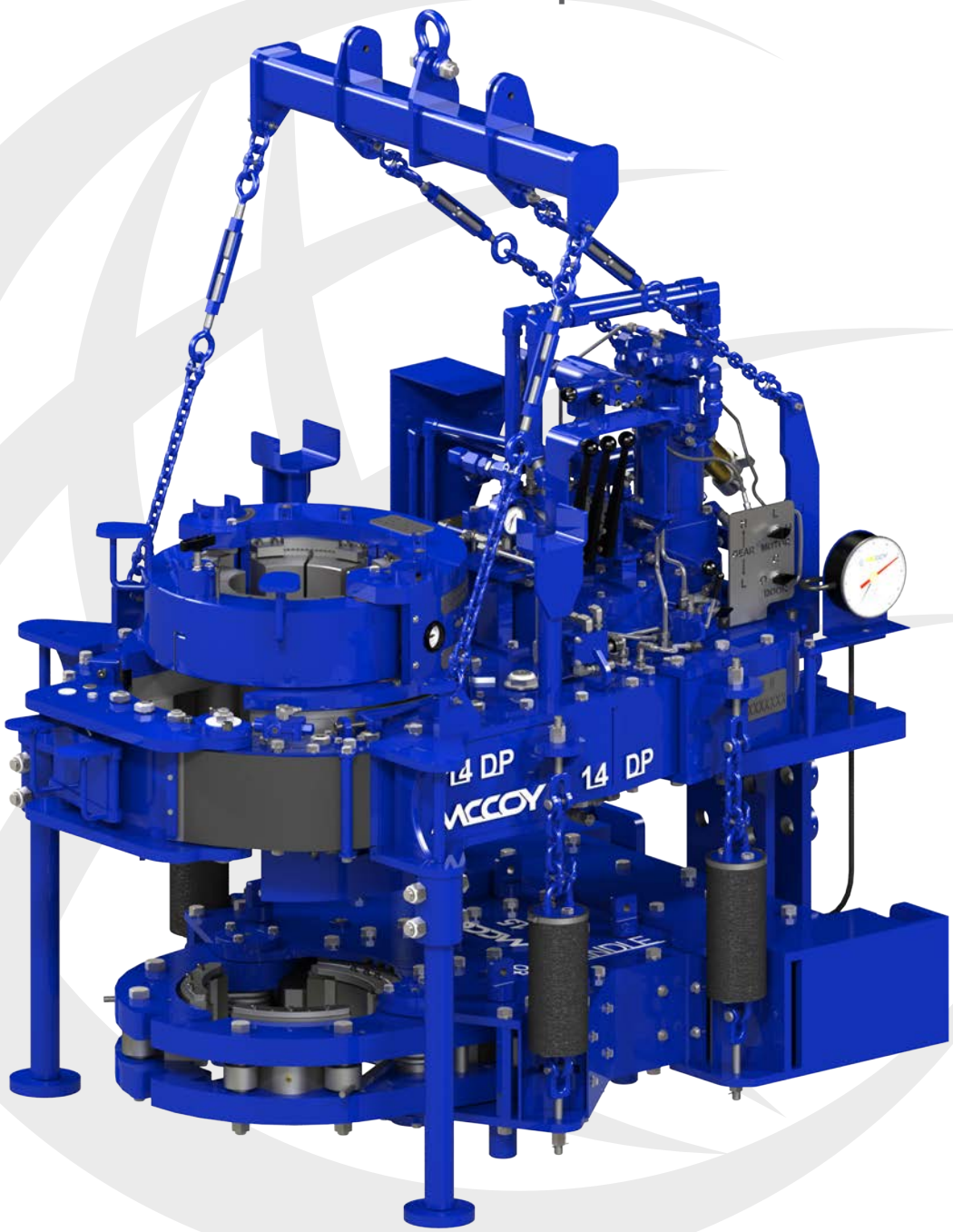
MCCOY GLOBAL

TECHNICAL MANUAL

CLE14000DP

14" (356 mm) 100,000 lbs-ft Hydraulic Power Tong
15" (381 mm) Lockjaw Backup
Includes Optional CHROMEMASTER™ System



SPECIFICATIONS | OPERATION | MAINTENANCE | PARTS

MCCOYGLOBAL.COM

ORIGINAL INSTRUCTIONS

THIS TECHNICAL DOCUMENT APPLIES TO THE FOLLOWING MODELS:

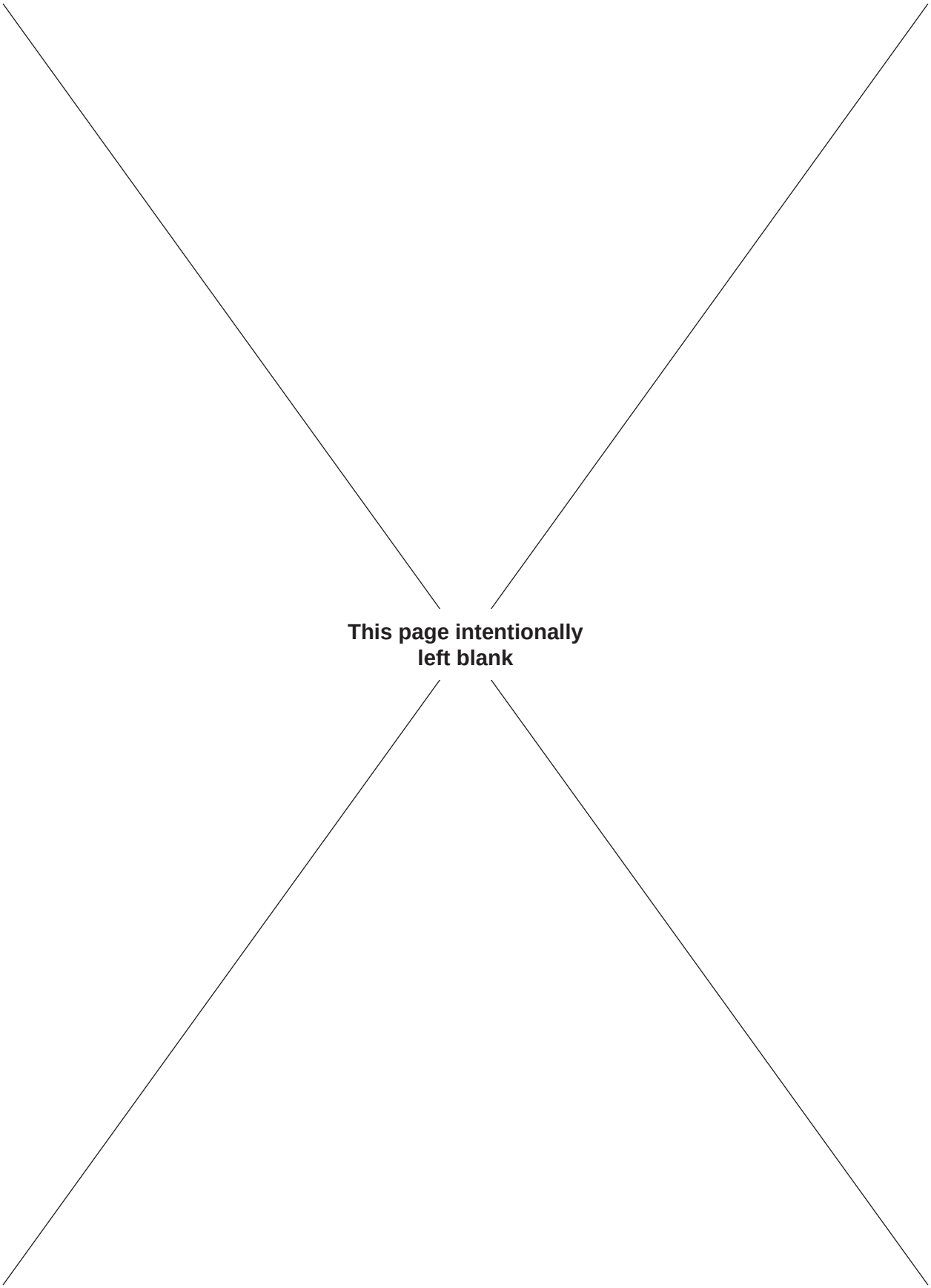
OVERALL MODEL: 80-140-10C-15T-000-4S-B1				
TONG MODEL	**BACKUP MODEL**	**MOUNTING KIT**	**REV**	**DESCRIPTION**
CLE14000DP-12	BUCST15000-02	MKBUCST15000-02	00	14” 100K hydraulic drill-pipe power tong equipped with manual door, 15” lockjaw backup, CHROMEMASTER™ system, & tension-style load cell. Configured for Baker-Hughes.

OVERALL MODEL: 80-140-100-15T-001-4S-B1				
TONG MODEL	**BACKUP MODEL**	**MOUNTING KIT**	**REV**	**DESCRIPTION**
CLE14000DP-11	BUCST15000-02	MKBUCST15000-02	00	14” 100K hydraulic drill-pipe power tong equipped with automatic door, 15” lockjaw backup, & tension-style load cell. Configured for Baker-Hughes.

ALL MCCOY TONGS ARE EQUIPPED WITH A “SAFETY DOOR” ROTATION INTERLOCK SYSTEM

McCoy has made an effort ensure that all illustrations are accurate, but please note that some illustrations used in this manual may not exactly visually match your equipment.

PATENTED & PATENTS PENDING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WARNING

READ BEFORE USING EQUIPMENT

AUTHORIZED USE ONLY

Only authorized personnel deemed competent to operate, maintain, and repair this equipment shall do so.

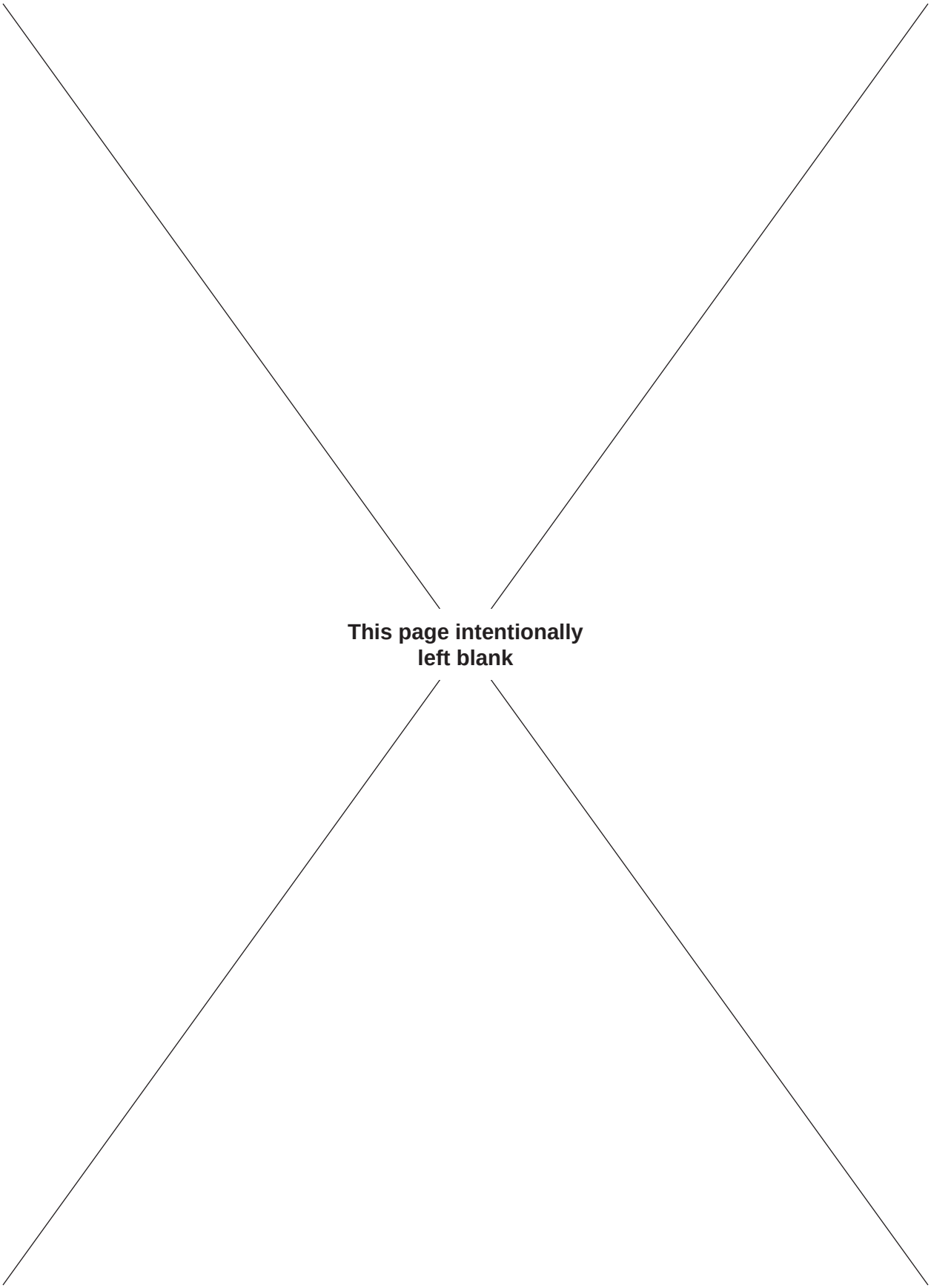
Do not operate equipment without fully reviewing and complying with all safety guidelines contained within this manual.

A "LOAD-BEARING DEVICE" IS A CHAIN SLING, RIGID SLING, SPREADER BAR ASSEMBLY, FRAME, OR ANY OTHER DEVICE THAT BEARS THE PARTIAL OR TOTAL WEIGHT OF THE EQUIPMENT FOR WHICH THIS MANUAL HAS BEEN PRODUCED

THE LOAD-BEARING DEVICE SUPPLIED BY MCCOY GLOBAL IS DESIGNED TO SUPPORT THE EQUIPMENT DESCRIBED IN THIS MANUAL. MCCOY GLOBAL WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE TO SUPPORT ANY OTHER PART, ASSEMBLY OR COMBINATION OF PARTS AND ASSEMBLIES. MCCOY GLOBAL WILL NOT GUARANTEE THE ABILITY OF THE LOAD-BEARING DEVICE TO LIFT OR SUPPORT THE EQUIPMENT DESCRIBED IN THIS MANUAL IF THERE ARE ANY MODIFICATIONS TO THE LOAD-BEARING DEVICE, OR ANY ADDITIONS TO THE EQUIPMENT DESCRIBED IN THIS MANUAL THAT ADD WEIGHT TO THE EQUIPMENT, UNLESS SUPPLIED BY MCCOY GLOBAL.

WHEN RE-ASSEMBLING LOAD-BEARING DEVICES (CHAIN SLINGS, RIGID SLINGS, BACKUP LEGS, ETC.) NOTE THAT THE ASSOCIATED FASTENERS MUST BE TIGHTENED TO THE CORRECT TORQUE SPECIFIED FOR THAT SIZE OF FASTENER (SEE SECTION 3 - OVERHAUL). ANY THREADED FASTENER IN A LOAD-BEARING DEVICE MUST BE SECURED WITH RED OR BLUE LOCTITE™.

ANY REPLACEMENT FASTENER (BOLTS, NUTS, CAP SCREWS, MACHINE SCREWS, ETC.) USED DURING MAINTENANCE OR OVERHAUL MUST BE GRADE 8 OR EQUIVALENT UNLESS OTHERWISE SPECIFIED.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Published by McCoy Global, Technical Publications Department
4225 HWY 90 East - Broussard, LA ,USA

McCoy has made every effort to ensure the information contained in this document is accurate and current. This manual is intended to provide equipment operation and safety instructions for your equipment. However, McCoy does not warrant or guarantee that the information is either complete or accurate in every respect and the user of the manual should consult with its McCoy sales representative for any clarifications and updates.

The user of the manual shall protect, indemnify, and hold harmless McCoy and its directors, officers, employees, and agents from and against all liability for personal injury, death, or property damage resulting directly or indirectly from the use of the information contained in this manual.

Observance of all descriptions, information and instructions set out in this manual is the full responsibility of the user. This manual is intended for guidance and informational purposes and must be used in association with adequate training and on-the-job supervision to provide safe and effective equipment use.

It is the responsibility of the user to conform to all regulations and requirements issued by an authority or agency which may affect the operation, safety or equipment integrity, that may overrule the content of this documentation.

The user will acknowledge and obey any general legal or other mandatory regulation in force relating to accident prevention, safety, and equipment integrity.

Summary Of Revisions			
Date	**Section**	**Page**	**Description Of Revision**
JUN 2014			Initial release
APR 2018	2	2.22	Updated backup jaw / jaw die charts

Continued on next page ...

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The information presented in this document will provide setup, operating, and maintenance instructions for your CLE14000DP tong and lockjaw backup assembly. Due to the wide variety of operating conditions, these instructions must be considered guidelines rather than absolute operating procedures. It is the responsibility of the user to use these guidelines together with an experienced manager to develop operating procedures that conform to all policies set forth by the operating authority (ies).

IDENTIFICATION OF OF WARNINGS AND OTHER NOMENCLATURE OF IMPORTANCE USED IN THIS INSTALLATION GUIDE

McCoy uses three indicators to describe items of three degrees of importance.

A **HAZARD** to operators or equipment is represented by an exclamation point within a red triangle and identifies items of the highest importance. Failure to heed information identified by a **HAZARD** symbol may result in bodily injury, death, catastrophic equipment damage, or any combination of these. A **HAZARD** may also indicate the potential for dangerous environmental contamination.

THIS IDENTIFIES A HAZARD TO OPERATORS OR EQUIPMENT

A **WARNING** is represented by an exclamation point within an orange triangle, and contains information that will alert personnel to a potential safety hazard that is not life-threatening. A **WARNING** may also serve to alert the user to information critical to the correct assembly or operation of the equipment in use.

THIS IDENTIFIES A WARNING TO USERS

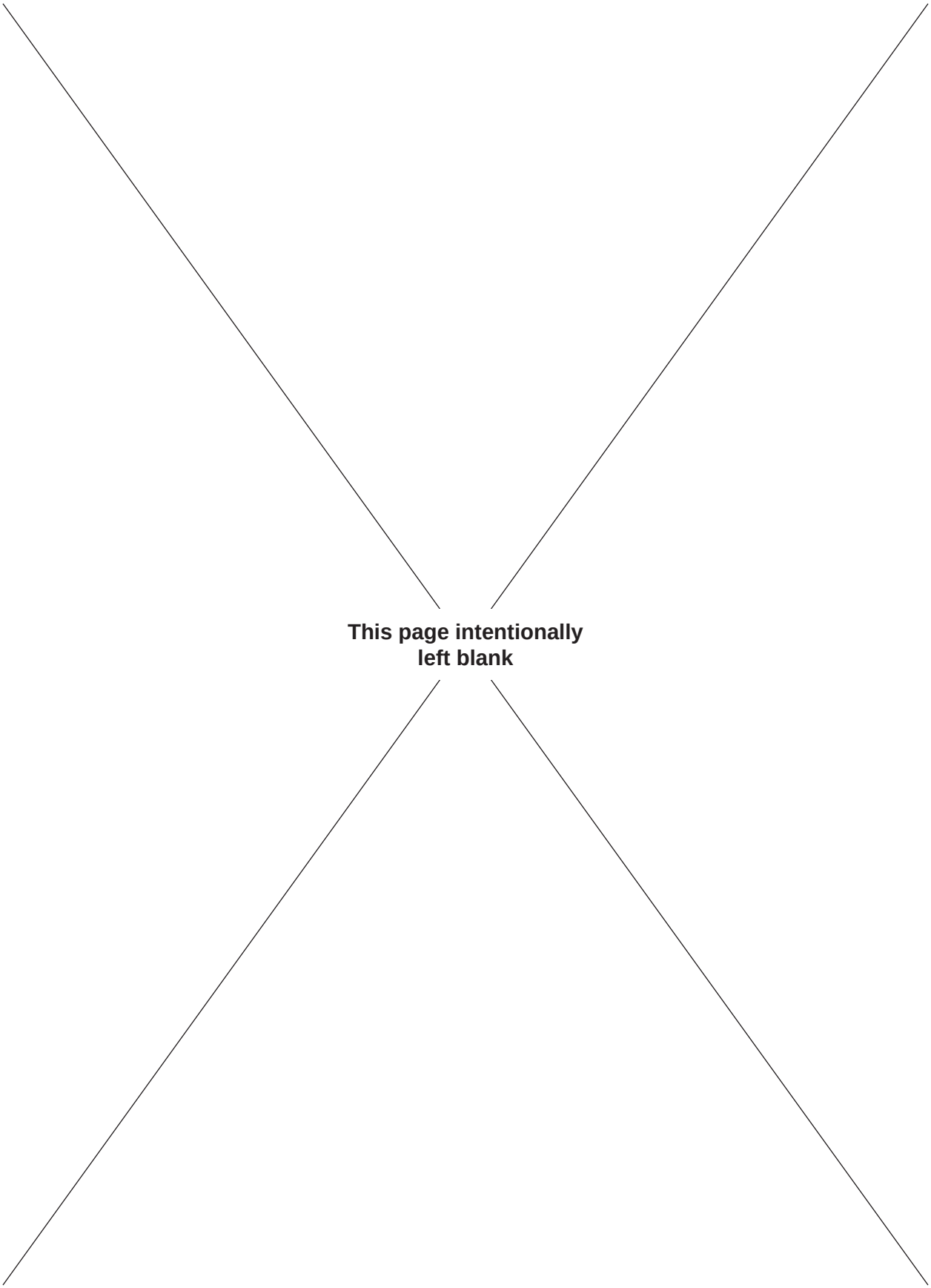
A **CAUTION** is represented by an exclamation point within a yellow triangle and highlights information that may aid the user during assembly or operation of your equipment. **CAUTIONs** are also used to ensure common errors are not made during assembly or operation of your equipment.

THIS IDENTIFIES A CAUTION TO USERS

Observance of the following is the full responsibility of the user:

- **all descriptions, information and instructions set out in this manual**
- **any regulation or requirement issued by an authority or agency which may influence operation, safety or integrity of the equipment that overrules the content of this document.**
- **any legal or other mandatory regulation in force governing accident prevention or environmental protection.**

SECTION 1: INTRODUCTION & SPECIFICATIONS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Congratulations on the purchase of your McCoy CLE14000DP hydraulic power tong and 15 inch lock jaw backup. This unit will provide you with years of outstanding performance. Simple maintenance and care will extend its life and ensure years of excellent performance and reliability. The setup, operating, and maintenance instructions in this manual will assist you in giving your equipment the care it requires. Please carefully read the manual before installing and using your equipment. Replacement parts are readily available from McCoy Global USA in Broussard, Louisiana. Should you need replacement parts, or should you experience any difficulty not covered in this manual, please contact:

McCoy Global USA Corp.

4225 Hwy, 90 East
Broussard, Louisiana
USA,

Phone: 1.337.837.8847
Fax: 1.337.837.8839
Email Customer Service: customerservice@mccoyglobal.com
Email Sales: dcsales@mccoyglobal.com

Website: http://www.mccoyglobal.com/drilling-completions

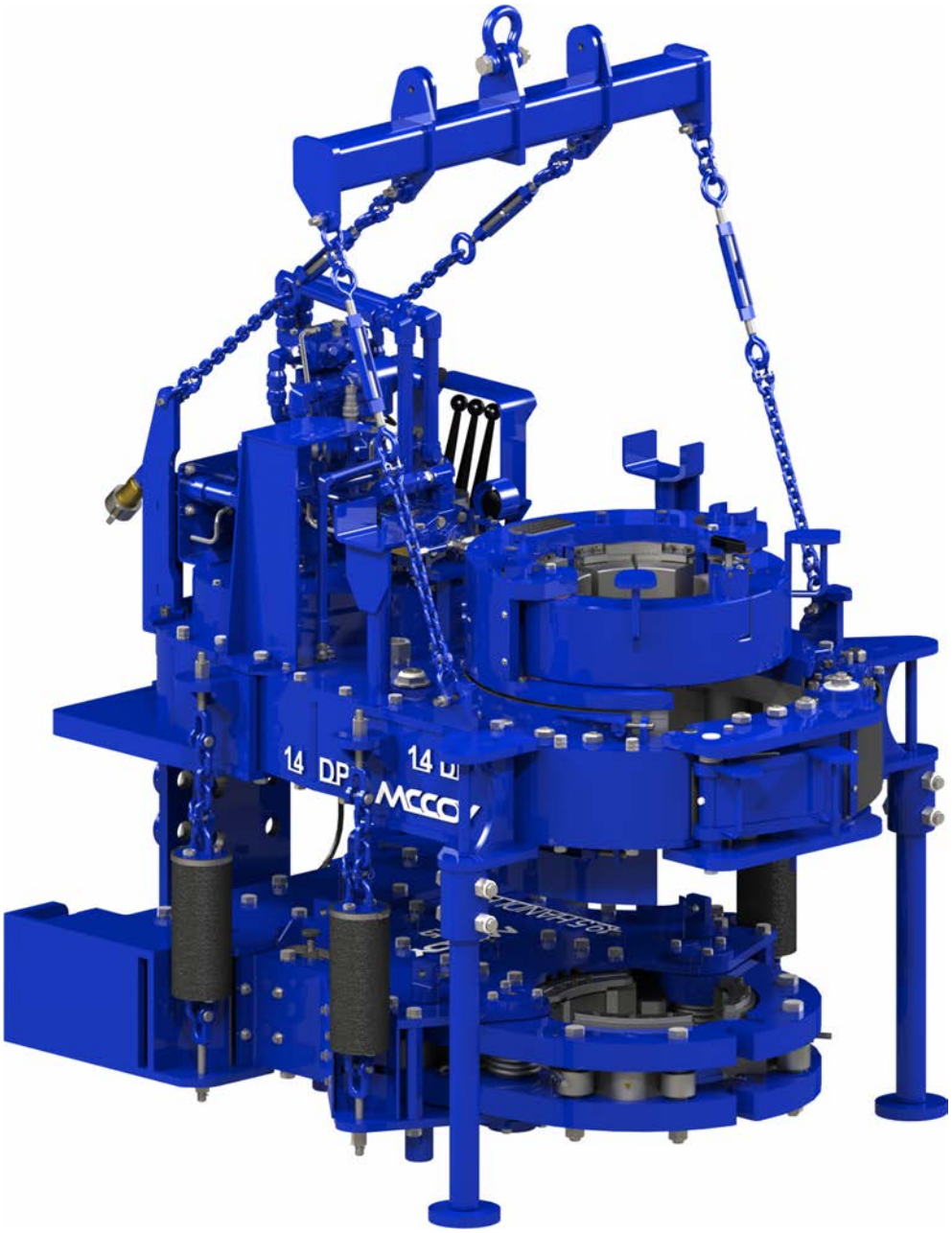


ILLUSTRATION 1.A.1: CM14000DP+CM15000DP+15" LJBU

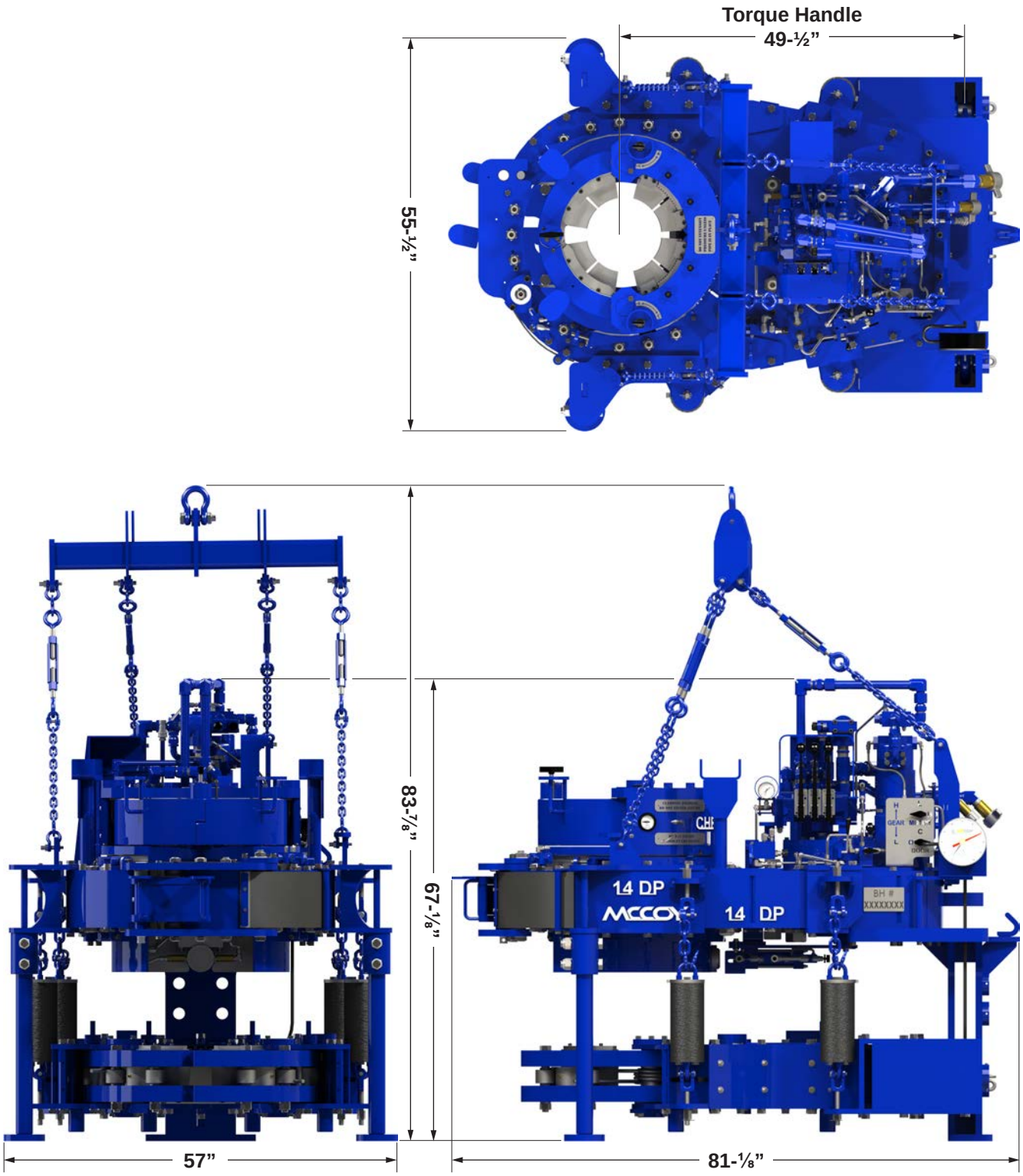
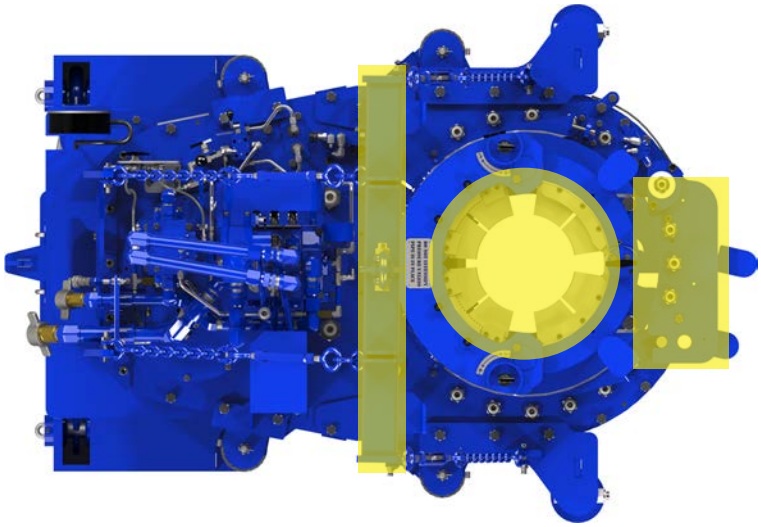


ILLUSTRATION 1.A.2: CLE14000DP+15” LJBU MAJOR DIMENSIONS (OPTIONAL CHROMEMASTER™ SHOWN)



A rotating cage plate assembly, backup clamp cylinders, and automated tong and backup doors present significant hazards when the equipment is active.

The areas highlighted in YELLOW on this page indicate potential crushing and snagging hazards during operation. Keep hands clear of indicated areas when equipment is energized.

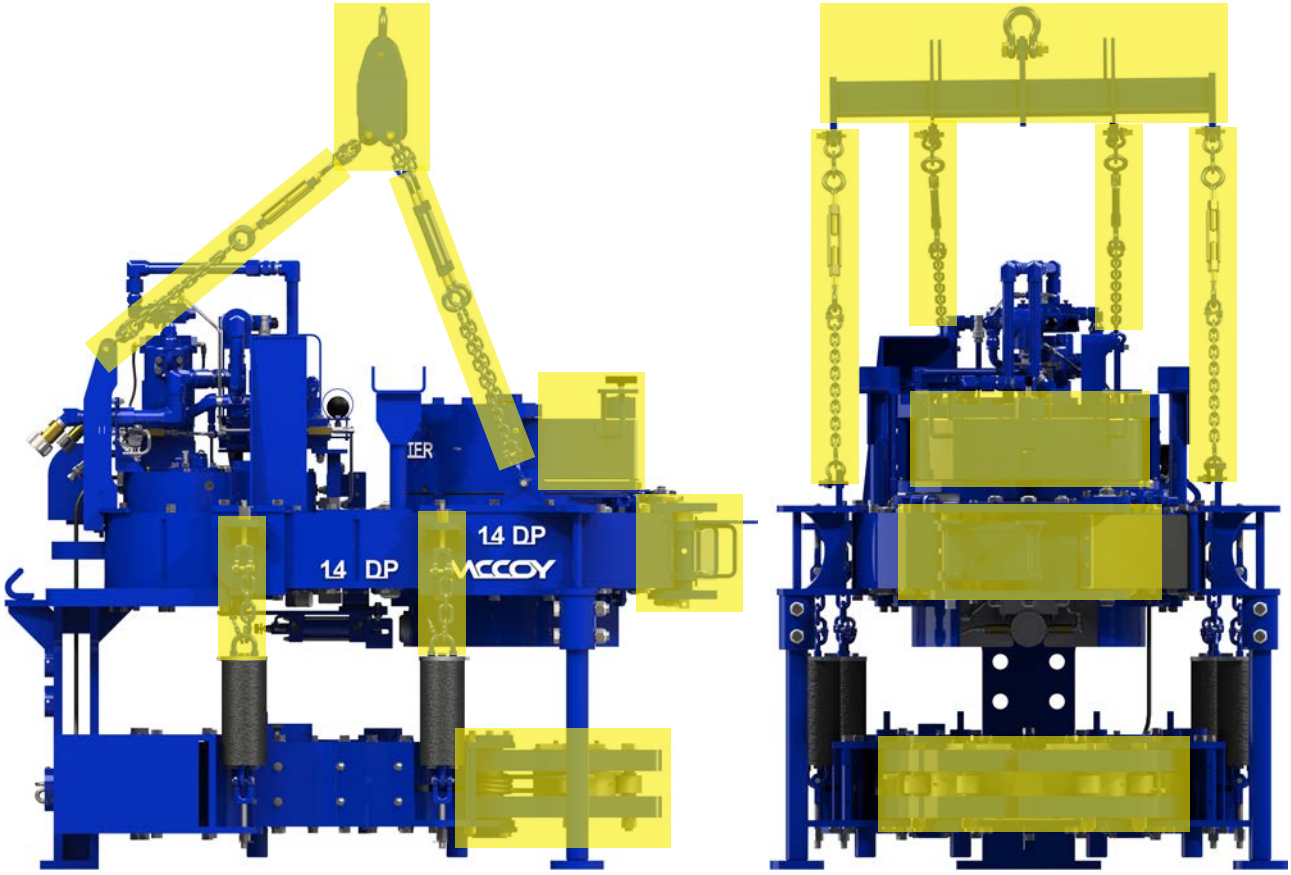


ILLUSTRATION 1.A.3: CLE14000DP+15" LJBU ADDITIONAL HAZARDS (OPTIONAL CHROMEMASTER™ SHOWN)

MAXIMUM RATED TORQUE

Please note that these are ideal values. Actual achieved torque is highly dependent upon tong efficiency and final position of rotary gear when full torque load is reached. Maximum torque is only available when hydraulic motor is run at full displacement (motor speed LOW), tong is in LOW gear, and the rotary gear remains in full contact with both idler assemblies.

STANDARD TONG

Pressure	HIGH GEAR				LOW GEAR			
	Motor Speed High		Motor Speed Low		Motor Speed High		Motor Speed Low	
PSI / Bar	Lbs.-ft.	Nm	Lbs.-ft.	Nm	Lbs.-ft.	Nm	Lbs.-ft.	Nm
2700 / 186.2	10,000	13558	20,000	27116	50,000	67,791	100,000	135,582

TONG WITH CHROMEMASTER™

Pressure	Motor Speed HIGH				Motor Speed LOW			
	High Gear		Low Gear		High Gear		Low Gear	
PSI / Bar	Lbs.-ft.	Nm	Lbs.-ft.	Nm	Lbs.-ft.	Nm	Lbs.-ft.	Nm
2700 / 186.2	10,000	13558	20,000	27116	50,000	67,791	75,000	101,686

MAXIMUM RATED TORQUE FOR CHROMEMASTER™ IS 75,000 LBS-FT

MAXIMUM MOTOR PRESSURE: 2700 PSI / 186.2 BAR
MAXIMUM SYSTEM PRESSURE: 3000 PSI / 206.8 BAR

Maximum Hydraulic Requirements	60 GPM (227.1 LPM)
	3000 PSI (20.684 MPa)
Maximum Dimensions:	
Length (Door Closed)	81-⅛ in / 2.061 m
Height	67-⅛ in / 1.705 m
Height (including sling & spreader bar)	83-⅞ in / 2.130 m
Width	57 in / 1.448 m
Maximum Vertical Travel (Tong)	± 3 in / 152.4 mm
Space Required On Pipe (Tong)	13 in / 330.2 mm
Space Required On Pipe (Tong, inc. CHROMEMASTER™)	26-¾ in / 679.5 mm
Torque Arm Length (Pipe center to anchor center)	49-½ in / 1257 mm
Dead Weight (Approximate, standard model)	7,205 lbs / 3268 kg (jaws not included)
Dead Weight (Approximate, with CHROMEMASTER™)	8,140 lbs / 3692 kg (jaws not included)
Sound Level (dBa)	
Tong Jaws available (inches)	All standard sizes from 7” to 14” (1)
CHROMEMASTER™ Jaws available (inches)	All standard sizes from 6-⅝” to 15” (1)
Backup Jaws available (inches)	All standard sizes from 7” to 15” (1)
Recommended Spring Hanger	55-0000029

1. Custom sizes available upon request

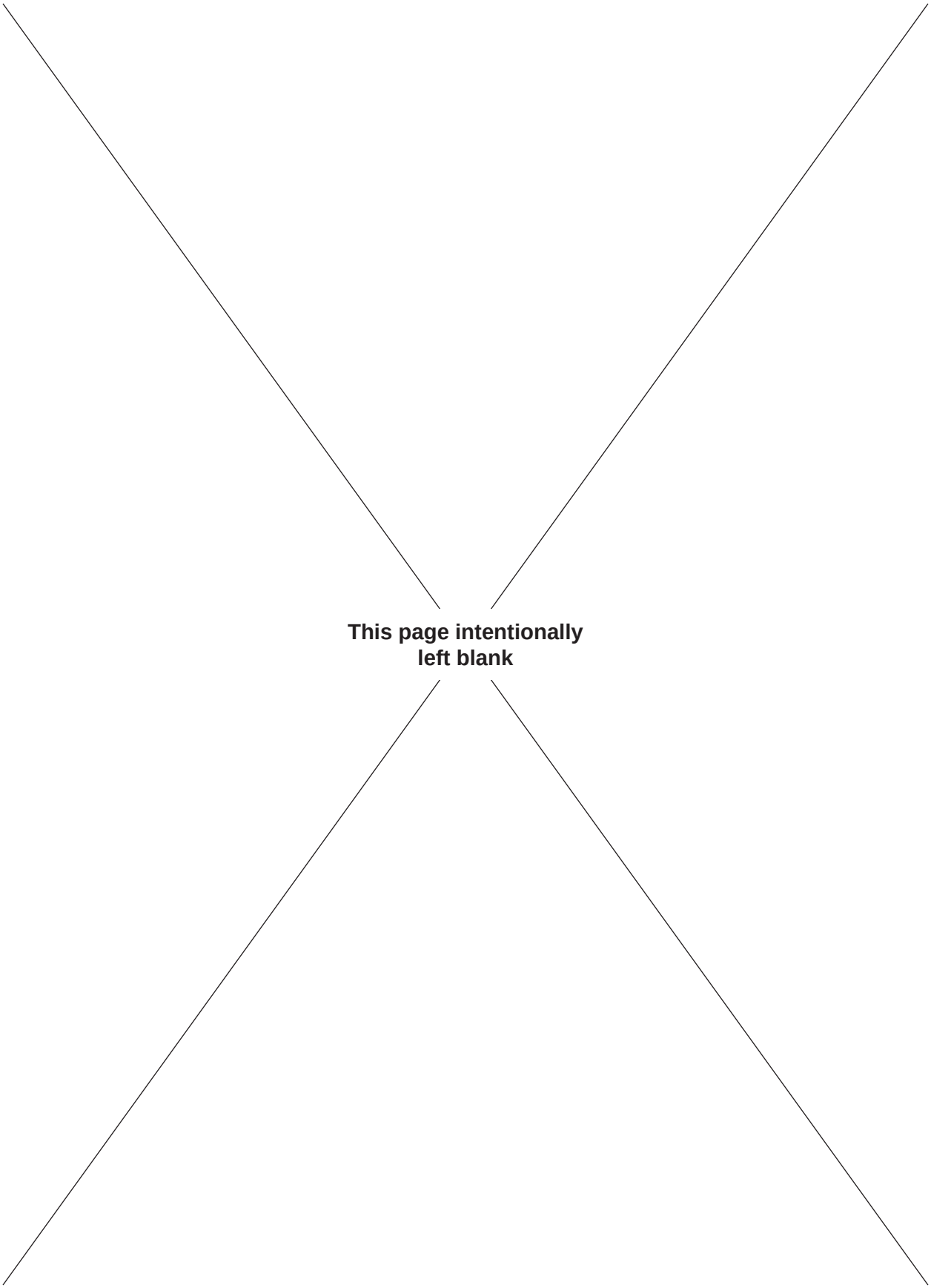
ONLY USE SPRING HANGERS SUPPLIED BY MCCOY GLOBAL.

Rotation Speed (RPM - Theoretical)				
	Motor Speed LOW		Motor Speed HIGH	
Flow (GPM/LPM)	Low Gear	High Gear	Low Gear	High Gear
10 / 37.9	0.5	2.3	0.9	4.6
20 / 75.7	0.9	4.6	1.7	9.2
40 / 151.4	1.7	9.3	3.4	18.5
60 / 227.1	2.6	13.9	5.1	27.7

Lubricant Standards:

McCoy recommends using good-quality hydraulic fluid with a viscosity of ISO 68. Allowing adequate time for the hydraulic fluid to reach an operating temperature of 38°C to 48°C (100°F to 118°F) permits the fluid to operate at its optimum operating viscosity, and maximizes the service life of the fluid and integrity of hydraulic components. System temperature above 54°C (130°F) exceeds the temperature that allows minimum operating viscosity of the fluid. Running your hydraulic system at temperatures continuously exceeding 60°C (140°F) will lead to premature component wear, leaking seals, slow hydraulic system response, and more frequent replacement of the hydraulic fluid. A hydraulic fluid cooler is recommended where operating temperatures are expected to exceed the recommended maximum.

McCoy recommends use of a good-quality EP synthetic multi-purpose grease with an NLGI consistency grade of "2" and an NLGI performance grade of "GC-LB" for general lubrication of bearings and metal-to-metal contact.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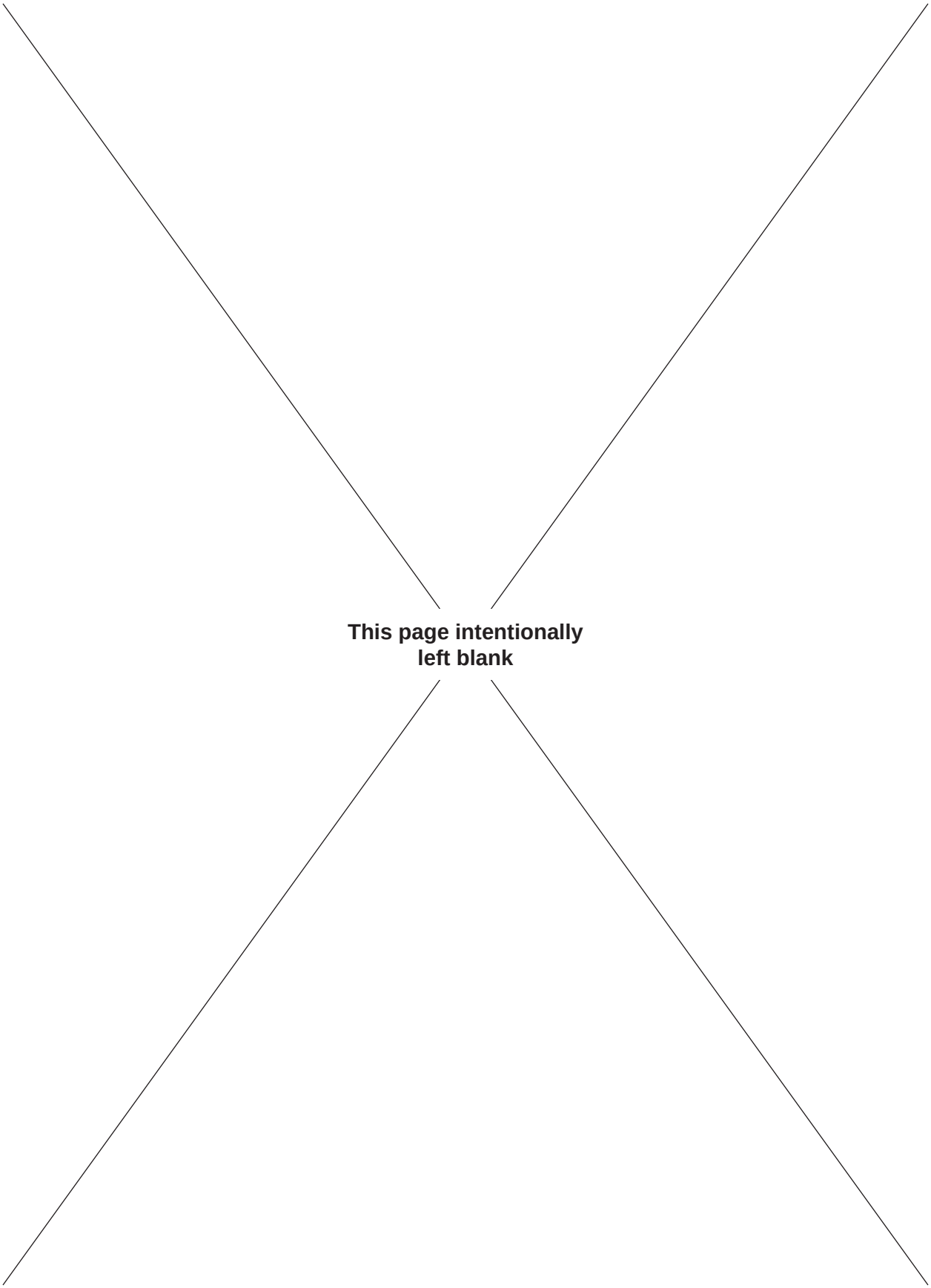
SECTION 2: INSTALLATION & COMMISSIONING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Adequate setup and proper hydraulic connections are essential in ensuring reliable operation of your McCoy mechanical roughneck. For best results and long term reliability, read and obey the installation and commissioning instructions in this section.

2.A RECEIPT, INSPECTION, AND HANDLING OF EQUIPMENT

YOUR EQUIPMENT HAS BEEN THOROUGHLY TESTED AND INSPECTED AT THE FACTORY. HOWEVER, MCCOY ADVISES INSPECTING YOUR EQUIPMENT FOR SHIPPING DAMAGE UPON RECEIPT AND TESTING YOUR EQUIPMENT BEFORE RELEASING TO AN OPERATIONAL ENVIRONMENT.

Upon receipt inspect packaging materials for shipping damage. Shipping damage may include (but not be limited to) perforation of a crate, misshapen crate, crushed corners, missing hardware, scraped or bent metal, and impact or orientation indicators (like a “tip’n’tell). Record all shipping damage on the shipping manifest and ensure shipping company and McCoy are immediately contacted.

Remove all protective shipping materials including plastic wrap, desiccant packs, padding, etc and perform a visual inspection of the equipment. Check structural components for bending or buckling indicative of vertical impact. Immediately identify any shipping damage to the shipping company, and correct all damage before connecting equipment to a hydraulic power source.

The spreader bar and sling supplied by McCoy Global is designed to safely hoist the equipment described in this manual. Hoist equipment using provided spreader bar and chain sling only.

2.B MAJOR COMPONENT IDENTIFICATION

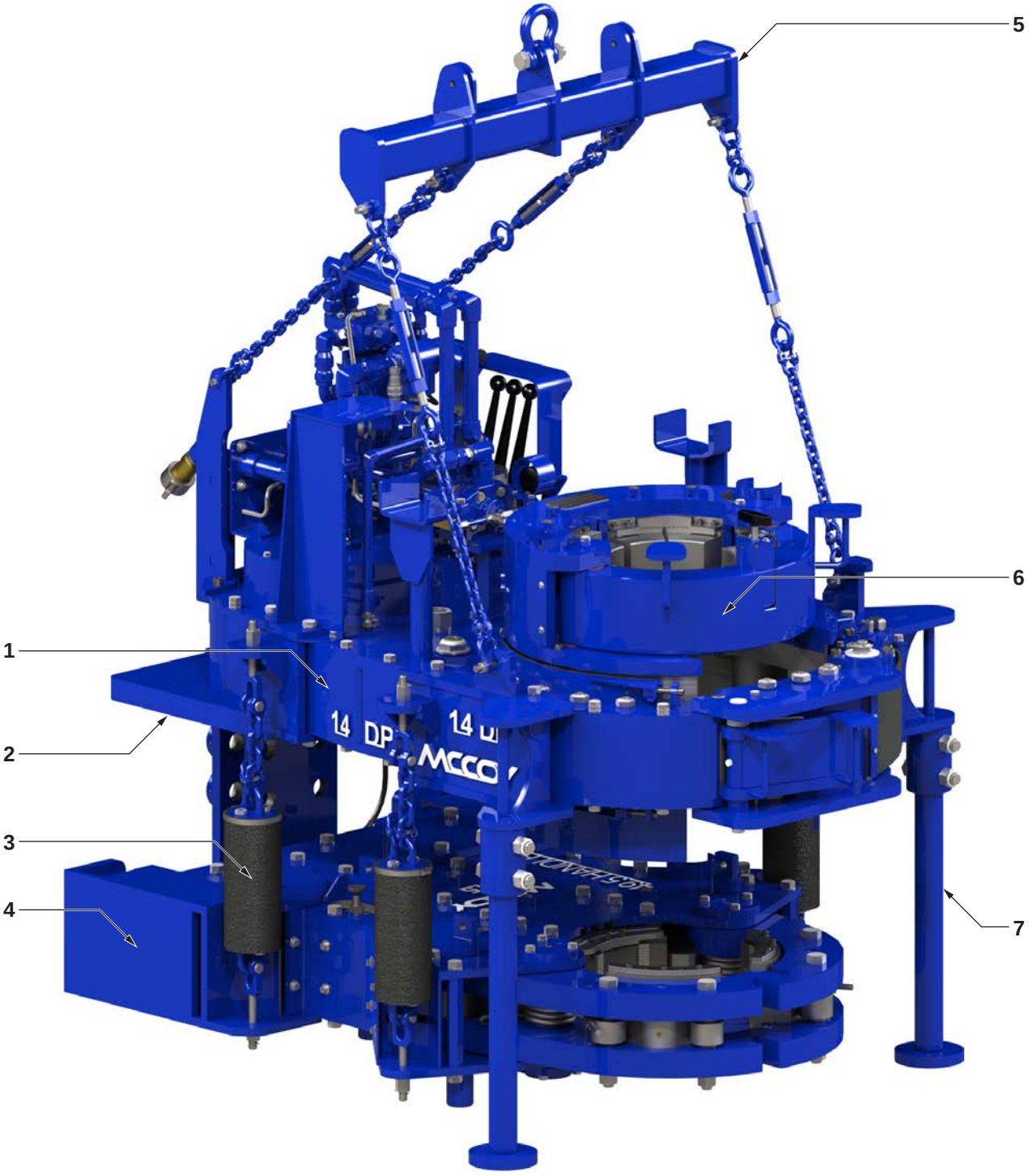


ILLUSTRATION 2.B.1: CLE14000DP+CHROMEMASTER™+15" LJBU COMPONENT ID 01

Item	Description
1	CLE14000DP-12 14" 100K lbs-ft hydraulic drill-pipe power tong (for use with CHROMEMASTER™)
2	Rear leg weldment
3	Spring hanger
4	15" lockjaw-style hydraulic backup

2.B MAJOR COMPONENT IDENTIFICATION (CONTINUED):

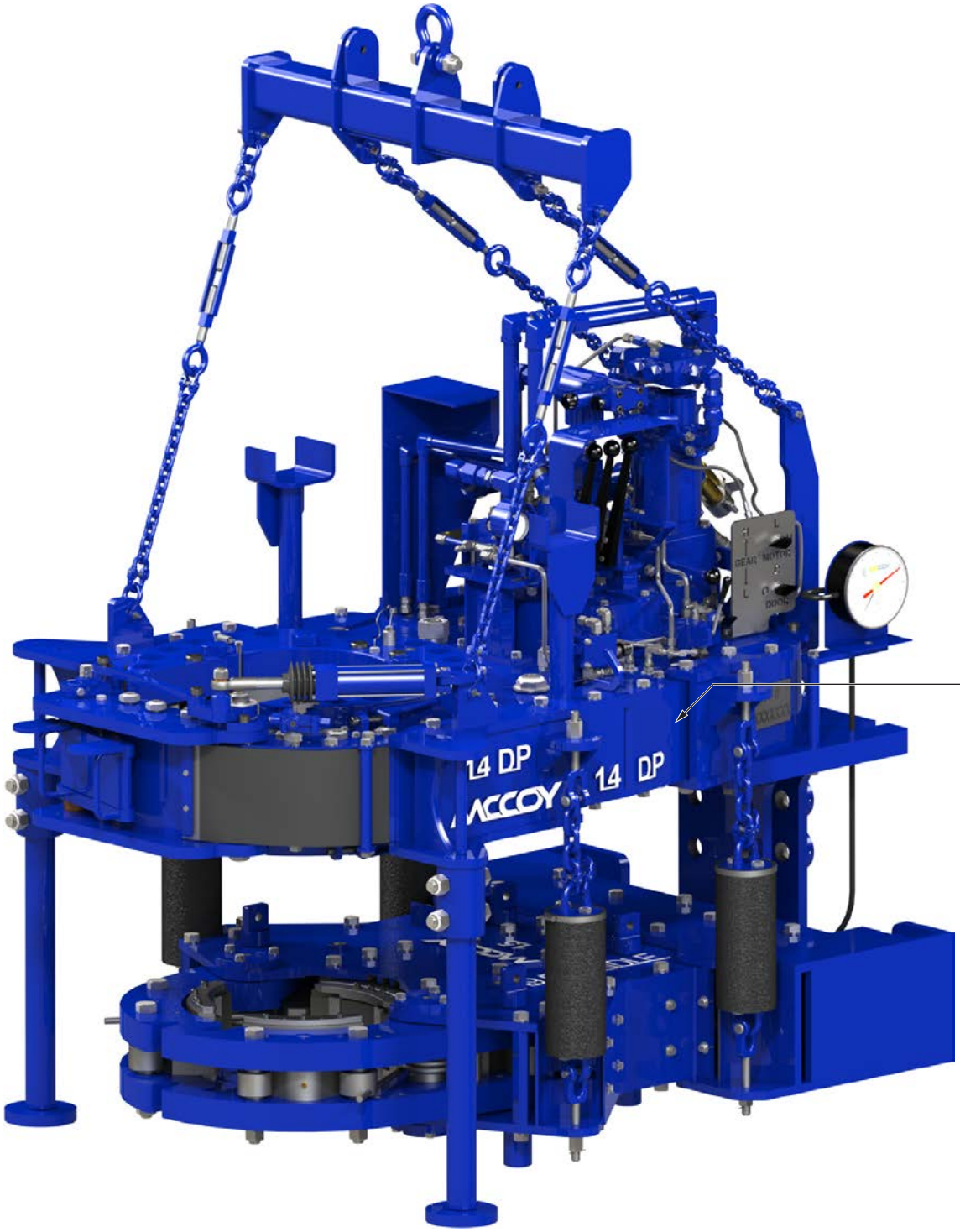


ILLUSTRATION 2.B.2: CLE14000DP+15" LJBU COMPONENT ID 01

Item	Description
5	Spreader bar and chain-style lifting sling (designed for use with Baker Hughes Leadhand)
6	Optional CHROMEMASTER™ system
7	Front leg weldment
8	CLE14000DP-11 14" 100K lbs-ft hydraulic drill-pipe power tong (stand-alone drill-pipe tong)

2.B MAJOR COMPONENT IDENTIFICATION (CONTINUED):

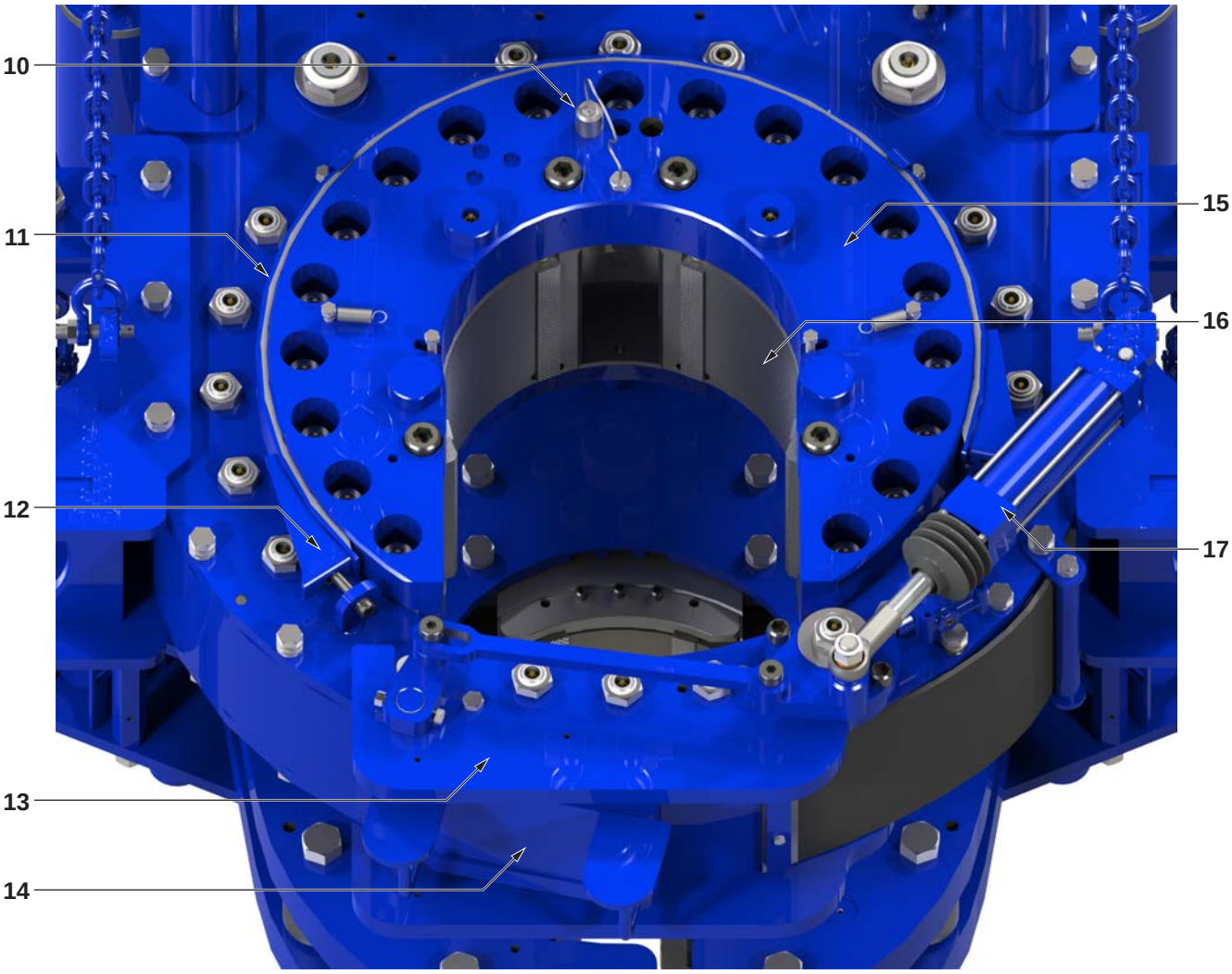


ILLUSTRATION 2.B.3: CLE14000DP+15" LJBU COMPONENT ID 02

Item	Description
10	Manually-operated reversing pin
11	Brake band
12	Brake band adjustment
13	Tong door weldment
14	Tong door latch assembly
15	Cage plate assembly
16	Tong jaws with die inserts
17	Hydraulic door cylinder (not available on CM-convertible tongs)

2.B MAJOR COMPONENT IDENTIFICATION (CONTINUED):

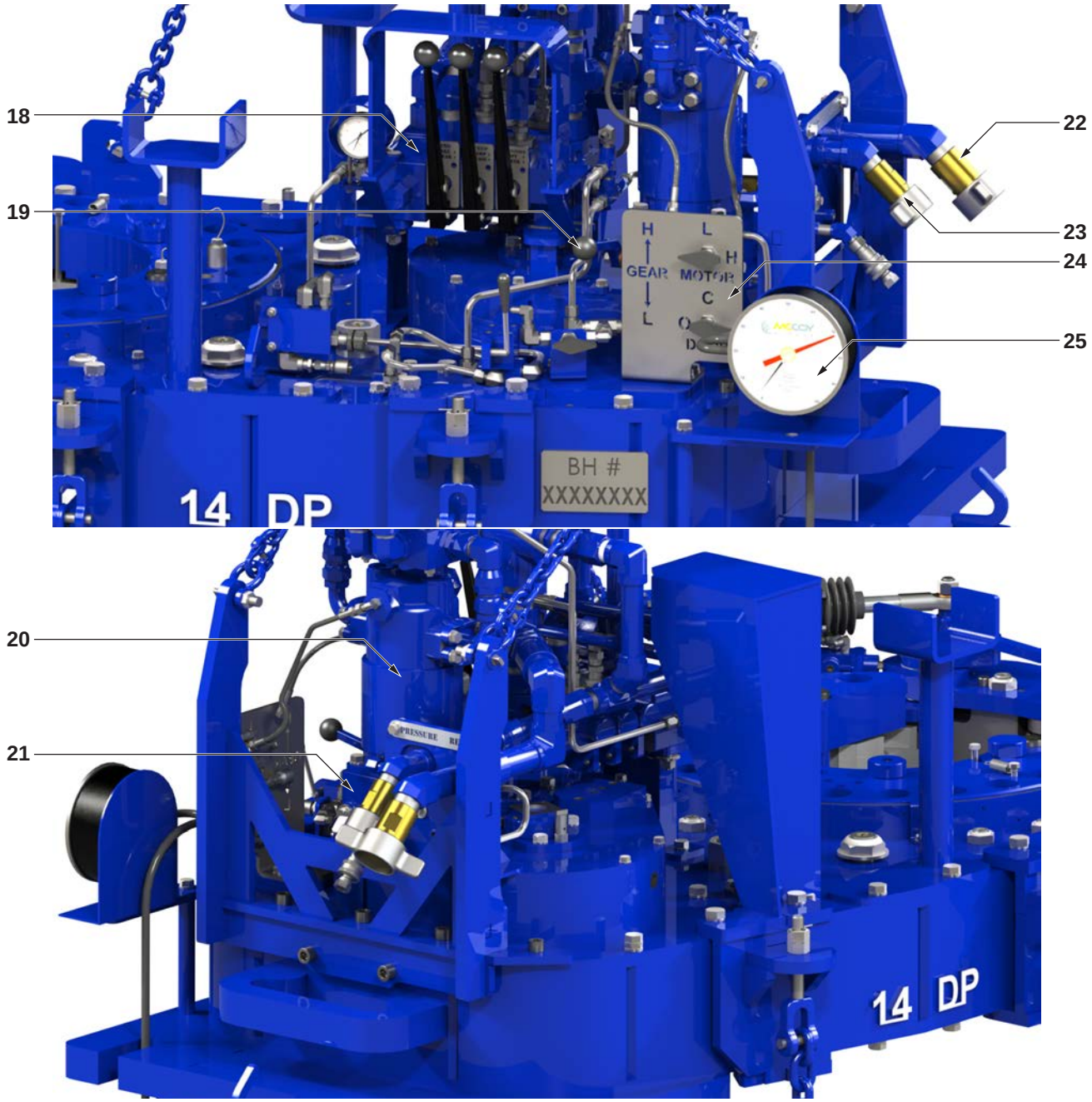


ILLUSTRATION 2.B.4: CLE14000DP+15" LJBU COMPONENT ID 03

Item	Description
18	Hydraulic valve assembly
19	Manual shifter
20	Hydraulic motor
21	Gearbox
22	Hydraulic fluid discharge
23	Hydraulic fluid supply
24	Additional hydraulic controls
25	Torque gauge

2.B MAJOR COMPONENT IDENTIFICATION (CONTINUED):

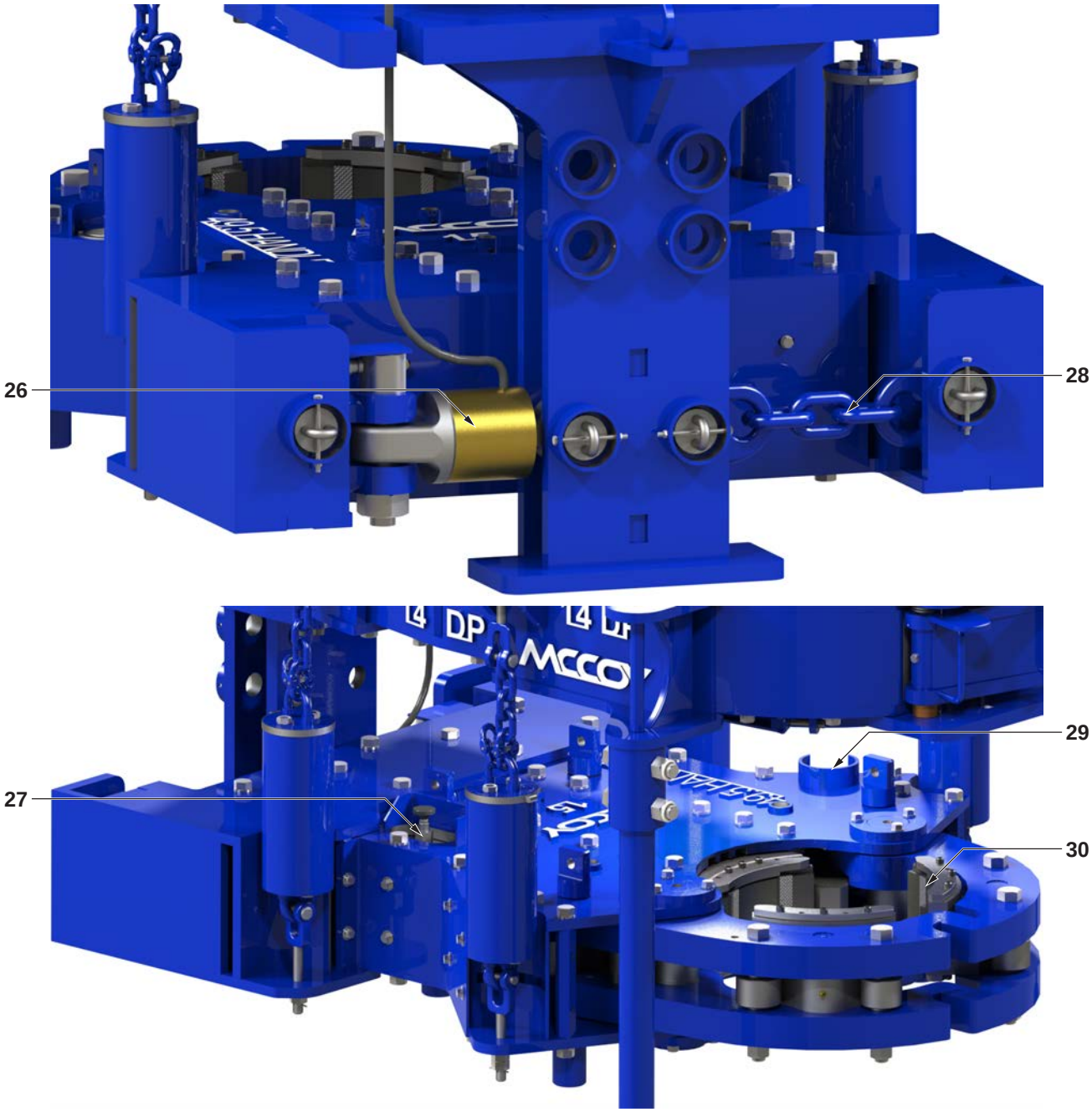


ILLUSTRATION 2.B.5: CLE14000DP+15" LJBU COMPONENT ID 04

Item	Description
26	Tension load cell
27	Backup pressure adjustment
28	Breakout chain
29	Backup pressure indicator
30	Backup jaw

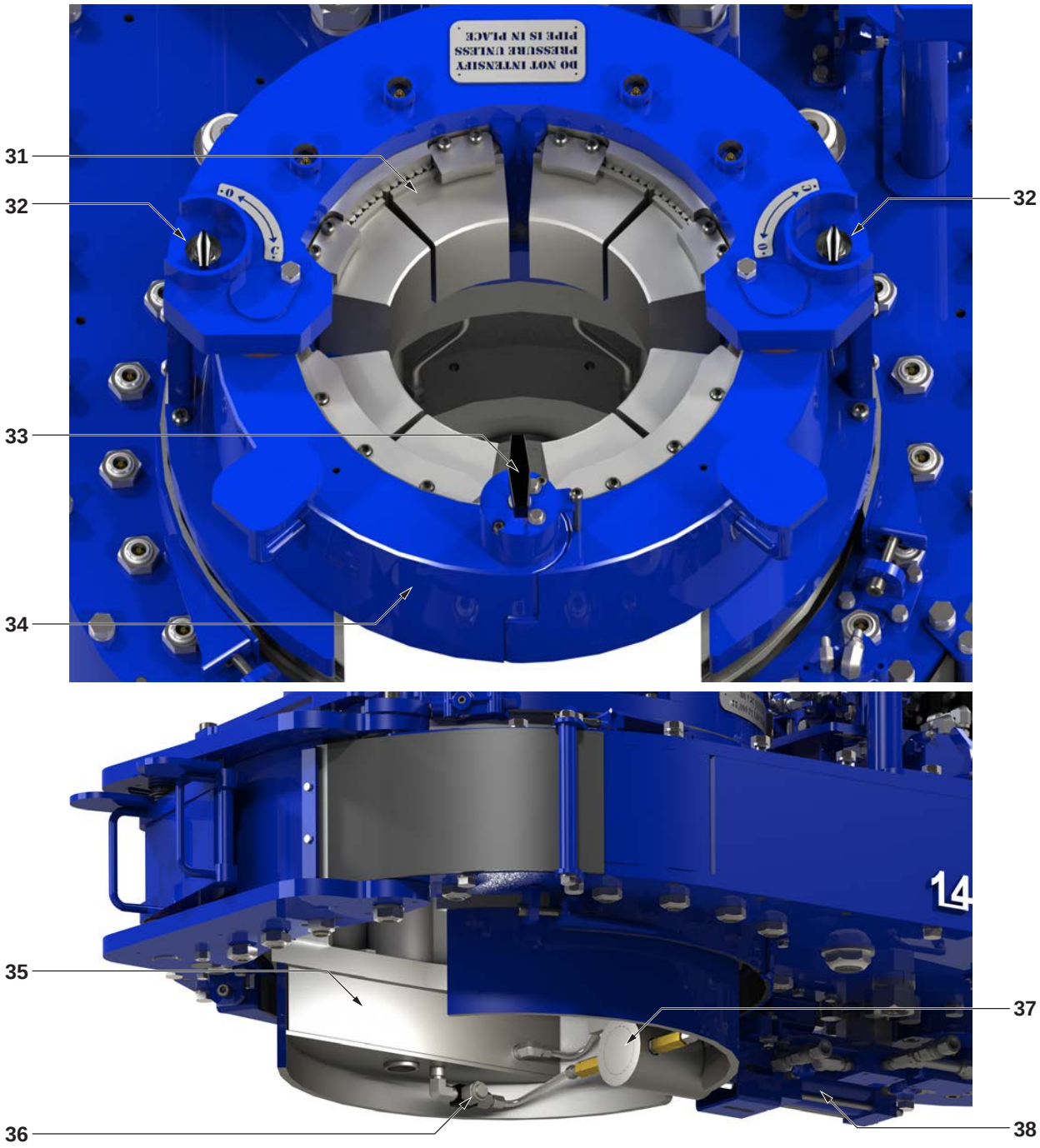


ILLUSTRATION 2.B.6: CM15000DP CHROMEMASTER™ COMPONENT ID 01

Item	Description
31	CHROMEMASTER™ rear jaw with grit-face dies
32	CHROMEMASTER™ hydraulic system block valve
33	CHROMEMASTER™ door latch pin
34	CHROMEMASTER™ swing door with grit-face dies
35	CHROMEMASTER™ hydraulic system reservoir
36	CHROMEMASTER™ hydraulic system filter
37	CHROMEMASTER™ hydraulic system pump
38	CHROMEMASTER™ pump cylinder

2.C SLING / LOAD BEARING DEVICE SAFETY

THE SUPPLIED LOAD-BEARING FRAME HAS BEEN SPECIFIED OR DESIGNED TO SUPPORT THE EQUIPMENT DESCRIBED IN THIS DOCUMENT. MCCOY WILL NOT GUARANTEE THE ABILITY OF THE FRAME TO SUPPORT ANY OTHER PART, ASSEMBLY OR COMBINATION OF PARTS AND ASSEMBLIES, OR ANY ADDITIONS TO THE EQUIPMENT DESCRIBED IN THIS MANUAL THAT ADD WEIGHT TO THE EQUIPMENT, UNLESS SUPPLIED BY MCCOY.

MCCOY GLOBAL DOES NOT GUARANTEE THE INTEGRITY OF MODIFIED OR DAMAGED FRAME, UNLESS THOSE MODIFICATIONS ARE PERFORMED BY MCCOY.

McCoy Global recommends following an industry-accepted standard such as OSHA, ASME B30.9-2006, or manufacturer's guidelines when performing any rigging and overhead lifting. Use by untrained persons is hazardous. Improper use will result in serious injury or death. Do not exceed rated capacity. Slings will fail if damaged, abused, misused, overused, or improperly maintained.

- Only grade 80 or grade 100 alloy chain should be used for overhead lifting applications.
- Working Load Limit (WLL) is the maximum allowable load in pounds which may be applied to the load-bearing device, when the device is new or in "as new" condition, and when the load is uniformly and directly applied. The WLL must never be exceeded.
- Working Load Limit (WLL) is the maximum working load for a specific minimum sling angle, measured from the horizontal plane. The Working Load Limit is identified on the sling.
- The Working Load Limit or Design factor may be affected by wear, misuse, overloading, corrosion, deformation, intentional alterations, sharp corner cutting action and other use conditions.
- Shock loading and extraordinary conditions must be taken into account when selecting alloy chain slings.
- See OSHA Regulation for Slings 1910.184, ANSI/ASME B30.9-"SLINGS", ANSI/ASME B30.10-"HOOKS" and ANSI/AMSE B30.26 "RIGGING HARDWARE" for additional information.

2.C.1 Inspection Of Slings

McCoy strongly recommends the following practices:

A complete inspection of new load-bearing devices and attachments shall be performed by a qualified, designated person prior to initial use. Each link and component shall be examined individually, taking care to expose and examine all surfaces including the inner link surface. The sling shall be examined for conditions such as those listed in the removal criteria below. In addition, daily inspection of slings, fastenings and attachments shall be performed by a designated person. If damage or defects are found at either inspection, the damaged or defective component shall be quarantined from service until it can be properly repaired or replaced.

Removal Criteria:

A load-bearing device shall be removed from service if conditions such as the following are present:

- Missing or illegible sling identification.
- Cracks or breaks
- Evidence of tampering is seen - sling tag has been modified or obscured, or tamper-proof nuts are missing.
- Signs of impact on load-bearing components, including spreader bars, lifting lugs, rigid slings & rigid sling weldments, and legs & leg mounts.
- Broken or damaged welds.
- Excessive wear, nicks, or gouges. Refer to the chart below to ensure minimum thickness on chain links supplied is not be below the values listed:

Minimum Allowable Chain Link Thickness at Any Point			
Nominal Chain Size		**Minimum Thickness**	
Inches	MM	Inches	MM
7/32	5.5	0.189	4.80
9/32	7	0.239	6.07
5/16	8	0.273	6.93
3/8	10	0.342	8.69
1/2	13	0.443	11.26
5/8	16	0.546	13.87
3/4	20	0.687	17.45
7/8	22	0.750	19.05
1	26	0.887	22.53
1-1/4	32	1.091	27.71
Refer To ASME B30.9			

2.C.1 Inspection Of Slings (Continued):

- Stretched, bent, twisted, or deformed chain links or components.
- Evidence of heat damage.
- Excessive pitting or corrosion.
- Lack of ability of chain or components to hinge (articulate) freely.
- Weld splatter.
- For hooks, removal criteria as stated in ASME B30.10
- Other conditions, including visible damage, that cause doubt as to the continued use of the sling.

Inspect all lugs and fixing points for signs of elongation and/or bending, or for material build-up around the hole. Repair or replace components that appear distorted. Ensure all hardware is tight and in good condition. Replace missing hardware if necessary. All hardware must be free of rust and corrosion.

Additional inspections shall be performed during sling use where service conditions warrant. Periodic inspection intervals shall not exceed one year. The frequency of periodic inspections should be based on:

- Frequency of use of the load-bearing device.
- Severity of service conditions
- Nature of lifts being made
- Experience gained on the service life of load-bearing devices used in similar circumstances.

Guidelines for the interval are:

- Normal Service - yearly
- Severe Service - monthly to quarterly
- Special Service - as recommended by a qualified person

Units designed and manufactured in accordance with EN 12079 and DNV 2.7-1 should be tested and examined in accordance with the following schedule of examination and test. The user of the load-bearing device shall place a permanent placard or plate upon which the type and date of the last test shall be recorded. To avoid confusion, the plate shall not carry the date of the next test or examination, only the most recent.

Test / Examination				
Time / Interval	Lifting Tests[1]	Non-Destructive Examination (NDE) of Lifting Points	Thorough Visual Examination	Suffix To Be Marked On Plate Attached To Unit
Initial Certification By McCoy	YES	YES	YES	T
Interval Not Exceeding 12 Months	At the discretion of inspection body	At the discretion of inspection body	YES	T or VN[3]
Interval Not Exceeding 60 Months	At the discretion of inspection body	YES	YES	T or VN
Following Substantial Repair or Alteration[4]	YES	YES	YES	T

1. Lifting test as per S 7.3 BS EN 12079 or DNV 2.7-1 May 1995
2. T = Proof Test, non-destructive examination; VN = non destructive examination and visual examination; V = visual examination.
3. Dependant upon whether non-destructive examination has been carried out.
4. For the purposes of this standard, a substantial repair or modification is defined as any repair and/or modification that has been carried out which may, in the opinion of the inspection body, affect the load-bearing elements of the container or lifting device, or elements that contribute directly to its structural integrity.

OBSERVED OR SUSPECTED MECHANICAL MECHANICAL DAMAGE TO A LOAD-BEARING DEVICE, OR OVERLOADING OF A THE LOAD-BEARING DEVICE HAS BEEN OVERLOADED REQUIRES REMOVAL FROM SERVICE AND QUARANTINING OF THE DEVICE UNTIL RE-CERTIFIED

Written records of the most recent periodic inspection shall be maintained, and shall include the condition of the sling.

2.C.2 Proper Use Of Load-Bearing Devices

Whenever any load-bearing device is used, the following practices shall be observed.

- Load-bearing devices that are damaged or defective shall not be used.
- Slings shall not be shortened with knots or bolts or other makeshift devices.
- Sling legs shall not be kinked.
- Load-bearing devices shall not be loaded in excess of their rated capacities.
- Slings shall be securely attached to their load.
- Load-bearing devices shall be protected from snagging, and shall not be further obstructed by any object.
- Suspended loads shall be kept clear of all obstruction.
- All employees shall be kept clear of loads about to be lifted and of suspended loads.
- Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.
- Shock loading is prohibited.
- Do not stand directly under a load during lifting.

Correct orientation of lifting sling shackles is critical for ensuring safe use of the lifting sling. Illustration 2.C.1 illustrates correct orientation - do not reverse the orientation of the shackles on the lifting sling.

ENSURE LIFTING SLING SHACKLES ARE CORRECTLY ORIENTED BEFORE HOISTING.

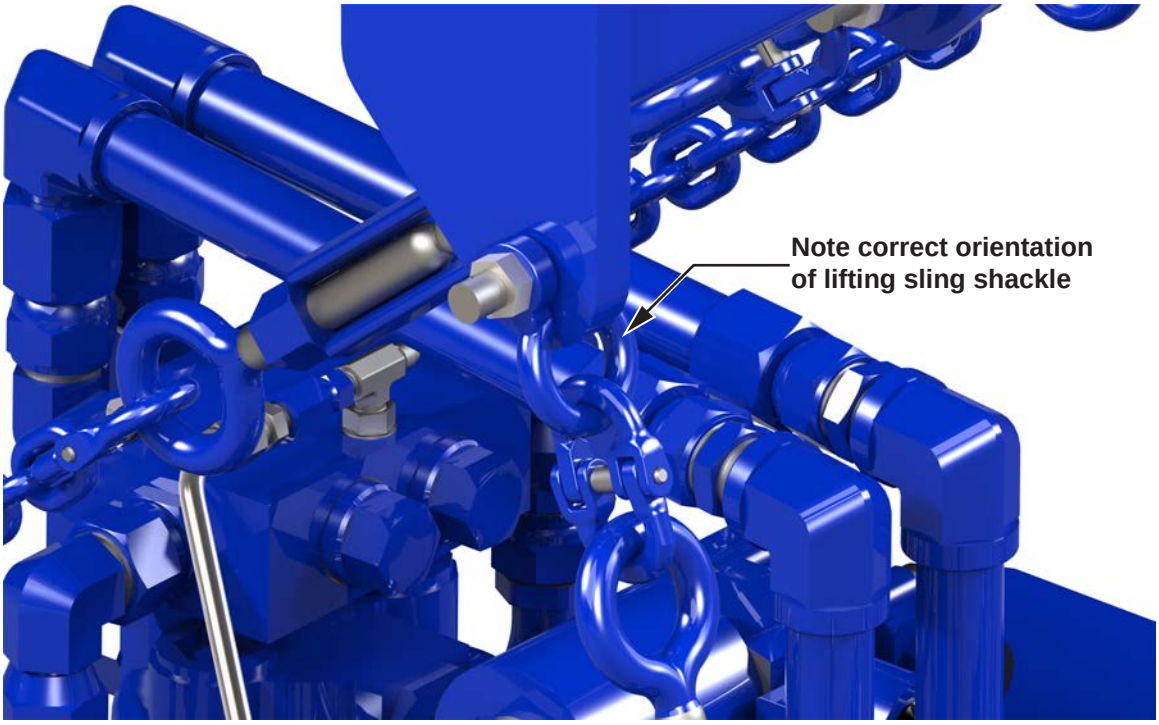


ILLUSTRATION 2.C.1: CORRECT ORIENTATION OF SHACKLES

2.C.3 Storage Of Load-Bearing Devices

Proper storage of out-of-service load bearing devices is important to ensure full integrity of the device once it is returned to service. McCoy recommends observing the following practices.

- Wipe off all excess grease. Use a solvent-based cleaner on rags to wipe all external surfaces to remove residual grease or hydraulic fluid. Once the outside surfaces have been de-greased, wipe all external surfaces with clean water to remove residual solvent.
- McCoy recommends that an anti-corrosive agent such as Tectyl® 506 be applied to all external surfaces. Refer to manufacturer data sheets for proper application and safety information. Allow the anti-corrosive coating ample time to dry - refer to manufacturer data sheets for drying times at room temperature.
- Store in a clean, dry location. When returning to service, note that a full inspection of the device must be performed.

2.D LIFT CYLINDER INSTALLATION

The lift cylinder is not orientation-specific; that is, the lift cylinder will function the same way independent of which end is connected to the crane and which end is connected to the main lifting lug of the tong (or the spring hanger, if used). However, McCoy recommends orienting the lift cylinder with the hydraulic hose connection at the bottom of the cylinder to ensure the hose is not stressed when cylinder is at full extension.

TEST LIFT CYLINDER BEFORE INSTALLATION. REFER TO THE LIFT CYLINDER TECHNICAL MANUAL FOR DETAILED TESTING AND OPERATING PROCEDURES, AND DETAILED SAFETY GUIDELINES.

ENSURE TO ACCOUNT FOR THE WEIGHT OF THE SPRING HANGER WHEN CALCULATING TOTAL SUSPENDED WEIGHT.

2.D.1 Installation Procedure

1. Use a crane to hoist the lift cylinder by the shackle, ensuring the hydraulic hose connection is at the bottom of the cylinder when it is hoisted.
2. Remove the two R-clips securing the clevis pin, and remove the clevis pin.
3. Orient the spring hanger so the piston will extend down during thread make-up, preventing water and debris from gathering around the seal.
4. Place the welded U-connection inside the clevis. Replace the clevis pin, and secure the clevis pin with the two R-clips.
5. Hoist the lift cylinder and spring hanger.
6. Place a 1” shackle around the master lifting link on the tong sling. Secure the shackle to the extending end of the spring hanger using the 1-⅛” UNC x 4-¾” modified hex bolt and 1-⅛” UNC hex jam nut. Secure the jam nut to the bolt using a $^{3}/_{16}$” x 1-¼” cotter pin.

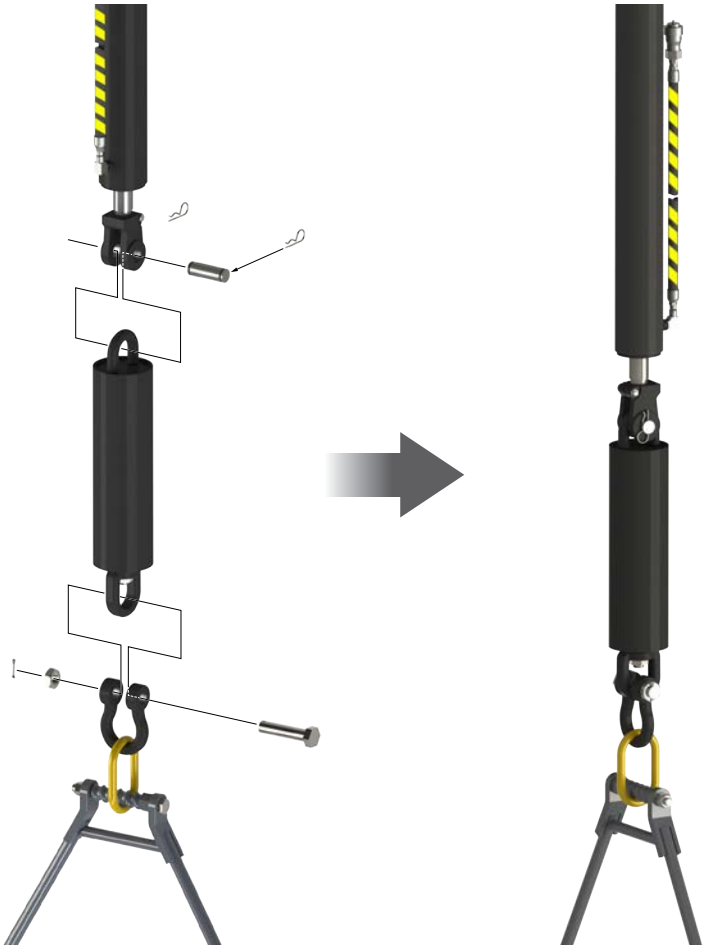


ILLUSTRATION 2.D.1: LIFT CYLINDER & SPRING HANGER INSTALLATION

2.D.2 Lift Cylinder Connection

Inspect the hydraulic hose before connection, ensuring the line is free of ruptures, cracks, cuts, or other damage. Inspect the female quick-connect fitting to ensure it is free from damage. Connect the female quick-connect on the lift cylinder hydraulic hose to the male quick-connect fitting attached to the needle valve on the tong valve bank. Once the fitting has snapped into place give the hydraulic line a light tug upwards to ensure the fitting is securely seated.

If not already done, connect the main hydraulic supply to the power tong (see section 2.F for proper hydraulic connection procedure). Energize the hydraulic supply to the power tong.

Lift the power tong approximately three inches off the work surface, and suspend the tong for approximately thirty seconds. Following the suspension alternately lift and lower the tong slightly to confirm that lift and lower functions each operate correctly.

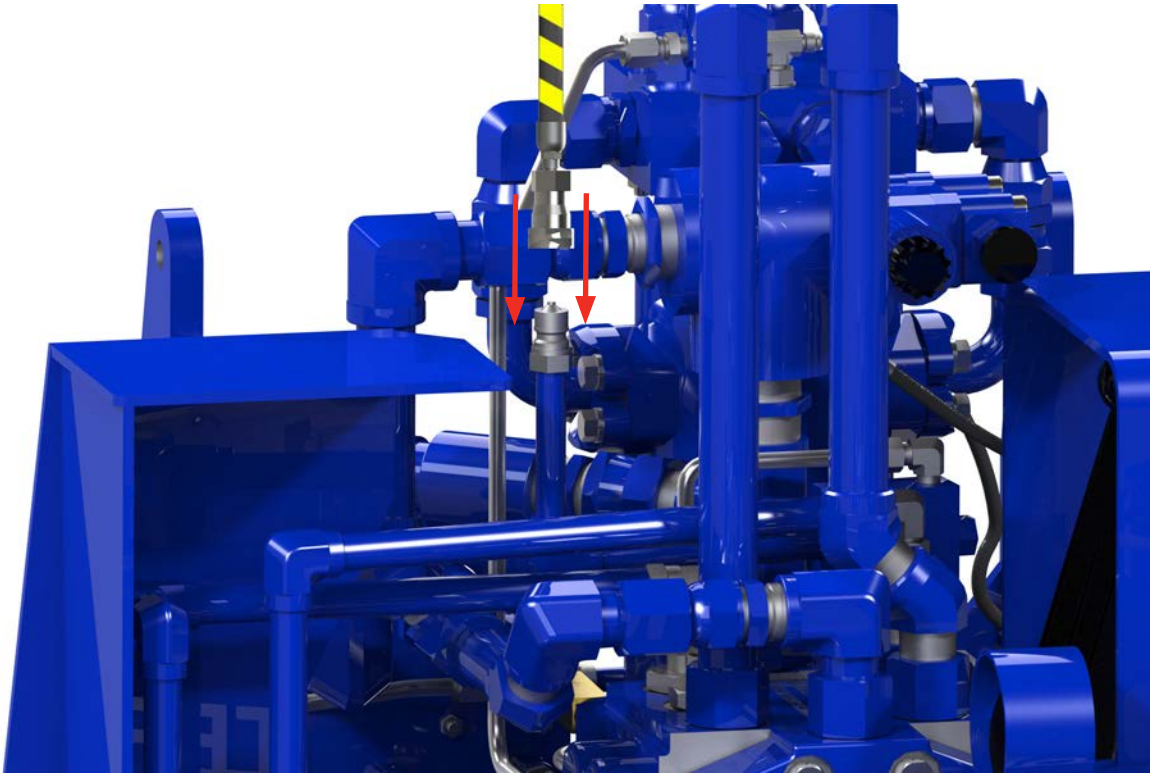


ILLUSTRATION 2.D.2: LIFT CYLINDER HYDRAULIC CONNECTION

2.D.3 Lift Cylinder Safety

A CLEARLY IDENTIFIED REMOTE POWER PACK EMERGENCY STOP MUST BE INSTALLED IN THE IMMEDIATE VICINITY OF THE TONG OPERATOR.

McCoy Global recommends following an industry-accepted standard such as OSHA, ASME B30.9-2006, or manufacturer's guidelines when performing any rigging and overhead lifting. Use by untrained persons is hazardous. Improper use will result in serious injury or death. Do not exceed rated capacity.

Working Load Limit (WLL) is the maximum allowable load in pounds which may be applied to the load-bearing device, when the device is new or in "as new" condition, and when the load is uniformly and directly applied. The WLL must never be exceeded.

The Working Load Limit or Design factor may be affected by wear, misuse, overloading, corrosion, deformation, intentional alterations, sharp corner cutting action and other use conditions.

See OSHA Regulation for Slings 1910.184, ANSI/ASME B30.9-"SLINGS", ANSI/ASME B30.10-"HOOKS" and ANSI/AMSE B30.26 "RIGGING HARDWARE" for additional information.

2.D.3 Lift Cylinder Safety (continued):

The flexible line providing hydraulic power to the lift cylinder has been equipped with abrasion-resistant, high visibility protective wrap. The high visibility wrap allows operators to easily see monitor the position of the hydraulic line at all times, and can easily see if the line appears to become entangled or snagged.

IMMEDIATELY CEASE LIFT CYLINDER OPERATION IN THE EVENT OF ENTANGLEMENT OF THE HYDRAULIC LINE WITH FIXED RIG COMPONENTS OR TONG SUPERSTRUCTURE.

The protective wrap also prevents wear of the hydraulic line though abrasion. Do not remove the protective wrap from the lift cylinder line, and replace protective wrap if it is missing, torn, or split. Regardless of use or condition, the hydraulic line supplying the lift cylinder must be replaced every two years.

REPLACE LIFT CYLINDER HYDRAULIC LINE EVERY TWO YEARS

The control valve section on the power tong is equipped with an internal check valve, preventing sudden drop of the tong in the event of hydraulic power failure. A speed-limiting orifice is installed in the breather port of the lift cylinder. The orifice prevents sudden drop of the lift cylinder in the event of a ruptured hydraulic line, limiting the speed at which the cylinder extends and the tong drops to a safe rate. Do not remove the speed-limiting orifice, and only replace with an identical orifice supplied by McCoy.

DO NOT REMOVE THE SPEED-LIMITING ORIFICE FROM THE LIFT CYLINDER BREATHER PORT

The working load limit (WLL) is clearly stenciled on to the side of the lift cylinder. Do not use lift cylinder if the WLL stencil has been rubbed off or intentionally removed. Locate the test certificate that accompanied the cylinder to the job site or, if necessary, obtain a copy of the test certificate from the location at which the original certificate has been stored. The lift cylinder must be clearly re-marked with the WLL before it is released to an operating environment.

DO NOT USE A LIFT CYLINDER WITH A MISSING OR DEFACED WLL STENCIL.

2.E HYDRAULICS

2.E.1 Hydraulic Schematic & B.O.M.

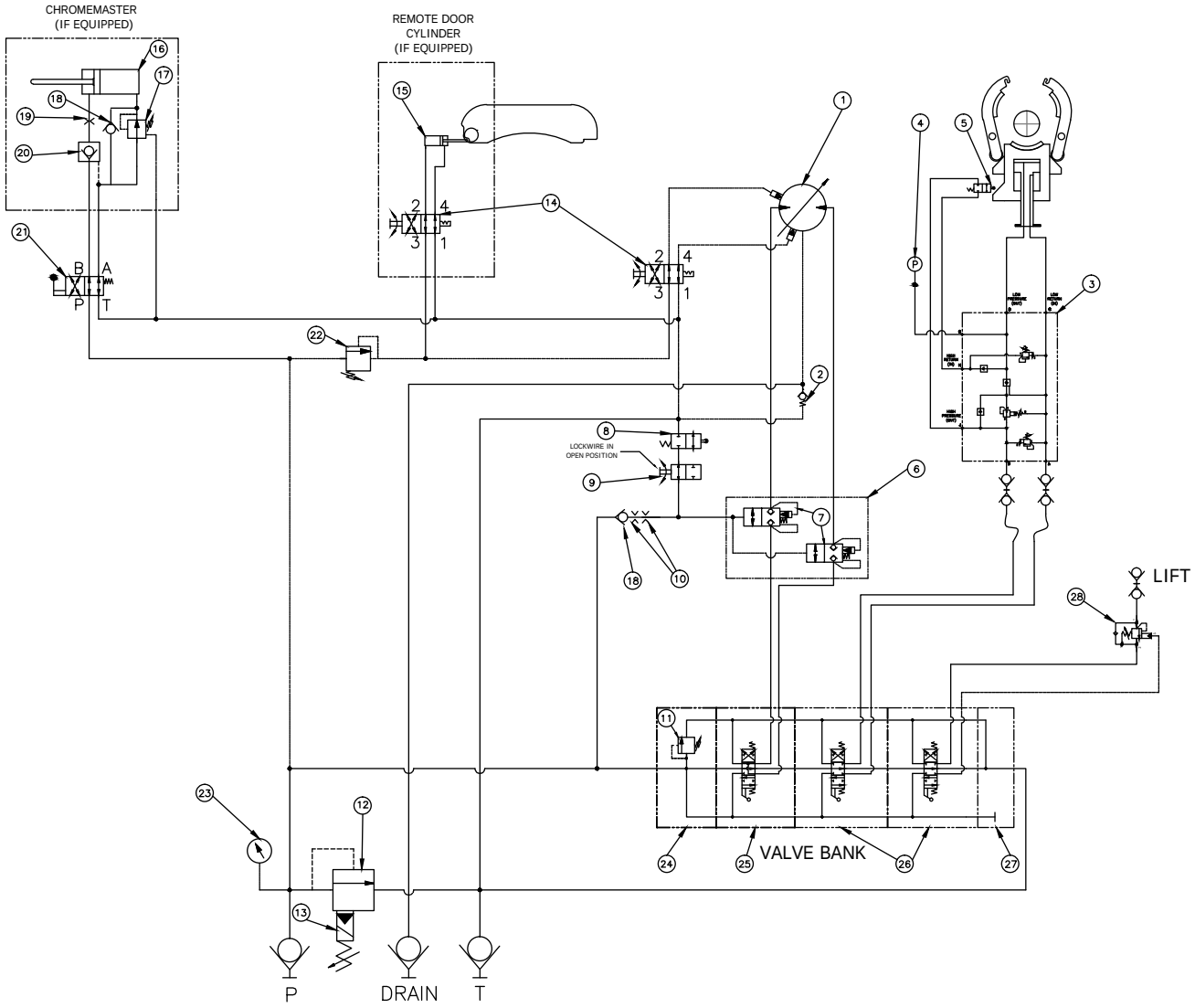


ILLUSTRATION 2.E.1: CLE14000DP+CM15000DP+BUCST15000 HYDRAULIC SCHEMATIC

Item	QTY	Description	Part Number	Location
1	1	30 in^3 2-speed hydraulic motor	20099	TONG
2	1	¼" check valve	CM4565	TONG
3	1	Backup manifold assembly	BUCS7699-01	BACKUP
4	1	0-5000 psi pressure indicator	BAC-5M25RCFF	BACKUP
5	1	Directional control valve, cam operated	SLV1000-04	BACKUP
6	1	Safety door hydraulic block	101-0727	TONG
7	2	Motor block valve cartridge	86052	TONG
8	1	Normally-closed door switch with vent	SLV1000-01	TONG
9	1	¼" high pressure ball valve	4F-B6LJ2-SSP	TONG
10	2	1/32" orifice	118-B	TONG
11	1	3000 psi relief cartridge	DVG35-HMRV	TONG
12	1	1-¼" dump valve	2070	TONG
13	1	VV01 dump valve kit 24 VDC	58058-S KIT	TONG
14	2	4-way ball valve	73028	TONG
15	1	Hydraulic door cylinder	82080-02	TONG
16	1	CHROMEMASTER™ push cylinder	CM7633	TONG
17	1	⅜" NPT pressure reducing valve	CM7654	TONG
18	1	¼" check valve	CM4565	TONG
19	1	1/32" orifice	118-B	TONG
20	1	Pilot-operated check valve	14790	TONG
21	1	Lever-operated directional valve	VMD03M	TONG
22	1	⅜" NPT pressure reducing valve	CM7654	TONG
23	1	0-3000 psi pressure indicator	1650	TONG
24	1	High pressure hydraulic inlet	DVG35-A980	TONG
25	1	Work section (motor)	DVG35-MA8	TONG
26	2	Work section (cylinder)	DVG35-DA8	TONG
27	1	High pressure hydraulic inlet	DVG35-TTR99	TONG
28	1	Counter-balance valve	86058	LIFT

2.E.2 Main Hydraulic Connections

Supply hydraulic pressure to your equipment through the 1" hydraulic supply connection. A 1-¼" return connection provides a return path to the power unit, and a ⅜" female quick-connect fitting allows motor case drain to tank. The different sizes of the supply and return lines eliminates the possibility of accidental cross-connections.

Ancillary devices (hydraulic motors, hydraulic cylinders, etc.) are connected through the hydraulic control valve block.

ILLUSTRATION 2.E.2: CLE14000DP+BUCST15000 HYDRAULIC CONNECTIONS 01

Inspect all connectors for damage, debris, or other contaminants before performing hydraulic connections. Clean connectors using compressed air, or an approved cleaning solvent and lint-free cloth. Always cover disconnected fittings with a clean brass or plastic dust cap, typically attached to each connector with a lightweight chain or flexible line. These caps provide significant protection from dust, dirt, other contaminants, and impact damage.

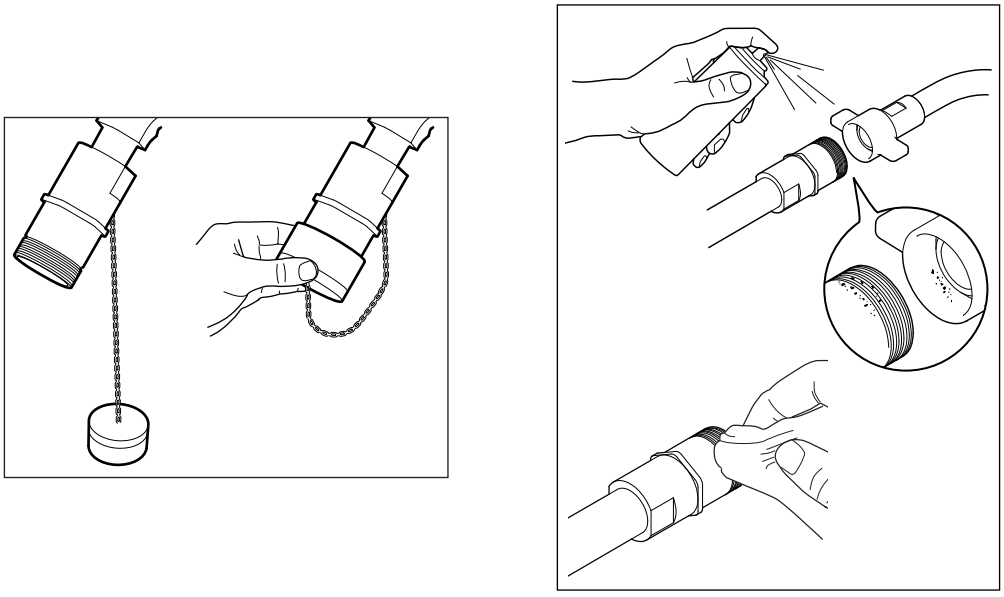


ILLUSTRATION 2.E.3: CLE14000DP+BUCST15000 HYDRAULIC CONNECTIONS 02

2.E.2 Main Hydraulic Connections (Continued):

Perform hydraulic connection when the power unit is not running, or when the hydraulic pump is disengaged. Wing-type connections are self-sealing, and must always be made up to the connection line on the male connector to prevent partial closure of the integral check valve.

Always make up the return connection first, followed by the supply side. When disconnecting hydraulic lines following de-pressurization of equipment, disconnect the supply connection first, followed by the return connection.

Self-sealing wing-type hydraulic disconnects should always be fully made up to the “fully engaged” indicator line on the male side of the connection. Inspect all hydraulic connections before energizing hydraulic power to ensure secure connections have been made. Supply of full hydraulic pressure without ensuring an established return line may result in system damage.

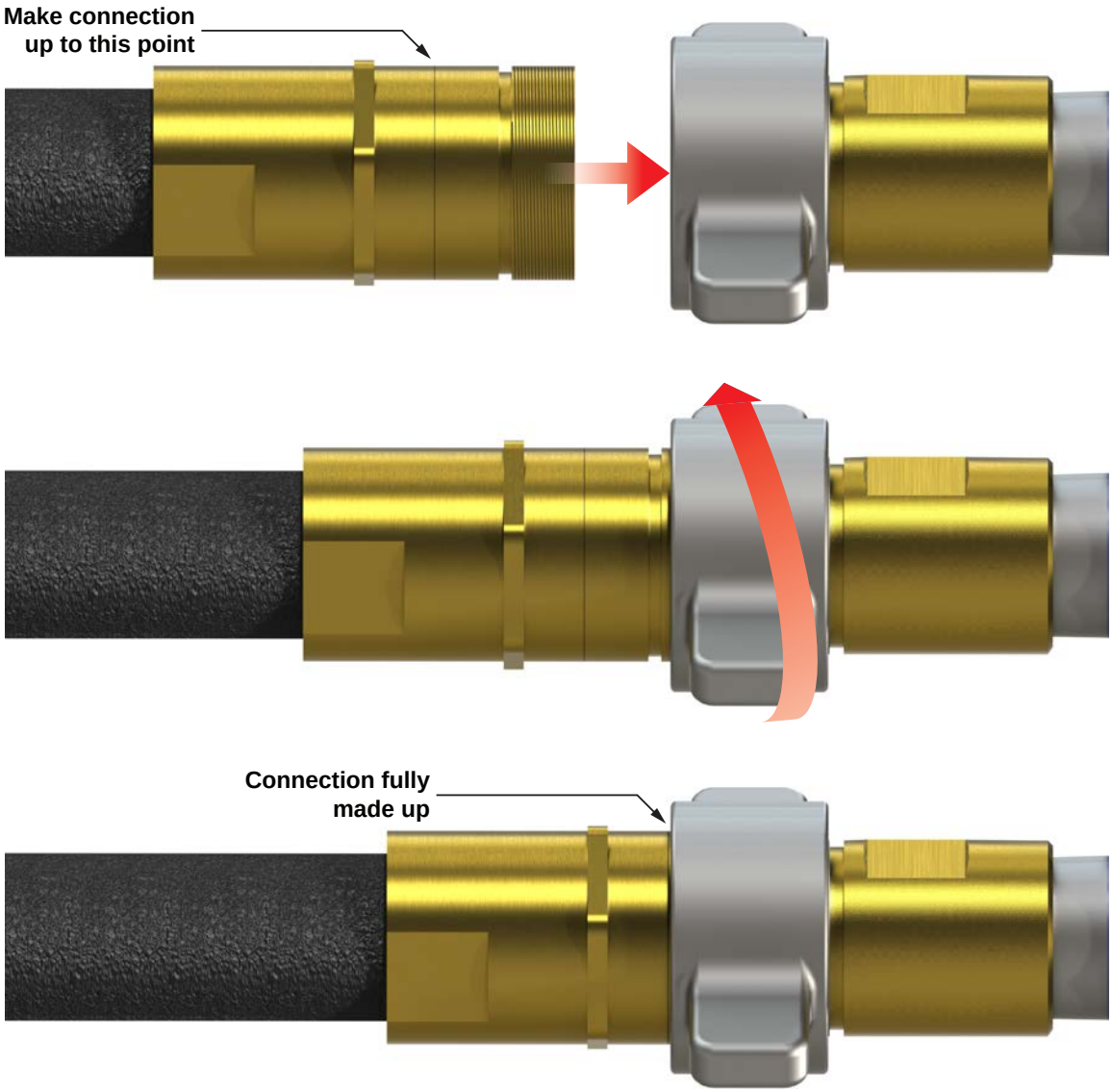


ILLUSTRATION 2.E.4: CLE14000DP+BUCST15000 HYDRAULIC CONNECTIONS 03

Before attempting to break out hydraulic connections, assure that the tong has be depressurized and is fully disconnected from any hydraulic power sources. Hydraulic return lines should always be made up first and broken out last in order to insure that pressure is not trapped in the valve package.

2.F TONG / BACKUP JAW AVAILABILITY & INSTALLATION

2.F.1 Tong Jaw Availability

The following table lists jaw die kits that are available as standard stocked sizes for this model of tong. A single jaw die kit contains two jaws (left and right), complete with jaw pins, rollers, one set of die inserts, and die insert retainers. McCoy Global offers a good selection of standard jaw sizes. However, please note that we can custom-engineer and manufacture any size of jaw within the range of the tong. Jaw systems are available to allow use of die inserts intended for specialized applications. Call our sales office for information on jaw and die systems designed for higher or lower grip, or non-marking applications.

The table lists standard die inserts that are available as spare parts. McCoy also offers a wide variety of diamond-tooth, GRITFACE®, aluminium, and wrap-around fine-tooth dies available for specialized applications. Please refer to our website for complete information:

http://www.mccoyglobal.com/dies-inserts

Standard Jaw Die Kits For CLE14000DP

Description	Part Number	Description	Part Number
7” Jaw Die Kit	CJDT14X07000	10-¾” Jaw Die Kit	CJDT14X10750
7-⅝” Jaw Die Kit	CJDT14X07625	11-¾” Jaw Die Kit	CJDT14X11750
9” Jaw Die Kit	CJDT14X09000	11-⅞” Jaw Die Kit	CJDT14X11875
9-⅜” Jaw Die Kit	CJDT14X09375	13-⅜” Jaw Die Kit	CJDT14X13375
9-⅝” Jaw Die Kit	CJDT14X09625	13-⅝” Jaw Die Kit	CJDT14X13625
9-⅞” Jaw Die Kit	CJDT14X09875	14” Jaw Die Kit	CJDT14X14000
10-⅛” Jaw Die Kit	CJDT14X10125		

Available Strip Die Inserts:

Part Number	Die Type	Thickness	Pipe Grip Range
DTI1601	Straight Tooth	½”	Equals jaw size
DTI1601D	Diamond Tooth	½”	Equals jaw size
DTI1661	Straight Tooth	$^{13}/_{16}$”	Undersize - equals jaw size minus ⅝”
DTI1651	Straight Tooth	¾”	Undersize - equals jaw size minus ½”
DTI1642	Straight Tooth	$^{11}/_{16}$”	Undersize - equals jaw size minus ⅜”
DTI1632	Straight Tooth	⅝”	Undersize - equals jaw size minus ¼”
DTI1622	Straight Tooth	$^{9}/_{16}$”	Undersize - equals jaw size minus ⅛”
DTI1612	Straight Tooth	$^{7}/_{16}$”	Oversize - equals jaw size plus ⅛”
DTI1612D	Diamond Tooth	$^{7}/_{16}$”	Oversize - equals jaw size plus ⅛”

NOTE: Undersize diamond tooth die inserts available on request

2.F.2 Tong Jaw/Jaw Die Removal

The tong jaws will often require removal to change jaw size or replace worn jaw die inserts. Disconnect or disable hydraulic power supply before proceeding.

DO NOT ACCESS ROTATING COMPONENTS UNLESS HYDRAULIC POWER SUPPLY HAS BEEN DEACTIVATED OR ISOLATED.

Disengage the jaw retraction spring from the retaining bolt on the jaw. Rotate the jaw towards the center of the tong opening. Support the jaw being removed from the bottom, and use a wrench to loosen and remove the jaw pivot bolt. Slide the jaw away from the rotary gear towards the center of the cage plate assembly, and lift clear of the tong (see Illustration 2.F.1).

JAWS MAY PRODUCE METAL SLIVERS. WEAR STURDY GLOVES WHEN REMOVING AND INSTALLING JAW DIE KITS.

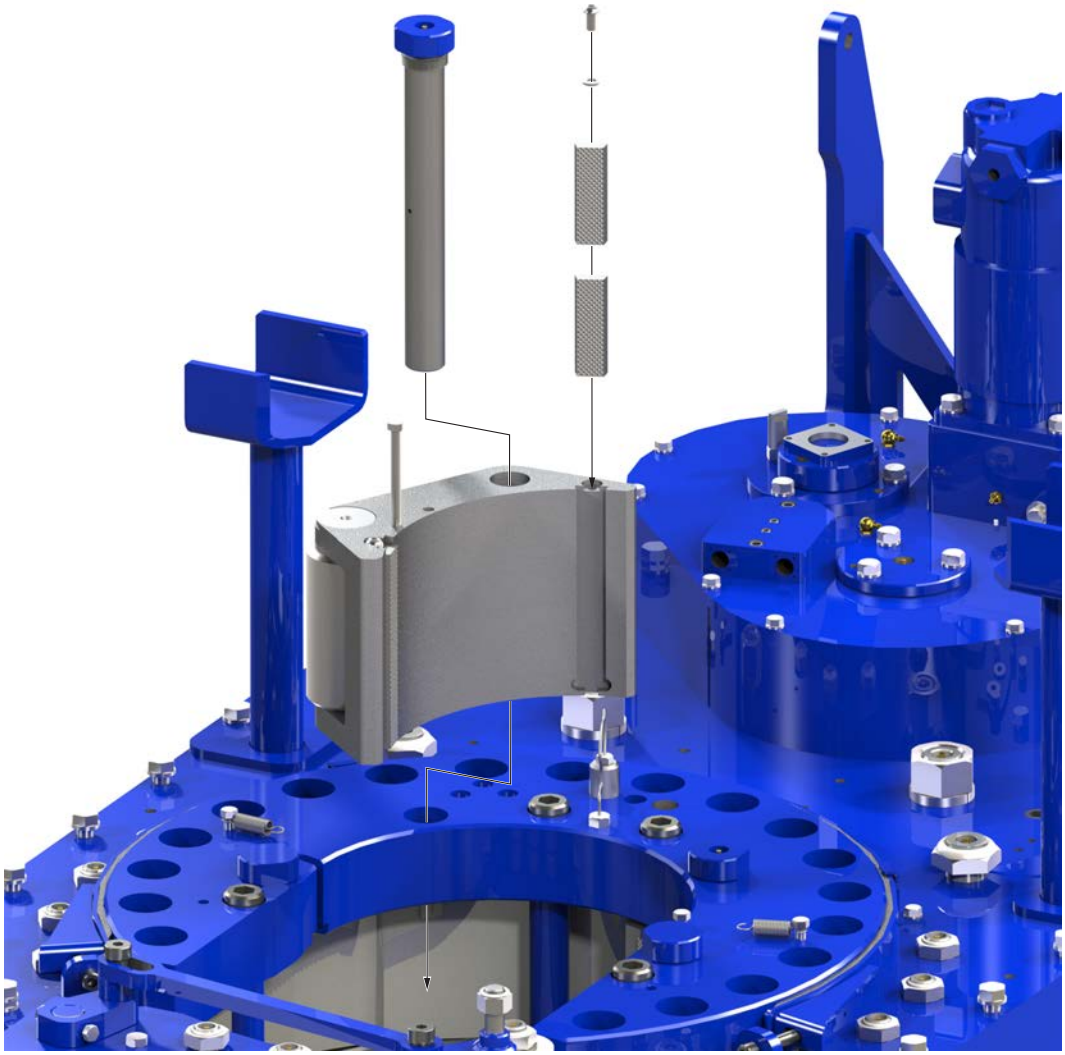


ILLUSTRATION 2.F.1: CLE14000DP JAW / JAW DIE REMOVAL

Once the jaw has been removed the jaw dies may be replaced by removing the keeper screw above the dies, and tap the dies from jaw using a hammer.

Clean the dovetail slots in the jaw using a stiff wire brush, and treat each slot with anti-seize compound before installing new dies. When the jaws are properly prepared slide the die in to the slots, lightly tapping them into place if necessary. Replace the keeper screws. Repeat for the other jaw.

2.F.3 Backup Jaw Availability

The following table lists all jaws available as standard stocked sizes for this model of backup. The table also lists standard die inserts that are available as spare parts. McCoy also offers a wide variety of diamond-tooth, GRITFACE®, aluminium, and wrap-around fine-tooth dies available for specialized applications.

Standard Jaw Die Kits For BUCST15000			
Description	**Part Number**	**Description**	**Part Number**
7” Splined Jaw	BUDT15H-07000	10-3/4” Splined Jaw	BUDT15H-10750
7-5/8” Splined Jaw	BUDT15H-07625	11-3/4” Splined Jaw	BUDT15H-11750
9” Splined Jaw	BUDT15H-09000	11-7/8” Splined Jaw	BUDT15H-11875
9-3/8” Splined Jaw	BUDT15H-09375	13-3/8” Splined Jaw	BUDT15H-13375
9-5/8” Splined Jaw	BUDT15H-09625	13-5/8” Splined Jaw	BUDT15H-13625
9-7/8” Splined Jaw	BUDT15H-09875	14” Splined Jaw	BUDT15H-14000
10-1/8” Splined Jaw	BUDT15H-10125		

Available Strip Die Inserts for Jaw Sizes LESS THAN 12-3/4”:			
Standard Tooth Part Number	**Diamond Tooth Part Number**	**Thickness**	**Pipe Grip Range**
13-0008-500-0	13-0008-500-D	1/2"	Equals jaw size
13-0013-500-0	13-0013-500-D	13/16"	Undersize - equals jaw size minus 5/8"
13-0012-500-0	13-0012-500-D	3/4"	Undersize - equals jaw size minus 1/2"
13-0011-500-0	13-0011-500-D	11/16"	Undersize - equals jaw size minus 3/8"
13-0010-500-0	13-0010-500-D	5/8"	Undersize - equals jaw size minus 1/4"
13-0009-500-0	13-0009-500-D	9/16"	Undersize - equals jaw size minus 1/8"
13-0007-500-0	13-0007-500-D	7/16"	Oversize - equals jaw size plus 1/8"

Available Strip Die Inserts for Jaw Sizes GREATER THAN 12-3/4”:			
Standard Tooth Part Number	**Diamond Tooth Part Number**	**Thickness**	**Pipe Grip Range**
13-0008-314-0	13-0008-314-D	1/2"	Equals jaw size
13-0013-314-0	13-0013-314-D	13/16"	Undersize - equals jaw size minus 5/8"
13-0012-314-0	13-0012-314-D	3/4"	Undersize - equals jaw size minus 1/2"
13-0011-314-0	13-0011-314-D	11/16"	Undersize - equals jaw size minus 3/8"
13-0010-314-0	13-0010-314-D	5/8"	Undersize - equals jaw size minus 1/4"
13-0009-314-0	13-0009-314-D	9/16"	Undersize - equals jaw size minus 1/8"
13-0007-314-0	13-0007-314-D	7/16"	Oversize - equals jaw size plus 1/8"

NOTE: Undersize diamond tooth die inserts available on request

2.F.4 Backup Jaw Removal

Removal of the dies are simple, requiring removal of only the top retainer, However, the backup jaws will often require removal to change jaw size or to remove worn jaw die inserts that are “frozen” in to the dovetail slots. Disconnect or disable hydraulic power supply before proceeding.

DO NOT ACCESS ROTATING COMPONENTS UNLESS HYDRAULIC POWER SUPPLY HAS BEEN DEACTIVATED OR ISOLATED.

Remove the three hex socket head cap screws securing the top retainer. Slide the worn dies out of the dovetail slots - lightly tap the bottoms of the dies with a hammer if necessary.

Complete removal of the jaws may be required. If this is the case the bottom retainer may require loosening to free the jaw from the backing plate.

JAWS MAY PRODUCE METAL SLIVERS. WEAR STURDY GLOVES WHEN REMOVING AND INSTALLING JAWS OR JAW DIES.

2.F.4 Backup Jaw Removal (Continued):

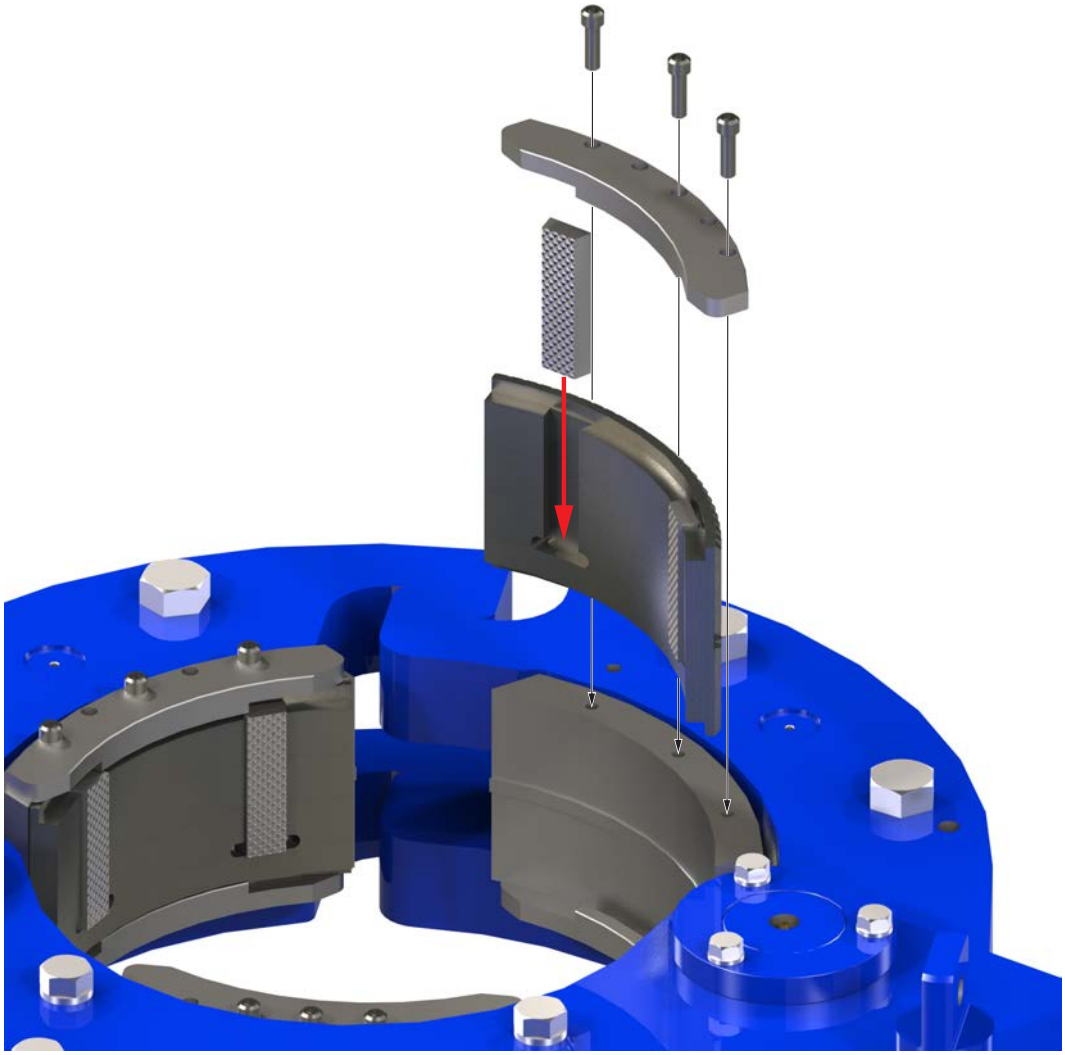


ILLUSTRATION 2.F.2: BUCST15000 LOCKJAW BACKUP JAW / JAW DIE REMOVAL

Clean the dovetail slots in the jaw using a stiff wire brush, and treat each slot with anti-seize compound before installing new dies. When the jaws are properly prepared slide the die in to the slots, lightly tapping them into place if necessary. Replace the top die retainer and the keeper screws. Repeat for the other jaws.

If jaw replacement is required, clean the keeper plate with a stiff wire brush before installing new jaw. Loosely install the bottom die retainer, install the jaw, then install the top retainer and keeper screws. Center the jaw on the backing plate and tighten all screws in the retainers.

2.F.5 CM15000DP CHROMEMASTER™ Jaw Die Availability (If Equipped)

The following table lists all GRITFACE® jaw dies available as standard stocked sizes for the CHROMEMASTER, which is available as an option on this hydraulic power tong.

Standard GRITFACE® Jaw Dies For CM15000DP			
Description	**Part Number**	**Description**	**Part Number**
6-⅝" GRITFACE® Die	BB150006625	11-¾" GRITFACE® Die	BB150011750
7" GRITFACE® Die	BB150007000	11-⅞" GRITFACE® Die	BB150011875
7-⅝" GRITFACE® Die	BB150007625	12-¾" GRITFACE® Die	BB150012750
8" GRITFACE® Die	BB150008000	13-⅜" GRITFACE® Die	BB150013375
9-⅝" GRITFACE® Die	BB150009625	13-⅝" GRITFACE® Die	BB150013625
9-⅞" GRITFACE® Die	BB150009875	14" GRITFACE® Die	BB150014000
10" GRITFACE® Die	BB150010000	14-⅜" GRITFACE® Die	BB150014375
10-¾" GRITFACE® Die	BB150010750	15" GRITFACE® Die	BB150015000

NOTE: Custom sizes available on request

2.F.6 CM15000DP CHROMEMASTER™ Jaw Die Replacement

Disconnect or disable hydraulic power supply before proceeding.

DO NOT ACCESS ROTATING COMPONENTS UNLESS HYDRAULIC POWER SUPPLY HAS BEEN DEACTIVATED OR ISOLATED.

Jaws mounted in the fixed portion of the CHROMEMASTER™ uses retainers on the top and bottom of each die, each secured by ⅜" UNC hex socket head cap screws. The pair of dies mounted in each CHROMEMASTER™ door are retained using a single die retainer on the top and bottom, each secured by three ⅜" UNC hex socket head cap screw.

Remove the two hex socket head cap screws securing the top retainers. Slide the worn dies out of the splines. Lightly tap die with a hammer to break it free of the spline if necessary.

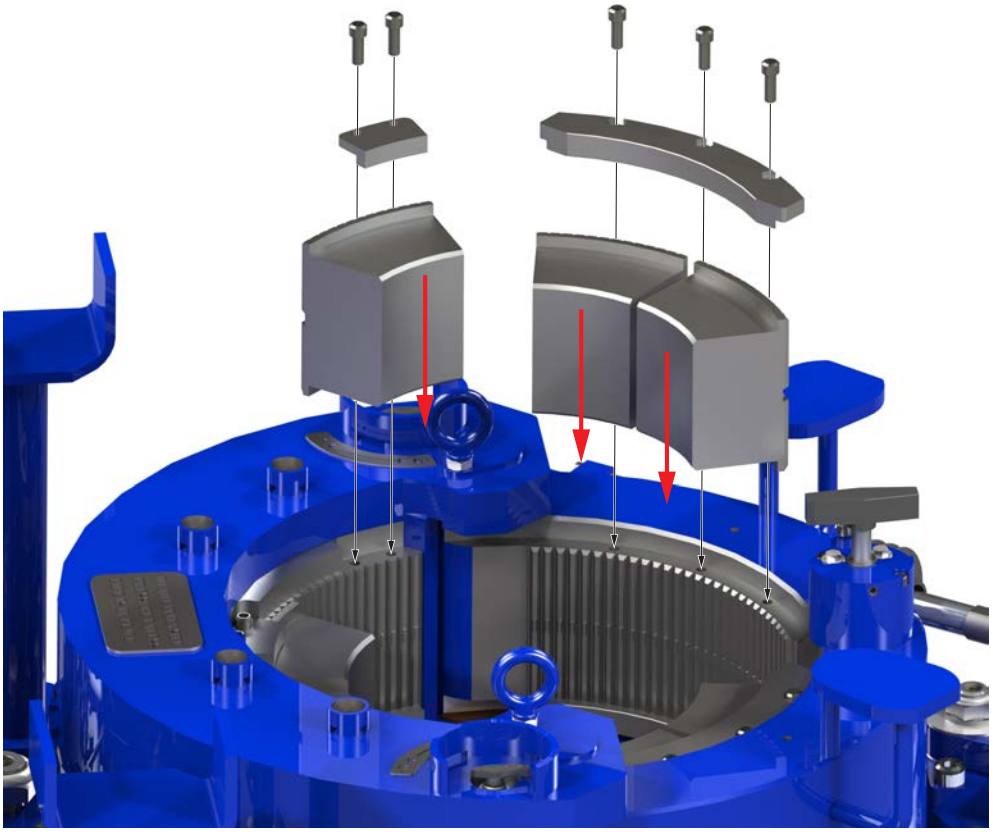


ILLUSTRATION 2.F.3: CM15000DP CHROMEMASTER™ JAW DIE INSTALLATION / REMOVAL

2.F.6 CM15000DP CHROMEMASTER™ Jaw Die Replacement (Continued):

JAWS MAY PRODUCE METAL SLIVERS. WEAR STURDY GLOVES WHEN REMOVING AND INSTALLING JAWS OR JAW DIES.

Clean the splines on the mounting plates with a stiff wire brush before installing new dies. Loosely install the bottom die retainers, install the dies, then install the top retainer and keeper screws. Ensure the keeper screws in all retainers are secured before releasing the tong to operations.

2.G TONG RIG-UP & LEVELING

2.G.1 Suspension & Restraint

PLEASE NOTE THAT THIS SUBSECTION ONLY APPLIES TO THOSE TOOLS BEING HUNG CONVENTIONALLY. WHEN SUSPENDING THE TOOL USING THE BAKER HUGHES LEADHAND THIS SUBSECTION DOES NOT APPLY.

Suspend the tong from a location as near to the centre of the drill rotary as possible, and from a location high enough on the mast to ensure easy handling. The lower the point from which the tong is suspended, the more effort will be required to move the tong to and from the connection point.

The suspension line may be extended over a pulley and balanced by a counterweight equal to the weight of the tong, or simply tied off in the derrick to form a dead line. When using a dead line arrangement it is necessary to use a FARR spring hanger assembly (see specification page for recommended spring hanger). This spring hanger compensates for the downward movement of the casing as the thread is made-up, and imparts additional force to the suspension cable:

- a “single spring” hanger typically applies 420 lbs. (191 kg.) to the suspension line for every inch of thread made up
- a “double spring” hanger typically applies 840 lbs. (382 kg.) to the suspension line for every inch of thread made up

If you do not know which specific spring hanger is in use, check the specification page in this manual for information on the recommended spring hanger for this application. McCoy Global will not guarantee or specify spring hangers other than what has been supplied by McCoy.

Many applications use a lift cylinder for adjusting the height of the tong. Ensure the weight of the lift cylinder is known if it has not been included in the total weight of the tong.

All forces upon the suspension line must be considered when calculating necessary strength of the suspension line. The weight of the tong, the weight of the lift cylinder, the weight of the spring hanger, and the force imparted on the suspension line by the spring hanger must all be added together in order to arrive at the total force supported by the suspension line. Select your suspension line based upon the total force and the margins of safety dictated by the policies of your company and by established engineering practices. Ultimately, calculating the force on the suspension line and selection of the suspension line is the complete responsibility of the customer.

McCoy Global recommends using dual backup (snub) lines of sufficient strength to withstand the force imparted by the maximum rated torque of the tong and backup assembly in use. The snub lines will arrest uncontrolled movement of the tong and backup in the event slipping of the backup jaws. Calculate the force on the snub lines by dividing the maximum torque of the tong by the tong’s torque arm (expressed in feet). For example, a 100,000 lbs.-ft. tong with a 49.5 inch (4.125 ft.) torque arm will generate 24,242 lbs. of force against the snub line. Select your snub lines based upon the total force and the margins of safety dictated by the policies of your company and by established engineering practices. Ultimately, calculating the force on the snub line and selection of the snub line is the complete responsibility of the customer.

Snub lines must be securely connected to the rear of the tong and backup assembly, and tied off to a suitably rated anchor. When properly installed the snub line should be taut enough to allow very little movement, preventing the tong from generating excessive force on the lines by “snapping” tight when rotation is applied.

MCCOY GLOBAL ACCEPTS NO RESPONSIBILITY FOR DESIGNING AND SELECTING AN ADEQUATE SUSPENSION AND RESTRAINT SYSTEM FOR YOUR DRILLING EQUIPMENT. FAILURE TO FOLLOW THE INSTRUCTIONS PROVIDED IN THIS SECTION MAY RESULT IN SERIOUS INJURY TO THE OPERATOR.

ALL SELECTED FASTENERS, SHACKLES, CLAMPS, ETC. USED FOR CONSTRUCTING THE SUSPENSION AND SNUB LINES MUST BE RATED FOR THE CALCULATED FORCES.

2.G.2 Tong Leveling

The tong must be leveled side-to-side and front-to-rear before placing into service. The following guidelines will assist you when leveling your tong.

FAILURE TO PROPERLY LEVEL TOOL MAY RESULT IN JAW SLIPPAGE OR FAILURE OF JAW COMPONENTS

1. Support the tong by the master lifting link on the spreader bar.
2. Preset the length of the four chains by rotating all four turnbuckles until the eye bolts are about half-way engaged in the turnbuckle. The turnbuckles can often be turned by hand; if a turnbuckle cannot be rotated by hand use an adjustable wrench across the flats on the turnbuckle to turn it.
3. Use a 3-foot level to check the level of the tong axially (side-to-side) at the very front of the tool. Identify the lowest corner of the tong, and adjust the turnbuckle on the corresponding chain until that corner is level with the adjacent corner.

ILLUSTRATION 2.G.1: TONG LEVELING 01

In the example in illustration 2.G.1, measurements indicate the front right corner to be the lowest, so the turnbuckle on the front right side of the tool must be adjusted until the right front is level with the left front.

4. Repeat the axial leveling adjustment at the rear of the tool, ensure the two rear corners are level with one another.

2.G.2 Tong Leveling (Continued):

5. Measure the level of the tool longitudinally. Identify the end of the equipment that is lowest, and simultaneously adjust the turnbuckles on the two chains at that end of the equipment until the tool is level. For example, if the rear of the tool is identified to be lower than the front, both rear turnbuckles are adjusted equally and simultaneously in order to bring the tool to level (as shown in the example in illustration 2.G.2).

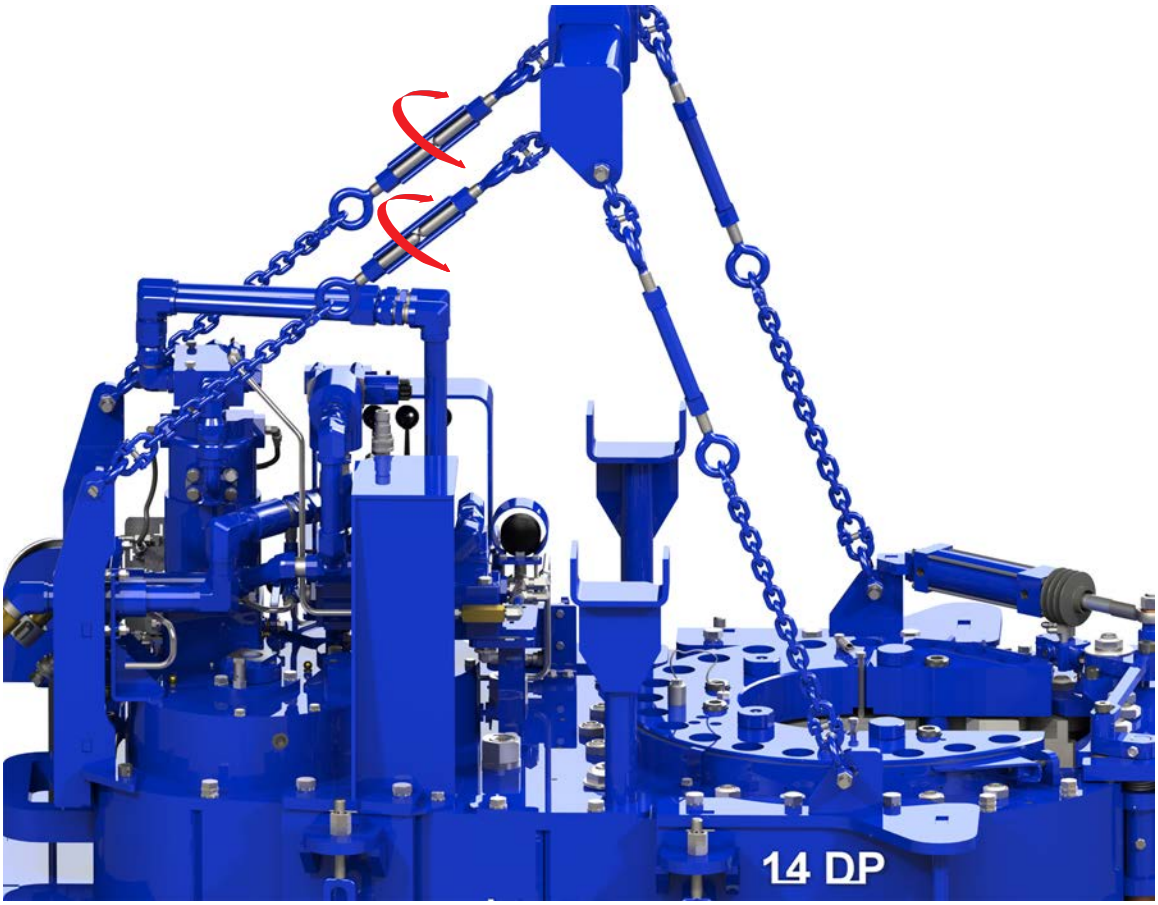


ILLUSTRATION 2.G.2: TONG LEVELING 02

6. Re-check level of the tool, and repeat leveling process if required.

ILLUSTRATION 2.G.4: TONG LEVELING 02

2.G.3. Load Cell Configuration

The backup is coupled to the rear leg of the assembly with a tension load cell on one side, and a restraint chain on the other. To change the torque measurement configuration (make up to break out or visa versa) simply remove the ¼" x 4" safety bolts and nuts securing the four load cell anchor pins, remove the four load cell anchor pins, and reverse the position of the load cell and restraint chain. Replace the four anchor pins, and secure the anchor pins with the safety bolts. For your reference Illustration 2.G.3 shows the load cell correctly configured for make up operations, and illustration 2.G.4 shows the load cell correctly configured for break out operations.

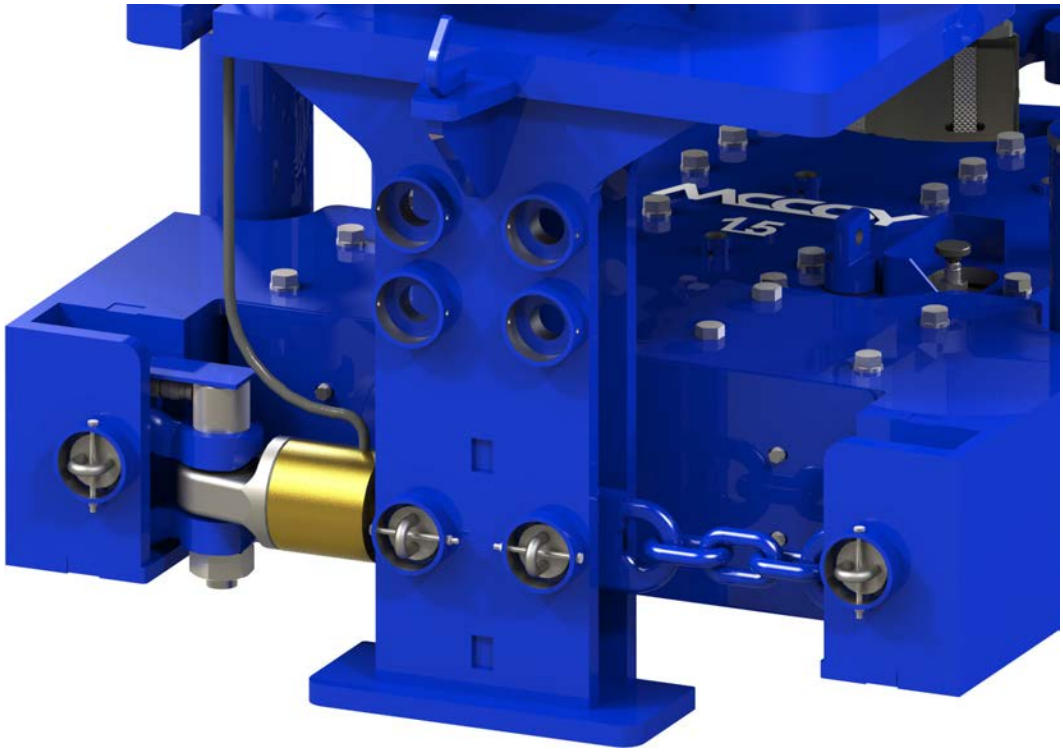


Illustration 2.G.3: Load Cell Configuration - Make Up

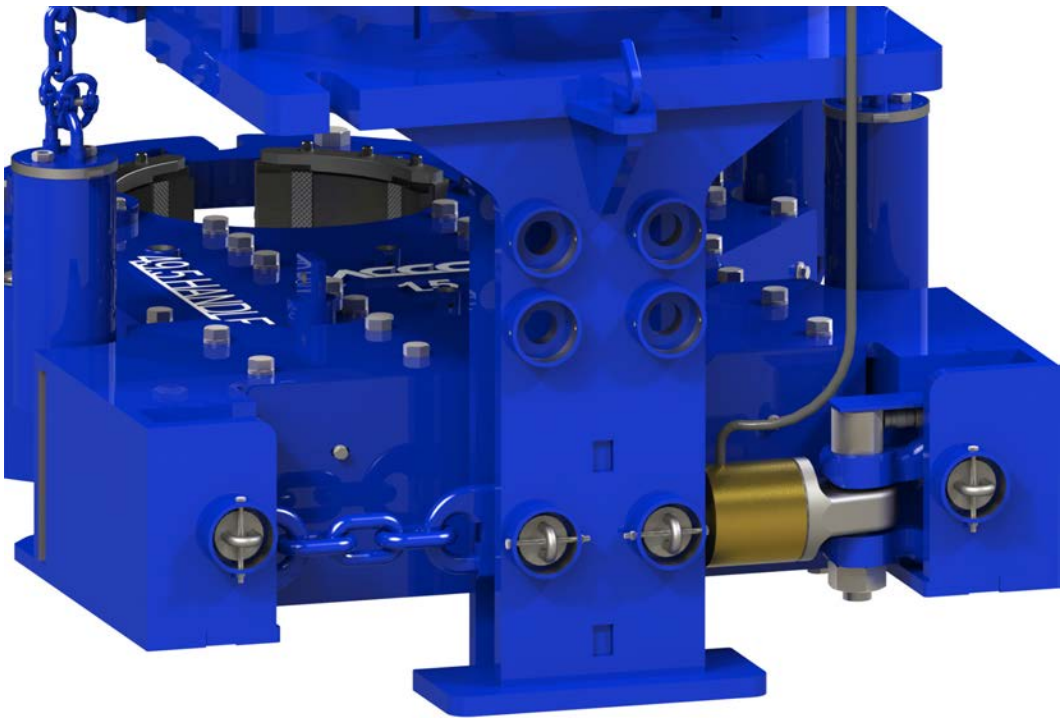


Illustration 2.G.4: Load Cell Configuration - Break Out

2.G.4 Adjusting Backup Clamping Pressure

The clamping pressure of the backup requires occasional adjustment to compensate for wear of the backup jaw die inserts and for re-setting the backup pressure to factory specification when new die inserts are installed. Occasional lowering of the backup clamping pressure may be required for thin-walled pipe or tubing, or if you are using the backup in non-marking applications.

A wide variety of operating conditions prevents McCoy from recommending an ideal backup pressure for any one type of pipe or joint; rather, the ideal pressure is only identified through a combination of “trial and error” and the operating manager’s best estimate based on their own experience.

Use this procedure to check and adjust the backup pressure. McCoy recommends that this procedure be performed with a tubular within the backup jaws to prevent placing unnecessary stress on the cylinder assembly fasteners:

1. The assembly must be connected to an active hydraulic fluid power source to perform this procedure.
2. Use the backup control valve to fully extend the backup clamp cylinder (see section 3 for valve operating procedures). When the cylinder is fully extended do not release the valve handle - maintain hydraulic pressure on the cylinder.
3. Backup clamping pressure is displayed on the backup pressure indicator (see illustration 2.G.5). Rotating the relief valve clockwise will increase the backup pressure, and rotating the relief valve counter-clockwise will decrease the backup pressure.

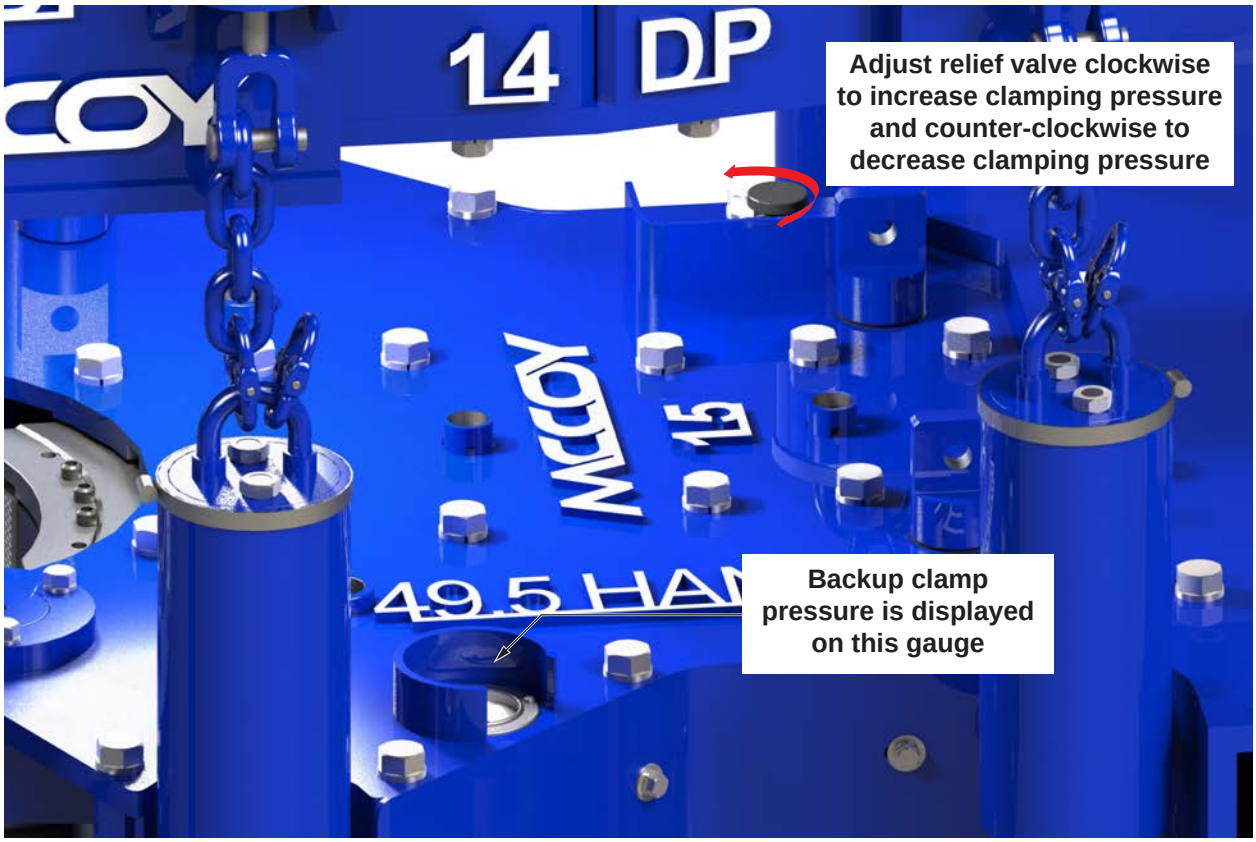
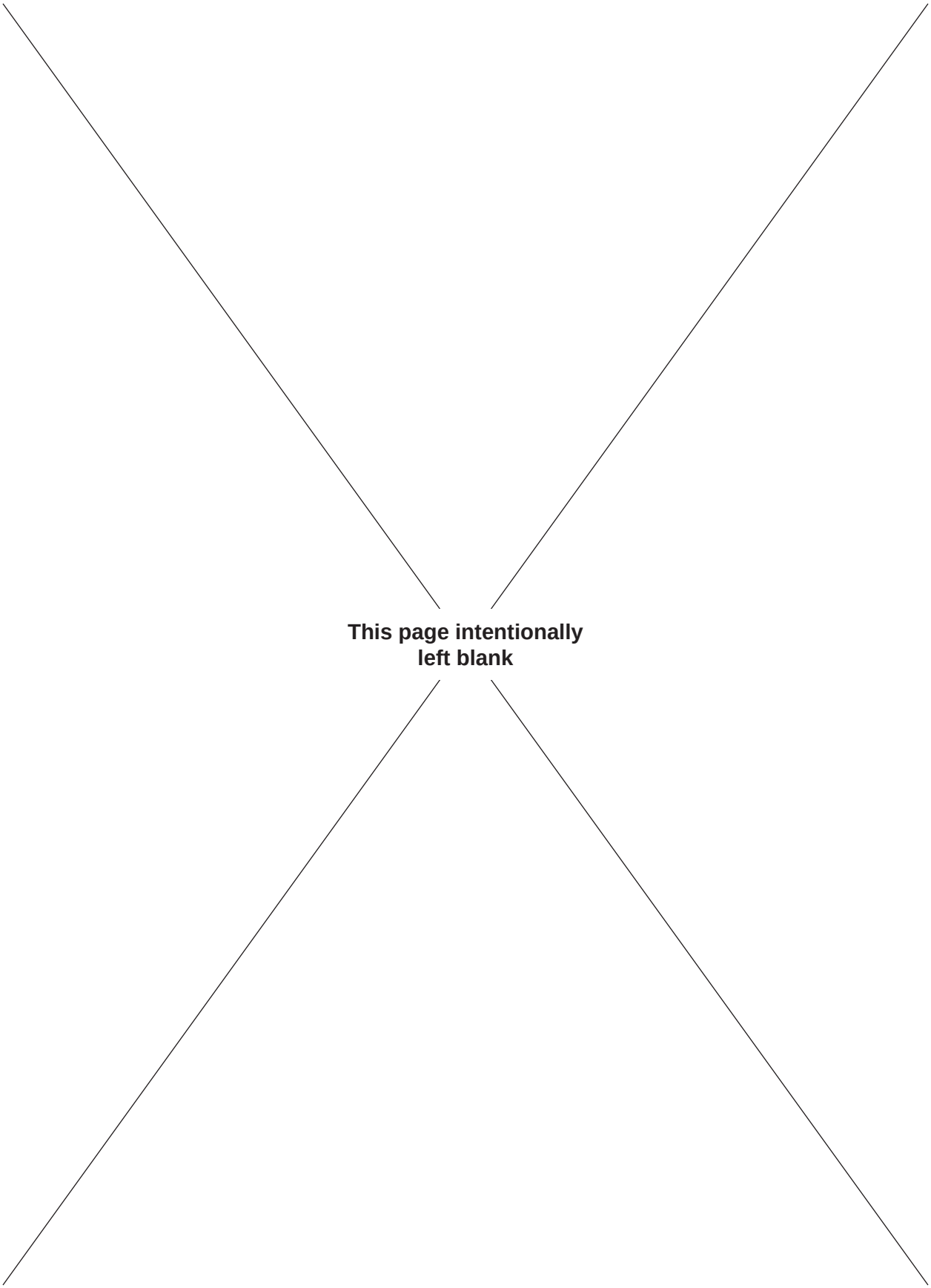


ILLUSTRATION 2.G.5: BACKUP CLAMP PRESSURE ADJUSTMENT

Maximum backup pressure is the system pressure (as displayed on the system pressure indicator on the tong), or 3000 PSI (20.684 MPa), whichever is lower. Never exceed a clamping pressure of 3000 PSI (20.684 MPa).

BACKUP CLAMPING PRESSURE MUST NEVER EXCEED 3000 PSI (20.684 MPA)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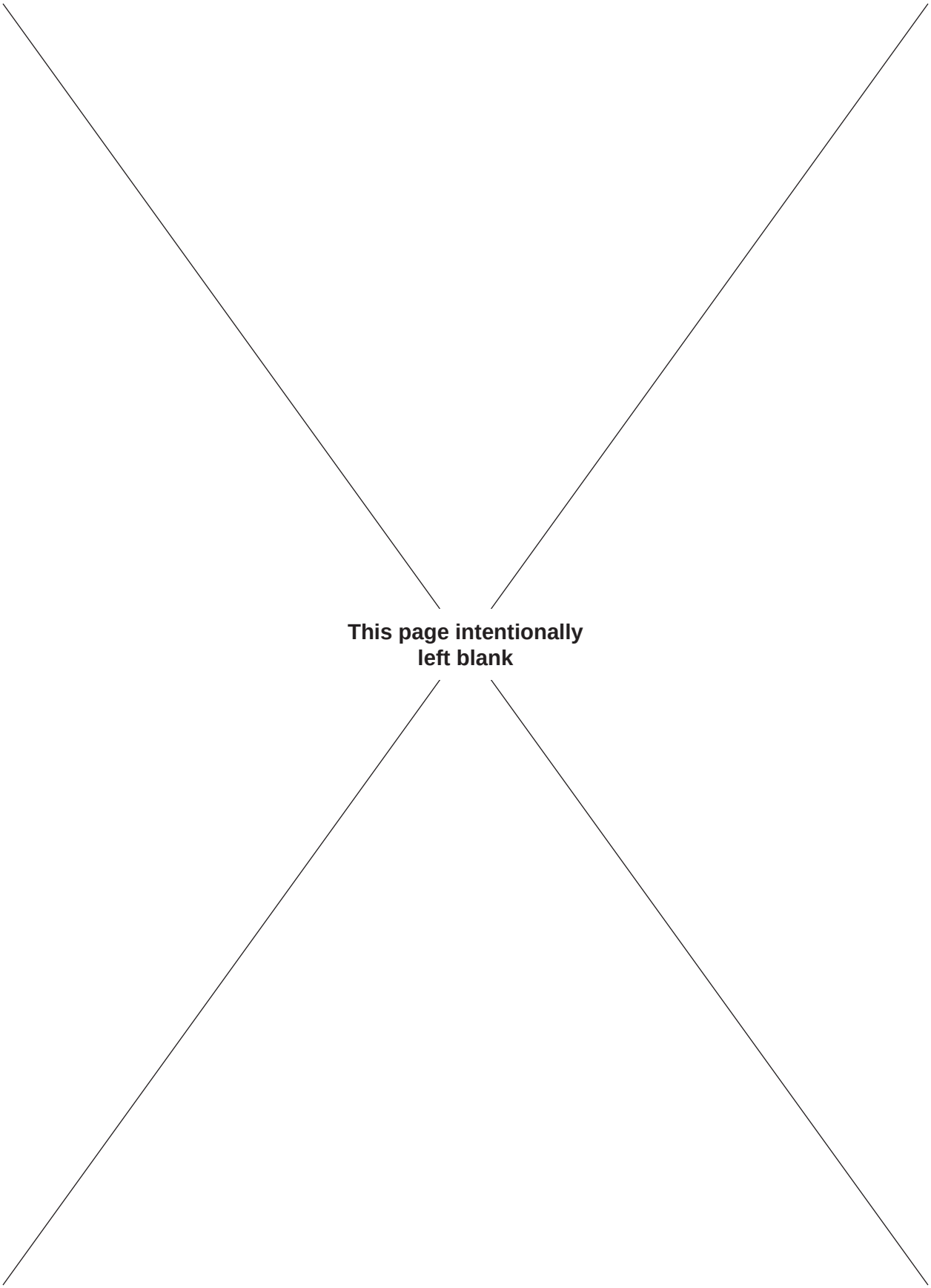
SECTION 3: OPERATION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3.A OPERATOR TRAINING

Many companies set qualification standards that must be met before equipment may be operated without supervision. McCoy Global recommends operator training, which typically consists of operation of the equipment under the supervision of a trained equipment operator until a satisfactory level of competence is achieved. Typical operator training should include:

- Introduction to and general description of equipment
- Technical specifications and performance data
- Operating instructions
- Control systems and interlocks
- Operating hazards
- Rigging and hoisting training
- Checks and inspections

3.B OPERATOR SAFETY

McCoy recommends that a hazard assessment of the work area be performed by a designated safety representative before commencing operations. A designated safety representative is responsible for verifying that all operators have adequate equipment and safety training.

The safety door system is the primary device protecting the tong operator and nearby personnel from the rotary gear. Confirm the correct operation of the safety door before every job. Never disable the safety door device.

The area surrounding the tong operating area must be clutter-free and free from tripping hazards, or protruding objects that may snag hydraulic hoses on the tong, backup, lift cylinder, or torque measurement system. Operating surface or drill floor must be kept free of slipping hazards like grease, oil, water, etc.

Adequate lighting of the work area is required. All warnings, labels, gauges, and signs must be clearly visible

The components of the tong commonly manipulated or requiring control input are painted green, and are safe for continuous handling. Areas painted yellow are designated as hazardous areas, and contact with those areas must be avoided during operation. Always wear all personal protective equipment (PPE) specified by your company's HSE policy, and follow all of your company's safety guidelines.

ALWAYS WEAR APPROVED PERSONAL PROTECTIVE EQUIPMENT (PPE) WHEN OPERATING HYDRAULICALLY-POWERED EQUIPMENT.

Ensure hydraulic power is deactivated and tong hydraulics are de-pressurized before disconnecting the main hydraulic lines. McCoy recommends de-pressurizing the tong hydraulic system before connecting or disconnecting quick-connect fittings.

DE-PRESSURIZE EQUIPMENT BEFORE DISCONNECTING MAIN HYDRAULIC LINES.

3.C HYDRAULIC VALVE OPERATION

Spring-loaded valves control operation of hydraulic devices on the tong assembly such as hydraulic motors and cylinders. When any one valve is "centered" or in the detent position, there is no hydraulic output from the valve. When the valve is pushed forward there is an effect, and when the valve is pulled back, there is an opposite effect. Some valves feature proportional control, which means that further extension of the valve handle (thereby further opening the valve orifice) results in proportionally higher hydraulic output to the controlled device.

Control valves may 'stick' (spool bind) in the incorrect position due to many factors including but not limited to:

- contaminated hydraulic fluid
- over-pressure
- misapplication of paint
- mechanical damage arising from shipping and abuse.

Adequate maintenance to the tool and hydraulic fluid will significantly reduce the prospect of such incidents occurring. However, should the operator notice malfunctioning control valves immediately discontinue equipment use, and isolate the equipment from hydraulic power until inspected, repaired, and returned to service by a designated, competent hydraulic technician.

The following illustrations demonstrate the type and effect of the hydraulic valves with which this tong is may be equipped.

TONG MOTOR

This is a proportional valve. Pushing the valve handle forward will cause the tong motor to rotate in a clockwise direction (as seen from the top of the tong). This is the desired direction of rotation for making up a joint. Pulling the valve handle in the opposite direction results in counter-clockwise rotation, which is the desired direction of rotation for breaking out a joint. Releasing the valve handle will cause the tong to immediately stop rotation.

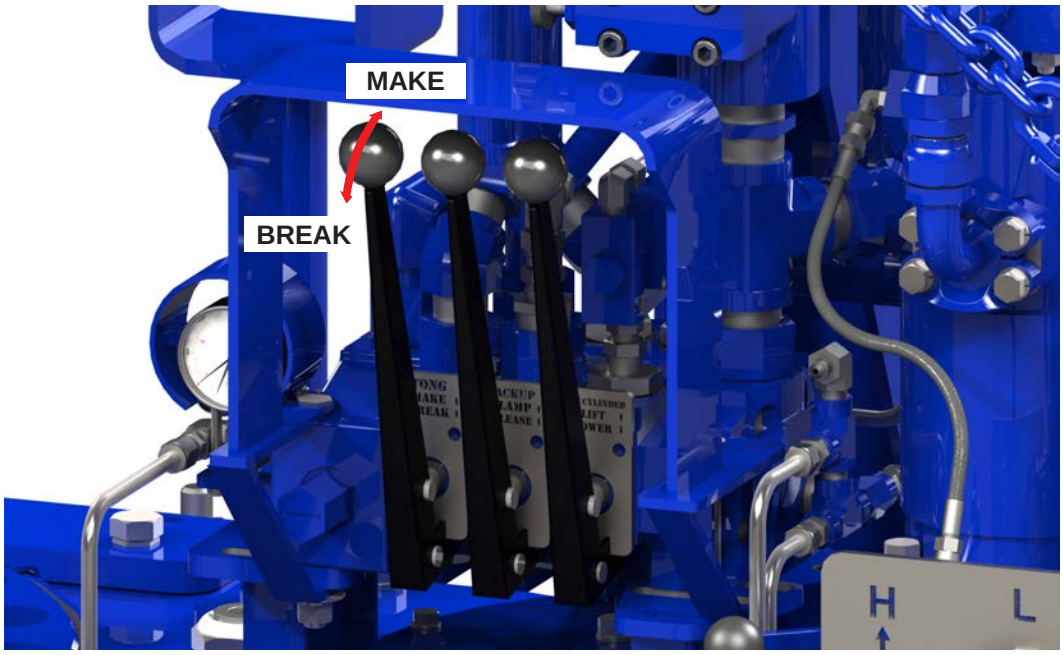


ILLUSTRATION 3.C.1: TONG MOTOR OPERATION

BACKUP DOOR / CLAMP

Pushing the valve handle forward extends the backup clamp cylinder causing the following actions to occur simultaneously:

- backup inner door closes. The inner door may or may not close against the tubular, depending upon the initial position of the backup on the stump.
- backup outer door closes against and locks with the inner door. The outer door may or may not close against the tubular, depending upon the initial position of the backup on the stump.
- clamp cylinder engages tubular, effectively centering the tool on well center and immobilizing the stump within all three jaws in the backup.

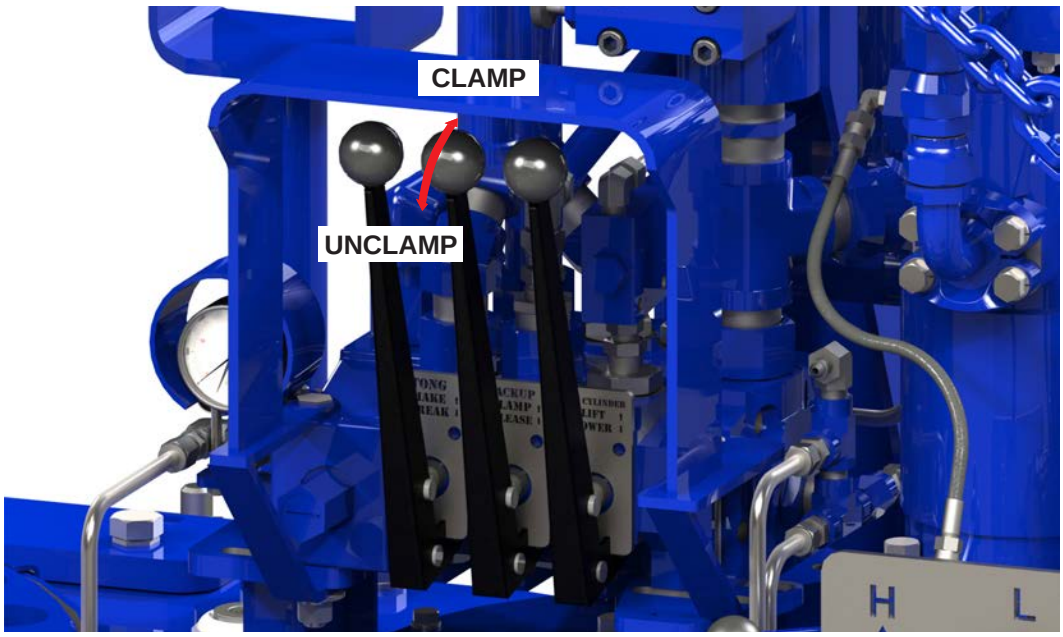


ILLUSTRATION 3.C.2: BACKUP OPERATION

BACKUP DOOR / CLAMP (Continued):

Pulling the valve handle backward (towards the operator) retracts the backup clamp cylinder causing the following actions to occur simultaneously:

- the clamp cylinder releases the tubular.
- backup outer door opens.
- backup inner door opens, releasing the tubular

LIFT CYLINDER CONTROL VALVE

This is a direct-acting valve. Pushing in on the valve handle will cause the lift cylinder to lift the tong vertically. Pulling out on the valve handle (toward the operator) will cause the lift cylinder to lower the tong. Releasing the valve handle will immediately stop the lifting or lowering action.

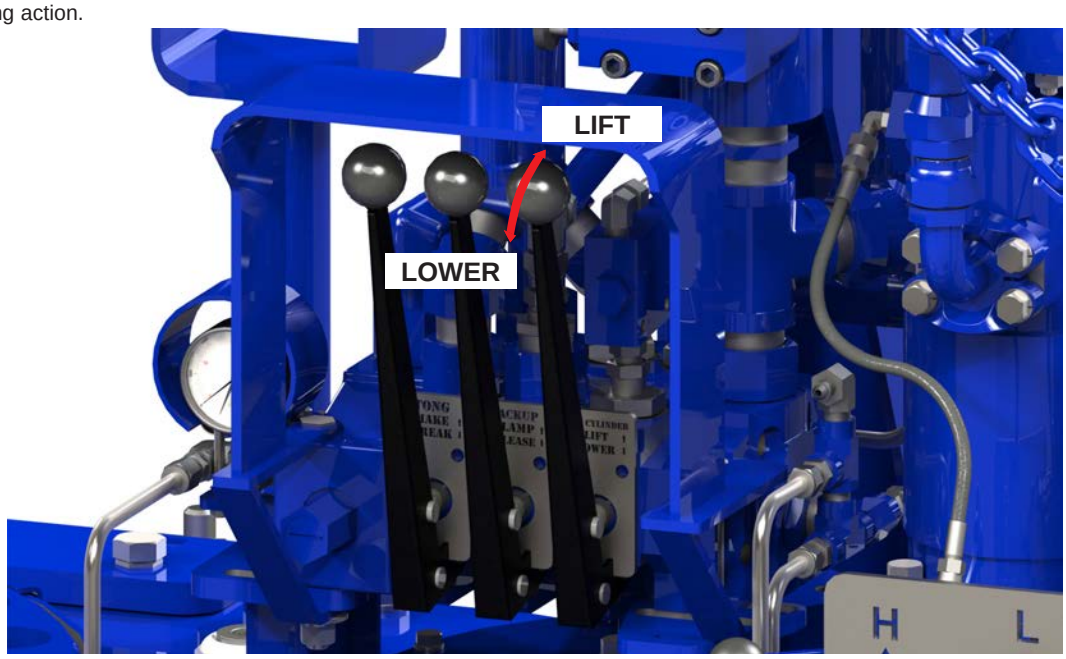


ILLUSTRATION 3.C.3: LIFT CYLINDER OPERATION

MOTOR SPEED

The ball valve labeled “Motor” controls the motor speed. Rotating the valve handle to “H” runs the motor at half displacement (high speed), which rotating the valve handle to “L” runs the motor at full displacement (low speed). Note that full torque is only available when running the motor at low speed.

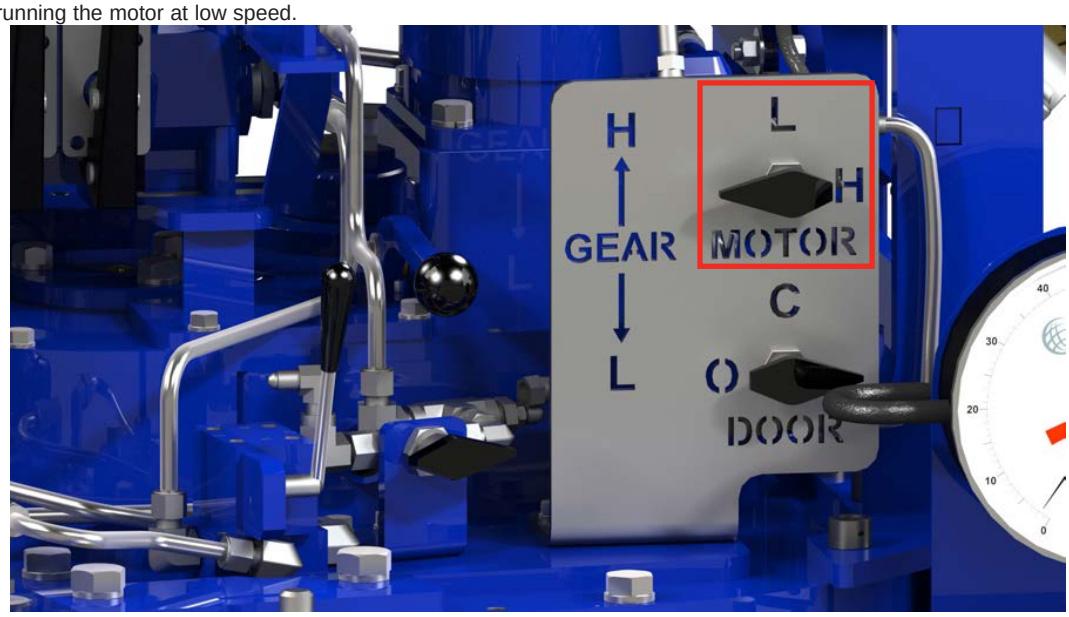


ILLUSTRATION 3.C.4: MOTOR SPEED CONTROL

HYDRAULIC DOOR

Open the hydraulic door by rotating the ball valve labeled “DOOR” to the “O” symbol. Close the door by rotating the ball valve to the “C” symbol. Do not attempt to open the door while the tong is rotating.

OPENING TONG DOOR WHILE ROTATING UNDER LOAD MAY RESULT IN GEAR FAILURE

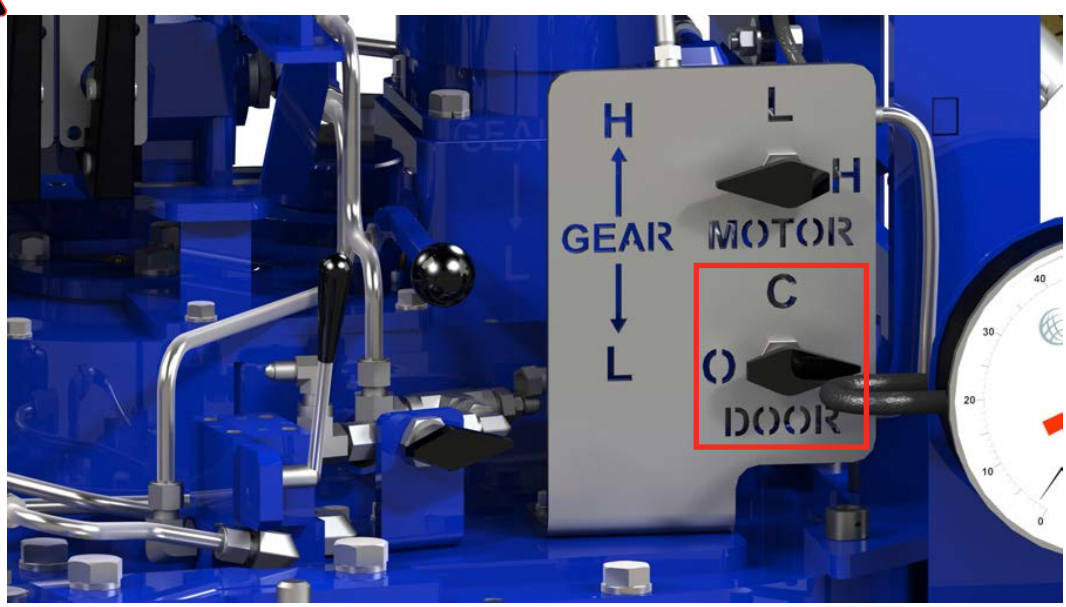


ILLUSTRATION 3.C.5: HYDRAULIC DOOR CONTROL

CHROMEMASTER™ HYDRAULIC BLOCK VALVES (If installed):

CHROMEMASTER™ hydraulic system block valves must both be in the closed position to allow the hydraulic circuit within the CHROMEMASTER™ head to pressurize, extending the CHROMEMASTER™ jaws. Opening either one of the block valves allows the fluid within the hydraulic circuit to drain back to the reservoir, de-pressurizing the hydraulic circuit and allowing the CHROMEMASTER™ jaws to retract.

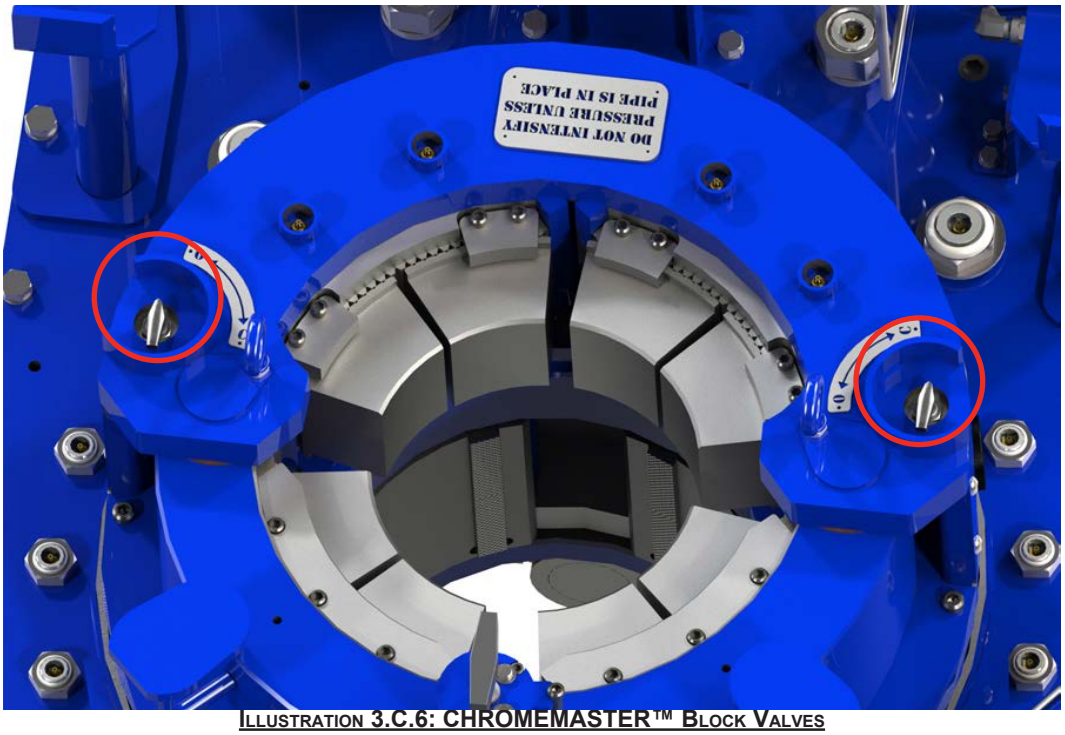


ILLUSTRATION 3.C.6: CHROMEMASTER™ BLOCK VALVES

CHROMEMASTER™ PUSH CYLINDER (If installed):

Push the CHROMEMASTER™ push cylinder control valve towards the center of the tong to extend the push cylinder rod against the pump cylinder on the CHROMEMASTER™ head, pressurizing the hydraulic circuit within the CHROMEMASTER™ when the both ball valves on top of the head are closed and extending the CHROMEMASTER™ jaws against the tubular. Pulling the push cylinder control valve towards the outside of the tong retracts the push cylinder rod, allowing the hydraulic circuit within the CHROMEMASTER™ to de-pressurize when either one of the ball valves on the CHROMEMASTER™ head are opened.

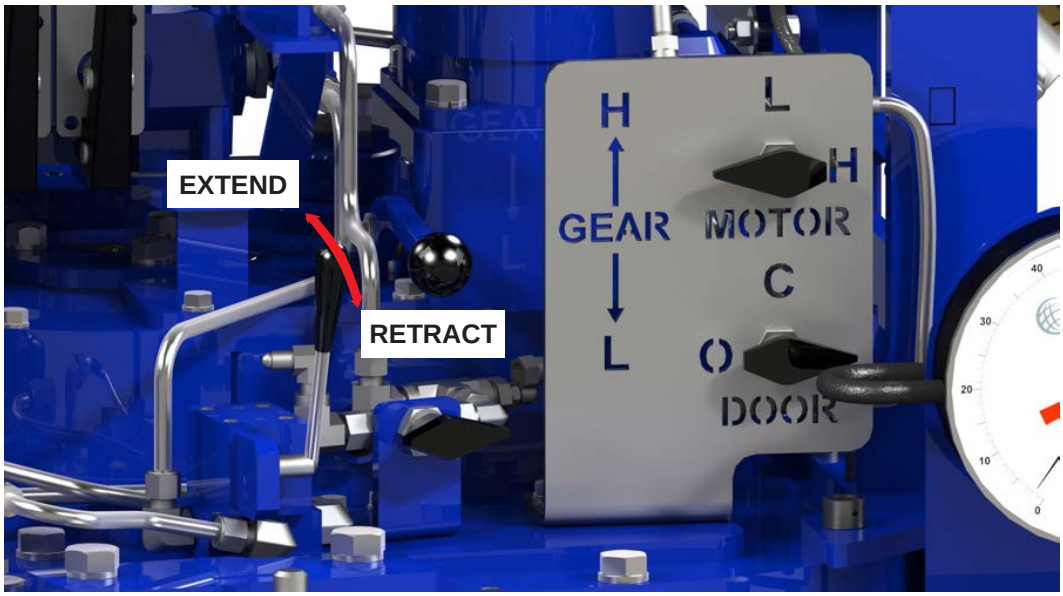


ILLUSTRATION 3.C.7: CHROMEMASTER™ PUSH CYLINDER CONTROL

3.D SHIFTING GEARS

Shift to the high-speed gear by moving the shifting handle upward from neutral position. Shift to the low-speed gear by moving the shifting handle down through neutral to its lowest position. Note that the high clutch gear or the low clutch gear may not be exactly aligned when shifting, so the operator may need to "bump" the motor control handle slightly to turn the main clutch gear shaft and shifting collar into alignment. This is most effective when applying a small amount of pressure on the gear shift lever in the direction you want to shift the tong, ensuring the shifting collar will "catch" when the main clutch gear aligns with either the high or low clutch gear. Note that maximum torque is only available in low gear at the lowest motor speed.

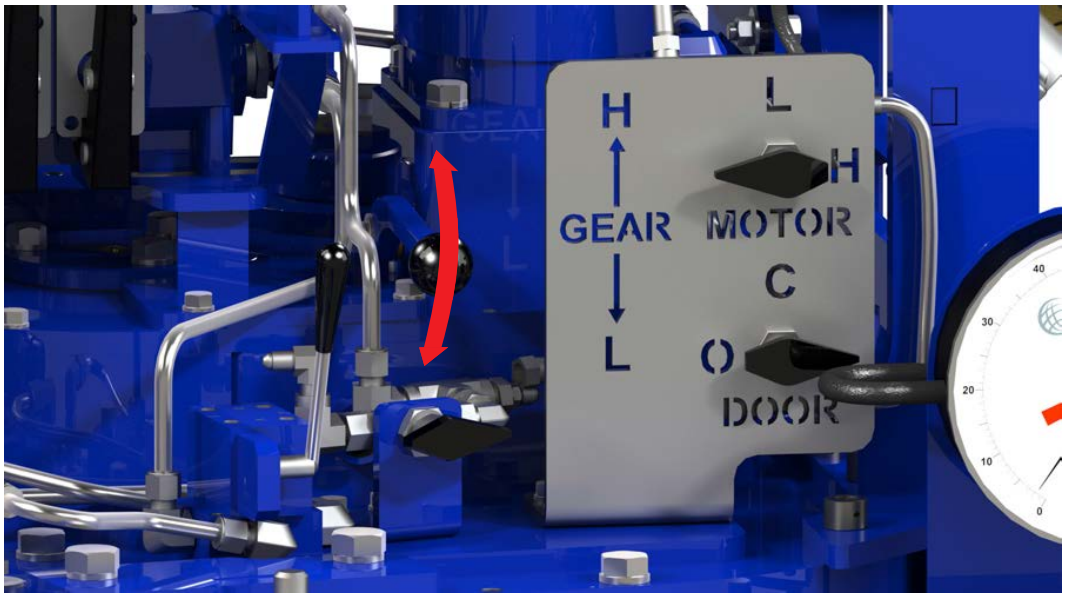


ILLUSTRATION 3.D.1: SHIFTING GEARS

SHIFTING TONG WHILE ROTATING THE MOTOR AND CAGE PLATE MAY RESULT IN CATASTROPHIC GEAR TRAIN FAILURE

3.E PRE-OPERATIONAL CHECKS

McCoy recommends that the following tests and inspections be performed prior to releasing the tong assembly to a operational environment :

1. Connect the tong to a hydraulic power source in a controlled environment. Ensure the power unit's operating parameters are within the specifications as identified on Pg. 1.6. Ensure the hydraulic connections from the power unit are properly and securely made up (see Section 2.E.3). Do not neglect to connect the motor drain line.
2. Energize hydraulic power to the tool. Inspect all hydraulic connections. Be aware that a restriction in the pressure supply hose will result in high pressure within the power unit hydraulic system, which may activate a hydraulic governor in a stand-alone power unit and increase the engine speed to as high as maximum RPM. A restriction in the return line will result in high pressure within both the power unit and the tong hydraulic system, and may cause failure of the motor seal.

A CLEARLY IDENTIFIED REMOTE POWER PACK EMERGENCY STOP MUST BE INSTALLED IN THE IMMEDIATE VICINITY OF THE TONG OPERATOR.

3. Allow hydraulic system to warm by circulating fluid for about 10 minutes, then slowly close the bypass valve to allow hydraulic fluid to circulate through the hoses and tong. Ensure circulating pressure does not exceed 200 psi.
4. Inspect all hydraulic hoses and connections on the tong. Immediately correct any hydraulic fluid leaks.
5. Inspect all gauges. Replace leaking or cracked gauges, or any gauge not registering a reading.
6. Confirm that all load-bearing pins and R-clip retainers are installed and in good condition (rigid sling pins, lift cylinder pins).
7. Confirm all hydraulic hoses (with the exception of the supply & return to the backup) are securely fastened to the tong, and are not in contact with the cage plate or creating a snagging hazard.
8. Test the tong door sensor/shutdown (safety door) system. The safety door system is an integral safety feature that must not be bypassed or disabled. Operating the power tong with a malfunctioning or non-operating door sensor/shutdown system exposes the operator and rig personnel to potentially fatal injury. do not operate tong with a malfunctioning or non-operating door sensor/shutdown system. Routinely testing the sensor/shutdown system operation before mobilizing and at each shift change ensures protection of drill floor personnel.

   A rotating tong potentially stores a large amount of kinetic energy in the gear train. Testing the sensor/shutdown system by suddenly opening the tong door to stop rotation will generate a shock load that could result in catastrophic equipment failure not covered by the manufacturer's warranty, and may present a hazard to personnel on the drill floor. The following procedure outlines the correct, safe procedure for testing the door sensor/tong shutdown system on a McCoy power tong.

   Using the correct testing procedure ensures the sensor/shutdown system is fully functional without exposing the equipment to a shock load or personnel to a potential hazard. The tests also verify that the shut down valve is positively sealing and rules out the possibility that contaminated hydraulic fluid or erosion is preventing the valve from completely shutting off the motor's supply of hydraulic fluid.

   i. Set the tong to low speed (see Section 3.C).

   ii. Stop all tong rotation.

   iii. Open the tong door.

   iv. Gradually attempt to turn the tong using one of the rotation control handles. Continue to gradually move the handle until the valve is fully stroked, and hold for 30 seconds. Verify the ring gear does not rotate while the rotation control is engaged. PROCEDURAL NOTE: a very small amount of ring gear movement is acceptable as the cartridge valve seats to stop rotation.

   v. Cease all rotation control and allow the control valve to go to the neutral position. Gradually attempt to rotate the tong in the opposite direction until the control is fully stroked, and hold the handle in the fully stroked position for 30 seconds. Verify the ring gear does not rotate while the rotation control is engaged. PROCEDURAL NOTE: a very small amount of ring gear movement is acceptable as the cartridge valve seats to stop rotation.

   vi. Ensure tong door is fully opened. Move the rotation control handle to approximately 50% of its full stroke. Slowly close the tong door while continuing to hold the directional control valve at 50%. Rotation should commence only once tong door is fully closed.

   If the safety door does not operate as designed, the safety door switch may require adjustment, or further troubleshooting of the safety door system may be required. See Section 4.F.2 for safety door switch adjustment procedures, and Section 5.B for safety door troubleshooting instructions.

DO NOT OPERATE TONG WITH A MALFUNCTIONING OR NON-OPERATING SAFETY DOOR SYSTEM.

3.F GENERAL OPERATIONAL COMMENTS

1. Position rotary gear in contact with both idler gears when breaking out joints or collars where high torques are required.

DO NOT BREAK A CONNECTION WITHOUT ENSURING ROTARY GEAR IS IN FULL CONTACT WITH BOTH IDLER GEARS.

2. When making-up integral (shouldered) joints, it is essential to make up the last turn of the threads with the motors running at the lowest speed at full motor displacement. This reduces the tendency of an instant stop or a sudden increase in torque, which induces extremely high stresses on the gear train.
3. **DO NOT** employ the “snap break” method of breaking-out joints when pulling a string. The extremely high stress placed on the gear train frequently causes gear failure.

THE “SNAP-BREAK” METHOD OF BREAKING CONNECTIONS IS HAZARDOUS TO RIG PERSONNEL AND EQUIPMENT

3.G MAKING AND BREAKING CONNECTIONS

Procedures for making and breaking connections vary widely depending on company policies and specific operating environments. McCoy recommends using the instructions in this section as guidelines in combination with your company’s policies when developing operating procedures specific to each working environment.

Set up and prepare your equipment for operation as per Section 2 of this manual. Refer to the following sections:

- 2.E.3 - Hydraulic Connections
- 2.F - Tong Jaw Installation
- 2.G.2 - Tong Leveling Leveling
- 2.G.3 - Load Cell Configuration

Your tong and backup assembly should be properly leveled, connected to a hydraulic power source, and ready to make or break connections at this point.

THESE OPERATING PROCEDURES ASSUME THE USER HAS PROPERLY SET UP AND PREPARED THE EQUIPMENT FOR OPERATION AS PER SECTIONS 2.D, 2.E, 2.F, & 2.G OF THIS MANUAL.

Set up and prepare your equipment for operation as per Section 2 of this manual Refer to the following sections:

3.G.1 Making A Connection

1. Energize hydraulic power to the tool.
2. Set the reversing pin for make-up operations.
3. Ensure the load cell is properly configured for making up connections.
4. Use the rig’s pipe-handling equipment to position the fresh tubular in position over the stump. Where possible manually engage the connection, and ensure the connection is not cross-threaded.
5. If equipped with an automatic door open the tong door by rotating the door control valve to “O” (open). See Section 3.C, Hydraulic Valve Operation. For those tools without an automatic door grasp and release the tong door latch, and swing the door fully open.
6. Open the backup doors by operating the “backup clamp release” valve. See Section 3.C, Hydraulic Valve Operation.
7. Position tool over the tubular connection.
8. Close the backup doors and engage the clamping jaw of the back-up using the back-up clamp control on the operator control panel.

SET BACKUP CLAMPING PRESSURE WITHIN THE RANGE PROSCRIBED BY THE PIPE SIZE AND WALL THICKNESS. SEE SECTION 2.H FOR BACKUP PRESSURE SETTING INSTRUCTIONS

9. If equipped with an automatic door close the tong door by rotating the door control valve to “C” (closed). See Section 3.C, Hydraulic Valve Operation. For those tools without an automatic door close the tong door until latch engages. Tug on the door handle to ensure the door is fully closed and securely latched.
10. Set tong speed to high by rotating the motor control valve to “H” (high) and shifting the tong to high gear (see Section 3.D). Begin rotation in the make up direction.

3.G.1 Making A Connection (Continued):

11. Run the tong at high speed until the joint begins to tighten (torque will begin to rapidly increase). Stop rotation. Set the tong to low speed (highest motor displacement) and shift the tong to low gear.

SHIFTING TONG WHILE ROTATING THE MOTOR AND CAGE PLATE MAY RESULT IN CATASTROPHIC GEAR TRAIN FAILURE

Continue to make up the joint in low gear at low speed. Cease rotation when the torque measurement reaches the pre-determined value, or when the Wincatt system actuates the pressure dump valve.

12. Rotate the rotary gear in the break-out direction until the jaws have disengaged from the pipe/casing, and the opening of the rotary gear aligns with the door opening.
13. If equipped with an automatic door open the tong door by rotating the door control valve to “O” (open). See Section 3.C, Hydraulic Valve Operation. For those tools without an automatic door grasp and release the tong door latch, and swing the door fully open.
14. Release the backup clamp cylinder. Performing this operation will also open the outer backup door, followed by the inner backup door.
15. Move the tool away from the drill string.
16. Follow steps 4 through 15 to make up the next connection.

3.G.2 Breaking A Connection

1. Ensure tool is properly prepared for break-out operations, including checking that the tong is level and confirming the correct size of jaws are installed.
2. Set the reversing pin for break-out operations.
3. Configure the load cell for break out operations if break-out torque measurement is required.
4. If equipped with an automatic door open the tong door by rotating the door control valve to “O” (open). See Section 3.C, Hydraulic Valve Operation. For those tools without an automatic door grasp and release the tong door latch, and swing the door fully open.
5. Open the backup doors by operating the “backup clamp release” valve.
6. Position tool over the tubular connection, ensuring the joint is approximately centered between the tong and backup.
7. Close the backup doors and engage the clamping jaw of the back-up using the back-up clamp control on the operator control panel.

SET BACKUP CLAMPING PRESSURE WITHIN THE RANGE PROSCRIBED BY THE PIPE SIZE AND WALL THICKNESS. SEE SECTION 2.H FOR BACKUP PRESSURE SETTING INSTRUCTIONS

8. If equipped with an automatic door close the tong door by rotating the door control valve to “C” (closed). See Section 3.C, Hydraulic Valve Operation. For those tools without an automatic door close the tong door until latch engages. Tug on the door handle to ensure the door is fully closed and securely latched.
9. Full break-out torque is only available in low motor speed and in low gear. Set motor speed to low by rotating the motor control valve to “L” (low) and shift the tong to low gear (see subsection 3.D).

SHIFTING TONG WHILE ROTATING THE MOTOR AND CAGE PLATE MAY RESULT IN CATASTROPHIC GEAR TRAIN FAILURE

Use the rotation control valve to begin rotating in the break-out direction. **OPERATIONAL NOTE:** Do not apply break-out torque if, for any reason (slippage, for example), the rotary gear rotates past 90 degrees without gripping the tubular. Applying full torque to break out a joint when the rotary gear is not in full contact with both idler gear assemblies presents a significant hazard of catastrophic tong failure.

DO NOT APPLY BREAK-OUT TORQUE IF THE ROTARY GEAR IS NOT IN FULL CONTACT WITH BOTH IDLER GEAR ASSEMBLIES.

10. Apply full torque after the tong jaws cam on to the tubular.
11. Stop rotation when the connection breaks. If desired, shifting motor speed to high and/or shifting the tong in to high gear enables the tong to completely un-thread the connection at high speed.

3.G.2 Breaking A Connection

12. When the connection is completely un-threaded stop rotation, then rotate in the make-up direction to release the tong jaws from the tubing.
13. When the tong jaws disengage align the opening in the rotary gear with the mouth of the tong.
14. Release the backup clamp and open the backup doors, and open the tong door to free the tong from the drill string.
15. Move the tool away from the string.
16. Use your rig's standard pipe handling procedures to remove and rack the freed tubing strand.
17. Repeat steps 6 through 16 as many times as necessary to break out and un-thread the desired number of connections

3.G.3 Making A Connection Using The CHROMEMASTER™ SYSTEM

1. Energize hydraulic power to the tool.
2. Ensure the load cell is properly configured for making up connections.
3. Use the rig's pipe-handling equipment to position the fresh tubular in position over the stump. Where possible manually engage the connection, and ensure the connection is not cross-threaded.
4. Inspect CHROMEMASTER™ push cylinder and ensure shaft is fully retracted before proceeding. Rotating the tong while push cylinder shaft is extended may result in severe equipment damage.

FULLY RETRACT PUSH CYLINDER SHAFT BEFORE BEGINNING ROTATION.

5. If required, rotate the CHROMEMASTER™ section to align the opening on the CHROMEMASTER™ with the opening of the power tong. Do this by aligning the arrow on the CHROMEMASTER™ with the arrow on the top plate of the tong.

ILLUSTRATION 3.G.1: CHROMEMASTER™ ALIGNMENT

6. Open the tong door by grasping the tong door latch to disengage the latch, and swing the door fully open.

3.G.3 Making A Connection Using The CHROMEMASTER™ SYSTEM (Continued):

7. Open the CHROMEMASTER™ doors. Lift the latch handle straight up, and swing the doors open to their widest point.

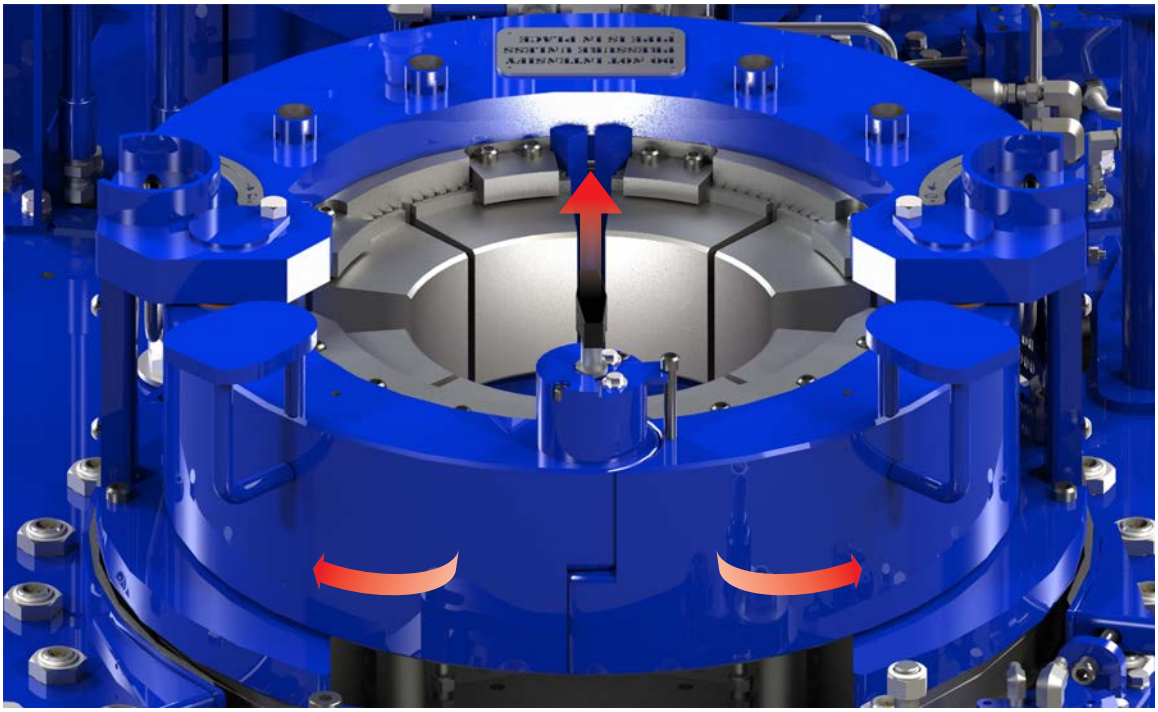


ILLUSTRATION 3.G.2: OPENING CHROMEMASTER™ DOORS

8. Open the backup doors by operating the “backup clamp release” valve.
9. Position tool over the tubular connection. If required use the “lift cylinder lift/lower” control valve to change the vertical position of the tool until the joint is satisfactorily positioned between the tong and backup.
10. Close the backup doors and engage the clamping jaw of the back-up using the back-up clamp control on the operator control panel.
11. Close the tong door. Tug on the door handle to ensure the door is fully closed and securely latched.
12. Close the CHROMEMASTER™ doors. Lift the latch handle straight up and swing the doors closed, allowing the spring-loaded latch pin to drop in to place. **OPERATIONAL NOTE:** If the latch pin does not drop in to place, the doors have not been correctly closed.
13. Double-check the alignment arrows, ensuring they have remained aligned prior to operating the push cylinder. Do not operate push cylinder if tong and CHROMEMASTER™ are misaligned.

DO NOT OPERATE PUSH CYLINDER UNLESS CHROMEMASTER™ AND TONG ARE ALIGNED.

14. Rotate both blocking valves on the CHROMEMASTER™ head to the “C” (closed) position.
15. Observe the pressure indicator on the CHROMEMASTER™ (see illustration 3.G.1). Actuate the CHROMEMASTER™ push cylinder control valve (see section 3.C) to extend the push cylinder shaft against the CHROMEMASTER™ pump, pressurizing the hydraulic system on the CHROMEMASTER™ and causing the CHROMEMASTER™ jaws to extend against the tubular. Maximum operating pressure of the CHROMEMASTER™ is 4500 psi. If the initial extension of the push cylinder does not “pump” the CHROMEMASTER™ pressure to the desired operating range retract the push cylinder, and repeat the extension process. Continue to “pump” the CHROMEMASTER™ hydraulic system until the optimum operating pressure is reached.
16. Ensure push cylinder rod is fully retracted before rotation. Rotating the tong while push cylinder shaft is extended may result in severe equipment damage.

FULLY RETRACT PUSH CYLINDER SHAFT BEFORE BEGINNING ROTATION.

3.G.3 Making A Connection Using The CHROMEMASTER™ SYSTEM (Continued):

17. Set tong speed to high by rotating the motor control valve to “H” (high) and shifting the tong to high gear (see Section 3.D). Begin rotation in the make up direction.
18. Run the tong at high speed until the joint begins to tighten (torque will begin to rapidly increase). Stop rotation. Set the tong to low speed (highest motor displacement) and shift the tong to low gear.

SHIFTING TONG WHILE ROTATING THE MOTOR AND CAGE PLATE MAY RESULT IN CATASTROPHIC GEAR TRAIN FAILURE

Continue to make up the joint in low gear at low speed. Cease rotation when the torque measurement reaches the pre-determined value, or when the Wincatt system actuates the pressure dump valve.

19. Disengage the jaws in the CHROMEMASTER™. Open either of the two blocking valves on the CHROMEMASTER™ head to relieve pressure in the CHROMEMASTER™ hydraulic system and retract the jaws. The two blocking valves operate on parallel circuits, meaning either will relieve the system pressure. Double-check the CHROMEMASTER™ head to ensure the jaws have retracted.
20. Rotate the CHROMEMASTER™ to align the CHROMEMASTER™ opening with the tong opening (see illustration 3.G.1).
21. Open the CHROMEMASTER™ doors. Lift the latch handle straight up, and swing the doors open to their widest point (see illustration 3.G.2).
22. Open the tong door by grasping the tong door latch to disengage the latch, and swing the door fully open.
23. Open the backup doors by operating the “backup clamp release” valve.
24. Swing the tool off the tubular, and prepare for the next connection.
25. Repeat steps 3 through 24 until the desired number of connections have been performed.

3.G.4 Breaking A Connection Using The CHROMEMASTER™ SYSTEM

1. Energize hydraulic power to the tool.
2. Ensure the load cell is properly configured for breaking out connections.
3. Inspect CHROMEMASTER™ push cylinder and ensure shaft is fully retracted before proceeding. Rotating the tong while push cylinder shaft is extended may result in severe equipment damage.

FULLY RETRACT PUSH CYLINDER SHAFT BEFORE BEGINNING ROTATION.

4. If required, rotate the CHROMEMASTER™ section to align the opening on the CHROMEMASTER™ with the opening of the power tong. Do this by aligning the arrow on the CHROMEMASTER™ with the arrow on the top plate of the tong (see illustration 3.G.1).
5. Open the CHROMEMASTER™ doors. Lift the latch handle straight up and swing the doors open to their widest point (see illustration 3.G.2).
6. Open the tong door by grasping the tong door latch to disengage the latch, and swing the door fully open.
7. Open the backup doors by operating the “backup clamp release” valve.
8. Position tool over the tubular connection. If required use the “lift cylinder lift/lower” control valve to change the vertical position of the tool until the joint is satisfactorily positioned between the tong and backup.
9. Close the backup doors and engage the clamping jaw of the back-up using the back-up clamp control on the operator control panel.
10. Close the tong door. Tug on the door handle to ensure the door is fully closed and securely latched.
11. Close the CHROMEMASTER™ doors. Lift the latch handle straight up, and hold while swinging the doors closed. Drop the spring-loaded latch pin into place, ensuring the pin engages both doors.
12. Double-check the alignment arrows, ensuring they have remained aligned prior to operating the push cylinder. Do not operate push cylinder if tong and CHROMEMASTER™ are misaligned.

DO NOT OPERATE PUSH CYLINDER UNLESS CHROMEMASTER™ AND TONG ARE ALIGNED.

3.G.4 Breaking A Connection Using The CHROMEMASTER™ SYSTEM (Continued):

13. Rotate both blocking valves on the CHROMEMASTER™ head to the “C” (closed) position.
14. Observe the pressure indicator on the CHROMEMASTER™ (see illustration 3.G.1). Actuate the CHROMEMASTER™ push cylinder control valve (see section 3.C) to extend the push cylinder shaft against the CHROMEMASTER™ pump, pressurizing the hydraulic system on the CHROMEMASTER™ and causing the CHROMEMASTER™ jaws to extend against the tubular. Optimum operating pressure of the CHROMEMASTER™ is between 4200 psi and 4500 psi. If the initial extension of the push cylinder does not “pump” the CHROMEMASTER™ pressure to the desired operating range retract the push cylinder, and repeat the extension process. Continue to “pump” the CHROMEMASTER™ hydraulic system until the optimum operating pressure is reached.
15. Ensure push cylinder rod is fully retracted before rotation. Rotating the tong while push cylinder shaft is extended may result in severe equipment damage.

FULLY RETRACT PUSH CYLINDER SHAFT BEFORE BEGINNING ROTATION.

16. The tool will only deliver break-out torque in low gear at lowest motor speed. Set tong speed to low by rotating the motor control valve to “L” (low), and shift tong to low gear (see section 3.D).

SHIFTING TONG WHILE ROTATING THE MOTOR AND CAGE PLATE MAY RESULT IN CATASTROPHIC GEAR TRAIN FAILURE

Use the rotation control valve to begin rotating in the break-out direction. **OPERATIONAL NOTE:** Do not apply break-out torque if, for any reason (slippage, for example), the rotary gear rotates past 90 degrees without gripping the tubular. Applying full torque to break out a joint when the rotary gear is not in full contact with both idler gear assemblies presents a significant hazard of catastrophic tong failure.

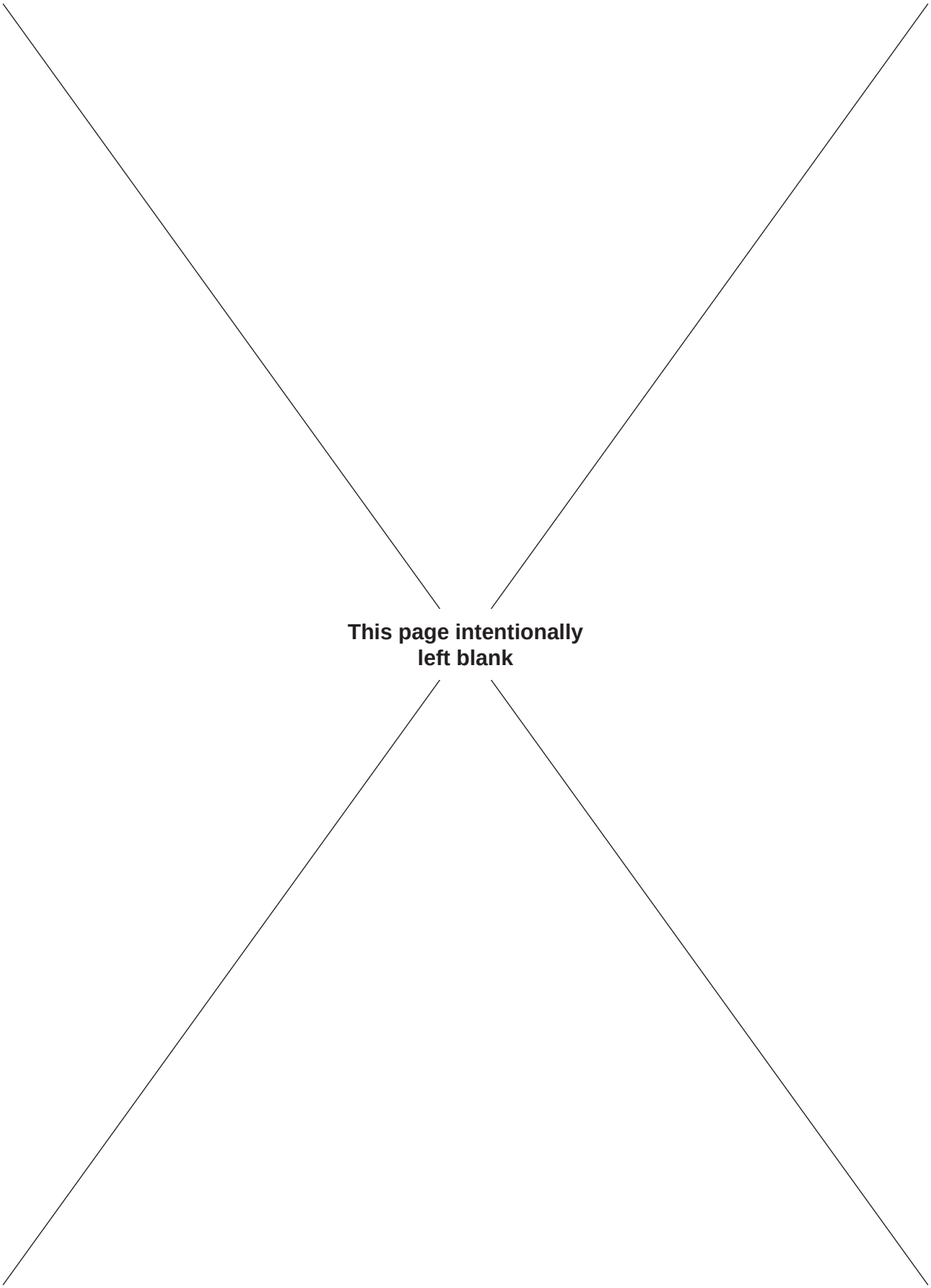
DO NOT APPLY BREAK-OUT TORQUE IF THE ROTARY GEAR IS NOT IN FULL CONTACT WITH BOTH IDLER GEAR ASSEMBLIES.

17. When the connection breaks stop rotation. If desired, shifting motor speed to high and/or shifting the tong in to high gear enables the tong to completely un-thread the connection at high speed.
18. When the joint is completely un-threaded disengage the jaws in the CHROMEMASTER™. Open either of the two blocking valves on the CHROMEMASTER™ head to relieve pressure in the CHROMEMASTER™ hydraulic system and retract the jaws. The two blocking valves operate on parallel circuits, meaning either will relieve the system pressure. Double-check the CHROMEMASTER™ head to ensure the jaws have retracted.
19. Rotate the CHROMEMASTER™ to align the CHROMEMASTER™ opening with the tong opening (see illustration 3.G.1).
20. Open the CHROMEMASTER™ doors. Lift the latch handle straight up and swing the doors open to their widest point (see illustration 3.G.2).
21. Open the tong door by grasping the tong door latch to disengage the latch, and swing the door fully open.
22. Open the backup doors by operating the “backup clamp release” valve.
23. Swing the tool off the tubular.
24. Use your rig’s standard pipe handling procedures to remove and rack the freed tubing strand.
25. Repeat steps 3 through 24 until the desired number of connections have been performed.

3.H EXTREME COLD WEATHER OPERATION CONSIDERATIONS

1. Consult the power unit engine operator’s manual for all cold weather operating procedures and precautions.
2. Select gear and bearing lubricants that are compatible with expected climatic conditions.
3. Select hydraulic fluid that is compatible with expected climatic conditions.
4. Allow hydraulic fluid to circulate for approximately 20 minutes after starting the power unit, prior to activating the bypass valve to allow fluid to circulate to tong. If the power unit is equipped with an oil temperature gauge, ensure that the fluid has reached operating temperature as specified by hydraulic fluid data sheet.
5. Allow for adequate drying of moisture (prior to lubricating) when cleaning tong parts in cold weather.

SECTION 4: MAINTENANCE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McCoy Completions & Drilling recognizes that minor on-site repairs and modifications are required to maintain peak operating condition of your equipment, or to match your equipment with the operating environment. Examples of minor repairs are

- replacement of damaged hydraulic hoses and fittings.
- replacement of malfunctioning pressure gauges and valves.
- replacement of door cylinders
- replacement of fasteners

Any replaced component must be an identical component supplied by McCoy Completions & Drilling. Replaced fasteners must be Grade 8 or equivalent, or whatever fastener is specified by McCoy.

4.A GENERAL MAINTENANCE SAFETY PRACTICES

The practices identified here are intended as a guideline. All personnel are responsible for performing their tasks in a manner that ensures worker, equipment, and environmental safety, and may require taking additional steps that are not identified in this section.

Equipment maintenance shall be performed only by designated qualified maintenance personnel. Wear approved eye wear and footwear, and follow all of your company's safety guidelines Do not begin a maintenance task without the proper tools or materials on hand, or the proper drawings and documentation necessary.

Schedule planned maintenance with operators to avoid conflicts, unnecessary downtime, and the danger of accidental equipment activation. Notify operations when maintenance procedures are complete and equipment functionality is restored.

Isolate the location of the maintenance under way to prevent unaware personnel from inadvertently exposing themselves to a hazard. Use tape, rope, or signage to clearly indicate "off-limits" area.

Replacement of large, heavy individual parts and/or heavy structural components must be performed using an approved lifting device of sufficient lifting capacity. Use care when attaching the lifting device, and safeguard area to avoid endangering personnel or equipment.

All spare parts must meet or exceed OEM specifications in order to maintain equipment integrity, especially protective equipment

Ensure your equipment is isolated from hydraulic power before commencing maintenance operations.

DO NOT PERFORM MAINTENANCE UNTIL TUBULAR CONNECTION EQUIPMENT HAS BEEN COMPLETELY ISOLATED FROM HYDRAULIC POWER

Your equipment uses materials that may be harmful to the environment if improperly disposed of (hydraulic fluid, grease, etc.). Dispose of all materials according to your company's proscribed environmental protection regulations.

4.B CLEANING

Clean tong thoroughly cleaned with a good petroleum-based cleaning agent after each job, prior to storage. McCoy recommends that the motor and valve assembly be periodically removed, along with the top tong plate, so that guides, rollers and gears can be properly cleaned. Ensure that cleaning solvents and chemicals are captured to prevent environmental contamination, and dispose of all materials according to your company's proscribed environmental protection regulations.

4.C PREVENTIVE MAINTENANCE PRACTICES

Regular maintenance programs are necessary, and must be established to assure safe, dependable operation of your Hydraulic Tubular Connection System and to avoid costly breakdown maintenance. The following maintenance procedures provides information required to properly maintain your equipment. Your equipment may require more, or less maintenance depending upon the frequency of use and the field conditions under which your equipment operates. These maintenance procedures are designed for equipment operating at 10°C to 35°C ambient temperature for 10 hours per day. McCoy recommends that the inspection and maintenance procedures in this section be performed as recommended in the maintenance checklists (see Appendices), or in conjunction with your maintenance foreman's experience and best estimate of when your equipment is due for this maintenance.

Manufacturers of purchased components included with your hydraulic tubular connection equipment (for example: motors, valves, etc.) may specify maintenance tasks and intervals over and above what McCoy recommends as part of their recommended procedures. Users of this equipment may choose to perform or ignore these additional tasks at their discretion.

Filtration of the hydraulic fluid must be 10 microns or better. Premature fouling of particulate filters within your prime mover or ancillary hydraulic power unit requires immediate hydraulic fluid laboratory analysis to prevent premature wear of hydraulic system due to high levels of wear metals in the fluid.

McCoy recommends tracking all maintenance activity including the lubrication schedule and replacement of hydraulic hoses. This may be a simple as keeping a paper log, or using a software-based maintenance tracking utility. A maintenance log is a valuable tool that can be used for easily retrieving maintenance history or identifying trends that require correction.

4.D HYDRAULIC SYSTEM DE-PRESSURIZATION

McCoy Drilling & Completions recommends that the hydraulic system be de-pressurized prior to maintenance on any hydraulic component. Perform the following steps to ensure the dangers posed by hydraulic fluid under pressure are minimized.

ENSURE ADEQUATE CONTAINMENT IS IN PLACE TO PREVENT ENVIRONMENTAL CONTAMINATION FROM RESIDUAL HYDRAULIC FLUID

1) Rotate the tong to the “open throat” position. Ensure tong and backup doors (if equipped) are closed. Fully extend the lift cylinder
2) De-energize the power unit.
3) Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.
4) Remove the hydraulic SUPPLY line from the equipment.
5) Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.
7) Disconnect the hydraulic RETURN line from the equipment.
8) Disconnect remaining hoses such as case drains, or lines connected to the turns counter.

HYDRAULIC PRESSURES AS HIGH AS OPERATING PRESSURE MAY REMAIN TRAPPED IN SMALL AREAS OF THE EQUIPMENT. ENSURE ALL MAINTENANCE IS CARRIED OUT BY A QUALIFIED SERVICE TECHNICIAN, AND THAT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT IS USED TO GUARD AGAINST PRESSURE INJURIES

4.E LUBRICATION INSTRUCTIONS

In general, McCoy recommends use of a good-quality EP synthetic multi-purpose grease with an NLGI consistency grade of “2” and an NLGI performance grade of “GC-LB” for general lubrication of bearings and metal-to-metal contact. Ensure selected grease remains within its viscosity range at expected operating temperatures.

McCoy recommends liberally coating the cam surface of the rotary drive gear with grease prior to jaw installation. Periodically remove the clutch inspection plate and apply grease generously to the clutch, drive gears and shifting shaft. Coat the jaw pins and rollers with a liberal amount of anti-seize compound when installing new jaw die kits.

McCoy recommends lubricating your equipment before beginning each shift, and immediately following operation prior to storage. This section identifies all necessary lubrication points.

4.E.1 Cage Plate Cam Followers

Apply grease to the cam followers in the top and bottom cage plates through the grease fittings on each cam follower (19 locations top, 19 locations bottom).

ILLUSTRATION 4.E.1: CAGE PLATE CAM FOLLOWER LUBRICATION

4.E.2 Support Rollers

Apply grease to the support roller bearings through the grease fittings recessed into the top of each support roller shaft (14 locations tong body (top), 14 locations tong body (bottom), 3 locations tong door (top), and 3 locations tong door (bottom).

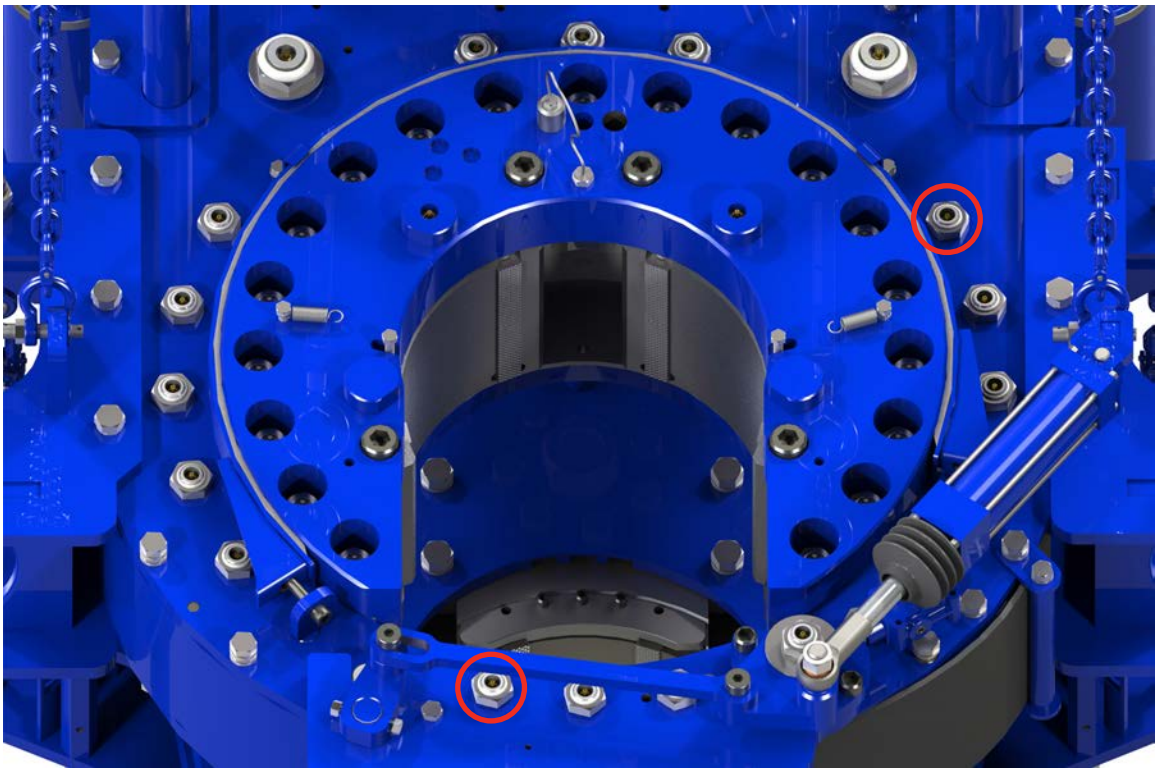

ILLUSTRATION 4.E.2: SUPPORT ROLLER LUBRICATION

4.E.3 Jaw Pivot Bolts

Apply grease to the jaw pivot bolts through the grease fittings recessed into the top of each (two locations total).

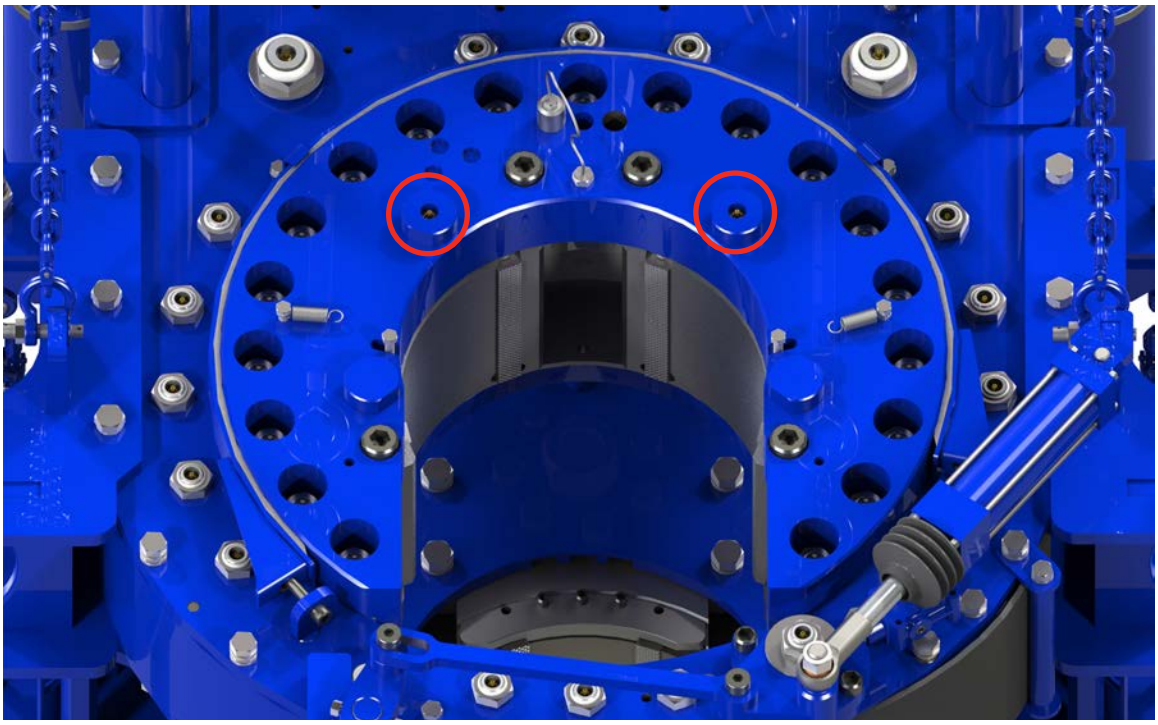

ILLUSTRATION 4.E.3: JAW PIVOT BOLT LUBRICATION

4.E.4 Raced Idler Gear Bearings

Apply grease to the raced idler gear bearings through the grease fittings recessed into the top of each shaft on the top and bottom faces of the tong (four locations total).

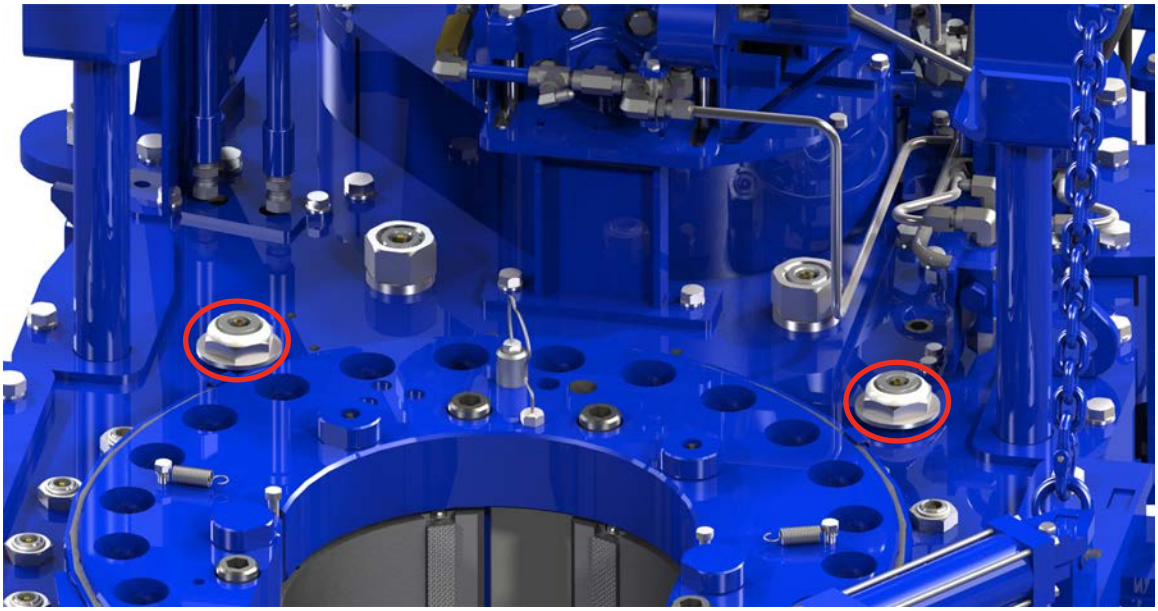

Illustration 4.E.4: Raced Idler Gear Lubrication (Top)

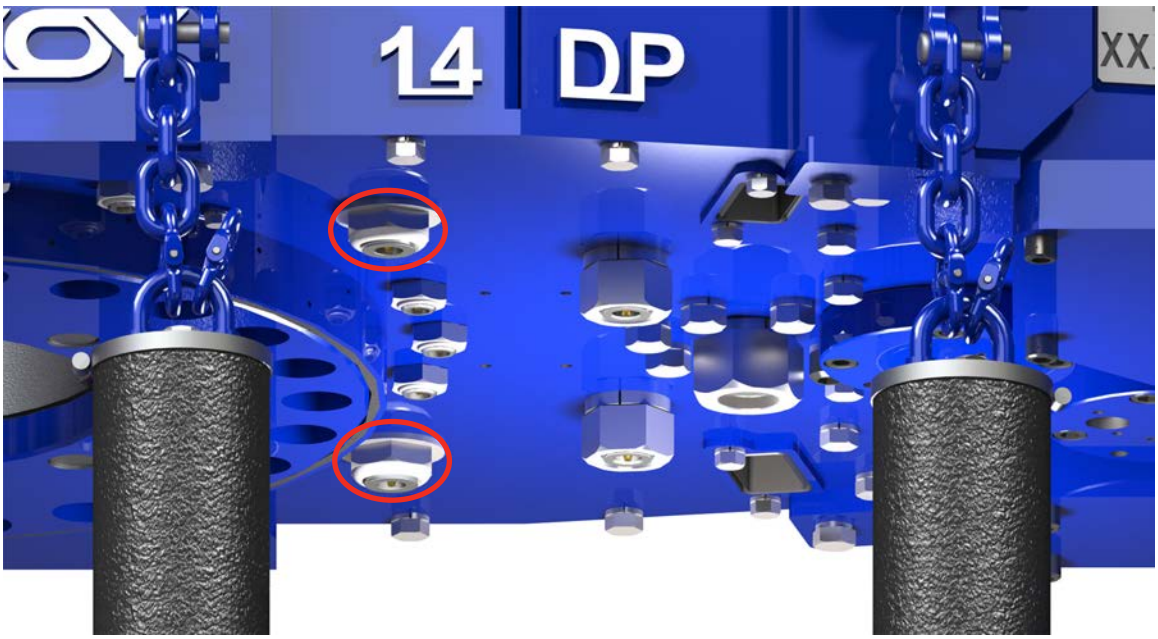

Illustration 4.E.5: Raced Idler Gear Lubrication (Bottom)

4.E.5 Outboard Idler Bearings

Apply grease to the mid-idler bearings through the grease fittings recessed into the top of each shaft. Lubricate two locations total from the top side of the tong, and five locations total from the bottom side of the tong.

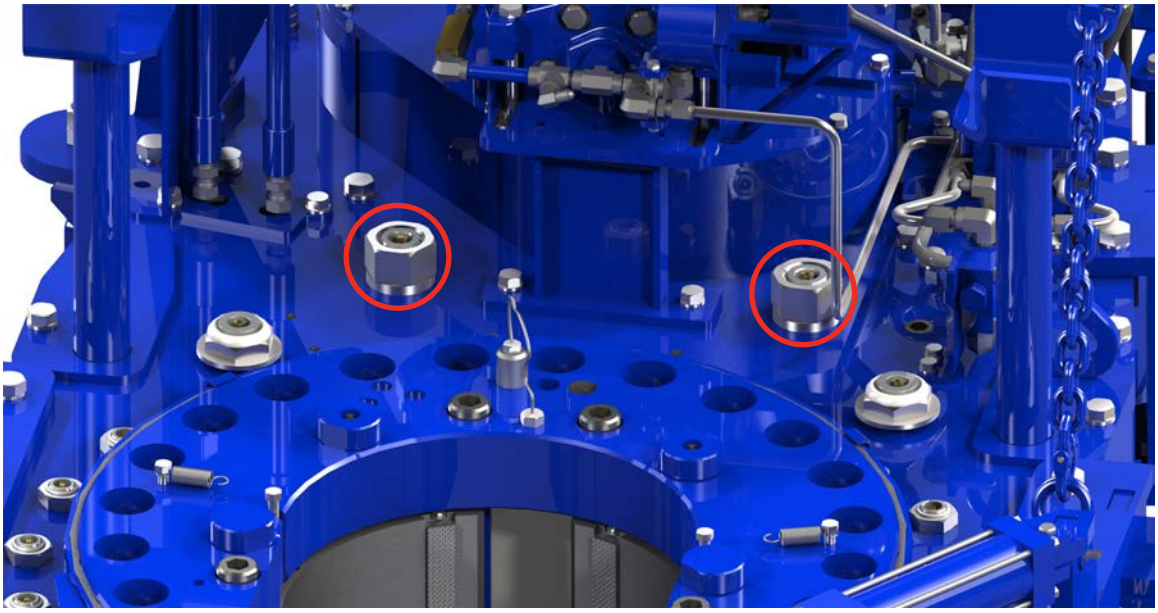

ILLUSTRATION 4.E.6: OUTBOARD IDLER LUBRICATION (TOP)

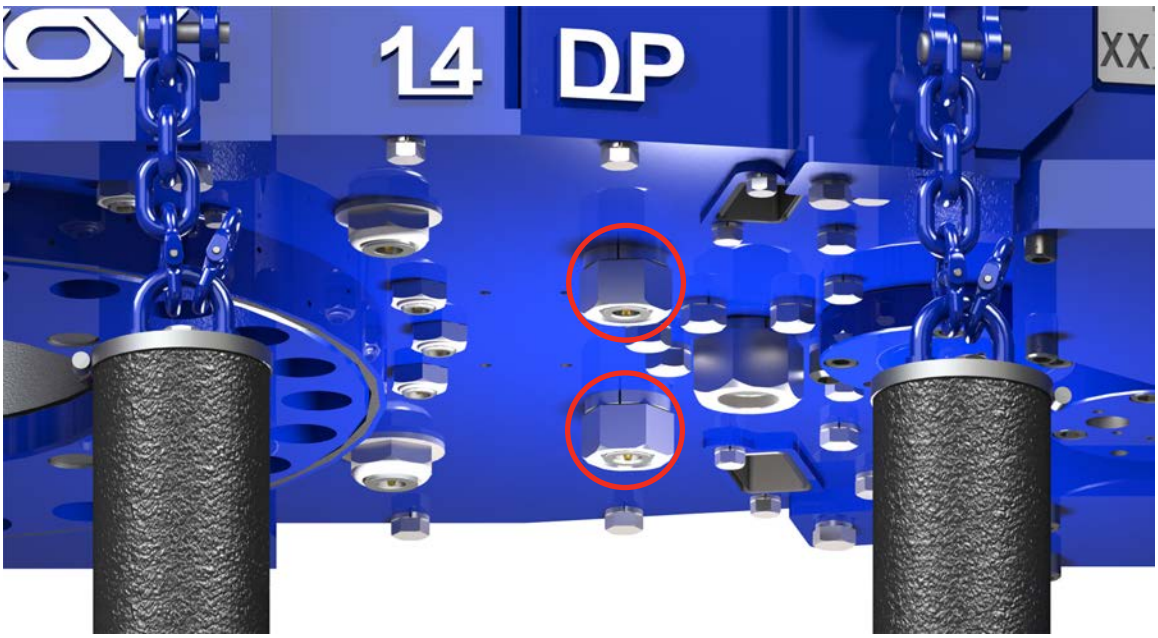

ILLUSTRATION 4.E.7: OUTBOARD IDLER LUBRICATION (BOTTOM)

4.E.6 Pinion Gear Assembly Lubrication

Apply grease to the bearings in the pinion gear assembly through the single grease fitting located on the top and bottom bearing caps (two locations total).

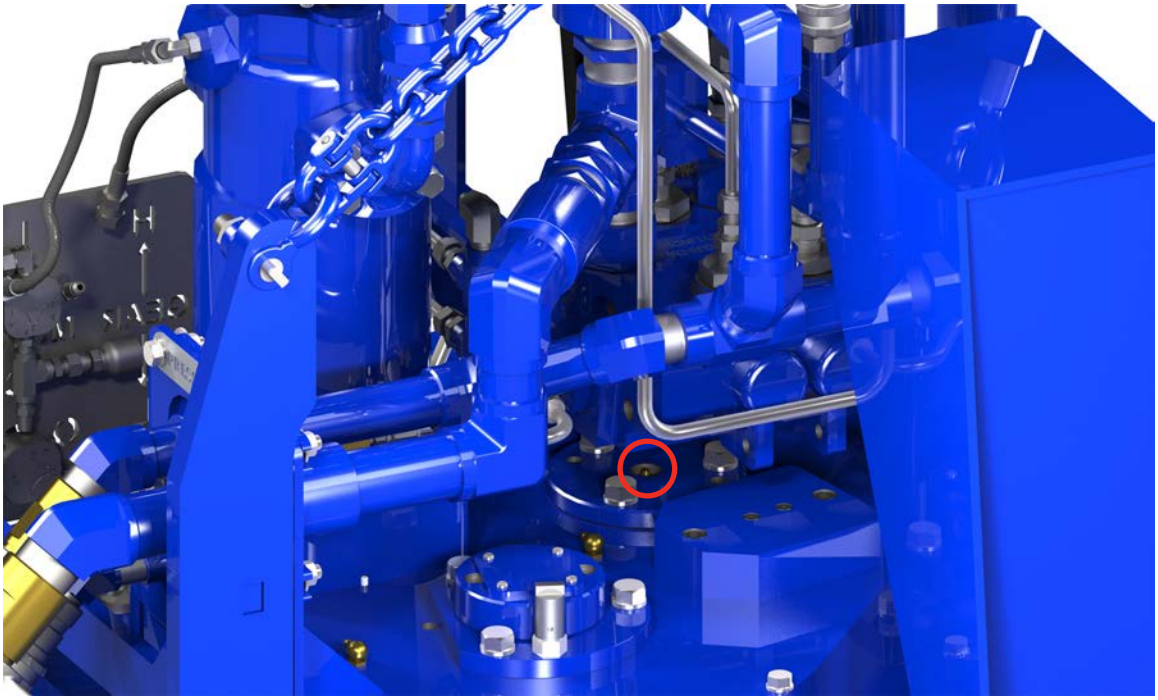

ILLUSTRATION 4.E.8: PINION GEAR ASSEMBLY LUBRICATION (TOP)

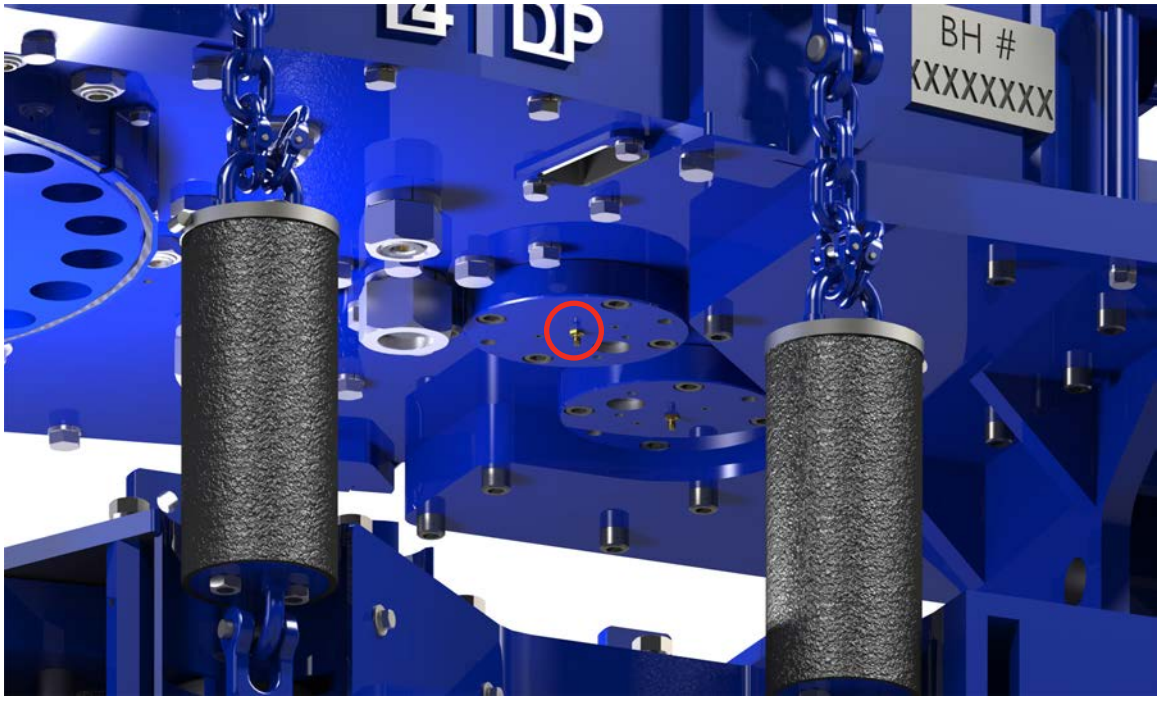

ILLUSTRATION 4.E.9: PINION GEAR ASSEMBLY LUBRICATION (BOTTOM)

4.E.7 Secondary Gear Assembly Lubrication

Apply grease to the bearings in the secondary gear assembly through the single grease fitting located on the bearing cap on the bottom rear of the tong (one location total).

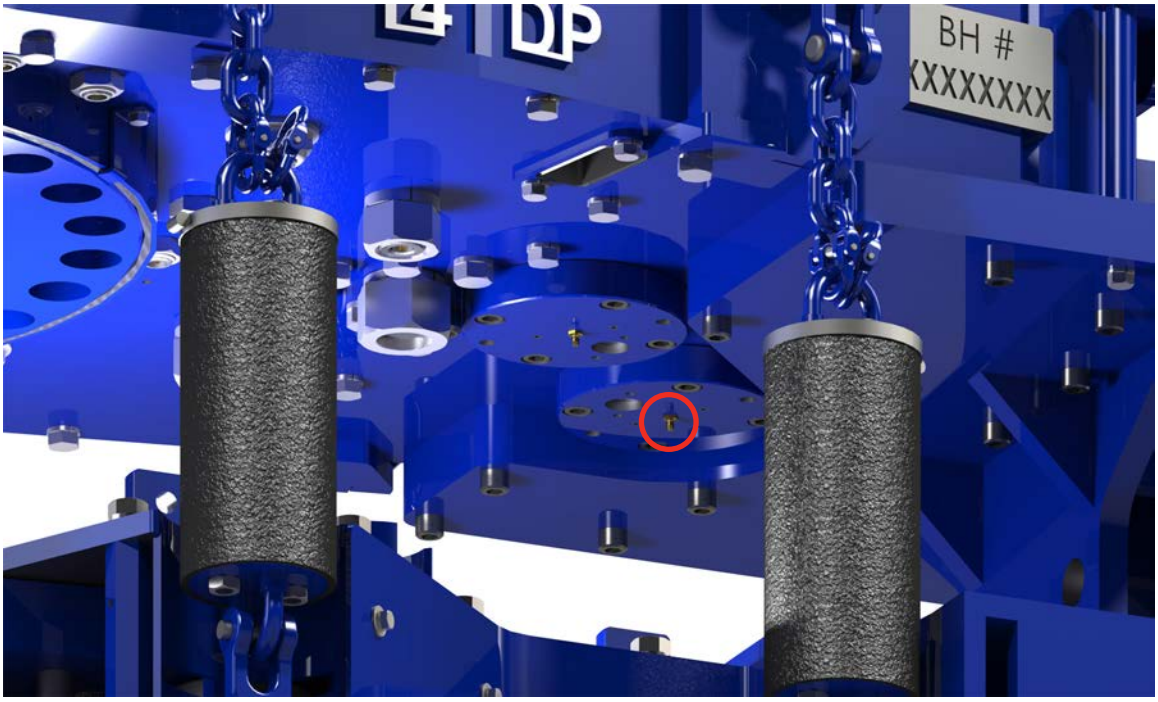

ILLUSTRATION 4.E.9: SECONDARY GEAR ASSEMBLY LUBRICATION

4.E.8 Gearbox Lubrication

Apply grease to the shifter gearbox through the grease fitting on the front side of the gearbox next to the gear shifting shaft (one location total).

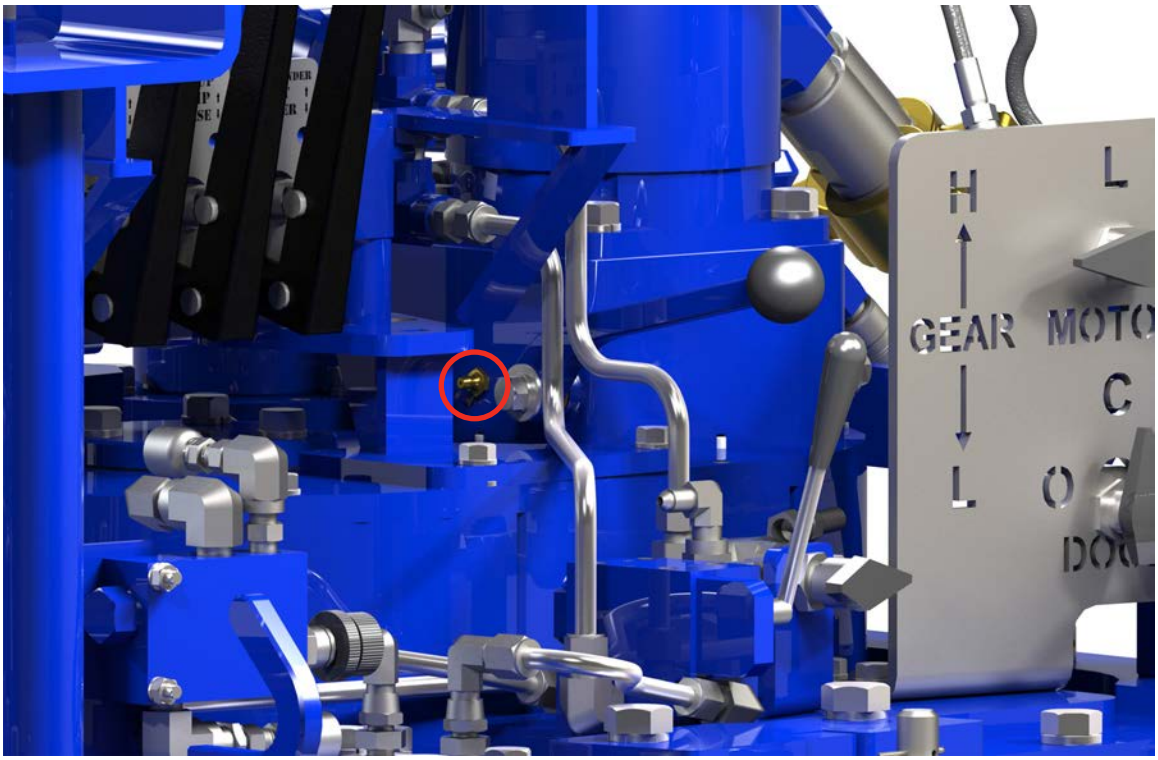

ILLUSTRATION 4.E.10: GEARBOX ASSEMBLY LUBRICATION

4.E.9 Low Gear Housing Lubrication

Apply grease to the low gear housing through the grease fittings in the top plate of the housing (two locations total).

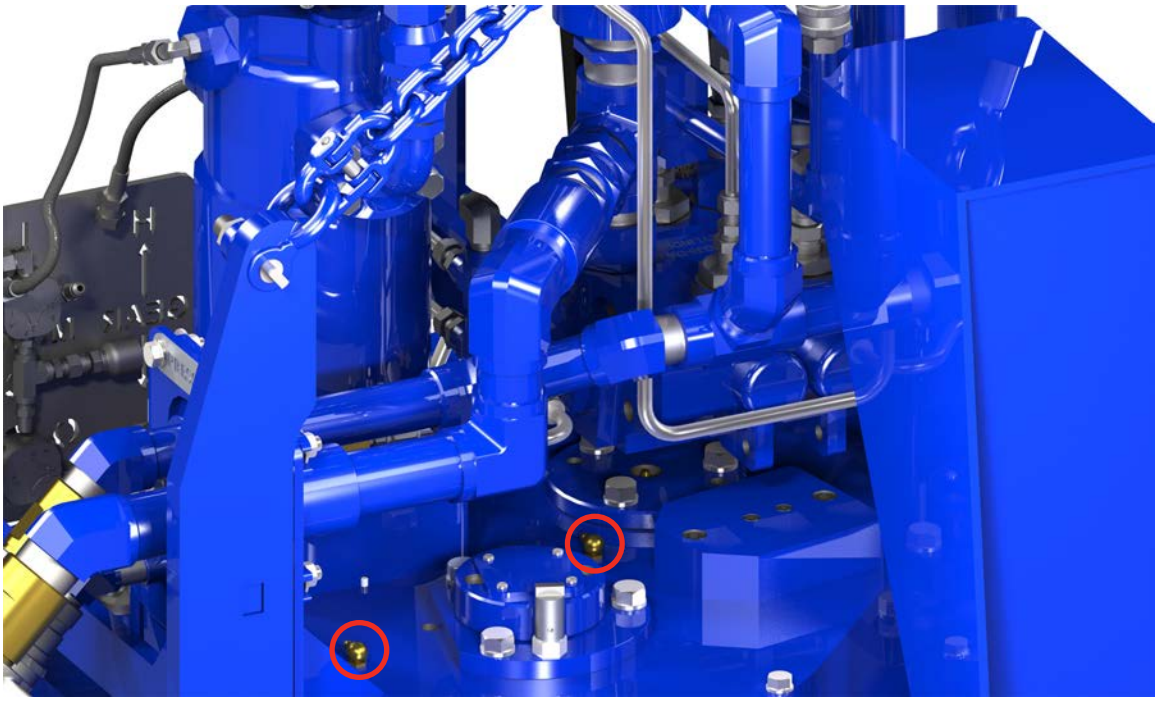

ILLUSTRATION 4.E.11: LOW GEAR HOUSING LUBRICATION

4.E.10 Door Pivot Shaft Lubrication

Apply grease to the door pivot shaft through the grease fittings recessed into the top and bottom of the shaft (two locations total).

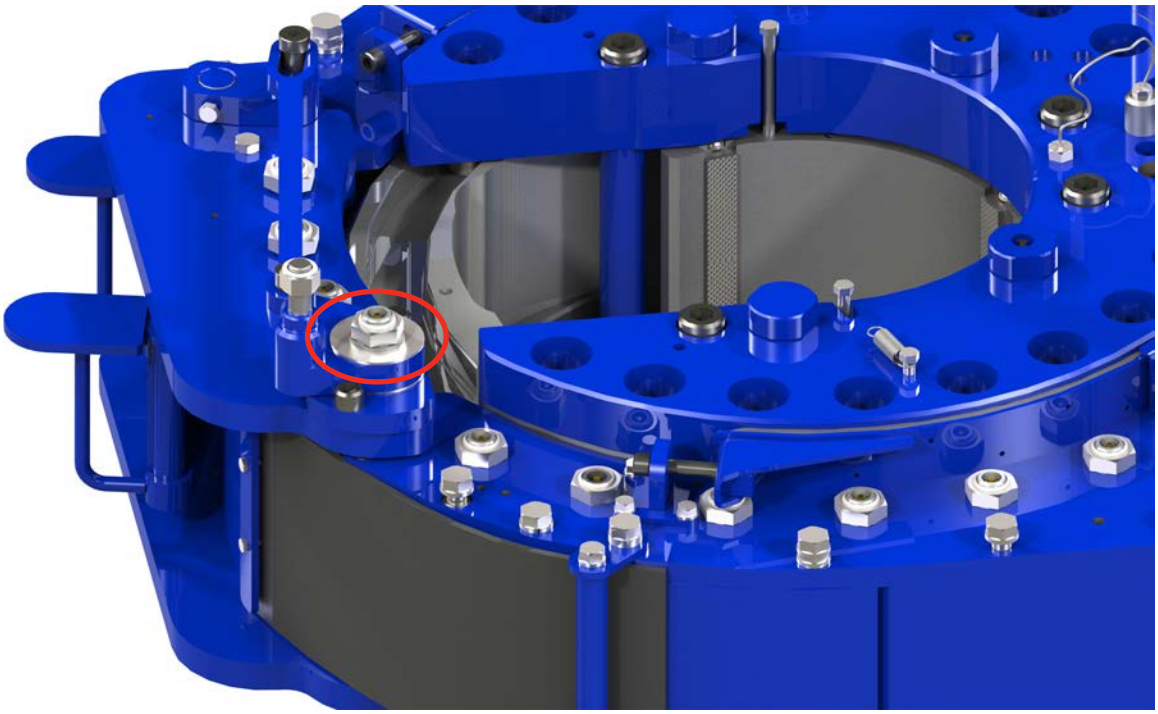

ILLUSTRATION 4.E.12: DOOR PIVOT SHAFT LUBRICATION

4.E.11 Lockjaw Backup Door Pivot Shaft Lubrication

Apply grease to the backup door pivot shafts through the grease fittings recessed into the top and bottom of each shaft (four locations total).

ILLUSTRATION 4.E.13: BACKUP DOOR PIVOT SHAFT LUBRICATION

4.E.12 Lockjaw Backup Door-Mounted Jaw Pin Lubrication

Apply grease to the pivot pins securing the door-mounted jaws through the grease fittings mounted on each jaw, between the main plates of each backup door (two locations total).

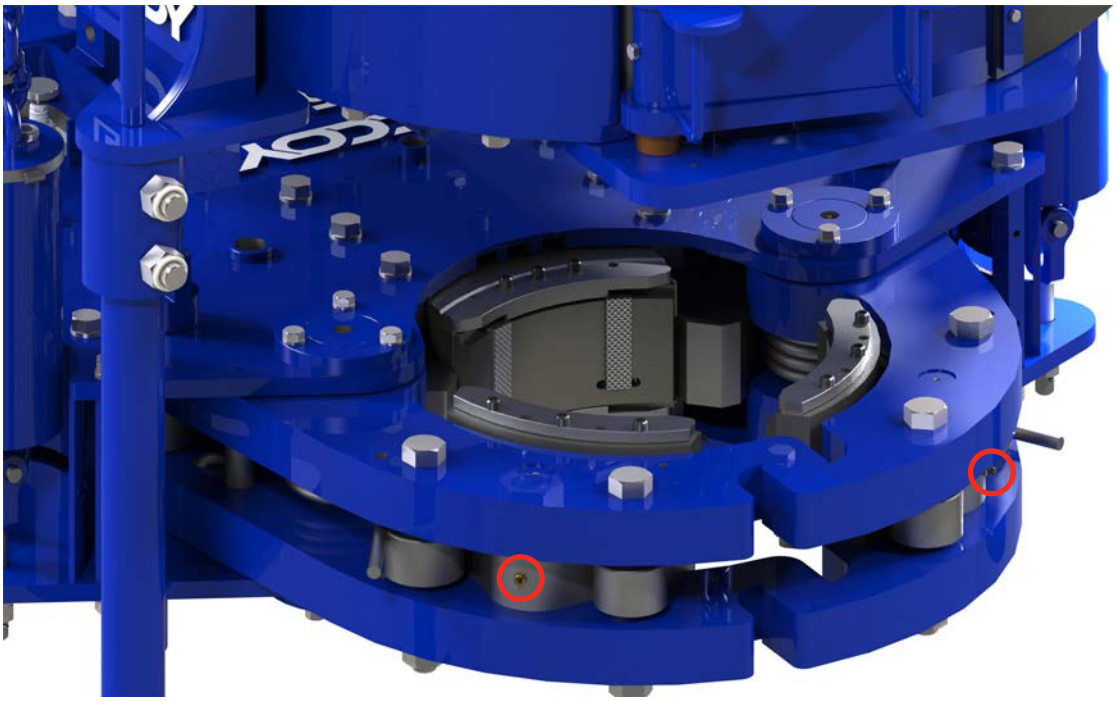

ILLUSTRATION 4.E.14: BACKUP DOOR-MOUNTED JAW PIN LUBRICATION

4.E.13 Lockjaw Backup Door/Clamp Cylinder Connection Pin Lubrication

Apply grease to the backup door/clamp cylinder pins through the grease fittings recessed into the top of each shaft (two locations total).

ILLUSTRATION 4.E.15: BACKUP DOOR CYLINDER PIN LUBRICATION

4.E.14 Lockjaw Backup Clamp Cylinder Lubrication

Lubricate the backup clamp cylinder through the grease fittings on the top and bottom plates of the backup (four locations total).

ILLUSTRATION 4.E.16: BACKUP CLAMP CYLINDER LUBRICATION

4.E.15 CHROMEMASTER™ Rear Jaw Cylinders

Apply grease to the rotary idler bearings through the grease fittings recessed into the top of each shaft on the top face of the tong (four locations total).

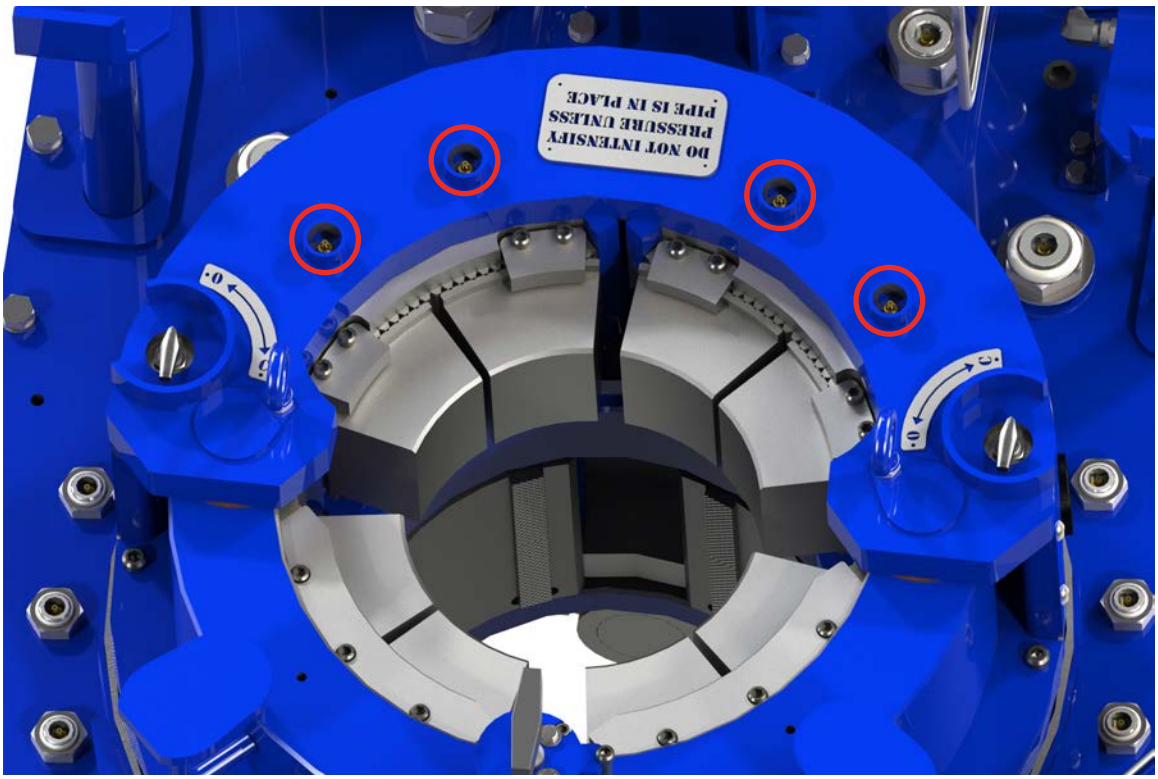

ILLUSTRATION 4.E.17: CHROMEMASTER™ JAW CYLINDER LUBRICATION

4.E.16 Recommended Lubrication Amounts

McCoy recommends lubricating your equipment before beginning each shift, and immediately following operation prior to storage. The grease amounts listed in the table below are estimated minimums, and should be used as a guideline when establishing a lubrication routine as part of a maintenance schedule.

Greasing Location	Min. Grease Amount (Each Location)
Cage plate cam followers (upper and lower)	2 shots
Support roller bearings (upper and lower)	3 shots
Jaw pivot bolt lubrication	2 shots
Raced idler bearings (upper & lower)	4 shots
Outboard idler bearings (upper & lower)	4 shots
Pinion gear bearings	4 shots
Secondary gear bearings	4 shots
Gearbox	8 shots
Low gear housing	8 shots
Door pivot shaft	3 shots
Backup door pivot shafts	3 shots
Backup door-mounted jaw pivot pins	2 shots
Backup door/clamp cylinder connection pin	3 shots
Backup clamp cylinder	4 shots
CHROMEMASTER™ rear jaw cylinders	4 shots

McCoy recommends liberally coating the cam surface of the rotary drive gear with grease prior to jaw installation. Periodically remove the clutch inspection plate and apply grease generously to the clutch, drive gears and shifting shaft. Coat the jaw pins and rollers with a liberal amount of anti-seize compound when installing new jaw die kits.

4.F ADJUSTMENTS

4.F.1 Brake Band Adjustment

The brake bands must be periodically adjusted to continue to provide smooth and efficient jaw cam action. Inadequate cage plate tension will allow the cage plate to rotate with the rotary gear, resulting in poor gripping of the pipe or casing due to improper "camming" action of the tong jaws. Tightening the brake band against the cage plates will increase frictional resistance, allowing jaws to cam properly and grip the casing. Adjust the brake band using the adjustment nut and bolt set as shown in the illustration below, using the following procedure:

1. Rotate the cage plate until it faces the rear of the tong.
2. Tighten the top and bottom brake bands a quarter turn each. Ensure both brake bands are adjusted simultaneously and equally.

TOP AND BOTTOM BRAKE BANDS MUST BE ADJUSTED SIMULTANEOUSLY AND EQUALLY

3. Rotate the cage plate in the make-up direction. If the jaws cam out, the procedure is complete. If jaws do not cam out, repeat steps 1 & 2.
4. Continue to repeat steps 1 through 3 until the jaws properly cam.

Do not over-tighten, as this causes excessive wear to the brake bands.

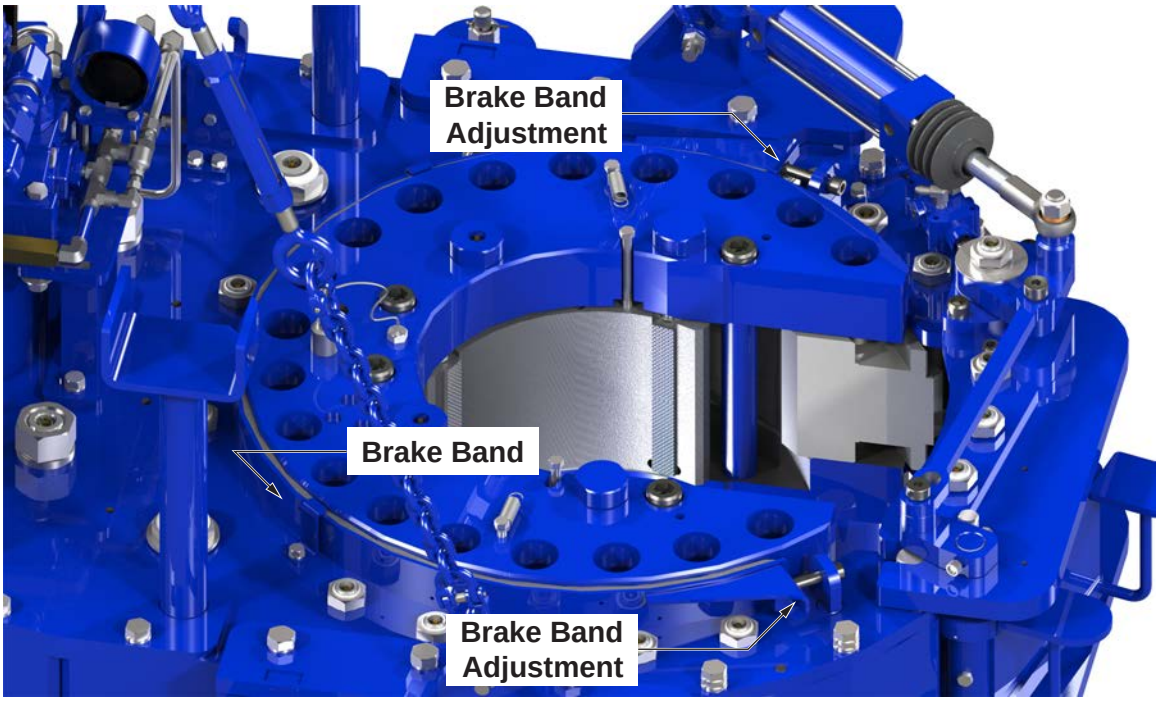

ILLUSTRATION 4.F.1: BRAKE BAND ADJUSTMENT

4.F.2 Safety Door Switch Adjustment

The safety door switch interrupts hydraulic power to the motor when the tong door is opened, or even slightly ajar. This is a critical safety system. Over time, normal use of the equipment results in a worn switch plunger or worn cam where it contacts the switch plunger, allowing enough clearance between the switch plunger and the door that the safety door system does not inhibit operation as designed when the door opens. This procedure enables the equipment user to restore the proper tolerances between the switch and the door to allow the safety door system to operate as designed.

1. Set the tong up in a controlled testing environment. Do not connect hydraulic power at this time.
2. Check the mechanical operation of the safety door hydraulic switch (see illustration 4.F.2):
   - Keep the tong door closed. Loosen the four nuts and bolts securing the safety door switch to the mounting plate, and slide the switch away from the cam actuator on the door assembly.
   - Check operation of the hydraulic switch plunger. Depress and allow it spring back several times to ensure smooth operation. If the plunger binds or jams, replace the safety door switch.

4.F.2 Safety Door Switch Adjustment (Continued):

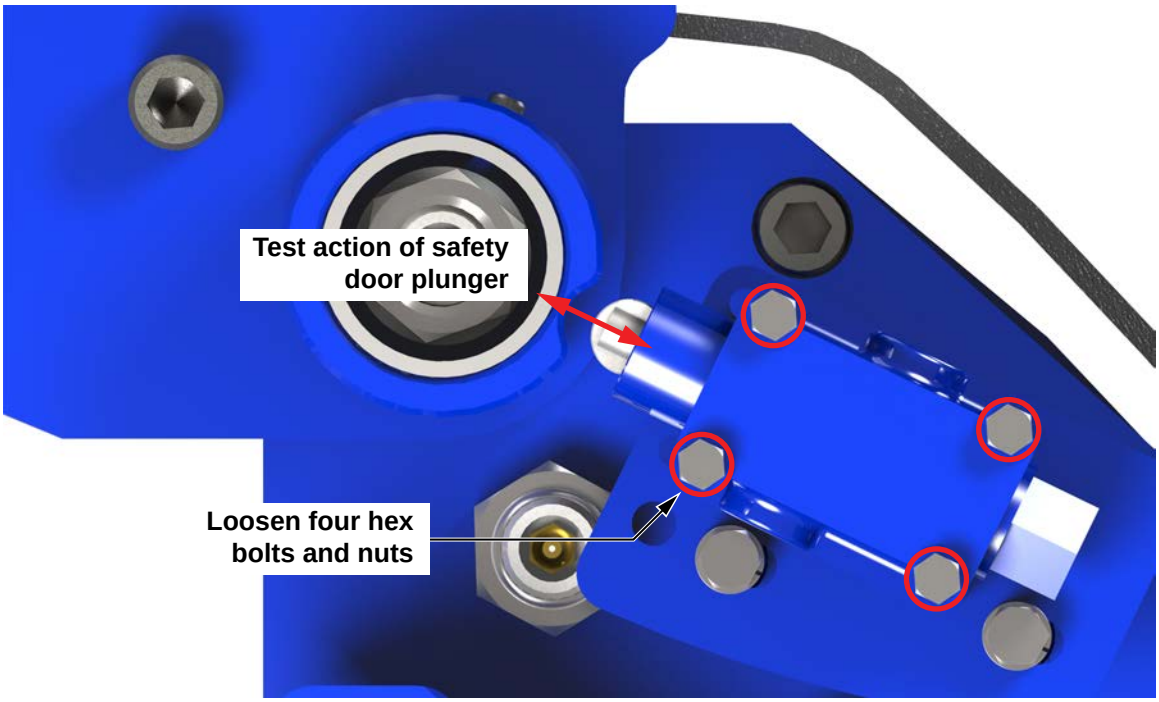

ILLUSTRATION 4.F.2: SAFETY DOOR ADJUSTMENT 01

3. If necessary, align the notch on the safety door cam with the safety door switch plunger. Loosen the two set screws securing the safety door cam to the door weldment, and rotate until the notch in the cam is centered with the plunger of the safety door switch (see illustration 4.F.3). When the cam has been satisfactorily aligned re-tighten the two set screws.

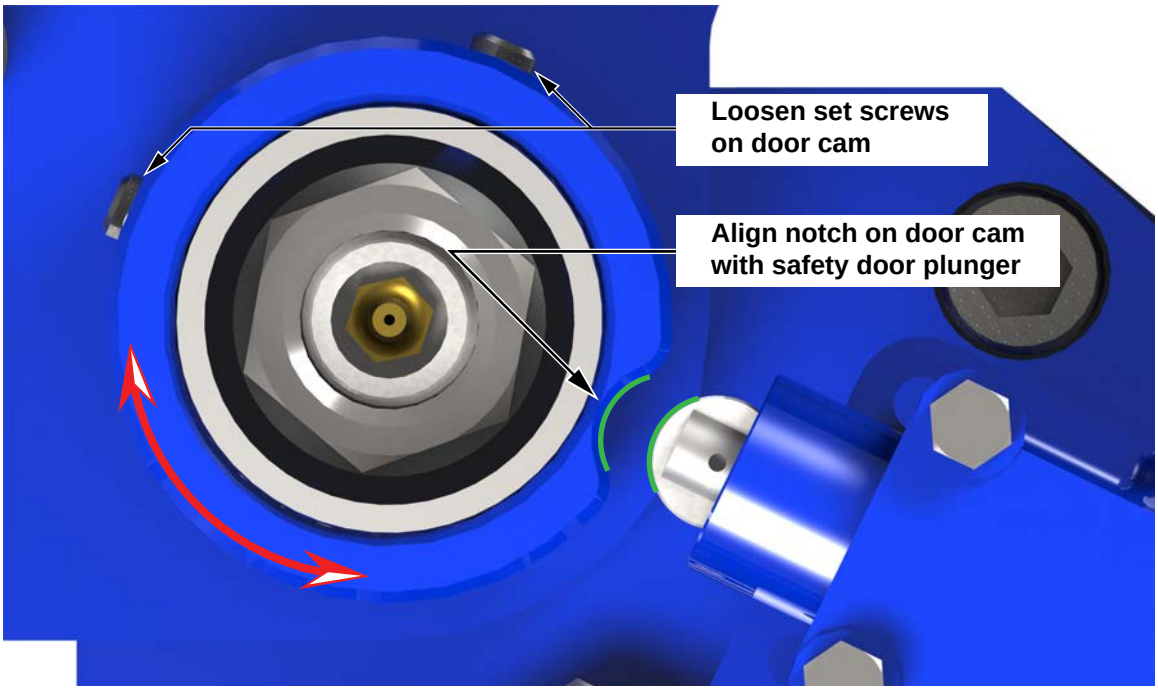

ILLUSTRATION 4.F.3: SAFETY DOOR ADJUSTMENT 02

4.F.2 Safety Door Switch Adjustment (Continued):

4. Slide the safety door switch toward the cam until the roller on the switch is in contact with the rounded notch on the cam. If the cam is not exactly centered with the roller, repeat step 3. Ensure that the roller on the switch is in contact with the cam without depressing the plunger. Tighten the four hex bolts and nuts to securely fasten the safety door switch in place.

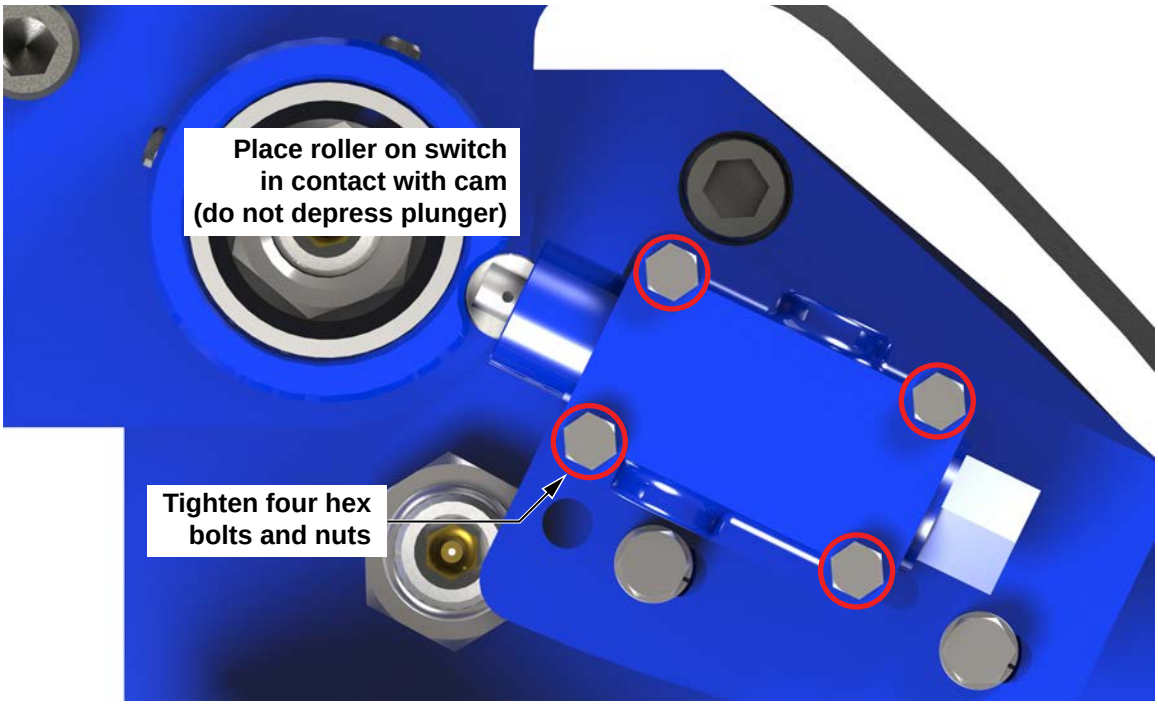

ILLUSTRATION 4.F.4: SAFETY DOOR ADJUSTMENT 03

5. Test the tong door sensor/shutdown (safety door) system. Using the correct testing procedure ensures the sensor/shutdown system is fully functional without exposing the equipment to a shock load or personnel to a potential hazard. The tests also verify that the shut down valve is positively sealing.
   i. Set the tong to rotate at low speed.
   ii. Stop all tong rotation.
   iii. Open the tong door.
   iv. Gradually attempt to turn the tong using the rotation control handle. Continue to gradually move the handle until the valve is fully stroked, and hold for 30 seconds. Verify the ring gear does not rotate while the rotation control is engaged. **PROCEDURAL NOTE**: a very small amount of ring gear movement is acceptable as the cartridge valve seats to stop rotation.
   v. Release the valve handle and allow the valve to go to the neutral position. Gradually attempt to turn the tong in the opposite direction until the valve is fully stroked, and hold the handle in the fully stroked position for 30 seconds. Verify the ring gear does not rotate while the rotation control is engaged. **PROCEDURAL NOTE**: a very small amount of ring gear movement is acceptable as the cartridge valve seats to stop rotation.
   vi. Ensure tong door is fully opened. Move the rotation control handle to approximately 50% of its full stroke. Have an assistant slowly close the tong door while continuing to hold the directional control valve at 50%. Rotation should commence only once tong door is fully closed and latched.
6. Any cage plate rotation with the door in any position except closed and latched indicates that further adjustment of the safety door switch is necessary. Remove hydraulic power from the tong.
7. Slightly loosen the four bolts/nuts securing the switch to the mounting plate. Using a lightweight hammer, or wooden or rubber mallet, lightly tap the switch from the back to move it towards the door cam approximately 1/32” (1 mm). Re-tighten the four mounting bolts/nuts.
8. Repeat step 5. If the safety door mechanism operates correctly and no further adjustment is required this procedure is complete. If further adjustment is required, repeat steps 6 and 7 until the safety door mechanism operates correctly. If your equipment reaches the adjustment limits before correct operation of the safety door mechanism is achieved contact the engineering department at McCoy Global for further technical advice.

4.G RECOMMENDED PERIODIC INSPECTIONS

4.G.1 Backing Pin

Perform a visual inspection of the backing pin after each job. Replace the pin if stress cracks or excessive wear is found, or if the pin is bent.

4.G.2 Torque Gauge Assembly

Periodic calibration of the torque gauge is recommended to assure accurate torque readings. When having the torque gauge serviced and calibrated, it is critical to note the arm length of the tong, as indicated in the “Specifications” section. McCoy recommends that the torque gauge assembly be calibrated yearly. Periodically check to ensure the load cell is filled with oil (see Section 7: Torque Measurement).

4.G.3 Spring Hangers

Proper maintenance of spring hangers is essential to assure the integrity of these load-bearing components. As a minimum, McCoy recommends the following procedures and intervals:

Interval	Recommended Procedure
Every six months	Disassemble and visually inspect adjustment rod threads, inner threads on the rod weldment, and all welds per API Spec 7K. Re-lubricate inside of rod weldment.
Once per year	Six-month visual inspection plus magnetic particle inspection of the areas identified in illustration 4.G.1
Every two years	Pull test at top and bottom connection points to 24,000 lbs, and hold for five (5) minutes, followed by six-month visual inspection and annual MPI.

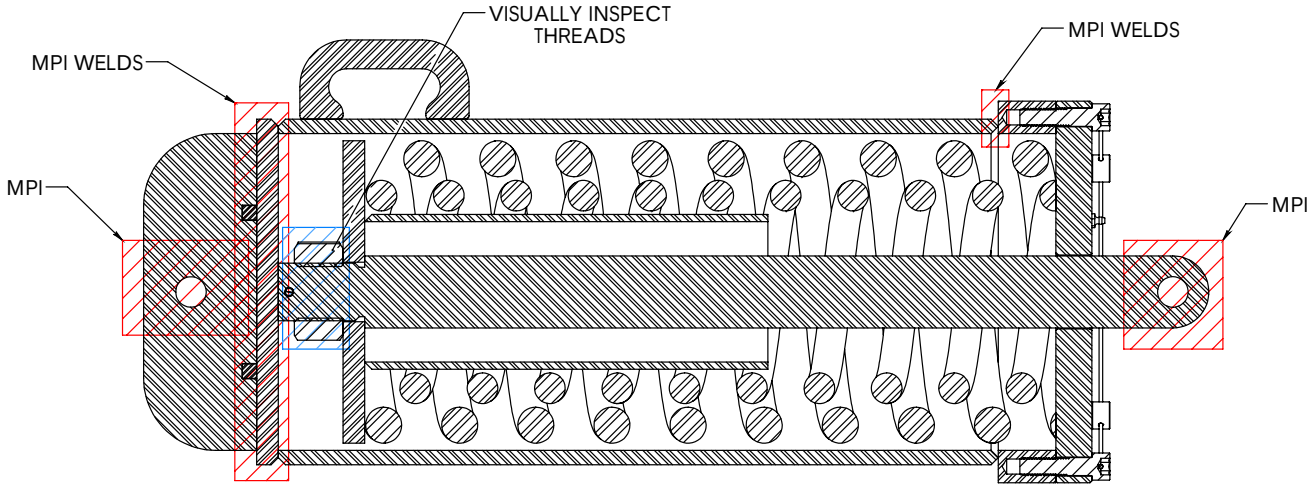

ILLUSTRATION 4.G.1: SPRING HANGER INSPECTION AREA MAP

4.G.3.2 Spring Hanger Disassembly

IF REQUIRED, PERFORM LOAD TESTS ON SPRING HANGERS BEFORE DISASSEMBLY

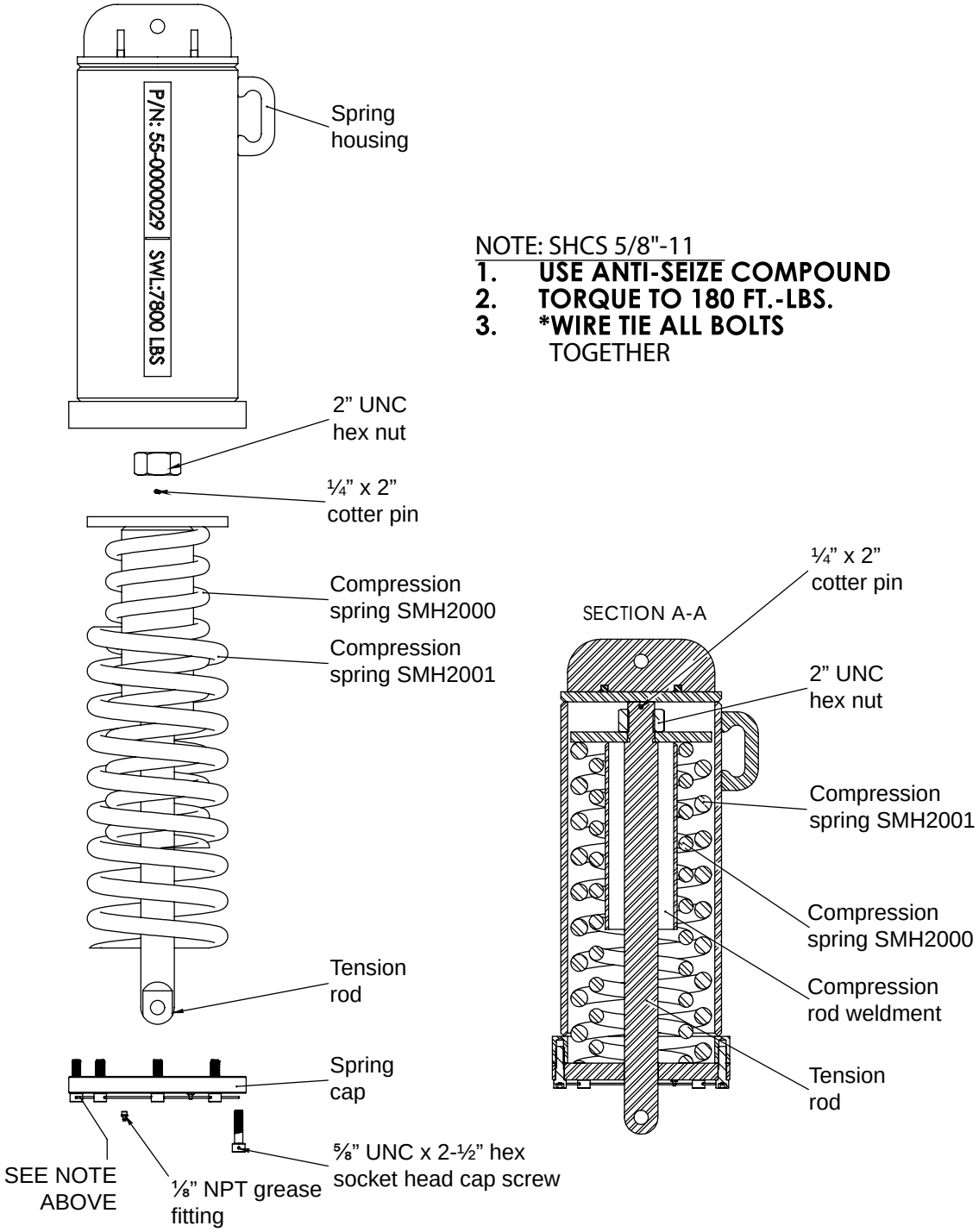

ILLUSTRATION 4.G.2: SPRING HANGER ASSEMBLY

1. The spring hanger assembly is under some tension even when not attached to the tool Clamp the spring housing to the spring cap before removing the fasteners.
2. Extract the six ⅝" x 2-½" socket head cap screws securing the spring hanger barrel weldment to the base. Slowly unclamp, and remove the barrel weldment.

4.G.3.2 Spring Hanger Disassembly (Continued):

3. Remove the two compression springs.
4. Remove the ¼" x 2" cotter pin securing the 2" hex nut to the tension rod. Discard the cotter pin following removal.
5. Remove the 2" hex nut securing the compression rod weldment to the tension rod.
6. Clean grease and debris from all components. The components are ready to be inspected. If load tests are necessary ensure these are complete before performing MPI and visual inspections.

4.G.3.3 Spring Hanger Maintenance & Reassembly

Following disassembly and cleaning perform a visual inspection of the threads on the tension rod, and all welds as per API Spec 7K. Perform MPI if required.

Secure the compression rod weldment to the tension rod using the 2" UNC hex nut. Prevent the nut from unthreading from the tension shaft by inserting a new ¼" x 2" cotter pin through the tension rod above the het nut.

Liberally coat the inside of the spring housing with grease. Slide the top end of the rod assembly (the end with the hex nut is the "top" end) all the way in to the spring housing.

Slide compression spring SMH2000 over the rod assembly, then insert compression spring SMK2001 over the first compression spring.

Slide the spring cap over the end of the tension rod. Align the threaded holes in the spring housing with the bolt holes on the spring cap, and clamp the cap completely flush with the housing.

Coat the threads of the six ⅝" UNC x 2-½ wire-lockable hex socket head cap screws with anti-seize compound. Secure the cap to the housing with the six cap screws and torque to 180 lbs-ft. Release the clamping mechanism, and wire-lock the fasteners.

4.H ASSEMBLY PRACTICES

Although the assembly of McCoy hydraulic power tongs is straightforward, and can be accomplished without the use of special tools, the instructions in this subsection are presented as a guide only and are similar to the assembly sequence our technician would use while assembling the tong in our plant.

NOTE ON INSTALLATION PRACTICES: Ensure all bearings are liberally greased before installing over a shaft or into gears or bearing caps. When inserting a shaft through a support roller assembly ensure shaft is greased. Also ensure all metal-to-metal contact in the gear train is adequately greased. Please refer to the relevant exploded diagrams in Section 6 when assembling components in this power tong and backup.

ALL FASTENERS USED DURING REASSEMBLY OF LOAD-BEARING COMPONENTS (CHAIN SLINGS, RIGID SLINGS, BACKUP LEGS) MUST BE TIGHTENED TO THE CORRECT TORQUE. THREADED FASTENERS USED IN LOAD-BEARING DEVICES MUST BE SECURED WITH RED LOCTITE™.

TIGHTENING TORQUE GUIDE			
SAE GRADE 8 - FINE THREAD			
SIZE	CLAMP LOAD	PLAIN	PLATED
¼ - 28 (.250)	3,263	14 ft. lbs.	10 ft. lbs.
5/16- 24 (.3125)	5,113	27 ft. lbs.	20 ft. lbs.
⅜ - 24 (.375)	7,875	49 ft. lbs.	37 ft. lbs.
7/16 - 20 (.4375)	10,650	78 ft. lbs.	58 ft. lbs.
½ - 20 (.500)	14,400	120 ft. lbs.	90 ft. lbs.
9/16 - 18 (.5625)	18,300	172 ft. lbs.	129 ft. lbs.
⅝ - 18 (.625)	23,025	240 ft. lbs.	180 ft. lbs.
¾ - 16 (.750)	33,600	420 ft. lbs.	315 ft. lbs.
⅞ - 14 (.875)	45,825	668 ft. lbs.	501 ft. lbs.
1 - 12 (1.000)	59,700	995 ft. lbs.	746 ft. lbs.
1 - 14 (1.000)	61,125	1019 ft. lbs.	764 ft. lbs.
1-⅛ - 12 (1.125)	77,025	1444 ft. lbs.	1083 ft. lbs.
1-¼ - 12 (1.125)	96,600	2012 ft. lbs.	1509 ft. lbs.
1-⅜ - 12 (1.375)	118,350	2712 ft. lbs.	2034 ft. lbs.
1-½ - 12 (1.500)	142,275	3557 ft. lbs.	2668 ft. lbs.

Continued on next page...

4.H ASSEMBLY PRACTICES (CONTINUED):

TIGHTENING TORQUE GUIDE (Continued):			
SAE GRADE 8 - COARSE THREAD			
SIZE	CLAMP LOAD	PLAIN	PLATED
¼ - 20 (.250)	2,850	12 ft. lbs.	9 ft. lbs.
5/16- 18 (.3125)	4,725	25 ft. lbs.	18 ft. lbs.
⅜ - 16 (.375)	6,975	44 ft. lbs.	33 ft. lbs.
7/16 - 14 (.4375)	9,600	70 ft. lbs.	52 ft. lbs.
½ - 13 (.500)	12,750	106 ft. lbs.	80 ft. lbs.
9/16 - 12 (.5625)	16,350	153 ft. lbs.	115 ft. lbs.
⅝ - 11 (.625)	20,325	212 ft. lbs.	159 ft. lbs.
¾ - 10 (.750)	30,075	376 ft. lbs.	282 ft. lbs.
⅞ - 9 (.875)	41,550	606 ft. lbs.	454 ft. lbs.
1 - 8 (1.000)	54,525	909 ft. lbs.	682 ft. lbs.
1-⅛ - 7 (1.125)	68,700	1288 ft. lbs.	966 ft. lbs.
1-¼ - 7 (1.125)	87,225	1817 ft. lbs.	1363 ft. lbs.
1-⅜ - 6 (1.375)	103,950	2382 ft. lbs.	1787 ft. lbs.
1-½ - 6 (1.500)	126,450	3161 ft. lbs.	2371 ft. lbs.

REPLACEMENT FASTENER (BOLTS, NUTS, CAP SCREWS, MACHINE SCREWS, ETC.) USED DURING MAINTENANCE OR OVERHAUL MUST BE GRADE 8 OR EQUIVALENT UNLESS OTHERWISE SPECIFIED.

IMPORTANT ASSEMBLY INFORMATION

DO NOT TORQUE NYLOCK NUTS. NYLOCK NUTS ARE NOT USED FOR CLAMPING PURPOSES AND SHOULD ONLY BE TIGHTENED UNTIL METAL-TO-METAL CONTACT IS MADE AND VERTICAL MOTION IS ELIMINATED. OVER-TIGHTENING WILL RESULT IN PREMATURE BUSHING FAILURE AND WILL INHIBIT ROTATION, AND MAY IMPART EXCESS STRESS ON ROTATING COMPONENTS.

NYLOCK NUTS ARE SINGLE-USE ONLY. DO NOT RE-USE NYLOCK NUTS THAT HAVE BEEN REMOVED FROM AN ASSEMBLY

4.I CHROMEMASTER™ CONVERSION INSTRUCTIONS

This section includes instructions for converting your tool to a standard CLE14000DP 100K unit by removing the CHROMEMASTER™ assembly and installing the necessary rotating components, or from a standard CLE14000DP 100K to a 75K “grit face” system by installing the CHROMEMASTER™ assembly.

4.I.1 Converting From CHROMEMASTER™ To Standard

1. Ensure the CHROMEMASTER™ push cylinder, located on the bottom plate of the tong, is fully retracted before isolating the tool from its hydraulic power source.
2. Isolate the tool from the hydraulic power source, and de-pressurize as per Section 4.D.
3. Remove the ½” hex head cap screws securing each pivot pin retainer to the upper CHROMEMASTER™ weldment. Thread a ½” UNC nut completely on to a ½” UNC eye bolt, and install the eye bolt/nut in place of the removed hex head cap screw. Thread the eye bolt until the nut bottoms on the pivot pin retainer, and then back the eye bolt out until it is parallel with the longitudinal axis of the tong. Lock the eye bolt in this position by tightening the nut against the pivot pin retainer. Repeat this procedure for the other pivot pin retainer.

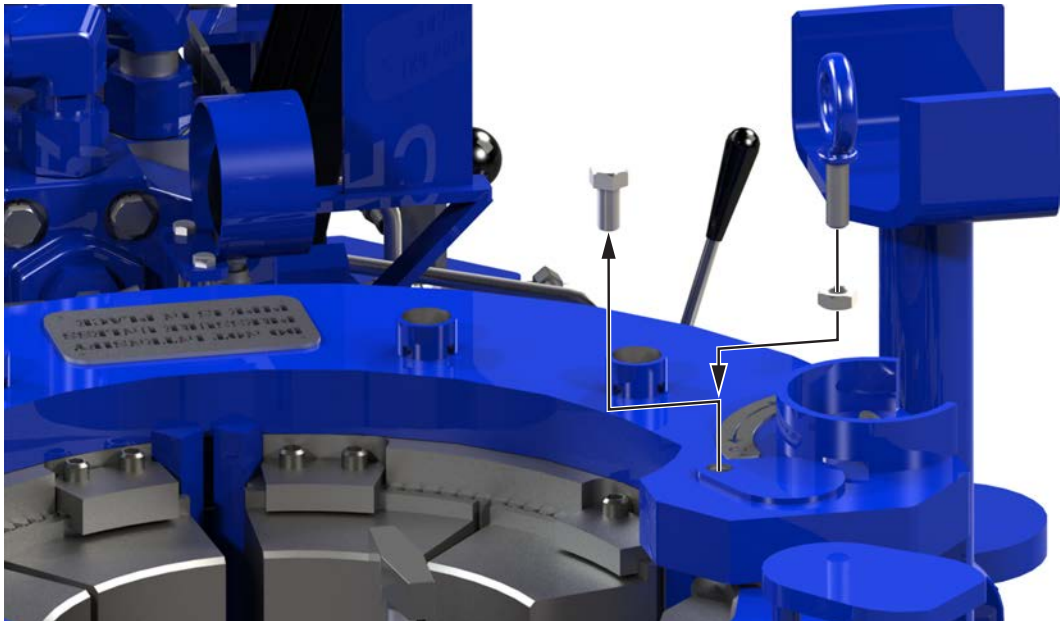

ILLUSTRATION 4.I.1: CHROMEMASTER™ REMOVAL 01

4. Disconnect the hydraulic plumbing from the bottom section of the CHROMEMASTER™ (two locations) and properly cap each connection.

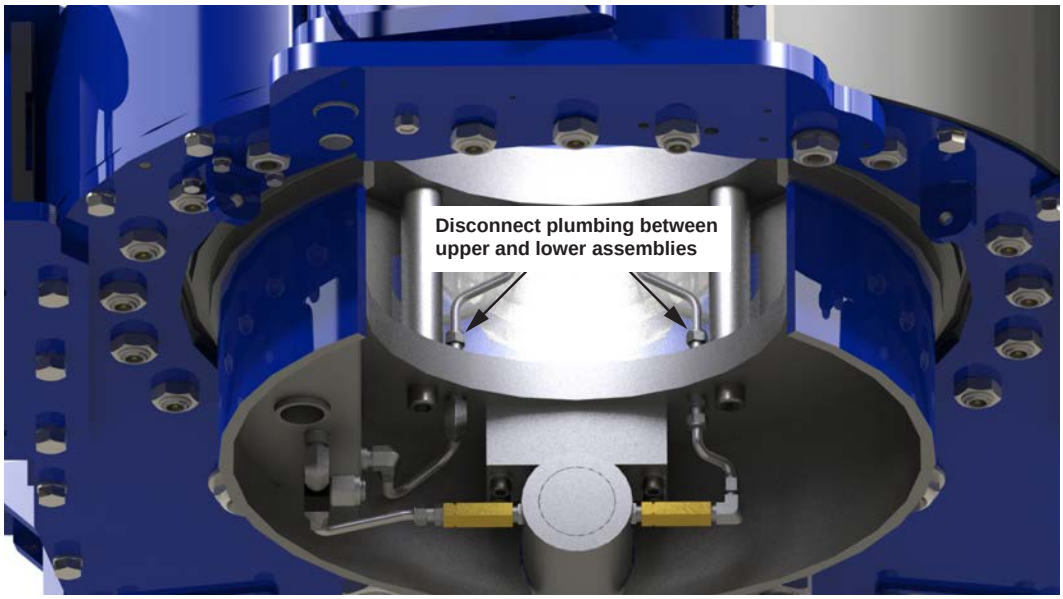

ILLUSTRATION 4.I.2: CHROMEMASTER™ REMOVAL 02

4.I.1 Converting From CHROMEMASTER™ To Standard (Continued):

5. Support the bottom of the CHROMEMASTER™ before continuing. The bottom (reservoir) assembly attaches to the upper assembly using four hex socket head cap screws. Removing the four cap screws frees the reservoir assembly (weight = 243 lbs/110 kg) from the upper section, so the reservoir assembly must be adequately supported prior to removing the fasteners.

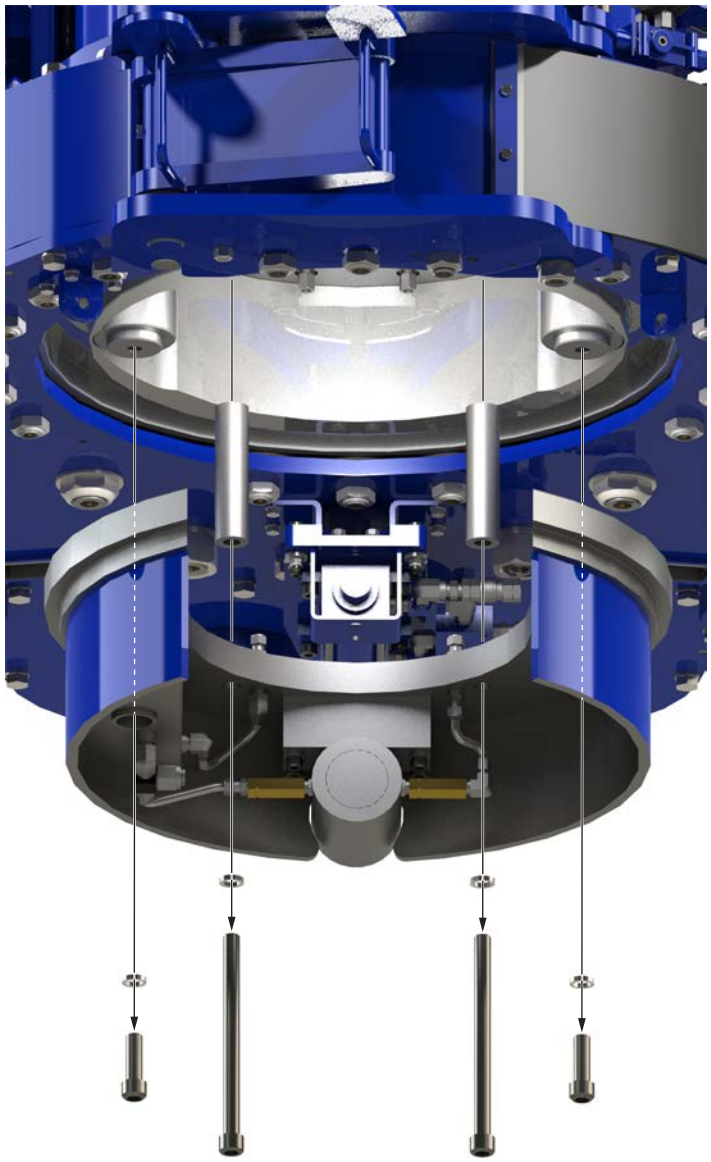

ILLUSTRATION 4.I.3: CHROMEMASTER™ REMOVAL 03

4.I.1 Converting From CHROMEMASTER™ To Standard (Continued):

6. Remove the reservoir section from beneath the tong and place on a sturdy, clean surface. Double-check to ensure all hydraulic connections are properly sealed.

7. Attach a temporary sling to the two eye bolts installed in Step 2. Use a crane to slowly and carefully hoist the upper section of the CHROMEMASTER™ straight up and off the tong (weight = approximately 1080 lbs/490 kg). Double-check to ensure all hydraulic connections are properly sealed.

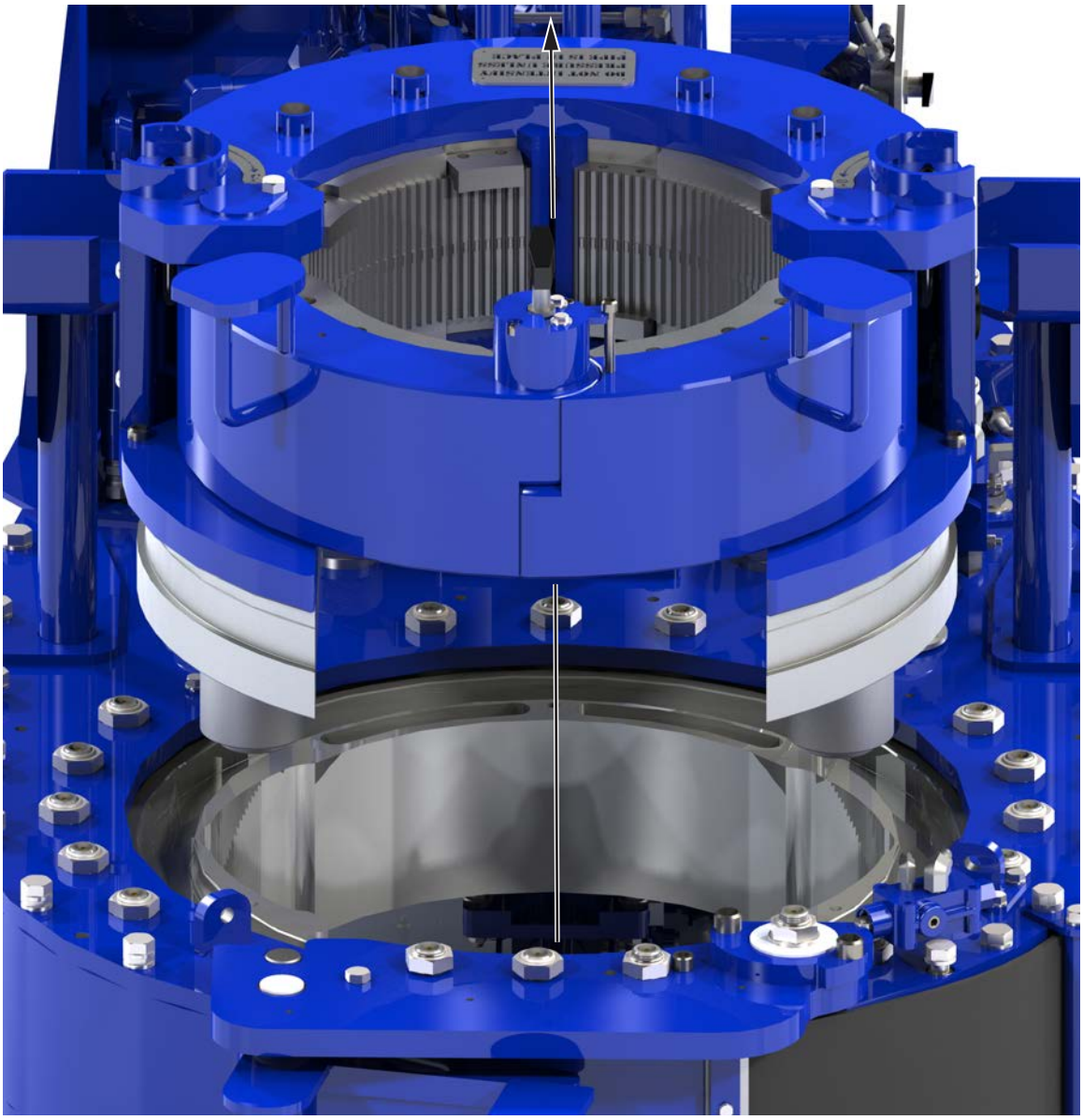

ILLUSTRATION 4.I.4: CHROMEMASTER™ REMOVAL 04

8. Wrap the upper and lower CHROMEMASTER™ assemblies with clean plastic wrap. Follow regular decommissioning and storage practices as described in Section 4.L, including preparations for long-term storage or storing in a humid environment. Store upper assembly and reservoir sections in the same location.

9. If required attach brake band assemblies to the top and bottom plates (see illustration 4.I.5):

   - Secure a lined brake band weldment (PN 14711) to the top and bottom plates using two brake band retainers (PN 14245) per weldment, two ⅜" UNC x 1" hex head cap screws and two ⅜" lock washers per weldment.
   - Secure the adjustment point of each brake band weldment to the brake band lugs using one ½" UNC x 2-½ hex socket head cap screw and one brake band nut (PN 78021-S5) per adjustment point (two of each per brake band weldment).

   Do not place any adjustment force on the brake band adjustments at this point - leave each brake band as slack as possible prior to installation of cage plates.

4.I.1 Converting From CHROMEMASTER™ To Standard (Continued):

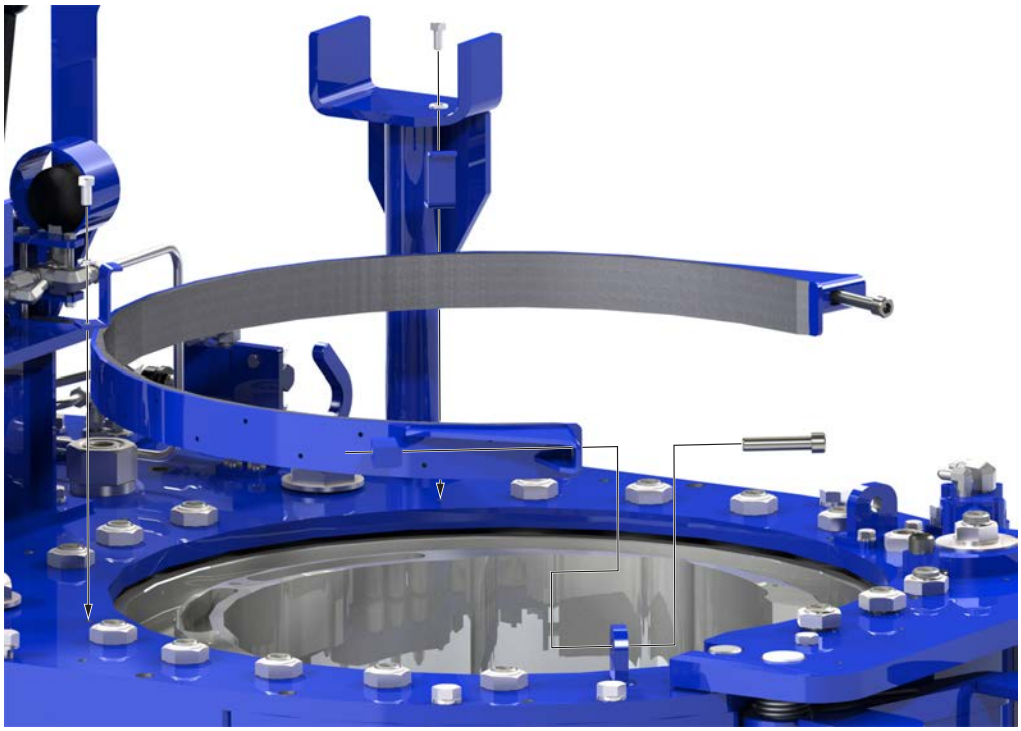

ILLUSTRATION 4.I.5: CHROMEMASTER™ REMOVAL 05

10. If required mount nineteen severe-service cam follower assemblies (PN SSCF1875) in the top cage plate (PN 14007-04) and nineteen in the bottom cage plate (PN 14007-08).

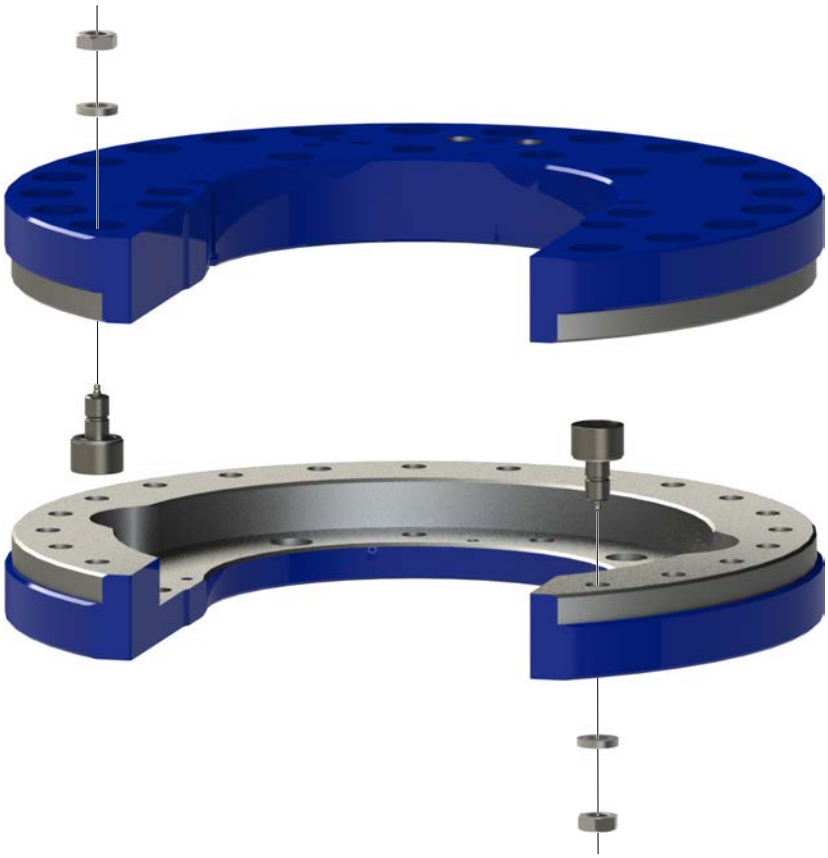

ILLUSTRATION 4.I.6: CHROMEMASTER™ REMOVAL 06

4.I.1 Converting From CHROMEMASTER™ To Standard (Continued):

11. Install the cage plate assemblies:
    - support the bottom cage plate assembly (weight = 225 lbs/102 kg) against the bottom of the ring gear so the cam followers nest inside the slot on the ring gear.
    - place the top cage plate assembly on top of the ring gear.
    - insert four cage plate spacers (PN 14647) between the top and bottom cage plates
    - attach the top cage plate to the bottom cage plate using four 1" UNC x 8-½ hex socket head cap screws, ensuring each cap screw passes through a cage plate spacer.

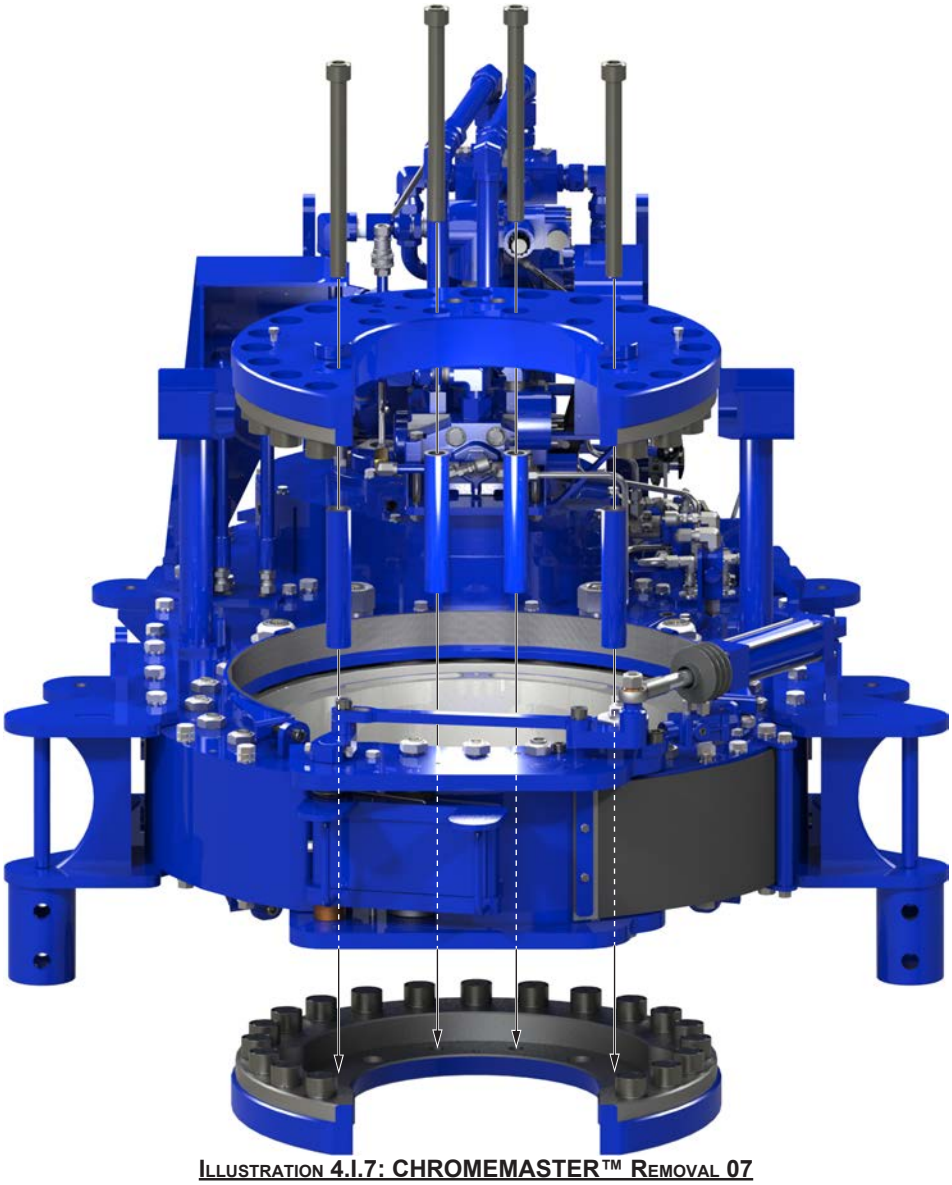

ILLUSTRATION 4.I.7: CHROMEMASTER™ REMOVAL 07

12. Use of jaw retraction springs requires installation of two ⅜" UNC x 1" hex head cap screws in the top cage plate. Slide each cap screw through one end of a jaw retraction spring (PN 58102), and thread each bolt in to the top cage plate next to the jaw retraction slots.
13. Attach the reversing pin (PN 14729) to the reversing pin chain weldment (PN 14801). Mount the chain weldment to the top cage plate (see illustration on Pg. 6.34) and place the reversing pin in one of the two reversing pin slots in the top cage plate.
14. Install jaws using jaw pivot bolts (PN 14623-01). See Section 2.F for jaw installation instructions.
15. Tighten the top and bottom brake bands an equal amount against the top and bottom cage plates. See Section 4.F for instructions for properly tightening the brake bands.

4.I.2 Converting From Standard To CHROMEMASTER™

1. Properly re-commission the upper CHROMEMASTER™ assembly and CHROMEMASTER™ reservoir assembly as per the instructions in Section 4.M. Ensure all required parts are on hand before beginning conversion process.
2. Isolate the tool from the hydraulic power source, and de-pressurize as per Section 4.D.
3. Remove the jaws from the power tong (see Section 2.F for instructions for removing jaws).
4. Pull the reversing pin from the top cage plate, and disconnect it from the reversing pin retainer weldment. The reversing pin retainer weldment may remain attached to the top cage plate.
5. Remove all tension from the top and bottom brake bands.
6. Adequately support the cage plate assembly from the bottom (weight = 225 lbs/102 kg).

THE CAGE PLATE BOLTS ARE THE ONLY ITEMS FASTENING THE BOTTOM CAGE PLATE TO THE TONG. SUPPORT THE BOTTOM CAGE PLATE FROM BELOW PRIOR TO REMOVING CAGE PLATE BOLTS IN ORDER TO PREVENT DAMAGE TO THE BOTTOM CAGE PLATE OR PERSONAL INJURY TO THE MECHANIC

When the bottom cage plate assembly is properly supported remove four 1” UNC x 8-½ hex socket head cap screws from the top cage plate. Remove the top cage plate assembly and four cage plate spacers.

7. Remove the bottom cage plate assembly.

INSPECT CAM FOLLOWER ASSEMBLIES ON TOP AND BOTTOM CAGE PLATE ASSEMBLIES. ONLY REMOVE OR REPLACE CAM FOLLOWER ASSEMBLIES IF THEY SHOW SIGNS OF DAMAGE, OR IF THEY DO NOT ROTATE SMOOTHLY

8. Wrap the upper and lower cage plate assemblies with clean plastic wrap. Follow regular decommissioning and storage practices as described in Section 4.L, including preparations for long-term storage or storing in a humid environment. Store both cage plate assemblies, four cage plate spacers, and two jaw pivot bolts together.
9. If required install two ½” UNC eye bolts in the upper CHROMEMASTER™ assembly. See Section 4.I.1, step 2 for instructions for doing this.
10. Attach a temporary sling to the two eye bolts installed in Step 8. Use a crane to slowly and carefully hoist the CHROMEMASTER™ upper assembly (weight = approximately 1080 lbs/490 kg) on to the tong. Carefully nest the bottom of the upper assembly in the top slot on the ring gear. Align the opening of the upper assembly with the opening of the ring gear before removing the crane and temporary lifting sling.
11. Position the CHROMEMASTER™ reservoir assembly beneath the ring gear (weight = 243 lbs/110 kg). Nest the top of the reservoir assembly inside the groove in the bottom of the ring gear. Align the two recesses in the top plate of the reservoir weldment with bottom of the fixed spacers on the upper assembly. Insert two further CHROMEMASTER™ spacers (PN CM15001DP-S1) between the upper assembly and the reservoir assembly.
12. Secure the reservoir assembly to the upper assembly using two ¾” UNC x 9-½ hex socket head cap screws, two ¾” UNC x 2-¼” hex socket head cap screws, and four ¾” lock washers. (see illustration 4.I.8 next page).

4.I.2 Converting From Standard To CHROMEMASTER™ (Continued):

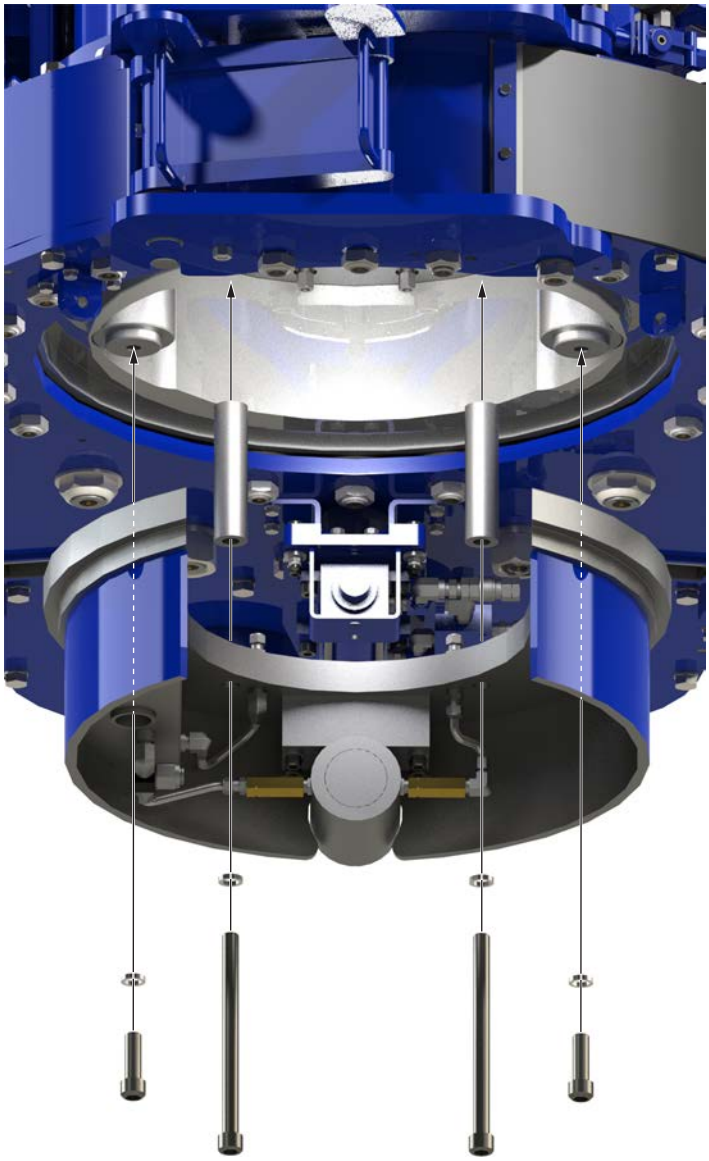

ILLUSTRATION 4.I.8: CHROMEMASTER™ INSTALLATION 01

12. Remove caps from the hydraulic connections on the upper CHROMEMASTER™ assembly and the reservoir assembly. Clean the connections if required, and connect the hydraulic lines in the upper CHROMEMASTER™ assembly to the reservoir assembly.
13. Check the level of the hydraulic fluid in the reservoir assembly. Remove the breather cap (see illustration 4.I.9), and use a thin, clean piece of plastic or metal as a dipstick to check the fluid level. The proper fluid level will show at approximately ½" below the top of the reservoir.
14. McCoy recommends replacing the in-line filter cartridge (PN CM4021) before beginning operations with the CHROMEMASTER™ system (see illustration 4.I.9).

4.I.2 Converting From Standard To CHROMEMASTER™ (Continued):

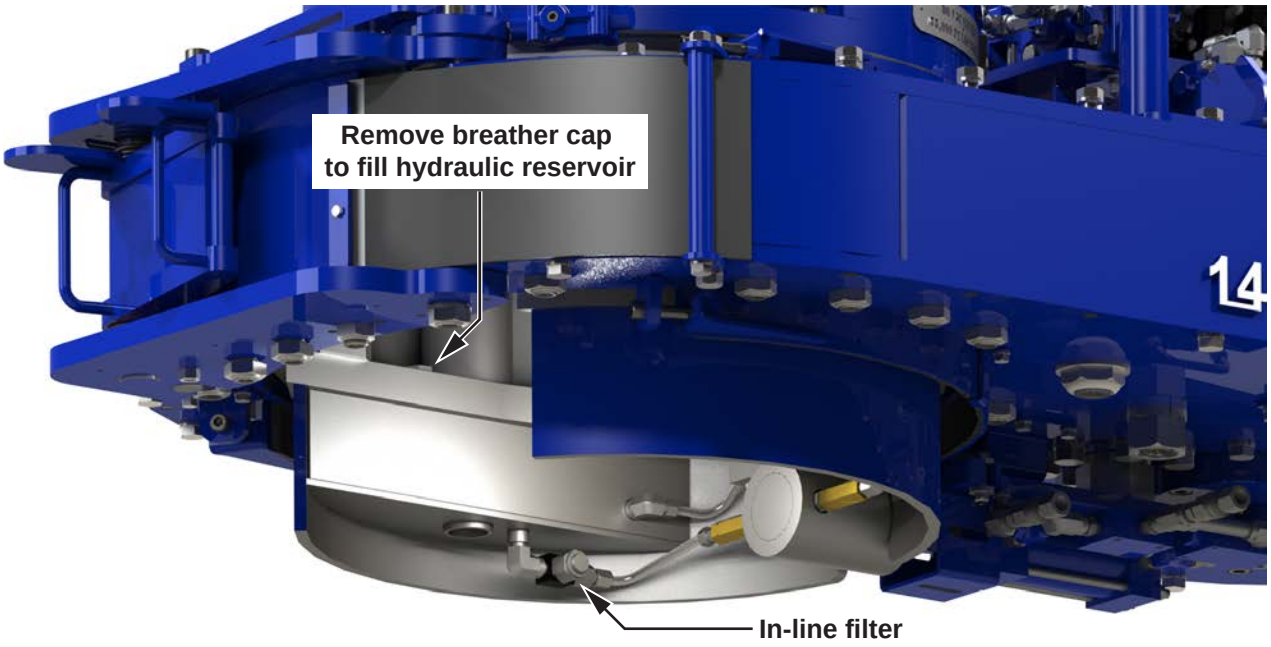

ILLUSTRATION 4.I.9: CHROMEMASTER™ INSTALLATION 02

15. McCoy recommends bleeding the hydraulic lines to eliminate the possibility of air in your CHROMEMASTER™ system following connection to hydraulic power, prior to perfoming makeup or breakout operations:
    - OPEN the ball valve in each side of the CHROMEMASTER™ head

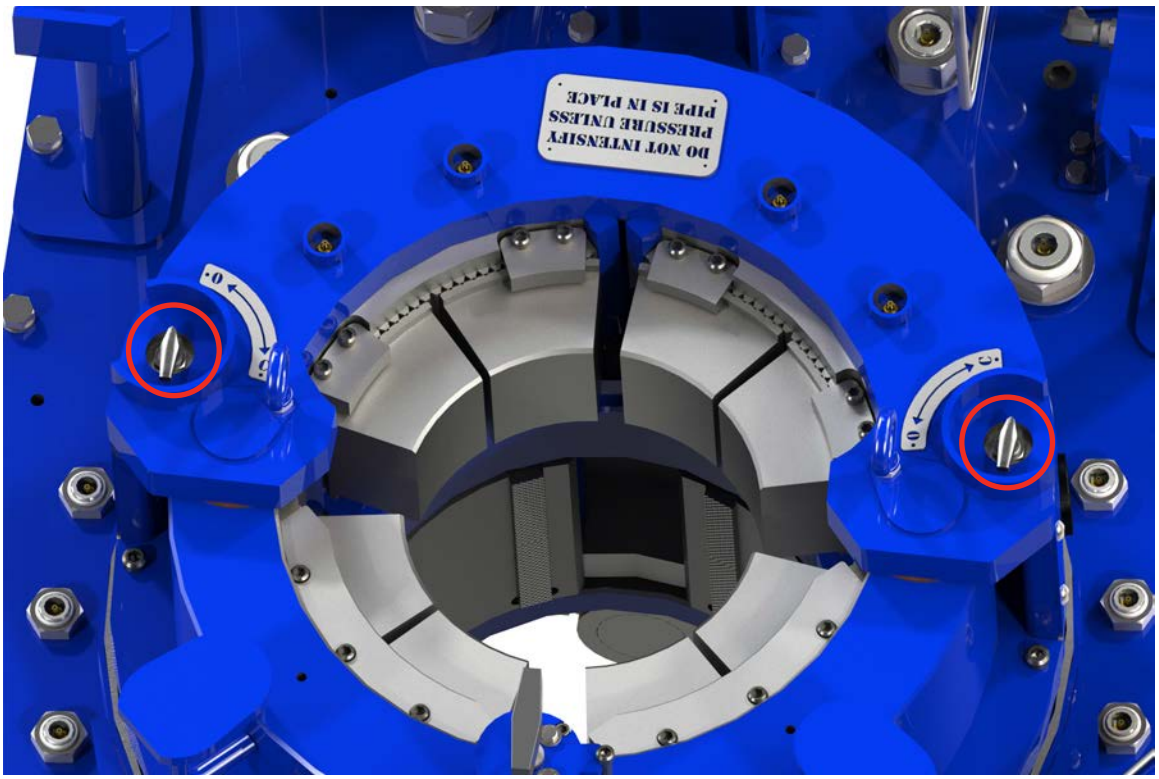

ILLUSTRATION 4.I.10: CHROMEMASTER™ INSTALLATION 03

4.I.2 Converting From Standard To CHROMEMASTER™ (Continued):

15. McCoy recommends bleeding the hydraulic lines... (continued)::

- cycle the push cylinder to pump fluid through the CHROMEMASTER™ head, forcing out air that may be trapped in the system. Repeat until all air is purged from the system before pressurizing the system.

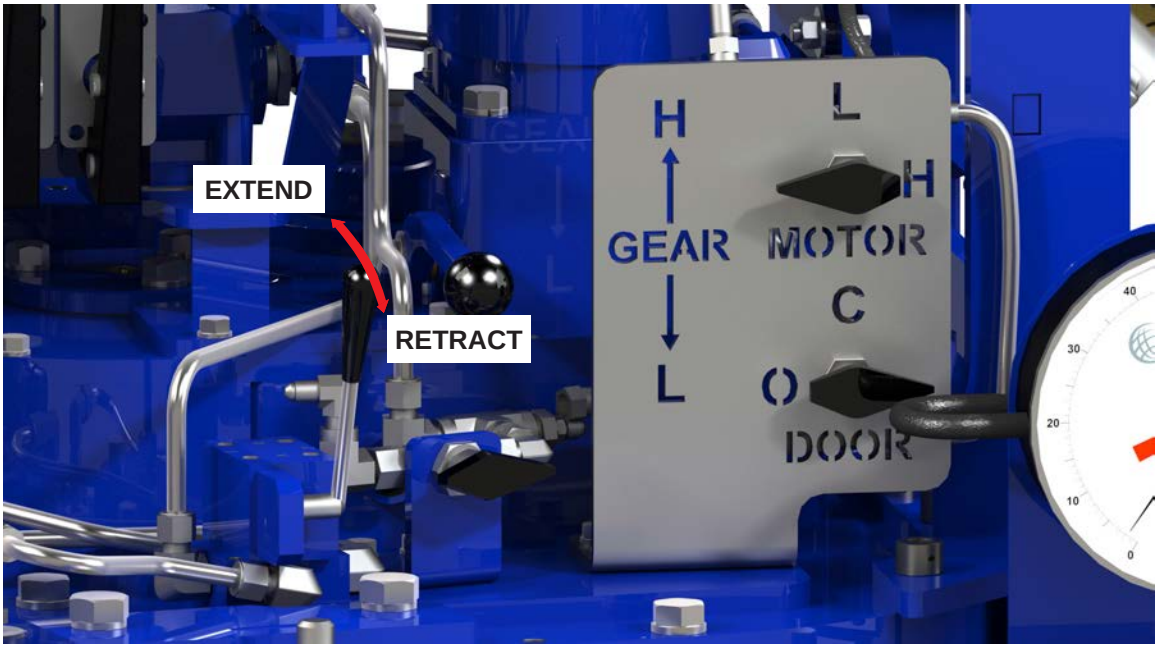

ILLUSTRATION 4.I.11: CHROMEMASTER™ INSTALLATION 04

4.J DAILY INSPECTION & MAINTENANCE CHECKLIST

McCoy recommends that the following inspection and maintenance procedures be performed before each use, and at least once per day when the tong is in steady use, in the order in which they are listed.

1. ☐ Rotate cage plate/rotary gear until the opening in the rotary gear faces towards the rear of the tong.

DO NOT PERFORM ANY FURTHER ACTIONS OR MAINTENANCE WHILE THE TONG IS CONNECTED TO ANY HYDRAULIC POWER SUPPLY. MCCOY RECOMMENDS THAT ALL HYDRAULIC LINES ARE FULLY DISCONNECTED, AND RESIDUAL HYDRAULIC PRESSURE IS BLED OFF. ENSURE ADEQUATE CONTAINMENT IS IN PLACE TO PREVENT ENVIRONMENTAL CONTAMINATION FROM RESIDUAL HYDRAULIC FLUID.

2. ☐ **DEPRESSURIZE HYDRAULIC SYSTEM IN PREPARATION FOR MAINTENANCE:**

1) Ensure tong and backup doors are closed and latched. Fully extend the lift cylinder (if equipped).
2) De-energize the power unit.
3) Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.
4) Remove the hydraulic SUPPLY line from the equipment.
5) Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.
7) Disconnect the hydraulic RETURN line from the equipment.
8) Disconnect remaining hoses such as case drains, or lines connected to the turns counter.

HYDRAULIC PRESSURES AS HIGH AS OPERATING PRESSURE MAY REMAIN TRAPPED IN SMALL AREAS OF THE EQUIPMENT. ENSURE ALL MAINTENANCE IS CARRIED OUT BY A QUALIFIED SERVICE TECHNICIAN, AND THAT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT IS USED TO GUARD AGAINST PRESSURE INJURIES

3. ☐ Remove the majority of dirt and grease build-up from the tong, backup, and frame assembly using a hose with spray nozzle, or a pressure washer set to the “low pressure” mode. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid and dirty grease.

4. ☐ Use a flashlight to perform a visual inspection of the gear train through the opening of the rotary gear. If gear damage or chips of metal are seen, the tong should be removed from service and overhauled to avoid further damage.

5. ☐ Perform a visual inspection of the interior of the backup from the openings on the rear of the mounting frame - use a flashlight if necessary. Premature wear where there are moving parts (bare metal where there used to be paint, and metal shavings in the grease are good indicators) may show where a component needs to be adjusted, or if necessary, replaced.

6. ☐ Perform a visual inspection of all fasteners and protruding body pieces (example: hydraulic valve mounts, inlet & outlet line supports, tong legs, shifter handle pivot lugs). Tighten or replace loose or missing fasteners. McCoy recommends that damaged or missing body parts be repaired or replaced as soon as possible.

7. ☐ Inspect the jaws and dies on the tong and backup. Inspect the jaw roller pins for signs of damage - replace pins if necessary. If the pins are welded in place, replace the entire jaw assembly. Ensure dies are secure in the jaw - replace worn dies if necessary. Ensure that the jaw rollers rotate freely. Check to ensure the size of the loaded jaws match the size of casing or pipe you are running.

8. ☐ Perform a visual inspection of all lifting points - if visible damage is seen, including cracks, broken lugs, distorted metal, etc. replace damaged part(s) before placing tong in service. Also inspect all chains, master links, and turnbuckles - again, if any damage is noted replace the damaged part(s) before placing the tong in service.

9. ☐ Inspect tong for signs of premature wear, or moving parts that are rubbing (bare metal where there used to be paint is a good indication of wear).

10. ☐ Inspect backing pin(s). If cracked, broken, or bent it (they) must be replaced.

11. ☐ Inspect top and bottom brake band linings - replace if necessary. Unequal wear of the brake bands indicates that the brake band tension is not evenly adjusted. Refer to the maintenance section of the manual for instructions on properly adjusting brake bands.

12. ☐ Perform a visual inspection of all hydraulic lines. Replace flexible lines if they appear to be cracked, fatigued, or have visible signs of wear from contact with a rigid object.

13. ☐ Perform a complete greasing of the tong and backup - refer to Maintenance section of the technical manual

14. ☐ Ensure main supply and return connections to the tong are fully made up. Re-connect the remainder of the hydraulic lines, and, if applicable, the electrical line to the turns counter.

FAILURE TO ENSURE THAT THE SELF-SEALING SUPPLY AND RETURN LINES ARE FULLY MADE UP MAY RESULT IN CATASTROPHIC EQUIPMENT FAILURE.

If using a stand-alone power unit, start it now - refer to the power unit technical manual for startup procedures. Listen to power unit for a moment to see if there are any unusual mechanical sounds (rubbing, grinding, excessive pump noise). If using a diesel unit, allow sufficient time for the engine to reach operating temperature before increasing engine RPM. Once engine is warm, gradually increase engine RPM until operating speed is reached.

15. ☐ Ensure that supply pressure is at or above the tong's specified operating pressure, and that the return pressure is less than 350 psi.

16. ☐ Perform a visual inspection of pressurized hydraulic lines. Document and correct any hydraulic fluid leaks.

17. ☐ Perform a full functional test of the tong. Report and correct any hydraulic leaks from the hydraulic valve bank, or from any hydraulic cylinders that are used.

18. ☐ Perform a visual inspection of the load cell. If using a tension load cell, replace any cracked, broken, or distorted components including links and chains.

19. ☐ If applicable, inspect the load cell anchor pins (tension load cell only). Replace the anchor pins if cracking or metal distortion is seen.

20. ☐ Test safety door feature. Refer to safety door testing procedure in Section 3.A.4, "Pre-operational Checks".

NEVER OPERATE YOUR EQUIPMENT WITH A BYPASSED OR MALFUNCTIONING SAFETY DOOR

21. ☐ While rotating the cage plate, ensure that the jaws properly cam. If the jaws do not cam properly, the brake bands need to be tightened. Incrementally adjust both the top and bottom brake bands EQUALLY until proper cam action is achieved (see section 4.F.1).

4.K MONTHLY MAINTENANCE CHECKLIST

The following maintenance checklist is intended as a guideline rather than a definitive maintenance schedule. Your equipment may require more, or less, maintenance depending upon the frequency of use, the percentage of maximum torque that your equipment is routinely subjected to, and the field conditions under which your equipment operates. McCoy Global recommends that the following inspection and maintenance procedures be performed monthly, or in conjunction with your maintenance foreman's experience and best estimate of when your equipment is due for this maintenance.

1. ☐ Rotate cage plate/rotary gear until the opening in the rotary gear faces towards the rear of the tong.

DO NOT PERFORM ANY FURTHER ACTIONS OR MAINTENANCE WHILE THE TONG IS CONNECTED TO ANY HYDRAULIC POWER SUPPLY. MCCOY RECOMMENDS THAT ALL HYDRAULIC LINES ARE FULLY DISCONNECTED, AND RESIDUAL HYDRAULIC PRESSURE IS BLED OFF. ENSURE ADEQUATE CONTAINMENT IS IN PLACE TO PREVENT ENVIRONMENTAL CONTAMINATION FROM RESIDUAL HYDRAULIC FLUID.

2. ☐

DE-PRESSURIZE HYDRAULIC SYSTEM IN PREPARATION FOR MAINTENANCE:

1) Ensure tong and backup doors (if equipped) are closed. Fully extend the lift cylinder
2) De-energize the power unit.
3) Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.
4) Remove the hydraulic SUPPLY line from the equipment.
5) Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.
7) Disconnect the hydraulic RETURN line from the equipment.
8) Disconnect remaining hoses such as case drains, or lines connected to the turns counter.

HYDRAULIC PRESSURES AS HIGH AS OPERATING PRESSURE MAY REMAIN TRAPPED IN SMALL AREAS OF THE EQUIPMENT. ENSURE ALL MAINTENANCE IS CARRIED OUT BY A QUALIFIED SERVICE TECHNICIAN, AND THAT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT IS USED TO GUARD AGAINST PRESSURE INJURIES

3. ☐ Clean the exterior of the tool thoroughly, using either a water hose with a spray nozzle or a pressure washer using a low-pressure wash wand, or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents.

4. ☐ Clean the interior spaces of the tool thoroughly, using either a water hose with a spray nozzle (do not use a pressure washer), or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents. Make a note if any metal shavings or metal pieces are flushed out of the gear train cavity - if shavings or metal pieces are seen the tong must be overhauled before it is returned to service.

5. ☐ Inspect all fasteners and fastener safety wires (if equipped). Replace any missing fasteners - use Grade 8 bolts only unless otherwise specified. Re-torque all external fasteners to SAE specifications.

6. ☐ Repair or replace any damaged or missing external body parts, such as torque gauge mounts, hydraulic supports, safety door protectors, etc.

7. ☐ Perform a visual inspection of all protruding body pieces (example: hydraulic valve mounts, inlet & outlet line supports, tong legs, shifter handle pivot lugs). Tighten or replace loose or missing fasteners. McCoy recommends that damaged or missing body parts be repaired or replaced as soon as possible.

8. ☐ Inspect tong for signs of premature wear, or moving parts that are rubbing (bare metal where there used to be paint is a good indication of wear.

9. ☐ Inspect all paint - locations in which the paint has been damaged must be repaired prior to the tong being returned to service. Prepare areas to be painted to ensure they are free of grease, dirt, or solvent. Touch up using a solvent-based acrylic paint. Allow sufficient time for paint to dry before proceeding.

10. ☐ Inspect all external welds. Any weld that is cracked or separating must be repaired and repainted before returning the tong to service.

11. ☐ Perform a visual inspection of all lifting points - if visible damage is seen, including cracks, broken lugs, distorted metal, etc. replace damaged part(s) before placing tong in service. Also inspect all chains, master links, and turnbuckles - again, if any damage is noted replace the damaged part(s) before placing the tong in service. Refer to Section 2.C of the technical manual (Sling/Load Bearing Device Safety) for information on recommended testing and recertification.

Continued on next page...

12. ☐ Rotate the tong gear train by hand, and use a flashlight to perform a visual inspection of the gear train through the opening of the rotary gear while the gear train is being rotated. If gear damage or chips of metal are seen, remove the tong from service for overhaul to avoid further damage.

13. ☐ Inspect all jaws and dies used since the last monthly inspection. Inspect jaw roller pins for signs of damage - replace pins if necessary. If damaged pins are welded in place, remove and quarantine the jaw until the weld is repaired. Ensure dies are secure in the jaw - replace worn dies if necessary. Ensure that the jaw rollers rotate freely.

14. ☐ Inspect backing pin(s). Replace cracked, broken, or bent pins.

15. ☐ Inspect top and bottom brake band linings - replace if necessary. Unequal wear of the brake bands indicates that the brake band tension is not evenly adjusted. Refer to the maintenance section of the manual for instructions on properly adjusting brake bands.

16. ☐ Extend all hydraulic cylinders, and inspect cylinder rods for signs of mechanical damage, flaking, or rust. McCoy recommends that damaged cylinders be replaced prior to storage.

17. ☐ Perform a visual inspection of all hydraulic lines. Replace flexible lines if they appear to be cracked, fatigued, or have visible signs of wear from contact with a rigid object. If your tong is equipped with rigid hydraulic lines, replace any line that is dented or appears to be stressed or cracked.

18. ☐ Generously fill the gear train housing with grease. Perform a full lubrication per section 4.E of this manual.

19. ☐ Ensure main supply and return connections to the tong are fully made up. Re-connect the remainder of the hydraulic lines, and, if applicable, the electrical line to the turns counter.

FAILURE TO ENSURE THAT THE SELF-SEALING SUPPLY AND RETURN LINES ARE FULLY MADE UP MAY RESULT IN CATASTROPHIC EQUIPMENT FAILURE.

If using a stand-alone power unit, start it now - refer to the power unit technical manual for startup procedures. Listen to power unit for a moment to see if there are any unusual mechanical sounds (rubbing, grinding, excessive pump noise). If using a diesel unit, allow sufficient time for the engine to reach operating temperature before increasing engine RPM. Once engine is warm, gradually increase engine RPM until operating speed is reached.

20. ☐ Ensure that supply pressure is at or above the tool's specified operating pressure, and that the return pressure is less than 350 psi.

21. ☐ Perform a visual inspection of pressurized hydraulic lines. If any hydraulic fittings or hoses are leaking they must be repaired or replaced before proceeding.

22. ☐ Rotate tong for one minute, stop, and reverse the direction of rotation for another minute, finishing with the opening of the rotary gear facing the gear train. De-energize the power unit, and perform another generous lubrication of the gear train, including the gear housing.

23. ☐ Energize power unit. Rotate tong for one minute, stop, and reverse the direction of rotation for another minute, ending with the opening of the rotary gear facing the gear train.

24. ☐ De-energize the power unit, and perform a third generous lubrication of the gear train, including the gear housing.

25. ☐ Rotate tong in low gear for 5 minutes while monitoring pressurized seals and hydraulic lines. If a seal, line, or fitting begins to leak while tong is rotating, it must be replaced before the equipment is returned to service.

26. ☐ Rotate tong in high gear for 5 minutes while monitoring temperature of top and bottom bearing caps. If the bearing caps are hot to the touch (higher than approximately 50°C) replace the applicable bearings. Likewise if the tong is making unusual noises check for damaged bearings (see section 6 for exploded views for all bearing locations).

27. ☐ Install load cell. Perform a visual inspection of the load cell components and replace any cracked, broken, or distorted items including links and chains. Check oil level in load cell and fill if necessary (refer to Section 7 of the technical manual).

28. ☐ Inspect the load cell anchor pins. Replace the anchor pins if cracking or metal distortion is seen.

29. ☐ While rotating the cage plate, ensure that the jaws properly cam. If the jaws do not cam properly, the brake bands need to be tightened. Incrementally adjust both the top and bottom brake bands EQUALLY until proper cam action is achieved. Refer to the section 4.F.1 for instructions on properly adjusting brake bands.

30. ☐ Perform a full functional test of the tong including, if applicable, backup components, lift cylinder, and float frame components. Report and correct any hydraulic leaks from the hydraulic valve bank, or from any hydraulic cylinders that are used.

Continued on next page...

37. ☐ Test safety door feature. Refer to safety door testing procedure in Section 3.A.4, “Pre-operational Checks”.

NEVER OPERATE YOUR EQUIPMENT WITH A BYPASSED OR MALFUNCTIONING SAFETY DOOR

38. ☐ McCoy recommends that an anti-corrosive agent such as Tectyl® 506 be applied to all external unpainted surfaces (and chain slings) EXCEPT cylinder rods, jaw rollers, and rotary gear camming surfaces. Refer to manufacturer data sheets for proper application and safety information.

Once all of the above maintenance checklist items have been satisfactorily completed the tool may be returned to service.

4.L TUBULAR CONNECTION EQUIPMENT DE-COMMISSIONING & SHIPPING

Perform the following decommissioning procedures when removing tubular connection equipment from service, with the intent of short to long-term storage. These procedures are essential for ensuring proper protection of the equipment from environmental attack, and to aid in the quick turnaround when returning the equipment to service.

Store all o-rings, seals, packings, gaskets, etc. in strong moisture proof, airtight containers. Ensure that these items are not crushed, nicked, or otherwise damaged.

Do not perform any further actions or maintenance while the tong is connected to any hydraulic power supply. Farr recommends that all hydraulic lines are fully disconnected, and residual hydraulic pressure is bled off. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid.

IN ORDER TO MAINTAIN THE INTEGRITY OF INSTALLED SEALS, MCCOY RECOMMENDS THAT THE MAXIMUM STORAGE INTERVAL NOT EXCEED ONE YEAR. AT LEAST ONCE PER YEAR ALL TUBULAR CONNECTION EQUIPMENT IN LONG-TERM STORAGE SHOULD BE RECOMMISSIONED AS PER SECTION 3.M. IF FURTHER STORAGE IS REQUIRED, THE EQUIPMENT SHOULD THEN BE PUT THROUGH ANOTHER DE-COMMISSIONING PROCEDURE.

De-pressurization Procedure In Preparation For Storage:

1) Rotate the tong so that the opening in the rotary gear faces the gear train (towards the rear of the tong). Ensure tong and backup doors are closed.
2) De-energize the power unit.
3) Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.
4) Remove the hydraulic SUPPLY line from the equipment.
5) Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.
7) Disconnect the hydraulic RETURN line from the equipment.
8) Disconnect all remaining quick-connect hoses.
9) Disconnect all remaining connections from the equipment - for example, load cell connections, turns counter connections, dump valve connections. Ensure the tool is completely free of all connections before beginning storage preparations.

HYDRAULIC PRESSURES AS HIGH AS OPERATING PRESSURE MAY REMAIN TRAPPED IN SMALL AREAS OF THE EQUIPMENT. ENSURE ALL MAINTENANCE IS CARRIED OUT BY A QUALIFIED SERVICE TECHNICIAN, AND THAT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT IS USED TO GUARD AGAINST PRESSURE-INDUCED INJURIES

1. ☐ Perform an initial wash of the tool in order to remove the majority of dirt and grease build-up. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid and dirty grease.
2. ☐ Clean the interior of the tong thoroughly, using either water (do not use a pressure washer), or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents. Make a note if any metal shavings or metal pieces are flushed out of the gear train cavity - if shavings or metal pieces are seen the tong must be overhauled before it is returned to service.
3. ☐ Clean the exterior of the tool thoroughly, using either water (do not use a pressure washer), or an appropriate solvent-based grease-cutting cleaner such as Varsol. Ensure adequate containment is in place to prevent environmental contamination from residual hydraulic fluid, dirty grease, and cleaning agents.
4. ☐ Inspect all fasteners and fastener safety wires (if equipped). Replace any missing fasteners - use Grade 8 bolts only. Re-torque all external fasteners to SAE specifications.
5. ☐ Inspect backing pin(s). Replace cracked, broken, or bent pins.
6. ☐ Repair or replace any damaged or missing external body parts, such as torque gauge mounts, hydraulic supports, safety door protectors, etc.
7. ☐ Inspect all paint - locations in which the paint has been damaged must be repaired prior to storage. Prepare areas to be painted to ensure they are free of grease, dirt, or solvent. Touch up using a solvent-based acrylic paint, and allow sufficient time for paint to dry before proceeding.
8. ☐ Perform a liberal lubrication of the equipment - refer to section 4.E in this manual to determine lubrication points. Generously fill the gear train housing with grease through the opening in the rotary gear.
9. ☐ Connect the equipment to a hydraulic power unit. Ensure all quick-connect control lines are securely connected to prevent equipment damage from excessive back pressure. Do not neglect to connect the motor drain.
10. ☐ Energize power unit.

Continued on next page...

11. ☐ Rotate tong for one minute, stop, and reverse the direction of rotation for another minute, ending with the opening of the rotary gear facing the gear train. De-energize the power unit, and perform another generous lubrication of the gear train, including the gear housing.

12. ☐ Energize power unit. Rotate tong for one minute, stop, and reverse the direction of rotation for another minute, ending with the opening of the rotary gear facing the gear train.

13. ☐ De-energize the power unit, and perform a third generous lubrication of the gear train, including the gear housing.

14. ☐ Energize power unit, and rotate the tong for a final time, one minute in one direction, stop, and reverse the direction of rotation for another minute, this time ending with the rotary gear in the “open throat” position.

15. ☐ Extend all hydraulic cylinders, and inspect cylinder rods for signs of mechanical damage, flaking, or rust. Farr recommends that damaged cylinders be replaced prior to storage.

16. ☐ If this procedure applies to a frame-mounted tool, the tong must be secured to the backup in order to remove the risk of sudden and catastrophic movement during transport. Install four supplied shipping legs (McCoy part number BUCST23024) between the tong and backup before transporting equipment.

DEPRESSURIZATION PROCEDURE FOR STORAGE:

1) Rotate the tong to the “open throat” position.
2) Exercise each hydraulic cylinder several times - open the tong and backup doors, retract and extend the reversing pins, retract and extend the float cylinders. Finish with all cylinders except for the door cylinders in their fully retracted position. The general idea is to have as little of the chrome cylinder rods exposed as possible.
3) De-energize the power unit.
4) Repeatedly actuate the tong motor control valve lever IN BOTH DIRECTIONS to dissipate any residual pressure in the valve and motor.
5) Remove the hydraulic SUPPLY line from the equipment.
6) Repeatedly actuate the remaining control valve levers IN BOTH DIRECTIONS to dissipate any residual pressure in the remainder of the hydraulic control system.
7) Connect a low-pressure air supply line (10 PSI or less) to the hydraulic supply line, and force a small amount of the remaining hydraulic fluid from the valve assembly - this will allow for thermal expansion of the hydraulic fluid if the equipment is stored or transported in high ambient temperatures. Failure to do this may result in damaged or destroyed seals in the equipment.
8) Disconnect the hydraulic RETURN line from the equipment.
9) Disconnect all remaining quick-connect hoses.
10) Disconnect all remaining connections from the equipment - for example, load cell connections, turns counter connections, dump valve connections. Ensure the tool is completely free of all connections before beginning storage preparations.

17. ☐ Repair or replace all leaking hydraulic fittings or hoses before proceeding.

18. ☐ Use a solvent-based cleaner on rags to wipe all external surfaces to remove all residual grease or hydraulic fluid. Once the exterior surfaces have been de-greased, wipe all external surfaces with clean water to remove residual solvent.

19. ☐ Apply grease or heavy oil to all exposed cylinder rods.

20. ☐ McCoy recommends that an anti-corrosive agent such as Tectyl® 506 be applied to all external surfaces EXCEPT cylinder rods (including chain slings). Refer to manufacturer data sheets for proper application and safety information.

DO NOT ALLOW ANTI-CORROSIVE AGENTS TO CONTACT CYLINDER RODS. CYLINDER ROD DAMAGE WILL OCCUR.

23. ☐ Allow the anti-corrosive coating ample time to dry - refer to manufacturer data sheets for drying times at room temperature.

24. ☐ Wrap entire assembly in 100 gauge (1 mil) corrosion-inhibiting wrap, at least 3 layers thick. Attempt to ensure that the tool is well-sealed within the wrapping, including the bottom.

If possible, store in a sealed, climate controlled environment. If isolated storage is not available, Farr recommends storing your wrapped equipment in a secure, out-of-the-way location, using silica gel desiccant to reduce the humidity within the wrapping. As a guideline, use 125 g. of desiccant for each cubic metre of space, or 3.5 g. per cubic foot.

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Calculation Of Required Desiccant:

1) Calculate the trapped air volume by measuring the outside dimensions of the tool to be stored, and treat that as the volume to be stored. For example, the overall external dimensions of this tool are 96.5” x 96.5” x 64.5”, which calculates to an approximate volume of 600640 in^3, or 348 ft^3 (9.854 m^3).

2) Multiply the calculated air volume, in cubic feet, by the recommended amount of desiccant (3.5 g) per cubic foot. Carrying forth the example used in the previous step, the required desiccant charge would be 3.5 g. x 348 ft^3, equaling 1218 g. Several manufacturers offer silica gel desiccant in packaged quantities of 125 grams per bag, so ten packages of desiccant distributed throughout the wrapped equipment would be required. Please keep in mind that this is a guideline only - more or less desiccant may be required in extreme environmental conditions.

For best corrosion resistance the equipment should be removed from storage and exercised on a regular basis, depending on the storage environment. Farr recommends that for equipment stored in a salt-water maritime or exposed dusty environment, repeat steps 9 through 24 monthly. For equipment stored in isolated storage in a non-maritime environment, repeat steps 9 through 24 quarterly. Replace desiccant packs at this time - depleted desiccant packs may be treated as regular dunnage.

4.M TUBULAR CONNECTION EQUIPMENT RE-COMMISSIONING PROCEDURE

Perform the following recommissioning procedures when removing tubular connection equipment from short or long-term storage back into regular service. These procedures are essential for ensuring proper equipment preparation and operation. The following procedures also assume that the decommissioning and storage procedures recommended by McCoy have been strictly observed.

1. ☐ Remove all protective plastic wrapping. Exhausted desiccant packs within the wrapping may be disposed of with the regular garbage.
2. ☐ Wipe excess grease or heavy oil from exposed cylinder rods.
3. ☐ Perform a visual inspection of all lifting points - visibly damaged components (cracks, broken lugs, distorted metal, etc.)must be replaced or repaired before placing tong in service. Inspect all chains, master links, and turnbuckles. Damaged components must be replaced before placing the tong in service. If your company requires yearly certification of lifting equipment, ensure that the most recent test date falls within the past year. Perform recertification if necessary.
4. ☐ Remove four shipping legs from between the tong and backup. Store the shipping legs for future use.
5. ☐ Perform a liberal lubrication of the equipment - refer to section 4.E to determine lubrication requirements. Generously fill the gear train housing with grease through the opening in the rotary gear.
6. ☐ Connect the equipment to a hydraulic power unit. Ensure all lines are fully made up to prevent equipment damage from excessive back pressure. Do not neglect to connect the motor drain.

FAILURE TO ENSURE THAT THE SELF-SEALING SUPPLY AND RETURN LINES ARE FULLY MADE UP MAY RESULT IN CATASTROPHIC EQUIPMENT FAILURE.

7. ☐ Energize power unit.
8. ☐ Ensure that supply pressure is at or above the equipment's specified operating pressure, and that the return pressure is less than 350 psi.
9. ☐ Perform a thorough inspection of pressurized hydraulic lines and fittings. Leaking hydraulic fluid lines or fittings must be replaced before returning the equipment to service.
10. ☐ Perform a thorough inspection of all seals. Any seal that is leaking or "weeping" must be replaced before returning the equipment to service.
11. ☐ Rotate tong at low speed for 5 minutes while monitoring pressurized seals and hydraulic lines. If a seal, line, or fitting begins to leak while tong is rotating, it must be replaced before returning the equipment to service. Finish this step with the rotary gear opening facing the gear train. De-energize the power unit.
12. ☐ Inspect all flexible hydraulic lines for signs of wear, blistering, or any other signs of potential failure - replace if signs of potential failure are identified.
13. ☐ Inspect the gear train housing. If the amount of grease is inadequate, liberally grease the gear train through the opening in the rotary gear.
14. ☐ Inspect top and bottom brake band linings - replace if necessary. Unequal wear of the brake bands indicates that the brake band tension is not evenly adjusted. Refer to the maintenance section of the manual for instructions on properly adjusting brake bands. Ensure that all grease is wiped from brake band linings and the parts of the cage plates that come into contact with the brake band linings
15. ☐ Re-install access panel. Install a set of pre-inspected jaws that are the correct size for the pipe or casing being run.
16. ☐ Install load cell. Perform a visual inspection and replace any cracked, broken, or distorted components including links and chains.
17. ☐ Inspect the load cell anchor pins. Replace the anchor pins if cracking or metal distortion is seen.
18. ☐ Re-energize power unit.
19. ☐ Perform a full functional test of the equipment including, if applicable, backup components and float frame components. Report and correct any hydraulic leaks from the hydraulic valve bank, or from any hydraulic cylinders that are used.
20. ☐ If using a frame-mounted tong and backup system, raise the tong off the beams that it is resting upon. Remove the beams and protective cloths - inspect the paint on top of the backup and the bottom of the tong to ensure it has not been damaged by the beam.

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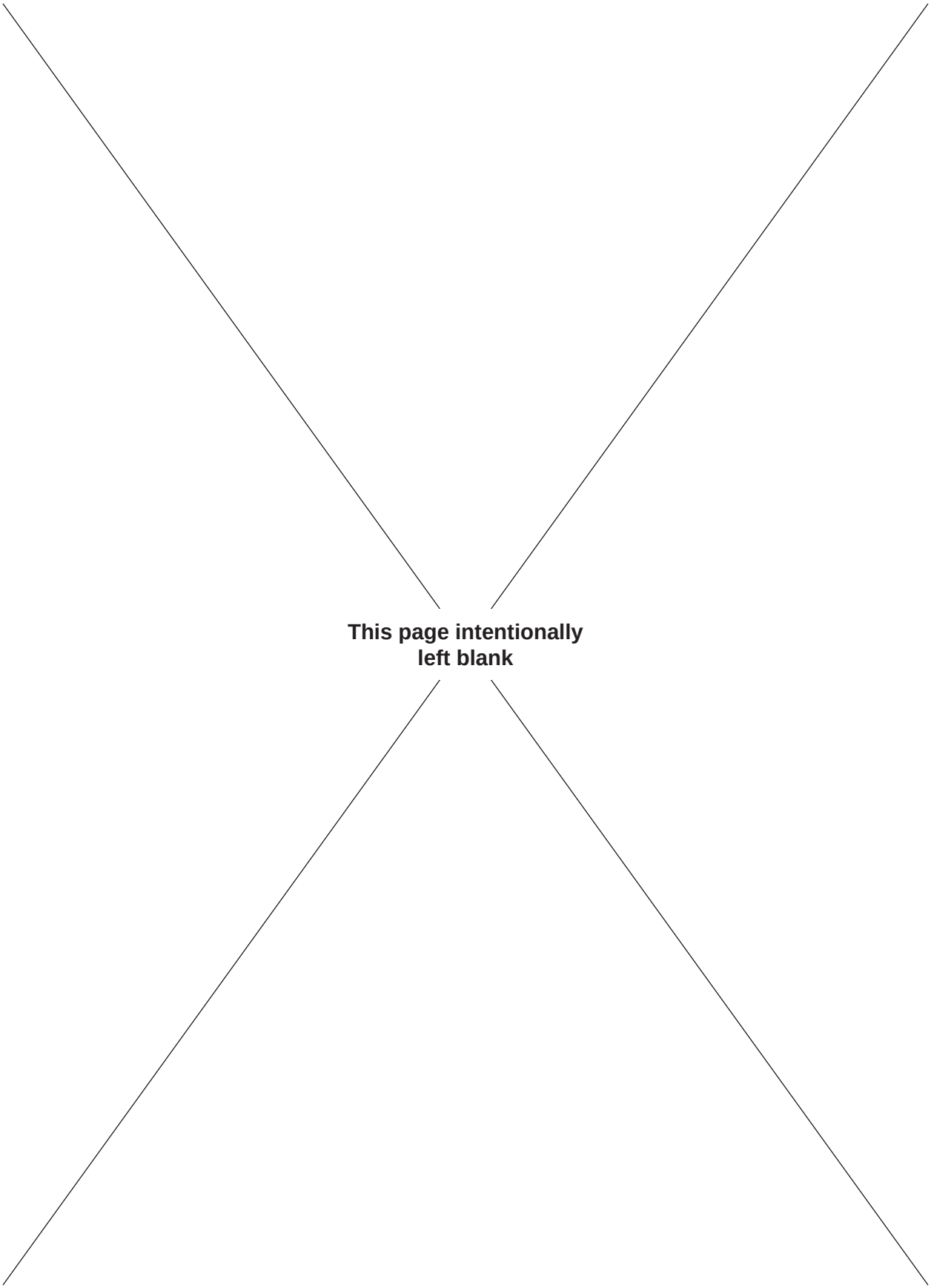
21. ☐ Test safety door feature. Refer to safety door testing procedure in Section 3.A.4, “Pre-operational Checks”.

NEVER OPERATE YOUR EQUIPMENT WITH A BYPASSED OR MALFUNCTIONING SAFETY DOOR

22. ☐ While rotating the cage plate, ensure that the jaws properly cam. If the jaws do not cam properly, the brake bands require tightening. Incrementally adjust both the top and bottom brake bands EQUALLY until proper cam action is achieved.

23. ☐ When all of the previous steps are completed, you may return your re-commissioned equipment to service.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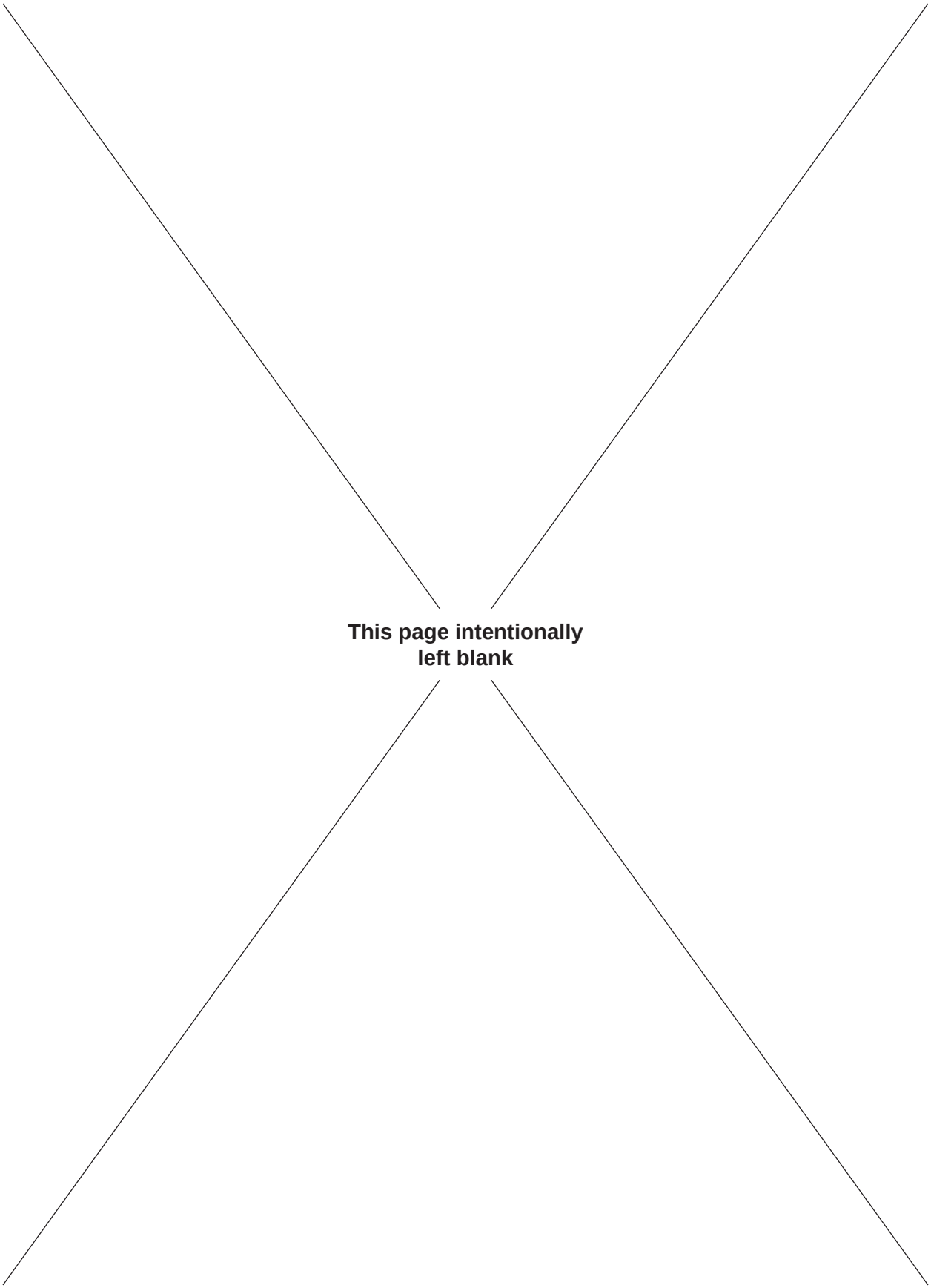
SECTION 5: TROUBLESHOOTING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Adequate maintenance and proper fluid selection is essential for minimizing hydraulic-related failures. All troubleshooting must be performed by a technician trained in hydraulic systems, and familiar with the equipment design, assembly and operation.

The following troubleshooting instructions are intended to be guidelines only. Any faults not solved through the use of this guide should be referred to our engineering department for their evaluation and recommendations.

5.A TONG WILL NOT DEVELOP SUFFICIENT TORQUE

	SYMPTOM	SOLUTION(S)
1	Malfunctioning relief valve on tong hydraulic circuit	Troubleshoot relief valve as per OEM instructions.
2	Directional valve is leaking	Check directional valve. Neutral position should return fluid directly to the reservoir. Replace or repair valve to ensure correct operation
3	Power unit is not producing adequate pressure	Troubleshoot power unit (see user's manual for your particular unit)
4	Poor hydraulic pressure at the tong despite adequate pressure at the power unit, or excessive back pressure in the return line.	Restrictions exist in line between power unit and tong. Inspect integrity of self-sealing couplings to ensure they are allowing full fluid flow. Check to ensure no other restrictions exist (contaminated catch screens or filters, for example)
5	Fluid viscosity is not appropriate (too high or too low)	Ensure hydraulic fluid being used is the viscosity recommended by McCoy Global. Power unit pump may not prime if fluid is too heavy, and the hydraulic system will overheat if fluid is too light. Replace with proper viscosity fluid
		Hydraulic fluid viscosity is affected by environmental conditions. Ensure the fluid being used is suitable for high or low temperatures. Replace with proper viscosity fluid for the operating conditions if necessary
6	Worn or damaged tong motor causing slippage	Replace or repair worn or damaged motor
7	Damaged bearings or gears causing excessive drag	Replace or repair worn or damaged gears or bearings
8	Jaws slipping on pipe	Ensure jaw dies are not worn to the point that they cannot grip. Ensure the correct sized jaws are in use
9	Torque gauge is indicating incorrectly	Incorrect gauge is being used. Ensure gauge is the proper range, and has been properly calibrated for the arm length of the equipment in use
		Gauge has been damaged. Check gauge operation and calibration on independent system
		Gauge has mistakenly been married to an incorrect load cell
10	Load cell is measuring incorrectly	Incorrect load cell is being used
		Air is trapped in torque measuring circuit (load cell, hydraulic line, or gauge. Refer to torque measurement troubleshooting in Section 7 of this manual
		Load cell has been damaged. Replace load cell, or return to McCoy for repair and re-calibration

MCCOY GLOBAL GUARANTEES CALIBRATION OF A LOAD CELL/TORQUE GAUGE ASSEMBLY FOR A PERIOD OF ONE YEAR. MCCOY RECOMMENDS THAT THE LOAD CELL/TORQUE GAUGE ASSEMBLY BE RETURNED TO THE FACTORY FOR RE-CALIBRATION ON A YEARLY BASIS.

	SYMPTOM	SOLUTION(S)
11	Incorrect motor speed selected (applies to 2-speed motors only)	Maximum torque can only be developed when LOW motor speed (maximum hydraulic displacement) is selected.

5.B SAFETY DOOR DOES NOT OPERATE OR IS MALFUNCTIONING

	SYMPTOM	SOLUTION(S)
1	Safety door switch requires adjustment.	Adjust switch as per section 4.F.2
2	Safety door switch has failed	Test safety door switch for proper function and replace if necessary
3	Contamination in hydraulic lines	Ensure all flexible hydraulic lines to safety door switch are free-flowing
4	Pilot-to-open valve in safety door valve block is malfunctioning.	Remove each valve. Inspect seats and springs. Replace valve(s) if damage is seen on valve seats, or if spring appears to be damaged or broken.

5.C TONG DOOR WILL NOT OPEN

	SYMPTOM	SOLUTION(S)
1	Tong is still clamped (under load)	Release tong jaws before opening tong door
2	No lubrication on latch claws or latch post	Lubricate latch claws and latch post using a high quality EP synthetic grease
3	Latch linkage is bent, broken, or missing	Inspect latch linkage. Replace damaged or missing components.
4	Hydraulic door cylinder is malfunctioning or has failed	Rebuild hydraulic cylinder(s) - disassemble, clean, and install new seal kit (see Section 6). Replace damaged components
		Install new hydraulic cylinder(s)

5.D FAILURE OF JAWS TO GRIP PIPE

	SYMPTOM	SOLUTION(S)
1	Dies have become too dull to provide adequate grip	Replace dies
2	Incorrect jaws are being used	Double-check jaw size to ensure they are rated for the diameter of pipe or casing being run
3	Incorrect dies are being used	Ensure dies loaded in the jaws are appropriate for the type of pipe or casing being run
4	Brake band(s) is (are) insufficiently adjusted, not allowing jaws to cam properly	Adjust brake bands to give proper resistance to cage plates
5	Jaw roller broken or worn	Remove jaw assembly and inspect. Replace rollers that are visibly “flat-spotted” or otherwise damaged

5.E TONG RUNNING TOO SLOWLY

	SYMPTOM	SOLUTION(S)
1	Obstruction in tong hydraulic circuit preventing adequate flow	Inspect self-sealing couplings to ensure they are properly engaged
		The main hydraulic lines (supply and discharge) to the tong are obstructed. Remove and clean if required
2	Power unit is not producing adequate flow or pressure	Troubleshoot power unit (see user's manual for your particular unit)
3	Tong motor is excessively worn and is leaking hydraulic fluid past the vanes	Replace or rebuild hydraulic motor.
4	Bearings in gear train and rotary section are excessively worn	Overhaul tong. Contact McCoy for instructions.
5	Hydraulic fluid viscosity too high	Ensure hydraulic fluid meets McCoy Global specifications
		Ensure hydraulic fluid is appropriate for climatic conditions, especially during cold-weather operation
6	By-pass valve not functioning	Check and repair

5.F BACKUP WILL NOT ENGAGE PIPE, OR DOES NOT PROVIDE ADEQUATE GRIP

	SYMPTOM	SOLUTION(S)
1	Hydraulic clamp cylinder failure or malfunction	Rebuild hydraulic cylinder(s) - disassemble, clean, and install new seal kit. Replace all damaged components (see Pp. 6.54 - 6.55)
		Install new hydraulic cylinder(s)
2	Inadequate lubrication of clamping cylinder	Grease cylinder as per instructions in Section 4.E
3	Metal fragment has become lodged between clamping cylinder and a fixed piece of the backup (top plate, bottom plate, or slider plate).	Thoroughly inspect area around clamp cylinder and remove the metal fragment if it is accessible. **NOTE:** Removal of trapped metal fragments may require removal of the top plate of the backup. Following removal of the fragment inspect moving components to ensure the metal has not been gouged or chipped. Damaged components may require replacement to ensure smooth cylinder movement.

HYDRAULIC PRESSURES AS HIGH AS OPERATING PRESSURE MAY REMAIN TRAPPED IN SMALL AREAS OF THE EQUIPMENT. DE-PRESSURIZE THE TONG AND BACKUP ASSEMBLY BEFORE PROCEEDING, AND ENSURE ALL MAINTENANCE IS CARRIED OUT BY A QUALIFIED SERVICE TECHNICIAN, AND THAT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT IS USED TO GUARD AGAINST PRESSURE-INDUCED INJURIES

	SYMPTOM	SOLUTION(S)
4	Incorrect size of die holders / jaws are being used	Double-check jaw size to ensure they are rated for the diameter of pipe or casing being run
5	Dies have become too dull to provide adequate grip	Replace dies
6	Incorrect dies are being used	Ensure dies loaded in the jaws are appropriate for the type of pipe or casing being run
7	Backup door is not closing properly	Ensure door weldments are not deformed, especially at the “locking” point.
		Ensure mechanisms attaching door weldments to clamp cylinder are intact.
		Backup door pivots or door/cylinder attachment pins require lubrication.
		Clamp cylinder is malfunctioning - see steps 1 & 2.

5.G BACKUP DOOR WILL NOT OPEN

	SYMPTOM	SOLUTION(S)
1	Hydraulic clamp cylinder failure or malfunction	Rebuild hydraulic cylinder(s) - disassemble, clean, and install new seal kit. Replace all damaged components (see Pp. 6.54 - 6.55)
		Install new hydraulic cylinder(s)
2	Insufficient pressure to energize clamp cylinder	Inspect hydraulic circuit to backup clamp cylinder. Measure pressure at the cylinder if necessary. Troubleshoot hydraulic circuit if inadequate pressure is measured.
3	Door weldment is jammed by a metal fragment or other debris	Thoroughly inspect areas around door weldments and remove metal fragment if it is accessible. **NOTE**: Removal of trapped metal fragments may require removal of the top plate of the backup. Following removal of the fragment inspect the door weldments and fixed backup components to ensure the metal has not been gouged or chipped. Damaged components may require replacement to ensure smooth operation.
4	Door weldment(s) have become deformed at the “locking” point	Inspect door weldments, and replace if necessary.
5	Mechanisms attaching door weldments to clamp cylinder have failed.	Inspect door weldment connection points to ensure the mechanisms have not become deformed, or have broken. Replace if required.
6	Backup door pin has broken	Replace backup door pin
7	Backup is still under load (still clamped to tubing)	Release backup jaws

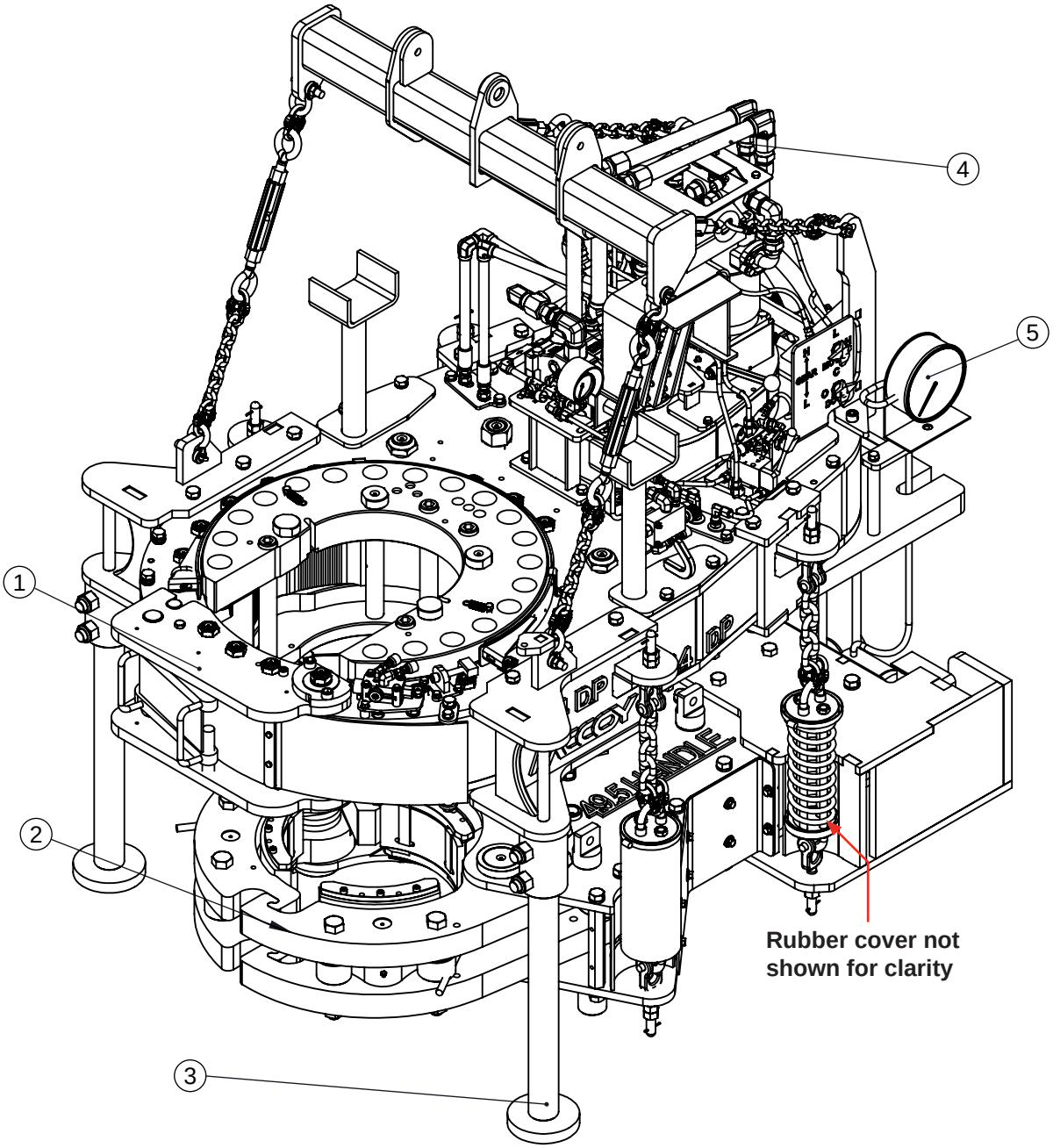
5.H GENERAL COMMENTS

The following factors generally contribute to poor hydraulic operation and premature wear of equipment:

1. Contaminated hydraulic fluid due to overuse, overheating, or inadequate fluid filtration.
2. Unsuitable hydraulic fluid, especially in extreme climatic conditions.
3. Defective packing or seals in components of the hydraulic system.
4. Poor or incomplete hydraulic system training. Users must be fully qualified to operate the equipment, and have complete understanding of the hydraulic system.

If your hydraulic troubleshooting procedures involve flow and pressure tests at the power unit, McCoy Completions & Drilling recommends construction of a test rig that can easily be connected to the main suction and discharge ports of the power unit.

SECTION 6: PARTS & ASSEMBLIES



CONFIGURED WITHOUT CHROMEMASTER

ILLUSTRATION 6.1: MODEL 80-140-100-15T-001-4S-B1 HYDRAULIC POWER TONG/LJ BACKUP

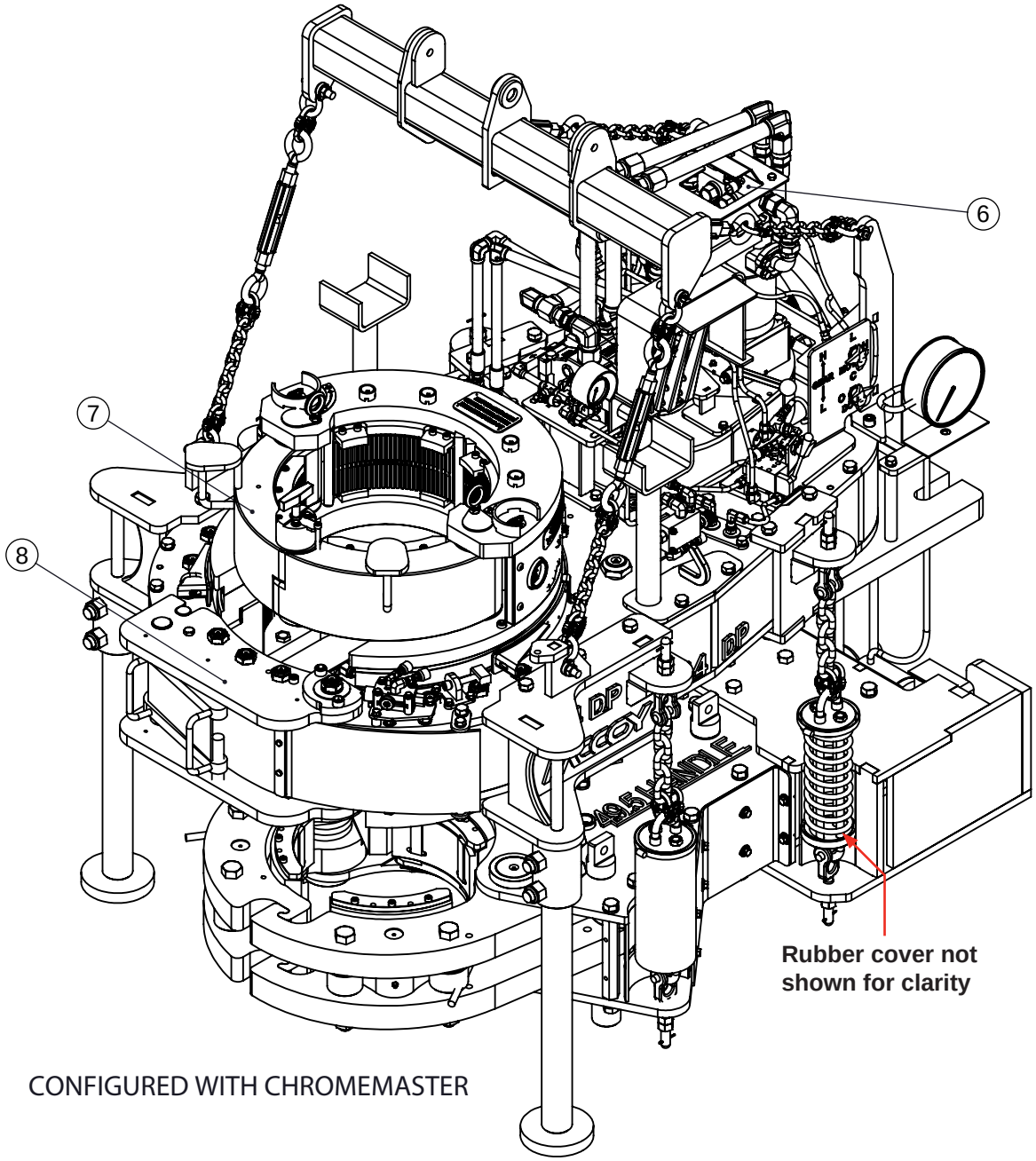


ILLUSTRATION 6.2: MODEL 80-140-10C-15T-000-4S-B1 HYDRAULIC POWER TONG/LJ BACKUP (WITH OPTIONAL CHROMEMASTER™)

Item	Type	Description	Qty	Part Number
1	Assembly	14-⅜" 100K drill-pipe hydraulic power tong (standard)	1	CLE14000DP11
2	Assembly	100K tension load cell-style hydraulic LOCKJAW backup	1	BUCST15000-02
3	Assembly	Mounting kit assembly	1	MKBUCST15000-02
4	Assembly	Valve package - 14" drill-pipe power tong	1	VP14000DP-335SAE-B1
5	Assembly	100K torque gauge assembly, tension load cell	1	SM100-49500-TS
6	Assembly	Valve package - 14" drill-pipe power tong (for use with CHROMEMASTER™)	1	VP14000DP-435SAE-B1
7	Assembly	15" 75,000 lbs-ft CHROMEMASTER™	1	CM15000DP
8	Assembly	14-⅜" 100K drill-pipe hydraulic power tong (for use with CHROMEMASTER™)	1	CLE14000DP12

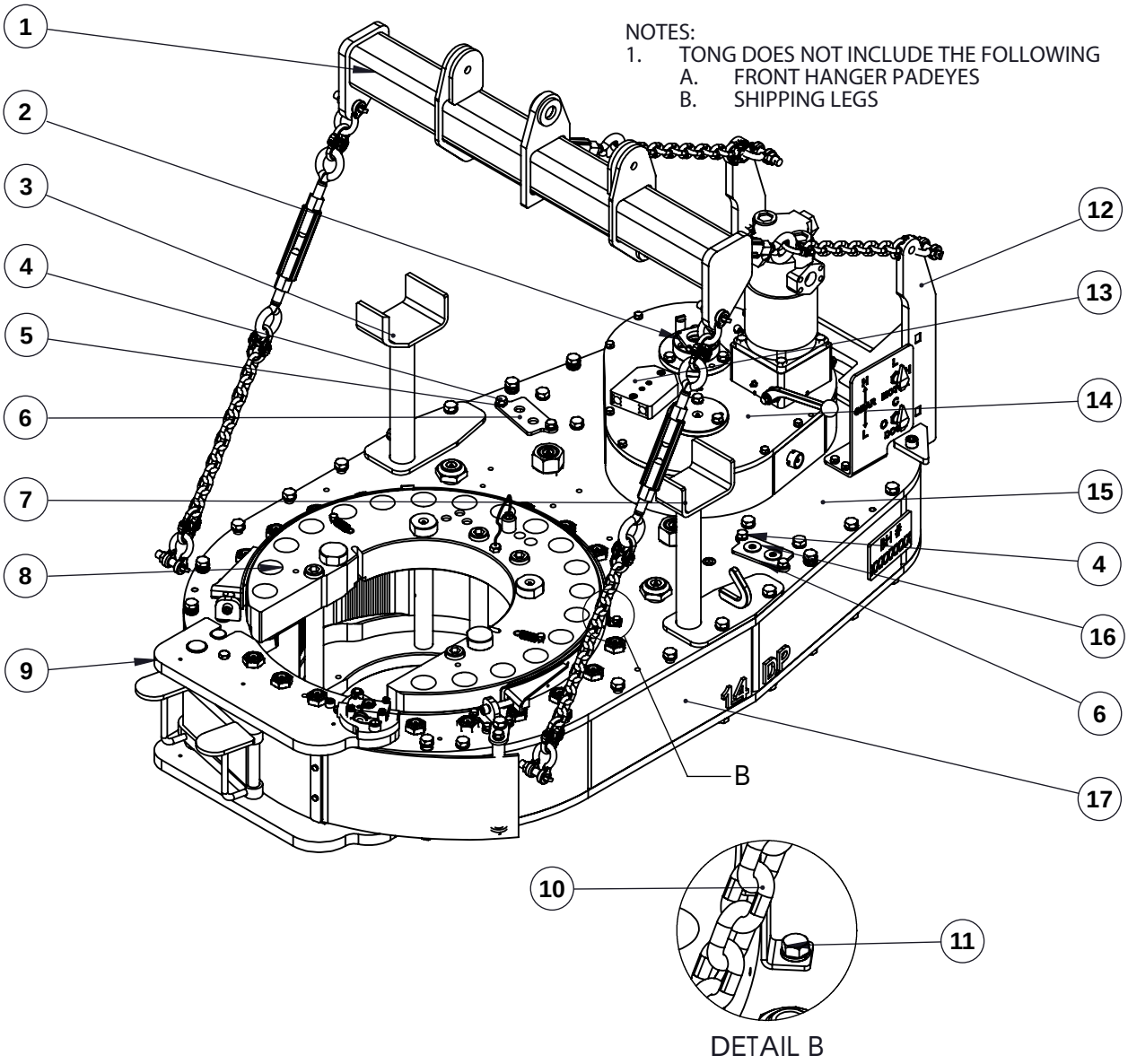
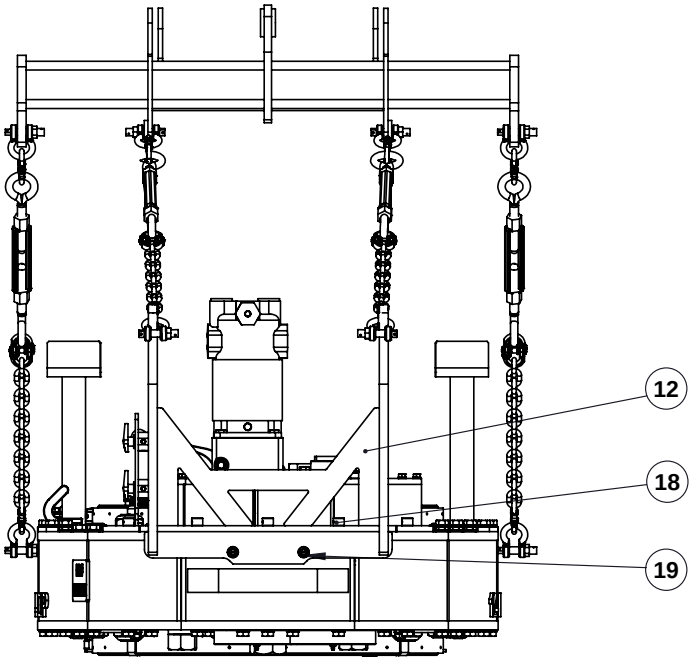
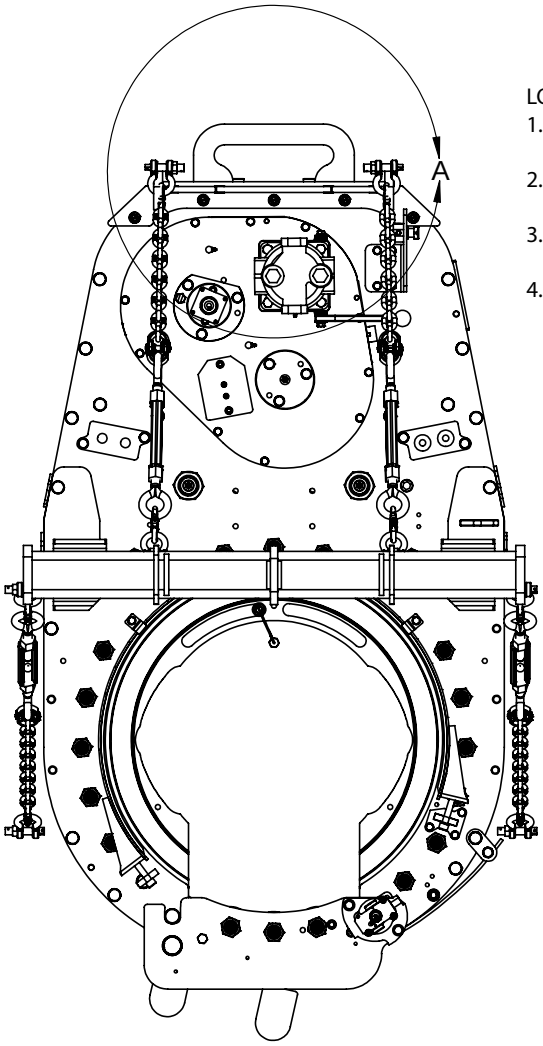


ILLUSTRATION 6.3: CLE14000DP POWER TONG OUTER BODY ASSEMBLY 01

Item	Description	Qty	PN	Item	Description	Qty	PN
1	Spreader bar	1	14855	11	⅜" UNC x ¾" hex head cap screw GR8	8	1046
2	Encoder spacer	1	1000501	12	Rear lifting weldment	1	14870
3	Left cradle weldment	1	14875	13	Turns counter mount assembly	1	76101BJ
4	½" UNC x 1" hex head cap screw GR8	8	1110	14	Gear box cover weldment	1	14450
5	½" lock washer GR8	8	1103	15	Top plate weldment	1	14612-03
6	Bulkhead plate	2	14883	16	½" flat washer GR8	2	1102
7	Right cradle weldment	1	14874	17	Mid-body final weldment	1	14603-02
8	Cage plate assembly	1	14745-04	18	⅝" UNC x 2-½" hex socket head cap screw	5	259A
9	Remote door assembly	1	14680-09	19	⅝" UNC x 2" hex socket head cap screw	2	1155B
10	Brake band tab	4	14245				





LOCKWIRE PROCEEDURE:

1. No more than three (3) bolts may be tied together. Lockwire bolts as indicated in drawing.
2. Bolt heads may be tied as shown only when the female thread receiver is captive
3. Lock wire must fill a minimum of 75% of the drilled hole provided for the use of lockwire.
4. Lock wire diameter required is determined by diamter of bolt. For thread sizes > 0.5 inch use 0.042 inch wire

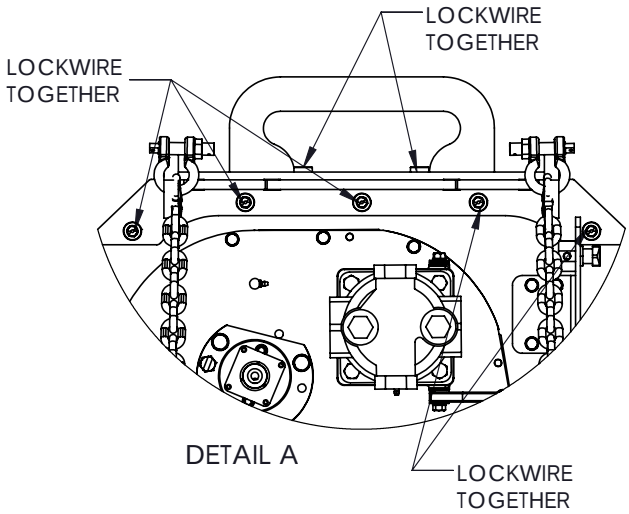


ILLUSTRATION 6.4: CLE14000DP POWER TONG OUTER BODY ASSEMBLY 02

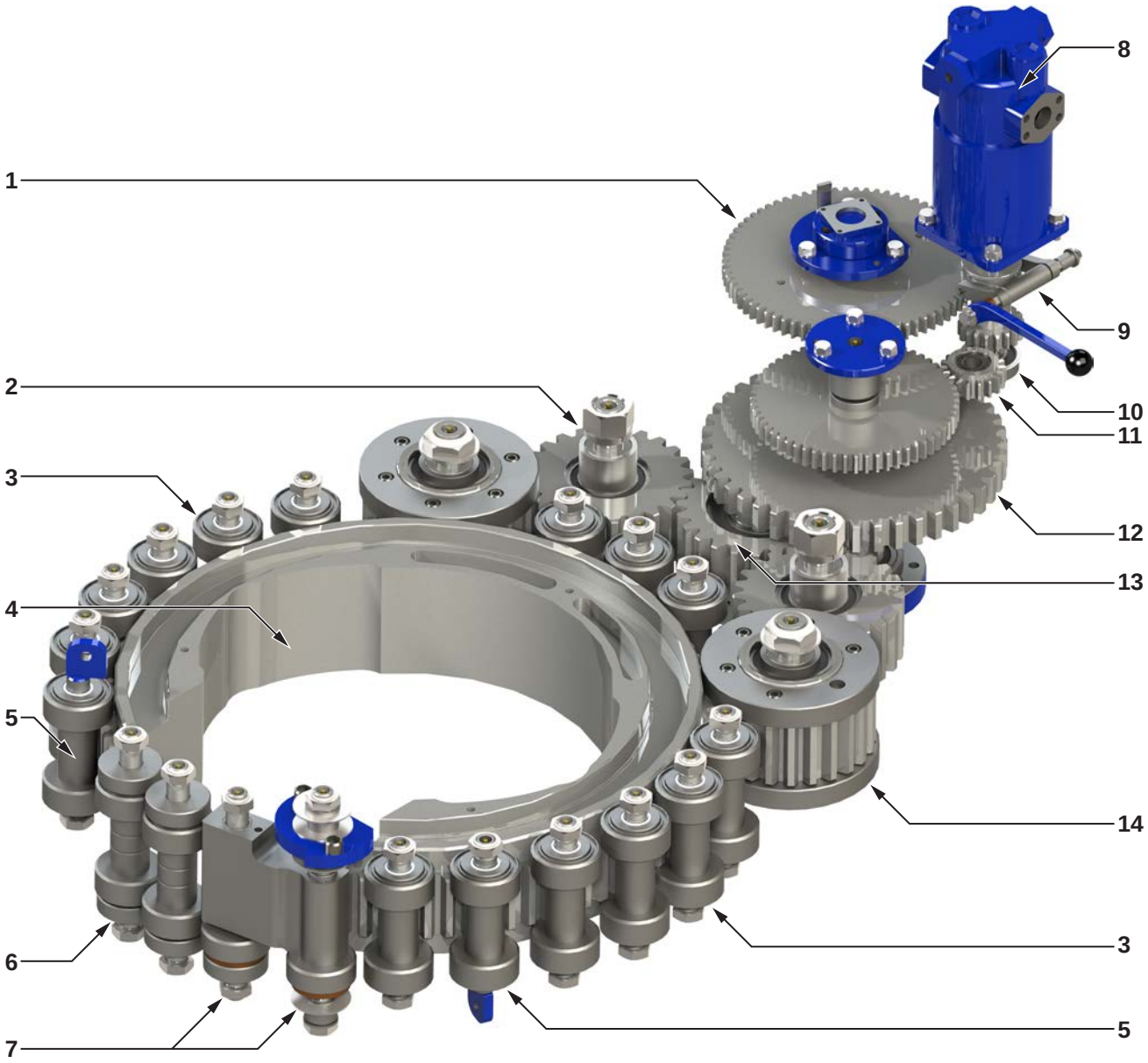


ILLUSTRATION 6.5: CLE14000DP GEAR TRAIN ISO VIEW

Item	Type	Description	Qty	Part Number
1	Assembly	Secondary gear assembly (Pp. 6.20 - 6.21)	1	26070
2	Assembly	Outboard idler gear assembly (Pp. 6.14 - 6.15)	2	14741
3	Assembly	Standard support roller assembly (Pp. 6.8 - 6.9)	13	73069
4	Part	Ring gear	1	14009-06
5	Assembly	Dumbbell roller - brake band coincidental (Pp. 6.8 - 6.9)	2	14674
6	Assembly	Door-mounted support roller assembly (Pp. 6.10 - 6.11)	2	14675
7	Assembly	Door pivot roller/door support (part of automatic door assembly, Pp. 6.34 - 6.35)		

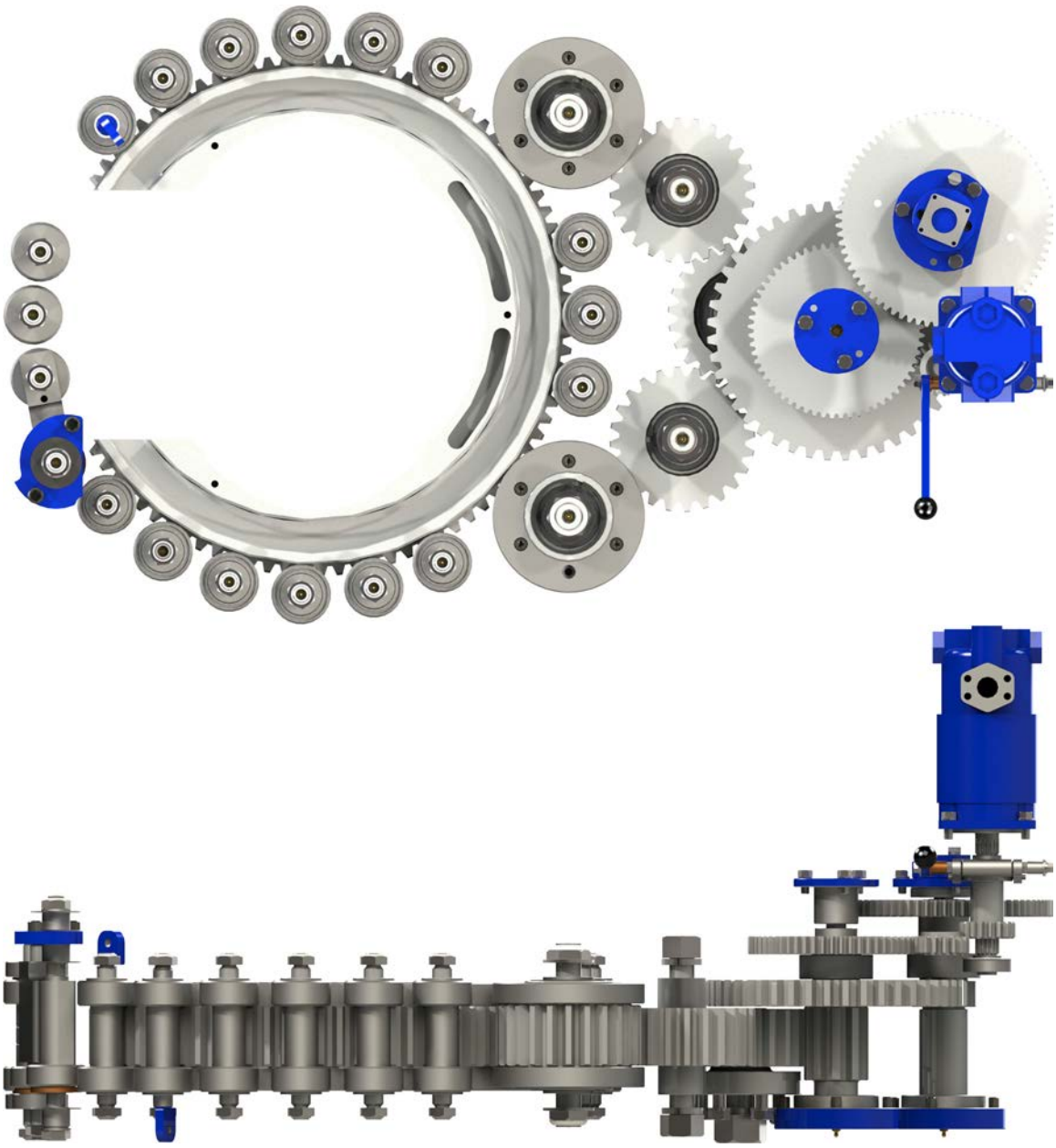


ILLUSTRATION 6.6: CLE14000DP GEAR TRAIN TOP/SIDE VIEWS

Item	Type	Description	Qty	Part Number
8	Part	Hydraulic motor	1	20099
9	Assembly	Shifting assembly (Pp. 6.26 - 6.27)	1	45091
10	Assembly	Motor gear assembly (part of motor drive assembly - Pp. 6.26 - 6.27)		
11	Assembly	High gear idler assembly (Pp. 6.28 - 6.29)	1	55197
12	Assembly	Pinion gear assembly (Pp. 6.18 - 6.19)	1	26068-01
13	Assembly	Short idler gear assembly (Pp. 6.16 - 6.17)	1	14740-01
14	Assembly	Raced idler gear assembly (Pp. 6.12 - 6.13	2	96137

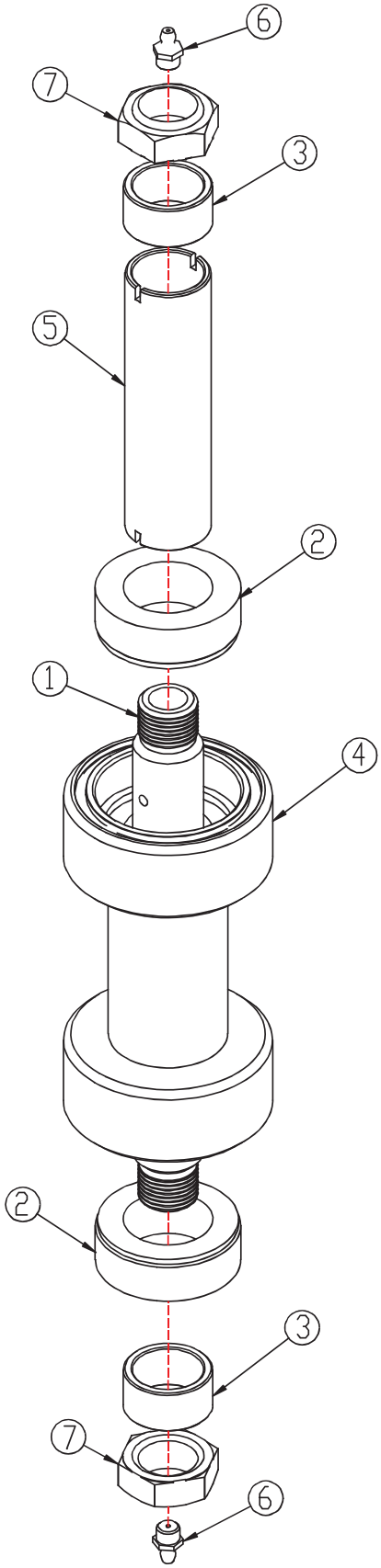


ILLUSTRATION 6.7: STANDARD SUPPORT ROLLER ASSEMBLY EXPLODED

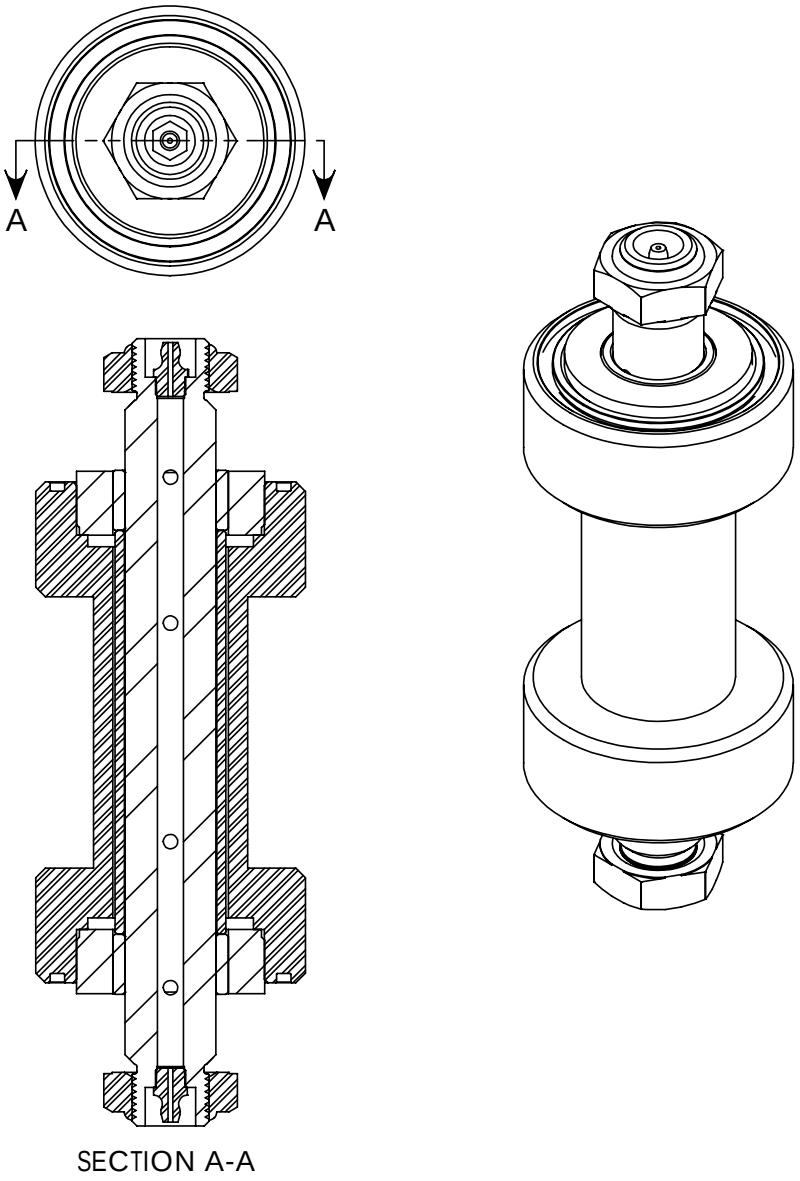


ILLUSTRATION 6.8: STANDARD SUPPORT ROLLER ASSEMBLY

Item	Type	Description	Qty	Part Number
1	Part	Dumbbell roller shaft [1]	1	55022-A
2	Part	Dumbbell roller bushing	2	55191
3	Part	Dumbbell roller spacer	2	55192
4	Part	Dumbbell roller	1	73070
5	Part	Dumbbell roller inner spacer	1	73071
6	Part	⅛" NPT grease fitting	2	1001
7	Part	1" UNF thin hex nylock nut	2	1213

1. Support roller assemblies coincidental with the brake band adjustment use dumbbell roller shaft 14715 (2 locations total)

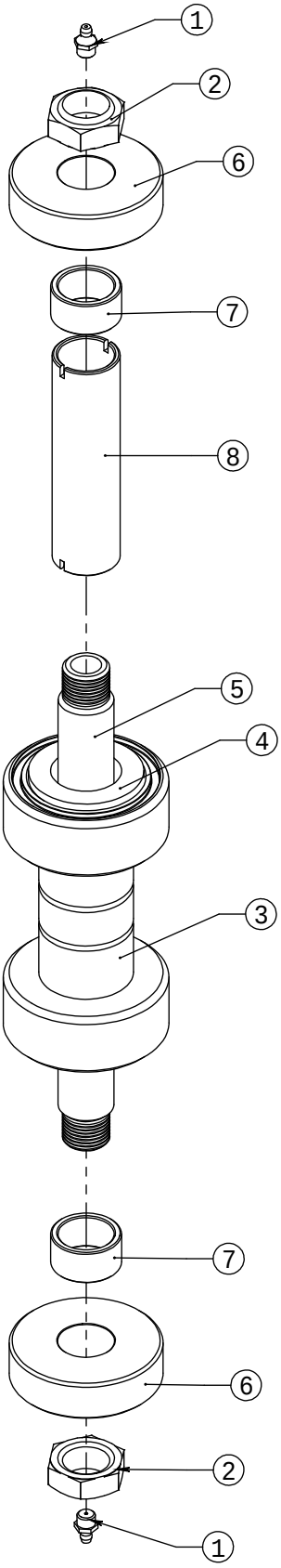


ILLUSTRATION 6.9: DOOR-MOUNTED SUPPORT ROLLER ASSEMBLY EXPLODED

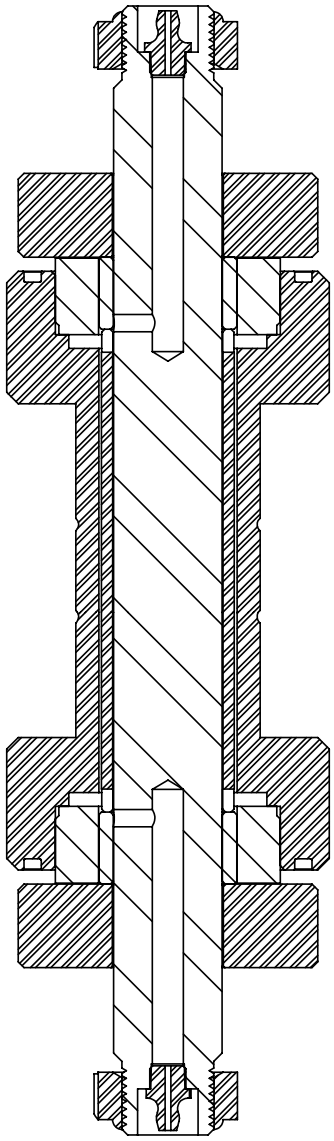


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ILLUSTRATION 6.10: DOOR-MOUNTED SUPPORT ROLLER ASSEMBLY

Item	Type	Description	Qty	Part Number
1	Part	⅛" NPT grease fitting	2	1001
2	Part	1" UNF thin hex nylock nut	2	1213
3	Part	Door-mounted dumbbell roller	1	14308
4	Part	Dumbbell roller bushing	2	55191
5	Part	Door-mounted dumbbell roller shaft	1	14677
6	Part	Door roller spacer	2	14676
7	Part	Dumbbell roller spacer	2	55192
8	Part	Dumbbell roller inner spacer	1	73071

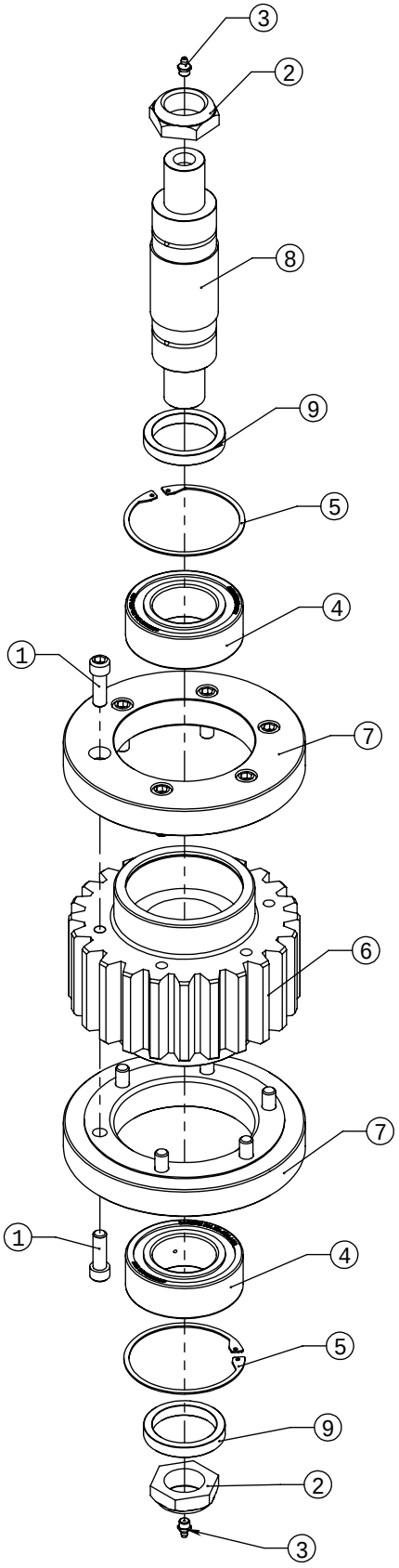

ILLUSTRATION 6.11: RACED IDLER GEAR ASSEMBLY EXPLODED

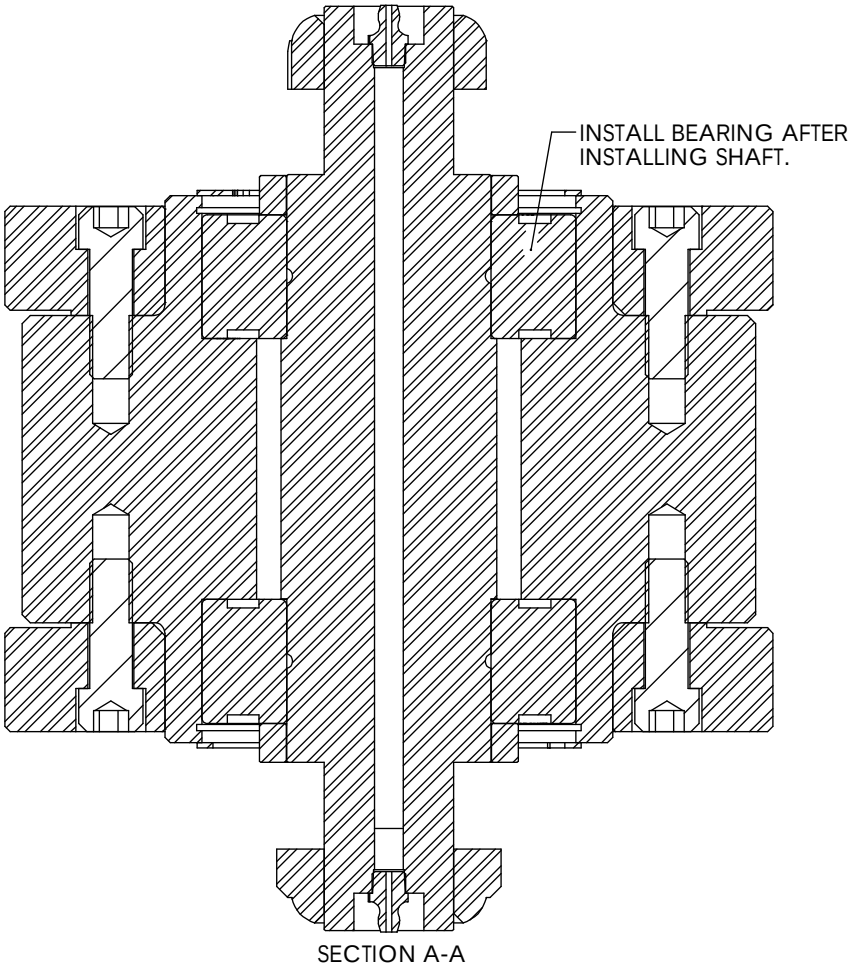

ILLUSTRATION 6.12: RACED IDLER GEAR ASSEMBLY

Item #	Qty.	Part Number	Part Name
1	12	1106-A	1/2-13 x 1 1/2 SHCS
2	2	1273	1 1/2-12 NYLOCK NUT
3	2	1001	1/8 NPT ZERT
4	2	1905	BEARING
5	2	1926	INTERNAL SNAP RING
6	1	82036	IDLER GEAR
7	2	82037	IDLER RACE
8	1	82038	IDLER SHAFT
9	2	82063	IDLER SPACER

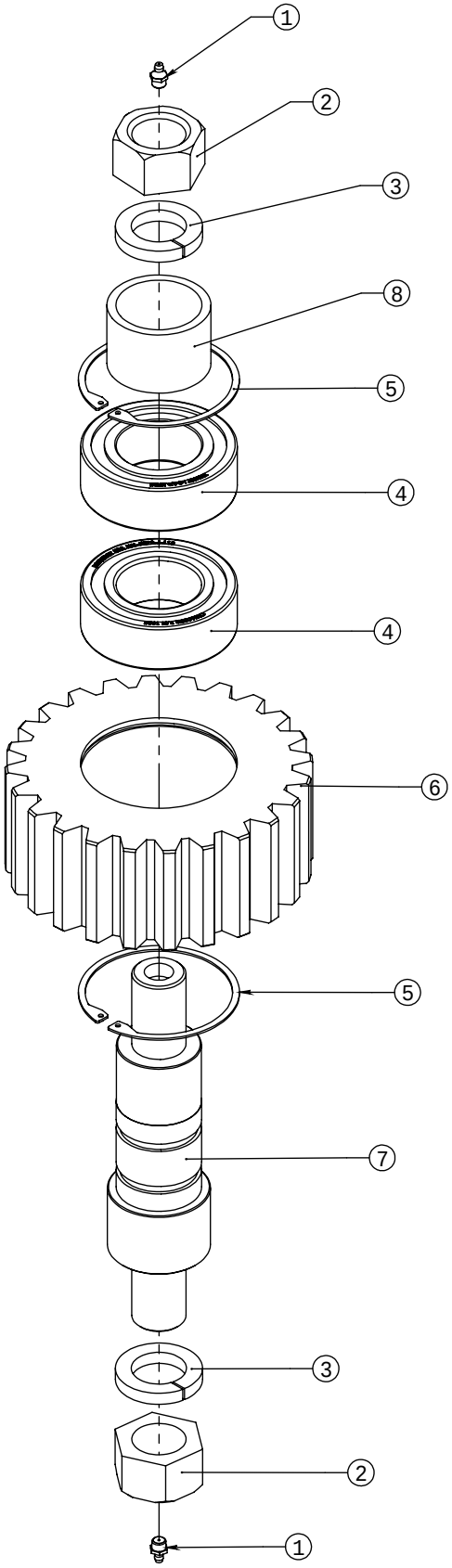

ILLUSTRATION 6.13: OUTBOARD IDLER GEAR ASSEMBLY EXPLODED

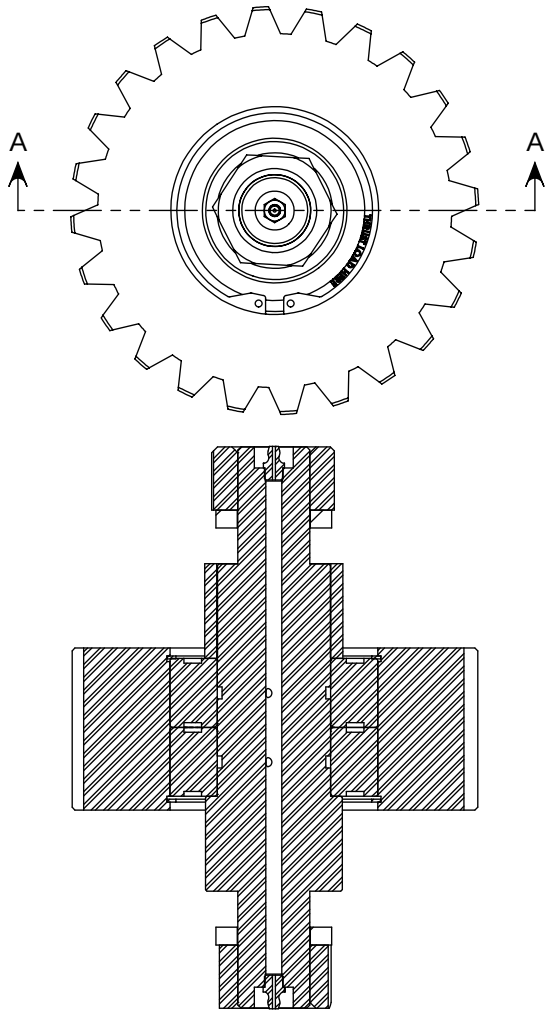

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ILLUSTRATION 6.14: OUTBOARD IDLER GEAR ASSEMBLY

Item #	Qty.	Part Number	Part Name
1	2	1001	1/8 NPT ZERT
2	2	1222	1 1/2"-12 HEX NUT
3	2	1223	1 1/2" LOCKWASHER
4	2	1905	BEARING
5	2	1926	INTERNAL SNAP RING
6	1	73077	IDLER GEAR
7	1	73078	OUTBOARD IDLER SHAFT
8	1	73088	OUTBOARD IDLER SPACER

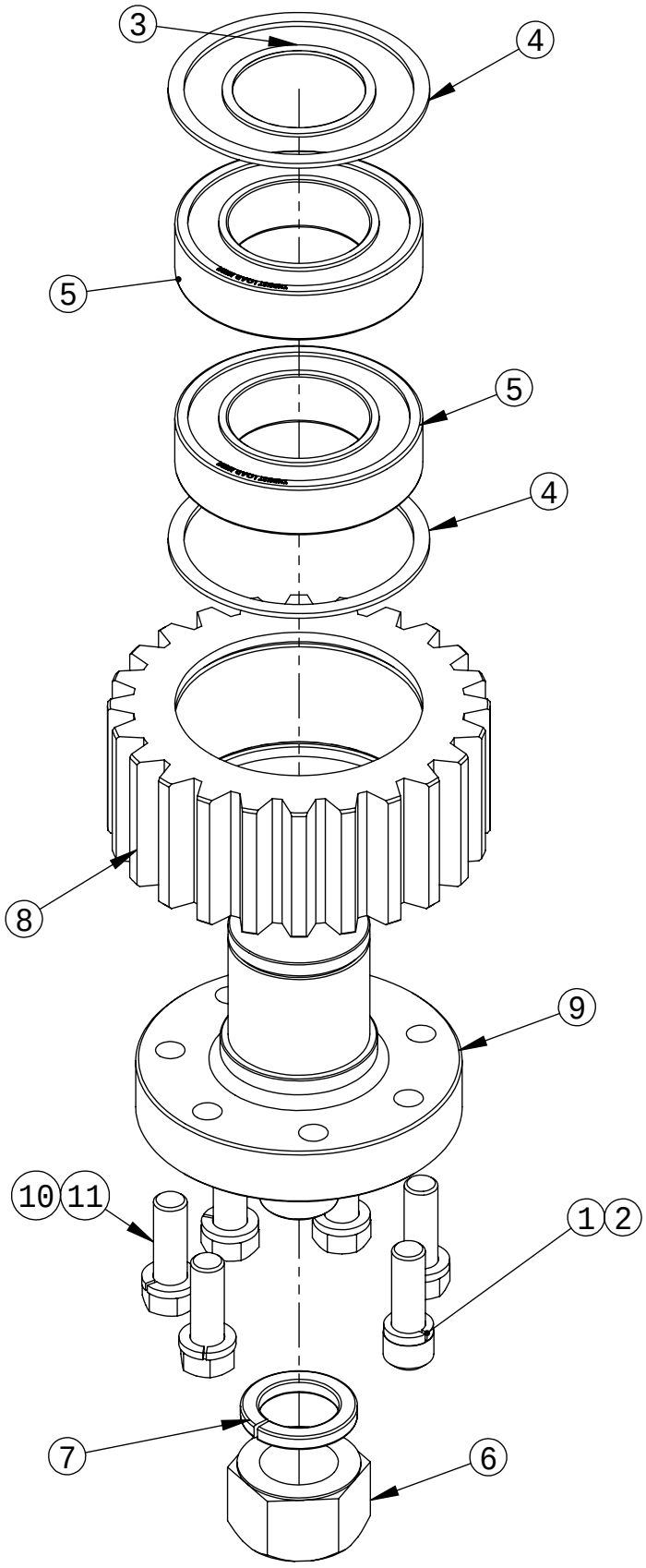
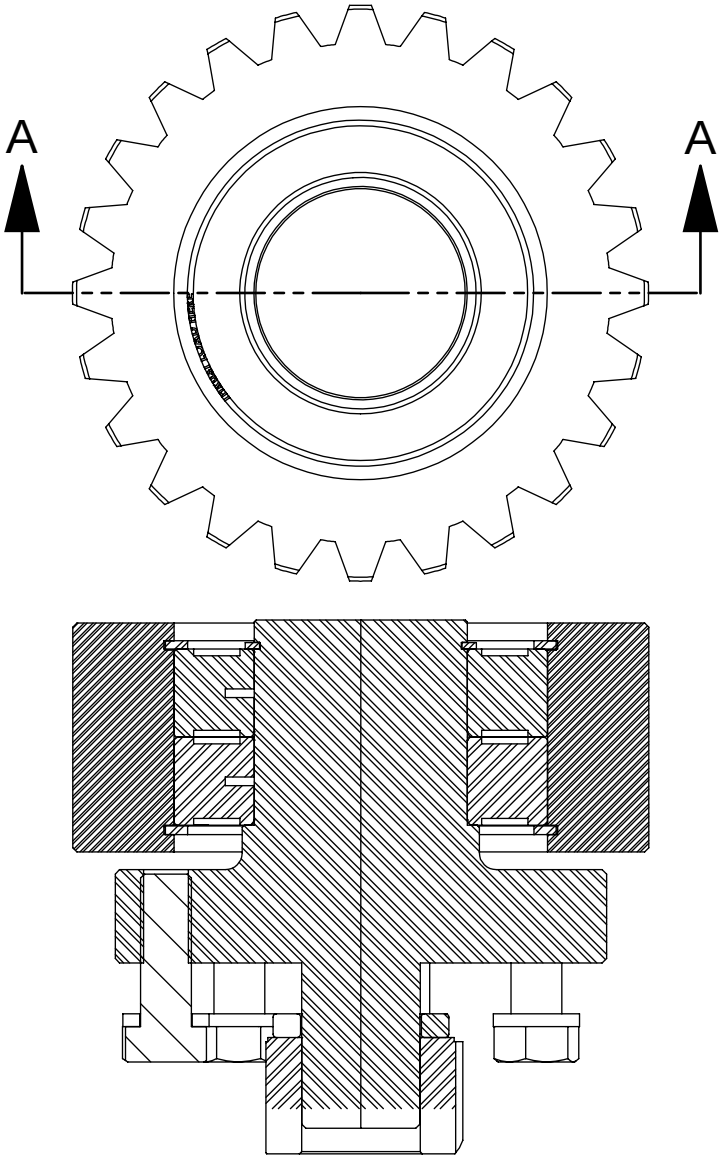


ILLUSTRATION 6.15: SHORT IDLER GEAR ASSEMBLY EXPLODED



SECTION A-A

ILLUSTRATION 6.16: SHORT IDLER GEAR ASSEMBLY

Item #	Qty.	Part Number	Part Name
1	1	1170-A	3/4 HI COLLAR LW
2	1	1277	3/4-10 x 2 1/4 SHCS
3	1	1944	EXTERNAL SPIROLOX RETAINING RING
4	2	1987	INTERNAL SPIROLOX RETAINING RING
5	2	1991	BEARING
6	1	73055	HEX NUT 1 3/4"-5 GR8
7	1	73056	1 3/4" LW
8	1	73077-01	IDLER GEAR
9	1	73089-01	SHORT IDLER SHAFT
10	5	1171	3/4" LOCKWASHER
11	5	1174	3/4"-10 X 2 1/4" HHCS

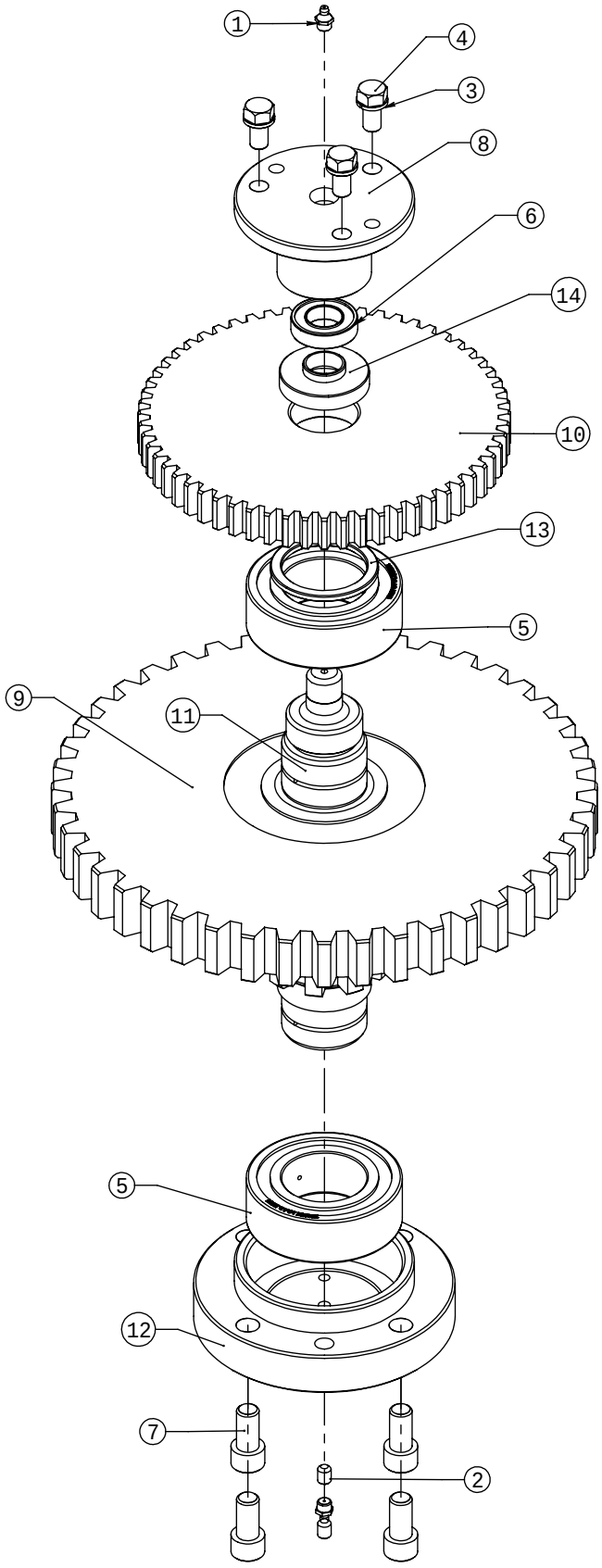


ILLUSTRATION 6.17: PINION GEAR ASSEMBLY EXPLODED

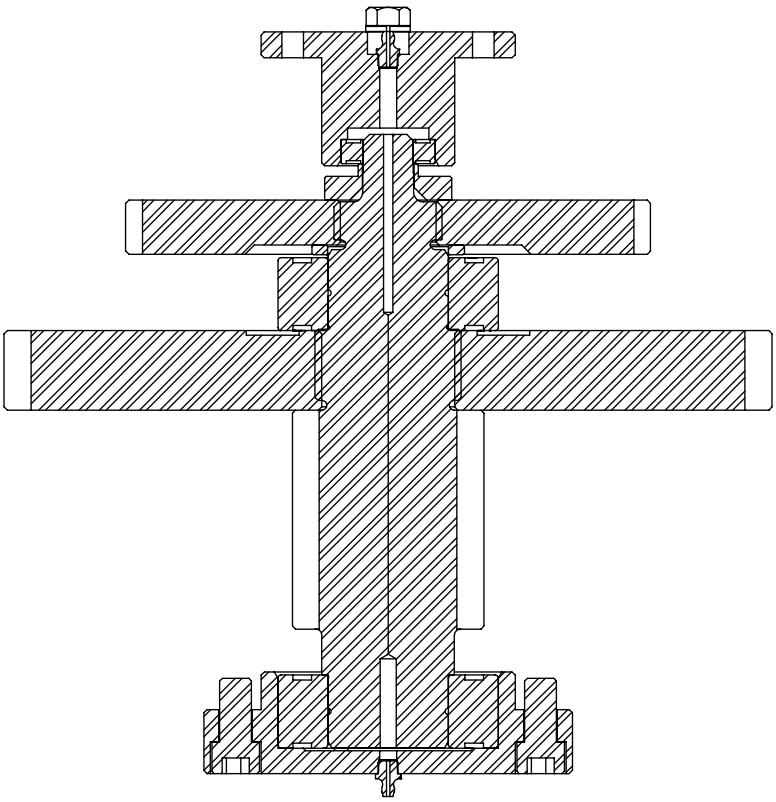


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ILLUSTRATION 6.18: PINION GEAR ASSEMBLY

Item #	Qty.	Part Number	Part Name
1	2	1001	1/8" NPT ZERT
2	2	1029	3/8"-16 X 1/2" SET SCREW
3	3	1103	1/2" LOCKWASHER
4	3	1110	1/2"-13 x 1" HHCS
5	2	1905	BEARING
6	1	1909	BEARING
7	4	256	5/8"-11 X 1 1/4" SHCS
8	1	73066-01	UPPER PINION BEARING CAP
9	1	73079-01	LOWER PINION GEAR
10	1	73081-01	HIGH GEAR
11	1	73082-03	PINION GEAR
12	1	73085	LOWER PINION BEARING CAP
13	1	73092	LOWER HIGH GEAR SPACER
14	1	73093	UPPER HIGH GEAR SPACER

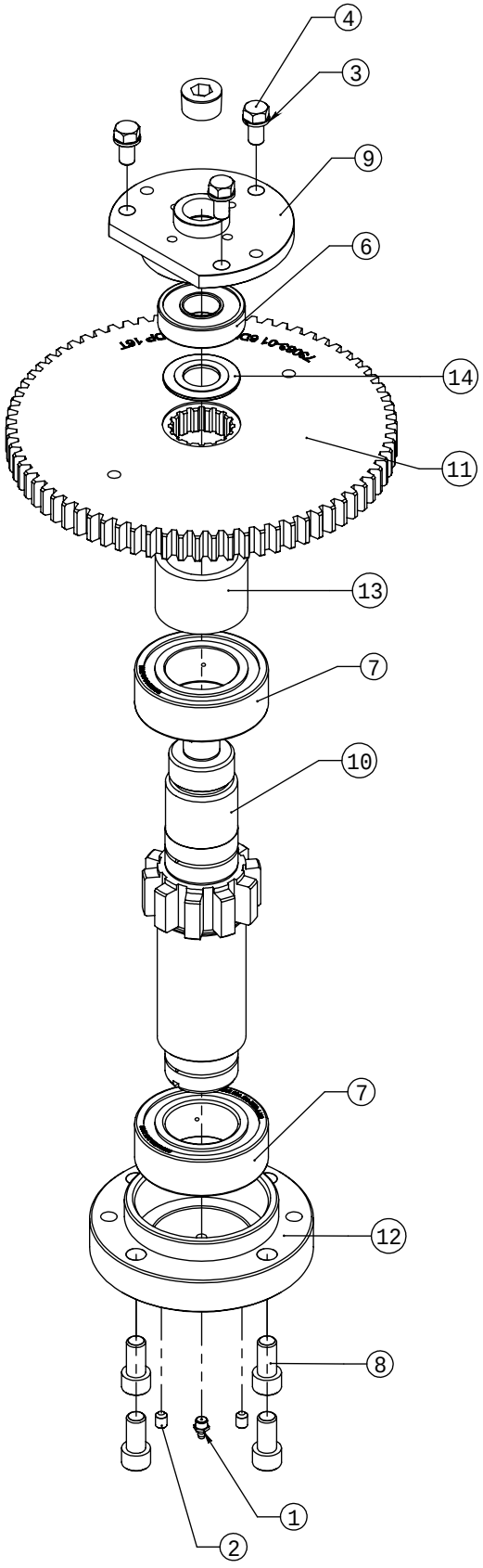
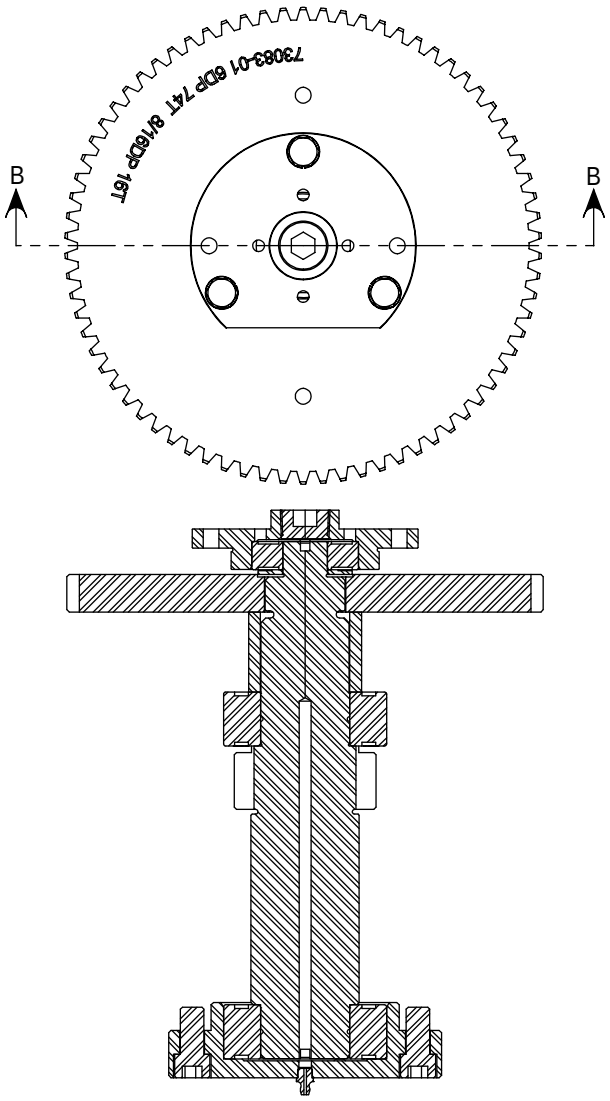


ILLUSTRATION 6.19: SECONDARY GEAR ASSEMBLY EXPLODED



SECTION B-B

ILLUSTRATION 6.20: SECONDARY GEAR ASSEMBLY

Item #	Qty.	Part Number	Part Name
1	1	1001	1/8 NPT ZERT
2	2	1029	3/8"-16 X 1/2" SET SCREW
3	3	1103	1/2" LOCKWASHER
4	3	1110	1/2"-13 x 1" HHCS
5	1	1611	1" NPT FLUSH PLUG
6	1	1901	BEARING
7	2	1905	BEARING
8	4	256	5/8"-11 X 1 1/4" SHCS
9	1	55143	TOP SECONDARY BEARING CAP
10	1	73080-02	SECONDARY INPUT GEAR
11	1	73083-01	UPPER LOW PINION GEAR
12	1	73085	LOWER PINION BEARING CAP
13	1	73097-01	UPPER LOW SPACER
14	1	73098	UPPER LOW PINION UPPER SPACER

Please refer to the following instructions when installing the proprietary sealed roller bearing, part number 1905, in an idler assembly. This full-compliment roller design offers greater load ratings than commercially available sealed ball bearings. The ported inner race allows the bearing to be re-lubricated without disassembly while the integral elastomeric seals allow grease to be be displaced without allowing migration of contaminants into the bearing.

The corrosion-resistant elastomeric seals are suitable for use in environments that are incompatible with traditional aluminum bearing shrouds. The unique geometric design allows rollers to absorb thrust loads to maximize component life.

Nominal I.D.	4.3307 in (110 mm)
Nominal O.D.	2.3622 in (60 mm)
Nominal Ht	1.4375 in (36.5 mm)
static rating	37540 lbs (17064 kg)
dynamic rating	29230 lbs (13286 kg) *

* 1 mm cycles, 33-⅓ RPM f/500 hours

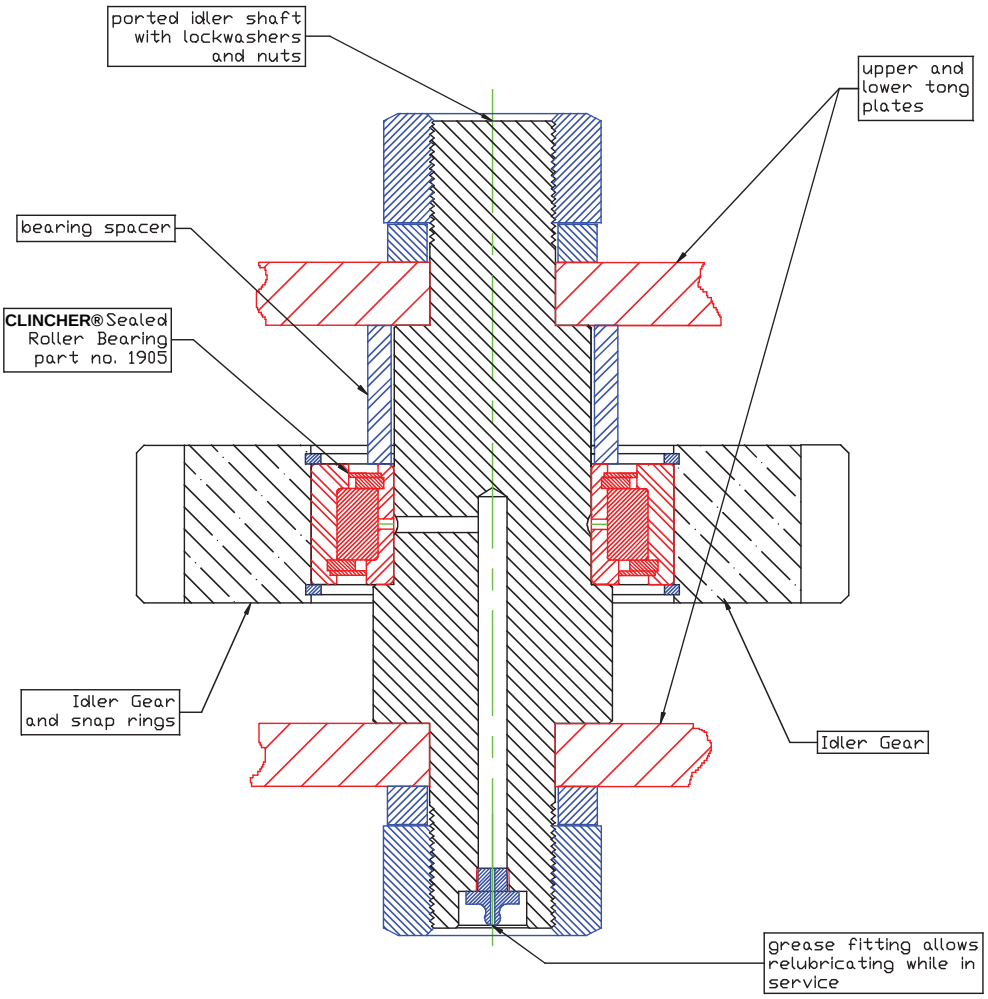


ILLUSTRATION 6.21: 1905 BEARING - SECTION VIEW OF TYPICAL APPLICATION

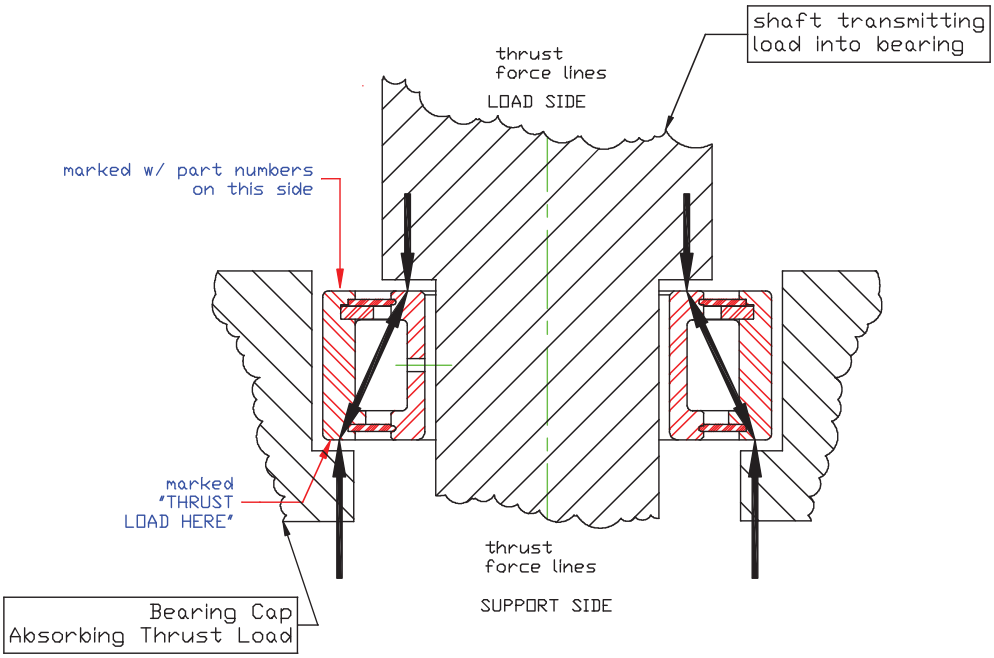


ILLUSTRATION 6.22: 1905 BEARING - BOTTOM BEARING CAP APPLICATION

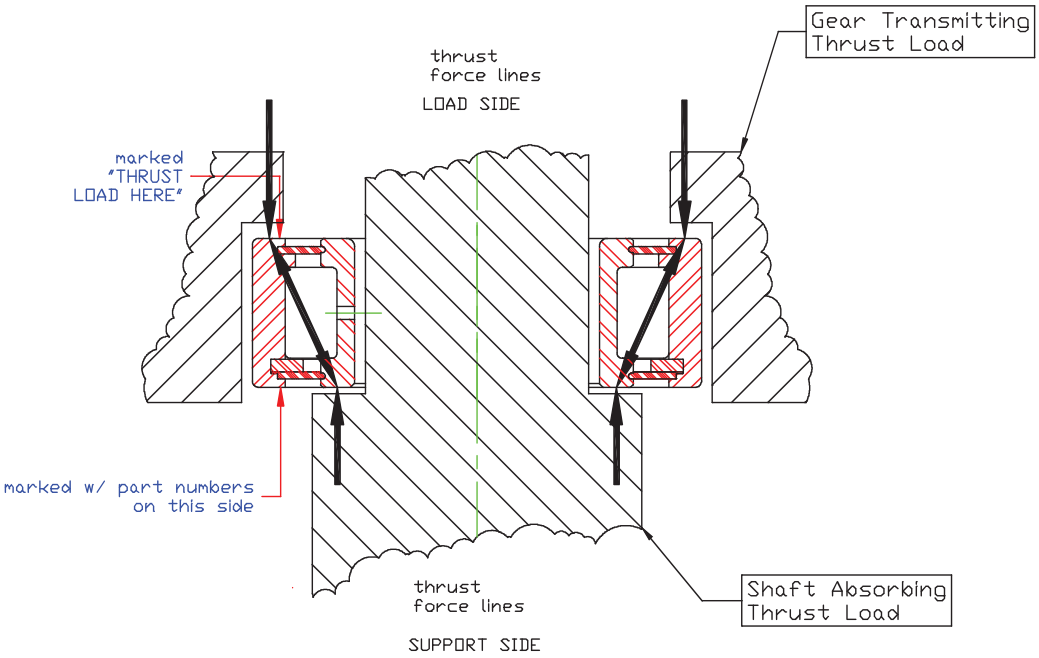


ILLUSTRATION 6.23: 1905 BEARING - GEAR SUPPORT APPLICATION

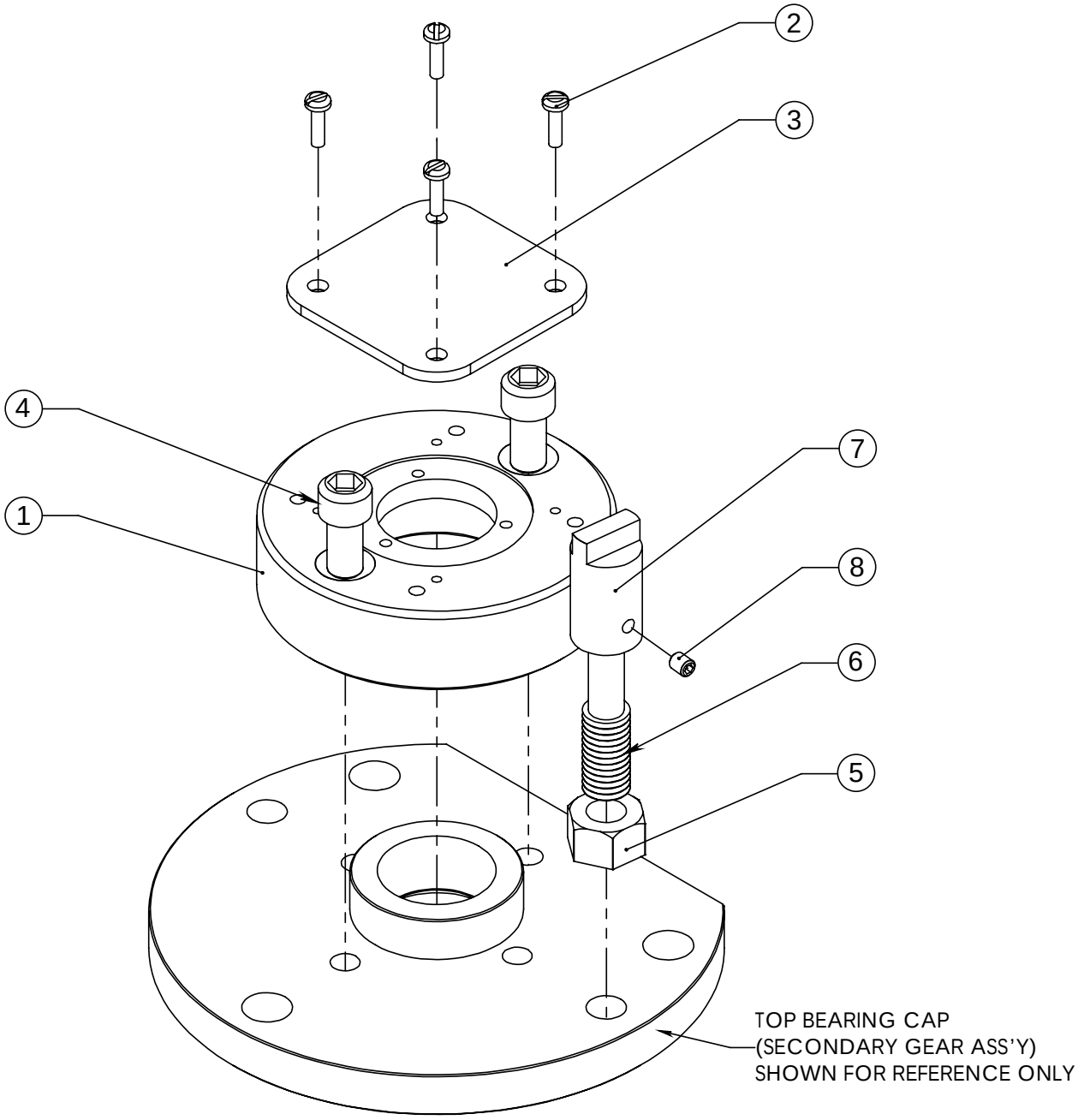


ILLUSTRATION 6.24: ENCODER ASSEMBLY EXPLODED

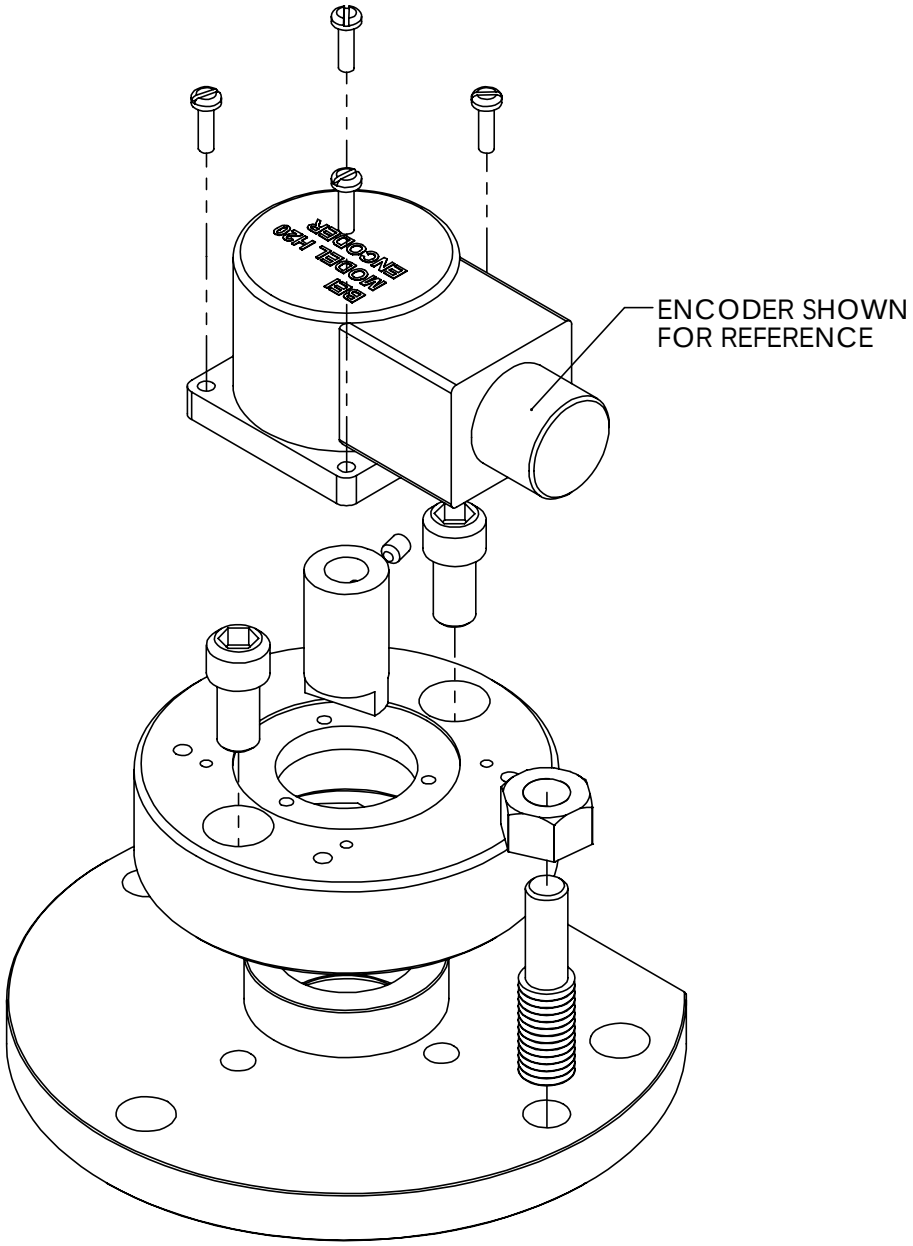


ILLUSTRATION 6.25: ENCODER ASSEMBLY

Item	Type	Description	Qty	Part Number
1	Part	Encoder mounting plate	1	51075
2	Part	#6-32 x ⅜" machine screw	4	1276-B
3	Part	Cover plate	1	40034
4	Part	⅜" UNC x ¾" hex socket head cap screw	2	1040-A
5	Part	½" UNC hex nut	1	1101
6	Part	Encoder coupling mount	1	51031
7	Part	Encoder coupling	1	55144
8	Part	#10-32 x ¼" hex socket head set screw	1	1034

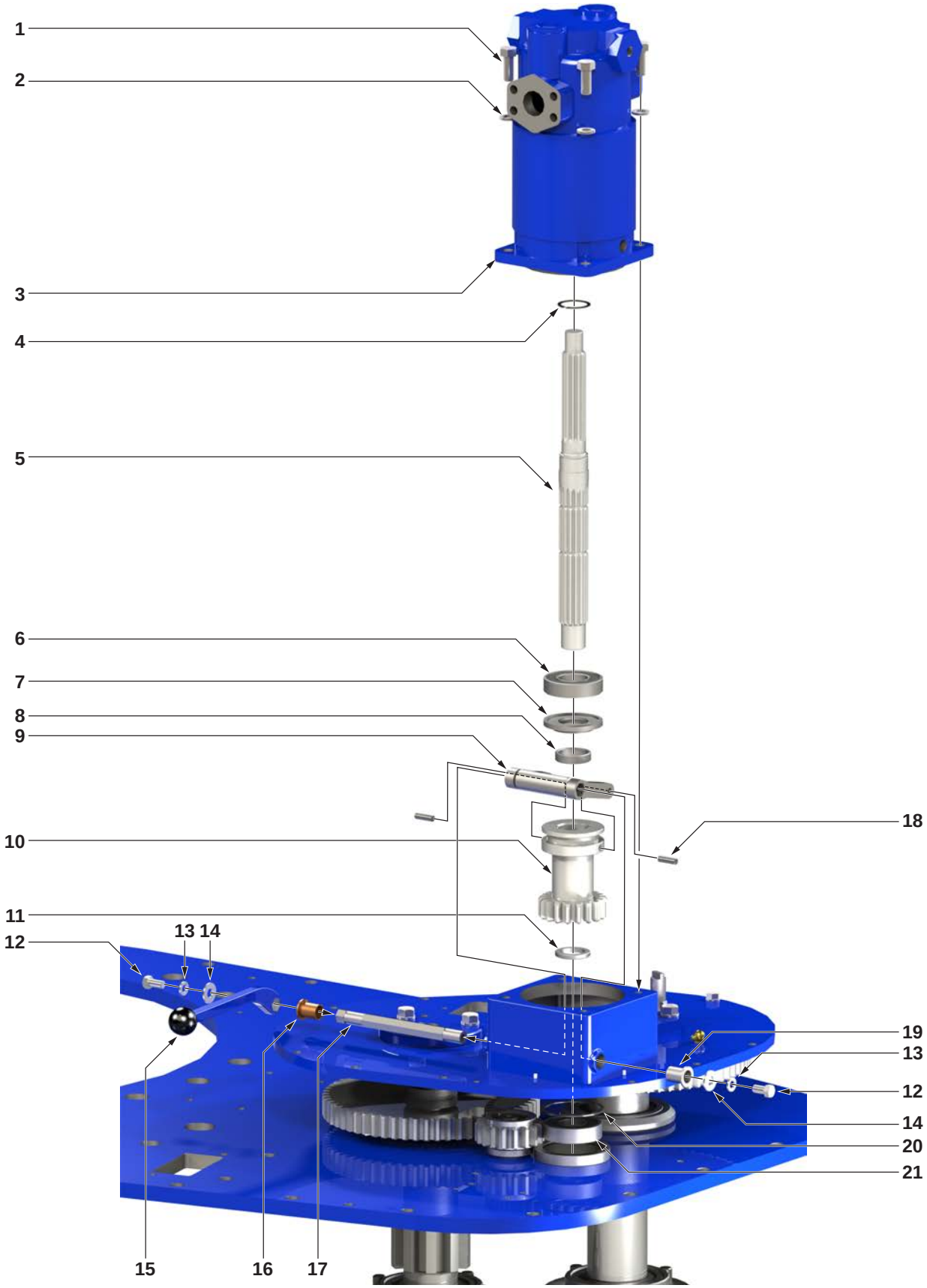


ILLUSTRATION 6.26: MOTOR & SHIFTER ASSEMBLY EXPLODED

ILLUSTRATION 6.27: MOTOR & SHIFTER ASSEMBLY

Item	Type	Description	Qty	Part Number
1	Part	½" UNC x 1-¼" hex head cap screw, GR8	4	1111
2	Part	½" lock washer, GR8	4	1103
3	Part	2-speed hydraulic motor	1	20099
4	Part	1-⅜" external snap ring	1	1945
5	Part	Splined motor shaft	1	73040-01
6	Part	Ball bearing	1	0150710
7	Part	Motor shaft seal retainer plate	1	55088
8	Part	Motor spacer	1	55085
9	Assembly	Shifting yoke (includes item 18 x 2)	1	45072
10	Part	Drive gear	1	55084-02
11	Part	Motor shaft bearing spacer	1	55121-01
12	Part	⅜" UNC x ¾" hex head cap screw, GR8	2	1046
13	Part	⅜" lock washer, GR8	2	1027
14	Part	⅜" flat washer, GR8	2	1025
15	Assembly	Shifting handle (includes the following)		
	Part	Straight yoke handle	1	45142
	Part	⅜" UNC x 1" hex socket head set screw	1	1030
	Part	Shifting handle knob	1	55071
16	Part	Half flange bearing	2	45106-A
17	Part	Shifting shaft	1	45143
18	Part	5/16" x 1" dowel pin	2	1023-G
19	Part	Self-lubricating flanged bushing	1	45092
20	Part	Internal retaining ring	1	1948
21	Part	Bottom motor shaft bearing	1	1901

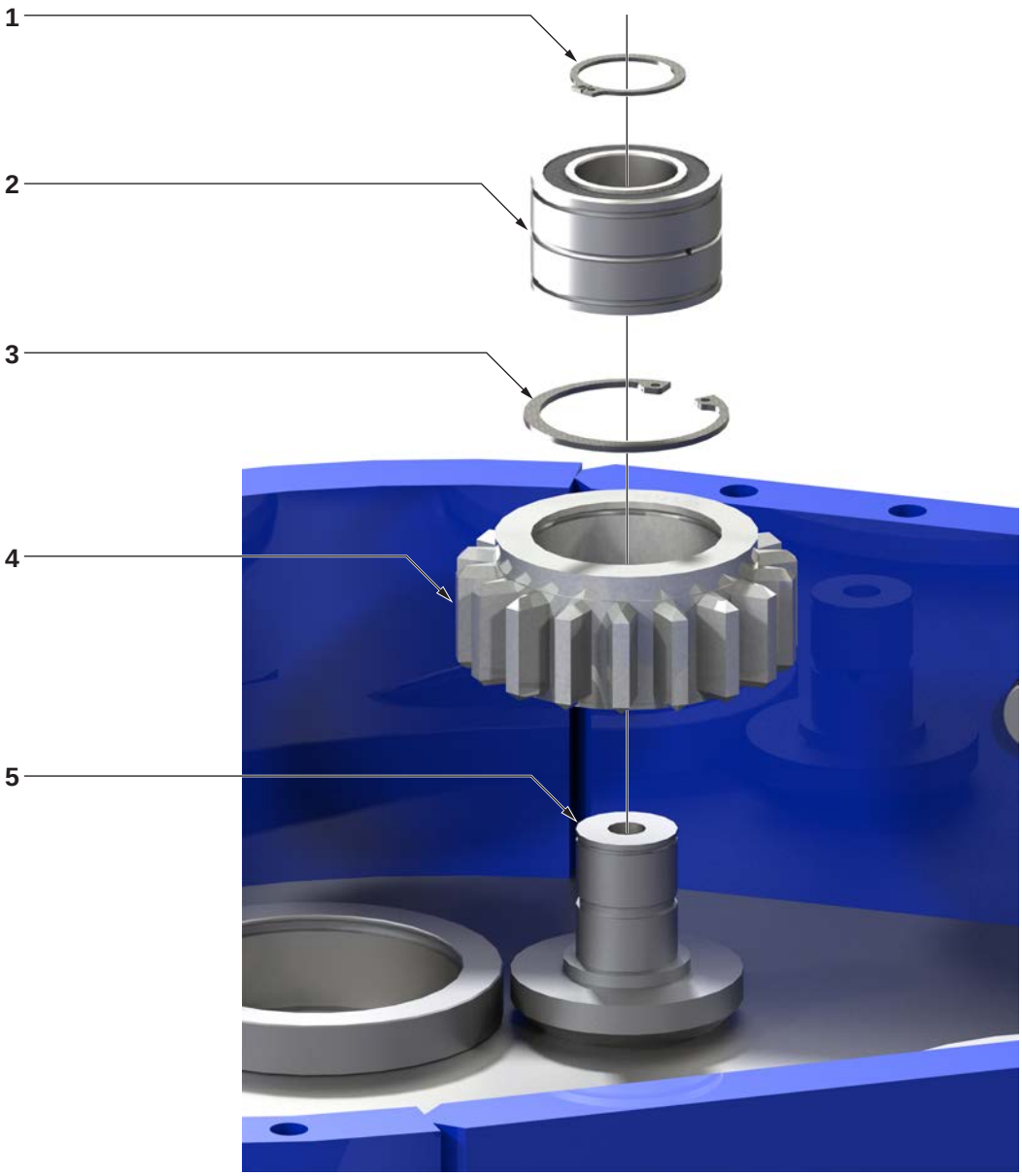


ILLUSTRATION 6.28: HIGH GEAR IDLER ASSEMBLY EXPLODED

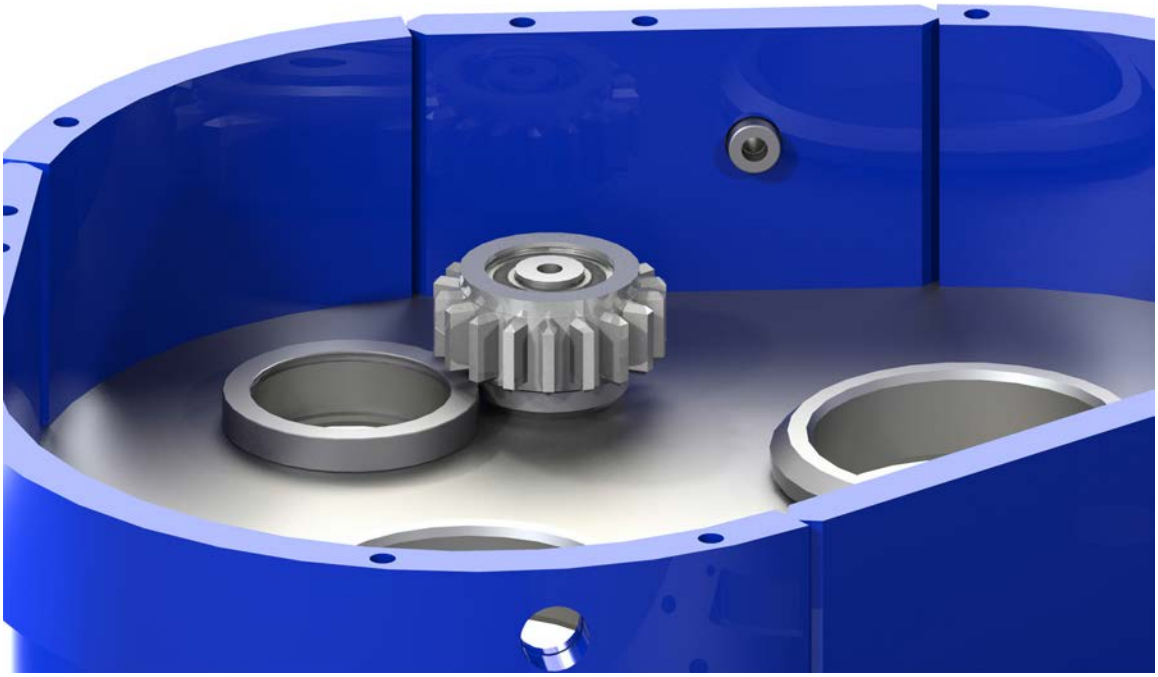


ILLUSTRATION 6.29: HIGH GEAR IDLER ASSEMBLY

Item	Type	Description	Qty	Part Number
1	Part	1” external retaining ring	1	1950
2	Part	Cylindrical roller bearing	1	1920
3	Part	1-⅞” internal retaining ring	1	1949
4	Part	Idler gear	1	55123-03
5	Part	Idler shaft (typically welded to top plate weldment - shown for illustration purposes only)		

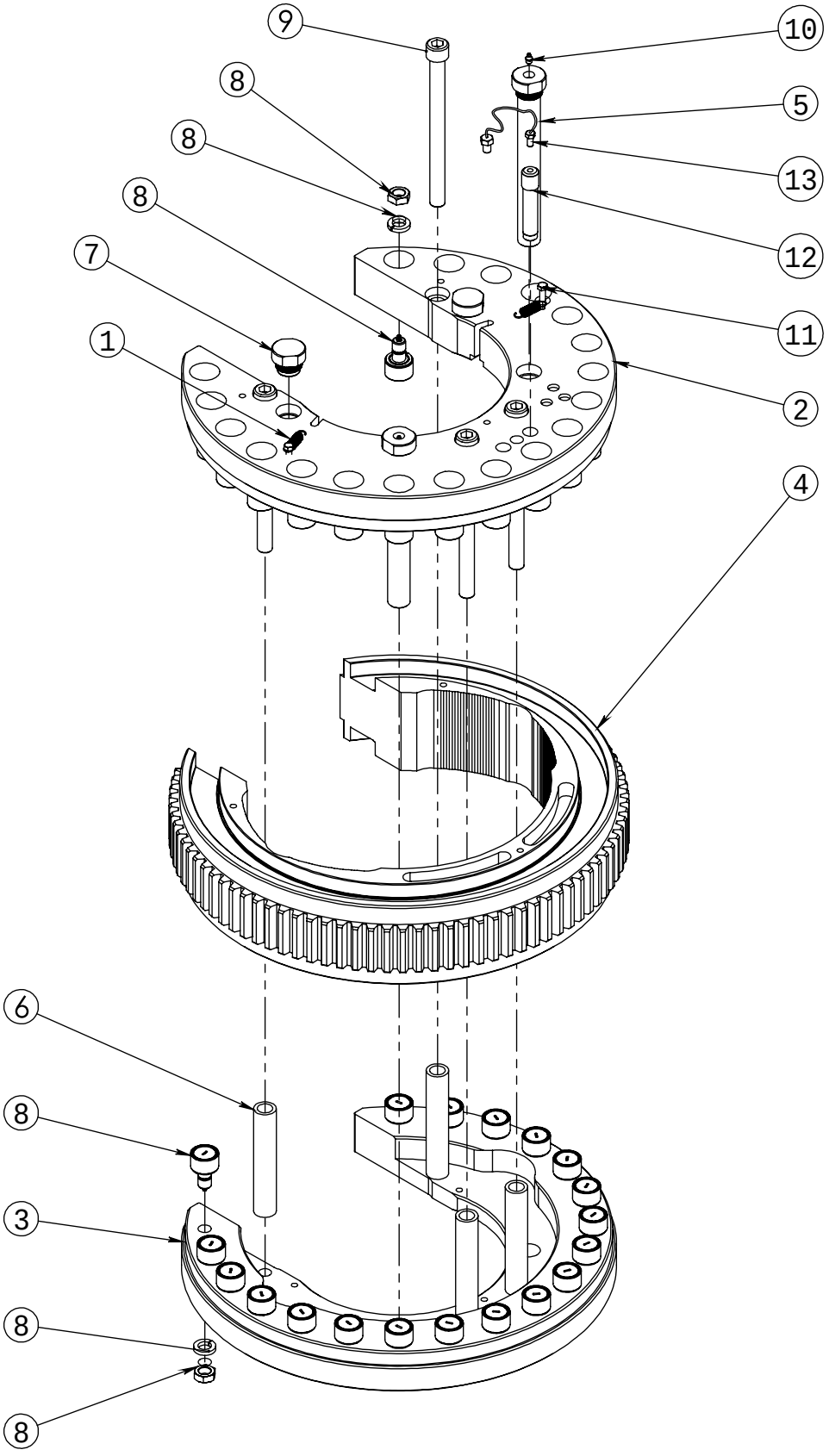


ILLUSTRATION 6.30: CAGE PLATE ASSEMBLY EXPLODED

Item	Type	Description	Qty	Part Number
1	Part	Jaw retraction spring	2	58102
2	Part	Top cage plate	1	14007-04
3	Part	Bottom cage plate	1	14008-04
4	Part	Ring gear	1	14009-06
5	Part	Jaw pivot bolt	2	14623-01
6	Part	Cage plate spacer	4	14647
7	Part	Thread protector	2	14800
8	Assembly	1-⅞" cam follower assembly (see below)	38	SSCF1875
9	Part	1" UNC x 9" hex socket head cap screw	4	1093
10	Part	⅛" NPT grease fitting	2	1001
11	Part	⅜" UNC x 1" hex head cap screw	2	1047
12	Part	Reversing pin	1	14729
13	Assembly	Reversing pin connecting chain assembly	1	14801

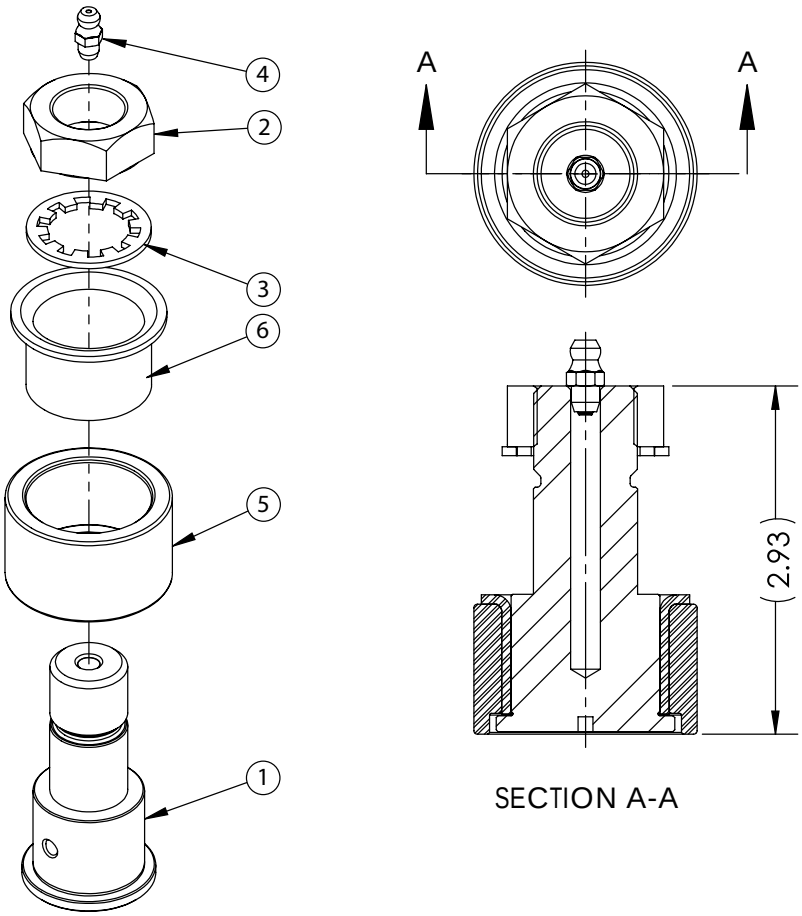


ILLUSTRATION 6.31: 1-⅞" CAM FOLLOWER EXPLODED

Item	Type	Description	Qty	Part Number
1	Part	Jaw retraction spring	2	58102
2	Part	Top cage plate	1	14007-04
3	Part	Bottom cage plate	1	14008-04
4	Part	Ring gear	1	14009-06
5	Part	Jaw pivot bolt	2	14623-01
6	Part	Cage plate spacer	4	14647

Jaw die kits up to 11-⅞" use welded jaws.
See Pp. 2.20 for a list of available sizes.

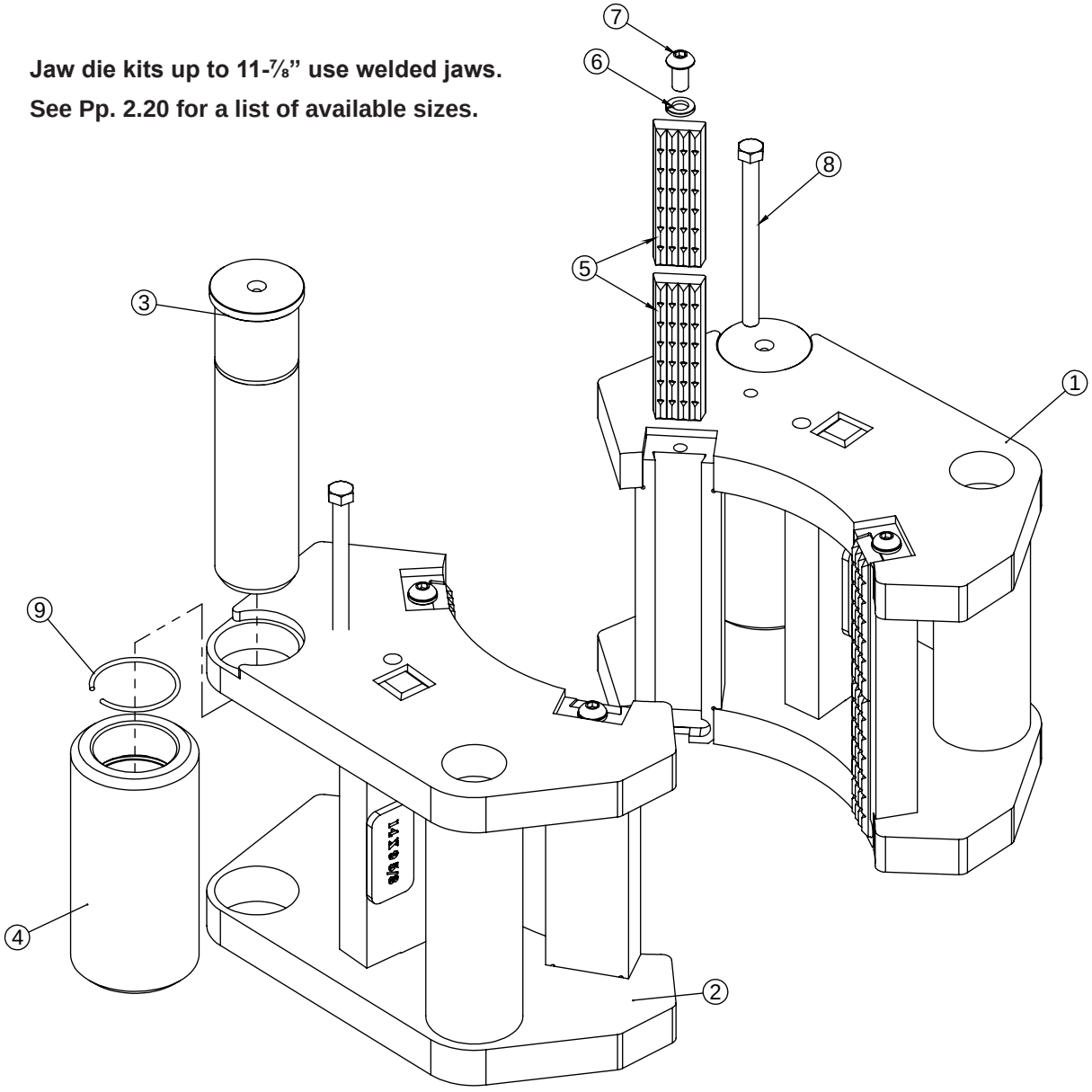


ILLUSTRATION 6.32: TYPICAL JAW DIE KIT - WELDED JAW (9-⅝" SHOWN)

Item #	Qty.	Part Number	Part Name
1	1	14XXXXXXL(1)	14 DP X XXXX LEFT JAW WELDMENT
2	1	14XXXXXXR(1)	14 DP X XXXX RIGHT JAW WELDMENT
3	2	14666	JAW PIN
4	2	14667	JAW ROLLER
5	8	DTI1601	1/2 x 1 1/4 x 3 7/8 DOVETAIL INSERT
6	4	1027	WASHER, LOCK 3/8"
7	4	1061	3/8"-16 X 3/4" BUTTON HD CS
8	2	1076	3/8-16 x 4 3/4 HHCS
9	2	RR1000-206	2" RETAINING RING

1. Where "XXXXXL" and "XXXXXR" indicate the jaw weldment size. For example "14X09625L" is the P/N for a 9-⅝" LH jaw

Jaw die kits 12” and up use solid jaws.

See Pp. 2.20 for a list of available sizes.

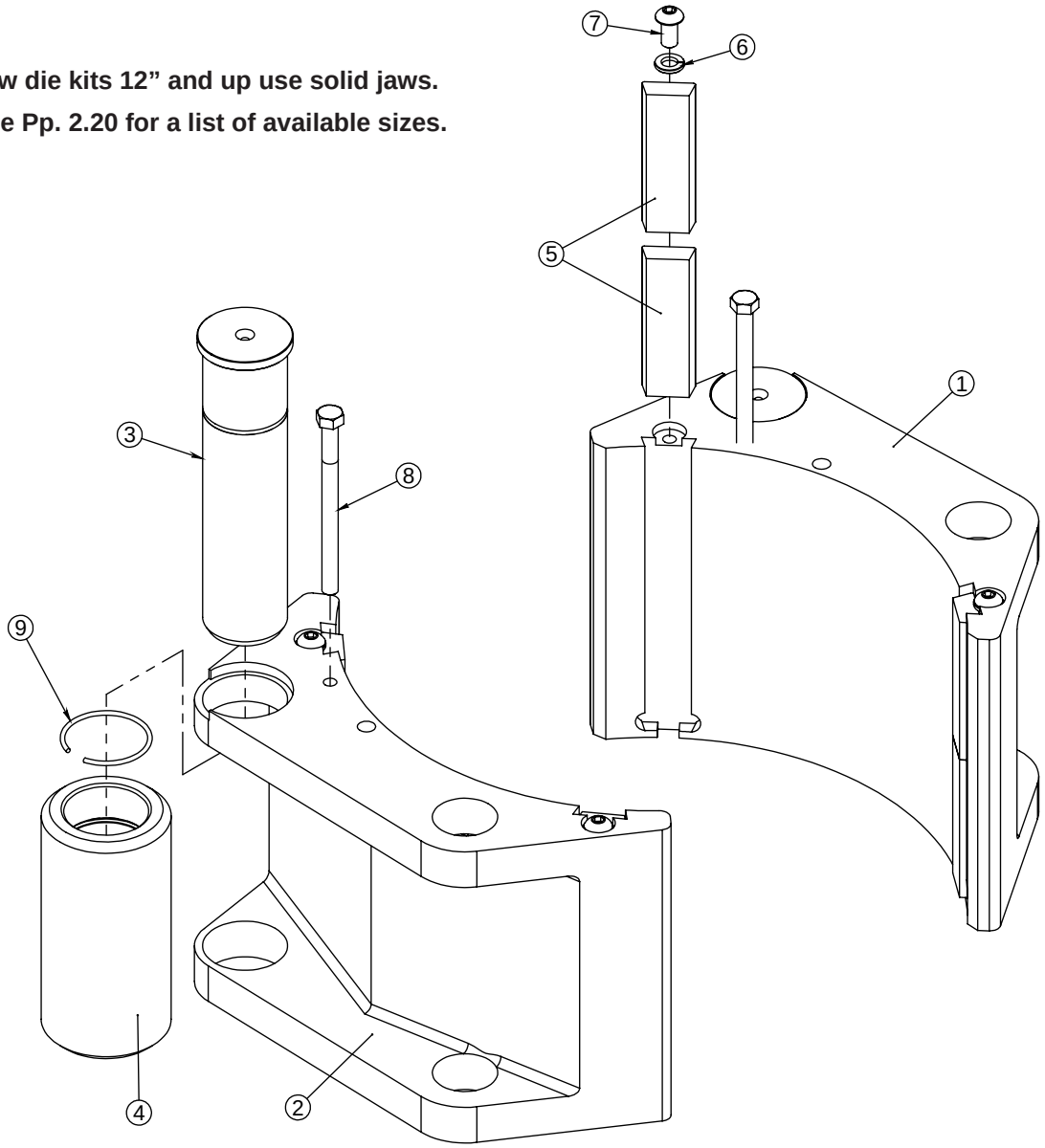


ILLUSTRATION 6.33: TYPICAL JAW DIE KIT - SOLID JAW (14” SHOWN)

Item #	Qty.	Part Number	Part Name
1	1	14620-XXXXX	LEFT DOVETAIL SOLID JAW
2	1	14621-XXXXX	RIGHT DOVETAIL SOLID JAW
3	2	14666	JAW PIN
4	2	14667	JAW ROLLER
5	8	DTI1601	1/2 x 1 1/4 x 3 7/8 DOVETAIL INSERT
6	4	1027	WASHER, LOCK 3/8"
7	4	1061	3/8"-16 X 3/4" BUTTON HD CS
8	2	1076	3/8-16 x 4 3/4 HHCS
9	2	RR1000-206	2" RETAINING RING

1. Where “XXXXX” indicates the solid jaw size. For example “14620-14000” is the P/N for a 14” LH solid jaw

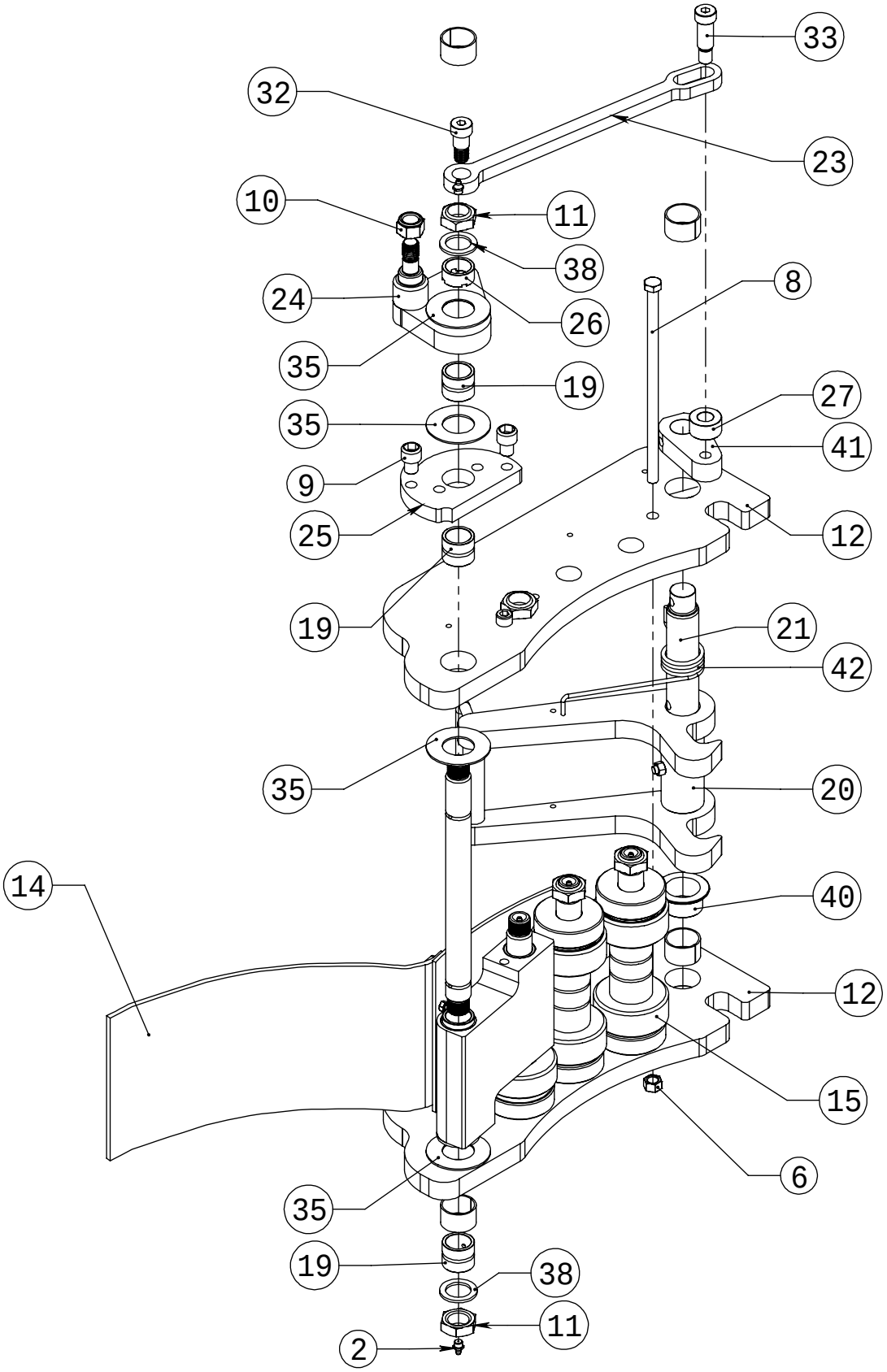


ILLUSTRATION 6.34: DOOR ASSEMBLY EXPLODED

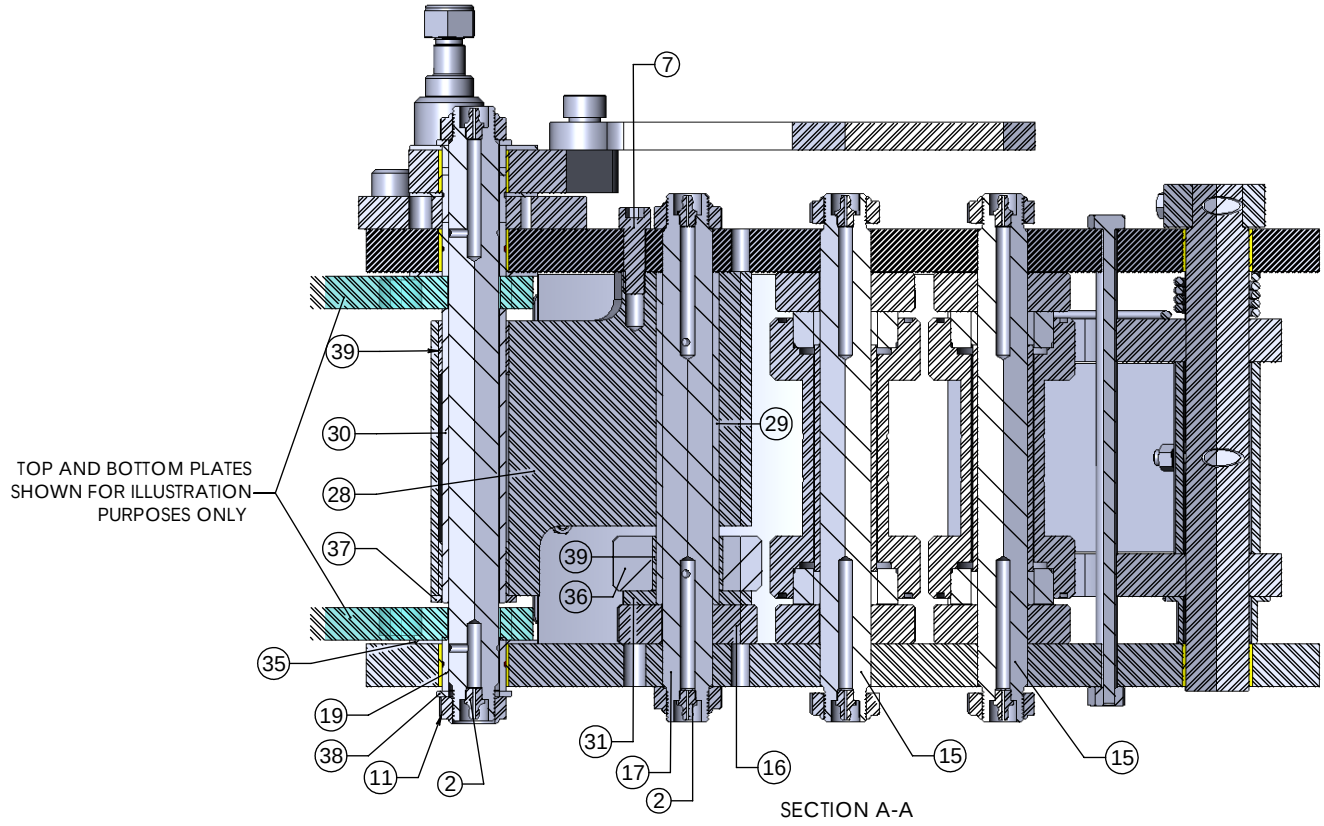


ILLUSTRATION 6.35: DOOR ASSEMBLY

Item #	Qty.	Part Number	Description	Item #	Qty.	Part Number	Description
1	2	100	¼" UNC hex nut GR8	22	1	14684	Tong door cover
2	4	1001	⅛" NPT grease fitting	23	1	1468602	Door latch linkage
3	2	1024	⅜" UNC hex nut	24	1	1471602	Door pivot linkage weldment
4	2	105	¼" UNC x 1" hex head cap screw GR8	25	1	14732-01	Door spacer
5	2	1060	⅜" UNC x 2-½" hex head cap screw	26	1	14733	Door pivot bushing
6	1	1101	½" UNC hex nut	27	1	1473401	Door arm spacer
7	1	1106-A	½" UNC x 1-½" socket head cap screw	28	1	14772	Door support
8	1	1128	½" UNC x 11" hex head cap screw	29	1	14773	Door roller spacer
9	2	1153-A	⅝" UNC x ¾" socket head cap screw	30	1	14774	Door support spacer
10	1	1167	¾" UNC hex nylock nut	31	1	14775	Door roller washer
11	4	1213	1" UNF thin hex nylock nut	32	1	1676A	⅝" UNC x ¾" SS UNC shoulder bolt
12	2	14604-S1	Tong door plate	33	1	1682	¾" x 1-½" SS UNC shoulder bolt
13	1	14672	Door flao mounting plate	34	5	2021	1-½" x 1" DU bearing
14	1	14673	Rubber door flap, ¼" DP tong	35	4	2025	Tong door thrust spacer
15	2	14675	Door-mounted dumbbell roller assembly	36	1	20262	Ring gear support roller
16	1	14676	Door roller spacer	37	1	20266	Door support thrust bushing
17	1	14677	Door dumbbell shaft	38	2	2040	Door bushing
18	1	14678	Door pivot shaft	39	3	24DU20	Garlock bushing
19	3	14679	Door pivot bushing	40	1	55027	Door bushing
20	1	14681	Door latch weldment	41	1	82042	Arm
21	1	14682	Door latch pivot pin	42	1	SMH1501-N	Torsion spring

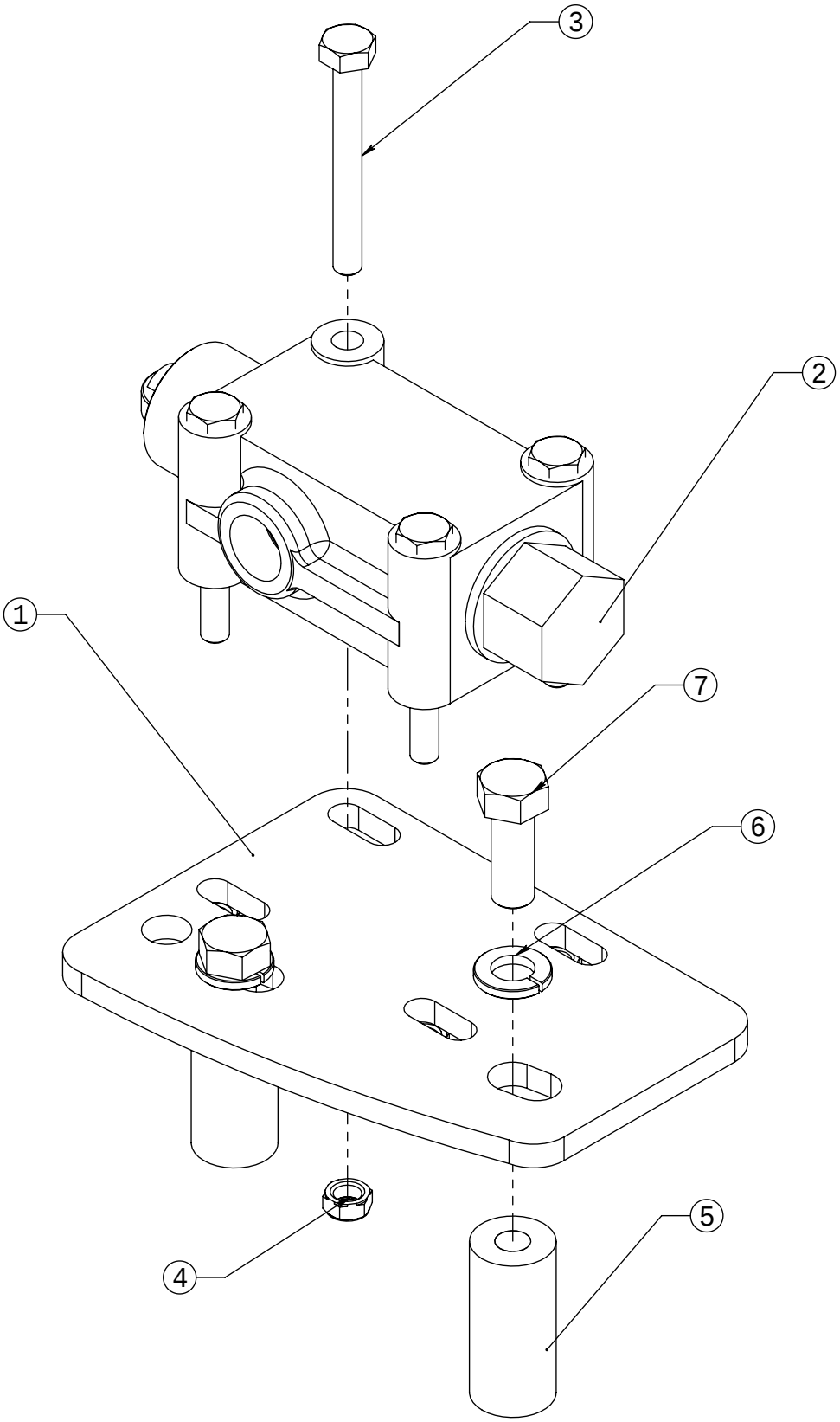


ILLUSTRATION 6.36: SAFETY DOOR SWITCH ASSEMBLY EXPLODED

Item	Type	Description	Qty	Part Number
1	Part	Backup sensor mount base	1	76128-S2
2	Part	Normally-closed self-lubricated hydraulic switch	1	SLV1000-01
3	Part	¼" UNC x 2-¼" hex cap screw	4	110
4	Part	¼" UNC hex nylock nut	4	212
5	Part	Door switch base mount	2	22246-S1
6	Part	⅜" lock washer	2	1027
7	Part	⅜" UNC x 1" hex head cap screw	2	1047

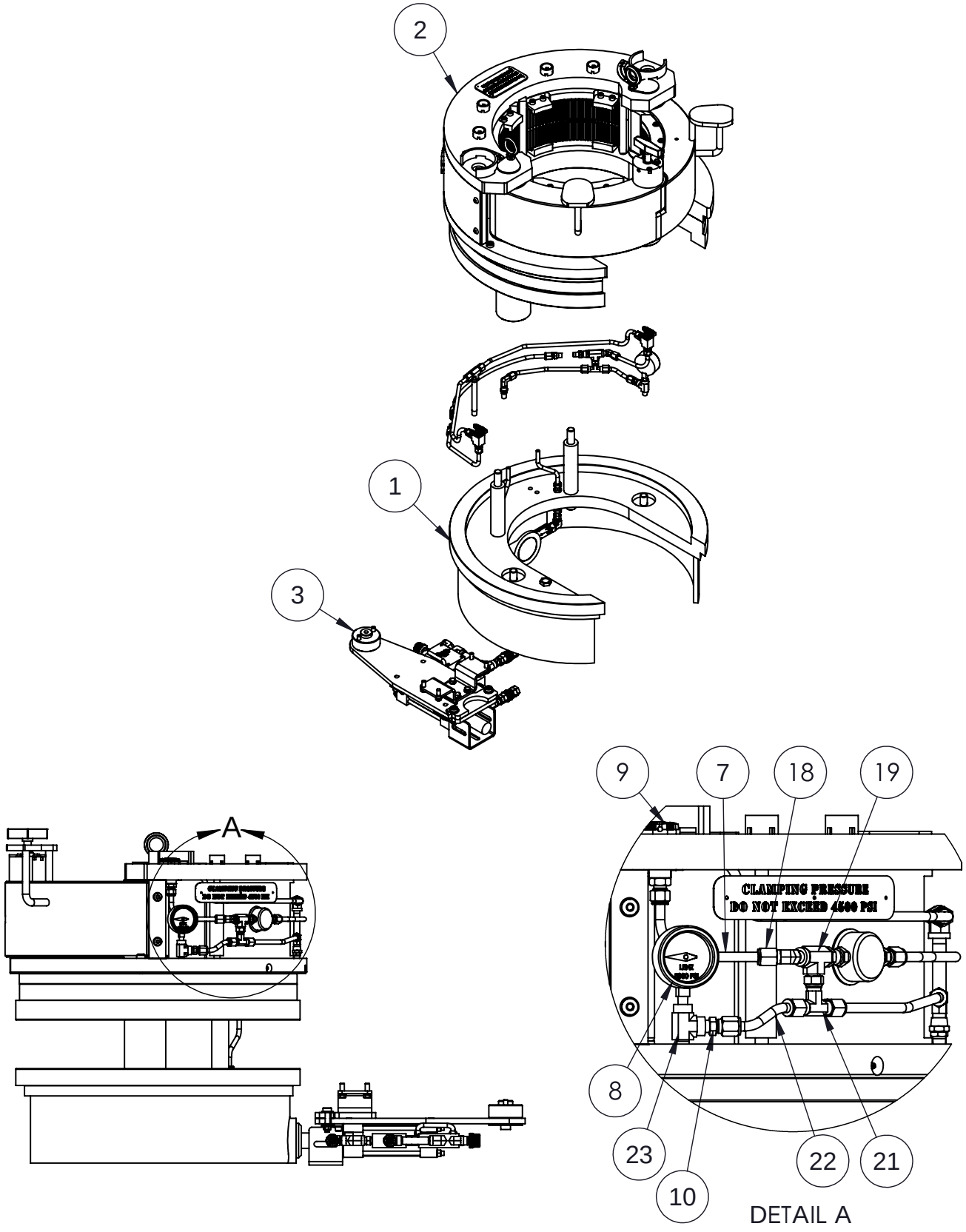
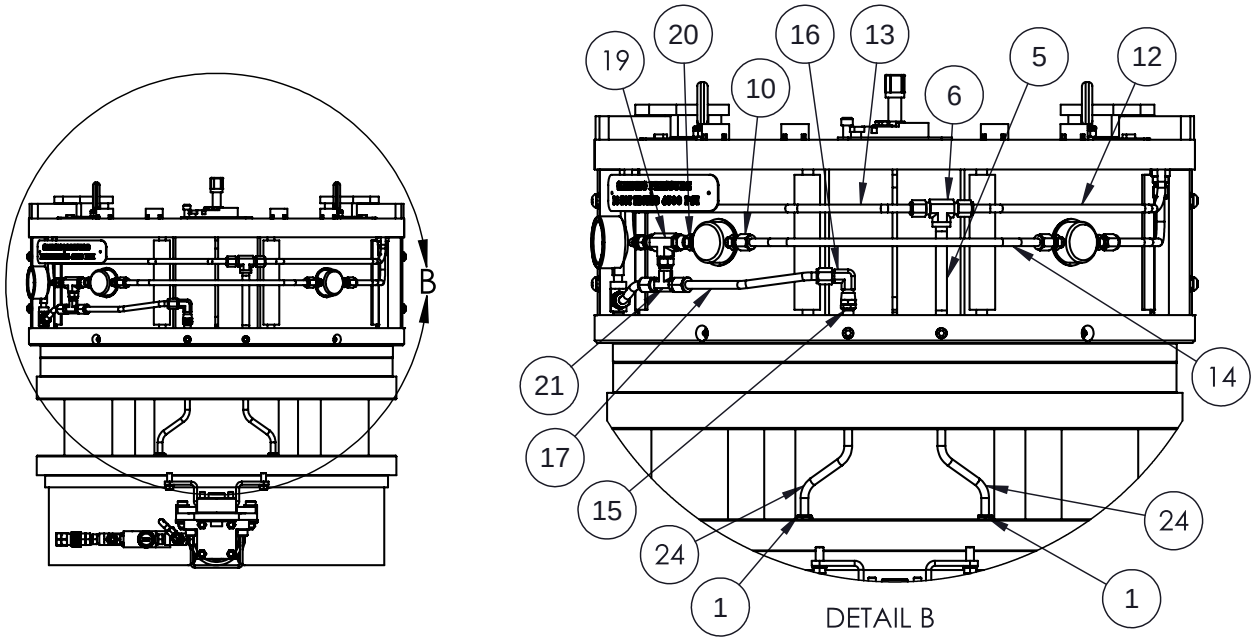


ILLUSTRATION 6.37: 15" CHROMEMASTER 01



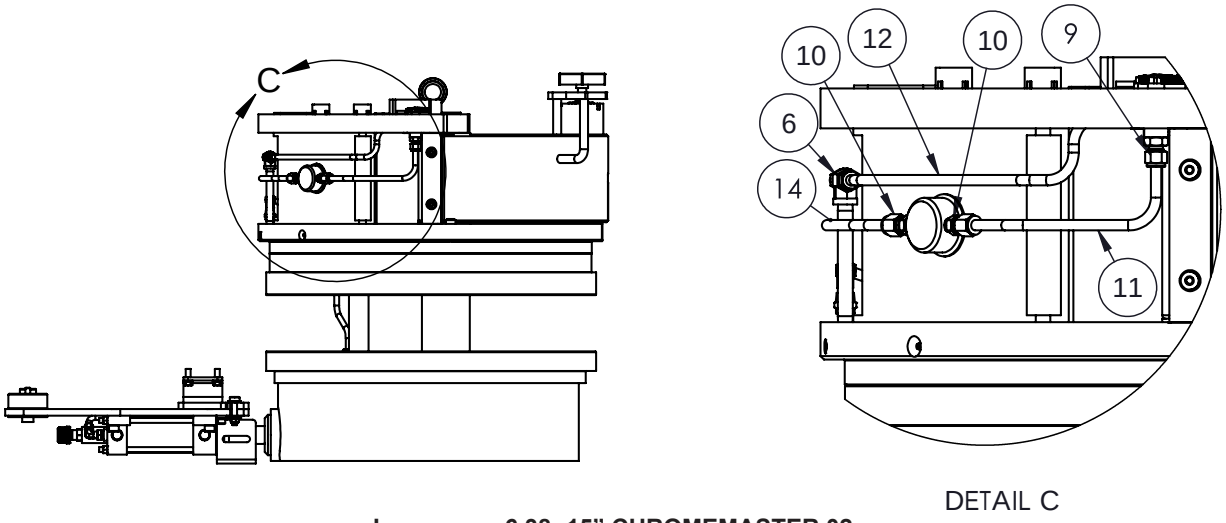


ILLUSTRATION 6.38: 15" CHROMEMASTER 02

Item	Type	Description	Qty	Part Number	Item	Type	Description	Qty	Part Number
1	Ass'y	Reservoir assembly	1	CM15001DP	13	Part	⅜" bent SS tubing (#11)	1	CM15211
2	Ass'y	Upper assembly	1	CM15002DP	14	Part	⅜" bent SS tubing (#4)	1	CM15204
3	Ass'y	Push cylinder assembly	1	CM15007DP	15	Part	¼" MNPT x ⅜" MJIC straight	1	1559
4	Part	Brake band liner	2	1622	16	Part	⅜" FJIC swivel x ⅜" tube 90°	1	6C6BU-S
5	Part	¼" NPT x 5" pipe nipple	1	PN4-5	17	Part	⅜" bent SS tubing (#5)	1	CM15205
6	Part	⅜" NPT x ⅜" tube branch tee	1	6OBU-S	18	Part	¼" MNPT x ⅜" tube 45°	1	1459-A
7	Part	⅜" bent SS tubing (#7)	1	CM15207	19	Part	¼" MNPT x ⅜" MJIC run tee	1	6MTX-S
8	Part	Pressure indicator	1	1651	20	Part	⅜" FJIC swivel x ¼" MNPT	1	6F6X-S
9	Part	⅜" high-pressure ball valve	2	H680108	21	Part	⅜" FJIC x ⅜" tube branch tee	1	6S6BU-S
10	Part	⅜" tube x ¼" MNPT adapter	4	6FBU-S	22	Part	⅜" bent SS tubing (#12)	1	CM15212
11	Part	⅜" bent SS tubing (#8)	1	CM15208	23	Part	¼" run tee	1	1594
12	Part	⅜" bent SS tubing (#10)	1	CM15210	24	Part	⅜" bent SS tubing (#6)	1	CM15206

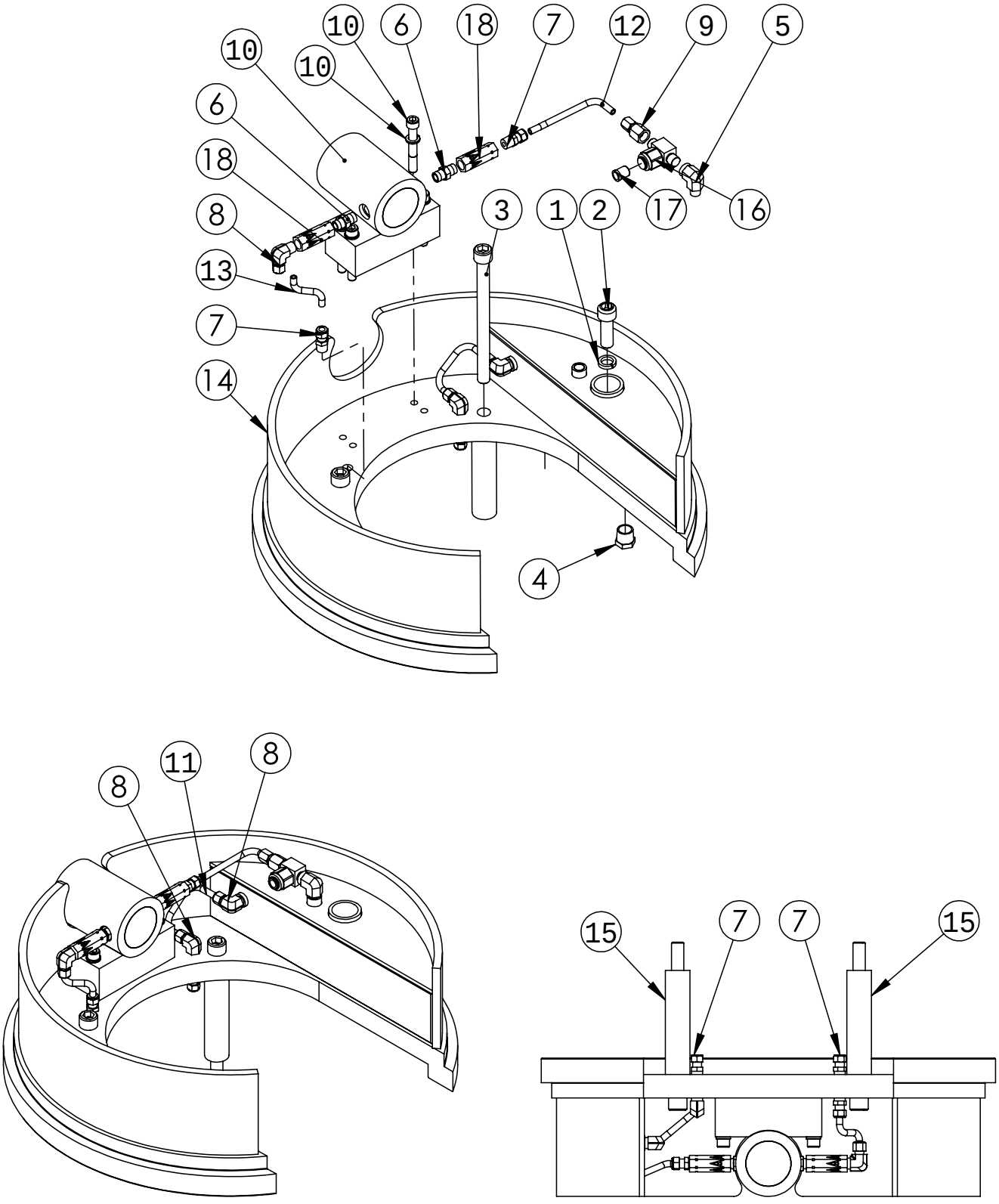


ILLUSTRATION 6.39: 15" CHROMEMASTER RESERVOIR

ITEM	QTY	P/N	DESCRIPTION
1	2	1170-A	3/4 HI COLLAR LW
2	2	1277	3/4-10 x 2 1/4 SHCS
3	2	1373	SHCS 3/4"-10 X 9 1/2"
4	1	1387	3/4 NPT BREATHER PLUG
5	1	1450	3/8" STREET ELBOW
6	2	1457	3/8" HEX NIPPLE
7	4	1570-A	3/8" MNPT X F TUBE STRAIGHT
8	3	1578	90 3/8" MNPT X 3/8" TUBE
9	1	1567	3/8" FNPT X TUBE SWIVEL ADAPTER
10	1	CM15010	PUMP CYLINDER ASSEMBLY
11	1	CM15201	3/8" SS 4500 PSI MIN TUBE #1
12	1	CM15202	3/8" SS 4500 PSI MIN TUBE #2
13	1	CM15203	3/8" SS 4500 PSI MIN TUBE #3
14	1	CM15300	WELDMENT RESERVOIR
15	2	CM15001DP-S1	SPACER TUBE
16	1	CM4020	FILTER TF SERIES
17	1	CM4021	FILTER
18	2	CM4554	VALVE CHECK 10,000 PSI 3/8 IN FNPT

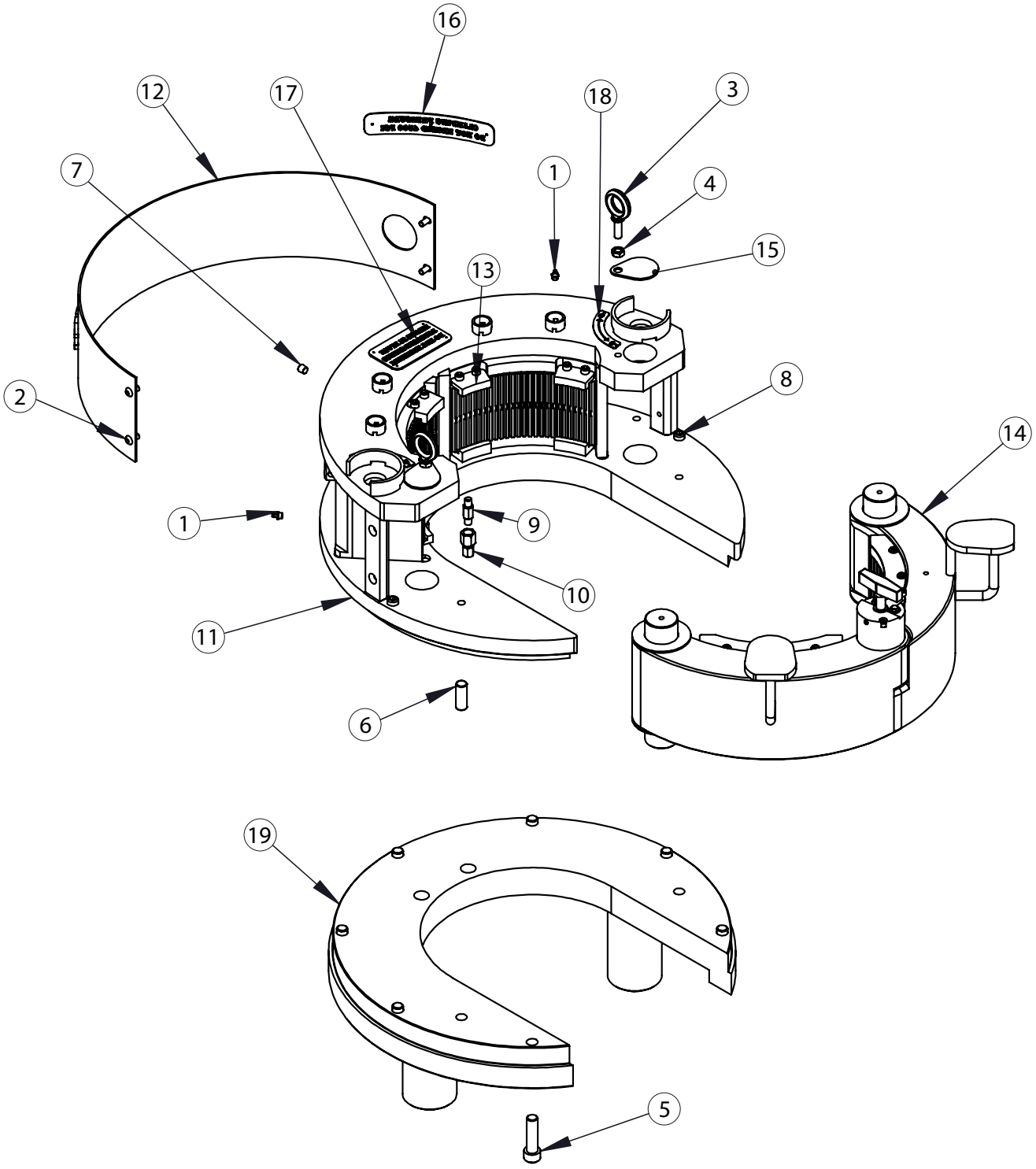


ILLUSTRATION 6.40: 15" CHROMEMASTER UPPER ASSEMBLY EXPLODED

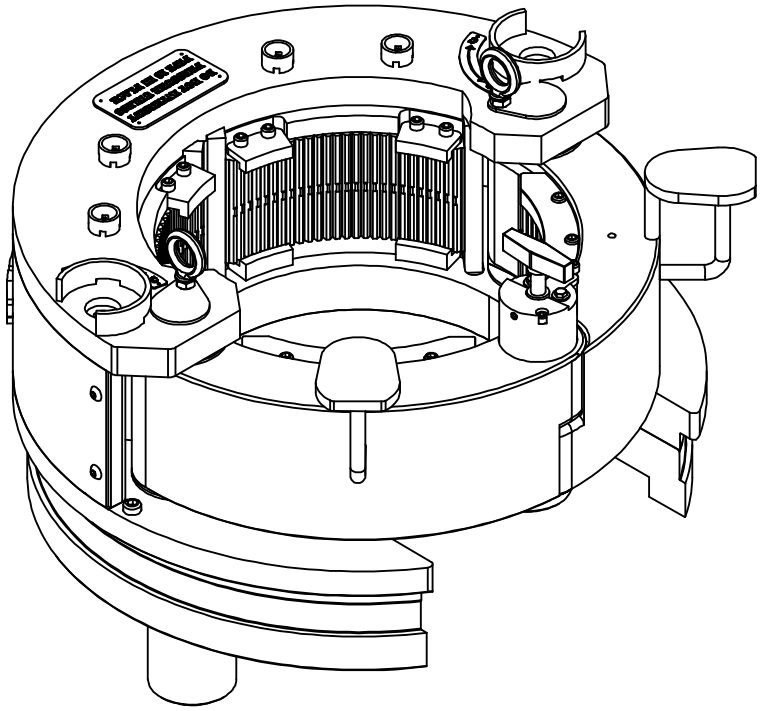


ILLUSTRATION 6.41: 15" CHROMEMASTER UPPER ASSEMBLY

ITEM	QTY	P/N	DESCRIPTION
1	6	1001	1/8 NPT ZERT
2	4	1061	SCREW .375 X .75 BHCS
3	2	1100	1/2-13 EYE BOLT
4	2	1118-a	1/2"-13 JAM NUT
5	7	1325	3/4-10 x 2 3/4 SHCS
6	2	1519	DOWEL PIN 3/4" X 2"
7	2	1606	1/4" NPT PLUG
8	2	246	1/2-13 x 1 SHCS
9	2	4X20FFF-SS	1/4" X 2" LONG HEX NIPPLE
10	2	1567	3/8" FNPT X TUBE SWIVEL ADAPTER
11	1	CM15500	UPPER WELDMENT
12	1	CM15015	COVER WELDMENT
13	2	CM15003	CHROMEMASTER CYLINDER
14	1	CM15004	DOOR ASSEMBLY
15	2	CM7696	PIVOT PIN RETAINER
16	1	CM7670	CLAMPING PRESSURE TAG
17	1	CB11029	TAG
18	2	CM7671	OPEN-CLOSED TAG
19	1	CM15400	ADAPTER PLATE WELDMENT

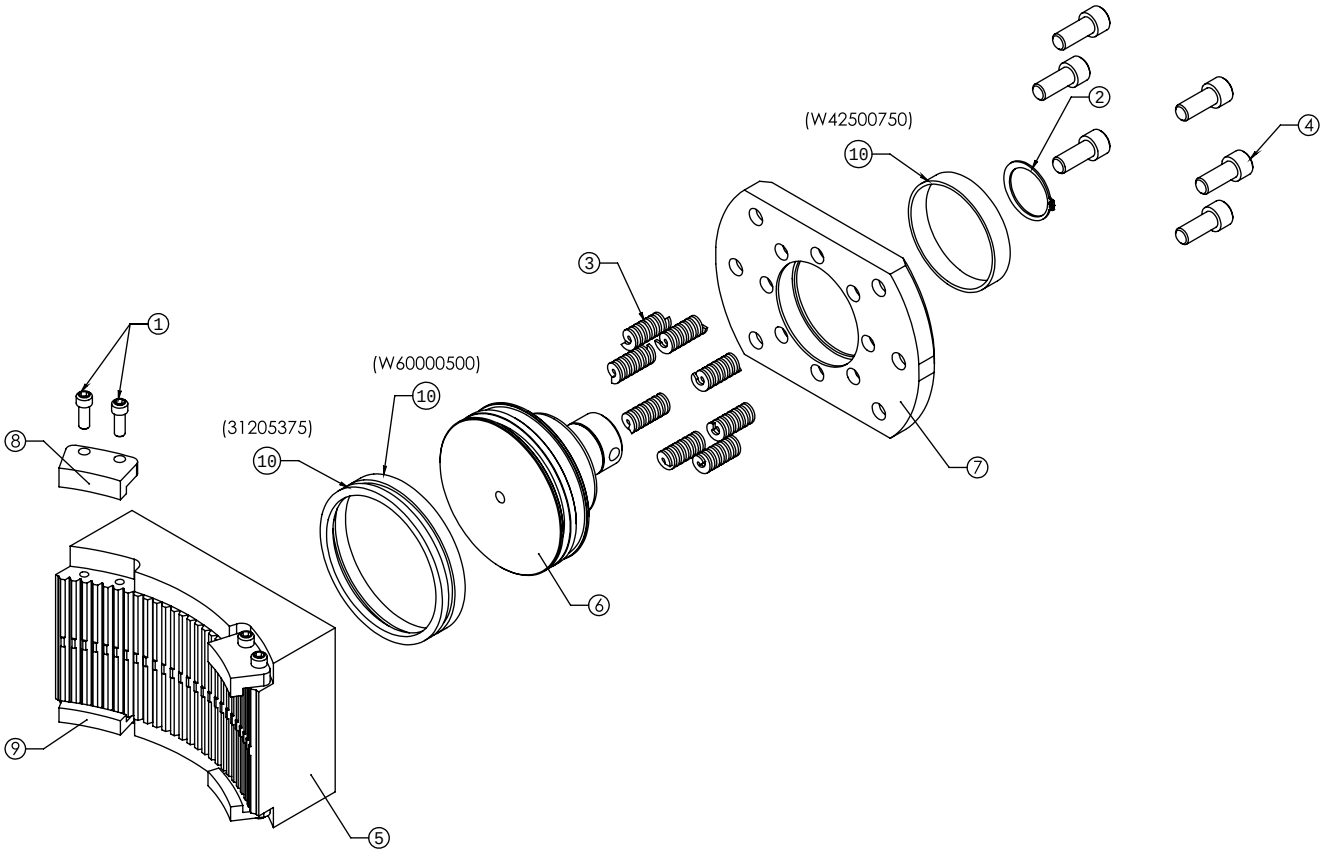


ILLUSTRATION 6.42: 15" CHROMEMASTER CYLINDER EXPLODED

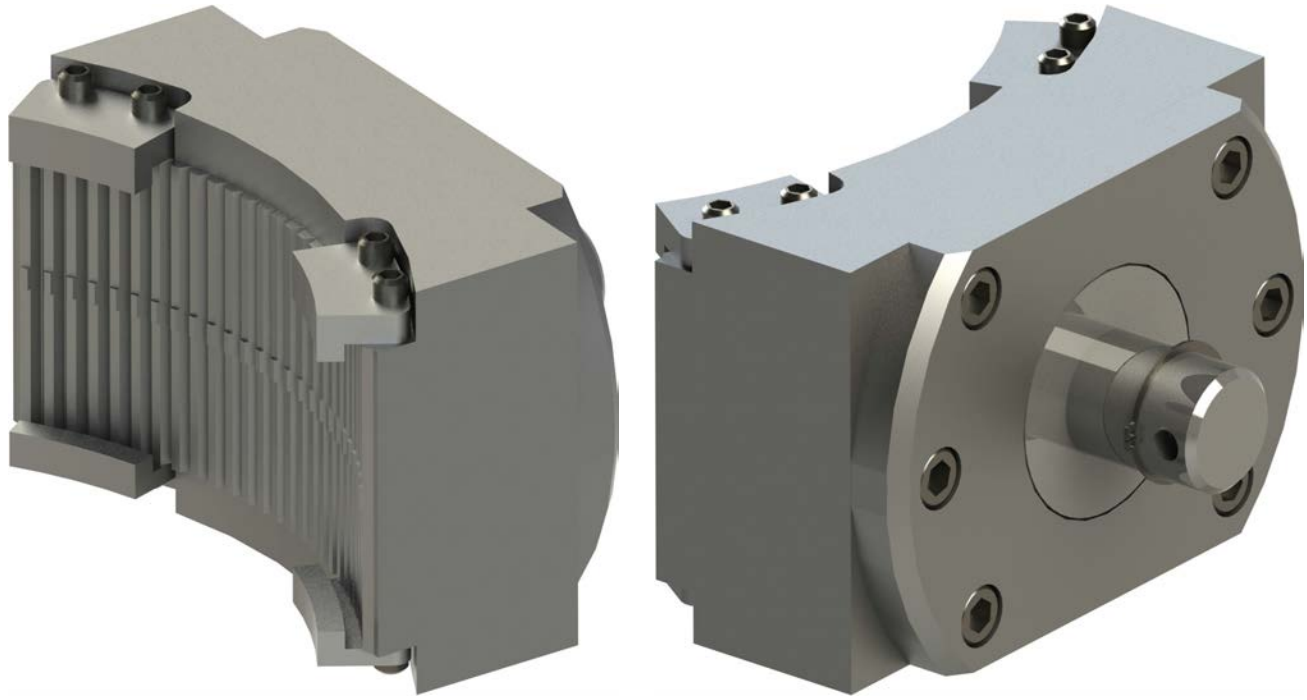


ILLUSTRATION 6.43: 15" CHROMEMASTER CYLINDER

Item	Type	Description	Qty	Part Number
1	Part	⅜" UNC x 1" hex socket head cap screw	8	1041
2	Part	Outside snap ring	1	1516
3	Part	Spring	8	1518
4	Part	⅝" UNC x 1-½" hex socket head cap screw	6	257
5	Part	Cylinder housing	1	CM15003-S1
6	Part	Piston	1	CM15003-S2
7	Part	Cylinder gland, 15" CHROMEMASTER™	1	CM15003-S3
8	Part	Top die clip, 15" CHROMEMASTER™	2	CM15003-S4
9	Part	Bottom die clip, 15" CHROMEMASTER™	2	CM15003-S5
10	Part	Cylinder seal kit	1	ASAP2394

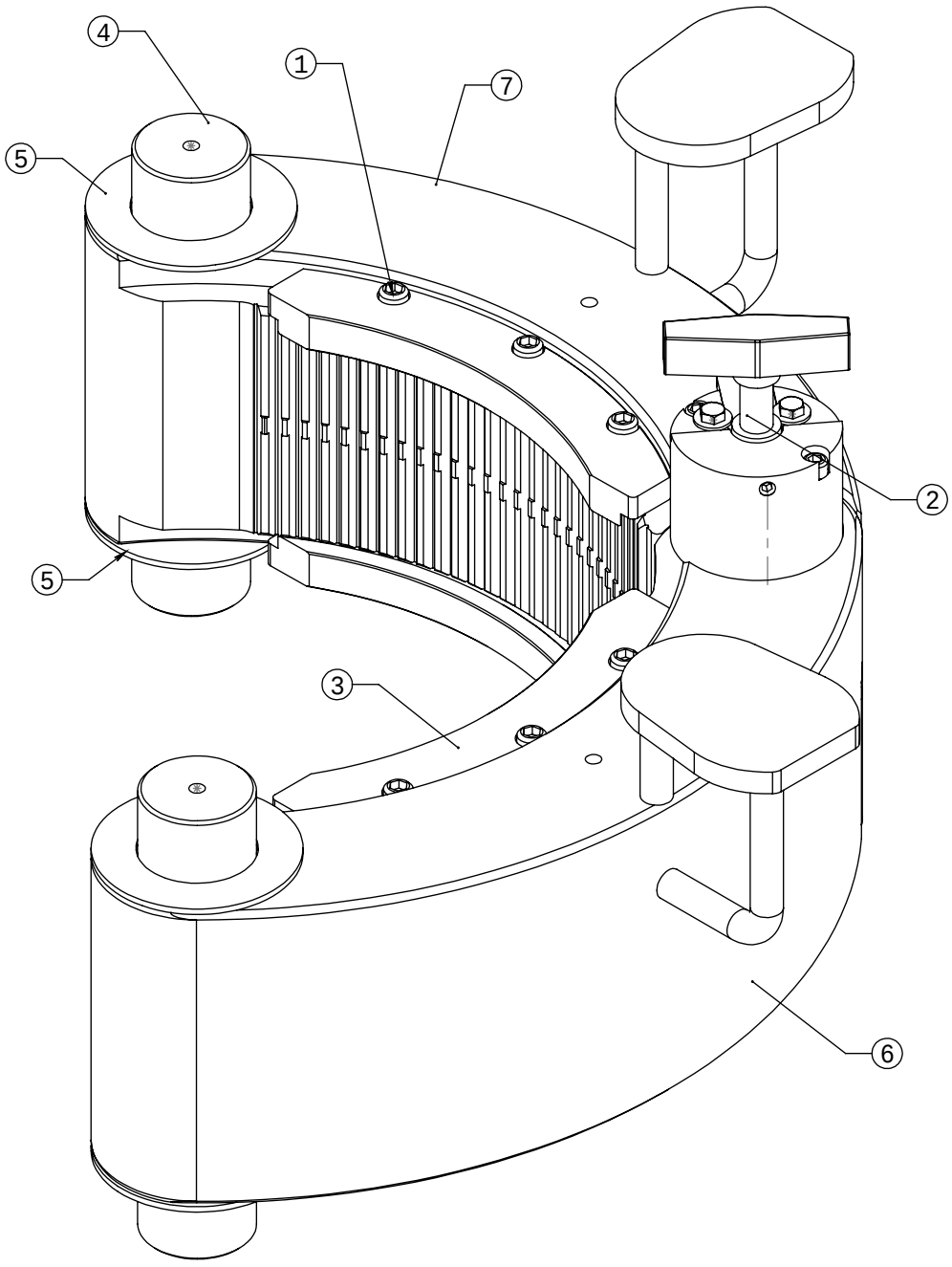


ILLUSTRATION 6.44: 15" CHROMEMASTER DOOR

Item #	Qty.	Part Number	Part Name
1	12	1041	3/8-16x1 1/4 SHCS
2	1	1044	3/8-16 x 3 SHCS
3	4	BUCST1508-02	CLIP
4	2	CM15004-S2	DOOR PIN
5	4	CM15004-S5	DOOR SPACER
6	1	CM15004-SL	LEFT DOOR WELDMENT
7	1	CM15004-SR	RIGHT DOOR WELDMENT
8	1	CM15005	LATCH ASSEMBLY

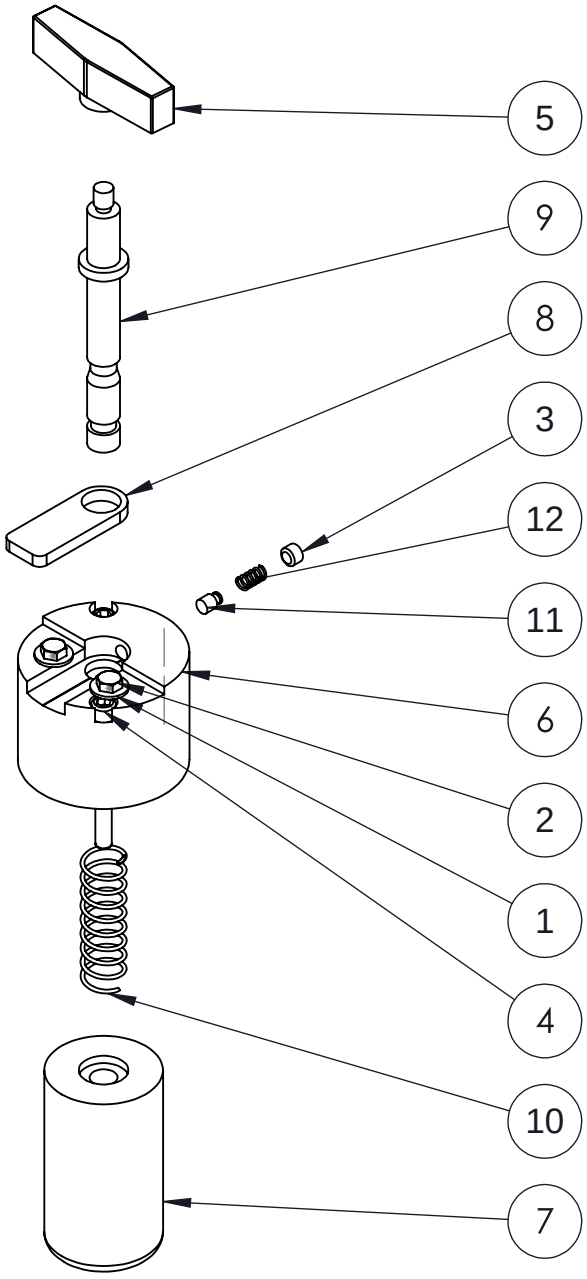


ILLUSTRATION 6.45: 15" CHROMEMASTER DOOR LATCH

ITEM	QTY	P/N	DESCRIPTION
1	2	1008-B2	FLATWASHER 1/4" GR8
2	2	1008-B3	1/4"-20 X 1/2" HHCS
3	1	1028	3/8"-16 x 1/4" SET SCREW
4	2	231	SHCS 5/16" - 18 X 3"
5	1	CLE1209-B	LATCH PIN HANDLE
6	1	CM15005-S1	BODY LATCH ASSY.
7	1	CM15005-S2	LATCH PIN
8	1	CM15005-S3	CATCH LATCH
9	1	CM7601-A	SHANK
10	1	CM7602-A	DOOR SPRING
11	1	CM7651	PLUNGER
12	1	CM7653	COMPRESSION SPRING .296

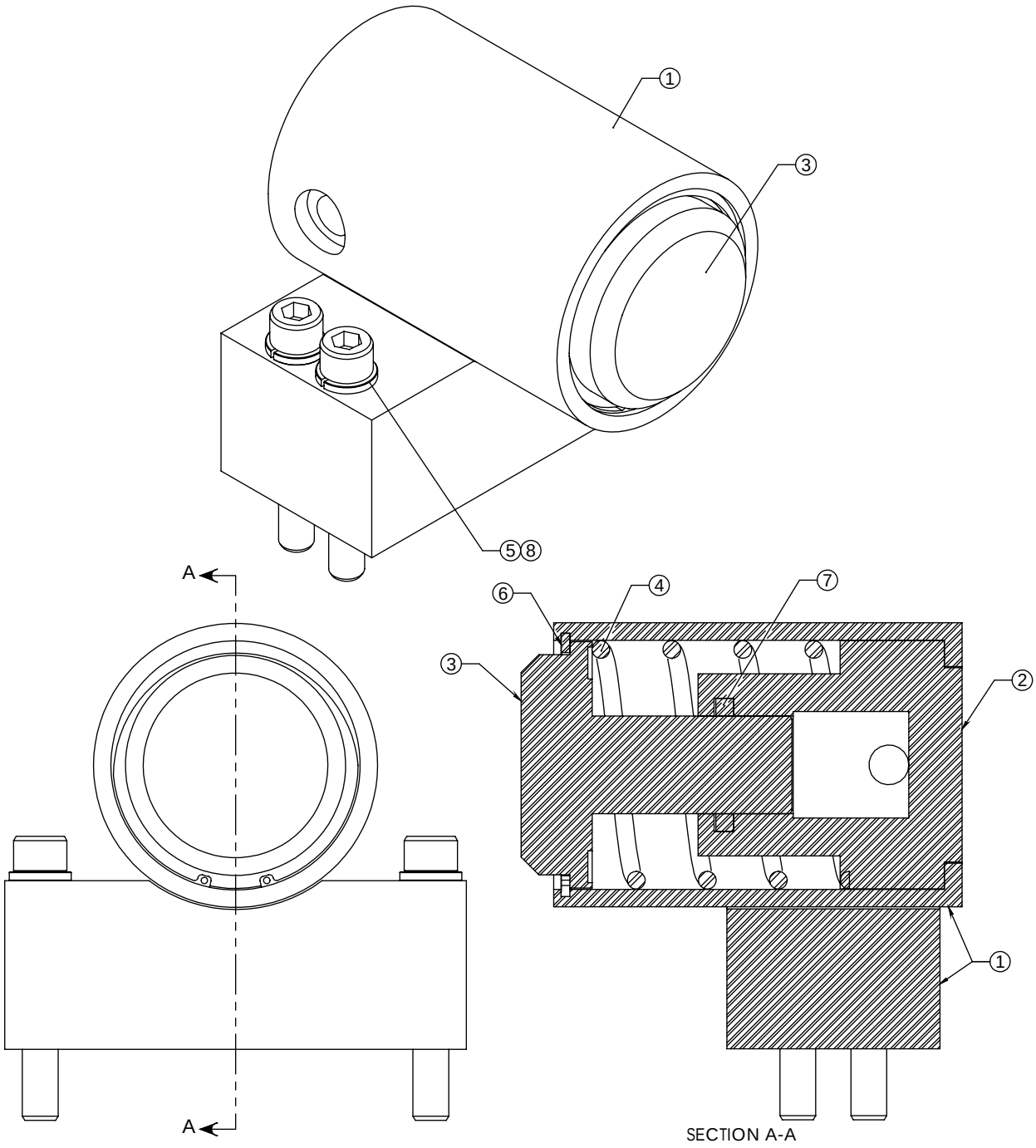


ILLUSTRATION 6.46: 15" CHROMEMASTER PUMP CYLINDER

Item #	Qty.	Part Number	Part Name
1	1	CM15011	PUMP HOUSING WELDMENT
2	1	CM7628	INTENSIFIER GLAND
3	1	CM7630	PUMP PLUNGER
4	1	CM7632	SPRINGS
5	4	1103	1/2" LOCKWASHER
6	1	1936	SNAP RING
7	1	25001375	POLYPACK
8	4	1108	1/2"-13 X 3 1/2" SHCS

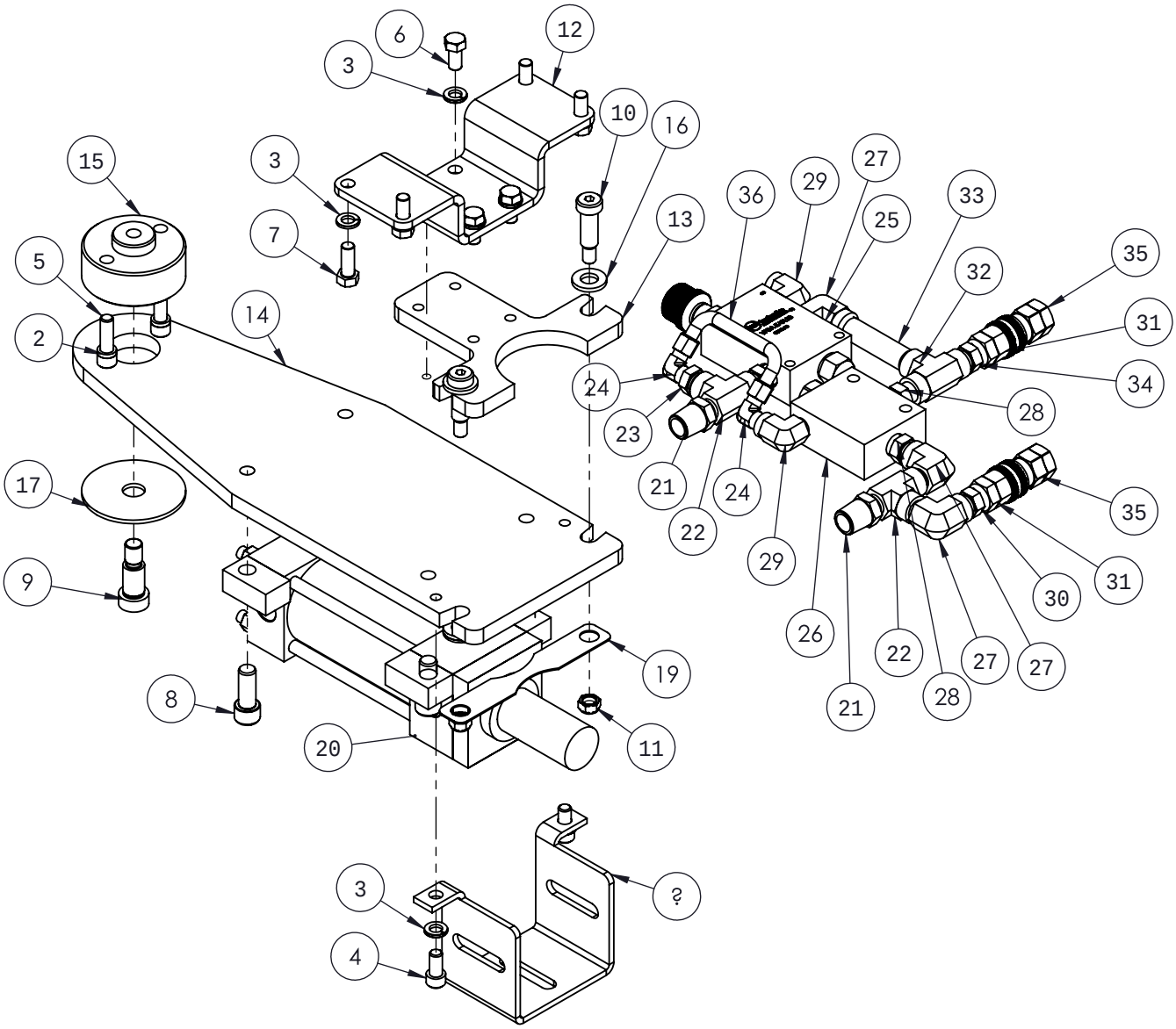


ILLUSTRATION 6.47: 15" CHROMEMASTER PUSH CYLINDER ASSEMBLY

ITEM	QTY	P/N	DESCRIPTION	ITEM	QTY	P/N	DESCRIPTION
1	2	1025	3/8 FLAT WASHER	19	1	CM45102	BREAK-AWAY TAB
2	2	1026	3/8 HI COLLAR LW	20	1	CM7633	LYNAIR CYLINDER
3	10	1027	LOCKWASHER .375	21	2	1491	REDUCER BUSHING 1/2" X 3/8"
4	2	1040-A	3/8-16 x 3/4 SHCS	22	2	1595	3/8" RUN TEE
5	2	1042	SHCS 3/8"-16 X 1 1/4"	23	1	1486	3/8" MNPT x 1/4" NPT REDUCER BUSHING
6	4	1046	HHCS 3/8-16 X 3/4	24	2	1575	90 1/4" MNPT X 1/4" TUBE
7	4	1047	3/8"-16 X 1" HHCS	25	1	CM7654	PRESSURE REDUCING VALVE
8	4	1106	SHCS 1/2"-13 X 1 1/4"	26	1	CM4551	PILOT OPERATED CK VALVE
9	1	1521	SHOULDER BOLT 5/8" X 1"	27	3	1450	3/8" STREET ELBOW
10	2	1522	SHOULDER BOLT 1/4" X 1 1/4"	28	3	1457	3/8" HEX NIPPLE
11	2	213	3/"-16 NYLOCK NUT	29	2	1449	1/4" STREET ELBOW
12	1	CM15007DPS1	CYLINDER BRACKET	30	1	CM7648	3/8" HEX NIPPLE WITH 0.0938 ORIFICE
13	1	CM15007DPS2	CYLINDER BRACKET ADAPTER PLATE	31	2	1429	3/8" Q.D. MALE SNAPTITE
14	1	CM15007DPS3	18-3/4" CYLINDER MOUNTING PLATE	32	1	1599	3/8" FEMALE TEE
15	1	CM15007DPS4	CYLINDER MOUNTING REAR FOOT	33	1	PN6-3.5	3/8" NPT PIPE NIPPLE (3 1/2" LG)
16	4	CM15007-S3	SPACER	34	1	CM7648-S1	
17	1	CM15007-S6		35	2	1428	3/8" FEMALE SNAPTITE QD
18	1	CM15007-S7		36	1	CM15224	3/8" SS 4500 PSI MIN TUBE #24

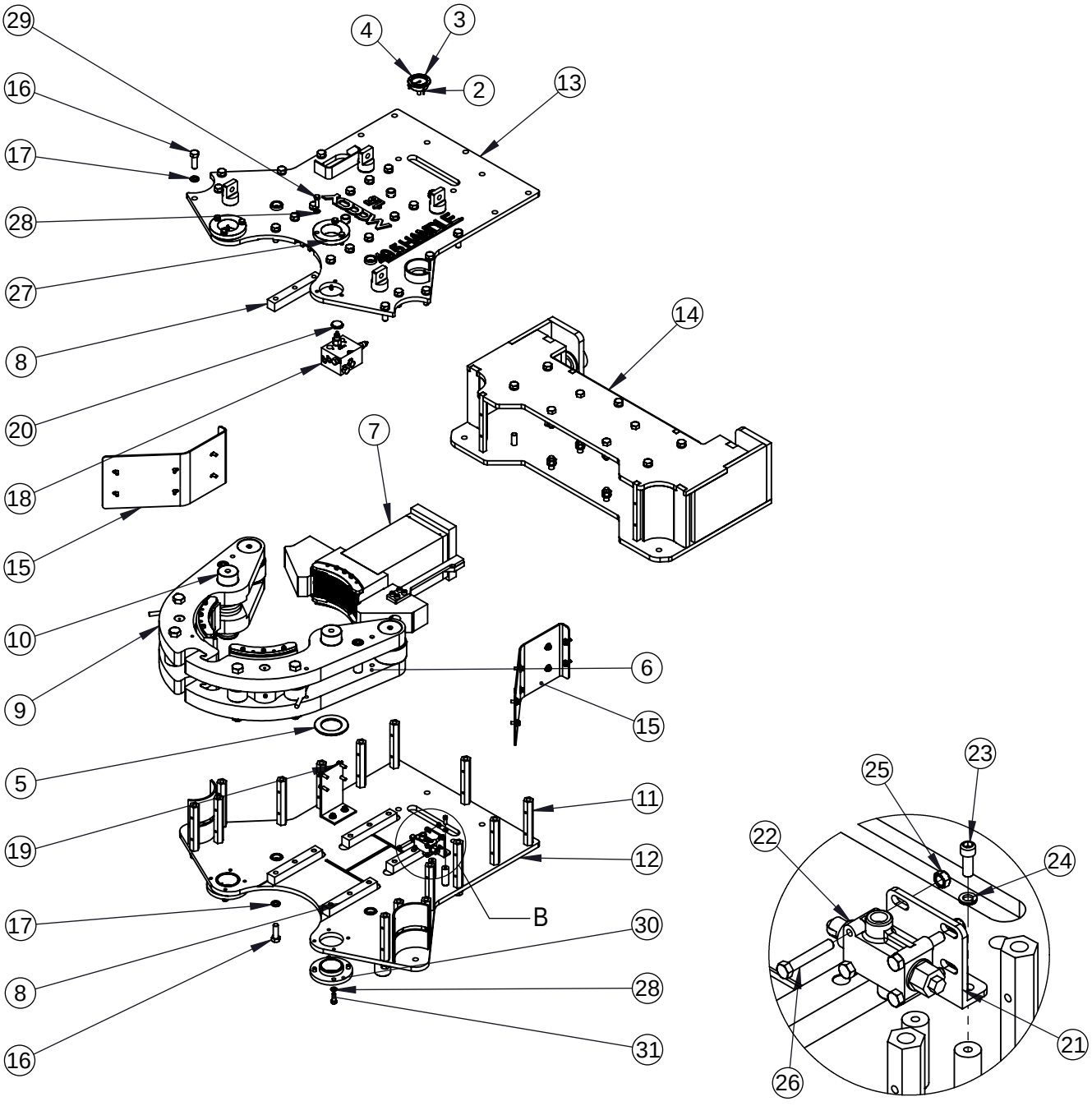


ILLUSTRATION 6.48: BUCST15000-02 OUTER BODY ASSEMBLY EXPLODED

Item	Type	Description	Qty	Part Number
1	Part	⅛" NPT grease fitting	8	1001
2	Part	#6-32 brass nut	3	1150-A
3	Part	#6-32 x 1" round slot-head brass machine screw	3	1150-C
4	Part	0-3000 psi rear-mount pressure indicator	1	BAC-3M25RCFF
5	Part	Door pivot bushing	2	BUCDP9618
6	Assembly	Outside door assembly	1	BUCS15005

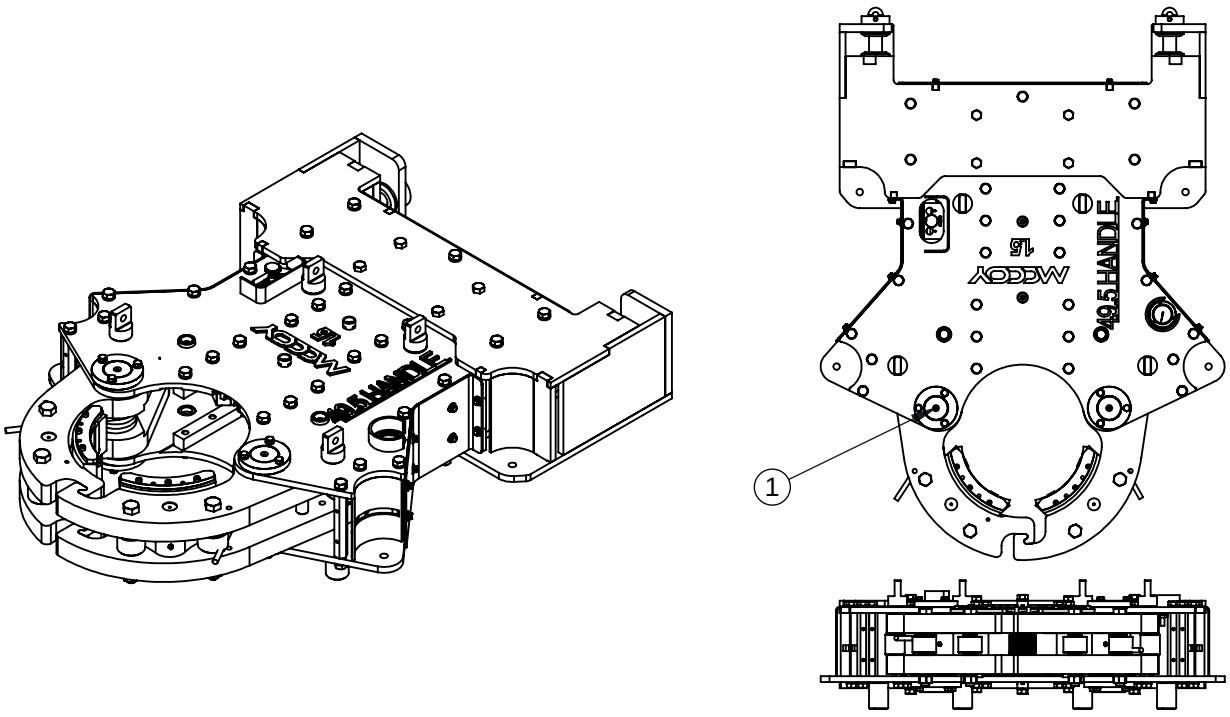


ILLUSTRATION 6.49: BUCST15000-02 OUTER BODY ASSEMBLY

Item	Type	Description	Qty	Part Number
7	Assembly	Cylinder assembly	1	BUCS15006
8	Part	Cylinder guide	8	BUCS15012
9	Assembly	Inside door assembly	1	BUCS15015
10	Part	Backup pivot pin	2	BUCS15021
11	Part	Backup column	15	BUCS15048
12	Weldment	Bottom backup plate weldment	1	BUCST15052
13	Weldment	Top backup plate weldment	1	BUCST15053
14	Assembly	100K fishtail assembly	1	BUCST15004-01
15	Assembly	Cover assembly	2	BUCST15005-01
16	Part	¾" UNC x 2-¼" hex head cap screw, GR8	44	1174
17	Part	¾" lock washer	44	1171
18	Part	Lockjaw backup manifold assembly (aluminum) without high pressure relief	1	BUCS7699-01
19	Assembly	Manifold bracket assembly	1	BUCST15056
20	Part	Replacement knob (Sun cartridges)	1	991-211
21	Part	Cam switch mounting bracket	1	1000112
22	Assembly	Normally-closed spool valve with vent assembly	1	SLV1000-04
23	Part	⅜" UNC x 1-¼" hex socket head cap screw	2	1041
24	Part	⅜" lock washer	2	1027
25	Part	⅜" UNC hex nylock nut, GR8	4	213
26	Part	⅜" UNC x 2-¼" hex head cap screw, GR8	4	1055
27	Part	Bolt-on doubler plate	2	1000579
28	Part	½" lock washer	14	1103
29	Part	½" UNC x 1-½" hex head cap screw	6	1112
30	Part	Bolt-on doubler plate, bottom	2	1000581
31	Part	½" UNC x 1-¼" hex head cap screw	8	1111

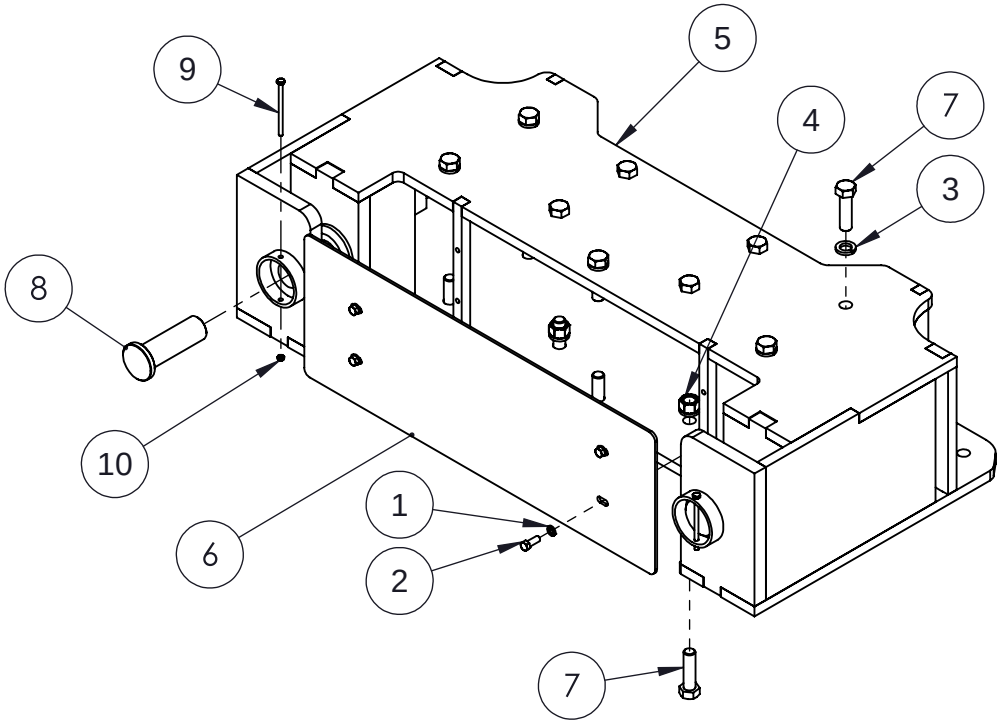
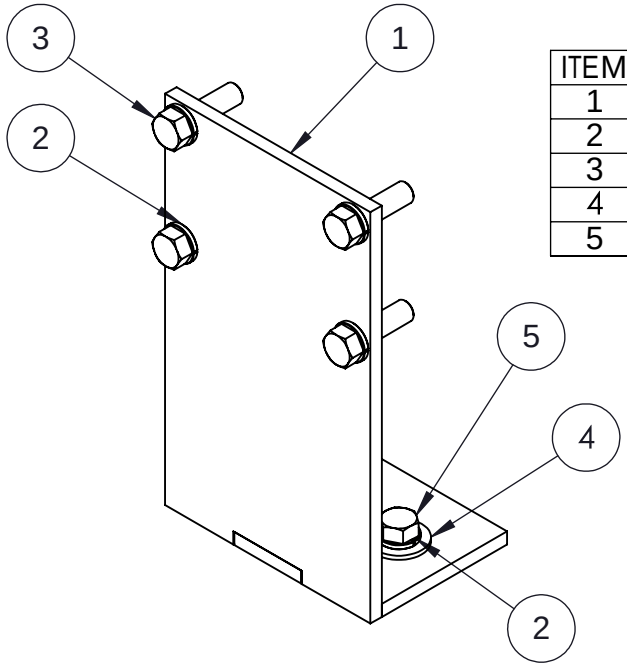


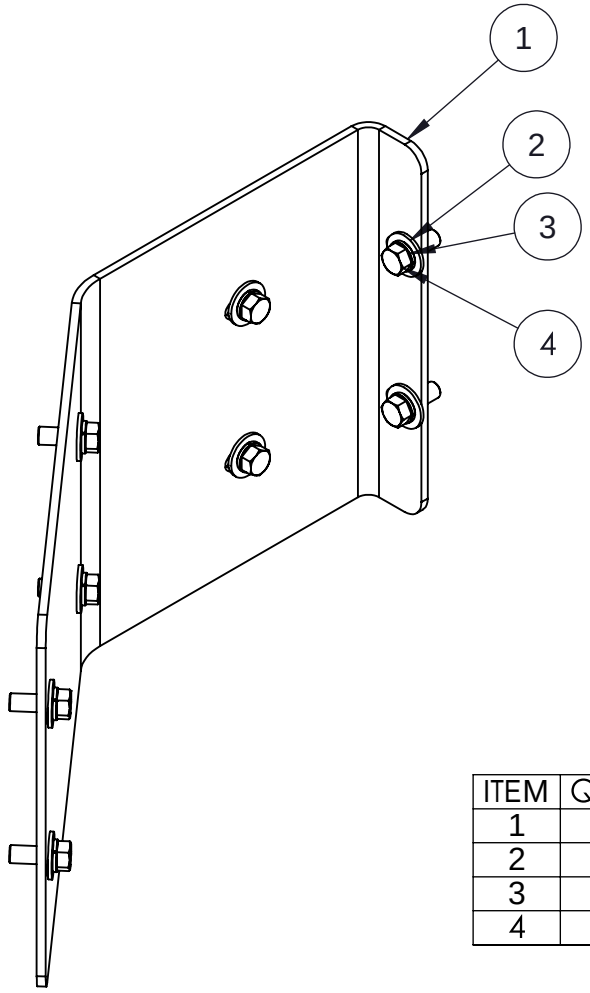
ILLUSTRATION 6.50: BUCST15000-02 FISHTAIL ASSEMBLY

ITEM	QTY	P/N	DESCRIPTION
1	4	1027	LOCKWASHER .375
2	4	1047	3/8"-16 X 1" HHCS
3	18	1171	3/4" LOCKWASHER
4	8	1176-A	3/4" GR. 8 NUT
5	1	BUCST15003-01	100K FISHTAIL WELDMENT
6	1	BUCST15008-01	FISHTAIL COVER
7	18	PH2.75FRMBLT	HHCS 3/4"-10 X 2 3/4"
8	2	RH15010-01	1-5/8" X 5" LINE PULL LOAD CELL HANGER PIN
9	2	115	1/4"-20 X 3 1/2" HHCS GR8
10	2	212	1/4-20 NYLOCK NUT



ITEM	QTY	P/N	DESCRIPTION
1	1	BUCST7699-S4	BRACKET MOUNTING
2	6	1027	LOCKWASHER .375
3	4	1048	3/8"-16 X 1 1/4" HHCS
4	2	1025	3/8 FLAT WASHER
5	2	1047	3/8"-16 X 1" HHCS

ILLUSTRATION 6.51: BUCST15000-02 MANIFOLD BRACKET ASSEMBLY



ITEM	QTY	P/N	DESCRIPTION
1	1	BUCST15005-01S1	COVER PLATE
2	8	1025	3/8 FLAT WASHER
3	8	1027	LOCKWASHER .375
4	8	1047	3/8"-16 X 1" HHCS

ILLUSTRATION 6.52: BUCST15000-02 COVER ASSEMBLY

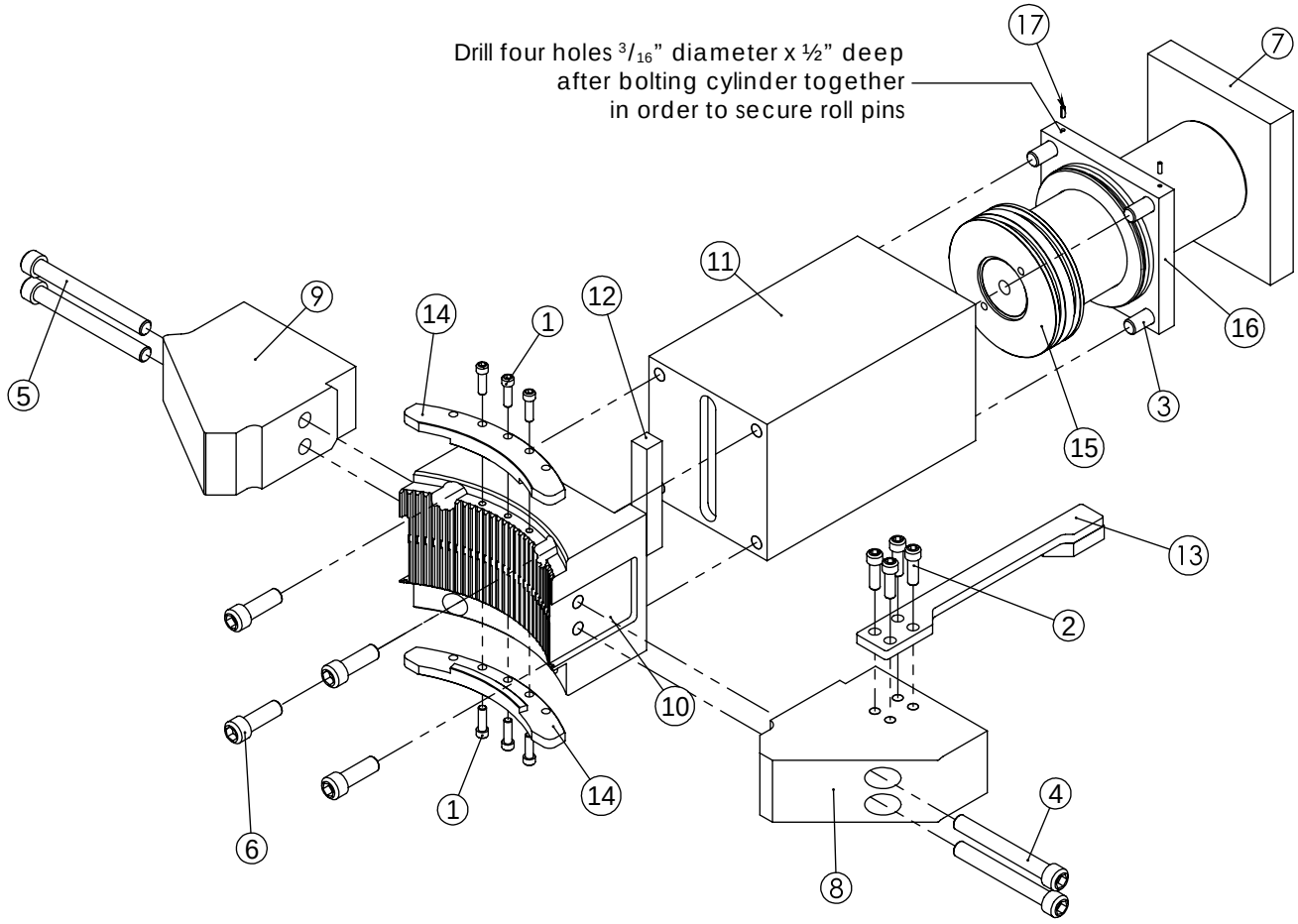


ILLUSTRATION 6.53: LOCKJAW BACKUP CLAMP CYLINDER ASSEMBLY EXPLODED

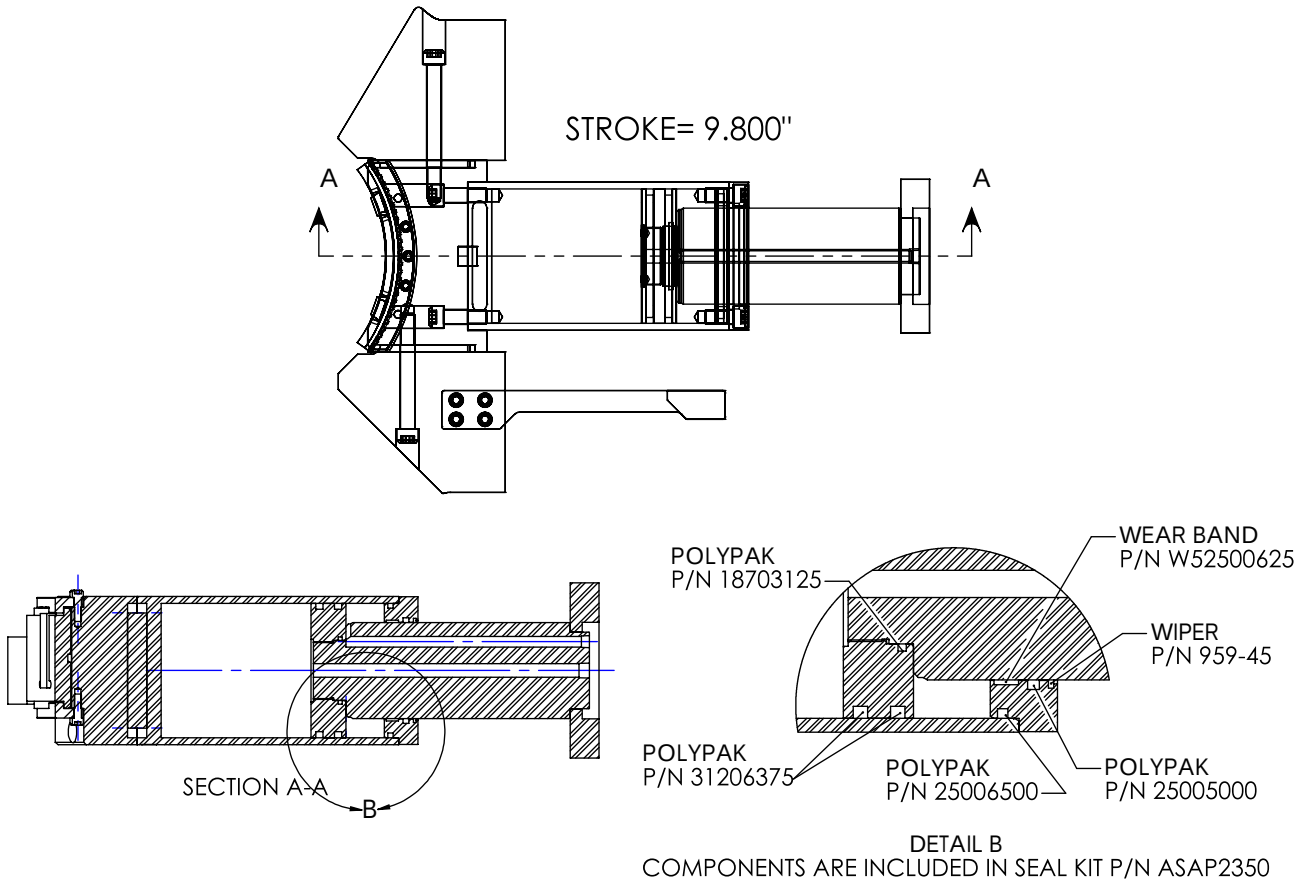


ILLUSTRATION 6.54: LOCKJAW BACKUP CLAMP CYLINDER ASSEMBLY

ITEM	QTY.	P/N	DESCRIPTION
1	6	1042	3/8-16x1 1/4 SHCS
2	4	1106-A	1/2-13 x 1 1/2 SHCS
3	4	1171-B	3/4-10 x 1 1/2 SHCS
4	2	1208	3/4-10 x 6 SHCS
5	2	1247	3/4-10 x 7 SHCS
6	4	1277	3/4-10 x 2 1/4 SHCS
7	1	BUCS15008	ROD WELDMENT
8	1	BUCS15017	OUTSIDE DOOR WEDGE
9	1	BUCS15019	INSIDE DOOR WEDGE
10	1	BUCS15033	CYLINDER JAW
11	1	BUCS15034	CYLINDER F/ 15" BACKUP
12	1	BUCS15035	CYLINDER KEY F/ 15" BACKUP
13	1	BUCS15070	CAM PLATE WELDMENT
14	2	BUCST1508	TOP & BOTTOM RETAINER CLIPS
15	1	CLE18504	PISTON
16	1	CLE18511	GLAND-CLE185
17	4	1005-A	3/16" X 1/2" ROLL PIN

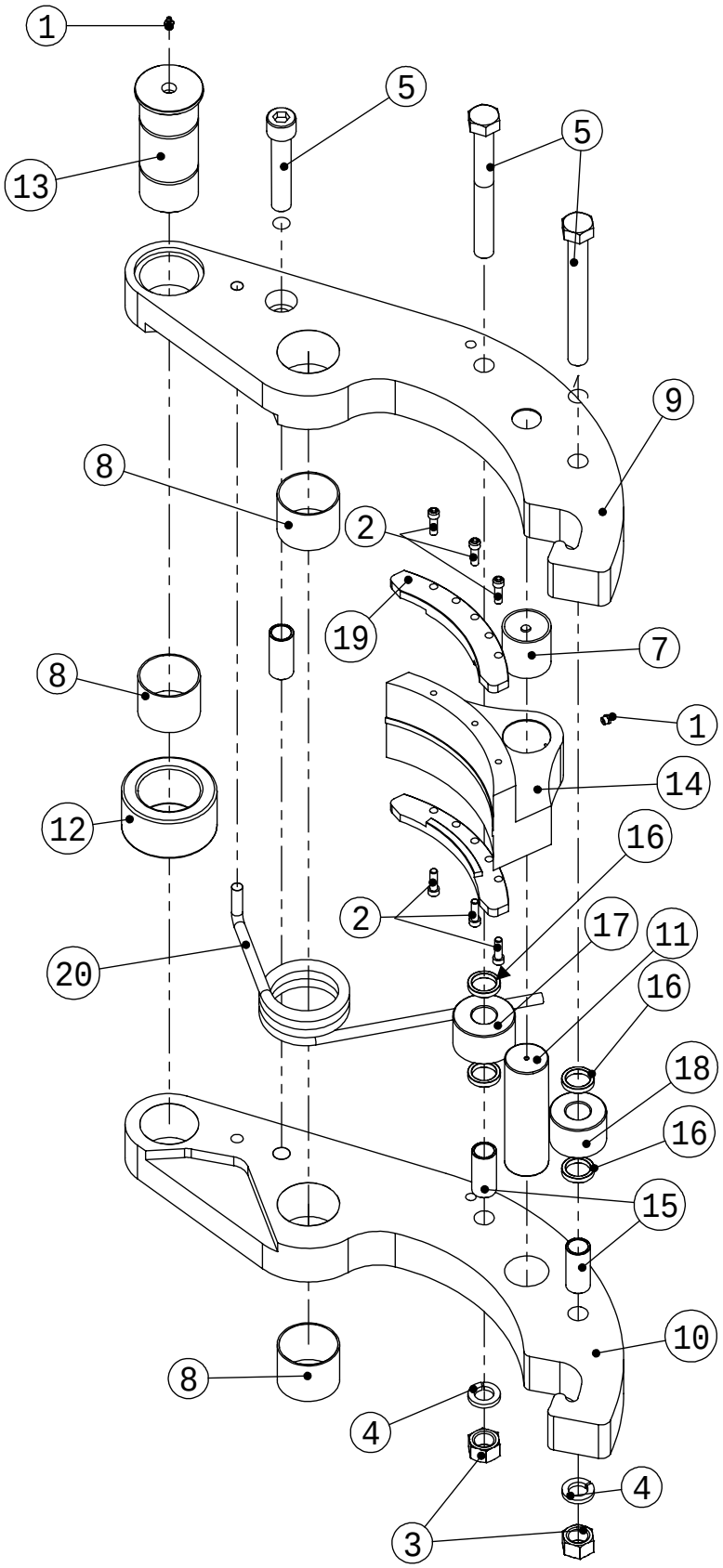


ILLUSTRATION 6.55: OUTER BACKUP DOOR ASSEMBLY EXPLODED

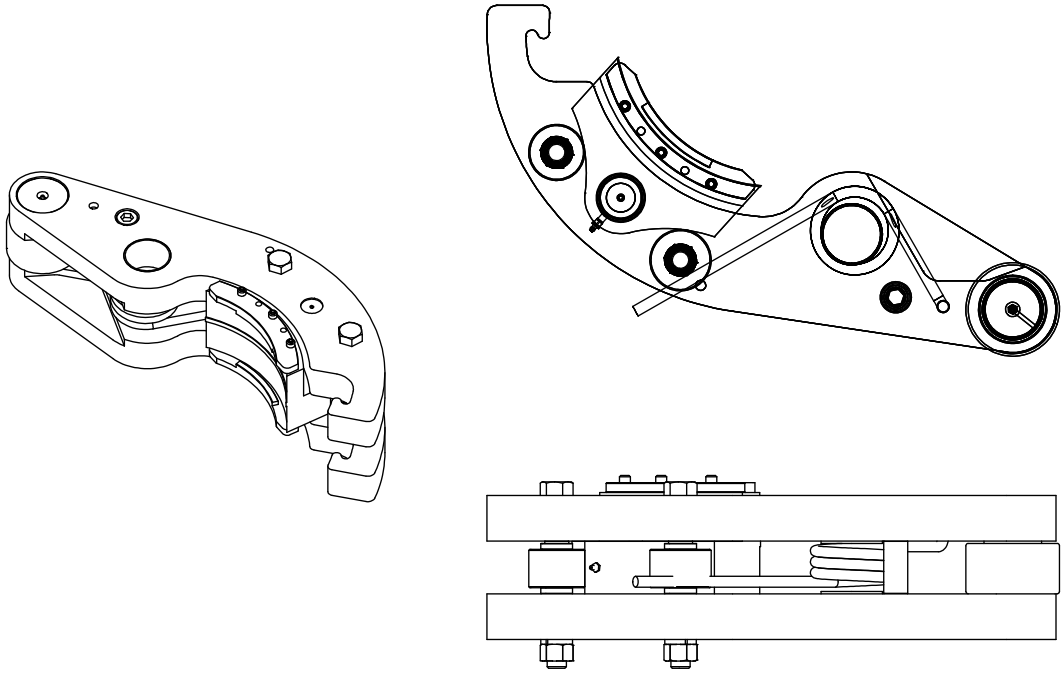


ILLUSTRATION 6.56: OUTER BACKUP DOOR ASSEMBLY

Item #	Qty.	Part Number	Part Name
1	2	1001	1/8 NPT ZERT
2	6	1042	3/8-16x1 1/4 SHCS
3	2	1210	1-8 NC HEX NUT
4	2	1218	1" LW
5	1	1342	1-8 x 5 1/4 SHCS
6	2	1211-A	1"-8 X 9" HHCS
7	1	36DU40-02	MODIFIED GARLOCK
8	3	48DU40	GARLOCK BUSHING
9	1	BUCDP15003	TOP OUTSIDE DOOR PLATE
10	1	BUCDP15007	BOTTOM OUTSIDE DOOR PLATE
11	1	BUCS15009	INSERT PIVOT PIN
12	1	BUCS15010	DOOR ROLLER
13	1	BUCS15011	DOOR ROLLER PIN
14	1	BUCS15020	DOOR INSERT
15	3	BUCS15037	DOOR SPACER
16	4	BUCS15054	INSERT SPRING SPACER
17	1	BUCS15075	REAR PIVOTING INSERT SPRING
18	1	BUCS15076	FRONT PIVOTING INSERT SPRING
19	2	BUCST1508	TOP & BOTTOM RETAINER CLIPS
20	1	SMH1501-L	TORSION SPRING

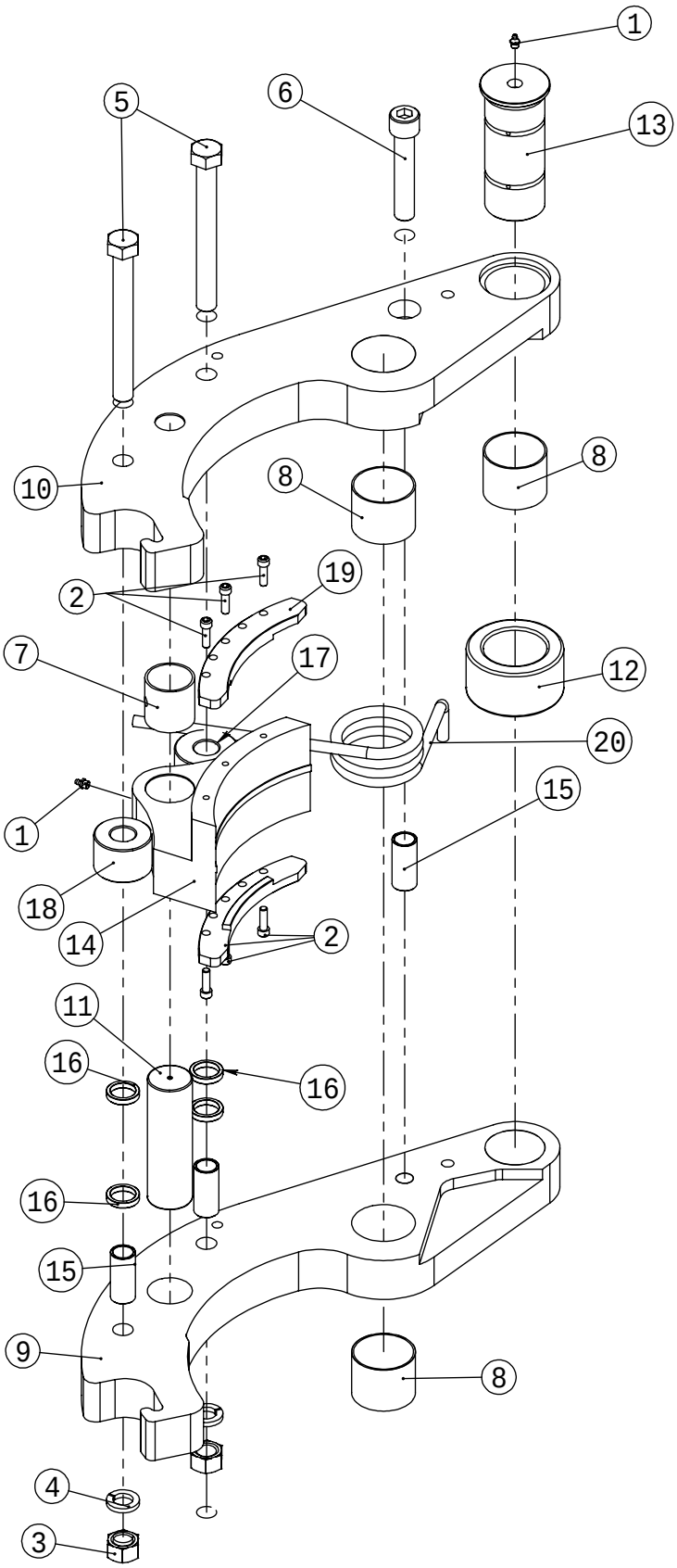


ILLUSTRATION 6.57: INNER BACKUP DOOR ASSEMBLY EXPLODED

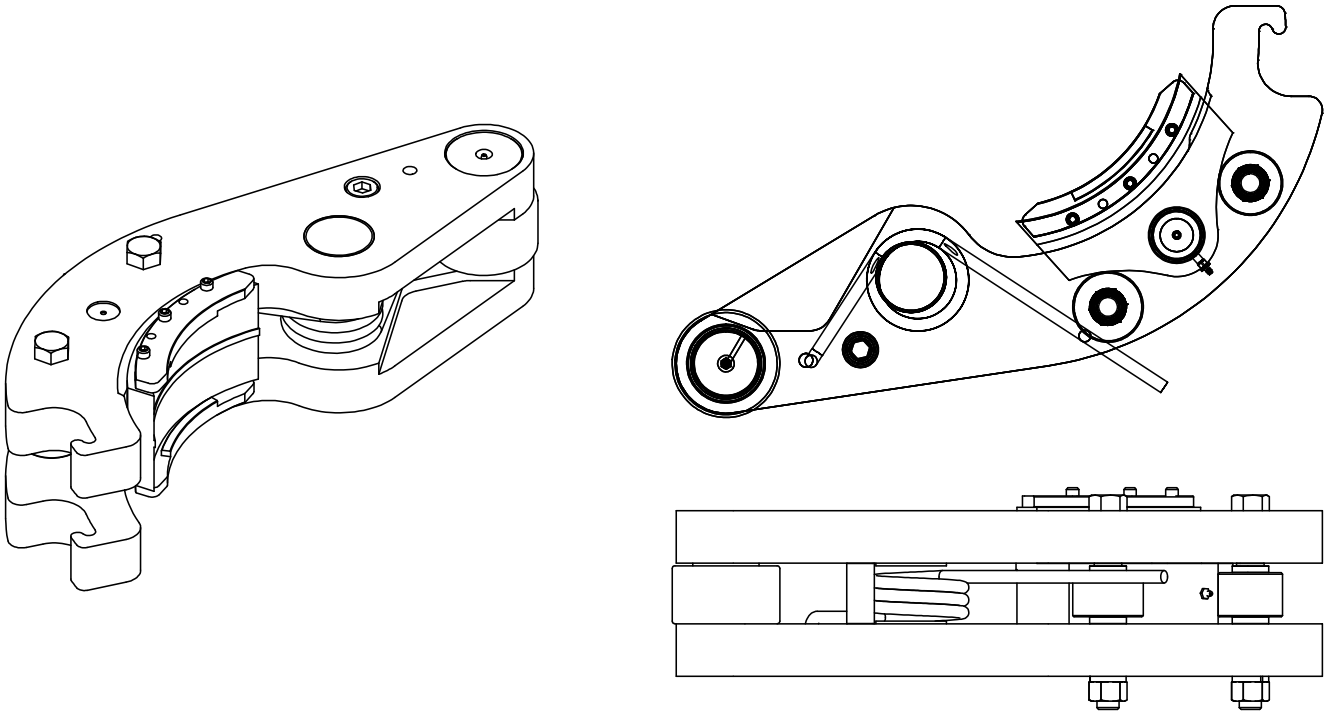


ILLUSTRATION 6.58: INNER BACKUP DOOR ASSEMBLY

Item #	Qty.	Part Number	Part Name
1	2	1001	1/8 NPT ZERT
2	6	1042	3/8-16x1 1/4 SHCS
3	2	1210	1-8 NC HEX NUT
4	2	1218	1" LW
5	2	1211-A	1"-8 X 9" HHCS
6	1	1342	1-8 x 5 1/4 SHCS
7	1	36DU40-02	MODIFIED GARLOCK
8	3	48DU40	GARLOCK BUSHING
9	1	BUCDP15012	BOTTOM INSIDE DOOR PLATE
10	1	BUCDP15013	TOP INSIDE DOOR PLATE
11	1	BUCS15009	INSERT PIVOT PIN
12	1	BUCS15010	DOOR ROLLER
13	1	BUCS15011	DOOR ROLLER PIN
15	3	BUCS15037	DOOR SPACER
16	4	BUCS15054	INSERT SPRING SPACER
17	1	BUCS15075	REAR PIVOTING INSERT SPRING
18	1	BUCS15076	FRONT PIVOTING INSERT SPRING
19	2	BUCST1508	TOP & BOTTOM RETAINER CLIPS
20	1	SMH1501-L	3 1/2 I.D x 9/16 W x 50 " #/deg. LEFT-HAND TORSION SPRING
14	1	BUCS15020	DOOR INSERT
15	3	BUCS15037	DOOR SPACER
16	4	BUCS15054	INSERT SPRING SPACER
17	1	BUCS15075	REAR PIVOTING INSERT SPRING
18	1	BUCS15076	FRONT PIVOTING INSERT SPRING
19	2	BUCST1508	TOP & BOTTOM RETAINER CLIPS
20	1	SMH1501-L	3 1/2 I.D x 9/16 W x 50 " #/deg. LEFT-HAND TORSION SPRING

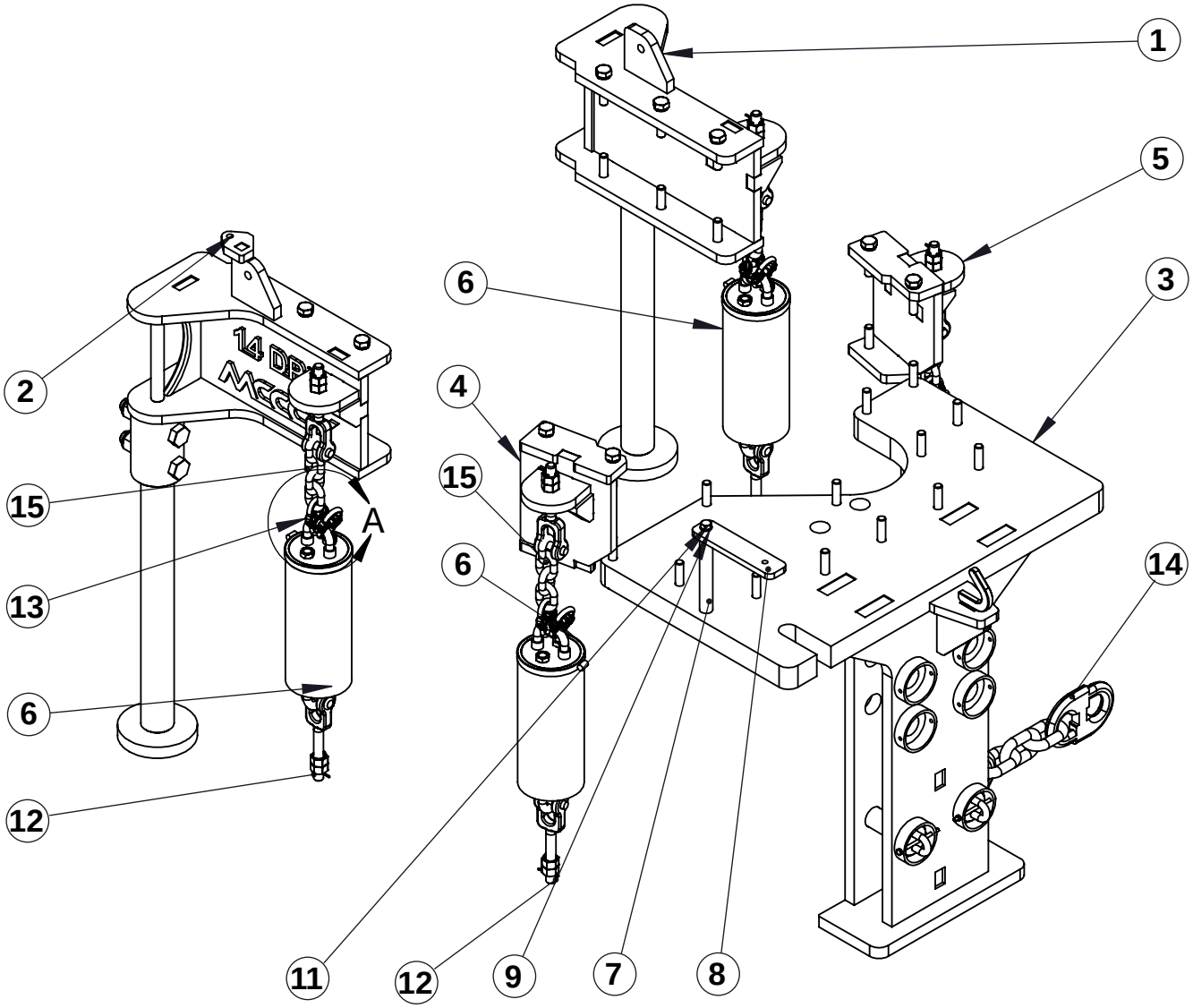


ILLUSTRATION 6.59: MKBUCST15000-02 MOUNTING KIT EXPLODED

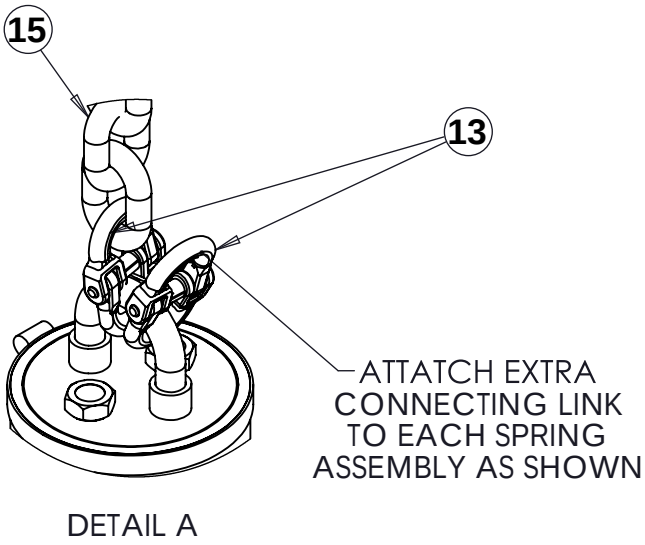
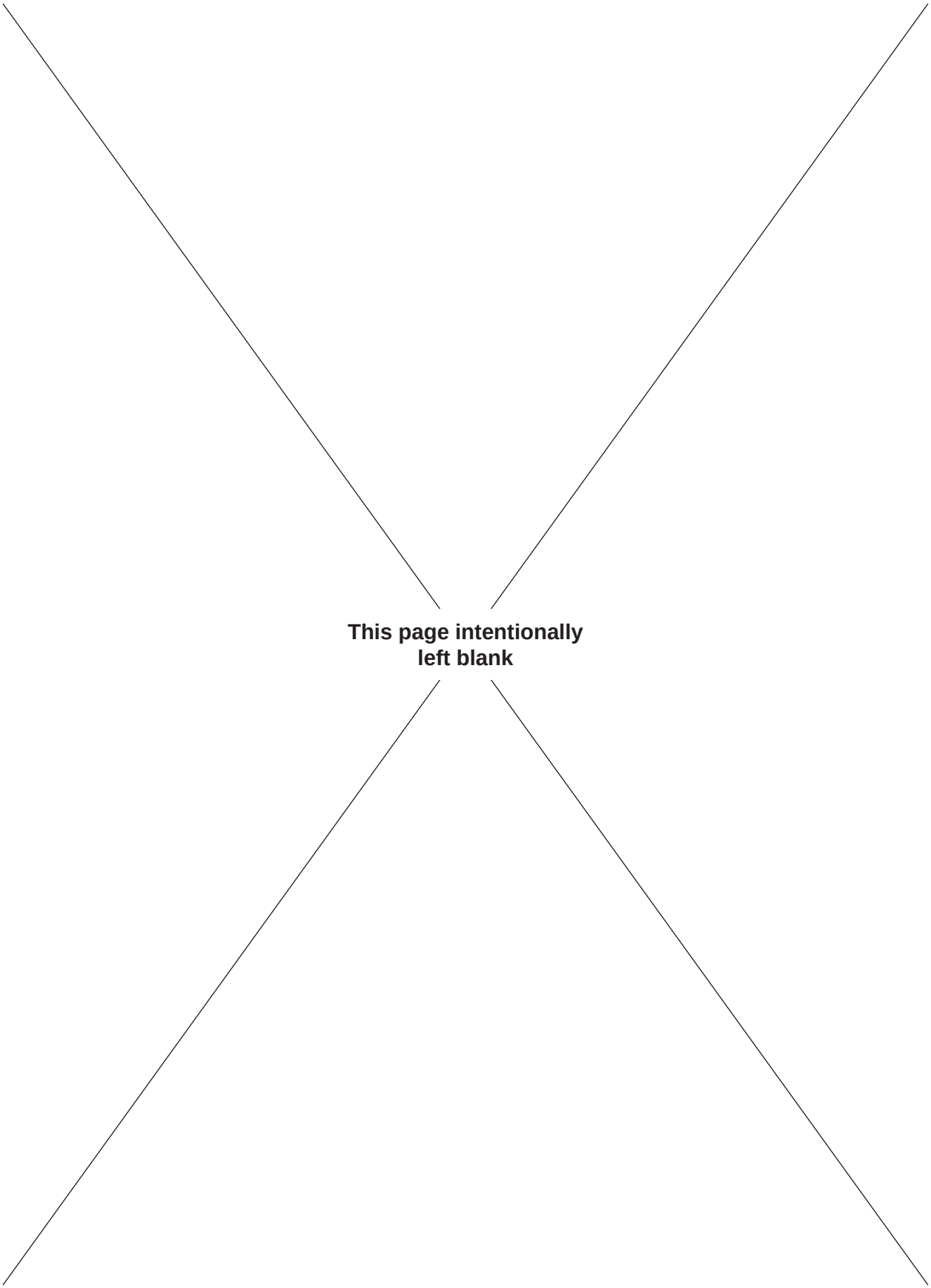


ILLUSTRATION 6.60: MKBUCST15000-02 MOUNTING KIT

ITEM	QTY	P/N	DESCRIPTION
1	1	14780L	LEFT LEG BRACKET ASSEMBLY
2	1	14780R	RIGHT LEG SOCKET ASSEMBLY
3	1	RH15005-02	REAR HANGER ASSEMBLY
4	1	14783R	RIGHT SIDE BRACKET ASSEMBLY
5	1	14783L	LEFT SIDE BRACKET ASSEMBLY
6	4	BUCST1528	FRONT HANGER SPRING ASSY. F/15" TENSION STYLE BACKUP
7	1	14890	PLATE MOUNT GAUGE
8	1	14870-S3	PLATE MOUNT GAUGE
9	2	1103	LOCKWASHER 1/2" GR8
10	1	1114	HHCS 1/2"-13 X 3" GR8
11	1	1112	HHCS 1/2"-13 X 1 1/2" GR8
12	8	BUCST1554	JAW END FITTING R/H THD ASSY 3/4 -10 X 6"
13	8	40027-S3	5/16" CONNECTING LINK GR.80
14	1	RH15004	BREAKOUT CHAIN ASSEMBLY; 35,300 SWL
15	4	1000498	CHAIN GR8 1/2 1200 LBS. WLL, 4 LINKS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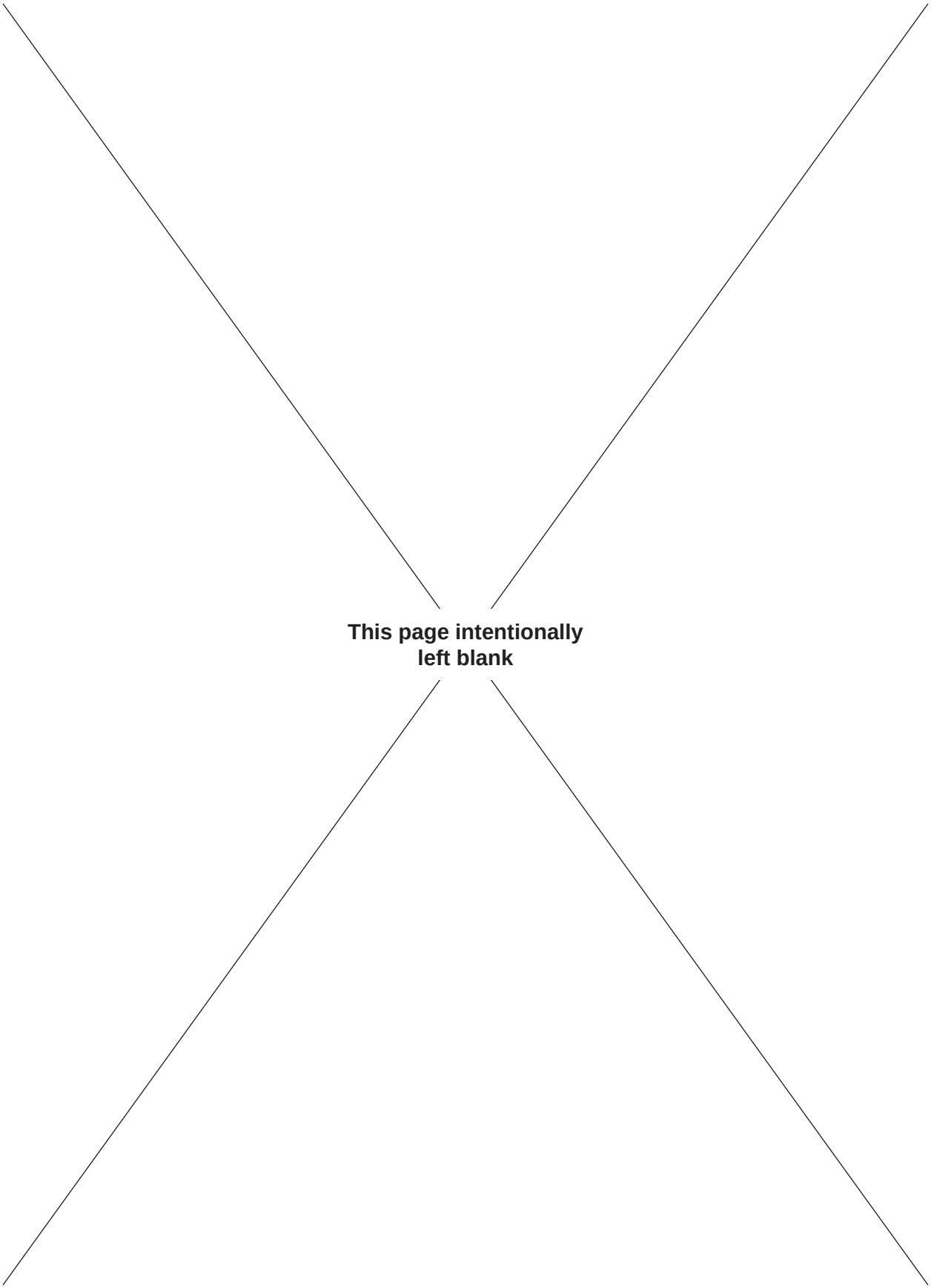
SECTION 7: TORQUE/TURNS MEASUREMENT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7.A BASIC TORQUE MEASUREMENT

Basic torque measurements are performed using a simple hydraulic measurement system. A hydraulic load cell connects to a calibrated torque gauge through a reinforced flexible hydraulic hose. The torque gauge is factory-calibrated to display accurate torque measurements for a tong or tong and backup assembly with a particular arm length. The arm length is a measurement from the centre of the pipe or casing to the centre of the force being applied to the load cell.

Two load cell options are available. A tension load cell is typically used with a suspended stand-alone tong. This application requires that the load cell be attached to the rear of the tong as part of the restraint line that opposes the force generated when the tong makes up or breaks out a joint. A compression load cell is used in a tong and backup assembly, and is typically located on the rear of the backup between the backup and a stationary frame. The load cell must be located in the centre of the compression force vector generated between the backup and the frame.

Hydraulic force generated by a load cell is transmitted to the torque gauge via a reinforced flexible hydraulic line. The hydraulic force is displayed as torque in units of Ft.-Lbs. The torque gauge has a red “peak torque” indicator that tracks with the torque gauge needle to the point of highest torque, and remains at the point of highest torque until manually reset. Note that every model of tong and tong and backup assembly has a unique arm length, and the torque gauge must be calibrated for that arm length. Torque gauges that are not calibrated for the arm length of the tool in service will not display correct torque. To ensure correct torque measurement, ensure the arm length or “handle” as displayed on your torque gauge matches the arm length of the tool in service as listed on the specifications page of the technical manual.

The images on this page are for illustration purposes only and may not accurately represent the torque gauge and load cell that have been supplied with your equipment.

THE IMAGES DISPLAYED ARE SUPPLIED FOR ILLUSTRATION PURPOSES ONLY

ILLUSTRATION 7.A.1: TORQUE GAUGE (FOR ILLUSTRATION PURPOSES ONLY)

ILLUSTRATION 7.A.2: TENSION LOAD CELL

Torque gauges and load cells are supplied as a matched calibrated pair. Substituting one or the other will render the calibration inaccurate even if the actual model numbers appear to be identical. The serial numbers of matching load cell and torque gauges are clearly identified on the calibration certificate. Should you suspect the accuracy of your torque measurements, or wish to replace either component the pair should be returned to the factory for re-calibration before placing into service.

TORQUE GAUGES AND LOAD CELLS ARE FACTORY-SUPPLIED SUPPLIED AS MATCHED CALIBRATED PAIRS. IF REPLACING EITHER COMPONENT THE LOAD CELL AND TORQUE GAUGE MUST BE RETURNED TO THE FACTORY FOR RE-CALIBRATION BEFORE PLACED INTO SERVICE.

The images on this page are for illustration purposes only and may not accurately represent the torque gauge and load cell that have been supplied with your equipment. Please note that the parts listed in the following table are correct for accurate torque measurement while using the equipment for which this manual is supplied.

7.A BASIC TORQUE MEASUREMENT (CONTINUED:)

THE TORQUE GAUGE USED IS FULLY DEPENDANT UPON THE ARM LENGTH AND TORQUE RANGE OF THE EQUIPMENT IN USE. THE PART NUMBERS LISTED IN THE FOLLOWING TABLE ARE CORRECT FOR ACCURATELY MEASURING TORQUE USING THE EQUIPMENT FOR WHICH THIS MANUAL IS SUPPLIED.

Item	Type	Description	Qty	Part Number
	Assembly	49.5” arm - 100K torque gauge / tension load cell assembly	1	SM100-49500-TS
1	Part	49.5” arm 100,000 lbs-ft torque gauge	1	
2	Part	10.8 in^2 tension load cell	1	CT110-1
3	Part	Hydraulic hose	1	CH113-05
4	Assembly	Break-out chain	1	MK23048

LOAD CELLS ARE NOT USER SERVICEABLE. DAMAGED LOAD CELLS MUST BE RETURNED TO THE FACTORY FOR REPAIR AND RE-CALIBRATION.

7.B TROUBLESHOOTING

Under normal operating conditions, and with proper maintenance, the torque gauge and load cell system are designed to give lasting trouble-free performance. Faulty indication on the gauge will very often define a fault within the gauge.

IF TROUBLESHOOTING REVEALS THAT THERE IS INSUFFICIENT FLUID IN THE SYSTEM, BEFORE RECHARGING, CHECK THAT ALL SYSTEM COMPONENTS ARE FREE FROM DAMAGE. THIS WILL ENSURE THAT FLUID LOSS WILL NOT CONTINUE AFTER RELOADING

1	SYMPTOM: NO INDICATION ON TORQUE GAUGE	
	POSSIBLE PROBLEM	**SOLUTION(S)**
	Hydraulic hose is obstructed	Check hydraulic hose for kinks
		Replace hydraulic hose
	Loss of hydraulic fluid	Recharge hydraulic fluid (see Section 6.C). NOTE: Ensure any breaches in the hydraulic system between the load cell and torque gauge are repaired to prevent further fluid loss.
	Internal mechanism of torque gauge is damaged	Replace gauge
2	SYMPTOM: GAUGE INDICATION UNEXPECTEDLY HIGH	
	POSSIBLE PROBLEM	**SOLUTION(S)**
	Excessive hydraulic fluid	Completely drain hydraulic fluid from torque gauge/load cell system. Recharge following the procedure in Section 6.C
	Internal mechanism of gauge is damaged	Replace gauge
	Incorrect torque gauge in use (not part of the original torque gauge/load cell pair)	Replace gauge with gauge properly calibrated for the load cell in service
3	SYMPTOM: GAUGE INDICATION UNEXPECTEDLY LOW	
	POSSIBLE PROBLEM	**SOLUTION(S)**
	Insufficient hydraulic fluid	Recharge hydraulic fluid (see Section 6.C). NOTE: Ensure any breaches in the hydraulic system between the load cell and torque gauge are repaired to prevent further fluid loss
	Obstruction in hydraulic hose	Check hydraulic hose for kinks
		Replace hydraulic hose
	Snub line not at right-angle to tong handle	Check angle of snub line and correct if necessary
	Internal mechanism of gauge is damaged	Replace gauge
	Incorrect torque gauge in use (not part of the original torque gauge/load cell pair)	Replace gauge with gauge properly calibrated for the load cell in service
4	SYMPTOM: GAUGE INDICATION IS ERRATIC OR SLUGGISH	
	POSSIBLE PROBLEM	**SOLUTION(S)**
	Insufficient hydraulic fluid in torque measurement section	Recharge hydraulic fluid (see Section 6.C). NOTE: Ensure any breaches in the hydraulic system between the load cell and torque gauge are repaired to prevent further fluid loss
	Loss of damping fluid in torque gauge	Top up or refill damping fluid (NOTE: Ensure leakage points in gauge are identified and repaired to prevent further loss of damping fluid)
	Air bubbles in hydraulic fluid in the torque measurement system	Bleed air from load cell and torque gauge and top up fluid (if necessary) as per Section 6.C
	Internal mechanism of gauge is damaged	Replace gauge

7.C PERIODIC INSPECTION AND MAINTENANCE

ONLY QUALIFIED, DESIGNATED PERSONNEL ARE PERMITTED TO PERFORM MAINTENANCE ON THE TORQUE MEASUREMENT SYSTEM.

7.C.1 Inspection

The torque measurement system supplied with your equipment is designed and built to provide years of trouble-free service with minimum maintenance. Periodic inspections of the load cell, hydraulic lines and fittings are recommended in order to keep the system in top operating condition. A thorough inspection should be made at each rig-up.

7.C.2 Fluid Recharge

Recharge hydraulic system with W15/16 fluid through the check valve on the torque indicating gauge. Recharging must only be performed when there is no load on the load cell. Refer to the illustrations on pages 6.3 & 6.4 for guidance if required.

a. Place the torque indicating gauge higher than the load cell. Remove the brass 1/4” cap from the fitting on the check valve on the top of the gauge.

b. Connect the hand pump to the check valve fitting.

c. Elevate the load cell so it is higher than the torque gauge and hand pump.

UNCONTAINED SPILLAGE OF THE HYDRAULIC FLUID IN THIS SYSTEM MAY CONTRAVENE GOVERNMENTAL ENVIRONMENTAL REGULATIONS, OR THE ENVIRONMENTAL REGULATIONS AND POLICIES OF YOUR COMPANY. FARR CANADA CORP. HIGHLY RECOMMENDS PLACING YOUR LOAD CELL IN A CONTAINMENT BASIN BEFORE PROCEEDING WITH THE BLEEDING & REFILLING PROCESS.

d. Fill hand pump bowl with W15/16 hydraulic fluid.

MAINTAIN GREATER-THAN HALF FULL FLUID LEVEL IN THE HAND PUMP BOWL TO AVOID PUMPING AIR INTO THE SYSTEM. DO NOT ALLOW THE LEVEL TO FALL BELOW ONE-HALF FULL

e. Remove the vent plug screw and Stat-O-Seal (Items C and D on Illustration 6.A.4, or item H on Illustration 6.A.5) to allow trapped air to escape.

f. Pump fluid into the system until no more air is seen escaping from the vent port.

g. Replace the vent plug screw and Stat-O-Seal and tighten securely.

h. Remove load cell from containment vessel and wipe clean. Reclaim the hydraulic fluid (if it is clean) or dispose of all waste materials according to governmental or your company’s proscribed environmental protection regulations.

i. Disconnect the hand pump from the torque gauge.

j. Replace the brass cap on the torque gauge check valve fitting.

7.C.3 Reference Checking Your Torque Measurement System

The following steps define a process for determining if your torque measurement system is correctly measuring and indicating within an expected range. This procedure is best suited for performing in a shop or location removed from the drill floor, within range of a crane. This is a reference check and not a calibration. Calibrations must be performed at an authorized calibration facility.

Tension Load Cell

a. Locate a known weight in the range of approximately 500 to 1000 lbs (227 to 455 kg), and move the weight next to the tong and backup assembly.

b. Remove the tension load cell from the tong, but do not disconnect from the torque gauge.

c. Suspend the load cell, piston side up, from a crane capable of supporting the known weight in Step 3a.

d. Connect the rod side of the load cell to the known weight, and use the crane to hoist the weight from the surface to be suspended freely.

Continued on next page...

7.C.3 Reference Checking Your Torque Measurement System (Continued):

Tension Load Cell (continued):

e. Perform a simple calculation to determine the expected indication on the torque gauge based on the known hoisted weight. This is a calculation that must be performed using imperial units (eg., pounds and feet). The calculation is: [KNOWN WEIGHT] x [ARM LENGTH (in feet)]. For example, if the arm length is 36 inches and the hoisted weight is 1000 lbs the calculation is:

1000 x (36/12) = 3000

Therefore, the expected indication on the torque gauge should be 3000 lbs-ft.

7.C.4 Repair And Calibration

Return the load cell and indicator gauge to the authorized repair facility for repairs and calibration.