRT1K Assembly Size: 7"-26" DWN: AJH DATE: 2/23/2017 APPD: RU DATE: 1/4/2019 REV: DWN: JL DATE: 01/21/2019 REV: APPD: RU DATE: 01/21/2019	
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10.1.3 Head Assembly, 1,000 Ton

8		7		6		IF IN DOUBT...PLEASE ASK!		3		2		1	
ITEM NO.	PART NUMBER	DESCRIPTION	Toolbox Size	Collapsed/QTY.	PART NUMBER	DESCRIPTION	606251 Overhaul Kit/Overhaul Kit/QTY.	606252 Rebuild Kit/Rebuild Kit/QTY.	606253 Redress Kit/Redress Kit/QTY.				
1	605752	Cable Guide Cover		1									
2	605621	Clutch		1									
3	605749	Clutch Spring Alignment Pin		6	605749	Clutch Spring Alignment Pin	6	-	-				
4	606472	Dovetail Mandrel Nut		1	700618	O-Ring	1	1	1				
5	606520	Housing		1	700617	O-Ring	1	1	-				
6	605453	Housing Cap		1	700619	O-Ring	1	1	-				
7	605460	Indicator		1	700807	PolyPak	1	1	1				
8	605450	Indicator Nut		1	701350	Set Screw	6	6	-				
9	605500	Locking Nut		1	700002	Set Screw	6	6	-				
10	700618	O-Ring	2-340	1	700000	Shoulder Bolt	6	-	-				
11	700617	O-Ring	2-272	1	701205	Snap Ring	1	-	-				
12	700619	O-Ring	2-459	1	701204	Snap Ring	1	-	-				
13	700807	PolyPak	9.00ODx8.375ID	1	701250	Spring	12	-	-				
14	605469	Safety Hanger Swivel		1	606456	Spring	3	-	-				
15	701352	Set Screw	3/8-16 x 3/4	12	700110	Spring	6	-	-				
16	701160	Shackle	3/4" 4-3/4 Ton	2	606262	Thrust Washer	2	-	-				
17	700000	Shoulder Bolt	1/2-13 x 5/8 SL 1	6	700806	Wiper Seal	1	1	-				
18	701205	Snap Ring	14.21ODx12.88ID	1									
19	701204	Snap Ring	15.15ODx13.65ID	1									
20	605451	Snorkel		1									
21	605501	Snorkel Spacer		1									
22	701250	Spring		12									
23	700110	Spring		6									
24	606456	Spring		3									
25	606409	Spring Plate		1									
26	605454	Spring Retaining Cage		1									
27	605458	Thrust Bearing		1									
28	605743	Thrust Ring		2									
29	606262	Thrust Washer		2									
30	60648X	Top Mandrel		1									
31	700806	Wiper Seal	10.50ODx9.50ID	1									
ITEM NO.	PART NUMBER	DESCRIPTION	Options/QTY.										
50	605655	Safety Ring	1										



<p>Notes:</p> <p>1. Refer to 60648X for available connections.</p> <p>2. Safety ring available in place of cable guide cover.</p>	<p>Hoist: 1000 Ton</p> <p>Torque: 75,000 ft-lb</p> <p>Pressure: -</p>		<p>Project: DW0004</p> <p>Description: Head Assembly</p> <p>Size: 1000 Ton</p>
	<p>CRITICAL COMPONENT: No</p> <p>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. BAKERS ALL CORNERS, ROUNDS, BEVELS, ALL SHARP EDGES. 200/300 X 45° OR 300/500 X 45°</p> <p>DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY</p> <p>1: -</p> <p>2: -</p> <p>3: -</p> <p>4: -</p>		<p>Material: <not specified></p> <p>PROCESSED BY:</p>
	<p>INTERIOR DRAWING PER ASME Y14.3-2009</p> <p>STANDARD AND FINISH SPECIFICATIONS REMAINS ON THE DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.</p> <p>© 2018 BY DRAWWORKS, L.P. - BOILING DEVELOPMENT GENERAL PARTNER</p> <p>THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF DRAWWORKS, L.P. (DW). IT MAY NOT BE COPIED OR REPRODUCED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THIS DOCUMENT AND ITS CONTENTS ARE UNCLASSIFIED WORK OF DW. DW OWNS ALL RIGHTS TO THE MARK AND DESIGN AND NEEDS TO MAINTAIN THE WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO BE SUBJECT TO THE FOLLOWING: ALL RIGHTS TO THE MARK AND DESIGN AND NEEDS TO MAINTAIN THE WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO BE SUBJECT TO THE FOLLOWING: ALL RIGHTS TO THE MARK AND DESIGN AND NEEDS TO MAINTAIN THE WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO BE SUBJECT TO THE FOLLOWING: ALL RIGHTS TO THE MARK AND DESIGN AND NEEDS TO MAINTAIN THE WORK CONFIDENTIAL AND AS A TRADE SECRET.</p>		<p>DWN: JL</p> <p>APPR: RU DATE: 01/21/2019</p> <p>REV: DWN: CH DATE: 05/01/2019</p> <p>REV: APPR: RU DATE: 05/01/2019</p>
	<p>DWT SCALE: 1:12 WEIGHT: 2083.465</p> <p>Part No: 606521</p> <p>SHEET: 2 of 2</p>		

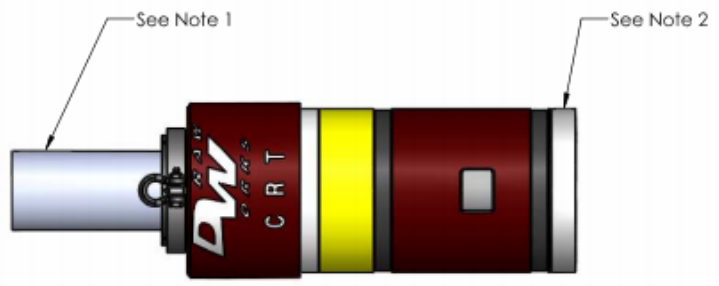
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ITEM NO.	PART NUMBER	DESCRIPTION	Toolbox Size	Collapsed/QTY.
1	605752	Cable Guide Cover		1
2	605621	Clutch		1
3	605749	Clutch Spring Alignment Pin		6
4	606472	Dovetail Mandrel Nut		1
5	606520	Housing		1
6	605453	Housing Cap		1
7	605460	Indicator		1
8	605450	Indicator Nut		1
9	605500	Locking Nut		1
10	700618	O-Ring	2-340	1
11	700617	O-Ring	2-272	1
12	700619	O-Ring	2-459	1
13	700807	PolyPak	9.00ODx8.375ID	1
14	605469	Safety Hanger Swivel		1
15	701352	Set Screw	3/8-16 x 3/4	12
16	701160	Shackle	3/4" 4-3/4 Ton	2
17	700000	Shoulder Bolt	1/2-13 x 5/8 SL 1	6
18	701205	Snap Ring	14.21 ODx12.88ID	1
19	701204	Snap Ring	15.15 ODx13.65ID	1
20	605451	Snorkel		1
21	605501	Snorkel Spacer		1
22	701250	Spring		12
23	700110	Spring		6
24	606456	Spring		3
25	606409	Spring Plate		1
26	605454	Spring Retaining Cage		1
27	605458	Thrust Bearing		1
28	605743	Thrust Ring		2
29	606262	Thrust Washer		2
30	60648X	Top Mandrel		1
31	700806	Wiper Seal	10.50ODx9.50ID	1

PART NUMBER	DESCRIPTION	606251 Overhaul Kit/Overhaul Kit/QTY.	606252 Rebuild Kit/Rebuild Kit/QTY.	606253 Redress Kit/Redress Kit/QTY.
605749	Clutch Spring Alignment Pin	6	-	-
700618	O-Ring	1	1	1
700617	O-Ring	1	1	-
700619	O-Ring	1	1	-
700807	PolyPak	1	1	1
701350	Set Screw	6	6	-
700002	Set Screw	6	6	-
700000	Shoulder Bolt	6	-	-
701205	Snap Ring	1	-	-
701204	Snap Ring	1	-	-
701250	Spring	12	-	-
606456	Spring	3	-	-
700110	Spring	6	-	-
606262	Thrust Washer	2	-	-
700806	Wiper Seal	1	1	-

ITEM NO.	PART NUMBER	DESCRIPTION	Options/QTY.
50	605655	Safety Ring	1



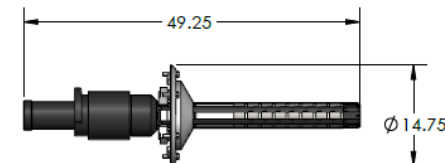
<p>Notes:</p> <p>1. Refer to 60648X for available connections.</p> <p>2. Safety ring available in place of cable guide cover.</p>	<p>Hoist: 1000 Ton</p> <p>Torque: 75,000 ft-lb</p> <p>Pressure: -</p>	<p>Project: DW0004</p> <p>Description: Head Assembly</p> <p>Size: 1000 Ton</p>
	<p>CRITICAL COMPONENT: No</p> <p>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED. BREAK ALL SHARP EDGES .005/0.02 @ 45° OR .005/0.02 R. CHILLED HOLES SHOULD BE ON THE FULL SIDE OF THE TOLERANCE.</p> <p>DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY</p> <p>X = ±.002 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACES</p> <p>XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 125RMS ID - ID .010 IR</p> <p>XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 IR AS B-SMACH. 025 IR</p>	<p>MATERIAL: Material <not specified></p> <p>PROCESS STYLE:</p> <p>1: -</p> <p>2: -</p> <p>3: -</p> <p>4: -</p>
	<p>INTERNET DRAWING FOR ASME Y14.5-2009</p> <p>MATERIAL AND PROCESS SPECIFICATIONS SUBSIDIARY OF THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.</p> <p>© 2018 BY DRAWWORKS LP - BOILING DEVELOPMENT GENERAL PARTNER</p> <p>THIS DOCUMENT IS UNCONTROLLED AND THE PROPERTY OF DRAWWORKS LP. THIS DRAWING MUST BE CONTROLLED OR REPRODUCED IN WHOLE OR IN PART IN ANY MANNER WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THIS DOCUMENT ALSO IS AN UNIMPROVED WORK OF DW. DW OWNS ALL RIGHTS TO THIS WORK AND AGREES TO MAKE AVAILABLE TO OTHERS. THIS DRAWING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK DRAWING MATERIAL AND PROCESS TO ANY OTHER PARTY.</p>	<p>DWN JL DATE</p> <p>APPD RU DATE 01/21/2019</p> <p>DEV DWN CH DATE 05/01/2019</p> <p>REV APPD RU DATE 05/01/2019</p>
	<p>Part No. 606521</p> <p>Rev. 2 of 2</p>	<p>DWG SCALE 1:12</p> <p>W8049380 2083.465</p>

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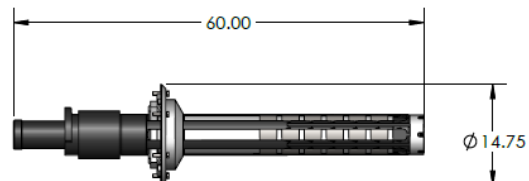
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10.2 Internal Gripping Assembly, 4-1/2" – 20"

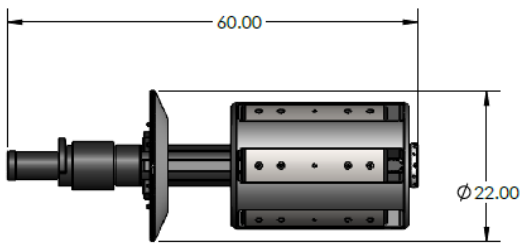
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140 Ton 4-1/2" 9.5-15.10# Display




450 Ton 7" 17-35# Display



450 Ton 20" 94-133# Display

Casing Range	Tension (Tons)	Torque (ft-lb.)	OAL w/circulator and Standard Head(ft)
4-1/2" 9.5-15.10#	140	13,000	8.6
5" 18-23.2#	160	15,000	8.6
5-1/2" 15.5-26.8#	225	25,000	8.9
5-1/2" 15.5-23#	255	25,000	8.9
5-1/2" 20-23#	300	30,000	8.9
6" 20-24.5#	430	30,000	9
6-5/8" 20-36.7#	370	50,000	9.6
7" 17-35#	450	65,000	9.6
7-5/8" 24-42.8#	450	65,000	9.6
8-5/8" 24-44#	450	65,000	9.7
9-5/8" 36-59.4#			
10-3/4" 40.5- 60.7#			
11-3/4" 47-71#			
13-3/8" 54.4-85#	450	65,000	10
16" 65-109#			
16-3/4" 65-109#			
18-5/8" 87.5-117#			
20" 94-133#			

All Configurations will need CRT Head and a Circulator Assembly

Hoist: CRITICAL COMPONENT: No DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .030/OD. BREAK ALL SHARP EDGES .030/OD X 45° OR .030/OD R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE. DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY X = ±.032 FRACTION 1/32 MACHINED 250RMS OD - ID .010 TIR XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR AS R/MACH. .025 TIR	Torque:		Pressure:
INTERPRET DRAWING PER ASME Y14.3-2009 MATERIAL AND PROCESS SPECIFICATION NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2019 BY DRAWWORKS, L.P. - BOLTING DEVELOPMENT AND GENERAL PARTNER THIS DOCUMENT IS UNCONTROLLED AND IS THE PROPERTY OF DRAWWORKS, L.P. IT MAY NOT BE COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY MANNER WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THIS WORK AND INTENDS TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THIS WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK UNLESS EXPRESSLY AUTHORIZED BY DW TO DO SO.	Project: DW0013 Description: Internal Gripping Assembly Size: 4-1/2" 20"	DWT SCALE: 1:14 WEIGHT(LBS): 257.469 Part NO.: 605730 REV. A SHEET 1 of 14	

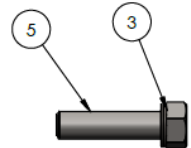
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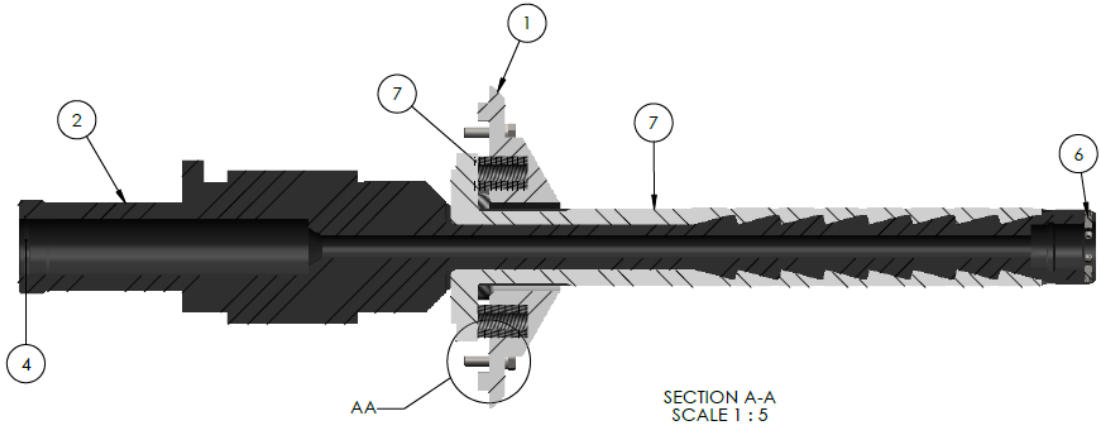
ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	4.5" 9.5-15.10/QTY.
1	605328	Bump Plate	4-1/2"-5"		1
2	606105	Dovetail Mandrel	4-1/2" 9.5-15.1# 140 Ton		1
3	700500	Lock Washer Internal Teeth			6
4	700802	PolyPak		3.00ODx2.500ID	1
5	700008	Safety Bolt		1/2-13 x 2	6
6	701352	Set Screw		3/8-16 x 3/4	6
7	606667	Slip	4-1/2" 9.5-15.1#		6
8	701254	Spring			6

Redress Kit
Part # 606201
Contains
QTY Part #
1) 700802
6) 700500

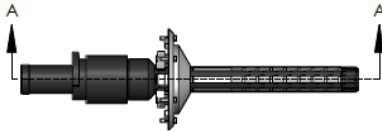
Overhaul Kit
Part # 606205
Contains
QTY Part #
1) 606201
6) 701254
6) 700008
6) 701352



DETAIL AA
SCALE 1 : 2



SECTION A-A
SCALE 1 : 5



Hoist:	Torque:	Pressure:
CRITICAL COMPONENT: No		Project DW0013
<u>UNLESS OTHERWISE SPECIFIED</u>	MATERIAL	Description Internal Gripping Assembly
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADII ALL CORNERS .025/047. BREAK ALL SHARP EDGES .005/020 X 45° OR .005/020 R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.	PROCESS SPECS:	Size 4-1/2" 20" 140 Ton 4-1/2"
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY	1: -	DFT SCALE 1:16 WEIGHT(LBS) 257.469
.X = ±.002 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACES	2: -	Part No. 605730
.XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR	3: -	REV. A
.XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR AS R/MACH. .025 TIR	4: -	SHEET 2 of 14
INTERPRET DRAWING PER ASME Y14.3-2009	DWN. JL DATE 8/31/2018	
MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.	APPL. TF DATE 9/25/2018	
© 2019 BY DRAWWORKS, L.P. POLING DEVELOPMENT GENERAL PARTNER	REV. DWN. JL DATE 06/28/2019	
USE OF PART # BY ANY MANUFACTURER WITHOUT WRITTEN CONSENT OF DW. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THE WORK AND INTENDS TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THE WORK UNLESS EXPRESSLY AUTHORIZED BY DW TO DO SO.	REV. APPD. JL DATE 09/27/2019	

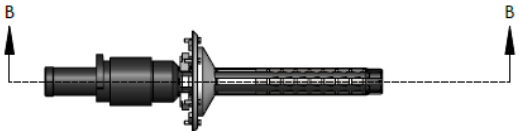
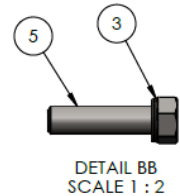
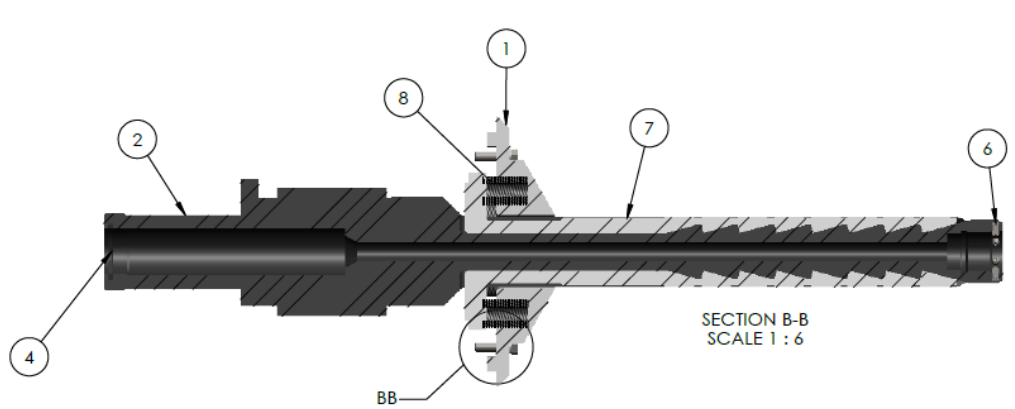
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	5" 18-23.2/QTY.
1	605328	Bump Plate	4-1/2"-5"		1
2	606106	Dovetail Mandrel	5" 18-23.2# 160 Ton		1
3	700500	Lock Washer Internal Teeth			6
4	700802	PolyPak		3.00ODx2.500ID	1
5	700008	Safety Bolt		1/2-13 x 2	6
6	701352	Set Screw		3/8-16 x 3/4	6
7	606668	Slip	5" 18-23.2#		6
8	701254	Spring			6

Redress Kit
Part # 606209
Contains
QTY Part #
1) 700802
6) 700500

Overhaul Kit
Part # 606210
Contains
QTY Part #
1) 606209
6) 701254
6) 700008
6) 701352



Hoist:	Torque:	Pressure:																												
CRITICAL COMPONENT: No																														
<p>ALL DIMENSIONS SPECIFIC</p> <p>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADII ALL CORNERS .025/047. BREAK ALL SHARP EDGES .005/020 X 45° OR .005/020 R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.</p> <table border="1"> <thead> <tr> <th>DECIMAL</th> <th>TOLERANCES</th> <th>SURFACE FINISH</th> <th>CONCENTRICITY</th> </tr> </thead> <tbody> <tr> <td>.X</td> <td>± 0.032</td> <td>FRACTION 1/32</td> <td>MACHINED 250RMS</td> </tr> <tr> <td>.XX</td> <td>± 0.015</td> <td>ANGULAR ± 0.50°</td> <td>MACHINED SURFACES</td> </tr> <tr> <td>.XXX</td> <td>± 0.005</td> <td>PERPEND. ± 0.25°</td> <td>STRAIGHT THDS. 175RMS</td> </tr> <tr> <td></td> <td></td> <td></td> <td>OD - ID .010 TIR</td> </tr> <tr> <td></td> <td></td> <td></td> <td>ID - ID .010 TIR</td> </tr> <tr> <td></td> <td></td> <td></td> <td>AS R./MACH. .025 TIR</td> </tr> </tbody> </table> <p>INTERPRET DRAWING PER ASME Y14.5-2009 MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2019 BY DRAWWORKS, LP - BOLLING DEVELOPMENT GENERAL PARTNER THIS DOCUMENT IS THE PROPERTY OF DRAWWORKS, LP. IT MAY NOT BE COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THIS WORK AND INTENDS TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO USE TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THIS WORK, MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK, UNLESS EXPRESSLY AUTHORIZED BY DW IN WRITING.</p>			DECIMAL	TOLERANCES	SURFACE FINISH	CONCENTRICITY	.X	± 0.032	FRACTION 1/32	MACHINED 250RMS	.XX	± 0.015	ANGULAR ± 0.50°	MACHINED SURFACES	.XXX	± 0.005	PERPEND. ± 0.25°	STRAIGHT THDS. 175RMS				OD - ID .010 TIR				ID - ID .010 TIR				AS R./MACH. .025 TIR
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			OD - ID .010 TIR																											
			ID - ID .010 TIR																											
			AS R./MACH. .025 TIR																											
		<p>Project DW0013</p> <p>Description Internal Gripping Assembly</p> <p>Size 4-1/2" 20" 160 Ton 5"</p>																												
<table border="1"> <tr> <td>DWN: JL</td> <td>DATE 8/31/2018</td> </tr> <tr> <td>APPD: TF</td> <td>DATE 9/25/2018</td> </tr> <tr> <td>REV. DWN: JL</td> <td>DATE 06/28/2019</td> </tr> <tr> <td>REV. APPD: JL</td> <td>DATE 09/27/2019</td> </tr> </table>	DWN: JL	DATE 8/31/2018	APPD: TF	DATE 9/25/2018	REV. DWN: JL	DATE 06/28/2019	REV. APPD: JL	DATE 09/27/2019	<table border="1"> <tr> <td>DFT SCALE 1:16</td> <td>WEIGHT(LBS) 257.469</td> </tr> <tr> <td>PART NO. 605730</td> <td>REV. A</td> </tr> <tr> <td></td> <td>SHEET 3 of 14</td> </tr> </table>	DFT SCALE 1:16	WEIGHT(LBS) 257.469	PART NO. 605730	REV. A		SHEET 3 of 14															
DWN: JL	DATE 8/31/2018																													
APPD: TF	DATE 9/25/2018																													
REV. DWN: JL	DATE 06/28/2019																													
REV. APPD: JL	DATE 09/27/2019																													
DFT SCALE 1:16	WEIGHT(LBS) 257.469																													
PART NO. 605730	REV. A																													
	SHEET 3 of 14																													

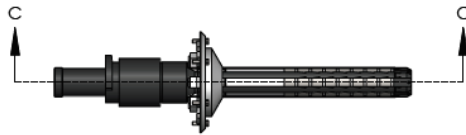
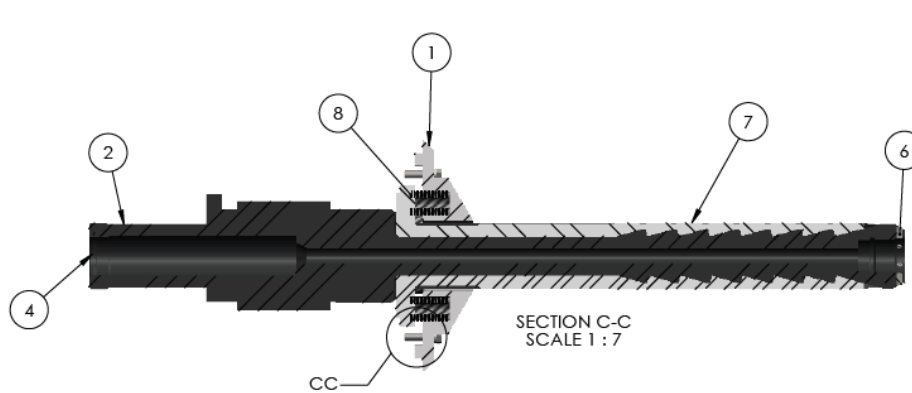
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	5.5" 15.5-26.8#/5.5" 15.5-26.8#/QTY.
1	605329	Bump Plate	5-1/2" 15.5-26.8#		1
2	606107	Dovetail Mandrel	5-1/2" 15.5-26.8# 225 Ton		1
3	700500	Lock Washer Internal Teeth			6
4	700802	PolyPak		3.00ODx2.500ID	1
5	700008	Safety Bolt		1/2-13 x 2	6
6	701352	Set Screw		3/8-16 x 3/4	6
7	606666	Slip	5-1/2" 15.5-26.8#		6
8	701254	Spring			6

Redress Kit
Part # 606201
Contains
QTY Part #
1) 700802
6) 700500

Overhaul Kit
Part # 606205
Contains
QTY Part #
1) 606201
6) 701254
6) 700008
6) 701352



Hoist:	Torque:	Pressure:
CRITICAL COMPONENT: No		Project: DW0013
UNLESS OTHERWISE SPECIFIED	MATERIAL:	Description: Internal Gripping Assembly
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .032/347. BREAK ALL SHARP EDGES .200/200 X 45° OR .200/200 R DRIILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE	PROCESS SPECS:	Size: 4-1/2" 20" 225 Ton 5-1/2" 15.5-26.8 #
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY	1: -	Part No: 605730
X = ±.032 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACE	2: -	DRW: JL DATE 8/31/2018
.XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR	3: -	APPD: TF DATE 9/25/2018
.XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR AS R/AMACH. 025 TIR	4: -	REV. DWN: JL DATE 06/28/2019
INTERPRET DRAWING PER ASME Y14.5-2009		REV. APPD: JL DATE 09/27/2019
MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.		DRYSCALE 1:16 WEIGHT(Est) 257.469
© 2019 BY DRAWWORKS, L.P. - HOLDING DEVELOPMENT GENERAL PARTNER		REV. SHEET
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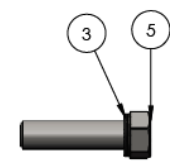
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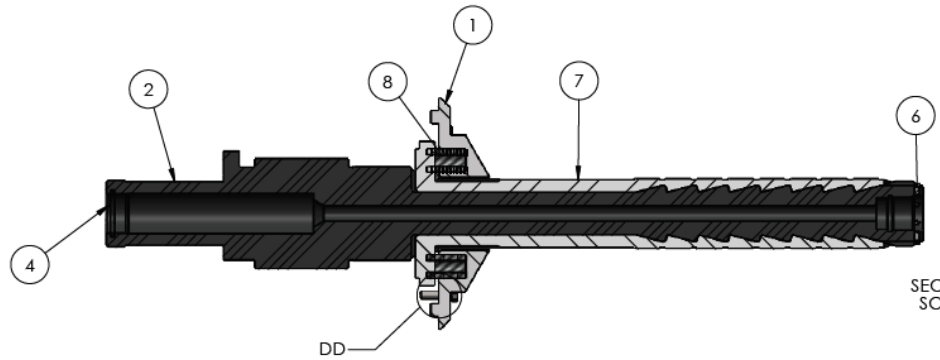
ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	5.5" 15.5-23#/QTY.
1	605573	Bump Plate	5-1/2" 15.5-23#		1
2	606108	Dovetail Mandrel	5-1/2" 15.5-23# 255 Ton		1
3	700500	Lock Washer Internal Teeth			6
4	700802	PolyPak		3.00ODx2.500ID	1
5	700008	Safety Bolt		1/2-13 x 2	6
6	701352	Set Screw		3/8-16 x 3/4	6
7	606666	Slip	5-1/2" 15.5-26.8#		6
8	701254	Spring			6

Redress Kit
Part # 606201
Contains
QTY Part #
1) 700802
6) 700500

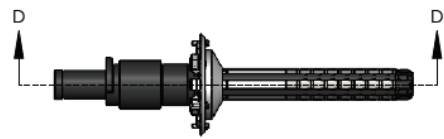
Overhaul Kit
Part # 606205
Contains
QTY Part #
1) 606201
6) 701254
6) 700008
6) 701352



DETAIL DD
SCALE 1 : 2



SECTION D-D
SCALE 1 : 7



Hoist:	Torque:		Pressure:
CRITICAL COMPONENT: No			Project: DW0013
UNLESS OTHERWISE SPECIFIED: DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .031/247. BREAK ALL SHARP EDGES .001/200 X 45° OR .005/100 R. DEBRIS HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.	MATERIAL: PROCESS SPECS: 1: - 2: - 3: - 4: -		Description: Internal Gripping Assembly
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY .X = ±.032 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACE .XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS OD - ID .010 TIR .XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR AS R./MACH. .025 TIR			Size: 4-1/2" 20" 255 Ton 5-1/2" 15.5-23#
INTERFERE DRAWING PER ASME Y14.5-2009 MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2019 BY DRAWWORKS, L.P. - POLING DEVELOPMENT GENERAL PARTNER THESE RIGHTS ARE RESERVED BY DRAWWORKS, L.P. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THE WORK AND INTENDS TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO USE TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THE WORK UNLESS EXPRESSLY AUTHORIZED BY DW TO DO SO.	DWN: JL DATE 8/31/2018 APPD: TF DATE 9/25/2018 REV. DWN: JL DATE 06/28/2019 REV. APPD: JL DATE 09/27/2019	DRYSCALE 1:16 WEIGHT(LBS) 257.469 Part NO. 605730 REV. A SHEET 5 of 14	

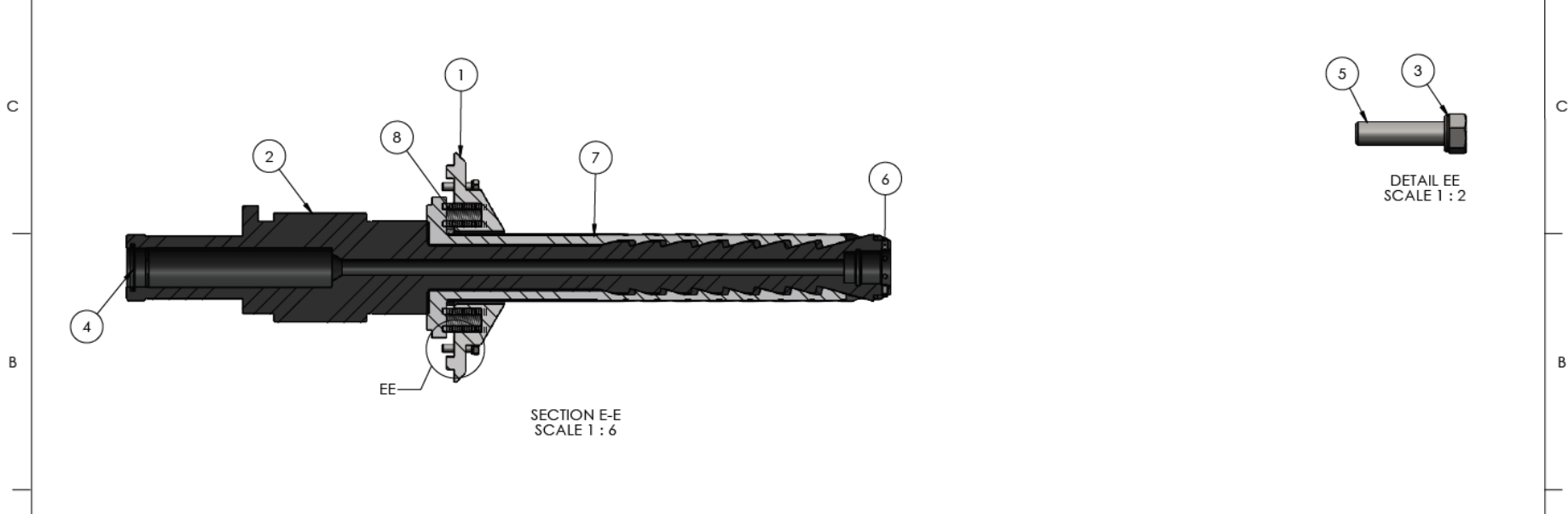
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	5.5" 20-23#/QTY.
1	605573	Bump Plate	5-1/2" 15.5-23#		1
2	606109	Dovetail Mandrel	5-1/2" 20-23# 300 Ton		1
3	700500	Lock Washer Internal Teeth			6
4	700802	PolyPak		3.00ODx2.500ID	1
5	700008	Safety Bolt		1/2-13 x 2	6
6	701352	Set Screw		3/8-16 x 3/4	6
7	605872	Slip	5-1/2" 20-23#		6
8	701254	Spring			6

Redress Kit
Part # 606201
Contains
QTY Part #
1) 700802
6) 700500

Overhaul Kit
Part # 606205
Contains
QTY Part #
1) 606201
6) 701254
6) 700008
6) 701352



SECTION E-E
SCALE 1 : 6

DETAIL EE
SCALE 1 : 2



Hoist:	Torque:	Pressure:
CRITICAL COMPONENT: No	MATERIAL:	Project DW0013
UNLESS OTHERWISE SPECIFIED	PROCESS SPECS:	Description Internal Gripping Assembly
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADII ALL CORNERS .025/64". BREAK ALL SHARP EDGES .005/620 X 45° OR .005/620 R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.	1: -	Size 4-1/2" 20"
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY	2: -	300 Ton 5-1/2" 20-23#
X = ±.032 FRACTION ±1/32 MACHINED 25GRMS MACHINED SURFACES	3: -	DWTSCALE 1:1x WEIGHT(LBS) 257.469
.XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR	4: -	Part NO. 605730
.XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR	AS R./MACH. .025 TIR	REV. A
INTERPRET DRAWING PER ASME Y14.5-2009		SHEET 6 of 14
MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.		
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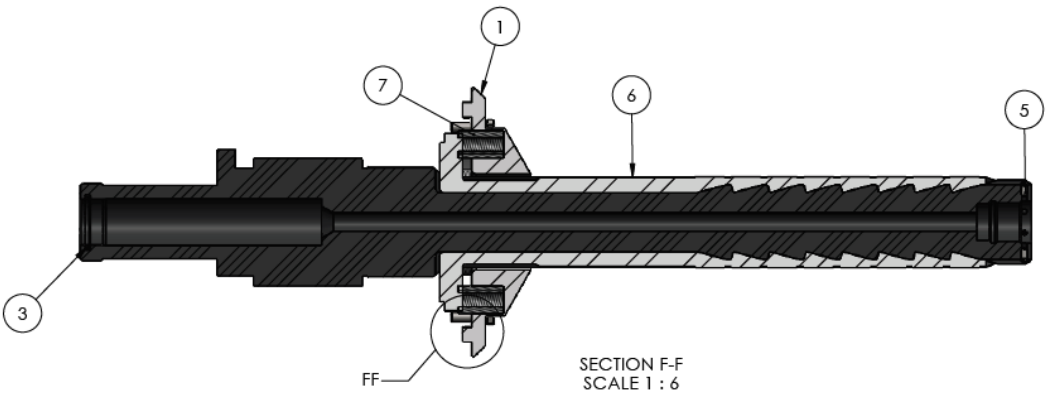
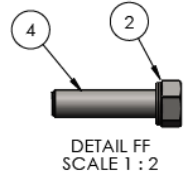
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IF IN DOUBT, PLEASE ASK!

ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	6" 20-24.5#/QTY.
1	605533	Bump Plate	6" 20-24.5#		1
2	700500	Lock Washer Internal Teeth			6
3	700802	PolyPak		3.00ODx2.500ID	1
4	700008	Safety Bolt		1/2-13 x 2	6
5	701352	Set Screw		3/8-16 x 3/4	6
6	606675	Slip	6" 20-24.5#		6
7	701254	Spring			6
8	606110	Dovetail Mandrel	6" 20-24.5# 430 Ton		1

Redress Kit
Part # 606201
Contains
QTY Part #
1) 700802
6) 700500

Overhaul Kit
Part # 606205
Contains
QTY Part #
1) 606201
6) 701254
6) 700008
6) 701352



Hoist:	Torque:	Pressure:																				
<p>CRITICAL COMPONENT: No</p> <p>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .031/32" MIN. ALL SHARP EDGES .031/32" X 45° OR .031/32" R DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE</p> <table border="1"> <thead> <tr> <th>DECIMAL</th> <th>TOLERANCES</th> <th>SURFACE FINISH</th> <th>CONCENTRICITY</th> </tr> </thead> <tbody> <tr> <td>X = ±.032</td> <td>FRACTION ± 1/32</td> <td>MACHINED 250RMS</td> <td>OD - ID .010 TIR</td> </tr> <tr> <td>.XX = ±.015</td> <td>ANGULAR ± 0.50°</td> <td>STRAIGHT THDS. 175RMS</td> <td>ID - ID .010 TIR</td> </tr> <tr> <td>.XXX = ±.005</td> <td>PERPEND. ± 0.25°</td> <td>TAPERED THDS. 125RMS</td> <td>OD - OD .010 TIR</td> </tr> <tr> <td></td> <td></td> <td>AS B./MACH. 325 TIR</td> <td></td> </tr> </tbody> </table>			DECIMAL	TOLERANCES	SURFACE FINISH	CONCENTRICITY	X = ±.032	FRACTION ± 1/32	MACHINED 250RMS	OD - ID .010 TIR	.XX = ±.015	ANGULAR ± 0.50°	STRAIGHT THDS. 175RMS	ID - ID .010 TIR	.XXX = ±.005	PERPEND. ± 0.25°	TAPERED THDS. 125RMS	OD - OD .010 TIR			AS B./MACH. 325 TIR	
DECIMAL	TOLERANCES	SURFACE FINISH	CONCENTRICITY																			
X = ±.032	FRACTION ± 1/32	MACHINED 250RMS	OD - ID .010 TIR																			
.XX = ±.015	ANGULAR ± 0.50°	STRAIGHT THDS. 175RMS	ID - ID .010 TIR																			
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		AS B./MACH. 325 TIR																				
<p>INTERPRET DRAWING PER ASME Y14.5-2009 MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2019 BY DRAWWORKS, L.P. - BOLING DEVELOPMENT GENERAL PARTNER THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF DRAWWORKS, L.P. (DW). IT MAY NOT BE COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THIS WORK AND AGREES TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THIS WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK UNLESS EXPRESSLY AUTHORIZED BY DW TO DO SO.</p>		<p>Project DW0013</p> <p>Description Internal Gripping Assembly</p> <p>Size 4-1/2" 20" 430 Ton 6" 20-24.5 #</p>																				
<p>DWN: JL DATE 8/31/2018</p> <p>APPD: TF DATE 9/25/2018</p> <p>REV. DWN: JL DATE 06/28/2019</p> <p>REV. APPD: JL DATE 09/27/2019</p>		<p>DWG SCALE 1:14 WEIGHT(S) 257.459</p> <p>Part NO. 605730</p> <p>REV. A</p> <p>SHEET 7 of 14</p>																				

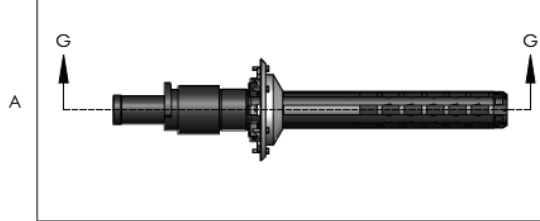
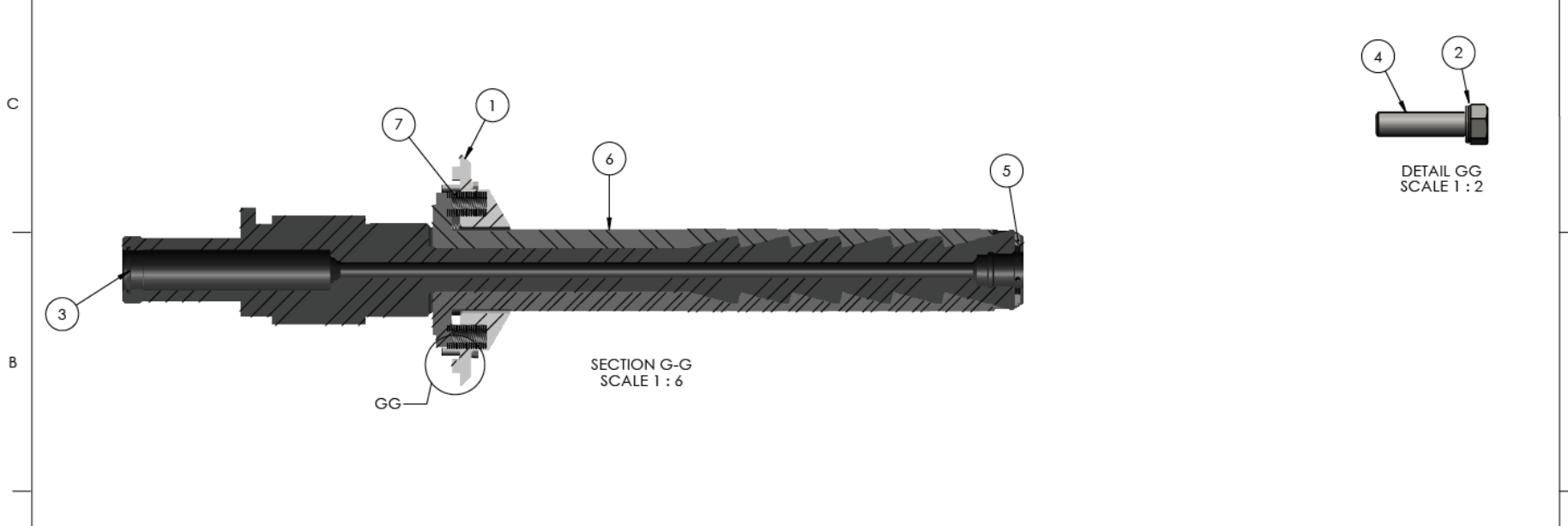
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	6.625" 20-36.7#/QTY.
1	605499	Bump Plate	6-5/8" 20-36.7#		1
2	700500	Lock Washer Internal Teeth			6
3	700802	PolyPak		3.00ODx2.500ID	1
4	700008	Safety Bolt		1/2-13 x 2	6
5	701352	Set Screw		3/8-16 x 3/4	6
6	606672	Slip	6-5/8" 20-36.7#		6
7	701254	Spring			6
8	606111	Dovetail Mandrel	6-5/8" 20-36.7#		1

Redress Kit
Part # 606201
Contains
QTY Part #
1) 700802
6) 700500

Overhaul Kit
Part # 606205
Contains
QTY Part #
1) 606201
6) 701254
6) 700008
6) 701352



Hoist:	Torque:	
CRITICAL COMPONENT: No		
UNLESS OTHERWISE SPECIFIED:		
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .031/64". BREAK ALL SHARP EDGES .001/32" X 45° OR .005/32" R DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE	MATERIAL:	
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY	PROCESS SPECS:	
X = ±.032 FRACTION ± 1/32 MACHINED 25SRMS MACHINED SURFACES	1: -	
.XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR	2: -	
.XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR	3: -	
	4: -	
	AS R./MACH. .025 TIR	
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		Project	DW0013	
		Description	Internal Gripping Assembly	
		Size	4-1/2" 20"	
		DRY SCALE	1:16	WEIGHT(LBS)
DWN	JL	DATE	8/31/2018	
APPD.	TF	DATE	9/25/2018	
REV. DWN.	JL	DATE	06/28/2019	
REV. APPD.	JL	DATE	09/27/2019	
Part NO.	605730	REV.	A	SHEET 8 of 14

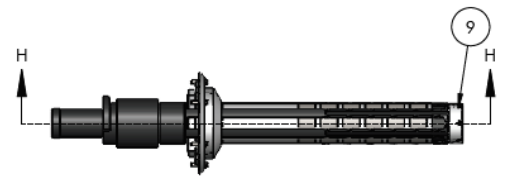
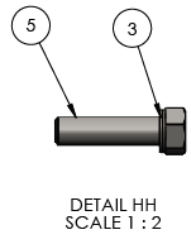
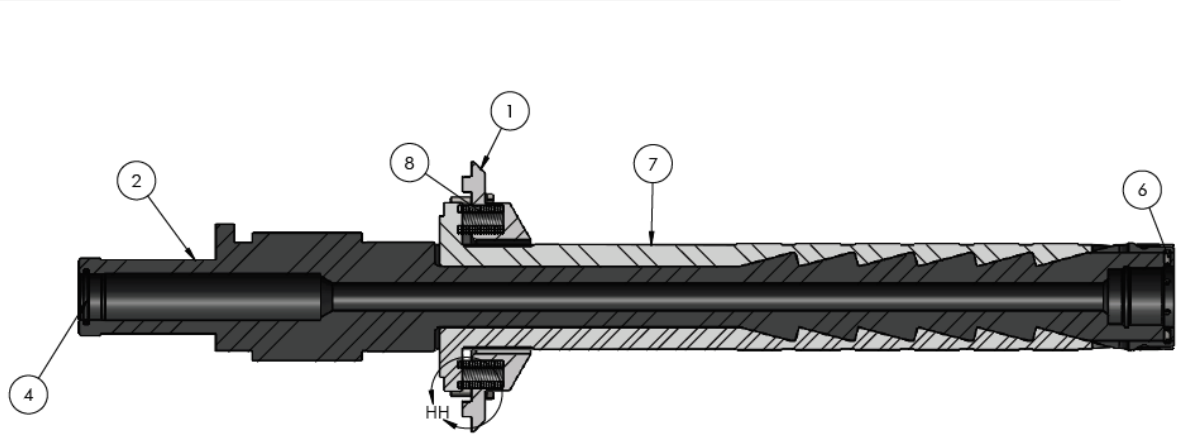
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	7" 17-35#/QTY.
1	605330	Bump Plate	7"		1
2	606112	Dovetail Mandrel	7"-20" 450 Ton		1
3	700500	Lock Washer Internal Teeth			6
4	700802	PolyPak		3.00ODx2.500ID	1
5	700008	Safety Bolt		1/2-13 x 2	6
6	701352	Set Screw		3/8-16 x 3/4	6
7	606664	Slip	7" 17-35#		6
8	701254	Spring			6
9	605287	Thread Protector	7" 17-35#		1

Redress Kit
Part # 606202
Contains
QTY Part #
1) 700802
6) 700500

Overhaul Kit
Part # 606206
Contains
QTY Part #
1) 606202
6) 701254
6) 700008
6) 701352



SECTION H-H
SCALE 1 : 6

Hoist:	Torque:		Pressure:
CRITICAL COMPONENT: No			Project: DW0013
<small>PLEASE OBSERVE SPECIFICATIONS</small> <small>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .031/32". BREAK ALL SHARP EDGES .001/32" X 45° OR .005/32" R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.</small>		<small>PROCESS SPECS.</small> 1: - 2: - 3: - 4: -	Description: Internal Gripping Assembly
<small>DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY</small> <small>.X = ±.032 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACE</small> <small>.XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR</small> <small>.XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR AS R./MACH. .025 TIR</small>		<small>DATE 8/31/2018</small> <small>DATE 9/25/2018</small> <small>DATE 06/28/2019</small> <small>DATE 09/27/2019</small>	<small>4-1/2" 20"</small> <small>450 Ton 7" 17-35#</small>
<small>INTERPRET DRAWING PER ASME Y14.5-2007</small> <small>MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.</small> <small>© 2019 BY DRAWWORKS, L.P. - BOLING DEVELOPMENT GENERAL PARTNER</small> <small>THIS DOCUMENT IS COPYRIGHTED BY DRAWWORKS, L.P. (DW). IT MAY NOT BE COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THE DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THIS WORK AND INTENDS TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO USE TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THE WORK UNLESS EXPRESSLY AUTHORIZED BY DW TO DO SO.</small>		<small>DWNL J.L.</small> <small>APPD. T.F.</small> <small>REV. DWN. J.L.</small> <small>REV. APPD. J.L.</small>	<small>DRY SCALE 1:16 WEIGHT(LBS) 257.469</small> <small>Part NO. 605730</small> <small>REV. A</small> <small>SHEET 9 of 14</small>

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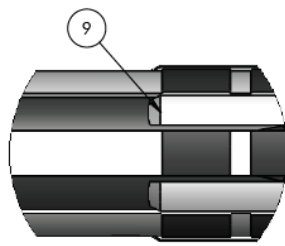
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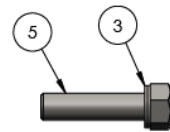
ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	7.625" 24-42.8#/QTY.
1	605374	Bump Plate	7-5/8"		1
2	606112	Dovetail Mandrel	7"-20" 450 Ton		1
3	700500	Lock Washer Internal Teeth			6
4	700802	PolyPak		3.00ODx2.500ID	1
5	700008	Safety Bolt		1/2-13 x 2	6
6	701357	Set Screw		3/8-16 x 1 1/2	6
7	606665	Slip	7-5/8" 24-42.8#		6
8	701254	Spring			6
9	605160	Wear Guide	7-5/8" 24-42.8#		6
10	605167	Wear Guide Nut	7-5/8" - 20"		1

Redress Kit
Part # 606202
Contains
QTY Part #
1) 700802
6) 700500

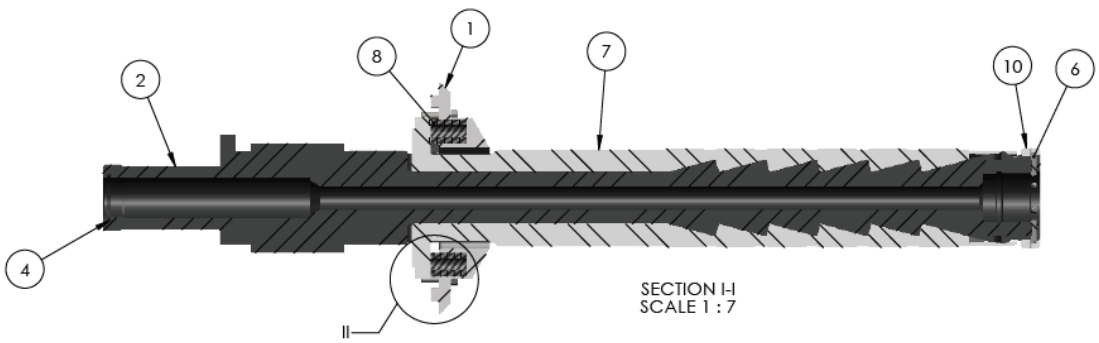
Overhaul Kit
Part # 606206
Contains
QTY Part #
1) 606202
6) 701254
6) 700008
6) 701357



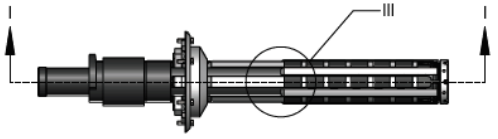
DETAIL III
SCALE 1 : 4



DETAIL II
SCALE 1 : 2



SECTION I-I
SCALE 1 : 7



Hoist:	Torque:		Pressure:
CRITICAL COMPONENT: No	MATERIAL:		Project: DW0013
UNLESS OTHERWISE SPECIFIED	PROCESS SPECS:		Description: Internal Gripping Assembly
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .031/247. BREAK ALL SHARP EDGES .001/250 X 45° OR .005/100 R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.	1: - 2: - 3: - 4: -		Size: 4-1/2" 20" 450 Ton 7-5/8"
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY		DWN: JL DATE 8/31/2018	Part No: 605730
X = ±.032 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACE		APPD: TF DATE 9/25/2018	DFTSCALE 1:1# WEIGHT(LBS) 257.469
.XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS OD - ID .010 TIR		REV. DWN: JL DATE 06/28/2019	REV. A
.XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR AS R/MACH. .025 TIR		REV. APPD: JL DATE 09/27/2019	SHEET 10 of 14

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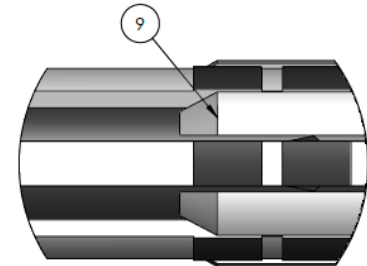
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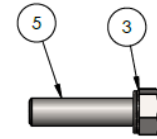
ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	8.625" 24-44#/QTY.
1	605331	Bump Plate	8-5/8" 13-5/8"		1
2	606112	Dovetail Mandrel	7"-20" 450 Ton		1
3	700500	Lock Washer Internal Teeth			6
4	700802	PolyPak		3.00ODx2.500ID	1
5	700008	Safety Bolt		1/2-13 x 2	6
6	701357	Set Screw		3/8-16 x 1 1/2	6
7	606669	Slip	8-5/8" 24-44#		6
8	701254	Spring			6
9	605161	Wear Guide	8-5/8" 24-44#		6
10	605167	Wear Guide Nut	7-5/8" - 20"		1

Redress Kit
Part # 606202
Contains
QTY Part #
1) 700802
6) 700500

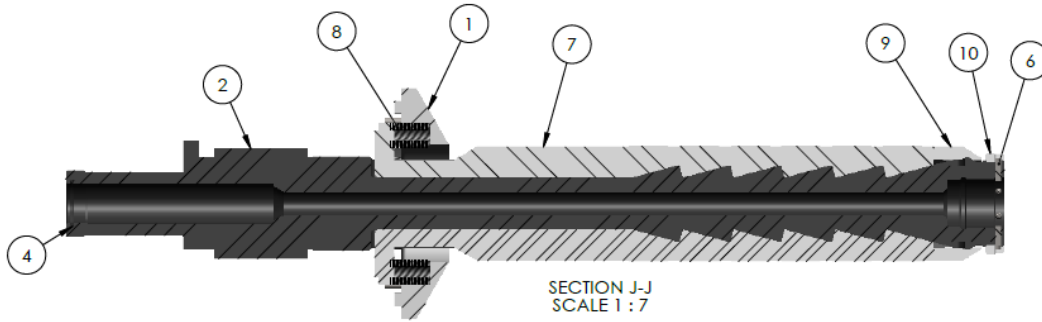
Overhaul Kit
Part # 606206
Contains
QTY Part #
1) 606202
6) 701254
6) 700008
6) 701357



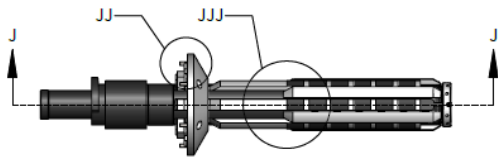
DETAIL JJJ
SCALE 1 : 4



DETAIL JJ
SCALE 1 : 2



SECTION J-J
SCALE 1 : 7



CRITICAL COMPONENT: No		
<u>UNLESS OTHERWISE SPECIFIED:</u>		
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .025/047. BREAK ALL SHARP EDGES .005/020 X 45° OR .005/020 R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.		MATERIAL
DECIMAL	TOLERANCES	SURFACE FINISH
.X = ±.032	FRACTION ± 1/32	MACHINED 250RMS
.XX = ±.015	ANGULAR ± 0.50°	STRAIGHT THDS. 175RMS
.XXX = ±.005	PERPEND. ± 0.25°	TAPERED THDS. 125RMS
		OD - OD .010 TIR
		AS R./MACH. .025 TIR
INTERFERE DRAWING PER ASME Y14.5-2009		PROCESS SPEC.
MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.		1: -
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DWN: JL	DATE 8/31/2018	4:
APPD: TF	DATE 9/25/2018	
REV. DWN: JL	DATE 06/28/2019	
REV. APPD: JL	DATE 09/27/2019	



Project	DW0013
Description	Internal Gripping Assembly
Size	4-1/2" 20" 450 Ton 8-5/8"
DWT SCALE	1:16
WEIGHT(LBS)	257.469
Part No.	605730
REV.	A
SHEET	11 of 14

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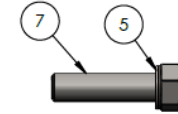
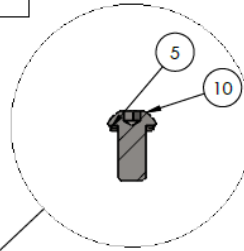
IF IN DOUBT, PLEASE ASK!

ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	9.625" 36-59.4#/QTY.
1	606764	Base Slip	9-5/8"-20"		6
2	605331	Bump Plate	8-5/8" 13-5/8"		1
3	606112	Dovetail Mandrel	7"-20" 450 Ton		1
4	605067	Insert	9-5/8" 36-59.4#		6
5	700500	Lock Washer Internal Teeth			30
6	700802	PolyPak		3.00ODx2.500ID	1
7	700008	Safety Bolt		1/2-13 x 2	6
8	701357	Set Screw		3/8-16 x 1 1/2	6
9	701254	Spring			6
10	700111	Torx Bolt		1/2-13 x 7/8	24
11	605162	Wear Guide	9-5/8" 36-59.4#		1
12	605167	Wear Guide Nut	7-5/8" - 20"		1

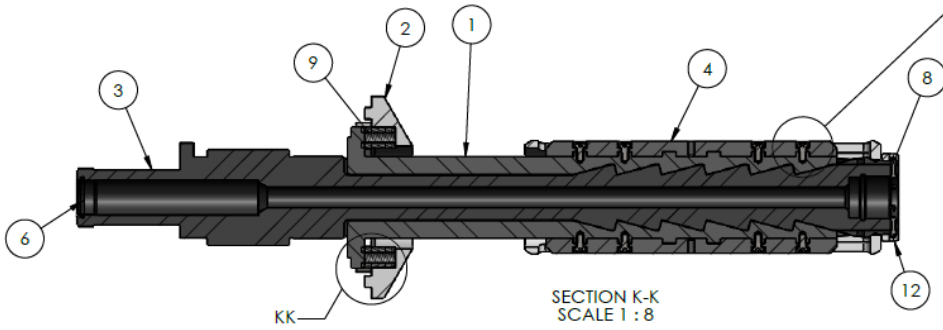
Other Size Configurations				
ITEM NO.	PART NUMBER	DESCRIPTION	Size	10.75" 40.5-60.7#/QTY.
4	605068	Insert	10-3/4" 40.5-60.7#	6
11	605163	Wear Guide	10-3/4" 40.5-60.7#	1
ITEM NO.	PART NUMBER	DESCRIPTION	Size	11.75" 47-71#/QTY.
4	605069	Insert	11-3/4" 47-71#	6
11	605164	Wear Guide	11-3/4" 47-71#	1
ITEM NO.	PART NUMBER	DESCRIPTION	Size	13.375 54.4-85# 13.625 88.2#/QTY.
4	605070	Insert	13-3/8" 54.4-85#	6
11	605165	Wear Guide	13-3/8" 54.4-85 #	1

Redress Kit
Part # 606203
contains
QTY Part #
1) 700802
30) 700500

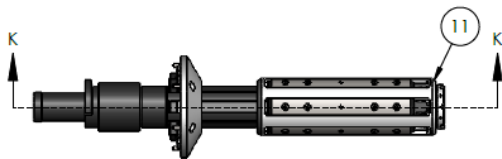
Overhaul kit
Part # 606207
Contains
QTY Part #
1) 606203
6) 701254
6) 700008
24) 700009
6) 701357



DETAIL KK
SCALE 1 : 2



SECTION K-K
SCALE 1 : 8



Hoist:	Torque:
CRITICAL COMPONENT: No	MATERIAL:
ALL DIMENSIONS SPECIFIED	PROCESS SPEC:
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .025/047. BREAK ALL SHARP EDGES .005/020 X 45° OR .005/020 R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.	1: -
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY	2:
.X = ±.032 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACES	3:
.XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR	4:
.XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR AS R/MACH. 025 TIR	
INTERPRET DRAWING PER ASME Y14.5-2007	
MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.	
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Pressure:	Project: DW0013
	Description: Internal Gripping Assembly
	Size: 4-1/2" 20"
	450 Ton 9-5/8 - 13-3/8
	DWT SCALE 1:16 WEIGHT(LBS) 257.469
	Part No: 605730
	REV. A
	SHEET 12 of 14

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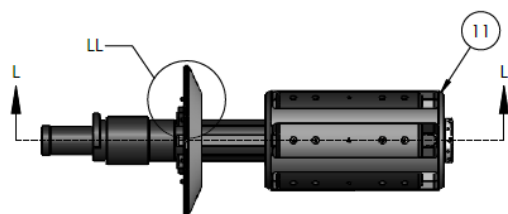
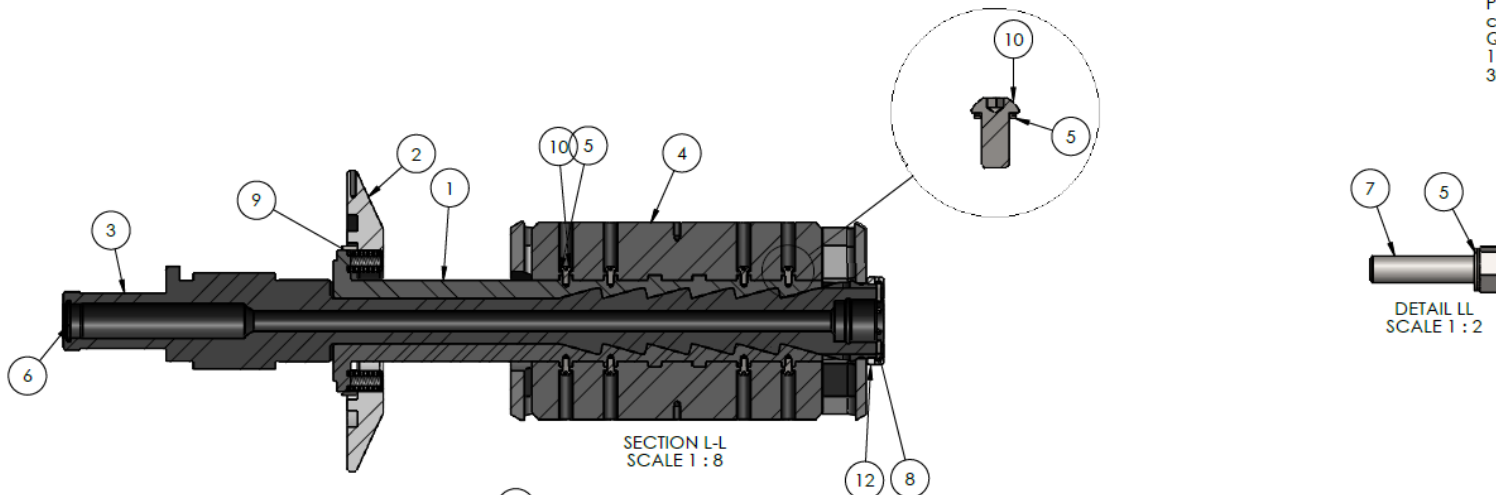
ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	16" 65-109#/QTY.
1	606764	Base Slip	9-5/8"-20"		6
2	605361	Bump Plate	16"-20"		1
3	606112	Dovetail Mandrel	7"-20" 450 Ton		1
4	605529	Insert	16" 65-109#		6
5	700500	Lock Washer Internal Teeth			30
6	700802	PolyPak		3.00ODx2.500ID	1
7	700008	Safety Bolt		1/2-13 x 2	6
8	701357	Set Screw		3/8-16 x 1 1/2	6
9	701254	Spring			6
10	700111	Torx Bolt		1/2-13 x 7/8	24
11	605530	Wear Guide	16" 65-109#		1
12	605167	Wear Guide Nut	7-5/8" - 20"		1

IF IN DOUBT, PLEASE ASK!

Other Size Configurations					
ITEM NO.	PART NUMBER	DESCRIPTION	Size	16.75" 65-109#/QTY.	
4	605422	Insert	16-3/4" 78#	6	
11	605421	Wear Guide	16-3/4" 78#	1	
ITEM NO.	PART NUMBER	DESCRIPTION	Size	18.625 87.5-117#/QTY.	
4	605527	Insert	18-5/8" 87.5-117#	6	
11	605528	Wear Guide	18-5/8" 87.5-117#	1	
ITEM NO.	PART NUMBER	DESCRIPTION	Size	20" 94-133#/QTY.	
4	605373	Insert	20" 94-133#	6	
11	605370	Wear Guide	20" 94-133#	1	

Redress Kit
Part # 606203
contains
QTY Part #
1) 700802
30) 700500

Overhaul kit
Part # 606207
Contains
QTY Part #
1) 606203
6) 701254
6) 700008
24) 700009
6) 701357



Hoist:	Torque:
CRITICAL COMPONENT: No	
<u>USE OBSERVABLE SPECIES</u>	
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADEE ALL CORNERS .025(.64). BREAK ALL SHARP EDGES .025(.64) X 45° OR .005(.127) R. DEELED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.	MATERIAL:
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY	PROCESS SPEC:
.X = ±.032 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACES	1: -
.XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS OD - ID .010 TR	2: -
.XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TR	3: -
	4: -
INTERPRET DRAWING PER ASME Y14.5-2009	
MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.	
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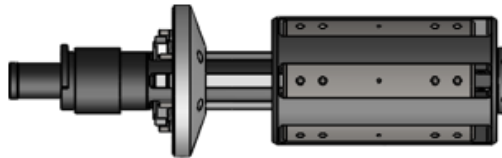
DWN: JL	DATE 8/31/2018	Pressure:	
APPD: TF	DATE 9/25/2018	Project	DW0013
REV. DWN: JL	DATE 06/28/2019	Description	Internal Gripping Assembly
REV. APPD: JL	DATE 09/27/2019	Site	4-1/2" 20" 450 Ton 16"-20"
		DWT SCALE 1:16	WEIGHT(LBS) 257.469
		Part No.	605730
		REV.	A
		SHEET	13 of 14

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10.3 Internal Gripping Assembly, 7" – 26"

Tubular Size	Weight Range	API 8C Hoist Capacity (Tons)	Torque Capacity (Locked ft-lb)	Torque Capacity (Unlocked ft-lb)	Minimum ID (in.)	Flow Rate (brl/min)	OAL (in.)	OAL w/ Autovalve (in.)	Aprox Weight (lbs.)
7"	17-35#	400	60,000	20,000	1.5	12	122	137	2950
7-5/8"	39-55.3#	500	65,000	25,000	1.5	12	122	137	3000
9-5/8"	36 -59.4 #	1000	100,000	75,000	2.25	20	130	153	3350
10-3/4"	40.5 - 60.7#	1000	100,000	75,000	2.25	20	130	153	3580
11-3/4"	47 - 71#	1000	100,000	75,000	2.25	20	130	153	3600
13-3/8"	54.4 - 85#	1000	100,000	75,000	2.25	20	130	153	4000
13-5/8"	88.2#	1000	100,000	75,000	2.25	20	130	153	4000
16"	65 -109#	1000	100,000	75,000	2.25	20	135	162	4400
16-3/4"	65 - 109#	1000	100,000	75,000	2.25	20	135	162	4500
18-5/8"	87.5 - 136#	1000	100,000	75,000	2.25	20	135	162	5050
20"	94 - 133#	1000	100,000	75,000	2.25	20	135	162	5300
20"	163-187#	1000	100,000	75,000	2.25	20	135	162	5350
22"	170-224#	1000	100,000	75,000	2.25	20	138	N/A	5850
24"	171-216#	1000	100,000	75,000	2.25	20	138	N/A	6500
26"	202-275#	1000	100,000	75,000	2.25	20	138	N/A	7100



1000 Ton 20" 94-133# Display

CRITICAL COMPONENT: <small>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REVOLVE ALL SURF. RADII UNLESS OTHERWISE SPECIFIED. BREAK ALL DIMENSIONS TO THE CENTER OF THE HOLE UNLESS OTHERWISE SPECIFIED. DIMENSIONS TO THE SURFACE OF THE TOLERANCE UNLESS OTHERWISE SPECIFIED.</small> DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY .XX ± .002 FRACTION ± 1/32 MACHINED SURFMS H & H SURFMS .XX ± .015 ANGULAR ± 0.50° STRAIGHT THRS. 12 SURFMS ID - ID .010 TR .XX ± .005 PERPEND. ± 0.25° TAPERED THRS. 12 SURFMS OD - OD .010 TR <small>AS B. MACH. 202 TR</small>			Project DW0004 Description Internal Grip Assembly Size 7'-26"
<small>INTERPRET DRAWING PER ASME Y14.5-2007 MATERIAL AND PROCESS SPECIFICATIONS SHOWN ON THE DRAWING ARE TO ALWAYS REPRESENT THE LATEST APPROVED REVISION. © DW ORKS. ALL RIGHTS RESERVED. THIS DOCUMENT AND ITS CONTENTS ARE THE PROPERTY OF DW ORKS. NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF DW ORKS. ALL RIGHTS TO THIS WORK AND ITS CONTENTS ARE RESERVED TO DW ORKS. NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF DW ORKS.</small>	DW JL DATE JFD TF DATE 10/08/2018 DW JL DATE 10/16/2018 DW RU DATE 10/18/2018		Scale 1:1 Weight (lbs) 1351.438 Form No. 606289 Rev. A 1 of 7

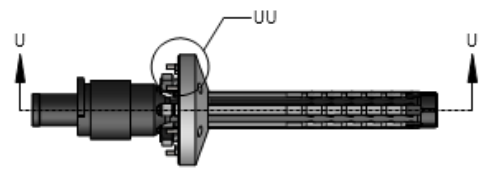
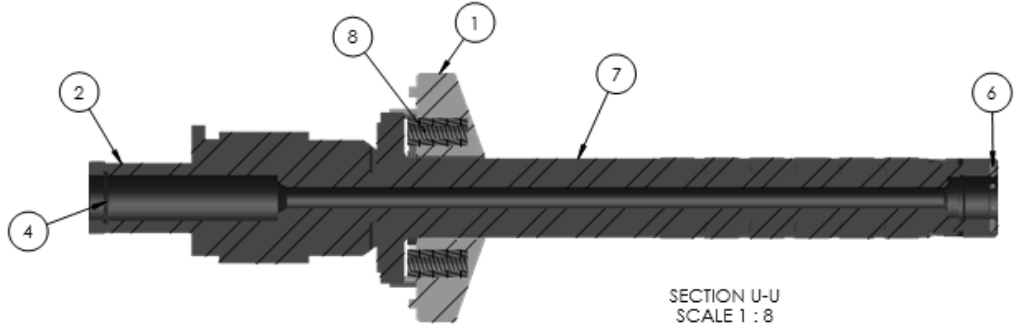
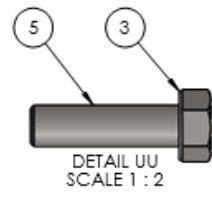
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IF IN DOUBT, PLEASE ASK!

ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	7 17-35#/QTY.
1	605830	Bump Plate	7" 17-35#		1
2	606115	Dovetail Mandrel	7" 17-35# 400 Ton		1
3	700503	Lock Washer Internal Tooth		3/4	6
4	700804	PolyPak		3.75ODx3.250ID	1
5	700094	Safety Bolt		3/4-10 x 2 3/4	6
6	700016	Set Screw		3/8-16 x 1	6
7	605829	Slip	7" 17-35#		6
8	701255	Spring			6

ITEM NO.	PART NUMBER	DESCRIPTION	Size	606313 Redress Kit 606314 Overhaul/QTY.
50	606313	Redress Kit	DWCRT1K	1
51	606314	Overhaul Kit	7"-7-5/8"	1



CRITICAL COMPONENT:		DATE
<p>DO NOT SCALE DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL ROUNDS. RADIUS ALL CORNERS 300 X 45° BREAK ALL SHARP EDGES 300 X 45° OR 300 X 60° R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.</p> <p>DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY</p> <p>1: .001 FRACTION ± 1/32 MACHINED SURFACES MACHINED SURFACES</p> <p>2: .002 ANGLULAR ± 0.50° CO - ID .010 IR</p> <p>3: .001 STRAIGHT THDS. 1.75RMS CO - ID .010 IR</p> <p>4: .0005 PERPEND. ± 0.25° TAPERED THDS. 1.25RMS CO - ID .010 IR AS B. MACH. CONTR.</p>	<p>DATE</p> <p>APPRO. TF DATE 10/08/2018</p> <p>REV. DWG. J.L DATE 10/16/2018</p> <p>REV. APP. R.U DATE 10/18/2018</p>	<p>DATE</p> <p>DATE 10/08/2018</p> <p>DATE 10/16/2018</p> <p>DATE 10/18/2018</p>



Project	DW0004
Description	Internal Grip Assembly
Size	7" 7"-26"
Part No.	606289
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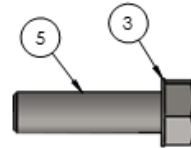
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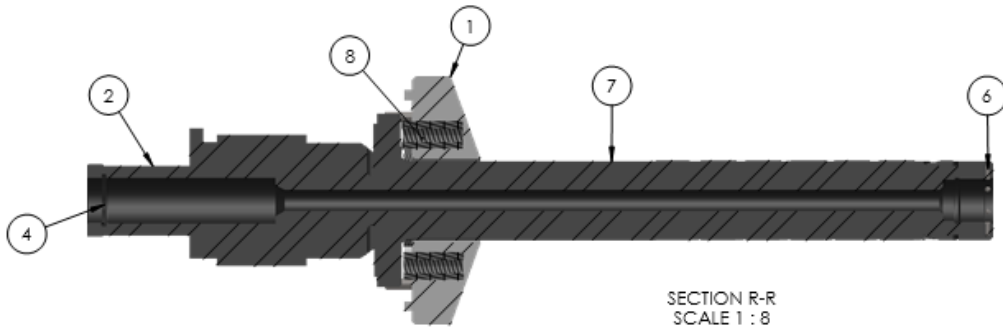
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	7.625 39-55.3#/QTY.
1	605769	Bump Plate	7-5/8"		1
2	606114	Dovetail Mandrel	7-5/8" 39-55.3# 500 Ton		1
3	700503	Lock Washer Internal Tooth		3/4	6
4	700804	PolyPak		3.75ODx3.250ID	1
5	700094	Safety Bolt		3/4-10 x 2 3/4	6
6	700016	Set Screw		3/8-16 x 1	6
7	605768	Slip	7-5/8" 39-55.3#		6
8	701255	Spring			6

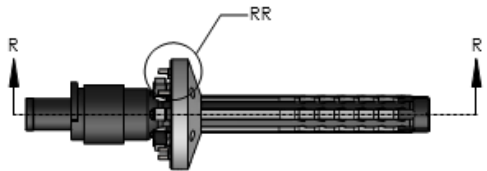
ITEM NO.	PART NUMBER	DESCRIPTION	Size	606313 Redress Kit 606314 Overhaul/QTY.
50	606313	Redress Kit	DWCRTIK	1
51	606314	Overhaul Kit	7"-7-5/8"	1



DETAIL RR
SCALE 1 : 2



SECTION R-R
SCALE 1 : 8



CRITICAL COMPONENT:			
<p>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. ROUND ALL EDGES. RADIUS ALL CORNERS .005 DIA. BREAK ALL SHARP EDGES .005 DIA X 45° OR .005 DIA R. DOWEL PINS SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.</p>			
DECIMAL	TOLERANCES	SURFACE FINISH	CONCENTRICITY
.X = ±.002	FRACTION ± 1/32	MACHINED 250RMS	MAX. 1/32 (31.75µm)
.XX = ±.015	ANGULAR ± 0.50°	STRAIGHT THDS. 175RMS	ID - ID .010 IR
.XXX = ±.005 PERPEND. ± 0.25°	TAPERED THDS. 125RMS	ID - OD .010 IR	AS B. MACH. 200 IR



Project	DW0004
Description	Internal Grip Assembly
Size	7-5/8" 7"-26"
DATE	DATE
APPD. TF	DATE 10/08/2018
REV. DWK. JL	DATE 10/16/2018
REV. APPD. RU	DATE 10/18/2018
DRYSCALE 1:1	WEIGHT(LBS) 1351.438
Part No.	606289
REV.	A
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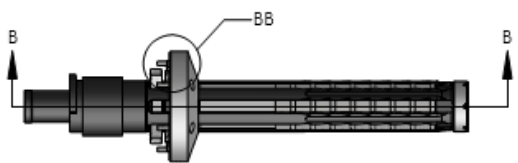
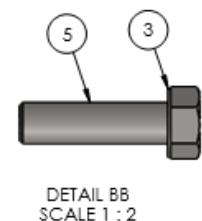
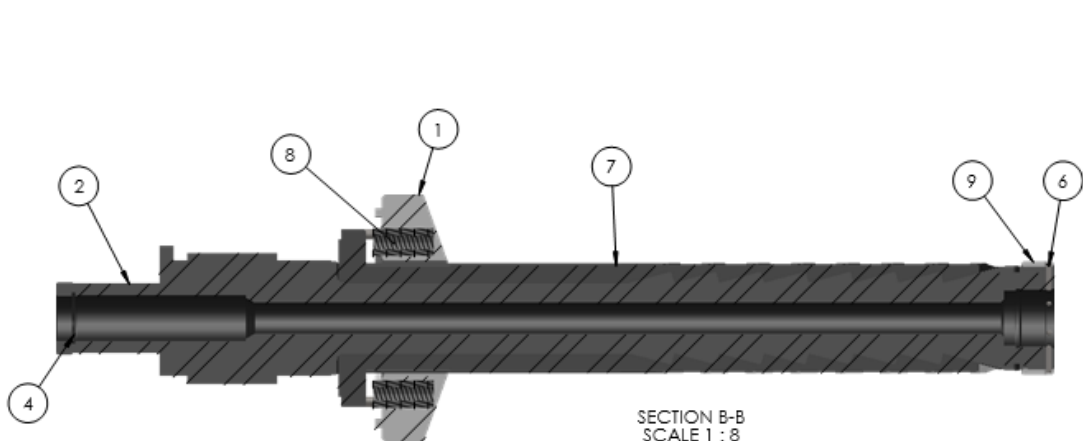
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	9.625" 36-59.4# 9.875" 62.8#/QTY.
1	605461	Bump Plate	9-5/8"		1
2	606113	Dovetail Mandrel	9-5/8"-26" 1000 Ton		1
3	700503	Lock Washer Internal Tooth		3/4	6
4	700804	PolyPak		3.75ODx3.25OD	1
5	700094	Safety Bolt		3/4-10 x 2 3/4	6
6	700020	Set Screw		3/8-16 x 2	6
7	605459	Slip	9-5/8" 36-59.2#		6
8	701255	Spring			6
9	605539	Wear Guide Thread Protector	9-5/8"		1

ITEM NO.	PART NUMBER	DESCRIPTION	Size	606313 Redress Kit 606315 Overhaul Kit/QTY.
50	606313	Redress Kit	DWCRTIK	1
51	606315	Overhaul Kit	9-5/8"-11-3/4"	1



CRITICAL COMPONENT:			
<p>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. ROUND ALL EDGES. RADIUS ALL CORNERS .0025". BREAK ALL SHARP EDGES .0025" X 45° OR .0025" X 90°. DOTTED LINES INDICATE ON THE PLUS SIDE OF THE TOLERANCE.</p>			
DECIMAL	TOLERANCES	SURFACE FINISH	CONCENTRICITY
.XX = ±.003	FRACTION ± 1/32	MACHINED 250RMS	MAX. 9.00 100% RZ
.XX = ±.015	ANGULAR ± 0.50°	STRAIGHT THDS. 175RMS	ID - ID .010 IR
.XXX = ±.005 PERPEND. ± 0.25°	TAPERED THDS. 125RMS	OD - OD .010 IR	AS B. MACH. 200 IR



Part:	DW0004
Description:	Internal Grip Assembly
Size:	9-5/8" 7'-26"
DATE	DATE
DATE 10/08/2018	DATE 10/16/2018
DATE 10/18/2018	DATE
DRGSCALE 1:1	WEIGHT(LBS) 1351.438
Partno:	606289
REV:	A
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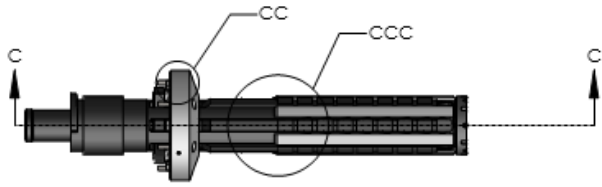
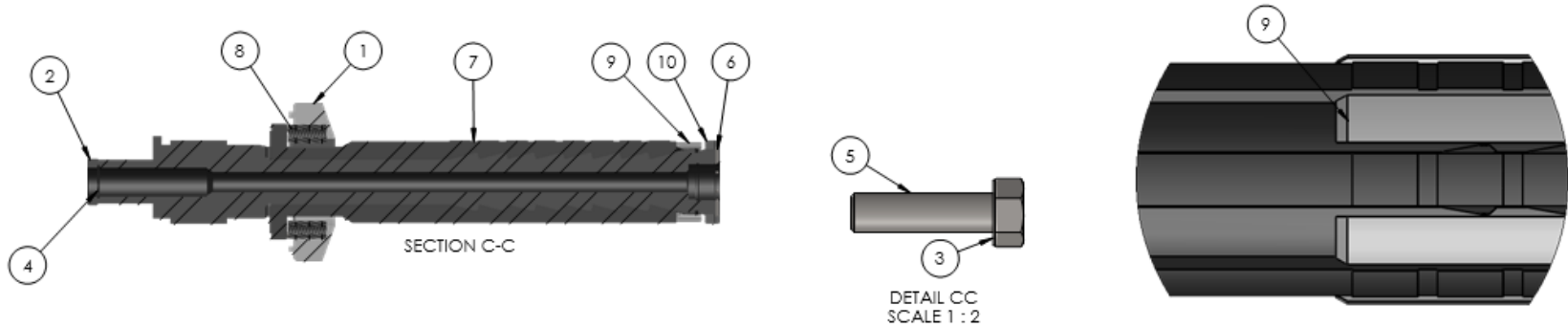
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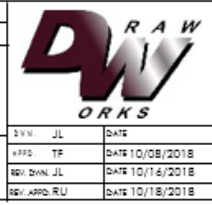
ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	10.75 40.5-60.7#/QTY.
1	605745	Bump Plate	10-3/4"		1
2	606113	Dovetail Mandrel	9-5/8"-26" 1000 Ton		1
3	700503	Lock Washer Internal Tooth		3/4	6
4	700804	PolyPak		3.75ODx3.250ID	1
5	700094	Safety Bolt		3/4-10 x 2 3/4	6
6	700020	Set Screw		3/8-16 x 2	6
7	605516	Slip	10 3/4" 40.5-60.7#		6
8	701255	Spring			6
9	605462	Wear Guide	10-3/4"		6
10	605505	Wear Guide Nut			1

ITEM NO.	PART NUMBER	DESCRIPTION	Size	11.75 47-71#/QTY.
1	605744	Bump Plate	11-3/4"	1
7	605523	Slip	11-3/4" 47-71#	6
9	605524	Wear Guide	11-3/4" 47-71#	6

ITEM NO.	PART NUMBER	DESCRIPTION	Size	606313 Redress Kit 606315 Overhaul Kit/QTY.
50	606313	Redress Kit	DWCRT1K	1
51	606315	Overhaul Kit	9-5/8"-11-3/4"	1



CRITICAL COMPONENT:			
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL SURF. ROUNDS ALL CORNERS 250 R25. WIRE ALL SHARP EDGES 250 R25 X 45° OR 30°/30°.	DECIMAL	TOLERANCES	SURFACE FINISH
.X = ±.003	FRACTION = 1/32	MACHINED SURF.	6-32 RMS
.001 = ±.015	ANGULAR = 0.50°	STRAIGHT THDS. 1.25 RMS	CD - CD .010 TR
.00X = ±.005 PERPEND. ± 0.25°	TAPERED THDS. 1.25 RMS	CD - CD .010 TR	AS B. MACH. 0.25 TR



Project	DW0004
Description	Internal Grip Assembly
Size	10-3/4" - 11-3/4" 7-26"
DATE	10/08/2018
DATE	10/16/2018
DATE	10/18/2018
Part No.	606289
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	Toolbox Size	13.375 54.4-85# 13.625 88.2#/QTY.
1	605680	Base Slip	13-3/8"-26" 1000 Ton		6
2	700011	Bolt			24
3	605447	Bump Plate	13-3/8"-20"		1
4	606113	Dovetail Mandrel	9-5/8"-26" 1000 Ton		1
5	605681	Insert	13-3/8" 54.4-85#		6
6	700500	Lock Washer Internal Tooth		1/2	24
7	700503	Lock Washer Internal Tooth		3/4	6
8	700804	PolyPak		3.750Dx3.250ID	1
9	700094	Safety Bolt		3/4-10 x 2 3/4	6
10	700020	Set Screw		3/8-16 x 2	6
11	701255	Spring			6
12	605683	Wear Guide	13-3/8" 54.4-85 #		1
13	605505	Wear Guide Nut			1

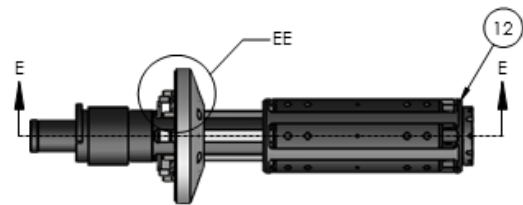
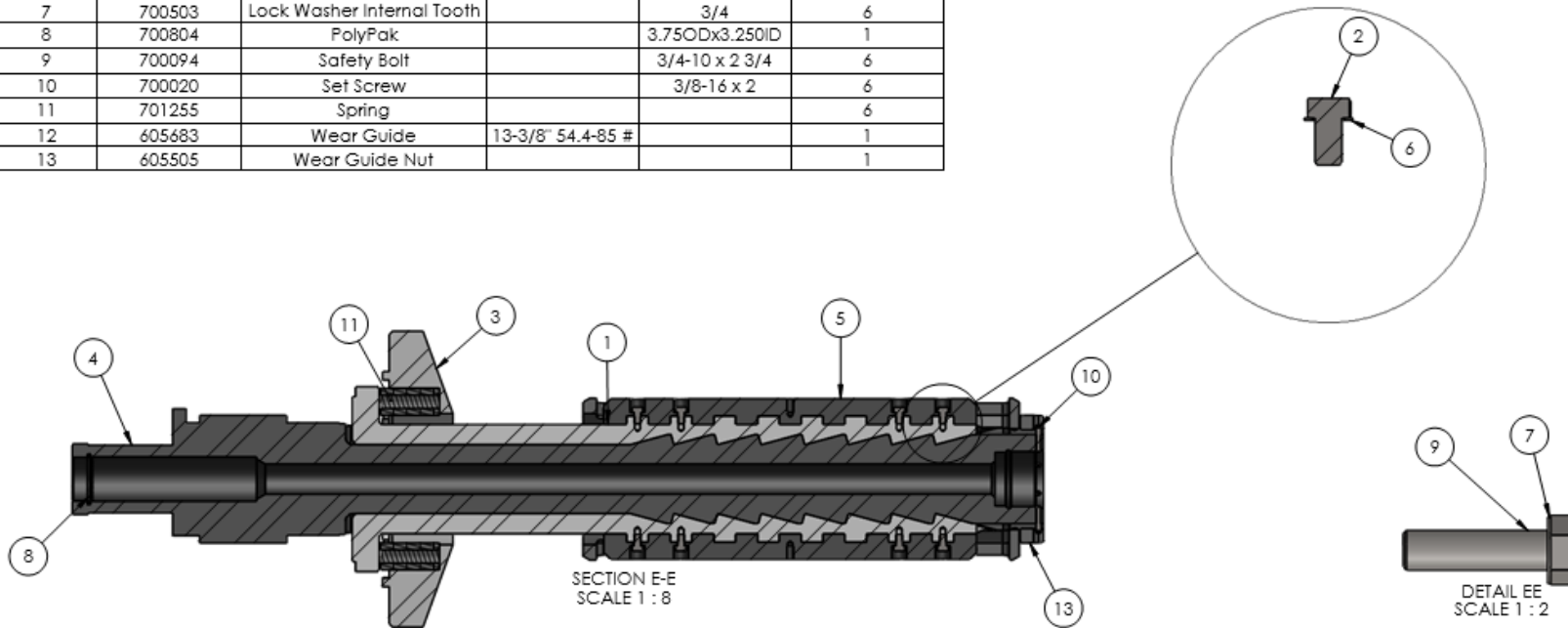
ITEM NO.	PART NUMBER	DESCRIPTION	Size	606316 Redress Kit 606317 Overhaul Kit/QTY.
50	606316	Redress Kit	13-3/8"-26"	1
51	606317	Overhaul Kit	13-3/8"-26"	1

D

C

B

A



CRITICAL COMPONENT:

DO NOT ASK FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS.
 RADIUS ALL CORNERS 0.0315" BREAK ALL SHARP EDGES 0.0315" X 45° OR 30°/45° R.
 DELETED HOLE SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.

DECIMAL	TOLERANCES	SURFACE FINISH	CONCENTRICITY
.XX	± 0.002	FRACTION ± 1/32	MACHINED 250RMS
.XXX	± 0.0015	ANGULAR ± 0.50°	Y-CHECKED 250RMS
.XXXX	± 0.001	PERPEND. ± 0.25°	STRAIGHT THOS. 175RMS
			TAPERED THOS. 125RMS
			AS B./MACH. CONTR.

INTEREST DRAWING FOR ISSUE 1/14/2009
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Project	DW0004
Description	Internal Grip Assembly
Size	13-3/8" - 26" 7"-26"
REV	DATE
1	10/08/2018
2	10/16/2018
3	10/16/2018
4	10/18/2018
Form No.	606289
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Sheet	6 of 7

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ITEM NO.	PART NUMBER	DESCRIPTION	Size	16 65-109#/QTY.	ITEM NO.	PART NUMBER	DESCRIPTION	Size	26" 202-275#/QTY.
5	605510	Insert	16" 65-109#	6	5	605521	Insert	26" 202-275"	6
12	605511	Wear Guide	16" 65-109 #	1	12	605522	Wear Guide	26" 202-275#	1

D

ITEM NO.	PART NUMBER	DESCRIPTION	Size	18.625 87.5-136#/QTY.
5	605512	Insert	18-5/8 87.5-136#	6
12	605513	Wear Guide	18-5/8" 87-136#	1

ITEM NO.	PART NUMBER	DESCRIPTION	Size	606316 Redress Kit 606317 Overhaul Kit/QTY.
50	606316	Redress Kit	13-3/8"-26"	1
51	606317	Overhaul Kit	13-3/8"-26"	1

D

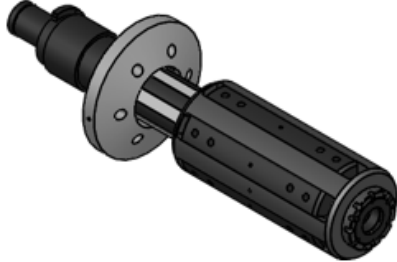
ITEM NO.	PART NUMBER	DESCRIPTION	Size	20" 94-133#/QTY.
5	605682	Insert	20" 94-133#	6
12	605684	Wear Guide	20" 94-133 #	1

C

ITEM NO.	PART NUMBER	DESCRIPTION	Size	20" 163-187#/QTY.
5	605514	Insert	20" 163-187#	6
12	605515	Wear Guide	20" 163-187#	1

C

ITEM NO.	PART NUMBER	DESCRIPTION	Size	22" 170-224#/QTY.
5	605517	Insert	22" 170-224#	6
12	605518	Wear Guide	22" 170-224#	1



B

ITEM NO.	PART NUMBER	DESCRIPTION	Size	24" 171-216 #/QTY.
5	605519	Insert	24" 171-216#	6
12	605520	Wear Guide	24" 171-216#	1

B

A

CRITICAL COMPONENT:	
<p>UNLESS OTHERWISE SPECIFIED:</p> <p>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REVOLVE ALL ROUNDS. RADIUS ALL CORNERS 200 X 200. BREAK ALL SHARP EDGES 200 X 200 X 45° OR 200°/200°. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.</p> <p>DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY</p> <p>.XX = ±.002 FRACTION ± 1/32 MACHINED SURFACES HATCHED SURFACES</p> <p>.XX = ±.015 ANGULAR ± 0.50° STRAIGHT THRO. TAPERING CD - CD .010 TR</p> <p>.XXX = ±.005 PERPEND. ± 0.25° TAPERED THRO. TAPERING CD - CD .010 TR AS B. (MACH. 222 TR)</p>	<p>FINISHES:</p> <p>1: 1:</p> <p>2: 2:</p> <p>3: 3:</p> <p>4: 4:</p>
<p>INTERPRET DRAWING PER ASME Y14.5-2009</p> <p>MATERIAL AND PROCESS SPECIFICATIONS CHANGES ON THE DRAWING ARE TO ALWAYS REPRESENT THE LATEST APPROVED REVISION.</p> <p>© 2011 DW ORKS. ALL RIGHTS RESERVED. THIS DOCUMENT AND ALL INFORMATION HEREON IS THE PROPERTY OF DW ORKS. NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN CONSENT OF DW ORKS. THIS DOCUMENT AND ALL INFORMATION HEREON IS THE PROPERTY OF DW ORKS. NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN CONSENT OF DW ORKS.</p>	<p>DRAW ORKS</p>

Project	DW0004
Description	Internal Grip Assembly
Size	13-3/8" - 26" 7"-26"
DATE	10/18/2018
APPD.	TF DATE 10/08/2018
REV. DWG.	JL DATE 10/14/2018
REV. APPD.	RU DATE 10/18/2018
Part No.	606289
REV.	A
Sheet	7 of 7

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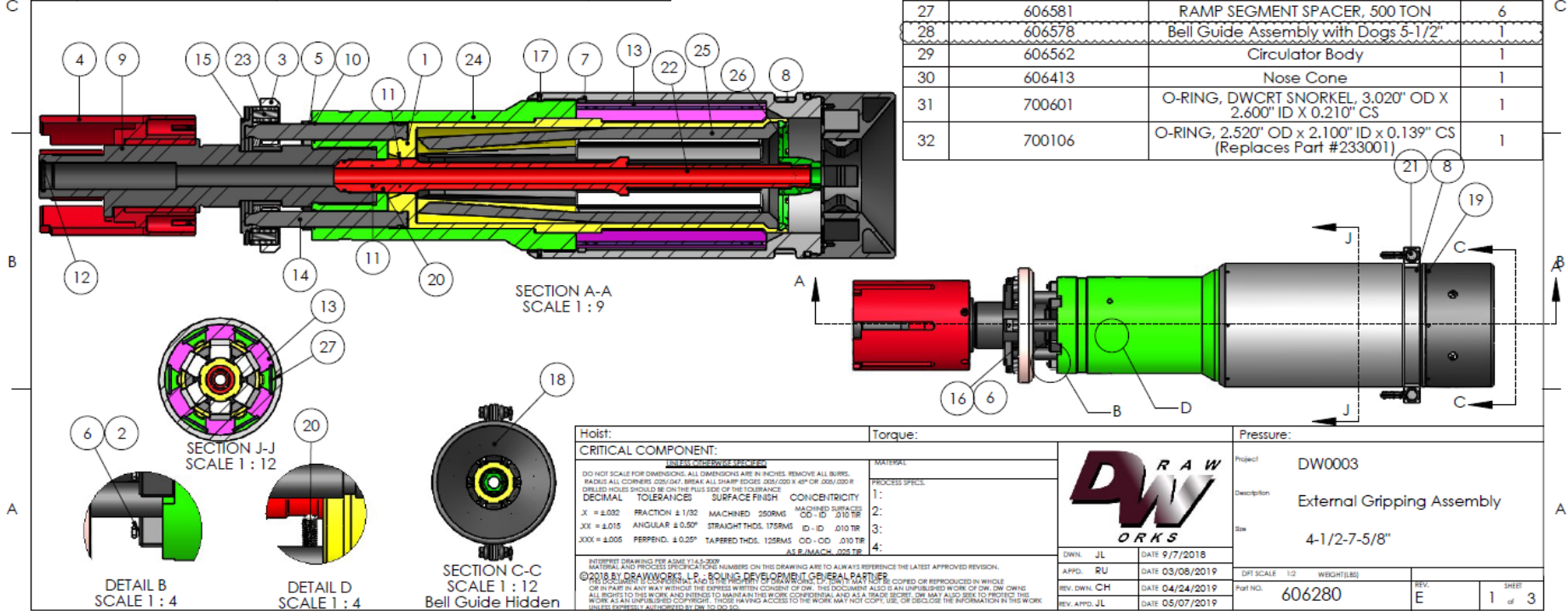
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10.4 External Grip Assembly, 4-1/2" – 7-5/8"

IF IN DOUBT, PLEASE ASK!

ITEM NO.	PART NUMBER	DESCRIPTION	5.5"/QTY.
1	606301	Basket, 500 Ton External	1
2	700711	BOLT, 1/2-13 X 2 1/4	6
3	605813	Bump Plate	1
4	606430	DOVETAIL MANDREL NUT, EXTERNAL	1
5	605982	Key Mandrel-Upper Housing	6
6	700500	LOCK WASHER INTERNAL TOOTH	12
7	605984	Lower Housing	1
8	606062	Lower Safety Clamp	2
9	605978	Mandrel	1
10	700670	O-RING, 1.895" OD x 1.475" ID x 0.210" CS	6
11	700616	O-RING, 2.137" OD x 1.859" ID x 0.139" CS (Replaces Part #222501)	2
12	700802	PolyPak, 3" OD x 2.50" ID x 0.25" CS (Replaces Part #505121)	1
13	606580	Ramp Segment	6

ITEM NO.	PART NUMBER	DESCRIPTION	5.5"/QTY.
14	606300	Rod	6
15	605981	Rod Head	6
16	700008	SAFETY BOLT 1/2-13 X 2	6
17	701351	SCREW, SET, 3/8-16, 3/8, STEEL, GR8	6
18	701352	Set Screw	6
19	700002	SET SCREW, HEX, CUP POINT, 3/8"-16 X 5/8" LG, STEEL	7
20	606754	SCREW, SET, SOCKET, MODIFIED, 5/8"-11, 1 3/4"	3
21	701160	SHACKLE, 3/4" BOLT TYPE ANCHOR, 4-3/4" TON	2
22	606011	SLIP, 5-1/2"	6
23	701254	SPRING, 104-710 (RAYMOND)	6
24	606561	Upper Housing	1
25	606513	WEAR GUIDE, 5-1/2"	1
26	606512	Wear Guide Lock	1
27	606581	RAMP SEGMENT SPACER, 500 TON	6
28	606578	Bell Guide Assembly with Dogs 5-1/2"	1
29	606562	Circulator Body	1
30	606413	Nose Cone	1
31	700601	O-RING, DWCRT SNORKEL, 3.020" OD X 2.600" ID X 0.210" CS	1
32	700106	O-RING, 2.520" OD x 2.100" ID x 0.139" CS (Replaces Part #233001)	1



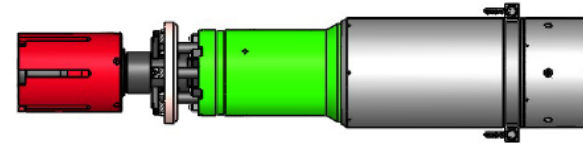
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ITEM NO.	PART NUMBER	DESCRIPTION	Size	4.5"/QTY.
21	606013	Slip 4 1/2"	4-1/2"	6
23	606437	Wear Guide (Leaf Spring Version)	4-1/2"	1
31	606759	Bell Guide Assembly 4 1/2"		1
ITEM NO.	PART NUMBER	DESCRIPTION	Size	5"/QTY.
23	606012	Slip 5"	5"	6
25	606438	Wear Guide (Leaf Spring Version)	5"	1
28	606760	Bell Guide Assembly 5"		1
ITEM NO.	PART NUMBER	DESCRIPTION	Size	5.5"/QTY.
22	606011	SLIP, 5-1/2"	5-1/2"	6
26	606513	WEAR GUIDE, 5-1/2"	5-1/2"	1
28	606578	Bell Guide Assembly with Dogs 5-1/2"	5-1/2"	1
ITEM NO.	PART NUMBER	DESCRIPTION	Size	6"/QTY.
23	606010	SLIP, 6", DWCRT EXTERNAL	6"	6
26	606439	WEAR GUIDE, 6", DWCRT EXTERNAL	6"	1
29	606761	ASSEMBLY, BELL GUIDE, 6" WITH DOGS		1
ITEM NO.	PART NUMBER	DESCRIPTION	Size	6.625"/QTY.
23	606335	Slip 6-5/8"	6-5/8"	6
26	606334	Wear Guide (Leaf Spring Version) 6 5/8"	6-5/8"	1
29	606762	ASSEMBLY, BELL, GUIDE, 6 5/8", WITH DOGS		1
ITEM NO.	PART NUMBER	DESCRIPTION	Size	6.625 Flush/QTY.
23	606335	Slip 6-5/8"	6-5/8"	6
26	606515	Wear Guide (Leaf Spring Version)	6-5/8 Flush	1
29	606762	ASSEMBLY, BELL, GUIDE, 6 5/8", WITH DOGS		1
ITEM NO.	PART NUMBER	DESCRIPTION	Size	7"/QTY.
2	606361	Bell Guide Assembly 7"	7"	1
24	606009	Slip 7"	7"	6
27	606516	Wear Guide 7"	7"	1
ITEM NO.	PART NUMBER	DESCRIPTION	Size	7.625"/QTY.
2	606362	Bell Guide Assembly 7 5/8"	7-5/8"	1
24	606008	Slip 7 5/8"	7-5/8"	6
28	606002	Wear Guide Ring 7-5/8"	7-5/8"	1

PART NUMBER	DESCRIPTION	Toolbox Size	606211 Overhaul Kit/QTY.	606212 Rebuild Kit/QTY.	606213 Redress Kit/QTY.
700670	O-RING, 1.895" OD x 1.475" ID x 0.210" CS		6	6	-
700671	O-RING, 5.650" OD x 5.100" ID x 0.275" CS		1	1	1
700820	O-RING, 9.025" OD x 8.475" ID x 0.275" CS		1	1	1
700802	PolyPak, 3" OD x 2.50" ID x 0.25" CS (Replaces Part #505121)		1	1	1
700008	Safety Bolt	1/2-13 x 2	6	6	-
701356	SCREW, SET, 3/8-16, 7/8, STEEL, GR8	3/8-16 x 7/8	6	6	-
701352	Set Screw	3/8-16 x 3/4	6	6	-
606754	SCREW, SET, SOCKET, MODIFIED, 5/8"-11, 1 3/4"		3	3	-
701254	SPRING, 104-710 (RAYMOND)		6	-	-
700002	SET SCREW, HEX, CUP POINT, 3/8"-16 X 5/8" LG, STEEL	3/8-16 x 5/8	6	-	-
700711	BOLT 1/2-13 X 2 1/4		6	6	-
700500	Lock Washer Internal Tooth	1/2	12	12	5



CRITICAL COMPONENT: <small>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS 0.0315/32". BREAK ALL SHARP EDGES 0.0315/32" X 45° OR 0.0315/32" R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.</small> <small>DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY</small> <small>X = ±0.002 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACES</small> <small>XX = ±0.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TR</small> <small>XXX = ±0.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TR</small> <small>AS P. / MACH. .002 TR</small>		Hoist: Torque: Pressure:		Project: DW0003 Description: External Gripping Assembly Size: 4-1/2-7-5/8"
<small>INTERPRET DRAWING PER ASME Y14.3-2009</small> <small>MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION.</small> <small>©2018 BY DRAWWORKS, LP - BOUNDED DEVELOPMENT GENERAL PARTNER</small> <small>THIS DOCUMENT IS UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THIS WORK AND REQUESTS TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THESE RIGHTS ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK WITHOUT EXPRESSLY AUTHORIZED BY DW TO DO SO.</small>	DWN: JL DATE: 09/07/2018 APPD: RU DATE: 03/08/2019 REV. DWN: CH DATE: 04/24/2019 REV. APPD: JL DATE: 05/07/2019	DWT SCALE: 1:2 WEIGHT(LBS) Part No.: 606280 REV: E SHEET 2 of 3		

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10.6 Bell Guide Assembly, 5"

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	606170	BELL GUIDE, 5", WITH DOGS	1
2	700753	CAP SCREW, SOCKET, FLAT, 3/8"-16 X 1/2", HEX DRIVE, ALLOY STEEL	6
3	606582	DOG, 4 1/2" - 7 5/8", 1/2"-13	6
4	606164	DOG, RETAINER, 5"	1
5	606088	Dog Spring Tensioner 5"	6
6	700654	SPRING, ASF 50 X 125, ASSOCIATED SPRING RAYMOND	6

SECTION A-A
SCALE 1 : 4

Engrave per spec #505300

REVISIONS			
REVISION	ECN NUMBER	ECN DESCRIPTION	ECN COMPLETED BY / ECN COMPLETED DATE
A	N/A	INITIAL RELEASE	N/A / N/A

Host: CRITICAL COMPONENT: No <small>UNLESS OTHERWISE SPECIFIED: D-DIMENSIONS FOR DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED RADIUS ALL CORNERS 0.0625" UNLESS OTHERWISE SPECIFIED 0.0005" SURFACE FINISH UNLESS OTHERWISE SPECIFIED DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY X = ±.002 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACE 0.0005" SURFACE FINISH XX = ±.015 ANGLE ± .05° STRAIGHT DIMS. 175RMS ID - OD DIMS 175RMS XXX = ±.005 PERPEND. ± .025° TAPERED DIMS. 125RMS OD - OD DIMS 175RMS AS F/MACH. DIMS. UNLESS OTHERWISE SPECIFIED</small>	Torque: N/A PROCESS SPECS: 1: 2: 3: 4:
<small>INTERFERED DIMS. ARE SHOWN IN RED MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFLECT THE LATEST APPROVED REVISION © 2018 BY DRAWWORKS, LP.; DESIGN DEVELOPMENT - GENERAL PARTNER THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF DRAWWORKS, LP. ANY REUSE OR REPRODUCTION WITHOUT THE WRITTEN PERMISSION OF DRAWWORKS, LP. IS STRICTLY PROHIBITED. ANY REUSE OR REPRODUCTION WITHOUT THE WRITTEN PERMISSION OF DRAWWORKS, LP. IS STRICTLY PROHIBITED. ANY REUSE OR REPRODUCTION WITHOUT THE WRITTEN PERMISSION OF DRAWWORKS, LP. IS STRICTLY PROHIBITED. ANY REUSE OR REPRODUCTION WITHOUT THE WRITTEN PERMISSION OF DRAWWORKS, LP. IS STRICTLY PROHIBITED.</small>	

BWH DATE	DATE	DATE
BWH DATE	DATE	DATE
BWH DATE	DATE	DATE

Pressure: N/A	Bell Guide Assembly 5"
Part No: 606760	WNC# 14627
Rev: A	Sheet: 1 of 1

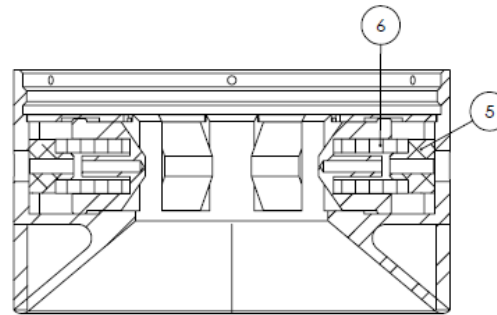
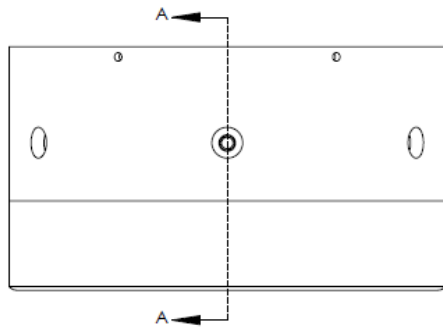
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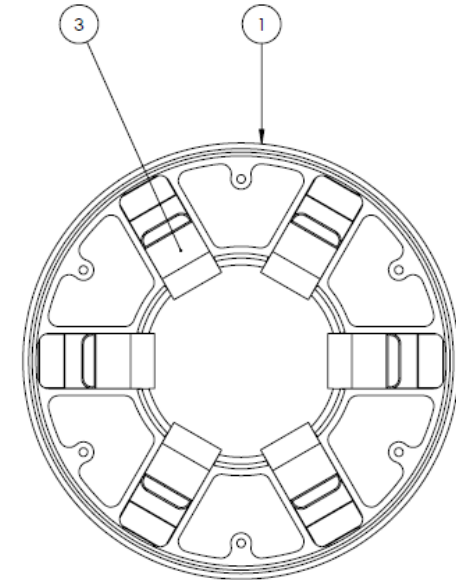
10.7 Bell Guide Assembly, 5-1/2"

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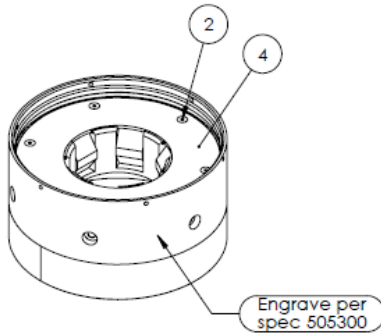
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	606171	Bell Guide with Dogs	1
2	700753	Countersunk Screw	6
3	606582	Dog	6
4	606165	Dog Retainer	1
5	606087	Dog Spring Tensioner	6
6	700654	Spring	6



SECTION A-A
SCALE 1 : 4



Dog Retainer, and Countersunk Screws
Hidden for clarity.



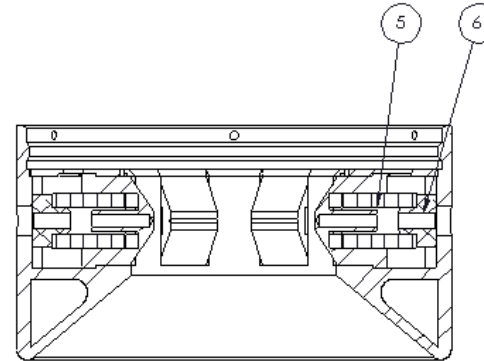
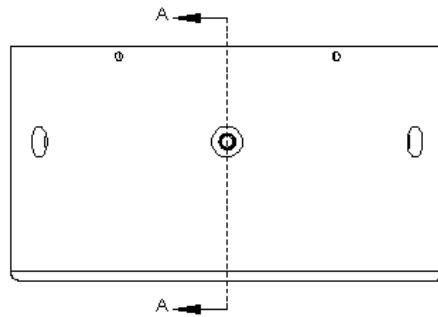
Hoist: -		Torque: -		Pressure: -	
CRITICAL COMPONENT:					
<small>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL SURFS. RADIUS ALL CORNERS 600/DWT. BREAK ALL SHARP EDGES 300/200 X 45° OR 200/100 X 45°. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.</small>			<small>MATERIAL:</small>		
<small>DECIMAL TOLERANCE: SURFACE FINISH: MACHINED SURFACE</small>			<small>PROCESS SPECS:</small>		
<small>.X = ±0.002 FRACTION ± 1/32 MACHINED 250RMS OD - ID .010 TIR</small>			<small>1:</small>		
<small>.XX = ±0.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR</small>			<small>2:</small>		
<small>.XXX = ±0.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR</small>			<small>3:</small>		
<small>AS B. / MACH. 005 TIR</small>			<small>4:</small>		
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DWN: JL		DATE: 04/30/2019		Project: DW0003	
APPR: TF		DATE: 05/06/2019		Description: Bell Guide Assembly with Dogs	
REV. DWN:		DATE:		Size: 5-1/2"	
REV. APPR:		DATE:		Part No: 606578	
				DW SCALE: 1:8 WEIGHT(LBS)	
				REV. A - 1 of 1	

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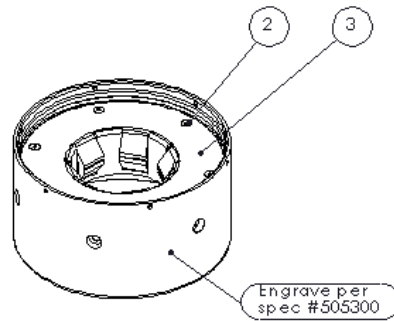
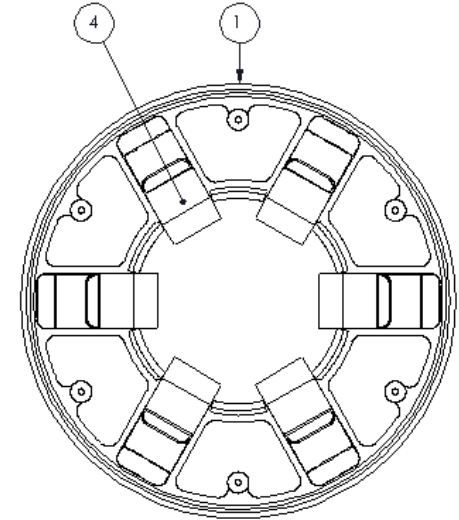
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10.8 Bell Guide Assembly, 6"

ITEM	QTY	P/N	DESCRIPTION	MATERIAL
1	1	606172	BELL GUIDE, 6"	505234
2	6	700753	CAP SCREW, SOCKET, FLAT, 3/8"-16 X 1/2", HEX DRIVE, ALLOY STEEL	Alloy Steel
3	1	606166	DOG, RETAINER, 6"	502368
4	6	606582	DOG, 4 1/2" - 7 5/8", 1/2"-13	500936
5	6	700654	SPRING, ASF 50 X 125, ASSOCIATED SPRING RAYMOND	Springs
6	6	606086	TENSIONER, DOG, SPRING 6", DWCRT EXTERNAL	505145



SECTION A-A
SCALE 1 : 4



PENDING APPROVAL

REVISIONS				
REVISION	ECN NUMBER	ECN DESCRIPTION	ECN COMPLETED BY	ECN COMPLETED DATE
A	N/A	INITIAL RELEASE	N/A	N/A
1. THIS DRAWING IS THE PROPERTY OF ACCOY GLOBAL. IT IS TO BE USED ONLY FOR THE PURPOSES SPECIFIED HEREIN. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.		CRITICAL COMPONENT: No	RATINGS: IF APPLICABLE	
2. THIS DRAWING IS THE PROPERTY OF ACCOY GLOBAL. IT IS TO BE USED ONLY FOR THE PURPOSES SPECIFIED HEREIN. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.		DESCRIPTION ASSEMBLY, BELL GUIDE, 6" WITH DOGS	SEE PART NO. 606761	REV A
3. THIS DRAWING IS THE PROPERTY OF ACCOY GLOBAL. IT IS TO BE USED ONLY FOR THE PURPOSES SPECIFIED HEREIN. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.		DATE: 06/02/2020	MATERIAL N/A	SHEET 1 OF 1
4. THIS DRAWING IS THE PROPERTY OF ACCOY GLOBAL. IT IS TO BE USED ONLY FOR THE PURPOSES SPECIFIED HEREIN. IT IS NOT TO BE REPRODUCED, COPIED, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.		WEIGHT 141.70 LBS.		

10/16/2005 6:00 AM P:\P\108\108.DWG: 10/16/2005 6:00 AM

10.10 Bell Guide Assembly, 7"

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	606173	Bell Guide	1
2	700753	Countersunk Screw	6
3	606582	Dog	6
4	606167	Dog Retainer	1
5	606531	Dog Spring Tensioner	6
6	700654	Spring	6

SECTION A-A

Dog Retainer, Countersunk Screws
Hidden for clarity.

Hoist: - CRITICAL COMPONENT: No <small>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL SURFS. RADII ALL CORNERS 20X45. BREAK ALL SHARP EDGES 20X45 X 45° OR 20X45 X 60°. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.</small> DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY .X = ±.002 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACES .XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS ID - ID .010 TIR .XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TIR AS B/MACH. 100 TIR	Torque: - MATERIAL: PROCESS SPECS. 1: 2: 3: 4:	
INTERPRET DRAWING PER ASME Y14.5-2009 MATERIAL AND PRECISION SPECIFICATIONS ALIGNED ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2019 BY DRAWWORKS, LP - BOLING DEVELOPMENT GENERAL PARTNER THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF DRAWWORKS, LP. IT MAY NOT BE COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY MANNER WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THE WORK AND INTENDS TO MAINTAIN THE WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THE WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK WITHOUT EXPRESSLY AUTHORIZED BY DW TO DO SO.	DWN: JL DATE: 10/30/2018 APPR: RU DATE: 03/08/2019 REV. DWN: JL DATE: 05/06/2019 REV. APPR: TF DATE: 05/06/2019	Project: DW0003 Description: Bell Guide Assembly Size: 7" Part No.: 606361 REV: C 1 of 1

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10.11 Bell Guide Assembly, 7-5/8"

	8	7	6	IF IN DOUBT, PLEASE ASK!	3	2	1
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ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	606174	Bell Guide	1
2	700753	Countersunk Screw	6
3	606582	Dog	6
4	606168	Dog Retainer	1
5	700654	Spring	6
6	700783	Washer Wide	6

SECTION A-A

Dog Retainer, and Countersunk Screws
Hidden for clarity.

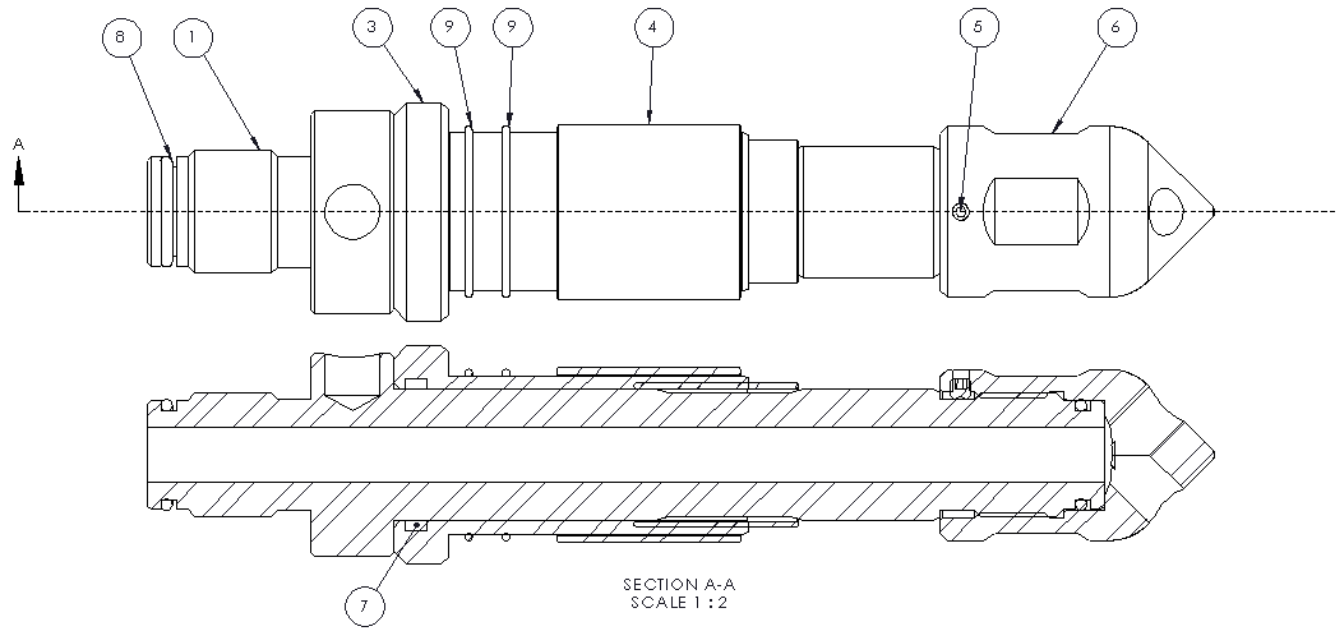
Hoist: CRITICAL COMPONENT: No <small>INTERPRET DRAWING PER ASME Y14.5-2009 MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2019 BY DRAWWORKS, LP - BOLING DEVELOPMENT GENERAL PARTNER ALL RIGHTS TO THE WORK AND INTEND TO MAINTAIN THE WORK CONFIDENTIAL AND AS A TRADE SECRET. DRW MAY ALSO SEEK TO PROTECT THE WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK UNLESS EXPRESSLY AUTHORIZED BY DRW TO DO SO.</small>	Torque: MATERIAL: PROCESS SPECS: 1: 2: 3: 4:	
Pressure: Project: DW0003 Description: Bell Guide Assembly Size: 7-5/8"	DWN: JL DATE: 4/10/2018 APPD: RU DATE: 03/08/2019 REV. DWN: JL DATE: 05/06/2019 REV. APPD: TF DATE: 05/06/2019	DWT SCALE: 1/4" WEIGHT(LBS): Part No. 606362 REV: C 1 of 1 SHEET

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ITEM	QTY	P/N	DESCRIPTION	MATERIAL
1	1	605102	CIRCULATOR BODY, 4-1/2"-6-5/8"	500938
2	1	601094	CUP LOCK SLEEVE, 4 1/2"-5"	500936
3	1	601093	CUP SLEEVE, 5-1/2"-6-5/8"	502365
4	1	601095	CUP LOCK SPACER, 5-1/2" - 6-5/8"	500936
5	3	701351	SCREW, SET, 3/8-16, 3/8, STEEL, GR8	GR8
6	1	605837	NOSE, 4-1/2"-6-5/8"	500938
7	1	700803	SEAL, ROTARY, 2.770" OD X 2.400" ID X 0.412" CS (Replaces Part 501908)	90 Duro Nitrile
8	2	700605	O-RING, 2.020" OD x 1.600" ID x 0.210" CS (Replaces Part #232601)	70 Duro
9	2	700606	O-RING, 3.137" OD X 2.859" ID X 0.139" CS (Replaces Part #223301)	90 Duro



SECTION A-A
SCALE 1 : 2

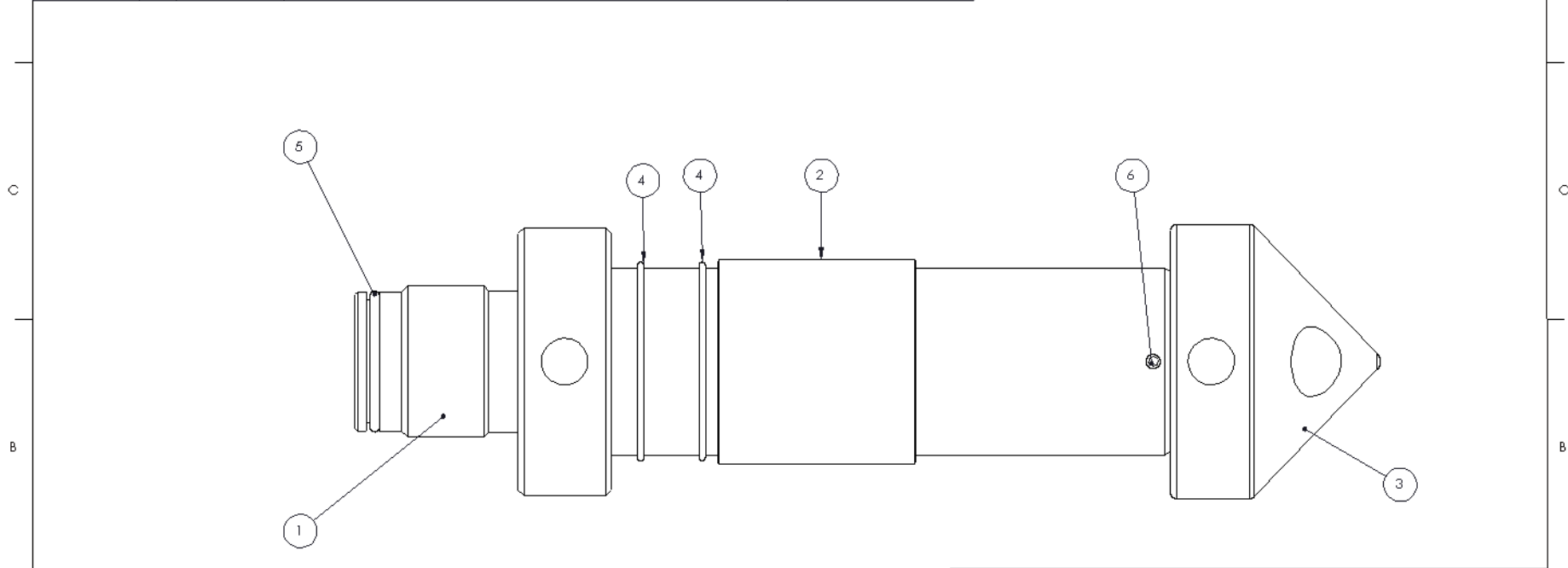
Hoist: -		Torque: -		Pressure: 10,000 PSI	
CRITICAL COMPONENT: No					
UNLESS OTHERWISE SPECIFIED					
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE TO BE TAKEN FROM THE DRAWING UNLESS OTHERWISE SPECIFIED.					
DIMENSIONS ARE TO BE TAKEN FROM THE DRAWING UNLESS OTHERWISE SPECIFIED.					
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY					
X = ±.002 FRACTION ±1/32 MACHINED 250 RMS WASHED SURFACE					
XX = ±.005 ANGULAR ±.030 STRAIGHT IN DS. 175 RMS OD - OD DID IR					
XXX = ±.005 PERPEND. ±.020 LAPERED IN DS. 125 RMS OD - OD DID IR					
AS B/MACH. EDS. IR					
UNLESS OTHERWISE SPECIFIED: SHOW MATERIAL AND PROCESS SPECIFICATIONS IN DIMENSIONS. ALL DIMENSIONS ARE TO BE TAKEN FROM THE DRAWING UNLESS OTHERWISE SPECIFIED.					
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UNLESS OTHERWISE SPECIFIED BY DW TO B.O.S.O.					
DWK		DATE: 1/13/2017		Project: Circulator	
APP: MHH		DATE: 4/19/2017		Description: Circulator Assembly 5 1/2- 6 5/8", Body, Spacer, Nose (BBAABA)	
REV: MHH - JL		DATE: 12/5/2017		Part No: 605101	
REV: APP: MHH		DATE: 1/3/2018		REV: A	
				Sheet: 1 of 1	

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10.12.2 Internal Circulators, 7" – 7-5/8"

8		7		6		IF IN DOUBT..PLEASE ASK!		3		2		1	
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION		Size								
1	1	605072	Circulator Body 7- 7-5/8"		7" 7-5/8"		Seal Kit Part Number 605149 Includes: 2) 700612 2) 700601 3) 701350						
2	1	605080	CUP SPACER, 7", 7 5/8", 4" ID		7"-7-5/8" 4"ID								
3	1	605441	NOSE, 7"-20"		7"-20"								
4	2	700612	O-RING, 4.226" OD x 3.948" ID x 0.139" CS (Replaces Part #224201)		-								
5	2	700601	O-Ring		-								
6	3	701350	SET SCREW, HEX, CUP POINT, #10-24 X 1/4" LG, STEEL										



REVISIONS				
REVISION	ECN NUMBER	ECN DESCRIPTION	ECN COMPLETED BY	ECN COMPLETED DATE
A	-	Initial Release	JARA	1/10/2020

Hoist: -	Torque: -	Pressure: 10,000 PSI
CRITICAL COMPONENT: Pressure Containing Component		
<p>UNLESS OTHERWISE SPECIFIED</p> <p>DO NOT SCALE FOR DIMENSIONS ALL DIMENSIONS ARE TO BEHIND DIMENSION LINES</p> <p>REMOVE ALL CHAMFER DIMENSION METRIC CHAMFER DIMENSION 0.5X45 OR 0.5X60</p> <p>SHOULDER HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE</p> <p>DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY</p> <p>X = ±.002 FRACTION ±.002 MACHINED SURFACES OD - ID DIA IN</p> <p>XX = ±.005 ANGULAR ±.05° STRAIGHT DIMS. 175RMS ID - ID DIA IN</p> <p>XXX = ±.005 PERPEND. ±.025 TAPERED DIMS. 175RMS OD - OD DIA IN</p> <p>AS E / MACH. DIMS IN</p>	<p>DATE</p> <p>1:</p> <p>2:</p> <p>3:</p> <p>4:</p>	<p>Product: Circulator</p> <p>Description: Circulator Assembly, 7" 7-5/8"</p>
<p>INTERPRET DRAWING PER ASME Y14.5-2009</p> <p>WEATHER AND PROTECT SPECIFICATIONS DIMENSIONS OF THIS DRAWING ARE TO REMAIN UNLESS OTHERWISE APPROVED BY DESIGN</p> <p>COPYRIGHT BY DRAWWORKS, L.P. - SOLE DEVELOPMENT GENERAL PARTNER</p> <p>THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF DRAWWORKS L.P. ANY REPRODUCTION OR DISSEMINATION OF THIS DOCUMENT WITHOUT THE WRITTEN PERMISSION OF DRAWWORKS L.P. IS STRICTLY PROHIBITED. ANY REPRODUCTION OR DISSEMINATION OF THIS DOCUMENT WITHOUT THE WRITTEN PERMISSION OF DRAWWORKS L.P. IS STRICTLY PROHIBITED.</p> <p>ALL RIGHTS TO THE MODEL AND RIGHTS TO OBTAIN THIS MODEL CONFIDENTIAL AND AS A TRADE SECRET. YOU MAY ALSO NEED TO OBTAIN THE RIGHTS TO AN APPROVED COPIE. THIS DRAWING IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS WITHOUT THE WRITTEN PERMISSION OF DRAWWORKS L.P.</p>	<p>DWG -</p> <p>DATE 1/28/2020</p> <p>APP: JWH</p> <p>DATE 4/13/2017</p> <p>BY: JWH</p> <p>DATE</p> <p>BY: JWH</p> <p>DATE</p>	<p>DATE</p> <p>DATE</p> <p>DATE</p> <p>DATE</p>
<p>605071-0013</p>		<p>REV: A</p> <p>SHEET: 1 of 1</p>

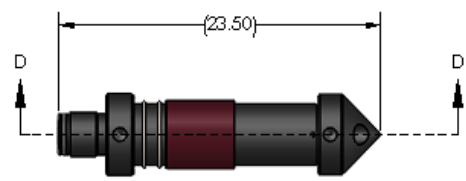
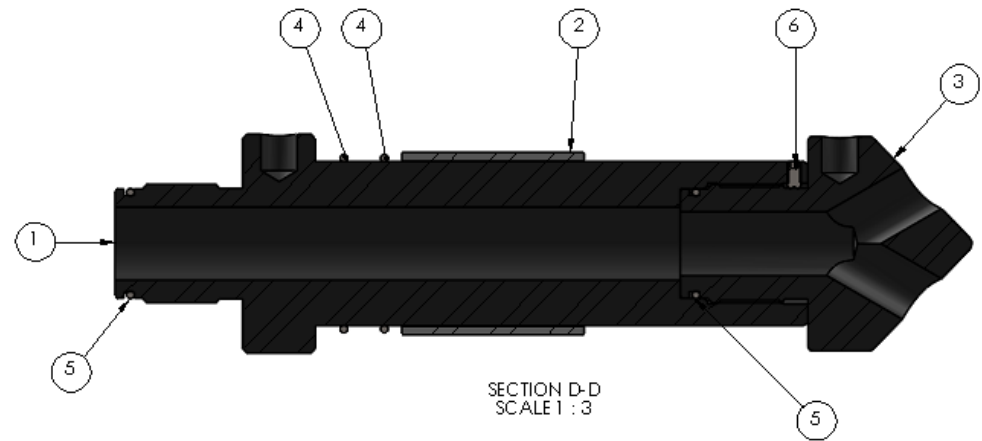
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10.12.3 Internal Circulators, 8-5/8" – 13-3/8"

ITEM NO.	PART NUMBER	QTY.	DESCRIPTION	
1	605091	1	CIRCULATOR BODY, 8 5/8" - 13 5/8"	Seal Kit Part # 605098 Includes: 2) 700005 2) 700601 3) 701352
2	600070	1	CUP SPACER, 8 5/8" - 20"	
3	605441	1	NOSE, 7"-20"	
4	700005	2	O-Ring	
5	700601	2	O-Ring	
6	701352	3	Set Screw	

See Packer Cup and Gage Ring list for complete list of available components 8-5/8" - 13-5/8"



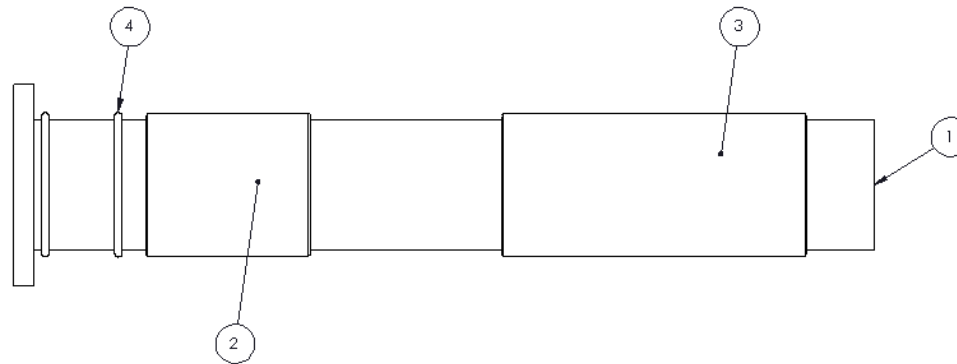
Hoist: -	Torque: -	Pressure: 10,000 PSI
CRITICAL COMPONENT: YES	SW-ivcrtrial@605319.SLDPR	
METRIC DIMENSIONS SPECIFIC DO NOT SCALE FOR THIS DRAWING. ALL DIMENSIONS ARE TO BEYOND UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE TO BEYOND UNLESS OTHERWISE SPECIFIED. DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY X = +0.02 FRACTION 1/32 FINISH 320 RA3 CS-10 010 IR XX = +0.03 ANGULAR 1/32 SRA3H 100 120 RA3 10-10 010 IR XXX = +0.05 FINISH 1/32 SRA3H 100 120 RA3 10-10 010 IR	PROCESSES 1: 2: 3: 4:	
APPROVED BY: J.L. DATE: 04/13/2017 APPROVED BY: M.H. DATE: 04/19/2017		DIFFSCALE: 1:1 WEIGHT: 89.483 P/N: 605090-0024 QTY: 1 SHIP: 1

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10.12.5 External Circulator Cartridge Assembly, 4-1/2" – 5"

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	606404	Circulator Sleeve	1
2	601094	CUP LOCK SLEEVE, 4 1/2"-5"	1
3	606410	Gage Ring Sleeve	1
4	700611	O-RING, 2.637" OD X 2.359" ID X 0.139" CS (Replaces Part #222901)	2



REVISIONS				
REVISION	ECO NUMBER	ECO DESCRIPTION	ECO COMPLETED BY	ECO COMPLETED DATE
A	N/A	INITIAL RELEASE	N/A	N/A

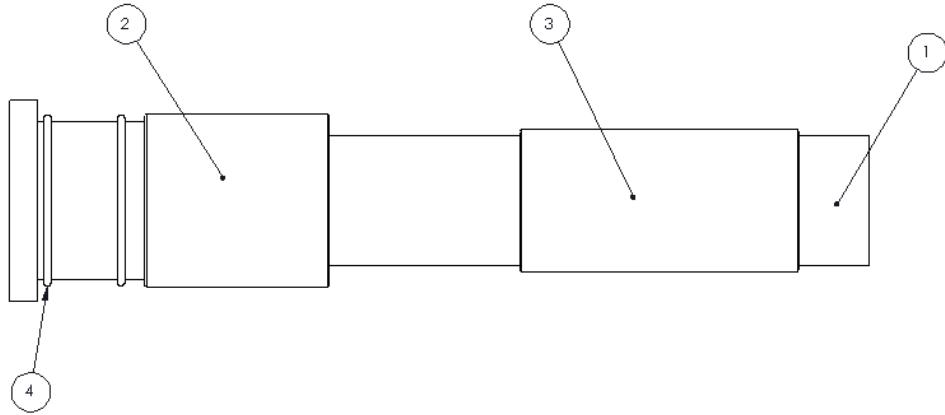
Hoist:	Torque:	Pressure:
CRITICAL COMPONENT: No		
UNLESS OTHERWISE SPECIFIED	UNLESS OTHERWISE SPECIFIED	
DD POSITIVE FOR DIMENSIONS ALL DIMENSIONS ARE TO BE TAKEN FROM THE SURFACE UNLESS OTHERWISE SPECIFIED DIMENSIONS TO BE TAKEN FROM THE SURFACE UNLESS OTHERWISE SPECIFIED DIMENSIONS TO BE TAKEN FROM THE CENTERLINE UNLESS OTHERWISE SPECIFIED DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY X = LEAD RADIUS 1/2D MATCHED SURFACES XX = LEAD ANGLE 1/2D STRAIGHT LINE 1/2D XXX = LEAD PERPEND. 1/2D IMPERF. 1/2D OD - OD DIM IN ASSEMBLY 1/2D	1: PROCESS SPEC 2: 3: 4:	Project: DW0003 Description: Circulator Cartridge 4-1/2" - 5" Size: 4-1/2" - 5"
INTERPRET DRAWING DIMENSIONS TO BE TAKEN FROM THE SURFACE UNLESS OTHERWISE SPECIFIED APPROVED BY: [Signature] ©2018 BY DRAWWORKS, L.P., BOILING DEVELOPMENT GENERAL PARTNER THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF DRAWWORKS, L.P. NO PART OF IT OR ANY OF ITS CONTENTS OR INFORMATION CONTAINED HEREIN IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF DRAWWORKS, L.P.	DWB JL DATE 4/4/2018 APD RU DATE 03/08/2019 DWB DATE DWB DATE	DYNAMIC VENDOR NUMBER: 606067-0007 PART NUMBER: A QUANTITY: 1 SHEET: 1

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10.12.6 External Circulator Cartridge Assembly, 5-1/2" – 6-5/8"

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	606405	Circulator Sleeve, 5 1/2" - 6 5/8" (Replaces Part #606035)	1
2	601095	CUP LOCK SPACER, 5-1/2" - 6-5/8"	1
3	606411	GAGE RING SLEEVE, 5 1/2" - 6 5/8"	1
4	700606	O-RING, 3.137" OD X 2.859" ID X 0.139" CS (Replaces Part #223301)	2



REVISIONS				
REVISION	ECO NUMBER	ECO DESCRIPTION	ECO COMPLETED BY	ECO COMPLETED DATE
A	N/A	INITIAL RELEASE	N/A	N/A

Hoist:	Torque:	Pressure:
CRITICAL COMPONENT: NO		
<p>UNLESS OTHERWISE SPECIFIED</p> <p>DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE TO BE TAKEN FROM UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE TO BE TAKEN FROM THE CENTERLINE UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE TO BE TAKEN FROM THE CENTERLINE UNLESS OTHERWISE SPECIFIED.</p> <p>DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY</p> <p>X = ±.002 FRACTION ±.002 MACHINED SURFACES UNFINISHED SURFACES</p> <p>XX = ±.015 ANGULAR ±.030° STRAIGHT DIMS. 15° RMS ID - ID DIDIR</p> <p>XXX = ±.005 PERPEND. ±.025° IMPERF DIMS. 15° RMS OD - OD DIDIR</p> <p>AS F/MACH. EDG. IF</p>		
		Project: DW0003 Description: EXTERNAL CIRCULATOR CARTRIDGE BASE KIT ASSY, 5-1/2" - 6-5/8" INCLUDES CARTRIDGE BODY, CUP SPACER Part No: 5-1/2" - 6-5/8"
DW JL Date: 04/05/2018 APG RU Date: 03/08/2019 TF Date: 08/22/2019 JLL Date: 08/23/2019	DIFFICULTY: *** WTC: ***** Part No: 606069-0011 Rev: A	SHEET: 1 OF: 1

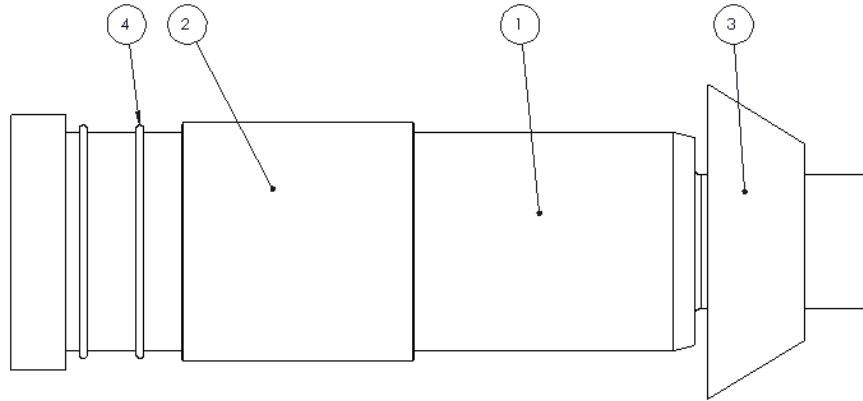
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10.12.7 External Circulator Cartridge Assembly, 7" – 7-5/8"

IF IN DOUBT...PLEASE ASK!

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	606406	Circulator Sleeve	1
2	605080	CUP SPACER, 7", 7 5/8", 4" ID	1
3	606412	Gage Ring Sleeve	1
4	700612	O-RING, 4.226" OD x 3.946" ID x 0.139" CS (Replaces Part #224201)	2



REVISIONS				
REVISION	ECO NUMBER	ECO DESCRIPTION	ECO COMPLETED BY	ECO COMPLETED DATE
A	N/A	INITIAL RELEASE	N/A	N/A

Hoist: CRITICAL COMPONENT: YES UNLESS OTHERWISE SPECIFIED DO NOT SCALE FOR DIMENSIONS ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED FINISH ALL CORNERS AND EDGES AT ALL SHARP POINTS WITH RADIUS R0.005 DIMENSIONS SHOWN FROM THE SURFACE UNLESS OTHERWISE SPECIFIED DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY X = ±.002 FRACTION ± 1/32 MACHINED SURFACES OD - ID DIA IN XX = ±.015 ANGULAR ±.05° SURFACE FINISH ID - OD DIA IN XXX = ±.005 PERPEND. ±.025 TAPERED INDS. 1/32 RMS OD - OD DIA IN AS B/A/C/D/E/F/G/H/I/J/K/L/M/N/O/P/Q/R/S/T/U/V/W/X/Y/Z DIFFERENT DRAWING SHEETS IN THIS DRAWING SET TO WHICH ANY OTHER SHEETS OF THIS SET APPROVED BY DATE BY DRAWING OFFICE, I.P.: SO LONG DEVELOPMENT GENERAL PARTS THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF DRAWWORKS I.P. ANY REPRODUCTION OR DISSEMINATION OF THIS DOCUMENT TO ANY OTHER PARTY WITHOUT THE WRITTEN PERMISSION OF DRAWWORKS I.P. IS STRICTLY PROHIBITED. ALL RIGHTS TO THIS WORK AND ANY RIGHTS TO OBTAIN PATENTS OR TRADEMARKS ARE RESERVED. THIS WORK IS THE PROPERTY OF DRAWWORKS I.P. AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.	Torque: DRAWWORKS PROJECT OFFICE 1: 2: 3: 4:	Pressure: DWORT external EXTERNAL CIRCULATOR CARTRIDGE BASE KIT ASSY, 7" - 7-5/8" INCLUDES CARTRIDGE BODY, CUP SPACER 7" - 7-5/8"
DWG: TF DATE: 04/05/2018 APPR: JL DATE: 11/30/2018 DWT: TF DATE: 11/30/2018 REV: APPR: DATE:	DWG: TF DATE: 04/05/2018 APPR: JL DATE: 11/30/2018 DWT: TF DATE: 11/30/2018 REV: APPR: DATE:	DWG: TF DATE: 04/05/2018 APPR: JL DATE: 11/30/2018 DWT: TF DATE: 11/30/2018 REV: APPR: DATE:

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Section 11 - DWCRT Assembly Tools

11.1 Internal Assembly Tools

8		7		6		IF IN DOUBT...PLEASE ASK!		3		2		1	
ITEM NO.	PART NUMBER	DESCRIPTION	606381-0001/Required/QTY.	606381-0002/Optional/QTY.	606381-0003/QTY.								
1	605242	ASSEMBLY STAND	-	1	1								
2	604080	C-Series Lock Nut Tool	1	1	1								
3	700053	DW Grease	1	1	1								
4	605244	ASSY MANDREL HANGING TOOL, 450 TON	1	1	1								
5	605235	Spanner Wrench	1	1	1								
6	605319	TRANSPORT CASE	-	1	1								
7	605571	Pressure Test Plug	-	-	1								
8	700778	DUCK TAPE	-	-	1								
9	606421	COMPRESSOR, SPRING PLATE, DWCRT 500 TON	-	-	2								
10	606560	Installation Rod	-	-	1								
11	605605	Thread Protector, Dovetail Mandrel, 4.25"-4	-	-	1								
12	605290	Thread Protector	-	-	1								
13	800020	Tool Bag	-	-	1								
14	800062	SHOP PRESS, 20 TON, H-FRAME	-	-	1								

Hoist:		Torque:		Pressure:	
CRITICAL COMPONENT: ALL DIMENSIONS SHOWN DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS 20X/24T. BREAK ALL SHARP EDGES 20X/20X X 45° OR 20X/20X R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE. DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY .X = ±.032 FRACTION ± 1/32 MACHINED .250RMS MACHINED SURFACE .XX = ±.015 ANGULAR ± 0.50° STRAIGHT THDS. 175RMS OD - ID .010 TR .XXX = ±.005 PERPEND. ± 0.25° TAPERED THDS. 125RMS OD - OD .010 TR AS & AMMACH. 025 TR		MATERIAL: PROCESS SPEC: 1: 2: 3: 4:		Project: DW0013 Description: Assembly Tools Title: DWCRT	
INTERPRET DRAWING PER ASME Y14.5-2009 MATERIAL AND PROCESS SPECIFICATION NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2019 BY DRAWWORKS, LP - BOLING DEVELOPMENT GENERAL PARTNER THIS DRAWING IS THE PROPERTY OF DRAWWORKS, LP. IT IS TO BE KEPT CONFIDENTIAL AND NOT REPRODUCED OR COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THIS WORK AND INTENDS TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK. USE IS HEREBY AUTHORIZED BY DW TO DWG.				DWN: JL DATE: 11/05/2018 APPD: DATE: 11/05/2018 REV: DWN: CH DATE: 05/21/2019 REV: APPD: RU DATE: 05/22/2019	
		DWT SCALE: 1:32 WEIGHT(LBS)		REV: G SHEET 1 of 1	

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11.2 Internal 1K Tools

ITEM NO.	PART NUMBER	DESCRIPTION	Optional/QTY.	Required/QTY.
1	605561	Assembly Stand	1	-
2	604080	C-Series Lock Nut Tool	1	1
3	700053	DW Grease	1	1
4	605244	Hanger Assembly	1	1
5	605491	Spanner Wrench	1	1
6	605548	Transport Case	1	-
7	700778	Tape	1	-
8	605571	Pressure Test Plug	1	-
9	606560	Installation Rod	1	-
10	606606	Dovetail Mandrel Thread Protector	1	-
11	605290	Thread Protector	1	-
12	800020	Tool Bag	1	-
13	800062	Shop Press	1	-

IF IN DOUBT, PLEASE ASK!

Hoist:	Torque:	Pressure:
CRITICAL COMPONENT: No		
UNLESS OTHERWISE SPECIFIED DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .005/047. BREAK ALL SHARP EDGES .005/020 X 45° OR .005/020 R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.		
DECIMAL TOLERANCES SURFACE FINISH CONCENTRICITY .X = ±.002 FRACTION ± 1/32 MACHINED 250RMS MACHINED SURFACE .XX = ±.015 ANGULAR ± 0.50° STRAIGHT THD. 175RMS OD - ID .010 TIR .XXX = ±.005 PERPEND. ± 0.25° TAPERED THD. 125RMS OD - OD .010 TIR AS B / MACH. .005 TIE	MATERIAL: PROCESS SPEC: 1: - 2: 3: 4:	
INTERPRET DRAWING PER ASME Y14.5-2009 MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2019 BY DRAWWORKS, LP - BOLING DEVELOPMENT GENERAL PARTNER THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF DRAWWORKS, LP. IT MAY NOT BE COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THE DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THE WORK AND INTENDS TO MAINTAIN THE WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THE WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK UNLESS EXPRESSLY AUTHORIZED BY DW TO DO SO.		
DWN: JL	DATE: 11/05/2018	Project: DW0004
APPD:	DATE:	Description: Assembly Tool
REV. DWN: CH	DATE: 05/21/2019	Size: DWCRT1K
REV. APPD: RU	DATE: 05/22/2019	Part No.: 606382
		DRY SCALE: 1:48 WEIGHT(LBS)
		REV: G
		1 of 1

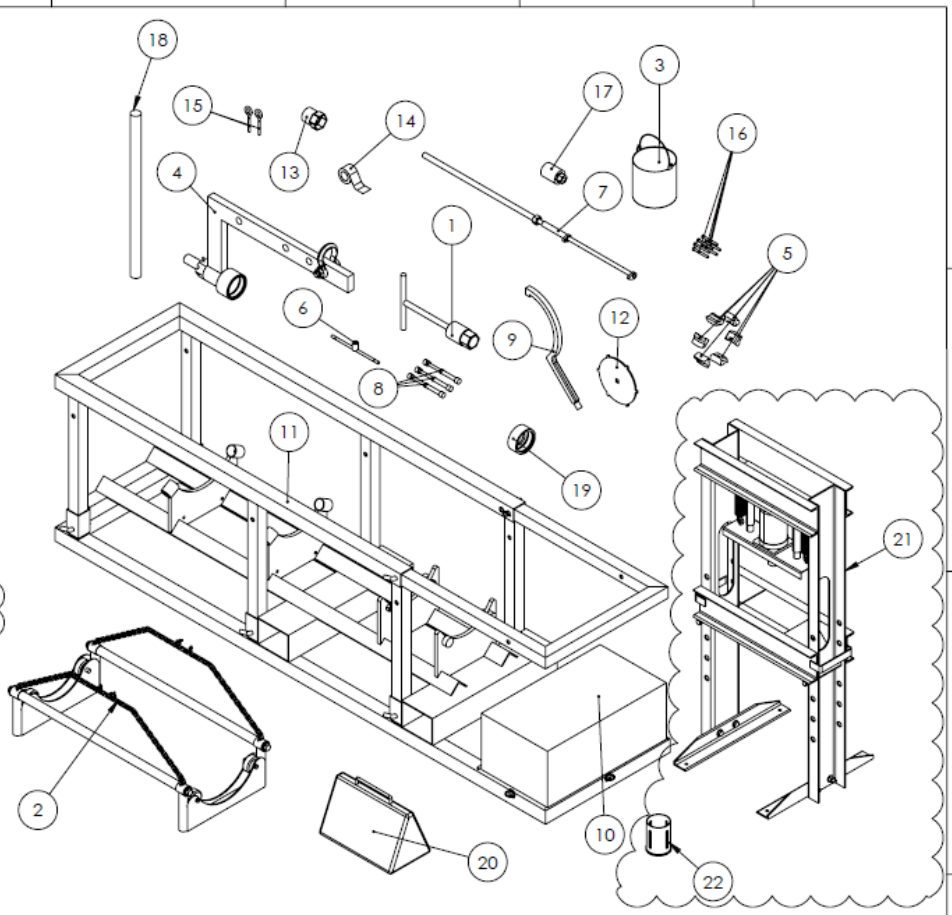
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11.3 External Assembly Tools

IF IN DOUBT, PLEASE ASK!

ITEM NO.	PART NUMBER	DESCRIPTION	Optional/QTY.	Required/QTY.
1	604080	C-Series Lock Nut Tool	1	1
2	606390	Cradle Assembly	1	-
3	700053	DW Grease	1	1
4	605244	Hanger Assembly	1	1
5	606419	Magnetic Wedge Assembly	6	6
6	606420	Ramp Segment Spinner	1	-
7	606046	Slip Installation Assembly	1	-
8	606307	Slip Jack Assembly Tool Assembly	3	-
9	605235	Spanner Wrench	1	1
10	700772	Tool Box	1	-
11	606267	Transport Case Assembly	1	-
12	606306	Wear Guide Lock Socket	1	-
13	700660	2-1/2" Hex Socket	1	1
14	700778	Tape	1	-
15	700779	Eye Bolt	2	-
16	700032	Bolt	6	-
17	606542	Pressure Test Plug External	1	-
18	606560	Installation Rod	1	-
19	606505	Dovetail Mandrel Thread Protector	1	-
20	800020	Tool Bag	1	-
21	800062	Shop Press	1	-
22	606605	Spring Compressor Assembly	1	-



Hoist: -		Torque: -		Pressure: -	
CRITICAL COMPONENT: No					
DO NOT SCALE FOR DIMENSIONS. ALL DIMENSIONS ARE IN INCHES. REMOVE ALL BURRS. RADIUS ALL CORNERS .020 DIA. BREAK ALL SHARP EDGES .020/000 X 45° OR .020/000 R. DRILLED HOLES SHOULD BE ON THE PLUS SIDE OF THE TOLERANCE.					
DECIMAL TOLERANCES		SURFACE FINISH		CONCENTRICITY	
.X = ±.002 FRACTION ± 1/32		MACHINED 250RMS		MACHINED SURFACES OD - ID .010 TIR	
.XX = ±.015 ANGULAR ± 0.50°		STRAIGHT THDS. 125RMS		ID - ID .010 TIR	
.XXX = ±.005 PERPEND. ± 0.25°		TAPERED THDS. 125RMS		OD - OD .010 TIR AS B / MACH. .002 TIR	
					
DWNL	CH	DATE	11/05/2018	Project	DW0003
APPR.	RU	DATE	03/18/2019	Description	Assembly Tools
REV. DWNL	CH	DATE	05/21/2019	Size	DWCRT External
REV. APPR.	RU	DATE	05/22/2019	Part No.	606383
<small>INTERPRET DRAWING PER ASME Y14.5-2009 MATERIAL AND PROCESS SPECIFICATIONS NUMBERS ON THIS DRAWING ARE TO ALWAYS REFERENCE THE LATEST APPROVED REVISION. © 2019 BY DRAWWORKS, L.P. - SOLIDWORKS DEVELOPMENT SPECIAL PARTNER THIS DOCUMENT IS CONFIDENTIAL AND IS THE PROPERTY OF DRAWWORKS, L.P. IT MAY NOT BE COPIED OR REPRODUCED IN WHOLE OR IN PART IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF DW. THIS DOCUMENT ALSO IS AN UNPUBLISHED WORK OF DW. DW OWNS ALL RIGHTS TO THE WORK AND INTENDS TO MAINTAIN THIS WORK CONFIDENTIAL AND AS A TRADE SECRET. DW MAY ALSO SEEK TO PROTECT THIS WORK AS AN UNPUBLISHED COPYRIGHT. THOSE HAVING ACCESS TO THE WORK MAY NOT COPY, USE, OR DISCLOSE THE INFORMATION IN THIS WORK UNLESS EXPRESSLY AUTHORIZED BY DW TO DO SO.</small>				<small>DRY SCALE: 1:24 WBSHT/ISS: n/a</small> REV. G SHEET 1 of 1	

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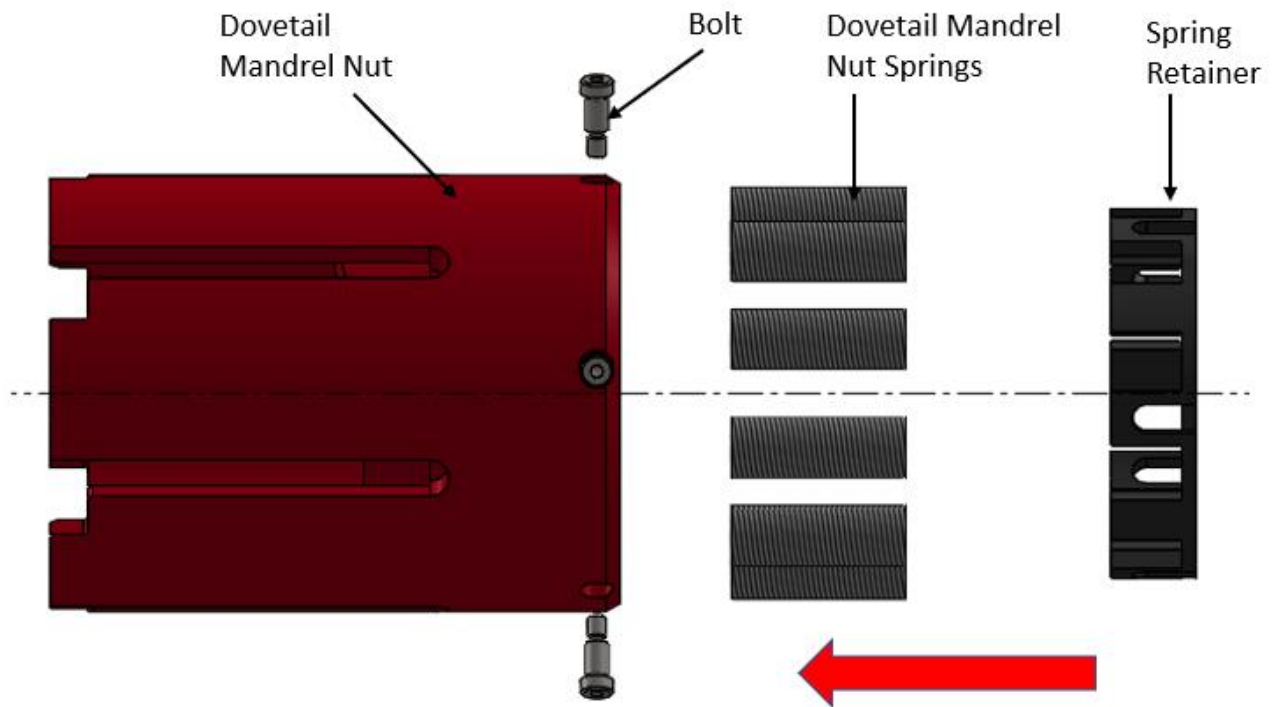
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Section 12 - Assembly - Head

NOTE:

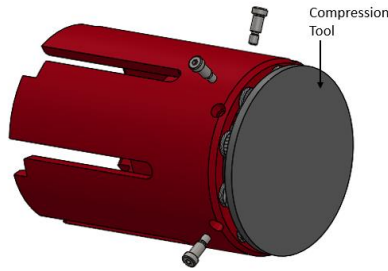
- The DWCRT is modular. Use the correct Mandrel and Mandrel Nut for the tool you are building.
- Refer to Assembly-BOM's for part number, description and quantity.
- Tool Assembly has pinch points. Keep your fingers and hands clear.

1. Load the Dovetail Mandrel Nut with the Dovetail Mandrel Nut Springs. Insert (Qty-10) Dovetail Mandrel Nut Springs into the counterbore holes on the bottom of the Dovetail Mandrel Nut.
2. Lay the Spring Retainer in the groove on the Dovetail Mandrel Nut and over the Dovetail Mandrel Nut Springs. The Spring Retainer should fall over the springs and fit into the groove, as seen below. Be sure the bolts line up with the horseshoe slots.



3. Compress the Dovetail Mandrel Nut Springs and Spring Retainer with a press (~10Ton) or Compression Assembly Tool. Use a flat plate to press all the Dovetail Mandrel Nut Springs and the Spring Retainer down at the same time. [The Force required to compress the springs to install the screws is 5000 lbs. \(2267 kg\) and the force to fully compress the springs is 13,500 lbs. \(6123 kg\)](#)

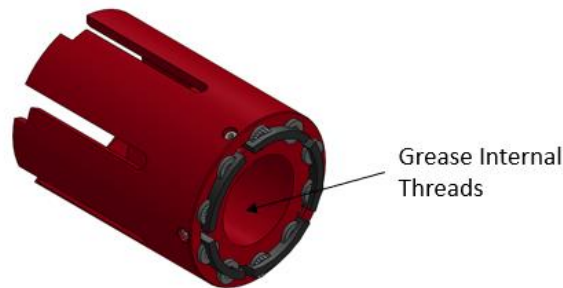
4. Coat the Dovetail Mandrel Nut Bolts with anti-seize. **Refer to DWCRT lubrication and maintenance requirement for more details.** While the Dovetail Mandrel Nut Springs are compressed, insert the Dovetail Mandrel Nut Bolts into the side holes on the Dovetail Mandrel Nut. Tighten the Dovetail Mandrel Nut Bolts. **Refer to Appendix 1.5: Bolt and Set Screw Torque for recommended torque chart.**



5. After locking the Spring Retainer with the Dovetail Mandrel Nut Bolts, the assembly should look as follows.



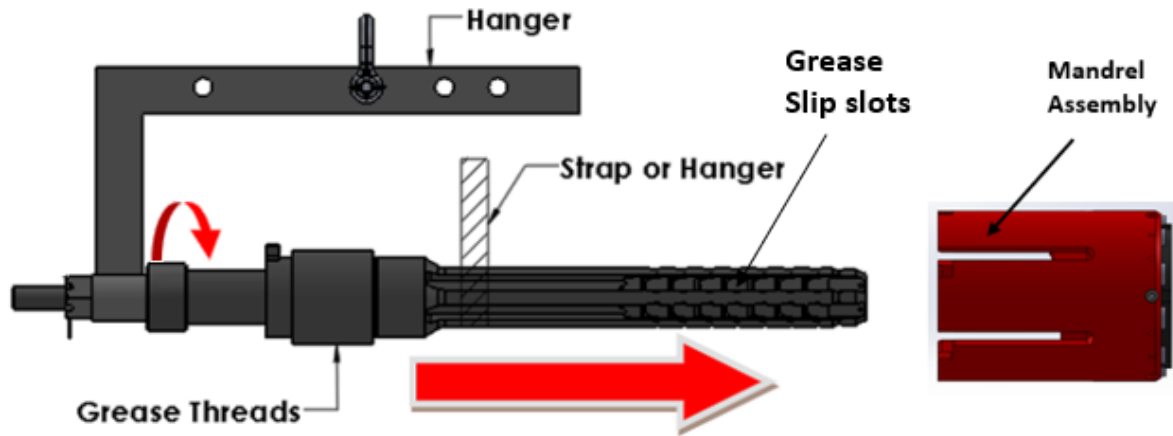
6. Lay the Dovetail Mandrel Nut on the floor or a pallet. Grease (DW Grease, 700053) ID Threads. **Use recommended grease, see DWCRT Lubrication and Maintenance for recommended grease.**



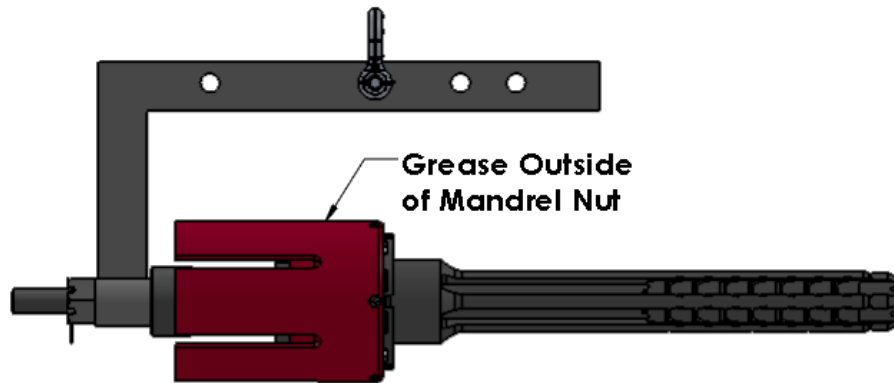
7. Select the Dovetail Mandrel size to be installed in the tool. We will use the 225 Ton 5½" Dovetail Mandrel for the illustration purposes of this assembly example. Refer to the list of different Dovetail Mandrels for size and tonnage ranges. **Refer to Appendix 1.1: Size and Ratings for other Mandrel Sizes.** Insert Polypak Seal into the mandrel with the O-ring facing away from the indicator.



8. Pick up the Dovetail Mandrel with a strap at the pickup point as shown below. Alternatively, use the McCoy L-Shaped Hanger for easier assembly. To use the L-Shaped Hanger, simply attach a crane to the shackle in the correct hole based on tonnage, screw the Hanger's cap onto the Dovetail Mandrel (using clockwise rotation) and pick up the Dovetail Mandrel. Shackle needs to be attached to the appropriate L-Shaped Hanger hole depending on the tool Hoist capacity. Raise the Dovetail Mandrel approximately 12" off the floor and grease (DW Grease, 700053) the threads / Slip slots. **Refer to DWCRT Lubrication and Maintenance requirement for more details.**

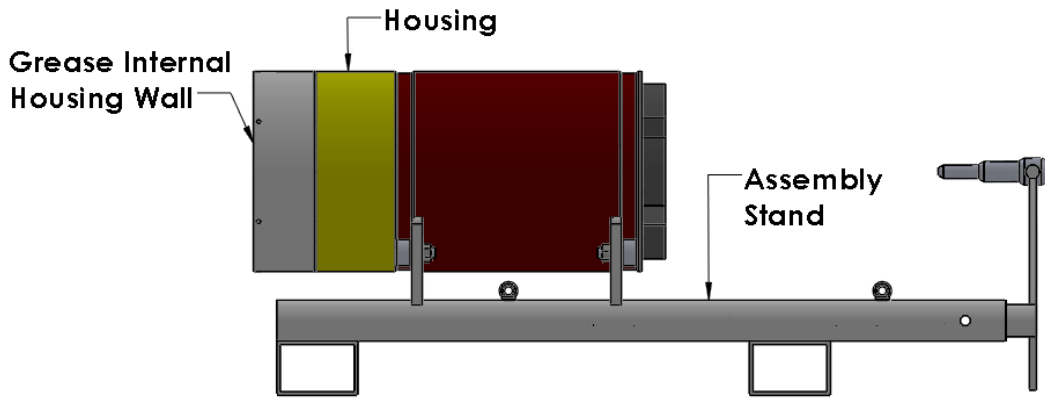


9. Slide the Dovetail Mandrel into and screw together with the Dovetail Mandrel Nut until completely made up. Use multi-purpose grease on the outside of the Mandrel nut.

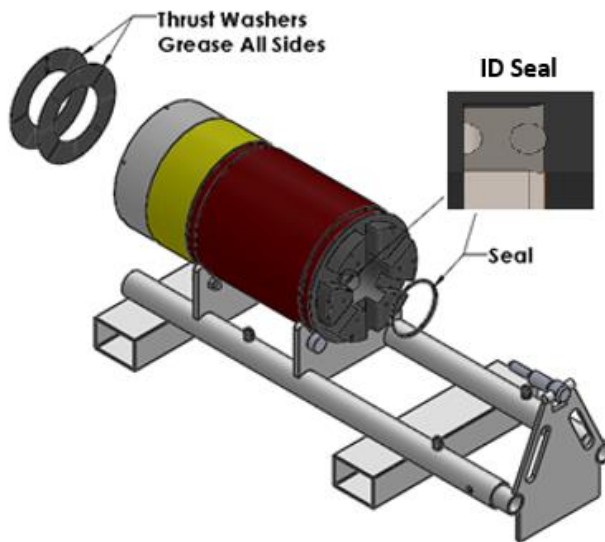


10. Now, lay the Housing on its side. While the tool may be assembled on the floor or on a pallet, utilize the McCoy CRT Assembly Stand for easier assembly. To do this, lay the Housing on the McCoy CRT Assembly Stand with the Indicator end facing away from the sliding triangle on the stand, as shown below. Use multi-purpose grease on the internal housing wall.

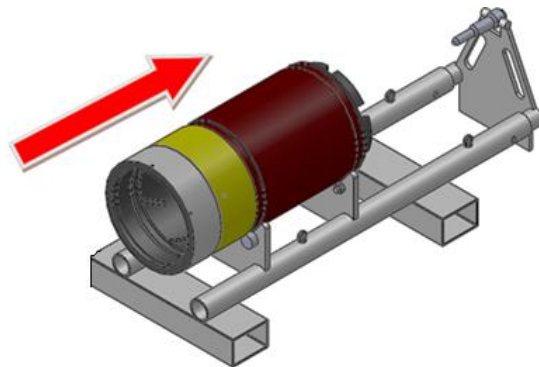
Warning: Strap the Housing to the Assembly Stand.



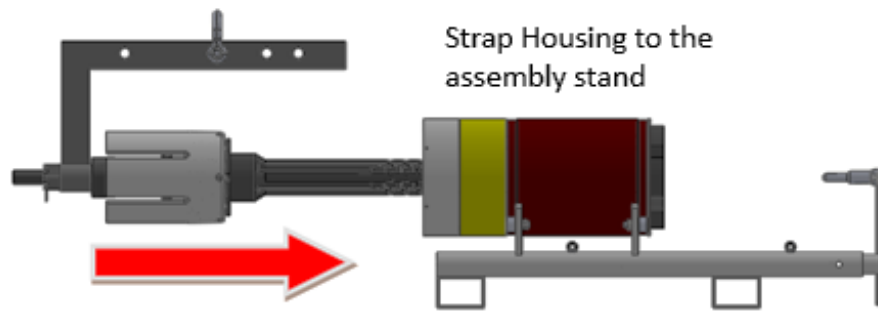
11. Use multi-purpose grease and insert the Housing ID Seal into the ID groove on the Housing. Orient the Housing ID Seal as shown in figure away from white painted end.
12. Thin grease all sides of both Thrust Washers using white lithium grease. Do not use any grease other than white lithium grease.



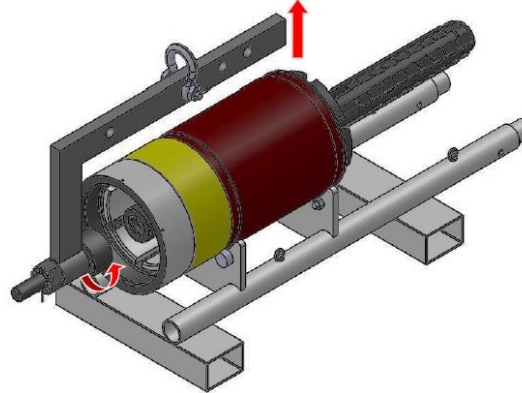
13. Insert both Thrust Washers into the Housing from the Indicator side. Make sure the internal housing wall has been thoroughly greased before insertion of the Thrust Washers.



14. (If assembling an external tool, ensure the Thread Protector is installed on the Mandrel prior to insertion in the Housing). Insert the Dovetail Mandrel subassembly into the Housing. Make sure the subassembly is inserted completely such that the Dovetail Mandrel Nut butts up to the Thrust Washers.

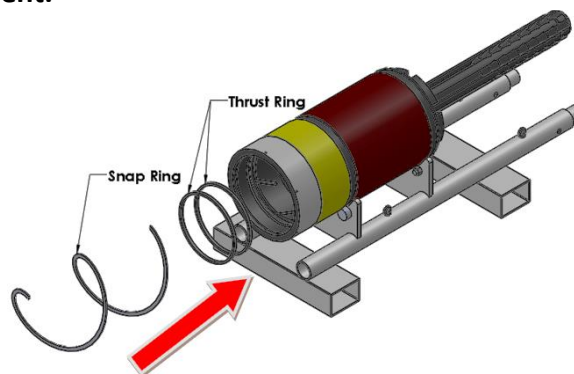


15. Once the Dovetail Mandrel subassembly is inserted into the Housing, the L-Shaped Hanger may be removed using counter-clockwise rotation. **Hint:** lifting on the end of the hanger tends to help in the Hanger removal process. Continue seating the mandrel against the thrust washers.

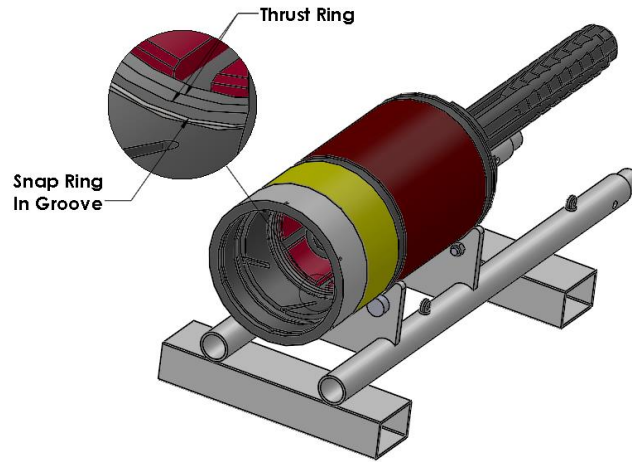


16. Use multi-purpose grease on the (Qty-2) Thrust Rings. Lock the Dovetail Mandrel subassembly into the Housing with (Qty-2) Thrust Rings followed by (Qty-1) Snap Ring. **Hint:** The Snap Ring is a spiral ring and can be installed easily by starting one end of the ring in the groove and rotating the ring until it seats completely, as illustrated below.

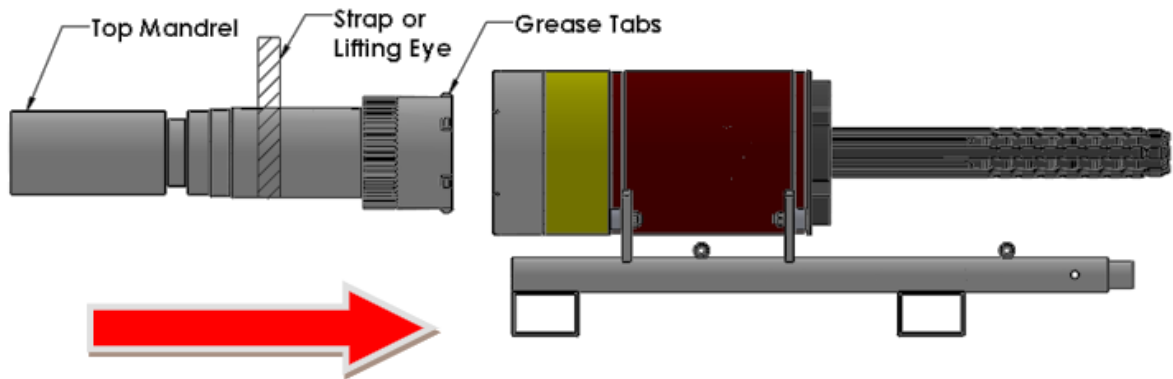
NOTE: If the Dovetail Mandrel is not coaxial with the housing, the Dovetail Mandrel Nut can move into the snap ring groove and prevent installation of the snap ring. Supporting the end of the Dovetail Mandrel can correct axial misalignment.



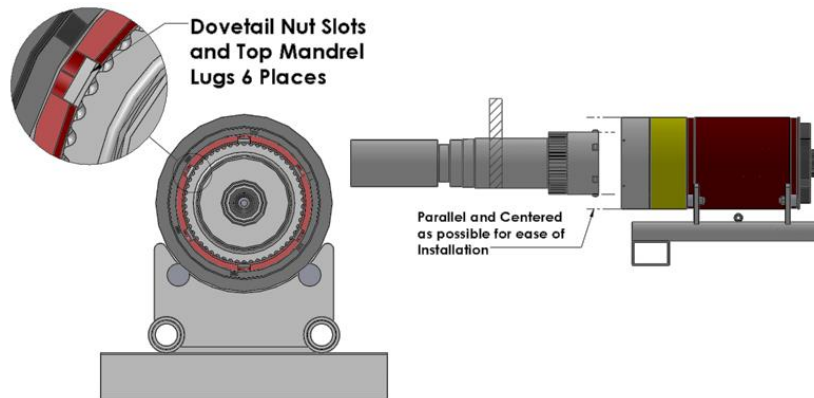
17. Once the (Qty-2) Thrust Rings (*If applicable*) and the Snap Ring are installed, verify that the Snap Ring is directly on top of the Thrust Rings as shown below (*If not applicable the snap ring will be directly on top of the Dovetail Mandrel Nut*).



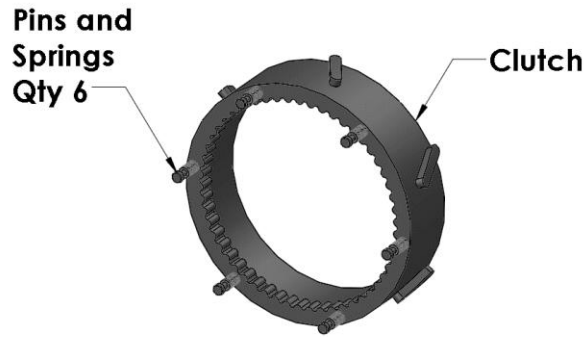
18. Apply multi-purpose grease on Top Mandrel lugs and splines. Pick up with a strap or a lifting eye and insert the Top Mandrel into the Housing. The Top Mandrel is offered in various tool joints. Rotate Top Mandrel to align with Dove Tail Mandrel Nut slot.



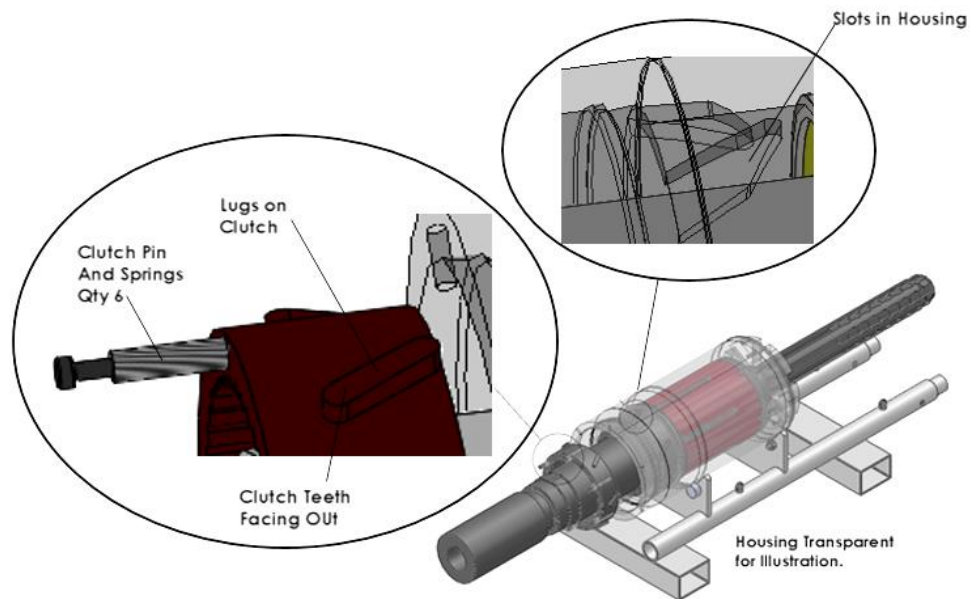
19. When inserting the Top Mandrel, line up the 6 tabs on the Top Mandrel's OD with the 6 slots of the Dovetail Mandrel Nut. Once lined up, the Top Mandrel may slide into the Housing. **Hint:** The Spiral Ring covers some of the Housing ID. This causes tight clearances while inserting the Top Mandrel. It is crucial that you have the Top Mandrel and the Housing as coaxial as possible.



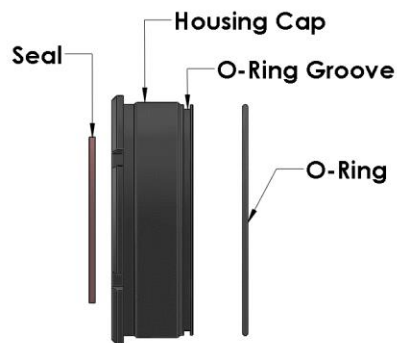
20. Apply multi-purpose grease on Clutch, Clutch Pins and Clutch Spring. Insert (Qty-6) Clutch Springs and (Qty-6) Clutch Pins into the Clutch.



21. Orient the Clutch such that the Clutch Springs face towards the tool joint (If applicable). Orient the Clutch so that the engraving “This Side Up” faces towards the tool joint. Slide the Clutch over the Top Mandrel all the way into the ID of the Housing. The OD lugs on the Clutch will fit into and engage the angled slots on the ID of the Housing.



22. Install the Housing Cap O-Ring in the O-ring groove on the OD of the Housing Cap. Make sure to apply multi-purpose grease on the O-ring and the O-ring groove.

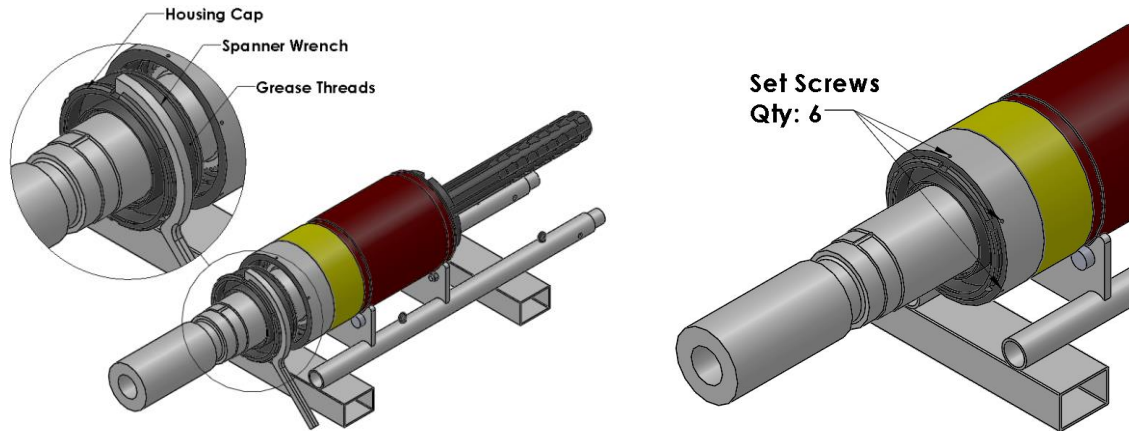


23. Place the Wiper Seal in the ID of the Housing Cap. Make sure Wiper Seal is completely in by applying pressure during installation.



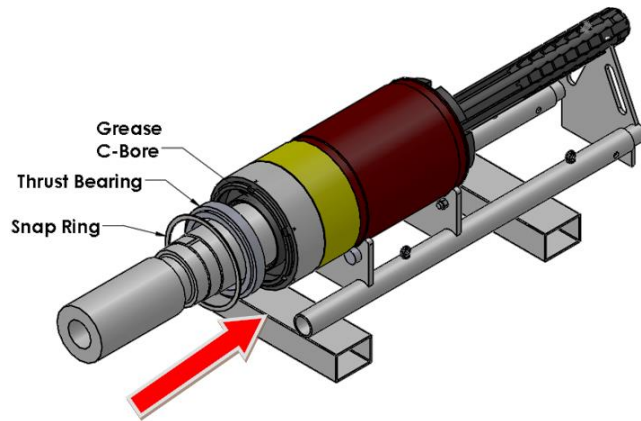
24. Use multi-purpose grease on the threads on the Housing Cap and place the Housing Cap over the Top Mandrel. Slide the Housing Cap over the Top Mandrel and screw the Housing Cap into the Housing. **Hint:** The seal may contact the Top Mandrel OD threads. You may need to use a rubber mallet to help get passed the OD threads. Also make sure Housing Cap is centered with the Top Mandrel while passing through the thread.

25. Use the McCoy Spanner Wrench to screw the Housing Cap into the Housing until cap shoulders. The Housing Cap is required to be rotated few degrees counterclockwise to align the set screw holes in the Housing. Grease Set Screws with anti-seize compound. Install and tighten (Qty-6) Set Screws into the screw holes on the OD of the Housing to lock the Housing Cap to the Housing. **Refer to Appendix 1.5: Bolt and Set Screw Torque for recommended torque chart.**

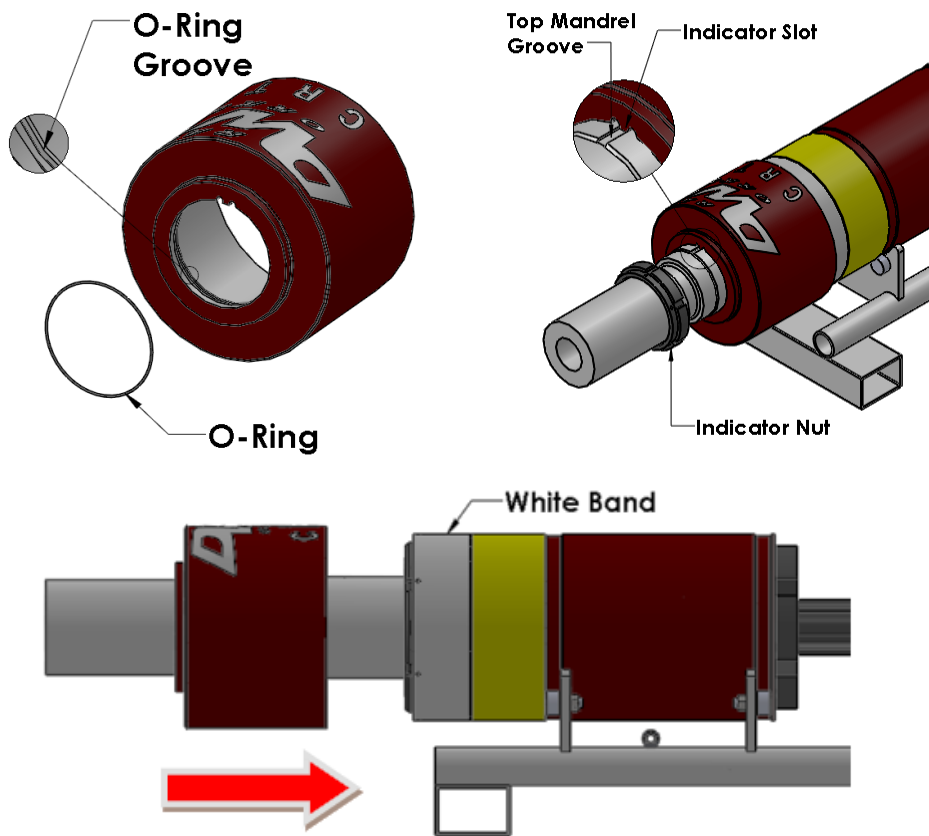


26. Grease the counterbore groove on top of the Housing Cap. Apply multi-purpose grease to complete OD of the Thrust Bearing for corrosion resistance and slide over the Top Mandrel into the Housing Cap counterbore groove.
27. Retain the Thrust Bearing by installing a Snap Ring in the Housing Cap groove just above the Thrust Bearing.

Hint: The Snap Ring is a spiral ring and can be installed easily by starting one end of the ring in the groove and rotating the ring until it seats completely, as illustrated.

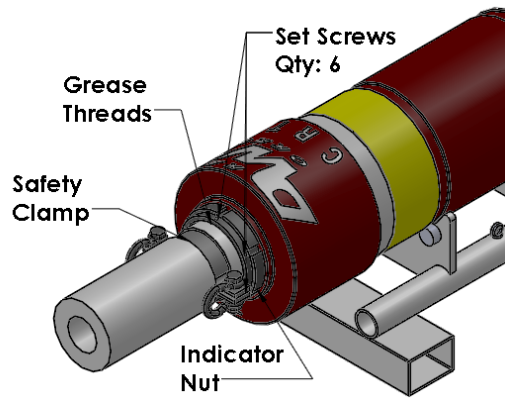


28. Prior to installing the Indicator, clean the white band. Install the O-Ring, in the O-Ring groove on the Indicator. Slide the Indicator over the Top Mandrel, Thrust Bearing, and Housing Cap. Orient the Indicator's tab to the slot in the Top Mandrel. If the Line is already on the Housing and the Indicator, make sure they are lined up during assembly.

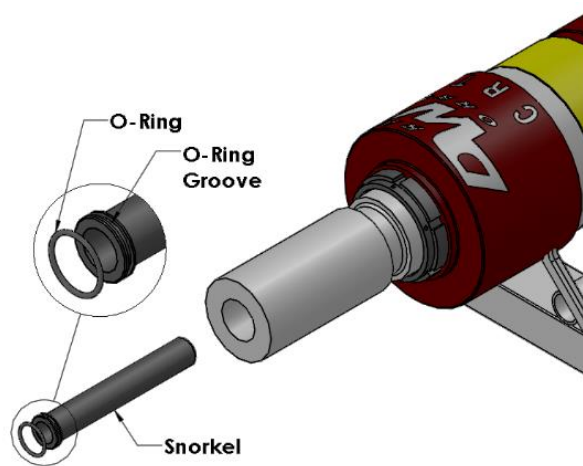


29. Apply multi-purpose grease on the OD threads of the Top Mandrel and screw on the Indicator Nut. This locks the Indicator to the Top Mandrel.

30. Anti-seize Set Screws and Insert (Qty-6) into the screw holes on the Indicator Nut and tighten to specified torque. Install Safety Clamp. **Refer to Appendix 1.5: Bolt and Set Screw Torque for recommended torque chart.**



31. Apply multi-purpose grease on the Snorkel's O-ring groove and install the O-ring. Push the Snorkel into the ID of the Top Mandrel through the tool joint.



Valve Requirements:

Operators running casing sizes 4½" to 5½" who require a valve should install a C-Series Valve (part# 602870) which provides a flow rate of 6 bbl/min.

Operators needing higher flow rates to run casing sizes 7" to 20", skip down to step 34 to install a Spacer Sleeve

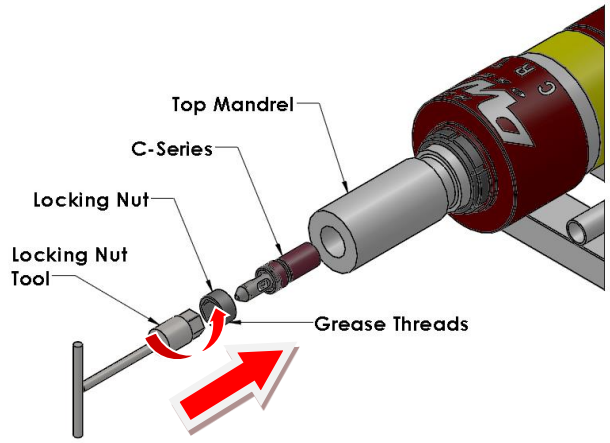
(part# 605113) instead of the C-Series Valve (part# 602870).

Higher flow rates can be achieved but are not recommended as accelerated wear may occur on the ID of the tool.

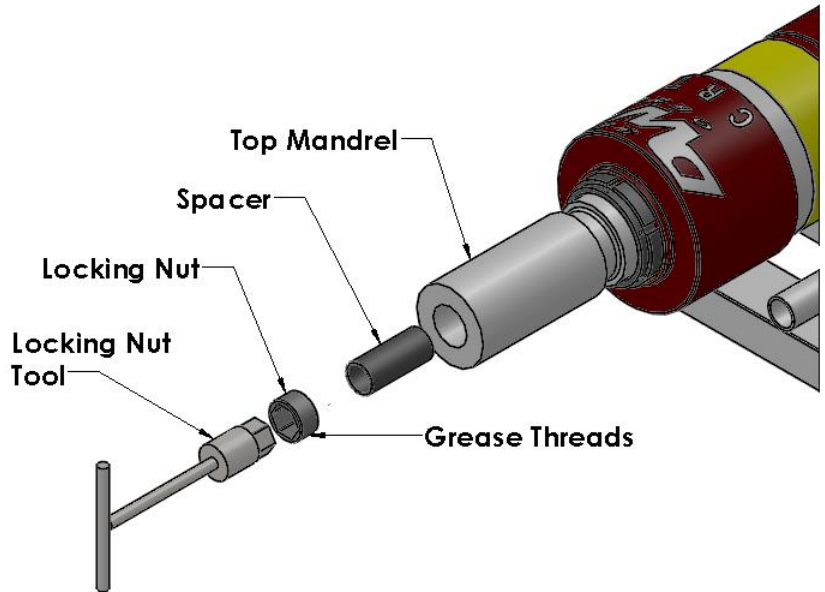
32. Grease the OD of the optional C-Series Valve and orient as shown below. Insert the C-Series Valve into the Top Mandrel until the valve flush mounts the Snorkel.

33. Grease the OD of the Locking Nut. Secure the C-Series Valve and Snorkel in place with the Locking Nut. The Locking Nut is left-hand threaded; rotate counterclockwise to set the nut. The McCoy C-Series Locking Nut Tool is required to install the Locking Nut.

NOTE: Make sure the Locking Nut is tightened to atleast 250 ft-lb. The tool may fill with mud if the Locking Nut is not tight, which may prevent the tool from releasing the casing.



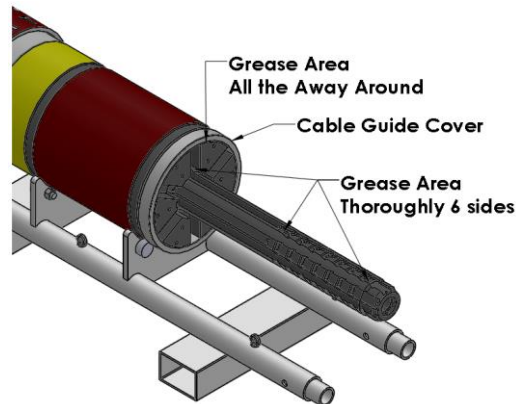
34. Higher flow rate operation: If you are running Casing sizes 7" to 20", insert the Spacer Sleeve instead of the C-Series Valve to protect the sealing area where the C-Series Valve sits. If you would like to install a valve, attach the Shorty AutoValve™ below the Circulator for higher flow rates.



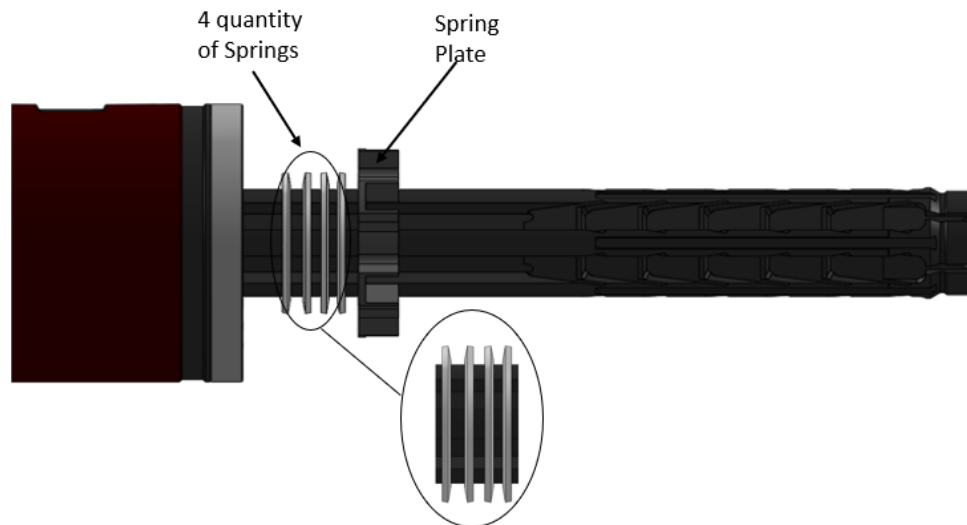
Section 13 - Assembly – Internal Grip

NOTE: The DWCRT is modular. Use the correct Dovetail Mandrel and Mandrel Nut for the tool you are building. For illustration purposes, multiple internal DWCRT Dovetail Mandrels are depicted below)

1. Apply multi-purpose grease on the ID of the Cable Guide Cover completely, Safety Ring or Attachment Ring such that it can rotate freely on the Housing. Install the Cable Guide Cover, Safety Ring or Attachment Ring over the OD groove of the Housing as shown below.
2. Grease (DW Grease, 700053) all the Dovetail Mandrel's dovetail grooves with light even grease. Refer to DWCRT lubrication and Maintenance section for more details. The dovetail grooves are very critical areas and McCoy recommends to re-grease these areas after every job.



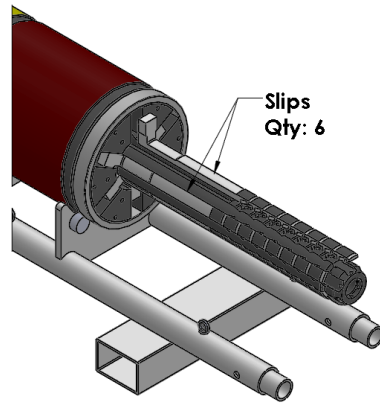
3. This step is only applicable for Gen 2. Apply multi-purpose grease on the spring plate. Insert 4 quantity of springs into the housing assembly along with Spring Plate. Note the directions of springs, the smaller diameter must face the indicator on the 1st spring, with alternating directions for the next 3.



Warning: When installing the slips be sure that they do not fall out of the track. The bump plate holds the slips to the housing but may need to be held by hand until the bump plate is installed.

4. Line up the dovetails of a Slip with the dovetail grooves of the Dovetail Mandrel. Insert a Slip by sliding the Slip towards the Head of the CRT. Repeat this for all (Qty-6) Slips. **Refer to Appendix 1.1: Size and Ratings for slip sizes and the Dovetail Mandrels they can be used in.** Each casing size has its own set of slips.

NOTE: On DWCRT All casing sizes from 9-5/8" to 20" use the Base Slip, DWCRT1K all casing sizes from 13-3/8"-26" use the Base Slip.



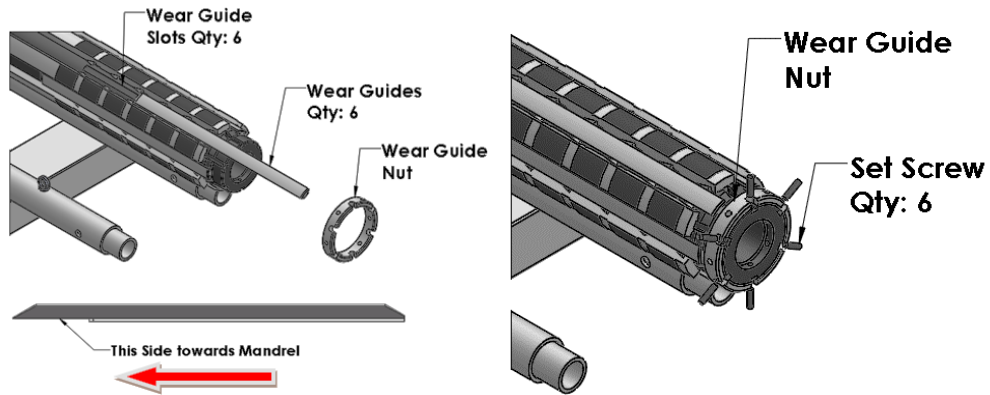
5. Bolt Spring Compression Tool to hold the Slips, Springs and Spring Plate. Place the Bump Plate on the Dovetail Mandrel and partially slide towards the Housing.



6. Remove Spring Compression Tool and insert the (Qty-6) Bump Plate Springs in the countersunk holes of the Bump Plate before seating the Bump Plate against the Housing. Apply anti-seize lubricant and bolt Bump Plate to the housing. Recheck bolt torque as per **Appendix 1.5: Bolt and Set Screw Torque** after all bolts are tightened and shouldered. Bolts should be torqued in an alternating pattern to ensure even force is applied on the Bump Plate.

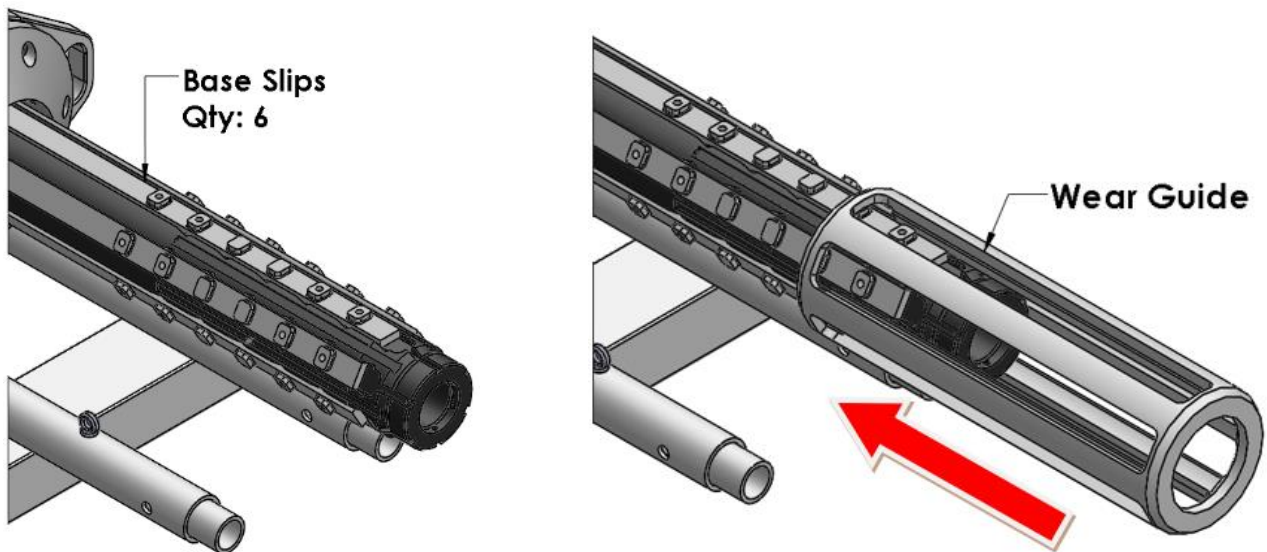


7. 7-5/8" & 8-5/8" Dovetail Mandrels require Wear Guides. Grease slots and slide (Qty-6) Wear Guides in the slots as shown below.
8. Grease the threads of the Wear Guide Nut and screw onto the threads at the lower end of the Dovetail Mandrel to lock the Wear Guides in place.
9. Anti-seize Set Screws. Bolt (Qty-6) Set Screws into the Wear Guide Nut to secure the Wear Guide Nut. *Refer to Appendix 1.5: Bolt and Set Screw Torque for recommended torque chart.*

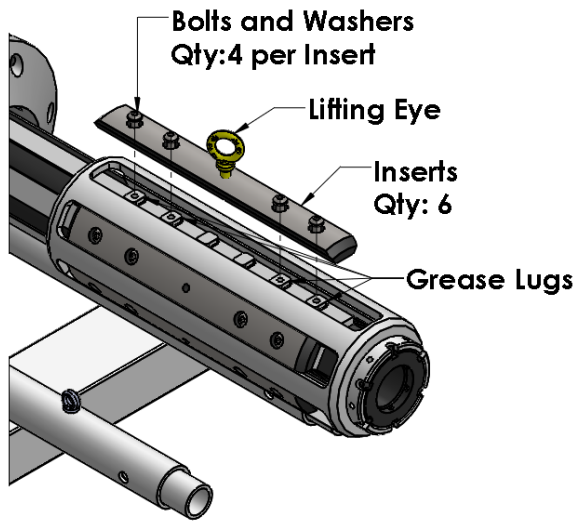


Note: For 450 T Tool sizes from 9-5/8" to 20" Base Slip are used. Also 1000 T Tool sizes from 13-3/8" to 26" Base Slip are used. Base Slip uses bolt on inserts. Below are the steps for using Base Slip with Inserts.

10. Apply multi-purpose grease on the Wear Guide slots and slide on the Wear Guide.



11. Apply multi-purpose grease to the lugs of the Base Slips. Bolt on the Insert needed for the size of the Casing being run.



12. Repeat step 8 and 9 to complete installing Wear Guide Nut and Set Screws.

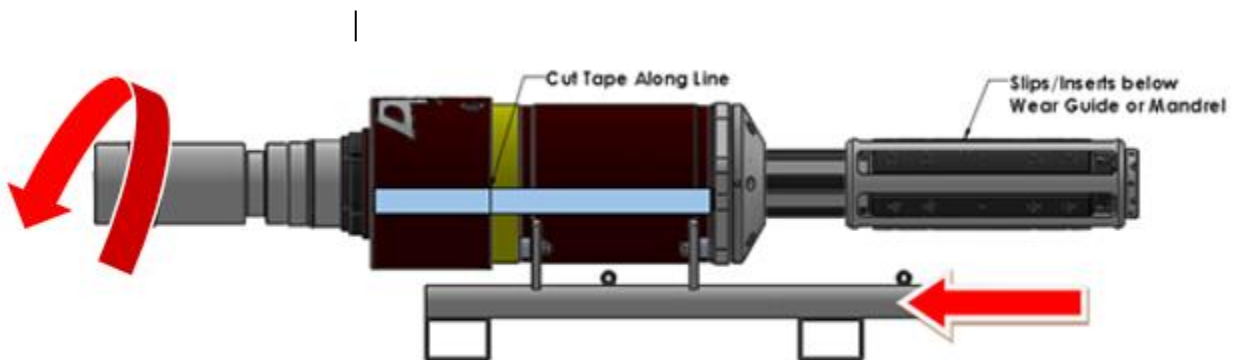
13. Now put the Line on the Indicator and the Housing. First, push the Top Sub and Indicator all the way down. Next, rotate both the Top Sub and the Indicator counterclockwise (when viewed from Mandrel side) until you hear a mechanical stop (audible click).

Warning: Loosen strap on the housing while rotating.

This should be the fully retracted position of the DWCRT. Two ways to verify that you are fully retracted are: 1) Slips/Inserts will be below the Dovetail Mandrel/Wear Guide. 2) Continued rotation will cause the Housing to rotate as well.

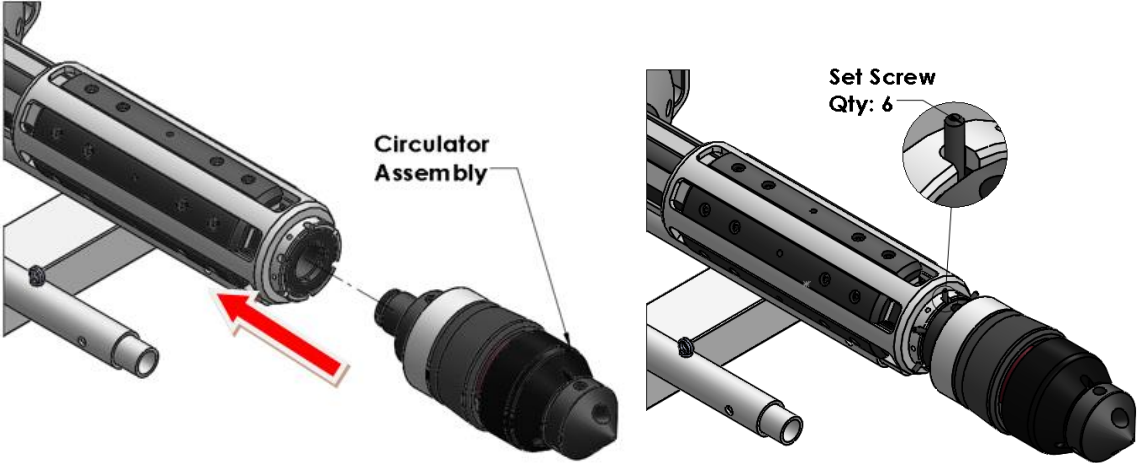
Note: If there is any increased resistance when releasing the tool before the internal stop is met, contact technical support. The hand operated break out activation needs to be smooth, uniform and continuous. Any additional torque during break out process may result in issues fully releasing the tool at the Rig.

Remove existing tape/paint on the indicator. Use silver duct tape to make a line straight down the side of the Indicator and Housing. Cut tape at Indicator and housing.



14. Screw greased Circulator Assembly into the bottom of the Dovetail Mandrel to 150 ft-lb torque (see following page for information on constructing the Circulator Assembly).

15. Anti-seize Set Screws. Insert the Set Screws corresponding to the selected Circulator Assembly. **Refer to Appendix 1.5: Bolt and Set Screw Torque for recommended torque chart.**

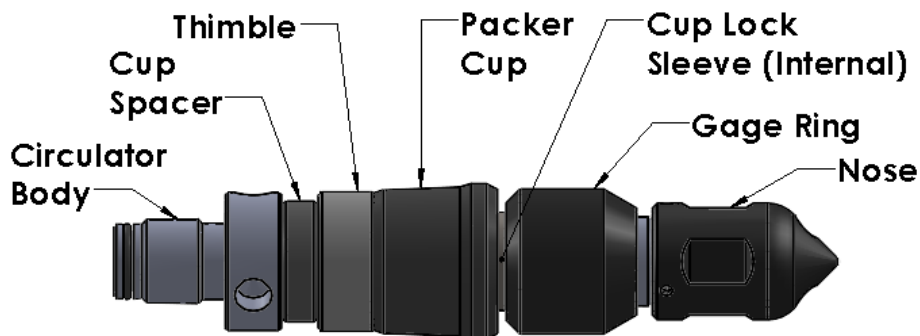


Section 14 - Assembly – Internal Circulator

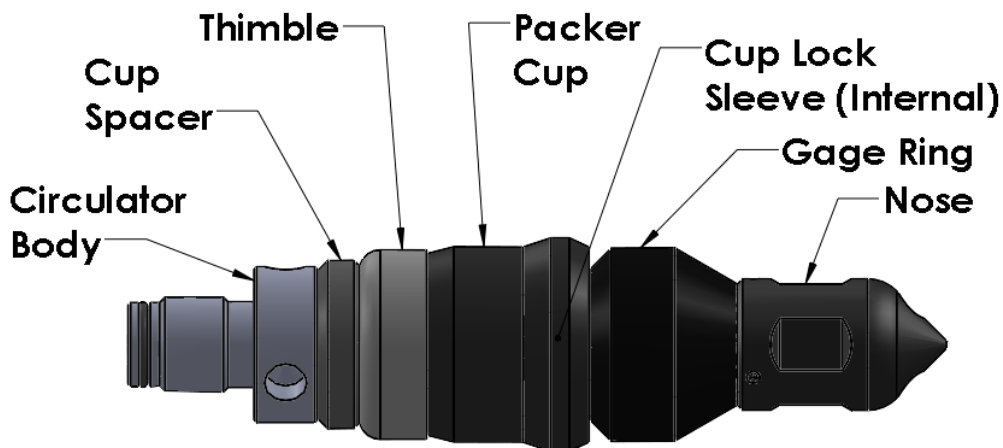
1. Grease and install an O-Ring in the groove on either end (Qty-2) of the Circulator Body.
2. Slide the Cup Spacer onto the Circulator Body until it shoulders.
3. Grease and insert an O-Ring (if required) into the ID groove on the Thimble.
4. Slide the Thimble (if applicable) onto the Circulator Body so it sits just on top of the Cup Spacer.
5. Insert a greased O-Ring into the ID groove on the Packer Cup and slide the Packer Cup onto the Circulator Body.
6. Slide the Cup Lock Sleeve onto the Circulator Body so it seats into the Packer Cup.
7. Slide the Gage Ring onto the Circulator Body.
8. Grease and thread on the Circulator Nose (the Circulator Nose are left-hand threaded). Tighten with a pipe wrench / spanner wrench to 250 ft-lb.
9. Install (Qty-3) Set Screws in the Circulator Nose’s set screw holes.

NOTE: Refer to drawing BOM for appropriate parts list

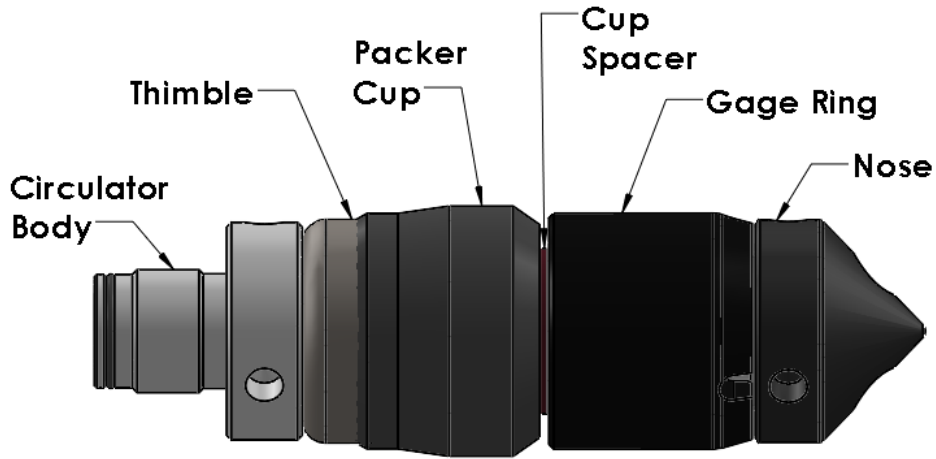
14.1 4-1/2” to 5” Circulator Assembly



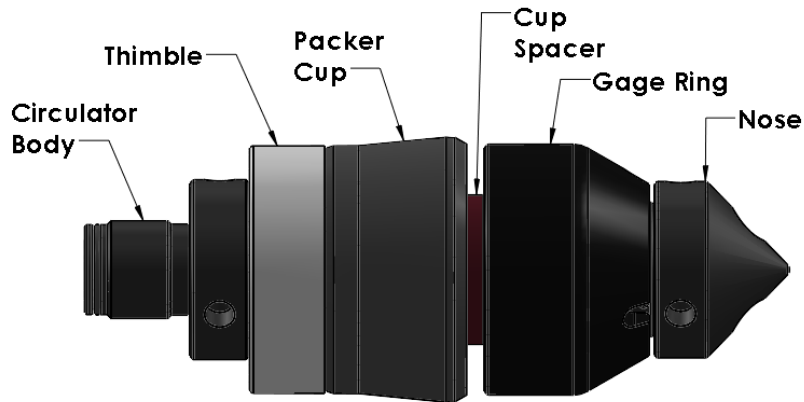
14.2 5-1/2” Circulator Assembly



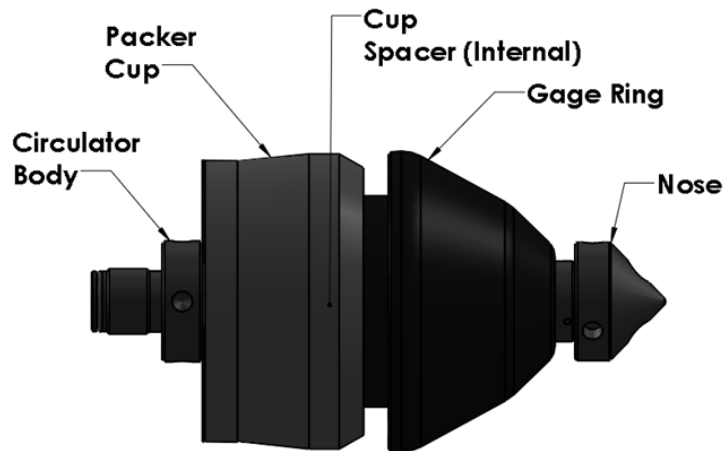
14.3 7" & 7-5/8" Circulator Assembly



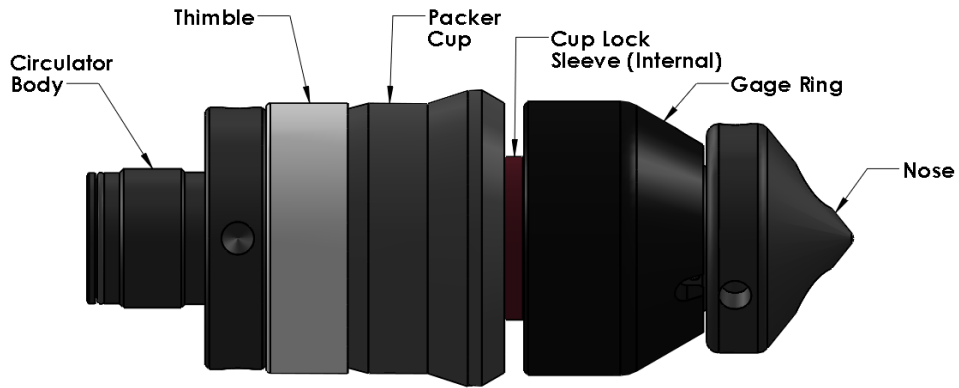
14.4 8-5/8" to 13-3/8" Circulator Assembly



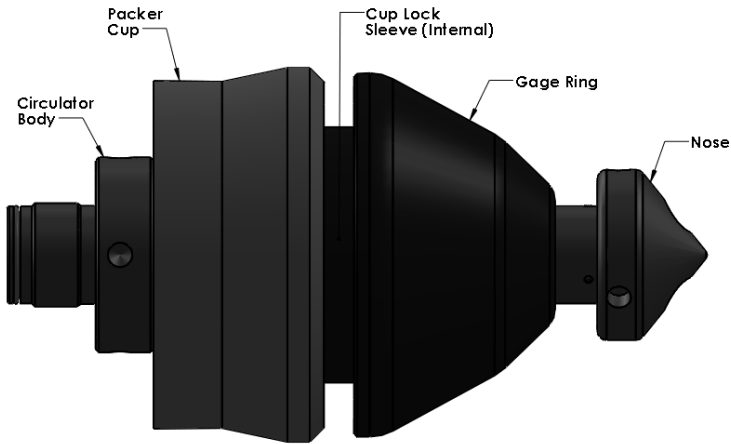
14.5 16"-20" Circulator Assembly



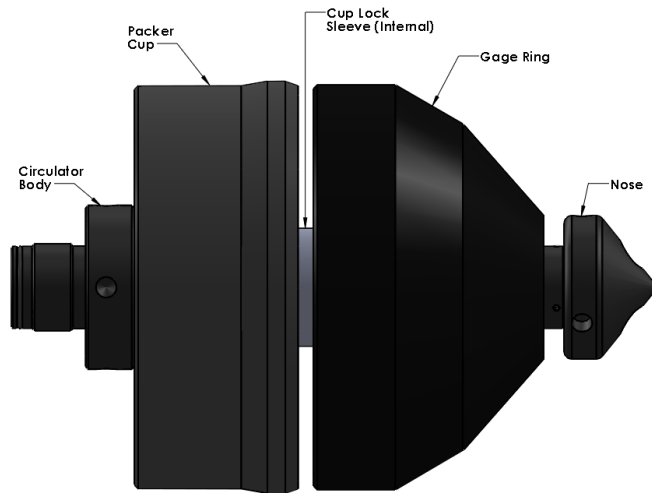
14.6 9-5/8" & 13 3/8" Circulator Assembly (1000 Ton)



14.7 16"-20" Circulator Assembly (1000 Ton)

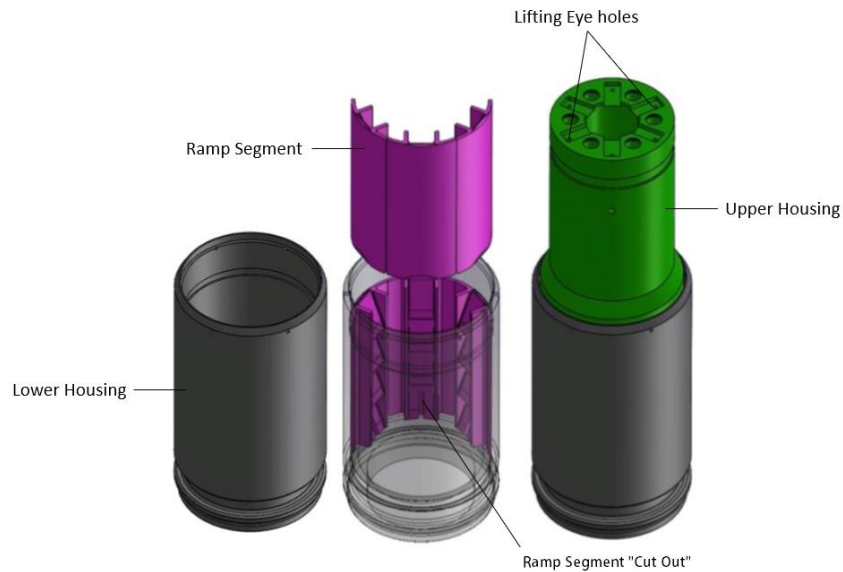


14.8 22"-26" Circulator Assembly (1000 Ton)

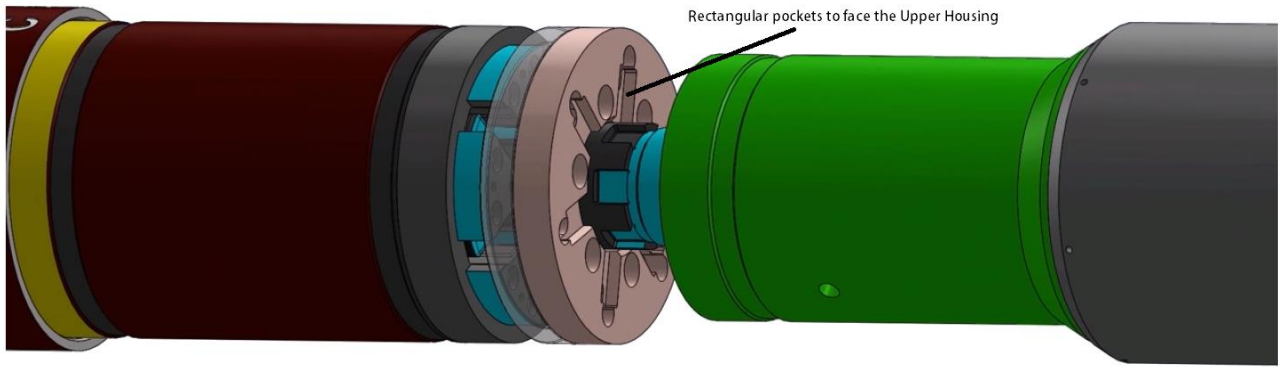


Section 15 - Assembly – External Grip

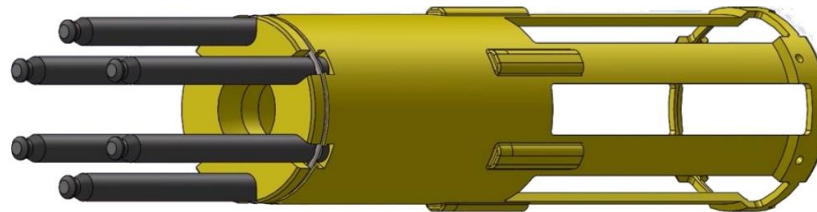
1. Stand up Lower Housing vertically. Grease the ID and the ID thread.
2. Insert 6 Ramp Segments into Lower Housing. Ensure they are installed in the correct orientation with cut out facing down as shown below.
3. Lift Upper Housing using 2 lifting eyes. Place the Upper Housing onto the Lower Housing. Thread the Upper Housing to the Lower Housing until the Upper Housing shoulders (very lightly).



4. Apply anti-seize to and install the 6 set screws into the Lower Housing. The set screws will likely not seat all the way. If the set screws don't fully seat, back off the Upper Housing slowly. Within 15 degrees, the set screws will align over their associated pockets in the Upper Housing. Stop backing-off the Upper Housing and fully set the set screws.
5. Ensure the Mandrel is in the fully "released" position (lugged out on the Mandrel Nut) by rotating the indicator counterclockwise until the Mandrel is in the fully released position. Ensure the Safety Ring and Bump Plate are in place on the Mandrel and that the Bump Plate is oriented correctly. Remove Mandrel thread protector and grease the thread. Thread the Gripping Assembly to the Mandrel and lightly shoulder.

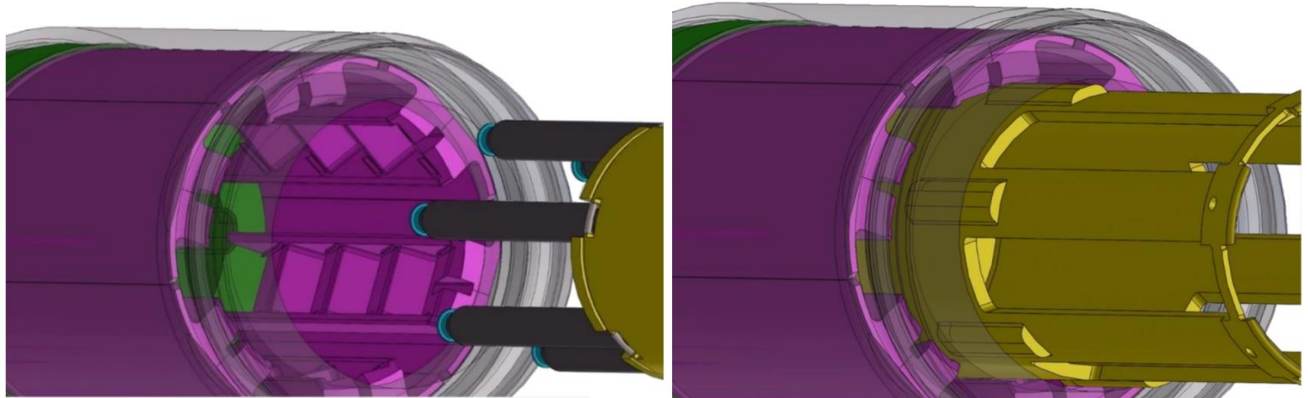


6. Grease Rods and Basket. Insert the Rods into the Basket and secure the Rods with O-Ring (rubber band).

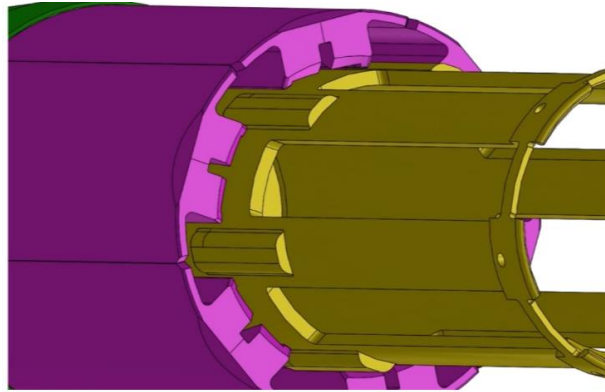


7. The lugs that protrude from the body of the Basket are timed to the Rods. The Rods can't be seen once the Basket is inserted into the Lower Housing. In order to ease the assembly, utilize the Ramp Segment Spinner, a socket extension, and a breaker bar or socket wrench to rotate the ramp segments. Align the holes in the Upper Housing with the cavities formed between each pair of Ramp Segments.

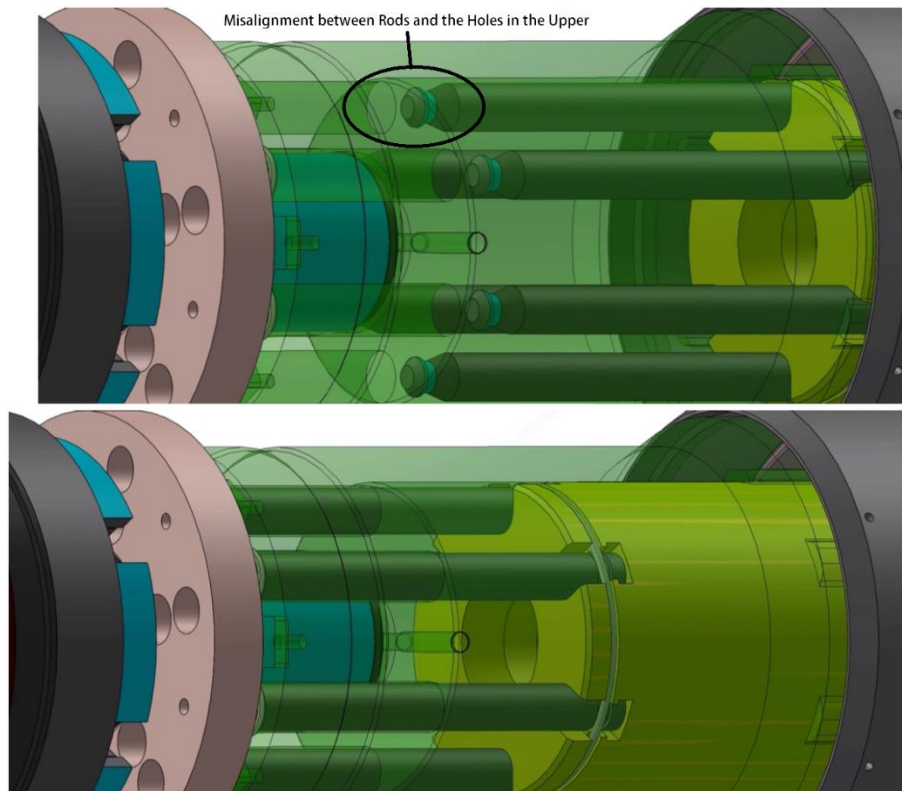
8. Insert Basket Assembly into the Lower Housing.



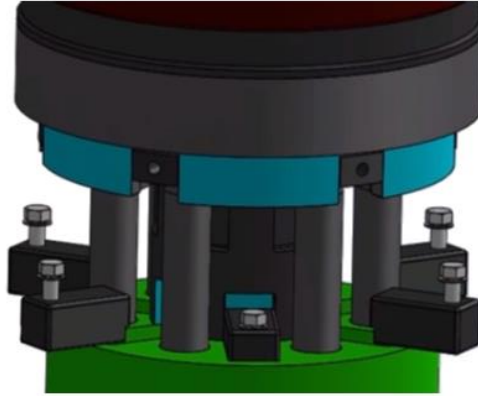
9. Rotate Basket Assembly until the Basket's lugs align with the cavities formed between each pair of Ramp Segments.



10. Insert the Basket until the Rods meet or slightly protrude from the Upper Housing. If proper alignment wasn't achieved in step 7, the Rods may bottom out inside the Upper Housing. If this occurs, rotate the Basket (and by extension the 6 Ramp Segments as the Ramp Segments are splined to the lugs of the Basket) until the Rods align with the holes in the Upper Housing. Finish inserting the basket into the Upper Housing until the tips of the Rods meet or slightly protrude from the Upper Housing.

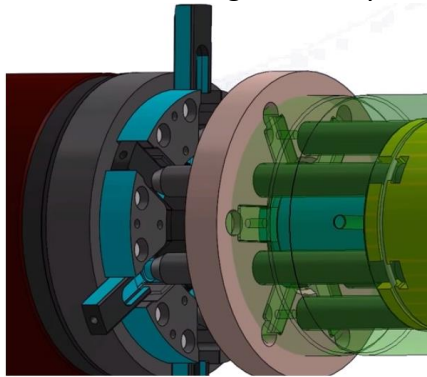


11. Back off the Gripping Assembly from the Mandrel until the Keys can be inserted between the Mandrel and the Upper Housing (up to a sixth revolution). Install the Keys with Nord-lock Washers. A ratcheting box end wrench may ease installation.



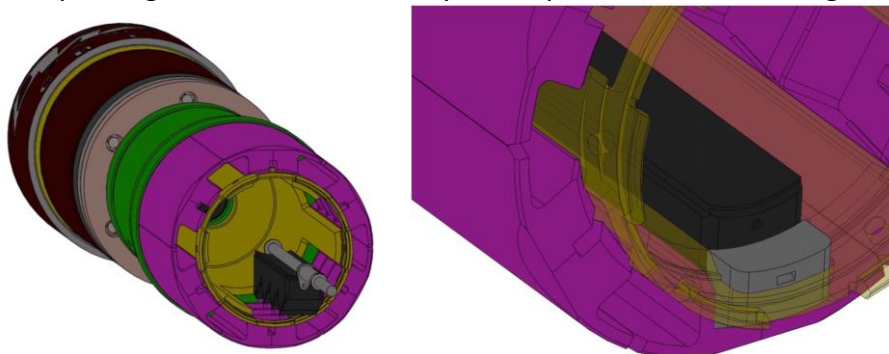
(Bump Plate and Safety Ring not displayed)

12. Insert the Rods into the relief cuts at the bottom of the Housing. The Gripping Assembly may need to be rotated slightly if the Rods don't align with the reliefs.
13. Slide the Safety Ring off of the Housing and onto the rods. Grease and install the 6 Rod Heads. Slide the Safety Ring off of the Rods and back onto the Housing to radially retain the Rod Heads.

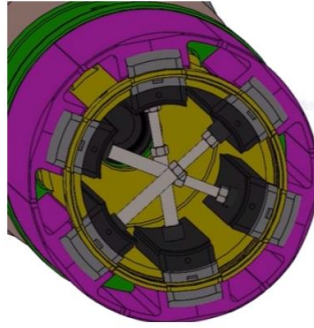


(Safety Ring not shown)

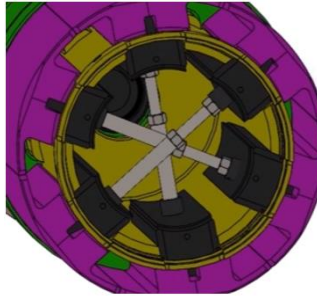
14. Insert the Bump Plate Springs into the Bump Plate. Bolt the bump plate to the Housing with Nord-Locks.
15. Lubricate and install the Slips using the Slip Insertion and Removal Tool. After installing a Slip, retain the Slip with a Magnetic Slip Wedge. Rotate the assembly and repeat for the remaining 5 Slips.



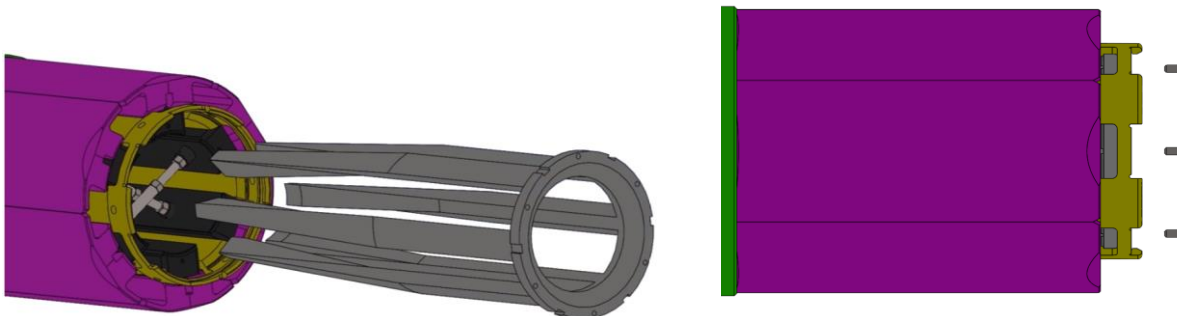
16. Install the 3 Slip Jacks (steel body with plastic ends) between the three sets of opposing Slips. Snug by hand. **Warning: Do not remove the Magnetic Slip Wedges without first installing the Slip Jacks or the slips may fall out and cause damage to the slip teeth, the tool, and/or the technician.**



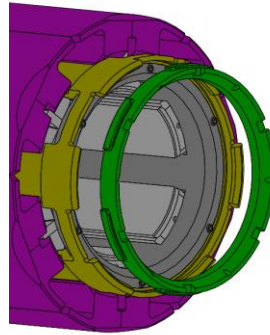
17. Remove the 6 Magnetic Slip Wedges by lightly prying out with a flat head screwdriver.



18. Grease and insert the Wear Guide. Firmly seat the Wear Guide to the Basket. Anti-seize the Wear Guide Set Screws. Thread the 6 Set Screws into the Wear guide until they are protruding between 0.015" and 0.050".



19. Grease the Wear Guide Lock. Insert the Wear Guide Lock into the basket. Rotate the Wear Guide Lock clockwise 15 degrees until the Wear Guide Lock lugs out on the Wear Guide Set Screws. If the Wear Guide Lock does not turn freely in the basket (10 ft-lb max), partially set the tool (rotate the top mandrel in the unlocked position ~20 degrees). Back off the Wear Guide Set Screws into the Wear Guide Lock by inserting an Allen Wrench or Allen Socket through the hole in the Wear Guide Lock.



20. Remove the 3 Slip Jacks.

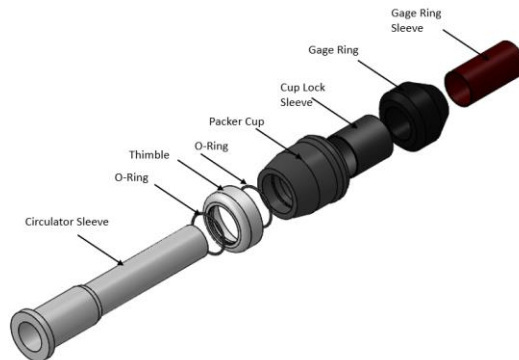
21. Grease Circulator Sleeve.

22. Insert O-Ring and Slide Thimble, Packer Cup, Cup Lock Sleeve, Gauge Ring and Gauge Ring Sleeve onto Circulator Sleeve. This forms a Circulator Cartridge Assembly.

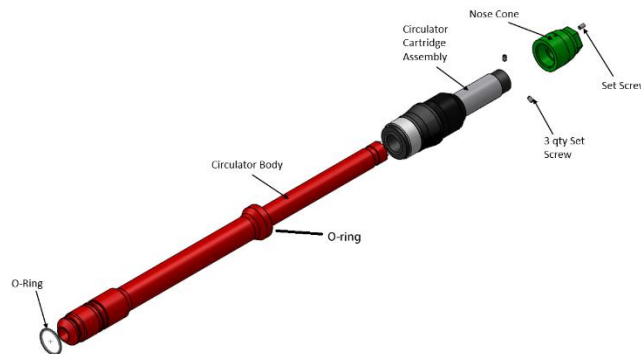
23. Grease and install the two O-rings onto the Circulator Body. Slide the Circulator Cartridge Assembly onto the Circulator Body.

24. Grease Nose Cone. Thread the Nose Cone onto the Circulator Body until snug. Anti-seize and install the three radial Set Screws into the Nose Cone.

Circulator Cartridge Assembly

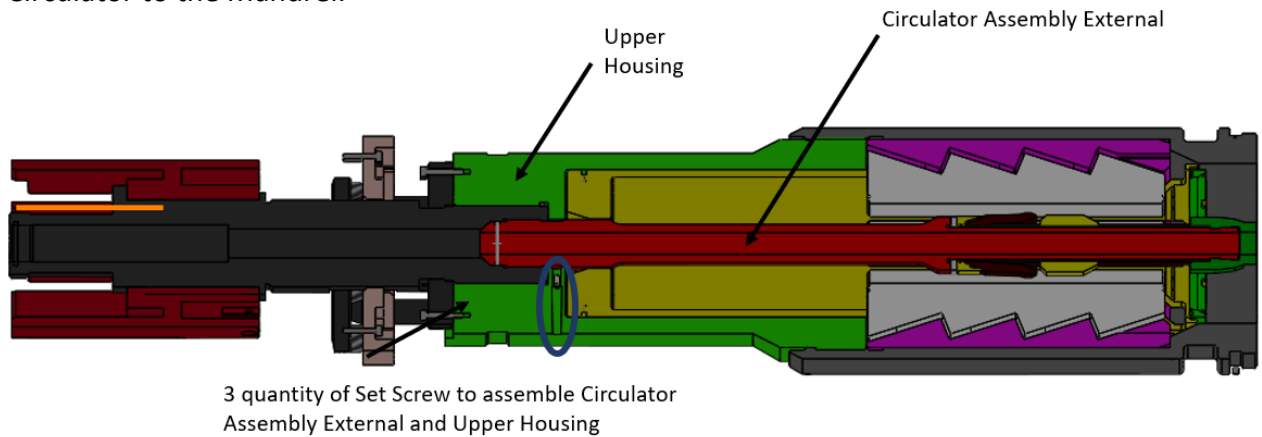


Circulator Assembly



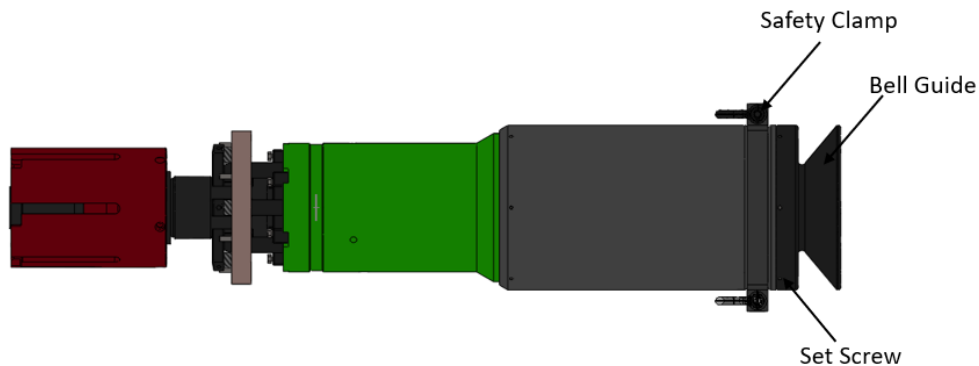
25. **NOTE:** A long rod running from the ID of the Mandrel to the bottom of the tool may aid installation of

the Circulator Assembly. Grease the Circulator Body's thread. The Circulator Assembly threads to the Mandrel with right-hand rotation. The nose of the Circulator may need to be lifted and aligned with the through bore when making up the Circulator to reduce the make-up torque. Thread the Circulator Assembly into the Mandrel until it is seated. Install the three Set Screws into the Upper Housing to secure the Circulator to the Mandrel.

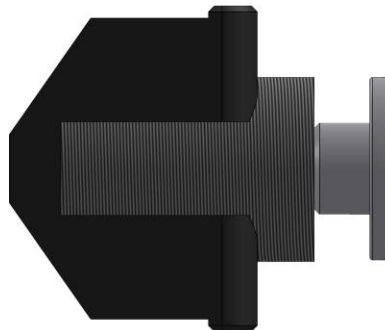


26. Grease the threads of the Bell Guide. Thread the Bell Guide onto the Lower Housing. Snug gently. Anti-seize and install the 6 Set Screws. If the set screws don't line up with the reliefs in the Lower Housing, slowly back off the Bell Guide until the set screws can be fully installed. Fully seat the Set Screws. Install Lower Safety Clamp.

NOTE: Sizes 7" and above utilize a different Bell Guide as described in steps 27, 28 and 29.

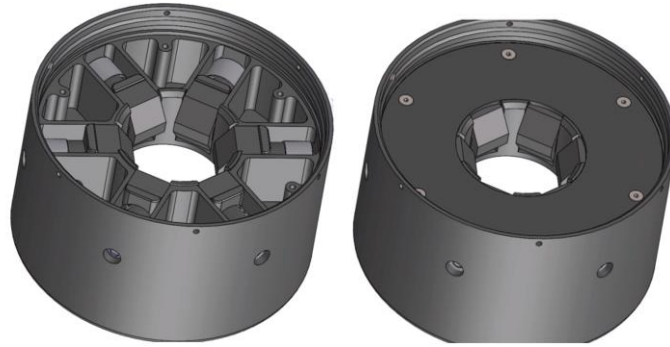


27. Grease and install the Ram Spring on the Ram, followed by the Bump Stop, and pretension bolt. Preload the Ram Assembly by hand (power tools have caused cross threading on previous installations) until the bolts bottom out.

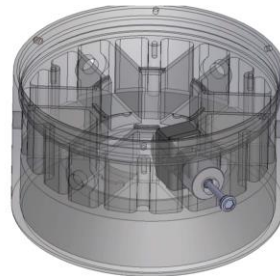


28. Grease and install the 6 preloaded ram assemblies into the Bell Housing. Grease and place the Bell

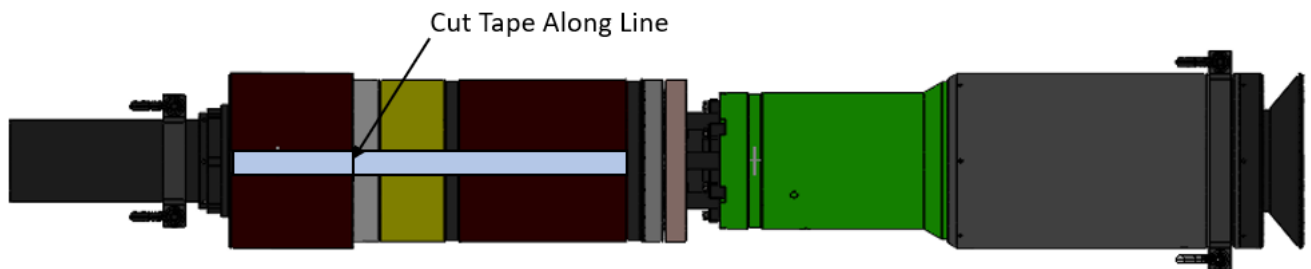
Housing's Top Plate on top of the Ram assemblies. Rotate the Top Plate 1/12th revolution. Anti-seize and bolt the Top Plate to the Bell Housing.



29. Remove the 6 pretension bolts.



30. Now put the Line on the Indicator and the Housing. First, push the Top Sub and Indicator all the way down. Next, rotate both the Top Sub and the Indicator counterclockwise until the mechanical stop is hit. An audible collision might be heard (a “click”). This should be the fully retracted position of the DWCRT. Two ways to verify that you are fully retracted are: 1) Slips will be below the Wear Guide. 2) Continued rotation will cause the Housing to rotate as well. Use silver duct tape to make a line straight down the side of the Indicator and Housing. Cut tape at Indicator and housing.



Appendix 1.1: Size and Ratings

DWCRT Internal Specifications													
Tubular Size	Weight Range	Casing ID (in.)	API 8C Hoist Capacity (Tons)	Torque Capacity (Locked ft-lb)	Torque Capacity (Unlocked ft-lb) Gen 1 Only	Set Down Weight (Tons)	Min ID (in.)	Flow Rate (bbl/min)	OAL (in.)	Shorty OAL (in.)	OAL w/ AutoValve (in.)	Shorty OAL w/ AutoValve (in.)	Approx. Weight (lbs.)
4-1/2"	9.5 - 15.1 #	4.090 - 3.826	140	13,000	5,000	50	1	6	103	87	114	98	1300
5"	15 -23.2#	4.408 - 4.044	160	15,000	5,000	50	1	6	103	87	114	98	1300
5-1/2"	15.5 - 26.8#	4.950 - 4.545	225	25,000	10,000	50	1	6	106	90	117	101	1300
5-1/2"	18 - 23 #	4.950 - 4.670	255	25,000	10,000	50	1	6	106	90	117	101	1300
5-1/2"	20 - 23#	4.778 - 4.670	300	30,000	10,000	50	1	6	106	90	117	101	1300
6"	20 -24.5 #	5.352 - 5.125	430	30,000	10,000	50	1	6	108	92	120	104	1500
6-5/8"	20 - 36.7 #	6.049 - 5.501	370	50,000	15,000	50	1	6	115	99	120	104	1500
7"	17 - 35#	6.538 - 6.004	450	65,000	50,000	50	1.5	12	115	99	120	104	1500
7-5/8"	24-42.8#	7.025 - 6.501	450	65,000	50,000	50	1.5	12	115	99	120	104	1500
8-5/8"	24 - 44 #	8.097 - 7.625	450	65,000	50,000	50	1.5	12	115	99	142	126	1500
9-5/8"	36 -59.4 #	8.921 - 8.407	450	65,000	50,000	50	1.5	12	115	99	142	126	1650
9-7/8"	62.8#	8.625	450	65,000	50,000	50	1.5	12	115	99	142	126	1650
10-3/4"	40.5 - 60.7#	10.050 - 9.660	450	65,000	50,000	50	1.5	12	115	99	142	126	1750
10-3/4"	65.7 - 85.3#	9.560 - 9.156	450	65,000	50,000	50	1.5	12	115	99	142	126	1800
11-3/4"	47 - 71#	11.000 - 10.586	450	65,000	50,000	50	1.5	12	115	99	142	126	1875
12-3/4"	44-77#	12.080-11.584	450	65,000	50,000	50	1.5	12	115	99	142	126	2000
13-3/8"	54.4 - 85#	12.615 - 12.159	450	65,000	50,000	50	1.5	12	115	99	142	126	2100
13-5/8"	88.2#	12.375	450	65,000	50,000	50	1.5	12	115	99	142	126	2100
16"	65 -109#	15.250 - 14.688	450	65,000	50,000	50	1.5	12	120	104	147	131	2400
16-3/4"	65 - 109#	16.250 - 15.750	450	65,000	50,000	50	1.5	12	120	104	147	131	2400
18-5/8"	87.5 - 117#	17.755 - 17.375	450	65,000	50,000	50	1.5	12	120	104	147	131	2900
20"	94 - 133#	19.124 - 18.730	450	65,000	50,000	50	1.5	12	120	104	147	131	3100
24"	171-216#	22.685 - 22.185	450	50,000	50,000	50	1.5	12	126	110	N/A	N/A	4500
26"	202-275#	24.550 - 24.050	450	50,000	50,000	50	1.5	12	126	110	N/A	N/A	5000
7-20"	High Flow Mandrel Option for the same Size and Weights		415	55,000	50,000	50	1.75	18	126	104	147	126	N/A

DWCRT External Specifications

Tubular Size	Coupling Length (in)	Coupling OD	API 8C Hoist Capacity (Tons)	Torque Capacity (Locked ft-lb)	Torque Capacity (Unlocked ft-lb) Gen 1 Only	Set Down Weight (Tons)	Min ID (in.)	Flow Rate (bbl/min)	OAL (in.)	Approx. Weight (lbs.)
4-1/2"	15.5	4.437 - 6.000	500	65,000	15,000	50	1.5	12	122	3500
5"		4.937 - 6.500								
5-1/2"		5.437 - 7.000								
6"		5.937 - 7.500								
7"		6.937 - 8.500								
7-5/8"		7.562 - 9.125								

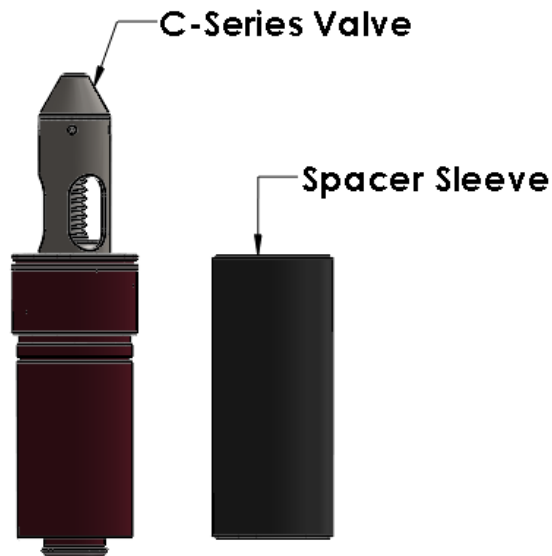
DWCRT 1K Specifications

Tubular Size	Weight Range	Casing ID (in.)	API 8C Hoist Capacity (Tons)	Torque Capacity (Locked ft-lb)	Torque Capacity (Unlocked ft-lb) Gen 1 Only	Set Down Weight (Tons)	Min ID (in.)	Flow Rate (bbl/min)	OAL (in.)	OAL w/ AutoValve (in.)	Approx. Weight (lbs.)
7"	17-35#	6.538 - 6.004	400	60,000	20,000	50	1.5	12	122	137	2950
7-5/8"	39-55.3#	6.625 - 6.125	500	65,000	25,000	50	1.5	12	122	137	3000
9-5/8"	36 - 59.4 #	8.921 - 8.407	1000	100,000	75,000	50	2.25	20	130	153	3350
9-7/8"	62.8 #	8.625	1000	100,000	75,000	50	2.25	20	130	153	3350
10-3/4"	40.5 - 60.7#	10.050 - 9.660	1000	100,000	75,000	50	2.25	20	130	153	3580
11-3/4"	47 - 71#	11.000 - 10.586	1000	100,000	75,000	50	2.25	20	130	153	3600
13-3/8"	54.4 - 85#	12.615 - 12.159	1000	100,000	75,000	50	2.25	20	130	153	4000
13-5/8"	88.2#	12.375	1000	100,000	75,000	50	2.25	20	130	153	4000
16"	65 - 109#	15.250 - 14.688	1000	100,000	75,000	50	2.25	20	135	162	4400
16-3/4"	65 - 109#	16.250 - 15.750	1000	100,000	75,000	50	2.25	20	135	162	4500
18-5/8"	87.5 - 136#	17.755 - 17.239	1000	100,000	75,000	50	2.25	20	135	162	5050
20"	94 - 133#	19.124 - 18.730	1000	100,000	75,000	50	2.25	20	135	162	5300
20"	163-187#	18.625 - 18.125	1000	100,000	75,000	50	2.25	20	135	162	5350
22"	170-224#	20.438 - 19.938	1000	100,000	75,000	50	2.25	20	138	N/A	5850
24"	171-216#	22.685 - 22.185	1000	100,000	75,000	50	2.25	20	138	N/A	6500
26"	202-275#	24.550 - 24.050	1000	100,000	75,000	50	2.25	20	138	N/A	7100
30"	234#	28.5	1000	100,000	75,000	50	2.25	20	138	N/A	7700

Appendix 1.2: DWCRT Valve Options

Internal (450 Ton) DWCRT Valve Options			
Tool Size	Valve	Flow Rate	OAL Added
4½" to 20"	C-Series	6 bbl/min	0"
4½" to 5½ "	4-1/2" to 5-1/2" Shorty AutoValve	6 bbl/min	15-1/4"
7" & 7-5/8"	7" & 7-5/8" Shorty AutoValve	12 bbl/min	17"
8-5/8" to 20"	8-5/8" to 20" Shorty AutoValve	12 bbl/min	22"

For the 450 Ton DWCRT we offer a C-SERIES Valve inside of a Crossover Sub which positions the valve for easy removal from job-to-job. In this configuration, a Spacer Sleeve is installed in the Top Mandrel as depicted in step



Spacer Sleeve (part# 605113) and C-Series Valve (part# 602870)

Appendix 1.3: Hoisting Capacity Reduction with Pressure

DWCRT Hoist Reduction with Pressure		
Casing Size	ID (Inches)	Tool Hoist Reduction in pounds for every 1 PSI of pressure
4½"	4.1	13
5"	4.6	17
5½"	5.1	20
6"	5.3	24
7"	6.6	34
7-5/8"	7.1	40
8-5/8"	8.1	52
9-5/8"	9.1	65
10-3/4"	10.2	82
11-3/4"	11.1	97
13-3/8"	12.8	129
13-5/8"	12.4	121
16"	15.3	184
18-5/8"	17.8	249
20"	19.2	290
22"	21.5	363
24"	23.5	433
26"	25.5	510

Effects of Circulation Pressure:

DWCRT hoist capacity is reduced when circulating. The amount of reduction depends on the circulation pressure and the Casing size.

Example: 225-ton Mandrel in 5-1/2" Casing at 4,000 psi = 20 x 4,000 = 80,000 lbs. = 40 tons

225 tons - 40 tons = 185 tons

Appendix 1.4: Minimum Set Torque

DWCRT Internal (450 Ton) and External (500 Ton)

Minimum Set Torque before Applying Torque in Locked Position		
DWCRT Mandrel	Minimum Set Torque	Make-Up Torque
140T 160T 225T 370T 450T 500T	3,500 ft-lb	0 – 9K ft-lb
140T 160T 225T 370T 450T 500T	5,000 ft-lb	10K – 19K ft-lb
225T 370T 450T 500T	10,000 ft-lb	20K – 39K ft-lb
370T 450T 500T	15,000 ft-lb	40K – 65K ft-lb

DWCRT Internal (1000 Ton)

Minimum Set Torque before Applying Torque in Locked Position		
DWCRT Mandrel	Minimum Set Torque	Make-Up Torque
1000 Ton	4,500 ft-lb	0 – 15K ft-lb
1000 Ton	7,500 ft-lb	15K – 30K ft-lb
1000 Ton	15,000 ft-lb	30K – 60K ft-lb
1000 Ton	25,000 ft-lb	60K – 100K ft-lb

Appendix 1.5: Bolt and Set Screw Torque

Cup Point Set Screw	Tightening Torque (In-lb.)
1/4"	94
5/16"	183
3/8"	317
7/16"	502
1/2"	750

Appendix 1.6: Tool Joint Sizes and Make-up Torque

Internal (450 Ton) and External (500 Ton)

Tool Joint Sizes & Makeup Torque		
Tool Joint Size	Hoist Capacity (Tons)	API Make-up Torque (ft-lb)
4-1/2 IF Box	500	49,000
6-5/8" REG Box	500	62,000
6-5/8" FH Box	425	35,000

Internal (1000 Ton)

Tool Joint Sizes & Makeup Torque		
Tool Joint Size	Hoist Capacity (Tons)	API Make-up Torque (ft-lb)
6-5/8" FH Box	1000	84,000
6-5/8" REG Box	1000	81,000
7-5/8 REG Box	1000	84,000

McCoy Box Connection is often stronger than the pin connection. The make-up torque and tension rating were calculated using small inner diameters for the pin. The load rating of the connection should be first based on the McCoy rating, then reduced if necessary, depending on the pin that will be connected to the McCoy Tool (and other connections between the DWCRT and Top Drive). Contact McCoy for higher torque requirement options.

Appendix 1.7: Packer Cup, Gage Ring, Thimble Size Chart

The DWCRT family is 10,000 PSI capable but limited to the maximum working pressure of the Packer Cup. The Below Sizes and rating are general guidelines and the compatibility in Special, or premium connections may require the use of a specialty cup or gage ring combination. High Pressure Cups are available upon special request up to 10,000 psi.

DWCRT Packer Cup Gage Ring Thimble Size Chart								
Casing Size	Weight Range	Gage Ring	OD	Packer Cup	OD	Packer Cup Rated Pressure	Thimble	OD
4-1/2"	9.5/11.6#	601096	4.150"	60110	4.150"	5,000 psi	60111	3.7"
	12.6/13.5#	601097	3.800"	601108	4.070"	5,000 psi	601114	3.73"
	15.10#	601988	3.701"	601927	3.95	5,000 psi	605276	3.63"
5"	15/18#	601098	4.150"	601109	4.620"	5,000 psi	601115	3.99"
	18/21.4#	601099	3.955"	601110	4.340"	5,000 psi	601115	3.99"
	23.2#	602061	3.785"	602604	4.230"	5,000 psi	601115	3.99"
5-1/2"	13/15.5#	601100	4.820"	601111	5.300"	5,000 psi	601116	4.50"
	17/20#	601101	4.600"	601112	5.090"	5,000 psi	601116	4.50"
	20/23#	601101/601102	4.600"/4.420"	601113	4.980"	5,000 psi	601116	4.50"
	23#	603635	4.545"	603531	4.800"	5,000 psi	605277	4.38"
	23/26#	601102	4.420"	605779	4.800"	5,000 psi	605277	4.38"
	26#	601102	4.420"	602593	4.700"	5,000 psi	605277	4.38"
6"	26.8#	601098	4.150"	601109	4.620"	5,000 psi	601115	3.99"
	20#	603935	5.200"	605047	5.590"	5,000 psi	605048	5.20"
	23#	1006135	5.061	1006133	5.350"	5,000 psi	1006134	4.840"
6-5/8"	20/23.2#	605672	5.845"	605674		5,000 psi	605556	5.50"
	24/28#	605673	5.666"	603960	6.020"	5,000 psi	605556	5.50"
	32-35#	603940	5.450"	603941	5.850"	5,000 psi	605556	5.50"
7"	17/23#	605074	6.241"	605001	6.740"	5,000 psi	605000	5.91"
	23/26#	605075	6.151"	605002	6.460"	5,000 psi	605000	5.91"
	26-30#	1005925	6.029"	1005924	6.38"	5,000 psi	605000	5.91"
	29/32#	605076	5.969"	605003	6.469"	5,000 psi	605000	5.91"
	35#	605077	5.875"	605012	6.200"	5,000 psi		
7-5/8"	24/26.4#	605078	6.750"	605438	7.150"	5,000 psi	605009	5.91"
	24/29.7#	605078	6.750"	605010	7.150"	5,000 psi	605009	5.91"
	29-33#	605676	6.640"	605437	7.050"	5,000 psi	605009	5.91"
	33.7/42.8#	605079	6.376"	605011	6.876"	5,000 psi	605009	5.91"
8-5/8"	20-24 #	605973	7.972"	602721	8.250 "	5,000 psi	605975	7.50"
	28/36#	605092	7.700"	600288	8.150"	4,250 psi	600304	7.50"
	40-44#	605974	7.500"	605977	-	4,250 psi	605976	7.38"

Casing Size	Weight Range	Gage Ring	OD	Packer Cup	OD	Packer Cup Rated Pressure	Thimble	OD
9-5/8"	29/36#	605780	8.765"	601925	9.210"	4,250psi	602205	8.77"
	36/47#	605093	8.379"	601207	9.061"	4,250psi	600305	8.26"
	47/53.5#	605093	8.379"	600290	8.850"	4,250psi	600305	8.26"
	53.5/59.4#	605094	8.250"	605781	8.700"	4,250psi	600305	8.26"
	58.4/71.8#	605782	7.969"	601184	8.700"	4,250psi	605783	Special
9-7/8"	62.8#	605093	8.379"	601207	9.061"	4,250psi	600305	8.26"
10-3/4"	40.5/60.7#	605095	9.504"	601217	10.200"	3,750 psi	600306	9.51"
10-3/4"	40.5-55.5			603363	10.010"			
10-3/4"	65.7-73.2#	606503	9.250"	600771	9.800"	3,750 psi	606504	9.17"
11-3/4"	38/54#				11.25	2,000 psi	600307	9.96"
11-3/4"	60/65#				10.96	2,000 psi	600307	9.96"
11-3/4"	65/71#				10.87	2,000 psi	600307	9.96"
11-3/4"	73/79#				10.7	2,000 psi		
11-3/4"	82#				10.61	2,000 psi		
11-3/4"	47/71#	605096	10.430"	601208	11.000"	2,000 psi	600307	9.96"
11-7/8"	71.8#	605096	10.430"	601208	11.000"	2,000 psi	600307	9.96"
12-3/4"	44-58#							
12-3/4"	65-77#							
13-3/8"	54.5/85#	605097	12.003"	601212	12.800"	2,000 psi	600308	12.00"
13-5/8"	88.2#	605097	12.003"	601212	12.800"	2,000 psi	600308	12.00"
16"	65/75#	602439	14.936"	601209	15.438"	2,000 psi	N/A	-
	84#	604611	14.800"	601895	15.270"	2,000 psi	N/A	-
	109#	600257	14.500"	600297	15.070"	2,000 psi	N/A	-
18-5/8"	87.5/106#	600634	17.400"	601210	18.020"	1,750 psi	N/A	-
	106/117.5#	603649	17.250"	600299	17.880"	1,750 psi	N/A	-
	123.4 -136 #	603849	16.982"	603958	17.430"	1,750 psi	N/A	-
20"	94/106.5#	600259	18.800"	601211	19.370"	1,500 psi	N/A	-
20"	106-118#	604000	18.740"	603781	19.250"	1,500 psi	N/A	-
20"	118-133#	605597	18.600"	603782	19.100"	1,500 psi	N/A	-
20" SPECIAL	129-133#	602641	18.500"	600301	18.980"	1,500 psi	N/A	-
* Are not based on any particular standard or manufacture for determining weight range. Please Verify ID and C								
22	170-224#	605542	19.810"	605502	20.200"	1,000 psi	N/A	-
24	171-216#	605543	22.060"	605503	22.875"	800 psi	N/A	-
26	202-275#	605544	23.900"	605504	24.750"	800 psi	N/A	

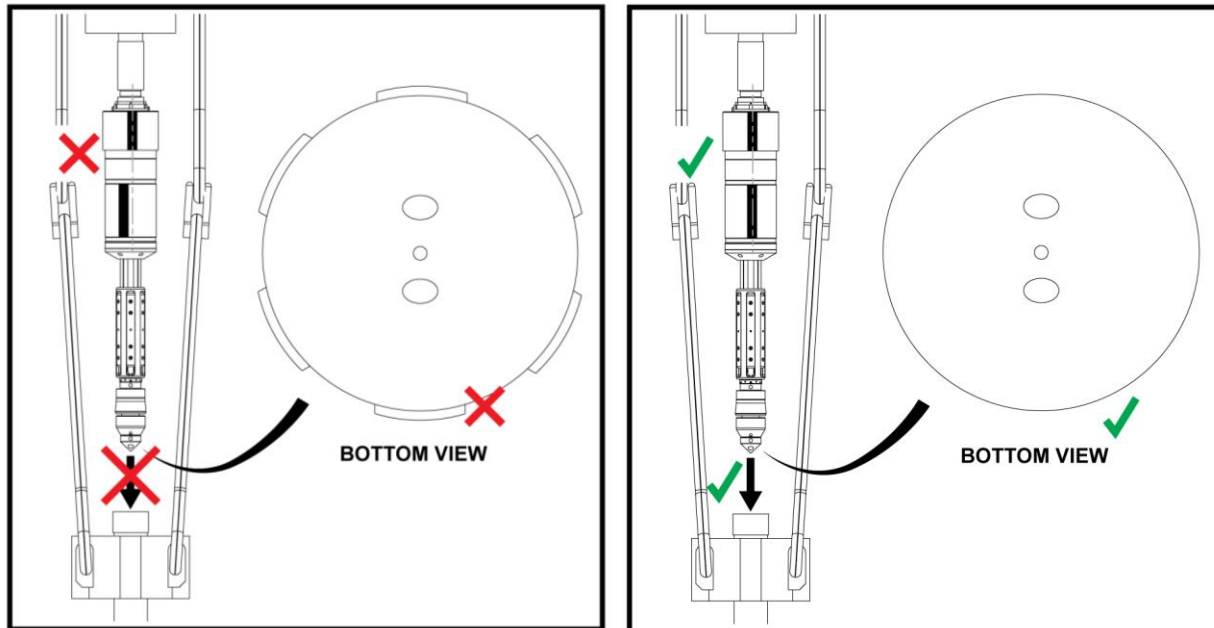
Section 16 - Troubleshooting

16.1 Rigging Up the DWCRT

1. DWCRT INDICATOR LINES HAVE MOVED PRIOR TO RIG UP AND ARE NO LONGER ALIGNED.

- Refer to Section 7 for information related to indicator lines. Compress the Head Assembly into the setting position (yellow window) and rotate by hand in the reverse direction until a hard stop is felt and indicator lines are aligned, verify Slip teeth are sitting below the Wear Guide before proceeding.

NOTE: DO NOT ATTEMPT TO RIG UP THE DWCRT IF THE INDICATOR LINES ARE NOT ALIGNED. SLIPS MAY BE PARTIALLY ACTIVATED CAUSING CLEARANCE ISSUES FOR STABBING INTO CASING.



2. DWCRT WILL NOT FIT INSIDE THE CASING.

- Confirm packer cup O.D. compared to casing I.D., verify correct packer cup has been installed.
- Confirm correct Slips have been installed on the DWCRT.
- Confirm correct Thimble and Gage Ring have been installed on the Circulator. Verify dimensions with casing I.D.
- If the Packer Cup is oversized and preventing insertion into casing you may opt to remove the Circulator Assembly, continue rigging up and install Circulator once the DWCRT has been connected to the top drive.
- Verify the casing weight is in the operation range of the mandrel and wear guides being used (internal).

16.2 Engaging the DWCRT

1. THE DWCRT ROTATES ON TOP OF THE CASING AND WILL NOT ENGAGE.

- Verify the DWCRT is in the Setting Position (yellow window). Apply enough set down weight to create friction between the Bump Plate and the Collar.
- If casing is not aligned with the CRT, moving the bails to adjust the casing position may assist with tool engagement.

1. Set make-up torque to a minimum of 3,500 ft-lb prior to hoisting the string.

NOTE: SETTING DOWN WEIGHT IS ONLY NECESSARY TO CREATE FRICTION ON THE PIPE COLLAR, EXCESSIVE SET DOWN WEIGHT COULD INCREASE FRICTION INSIDE THE DWCRT AND PREVENT ACTIVATION.

NOTE: REFER TO Appendix 1.4: Minimum Set Torque.

2. DURING TOOL ENGAGEMENT THE DWCRT ONLY ROTATES 1/2 TURN BEFORE TORQUE IS OBSERVED AND TOOL STOPS ROTATION.

- The DWCRT does not require a large amount weight to be applied when engaging the tool, reduce set down weight and continue rotation.
 1. Verify tool has rotated the same number of rotations as observed during the “Stump Test” when the DWCRT was rigged up.
 2. If the number of rotations cannot be confirmed, increase torque and observe for additional rotation.

NOTE: Tool engagement verification requires observing both rotation and torque prior to hoisting the string.

16.3 Disengaging the DWCRT

1. THE DWCRT DOES NOT FULLY DISENGAGE - INDICATOR LINES ARE NOT ALIGNED.

- Verify mud pumps are turned off and pressure reads 0. (It is good practice to open the Stand Pipe to bleed pressure).
- Lower top drive until the yellow window is completely covered. Apply 3000lbs of set down weight to create friction on the casing collar and rotate in reverse.

NOTE: SETTING DOWN WEIGHT IS ONLY NECESSARY TO CREATE FRICTION ON THE PIPE COLLAR, EXCESSIVE SET DOWN WEIGHT COULD INCREASE FRICTION INSIDE THE DWCRT AND PREVENT ROTATION.

2. THE DWCRT IS FULLY DISENGAGED AND STARTS TO COME OUT OF THE CASING WITHOUT HOISTING.

- Verify mud pumps are turned off and pressure reads 0. (It is good practice to open the Stand Pipe to bleed pressure).
- Fluid pressure against the packer cup can have enough force to lift the DWCRT if the Slips are not engaged and fluid pressure is present.

NOTE: BLEED OFF THE STAND PIPE PRESSURE AND CONFIRM A ZERO READING ON THE GAUGES PRIOR TO DISENGAGING THE DWCRT.

3. DWCRT INDICATOR LINES HAVE MOVED AND ARE NO LONGER LINED UP – WHILE RIGGED INTO TOP DRIVE AND DWCRT IS OUTSIDE OF CASING.

- The Housing needs to be held and the tool put in the Setting Position (yellow window).
- Place a soft sling under the Bump Plate and lift with air hoist until the DWCRT is in the Setting Position (yellow window). Grip the Housing above the Bump Plate with a chain tong and rotate by hand in the clockwise direction until the indicator lines are aligned.

NOTE: ENSURE THE DRILLER HAS LOCKED OUT THE TOP DRIVE PRIOR TO PERFORMING ANY WORK ON THE DWCRT WHILE RIGGED IN.

4. WHILE REMOVING THE DWCRT FROM THE CASING THE SLIPS SNAG OR LIFT THE CASING.

- **Immediately Stop Lifting!**
- If there are only 1-2 joints of casing in the hole the packer cup may have enough friction to hoist the string.

1. Hoist slowly and monitor for casing movement. Lubricate the packer cup seal prior to inserting into the next joint of casing.
- If string weight is sufficient and Slips snag on the casing, lower DWCRT back into the pipe, confirm indicator lines are aligned by rotating in reverse with the tool in the Setting Position (yellow window).
 1. Hoist slowly and monitor for casing movement.
 2. Inspect the Slip Head for damage once removed from the casing.

NOTE: CONTACT THE MCCOY TEAM IF YOU ARE UNSURE OF HOW TO INSPECT FOR DAMAGE.

5. EXCESSIVE SET DOWN (TOP DRIVE) WEIGHT NECESSARY TO PLACE THE DWCRT INTO THE SETTING POSITION (YELLOW WINDOW).

- The internal seals on the Snorkel may be leaking, which could allow fluid to enter the Housing.
 1. Fluid needs to be displaced by slowly applying down force with the top drive and letting the fluid bleed off between the Head and the Housing. Once the tool can be placed in the Setting Position (yellow window), rotate in reverse until Indicator lines are aligned.

NOTE: CONTACT THE MCCOY TEAM IF YOU ARE UNSURE OF HOW TO INSPECT FOR DAMAGE.

6. WHEN ATTEMPTING TO RELEASE THE TORQUE SET IN THE DWCRT, THE TOOL JOINT CONNECTION BREAKS

- If available, lower the grabber box over the tool joint connection and torque to a minimum of 1.25 times the make-up torque.
- If a grabber box is not available and manual tongs cannot be used as back-up on the DWCRT tool joint, follow the instructions below.
 1. With the DWCRT placed in the Setting Position (yellow window), rotate in the forward direction until the tool joint shoulders, apply a minimum of 3,500 ft-lb of torque.
 2. Allow DWCRT to move into the Locked Position (white window) by slowly hoisting. Place back-ups on the casing and torque through the DWCRT until desired tool joint torque is achieved.
 3. Place DWCRT in the Setting Position (yellow window) and release the initial setting torque of 3,500 ft-lb.

NOTE: ADDITIONAL TORQUEING OF THE TOP DRIVE TOOL JOINT MUST BE DONE IN THE LOCKED POSITION (WHITE WINDOW) TO AVOID OVER TORQUEING THE DWCRT.

7. WHEN ATTEMPTING TO UNSET THE DWCRT, THE TOOL DOES NOT UNSET OR REQUIRES HIGHER THAN NORMAL TORQUE

- If possible, modify the makeup procedure to apply high torque in the Locked Position.
- If side load is present or to reduce the effect of side load while unsetting the tool, follow the instructions below.
 1. Hoist the DWCRT and casing from the rig floor to approximately 20 – 40 ft in the air just so the first coupled connection is below the rotational restraint (slips or back up tongs).
 2. Unset the tool by following the Unset procedure.
 3. Set the slips with the minimum required set torque using the Set procedure at the elevated height.
 4. Lower the DWCRT to the rig floor and follow the unset Procedure.

NOTE: Engaging the DWCRT to the minimum setting torque (3,500 ft-lbs.) will aid in releasing the DWCRT

when side load is present.

- If a higher torque is needed to unset the tool, the following steps may be taken.
 1. Ensure the DWCRT is in the unlocked position. Place a manual tong on the tool joint connection of the DWCRT above the indicator.
 2. Place the second back up manual tong/ belt tong on the housing of the DWCRT just above the bump plate. The Backup is only necessary if string weight is not sufficient.
 3. Set the top drive to the lowest RPM setting and apply left hand torque to the tool in the unlocked position.
 4. While applying torque with the top drive and holding back up with the manual tong, apply torque to the tong placed on the tool joint connection to help unset the tool.

16.4 Backing Out Casing with the DWCRT

1. HIGH TORQUE CASING CONNECTION NEEDS TO BE “BROKEN-OUT” – DWCRT DRESSED WITH 140 - 450T MANDREL

- With the Housing in the Locked Position (white window), apply sufficient reverse torque to break the casing connection. **REFER TO APPENDIX 1.1: SIZE AND RATINGS FOR RECOMMENDED TORQUES.**
 1. Once the make-up torque has released from the casing connection (approximately 1 full rotation), stop rotation.
 2. Apply manual tong on casing collar and release DWCRT from the casing and immediately re-torque to 3,500 ft-lb.
 3. Place DWCRT into the Locked Position (white window) by slowly hoisting. Continue backing out threaded connection and follow procedure for “Backing Out Casing”.

2. HIGH TORQUE CASING CONNECTION NEEDS TO BE “BROKEN-OUT” – DWCRT DRESSED WITH 1000T MANDREL

- With the Housing in the Locked Position (white window), apply sufficient reverse torque to break the casing connection.
 1. Once the make-up torque has released from the casing connection (approximately 1 full rotation), stop rotation.
 2. Apply manual tong on casing collar and release DWCRT from the casing and immediately re-torque to 4,500 ft-lb.
 3. Place DWCRT into the Locked Position (white window) by slowly hoisting. Continue backing out threaded connection and follow procedure for “Backing Out Casing”.

16.5 Resetting the Nut if the tool will not come out of the push position

- o If top Drive weight is applied when removing the tool from the push position, the tool can become stuck.
 1. While stuck in the push position, slightly hoist until the indicator rises approx. 3/8”, then apply minimal left-hand torque.
 2. With minimal left-hand torque applied, apply between 4,000 and 10,000 lbs. of top drive weight.
 3. With top drive weight applied, rotate to the right at the maximum previously applied right hand torque.
 4. With Torque still applied. Remove top drive weight and hoist until vertical travel is detected, approx. 3/8”.

5. Release right hand torque and apply left hand torque at minimal RPM up to the applied make-up torque. Observe for 12 degree of rotation out of the push position.
 6. Set down top drive weight once left-hand rotation has been achieved.
 7. If left hand rotation of 12 degree was not observed to allow removal from the push position, repeat steps by increasing the right-hand torque by 30% until the MUT (Make up Torque) for the Tubular is achieved.
 8. Set down top drive weight and continue unset procedure to unset slips.
- o **If tool has become stuck after right hand torque has followed a heavy hoist load the following steps should be followed.**
1. Apply between 10,000 and 15,000 lbs. of tension to the tool.
 2. With top drive holding tension on the tool, rotate to the right at the maximum previously applied right hand torque.
 3. With torque still applied. Remove the tension and place in a neutral or slight compression on the top. Vertical travel of approx. 3/8" of the indicator should be seen when moving from tension to compression.
 4. Place the tool in a neutral or slight tension state and release right hand torque
 5. Apply left hand torque at minimal RPM up to the applied make-up torque. Observe for 12 degree of rotation out of the push position.
 6. Set down top drive weight once left-hand rotation has been achieved.
 7. If left hand rotation of 12 degree was not observed to allow removal from the push position, repeat steps but increase the right-hand torque by 30% until the MUT (Make up Torque) for the Tubular is achieved.
 8. Set down top drive weight and continue unset procedure to unset slips.

16.6 Applying low torque to hoist or lower casing

1. Top casing connection of the hanger assembly should be compatible with the corresponding configuration of the CRT. Casing size and weight to be confirmed with TRS company.
2. Hanger representative to confirm proper make-up position of the acme thread and place vertical alignment marks across the mating pieces with a mark visible to the driller.
3. Pick-up hanger with appropriate handling equipment and place lower side pin into the mating box connection.
4. Slowly lower the top drive until the CRT nose cone enters the top box connection, placing the gage ring inside the box but still visible to the driller. **(Note. Gage ring material is designed to protect the casing threads from damage when centering the CRT).**
5. Place power tong on lower connection and make up thread to appropriate connection torque
6. Once connection torque and graph have been verified, remove power tong and continue insertion of CRT until Bump Plate reaches the collar.
7. Continue lowering the top drive until the CRT Indicator reaches the bottom of the Yellow band.
8. Torque/turn computer to be setup and ready to record torques placed through the CRT. Minimum of 1000 ft/lbs. to be recorded before hoisting string.
9. Place 10k set down weight through top drive. Set TD make-up torque to 2000 ft/lbs. and TD RPM to 5 RPM or less.
10. Driller to have clear line of communication with CRT technician and Hanger representative during CRT engagement. **(Note. If any amount of rotation of the hanger is noted driller to stop TD rotation immediately).**
11. Press Record on torque/turn graph.
12. Driller to start TD rotation at the direction of the CRT technician. CRT Indicator will rotate

approximately 2 rotations +/- before any torque is recorded.

13. Once CRT technician confirms full rotation and a minimum of 1000 ft/lbs. torque, driller to confirm all torque has been released before proceeding to next step. Once confirmed, driller can begin steps for hoisting string. **(Note. Torque verification to be confirm on torque/turns computer).**
14. Driller to pull weight through slips until full string weight is achieved before giving command to open FMS or remove hand slips.
15. Lower string until hanger assembly is past the floor, set slips at appropriate stump height. **(Note. No rotation of the top drive to occur while lowering string through the table. Table to remain in the unlocked position for the duration of this procedure).**
16. Set slips and lower CRT Indicator into the yellow band, release torque by rotating in the reverse direction.

Section 17 - Customer Feedback Form

www.mccoysglobal.com

Email: sales@mccoysglobal.com

Thank you for choosing a DWCRT. Your honest feedback will help us to serve you better and enable us to work on improving our product standards. Thank you.

Name		
Organization		
Address		
Email		
Phone		
Product		
Date:		location:

- | | Yes | No |
|---|--------------------------|--------------------------|
| 1. Product was easy to assemble | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Product came with all required tools | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Product included user manual | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Customer support were responsive | <input type="checkbox"/> | <input type="checkbox"/> |

Suggestion and Comment for the Product:

Section 18 - Additional Documentation



Customer:		Location:	Date:	New JSEA: <input type="radio"/> Yes <input type="radio"/> No	Revised JSEA: <input type="radio"/> Yes <input type="radio"/> No	
Casing Running Tool (CRT)						
Basic Job Steps	Potential HS&E Concerns	Recommended Safe Procedures/Protection				Responsible Party
Look over worksite	Employees not familiar with potential hazards of worksite and task.	All employees involved in the task shall be familiarized with all areas they will be working in.				Everyone involved in this task.
Conduct safety meeting & review JSEA with rig crew.	Employees unfamiliar with task to be performed. SSE involved in task. Defective tools/equipment/PPE. Bad communication.	Review JSEA with rig crew so crew understands what they will be doing. Identify communication process to be used and identify PPE needed/safe handling procedure. Repair or replace defective tools/equipment/PPE.				Everyone involved in this task
Pick up or lay down DW/CRT from rig floor to catwalk or vise-versa.	Overexertion or strain due to over extension. Tool damage, pinch points, overhead suspended/swinging loads.	Use tag lines to tag all equipment out the V-door. Watch hand/finger placement. Do not get under suspended loads. Establish good communication with winch operator. Use the fast line if a lay-down machine is available.				Everyone involved in this task
Lowering the DW/CRT to casing or rotary table.	Overexertion or strain due to over extension. Tool damage, pinch points, overhead suspended/swinging loads. Damage to Inserts or Packer Cup.	Use tag lines to tag all equipment out the V-door. Watch hand, finger placement. Do not get under suspended loads. Establish good communication with winch operator. Lock the rotary table. Never clamp slips on DW/CRT Inserts. Grease Packer Cup before inserting in casing.				Driller, rig crew, CRT specialist
Making up DW/CRT to top drive.	Over torquing and setting insert into casing. Alignment issues may be present, which could affect how smoothly the CRT slinger enters casing.	Only apply recommended torque for tool joint. Once torque is set on tool joint with back ups, release back ups and rotate counter clockwise until DW/CRT is in the retracted position.				Driller/CRT specialist
Making up DW/CRT to casing.	Off-center hole causes casing stabbing difficulties. Inserts or Bump Plate slip.	Level top drive/derrick as needed. Use link tilts if available to straighten pipe to receive the stringer of CRT smoothly. Replace worn Slips/Inserts. Set down more weight to stop Bump Plate from slipping.				Driller/CRT specialist
Lowering casing with DW/CRT.	Dies slipping. Overhead hazzard.	Use more set torque on Slips/Inserts. Replace dies if needed. Be aware of overhead work and stand clear of lifted loads.				Driller, rig crew
Fill-Up & Circulating	Potential of washing out a valve.	Wait for pressure to drop under the valve agreed upon between driller and CRT specialist.				Driller, CRT specialist

Removing DWCRT from casing after circulating.	Damage packer cup. Spray drilling fluids over the rig and employees.	Ensure all pressure is bled off and IBOP and 2" is open.	Driller
Releasing DWCRT from casing.	High torque release. Not being able to release.	Verify the set torque and adjust to same or slightly higher. Release set torque before setting weight on the tool. Communicate with winch operator.	Driller/CRT Specialist
Releasing DWCRT from casing after circulating.	Tool getting over torqued from long periods of circulating while rotating.	Take necessary precautions such as releasing and reengaging the tool every few hours.	Driller/CRT Specialist
Rig down DWCRT	Tool damage, pinch points, overhead suspended/swinging loads.	Use rig tongs or grabber box to break crossover sub. Watch hand. Finger placement using rig tongs. Do not get under suspended loads. Establish good communication with winch operator.	Everyone involved in this task
	Pinch points between waiting	Watch hand/foot placement. Use tag lines.	Everyone involved in this task
	Loss/damage equipment or vehicle because of improper securing or traffic accidents.	Make sure tools are secured properly. Drive safely, stop and rest when too tired to drive.	DrawWorks personnel
	Include HSE concerns	Include recommended safe procedure/protection.	

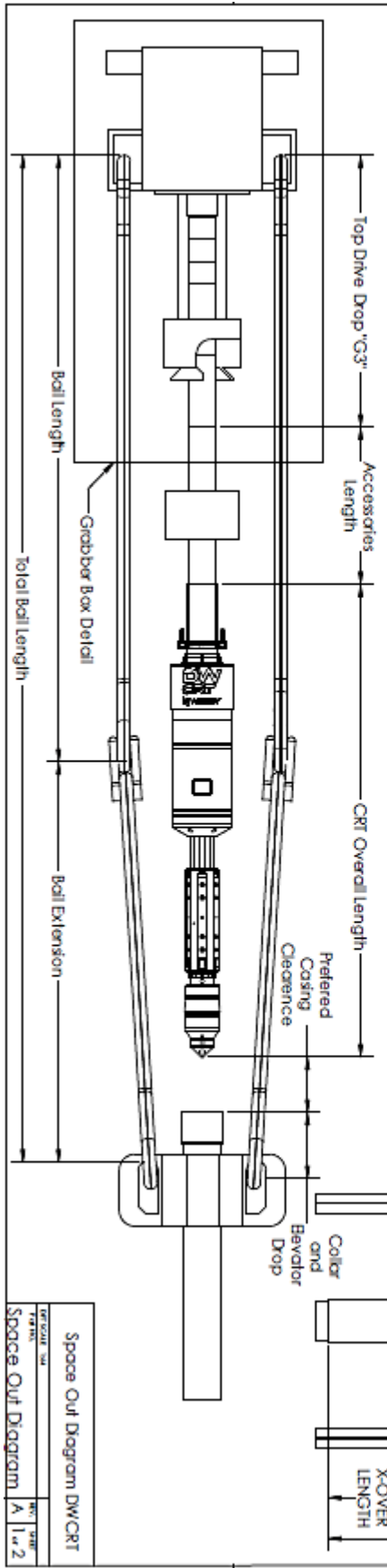
Accessories	Length*	Actual	CRT Internal	Length*	Actual
X-Over	TBD		140-300	106.8 IN	
DWSES	24-36 IN		450 (7'-13.3/8")	116.4 IN	
McCoy TTS Sub	15-36 IN		450 (11.6'-20")	120 IN	
			1000 Ton (9.5/8"-13.5/8")	130 IN	
			1000 Ton (11.6'-20")	135 IN	
			1000 Ton (22'-26")	138 IN	
			CRT External	Length	Actual
			4-1/2"-7-5/8"	123.6 IN	

*Optional configurations can vary OAL, please confirm before use.

Grabber Box Drop Calculation
 G1 + G2 - G4 = Greater than 12"
 (12" is the set minimum allowance
 for Manual Tong Gripping - when necessary)

DROP 'G3' + ACCESSORIES + DWCRT + PREFERRED CLEARANCE + COLLAR & ELEVATOR DROP = TOTAL BAIL LENGTH

X-OVER + SUM OF DROP = BAIL LENGTH + SLINGS/CABLES
 "G2"
 (G1, ACCS, DWCRT,
 PF, CLEARANCE,
 COLLAR/ELEVATOR)





RIG SURVEY

Surveyor:	Date:
Location:	Rig Manager:
Drilling Contractor:	Rig Name:
Operator:	Rep:

Casing/Connection Data

Diameter:	String Length:	
Weight:	Est. String Weight:	Drift Measured:
Grade:	Pipe Body Yld (lbs):	Torque (ft. lbs) Min:
Connection:	CRT Hoist (ton):	Opt:
Pipe Range:	Casing Yld Strength (psi):	Max:

Casing/Connection Data

Diameter:	String Length:	
Weight:	Est. String Weight:	Drift Measured:
Grade:	Pipe Body Yld (lbs):	Torque (ft. lbs) Min:
Connection:	CRT Hoist (ton):	Opt:
Pipe Range:	Casing Yld Strength (psi):	Max:

Rig Information

Rig type:	Rig bail Length:
Top Drive Type:	Bail Extensions:
Top drive Connection:	Casing Bail Length:
Top Drive Drop:	Grabber Box Max OD:
Joystick or Brake Handle:	Iron Roughneck : Yes: <input type="checkbox"/> No: <input type="checkbox"/>

Quill Connection

Connection	ID	OD	Max. Trq

Bail / Saver Sub Requirements

Bail Length Required:	Bail Extension Length Required:	
Saver Sub OD / Grabber Box ID Confirmed:	Saver Sub Length Required:	Elevator Capacity Required:

Type of Elevator

Type of Elevator:	Rating:
Comment:	

Pipe Handling

V-Door equipped Rigs	Non V-Door Rigs
Pipe Wrangler w/ pipe skate:	Pipe Cart (Handles Multiple Tubulars):
Standard Catwalk w/skate:	Catwalk Shuttle (Single Tubular):
Crane-In Operation only (pipe deck):	Crane-In Operation only (pipe deck):
Pick-up / Lay-down Machine:	Eagle Pipe Handler Set Down Capacity:
Other:	

Rig Floor and V-door Measurements

A:	B:	C:	D:
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